APPENDIX 2

CBP PUT, TAKE, and Program Alternatives Evaluation Technical Memorandum #2

Brown AND Caldwell

IN ASSOCIATION WITH WSC WATER SYSTEMS CONSULTING, INC.

DRAFT FINAL

Chino Basin Program PUT, TAKE, and Program Alternatives Evaluation

Technical Memorandum No. 2

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Prepared for

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

CBP CHINO BASIN PROGRAM

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List of Abbreviations

AFM	acre-feet per month
AFY	acre-feet per year
AWPF	advanced water purification facility
CBP	Chino Basin Program
CBWM	Chino Basin Watermaster
CCR	California Code of Regulations
CCWRF	Carbon Canyon Water Recycling Facility
CECs	constituents of emerging concern
CVWD	Cucamonga Valley Water District
DDW	Division of Drinking Water
DLR	detection limit for reporting purposes
DP	discharge point
EW	extraction well
ft	feet
fps	feet per second
FWC	Fontana Water Company
FY	fiscal year
gpd	gallons per day
gpm	gallons per minute
GWR	groundwater recharge

HGL	hydraulic grade line
hP	horsepower
IEUA	Inland Empire Utilities Agency
in	inches
IW	injection well
JCSD	Jurupa Community Services District
kWh	kilowatt hour
lbs	pounds
MBR	membrane bioreactor
MCL	maximum contaminant level
mgd	million gallons per day
MWD	Metropolitan Water District of Southern California
NDMA	N-Nitrosodimethylamine
NL	notification level
NRW	Non-Reclaimable Wastewater
PDR	preliminary design report
PFAS	Per- and Polyfluoroalkyl Substances
PS	pump station
RP-1	Regional Water Recycling Plant No. 1
RP-2	Regional Water Recycling Plant No. 2
RP-4	Regional Water Recycling Plant No. 4
RP-5	Regional Water Recycling Plant No. 5
RW	recycled water
RWQCB	Regional Water Quality Control Board
SAR	sodium absorption ratio
sMCL	secondary maximum contaminant level
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAFM	thousand acre-feet per month
TAFY	thousand acre-feet per year
TDH	total dynamic head
TDS	total dissolved solids
TM	technical memorandum
TM1	Technical Memorandum 1
TM2	Technical Memorandum 2
TM3	Technical Memorandum 3
TVMWD	Three Valleys Municipal Water District
Watermaster	Chino Basin Watermaster
Western	Western Municipal Water District
WRCRWA	Western Riverside County Regional Wastewater Authority
WRP	water reclamation plant
WSIP	Water Storage Investment Program
WTP	water treatment plant
WWTP	wastewater treatment plant
$M	millions of dollars

Section 1: Introduction

The Chino Basin Program (CBP or Program) is an innovative local water supply project that combines local infrastructure needs and salinity management with groundwater storage and water supply needs in Northern California. This project is being led by the Inland Empire Utilities Agency (IEUA) to develop necessary infrastructure within the IEUA service area and the area of the Chino Groundwater Basin (Chino Basin). This project, the CBP Technical Feasibility Study (Study), is being completed to advance the projects that comprise the CBP. This project includes two main elements:

1. Identification and evaluation of PUT, TAKE, and program alternatives to identify the preferred CBP approach.
2. The conceptual design for elements of the recommended program.

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. The PUT and TAKE components are summarized in Table 1-1.

Table 1-1. Summary of PUT and TAKE Components	
PUT Components	**TAKE Components**
• Tertiary recycled water supply and conveyance • Advanced water purification facility (AWPF) • Purified water pumping and conveyance • Groundwater recharge (injection wells and/or recharge basins)	• Groundwater extraction and treatment • Potable water pumping and conveyance • Potable water usage (MWD pump back or in-lieu)
The CBP will comprise both PUT and TAKE components.	

The Study will be the primary deliverable for the overall project and will present the overall findings of the project, including the conceptual design for elements of the recommended program. The alternatives evaluation of the PUT, TAKE, and program alternatives, which will define the recommended CBP for documentation in the Study, is documented in the following technical memoranda (TM):

- **TM1 – CBP Assumptions:** documents the assumptions used to develop the PUT and TAKE alternatives and presents the approach used to evaluate the PUT, TAKE, and program alternatives.
- **TM2 – PUT, TAKE, and Program Alternatives Development and Evaluation (this TM):** presents the development and formation of the PUT and TAKE alternatives and evaluation and the selected program alternative for the overall CBP.

These TMs will be appended to the Study. The relationship between the three CBP documents is shown graphically in Figure 1-1.

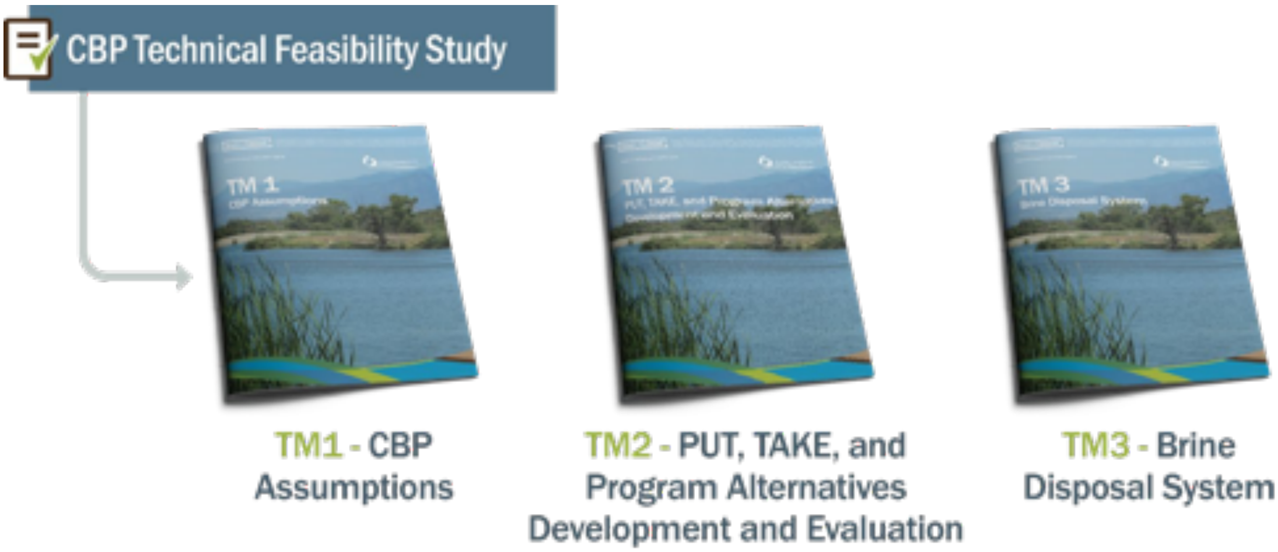

Figure 1-1. CBP Documents

The following information is presented in TM2:

- **Section 2: Initial Groundwater Modeling** – summarizes the characteristics of the Chino Basin and presents optimum locations for PUT and TAKE alternative infrastructure to maximize basin storage capacity and minimize and/or mitigate material physical injury to the basin and its surrounding area.
- **Section 3: PUT Alternatives** – presents an overview of the six PUT alternatives and components, including tertiary recycled water supply, AWPF, purified water conveyance, and groundwater recharge with injection wells. Each alternative includes a description, evaluation, and recommendations for inclusion in the recommendation CBP alternative.
- **Section 4: TAKE Alternatives** – presents an overview of the TAKE alternatives including alternative components, delivery mechanism, and delivery conditions for each alternative. Each alternative includes a description and recommendations for inclusion in the recommended CBP alternative.
- **Section 5: Program Recommendations** – presents the recommended program alternative developed from the recommended PUT and TAKE alternatives.

Section 2: Initial Groundwater Modeling

The project was planned to have groundwater modeling completed for the four program alternatives. However, during development of the PUT and TAKE alternatives it was determined that initial, interim modeling would be beneficial to help guide the alternatives development process. Wildermuth Environmental, Inc. (WEI) completed four interim groundwater modeling scenarios for the initial PUT and TAKE concepts to determine if potential program elements align with the Optimum Basin Management Plan (OBMP) objectives and the Storage Framework Investigation. The modeling also identified potential pumping constraints in the existing well fields with the new extraction wells and evaluated groundwater travel time requirements between recharge locations (i.e., injection wells) and extraction wells. This early modeling input allowed the team to modify the PUT and TAKE components to better align with Chino Basin requirements.

The modeling runs evaluated the following PUT and TAKE components:

- Potential PUT locations, including initial and refined injection well locations in MZ-2.
- Potential TAKE locations in MZ-1, MZ-2, and MZ-3.
- Asymmetrical PUT and TAKE with the majority of the groundwater recharge in MZ-2 and extraction in MZ-2 and MZ-3.

The following results were determined from the initial groundwater modeling:

- Confirmed that injection wells located in the northern portion of MZ-2 can support the level of TAKE in the CBP.
- The initial model runs showed that the PUT and TAKE components achieved hydraulic control and minimized impact to pumping sustainability and net recharge.
- The refined MZ-2 injection well locations (selected to reduce purified water conveyance infrastructure) were acceptable and meet travel time requirements. The initial and refined injection well locations are discussed further in Section 3.2.4.
- Asymmetrical PUT and TAKE is acceptable for recharge in MZ-2 and extraction in MZ-2 and MZ-3.
- TAKE in MZ-1 is feasible with symmetric, upgradient PUT.

Table 2-1 summarizes the initial groundwater modeling runs with the PUT and TAKE assumptions and the corresponding results. The order of the model runs was dictated by the development of the overall CBP concepts with the formulation and refinements of the PUT and TAKE alternatives.

Table 2-1. Summary of Initial Groundwater Modeling

Model Run	PUT Assumptions	TAKE Assumptions[1]	Results
1	• 15.0 TAFY • Recharge assumptions ○ MZ-1: 3.0 TAFY via 3 injection wells ○ MZ-2: 9.0 TAFY via recharge basins2 ○ MZ-3: 3.0 TAFY via 3 injection wells	• No pre-delivery (50.0 TAFY) • Extraction assumptions ○ MZ-1: 4.0 TAFY ○ MZ-2: 34.3 TAFY ○ MZ-3: 11.7 TAFY • Call occurs in last 3 years of a 10-year cycle (e.g., Years 8-10)	• TAKE in MZ-1 is feasible with symmetric, upgradient PUT • PUT and TAKE facilities should be closer together in MZ-2 • Utilize injection wells in MZ-2 • Identified potential pumping constraints in the existing MZ-2 and MZ-3 well fields • Achieved hydraulic control • TAKE in MZ-3 requires more evaluation
2	• 15.0 TAFY via 16 injection wells in MZ-2[3]	• No pre-delivery (50.0 TAFY) • Extraction in MZ-2 • Call occurs in last 3 years of a 10-year cycle (e.g. Years 8-10)	• Identified potential pumping constraints in the existing well fields • Identified travel time constraints • Achieved hydraulic control

Table 2-1. Summary of Initial Groundwater Modeling			
Model Run	**PUT Assumptions**	**TAKE Assumptions**[1]	**Results**
3	• 15.0 TAFY • Recharge assumptions ○ 12.0 TAFY via 12 injection wells in MZ-2[3] ○ 3.0 TAFY via 3 injection wells in MZ-3	• No pre-delivery (50.0 TAFY) • Extraction in MZ-2 • Call occurs in last 3 years of a 10-year cycle (e.g. Years 8-10)	• Achieved hydraulic control • Elevated groundwater levels in MZ-3 and satisfied the sustainability criteria in existing well fields • Identified potential pumping constraints in the existing MZ-2 well fields
4	• 15.0 TAFY via 16 injection wells in MZ-2[4]	• No pre-delivery (50.0 TAFY) • Extraction in MZ-2 • Call occurs in last 3 years of a 10-year cycle (e.g. Years 8-10)	• Tightened the distribution of injection wells and extraction wells to reduce the conveyance infrastructure. • Achieved hydraulic control • Minimized impact to sustainability constraints • Meets travel time requirements

Notes:

[1]No pre-delivery was assumed for all initial model runs since this is the most conservative extraction assumption. Pre-delivery would have less impacts on the Chino Basin.

[2]Model Run #1 included recharge basins for the following reasons, 1) provide insight on the effectiveness of utilizing the recharge basins, 2) determine if the location of the basins was conducive to a corresponding TAKE, and 3) a preference to utilize existing facilities to reduce cost. The use of recharge basins in the CBP was not considered after Model Run 1 primarily because the capacity of the recharge basins to accept CBP water through the storm season was not feasible without modifying the existing operations at the recharge facilities, the CBP water recharged at the recharge basins takes too long to reach the extraction facilities due to the thick vadose zone in MZ-2, and the proximity to the extraction well field exceeded the sustainability constraints in the MZ-2 well fields.

[3]Injection wells assumed in two east-west alignments on the Pacific Electric Inland Empire Trail and Foothill Boulevard (initial alignments).

[4]Injection wells assumed in two east-west alignments on Foothill Boulevard and Arrow Route (refined alignments).

Section 3: PUT Alternatives

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. Each PUT alternative includes the following components:

- Tertiary recycled water supply,
- Tertiary recycled water conveyance,
- Advanced water purification,
- Purified water pumping and conveyance, and
- Groundwater recharge with injection wells.

The PUT alternatives were developed based on the assumptions presented in TM1 Section 4 PUT Components and TM1 Section 6 Conveyance Approach. The components were refined during the alternatives development process based on the initial groundwater modeling that was completed using the Chino Basin Groundwater Model (TM2 Section 2:) to optimize the injection and extraction well locations to minimize infrastructure costs.

This section includes PUT alternative development details, an overview and detailed description of each alternative, as well as the evaluation of the PUT alternatives and recommendation of which PUT alternatives to carry forward into the program alternatives.

3.1 PUT Alternatives Development Approach and Overview

PUT alternatives were identified to compare the tradeoffs between the locations for recharging the purified water and the AWPFs. These tradeoffs are as follows:

- **Recharge approaches:** The PUT alternatives were developed assuming injection wells to recharge the purified water into the Chino Basin. The recharge approaches were developed in alignment with the Storage Framework Investigation (WEI, October 2018), which included managed storage and recovery programs. For these storage and recovery programs, active storage and recovery (ASR) wells were assumed in the northern MZ-2 area. Therefore, the PUT alternatives were developed assuming the majority of the purified water would be recharged into MZ-2. Additionally, some purified water was also assumed to be recharged into MZ-1 or MZ-3. These areas are not preferred for large storage and recovery activities due to subsidence and pumping sustainability concerns, respectively.
- **AWPF locations**: As presented in TM1 Section 4.2, RP-1 and RP-4 were identified as the two potential locations for the main AWPF. These locations have tradeoffs in terms of conveying purified recycled water to the primary recharge location in MZ-2 (i.e., RP-4 is closer to the MZ-2 recharge location, but an AWPF at RP-1 may require fewer additional processes since RP-1 will be expanded with an MBR). These AWPF locations are paired up with the potential recharge locations to create the PUT alternatives. For PUT alternatives that include recharge in MZ-1, a small AWPF at Monte Vista Water District (MVWD) Plant 28 is included to create the purified water closer to the recharge location and minimize pipeline needs.

Six PUT alternatives were developed to compare the proposed recharge locations and the AWPF locations. The PUT alternatives were developed with the primary AWPF at either RP-1 (Alternatives 1 through 3) or RP-4 (Alternatives 4 through 6). These two groups of alternatives were then distinguished by how the purified water is recharged to the Chino Basin as summarized below and in Table 3-1:

- **Alternatives 1 and 4:** 12.0 TAFY of purified water would be recharged into MZ-2 and 3.0 TAFY would be recharged into MZ-3 supplied from a single AWPF at RP-1 or RP-4, respectively.
- **Alternatives 2 and 5:** All 15.0 TAFY of the purified water would be recharged into MZ-2 supplied from a single AWPF at RP-1 or RP-4, respectively.
- **Alternatives 3 and 6:** 12.0 TAFY of purified water would be recharged into MZ-2 and 3.0 TAFY would be recharged into MZ-1. The purified water would be provided by two AWPFs: a larger AWPF at either RP-1 or RP-4, respectively, and a smaller, satellite AWPF at the MVWD Plant 28 site.

Table 3-1. PUT Alternatives Summary

PUT Alternatives		AWPF (s)				Recharge			
		AWPF Location/Production Capacity (TAFY)				MZ Recharge Location/Quantities (TAFY)			
		RP-1	RP-4	MVWD	Total	MZ-1	MZ-2	MZ-3	Total
AWPF at RP-1	PUT-1	15.0	-	-	15.0	-	12.0	3.0	15.0
	PUT-2	15.0	-	-	15.0	-	15.0	-	15.0
	PUT-3	12.0	-	3.0	15.0	3.0	12.0	-	15.0
AWPF at RP-4	PUT-4	-	15.0	-	15.0	-	12.0	3.0	15.0
	PUT-5	-	15.0	-	15.0	-	15.0	-	15.0
	PUT-6	-	12.0	3.0	15.0	3.0	12.0	-	15.0

3.2 PUT Components

PUT Alternatives 1 through 6 were then developed using the PUT components. These components build upon the assumptions included in TM1 and include the following:

- Tertiary recycled water,
- AWPF,
- Purified water conveyance, and
- Groundwater recharge with injection wells.

3.2.1 Tertiary Recycled Water

Tertiary recycled water is the source water for the program. As discussed in TM1 Section 4.1, additional tertiary recycled water supplies have been identified to supplement IEUA's recycled water system and create the AWPF supply. The tertiary recycled water supplies are included in each PUT alternative and include water from Jurupa Community Services District (JCSD) through its recycled water from Western Riverside County Regional Wastewater Authority (WRCRWA) Treatment Plant and the City of Rialto.

In addition, IEUA's recycled water system operations must be adjusted to incorporate these external supplies into the system and to supply tertiary recycled water to the new AWPF as well as existing and future tertiary recycled water customers and groundwater replenishment. The system operation and associated recycled water pumping was evaluated for both AWPF locations (RP-1 or RP-4), and the pumping costs were incorporated into the PUT alternatives evaluation.

These two new recycled water supplies and the evaluation of IEUA's tertiary recycled water system operations are discussed in this section.

3.2.1.1 WRCRWA Supply

JCSD is in discussions to provide up to 5.0 TAFY of recycled water to the CBP from WRCRWA Treatment Plant. The elements associated with moving recycled water supply from WRCRWA to IEUA's recycled water system are as follows:

- Usage: WRCRWA would provide recycled water to support the CBP in two ways:
  - Six months of the year WRCRWA would provide recycled water to the IEUA recycled water system for the CBP AWPF for purification and groundwater recharge.

  - The other six months of the year WRCRWA would provide recycled water to the Santa Ana River, helping IEUA meet its discharge obligation.
- Tie-in Location: Recycled water from WRCRWA would be pumped into the IEUA 930 pressure zone.
- Pump Station: A 7.2 million gallons per day (mgd) pump station would be constructed at the WRCRWA Treatment Plant to deliver the additional flow to IEUA's system.
  - 4.5 mgd would be pumped into the IEUA 930 pressure zone.
  - A maximum flow of 2.7 mgd would be pumped into JCSD's recycled water system to deliver JCSD 1.0 TAFY.
  - The pump station would be designed to be expanded in the future from 7.2 mgd to 10.7 mgd.
- Pipelines: There are two pipelines associated with WRCRWA recycled water supply:
  - A 24-inch diameter pipe extending 16,300 linear feet from the WRCWRA Treatment Plant to the American Heroes Park. Note that this segment of pipeline would be designed for the future flow of 10.7 mgd.
  - A 24-inch diameter pipeline extending 10,000 linear feet from American Heroes Park to the IEUA 930 pressure zone.

3.2.1.2 City of Rialto Supply

The City of Rialto has committed to providing 3.5 TAFY of recycled water from the Rialto Wastewater Treatment Plant (WWTP) to the CBP. Recycled water will only be available to the CBP for six months of the year from May through October. The elements associated with moving the supply from Rialto Water Services to IEUA's recycled water system are as follows:

- Tie-in Location: Recycled water from the Rialto WWTP would enter the IEUA recycled water system at RP-4.
- Pump Station: A proposed pump station would be located at the Rialto WWTP to convey 3.5 TAFY to IEUA's recycled water system. The pump station would be designed to be expanded from 6.3 mgd to 11 mgd.
- Pipelines: A 24-inch diameter pipeline extending approximately 58,700 linear feet from the Rialto WWTP to the IEUA recycled water system (note: includes additional capacity for potential, future increase in supply availability).

3.2.1.3 IEUA's Existing Recycled Water System

As described in TM1 Section 4 PUT Components, IEUA's recycled water hydraulic model was used to evaluate the PUT Alternatives. A goal of the modeling was to maintain the tertiary recycled water system's operations and continue to meet existing demands, including groundwater recharge, with the implementation of the CBP. This requires the transfer of recycled water from the southern portion of the IEUA system north to the recharge basins, resulting in additional energy costs to convey the tertiary recycled water.

The hydraulic model was used to evaluate the difference in recycled water pumping costs when the AWPF is located at RP-1 and when it is located at RP-4. Three scenarios were used in the recycled water pumping analysis, including a baseline 2026 scenario with no CBP, a 2026 CBP scenario with the AWPF at RP-1, and a 2026 CBP scenario with the AWPF at RP-4. Because the recycled water system demands change seasonally and Rialto supplemental supply will only be available from May to October, four seasonal supply and demand alternatives were used to model annual energy consumption in the recycled water system: (1) Summer, (2) Fall/ Spring with Rialto, (3) Fall/ Spring without Rialto, and (4) Winter.

Each of the three scenarios (2026 baseline, AWPF at RP-1 and AWPF at RP-4) were run under each of the four seasonal supply and demand alternatives. Table 3-2 includes the modeled supplies and demands for each modeled scenario. Assumptions were required to distribute the demands appropriately, listed below:

1. Supplies and demands were developed for year 2026 using monthly demand factors based on the supply and demand distribution in Fiscal Year (FY) 2016-17 (the time period last used to calibrate the hydraulic model) with adjustments to reduce the need for seasonal storage.
2. The use of groundwater recharge (GWR) basins in the summer scenarios was based on GWR basins used during the calibration scenario in the hydraulic model (August 2016), with additional GWR demand distributed to Turner Basin after other basins met their maximum GWR flowrate.
3. GWR Basins in the fall/ spring and winter scenarios were based on projected recycled water recharge in year 2026 by basin as listed in the 2018 Storage Framework Investigation.
4. In summer conditions, Prado Discharges would occur at Discharge Point (DP) 002 to meet minimum discharge flows at RP-1. In the winter scenarios, Prado discharges were distributed based on historical discharge between the four discharge points.
5. Prado discharge demands (DP 001, 002, 003, and 004) are assumed to occur on the discharge side of pump stations and meeting these demands would contribute to energy consumption in the system.

The WRCRWA pump station was modeled with similar operations in the summer and winter scenarios. However, WRCRWA flows may be discharged to the Santa Ana River to meet Prado obligations at WRCRWA in the winter. This strategy would require less energy than pumping the recycled water up to the IEUA system and then discharging it to Prado.

Table 3-2. Recycled Water Energy Analysis Scenarios

		Recycled Water Supplies, MGD				Recycled Water Demands, MGD																			
						Groundwater Reuse																			
						Basins												Prado Discharge					AWPF		
	Scenarios	IEUA	WRCWRA	Rialto	Total Supplies	7th & 8th St	Banana	Brooks	Declez	Ely	Hickory	RP-3	San Sevaine	Turner	Victoria	Total GWR	Direct Use	DP 001	DP 002	DP 003	DP 004	Total Prado Discharge	RP-1	RP-4	Total Demands
Summer (August)	Baseline Scenario (2026)	57.9	0	0	**57.9**	0	1.4	0	0	3.1	4.9	0	0	1.4	0	**10.8**	**40.3**	0	0.5	0	0	**0.5**	**0.0**	**0.0**	**51.6**
	AWPF at RP-1	57.9	4.5	6.3	**68.7**	0	1.4	0	0	3.1	4.9	0	0	1.4	0	**10.8**	**40.3**	0	0.5	0	0	**0.5**	**15.2**	**0.0**	**66.8**
	AWPF at RP-4	57.9	4.5	6.3	**68.7**	0	1.4	0	0	3.1	4.9	0	0	1.4	0	**10.8**	**40.3**	0	0.5	0	0	**0.5**	**0.0**	**15.2**	**66.8**
Fall/Spring (with Rialto)	Baseline Scenario (2026)	53.3	0	0	**53.3**	2.0	1.4	2.7	1.7	1.5	2.2	5.9	1.1	1.5	2.1	**22.1**	**24.8**	0	0.5	0	0	**0.5**	**0.0**	**0.0**	**47.4**
	AWPF at RP-1	53.3	4.5	6.3	**64.1**	2.0	1.4	2.7	1.7	1.5	2.2	5.9	1.1	1.5	2.1	**22.1**	**24.8**	0	0.5	0	0	**0.5**	**15.2**	**0.0**	**62.6**
	AWPF at RP-4	53.3	4.5	6.3	**64.1**	2.0	1.4	2.7	1.7	1.5	2.2	5.9	1.1	1.5	2.1	**22.1**	**24.8**	0	0.5	0	0	**0.5**	**0.0**	**15.2**	**62.6**
Fall/Spring (without	Baseline Scenario (2026)	54.3	0	0	**54.3**	1.8	1.3	2.5	1.5	1.4	2.0	5.4	1.0	1.4	1.9	**20.2**	**14.4**	0	2.4	2.7	2.8	**7.9**	**0.0**	**0.0**	**42.5**
	AWPF at RP-1	54.3	4.5	0	**58.8**	1.8	1.3	2.5	1.5	1.4	2.0	5.4	1.0	1.4	1.9	**20.2**	**14.4**	0	2.4	2.7	2.8	**7.9**	**15.2**	**0.0**	**57.7**
	AWPF at RP-4	54.3	4.5	0	**58.8**	1.8	1.3	2.5	1.5	1.4	2.0	5.4	1.0	1.4	1.9	**20.2**	**14.4**	0	2.4	2.7	2.8	**7.9**	**0.0**	**15.2**	**57.7**
Winter (January)	Baseline Scenario (2026)	62.7	0	0	**62.7**	0.5	0.3	0.7	0.4	0.4	0.5	1.5	0.3	0.4	0.5	**5.4**	**5.5**	1.4	13.1	2.5	3.7	**20.7**	**0.0**	**0.0**	**31.6**
	AWPF at RP-1	62.7	4.5	0	**67.2**	0.5	0.3	0.7	0.4	0.4	0.5	1.5	0.3	0.4	0.5	**5.4**	**5.5**	1.4	13.1	2.5	3.7	**20.7**	**15.2**	**0.0**	**46.8**
	AWPF at RP-4	62.7	4.5	0	**67.2**	0.5	0.3	0.7	0.4	0.4	0.5	1.5	0.3	0.4	0.5	**5.4**	**5.5**	1.4	13.1	2.5	3.7	**20.7**	**0.0**	**15.2**	**46.8**

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The model was run for a 24-hour period under each scenario and the pump station information, including the individual pump flowrate, total dynamic head (TDH), and run time over the 24-hour period, was extracted from the model. Each pump station is comprised of two to seven individual pumps, and the total pump station energy was calculated using the information from each individual pump. The data extracted from the model was used to calculate the estimated energy consumption in kilowatt hours (kWh) and costs for the 24-hour model run with an assumed total pump efficiency of 70 percent and an energy rate of $0.16 per kWh. This analysis was based on a constant cost for electricity and did not incorporate time-of-use energy rates.

Since the energy consumption and costs were developed for a 24-hour period for each season, annual energy consumption and costs were calculated by multiplying the daily rates by 91.25 days. This assumes the daily costs in the 24-hour model scenario are representative of the entire season. The model scenarios are considered to be a conservative estimate of conditions since they use the maximum day demands for the summer scenario and the peak groundwater recharge months for the spring and fall scenarios. Therefore, the estimated annual energy consumption and costs, listed in Table 3-3, are therefore considered to be conservative estimates. For comparative purposes, the actual recycled water system energy consumption in 2013/2014 was 19,517,000 kWh, compared to an estimated 28,161,000 kWh in 2026 for the baseline scenario. Since energy costs and pumping requirements are expected to increase between now and 2026, this conservative estimate was considered reasonable. It is also worth noting that CBP scenarios would always have higher energy use than the baseline scenario because they include the addition of new WRCRWA and Rialto pump stations.

Table 3-3. Estimated Annual Recycled Water System Energy Consumption and Costs

Seasonal Scenario	Energy Consumption, kWh			Energy Costs		
	Baseline Scenario (2026)	AWPF at RP-1	AWPF at RP-4	Baseline Scenario (2026)	AWPF at RP-1	AWPF at RP-4
Summer (3 months)	7,930,000	8,678,000	10,996,000	$1,268,000	$1,387,000	$1,761,000
Fall/Spring with Rialto (3 months)	8,596,000	9,326,000	11,762,000	$1,378,000	$1,497,000	$1,889,000
Fall/Spring without Rialto (3 months)	7,063,000	8,057,000	10,074,000	$1,132,000	$1,296,000	$1,624,000
Winter (3 months)	4,572,000	5,055,000	7,318,000	$739,000	$812,000	$1,168,000
Total Annual Pumping Consumption & Costs	**28,161,000**	**31,116,000**	**40,150,000**	**$4,517,000**	**$4,992,000**	**$6,442,000**

Notes:

[1]*Energy consumption assumes all pumps operate at 70% efficiency*

[2]*Energy costs based on a constant rate of $0.16/kWh*

3.2.2 AWPF

The AWPF assumptions for the PUT alternatives are discussed in TM1 Section 4.2. The PUT alternatives are based on locating the 15.0-TAFY AWPF at either RP-1 or RP-4. Two alternatives also consider a smaller 3.0-TAFY AWPF in MZ-1 at the MWVD Plant 28 site combined with a larger 12.0-TAFY AWPF at either RP-1 or RP-4.

Different purification processes are assumed for the AWPF locations based on IEUA's Capital Improvement Program (CIP) to upgrade the existing treatment Plants. IEUA is planning to upgrade the RP-1 secondary process to a membrane bioreactor (MBR) within the timeframe of this program with the MBR anticipated to be online by 2030. RP-4 is also planned to be upgraded to an MBR in the future but is anticipated to have the existing conventional secondary treatment through 2040. The smaller AWPF at the MVWD Plant 28 site would be supplied with tertiary recycled water from the IEUA recycled water system. Therefore, the assumed treatment processes are as follows:

- RP-1: MBR, reverse osmosis (RO), and an ultraviolet (UV) advanced oxidation process (AOP) (MBR-RO-AOP); and,
- RP-4 and MVWD Plant 28: membrane filtration (MF), RO, and UV-AOP (MF-RO-AOP).

This section describes the preliminary sizing and AWPF layouts for RP-1, RP-4, and MVWD Plant 28 that were used as the basis for the PUT alternatives.

Each AWPF includes brine disposal to the Non-Reclaimable Wastewater System (NRWS), which runs near each of the AWPF locations.

3.2.2.1 AWPF at RP-1

If the AWPF is located at RP-1, then the treatment process would be MBR-RO-AOP. The sizing assumptions for the 15.0-TAFY AWPF at RP-1 are summarized in Table 3-4.

Table 3-4. Sizing Assumptions for 15.0-TAFY AWPF at RP-1

Process or Facility	Description	Units	Value[1]
Equalization	Equalization Lagoon[2]	MG	2.5
MBR	MBR system required production for AWPF	mgd	14.4
	Number of available 10 MBR trains needed to supply the AWPF	No.	4
RO System	RO system production capacity	mgd	14.1
	RO feed tank	gal	105,000
	RO feed pumps	No.	4 + 1
	Capacity, per pump	gpm	2,640
	Cartridge filters	No.	4 + 1
	Capacity, per cartridge filter	gpm	2,640
	RO trains	No.	4 + 1
	Permeate, per train	gpm	2,450
	RO interstage booster pumps	No.	1 Per Train
	Capacity, per pump	gpm	650
	RO flush tank	gal	18,900
	RO flush pumps	No.	1 + 1
	Capacity, per pump	gpm	900

Table 3-4. Sizing Assumptions for 15.0-TAFY AWPF at RP-1			
Process or Facility	Description	Units	Value[1]
UV-AOP System	UV-AOP system production capacity	mgd	14.10
	UV reactors	No.	2 + 1
	Flow, per reactor	gpm	4,900
Chemical Facilities	Sulfuric acid tank	No.	2
	Tank volume	gal	11,900
	Sodium hypochlorite tank	No.	2
	Tank volume	gal	13,100
	Caustic soda totes	No.	2
	Tote volume	gal	300
	Ammonium sulfate tank	No.	1
	Tank volume	gal	13,500
	Antiscalant tank	No.	1
	Tank volume	gal	6,100
	Hydrogen peroxide tank	No.	1
	Tank volume	gal	7,300
	Sodium bisulfite tote	No.	2
	Tote volume	gal	300
Post Treatment	Lime system	No.	2 + 0
	Decarbonator system	No.	2 + 0
CIP Systems	MF CIP system tanks	No.	2
	RO CIP system tanks	No.	2
	RO CIP cartridge filter	No.	1

Notes:

[1]Equipment quantities are shown in the format of duty + standby, i.e., MF feed pumps are 3 + 1, or 3 duty + 1 standby.

[2]It is assumed that one of the existing RP-1 lagoons can be modified to be used for equalization upstream of the AWPF.

The MBR is assumed as pretreatment for the RO system since RP-1 is planned to be upgraded to an MBR within the timeframe of the CBP. But, since the CBP is proposed to be online by 2026 and the MBR is proposed to be in service around 2030, the MBR at RP-1 would need to be constructed sooner than originally anticipated. Therefore, the PUT alternatives that include the AWPF at RP-1 (PUT-1, PUT-2, and PUT-3) assumed that the MBR capital cost would partially be funded by the CBP. The RP-1 MBR preliminary design was completed as part of the RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report (Carollo, April 2019) and is based on ten MBR trains to achieve 40-mgd capacity at RP-1. Four MBR trains are needed to supply 14.4 mgd of MBR filtrate to the RO treatment and that proportion of costs are included in the RP-1 AWPF costs. To maintain the overall RP-1 secondary treatment capacity of 40 mgd and avoid complications associated with phasing the MBR system, it is recommended that the entire MBR be constructed early instead of building a portion for the AWPF by 2026 and the rest of the system by 2030. It is assumed that the remainder of the MBR cost would be funded by IEUA's CIP.

The location of the AWPF at RP-1 would be on the southwestern corner of the site in place of the existing solar panels and the MBR in the southeast corner as proposed in the RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report (Carollo, April 2019). Note that IEUA's solar contract ends in June 2029; if RP-1 was selected as the AWPF location, then IEUA would need to partner with the solar provider to discuss solutions. Costs associated with modifying the solar contract are not included in the AWPF costs.

Figure 3-1 shows the location of the 15.0-TAFY AWPF with the MBR. Figure 3-2 shows more detail of the RO and UV-AOP processes at the AWPF and the four MBR trains and their supporting facilities. For PUT-3, which combines a 12.0-TAFY AWPF at RP-1 with a 3.0-TAFY AWPF at MWVD Plant 28, the AWPF at RP-1 would be slightly smaller than the AWPF shown in Figure 3-1 and Figure 3-2.

Figure 3-1. RP-1 Site Layout with MBR

Figure 3-2. RP-1 AWPF and MBR Site Layout

3.2.2.2 AWPF at RP-4

If the AWPF is located at RP-4, then the treatment process would be MF-RO-AOP. The sizing assumptions for the 15.0-TAFY AWPF at RP-4 are summarized in Table 3-5.

Table 3-5. Sizing Assumptions for 15.0-TAFY AWPF at RP-4

Process or Facility	Description	Units	Value[1]
Equalization	Equalization Tank	MG	1.2[2]
MF System	MF system production capacity	MGD	15.1
	MF feed pumps	No.	3 + 1
	Capacity, per pump	gpm	4,700
	MF strainers	No.	3 + 1
	Capacity, per strainer	gpm	4,700
	MF trains	No.	7 + 2
	Filtrate flow, per train	gpm	1,500
	MF backwash pumps	No.	1 + 1
	Capacity, per pump	gpm	2,010

Table 3-5. Sizing Assumptions for 15.0-TAFY AWPF at RP-4			
Process or Facility	**Description**	**Units**	**Value[1]**
RO System	RO system production capacity	MGD	14.1
	RO feed tank	gal	105,000
	RO feed pumps	No.	4 + 1
	Capacity, per pump	gpm	2,640
	Cartridge filters	No.	4 + 1
	Capacity, per cartridge filter	gpm	2,640
	RO trains	No.	4 + 1
	Permeate, per train	gpm	2,450
	RO interstage booster pumps	No.	1 Per Train
	Capacity, per pump	gpm	650
	RO flush tank	gal	18,900
	RO flush pumps	No.	1 + 1
	Capacity, per pump	gpm	900
UV-AOP System	UV-AOP system production capacity	MGD	14.1
	UV reactors	No.	2 + 1
	Flow, per reactor	gpm	4,900
Chemical Facilities	Sulfuric acid tank	No.	2
	Tank volume	gal	11,900
	Sodium hypochlorite tank	No.	2
	Tank volume	gal	13,100
	Caustic soda totes	No.	2
	Tote volume	gal	300
	Ammonium sulfate tank	No.	1
	Tank volume	gal	13,500
	Antiscalant tank	No.	1
	Tank volume	gal	6,100
	Hydrogen peroxide tank	No.	1
	Tank volume	gal	7,300
	Sodium bisulfite tote	No.	2
	Tote volume	gal	300
Post Treatment	Lime system	No.	2 + 0
	Decarbonator system	No.	2 + 0

Table 3-5. Sizing Assumptions for 15.0-TAFY AWPF at RP-4			
Process or Facility	**Description**	**Units**	**Value[1]**
CIP Systems	MF CIP system tanks	No.	2
	RO CIP system tanks	No.	2
	RO CIP cartridge filter	No.	1

Notes:

[1]Equipment quantities are shown in the format of duty + standby, i.e., MF feed pumps are 3 + 1, or 3 duty + 1 standby.

[2]Size is limited by available space near existing chlorine contact basins. The size and location of the equalization tank will be evaluated in more detail during future phases of the project.

IEUA is planning to upgrade and expand the secondary treatment process at RP-4 to an MBR around year 2040. Since the AWPF would be online by 2026, a conceptual MBR layout was developed and coordinated with IEUA in conjunction with the AWPF layout to avoid conflicts between the future facilities. The future MBR system will require new fine screens ahead of the existing oxidation basins and the new MBR facilities downstream of the existing oxidation basins. In addition, IEUA needs to expand the primary clarifier capacity and is planning to construct a new clarifier in the future. The location of the 15.0-TAFY AWPF at RP-4 would be on the western portion of the site and the future primary clarifier and MBR facilities would be integrated into the existing RP-4 process areas.

The AWPF would be in the vicinity of the existing wind turbine located on the western side of the plant. The layout incorporates a conservative minimum setback of about 25 feet from the turning radius of the turbine blades to any structures, which will be confirmed during final design. Note that the chemical facilities are located within the 25-foot setback, but outside of the 74-foot turbine blade radius. A new road would be constructed on the western edge of the plant to facilitate chemical deliveries and provide vehicle access around the entire AWPF. An equalization tank to equalize flows prior to MF is proposed in the southwest corner of the plant.

The MBR and AWPF facilities will be evaluated in more detail as they are advanced from planning-level evaluations into design. Two items that will require further evaluation are the location of the fine screens and the size and location of the AWPF equalization/MF feed tank.

- For the MBR process, fine screens are required downstream of the existing primary clarifiers and upstream of the existing oxidation basins. Three location options are shown and the preferred location is Alternative 3 (shown in Figure 3-3 and Figure 3-4), which is in the location of the existing polymer and ferric chemical facilities. This location is preferred because it is adjacent to the primary effluent pipeline and would require the least amount of piping modifications to convey primary effluent to the new screens. The polymer and ferric facilities could be relocated further south to the area Alternative 2 for the fine screens.
- For planning purposes, the AWPF equalization/MF feed tank is assumed to be 1.2 million gallons and is shown in the southwest corner of the plant near the AWPF. If a larger equalization volume is needed once the detailed hydraulic calculations are completed, then another option could be to segment the existing basin for off-specification recycled water into two portions: one for off-specification recycled water and one for AWPF equalization. This alternative would require improvements to the diversion capability at the RP-4 headworks to divert wastewater to RP-1.

Figure 3-3 shows the location of the 15.0-TAFY AWPF and the future improvements at RP-4 (new primary clarifier, fine screen location alternatives, MBR facility, and relocated polymer and ferric facilities). Figure 3-4 shows more detail of the MF, RO, and UV-AOP processes at the AWPF as well as the influent equalization and chemical storage area. For the PUT alternative that combines a 12.0-TAFY AWPF at RP-4 with a 3.0-TAFY AWPF at MWVD Plant 28 would be slightly smaller than the AWPF shown in Figure 3-3 and Figure 3-4.

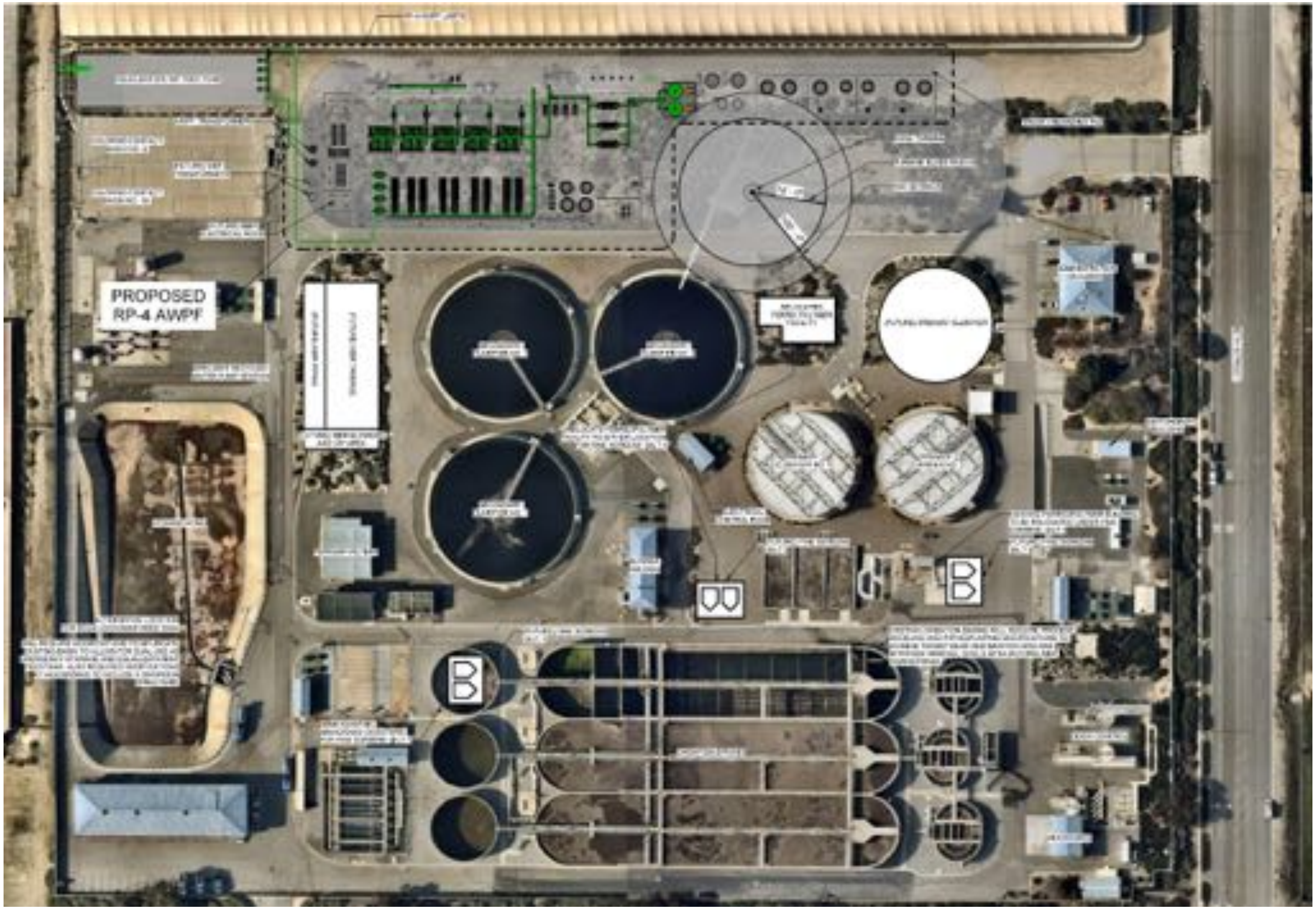

Figure 3-3. RP-4 Site Layout

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Figure 3-4. RP-4 AWPF Site Layout

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3.2.2.3 AWPF at MVWD Plant 28

MVWD's Plant 28 site was identified as a potential location for an AWPF in MZ-1 as part of the Feasibility Study of Recycled Water Interconnections Between the City of Pomona, Monte Vista Water District (MVWD), and IEUA (Carollo, January 2016). The CBP team confirmed with MVWD staff that the Plant 28 site may still be available as a suitable location for a satellite AWPF, provided any demolished facilities are replaced in kind. The cost to purchase new land for MVWD is included with the alternatives that include the AWPF at MVWD Plant 28.

The 3.0-TAFY AWPF was conceptually sized as part of the Feasibility Study of Recycled Water Interconnections Between the City of Pomona, MVWD, and IEUA (Carollo, January 2016) and the same sizing and layout was assumed for this evaluation. Figure 3-5 shows the layout of the 3.0-TAFY AWPF at MVWD Plant 28 with MF, RO, and UV AOP processes, and supporting facilities. PUT alternatives that include the AWPF at MVWD Plant 28 are coupled with a 12.0-TAFY AWPF at either RP-1 or RP-4.

Figure 3-5. AWPF at MWVD Site 28 (Carollo, January 2016)

3.2.3 Purified Water Conveyance

The PUT alternatives include purified water conveyance (pump stations and pipelines) to convey the purified water produced from AWPFs to recharge locations. The purified recycled water conveyance system would be dedicated to purified water to meet the regulatory requirements for injection wells recharging water into the Chino Basin. The design criteria for conveyance systems are presented in TM1 Section 6. As described in TM1 Section 6, all proposed conveyance pipelines would be aligned through the public Right-of-Way (ROW) and properties would be owned or acquired by IEUA to reduce the number of easements required for construction and maintenance. Pipe routings were developed with a focus on minimizing community impacts and avoiding major freeway and river crossings.

3.2.4 Groundwater Recharge with Injection Wells

The PUT alternatives assume that the purified water would be recharged to the Chino Basin using injection wells. As summarized in Section 3.1, the following recharge amounts are assumed in each groundwater management zone.

- MZ-1: 0 or 3.0 TAFY
- MZ-2: 12.0 TAFY (when combined with MZ-1 or MZ-3 recharge) or 15.0 TAFY (when only MZ-2 recharge)
- MZ-3: 0 or 3.0 TAFY

TM1 Section 4.3 presents the maximum assumed injection well capacities for each groundwater management zone based on production data for nearby groundwater extraction wells. For planning purposes, it is assumed that the capacity of an injection well is 50 percent of the extraction rate of nearby extraction wells. The injection well siting approach, and the injection well locations and quantities in each management zone are summarized in the following sections.

3.2.4.1 Injection Well Siting Criteria

The injection well fields must be located upgradient of the extraction well fields to allow for the TAKE portion of the program to occur without causing material physical injury (MPI) to the Chino Basin as defined by the Watermaster. The CBP built on the assumptions described in the Storage Framework Investigation (WEI, October 2018).

The main criteria used to determine injection well locations are listed below:

- Proximity to existing agency wells (production or injection) to reduce the possibility of hydraulic interference and to meet travel time requirements.
- Arrangement of the injection wells in clusters was considered to allow for less conveyance infrastructure and reduced monitoring costs.
- Access to public right-of-way, and alignment with member agency infrastructure planning.
- Site footprint to confirm sufficient available space to accommodate a concrete pad, wellhead, above-ground piping and appurtenances, signage, and safety features. The minimum area needed to construct an injection well is approximately 0.25 acres.
- The spacing between injection wells was set at a minimum of approximately 1,000 feet to prevent interference.

Injection well locations need to consider nearby groundwater extraction well locations to confirm that there is sufficient travel time between the injection well and groundwater extraction well to meet regulatory requirements. Under the Title 22 Regulations for Groundwater Replenishment Using Recycled Water, purified recycled water must have a minimum response retention time (i.e., minimum period of time recycled water is retained underground, or travel time) of at least two months as demonstrated with tracer study after construction (see TM1 Appendix A, Summary of Title 22 Regulations for Groundwater Replenishment Using Recycled Water). Also in accordance with the Title 22 regulations, numerical modeling is granted 50% credit of a tracer test and must demonstrate four months of travel time between injection and extraction wells. A minimum travel time of six months between the injection wells and extraction wells was assumed for the initial groundwater modeling to be conservative. Some of the preliminary injection well locations were adjusted based on the initial groundwater modeling results to provide sufficient travel time between the injection and extraction wells.

The injection well locations for MZ-1, MZ-2, and MZ-3 were identified using satellite images from Google Earth (completed in fall/winter 2019). The preliminary locations shown in each groundwater management zone are in open lots, large fields (e.g., large athletic fields associated with facilities such as schools and churches), large parking lots, and other similar areas. These locations are preliminary and assumed to be representative for injection well locations in the target recharge areas. Land ownership and availability have not been investigated for these representative locations. Land acquisition costs are assumed for each injection well (land acquisition cost assumptions are discussed in TM1 Section 7).The next phase of this program will include more extensive siting studies for injection wells for the selected PUT alternative.

The MZ-1, MZ-2, and MZ-3 injection well locations are discussed in the following sections.

3.2.4.2 MZ-1 Injection Wells

The injection wells in MZ-1 were assumed to be located near the Montclair Basins, which are north of the proposed AWPF at MVWD Plant 28.

The Montclair Basins were originally assumed as a potential recharge location for purified water as part of the Feasibility Study of Recycled Water Interconnections Between the City of Pomona, Monte Vista Water District (MVWD), and IEUA (Carollo, January 2016). Insufficient groundwater travel time was identified between the recharge basins and nearby extraction wells. Due to travel time issues and the need to prioritize stormwater recharge at these basins, injection wells are assumed for MZ-1.

Table 3-6 summarizes the MZ-1 injection wells assumed for the PUT alternatives. The number of injection wells was determined using the maximum capacity per well defined in TM1 Section 4.3.

Table 3-6. MZ-1 Injection Wells

Recharge Goal (TAFY)	Maximum Capacity per Injection Well (gpm)[1]	Conceptual Design	
		Number of Injection Wells	Capacity per Injection Well (gpm)
3.0	850	Duty = 3, Standby = 1 Total = 4	620

Note:

[1]From TM1 Section 4.3.

3.2.4.3 MZ-2 Injection Wells

The northern portion of MZ-2 was identified as the primary recharge location for purified water since it had been evaluated previously as part of the Storage Framework Investigation (WEI, October 2018). The northern portion of MZ-2is generally outside of known areas of contamination, and does not have subsidence constraints or significant pumping depressions. The Storage Framework Investigation also included managed storage and recovery programs within operational bands 2, 3, and 4. For these storage and recovery programs, ASR wells, which can be used for both injection and extraction, were assumed in the northern MZ-2 area in two east-west alignments in Rancho Cucamonga. ASR wells were not considered in the CBP because current regulations do not allow ASR wells to inject and extract purified recycled water.

For the PUT alternatives, two sets of potential injection well locations in MZ-2 were identified, which are as follows:

- Initially, potential injection well locations were identified in MZ-2 in Rancho Cucamonga in similar locations as assumed for the Storage Framework Investigation. One east-west alignment was assumed on the Pacific Electric Inland Empire Trail and one along Foothill Boulevard.
- In order to reduce the infrastructure required to convey the purified water from the AWPF to the injection wells, a second set of injection well locations were identified in MZ-2. These were located further south

than the initial set (closer to both RP-1 and RP-4) to reduce the overall purified water pipeline lengths. The east-west alignments of injection wells were assumed along Foothill Boulevard and Arrow Route in Rancho Cucamonga.

As described in Section 2:, preliminary groundwater modeling was completed for both sets of preliminary injection well locations and results indicate that both alternatives align with the OBMP objectives and the Storage Framework Investigation. The second set of injection wells (located on Foothill Boulevard and Arrow Route) are assumed for the PUT alternatives to reduce the overall infrastructure costs.

Table 3-7 summarizes the MZ-2 injection wells assumed for the PUT alternatives. The number of injection wells was determined using the maximum capacity per well defined in TM1 Section 4.3.

Table 3-7. MZ-2 Injection Wells

Recharge Goal (TAFY)	Maximum Capacity per Injection Well (gpm)[1]	Conceptual Design	
		Number of Injection Wells	Capacity per Injection Well (gpm)
12.0	830	Duty = 9, Standby = 3 Total = 12	830
15.0	830	Duty = 12, Standby = 4 Total = 16	775

Note:

[1]From TM1 Section 4.3.

3.2.4.4 MZ-3 Injection Wells

Injection well locations were identified in MZ-3 north of the JCSD well field. This area has experienced pumping sustainability challenges and injection wells were considered in this area to potentially improve groundwater levels, as well as support the program.

Table 3-8 summarizes the MZ-3 injection wells assumed for the PUT alternatives. The number of injection wells was determined using the maximum capacity per well defined in TM1 Section 4.3.

Table 3-8. MZ-3 Injection Wells

Recharge Goal (TAFY)	Maximum Capacity per Injection Well (gpm)[1]	Conceptual Design	
		Number of Injection Wells	Capacity per Injection Well (gpm)
3.0	1,130	Duty = 2, Standby = 1 Total = 3	930

3.3 PUT Alternatives Descriptions

PUT Alternatives 1 through 6 are described in the following sections. Section 3.3.7 includes a detailed facilities summary and cost summary (capital, O&M, and NPV costs) for the six alternatives.

3.3.1 PUT Alternative 1

PUT Alternative 1 (PUT-1) assumes that the AWPF is located at RP-1, where 15.0 TAFY of purified recycled water is produced and recharged into MZ-2 and MZ-3. The elements of PUT Alternative 1 are as follows:

- Recharge locations
  - MZ-2: The majority of the purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
  - MZ-3: A smaller portion of water would be recharged via injection wells in MZ-3.
- AWPF
  - The AWPF (MBR-RO-AOP) would be located at RP-1. The preliminary RP-1 AWPF layout is shown in Figure 3-2.
- Conveyance
  - Purified water would be pumped from the AWPF to the injection well sites in MZ-2 and MZ-3.
  - Brine from the AWPF would be pumped in to the NRWS pipeline which conveys non-reclaimable waste to the Los Angeles County Sanitation Districts (LACSD) for disposal.

PUT Alternative 1 is summarized in Table 3-9 and shown in Figure 3-6.

Table 3-9. PUT Alternative 1

Parameter	Description
Recharge Locations	MZ-2, MZ-3
AWPF	
Location	RP-1
Process	MBR/RO/UV-AOP
Capacity (TAFY)	15.0
Purified water conveyance	
Pipelines	16.2 miles (8-inch to 30-inch)
Pump station	
Location	RP-1
Size	2,600 HP
Number of injection wells	15 (11 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS
Pipeline	3,900 ft (8-inch)

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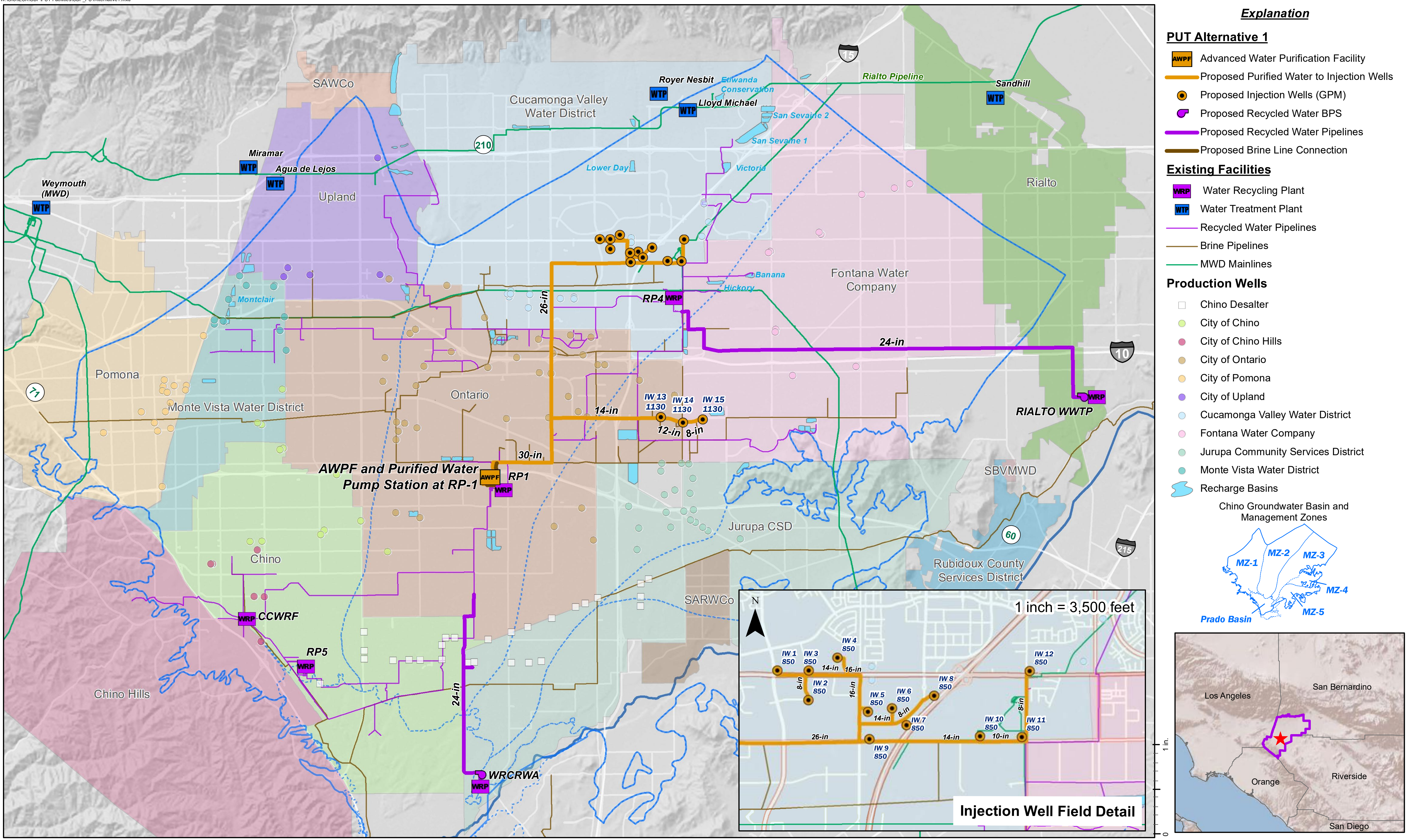

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

Date: 5/22/2020

File Name: CBP_PUTAlternative1

N

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

Project:

CBP CHINO BASIN PROGRAM

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PUT Alternative 1

Figure 3-6

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3.3.2 PUT Alternative 2

PUT Alternative 2 (PUT-2) assumes that the AWPF is located at RP-1, where 15.0 TAFY of purified recycled water is produced and recharged into MZ-2. The elements of PUT Alternative 2 are as follows:

- Recharge location
  - MZ-2: All purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
- AWPF
  - The AWPF (MBR-RO-AOP) would be located at RP-1. The preliminary AWPF layout at RP-1 is shown in Figure 3-2.
- Conveyance
  - Purified water would be pumped from the AWPF to the injection well sites in MZ-2.
  - Brine from the AWPF would be pumped in to the NRWS pipeline and conveyed to LACSD for disposal.

PUT Alternative 2 is summarized in Table 3-10 and shown in Figure 3-7.

Table 3-10. PUT Alternative 2

Parameter	Description
Recharge Locations	MZ-2
AWPF	
Location	RP-1
Process	MBR/RO/UV-AOP
Capacity (TAFY)	15.0
Purified water conveyance	
Pipelines	14.1 miles (8-inch to 30-inch)
Pump station	
Location	RP-1
Size	2,700 HP
Number of injection wells	16 (12 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS
Pipeline	3,900 ft (8-inch)

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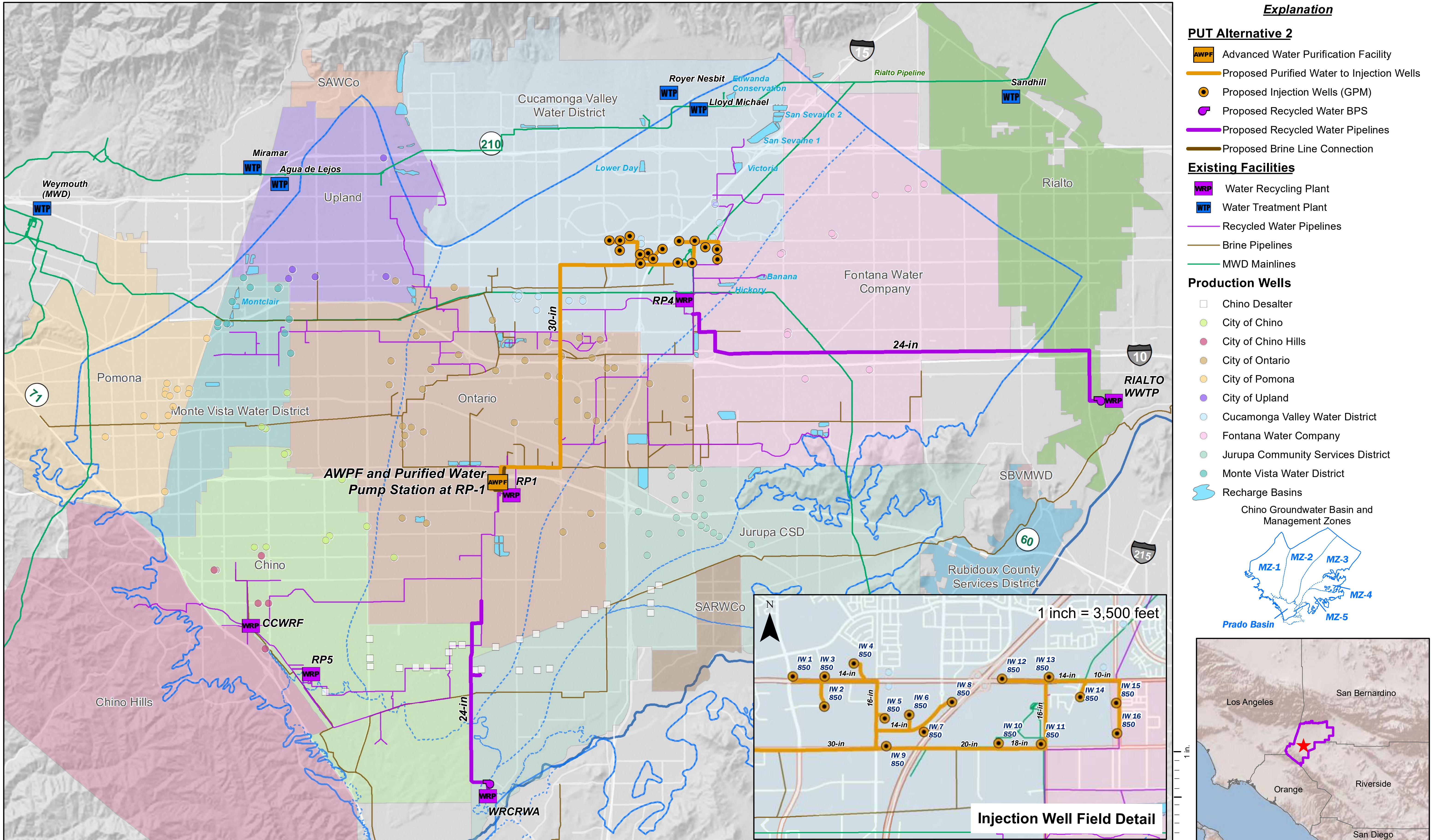

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Author: HF
File Name: CBP_PUTAlternative2
Date: 5/22/2020

1 in : 2 miles
0 3,000 6,000 Feet
0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 2

Figure 3-7

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3.3.3 PUT Alternative 3

PUT Alternative 3 (PUT-3) assumes that the AWPFs are located at RP-1 and MVWD's Plant 28, where 12.0 TAFY and 3.0 TAFY of purified water is produced, respectively, and recharged into MZ-2 and MZ-1. The elements of PUT Alternative 3 are as follows:

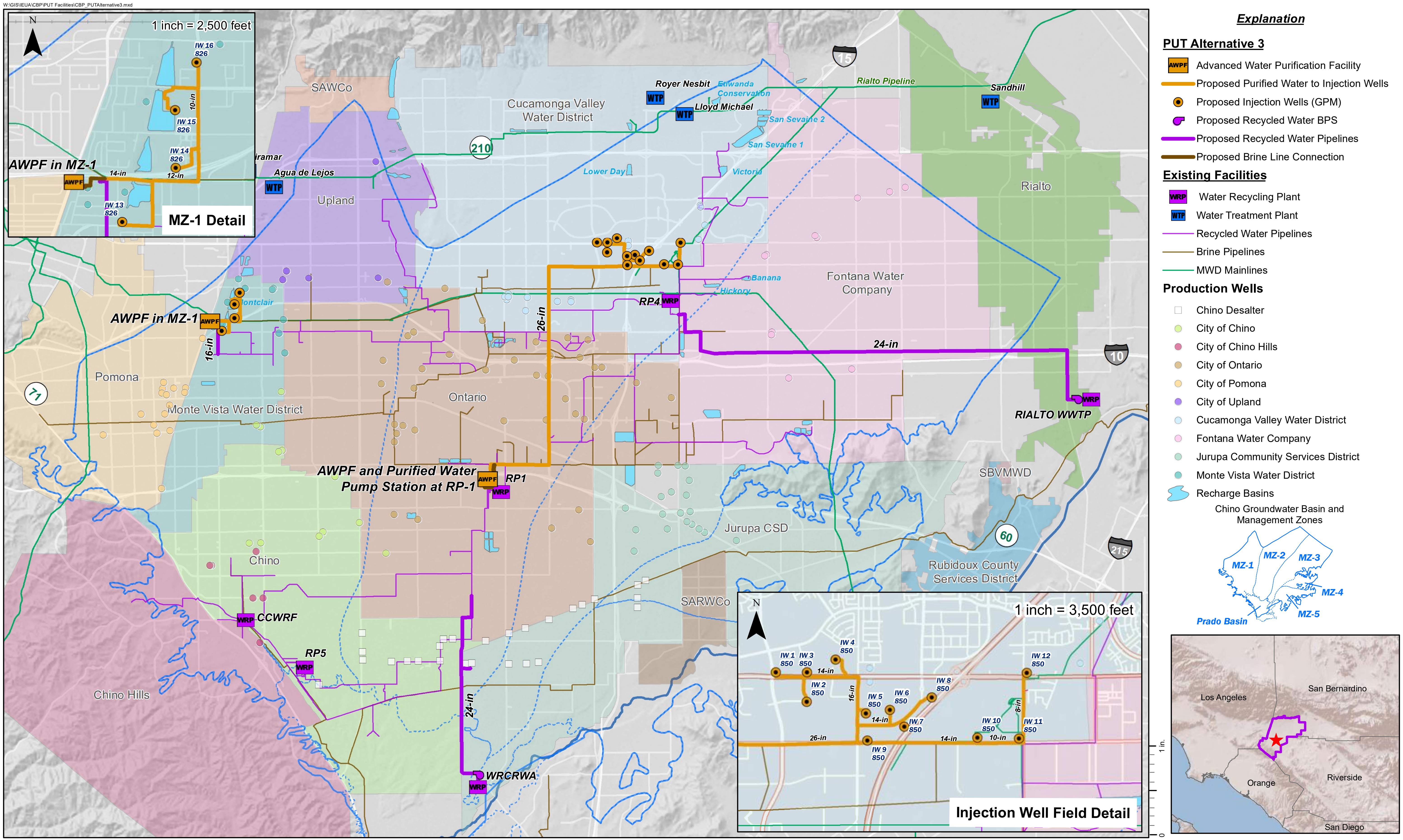
- Recharge locations
  - MZ-2: The majority of the purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
  - MZ-1: A smaller portion of water would be recharged via injection wells in MZ-1.
- AWPF
  - Two AWPFs would be developed for this alternative: the main AWPF (MBR-RO-AOP) at RP-1 and a smaller AWPF (MF-RO-AOP) at MVWD's Plant 28.
  - The preliminary AWPF layouts at RP-1 and Plant 28 are shown in Figure 3-2 and Figure 3-5, respectively.
- Conveyance
  - Purified water would be pumped from the RP-1 AWPF to the injection well sites in MZ-2, and from the MVWD Plant 28 AWPF to injection well sites in MZ-1.
  - Brine from the RP-1 AWPF would be pumped to the NRWS and brine from the MVWD Plant 28 AWPF would be pumped to the Etiwanda Wastewater Line (EWL); both the NRWS and EWL discharge into LACSD's system for disposal.

PUT Alternative 3 is summarized in Table 3-11 and shown in Figure 3-8.

Table 3-11. PUT Alternative 3

Parameter	Description
Recharge Locations	MZ-1, MZ-2
AWPF (MZ-1)	
Location	MVWD Plant 28
Process	MF/RO/UV-AOP
Capacity (TAFY)	3.0
AWPF (MZ-2)	
Location	RP-1
Process	MBR/RO/UV-AOP
Capacity (TAFY)	12.0
Purified water conveyance	
Pipelines	15.0 miles (8-inch to 26-inch)
Pump station	
Location	RP-1
Size	2,200 HP
Pump station	

Table 3-11. PUT Alternative 3	
Parameter	**Description**
Location	MVWD Plant 28
Size	150 HP
Number of injection wells	16 (12 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS (RP-1) EWL (Plant 28)
Pipeline	5,100 ft (4-inch to 8-inch)



Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

File Name: CBP_PUTAlternative3

Date: 5/22/2020

N

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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A MUNICIPAL WATER DISTRICT

PUT Alternative 3

Figure 3-8

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3.3.4 PUT Alternative 4

PUT Alternative 4 (PUT-4) assumes that the AWPF is located at RP-4, where 15.0 TAFY of purified recycled water is produced and recharged into MZ-2 and MZ-3. The elements of PUT Alternative 4 are as follows:

- Recharge locations
  - MZ-2: The majority of the purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
  - MZ-3: A smaller portion of water would be recharged via injection wells in MZ-3.
- AWPF
  - The AWPF (MF-ROP-AOP) would be located at RP-4. The preliminary RP-4 AWPF layout is shown in Figure 3-4.
- Conveyance
  - Purified water would be pumped from the AWPF to the injection well sites in MZ-2 and MZ-3.
  - Brine from the AWPF would be pumped in to the NRWS pipeline and conveyed to LACSD for disposal.

PUT Alternative 4 is summarized in Table 3-12 and shown in Figure 3-9.

Table 3-12. PUT Alternative 4

Parameter	Description
Recharge Locations	MZ-2, MZ-3
AWPF	
Location	RP-4
Process	MF/RO/UV-AOP
Capacity (TAFY)	15.0
Purified water conveyance	
Pipelines	9.4 miles (8-inch to 26-inch)
Pump station	
Location	RP-4
Size	1,000 HP
Number of injection wells	15 (11 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS
Pipeline	1,400 ft (8-inch)

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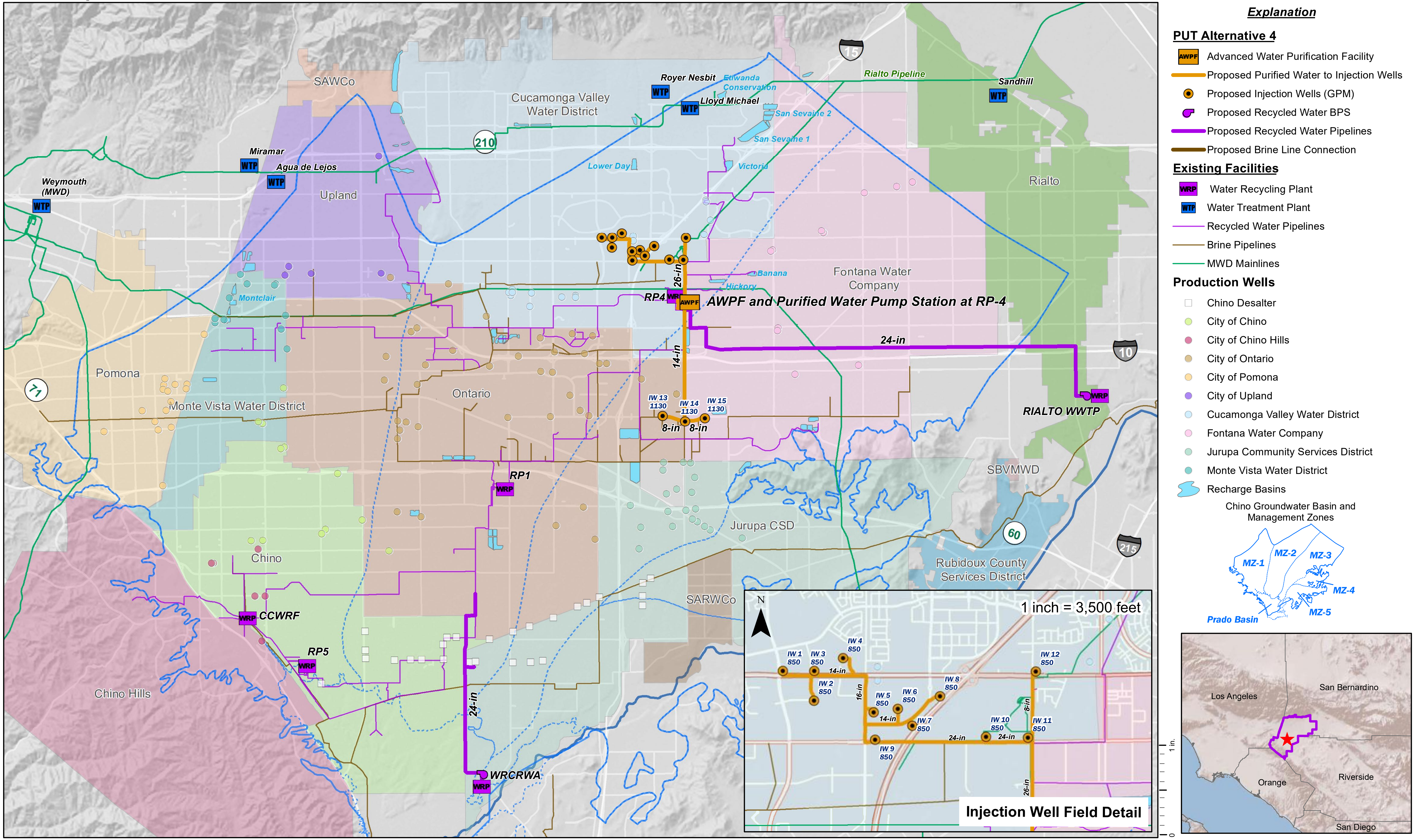

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

Date: 5/22/2020

File Name: CBP_PUTAlternative4

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 4

Figure 3-9

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3.3.5 PUT Alternative 5

PUT Alternative 5 (PUT-5) assumes that the AWPF is located at RP-4, where 15.0 TAFY of purified recycled water is produced and recharged into MZ-2. The elements of PUT Alternative 5 are as follows:

- Recharge location
  - MZ-2: All purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation .
- AWPF
  - The AWPF (MF-ROP-AOP) would be located at RP-4. The preliminary RP-4 AWPF layout is shown in Figure 3-4.
- Conveyance
  - Purified water would be pumped from the AWPF to the injection well sites in MZ-2.
  - Brine from the AWPF would be pumped in to the NRWS pipeline and conveyed to LACSD for disposal.

PUT Alternative 5 is summarized in Table 3-13 and shown in Figure 3-10.

Table 3-13. PUT Alternative 5

Parameter	Description
Recharge Locations	MZ-2
AWPF	
Location	RP-4
Process	MF/RO/UV-AOP
Capacity (TAFY)	15.0
Purified water conveyance	
Pipelines	7.1 miles (8-inch to 30-inch)
Pump station	
Location	RP-4
Size	1,500 HP
Number of injection wells	16 (12 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS
Pipeline	1,400 ft (8-inch)

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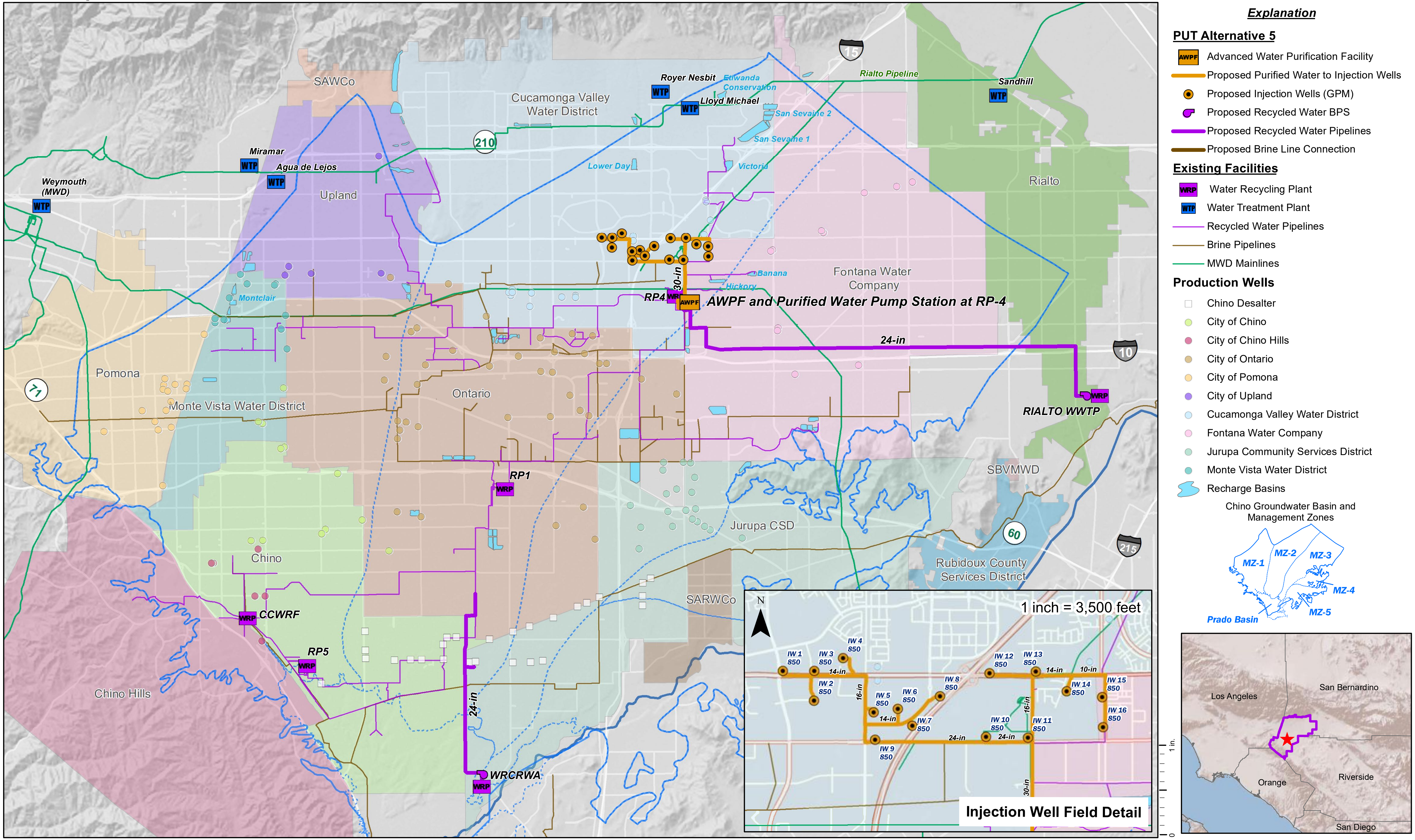

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

Date: 5/22/2020

File Name: CBP_PUTAlternative5

N

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 5

Figure 3-10

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3.3.6 PUT Alternative 6

PUT Alternative 6 (PUT-6) assumes that the AWPFs are located at RP-4 and MVWD's Plant 28, where 12.0 TAFY and 3.0 TAFY of purified water is produced, respectively, and recharged into MZ-2 and MZ-1. The elements of PUT Alternative 6 are as follows:

- Recharge locations
  - MZ-2: The majority of the purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
  - MZ-1: A smaller portion of water would be recharged via injection wells in MZ-1.
- AWPF
  - Two AWPFs would be developed for this alternative: the main AWPF (MF-RO-AOP) at RP-4 and a smaller AWPF (MF-RO-AOP) at MVWD's Plant 28.
  - The preliminary AWPF layouts at RP-4 and Plant 28 are shown in Figure 3-4 and Figure 3-5, respectively.
- Conveyance
  - Purified water would be pumped from the RP-4 AWPF to the injection well sites in MZ-2, and from the MVWD Plant 28 AWPF to injection well sites in MZ-1.
  - Brine from the RP-4 AWPF would be pumped to the NRWS and brine from the MVWD Plant 28 AWPF would be pumped to the EWL; both the NRWS and EWL discharge into LACSD's system for disposal.

PUT Alternative 6 is summarized in Table 3-14 and shown in Figure 3-11.

Table 3-14. PUT Alternative 6

Parameter	Description
Recharge Locations	MZ-1, MZ-2
AWPF (MZ-1)	
Location	MVWD Plant 28
Process	MF/RO/UV-AOP
Capacity (TAFY)	3.0
AWPF (MZ-2)	
Location	RP-4
Process	MF/RO/UV-AOP
Capacity (TAFY)	12.0
Purified water conveyance	
Pipelines	7.9 miles (8-inch to 26-inch)
Pump station	
Location	RP-4
Size	1,000 HP
Pump station	

Table 3-14. PUT Alternative 6	
Parameter	**Description**
Location	MVWD Plant 28
Size	150 HP
Number of injection wells	16 (12 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS (RP-1) EWL (Plant 28)
Pipeline	2,200 ft (4-inch to 8-inch)

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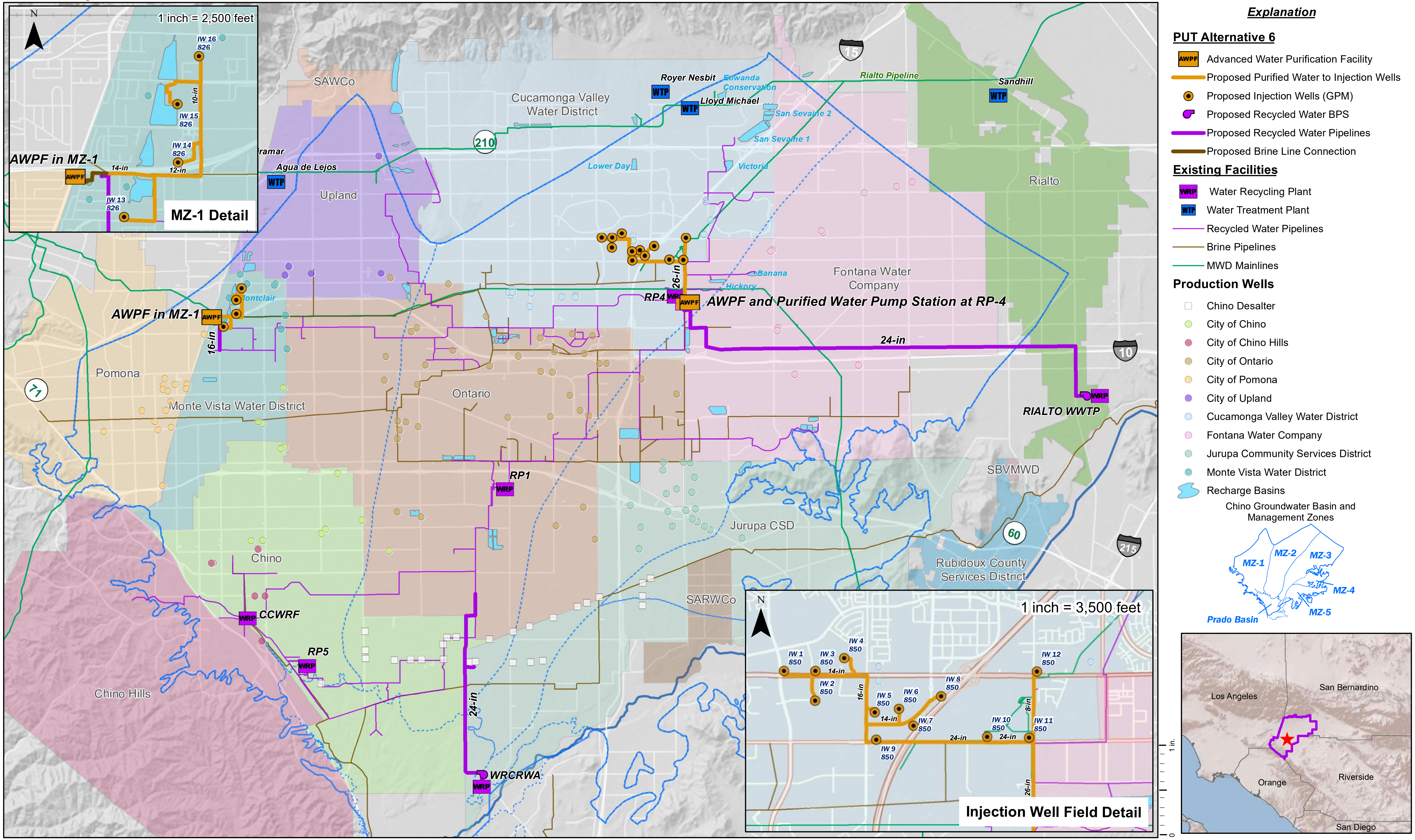

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

File Name: CBP_PUTAlternative6

Date: 5/22/2020

N

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 6

Figure 3-11

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3.3.7 PUT Alternatives Summary and Costs

Major components of each PUT alternative are summarized in Table 3-15. This table includes the detailed assumptions for each PUT component for PUT Alternatives 1 through 6, including recycled water conveyance, AWPF(s), purified water conveyance, recharge approach, and brine conveyance.

The PUT alternatives conceptual capital cost estimates are summarized in Table 3-16 and O&M and NPV cost estimates are summarized in Table 3-17. The capital and O&M costs were developed for each major component using a unit cost basis, which is described in detail in TM 1 Section 7. The capital cost estimates are Class 5 estimates based on the AACE International Cost Estimate Classification System criteria, which corresponds to a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate are -20 to -50 percent on the low end and +30 to +100 on the high end. NPV costs were developed over a project life-cycle of 50 years using the economic analysis tool that is described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020).

The capital costs for the PUT alternatives range from a low of $306M (PUT-5) to a high $379M (PUT-3) (in 2019 dollars), the annual O&M costs range from a low of $10.9M/year (PUT-4) to a high of $14.7M/year (PUT-2), and the NPV costs range from $829M (PUT-4) to $1,064M (PUT-2). Following are observations of the estimated costs for the six PUT alternatives:

- The PUT alternatives that include the main AWPF at RP-1 (PUT-1, PUT-2, and PUT-3) are more expensive on capital, O&M, and NPV costs than the PUT alternatives that include the main AWPF at RP-4 (PUT-4, PUT-5, and PUT-6).
  - On a capital cost basis, the capital costs for PUT-1 to PUT-3 are $59-72M higher than PUT-4 to PUT-6: the capital costs for PUT-1 to PUT-3 range from $373M to $379M and PUT-4 to PUT-6 range from $306M to $320M. The higher capital costs for PUT-1 to PUT-3 are due to higher costs for the AWPF(s), pipelines, and pump stations.
  - On an O&M cost basis, the O&M costs for PUT-1 to PUT-3 are $2.5M/year to $3.6M/year higher than PUT-4 to PUT-6: the O&M costs for PUT-1 to PUT-3 range from $13.7M/year to $14.7M/year and PUT-4 to PUT-6 range from $10.9M/year to $11.4M/year. The higher O&M costs for PUT-1 to PUT-3 are due to the higher purified water pumping costs since RP-1 is further away from the injection wells than RP-4.
  - On an NPV basis, the NPV costs for PUT to PUT-3 are $161M to $222M higher than PUT-4 to PUT-6: the NPV costs for PUT-1 to PUT-3 range from $1,009M to $1,064M and PUT-4 to PUT-6 range from $829M to $855M.
- Within the RP-4 alternatives (i.e., PUT-4 to PUT-6), PUT-6 has the highest capital cost of the three alternatives, which is due to the higher costs for two AWPFs versus one AWPF in PUT-4 and PUT-5. PUT-6 has an estimated capital cost of $320M and PUT-4 and PUT-5 are $309M and $306M, respectively.
  - The same trend exists within the RP-1 alternatives (PUT-1 to PUT-3), but the cost differential between PUT-3 (the alternative with two AWPFs) is not as great when compared to PUT-1 and PUT-2, each with just one AWPF. PUT-3 has an estimated capital cost of $379M versus $373M and $378M for PUT-1 and PUT-2, respectively.

The costs for the PUT alternatives are incorporated into the alternatives evaluation, which is presented in the following section.

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Table 3-15. PUT Alternatives Summary

PUT Elements	Parameters	PUT Alternatives 1 AWPF at RP-1 Recharge in MZ2 and MZ3	2 AWPF at RP-1 Recharge in MZ2	3 AWPFs at RP-1 and in MZ1 Recharge in MZ1 and MZ2	4 AWPF at RP-4 Recharge in MZ2 and MZ3	5 AWPF at RP-4 Recharge in MZ2	6 AWPFs at RP-4 and in MZ1 Recharge in MZ1 and MZ2
Recycled Water Conveyance	Description	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •83,600 ft 16-inch •2,000 ft trenchless **•85,600 ft Total** **•16.2 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •83,600 ft 16-inch •2,000 ft trenchless **•85,600 ft Total** **•16.2 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •87,740 ft 16-inch •2,000 ft trenchless **•89,740 ft Total** **•17.0 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •83,600 ft 16-inch •2,000 ft trenchless **•85,600 ft Total** **•16.2 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •83,600 ft 16-inch •2,000 ft trenchless **•85,600 ft Total** **•16.2 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •87,740 ft 16-inch •2,000 ft trenchless **•89,740 ft Total** **•17.0 miles Total**
AWPF(s)	Description	*RP-1* •14.03-mgd AWPF (MBR/RO/UVAOP) (95.5% online factor) •Equalization: Modification of existing RP-1 lagoon *RP-4* •None *MZ1 at MVWD Plant 28 Site* •None	*RP-1* •14.03-mgd AWPF (MBR/RO/UVAOP) (95.5% online factor) •Equalization: Modification of existing RP-1 lagoon *RP-4* •None *MZ1 at MVWD Plant 28 Site* •None	*RP-1* •11.20-mgd AWPF (MBR/RO/UVAOP) (95.5% online factor) •Equalization: Modification of existing RP-1 lagoon *RP-4* •None *MZ1 at MVWD Plant 28 Site* •2.83-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 0.75-MG tank	*RP-1* •None *RP-4* •14.03-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 2.5-MG tank *MZ1 at MVWD Plant 28 Site* •None	*RP-1* •None *RP-4* •14.03-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 2.5-MG tank *MZ1 at MVWD Plant 28 Site* •None	*RP-1* •None *RP-4* •11.20-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 2.5-MG tank *MZ1 at MVWD Plant 28 Site* •2.83-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 0.75-MG tank
Purified Water Conveyance to Injection Wells & Recharge Basins	Description	*RP-1 AWPF Pump Station* •2,600 hP pump station *Pipelines* •8-inch:13,020 ft •10-inch: 2,234 ft •12-inch: 2,757 ft •14-inch: 20,304 ft •16-inch: 2,861 ft •20-inch: 720 ft •26-inch: 27,566 ft •30-inch: 16,065 ft •Trenchless: 11,170 ft **•Total: 85,527 ft** **•Total: 16.2 miles**	*RP-1 AWPF Pump Station* •2,700 hP pump station *Pipelines* •8-inch: 11,113 ft •10-inch: 2,757 ft •14-inch: 4,325 ft •16-inch: 5,411 ft •18-inch: 1,689 ft •20-inch: 5,517 ft •30-inch: 43,631 ft •Trenchless: 10,400 **•Total: 74,443 ft** **•Total 14.1 miles**	*RP-1 AWPF Pump Station* •2,200 hP pump station *Pipelines* •8-inch: 10,203 ft •10-inch: 2,234 ft •14-inch: 7,248 ft •16-inch: 2,861 ft •20-inch: 720 ft •26-inch: 43,620 ft •Trenchless: 9,950 ft **•Total: 66,886 ft** **•Total: 12.7 miles** *MVWD Plant 28 AWPF PS* •150 hP pump station at Plant 28 *Pipelines* •8-inch: 6,038 ft •10-inch: 1,741 ft •12-inch: 2,305 ft •14-inch: 2,199 ft •Trenchless: 1,180 **•Total: 12,283 ft** **•Total: 2.3 miles**	*RP-4 AWPF Pump Station* •1,000 hP pump station *Pipelines* •8-inch: 15,686 ft •10-inch: 545 ft •12-inch: 76 ft •14-inch: 17,117 ft •16-inch: 2,458 ft •20-inch: 1,120 ft •24-inch: 6,269 ft •26-inch: 6,496 ft •Trenchless: 3,700 ft **•Total: 49,766 ft** **•Total: 9.4 miles**	*RP-4 AWPF Pump Station* •1,500 hP pump station *Pipelines* •8-inch: 11,113 ft •10-inch: 2,757 ft •14-inch: 4,325 ft •16-inch: 5,230 ft •20-inch: 1,120 ft •24-inch: 6,269 ft •30-inch: 6,496 ft •Trenchless: 2,650 ft **•Total: 37,310 ft** **•Total: 7.1 miles**	*RP-4 AWPF Pump Station* •1,000 hP pump station *Pipelines* •8-inch: 10,016 ft •10-inch: 545 ft •14-inch: 2,854 ft •16-inch: 2,458 ft •20-inch: 1,120 ft •24-inch: 6,269 ft •26-inch: 6,496 ft •Trenchless: 2,200 ft **•Total: 29,758 ft** **•Total: 5.6 ft** *MVWD Plant 28 AWPF PS* •150 hP pump station at Plant 28 *Pipelines* •8-inch: 6,038 ft •10-inch: 1,741 ft •12-inch: 2,305 ft •14-inch: 2,199 ft •Trenchless: 1,180 ft **•Total: 12,283 ft** **•Total: 2.3 miles**
Recharge Approach	Description	*MZ1* •None *MZ2* •12 injection wells (9 duty, 3 standby) •1,333 AFY (830 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ3* •3 injection wells (2 duty, 1 standby) •1,500 AFY (930 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells	*MZ1* •None *MZ2* •16 injection wells (12 duty, 4 standby) •1,250 AFY (775 gpm) injection capacity/well •0.23-acres land purchase/well •4 monitoring wells *MZ3* •None	*MZ1* •4 injection wells (3 duty, 1 standby) •1,000 AFY (620 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ2* •12 injection wells (9 duty, 3 standby) •1,333 AFY (830 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ3* •None	*MZ1* •None *MZ2* •12 injection wells (9 duty, 3 standby) •1,333 AFY (830 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ3* •3 injection wells (2 duty, 1 standby) •1,500 AFY (930 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells	*MZ1* •None *MZ2* •16 injection wells (12 duty, 4 standby) •1,250 AFY (775 gpm) injection capacity/well •0.23-acres land purchase/well •4 monitoring wells *MZ3* •None	*MZ1* •4 injection wells (3 duty, 1 standby) •1,000 AFY (620 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ2* •12 injection wells (9 duty, 3 standby) •1,333 AFY (830 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ3* •None
Brine Conveyance	Description	*RP-1 Pipeline* •8-inch: 3,907 ft •Trenchless: 400 ft *MZ1 Pipeline at MVWD Plant 28 Site* •None	*RP-1 Pipeline* •8-inch: 3,907 ft •Trenchless: 400 ft *MZ1 Pipeline at MVWD Plant 28 Site* •None	*RP-1 Pipeline* •8-inch: 3,907 ft •400 ft trenchless *MZ1 Pipeline at MVWD Plant 28 Site* •4-inch: 819 ft	*RP-4 Pipeline* •8-inch: 1,358 ft *MZ1 Pipeline at MVWD Plant 28 Site* •None	*RP-4 Pipeline* •8-inch: 1,358 ft *MZ1 Pipeline at MVWD Plant 28 Site* •None	*RP-4 Pipeline* •8-inch: 1,358 ft *MZ1 Pipeline at MVWD Plant 28 Site* •819 ft 4-inch

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Table 3-16. PUT Alternatives Conceptual-Level Capital Cost Estimates						
Parameter	**PUT Alternatives ($M)**					
	PUT-1	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
AWPF(s)	$116.5	$116.5	$120.2	$113.7	$113.7	$117.9
Pipelines[1]	$52.5	$53.7	$50.7	$21.3	$16.9	$19.7
Pump Stations	$12.6	$13.4	$11.3	$5.0	$7.1	$5.6
Injection Wells	$30.0	$32.0	$32.0	$30.0	$32.0	$32.0
Monitoring Wells	$4.5	$3.0	$4.5	$4.5	$3.0	$4.5
AWPF Equalization Tank(s)	$0.05	$0.05	$1.0	$3.3	$3.3	$4.2
Brine Disposal (NRWS)	$10.9	$10.9	$10.9	$10.9	$10.9	$10.9
Land	$2.6	$2.8	$2.8	$2.6	$2.8	$2.8
Subtotal	$229.7	$232.3	$233.4	$191.2	$189.5	$197.6
Contingency (30%)[2]	$64.8	$65.6	$65.9	$53.3	$52.7	$55.2
Subtotal	$294.5	$297.9	$299.3	$244.5	$242.2	$252.8
Implementation (28%)[2]	$78.7	$79.6	$80.0	$64.7	$64.0	$66.9
Total Capital Cost ($M)						
Total Capital Cost ($2019)	**$373.3**	**$377.5**	**$379.3**	**$309.1**	**$306.2**	**$319.7**
Total Capital Cost ($2024)[3]	$412.1	$416.8	$418.8	$341.3	$338.1	$353.0

Notes:

[1]*Includes purified water and brine pipelines. Recycled water pipeline accounted for under external supplies.*

[2]*Brine disposal (NRW) and land costs not included in contingency or implementation calculations.*

[3]*2024 is the estimated mid-point of construction.*

[4]*Costs for external recycled water supplies are not included in the PUT Alternatives Conceptual-Level Cost Estimates.*

Table 3-17. PUT Alternatives Conceptual-Level Annual O&M Cost Estimates						
Parameter	**PUT Alternatives ($M/year)**					
	PUT-1	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
PUT - Subtotal						
AWPF[1]	$8.5	$8.5	$7.9	$5.4	$5.6	$5.3
Pipelines[2]	$0.09	$0.08	$0.08	$0.05	$0.04	$0.05
Pumping – Purified Water	$3.2	$3.4	$2.8	$1.2	$1.8	$1.4
Pumping – Recycled Water (IEUA System)	$0.5	$0.5	$0.7	$2.0	$2.0	$2.2
Injection/Monitoring Wells	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5
NRW Disposal	$1.3	$1.3	$1.3	$1.3	$1.3	$1.3
External supplies – subtotal						
Pipelines – Recycled Water	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08
Pump Stations – Recycled Water	$0.4	$0.4	$0.4	$0.4	$0.2	$0.4
Annual O&M Cost ($2019) ($M/year)	**$14.5**	**$14.7**	**$13.7**	**$10.9**	**$11.4**	**$11.2**
NPV Cost[3] ($2019) ($M)	**$1,051**	**$1,064**	**$1,009**	**$829**	**$855**	**$848**

Notes:

[1]Includes purified water pump station and equalization tank.

[2]Includes purified water and brine pipelines.

[3]From the economic analysis tool, Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The PUT NPV costs were estimated on a program basis assuming TAKE-4c for the TAKE alternative.

[4]Costs for external recycled water supplies are not included in the PUT Alternatives Conceptual-Level Cost Estimates.

3.4 PUT Alternatives Evaluation

Alternatives were evaluated using a multi-criteria approach, which allows for the quantification and visualization of the relative performance of each individual alternative so they can be compared with one another on a common basis. This approach is organized with five overarching program objectives that encompass the CBP goals, each with associated evaluation criteria to measure how well each alternative meets the objectives. All PUT alternatives were developed to meet the two minimum requirements for alternatives, which include (1) meet Basin-wide objectives and regulatory requirements and (2) provide water exchange for the benefit of the Delta Ecosystem. The minimum requirements are described in more detail in TM1 Section 8

This section summarizes the PUT alternatives evaluation for PUT-1 through PUT-6 with scores assigned for each alternative for each criterion. The following Sections 3.4.1 through 3.4.5 describe the scoring rationale for all evaluation criteria, organized by the five project objectives. The scores were assigned as follows:

- Each alternative was analyzed for each criterion and assigned a score of 1 through 5, with 5 being most advantageous and 1 being the least advantageous.
- The evaluation criteria are scored either quantitatively or qualitatively. Quantitative criteria are those criteria that are scored based on attributes that can be measured, such as pipeline length. Qualitative criteria are scored based on an opinion of how well that alternative supports the evaluation criterion, such as the ability to meet future direct potable reuse (DPR) needs. Criteria that require qualitative scored with whole numbers, while criteria that are scored qualitatively have rational numbers as scores.

Note that the evaluation criteria were defined for the program alternatives and some individual criteria do not apply to the PUT alternatives. In addition, some of the criteria are non-differentiators when applied to the CBP alternatives alone but would show differentiation if used to compare CBP and non-CBP alternatives. These non-differentiating criteria were included in this evaluation and are described in the following sections. The scoring approach for all criteria is further detailed in TM1 Section 8.

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Table 3-18. PUT Alternatives Evaluation

Objectives			Evaluation Criteria			Alternatives					
No.	Name	Baseline Weighting (%)	No.	Criteria	Baseline Weighting (%)	PUT - 1	PUT - 2	PUT - 3	PUT - 4	PUT - 5	PUT - 6
					AWPF Location(s)	*RP-1*	*RP-1*	*RP-1 & MZ1*	*RP-4*	*RP-4*	*RP-4 & MZ1*
					Recharge Location(s)	*MZ2 & MZ3*	*MZ2*	*MZ1 & MZ2*	*MZ2 & MZ3*	*MZ2*	*MZ1 & MZ2*
					Recharge Approach	*IWs Only*	*IWs Only*	*IWs Only*	*IWs Only*	*IWs Only*	*IWs Only*
1	Develop Basin-wide water supply infrastructure	25%	1a	Create regional exchange opportunities	0%	-	-	-	-	-	-
			1b	Provide synergy with region's planned projects	50%	5.0	5.0	5.0	5.0	5.0	5.0
			1c	Ability to meet future Direct Potable Reuse conveyance needs (raw water augmentation)	50%	4.0	4.0	4.0	4.0	4.0	4.0
			1d	Enhance MWD Rialto Pipeline reliability	0%	-	-	-	-	-	-
			1e	Integrate with other storage programs	0%	-	-	-	-	-	-
			Total - 1a through 1e (Must equal 100%)		100%	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**
2	Increase water supply reliability	15%	2a	Insurance water (critically dry year access to treatment and unused water) (access to emergency supply)	0%	-	-	-	-	-	-
			2b	Address CECs on the horizon (such as PFAS)	50%	5.0	5.0	5.0	5.0	5.0	5.0
			2c	Increased potable water supply (beyond 25-year CBP)	50%	5.0	5.0	5.0	5.0	5.0	5.0
			Total - 2a through 2c (Must equal 100%)		100%	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
3	Streamline operations and maintenance	15%	3a	Minimize operational complexity	40%	3.0	5.0	2.0	3.0	5.0	2.0
			3b	Minimize impacts to water levels in existing wells	25%	4.0	3.0	3.0	4.0	3.0	3.0
			3c	Optimize energy use	35%	3.0	3.0	4.0	3.0	2.0	3.0
			Total - 3a through 3c (Must equal 100%)		100%	**3.3**	**3.8**	**3.0**	**3.3**	**3.5**	**2.6**
4	Minimize program complexity	20%	4a	Minimize institutional complexity	30%	4.0	4.0	2.0	4.0	4.0	2.0
			4b	Minimize implementation complexity	30%	3.0	3.0	2.0	4.0	5.0	3.0
			4c	Leverage existing available land to minimize land acquisition	40%	5.0	4.8	1.0	5.0	4.8	1.0
			Total - 4a through 4c (Must equal 100%)		100%	**4.1**	**4.0**	**1.6**	**4.4**	**4.6**	**1.9**
5	Support cost effectiveness	25%	5a	Minimize NPV costs (includes $206.9 M funding for CBP alternatives) (with pre-delivery charge)	40%	1.2	1.0	1.9	5.0	4.6	4.7
			5b	Minimize capital costs	30%	1.3	1.1	1.0	4.8	5.0	4.3
			5c	Minimize annual O&M costs (with pre-delivery charge)	30%	1.2	1.0	2.1	5.0	4.5	4.7
			Total - 5a through 5c (Must equal 100%)		100%	**1.3**	**1.0**	**1.7**	**5.0**	**4.7**	**4.6**
Total Objectives 1 - 5 (Must equal 100%)		100%			**Total Score:**	**3.5**	**3.5**	**3.1**	**4.5**	**4.5**	**3.8**

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3.4.1 Objective 1 - Develop Basin-Wide Water Supply Infrastructure

PUT alternatives require new infrastructure and facilities, so it is important to have the first objective analyze basin-wide water supply infrastructure to be inclusive of IEUA's and stakeholders' goals. The evaluation criteria used for the objective to develop Basin-wide water supply infrastructure for the PUT alternatives are as follows:

- 1b – Provide Synergy with Region's Planned Projects and
- 1c – Ability to Meet Future Direct Potable Reuse Conveyance Needs.

Note that three criteria under Objective 1 do not apply to the PUT alternatives and, therefore, are not discussed. These include Create Regional Exchange Opportunities (Criterion 1a); Enhance MWD Rialto Feeder Reliability (Criterion 1d); and Integrate with Other Storage Programs (Criterion 1e) . The following sections discuss the applicable criteria, their performance measures, and the scores for each PUT alternative.

3.4.1.1 Provide Synergy with Region's Planned Projects (Criterion 1b)

The ability to combine stakeholders' planned projects with the CBP alternatives is a significant component in developing the basin-wide water supply infrastructure for the CBP since it would enable the stakeholders to benefit more from the program. The performance measured is based on number of planned projects incorporated in the alternative. Alternatives that provide more synergies with stakeholders' planned projects scored higher than alternatives that provide fewer synergies. Because all PUT alternatives provide at least one AWPF, they all score a 5.0 (note that this criterion has more relevance and relative comparison with the TAKE alternatives as described in Section 4.4.). The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The PUT alternatives scores are shown in Table 3-19

Table 3-19. PUT Alternatives – Scoring for Provide Synergy with Region's Planned Projects (Criterion 1b)

Alternative	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Criterion 1b Score	5.0	5.0	5.0	5.0	5.0	5.0

3.4.1.2 Ability to Meet Future Direct Potable Reuse Conveyance Needs (Criterion 1c)

The ability to meet future DPR conveyance needs is an interest to the stakeholders since they may decide to produce recycled water for DRP applications in the future once the regulations are developed. It is assumed that any future DPR project would be raw water augmentation (RWA) and purified water would need to be pumped back to either the Rialto Pipeline or upstream of a surface water treatment plant. This criterion is based on the locations of the AWPF and purified water conveyance infrastructure relative to water treatment plants and the Rialto Pipeline, where the alternatives that are closer to the water treatment plants and Rialto Pipeline score better than those further away. However, due to the limited number of AWPF and conveyance alternatives being considered, all PUT alternatives scored a 4.0. This score was applied over a score of 5.0 because the PUT alternatives would still require additional conveyance for RWA. The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The PUT alternative scores are shown in Table 3-20.

Table 3-20. PUT Alternatives – Scoring for Ability to Meet Future Direct Potable Reuse Conveyance Needs (Criterion 1c)						
Alternative	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
Criterion 1c Score	4.0	4.0	4.0	4.0	4.0	4.0

3.4.2 Objective 2 - Increase Water Supply Reliability

The CBP can diversify and increase the regional water supply portfolio for IEUA and stakeholders. This second objective analyzes alternatives on the basis that it would increase the region's water supply and water quality. The evaluation criteria used for the objective to increase water supply reliability for the PUT alternatives are as follows:

- 2b – Address CECs on the Horizon and
- 2c – Increased Potable Water Supply.

Provide Insurance Water (Criterion 2a) does not apply to PUT alternatives and is not discussed. The following sections discuss the applicable criteria, their performance measures, and the scores for each PUT alternative.

3.4.2.1 Address CECs on the Horizon (Criterion 2b)

The ability to address CECs that are on the horizon are important as it allows for the technology to be implemented before a limit is placed by regulators. An example of a forthcoming CEC limit is for Per- and Polyfluoroalkyl Substances (PFAS). PUT alternatives with full advanced treatment score better than those that do not since CECs are removed prior to groundwater discharge. Because all PUT alternative provide an AWPF, they all score a 5.0. The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The PUT alternative scores are shown in Table 3-21.

Table 3-21. PUT Alternatives – Scoring for Address CECs on the Horizon (Criterion 2b)						
Alternative	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
Criterion 2b Score	5.0	5.0	5.0	5.0	5.0	5.0

3.4.2.2 Increased Potable Water Supply (Criterion 2c)

The ability to increase potable water supply for the region beyond the 25-year CBP is based on IEUA and stakeholders capitalizing on the existing assets developed from the program. The performance measure is the amount of new potable water generated in the Chino Basin area. Since each PUT alternative provides 15.0 TAFY of purified water for groundwater recharge, all score a 5.0. The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The PUT alternatives scores are shown in Table 3-22.

Table 3-22. PUT Alternatives – Scoring for Increased Potable Water Supply (Criterion 2c)						
Alternative	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
Criterion 2c Score	5.0	5.0	5.0	5.0	5.0	5.0

3.4.3 Objective 3 - Streamline Operations and Maintenance

The CBP would introduce new treatment processes and multiple wells that would need to be operated and maintained, thus the ability to streamline the alternative's operation and maintenance is an important third objective. Streamlining these efforts provides efficiency and a smoother transition to these new services amongst stakeholders. The evaluation criteria used for the objective to streamline operations and maintenance for the PUT alternatives are as follows:

- 3a – Minimize Operational Complexity,
- 3b – Minimize Impacts to Water Levels in Existing Wells, and
- 3c – Optimize Energy Use.

The following sections discuss these criteria, their performance measures, and the scores for each PUT alternative.

3.4.3.1 Minimize Operational Complexity (Criterion 3a)

The ability to minimize operational complexity's PUT performance measure is based on the intricacy of operations measured in number of AWPFs and injection wellfields. PUT alternatives that have fewer AWPFs and injection wells fields score better than those that have more. Table 3-22 summarizes the number of AWPS, number injection wells, and scores for each PUT alternative. Note that each PUT alternative would provide the same purified water flow but may be split into multiple AWPF locations. When a PUT alternative requires two AWPFs, 1.0 point is deducted from the overall score. The addition of a second injection wellfield presents more complexity and, therefore, PUT alternatives with two injection wellfields have 2.0 points deducted from their overall score.

Table 3-23. PUT Alternatives – Scoring for Minimize Operational Complexity (Criterion 3a)						
Parameter	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
Number of AWPFs	1 (RP-1)	1 (RP-1)	2 (RP-1 and MZ-1)	1 (RP-4)	1 (RP-4)	2 (RP-4 and MZ-1)
Number of Injection Wellfields	2 (MZ-2 and MZ-3)	1 (MZ-2)	2 (MZ-1 and MZ-2)	2 (MZ-2 and MZ-3)	1 (MZ-2)	2 (MZ-1 and MZ-2)
Criterion 3a Score	3.0	5.0	2.0	3.0	5.0	2.0

3.4.3.2 Minimize Impacts to Water Levels in Existing Wells (Criterion 3b)

The PUT alternatives may positively impact nearby existing wells by increasing groundwater levels at the existing wells. This criterion is evaluated by reviewing well hydrographs and analyzing the water levels at nearby existing wells. When PUT alternatives have minimal changes to local groundwater levels, they were assigned an average score of 3.0. PUT alternatives that positively impact groundwater levels (i.e., increase groundwater levels) receive an increase to the average score by 1.0 point. Based on the preliminary groundwater modeling (see Section 2:), none of the PUT alternatives would negatively impact groundwater levels at nearby extraction wells. Table 3-24 summarizes the groundwater level impacts at nearby wells for each alternative and the associated score.

Table 3-24. PUT Alternatives – Scoring for Minimize Impacts to Water Levels in Existing Wells (Criterion 3b)

Parameter	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Groundwater Level Impacts at Nearby Wells	Increases level	None	None	Increases level	None	None
Criterion 3b Score	4.0	3.0	3.0	4.0	3.0	3.0

3.4.3.3 Optimize Energy Use (Criterion 3c)

The PUT alternatives incorporate infrastructure requiring significant energy and optimization of that energy use must be considered. The performance measure is based on the total energy demand in 1,000 kilowatt-hours (kWh) for the AWPFs and the recycled water and purified water pumping. A lower energy demand results in a higher (better) score. Table 3-25 summarizes the power consumption of the pump stations and AWPF. Note that the energy cost for the RP-1 AWPF does not include the energy required for the RP-1 MBR operation since that process would be both secondary treatment and pre-treatment for RO.

Table 3-25. PUT Alternatives – Scoring for Optimize Energy Use (Criterion 3c)

Component	Power Consumption (1,000 kWh)					
	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Recycled Water Pumping	16,500	17,500	13,900	6,500	9,200	12,900
Purified Water Pumping	2,960	3,000	4,000	12,000	12,000	6,400
AWPF	11,700	11,700	11,900	12,900	12,900	13,000
Total	31,160	32,200	29,800	31,400	34,100	32,300
Criterion 3c Score	3.0	3.0	4.0	3.0	2.0	3.0

3.4.4 Objective 4 – Minimize Program Complexity

The CBP would be a complex program including many stakeholders. This objective measures the complexity of the proposed PUT alternatives. The evaluation criteria used for the objective to minimize program complexity for the PUT alternatives are as follows:

- 4a – Minimize Institutional Complexity,
- 4b – Minimize Implementation Complexity, and
- 4c – Leverage Existing Available Land to Minimize Land Acquisition.

The following sections discuss these criteria, their performance measures, and the scores for each PUT alternative.

3.4.4.1 Minimize Institutional Complexity (Criterion 4a)

The performance measure for the ability to minimize institutional complexity is based on the numbers of contracts/agreements needed with stakeholders. The fewer the agreements with stakeholders the better the score. The Criterion 4a score is based on the number of contracts with stakeholders required for the recycled water, AWPFs, and injection wells. All alternatives would require contracts with JCSD and City of Rialto for tertiary recycled water and Cucamonga Valley Water District (CVWD) for injection wells in MZ-2. PUT-3 and PUT-6 would also require contracts with MVWD for the AWPF at MVWD's Plant 28 site and MVWD and the City of Montclair for the injection wells. Table 3-26 summarizes the contracts needed for each PUT alternative and the scores.

Table 3-26. PUT Alternatives – Scoring for 3.4.4.1 Minimize Institutional Complexity (Criterion 4a)

Parameter	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Required Contracts	JCSD[1], Rialto, CVWD	JCSD[1], Rialto, CVWD	JCSD[1], Rialto, CVWD, MVWD, City of Montclair	JCSD[1], Rialto, CVWD	JCSD[1], Rialto, CVWD	JCSD[1], Rialto, CVWD, MVWD, City of Montclair
Criterion 4a Score	4.0	4.0	2.0	4.0	4.0	2.0

Notes:
[1]For JCSD's recycled water from WRCRWA.

3.4.4.2 Minimize Implementation Complexity (Criterion 4b)

The ability to minimize implementation complexity is scored based on the numbers of project elements and permits for each PUT alternative. The fewer the projects and permits, the better the score. The PUT alternatives were evaluated using the number of projects based on pump stations, miles of pipeline, and pipeline crossings. Crossings refer to pipelines that are constructed below highways or railroad tracks. Each score was calculated individually for each element and then averaged and rounded to the whole number to determine the final score for each PUT alternative. Table 3-27 summarizes the number of AWPFs, pump stations, and crossings; miles of pipelines; and Criterion 1b scores. Note that all PUT alternatives require the same number of permits; since this is not a differentiator, this was not taken into account in the scoring.

Table 3-27. PUT Alternatives – Scoring for Minimize Implementation Complexity (Criterion 4b)

Parameter	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Number of Pump Stations	1	1	2	1	1	2
Number of AWPFs	1	1	2	1	1	2
Number of Crossings	12	11	12	4	4	5
Miles of Pipelines	32.4	30.3	32.0	25.6	23.3	24.9
Criterion 4b Score	3.0	3.0	2.0	4.0	5.0	3.0

3.4.4.3 Leverage Existing Available Land to Minimize Land Acquisition (Criterion 4c)

Since the CBP needs to be implemented by 2026, using existing available land for CBP facilities was identified as a critical element to keep the project on schedule by avoiding complications with land purchases and rezoning or permitting new parcels. Using existing land also helps reduce program costs. Alternatives that require less land acquisition score better than alternatives that require more land acquisition. The scores were calculated by evaluating the total acreage required for injection wells, monitoring wells, and to purchase an equivalent amount of land for MVWD for the Plant 28 site. AWPFs located at RP-1 or RP-4 would be located on IEUA property and no additional land is required. All pipelines would be constructed within public right-of-way. Table 3-28 summarizes the acreage for each component, total acreage, and score.

Table 3-28. PUT Alternatives – Scoring for Leverage Existing Available Land to Minimize Land Acquisition (Criterion 4c)

Component	Land Acquisition (Acres)					
	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Injection Wells	3.4	3.7	3.7	3.4	3.7	3.7
Monitoring Wells	0.09	0.06	0.09	0.09	0.06	0.09
MVWD Plant 28 Site	0	0	2.9	0	0	2.9
Total	3.5	3.7	6.7	3.5	3.7	6.7
Criterion 4c Score	5.0	4.8	1.0	5.0	4.8	1.0

3.4.5 Objective 5 - Support Cost Effectiveness

The ability to support cost effectiveness is an important objective in the multi-criteria evaluation. The cost estimates are summarized in Section 3.3.7 with the cost estimating approach presented in TM1 Section 7. Cost scores were calculated based on the highest cost was the lowest score of 1 and the lowest cost was the highest score of 5. The evaluation criteria used for this objective are as follows:

- 5a – Minimize NPV Costs,
- 5b – Minimize Capital Costs, and
- 5c – Minimize Annual O&M Costs.

For all cost criteria, lower costs result in higher (better) scores and higher costs result in lower (worse) scores. The following sections discuss these criteria, their performance measures, and the scores for each PUT alternative.

3.4.5.1 Minimize NPV Costs (Criterion 5a)

NPV costs were developed over a project lifecycle of 50 years using the economic analysis tool that is described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The NPV costs represent the present value of cash flow over the 25-year CBP and the 25 years following the CBP. The NPV costs include capital costs, replacement costs, annual O&M costs, non-recoverable wastewater disposal costs, and supplemental external source water cost (i.e., recycled water supplies from JCSD and City of Rialto). For the CBP alternatives, the NPV costs take into account the Proposition 1 Water Storage Investment Program (WSIP) funding of $206.9M. The NPV costs are in 2019 dollars.

The economic analysis tool was developed to calculate the NPV costs for overall CBP costs. Therefore, the program costs were estimated for the six PUT alternatives assuming that the TAKE portion was TAKE-4c, and then the PUT portion of the NPV cost was separated out. Table 3-29 summarizes the NPV costs and scores.

Table 3-29. PUT Alternatives – Scoring for Minimize NPV Costs (Criterion 5a)

Alternatives	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
NPV Cost ($M 2019)	$1,051	$1,064	$1,009	$829	$855	$848
Criterion 5a Score	1.2	1.0	1.9	5.0	4.6	4.7

3.4.5.2 Minimize Capital Costs (Criterion 5b)

Capital costs include the cost of equipment and construction costs including direct and indirect costs of all elements. The capital costs for the PUT alternatives include all PUT components as summarized in Table 3-15 PUT Alternatives Summary, which includes recycled water conveyance for supplies from JCSD and the City of Rialto), the AWPF(s), purified water conveyance (pump station and pipelines), injection wells for groundwater recharge and monitoring wells, and brine conveyance. The capital costs include contingency and project implementation costs for engineering services, client administration, and construction management. The capital costs are in 2019 dollars. Table 3-30 summarizes the capital costs and scores.

Table 3-30. PUT Alternatives – Scoring for Minimize Capital Costs (Criterion 5b)

Alternatives	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Capital Cost ($M 2019)	$373.3	$377.5	$379.3	$309.1	$306.2	$319.7
Criterion 5b Score	1.3	1.1	1.0	4.8	5.0	4.3

3.4.5.3 Minimize Annual O&M Costs (Criterion 5c)

O&M costs include annual costs to operate, manage, and maintain the equipment and infrastructure for each alternative. The annual O&M costs for the PUT alternatives include annual O&M costs for recycled water conveyances, the AWPFs, purified water conveyance, brine disposal, and injection well and monitoring wells. The annual O&M costs are in 2019 dollars. Table 3-31 summarizes the O&M costs and scores.

Table 3-31. PUT Alternatives – Scoring for Minimize Annual O&M Costs (Criterion 5c)

Alternatives	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Annual O&M Cost ($M/year 2019)	$14.5	$14.7	$13.7	$10.9	$11.4	$11.2
Criterion 5c Score	1.2	1.0	2.1	5.0	4.5	4.7

3.5 PUT Alternatives Recommendations

Based on the results of the PUT alternatives evaluation, and as shown in Table 3-18 PUT Alternatives Evaluation, PUT Alternatives 4 and 5 were the highest ranked. Both alternatives locate the AWPF at RP-4 with the water recharged in both MZ-2 and MZ-3 under PUT-4 and in MZ-2 only in PUT-5.

PUT-1 through PUT-3, which all include the main AWPF at RP-1 and PUT-3 also includes a smaller AWPF in MZ-1, and PUT-6, which includes the main AWPF at RP-4 and a smaller AWPF in MZ-1, did not score as well for the following reasons:

- **AWPF at RP-1:** PUT-1 through PUT-3 (AWPF at RP-1) scored lower overall than PUT-4 through PUT-6 (AWPF at RP-4). The primary objective that differentiated the scores between these two sets of alternatives is Objective 5 – Support cost effectiveness. PUT-1 through PUT-3 scored between 1.0 and 1.7, whereas PUT-4 through PUT-6 scored in the range of 4.6 to 5.0. PUT-1 through PUT-3 are more costly than PUT-4 through PUT-6 due to the following differences:
  - Slightly higher AWPF costs at RP-1 due to early integration of MBR with the AWPF (MBR has a higher unit cost than MF). For the purpose of this conceptual-level cost evaluation, the proportion of the MBR costs associated with the AWPF are included as the CBP requires construction of the MBR retrofit earlier (online by 2026) than IEUA's capital planning indicates (online around 2030).
  - Higher purified water conveyance costs for PUT-1 through PUT-3 for both pipelines and the pump station because RP-1 is farther away from the injection wells than RP-4.
  - Higher annual O&M costs due to increased pumping costs from RP-1 to the injection wells.
- **AWPF at MVWD Plant 28:** PUT-3 and PUT-6 both include the 3.0-TAFY AWPF at MVWD Plant 28 in MZ-1, as well as the larger 12.0-TAFY AWPF at RP-1 and RP-4, respectively. Both of these alternatives did not score as well on Objective 3 – Streamline operations and maintenance or Objective 4 – Minimize program complexity because of the following:
  - Objective 3 – Streamline operations and maintenance: PUT-3 and PUT-6, which have two AWPFs, score lower because these alternatives are more operationally complex than PUT-1, 2, 5, and 6, which only have one AWPF.
  - Objective 4 – Minimize program complexity: PUT-3 and PUT-6 score lower because they are more institutionally complex with an AWPF located on MVWD's property, more complex implementation due to two AWPFs and two purified water conveyance systems, and would require land acquisition to replace the MVWD Plant 28 site for MVWD.

It should also be noted that the location of the AWPF at RP-1 would be on the southwestern corner of the site in place of the existing solar panels. IEUA's solar contract ends in June 2029, but the AWPF needs to be in service by 2026. The costs associated with modifying the solar contract for an earlier end date are not included in the AWPF costs. If these were included, then the PUT-1 through PUT-3 costs would increase and their overall scores would decrease.

Since PUT Alternative 4 scored equally to PUT Alternative 5, IEUA could consider advancing both concepts in the next stages of the project. The primary difference between these alternatives is the recharge approach: PUT Alternative 5 assumes all water is recharged in MZ-2 and PUT Alternative 4 assumes that 12.0 TAFY is recharged in MZ-2 and 3.0 TAFY is recharged in MZ-3. Advancing PUT Alternative 4 would include evaluating injection well locations in MZ-3 and pipeline alignments in parallel with advancing PUT Alternative 5. However, based on alignment with the Storage Framework Investigation and preferred injection locations (i.e., northern MZ-2), PUT Alternative 5 is recommended to carry forward as the PUT approach for the program alternatives.

Basis for AWPF Site Location – Expanded Summary

As described in TM1 Section 4.2, locations at RP-1, RP-4 and RP-5 were considered for the AWPF to meet CBP objectives and regulatory compliance. As discussed in IEUA's *"2020 Regulatory Challenges Memorandum,"* the need for an AWPF was established to meet both IEUA's wastewater NPDES Permit limit conditions for TDS and for its GWR Permit Regulations compliance for constituents such as 1,2,3-TCP and PFAS.

RP-5 was initially considered because of the impending expansion project at RP-5, which includes conversion to a Membrane Bio Reactor (MBR) treatment system which could be advantageous for planning a downstream AWPF, pending regulatory development and approval. If an AWPF is constructed at RP-5, it will address only the recycled water effluent NPDES permit limits; it will not address the use of recycled water within the basin and the GWR regulations compliance. Also since RP-5 is situated hydraulically low in the IEUA recycled water distribution system, the use of its advanced purified water would be limited to discharge of unused recycled water as effluent to the Chino Creek/Santa Ana River and would not provide the same operational flexibility and benefits of locating in the northern service area of either RP-1 or RP-4. If the AWPF is located at RP-5 in the far southern end of the service area, significant piping and pumping infrastructure would be needed to get this high-quality water to ideal recharge locations in the northern service area. Further, the Chino Basin Watermaster's 2018 Storage Framework Investigation (SFI) prioritized recharge ("PUTS") to occur in the north eastern portion of the Chino Basin (Management Zone 2) to minimize pumping sustainability challenges, minimize impacts of storage and recovery, preserve the current state of hydraulic control, and to take advantage of the groundwater storage capabilities in Management Zone 2.

As a result, RP-1 and RP-4 were identified as preferred options for modification to include advanced water purification as part of the CBP because of their advantages relative to operational flexibility and compatible future expansion plans. As part of PUT Alternative 5 (PUT-5), this TM identifies RP-4 to be the preferred AWPF location over RP-1 due to its proximity to recharge basins, its greater capacity to pump to recharge basins, future injection wells, space availability, ability to integrate with future direct potable reuse opportunities and proximity of surface water treatment plants, its consistency with the SFI recharge prioritization, and overall operational flexibility. An AWPF at RP-4 will meet regulatory and permit requirements.

Section 4: TAKE Alternatives

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. Each TAKE alternative includes the following components:

- Groundwater extraction
- Blending and potential treatment of extracted groundwater
- Delivery of potable water to MWD and/or IEUA member agencies and neighboring agencies

The TAKE alternatives were developed based on the assumptions presented in TM1 Section 5 TAKE Components and TM1 Section 6 Conveyance Approach. The components were refined during the alternatives development process based on the initial groundwater modeling that was completed using the Chino Basin Groundwater Model (see Section 2:) to optimize the locations of the injection and extraction wells to minimize infrastructure costs.

This section describes how the TAKE alternatives were developed and provides both an overview and detailed description of each alternative, as well as the evaluation of the TAKE alternatives and recommendation of which TAKE alternatives to carry forward into the program alternatives.

4.1 TAKE Alternatives Development Approach and Overview

Six TAKE alternatives were created and evaluated to determine the best alternative for extracting and delivering stored CBP water. The following three variables were used to formulate the TAKE alternatives:

- Water delivery conditions (standard delivery or pre-delivery);
- Multiple available water delivery mechanisms (MWD pump back, In-Lieu CBP, and In-Lieu Local); and
- Physical limitations on IEUA member agencies' ability to use CBP water in-lieu of wet imported water.

The factors are discussed in the following sections, and a summary of the proposed alternatives is provided in Section 4.1.4.

4.1.1 Amount of Water to be Delivered

The WSIP funding agreement is based on delivering 375.0 TAF of water via in-lieu exchange to the Sacramento - San Joaquin Delta (Delta) from IEUA over the 25-year life of the Program. This is a contribution of raw water by IEUA from the Chino Basin directly to DWR for environmental benefit in the Delta in exchange for the WSIP funding. Over the 25-year Program, DWR would declare 7.5 years as call years, which require a reduction in pumping from the Delta by 50.0 TAF in that year, which equates to 375.0 TAF to the Delta over the Program duration. This is achieved through a transfer of water during call years from IEUA to DWR using MWD as its State Water Project Contractor and intermediate party, as follows:

1. DWR would declare a call year and, on behalf of IEUA, MWD would pump 50.0 TAF less water out of the Delta in that year, making MWD 50.0 TAF short of water.
2. IEUA would make MWD whole by extracting 50.0 TAF of water stored in the Chino Basin and delivering it to MWD by any one or a combination of the delivery mechanisms further described in Section 4.1.2. This delivery of water from IEUA to MWD constitutes the TAKE portion of the Project.

Item 2 above can be achieved by a simultaneous or a deferred exchange of water. A simultaneous exchange (i.e., delivering 50.0 TAFY in the call year) is considered standard delivery, and a deferred exchange (i.e., delivering water every year) is referred to as pre-delivery. Standard delivery and pre-delivery are described further below:

- **Standard delivery:** Under standard delivery (e.g., no pre-delivery), the multi-party transfer of water is a simultaneous or bucket-for-bucket transfer. When DWR declares a call year and MWD leaves 50.0 TAFY in the Delta for that year, IEUA immediately delivers 50.0 TAFY of water to MWD (or to IEUA member agencies on behalf of MWD, as discussed in TAKE Mechanisms Section 4.1.2). TAKE facilities would be sized to produce and convey 50.0 TAFY of stored groundwater to repay MWD for the 50.0 TAFY they are leaving in the Delta during call years. During the 17.5 non-call years, no water would be delivered from IEUA to MWD. The following equation summarizes how the 375 TAF of water transfer is delivered to MWD over the life of the project in this condition:

$$7.5\ Call\ Years\ \times \frac{50.0\ TAF}{Call\ Year} = 375.0\ TAF$$

- **Pre-Delivery:** Under pre-delivery, the multi-party transfer is a deferred exchange. When DWR declares a call year and MWD leaves 50.0 TAFY in the Delta for that year, IEUA would pay back 26.7 TAFY during that call year rather than 50.0 TAFY for standard delivery. During non-call years, even though MWD would not be leaving water in the Delta, IEUA would deliver 10.0 TAFY to MWD to complete the 375.0 TAF total transfer over the 25-year Program. Pre-delivery allows the TAKE infrastructure to be sized for a peak flow of 26.7 TAFY rather than 50 TAFY which reduces infrastructure costs, and also allows for more consistent delivery of water from year to year. Note that 10.0 TAFY was the assumed pre-delivery amount for developing the

TAKE alternatives. The following equations summarize how the 375.0 TAFY of water transfer is delivered to MWD over the life of the project in this condition:

$$7.5\ Call\ Years\ \times \frac{26.7\ TAF}{Call\ Year} = 200.0\ TAF$$

$$17.5\ Non\ Call\ Years\ \times \frac{10.0\ TAF}{Non\ Call\ Year} = 175.0\ TAF$$

$$7.5\ Call\ Years + 17.5\ Non\ Call\ Years = 25\ Years$$

$$200.0\ TAF + 175.0\ TAF = 375.0\ TAF$$

Table 4-1 provides an example breakdown of water delivery over the 25-year Program for both standard delivery and pre-delivery, as well as the assocated delivery from MWD to the Delta.

Table 4-1. Example Breakdown of Call Year and Non-Call Year Deliveries from IEUA to MWD and from MWD to the Delta

Year of Project	Call or Non-Call Year[1]	Standard Delivery (TAF)	Pre-Delivery (TAF)[2]	MWD Delivery to Delta (TAF)
1	Call	50.0	26.7	50.0
2	Non-Call	0	10.0	0
3	Non-Call	0	10.0	0
4	Non-Call	0	10.0	0
5	Call	50.0	26.7	50.0
6	Non-Call	0	10.0	0
7	Non-Call	0	10.0	0
8	Non-Call	0	10.0	0
9	Call	50.0	26.7	50.0
10	Non-Call	0	10.0	0
11	Non-Call	0	10.0	0
12	Non-Call	0	10.0	0
13	Non-Call	0	10.0	0
14	Call	50.0	26.7	50.0
15	Non-Call	0	10.0	0
16	Non-Call	0	10.0	0
17	Call	50.0	26.7	50.0
18	Non-Call	0	10.0	0
19	Non-Call	0	10.0	0

Table 4-1. Example Breakdown of Call Year and Non-Call Year Deliveries from IEUA to MWD and from MWD to the Delta

Year of Project	Call or Non-Call Year[1]	Standard Delivery (TAF)	Pre-Delivery (TAF)[2]	MWD Delivery to Delta (TAF)
20	Non-Call	0	10.0	0
21	Call	50.0	26.7	50.0
22	Non-Call	0	10.0	0
23	Call	50.0	26.7	50.0
24	Non-Call	0	10.0	0
25	Non-Call/Call Split	25.0	18.3[3]	25.0 AF
Total	17.5 Non-Call 7.5 Call	375.0 TAF	375.0 TAF	375.0 TAF

Notes:

[1]Call years listed here are an example only; the 7.5 call years that would actually occur would be determined by the DWR based on rainfall and other environmental conditions.

[2]Under pre-delivery, call year deliveries would total 26.7 TAF.

[3]The split year delivery equals one-half of a call year delivery plus one-half of a non-call year delivery.

With pre-delivery, if a call year is declared in Year 1, IEUA would have only delivered 26.7 TAFY to MWD in that year, while MWD would be responsible for leaving 50.0 TAFY to DWR in that year, meaning MWD would have a deficit of water until IEUA delivers more water during non-call years. Or conversely, if a call year is not declared until Year 7, IEUA would have pre-delivered 60.0 TAF total in the first six years while MWD would have not yet left any in the Delta for DWR, meaning MWD would store a surplus of water that would eventually be delivered to the Delta during the next call year.

Because of these deferrals, it is anticipated that MWD may charge IEUA either a storage surcharge for storing water in the MWD system before DWR declares a call year and it can be delivered to the Delta, or a water readiness surcharge for providing more water to the Delta that IEUA has yet delivered to MWD.

Due to operational and economic considerations and upon further evaluation and discussions with MWD, pre-delivery was later determined not to be feasible. Those TAKE alternatives developed during the evaluation that considered pre-delivery are no longer being considered for the CBP.

4.1.2 TAKE Mechanisms (MWD Pump Back, In-Lieu CBP, In-Lieu Local)

MWD provides imported water to IEUA and its member agencies. With the CBP, IEUA would be responsible for delivering water to MWD to replace what MWD leaves in the Delta. The CBP water could either be pumped back into MWD's system or used directly be IEUA's member agencies.

There are three delivery mechanisms by which IEUA can deliver CBP water to MWD:

- MWD pump back
- In-Lieu CBP
- In-Lieu Local

4.1.2.1 MWD Pump Back

MWD pump back involves extracting stored groundwater from a new dedicated wellfield and directly pumping the potable water into MWD's Rialto Pipeline. The Rialto Pipeline is a raw water pipeline so the CBP water would be blended with raw imported water and becomes raw water. The water in the Rialto Pipeline would then be distributed to IEUA member agencies via existing turnouts to water treatment plants. This mechanism uses the existing Rialto Pipeline and downstream infrastructure to convey water to individual member agencies. Water would be purchased from the Rialto Pipeline at the raw imported water rate as usual.

4.1.2.2 In-Lieu CBP

In-Lieu CBP involves extracting banked groundwater from a new dedicated wellfield and delivering it to IEUA's member agencies through a new regional conveyance system. In-lieu CBP requires the construction of conveyance infrastructure to move potable water around to agencies overlying the Chino Basin, but allows member agencies to use potable water directly without needing it to be treated again (the MWD pump back mechanism required treatment).

CBP water delivered in this mechanism would be purchased from MWD at the raw imported water rate since MWD would not be covering the cost of treatment and would therefore not be paid a Treatment Surcharge.

4.1.2.3 In-Lieu Local

In-Lieu Local allows member agencies to receive potable water by using their own existing or new wells and infrastructure to extract and deliver banked groundwater to their customers. This has the least TAKE infrastructure requirements as it leverages existing potable facilities, but it does not allow for robust accounting of water use.

The pricing schedule would be different for the locally supplied CBP water versus locally supplied groundwater. Since wells already in service to produce groundwater would also produce CBP water it would be challenging to determine how much water should be considered as being purchased from MWD and how much would be considered natural groundwater produced for any given well. Because of this, this mechanism is only feasible if an existing well is pumping 100% CBP water and not groundwater rights.

CBP water delivered in this mechanism would be purchased from MWD at the raw imported water rate since MWD would not be covering the cost of treatment and would therefore not be paid a Treatment Surcharge.

4.1.3 Delivery Capacity Limitations to Member Agencies and MWD

In each TAKE alternative, 50.0 TAFY or 26.7 TAFY of CBP water must be distributed between one or more of MWD, IEUA member agencies, or neighboring agencies overlying the Chino Basin under a standard delivery or pre-delivery scenario, respectively. Table 4-2 provides the list of all agencies that could accept CBP water in-lieu of imported water, as well as MWD (which would receive water via pump back).

Table 4-2. Possible Recipients of CBP Water

Agency	Agency Type	MWD Member Agency Wholesaler
Metropolitan Water District of Southern California	State Water Contractor/Regional Wholesaler	N/A
City of Chino	Retailer	Inland Empire Utilities Agency
City of Chino Hills	Retailer	Inland Empire Utilities Agency
City of Ontario	Retailer	Inland Empire Utilities Agency

Table 4-2. Possible Recipients of CBP Water		
Agency	**Agency Type**	**MWD Member Agency Wholesaler**
City of Upland	Retailer	Inland Empire Utilities Agency
Cucamonga Valley Water District	Retailer	Inland Empire Utilities Agency
Fontana Water Company	Retailer	Inland Empire Utilities Agency
Monte Vista Water District	Retailer	Inland Empire Utilities Agency
Jurupa Community Services District	Retailer	Western Municipal Water District
Western Municipal Water District	Wholesaler	Western Municipal Water District
Three Valleys Municipal Water District	Wholesaler	Three Valleys Municipal Water District

4.1.3.1 Minimum Allocation to MWD

For MWD pump back, MWD would track deliveries through a meter at the connection into the Rialto Pipeline. However, in-lieu use would require MWD to record the amount of CBP water that each member agency uses throughout each year from turnout meters (for In-Lieu CBP) or from well data from member agencies and historical well production data (for In-Lieu Local). For all alternatives, MWD would track the total amount of CBP water used in-lieu of imported water or directly pumped back to the Rialto Pipeline and track their own deliveries of water to the Delta. MWD would manage the accounting of these water exchanges and deliveries, which should be coordinated with IEUA. Additionally, for pump back, MWD would be responsible for integrating CBP systems into Rialto Pipeline operation, which would also require extensive coordination. This Study assumes that for any TAKE alternative involving MWD pump back, MWD would receive a minimum of 10.0 TAFY during call years to provide a sizeable enough amount of water to make the accounting and operation efforts by MWD worthwhile and to retain their support for the Program.

4.1.3.2 Maximum Allocation to Member Agencies

For alternatives that include in-lieu use (either In-Lieu Local or In-Lieu CBP), member agencies would receive a direct delivery of CBP water and use it instead of imported water from MWD's Rialto Pipeline. The amount of CBP water that member agencies can receive in-lieu of Rialto Pipeline raw water is limited by the minimum flowrate required to keep each WTP operating reliably because In-Lieu CBP water is potable water and would not be treated at their WTPs.

The four active WTPs that treat raw water from the Rialto Pipeline and provide supply to IEUA member agencies and neighboring Three Valleys Municipal Water District (TVMWD) are the Fontana Water Company (FWC) Sandhill WTP, the CVWD Lloyd W. Michael WTP, the Water Facilities Authority (WFA) Agua de Lejos WTP, and TVMWD Miramar WTP. These agencies, the respective WTPs, and the minimum flowrate for each WTP are summarized in Table 4-3.

Table 4-3. Minimum WTP Flowrates for Rialto Pipeline Users				
Agency	**Wholesaler**	**WTP**	**Minimum Flowrate[1]**	**Converted Minimum Flowrate (acre-feet/month (AFM))**
Cucamonga Valley Water District	IEUA	Lloyd W. Michael	10 mgd (15.5 cfs)	930
Fontana Water Company	IEUA	Sandhill	4 cfs (2.6 mgd)	240
Water Facilities Authority	IEUA	Agua de Lejos	9 mgd (13.9 cfs)	840
Three Valleys Municipal Water District	Three Valleys Municipal Water District	Miramar	10 cfs (6.5 mgd)	600

Note:

[1]Minimum flow rates provided by each agency.

Table 4-4 summarizes each Agency's projected demand from the SFI (WEI, September 2018), calculated minimum monthly imported water demand, minimum WTP flowrate, and total in-lieu capacity for CBP water. Each member agency provided imported water demand estimates through 2040 for the SFI. The projected imported water demand in 2025 (one year before the start of the CBP) for each member agency was taken from the SFI Table A-2. The project team assumed that the typical water demand of a member agency in the winter months is 60 percent of average monthly water demand based on historical monthly WTP production from Miramar WTP and the five WFA agencies (cities of Chino, Chino Hills, Upland, and Ontario, and the Monte Vista Water District). Low month imported water demand can be found be the following expression:

$$Low\ Month\ Imported\ Water\ Demand\ (TAFM) = \frac{\text{Annual Imported Water Demand (TAFY)} * 60\%}{12\ Months/Year}$$

For example, a member agency using 20.0 TAFY of imported water would have a low month demand of 1.0 TAFM AFM.

This equation was applied to each member agency's 2025 projected imported water demand. The calculated in-lieu capacities were rounded down to establish the assumed in-lieu capacity used in the analysis to account for possible variability in actual 2025 imported water demand from SFI projections in 2018. The sum of CBP water delivered to each WFA agency in-lieu of imported water may not exceed the total WFA capacity of 10.0 TAFY.

Table 4-4. In-Lieu Capacities of Member Agencies and TVMWD						
Agency	SFI 2025 Projected Imported Water Demand (TAFY)	Low Month Imported Water Demand (TAFM)	Minimum WTP Flowrate (TAFM)	In-Lieu Capacity (TAFM)	In-Lieu Capacity (TAFY)	Assumed In-Lieu Capacity (TAFY)
Cucamonga Valley Water District	33.1	1.65	0	0.72	8.6	**8.0**
Fontana Water Company	12.0	0.60	0.24	0.36	4.3	**4.0**
Water Facilities Authority	43.2	2.16	0.84	1.32	15.8	**10.0**
Three Valleys Municipal Water District[1]	N/A	1.00	0.60	0.40	4.8	**4.0**

Notes:

[1]Not included in the SFI report, however TVMWD provided historical WTP production rates which were used to estimate imported water demand in low-demand months.

4.1.3.3 Jurupa Community Services District and Western Municipal Water District Allocations

JCSD is a retail water provider in northwest Riverside County which does not currently have an imported water connection. JCSD's in-lieu capacity is not limited by a minimum water treatment plant flow rate. The project team assumed that JCSD's in-lieu capacity is no more than 2.5 TAFY assuming a mechanism to deliver imported water to JCSD is established prior to Program start.

Western Municipal Water District (Western) is an MWD member, and wholesaler and retailer of water in the western portion of Riverside County with imported water supplies from MWD from both the Colorado River Aqueduct and the State Water Project (SWP). Western could be a recipient of CBP water if they could modify operations to reduce SWP water when accepting deliveries from CBP. Because JCSD is a Western member agency, and interties exist between their two systems, CBP water would be delivered to Western by a direct delivery to JCSD, and JCSD and Western would be responsible for their own accounting of water deliveries to Western (either wet or by exchange). Because this approach depends on a connection to CBP through JCSD, Western can only receive deliveries in alternatives that include deliveries to JCSD. In a meeting with Western staff in August 2019, Western established that there was no limit to how much CBP water they could use in-lieu of imported water from the SWP. A maximum combined allocation between Western and JCSD of 5.0 TAFY was established by the project team to prioritize CBP water delivery within the IEUA service area.

4.1.3.4 Summary of Delivery Limitations

Table 4-5 provides boundaries for how much CBP water could be allocated to each agency. Limitations are based on call year deliveries. Non-call year deliveries would be within the limits shown in Table 4-5.

Table 4-5. Minimum and Maximum Call Year CBP Water Allocations		
Agency	**Minimum CBP Call Year Delivery (TAFY)**	**Maximum CBP Call Year Delivery (TAFY)**
Metropolitan Water District	10.0[1]	50.0
Cucamonga Valley Water District	0	8.0
Fontana Water Company	0	4.0
Water Facilities Authority	0	10.0
Three Valleys Municipal Water District	0	4.0
Jurupa Community Services District	0	2.5
Western Municipal Water District & Jurupa Community Services District Combined	0	5.0[2]
In-Lieu Total (without MWD)	--	33.5

Notes:

[1]MWD may be allocated 0 TAFY for any alternatives that do not include MWD pump back.

[2] A maximum allocation of 5.0 TAFY between Western and JCSD combined was established by the project team to keep as much CBP water within the IEUA service area as possible.

4.1.4 Alternatives Overview

The parameters discussed in Section 4.1 provided the framework for creating the TAKE alternatives. Six initial alternatives were developed based on the delivery mechanism (pump back or in-lieu) and the delivery condition (standard or pre-delivery). The six alternatives include the two bookends for the delivery mechanism with 100 percent pump back (TAKE-1 and TAKE-2) and 100 percent in-lieu (TAKE-5 and TAKE-6) as well as combination alternatives with partial pump back and partial in-lieu (TAKE-3 and TAKE-4). Each of these three delivery mechanisms were the combined with standard delivery and pre-delivery. For this Study, pre-delivery in non-call years was assumed to be 10.0 TAFY.

However, as noted previously, pre-delivery was later determined not to be feasible and is no longer being considered for the CBP. Two additional alternatives (TAKE-7 and TAKE-8) were developed following further discussions with interested, participating agencies and include both pump back and in-lieu. Also, TAKE-8 could be operated as 100 percent in-lieu. The preliminary TAKE alternatives are summarized in Table 4-6.

Table 4-6. Preliminary TAKE Alternatives Summary		
Alternative	**Pump Back and/or In-Lieu**	**Standard Delivery[1] or Pre-Delivery[2]**
TAKE-1	100% Pump Back	Standard
TAKE-2	100% Pump Back	Pre-Delivery
TAKE-3	Partial Pump Back and Partial In-Lieu	Standard
TAKE-4	Partial Pump Back and Partial In-Lieu	Pre-Delivery
TAKE-5	100% In-Lieu	Standard
TAKE-6	100% In-Lieu	Pre-Delivery
TAKE-7	0 to 100% Pump Back and/or In-Lieu with Expansion Capability	Standard
TAKE-8	Partial Pump Back and Partial In-Lieu or 100% In-Lieu (not including carriage water)	Standard

Notes:

[1]Standard delivery assumes water delivery would only during call years (50.0 TAFY) and there would be no delivery during non-call years.

[2]Pre-delivery assumes water would be pre-delivered during non-call years. A pre-delivery amount of 10.0 TAFY was assumed for this Study. Although included in the summary table above, alternatives relying on pre-delivery are no longer being considered for the CBP.

The preliminary alternatives were refined based on the evaluation of the member agencies' in-lieu capabilities (see Section 4.1.3). Alternative 5 (100 percent in-lieu with standard delivery) was determined infeasible because the combined in-lieu capacity of all member agencies and neighboring agencies (JCSD, Western, and TVMWD) was less than 50.0 TAFY (refer to Table 4-5) when accounting for the required minimum WTP flowrates. This is contrary to the aforementioned TAKE-8 that also assumes possible 100 percent in-lieu operation. However, TAKE-8 was developed in close coordination with specific, interested participating agencies and a reduced annual extraction when considering carriage water losses to meet the call year obligation (carriage water losses are introduced later in this section). In addition, predelivery was considered infeasible after further discussions with MWD. As a result, TAKE-2, TAKE-4, and TAKE-6 were determined infeasible.

IEUA preferred to have multiple delivery options for alternatives with in-lieu deliveries (e.g., TAKE-4 and TAKE-6) to consider different strategies for delivering the CBP water, which resulted in three approaches for TAKE-4 (TAKE-4a, TAKE-4b, and TAKE-4c) and two approaches for TAKE-6 (TAKE-6a and TAKE-6b). TAKE-7 also considers the option to increase the conveyance pipes to accommodate a potential future MWD water banking project.

The call year delivery in TAKE-8 was adjusted to account for carriage water. The conveyance of water across the Delta to the Delta export pumps requires additional water, known as carriage water, to be released upstream of the Delta export pumps. The carriage water is approximately 20 to 30 percent of the amount exported. Compared to normal operations, in-lieu delivery would lead to an accrual of carriage water savings in Lake Oroville. IEUA proposed that the carriage water savings be accounted for as 20 percent of the pulse flow release and applied towards the repayment of the flow. This would allow SWP water to be used for other purposes and allow 20 percent of the CBP water to be used locally. Accordingly, IEUA proposed that the maximum annual quantity of a CBP exchange be reduced from 50,000 acre-feet to 40,000 acre-feet.

Based on these refinements, eight TAKE alternatives were developed, which are summarized in Table 4-7. Since discussions with MWD determined that pre-delivery is not feasible, all alternatives with pre-delivery were eliminated. Thus, the remaining alternatives include TAKE-1, TAKE-3, TAKE-7, and TAKE-8 and are described in further detail in Section 4.3. Descriptions of the alternatives that have been determined infeasible (TAKE-2, TAKE-4, TAKE-5, and TAKE-6) are included in Appendix A.

Table 4-7. TAKE Alternatives Summary

TAKE Alternative	Description		Non-Call Year Deliveries (Pre-Delivery) (TAFY)	Call Year Deliveries (Includes Pre-Delivery)			Total Delivery over 25 Years		
	Pump Back and/or In-Lieu	Standard Delivery or Pre-Delivery		Pump Back (TAFY)	In-Lieu (TAFY)	Total (TAFY)	Pre-Delivery (TAF)	Call Year Deliveries (TAF)	Total (TAF)
TAKE-1	100% Pump Back	Standard	-	50.0	-	50.0	-	375.0	375.0
TAKE-2 Not feasible[1]		Pre-Delivery	10.0	26.7	-	26.7	250.0	125.0	375.0
TAKE-3	Partial Pump Back and Partial In-Lieu	Standard	-	25.5	24.5	50.0	-	375.0	375.0
TAKE-4: TAKE-4a TAKE-4b TAKE-4c Not feasible[1]		Pre-Delivery	10.0	10.0	16.7	26.7	250.0	125.0	375.0
TAKE-5 Not feasible[2]	100% In-Lieu	Standard	-	-	50.0	50.0	-	375.0	375.0
TAKE-6: TAKE-6a TAKE-6b Not feasible[1]		Pre-Delivery	10.0	-	26.7	26.7	250.0	125.0	375.0
TAKE-7[3] TAKE-7a TAKE-7b	0 to 100% Pump Back and/or In-Lieu with Expansion Capability	Standard	-	28.0	22.0	50.0	-	375.0	375.0
TAKE-8[4]	Partial Pump Back and Partial In-Lieu or 100% In-Lieu	Standard	-	0.0 – 10.0	30.0 – 40.0	40.0	-	300.0	300.0

Notes:

[1]Since discussions with MWD determined that pre-delivery is not feasible, all alternatives with pre-delivery (TAKE-2, TAKE-4, and TAKE-6) are no longer being considered for the CBP.

[2]TAKE-5 was determined not to be feasible due to in-lieu deliveries exceeding in-lieu capacity when accounting for the required minimum WTP flowrates.

[3]Two approaches for TAKE-7 were developed: TAKE-7a and TAKE-7b. TAKE-7b includes the option for MWD to extract an additional 50 TAFY banked by MWD.

[4]The TAKE-8 call year delivery was adjusted to account for carriage water (see discussion earlier in this section).100 percent in-lieu operation was determined feasible for TAKE-8 since it was developed in close coordination with specific, interested participating agencies and a reduced annual extraction when considering carriage water losses.

4.2 TAKE Components

This section describes the components that comprise each of the eight TAKE alternatives. The TAKE components are described within two categories: In-Lieu CBP and MWD pump back (Section 4.2.1) and In-Lieu Local (Section 4.2.2).

4.2.1 In-Lieu CBP and MWD Pump Back

Both In-Lieu CBP and MWD pump back involve the direct delivery of CBP water to a member agency or to MWD, respectively, from a dedicated regional potable CBP pipeline. Therefore, they are essentially the same regarding operations and construction of new facilities, the only difference being the location where the CBP water is being delivered. Both delivery mechanisms have three components:

- Component A – Groundwater Extraction and Blending, which includes extraction wells, well collector pipelines, and a blending and storage reservoir.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir, which includes pump stations, high-hydraulic grade line (HGL) potable water pipelines, and turnouts and in-conduit hydropower facilities.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir, which includes low-HGL potable water pipelines and turnouts and in-conduit hydropower facilities.

Each of these components is described in the following sections.

4.2.1.1 Component A – Groundwater Extraction and Blending

Component A includes the groundwater extraction wells, well collector pipe network, and storage and blending reservoir. Both In-Lieu CBP and MWD pump back require the construction and operation of an extraction well field to extract stored CBP water. For each TAKE alternative, an extraction well field is needed to extract stored groundwater, that is then collected through a network of well collector pipelines and discharged to a reservoir that provides blending and serves as the forebay for all CBP water deliveries made by In-Lieu CBP or MWD pump back.

4.2.1.1.1 Extraction Wells

A field of extraction wells is proposed in the general area north of the I-15/I-10 interchange to produce the CBP water for MWD pump back and/or In-Lieu CBP use. The amount of extraction wells required varies between eight and 17, producing between 20.7 TAFY (12,900 gpm) and 50.0 TAFY (31,100 gpm). The estimated flowrates of proposed wells in the area are between 1,500 gpm and 2,000 gpm, based on production data from other nearby wells. It is assumed that one redundant well would be constructed for each alternative such that the firm production capacity with the largest well offline would still produce the amount of CBP water required for the alternative. A sampling port would be installed at all wellheads to facilitate routine water quality sampling. Each well would be able to deliver water to an HGL between 1,100 and 1,350 feet (ft), which covers the expected range of operational water elevations of the proposed blending and storage reservoir, depending on its location. Chlorine would be injected at each wellhead to prevent biological growth in well collector pipelines.

4.2.1.1.2 Well Collector Pipelines

A network of pipelines would be installed to connect each well to the blending and storage reservoir. The collector pipeline diameters would range from 12- to 54-inch, and are sized to keep pipeline velocity below 5 feet per second (fps). Collector pipes are considered separately from the regional potable pipelines because they would convey raw groundwater to a reservoir for blending. After blending in the reservoir and addition of chlorine, the water would be considered potable. It is assumed that additional groundwater treatment would not be necessary as water quality in the proposed wellfield location meets drinking water standards. If additional treatment becomes necessary in the future, either a wellhead or centralized treatment facility can be integrated and located at either an individual well site or adjacent to the blending and storage reservoir.

4.2.1.1.3 Blending and Storage Reservoir

The reservoir would provide blending and storage of extracted groundwater and a constant head for the wells to pump into. Based on preliminary siting assumptions the reservoir would have an HGL of either 1,100 ft, 1,180 ft, or 1,350 ft, which is sufficient to deliver water to JCSD and some pressure zones of Ontario and FWC, as discussed in Section 4.2.1.3. The reservoir has been sized in each alternative to provide approximately three hours of retention time to complete blending, which also corresponds to three hours of storage time due to the constant-flow nature of the TAKE delivery systems.

The reservoir would constantly be filled by the extraction well field and would constantly provide water to member agencies and/or MWD, as discussed in Sections 4.2.1.2 and 4.2.1.3. Chlorine would be dosed within the tank and at the outlet(s) of the tank to provide disinfection and residual chlorine in the distribution system. Coordination may be required for those agencies that utilize chloramination (i.e., WFA agencies).

The land acquired for the reservoir is to be large enough to accommodate the future construction of a groundwater treatment facility. If the extraction well field begins producing low-quality water that cannot be blended out, a treatment facility may be constructed on the same site as the reservoir and would remove the contaminant(s) prior to discharging extracted groundwater into the reservoir.

4.2.1.2 Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir

Component B includes one or more pump stations, potable water pipelines, and turnouts and hydropower facilities to agencies with HGLs higher than the storage reservoir. The HGL of the Rialto Pipeline, as well as some member agencies pressure zones, is higher than the proposed storage and blending reservoir. To deliver In-Lieu CBP water or MWD pump back water to those pressure zones, a pump station and pressurized pipeline network is required above the reservoir. Coincidentally, the project area is on a south facing slope from the San Gabriel Mountain Range to the north, and all of the delivery locations that are higher in elevation than the proposed reservoir are north of the reservoir as well. The inverse is true that all delivery locations south of the proposed reservoir are lower in elevation than the reservoir.

Agencies that may receive water from the Component B facilities include the following with the HGL of the facility indicated:

- MWD: Rialto Pipeline – 1,936 ft
- CVWD: Zone III – 1,658 ft
- CVWD: Zone II – 1,420 ft
- FWC: Highland Zone – 1,504 ft
- FWC: Juniper Zone – 1,103 ft
- WFA Agencies: Agua de Lejos WTP Clearwell – 1,630 ft
- Upland: Agua de Lejos WTP Clearwell (Upland Zone II) – 1,632 ft
- TVMWD: Miramar WTP Clearwell – 1,630 ft

4.2.1.2.1 Pump Stations

TAKE alternatives include the construction of Potable Water Pump Station #1, which is to be located adjacent to the proposed reservoir and would use the reservoir as a forebay to provide suction head. Typically, Pump Station #1 would lift water up to the highest HGL of all of the Component B turnouts (Rialto Pipeline, HGL 1,936 ft). Because all other Component B turnouts are lower than the Rialto Pipeline, this would result in over-pressurizing some water which would require PRV stations or in-conduit hydropower facilities to reduce the head as discussed in Section 4.2.1.2.3.

In some alternatives, it is more cost effective to construct a second pump station (Potable Water Pump Station #2) to lift MWD's share of water to the HGL of the Rialto Pipeline (1,936 ft), rather than requiring Pump Station #1 to lift all water in Component B up to 1,936 ft. This was typically done when the allocation of water to MWD was low enough to make the cost of constructing Pump Station #2 lower than the cost of losing energy from over-pressurizing water to every other member agency turnout in Component B. In alternatives with Pump Station #2, Pump Station #1 lifts water to the HGL of the second highest turnout in Component B (CVWD Zone III – 1,658 ft), and Pump Station #2 takes only MWD's share of water and lifts it from 1,658 ft to the Rialto Pipeline HGL. The decision to construct a second pump station would be re-evaluated using a hydraulic model in the preliminary design phase once the preferred TAKE alternative has been selected.

4.2.1.2.2 High-HGL Potable Water Pipelines

A potable pipeline network is proposed north of the blending and storage reservoir to deliver water to the agencies and pressure zones listed in Section 4.2.1.2. The primary feature is the northern pipeline, which would comprise pipelines with diameters ranging from 30 and 54 inches and would align from the reservoir north along Milliken Avenue, east along Baseline Road, and north along Day Creek Boulevard to the general area of the CWWD Lloyd W. Michael WTP. The Lloyd W. Michael WTP is owned and operated by CVWD and is the location of some of CVWD's Zone III tanks. This northern pipeline would supply CVWD Zone III and the MWD Rialto Pipeline.

For alternatives that include delivery to FWC's Highland Zone, a 12- to 24-inch pipeline would branch off from the northern pipeline at the intersection of Day Creek Boulevard and Baseline Road and would align East in Baseline Road until reaching FWC's system.

For alternatives that include delivery to MVWD, Upland, CVWD Zone III, and/or TVMWD, a proposed 16- to 36-inch east-west pipeline would branch off from the northern pipeline at the intersection of Foothill Boulevard and Milliken Avenue. The east-west pipeline would align in Foothill Boulevard until turning North at Mountain Avenue in Upland, then turning west again at 18th Street toward the Agua de Lejos and Miramar WTPs. The east-west pipeline would terminate at its connections to Miramar and/or Agua de Lejos. Maps of all potable pipeline alignments are provided with the TAKE alternatives descriptions in Section 4.3.

4.2.1.2.3 Turnouts and In-Conduit Hydropower Facilities

MWD would receive delivery of CBP water into the Rialto Pipeline near the Lloyd W. Michael WTP in Rancho Cucamonga (off the northern pipeline) or the Miramar WTP in Claremont (off the east-west pipeline). In either case, a new turnout would need to be constructed from the regional CBP pipeline into the Rialto Pipeline. The turnout would include a sampling port for monitoring CBP water quality flowing into the Rialto Pipeline, and a backflow prevention device to prevent water from the Rialto Pipeline from entering the CBP pipeline. Because the CBP regional pipeline network is potable and Rialto Pipeline is raw, the Division of Drinking Water would need to be involved in the permitting of the interconnection between the Rialto Pipeline and the CBP pipeline. Very strict redundancy and safety requirements to ensure the potable pipelines are not contaminated with raw Rialto Pipeline water would be required.

CVWD Zone III would receive delivery of CBP water at the storage tanks on the Lloyd W. Michael WTP site from the northern pipeline. The HGL of the northern pipeline would be 1,936 ft (Rialto Pipeline) in some alternatives, and therefore the turnout to CVWD Zone III may include a PRV station or in-conduit hydropower facility to recapture energy. The CVWD Zone III turnout would include a sampling port to monitor water quality entering CVWD's system.

CVWD Zone II would receive delivery of CBP water via a turnout into a transmission main at the intersection of Archibald Avenue and Foothill Boulevard off the east-west pipeline. The HGL of the east-west pipeline would be at least 1,632 ft to reach other downstream turnouts, so CVWD's Zone II turnout (1,420 ft) would require a PRV or in-conduit hydropower facility to reduce pressure into CVWD Zone II. The CVWD Zone II turnout would include a sampling port to monitor water quality entering CVWD's system.

FWC Highland Zone would receive delivery of CBP water into a transmission main in Baseline Avenue (Baseline becomes "Avenue" East of the Fontana/Rancho Cucamonga city line). The HGL of the Highland Zone is 1,504 ft, and the FWC Highland turnout would always require a PRV station or in-conduit hydropower facility to reduce pressure to the Highland Zone HGL. The FWC Highland turnout would include a sampling port to monitor water quality entering FWC's system.

Upland and MVWD receive imported water currently from the Agua de Lejos WTP in Upland. The Agua de Lejos WTP has a clearwell with a surface elevation of 1,632 ft that provides water supply to both Upland Zone II and MVWD Z1. Upland Zone II is supplied from the clearwell by a set of pumps that pump treated water into Upland's system. MVWD Z1 is supplied via the Benson Avenue feeder, which carries treated water from Agua de Lejos to Ontario, MVWD, and Chino. MVWD uses a hydropower facility in Montclair to reduce the HGL from 1,632 ft to the MVWD Z1 HGL of 1,351 ft. The Agua de Lejos clearwell is the ideal location to deliver CBP water to MVWD and Upland because it provides the CBP water in the same location as imported water currently enters their systems. The turnout to MVWD and Upland would be a connection to the Agua de Lejos Clearwell from the east-west pipeline, including a sampling port to monitor water quality entering their systems.

TVMWD would receive delivery of CBP water at the Miramar WTP clearwell in Claremont, which has an HGL of 1,630 ft. The turnout to TVMWD from the east-west pipeline requires crossing CA-210, however a 48-inch sleeve already exists under the freeway which may be used to house the interconnection piping. The turnout to TVMWD would include a sampling port to monitor water quality entering the TVMWD system.

4.2.1.3 Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir

Component C includes the potable water pipelines and turnouts and hydropower facilities to agencies with HGLs lower than the storage reservoir. Some delivery locations, including JCSD's 1110 Zone, Ontario's 1010 Zone, and FWC's Juniper Zone (HGL 1,103 ft) are at HGLs below the proposed reservoir and can receive water via gravity.

4.2.1.3.1 Low-HGL Potable Water Pipelines

The southern pipeline would deliver CBP water from the proposed reservoir to Ontario's 1010 Zone and JCSD's 1110 Zone. The pipeline varies in size based on the delivery amount to those agencies in each alternative. The southern pipeline is proposed to be aligned in Milliken Avenue from the reservoir (near the intersection of Jersey Boulevard and Milliken Avenue) the Northwest edge of JCSD's service area at the intersection of Philadelphia Street and Milliken Avenue.

The southern pipeline also includes a branch pipeline to FWC's Juniper Zone (HGL 1,103 ft) in TAKE-4b, which would align in 4th Street. In all other Alternatives, FWC's delivery point is above the proposed reservoir.

4.2.1.3.2 Turnouts and In-Conduit Hydropower Facilities

The southern pipeline is proposed to terminate at a turnout to JCSD's 1110 Zone at the intersection of Philadelphia Street and Milliken Avenue. A turnout to Ontario's 1010 Zone is proposed along the southern pipeline near the intersection of Lowell Street and Milliken Avenue. Because of the high difference in HGL from the proposed reservoir (1,180 ft) to the Ontario 1010 Zone, an in-conduit hydropower facility should be considered at Ontario's turnout. There is not enough of a difference in head to justify an in-conduit hydropower facility at JCSD's turnout.

In TAKE-4b, a turnout to FWC's Juniper Zone is proposed at the end of the FWC branch of the pipeline. In-conduit hydropower would not be considered because there is not enough head differential between the southern pipeline HGL and the FWC Juniper Zone.

Sampling ports would be included at all turnouts to monitor water quality entering member agencies' systems.

4.2.2 In-Lieu Local

The In-Lieu Local delivery mechanism involves using either new or existing wells and piping to locally produce groundwater stored by CBP. If existing wells were used for In-Lieu Local, then it was assumed that only existing wells that are currently offline would be considered to exclusively to produce CBP water when they are brought back into service. In-Lieu Local is Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects).

For the purposes of this Study, two example In-Lieu Local projects were identified in Chino and Chino Hills. These projects are considered examples only for establishing the In-Lieu Local delivery concept. Chino and Chino Hills are far from the proposed extraction well field and proposed reservoir, making it costly to provide access to water via In-Lieu CBP use. Several offline wells in the Chino and Chino Hills service areas could be reinstated and retrofitted with wellhead treatment to remove nitrate and produce potable water. This In-Lieu Local water would be delivered to Chino and Chino Hills via the agencies' existing potable infrastructure. Because the wells are currently offline, all water produced by these wells and treated by the proposed wellhead treatment systems would be considered CBP water. The delivery amount to Chino and Chino Hills via this method varies from alternative to alternative, though they are always equivalent to each other.

These example projects were developed for existing wells, but new wells could also be considered for In-Lieu Local projects. The wells would be equipped with wellhead treatment if groundwater contamination exists in the proposed area.

The remainder of this section discusses the proposed groundwater treatment for these two In-Lieu Local projects for the cities of Chino and Chino Hills. These In-Lieu Local projects were included in all TAKE alternatives that include in-lieu use (TAKE-3, TAKE-4a, TAKE-4b, TAKE-4c, TAKE-6a, and TAKE-6b).

4.2.2.1 City of Chino

The City of Chino owns several groundwater extraction wells, including Wells 10, 12, and 14, that have water quality issues. Contaminants of concern include 1,2,3-Trichloropropane (1,2,3-TCP), nitrate, perchlorate, and hexavalent chromium. Instead of implementing wellhead treatment to meet new potable water standards, the City has relied on imported water. However, to reduce their dependence on imported water the City is now re-examining wellhead treatment with a proposed facility on the southwest corner of Philips Blvd and Central Ave. The City recently completed the City of Chino Water Quality Feasibility Study (Hazen and Sawyer, May 2019) that recommended granular activated carbon (GAC) and ion exchange (IX) for the wellhead treatment process.

The treatment approach was reviewed as part of this Study and a biological treatment system with an ion exchange polishing step is recommended to eliminate brine generated from the treatment system, and eliminate brine disposal costs. The proposed centralized wellhead treatment facility would have the following characteristics:

- Water Quality
  - Current concentrations of 1,2,3-TCP, nitrate, perchlorate, and arsenic are above the maximum contaminant level (MCL). Hexavalent chromium levels are also elevated and near or above current regulatory notification levels.

- Wellhead Treatment Facility
  - The proposed facility is located at the southwest corner of Philips Blvd and Central Ave, also known as the Philips Site. The Philips Site also includes Wells 1, 2, 3, 10 and 12; Reservoirs 2 and 4; and the Philips Booster Station.
  - The facility would treat 3.0 TAFY of groundwater from existing Wells 10, 12, and 14.
  - The proposed treatment process is a fixed-bed bioreactor (FXB) followed by a perchlorate-selective ion-exchange polishing step to treat the entire influent flow.

The City of Chino Wellhead Treatment Facility is summarized in Table 4-8 and shown in Figure 4-1.

Table 4-8. City of Chino Wellhead Treatment Facility

Parameter	Description
Location	Philips Site (Philips Blvd and Central Ave)
Treatment Capacity (Product Water) (TAFY)	3.0
Number of Extraction Wells (existing)	3 (Wells 10, 12, 14)
FXB Bioreactor System	
Number of Vessels	5 (1 per train)
Vessels Diameter (ft)	14
System Capacity (gpm)	1,956
Perchlorate-Selective IX System	
Type	Single-use
Number of Vessels	3
Vessels Diameter (ft)	11
Resin Life (years)	>2
System Capacity (gpm)	1,956

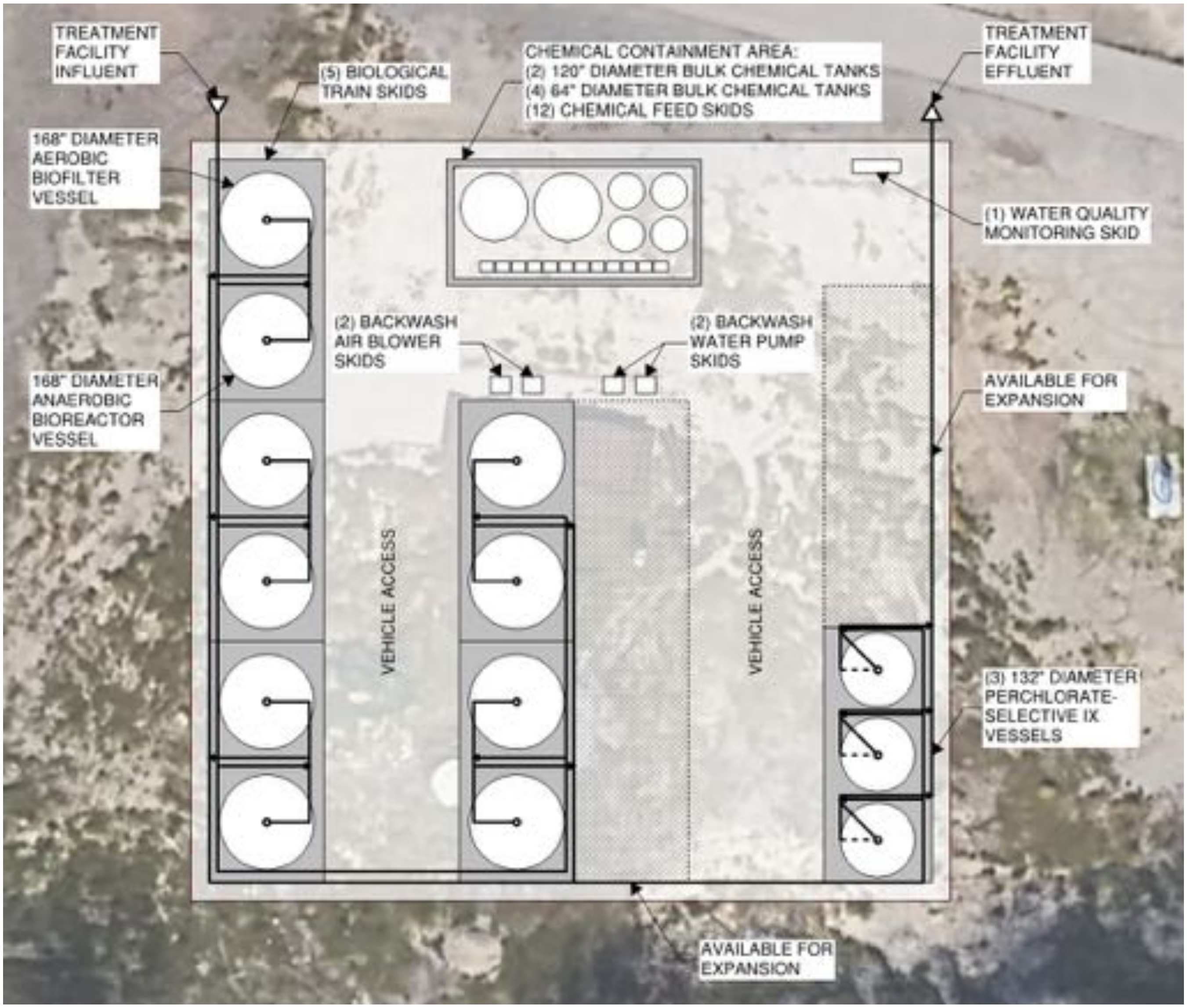

Figure 4-1. City of Chino Wellhead Treatment Facility (Example In-Lieu Local Project)

4.2.2.2 City of Chino Hills

The City of Chino Hills owns four wells that previously extracted potable water from the Chino Basin. The City of Chino Hills Booster 9 Pump Station historically received flow from the four extraction wells and pumped the potable water into the drinking water system. The wells are currently not in operation due to the concentrations of 1,2,3-TCP exceeding the MCL A wellhead treatment facility would be required to reduce the concentration of 1,2,3-TCP and resume operation of the four wells for potable water usage. The City recently completed the Preliminary Design Technical Memorandum for the Chino Hills 123-TCP Removal Project (Michael Baker International, December 2018) that recommended GAC for the wellhead treatment process.

The treatment approach was reviewed as part of this Study and GAC with an ion exchange polishing step to reduce the nitrate concentrations. The elements of the proposed facility would be as follows:

- Water Quality - The water quality of Booster 9 Pump Station discharge is regulated by the Domestic Drinking Water Supply Permit issued to the City of Chino Hills.

- The blended flow concentration of 1,2,3-TCP at Wells 1A, 7B, 7B, and 17 currently exceeds the MCL.
- The blended flow concentration of nitrate exceeds the treatment goal of 80 percent, or less, of the MCL set forth by the Domestic Drinking Water Supply Permit issued to the City of Chino Hills.

- Wellhead Treatment Facility
  - The proposed wellhead treatment facility would located adjacent to the City of Chino Hills Booster 9 Pump Station. The facility would produce at least 3.0 TAFY by treating flow from existing Wells 1A, 7A, 7B, and 17.
  - The proposed treatment process is GAC-IX to reduce the blended flow concentrations of 1,2,3-TCP and nitrate.
- Pipelines
  - Approximately 6,800 linear feet of 8-inch HDPE piping would be constructed to connect to the IEBL System for brine disposal.

The City of Chino Hills wellhead treatment facility is summarized in Table 4-9 and shown in Figure 4-2.

Table 4-9. City of Chino Chills Potential Wellhead Treatment Facility

Parameter	Description
Wellhead Treatment Facility	
Location	City of Chino Hills Booster 9 Pump Station site
Treatment Capacity (Product Water) (TAFY)	3.0
Number of Extraction Wells (existing)	4 (Wells 1A, 7A, 7B, 17)
GAC System	
Number of Vessels	4 total (2 pairs)
Vessels Diameter (ft)	12
System Capacity (gpm)	2,070
Media Type	Coconut Shell-Based Carbon
Media Weight per Vessel (lbs)	40,000
IX System	
Type	Regenerable
Number of Vessels	3
Vessel Diameter (ft)	6
System Capacity (gpm)	550
Resin Capacity in each Vessel (ft^3)	99
Brine Conveyance	
Disposal System	IEBL
Disposal Capacity (gpd)	4,900
Pipeline Length (ft)	6,800 (8-inch)

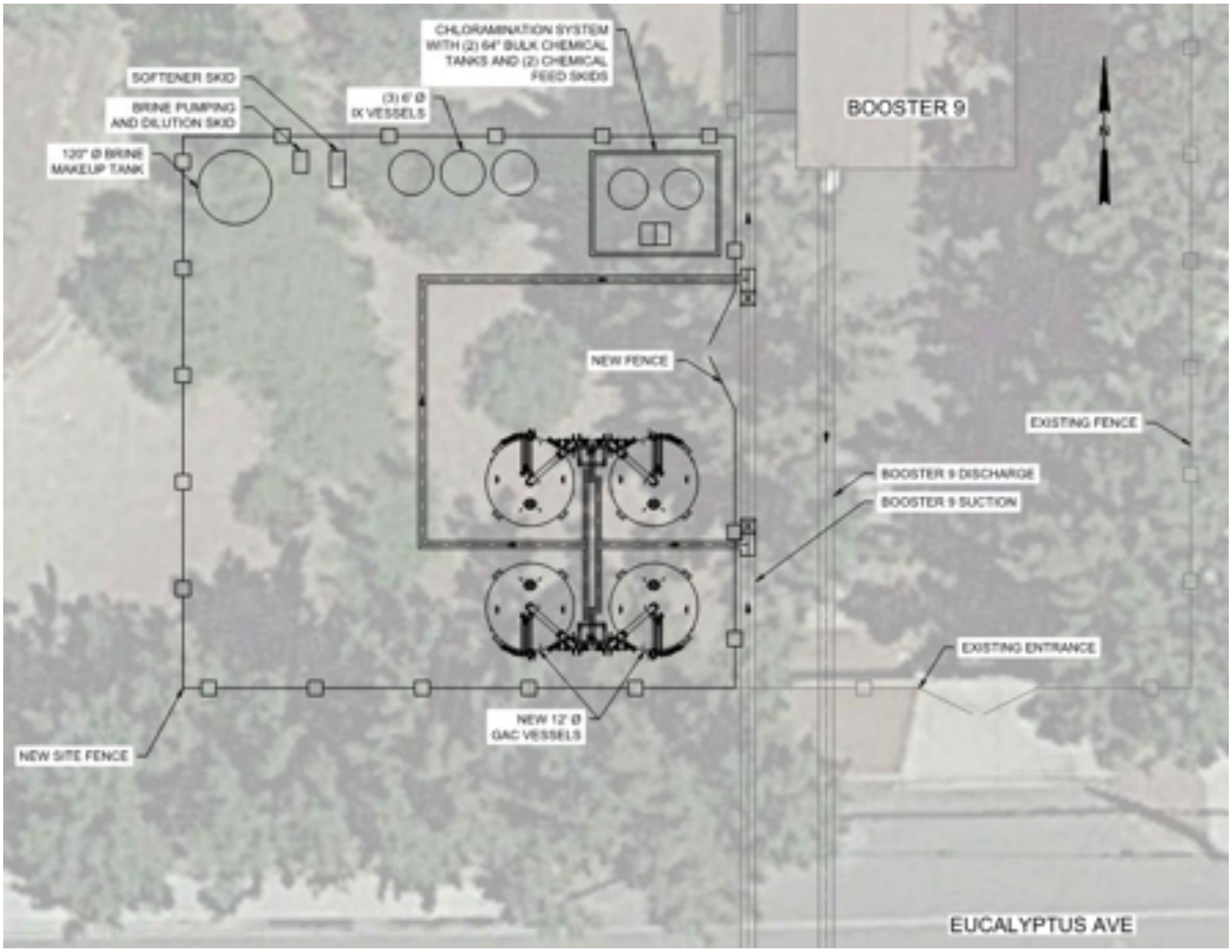

Figure 4-2. City of Chino Hills Wellhead Treatment Facility (Example In-Lieu Local Project)

4.3 TAKE Alternatives Descriptions

The four feasible TAKE alternatives, TAKE-1, TAKE-3, TAKE-7, and TAKE-8, are described in the following sections. The descriptions for each alternative are comprised of the TAKE components presented in Section 4.2 with minor modifications described in this section. Section 4.3.7 includes a detailed facilities summary and cost summary (capital and O&M costs) for the eight alternatives.

The alternatives descriptions for the initial TAKE alternatives that included pre-delivery and were determined to be infeasible (TAKE-2, TAKE-4, and TAKE-6) are included in Appendix A.

4.3.1 TAKE Alternative 1 – 100% MWD Pump Back, Standard Delivery

TAKE Alternative 1 (TAKE-1) includes delivery of 50.0 TAFY of CBP water to the Rialto Pipeline during call years, with standard delivery (i.e., no pre-delivery of CBP water during non-call years) and no delivery of CBP water to member agencies for in-lieu. Table 4-10 provides the breakdown of CBP water deliveries to MWD and the member agencies during call and non-call years.

Table 4-10. TAKE Alternative 1 Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	50.0	-
Cucamonga Valley Water District	-	-
Fontana Water Company	-	-
City of Chino[1]	-	-
City of Chino Hills[1]	-	-
City of Ontario[1]	-	-
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	-	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**50.0**	-

Note:
[1]Water supplied from the WFA Agua de Lejos WTP.

TAKE Alternative 1 includes the following facilities, shown on Figure 4-3:

- Component A – Groundwater Extraction and Blending
  - 17 extraction wells
  - 9 miles of 12- to 36-inch collector pipelines
  - 5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 9,300 HP, 31,100 gpm firm capacity, 823 ft TDH

  - 5 miles of 54-inch potable northern pipeline
  - Proposed 54-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - None
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - None
- Existing Facilities
  - Rialto Pipeline (HGL 1,936 ft)

TAKE Alternative 1 would be operated to deliver 50.0 TAFY to the Rialto Pipeline during call years. Although the facilities would not be operated for Program purposes during non-call years, the infrastructure would be available for local and/or regional uses. The operation of the TAKE-1 components during call years is described below.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 50.0 TAFY (about 31,100 gpm) of groundwater during call years (see Section 4.2.1.1).
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. During call years, Pump Station #1 would deliver 50.0 TAFY of water to the Rialto Pipeline through a proposed 54-inch northern pipeline and a proposed 54-inch turnout into the Rialto Pipeline.

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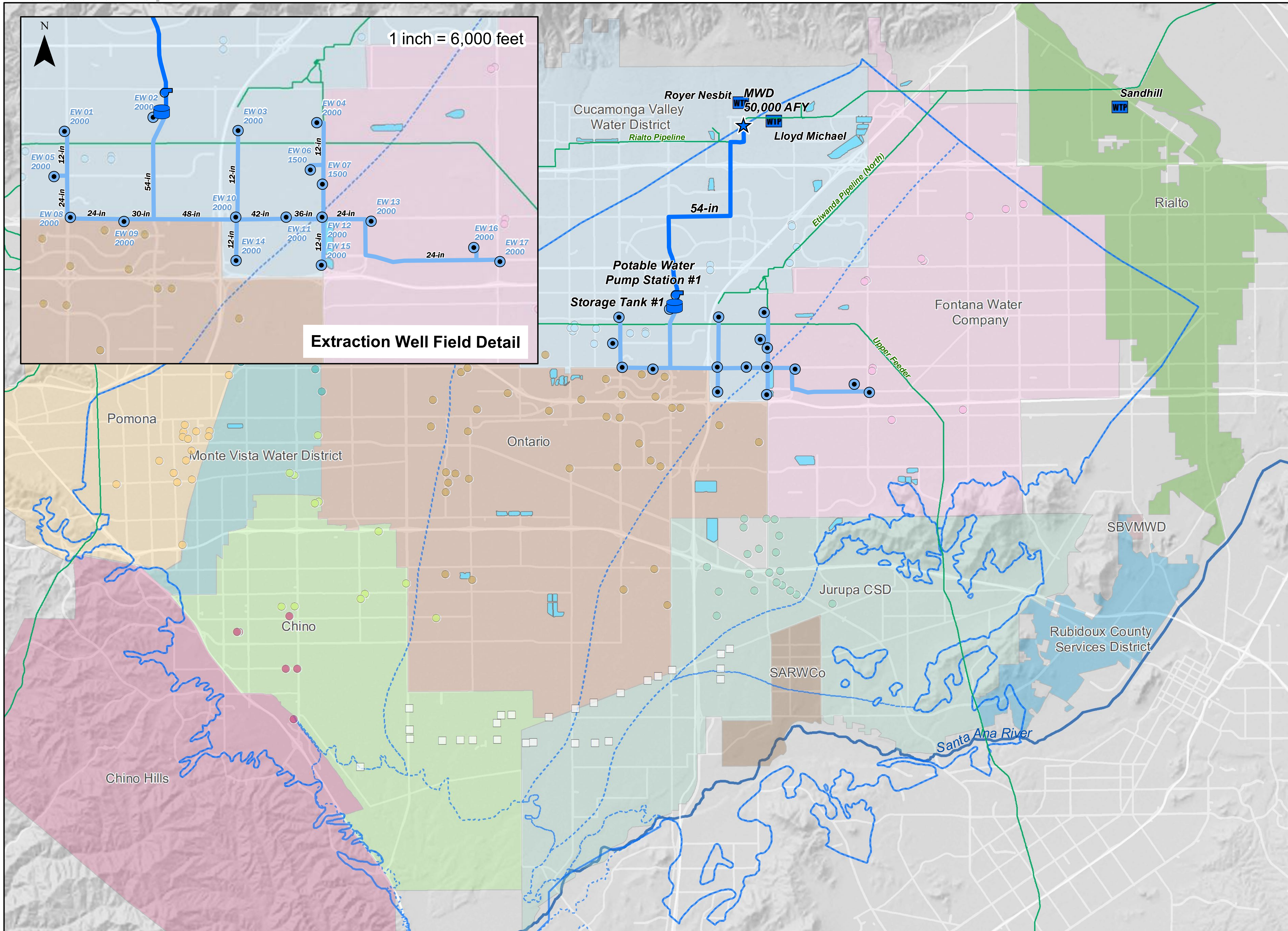


Explanation

TAKE Alternative 1

- Proposed Interconnection (Call Year Delivery)
- Proposed Booster Pump Station
- Proposed Tank
- Proposed Potable Pipelines
- Proposed Extraction Well Collectors
- Proposed Extraction Wells (GPM)

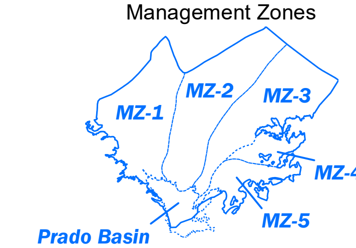
Existing Facilities

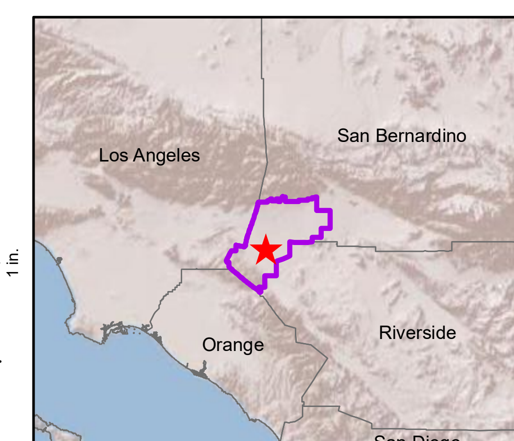
- MWD Mainlines
- Water Treatment Plant
- Recharge Basins

Production Wells

- Chino Desalter
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District

Chino Groundwater Basin and Management Zones





Prepared by: Brown AND Caldwell | WSC Water Systems Consulting, Inc.

Author: AWM | Date: 6/22/2020

File Name: CBP_TAKEAlternative1

N

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project: CBP Chino Basin Program

Preliminary Design Report

Prepared for: Inland Empire Utilities Agency, A Municipal Water District

TAKE Alternative 1

Figure 4-3

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4.3.2 TAKE Alternative 3 – Partial MWD Pump Back and Partial In-Lieu, Standard Delivery

TAKE Alternative 3 (TAKE-3) involves the delivery of 50.0 TAFY combined during call years to the Rialto Pipeline, five member agencies, and Jurupa Community Services District. Since this alternative is based on standard delivery, no water would be delivered during non-call years. Table 4-11 provides the deliveries to each Agency in Alternative 3.

Table 4-11. TAKE Alternative 3 Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	25.5	-
Cucamonga Valley Water District	8.0	-
Fontana Water Company	4.0	-
City of Chino[1]	3.0	-
City of Chino Hills[1]	3.0	-
City of Ontario[1]	4.0	-
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	2.5	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**50.0**	**-**

Note:

[1]Water supplied from the WFA Agua de Lejos WTP.

TAKE Alternative 3 includes construction or use of the following facilities, shown on Figure 4-4:

- Component A – Groundwater Extraction and Blending
  - 15 extraction wells
  - 9 miles of 12- to 42-inch collector pipelines
  - Storage Tank #1: 5 MG and in-conduit hydropower facility
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 7,000 HP, 23,300 gpm firm capacity, 823 ft TDH
  - 8 miles of 16- through 48-in potable northern pipeline (includes branches to FWC and CVWD)
  - Proposed 16-inch turnout to FWC Highland Zone (and optional hydropower facility)
  - Proposed 24-inch turnout to CVWD Zone III (and optional hydropower facility)
  - Proposed 36-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 12- through 24-inch potable southern pipeline
  - Proposed 24-inch turnout to Ontario 1010 Zone (and optional hydropower facility)

  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 3.0-TAFY wellhead treatment for Chino Well Nos. 10, 12, and 14
  - 3.0-TAFY wellhead treatment for Chino Hills Well Nos. 1A, 7A, 7B, and 17
- Existing Facilities:
  - Rialto Pipeline (HGL 1,936 ft)
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)

TAKE Alternative 3 would be operated to deliver 50.0 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years only. Although the facilities would not be operated for Program purposes during non-call years, the infrastructure would be available for local and/or regional uses. The operation of the TAKE-3 components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 44.0 TAFY (about 27,300 gpm) of groundwater during call years in (see Section 4.2.1.1).
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. During call years, Pump Station #1 would deliver 37.5 TAFY combined of water to the Rialto Pipeline, CVWD Zone III, and FWC Highland Zone through the proposed 7.1-mile northern pipeline network and turnouts to all three agencies.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - Potable Water Pump Station #1 is designed to lift water to an HGL of 1,936 ft to be able to deliver to the Rialto Pipeline. CVWD and FWC, who would both receive water from Pump Station #1, are at HGLs much lower than 1,936 ft. To recapture some of the lost energy from over-pumping, in-conduit hydropower facilities are proposed at both the CVWD and FWC turnouts. Preliminary calculations showed that the energy loss from over-pumping and recovering energy from hydropower facilities is less costly than the expense of constructing two additional pump stations designed to deliver water exactly to the HGLs of CVWD and FWC (1,658 ft and 1,504 ft, respectively).
  - 6.5 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone and JCSD's 1110 Zone along a proposed 24-inch southern pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not for JCSD's turnout.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 6.0 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 3 proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 3.0 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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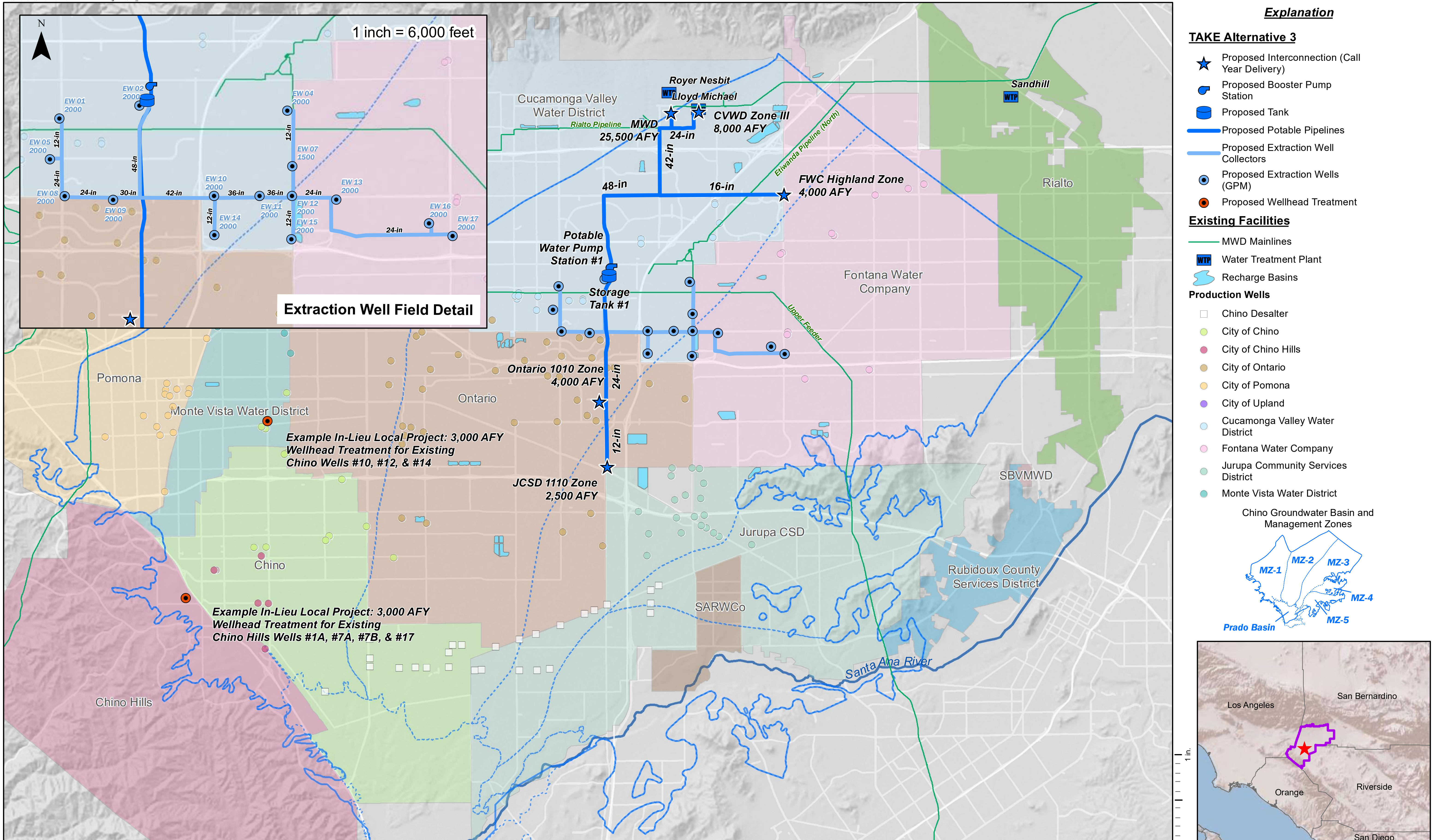

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative3

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1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

TAKE Alternative 3

Figure 4-4

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4.3.3 TAKE Alternative 7 – 0 to 100% Pump Back and/or In-Lieu with Expansion Capability, Standard Delivery

TAKE Alternative 7 (TAKE-7) involves the delivery of a total of 50.0 TAFY during call years to MWD through pump-back to the Rialto Pipeline and in-lieu deliveries to all 7 member agencies. Since this alternative is based on standard delivery, no water would be delivered during non-call years under CBP. Table 4-12 provides the deliveries to each Agency in Alternative 7.

Table 4-12. TAKE Alternative 7 Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	28.0	-
Cucamonga Valley Water District	8.0	-
Fontana Water Company	4.0	-
City of Chino[1]	2.0	-
City of Chino Hills[1]	2.0	-
City of Ontario[1]	2.0	-
City of Upland[1]	2.0	-
Monte Vista Water District[1]	2.0	-
Jurupa Community Services District	-	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**50.0**	**-**

Note:

[1]Water supplied from the WFA Agua de Lejos WTP.

TAKE Alternative 7 includes construction or use of the following facilities, shown on Figure 4-5:

- Component A – Groundwater Extraction and Blending
  - 17 extraction wells
  - 14 miles of 12- to 54-inch collector pipelines
  - Storage Tank #1: 5 MG
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir (Storage Tank #1)
  - Potable Water Pump Station #1 – Reservoir to CVWD and MWD: 4,800 HP, 22,300 gpm firm capacity, 600 ft TDH
  - Potable Water Pump Station #2 – Reservoir to FWC F16 Tanks: 220 HP, 2,500 gpm firm capacity, 250 ft TDH
  - Potable Water Pump Station #3 – Reservoir to Agua de Lejos Clearwell: 830 HP, 6,200 gpm firm capacity, 370 ft TDH
  - 4.5 miles of 36- to 54-inch potable pipeline from reservoir to CVWD and MWD

  - 7 miles of 24-inch potable pipeline from reservoir to FWC
  - 7 miles of 36-inch potable pipeline from reservoir to Agua de Lejos clearwell. Existing infrastructure, including the Benson Avenue Feeder, will be used to convey water from Agua de Lejos to all 5 WFA member agencies.
  - Proposed 54-inch turnout to the Rialto Pipeline
  - Proposed 36-inch turnout to CVWD Zone III (and optional hydropower facility)
  - Proposed 24-inch turnout to FWC Highland Zone
  - Proposed 36-inch turnout to WFA Agua de Lejos clearwell
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - No infrastructure
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - No infrastructure
- Existing Facilities:
  - Rialto Pipeline (HGL 1,936 ft)
  - Agua de Lejos clearwell (HGL 1,632 ft)
  - Benson Avenue Feeder (HGL 1,632 ft)

TAKE Alternative 7 would be operated to deliver 50.0 TAFY to the Rialto Pipeline and member agencies during call years only. Although the facilities would not be operated for Program purposes during non-call years, the infrastructure would be available for local and/or regional uses. The operation of the TAKE-7 components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 50.0 TAFY (about 31,100 gpm) of groundwater during call years in (see Section 4.2.1.1).
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Stations #1, #2, and #3.
  - Pump Station #1 would deliver 36.0 TAFY total to the Rialto Pipeline and CVWD Zone III.
  - Pump Station #2 would deliver 4.0 TAFY to the FWC Highland Zone.
  - Pump Station #3 would deliver 10.0 TAFY to the Agua de Lejos clearwell for distribution to the WFA agencies.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - No operations
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - No operations

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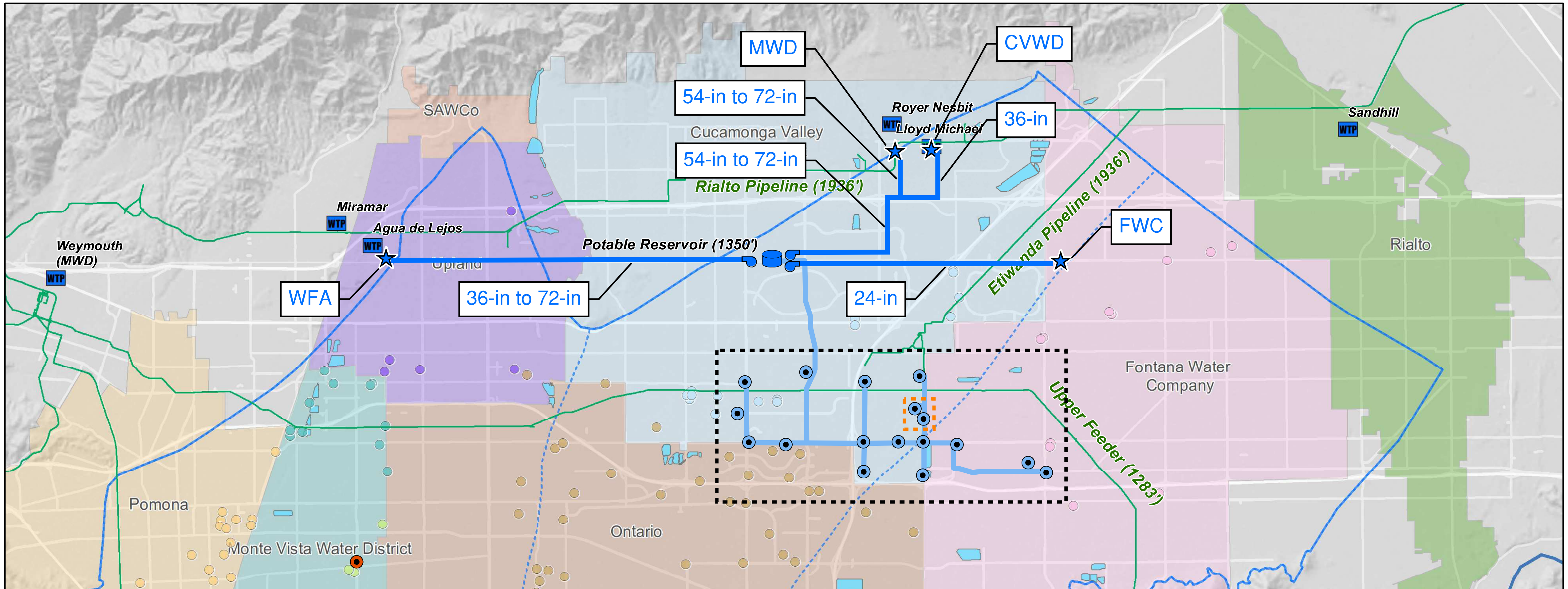


Explanation

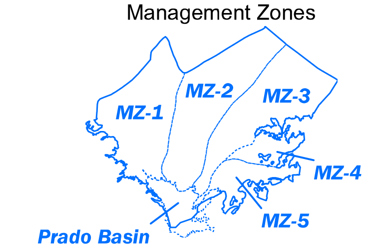
TAKE MWD Integration

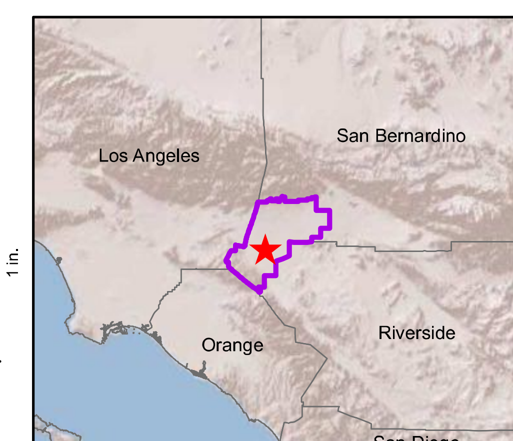
- WSIP Interconnection (WSIP Call Year Delivery)
- Proposed Tank
- Proposed Extraction Well Collectors
- Proposed Extraction Wells
- Proposed Booster Station

Existing Production Wells

- Chino Desalter
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District

Chino Groundwater Basin and Management Zones





Delivery Points
1. WFA: Agua de Lejos Clearwell - HGL 1,632 ft
2. FWC: Highland Zone @ Baseline & Cherry - HGL 1,504 ft
3. CVWD: Lloyd Michael Clearwell - HGL 1,658 ft
4. MWD: Rialto Pipeline @ CB-7 (upsized) - HGL 1,936 ft

Pipeline Alignments
1. 36-in to 72-in WFA Pipeline: Baseline, Benson (7.0 miles)
2. 24-in FWC Pipeline: Baseline: (4.5 miles)
3. 54-in to 72-in & 36-in CVWD/MWD Pipeline: Baseline, Day Creek, Banyan, Etiwanda (4.5 miles)
4. 54-in to 72-in MWD Pipeline: Bluegrass (0.3 miles)

Pump Stations
1. WFA Booster: 1,700 HP
2. FWC Booster: 300 HP
3. CVWD/MWD Booster: 4,800 HP

Extraction Wells
1. 15x 2,000 gpm
2. 2x 1,500 gpm
53,000 AFY total production capacity
Average Well Pump HP: 600 HP

Delivery Schedule
WSIP Call Year
WFA: 10,000 AFY
FWC: 4,000 AFY
CVWD: 8,000 AFY
MWD: 28,000 AFY

Note 1: During WSIP Non-Call Years, MWD could use the facilities shown (smaller diameters) to extract up to 50,000 AFY from the Chino Basin and deliver it to the Rialto Pipeline, provided MWD had banked water in the basin previously.

Note 2: During WSIP Non-Call Years, MWD could use the facilities shown (larger diameters) to extract up to 100,000 AFY from the Chino Basin and deliver it to the Rialto Pipeline or Weymouth, provided MWD had banked the water in the basin previously.

Further, for a 100,000 AFY banking program, MWD would need to install an additional 50,000 AFY of extraction well capacity, upsize the extraction well collector network, provide additional surface storage, upsize the CVWD/MWD Booster, upsize the WFA Booster (if delivering to Weymouth), and extend the WFA Pipeline to Weymouth (if delivering to Weymouth). These additional or upsized facilities are not included in this Environmental Impact Report.

Assumptions
1. Diameters based on 5 fps.
2. Extraction wells will produce 2,000 gpm, except wells outlined in orange will produce 1,500 gpm.

Pipe Capacities by Diameter

12-in	3,000 AFY
16-in	5,000 AFY
24-in	11,500 AFY
30-in	18,000 AFY
36-in	25,500 AFY
42-in	35,000 AFY
48-in	45,500 AFY
54-in	57,500 AFY
60-in	71,000 AFY
66-in	86,000 AFY
72-in	102,000 AFY

Prepared by: Brown AND Caldwell; WSC Water Systems Consulting, Inc.
Author: AWM
Date: 12/8/2020
File Name: CBP_TAKE_MWD Integration Canvas_2020-12-08

N
1 in : 2 miles
0 3,000 6,000 Feet
0 0.75 1.5 Miles

References/Notes:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project: CBP Chino Basin Program
Preliminary Design Report

Prepared for: Inland Empire Utilities Agency, A Municipal Water District

TAKE Alternative 7

Figure 4-5

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4.3.4 TAKE Alternative 8 – Partial MWD Pump Back and Partial In-Lieu or 100% In-Lieu, Standard Delivery

TAKE Alternative 8 (TAKE-8) involves the delivery of a total of 40.0 TAFY during call years to MWD through pump-back to the Rialto Pipeline, and in-lieu deliveries to CVWD and FWC. TAKE-8 also allows for in-lieu delivery of the full 40 TAFY to CVWD and FWC if MWD elects not to have water pumped back into the Rialto Pipeline.TAKE-8 is based on delivering 40.0 TAFY with the assumption that a credit for the balance of 10.0 TAFY will be given for carriage water not required to be released from Lake Oroville for SWP deliveries, as discussed in Section 4.1.4. Since this alternative is based on standard delivery, no water would be delivered during non-call years under CBP. Table 4-11 provides the deliveries to each Agency in Alternative 8.

Table 4-13. TAKE Alternative 8 Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District[1]	0.0 to 10.0	-
Cucamonga Valley Water District[1]	20.0 to 30.0	-
Fontana Water Company	10.0	-
City of Chino[1]	-	-
City of Chino Hills[1]	-	-
City of Ontario[1]	-	-
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	-	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**40.0**	**-**

Note:

[1]*When MWD Pump Back is not used, CVWD will accept delivery of 30.0 TAFY instead of 20.0 TAFY.*

TAKE Alternative 8 includes construction or use of the following facilities, shown on Figure 4-4:

- Component A – Groundwater Extraction and Blending
  - 17 extraction wells
  - 12 miles of 12- to 48-inch collector pipelines
  - Storage Tank #1: 5 MG
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir (Storage Tank #1)
  - Potable Water Pump Station #1 – Reservoir to Lloyd Michael clearwell (CVWD Zone III): 5,300 HP, 25,000 gpm firm capacity, 590 ft TDH
  - Potable Water Pump Station #2 – Lloyd Michael clearwell to the Rialto Pipeline: 650 HP, 6,200 gpm firm capacity, 290 ft TDH

  - 6.3 miles of 48-inch potable pipeline from reservoir to Lloyd Michael clearwell
  - 0.8 miles of 24-inch potable pipeline from Lloyd Michael clearwell to the Rialto Pipeline
  - 7.0 miles of 24-inch potable pipeline from Lloyd Michael clearwell to FWC F13 tanks
  - 48-inch turnout to Lloyd Michael clearwell
  - 24-inch turnout to FWC F13 tanks
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 0.7 miles of 24-inch potable pipeline from well field pipe network to FWC F17 tank
  - 2.0 miles of 36-inch potable pipeline from reservoir to proposed JCSD Etiwanda Water Supply pipe network (possible connection to a separate pipeline being constructed to connect the JCSD and CVWD systems). The cost of this pipeline is not included in the cost estimate for this alternative, as it would only be constructed at the direction of JCSD to benefit the Etiwanda Water Supply project.
  - 24-inch turnout to FWC F17 tank
  - 36-inch turnout to proposed JCSD Etiwanda Water Supply pipe network. The cost of this pipeline is not included in the cost estimate for this alternative, as it would only be constructed at the direction of JCSD to benefit the Etiwanda Water Supply project.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - No infrastructure
- Existing Facilities:
  - Rialto Pipeline (HGL 1,936 ft)
  - Lloyd Michael clearwell (HGL 1,658 ft)
  - CB-7 turnout (18-inch)

TAKE Alternative 8 would be operated to deliver 40.0 TAFY to the Rialto Pipeline and member agencies during call years only. Although the facilities would not be operated for Program purposes during non-call years, the infrastructure would be available for local and/or regional uses. The operation of the TAKE-8 components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 40.0 TAFY (about 25,500 gpm) of groundwater during call years in (see Section 4.2.1.1).
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Stations #1.
  - Pump Station #1 would deliver 40.0 TAFY total to the Lloyd Michael clearwell.
  - Pump Station #2 would deliver 10.0 TAFY to the Rialto Pipeline from the Lloyd Michael clearwell.
  - If MWD is receiving 10 TAFY of water into the Rialto Pipeline through Pump Station #2,, CVWD will receive 20.0 TAFY into their distribution system in Zone III at Lloyd Michael. If MWD is not receiving water into the Rialto Pipeline, CVWD will receive 30.0 TAFY into their distribution system.
  - FWC will receive 10.0 TAFY via pipeline from Lloyd Michael to the F13 tanks.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - FWC may elect to receive up to 10.0 TAFY at the F17 tank in the Juniper Zone adjacent to the extraction well field rather than at the F13 tanks in the Highland Zone. In this scenario, a valve would isolate the

easternmost extraction wells (up to 3) and divert up to 10.0 TAFY into the F17 tank. The volume pumped through Pump Station #1 and the pipeline from Lloyd Michael to the FWC F13 tanks would be reduced by the amount delivered to FWC at the F17 tank such that FWC received at total of 10 TAFY combined at the two deliver points.

 – The 36-inch pipe connecting with JCSD's Etiwanda Water Supply project may be used to facilitate exchanges between CVWD and JCSD, but does not have a role in facilitating CBP operations. The costs of this pipeline and turnout are not included in the cost estimate for this alternative, as they would only be constructed at the direction of JCSD to benefit the Etiwanda Water Supply project.

- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - No operations

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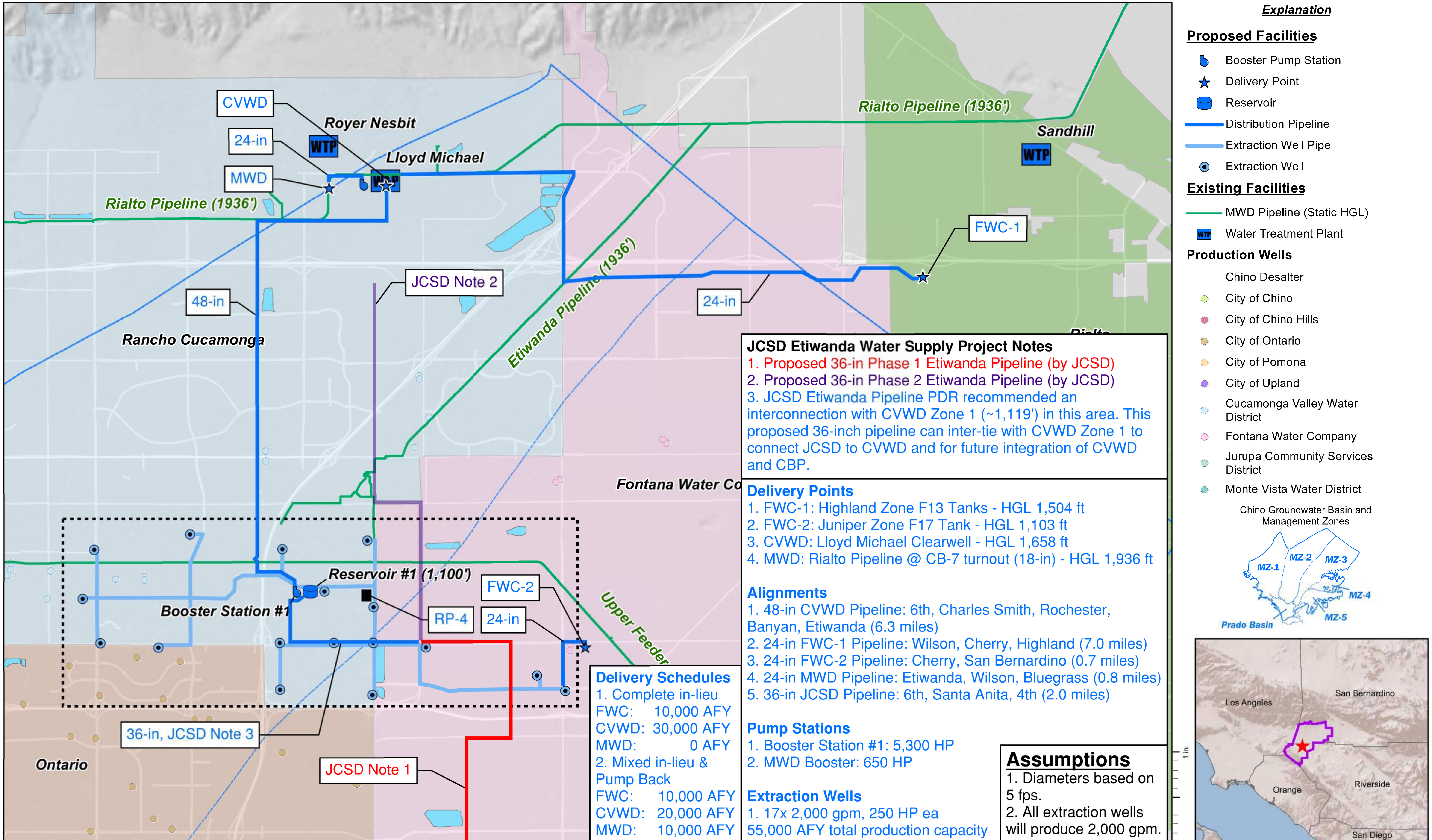

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: AWM

Date: 7/23/2021

File Name: WSIP_TAKE 40TAFY-10PB

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1 in : 0.9 miles

0 1,450 2,900 Feet

0 0.45 0.9 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency A MUNICIPAL WATER DISTRICT

TAKE Alternative 8

Figure 4-6

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4.3.5 TAKE Alternatives Summary and Cost

Major components of each TAKE alternative are summarized in Table 4-14. This table includes the detailed assumptions for each TAKE component for each TAKE Alternative, including extraction wells, wellhead treatment, potable water conveyance, and potable water storage.

The TAKE alternatives conceptual capital cost estimates are summarized in Table 4-15and O&M cost estimates are summarized in Table 4-16. The capital and O&M costs were developed for each major component using a unit cost basis, which is described in detail in TM 1 Section 7. The capital cost estimates are Class 5 estimates based on the AACE International Cost Estimate Classification System criteria, which corresponds to a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate are -20 to -50 percent on the low end and +30 to +100 on the high end. NPV costs were developed for the TAKE alternatives and described in the Draft IEUA's Chino Basin Program Economic Analysis TM (GEI, June 2020).

The capital costs for the TAKE alternatives range from a low of $248.9M (TAKE-1) to a high $326.9M (TAKE-7) (in 2019 dollars) and the annual O&M costs range from a low of $15.0M/year (TAKE-8) to a high of $18.3M/year (TAKE-7).

Note that the costs for the TAKE alternatives do not include any income generated from inline hydropower facilities.

Table 4-14. TAKE Alternatives Summary

TAKE Components	TAKE Alternatives			
	TAKE-1 100% MWD Pump Back, Standard Delivery	TAKE-3 Partial MWD Pump Back and Partial In-Lieu, Standard Delivery	TAKE-7 Partial MWD Pump Back and Partial In-Lieu, Standard Delivery	TAKE-8 Partial MWD Pump Back and Partial In-Lieu or 100% In-Lieu, Standard Delivery
Extraction Wells	*MZ1* •None *MZ2* • 15-2,000 gpm extraction wells • 2-1,500 gpm extraction wells **• 17 wells Total** *MZ3* •None	*MZ1* •None *MZ2* • 14-2,000 gpm extraction wells • 1-1,500 gpm extraction well **• 15 wells Total** *MZ3* •None	*MZ1* •None *MZ2* • 15-2,000 gpm extraction wells • 2-1,500 gpm extraction wells **• 17 wells Total** *MZ3* •None	*MZ1* •None *MZ2* • 17-2,000 gpm extraction wells **• 17 wells Total** *MZ3* •None
Wellhead Treatment	•None	*MZ1* • 1-3,000 AFY Biological Treatment • 1-3,000 AFY GAC Treatment	•None	•None
Potable Water Conveyance	*Pump Station #1* •9,300 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* •27,700 ft 54-inch •3,100 ft 42-inch •2,300 ft 36-inch •1,800 ft 30-inch •21,000 ft 24-inch •21,200 ft 12-inch **•77,100 ft Total** **•14.6 miles Total**	*Pump Station #1* •7,100 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* •16,700 ft 48-inch •14,400 ft 42-inch •7,100 ft 36-inch •1,800 ft 30-inch •39,700 ft 24-inch •14,500 ft 16-inch •24,100 ft 12-inch **•118,300 ft Total** **•22.4 miles Total**	*Pump Station #1* •4,800 HP booster pump station near intersection of Baseline and Spruce (land included in Tank #1 site) *Pump Station #2* •220 HP booster pump station near intersection of Baseline and Spruce (land included in Tank #1 site) *Pump Station #3* •830 HP booster pump station near intersection of Baseline and Spruce (land included in Tank #1 site) *Pipelines* •19,400 ft 54-inch •23,500 ft 48-inch •4,600 ft 42-inch •2,300 ft 36-inch •1,800 ft 30-inch •63,300 ft 24-inch •37,000 ft 16-inch •22,200 ft 12-inch	*Pump Station #1* •5,300 HP booster pump station near intersection of 6th and Santa Anita (land included in Tank #1 site) *Pump Station #2* •700 HP booster pump station at Lloyd Michael WTP *Pipelines* •33,500 ft 48-inch •5,300 ft 42-inch •14,000 ft 36-inch •6,100 ft 30-inch •67,100 ft 24-inch •27,100 ft 12-inch **•153,100 ft Total** **•29.0 miles Total**
Potable Water Storage	*Storage Tank #1* •5 MG tank near intersection of Milliken and Jersey •2 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* •5 MG tank near intersection of Milliken and Jersey •2 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* •5 MG tank near intersection of Spruce and Baseline •2 acres of land acquisition (includes land for Booster Station #1, #2, and #3)	*Storage Tank #1* •5 MG tank near intersection of 6th and Santa Anita •2 acres of land acquisition (includes land for Booster Station #1)

Table 4-15. TAKE Alternatives Conceptual-Level Capital Cost Estimates				
	TAKE Alternatives ($M)			
Parameter	**TAKE-1**	**TAKE-3**	**TAKE-7**	**TAKE-8**
Pipelines[1]	$50.9	$67.2	$106.3	$81.8
Turnouts/Connections	$0.5	$2.5	$2.0	$1.5
Pump Stations	$46.5	$35.5	$34.0	$29.9
Extraction Wells	$42.5	$37.5	$47.6	$47.6
Wellhead Treatment	-	$9.2	$0	$0
Water Storage Tank(s)	$6.5	$6.5	$6.5	$6.5
Brine Disposal (NRWS)	-	$0.06	$0	$0
Land	$4.4	$4.1	$4.4	$4.4
Subtotal	$151.4	$162.6	$200.8	$171.7
Contingency (30%)[2]	$44.1	$47.5	$58.9	$50.2
Subtotal	$195.4	$210.1	$259.8	$221.9
Implementation (28%)[2]	$53.5	$57.7	$71.5	$60.9
Total Capital Cost ($M)				
Total Capital Cost ($2019)	**$248.9**	**$267.7**	**$331.3**	**$282.8**
Total Capital Cost ($2024)[3]	$274.8	$295.6	$403.0	$344.1

Notes:

[1]Includes potable water and brine pipelines.

[2]Brine disposal (NRW) and land costs not included in contingency or implementation calculations.

[3]2024 is the estimated mid-point of construction

Table 4-16. TAKE Alternatives Conceptual-Level Annual O&M Cost Estimates				
TAKE Alternatives ($M/year)				
Parameter	TAKE-1	TAKE-3	TAKE-7	TAKE-8
Fixed O&M[1]				
Pipelines	$0.07	$0.1	$0.2	$0.1
Turnouts	$0.005	$0.03	$0.02	$0.02
Extraction Wells	$0.5	$0.5	$0.5	$0.5
EQ Tank	$0.1	$0.1	$0.1	$0.1
Pump Stations	$1.4	$1.1	$1.0	$0.9
NRW	$0	$0.005	$0	$0
Variable O&M[2]				
Extraction Wells	$4.6	$4.0	$8.9	$6.7
Pump Stations	$10.3	$7.8	$7.6	$6.6
Wellhead Treatment	$0	$1.8	$0	$0
NRW	$0	$0.003	$0	$0
Annual O&M Cost ($2019) ($M/year)	**$17.0**	**$15.4**	**$18.3**	**$15.0**

[1]*Includes costs for routine annual maintenance.*

[2]*Includes operations and maintenance costs during call years.*

4.4 TAKE Alternatives Evaluation

Initial alternatives (TAKE-1 through TAKE-6) were evaluated with a similar process as the PUT alternatives to compare on a common basis. This multi-criteria evaluation was completed prior to the development of TAKE-7 and TAKE-8. It was later determined that the alternatives with pre-delivery were not feasible. The multi-criteria evaluation of the initial alternatives are included in Appendix B. Since TAKE-7 and TAKE-8 were developed with participating agencies and have their support, these alternatives were not carried through the multi-criteria evaluation.

Section 5: Program Recommendations

This section describes the program alternatives that were developed based on the recommended PUT alternative from Section 3.5 and the recommended TAKE alternatives from Section 4.5.

The PUT and TAKE alternatives were developed and evaluated separately. Based on those evaluations, the following alternatives were recommended to be carried forward into the program alternatives evaluation:

- Recommended PUT alternative (see Section 3.5)
  - PUT-5: AWPF at RP-4 and groundwater recharge in MZ-2
- Recommended TAKE alternatives (see Section 4.4)
  - TAKE-1: 100% pump back with standard delivery
  - TAKE-3: Partial pump back and partial in-lieu with standard delivery
  - TAKE-7: 0 to 100% Pump Back and/or In-Lieu with Expansion Capability with standard delivery
  - TAKE-8: Partial pump back and partial in-lieu or 100% in-lieu with standard delivery

The selection of PUT-5 confirms that the preferred location for the AWPF is at RP-4 with the groundwater recharged focused in MZ-2. Since pre-delivery is not feasible, the recommended TAKE alternatives include TAKE-1, TAKE-3, TAKE-7, and TAKE-8. CVWD and FWC have expressed support for TAKE-8. Due to the participating agency support, TAKE-8 is the preferred TAKE alternative resulting in a recommended program alternative of PUT-5 and TAKE-8. However, all four TAKE alternatives are included in the environmental reports to account for the infrastructure that is not in TAKE-8. This allows IEUA and stakeholders to ultimately select a different TAKE alternative, or combination of infrastructure from multiple alternatives. Thus, though PUT-5 and TAKE-8 comprise the preferred program alternative, all four TAKE alternatives remain as recommendations until the environmental process is complete. Further consideration of the TAKE alternatives was evaluated separately to determine the projected impacts and incorporated into a groundwater modeling TM by West Yost.

The total program costs are summarized in Table 5-1.

Table 5-1. Program Alternatives Conceptual-Level Cost Estimates

Capital Cost ($M, $2019)				
Component	**PUT-5 & TAKE-1**	**PUT-5 & TAKE-3**	**PUT-5 & TAKE-7**	**PUT-5 & TAKE-8**
PUT	$306	$306	$306	$306
TAKE	$257	$268	$331	$283
Subtotal	***$563***	***$574***	***$637***	***$589***
External supply infrastructure	$79	$79	$79	$79
Total	**$642**	**$671**	**$716**	**$668**
Annual O&M Cost ($M, $2019)				
Component	**PUT-5 & TAKE-1**	**PUT-5 & TAKE-3**	**PUT-5 & TAKE-7**	**PUT-5 & TAKE-8**
PUT	$11.4	$11.4	$11.4	$11.4
TAKE (call year)	$17.0	$15.4	$18.3	$15.0
Subtotal	***$28.4***	***$26.8***	***$29.7***	***$26.4***
External supply infrastructure	$0	$0	$0	$0
Total	**$28.4**	**$26.8**	**$29.7**	**$26.4**

Appendix A: Pre-Delivery TAKE Alternatives

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Section A-1: Introduction

The TAKE alternatives that were initially developed, evaluated, and documented in the Draft TM2 (dated July 6, 2020) are summarized in Table A-1. As discussed in TM2 Section 4, the six initial alternatives were developed based on the delivery mechanism (pump back or in-lieu) and the delivery condition (standard or pre-delivery). The six alternatives include the two bookends for the delivery mechanism with 100 percent pump back (TAKE-1 and TAKE-2) and 100 percent in-lieu (TAKE-5 and TAKE-6) as well as combination alternatives with partial pump back and partial in-lieu (TAKE-3 and TAKE-4). Each of these three delivery mechanisms were the combined with standard delivery and pre-delivery. For this Study, pre-delivery in non-call years was assumed to be 10.0 TAFY.

However, pre-delivery was later determined not to be feasible and is no longer being considered for the CBP. Two additional alternatives (TAKE-7 and TAKE-8) were developed following further discussions with interested, participating agencies and include both partial pump back and partial in-lieu. Also, TAKE-8 could be operated as 100 percent in-lieu.

This section presents the TAKE alternatives descriptions for the pre-delivery alternatives, which include TAKE-2, TAKE-4 (TAKE-4a, 4b, and 4c), and TAKE-6 (TAKE-6a and 6b) and which were originally documented in the Draft TM2 (dated July 6, 2020). Since these alternatives include pre-delivery, these alternatives were eliminated from consideration.

Note that TAKE-5 was envisioned to include in-lieu delivery of 50.0 TAFY of CBP water during call years (i.e., Standard Delivery). TAKE-5 was removed from consideration because the total in-lieu capacity for all member agencies, JCSD, Western, and TVMWD combined was less than 50.0 TAFY when accounting for the required minimum WTP flowrates, and therefore it was impossible to deliver all 50.0 TAFY via in-lieu.

Table A-1. Summary of Initial TAKE Alternatives (Draft TM2 dated July 6. 2020)									
TAKE Alternative	Description		Non-Call Year Deliveries (Pre-Delivery) (TAFY)	Call Year Deliveries (Includes Pre-Delivery)			Total Delivery over 25 Years		
	Pump Back and/or In-Lieu	Standard Delivery or Pre-Delivery		Pump Back (TAFY)	In-Lieu (TAFY)	Total (TAFY)	Pre-Delivery (TAF)	Call Year Deliveries (TAF)	Total (TAF)
TAKE-1	100% Pump Back	Standard	-	50.0	-	50.0	-	375.0	375.0
TAKE-2		Pre-Delivery	10.0	26.7	-	26.7	250.0	125.0	375.0
TAKE-3	Partial Pump Back and Partial In-Lieu	Standard	-	25.5	24.5	50.0	-	375.0	375.0
TAKE-4[1]: TAKE-4a TAKE-4b TAKE-4c		Pre-Delivery	10.0	10.0	16.7	26.7	250.0	125.0	375.0
TAKE-5 Not feasible[2]	100% In-Lieu	Standard	-	-	50.0	50.0	-	375.0	375.0
TAKE-6[3]: TAKE-6a TAKE-6b		Pre-Delivery	10.0	-	26.7	26.7	250.0	125.0	375.0

[1]Three approaches for TAKE-4 were developed: TAKE-4a, TAKE-4b, and TAKE-4c.

[2]TAKE-5 was determined not to be feasible due to in-lieu deliveries exceeding in-lieu capacity.

[3]Two approaches for TAKE-6 were developed: TAKE-6a and TAKE-6b.

A-1.1 TAKE Alternative 2 – 100% MWD Pump Back, Pre-Delivery

TAKE Alternative 2 (TAKE-2) includes delivery of 26.7 TAFY of CBP water to the Rialto Pipeline during call years, 10.0 TAFY pre-delivery of water to the Rialto Pipeline during non-call years, and no delivery of water to member agencies for in-lieu. Table A-2 provides the breakdown of CBP water deliveries during call and non-call years.

Table A-2. TAKE Alternative 2 Deliveries to Each Agency (TAFY)		
Agency	Call Year	Non-Call Year
Metropolitan Water District	26.7	10.0[2]
Cucamonga Valley Water District	-	-
Fontana Water Company	-	-
City of Chino[1]	-	-
City of Chino Hills[1]	-	-
City of Ontario[1]	-	-
City of Upland[1]	-	-

Table A-2. TAKE Alternative 2 Deliveries to Each Agency (TAFY)		
Agency	**Call Year**	**Non-Call Year**
Monte Vista Water District[1]	-	-
Jurupa Community Services District	-	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]Water supplied from the WFA Agua de Lejos WTP.

[2]Could either be MWD Pump Back or In-Lieu CBP. Exact deliveries to agencies during non-call years has not been determined.

TAKE Alternative 2 includes construction or use of the following facilities, shown on Figure A-1:

- Component A – Groundwater Extraction and Blending
  - 10 extraction wells
  - 6 miles of 12- to 30-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 5,000 HP, 16,600 gpm firm capacity, 823 ft TDH
  - 5 miles of 42-inch potable northern pipeline
  - Proposed 42-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - None
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - None
- Existing Facilities:
  - Rialto Pipeline (HGL 1,936 ft)

TAKE Alternative 2 would be operated to delivery 26.7 TAFY to the Rialto Pipeline during call years, and 10.0 TAFY during non-call years. The operation of the TAKE-2 components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 26.7 TAFY (about 16,600 gpm) of groundwater as described in TM 2 Section 4.2.1.1 during call years and 10.0 TAFY (6,200 gpm) during non-call years. Unused extraction capacity during non-call years would be available for other local or regional uses.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir

Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. During call years, Pump Station #1 would deliver 26.7 TAFY of water to the Rialto Pipeline through a proposed 42-inch pipeline and a proposed 42-inch turnout into the Rialto Pipeline. During non-call years, Pump Station #1 would deliver 10.0 TAFY to the Rialto Pipeline.

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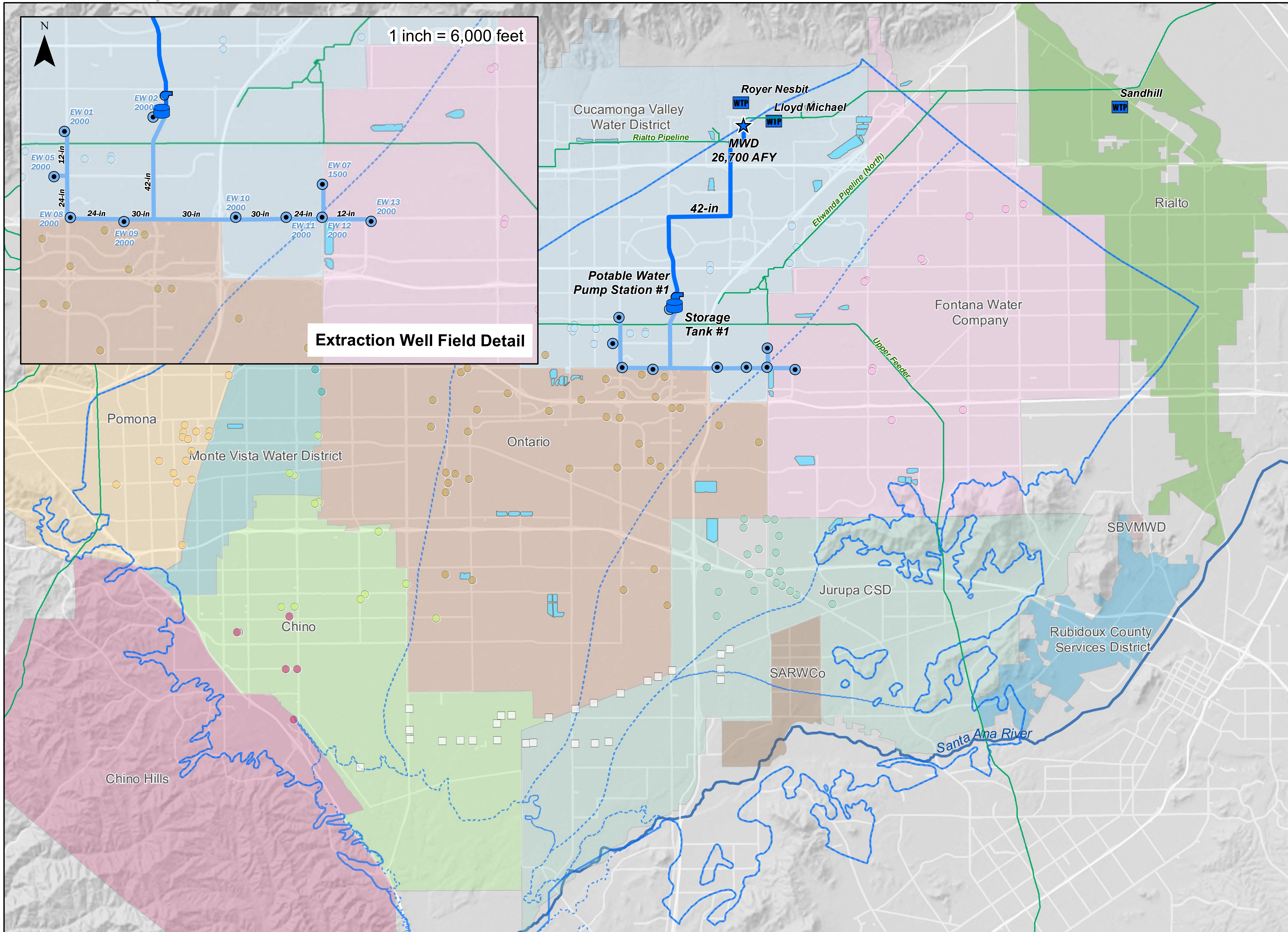


Explanation

TAKE Alternative 2

- Proposed Interconnection (Call Year Delivery)
- Proposed Booster Pump Station
- Proposed Tank
- Proposed Potable Pipelines
- Proposed Extraction Well Collectors
- Proposed Extraction Wells (GPM)

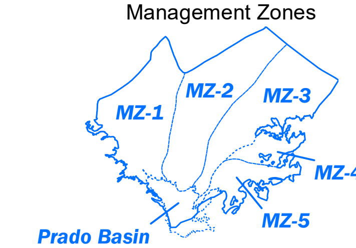
Existing Facilities

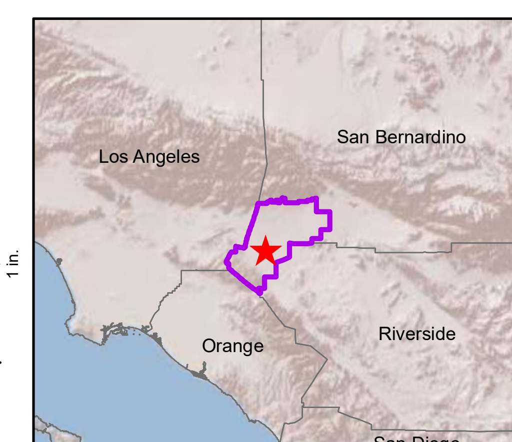
- MWD Mainlines
- Water Treatment Plant
- Recharge Basins

Production Wells

- Chino Desalter
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District

Chino Groundwater Basin and Management Zones





Prepared by: Brown AND Caldwell | WSC Water Systems Consulting, Inc.

Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative2

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1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
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Project: CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for: Inland Empire Utilities Agency, A Municipal Water District

TAKE Alternative 2

Figure A-1

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A-1.2 TAKE Alternatives 4a, 4b, and 4c – Partial MWD Pump Back and Partial In-Lieu, Pre-Delivery

TAKE Alternative 4 includes partial MWD pump back and partial in-lieu use and pre-delivery. Three variations of TAKE Alternative 4 were developed, TAKE Alternatives 4a, 4b, and 4c, to evaluate different approaches for potable water supply infrastructure. All three alternatives include infrastructure to deliver 26.7 TAFY combined curing call years to the Rialto Pipeline, five to all seven member agencies, and JCSD, and to deliver 10.0 TAFY during non-call years. The three TAKE Alternative 4 variations are as follows:

- TAKE Alternative 4a includes predominantly north-south pipelines and would connect to the Rialto Pipeline near CVWD's Lloyd W. Michael WTP. This alternative includes the least pipeline length, but only delivers in-lieu water to five member agencies and JCSD.
- TAKE Alternative 4b includes predominantly east-west pipelines and would connect to the Rialto Pipeline near the TVMWD's Miramar WTP. This alternative includes more pipeline length than TAKE Alternative 4a, but less than TAKE Alternative 4c, and delivers in-lieu water to seven member agencies and JCSD.
- TAKE Alternative 4c includes north-south and east-west pipelines and would connect to the Rialto pipeline near CVWD's Lloyd W. Michael WTP. This alternative includes the most pipeline length and delivers in-lieu water to seven member agencies and JCSD.

TAKE Alternatives 4a, 4b, and 4c are described in more detail in the following sections.

A-1.2.1 TAKE Alternative 4a – Partial MWD Pump Back and Partial In-Lieu, Pre-Delivery

TAKE Alternative 4a (TAKE-4a) includes the delivery of 26.7 TAFY combined during call years to the Rialto Pipeline, five member agencies, and JCSD. 10.0 TAFY of water would be delivered during non-call years to either MWD or In-Lieu CBP. Table A-3 provides the TAKE Alternative 4a deliveries to each agency.

Table A-3. TAKE Alternative 4a Deliveries (TAFY)		
Agency	**Call Year**	**Non-Call Year**
Metropolitan Water District	10.0	10.0[2]
Cucamonga Valley Water District	2.95	-
Fontana Water Company	2.95	-
City of Chino[1]	2.95	-
City of Chino Hills[1]	2.95	-
City of Ontario[1]	2.95	-
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	1.95	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]Water supplied from the WFA Agua de Lejos WTP.

[2]Could either be MWD Pump Back or In-Lieu CBP. Exact deliveries to agencies during non-call years has not been determined.

TAKE Alternative 4a includes construction or use of the following facilities, shown on Figure A-2:

- Component A – Groundwater Extraction and Blending
  - 8 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 2,000 HP, 9,900 gpm firm capacity, 552 ft TDH
  - 8 miles of 16- through 30-in potable northern pipeline (includes branches to FWC and CVWD)
  - Proposed 16-inch turnout to FWC Highland Zone (and optional hydropower facility)
  - Proposed 16-inch turnout to CVWD Zone III
  - Potable Water Pump Station #2: 700 HP, 6,200 gpm firm capacity, 282 ft TDH
  - Proposed 24-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 12- and 16-inch potable southern pipeline
  - Proposed 16-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 2.95 TAFY wellhead treatment for Chino Well Nos. 10, 12, and 14
  - 2.95 TAFY wellhead treatment for Chino Hills Well Nos. 1A, 7A, 7B, and 17
- Existing Facilities
  - Rialto Pipeline (HGL 1,936 ft)
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)

All facilities in TAKE Alternative 4a would be operated to deliver 26.7 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to MWD through Pump Station #1 and Pump Station #2. The following sections discuss call year operation.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 20.8 TAFY (about 12,900 gpm) of groundwater as described in TM 2 Section 4.2.1.1.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 15.9 TAFY combined of water to the Rialto Pipeline (via Pump Station #2), CVWD Zone III, and FWC Highland Zone through a proposed 36-inch pipeline, branching pipelines to CVWD and FWC, and turnouts to all three agencies. Potable Water Pump Station #2 would be at a turnout off the northern

pipeline to lift water to the Rialto Pipeline. Based on preliminary calculations, it is more cost effective to construct Pump Station #2 exclusively to lift water to the Rialto Pipeline rather than over-pumping FWC and CVWD deliveries to 1,936 ft and recovering excess energy with hydropower facilities.

- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4.9 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone and JCSD's 1110 Zone along a proposed 12- and 16-inch southern pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not JCSD's turnout.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 5.9 TAFY (of 26.7 TAFY) would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 4a proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 2.95 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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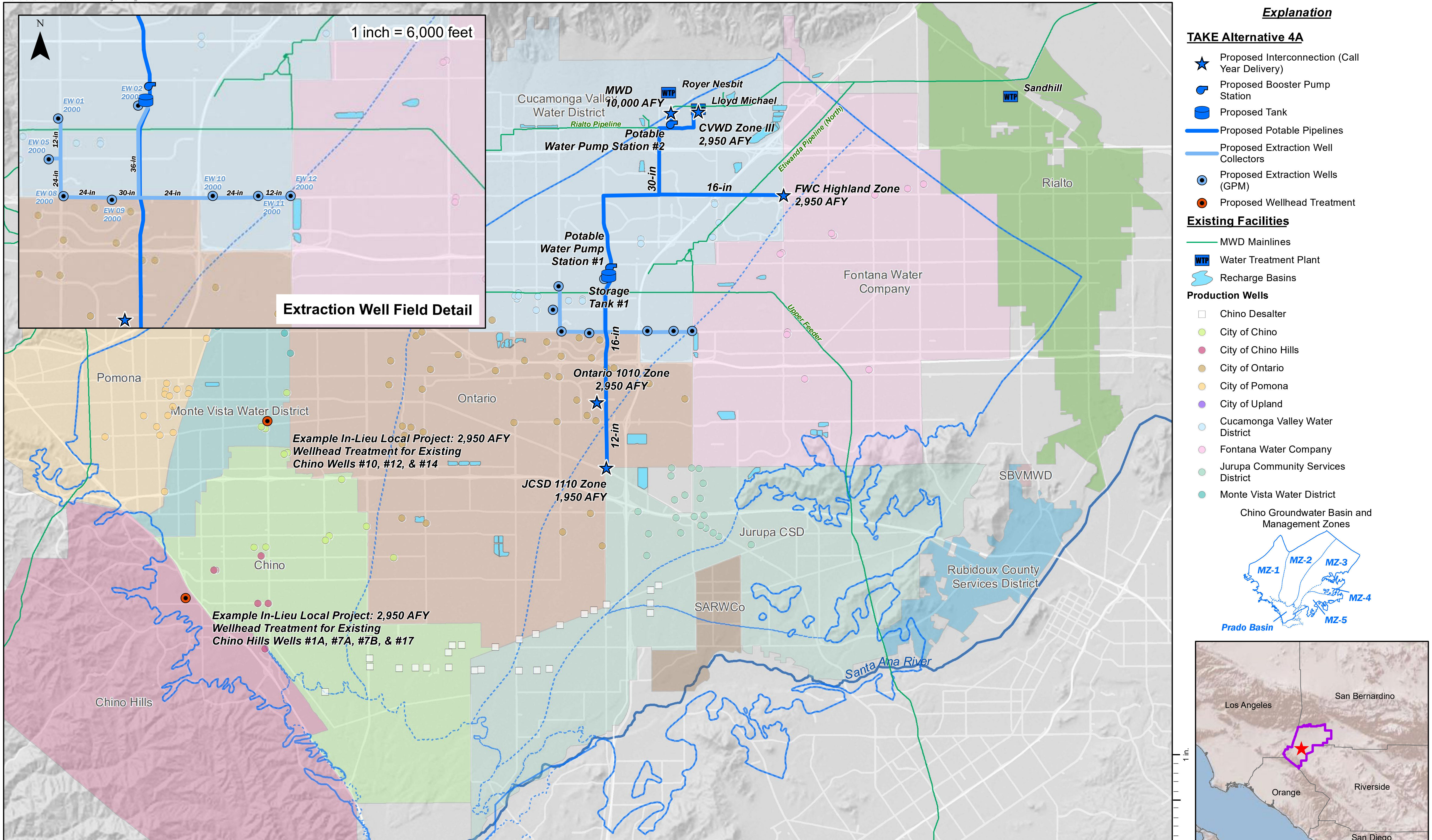

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Date: 6/22/2020

File Name: CBP_TAKEAlternative4A

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1 in : 2 miles

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0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency A MUNICIPAL WATER DISTRICT

TAKE Alternative 4A

Figure A-2

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A-1.2.2 TAKE Alternative 4b – Partial MWD Pump Back and Partial In-Lieu, Pre-Delivery

TAKE Alternative 4b (TAKE-4b) involves the delivery of 26.7 TAFY combined during call years to the Rialto Pipeline, all seven member agencies, and Jurupa Community Services District. 10.0 TAFY of water would be delivered during non-call years to either MWD or In-Lieu CBP. TAKE Alternative 4b is different than TAKE-4b in that it includes construction of an east-west pipeline that accommodates delivery of CBP water to member agencies on the west side of the IEUA service area (Upland and MVWD), and also moves the location of MWD pump back to a proposed turnout along the Rialto Pipeline near the TVMWD Miramar WTP in Claremont. Table A-4 provides the deliveries to each agency in TAKE Alternative 4b.

Table A-4. TAKE Alternative 4b Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	10.0	10.0[2]
Cucamonga Valley Water District	2.5	-
Fontana Water Company	2.5	-
City of Chino[1]	1.95	-
City of Chino Hills[1]	1.95	-
City of Ontario[1]	1.95	-
City of Upland[1]	1.95	-
Monte Vista Water District [1]	1.95	-
Jurupa Community Services District	1.95	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]*Water supplied from the WFA Agua de Lejos WTP.*

[2]*Could either be MWD Pump Back or In-Lieu CBP. Exact deliveries to agencies during non-call years has not been determined.*

TAKE Alternative 4b includes construction or use of the following facilities, shown on Figure A-3:

- Component A – Groundwater Extraction and Blending
  - 9 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 2,300 HP, 10,200 gpm firm capacity, 599 ft TDH
  - 10 miles of 30-inch east-west pipeline (the first mile of this pipeline in Milliken Avenue from Jersey Street to Foothill Boulevard is part of the northern pipeline in other alternatives. It is considered part of the east-west pipeline in this alternative because the pipeline turns west and does not actually continue to any turnouts in the northern part of the project area).

- Proposed 12-inch turnout to CVWD Zone II
    - Proposed 16-inch turnout to Agua de Lejos clearwell (Upland and MVWD)
    - Potable Water Pump Station #2: 800 HP, 6,200 gpm firm capacity, 314 ft TDH
    - Proposed 24-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
    - 6 miles of 12- to 24-inch potable southern pipeline
    - Proposed 12-inch turnout to FWC Juniper Zone (HGL 1,103 ft)
    - Proposed 12-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
    - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
    - 1.95 TAFY wellhead treatment for Chino Well Nos. 10, 12, and 14
    - 1.95 TAFY wellhead treatment for Chino Hills Well Nos. 1A, 7A, 7B, and 17
- Existing Facilities
    - Rialto Pipeline (HGL 1,936 ft)
    - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
    - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)
    - Agua de Lejos WTP Clearwell (HGL 1,632 ft)

All facilities in TAKE Alternative 4b would be operated to deliver 26.7 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to MWD through Pump Station #1 and Pump Station #2. The following sections discuss call year operation.

- Component A – Groundwater Extraction and Blending
    - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 22.8 TAFY (14,200 gpm) of groundwater as described in TM 2 Section 4.2.1.1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
    - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 16.4 TAFY combined of water to the Rialto Pipeline, CVWD Zone II (HGL 1,420 ft), and Upland and MVWD via the WFA Agua de Lejos WTP clearwell (HGL 1,632 ft) through a proposed 10-mile 30-inch east-west pipeline and three turnouts.
    - Pump Station #2 would be at the final turnout on the East-West pipeline would be to lift water to the Rialto Pipeline. In TAKE Alternative 4b and based on preliminary calculations, it is more cost effective to construct Pump Station #2 exclusively to lift water to the Rialto Pipeline rather than over-pumping CVWD and Agua de Lejos deliveries to 1,936 ft and recovering excess energy with hydropower facilities.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
    - 6.4 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone, FWC's Juniper Zone (HGL 1,103 ft), and JCSD's 1110 Zone along a proposed 12- to 24-inch Southern Pipeline (in TAKE Alternative 4b, the southern pipeline also includes a branching pipeline to deliver water to FWC's Juniper Zone through a 12-inch turnout). Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout. Pressure reducing valve stations without energy recapture ability are not appropriate for JCSD and FWC's turnouts due to the small difference in head between their HGLs and Storage Tank #1.

- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 3.9 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 4b proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 1.95 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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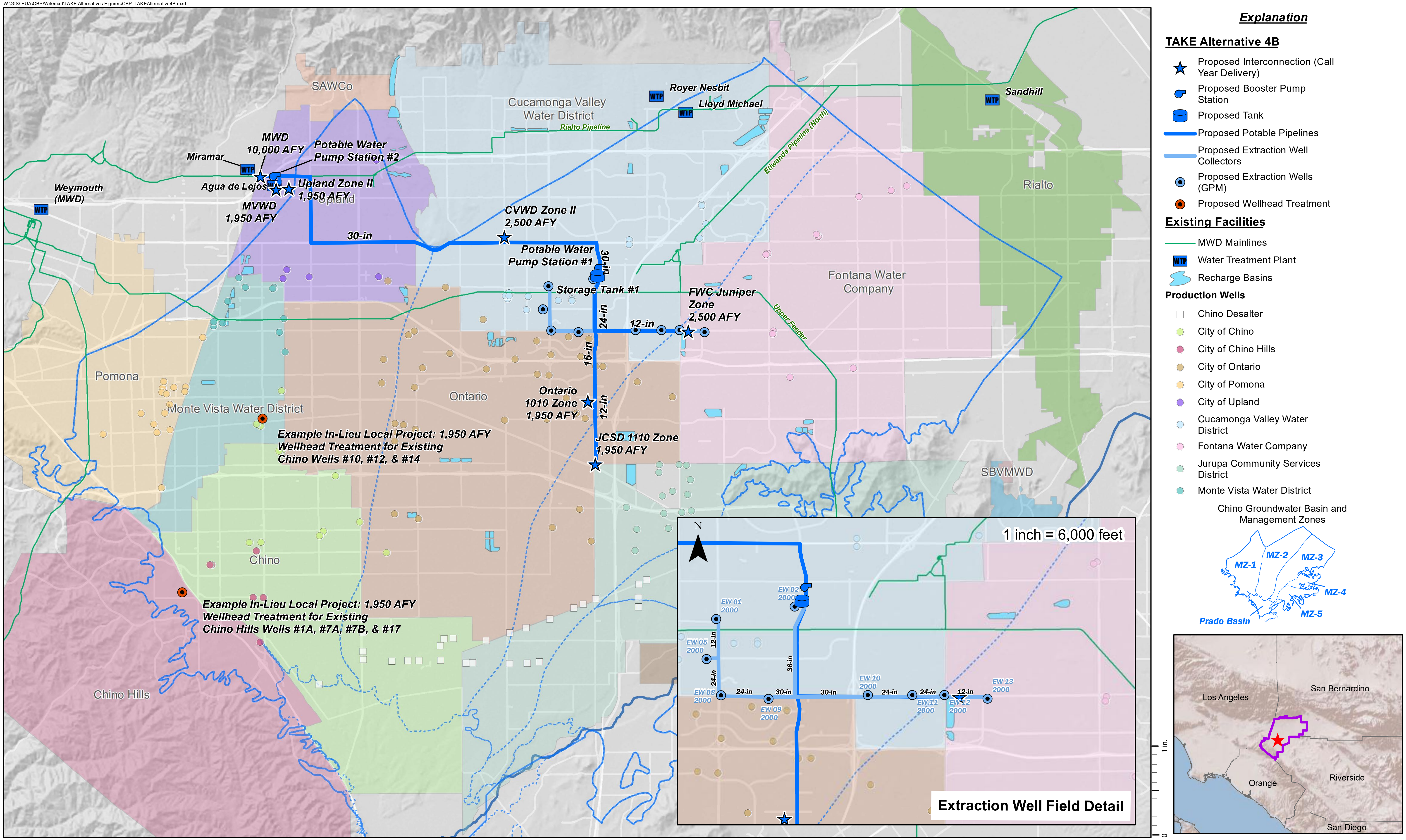

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Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative4B

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
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2.
3.

Project:

CBP CHINO BASIN PROGRAM

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Prepared for:

Inland Empire Utilities Agency A MUNICIPAL WATER DISTRICT

TAKE Alternative 4B

Figure A-3

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A-1.2.3 TAKE Alternative 4c – Partial MWD Pump Back and Partial In-Lieu, Pre-Delivery

TAKE Alternative 4c (TAKE-4c) involves the delivery of 26.7 TAFY combined during call years to the Rialto Pipeline, all seven member agencies, and Jurupa Community Services District. 10.0 TAFY of water would be delivered during non-call years to either MWD or In-Lieu CBP. TAKE Alternative 4c is nearly identical to TAKE Alternative 4b, with the only changes being MWD's proposed turnout being located near CVWD's Lloyd W. Michael WTP, and CVWD and FWC's turnouts being moved to higher pressure zones to provide them with more operational flexibility. TAKE Alternative 4c is different from TAKE-4a in that it also includes the east-west pipeline to deliver water to Upland and MVWD. Table A-5 provides the deliveries to each agency for TAKE Alternative 4c.

Table A-5. TAKE Alternative 4c Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	10.0	10.0[2]
Cucamonga Valley Water District	2.5	-
Fontana Water Company	2.5	-
City of Chino[1]	1.95	-
City of Chino Hills[1]	1.95	-
City of Ontario[1]	1.95	-
City of Upland[1]	1.95	-
Monte Vista Water District[1]	1.95	-
Jurupa Community Services District	1.95	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]*Water supplied from the WFA Agua de Lejos WTP.*

[2]*Could either be MWD Pump Back or In-Lieu CBP. Exact deliveries to agencies during non-call years has not been determined.*

TAKE Alternative 4c includes construction or use of the following facilities, shown on Figure A-4:

- Component A – Groundwater Extraction and Blending
  - 9 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 2,600 HP, 11,700 gpm firm capacity, 599 ft TDH
  - 8 miles of 12- to 36-inch northern pipeline
  - Proposed 12-inch turnout to FWC Highland Zone

- Proposed 12-inch turnout to CVWD Zone III
- Potable Water Pump Station #2: 700 HP, 6,200 gpm firm capacity, 281 ft TDH
- Proposed 24-inch turnout to the Rialto Pipeline
- 9 miles of 16-inch east-west pipeline
- Proposed 16-inch turnout to Agua de Lejos clearwell (Upland and MVWD)

- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 12- and 16-inch potable southern pipeline
  - Proposed 12-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 1.95-TAFY biological wellhead treatment at Chino Well 14
  - 1.95-TAFY biological wellhead treatment at Chino Hills Well TBD
- Existing Facilities
  - Rialto Pipeline (HGL 1,936 ft)
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)
  - Agua de Lejos WTP Clearwell (HGL 1,632 ft)

All facilities in TAKE Alternative 4c would be operated to deliver 26.7 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to MWD through Pump Station #1 and Pump Station #2. The following sections discuss call year operation.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 22.8 TAFY (about 14,200 gpm) of groundwater as described in TM 2 Section 4.2.1.1.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 18.9 TAFY combined of water to the Rialto Pipeline, CVWD Zone III (HGL 1,658 ft), FWC Highland Zone (HGL 1,504), and Upland and MVWD via the WFA Agua de Lejos clearwell (HGL 1,632 ft) through the proposed northern and east-west pipelines network, and four turnouts.
  - Potable Water Pump Station #2 would be at a turnout off the northern pipeline to lift water to the Rialto Pipeline. In TAKE Alternative 4c and based on preliminary calculations, it is more cost effective to construct Pump Station #2 exclusively to lift water to the Rialto Pipeline rather than over-pumping FWC and CVWD deliveries to 1,936 ft and recovering excess energy with hydropower facilities.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4.9 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario’s 1010 Zone, FWC’s Juniper Zone (HGL 1,103 ft), and JCSD’s 1110 Zone along a proposed 16-inch southern pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario’s turnout, but not JCSD’s turnout.

- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)

The remaining 3.9 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 4c proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 1.95 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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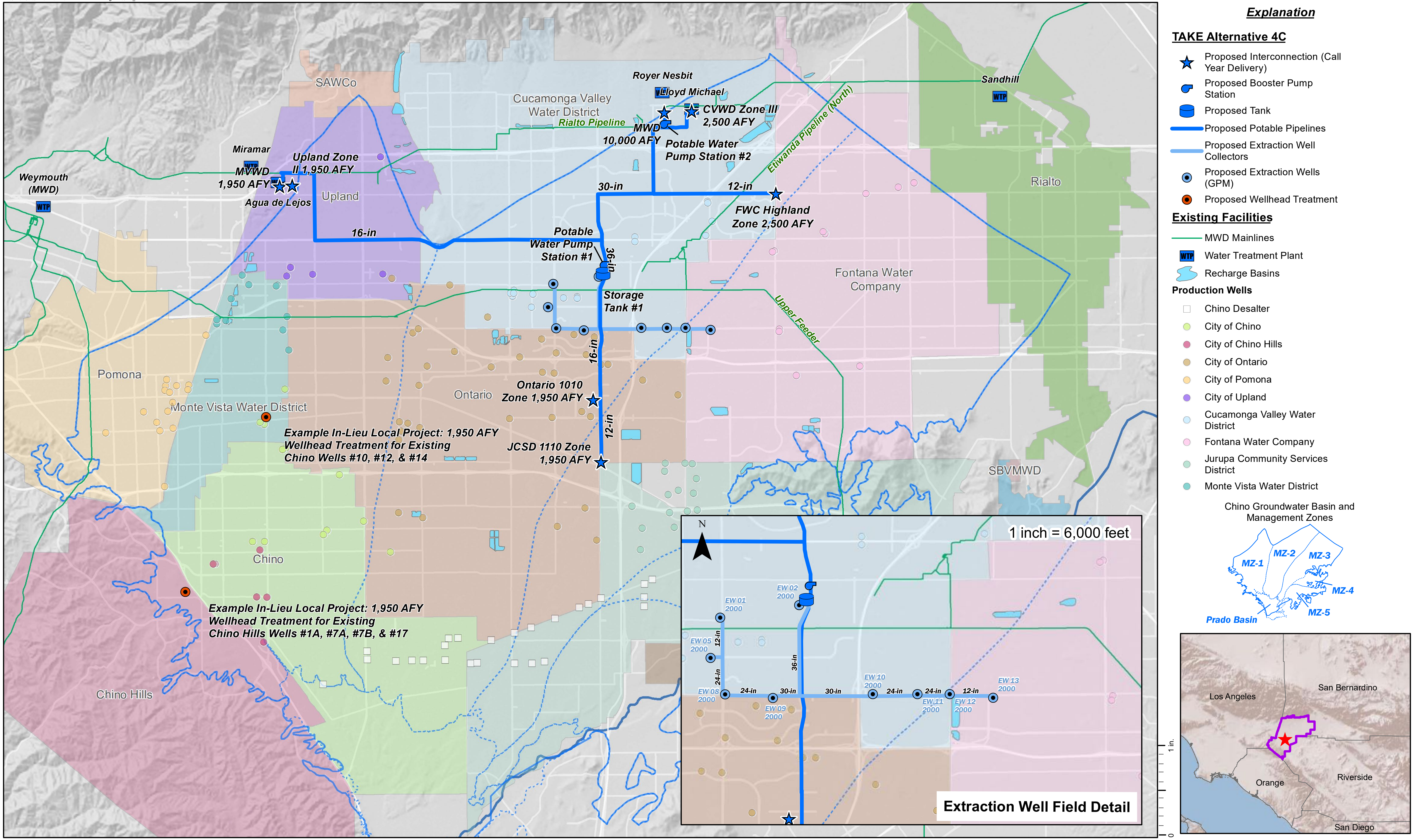

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: AWM

File Name: CBP_TAKEAlternative4C

Date: 6/22/2020

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1 in : 2 miles

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0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency — A Municipal Water District

TAKE Alternative 4C

Figure A-4

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A-1.3 TAKE Alternatives 6a and 6b – 100% In-Lieu, Pre-Delivery

TAKE Alternative 6 includes 100% in-lieu use and pre-delivery. Two variations of TAKE Alternative 6 were developed, TAKE Alternatives 6a and 6b, to evaluate different approaches for potable water supply infrastructure. Both alternatives include infrastructure to deliver 26.7 TAFY combined curing call years and 10.0 TAFY during non-call years to member agencies and outside agencies, including JCSD, Western, and/or TVMWD. TAKE Alternatives 6a and 6b do not have MWD pump back to the Rialto Pipeline. The two TAKE Alternative 6 variations are as follows:

- TAKE Alternative 6a includes predominantly north-south pipelines and delivers in-lieu water to five agencies, JCSD, and Western.
- TAKE Alternative 6b includes predominantly east-west pipelines and delivers in-lieu water to all seven member agencies, JCSD, and TVMWD.

TAKE Alternatives 6a and 6b are described in more detail in the following sections.

A-1.3.1 TAKE Alternative 6a – 100% In-Lieu, Pre-Delivery

TAKE Alternative 6a (TAKE-6a) involves the delivery of 26.7 TAFY of CBP water to five member agencies, JCSD, and Western during call years and 10.0 TAFY in non-call years. Table A-6 provides the deliveries to each agency for TAKE Alternative 6a.

Table A-6. TAKE Alternative 6a Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	-	-
Cucamonga Valley Water District	7.7	2.0
Fontana Water Company	4.0	1.0
City of Chino[1]	3.0	3.0
City of Chino Hills[1]	3.0	3.0
City of Ontario[1]	4.0	1.0
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	2.5	-
Western Municipal Water District	2.5	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]*Water supplied from the WFA Agua de Lejos WTP.*

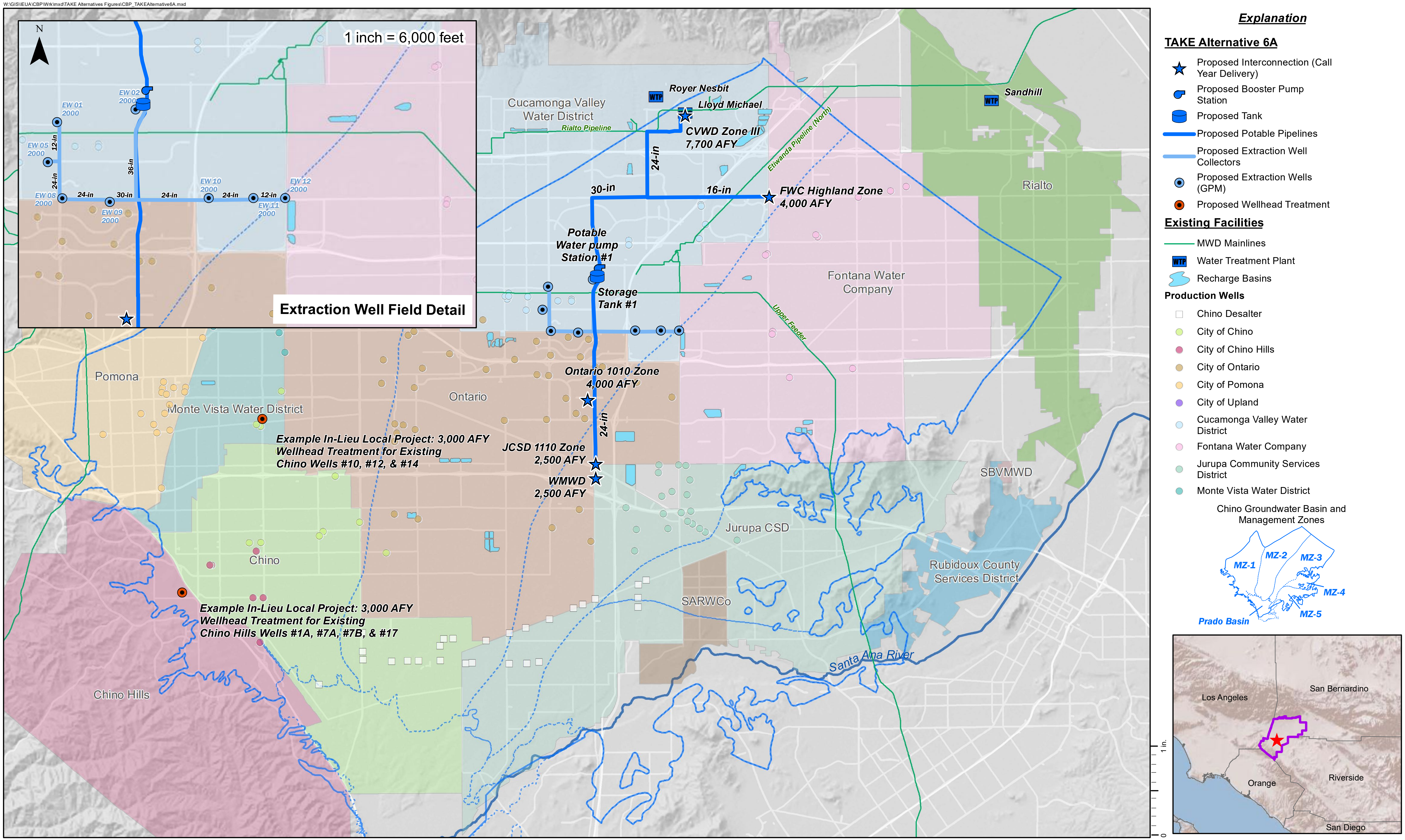
TAKE Alternative 6a includes construction or use of the following facilities, shown on Figure A-5:

- Component A – Groundwater Extraction and Blending
  - 8 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1

- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 1,500 HP, 7,300 gpm firm capacity, 552 ft TDH
  - 8 miles of 16- to 30-inch northern pipeline
  - Proposed 16-inch turnout to FWC Highland Zone
  - Proposed 24-inch turnout to CVWD Zone III
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 24-inch potable southern pipeline
  - Proposed 16-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 24-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 3.0-TAFY biological wellhead treatment at Chino Well 14
  - 3.0-TAFY biological wellhead treatment at Chino Hills Well TBD
- Existing Facilities
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)

All facilities in TAKE Alternative 6a would be operated to deliver 26.7 TAFY to member agencies, JCSD, and Western during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to member agencies. The following sections discuss call year operation.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 20.7 TAFY (about 12,900 gpm) of groundwater as described in TM 2 Section 4.2.1.1.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 11.7 TAFY combined of water to CVWD Zone III and FWC Highland Zone through a proposed 30- and 24-inch pipeline, with a branch to FWC and turnouts to both agencies.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 9.0 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone and JCSD's 1110 Zone along a proposed 16- to 24-inch Southern Pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not JCSD's turnout. Western would receive its 2.5 TAFY delivery through JCSD's 1110 Zone, making the delivery to JCSD's 1110 Zone 5.0 TAFY.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 6.0 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 6a proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 3.0 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.



Prepared by:

Brown AND Caldwell

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Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative6A

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1 in : 2 miles

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References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
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2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

TAKE Alternative 6A

Figure A-5

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A-1.3.2 TAKE Alternative 6b – 100% In-Lieu, Pre-Delivery

TAKE Alternative 6b (TAKE-6b) involves the delivery of 26.7 TAFY of CBP water to all seven member agencies, JCSD, and TVMWD during call years and 10.0 TAFY during non-call years. Table A-7 provides the deliveries to each agency for TAKE Alternative 6b.

Table A-7. TAKE Alternative 6b Deliveries to Each Agency (TAFY)		
Agency	**Call Year**	**Non-Call Year**
Metropolitan Water District	-	-
Cucamonga Valley Water District	7.7	2.0
Fontana Water Company	2.0	1.0
City of Chino[1]	2.0	2.0
City of Chino Hills[1]	2.0	2.0
City of Ontario[1]	2.0	1.0
City of Upland[1]	2.0	1.0
Monte Vista Water District[1]	2.0	1.0
Jurupa Community Services District	2.5	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	2.5	-
TOTAL	**26.7**	**10.0**

[1]Water supplied from the WFA Agua de Lejos WTP.

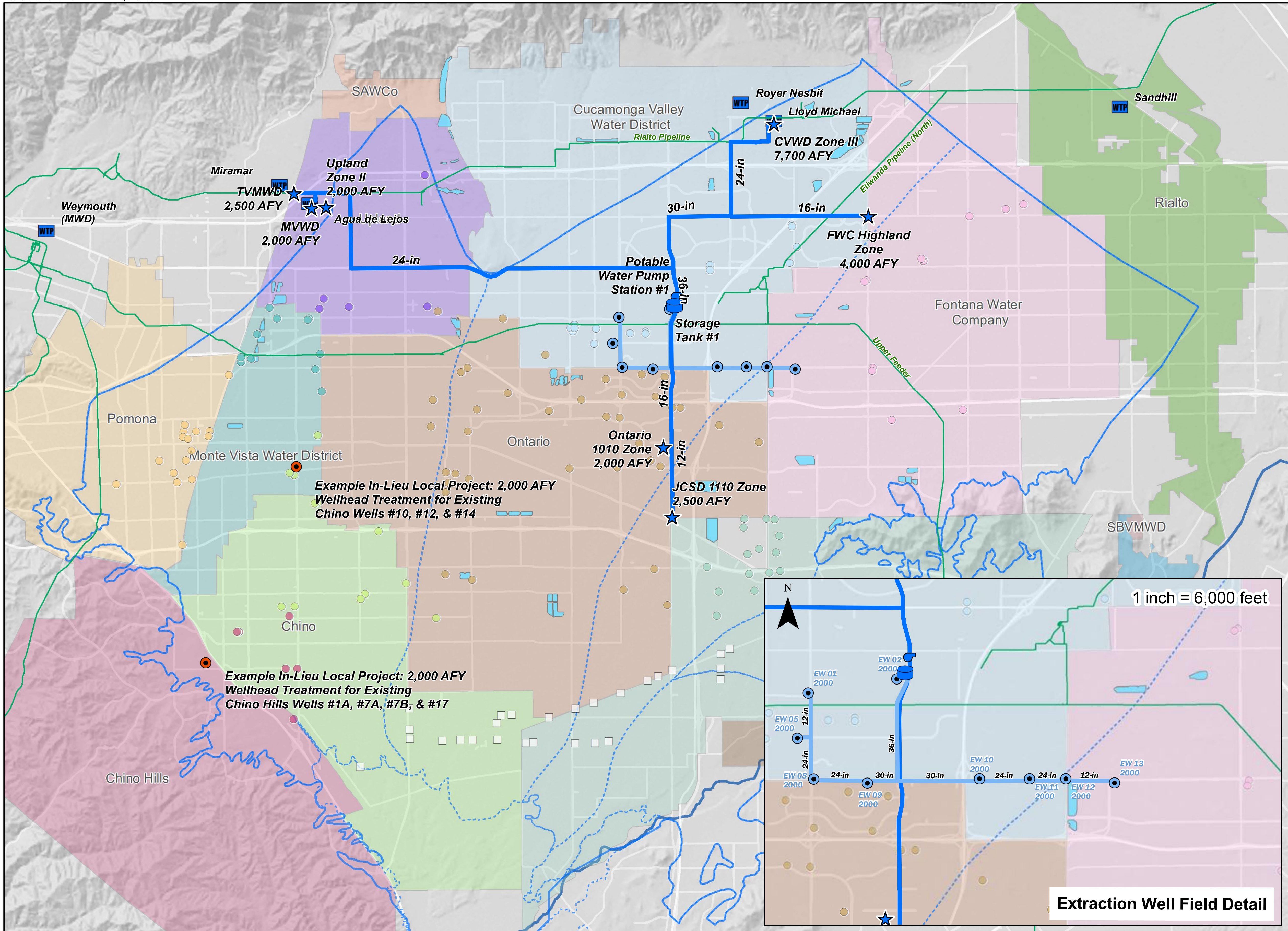
TAKE Alternative 6b includes construction or use of the following facilities, shown on Figure A-6:

- Component A – Groundwater Extraction and Blending
  - 9 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 2,500 HP, 11,300 gpm firm capacity, 599 ft TDH
  - 8 miles of 16- to 36-inch northern pipeline
  - Proposed 16-inch turnout to FWC Highland Zone
  - Proposed 24-inch turnout to CVWD Zone III
  - 9 miles of 24-inch east-west pipeline
  - Proposed 16-inch turnout to Agua de Lejos clearwell (Upland and MVWD)
  - Proposed 12-inch turnout to TVMWD Miramar WTP clearwell (HGL 1,630ft)

- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 12- and 16-inch potable southern pipeline
  - Proposed 12-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 2.0-TAFY biological wellhead treatment at Chino Well 14
  - 2.0-TAFY biological wellhead treatment at Chino Hills Well TBD
- Existing Facilities
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)

All facilities in TAKE Alternative 6b would be operated to deliver 26.7 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to member agencies. The following sections discuss call year operation. The operation of the TAKE-6b components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 22.7 TAFY (about 14,100 gpm) of groundwater as described in TM 2 Section 4.2.1.1.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 18.2 TAFY combined of water to CVWD Zone III, FWC Highland Zone, Upland Zone II, MVWD, and TVMWD through a proposed network of 16- to 36-inch pipelines.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4.5 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone and JCSD's 1110 Zone along a proposed 16-inch southern pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not JCSD's.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 4.0 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 6b proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 2.0 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.



Explanation

TAKE Alternative 6B

- Proposed Interconnection (Call Year Delivery)
- Proposed Booster Pump Station
- Proposed Tank
- Proposed Potable Pipelines
- Proposed Extraction Well Collectors
- Proposed Extraction Wells (GPM)
- Proposed Wellhead Treatment

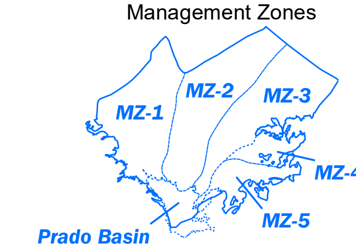
Existing Facilities

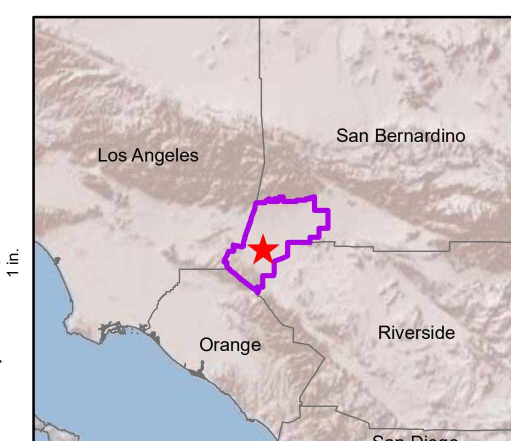
- MWD Mainlines
- Water Treatment Plant
- Recharge Basins

Production Wells

- Chino Desalter
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District

Chino Groundwater Basin and Management Zones





Prepared by: Brown AND Caldwell | WSC Water Systems Consulting, Inc.

Author: AWM
Date: 6/22/2020
File Name: CBP_TAKEAlternative6B

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0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project: CBP Chino Basin Program
Preliminary Design Report

Prepared for: Inland Empire Utilities Agency A Municipal Water District

TAKE Alternative 6B

Figure A-6

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A-1.4 Initial TAKE Alternatives Summary and Cost

Major components of each initial TAKE alternative (TAKE-1 through TAKE-6) are summarized in Table A-9. This table includes the detailed assumptions for each TAKE component for each TAKE Alternative initially developed, including extraction wells, wellhead treatment, potable water conveyance, and potable water storage.

The initial TAKE alternatives conceptual capital and O&M cost estimates are summarized in Table A-8. The capital and O&M costs were developed for each major component using a unit cost basis, which is described in detail in TM 1 Section 7. The capital cost estimates are Class 5 estimates based on the AACE International Cost Estimate Classification System criteria, which corresponds to a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate are -20 to -50 percent on the low end and +30 to +100 on the high end. NPV costs were developed for the TAKE alternatives and described in the Draft IEUA's Chino Basin Program Economic Analysis TM (GEI, June 2020). Note that the costs for the TAKE alternatives do not include any income generated from inline hydropower facilities.

Since the initial TAKE alternatives were developed prior to TAKE-7 and TAKE-8, Tables A-8 and A-9 do not include TAKE-7 and TAKE-8, which are included in TM 2.

Table A-8. Initial TAKE Alternatives Conceptual-Level Cost Estimates (Draft TM2 dated July 6, 2020)

Parameter	TAKE Alternatives ($M)							
	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Pipelines[1]	$50.9	$40.7	$67.2	$47.6	$60.7	$66.0	$49.5	$71.1
Turnouts/Connections	$0.5	$0.5	$2.5	$2.5	$3.5	$3.5	$2.0	$3.5
Pump Stations	$46.5	$25.0	$35.5	$13.5	$15.5	$16.5	$7.5	$12.5
Extraction Wells	$42.5	$25.0	$37.5	$20.0	$22.5	$22.5	$20.0	$22.5
Wellhead Treatment	-	-	$9.2	$9.2	$6.1	$6.1	$9.2	$6.1
Water Storage Tank(s)	$6.5	$3.3	$6.5	$3.3	$3.3	$3.3	$3.3	$3.3
Brine Disposal (NRWS)	-	-	$0.06	$0.06	$0.04	$0.04	$0.06	$0.04
Land	$4.4	$2.8	$4.1	$2.9	$2.7	$2.7	$2.5	$2.7
Subtotal	$151.4	$97.3	$162.6	$99.0	$114.3	$120.6	$94.0	$121.7
Contingency (30%)[2]	$44.1	$28.3	$47.5	$28.8	$33.5	$35.4	$27.4	$35.7
Subtotal	$195.4	$125.6	$210.1	$127.8	$147.8	$155.9	$121.5	$157.4
Implementation (28%)[2]	$53.5	$34.4	$57.7	$35.0	$40.6	$42.9	$33.3	$43.3
Total Capital Cost ($M)								
Total Capital Cost ($2015)	$227.1	$145.9	$244.3	$148.5	$171.9	$181.4	$141.2	$183.1
Total Capital Cost ($2019)	**$248.9**	**$160.0**	**$267.7**	**$162.7**	**$188.5**	**$198.8**	**$154.8**	**$200.7**
Total Capital Cost ($2024)[3]	$274.8	$176.6	$295.6	$179.7	$208.1	$219.5	$170.9	$221.6

Table A-8. Initial TAKE Alternatives Conceptual-Level Cost Estimates (Draft TM2 dated July 6, 2020)								
	TAKE Alternatives ($M)							
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Annual O&M Cost ($2019) ($M/year)								
Fixed O&M[4]	$2.1	$5.3	$1.8	$4.9	$5.1	$5.1	$4.8	$5.0
Variable O&M[5]	$14.9	$8.3	$13.7	$6.9	$7.1	$7.3	$5.6	$6.4
Annual O&M Cost	**$17.0**	**$13.6**	**$15.4**	**$11.8**	**$12.1**	**$12.4**	**$10.3**	**$11.4**
NPV Cost[6] ($2019) ($M)	**$463**	**$367**	**$429**	**$303**	**$328**	**$343**	**$249**	**$311**

[1]Includes potable water and brine pipelines.

[2]Brine disposal (NRW) and land costs not included in contingency or implementation calculations.

[3]2024 is the estimated mid-point of construction

[4]Includes costs for routine annual maintenance.

[5]Includes operations and maintenance costs during call years.

[6]From the economic analysis tool, Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The TAKE NPV costs were estimated on a program basis assuming PUT-5 for the PUT alternative.

Table A-9. Initial TAKE Alternatives Summary

		TAKE Alternatives							
TAKE Components	**Parameters**	**TAKE-1 100% MWD Pump Back with Standard Delivery**	**TAKE-2 100% MWD Pump Back with Pre-Delivery**	**TAKE-3 Mixed Pump Back and In-Lieu Use with Standard Delivery**	**TAKE-4a Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-4b Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-4c Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-6a 100% In-Lieu Use with Pre-Delivery**	**TAKE-6b 100% In-Lieu Use with Pre-Delivery**
Extraction Wells	Description	*MZ1* • None *MZ2* • 15-2,000 gpm extraction wells • 2-1,500 gpm extraction wells • **17 wells Total** *MZ3* • None	*MZ1* • None • *MZ2* 9-2,000 gpm extraction wells • 1-1,500 gpm extraction well • **10 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 14-2,000 gpm extraction wells • 1-1,500 gpm extraction well • **15 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 8-2,000 gpm extraction wells • 8 wells Total *MZ3* • None	*MZ1* • None *MZ2* • 9-2,000 gpm extraction wells • **9 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 9-2,000 gpm extraction wells • **9 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 8-2,000 gpm extraction wells • **8 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 9-2,000 gpm extraction wells • **9 wells Total** *MZ3* • None
Wellhead Treatment	Description	• None	• None	*MZ1* • 1-3,000 AFY Biological Treatment • 1-3,000 AFY GAC Treatment	*MZ1* • 1-2,950 AFY Biological Treatment • 1-2,950 AFY GAC Treatment	*MZ1* • 1-1,950 AFY Biological Treatment • 1-1,950 AFY GAC Treatment	*MZ1* • 1-1,950 AFY Biological Treatment • 1-1,950 AFY GAC Treatment	*MZ1* • 1-3,000 AFY Biological Treatment • 1-3,000 AFY GAC Treatment	*MZ1* • 1-2,000 AFY Biological Treatment • 1-2,000 AFY GAC Treatment
Potable Water Conveyance	Description	*Pump Station #1* • 9,300 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipeline* • 27,700 ft 54-inch • 3,100 ft 42-inch • 2,300 ft 36-inch • 1,800 ft 30-inch • 21,000 ft 24-inch • 21,200 ft 12-inch • **77,100 ft Total** • **14.6 miles Total**	*Pump Station #1* • 5,000 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* • 34,300 ft 42-inch • 9,900 ft 30-inch • 8,400 ft 24-inch • 9,000 ft 12-inch • **61,600 ft Total** • **11.7 miles Total**	*Pump Station #1* • 7,100 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* • 16,700 ft 48-inch • 14,400 ft 42-inch • 7,100 ft 36-inch • 1,800 ft 30-inch • 39,700 ft 24-inch • 14,500 ft 16-inch • 24,100 ft 12-inch • **118,300 ft Total** • **22.4 miles Total**	*Pump Station #1* • 2,000 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pump Station #2* • 700 HP booster pump station near intersection of Bluegrass and Banyan • 0.5 acres of land acquisition *Pipelines* • 6,600 ft 36-inch • 27,800 of 30-inch • 15,900 ft 24-inch • 35,300 ft 16-inch • 14,100 ft 12-inch • **99,700 ft Total** • **18.9 miles Total**	*Pump Station #1* • 2,300 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pump Station #2* • 800 HP booster pump station near Miramar Water Treatment Plant • 0.5 acres of land acquisition *Pipelines* • 6,600 ft 36-inch • 58,000 of 30-inch • 20,200 ft 24-inch • 8,700 ft 16-inch • 26,300 ft 12-inch • **119,800 ft Total** • **22.7 miles Total**	*Pump Station #1* • 2,600 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pump Station #2* • 700 HP booster pump station near intersection of Bluegrass and Banyan • 0.5 acres of land acquisition *Pipelines* • 12,200 ft 36-inch • 29,100 of 30-inch • 11,400 ft 24-inch • 62,700 ft 16-inch • 34,800 ft 12-inch • **150,200 ft Total** • **28.4 miles Total**	*Pump Station #1* • 1,500 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* • 6,600 ft 36-inch • 18,500 ft 30-inch • 51,600 ft 24-inch • 14,500 ft 16-inch • 6,500 ft 12-inch • **97,700 ft Total** • **18.5 miles Total**	*Pump Station #1* • 2,500 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* • 10,400 ft 36-inch • 19,700 ft 30-inch • 73,200 ft 24-inch • 29,900 ft 16-inch • 17,200 ft 12-inch • **150,400 ft Total** • **28.5 miles Total**

Table A-9. Initial TAKE Alternatives Summary									
		TAKE Alternatives							
TAKE Components	**Parameters**	**TAKE-1 100% MWD Pump Back with Standard Delivery**	**TAKE-2 100% MWD Pump Back with Pre-Delivery**	**TAKE-3 Mixed Pump Back and In-Lieu Use with Standard Delivery**	**TAKE-4a Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-4b Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-4c Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-6a 100% In-Lieu Use with Pre-Delivery**	**TAKE-6b 100% In-Lieu Use with Pre-Delivery**
Potable Water Storage	Description	*Storage Tank #1* • 5 MG tank near intersection of Milliken and Jersey • 2 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 5 MG tank near intersection of Milliken and Jersey • 2 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)

Appendix B: Initial TAKE Alternatives Evaluation

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Section B-1: Introduction

Initial alternatives including pre-delivery were evaluated using a similar multi-criteria evaluation process as the PUT alternatives. The initial TAKE alternatives evaluation was completed prior to the development of TAKE-7 and TAKE-8 and the results of the evaluation were documented in the Draft TM2 (dated July 6, 2020). This section describes the process used to evaluate the initial alternatives (TAKE-1 through TAKE-6). As discussed in TM2, pre-delivery was later determined to be infeasible based on discussions with MWD and TAKE-2, TAKE-4 (TAKE-4a, 4b, and 4c), and TAKE-6 (TAKE-6a and 6b) were eliminated from consideration. Please refer to TM2 Section 4 for descriptions of TAKE-1 and TAKE-3 and to TM2 Attachment A for descriptions of TAKE-2, TAKE-4 (TAKE-4a, 4b, and 4c), and TAKE-6 (TAKE-6a and 6b). Note that TAKE-5 was determined to be infeasible before the initial TAKE alternatives evaluation was completed and was not compared in this analysis.

The initial alternatives were evaluated using a multi-criteria approach, which allows for the quantification and visualization of the relative performance of each individual alternative so they can be compared with one another on a common basis. This approach is organized with five overarching program objectives that encompass the CBP goals, each with associated evaluation criteria to measure how well each alternative meets the objectives. All TAKE alternatives were developed to meet the two minimum requirements for alternatives, which include (1) meet Basin-wide objectives and regulatory requirements and (2) provide water exchange for the benefit of the Delta Ecosystem. The minimum requirements are described in more detail in TM1 Section 8.

Table B-1 summarizes the TAKE alternatives evaluation for TAKE-1 through TAKE-6b with scores assigned for each alternative for each criterion. The following Sections B-1.1 through B-1.5 describe the scoring for all evaluation criteria, organized by the five project objectives. The scores were assigned as follows:

- Each alternative was analyzed for each criterion and assigned a score of 1 through 5, with 5 being most advantageous and 1 being the least advantageous.
- The evaluation criteria are scored either quantitatively or qualitatively. Quantitative criteria are those criteria that are scored based on attributes that can be measured, such as pipeline length. Qualitative criteria are scored based on an opinion of how well that alternative supports the evaluation criterion, such as the ability to meet future direct potable reuse (DPR) needs. Criteria that require qualitative scored with whole numbers, while criteria that are scored qualitatively have rational numbers as scores.

Note that the evaluation criteria were defined for the program alternatives and some individual criteria do not apply to the TAKE alternatives. In addition, some of the criteria are non-differentiators when applied to the CBP alternatives alone but would show differentiation if used to compare CBP and non-CBP alternatives. These non-differentiating criteria were included in this evaluation and are described in the following sections. The scoring approach for all criteria is further detailed in TM1 Section 8.

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Table B-1. TAKE Alternatives Evaluation

Objectives: No.	Objectives: Name	Objectives: Baseline Weighting (%)	Evaluation Criteria: No.	Evaluation Criteria: Description	Baseline Weighting (%)	TAKE - 1	TAKE - 2	TAKE - 3	TAKE - 4a	TAKE - 4b	TAKE - 4c	TAKE - 6a	TAKE - 6b
					Pump Back vs. In Lieu	*100% PB*	*100% PB*	*PB & IL*	*PB & IL*	*PB & IL*	*PB & IL*	*100% IL*	*100% IL*
					Pre-Delivery	*Standard Delivery*	*Pre-Delivery*	*Standard Delivery*	*Pre-Delivery*	*Pre-Delivery*	*Pre-Delivery*	*Pre-Delivery*	*Pre-Delivery*
					E-W Pipeline	-	-	-	-	X	X	-	X
					Northern part of N-S pipeline to Rialto Pipeline	X	X	X	X	-	X	X	X
					Southern part of N-S pipeline to JCSD	-	-	X	X	X	X	X	X
1	Develop Basin-wide water supply infrastructure	25%	1a	Create exchange opportunities within Chino Basin	30%	1.0	1.0	3.7	3.7	5.0	5.0	3.7	5.0
			1b	Provide synergy with region's planned projects	20%	1.0	1.0	3.0	3.0	5.0	5.0	3.0	5.0
			1c	Ability to meet future Direct Potable Reuse conveyance needs (raw water augmentation)	0%	-	-	-	-	-	-	-	-
			1d	Enhance MWD Rialto Pipeline reliability	30%	1.0	1.0	1.0	1.0	3.0	4.5	1.0	5.0
			1e	Integrate with other storage programs	20%	5.0	4.0	4.0	2.0	2.0	2.0	1.0	1.0
			Total - 1a through 1e (Must equal 100%)		100%	1.8	1.6	2.8	2.4	3.8	4.3	2.2	4.2
2	Increase water supply reliability	15%	2a	Insurance water (critically dry year access to treatment and unused water) (access to emergency supply)	40%	5.0	1.7	5.0	1.7	1.7	1.7	1.7	1.7
			2b	Address CECs on the horizon (such as PFAS)	20%	4.0	3.0	5.0	4.0	4.0	4.0	4.0	4.0
			2c	Increased potable water supply (beyond 25-year CBP)	40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
			Total - 2a through 2c (Must equal 100%)		100%	**4.8**	**3.3**	**5.0**	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**
3	Streamline operations and maintenance	15%	3a	Minimize operational complexity	40%	3.0	4.0	2.7	3.0	2.8	2.8	3.7	3.5
			3b	Minimize impacts to water levels in existing wells	25%	3.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0
			3c	Optimize energy use	35%	1.0	1.0	2.5	2.5	1.5	1.5	5.0	4.0
			Total - 3a through 3c (Must equal 100%)		100%	2.3	3.2	2.7	3.3	2.9	2.9	4.5	4.1
4	Minimize program complexity	20%	4a	Minimize institutional complexity	30%	5.0	4.0	2.0	2.0	1.0	1.0	2.0	1.0
			4b	Minimize implementation complexity	30%	4.1	4.5	2.8	2.7	2.4	1.5	3.2	2.0
			4c	Leverage existing available land to minimize land acquisition	40%	1.5	4.0	2.3	4.0	4.3	4.3	4.5	4.3
			Total - 4a through 4c (Must equal 100%)		100%	3.3	4.2	2.3	3.0	2.7	2.5	3.4	2.6
5	Support cost effectiveness	25%	5a	Minimize NPV costs (includes $206.9 M funding for CBP alternatives) (with pre-delivery charge)	40%	1.0	2.8	1.6	4.0	3.5	3.2	5.0	3.8
			5b	Minimize capital costs	30%	1.7	4.8	1.0	4.7	3.8	3.4	5.0	3.4
			5c	Minimize annual O&M costs (with pre-delivery charge)	30%	1.0	3.0	2.0	4.1	3.9	3.7	5.0	4.3
			Total - 5a through 5b (Must equal 100%)		100%	1.2	3.5	1.5	4.2	3.7	3.5	5.0	3.9
Total Objectives 1 through 5 (Must equal 100%)		100%			**Total Score:**	**2.5**	**3.1**	**2.7**	**3.3**	**3.4**	**3.4**	**3.7**	**3.7**

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B-1.1 Objective 1 – Develop Basin-Wide Water Supply Infrastructure

TAKE alternatives require new infrastructure and facilities, so it was important to have the first objective analyze Basin-wide water supply infrastructure to be inclusive of IEUA's and stakeholders' goals. The evaluation criteria for the TAKE alternatives are as follows:

- 1a – Create Exchange Opportunities within Chino Basin,
- 1b – Provide Synergy with Region's Planned Projects,
- 1d – Enhance MWD Rialto Pipeline Reliability, and
- 1e – Integrate with Other Storage Programs.

Note that Criterion 1c – Ability to Meet Future Direct Potable Reuse Conveyance Needs does not apply to TAKE alternatives and is not discussed. The following sections discuss the applicable criteria, their performance measures, and the scores for each TAKE alternative.

B-1.1.1 Create Exchange Opportunities within Chino Basin (Criterion 1a)

This criterion analyzes new TAKE connections that are developed basin wide. The performance is measured by the ability to have access to new potable water infrastructure via number of new interconnections added to existing infrastructure. TAKE alternatives that provide more interconnections score better than those that provide fewer interconnections. Table B-2 shows the number of new interconnections for each TAKE alternative and the scores.

Table B-2. TAKE Alternatives – Scoring for Create Exchange Opportunities within Chino Basin (Criterion 1a)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Number of Interconnections	1	1	5	5	7	7	5	7
Criterion 1a Score	1.0	1.0	3.7	3.7	5.0	5.0	3.7	5.0

B-1.1.2 Provide Synergy with Region's Planned Projects (Criterion 1b)

The ability to combine stakeholders' planned projects with the alternatives is a significant component in developing the basin-wide water supply infrastructure for the CBP since it would enable the stakeholders to achieve more from the program. The performance measure is based on the number of planned projects incorporated in the alternative. Alternatives that provide more synergies with stakeholders' planned projects scored higher than alternatives that provide fewer synergies. The scoring criterion is based on current understanding of stakeholders' planned projects. The current planned projects include the following:

- Wellhead treatment: treatment projects for existing wells at Chino and Chino Hills (example In-Lieu Local projects)
- North-south (or northern) pipeline: Projects to include north-south pipeline to JCSD that can provide dual benefit for the program in-lieu as well as CVWD imported water to JCSD.
- East-west pipeline: Project to extend east-west pipeline.

Table B-3 summarizes the planned projects for each TAKE alternative and the scores. Note that TAKE Alternative 6b can further extend to TVMWD which can provide dual benefit for CBP in-lieu and meet TVMWD's goal to access Chino Basin groundwater storage, but it does not hold more weight than other TAKE alternatives that also extend the east-west pipeline.

Table B-3. TAKE Alternatives – Scoring for Provide Synergy with Region's Planned Projects (Criterion 1b)								
Planned Projects	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Wellhead Treatment	-	-	X	X	X	X	X	X
North-South Pipeline	-	-	X	X	X	X	X	X
East-West Pipeline	-	-	-	-	X	X	-	X
Criterion 1b Score	1.0	1.0	3.0	3.0	5.0	5.0	3.0	5.0

B-1.1.3 Enhance MWD Rialto Pipeline Reliability (Criterion 1d)

The ability to increase the reliability of imported water deliveries during a shutdown of the MWD Rialto Pipeline is important in planning and developing Basin-wide water supply infrastructure. TAKE alternatives that enhance the reliability of the MWD Rialto Pipeline by providing parallel east-west conveyance for imported water during Rialto Pipeline shutdowns, thus supplementing the Rialto Pipeline, are scored higher than alternatives that do not enhance reliability. Table B-4 summarizes the east-west pipelines for each TAKE alternative and the scores.

Table B-4. TAKE Alternatives – Scoring for Enhance MWD Rialto Pipeline Reliability (Criterion 1d)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
East-West Pipeline	-	-	-	-	X	X	-	X
FWC Highland Zone Pipeline	-	-	-	-	-	X	-	X
Diameter (inches)	-	-	-	-	30	12 - 16	-	16 - 24
Criterion 1d Score	1.0	1.0	1.0	1.0	3.0	4.5	1.0	5.0

B-1.1.4 Integrate with Other Storage Programs (Criterion 1e)

The ability to transport more water to storage programs outside of Chino Basin is significant in evaluating pump back to MWD. The performance measure is standard delivery (e.g., no pre-delivery) alternatives and non in-lieu alternatives score higher since standard delivery alternatives move more water and MWD pump back alternatives convey water to MWD. This movement of water allows for other programs outside of Chino Basin to capture the water and use it in their storage programs. The most advantageous score would require 100% pump back and no pre-delivery while the least advantageous would score would require 100 percent in-lieu with pre-delivery. Table B-5 summarizes the delivery mechanisms for each TAKE alternative and the scores.

Table B-5. TAKE Alternatives – Scoring for Integrate with Other Storage Programs (Criterion 1e)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Pump Back vs. In-Lieu	100% Pump Back	100% Pump Back	Pump Back and In-Lieu	Pump Back and In-Lieu	Pump Back and In-Lieu	Pump Back and In-Lieu	100% In-Lieu	100% In-Lieu
Delivery Type: Standard or Pre-Delivery	Standard	Pre-Delivery	Standard	Pre-Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery
Criterion 1e Score	5.0	4.0	4.0	2.0	2.0	2.0	1.0	1.0

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B-1.2 Objective 2 – Increase Water Supply Reliability

The Program has the ability to diversify and increase the regional water supply portfolio for IEUA and stakeholders. This second objective analyzes alternatives on the basis that it would increase the region's water supply and water quality. The evaluation criteria for the TAKE alternatives are as follows:

- 2a – Insurance Water,
- 2b – Address Contaminants of Emerging Concern (CECs) on the Horizon, and
- 2c – Increased Potable Water Supply.

The following sections discuss these criteria, their performance measures, and the scores for each TAKE alternative.

B-1.2.1 Insurance Water (Criterion 2a)

The ability to provide insurance water allows for the region to access unused water during critically dry years or during times of emergency. TAKE alternatives that provide more water to the Chino Basin score better than those that divert more water to MWD. Scores are based on Year 7 storage amounts for each TAKE alternative assuming that the first call year is Year 8. The TAKE alternative that has the largest storage volume score a 5 and the other alternatives were scaled proportional from the largest storage volume to their respective storage volumes. Table B-6 summarizes the storage amount at the end of Year 7 for each TAKE alternative and the scores.

Table B-6. TAKE Alternatives – Scoring for Insurance Water (Criterion 2a)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Storage at end of Year 7	105 TAF	35 TAF	105 TAF	35 TAF	35 TAF	35 TAF	35 TAF	35 TAF
Criterion 2a Score	5.0	1.7	5.0	1.7	1.7	1.7	1.7	1.7

B-1.2.2 Address CECs on the Horizon (Criterion 2b)

It is important to have the ability to address CECs that are on the horizon by analyzing different elements that would provide more treatment to improve water quality. An example of a forthcoming CEC limit is for PFAS. TAKE alternatives that have standard delivery alternatives score better because more extraction occurs in better water quality areas. Similarly, alternatives with groundwater treatment (e.g., Chino and Chino Hills example In-Lieu Local projects) score better. All TAKE alternatives provide extraction wells in better water quality areas, however alternatives with standard delivery provide more wells and provide more access to better quality water than those that have pre-delivery. Wells that have fewer extraction wells score lower since not as much higher-quality potable water can be extracted. Table B-7 summarizes the TAKE alternatives delivery type, applicable wellhead treatment, and scores.

Table B-7. TAKE Alternatives – Scoring for Address CECs on the Horizon (Criterion 2b)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Delivery Type	Standard Delivery	Pre-Delivery	Standard Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery
Wellhead Treatment	-	-	X	X	X	X	X	X
Criterion 2b Score	4.0	3.0	5.0	4.0	4.0	4.0	4.0	4.0

B-1.2.3 Increased Potable Water Supply (Criterion 2c)

The ability to increase potable water supply for the region beyond the 25-year Program is based on IEUA and stakeholders capitalizing the existing assets developed from the program. The performance measure is the amount of new potable water generated in the Chino Basin Area. TAKE alternatives that provide infrastructure that allows for the largest amount of new potable water to be generated in the Chino Basin area score better than those that limit water production. Because all TAKE alternatives generate 375.0 TAF beyond the 25-year program, they all score a 5.0. The TAKE is analyzed in this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The TAKE alternatives scores are shown in Table B-8.

Table B-8. TAKE Alternatives – Scoring for Increased Potable Water Supply (Criterion 2c)								
Alternative	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Criterion 2c Score	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

B-1.3 Objective 3 – Streamline Operations and Maintenance

The CBP would introduce new treatment processes and multiple wells that would need to be operated and maintained, thus the ability to streamline O&M is an important third objective. Streamlining these efforts provides efficiency and a smoother transition to these new services amongst stakeholders. The evaluation criteria used for the TAKE alternatives are as follows:

- 3a – Minimize Operational Complexity,
- 3b – Minimize Impacts to Water Levels in Existing Wells, and
- 3c – Optimize Energy Use.

The following sections discuss these criteria, their performance measures, and the scores for each TAKE alternative.

B-1.3.1 Minimize Operational Complexity (Criterion 3a)

The ability to minimize operational complexity is important for a region-wide program. The TAKE alternative's performance measures are based on the complexity of operations measured in number of extraction wells and booster pump stations, and wellhead treatment. Table B-9 summarizes the performance measure elements and scores for each TAKE alternative.

Table B-9. TAKE Alternatives – Scoring for Minimize Operational Complexity (Criterion 3a)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Extraction Wells	17	10	15	8	9	9	8	9
Wellhead Treatment	-	-	X	X	X	X	X	X
Pump Stations	1	1	1	2	2	2	1	1
Criterion 3a Score	3.0	4.0	2.7	3.0	2.8	2.8	3.7	3.5

B-1.3.2 Minimize Impacts to Water Levels in Existing Wells (Criterion 3b)

The new TAKE extraction wells may negatively affect the groundwater basin by overdrawing and reducing water levels in nearby existing wells. This criterion is evaluated by reviewing well hydrographs and analyzing the water levels at nearby existing wells. Table B-10 summarizes the wellhead impacts for each alternative and their scoring. Note that the initial groundwater modeling has only been done for the standard delivery options which show minimal drawdown. The remaining TAKE alternatives have yet to be modeled, but it is anticipated they would have less drawdown on neighboring wells due to their lower pumping rate, therefore were scored a 5.0.

Table B-10. TAKE Alternatives – Scoring for Minimize Impacts to Water Levels in Existing Wells (Criterion 3b)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Groundwater Level Impacts at Nearby Wells	Minimal Drawdown	N/A	Minimal Drawdown	N/A	N/A	N/A	N/A	N/A
Criterion 3b Score	3.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0

B-1.3.3 Optimize Energy Use (Criterion 3c)

The criterion to optimize energy use is based on the energy demand in 1,000 kWh for project components. The TAKE alternatives are evaluated by the energy demand for the extraction wells, wellhead treatment, and pump stations. Because each TAKE alterative has differing energy demands between normal (non-call) years and call years, the energy use for the alternatives were evaluated across the lifetime of the program. Across the entirety of the program, there are 7.5 call years and 17.5 normal (non-call) years. A lower energy demand scores higher in the evaluation. Table B-11 summarizes the scores and power consumption of the call years and normal years throughout the program as well as applicable wellhead treatment that slightly impacts energy use. Note that the wellhead treatment only operates during call years for standard delivery options while pre-delivery options would operate during both normal years and call years.

Table B-11. TAKE Alternatives – Scoring for Optimize Energy Use (Criterion 3c)								
	Power Consumption (1,000 kWH)							
Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Call Years	637,100	340,600	538,700	215,200	237,400	247,200	161,300	224,800
Non-Call Years (Normal Years)	-	297,300	-	309,900	337,600	323,400	117,900	145,100
Wellhead Treatment	-	-	7,000	23,200	15,500	15,500	23,200	15,500
Total	637,100,	637,900	545,700	548,300	590,500	586,100	302,400	385,400
Criterion 3c Score	1.0	1.0	2.5	2.5	1.5	1.5	5.0	4.0

B-1.4 Objective 4 – Minimize Program Complexity

Each alternative includes many shared components amongst stakeholders, so a significant fourth objective is to minimize program complexities. The evaluation criteria used for the TAKE alternatives are as follows:

- 4a – Minimize Institutional Complexity,
- 4b – Minimize Implementation Complexity, and
- 4c – Leverage Existing Available Land to Minimize Land Acquisition.

The following sections discuss these criteria, their performance measures, and the scores for each TAKE alternative.

B-1.4.1 Minimize Institutional Complexity (Criterion 4a)

The performance measure for the ability to minimize institutional complexity is based on the numbers of contracts/agreements needed with stakeholders. The fewer the agreements with stakeholders the better the score. This criterion evaluates the delivery contracts between all applicable agencies. Since all TAKE alternatives would require agreements with IEUA member agencies, Chino Basin parties, and MWD, they are not included as a contract in the scoring. Table B-12 summarizes the number of contracts needed for each TAKE alternative and the scores. The agency names are detailed in TM 2 Sections 4.3.1 through 4.3.2 and Appendix A Sections A-1.2.1 through A-1.2.3. Note that despite TAKE-1 and TAKE-2 only requiring one contract, the contract for TAKE-1 is less complex with standard delivery.

Table B-12. TAKE Alternatives – Scoring for Minimize Institutional Complexity (Criterion 4a)								
Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Number of Contracts	1	1	7	7	9	9	7	9
Criterion 4a Score	5.0	4.0	2.0	2.0	1.0	1.0	2.0	1.0

B-1.4.2 Minimize Implementation Complexity (Criterion 4b)

The ability to minimize implementation complexity is scored based on the numbers of project elements and permits for each alternative. The fewer the projects and permits, the better the score. The TAKE alternatives were evaluated using the number of projects based on pump stations, miles of pipelines, pipeline crossings, and wellhead treatment. All TAKE alternatives are assumed to require the same number of permits, so it is not a differentiator. Table B-13 summarizes the number of pump station and pipeline crossings, miles of pipelines, wellhead treatment example projects for Chino and Chino Hills, and the score for this criterion.

Table B-13. TAKE Alternatives – Scoring for Minimize Implementation Complexity (Criterion 4b)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Number of Pump Stations	1	1	1	2	2	2	1	1
Number of Crossings	9	7	12	10	11	15	10	15
Miles of Pipelines	14.6	11.7	22.4	18.9	22.7	28.4	18.5	28.5
Wellhead Treatment	-	-	X	X	X	X	X	X
Criterion 4b Score	4.1	4.5	2.8	2.7	2.4	1.5	3.2	2.0

B-1.4.3 Leverage Existing Available Land to Minimize Land Acquisition (Criterion 4c)

Since the CBP needs to be implemented by 2026, using existing available land for CBP facilities was identified as a critical element to keep the project on schedule by avoiding complications with land purchases and rezoning or permitting new parcels. Using existing land also helps reduce program costs. Alternatives that require less land acquisition score better than alternatives that require more land acquisition. The scores were calculated by evaluating the total acreage required for extraction wells, storage tanks, and pump stations. Table B-14 summarizes the score and total acreage including extraction wells, storage tanks, and pump stations acreage.

Table B-14. TAKE Alternatives – Scoring for Leverage Existing Available Land to Minimize Land Acquisition (Criterion 4c)

Acreage	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Extraction Wells	3.9	2.3	3.4	1.8	2.1	2.1	1.8	2.1
Storage Tanks	2	1.5	2	1.5	1.5	1.5	1.5	1.5
Pump Stations	-	-	-	0.5	-	-	-	-
Total	5.9	3.8	5.4	3.8	3.6	3.6	3.3	3.6
Criterion 4c Score	1.5	4.0	2.3	4.0	4.3	4.3	4.5	4.3

B-1.5 Objective 5 – Support Cost Effectiveness

The ability to support cost effectiveness is part of the BCE and an important factor in the multicriteria evaluation to ensure costs are accounted for. The cost estimates are summarized in Section 4.3.7 of this TM with the cost estimating approach presented in TM1 Section 7. Cost scores were calculated based on the highest cost was the lowest score of 1 and the lowest cost was the highest score of 5. The evaluation criteria used for the TAKE alternatives are as follows:

- 5a – Minimize NPV Costs,
- 5b – Minimize Capital Costs, and
- 5c – Minimize Annual O&M Costs.

The following sections discuss these criteria, their performance measures, and the scores for each PUT alternative.

B-1.5.1 Minimize NPV Costs (Criterion 5a)

NPV costs were developed over a project lifecycle of 50 years using the economic analysis tool that is described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The NPV costs represent the present value of cash flow over the 25-year CBP and the 25 years following the CBP. The NPV costs include capital costs, replacement costs, annual O&M costs, non-recoverable wastewater disposal costs, and supplemental external source water cost (i.e., recycled water supplies from JCSD and City of Rialto). For the CBP alternatives, the NPV costs take into account the Proposition 1 Water Storage Investment Program (WSIP) funding of $206.9M. The NPV costs are in 2019 dollars.

The economic analysis tool was developed to calculate the NPV costs for overall CBP costs. Therefore, the program costs were estimated for the eight TAKE alternatives assuming that the PUT portion was PUT-5, and then the TAKE portion of the NPV cost was separated out. Table B-15 summarizes the NPV costs and scores.

Table B-15. TAKE Alternatives – Scoring for Minimize NPV Costs (Criterion 5a)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
NPV ($M 2019)	$463	$367	$429	$303	$328	$343	$249	$311
Criterion 5a Score	1.0	2.8	1.6	4.0	3.5	3.2	5.0	3.8

B-1.5.2 Minimize Capital Costs (Criterion 5b)

Capital costs include the cost of equipment and construction costs including direct and indirect costs of all elements. The capital costs for the TAKE alternatives include all TAKE components as summarized in TM 2 Table 4-14 and Appendix A Table A-9 TAKE Alternatives Summary, which includes extraction wells, wellhead treatment, potable water conveyance, and potable water storage. The capital costs include contingency and project implementation costs for engineering services, client administration, and construction management. The capital costs are in 2019 dollars. Table B-16 summarizes the capital costs and scores.

Table B-16. TAKE Alternatives – Scoring for Minimize Capital Costs (Criterion 5b)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Capital Cost ($M 2019)	$248.9	$160.0	$267.7	$162.7	$188.5	$198.8	$154.8	$200.7
Criterion 5b Score	1.7	4.8	1.0	4.7	3.8	3.4	5.0	3.4

B-1.5.3 Minimize Annual O&M Costs (Criterion 5c)

The O&M costs describe the annual costs to manage and maintain the equipment and infrastructure for the alternative of interest. The annual O&M costs for the TAKE alternatives include annual O&M costs for extraction wells, wellhead treatment, potable water conveyance, and potable water storage. The annual O&M costs for the TAKE alternatives are split between fixed and variable O&M costs and summed for the total annual O&M cost, which was used for the alternatives evaluation. The lower the O&M cost, the higher the score. The O&M costs were evaluated with the pre-delivery charge to MWD for all alternatives that include pre-delivery. Table B-17 summarizes the O&M costs and scores.

Table B-17. TAKE Alternatives – Scoring for Minimize Annual O&M Costs (Criterion 5c)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
O&M Cost ($M 2019)	$17.0	$13.6	$15.4	$11.8	$12.1	$12.4	$10.3	$11.4
Criterion 5c Score	1.2	3.5	1.5	4.2	3.7	3.5	5.0	3.9

B-1.6 TAKE Alternatives Recommendations

Based on the results of the TAKE alternatives evaluation, and as shown in Table B-1 TAKE Alternatives Evaluation, TAKE-6a and TAKE-6b were the highest ranked alternatives with scores of 3.7; followed by TAKE-2, TAKE-4a, TAKE-4b, and TAKE-4c with a range of scores between 3.1 and 3.4; and TAKE-1 and TAKE-3 with the lowest scores of 2.5 to 2.7.

Overall, the six alternatives with pre-delivery scored better than two alternatives with standard delivery (i.e., no pre-delivery): TAKE-2, TAKE-4a, TAKE-4b, TAKE-4c, TAKE-6a, and TAKE-6b (with pre-delivery) all scored in the range of 3.1 to 3.7, whereas TAKE-1 and TAKE-3 (with standard delivery) scored 2.5 and 2.7, respectively. Some of the scoring trends for the pre-delivery alternatives and standard delivery alternatives include:

- Pre-delivery alternatives
  - The six pre-delivery alternatives scored better than the standard delivery alternatives in terms of Objective 5 Support Cost Effectiveness because the pre-delivery alternatives all had lower capital, annual O&M, and NPV costs than the standard delivery alternatives.
  - In general, the pre-delivery alternatives also scored better in terms of Objective 1 Develop Basin-Wide Water Supply Infrastructure (with the exception of TAKE-2, which scored similarly to TAKE-1) because they each include more regional infrastructure than TAKE-1 and TAKE-3; and Objective 3 Streamline O&M (with the exception of TAKE-4b and TAKE-4c, which scored similarly to TAKE-3) because the pre-delivery alternatives pump groundwater at a more constant rate than standard delivery and are expected to minimize impacts to water levels in existing wells.
  - The pre-delivery alternatives scored worse in terms of Objective 2 Increase Water Supply Reliability because not as much water would be stored in the Chino Basin and available as an emergency supply.
- Standard delivery alternatives
  - The two alternatives with standard delivery both scored the best of all alternatives on Objective 2 Increased Water Supply Reliability because more water would be stored in the Chino Basin with standard delivery.

- The standard delivery alternatives scored the lowest on Objective 5 Support Cost Effectiveness because of the extensive infrastructure required to delivery 50.0 TAFY during call years. The standard delivery alternatives also scored low on the other three objectives, Objectives 1, 3, and 4.

But, even though the pre-delivery alternatives scored better overall than the standard delivery alternatives, because the original CBP concept was based on standard delivery, the CBP team recommended that the TAKE alternatives selected to move forward into the program alternatives evaluation needed to include both standard and pre-delivery alternatives. In addition, since a single PUT alternative was selected to move forward into the program alternatives (PUT-5), four TAKE alternatives were carried forward to create four program alternatives. It was decided to carry forward two standard delivery alternatives and two pre-delivery alternatives to be able to compare a range of CBP alternatives that cover 100% MWD pump back, partial MWD pump back and partial in-lieu, and 100% in-lieu with both standard delivery and pre-delivery.

Based on this reasoning, the following TAKE alternatives were selected to move forward:

- Standard delivery: TAKE-1 and TAKE-3, which are the only standard delivery alternatives.
- Pre-delivery: TAKE-4c and TAKE-6b, which were two of the six pre-delivery alternatives. These alternatives were selected for the following reasons:
  - TAKE-6a and TAKE-6b scored the best overall and scored equivalently, but it was recommended to carry forward only one 100% in-lieu alternative. TAKE-6b includes more regional infrastructure and scored better on Objective 1 Develop Basin-Wide Water Supply Infrastructure because the alternative creates more exchange opportunities within the Chino Basin, provides synergy with the region's planned projects, and enhances the reliability of the MWD Rialto Pipeline with the inclusion of the east-west pipeline.
  - TAKE-2 was not selected because (1) it includes 100% MWD pump back, which is included in the program alternatives as part of TAKE-1, and (2) it was the lowest performing pre-delivery alternative.
  - Of the three alternatives developed for TAKE-4, TAKE-4c was selected to for similar reasons as TAKE-6b: it scored highest on Objective 1 Develop Basin-Wide Water Supply infrastructure because it includes more regional infrastructure that would benefit the agencies in the Chino Basin.