SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

FEASIBILITY STUDY

FINAL
January 2017

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1.0 EXECUTIVE SUMMARY

Over the past few decades, groundwater levels in the Paso Robles Groundwater Basin (Paso Basin) have dropped. To ensure a sustainable water supply for customers in the Paso Basin area, the San Luis Obispo County Flood Control and Water Conservation District (SLOCFCWCD, District) initiated this feasibility study to identify additional sources of water to supplement the Paso Basin. These sources of water are described below along with several scenarios for water supply and delivery to maximize the water supplies available.

1.1 Summary of Supply Options

This study evaluated three water sources: The Nacimiento Water Project (NWP), State Water Project (SWP), and recycled water (RW).

The NWP conveys raw water from Lake Nacimiento to San Luis Obispo County communities. Recently, the NWP was fully allocated, although some supplies (4,200 to 8,600 acre-feet a year or AFY) are available for temporary purchase each year.

The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants that extend from Northern to Southern California for over 600 miles. The SWP's Coastal Branch passes through the southern portion of Paso Basin, meaning approximately 8,000 AFY of surplus water from the District could be available for purchase.

As the City grows, recycled water use is increasing. Currently, the City has 3,300 AFY of recycled water available and plans to use 5,500 AFY.

1.2 Alternatives

Based on computer model projections of Paso Basin conditions in 2040, the expected average annual deficit in the basin (32,844 AFY) exceeds the projected average annual supplemental supplies available (20,000 AFY). To account for this, each alternative uses all three sources to meet Basin Management Objectives (BMOs) for individual subareas as much as possible.

Furthermore, specific conditions vary throughout the Paso Basin. Thus, priority subareas were chosen for locating alternatives based on depleting groundwater levels and their potential impact on adjacent subareas. These subareas are Estrella, Creston, San Juan, and Shandon.

Scenarios were then developed to combine water supply sources and target subareas to maximize each source by combining direct deliveries and percolation basins. With this approach, all sources could be used, even in non-irrigation months. Basin benefits were also estimated using information developed by modeling runs for each subarea.

1.3 Summary of Costs and Benefits of Alternatives

Table 1 summarizes the annualized water supply benefit and costs of alternatives. Although the alternatives require extensive infrastructure to deliver water into the basin, a significant portion of the annual cost comes from purchasing water supplies. While expensive, these costs are in line with the cost of "new water" that other Central Coast communities incur.

Table 1 Summary of Alternatives' Estimated Annualized Benefits and Costs (in 2016 Dollars)
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Component	Water Supply (AFY)	Delivery Method	Predicted Basin Benefit (AFY)(1)	Total Annual Infrastructure Cost(2)	Water Purchase Cost(3)	Unit Cost ($/AFY of Benefit)
Scenario A - Maximize Direct Delivery						
NWP & RW to Estrella	11,100	Direct & Recharge	8,550	$6.0M	$22.2M	$3,299
SWP to Creston	4,380	Direct	4,380	$4.2M	$11.0M	$3,452
SWP to Shandon	4,480	Recharge	2,203	$1.3M	$11.2M	$5,660
Total Scenario A	***19,960***		***15,133***	***$11.4M***	***$44.4M***	***$3,687***
Scenario B - Maximize Direct Delivery (San Juan)						
NWP & RW to Estrella	9,600	Direct & Recharge	7,187	$5.3M	$19.2M	$3,404
NWP to Creston	1,500	Direct	1,500	$1.8M	$3.0M	$3,213
SWP to Creston	4,950	Recharge	4,816	$2.1M	$12.4M	$3,000
SWP to San Juan	3,910	Direct	3,910	$1.9M	$9.8M	$2,992
Total Scenario B	***19,960***		***17,413***	***$11.1M***	***$44.4M***	***$3,183***
Scenario C - Maximize Recharge						
NWP & RW to Estrella	11,100	Recharge	4,978	$2.9M	$22.2M	$5,036
SWP to Creston	8,860	Recharge	8,585	$2.0M	$22.2M	$2,811
Total Scenario C	***19,960***		***13,563***	***$4.9M***	***$44.4M***	***$3,628***
Scenario D - Combination of Direct Delivery and Recharge						
NWP & RW to Estrella	11,100	Recharge	8,319	$3.9M	$22.2M	$3,143
SWP to Creston	4,950	Recharge	4,816	$2.1M	$12.4M	$3,010
SWP to San Juan	3,910	Direct	3,910	$1.9M	$9.8M	$2,992
Total Scenario D	***19,960***		***17,045***	***$8.0M***	***$44.4M***	***$3,071***

Notes:
(1) Basin benefit predicted based upon efficiency factors determined from the groundwater modeling runs depending on the location and delivery method.
(2) The annualized costs assume a 5% interest for 30-year term (standard for bond issuance).
(3) Water purchased cost based upon the cost of water for a full NWP or SWP participant, which is assumed to be the starting point of negotiations.

1.4 Summary of Next Steps

Changing regulations, such as the Sustainable Groundwater Management Act (SGMA), require addressing declining water levels in the Paso Basin in a plan by 2020 and through actions by 2040. As soon as one or more groundwater management agencies is formed, decisions will need to be made to determine if any option is favorable and, if so, what work needs to be done. These and other decisions on managing the basin will depend on the GSA's sustainability goals and the law's requirements.

2.0 INTRODUCTION

The Paso Robles Groundwater Basin (Paso Basin), DWR sub-basin No 3-4.06, is located in the upper portion of the Salinas River watershed and serves as the primary water source for North San Luis Obispo County. The Paso Basin is approximately 505,000 acres (790 square miles), 20 percent of which extends into Monterey County.

To some degree, all communities within the Paso Basin rely on the basin's groundwater. Rural residences, urban development, vineyards, and other agricultural users all pump water from the basin for potable and non-potable uses.

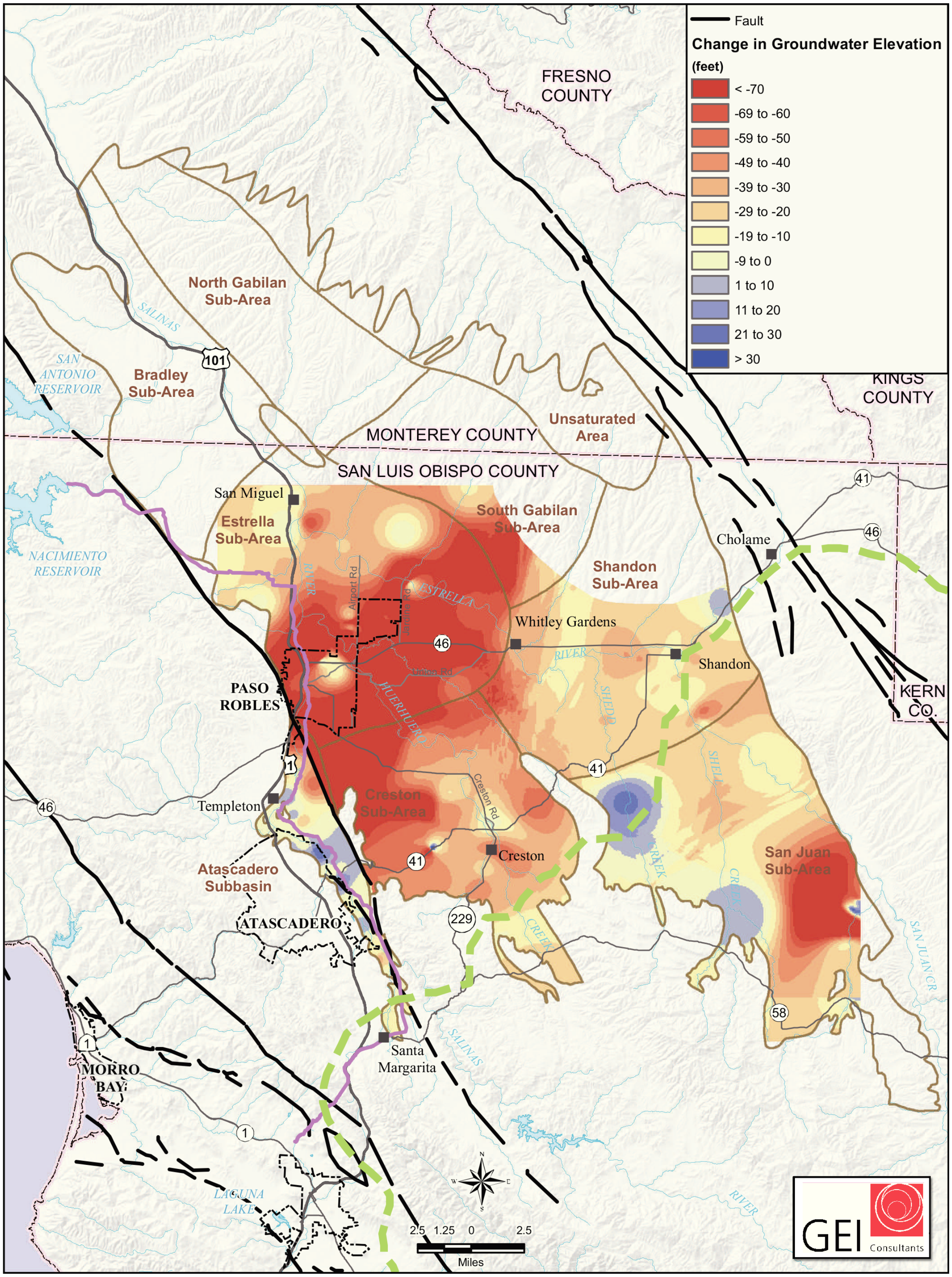
Over the last few years, the District has studied the basin's hydrogeology and the Paso Basin's groundwater supply and demand. Through these studies, the District found that groundwater levels in the basin have been dropping for several decades.

In response, the District performed additional studies to update the perennial[1] yield and determine whether it was being exceeded. According to these studies, the groundwater basin has reached--and perhaps surpassed--its perennial yield.

The 2014 Paso Robles Groundwater Basin Model Update estimated that between 1981 and 2011, annual outflows exceeded the inflows to the basin by 2,400 AFY. In some areas, these exceedances have manifested in declining groundwater levels, as depicted in Figure 1 for 1997-2013. Simulated likely future conditions show a further aggravated imbalance, highlighting the need for supply alternatives to offset additional Paso Basin groundwater pumping.

To ensure a sustainable water supply for customers in the Paso Basin area, the District initiated the Paso Robles Groundwater Basin Supplemental Water Supply Options Feasibility Study Project (Supply Options Study). This study identifies sources of supply that can supplement the Paso Basin using the Nacimiento Water Project (NWP), State Water Project (SWP), and recycled water (RW).

[1] For this report, the perennial yield for the Paso Basin is defined as the amount of water that can be withdrawn and consumed on an average annual basis over the long-term and under given land use conditions without exceeding the combined natural and artificial recharge to the groundwater basin (total pumping – change in storage). Managing groundwater basins in a manner consistent with its perennial yield helps avoid long-term adverse impacts such as groundwater level declines. Because land uses and hydrologic conditions can change over time, the perennial yield must be reevaluated periodically. Perennial yield is interchangeable with terms like “safe” or “sustainable” yield.



NOTE:

Figure originally prepared for County of San Luis Obispo by GEI Consultants in August 2013.

GENERALIZED DIFFERENCE IN SPRING GROUNDWATER ELEVATIONS BETWEEN 1997-2013

FIGURE 1

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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The Supply Options Study was also completed to form a prioritized list of the most beneficial and viable options for procuring available local and state water resources. This list will help wholly or partially stabilize groundwater levels and provide a clear path to obtaining supplies for the Paso Basin. The study progressed in phases, coordinating a comprehensive groundwater model refinement and calibration with alternative development and supplemental supply investigations.

The Supply Options Study Team compiled the body of conducted work into the following documents:

- Refinement of the Paso Robles Groundwater Basin Model and Results of Supplemental Water Supply Options Predictive Analysis Report, 2016 (Model Update Report).
- Technical Memorandum No. 1: Project Goals, Objectives, Approach, and Evaluation Process for Strategy Development (Technical Memorandum [TM] 1).
- TM No. 2: Supply Options and Point of Delivery for Nacimiento Project Water (TM2).
- TM No. 3: Potential Supply Options and Point of Delivery for State Water (TM3).
- TM No. 4: Recycled Water Supply Options and Points of Delivery (TM4).
- Paso Robles Groundwater Basin Supplemental Water Supply Options Feasibility Study (this Document, Supply Options Study).

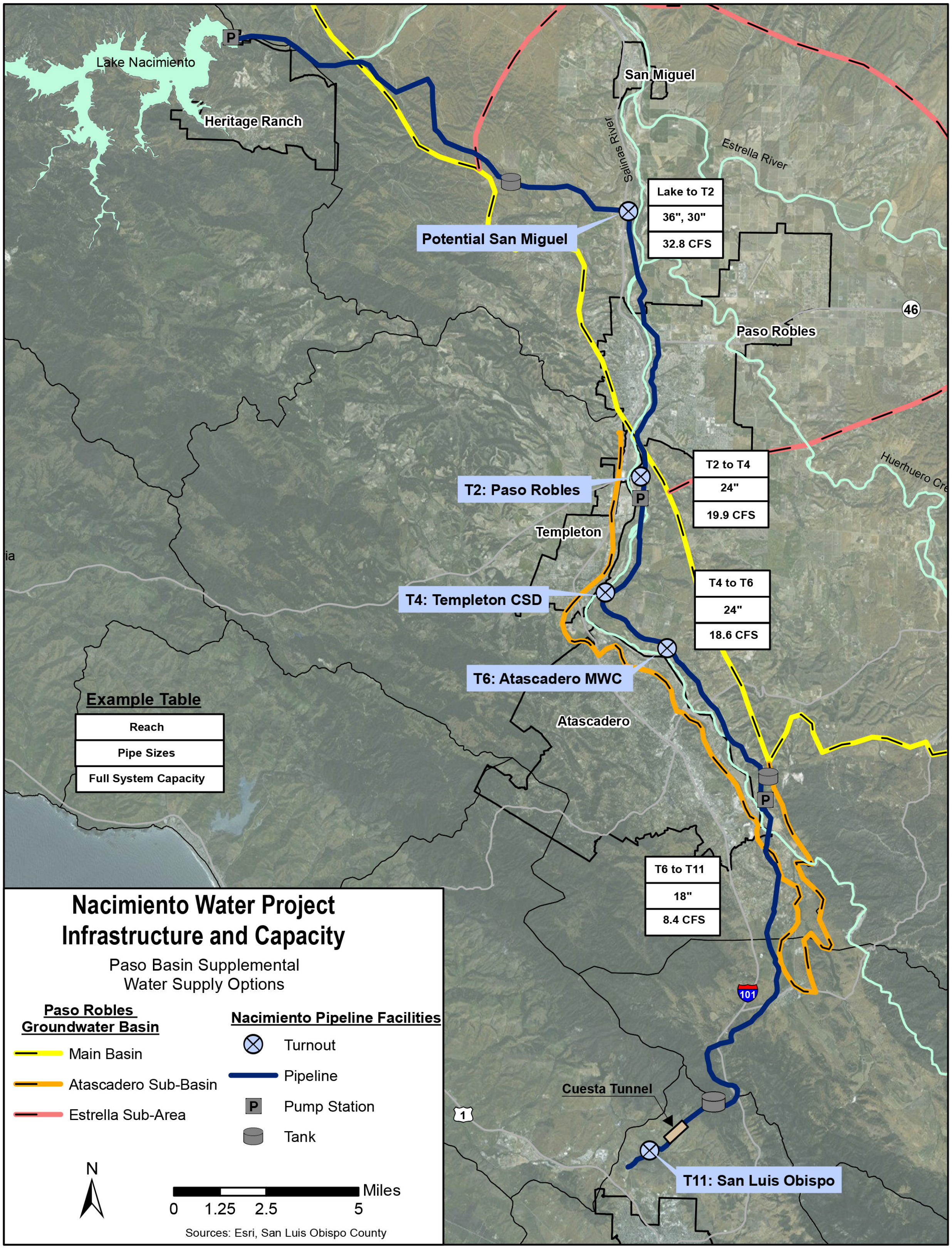
2.1 Supplemental Water Supplies

For this study, three sources of supplemental water supply were identified: Nacimiento Water Project (NWP), State Water Project (SWP), and recycled water (RW). Because the source for the NWP and SWP is not in the Paso Basin, both represent new water. Although RW is not necessarily new water, it involves resources already in the basin but using them in a new way that adds benefit.

The long-term average annual available supplemental water supply from the three sources is approximately 20,000 AFY. Each individual supply type is discussed below.

2.1.1 Nacimiento Water Project

The Nacimiento Water Project (NWP) consists of 45 miles of pipeline that conveys raw water from Lake Nacimiento in the northern portion of San Luis Obispo County to communities within San Luis Obispo County. Figure 2 shows an overview of the NWP.



NACIMIENTO WATER PROJECT INFRASTRUCTURE AND CAPACITY

FIGURE 2

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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Monterey County Water Resource Agency (MCWRA) manages and operates Lake Nacimiento. The District has an entitlement of 17,500 AFY through a Master Water Agreement with MCWRA negotiated in 1959. Of this amount, 1,750 AFY is permanently allocated to lakeside customers, and the rest is allocated to seven participants.

Because the NWP is typically more expensive than groundwater, participants tend to limit the amount they use. In 2016, the NWP entitlement was revised to fully allocate project entitlements to project participants, as shown in Table 2. As a result, any surplus NWP water must be obtained through the existing participants.

Table 2 Nacimiento Water Project Participants and Allocations
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Agency	Previous Allocation	New Allocation
City of Paso Robles	4,000	6,488
Templeton Community Services District (CSD)	250	406
Atascadero Mutual Water Company (MWC)	2,000	3,244
City of San Luis Obispo	3,380	5,482
County Service Area 10A (CSA 10A)	25	40
Bella Vista Mobile Home Park		10
Santa Margarita Ranch Mutual Water Company		80
Total	**9,655**	**15,750**

Table 3 shows the projected surplus NWP water based on the participants' projected use of NWP. Note that in dry years, participants generally use more of their allocation to supplement supplies, making less surplus water available. Assuming that one in every three years is dry, the long-term average available supply is 7,100 AFY.

Table 3 Nacimiento Water Project Projected Annual Surplus Supply
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

	Normal Year (AFY)	Dry Year (AFY)
2020	10,135	5,577
2030	8,473	4,045
2040	7,269	2,852
Average Supply	**8,626**	**4,158**
Long-Term Average(1)	**7,100**	

Notes:
(1) Long-term average calculated assuming one out of every three years is a dry year.

The NWP contract established the process for determining the cost per AF of surplus water. According to the contract, the cost of surplus water to each NWP participant has two components: 1) operations and maintenance costs per AF of surplus water for the prior year; and 2) variable energy costs associated with delivering the surplus water. For non-participants, a third component is added: debt service costs per AF for surplus water delivered for the current year. Table 4 shows the estimated costs for FY 2015/16, which were established before full allocation.

Table 4 Nacimiento Water Project Estimated Costs(1)
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Location	For Participants	For Non-Participants(2)
City of Paso Robles	$216/AF	$1,299/AF
Templeton CSD	$234/AF	$1,967/AF
Atascadero MWC	$235/AF	$1,554/AF

Notes:
(1) For FY 2015/16.
(2) This category was only applicable prior to full authorization in April 2016.

Under full allocation, the NWP contract requires selling surplus water at a cost the market can bear but not less than costs participants pay for the delivery of the same unit or units of water. At the time of this report, no surplus water sales have occurred after full allocation approval in April 2016. Thus, a range of purchase costs was assumed.

The minimum cost of $250/AF is based on FY 2015/16 costs for participants, representing the cost to convey the water to a turnout. The maximum cost of $2,000/AF was assumed based on FY 2015/16 costs for non-participants, including the debt service cost. However, the actual cost must be negotiated between the purchaser and the NWP participants.

Because the NWP is now fully allocated, a non-participant must purchase NWP water from an NWP participant every year. However, the non-participant will not have permanent rights to the water unless a participant is willing to sell a portion of its NWP allotment. Thus, a multi-year purchase agreement from a non-participant is likely required to support capital investment (associated debt service) in conveyance facilities. For more information on the NWP, current participants, and water procurement intricacies, consult TM 2.

For this study, a long-term average availability of 7,100 AFY NWP water was assumed available for purchase to account for average versus dry year availability. To develop cost estimates for water purchases, a unit cost of $2,000/AF was used for the NWP to represent a full buy-in cost for a non-participant interested in obtaining a long-term agreement. This cost is conservative and could be negotiated to a lower unit price with a willing seller/participant.

2.1.2 State Water Project

The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants that extends for more than 600 miles from Northern to Southern California. Its main purpose is to divert and store surplus water during wet periods and distribute it to areas in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California.

The Coastal Branch of this system extends from the California Aqueduct for 160 miles through the southern portion of Paso Basin. Figure 3 shows the California Aqueduct and the Coastal Branch. As further detailed in TM 3, the District currently has 25,000 AFY of Table A Allocation. Of this amount, 10,477 AFY is allocated to subcontractors, leaving an "Excess Allocation" of 14,523 AFY.

Before treatment at the Polonio Pass Water Treatment Plant (PPWTP), water in the Coastal Branch is untreated. After the PPWTP, water in the pipeline is potable and is delivered to District and Central Coast Water Authority (CCWA) subcontractors.

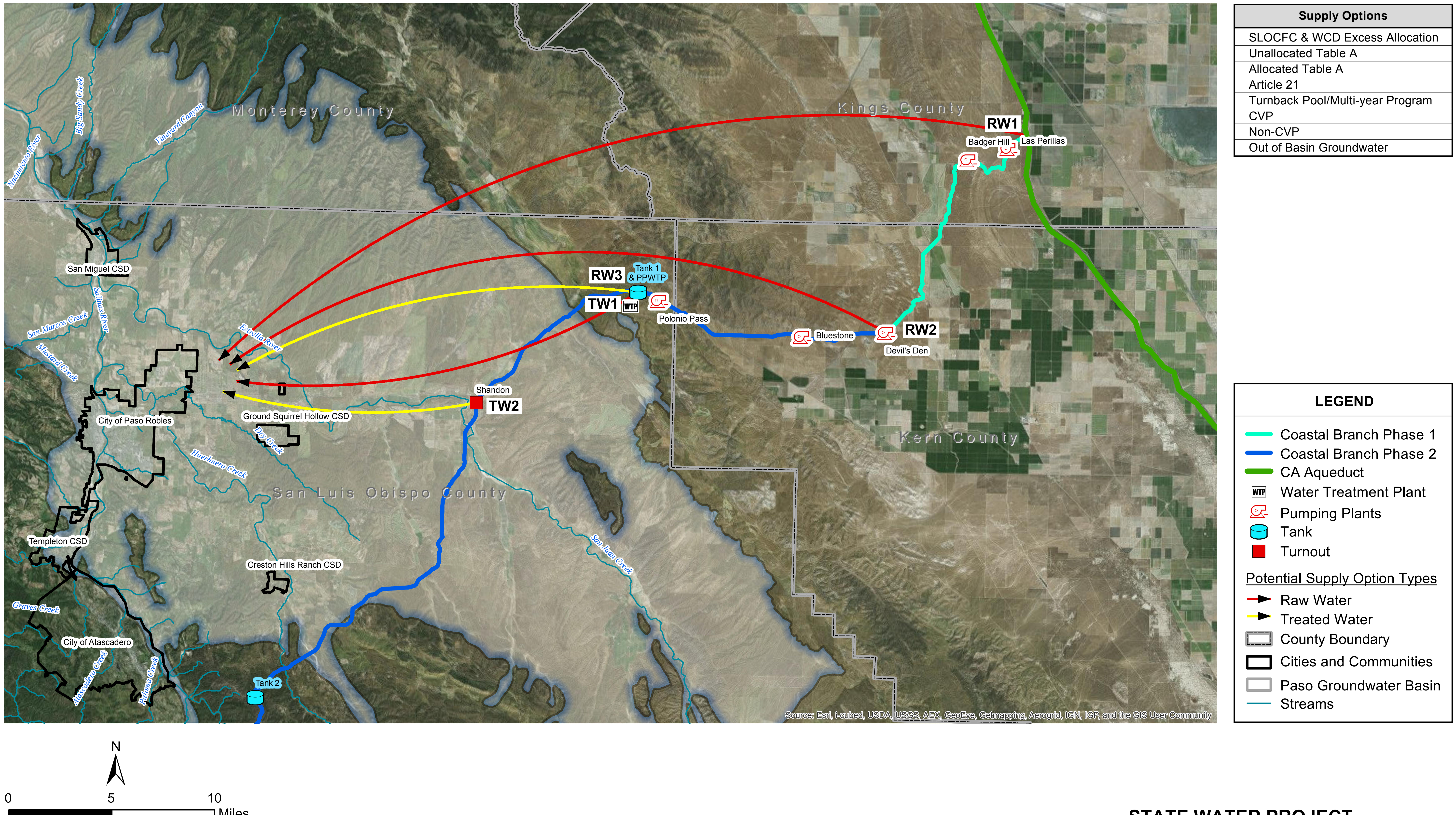
According to a study on the Coastal Branch, enough hydraulic capacity exists to deliver water that exceeds the District's contracted capacity within the Coastal Branch pipeline. Table 5 shows the predicted available supply for SWP water. Based on information provided by the Department of Water Resources (DWR), the District's future "Excess Allocation" is estimated to yield an average of approximately 8,860 AFY. In dry years, however, this supply could be as low as 3,970 AFY.

Table 5 SWP Projected Annual Surplus Supply
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

	Long-Term Average (AFY)	Average Dry Year (AFY)
2020	9,470	4,280
2030	8,860	3,970
2040	8,860	3,970

Additionally, existing District subcontractors can increase their SWP allocations. For example, the Oceano Community Services District recently contracted with the District for 750 AFY of additional drought buffer. These increases could limit the amount of "Excess Allocation" water available to the Paso Basin.

The existing District SWP subcontractors paid for an analysis of the historical and anticipated future costs. This analysis determined the range of costs for raw and treated water, shown in Table 6.



STATE WATER PROJECT
COASTAL BRANCH OVERVIEW

FIGURE 3

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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Table 6 SWP Costs Paid by Existing Subcontractors Based on Point of Delivery Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD

Turnout Location[1]	Water Quality	Estimated Unit Cost ($/AF)
RW1 – Phase 1 Turnout	Raw	$467
RW3 – PPWTP	Raw	$1,793
TW1 – PPWTP	Treated	$2,292
TW2 – Reach 2 Turnout (Shandon)	Treated	$2,503

Notes:
(1) Refer to Figure 3 for location.

The costs in Table 6 represent costs the existing subcontractors paid for supply and capacity within the SWP system. These costs also factor in the SWP system's anticipated future reliability, meaning they are intended to represent costs for “wet water” available for delivery.

Raw water is available only to the PPWTP, at which point the water is treated. To secure the lower raw water cost, new infrastructure must be constructed to pipe water from either the PPWTP or an upstream location to the Paso Basin.

A brief analysis was conducted to determine the incremental cost of piping raw water to the Paso Basin. A 24-mile long 30-inch diameter pipeline routed along the existing Coastal Branch alignment from the PPWTP to a potential turnout in Creston Subarea would cost approximately $103 million. Because the PPWTP is at a high elevation, pumping would likely not be required.

Assuming that an average of 8,860 AFY would be delivered, the amortized annual unit infrastructure cost is approximately $785/AF. When added to the cost of purchased raw water at the PPWTP ($1,792/AF), the unit cost increases to $2,577/AF. The pipeline alignment could be optimized to decrease this cost, but it would still be relatively similar to the cost of treated water at $2,500/AF. Thus, a cost of $2,500/AF was assumed as a conservative estimate for either raw or treated water.

SWP water can be procured in two ways: negotiating with a current District or CCWA subcontractor similar to the NWP or negotiating with the District or CCWA to receive an annual allocation as a new subcontractor.

With the first method, the purchaser would hold a sub-agreement with an existing subcontractor and not have a relationship with either the District or the CCWA. The second method would come with an annual buy-in cost and a unit cost of water. It would also, however, increase the certainty of supply.

TM3 discusses the SWP, available allocations, and water procurement possibilities in greater detail. This report assumes that an average of 8,860 AFY of surplus SWP water will be available at $2,500/AF to represent a full buy-in, annualized cost for a non-contractor wanting to obtain a long-term agreement. This cost is conservative and negotiable.

2.1.3 Recycled Water

The Paso Basin boundary contains four wastewater treatment plants (WWTPs): Paso Robles WWTP, San Miguel WWTP, Templeton CSD WWTP, and Atascadero WWTP. The City of Paso Robles is pursuing an RW program to offset groundwater pumping. Because its WWTP is the largest of the four in-basin plants, it was selected as the study's primary focus.

By 2040, the flow for the Paso Robles WWTP is projected to be 5,500 AFY. Of this amount, the City of Paso Robles is estimated to use approximately 430 AFY for landscape irrigation. Table 7 shows the predicted available RW supply.

Table 7 Recycled Water Projected Available Supply (City of Paso Robles)
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

	Estimated Production (AFY)	Estimated Paso Robles Reuse (AFY)	Surplus for Supply (AFY)
2020	3,360	430	2,930
2030	4,410	430	3,980
2040	5,500	430	5,070
Average	4,960	430	4,000

The City's RW program is evolving. As such, the available RW presented is only an estimate and is subject to change.

The Paso Robles WWTP discharges treated effluent to the Salinas River. A portion of this water percolates to the Paso Robles Formation. The remainder, especially during the winter when flows in the Salinas River alluvium increase, likely exits the Paso Basin through surface and subsurface flow along the Salinas River corridor.

Using RW within the Paso Basin would divert this water from the Salinas River corridor to other locations in the Paso Basin through direct delivery or recharge in percolation basins. Thus, RW does not have the same benefit of a new water supply, since it has already partially supplemented the Paso Basin. However, using the RW to offset pumping or recharge the Paso Basin can provide more benefit.

The Paso Robles WWTP requires treatment upgrades to produce recycled water permitted for unrestricted use. To carry this out, the City is currently designing tertiary treatment. Because City rate payers will pay for this project, costs to upgrade the WWTP are not included in the capital cost estimates. However, the City may decide to recoup some of the costs by selling recycled water.

The City is still determining the price of recycled water. The cost to operate and maintain the RW facility should be included in the unit cost to purchase the RW. For RW, an available supply of 4,000 AFY is assumed at a cost of $2000/AF, representing the sales price of RW and the operations and maintenance costs of producing recycled water. For more information on RW as a supplemental water supply, consult TM4.

2.2 Blue Ribbon Steering Committee

To implement the Paso Robles Groundwater Basin Management Plan, the District Board of Supervisors formed a two-year Blue Ribbon Steering Committee (BRC) to discuss ways to address the declining groundwater level problem. The BRC consisted of volunteers and District staff, representing a wide set of stakeholders.

From this effort, a list of top-ranked solutions was formed in August 2013. Table 8 summarizes the solutions relevant to this study.

Table 8 Selected Solutions from the Blue Ribbon Committee Recommendations Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD

Solution	Implementation Time Frame(1)	Expected Yield(2)	Est. Cost(2)	Feasibility(2)
Maximize or increase use of full allocation of Nacimiento Water	S	L	L	H
Connect Shandon to State Water Project and set up distribution system	S	L	L	H
Exchange or bank Nacimiento Water with Santa Margarita Lake	S	M	L	H
Construct Basins in Salinas River alluvium within Estrella subarea to recharge unused Nacimiento allocation	S	L	M	M
Turn out the State Water Project Coastal Branch at the City of San Luis/Nacimiento Junction	M	H	L	L
Direct delivery of Nacimiento or State Water Project Water	L	H	H	M

Notes:
(1) S = short-term (1-5 years); M = medium term (6-10 years); L = long term (11 or more years).
(2) L = Low; M = Medium; H = High.

For maximum basin benefit, both water management solutions and supplemental water supply solutions are necessary. This report, however, considers only supply-based solutions that have directed the Supply Options Study Team's investigation.

2.3 Basin Management Objectives (BMOs) and Groundwater Management Activities (GMAs)

Basin Management Objectives (BMOs) were developed through workshops in 2010 and 2011 per the 2011 Paso Robles Basin Groundwater Management Plan (Basin Management Plan). The BMOs are goals for addressing individual subareas, such as setting a range of desired groundwater levels in groundwater monitoring wells. Due to varying water levels and rates of decline per subarea (shown in Figure 4), BMOs must also vary.

This study was developed to recommend alternatives that satisfy the BMOs, since BMO compliance represents Paso Basin health more than the net change in groundwater storage. For more information on specific levels of BMOs and targeted wells, consult the Basin Management Plan.

From the BMOs, representatives from individual subareas identified Groundwater Management Activities (GMAs), which are specific actions to take to achieve the BMOs. Table 9 summarizes the BMOs and GMAs.

2.4 Paso Robles Groundwater Basin Advisory Committee

After the BRC disbanded in 2014, the Paso Robles Groundwater Basin Advisory Committee (PBAC) was formed to advise the Board of Supervisors about policy decisions related to groundwater enhancement projects. Like the BRC, the PBAC consisted of members of local agencies, organizations, associations, and residential representatives. Its term of service was two years, with the option to extend it as needed.

The PBAC recommended forming a water district, updating basin management plans, and providing input on this Supply Options Study. Although the PBAC disbanded in January 2016 at the end of its term, members and their subcommittees continued to discuss this study's development by reviewing TMs and participating in public meetings.

REFINEMENT OF THE PASO ROBLES GROUNDWATER BASIN MODEL AND
RESULTS OF SUPPLEMENTAL WATER SUPPLY OPTIONS PREDICTIVE ANALYSIS

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

PROJECT LOCATION

EXPLANATION

- Paso Robles Groundwater Basin Boundary with Sub-Areas (Source: Fugro and Cleath, 2002)
- Paso Robles Area Watershed Model Boundary
- Paso Robles Area Watershed Boundary
- California Aqueduct
- Coastal Branch of the State Water Project Pipeline
- Nacimiento Water Project Pipeline
- County Boundary

Regional Location

GEOSCIENCE

GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

NOTE:
Figure prepared for County of San Luis Obispo by Geoscience, Inc. in July 2016.

PASO ROBLES GROUNDWATER BASINS SUB-AREA DELINEATION

FIGURE 4

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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Table 9	BMOs and GMAs by Subarea[1] Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD							
Subarea	**Atascadero**	**Bradley**	**Creston**	**Estrella**	**North Gabilan**	**San Juan**	**Shandon**	**South Gabilan**
Goal/BMO[2]	S	M	S	S	M	M	S	M
Increase monitoring & Reporting	X	X	X	X		X		
Increase Water Conservation	X		X	X			X	
Manage Growth	X		X					
Use NWP Water	X			X				
Cloud Seeding		X					X	
Prevent Export from Basin			X					
GW Recharge and Banking	X		X				X	
Use SWP Water							X	
Form Irrigation or Water District							X	

Notes:

(1) BMOs and GMAs as reported in the 2011 Paso Robles Basin Groundwater Management Plan.
(2) S = Stabilize groundwater levels; M = Maintain groundwater levels. BMOs are the “band of stabilization” depicted by the yellow on each subarea’s composite hydrograph.

3.0 ALTERNATIVES DEVELOPMENT

This study's alternatives were developed from BRC recommendations, public meetings, and discussions with the PBAC. To maintain a concern for depleting groundwater levels and the potential impact on adjacent subareas of concern, the following initial priority subareas were chosen for study alternatives:

- Atascadero Subarea.
- Estrella Subarea.
- Creston Subarea.
- Shandon Subarea.

To benefit the entire Paso Basin and achieve BMOs, alternatives combined various water supply sources and target subareas. These alternatives and their corresponding Paso Basin model runs were developed with input from PBAC and its subcommittees and were modeled by Geoscience. Table 10 summarizes the alternatives, which are also described in detail in Appendix A.

Table 10 Paso Basin Alternatives and Model Runs
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Model Runs		**Brief Description**
1	Conservation/Demand Management	Estimate the effect on basin water levels of uniform demand reduction across the basin.
2	Salinas River Recharge	Estimate the effect on basin water levels of recharging unused Nacimiento water in recharge facilities along the river in the Atascadero Subarea.
3	Offset Basin Pumping with Recycled Water	Estimate the effect on basin water levels of using recycled water projected to be available for direct use in lieu of pumping.
4	Offset Water Demand in Estrella Subarea	Estimate the amount of supplemental supply for direct use and recharge in this subarea needed to achieve stable levels in the Estrella Subarea.
5	Additional Releases to Huer Huero Creek	Estimate the amount of supplemental supplies that need to be recharged along Huer Huero Creek to achieve stable water levels in the Estrella Subarea.
6	Additional Releases to Estrella River	Estimate the amount of supplemental supplies that need to be recharged along the Estrella River to achieve stable water levels in the Estrella and Shandon Subareas.
7	Offset Pumping in Creston Subarea	Estimate the amount of supplemental supply needed for direct use and recharge to stabilize stable water levels in the Creston Subarea.
8	Offset Pumping in Shandon Subarea	Estimate the amount of supplemental supply for direct use and recharge needed to achieve stable water levels in the Shandon Subarea.

The PBAC modeling subcommittee and the District determined that the goal of the model runs was to identify the amount of water needed to achieve the BMOs listed in the Basin Model Report. As modeling efforts progressed, the alternatives described in Appendix A needed to be modified to meet the BMO targets. Specifically, additional water into the basin was required in additional locations.

Nonetheless, the original locations and alternative descriptions in Appendix A are still valid for the alternatives discussed in subsequent sections of this report. The most current model run descriptions to meet BMOs can be found in the Model Update Report.

Each predictive alternative was also evaluated to identify the localized benefits it could provide to the Paso Basin through 2040. This evaluation also helped understand the benefit of supplying water to different parts of the basin and using different methods to get it there, such as offset pumping with direct deliveries or recharge basins. Table 11 shows the supply options for each alternative.

Table 11 Supply Options to be Evaluated using Paso Basin Model Run Results Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD

Model Runs		Recycled Water	State Water	Nacimiento Water	Direct Delivery	Recharge
Salinas River Recharge	2			X		X
Offset Basin Pumping with Recycled Water	3	X			X	
Offset Water Demand in Estrella Subarea	4(1)	X		X	X	X
Additional Releases to Huer Huero Creek	5A(1)	X		X		X
	5B	X	X	X		X
Additional Releases to Estrella River	6A(1)	X		X		X
	6B	X	X	X		X
	6C	X		X		X
Offset Pumping in Creston Subarea	7A			X	X	
	7B		X	X	X	X
Offset Pumping in Shandon Subarea	8		X		X	X

Notes:
(1) These alternatives have been updated in the November 2016 model runs to include multiple iterations with varying percolation basin locations.

The model runs did not consider the actual amount of water available by supply type or delivery cost. That evaluation is part of this study and report.

While the San Juan Subarea is also depleted, its BMO is to maintain existing groundwater levels, not to stabilize them. For this reason, the San Juan Subarea was included only in the conservation run of the groundwater modeling effort, not in the specific supply alternatives. However, as discussed later, the modeling revealed the need for active basin restoration or conservation in San Juan.

3.1 Delivery Assumptions

This study and the model runs assumed two primary water delivery methods: percolation of new supplies into the groundwater (recharge) and direct deliveries to agricultural customers. Direct deliveries to rural residential and urban potable water users in the Paso

Basin were not considered because of the extensive piping network required and the need for treated water that is not available for all supply types.

For groundwater recharge, percolation basins were preferable to injection wells because of their lower relative costs, less permitting, and lower treatment requirements. A percolation rate of 0.5 ft/day was used to conservatively estimate the long-term performance of a recharge facility in the basin. Percolation basin sizing was based on the amount of water percolated. To account for the containment berms, site access, and other facilities needed for the percolation basin, a factor of 20 percent was added.

Based on modeling results, percolation basins were located in areas with the greatest potential to recharge the deeper aquifer. Additional hydrogeological investigation would be required before siting and constructing percolation basins.

Agricultural pumping and irrigation represent the largest portion of overall water consumption within the Paso Basin (68 percent of discharge from basin). Thus, to simplify alternative development, direct deliveries were assumed to be solely for agricultural irrigation. Because this study focuses on supply, not distribution, individual customers were not identified.

For this study, agricultural irrigation potential service areas and percolation basin locations and pipeline alignments are preliminary and will require further investigation after the initial alternatives are recommended. Demands that could be served by direct deliveries along pipe alignments were based on data collected during the modeling effort.

3.2 Evaluation Criteria

At the start of this supply options study, evaluation criteria were developed to narrow down potential alternatives to recommended projects. These criteria are as follows:

- Quantity, quality, and reliability of supply.
- Cost (Capital and O&M).
- Environmental Impacts.
- Schedule.
- Regulatory/contractual/permitting approvals.
- Public Acceptance (Community and Regional Support).
- Technical Complexity.

While developing and modeling the criteria, it was clear that few differentiating criteria could be evaluated for the scenarios. At the conceptual level, each option's specificity was not developed enough to determine its regulatory, permitting, environmental, and technical complexity. Additional detailed analysis would therefore be required to more fully develop the projects and to assess environmental impacts and regulatory/contractual/permitting approvals. In addition, public acceptance of these scenarios has not been measured through public outreach, education, and surveys.

Despite the lack of differentiation between scenarios, each criterion is discussed at the end of the study to contextualize proceeding with supplemental water supplies in the Paso Basin.

4.0 GROUNDWATER MODELING

The eight supply alternatives were modeled in the Paso Robles Groundwater Basin Model (Basin Model) over several months. New water supply sources (NWP or SWP) were iteratively increased within each alternative, regardless of supply limitations, until the physical limits of the percolation basins or the availability of direct delivery customers were reached.

In some alternatives, the BMOs could not be satisfied within the boundaries initially set. Thus, more iterations were run with slightly different criteria until the composite BMOs were satisfied for each alternative. Because RW is already being returned to the basin through indirect routes, it was not classified as a new water source. Alternatives containing only recycled water were run only up to the maximum identified recycled water capacity.

4.1 Groundwater Modeling Update

In 2005, a MODFLOW model of 1981-1997 was completed. The model was then updated in 2014 to include more modern modeling software, data collected through 2011, a watershed model for better estimations of surface/ground interactions, and a recalibration. The most recent refinement to the model update was completed in 2016, incorporating several new modules to more accurately predict flows in the alluvial layer. The Model Update Report discusses the Basin Model refinement and update in greater detail.

After concluding the 2015/2016 refinement, an updated baseline model run was conducted to predict the change in groundwater basin storage from 2014 through 2040. The draft results of this run showed an average annual decrease in basin storage of approximately 30,700 acre-feet per year (AFY).

When these draft results were presented to the PBAC modeling committee in a July 2016 workshop, stakeholders voiced concerns over several assumptions used for water pumping and recharge locations. This feedback was incorporated into the final revised Basin Model and published in the final Model Update Report.

The current projection of the baseline deficit is approximately 32,844 AFY. This most recent prediction updates the 2014 prediction of an annual 26,200 AFY decrease. The baseline model run for the revised model update also revealed that the Atascadero and Shandon

Subareas achieved BMOs without any additional water or conservation efforts. The Model Update Report discusses the baseline run in more detail.

4.2 Groundwater Modeling Runs

Alternatives were developed for distributing supplemental water in areas of critically lowered water levels throughout the Paso Basin. Appendix A (Alternatives Development Guide) includes information on developing these alternatives, including the rationale and assumptions behind them.

After developing alternatives to satisfy all composite BMO targets for each subarea, additional model runs were required. In most cases, extra percolation basins were added where needed. Figure 5 shows these basins and the original basins highlighted in Appendix A.

The alternatives were used as the basis for model runs to determine the benefit of various recharge and direct delivery locations. A total of 15 different scenarios were modeled.

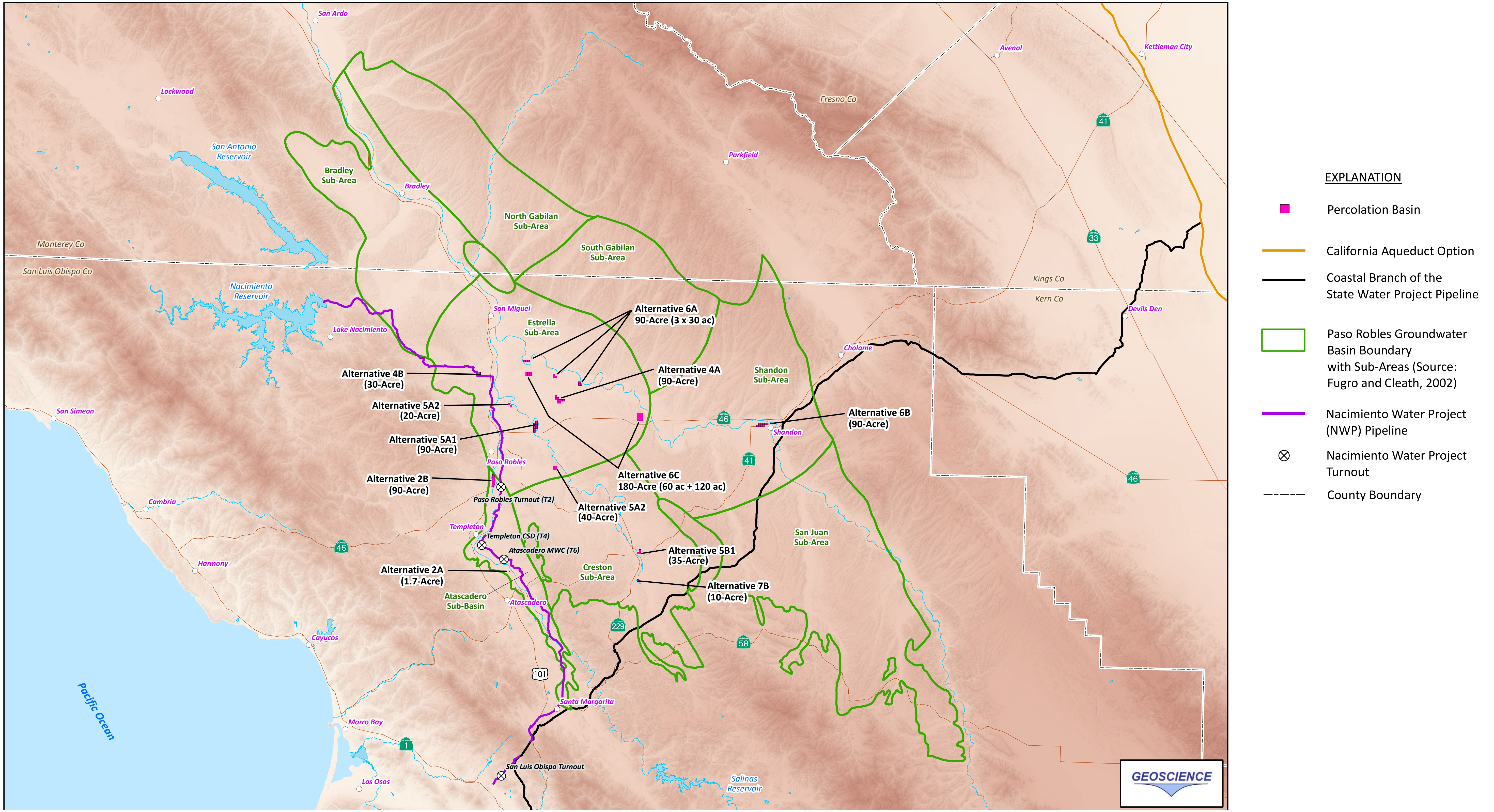
The two main criteria for evaluating model run or alternative success were whether the alternative satisfied the BMO requirement and whether it provided the total basin benefit (net change in basin storage from the baseline) compared to the total supply (recharge efficiency). As discussed later, the quantity of water needed to stabilize the BMOs is significantly more than what supplemental supplies supply. Thus, recharge efficiency becomes the more important variable.

Early modeling revealed that the Shandon Subarea target BMOs were reached under the updated baseline run. Since supplemental water is not needed to satisfy the BMOs, an alternative focused solely on the Shandon Subarea is not necessary. Thus, although the Alternative 8 model run is included in this report, it is not included in the Model Update Report. Information from the Alternative 8 model run was, however, used in later scenario development as a destination for excess supply water.

4.2.1 <u>Supplemental Supply Benefits</u>

The modeled alternatives revealed a widely varying benefit to the basin, from an annual average departure from the baseline of 740 AFY to 22,800 AFY (not including the conservation run). No alternative predicted a full basin recovery on its own.

To determine the best alternatives to investigate further, each alternative was evaluated for its total basin benefit (represented by the annual average increase in basin storage from the baseline run), its ability to satisfy BMOs, and its calculated efficiency factors.



LOCATION OF PERCOLATION BASINS USED IN GROUNDWATER MODELING

FIGURE 5

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

carollo RMC WSC Water Systems Consulting, Inc.

slo1216rf1-9590.ai

4.2.1.1 Efficiency Factors

Efficiency factors were calculated by dividing the total basin benefit (net increase in basin storage from the baseline run) by the total water supply added.

$$Efficiency, \%\ (E) = \frac{Total\ Basin\ Benefit, AFY\ (B)}{Supplemental\ Water\ Supply, AFY\ (S)} * 100\%$$

Conservation and direct deliveries both result in approximately 100 percent efficiency from offsetting pumping or stopping basin pumping. However, recharge efficiency is affected by several hydrogeological factors that can make one location more efficient than another. Because it is not a new water source to the basin, the efficiency of RW is even more complicated.

Currently, treated wastewater effluent is discharged into the Salinas River and some is returned to the basin. To generate RW, this water would receive additional treatment, meaning that using RW avoids discharging to the Salinas River and thus lowers overall efficiency. Model Run 3, the only analysis to use only RW for direct delivery (efficiency of 50 percent), clearly shows the reduced efficiency.

Because efficiency for direct deliveries of "new water" is at or near 100 percent, all efficiencies involving RW are expected to be 50 percent as efficient as those using new water.

The following equation was used to calculate efficiencies not only by delivery type, but also by source:

$$E_{New,Recharge} = \frac{B - (S_{RW,direct} * 50\% + S_{New,direct})}{S_{RW,Recharge} * 50\% + S_{New,Recharge}}$$

$$E_{RW,Recharge} = E_{New,Recharge} * 50\%$$

where E = efficiency, S = supply, B = basin benefit or increase in groundwater storage from the baseline. All units are AFY.

4.3 Evaluation of Results

This section briefly discusses each model run. The Model Update Report provides more detailed evaluations.

4.3.1 <u>Model Run 1 - Conservation Run</u>

The results of the conservation run for the groundwater model show the approximate amount of water, per subarea, necessary to balance the basin. Table 12 summarizes the results.

Table 12 Conservation Run Results (Model Run 1) Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD		
Subarea	**Percent of Pumping Reduction Required**	**Total Supplemental Water Required (AFY)(1)**
Estrella	65%	27,068
Creston	25%	4,116
San Juan	40%	3,909
	Total	**35,093**

Notes:

(1) Values shown are averages over 40 year modeling period. Subareas may require more or less water annually depending on the year.

Shandon and Atascadero Subareas were not included in the conservation run because the updated baseline model showed that these subareas would meet their BMO targets without intervention.

The Estrella Subarea requires the most amount of conservation to restore groundwater levels and reach BMO targets, needing approximately 27,100 AFY. To reach target BMOs, Creston and San Juan Subareas would need around 4,000 AFY.

The results of this run show that approximately 35,100 AFY of supplemental water is needed to restore basin levels. However, only around 20,000 AFY of supply water is available when combining NWP, SWP, and RW. Of the available water, not all can be delivered in a way that directly benefits the basin.

Model runs 2 through 8 show the benefit of various methods of supply water deliveries. Results from these runs were used to develop supply option scenarios to maximize the available supply.

4.3.2 Model Run 2 - Salinas River Recharge

For Alternative 2, the model input 5,100 AFY of NWP water to recharge basins alongside the Salinas River in both the Atascadero and Estrella Subareas. While much of this water left the basin when sent to the Atascadero area, approximately 42 percent of the water recharged in the Estrella Subarea increased basin storage. Regardless, Estrella's BMO was not satisfied.

Because Alternative 2 did not provide enough benefit to the basin, it was not selected for scenario development. Table 13 shows the results of the model run for this alternative in terms of benefit to the basin and the BMO targets achieved.

Alternative 2 - Salinas River Recharge was not carried forward.

Table 13 Model Run 2 Results Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD								
Model Run	Water Source	Delivery Method	Location	Supply Amount (AFY)	Benefit (AFY)	Efficiency (%)	BMO Achieved	
							Local	Composite
2A	NWP	Recharge	Atascadero	2,190	740	34%	Yes	Yes
2B	NWP	Recharge	Estrella	2,942	1,235	42%	No	No

4.3.3 Model Run 3 - Offset Basin Pumping with Recycled Water

Alternative 3 modeled RW delivery directly to customers in and around the City of Paso Robles, up to an average of 4,059 AFY. The model results showed an increase in basin storage of 2,035 AFY with a 50 percent efficiency. This supply is not 100 percent efficient because using RW for direct delivery removes the current discharge of WWTP effluent to the Salinas River. Although the local BMOs for Estrella were satisfied, the composite BMOs were not.

Alternative 3 did not provide enough benefit to the basin to send it into scenario development. Table 14 shows the results of the model run for Alternative 3 in terms of benefit to the basin and BMO targets achieved.

Table 14 Model Run 3 Results Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD								
Model Run	Water Source	Delivery Method	Location	Supply Amount (AFY)	Benefit (AFY)	Efficiency (%)	BMO Achieved	
							Local	Composite
3	RW	Direct Delivery	Estrella	4,059	2,035	50%	Yes	No

Alternative 3 – Offset Basin Pumping with Recycled Water was not carried forward on its own.

4.3.4 Model Run 4 - Offset Pumping in Estrella Subarea

Alternative 4A provides 20,500 AFY of NWP and RW water for direct delivery to agricultural customers in the Estrella Subarea and recharge in a 90-acre percolation basin near the Paso Robles Airport. The resulting total increase in basin storage is 16,955 AFY.

The model results show a recycled water direct delivery efficiency of 50 percent and a recharge efficiency of 91 percent (with NWP water). Despite the high efficiency, the composite BMO target range was not achieved.

In Alternative 4B, a 30-acre basin was added on the west side of the Salinas River, satisfying the composite BMO range. The efficiency for this second percolation basin was lower, closer to 71 percent.

Because of the high efficiency and potential to serve more RW customers along the route, the airport percolation location associated with alternative 4A was selected for further development. Table 15 shows the results of the model run for Alternative 4 in terms of benefit to the basin and BMO targets achieved.

Table 15 Model Run 4 Results
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Model Run	Water Source	Delivery Method	Location	Supply Amount (AFY)	Benefit (AFY)	Efficiency (%)	BMO Achieved	
							Local	Composite
4A	RW	Direct Delivery	Estrella	4,059	2,035	50%	Yes	No
	NWP	Recharge	Estrella	16,436	14,920	91%		
4B	NWP	Recharge	Estrella	5,479	3,900	71%	Yes	Yes

Alternative 4A - Offset Pumping in Estrella Subarea was selected for further development.

4.3.5 Model Run 5 - Releases to Huer Huero Creek

Alternative 5A, 5B, and their iterations are recharge-only options along Huer Huero Creek. Alternative 5A uses NWP and RW in percolation basins in the Estrella Subarea. 5A1 includes the original 90-acre percolation basin from the 2008 Paso Robles Groundwater Subbasin Water Banking Feasibility Study (Banking Study).

When the maximum flow through that basin did not achieve the BMO target, two new percolation basins were added: one 40-acre basin and one 20-acre basin (Alternative 5A2). Once the basins were added, the composite BMO was achieved.

Alternative 5A1 showed an overall efficiency of 48 percent. The breakdown is approximately 55 percent basin benefit efficiency for NWP recharge and 27 percent for RW recharge. Alternative 5A2, with the two additional basins and recharging NWP only, showed an efficiency closer to 72 percent.

Throughout the modeling effort, smaller basins were more effective than larger basins. Large basins tended to cause water to resurface in the stream channel instead of percolating to deeper layers in the model.

Alternative 5B sent SWP water to a 35-acre percolation basin located in the Creston subarea. It had a modeled efficiency of approximately 97 percent.

Alternative 5A1, although having a lower efficiency, had a location more suited to the percolation basin for combined RW and NWP flows. For recharging RW, blending with another raw water will be necessary to meet the regulations for surface spreading groundwater recharge (Title 22 Recycled Water Regulations). The percolation basin's location allows building off the proposed alignment for Paso Robles' RW project to achieve the RW blending requirement for recharge. It also introduces potential cost-sharing elements into the project. Table 16 shows the results of the model runs for Alternative 5 in terms of benefit to the basin and BMO targets achieved.

Table 16 Model Run 5 Results
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Model Run	Water Source	Delivery Method	Location	Supply Amount (AFY)	Benefit (AFY)	Efficiency (%)	BMO Achieved	
							Local	Composite
5A1	NWP	Recharge	Estrella	12,377	7,891	55%	Yes	No
	RW	Recharge	Estrella	4,059		27%		
5A2	NWP	Recharge	Estrella	10,958	7,894	72%	Yes	Yes
5B	SWP	Recharge	Creston	3,203	3,094	97%	Yes	Yes

Alternative 5A1 and 5B - Releases to Huer Huero Creek were selected for further investigation.

4.3.6 Model Run 6 - Releases to Estrella River

Alternatives 6A, 6B, and 6C involve adding recharge basins along the Estrella River in two locations in the Estrella Subarea and one in the Shandon Subarea.

Alternative 6A uses three 30-acre recharge ponds for NWP water and RW in the Estrella Subarea. The combined efficiency of both NWP and RW recharge is 58 percent; RW is at 33 percent efficiency, and NWP water is at 66 percent efficiency. The composite BMOs for the Estrella Subarea were not satisfied during this run.

Alternative 6B showed a 21 percent efficiency for the 90-acre recharge basin in the Shandon Subarea. This lower efficiency could be because the Shandon Subarea reaches its target BMOs within the baseline run and the extra water may flow out of the basin.

Model run 6C was added after 6A did not reach the composite BMO target in the Estrella Subarea. Two additional percolation basins were added, one 60-acre basin and one 120-acre basin. The BMO target range was satisfied after adding 32,873 AFY of NWP water, which resulted in an efficiency of 40 percent.

Because of the large amount of water necessary to reach the target BMO, and the lower efficiency, Alternative 6 was not selected for further evaluation. Table 17 shows the results of the model run for Alternative 6 in terms of benefit to the basin and BMO targets achieved.

Table 17	Model Run 6 Results Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD							
Model Run	Water Source	Delivery Method	Location	Supply Amount (AFY)	Benefit (AFY)	Efficiency (%)	BMO Achieved	
							Local	Composite
6A	NWP	Recharge	Estrella	12,377	9,554	66%	Yes	No
	RW	Recharge	Estrella	4,059		33%		
6B	SWP	Recharge	Shandon	16,436	3,465	21%	Yes	Yes
6C	NWP	Recharge	Shandon	32,873	13,252	40%	Yes	Yes

Alternatives 6A, 6B, 6C - Releases to Estrella River were not carried forward.

4.3.7 Model Run 7 - Offset Pumping in Creston Area

Alternative 7A and 7B both focus on offsetting pumping in the Creston Subarea with NWP and SWP water. Alternative 7A uses direct delivery only and has a 99 percent efficiency. Alternative 7B combines direct delivery and recharge with SWP water with efficiencies of 100 percent and 83 percent, respectively.

Water input to the basin was relatively low, with 1,530 AFY of NWP water and 2,850 AFY for SWP, closely matching the total anticipated subarea need of 4,100 AFY from Model Run 1. Additional supplemental water may be available for this subarea. However, because higher flows into the subarea were not modeled, it is not clear whether additional flows would add basin benefit. Table 18 shows the results of the model run for Alternative 7 in terms of benefit to the basin and BMO targets achieved.

Table 18	Model Run 7 Results Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD							
Model Run	Water Source	Delivery Method	Location	Supply Amount (AFY)	Benefit (AFY)	Efficiency (%)	BMO Achieved	
							Local	Composite
7A	NWP	Direct Delivery	Creston	1,531	1,516	99%	Yes	No
7B	SWP	Direct Delivery	Creston	1,020	1,020	100%	Yes	Yes
	SWP	Recharge	Creston	1,826	1,521	83%		

Alternatives 7A and 7B - Offset Pumping in Creston Area were selected for further investigation.

4.3.8 Model Run 8 - Offset Pumping in Shandon Subarea

This alternative modeled direct deliveries and groundwater recharge with SWP water for the Shandon Subarea. For this alternative, 6,100 AFY of SWP water was simulated as an input to the Subarea. The basin storage increased approximately 3,000 AFY from the baseline, for an efficiency of 49 percent.

The effect of supplying water to the Shandon Subarea is difficult to quantify. Model runs show that Shandon BMOs were achieved within the baseline run. The efficiency factors show that Alternative 6 provided more basin benefit with recharge water.

However, Alternative 8, when supplemental water recharge was combined with direct deliveries, showed little basin benefit. The model revealed that supplemental water added to the Shandon Subarea will likely leave the subarea, migrating into the Estrella Subarea.

Alternative 8 was selected for further study in case additional water becomes available. Table 19 shows the results of the model run for Alternative 8 in terms of benefit to the basin and BMO targets achieved.

Table 19 Model Run 8 Results
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Model Run	Water Source	Delivery Method	Location	Supply Amount (AFY)	Benefit (AFY)	Efficiency (%)	BMO Achieved	
							Local	Composite
8	SWP	Recharge	Shandon	6,085	3,000	49%	Yes	Yes

Alternative 8 - Offset Pumping in Shandon Subarea was selected for further investigation.

4.3.9 Summary of Model Runs

When seeking to combine these alternatives so they use all potential water supplies to maximize basin benefit, the alternative model runs should be evaluated based on relative benefit. Table 20 summarizes the overall supplies, basin benefits, and overall efficiency of model runs and establishes whether the BMO targets were met.

Table 20 Groundwater Modeling Results[1]
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Predictive Alternative	Model Run	Existing/Supplemental Water Supply	Subarea?	Local BMO achieved?	Composite BMO achieved[2]?	Difference in Groundwater Storage from Basin (Net Benefit)[3]
Baseline with Growth	NA	N/A	Atascadero Estrella Creston Shandon San Juan		Yes No No Yes No	0
Pumping Demand Reduction in Estrella, Creston, and San Juan Subareas	1	33,241 AFY Agricultural (Reduction) 1,852 AFY Municipal (Reduction) **35,094 AFY Total**	Atascadero Estrella Creston Shandon San Juan		Yes Yes Yes Yes Yes	30,233 AFY
Salinas River Artificial Recharge in Atascadero Sub-Basin	2A	2,190 AFY NWP (at AMWC Basins)	Atascadero Estrella	Yes[4] No	Yes[4] No	740 AFY (34% Efficiency)
	2B	2,190 AFY NWP (at AMWC Basins) 2,942 AFY NWP (at New Basins) **5,133 AFY Total**	Atascadero Estrella	Yes[4] No	Yes[4] No	1,975 AFY (38% Efficiency)
Offset Pumping Demand in Estrella Subarea	3	4,059 AFY RW (Direct Delivery)	Estrella	Yes	No	2,035 AFY (50% Efficiency)
Offset Pumping Demand and Artificial Recharge in Estrella Subarea	4A	4,059 AFY RW (Direct Delivery) 16,436 AFY NWP (Recharge) **20,495 AFY Total**	Estrella	Yes	No	16,955 AFY (83% Efficiency)
	4B[5]	4,059 AFY RW (Direct Delivery) 21,915 AFY NWP (Recharge) **25,974 AFY Total**	Estrella	Yes	Yes	20,855 AFY (80% Efficiency)

Table 20 Groundwater Modeling Results[1]
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Predictive Alternative	Model Run	Existing/Supplemental Water Supply	Subarea?	Local BMO achieved?	Composite BMO achieved[2]?	Difference in Groundwater Storage from Basin (Net Benefit)[3]
Artificial Recharge of Supplemental Water Supplies in Estrella and Creston Subareas	5A1	4,059 AFY RW (Recharge) 12,377 AFY NWP (Recharge) **16,436 AFY Total**	Estrella	Yes	No	7,891 AFY (48% Efficiency)
	5A2[5]	4,059 AFY RW (Recharge) 23,335 AFY NWP (Recharge) **27,394 AFY Total**	Estrella	Yes	Yes	15,785 AFY (58% Efficiency)
	5B1	4,059 AFY RW (Recharge) 12,377 AFY NWP (Recharge) 3,203 AFY SWP (Recharge) **19,632 AFY Total**	Estrella Creston	Yes Yes	No Yes	10,985 AFY (56% Efficiency)
	5B2[5]	4,059 AFY RW (Recharge) 23,335 AFY NWP (Recharge) 3,203 AFY SWP (Recharge) **30,597 AFY Total**	Estrella Creston	Yes Yes	Yes Yes	18,878 AFY (62% Efficiency)
Artificial Recharge of Supplemental Water Supplies in Estrella and Shandon Subareas	6A	4,059 AFY RW (Recharge) 12,377 AFY NWP (Recharge) **16,436 AFY Total**	Estrella)	Yes	No	9,554 AFY (58% Efficiency)
	6B	4,059 AFY RW (Recharge) 12,377 AFY NWP (Recharge) 16,436 AFY SWP (Recharge) **32,872 AFY Total**	Estrella Shandon	Yes Yes[4]	No Yes[4]	13,019 AFY (40% Efficiency)
	6C[5]	4,059 AFY RW (Recharge) 45,250 AFY NWP (Recharge) **49,309 AFY Total**	Estrella	Yes	Yes	22,806 AFY (35% Efficiency)

Table 20	**Groundwater Modeling Results[1] Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD**					
Predictive Alternative	**Model Run**	**Existing/Supplemental Water Supply**	**Subarea?**	**Local BMO achieved?**	**Composite BMO achieved[2]?**	**Difference in Groundwater Storage from Basin (Net Benefit)[3]**
Offset Pumping Demand and Artificial Recharge in Creston Subarea	7A	1,531 AFY NWP (Direct Delivery)	Creston	Yes	No	1,516 AFY (99% Efficiency)
	7B	1,531 AFY NWP (Direct Delivery) 1,020 AFY SWP (Direct Delivery) 1,826 AFY SWP (Recharge) **4,377 AFY Total**	Creston	Yes	Yes	4,057 AFY (89% Efficiency)
Offset Pumping Demand and Artificial Recharge in Shandon Subarea	8	4,259 AFY SWP (Direct Delivery) 1,826 AFY SWP (Recharge) **6,085 AFY Total**	Shandon	Yes	Yes[4]	3,000 AFY (49% Efficiency)

Notes:

(1) Table results can be found in detail in Module Update Report.
(2) Multiple BMO monitoring wells exist in each subarea. The BMO stabilization represents a composite calculation that includes all BMO wells within the subarea.
(3) Efficiencies represented in this table reflect overall efficiencies, which may be different than the individual efficiencies represented earlier in the section.
(4) BMO criteria already achieved under baseline conditions.
(5) Alternative added in second iteration of modeling conducted in October/November 2016.

5.0 SELECTED ALTERNATIVES FOR FURTHER CONSIDERATION

Based on total basin benefit (increase in net basin storage from baseline) and satisfying BMO criteria determined in the modeling runs, the following alternatives were selected for further investigation:

- Alternative 4A.
- Alternatives 5A1 and 5B1.
- Alternatives 7A and 7B.
- Alternative 8.

Various components of each alternative will be combined to create Supply Option Scenarios. While the goal of the model runs was to assess the amount of water needed to achieve BMOs, scenario development and evaluation aim to apply the available supplies in the most efficient and cost-effective manner.

The conservation run showed that approximately 35,000 AFY of water is needed to balance the basin. Combined, the available supplies identified can provide an approximate average of only 20,000 AFY. Each scenario will use all available water supplies, and the rest of the water balance would presumably need to come from groundwater demand management.

Each scenario considers the delivery method and its efficiency for overall basin benefit. Direct delivery has the highest benefit to the basin relative to supply. However, direct deliveries require large infrastructure investments to maximize distribution and use water only during irrigation season, which does not always correspond with the availability of water supplies.

Although percolation ponds are less expensive, they have a lower efficiency in general. Percolation ponds provide the opportunity to supply water to the basin when winter water supplies and conveyance infrastructure are generally more available. They also maximize water that can be put into the basin rather than being limited to the irrigation season only.

Supply scenarios were developed to provide various options that range from maximizing direct deliveries to maximizing groundwater recharge. The San Juan Subarea was included in the updated scenarios because the conservation run showed the need for supplemental water supplies. Because no groundwater recharge basins were modeled in the San Juan Subarea, direct delivery was assumed.

Four scenarios were developed to explore the options available for supplemental water supplies. They are summarized in Table 21.

Table 21	Supplemental Water Supply Scenarios List Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD				
Scenario	**NWP**	**RW**	**SWP**	**Notes**	**Direct Delivery vs Recharge**
A	Direct deliveries in Estrella Subarea (Airport recharge in off-seasons)		Direct deliveries in Creston Subarea. Recharge in Shandon in off-season.	Combination of Alternatives 4, 7, and 8.	Maximizes Direct Delivery
B	Direct deliveries in Estrella & Creston Subarea (Airport recharge in off-seasons)		Direct deliveries in San Juan Subarea. Recharge in Creston Subarea in off-season	Combination of Alternatives 4, 5B, and 7B.	Maximizes Direct Delivery
C	Recharge near Huer Huero Creek (Estrella Subarea)		Recharge near Huer Huero Creek (Creston Subarea)	Combination of Alternative 5A1 and 5B1	Maximizes Recharge
D	Recharge near airport (Estrella Subarea)		Direct deliveries in San Juan Subarea. Recharge in Creston Subarea in off-season	Combination of Alternatives 4, 5B, 7A, and 7B.	Combination of Recharge and Direct Delivery

5.1 Scenario Development Assumptions

Numerous factors constrain the amount and timing of NWP and SWP water delivery to users in the Paso Basin, including the annual availability of SWP and NWP water, available capacity within the project pipelines (Coastal Branch and NWP), and seasonal demand patterns. Figure 6 shows irrigation demand ratios used to predict demand timing.

5.1.1 NWP Supply Availability

NWP water is available year-round without timing restrictions. However, the amount of surplus water available depends on whether it is a wet or dry year. In dryer years, participants tend to use more of their allocations, and surplus water is limited.

Figure 7 shows an example distribution of the available NWP in a normal year, with equal amounts distributed throughout the year, some to irrigation during the summer months, and some to recharge when direct deliveries for irrigation are not an option. Available pipeline capacity was calculated by taking the hydraulic capacity of the pipe and subtracting the projected monthly demands for existing NWP participants (see TM 2 for more detail). As Figure 7 shows, during summer months, there is still enough available capacity in the pipeline to increase irrigation deliveries if desired. To maximize the distribution of water to agricultural irrigation customers year-round, supplemental supplies are assumed to supply

70 percent of peak month demand. This corresponds to approximately 90 percent of annual irrigation demand.

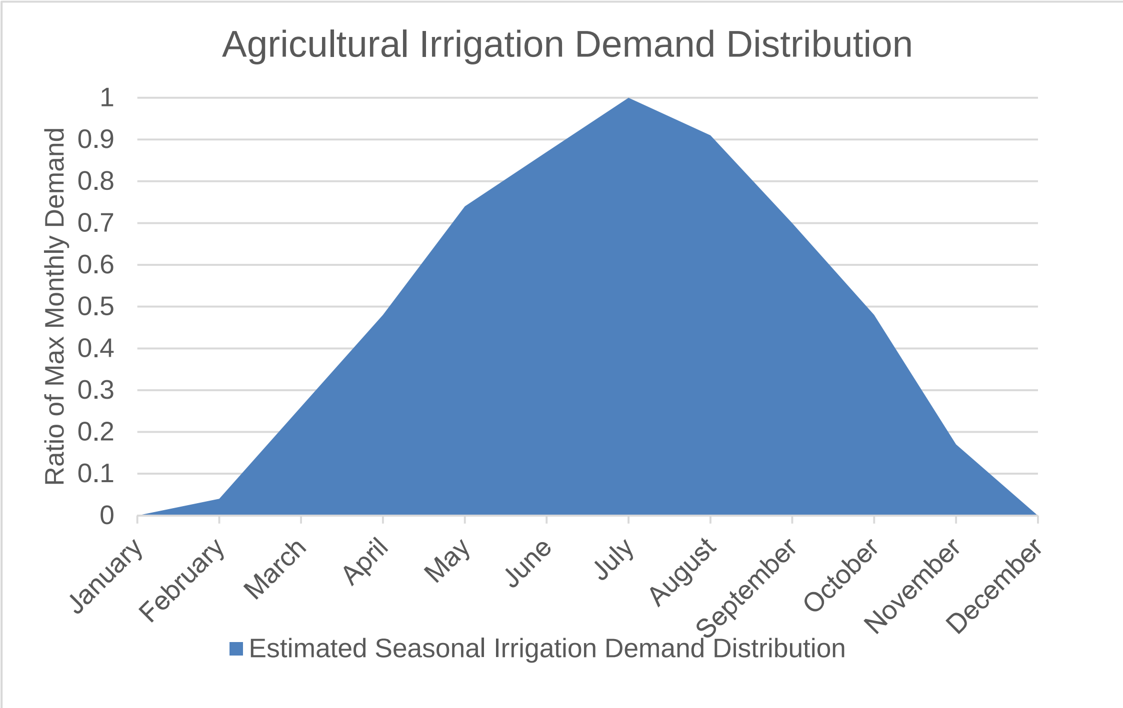


Figure 6 Estimated Seasonal Irrigation Demand Distribution

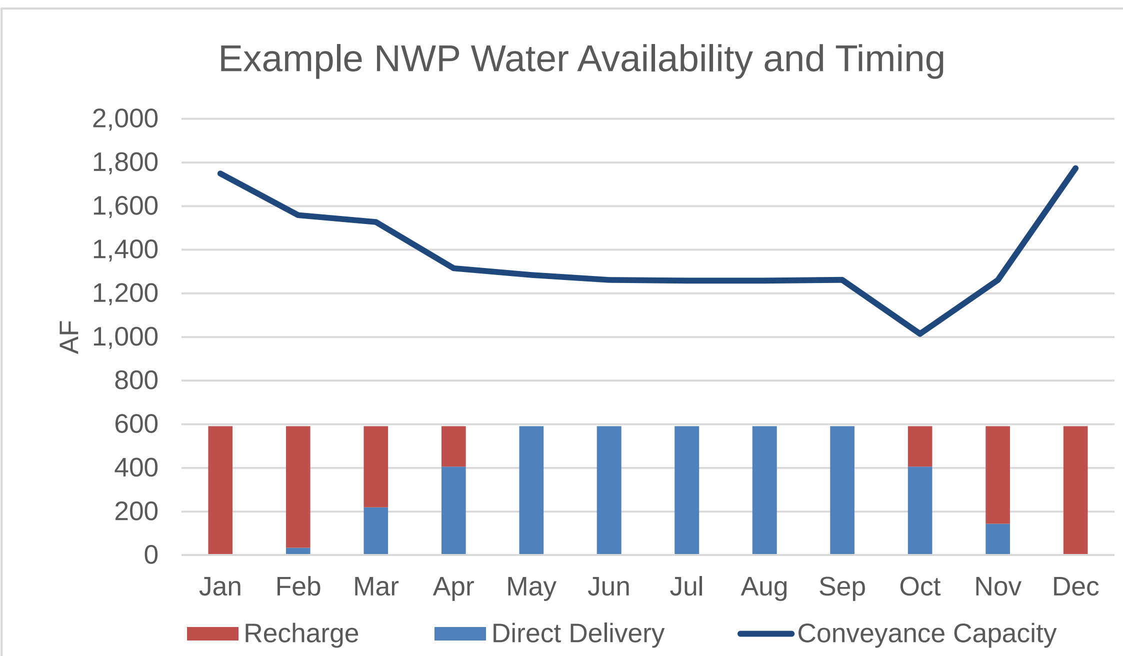


Figure 7 Example Normal Year NWP Water Availability and Timing

5.1.2 SWP Supply Availability

To model the impact of the various constraints on SWP, a water supply, delivery, and demand model was developed for the Coastal Branch pipeline. This model showed that the capacity to deliver SWP water directly for irrigation was limited to approximately 4,910 AFY during the irrigation season.

To connect the highest number of customers and maximize distribution, SWP water was assumed to supply 80 percent of the irrigation demand for connected agricultural users. Higher amounts of direct delivery water could be achieved by connecting additional agricultural users and delivering a smaller percentage of the annual demand. However, this would likely require significant additional delivery infrastructure, such as transmission pipelines, agricultural irrigation service pipelines, and customer conversions.

Under normal and wet year conditions, additional SWP water not used for direct delivery could recharge the groundwater basin. Under these conditions, approximately 3,950 AFY of SWP would be available for recharge.

In years with surplus SWP, the timing of water delivery is limited by the available pipeline capacity of the Coastal Branch. When factoring in other SWP users, this capacity is close to 971 AFM but can decrease in summer months where demand is higher. Figure 8 shows an example seasonal delivery pattern modeled for the SWP direct delivery and recharge scenarios. To allow for annual pipeline maintenance, no deliveries were assumed to take place in November. More information about existing users and monthly demands can be found in TM 3.

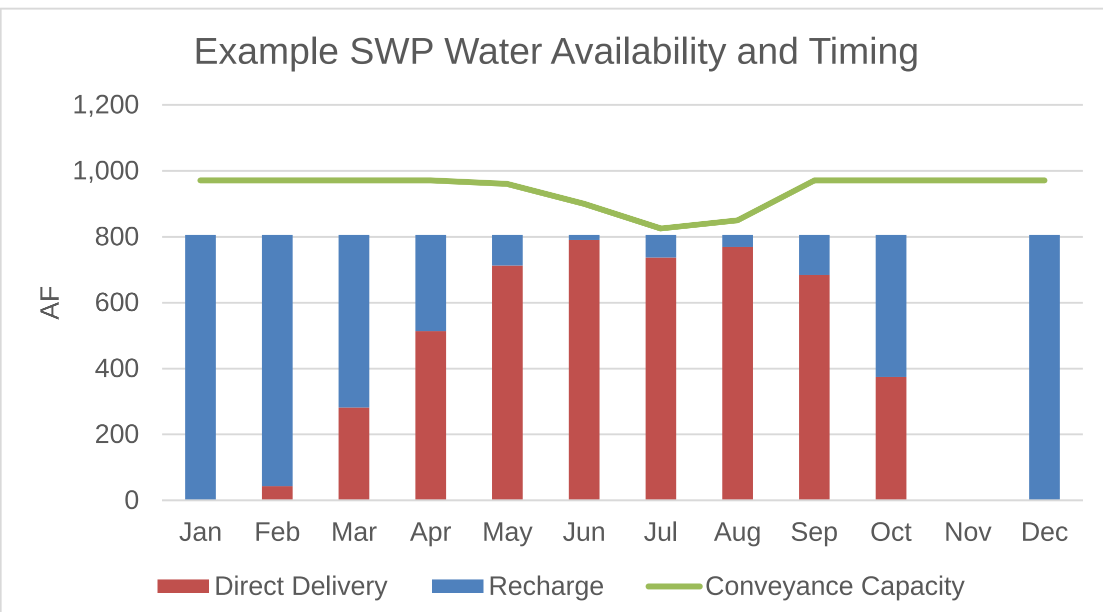


Figure 8 Example Normal Year SWP Water Availability and Timing

5.1.3 RW Supply Availability

RW is available year-round, with higher flows in the winter from increased wastewater flows and the City of Paso Robles' summer irrigation demand (see Figure 9). Based on the water quality needs of potential agricultural users, RW may need to be blended to reduce salinity. However, this is not necessarily a constraint. RW timing and delivery is dependent upon the availability of the supply. Since it would have a new distribution system, conveyance is not a constraint.

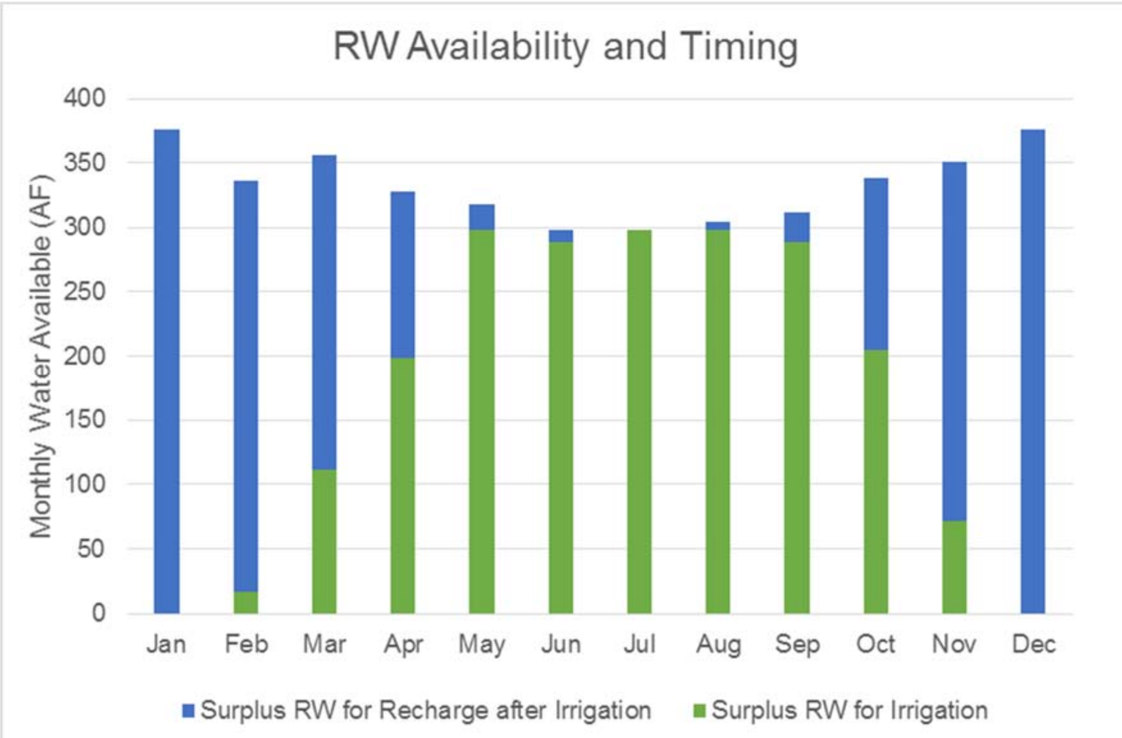


Figure 9 Seasonal RW Availability and Timing

To estimate the amount of water available for irrigation distribution, this study assumed that RW will be blended 50/50 with NWP water to protect sensitive crops. The existing groundwater supplies could be an alternative source of blend water. Although the City of Paso Robles does not currently plan to use NWP to blend with RW for its in-city uses, agriculture may have different requirements.

5.1.4 Recycled Water Contribution to Groundwater Recharge

In June 2014, the California Division of Drinking Water (DDW) revised and adopted new regulations in Title 22 that replaced existing, less definitive guidelines for groundwater replenishment reuse projects (GRRPs).These projects were originally adopted in 1978 and typically involved evaluating projects individually.

DDW covers two types of GRRPs: surface application and subsurface injection. For tertiary recycled water that has not undergone additional purification processes, the initial recycled water contribution (RWC) to a percolation or surface spreading operation cannot exceed 20 percent. The other 80 percent must be provided by a diluent water, in this case NWP.

The RWC can be increased over time if adequate testing/data show soil aquifer treatment for the recharge operation. For this high-level study, the RWC is allowed up to 30 percent for long-term averages in our scenarios. However, the 20 percent initial contribution would be required for startup and likely the first few years of operation.

5.2 Scenario A – Estrella, Creston, and Shandon Subareas, Maximized Direct Deliveries

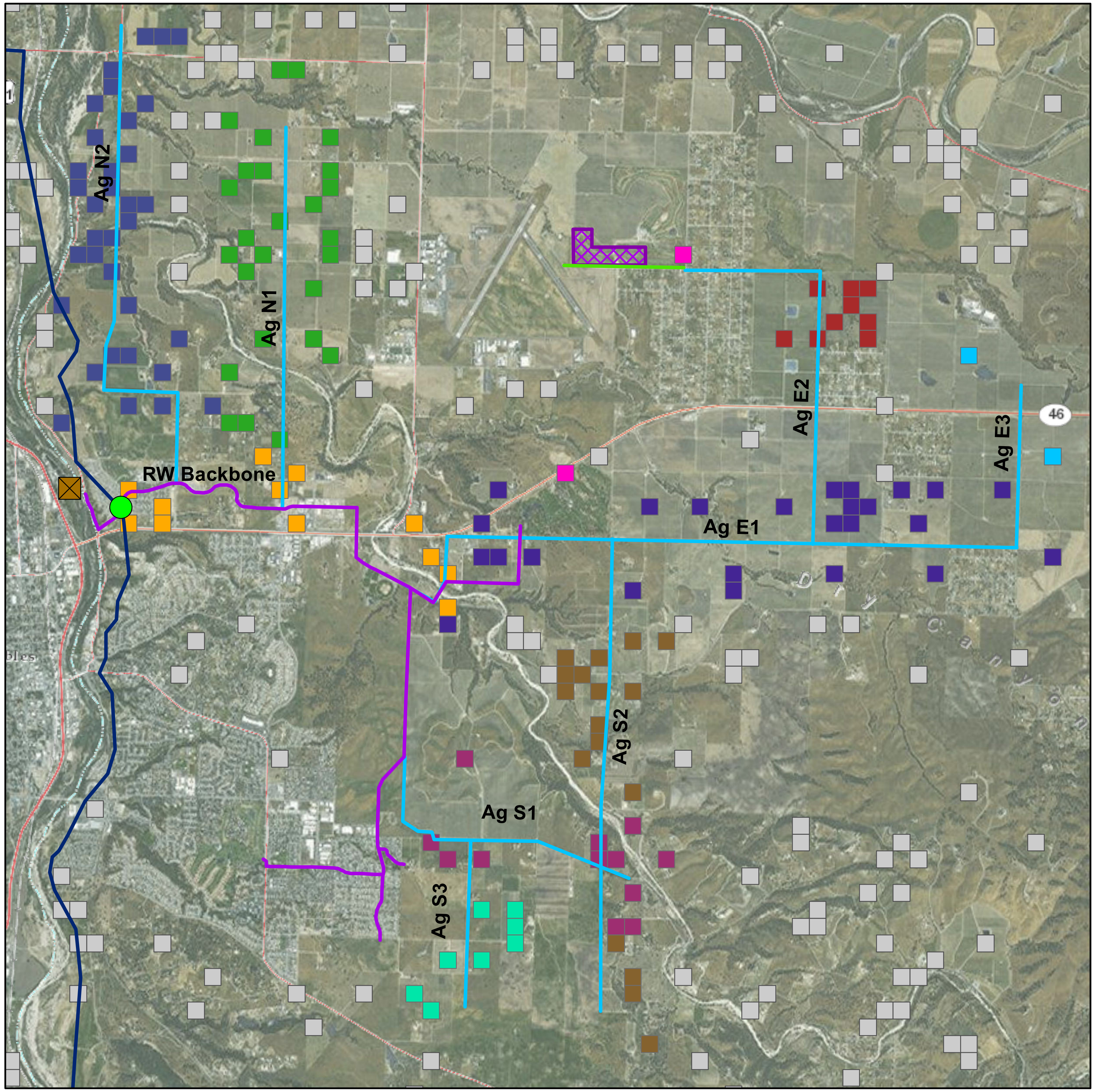
The first scenario, Scenario A, would use all three supplemental supplies to maximize direct deliveries. In this scenario, the Coastal Branch Pipeline's hydraulic capacity would primarily limit the SWP, and the infrastructure would limit RW/NWP water. Off-season flows would be sent to recharge basins. NWP water and RW could be combined in the pump station's wet well and delivered to agricultural customers within the Estrella Subarea, with off-season flows sent to a recharge basin near the Paso Robles Airport (basin model Alternative 4A).

Direct deliveries of SWP water would be maximized within the Creston Subarea (basin model Alternative 7B). In Scenario A, the rest of the available SWP water would be sent to recharge basins in the Shandon Subarea (basin model Alternative 8).

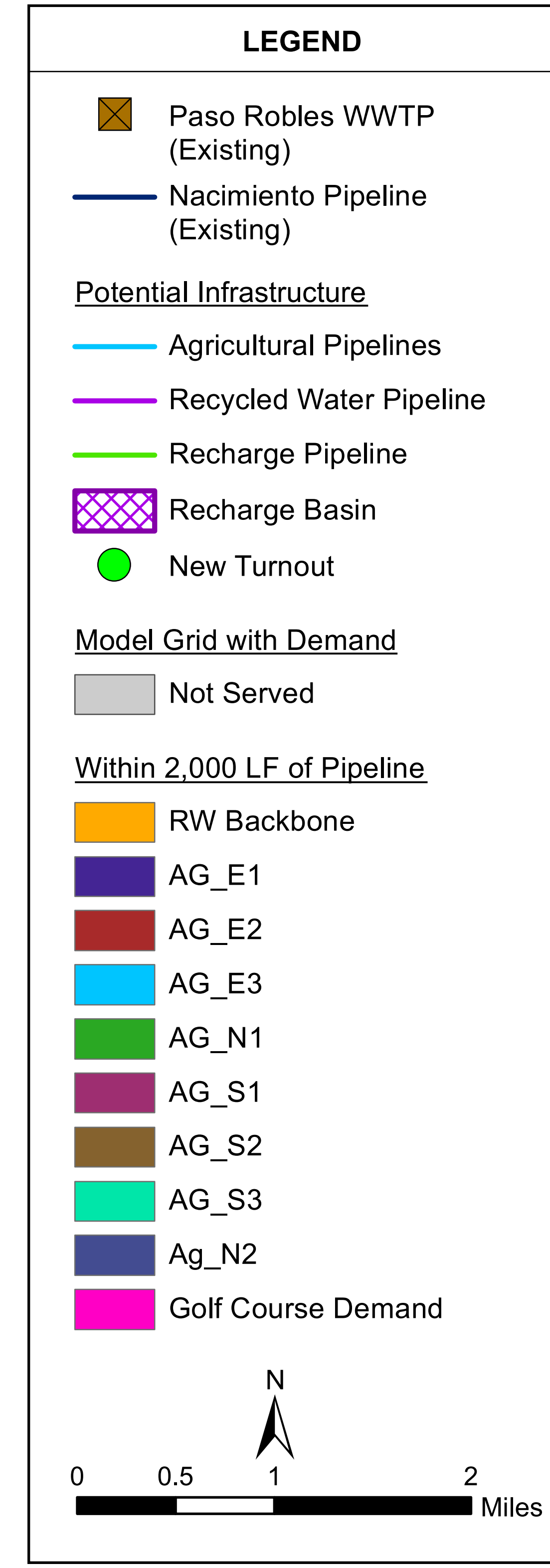
Table 22 summarizes Scenario A. Figures 10 through 12 show Scenario A, with Figure 10 showing all possible pipeline alignments. A project serving the Estrella subarea would select the appropriate segments to supply approximately 4,100 AFY of combined NWP water and RW for direct delivery. In the cost estimate, Segments E1, E2, and a portion of E3 were used.

Table 22 Scenario A Description
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Water Supply	Based on Alternative	Use Location	Type of Use	Supply Amount	Efficiency	Basin Benefit
NWP	Alt 4A	Estrella	Direct Delivery	2,050	100%	2,050
NWP	Alt 4A	Estrella	Recharge	5,050	91%	4,584
RW	Alt 4A	Estrella	Recharge	1,950	46%	887
RW	Alt 4A	Estrella	Direct Delivery	2,050	50%	1,028
SWP	Alt 7B	Creston	Direct Delivery	4,380	100%	4,380
SWP	Alt 8	Shandon	Recharge	4,480	49%	2,203
			Total	**19,960**	**76%**	**15,133**



Segment	Length (LF)	Demand (AFY)
RW	18,039	56
Ag E1	26,612	3,208
Ag E2	16,034	1,168
Ag E3	6,388	1,211
Ag N1	14,945	1,724
Ag N2	20,849	1,214
Ag S1	12,036	914
Ag S2	18,577	711
Ag S3	6,505	301
SUM	*139,986*	*10,507*



SCENARIO A - NWP WATER AND RW TO ESTRELLA SUBAREA

FIGURE 10

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

carollo RMC WSC

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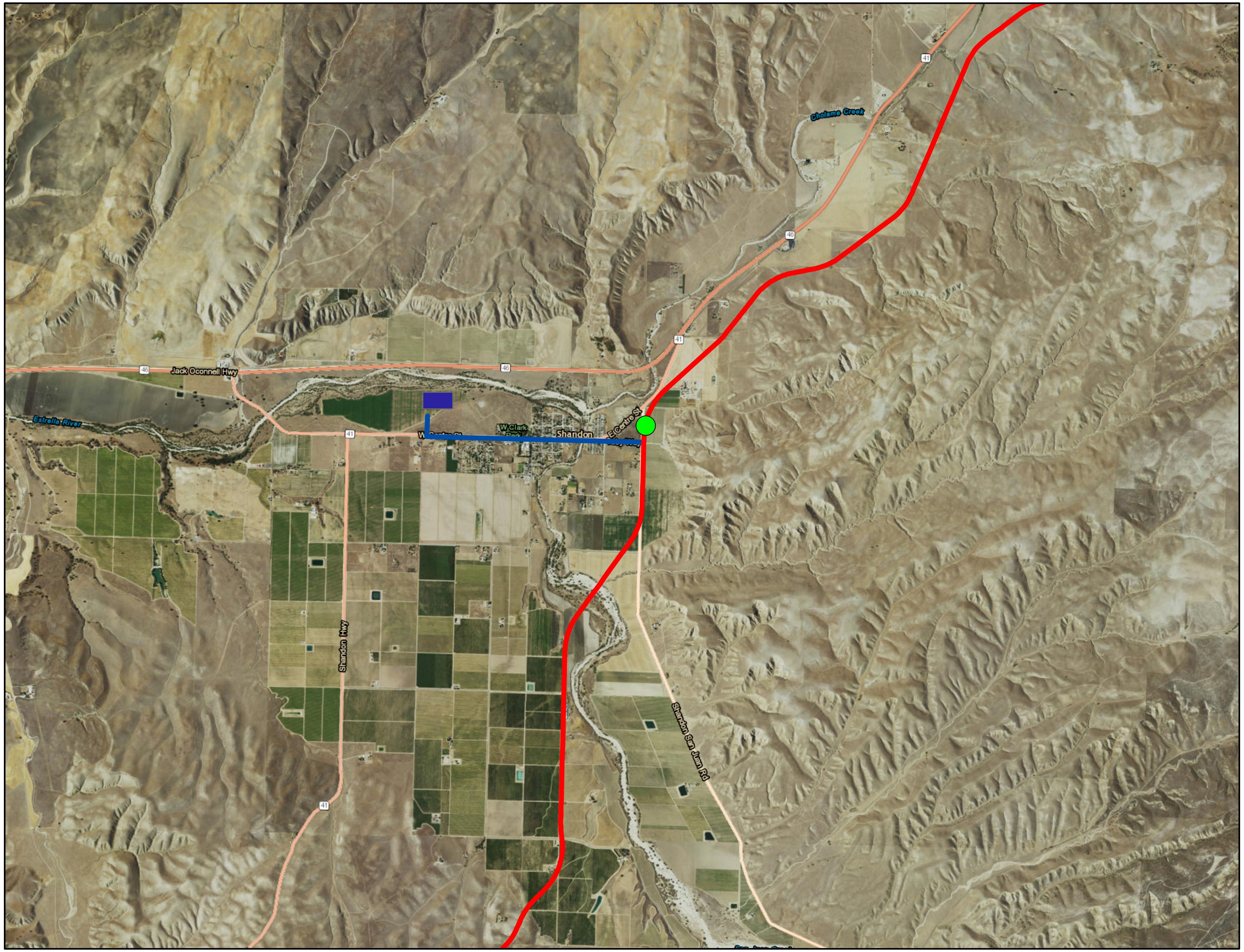

LEGEND

Coastal Branch Pipeline

Potential Infrastructure

Shandon Turnout (New)

Shandon Percolation Basin

Shandon Pipeline

N

0 0.75 1.5 Miles

	Total Delivered Demand (AFY)	Length of Pipe (LF)
Shandon GW Basin	4,481	9,300

SCENARIO A - SWP WATER TO SHANDON SUBAREA

FIGURE 11

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

carollo RMC water and environment WSC Water Systems Consulting, Inc.

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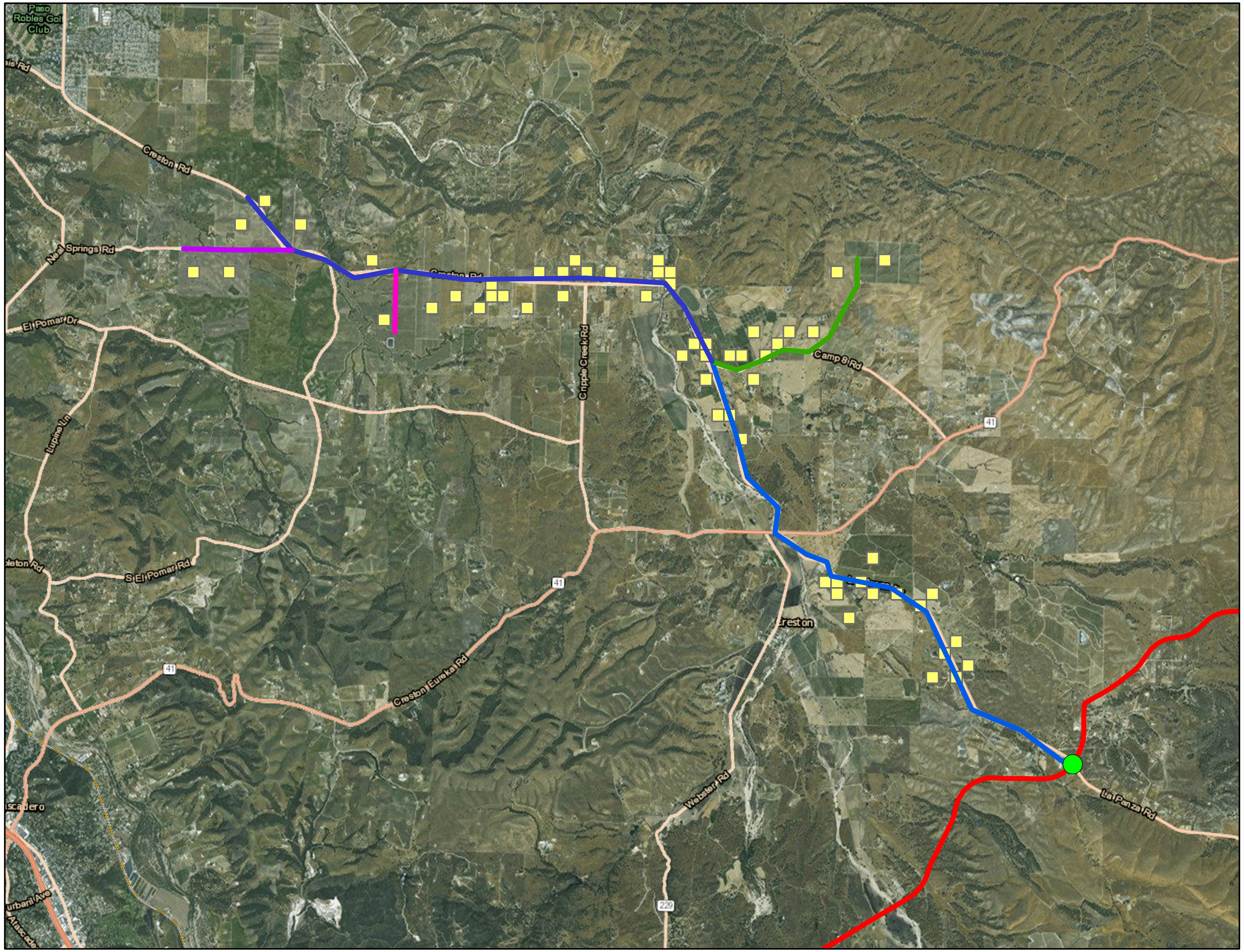

LEGEND

- Coastal Branch Pipeline
- Agricultural Irrigation Areas

Potential Infrastructure

- New Turnout
- Delivery Pipeline Segment 1
- Delivery Pipeline Segment 2
- Delivery Pipeline Segment 3
- Delivery Pipeline Segment 4

N

0 0.75 1.5 Miles

	Total Delivered Demand (AFY)	Length of Pipe (LF)
Creston	4,377	87,200

SCENARIO A - SWP WATER TO CRESTON SUBAREA

FIGURE 12

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

carollo RMC WSC Water Systems Consulting, Inc.

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5.3 Scenario B – Estrella, Creston, and San Juan Subareas, Maximized Direct Deliveries

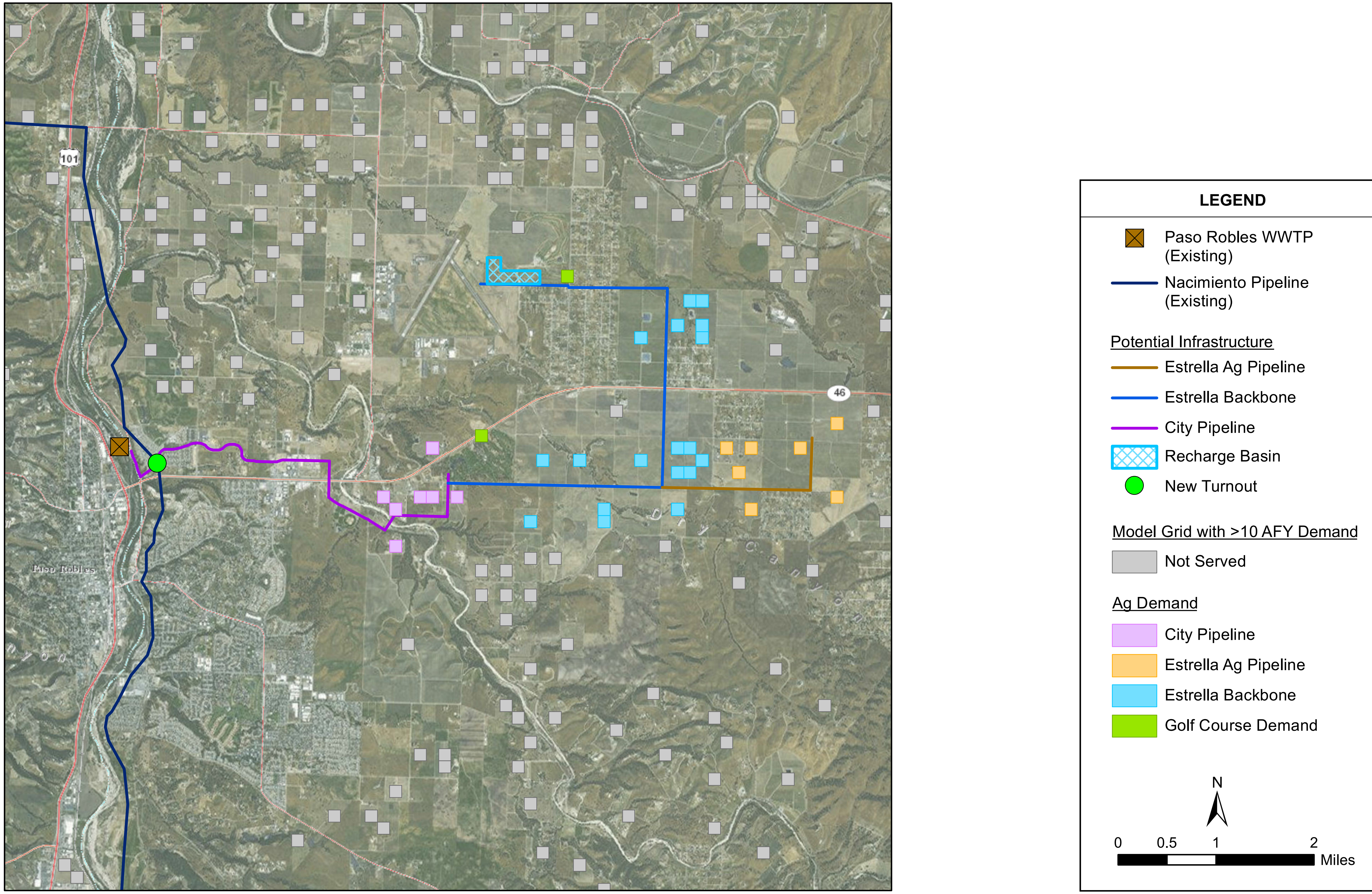
Scenario B would also maximize direct delivery, but it includes deliveries to the San Juan Subarea. NWP water would be delivered directly to agricultural users in both Estrella and Creston Subareas, with off-season water sent to recharge basins near the Paso Robles Airport (basin model Alternatives 4A and 7A).

Agricultural users within San Juan Subarea and Creston Subarea (Alternative 7B) would receive SWP water from a potential Shandon turnout. Off-season flows would be sent to a recharge basin near Huer Huero Creek in the Creston Subarea (Alternative 5B1).

Table 23 lists flow allocations. Figures 13 through 16 illustrate Scenario B.

Table 23 Scenario B Description
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Water Supply	Based on Alternative	Use Location	Type of Use	Supply Amount	Efficiency	Basin Benefit
NWP	Alt 4A	Estrella	Direct Delivery	2,050	100%	2,050
NWP	Alt 4A	Estrella	Recharge	3,550	91%	3,223
NWP	Alt 7A	Creston	Direct Delivery	1,500	100%	1,500
RW	Alt 4A	Estrella	Direct Delivery	2,050	50%	1,028
RW	Alt 4A	Estrella	Recharge	1,950	46%	887
SWP	Alt 7B	Creston	Direct Delivery	1,000	100%	1,000
SWP		San Juan	Direct Delivery	3,910	100%	3,910
SWP	Alt 5B1	Creston	Recharge	3,950	97%	3,816
			Total	**19,960**	**87%**	**17,413**



SCENARIO B - NWP WATER AND RW TO ESTRELLA SUBAREA

FIGURE 13

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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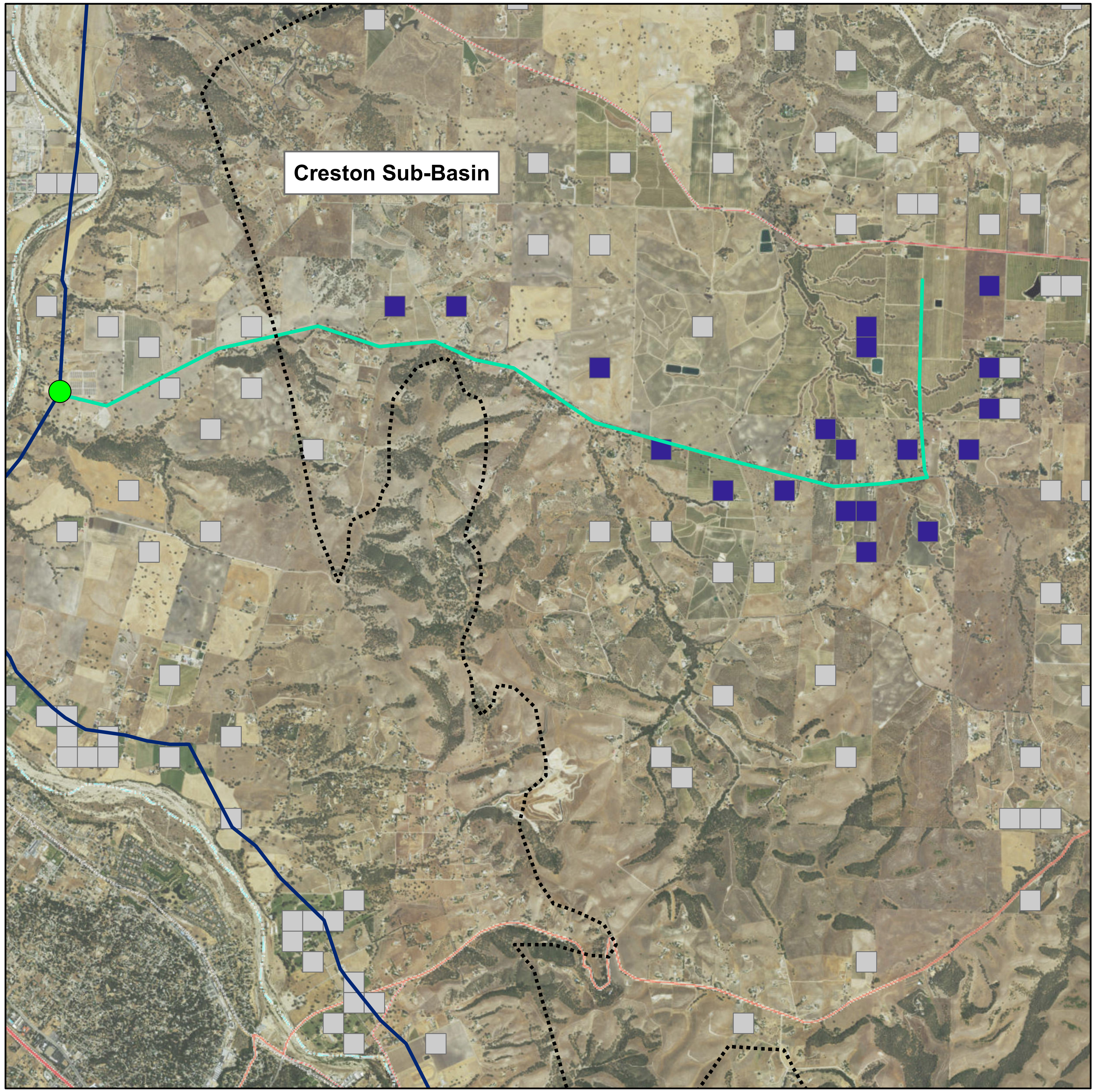

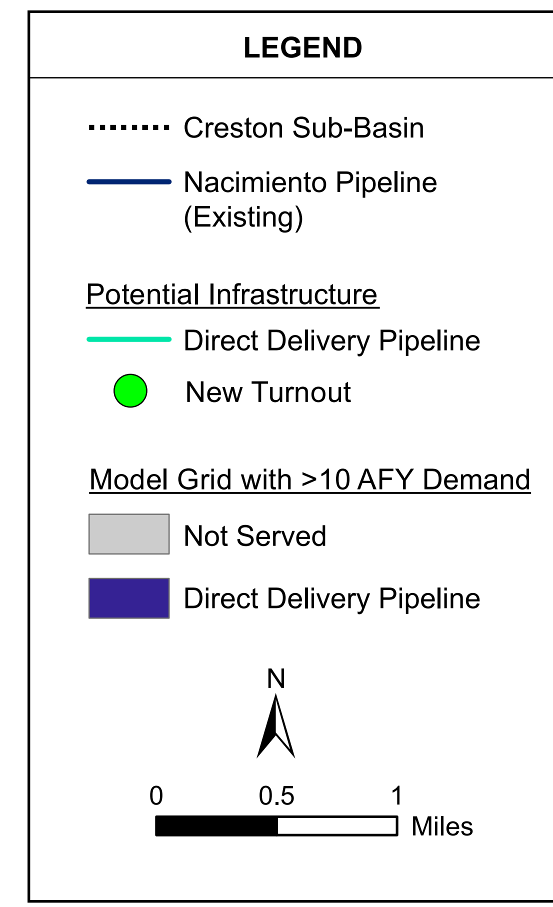

SCENARIO B - NWP WATER TO CRESTON SUBAREA

FIGURE 14

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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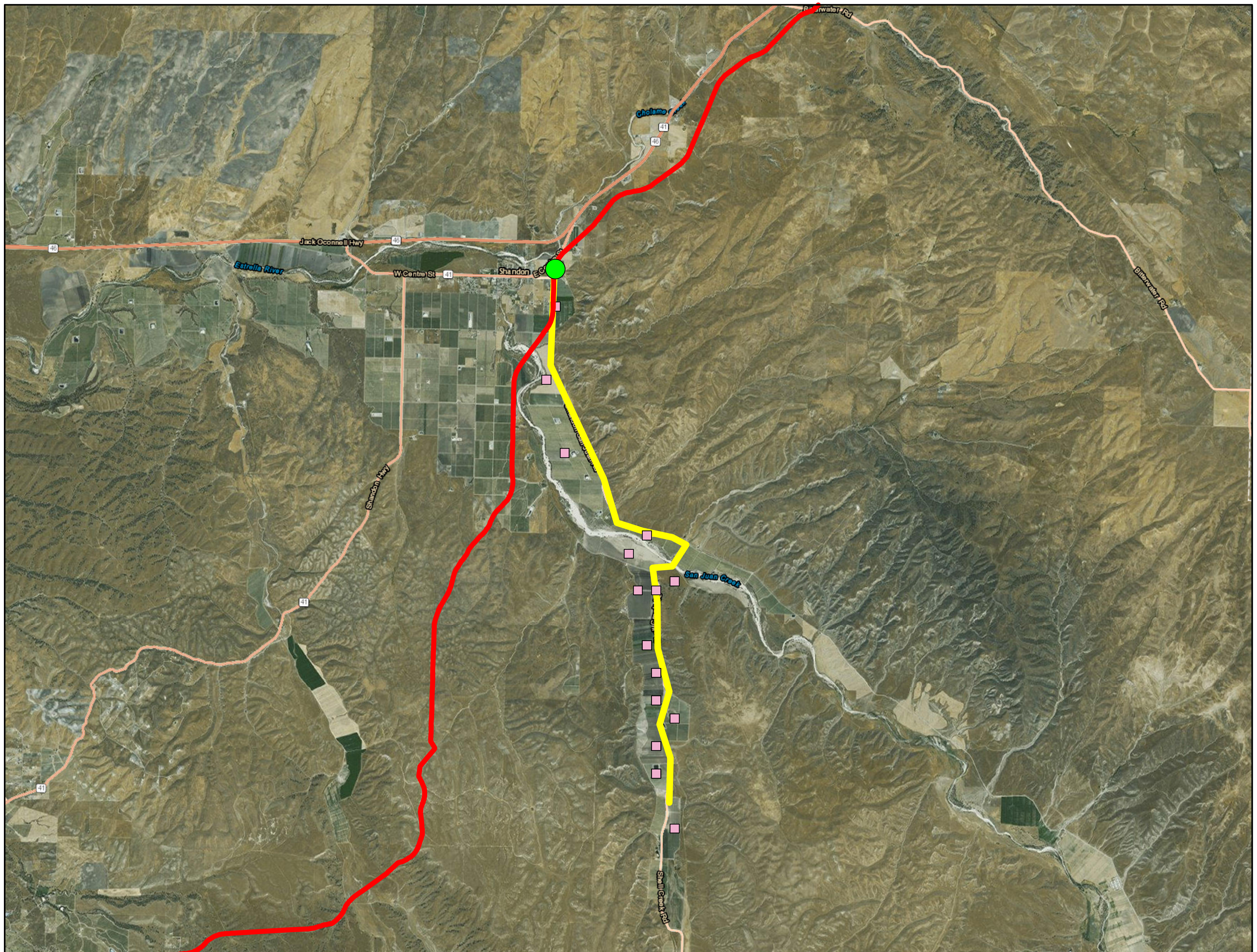

LEGEND

- Coastal Branch Pipeline
- Agricultural Irrigation Areas

Potential Infrastructure

- Shandon Turnout (New)
- San Juan Irrigation Pipeline

N

0 1.25 2.5 Miles

	Total Delivered Demand (AFY)	Length of Pipe (LF)
San Juan	3,909	45,100

SCENARIO B - SWP WATER TO SAN JUAN SUBAREA

FIGURE 15

COUNTY OF SAN LUIS OBISPO
SUPPLY OPTIONS STUDY

carollo RMC WSC Water Systems Consulting, Inc.

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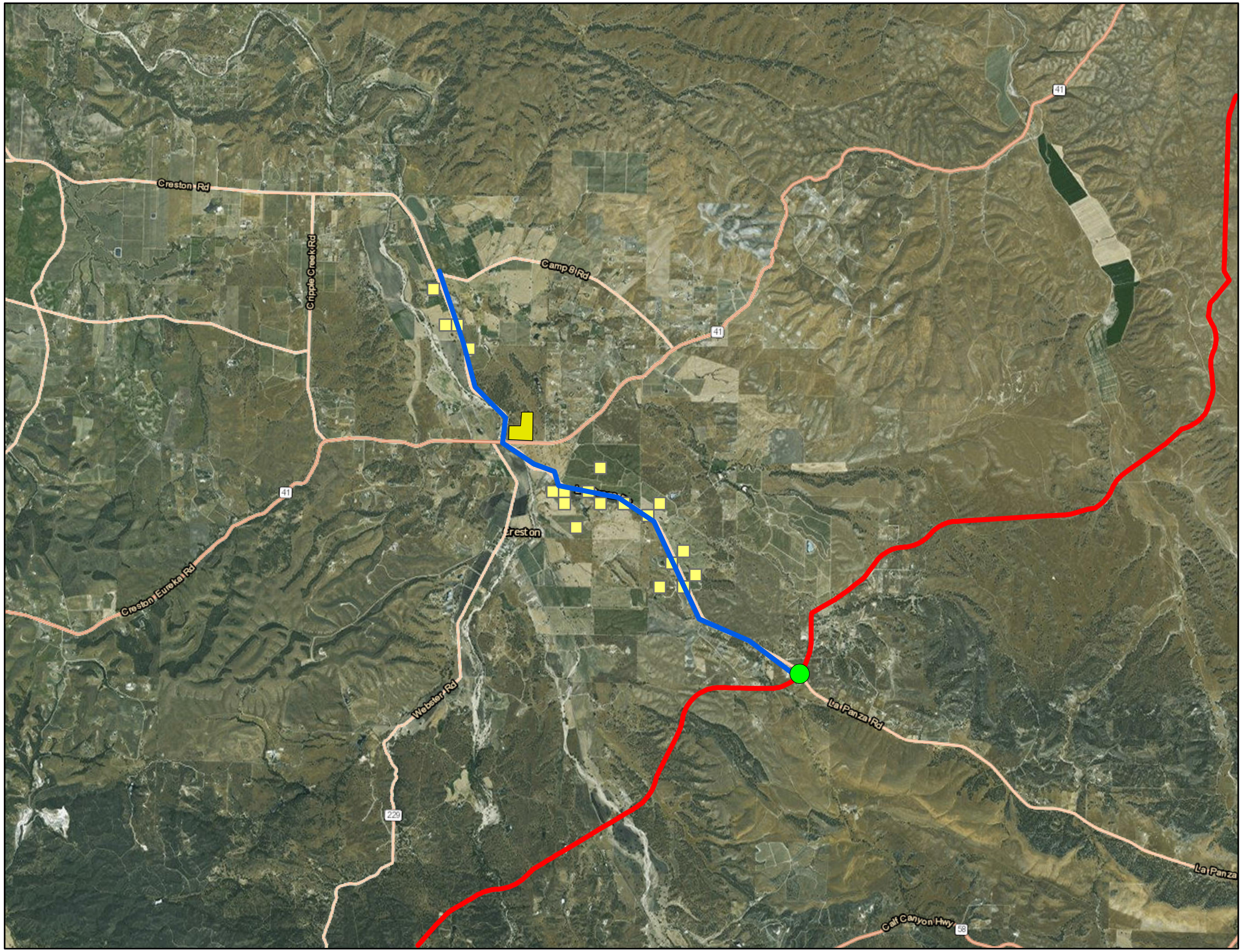

LEGEND

- Coastal Branch Pipeline
- Agricultural Irrigation Areas

Potential Infrastructure

- Creston Percolation Basin
- New Turnout
- Delivery Piepline Segment 1

N

0 0.75 1.5 Miles

	Total Delivered Demand (AFY)	Length of Pipe (LF)
Creston	1,000	3,600
Creston GW Basin	3,949	22,300

SCENARIO B - SWP WATER TO CRESTON SUBAREA (RECHARGE)

FIGURE 16

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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5.4 Scenario C - Estrella and Creston Subareas, Maximized Recharge (Huer Huero Creek)

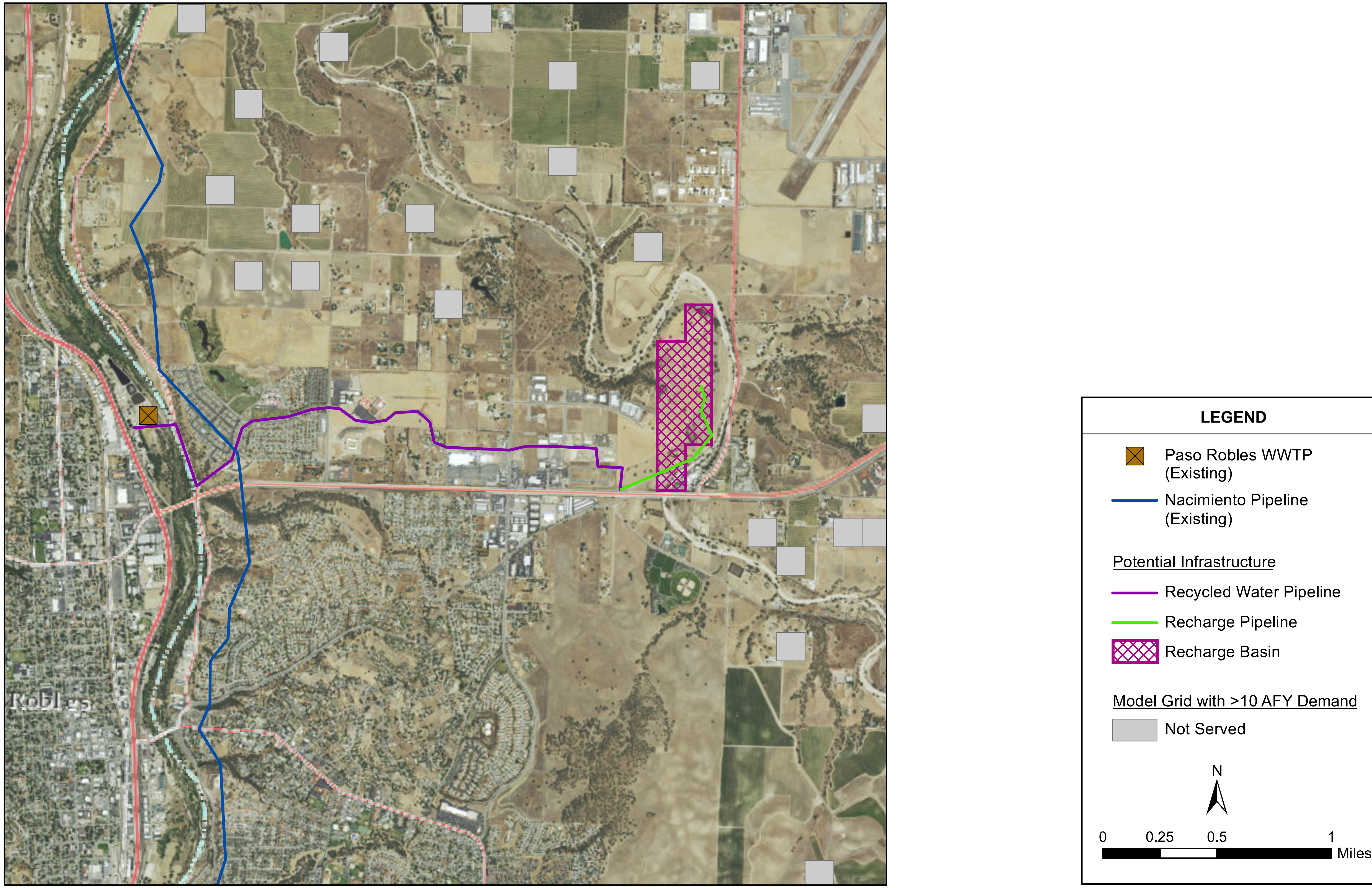
Scenario C maximizes recharge within Estrella and Creston Subareas. This scenario is based on basin model Alternative 5A1 and 5B1 (Releases to Huer Huero Creek).

NWP water and RW water would be combined to recharge the Estrella Subarea. SWP water would be piped through a new turnout to recharge basins along Huer Huero Creek in the Creston Subarea, with direct deliveries sent only to irrigation users directly along the pipeline alignment.

Table 24 lists flow allocations, and Figures 17 and 18 show Scenario C.

Table 24 Scenario C Description
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Water Supply	Based on Alternative	Use Location	Type of Use	Supply Amount	Efficiency	Basin Benefit
NWP	Alt 5A1	Estrella	Recharge	7,100	55%	3,882
RW	Alt 5A1	Estrella	Recharge	4,000	27%	1,096
SWP	Alt 5B1	Creston	Recharge	8,090	97%	7,815
SWP	Alt 5B1	Creston	Direct Delivery	770	100%	770
			Total	**19,960**	**71%**	**13,563**



SCENARIO C - NWP WATER AND RW TO ESTRELLA SUBAREA (RECHARGE)

FIGURE 17

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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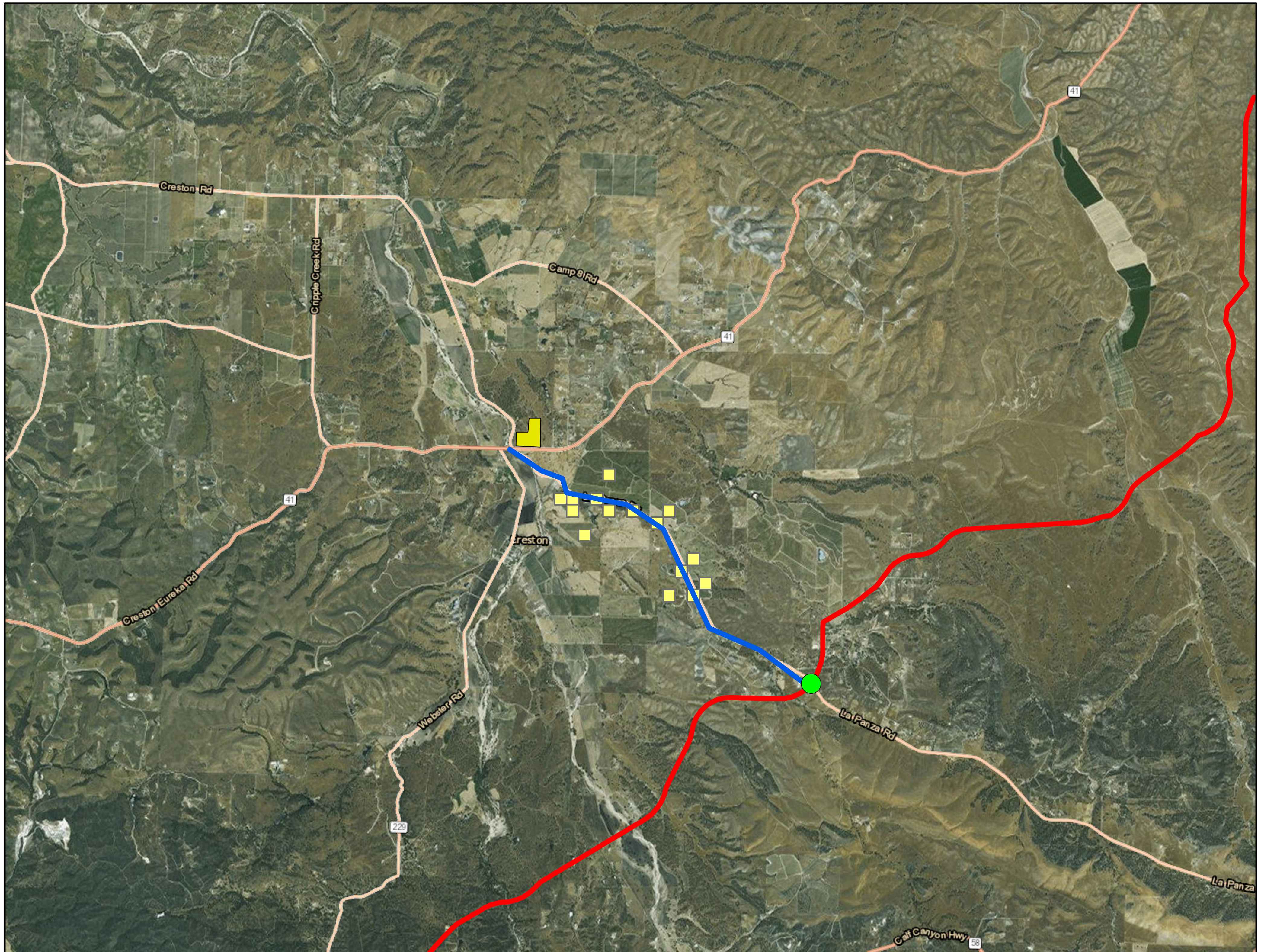

LEGEND

Coastal Branch Pipeline
Agricultural Irrigation Areas

Potential Infrastructure

Creston Percolation Basin
New Turnout
Delivery Pipeline Segment 1

N

0 0.75 1.5 Miles

	Total Delivered Demand (AFY)	Length of Pipe (LF)
Creston	765	
Creston GW Basin	8,093	22,300

SCENARIO C - SWP WATER TO CRESTON SUBAREA (RECHARGE)

FIGURE 18

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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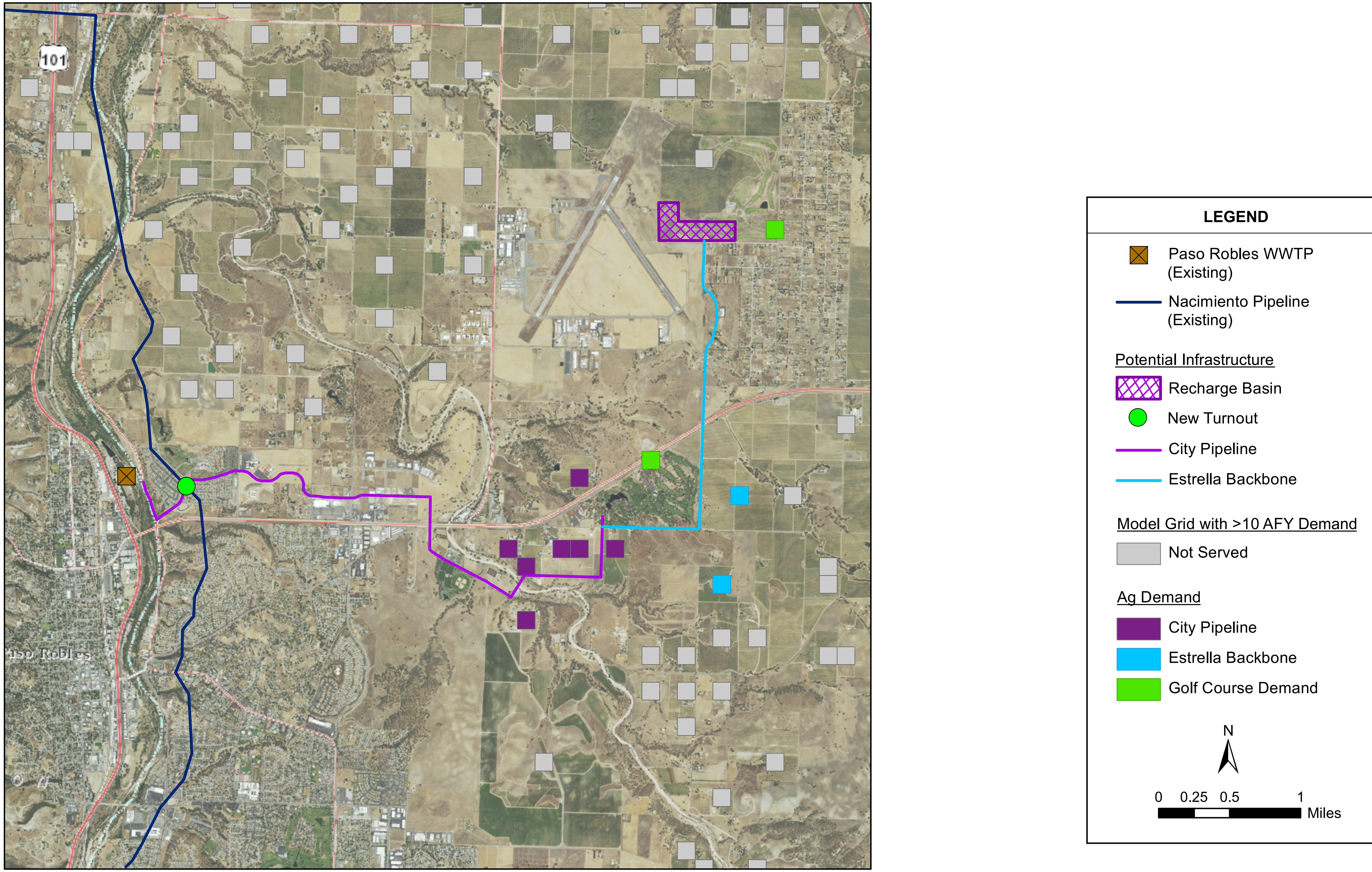
5.5 Scenario D - Estrella, Creston, and San Juan Subareas, Combination of Direct Delivery and Recharge

Scenario D represents a combination of direct delivery and recharge (basin model Alternatives 4A, 7A, 7B, and 5B1). This scenario sees SWP water direct deliveries in San Juan, SWP water recharge in the Creston Subarea, and NWP water and RW recharge in Estrella, with direct deliveries along the pipeline to the recharge basins.

Like Scenario B, the recharge basins for Scenario D would be near the airport. However, fewer agricultural users would be served. Table 25 lists flow allocations, and Figure 19 shows Scenario D, with the SWP portion the same as Scenario B, shown in Figures 14 and 15.

Table 25 Scenario D Description
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Water Supply	Based on Alternative	Use Location	Type of Use	Supply Amount	Efficiency	Basin Benefit
NWP	Alt 4A	Estrella	Direct Delivery	390	100%	390
NWP	Alt 4A	Estrella	Recharge	6,710	91%	6,091
RW	Alt 4A	Estrella	Direct Delivery	390	50%	196
RW	Alt 4A	Estrella	Recharge	3,610	46%	1,643
SWP	Alt 5B1	Creston	Recharge	3,950	97%	3,816
SWP	Alt 7B	Creston	Direct Delivery	1,000	100%	1,000
SWP		San Juan	Direct Delivery	3,910	100%	3,910
			Total	**19,960**	**85%**	**17,045**



SCENARIO D - NWP WATER AND RW TO ESTRELLA SUBAREA (RECHARGE AND DIRECT DELIVERY)

FIGURE 19

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

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6.0 COST EVALUATION

6.1 Assumptions

Cost estimates for each scenario were prepared for a Class 5 cost estimate in accordance with guidelines from the Association for the Advancement of Cost Estimating (AACE). Appendix B contains the basis of cost and more detailed cost breakdowns.

Table 26 summarizes the cost estimates' key assumptions. The cost of supplemental water supplies is estimated from a range of potential costs. Because the NWP is fully allocated, water must be purchased from an existing participant.

Table 26 Cost Estimate Assumptions
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Item	Unit	Value
NWP Turnout Construction(1)	EA	$300,000
SWP Turnout Construction(1)	EA	$300,000
NWP Water(2)	AF	$250 - $2,000 ($2,000 assumed)
SWP Water(3)	AF	$2,292 - $2,503 ($2,500 assumed)
RW(4)	AF	$2,000

Notes:
(1) Construction cost based on recent turnout from SWP pipeline to Shandon (San Luis Obispo's County Capital Project Summary, May 2016). Increased slightly to accommodate a larger turnout.
(2) NWP water cost based on highest reported purchase price of water for a non-participant. Actual price depends on the market and will need to be negotiated.
(3) SWP water cost based upon the SWP buy-in estimate of treated water. Raw water buy-in costs may range from $467/AF to $1,793/AF but would require additional infrastructure as discussed in Section 2.1.2. Actual water price may vary depending on whether the water is purchased from an existing user or the SWP.
(4) Assumed recycled water purchase cost. Actual price to be determined.

Ever since full allocation, no surplus water sales agreements have been made to estimate the future surplus NWP purchase costs for non-participants. The cost to purchase the NWP water for a non-participant is assumed to be $2,000/AF, which is the highest potential price of NWP water assumed and a starting point for negotiations.

Allocations within the SWP Table A are available. The most reliable method of securing water delivery would be to purchase a permanent allocation. While SWP water also has a range of costs depending on the point of delivery and water quality, the full buy-in cost of $2,500/AF was assumed.

Even if it were possible to purchase surplus water from an existing user, the full allocation price would be the starting point for negotiations for a long-term agreement. As discussed in

Section 2.1.2, the cost of $2,500/AF represents the treated water cost at a point of delivery downstream of the Shandon Turnout.

Because the RW program with the City of Paso Robles is still in development, its price is not yet determined. For this study, $2000/AF was assumed.

6.2 Scenario Cost Estimate

Because all scenarios use the maximum estimated available water, infrastructure costs are the differentiating values. Table 27 shows the cost estimates for each scenario's infrastructure, including total project cost, annualized project cost, and O&M costs. The infrastructure total project costs range from the least expensive scenario (Scenario C) at $53.2 million to the most expensive (Scenario B) at $146.3 million.

In general, O&M costs for each scenario are relatively similar, around $1.4 to $2 million annually. These costs include pumping, pipeline, and recharge pond maintenance. Since all available supplies are used in each alternative, as shown in Table 28, the total water purchase cost is the same across all scenarios.

Annualized project costs were based on a typical bond interest rate of 5 percent and a payback period of 30 years. Annualized costs range from the least expensive (Scenario C) at $3.5 million annually to the most expensive (Scenario A) at $9.5 million.

Each scenario requires procuring the same amount of supplemental water. However, due to varied delivery methods, the amount of estimated basin benefit from the supplemental water varies with each scenario.

The last column of Table 27 shows the infrastructure unit cost of water. Of all scenarios, Scenario C is the most cost-effective infrastructure project ($358/AF). However, when accounting for water purchase, the additional basin benefit of Scenario D outweighs the higher infrastructure investment. Scenario D then becomes the most favorable ($3,071/AF).

If a State Revolving Fund (SRF) loan funds a project, the interest rate would drop to approximately 1.8 percent (current rate) and the annualized costs would be significantly cheaper (by about 3 percent through 7 percent). The least expensive option would then be around $2,944 per AF of basin benefit.

As Table 28 shows, the purchase price of water makes up a significant portion of each scenario's annual cost. This cost is highly variable and depends on negotiations with current NWP and SWP water users and the City of Paso Robles (RW). However, the water's purchase price is the same among all scenarios.

Table 27 Scenario Infrastructure Cost Estimates (in 2016 Dollars)
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Component	Water Supply (AFY)	Predicted Benefit (AFY)(1)	Total Project Cost	Annualized Project Cost(2)	O&M Cost(3)	Total Annual Cost	Unit Cost ($/AFY of Benefit)
Scenario A - Maximize Direct Delivery							
NWP & RW to Estrella Subarea	11,100	8,550	$75,960,000	$4,941,000	$1,069,000	$6,010,000	**$703**
SWP to Creston Subarea	4,380	4,380	$55,750,000	$3,627,000	$542,000	$4,169,000	**$952**
SWP to Shandon Subarea	4,480	2,203	$13,340,000	$868,000	$402,000	$1,270,000	**$576**
Total Scenario A Costs	**19,960**	**15,133**	**$145,050,000**	**$9,436,000**	**$2,013,000**	**$11,449,000**	**$757**
Scenario B - Maximize Direct Delivery (San Juan)							
NWP & RW to Estrella Subarea	9,600	7,187	$66,420,000	$4,321,000	$944,000	$5,265,000	**$733**
Nacimiento to Creston Subarea	1,500	1,500	$25,910,000	$1,685,000	$134,000	$1,819,000	**$1,213**
SWP to Creston Subarea	4,950	4,816	$25,300,000	$1,646,000	$428,000	$2,074,000	**$431**
SWP to San Juan Subarea	3,910	3,910	$28,640,000	$1,863,000	$61,000	$1,924,000	**$492**
Total Scenario B Costs	**19,960**	**17,413**	**$146,270,000**	**$9,515,000**	**$1,567,000**	**$11,082,000**	**$636**
Scenario C - Maximize Recharge							
NWP & RW to Estrella Subarea	11,100	4,978	$29,230,000	$1,901,000	$967,000	$2,868,000	**$576**
SWP to Creston Subarea	8,860	8,585	$23,980,000	$1,560,000	$425,000	$1,985,000	**$231**
Total Scenario C Costs	**19,960**	**13,563**	**$53,210,000**	**$3,461,000**	**$1,392,000**	**$4,853,000**	**$358**
Scenario D - Combination of Direct Delivery and Recharge							
NWP & RW to Estrella Subarea	11,100	8,319	$45,230,000	$2,942,000	$1,002,000	$3,944,000	**$474**
SWP to Creston Subarea	4,950	4,816	$26,040,000	$1,694,000	$429,000	$2,123,000	**$441**
SWP to San Juan Subarea	3,910	3,910	$28,640,000	$1,863,000	$61,000	$1,924,000	**$492**
Total Scenario D Costs	**19,960**	**17,045**	**$99,910,000**	**$6,499,000**	**$1,492,000**	**$7,991,000**	**$469**

Notes:
(1) Basin benefit predicted from efficiency factors determined from the groundwater modeling runs depending on the location and delivery method.
(2) The annualized costs assume a 5% interest, on a 30-year term, which is standard for bond issuance. If the projects are funded with a State Revolving Fund (SRF) loan, this annualized cost will be lower.
(3) O&M costs include only costs pertaining to pumping, pipeline, and recharge basin maintenance; they do not include the purchase cost of water.
(4) This estimate reflects our current professional opinion of accurate costs and is subject to change as the project design matures. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented.

Table 28 Full Scenario Cost Estimates (in 2016 dollars) Paso Robles Groundwater Basin Supplemental Supply Options SLOCFCWCD						
Component	**Water Supply (AFY)**	**Predicted Benefit (AFY)(1)**	**Total Annual Inf. Cost(2)**	**Water Purchase Cost(3)**	**Total Annual Cost**	**Unit Cost ($/AFY of Benefit)**
Scenario A - Maximize Direct Delivery						
NWP & RW to Estrella Subarea	11,100	8,550	$6.0M	$22.2M	$28.2M	$3,299
SWP to Creston Subarea	4,380	4,380	$4.2M	$11.0M	$15.1M	$3,452
SWP to Shandon Subarea	4,480	2,203	$1.3M	$11.2M	$12.5M	$5,660
Total Scenario A Costs	**19,960**	**15,133**	**$11.4M**	**$44.4M**	**$55.8M**	**$3,687**
Scenario B - Maximize Direct Delivery (San Juan)						
NWP & RW to Estrella Subarea	9,600	7,187	$5.3M	$19.2M	$24.5M	$3,404
NWP to Creston Subarea	1,500	1,500	$1.8M	$3.0M	$4.8M	$3,213
SWP to Creston Subarea	4,950	4,816	$2.1M	$12.4M	$14.4M	$3,000
SWP to San Juan Subarea	3,910	3,910	$1.9M	$9.8M	$11.7M	$2,992
Total Scenario B Costs	**19,960**	**17,413**	**$11.1M**	**$44.4M**	**$55.4M**	**$3,183**
Scenario C - Maximize Recharge						
NWP & RW to Estrella Subarea	11,100	4,978	$2.9M	$22.2M	$25.1M	$5,036
SWP to Creston Subarea	8,860	8,585	$2.0M	$22.2M	$24.1M	$2,811
Total Scenario C Costs	**19,960**	**13,563**	**$4.9M**	**$44.4M**	**$49.2M**	**$3,628**
Scenario D - Combination of Direct Delivery and Recharge						
NWP & RW to Estrella Subarea	11,100	8,319	$3.9M	$22.2M	$26.1M	$3,143
SWP to Creston Subarea	4,950	4,816	$2.1M	$12.4M	$14.5M	$3,010
SWP to San Juan Subarea	3,910	3,910	$1.9M	$9.8M	$11.7M	$2,992
Total Scenario D Costs	**19,960**	**17,045**	**$8.0M**	**$44.4M**	**$52.3M**	**$3,071**

Notes:

(1) Basin benefit predicted based upon efficiency factors determined from the groundwater modeling runs depending on the location and delivery method.
(2) The annualized costs assume a 5% interest, on a 30-year term, which is standard for bond issuance.
(3) Water purchased cost based upon the cost of water for a full NWP or SWP participant, which is assumed to be the starting point of negotiations.

6.3 Supplemental Supply Cost Comparison

Although they are the focus of this study, NWP water, SWP water, and RW are not the only possible supplemental water supplies. Other supplies include, but are not limited to, indirect and direct potable reuse, desalination, conservation, and stormwater capture. Across California's Central Coast, many water supply options were also investigated. For context and a reference point, this section compares the scenarios developed for this project with costs for alternative water sources developed in other locations.

Note that the costs in the table are unit costs based on supply amount. They do not reflect the amount of basin benefit resulting from supplemental water. If the method of delivery is not 100 percent effective (like direct delivery), the unit cost will be higher when based on the amount of beneficial water. Table 29 summarizes the estimated water supplies, yields, and costs.

Table 29 Alternate Supply Option Comparison
Paso Robles Groundwater Basin Supplemental Supply Options
SLOCFCWCD

Component	Estimated Supply (AFY)	Predicted Benefit (AFY)[1]	Supply Unit Cost ($/AF)	Benefit Unit Cost ($/AF)
Santa Barbara County - Desalination[2]	3,125	3,125	$1,630	$1,630
Pismo Beach - Groundwater Recharge (Coastal Injection)[3]	930	698	$1,900	$2,700
Scenario C - Maximize Recharge	19,960	13,563	$2,091	$3,628
Pismo Beach - Groundwater Recharge (Inland injection)[3]	930	698	$2,100	$2,800
Scenario B - Maximize Direct Delivery (San Juan)	19,960	17,413	$2,162	$3,183
Santa Barbara County - Recycled Water[4]	2,900 to 7,600	N/A	$300 to $2,200	N/A
Scenario D - Combination	19,960	17,045	$2,248	$3,071
Scenario A - Maximize Direct Delivery	19,960	15,090	$2,422	$3,687
Pure Water Monterey Groundwater Replenishment Project[5]	3,500	N/A	$2,500	N/A
Santa Barbara County - Stormwater Capture[4]	2,100 to 56,000	N/A	$12 to $2,800	N/A
Monterey Peninsula Water Supply Project[6]	10,600	10,600	$3,800	$3,800
Pismo Beach - Secondary-23 Irrigation[3]	17	17	$15,900	$15,900

Notes:
(1) Most comparison projects did not provide a predicted benefit.
(2) Santa Barbara County Desalination Project Bid Documents (March 2015).
(3) Information and costs from the Pismo Beach Final Draft 2015 Urban Water Management Plan (June 2016).
(4) Information and costs from the December 2015 Long Term Supplemental Water Supply Alternatives Report prepared for the County of Santa Barbara, CA.
(5) Yield from the Pure Water Monterey Groundwater Recharge Joint Public Hearing (August 2016). Costs from Amended CalAm MPWSP Application (March 2016).
(6) Information and costs from the Amended Application of the California-American Water Company for the Approval of the Monterey Peninsula Water Supply Project (March 2016).

6.3.1 Santa Barbara Water Supply Options

In December 2015, the County of Santa Barbara published its Long-Term Supplemental Water Supply Alternatives Report, which investigated several options for adding resilience to its water portfolio by diversifying sources, including stormwater capture, recycled water, desalination, imported water, and additional groundwater. The supply ranges and costs for each source are summarized below:

- Stormwater Capture - 2,100 AFY to 56,000 AFY of potential supply, costing from $12/AF to $2,800/AF.
- Recycled Water - numerous projects ranging from 2,900 AFY to 7,600 AFY of recycled water at costs near $300/AF to $2,200/AF.
- Desalination - from 2,800 AFY to 26,000 AFY of ocean desalination, estimated to cost from $1,900/AF to $2,900.
- Imported Water - 3,400 AFY to 8,000 AFY of imported water available, from $400/AF to $2,800/AF.

6.3.2 Monterey Water Supply Options

The California-American Water Company (CalAm) has been investigating alternate sources of water for the Monterey area since 2004. Currently, CalAm is pursuing the Monterey Peninsula Water Supply Project (MPWSP), a desalination project estimated to provide up to 10,600 AFY.

A project variant includes the potential to purchase water from the proposed Pure Water Monterey Groundwater Replenishment Project (GWR), up to 3,500 AFY, with desalination providing the rest of the water. Water costs for desalination are estimated to be approximately $3,800/AF. Purchased water from the GWR was estimated to be around $2,500/AF (as of March 2016).

6.3.3 Pismo Beach Water Supply Options

The City of Pismo Beach also investigated alternative water supplies, specifically recycled water, in its Recycled Water Facilities Planning Study (April 2015). The study investigated various Title 22 treatment levels and applications, from Disinfected Secondary-23 to groundwater replenishment.

The estimated production of RW ranged from 17 AFY (Disinfected Secondary-23) to 930 AFY (groundwater recharge). Unit costs per amount of recoverable water were estimated to be $2,700 (groundwater recharge) to $15,900 (Disinfected Secondary-23).

7.0 EVALUATION OF SCENARIOS USING CRITERIA

As discussed earlier, the original intent was to compare supply options using various evaluation criteria, such as 1) quantity, quality, and reliability of supply; 2) cost (Capital and O&M); 3) environmental impacts; 4) schedule; 5) regulatory/contractual/permitting approvals; 6) public acceptance (community and regional support); and 7) technical complexity. These original criteria were developed assuming that different types of supplies and deliveries would have unique challenges worth comparing.

As this study progressed, it became clear that all sources of water considered would be needed in the basin to achieve basin stabilization and sustainability, and that additional conservation would be required. Because all supply options were used in the scenarios, many criteria were difficult to differentiate. However, applying the criteria to discuss implementation remained valid and was therefore included in this section.

7.1 Quantity, Quality, and Reliability of Supply

Because all scenarios maximize all potential supplies, the amount of water applied does not vary among scenarios. However, the benefit to the basin does vary according to the overall efficiency of the location and the method of delivering water into the basin.

Reliability varies with each supply option, but it does not vary among scenarios. To calculate costs, the longer term average expected supply was used. However, as noted in other sections of this report, the availability of water and the costs to secure that water will vary from year to year depending on climatic conditions and the amount other users plan to use in a given year.

Using all three supply options is also beneficial for geographic diversity. Because each source comes from a separate region, climatic stresses in one region may not necessarily affect another region. For instance, a series of dry periods in Central California where NWP water is located does not imply a drought in Northern California (SWP). Spreading out supply sources geographically adds to the supply portfolio's security.

Reliability also depends on the water's type of purchase agreement. For SWP water, both permanent allocations and year-by-year surplus water agreements may be available. Permanent allocations are likely to be more expensive annually, but they provide more reliable water delivery, especially in drought years where current participants are likely to use more of their allotment.

Due to the open-market nature of purchasing from existing users, the second option may be less expensive. However, the amount of surplus water will depend on the initial user's consumption. Given the recent drought, more entities may vie for unallocated SWP supplies and existing District subcontractors, potentially increasing their allocations to improve reliability in potential future drought years.

Existing subcontractors may also purchase the District's "Excess Allocation" or may want to increase the amount of SWP stored each year. Both cases would decrease the amount of SWP available for the basin and make timely action more imperative.

With NWP water, becoming a participant is not likely. This is because the water was recently allocated, meaning it must be purchased temporarily from the existing participants. To increase the certainty of supply to support long-term infrastructure investments, a long-term purchase agreement for surplus NWP water was assumed to be negotiated.

Because the City of Paso Robles is actively working on its RW program, the City's actual RW use may exceed the 450 AFY assumed in this study, meaning less would be available for the various supply options.

7.2 Cost

The previous section presented the capital, operation and maintenance, and total annualized costs for the water supply options. These costs vary among scenarios; all scenarios require significant investment to secure and supply new water for the basin.

Balance must be sought between 100 percent efficiency of direct delivery at a high infrastructure cost and recharge with lower basin benefit. Scenarios that maximize direct delivery or recharge (A and C) are the most expensive, while scenarios that seek to balance higher basin benefit (B and D) are the least expensive, considering the $/AF benefit.

7.3 Environmental Impacts

Environmental impacts are not expected to vary significantly among scenarios. However, the next step for implementation would be to complete a CEQA evaluation and documentation, likely an Environmental Impact Report (EIR). An EIR would consider multiple alternatives and evaluate impacts from building the infrastructure, including traffic, air quality, water quality, and habitat impacts.

Impacts associated with these water supply scenarios are expected to include short-term during construction and long term-impacts associated with loss of agricultural land for the construction of percolation basins. Environmental benefits would include the increased water levels in the groundwater basin. There could also be water quality impacts from transferring salts to different parts of the basin or from one watershed to another.

7.4 Schedule of Implementation

Because each project's magnitude is similar, with similar piping lengths, the schedule of implementation for each scenario will not vary greatly. Figure 20 shows a general schedule of implementation.

Project implementation is estimated to take approximately 6 years from selection to the end of construction. However, various factors can affect a project's duration, which are summarized below in Figure 20. Figure 20 also lists the next steps toward implementation.

7.4.1 Institutional

Institutional factors that may affect project execution include:

- Procuring the various supplemental water supplies, including negotiations with current participants of the NWP and SWP and the City of Paso Robles for using RW.
- Purchasing available land for recharge basins and right-of-way negotiations for the pipeline alignments.
- Completing contractual negotiations with agricultural users for direct delivery.
- Obtaining appropriate regulatory approvals, often involving permitting processes, such as Title 22 RW discharge permit, Department of Fish and Wildlife permit for likely mitigation or infrastructure streambed crossings.

7.4.2 Environmental

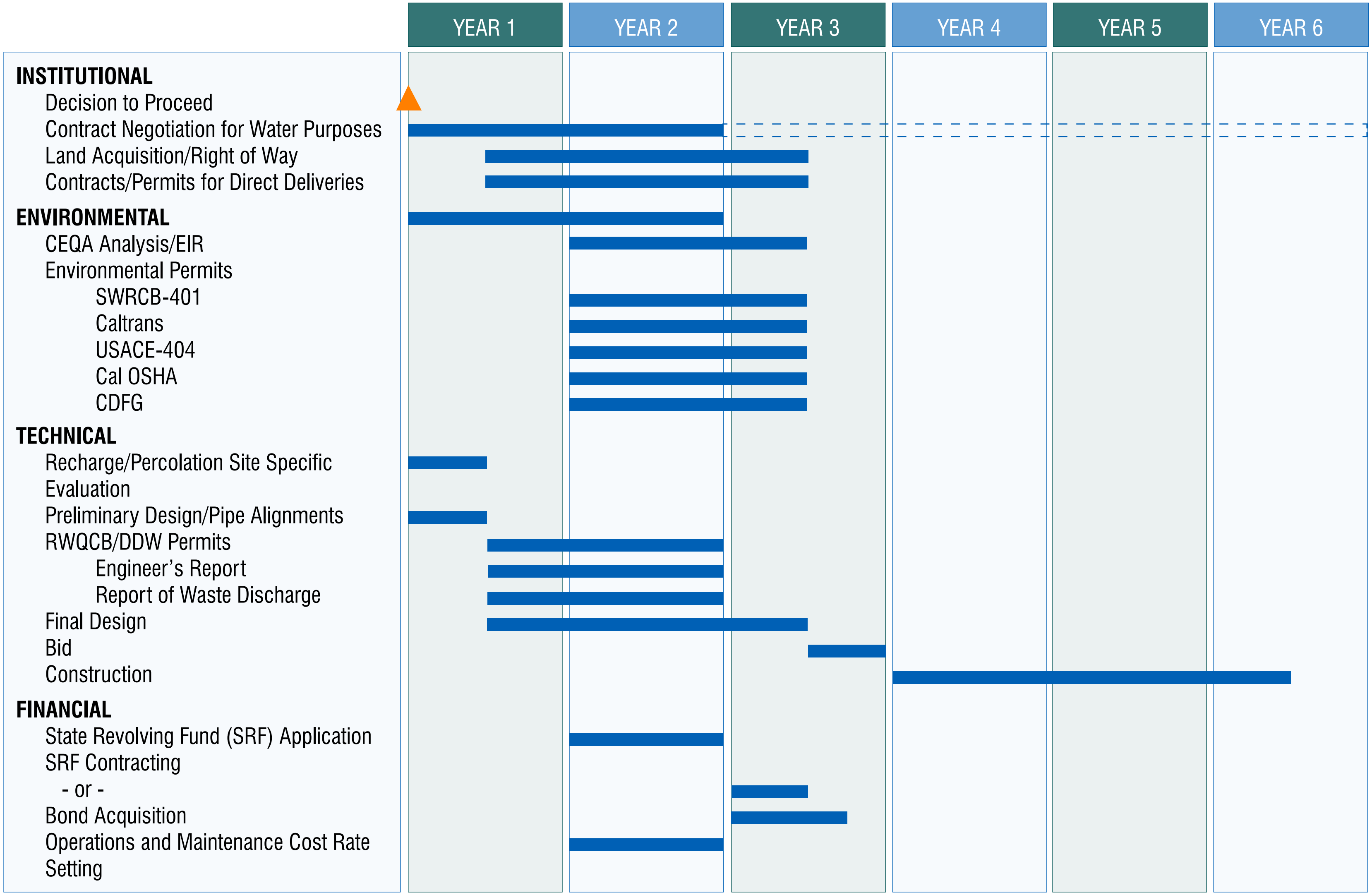
Environmental requirements also affect the implementation schedule. More extensive piping systems may increase the environmental permitting process (California Environmental Quality Act, CEQA) and mitigation efforts. Water crossings may also increase the permitting effort.

Permitting may be required from entities like Caltrans, the US Army Corps of Engineers (USACE), or the State Water Resources Control Board (SWRCB). If RW is being delivered, a General Order must be obtained. Additional permits would also be required for recharge basins using RW.

7.4.3 Technical

The technical elements of this project that will affect the schedule include:

- Preliminary design and pipeline alignments.
- Site-specific analysis of recharge capacities and impacts.
- Regional Water Quality Control Board (RWQCB)/DDW permits.
- Final design of recommended project.
- Bidding and construction of selected project.



SUPPLEMENTAL SUPPLY OPTION
CONCEPTUAL IMPLEMENTATION SCHEDULE

FIGURE 20

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS

carollo RMC water and environment WSC Water Systems Consulting, Inc.

slo1216rs1-9590.ai

Increases in infrastructure complexity can prolong the time it takes to complete these tasks, leading to longer project implementation times.

7.4.4 Financial

The selected supplemental water supply option project's duration depends greatly on the source of funding or financing for the capital project (permitting, design, and construction of the infrastructure required to deliver water). If the project is financed entirely through bonds, the responsible party can dictate the project's terms and proceed rapidly. However, if the project is funded through grants, the required benchmark meetings and check-ins may make the project take longer, even if it is cheaper.

In terms of timing, SRF funding may be the middle ground between these two options. Note, however, that grants and SRF loans typically only fund capital costs and not O&M costs. With few exceptions, O&M costs are funded through rate collection.

7.4.5 Legal Challenges

As with nearly any large water supply project being considered in California, the selected option will likely face legal challenges, such as:

- Challenges to the project EIR.
- Challenges to land purchase and/or right-of-way agreements.
- Challenges to potential water purchase agreements targeting available water from other current SWP or NWP contractors.
- Challenges during or after selecting an entity with operational and management control over the project, such as establishing a new water district.

7.5 Regulatory, Contractual, Permitting

All scenarios face the same type of regulatory, contractual, and permitting issues. Contracts for buying the water will be required for each scenario for NWP, SWP, and RW. Because all scenarios propose recharging RW, they will have to comply with Title 22's regulations and permitting requirements.

As discussed under the schedule section, all scenarios will need to secure permits from agencies such as CalTrans, SWRCB, RWQCB, the US Army Corp of Engineers, and others to construct infrastructure. The detailed permitting needs would come out of the next steps of CEQA evaluation and preliminary design, which would involve identifying pipeline alignments.

7.6 Public Acceptance

The basin has varying degrees of public acceptance for procuring new water supplies. Attendees at public meetings held for this study supported evaluating supplemental supply options. However, land owners in the basin voted against forming and funding a groundwater management district in March 2016. As a result, it is not clear whether basin land owners will also reject paying for supplemental supplies to the basin.

In the past, the public has been critical of reliance on imported water, or SWP, meaning there may be public bias against including SWP elements in the scenarios. Thus, the benefits of spreading out supply sources to increase reliability, both geographically and institutionally, as described in Section 7.1, should be reiterated in future public discussions.

Since all scenarios maximize the use of available supplies, one scenario will likely not be preferred over another. In general, a future basin management entity will need to conduct public outreach and education to gain support for implementing supplemental supply projects.

7.7 Technical Complexity

All scenarios have some degree of technical complexity. Operating a system that includes multiple water sources, multiple permits, different operations at different times of year, and variability in the supply availability each year will inevitably be complex. This is especially true considering that currently proposed users rely on a system of wells that are much simpler to operate.

However, all scenarios include delivery networks that eliminate the need for additional treatment so the system's construction has little complexity, since it predominately consists of piping, turnouts for delivery, and percolation basins. Recharging RW in the percolation basins will require additional monitoring with a system of monitoring wells, testing, and permit compliance documentation development.

8.0 SUMMARY AND CONCLUSIONS

Groundwater modeling results show several promising alternatives for stabilizing water levels within Paso Basin. However, the total average amount of water needed to balance the basin (35,100 AFY) is more than the total average available supply (20,000 AFY).

Additionally, timing and infrastructure constraints make it so the available supplemental supplies cannot provide 100 percent benefit to the basin. Delivering water directly provides the most benefit (close to 100 percent in most alternatives). However, because of the timing of water accessibility, the amount of direct delivery is limited. Direct delivery also requires significant investment in infrastructure.

Recharge via percolation basins is an alternative water delivery method with much less infrastructure cost but also lower efficiency. It can, however, take advantage of off-season supply availability more than direct delivery.

This study lays out several scenarios for water supply and delivery to maximize available water supplies given cost, timing, and infrastructure constraints. With this goal in mind, each water source (Nacimiento, State, and Recycled Water) is essential to restoring the basin, since adequate supplies are available to fully address the basin deficit. Securing a diverse supply of water is not only prudent for reliability, but is also necessary to obtain adequate volumes for stabilizing the basin.

The four scenarios developed ranged from maximizing direct delivery for irrigation uses to channeling all water toward groundwater recharge. The recharge option (Scenario C) had the least amount of infrastructure while still achieving a moderately high estimated basin benefit of approximately 13,600 AFY. If an option like this is pursued, the rest of the basin restoration (19,300 AFY) would have to come from conservation efforts or other supplemental water supply.

Performing a site-specific analysis will be necessary to confirm the recharge viability. The highest amount of basin benefit came from Scenario B, a combination of direct delivery and recharge, with 17,413 AFY of estimated basin benefit. But the most cost-effective scenario, Scenario D (17,045 AFY of benefit), came out to $3,071/AF of benefit. Thus, at face value, Scenario D appears to be the best option.

These scenario costs and basin benefits are preliminary and should be reassessed during the next steps. The model results are promising, but numerous factors are at play with groundwater hydrogeology, making it difficult to extrapolate results. This report's results, costs, and predicted available supplies are only a snapshot of the current situation.

As time goes on, the amount of surplus water will likely decrease as existing and other future users position for supplies. Conversely, unit costs will likely increase. The following section details the potential next steps and recommendations to allow a basin management entity/Groundwater Sustainability Agency to act timely.

8.1 Summary of Next Steps

Once a supplemental water supply option project is selected, a yet-to-be-determined entity or entities will need to carry out the steps below. This entity will have the necessary authority to enter into supply agreements, purchase land, etc. (See discussion under Section 8.2).

1. Basin management entity or entities/Groundwater Sustainability Agency(s) review.

2. Development of funding.

3. Water procurement discussions with NWP and SWP participants RW providers:

a. Long-term vs. temporary agreement.

4. Supplemental Studies:
    a. Pipeline alignment studies.
    b. Geotechnical study for placing and sizing recharge basins and pipeline alignments.
    c. Environmental Impact Report (EIR).

5. Preliminary design.

6. Land acquisition.

7. Right-of-way discussions.

8. Legal risk discussions.

9. Permitting of water users.

10. Final design.

11. Construction and operation.

8.2 Applicability to SGMA

According to the 2014 California Water Action Plan, "Groundwater is a critical buffer to the impacts of prolonged dry periods and climate change on our water system." Recognizing the serious impacts of the state-wide annual overdraft of 1-2 million AFY of groundwater, the State of California enacted the Sustainable Groundwater Management Act (SGMA) in 2014, which took effect on January 1, 2015. The SGMA provides a state framework to regulate groundwater for the first time in California history.

The SGMA helps prepare and implement Groundwater Sustainability Plans (GSP) for high and medium priority groundwater basins. Based on the State Department of Water Resources' (DWR) 2014 Final Basin Prioritization, the Paso Robles Basin is considered high priority.

The SGMA established a new structure for local agencies to manage California's groundwater resources locally. SGMA requires the formation of locally controlled groundwater sustainability agencies (GSAs) in the state's priority groundwater basins. SGMA also requires GSAs to develop and implement a groundwater sustainability plan (GSP) to meet the basin or subarea's sustainability goal to ensure it operates within its sustainable yield without undesirable results.

GSAs responsible for high- and medium-priority basins must adopt GSPs by 2022, or 2020 if DWR determines the basin to be in critical overdraft. Basins must achieve groundwater sustainability within 20 years of GSP adoption. If deadlines aren't met, the State Water Resources Control Board (State Water Board) can intervene, require monitoring and reporting, and establish an interim plan after public notice and hearing. It can also collect fees to cover costs.

The GSA is the primary agency responsible for achieving sustainability within the stated timeframe. The SGMA has many new authorities and tools for GSAs. For example, when developing and implementing a GSP, a GSA may conduct investigations, measure and limit extraction, require registration of wells or impose fees for groundwater management.

This study offers a tool that a future GSA or multiple GSAs in the Paso Basin can use to identify options for achieving sustainability. The study, along with the Basin modeling results, could form the basis for the GSP and could inform funding efforts for running the GSA and implementing solutions toward sustainability.

As the GSA or GSAs start developing GSPs, they will have to make several important decisions and comply with state mandates:

- What is the definition of sustainability for the basin over time?
  - Determine sustainability goal for whole basin and undesirable results.
  - Determine minimum thresholds for sustainability indicators (levels, quality, land subsidence, interconnected surface water, water in storage underground).
  - Determine objectives in 5-year increments to monitor progress and demonstrate trajectory will meet sustainability goal.
- Do the existing, completed studies, including this one, provide enough information to proceed with developing a GSP? Do they fulfill regulatory requirements?
- What methods should be used to meet groundwater sustainability?
  - Water use conservation/cut backs?
  - Growth caps?
  - Supplemental Water Supplies?
  - Combination of the above?
- If supplemental water supplies are included in the GSP, what is the preferred method of delivery into the Basin?
- How can costs and benefits of implementing the GSP be distributed fairly?

Until the GSA is formed, the answers to these questions will remain uncertain. Moving forward, the GSA will need to engage the public in a frank discussion about the completed work on the Paso Basin. The extensive library of information and studies on the basin will be a strong foundation for making decisions and proceeding with sustainable basin management.

APPENDIX A - ALTERNATIVE DEVELOPMENT TO GUIDE GROUNDWATER MODELING RUNS

This document is released for the purpose of information exchange review and planning only under the authority of Lydia A. Holmes, October 7, 2015, State of California, PE No. 56616.

COUNTY OF SAN LUIS OBISPO

PASO BASIN SUPPLEMENTAL WATER SUPPLY OPTIONS

ALTERNATIVE DEVELOPMENT TO GUIDE GROUNDWATER MODELING RUNS

DRAFT

October 2016

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SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL WATER SUPPLY OPTIONS

ALTERNATIVES DEVELOPMENT TO GUIDE GROUNDWATER MODELING RUNS

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APPENDIX A - ALTERNATIVES DEVELOPMENT TO GUIDE GROUNDWATER MODELING RUNS

1.0 INTRODUCTION

The purpose of this document is to provide a summary of the water supply options evaluated for the Paso Robles Groundwater Basin Supplemental Water Supply Options Feasibility Study (Supply Options Study) in order to guide the groundwater modeling process conducted for the San Luis Obispo County Flood Control and Water Conservation District (SLOCFCWCD, District). There are eight alternatives that have been defined to be modeled with the Paso Robles Groundwater Basin Model Update Project (Basin Model), as shown in Table A1. Alternatives 2 through 8 investigate potentials for three different sources of water, Nacimiento Water Project (NWP) water, Recycled Water (RW) from the City of Paso Robles Wastewater Treatment Plant (WWTP), and water from the State Water Project (SWP) pipeline, to balance groundwater levels in the Estrella, Creston, Atascadero, and Shandon subareas. These four subareas have been identified as areas of greatest concern due to declining groundwater levels and interest expressed by representatives of the subarea to restore the groundwater. The goal of the alternatives evaluation is to develop a prioritized list of the most beneficial and viable options for procuring available water resources to stabilize, wholly or partially, groundwater levels, and to provide a clear path forward to obtaining these supplies for the Paso Robles Groundwater Basin (Paso Basin). The alternatives developed in this document were evaluated as individual model runs in the Paso Basin Groundwater Model and adapted as necessary to meet modeling goals. Model run success was determined by the amount of increase in groundwater storage from the baseline run and satisfaction of the Basin Management Objectives (BMOs) which are discussed in detail in the Supply Options Study. The finalized modeling runs are described in detail in the Refinement of the Paso Robles Groundwater Basin Model and Results of Supplemental Water Supply Options Predictive Analysis Report (Model Update Report).

2.0 GENERAL ASSUMPTIONS

All potential percolation basin and agricultural irrigation locations highlighted within this document were preliminary estimates and were refined during the modeling effort. The modeled runs are presented in more detail in the Model Update Report. Potential percolation basins were chosen as the primary infrastructure option for groundwater recharge for this preliminary analysis. The recently developed Soil Agricultural Groundwater Banking Index (SAGBI) Tool and the 2002 Paso Robles Groundwater Basin Study were instrumental in displaying areas of potential success in groundwater recharge through percolation. However, depending on the model results, it may be necessary to replace percolation basins with groundwater injection wells. Percolation basin locations were chosen to be closest to the areas of deepest drawdown with the highest estimated hydraulic conductivity with the given information. These locations for recharge were preliminary and were adjusted based on further modeling input.

Table A.1 Supply Option Alternatives to be Evaluated by Basin Model Runs
Paso Basin Supplemental Water Supply Options
SLOCFCWCD

Alternatives		Recycled Water	State Water	Nacimiento Water
1	Conservation			
2	Salinas River Recharge			X
3	Offset Basin Pumping with Recycled Water	X		
4	Offset Water Demand in Estrella Subarea	X		X
5	Additional Releases to Huer Huero Creek	X	X	X
6	Additional Releases to Estrella River	X	X	X
7	Offset Pumping in Creston Subarea		X	X
8	Offset Pumping in Shandon Subarea		X	

Potential routes and alignments were chosen to follow county or local roads while minimizing length and avoiding excessive river crossings and state highways. Land owner information has not been discovered thus far regarding potential locations of the percolation basins, so locations may change based on acquisition ability. Some potential agricultural users around the City of Paso Robles have been identified in the 2014 Recycled Water Master Plan (RWMP), but further investigation is necessary to determine irrigation customers in other parts of the basin. A summary of this investigation can be found in Technical Memorandum No. 4: Recycled Water Supply Options and Points of Delivery (TM4).

The potential percolation basin size was assumed to be 90 acres to be consistent with the 2008 Paso Robles Groundwater Subbasin Water Banking Feasibility Study (Banking Study). A more specific number was determined by the results of the model run.

3.0 ALTERNATIVE 1 - CONSERVATION

Alternative 1 is a strategy to reduce basin overdraft through water demand conservation measures to reduce the amount of pumping from the Paso Basin. This alternative does not include any new water sources and is therefore not discussed further in this document.

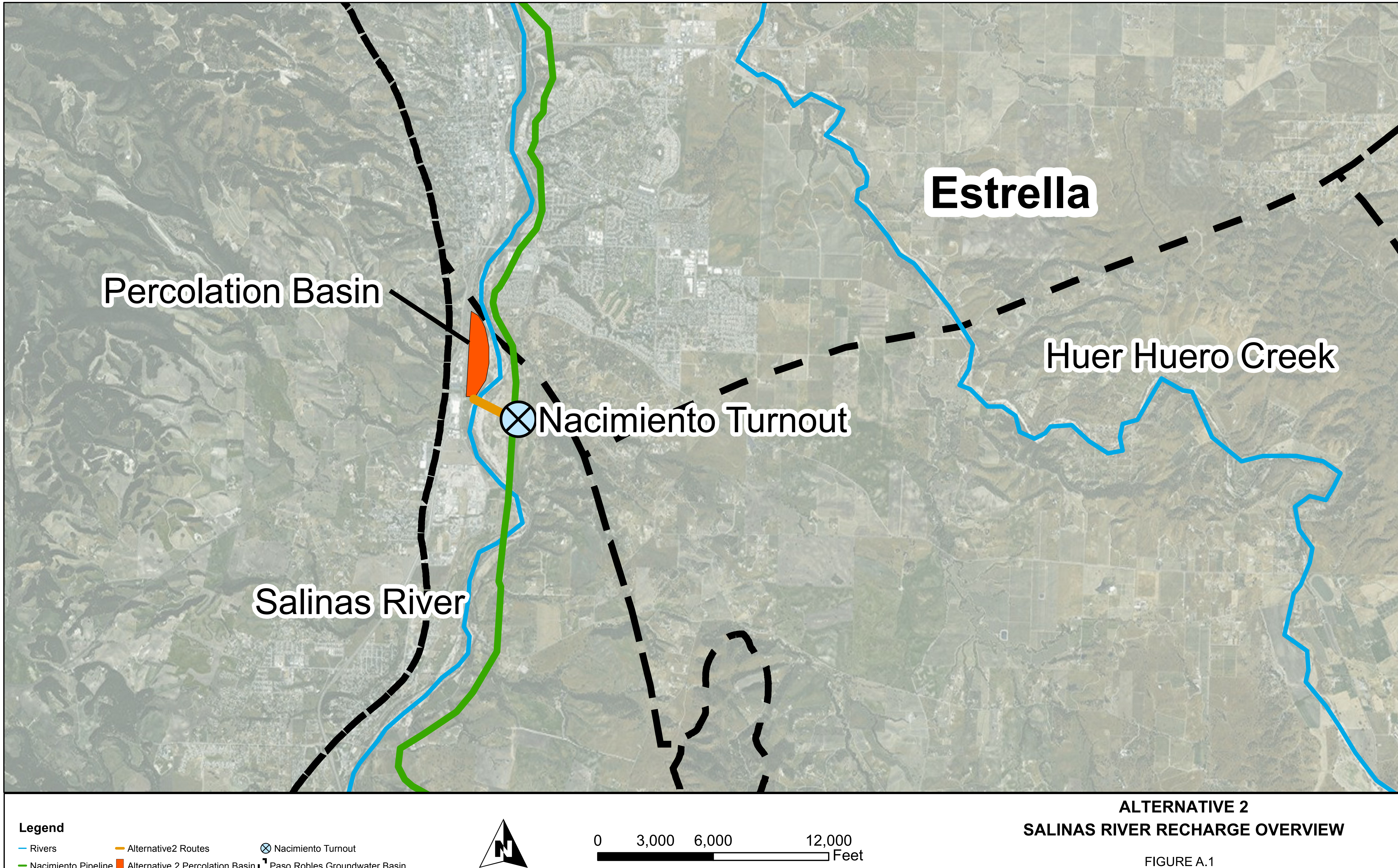
4.0 ALTERNATIVE 2 - SALINAS RIVER RECHARGE

The Salinas River runs alongside the Nacimiento water pipeline for several miles through the Paso Basin. The Atascadero Mutual Water Company (AMWC) currently receives Nacimiento water into their percolation basins located adjacent to the Salinas River. This alternative first attempts to maximize the capacity in existing AMWC facilities. Should that amount of water be insufficient to reach the target BMOs, additional water can be obtained through the existing Nacimiento water City of Paso Robles turnout and piped a short distance to a future spreading basin(s) adjacent to the Salinas River. While the City of Paso Robles currently receives its Nacimiento water to the Salinas River and then recovers the water downstream with shallow wells, for this study we are assuming use of spreading basins to recharge the aquifer and to reduce the risk of losing the water downstream. Figure A.1 shows the location of the Paso Robles turnout with respect to the potential percolation basin and Figure A.2 illustrates the infrastructure needed for realization of this project.

Table A.2 Alternative 2 (Salinas River Recharge Schematic) Project Elements
Paso Basin Supplemental Water Supply Options
County of San Luis Obispo

Alt Number	2A	2B
Source(s)	Nacimiento	Nacimiento
Turnout	Atascadero	Paso Robles
New Pipe Length	Existing	1,000 ft
Pipe Description	Existing Pipe	Raw water pipe Potential stream crossing
Distribution Method	Use of Atascadero's existing percolation basins	• Percolation Basin – Percolation rate: 0.5 ft/day • 90 acre basin system
Distribution Location	Land adjacent to Salinas River	Land adjacent to Salinas River
Treatment	None	None
Land Owner	City of Atascadero	To be determined
Available Area	N/A	To be determined
Water Delivered (AFY) Operation Period	Percolation Basin: 2,190 AFY[(1)] Likely most available during shoulder months	Percolation Basin: 2,900 AFY Likely most available during shoulder months
Additional Cost Elements	To be determined	Initial Nacimiento Project Buy-in

Notes:
(1) Value represents average over the modeling period. Existing AWMC recharge is 1,242 AFY.



ALTERNATIVE 2
SALINAS RIVER RECHARGE OVERVIEW

FIGURE A.1

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO BASIN GROUNDWATER BASIN SUPPLIMENTAL SUPPLY OPTION

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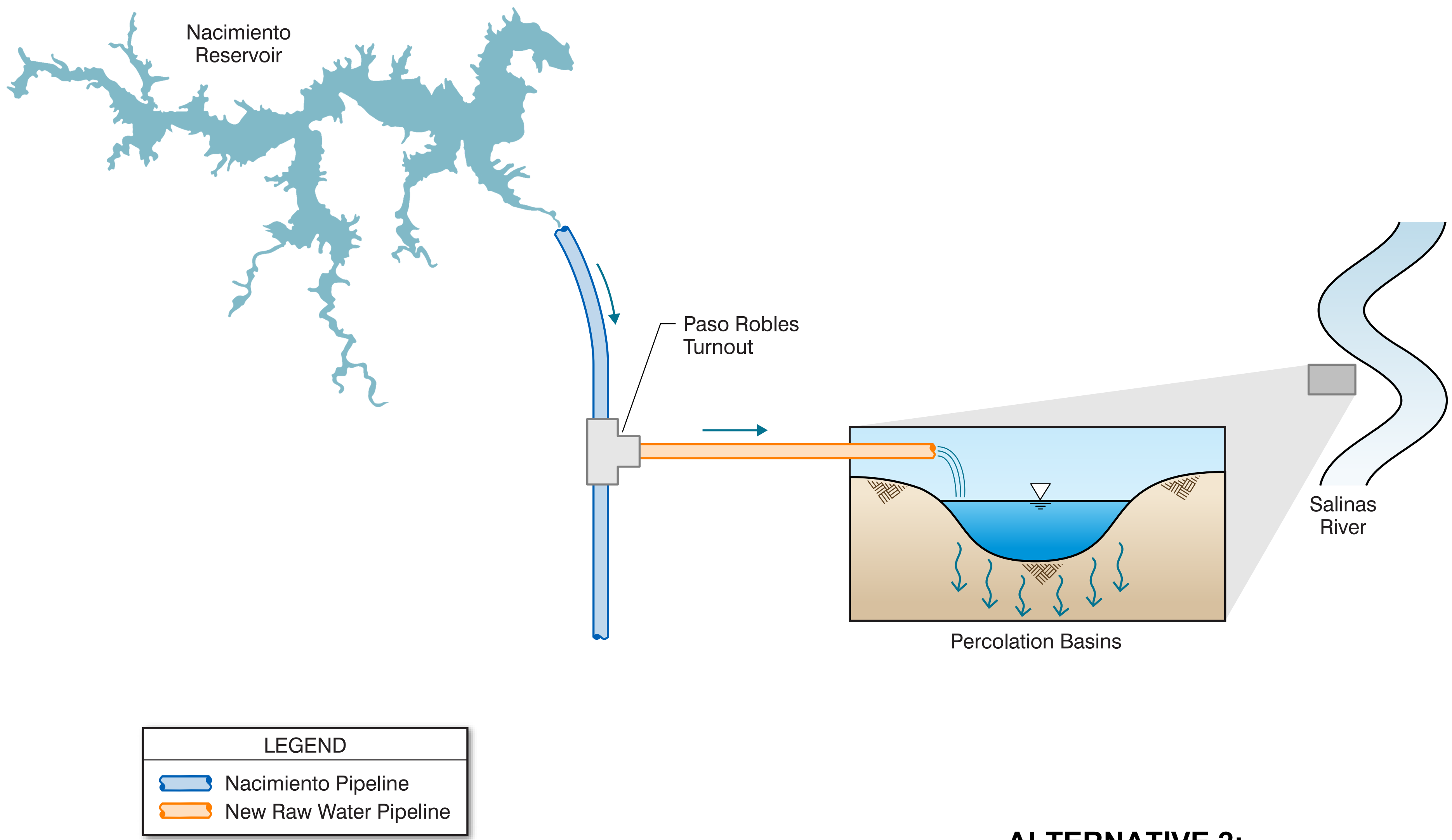

ALTERNATIVE 2:
SALINAS RIVER RECHARGE SCHEMATIC

FIGURE A.2

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS STUDY

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Alternative 2 involves a small infrastructure cost, assuming that the identified locations for the percolation basins are able to be obtained. Capital costs for this alternative include piping, land purchase (if necessary), construction costs for the percolation basin(s), and potentially Nacimiento Project buy-in costs, depending on the avenue of participation. Operations and maintenance (O&M) costs include purchase of water from Nacimiento Reservoir and pipeline and percolation basin maintenance.

5.0 ALTERNATIVE 3 - OFFSET BASIN PUMPING WITH RECYCLED WATER

Several WWTPs have been identified for potential recycled water upgrades and are discussed in TM4. The City of Paso Robles WWTP was chosen as a location for Alternative 3 because of its high flow, interest in pursuing recycled water, and proximity to one area of concern in the basin. The City of Paso Robles WWTP currently discharges 3.0 million gallons per day (mgd) of treated effluent, with plans to build out to 4.9 mgd. Alternative 3 involves the upgrade of the WWTP from advanced secondary to tertiary filtration and distribution to recycled water users. Some users have already been identified in the 2014 Paso Robles Recycled Water Master Plan, including urban as well as agricultural users. The alignment presented in Figure A.3 follows the route laid out in the Recycled Water Master Plan. Figure A.4 shows the various potential end uses for the recycled water.

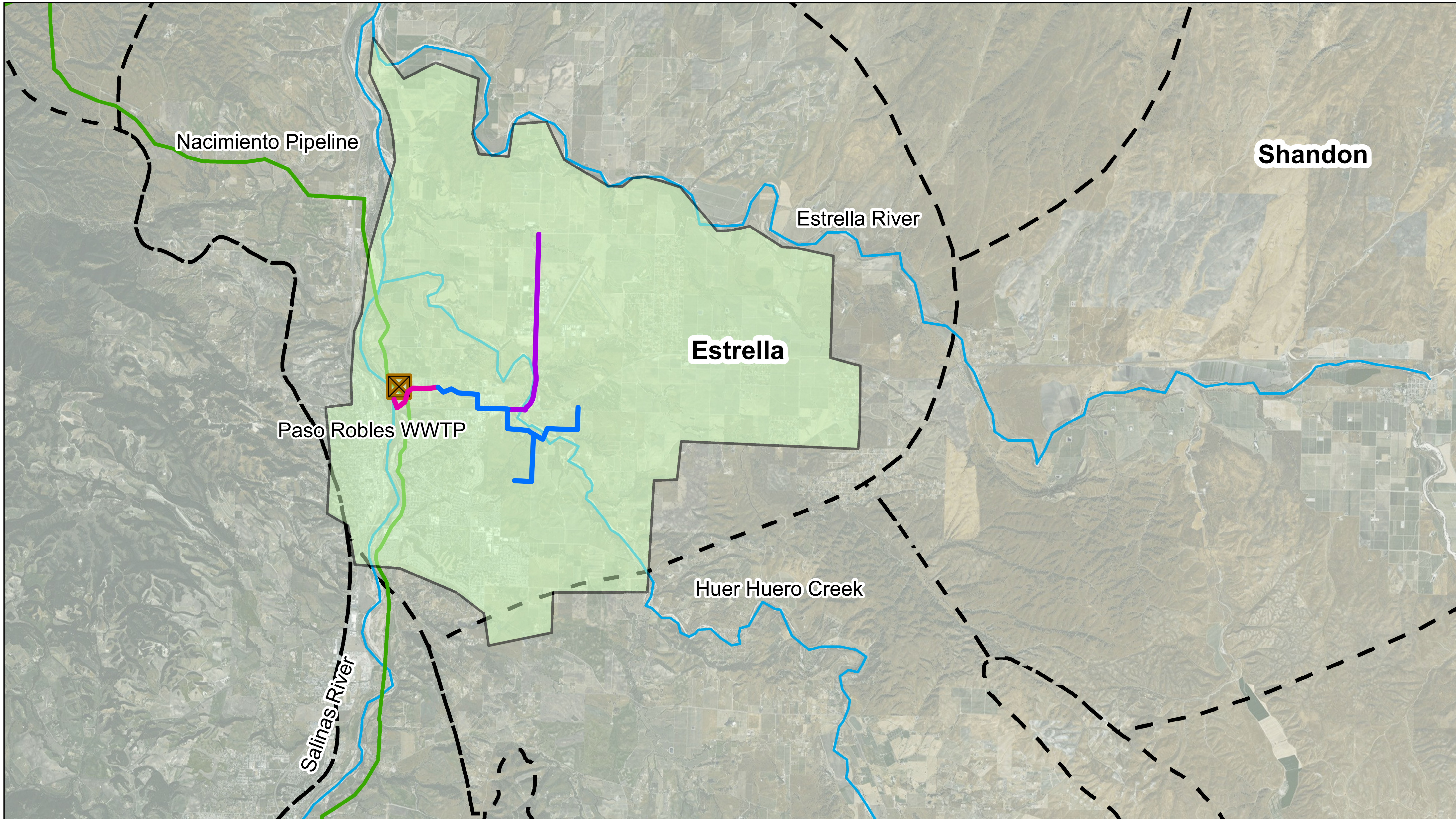
This alternative will require installation of purple pipe and irrigation customer connections. Other capital costs include the Paso Robles WWTP treatment upgrade from advanced secondary to tertiary filtration.

A variation of this approach is to blend Nacimiento Water with the recycled water to achieve the desired water quality with respect to salts. Currently, it is assumed that the agricultural customers can blend groundwater from existing wells for salt control.

6.0 ALTERNATIVE 4 - OFFSET DEMAND IN ESTRELLA SUB-AREA

Alternative 4 offsets water demand in the Estrella Subarea. The model run was designed to evaluate how much water supply would be needed to stabilize the areas of greatest concern in the Estrella area. Both raw Nacimiento and Recycled Water could be potential sources for this option. The main potential end use is direct delivery to agriculture.

Recycled water from Paso Robles WWTP could be delivered to users in Paso Robles and the surrounding agricultural areas through the proposed alignment from the RWMP. Additional water could be supplied from the Nacimiento pipeline via a new turnout constructed near the WWTP. The potential alignments for this alternative are shown in Figure A.5. The conceptual schematic for this alternative is shown in Figure A.6.



Legend

- Rivers
- Nacimiento Pipeline

Phase

- New Pipeline
- Reach A
- Reach B

- WWTP
- Paso Robles Groundwater Basin
- Alternative 3 Service Area

N

0 5,000 10,000 20,000 Feet

ALTERNATIVE 3
OFFSET PUMPING WITH RECYCLED WATER OVERVIEW

FIGURE A.3

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO BASIN GROUNDWATER BASIN SUPPLIMENTAL SUPPLY OPTION

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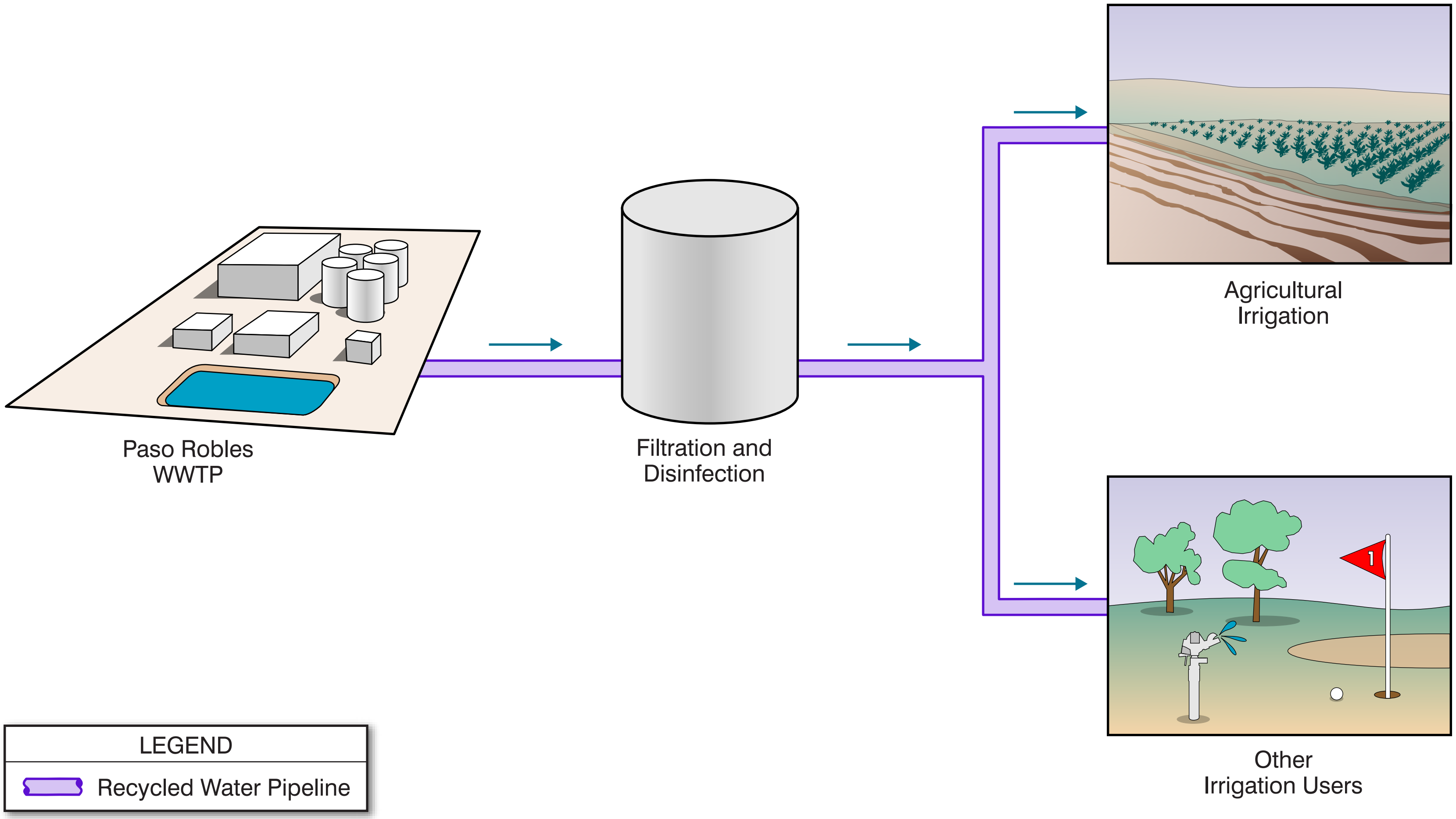

ALTERNATIVE 3: OFFSET PUMPING WITH RECYCLED WATER SCHEMATIC

FIGURE A.4

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS STUDY

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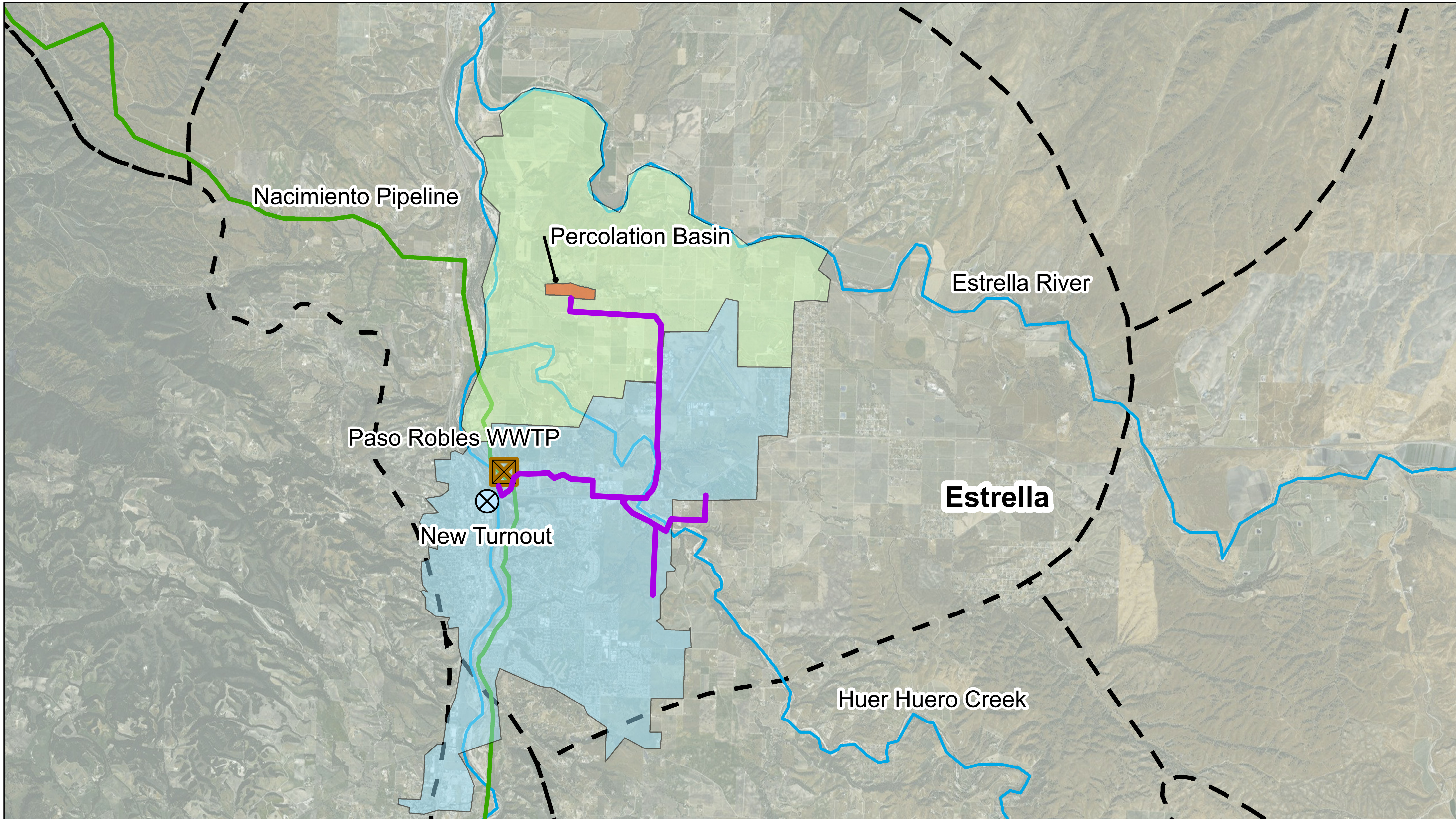

Legend

- Rivers
- Nacimiento Pipeline
- Nacimiento Turnout
- Paso Robles Groundwater Basin
- WWTP

Alternative 4 Routes

- Recycled Water Pipeline

Usage

- Agricultural Irrigation
- Percolation Basin
- Treated Water Distribution

N

0 5,000 10,000 20,000 Feet

ALTERNATIVE 4
OFFSET DEMAND IN ESTRELLA OVERVIEW

FIGURE A.5

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

PASO BASIN GROUNDWATER BASIN SUPPLIMENTAL SUPPLY OPTION

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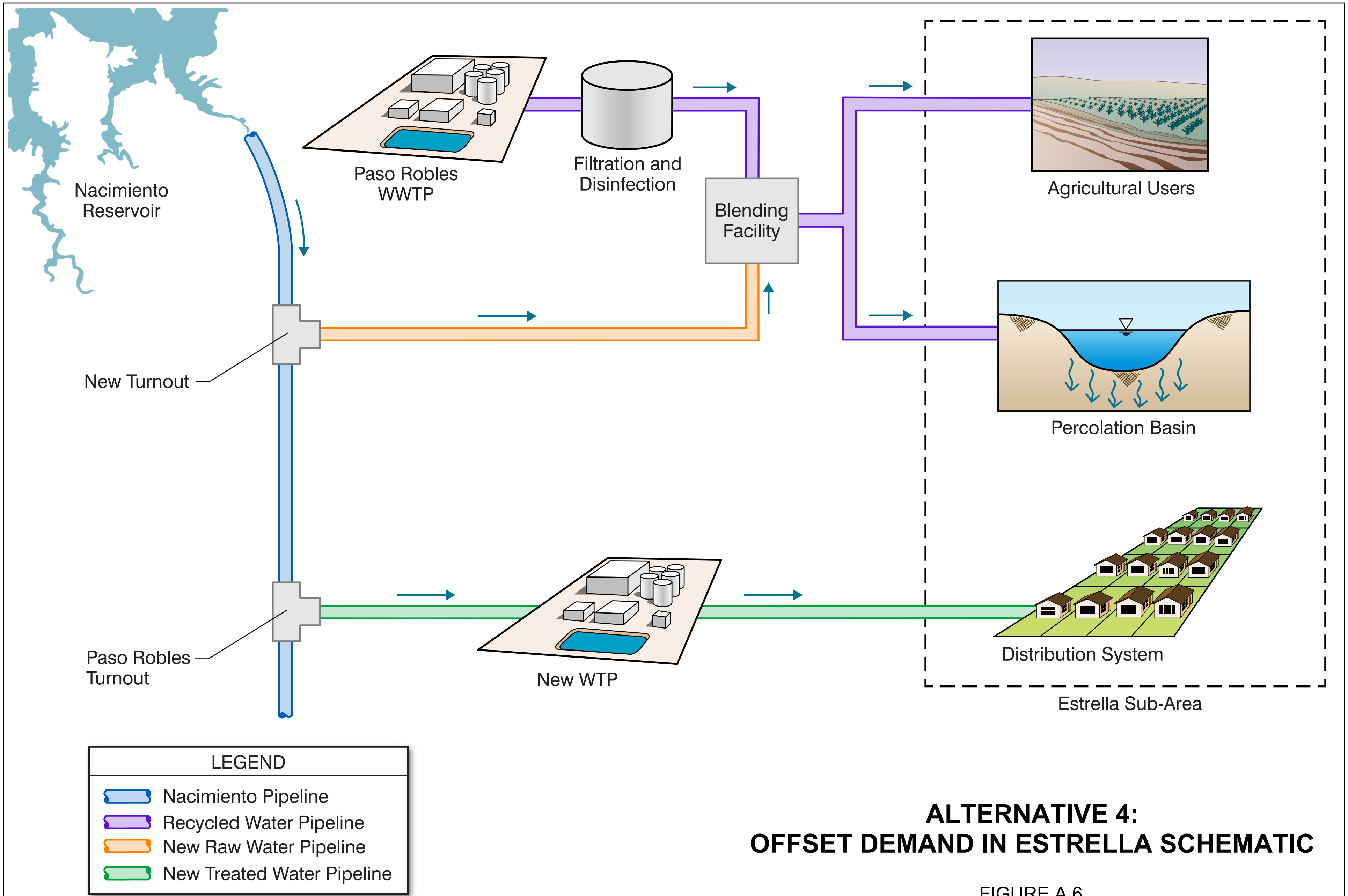

ALTERNATIVE 4:
OFFSET DEMAND IN ESTRELLA SCHEMATIC

FIGURE A.6

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS STUDY

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This alternative requires pipeline installations, both for raw water and recycled water (purple pipe), customer connections, turnout construction (for the new Nacimiento Turnout), land acquisition, construction of the tertiary recycled water facilities and percolation basins, and a potential capacity upgrade for the Paso Robles WTP. O&M costs include purchase of Nacimiento water, treatment costs, pumping energy, and pipe maintenance.

Table A.3 Alternative 3 (Offset Basin Pumping with RW) Project Elements
Paso Basin Supplemental Water Supply Options
County of San Luis Obispo

Alt Number	Alternative 3
Sources	Paso Robles WWTP
Turnout	None
New Pipe Length	47,300 ft(1)
Pipe Description	2 water (stream) crossings - Purple pipe
Distribution Method Distribution Elements	• Delivery to Agriculture and Urban Users – All agricultural users within 18,500 ft radius (~120 connections)
Distribution Location	City of Paso Robles (urban reuse) Surrounding Agriculture
Treatment	Tertiary Filtration Upgrade
Land Owner	Various
Available Area	N/A
Water Delivered (AFY) Operation Period	Agriculture Irrigation: 4,100 AFY(2) March through November Percent of selected ag demands served: 40%
Additional Cost Elements	Not yet determined
Key Assumptions	Sufficient number of customers are willing to participate. Agricultural users will blend with groundwater (~50%) to reach desired quality. Alignment follows alignment laid out in 2014 Recycled Water Master Plan with extensions if necessary.

Notes:
(1) Does not include individual customer branches. Backbone pipeline only.
(2) Average value based upon available estimated recycled water production.

Table A.4 Alternative 4 (Offset Demand in Estrella) Project Elements Paso Basin Supplemental Water Supply Options County of San Luis Obispo		
Alt Number	**Alternative 4**	
Sources	Nacimiento	Paso Robles WWTP
Turnout	New Turnout	-
New Pipe Length	53,600 ft	
Pipe Description	2 stream crossings Purple Pipe Blending Facility	
Distribution Method Distribution Elements	• Percolation Basins – Percolation Rate: 0.5 ft/day – 90 acre system • Delivery to Agriculture and Urban Users – ~120 Ag connections	
Distribution Location	City of Paso Robles/Estrella Subarea	
Treatment	None	Tertiary Filtration Upgrade
Land Owner	TBD	
Available Area	Land near Wellsona Road and River Road	
Water Delivered (AFY) Operation Period	Agriculture: 4,100 AFY March through November Percentage of ag demands served: 40% Percolation Basins: 16,400 AFY Year-Round	
Additional Cost Elements	Initial buy-in for Nacimiento Project Water	Not yet determined

7.0 ALTERNATIVE 5 - ADDITIONAL RELEASES TO HUER HUERO CREEK

The intended model run for Alternative 5 was designed to evaluate if additional flows in the Huer Huero Creek watershed provide a benefit to the basin through percolation. In order to avoid potential environmental permitting issues, releases to the creek bed are not recommended and instead spreading basins in the vicinity of the creek are suggested. While direct delivery to basin users, such as agriculture, could be provided as turnoffs from the pipelines to recharge facilities, these opportunities were not explored in this model run.

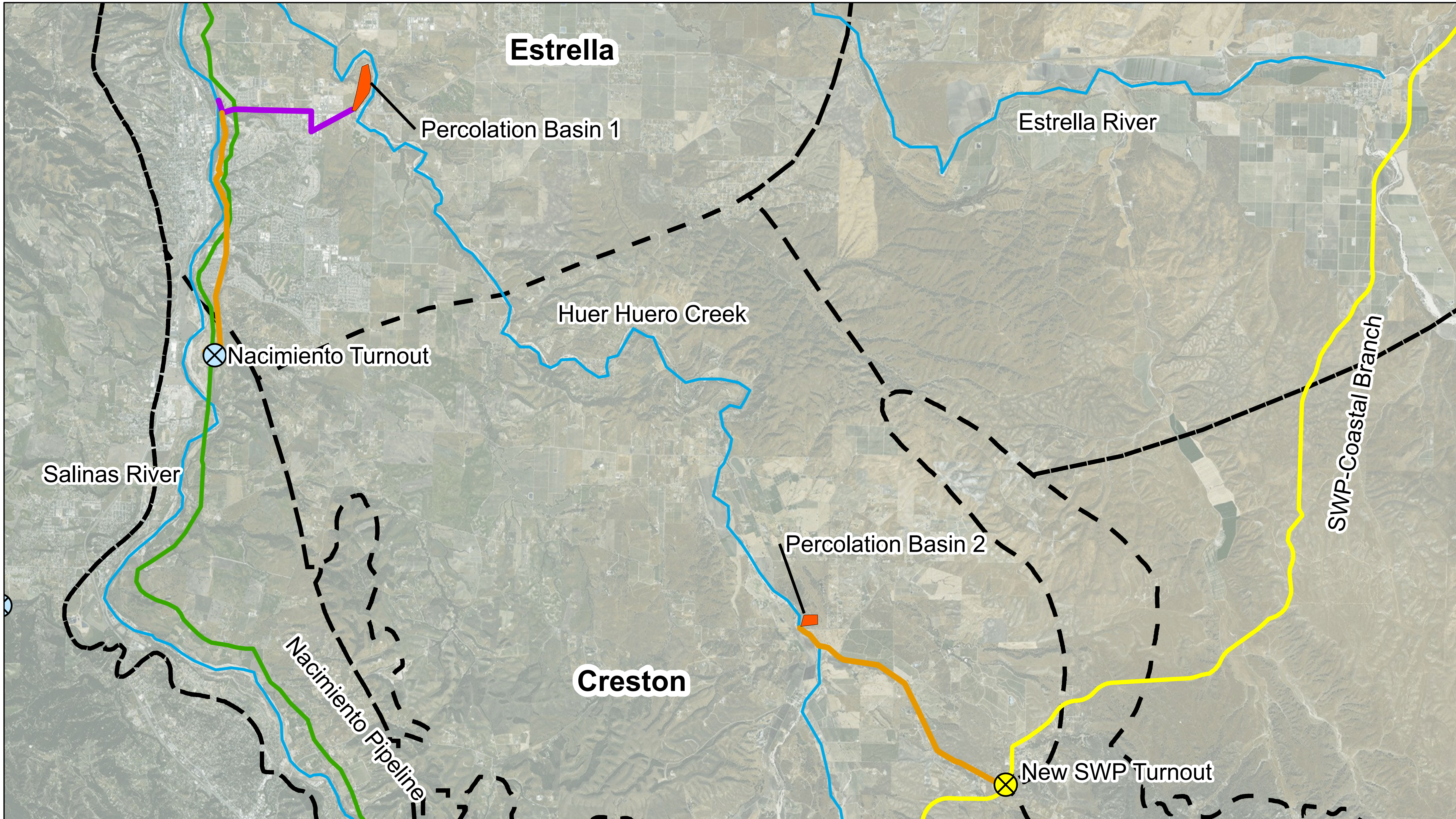
Alternative 5 draws from all three water sources to recharge groundwater levels through percolation basins located near Huer Huero Creek. Because the SWP pipeline is so far from the other two sources (City of Paso Robles WWTP and Nacimiento pipeline), two potential locations for percolation basins have been chosen. These locations were selected based upon perceived land use (unused) and proximity to the most depleted areas of Paso Basin. As is shown in Figure A.7, Nacimiento water could be pumped from the City of Paso

Robles Turnout (or a new turnout) and combined with recycled water from City of Paso Robles WWTP to be piped to a percolation basin area next to Huer Huero Creek within the Estrella Subarea. For the SWP alternative, a new turnout could be constructed along the Coastal Branch Pipeline, where it crosses La Panza Road. A new pipeline could bring water to the second percolation basin area in Figure A.7, which is in the Creston Subarea. All water within the SWP Coastal Branch Pipeline downstream of the Polonio Pass Water Treatment Plant (PPWTP) is treated water. Further analysis of SWP supply options is provided in Technical Memorandum No. 3: Potential Supply Options and Point of Delivery for State Water (TM3). The conceptual schematic for this alternative is shown in Figure A.8.

Cost implications for Alternative 5 (Table A.5) include construction of a new SWP pipeline turnout, pipelines from all three sources, tertiary treatment for recycled water, land acquisition, and percolation basin construction. O&M costs include purchase of Nacimiento water and SWP water, tertiary recycled water treatment, and pipeline and percolation basin maintenance.

Table A.5 Alternative 5 (Additional Releases to Huer Huero) Project Elements
Paso Basin Supplemental Water Supply Options
County of San Luis Obispo

Alt Number	5A		5B
Sources	Nacimiento	Paso Robles WWTP	SWP
Turnout	Paso Robles	-	New Turnout
New Pipe Length	21,000 ft	13,500 ft	21,500 ft
Pipe Description	2 stream crossings Purple piping from WWTP to perc. Basin Raw water piping from Naci to RW pipeline Blending Facility		Treated water pipeline throughout
Distribution Method	• Percolation Basin – Percolation rate: 0.5 ft/day – 90-acre basin system		• Percolation Basin – Percolation rate: 0.5 ft/day – 35-acre basin system
Distribution Location	Land adjacent to Huer Huero Creek in Estrella Sub-Basin		Land adjacent to Huer Huero Creek in Creston Sub-Basin
Treatment	None	Tertiary Filtration Upgrade	None
Land Owner	TBD	TBD	TBD
Available Area	TBD	TBD	TBD
Water Delivered (AFY) Operation Period	Percolation Basins: Recycled Water: 4,100 AFY March through November NWP Water: 16,400 AFY Likely most available in shoulder months		Percolation Basins: 3,200 AFY Likely most available in shoulder months
Additional Cost Elements	Initial NWP Buy-In Cost	TBD	Initial SWP Buy-In Cost
Key Assumptions	Perc basin location chosen for proximity to area that provides deep basin recharge near deepest groundwater drawdown		Location chosen to minimize piping and proximity to area that provides deep basin recharge near deepest groundwater drawdown



Legend

- Rivers
- Nacimiento Pipeline
- SWP-Coastal Branch
- New SWP Turnout
- Nacimiento Turnout
- Paso Robles Groundwater Basin
- Alternative 5 Percolation Basin

Alternative 5 Routes

- Other Water Pipeline
- Recycled Water Pipeline

N

0 5,000 10,000 20,000 Feet

ALTERNATIVE 5
ADDITIONAL RELEASE TO HUER HUERO CREEK OVERVIEW

FIGURE A.7

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO BASIN GROUNDWATER BASIN SUPPLIMENTAL SUPPLY OPTION

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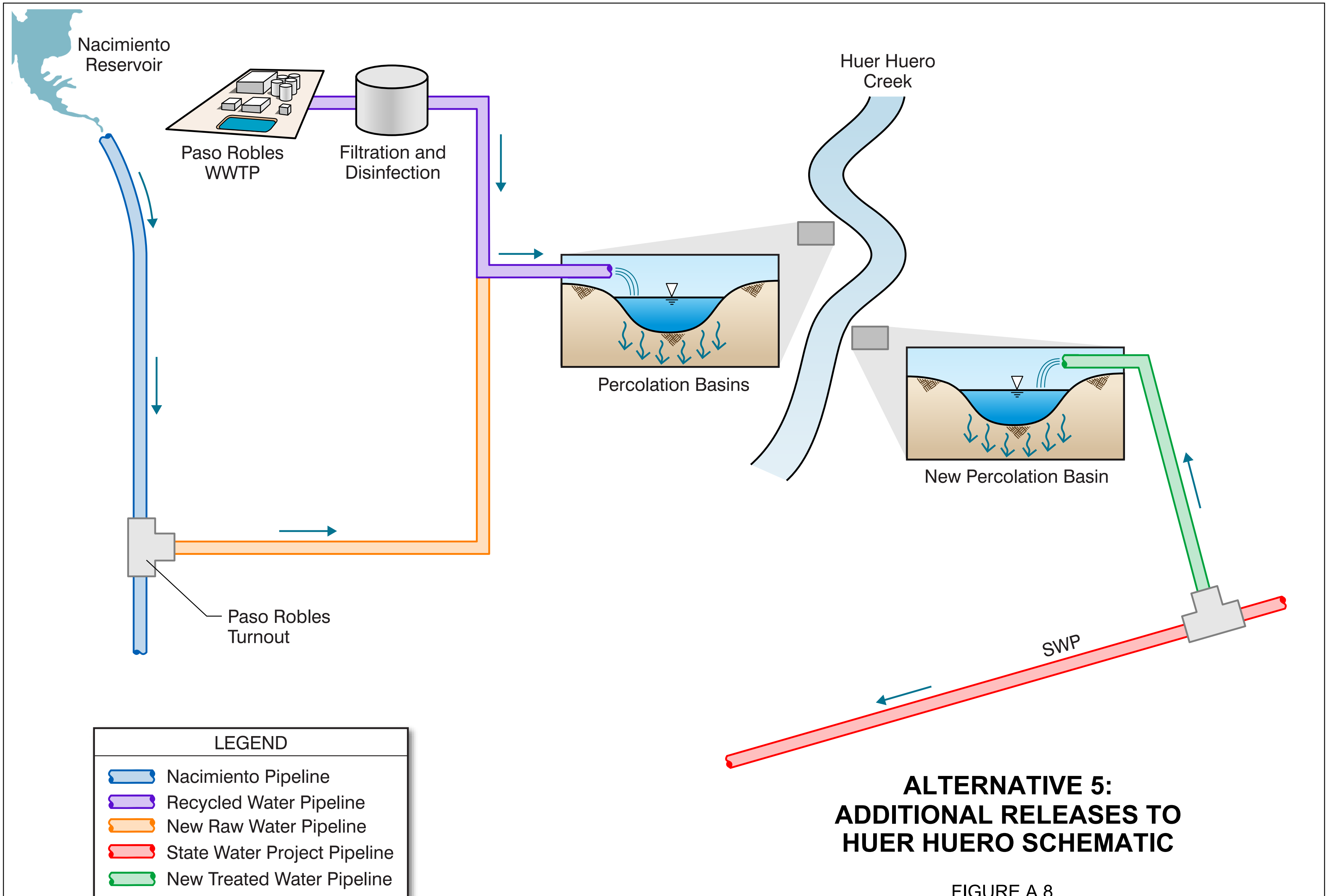


ALTERNATIVE 5: ADDITIONAL RELEASES TO HUER HUERO SCHEMATIC

FIGURE A.8

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS STUDY

8.0 ALTERNATIVE 6 - ADDITIONAL RELEASES TO ESTRELLA RIVER

This model run was designed to determine the amount of supplemental water to the Estrella River watershed that would provide a benefit to the basin through percolation. Alternative 6 combines all three water sources to contribute to percolation basins. Nacimiento water could be pumped from a new turnout and combined with recycled water from the City of Paso Robles WWTP to percolate into the groundwater at a percolation basin located adjacent to the Estrella River in the Estrella Subarea. SWP water could be piped from the existing SWP Turnout in the community of Shandon to be discharged in a percolation basin near the Estrella River in the Shandon Subarea. Alternatively a new SWP turnout could be constructed. The potential routes are shown in Figures A.9. The conceptual schematic for this alternative is shown in Figure A.10.

Potential costs for Alternative 6 include construction of a new Nacimiento pipeline turnout, pipelines from all three sources, tertiary treatment for recycled water, land acquisition, and percolation basin construction. O&M costs include Nacimiento water purchase and treated SWP water purchase, as well as pipeline and percolation basin maintenance.

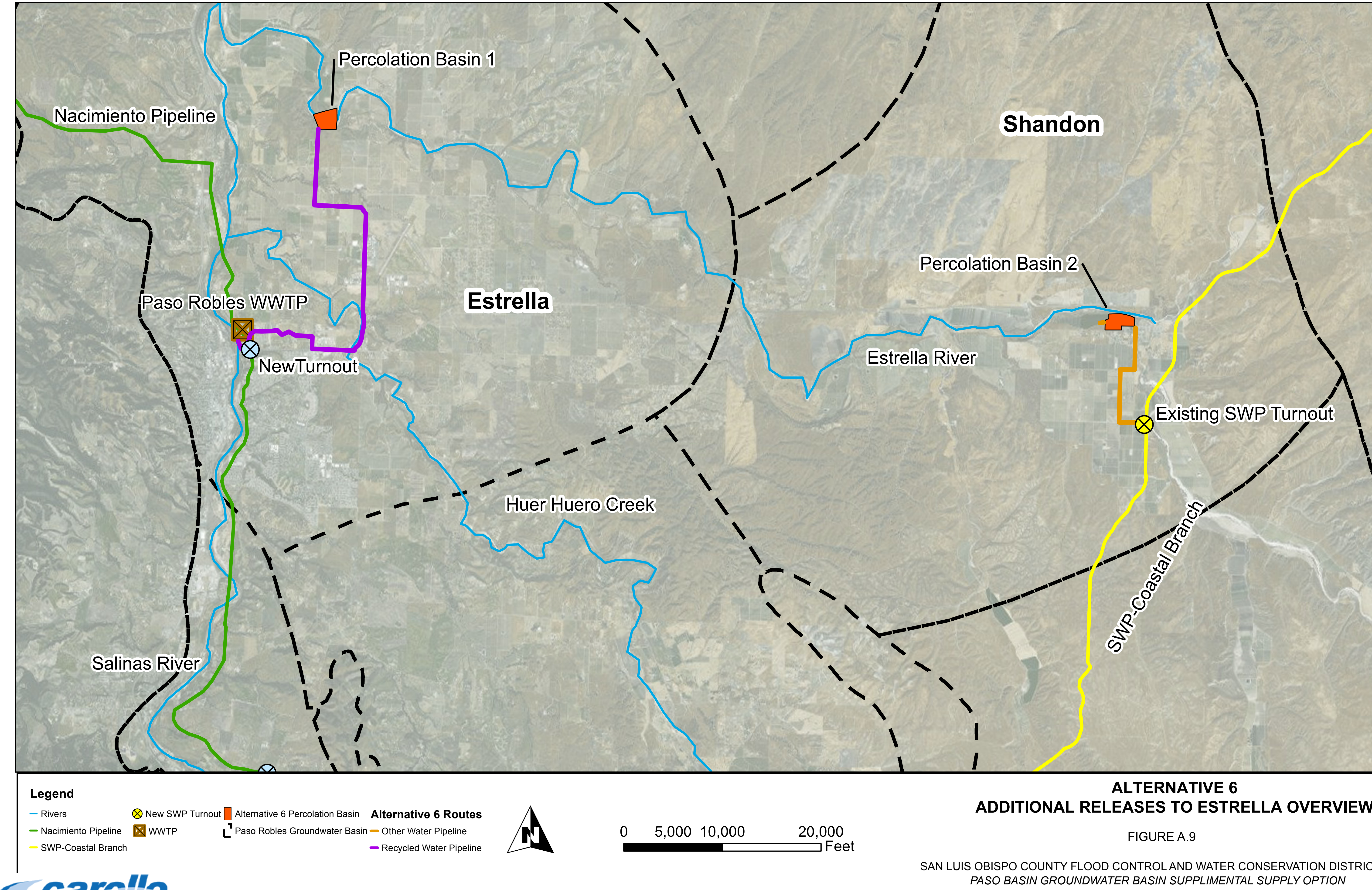
9.0 ALTERNATIVE 7 - OFFSET PUMPING IN CRESTON SUBAREA

The goal of Alternative 7 is to offset pumping in the Creston Subarea. This could be accomplished by combining raw Nacimiento water from the existing AMWC Turnout and treated SWP water (from a new turnout). Potential end uses include:

- Direct delivery of either treated water to potable uses (SWP) and agricultural uses or raw water to agriculture uses (NWP), or
- Percolation basins to supplement the deep water basin (SWP)

Potential percolation basin locations were chosen to minimize piping costs. Percolation basins were not chosen for NWP water because the SAGBI Tool showed poor geology throughout the area closest to the pipeline. It may be beneficial to put injection wells in the areas of greatest concern in Creston. If injection wells were to be used the water must be treated. However, percolation basins in the upper Creston basin along Huer Huero creek using SWP water are shown for this alternative. Potential agricultural customers, and potential percolation basins are shown in Figure A.11. The alternative schematic is shown in Figure A.12.

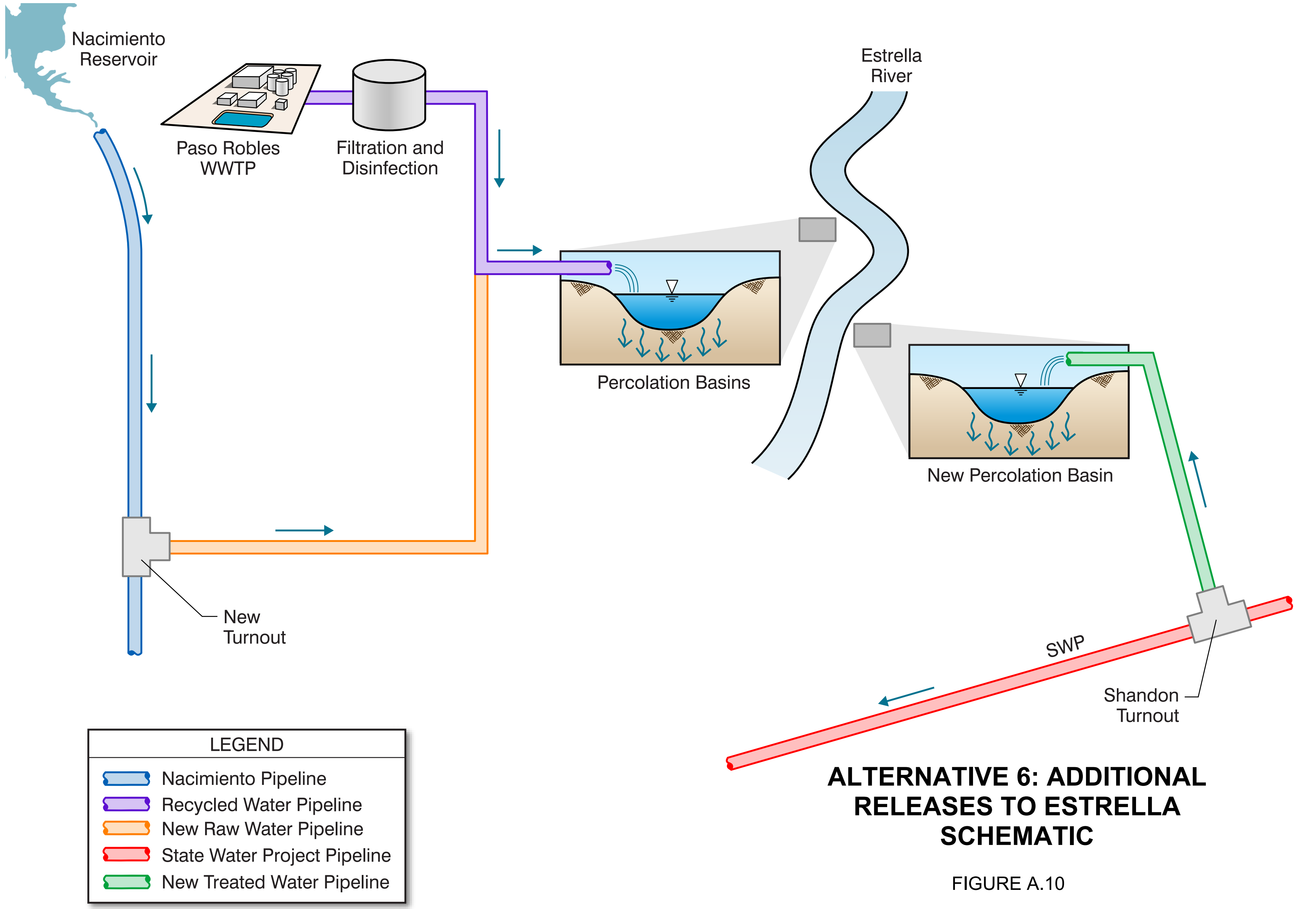
Capital costs for this alternative include construction of pipeline, a new turnout for the SWP pipeline, new customer connections, and land acquisition for and construction of percolation basins and injection wells. (See Table A.7.)



ALTERNATIVE 6
ADDITIONAL RELEASES TO ESTRELLA OVERVIEW

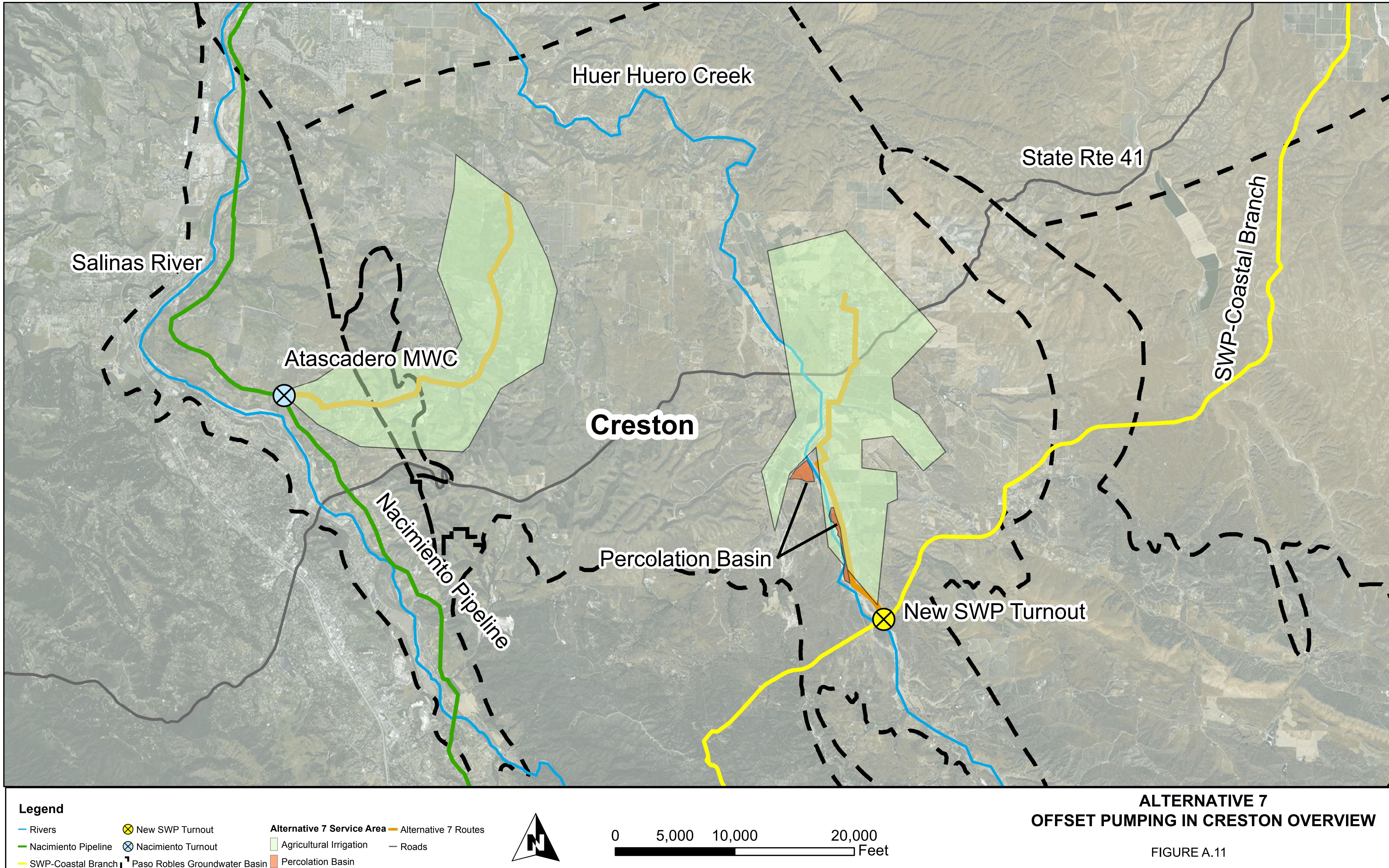
FIGURE A.9

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO BASIN GROUNDWATER BASIN SUPPLIMENTAL SUPPLY OPTION



ALTERNATIVE 6: ADDITIONAL RELEASES TO ESTRELLA SCHEMATIC

FIGURE A.10



ALTERNATIVE 7
OFFSET PUMPING IN CRESTON OVERVIEW

FIGURE A.11

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO BASIN GROUNDWATER BASIN SUPPLIMENTAL SUPPLY OPTION

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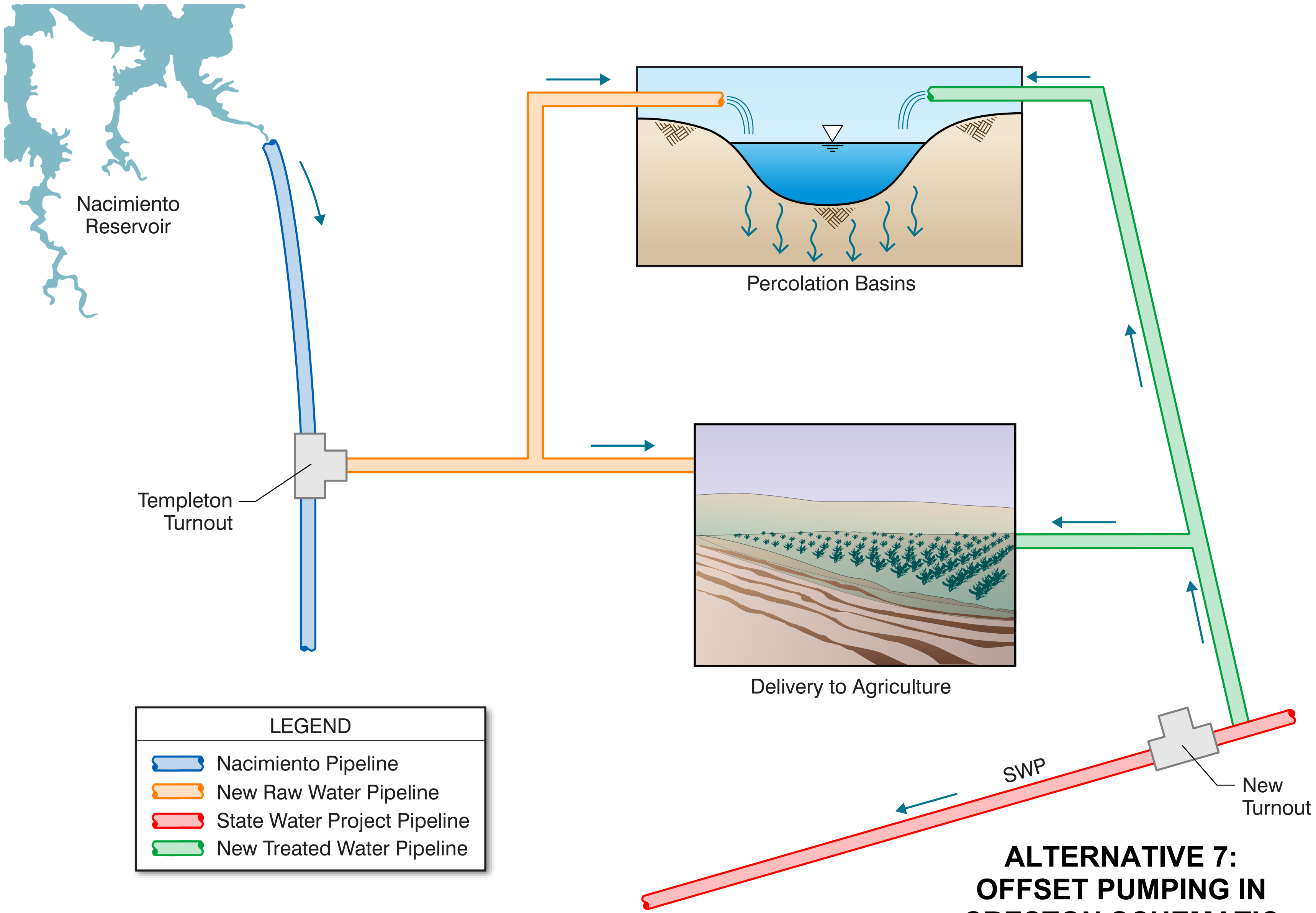

ALTERNATIVE 7: OFFSET PUMPING IN CRESTON SCHEMATIC

FIGURE A.12

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS STUDY

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Table A.6	**Alternative 6 (Additional Releases to Estrella) Project Elements Paso Basin Supplemental Water Supply Options County of San Luis Obispo**		
Alt Number	**6A**		**6B**
Sources	NWP	Paso Robles WWTP	SWP
Turnout	New Turnout	-	New Turnout
New Pipe Length	Alignment A: 42,300 feet Alignment B: 36,700 feet		Alignment A: 13,300 ft Alignment B: 13,300 ft
Pipeline Description	1 stream crossing Purple pipe throughout Blending Facility near WWTP New Turnout		Treated water pipeline throughout
Distribution Method	• Percolation Basin – Percolation rate: 0.5 ft/day – Three 30-acre basins		• Percolation Basin – Percolation rate: 0.5 ft/day – 90-acre basin
Distribution Location	Near Estrella River	Near Estrella River	Near Estrella River
Treatment	None	Tertiary Filtration Upgrade	N/A
Land Owner	TBD		TBD
Available Area	Land adjacent to Estrella River		Land adjacent to Estrella River
Water Delivered (AFY) Operation Period	Percolation Basins: 16,400 AFY Recycled Water: 4,100 AFY Year-Round Naci Water: 12,400 AFY Likely most available in shoulder months		Percolation Basins: 16,400 AFY Likely most available during shoulder months
Additional Cost Elements	Initial Nacimiento Project Buy-In Cost	None	Initial SWP Buy-In Cost
Key Assumptions	Percolation basin location chosen to be near Estrella River and further from City of Paso Robles, as close to the area that provides deep basin recharge near deeper groundwater drawdown areas		Location chosen to minimize piping and be in areas of greatest concern

Table A.7 Alternative 7 (Offset Pumping in Creston) Project Element
Paso Basin Supplemental Water Supply Options
County of San Luis Obispo

Alt Number	7A	7B
Sources	Nacimiento	SWP
Turnout	Atascadero	New Turnout
New Pipe Length	34,500 ft	25,800 ft
Pipeline Description	1 stream crossing Raw water pipe throughout	Treated water pipe throughout
Distribution Method	• Delivery to Agriculture and Urban Users – ~40 Ag connections	• Delivery to Agriculture and Urban Users – ~60 Ag connections • Percolation Basin – Percolation Rate: 0.5 ft/day – 10 acre basin
Distribution Location	Creston Subarea	Creston Subarea
Treatment	None	None
Land Owner	TBD	TBD
Available Area	TBD	TBD
Water Delivered (AFY) Operation Period	Agriculture: 1,500 AFY March through November Percentage of selected ag demands served: 50%	Agriculture: 1,000 AFY March through November Percentage of selected ag demands served: 20% Percolation Basins: 1,830 AFY Likely most available during shoulder months
Additional Cost Elements	Initial Nacimiento Project Buy-In Cost	Initial SWP Buy-In Cost
Key Assumptions	Agricultural customers were chosen based upon proximity to the Nacimiento turnout. Distribution pipeline based upon road alignments.	Percolation basin location chosen for proximity to more drawn down areas of the basin.

10.0 ALTERNATIVE 8 - OFFSET PUMPING IN SHANDON SUBAREA

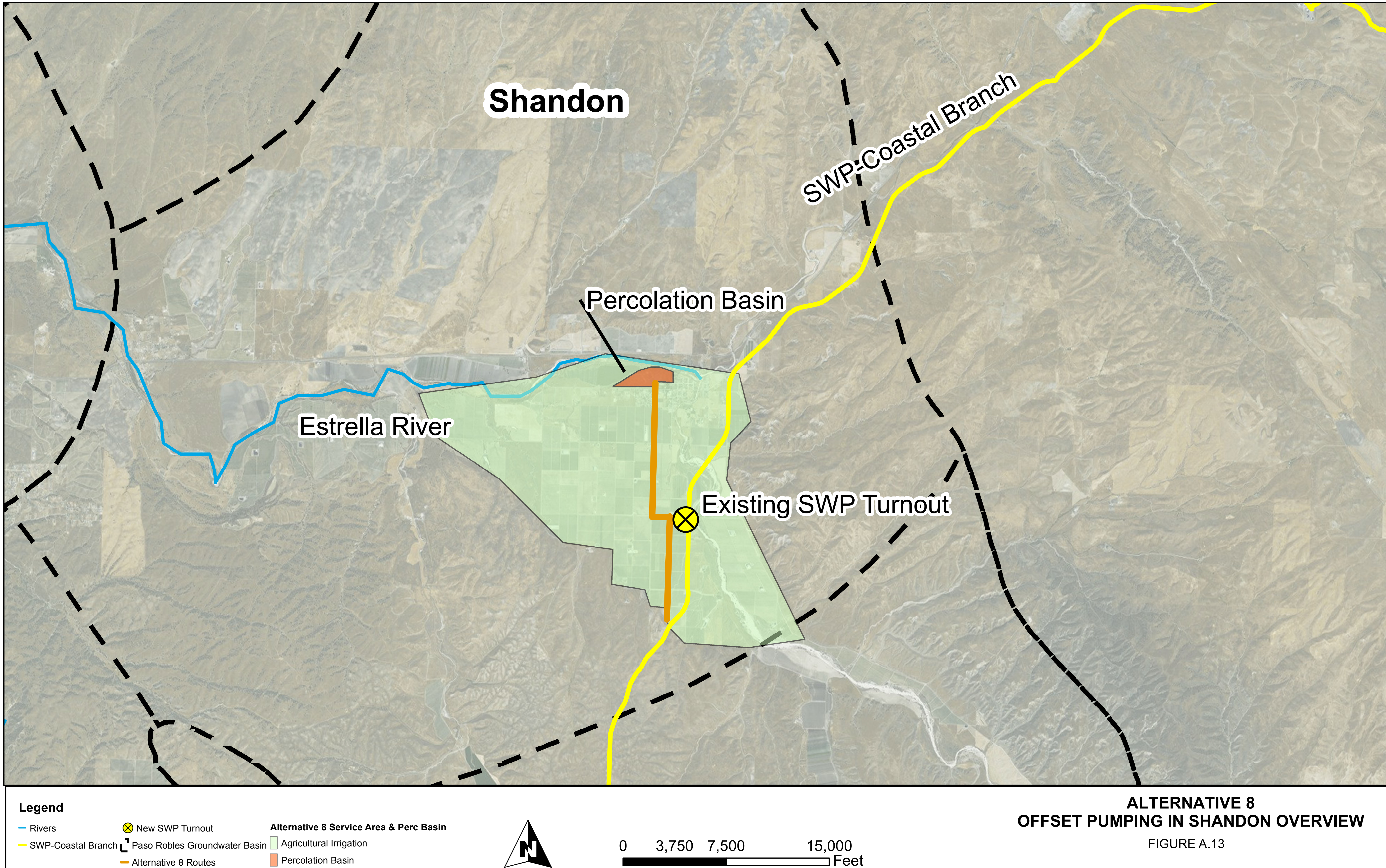
Alternative 8 aims to alleviate groundwater pumping stress in the Shandon Subarea using treated SWP water. Potential end uses include:

- Direct delivery of either treated water to potable and agricultural uses (SWP) or direct delivery of raw water to agriculture uses (SWP).
- Percolation basins to supplement the deep water basin (SWP).

Potential agricultural customers, and potential percolation basins are shown in Figure A.13. Percolation basins can be placed near the Estrella River, in similar areas as in Alternative 6. The schematic for this alternative is shown in Figure A.14.

Costs for this alternative include construction of pipelines, injection wells, percolation basins, and customer connections. O&M costs include pumping costs as well as SWP water purchase and pipe maintenance. (See Table A.8.)

Table A.8	**Alternative 8 (Offset Pumping in Shandon) Project Elements Paso Basin Supplemental Water Supply Options County of San Luis Obispo**
Alt Number	**Alternative 8**
Sources	SWP
Turnout	Shandon
Pipe	18,500 ft
Pipe (Other)	Treated water pipe throughout Assumes no stream crossings (stay on south side of Estrella River)
Distribution Method	• Percolation Basins – Percolation Rate: 0.5 ft/day – 10-acre basin • Delivery to Agriculture and Urban Users – ~75 Ag connections
Distribution Location	Community of Shandon and Surrounding Agriculture. Injection near Estrella River.
Treatment	None
Land Owner	TBD
Available Area	TBD
Water Delivered (AFY) Operation Period	Agriculture: 4,300 AFY March through November Percentage of selected ag demand served: 50% Percolation Basin: 1,800 AFY Likely most available in shoulder months
Additional CostElements	Initial SWP Buy-In Cost
Key Assumptions	Agriculture irrigation routing chosen to reach maximum number of irrigation customers within Shandon valley area without crossing Estrella River. Percolation basins location based upon deepest drawdown area.



ALTERNATIVE 8
OFFSET PUMPING IN SHANDON OVERVIEW

FIGURE A.13

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO BASIN GROUNDWATER BASIN SUPPLIMENTAL SUPPLY OPTION

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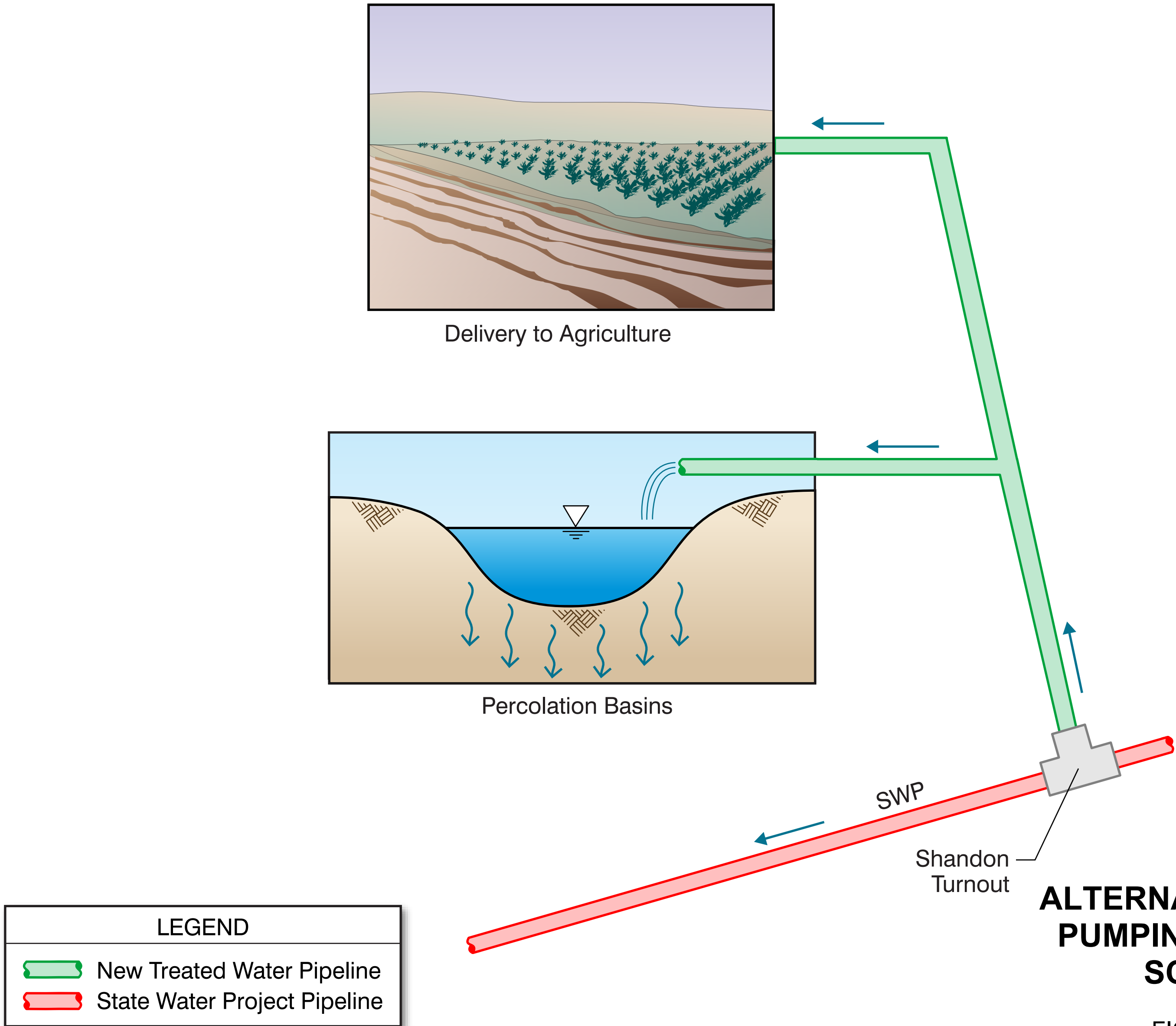

ALTERNATIVE 8: OFFSET PUMPING IN SHANDON SCHEMATIC

FIGURE A.14

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PASO ROBLES GROUNDWATER BASIN SUPPLEMENTAL SUPPLY OPTIONS STUDY

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APPENDIX B - DETAILED COST TABLES

APPENDIX B – DETAILED COST TABLES

B.1 BASIS OF COST

The basis of cost estimates for this alternatives analysis was based on planning level conceptual alternative configurations. Construction costs were estimated using unit costs developed from past construction contracts, estimating guides, unit prices, and construction costs of similar facilities and configurations at other locations. Using these sources, adjusted capital costs were developed.

Construction costs have historically escalated with time. This trend is expected to continue in the future. To record these trends in rising costs, several indices have been established for various fields of construction. The standard indicator of changes in heavy construction prices is the Construction Cost Index (ENR-CCI). Capital costs for the alternative analysis are based on July 2016 20-Cities Average ENR-CCI of 10379 and the R.S. Means Location Factor for San Luis Obispo, CA, of 105.0.

For the alternatives presented herein, cost estimates were developed following the Association for the Advancement of Cost Estimating (AACE) International Recommended Practice No. 18R-97 estimate class 5. A summary of the AACE Classes is shown in Table B.1.

Class 5 estimates are prepared for any number of strategic business planning purposes including, but not limited to, detailed strategic planning, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage. Limited information is available at the time when a Class 5 estimate is developed. Therefore, Class 5 estimates also use stochastic estimating methods such as parametric or other modeling techniques. Subsequently, estimated costs have fairly wide accuracy ranges. Typical accuracy ranges for Class 5 estimates are -20 percent to -50 percent on the low side, and +30 percent to +100 percent on the high side, depending on the technological complexity of the project, availability and accuracy of appropriate reference information, and the inclusion of an appropriate contingency determination.

Table B.1 Classes of Cost Estimates[1]
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

	Primary Characteristic	Secondary Characteristic			
Estimate Class	**Level of Project Definition** Expressed as % of complete definition	**End Usage** Typical purpose of estimate	**Methodology** Typical estimating method	**Expected Accuracy Range** Typical variation in low and high ranges[(1)(a)]	**Preparation Effort** Typical degree of effort relative to least cost index of[(1)(b)]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: - 15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: - 10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: - 5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: - 3% to -10% H: +3% to +15%	5 to 100

Notes:

(1) Table 1 comes from the AACE International Recommended Practices, No. 18R-97:
   a. The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for a given scope.
   b. If the range index value of “1” represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

To account for unforeseen variables, construction contingencies and project costs factors were added onto the direct costs and are shown in Table B.2.

Table B.2	**Basis of Estimating Project Costs Paso Robles Groundwater Basin Supplemental Supply Options San Luis Obispo County Flood Control and Water Conservation District**
Item	**Estimated Cost**
Direct Cost[1] Estimating Contingency	"A" + 30% of "A"
Subtotal Direct Cost	**"B"**
General Conditions	+15% of "B"
Subtotal	**"C"**
Contractor Overhead & Profit	+10% of "C"
Sales Tax on 50%	4.0% of "B"
Total Estimated Construction Cost	**"D"**
Engineering, Legal, Administrative, and Construction Management Fees	+ 30% of "D"
Total Project Cost[2]	**"E"**

Notes:
(1) Based on estimating guides and construction costs of similar facilities.
(2) Includes project contingencies, construction management, administrative, engineering, and legal costs.

B.2 SCENARIO DETAILED COST ESTIMATES

The scenarios were broken down into project components based upon destination of the supply water. Detailed cost estimates are shown in Table C.3 through C.14. These costs are in July 2016 dollars.

Table B.3 **Scenario A - NWP & RW to Estrella Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
Nacimiento Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
6"	34,045	LF	$ 140	$ 4,766,000
12"	11,291	LF	$ 200	$ 2,258,000
30"	55,565	LF	$ 360	$ 20,003,000
Total Pipeline	100,901	LF		$ 27,027,000
River Crossings				
30"	1,000	LF	$ 360	$ 360,000
Total Crossing	1,000	LF		$ 360,000
Pump Station	552	HP	$ 6,360	$ 3,512,000
Agricultural Customer Connection	34	EA	$ 23,000	$ 782,000
Recharge Basin	86	AC	$ 15,000	$ 1,290,000
Total Direct Cost				*$ 33,271,000*
Estimating Contingency	30%			$ 9,981,000
Subtotal				*$ 43,252,000*
General Conditions	15%			$ 6,488,000
Subtotal				*$ 49,740,000*
Contractor Overhead & Profit	10%			$ 4,974,000
Subtotal				*$ 54,714,000*
Sales Tax	8%			$ 1,730,000
TOTAL CONSTRUCTION COST				*$ 56,444,000*
Engineering, Legal, Administrative, and Project Cont	30%			**$ 16,933,000**
Land Acquisition	103	AC	$ 25,000	$ 2,580,000
TOTAL PROJECT COST				**$ 75,960,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 135,000
Pump Station			1%	$ 35,000
Recharge Basins	86	AC	$ 5,000	$ 430,000
Pump Station Energy Cost	3,607,079	kWh	$ 0.13	$ 469,000
Total Annual O&M Cost				$ 1,069,000
Nacimiento Water Cost	7,100	AF	$ 2,000	$ 14,200,000
Recycled Water O&M	4,000	AF	$ 2,000	$ 8,000,000
Annualized Project Cost				$ 4,941,000
TOTAL ANNUAL COST				**$ 28,210,000**

Table B.4 **Scenario A - SWP to Creston Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
SWP Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
8"	6,100	LF	$ 160	$ 976,000
10"	3,500	LF	$ 180	$ 630,000
16"	11,900	LF	$ 230	$ 2,737,000
24"	65,700	LF	$ 290	$ 19,053,000
Total Pipeline	87,200	LF		$ 23,396,000
River/Railroad Crossings				
24"	500	LF	$ 290	$ 145,000
24"	350	LF	$ 290	$ 102,000
Total Crossing	500	LF		$ 247,000
Pump Station	0	HP	$ 9,740	$ -
Agricultural Customer Connection	58	EA	$ 23,000	$ 1,334,000
Recharge Basin	0	AC	$ 15,000	$ -
Total Direct Cost				*$ 25,277,000*
Estimating Contingency	30%			$ 7,583,000
Subtotal				*$ 32,860,000*
General Conditions	15%			$ 4,929,000
Subtotal				*$ 37,789,000*
Contractor Overhead & Profit	10%			$ 3,779,000
Subtotal				*$ 41,568,000*
Sales Tax	8%			$ 1,314,000
TOTAL CONSTRUCTION COST				*$ 42,882,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 12,865,000**
Land Acquisition	0	AC	$ 25,000	$ -
TOTAL PROJECT COST				**$ 55,750,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 117,000
Pump Station			1%	$ -
Recharge Basins	0	AC	$ 5,000	$ -
Pump Station Energy Cost	3,266,166	kWh	$ 0.13	$ 425,000
Total Annual O&M Cost				$ 542,000
SWP Water Cost	4,380	AF	$ 2,500	$ 10,950,000
Annualized Project Cost				$ 3,627,000
TOTAL ANNUAL COST				**$ 15,119,000**

Table B.5 **Scenario A - SWP to Shandon Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
SWP Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
30"	9,300	LF	$ 360	$ 3,348,000
Total Pipeline	9,300	LF		$ 3,348,000
River/Railroad Crossings				
30"	550	LF	$ 360	$ 198,000
Total Crossing	550	LF		$ 198,000
Pump Station	0	HP	$ 9,740	$ -
Agricultural Customer Connection	0	EA	$ 23,000	$ -
Recharge Basin	77	AC	$ 15,000	$ 1,155,000
Total Direct Cost				*$ 5,001,000*
Estimating Contingency	30%			$ 1,500,000
Subtotal				*$ 6,501,000*
General Conditions	15%			$ 975,000
Subtotal				*$ 7,476,000*
Contractor Overhead & Profit	10%			$ 748,000
Subtotal				*$ 8,224,000*
Sales Tax	8%			$ 260,000
TOTAL CONSTRUCTION COST				*$ 8,484,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 2,545,000**
Land Acquisition	92	AC	$ 25,000	$ 2,310,000
TOTAL PROJECT COST				**$ 13,340,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 17,000
Pump Station			1%	$ -
Recharge Basins	77	AC	$ 5,000	$ 385,000
Pump Station Energy Cost	0	kWh	$ 0.13	$ -
Total Annual O&M Cost				$ 402,000
SWP Water Cost	4,480	AF	$ 2,500	$ 11,200,000
Annualized Project Cost				$ 868,000
TOTAL ANNUAL COST				**$ 12,470,000**

Table B.6 **Scenario B - NWP & RW to Estrella Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
Nacimiento Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
6"	34,045	LF	$ 140	$ 4,766,000
12"	11,291	LF	$ 200	$ 2,258,000
24"	55,565	LF	$ 290	$ 16,114,000
Total Pipeline	100,901	LF		$ 23,138,000
River/Railroad Crossings				
24"	550	LF	$ 290	$ 160,000
Total Crossing	550	LF		$ 160,000
Pump Station	485	HP	$ 7,350	$ 3,564,000
Agricultural Customer Connection	34	EA	$ 23,000	$ 782,000
Recharge Basin	76	AC	$ 15,000	$ 1,140,000
Total Direct Cost				*$ 29,084,000*
Estimating Contingency	30%			$ 8,725,000
Subtotal				*$ 37,809,000*
General Conditions	15%			$ 5,671,000
Subtotal				*$ 43,480,000*
Contractor Overhead & Profit	10%			$ 4,348,000
Subtotal				*$ 47,828,000*
Sales Tax	8%			$ 1,512,000
TOTAL CONSTRUCTION COST				*$ 49,340,000*
Engineering, Legal, Administrative, and Project Con	30%			**$ 14,802,000**
Land Acquisition	91	AC	$ 25,000	$ 2,280,000
TOTAL PROJECT COST				**$ 66,420,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 116,000
Pump Station			1%	$ 36,000
Recharge Basins	76	AC	$ 5,000	$ 380,000
Pump Station Energy Cost	3,167,191	kWh	$ 0.13	$ 412,000
Total Annual O&M Cost				$ 944,000
Nacimiento Water Cost	5,600	AF	$ 2,000	$ 11,200,000
Recycled Water O&M	4,000	AF	$ 2,000	$ 8,000,000
Annualized Project Cost				$ 4,321,000
TOTAL ANNUAL COST				**$ 24,465,000**

Table B.7 **Scenario B - NWP & RW to Creston Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
Nacimiento Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
6"	19,578	LF	$ 140	$ 2,741,000
12"	37,021	LF	$ 200	$ 7,404,000
Total Pipeline	56,599	LF		$ 10,145,000
River/Railroad Crossings				
12"	500	LF	$ 200	$ 100,000
Total Crossing	500	LF		$ 100,000
Pump Station	104	HP	$ 7,350	$ 767,000
Agricultural Customer Connection	19	EA	$ 23,000	$ 437,000
Recharge Basin	0	AC	$ 15,000	$ -
Total Direct Cost				*$ 11,749,000*
Estimating Contingency	30%			$ 3,525,000
Subtotal				*$ 15,274,000*
General Conditions	15%			$ 2,291,000
Subtotal				*$ 17,565,000*
Contractor Overhead & Profit	10%			$ 1,757,000
Subtotal				*$ 19,322,000*
Sales Tax	8%			$ 611,000
TOTAL CONSTRUCTION COST				*$ 19,933,000*
Engineering, Legal, Administrative, and Project Cont	30%			**$ 5,980,000**
Land Acquisition	0	AC	$ 25,000	$ -
Nacimiento Buy-In Cost	0	LS	$ -	**$ -**
TOTAL PROJECT COST				**$ 25,910,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 37,000
Pump Station			1%	$ 8,000
Recharge Basins	0	AC	$ 5,000	$ -
Pump Station Energy Cost	681,826	kWh	$ 0.13	$ 89,000
Total Annual O&M Cost				$ 134,000
Nacimiento Water Cost	1,500	AF	$ 2,000	$ 3,000,000
Annualized Project Cost				$ 1,685,000
TOTAL ANNUAL COST				**$ 4,819,000**

Table B.8 **Scenario B - SWP to Creston Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
SWP Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
6"	3,600	LF	$ 140	$ 504,000
30"	22,300	LF	$ 360	$ 8,028,000
Total Pipeline	25,900	LF		$ 8,532,000
River/Railroad Crossings				
6"	0	LF	$ 140	$ -
Total Crossing	0	LF		$ -
Pump Station	0	HP	$ 9,740	$ -
Agricultural Customer Connection	19	EA	$ 23,000	$ 437,000
Recharge Basin	77	AC	$ 15,000	$ 1,155,000
Total Direct Cost				*$ 10,424,000*
Estimating Contingency	30%			$ 3,127,000
Subtotal				*$ 13,551,000*
General Conditions	15%			$ 2,033,000
Subtotal				*$ 15,584,000*
Contractor Overhead & Profit	10%			$ 1,558,000
Subtotal				*$ 17,142,000*
Sales Tax	8%			$ 542,000
TOTAL CONSTRUCTION COST				*$ 17,684,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 5,305,000**
Land Acquisition	92	AC	$ 25,000	$ 2,310,000
TOTAL PROJECT COST				**$ 25,300,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 43,000
Pump Station			1%	$ -
Recharge Basins	77	AC	$ 5,000	$ 385,000
Pump Station Energy Cost	0	kWh	$ 0.13	$ -
Total Annual O&M Cost				$ 428,000
SWP Water Cost	4,950	AF	$ 2,500	$ 12,375,000
Annualized Project Cost				$ 1,646,000
TOTAL ANNUAL COST				**$ 14,449,000**

Table B.9 **Scenario B - SWP to San Juan Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
SWP Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
20"	45,100	LF	$ 270	$ 12,177,000
Total Pipeline	45,100	LF		$ 12,177,000
River/Railroad Crossings				
20"	600	LF	$ 270	$ 162,000
Total Crossing	600	LF		$ 162,000
Pump Station	0	HP	$ 9,740	$ -
Agricultural Customer Connection	15	EA	$ 23,000	$ 345,000
Recharge Basin	0	AC	$ 15,000	$ -
Total Direct Cost				*$ 12,984,000*
Estimating Contingency	30%			$ 3,895,000
Subtotal				*$ 16,879,000*
General Conditions	15%			$ 2,532,000
Subtotal				*$ 19,411,000*
Contractor Overhead & Profit	10%			$ 1,941,000
Subtotal				*$ 21,352,000*
Sales Tax	8%			$ 675,000
TOTAL CONSTRUCTION COST				*$ 22,027,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 6,608,000**
Land Acquisition	0	AC	$ 25,000	$ -
TOTAL PROJECT COST				**$ 28,640,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 61,000
Pump Station			1%	$ -
Recharge Basins	0	AC	$ 5,000	$ -
Pump Station Energy Cost	0	kWh	$ 0.13	$ -
Total Annual O&M Cost				$ 61,000
SWP Water Cost	3,910	AF	$ 2,500	$ 9,775,000
Annualized Project Cost				$ 1,863,000
TOTAL ANNUAL COST				**$ 11,699,000**

Table B.10 **Scenario C - NWP & RW to Estrella Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
Nacimiento Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
30"	18,393	LF	$ 360	$ 6,621,000
Total Pipeline	18,393	LF		$ 6,621,000
River/Railroad Crossings				
30"	1,000	LF	$ 360	$ 360,000
Total Crossing	1,000	LF		$ 360,000
Pump Station	552	HP	$ 6,360	$ 3,512,000
Agricultural Customer Connection	0	EA	$ 23,000	$ -
Recharge Basin	86	AC	$ 15,000	$ 1,290,000
Total Direct Cost				*$ 12,083,000*
Estimating Contingency	30%			$ 3,625,000
Subtotal				*$ 15,708,000*
General Conditions	15%			$ 2,356,000
Subtotal				*$ 18,064,000*
Contractor Overhead & Profit	10%			$ 1,806,000
Subtotal				*$ 19,870,000*
Sales Tax	8%			$ 628,000
TOTAL CONSTRUCTION COST				*$ 20,498,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 6,149,000**
Land Acquisition	103	AC	$ 25,000	$ 2,580,000
TOTAL PROJECT COST				**$ 29,230,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 33,000
Pump Station			1%	$ 35,000
Recharge Basins	86	AC	$ 5,000	$ 430,000
Pump Station Energy Cost	3,607,079	kWh	$ 0.13	$ 469,000
Total Annual O&M Cost				$ 967,000
Nacimiento Water Cost	7,100	AF	$ 2,000	$ 14,200,000
Recycled Water O&M	4,000	AF	$ 2,000	$ 8,000,000
Annualized Project Cost				$ 1,901,000
TOTAL ANNUAL COST				**$ 25,068,000**

Table B.11 **Scenario C - SWP to Creston Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
SWP Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
30"	22,300	LF	$ 360	$ 8,028,000
Total Pipeline	22,300	LF		$ 8,028,000
River/Railroad Crossings				
30"	0	LF	$ 360	$ -
Total Crossing	0	LF		$ -
Pump Station	0	HP	$ 9,740	$ -
Agricultural Customer Connection	15	EA	$ 23,000	$ 345,000
Recharge Basin	77	AC	$ 15,000	$ 1,155,000
Total Direct Cost				*$ 9,828,000*
Estimating Contingency	30%			$ 2,948,000
Subtotal				*$ 12,776,000*
General Conditions	15%			$ 1,916,000
Subtotal				*$ 14,692,000*
Contractor Overhead & Profit	10%			$ 1,469,000
Subtotal				*$ 16,161,000*
Sales Tax	8%			$ 511,000
TOTAL CONSTRUCTION COST				*$ 16,672,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 5,002,000**
Land Acquisition	92	AC	$ 25,000	$ 2,310,000
TOTAL PROJECT COST				**$ 23,980,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 40,000
Pump Station			1%	$ -
Recharge Basins	77	AC	$ 5,000	$ 385,000
Pump Station Energy Cost	0	kWh	$ 0.13	$ -
Total Annual O&M Cost				$ 425,000
SWP Water Cost	8,860	AF	$ 2,500	$ 22,150,000
Annualized Project Cost				$ 1,560,000
TOTAL ANNUAL COST				**$ 24,135,000**

Table B.12 **Scenario D - NWP & RW to Estrella Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
Nacimiento Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
6"	8,270	LF	$ 140	$ 1,158,000
30"	37,904	LF	$ 360	$ 13,645,000
Total Pipeline	37,904	LF		$ 13,645,000
River/Railroad Crossings				
30"	1,000	LF	$ 360	$ 360,000
Total Crossing	1,000	LF		$ 360,000
Pump Station	552	HP	$ 6,360	$ 3,512,000
Agricultural Customer Connection	10	EA	$ 23,000	$ 230,000
Recharge Basin	86	AC	$ 15,000	$ 1,290,000
Total Direct Cost				*$ 19,337,000*
Estimating Contingency	30%			$ 5,801,000
Subtotal				*$ 25,138,000*
General Conditions	15%			$ 3,771,000
Subtotal				*$ 28,909,000*
Contractor Overhead & Profit	10%			$ 2,891,000
Subtotal				*$ 31,800,000*
Sales Tax	8%			$ 1,006,000
TOTAL CONSTRUCTION COST				*$ 32,806,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 9,842,000**
Land Acquisition	103	AC	$ 25,000	$ 2,580,000
TOTAL PROJECT COST				**$ 45,230,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 68,000
Pump Station			1%	$ 35,000
Recharge Basins	86	AC	$ 5,000	$ 430,000
Pump Station Energy Cost	3,607,079	kWh	$ 0.13	$ 469,000
Total Annual O&M Cost				$ 1,002,000
Nacimiento Water Cost	7,100	AF	$ 2,000	$ 14,200,000
Recycled Water O&M	4,000	AF	$ 2,000	$ 8,000,000
Annualized Project Cost				$ 2,942,000
TOTAL ANNUAL COST				**$ 26,144,000**

Table B.13 **Scenario D - SWP to Creston Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
SWP Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
12"	4,200	LF	$ 200	$ 840,000
30"	22,300	LF	$ 360	$ 8,028,000
Total Pipeline	26,500	LF		$ 8,868,000
River/Railroad Crossings				
12"	0	LF	$ 200	$ -
Total Crossing	0	LF		$ -
Pump Station	0	HP	$ 9,740	$ -
Agricultural Customer Connection	19	EA	$ 23,000	$ 437,000
Recharge Basin	77	AC	$ 15,000	$ 1,155,000
Total Direct Cost				*$ 10,760,000*
Estimating Contingency	30%			$ 3,228,000
Subtotal				*$ 13,988,000*
General Conditions	15%			$ 2,098,000
Subtotal				*$ 16,086,000*
Contractor Overhead & Profit	10%			$ 1,609,000
Subtotal				*$ 17,695,000*
Sales Tax	8%			$ 560,000
TOTAL CONSTRUCTION COST				*$ 18,255,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 5,477,000**
Land Acquisition	92	AC	$ 25,000	$ 2,310,000
TOTAL PROJECT COST				**$ 26,040,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 44,000
Pump Station			1%	$ -
Recharge Basins	77	AC	$ 5,000	$ 385,000
Pump Station Energy Cost	0	kWh	$ 0.13	$ -
Total Annual O&M Cost				$ 429,000
SWP Water Cost	4,950	AF	$ 2,500	$ 12,375,000
Annualized Project Cost				$ 1,694,000
TOTAL ANNUAL COST				**$ 14,498,000**

Table B.14 **Scenario D - SWP to San Juan Subarea**
Paso Robles Groundwater Basin Supplemental Supply Options
San Luis Obispo County Flood Control and Water Conservation District

CAPITAL COST ESTIMATE

Classification	Quantity	Units	Unit Cost	Estimated Cost
SWP Turnout	1	EA	$ 300,000	$ 300,000
Pipeline by Diameter				
20"	45,100	LF	$ 270	$ 12,177,000
Total Pipeline	45,100	LF		$ 12,177,000
River/Railroad Crossings				
20"	600	LF	$ 270	$ 162,000
Total Crossing	600	LF		$ 162,000
Pump Station	0	HP	$ 9,740	$ -
Agricultural Customer Connection	15	EA	$ 23,000	$ 345,000
Recharge Basin	0	AC	$ 15,000	$ -
Total Direct Cost				*$ 12,984,000*
Estimating Contingency	30%			$ 3,895,000
Subtotal				*$ 16,879,000*
General Conditions	15%			$ 2,532,000
Subtotal				*$ 19,411,000*
Contractor Overhead & Profit	10%			$ 1,941,000
Subtotal				*$ 21,352,000*
Sales Tax	8%			$ 675,000
TOTAL CONSTRUCTION COST				*$ 22,027,000*
Engineering, Legal, Administrative, and Project Contingency	30%			**$ 6,608,000**
Land Acquisition	0	AC	$ 25,000	$ -
TOTAL PROJECT COST				**$ 28,640,000**

Operations & Maintenance Cost Estimate

Classification	Quantity	Units	Unit Cost	Estimated Cost
Annual Maintenance Costs				
Pipeline			1%	$ 61,000
Pump Station			1%	$ -
Recharge Basins	0	AC	$ 5,000	$ -
Pump Station Energy Cost	0	kWh	$ 0.13	$ -
Total Annual O&M Cost				$ 61,000
SWP Water Cost	3,910	AF	$ 2,500	$ 9,775,000
Annualized Project Cost				$ 1,863,000
TOTAL ANNUAL COST				**$ 11,699,000**