

Chapter 7 - Recycled Water System Feasibility Analysis



Chapter 7

RECYCLED WATER SYSTEM FEASIBILITY ANALYSIS

This chapter describes the feasibility analysis for the implementation of a recycled water distribution system for irrigation to the potential non-potable customers identified in Chapter 3. This chapter is divided into the following sections:

- **Potential Sources of Recycled Water.** This section discusses the existing non-potable recycled water systems in the City of Pasadena (Pasadena), the Upper San Gabriel Valley Municipal Water District (USGVMWD or Upper District), and the Central Basin Municipal Water District (Central Basin MWD) and their potential to supply recycled water to the City.
- **Potential Recycled Water Customers and System Layout.** These sections describe the potential recycled water customers within the City as well as potential pipeline alignment options for serving these customers.
- **Recycled Water Model and Feasibility Analysis** – These sections discuss how the recycled water pipeline alternative options were modeled and evaluated.
- **Summary of Recommendations.** The alternatives are compared, and implementation of the most cost-effective option is discussed.

7.1 Potential Sources of Recycled Water

The City currently does not have a recycled water system, but could potentially receive recycled water from Pasadena, the Upper District, or the Central Basin MWD in the future.

7.1.1 Pasadena Non-Potable Water Project

Since 1993, Pasadena has had an agreement with the City of Glendale to purchase up to 6,000 afy of non-potable recycled water from the Los Angeles-Glendale Water Reclamation Plant. The Los Angeles-Glendale Water Reclamation Plant (LAGWRP) can produce up to 20 mgd of tertiary treated recycled water that is currently shared between the LADWP and the City of Glendale.

The City of Glendale has water rights to 50 percent of the plant flow. The LAGWRP has a rated capacity of 20 mgd; however, the average influent flow is about 17 mgd (City of LA, 2018). Hence, the City of Glendale can receive roughly 8.5-10 mgd of tertiary treated recycled water. The City of Glendale has an existing recycled water system with a demand of roughly 1,500 afy and plans for minor expansions that would add approximately 350 afy, resulting in a future demand of approximately 1,850 afy or 1.65 mgd. Based on a 2.0 peaking factor, this would equate to a MDD of about 3.3 mgd. The City of Pasadena has rights to 6,000 afy (5.4 mgd); however, their build out recycled water demand is only estimated to reach 3,100 afy (2.8 mgd). Based on an average flow allocation of to the City of Glendale 10 mgd (11,200 afy), the estimated future recycled water flow that may be available to the City is 6,250 afy (5.6 mgd).

This would equate to about 2.8 mgd ADD when considering a peaking factor of 2.0 for MDD consistent with the City of Glendale 2016 Water and Recycled Water Master Plan.

The City of Glendale's recycled water system has a tank on Glenoaks Boulevard east of the Scholls Canyon Golf Course, which would be the connection point to wheel recycled water to Pasadena. While Pasadena does not currently operate a recycled water system, plans have been developed and designed to construct a new recycled water distribution system from the tank at Scholl Canyon to Brookside Golf Course and the Rose Bowl in Pasadena. According to the Environmental Impact Report (EIR) for this project, Phase I of this project involves the construction of approximately 4.7 miles of 8-inch to 24-inch diameter pipeline from the Glendale's 1.25 MG Scholl Canyon Reservoir (HGL of 1,666 ft-msl) to Pasadena's 1.25 MG Sheldon Non-Potable Water Reservoir(s) (HGL of 1,050 ft-msl) (RMC & PCR, 2015). From the Sheldon Water Reservoirs, the recycled water pipeline would extend south and ends at Brookside Park. Additional phases for this project are anticipated through year 2028 with a total of 18.2 miles pipelines extending from the Phase I Project. The estimated demand for the Phase I Project is approximately 700 afy, while the total estimated potential demand by year 2028 is 3,100 afy.

One of the customers for the Phase II extension is the Pasadena's Glenarm Power Plant, located on Fair Oaks Avenue and West Glenarm Street, just 0.3 mile north of the border with the City of South Pasadena. To reach the Glenarm Power plant, approximately 3 miles of pipeline would be required from the Rose Bowl area, which will be the main customer in Phase I of Pasadena's planned recycled water program. Pending a purchase agreement with the Pasadena and the construction of Pasadena's own recycled water system, the City could potentially purchase recycled water from Pasadena and connect to Pasadena's recycled water system near the Glenarm Power Plant if this alignment would be constructed.

Alternatively, the City of Pasadena could construct a wastewater scalping plant to serve the Glenarm Power plant and additional nearby non-potable water customers, including the City of South Pasadena. It should be noted that both recycled water supply options from Pasadena are highly uncertain at this time but could materialize in the future.

7.1.2 Upper San Gabriel Valley MWD

The Upper District is the regional recycled water supplier that produces approximately 10,000 afy of recycled water from the Whittier Narrows Water Reclamation Plant (WNWRP) and approximately 67,000 afy from the San Jose Creek Water Reclamation Plant (SJCWRP). These facilities provide recycled water to customers for landscape irrigation within the Upper District's service area. The closest Upper District recycled water pipeline to the City is located in the Whittier Narrows area in the City of Rosemead, roughly 8 miles from the City's western boundary. If the City were to receive recycled water from the Upper District, it would likely need to be through a joint project with the cities of Alhambra, San Gabriel, and Rosemead in order to deliver more recycled water and distribute the cost of building such a long pipeline. A June 2008 Recycled Water Master Plan for the Upper District estimated that this option would cost the City approximately \$1,700 per af (MWH, 2008). Scaled up to 2020 costs, the cost to deliver recycled water from the Upper District to the City would be approximately \$2,200 per af.

In addition to non-potable recycled water, the Upper District is developing an indirect potable reuse program with the goal of replenishing the Main Basin. This program will provide up to 10,000 afy of treated recycled water from the SJCWRP for groundwater replenishment via spreading basins.

7.1.3 Central Basin MWD

The Central Basin MWD's recycled water system provides over 5,000 afy of recycled water to 300 industrial, landscape, and irrigation customers in southeast Los Angeles County. The recycled water for this system is produced at the San Jose Creek Water Reclamation Plant in Whittier and the Los Coyotes Water Reclamation Plant in Cerritos, both of which are owned and operated by the Sanitation Districts of Los Angeles County. The closest access point to this system for the City is a recycled water tank located at the northern edge of the City of Montebello, approximately 6.5 miles south of the City. If the City were to recycle recycled water from the Central Basin MWD, it would likely need to be through a joint project with the cities of Monterey Park and Alhambra in order to deliver more recycled water and distribute the cost of building the long pipeline. While a cost estimate and more detailed evaluation for this recycled water supply option has not been developed in the past, it can reasonably be assumed to be of similar cost to receiving water from the Upper District at approximately \$2,200 per af. It may be slightly cheaper since the pipeline from the Central Basin MWD's tank would be shorter than the pipeline from Whittier Narrows.

7.1.4 Potential Supply Considerations

These recycled water supply options available to the City have significant cost and uncertainty associated with them. Receiving recycled water from Pasadena would require Pasadena to first construct their own recycled water system to distribute recycled water and extend this system from the Rose Bowl area to the Glenarm Power Plant or the construction of a scalping plant that would produce recycled water for the Glenarm Power Plant.

Receiving recycled water from the Upper District would require the construction of a long, approximately 8-mile long pipeline, which would likely be cost-prohibitive at a cost of \$2,200 per af. Similarly, receiving recycled water from the Central Basin MWD would require the construction of an approximately 6.5-mile pipeline, which may also likely be cost-prohibitive. The locations of the LAGWRP, WNWRP, and SJCWRP as well as possible tie-in locations for the City at the Glenarm Power Plant and Central Basin MWD recycled water tank are shown in Figure 7.1.

7.2 Potential Recycled Water Customers

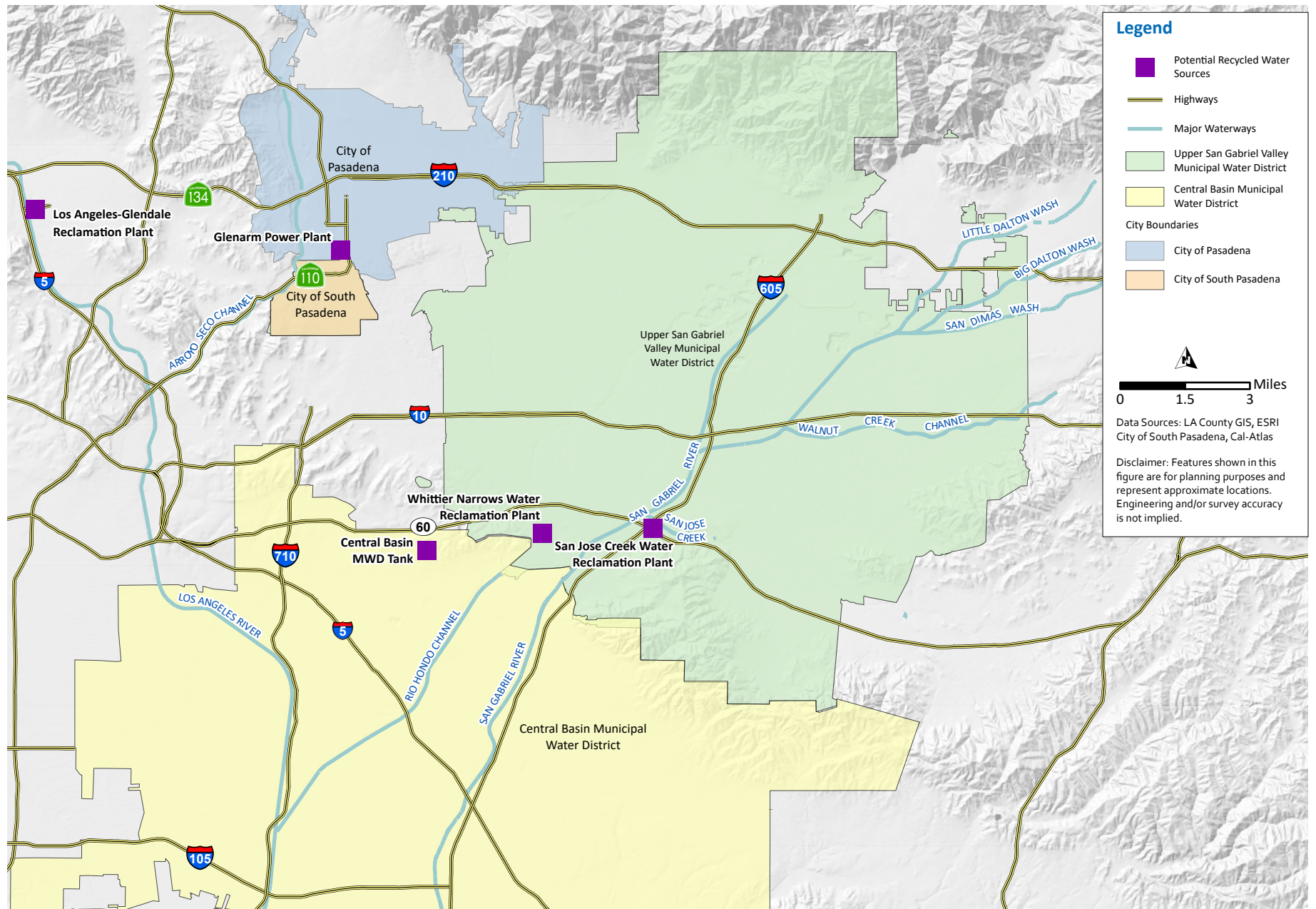
As described in Chapter 3 of this One Water 2050 Plan, a number of future potential recycled water customers have been identified and are listed in Table 7.1. These customers could potentially use non-potable recycled water for irrigation. Estimated recycled water demand is based on those customers' current potable water use and a recycled water use factor to estimate how much of that demand could be converted to recycled water. As indicated in the table, the Arroyo Seco Golf Course is the largest potential user within the City and makes up over half of the potential total recycled water demand of 176 afy. The locations of these potential recycled water customers are shown in Figure 7.2.

Table 7.1 Potential Recycled Water Customers and Total Estimated Recycled Water Demand

User	2015 -2016 Potable Use (afy)	Percent of Potable Use to be Converted to Recycled Water	Estimated Recycled Water Demand (afy)
Arroyo Seco Golf Course	117.4	95%	111.5
Caltrans along 110 -11	7.4	95%	7.0
Caltrans along 110 -21	6.7	95%	6.4
Caltrans along 110 -31	5.4	95%	5.2
Caltrans along 110 -41	4.3	95%	4.1
Arroyo Park North	8.6	95%	8.2
Arroyo Park South	8.6	95%	8.2
Garfield Park	8.3	95%	7.8
San Pascual Equestrian Center	8.1	95%	7.7
Marengo Elementary	5.9	50%	2.9
Metro MTA	3.8	95%	3.6
Arroyo Vista Elementary	2.4	50%	1.2
Eddie Park	0.8	95%	0.8
Orange Grove Park	0.6	95%	0.6
Library Park	0.2	50%	0.1
War Memorial Park	0.2	50%	0.1
Total	189	-	176

Note:

(1) Caltrans is separated into multiple potential users corresponding with different irrigation areas along Interstate 110.



Legend

- Potential Recycled Water Sources
- Highways
- Major Waterways
- Upper San Gabriel Valley Municipal Water District
- Central Basin Municipal Water District

City Boundaries

- City of Pasadena
- City of South Pasadena

0 1.5 3 Miles

Data Sources: LA County GIS, ESRI
City of South Pasadena, Cal-Atlas

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Figure 7.1 Potential Recycled Water Sources

-This Page Intentionally Left Blank-

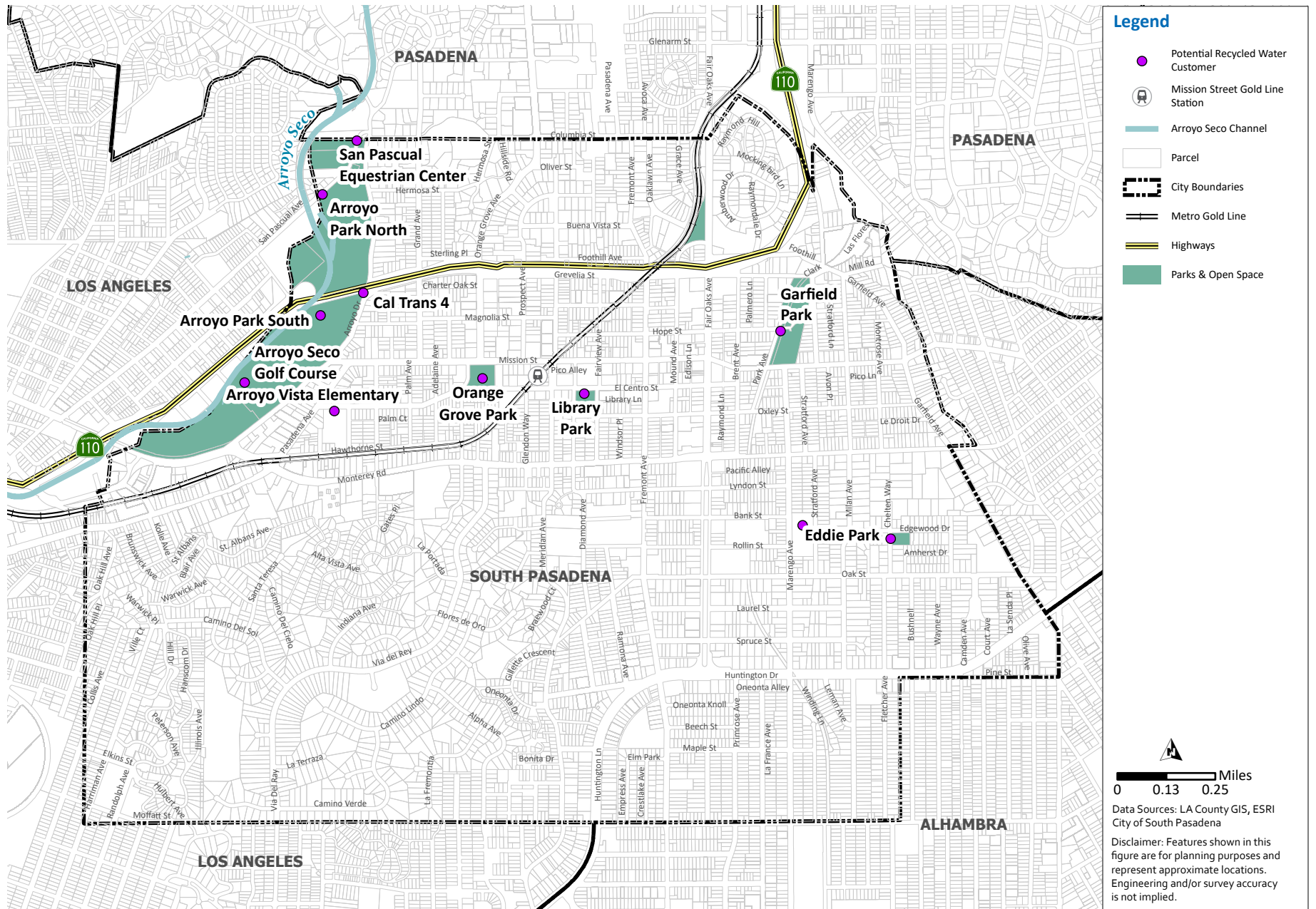


Figure 7.2 Potential Recycled Water Customers

-This Page Intentionally Left Blank-

7.3 Potential System Layout

To evaluate the feasibility of implementing a non-potable recycled water system in the City, several pipeline alignments were developed to serve recycled water to the potential recycled water customers shown in Table 7.1. These pipeline alignment options were developed with the objective of being as cost-effective as possible or serving the largest volume of recycled water with the shortest possible distribution system. Constructability was also considered by avoiding high traffic corridors such as Mission Street and Fair Oaks Avenue, where possible.

All recycled water pipeline options start with a connection to Pasadena's potential future recycled water system at the Glenarm Power Plant. However, if recycled water were to be provided by the Central Basin MWD instead of Pasadena or the Upper District, the connection would likely be at the southern end of the City instead. While the alignment options were created to serve as many potential recycled water customers as possible, none of the alignments include service to three of the four Caltrans irrigation areas, the Metro MTA irrigation area, or the War Memorial Park. These potential customers are located too far away from other potential customers or would require pipeline construction through either high traffic areas or require costly crossings of the 110 Freeway and were thus excluded from the potential alignment options.

Each recycled water pipeline option is described below and shown on Figure 7.3 through Figure 7.9. Additionally, Table 7.2 shows the customers served and the total estimated recycled water served for each alignment option.

- Option 1** – From the Glenarm Power Plant, the recycled water pipeline goes southeast to first serve Garfield Park via S Marengo Avenue, then serves Library Park, Orange Grove Park, and Arroyo Vista Elementary via El Centro Street. The pipeline then bifurcates to serve the Arroyo Seco Golf Course, Arroyo Park, the San Pascual Equestrian Center, and a Caltrans irrigation area. This option would consist of 3.8 mi of pipeline and serve an estimated 146 afy of recycled water to customers. The Option 1 alignment and the potential recycled water customers it serves are shown in Figure 7.3.
- Option 2** – This option follows the same alignment as Option 1, but also includes an additional pipeline that continues south from Garfield Park along Stafford Avenue to serve Marengo Elementary School and Eddie Park. This option would consist of 4.5 mi of pipeline and serve an estimated 149 afy of recycled water to customers. The Option 2 alignment and the potential recycled water customers it serves are shown in Figure 7.4.
- Option 3** – From the Glenarm Power Plant, the recycled water pipeline goes southwest to serve the San Pascual Equestrian Center, Arroyo Park, a Caltrans irrigation area, and the Arroyo Seco Golf course via Columbia Street, Hermosa Street, and Arroyo Drive. This option would consist of 2.4 mi of pipeline and serve an estimated 140 afy of recycled water to customers. The Option 3 alignment and the potential recycled water customers it serves are shown in Figure 7.5.
- Option 4** – The shortest pipeline option, this alignment goes southwest from the Glenarm Power Plant to serve the San Pascual Equestrian Center and the northern portion of Arroyo Park via Columbia Street and Hermosa Street. This option would consist of 1.6 mi of pipeline and serve an estimated 16 afy of recycled water to customers. The Option 4 alignment and the potential recycled water customers it serves are shown in Figure 7.6.

- Option 5** – From the Glenarm Power Plant, the recycled water pipeline bifurcates, and one pipeline goes southeast to serve Garfield Park via S Marengo Avenue and the other goes southwest to serve the San Pascual Equestrian Center, Arroyo Park, and the Arroyo Seco Golf Course via Columbia Street, Hermosa Street, and Arroyo Drive. This option would consist of 3.4 mi of pipeline and serve an estimated 148 afy of recycled water to customers. The Option 5 alignment and the potential recycled water customers it serves are shown in Figure 7.7.
- Option 6** – This option follows the same alignment as Option 5, but the pipeline to the east continues south past Garfield Park to also serve Marengo Elementary via Stafford Ave. This option would consist of 4.0 mi of pipeline and serve an estimated 152 afy of recycled water to customers. The Option 6 alignment and the potential recycled water customers it serves are shown in Figure 7.8.
- Option 7** – The most comprehensive option, Option 7 combines all of the above options to serve as many recycled water customers as possible. This option would consist of 5.9 miles of pipeline and serve an estimated 153 afy of recycled water to customers. The Option 6 alignment and the potential recycled water customers it serves are shown in Figure 7.9.

Table 7.2 Potential Recycled Water Users, Total Demand, and Pipeline Length by Alignment Option

User	Estimated Recycled Water Demand (afy)	Option						
		1	2	3	4	5	6	7
Arroyo Seco Golf Course	112	✓	✓	✓		✓	✓	✓
Caltrans along 110 -1	7.0							
Caltrans along 110 -2	6.4							
Caltrans along 110 -3	5.2							
Caltrans along 110 -4	4.1			✓		✓	✓	✓
Arroyo Park North	8.2	✓	✓	✓	✓	✓	✓	✓
Arroyo Park South	8.2	✓	✓	✓		✓	✓	✓
Garfield Park	7.8	✓	✓			✓	✓	✓
San Pascual Equestrian Center	7.7	✓	✓	✓	✓	✓	✓	✓
Marengo Elementary	2.9		✓				✓	✓
Metro MTA	3.6							
Arroyo Vista Elementary	1.2	✓	✓				✓	✓
Eddie Park	0.8		✓					✓
Orange Grove Park	0.6	✓	✓					✓
Library Park	0.1	✓	✓					✓
War Memorial Park	0.1							
Total Potential Recycled Water Demand (afy)	176	146	149	140	16	148	152	153
Total Pipeline Length (mi)	-	3.8	4.5	2.4	1.6	3.4	4.0	5.9

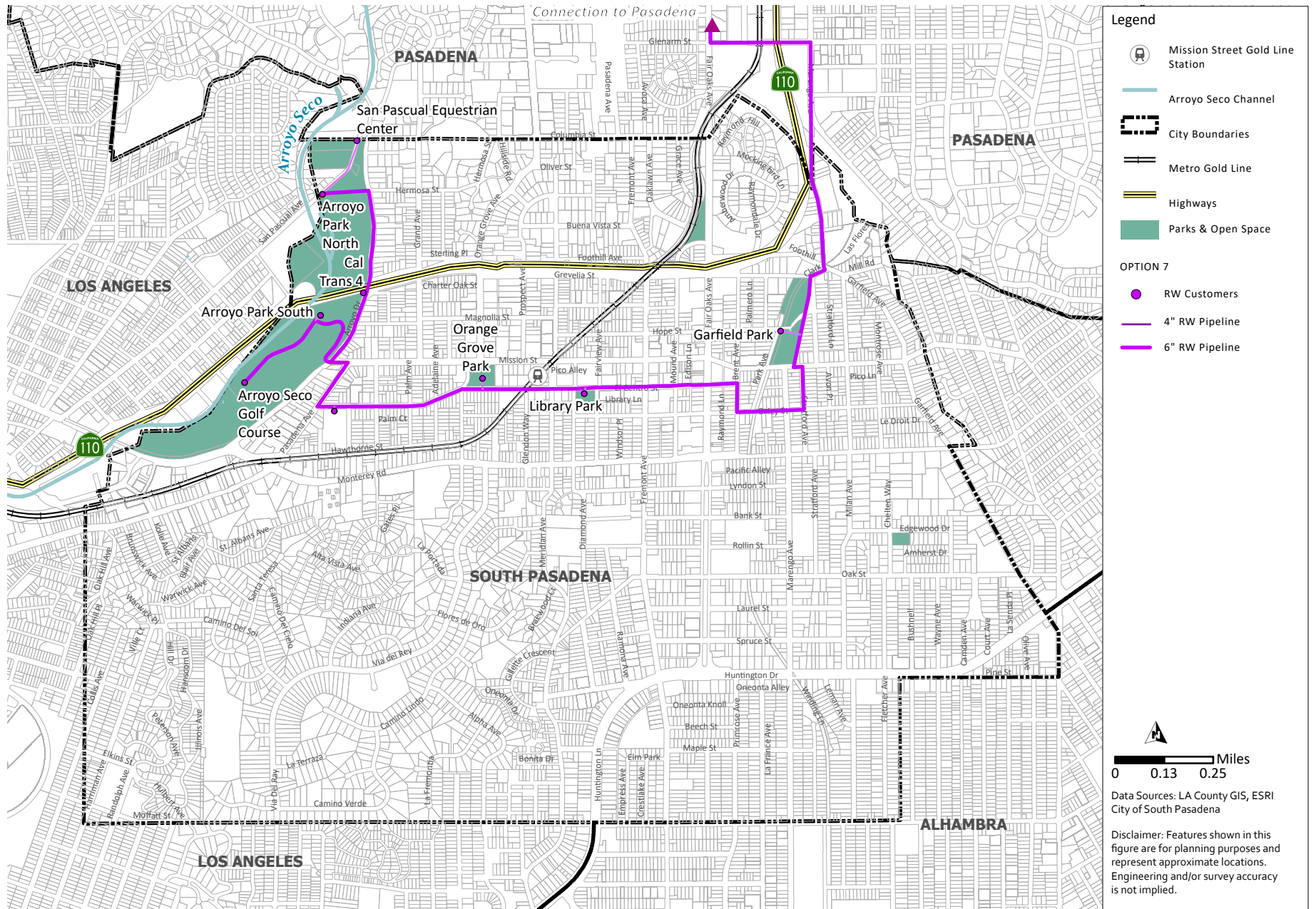


Figure 7.3 Proposed Recycled Water Alignment Option 1

-This Page Intentionally Left Blank-

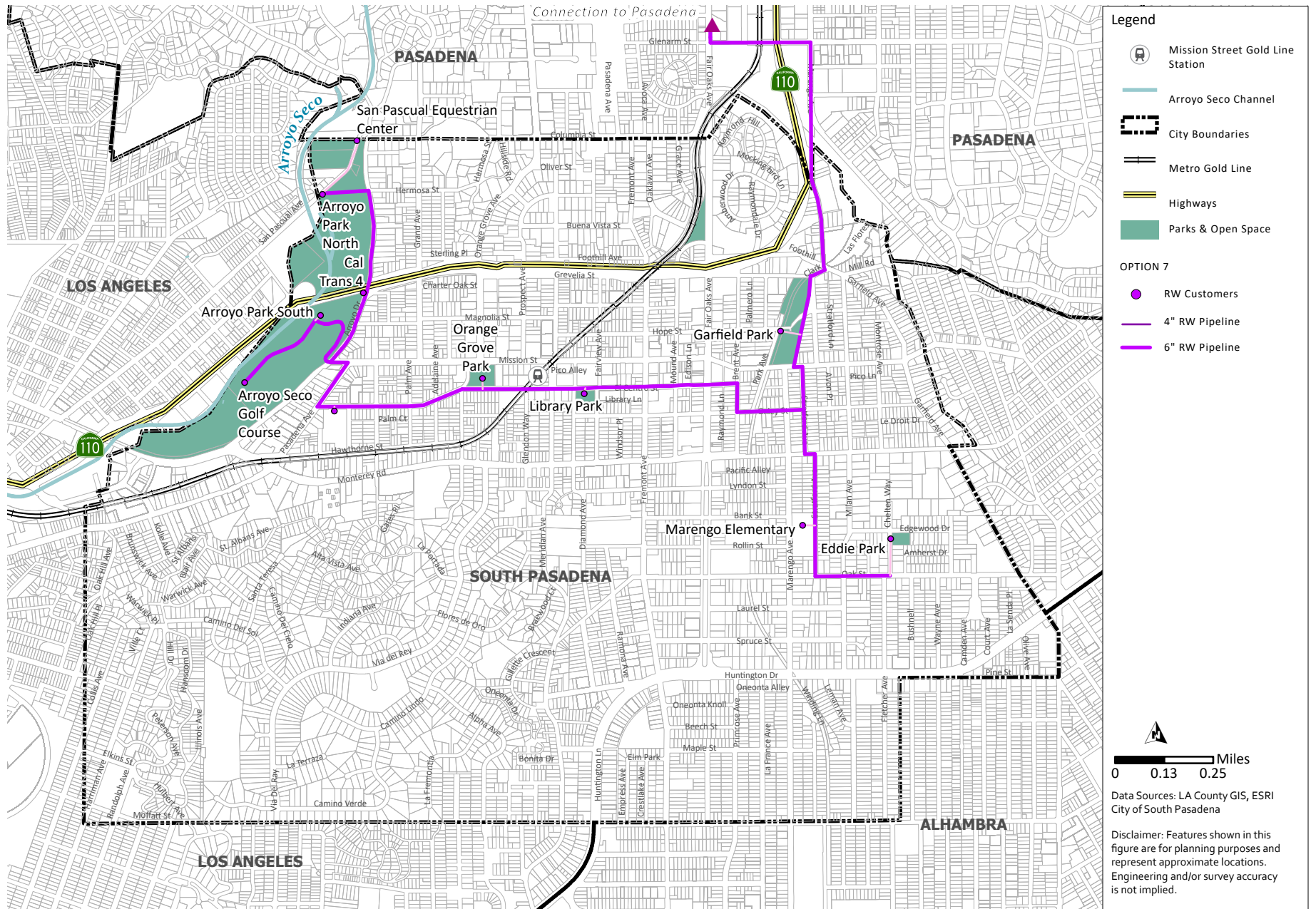


Figure 7.4 Proposed Recycled Water Alignment Option 2

-This Page Intentionally Left Blank-

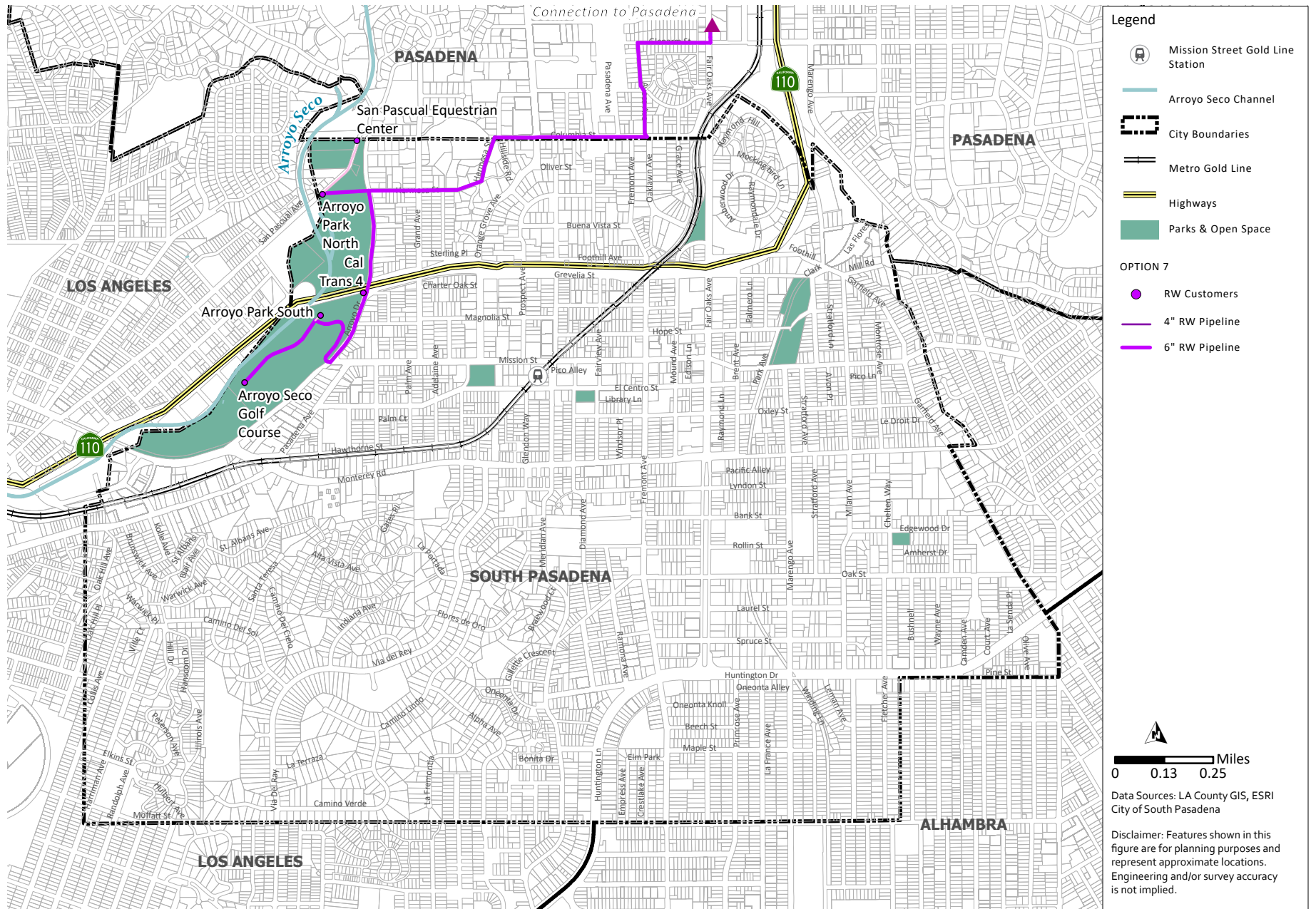


Figure 7.5 Proposed Recycled Water Alignment Option 3

-This Page Intentionally Left Blank-

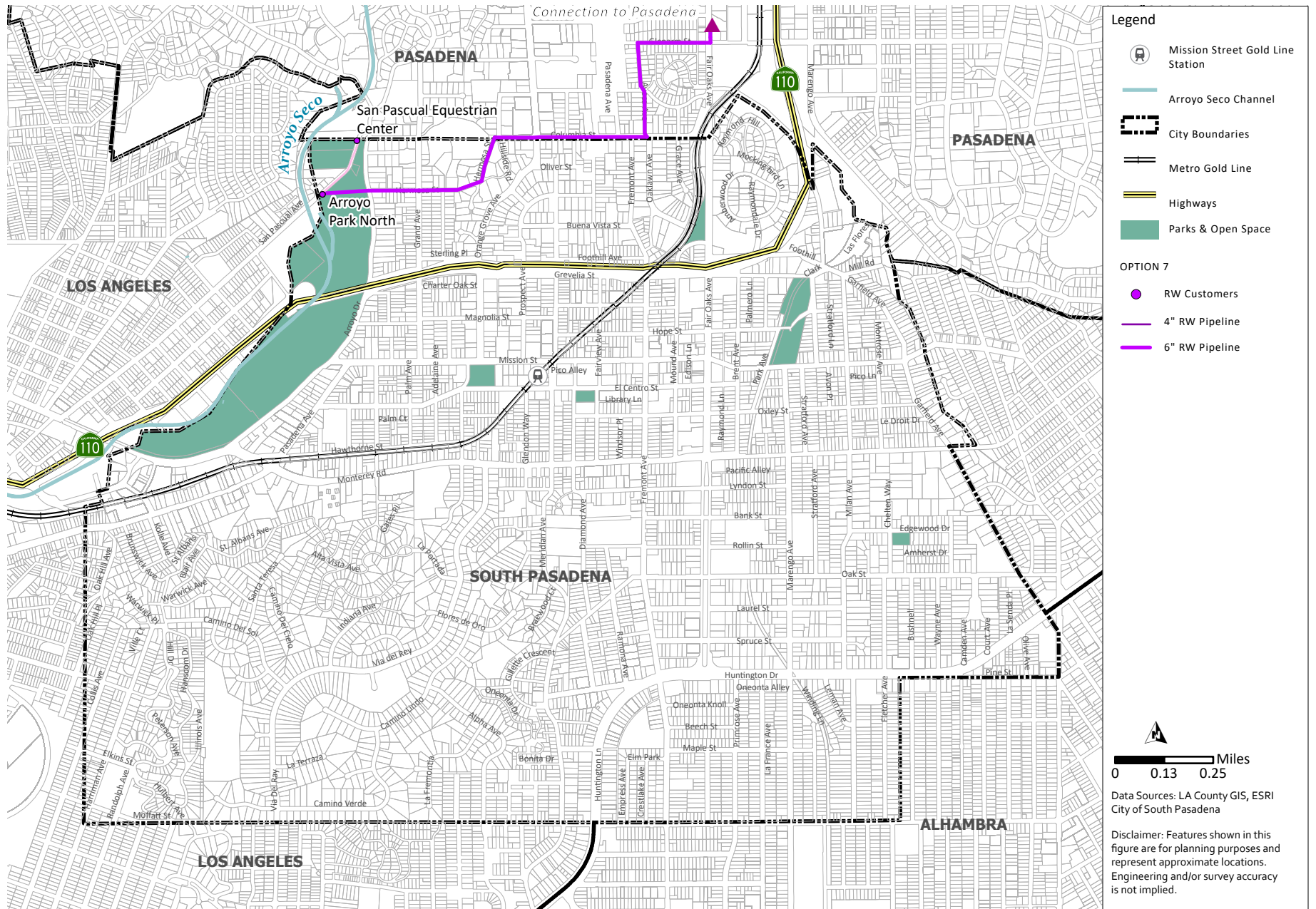


Figure 7.6 Proposed Recycled Water Alignment Option 4

-This Page Intentionally Left Blank-

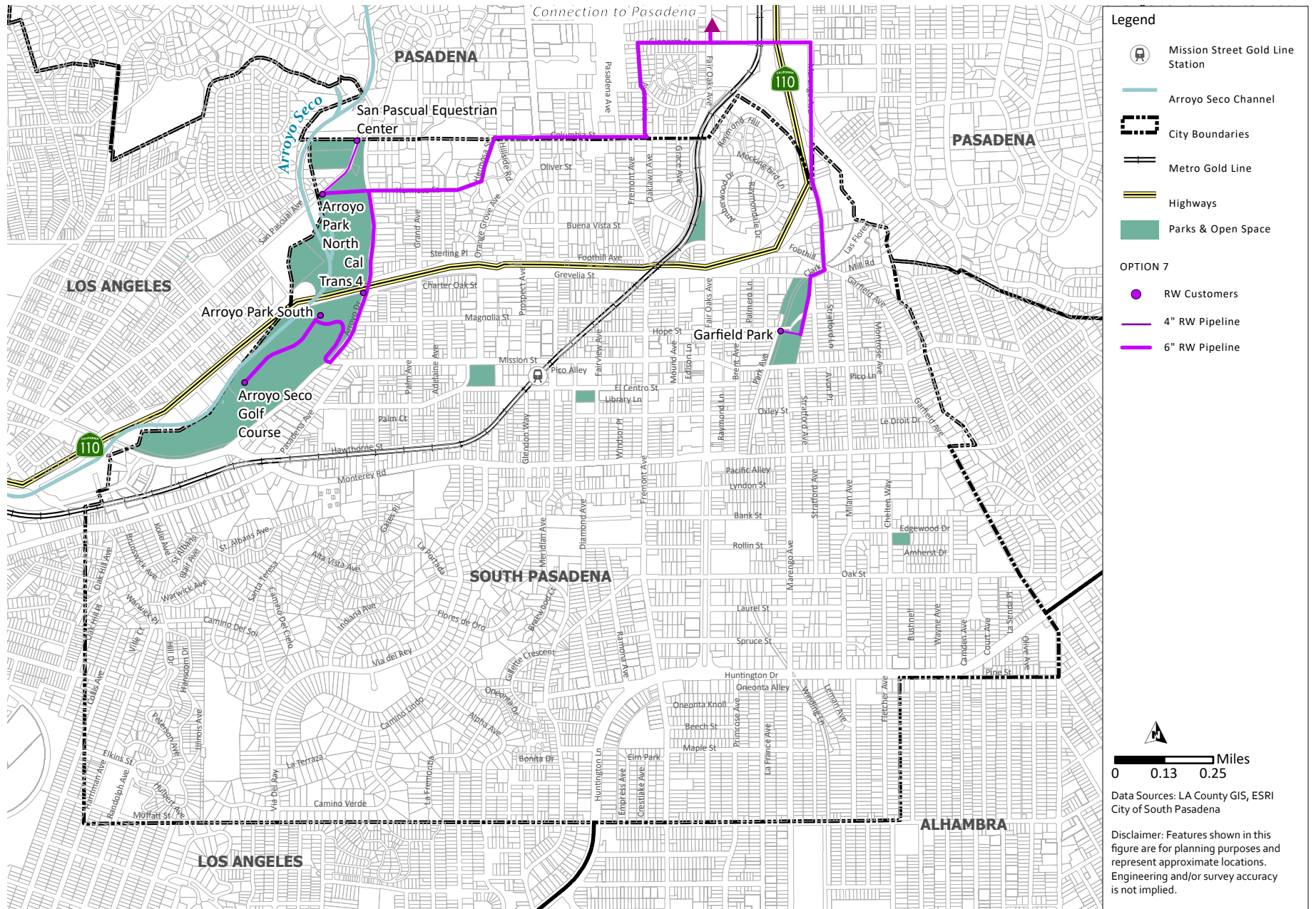


Figure 7.7 Proposed Recycled Water Alignment Option 5

-This Page Intentionally Left Blank-

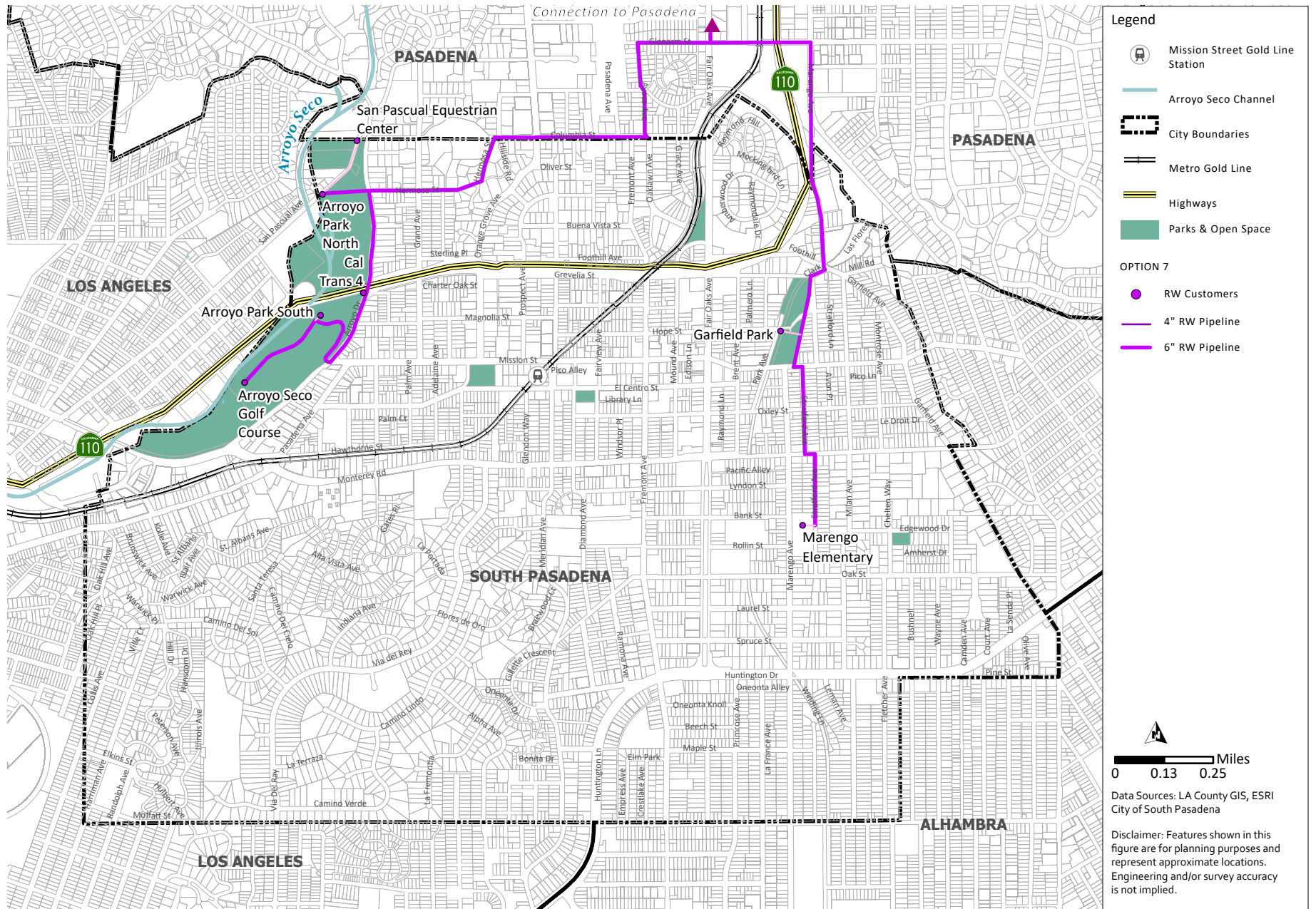


Figure 7.8 Proposed Recycled Water Alignment Option 6

-This Page Intentionally Left Blank-

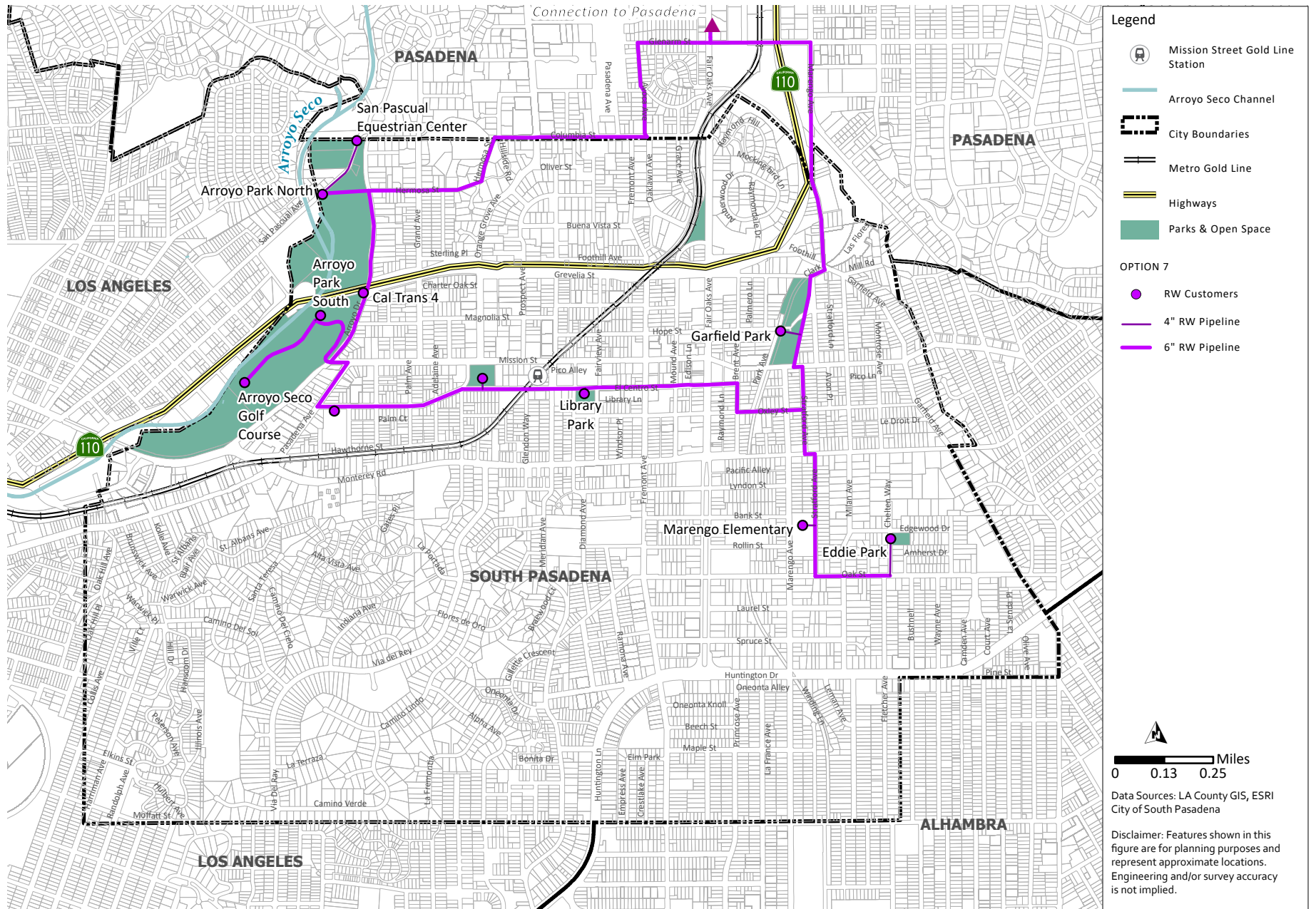


Figure 7.9 Proposed Recycled Water Alignment Option 7

-This Page Intentionally Left Blank-

7.4 Recycled Water Model

Each recycled water pipeline alignment option was modeled to determine the sizing of the recycled water pipelines. Additionally, the model was used to determine if there would be adequate delivery pressures at each of the potential customer locations. The hydraulic model results show that the pressures in the recycled water pipe network would range between 35 psi and 120 psi for all pipeline alignment options. The backbone pipelines in the recycled water system were sized using diameters of 6 inches, while some of the laterals serving single customers could be reduced 4-inch diameter pipes. Pipeline sizes are shown in Figures 7.3 through 7.9.

7.5 Feasibility Analysis

Based on the pipe length and sizing determined with the hydraulic model, planning-level construction and operations and maintenance (O&M) cost estimates were developed for each alignment option. These cost estimates were then used to develop unit costs to compare the cost-effectiveness of the options against each other and against other water sources.

7.5.1 Cost Estimating Assumptions

The recycled water alignments are comprised of 4 inch and 6 inch diameter pipes. The assumed unit costs of these pipes as well additional costs associated with freeway crossings are included in Table 7.3 and construction cost markup assumptions are listed in Table 7.4. The O&M cost included in this analysis is the cost of recycled water from Pasadena, which is assumed to be \$1,000 per af for the purposes of this economic evaluation.

Table 7.3 Construction Unit Cost Assumptions

Component	Unit Cost (\$/lf)
4 in Pipeline	\$128
6 in Pipeline	\$168
Freeway Crossing	\$192

Note:

(1) These cost assumptions do not match what is presented in the Capital Improvement Program in Chapter 10. These were developed at an earlier time in the project and are useful for comparison purposes.

Table 7.4 Construction Cost Markup Assumptions

Markup	Percentage
Contingency	30%
Engineering	10%
Construction Management	10%
Environmental & Legal	8%
Total Mark-up Coefficient	1.66

7.5.2 Pipeline Alignment Cost Estimates

The total and unit cost expressed in \$/af for each recycled water pipeline alignment option was calculated using the cost estimate assumptions listed above and the pipe sizing information from the hydraulic model. Construction costs were amortized over 50 years using a discount rate of 3 percent. The estimated total and unit cost estimate for each alignment option is summarized in Table 7.5.

Table 7.5 Alignment Option Unit Costs

Alignment Option	Demand (afy)	Capital Cost (\$M)	Recycled Water Purchase and Other O&M Cost \$1000/af (\$/Year)	50 Year Amortized Annual Cost (3%) (\$/Year)	Unit Cost (\$/af)
1	145	\$6.31	\$146,000	\$240,000	\$2,654
2	149	\$6.57	\$150,000	\$250,000	\$2,681
3	140	\$3.47	\$140,000	\$130,000	\$1,932
4	16	\$2.22	\$16,000	\$80,000	\$6,019
5	148	\$4.96	\$148,000	\$190,000	\$2,290
6	152	\$5.79	\$152,000	\$220,000	\$2,451
7	153	\$8.56	\$154,000	\$330,000	\$3,158

As shown in Table 7.5, Alignment Option 3 is the most cost-effective option at approximately \$1,900 per af. Most other options range from \$2,300 per af to \$3,200 per af, with Alignment Option 4 being significantly more expensive than the others at \$6,000 per af. This option is the most expensive as it is the only option that does not serve Arroyo Seco Golf Course, the largest customer considered in this analysis, and thus has far less potential demand than the other options.

It should be noted that the recycled water alignment option unit costs listed above are highly sensitive to the cost of purchasing recycled water from Pasadena. If Pasadena builds their recycled water system and is able to provide water to the City, then this analysis should be updated to reflect that cost of water and may yield different results.

7.6 Summary of Recommendations

Based on the analysis described above, alignment Option 3 would be the most cost effective and efficient recycled water alternative. This alignment would serve recycled water to some of the largest potential recycled water customers in the City, including the San Pascual Equestrian Center, Arroyo Park, a Caltrans irrigation area, and the Arroyo Seco Golf course, with a total pipeline length from the Glenarm Power Plant of approximately 2.4 mi. However, at \$1,932 per af, using recycled water is more costly than the City's groundwater supply, which costs roughly \$315 per af¹. Depending on the purchase cost of recycled water from Pasadena, this option may also be more expensive than the purchase of imported water from MWD at \$1,268 (Tier 2 plus Upper District fee, see Chapter 5 for details).

¹ Cost based on FY2019/2020 groundwater pumping volume and costs. Groundwater unit cost varies from year to year, largely based on the volume of water pumped beyond the City's groundwater rights since the cost of replenishment water is significantly higher than the cost of groundwater.

Besides cost considerations, the key constraint for implementing Option 3 is the uncertainty associated with the recycled water system implementation by the City of Pasadena. Both the uncertainty around timing and point of connection makes it difficult for the City of South Pasadena to plan for and implement a recycled water system. If Pasadena were to implement their planned recycled water program, Option 3 is the most cost-effective alternative for serving recycled water in the City, especially if alternative water supplies were to become more expensive or less reliable.

-This Page Intentionally Left Blank-