Technical Memorandum

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Project: Diablo Canyon Power Plant Desalination Hydraulic Feasibility Analysis

SUBJECT: FINAL DRAFT – DCPP DESALINATION PIPELINE FEASIBILITY STUDY

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1. Executive Summary

This memorandum summarizes the hydraulic feasibility and planning-level cost estimates for delivering desalinated water from the Diablo Canyon Power Plant near Avila Beach, California, to the current Zone 3 customers along the Lopez Pipeline. Three flow scenarios were evaluated utilizing hydraulic modeling to identify potential pressure and capacity pipeline upgrade requirements. It was found that under all three scenarios, sections of the current Lopez pipeline would need to be upgraded for pressure class, and under two scenarios sections of the current Lopez pipeline would need to be upgraded for capacity. The capital costs identified for infrastructure required to deliver the water from the Diablo Canyon Power Plant (DCPP) to the connection on the Lopez pipeline and for upgrades to the existing Lopez pipeline ranged from $21,735,000 to $36,368,000. The associated unit costs for the water, including delivery infrastructure and operations and maintenance, ranged from $1,800/acre-foot (AF) to $3,100/AF. This excludes the cost to desalinate the water at the treatment plant. It is concluded that the project could be both technically and potentially economically feasible, depending on the desalination costs (which are to be provided separately). Based on these findings, the recommendation is to proceed with the evaluation of the project and to further identify opportunities to reduce pipeline and conveyance infrastructure costs as the project progresses.

2. Purpose

The DCCP Desalination Pipeline Feasibility Study TM was prepared by Water Systems Consulting, Inc. (WSC) on behalf of the County of San Luis Obispo (County), and provides an analysis of the feasibility of utilizing the Lopez Pipeline to deliver water from Pacific Gas and Electric (PG&E) Company's Diablo Canyon Power Plant (DCPP) Desalination Facility to the residents of southern San Luis Obispo County.

This memorandum includes the following sections: Executive Summary, Purpose, Background, Scenario Evaluation, Modeling Results, Cost Estimates, Conclusions, and Recommendations.

3. Background

To evaluate the feasibility of using the Lopez Pipeline to deliver water from the Desalination Facility, WSC prepared a GIS-based hydraulic model using Bentley WaterGEMS® software. The model included the Lopez Water Treatment Plant Terminal Reservoir, the existing Lopez Pipeline and approximately seven (7) miles of new pipeline to connect to the Desalination Facility. This new pipeline would deliver desalinated water (seawater treated at the DCPP by filtration, ultraviolet exposure, and reverse osmosis (RO)) to the Lopez Pipeline, shown with pipe diameters and turnouts in Figure 1 on page 3. The model includes Zone 3 turnouts along the Lopez Pipeline, which were assigned demands based on historical Zone 3 demand data and other relevant data (Appendix I, Tables 5 and 6). The Desalination Facility currently treats water used internally at the DCPP. PG&E has indicated that there is the option of increasing the capacity of the Desalination Facility to deliver either 500 acre-feet per year (AFY) or 1300 AFY to the Lopez Pipeline.

The road from the DCPP to Avila Beach Drive climbs an approximate 406 ft hill before dropping into the Port San Luis area. This hill provides a significant obstacle to delivering water to the Lopez Pipeline, as seen in Figure 2 on page 4. As described in Scenario Evaluation in the next section, the hydraulic grade line (HGL) chosen at the top of the hill was significant in determining pressures and velocities in the system as a whole and pumping requirements. Minimum pumping occurs when the HGL is set to nearly the ground elevation at the top of the hill.

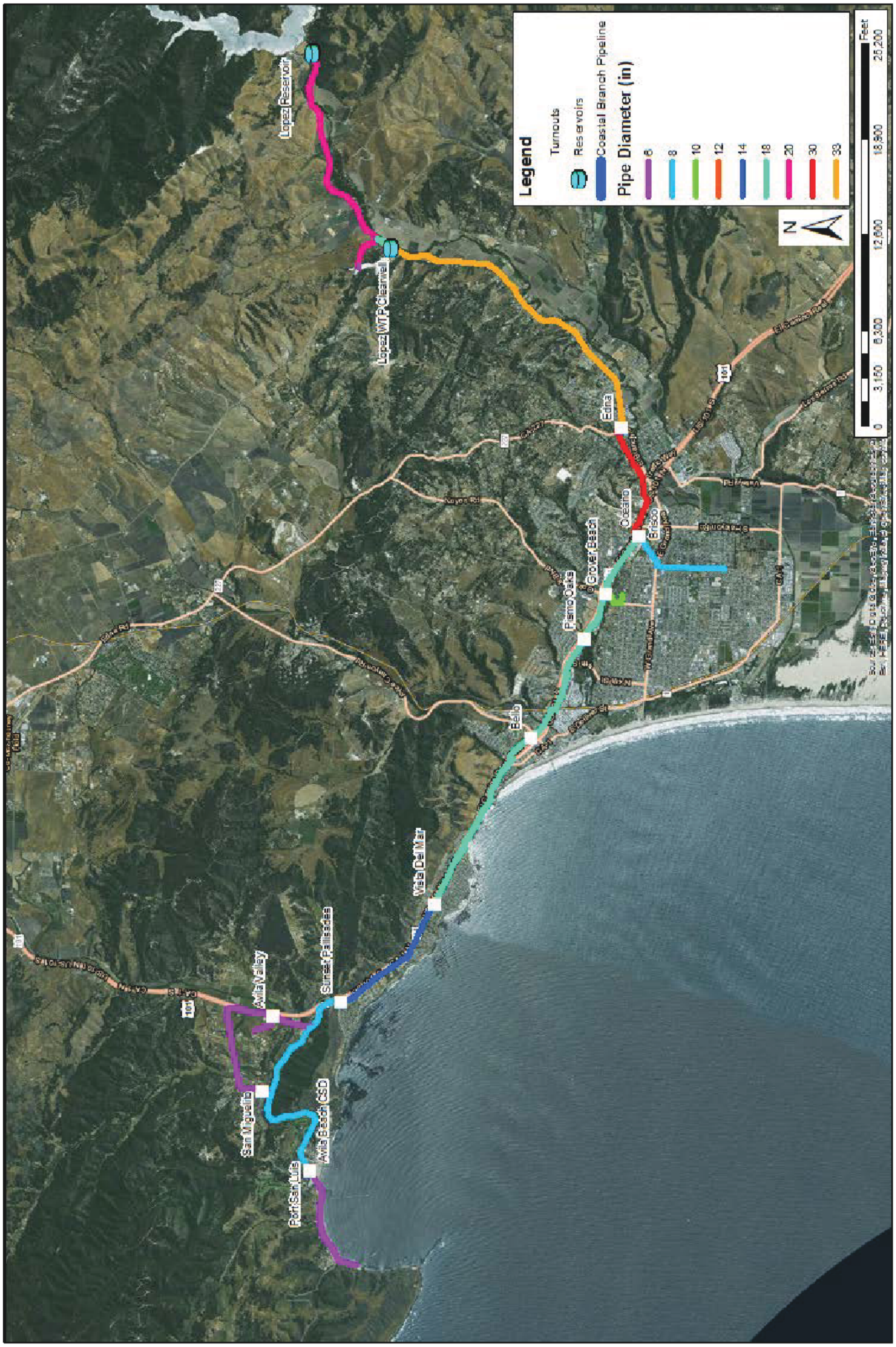

Figure 1. Lopez Pipeline with Turnouts and Current Pipe Diameters

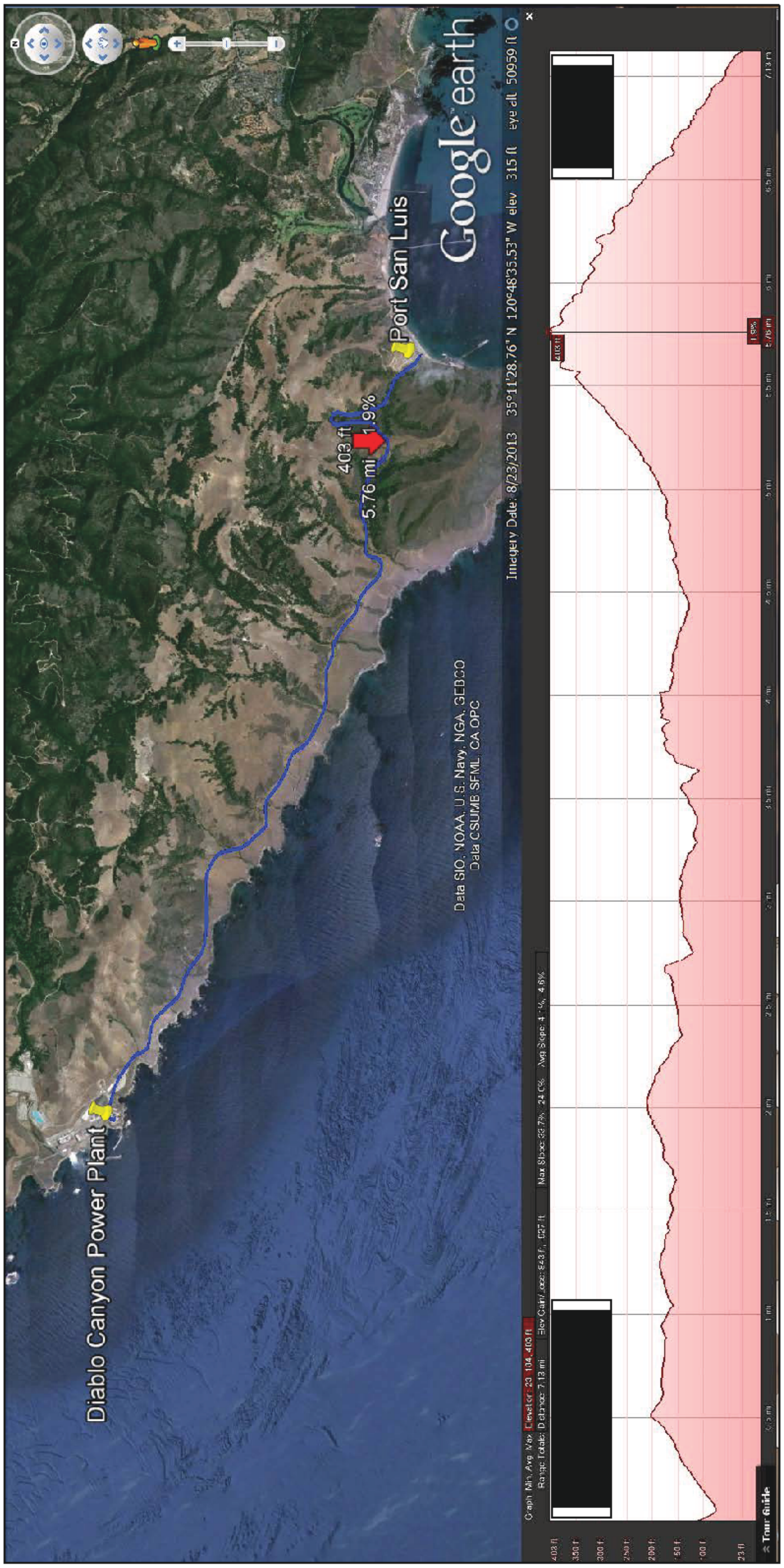

Figure 2. Diablo Canyon Road and Elevation Profile

4. Scenario Evaluation

To evaluate the feasibility of connecting the Desalination Facility to the Lopez Pipeline, three different scenarios were analyzed to provide a rough estimate of the potential hydraulic requirements and project costs. The three scenarios that were evaluated in this analysis are outlined below (with the associated hydraulic profiles in Appendix II, Figures 3 to 5):

> ***Scenario 1:*** 500 AFY discharge from the DCPP, with a 10" diameter DCPP pipeline and the HGL set to 410 ft at the top of the hill to limit pumping costs.
>
> ***Scenario 2A:*** 1300 AFY discharge from the DCPP, with a 10" DCPP pipeline and the smallest necessary diameter pipes chosen for minimal capacity upgrades. The HGL was allowed to go higher than the hill elevation, which results in higher pressures in the existing Lopez line and more pressure upgrades are necessary.
>
> ***Scenario 2B:*** 1300 AFY discharge from the DCPP, with a 12" section and a 10" section of DCPP pipeline and the HGL set to 410 ft at the top of the hill to limit pumping costs. This decreases the pressures in the existing Lopez line, but requires larger diameter pipes for capacity upgrades.

Key Assumptions

The following key assumptions were included in the development of the scenarios outlined above.

Desalination Pipeline – It was assumed that the pipeline connecting the Desalination Facility to the Lopez Pipeline would follow Diablo Canyon Road from the DCPP RO treatment facility to connect near the intersection with Avila Beach Drive. The total length of this pipeline is 7.13 miles (37,666 ft), with the highest elevation along the road cresting at approximately 406 ft.

Production Rate – Another key assumption, provided by PG&E, was that the plant would be producing and delivering desalinated water for 95% of the time per year, also known as a 95% "up time". This results in a slightly increased gallon per minute (gpm) discharge rate from the facility to achieve the 500 or 1300 AFY values, while accounting for 5% down time.

Pipeline Pressure – It was assumed that any of the existing sections of the Lopez Pipeline that could possibly experience a pressure greater than 125 pounds per square inch (psi) would require pressure class upgrades. The assumption of 125 psi was based on previous analysis of the Lopez Pipeline pressure class (1) and review of the ASTM asbestos-cement pipeline standard (2). Each scenario was evaluated under high, low, and no turnout demands to evaluate potential exceedances of the pressure criteria. Evaluation of each of the demand alternatives determined that the highest pressures in the existing Lopez Pipeline were observed under no turnout demands. There may be potential opportunities for operational safeguards (e.g. redundant pressure reducing valves, automatic isolation valves, etc.) to reduce the need for some of the upgrades for pipeline pressure class.

In order to identify the sections of pipe that would exceed the pipeline pressure criteria of 125 psi, the three scenarios were modeled for low demand, and then run under no demand to highlight the additional pipe that would need upgrading for pressure class. This ensures that under no demand the pipeline could withstand pressures greater than 125 psi, while being suitable for delivering the 500 AFY or 1300 AFY under low demand operation. Tables 1, 2, and 3 on the following pages outline the percent of the no demand upgrades that would be required for low demand delivery. Low demand was chosen for this analysis, as opposed to high demand, because under low demand condition, more pressure would be required to deliver the target flow rate. A system designed to deliver flow and withstand pressures under a low demand scenario would see lower pressures under high demands, and therefore is adequate for a high demand scenario.

5. Modeling Results

Each of the three scenarios outlined were evaluated using the hydraulic model to evaluate the feasibility of connecting the Desalination Facility to the Lopez Pipeline. Through this process, it was determined which pipes, if any, would need upgrading for either pressure class, capacity, or both. The results are summarized in Tables 1 to 3.

It should be noted that Scenario 1, Scenario 2A, and Scenario 2B are intended to represent conceptual hydraulic scenarios and are not necessarily an optimized evaluation of the lowest life cycle cost alternative. It is recommended that further pipeline optimization be performed as the project progresses.

Table 1. Scenario 1 Results

	Value	Length of Pipe	% Upgrades Required for Low Demand
DCPP Discharge Rate	500 AFY 326 gpm[1]	-	-
Resulting Lopez Discharge Rate	2,621 gpm	-	-
DCPP Pipe – New Pipe	10"	37,666'	100%
Pressure Class Upgrades – Existing Pipe	6"	12,363'	69%
	8"	15,435'	57%
	18.3"	3,356'	71%
Capacity Upgrades – Existing Pipe	-	-	-
TOTAL	-	**68,820'**	**63%**
DCPP Head	440'	-	-
Top-of-Hill Head	410'	-	-

[1]This is not a direct conversion from AFY to gpm due to the 95% up time assumption used in the model.

Scenario 1 requires upgrades for pressure class only. This means that the identified pipes would experience pressures greater than 125 psi if no demands were on the system, and most of these lengths of pipe would also experience pressures greater than 125 psi under low demands, as seen by the % upgrades required for low demand.

Table 2. Scenario 2A Results

	Value	Length of Pipe	% Upgrades Required for Low Demand
DCPP Discharge Rate	1300 AFY 848 gpm[2]	-	-
Resulting Lopez Discharge Rate	2,099 gpm	-	-
DCPP Pipe – New Pipe	10”	37,666’	100%
Pressure Class Upgrades – Existing Pipe	6”	13,060’	100%
	8”	15,436’	100%
	18.3”	3,356’	100%
Capacity Upgrades – Existing Pipe	8” (up from 6”)	7,857’	100%
TOTAL	-	**77,375’**	**100%**
DCPP Head	760’	-	-
Top-of-Hill Head	620’	-	-

[2]This is not a direct conversion from AFY to gpm due to the 95% up time assumption used in the model.

Scenario 2A included both pressure class and capacity upgrades. The HGL values are higher than in Scenario 1 due to the higher discharge rate. The majority of upgrades in this scenario are for pressure.

Table 3. Scenario 2B Results

	Value	Length of Pipe	% Upgrades Required for Low Demand
DCPP Discharge Rate	1300 AFY 848 gpm[3]	-	-
Resulting Lopez Discharge Rate	2,099 gpm	-	-
DCPP Pipe – New Pipe	10”	7,346’	100%
	12”	30,320’	100%
Pressure Class Upgrades – Existing Pipe	6”	8,555’	100%
	18.3”	3,356’	100%
Capacity Upgrades – Existing Pipe	12” (up from 6” & 8”)	27,798’	100%
TOTAL	-	**77,375’**	**100%**
DCPP Head	470’	-	-
Top-of-Hill Head	410’	-	-

[3]This is not a direct conversion from AFY to gpm due to the 95% up time assumption used in the model.

Scenario 2B decreased pumping costs from Scenario 2A by setting the HGL to 410 ft at the top of the hill. This resulted in 12” diameter pipe for the first half of the 7 mile pipe from the DCPP to the hill, and a 10” pipe from the top of the hill to the Lopez Pipeline. Both pressure class and capacity upgrades are necessary under this scenario. Note that the total lengths of pipe that require upgrades for Scenarios 2A and 2B are equal, but differ in the amount for pressure upgrades, capacity upgrades, and size of pipe diameters.

6. Cost Estimates

To aid in evaluating the feasibility of connecting the Desalination Facility to the Lopez Pipeline, preliminary cost estimates of the three proposed alternatives were developed. These cost estimates included the following elements, and the key assumptions described in the next section:

- Pipes, including fittings, etc. and installation
- Pump stations
- Pipeline maintenance
- Pump station maintenance
- Pumping electricity
- Post-reverse osmosis (post-RO) chemical addition capital and operation
- Staffing needs
- Construction contingency, unaccounted for costs, and implementation costs

Key Assumptions

The following key assumptions were included in the development of the above outlined scenarios. (Appendix III, Tables 7 to 10 also include detailed cost assumptions).

Pipeline Pressure – It was assumed that all new pipes installed would be able to withstand the maximum pressures for each respective scenario. It was assumed that Class 50 ductile iron pipes could withstand a working pressure of 350 psi (3).

> ***Scenario 1:*** For 10", 8", and 6" pipe, class 150 PVC with a 10% increase in $/LF was used for higher pressure class PVC upgrades. Class 50 ductile iron was used for the 18.3" pipe upgrades.
>
> ***Scenario 2A:*** Class 50 ductile iron was used for the 18.3", 10", 8", and 6" pipe upgrades.
>
> ***Scenario 2B:*** For 10" and 6" pipe, class 150 PVC with a 10% increase in $/LF was used for higher pressure class PVC upgrades. Class 50 ductile iron was used for the 12" and 18.3" pipe upgrades.

Pumping Costs – Pump station costs were estimated based on a cost curve developed from a reference cost curve (4) (adjusted for inflation) and other recent relevant projects. Pumping electricity was based on 95% up time and the flow rate at the DCPP converted to KW-hr/yr. A $0.14/KW-hr factor was assumed. Both pipe maintenance and pump station maintenance costs were calculated as a percentage of capital costs, 1% and 5% respectively.

Treatment – It was assumed that PG&E would deliver the desalinated water to the County at a price yet to be determined. Costs for PG&E's desalination treatment and delivery of the water were not included in this analysis. However, costs for post-RO capital (chemical feed pump, tank, and control system) and O&M costs for disinfection (chlorine) and re-mineralization (calcium carbonate) were included in the costs estimates (5).

Results

Using the assumptions and analysis described previously, the cost per acre-foot ($/AF) of water has been estimated for the three scenarios, summarized in Table 4 on the next page (with additional detail in Appendix IV, Tables 11 to 13).

Table 4. Cost Estimating Results

Scenario	Capital Cost	Annual O&M Cost	Cost of Water ($/AF)[4]
Scenario 1	$21,735,000	$281,000	**$3,100**
Scenario 2A	$29,856,000	$591,000	**$1,800[5]**
Scenario 2B	$36,368,000	$556,000	**$2,100[5]**

[4]These cost estimates do not include desalination costs that may be charged by PG&E, which will likely significantly increase the unit cost of the water.
[5]There is the potential that the Disadvantaged Community (DAC) status of some of the member agencies could allow for Drinking Water State Revolving Fund financing over a 30-year term, reducing the annual financing cost by approximately $400/AF for Scenarios 2A and 2B.

Discussion

There is a potential opportunity for optimization of pumping costs vs. pipe size/construction costs in future phases. For less capacity upgrades with 1300 AFY discharge, the water must be pumped to a higher head to ensure delivery to the Zone 3 Agencies. This decreases pipe costs by using smaller pipes, but increases electricity pumping costs in order to push the water through the smaller pipes. With increased pipe sizes, the pipeline installation costs increase and could potentially lead to additional construction costs. However, this requires less pumping energy, therefore decreasing the associated pump O&M cost.

There is also an opportunity in future phases to select a different pipeline layout and optimize for distance, elevation, pumping costs, pipe diameter, and possible storage.

7. Conclusions

It can be concluded that connecting the DCPP to the Lopez Pipeline in order to deliver desalinated drinking water to the Zone 3 agencies is technically feasible. While significant portions of the existing Lopez Pipeline will need to be upgraded to withstand higher pressures and/or allow for additional capacity, it is possible to deliver DCPP desalinated water to the Zone 3 member agencies through the a connection near Port San Luis.

The project is also potentially economically feasible, based on the engineering cost analysis over a 20-year loan term (6). Depending on PG&E's costs for delivery of desalinated water, the estimated $/AF may be comparable with other imported or desalinated water projects.

8. Recommendations

Our recommendations for next steps are to continue collaboration with PG&E to better define the desalination costs and to further optimize the conveyance infrastructure through additional evaluation of pipeline diameter, pumping requirements, pressure class upgrade requirements, and pipeline layout. Such potential optimization could include installing pressure reducing valves to reduce the amount of pressure upgrades, tunneling under the hill to reduce overall pressures in the system and reduce pumping requirements, and/or finding an optimum flow rate between 500 AFY and 1,300 AFY to minimize the $/AF cost of the water.

9. Works Cited

1. **Navigant Consulting, Inc.** *Lopez Water Distribution System Capacity Evaluation - Revised Supplement to Final Report.* 1999.

2. **ASTM International.** *Standard Specification for Asbestos-Cement Pressure Pipe.* West Conshohocken : ASTM International, 2015. C296/C296M.

3. **American Water Works Association.** *Ductile-Iron Pipe and Fittings.* Denver : AWWA, 2009. Manual of Water Supply Practices M41 Third Edition.

4. **Jones, Garr M., et al., [ed.].** *Pumping Station Design.* 3rd Edition. Burlington : Butterworth-Heinemann, 2008. pp. Figure 29-7.

5. ***Cost of Water Analysis for the City of Morro Bay.*** 2009.

6. **Drinking Water State Revolving Fund Program (DWSRF) Basics.** *California Environmental Protection Agency State Water Resources Control Board.* [Online] State of CA, November 17, 2015. [Cited: March 2, 2016.] http://www.waterboards.ca.gov/drinking_water/services/funding/dwsrf_basics.shtml.

10. Appendix I: Modeling Assumptions

- Maximum velocity constraint: 7 ft/s
- Existing Class 150 Asbestos Cement Pipe working pressure: 125 psi

Table 5. Historical Demands on the Lopez Pipeline

Zone 3 Agency Turnout	Historical Low Demand Value (AFY)	Historical Low Demand Value (gpm)	Averaging Period
City of Arroyo Grande	144.91	1,078.06	5-yr February average
Oceano CSD	51.47	382.91	4-yr December average
City of Grover Beach	62.40	464.23	4-yr December average
City of Pismo Beach	123.51	918.86	5-yr February average
CSA 12	10.32	76.78	4-yr February average
San Miguelito MWC	3.64	27.08	3-yr November average

Table 6. Demands Incorporated into the Hydraulic Model

Zone 3 Agency Turnout	Model Low Demand Value (gpm)	% of Historical Demand
Edna	539.03	50% of Arroyo Grande demand
Brisco	539.03	50% of Arroyo Grande demand
Oceano CSD	382.91	NA
City of Grover Beach	464.23	NA
Pismo Oaks	108.10	12% of Pismo Beach demand
Bello	324.30	35% of Pismo Beach demand
Vista del Mar	324.30	35% of Pismo Beach demand
Sunset Palisades	162.15	18% of Pismo Beach demand
Avila Valley	25.34	33% of CSA 12 demand
San Miguelito MWC	27.08	NA
Avila Beach CSD	25.34	33% of CSA 12 demand
Port San Luis	25.34	33% of CSA 12 demand

11. Appendix II: Low Demand HGL Profiles[6]

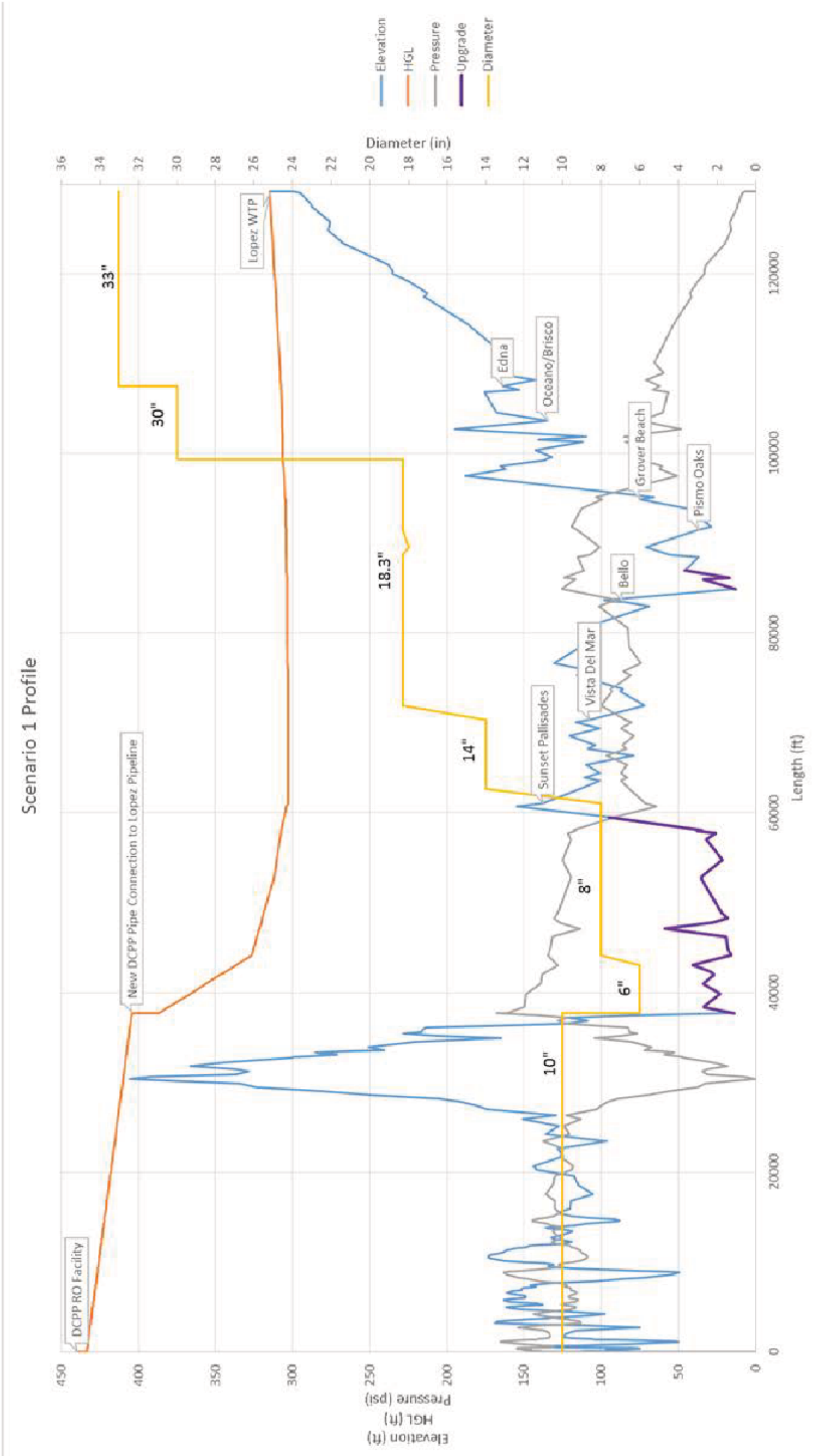

Figure 3. Scenario 1 Profile

[6]These profiles do not include the San Miguelito/Avila Valley loop of 6" pipe. Therefore, the upgrades highlighted in Figures 3 through 5 do not include that section.

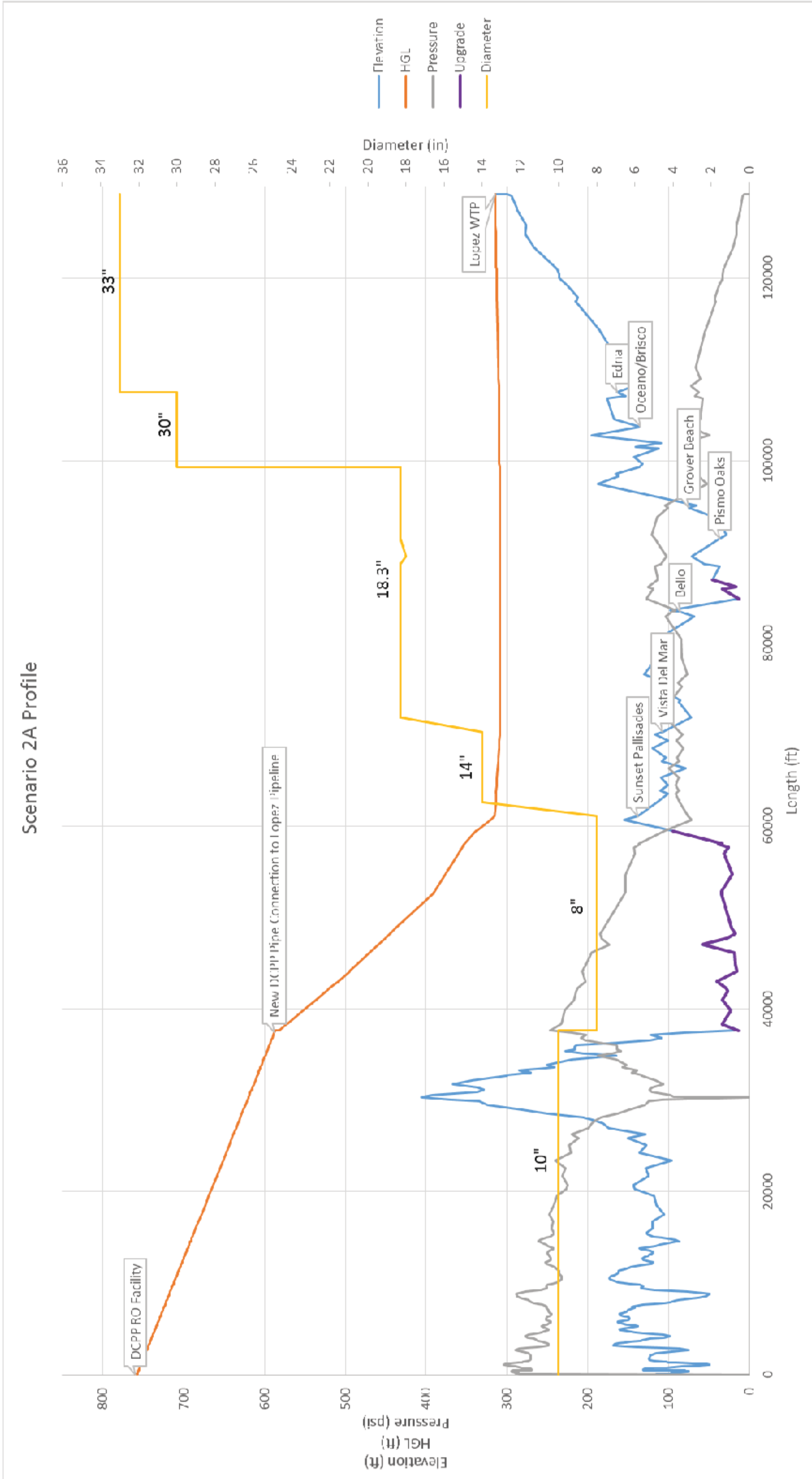

Figure 4. Scenario 2A Profile

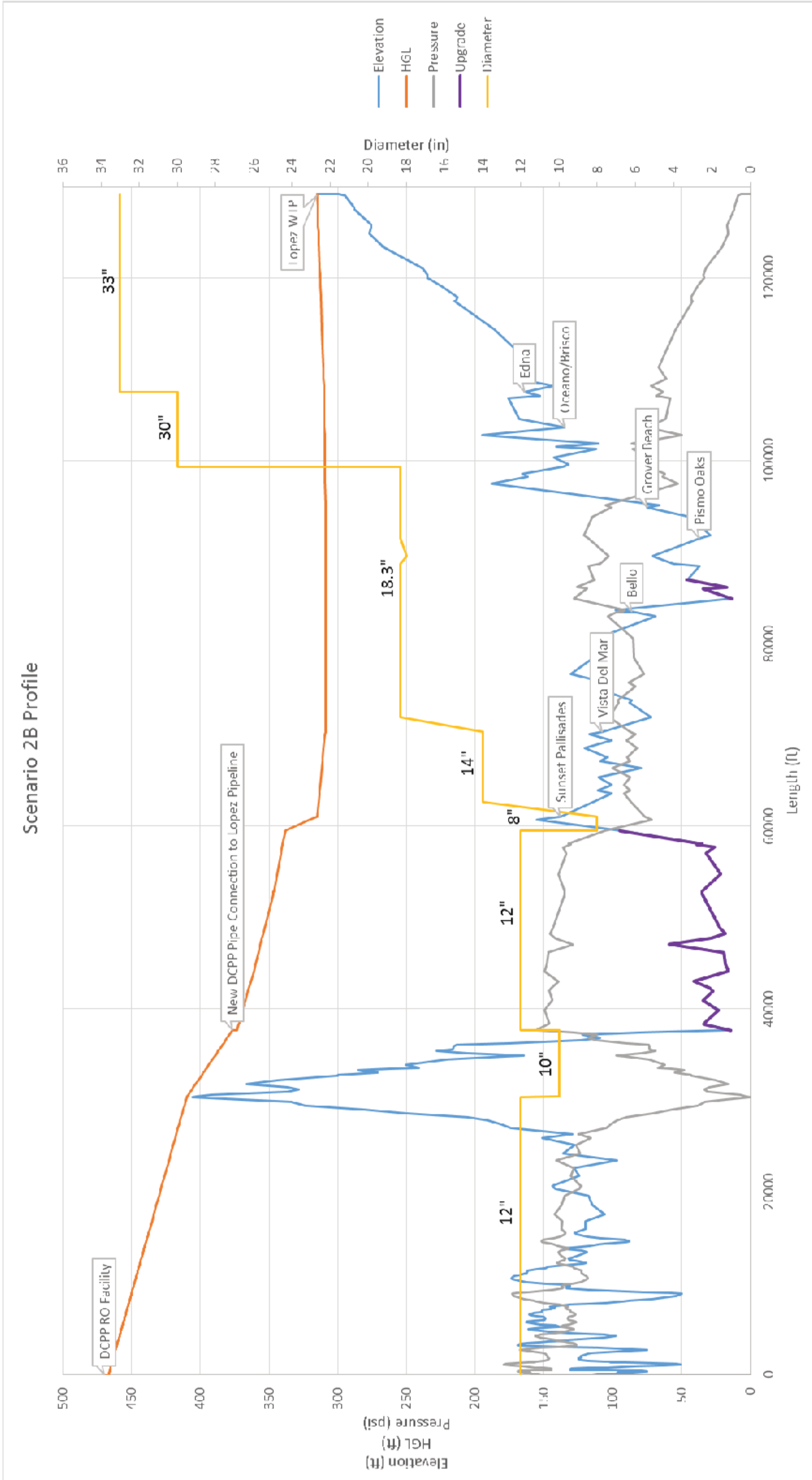

Figure 5. Scenario 2B Profile

12. Appendix III: Cost Estimating Assumptions

Table 7. Contingencies Used

Contingency	Percentage
Construction Contingency	25% of Construction Subtotal
Unaccounted For Costs	5% of Construction Subtotal
Implementation Costs	25% of (Subtotal + Construction Contingency Total + Unaccounted for Costs Total)
Engineering	10%
CM, Inspection, and Testing	10%
Engineering During Construction	3%
Administration	2%
O&M Contingency	10% of Total Annual O&M Cost

Table 8. Capital Cost Assumptions

Cost Assumption	Value	Units	Reference
Pump Station – 1300 AFY	$2.45244*(Flow^{0.8182})*10^3$	Flow in gpm, Pump Station cost in $	WSC
Pump Station – 500 AFY	40,000	$	WSC
18" pipe, Ductile Iron Class 50	400.37	$/LF	WSC
12" pipe, Ductile Iron Class 50 with sand import	293.54	$/LF	WSC
12" pipe, Ductile Iron Class 50 without sand import (DCPP pipe)	292.83	$/LF	WSC
10" pipe, Ductile Iron	220.00	$/LF	WSC
8" pipe, Ductile Iron	205.00	$/LF	WSC
6" pipe, Ductile Iron	195.00	$/LF	WSC
10" pipe, PVC Class 150 with sand import	158.03	$/LF	WSC
10" pipe, PVC Class 150 without sand import (DCPP pipe)	157.26	$/LF	WSC
8" pipe, PVC Class 150	145.37	$/LF	WSC
6" pipe, PVC Class 150	135.12	$/LF	WSC
PVC Pressure Class Pipe Upgrade Factor	10	% of $/LF value	WSC
Addition for Slurry Backfill on Desal pipe – 10" pipe	16.20	$/LF	Calculated based off of $\$125/yd^3$
Addition for Slurry Backfill on Desal pipe – 12" pipe	17.36	$/LF	Calculated based off of $\$125/yd^3$
Post-RO Treatment	200,000	$	WSC

Table 9. Operation & Maintenance Cost Assumptions

Cost Assumption	Value	Reference
Post-RO Treatment	$51.32 / AF	WSC
Chlorine	0.24 gal/AF at $1.64/gal	WSC
Calcium Carbonate	52.4 lbs/AF at $0.97/lb	WSC
Pipe Replacement	1% of Pipe Capital	WSC
Storage Replacement	1% of Storage Capital	WSC
Pump Station Maintenance	5% of Pump Station Capital	WSC
Electricity	$0.14 / KW-hr	WSC
Added HGL Buffer	20 ft	WSC
500 AFY Scenario Staff	0.5 FTE	SLO County
1300 AFY Scenario Staff	1.0 FTE	SLO County
Staffing	$100,000 / FTE / yr	SLO County

Table 10. Equal Annual Payment Assumptions

Cost Assumption	Value	Reference
Loan Period	20 yr	Drinking Water State Revolving Fund (6)
Interest Rate	1.6%	Drinking Water State Revolving Fund (6)

13. Appendix IV: Cost Estimating Tables

Table 11. Scenario 1 Cost Estimates

Scenario 1				
500 AFY Discharge Upgrades	500	AFY Discharge		
Capital Cost				
	Value	**Units**	**Pressure or Capacity Upgrade?**	**Cost**
Potable Water Main - 18"	3,356	LF	Pressure Upgrade	$ 1,343,625
Potable Water Main - 10"	37,666	LF	New Pipe	$ 7,126,187
Potable Water Main - 8"	15,435	LF	Pressure Upgrade	$ 2,468,148
Potable Water Main - 6"	12,363	LF	Pressure Upgrade	$ 1,837,565
Storage	0.0	MG		$ -
Pump Station	326.29	gpm		$ 400,000
Post-RO Treatment	200,000	$		$ 200,000
Construction Subtotal				**$ 13,375,524**
Construction Contingency	25%	Subtotal		$ 3,343,881
Unaccounted For Costs	5%	Subtotal		$ 668,776
Implementation Costs		Subtotal, Const, Unacc.		$ 4,347,045
Engineering	10%			
CM, Inspection, and Testing	10%			
Engineering During Construction	3%			
Administration	2%			
Total Capital Cost				**$ 21,735,226**
O&M Cost Estimates				
	Capacity/Size	**Units**		**Cost**
Pipeline	68,820	LF		$ 127,755
Storage	0.0	MG		$ -
Pump Station	326	gpm		
Maintenance				$ 20,000
Power				$ 32,312
PG&E Treatment	500	AF for one year		$ -
Post-RO Treatment	500	AF for one year		$ 25,662
Staffing	0.50	FTE		$ 50,000
O&M Contingency	10%	Total O&M Costs		$ 25,573
Total Annual O&M Cost				**$ 281,302**

Capital Cost	$ 21,735,226
Annual O&M Cost	$ 281,302
Annual Payment - Capital	$ 1,278,499
Total Annual Payment	**$ 1,559,801**
Cost per AF ($/AF)	**$ 3,120**
Interest Rate	1.6%

Table 12. Scenario 2A Cost Estimates

Scenario 2A						
1300 AFY Discharge Upgrades	1300	AFY Discharge				
Capital Cost						
	Value	**Units**	**Pressure or Capacity Upgrade?**	**Cost**		
Potable Water Main - 18"	3,356	LF	Pressure Upgrade	$ 1,343,625		
Potable Water Main - 10"	37,666	LF	New Pipe	$ 8,896,849		
Potable Water Main - 8"	23,293	LF	7,857 ft Capacity Upgrade; 15,436 ft Pressure Upgrade	$ 4,775,065		
Potable Water Main - 6"	13,060	LF	Pressure Upgrade	$ 2,546,700		
Storage	0.0	MG		$ -		
Pump Station	848.37	gpm		$ 610,612		
Post-RO Treatment	200,000	$		$ 200,000		
Construction Subtotal				**$18,372,851**	**Capital Cost**	$ 29,855,882
Construction Contingency	25%	Subtotal		$ 4,593,213	**Annual O&M Cost**	$ 591,143
Unaccounted For Costs	5%	Subtotal		$ 918,642.53		
Implementation Costs		Subtotal, Const, Unacc.		$ 5,971,176	**Annual Payment - Capital**	$ 1,756,168
Engineering	10%					
CM, Inspection, and Testing	10%				**Total Annual Payment**	**$ 2,347,311**
Engineering During Construction	3%				**Cost per AF ($/AF)**	**$ 1,806**
Administration	2%					
Total Capital Cost				**$29,855,882**	Interest Rate	1.6%
O&M Cost Estimates						
	Capacity/Size	**Units**		**Cost**		
Pipeline	77,375	LF		$ 175,622.39		
Storage	0.0	MG		$ -		
Pump Station	848	gpm				
Maintenance				$ 30,531		
Power				$ 164,528		
PG&E Treatment	1300	AF for one year		$ -		
Post-RO Treatment	1300	AF for one year		$ 66,722		
Staffing	1.00	FTE		$ 100,000		
O&M Contingency	10%	O&M Costs		$ 53,740		
Total Annual O&M Cost				**$ 591,143**		

Table 13. Scenario 2B Cost Estimates

Scenario 2B							
1300 AFY Discharge Upgrades	1300	AFY Discharge			30,320	LF 12" DCPP	
					27,798	LF 12" Lopez	
Capital Cost					7,346	LF 10" DCPP	
	Value	**Units**	**Pressure or Capacity Upgrade?**	**Cost**	-	LF 10" Lopez	
Potable Water Main - 18"	3,356	LF	Pressure Upgrade	$ 1,343,625			
Potable Water Main - 12"	58,118	LF	30,320 ft New Pipe; 27,798 ft Capacity Upgrade	$ 17,564,794			
Potable Water Main - 10"	7,346	LF	New Pipe	$ 1,389,820			
Potable Water Main - 6"	8,555	LF	Pressure Upgrade	$ 1,271,566			
Storage	0.0	MG		$ -			
Pump Station	848.37	gpm		$ 610,612			
Post-RO Treatment	200,000	$		$ 200,000			
Construction Subtotal				**$22,380,417**		**Capital Cost**	$ 36,368,178
Construction Contingency	25%	Subtotal		$ 5,595,104		**Annual O&M Cost**	$ 555,747
Unaccounted For Costs	5%	Subtotal		$ 1,119,021			
Implementation Costs		Subtotal, Const, Unacc.		$ 7,273,636		**Annual Payment - Capital**	$ 2,139,232
Engineering	10%						
CM, Inspection, and Testing	10%					**Total Annual Payment**	**$ 2,694,978**
Engineering During Construction	3%					**Cost per AF ($/AF)**	**$ 2,073**
Administration	2%						
Total Capital Cost				**$36,368,178**		Interest Rate	1.6%
O&M Cost Estimates							
	Capacity/Size	**Units**		**Cost**			
Pipeline	77,375	LF		$ 215,698			
Storage	0.0	MG		$ -			
Pump Station	848	gpm					
Maintenance				$ 30,531			
Power				$ 92,274			
PG&E Treatment	1300	AF for one year		$ -			
Post-RO Treatment	1300	AF for one year		$ 66,722			
Staffing	1.00	FTE		$ 100,000			
O&M Contingency	10%	O&M Costs		$ 50,522			
Total Annual O&M Cost				**$ 555,747**			