

## Section 6

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### **Preliminary Project Analyses of the Highest Ranked Hydro Options**

Section 4 (Approach and Process to Develop Plan) explained the steps and methods that were used to inventory, screen, and analyze the hydro options, while Section 5 presented the inventory of hydro options for El Dorado County by category and summarized the potential capacity and energy of the highest ranked options by purveyor. This section focuses on the preliminary project analyses that were performed for the 19 hydro options that were highest ranked through the inventory, screening, and preliminary evaluation steps.

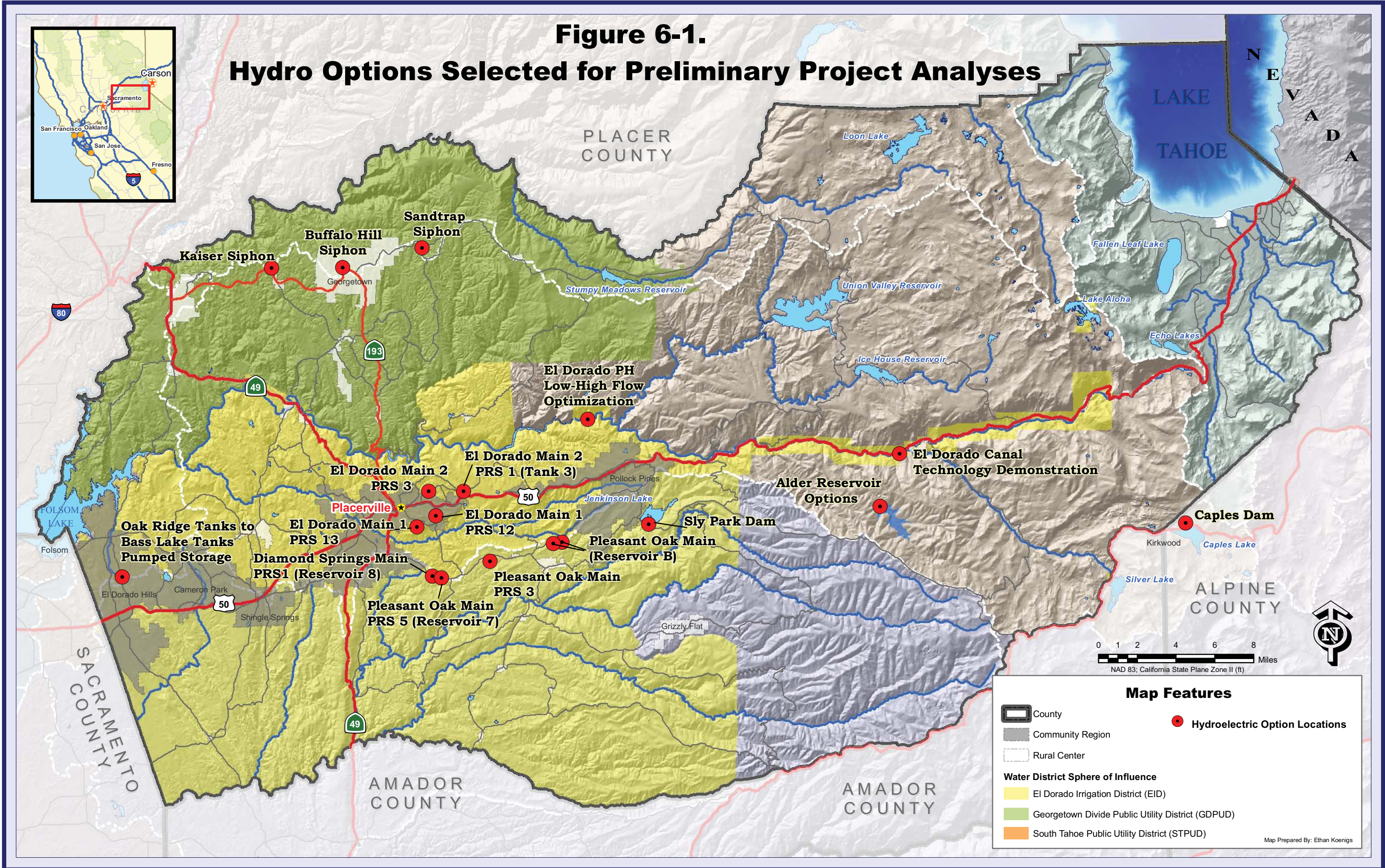
#### 6.1 Overview of Preliminary Project Analyses

The preliminary project analyses investigated the engineering, water supply, regulatory, environmental, and economic characteristics of each of the short-listed 19 projects, which are shown in Figure 6-1. Project-specific information was developed on location, design, licensing, permitting, construction, utility interconnection, and operation. The preliminary analyses were presented to the EDCWA, HAP and purveyors for review, comment, and input on projects that should be advanced to the “top 10” for detailed economic and financial analyses as described in Section 4 (Approach and Process to Develop Plan).

All of the 19 hydro options analyzed are at existing water facilities, except two. The two not at an existing facility are the Small Alder Reservoir option and the Medium Alder Reservoir option, which are different sized alternatives to the same project. These two are the only new water storage options that were advanced for preliminary project analyses. No other water storage projects were found to: 1) have the potential for financially supporting a new reservoir project with hydroelectric revenues, and 2) offer a viable operation for County purveyors relative to existing systems.

Two other of the short-listed 19 hydro options also are alternatives to each other. These are the Kaiser Siphon (major pipeline) and Kaiser Siphon (minor pipeline) options. Initially, only the Kaiser Siphon (minor pipeline) was identified for project analyses, primarily because the Kaiser Siphon (major pipeline) hydro option was not believed to qualify for CEC certification as a RPS project, and therefore would not be eligible for the PG&E FIT contract. Upon further discussion with GDPUD staff, it appears that the Kaiser Siphon (major pipeline) hydro option may qualify for the FIT program, which substantially improves the economic characteristics of the project. Before GDPUD decides to proceed with this project, additional investigation and verification of its eligibility under the FIT program is required. If it does not qualify, then GDPUD may wish to revisit the Kaiser Siphon (minor pipeline) option, which was determined by this study to qualify for the FIT program. Further information on the eligibility requirements for the FIT program can be found in Section 2 (Energy Policies Supporting Hydroelectric Generation) and in Appendix C (Environmental Regulatory, Permitting, and Feed-In Tariff RPS Certification and Contract Requirements).

**Figure 6-1.**  
**Hydro Options Selected for Preliminary Project Analyses**



**Map Features**

- County
- Community Region
- Rural Center
- Water District Sphere of Influence**
  - El Dorado Irrigation District (EID)
  - Georgetown Divide Public Utility District (GDPUD)
  - South Tahoe Public Utility District (STPUD)
- Hydroelectric Option Locations

Map Prepared By: Ethan Koenigs

As the project analyses were performed, new issues were identified that led to additional research and information requests to the purveyors. For example, the Consultant Team discussions with EID staff regarding the El Dorado Powerhouse Low-High Flow Optimization option identified the need for a broader powerhouse operations optimization study. There is also a potential for high flow generation at this location, which is operationally possible with the turbine generators, but is currently constrained by the transformers interconnecting the powerhouse with PG&E's grid. During low flow conditions, EID can intermittently start and stop generation as water accumulates in Forebay. However, when water is available during high flow conditions, EID cannot generate at the maximum capacity of the powerhouse. The incremental 1 MW of additional capacity that could be generated during high flows or during peak energy demand periods is expected to qualify for the RPS FIT rates, which are more than twice the energy values that EID now receives for generation sold on the spot market. With recent and projected changes in canal flows, an optimization study is needed that assesses the tradeoffs and cost-benefits of powerhouse equipment modifications that would allow generation both below the current minimum of 3 MW and above the current maximum of 21 MW.

## 6.2 Limitations of Analyses

Although the preliminary analyses were project-specific, completing the analyses required that certain assumptions be made regarding site conditions, flows, equipment selection, water facility operations, regulatory agency requirements, utility interconnection equipment, and other parameters. For existing water facilities, there is a relatively high level of confidence in the results of the analyses. However, for the hydro options where there are no existing facilities, there is less confidence in the results; insufficient information was available to reasonably design certain features, estimate costs, or predict what the interconnecting utility will require.

The degree of information and Project Team confidence in the preliminary analyses also factored into the decisions on projects that were advanced for detailed economic and financial analyses (see Section 7, Detailed Project Analyses of "Top 10" Options). In fact, all of the "top 10" hydro options advanced for detailed analyses are at existing water facilities.

## 6.3 Results of Preliminary Analyses

Preliminary project analyses were completed for all 19 projects. Excluding economic considerations, all projects are considered viable but additional detailed feasibility studies are required for some options such as the Alder Reservoir and El Dorado Powerhouse Low-High Flow Optimization options. Further discussion of those projects warranting separate, near-term study is presented in Section 8 (Projects Warranting Additional Detailed Analyses). Setting aside the projects identified for a separate feasibility study, and also the El Dorado Canal technology demonstration project that is

proposed by an outside entity, this reduced the number of hydro options eligible for further analysis in this study from 19 to 15.

To identify the final “top 10” for detailed economic/financial analyses, the Project Team turned to the preliminary economic analyses that were completed for the 15 remaining projects. First, the 15 projects were plotted in a scatter diagram using the estimated capital cost (\$)/average annual MWh. These results are shown in Table 6-1. Next, the preliminary economic analyses were considered to assess each project’s economic merit.

For the preliminary economic analyses of the 15 projects, the estimated costs were first calculated for project planning, design, permitting, and construction and operation. These costs were escalated to 2011 (the anticipated online date for FIT projects given the 18-month time limit for start of operation), and include a 5 percent per year factor for interest during construction. At the time of the preliminary project analyses, projects were assumed to be financed with tax-exempt bonds having a 20- to 30-year life and annual interest rate of 5 percent. Financing costs would be included in the bond issuance amounting to a fee of 1.5 percent of planning and construction costs. Project costs during operation are expected to consist of the following: 1) annual debt service (principal and interest) to finance the project, and 2) Incremental O&M and replacement costs.

The 5 percent interest rate was used in the initial analysis because that was the typical market rate at the time that the analysis was started. An interest rate of 6 percent was used in the final analysis (see Section 7) because 6 percent more closely approximates the purveyor financing terms that would be expected for the projects.

Except for the Caples Lake hydro option and possibly the Kaiser Siphon (major pipeline) option discussed previously, the preliminary economic analyses assumed that the projects would qualify for FIT contracts with PG&E. For the 2011 start date, the projects would receive an average of \$117.30/MWh assuming that generation is evenly distributed throughout the year. However, energy values under the FIT contracts are affected by TOD multipliers that PG&E applies to actual project generation. The effects of the multipliers on project revenues were not assessed for this stage of analysis, but were computed for the detailed economic/financial analyses presented in Section 7.

The results of the preliminary economic analyses are presented in Table 6-2. Both 20-year and 30-year financing were considered because the FIT contract energy payments cannot be guaranteed for longer than 20 years (PG&E currently offers 10-, 15- and 20-year FIT contract options), but purveyor financing was assumed for a period of 30 years. Further information on the PG&E FIT contract terms is presented in Appendix C (Environmental Regulatory, Permitting, and Feed-In Tariff RPS Certification and Contract Requirements).

**Table 6-1: Hydroelectric Project Options Selected for Preliminary Analysis**

<b>Project</b>	<b>Capital Cost</b>	<b>Energy Output</b>	<b>Cost/Annual MWh</b>
Pleasant Oak Main PRS 5 (Reservoir 7)	\$1,523,000	2,321	\$656
Oak Ridge Tanks to Bass Lake Tanks Pumped Storage	\$774,000	874*	886*
El Dorado Main 2-PRS 1 (Tank 3)	\$1,556,000	1,739	\$895
Sandtrap Siphon	\$1,456,000	1,130	\$1,288
Pleasant Oak Main @ Res B (2 stations)	\$3,591,000	2,657	\$1,351
Sly Park Dam	\$2,571,000	1,833	\$1,402
Kaiser Siphon (major pipeline option - 8,000 ft)	\$5,172,000	3,638	\$1,422
Buffalo Hill Siphon	\$1,284,000	860	\$1,493
Kaiser Siphon (minor pipeline option)	\$1,423,000	950	\$1,498
Diamond Springs Main PRS 1 (Reservoir 8)	\$1,082,000	688	\$1,573
El Dorado Main 2-PRS 3	\$1,409,000	892	\$1,580
Pleasant Oak Main PRS 1 (Reservoir B)	\$2,149,000	1,200	\$1,791
El Dorado Main 1-PRS 13 @ Res 6	\$1,058,000	590	\$1,793
Pleasant Oak Main PRS 3	\$1,385,000	620	\$2,234
Caples Dam	\$2,974,000	1,000	\$2,974
El Dorado Main 1-PRS 12 (at airport)	\$1,032,000	220	\$4,691

\*Excludes pumping energy requirements

The preliminary economic analyses showed that two of the hydro options have strong economic characteristics (Table 6-2):

- El Dorado Main 2 Pressure Reducing Station (PRS) 1, and
- Pleasant Oak Main PRS 5 at Reservoir 7.

The analyses showed that five other hydro options had slightly positive economic characteristics under the 30-year financing scenario:

- Sly Park Dam,
- Pleasant Oak Main at Reservoir B,
- Kaiser Siphon (minor pipeline),
- Sandtrap Siphon, and
- Buffalo Hill Siphon

The analyses also showed that two of the remaining hydro options (El Dorado Main 2 PRS 3 and Diamond Springs Main PRS 1) had marginally negative economic characteristics, while the rest were strongly negative. Of the economic analyses performed, the results for the Oak Ridge Tanks to Bass Lake Tanks Pumped Storage Project are neither comparable to the other projects nor directly applicable to a pumped storage project. While it did consider net energy generation, this preliminary analysis did not consider other factors for this type of project, including differential pricing between pumping and operation and requirements for use of renewable energy for the pumping operation. The above results were deliberated by the Project Team in narrowing the list of hydro options to the “top 10” for the final step of detailed economic and financial analyses.

Table 6-2: Results of Preliminary Economic Analysis

20-YEAR FINANCING/20-YEAR FIT WITHOUT TIME OF DELIVERY FAC

Project Option	Annual Generation (MWh)	Total Planning and Construction Cost	Finance Fee	Capital Cost w/Financing	Finance Rate	Loan Term (Years)	Annual Costs			Annual Operating Revenue (Cost)	Annual Net Revenue (Cost)	Debt Service Coverage
							Debt Service	O&M and Replacement	Total			
Sly Park Dam	1,800	\$2,571,000	1.5%	\$2,609,565	5.0%	20	(\$209,398)	(\$22,807)	(\$232,205)	\$188,333	(\$21,065)	0.90
El Dorado Main 2 PRS1 (Tank 3)	1,700	\$1,556,000	1.5%	\$1,579,340	5.0%	20	(\$126,730)	(\$19,280)	(\$146,010)	\$180,130	\$53,400	1.42
El Dorado Main 2 PRS3	890	\$1,409,000	1.5%	\$1,430,135	5.0%	20	(\$114,758)	(\$15,684)	(\$130,442)	\$88,713	(\$26,045)	0.77
Diamond Springs Main PRS1	690	\$1,082,000	1.5%	\$1,098,230	5.0%	20	(\$88,125)	(\$14,053)	(\$102,178)	\$66,884	(\$21,241)	0.76
Pleasant Oak Main (Reservoir B)	2,600	\$3,591,000	1.5%	\$3,644,865	5.0%	20	(\$292,473)	(\$28,226)	(\$320,699)	\$276,754	(\$15,719)	0.95
Pleasant Oak Main PRS5 (Reservoir 7)	2,300	\$1,523,000	1.5%	\$1,545,845	5.0%	20	(\$124,043)	(\$21,609)	(\$145,652)	\$248,181	\$124,138	2.00
Oak Ridge Tanks to Bass Lake Tanks Pumped Storage	-30	\$774,000	1.5%	\$785,610	5.0%	20	(\$63,039)	(\$9,762)	(\$72,801)	(\$13,281)	(\$76,320)	(0.21)
Buffalo Hill Siphon	860	\$1,284,000	1.5%	\$1,303,260	5.0%	20	(\$104,577)	(\$14,888)	(\$119,465)	\$85,990	(\$18,587)	0.82
Kaiser Siphon (major pipeline - 8,000 feet)*	3,600	\$5,172,000	1.5%	\$5,249,580	5.0%	20	(\$421,240)	(\$31,782)	(\$453,022)	NA	NA	NA
Sandtrap Siphon	1,130	\$1,456,000	1.5%	\$1,477,840	5.0%	20	(\$118,586)	(\$16,065)	(\$134,651)	\$116,484	(\$2,102)	0.98
<b>El Dorado Main 1 PRS13</b>	590	\$1,058,000	1.5%	\$1,073,870	5.0%	20	(\$86,170)	(\$13,570)	(\$99,740)	\$55,637	(\$30,533)	0.65
<b>Caples Dam</b>	1,000	\$2,974,000	1.5%	\$3,018,610	5.0%	20	(\$242,221)	(\$21,128)	(\$263,349)	\$96,172	(\$146,049)	0.40
<b>El Dorado Main 1 PRS12</b>	220	\$1,032,000	1.5%	\$1,047,480	5.0%	20	(\$84,053)	(\$12,019)	(\$96,072)	\$13,787	(\$70,266)	0.16
<b>Pleasant Oak Main PRS3</b>	620	\$1,385,000	1.5%	\$1,405,775	5.0%	20	(\$112,803)	(\$14,586)	(\$127,389)	\$58,140	(\$54,663)	0.52
<b>Kaiser Siphon Minor Pipeline</b>	950	\$1,423,000	1.5%	\$1,444,345	5.0%	20	(\$115,898)	(\$14,690)	(\$130,588)	\$96,745	(\$19,153)	0.83
<b>El Dorado Powerhouse Low-High Flow Optimization</b>	2,000	\$562,500	1.5%	\$570,938	5.0%	20	(\$45,814)	TBD	(\$45,814)	NA	NA	NA
<b>Small Alder</b>	28,300	TBD	1.5%	TBD	5.0%	20	TBD	TBD	TBD	NA	NA	NA
<b>Medium Alder</b>	TBD	TBD	1.5%	NA	5.0%	20	NA	TBD	\$0	NA	NA	NA
<b>El Dorado Canal Technology Demonstration</b>	100	TBD	1.5%	NA	5.0%	20	NA	TBD	\$0	NA	NA	NA

30-YEAR FINANCING/20-YEAR FIT WITHOUT TIME OF DELIVERY FAC

Project Option	Annual Generation (MWh)	Total Planning and Construction Cost	Finance Fee	Capital Cost w/Financing	Finance Rate	Loan Term (Years)	Annual Costs			Annual Operating Revenue (Cost)	Annual Net Revenue (Cost)	Debt Service Coverage
							Debt Service	O&M and Replacement	Total			
Sly Park Dam	1,800	\$2,571,000	1.5%	\$2,609,565	5.0%	30	(\$169,756)	(\$22,807)	(\$192,563)	\$188,333	\$18,577	1.11
El Dorado Main 2 PRS1 (Tank 3)	1,700	\$1,556,000	1.5%	\$1,579,340	5.0%	30	(\$102,738)	(\$19,280)	(\$122,018)	\$180,130	\$77,392	1.75
El Dorado Main 2 PRS3	890	\$1,409,000	1.5%	\$1,430,135	5.0%	30	(\$93,032)	(\$15,684)	(\$108,716)	\$88,713	(\$4,319)	0.95
Diamond Springs Main PRS1	690	\$1,082,000	1.5%	\$1,098,230	5.0%	30	(\$71,441)	(\$14,053)	(\$85,494)	\$66,884	(\$4,557)	0.94
Pleasant Oak Main (Reservoir B)	2,600	\$3,591,000	1.5%	\$3,644,865	5.0%	30	(\$237,104)	(\$28,226)	(\$265,330)	\$276,754	\$39,650	1.17
Pleasant Oak Main PRS5 (Reservoir 7)	2,300	\$1,523,000	1.5%	\$1,545,845	5.0%	30	(\$100,559)	(\$21,609)	(\$122,168)	\$248,181	\$147,622	2.47
Oak Ridge Tanks to Bass Lake Tanks Pumped Storage	-30	\$774,000	1.5%	\$785,610	5.0%	30	(\$51,105)	(\$9,762)	(\$60,867)	(\$13,281)	(\$64,386)	(0.26)
Buffalo Hill Siphon	860	\$1,284,000	1.5%	\$1,303,260	5.0%	30	(\$84,779)	(\$14,888)	(\$99,667)	\$85,990	\$1,211	1.01
Kaiser Siphon (major pipeline - 8,000 feet)*	3,600	\$5,172,000	1.5%	\$5,249,580	5.0%	30	(\$341,493)	(\$31,782)	(\$373,275)	NA	NA	NA
Sandtrap Siphon	1,130	\$1,456,000	1.5%	\$1,477,840	5.0%	30	(\$96,136)	(\$16,065)	(\$112,201)	\$116,484	\$20,348	1.21
<b>El Dorado Main 1 PRS13</b>	590	\$1,058,000	1.5%	\$1,073,870	5.0%	30	(\$69,857)	(\$13,570)	(\$83,427)	\$55,637	(\$14,220)	0.80
<b>Caples Dam</b>	1,000	\$2,974,000	1.5%	\$3,018,610	5.0%	30	(\$196,365)	(\$21,128)	(\$217,493)	\$96,172	(\$100,193)	0.49
<b>El Dorado Main 1 PRS12</b>	220	\$1,032,000	1.5%	\$1,047,480	5.0%	30	(\$68,140)	(\$12,019)	(\$80,159)	\$13,787	(\$54,353)	0.20
<b>Pleasant Oak Main PRS3</b>	620	\$1,385,000	1.5%	\$1,405,775	5.0%	30	(\$91,448)	(\$14,586)	(\$106,034)	\$58,140	(\$33,308)	0.64
<b>Kaiser Siphon Minor Pipeline</b>	950	\$1,423,000	1.5%	\$1,444,345	5.0%	30	(\$93,957)	(\$14,690)	(\$108,647)	\$96,745	\$2,788	1.03
<b>El Dorado Powerhouse Low-High Flow Optimization</b>	2,000	\$562,500	1.5%	\$570,938	5.0%	30	(\$37,140)	TBD	(\$37,140)	NA	NA	NA
<b>Small Alder</b>	28,300	TBD	1.5%	TBD	5.0%	30	TBD	TBD	TBD	NA	NA	NA
<b>Medium Alder</b>	TBD	TBD	1.5%	NA	5.0%	30	NA	TBD	\$0	NA	NA	NA
<b>El Dorado Canal Technology Demonstration</b>	TBD	TBD	1.5%	NA	5.0%	30	NA	TBD	\$0	NA	NA	NA

Shading denotes projects that are recommended for further analysis in Tasks 7 and 8; un-shaded projects are recommended for separate feasibility studies.

\*Further investigation is required to confirm that Kaiser Siphon major pipeline qualifies for the Feed-In Tariff program, which is a critical assumption for this economic analysis.

NA - Not Analyzed

**Project Category**

FIT = Feed In Tariff options

RPS = Renewable Portfolio Standard option for Mountain Utilities

NS = New site options

Tech = Technology demonstration option