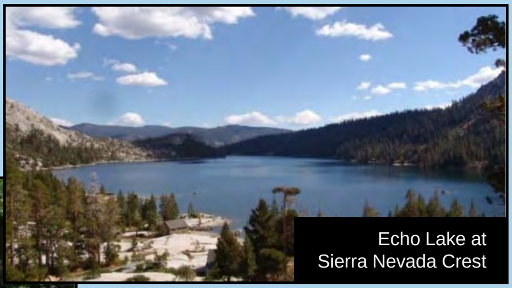
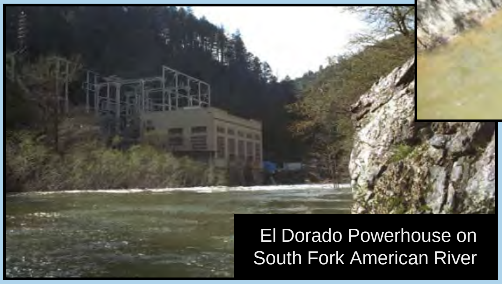
Final El Dorado County
Hydroelectric Development Options Study



Echo Lake at Sierra Nevada Crest

Buffalo Hill Siphon on Georgetown Ditch



El Dorado Powerhouse on South Fork American River

Prepared for

El Dorado County Water Agency
3932 Ponderosa Road, Suite 200
Shingle Springs, CA 95682

El Dorado Irrigation District
2890 Mosquito Road
Placerville, California 95667

Prepared by

EN2 Resources, Inc. Water and Energy Consulting Services

July 24, 2009

Final El Dorado County Hydroelectric Development Options Study

Prepared for

El Dorado County Water Agency
3932 Ponderosa Road, Suite 200
Shingle Springs, CA 95682

El Dorado Irrigation District
2890 Mosquito Road
Placerville, California 95667

Prepared by

EN2 Resources, Inc.
Water and Energy Consulting Services

In Association With
California Water Consulting, Inc.
Carlton Engineering, Inc.
Domenichelli & Associates
Navigant Consulting, Inc.
Water Resources Engineering

July 24, 2009

Table of Contents

List of Figures

List of Tables

List of Photos

Appendices

Executive Summary

Energy markets and regulations are changing rapidly. Today's focus is on renewable energy, including hydropower, which is gaining prominence similar to that seen during the oil crisis of the 1970s and early 1980s. Widespread public support seems greater than ever for renewable energy.

There are tremendous demands for new non-carbon, dependable electrical energy generation, and that trend is expected to grow given the state and national policy climates. El Dorado County's (County) purveyors are in a unique position to capitalize on incentives associated with small hydro [1.5 megawatt (MW) or less] and energy efficiency/load shifting within existing water systems. The County's purveyors have a further opportunity to develop and finance water supply/pumped storage reservoir systems utilizing the revenues from the small hydro incentives. As with all legislative or regulatory incentives and mandates, they can be discontinued. When incentives such as these arise, the window of opportunity should be seized before the window closes.

Advances in renewable energy generation, energy storage, energy transmission, and energy efficiency are seen by policymakers as a key to America's independence from foreign oil, economic recovery, air basins seeking improved air quality, and goals to reduce greenhouse gas emissions. Current policies emphasize interagency planning and cross-sector (e.g., energy, transportation, water, manufacturing, and agriculture) actions to achieve energy independence at local, regional, statewide and national levels.

The El Dorado County Water Agency's (EDCWA) Water Resources Development and Management Plan (WRD&MP 2007) identifies hydroelectric development as important to the County's future water supplies and operations. Hydropower projects produce revenues and reduce the costs of operating water facilities. Examples include Project 184, the Central Valley Project, and the State Water Project. Hydroelectric power is a proven technology typically with reliable operations over a 40- to 50-year project life, and (in the case of pumped storage) is considered by the California Independent System Operator as a critical source of dependable energy storage (CAISO 2009) that will provide a reliable balance to renewable energy sources that are not dependable, such as solar and wind.

Scope of Hydroelectric Development Options Study

This study was sponsored by the EDCWA and the El Dorado Irrigation District (EID), and included the participation of the Georgetown Divide Public Utility District (GDPUD). With guidance from the EDCWA, County water purveyors, and a Hydro Advisory Panel (HAP) with extensive local knowledge, EN2 Resources, Inc. and a supporting team of consultants (Consultant Team) identified, evaluated, narrowed, and recommend the most promising options for either: 1) immediate implementation, 2) detailed feasibility evaluation, or 3) future re-evaluation as the energy industry, market, and regulations continue to evolve.

Approximately 100 hydroelectric development options were initially identified throughout the County. Of the 100 options evaluated, detailed economic and financial analyses were performed on the "top 10" hydro options.

Hydro Options Recommended for Immediate Implementation

Based on this study, seven hydro options are recommended for immediate implementation. The two with the strongest economic characteristics (Table ES-1A) are Pleasant Oak Main PRS 5 at Reservoir 7 and El Dorado Main 2 PRS 1 at Tank 3. The other five projects recommended for immediate implementation (Table ES-1B) are: Kaiser Siphon, Pleasant Oak Main at Reservoir B, Sandtrap Siphon, Sly Park Dam, and a technology (hydrokinetic) demonstration project on the El Dorado Canal immediately downstream of the El Dorado Diversion Dam.

The seven recommended projects qualify for "must take" power purchase contracts (up to 20-year terms) with Pacific Gas and Electric Company (PG&E), except possibly for Kaiser Siphon (major pipeline option). All are economically superior to other projects evaluated and should proceed without delay to permitting, design, and construction to take advantage of this year's unprecedented rate incentives under the California Public Utilities Commission's (CPUC) Feed-In Tariff (FIT) program. The scope of the Kaiser Siphon option requires some site-specific investigations to confirm that it meets Renewable Portfolio Standard (RPS) eligibility criteria for the FIT program.

Detailed economic and financial analyses were used to identify the economically viable projects, which are recommended for implementation as described above. Because the projects recommended for immediate implementation all rely on the FIT program for viability, a critical path condition is that the projects be online within 18 months of FIT contract execution. Assuming that FIT contracts are executed not later than November 2009 (December 2009 is when the FIT program likely will be revised), then the recommended projects will need to be online by May 2011 to receive the energy price assumed in this report's economic analyses. Otherwise, PG&E has the discretion to re-queue the project and apply a new FIT contract and rates that are in effect following the expiration of the 18-month period.

The FIT program is evolving toward a 'cost-plus' margin rate structure. Because the price of oil has declined dramatically thus far in 2009, future terms likely will be less attractive for small hydro. Lower rates, increased administrative hurdles to assess 'cost-plus' margins, and increased competition for establishing a PG&E contract may make the recommended projects infeasible. Furthermore, PG&E is obligated only to accept FIT contracts totaling about 105 MW for all eligible public energy projects (e.g., hydro, solar, wind, biodiesel, and biomass) associated with water and wastewater systems. Recent and projected reductions in world petroleum prices caused by the worldwide economic downturn are likely to at least temporarily weaken future rates for renewable energy in general.

Table ES-1A: Hydro Options with Strong Economic Characteristics (with 20-Year Feed-In Tariff Contract)

Project Name	Plant Size (kW)	Avg. Annual Generation (MWh)	Annual Revenues	Initial Year of Operation	Capital Cost	Cost/ Years of Debt	IRR (%)	NPV	Payback Period (years)
Pleasant Oak Main PRS 5 (Reservoir 7)	510	2,321	$ 287,082	2011	$ 1,523,000	6.00% / 30	19.82	$ 1,702,726	7
El Dorado Main 2 PRS 1 (Tank 3)	360	1,739	$ 205,976	2011	$ 1,556,000	6.00% / 30	11.46	$ 777,089	14
Total	*870*	*4,060*	*$ 493,058*	-	*$ 3,079,000*	-	-	*$ 2,479,815*	-

Table ES-1B: Additional Hydro Options with Viable Economic Characteristics (with 20-Year Feed-In Tariff Contract)

Project Name	Plant Size (kW)	Avg. Annual Generation (MWh)	Annual Revenues	Initial Year of Operation	Capital Cost	Cost/ Years of Debt	IRR (%)	NPV	Payback Period (years)
Kaiser Siphon*	580	3,638	$ 448,331	2011	$ 5,172,000	6.00% / 30	5.34	$ 347,616	20-30
Pleasant Oak Main (Reservoir B)	450	2,657	$ 326,980	2011	$ 3,591,000	6.00% / 30	5.66	$ 319,690	20-30
Sandtrap Siphon	232	1,130	$ 140,752	2011	$ 1,456,000	6.00% / 30	5.96	$ 158,462	20-30
Sly Park Dam	400	1,833	$ 227,978	2011	$ 2,571,000	6.00% / 30	5.04	$ 121,711	20-30
Total	*1,662*	*9,258*	*$ 1,144,041*	-	*$12,790,000*	-	-	*$ 947,479*	-
El Dorado Canal - Technology Demonstration**	40	70	TBD	TBD	TBD	TBD	TBD	TBD	TBD

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

**Verdant Power proposes to design and construct this project at no cost to El Dorado Irrigation District, and is prepared to submit a proposal upon EID's execution of a confidentiality agreement.

Annual Revenues – assumes 20-year FIT agreement with PG&E. Annual revenues cannot be reasonably projected beyond the 20-year analysis period.
IRR – Internal Rate of Return – the interest rate received for an investment consisting of payments and income that occur at regular periods. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments of equal risk (the hurdle rate). In a fully debt-funded project, the hurdle rate is generally the cost of the debt.
NPV – Net Present Value – the total present value (PV) of a time series of cash flows. It is a standard method for using the time value of money to appraise long-term projects. The NPV is based on a 20-year analysis. The project life is 40 to 50 years.
Payback Period – the number of years it would take to pay off the capital cost of a project if annual cash flows were used to pay down the principal component of the debt incurred to finance the project. If energy values remain the same after expiration of the PG&E contract, the payback period would be as follows: Pleasant Oak Main PRS 5 (Reservoir 7) – 7 years; El Dorado Main 2 PRS 1 (Tank 3) – 14 years; Kaiser Siphon – 26 years; Pleasant Oak Main (Reservoir B) – 26 years; Sandtrap Siphon – 25 years; Sly Park Dam – 27 years.

The Project Team (comprised of County water purveyors, HAP members, and the Consultant Team) recommends further project evaluations that will be performed (EID 2009) as part of a grant received from the CEC under its Renewable-based Energy Secure Communities (RESCO) Public Interest Energy Research (PIER) program. This evaluation will identify the extent to which water system re-operation could further benefit the economics of the recommended hydro options, and possibly make additional hydro options economically viable. System reoperation could include changing the TOD or flow-frequency of an existing water system, thereby taking advantage of peak energy pricing and shoulder peak energy pricing periods. Reoperation could further include the installation of additional storage tanks that could establish system-wide changes in the timing of flows through multiple in-conduit generators of the same system.

Economic Highlights of the Recommended Hydro Options

The economic analyses for the recommended projects were based on accepted financing assumptions for public water agencies and are summarized in Tables ES-1A and ES-1B. Because the technology demonstration project would be paid for and installed by Verdant Power, the limited cost and the public benefits of the hydrokinetic demonstration project support its recommendation for immediate development.

The recommended projects are viable primarily because of the applicable FIT contracts with guaranteed rates for up to 20 years, which are more than double current energy market values. FIT rates increased by more than 15 percent from 2008 to 2009, but similar increases are not expected in future years as the CPUC seeks to reduce cost impacts of the FIT and RPS programs to utility customers.

The economics of the projects are expected to improve as designs (e.g., turbine generator efficiencies) are optimized for the flows and other operating conditions at each site. The hydro option cost estimates are comprehensive and include design, permitting, construction, operation, maintenance, and equipment replacement. For Sly Park Dam, there will be new regulatory compliance costs to meet Federal Energy Regulatory Commission (FERC) dam safety requirements, which will include dam inspections, FERC fees, and possible periodic studies (e.g., emergency action plans). The costs for the new FERC dam safety requirements were not included in the Sly Park Dam project cost estimate, and do not apply to any of the other hydro options recommended for immediate implementation.

Increases in system demands over time are expected to increase total generation, substantially strengthening the projects' economic viability. For this study, energy generation and revenues for EID hydro options were projected using a conservative 0.5 percent average annual increase over the 20-year analysis period. Actual energy generation and revenues are expected to be greater under the County-adopted 2004 General Plan. Through 2025 and through hypothetical build-out, the 2004 General Plan estimates total population growth increases for the County's west slope of 65 percent and 170 percent, respectively. Because the Georgetown Ditch system is at or near capacity, no increases in flows or generation were projected for GDPUD hydro options.

Approaches for Alternative Financing for Recommended Hydro Options

One near-term option for financing some or all of the “top 10” hydro projects is the American Recovery and Reinvestment Act of 2009 (ARRA), which authorizes $1.6 billion of new Clean Renewable Energy Bonds (New CREBs) and $2.4 billion of new Qualified Energy Conservation Bonds (QECBs). Under the ARRA, New CREBs and QECBs are being made available for financing renewable energy and greenhouse gas emission reduction initiatives. New CREBS most directly apply to the hydro options. The application deadline for New CREBs is August 4, 2009. QECBs have no projected closing date, other than award of total available bonds.

With New CREBs (those authorized via the 2009 ARRA), the bond holder receives a tax credit that is equal to 70 percent of the IRS-approved bond market rate for New CREBs. The effective interest rate of the New CREBs for the bond issuer (e.g., EID or GDPUD) should be close to the difference between the current tax-exempt bond rate in the market and the tax credit to the bond holder, but may be somewhat more or less than this. Assuming effective interest rates on a New CREBs bond issuance and a standard tax-exempt bond issuance are 1.8 percent and 6 percent, respectively, Table ES-2 compares the overall effect of 15-year New CREBs (1.8 percent) to typical 30-year bond (6 percent) financing. Table ES-3 displays the sensitivity of the “top 10” hydro options to this same CREBs scenario for a 20-year financing analysis period.

Table ES-2: Comparison of 30-Year Bonds to Example New CREBS Financing for the “Top 10” Hydro Options

Financing	Capital Cost (Top 10 Options)	Net Present Value (20-Year Analysis Period)	Capacity (kW)/ Annual kWh
30-Year Bonds	$ 20,418,000	$ 2,962,136	3,315/16,632,000
CREBs/QECBs	$ 20,418,000	$ 5,194,196	3,315/16,632,000

Combining or ‘batching’ hydro projects by water system (e.g., Pleasant Oak Main and Georgetown Ditch) is a possible approach for financing and it also offers opportunities for multiple project economies of scale where proximity and system similarities can reduce design, permitting, financing, construction, and other development and operation costs. Estimating such cost savings would require that specific combinations of projects be identified. Table ES-3 displays how hydro options could be grouped by water system.

Table ES-3: "Top 10" Hydro Options Sensitivity to Example Clean Renewable Energy Bonds (with 20-Year Feed-In Tariff Contract)

Project Name	Plant Size (kW)	Avg. Annual Generation (MWh)	Initial Year of Operation	Capital Cost	Cost/ Years of Debt	IRR (%)	NPV	Payback Period (years)
El Dorado Main System*								
El Dorado Main 2 PRS 1 (Tank 3)	360	1,739	2011	$ 1,556,000	1.80% / 15	11.46	$ 947,188	8
El Dorado Main 2 PRS 3	195	892	2011	$ 1,409,000	1.80% / 15	2.57	$ 1,047	>15
El Dorado Hills System*								
Oak Ridge Tanks to Bass Lake Tanks Pumped Storage	280	874	2011	$ 774,000	1.80% / 15	2.39	$ 10,446	>15
Georgetown Ditch System*								
Sandtrap Siphon	232	1,130	2011	$ 1,456,000	1.80% / 15	5.96	$ 317,629	13
Buffalo Hill Siphon	168	860	2011	$ 1,284,000	1.80% / 15	3.46	$ 71,073	>15
Kaiser Siphon	580	3,638	2011	$ 5,172,000	1.80% / 15	5.34	$ 913,010	13
Pleasant Oak Main System*								
Sly Park Dam	400	1,833	2011	$ 2,571,000	1.80% / 15	5.04	$ 402,768	14
Pleasant Oak Main (Reservoir B)	450	2,657	2011	$ 3,591,000	1.80% / 15	5.66	$ 712,252	13
Pleasant Oak Main PRS 5 (Reservoir 7)	510	2,321	2011	$ 1,523,000	1.80% / 15	19.82	$ 1,869,218	5
Diamond Springs Main PRS 1 (Reservoir 8)	140	688	2011	$ 1,082,000	1.80% / 15	1.76	$ (50,435)	>15
Total	*3,315*	*16,632*	-	*$20,418,000*	-	-	*$ 5,194,196*	-

*Examples of potential hydro option groupings that could be used to apply for CREBs or Qualified Energy Conservation Bonds, or to pursue economies of scale in hydro option development.

Note: The New CREBs interest rate on July 1, 2009 was 7.05%. Assuming issuer and holder agree to this bond rate, then financing would have an effective rate of 2.11%.

IRR – Internal Rate of Return – the interest rate received for an investment consisting of payments and income that occur at regular periods. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments of equal risk (the hurdle rate). In a fully debt-funded project, the hurdle rate is generally the cost of the debt.

NPV – Net Present Value – the total present value (PV) of a time series of cash flows. It is a standard method for using the time value of money to appraise long-term projects.

Payback Period – the number of years it would take to pay off the capital cost of a project if annual cash flows were used to pay down the principal component of the debt incurred to finance the project.

Hydro Options Recommended for Detailed Feasibility Evaluation

A grant was recently awarded to EID et al. (2009) by the California Energy Commission (CEC) to evaluate reoperation of selected water systems. The reoperation evaluation will seek to maximize water system (e.g., El Dorado Main and Georgetown Ditch) hydro generation during peak energy value periods, improve system energy efficiencies, and shift water system energy loads to off-peak periods. A key aspect of this grant will be to assess the feasibility of reoperation by incorporating intermittent energy storage systems, primarily water storage tanks, which would allow turbine-generator efficiency optimization and peaking re-regulation of flows to maximize hydroelectric revenues. Basically, the water systems would be re-operated to uncouple customer demand from daily operations.

The four projects shown in Table ES-4 (Diamond Springs Main PRS 1, El Dorado Main 2 PRS 3, Oak Ridge Tanks to Bass Lake Tanks Pumped Storage, and Buffalo Hill Siphon) do not appear economically viable based solely on analyses of existing water system operations. The reoperation evaluation grant may demonstrate that these and other system options would be economically viable with flow re-regulation (made possible with increased storage at key locations), energy efficiency cost savings, and load management to take advantage of energy prices at different times of the day. The intermittent storage systems would also boost overall water system reliability. Indeed, EID and GDPUD may have other facility improvement and operation considerations that could make these hydro options attractive for reasons other than economics.

Additional hydro options, other than the four projects identified for reoperation, warrant detailed feasibility studies to better assess their merits. The most promising are identified in Table ES-5. Included are hydro options within the South Tahoe Public Utility District (STPUD) and Heavenly Ski Resort water systems. Studies by Heavenly Ski Resort and STPUD's update to its 2001 evaluation of the "C-Line" treated wastewater pipeline are expected to identify some viable options.

Of the projects listed in Table ES-5, the greatest potential for hydroelectric generation would be from the Alder Reservoir hydro options. Previous studies of Alder Reservoir focused on either a very large alternative to support then-proposed South Fork American River (SOFAR) Project, or a smaller, stand-alone alternative that was limited to storing Alder Creek flows. This study identified Alder Reservoir concept alternatives that include water projects shared and jointly studied with other County purveyors or downstream purveyors (e.g., members of the American River Basin Regional Water Authority) that may be seeking drought, conjunctive use, or other water rights.

Table ES-4: Hydro Options that May Become Viable with System Reoperation (with 20-Year Feed-In Tariff Contract)

Project Name	Plant Size (kW)	Avg. Annual Generation (MWh)	Annual Revenues	Initial Year of Operation	Capital Cost	Cost/ Years of Debt	IRR (%)	NPV	Payback Period (years)
Diamond Springs Main PRS 1	140	688	$ 82,196	2011	$ 1,082,000	6.00% / 30	1.76	$ (168,717)	>30
El Dorado Main 2 PRS 3	195	892	$ 109,667	2011	$ 1,409,000	6.00% / 30	2.57	$ (152,982)	>30
Oak Ridge Tanks to Bass Lake Tanks Pumped Storage	280	874	$ 117,388	2011	$ 774,000	6.00% / 30	2.39	$ (74,167)	>30
Buffalo Hill Siphon	168	860	$ 106,777	2011	$ 1,284,000	6.00% / 30	3.46	$ (69,292)	>30
Total	*783*	*3,314*	*$ 416,028*	-	*$ 4,549,000*	-	-	*$ (465,158)*	-

Annual Revenues – assumes 20-year FIT agreement with PG&E. Annual revenues cannot be reasonably projected beyond the 20-year analysis period.

IRR – Internal Rate of Return – the interest rate received for an investment consisting of payments and income that occur at regular periods. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments of equal risk (the hurdle rate). In a fully debt-funded project, the hurdle rate is generally the cost of the debt.

NPV – Net Present Value – the total present value (PV) of a time series of cash flows. It is a standard method for using the time value of money to appraise long-term projects.

Payback Period – the number of years it would take to pay off the capital cost of a project if annual cash flows were used to pay down the principal component of the debt incurred to finance the project.

Table ES-5: Hydro Options Recommended for Detailed Feasibility Study

Project Name	Description	Estimated Plant Size	Estimated Generation	Additional Comments
Alder Reservoir Hydroelectric Options	*Generation from a new 50,000 to 100,000 acre-foot reservoir to function as seasonal pumped storage and to supplement generation at the El Dorado Powerhouse*	about 15 MW at Alder Powerhouse; no change to El Dorado Powerhouse	Net increase of roughly 50,000,000 kWh annually for Alder and El Dorado Powerhouse generation combined	This option could support water rights storage and delivery to EID and possibly other El Dorado County purveyors through purveyor pipeline interties and operating agreements. Reservoir sizing could incorporate drought period and other water rights dedicated to downstream purveyors that partially finance the reservoir and hydropower facilities.
Caples Dam	*This option could interconnect with Mountain Utilities to supply Kirkwood Resort; analyses of this option indicate that the conduit through Caples Dam downstream of the slide gate would need to be modified; an option to the 280 kW project could be a smaller capacity unit (e.g., 40 kW) that is sized for the Caples Dam Outlet works, Caples Resort, Caples Lake boat launch facility, Hwy 88 rest area at the auxiliary dam, and Caltrans maintenance station*	About 280 kW	About 1,000,000 kWh annually	Caples Resort has expressed interest in exploring the possibility of participating with EID in a downsized project if Kirkwood area interests do not wish to develop a larger project.
El Dorado Hydroelectric (FERC) Project 184 Minimum Instream Flows	*Since the Federal Energy Regulatory Commission (FERC) 2006 relicensing of Project 184, the El Dorado Powerhouse has generated substantially less energy due in part to the increased minimum instream flow requirements for the South Fork American River and feeder streams along the El Dorado Canal; this project would revisit instream flows of the El Dorado Relicensing Settlement Agreement to evaluate options to recover unexpected losses in El Dorado Powerhouse generation*	No change to El Dorado Powerhouse	Recovery of generation lost with the 2006 relicensing of the El Dorado Powerhouse	The new FERC License instream flow conditions for Project 184 were based on a generalized hydrologic model. The power generation model was based on monthly water supply averages over a historical period. The power generation analyses and relicensing condition decisions may have overestimated the power generation. EID could more accurately model power generation, consult with the Settlement Agreement Parties and FERC, and propose modifications to minimum instream flows that would allow EID to recoup unintended losses in renewable energy.

El Dorado Powerhouse Low-High Flow Optimization	*El Dorado Canal flows vary based on water year conditions. This option would evaluate minimum and maximum generation capability at the El Dorado Powerhouse.*	Incremental 0.5 to 1.0 MW	Net annual increase dependent on canal flows and operations	An incremental generation option (up to 1 MW) would qualify for FIT rates, which are more than double the rates that EID currently receives for El Dorado PH generation; an optimization study should also consider low flow operations of less than 3 MW.
Heavenly Ski Resort California Base Pump Station	*Heavenly Ski Resort currently receives treated water from STPUD through a Heavenly Ski Resort re-regulating tank and pressurized pipeline. Water is then pumped about halfway up the Resort's ski area to its California Dam Reservoir; this project simply replaces a pressure reduction valve at the Resort's pump station with an in-conduit generator*	about 60 kW	about 150,000 kWh annually	Generation would generally be limited to the October through January period when the Resort is making snow (flows are continuous during this period); an in-conduit generator would operate at a high capacity and efficiency for the entire period, and could be used to help pay for or offset pumping, snowmaking, and other Resort peak season energy loads.
South Tahoe Public Utility District "C-Line" Treated Wastewater Outfall	*Replacement of the existing 42-year-old gravity flow pipeline with a high-pressure pipeline to allow installation of one or more in-conduit turbine generators*	about 1,000 kW with a new pressurized pipeline	about 7,500,000 kWh annually	The existing pipeline has an uncertain number of years of remaining useful life; analyses of alternatives involving low pressure hydro installations now, and incorporation of higher capacity generation with the replacement pipeline later, should be considered.
Stumpy Meadows Dam	*GDPUD has analyzed this project intermittently since the early 1980s, and it represents an example of a non-powered, viable hydro option; this project has not been developed to date because the nearest point of interconnection is a 2-phase power line about 3 miles distant that would need to be upgraded to 3-phase and extended to the dam outlet*	about 485 kW	about 2,000,000 kWh annually	Existing public and/or Sierra Pacific Industries' access roads could be used for extending the power line. Past coordination efforts with PG&E have been unsuccessful due to planning and construction costs; GDPUD could request that the CA Public Utilities Commission support power line financing provisions for Feed-In Tariff projects, or ask PG&E directly for assistance with financing the power line extension to the project site.

A new Alder Reservoir and seasonal pumped storage concept identified by this study consists of a medium-sized (50,000 to 100,000 acre-foot) reservoir that would support an approximately 15 MW Alder powerhouse, augment water supplies for the 21 MW El Dorado Hydroelectric Project, store existing and supplemental County purveyor water rights, and possibly augment flows for instream and other downstream beneficial uses. Water would come from two sources: 1) Alder Creek flows that include existing EID hydroelectric water rights and 2) existing and possibly supplemental water rights diverted from the South Fork American River during high flow runoff periods when instream resources would not be adversely affected by increased diversions. More specifically, increased diversions in the El Dorado Canal between the Kyburz diversion and Alder Siphon would be used to convey high runoff period flows to a pump station, at the Alder Siphon, that would lift water to the Alder Reservoir. This winter/spring runoff from the South Fork American River, together with Alder Creek basin water, would be released for hydroelectric generation at a new Alder Powerhouse and the existing El Dorado Powerhouse during peak generation revenue periods in the summer and fall. Besides providing new storage and power generation facilities, this option capitalizes on excess capacity in the existing canal and increases power generation at an existing powerhouse by prolonging power generation into late summer and fall, which is currently not possible due to release restrictions.

Of all previous reservoir concepts considered, the newly identified Alder Reservoir seasonal pumped storage hydroelectric option offers substantial promise for an energy revenue-supported, long-term water supply project for El Dorado County purveyors. Based on preliminary estimates, a 50,000 acre-foot Alder Reservoir and 15 MW Powerhouse would yield a net increase of about 50,000,000 kWh (50,000 MWh) and roughly $5 million/year in net energy revenues for Alder and El Dorado Powerhouse generation combined. Additional storage would allow electric generation for both hydro projects (Project 184 and Alder) during the highest demand/price periods as water released from Alder could flow to Forebay reservoir and the El Dorado Powerhouse to help meet seasonal, daily peak, and ‘on-call’ demands for electricity.

Hydro Options in Changing Regulatory and Climatic Environments

Public proceedings on current energy programs, evaluations of foreign energy programs, new state and federal legislation, and industry-sponsored initiatives for California’s renewable energy future are re-shaping the regulatory and economic framework for hydro development. However, history indicates that today’s renewable energy boom could periodically experience a sudden decline as occurred following the 1980s drop in international oil prices. Oil prices have decreased substantially to date in 2009. In contrast, the forces of public policy or the energy market could continue to drive up the value of renewable energy to levels not previously thought possible. Consequently, County purveyors should continue to closely track and participate in the policy and regulatory proceedings affecting the value and scope of hydro options that could measurably support existing and future water and wastewater system operations in the County. This is especially important because of increasing indications that energy management could become a regulated aspect of water system operations in the future.

The Alder project offers extraordinary potential for premium price energy production as well as additional water supply. The water stored here has substantial potential to be a synergistic addition with variable options to strengthen the late season supply or storage at existing reservoirs (Sly Park) or possible new sites (Texas Hill), or to feed the El Dorado Power Plant for power generation during peak demand/price time periods. It would offer far greater value as an integrated part of the EID Project 184 system than it would as a stand-alone reservoir and power plant. This would also be a key site for capturing water into storage as climatic fluxes raise and lower the snow/rain elevation interface. During periods with a rising snow line, it will be important to have the capability to change the timing for capturing rainfall into storage.

Other Potential Benefits of Hydro Options

Non-economic and indirect economic benefits of the identified hydro options were not quantified by this study, but can be important when considering project viability and system operations:

- Long-term economic value (40- to 50-year project life) of energy sales beyond the 20-year economic analysis period;
- Progress toward a Hydro Advisory Panel-proposed policy of energy independence for the customers served by the water systems;
- Renewable energy credits (for non-FIT and post-FIT projects) that could be either applied toward future purveyor requirements, sold in a developing cap and trade greenhouse gas emissions reductions market, or used to meet future purveyor greenhouse gas emission reduction requirements;
- Public policy benefits of developing renewable energy to help displace fossil fuel-fired electricity consumed by water system operations;
- Jobs creation and multiplier benefits to the local, water sector, and renewable energy economies from project development; and,
- Enhanced monitoring and control systems at the hydro project sites that would improve water service reliability and system equipment longevity.

Customers will also benefit economically from the hydro options. The NPV represents net revenues for reducing total costs to purveyor customers for the first 20 years of operation. Because the projects typically have 40- to 50-year project lives, substantial net revenues also are expected beyond the initial 20-year period.

Conclusions

The hydro options identified in Tables ES-1A and ES-1B warrant proceeding to design and permitting without delay to take advantage of the 20-year FIT rates with PG&E's "must take" standard contracts. The FIT rates and conditions are under review and likely will change in December 2009. Therefore, lengthy FERC license exemption and other regulatory processes must be initiated immediately to help ensure that PG&E FIT contract 18-month deadlines are met for commercial operation. The hydro options identified in Tables ES-4 and ES-5 are recommended for detailed feasibility evaluations, with initial emphasis on: 1) reoperation of the existing water systems, and 2) defining the scope and potential framework for the Alder Reservoir hydro options. Figure ES-1 shows the locations of these recommended hydro options.

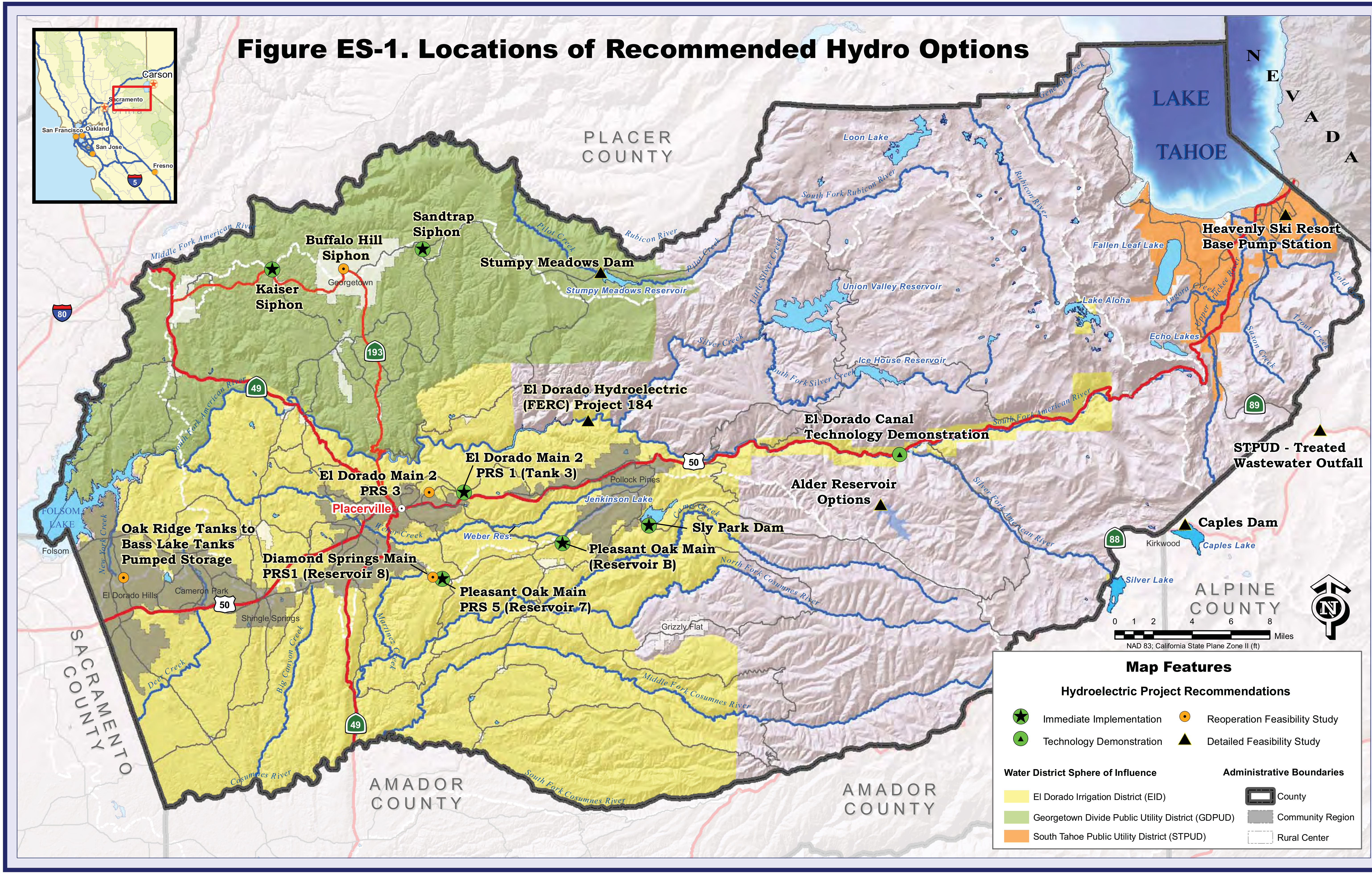
Recommended Next Steps

The next steps are to:

1) authorize the design, FERC review, permitting, and CEC RPS renewable energy pre-certification of the hydro options in Table ES-1A and Table ES-1B,
2) assign purveyor staff workgroups responsible for overseeing development of the selected projects,
3) consider whether to adopt a Hydro Advisory Panel-recommended policy of energy independence for water system operators and/or County agencies,
4) complete the water system reoperation study, funded by the CEC, and evaluate reoperation changes to the economics of the hydro options in Table ES-4,
5) consider applying for CREBs or QECB low-interest bonds for some or all of the "top 10" projects (Table ES-3),
6) sign and submit the PG&E "must-take" FIT agreements for the selected projects by November 2009,
7) initiate detailed feasibility studies on the projects identified in Table ES-5, and
8) initiate dialogue with PG&E, SMUD, and/or others regarding partnering or financing all, or elements of, the projects recommended for further feasibility study (e.g., GDPUD Stumpy Meadows).

The PG&E "must-take" FIT agreements for the recommended projects will require that the projects be operational within 18 months of signing, otherwise, PG&E may void the FIT contracts or re-queue the projects under a new and less favorable tariff in effect at that time. Therefore, to help ensure successful development of the economically viable projects, this study strongly recommends an immediate start for FERC review, permitting and design, and diligence through construction. Assuming that FIT agreements are signed and submitted in November 2009, the selected projects would need to be on-line by May 2011.

Figure ES-1. Locations of Recommended Hydro Options



C:\GIS Data\Projects\2008\El Dorado Hydro\Final\Project_overview_07_13_09.mxd

Map Prepared By: Ethan Koenigs 07/13/09

Section 1

Introduction

This report summarizes substantial pre-existing and new information that was collected, analyzed and produced as part of the El Dorado County Water Agency (EDCWA) Hydroelectric Development Options Study. This section gives an overview of the methodologies used and content of the report.

As with most studies, previous studies were researched first. This proved more challenging than expected given the vast history and dispersed locations of the documents for the previous investigations. To help with future investigations, the EDCWA organized and cataloged previous reports into the EDCWA document library.

The information in this report generally follows the Hydroelectric Development Options study process. Early in the study, energy market trends and recent water-related planning initiatives were investigated. Emerging regulatory measures for water system energy use and production, combined with California Public Utilities Commission (CPUC)-mandated utility contracts and rates for small hydro, significantly influenced early investigations and a focus on existing facility energy recovery hydro options.

The energy industry and markets have been exceptionally dynamic over the past three years as a result of the passage of Assembly Bill (AB) 32 and associated legislation. In contrast, water system operations remain relatively unchanged, with current concerns over drought and State policies regarding: 1) water conservation (i.e., Governor Schwarzenegger's 20% per capita reduction by 2020) and, 2) interregional water conveyance through the Sacramento-San Joaquin Delta. The related topics and forces of the evolving energy industry (e.g., renewable energy and water system energy efficiency) and regional water management (e.g., local hydro development and other beneficial uses) are discussed in Section 2 (Energy Policies Supporting Hydroelectric Generation) and Section 3 (Water and Wastewater Energy Management Goals and Objectives for El Dorado County) of this report, respectively.

Screening and analyzing the hydro options gradually narrowed the list of the 100-plus hydro options identified for evaluation to those that are the most viable. New sites (including many with new reservoirs), options at existing water and wastewater facilities, and technology demonstration options were evaluated using multi-disciplinary fatal flaw and ranking criteria. This ultimately led to a "top 10" list of projects for which detailed economic and financial analyses were performed. The study process also concluded with technology demonstration, existing facility energy recovery, and new facility hydro options that are recommended for detailed feasibility analyses. The evaluation processes and results are described in the following sections: Section 4 (Study Approach and Process to Develop Plan), Section 5 (Inventory of County Hydroelectric Potential), Section 6 (Preliminary Project Analyses of the Highest Ranked Hydro Options), Section 7 (Detailed Project Analyses of "Top Ten" Options), and Section 8 (Projects Warranting Additional Detailed Feasibility Analyses).

Over the nine-month study period, there have been numerous intergovernmental proceedings and joint planning sessions between the California Energy Commission (CEC), CPUC, and California Air Resources Board (CARB) to promote renewable energy and energy efficiency. Also over this period, the United States has lapsed into a severe economic recession. Newly elected President Obama recently authorized the American Recovery and Reinvestment Act of 2009 that includes renewable energy investment as one of the cornerstones for the nation's economic recovery. California's third year of drought and local/statewide drought declarations highlight the need for additional water storage that would extend water and power benefits to downstream hydroelectric operators and water purveyors.

These economic, water supply, and energy market settings present EDCWA and El Dorado County purveyors with tremendous, short-term opportunities to develop long-term energy revenue and water supply benefits for the County. The hydro options identified as economically viable for immediate development and the specific steps and timing that will be necessary to take advantage of these opportunities are discussed in Section 9 (Recommendations and Next Steps).

Participants in the study process included EDCWA and water purveyor management and staff, Citizens for Water Chair Harry Dunlop, a panel of local land and water management experts (i.e., Robert Smart, Fred McKain, Doug Leisz, Bob Harris and Jack Hannaford), and a technical team of regulatory, economic, engineering, and environmental consultants that performed the study under the guidance of the EDCWA and water purveyor staff. The study participants, meetings held, additional persons consulted, and study organizations are explained in Section 10 (Study Participants and Meetings Held).

Acronyms are provided in Section 11 (Acronyms and Other Terms) to identify abbreviated phrases, measurements, agencies and organizations. References cited are in Section 12 (References).

Several appendices are included with this report. The appendices provide additional detail on the assumptions, calculations, water flow projections, hydro design assumptions, energy generation estimates, cost estimates, environmental and regulatory permitting processes, and renewable energy certification programs affecting hydroelectric development options in El Dorado County. For the reader's ease of reference, some appendices contain website and related materials that helped form the analyses and conclusions of this study, but which may not be readily accessible at the time this report is reviewed.

Section 2
Energy Policies Supporting Hydroelectric Generation

California and national energy policies and regulations have changed significantly over the past two to three years, and are expected to change even more dramatically over the next several years. The changes stem from growing scientific community consensus on global climate change, public official policies addressing the increasing public health costs of fossil fuel effects on air quality, ongoing petroleum shortages and volatile fossil fuel prices, geopolitical and national security issues related to foreign energy dependence, and political support for California leading the nation toward a "clean energy economy". These trends have enhanced, and may further enhance, the economics of hydroelectric development in El Dorado County.

This section summarizes current and developing energy policies and programs affecting the feasibility of renewable energy in general and hydroelectric energy in the water sector specifically. The current policy mandates and renewable energy programs are the key reasons why this study focused on hydro options at existing facilities; these policies and programs are the basis for this study's findings and recommendations.

Overview

Effective February 1, 2008, the CPUC required Pacific Gas & Electric Company (PG&E) to begin purchasing power under standardized agreements from qualifying small hydro projects at water and wastewater facilities. Qualifying projects can be up to 1.5 megawatt (MW) and rates are guaranteed for 10-, 15- or 20-year terms. The guaranteed power purchase rates [i.e., Feed-In Tariff (FIT)] are about 200 percent of PG&E's Market Price Referent (MPR) during peak energy demand periods in the summer, and about 110 percent during peak energy demand periods in the winter.

The effect of the FIT rates cannot be overstated. While a small hydro project in 2007 may have commanded $0.09/kilowatt hour (kWh) regardless of the time of day, the PG&E FIT now guarantees about $0.20/kWh during the peak hours on summer weekdays. Southern California Edison "Feed-In Tariffs" include peak period payments of more than $0.30/kWh, which reflects the rapidly rising, peak energy demand period value of renewable energy. Additionally, federal and California regulatory exemptions for small hydro projects at existing facilities and hydro project planning, design, permitting, procurement, and power purchase/interconnection agreements allow for the development of small hydro facilities within about 18 months.

Driven by California legislative requirements (AB 32 – Global Warming Solutions Act of 2006) to reduce greenhouse gas (GHG) emissions to 1990 levels by 2020 (about a 30 percent reduction), the CARB is mandated by AB 32 to work expeditiously with the CPUC, CEC, and California Independent System Operator (CAISO) to establish additional regulations that will achieve the 2020 GHG reduction goals. These include additional economic incentives for "small hydro" (up to 30 MW) and other renewable energy resources (e.g., solar, wind, biogas, biomass and biodiesel), economic disincentives for use of fossil fuels (e.g., "carbon tax"), and proposed new regulations to increase the energy efficiency (including system reoperation) of water and wastewater systems. Also to help meet the GHG goals, California's electric utilities are mandated to procure 20 percent of their energy supplies from renewable sources by 2010, and 33 percent of their supplies from renewable sources by 2020. Because hydropower is a renewable energy resource that is both non-carbon and dependable (can be dispatched when needed - unlike solar or wind), hydroelectric energy is expected to increase in value into the foreseeable future.

2.1 Current Energy Policy Direction

Legislative and regulatory initiatives are focusing on reducing dependence on fossil fuels. The regulatory focus has been on all major carbon-generating sectors of the economy, differing somewhat between the national and state policies, but overall the emphasis has been on the following themes:

- Reduce greenhouse gas emissions to reduce the effects of manmade contributions to global climate change ("Global Warming")
- Reduce reliance on fossil fuels and imported fuels for energy production to reduce the negative economic consequences associated with international disruptions in petroleum production ("Energy Independence")
- Increase limitations on pollutants from energy generation to improve ambient air quality and reduce adverse public health effects and costs ("Public Health Costs")
- Shift energy policies from near-term, economic-driven decisions to long-term environmental and sustainability-driven decisions ("Clean-Energy Economy")
- Stimulate the national and California economies with investments, incentives, and jobs in infrastructure to support new (e.g., fuel cell) and emerging (e.g., electric car) industries, including a focus on efficiency in the water industry that is heavily dependent on energy ("Renewables Industry" and "Energy Efficiency")

2.2 Energy Policy Effects on the Water Sector

Historically, California water policies and regulations focused on water supply, water conservation, and water quality, and have been largely independent of energy policies and regulations. However, because the water industry (including conveyance, treatment, and distribution) uses approximately one-fifth (19 percent) of electricity and 30 percent of non-power plant natural gas in the State (CARB 2008), the water sector is being targeted for regulation from a different angle – namely, energy as it relates to water use efficiency, water recycling, water system energy efficiency, and energy recovery/renewable energy production.

The changing energy policies require new thinking about water supply, conveyance, treatment, distribution, and hydroelectric generation in El Dorado County. How much and what type of energy is used, when energy is used to treat and deliver water, efficiency of conveyance and treatment of current water sources, energy requirements to convey and treat additional water sources, and energy recovery are becoming increasingly emphasized.

2.3 Hydropower as Key Component of Energy Policy Incentives

Hydropower at existing facilities is being directly promoted (e.g., financial incentives for in-conduit hydro units) as a renewable energy resource. New regulations also are indirectly promoting hydropower through measures designed to penalize carbon-based energy (e.g., the 'carbon tax' greenhouse gas reduction measure that is being proposed by CARB staff through its December 2008 Scoping Plan (CARB 2008) measures for carbon-emitting energy sources). Additionally, hydropower facilities have some distinct advantages over other renewable energy developments. For example, the technology is well established so that planning is more predictable and less vulnerable to unknown factors influencing final project installation and operation.

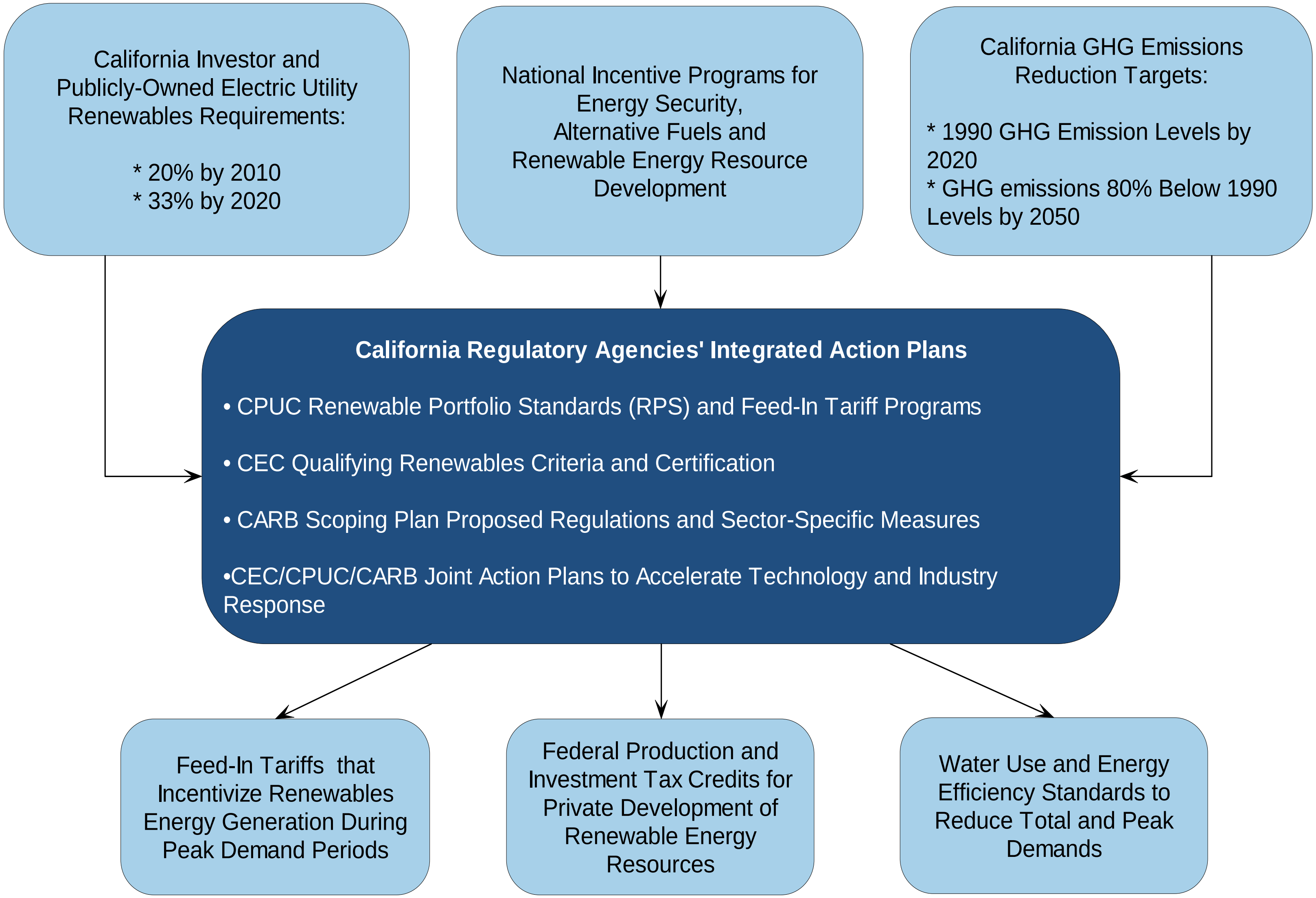
Financial incentives (i.e., "must take" contracts with guaranteed power purchase rates via the FIT program), expedited permitting (e.g., Federal Regulatory Energy Commission (FERC) and state permit exemptions for existing facilities), standardized utility power purchase/interconnection agreements, and other incentives are available today for small hydroelectric development and other renewable energy generation at existing water and wastewater facilities (Figure 2-1). The goals of the incentives for hydropower and other renewable energy resources are to help reduce greenhouse gas emissions by 30 percent from "business-as-usual" levels (i.e., taking into account population growth) by the year 2020. Overall, the program goals are to promote renewable energy resources (including hydro power development), increase the value of non-carbon (e.g., hydropower) energy generation to make it competitive with fossil fuels, and improve water system energy use efficiency and load demand management.

2.4 Role of Renewables Portfolio Standard in California's Long-Term GHG Reduction Requirements

The CPUC and CEC are jointly responsible for implementing a program [Senate Bill (SB) 107] that targets the State's Investor Owned Utilities (IOUs) and others to reduce greenhouse gas emissions by mandating electric utility acquisition of required levels of renewable energy. The CPUC July 2008 Renewables Portfolio Standard (RPS) Quarterly Report indicates that a 20 percent goal by 2010 will not be accomplished, but could be accomplished by the 2012-2013 timeframe if identified barriers to project development are removed. Only one of the major barriers (i.e., transmission) applies to the County purveyors' small-hydro opportunities and only to a few of the most promising alternatives (i.e., Stumpy Meadows).

The CPUC January 2009 RPS Quarterly Report indicates that 2008 was a turning point in the RPS program. During that year, more than 500 MW of new RPS-eligible generating capacity completed construction, representing 60% of the total new construction installed since 2003. Additionally, more than 2,800 MW of RPS contracts were approved by the CPUC in 2008.

Figure 2-1: Key Energy Policy Mandates and Incentives for Hydroelectric and Other Renewables Development



Governor Schwarzenegger's Executive Order S-14-08, issued on November 17, 2008, established an RPS goal of 33% renewable energy by 2020. According to the CPUC January 2009 RPS Quarterly Report, the CPUC is working on a 33% RPS Implementation Analysis that will update renewable resource portfolios, barrier assessment, implementation solutions, and cost impact of the 33 percent RPS requirement.

SB 1368 (Emission Performance Standards), a companion bill to AB 32, limits electric utilities' (both IOUs and public utilities) long-term investments in baseload generation to plants that meet an emission performance standard (EPS) equal to a natural gas-fired combined-cycle plant. This limits the ability of the utilities to contract for generation produced outside the state of California that exceeds the EPS (e.g., coal-fired facilities and less-efficient natural gas-fired facilities) and places an even greater premium on non-carbon generation sources as a part of the utilities' baseload energy requirements.

According to the CPUC's July 2008 quarterly report, the 33 percent RPS goal by 2020 equates to an additional 60 percent increase in renewable energy resources beyond the RPS 20 percent goal. Between 2013 and 2020, this … "will require an infrastructure build-out on a scale and timeline perhaps unparalleled anywhere in the world." This conclusion recognizes that the most feasible RPS projects ("low-hanging fruit") already will have been developed by the 2013 timeframe.

SB 1038, SB 1078, SB 1250, and SB 107 established specific roles for the CEC and the CPUC and direct the two agencies to work together to implement the RPS. Although the laws assign lead roles for specific implementation efforts to each agency, the roles of the two agencies are interrelated. According to the January 2008 CEC Guidebook on Renewables Portfolio Standard Eligibility (RPS Guidebook, CEC 2008), the CEC is responsible for certifying eligible renewable resources and tracking the procurement of such resources to ensure compliance with the RPS. The CPUC is responsible for establishing targets for the amount of eligible renewable energy resources that retail sellers of electricity must procure to comply with the RPS and verifies compliance with the requirements. Retail sellers include IOUs such as PG&E and electric service providers (ESPs) such as the Sacramento Municipal Utility District (SMUD).

Proposed regulations and policies are now being developed by the CARB and others that, when implemented, will require the County's water purveyors to work with public and private energy utilities toward the long-term goal of stabilizing concentrations of carbon dioxide in the atmosphere by 2050 (Governor Schwarzenegger's Executive Order S-3-05). This goal represents an 80 percent reduction in California's GHG emissions below 1990 levels.

The targeted phase-out of pollution- and carbon-heavy energy generating resources, new carbon cap-and-trade programs, policies supporting development of electric powered cars, converting diesel and natural gas-fired pumps to electric, and the anticipated growth in the County's and State's population will all contribute to an increasing demand for clean electric power at the same time that California is reducing its in-state and imports of out-of-state fossil fuel-fired electricity. Out of state coal-fired electrical generation alone accounts for close to 15 percent of California's annual energy supply, indicating that a substantial amount of renewable energy resources will be necessary to replace the phase-out of carbon-heavy generation and to meet the growing RPS requirement.

2.5 Hydro Options Eligibility for RPS Feed-In Tariff Program

AB 1969, approved on September 29, 2006, adds Section 399.20 to the Public Utilities (PU) Code. It requires all electrical corporations to file with the CPUC a standard tariff (i.e., FIT) to provide payment for every kWh of renewable energy output produced at an electric generation facility at the market price determined by the CPUC for a period of 10, 15, or 20 years. For purposes of Section 399.20, an eligible generation facility must be an eligible renewable energy resource owned and operated by a public water or wastewater agency that is a retail customer of the electric utility (e.g., PG&E), interconnected and operated in parallel with the utility's transmission and distribution system, and be sized to offset part or all of the electric demand of the public agency.

Section 399.20 limits payment to eligible facilities to a cumulative rated generating capacity of 250 MW statewide. Service will be available upon request on a first-come-first-served basis until the utility meets its proportionate share (i.e., about 105 MW allocated for water and wastewater facilities for PG&E) of the statewide limit.

The RPS Guidebook (CEC 2008) states that to qualify for the FIT program and other renewable energy incentives, an RPS-eligible small hydroelectric facility or conduit hydroelectric facility must not exceed 30 MW and must meet certain other criteria. In addition to a certification/pre-certification applications (see Appendix C, Environmental Regulatory, Permitting, and Feed-In Tariff RPS Certification and Contract Requirements), applicants for small hydroelectric facilities or conduit hydroelectric facilities must complete a supplemental application form and provide additional required information. The requirements are described in greater detail below.

Small Hydroelectric (not conduit)

Generation from a small hydroelectric facility that commences commercial operations or is repowered on or after January 1, 2006, is eligible for the California RPS certification if the facility meets all of the following criteria:

- The facility is 30 MW or less, with an exception for eligible efficiency improvements made after January 1, 2008
- The facility is located in-state or satisfies the out-of-state requirements
- The facility does not "cause an adverse impact on instream beneficial uses or cause a change in the volume or timing of streamflow"

Conduit Hydroelectric

To be eligible for RPS certification, a conduit hydroelectric facility must use for its generation only the hydroelectric potential of an existing pipe, ditch, flume, siphon, tunnel, canal, or other manmade conduit that is operated to distribute water for a beneficial use. A conduit hydroelectric facility may be considered a separate project even though the facility itself is part of a larger hydroelectric facility.

Generation from a conduit hydroelectric facility that commences commercial operations or is repowered on or after January 1, 2006, is eligible for the California RPS if the facility meets all of the following criteria:

- The facility is 30 MW or less, with an exception for eligible efficiency improvements made after January 1, 2008
- The facility is located in-state or satisfies the out-of-state requirements
- The facility does not “cause an adverse impact on instream beneficial uses or cause a change in the volume or timing of streamflow”

Eligible Efficiency Improvements

Eligible efficiency improvements to hydroelectric facilities are limited to those improvements that make more efficient use of the existing water resource and equipment, rather than increase the storage capacity or head of an existing water reservoir. Efficiency improvements do not include regular or routine maintenance activities. Eligible efficiency improvements may include the following measures:

- Rewinding or replacing the existing turbine generator
- Replacing turbines, turbine runners, and nozzles
- Computerizing control of turbines and generators to optimize regulation of flows for generation
- Adding tailwater suppression equipment to permit operation during high flow river stage

The applicant is responsible for showing that its facility qualifies for the RPS. Additional information required of applicants for small hydroelectric, conduit hydroelectric facilities and incremental generation regardless of output is discussed in Appendix C of this report and in RPS Guidebook Section III: Certification (CEC 2008).

Pumped storage

A pumped storage hydroelectric facility may qualify for the RPS if: 1) the facility meets the eligibility requirements for small hydroelectric facilities, and 2) the electricity used to pump the water into the storage reservoir qualifies as RPS eligible. The amount of energy that may qualify for the RPS certification is the amount of electricity dispatched from the pumped storage facility. Pumped storage facilities qualify for the RPS on the basis of the renewable electricity used for pumping water into the storage reservoir, but the storage facilities will not be certified for the RPS as separate or distinct renewable facilities. A facility certified as RPS-eligible may include an electricity storage device if it does not conflict with other RPS eligibility criteria.

2.6 Federal and State Exemptions for Small Hydroelectric Projects

The FERC has two classes of exemptions for small hydroelectric facilities. One class (“Small Hydroelectric” Exemption) is for projects that are 5 MW or less that will be built at an existing dam, or projects that utilize a natural water feature for head or an existing project that has a capacity of 5 MW or less and proposes to increase capacity. The second class (“In-Conduit” Exemption) is for projects that are 40 MW or less (municipal projects) and that are constructed on an existing conduit that was previously constructed primarily for purposes other than power production and that must be located entirely on non-federal lands (i.e., the generating facility).

The California Environmental Quality Act (CEQA) includes a “Small Hydroelectric Categorical Exemption” (CEQA Guidelines Section 15328) for projects at existing facilities that meet certain criteria (e.g., projects with capacities of 5 MW or less and that do not affect instream flows or special-status species). Both the federal and State exemptions for small hydroelectric projects are discussed in greater detail in Appendix C of this study.

2.7 Ongoing Changes to Existing FIT Program: SB 380 and Additional CPUC Consideration of a Feed-In Tariff

Changes are being evaluated for the existing FIT Program as well as for expanding the program for larger projects to accelerate renewable energy development. On September 28, 2008, SB 380 (Kehoe) amended Public Utilities Code § 399.20. As a result of SB 380, the CPUC is considering modifications to the existing FIT program for generators up to 1.5 MW.

The CPUC staff is now proposing to adopt rules for a FIT for Renewable Generators greater than 1.5 MW. The CPUC Energy Division Staff Proposal (CPUC 2009) considers generators between 1.5 MW and 20 MW, and was made part of the record by the Administrative Law Judge’s Ruling on Additional Commission Consideration of a Feed-In Tariff, filed March 27, 2009. Table 2-1 is from Appendix A of the Energy Division Staff Proposal that compares the existing Feed-In-Tariff program for projects up to 1.5 MW to the staff proposal for the FIT program expansion for projects between 1.5 MW and 20 MW.

For El Dorado County hydro options at existing facilities, potential changes for generators up to 1.5 MW would likely mean increased competition, future reduced rates of the tariffs, “leveling the playing field” for less cost-effective (e.g., wind) qualifying renewable energy sources, and complicating the regulatory process for developing hydroelectric options within the County.

Table 2-1: Comparison between Existing FIT Program and CPUC Staff Proposal to Expand FIT

	Existing FIT program (0 - 1.5 MW)	Staff Proposal for FIT Program Expansion (>1.5 MW to 10 MW)
Program Design Issues		
Utility Applicability	All CPUC jurisdictional IOUs	Only the 3 large IOUs: PG&E, Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E)
Total Program Size Cap	500 MW	Additional 1,000 MW for all projects in this category
Contract Price	Market price referent	No change
Location Restrictions	Must be an IOU retail customer	Must be within CAISO Controlled Grid
FIT contract terms	Each IOU developed own language based on D.07-07-027	New terms and conditions must be the same across all 3 IOUs
Contract Terms and Conditions		
Length of Time to Achieve Commercial Operation	Within 18 months, with opportunity to extend online date	Within 18 months, with opportunity to extend online date by 6 months for regulatory delays
Excess Sales/Full Export	Projects can choose either excess sales or full export	No choice, all producers must export all energy production
Development Security	None	$20/kilowatt (kW)
Performance Assurance	None	5% of expected total project revenue for projects (only applies to >5 MW – 10 MW)
Performance Obligation/Energy Delivery Obligation	Utility can terminate contract if deliveries are not made according to good utility practice or prudent electrical practices	Add minimum requirement: 140% of expected annual net energy production based on two years of rolling production
Damage Calculation	Damages are actual direct damages; they are neither calculated by a formula nor capped	Capped damages equal to contract energy price minus average market price for the term year, but not greater than $0.05 nor less than $0.02/kWh
Insurance	SCE/SDG&E: $2 million (>100 kW) PG&E: $1 million (>100 kW)	No change
FERC Certification	IOUs currently require FERC Certification	Not required

Source: http://docs.cpuc.ca.gov/efile/RULINGS/99105.pdf

2.8 Role of Energy Storage in a Renewable Energy Future

The CPUC issued a Data Request on February 18, 2009 for input from stakeholders on Advanced Energy Storage (AES) technologies and the benefits of increased energy storage on both the customer and utility sides of the meters. On March 6, 2009, the CAISO issued a response to this request that included the following regarding pumped storage:

- The increase in the amount of wind generation over the next five to ten years will result in serious mismatch of load and generation in off-peak periods. Energy storage can provide the additional nighttime load that will be essential for capturing the excess production of green energy and to shift the delivery to critical afternoon peak load periods. Pumped storage is listed as the first technology that is capable of achieving the shift in energy loads.
- Smart metering and the development of 'Smart Grid' systems are likely to be key infrastructure requirements. The CPUC should support pilot projects that evaluate the value of such resources to ratepayers.

2.9 Energy Independence for El Dorado County

The El Dorado County Hydro Advisory Panel (HAP) has recommended that, consistent with State and Federal policies, El Dorado County adopt a policy to encourage independence from foreign oil. The following language has been developed through HAP and purveyor meetings on this study to help meet this policy goal:

"It is the policy of the (stated agency) that resources planning and infrastructure, including water and wastewater systems, emphasize renewable energy and energy efficiency toward a goal of Energy Independence for El Dorado County and its citizens."

At the February 24, 2009 HAP meeting, the EDCWA and purveyor staff concluded that the above resolution should be considered for possible adoption by the El Dorado County Board of Supervisors and water purveyors, but that it should first be presented to the EDCWA Board for consideration and possible adoption. In presenting the recommendation, the HAP also suggested the following consideration:

"In support of the County Policy of Energy Independence for El Dorado County and its citizens, we urge EDCWA and its member agencies to vigorously pursue an allocation of hydro power generated at Folsom and Nimbus dams from water originating in El Dorado County for use primarily by public agencies within the County (i.e., County government, schools, special districts, City of Placerville, etc.). This would be in keeping with previous federal government allocation of hydropower to upstream areas on a number of federal projects within the Sierra Nevada region. Such an allocation to El Dorado County would substantially reduce the time required for the County to reach this stated goal of Energy Independence for El Dorado County and its citizens."

2.10 Policy Effects on Hydropower's Future Role in El Dorado County

In addition to developing small hydro at existing facilities, the County's interests also should extend to "small" hydro (up to 30 MW) at new facilities that, in combination with water storage, can increase hydropower generation at existing facilities such as the El Dorado Hydroelectric Project. Because the largest potential renewable energy resources (e.g., wind and solar) are not dependable from an energy contracting perspective, reliable energy resources (such as hydropower generation from reservoirs) must also be acquired to 'firm-up' the non-dependable energy resources. Hydropower with a storage component has the greatest potential (behind nuclear power) to provide dependable, non-carbon energy that can balance increasing proportions of non-firm, renewable energy resources (e.g., wind and solar). As a result, hydropower energy values are expected to exceed those of other renewable energy resources over the long term.

There are tremendous demands for new sources of non-carbon based, dependable electrical energy generation, and that trend is expected to grow given the national policy climate. El Dorado County's purveyors are in a unique position to capitalize on today's opportunities associated with FIT small hydro (1.5 MW or less) and energy load shifting within the existing water systems. Because of the requirements for future sources of dependable, clean energy (at least through 2020), the County's purveyors have a unique opportunity to develop and finance future water supply pumped storage reservoir systems utilizing the value of hydropower generation revenues. As with all legislative or regulatory incentives and mandates, FIT and other incentives may be discontinued in the future. When incentives such as these arise, the window of opportunity should be seized before the window closes.

For the reader's reference, attached is Table 2-2 summarizing existing laws and regulations that are particularly relevant to hydroelectric project development in El Dorado County today. Developing laws and regulations or economic incentives that actively promote hydropower should be continuously monitored.

Table 2-2: Brief Summary of Existing Laws, Regulations and Policies Relevant to Small Hydro Development
AB 1969 - Renewable Portfolio Standards
Requires electrical corporations to file a tariff for purchasing renewable energy from water/wastewater agencies · Directed the CPUC to establish market price at which renewable energy would be purchased · CPUC February 2008 Resolution E-4137 set FITs for investor-owned utilities (e.g., PG&E) · CPUC FIT requires PG&E to purchase/interconnect qualifying facility power under standardized contracts · PG&E tariff rates range from $0.06 to $0.18/kWh for 2008 based on season and time of day · FITs are adjusted annually and rates are guaranteed for the term of the 10-, 15- or 20-year contract
California AB 32 Global Warming Solutions Act of 2006
Establishes economy-wide cap on GHG emissions at 1990 levels by 2020 · represents an 11 percent reduction from current levels, which doesn't account for growth · CARB is the lead agency for implementing AB 32 requirements to achieve a "clean-energy economy · CARB "must develop a Scoping Plan to lower GHG emissions to reach the 2020 limit · Mandatory GHG reduction measures are being developed for each sector of the economy, including water · CARB proposes 6 GHG measures for the water sector. Four are directly applicable to El Dorado County: > water use efficiency, > water recycling, > water system energy efficiency, and > renewable energy production at water and wastewater facilities · CARB proposes a "Public Goods Charge" of $10 to $50 per water connection to fund GHG measures · CARB proposes to expand RPS requirements from 20 percent by 2010 to 33 percent by 2020
California SB 1368 Emission Performance Standards
· Prohibits an electricity provider from entering into long-term contracts unless the generation complies with emission standards - regardless of facility location · Rule is in place with no phase-in · Also impacts existing generation facilities - capital investments in non-complying existing facilities are limited to routine maintenance
Exec. Order S-3-05 - Governor directive to reduce California GHG emissions to 80 percent below 1990 levels by 2050
CEQA Guidelines Section 15328 - Small Hydroelectric Categorical Exemption
· Exemption applies to projects of 5 MW or less capacity at existing facilities · Projects cannot affect instream flows or special status species
Public Law 110-140 Energy Independence and Security Act of 2007
· Establishes a grant program for public agency projects that encourage the use of plug-in electric vehicles · Requires new automobile rating for consumers to compare fuel economy and GHG emissions at purchase
Federal Energy Regulatory Commission Small Hydro (at existing dam) and "In-Conduit" Exemptions
· Small hydro includes qualifying facilities up to 5 MW at existing dam or utilizing a natural water feature · In-conduit includes qualifying facilities not on federal lands up to 40 MW that are constructed on an existing conduit

Section 3

Water and Wastewater Energy Management Goals and Objectives for El Dorado County

Multiple public water purveyors treat and deliver water to customers in El Dorado County. Additional hydroelectric development within the County would provide many water and energy management benefits to those purveyors as well as to their customers. The potential benefits, as well as related interregional planning efforts and their goals and objectives, are explained below.

3.1 Hydroelectric Revenue Support of Water Systems and Operations

El Dorado Irrigation District (EID), Georgetown Divide Public Utility District (GDPUD), Grizzly Flats Community Services District (GFCSD), South Tahoe Public Utility District (STPUD), Tahoe City Public Utility District (TCPUD), and the U.S. Bureau of Reclamation make up the public water purveyors delivering water to customers in El Dorado County. These water purveyors have a continuing obligation to provide water to meet the demand in their service areas in an efficient and affordable manner. Each have long histories of providing high quality water in a fiscally responsible manner, and in the case of EID and GDPUD, also have a history of developing hydroelectric power.

Hydroelectric generation produces revenue to help offset purveyor operational costs. Revenue associated with hydroelectric facilities can not only be used to assist with financing hydroelectric facilities, but also for other purveyor project operations and infrastructure needs such as water conveyance, treatment facilities, other infrastructure, and operation and maintenance requirements associated with the treatment and delivery of water to customers.

3.2 Water Supply Reliability and Drought Protection for El Dorado County

In addition to revenues, hydroelectric facilities can contribute other benefits including increased water supply, drought protection, water supply reliability, and operational flexibility. Hydroelectric developments providing water storage can serve the dual purposes of providing water for hydroelectric generation as well as making storage available to provide consumptive water to purveyors, which is especially important during times of drought. Integrating hydroelectric developments into existing and planned water infrastructure can have added purposes such as dissipating energy to facility conveyance of water, especially in the topography seen in El Dorado County.

The future of hydroelectric development in El Dorado County will be affected by water supply policies and plans both within and beyond the County's boundaries. These include 'foreseeable future' water demands and deliveries per the County's 2004 General Plan, the need for drought protection for municipal, agricultural, public safety (fire fighting), and environmental beneficial uses, and Folsom Lake's storage constraints for flood control that also limit coldwater pool management and flows for the Lower

American River fisheries. Additional considerations include the State's renewed interest in a Delta Conveyance Facility (formerly known as a "Peripheral Canal") or other conveyance for San Joaquin Valley and southern California water deliveries, and more stringent drinking water quality standards that are making the treatment of Central Valley groundwater supplies more costly.

Several current planning and policy documents address the above issues including: the EDCWA's December 2007 Final Water Resources Development and Management Plan; the County purveyors' drought plans; the Cosumnes, American, Bear and Yuba Integrated Regional Water Management Plan (IRWMP); and, the American River Basin IRWMP. The goals and objectives of these and other purveyor- and stakeholder-driven planning efforts are addressed in the following sections.

3.3 Interregional Stakeholder Interest in Water Supply-Related Hydroelectric Development in El Dorado County

Benefits of hydroelectric development to water purveyors and the people of El Dorado County are not constrained to the County borders. Benefits can cross county boundaries and extend to the larger region. Hydroelectric development goals and objectives are consistent with many ongoing local, regional, and interregional planning initiatives. Some of these complementary interregional planning initiatives and their goals are identified below.

<u>Mountain Counties Water Resources Association (MCWRA)</u>

- Enhance Mountain County water resources
- Support MCWRA member project initiatives

<u>Cosumnes American Bear Yuba (CABY)</u>

- Achieve sustainable surface water supply
- Provide benefits from management of water resources, diversions and infrastructure
- Improve storage capacity
- Promote management strategies to alleviate potential impacts of drought and climate change
- Improve operation (reduce degradation and optimize benefits) of inter-basin transfers of water
- Maintain and promote recreational and environmental values associated with water infrastructure
- Evaluate and modify water infrastructure to improve efficiency
- Manage rivers, tributaries and infrastructure to provide flow regimes that benefit ecosystem function

Lower Cosumnes River Interests (including Southeast Sacramento County Agricultural Water Authority, The Nature Conservancy, the Sacramento County Water Agency and the Anadromous Fish Restoration Program)

- Contribute to the fish doubling goals of the Central Valley Project Improvement Act
- Provide fish habitat restoration via flow modification to improve passage and spawning habitat for fall-run chinook salmon
- Increase ground water recharge for improved management and opportunities for conjunctive use projects

SMUD

- Increase peaking electrical generation
- Increase renewable energy sources

PG&E

- Increase peaking electrical generation
- Increase renewable energy sources (20 percent RPS required by 2010 and 33 percent RPS required by 2020)

Sempra Energy Services (Project No. 184 Power Purchaser)

- Purchase additional dependable energy
- Increase renewable energy sources (20 percent RPS required by 2010 and 33 percent RPS required by 2020)

American River Basin IRWMP

- Increase water supply reliability
- Identify and develop specific integrated facilities and operations that will enhance regional and individual drinking water supply availability
- Identify, cultivate and promote multi-jurisdictional infrastructure and joint operational partnerships to enhance water supply system capacity/capability and reliability to the region
- Recognize the importance of reliable and affordable water supplies for disadvantaged, self-supplied and agricultural groundwater users, which are all noted as goals and objectives consistent with new hydroelectric development in El Dorado County

Sacramento Area Water Forum (Water Forum)

- Provide a reliable and safe water supply for the region's economic health
- Preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River

State of California

- Provide water supply benefits
- Control flooding and integrate with water supply benefits
- Improve operational efficiency and reliability

- Redistribute water
- Augment water supplies
- Improve system flexibility
- Provide environmental benefits
- Increase energy generation benefits
- Reduce energy consumption
- Increase energy resources to operate the State Water Project more economically and reliably
- Reduce per capita water use by 20% by 2020 (per Governor Schwarzenegger, February 2008 Executive Order No. S-14-08)

Regional Environmental Interests [including State Water Resources Control Board (SWRCB), Regional Water Quality Control Board (RWQCB), California Department of Fish and Game (CDFG), U.S. Fish & Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA) Fisheries, Sierra Nevada Conservancy (SNC), American River Conservancy, Sierra Club, Sierra Nevada Alliance, Friends of the River, et al.]

- Augment South Fork and Lower American River summer/fall flows
- Reduce Folsom Reservoir pumping (protection of cold water pool and energy conservation)
- Increase retention and use of the Folsom cold water pool for the lower American River
- Reduce size and cost of Folsom Reservoir proposed temperature control device
- Augment North Fork and Lower Cosumnes River summer/fall flows
- Augment Cosumnes River basin ground water recharge

Outside County Water Purveyors

- Develop drought protection measures
- Increase water supply

3.4 Energy and Water Management Efficiency Improvements

The purveyors are continuously looking for methods to increase efficiency and reduce costs to capture, convey, treat and deliver water to customers. One significant cost, in the case of EID, is the energy required to pump water from Folsom Reservoir. EID currently has the right to pump about 10,000 acre-feet per year of water from Folsom Reservoir and is working toward securing the right to pump an additional 47,000 acre-feet per year. The energy cost to pump this amount of water and associated infrastructure requirements, such as the new temperature control device, is significant. There could be significant energy and cost savings found by developing methods to take advantage of gravity flow to reduce pumping requirements from Folsom Reservoir, especially when considering beneficial uses pending new water supplies. Projects like the Bass Lake/Folsom Pumped Storage Project could also offset pumping costs for supplies taken out of Folsom.

3.5 Other Benefits Afforded By Hydroelectric Development

The primary benefits of the development and operation of hydroelectric facilities are the energy production, associated revenue, and displacement of energy generated from fossil fuels. In addition, there are other important benefits to consider such as socioeconomic and non-use attributes of new hydroelectric development that are provided to the host community. These consequential types of benefits are important to local entities, such as El Dorado County, that are concerned with the community's overall wellbeing beyond that of just efficient and affordable water purveying.

Socioeconomic values occur both within and beyond project boundaries related to the multi-purpose functioning of hydroelectric projects and their associated facilities (such as water supply, flood control, and recreation when considering reservoirs). This type of benefit also includes the economic stimuli that projects provide to the host community during both construction and operation.

Non-use attributes are values that accrue to those entities that do not directly or currently participate, and might not intend to participate, in the benefits of the project. These can include the existence values (knowledge of the continued existence of a resource), heritage value (preserving the resource for future generations), and option value (having the option to use the resource in the future).

Section 4

Study Approach and Process to Develop Plan

This section describes the process by which the hydroelectric development options were identified, screened, designed, ranked, reviewed for constructability, and analyzed using a variety of economic tools. A primary goal of this study was to target projects that demonstrate immediate viability under the financial and economic incentives available in 2009. One prominent economic incentive for hydro options at existing facilities is the FIT (see Section 2), which was not in place during past investigations such as EID's Energy Recovery Study (Black & Veatch 2007). Another primary goal of this study is to identify additional projects that may be immediately viable, but require further study to assess their feasibility. This latter category includes projects that are more complex, such as those with new water storage features or those requiring reoperation.

4.1 Types of Hydro Options Considered

Hydro options previously studied and new hydro options identified by the County's purveyors, HAP, and consultant team were considered in this study. Some initially identified hydro options were later dropped because they were deemed clearly infeasible at this time. Examples include projects where flows would be insufficient to generate power to economically support the project (e.g., GDPUD's Knickerbacher Creek diversion into the Pilot Creek watershed), projects where substantial hydropower potential exists but public objections would make it infeasible (e.g., Echo Creek cascades into the Tahoe Basin), or new/expanded water storage that would require legislative or regulatory change to allow for construction of the project.

Based on regulatory, economic and other considerations, the hydro options fall into three general categories: 1) FIT options that could be installed immediately at existing facilities with or without the need for water system reoperation, 2) new site options where there are no or limited existing facilities, and which could become multi-purpose with new water storage, and 3) technology demonstration projects that could be readily installed at existing facilities to test or display emerging developments in water-related energy generation technology. These groups of projects are further discussed below.

4.1.1 Feed-In Tariff Options

The CPUC (Resolution E-4137 February 14, 2008) adopted a version of Europe's FIT program to simplify small renewable generators' (less than 1.5 MW) ability to sell power to utilities at predefined terms and conditions, without contract negotiations. As described in Section 2 (Energy Policies Supporting Hydroelectric Generation), sellers receive a fixed base rate determined by the current CPUC-approved MPR for a period of 10, 15, or 20 years. The rates are set and adjusted by Time of Delivery (TOD) factors (for the larger utilities such as PG&E) as authorized by the CPUC. The MPR is the predicted annual average cost of energy production from a combined-cycle natural gas fired baseload proxy plant, which is intended to represent the utility's avoided cost of producing power.

Energy produced during utility peak hours commands a higher price. Conversely, energy produced during off-peak hours is less valuable to the utility and the FIT accordingly. Numerous small hydro projects in El Dorado County qualify for this program and this category represents the majority of options analyzed in detail as the study progressed. Importantly, FIT rates currently are between two and three times spot-market energy values; therefore, a reasonable level of certainty should be established that a hydro option qualifies for the FIT program before substantial resources are expended on that hydro option.

To qualify for the FIT contracts with PG&E, the projects must be certified by the CEC as qualifying for the RPS program for investor-owned utilities. Pre-certification applications can be submitted to and approved by the CEC in advance of project operation. The conditions and processes that hydro options must satisfy to qualify for the FIT contracts, as well as the CEC RPS certification, are presented in Appendix C.

4.1.2 New Site Options, Including New Water Storage

New site options are typically more traditional, long-term, and multi-use hydropower projects. These options include the construction of new small or large storage facilities, providing water for consumptive use as well as drought and fire protection and downstream beneficial uses. In the case of larger impoundments, recreation adds another benefit to these “multi-use” projects. Large capital outlay projects with significant risk to the County’s purveyors for major water storage opportunities were identified in this study. Only the Alder Creek Reservoir option was evaluated to a greater level of detail (see Section 6, Preliminary Project Analyses of Highest Ranked Hydro Options).

Except for the Alder Reservoir component of the South Fork American River (SOFAR) Project, previously studied major water storage alternatives were screened out early because hydroelectric revenues alone were not sufficient to support these projects. Only those hydroelectric opportunities that deliver substantial hydroelectric generation revenues were given the highest priority.

4.1.3 Technology Demonstration Options

This is a relatively small subset of the total hydro options. These projects represent applications of new technology, such as hydrokinetic turbines, that can be deployed rapidly with minimal construction costs at sites where traditional hydropower does not work. These non-traditional opportunities capture minor energy potential with limited head and/or flows. Because these projects have relatively small generating potential and minimal capacity, they were not a major focus of the analysis.

4.2 Hydro Options Evaluation Process

The hydro option identification and evaluation process followed the approach outlined in the consultant's scope of work for the study (Figure 4-1). EDCWA, County water purveyors, HAP, and consultant team representatives (collectively the "Project Team") actively participated throughout the study process. Six meetings were held with both the HAP members and purveyors at key points in the process to review and guide the hydro evaluation process and products. The meetings, products, and input were documented as the study was completed (see Section 10, Study Participants and Meetings Held). The study process steps that were followed to narrow the hydro options from approximately 100 to the final "top 10" are described below.

4.2.1 Hydro Option Identification

The Project Team convened an exhaustive literature search for hydroelectric projects proposed for development in El Dorado County over the past five decades. The list was developed from a combination of sources, including an inventory of the EID, EDCWA, and GDPUD technical libraries. Figure 4-2 summarizes the sources used to compile the initial list of projects. The Project Team interviewed HAP members and Citizens for Water Chair Harry Dunlop, researched existing water facilities not owned or operated by County purveyors (e.g., Sacramento Municipal Utility District Upper American River Project), and consulted with additional individuals and organizations (e.g., Heavenly Ski Resort) with potential knowledge of hydro options in El Dorado County. The results of the hydro identification process are described in Section 5 (Inventory of County Hydroelectric Potential).

The comprehensive list of hydro options was reviewed by and later presented to the EDCWA, purveyors and HAP for concurrence. Over the study process, the initial list of hydro options was modified several times based on new information received by the Project Team. For this study, all projects were included, regardless of costs, so long as the hydro options did not display characteristics that clearly warranted their non-inclusion (see Section 4.1).

4.2.2 Hydro Option Screening Evaluations

The list of hydro options, which exceeded one hundred projects, needed to be reduced to those with the greatest potential. To accomplish this, the next task focused on screening techniques necessary to produce a list of the most viable projects that could be analyzed in greater detail.

Figure 4-1: Overview Process for Evaluating Hydroelectric Development Options

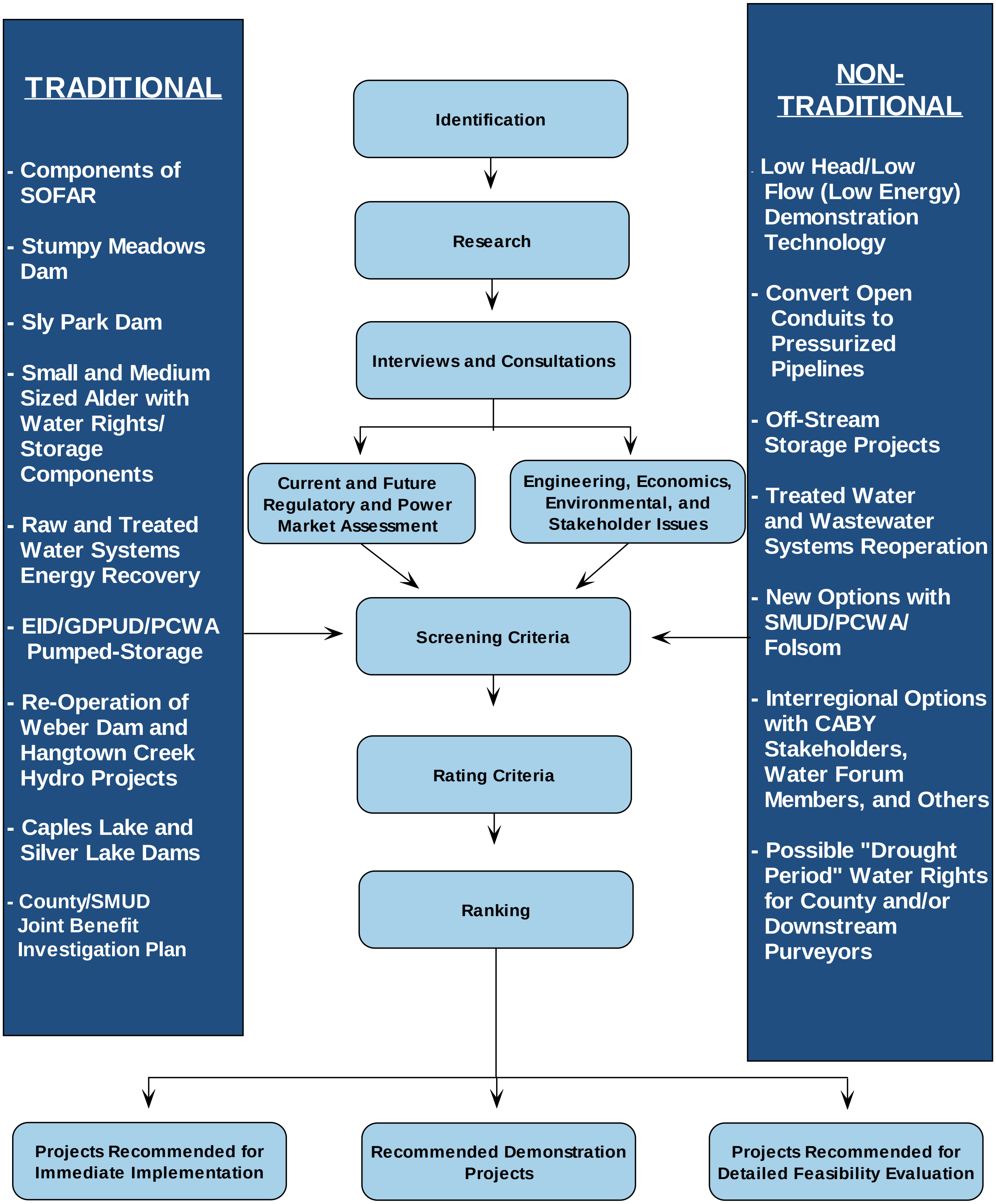
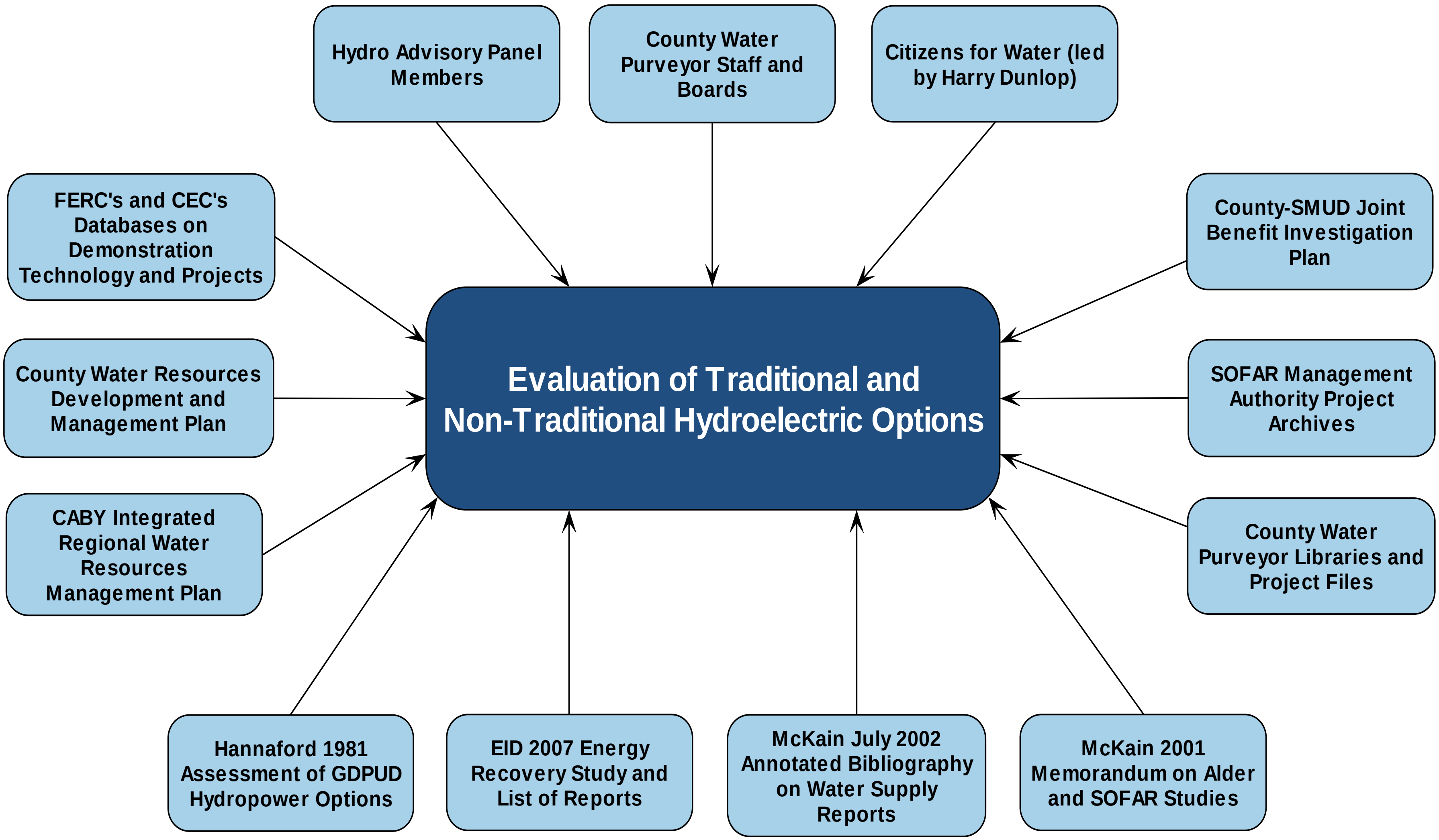


Figure 4-2: Initial Sources for Identifying New and Updating Previous Studies on Hydropower Projects



The projects were placed into a matrix and data was collected for each project using available information from previous studies, existing purveyor records and databases, Project Team knowledge, and existing public data sources. The information developed for the screening matrix included the project type (see Section 4.1), design head and flow, plant factor and capacity, annual generation, previously or newly estimated project costs, and a factor [Capital Cost/Average Annual Megawatt Hours (MWh)] that could be used to compare the relative economic merits of the options.

The consultant team devised a flowchart and considered engineering, operations, environmental, cost, generation potential, site ownership, and other criteria to screen, compare, and rank the hydro options. Initially, the flowchart showed separate paths for FIT options, options at new sites, and options requiring reoperation, but it was determined later that all project options should follow the same review steps. Therefore, the evaluation flowchart was simplified, refined and applied to all hydro options, which is presented as Figure 4-3.

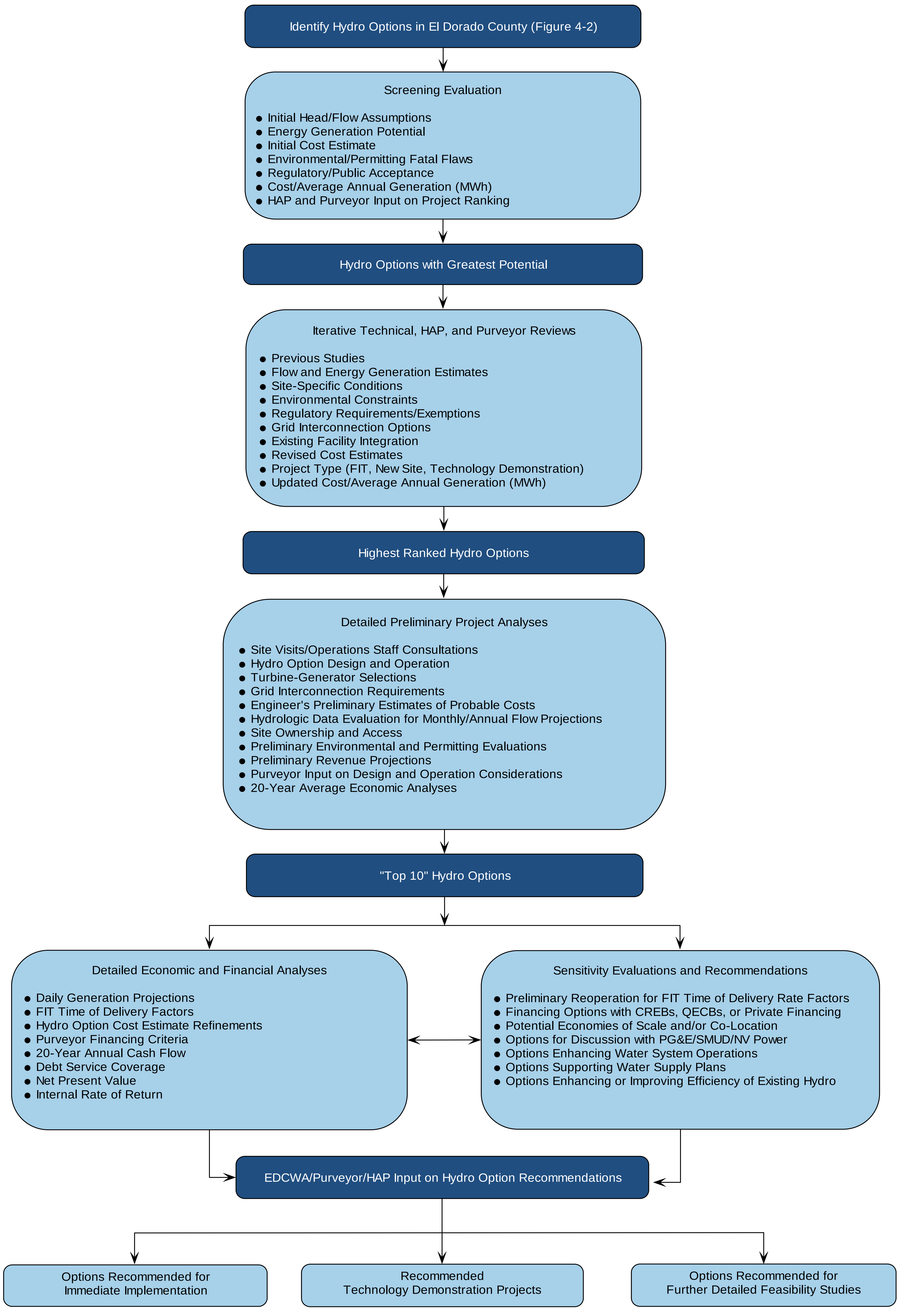
At this point, only one technology demonstration project had been identified as potentially viable. Renewed contacts with Verdant Power confirmed their continued interest to design and install a hydrokinetic demonstration project along the El Dorado Canal. Therefore, this project was automatically advanced as a technology demonstration project for further evaluation.

4.2.3 Hydro Options Advanced by Screening Evaluation

The screening evaluation process yielded a proposed ranking of all hydro options according to three tiers: 1) hydro options that were clearly superior to others in the same category based on the cost per average annual MWh, 2) hydro options that had higher costs per MWh, but which had other characteristics that warranted additional evaluation, and 3) hydro options that were clearly not cost effective based on hydroelectric generation, fatal flaw considerations, or other factors, and therefore did not warrant further consideration beyond the screening evaluation at this time.

The results and ranking of the hydro options from the screening evaluation were displayed in a comprehensive evaluation matrix (see Table 5-1 in Section 5, Inventory of County Hydroelectric Potential). The project options were segregated into three tiers of shading that corresponded to their potential feasibility. EDCWA, HAP and purveyor representatives reviewed and concurred with the tiering. The highest tier (no shading) represented projects that would be advanced for more project analyses. To assist with the selection of projects to be advanced for further analyses, the Consultant Team plotted average annual generation (abscissas) vs. estimated capital cost to construct (ordinates) to develop a “scatter plot” that visually compares projects. For ease of review, the scatter plot data was converted to tabular format and is presented in Table 6-1 in Section 6 (Preliminary Project Analyses of Highest Ranked Hydro Options). In general, hydro options that did not have critical flaws and that were about $1,500 to $2,000 or less per average annual MWh were considered superior to the other options and identified for project-specific analyses.

Figure 4-3: Hydro Option Technical Evaluation Process



Some changes were made to the ranking of projects after the scatter plots and matrix were completed based on newly acquired information. In some instances, the new information changed the anticipated feasibility of the hydro options. Furthermore, because the FIT options have substantially higher energy values with the CPUC MPR rates (see Section 4.1.1, Feed-In Tariff Options), and because the CPUC's MPR schedule increased FIT rates in December 2008 by about 15 to 30 percent over the prior year's rates, the HAP members and purveyors recommended emphasis on FIT projects. Meetings were then held with the HAP and purveyors in which concurrence was reached on a final set of options for project specific analyses.

At the conclusion of the screening evaluations, a short list of 19 hydro options were identified to advance for detailed project analyses, from which the "top 10" would be identified for further detailed economic and financial analyses. The short-listed 19 projects identified are described in Section 6 (Preliminary Project Analyses of Highest Ranked Hydro Options). As noted above, the hydrokinetic demonstration project on EID's El Dorado Canal had already been identified for further evaluation and was included in the 19 options to be advanced.

4.2.4 Detailed Project Analyses on Highest Ranked Options

The detailed project analyses on the short-listed 19 hydro options were performed in two stages. First, preliminary project analyses were completed and compiled into an early draft report that was reviewed by the EDCWA, HAP, and purveyor representatives. Second, based on meetings with the Project Team and oral and written comments received, the "top 10" of the short-listed 19 projects were identified, refined and analyzed to assess their financial merits in the draft of this Final Report.

The first series of detailed project analyses were based on engineering, operations, hydrologic and system operation modeling, energy generation projections, site inspections, environmental reviews, permitting, other regulatory requirements, and general economic analyses. The specific issues and criteria considered include those presented in Table 4-1.

The short-listed 19 project options were next analyzed by applying the average 20-year FIT (117.30/MWh) to the revenue streams projected from average annual generation. This "FIT-adjusted" revenue stream was compared to debt service and annual Operation and Maintenance (O&M) costs projected over the same 20-year period. An annual "net" revenue (or cost) was then calculated and reduced to a single figure representing average net revenue (or cost) over 20-year and 30-year financing periods. This number enabled comparison among the 19 projects and allowed the Consultant Team to discern the "top 10" best projects out of the short-listed 19. This analysis is presented in Section 6.

Table 4-1: Issues and Criteria Addressed in Project Analyses

Hydro Option Characteristics	
Project Category	Existing Facility, Existing Facility w/Reoperation, New Facility, Hydro w/ new water supply, Demonstration/New Technology
Operational Mode	Most likely operational mode (peaking, baseload, or as determined by water system demand)
Transmission Line Access (distance)	Distance from transmission facilities for interconnection; Accessibility to transmission facilities for connection to project site
Property Ownership	Owners and type of ownership (fee ownership by purveyor, private property, or government-owned property);ease or difficulty of acquiring land ownership to build project
Water Rights	Favorability of ownership of existing water rights or ease of transferability of water rights for proposed project needs
Access Right-of-Way	Project site accessibility for construction, equipment staging, and operation & maintenance
Design and Cost Criteria	
Head (ft)	Gross head of the hydroelectric project in feet
Flow (cfs)	Available flow through the hydroelectric project in cubic feet per second
Capacity (MW) and (AF)	Hydroelectric plant capacity in MW and firm annual yield of a water supply component in Acre-Feet
Flow Frequency	Permanent or intermittent flow available for hydro plant operations
Project Design and Construction Costs ($/kW)	Site constructability and/or engineering design challenges considering location and existing facilities
O&M Cost ($/kWh)	Project operation & maintenance challenges after project completion; annual and replacement cost
Flow, Energy, and Revenue Criteria	
Feed-In Tariff	Eligibility for FIT program or other incentive
Amount of Generation	Annual, seasonal, and diurnal generation based on flow data
Timing and Value of Generation (peaking factor)	Potential power marketing revenue that the project would produce; FIT rate multipliers for TOD
Water Supply	Water supply features of project
Environmental and Regulatory Criteria	
Resource Agency Coordination/Consultation	Resource and land management issues for permitting
Environmental Permitting and Review [National Environmental Policy Act (NEPA)/CEQA)]	Eligibility for CEQA/NEPA exemptions; anticipated environmental review processes
FERC Exemption/Permitting	Eligibility for FERC exemption from licensing
CEC RPS Certification	Eligibility for RPS and FIT
Public Support	Public acceptability or anticipated support/objections
Recreation	Recreational benefits including instream flows
Habitat Enhancement	Opportunities for downstream aquatic resource and other environmental benefits

A primary refinement used on the “top 10” but not on the “short-listed 19” was the application of the FIT TOD energy values based on existing water system operations. Through the preliminary and final analyses, the effect of the time-of-day and time-of-year FIT rate multipliers (collectively, TOD) became evident. Instead of the average $117.30/MWh 20-year rate that was assumed for the general economic analyses on the short-listed 19 hydro options, CPUC-approved TOD rate multipliers for PG&E”s standard FIT contract were applied in the detailed economic and financial analyses of the “top 10” projects. This is discussed in greater detail in Section 6.

Another refinement used in the economic analyses for the “top 10” projects was the preparation of annual cash flow projections over the 20-year analysis period. The financial spreadsheet model for the “top 10” produced estimates for key economic indicators including internal rate of return, debt service coverage, payback period, and net present value.

The economic and financial analyses for the projects were initially anticipated to address the possibility of private investment or ownership in the hydro options. However, the results of the analyses in Section 7 (Detailed Project Analyses of “Top Ten” Options) do not indicate a rate of return that would typically support the “hurdle” for private investments (i.e., 20 percent); private investor financing scenarios were therefore not completed.

The design, costs, hydrology, operations, energy, economic, financial, environmental, regulatory permitting, and other assumptions that were used for the detailed project analyses are described further in technical appendices to this Plan as follows:

- Appendix A – Project-Specific Cost Estimates and Technology and Design Considerations
- Appendix B – Hydrologic, Energy, and Economic/Financial Analyses and Assumptions
- Appendix C – Environmental Regulatory, Permitting, and RPS Certification and FIT Contract Requirements

Appendix A lists the unit costs assumed for the project cost estimates and includes a breakdown of the engineer’s preliminary estimate of probable costs by project. Project estimates include the cost of financing and operation and maintenance costs, including allowances for future equipment renewals and replacements. Appendix A also discusses the design options and operational issues that were considered in selecting the turbine-generators for the projects.

Appendix B presents the flow modeling and projections that were developed for estimating energy generation. This includes the assumptions for turbine generator efficiencies, projections for future water demand, and the time of day and time of year estimates that were applied for the FIT rate multiplier (TOD) factors. Using the projected energy values from Appendix B and the cost estimates from Appendix A, detailed financial analyses for each project were prepared, the results of which are also presented in Appendix B. The financial analyses compare the project revenues and costs on an annual basis for a 20-year analysis period. The financial analyses are based on assumptions provided by EID that the projects would be funded using system funds, the most recent of which were 30-year bonds with an interest rate of 6 percent.

Appendix C describes the anticipated regulatory requirements for permitting, hydroelectric licensing and exemptions, environmental review processes and exemptions, and public consultations. This appendix describes the CEC RPS certification that is required for the hydro options to qualify for the standard PG&E FIT contracts and rates, including TOD multipliers. Copies of the PG&E standard FIT contract and an overview of the FIT program are also included in Appendix C.

The detailed economic and financial analyses were used to identify the economically viable projects, which are recommended for implementation as described in Section 9 (Recommendations and Next Steps). Because the projects recommended for immediate implementation all rely on the FIT program for viability, an important condition is that the project be online within 18 months of FIT contract execution. Assuming that FIT contracts are executed not later than November 2009 (December 2009 is when the FIT program likely will be revised, which is further discussed in Section 2), then the recommended projects will need to be online by May 2011 to receive the energy payments assumed in this report’s economic analyses. Otherwise, PG&E has the discretion to re-queue the project and apply a new FIT contract and rates that are in effect following the expiration of the 18-month period.

The Project Team recommends further project evaluations that will be funded (EID 2009) through a grant received from the CEC under its Renewable-based Energy Secure Communities (RESCO) Public Interest Energy Research (PIER) program. This evaluation will identify the extent to which system re-operation would further benefit the economics of the recommended hydro options, and possibly make additional hydro options economically viable. System reoperation could include changing the TOD or flow-frequency of an existing water system, thereby taking advantage of peak pricing and shoulder peak pricing periods. Reoperation could further include the installation of additional storage tanks that could establish system-wide changes in the timing of flows through multiple in-conduit generators of the same system.

Section 5

Inventory of County Hydroelectric Potential

Identifying hydro options in El Dorado County was the first step in the study process, as described in Section 4, Study Approach and Process to Develop Plan. Once the hydro options were identified, a project matrix was developed to organize key features of each of those options. The matrix, Table 5-1, is organized primarily by geographic, water system, and purveyor categories, and includes hydro options at existing and new water and wastewater facility locations.

General descriptions and summary statistics on the hydro options identified for each of the County purveyors and others that participated in the study are presented below. The summary statistics were developed from the information presented on the matrix in Table 5-1. In calculating the total capacity (MW) and generation (MWh) for the summaries, alternate projects (where more than one option is available for a site) and projects without defined numbers were excluded. Where alternate projects exist, the project with the highest potential capacity was used in the summary calculations.

5.1 Options for Existing Water and Wastewater Facilities and Operations

Numerous existing facilities operated by EID, GDPUD, STPUD, and SMUD offer the potential to generate energy either via in-conduit turbines or generation facilities at existing impoundments. In most instances, these projects qualify under the CPUC RPS program, and would meet the requirements for investor-owned utility FIT contracts. Importantly, the FIT program with "must take" contracts is a requirement of all investor-owned utilities (including PG&E, NV Energy, and Mountain Utilities that serve this study area) for qualifying water and wastewater facilities. Additional information on this program can be found in Section 2 and at http://www.cpuc.ca.gov/PUC/energy/Renewables/feedintariffssum.htm.

The "top 10" hydro options selected for detailed analysis in this study are at existing water system facilities. These projects have the fewest regulatory reviews, command the highest energy payment values through the FIT program, and are typically the easiest to construct.

Table 5-1 Hydroelectric Development Options Project Screening Matrix

White = Recommended for further detailed study Light Gray = Warrants near-term additional study outside the scope of this study Gray = Postpone further study at this time	Project Categories	Design Head (ft)	Design Flow (cfs)	Plant Factor	Nameplate Capacity (kW)	Annual Generation (MWH/year)	Capital Cost to Construct ($)	Capital Cost/ Average Annual MWh
EID PROJECT 184 OPTIONS								
Canal drop preceding Forebay	FIT	Evaluation pending conduit survey results						
Capacity Increase at PH	FIT	1,940	incremented 22 cfs	0.6	incremented 1 MW	TBD	TBD	TBD
El Dorado Dam high flow to canal/return to SFAR (Spillway 4 option)	NS/W	60	50	0.2	206	361	$2,000,000	$5,542
Expanded Forebay	NS/W	1,786	165	0.6	21,000	TBD	TBD	TBD
Low-Flow Energy Recovery at PH	FIT	1,910	5 to 22	Optimization study recommended			$562,000	TBD
New Forebay	NS/W	offstream	165	0.6	21,000	TBD	TBD	TBD
Plum Creek Reservoir	NS/W	Information not developed for this option						
Small Silver Lake Reservoir (upstream of Slver Lake)	NS/W	Information not developed for this option						
ALDER OPTIONS								
Small Alder Reservoir (32,000 AF)	NS/W	1,345	60	TBD	5,700	28,300	About $100 M	TBD
Medium Alder Reservoir (up to 100,000 AF)	NS/W	1,345	165	TBD	15,000	50,000	Over $100 M	TBD
Alder Dam Minimum Instream Flow (MIF) Release	NS/W	140	50	0.4	500	1,500	$1,500,000	$1,000
Large Alder (175,000 AF)	NS/W	Information not developed for this option						
Existing Alder Diversion to Canal	FIT	98	15	0.3	100	260	$3,000,000	$11,500
Existing Alder Diversion Dam	FIT	8	15	0.5	10	35	$2,000,000	$57,000
Alder Pump Station Options (River option)	NS/W	1,345	60	0.75 (Alder)	5,700	36,500	TBD	TBD
EID TEXAS HILL OPTIONS								
Gravity Feed to Texas Hill (22,000 AF)	NS/W	100	90	0.5	580	2,345	$89,000,000	$38,000
Texas Hill Options	NS/W	120	120	0.5	1036	4,084	$125,000,000	$31,000
Placerville Ridge conduit turnout to Res 11	NS/W	50	60	0.5	216	851	$27,000,000	$32,000
Placerville Ridge conduit turnout to Res 12	NS/W	50	60	0.5	216	851	$18,000,000	$21,000
SMUD UARP OPTIONS								
Ice House 1 - Tunnel/Pipe to Kyburz with PH	NS/W	1,300	60	0.5	5,600/ 21,000	22,000	$55,000,000	$2,500
Ice House 2 - New Lower Reservoir	NS/W	230	30	0.7	500	2,600	$87,000,000	$33,000
Union Valley Dam Afterbay (Juction Res.)	FIT	168	70	0.3	846	2,195	$4,300,000	$1,960
Gerle Creek Below Loon Lake	FIT	160	50	0.4	576	2,018	$3,000,000	$1,490
Ice House Dam Outlet	FIT	150	70	0.4	756	2,649	$3,800,000	$1,430
White Rock Turnout/Bray Res (Option A)	NS/W	235	80	0.5	1,353	5,332	$22,000,000	$4,100
White Rock Turnout/Bray Res (Option B)	NS/W	200	100	0.4	1439	5,672	$35,000,000	$6,200
MAINSTEM AR/COSUMNES RIVER OPTIONS								
Coloma Reservoir and PH (17,500 AF)	NS/W	160	50	0.4	45,000	132,000	$30,000,000	
Salmon Falls Reservoir and PH (113,000 AF)	NS/W	490	150	0.5	83,000	245,000	$70,000,000	
Nashville Reservoir and PH (1,155,000 AF)	NS/W	Information not developed for this option						
Forni Reservior (2,150 AF)	NS/W	Information not developed for this option						
Capps Crossing Reservoir (NF Cosumnes 25,000 AF)	NS/W	198	50	0.5	700	2,800	$100,000,000	$36,000
Sayles Flat Re-Operation	NS/W	Litigation removed previous project						
TAHOE OPTIONS								
Upper Truckee River	NS/W	400	40	0.5	1,152	5,046	$5,370,270	$1,060
Heavenly Ski Resort CA Base Pump Station	FIT	170	4	0.3	60	175	$250,000	$1,400
Heavenly Ski Resort Pumped Storage	FIT	2,290	5	Information not developed for this option				
Fallen Leaf (Water System) to Camp Richardson	NS/W	80	80	0.4	461	1,615	$4,397,600	$2,720
Cascade Lake	NS/W	240	Information not developed for this option					
STPUD Treated Wastewater Export "C-line"	FIT	2,000	7	0.9	1,235	8,760	$33,000,000	$3,770
STPUD "A-line/B-line" pumped storage	FIT/R	1,400	7	0.3	705	1,850	TBD	TBD
STPUD Harvey Place Reservoir Dam	FIT	60	18	0.3	78	205	TBD	TBD
STUPD Harvey Place Reservoir Outflow Outfall	FIT	30	18	0.3	39	102	TBD	TBD
EID ENERGY RECOVERY OPTIONS								
Sly Park Dam	FIT	95	55	0.85	400	1,833	$2,751,000	$1,530
Sly Park Dam Fish Release	FIT	121	5	0.9	44	343	$250,000	$730
New Sly Park Dam (downstream of existing) (Add'l 10,000 AF)	NS/W	Information not developed for this option						
Raise Sly Park Dam	NS/W	Information not developed for this option						
Sly Park Narrows Dam (add'l reservoir storage not estimated)	NS/W	40	200	0.8	576	4,037	$25,000,000	$6,190
Sly Park Pumped Storage (EID 40-acre parcel)	NS/W	Information not developed for this option						
Weber Dam Re-Op	FIT	71	40	0.3	204	581	$1,400,000	$2,380
Weber Dam Re-Op w/ Flashboards	FIT/R	75	40	0.3	216	615	$1,500,000	$2,410
Caples Lake (Mountain Utilities or Kirkwood Meadows PUD)	FIT	60	36	0.8	280	1,000	$2,974,000	$2,970
Silver Lake	NS/W	20	20	0.3	29	76	$540,000	$7,110
Echo Lake Dam	NS/W	40	50	0.4	144	505	$1,900,000	$3,800
El Dorado Main 1-PRS 12 (at airport)	FIT	130	6	0.8	25	220	$1,047,480	$4,760
El Dorado Main 1-PRS 13 @ Res 6 (Tank 6 inlet)	FIT	280	6	0.8	110	590	$1,058,000	$1,790
El Dorado Main 2 PRS 1 (Tank 3)	FIT	222	24	0.6	360	1,739	$1,556,000	$895
El Dorado Main 2 - PRS 4 (Whispering Pines)	FIT	104	12	0.6	90	472	$580,000	$1,240
El Dorado Main PRS 3	FIT	152	24	0.6	195	892	$1,409,000	$1,580
El Dorado MainTanks @ Thompson Hill (Storage for Re-Op of EDM 2)	FIT/R	Re-evaluate if water system operations are modified.						
Diamond Springs Main PRS I (Reservoir 8)	FIT	136	17	0.6	140	690	$1,082,000	$1,570
Pleasant Oak Main @ Res B (2 stations)	FIT	139/199	24	0.6	450	2,657	$3,591,000	$1,350

White = Recommended for further detailed study Light Gray = Warrants near-term additional study outside the scope of this study Gray = Postpone further study at this time	Project Categories	Design Head (ft)	Design Flow (cfs)	Plant Factor	Nameplate Capacity (kW)	Annual Generation (MWH/year)	Capital Cost to Construct ($)	Capital Cost/ Average Annual MWh
Pleasant Oak Main (Reservoir B)	FIT	139	24	0.6	180	1,200	$2,149,000	$1,790
Pleasant Oak Main PRS 2 @ Res C	FIT	161	15	0.6	174	914	$1,100,000	$1,220
Pleasant Oak Main PRS 3	FIT	160	17	0.6	140	620	$1,385,000	$2,230
Pleasant Oak Main PRS 4	FIT	90	14	0.6	91	477	$590,000	$1,240
Pleasant Oak Main PRS 5 (Reservoir 7)	FIT	340	24	0.6	510	2,321	$1,523,000	$656
Deer Creek WWTP outflow	FIT	30	1.55	0.9	3	26	$270,000	$10,100
Deer Creek WWTP (0.5-1.0 mgd year-round) pipeline to Marble Valley	NS/W	Information not developed for this option						
Oak Ridge Tanks to Bass Lake Tanks Pumped Storage	FIT	400	10	0.5	280	874	$774,000	$886
Res 1 to Pollock Pines Reservoir	FIT	Information not developed for this option						
A Leg (To/from Res 12)	FIT	Information not developed for this option						
PRS into Bass Lake Tanks Sta 6.5 (1477')	FIT	100	10	0.9	72	567	$600,000	$1,060
GDPUD ENERGY RECOVERY OPTIONS								
Stumpy Meadows (T-Line ~ 3-4 miles; need to contact PG&E)	FIT	150	55	0.3	485	2,000	$3,100,000	$1,550
Rubicon River Diversions into Pilot Creek	NS/W	low	30	0.3	low	low	$60,000,000	very high
Buffalo Hill Siphon	FIT/R	141	20	0.6	180	860	$1,284,000	$1,493
Sandtrap Siphon (Walton Lake)	FIT/R	137	24	0.8	180	1,130	$1,456,000	$1,288
Kaiser Siphon (minor pipeline option)	FIT/R	185	15	0.5	170	950	$1,423,000	$1,500
Kaiser Siphon (major pipeline option - 8,000ft)	TBD	668	15	0.5	580	3,638	$5,172,000	$1,420
Greenwood WTP (pending construction)	FIT/R	550	4	0.95	160	1,200	$650,000	$540
OTHER CANAL/DITCH/TUNNEL/CREEK/PUMPED STORAGE/PIPELINE OPTIONS								
Camp Creek tunnel outlet & diversion dam (dam ht.=11 ft)	NS/W	39	200	0.85	1,500	11,169	$7,500,000	$670
Crawford Ditch piping and hydro re-op	NS/W	260	10	0.4	180	631	$3,000,000	$4,760
China Flat (Clair Hill Study)	NS/W	Information not developed for this option						
Camino Conduit to NF Weber	NS/W	Information not developed for this option						
Coloma Lotus ditch (flow within 100')	NS/W	Information not developed for this option						
GDPUD/PCWA Pumped Storage	NS/W	980	22	0.45	1,550	5,500	$16,000,000	$2,900
Bass Lake/Folsom Reservoir Pumpted Storage Options	NS/W	750	200	0.25	up to 8,100	17,740	$22,000,000	$1,240
Omo Ranch Sopiago Ck diversion	NS/W	Information not developed for this option						
Outingdale Pipeline/Intertie (~ 10 miles from Pleasant Valley)	NS/W	Would warrant further study if pipeline constructed.						
Grizzly Flat Pipeline/Intertie (~ 15 miles from Pleasant Valley; shorter pipeline possible with direct route from Sly Park)	NS/W	Would warrant further study if pipeline constructed.						
GDPUD Pipeline/Intertie (~10 miles from Swansboro to Walton Lake)	NS/W	Would warrant further study if pipeline constructed.						
Onion Creek to Pilot Creek	NS/W	300	1	0.5	20	80	$3,600,000	$45,000
Knickerbacher Creek	NS/W	1,000	1	0.5	70	275	$2,000,000	$7,300
City of Placerville WWTP	FIT	6	1.55	0.9	Information not developed for this option			
Hangtown Creek at Weber Creek		Information not developed for this option						
OTHER RESERVOIR OPTIONS								
Canyon Creek (17,500 AF)	NS/W	200	50	0.2	700	1,100	$108,400,000	$99,000
Grizzly Flats CSD (Spring Flat) Reservoir (400 ac-ft)	NS/W	Information not developed for this option						
Upper Pilot Creek storage (12,250 AF max yield)	NS/W	140	50	0.4	500	1,600	$108,400,000	$68,000
Wholesale Recycled Water Pipeline	NS/W	600	8	0.9	345	2,722	$8,000,000	$2,938
Blakely Reservoir near Camino	FIT	Information not developed for this option						
Jim Baldwin 1960s Study of El Dorado Hills Reservoirs	NS/W	Information not developed for this option						
DEMONSTRATION PROJECTS								
El Dorado Canal Technology Demonstration	Tech/FIT	N/A	N/A	0.5	30-40	70	TBD	TBD
El Dorado Canal west of Riverton	Tech	Information not developed for this option						
OTHER HYDRO CONSIDERATIONS IDENTIFIED								
County Policy on Energy Independence								
Federal Energy Allocation from Folsom to Upstream Entities								
Wet Year Gravity Deliveries/Dry Year Folsom Pumping Deliveries								
RWA ARB Conjunctive Use								
Pleasant Valley Conjunctive Use								
Project 184 FERC License MIF Conditions								
Transfer of Fazio Water Rights Upstream								
Role/Transfer of Pre-1914 Rights for Hydro								
EID Transfer 17k ac-ft Rights From Folsom to Upstream Storage.								
Placement of New Reservoir Recreation Facitlities								
Headwater Benefits to Upstream Purveyors								

Project Category

FIT = Feed In Tariff options

FIT/R = Feed In Tariff w/ reoperation and/or New Facilities

Tech = Technology demonstration options

NS/W = New site options with no/ minor/substantial water storage

Note: The energy generation and project construction costs presented in the table are for comparing projects relative to each other, and do not represent detailed engineering or economic estimates.

About 30 MW of capacity and 64,000 MWh per year of generation from 37 projects are identified in the matrix for hydro options at existing water or wastewater facilities, which can be subdivided as follows:

Table 5-2: Hydro Options at Existing Water or Wastewater Facilities

El Dorado Irrigation District	3.89 MW	17,770 MWh
Georgetown Divide PUD	2.98 MW	13,128 MWh
Heavenly Ski Resort	0.06 MW	175 MWh
South Tahoe PUD	2.06 MW	10,917 MWh
Unidentified Sponsor	21.00 MW	22,000 MWh
TOTAL	*29.99 MW*	*63,990 MWh*

One critical requirement for a new hydro option (even at existing water and wastewater facilities) under the FIT program is that it meet conditions of the investor-owned utility RPS as defined under PU Code 399.12, which states, "A new hydroelectric facility is not an eligible renewable energy resource if it will cause an adverse impact on instream beneficial uses or cause a change in the volume or timing of streamflow." An important additional requirement for a pumped storage hydro option is that it must also rely on renewable energy for pumping operations.

Most existing facility hydro options could benefit from the reoperation of individual facilities or entire water systems. Reoperation could include new energy (water) storage facilities or changing the timing of pumping or releases within a purveyor's water system. Reoperation can establish opportunities for pumped storage operations, which take advantage of peak period energy values.

In general, reoperation could allow purveyors to: 1) better regulate flows for water system hydroelectric generation, 2) reduce energy demand during peak periods, 3) create energy storage and increase overall energy efficiency, and 4) support the electric grid through communications and coordinated operations with the serving utility and/or independent system operator.

5.2 Options at New Water and Wastewater Facilities

These projects include new storage reservoirs or the construction of new networks to link water systems. New facilities present bigger challenges due to higher costs, increased regulatory oversight, greater public interest, and lower values for hydroelectric energy because they likely do not qualify for the FIT or RPS programs. On the other hand, these projects often have the potential to produce substantially greater amounts of hydroelectric power as well as create new water supplies.

Most of the large water projects identified in the matrix were not identified for further study primarily because these projects would not be supported economically to any significant degree by the estimated hydropower generation. Some projects begin to look attractive when viewed as increased storage for consumptive demand, drought protection, and fire protection. For this study and plan, projects had to be economically viable based on hydropower production, so many promising projects with multiple non-power benefits were not considered for detailed study. One primary exception to this finding is the Alder Reservoir hydro options, which were identified for further evaluation.

About 167 MW of capacity and 536,000 MWh per year of generation from 25 projects are identified in the matrix for hydro options at new water or wastewater facilities, which can be subdivided as follows:

Table 5-3: Hydro Options at New Water or Wastewater Facilities

El Dorado Irrigation District	34.49 MW	132,791 MWh
Georgetown Divide PUD	0.160 MW	1,200 MWh
Unidentified Sponsor	132.63 MW	395,469 MWh
TOTAL	*167.28 MW*	*536,460 MWh*

5.3 Hydro Related (Non-Project) Issues and Opportunities

Over the course of the study and Project Team meetings, numerous hydro-related issues and opportunities were identified that did not represent a hydro project per se. However, these issues and opportunities, such as moving water rights upstream to reduce pumping costs, are considered important to this document and for the record as the purveyors consider their options, authorities, and obligations for serving their customers in the future. Some of the items have historical or legal context that are beyond the scope of this study, but are included on the matrix (Table 5-1) under the heading “Other Hydro Considerations Identified”. Additional background information on these hydro related issues and opportunities are contained in the meeting notes recorded for each of the HAP and purveyor meetings.

5.4 Results of Screening Matrix Evaluation

As explained in Section 4.2.3, the hydro options were grouped into three rankings based on several considerations. The three rankings as shown on Table 5-1 are: 1) hydro options shown in white that were recommended for further detailed study, 2) hydro options with light gray shading that warrant near-term study outside of the scope of this study, and 3) hydro options with dark gray shading that are not recommended for further study at this time. Because the STPUD and Heavenly Ski Resort were not actively participating in the study, information on their hydro options was obtained late in the process and did not benefit from the iterative analyses or criteria evaluations applied to the remaining projects. As a result, none of the Tahoe Basin options were ranked in the first category.

About 19 MW of capacity and 98,000 MWh per year of generation are identified in the matrix for the short-listed 19 (white) hydro options. These were recommended for further detailed study for this hydro plan, and can be subdivided by purveyor as follows:

Table 5-4: Options Recommended for Further Study (MW/MWh by Purveyor)

EID	17.93 MW	91,806 MWh
GDPUD	0.94 MW	6,578 MWh
TOTAL	*18.87 MW*	*98,384MWh*

About 16 MW of capacity and 60,000 MWh per year of generation are identified in the matrix for the 22 second highest ranked (light gray) category of hydro options. These warrant near-term additional study outside the scope of this hydro plan, and can be subdivided as follows:

Table 5-5: Options that Warrant Near-Term Additional Study (MW/MWh by Purveyor)

EID	10.82 MW	35,428 MWh
GDPUD	0.65 MW	3,200 MWh
Heavenly Ski Resort	0.06 MW	175 MWh
STPUD	1.35 MW	9,067 MWh
SMUD	2.18 MW	6,862 MWh
Unidentified Sponsor	1.15 MW	5,046 MWh
TOTAL	*16.21 MW*	*59,778 MWh*

From the above and as shown in Table 5-1, El Dorado County has substantial opportunities to develop near term hydroelectric generation projects at existing water and wastewater facilities. The value and importance of this generation to the electric utility grid can be enhanced further with readily available, proven technology (i.e., water storage tanks) that would help maximize renewable energy generation when the need for peaking power is greatest.

Section 6

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.

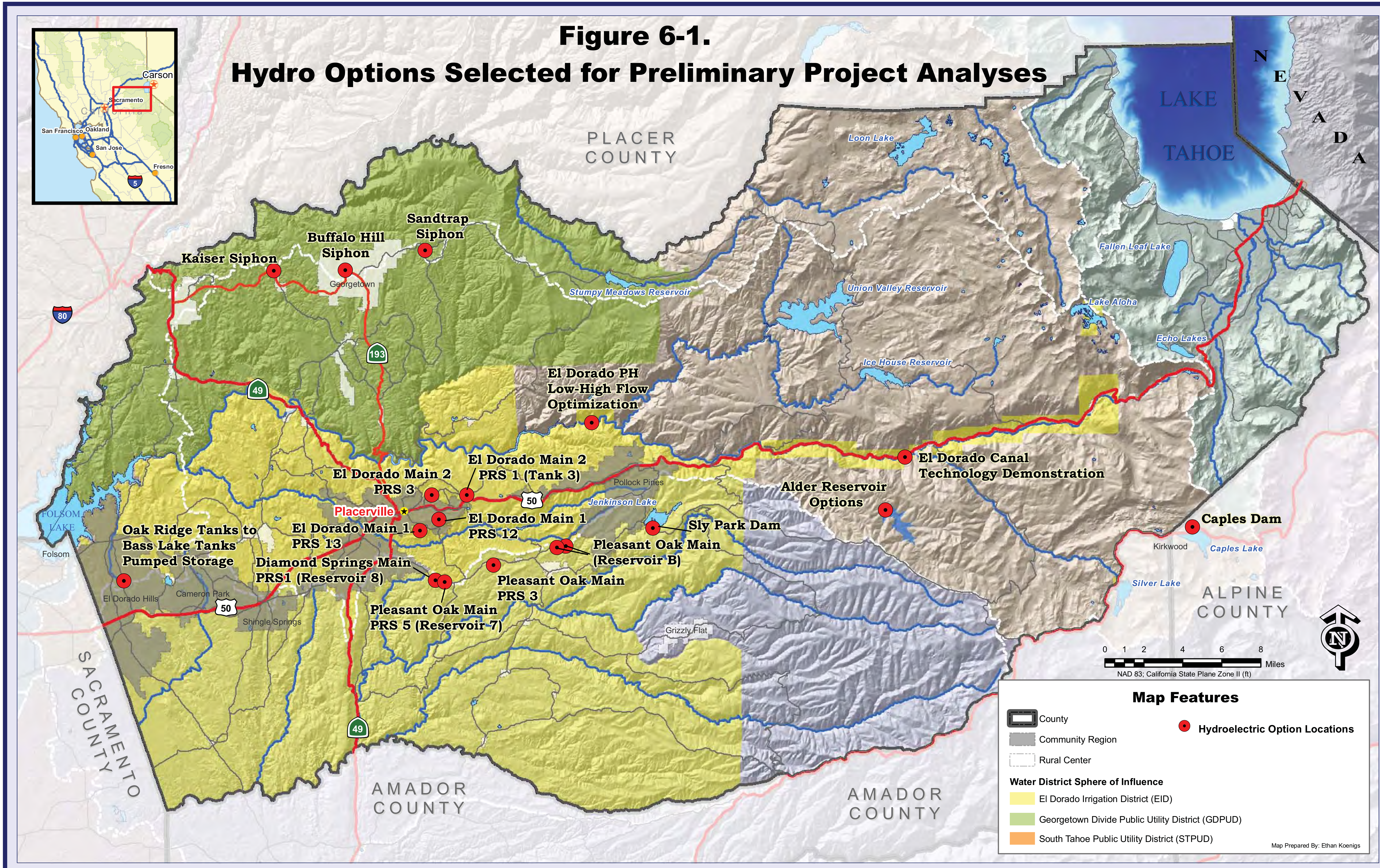
6.1 Overview of Preliminary Project Analyses

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



C:\GIS Data\Projects\2008\El Dorado Hydro\Final\Figure_6_1_071309

07/13/09

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

Project	Capital Cost	Energy Output	Cost/Annual MWh
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 Analsys

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

							Annual Costs					
Project Option	**Annual Generation (MWh)**	**Total Planning and Construction Cost**	**Finance Fee**	**Capital Cost w/Financing**	**Finance Rate**	**Loan Term (Years)**	**Debt Service**	**O&M and Replacement**	**Total**	**Annual Operating Revenue (Cost)**	**Annual Net Revenue (Cost)**	**Debt Service Coverage**
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
El Dorado Main 1 PRS13	590	$1,058,000	1.5%	$1,073,870	5.0%	20	($86,170)	($13,570)	($99,740)	$55,637	($30,533)	0.65
Caples Dam	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
El Dorado Main 1 PRS12	220	$1,032,000	1.5%	$1,047,480	5.0%	20	($84,053)	($12,019)	($96,072)	$13,787	($70,266)	0.16
Pleasant Oak Main PRS3	620	$1,385,000	1.5%	$1,405,775	5.0%	20	($112,803)	($14,586)	($127,389)	$58,140	($54,663)	0.52
Kaiser Siphon Minor Pipeline	950	$1,423,000	1.5%	$1,444,345	5.0%	20	($115,898)	($14,690)	($130,588)	$96,745	($19,153)	0.83
El Dorado Powerhouse Low-High Flow Optimization	2,000	$562,500	1.5%	$570,938	5.0%	20	($45,814)	TBD	($45,814)	NA	NA	NA
Small Alder	28,300	TBD	1.5%	TBD	5.0%	20	TBD	TBD	TBD	NA	NA	NA
Medium Alder	TBD	TBD	1.5%	NA	5.0%	20	NA	TBD	$0	NA	NA	NA
El Dorado Canal Technology Demonstration	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

							Annual Costs					
Project Option	**Annual Generation (MWh)**	**Total Planning and Construction Cost**	**Finance Fee**	**Capital Cost w/Financing**	**Finance Rate**	**Loan Term (Years)**	**Debt Service**	**O&M and Replacement**	**Total**	**Annual Operating Revenue (Cost)**	**Annual Net Revenue (Cost)**	**Debt Service Coverage**
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
El Dorado Main 1 PRS13	590	$1,058,000	1.5%	$1,073,870	5.0%	30	($69,857)	($13,570)	($83,427)	$55,637	($14,220)	0.80
Caples Dam	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
El Dorado Main 1 PRS12	220	$1,032,000	1.5%	$1,047,480	5.0%	30	($68,140)	($12,019)	($80,159)	$13,787	($54,353)	0.20
Pleasant Oak Main PRS3	620	$1,385,000	1.5%	$1,405,775	5.0%	30	($91,448)	($14,586)	($106,034)	$58,140	($33,308)	0.64
Kaiser Siphon Minor Pipeline	950	$1,423,000	1.5%	$1,444,345	5.0%	30	($93,957)	($14,690)	($108,647)	$96,745	$2,788	1.03
El Dorado Powerhouse Low-High Flow Optimization	2,000	$562,500	1.5%	$570,938	5.0%	30	($37,140)	TBD	($37,140)	NA	NA	NA
Small Alder	28,300	TBD	1.5%	TBD	5.0%	30	TBD	TBD	TBD	NA	NA	NA
Medium Alder	TBD	TBD	1.5%	NA	5.0%	30	NA	TBD	$0	NA	NA	NA
El Dorado Canal Technology Demonstration	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

Section 7

Detailed Project Analyses of “Top 10” Hydro Options

Section 6 describes the preliminary project analyses of the 19 highest ranked hydro options. The preliminary analyses concluded that seven of the 19 options show positive debt service coverage and annual net revenues with 30-year financing. Two are very strong economically. Eight others show potential viability with water system reoperation and the addition of intermittent storage to maximize generation during peak energy pricing periods. Three of the four remaining options (Small Alder Reservoir, Medium Alder Reservoir, and El Dorado Powerhouse Low-High Flow Optimization) were not considered eligible for the “top 10” list, but are recommended for further detailed feasibility studies (Section 8, Projects Warranting Additional Detailed Feasibility Studies). The El Dorado Canal Technology Demonstration is identified for immediate implementation.

This section describes the additional detailed analyses that were performed on the “top 10” hydro options. Results of the detailed economic and financial analyses are presented first, which are then followed by initial engineering design, operations, environmental, regulatory, and economic descriptions for each of the 10 options. Following the project descriptions, additional economic considerations are discussed, including sensitivity of the project economics to financing and other scenarios, other financial incentives and financing options, and market price and counterparty considerations that could apply to some of the hydro options.

7.1 The Selected “Top 10” Hydro Options

As noted in Section 6, all 19 of the highest ranked projects are considered viable based on technical, environmental, and regulatory considerations. Therefore, the “top 10” hydro options were selected for additional detailed project analyses based primarily on economics, with the exception of the Oak Ridge Tanks to Bass lake Tanks Pumped Storage option, which was included because it represented a different category of hydro option operationally. From Table 6-1, the “top 10” projects, plus the El Dorado Canal Technology Demonstration, are shown in Figure ES-1 and listed below by purveyor:

El Dorado Irrigation District
El Dorado Main 2 PRS 1 (Tank 3)
El Dorado Main 2 PRS 3
Oak Ridge Tanks to Bass Lake Tanks Pumped Storage
Sly Park Dam
Pleasant Oak Main (Reservoir B)
Pleasant Oak Main PRS 5 (Reservoir 7)
Diamond Springs Main PRS 1 (Reservoir 8)
El Dorado Canal Technology Demonstration

Georgetown Divide Public Utility District
Sandtrap Siphon
Buffalo Hill Siphon
Kaiser Siphon

7.2 Additional Analyses of the “Top 10” Hydro Options

The detailed project analyses of the “top 10” hydro options included: 1) updating and refining the earlier engineering, operations, project cost, environmental, and regulatory evaluations, 2) modeling the existing water system flows to estimate the time of day and time of season (collectively, the time of delivery or “TOD” as described earlier) energy generation, 3) applying the TOD energy generation projections to the FIT rate multipliers based on existing water system operations, and 4) preparing a 20-year annual cash flow analysis (assuming 30-year bonds at 6 percent interest) using a financial spreadsheet for each project that produces key economic indicators including internal rate of return, debt service coverage, payback period, and net present value.

The hydro option cost estimates are comprehensive and include design, permitting, construction, operation, maintenance, and equipment replacement. For Sly Park Dam, there will be new regulatory compliance costs to meet FERC dam safety requirements, which will include dam inspections, FERC fees, and possible periodic studies (e.g., emergency action plans). The costs for the new FERC dam safety requirements were not included in the Sly Park Dam project cost estimate, and do not apply to any of the other hydro options recommended for immediate implementation.

The above tasks were completed for each of the “top 10” projects, but not for the technology demonstration project since the developer (Verdant Power) proposes to design and install the hydrokinetic demonstration project without charge to EID. The design, costs, hydrology, operations, energy, economic, financial, environmental, regulatory permitting, and other assumptions that were used for the detailed analyses are described in the technical appendices to this plan.

7.3 Summary Results of Analyses of “Top 10” Hydro Options

Summary results of the analyses of the “top 10” options are presented in Table 7-1, which organizes the projects by water system. The effects of the estimated TOD energy values can be seen in the column entitled “Average Price Received ($/MWh)”. Whereas the FIT contract average rate is $117.30/MWh, the projected average rate received varies considerably between projects. This variability is directly a function of water system operations based on existing seasonal and daily customer demands for water.

Based on the analyses, two hydro options show strong economic characteristics. The project with the strongest economic characteristics, Pleasant Oak Main PRS 5 at Reservoir 7, has a net present value approximately equal to its capital cost. The next strongest, El Dorado Main 2 PRS 1 at Tank 3, has a net present value of approximately one half its capital cost.

Table 7-1 Summary of Detailed Economic Analyses for 'Top 10' Hydro Options

Project Name	Plant Size (kW)	Avg. Annual Generation (MWh)	Initial Year of Operation	Capital Cost	Cost of Debt	Term of Debt (years)	Length of Feed-In Tariff Contract (years)	Project Physical Life (years)	IRR	NPV	Payback Period (years)	Average/ Minimum Annual Debt Service Coverage	Average Price Received ($/MWh)
El Dorado Main System*													
El Dorado Main 2 PRS 1 (Tank 3)	360	1,739	2011	$1,556,000	6.00%	30	20	50	11.46%	$777,089	14	1.58/1.53	$118.46
El Dorado Main 2 PRS 3	195	892	2011	$1,409,000	6.00%	30	20	50	2.57%	($152,982)	>20	0.86/0.81	$122.95
El Dorado Hills System*													
Oak Ridge Tanks to Bass Lake Tanks Pumped Storage	280	874	2011	$774,000	6.00%	30	20	50	2.39%	($74,167)	>20	0.83/0.52	$134.33
Georgetown Ditch System*													
Sandtrap Siphon	180	1130	2011	$1,456,000	6.00%	30	20	50	5.96%	$158,462	>20	1.12/1.07	$124.56
Buffalo Hill Siphon	180	860	2011	$1,284,000	6.00%	30	20	50	3.46%	($69,292)	>30	0.93/0.88	$124.16
Kaiser Siphon	580	3,638	2011	$5,172,000	6.00%	30	20	50	5.34%	$347,616	>20	1.07/1.05	$123.23
Pleasant Oak Main System*													
Sly Park Dam	400	1,833	2011	$2,571,000	6.00%	30	20	50	5.04%	$121,711	>20	1.02/1.01	$124.36
Pleasant Oak Main (Reservoir B)	450	2,657	2011	$3,591,000	6.00%	30	20	50	5.66%	$319,691	>20	1.10/1.06	$123.05
Pleasant Oak Main PRS 5 (Reservoir 7)	510	2,321	2011	$1,523,000	6.00%	30	20	50	19.82%	$1,702,726	7	2.31/2.25	$123.71
Diamond Springs Main PRS 1 (Reservoir 8)	140	688	2011	$1,082,000	6.00%	30	20	50	1.76%	($168,717)	>20	0.81/0.75	$119.50
Technology Demonstration													
El Dorado Canal Technology Demonstration**	40	70	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Total	*3,315*	*16,702*	-	*$20,418,000*	-	-	-	-	-	*$2,962,137*	-	-	-

*Examples of potential hydro option groupings that could be used to apply for CREBs or Qualified Energy Conservation Bonds, or to pursue economies of scale in hydro option development.

**Verdant Power proposes to design and construct this project at no cost to El Dorado Irrigation District, and is prepared to submit a proposal upon EID's execution of a confidentiality agreement.

IRR – Internal Rate of Return – the interest rate received for an investment consisting of payments and income that occur at regular periods. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments of equal risk (the hurdle rate). In a fully debt-funded project, the hurdle rate is generally the cost of the debt.

NPV – Net Present Value – the total present value (PV) of a time series of cash flows. It is a standard method for using the time value of money to appraise long-term projects. The NPV is based on a 20-year analysis. The project life is 50 years.

Payback Period – the number of years it would take to pay off the capital cost of a project if annual cash flows were used to pay down principal on the debt incurred to finance the project. If energy values remain the same after expiration of the PG&E contract, the payback period would be as follows: Pleasant Oak Main PRS 5 (Reservoir 7) – 7 years; El Dorado Main 2 PRS 1 (Tank 3) – >30 years; Sly Park Dam – >30; Sandtrap Siphon – 25 years; Pleasant Oak Main (Reservoir B) – 26 years; Kaiser Siphon – 26 years.

Debt Service Coverage – the annual operating income of a project divided by the annual debt service cost of that project.

Average/Minimum Annual Debt Service Coverage – the average/minimum annual debt service coverage over the course of a project's full term of debt.

Four other projects appear economically viable and are presented below in decreasing order of net present value:

- Kaiser Siphon (major pipeline)
- Pleasant Oak Main at Reservoir B
- Sandtrap Siphon
- Sly Park Dam

The above projects are economically viable primarily because of the applicable FIT contracts with guaranteed energy values for 20 years, which are more than double current open market values.

Since the program's authorization in February 2008, FIT rates increased by more than 15 percent from 2008 to 2009. However, similar increases are not expected in future years as the CPUC seeks to reduce cost impacts of the FIT and RPS programs to utility customers.

7.3.1 Notes on Kaiser Siphon

The Kaiser Siphon hydro option requires an onsite investigation to confirm that it meets certain criteria for the FIT program. Specifically, an investigation is needed of the 8,000-foot open ditch that is to be replaced by a pipeline. The investigation needs to confirm that the pipeline would not alter the amount, timing or quality of any streams receiving direct or indirect flows from the Georgetown Ditch in this area.

It is worthwhile to note that the Kaiser Siphon analyses include the costs of permitting, design, and construction of the 8,000-foot pipeline and open ditch combination that would replace the open ditch. The pipeline costs represent almost half of the total hydro option costs (Appendix A). Without this hydro option qualifying for the FIT program, GDPUD still could pursue a smaller alternative (described in earlier sections as the Kaiser Siphon minor pipeline) that clearly qualifies for the FIT program, although it has less attractive economics.

7.3.2 Notes on Sly Park Dam

Sly Park Dam has the lowest net present value of the recommended hydro options, but other considerations including annual generation quantity and long-term increases in customer demand support its viability. Generation quantity (i.e., MWh) is relatively high for this project and improvements in generation efficiency (i.e., optimization of final project design for turbine generator efficiencies) will have positive impacts on project economics. Project economics will also improve substantially from increases in future water deliveries and future reoperation, including the integration of intermittent storage, and could benefit also from economies of scale as a third project to be implemented on the Pleasant Oak Main system. For these reasons, Sly Park Dam is considered economically viable.

The generation quantity, generation efficiency, reoperation, and economies of scale issues described for the Sly Park Dam hydro option also apply to several other hydro options. For purposes of this study and plan, the economic and financial analyses are based on existing conditions. Therefore, project economics for all options would be expected to improve as these other considerations and factors may apply with project implementation.

7.4 “Top 10” Project-Specific Descriptions and Analyses

Presented in the following subsections are the project-by-project results of the detailed analyses. For each project, a summary sheet is provided first, followed by descriptions of the existing water system facilities, proposed hydro option features and operations, estimated flows and hydroelectric generation, anticipated regulatory approvals and permits, project economics, and conclusion/recommendation for each project. The projects are presented in the same order as Table 7-1. The El Dorado Canal Technology Demonstration project is added at the end to provide the reader with additional information on this option.

7.4.1 El Dorado Main 2 PRS 1

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 222

Design Flow (cfs): 24

Nameplate capacity (kW): 360

Estimated Annual MWh/year: 1,739

Photo 1 - El Dorado Main 2 Pressure Reducing Station No. 1 at Reservoir 3

Capital Cost to Construct (Estimated): $1,556,000

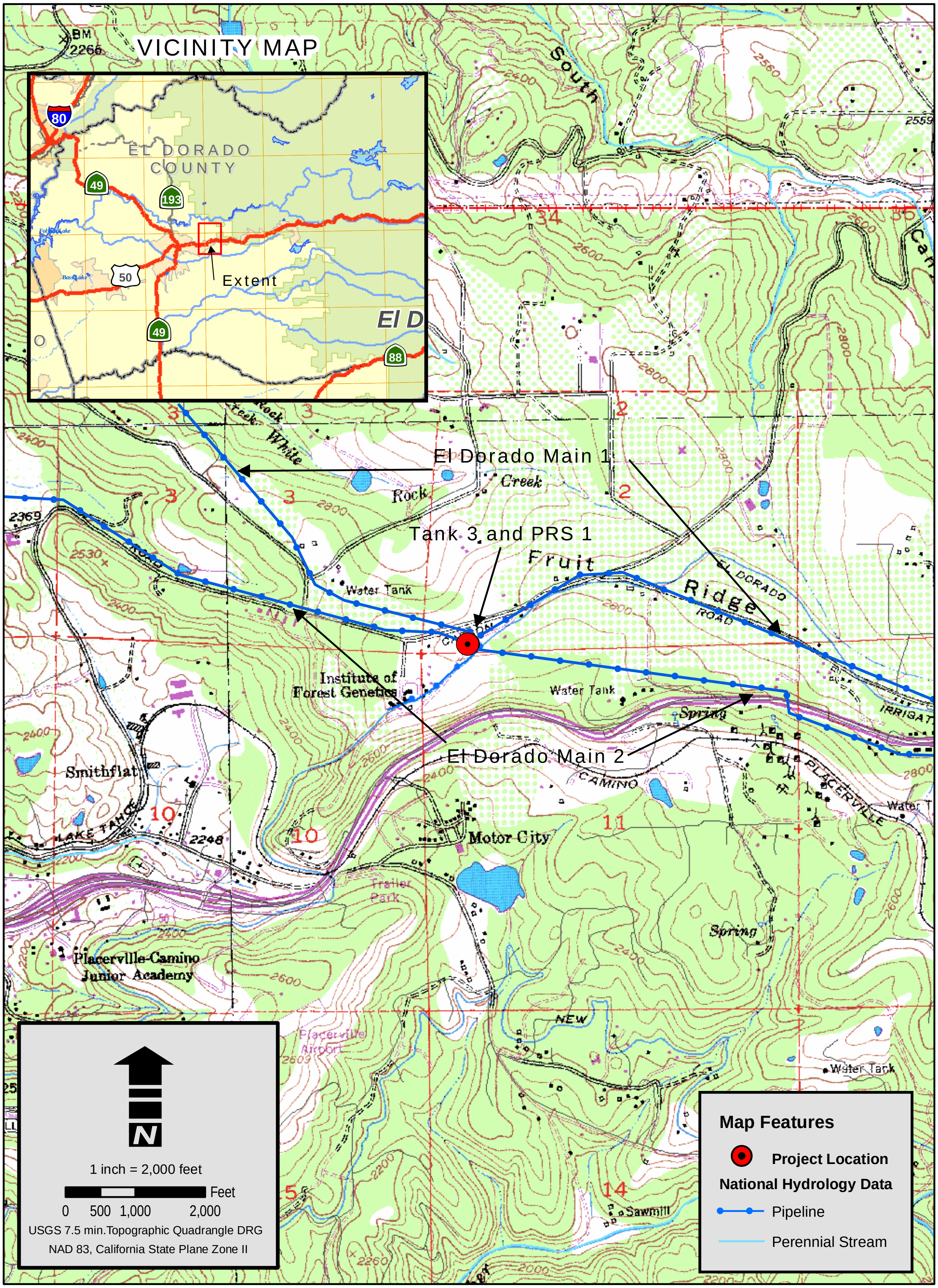
Annual Income: $205,976 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
21	**500**	**30**	**Y**	**Y**	**EID/USFS**

PROJECT DESCRIPTION:

This project is at an existing PRS on El Dorado Main 2 at the inlet to Reservoir 3, located adjacent to the U.S. Forest Service (USFS), Institute of Forest Genetics property, on Carson Road. The energy production is somewhat higher when compared to the other PR sites (approx. 1,700 MWh). The PRS structure is located adjacent to the Reservoir 3 property. Area within the Reservoir 3 property is available with few structures other than the existing tank. Placement on the adjacent USFS property would be an option. 3-phase power is nearby. Placing the hydro site on the Reservoir 3 property would require additional piping from the existing 30-inch pipeline, adding cost to the project. The hydro station would consist of three PATs, with one turbine operating at variable speed with a regenerative power converter. The facilities would be housed in a masonry building approximately 400 square feet in area. The flows vary more than some sites but are higher and there is available storage at Reservoir 3 to assist in flow regulation. This is a FIT project.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-1: El Dorado Main 2 PRS1 (Tank 3)
Project Location and Vicinity

A. Existing Facilities

El Dorado Main 2 PRS 1 (Tank 3) is part of EID's system fed from Reservoir 1. PRS 1 is located on the pipeline conveying flow from Reservoir 2a/2b to Reservoir 3. Flow at the PRS splits and part of the flow is diverted into Reservoir 3 and the remainder of the flow continues down El Dorado Main 2 to Reservoir 4 supplying water to several laterals and customers. Pressure upstream of the PRS varies from 150 pounds per square inch (psi) to 110 psi. The PRS maintains a downstream pressure of 50 psi in the pipeline. Flow in the pipeline varies from 5 cubic feet per second (cfs) to 38 cfs with daily variations of 25 to 30 percent. These daily variations in flow will occur up to 5 to 6 times daily during peak demand months.

The PRS on El Dorado Main 2 consists of one 16-inch, two 14-inch and one 6-inch valves. The PRS to Reservoir 3 consists of one 14-inch, one 10-inch and one 6-inch valves. The PRS structure is located adjacent to the Reservoir 3 property. Area within the Reservoir 3 property is available with few structures on the property other than the existing tank and El Dorado Main 1 PRS 1. Placing the hydro site on the Reservoir 3 property would require additional piping from the existing 30-inch pipeline adding cost to the project.

B. Project Facilities and Operation

The hydro station would be located prior to the split in flow (on the existing 30-inch pipeline) in order to utilize the highest flows and pressures for power generation. The hydro station would consist of three PATs with one turbine operating at variable speed with a regenerative power converter. The other two units will operate at fixed speed. The facilities would be housed in a masonry building approximately 400 square feet in area. Associated fencing and security features will be included in the design.

The hydro station will include flow control and pressure regulating valves in addition to the turbine units to regulate the plant operation while maintaining the required 50 psi downstream pressure. A bypass will be provided at the hydro station to allow continuous flow in the EID system during an emergency and while the hydro station is off line for repairs or maintenance. Due to the degree of variability of flows, the station will rely on a programmable control system to augment mechanical operation for regulating flows to the hydro station.

The controller will split flow to the individual turbine units based on system flow read from an in-line flow meter. This flow based control scheme will also regulate flow through the motorized bypass valve during operation. A separate pressure relief valve is included in the bybass in case of a sudden shut down of the hydro system.

The Engineer's Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

Flow records were examined to determine typical flow releases that would be available for hydropower generation at the El Dorado Main 2 PRS 1 (Tank 3). The average monthly and annual powerhouse flow expected to be available is shown below. Average power generation at the El Dorado Main 2 PRS 1 (Tank 3) powerhouse is estimated based on available water, head, efficiency, loss estimates and typical operation. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-2: El Dorado Main 2 PRS 1 Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through El Dorado Main 2 PRS 1 Powerhouse													
CFS	**15**	**14**	**8**	**10**	**9**	**12**	**14**	**21**	**24**	**24**	**24**	**21**	**16**
AF	900	800	500	600	500	700	900	1,300	1,400	1,500	1,500	1,300	11,900
Projected Average Power Generation of El Dorado Main 2 PRS 1													
MWh	160	140	90	110	110	130	150	180	160	160	160	180	1,700

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-3: El Dorado Main 2 PRS 1 Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
EID	CEQA LEAD AGENCY	
	CEQA Exemption	2 to 4
FERC	Federal Power Act (FPA)/NEPA LEAD AGENCY	
	Small Hydro Exemption	18
	Small Generator Interconnection Agreement	6
USFS	Special Use Permit	4 to 6
El Dorado County	Air Quality/ Emergency/Building	2 to 4
State Health Dept.	Possible Permit Amendment	2 to 4
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent factor/year for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $1,556,000 total capital cost – the annual debt service is estimated at $114,737. The average annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($19,280) and is estimated at $134,017.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E’s TOD factors. Under these conditions, the project would receive an annual average of $118.46 per MWh delivered. The project is expected to deliver 1,739 MWh per year. Applying TOD multipliers results in annual gross revenues of $205,976.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. The EDM 2 PRS 1 (Tank 3) hydro option would have $205,976 annual revenue under 20-year financing and greater annual net revenue under 30-year financing. This project shows strong economic characteristics and is therefore recommended for immediate implementation to take advantage of the terms and conditions of the 2009 FIT program.

7.4.2 El Dorado Main 2 PRS 3

PRIORITY:
Recommended for reoperation study

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 152

Design Flow (cfs): 24

Nameplate capacity (kW): 195

Estimated Annual MWh/year: 892

Capital Cost to Construct (Estimated): $1,409,000

Photo 2 – El Dorado Main 2 Pressure Reducing Station No. 3 west of Reservoir 3

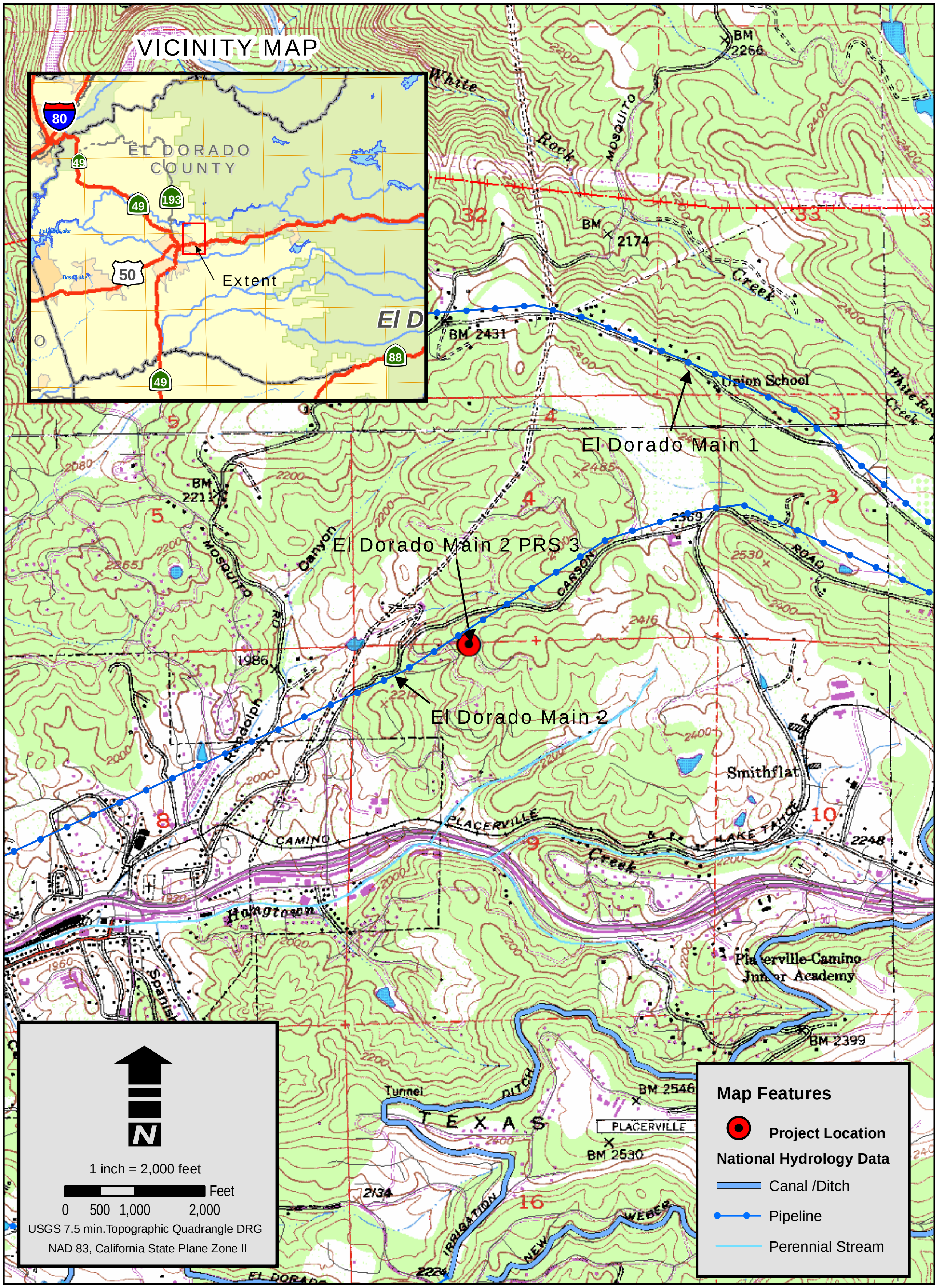
Annual Income: $109,667 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
14	**1,000**	**24**	**Y**	**Y**	**EID**

PROJECT DESCRIPTION:

This project is at an existing PRS on EID's El Dorado Main 2 system, located 4,500 feet downstream from Reservoir 3 on Whispering Wind Drive. The site, situated at 2,270 feet elevation, is relatively flat and has good construction access and 3-phase power nearby. The hydro station would consist of three PATs with one turbine operating at variable speed with a regenerative power converter. The proposed facilities will be housed in a masonry building approximately 400 square feet in area. As with many of the PRS sites there is no system storage and flows vary widely, requiring flow regulation through multiple units and valve controls. This is a FIT project with relatively low construction costs.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-2: El Dorado Main 2 PRS 3 Project Location and Vicinity

A. Existing Facilities

El Dorado Main 2 is part of EID's system fed from Reservoir 1. PRS 3 is located on the pipeline conveying flow from Reservoir 3 to Reservoir 4. Pressure upstream of the PRS varies from 145 psi to 110 psi. The PRS maintains a downstream pressure of 78 psi in the pipeline. Flow in the pipeline varies from 5 cfs to 27 cfs with daily variations of 25 to 30 percent. These daily variations in flow will occur up to 5 to 6 times daily during peak demand months. The PRS on El Dorado Main 2 consists of one 16-inch, one 14-inch, one 10-inch and one 6-inch valves. The existing structure takes up most of the site area and additional right-of-way would be required adjacent to the site for this hydro option.

B. Project Facilities and Operation

The hydro station would be located on the existing 24-inch pipeline adjacent to the existing PRS. The hydro station would consist of three PATs with one turbine operating at variable speed with a regenerative power converter. The other two units will operate at fixed speed. The proposed facilities will be housed in a masonry building approximately 400 square feet in area. Associated fencing and security features will be included in the design.

The hydro station would include flow control and pressure regulating valves in addition to the turbine units to regulate the plant operation while maintaining the required 78 psi downstream pressure. A bypass will be provided at the hydro station to allow continuous flow in the EID system during an emergency and while the hydro station is off line for repairs or maintenance. Due to the degree of variability of flows, the station will rely on a programmable control system to augment mechanical operation for regulating flows to the hydro station.

The Engineer's Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

Flow records were examined to determine typical flow releases that would be available for hydropower generation at the El Dorado Main 2 PRS 3. The average monthly and annual powerhouse flow expected to be available is shown below. Average power generation at the El Dorado Main 2 PRS 3 powerhouse is estimated based on available water, head, efficiency, loss estimates and typical operation. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-4: El Dorado Main 2 PRS 3 Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through El Dorado Main 2 PRS 3 Powerhouse													
CFS	**9**	**6**	**6**	**5**	**6**	**7**	**13**	**17**	**24**	**23**	**24**	**17**	**13**
AF	600	400	400	300	300	400	800	1,000	1,400	1,400	1,500	1,000	9,500
Projected Average Power Generation of El Dorado Main 2 PRS 3													
MWh	56	41	42	25	38	52	87	104	115	109	119	101	890

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-5: El Dorado Main 2 PRS 3 Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
EID	CEQA LEAD AGENCY	
	CEQA Exemption	2 to 4
FERC	FPA/NEPA LEAD AGENCY	
	In-conduit exemption	18
	Small Generator Interconnection Agreement	6
El Dorado County	Air Quality/Emergency Response/Building	2 to 4
State Health Dept.	Possible Permit Amendment	2 to 4
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent factor/year for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $1,409,000 total capital cost – the annual debt service is estimated at $103,898. The annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($15,684) and is estimated at $119,582.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E’s TOD factors. Under these conditions, the project would receive an annual average of $122.95 per MWh delivered. The project is expected to deliver 892 MWh per year. Applying TOD multipliers result in gross revenues of $109,667.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. Reoperation of flows through this site with new water system storage could concentrate generation during peak periods when FIT energy values increase from about 10 to 100 percent. This project’s revenue deficit could be outweighed by the corresponding increase in revenues; therefore, this hydro option is recommended for reoperation study.

7.4.3 Oak Ridge Tanks to Bass Lake Tanks Pumped Storage

PRIORITY:
Recommended for reoperation study

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 400

Design Flow (cfs): 10

Nameplate capacity (kW): 280

Photo 3 – One of Bass Lake Tanks

Estimated Gross/Net Annual MWh/year: 874/(30)

Capital Cost to Construct (Estimated): $774,000

Gross Annual Income: $117,388 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
5	**300**	**18**	**Y**	**Y**	**EID**

PROJECT DESCRIPTION:

This project is at a pumping station currently under design at the Oak Ridge storage facilities in the community of El Dorado Hills. The project would be a pumped storage project, pumping flow from the Oak Ridge storage tanks to Bass Lake storage tanks during off-peak hours, then generating power at the Oak Ridge tanks site during peak energy demand periods. The hydro station will consist of one PAT with variable speed and a regenerative power converter. The facilities will be housed in a masonry building approximately 400 square feet in area. Access and distance to power grid are good. This is a FIT project with relatively low overall construction costs. Whether or not the existing storage is sufficient for feasible operations will be an important component to the future review of this hydro option.

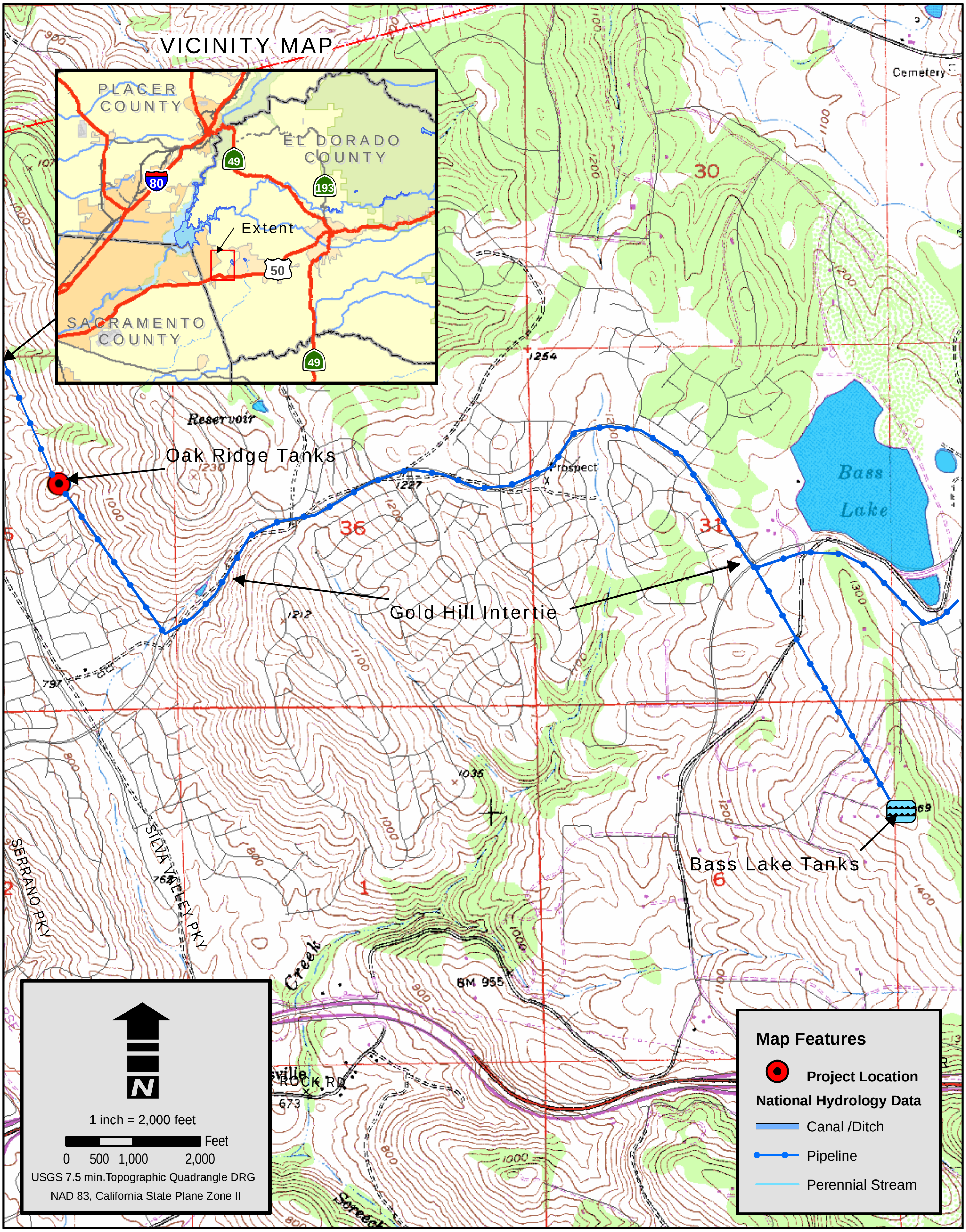


Figure 7-3: Oak Ridge Tanks to Bass Lake Tanks Pumped Storage Project Location and Vicinity

Created By: Ethan Koenigs
Date:06/29/09

A. Existing Facilities

The Gold Hill Intertie is part of the Reservoir 1 treated water supply system and conveys flow to the Bass Lake tanks (8MG). The pipeline also connects the Bass Lake tanks to the Oak Ridge tanks (6 MG), which supply the El Dorado Hills area. The Oak Ridge tanks are also connected to and fed mainly from the El Dorado Hills Water Treatment Plant (WTP). The Bass Lake tanks serve the Cameron Park and El Dorado Hills area and have been sized for build out conditions. To augment the flow to the Bass Lake tanks for future needs in the Cameron Park area, a pump station upgrade is currently under design that would send flow from the Oak Ridge tanks to the Bass Lake tanks.

B. Project Facilities and Operation

This hydro option would be a pumped storage project, pumping flow from the Oak Ridge storage tanks to Bass Lake storage tanks during off-peak hours, then generating power back at the Oak Ridge site during peak energy demand periods. The concept of pumped storage can be achieved while there is excess storage available at the Bass Lake tanks. As the Cameron Park/El Dorado Hills area water usage increases over time, the volume of storage available for hydro generation will decrease.

The hydro station would be located on the Oak Ridge storage tanks site near the pump station. It is assumed that the hydro turbine facilities will be separate from the pump station, but may share common building walls. The hydro station will consist of one 280 kW PAT with variable speed and a regenerative power converter. The facilities will be housed in a masonry building approximately 400 square feet in area. Associated fencing and security features will be included in the design.

An option to use a single turbine/pump unit to pump water to Bass Lake tanks and generate power was considered. Due to the significant difference between pumping head and generating head, this concept would require a more complex and expensive turbine unit such as a Francis turbine.

For this analysis, it is assumed that the pump/generation would occur once per day for 70% of the day throughout the year. Water would be pumped at a rate of 10 cfs for about 6 hours totaling about 1.5 million gallons. This water would then be available to return through the powerhouse to generate power.

The Engineer's Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

The Oak Ridge Tanks to Bass Lake Tanks Pumped Storage option operates by pumping water to the Bass Lake Tanks during the off-peak period of the day and then generation with the same water during the peak period of the day. Operation of this option would depend largely on the peak and off-peak differential in energy price. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-6: Oak Ridge Tanks to Bass Lake Tanks Pumped Storage Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Pumping Requirement of Gold Hill option													
MWh	34	34	34	34	34	34	34	34	34	34	34	34	410
Projected Average Power Generation of Gold Hill option													
MWh	32	32	32	32	32	32	32	32	32	32	32	32	380

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-7: Oak Ridge Tanks to Bass Lake Tanks Pumped Storage Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
EID	CEQA LEAD AGENCY	
	CEQA Exemption	2 to 4
FERC	FPA/NEPA LEAD AGENCY	
	In-conduit exemption	12
	Small Generator Interconnection Agreement	6
El Dorado County	Air Quality/Emergency Response Building	2 to 4
State Health Dept.	Possible Permit Amendment	2 to 4
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent factor/year for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $774,000 total capital cost – the annual debt service is estimated at $57,074. The annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($54,816) and is estimated at $111,890.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this preliminary analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E’s TOD factors. Under these conditions, the project would receive an annual average of $134.33 per MWh delivered. The project is expected to deliver 874 MWh per year. Applying TOD multipliers result in gross revenues of $117,388.

For pumped storage projects to qualify for FIT contracts and rates, the energy used to pump the water must be from renewable energy sources. Therefore, this project would require that EID establish a power purchase agreement with a renewable energy provider or dedicate a sufficient amount of renewable energy from its other projects to meet the pumping loads of this project.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. The Oak Ridge Tanks to Bass Lake Tanks Pumped Storage option would have negative annual generation (i.e., uses more energy than it produces) due to pipeline and equipment efficiency losses during pumping and generation operations. The amount of net energy loss would be roughly 8 to 10 percent. However, the energy produced would be during peak utility demand periods when energy prices are highest and the electric grid is heavily loaded and in need of additional generation. Energy used by pumped storage projects is during off-peak periods when the power grid has more than sufficient power supplies and energy costs are lowest.

The increasing limitations on water tank capacity for the pumped storage operations of this hydro option will shorten the economic life of this project. Combined with the requirement for renewable energy for the pumping operation, there are at least two critical feasibility issues to be addressed: 1) there is a need for additional storage and reoperation to extend the economic life of the project, and 2) EID will need to consider the practical and economic aspects of securing a renewable energy supply that is dedicated to the project's pumping operation. Current deficit projections for this project could be outweighed by additional generation associated with reoperation; therefore, this project is recommended for a reoperation study that considers future infrastructure for this area.

7.4.4 Sandtrap Siphon

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: GDPUD

Project Category: Feed-In Tariff

Design Head (ft): 137

Design Flow (cfs): 24

Nameplate capacity (kW): 230

Estimated Annual MWh/year: 1,130

Capital Cost to Construct (Estimated): $1,456,000

Photo 4 – Aerial of Walton Reservoir at the Outlet of Sandtrap Siphon

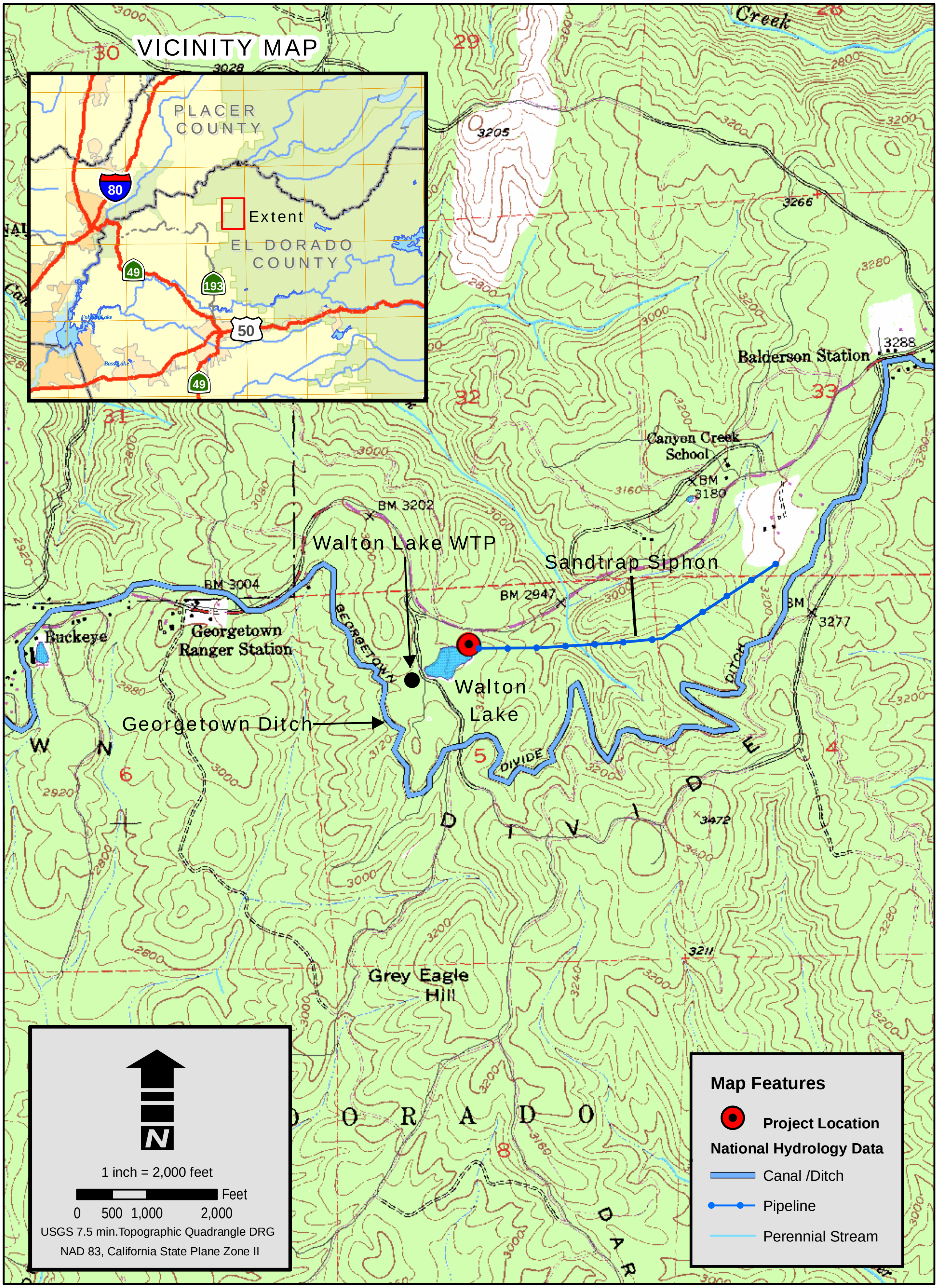
Annual Income: $140,752 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
17	**500**	**36**	**Y**	**Y**	**GDPUD**

PROJECT DESCRIPTION:

As part of the Stumpy Meadows Project, the GDPUD diverts water at the Pilot Creek Diversion Dam and conveys it in the Georgetown Ditch. The Georgetown Ditch conveyance system includes the inverted Sandtrap Siphon located east of the town of Georgetown. The site is located adjacent to Walton Lake and the Walton Lake Water Treatment Plant, and is within land zoned as commercial. Access to the project is very good. The elevation at the site is approximately 3,100 feet. The project would likely occur within the existing GDPUD easement area, but may require adjacent landowner right-of-way. The Sandtrap hydro option would be located where the Sandtrap Siphon pipeline enters Walton Lake and would include a new 230 kW hydroelectric generating facility, consisting of three units – two fixed and one variable pumps operated as turbines that would collectively have a design flow of 24 cfs. A small powerhouse would be constructed near the Walton Lake shoreline to house the generating equipment. The average annual generation would be approximately 1,130 MWh.



Created By: Ethan Koenigs
Date: 07/22/09

Figure 7-4: Sandtrap Siphon Project Location and Vicinity

A. Existing Facilities

The siphon is a 36-inch diameter ductile iron pipeline. The pipe discharges into an energy dissipating structure to Walton Lake. Walton Lake is adjacent to the Walton Lake Water Treatment Plant. The total difference in elevation between the water surface at the entry to the siphon and at the exit from the siphon is about 140 feet. The existing water supply, Georgetown Ditch conveyance system, Sandtrap Siphon and energy dissipater would all be utilized with the Sandtrap option.

B. Project Facilities and Operation

The Sandtrap Siphon hydro option would be located where the Sandtrap Siphon pipeline enters Walton Lake and would include a new 230 kW hydroelectric generating facility, consisting of 3 units – two fixed and one variable pumps operated as turbines. The Sandtrap option is sized at 24 cfs capacity to capture most flows at this location that occur during the irrigation season. The maximum static head will be about 140 feet. The operating head is variable dependent on flow rate, but is expected to average about 120 feet.

The project would utilize the existing Sandtrap Siphon and therefore would not require construction of a new pipeline. A "Y" would be installed immediately upstream of the existing energy dissipating structure to divert water to the units. The pipe to the power plant would be about 24 inches in diameter with a 24-inch shut-off valve. A small powerhouse would be constructed near the Walton Lake shoreline to house the generating equipment. Release from the energy dissipater would flow through the powerhouse foundation structure. The 24-inch segment of the "Y" would discharge through the turbine with the outlet discharging directly into Walton Lake.

The Engineer's Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

The maximum flow expected to occur is during the irrigation season, from about May 1 through October 1 of each year, at about 30 cfs. Flows during the winter months will vary between about 3 and 10 cfs depending on water demands, availability and operational requirements.

Flow records were examined to determine typical flow releases that would be available for hydropower generation. Average power generation is estimated based on available water, head, efficiency, loss estimates and typical operation. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-8: Sandtrap Siphon Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through Sandtrap Siphon Powerhouse													
CFS	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**30**	**30**	**30**	**30**	**30**	**17**
AF	400	400	400	400	300	400	400	1,800	1,800	1,800	1,800	1,800	11,800
Projected Average Power Generation of Sandtrap Siphon													
MWh	45	44	45	45	41	45	44	167	162	167	167	162	1,130

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-9: Sandtrap Siphon Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
GDPUD	CEQA LEAD AGENCY	
	CEQA Exemption	2 to 4
FERC	FPA/NEPA LEAD AGENCY	
	In-conduit exemption	18
	Small Generator Interconnection Agreement	6
El Dorado County	Air Quality/Emergency Response/ Building	2 to 4
SWRCB	Clean Water Act (CWA) Section 401	4 to 6
RWQCB	CWA Section 402	4 to 6
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent/year factor for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier – 30-year term, 6.0 percent annual interest, $1,456,000 total capital cost – the annual debt service is estimated at $107,363. The annual cost of generation is the sum of the annual debt service and the annual O&M and replacement cost ($16,066) and is estimated at $123,429.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E's TOD factors. Under these conditions, the project would receive an annual average of $124.56 per MWh delivered. The project is expected to deliver 1,130 MWh per year. Applying TOD multipliers result in gross revenues of $140,752.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. The economic analyses show this project to be viable, even without potential reoperation and other considerations that are expected to improve the economic characteristics of this project; therefore, this hydro option is recommended for immediate implementation.

7.4.5 Buffalo Hill Siphon

PRIORITY:
Recommended for reoperation study

PURVEYOR LEAD: GDPUD

Project Category: Feed-In Tariff

Design Head (ft): 141

Design Flow (cfs): 20

Nameplate capacity (kW): 170

Estimated Annual MWh/year: 860

Capital Cost to Construct (Estimated): $1,284,000

Photo 5 – Outlet Structure at Buffalo Hill

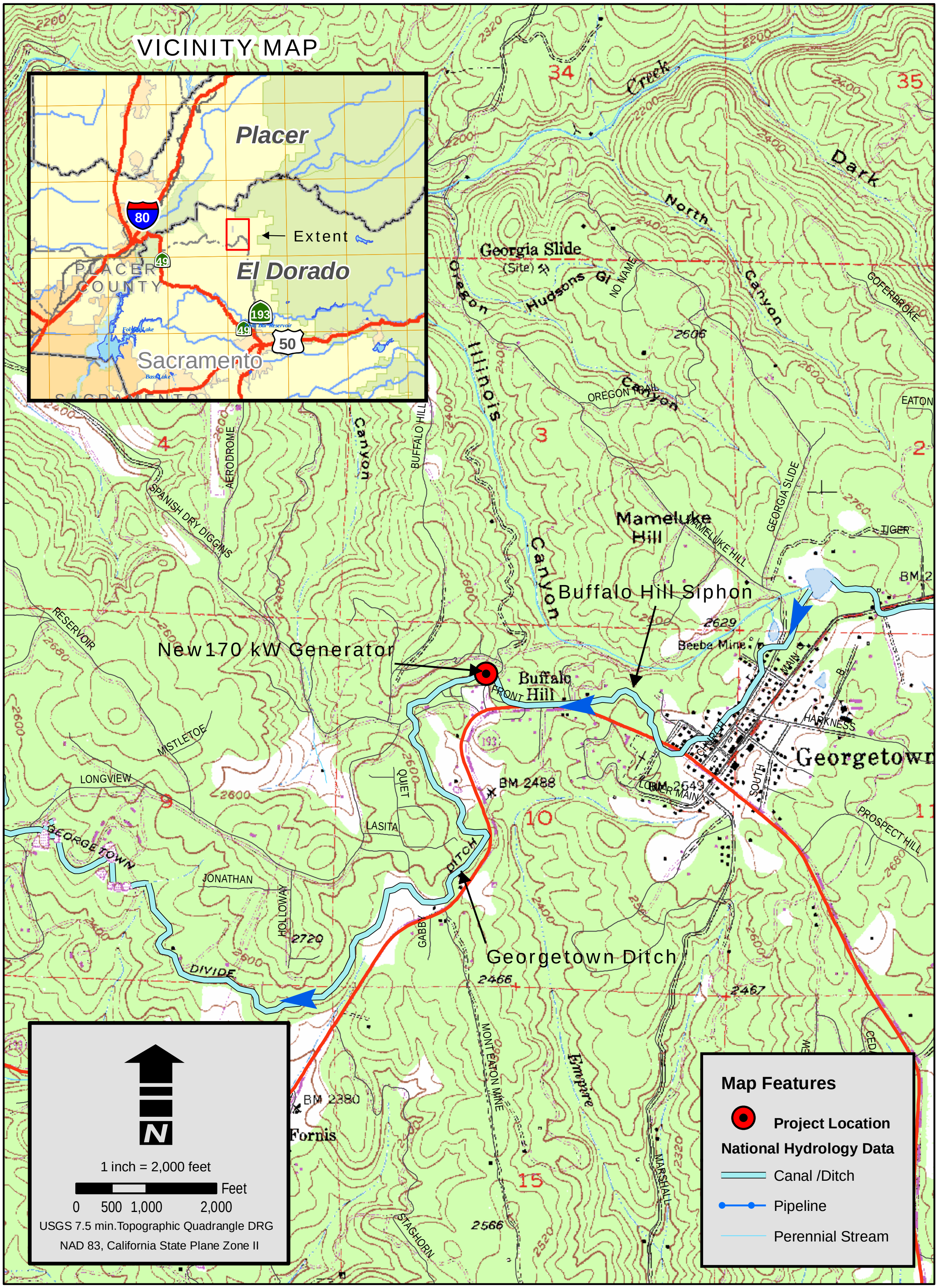
Annual Income: $106,777 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
15	**300**	**24**	**Y**	**N**	**GDPUD**

PROJECT DESCRIPTION:

The Buffalo Hill inverted siphon is located on the Georgetown Ditch conveyance system just north of the town of Georgetown, near Highway 193. The Buffalo Hill Siphon hydro option would capture the energy available at the existing 24-inch Buffalo Hill Siphon with a 170 kW hydroelectric generating facility located near the energy dissipating structure at the terminus of the siphon. The project would be sized for a maximum flow of 20 cfs, which approximates the peak flows between May and October. Annual flows are expected to average 12 cfs due to lower demand in the winter. The operating head would be variable, depending on flow rate, but is expected to average about 115 feet (141 feet max.). The project would operate using existing and future water supplies required by the GDPUD distribution system. No reoperation of the Stumpy Meadows Project or the Georgetown Ditch is expected. The average annual generation expected from the Buffalo Hill Siphon option is about 860 MWh.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-5: Buffalo Hill Siphon Project Location and Vicinity

A. Existing Facilities

The siphon is a 24-inch diameter ductile iron pipeline that is buried with concrete thrust blocks and rated at 350 psi. The fittings are rated at 250 psi. The pipe is about 5,400 feet (1 mile) long and terminates with a 14-inch diameter butterfly valve shut-off which discharges into an energy dissipating structure near Buffalo Hill. The total difference in elevation between the water surface at the entry to the siphon and at the exit from the siphon is about 145 feet. The existing water supply, Georgetown Ditch conveyance system, Buffalo Hill Siphon and energy dissipater would all be utilized with the Buffalo Hill Siphon hydro option.

B. Project Facilities and Operation

The Buffalo Hill hydro option would be located immediately adjacent to and downstream from the existing energy dissipating structure and would include a new 170 kW hydroelectric generating facility, consisting of three units – two fixed and one variable PAT. The maximum static head of the Buffalo Hill unit will be about 145 feet. The operating head is variable dependent on flow rate, but is expected to average about 115 feet.

The project would utilize the existing Buffalo Hill Siphon and therefore would not require construction of a new pipeline. A “Y” would be installed immediately upstream of the exiting butterfly valve to divert water to the hydro unit. The segment to the power plant would be 16 inches in diameter with a 16-inch shut-off valve. A small powerhouse would be constructed to house the generating equipment. The powerhouse turbines would discharge flows through the foundation structure, with the outlet discharging directly into the ditch.

The Engineer’s Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

The maximum flow is expected during the irrigation season, from about May 1 through October 1 of each year, at about 20 cfs. Flows during the winter months will vary between about 3 and 10 cfs depending on water demands, availability and operational requirements.

Average power generation at the Buffalo Hill powerhouse is estimated based on available water, head, efficiency, loss estimates and typical operation. The average monthly and annual powerhouse flow and generation expected to be available is shown below. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-10: Buffalo Hill Siphon Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through Buffalo Hill Siphon Powerhouse													
CFS	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**20**	**20**	**20**	**20**	**20**	**12**
AF	400	400	400	400	300	400	400	1,200	1,200	1,200	1,200	1,200	8,700
Projected Average Power Generation of Buffalo Hill Siphon													
MWh	37	36	37	37	34	37	36	121	117	121	121	117	850

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-11: Buffalo Hill Siphon Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
GDPUD	CEQA LEAD AGENCY	
	CEQA Exemption	2 to 4
FERC	FPA/NEPA LEAD AGENCY	
	In-conduit Exemption	18
	Small Generator Interconnection Agreement	6
El Dorado County	Air Quality/Emergency Response/Building	2 to 4
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each Certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent factor/year for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $1,284,000 total capital cost – the annual debt service is estimated at $94,680. The annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($14,888) and is estimated at $109,568.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this preliminary analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E's TOD factors. Under these conditions, the project would receive an annual average of $124.16 per MWh delivered. The project is expected to deliver 860 MWh per year. Applying TOD multipliers result in gross revenues of $106,777.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. The Buffalo Hill Siphon hydro option shows a negative cash flow under 20-year financing, and has a slightly negative cash flow under 30-year financing. Reoperation of flows through this site with new water system storage could concentrate generation during peak periods when FIT energy values increase from about 10 to 100 percent. Estimated deficits could be outweighed by the corresponding increases in revenues; therefore, this hydro option is recommended for a reoperation study.

7.4.6 Kaiser Siphon

Photo 6 – Aerial of Approximate Pipeline Alignment (shown in green)

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: GDPUD

Project Category: FIT (to be confirmed)

Design Head (ft): 668

Design Flow (cfs): 15

Nameplate capacity (kW): 580

Estimated Annual MWh/year: 3,638

Capital Cost to Construct (Estimated): $5,172,000 (includes 8,000-foot pipeline)

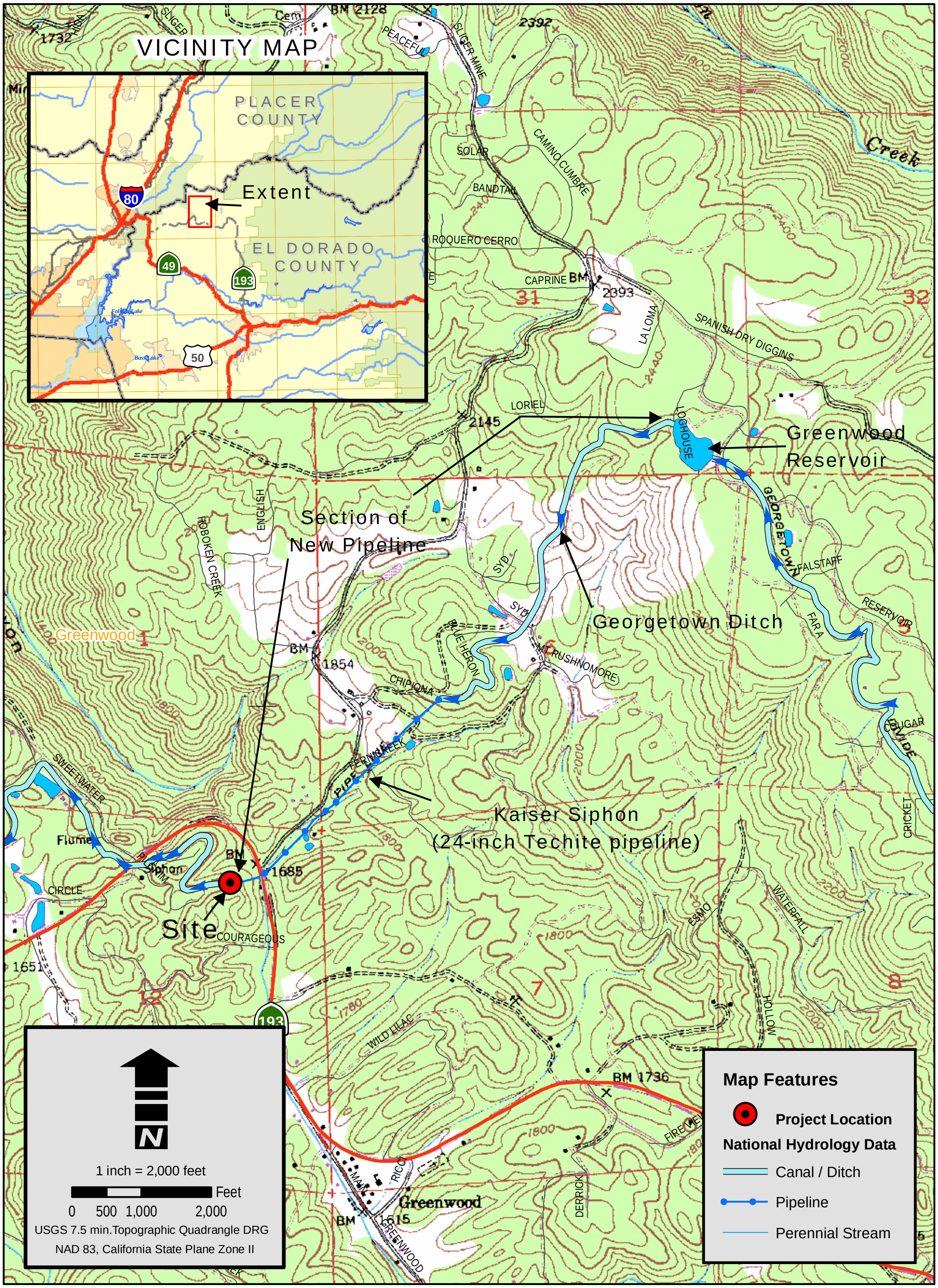
Annual Income: $448,331 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
10	**1,200**	**24**	**Y**	**N**	**GDPUD/Priv.**

PROJECT DESCRIPTION:

The Kaiser inverted siphon is located on the Georgetown Ditch conveyance system near Highway 193 just north of Greenwood, near the Auburn Lake Trails Water Treatment Plant. The existing siphon is a 24-inch diameter buried pipeline that flows to an energy dissipater at its terminus. This project option includes replacing an existing reinforced plastic mortar (Techite) pipe and an open channel section upstream of the siphon with new, 24-inch diameter pipe, for a total distance of 8,000 feet. The extended pipe provides for a significant increase in available head and resulting project benefit. The proposed 580 kW generating facility would be located immediately adjacent to and downstream from the existing energy dissipating structure. The project is sized for an estimated maximum flow of 15 cfs, which would occur between May and October. Annual flows are expected to average 10 cfs due to lower demand in the winter. The operating head would be variable, depending on flow rate, but is expected to average about 540 feet. The proposed project would operate using existing and future water supplies required by the GDPUD distribution system. No reoperation of the Stumpy Meadows Project or the Georgetown Ditch is expected. The average annual generation expected from the Kaiser Siphon hydroelectric project is about 3,600 MWh.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-6: Kaiser Siphon Project Location and Vicinity

A. Existing Facilities

The existing water supply, Pilot Creek Diversion Dam, Georgetown Ditch conveyance system, Kaiser Siphon and energy dissipater would all be utilized with the Kaiser Siphon hydro option. Three-phase distribution voltage level power lines are within about 1,200 feet of the site for project interconnection. The Kaiser Siphon is primarily a steel 24-inch diameter pipe. A section of the existing pipeline is reinforced plastic mortar (Techite) pipeline. This pipe material is prone to failure and would be replaced with high pressure rated pipeline to accommodate the Kaiser Siphon hydro project.

B. Project Facilities and Operation

Currently, the Georgetown Ditch flows as an open channel from Greenwood Reservoir to the Kaiser Siphon. This project option would include piping this section plus the section of Techite pipe, about 8,000 feet (1.5 miles) total distance. This would significantly increase head and resulting project generation. A pipe size of about 24 inches would be necessary to maintain capacity of the ditch in this section. The total difference in elevation between the water surface at the entry to the proposed new pipeline and the exit from the existing Kaiser Siphon is about 675 feet.

The project would include a 580 kW generating facility, which is sized for an estimated maximum flow of 15 cfs. The operating head is variable dependent on flow rate but will be expected to average about 540 feet.

There would be a water reliability benefit by replacing the Techite pipe as well as a possible water conservation component of this project for losses in this section of the Georgetown Ditch conveyance system.

The Engineer's Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

The maximum flow expected to occur is during the irrigation season, from about May 1 through October 1 of each year, at about 15 cfs. Flows during the winter months will vary between about 3 and 10 cfs depending on water demands, availability and operational requirements.

Flow records were examined to determine typical flow releases that would be available for hydropower generation at the Kaiser Siphon. Average power generation at the Kaiser Siphon powerhouse is estimated based on available water, head, efficiency, loss estimates and typical operation. The average monthly and annual powerhouse flows and generation expected to be available is estimated in Table 7-12 below. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-12: Kaiser Siphon Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through Kaiser Siphon Powerhouse													
CFS	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**15**	**15**	**15**	**15**	**15**	**10**
AF	400	400	400	400	300	400	400	900	900	900	900	900	7,200
Projected Average Power Generation of Kaiser Siphon Powerhouse													
MWh	196	190	196	196	177	196	190	466	451	466	466	451	3,600

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-13: Kaiser Siphon Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
GDPUD	CEQA LEAD AGENCY	
	Mitigated Negative Declaration Process	10 to 14
FERC	FPA/NEPA LEAD AGENCY	
	Small Hydro Exemption/ Environmental Assessment (EA) Processes	18 to 20
	Small Generator Interconnection Agreement	6
U.S. Army Corps of Engineers (USACE)	CWA Section 404	4 to 6
USFWS	Federal Endangered Species Act (ESA)	2 to 4
SWRCB	CWA Section 401	4 to 6
RWQCB	CWA Section 402	4 to 6
CDFG	Section 1600 et seq.; CA ESA	4 to 6
State Historic Preservation Officer (SHPO)	National Historic Preservation Act (NHPA) Section 106	4 to 6
California Department of Transportation (Caltrans)	Hwy 193 Encroachment	2 to 4
El Dorado County	Air Quality/Emergency Response/Building	4 to 6
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent/year factor for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $5,172,000 total capital cost – the annual debt service is estimated at $381,376. The annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($30,082) and is estimated at $411,458.

The above cost estimate and debt service assume that all identified costs are attributable to the hydro project. However, GDPUD has identified a prior need to replace sections of existing pipe for reliability purposes. It could be argued that the pipeline replacement and certain other costs therefore should not be part of the hydro project option economic analyses. Further information is needed on what costs should be assigned to the hydro option. This information could affect the hydro option’s permitting requirements, potential financing with CREBs, and eligibility for a FIT from PG&E.

In addition to the above, if the pipeline is deemed part of the hydro option, then additional investigation is required to confirm that the project does not alter the amount, timing, or quality of stream flows that could be affected by the hydro option. If it does, then the project would not qualify for the FIT contract and GDPUD should reconsider the Kaiser Siphon minor pipeline hydro option as it is expected to meet FIT conditions.

For this analysis, it is assumed that the project entered into a 20-year FIT contract that initiates delivery in 2011 and receives energy payments based on PG&E’s TOD factors. Under these conditions, the project would receive an annual average of $123.23 per MWh delivered. The project is expected to deliver 3,638 MWh per year. Applying TOD multipliers result in gross revenues of $448,331.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. Of the top 10 hydro options, this project has the greatest estimated generation potential with a significant revenue stream. The multiple benefits with a substantial net present value support the immediate implementation of this project, especially considering the project’s ability to carry the added cost burden of the 8,000-foot pipeline.

7.4.7 Sly Park Dam

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 95

Design Flow (cfs): 55

Nameplate capacity (kW): 400

Estimated Annual MWh/year: 1,833

Photo 7 – Sly Park Dam, Hydroelectric Project at Dam Section on Right

Capital Cost to Construct (Estimated): $2,571,000

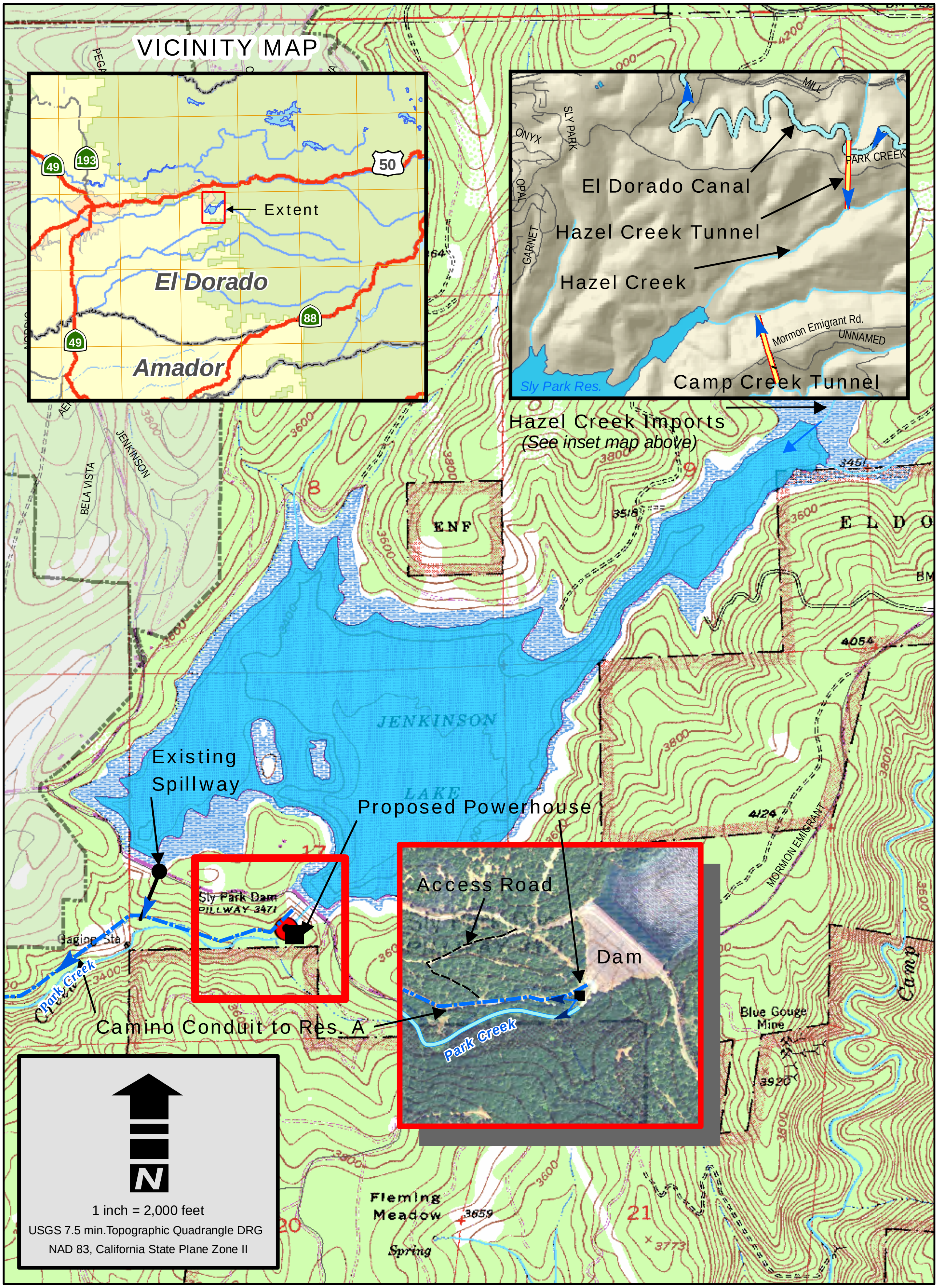
Annual Income: $227,978 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
75	**1,000**	**48**	**Y**	**N**	**EID**

PROJECT DESCRIPTION:

The Sly Park Dam hydro option would replace a pressure reducing valve (PRV) on the dam outlet works with a hydroelectric facility that has at least two operational sub-options. Sly Park Dam impounds Jenkinson Lake just to the southeast of Pollock Pines. The main dam is approximately 176 feet high with a crest length of 760 feet and elevation 3,482 feet. The first option would generate power from the Camino Conduit flows. The second option would add Jenkinson spillway flows. This is a FIT project with good road access and relatively close proximity to existing transmission lines. Power generation from the first option is expected to be approximately 1,800 MWh per year using four vertical turbine PATs.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-7: Sly Park Dam Project Location and Vicinity

Feet
0 500 1,000 2,000

El Dorado County Hydroelectric Development Options

A. Existing Facilities

The Sly Park Dam is comprised of two earth and rockfill structures. The main dam is approximately 176 feet high with a crest length of 760 feet and elevation 3,482 feet. The dike section, located ½ mile to the west, is 130 feet high with a crest length of 640 feet. The dike contains the U-shaped spillway structure, which has a weir crest elevation of 3,471 feet. The spillway releases water into the natural channel of Park Creek below the dam.

The main dam section contains the outlet works and valve control house and would be the location for the new hydro-generator and associated equipment. The existing outlet is comprised of a 36-inch conduit installed inside a 6.5-foot diameter modified horseshoe shaped tunnel, which passes through the dam section. Minimum stream flows are released into Park Creek from the existing valve control house.

B. Project Facilities and Operation

First Option – Generation from Camino Conduit Flows: Under the first option, a hydro-generator installed at the base of Sly Park Dam would enable the District to generate power whenever water is released through the outlet works. The Conduit is precast concrete comprised of 48-inch and 42-inch sections. Flows through the Conduit range from 10 to 65 cfs. Jenkinson serves as an upstream regulating reservoir as it supplies the flow for the treatment plant plus minimum stream flow releases into Park Creek. At Reservoir A WTP, the treated water enters the District's treated water distribution system, supplying homes and businesses with drinking water. Treated water demand generally increases throughout the hot summers and Jenkinson Lake is gradually drawn down.

Second Option – Generation from Jenkinson Spill Flows: Under the second option, the hydro generator would operate at a higher capacity whenever Jenkinson would spill. Instead of allowing spills to pass over the spillway into Park Creek, the outlet works would be modified to add a wye bifurcation immediately downstream of the turbine. One end of the wye would connect to Camino Conduit, while the other end would discharge directly into the existing channel flowing into Park Creek. Much of the water that would normally spill would be routed through the outlet works, through the hydro-generator, and then be released through the wye into Park Creek.

For this evaluation, which addresses the "First Option," four vertical turbine PATs were selected to save on capital cost without sacrificing much efficiency. One of these units would be variable speed, and collectively the units would perform over highly variable heads and flows between 65 to 103 feet and 14 to 55 cfs, respectively.

The Engineer's Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

Flow records were examined to determine typical flow releases that would be available for hydropower generation at Sly Park Reservoir. Average power generation at the Sly Park powerhouse is estimated based on available water, head, efficiency, loss estimates and typical operations. The average monthly and annual powerhouse flow and generation expected to be available are shown below. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-14: Sly Park Dam Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through Sly Park Powerhouse													
CFS	**48**	**27**	**17**	**14**	**15**	**15**	**18**	**43**	**51**	**27**	**55**	**52**	**32**
AF	3,000	1,600	1,000	900	800	900	1,100	2,600	3,000	1,700	3,400	3,100	23,100
Projected Average Power Generation of Sly Park Powerhouse													
MWh	237	129	80	65	63	70	83	213	244	134	272	249	1,800

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-15: Sly Park Dam Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
EID	CEQA LEAD AGENCY	
	Categorical Exemption/Mitigated Negative Declaration Process	4 to 12
FERC	FPA/NEPA LEAD AGENCY	
	Small hydro exemption	18 to 20
	Small Generator Interconnection Agreement	6
USACE	CWA Section 404	4 to 6
USFWS	Federal ESA	4 to 6
Division of Safety of Dams (DSOD)	Approval	12 to 14
RWQCB	CWA Section 402	4 to 6
SWRCB	CWA Section 401	4 to 6
CDFG	Section 1600 et seq. and CA ESA	4 to 6
SHPO	NHPA Section 106	4 to 6

El Dorado County	Air Quality/Emergency Response/Building	2 to 4
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent/year factor for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $2,571,000 total capital cost – the annual debt service is estimated at $202,855. The average annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($22,807) and is estimated at $225,662.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E’s TOD factors. Under these conditions, the project would receive an annual average of $124.36 per MWh delivered. The project is expected to deliver about 1,833 MWh per year. Applying TOD multipliers results in gross revenues of $227,978.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. The economic analysis for this project was based on the “First option,” which considers Camino Conduit flows plus minimum in-stream flow releases to Park Creek. Generation revenues would be greater with the addition of spill flows. The economic analyses show this project to be viable, even without potential reoperation and other considerations that are expected to improve the economic characteristics of this project; therefore, this hydro option is recommended for immediate implementation.

When the economics of this project, as defined above, are considered with: 1) inclusion of spill flows, 2) potential economies of scale as described in Section 7.6.2, and 3) future increases in flows at this site for the reasons explained in Section 7.6.4, then the long term economics of this hydro option are expected to shift to strongly viable. These considerations support this project for immediate implementation.

7.4.8 Pleasant Oak Main (Reservoir B)

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff (2-plants)

Design Heads (ft): 139/199

Design Flow (cfs): 24

Nameplate capacities (kW): 180/ 270

Estimated Annual MWh/year: 2,657

Photo 8 – Existing Pressure Reducing Station at Reservoir B

Capital Cost to Construct (Estimated): $3,591,000

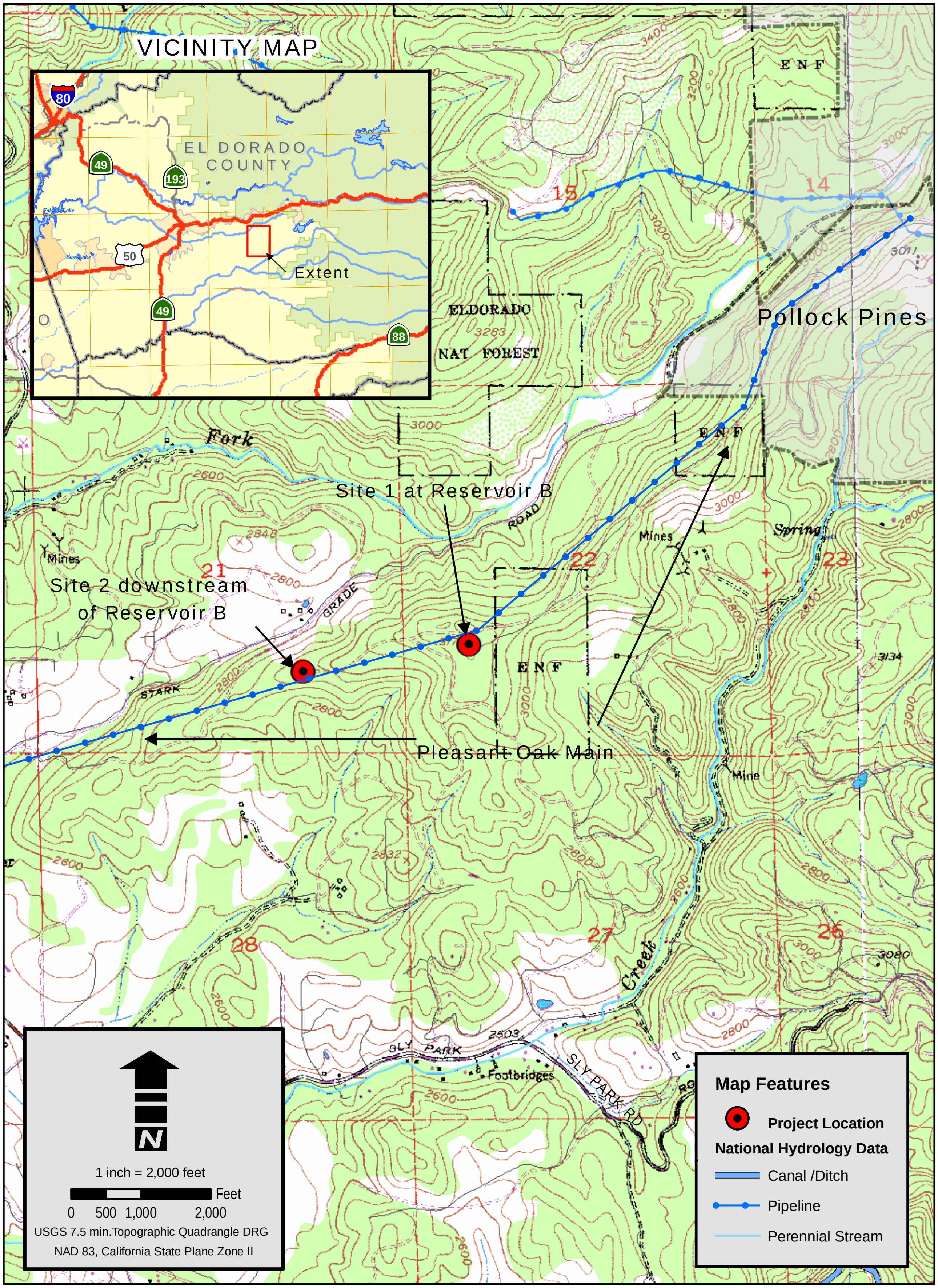
Annual Income: $326,980 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
16	**10,000**	**36**	**Y**	**Y**	**EID**

PROJECT DESCRIPTION:

The Pleasant Oak Main (POM) at Reservoir B hydro option is a dual station project, located off of Pleasant Valley Road. One unit would be upstream at the Reservoir B site and one unit downstream (west) of Reservoir B along the District access road. The two stations would share transmission line facilities and the same flow rates through the POM pipeline. The two sites are relatively flat and have good construction access. There is sufficient area on the Reservoir B site for the proposed project. The second site may require a small amount of new right-of-way adjacent to the District's access road to Reservoir B. 3-phase transmission lines are approximately 10,000 feet from the furthest unit. The two hydro stations would be located on the existing 36-inch pipeline. Each hydro station will have three PATs with one turbine operating at variable speed with a regenerative power converter. Each hydro station will be housed in a masonry building approximately 400 square feet in area. The combined power generating capacity of the two hydro stations is projected to be about 2,600 MWh per year.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-8: Pleasant Oak Main (Reservoir B) Project Location and Vicinity

A. Existing Facilities

POM 1 at Reservoir B is located on the pipeline conveying flow from Reservoir A WTP to Reservoir B. Two plants are planned for this project. The upstream site is the first PRS on the POM and therefore conveys the most flow. The PRS discharges into Reservoir B. Flow in the pipeline varies from 5 cfs to 28 cfs with daily variations of 25 to 30 percent. These daily variations in flow will occur up to 5 to 6 times daily during peak demand months. The PRS consists of two 16-inch, one 14-inch and one 8-inch valves. The existing site has additional area available for the hydro station.

The POM pipeline leaves Reservoir B following an existing access road along the ridgeline to the west before heading down the hill to Pleasant Valley Road. The second station will be off of the POM, adjacent to the access road approximately 2,300 feet west of Reservoir B. The flows in the POM at this location are similar to those at Reservoir B, with no laterals between the two sites.

B. Project Facilities and Operation

The two hydro stations would be located on the existing 36-inch pipeline as described above. Each hydro station will consist of three PATs with one turbine operating at variable speed with a regenerative power converter. The other two pump units will operate at fixed speed. The facilities will be housed in a masonry building approximately 400 square feet in area. Associated fencing and security features will be included in the design.

The hydro stations will include flow control and pressure regulating valves in addition to the turbine units to regulate the plant operation. A bypass will be provided at each hydro station to allow continuous flow in the EID system during an emergency and while the hydro station is off line for repairs or maintenance. Due to the degree of variability of flows, each station will rely on a programmable control system to augment mechanical operation for regulating flows to the hydro station.

The Engineer’s Preliminary Estimates of Probable Costs in Appendix A identifies each project’s components, costs, and related assumptions. A typical layout has been developed for each station and is presented in Appendix A.

C. Estimated Generation

Flow records were examined to determine typical flow releases that would be available for hydropower generation at the POM 1 at Reservoir B and downstream of Reservoir B combined. Average combined power generation at both of the Pleasant Oak Main at Reservoir B powerhouses is estimated based on available water, head, efficiency, loss estimates and typical operation. The average monthly and annual powerhouse flows and generation expected to be available are shown below. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-16: Pleasant Oak Main (Reservoir B) Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through Each Pleasant Oak Main @ Res B Powerhouse													
CFS	**13**	**9**	**7**	**6**	**6**	**9**	**15**	**17**	**24**	**24**	**24**	**23**	**15**
AF	800	500	400	400	300	600	900	1,000	1,400	1,500	1,500	1,400	10,700
Projected Average Power Generation of Pleasant Oak Main @ Res B Powerhouses													
MWh	208	149	117	95	86	153	237	267	343	330	325	336	2600

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-17: Pleasant Oak Main (Reservoir B) Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
EID	CEQA LEAD AGENCY	
	CEQA Exemption	2 to 4
FERC	FPA/NEPA LEAD AGENCY	
	In-conduit exemption	18
	Small Generator Interconnection Agreement	6
El Dorado County	Air Quality/ Emergency Response/Building	2 to 4
State Health Dept.	Possible Permit Amendment	2 to 4
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each Certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent factor/year for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $3,591,000 total capital cost – the annual debt service is estimated at $264,795. The average annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($28,165) and is estimated at $292,960.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E's TOD factors. Under these conditions, the project would receive an annual average of $123.05 per MWh delivered. The project is expected to deliver 2,657 MWh per year. Applying TOD multipliers result in gross revenues of $326,980.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. Future water system operations could concentrate generation during peak periods when FIT energy values increase from about 10 to 100 percent. The economic analyses show this project to be viable, even without potential reoperation and other considerations that are expected to improve the economic characteristics of this project; therefore, this hydro option is recommended for immediate implementation.

7.4.9 Pleasant Oak Main PRS 5 (Reservoir 7)

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 340

Design Flow (cfs): 24

Nameplate capacity (kW): 510

Estimated Annual MWh/year: 2,321

Photo 9 – Tanks and Pressure Reducing Station at Reservoir 7

Capital Cost to Construct (Estimated): $1,523,000

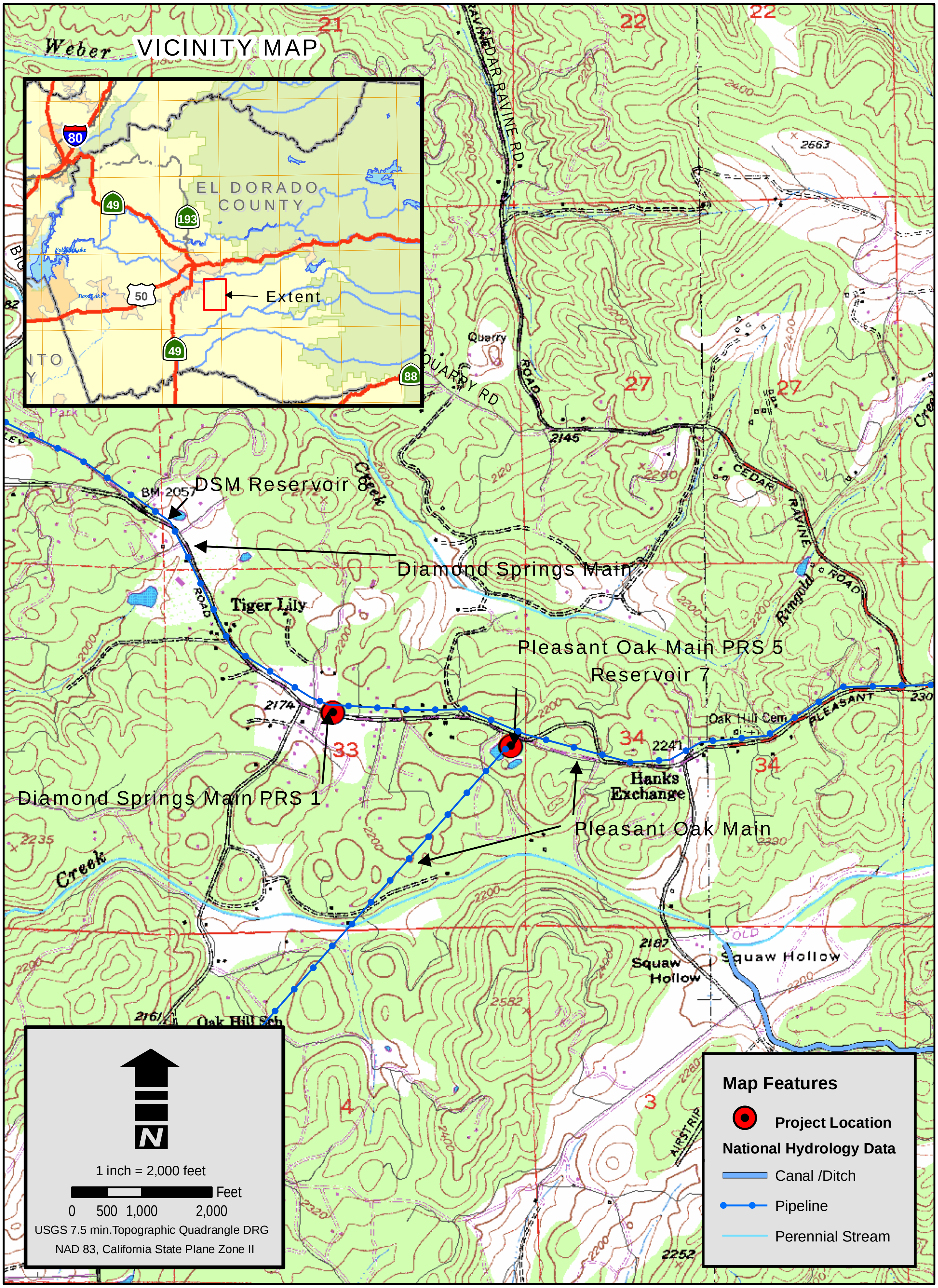
Annual Income: $287,082 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
14	**40**	**24**	**Y**	**Y**	**EID**

PROJECT DESCRIPTION:

The POM Pressure Reducing Station 5 (PRS 5) hydro option would be located on the northeast side of the Reservoir 7 tank site, off of Pleasant Valley Road. There is sufficient area on the existing site for the proposed project. The site is situated at approximately 2,230 feet elevation, is relatively flat, and has good construction access. The surrounding land use is low density residential and open space. The hydro station will consist of three PATs with one turbine operating at variable speed with a regenerative power converter. The facilities will be housed in a masonry building approximately 400 square feet in area. Minor changes in operations for delivery of flow to Reservoir 7 can smooth out the variability of the flow which can result in less complicated control, greater generation, and less potential wear on the hydro station components. Annual power generation is expected to be approximately 2,300 MWh.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-9: Pleasant Oak Main PRS 5 (Reservoir 7) Project Location and Vicinity

A. Existing Facilities

PRS 5 is located on the pipeline conveying flow from Reservoir C to Reservoir 7. Pressure upstream of the PRS varies from 150 psi to 90 psi. The PRS discharges into the tanks at Reservoir 7. Flow in the pipeline varies from 3 cfs to 24 cfs with daily variations of 25 to 30 percent. These daily variations in flow will occur up to 5 to 6 times daily during peak demand months.

PRS 5 consists of one 12-inch, one 8-inch and one 6-inch valves. The site has area available for the hydro option. The site is located at the existing Reservoir 7 tank site which houses EID staff operations buildings. The site also contains a former WTP that is no longer in service. Three-phase electrical service is adjacent to the site for project interconnection.

B. Project Facilities and Operation

The hydro option would be located on the existing 24-inch pipeline adjacent to the existing PRS. The hydro station will consist of three PATs with one turbine operating at variable speed with a regenerative power converter. The other two pump units will operate at fixed speed. The facilities will be housed in a masonry building approximately 400 square feet in area. Associated fencing and security features will be included in the design.

The hydro station will include flow control and pressure regulating valves in addition to the turbine units to regulate the plant operation. A bypass will be provided at the hydro station to allow continuous flow in the EID system during an emergency and while the hydro station is off line for repairs or maintenance. Due to the degree of variability of flows, the station will rely on a programmable control system to augment mechanical operation for regulating flows to the hydro station.

The Engineer’s Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

Flow records were examined to determine typical flow releases that would be available for hydropower generation at the Pleasant Oak Main PRS 5 at Reservoir 7. Average power generation at the powerhouse is estimated based on available water, head, efficiency, loss estimates and typical operation. The average monthly and annual powerhouse flows and generation expected to be available are shown below. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-18: Pleasant Oak Main PRS 5 (Reservoir 7) Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through Pleasant Oak Main PRS 5 @ Res 7 Powerhouse													
CFS	**10**	**8**	**6**	**6**	**6**	**8**	**10**	**17**	**22**	**24**	**24**	**21**	**14**
AF	600	500	400	400	300	500	600	1,000	1,300	1,500	1,500	1,200	9,800
Projected Average Power Generation of Pleasant Oak Main PRS 5 @ Res 7													
MWh	143	135	96	96	86	140	138	267	300	322	322	293	2,300

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-19: Pleasant Oak Main PRS 5 (Reservoir 7) Anticipated Regulatory Approvals

Agency	Permit/Approval	Expected Agency Review Time (months)
EID	CEQA LEAD AGENCY	
	CEQA Exemption	2 to 4
FERC	FPA/NEPA LEAD AGENCY	
	In-conduit exemption	18
	Small Generator Interconnection Agreement	6
El Dorado County	Air Quality/Emergency Response /Building	2 to 4
State Health Dept.	Possible Permit Amendment	2 to 4
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent factor/year for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $1,523,000 total capital cost – the annual debt service is estimated at $112,304. The annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($21,609) and is estimated at $133,913.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E’s TOD factors. Under these conditions, the project would receive an annual average of $123.71 per MWh delivered. The project is expected to deliver 2,321 MWh per year. Applying TOD multipliers result in gross revenues of $287,082.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. The POM PRS 5 at Reservoir 7 hydro option would have $124,138 annual net revenue under 20-year financing and greater annual net revenue under 30-year financing. Because of the strong economic characteristics of this project, this hydro option is recommended for immediate implementation.

7.4.10 Diamond Springs Main PRS 1 (Reservoir 8)

PRIORITY:
Recommended for reoperation study

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 136

Design Flow (cfs): 17

Nameplate capacity (kW): 140

Estimated Annual MWh/year: 690

Capital Cost to Construct (Estimated): $1,082,000

Photo 10 – DSM Pressure Reducing Station

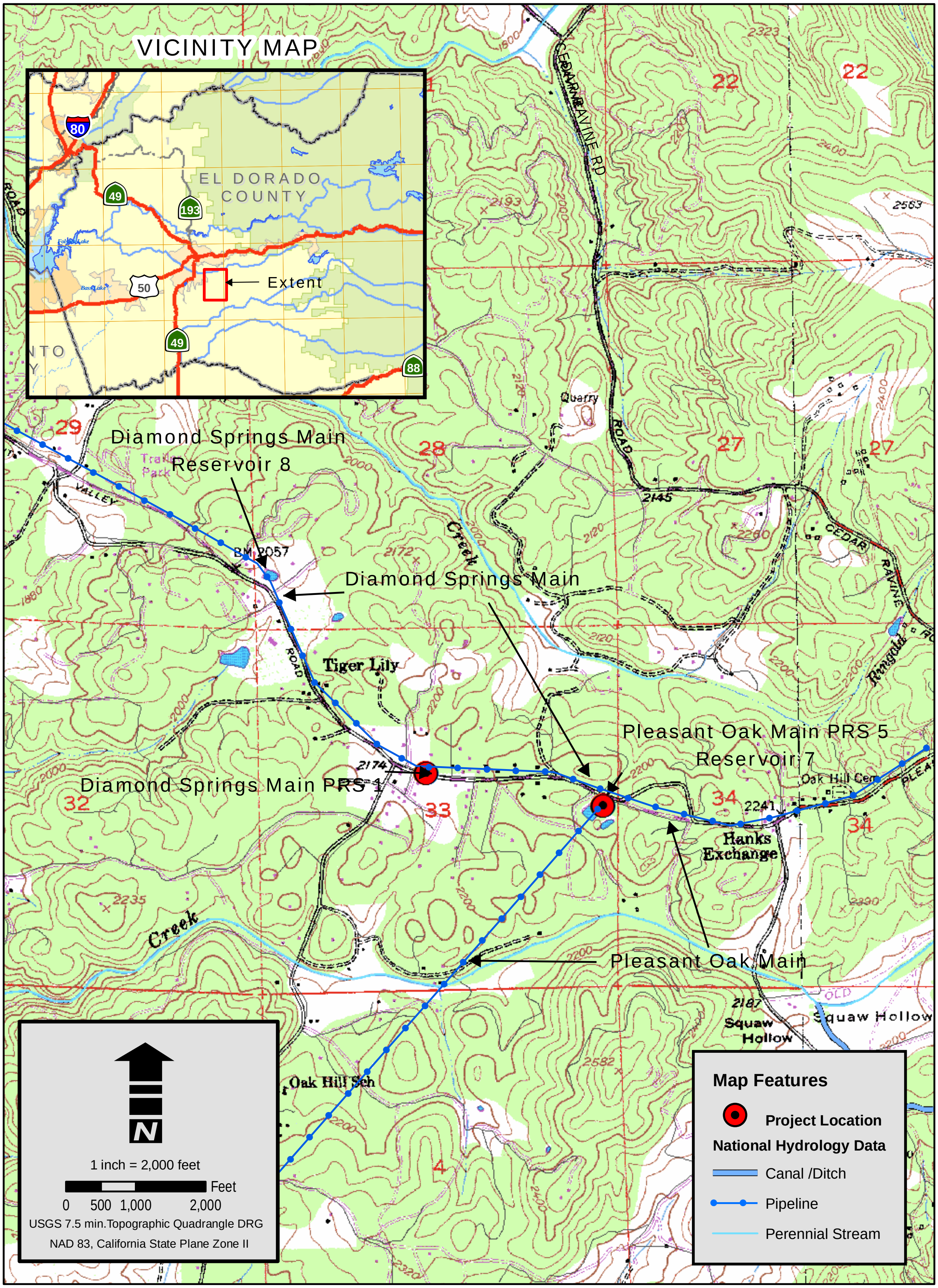
Annual Income: $82,196 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
11	**40**	**24**	**Y**	**N**	**EID**

PROJECT DESCRIPTION:

This project is at an existing pressure reducing (PR) station on EID’s Diamond Springs Main at the old Reservoir 8 Site. The site, at an elevation of 2,080 feet, is relatively flat and has good construction access. The surrounding land use is low and medium density residential and open space. The hydro station will consist of two PATs with one turbine operating at variable speed with a regenerative power converter. The energy production is moderate (690 MWh) when compared to some of the other more favorable sites due to less head and flow. As with many of the PR sites, onsite storage is not available to regulate flows, requiring flow regulation through multiple units and valve controls. However, access and distance to power grid are reasonable. The proposed facilities would be housed in a masonry building approximately 230 square feet in area.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-10: Diamond Springs Main PRS 1 (Reservoir 8) Project Location and Vicinity

A. Existing Facilities

The PRS on DSM consists of two 12-inch and one 8-inch valves. The existing site has area available for the hydro project. DSM is part of EID's system fed from Reservoir A through the POM. PRS 1 is located on the pipeline conveying flow from Reservoir 7 to Reservoir 8. Pressure upstream of the PR station varies from 110 psi to 70 psi. The PR station maintains a downstream pressure of 50 psi in the pipeline. Flow in the pipeline varies from 3 cfs to 23 cfs with daily variations of 25 to 30%. These daily variations in flow will occur up to 5 to 6 times daily during peak demand months.

B. Project Facilities and Operation

The hydro option would be located on the existing 24-inch pipeline adjacent to the existing PRS. The hydro station will consist of two PATs with one turbine operating at variable speed with a regenerative power converter. The other unit will operate at fixed speed. The proposed facilities will be housed in a masonry building approximately 230 square feet in area. Associated fencing and security features will be included in the design.

The hydro station will include flow control and pressure regulating valves in addition to the turbine units to regulate the plant operation while maintaining the required 50 psi downstream pressure. A bypass will be provided at the hydro station to allow continuous flow in the EID system during an emergency and while the hydro station is off line for repairs or maintenance. Due to the degree of variability of flows, the station will rely on a programmable control system to augment mechanical operation for regulating flows to the hydro station.

The Engineer's Preliminary Estimate of Probable Costs in Appendix A identifies the project components, costs, and related assumptions. A typical layout has been developed for this station and is presented in Appendix A.

C. Estimated Generation

Flow records were examined to determine typical flow releases that would be available for hydropower generation at the Diamond Springs Main PRS 1 at Reservoir 8. Average power generation is estimated based on available water, head, efficiency, loss estimates and typical operation. The average monthly and annual powerhouse flows and generation expected to be available are shown below. Appendix B provides a detailed breakdown of the flow and generation estimates for this hydro option.

Table 7-20: Diamond Springs Main PRS 1 (Reservoir 8) Powerhouse Flow and Generation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Projected Average Flow Through Diamond Springs Main PRS 1 @ Res 8 Powerhouse													
CFS	**9**	**8**	**6**	**6**	**6**	**8**	**9**	**17**	**17**	**17**	**17**	**17**	**11**
AF	600	500	400	400	300	500	500	1,000	1,000	1,000	1,000	1,000	8,200
Projected Average Power Generation of Diamond Springs Main PRS 1 @ Res 8													
MWh	49	53	38	38	35	55	47	95	74	68	68	68	690

D. Anticipated Regulatory Approvals and Permits

The tables below summarize the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-21: Diamond Springs Main PRS 1 (Reservoir 8) Anticipated Regulatory Approvals

Agency	**Permit/Approval**	**Expected Agency Review Time (months)**
EID	CEQA LEAD AGENCY	
	Mitigated Negative Declaration Process	6 to 10
FERC	FPA/NEPA LEAD AGENCY	
	In-conduit exemption	18
	Small Generator Interconnection Agreement	6
El Dorado County	Air Quality/ Emergency Response/Building	2 to 4
State Health Dept.	Possible Permit Amendment	2 to 4
CEC	RPS FIT Pre-certification and Certification	2 to 3 for each certification

E. Project Economics

Appendix A provides a detailed cost breakdown for project planning, design, permitting, and construction and operation. The construction costs were escalated to 2011, and include a 5 percent factor/year for interest during construction.

Project costs are expected to consist of the annual debt service paid (principal and interest) to finance the project and incremental O&M and replacement costs attributable to the power generation portion of the broader water project. Based on the financing parameters identified earlier - 30-year term, 6.0 percent annual interest, $1,082,000 total capital cost – the annual debt service is estimated at $79,785. The average annual cost of generation is the sum of the annual debt service and the annual O&M and replacement costs ($14,053) and is estimated at $93,838.

Based on the project characteristics, it is eligible to enter into a FIT contract with PG&E. For this analysis, it is assumed that the project enters into a 20-year contract that initiates delivery in 2011 and receives energy payments based on PG&E's TOD factors. Under these conditions, the project would receive an annual average of $119.52 per MWh delivered. The project is expected to deliver 690 MWh per year. Applying TOD multipliers result in gross revenues of $82,196.

F. Conclusion/Recommendation

Table 7-1 provides a summary and Appendix B provides a detailed breakdown of the annual cash flow and economic analysis for this project. Reoperation of flows through this site with new water system storage could concentrate generation during peak periods when FIT energy values increase from about 10 to 100 percent. This project's revenue deficit could be outweighed by the corresponding increase in revenues; therefore, this hydro option is recommended for reoperation study.

7.4.11 El Dorado Canal Technology Demonstration

Photo 11 – El Dorado Canal Diversion on South Fork American River near Kyburz

PRIORITY:
Recommended for immediate negotiation with Verdant Power

PURVEYOR LEAD: EID

Project Category: Technology Demonstration

Design Head (ft): N/A (hydrokinetic unit)

Design Flow (cfs): N/A (existing canal flows)

Nameplate capacity (kW): 30–40

Estimated Annual MWh/year: 50-70

Capital Cost to EID to Construct (Estimated): $0

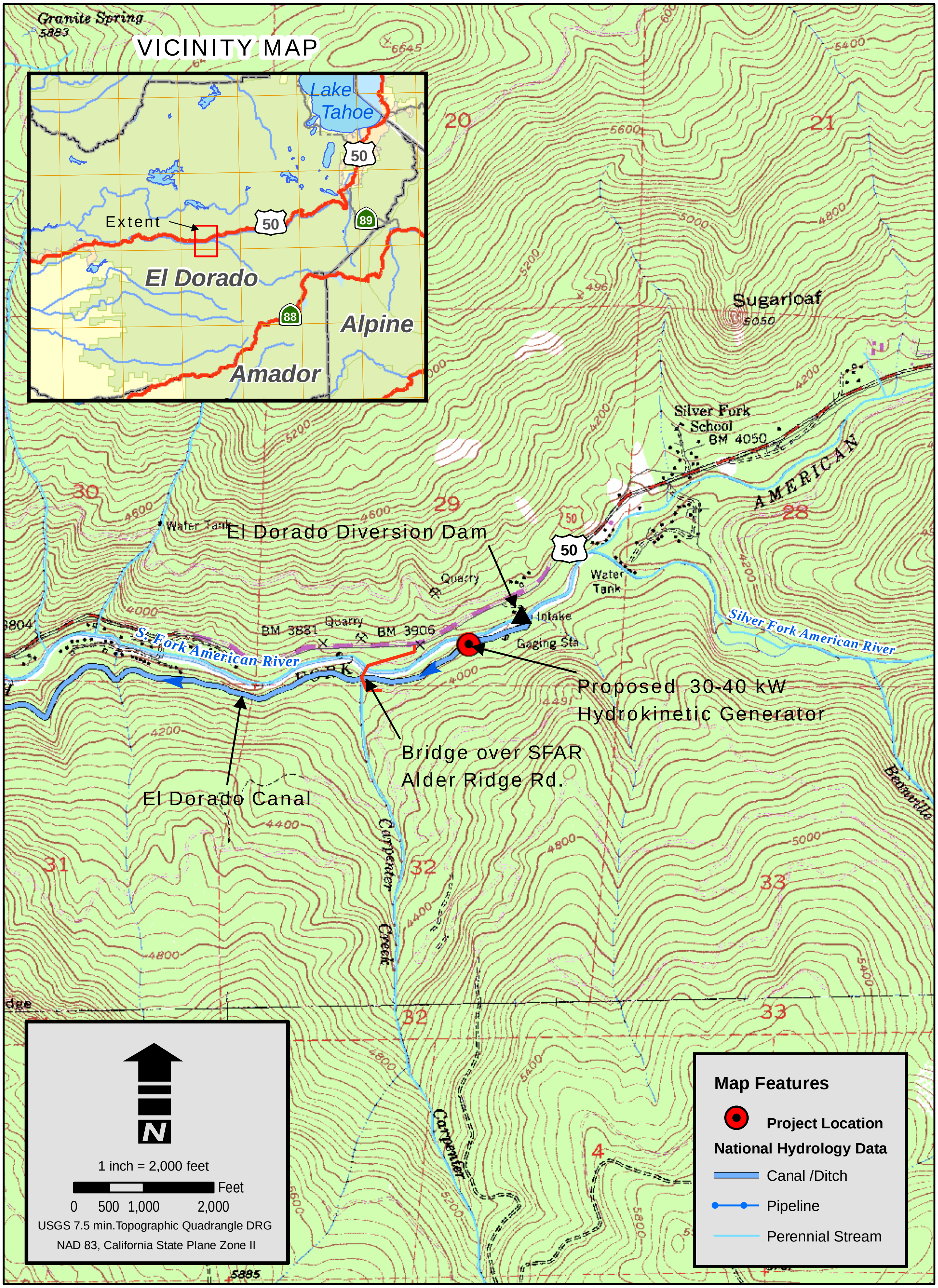
Annual Income: TBD

EXISTING FEATURES:

Max. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
156	**1,000**	**Canal**	**N**	**N/A**	**EID**

PROJECT DESCRIPTION:

This project entails installation of a demonstration technology hydrokinetic turbine designed by Verdant Power. A vertical turbine would be located approximately 300 yards below the Project 184 Diversion Dam, on the El Dorado Canal at an elevation of approximately 3,900 feet. Due to high flow velocities (10 ft/sec) and historically low debris accumulation in this area, the site was identified by Verdant Power as the best place to deploy this technology. The unit would be connected to a new or upgraded transmission line feeding the Diversion Dam control house. The entire unit would be easily removable from the Canal to facilitate debris removal and other maintenance. Verdant Power would design and install the unit in the Canal at no cost to the District.



Created By: Ethan Koenigs
Date: 06/29/09

Figure 7-11: El Dorado Canal - Technology Demonstration Project Location and Vicinity

A. Existing Facilities

Verdant Power visited EID in November 2007. District staff showed Verdant several sites and determined that the location best suited for technology demonstration was the El Dorado Canal below the diversion dam. It is a long straight reach, with water velocities approaching 10 ft/sec, ideal for a hydrokinetic turbine. Because of the steep gradient and fast moving water, icing would generally not be a problem nor would debris accumulation, because there are few trees upstream to drop organic material in the water. The Canal was measured and determined by Verdant to be of the correct size and depth needed for deployment of a hydrokinetic unit.

B. Project Facilities and Operation

This project involves installation of a hydrokinetic turbine-generator in the El Dorado Canal below the District's diversion dam at Kyburz. The unit would be self-contained and include the turbine, generator, governor, and electrical and control systems in a single package. The unit would be readily removable from the El Dorado Canal to facilitate canal maintenance including ice removal and debris clearing. The unit would produce power in the 30 to 40 kW range. Public access to this site as a demonstration facility would be possible via the Sand Flat Campground and USFS access road nearby.

C. Estimated Generation

Assuming the project would operate an average of roughly 4,000 hours per year at about 50 percent average capacity, the project would produce roughly 50 to 70 MWh per year.

D. Anticipated Regulatory Approvals and Permits

The table below summarizes the anticipated environmental approvals and permits. A detailed discussion of environmental, regulatory, and other permitting requirements is provided in Appendix C.

Table 7-22: El Dorado Canal Technology Demonstration Anticipated Regulatory Approvals

Agency	**Permit/Approval**	**Expected Agency Review Time (months)**
EID	CEQA LEAD AGENCY	
	CEQA Exemption	2 to 4
FERC	FPA/NEPA LEAD AGENCY	
	In-conduit Exemption	18
	Small Generator Interconnection Agreement	6
USFS	4(e)s/Special Use Permits	4 to 6

USACE	CWA Section 404	4 to 6
USFWS	Federal ESA	2 to 4
SWRCB	CWA Section 401	4 to 6
RWQCB	CWA Section 402	4 to 6
SHPO	NHPA Section 106	2 to 4
El Dorado County	Air Quality/Emergency Response/Building	2 to 4
CEC	RPS FIT Pre-Certification and Certification	2 to 3 for each certification

E. Project Economics

Based on the project characteristics, Verdant Power could enter into a FIT contract with PG&E. Revenues received under an FIT are based on the term of the contract, the initial year the project delivers power under the contract, and the time of day and week that power is delivered under the contract. Verdant Power would pay for the project and manage the construction, installation, and start-up. EID would negotiate an agreement with Verdant Power for an annual rent, share of the energy revenues, transfer of the project to EID (if desired), and other possible provisions and conditions.

F. Conclusion/Recommendation

Verdant's installation of a hydrokinetic turbine on EID's canal would contribute to industry experience with hydrokinetic technology and could also contribute to EID's public relations programs.

Assuming that Verdant Power could provide EID sufficient assurances that the project and its operation would not adversely impact El Dorado Canal operations, this project is recommended for immediate negotiation with Verdant Power, which would start with a confidentiality agreement requested by Verdant.

7.5 Other Economic Considerations

Several other financial and economic considerations could further affect the viability of the "top 10" and other hydro options recommended for detailed analyses separate from this study. These include tax credits for private developers, low-interest public bond financing, changes in the market prices and costs of renewable energy, impacts of the developing carbon taxes and greenhouse gas emissions cap and trade programs on prices of existing fossil fuel-based energy, future values of renewable energy credits, future changes in the FIT and associated RPS programs that are linked to the annual CPUC-determined Market Price Referents for renewable energy, and market effects on energy buyers, or 'counterparties', that may be seeking to purchase hydropower from some of the larger hydro options considered in this study. Presented below is a discussion of these and related topics.

7.5.1 Financial Incentives

Several financial incentives exist for renewable energy resource development. Tax credits exist for private developers, but these do not reduce the cost of financing a project (either via debt or equity) to the level of traditional tax-exempt debt financing (which the purveyors in El Dorado County are eligible to use).

.

One near-term option for financing some or all of the "top 10" hydro projects is the American Recovery and Reinvestment Act of 2009 (ARRA), which authorizes $1.6 billion of New CREBs and $2.4 billion of new QECBs. Under the ARRA, New CREBs and QECBs are being made available for financing renewable energy and greenhouse gas emission reduction initiatives. New CREBS most directly apply to the hydro options.

With New CREBs (those authorized via the 2009 ARRA), the bond holder receives a tax credit that is equal to 70 percent of the IRS-approved bond market rate for New CREBs. The effective interest rate of the New CREBs for the bond issuer (e.g., EID or GDPUD) should be close to the difference between the current tax-exempt bond rate in the market and the tax credit to the bond holder, but may be somewhat more or less than this. The application deadline for CREBs is August 4, 2009, whereas the QECBs have no projected closing date, other than award of total available bonds.

Contract incentives are also available through the IOUsin California. The requirement of the three largest IOUs (PG&E, SCE, and SDG&E) to meet 33% of their customer energy requirements through renewable energy sources by 2020 (i.e., RPS) has opened a market for annual bids for bilateral contracts with renewable energy providers that are based on a cost-plus methodology. These requirements are further described in Section 2.4. More enticing for smaller (<1.5 MW) projects developed by public water and wastewater entities in an IOU service area, is the ability to enter into a contract with the IOU (in the case of El Dorado County, PG&E) to receive a specific incentive tariff (a FIT) at specified, time-of-day rates by season for all generation from the project for a contract term of 10, 15 or 20 years. The tariff rate is significantly higher than any market contract rates currently available.

7.5.2 Financing and Funding Options

For this study all projects are anticipated to be owned and operated by public water and/or wastewater agencies. As a result, these agencies have the ability to finance projects with tax-exempt debt. While it is possible to develop a project using both debt and equity, the effective cost of financing is significantly lower using 100 percent tax-exempt debt financing. EID, as an example, expects to be able to finance debt using the entire system for collateral backing at an annual rate of approximately 6 percent. A required return on equity for a private developer often approaches 20 percent, and even a public entity such as EID would expect a return on equity that exceeds the cost of tax-exempt debt. As identified in the earlier discussion about financial incentives, tax-exempt financed projects may also be eligible to use CREBs or QECBs as a supplemental financing vehicle.

Renewable energy grants are also available for certain projects through the CEC PIER program. EID recently was awarded a grant from PIER to evaluate reoperation of selected water systems. The study will seek to moderate flow variation, maximize water system (i.e., Georgetown Ditch, Pleasant Oak Main, Oak Ridge Tanks to Bass Lake Tanks, and El Dorado Main) hydro generation during peak energy value periods, improve system energy efficiencies, and shift system energy loads to off-peak periods. A key aspect would be the feasibility of intermittent energy storage (e.g., water storage tanks) that would allow re-regulation of flows to maximize TOD hydroelectric revenues from water system operations. Such improvements would increase the economic viability of the hydro options.

7.5.3 Market Prices

The absence of a robust and transparent electricity market in California presents a significant challenge in estimating and projecting the likely wholesale price that a project could receive in a bilateral contract agreement. Based on approximate reports of on-peak and off-peak pricing in California published by industry newsletters, annual average market prices are generally in the $35-50/MWh range. During peak periods, it is not uncommon to see prices rise over $75/MWh. During periods of low demand, it is not uncommon to see prices fall below $25/MWh. Future prices will depend heavily on future supply and demand, transmission constraints, and natural gas prices.

No government agency has published a wholesale price forecast in recent years. The development of a thorough wholesale price forecast generally requires a market simulation that considers the factors noted above. Such an analysis is beyond the scope of this study and is also unnecessary for this study due to the identification of quickly developable projects that take advantage of the FIT program.

It is also possible that the value of renewable power will receive a price premium in the future due to economic transfer of carbon costs in the form of renewable energy credits, greenhouse gas reduction credits, or simply a premium on the market price of the energy if a carbon tax is instituted on non-renewable energy sources. The method and value of carbon reduction markets is extremely uncertain at this time, but there is growing consensus that some form of market mechanism will eventually be implemented.

7.5.4 Potential Counterparties

The primary constraint to accessing a large number of potential counterparties for the hydro options is the ability and/or cost of transmitting power from the generation source to the service area of the utility that might serve as the counterparty. Because the El Dorado County "top 10" hydro options are in PG&E's service area, PG&E is the most likely counterparty. For the other hydro options not in the "top 10", including those in the Tahoe Basin, the Alder options, Stumpy Meadows, and the Caples Dam option, the purveyors could approach other counterparties including NV Energy, SMUD, and either Mountain Utilities or Kirkwood Meadows Public Utility District, respectively.

For the "top 10" FIT projects, the distance to the SMUD service area is not great, but there are less incentives currently available (e.g., incentive tariffs) and additional cost for transmitting (aka "wheeling") the energy from PG&E's system to SMUD's system. Other investor-owned utilities seeking to meet RPS procurement requirements (i.e., 20 percent by 2010 and 33 percent by 2020) include SCE, SDG&E, and Bear Valley Electric Service that could, in theory, enter into bilateral contracts with EID or GDPUD and pay a premium to market rates. It is likely, however, that the best premium could be provided by PG&E on a bilateral contract because of the significantly lower costs of transmission.

The primary reason, however, that PG&E is the most attractive counterparty for the "top 10" hydro options is that PG&E is able to offer the highest price (likely by far) of any counterparty through the use of the FIT program. The use of the FIT contract negates the need for negotiations, and PG&E is obligated to enter into ("must take") the tariff agreement as long as the project is signed up prior to PG&E reaching its CPUC-mandated cap for FIT capacity (i.e., 105 MW for all renewable energy projects at water and wastewater facilities). The only condition is that such projects are subject to expeditious (18 months from the time of contract sign-up) implementation; otherwise, PG&E has the discretion to renew the FIT contract based on tariffs in place at the conclusion of the 18-month period.

7.6 Sensitivity Evaluations

With the uncertainties described in the preceding sections, four "what if" scenarios were considered to assess the potential response of the project analyses to differing assumptions including: 1) potential reoperation of the existing water systems to maximize generation during peak FIT TOD rate multiplier periods, 2) potential benefits of alternative financing through the ARRA authorizations for CREBs or QECBs programs, 3) potential economies of scale associated with grouping projects for permitting, design, financing and construction, especially those within the same water system or in close proximity, and 4) future increases in water system flows. The first two scenarios are addressed in this study. The third and fourth scenarios were not analyzed in detail, but are recognized as having potential positive economic effects on the hydro options. Initially, this study also was to consider future energy pricing scenarios using a Monte Carlo-type simulation. However, this study concluded with all "top 10" projects being eligible for guaranteed energy pricing under the FIT program. Future pricing scenarios were not evaluated because the FIT program rates are fixed for up to the first 20 years and because projections of energy rates between 20 and 30 years from now would be highly speculative.

7.6.1 Existing Water System Reoperation

The potential economic benefits of re-operating the existing water systems were initially investigated. The purpose of reoperation would be to maximize hydro power generation during peak energy price periods under the FIT. Although some reoperation of the existing systems is considered possible with only minor operational changes, reoperation for purposes of maximizing energy revenues in many cases would require the addition of new water storage tanks at key locations to uncouple customer demands from water system flows.

Preliminary reoperation evaluations were performed for the GDPUD Kaiser Siphon, EID Sly Park Dam, and the EID Pleasant Oak Main Reservoir B hydro options. The results, which are presented in Table 7-23, show that energy values are expected to improve substantially for these projects. Total energy generation changes are noted because of differing equipment efficiencies at different flow rates. If intermittent storage is installed where multiple hydro projects can benefit from the same tank(s), then the total increase in the system-wide energy values could outweigh the incremental costs of the intermittent storage. Other benefits expected with intermittent storage and reoperations include: 1) peak demand period power benefits to the electric utility grid, 2) increased water supply reserves (including fire protection benefits) of the intermittent storage, and 3) improved efficiencies, and therefore reduced operation and maintenance, for the hydro power and water delivery equipment. These and other options and issues will be addressed in the CEC PIER grant study.

Table 7-23 Example Reoperation Effects on Hydro Option Economics

	Existing Operation Estimates					System Reoperation Estimates					
Water System	Plant Size (kW)	Avg. Annual Generation (MWh)	Initial Year of Operation	Average Price Received	Total Generation Revenues	Plant Size (kW)	Avg. Annual Generation (MWh)	Initial Year of Operation	Average Price Received	Total Generation Revenues	Net Revenue Difference From Reoperation
Kaiser Siphon	580	3,638	2011	$ 123	$ 447,500	580	3,530	2011	$ 136	$ 480,100	$ 32,600
Sly Park Dam	400	1,833	2011	$ 124	$ 227,300	400	1,850	2011	$ 134	$ 247,900	$ 20,600
Pleasant Oak Main at Reservoir B	450	2,657	2011	$ 123	$ 326,800	450	2,570	2011	$ 130	$ 334,100	$ 7,300

7.6.2 Financing with CREBs or QECBs

The potential benefits of the New CREBs and QECBs as an alternative form of financing were also investigated. With New CREBs (those authorized via the 2009 ARRA), the bond holder receives a tax credit that is equal to 70 percent of the IRS-approved bond market rate for New CREBs. The effective interest rate of the New CREBs for the bond issuer (e.g., EID or GDPUD) should be close to the difference between the current tax-exempt bond rate in the market and the tax credit to the bond holder, but may be somewhat more or less than this. The application deadline for CREBs is August 4, 2009, whereas the QECBs have no projected closing date, other than award of total available bonds.

Assuming effective interest rates on a New CREBs bond issuance and a standard tax-exempt bond issuance are 1.8 percent and 6 percent, respectively, Table 7-24 compares the overall effect of 15-year New CREBs (1.8 percent) to typical 30-year bond (6 percent) financing. Table ES-3 displays the sensitivity of each of the "top 10" hydro options to this same CREBs scenario for a 20-year financing analysis period.

Table 7-24: Comparison of 30-Year Bonds to Example New CREBs Financing for the "Top 10" Hydro Options

Financing	Capital Cost (Top 10 Options)	Net Present Value **(20-Year Analysis Period)**	Capacity (kW)/ Annual kWh
30-Year Bonds	$ 20,418,000	$ 2,962,136	3,315/16,632,000
CREBs/QECBs	$ 20,418,000	$ 5,194,196	3,315/16,632,000

Described below are additional CREBs details, including term of CREBs, guidance for appropriation of CREBs, and ability to bundle CREB allocations within a single bond issuance.

Term of CREBs - The term of any bond issued as a CREB must not exceed the term posted daily by the Bureau of Public Debt. The maximum term can vary daily, but has only varied between 14 and 16 years in 2009. When the bond is sold, the rate and term are set and do not vary.

Guidance for Appropriation of CREBs - CREB capacity will be allocated to those projects that qualify and have met the August 4, 2009 submittal deadline on the basis of dollar amount requested, with smallest projects filling the queue first. No other criteria will be considered to "rank" competing projects for available CREB capacity.

Ability to bundle CREB Allocations Within a Single Bond Issuance– If several projects are being funded via CREBs, an underlying single bond can be issued for all of the projects together, but applications for CREB allocations can be made individually for the projects. This accomplishes two goals, achieving some economy of scale on bond issuance, and allowing the submittal of CREB applications for smaller individual projects in order to move the smaller projects higher into the allocation queue.

7.6.3 Multiple Hydro Options Development

Combining or 'batching' hydro projects by water system (e.g., Pleasant Oak Main and Georgetown Ditch) is a possible approach for financing and it also offers opportunities for multiple project economies of scale where proximity and system similarities can reduce design, permitting, financing, construction, and other development and operation costs. Estimating such cost savings would require that specific combinations of projects be identified. Table ES-5 displays how hydro options could be grouped by water system.

7.6.4 Future Increases in Water Deliveries

For the detailed project analyses, EID water system flows were assumed to increase annually by 0.5 percent over the 20-year analysis period. No annual increase was assumed for the GDPUD system water deliveries. The recent economic recession, future uncertainty on the timing of growth in El Dorado County, continuing concerns over drought and climate change, the State's policies to increase water conservation, and facility and current supply constraints on GDPUD's system are believed to support these flow assumptions for purposes of this hydro options development plan.

Despite the above considerations, El Dorado County's updated General Plan estimates more than a doubling of population before the County reaches build-out. In the near term, the 2025 planning horizon, population is estimated to increase by about 65 percent, which equates to roughly a 3 percent annual increase from the 2004 General Plan base year. Based on historical data, the County has seen a wide range of growth rates, many years of which greatly exceed the 0.5 percent increase assumed for the EID water systems and 0 percent increase assumed for the GDPUD water systems. Given that this study: 1) assumed conservative values for increases in water deliveries, 2) was based only on the first 20 years of project operation (and therefore accounted for only about a 10 percent increase in EID's deliveries), and 3) build-out projections call for more than a doubling of population over the probable life of the hydro options, on balance, generation and corresponding energy revenues from the hydro options are very likely to be significantly greater than accounted for by this study. Therefore, the long-term economic viability of the hydro options recommended by this study is expected to be much higher than what was concluded in these analyses.

Section 8

Projects Warranting Additional Detailed Feasibility Evaluation

A grant was recently awarded to EID et al. (2009) by the California Energy Commission (CEC) to evaluate reoperation of selected water systems. The reoperation evaluation will seek to maximize water system (e.g., El Dorado Main and Georgetown Ditch) hydro generation during peak energy value periods, improve system energy efficiencies, and shift water system energy loads to off-peak periods. A key aspect of this grant will be to assess the feasibility of reoperation by incorporating intermittent energy storage systems, primarily water storage tanks, which would allow turbine-generator efficiency optimization and peaking re-regulation of flows to maximize hydroelectric revenues. Basically, the water systems would be re-operated to uncouple customer demand from daily operations.

The four projects shown in Table ES-4 (Diamond Springs Main PRS 1, El Dorado Main 2 PRS 3, Oak Ridge Tanks to Bass Lake Tanks Pumped Storage, and Buffalo Hill Siphon) do not appear economically viable based solely on analyses of existing water system operations. The reoperation evaluation through the grant application may demonstrate that these and other system options would be economically viable with system flow re-regulation (made possible with increased storage at key locations), energy efficiency cost savings, and load management to take advantage of energy prices at different times of the day.

An example of potential energy generation benefits from reoperation is presented in Section 7.6.1. The intermittent storage systems would also boost overall water system reliability. Indeed, EID and GDPUD may have other facility improvement and operation considerations that could make these hydro options attractive for reasons other than economics.

Additional hydro options, other than the four projects identified for reoperation, warrant detailed feasibility studies to better assess their merits. The most promising are identified in Table ES-5. Included are hydro options within the South Tahoe Public Utility District (STPUD) and Heavenly Ski Resort water systems. Studies by Heavenly Ski Resort and STPUD's update to its 2001 evaluation of the "C-Line" treated wastewater pipeline are expected to identify some viable options.

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. The potential high flow generation at this location is operationally possible with the turbine generators, but is currently constrained by the transformers interconnecting the powerhouse with PG&E's grid. 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 would qualify for the FIT rates and TOD multipliers, 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 equipment modifications that would allow generation both below the current minimum of 3 MW and above the current maximum of 21 MW.

Of the projects listed in Table ES-5, the greatest potential for hydroelectric generation would be from the Alder Reservoir hydro options. Previous studies of Alder Reservoir focused on either a very large alternative to support then-proposed South Fork American River (SOFAR) Project, or a smaller, stand-alone alternative that was limited to storing Alder Creek flows. This study identified Alder Reservoir concept alternatives that include water projects shared and jointly studied with other County purveyors or downstream purveyors (e.g., members of the American River Basin Regional Water Authority) that may be seeking drought, conjunctive use, or other water rights.

A new Alder Reservoir and seasonal pumped storage concept identified by this study consists of a medium-sized (50,000 to 100,000 acre-foot) reservoir that would support an approximately 15 MW Alder powerhouse, augment water supplies for the 21 MW El Dorado Hydroelectric Project, store existing and supplemental County purveyor water rights, and possibly augment flows for instream and other downstream beneficial uses. Water would come from two sources: 1) Alder Creek flows that include existing EID hydroelectric water rights and 2) existing and possibly supplemental water rights diverted from the South Fork American River during high flow runoff periods when instream resources would not be adversely affected by increased diversions. More specifically, increased diversions in the El Dorado Canal between the Kyburz diversion and Alder Siphon would be used to convey high runoff period flows to a pump station, at the Alder Siphon, that would lift water to the Alder Reservoir. This winter/spring runoff from the South Fork American River, together with Alder Creek basin water, would be released for hydroelectric generation at a new Alder Powerhouse and the existing El Dorado Powerhouse during peak generation revenue periods in the summer and fall. Besides providing new storage and power generation facilities, this option capitalizes on excess capacity in the existing canal and increases power generation at an existing powerhouse by prolonging power generation into late summer and fall, which is currently not possible due to release restrictions.

Of all previous reservoir concepts considered, the newly identified Alder Reservoir seasonal pumped storage hydroelectric option offers substantial promise for an energy revenue-supported, long-term water supply project for El Dorado County purveyors. Based on preliminary estimates, a 50,000 acre-foot Alder Reservoir and 15 MW Powerhouse would yield a net increase of about 50,000,000 kWh (50,000 MWh) and roughly $5 million/year in net energy revenues for Alder and El Dorado Powerhouse generation combined. Additional storage would allow electric generation for both hydro projects (Project 184 and Alder) during the highest demand/price periods as water released from Alder could flow to Forebay reservoir and the El Dorado Powerhouse to help meet seasonal, daily peak, and ‘on-call’ demands for electricity.

Discussions of other hydro options recommended for additional detailed study are presented in the Executive Summary (Caples Dam), Section 6.1 (El Dorado Powerhouse Low-High Flow Optimization), and Section 9.6 (Stumpy Meadows). These additional studies should be carried out and completed prior to the expiration of the current renewable energy program incentives.

Section 9

Recommendations and Next Steps

Of the approximately 100 hydro options studied, seven are economically viable for immediate implementation. All seven projects qualify for "must take" Feed-In Tariff (FIT) power purchase contracts (up to 20-year terms) with PG&E, except possibly Kaiser Siphon that requires additional investigation to confirm that it qualifies under the FIT contract conditions (see Section 7.3, Summary Results of Analyses of "Top 10" Hydro Options and Appendix C, Environmental Regulatory, Permitting and Feed-In Tariff RPS Certification and Contract Requirements).

Regulatory and electric utility programs currently promote renewable energy development with energy rate incentives, permitting exemptions, and standard contracts for energy purchases and interconnection. Exceptional economic opportunities exist for El Dorado County water purveyors to install qualifying small hydroelectric projects up to 1.5 MW in capacity at existing water and wastewater infrastructure.

California and national legislation and regulations likely will continue to promote renewable energy until the United States reduces its dependence on foreign oil, the economy recovers from the ongoing severe economic recession, air basins achieve attainment with air quality standards, and California reaches legislated goals to reduce greenhouse gas emissions. Details on these programs, legislative mandates, incentives, and exemptions that support renewable energy, including small hydroelectric development at existing facilities, are presented in Section 2 (Energy Polices Supporting Hydroelectric Generation).

Four of the projects recommended for immediate implementation are within EID's service area and would have 1,720 kW of capacity and generate 8,550,000 kWh annually. The Kaiser Siphon and Sandtrap Siphon hydro options in GDPUD's service area would have a capacity of 580 kW and 230 kW, respectively, and would generate 3,640,000 kWh and 1,130,000 kWh annually, respectively. The seventh project is a technology demonstration project on EID's El Dorado Canal immediately downstream of the El Dorado Diversion Dam where Verdant Power proposes to design and install a hydrokinetic unit that would have between 30 and 40 kW of capacity and generate roughly 50,000 to 70,000 kWh annually. All of these projects except the Technology Demonstration Project are discussed in detail in Section 7 (Detailed Project Analyses of "Top 10" Hydro Options). The six projects alone would produce about half of the total annual amount of electricity that EID reportedly used in the 2007-2008 timeframe.

In addition to the seven economically viable projects, at least seven more hydro options warrant additional study beyond the scope of this plan. Recommendations on additional detailed studies for these projects are discussed in the Executive Summary and Section 8 (Projects Warranting Additional Detailed Feasibility Analyses). Sections 5.1 (Options for Existing Water and Wastewater Facilities and Operations), 7.6.1 (Existing Water System Reoperation), and 9.4 (Perform Detailed Reoperation and Energy Storage

Study of Selected Water Systems) discuss issues related to reoperation of the existing water systems.

The hydro options recommended for additional detailed study include the following:

- Small and Medium Alder Reservoir Options,
- Caples Dam Options,
- El Dorado Powerhouse Low-High Flow Optimization,
- Heavenly Ski Resort CA Base Pump Station,
- STPUD “C-Line” Treated Wastewater Outfall,
- GDPUD Stumpy Meadows Dam, and
- GDPUD and EID Water System-Specific Reoperation Options.

Additionally, this study identified and evaluated a large number of other hydro options that have significant generation and capacity potential (See Section 5, Inventory of County Hydroelectric Potential). As California and national energy policies continue to evolve, other hydro options may become viable depending on: 1) the price of energy, 2) the desire or need to further reduce our nation’s dependence on foreign oil, 3) the need for new sources of dependable energy (e.g., hydropower) to back-up increasing percentages of non-dependable renewable resources (e.g., wind), and/or 4) the extent to which our policymakers are concerned with energy independence and greenhouse gas emission effects on global climate change. If future climate changes adversely affect water supply availability, then the value of water would increase and new water storage hydro options would become more viable.

Based on the above summary findings, the remainder of this section focuses on the specific recommendations and next steps for purveyors and others to proceed with the identified hydroelectric development options in El Dorado County.

9.1 Implement the Six Economically Superior Options that Qualify for FIT Program

This plan recommends that EID and GDPUD implement the six economically viable hydro options without delay to take advantage of this year’s unprecedented rate incentives under the FIT program. By November 2009, EID and GDPUD should execute and submit to PG&E a FIT agreement for each of the six projects. Between now and November 2009, the projects can be designed and regulatory/permitting can be initiated to validate the findings of this study prior to submitting the FIT agreement to PG&E. This includes the pre-certification filing of the hydro options with the CEC for pre-qualifying the projects as RPS eligible (and therefore eligible for the FIT “must take” contracts). During this period, financing options can be further explored, including submitting applications for CREBs, recognizing that the projects are economically viable assuming purveyor 30-year bonds at 6 percent interest. Because the CPUC is seeking ways to minimize rate impacts to utility customers from the renewable energy programs, and because the FIT program rates likely will be adjusted again in December 2009, these projects cannot be delayed without risking changes to the economic viability of the hydro options.

The six economically viable projects that would be developed by EID and GDPUD:

- are financially superior and show positive net present values (Table 7-1) for the 20-year analysis period, even with conservative financing and other economic assumptions;
- qualify for "must take" 20-year guaranteed energy payment and interconnection contracts with PG&E;
- represent a very limited risk to the purveyors and their customers under the current FIT program requirements and based on the proven technology and reliability of hydroelectric generation;
- would also have indirect economic and non-economic benefits to existing water system operations and customers as described in Section 7.5 (Other Economic Considerations), Section 7.6.1 (Existing Water System Reoperation) and Section 9.8 below; and,
- would help purveyors meet expected future renewable energy and energy efficiency targets as California works to achieve its goal to reduce greenhouse gas emissions to 1990 levels by 2020 (Section 2, Energy Policies Supporting Hydroelectric Generation).

To implement the projects, assigned staff workgroups are recommended from both EID and GDPUD that will be responsible for overseeing the implementation of the hydro options. The workgroups would review and advise on the design, operations, permitting, financing, contracting and construction documents to be developed by those retained to support EID and GDPUD. The purveyors may determine that joint financing or other common objectives are desired for these and/or other hydro options identified for further study. A dedicated staff is necessary to succeed on these types of time-critical, large initiatives that require specialized expertise and knowledge.

9.2 Initiate Discussions with Verdant Power on Hydrokinetic Demonstration Project

During the 2007 EID Energy Recovery Study (Black & Veatch 2007), Verdant Power and EID discussed the potential installation of a hydrokinetic demonstration project along EID's El Dorado Canal below the El Dorado Diversion Dam. The project was put on hold pending execution of a confidentiality agreement, which was not pursued due to operational concerns and the limited findings of the study. The FIT program has since been approved by the CPUC and average energy values increased from an average of $0.09/kWh assumed by the Black & Veatch study to $0.1173/kWh under the FIT program for projects coming online in 2011. Anticipated energy prices for the FIT hydro options have therefore increased by about 23 percent. In addition, new policy mandates and regulations have been issued that require utilities such as PG&E to accelerate development and acquisition of renewable energy resources (see Section 2, Energy Policies Supporting Hydroelectric Generation).

With the FIT program, and based on the findings of this study, discussions with Verdant Power should be reinitiated and also extend to other areas in El Dorado County that could possibly benefit from the type and size of hydrokinetic units proposed by Verdant

Power. More specifically, the Georgetown Ditch is an open canal similar in design to EID's El Dorado Canal. In addition, if neither Mountain Utilities nor Kirkwood Meadows PUD elect to investigate a joint project with EID at Caples Dam, then EID could consider a smaller capacity, hydrokinetic unit at Caples Dam that could meet the power supply needs of the dam outlet works, new boat launch facilities, and possibly the Caltrans maintenance station and Caples Resort.

9.3 Adopt Policy of Energy Independence

The Hydro Advisory Panel and water purveyors have recommended that, consistent with State and Federal policies, El Dorado County consider adopting a policy to encourage independence from foreign oil. The following language has been developed through HAP and purveyor meetings on this study to help meet this policy goal:

"It is the policy of the (stated agency) that resources planning and infrastructure, including water and wastewater systems, emphasize renewable energy and energy efficiency toward a goal of Energy Independence for El Dorado County and its citizens."

To facilitate purveyor, local government, and citizen attention to renewable energy and associated economic and social benefits, the El Dorado County Water Agency and each of the water purveyors are encouraged to consider and adopt, as appropriate, the above or similar language to promote development of hydroelectric energy in El Dorado County. Further discussion and issues important to the recommended policy is presented in Section 2.9 (Energy Independence for El Dorado County).

9.4 Consider Clean Renewable Energy Bond Financing of Viable Projects

One near-term option for financing some or all of the "top 10" hydro projects is the ARRA of 2009, which authorizes $1.6 billion of New CREBs and $2.4 billion of new QECBs. Under the ARRA, New CREBs and QECBs are being made available for financing renewable energy and greenhouse gas emission reduction initiatives. New CREBS most directly apply to the hydro options.

With New CREBs (those authorized via the 2009 ARRA), the bond holder receives a tax credit that is equal to 70 percent of the IRS-approved bond market rate for New CREBs. The effective interest rate of the New CREBs for the bond issuer (e.g., EID or GDPUD) should be close to the difference between the current tax-exempt bond rate in the market and the tax credit to the bond holder, but may be somewhat more or less than this. The application deadline for CREBs is August 4, 2009, whereas the QECBs have no projected closing date, other than award of total available bonds.

Table ES-5 displays the sensitivity of the "top 10" hydro options to CREBs. Overall, the effect of 15-year CREBs (1.8 percent) financing can be compared to 30-year bond (6 percent) financing used in the detailed economic analyses of Section 7 (Detailed Project Analyses of "Top 10" Options) as follows:

Table 9-1: Comparison of 30-Year Bonds to Example New CREBs Financing for the "Top 10" Hydro Options

Financing	Capital Cost (Top 10 Options)	Net Present Value **(20-Year Analysis Period)**	Capacity (kW)/ Annual kWh
30-Year Bonds	$ 20,418,000	$ 2,962,136	3,315/16,632,000
CREBs/QECBs	$ 20,418,000	$ 5,194,196	3,315/16,632,000

Combining or 'batching' hydro projects by water system (e.g., Pleasant Oak Main and Georgetown Ditch) is a possible approach for financing and it also offers opportunities for multiple project economies of scale where proximity and system similarities can reduce design, permitting, financing, construction, and other development and operation costs. Estimating such cost savings would require that specific combinations of projects be identified. Table 7-1 displays how hydro options could be grouped by water system.

9.5 Perform Detailed Reoperation and Energy Storage Study of Water Systems

Section 8 describes how EID was recently awarded a grant from the CEC to evaluate reoperation of selected water systems. The reoperation evaluation will seek to moderate flow variation, maximize water system (e.g., El Dorado Main and Georgetown Ditch) hydro generation during peak energy value periods, improve system energy efficiencies, and shift water system energy loads to off-peak periods. A key aspect of this grant would be to assess the feasibility of reoperation by incorporating intermittent energy storage systems, primarily water storage tanks, which would allow turbine-generator efficiency optimization and peaking re-regulation of flows to maximize hydroelectric revenues. Basically, the water systems would be re-operated to uncouple customer demand from daily operations.

The four projects shown in Table ES-4 (Diamond Springs Main PRS 1, El Dorado Main 2 PRS 3, Oak Ridge Tanks to Bass Lake Tanks Pumped Storage, and Buffalo Hill Siphon) do not appear economically viable based solely on analyses of existing water system operations. The reoperation evaluation grant may demonstrate that these and other system options would be economically viable with system flow re-regulation (made possible with increased storage at key locations), energy efficiency cost savings, and load management to take advantage of energy prices at different times of the day.

A cursory evaluation of two water systems, the GDPUD Georgetown Ditch and the EID Pleasant Oak Main Pipeline, was performed as part of this study to initially assess the potential benefits of reoperation with intermittent storage. The results of the cursory evaluation are described in Section 7.6.1 (Existing Water System Reoperation), which show that significant increases in energy revenues would be expected with reoperation.

Reoperation with the intermittent storage systems would also boost overall water system reliability. Indeed, EID and GDPUD may have other facility improvement and operation considerations that could make water system hydro options attractive for reasons other than economics.

9.6 Consult with PG&E on Projects Requiring Power Line Extensions or Upgrades

Certain hydro options for EID, GDPUD, and others are either less or not cost-effective due to the estimated costs and processes required to either extend or upgrade an existing power line to the hydro option site. A prime example is GDPUD's Stumpy Meadows Dam that represents an otherwise viable FIT hydro option that meets key criteria except for utility interconnection. Other examples where interconnection issues substantially affect hydro option viability include South Tahoe PUD's treated wastewater "C-Line", which is in NV Energy's service territory, and Pleasant Oak Main at Reservoir B, which is in PG&E's service area.

This study recommends that EID and GDPUD actively solicit PG&E assistance with investigating alternative approaches to plan, permit, finance, and construct power line interconnections for geographically isolated hydro options that are otherwise considered viable. Concurrently, EID and GDPUD are encouraged to participate and submit comments through ongoing CEC proceedings regarding roadblocks to achieving the ambitious 20 percent by 2010 and 33 percent by 2020 mandated targets for renewable energy. In some cases such as the Pleasant Oak Main at Reservoir B hydro option, even the requirement to add 10,000 feet of a third wire to existing power poles adds a considerable expense to an otherwise attractive project.

9.7 Develop Framework for Joint Investigations of Alder Reservoir Options

Section 3 (Water and Wastewater Energy Management Goals and Objectives for El Dorado County) discusses the interrelated water management goals and objectives of El Dorado County purveyors and other stakeholders. Of the hydro options recommended for additional detailed feasibility study, the Alder Small Reservoir and Alder Medium Reservoir hydro options represent the greatest opportunity for hydroelectric generation to financially support new water supply storage.

The costs and benefits of a Small Alder Reservoir hydro option or a Medium Alder Reservoir hydro option include major water supply components that extend far beyond hydroelectric generation. Hydropower from an Alder Powerhouse and the El Dorado Powerhouse would help to finance the water supply, drought protection, and other potential benefits of the reservoir for El Dorado County. With renewable energy becoming increasingly important to California's AB 32 goals, and given both the increasing value of dependable energy and El Dorado County's future water supply needs, this project is highly recommended for separate, detailed feasibility studies along with the Small Alder Reservoir options. Further discussions on the Alder Reservoir options are presented in Table ES-6 and Section 8.

As a first step, this study recommends that specific design and operation concepts be outlined and evaluated by EID to identify the project alternatives that would best achieve EID's long-term hydroelectric and water supply objectives. Those concepts should include alternatives that incorporate the potential goals and objectives of other County and non-County purveyors that could help fund future studies and share the costs of project development. Potential participants and their water-related goals and objectives are described in Section 3. Of particular importance to County purveyors is the potential for an Alder Reservoir to support water right deliveries through interties and associated operating agreements with EID.

9.8 Consider Non-Economic and Indirect Economic Benefits of Hydro Options

As described in Section 5 (Inventory of County Hydroelectric Potential), hydro power options are numerous in El Dorado County at both existing water and wastewater facilities, and at new sites. Section 8 (Projects Warranting Additional Detailed Feasibility Evaluation) describes several promising hydro options that display characteristics warranting further study. These include existing water system reoperation (Section 9.5) and the Alder Reservoir (Section 9.7) options discussed above.

As EID, GDPUD, and other purveyors consider the hydro options, and as water system capital improvements are being planned, this study recommends that the purveyors also consider the potential indirect and non-economic benefits associated with hydro generation and energy efficiency improvements. These can be important considerations to project decisions and can include some or all of the following benefits:

- Long-term economic value (40 to 50-year project life) of energy sales beyond the 20-year economic analysis period;
- Progress toward a Hydro Advisory Panel-proposed policy of energy independence for the customers served by the water systems;
- Renewable energy credits (for non-FIT and post-FIT projects) that could be either applied toward future purveyor requirements, sold in a developing cap and trade greenhouse gas emissions reductions market, or used to meet future purveyor greenhouse gas emission reduction requirements;
- National defense and regional air quality public policy benefits of developing renewable energy to help displace fossil fuel-fired electricity consumed by water system operations;
- Jobs creation and multiplier benefits to the local, water sector, and renewable energy economies from project development; and,
- Enhanced monitoring and control systems at the hydro project sites that would improve water service reliability and system equipment longevity.

Section 10

Study Participants and Meetings Held

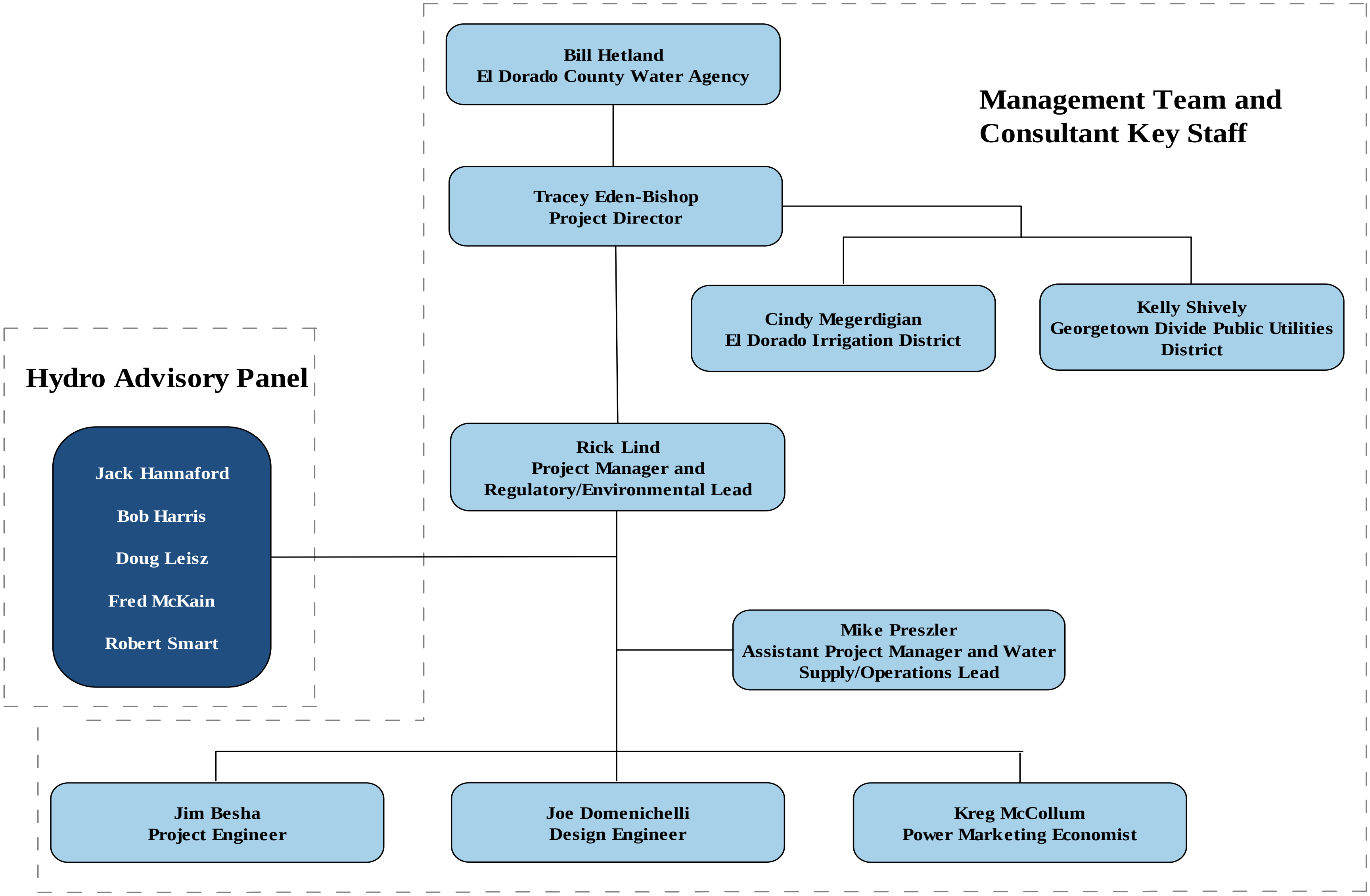
The Hydroelectric Development Options Study was directed by EDCWA and jointly funded by EDCWA and EID. EDCWA, EID, and GDPUD representatives (Table 10-1) actively participated throughout the course of the study. The organization of the study management team and lead consultants is presented in Figure 10-1.

Table 10-1: Study Management Team and Participants

Organization	Name
El Dorado County Water Agency	
	Bill Hetland - General Manager Tracey Eden-Bishop – Project Manager
Citizens for Water	
	Harry Dunlop – Advisor to EDCWA
El Dorado Irrigation District	
	Cindy Megerdigian - Lead Representative Steve Setoodeh – Special Advisor/Technical Projects Andy Urteaga – Assistant Engineer
Georgetown Divide Public Utility District	
	Kelly Shively – Lead Representative Hank White – General Manager Steve Gau – Operations Manager, Planner

At the beginning of the study, STPUD and GFCSD were invited to participate in the same manner as EID and GDPUD. Although STPUD and GFCSD decided not to participate, a meeting was held with STPUD staff and hydro options in the STPUD and GFCSD service areas were identified and screened through the study process. Potentially viable hydro options were identified in STPUD's service area, but no potentially viable options were identified in GFCSD's service area.

Figure 10-1: El Dorado County Water Agency Hydroelectric Development Options Team Organization



A technical team of engineering, regulatory, environmental, hydrologic, electrical transmission, and power marketing and economic consultants supported the lead consultants on the study. The Consultant Team members (Table 10-2) were specifically selected for their County water and electric utility knowledge and project-level planning and analysis of licensing, permitting, financing, construction, and operations of the hydro options.

Table 10-2: Consultant Team

Organization	Name
EN2 Resources, Inc.	
	Rick Lind - Project Manager Len Marino Karen Quidachay Ethan Koenigs Megan Buchanan Rayann La France
California Water Consulting, Inc.	
	Mike Preszler - Assistant Project Manager
Domenichelli & Associates	
	Joe Domenichelli Sara Rogers
Navigant Consulting	
	Kreg McCollum David Larsen
Water Resources Engineering, Inc.	
	Gustavo Arboleda Jim Besha
Carlton Engineering, Inc.	
	Dave Curtis David Jermstad Melissa Larson

The Consultant Team expertise was enhanced with the support of six community leaders that served in an advisory role for the study. Harry Dunlop advised the EDCWA directly. The Hydro Advisory Panel advised the Consultant Team and brought first-hand knowledge of County water supply systems (Sierra Hydrotech's Jack Hannaford), the Tahoe Basin and Eldorado National Forests (Bob Harris and Bob Smart), Forest Service policies at the national/regional levels and water and agricultural interests at the local level (Doug Leisz), and the SOFAR Project and Management Authority (Fred Mc Kain). The local institutional experience of this group over the past 40-plus years helped guide the Consultant Team in the identification and evaluations of the County's most promising hydroelectric and water supply options.

Individuals identified in Table 10-1, Table 10-2, and Table 10-3 participated in one or more of the meetings listed below. Prior to each meeting, advance review materials and an agenda were distributed to the participants. Following each meeting, minutes were drafted and circulated to the participants for review and comment. All written comments of the HAP members regarding the hydro options study were distributed to the EDCWA and purveyor representatives, as well as the other HAP members, for their review and information.

Table 10-3: Other Persons Consulted

Organization	Name
El Dorado Irrigation District	
	Vicki Caulfield
	Dan Downey
	Steve Lindstrom
	Kurt Mikkola
	Bob Pretzer
	Dana Strahan
	Redenko Odzakovic
Eldorado National Forest	
	Ramiro Villalvazo - Forest Supervisor
	Jon Jue – Acting District Ranger
	Tony Valdez – Resource Officer
South Tahoe Public Utility District	
	Paul Sciuto – Assistant General Manager
	Hal Bird – Land Application Manager
	Ross Johnson – Plant Operations Manager
Heavenly Ski Resort Lake Tahoe	
	Andrew Strain – Vice President of Planning & Governmental Affairs
	Thierry Burkhart – Consultant to Heavenly Ski Resort
Kirkwood Meadows Public Utility District	
	Tom Henie – General Manager

Project Kick-Off Meeting
July 17, 2008

Hydro Advisory Panel Workshops
August 4, 2008
September 18, 2008
November 3, 2008
December 15, 2008
February 24, 2009
April 27, 2009

Water Agency/Purveyor Workshops
September 24, 2008
November 12, 2008
November 14, 2008
December 22, 2008
March 11, 2009
April 29, 2009

Heavenly Ski Resort
January 14, 2009 (afternoon)

South Tahoe Public Utility District
January 14, 2009 (morning)

Eldorado National Forest
September 22, 2008

Section 11

Acronyms and Other Terms

AB	Assembly Bill
AES	Advanced Energy Storage
ARRA	American Recovery and Reinvestment Act of 2009
CABY	Cosumnes American Bear Yuba
CAISO	California Independent System Operator
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCAs	community choice aggregators
CDFG	California Department of Fish and Game
CEC	California Energy Commission
CEQA	California Environmental Quality Act
cfs	cubic feet per second
Consultant Team	EN2 Resources, Inc. Staff and Subconsultants
CPUC	California Public Utilities Commission
CREBs	Clean Renewable Energy Bonds
CWA	Clean Water Act
DSOD	Division of Safety of Dams
EA	Environmental Assessment
EDCWA	El Dorado County Water Agency
EID	El Dorado Irrigation District
EPS	emission performance standard
ESA	Endangered Species Act
ESPs	electric service providers
FERC	Federal Energy Regulatory Commission
FIT	Feed-In Tariff
FPA	Federal Power Act
ft/sec	feet per second
GHG	greenhouse gas
GDPUD	Georgetown Divide Public Utility District
GFCSD	Grizzly Flats Community Services District
HAP	Hydro Advisory Panel
IOUs	Investor Owned Utilities
IRR	internal rate of return
IRWMP	Integrated Regional Water Management Plan
kW	kilowatt
kWh	kilowatt hour
MCWRA	Mountain Counties Water Resources Association
MPR	Market Price Referent
MW	megawatt
MWh	megawatt hour
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration

NPV	net present value
O&M	Operation and Maintenance
PATs	pumps operating as turbines
PG&E	Pacific Gas and Electric Company
PIER	Public Interest Energy Research
POM	Pleasant Oak Main
Project Team	Consultant Team, HAP Members, and Water Purveyors
PRS	pressure reducing station
PRV	pressure reducing valve
psi	pounds per square inch
PU	Public Utilities
QECBs	Qualified Energy Conservation Bonds
RESCO	Renewable-based Energy Secure Communities
RPS	Renewable Portfolio Standard
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SCE	Southern California Edison Company
SDG&E	San Diego Gas & Electric Company
SHPO	State Historic Preservation Officer
SMUD	Sacramento Municipal Utility District
SNC	Sierra Nevada Conservancy
SOFAR	South Fork American River
STPUD	South Tahoe Public Utility District
SWRCB	State Water Resources Control Board
TCPUD	Tahoe City Public Utility District
TOD	Time of Delivery
TOU	Time of Use
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish & Wildlife Service
WRD&MP	Water Resources Development and Management Plan
WTP	Water Treatment Plant

References

Administrative Law Judge's Ruling. March 27, 2009. Additional Commission Consideration of a Feed-In Tariff.

Black & Veatch. 2007. El Dorado Irrigation District Energy Recovery Study.

California Air Resources Board. June 2008. Discussion Draft of the Climate Change Draft Scoping Plan – A Framework for Change: Executive Summary.

California Air Resources Board. July 22, 2008. Draft Scoping Plan – A Framework for Change: Appendix C – Sector Overviews and Emission Reduction Strategies.

California Energy Commission. January 2008. Guidebook on Renewables Portfolio Standard Eligibility.

California Environmental Quality Act. Section 15328 – Small Hydroelectric Exemption. http://www.ceres.ca.gov/ceqa/guidelines/15300-15333_web.pdf

California Independent Systems Operator. 2009. Response to CPUC Energy Division Data Request.

California Public Utilities Commission and California Energy Commission. February 2008. 2008 Update – Energy Action Plan.

California Public Utilities Commission. 2009. Energy Division Staff Proposal.

California Public Utilities Commission. February 14, 2008. Resolution E-4137 – Establishment of Tariffs for Purchase of Eligible Renewable Generation (AB 1969).

California Public Utilities Commission. July 2008. Renewables Portfolio Standard – Quarterly Report.

El Dorado County. 2004. El Dorado County General Plan.

El Dorado County Water Agency. December 2007. Water Resources Development and Management Plan.

El Dorado Irrigation District. October 31, 2007. El Dorado Irrigation District Final (Revised) Energy Recovery Study.

El Dorado Irrigation District et al. February 27, 2009. Grant Application to the California Energy Commission.

Federal Energy Regulatory Commission. Small Hydro and Hydropower Exemptions. http://www.ferc.gov/industries/hydropower/gen-info/licensing/exemptions.asp

Office of the Governor. February 29, 2008. Press Release – Governor Schwarzenegger Outlines Comprehensive Actions Needed to Fix Delta. http://www.gov.ca.gov/press-release/8911/

Office of the Governor. Executive Order S-3-05 (GHG Emission Reduction Targets). http://gov.ca.gov/executive-order/1861/

Office of the Governor. Executive Order No. S-14-08.