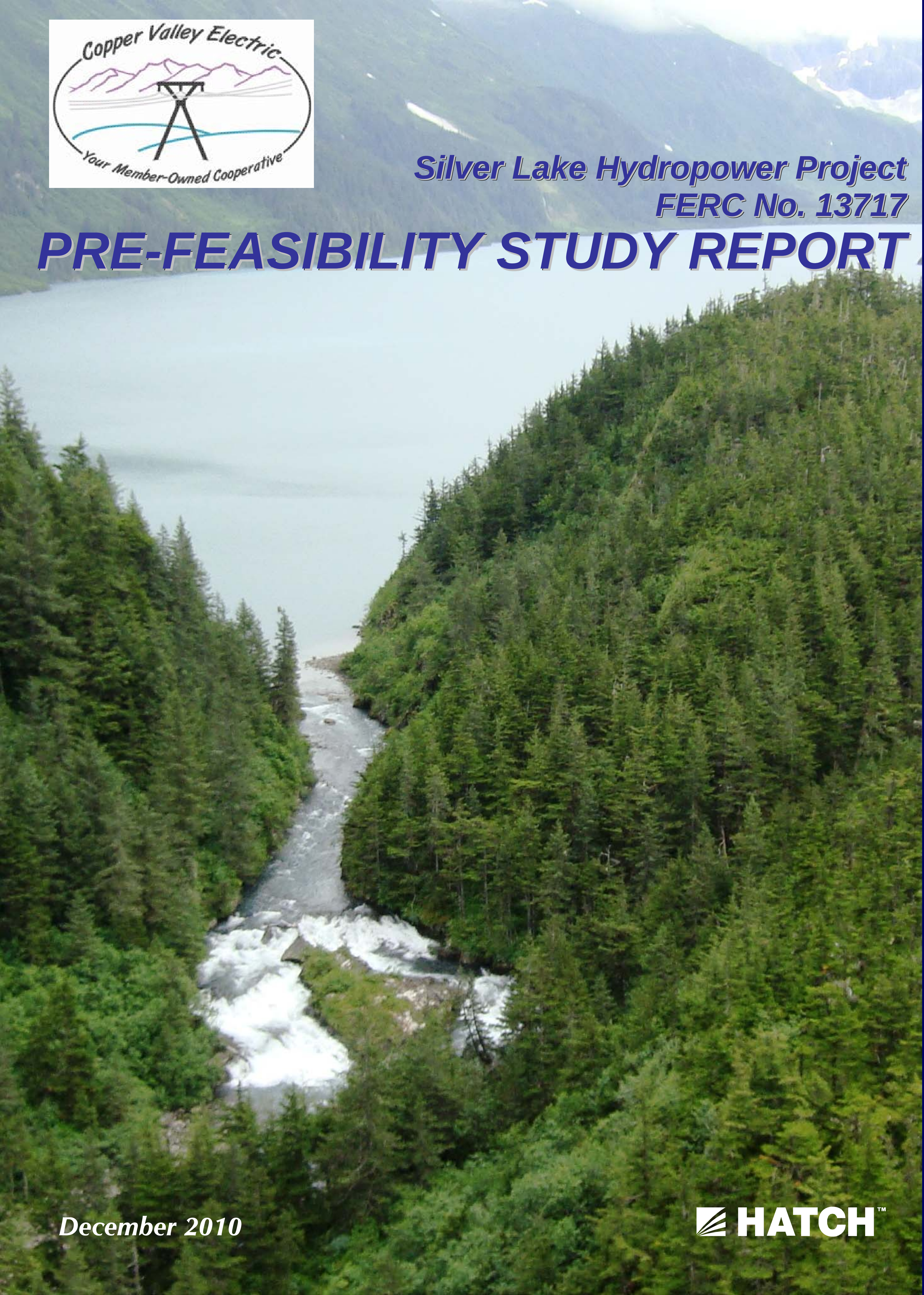
Copper Valley Electric

Your Member-Owned Cooperative

Silver Lake Hydropower Project
FERC No. 13717

PRE-FEASIBILITY STUDY REPORT



December 2010

HATCH™

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Robert A. Wilkinson, CEO
Copper Valley Electric Association
P.O. Box 45
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December 16, 2010
H-333289

Dear Robert

Subject: Silver Lake Hydroelectric Project
Pre-Feasibility Study

We are pleased to submit herewith our **Final Feasibility Study** for the Silver Lake Hydroelectric Project. The development of this study has been performed as Task Orders S1 through S3 under our Professional Services Contract for General Services between the Copper Valley Electric Association, Inc. (CVEA) and Hatch Acres Corporation.

The report presents our analysis of the hydroelectric potential of the Silver Lake basin. Our principal conclusions as stated within the report include:

- The Project is technically very attractive.
- It has challenging land usage and basic environmental issues that are not considered to be fatal flaws at this time.
- The first year cost of power of $0.39 per kWh indicates that the Silver Lake Hydroelectric Project is currently not economically viable.

We greatly appreciate the opportunity to work with you on this interesting project. If you have any questions regarding the subject report, be sure to give us a call.

Yours very truly,

A. Richard Griffith, P.E.
Project Manager

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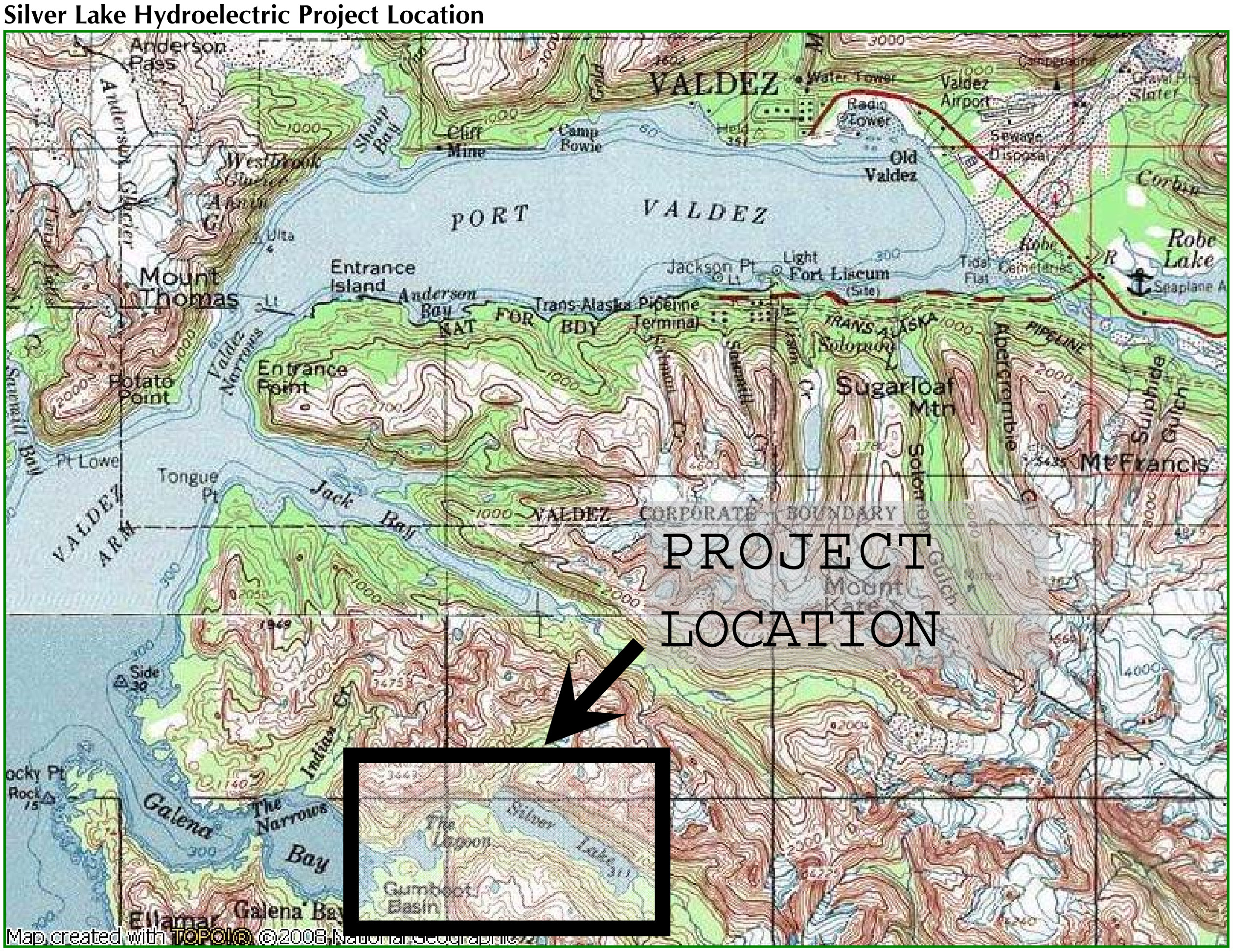
1. Introduction

The purpose of this present Pre-Feasibility Study is to evaluate the economic viability of alternative arrangements for the addition of the Silver Lake drainage to the generating resources within the existing Copper Valley Electric Association, Inc. (CVEA) electric system. The Silver Lake Hydroelectric Project (Project) is located within Prince William Sound, about 15 miles southwest of Valdez, Alaska as shown in **Figure 1.1**. The lake is approximately 3 miles long, has a normal surface elevation of 306 feet, and a surface area of 978 acres. The total drainage basin is approximately 24.5 square miles. The lake discharges into the Duck River through a narrow gorge and falls 306 feet over 1-1/2 miles to the lagoon on Galena Bay. There are four sets of falls greater than 10 feet, with the largest approximately 60 feet in height.

Figure 1.1
Silver Lake Hydroelectric Project Location



Previous investigations of the Project by Stone and Webster (S&W) in 1982 and HDR Engineering, Inc. (HDR) in 1992 evaluated potential project configurations and costs for maximizing the Silver Lake resource. In the S&W study, a 15 MW project was proposed with dam alternatives at El. 410 feet and El. 450 feet and powerhouse location alternatives at tidewater and El. 65 feet on the Duck River.

The 1992 HDR study focused on updating costs and energy estimates for the Silver Lake Project to be used in comparison to the Allison Lake Hydroelectric Project alternatives then under consideration.

Currently, CVEA's primary source of power is from the 12-megawatt (MW), Solomon Gulch Hydroelectric Project. Due to the seasonal pattern of the power production from this resource, CVEA must also rely on other resources during the winter months. Most important of these is a 5.2 MW cogeneration facility where exhaust heat is recovered and sold to and used by Petro Star for refining purposes. Diesel-fueled reciprocating gensets are also operated and maintained by CVEA for supplemental power requirements and for reserve purposes.

Although the Solomon Gulch Project operates year round, during winter months the Solomon Gulch Project operates at reduced levels and CVEA must rely heavily on the above listed fossil resources to meet system load. The objective for pursuing potential development of Silver Lake is to fill this gap with additional hydropower generation as well as to provide for future load growth. The general configuration of the evaluated arrangement would consist of:

- A 120 foot high, roller compacted concrete (RCC) dam with integral spillway,
- an intake at the existing lake level of El. 306 feet,
- a 6,000-foot-long 9-foot-diameter steel penstock,
- a steel surge tower, a 60 x 80 foot powerhouse at El. 65 feet,
- a switchyard, approximately 25 miles of 115 kV overhead transmission line, and
- a dock located at Galena Bay, access roads, and operator housing.

Additional project details are shown in **Figures 1.2, through 1.6**.

Figure 1.2
Drainage Area

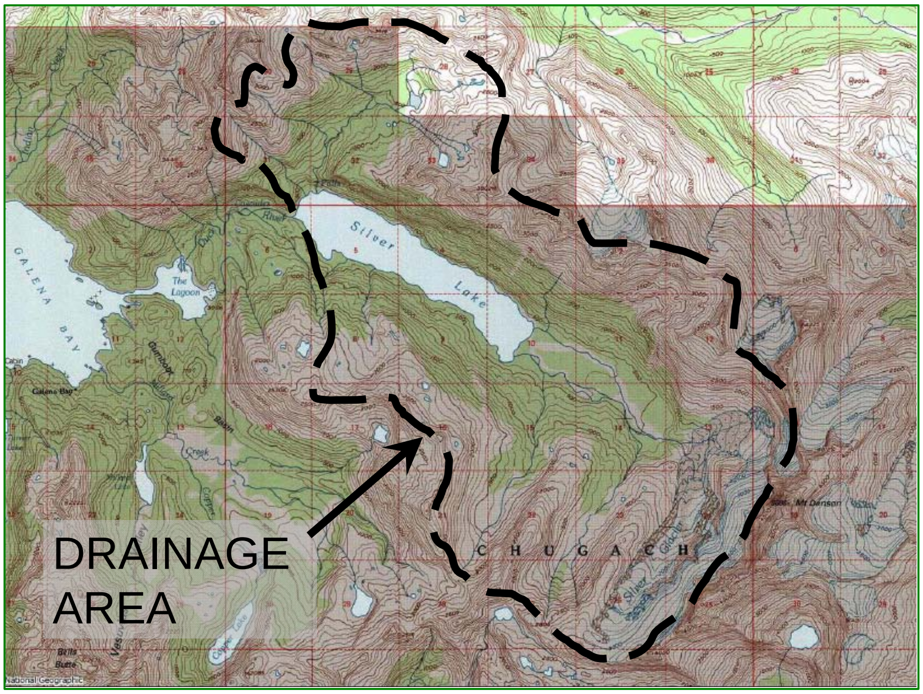


Figure 1.3
Project Layout

Figure 1.4
Silver Lake Dam Site 1

Figure 1.5
Silver Lake Dam Site 2

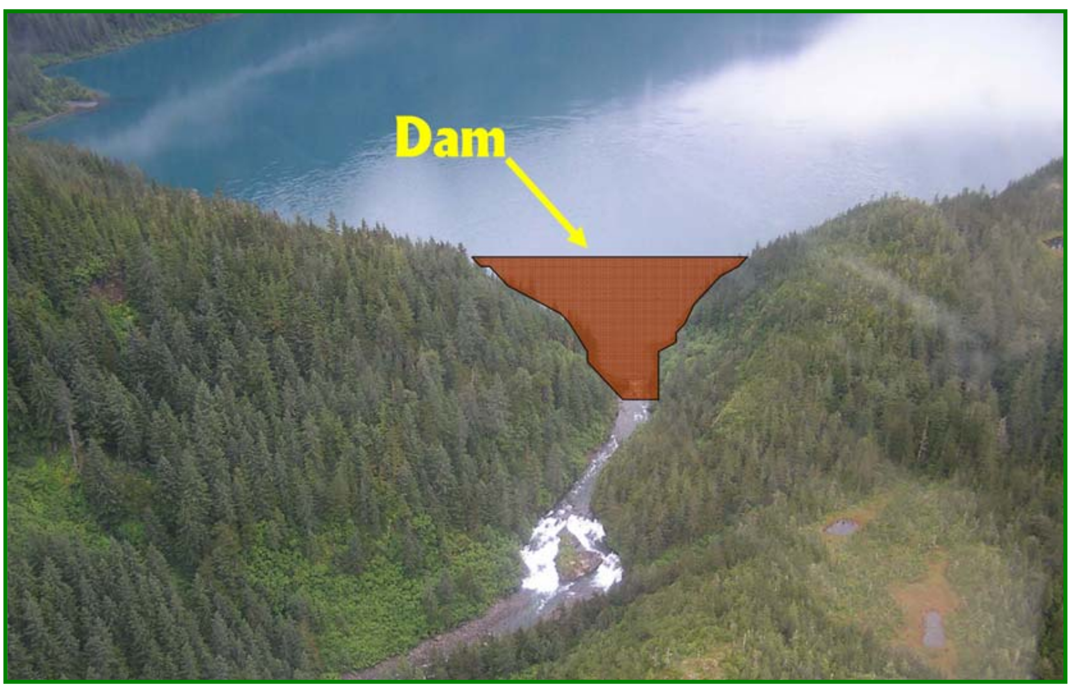


Figure 1.6
Silver Lake Powerhouse Location

The scope of work for this Pre-Feasibility Study included the following activities:

1. Data collection and literature review.
2. Field reconnaissance of Silver Lake area.
3. Development of general arrangement.
4. Development of Transmission route alternatives and costs.
5. Analysis of Silver Lake energy potential.
6. Preliminary layout and cost estimate of hydroelectric project features.
7. Economic evaluation of the project.
8. Environmental review of the proposed project.
9. Preparation of this Pre-Feasibility Report including the resulting conclusions and recommendations.

2. Field Reconnaissance

2.1 Stream Gaging

In October 2009, Hatch subconsultants, R&M Consultants, Inc. (R&M) mobilized to the outlet of Silver Lake where it drains into the Duck River and selected a suitable location to install a stream gage. The selected gage location was at approximate El. 335 feet on the left bank of the Duck River, approximately 700 feet downstream of the outlet of Silver Lake, on a relatively straight section of river between two sets of falls. The coordinates of the stream gage location, relative to the WGS84 horizontal datum, are 60°56′57″N, 146°32′02″W.

R&M installed pressure/temperature data logger instruments to record stream stage, barometric pressure, and water temperature. The instruments were mounted inside a protective pipe which was anchored to a near-vertical bedrock creek bank. A sequential set of two dye discharge measurements was subsequently conducted at a downstream location, yielding values of 193.9 and 194.3 cubic feet per second (cfs).

2.2 Water Quality

R&M collected water quality data in the upper reach of the Duck River below the lake outlet, near the stream gage installation. During each visit to the gage site in October 2009 and May 2010, surface water temperature, pH (potential of hydrogen), specific conductivity, turbidity, and dissolved oxygen were measured in situ and real-time. This was accomplished by placing a Horiba U-50 multi-parameter water quality meter directly into the stream and allowing sufficient time for all parameters to stabilize. Water quality data collected to date are presented in **Table 2.1**.

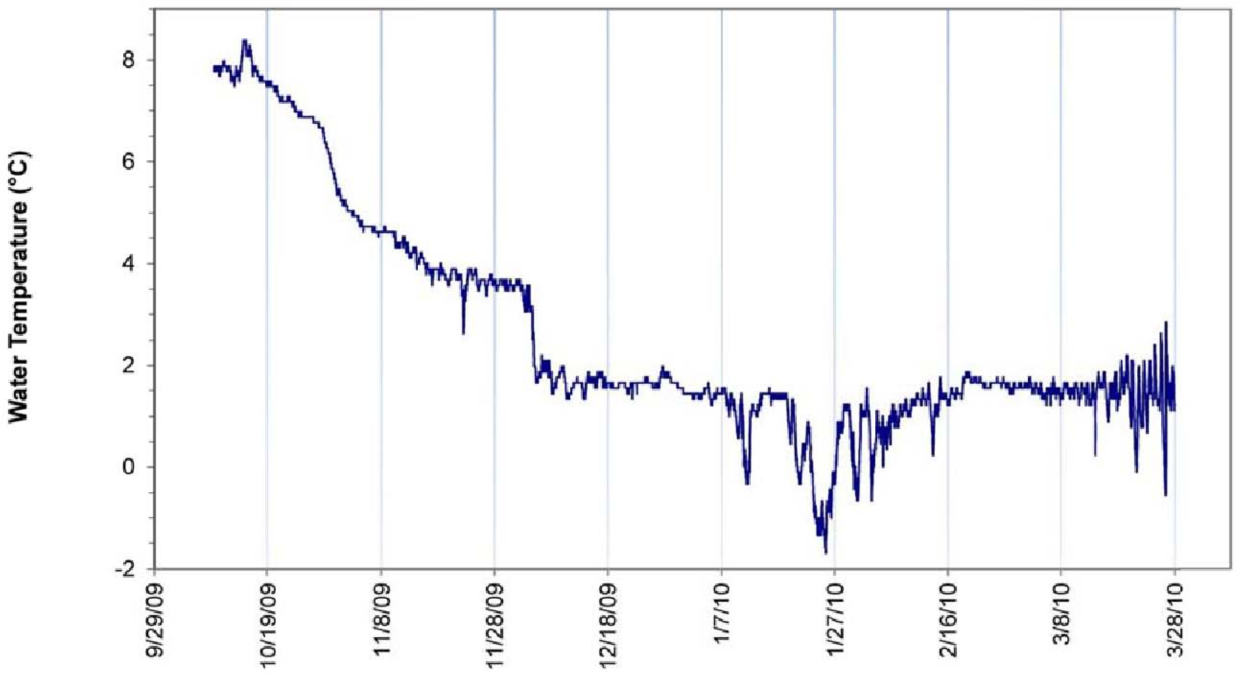
Table 2.1
Duck River Opportunistic In-Situ Water Quality Data

Date	Temperature (°C)	pH	Specific Conductivity (µS/cm)	Turbidity (NTU's)	Dissolved Oxygen (mg/L)
10//9/2009	8.0	6.2	17	7.5	11.6
5/21/2010	4.0	6.5	17	4.7	14.8

Note: Shaded cell indicates reading that – while reasonable – may become questionable when compared to trends over time. Data should be used cautiously, as erratic turbidity sensor behavior was observed.

The data loggers used for the stream gage installations have a built-in temperature monitoring feature that allows continuous temperature data collection. By utilizing this function, temperature data have been collected in thee upper Duck River since 9 October 2009. Temperature readings are set to be recorded once every fifteen minutes, and are recorded accurate to the nearest 0.1°C. Temperature data to date are presented below in **Figure 2.2**.

Figure 2.1
Duck River Continuous Temperature Monitoring
9 October 2009 to 27 March 2010



2.3 Site Reconnaissance, CVEA Staff and Consultants

On site reconnaissance to understand the key water and land features was conducted by helicopter and foot on September 4, 2008 with a subsequent second trip on July 14, 2009. No exceptional issues were noted and the trips were documented in film and photographs. See **Appendix A Photographs**. As mentioned in 1982 S&W study, the dam location appears to be "superior" rock for dam construction.

3. Project General Arrangement

The arrangement evaluated for this study is most similar to that as set forth by Stone & Webster in 1982. What follows is a brief description of the major components. The transmission line is addressed in it's own section.

3.1 Dam, Spillway and Reservoir

The proposed dam would be a 120-foot high RCC dam near the natural lake outlet, raising the normal pool from El. 306 feet to El. 410 feet with maximum pool at El. 425 feet (see **Figures 1.4 and 1.5**). The un-gated overflow spillway would be integral with the dam. If the intake was constructed as designed at the current lake level, there would be approximately 160,000 acre-feet of storage which would provide the assumed 200 cfs average flow.

3.2 Penstock and Surge Tower

The proposed penstock would be 9 foot diameter with 7/16 inch and 3/8 inch wall thicknesses. It will take approximately 6,000 feet of steel pipe to reach the powerhouse from the intake with seven or eight concrete thrust blocks. Saddle pipe supports will be spaced about every 64 feet. There would be a 20-foot diameter by 200-foot high cable braced surge tower approximately 1,600 feet upstream from the powerhouse. The route would stay on the south side of the Duck River to keep out of avalanche terrain (see **Figure 1.3**).

3.3 Powerhouse

The powerhouse would be situated on the south shore of the Duck River at El. 65 feet, about 3,000 feet upstream of the river mouth at low mean high tide. Plant outfall would be by open channel weir and returned to the river upstream of the known salmon spawning grounds (see **Figures 1.3 and 1.6**). The 60 foot by 80 foot powerhouse would contain three 5MW Francis turbines, and associated equipment.

3.4 Dock and Access Road

A dock would be constructed on the southeast side of Galena Bay. An access road would connect the dock to the powerhouse before continuing up to the dam (see **Figure 1.3**).

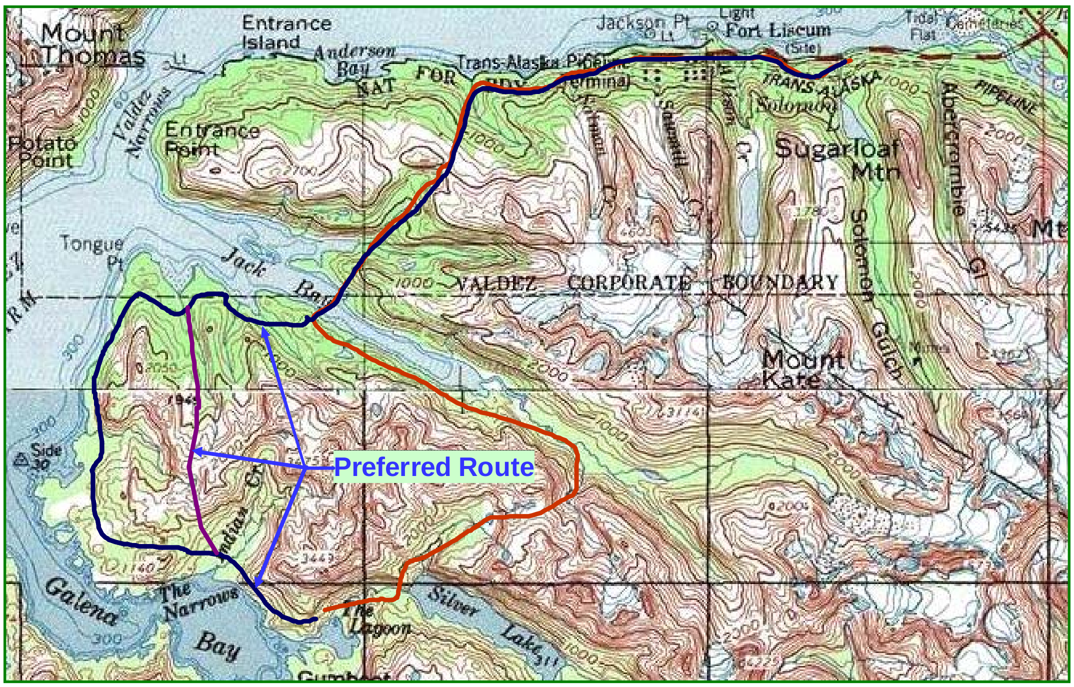
3.5 Substations

The switchyard and substations on both ends of the line will require sectionalizing switches and circuit breakers. The powerhouse substation will require a 13.8: 138 kV transformer as well.

4. Transmission Route Alternatives and Cost

Commonwealth Associates, Inc. was retained to review transmission route alternatives. Potential routes were flown by helicopter. Three transmission line routes were considered (see **Figure 4.1**) with the middle route selected due to the east route's proximity to avalanches and the west's route need for additional clearing and longer length.

Figure 4.1
Transmission Route Alternatives



The preferred proposed route is 26.5 miles long. 13% (3.5 miles) of route is above El. 1,000 feet. There are two high elevation sections with 1,600 and 2,000 foot maximum elevations with no obvious avalanche risk areas. 65% of route requires clearing. Termination of the 138kV line would be at Meals Substation, approximately 4 miles east of Solomon Lake Project powerhouse. The first 4 miles from Meals Substation going west will require overbuilding of an existing double circuit 25 kV line. Structures, loading, and foundations are anticipated to be similar to those used on Southeast Alaska Power Authority (SEAPA)'s, recently completed, 57 mile long, Swan-Tyee Intertie between the Swan Lake and Tyee Lake Hydroelectric Projects in Southeast Alaska.

5. Energy Potential

Annual firm energy was estimated by using the nearby Allison Lake hydrology as recently developed from historic Power Creek hydrology and pro-rating it to the Silver Lake drainage. The estimated flow rate agreed closely with the S&W analysis corresponding to an estimated annual flow rate of 200 cfs and annual firm energy of 36,800 MWh. **Table 5.1** summarizes the estimates made in 1982 and 1992.

Table 5.1
Energy Estimate Comparison

	Stone & Webster (1982)	HDR (1992)
Average Annual Discharge	200 cfs	244 cfs
Estimated Firm Annual Energy	36,800 MWh	44,800 MWh

6. Project Construction Cost and Schedule

6.1 Construction Cost Estimates

The cost estimate is based on 2010 bid price levels. The Direct Construction Cost is the total of all costs directly chargeable to the construction of the Project and in essence represents a contractor's bid. Indirect costs are defined as those which are added to the Direct Construction Cost to result in the Total Construction Cost. The cost estimating data was obtained from in-house cost data and from recently obtained bid prices on similar construction such as:

- RCC Dam: Current estimates for Susitna RCC alternative for AEA factored for smaller quantities
- Reservoir Clearing unit costs: Blue Lake estimate
- Penstock: Humpback Creek contractor bids & Blue Lake estimates
- Powerhouse: Blue Lake estimates & equipment bid
- Transmission Line: Swan-Tyee Intertie
- Switchyard: Swan-Tyee Intertie

Indirect costs include an allowance for contingencies, Engineering and Owner Administration. The contingency used for all alternatives was 30%. Engineering and Owner Administration assumed for all alternatives was 15% of construction cost, inclusive of contingencies.

The period of time required to complete the process for obtaining a Federal Energy Regulatory Commission (FERC) License can be expected to be 5^+ years. Adding another 2 years to construct the Project suggests that a realistic on-line date of the Project to be in the range of 2015. Accordingly, it is appropriate to include escalation to the above costs to determine a realistic on-line cost for the Project. However, for the purposes of the present economic analyses, 2010 dollars are used herein to avoid the need to hypothesize what the cost of thermal generation may be that far into the future. See T**able 6.1** for a summarized cost estimate by FERC cost code. See **Appendix B** for a detailed construction cost estimate.

Table 6.1
Hatch Estimate – Total Construction Cost

Item	
Mobilization	$1,573,000
Structures and Improvements	$4,836,500
Reservoirs, Dams and Waterways	$47,891,639
Turbines and Generators	$9,375,000
Accessory Electrical Equipment	$1,425,000
Miscellaneous Power Plant Equipment	$285,000
Structures and Improvements Substation	$550,000
Switchyards	$2,380,000
Overhead Conductors and Devices	$34,000,000
Direct Construction Cost (Bid 1/10)	**$102,316,139**
Contingencies	**$30,695,000**
Engineering & Owner Admin.	**$19,952,000**
Total Construction Cost (Bid 1/10)	**$152,963,139**

6.2 Cost Comparison with Previous Studies

The present cost estimate was compared with previous estimates for the project prepared by S&W and HDR. The cost estimate presented in this report is nearly in agreement with the escalated S&W estimate as can be seen in **Table 6.2**. All arrangements were similar in size and scope.

Table 6.2
Hatch Estimate – Direct Construction Cost Comparison with Previous Studies

FERC Acct	Description & Items	S&W 1982	HDR 1992	HATCH 2010
330	Land and Land Rights	$837,000	$1,175,000	$2,500,000
331	Structures and Improvements	$2,633,000	$2,571,000	$4,837,000
332	Reservoirs, Dams and Waterways	$26,050,000	$20,620,000	$47,892,000
333	Turbines and Generators	$2,970,000	$4,095,000	$9,375,000
334	Accessory Electrical Equipment	$300,000	$440,000	$1,425,000
335	Miscellaneous Power Plant Equipment	$0	$50,000	$285,000
352	Structures and Improvements Substation	$0	$30,000	$550,000
353	Switchyards	$500,000	$300,000	$2,380,000
356/366	Transmission Line	$9,350,000	$6,600,000	$34,000,000
	TOTAL DIRECT CONSTRUCTION COST =	**$42,640,000**	**$35,881,000**	**$103,244,000**
	USBR Construction Composite Cost Index =	**150**	**186**	**318**
	Escalated Cost - 2010 =	**$90,397,000**	**$61,345,000**	**$103,244,000**

6.3 Economic Analysis

The Total Investment cost includes interest during construction (IDC) over an assumed 24-month construction period. We have assumed that construction at the project site would come to a stop during the winter months, with the possible exception of equipment installation within the powerhouse structure.

Annual costs of the Project can be apportioned into fixed and variable costs. For this analysis, the fixed amount, amortization of the Total Capital Requirements less earnings on Reserves, is based on 7% interest rate financing over a 30-year term. Variable annual costs escalate each year and include operation and maintenance (O&M) costs, administrative and general expenses, interim replacements and insurance. The basic assumptions for determining the annual fixed and variable costs of the Project are shown in **Table 6.3**. The development of the annual cost as well as the resulting unit cost of power for each of the alternative development schemes considered herein are shown in 2010 dollars on **Table 6.4**.

Table 6.3
Basic Assumptions for Economic Analyses

Item	Value	
Financing Costs:		
Construction Period	30	months
Financing Term	30	years
Financing Interest Rates	7%	
Reinvestment Rate	7%	Same as interest rate
Escalation of Project Costs	3%	annually
Financing Reserve	1	year of debt service
Financing Expenses	3%	of Total Investment Cost
Annual Costs:		
Operation & Maintenance	$280,000	
Administrative and General	40%	of O & M
Insurance	$50,000	
Interim Replacements	$50,000	

Table 6.4
First Year Cost of Power (2010 Dollars)

Item	
Total Construction Cost (Bid 1/10)	**$152,963,139**
Interest During Construction	13,830,000
Total Investment Cost	**$166,793,139**
Reserve Fund	14,920,000
Financing & Legal	5,004,000
Working Capital	100,000
Total Capital Requirements (1/10)	**$186,817,139**
Annual Cost	
Debt Service	$15,055,000
O&M Cost	280,000
Administrative & General	112,000
Insurance	50,000
Interim Replacements	50,000
Earnings on Reserve Fund	(1,054,000)
Total First-Year Annual Cost	**$14,493,000**
Generation - (kWh)	36,800,000
First-Year Cost of Power (1/2010) ($/kWh)	**$0.394**

7. Environmental and Regulatory Considerations

7.1 Silver Lake Environmental Considerations

7.1.1 Project Lands

Project lands are owned by the Chugach Alaska and Tatitlik Corporations and portions are within Conservation Easement as negotiated between the Exxon Valdez Oil Spill Trustee Council and Tatitlek Corporation.

7.1.2 Transmission Easement

Transmission line route is primarily located on U.S. Forest Service (USFS) lands. A Special Use Authorization for land use easement will be necessary.

7.1.3 Possible Fish Concerns

Per the S&W report the lower Duck River is “one of the most productive salmon streams in Prince William Sound.” In an effort to mitigate negative impacts on salmon, the proposed powerhouse would be cited to return water at the impassable natural fish barrier for salmon, approximately ½ mile upstream from the Galena Bay lagoon at El. 65 feet. Dolly Varden are know to occur throughout Duck River, Silver Lake and in the majority of the tributaries of the Galena Bay lagoon, Duck River and Silver Lake.

7.1.4 Hunting

Silver Lake is a popular goat hunting area.

7.1.5 Aesthetics

The Silver Lake valley and the Galena Bay lagoon have considerable aesthetic appeal. The dam, penstock, powerhouse and access roads will change the landscape.

7.2 Regulatory Requirements for a New License

Through its ownership of the Solomon Gulch Project and its pursuit of a new license for the Allison Lake Project, CVEA is familiar with the Federal, state and local processes for obtaining a FERC License, required Federal and state permits, and meeting other regulatory requirements associated with project development and operation and maintenance. This section provides a general overview of the requirements as they would apply to the proposed Silver Lake Project.

The FERC hydropower licensing process requires applicants to identify all interested resource agencies, Tribes, and other interested persons and organizations and provide opportunities for participation by all participants throughout the pre-filing preparation of the application and the post-filing activities during the FERC staff processing of the application.

- Consultations with resource agencies and other participants; identification of necessary field and office studies to support an application to the FERC; performance of field and office studies and report preparation; and preparation of the application document would require 2 to 3 years.

- FERC staff review of the filed application and preparation of a recommendation to the Commission regarding issuance of a license: potential requests for additional information; consultation with state and federal resource agencies as required under the Federal Power Act (FPA) and the FERC regulations; preparation of the FERC documents required under the National Environmental Policy Act (NEPA), either an Environmental Assessment (EA) or Environmental Impact Statement (EIS), and related noticing and comment periods; and preparation of the Order Issuing License may require approximately 2 to 2.5 years
- Following issuance of the Commission's Order, the licensee would be required to obtain approval of the Regional Engineer of drawings, specifications, and construction plans prior to starting construction.

Regulatory requirements of the above-described process include:

- Request by CVEA to FERC to use one of three options for the FERC licensing process: 1) the Integrated Licensing Process (ILP) that imposes strict timelines for all activities (default option); 2) the Alternative Licensing Process (ALP), a collaborative process that allows greater flexibility, but includes some FERC-required deadlines; and 3) the Traditional Licensing Process (TLP) that potentially exposes applicants to additional exposure to late-requested agency requirements
- Consultation process as required by the FERC regulations, including negotiations with resource agencies, et. al., regarding required studies program.
- Consultation with the Tatitlek Corporation for use of their lands.
- Resource agency recommended and mandatory measures under their separate authorities that shape the construction and operation of FERC-licensed projects – includes fisheries, wildlife, and historic/cultural resources.
- Requests for "protection, mitigation, and enhancement" measures to address project-related effects on natural and cultural resources.

8. Conclusions

- The Project is technically very attractive.
- It has challenging land usage and basic environmental issues that are not considered to be fatal flaws at this time. The project land owners are very interested in connecting to the project and displacing their diesel generation. There may be some difficulty acquiring land use easements from the USFS due to the scenic nature of the surrounding area.
- There is concern about the wide variation in past cost and energy estimates and additional effort would be required to narrow the gaps. Hydrology could be refined by compiling the historic Solomon Gulch inflows and pro-rating that for the Silver Lake drainage area.
- With a first year cost of power at $0.39 per kWh, present review indicates that the Silver Lake Hydroelectric Project is not currently economically viable relative to the other resources available to the CVEA.

9. References

1. Alaska Power Authority, Application for Preliminary Permit for the Silver Lake Hydroelectric Project, P-6861, November 18, 1982.
2. HDR Engineering, Inc., Allison Lake Reconnaissance Study, Appendix 8, Silver Lake Alternatives 8 and 9, prepared for Alaska Energy Authority, September 1992.
3. Stone & Webster Corporation, Cordova Power Supply, Interim Feasibility Assessment, Executive Summary, June 1982.
4. Stone & Webster Engineering Corporation, Cordova Power Supply, Interim Feasibility Assessment, Volume 1, June 1982.
5. Stone & Webster Engineering Corporation, Cordova Power Supply, Interim Feasibility Assessment, Volume 2, June 1982.
6. Stone & Webster Engineering Corporation, Cordova Power Supply, Interim Feasibility Assessment, Addendum 1, Revised Cost Estimates, November 1982.
7. U.S. Army Corps of Engineers, Electric Power for Valdez and the Copper River Basin, Interim Feasibility Report and Final Environmental Impact Statement, March 1981.

Appendix A

Photographs

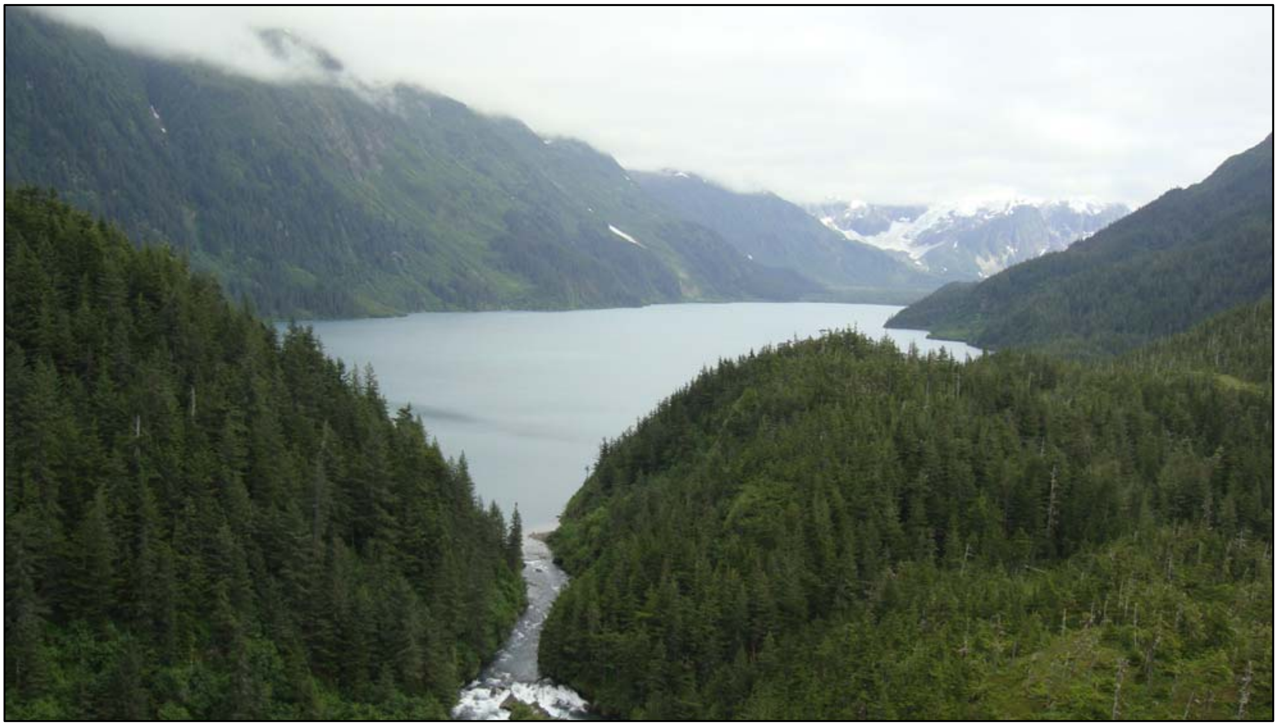


Photo 1: Silver Lake Outlet – Looking South

Photo 2: Head of Silver Lake – Looking North

Photo 3: Silver Lake Outlet – Looking Downstream

Photo 4: Silver Lake Outlet Area – Looking North

Photo 5: Silver Lake Dam Area – Left Bank

Photo 6:Duck Creek – Flows

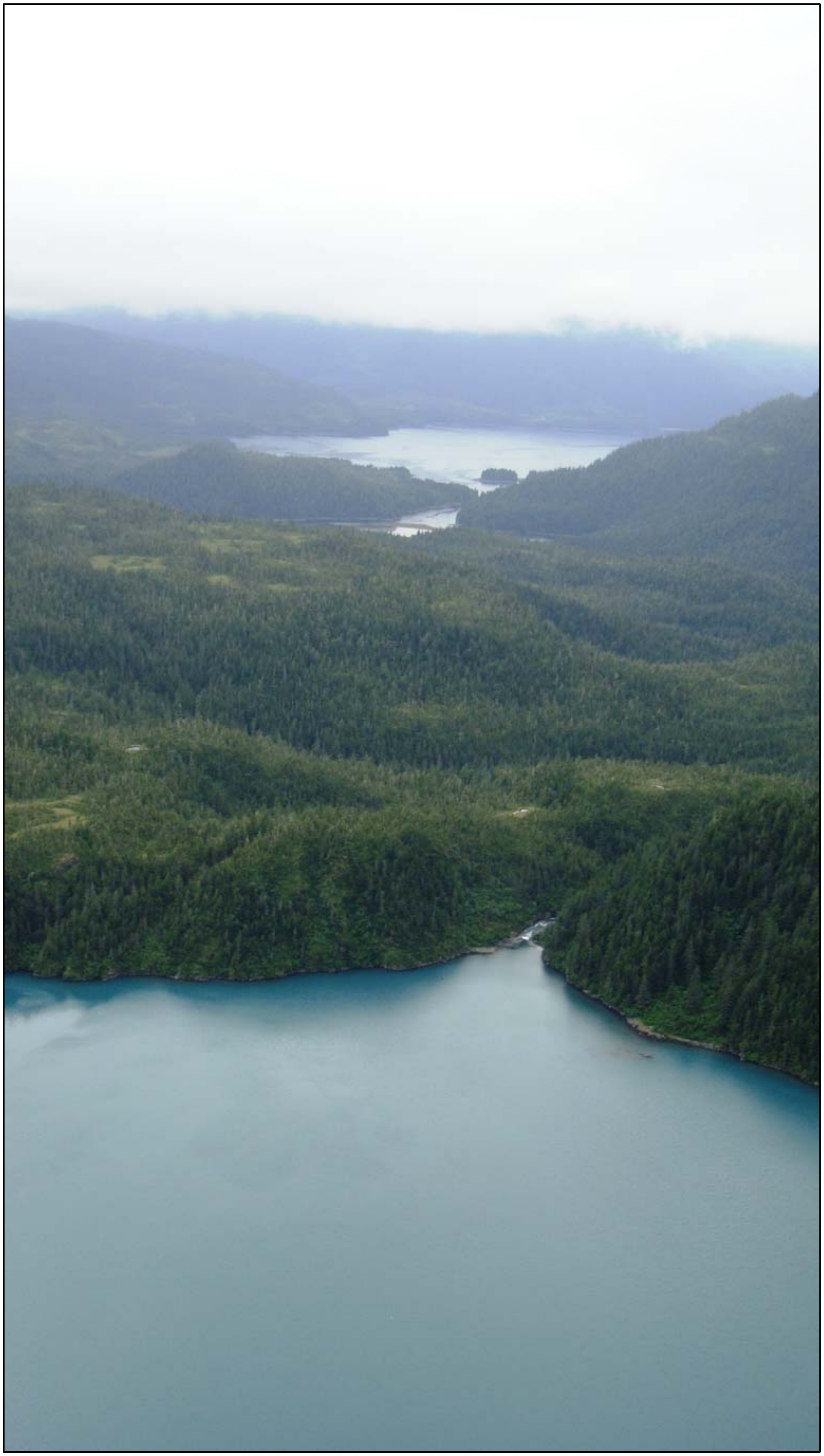


Photo 7: Silver Lake Looking North,
Lagoon and Galena Bay in Background

Photo 8: Silver Lake
Dam Area, Left Bank Close Up

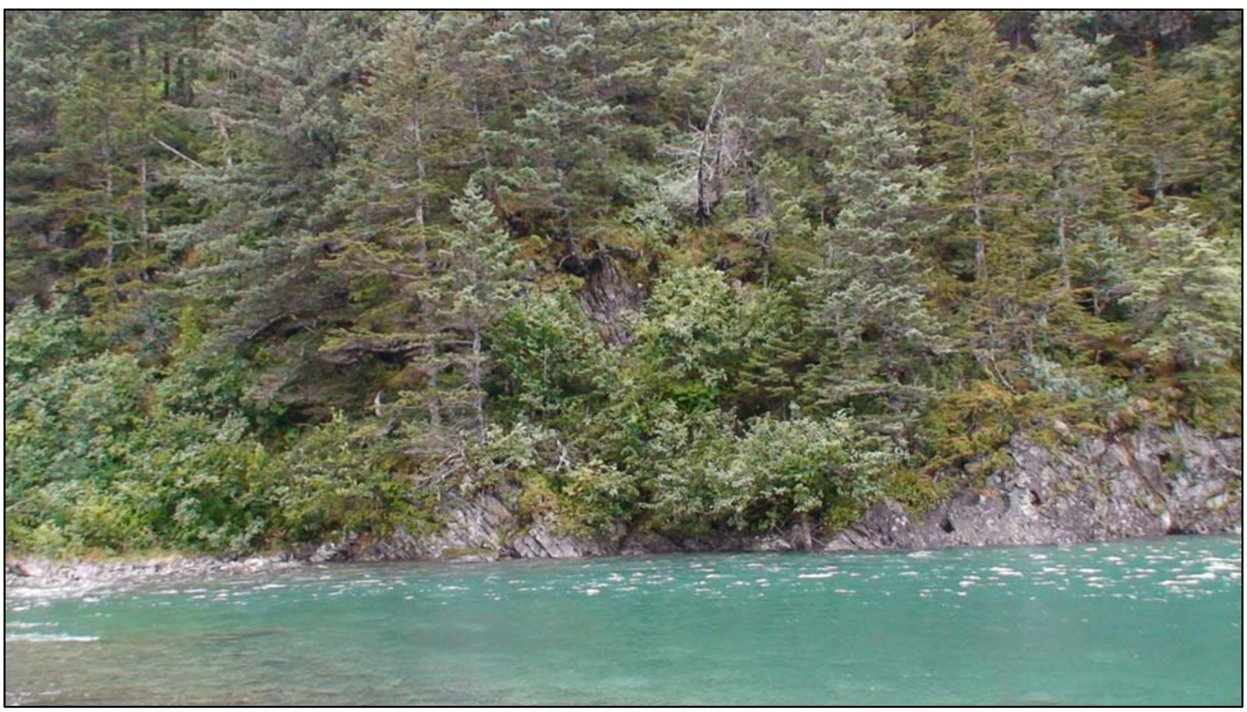


Photo 9: Silver Lake
Dam Area, Right Bank

Appendix B

Cost Estimate

Appendix B - Cost Estimate Detail

Silver Lake Hydroelectric Project

Pre-Feasibility Study Report

<u>Silver Lake Hydroelectric Project</u>
Cost Estimate

				Stone and Webster 1982			HDR 1992			Hatch 2010			
FERC Acct	**Description & Items**	**Qty.**	**Unit**	**Unit Cost**	**Cost**	**Total**	**Unit Cost**	**Cost**	**Total**	**Unit Cost**	**Cost**	**Total**	**Comments**
330	**Land and Land Rights**					**$837,300**			**$1,175,000**			**$2,500,000**	Dick
		1	*LS*		$837,300			$1,175,000		$0	$2,500,000		
331	**Structures and Improvements**					**$2,632,688**			**$2,571,250**			**$4,836,500**	Joe and Peter
	Excavation	4500	*CY*	$16	$72,000		$75	$337,500		$35	$157,500		
	Concrete and Reinforcing	1100	*CY*	$1,995	$2,194,500		$1,000	$1,100,000		$920	$1,012,000		BL 800.00 cy, Reinf @ 80#/cy reinf @ 1.50
	Building Superstructure	1	*LS*	$366,188	$366,188		$600,000	$600,000		$2,804,000	$2,804,000		BL
	HVAC Plumbing Electrical	1	*LS*	$0	$0		$100,000	$100,000		$60,000	$60,000		BL
	Misc Metals	1	*LS*	$0	$0		$50,000	$50,000		$230,000	$230,000		BL
	Inlet Valves	3	*ea*	$0	$0		$50,000	$150,000		$180,000	$540,000		BL
	Potable Water/Sewer	1	*LS*							$33,000	$33,000		BL
	Mobilization	1	*LS*		$0		$233,750	$233,750		see MOB sht			
332	**Reservoirs, Dams and Waterways**					**$7,370,000**			**$10,215,000**			**$19,805,956**	Dick, Keith (Dam)
	Dock	1	*LS*	$150,000	$150,000		$400,000	$400,000		$770,526	$770,526		HDR USBR Cost Escalation
	Access Road	28000	*LF*	$60	$1,680,000		$75	$2,100,000		$149	$4,180,000		HDR USBR Cost Escalation
	Reservoir Clearing	100	*AC*							$10,000	$1,000,000		BL
	Excavation	5000	*CY*	$40	$200,000		$75	$375,000		$135	$675,000		HDR USBR Cost Escalation
	Rock Drilling	4000	*LF*	$25	$100,000		$50	$200,000		$90	$359,140		HDR USBR Cost Escalation
	Grout Curtain	1400	*CY*	$50	$70,000		$100	$140,000		$180	$251,398		HDR USBR Cost Escalation
	Concrete Structural	1500	*CY*	$780	$1,170,000		$1,000	$1,500,000		$1,796	$2,693,548		HDR USBR Cost Escalation
	RCC	50000	*CY*	$60	$3,000,000		$100	$5,000,000		$180	$8,978,495		1.8 times Suisitna RCC Estimate
	Diversion and Water Care	1	*LS*	$1,000,000	$1,000,000		$500,000	$500,000		$897,849	$897,849		HDR USBR Cost Escalation

Appendix B - Cost Estimate Detail
Silver Lake Hydroelectric Project
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Silver Lake Hydroelectric Project
Cost Estimate

				Stone and Webster 1982			HDR 1992			Hatch 2010			
FERC Acct	**Description & Items**	**Qty.**	**Unit**	**Unit Cost**	**Cost**	**Total**	**Unit Cost**	**Cost**	**Total**	**Unit Cost**	**Cost**	**Total**	**Comments**
332	**Penstock**					**$18,680,000**			**$10,404,500**			**$28,085,683**	Jim
	Penstock Pipe Procurement (108" Dia., 5,000 LF) - Fabricate and Supply (to site)	######	LB							$7	$18,431,608		Assume 7/16" used for first 1600 LF and remainder is 3/8" wall thickness. Based on HBC BI# 41
	Surge Tower, 20 ft diameter x 200 ft high steel cylinder with cable supports at TB 4.	155,000	LB							$7	$1,249,300		Assume 1/4" wall thickness with 20% added to account for bracing and stiffening.
	Expansion Joints - Supply and Install	77	EA							$30,000	$2,864,400		Use HBC rate for 52" dia expansion joint, BI# 42
	Penstock Saddles & Misc. Steel - Fabricate and Supply (to site, 154 pieces x 475 LB ea.)	73,150	LB							$6	$498,883		HBC saddle weight is approx 190#. Assume 475# per saddle based on ratio of diameters.
	Tunnel Construction	1,200	LF								$0		HBC BI# 19, 22A, 23A, 23-1A ratioed for cross
	Construction	815	CY							$2,900	$2,930,740		HBC BI# 60 and 61 used to get unit cost + cost of
	Thrust Block 1 (Sta 0+20)	35	CY								$0		Based on prelimin design.
	Thrust Block 2 (Sta 2+00)	200	CY								$0		Based on prelimin design.
	Thrust Block 3 (Sta 11+30)	35	CY								$0		Based on prelimin design.
	Thrust Block 4 (Sta 16+00), includes surge tower foundation	300	CY								$0		Based on prelimin design.
	Thrust Block 5 (Sta 33+00)	140	CY								$0		Based on prelimin design.
	Thrust Block 6 (Sta 37+00)	35	CY								$0		Based on prelimin design.
	Thrust Block 7 (Sta 43+00)	35	CY								$0		Based on prelimin design.
	Tunnel Upstream Portal	35	CY								$0		Based on prelimin design.
	Saddle Support Foundations (77 locations)	385	CY							$2,900	$1,384,460		Estimated fondation qtys + unit cost for TBs
	Helicopter cost to provide 125 drops of 40 ft long penstock segments (9 ft dia.), 8 drops of 25 ft long surge tower segments (20' dia.) + 15 drops other stuff	148	drops							$2,400	$440,448		Columbia helicopter rates per CM contact and quoted rate for "sky crane". Assume 1 drop in 1 hrs.
	Coating Repairs to Weld Joints (125 locations x 6" wide area repaired per joint	1,770	SF							$30	$65,844		HBC BI# 64 x 1.5 to reflect interior work with worker safety provisions.
	Penstock, 108" Pipe	6000	*LF*	$2,400	$14,400,000		$1,000	$6,000,000					
	Supports, Concrete	4000	*CY*	$780	$3,120,000		$500	$2,000,000					
	Surge Tank	140000	*LB*	$4	$560,000		$3	$420,000					
	Trifurcation	1	*LS*	$0	$0		$110,000	$110,000		$220,000	$220,000		HDR USBR Cost Escalation
	Mobilization	1	*LS*	$600,000	$600,000		$1,874,500	$1,874,500			$0		

Appendix B - Cost Estimate Detail

Silver Lake Hydroelectric Project

Pre-Feasibility Study Report

Silver Lake Hydroelectric Project

Cost Estimate

FERC Acct	Description & Items	Qty.	Unit	Stone and Webster 1982			HDR 1992			Hatch 2010			Comments
				Unit Cost	Cost	Total	Unit Cost	Cost	Total	Unit Cost	Cost	Total	
333	**Turbines and Generators**					**$2,970,000**			**$4,095,000**			**$9,375,000**	Joe w/ Peter oversight
	Supply	3	*ea.*	$990,000	$2,970,000		$1,050,000	$3,150,000	.	$2,500,000	$7,500,000		BL
	Install	3	*ea.*	$0	$0		$315,000	$945,000		$625,000	$1,875,000		25% of supply
	Governor supply										$0		included in turbine
	Exciter supply										$0		included in generator
334	**Accessory Electrical Equipment**					**$300,000**			**$440,000**			**$1,425,000**	Peter or Gene?
	Controls supply	1	*LS*	$300,000	$300,000		$250,000	$250,000		$150,000	$150,000		BL
	Station Service	1	*LS*							$225,000	$225,000		BL
	Switchgear supply	1	*LS*	$0	$0		$90,000	$90,000		$400,000	$400,000		BL
	Misc Electrical	1	*LS*	$0	$0		$100,000	$100,000		$650,000	$650,000		BL
	Control and switchgear install										$0		
	125 V dc battery system										$0		
335	**Miscellaneous Power Plant Equipment**					**$0**			**$50,000**			**$285,000**	Peter
	Crane (20 Ton)	1	*LS*	$0	$0		$50,000	$50,000		$235,000	$235,000		BL
	Cooling water system	1	*LS*							$40,000	$40,000		BL
	Fire Protection	1	*LS*							$10,000	$10,000		BL
	Tailwater depression system										$0		
352	**Structures and Improvements Substation**					**$0**			**$30,000**			**$550,000**	Joe
	Excavation	1	*LS*							$60,000	$60,000		STI Costs
	Substation Foundation	1	*LS*	$0	$0		$10,000	$10,000		$180,000	$180,000		STI Costs
	Oil Spill Containment	1	*LS*	$0	$0		$10,000	$10,000		$250,000	$250,000		STI Costs
	Ground Grid	1	*LS*	$0	$0		$10,000	$10,000		$60,000	$60,000		STI Costs
353	**Switchyards**					**$500,000**			**$300,000**			**$2,380,000**	Joe
	GSU transformer supply	1	*LS*	$500,000	$500,000		$200,000	$200,000		$700,000	$700,000		BL
	Circuit switcher supply	1	*ea*		$0			$0		$180,000	$180,000		STI Costs
	Equipment install	1	*ea*		$0			$0		$1,500,000	$1,500,000		STI Costs
	Switchyard Buswork	1	*LS*		$0			$0			$0		Included in Install
	Accessory Switchgear Equipment	1	*LS*		$0		$100,000	$100,000			$0		Included in Install
356	**Overhead Conductors and Devices**					**$9,350,000**			**$6,600,000**			**$34,000,000**	Commonwealth
	Transmission Line	22	*MI*	$425,000	$9,350,000		$300,000	$6,600,000			$34,000,000		
366	**Poles and Fixtures**											**$0**	
TOTAL DIRECT CONSTRUCTION COST						**$42,639,988**			**$35,880,750**			**$103,243,139**	

1982 USBR Cost Index ~	**150**	**2010 Cost = $90,397,000**	**2010 Cost = $61,345,000**	**2010 Cost = $104,816,000 (Includes Mobilization)**
1992 USBR Cost Index =	**186**			
2010 USBR Cost Index =	**318**			