Southeast Alaska Energy Export Study

FINAL REPORT

Lake Tyee powerhouse and switchyard near the head of the Bradfield Canal.

Prepared for

The Southeast Conference

Juneau, Alaska

by

DHITTLE & ASSOCIATES, INC.
Engineers and Consultants

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In association with:

Commonwealth Associates, Inc.

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Introduction

Over the past few years, the Southeast Conference has conducted several studies with regard to development of an integrated transmission system in Southeast Alaska. For the most part, the electric systems that serve the residents and businesses in the region are community based and isolated from each other. Further, none of the electric utility systems in Southeast Alaska are interconnected with any other utility systems in Alaska, the rest of the country or Canada. Some of the previous transmission studies have evaluated the feasibility of constructing transmission lines primarily among the utilities in Southeast Alaska and to a lesser degree to Canada.

As a follow-on to its 2003 Southeast Alaska Intertie Study and 2005 Kake-Petersburg Intertie Study, the Southeast Conference retained D. Hittle & Associates, Inc. (DHA) to conduct a study of the feasibility of a transmission interconnection between Southeast Alaska and British Columbia, Canada through the Bradfield Canal region (the "Bradfield Intertie"). In general, the purpose of the Bradfield Intertie would be to provide Southeast Alaska hydroelectric power producers with access to power markets in Canada and the United States. As such, this study (referred to in this report as the "Energy Export Study") evaluates the feasibility of the Bradfield Intertie based on the revenue that would be produced from power sales over the line as compared to the costs of its operation and maintenance.

For the most part, electric energy in Southeast Alaska is produced by hydroelectric generating facilities and diesel generators. The potential for development of hydroelectric resources in Southeast Alaska has always exceeded the regional demand and as a result, the full potential for hydroelectric development has not been realized. The energy generation potential of several regional hydroelectric facilities developed in the past has exceeded the local demand for power creating significant generation surpluses for many years after initial operation. For the Lake Tyee hydroelectric project[1] located near the head of the Bradfield Canal, over half of the annual energy generation potential continues to be surplus to the needs of Wrangell and Petersburg, the communities to which it is connected[2]. The Bradfield Intertie would serve as a means to transmit existing regional surplus hydroelectric generation capability to Canadian and US markets as well as encourage the development of new hydroelectric facilities in Southeast Alaska.

A critical element related to the Bradfield Intertie is the interconnection with the transmission system located in British Columbia (BC). From the perspective of Alaska, the Bradfield Intertie would only extend as far as the Alaska-Canada border. It will be necessary for Canadian interests to construct the length of transmission line needed between this border crossing location to the interconnection point with the existing BC transmission system. At the present time, the transmission system in BC extends only as far north as Meziadin Junction, approximately 145 miles from the proposed Alaska-Canada border crossing of the Bradfield Intertie. British

[1] The 22.5-MW Lake Tyee hydroelectric project is owned and operated by the Four Dam Pool Power Agency. It was constructed by the State of Alaska and began operation in 1984.
[2] The Swan-Tyee Intertie, presently under development, will connect the Lake Tyee project to Ketchikan for the purpose of transmitting a portion of the existing surplus hydroelectric generation.

miles from the proposed Alaska-Canada border crossing of the Bradfield Intertie. British Columbia Transmission Corporation[3] (BCTC) and British Columbia Hydro[4] (BC Hydro) are currently evaluating the feasibility of extending the BC transmission system further north along the Highway 37 corridor to provide power to potential new mining loads in the area near Iskut, BC.

A private developer, Coast Mountain Power (CMP)[5], has obtained the necessary permits and is prepared to begin construction of a 138-kV transmission line between Meziadin Junction and CMP's proposed 115-MW Forrest Kerr hydroelectric project. The CMP transmission line will extend approximately 110 miles to a point approximately 30 miles east of the proposed border crossing of the Bradfield Intertie. CMP has indicated that it would be interested in constructing an extension to its planned transmission line to interconnect with the Bradfield Intertie. No action has been taken by CMP or any other Canadian entity to develop the necessary transmission interconnection at the Alaska border.

In the late 1980's, Bradfield Electric, Inc., a private corporation, in cooperation with the State of Alaska / Alaska Power Authority[6] applied for a Presidential Permit to construct and operate a 69-kV transmission line along the North Fork Bradfield and Craig River drainages between the Lake Tyee hydroelectric project and the Johnny Mountain mine area in BC. An Environmental Assessment was prepared by the US Forest Service and a Finding of No Significant Impact (FONSI) was issued for the project on May 6, 1988. A Presidential Permit was issued on May 4, 1989[7]; however, the Bradfield Electric transmission project was never constructed. The US Department of Energy indicates that the Presidential Permit has not expired, however, it is not transferable and would only apply to the exact project as originally proposed.

As previously indicated, the primary purpose of the Bradfield Intertie will be to provide an opportunity for the export of Southeast Alaska's surplus hydroelectric generation to outside power markets. In the Pacific Northwest and elsewhere on the West Coast there is a significant need for additional electric power supply in the future. Puget Sound Energy (PSE), the largest electric utility in Washington, has projected an energy deficit of 915,000 MWh during 2007. By 2015, PSE's growing annual energy need is projected to be 11,500,000 MWh over the currently projected supply. With the Bradfield Intertie, electric energy from Alaska could potentially be sold to PSE to partially address this projected shortage.

The Bradfield Intertie is of interest to BC Hydro in that interconnection with Alaska power generating resources could contribute to more stable operation of the northern portion of BC Hydro's electric system. If constructed, the Bradfield Intertie could also be used to import

[3] British Columbia Transmission Corporation (BCTC) is a provincial Crown corporation that was established in May 2003 to maintain, operate and plan BC Hydro's transmission assets. The core transmission assets are owned by BC Hydro.
[4] BC Hydro is a Crown corporation owned by the Province of British Columbia. It is the largest electric utility in BC serving over 90 percent of the province's population.
[5] In April 2006, NovaGold Resources, Inc. indicated that it was pursuing acquisition of CMP.
[6] The Alaska Power Authority was superseded by the Alaska Energy Authority.
[7] Presidential Permit PP-87 authorizing Bradfield Energy, Inc. and the Alaska Power Authority to Construct, Operate and Maintain Electric Transmission Facilities Across the International Border Between the United States and Canada, dated May 4, 1989.

electricity for new large loads in Southeast Alaska. The construction of the Bradfield Intertie could help stimulate the development of new hydroelectric facilities in Southeast Alaska by providing a market for the power before local loads grow to accommodate additional generation.

At the present time, the existing electric transmission system in Southeast Alaska is not extensive. Petersburg and Wrangell are connected by means of the Lake Tyee transmission line. The Four Dam Pool Power Agency (FDPPA) has undertaken construction of a transmission line to interconnect Ketchikan to the Lake Tyee project (the "Swan-Tyee Intertie") but has halted construction and is seeking funds to complete this project. The Swan – Tyee Intertie could make surplus hydroelectric generation in the Ketchikan area available for export over the Bradfield Intertie. In the future it would be necessary to construct additional transmission lines in Southeast Alaska to make hydroelectric generation in the Sitka and Juneau areas available for export. These additional transmission lines have been studied but are not under development at the present time.

In evaluating the Bradfield Intertie, it is important to note that a number of issues outside the scope of this study must be factored into the overall assessment of the project. Principal among these are the various commercial and contractual arrangements that would be needed to allow for transmission interconnection, transmission access, power sales and power purchases. The terms and conditions associated with these arrangements will need to be negotiated and could significantly affect what benefits and costs actually are to be derived with the Bradfield Intertie. Further, the potential development of new hydroelectric facilities in Southeast Alaska would be dependent on the economic and technical feasibility of each of these projects. No attempt has been made in this study to determine if any of the new hydroelectric projects could be proven to be feasible or if they could be successfully financed.

Finally, one of the elements typically considered in evaluating the economic feasibility of electric transmission and generation projects in Alaska is the projected impact on electric ratepayers. Because of the significant number of uncertainties related to the potential costs and benefits associated with the Bradfield Intertie, an estimate of the impact on electric rates would be highly speculative at this point. The ability to sell surplus energy from regional hydroelectric projects should act to lower the cost of electricity to electric consumers in Southeast Alaska and potentially elsewhere in Alaska[8]. As work proceeds towards development of the Bradfield Intertie and more facts become known, the impact on electric rates in the region can be better quantified.

Study Approach

The primary tasks undertaken for the Energy Export Study as defined in the scope of services are as follows:

1. Identify the estimated surplus power from existing, planned and potential hydroelectric resources in Southeast Alaska and estimate the cost of power production from these hydroelectric projects.

[8] Sales of surplus hydroelectric energy from the Lake Tyee project could potentially lower the cost of power to all Four Dam Pool communities.

2. Evaluate the conditions associated with a potential sale of power from Southeast Alaska to and through British Columbia to electric utilities or markets in the Lower 48. Determine how power exchanges might be a factor as an option to direct power sales.

3. Identify regulatory and/or political constraints with respect to the proposed interconnection and power transfers/sales between Alaska, Canada and the Lower 48. Determine what options may exist to mitigate or avoid FERC and other jurisdictional problems.

4. Provide preliminary construction and operating cost estimates for the transmission line between Southeast Alaska and British Columbia.

5. Estimate the costs associated with wheeling power through the BC Hydro system to the Lower 48.

6. Evaluate the economic feasibility of the proposed transmission interconnection and exporting of power as it pertains to overall costs and benefits to the State, Canadian interests, Lower 48 interests and in particular to the residents and electric consumers in Southeast Alaska.

7. Provide a "fatal law" review of potential environmental issues.

8. Provide a report of the findings of the Study which includes identification of the recommended next steps necessary to pursue development of the interconnection with BC.

For the purpose of the economic analysis included in Item 6, it has been assumed that Bradfield Intertie construction costs will be funded with grants, however, it is expected that the annual costs of operating and maintaining the Bradfield Intertie are to be borne by the users of the transmission line.

In evaluating the economic feasibility of the Bradfield Intertie, the revenues from power sales to outside markets have been estimated on an annual basis. These revenues were then reduced by the estimated costs of operating and maintaining the Bradfield Intertie and paying the costs of transmitting the exported power over the Canadian system. The resulting net revenues are presented as the "breakeven cost of power" that can be incurred to pay for power generated at existing and new power plants in Southeast Alaska. As such, the breakeven power cost would be the amount that could be paid for power so that when combined with the estimated costs associated with transmitting power outside Alaska, the total costs are equal to the estimated revenues from power sales.

During the course of the Energy Export Study a number of reports were reviewed and discussions were held with representatives of many agencies, organizations and companies.

Conclusions

The following conclusions are offered with regard to the Energy Export Study. Although these conclusions are offered at this point in the report, it is important to understand the assumptions and other factors described in subsequent sections of this report that contribute to the conclusions.

Technical characteristics and construction costs

- The construction of the Bradfield Intertie is technically feasible. The recommended corridor for the Bradfield Intertie is very similar to the proposed corridor for the Bradfield River Road[9]. The Bradfield Intertie would originate at the existing Lake Tyee hydroelectric project located near the head of the Bradfield Canal and the mouth of the Bradfield River, proceed along the North Fork of the Bradfield River for 22.5 miles, cross into the drainage of the South Fork of the Craig River, and follow the Craig River for four miles to the Alaska – Canada border. At the border, the Bradfield Intertie is proposed to meet a similar transmission line to be built by Canadian interests that would interconnect with the main BC transmission grid. (See Figure 1-1)

- Based on the current configuration of the existing Lake Tyee transmission system[10] and the plans for new transmission construction on the Canadian side of the border, it is recommended that the Bradfield Intertie be constructed at 138-kV. Depending on the timing of new electric generating facility development in Southeast Alaska, initial operation of the Bradfield Intertie at 69-kV could be appropriate. It is estimated that at 69-kV and 138-kV, up to approximately 105 MW and 185 MW, respectively, could be exported over the Bradfield Intertie.

- The Bradfield Intertie is proposed to be constructed as a single wood pole, single circuit 138-kV line with A-frame type structures used to support some extremely long spans. The conductor proposed to be used is 556 kcmil aluminum core steel reinforced (ACSR) conductor at lower elevations and 37/8 Alumoweld at higher elevations and for longer spans.

- Based on the proposed configuration provided in this study, the estimated cost of the Bradfield Intertie is between $21.4 million and $26.8 million, at present cost levels. This cost estimate assumes that a road is not constructed adjacent to the transmission line route prior to the construction of the line. This cost estimate also does not include any costs for construction of transmission facilities in Canada.

[9] The Bradfield River Road project is described in the report entitled "Bradfield River Road Final Scoping and Pre-NEPA Engineering Feasibility Study" prepared by the US Department of Transportation Federal Highway Administration, dated January 10, 2005.

[10] The Tyee transmission line interconnects the Lake Tyee hydroelectric project with the electric systems of Petersburg and Wrangell. It was constructed for 138-kV but is operated at 69-kV. There are no current plans to upgrade the operating voltage of the Tyee line, however, it is expected that this could be accomplished without significant expense.

TABLE 1-1
Bradfield Intertie
Estimated Cost of Construction for Alternative Configurations
(2006 Cost Levels)

		Option 1 138-kV 556 KCM	Option 2 138-kV 954 KCM	Option 3 138-kV Tunnel 556 KCM	Option 4 69-kV 556 KCM
Materials					
Transmission Poles		$ 1,010,880	$ 1,399,680	$ 942,840	$ 748,000
Insulators & Hardware (Polymer Post)		523,200	622,080	523,200	374,400
Guys & Anchors		212,000	212,000	202,000	212,000
Conductor w/Accessories		622,567	1,393,206	3,558,161	622,567
Other		186,888	261,332	186,888	186,888
Subtotal - Materials		$ 2,555,535	$ 3,888,298	$ 5,413,089	$ 2,143,855
Labor Cost		2,455,555	3,400,000	2,455,555	2,455,555
Incidentals		4,479,950	5,455,000	4,479,950	4,479,950
Bond & Insurance	5.0%	223,998	272,750	223,998	223,998
Clearing/Access Construction		1,952,000	1,952,000	1,886,000	1,952,000
Tyee Switchyard		1,200,000	1,200,000	1,200,000	850,000
Communications System		200,000	200,000	200,000	200,000
System Cut-Over		160,000	160,000	160,000	-
Patrol/Maintenance Repair		120,000	250,000	120,000	-
Subtotal		$ 13,347,038	$ 16,778,048	$ 16,138,592	$ 12,305,358
Contingency	30.0%	4,004,111	5,033,414	4,841,578	3,691,607
Indirect Costs (Permitting, Engineering,etc.)	30.0%	4,004,111	5,033,414	4,841,578	3,691,607
Total Cost		$ 21,355,260	$ 26,844,876	$ 25,821,748	$ 19,688,572

Operation and maintenance costs

- Operations and maintenance (O&M) costs for the Bradfield Intertie are estimated to be approximately $281,000 annually for routine inspections, right-of-way clearing and regular repairs. Costs could exceed this amount periodically due to damage from infrequent tree strikes, landslides, avalanches and other events. The Bradfield Intertie will be located in a remote area where access is generally limited to helicopters.

Interconnection with Canadian transmission system

- Interest in Canada to the Bradfield Intertie appears to be high. BCTC has recently prepared a technical study to evaluate the capability of the existing and proposed BCTC transmission system if it were interconnected to the Southeast Alaska system.

- At the present time, Coast Mountain Power (CMP) is planning to construct a 110 mile-long 138-kV transmission line from the northern end of the BC Hydro transmission system in Meziadin Junction to the Forrest Kerr hydroelectric project located on the Iskut River. CMP has the necessary permits to construct this transmission line and is working to secure the final $20 million (Cdn) portion of its funding requirement to begin construction of the transmission line and the Forrest Kerr hydroelectric project. At the present time, CMP is planning to complete construction of the transmission line by the end of 2007. The transmission line will be built adjacent to Highway 37 for 84 miles and

end of 2007. The transmission line will be built adjacent to Highway 37 for 84 miles and along the Eskay Creek Mine Access Road for 23 miles. In late April 2006 CMP reported that NovaGold Resources, Inc., owner of the Galore Creek mine, is pursuing acquisition of CMP and the Forrest Kerr hydroelectric project. NovaGold has expressed an interest in the energy generation capability of the Forrest Kerr project and the project's associated transmission line.

- There are currently no plans to construct a transmission line between the Forrest Kerr project and the Alaska – Canada border, a distance of approximately 35 miles, to interconnect with the proposed Bradfield Intertie. CMP had, however, indicated an interest in constructing such a line if it were deemed economically feasible. There have been previous studies of transmission lines and roads along this route and although some protected areas are indicated to exist near the headwaters of the Craig River, CMP does not anticipate that there would be any significant problems in permitting and constructing this transmission line segment.

- In March 2006 the Province of BC presented a study evaluating a potential transmission interconnection between Southeast Alaska and the BC Hydro transmission system[11]. This study concluded that with a 287-kV transmission line between Meziadin Junction and the Alaska border, the stable transfer limit at Meziadin Junction would be 340 MW. This study assumes that the transmission connection between Meziadin Junction and the Alaska border would be completely separate from the proposed CMP 138-kV line; however, the two lines would follow essentially the same route.

- Other BCTC and BC Hydro studies have evaluated the feasibility of extending the BCTC transmission system north of Meziadin Junction along Highway 37 to as far north as the area around Iskut. Significant mining operations, including Galore Creek and Red Chris, are proposed in this region that will need access to the main BC Hydro power system. If BCTC were to extend its transmission system north, this line extension would parallel the CMP 138-kV transmission line along Highway 37 until the CMP line turns west at the Eskay Creek Mine Access Road.

Available hydroelectric surplus power

- Surplus hydroelectric generation capability presently exists at the Lake Tyee hydroelectric project. At current load levels it is estimated that approximately 60,000 MWh (6.8 average MW[12]) of annual energy generation is surplus to the needs of the interconnected Petersburg and Wrangell electric systems. If the Cascade Creek hydroelectric project, located just north of Petersburg, were to be constructed it is estimated that approximately 263,000 MWh (30.0 average MW) of annual surplus hydroelectric generation capability would be available for export over the Bradfield Intertie.

[11] Alaska – BC Intertie Study, Project 16239-21-00, prepared for BCTC, March 3, 2006.
[12] Average MWs are calculated as MWh divided by 8,760, the number of hours in a year. This value is used to provide a measure of the average capacity of energy deliveries over a period of time.

- A number of other hydroelectric projects have been identified in the Petersburg, Wrangell, Ketchikan and Metlakatla areas. If the Tyee-Swan transmission line were to be completed and a transmission line between Ketchikan and Metlakatla were to be constructed as well as the Cascade Creek project and other potential hydroelectric projects, it is estimated that approximately 676,000 MWh (77.2 average MW) of annual surplus hydroelectric energy generation capability would be available for export over the Bradfield Intertie.

Pacific Northwest power markets and marketing of Alaska power

- Pursuant to the terms of a 1961 treaty between the United States and Canada (the "Treaty"), Canada is entitled to one-half the downstream power benefits resulting from the construction of water storage projects on the Columbia River in British Columbia. Canada's share of the downstream power benefits are provided as power deliveries at the Washington – Canada border. It is not considered likely that the delivery points for the Canadian Entitlement power could be changed to the Alaska-Canada border without modification of the Treaty. Such action would require significant effort.

- Electric utilities in the Pacific Northwest have expressed interest in acquiring hydroelectric power from Alaska. Many large utilities in the Pacific Northwest are projecting the need for significant new power supply resources within the next ten years. The market value of power from Alaska hydroelectric power is highly subjective but will most likely be tied to the alternative cost of power generation with a potential premium because of the generally favorable perception of Alaska hydroelectric power.

- For the purpose of this analysis, it is estimated that a power sales rate in the range of between 6.0 cents per kWh and 7.2 cents per kWh in Washington State at the present time is a reasonable estimate for evaluating the economic feasibility of power exported from Alaska. In the future, this rate would be expected to change relative to the price of generation fuel and the cost of building new power facilities. Forecasts of future avoided costs and new resource costs in the Pacific Northwest developed by Puget Sound Energy, Avista and PacifiCorp indicate a possible decrease in power prices over the next five years consistent with a projected decrease in the price of natural gas. As such, for purposes of this analysis, it is assumed that the power sales rate would remain constant for five years and then increase annually at the rate of general inflation.

Charges for transmission over lines owned by others

- As presently envisioned, power from Alaska will be transmitted over lines in BC owned by BCTC and potentially CMP. Unless other provisions can be negotiated, both of these entities will require that certain transmission charges be paid for access to their respective transmission systems. BCTC has filed an Open Access Transmission Tariff specifying a transmission rate of $4.35 Cdn per kW-month for point-to-point transmission service. This would correspond to a rate of approximately $5.12 US per MWh (0.512 cents per kWh) of energy transmitted from Alaska hydroelectric facilities.

- It is further estimated that if CMP were to own and operate the only transmission line between the border and Meziadin Junction, CMP would assess a transmission charge of between $4.00 US and $8.80 US per MWh for wheeling charges over its transmission system. The significant variance in this range is caused by the uncertainty in the quantity of power to be transmitted. Since most of the costs associated with owning and maintaining a transmission line are fixed, as the total energy transmitted goes up, the cost per kWh goes down. If BCTC were to construct a transmission line to the Alaska border, the charges as indicated for CMP would not be applicable.

- In addition to transmission charges in BC, the Four Dam Pool Power Agency would be expected to charge for the use of its transmission system by other entities to contribute towards the cost of maintenance, renewals and repairs. For purposes of this analysis, it is assumed that a rate of $2.00 US per MWh would be charged for transmitting power over the FDPPA lines. This assumed unit cost of transmission should decrease with higher power flows.

Estimated net economic benefits of Bradfield Intertie

- Based on the estimated energy available, the estimated costs of O&M for the Bradfield Intertie and the estimated transmission charges on BCTC and CMP transmission lines, the net revenues that would be realized in Alaska for power sales in the Pacific Northwest can be estimated. If the construction cost of the Bradfield Intertie were fully grant funded, the estimated net revenues could be used to pay for the costs of power generated in Southeast Alaska. The net revenues and breakeven power cost are summarized in the following table.

TABLE 1-2
Estimated Energy Exported, Net Revenues and Breakeven Cost of Power
(Nominal Cost Levels)

	2010	2015	2020	2025
Delivered Power Sales Rate ($/MWh) [1]	$ 72.00	$ 81.46	$ 92.17	$ 104.28
Case 1: Existing Tyee Surplus [2]				
Energy Exported (MWh)	59,600	59,600	59,600	59,600
Energy Delivered to PNW (MWh) [3]	54,900	54,900	54,900	54,900
Net Annual Revenues ($000) [4]	$ 3,160	$ 3,650	$ 4,160	$ 4,740
Breakeven Power Cost (¢/kWh) [5]	5.31	6.13	6.99	7.96
Case 2: Existing with Cascade Creek [2]				
Energy Exported (MWh)	259,100	252,900	246,400	239,700
Energy Delivered to PNW (MWh) [3]	238,700	233,000	227,000	220,800
Net Annual Revenues ($000) [4]	$ 14,930	$ 16,650	$ 18,470	$ 20,450
Breakeven Power Cost (¢/kWh) [5]	5.76	6.58	7.50	8.53
Case 3: Existing with All PWK New Hydro [6]				
Energy Exported (MWh)	473,600	676,400	669,900	663,200
Energy Delivered to PNW (MWh) [3]	436,300	623,100	617,100	610,900
Net Annual Revenues ($000) [4]	$ 27,600	$ 45,140	$ 50,930	$ 57,410
Breakeven Power Cost (¢/kWh) [5]	5.83	6.67	7.60	8.66
Case 4: Existing with All Regional New Hydro [7]				
Energy Exported (MWh)	600,800	797,900	785,500	772,500
Energy Delivered to PNW (MWh) [3]	553,500	735,000	723,600	711,600
Net Annual Revenues ($000) [4]	$ 35,100	$ 53,310	$ 59,790	$ 66,950
Breakeven Power Cost (¢/kWh) [5]	5.84	6.68	7.61	8.67

[1] Estimated energy sales rate for power delivered in the Pacific Northwest.

[2] Assumes the Swan – Tyee Intertie is not constructed and consequently excludes any sales from Lake Tyee to Ketchikan.

[3] Energy Exported less estimated transmission losses through the BCTC system.

[4] Revenues from power sales in the Pacific Northwest less transmission charges and O&M costs associated with the Bradfield Intertie.

[5] Estimated cost of power production or purchase in Alaska that would breakeven with the estimated net annual revenues.

[6] Assumes the Swan-Tyee Intertie is constructed and that all identified potential hydroelectric projects in the interconnected Petersburg-Wrangell-Ketchikan (PWK) are developed.

[7] Includes all hydroelectric projects for Case 3 as well as the Takatz Lake, Katlian River and Sterling Bolima hydroelectric projects.

- The cumulative present value of the net annual revenues over the 25-year period 2010 through 2034, is estimated to be $41 million, $184 million, $492 million and $580 million for the four hydroelectric development cases shown in Table 1-2, respectively. If interconnection at the border were to CMP and not to the BC Hydro transmission system directly, the cumulative present value is estimated to be between $25 million and $30 million lower due to the costs of transmission over this separately owned system.

Environmental issues

- It is not expected that any significant environmental issues would preclude development of the Bradfield Intertie. In 1988, an environmental assessment was conducted and the US Forest Service issued a Finding of No Significant Impact (FONSI) associated with the proposed development of the Bradfield Electric transmission line. Although the Bradfield Intertie is proposed to follow essentially the same route of the Bradfield Electric line, an updated environmental assessment would be expected to be needed for the Bradfield Intertie.

Regulatory issues

- The Federal Energy Regulatory Commission (FERC) generally has jurisdiction over interstate transmission. If the Bradfield Intertie was developed and power was to be sold between Alaska and the Pacific Northwest, it is expected that FERC could require open access transmission in Southeast Alaska and filings of transmission tariffs pursuant to FERC Orders 888 and 889. These requirements are not expected to be onerous and generally do not apply to transmission lines owned by municipalities and other government agencies. FERC could have some involvement in the permitting process if the Bradfield Intertie were considered to modify the Lake Tyee project in any way. Generally though, it is not expected that FERC would have any jurisdiction over the technical, permitting or operational aspects of the Bradfield Intertie.

Recommendations

- Continue to monitor development of transmission facilities on the Canadian side of the border particularly with regard to funding commitments to construct facilities needed for interconnection to the Bradfield Intertie.

- Conduct preliminary discussions with the FDPPA, CMP, BCTC, BC Hydro and Pacific Northwest electric utilities to establish necessary parameters for future contractual arrangements related to transmission access, new transmission construction, future power purchases and future power sales. If possible, prepare a Memorandum of Understanding among the various parties.

- Develop a plan of finance for the Bradfield Intertie and conduct initial discussions with potential providers of funds.

- Conduct necessary preliminary engineering and permitting activities related to development of the Bradfield Intertie.

- Monitor Bradfield Road development plans and activities.

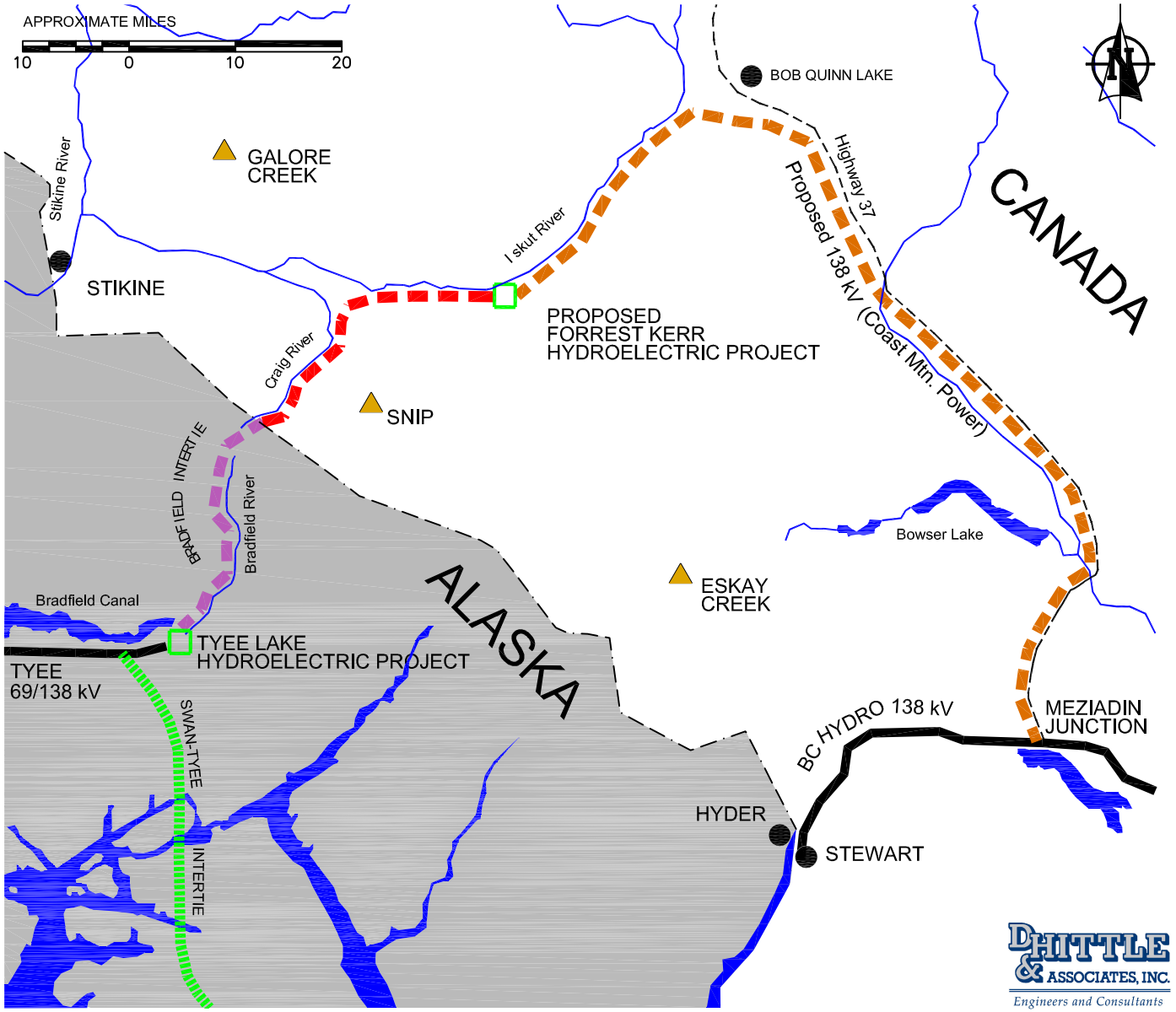


FIGURE 1-1
Southeast Alaska Energy Export Study
Proposed Bradfield Intertie Location

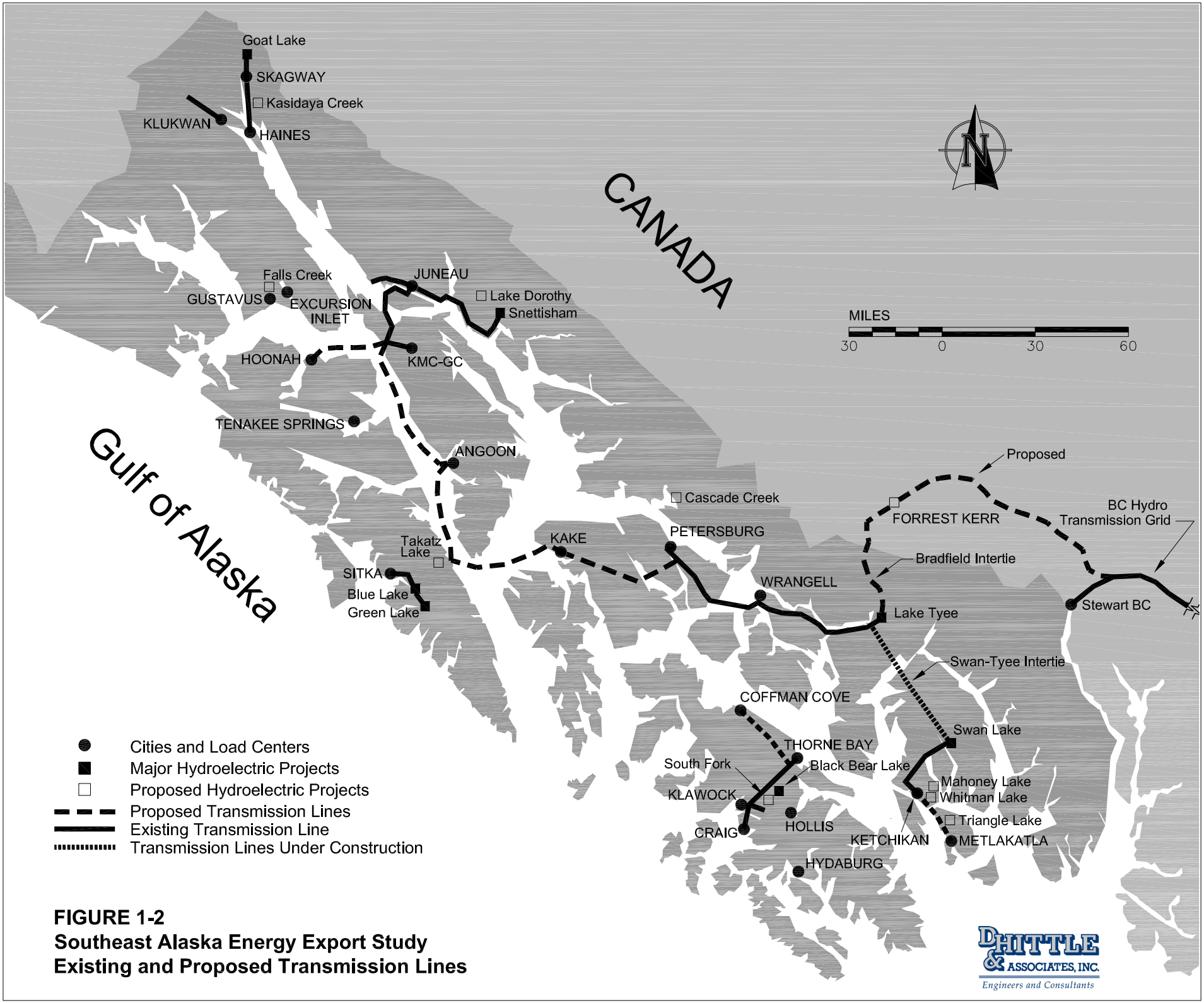


FIGURE 1-2
Southeast Alaska Energy Export Study
Existing and Proposed Transmission Lines

DHITTLE & ASSOCIATES, INC.
Engineers and Consultants

Transmission Line Route Alternatives and Technical Characteristics

Introduction

This section of the report describes the preferred route for an over-land transmission line from Southeast Alaska to Canada within the Bradfield River corridor. The technical characteristics of the line have been determined from a preliminary design concept and cost estimates for the various alternatives have been developed.

The Bradfield Intertie would begin approximately 25 miles southeast of the city of Wrangell at the Lake Tyee hydroelectric project powerhouse and switchyard, near the head of the Bradfield Canal. From the mouth of the Bradfield River, the proposed transmission alignment is very similar to that proposed for the Bradfield River Road. The power line would follow the North Fork of the Bradfield River for 22.5 miles, crossing into the South Fork of the Craig River drainage for another four miles to the Canadian border. At the Canadian border, the line is proposed to meet a similar transmission line facility to be constructed by BCTC or CMP, the developer of the Forrest Kerr hydroelectric project (Forrest Kerr). The estimated distance from the Canadian border to Forrest Kerr is approximately 35 miles, for a total distance of 61.5 miles between Lake Tyee and Forrest Kerr.

At the present time, CMP is planning to construct a 110 mile-long 138-kV transmission line from the northern end of the BC Hydro transmission system in Meziadin Junction to Forrest Kerr located on the Iskut River. CMP has the necessary permits to construct this transmission line and is working to secure the final $20 million (Cdn) portion of its funding requirement to begin construction of the transmission line and the Forrest Kerr hydroelectric project. At the present time, CMP is planning to complete construction of the transmission line by the end of 2007. The CMP transmission line will be built adjacent to Highway 37 for 84 miles and along the Iskut Mine Road for 23 miles.

Without making a site visit to view the proposed route alternatives, this report has relied on the documentation of previous studies. The 1988 Southeast Alaska Transmission Intertie Study – Tyee/Johnny Mountain Transmission Line Study[13] provides significant detail in transmission line routing, environmental, and construction standards. The US Department of Transportation's Bradfield River Road Final Scoping and Pre-NEPA Engineering Feasibility Study, dated January 10, 2005, provided great detail in the proposed alignment of the Bradfield River Road which will follow the approximate alignment of the Bradfield Intertie to the Canadian border.

History

The Bradfield Canal region has been the subject of numerous transportation and transmission studies over the years. The Bradfield Canal region was originally proposed as a transportation

[13] Alaska Power Authority, Southeast Alaska Transmission Intertie Study, Addendum 1, Tyee/Johnny Mountain Transmission Line Study - Draft, prepared by Harza Engineering Company, dated April 1988.

corridor to provide a land-based "road" link between Southeast Alaska and the interior of BC. This transportation link was intended to support mining and faster movement of seafood and timber products to market. In addition, it also was intended to provide access for the export and import of electrical energy from Southeast Alaska through the construction of a transmission line interconnecting the BC hydro power grid with Southeast Alaska.

The Bradfield route began to receive serious attention in the late 1980's as the result of mining activity in the Iskut River area. The area of interest was known as the Johnny Mountain mining development. Bradfield Electric, Inc. along with the Alaska Power Authority made studies and prepared feasibility cost and design estimates for a transmission line along the Bradfield Canal and Bradfield River.

A Presidential Permit, Number PP-87, was granted to Bradfield Electric, Inc. for the purpose of constructing and maintaining an electric transmission facility that would cross from Alaska into British Columbia. The permitted project was to have had a 60 foot wide right-of-way with hazard trees felled to a distance of 100 feet from the center line. Pursuant to the Presidential Permit, the expected maximum power transmission was to have been 5 MW over this line.

The US Forest Service, Tongass National Forest, Wrangell Ranger District provided an Environmental Assessment and a Finding of No Significant Impact for Bradfield Electric transmission line in 1988. Although this transmission line was never constructed, the Presidential Permit was amended in 1999 by the US Department of Energy (DOE) to include the provisions of FERC Order 888 for open access transmission[14].

Because of the potential economic benefits to Alaska from the proposed export of surplus electrical energy and the interest in a road to the Iskut area, in 1990 the Alaska Legislature passed House Bill 311, authorizing the issuance of revenue bonds for up to $ 22.3 million for construction of a Bradfield River resource road.

Recent studies examining the feasibility of constructing a road and transmission power line through the Bradfield Canal include:

Transmission Line Studies

- *Tyee / Johnny Mountain Transmission Line Study*, Draft, prepared by Harza Engineering Company for the Alaska Power Authority, April 1988. The study concluded that the appropriate operating voltage for the exportation of power was 69-kV. If the line was to be utilized in the future for importing power from Canada, the transmission line and required substation facilities should be constructed to the 138-kV standards similar to the Lake Tyee system. It was determined the capacity of the line in an importation role could be as high as 95 MW at 138-kV with 336.4 KCM "Oriole" ACSR conductors. A right-of-way width of 40-foot was recommended with danger trees being selectively cleared.

- *Proposed Johnny Mountain 69-kV Transmission Line, Project Concept Summary*, prepared by R.W. Beck and Associates, Inc. for Bradfield Electric Inc., August 26, 1988.

[14] Federal Register Vol. 64, No. 143, Tuesday, July 27, 1999.

The study concluded the appropriate operating voltage for the exportation of power was 69-kV. The transmission line would extend from the Lake Tyee powerhouse at tidewater on Bradfield canal up the Bradfield River Valley in the US and down the Craig River Valley in Canada to the area known as Johnny Mountain, a total distance of 42 miles. The line was proposed as a single wood pole, single circuit 69-kV capable of transmitting up to 10 MW. The conductor selected was 4/0 ACSR. A right-of-way width of 30-foot was recommended with danger trees being selectively cleared.

Both of these transmission line studies followed essentially the same route and corridor. The Harza study, dated April 1988 indicates that limited site reconnaissance was conducted for the study. "Site Reconnaissance" was indicated to have been a visual inspection of the proposed transmission line route by the Alaska Power Authority's project manager, an electrical engineer, and an environmental specialist from Harza. In addition to the above mentioned team, Harza met with USFS representatives, Alaska Department of Fish and Game, and U.S. Fish and Wildlife Service, and representatives of Bradfield Electric Inc. It is our opinion Harza's study presents important information and is also supported by the companion R.W. Beck study that was performed during the same time frame in 1988.

Previous and Current Road Studies

- *Bradfield River Road Final Scoping and Pre-NEPA Engineering Feasibility Study* prepared by Western Federal Lands Highway Division, Federal Highway Administration, January 10, 2005. The total length of this transportation route varies between 27.47 miles, 29.09 miles, and 32.20 miles dependent on the option used for Segment 1 of alignment. A major component of this conceptual design contains a proposed 8,000 linear foot tunnel. The conceptual cost estimate developed by this study and the Alaska Department of Transportation and Public Facilities (DOT/PF) presents a variance of costs ranging from approximately $ 175,532,200 up to $ 353 million. The analysis and recommendations by the various agencies illustrate that many other alignments are feasible and are being analyzed during the NEPA process.

- *The Southeast Alaska Transportation Plan,* prepared by the Alaska Department of Transportation and Public Facilities, dated August 14, 2004 includes the Bradfield road and various related developments. The cost of the road project is estimated at $257 million for the 28 miles to the border.

- In 1998, The US Department of Agriculture Forest Service estimated the cost of a public highway from Ketchikan to the border at $340 million. The USDA Forest Service reviewed a wide range of Southeast Alaska proposed public road and ferry projects. Their estimate for 14 miles of new road and 14 miles of upgrading an existing forest service road from Bradfield to the border was $140 million.

Recommended Transmission Line Corridor

Based on our preliminary knowledge and a literature search of the project vicinity and, in coordination with the DOT/PF, we recommend a single transmission line corridor for the Energy

Export Study. This selected corridor is very similar to the proposed road alignment considered by DOT/PF in 1986. The corridor, which follows the North Fork of the Bradfield River and South Fork of the Craig River from the head of Bradfield Canal, corresponds to Bradfield Electric's proposed route identified in 1988. (See Figure 1-1)

We have independently investigated the reports discussing the Bradfield region, made literature searches of previous development proposals and activity in the area and concluded the previously proposed Bradfield Electric transmission corridor will support the construction of a 138-kV transmission line.

The area in which the Bradfield Intertie will be located is typical of Southeast Alaska with rugged, forested terrain crossed by numerous creek or river drainages. To be consistent with previous transmission and highway studies, the route identified for the Bradfield Intertie follows two major river valleys for a large portion of the route. The route description is divided into five segments based upon terrain and construction access. A route map is included at the end of this section.

Definitions – Low altitude - below 600' elevation
High altitude - above 600' elevation

Segment A

This segment is approximately 2.2 miles in length generally paralleling an existing road and extends from the Lake Tyee switchyard to the Bradfield River East Fork. The entire segment is below 100 feet elevation, with soils anticipated to be mostly alluvial or glacial till deposits. The area crossed by Segment A has been clear cut logged in the past, and the majority of existing vegetation is alder with some interspersed cottonwood.

Attributes:

- Parallels an existing road from the Lake Tyee switchyard to East Fork Bradfield River
- Clearing requirements

  100' with removal of danger trees

  This area has been previously cleared. Mostly alder.
- Low altitude construction

Segment B

This segment is approximately 11.6 miles in length and extends from the crossing of the East Fork Bradfield River to a crossing of the North Fork Bradfield River. The segment is generally located in the river valley bottom paralleling the river. The majority of the segment is at the foot of the valley's eastern slope. A few short sections, however, may cross individual ridge fingers. An old network of logging roads exists in the area of the river and could be utilized with minor brush clearing. This segment is below 500 feet elevation with soils anticipated to be alluvial or glacial till deposits, although some areas of muskeg or shallow rock are expected. The area crossed has been clear cut logged in the past, and the majority of existing vegetation is Alder, with some interspersed Cottonwood and a few stands of Hemlock forest.

- Crosses East Fork Bradfield to North Fork Bradfield
- Located near river bottom (above flood stage). Line would parallel river.
- There appear to be a number of old logging roads, which are overgrown and would need to be re-established with gravel and culverts where washed out. Area appears to have been "clean cut" in years past. New growth of Alder and some Hemlock.
- Hill sides may pose some risk – will need to selectively remove all danger trees from this area
- Low altitude construction

Segment C

This segment is approximately 4.7 miles in length and extends from the crossing of the North Fork Bradfield River to the confluence of the east and west branches of the headwaters for the river. The segment is generally located in the river valley bottom paralleling the river, however, for a portion of this segment the valley bottom has significant slope, resulting in the line advancing upslope with an elevation gain from 300 to 1,000 feet. In addition, the terrain is more rugged due to the presence of more closely spaced ridge lines. Roads do not exist along this segment and access by helicopter is anticipated. This segment is at elevations ranging from 400 to 1,000 feet, with soils anticipated to be shallow rock with some areas of deeper stands of Hemlock forest.

- High Altitude Construction
- There is no evidence of previous logging nor are there old logging roads.
- Anticipate steep side slopes and rock with some shallow glacial till.
- Trees are dense Spruce.
- Helicopter access required – no roads
- Classify this segment as moderate rugged.
- This segment contains many challenges for construction of the transmission line. Steep valley slopes and granitic rock will make mobility and construction work difficult.

Segment D

This segment is approximately 3.3 miles in length and extends along the eastern branch of the Bradfield River headwaters and climbs from 800 feet elevation to 2,600 feet in order to cross the pass between the Bradfield and Craig River Valleys. The segment advances up a steep slope, paralleling the drainage over rolling terrain which is very rugged in the immediate vicinity of the pass. Roads do not exist along this segment, and access by helicopter is anticipated. This segment is generally at elevations from 1,000 to 2,400 feet, with soils anticipated to be shallow rock with some areas of deeper glacial till and numerous areas of muskeg. In the immediate pass area much of the terrain is comprised of surface rock. The vegetation along this segment is sparse Hemlock stands.

- This area has exposed slopes vulnerable to possible avalanche, granitic rock, and some shallow glacial till.
- This will be a helicopter access area.

- There are no roads.
- Sparsely forested with some Spruce and Hemlock.

Segment E

This segment is approximately 4.7 miles in length and extends from the pass between the Bradfield and Craig River Valleys, along the Craig River to the U.S. – Canada border. This segment generally follows along the valley floor above flood level. The majority of the segment is at the foot of the valley side slope. However, a few shot sections may cross individual ridge fingers. Roads do not exist along this segment, and access by helicopter is anticipated. This segment is generally at elevations from 700 to 1,000 feet, with soils anticipated to be alluvial or glacial till deposits with some areas of muskeg or shallow rock. The vegetation along this segment is sparse Hemlock stands on the valley bottom with denser Hemlock forests on the side slopes.

- This will be a helicopter access area unless it can be accessed from the British Columbia (Forrest Kerr) area. There is an abandoned air strip and some buildings that were apparently used in the exploration of the Johnny Mountain mine.
- It can be expected that a portion of this line would be built on side slopes and extend over ridges or small areas of land jutting into the river bottom.
- Some high altitude construction
- Helicopter construction required
- Sparse to dense Spruce

Transmission Design Concepts

Transmission Voltage

The Lake Tyee project supplies the load demand of Wrangell and Petersburg. The power flow from Tyee to these communities is via an existing 69-kV / 138-kV overhead transmission line with 138-kV submarine cable crossings. It should be noted this existing transmission line is operated at 69-kV. The step-down transformers at Petersburg and Wrangell are dual rated on the high side for 69-kV / 138 kV. There are no current plans to upgrade this existing line from 69-kV to 138-kV operation.

Figures 2-1 shows a “one-line” sketch of the existing Lake Tyee system network and the study to interconnect Lake Tyee to the Bradfield Intertie. In addition, the proposed interconnection of the Tyee system and Swan-Tyee Intertie systems is shown.

A previous load flow study made in support of the feasibility study for the Kake/Petersburg Transmission Line, indicated that the existing operation of the Tyee – Wrangell – Petersburg transmission line can remain at 69-kV. The possible upgrade of this line to 138-kV will come about due to load growth or the need to move or export power from a future energy source. One such source of interest is the proposed 95-MW Thomas Bay hydroelectric project located across

Frederick Sound from Petersburg which would require a submarine cable, substation, and terminals to link into the existing Tyee / Petersburg grid.

The export of energy via the Bradfield Intertie was studied as a 69-kV and 138-kV line. A 230-kV line was discounted early in this study as there is no plan for a grid on either side of the border in the near future to support such a consideration. However, BCTC has recently completed a study evaluating system power transfer capabilities on the Canadian side of the border if a 287-kV transmission line were constructed. If such a voltage were to be a serious consideration in BC, it would be necessary to reconsider the voltage on the Alaska side of the border.

CMP has solicited bids for construction of a 138-kV transmission line from Meziadin Junction to the Forrest Kerr hydroelectric station transmission facility and announced plans to have the line completed by 2008. Both CMP and BC Hydro feel there is merit to interconnect the Southeast Alaska electric system to the Canadian grid. To verify this, BCTC has commissioned a mini-study to review the issues of stability. It should be noted that the transmission system proposed by CMP for the Forrest Kerr project will have a design capacity of 240 MW. The estimated generation capacity of the Forrest Kerr project is 115 MW.

If the Bradfield Intertie were designed and constructed for future operation at 138-kV, it could additionally be used to bring power from the Forrest Kerr hydroelectric project to the Lake Tyee substation and into the Tyee grid. Further, 138-kV is the proposed for the Southeast Intertie System.

Voltage and conductor options considered for the Bradfield Intertie are:

- Option 1 – 69-kV transmission line, 26.4 miles long – 556.5 ACSR (Dove), single wood pole, with post insulators, estimated line capacity 82 MW

- Option 2 – 138-kV transmission line, 26.4 miles long – 336.4 ACSR (Oriole), single wood pole, with Davit arm, estimated line capacity 165 MW

- Option 3 – 138-kV transmission line, 26.4 miles long – 954 ACSR (Cardinal), single wood pole, with polymer post, estimated line capacity 249 MW

It is recommended that the Bradfield Intertie be constructed at 138-kV and operated at 69-kV until such time the system loads will place demands to upgrade the Tyee Grid to 138-kV. The cost estimate for this option includes the cost to place a “step-up” substation at the Forrest Kerr project area since the CMP system will be operating at 138-kV. It is estimated that this 69-kV/138-kV voltage level will allow the export of approximately 105 MW. The final selection of the conductor for the line would be dependent on the expected power flow requirement of the line.

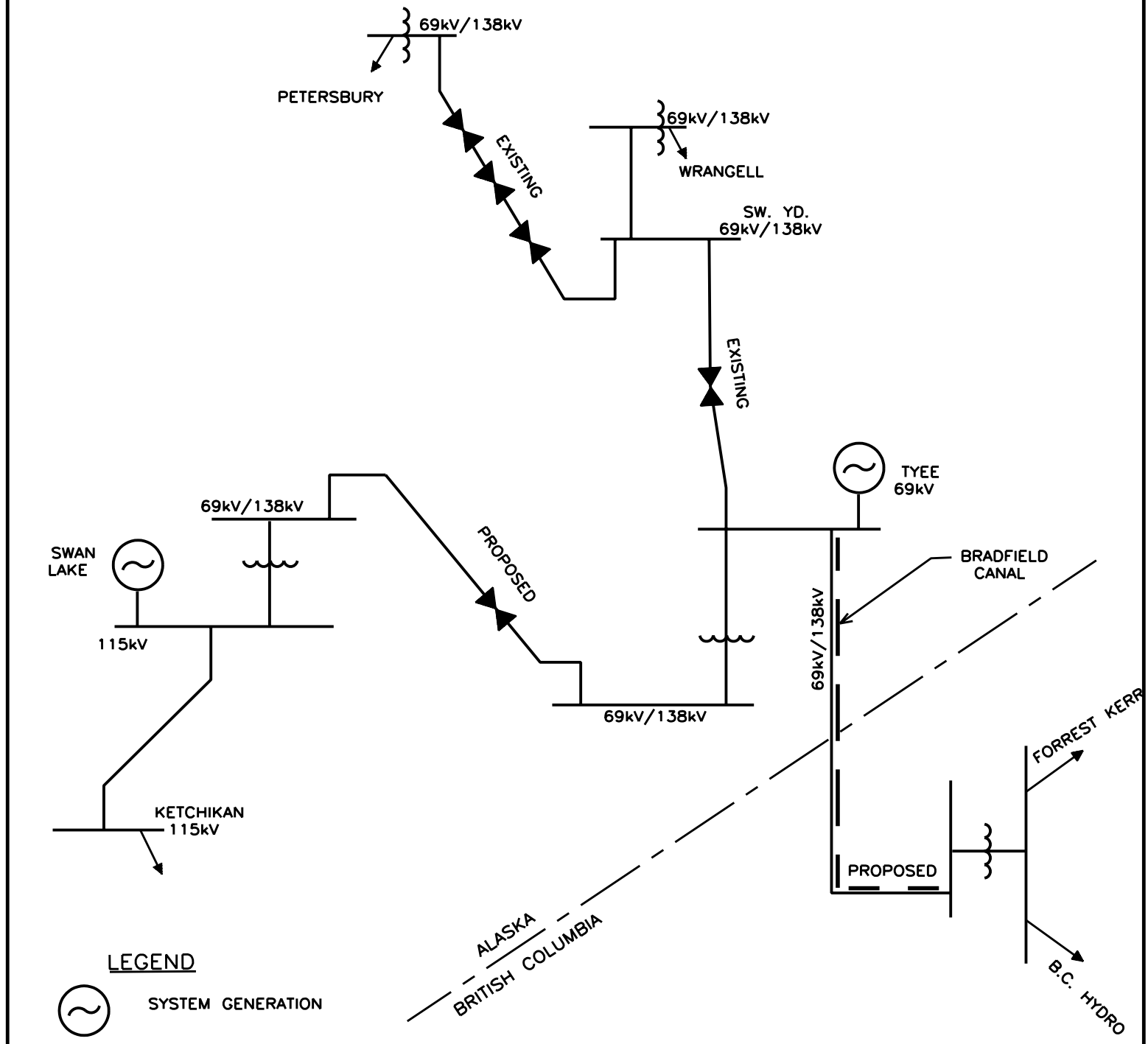
Physical Loadings

The basic design criteria for this line are considerably more stringent than standard code requirements. This is appropriate due to the severe Southeast Alaska conditions, remoteness of the line and history of lines in the immediate area. The conceptual design criteria have been developed with the intent of having a slightly conservative design based on a 50-year recurrence period for wind and ice loading. A potential transmission line in the Bradfield region has had the benefit of being considered by several engineering firms in the past.

The Bradfield Intertie is proposed as a single wood pole, single circuit 69-kV/138-kV line. It is to be located in a sub-artic environment that experiences relatively mild weather during spring, summer, and fall, marked with extended rainy periods. The severity of winter weather is directly affected by elevation, with much of the proposed route commonly experiencing snow accumulations up to 6-8 feet for a portion of the winter. A short section, approximately 7,000 feet, of the route is in a pass area at elevations over 2,000 feet, where snow accumulations of 8-10 feet are anticipated to last for several months. For this study, the following loading criteria were assumed:

a. National Electrical Safety Code (NESC) Heavy Load
   4 psf wind (40 mph)
   ½ inch radial ice
   0 degrees F
   with NESC specified overload capacity factors
b. Extreme Wind Loading: NESC 2002
   34 psf wind (120 mph)
   no ice
   60 degrees F
   with overload capacity factor of 1.3
c. Extreme Ice Loading:
   Pass area
     no wind
     1-inch radial ice
     30 degrees F
     with overload capacity factor of 1.3
   Non-pass area
     no wind
     ¾-inch radial ice
     30 degrees F
     with overload capacity factor of 1.3
d. Extreme Combined Ice & Wind:
   4 psf wind (40 mph)
   31/4-inch radial ice
   -10 degrees F

The structure concepts used in our estimate(s) and design consideration are shown in Figures 2-2, 2-3 and 2-4.



SOUTHEAST CONFERENCE
"PROPOSED BRADFIELD CANAL"
SYSTEM ONE-LINE

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	TSS	TSS	--

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CAI **COMMONWEALTH ASSOCIATES INC.**

JACKSON, MICHIGAN LA CONNER, WASHINGTON

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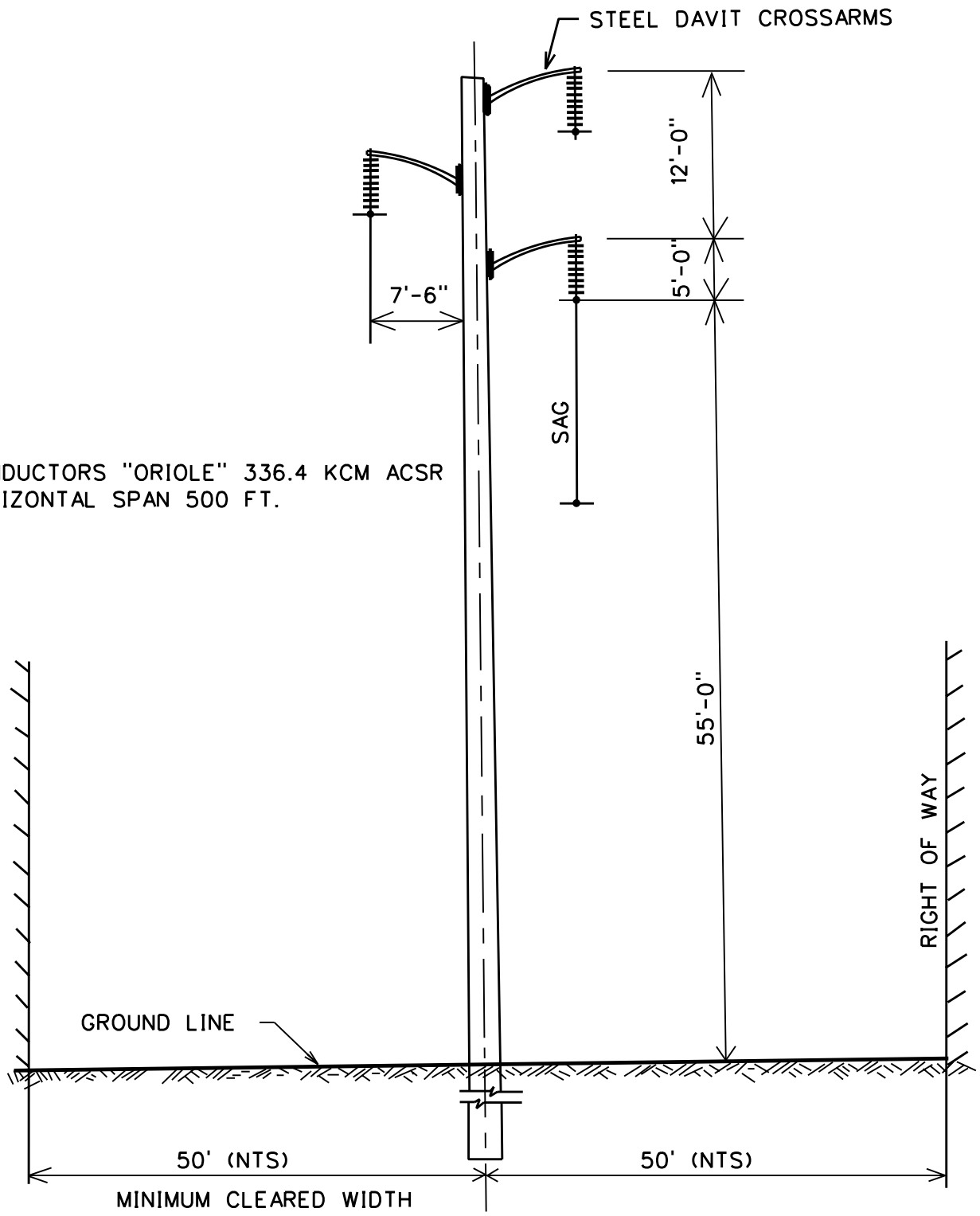

CONDUCTORS "ORIOLE" 336.4 KCM ACSR
HORIZONTAL SPAN 500 FT.

MINIMUM CLEARED WIDTH
OF 100 FT.

SOUTHEAST CONFERENCE
"PROPOSED BRADFIELD CANAL"
138kV WOOD POLE
TANGENT STRUCTURE

NOTE:

1. RIGHT OF WAY WIDTH, 100 FT.
2. ROW ACREAGE, 12.1 AC/MI.

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	DKS	TSS	TSS

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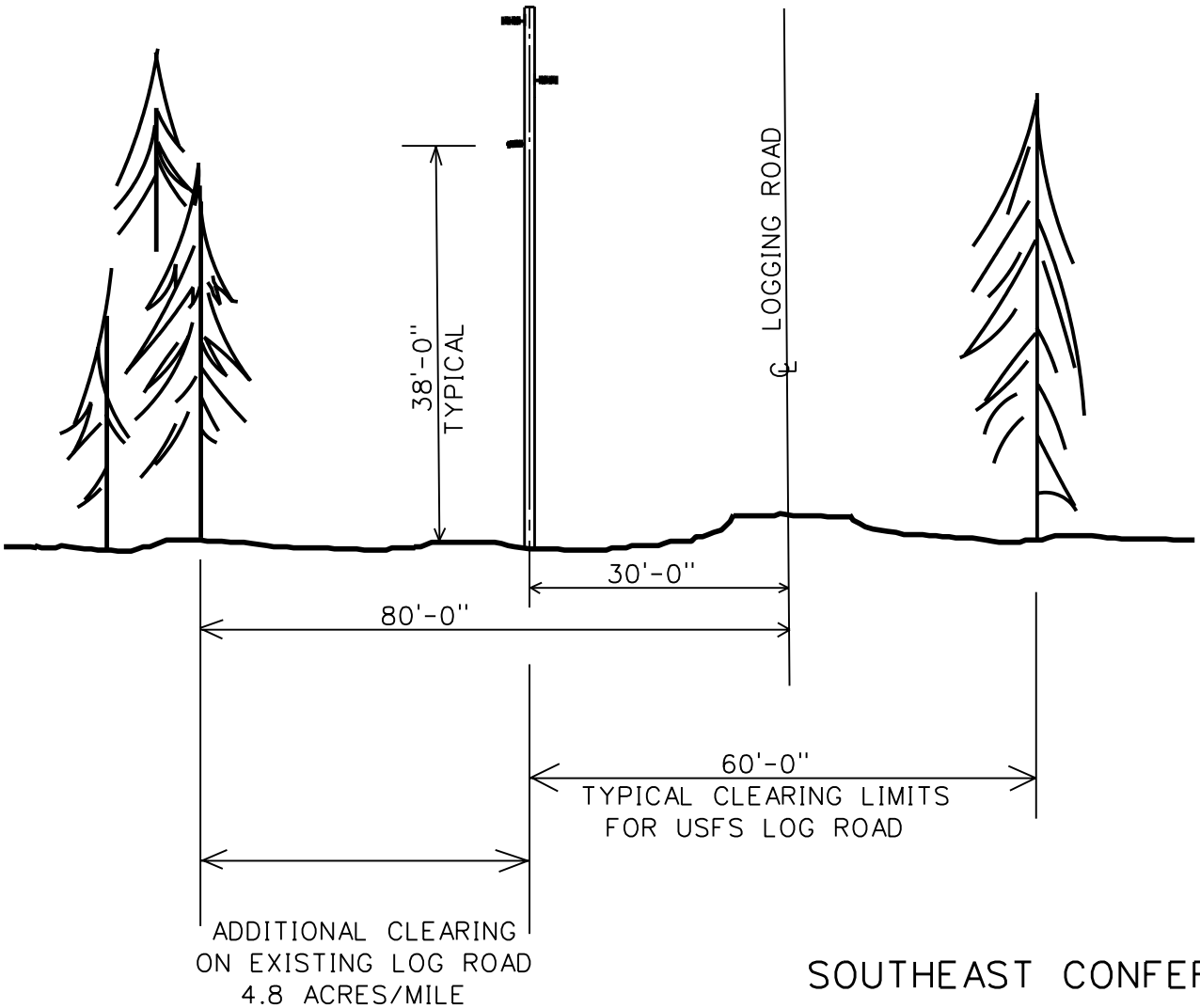
CONDUCTOR 336 KCM ACSR
HORIZONTIAL SPAN: 400'



SOUTHEAST CONFERENCE
"PROPOSED BRADFIELD CANAL"
138kV WOOD POLE
TANGENT STRUCTURE

EMBEDMENT:
- ROCK 10% POLE PLUS 2'
- MUSKEG 10% POLE PLUS 4'

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	DKS	TSS	TSS

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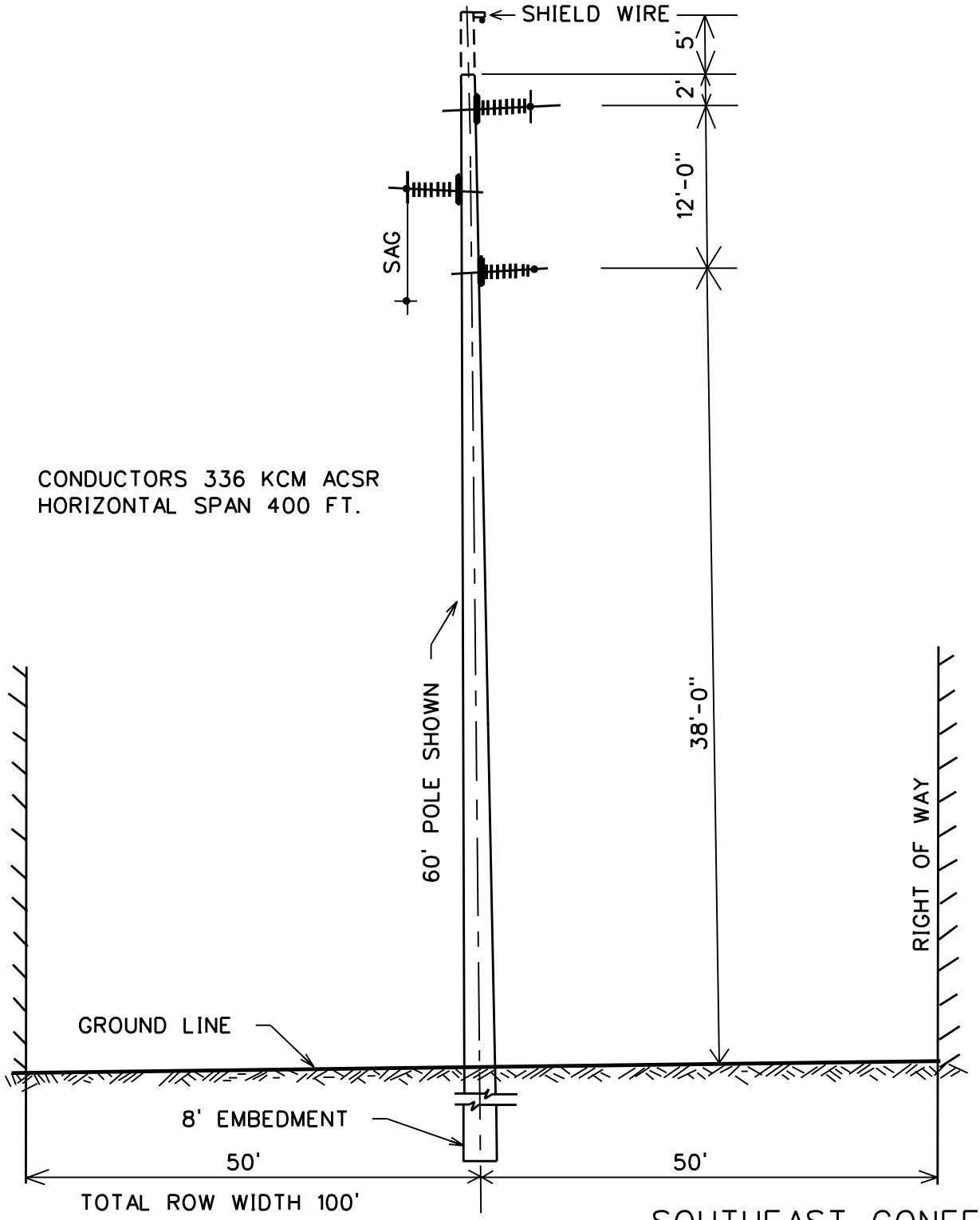

SOUTHEAST CONFERENCE
"PROPOSED BRADFIELD CANAL"
138kV WOOD POLE
TANGENT STRUCTURE

TYPE T1- TANGENT

TYPE T2- TANGENT W/SHEILD

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	DKS	TSS	TSS

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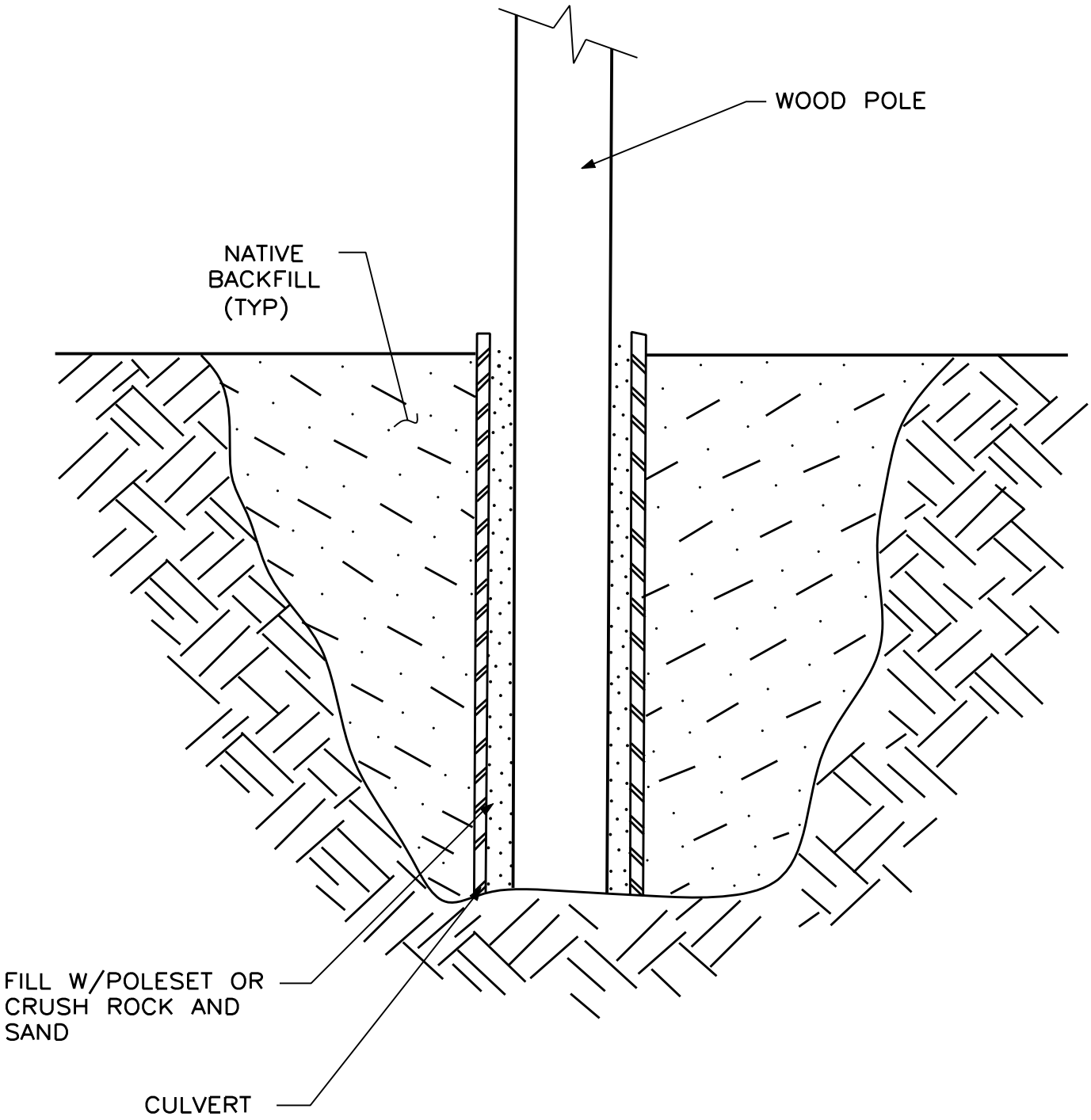

SOUTHEAST CONFERENCE
"PROPOSED BRADFIELD CANAL"
TRANSMISSION LINE
STRUCTURE SETTINGS CONCEPT

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	TSS	TSS	--

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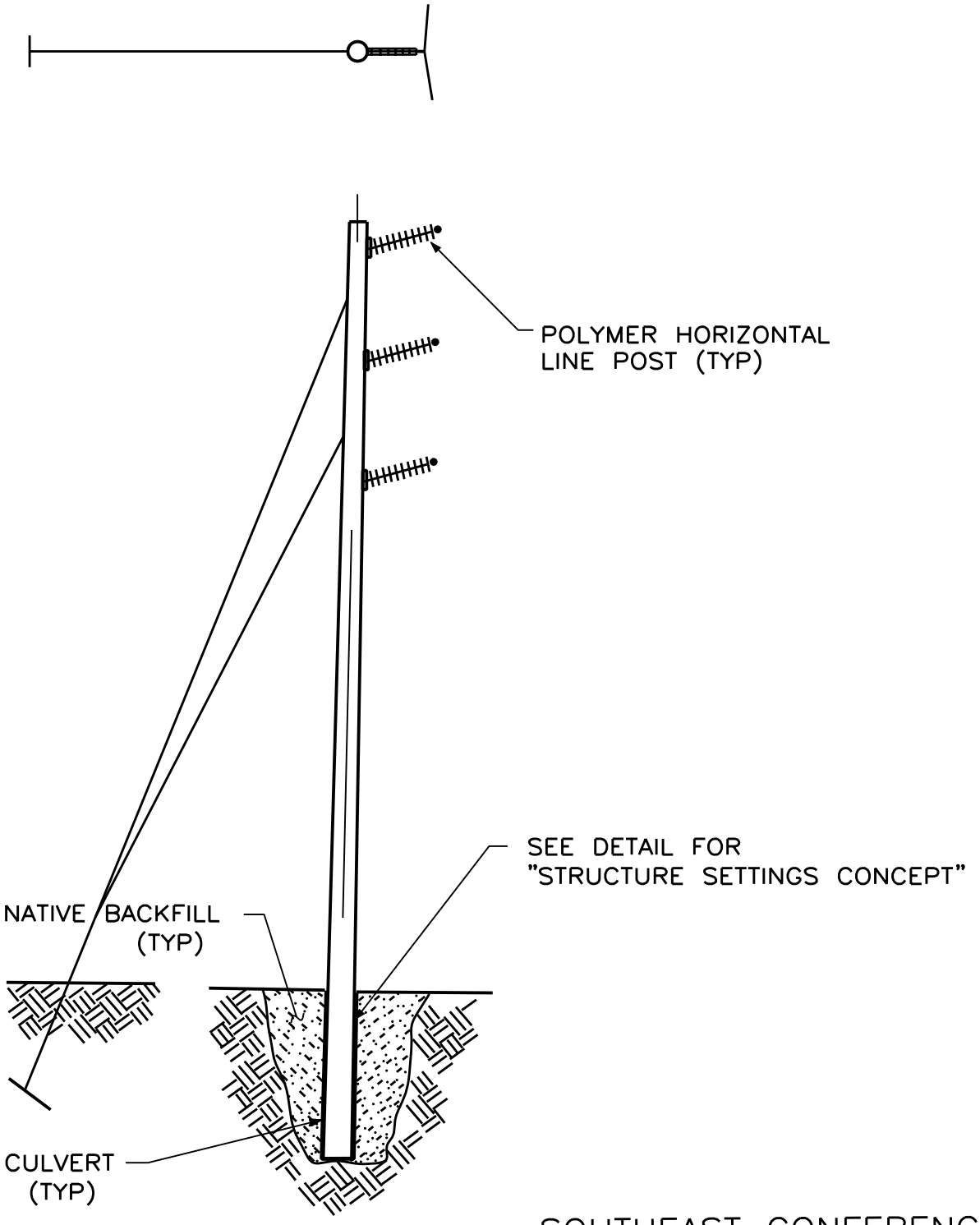

TYPE A1
LIGHT ANGLE
(0–15°)

SOUTHEAST CONFERENCE
"PROPOSED BRADFIELD CANAL"
STRUCTURE TYPE A1

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	TSS	TSS	--

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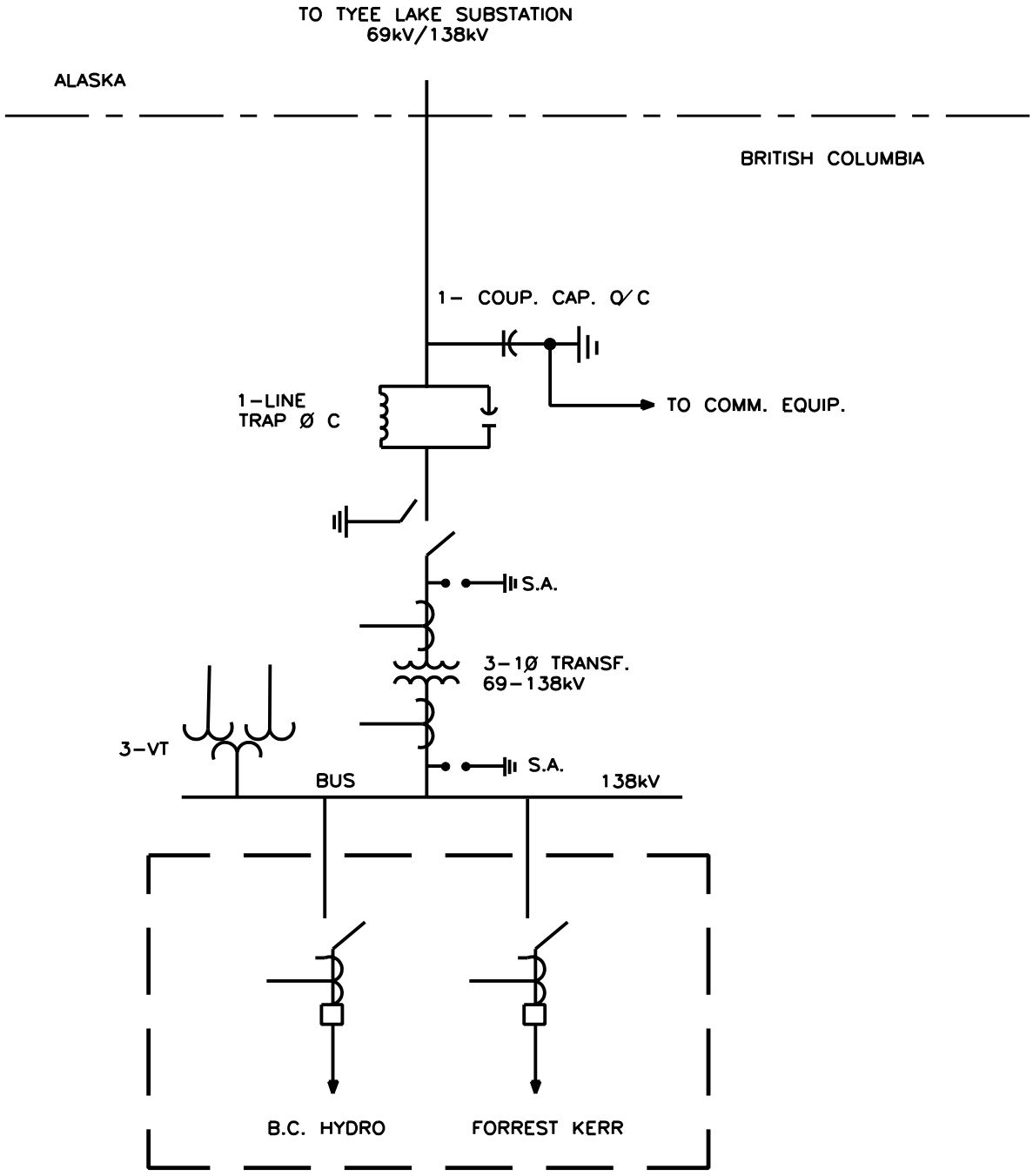

SOUTHEAST CONFERENCE
"PROPOSED BRADFIELD CANAL"
SUBSTATION
ONE-LINE DIAGRAM

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	TSS	TSS	--

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Environmental Issues

Introduction

A limited review of environmental issues associated with the Bradfield Intertie has been conducted as part of this study. The connection of the Bradfield Intertie to the BC Hydro transmission grid will require the construction of new transmission facilities in BC. Close coordination with the Ministry of Forests and Lands in Canada will need to be conducted to assure that the overall Southeast Alaska – BC Hydro transmission line complies with all environmental requirements.

As indicated earlier in this report, an Environmental Assessment (EA) was prepared in 1988 with regard to the previously proposed Bradfield Electric, Inc. 69-kV transmission line to Johnny Mountain. The Bradfield Intertie is proposed to follow essentially the same route as the Bradfield Electric transmission line. In the EA, it was noted that approximately 13 miles of the transmission route would pass through Land Use Designation (LUD) area designated as LUD IV whereas the remainder of the route would pass through LUD II designated area. The Tongass Land Management Plan (TLMP) allows power developments within both LUDs.

The scope of the 1988 EA, prepared by the US Forest Service (USFS), addressed the impact of the project on the environment and National Forest resources including:

- Potential disruption of goats during spring kidding by increased noise levels from construction activities and helicopter use.
- Potential raptor electrocution and other bird strikes with power transmission lines.
- Abandonment and cleanup requirements and reclamation bonding.
- Potential bear/human conflicts during construction and maintenance.
- Potential for right-of-way slash to inhibit wildlife movement.
- Potential for landslides caused by blasting for power transmission pole holes on unstable slopes.
- Locating power transmission poles within the active river floodplains.

In its Finding of No Significant Impact (FONSI), the USFS adopted the proposed "Short Span Power Line" alternative. This alternative provided for a transmission line with pole supported short spans, with construction similar to the Tyee transmission line along the Mitkof Highway into Petersburg. The transmission line was to be built on the valley bottom and/or along the toe slopes and could have single or multiple pole wood structures or similar appearing steel structures as required by location.

Affected Resources

The proposed Bradfield Intertie will follow the Bradfield River drainage, a glacial river valley, which would cross into the Craig River drainage. The most obvious environmental impacts will be related to wetlands, fish and their habit, and water quality. Due to the remote location and the pristine condition of the area (beyond the end of the abandoned USFS logging road and clear cuts), wildlife habitat, riparian zones and aesthetics resources will receive more attention from the resource management agencies than they would in more highly disturbed and populated areas.

The Bradfield River Valley supports a wide variety of wildlife. Big game animals include brown and black bears, mountain goat, and wolf, moose, and Sitka black - tailed deer.

- **Furbearers** – beaver, wolverine, marten and land otter. ADFG maps indicate that marten are the most frequently trapped of the furbearers. Moose and Sitka black-tailed deer are also shown throughout the valley.

- **Bear** – The Bradfield River drainage supports a large number of both black and brown bear, with black outnumbering browns roughly 2:1 (Low, 1988). The mouth of the Bradfield River is a spring feeding area for both blacks and browns during the salmon spawning season. This area extends up the river approximately 15 miles to a point just north of the location where the North Fork turns to the east.

- **Waterfowl** – The mouth of the Bradfield River is designated as a spring / fall waterfowl concentration area. Trumpeter swans use this area as a wintering location (ADFG 1983). Up the river valley, beaver ponds create off-channel habitat that is also used by waterfowl.

- **Eagle Nest Sites** – No surveys has been done for the river drainage and there are no eagle nest sites known to exist above the head of the Bradfield Canal (Lowe 1988).

The Alaska Department of Fish and Game (ADF&G) have reported that the Bradfield River contains all five species of salmon (Chinook, Coho, Chum, Sockeye, and Pink), Steelhead, Cutthroat trout, and Dolly Varden char. The presence of salmon, trout and char designate this river as an anadromous stream. There are relatively narrow mid-summer in-water work windows in such streams that could have a significant effect on the timing of construction for structures in the water." (*Bradfield River Road Scoping and Pre-NEPA Engineering Feasibility Study,* November 2004). The Craig River is also considered an important anadromous fish stream.

It is known that there is a natural barrier (waterfall) to fish migration at approximately river mile 14 on the Bradfield River. Upstream of that waterfall, there are no anadromous fish and as a result, there will be fewer fish related restrictions on construction related activities.

The primary land owner in the vicinity of the Bradfield Intertie, the U.S. Department of Agriculture, is responsible for the management of the Tongass National Forest, within which lies

the land for the proposed corridor under consideration. For an overhead utility corridor with an adjacent maintenance road, important management prescriptions include:

- Construction of the transmission lines (poles) per the USFS design criteria to minimize avian resource loss and minimize impacts to scenic viewsheds
- Maintenance of culverts and bridges associated with roadways to minimize aquatic resource impacts
- Avoidance of heritage resources
- Avoiding, minimizing, and possible mitigation of wildlife habitat fragmentation from construction of new roads.

Other general issues along the proposed route of the Bradfield Intertie include:

Stream crossings – Anadromous streams crossed would require a permit from DNR—OHMP. The utility pole placement is expected to avoid streams but the maintenance roadway would likely be culverted or bridged. These roads and their associated culverts and drainages would be required to be placed and constructed per the TLMP transportation prescriptions.

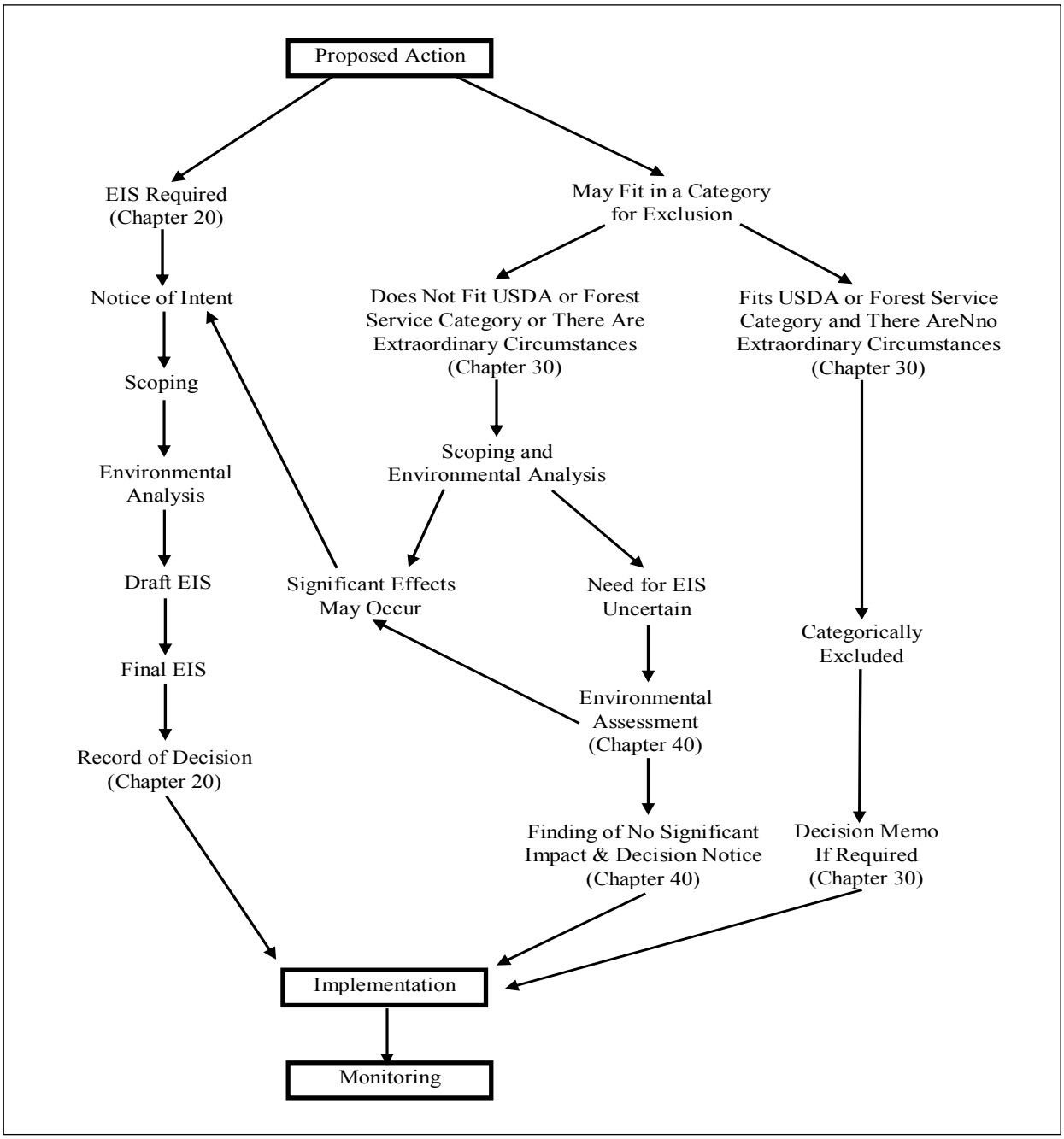
Avoidance of stream crossings where possible and minimization of impacts would be expected as part of the NEPA process. For those unavoidable locations, some sort of mitigation is generally required. Upgrading existing failing culverts, drainages, and other stream structures that would occur during project implementation could be counted as mitigation.

Eagle nests – Eagles and their nests are under the protection of the US Fish and Wildlife service. Nest trees may not be removed and if construction would occur within a certain distance of a nest tree, construction windows may be applied as a permit condition or observers could be required during construction.

National Environmental Policy Act Process

Figure 3-1 diagrams the National Environmental Policy Act (NEPA) process as implemented by the U.S. Department of Agriculture/U.S. Forest Service (Forest Service Handbook, 1909.15, page 13 of 15; Approved: June 29, 2004).

FIGURE 3-1
NEPA Process Overview



Under NEPA, if a project is not allowable under a categorical exclusion and there is uncertainty regarding the potential impacts, the project proponent can conduct an Environmental Assessment (EA). In some cases, if a corridor is a designated utility corridor, an EA could be considered adequate to verify that a proposed transmission line project is compatible with that designation.

However, under the current NEPA implementation protocols of the U.S. Forest Service, the EA and Environmental Impact Statement (EIS) processes are becoming more similar and the threshold for what could be significant is dropping[15]. The U.S. Forest Service recommends that a proponent expect their project be analyzed under the EIS process, thus removing the uncertainty of the overall process.

Summary

Assuming proper construction procedures and appropriate mitigation measures are followed, construction of the proposed Bradfield Intertie should not present significant impacts to fish and wildlife resources. Extensive changes in habitat types are not anticipated and most impacts will be short-term as they are associated with construction. CMP, potential developer of the transmission line in BC that will connect the Bradfield Intertie to the BC Hydro grid, has indicated that it does not foresee any significant environmental constraints associated with construction of the transmission line between the Forrest Kerr hydroelectric project and the Bradfield Intertie connection point at the border.

[15] Personal communication D. Rogers, U.S. Forest Service with J. Gendron, CH2M Hill; July 20, 2005.

Estimated Costs of Construction and Operation

Costs of Construction

The costs to develop and construct the Bradfield Intertie have been estimated for each of four configuration alternatives. The cost estimate is based on an estimate of the required material quantities as determined from a conceptual design of the overhead sections of the line and substation and switchyard requirements. Labor costs have been estimated based on recent experience on similar projects as well as discussions with individuals familiar with transmission line construction in Southeast Alaska. The estimated unit costs of materials are based on quotes from vendors and recent experience with similar construction projects.

The estimated costs of the Bradfield Intertie alternatives as provided in this section of the report include all estimated costs of engineering and design, permitting, materials, equipment and construction. Primary components of each line are identified separately in the cost estimate. Since the design of the Bradfield Intertie is still conceptual, a contingency factor of 30% has been applied to all costs. As design proceeds and more precision can be used in estimating the costs, the contingency included in the total cost estimate can possibly be lowered. In any major project of this type, however, the actual cost of construction can very significantly from the engineer's estimate due to market conditions for the materials and services needed at the time of procurement.

The cost estimates included in this report are based on the routing and technical information described in Section 2. Primary characteristics of the line are 138-kV single-pole construction. It is expected that the owner of the transmission lines, will contract for all services of permitting, design, construction and construction management. An allowance for the costs of these services is included in the total cost estimate.

The four configuration alternatives are differentiated primarily be line voltage and conductor size. The larger conductor would allow a greater power transfer but would require more structural strength in the support system. The tunnel option assumes that a permanent road is built either first or concurrently with the transmission line and a tunnel for the road is constructed between the Bradfield and Craig River valleys. As proposed by the US Department of Transportation in its Bradfield River Road Final Scoping and Pre-NEPA Engineering Feasibility Study, the tunnel is estimated to be about 8,000 feet in length.

With the road and tunnel in place, the transmission line would be placed in the tunnel, most likely as a cable buried in the road bed. With the tunnel, the transmission line would not be constructed as an overhead line crossing the pass between the Bradfield and Craig River valleys, thereby avoiding a potentially vulnerable overhead location for the line. The cost of the buried 138-kV cable, however, is higher than overhead construction and the additional construction costs would need to be weighed against the benefits of potentially lower long-term maintenance costs. The design configuration options included in the study are as follows:

- Option 1 – 138-kV – 556 ACSR (Dove), single wood pole, with Davit arm

- Option 2 – 138-kV – 954 ACSR (Cardinal), single wood pole, with polymer post insulators
- Option 3 – 138-kV – 556 ACSR (Dove), single wood pole with underground cable in the 8,000 foot long road tunnel
- Option 4 – 69-kV – 556 ACSR (Dove), single wood pole with polymer post insulators

The estimated total costs for each alternative are summarized in the following table. For the purpose of the cost estimates, a 30% contingency has been applied. Also, a 30% factor for indirect costs, including permitting, engineering, construction management, and owner's costs, has been included.

TABLE 4-1
Bradfield Intertie – Lake Tyee to Border
Estimated Comparable Costs of Development and Construction

		Option 1	Option 2	Option 3	Option 4
		138-kV	138-kV	138-kV Tunnel	69-kV
		556 KCM	954 KCM	556 KCM	556 KCM
Materials					
Transmission Poles		$ 1,010,880	$ 1,399,680	$ 942,840	$ 748,000
Insulators & Hardware (Polymer Post)		523,200	622,080	523,200	374,400
Guys & Anchors		212,000	212,000	202,000	212,000
Conductor w/Accessories		622,567	1,393,206	3,558,161	622,567
Other		186,888	261,332	186,888	186,888
Subtotal - Materials		$ 2,555,535	$ 3,888,298	$ 5,413,089	$ 2,143,855
Labor Cost		2,455,555	3,400,000	2,455,555	2,455,555
Incidentals		4,479,950	5,455,000	4,479,950	4,479,950
Bond & Insurance	5.0%	223,998	272,750	223,998	223,998
Clearing/Access Construction		1,952,000	1,952,000	1,886,000	1,952,000
Tyee Switchyard		1,200,000	1,200,000	1,200,000	850,000
Communications System		200,000	200,000	200,000	200,000
System Cut-Over		160,000	160,000	160,000	-
Patrol/Maintenance Repair		120,000	250,000	120,000	-
Subtotal		$ 13,347,038	$ 16,778,048	$ 16,138,592	$ 12,305,358
Contingency	30.0%	4,004,111	5,033,414	4,841,578	3,691,607
Indirect Costs (Permitting, Engineering,etc.)	30.0%	4,004,111	5,033,414	4,841,578	3,691,607
Total Cost		$ 21,355,260	$ 26,844,876	$ 25,821,748	$ 19,688,572

As shown in Table 4-1, the estimated cost of Option 1, 138-kV and 556 KCM conductor, is $21.4 million. Option 1 is the preferred alternative. Based on information provided by Canadian contractors and CMP, it is estimated that the cost of the transmission line between the border and the Forrest Kerr hydroelectric project is $17.4 million. The estimated cost of the line on the Canadian side of the border to the Forrest Kerr hydroelectric project is shown in the following table.

TABLE 4-2
Canadian Interconnection – Border to Forrest Kerr Hydro Project
Estimated Comparable Costs of Development and Construction
(US Dollars)

		138-kV 795 KCM
Materials		
Transmission Poles		$ 1,032,500
Insulators & Hardware (Polymer Post)		
Guys & Anchors		11,240
Conductor w/Accessories		1,400,000
Other		529,400
Subtotal - Materials		$ 2,973,140
Labor Cost		4,139,200
Incidentals		1,784,400
Bond & Insurance		-
Clearing/Access Construction		1,335,000
Tyee Switchyard		-
Communications System		-
System Cut-Over		-
Patrol/Maintenance Repair		-
Subtotal		$ 10,231,740
Contingency	40%	4,092,696
Indirect Costs (Permitting, Engineering,etc.)	30%	3,069,522
Total Cost		$ 17,393,958

Operation and Maintenance Costs

General

The following proposed operation and maintenance (O&M) program for the Bradfield Intertie is similar in scope to what is now being implemented on the Swan and Lake Tyee transmission lines. The following cost estimates assume a standalone O&M contract for the Bradfield Intertie, however, some savings may be realized if a single O&M contract is let for all three lines as a group. The primary O&M activities are:

- Right-of-way maintenance and clearing
- Thermographic survey
- Facility inspection and maintenance

Access to the line is a major cost item and is generally limited to helicopters. It has been assumed for this study that permanent helicopter landing sites will be developed during the construction phase and that these landing sites will be located along the line route and will provide access to all structures with no more that one-half mile required travel between a landing site and line structure. If permanent sites are not established during the construction phase, future O&M contractors will be required to build temporary sites, the cost of which is not included in the annual O&M cost in this study. If permanent sites are constructed, it is important that they be adequately maintained, preventing them from becoming either not usable or a safety hazard if they are used.

Portions of the line that are located near existing logging roads or water have a large access cost advantage since a barge can be located for fueling and staging of work that is in close proximity to the work site. The remoteness of the Bradfield and distance from water was considered in the cost estimates.

Annual Inspection and Maintenance Program

The proposed O&M program is based on providing a climbing inspection of ten structure sites each year. The sites would be selected to generally include a minimum of one from each structure type on the line. The site rotation would result in all structure types undergoing a climbing inspection every year and all structures on the line being climbed once every 20 years.

Climbing inspections will include a thorough visual inspection of the structure and all appurtenances. The climbing inspection team will also be required to perform routine maintenance. The inspection will require observing and recording the condition of the structure including foundation, guys, anchors, poles, arms, attachments, insulators, insulator hardware, conductor attachment hardware and dampers. The observations will include checking the condition of all bolts, nuts and cotter keys.

Based on the maintenance history of the Swan Lake and Lake Tyee lines, the dampers begin to fail at 10 to 12 years of service. Therefore, the proposed O&M program has assumed that dampers will be replaced on all structures undergoing a climbing inspection after the first 7 years. By year 15, over 40 percent of the dampers will have been replaced and the dampers that are being replaced can be inspected to determine if the damper replacement program needs to be maintained or accelerated. The cost estimate considers damper replacement starting in the eighth year.

The inspection program will need to carefully select the structures to be climbed based on the previous year's findings and consideration that more attention should be given to the high altitude and long-span structures. Failures in these areas can result in extended outage time and costly repairs.

Visual (on ground) Inspection

Visual inspections include correcting minor items that can be accessed form the ground, such as loose guys and missing or loose nuts and bolts. Binoculars will be used to inspect the tower and appurtenances not accessible from the ground.

The proposed O&M program is based on providing a visual (on ground) inspection of 20 structure sites each year. The 20 sites would be selected to generally include a minimum of one from each structure type on the line. The 20-site rotation combined with the proposed climbing inspection (of 10 sites each year) would result in all structure types undergoing a detailed inspection (climbing or visual) every 5 years.

Spare Materials

Most materials used on the Bradfield Intertie are long-delivery items. It has been assumed that, as part of the construction contract, sufficient spare materials for routine maintenance and any catastrophic failures that may occur will be purchased and stockpiled. These materials will include spare towers (all types), conductor, hardware, insulators, foundation materials, compression dead-end, guy wire, guy materials, dampers, armor rods, anchor rods and other minor materials.

Helicopter Survey

A helicopter review of all structure sites should be completed a minimum of once each year. The survey should be completed by an experienced lineman and should include a review of the conductor, insulators, structures, structure sites, helicopter landing sites, and right-of-way conditions.

Thermographic Survey

After the line is energized and placed under load, a thermographic survey of all connections on the line needs to be performed. The aluminum bolts connecting the jumper paddles on the dead-end structures can be "over torqued," leading to a bad connection and ultimate line failure. Ideally, this survey should be done just prior to the climbing inspections and every 5 years thereafter.

Right-of-way Clearing

A clearing and logging contract generally requires a width of 100 feet of clear-cut following the proposed transmission centerline. The clear-cut will be offset toward the uphill side to maximize its effectiveness. The clearing specification requires that, in addition to the clear-cut, all danger trees (any tree that could rotate about its base and strike the line) be removed.

Following a clear-cut, the first severe storm often takes out additional trees that were protected by the other trees prior to the clear-cut. These pre-construction storms will have eliminated many of the trees that were exposed by the clear-cut and thus should reduce the number of potential strikes in the early years of the line.

The very low-altitude sections of this line will require frequent clearing, as often as every 3 to 5 years. The alders, prevalent in this area, have been known to grow 5 feet or more per year. Above 500 feet, the conifers will grow at a much slower rate and require clearing on a less frequent cycle, approximately every 10 years. Clearing around helipads will be required every 3 years.

Catastrophic Failures

In addition to routine maintenance, certain catastrophic failures can occur periodically. Based on the experience of other transmission lines in the area, these failures could include long-span conductor drop, landslides, avalanches and tree strikes. The costs of repairing damage caused by these events can vary greatly depending on a number of factors.

Long-span conductor drop occurred on the Lake Tyee line when a compression dead-end failed. It is assumed there is a probability of this happening on the Bradfield Intertie at least once in the line's 30-year life.

Landslides and avalanches occur frequently in Southeast Alaska. Support structures (pole line) are not designed to withstand forces caused by these events. The routing of this line provides the primary avoidance mechanism for landslides and avalanche. Attempts were made to route the line away from known slide areas; however, outside factors do not allow complete free wheeling of the line route. The majority of the Bradfield Intertie is not in an area prone to landslides and avalanche.

Where the Bradfield Intertie is routed on steep slopes, the probability of a tree strike is high. Trees that roll downhill and hit towers, foundations, or guy wires could do severe damage. Mid-span conductor hits would do much less damage. A tree strike should be expected every 3 to 5 years.

Estimated O&M Costs

The estimated costs of O&M are shown in the following table.

TABLE 4-3
Bradfield Intertie
Estimated Costs of Operation and Maintenance
(2006 Cost Levels)

	Year 1	2	3	4	Year 5	6	7	8	9	Year 10	11	12	13	14	Year 15	16	17	18	19	Year 20	21	22	23	24	Year 25	26	27	28	29	Year 30
I. Yearly Inspection & Maintenance																														
Reflected in 2006 dollars.																														
A. Visual/Climbing Inspection	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250	$161,250
B. Spare Materials					$10,000					$10,000					$10,000					$10,000					$10,000					$10,000
C. First Year Helicopter Survey All Towers	$19,600																													
D. Thermo Graphic Survey	$18,000				$18,000					$18,000					$18,000					$18,000					$18,000					$18,000
E. Right-of-way Clearing	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000
II. Catastrophic Failures																														
Reflected in 2006 dollars.																														
A. Long Span Conductor Drop										$125,000										$125,000										
B. Landslide/Avalanche					$275,000										$275,000										$275,000					
C. Tree Strike					$110,000					$110,000					$110,000					$110,000					$110,000					$110,000
III. Annual Total	$318,850	$281,250	$281,250	$281,250	$694,250	$281,250	$281,250	$281,250	$281,250	$544,250	$281,250	$281,250	$281,250	$281,250	$694,250	$281,250	$281,250	$281,250	$281,250	$544,250	$281,250	$281,250	$281,250	$281,250	$694,250	$281,250	$281,250	$281,250	$281,250	$419,250

Power Supply Evaluation and Economic Analysis

Power Supply Evaluation

Overview

The Bradfield Intertie is expected to be used primarily to transmit power generated in Southeast Alaska to power markets in the Pacific Northwest. In order to evaluate the costs and benefits associated with this intended use of the project, it is necessary to determine the quantity of power available for export. Hydroelectric generation provides most of the electric power in Southeast Alaska. At the present time, there is some hydroelectric generation capability surplus to the needs of the electric consumers interconnected with these resources. The largest single source of existing surplus hydroelectric generation in the region is the Lake Tyee hydroelectric project. In the future, new hydroelectric projects can be constructed earlier than they would otherwise if the generation output can be sold outside the region.

The power supply evaluation conducted for the Energy Export Study has three primary elements: (1) identify the existing hydroelectric generation capability in Southeast Alaska; (2) estimate the future energy requirements of the residents and businesses connected to these projects; (3) determine the surplus generation capability; and (4) identify the energy generation capability of hydroelectric projects that could be developed in the region if a market existed for their output. In the future it is expected that electric loads will increase in the region and the available surplus hydroelectric energy generation would decrease over time if no other generation plants were constructed. Further, new transmission lines are planned that would bring hydroelectric power to communities currently served by diesel generation. Greater utilization of hydroelectric energy in Southeast Alaska will also reduce the energy available for export.

There are a number of factors that will affect the available power for export. Principal among these factors is the development of new transmission and generation resources in the region. At the present time, if the Bradfield Intertie were to be constructed, the only power available for export would be the surplus generation from the Lake Tyee hydroelectric project. Completion of the Swan-Tyee Intertie would initially reduce the Lake Tyee surplus available for export since Ketchikan is forecasted to use some of this power. In the long run, however, new hydroelectric generation facilities could be constructed in the Ketchikan and Metlakatla areas that could increase the available surplus with the Swan-Tyee Intertie in place. It should also be noted that the FDPPA indicates that it is beginning a program to displace heating oil with electric heat in Wrangell and Petersburg[16]. This may reduce the amount of power available for export.

The Bradfield Intertie will be used to transmit hydroelectric energy that is either surplus to the needs of the interconnected electric utilities of Petersburg, Wrangell and potentially Ketchikan or from interconnected hydroelectric plants to be built in the future[17]. Although it is assumed for

[16] The FDPPA fuel displacement program will initially be applied to government buildings.
[17] Other existing hydroelectric facilities used to supply power to Petersburg and Ketchikan are fully utilized.

the purpose of this analysis that surplus Lake Tyee power would be available for export, it is important to note the commercial and contractual arrangements that are in place that could potentially limit the availability of power resources for sale to other utility systems. For example, the Lake Tyee project is owned and operated by the FDPPA and its output is sold to Petersburg and Wrangell pursuant to the Four Dam Pool Power Sales Agreement. Petersburg, Wrangell and eventually Ketchikan when it is interconnected, will always have first priority to the output of the Lake Tyee Project pursuant to the Four Dam Pool Power Sales Agreement.

For the purpose of this analysis, four resource availability scenarios have been considered. Each of these scenarios provides for a progressively larger interconnected electric system in Southeast Alaska and as a result, a larger quantity of electric power for export. The four scenarios are as follows:

Case 1: Petersburg-Wrangell-Lake Tyee electric system as it currently exists. The energy available for export is the forecasted surplus from the Lake Tyee hydroelectric project. No new interconnected hydroelectric facilities are projected to be constructed.

Case 1A: Same as Case 1 with the assumed completion of the Swan – Tyee Intertie that would interconnect the electric system of Ketchikan with Petersburg and Wrangell. In this case, Ketchikan is forecasted on average to use some of the output of the Lake Tyee project thereby reducing the amount of energy available for export. No new hydroelectric facilities are projected to be constructed in the Petersburg-Wrangell-Ketchikan (PWK) interconnected system.

Case 2: Same as Case 1A with the assumed construction of the Cascade Creek hydroelectric project and interconnection with the PWK system.

Case 3: Same as Case 2 with the addition of all potential hydroelectric projects currently identified in the PWK area. This case assumes the construction of a transmission line between Metlakatla and Ketchikan.

Case 4: Same as Case 3 with the addition of a transmission interconnection between Petersburg, Kake, Sitka and Angoon. Additional potential hydroelectric facilities are assumed to be built in the Sitka area and in Angoon.

For each of these cases a projection of surplus hydroelectric energy generation has been made for each year of a 30-year projection period. The annual projections are based on assumed load growth for the interconnected electric utilities and the average energy generation capability of the existing and potential hydroelectric projects. Specific assumptions used in the analysis, subject to the provisions of each of the previously defined cases, are as follows:

1. Electric loads in Petersburg and Wrangell will increase at 0.0% per year and will increase in Ketchikan at 0.8% per year[18].

[18] Electric loads in all of these communities could increase at higher rates if potential programs are established to encourage conversions to electric heat and provide shore based electricity sales to docked cruise ships, among others. Source of assumed load increases is the report entitled "Swan-Tyee Economic Analysis" prepared for the FDPPA by Commonwealth Associates, Inc. (CAI) dated March 2006.

2. The average annual energy generation capability of the 22.5 MW Lake Tyee hydroelectric project is 116,820 MWh[19].

3. The Swan – Tyee Intertie will become operational in 2008[20].

4. The Bradfield Intertie will become operational in 2010.

5. For the cases that include new hydroelectric projects, the new facilities will become operational in 2010, with the exception of the Ruth Lake and Scenery Lake projects which become operational in 2012. Note that the assumed availability dates of these new projects are provided only for the purpose of estimating the potential hydroelectric energy available in the region. The actual time required to develop and construct these projects could be much greater than assumed, particularly if all of the projects were being jointly developed.

6. The potential new hydroelectric facilities that have been identified for the Petersburg-Wrangell-Ketchikan (PWK) region that are considered in this analysis are as follows:

   - Lake Tyee Third Turbine[21] – Petersburg/Wrangell; 10 MW, 12,000 MWh annually
   - Thomas Bay Project - Cascade Creek[22] - Petersburg; 45 MW; 203,000 estimated MWh annually
   - Thomas Bay Project[23] (Ruth Lake, Scenery Lake) – Petersburg; 50 MW, 209,000 MWh
   - Sunrise Lake – Wrangell; 4 MW; 12,200 MWh annually
   - Anita - Kunk Lake – Wrangell; 8 MW, 28,200 MWh annually
   - Virginia Lake – Wrangell; 12 MW, 42,700 MWh annually
   - Thoms Lake – Wrangell; 7.3 MW, 25,600 MWh annually
   - Whitman Lake – Ketchikan; 4.6 MW, 19,600 MWh annually
   - Connell Lake – Ketchikan; 1.9 MW, 11,640 MWh
   - Mahoney Lake – Ketchikan; 9.6 MW, 45,600 MWh annually
   - Triangle Lake[24] – Metlakatla; 3.9 MW, 16,900 MWh annually

[19] As projected for the Four Dam Pool Power Agency by Commonwealth Associates, Inc. assuming average inflows without drawdown of the reservoir. Additional energy would be available in years with high inflows.
[20] Construction of the Swan – Tyee Intertie began in 2004 but was halted later in the year pending acquisition of additional funding to complete the project. Neither the FDPPA nor the interconnected municipal utility systems can predict when or if construction will begin again. Approximately one more year of construction is needed to complete the project.
[21] As estimated by Commonwealth Associates assuming average inflows without drawdown of the reservoir. With maximum inflows, the third turbine is estimated to provide up to 78,000 MWh of additional energy. The turbine would also allow greater operational flexibility and greater capacity output at certain times.
[22] The Cascade Creek project, as proposed by Tollhouse Energy, is one component of the larger Thomas Bay hydroelectric project identified by Hosey & Associates in a study for the City of Petersburg dated December 1985. The Cascade Creek project is the Swan Lake portion of the overall Thomas Bay potential development.
[23] The Scenery Lake and Ruth Lake projects are two additional projects in the Thomas Bay Project as proposed by Tollhouse Energy.

7. Other Southeast Alaska hydroelectric projects included in Case 4 of the analysis include:
   - Takatz Lake – Sitka; 20 MW, 82,800 MWh annually
   - Katlian River- Sitka; 7.0MW, 29,800 MWh annually
   - Sterling Bolima - Angoon; 1.0 MW, 8,500 MWh annually

In addition to the projects listed above, Coast Mountain Hydro Corporation, a Canadian company and subsidiary of CMP, has proposed to develop the 115-MW Forrest Kerr hydroelectric project at the confluence of Forrest Kerr Creek and the Iskut River approximately 30 miles northeast of the Alaska-Canada border. The project will be run-of-river and the power output is to be sold to BC Hydro. A 110-mile long 138-kV transmission line is proposed to be constructed from Meziadin Junction to the Forrest Kerr Project. Several mines in the general vicinity of the Forrest Kerr Project are looking to purchase power from BC Hydro so the new transmission line could have multiple uses. In April 2006, NovaGold Resources, Inc. indicated that it is pursuing acquisition of CMP.

The estimated surplus hydroelectric energy available for the six year period 2010 through 2015 for the four cases is summarized in Table 5-1. A more detailed presentation of the estimated loads and resources is shown in Table 5-3 at the end of this section.

TABLE 5-1
Estimated Surplus Hydroelectric Energy (MWh) [1]

	2010	2011	2012	2013	2014	2015
Case 1 - Existing Tyee						
Surplus Hydro - MWh	59,574	59,574	59,574	59,574	59,574	59,574
Surplus Hydro - Ave MW	6.80	6.80	6.80	6.80	6.80	6.80
Case 1A - Petersburg-Wrangell-Ketchikan (PWK) Existing						
Surplus Hydro - MWh	56,148	54,922	53,686	52,440	51,184	49,918
Surplus Hydro - Ave MW	6.41	6.27	6.13	5.99	5.84	5.70
Case 2 - PWK w/ Cascade Creek						
Surplus Hydro - MWh	259,148	257,922	256,686	255,440	254,184	252,918
Surplus Hydro - Ave MW	29.58	29.44	29.30	29.16	29.02	28.87
Case 3 - PWK w/ All New Hydro						
Surplus Hydro - MWh	473,613	472,387	680,151	678,905	677,649	676,383
Surplus Hydro - Ave MW	54.07	53.93	77.64	77.50	77.36	77.21
Surplus Capacity - MW [1]	90.1	89.9	129.4	129.2	128.9	128.7
Case 4 - PWK w/ Sitka, Angoon						
Surplus Hydro - MWh	600,794	598,460	805,106	802,730	800,333	797,914
Surplus Hydro - Ave MW	68.58	68.32	91.91	91.64	91.36	91.09
Surplus Capacity - MW [1]	114.3	113.9	153.2	152.7	152.3	151.8

[1] Based on assumed 60% capacity factor.

[24] A relatively short overhead and submarine transmission system would be needed to interconnect the electric systems of Ketchikan and Metlakatla Power & Light.

Economic Analysis

Introduction and Assumptions

An economic analysis has been conducted to determine the net benefits to be realized in Southeast Alaska with the Bradfield Intertie. These net benefits are defined as the revenues estimated to be received from the sale of power to outside markets less the costs of transmitting power to these markets. The costs of transmission include O&M expenses for the Bradfield Intertie as well as wheeling charges assessed by owners of transmission lines in BC. There is a cost associated with power generation in Southeast Alaska and the net benefit determined in this analysis would represent the amount that could be used to pay for power purchases and/or the costs of constructing new hydroelectric generation facilities in the region.

Although the amount available to pay for power purchases and new powerplant development has been estimated, no attempt has been made to determine if this amount is sufficient to pay the costs associated with purchasing power or developing new projects in Southeast Alaska. This is an important economic factor that is outside the scope of this study. As development of the Bradfield Intertie proceeds, it will be necessary to conduct discussions with the owners of existing and proposed generating facilities to determine if the net revenues available from sales of power to outside markets would make the sale of power or development of new powerplants economically viable.

In conducting the economic analysis, it has been assumed that the cost of constructing the Bradfield Intertie will be funded with federal or State grants. This assumption is consistent with the funding assumptions used in previous Southeast Alaska transmission studies and is based on federal legislation in 2000 authorizing federal expenditures of $384 million for construction of the Southeast Alaska Electrical Intertie System.

The economic analysis presents the estimated annual revenues from the sales of power to outside electrical markets, presumably in the Pacific Northwest, on an annual basis for each year of a 25-year projection period. The power sales revenues are estimated separately for each of the four power supply scenarios defined previously. The estimated annual costs of transmission over BCTC transmission lines have been subtracted from the estimated annual power sales revenues to determine the estimated net revenues for each year. The net revenues are then divided by the total estimated energy sales to determine the "breakeven" power cost which represents the amount that can be paid for power in Southeast Alaska on a cost per kWh basis.

In preparing the economic analysis, several assumptions have been made. The most significant of these assumptions are:

1. Capital costs of the Bradfield Intertie are to be grant funded.
2. The annual rate of inflation is 2.5%.
3. O&M costs for the Bradfield Intertie will escalate at the assumed annual inflation rate.

4. Estimated wheeling charges will increase annually at one-half the assumed annual inflation rate.
5. In general, the power sales rate for sales to outside markets will increase at the assumed rate of inflation.
6. Wheeling charges over the existing transmission system in Southeast Alaska will be $2.00 per MWh in 2010.
7. Transmission losses between Southeast Alaska power generators and the Alaska-Canada border are 2% and from the border to the Pacific Northwest are an additional 6%, based on assumed contractual arrangements.
8. The exchange rate for the purpose of establishing comparable costs is $0.88 US per $1.00 Canadian.
9. The discount rate for present value calculations is 6.0%.
10. New transmission lines needed to interconnect the Bradfield Intertie to other generating resources in Southeast Alaska will either be grant funded or included in the cost of new generating projects. For example, the transmission line to interconnect the Cascade Creek project to Petersburg will be funded as part of that project.

Additional assumptions related to the base amounts for power sales rates and wheeling charges are defined in the following subsections.

Outside Power Sales Markets

Many large utilities in the Pacific Northwest are projecting the need for significant new power supply resources within the next ten years. In a recent solicitation[25] for power supply resources, Puget Sound Energy[26] (PSE) indicated a need in 2010 for 1,277 MW of peak capacity and approximately 2,000,000 MWh of electric energy over the amount currently estimated to be available from existing resources. By 2015, the PSE annual energy deficit increases to 11,500,000 MWh. In similar planning studies, Avista Corporation and PacifiCorp indicated needs for significant additional power supply in the relatively near future. California utilities have also identified the need for power supply in the future.

In particular, the need for "green" and "renewable" power resources is continuing to expand. These resources typically are power generators that use non-fossil, naturally renewable or waste materials as a fuel source, such as wind energy generation systems, geothermal or landfill gases. Although hydroelectric resources are not generally considered green or renewable at the present time, it could be that in certain circumstances Alaska hydroelectric power might be receive some sort of renewable classification. There is usually a premium paid for green and renewable energy resources as compared to power generated at natural gas, coal, oil and nuclear fueled power plants.

[25] Puget Sound Energy, All Source RFP, Exhibit 1, November 1, 2005.
[26] Puget Sound Energy is the largest electric utility in Washington State serving much of the region surrounding Puget Sound, with the most noticeable exceptions being Seattle, Tacoma and Snohomish County.

It should also be noted that power generation from Alaska could be used to partially supply the needs of new mining interests in Northern BC. From a load flow perspective, power generation from Alaska would actually be used to supply loads in this area. As an alternative to selling power directly to Western US utilities, the Southeast Alaska energy producers may sell power at the border to Powerex, the energy marketing subsidiary of BC Hydro. Powerex would either arrange to use the power in BC or market it externally. The power sales rate received from Powerex could potentially be lower than what would be received from selling power to US utilities, but transmission charges through BC would be avoided.

The price to be paid for power sales outside Southeast Alaska is highly speculative. In the future it will be dependent primarily on the need for power and the alternative cost of power supply. In the Pacific Northwest, a significant need for new power generating resources has been identified in the relatively near future. The cost of producing power in the future will most likely be tied in some manner to the price of natural gas and coal.

For the purpose of this analysis, it is estimated that a power sales rate in the range of between 6.0 cents per kWh and 7.2 cents per kWh in Washington State at the present time is a reasonable estimate for evaluating the economic feasibility of power exported from Alaska. In the future, this rate would be expected to change relative to the price of generation fuel and the cost of building new power facilities. Forecasts of future avoided costs and new resource costs in the Pacific Northwest developed by Puget Sound Energy, Avista and PacifiCorp indicate a possible decrease in power prices over the next five years consistent with a projected decrease in the price of natural gas. For purposes of this analysis, it is assumed that the power sales rate would remain constant for five years and then increase annually at the rate of general inflation.

It should be noted that in its April 2005 Least Cost Plan, PSE provided a projection of Pacific Northwest annual power prices for the 20 year period, 2006 through 2025. This projection was also filed as PSE's avoided cost pursuant to the requirements of the Washington Administrative Code. In the PSE projection, the power price for 2010 is forecasted to be 3.1 cents per kWh, down from 4.2 cents per kWh in 2007. In 2015, the forecasted power price is 4.9 cents per kWh. The PSA avoided cost filing also indicates that the levelized cost of power from a recently acquired wind energy project is 4.6 cents per kWh over the 20-year projected life of the project.

The avoided cost filing does not necessarily reflect the cost of power resources today. Fuel prices have increased significantly over the past year which should have an upward impact on the forecasted price of power. If evaluation of the Bradfield Intertie continues, it will be necessary to conduct discussions with the potential buyers of Southeast Alaska power to determine the actual rate that would be paid for the power.

Transmission Charges

In order to deliver power to the Pacific Northwest from Alaska, it will be necessary to transmit power over transmission lines in BC. BCTC has an Open Access Transmission Tariff (OATT) that would conceivably define the cost to transmit over the BCTC system. At the present time, it is not known what entity would construct the transmission line needed on the Canadian side of the border to connect the Alaska system to the BCTC grid. Potentially, if CMP or its potential successor, NovaGold, constructs the proposed 138-kV line between Forrest Kerr and Meziadin

Junction, an extension of this line could be constructed to the border. CMP would be expected to charge a transmission wheeling rate sufficient to cover the O&M and capital recovery costs of the CMP transmission system. Alternatively, if BCTC were to build the transmission line to the border and interconnect directly with the Alaska system, the BCTC OATT would be expected to be the only charge to be paid for transmission in Canada.

As provided in the BCTC OATT for Point to Point Transmission, Schedule 01, dated April 1, 2005, the transmission service rate is $4.25 Cdn per kW-month. Based on an assumed average kW level for power transmission from Southeast Alaska, this rate is estimated to convert to $5.12 US per MWh transmitted. For purpose of this analysis, it is assumed that this charge would increase annually at the assumed rate of inflation.

For purpose of the base case analytical results as presented in the following tables, it is assumed that the Bradfield Intertie would be connected directly to the BCTC grid and consequently only BCTC transmission charges would be applied. If however, BCTC does not build the transmission line to the border and CMP does, the charge for use of the proposed CMP transmission line between the Alaska – Canada border and Meziadin Junction is assumed to be based on the estimated revenue requirement associated with this line. CMP, as owner of this line, will want to receive revenues sufficient to pay the costs of O&M as well as capital recovery. Assuming that the line between the border and the Forrest Kerr project is used exclusively for Alaska power exports and that the line between Forrest Kerr and Meziadin Junction is used for Alaska power and Forrest Kerr power, the unit cost of transmission has been estimated. Since the costs associated with CMP transmission line are essentially fixed, the rate per MWh is different for each of the power supply scenarios to reflect the varying amount of energy projected to be transmitted. The costs are estimated to increase annually at the assumed rate of inflation.

Although the projected annual O&M costs for the Bradfield Intertie are explicitly included as an expense, there may also be charges for the use of existing transmission lines in Southeast Alaska. A $2.00 US per MWh charge has been included in the analysis to reflect the cost of using the existing transmission system.

Results

The results of the economic analysis are summarized in Table 5-2 and shown in more detail in Tables 5-4, 5-5 and 5-6 for the alternative power supply scenarios. In these tables, the "Breakeven Power Cost" is defined as the amount that can be paid for power in Southeast Alaska so that power sales revenues will equal power production and transmission costs. It is calculated as the estimated revenues from the sale of power less the costs of transmission and less the O&M costs on the Bradfield Intertie. The net present value shown in Table 5-2 is the cumulative present value of the annual Breakeven Power Cost amounts.

It is important to note that the results of the economic analysis are highly dependent on the assumptions and estimates previously discussed. Alternative assumptions would produce different results.

TABLE 5-2
Estimated Annual Breakeven Power Cost and Net Present Value of Net Revenues

	2010	2015	2020	2025
Delivered Power Sales Rate ($/MWh) [1]	$ 72.00	$ 81.46	$ 92.17	$ 104.28
Case 1: Existing Tyee Surplus [2]				
Breakeven Power Cost (¢/kWh) [3]	5.31	6.13	6.99	7.96
Present Value of Net Revenues (2006$000) [4]	$ 40,880			
Case 2: Existing with Cascade Creek [5]				
Breakeven Power Cost (¢/kWh) [3]	5.76	6.58	7.50	8.53
Present Value of Net Revenues (2006$000) [4]	$ 184,024			
Case 3: Existing with All PWK New Hydro [6]				
Breakeven Power Cost (¢/kWh) [3]	5.83	6.67	7.60	8.66
Present Value of Net Revenues (2006$000) [4]	$ 491,847			
Case 4: Existing with All Regional New Hydro [7]				
Breakeven Power Cost (¢/kWh) [3]	5.84	6.68	7.61	8.67
Present Value of Net Revenues (2006$000) [4]	$ 580,222			

[1] Estimated energy sales rate for power delivered in the Pacific Northwest.

[2] Assumes the Swan – Tyee Intertie is not constructed and consequently excludes any sales from Lake Tyee to Ketchikan.

[3] Estimated cost of power production or purchase in Alaska that would breakeven with the estimated net annual revenues received from sales of power.

[4] Net present value of net annual revenues from sales of power over the 25-year period, 2010 through 2034, at assumed discount rate of 6.0% to January 2006.

[5] Assumes the Swan-Tyee Intertie is constructed and that the Cascade Creek hydroelectric project is constructed.

[6] Assumes the Swan-Tyee Intertie is constructed and that all identified potential hydroelectric projects in the interconnected Petersburg-Wrangell-Ketchikan (PWK) are developed.

[7] Includes all hydroelectric projects for Case 3 as well as the Takatz Lake, Katlian River and Sterling Bolima hydroelectric projects.

The present value amounts shown in the previous table assume that interconnection at the border would be directly to the BC Hydro transmission system. If CMP, or its successor entity, were to own and operate the transmission connection between the Alaska border and the BC Hydro system, additional transmission charges could be assessed on power wheeled over this independent system. It is estimated that the cumulative net present value amounts shown in Table 5-2 would be between $25 million and $35 million lower if these additional transmission charges were to be applied. It is further estimated that the breakeven power cost would be approximately 0.4 cents per kWh lower than shown in Table 5-2 for Case 3, as an example.

TABLE 5-3
Southeast Alaska Energy Export Study
Loads, Resources and Surplus Hydroelectric Energy

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Tyee Region									
Energy Requirements (MWh)									
Petersburg [1]	42,664	42,664	42,664	42,664	42,664	42,664	42,664	42,664	42,664
Wrangell [2]	26,362	26,362	26,362	26,362	26,362	26,362	26,362	26,362	26,362
Total	69,026	69,026	69,026	69,026	69,026	69,026	69,026	69,026	69,026
Resources Available (MWh)									
Blind Slough	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Lake Tyee	116,800	116,800	116,800	116,800	116,800	116,800	116,800	116,800	116,800
Diesel	800	800	800	800	800	800	800	800	800
Total	128,600	128,600	128,600	128,600	128,600	128,600	128,600	128,600	128,600
Surplus Existing Hydro (MWh)	59,574	59,574	59,574	59,574	59,574	59,574	59,574	59,574	59,574
Surplus Existing Hydro (Ave MW)	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80
Potential New Hydro (MWh)									
Cascade Creek					203,000	203,000	203,000	203,000	203,000
Surplus w/Cascade Creek (MWh)					262,574	262,574	262,574	262,574	262,574
Surplus w/Cascade Creek (Ave MW)					29.97	29.97	29.97	29.97	29.97
Other Potential Projects									
Lake Tyee Third Turbine					12,000	12,000	12,000	12,000	12,000
Sunrise Lake					12,200	12,200	12,200	12,200	12,200
Anita - Kunk Lake					28,200	28,200	28,200	28,200	28,200
Virginia Lake					42,700	42,700	42,700	42,700	42,700
Thoms Lake					25,600	25,600	25,600	25,600	25,600
Thomas Bay (Ruth Lake, Scenery Lake)					-	-	209,000	209,000	209,000
Subtotal - Other Potential					120,700	120,700	329,700	329,700	329,700
Surplus w/Csd Crk & Other (MWh)					383,274	383,274	592,274	592,274	592,274
Surplus w/Csd Crk & Other (Ave MW)					43.75	43.75	67.61	67.61	67.61

TABLE 5-3
Southeast Alaska Energy Export Study
Loads, Resources and Surplus Hydroelectric Energy

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Ketchikan									
Energy Requirements (MWh)	148,477	149,665	150,862	152,069	153,286	154,512	155,748	156,994	158,250
Existing Resources Available (MWh)									
Municipal Hydro	67,900	67,900	67,900	67,900	67,900	67,900	67,900	67,900	67,900
Swan Lake	81,960	81,960	81,960	81,960	81,960	81,960	81,960	81,960	81,960
Subtotal - Existing	149,860	149,860	149,860	149,860	149,860	149,860	149,860	149,860	149,860
Net Requirement	(1,383)	(195)	1,002	2,209	3,426	4,652	5,888	7,134	8,390
Surplus Existing Hydro (MWh)	1,383	195	-	-	-	-	-	-	-
Surplus Existing Hydro (Ave MW)	0	0	-	-	-	-	-	-	-
Ketchikan Area Potential New Hydro									
Whitman Lake					19,640	19,640	19,640	19,640	19,640
Connell Lake					11,640	11,640	11,640	11,640	11,640
Mahoney Lake					45,600	45,600	45,600	45,600	45,600
Triangle Lake - Metlakatla					16,885	16,885	16,885	16,885	16,885
Subtotal - New Hydro					93,765	93,765	93,765	93,765	93,765
Surplus w/New Hydro (MWh)					90,339	89,113	87,877	86,631	85,375
Surplus w/New Hydro (Ave MW)					10.31	10.17	10.03	9.89	9.75
Integrated Petersburg-Wrangell-Ketchikan (PWK) System									
Surplus Existing Hydro w/STI (MWh)	59,574	59,574	58,572	57,365	56,148	54,922	53,686	52,440	51,184
Surplus Existing Hydro (Ave MW)	6.80	6.80	6.69	6.55	6.41	6.27	6.13	5.99	5.84
Surplus w/Cascade Creek (MWh)	59,574	59,574	58,572	57,365	259,148	257,922	256,686	255,440	254,184
Surplus w/Cascade Creek (Ave MW)	6.80	6.80	6.69	6.55	29.58	29.44	29.30	29.16	29.02
Surplus w/All New Hydro (MWh)	59,574	59,574	58,572	57,365	473,613	472,387	680,151	678,905	677,649
Surplus w/All New Hydro (Ave MW)	6.80	6.80	6.69	6.55	54.07	53.93	77.64	77.50	77.36

TABLE 5-3
Southeast Alaska Energy Export Study
Loads, Resources and Surplus Hydroelectric Energy

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Tyee Region										
Energy Requirements (MWh)										
Petersburg [1]	42,664	42,664	42,664	42,664	42,664	42,664	42,664	42,664	42,664	42,664
Wrangell [2]	26,362	26,362	26,362	26,362	26,362	26,362	26,362	26,362	26,362	26,362
Total	69,026	69,026	69,026	69,026	69,026	69,026	69,026	69,026	69,026	69,026
Resources Available (MWh)										
Blind Slough	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Lake Tyee	116,800	116,800	116,800	116,800	116,800	116,800	116,800	116,800	116,800	116,800
Diesel	800	800	800	800	800	800	800	800	800	800
Total	128,600	128,600	128,600	128,600	128,600	128,600	128,600	128,600	128,600	128,600
Surplus Existing Hydro (MWh)	59,574	59,574	59,574	59,574	59,574	59,574	59,574	59,574	59,574	59,574
Surplus Existing Hydro (Ave MW)	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80
Potential New Hydro (MWh)										
Cascade Creek	203,000	203,000	203,000	203,000	203,000	203,000	203,000	203,000	203,000	203,000
Surplus w/Cascade Creek (MWh)	262,574	262,574	262,574	262,574	262,574	262,574	262,574	262,574	262,574	262,574
Surplus w/Cascade Creek (Ave MW	29.97	29.97	29.97	29.97	29.97	29.97	29.97	29.97	29.97	29.97
Other Potential Projects										
Lake Tyee Third Turbine	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Sunrise Lake	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200
Anita - Kunk Lake	28,200	28,200	28,200	28,200	28,200	28,200	28,200	28,200	28,200	28,200
Virginia Lake	42,700	42,700	42,700	42,700	42,700	42,700	42,700	42,700	42,700	42,700
Thoms Lake	25,600	25,600	25,600	25,600	25,600	25,600	25,600	25,600	25,600	25,600
Thomas Bay (Ruth Lake, Scenery L	209,000	209,000	209,000	209,000	209,000	209,000	209,000	209,000	209,000	209,000
Subtotal - Other Potential	329,700	329,700	329,700	329,700	329,700	329,700	329,700	329,700	329,700	329,700
Surplus w/Csd Crk & Other (MWh)	592,274	592,274	592,274	592,274	592,274	592,274	592,274	592,274	592,274	592,274
Surplus w/Csd Crk & Other (Ave I	67.61	67.61	67.61	67.61	67.61	67.61	67.61	67.61	67.61	67.61

TABLE 5-3
Southeast Alaska Energy Export Study
Loads, Resources and Surplus Hydroelectric Energy

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ketchikan										
Energy Requirements (MWh)	159,516	160,792	162,078	163,375	164,682	165,999	167,327	168,666	170,015	171,375
Existing Resources Available (MWh)										
Municipal Hydro	67,900	67,901	67,902	67,903	67,904	67,905	67,906	67,907	67,908	67,909
Swan Lake	81,960	81,960	81,960	81,960	81,960	81,960	81,960	81,960	81,960	81,960
Subtotal - Existing	149,860	149,861	149,862	149,863	149,864	149,865	149,866	149,867	149,868	149,869
Net Requirement	9,656	10,931	12,216	13,512	14,818	16,134	17,461	18,799	20,147	21,506
Surplus Existing Hydro (MWh)	-	-	-	-	-	-	-	-	-	-
Surplus Existing Hydro (Ave MW)	-	-	-	-	-	-	-	-	-	-
Ketchikan Area Potential New Hydro										
Whitman Lake	19,640	19,640	19,640	19,640	19,640	19,640	19,640	19,640	19,640	19,640
Connell Lake	11,640	11,640	11,640	11,640	11,640	11,640	11,640	11,640	11,640	11,640
Mahoney Lake	45,600	45,600	45,600	45,600	45,600	45,600	45,600	45,600	45,600	45,600
Triangle Lake - Metlakatla	16,885	16,885	16,885	16,885	16,885	16,885	16,885	16,885	16,885	16,885
Subtotal - New Hydro	93,765	93,765	93,765	93,765	93,765	93,765	93,765	93,765	93,765	93,765
Surplus w/New Hydro (MWh)	84,109	82,834	81,549	80,253	78,947	77,631	76,304	74,966	73,618	72,259
Surplus w/New Hydro (Ave MW)	9.60	9.46	9.31	9.16	9.01	8.86	8.71	8.56	8.40	8.25
Integrated Petersburg-Wrangell-Ketc										
Surplus Existing Hydro w/STI (MWh)	49,918	48,643	47,358	46,062	44,756	43,440	42,113	40,775	39,427	38,068
Surplus Existing Hydro (Ave MW)	5.70	5.55	5.41	5.26	5.11	4.96	4.81	4.65	4.50	4.35
Surplus w/Cascade Creek (MWh)	252,918	251,643	250,358	249,062	247,756	246,440	245,113	243,775	242,427	241,068
Surplus w/Cascade Creek (Ave MW)	28.87	28.73	28.58	28.43	28.28	28.13	27.98	27.83	27.67	27.52
Surplus w/All New Hydro (MWh)	676,383	675,108	673,823	672,527	671,221	669,905	668,578	667,240	665,892	664,533
Surplus w/All New Hydro (Ave MW)	77.21	77.07	76.92	76.77	76.62	76.47	76.32	76.17	76.02	75.86

TABLE 5-3
Southeast Alaska Energy Export Study
Loads, Resources and Surplus Hydroelectric Energy

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Tyee Region										
Energy Requirements (MWh)										
Petersburg [1]	42,664	42,664	42,664	42,664	42,664	42,664	42,664	42,664	42,664	42,664
Wrangell [2]	26,362	26,362	26,362	26,362	26,362	26,362	26,362	26,362	26,362	26,362
Total	69,026	69,026	69,026	69,026	69,026	69,026	69,026	69,026	69,026	69,026
Resources Available (MWh)										
Blind Slough	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Lake Tyee	116,800	116,800	116,800	116,800	116,800	116,800	116,800	116,800	116,800	116,800
Diesel	800	800	800	800	800	800	800	800	800	800
Total	128,600	128,600	128,600	128,600	128,600	128,600	128,600	128,600	128,600	128,600
Surplus Existing Hydro (MWh)	59,574	59,574	59,574	59,574	59,574	59,574	59,574	59,574	59,574	59,574
Surplus Existing Hydro (Ave MW)	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80	6.80
Potential New Hydro (MWh)										
Cascade Creek	203,000	203,000	203,000	203,000	203,000	203,000	203,000	203,000	203,000	203,000
Surplus w/Cascade Creek (MWh)	262,574	262,574	262,574	262,574	262,574	262,574	262,574	262,574	262,574	262,574
Surplus w/Cascade Creek (Ave MW	29.97	29.97	29.97	29.97	29.97	29.97	29.97	29.97	29.97	29.97
Other Potential Projects										
Lake Tyee Third Turbine	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Sunrise Lake	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200
Anita - Kunk Lake	28,200	28,200	28,200	28,200	28,200	28,200	28,200	28,200	28,200	28,200
Virginia Lake	42,700	42,700	42,700	42,700	42,700	42,700	42,700	42,700	42,700	42,700
Thoms Lake	25,600	25,600	25,600	25,600	25,600	25,600	25,600	25,600	25,600	25,600
Thomas Bay (Ruth Lake, Scenery L	209,000	209,000	209,000	209,000	209,000	209,000	209,000	209,000	209,000	209,000
Subtotal - Other Potential	329,700	329,700	329,700	329,700	329,700	329,700	329,700	329,700	329,700	329,700
Surplus w/Csd Crk & Other (MWh)	592,274	592,274	592,274	592,274	592,274	592,274	592,274	592,274	592,274	592,274
Surplus w/Csd Crk & Other (Ave I	67.61	67.61	67.61	67.61	67.61	67.61	67.61	67.61	67.61	67.61

TABLE 5-3
Southeast Alaska Energy Export Study
Loads, Resources and Surplus Hydroelectric Energy

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Ketchikan										
Energy Requirements (MWh)	172,746	174,128	175,521	176,925	178,340	179,767	181,205	182,655	184,116	185,589
Existing Resources Available (MWh)										
Municipal Hydro	67,910	67,911	67,912	67,913	67,914	67,915	67,916	67,917	67,918	67,919
Swan Lake	81,960	81,960	81,960	81,960	81,960	81,960	81,960	81,960	81,960	81,960
Subtotal - Existing	149,870	149,871	149,872	149,873	149,874	149,875	149,876	149,877	149,878	149,879
Net Requirement	22,876	24,257	25,649	27,052	28,466	29,892	31,329	32,778	34,238	35,710
Surplus Existing Hydro (MWh)	-	-	-	-	-	-	-	-	-	-
Surplus Existing Hydro (Ave MW)	-	-	-	-	-	-	-	-	-	-
Ketchikan Area Potential New Hydro										
Whitman Lake	19,640	19,640	19,640	19,640	19,640	19,640	19,640	19,640	19,640	19,640
Connell Lake	11,640	11,640	11,640	11,640	11,640	11,640	11,640	11,640	11,640	11,640
Mahoney Lake	45,600	45,600	45,600	45,600	45,600	45,600	45,600	45,600	45,600	45,600
Triangle Lake - Metlakatla	16,885	16,885	16,885	16,885	16,885	16,885	16,885	16,885	16,885	16,885
Subtotal - New Hydro	93,765	93,765	93,765	93,765	93,765	93,765	93,765	93,765	93,765	93,765
Surplus w/New Hydro (MWh)	70,889	69,508	68,116	66,713	65,299	63,873	62,436	60,987	59,527	58,055
Surplus w/New Hydro (Ave MW)	8.09	7.93	7.78	7.62	7.45	7.29	7.13	6.96	6.80	6.63
Integrated Petersburg-Wrangell-Ketc										
Surplus Existing Hydro w/STI (MWh)	36,698	35,317	33,925	32,522	31,108	29,682	28,245	26,796	25,336	23,864
Surplus Existing Hydro (Ave MW)	4.19	4.03	3.87	3.71	3.55	3.39	3.22	3.06	2.89	2.72
Surplus w/Cascade Creek (MWh)	239,698	238,317	236,925	235,522	234,108	232,682	231,245	229,796	228,336	226,864
Surplus w/Cascade Creek (Ave MW)	27.36	27.21	27.05	26.89	26.72	26.56	26.40	26.23	26.07	25.90
Surplus w/All New Hydro (MWh)	663,163	661,782	660,390	658,987	657,573	656,147	654,710	653,261	651,801	650,329
Surplus w/All New Hydro (Ave MW)	75.70	75.55	75.39	75.23	75.07	74.90	74.74	74.57	74.41	74.24

TABLE 5-4
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 1: Existing Tyee Surplus Only

	2010	2011	2012	2013	2014	2015	2016
Surplus Energy Available (MWh)	59,574	59,574	59,574	59,574	59,574	59,574	59,574
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy at Border (MWh)	58,383	58,383	58,383	58,383	58,383	58,383	58,383
Wheeling Charges ($/MWh)							
Alaska Grid	$ 2.00	$ 2.03	$ 2.05	$ 2.08	$ 2.10	$ 2.13	$ 2.15
CMP System	-	-	-	-	-	-	-
BC Hydro System	5.46	5.53	5.60	5.67	5.74	5.82	5.89
Charge Escalation		1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	54,880	54,880	54,880	54,880	54,880	54,880	54,880
Price at BC/WA Border ($/MWh)	$ 72.00	$ 73.80	$ 75.65	$ 77.54	$ 79.47	$ 81.46	$ 83.50
Price Escalation		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 3,951	$ 4,050	$ 4,151	$ 4,255	$ 4,362	$ 4,471	$ 4,582
Other	-	-	-	-	-	-	-
Total Revenues	$ 3,951	$ 4,050	$ 4,151	$ 4,255	$ 4,362	$ 4,471	$ 4,582
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	119	121	122	124	125	127	128
CMP System	-	-	-	-	-	-	-
BC Hydro System	319	323	327	331	335	340	344
Other	-	-	-	-	-	-	-
Subtotal	$ 438	$ 444	$ 449	$ 455	$ 461	$ 466	$ 472
Transmission O&M							
Bradfield Intertie	352	318	326	334	846	351	360
Other	-	-	-	-	-	-	-
Subtotal	$ 352	$ 318	$ 326	$ 334	$ 846	$ 351	$ 360
Other	-	-	-	-	-	-	-
Total Expenses	$ 790	$ 762	$ 775	$ 789	$ 1,306	$ 818	$ 832
NET REVENUES ($000)	$ 3,161	$ 3,288	$ 3,376	$ 3,466	$ 3,055	$ 3,653	$ 3,750
Breakeven Power Cost	$ 3,161	$ 3,288	$ 3,376	$ 3,466	$ 3,055	$ 3,653	$ 3,750
Breakeven Pwr Cost ($/MWh)	$ 53.06	$ 55.20	$ 56.67	$ 58.18	$ 51.28	$ 61.32	$ 62.95
Net Present Value (2006$000)	$ 40,880						

TABLE 5-4
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 1: Existing Tyee Surplus Only

	2017	2018	2019	2020	2021	2022	2023
Surplus Energy Available (MWh)	59,574	59,574	59,574	59,574	59,574	59,574	59,574
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy at Border (MWh)	58,383	58,383	58,383	58,383	58,383	58,383	58,383
Wheeling Charges ($/MWh)							
Alaska Grid	$ 2.18	$ 2.21	$ 2.24	$ 2.26	$ 2.29	$ 2.32	$ 2.35
CMP System	-	-	-	-	-	-	-
BC Hydro System	5.96	6.04	6.11	6.19	6.27	6.34	6.42
Charge Escalation	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	54,880	54,880	54,880	54,880	54,880	54,880	54,880
Price at BC/WA Border ($/MWh)	$ 85.59	$ 87.73	$ 89.92	$ 92.17	$ 94.47	$ 96.83	$ 99.25
Price Escalation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 4,697	$ 4,814	$ 4,935	$ 5,058	$ 5,184	$ 5,314	$ 5,447
Other	-	-	-	-	-	-	-
Total Revenues	$ 4,697	$ 4,814	$ 4,935	$ 5,058	$ 5,184	$ 5,314	$ 5,447
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	130	132	133	135	137	138	140
CMP System	-	-	-	-	-	-	-
BC Hydro System	348	352	357	361	366	370	375
Other	-	-	-	-	-	-	-
Subtotal	$ 478	$ 484	$ 490	$ 496	$ 502	$ 509	$ 515
Transmission O&M							
Bradfield Intertie	369	378	750	397	407	418	428
Other	-	-	-	-	-	-	-
Subtotal	$ 369	$ 378	$ 750	$ 397	$ 407	$ 418	$ 428
Other	-	-	-	-	-	-	-
Total Expenses	$ 847	$ 862	$ 1,240	$ 894	$ 911	$ 928	$ 946
NET REVENUES ($000)	$ 3,850	$ 3,952	$ 3,694	$ 4,164	$ 4,274	$ 4,386	$ 4,501
Breakeven Power Cost	$ 3,850	$ 3,952	$ 3,694	$ 4,164	$ 4,274	$ 4,386	$ 4,501
Breakeven Pwr Cost ($/MWh)	$ 64.62	$ 66.34	$ 62.01	$ 69.90	$ 71.74	$ 73.62	$ 75.55

Net Present Value (2006$000)

TABLE 5-4
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 1: Existing Tyee Surplus Only

	2024	2025	2026	2027	2028	2029	2030
Surplus Energy Available (MWh)	59,574	59,574	59,574	59,574	59,574	59,574	59,574
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy at Border (MWh)	58,383	58,383	58,383	58,383	58,383	58,383	58,383
Wheeling Charges ($/MWh)							
Alaska Grid	$ 2.38	$ 2.41	$ 2.44	$ 2.47	$ 2.50	$ 2.53	$ 2.56
CMP System	-	-	-	-	-	-	-
BC Hydro System	6.50	6.58	6.67	6.75	6.83	6.92	7.01
Charge Escalation	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	54,880	54,880	54,880	54,880	54,880	54,880	54,880
Price at BC/WA Border ($/MWh)	$ 101.73	$ 104.28	$ 106.88	$ 109.56	$ 112.30	$ 115.10	$ 117.98
Price Escalation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 5,583	$ 5,723	$ 5,866	$ 6,012	$ 6,163	$ 6,317	$ 6,475
Other	-	-	-	-	-	-	-
Total Revenues	$ 5,583	$ 5,723	$ 5,866	$ 6,012	$ 6,163	$ 6,317	$ 6,475
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	142	144	145	147	149	151	153
CMP System	-	-	-	-	-	-	-
BC Hydro System	380	384	389	394	399	404	409
Other	-	-	-	-	-	-	-
Subtotal	$ 521	$ 528	$ 535	$ 541	$ 548	$ 555	$ 562
Transmission O&M							
Bradfield Intertie	1,083	450	461	472	484	740	509
Other	-	-	-	-	-	-	-
Subtotal	$ 1,083	$ 450	$ 461	$ 472	$ 484	$ 740	$ 509
Other	-	-	-	-	-	-	-
Total Expenses	$ 1,608	$ 983	$ 1,001	$ 1,021	$ 1,040	$ 1,304	$ 1,080
NET REVENUES ($000)	$ 3,975	$ 4,740	$ 4,864	$ 4,992	$ 5,123	$ 5,013	$ 5,394
Breakeven Power Cost	$ 3,975	$ 4,740	$ 4,864	$ 4,992	$ 5,123	$ 5,013	$ 5,394
Breakeven Pwr Cost ($/MWh)	$ 66.72	$ 79.57	$ 81.65	$ 83.79	$ 85.99	$ 84.15	$ 90.55
Net Present Value (2006$000)							

TABLE 5-4
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 1: Existing Tyee Surplus Only

	2031	2032	2033	2034
Surplus Energy Available (MWh)	59,574	59,574	59,574	59,574
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%
Energy at Border (MWh)	58,383	58,383	58,383	58,383
Wheeling Charges ($/MWh)				
Alaska Grid	$ 2.60	$ 2.63	$ 2.66	$ 2.69
CMP System	-	-	-	-
BC Hydro System	7.09	7.18	7.27	7.36
Charge Escalation	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	54,880	54,880	54,880	54,880
Price at BC/WA Border ($/MWh)	$ 120.93	$ 123.95	$ 127.05	$ 130.23
Price Escalation	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)				
Power Sales	$ 6,637	$ 6,802	$ 6,973	$ 7,147
Other	-	-	-	-
Total Revenues	$ 6,637	$ 6,802	$ 6,973	$ 7,147
EXPENSES ($000)				
Power Purchases	$ -	$ -	$ -	$ -
Wheeling Expense				
Alaska	155	157	159	161
CMP System	-	-	-	-
BC Hydro System	414	419	425	430
Other	-	-	-	-
Subtotal	$ 569	$ 576	$ 583	$ 590
Transmission O&M				
Bradfield Intertie	521	534	548	1,386
Other	-	-	-	-
Subtotal	$ 521	$ 534	$ 548	$ 1,386
Other	-	-	-	-
Total Expenses	$ 1,101	$ 1,122	$ 1,144	$ 1,990
NET REVENUES ($000)	$ 5,535	$ 5,680	$ 5,829	$ 5,156
Breakeven Power Cost	$ 5,535	$ 5,680	$ 5,829	$ 5,156
Breakeven Pwr Cost ($/MWh)	$ 92.92	$ 95.35	$ 97.84	$ 86.55

Net Present Value (2006$000)

TABLE 5-5
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 2: Tyee Surplus with Cascade Creek

	2010	2011	2012	2013	2014	2015	2016
Surplus Energy Available (MWh)	259,148	257,922	256,686	255,440	254,184	252,918	251,643
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy at Border (MWh)	253,965	252,764	251,552	250,331	249,100	247,860	246,610
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.00	$ 2.03	$ 2.05	$ 2.08	$ 2.10	$ 2.13	$ 2.15
CMP System	-	-	-	-	-	-	-
BC Hydro System	5.46	5.53	5.60	5.67	5.74	5.82	5.89
Charge Escalation		1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	238,727	237,598	236,459	235,311	234,154	232,988	231,814
Price at BC/WA Border ($/MWh)	$ 72.00	$ 73.80	$ 75.65	$ 77.54	$ 79.47	$ 81.46	$ 83.50
Price Escalation		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 17,188	$ 17,535	$ 17,887	$ 18,245	$ 18,609	$ 18,980	$ 19,356
Other	-	-	-	-	-	-	-
Total Revenues	$ 17,188	$ 17,535	$ 17,887	$ 18,245	$ 18,609	$ 18,980	$ 19,356
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	518	522	526	530	534	538	542
CMP System	-	-	-	-	-	-	-
BC Hydro System	1,388	1,399	1,409	1,420	1,431	1,441	1,452
Other	-	-	-	-	-	-	-
Subtotal	$ 1,906	$ 1,921	$ 1,936	$ 1,950	$ 1,965	$ 1,980	$ 1,994
Transmission O&M							
Bradfield Intertie	352	318	326	334	846	351	360
Other	-	-	-	-	-	-	-
Subtotal	$ 352	$ 318	$ 326	$ 334	$ 846	$ 351	$ 360
Other	-	-	-	-	-	-	-
Total Expenses	$ 2,258	$ 2,239	$ 2,262	$ 2,285	$ 2,811	$ 2,331	$ 2,354
NET REVENUES	$ 14,930	$ 15,296	$ 15,625	$ 15,961	$ 15,798	$ 16,649	$ 17,002
Breakeven Power Cost	$ 14,930	$ 15,296	$ 15,625	$ 15,961	$ 15,798	$ 16,649	$ 17,002
Breakeven Pwr Cost ($/MWh)	$ 57.61	$ 59.30	$ 60.87	$ 62.48	$ 62.15	$ 65.83	$ 67.56
Net Present Value (2006$000)	$ 184,024						

TABLE 5-5
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 2: Tyee Surplus with Cascade Creek

	2017	2018	2019	2020	2021	2022	2023
Surplus Energy Available (MWh)	250,358	249,062	247,756	246,440	245,113	243,775	242,427
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy at Border (MWh)	245,351	244,081	242,801	241,511	240,211	238,900	237,578
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.18	$ 2.21	$ 2.24	$ 2.26	$ 2.29	$ 2.32	$ 2.35
CMP System	-	-	-	-	-	-	-
BC Hydro System	5.96	6.04	6.11	6.19	6.27	6.34	6.42
Charge Escalation	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	230,630	229,436	228,233	227,021	225,798	224,566	223,324
Price at BC/WA Border ($/MWh)	$ 85.59	$ 87.73	$ 89.92	$ 92.17	$ 94.47	$ 96.83	$ 99.25
Price Escalation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 19,739	$ 20,127	$ 20,522	$ 20,924	$ 21,331	$ 21,745	$ 22,166
Other	-	-	-	-	-	-	-
Total Revenues	$ 19,739	$ 20,127	$ 20,522	$ 20,924	$ 21,331	$ 21,745	$ 22,166
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	546	550	554	558	562	566	570
CMP System	-	-	-	-	-	-	-
BC Hydro System	1,463	1,473	1,484	1,494	1,505	1,515	1,526
Other	-	-	-	-	-	-	-
Subtotal	$ 2,009	$ 2,023	$ 2,038	$ 2,052	$ 2,067	$ 2,081	$ 2,096
Transmission O&M							
Bradfield Intertie	369	378	750	397	407	418	428
Other	-	-	-	-	-	-	-
Subtotal	$ 369	$ 378	$ 750	$ 397	$ 407	$ 418	$ 428
Other	-	-	-	-	-	-	-
Total Expenses	$ 2,378	$ 2,402	$ 2,788	$ 2,450	$ 2,475	$ 2,501	$ 2,527
NET REVENUES	$ 17,361	$ 17,726	$ 17,734	$ 18,474	$ 18,856	$ 19,244	$ 19,639
Breakeven Power Cost	$ 17,361	$ 17,726	$ 17,734	$ 18,474	$ 18,856	$ 19,244	$ 19,639
Breakeven Pwr Cost ($/MWh)	$ 69.34	$ 71.17	$ 71.58	$ 74.96	$ 76.93	$ 78.94	$ 81.01

Net Present Value (2006$000)

TABLE 5-5
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 2: Tyee Surplus with Cascade Creek

	2024	2025	2026	2027	2028	2029	2030
Surplus Energy Available (MWh)	241,068	239,698	238,317	236,925	235,522	234,108	232,682
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy at Border (MWh)	236,247	234,904	233,551	232,187	230,812	229,426	228,028
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.38	$ 2.41	$ 2.44	$ 2.47	$ 2.50	$ 2.53	$ 2.56
CMP System	-	-	-	-	-	-	-
BC Hydro System	6.50	6.58	6.67	6.75	6.83	6.92	7.01
Charge Escalation	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	222,072	220,810	219,538	218,255	216,963	215,660	214,347
Price at BC/WA Border ($/MWh)	$ 101.73	$ 104.28	$ 106.88	$ 109.56	$ 112.30	$ 115.10	$ 117.98
Price Escalation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 22,592	$ 23,025	$ 23,465	$ 23,911	$ 24,364	$ 24,823	$ 25,289
Other	-	-	-	-	-	-	-
Total Revenues	$ 22,592	$ 23,025	$ 23,465	$ 23,911	$ 24,364	$ 24,823	$ 25,289
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	574	578	581	585	589	593	597
CMP System	-	-	-	-	-	-	-
BC Hydro System	1,536	1,547	1,557	1,567	1,577	1,588	1,598
Other	-	-	-	-	-	-	-
Subtotal	$ 2,110	$ 2,124	$ 2,138	$ 2,153	$ 2,167	$ 2,180	$ 2,194
Transmission O&M							
Bradfield Intertie	1,083	450	461	472	484	740	509
Other	-	-	-	-	-	-	-
Subtotal	$ 1,083	$ 450	$ 461	$ 472	$ 484	$ 740	$ 509
Other	-	-	-	-	-	-	-
Total Expenses	$ 3,197	$ 2,579	$ 2,605	$ 2,632	$ 2,659	$ 2,929	$ 2,713
NET REVENUES	$ 19,395	$ 20,447	$ 20,860	$ 21,279	$ 21,705	$ 21,894	$ 22,576
Breakeven Power Cost	$ 19,395	$ 20,447	$ 20,860	$ 21,279	$ 21,705	$ 21,894	$ 22,576
Breakeven Pwr Cost ($/MWh)	$ 80.46	$ 85.30	$ 87.53	$ 89.81	$ 92.16	$ 93.52	$ 97.02
Net Present Value (2006$000)							

TABLE 5-5
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 2: Tyee Surplus with Cascade Creek

	2031	2032	2033	2034
Surplus Energy Available (MWh)	231,245	229,796	228,336	226,864
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%
Energy at Border (MWh)	226,620	225,200	223,769	222,327
Wheeling Charge ($/MWh)				
Alaska Grid	$ 2.60	$ 2.63	$ 2.66	$ 2.69
CMP System	-	-	-	-
BC Hydro System	7.09	7.18	7.27	7.36
Charge Escalation	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	213,023	211,688	210,343	208,987
Price at BC/WA Border ($/MWh)	$ 120.93	$ 123.95	$ 127.05	$ 130.23
Price Escalation	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)				
Power Sales	$ 25,761	$ 26,239	$ 26,725	$ 27,216
Other	-	-	-	-
Total Revenues	$ 25,761	$ 26,239	$ 26,725	$ 27,216
EXPENSES ($000)				
Power Purchases	$ -	$ -	$ -	$ -
Wheeling Expense				
Alaska	600	604	608	611
CMP System	-	-	-	-
BC Hydro System	1,608	1,617	1,627	1,637
Other	-	-	-	-
Subtotal	$ 2,208	$ 2,222	$ 2,235	$ 2,248
Transmission O&M				
Bradfield Intertie	521	534	548	1,386
Other	-	-	-	-
Subtotal	$ 521	$ 534	$ 548	$ 1,386
Other	-	-	-	-
Total Expenses	$ 2,740	$ 2,768	$ 2,796	$ 3,648
NET REVENUES	$ 23,020	$ 23,471	$ 23,929	$ 23,568
Breakeven Power Cost	$ 23,020	$ 23,471	$ 23,929	$ 23,568
Breakeven Pwr Cost ($/MWh)	$ 99.55	$ 102.14	$ 104.80	$ 103.88

Net Present Value (2006$000)

TABLE 5-6
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 3: All New PWK Hydro

	2010	2011	2012	2013	2014	2015	2016
Surplus Energy Available (MWh)	473,613	472,387	680,151	678,905	677,649	676,383	675,108
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy Sales (MWh)	464,141	462,939	666,548	665,327	664,096	662,855	661,606
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.00	$ 2.03	$ 2.05	$ 2.08	$ 2.10	$ 2.13	$ 2.15
CMP System	-	-	-	-	-	-	-
BC Hydro System	5.46	5.53	5.60	5.67	5.74	5.82	5.89
Charge Escalation		1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	436,292	435,163	626,555	625,407	624,250	623,084	621,909
Price at BC/WA Border ($/MWh)	$ 72.00	$ 73.80	$ 75.65	$ 77.54	$ 79.47	$ 81.46	$ 83.50
Price Escalation		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 31,413	$ 32,115	$ 47,396	$ 48,492	$ 49,612	$ 50,757	$ 51,928
Other	-	-	-	-	-	-	-
Total Revenues	$ 31,413	$ 32,115	$ 47,396	$ 48,492	$ 49,612	$ 50,757	$ 51,928
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	928	937	1,367	1,381	1,396	1,411	1,426
CMP System	-	-	-	-	-	-	-
BC Hydro System	2,536	2,562	3,734	3,774	3,814	3,855	3,895
Other	-	-	-	-	-	-	-
Subtotal	$ 3,465	$ 3,499	$ 5,101	$ 5,155	$ 5,210	$ 5,265	$ 5,321
Transmission O&M							
Bradfield Intertie	352	318	326	334	846	351	360
Other	-	-	-	-	-	-	-
Subtotal	$ 352	$ 318	$ 326	$ 334	$ 846	$ 351	$ 360
Other	-	-	-	-	-	-	-
Total Expenses	$ 3,817	$ 3,817	$ 5,427	$ 5,490	$ 6,056	$ 5,616	$ 5,681
NET REVENUES	$ 27,596	$ 28,298	$ 41,969	$ 43,002	$ 43,556	$ 45,141	$ 46,247
Breakeven Power Cost	$ 27,596	$ 28,298	$ 41,969	$ 43,002	$ 43,556	$ 45,141	$ 46,247
Breakeven Pwr Cost ($/MWh)	$ 58.27	$ 59.90	$ 61.70	$ 63.34	$ 64.28	$ 66.74	$ 68.50
Net Present Value (2006$000)	$ 491,847						

TABLE 5-6
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 3: All New PWK Hydro

	2017	2018	2019	2020	2021	2022	2023
Surplus Energy Available (MWh)	673,823	672,527	671,221	669,905	668,578	667,240	665,892
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy Sales (MWh)	660,347	659,076	657,797	656,507	655,206	653,895	652,574
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.18	$ 2.21	$ 2.24	$ 2.26	$ 2.29	$ 2.32	$ 2.35
CMP System	-	-	-	-	-	-	-
BC Hydro System	5.96	6.04	6.11	6.19	6.27	6.34	6.42
Charge Escalation	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	620,726	619,532	618,329	617,116	615,894	614,661	613,420
Price at BC/WA Border ($/MWh)	$ 85.59	$ 87.73	$ 89.92	$ 92.17	$ 94.47	$ 96.83	$ 99.25
Price Escalation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 53,125	$ 54,348	$ 55,599	$ 56,877	$ 58,184	$ 59,519	$ 60,884
Other	-	-	-	-	-	-	-
Total Revenues	$ 53,125	$ 54,348	$ 55,599	$ 56,877	$ 58,184	$ 59,519	$ 60,884
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	1,441	1,456	1,471	1,487	1,502	1,518	1,534
CMP System	-	-	-	-	-	-	-
BC Hydro System	3,937	3,978	4,020	4,062	4,105	4,148	4,191
Other	-	-	-	-	-	-	-
Subtotal	$ 5,377	$ 5,434	$ 5,491	$ 5,549	$ 5,607	$ 5,666	$ 5,725
Transmission O&M							
Bradfield Intertie	369	378	750	397	407	418	428
Other	-	-	-	-	-	-	-
Subtotal	$ 369	$ 378	$ 750	$ 397	$ 407	$ 418	$ 428
Other	-	-	-	-	-	-	-
Total Expenses	$ 5,746	$ 5,812	$ 6,242	$ 5,946	$ 6,015	$ 6,083	$ 6,153
NET REVENUES	$ 47,379	$ 48,536	$ 49,357	$ 50,931	$ 52,169	$ 53,435	$ 54,730
Breakeven Power Cost	$ 47,379	$ 48,536	$ 49,357	$ 50,931	$ 52,169	$ 53,435	$ 54,730
Breakeven Pwr Cost ($/MWh)	$ 70.31	$ 72.17	$ 73.53	$ 76.03	$ 78.03	$ 80.08	$ 82.19

Net Present Value (2006$000)

TABLE 5-6
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 3: All New PWK Hydro

	2024	2025	2026	2027	2028	2029	2030
Surplus Energy Available (MWh)	664,533	663,163	661,782	660,390	658,987	657,573	656,147
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy Sales (MWh)	651,242	649,900	648,546	647,182	645,807	644,422	643,024
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.38	$ 2.41	$ 2.44	$ 2.47	$ 2.50	$ 2.53	$ 2.56
CMP System	-	-	-	-	-	-	-
BC Hydro System	6.50	6.58	6.67	6.75	6.83	6.92	7.01
Charge Escalation	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	612,168	610,906	609,634	608,351	607,059	605,756	604,443
Price at BC/WA Border ($/MWh)	$ 101.73	$ 104.28	$ 106.88	$ 109.56	$ 112.30	$ 115.10	$ 117.98
Price Escalation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 62,278	$ 63,704	$ 65,160	$ 66,649	$ 68,170	$ 69,724	$ 71,312
Other	-	-	-	-	-	-	-
Total Revenues	$ 62,278	$ 63,704	$ 65,160	$ 66,649	$ 68,170	$ 69,724	$ 71,312
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	1,550	1,566	1,582	1,599	1,615	1,632	1,649
CMP System	-	-	-	-	-	-	-
BC Hydro System	4,235	4,279	4,324	4,368	4,414	4,459	4,505
Other	-	-	-	-	-	-	-
Subtotal	$ 5,785	$ 5,845	$ 5,906	$ 5,967	$ 6,029	$ 6,091	$ 6,154
Transmission O&M							
Bradfield Intertie	1,083	450	461	472	484	740	509
Other	-	-	-	-	-	-	-
Subtotal	$ 1,083	$ 450	$ 461	$ 472	$ 484	$ 740	$ 509
Other	-	-	-	-	-	-	-
Total Expenses	$ 6,868	$ 6,295	$ 6,367	$ 6,440	$ 6,513	$ 6,831	$ 6,663
NET REVENUES	$ 55,411	$ 57,409	$ 58,794	$ 60,209	$ 61,657	$ 62,893	$ 64,650
Breakeven Power Cost	$ 55,411	$ 57,409	$ 58,794	$ 60,209	$ 61,657	$ 62,893	$ 64,650
Breakeven Pwr Cost ($/MWh)	$ 83.38	$ 86.57	$ 88.84	$ 91.17	$ 93.56	$ 95.64	$ 98.53
Net Present Value (2006$000)							

TABLE 5-6
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 3: All New PWK Hydro

	2031	2032	2033	2034
Surplus Energy Available (MWh)	654,710	653,261	651,801	650,329
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%
Energy Sales (MWh)	641,616	640,196	638,765	637,322
Wheeling Charge ($/MWh)				
Alaska Grid	$ 2.60	$ 2.63	$ 2.66	$ 2.69
CMP System	-	-	-	-
BC Hydro System	7.09	7.18	7.27	7.36
Charge Escalation	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	603,119	601,784	600,439	599,083
Price at BC/WA Border ($/MWh)	$ 120.93	$ 123.95	$ 127.05	$ 130.23
Price Escalation	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)				
Power Sales	$ 72,935	$ 74,593	$ 76,287	$ 78,018
Other	-	-	-	-
Total Revenues	$ 72,935	$ 74,593	$ 76,287	$ 78,018
EXPENSES ($000)				
Power Purchases	$ -	$ -	$ -	$ -
Wheeling Expense				
Alaska	1,666	1,683	1,700	1,717
CMP System	-	-	-	-
BC Hydro System	4,551	4,598	4,645	4,693
Other	-	-	-	-
Subtotal	$ 6,217	$ 6,281	$ 6,345	$ 6,410
Transmission O&M				
Bradfield Intertie	521	534	548	1,386
Other	-	-	-	-
Subtotal	$ 521	$ 534	$ 548	$ 1,386
Other	-	-	-	-
Total Expenses	$ 6,739	$ 6,815	$ 6,893	$ 7,796
NET REVENUES	$ 66,196	$ 67,778	$ 69,394	$ 70,221
Breakeven Power Cost	$ 66,196	$ 67,778	$ 69,394	$ 70,221
Breakeven Pwr Cost ($/MWh)	$ 101.11	$ 103.75	$ 106.46	$ 107.98

Net Present Value (2006$000)

TABLE 5-7
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 4: All New PWK Hydro w/Sitka, Angoon

	2010	2011	2012	2013	2014	2015	2016
Surplus Energy Available (MWh)	600,794	598,460	805,106	802,730	800,333	797,914	795,474
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy Sales (MWh)	588,778	586,491	789,004	786,675	784,326	781,955	779,564
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.00	$ 2.03	$ 2.05	$ 2.08	$ 2.10	$ 2.13	$ 2.15
CMP System	-	-	-	-	-	-	-
BC Hydro System	5.46	5.53	5.60	5.67	5.74	5.82	5.89
Charge Escalation		1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	553,451	551,302	741,664	739,475	737,266	735,038	732,791
Price at BC/WA Border ($/MWh)	$ 72.00	$ 73.80	$ 75.65	$ 77.54	$ 79.47	$ 81.46	$ 83.50
Price Escalation		2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 39,848	$ 40,686	$ 56,103	$ 57,336	$ 58,594	$ 59,877	$ 61,186
Other	-	-	-	-	-	-	-
Total Revenues	$ 39,848	$ 40,686	$ 56,103	$ 57,336	$ 58,594	$ 59,877	$ 61,186
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	1,178	1,188	1,618	1,633	1,649	1,664	1,680
CMP System	-	-	-	-	-	-	-
BC Hydro System	3,218	3,245	4,420	4,462	4,505	4,547	4,590
Other	-	-	-	-	-	-	-
Subtotal	$ 4,395	$ 4,433	$ 6,038	$ 6,095	$ 6,153	$ 6,211	$ 6,270
Transmission O&M							
Bradfield Intertie	352	318	326	334	846	351	360
Other	-	-	-	-	-	-	-
Subtotal	$ 352	$ 318	$ 326	$ 334	$ 846	$ 351	$ 360
Other	-	-	-	-	-	-	-
Total Expenses	$ 4,747	$ 4,751	$ 6,364	$ 6,430	$ 6,999	$ 6,563	$ 6,630
NET REVENUES	$ 35,101	$ 35,935	$ 49,739	$ 50,906	$ 51,595	$ 53,315	$ 54,557
Breakeven Power Cost	$ 35,101	$ 35,935	$ 49,739	$ 50,906	$ 51,595	$ 53,315	$ 54,557
Breakeven Pwr Cost ($/MWh)	$ 58.42	$ 60.05	$ 61.78	$ 63.42	$ 64.47	$ 66.82	$ 68.58
Net Present Value (2006$000)	$ 580,222						

TABLE 5-7
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 4: All New PWK Hydro w/Sitka, Angoon

	2017	2018	2019	2020	2021	2022	2023
Surplus Energy Available (MWh)	793,012	790,528	788,021	785,493	782,941	780,365	777,767
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy Sales (MWh)	777,152	774,717	772,261	769,783	767,282	764,758	762,212
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.18	$ 2.21	$ 2.24	$ 2.26	$ 2.29	$ 2.32	$ 2.35
CMP System	-	-	-	-	-	-	-
BC Hydro System	5.96	6.04	6.11	6.19	6.27	6.34	6.42
Charge Escalation	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	730,523	728,234	725,925	723,596	721,245	718,872	716,479
Price at BC/WA Border ($/MWh)	$ 85.59	$ 87.73	$ 89.92	$ 92.17	$ 94.47	$ 96.83	$ 99.25
Price Escalation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 62,522	$ 63,884	$ 65,274	$ 66,691	$ 68,136	$ 69,610	$ 71,113
Other	-	-	-	-	-	-	-
Total Revenues	$ 62,522	$ 63,884	$ 65,274	$ 66,691	$ 68,136	$ 69,610	$ 71,113
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	1,696	1,711	1,727	1,743	1,759	1,775	1,792
CMP System	-	-	-	-	-	-	-
BC Hydro System	4,633	4,676	4,720	4,763	4,807	4,851	4,895
Other	-	-	-	-	-	-	-
Subtotal	$ 6,328	$ 6,387	$ 6,447	$ 6,506	$ 6,566	$ 6,627	$ 6,687
Transmission O&M							
Bradfield Intertie	369	378	750	397	407	418	428
Other	-	-	-	-	-	-	-
Subtotal	$ 369	$ 378	$ 750	$ 397	$ 407	$ 418	$ 428
Other	-	-	-	-	-	-	-
Total Expenses	$ 6,697	$ 6,766	$ 7,197	$ 6,904	$ 6,974	$ 7,044	$ 7,115
NET REVENUES	$ 55,825	$ 57,119	$ 58,077	$ 59,787	$ 61,162	$ 62,566	$ 63,998
Breakeven Power Cost	$ 55,825	$ 57,119	$ 58,077	$ 59,787	$ 61,162	$ 62,566	$ 63,998
Breakeven Pwr Cost ($/MWh)	$ 70.40	$ 72.25	$ 73.70	$ 76.11	$ 78.12	$ 80.17	$ 82.28

Net Present Value (2006$000)

TABLE 5-7
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 4: All New PWK Hydro w/Sitka, Angoon

	2024	2025	2026	2027	2028	2029	2030
Surplus Energy Available (MWh)	775,145	772,500	769,830	767,136	764,418	761,676	758,908
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Energy Sales (MWh)	759,642	757,050	754,433	751,794	749,130	746,443	743,730
Wheeling Charge ($/MWh)							
Alaska Grid	$ 2.38	$ 2.41	$ 2.44	$ 2.47	$ 2.50	$ 2.53	$ 2.56
CMP System	-	-	-	-	-	-	-
BC Hydro System	6.50	6.58	6.67	6.75	6.83	6.92	7.01
Charge Escalation	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	714,064	711,627	709,167	706,686	704,182	701,656	699,106
Price at BC/WA Border ($/MWh)	$ 101.73	$ 104.28	$ 106.88	$ 109.56	$ 112.30	$ 115.10	$ 117.98
Price Escalation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)							
Power Sales	$ 72,645	$ 74,207	$ 75,799	$ 77,422	$ 79,076	$ 80,763	$ 82,481
Other	-	-	-	-	-	-	-
Total Revenues	$ 72,645	$ 74,207	$ 75,799	$ 77,422	$ 79,076	$ 80,763	$ 82,481
EXPENSES ($000)							
Power Purchases	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wheeling Expense							
Alaska	1,808	1,824	1,841	1,857	1,874	1,890	1,907
CMP System	-	-	-	-	-	-	-
BC Hydro System	4,940	4,985	5,030	5,075	5,120	5,165	5,211
Other	-	-	-	-	-	-	-
Subtotal	$ 6,748	$ 6,809	$ 6,870	$ 6,932	$ 6,993	$ 7,055	$ 7,118
Transmission O&M							
Bradfield Intertie	1,083	450	461	472	484	740	509
Other	-	-	-	-	-	-	-
Subtotal	$ 1,083	$ 450	$ 461	$ 472	$ 484	$ 740	$ 509
Other	-	-	-	-	-	-	-
Total Expenses	$ 7,831	$ 7,258	$ 7,331	$ 7,404	$ 7,478	$ 7,795	$ 7,626
NET REVENUES	$ 64,814	$ 66,948	$ 68,468	$ 70,018	$ 71,599	$ 72,967	$ 74,854
Breakeven Power Cost	$ 64,814	$ 66,948	$ 68,468	$ 70,018	$ 71,599	$ 72,967	$ 74,854
Breakeven Pwr Cost ($/MWh)	$ 83.62	$ 86.66	$ 88.94	$ 91.27	$ 93.66	$ 95.80	$ 98.63

Net Present Value (2006$000)

TABLE 5-7
Southeast Alaska Energy Export Study
Estimated Revenues and Expenses
Case 4: All New PWK Hydro w/Sitka, Angoon

	2031	2032	2033	2034
Surplus Energy Available (MWh)	756,116	753,298	750,455	747,586
Losses to AK/BC Border (%)	2.0%	2.0%	2.0%	2.0%
Energy Sales (MWh)	740,994	738,232	735,446	732,634
Wheeling Charge ($/MWh)				
Alaska Grid	$ 2.60	$ 2.63	$ 2.66	$ 2.69
CMP System	-	-	-	-
BC Hydro System	7.09	7.18	7.27	7.36
Charge Escalation	1.25%	1.25%	1.25%	1.25%
Losses in BC (%)	6.0%	6.0%	6.0%	6.0%
Energy at BC/WA Border (MWh)	696,534	693,938	691,319	688,676
Price at BC/WA Border ($/MWh)	$ 120.93	$ 123.95	$ 127.05	$ 130.23
Price Escalation	2.5%	2.5%	2.5%	2.5%
REVENUES ($000)				
Power Sales	$ 84,232	$ 86,016	$ 87,833	$ 89,685
Other	-	-	-	-
Total Revenues	$ 84,232	$ 86,016	$ 87,833	$ 89,685
EXPENSES ($000)				
Power Purchases	$ -	$ -	$ -	$ -
Wheeling Expense				
Alaska	1,924	1,940	1,957	1,974
CMP System	-	-	-	-
BC Hydro System	5,256	5,302	5,348	5,395
Other	-	-	-	-
Subtotal	$ 7,180	$ 7,243	$ 7,306	$ 7,369
Transmission O&M				
Bradfield Intertie	521	534	548	1,386
Other	-	-	-	-
Subtotal	$ 521	$ 534	$ 548	$ 1,386
Other	-	-	-	-
Total Expenses	$ 7,702	$ 7,777	$ 7,854	$ 8,755
NET REVENUES	$ 76,530	$ 78,239	$ 79,980	$ 80,930
Breakeven Power Cost	$ 76,530	$ 78,239	$ 79,980	$ 80,930
Breakeven Pwr Cost ($/MWh)	$ 101.21	$ 103.86	$ 106.58	$ 108.26

Net Present Value (2006$000)

Other Factors

Federal Energy Regulatory Commission (FERC)

The Federal Energy Regulatory Commission (FERC) has very little involvement with international power transactions but through the Federal Power Act has jurisdiction over interstate power transmission. If power were to be sold between Alaska and electric utilities in the US Pacific Northwest, FERC would require certain regulations related to interstate transmission be followed. Principal among these are open access transmission pursuant to FERC Order 888 and the filing of transmission rates. With the Bradfield Intertie and the proposed sale of power to utilities in other states, FERC could potentially seek jurisdiction over transmission within Alaska. Most likely, however, FERC would only be interested in transmission arrangements as they relate to Southeast Alaska and the Bradfield Intertie.

In general, FERC would want to see information related to transmission access and sales and resales of transmission services in Southeast Alaska. Rates charged for transmission services would need to be filed and made available to other potential users of the transmission system. Certain exceptions in filing and open access requirements exist for transmission lines owned by government agencies and municipal utilities. It is not expected that FERC requirements imposed as a result of the Bradfield Intertie would be necessarily onerous. These requirements, however, could change certain exclusive transmission operating arrangements that may exist in Southeast Alaska by mandating open transmission access. It is important to note that the FERC involvement in transmission issues is different than FERC approval and monitoring of hydroelectric projects.

The Columbia Treaty

On January 17, 1961, the "Treaty between the United States of America and Canada Relating to the Cooperative Development of the Water Resources of the Columbia River Basin" (the "Treaty") was signed by the United States and Canada. The Treaty provides for regulation of the Canadian portion of the Columbia River to produce flood control, power and other incidental benefits to the United States as well as benefits in Canada. Pursuant to the terms of the Treaty, Canada is entitled to one-half the downstream power benefits resulting from the construction of water storage projects on the Columbia River in British Columbia. Canada's share of the downstream power benefits are provided as power deliveries at the Washington – Canada border.

As part of this study, the possibility of potentially aiding in compliance with the terms of the Treaty by delivering power at the Alaska – Canada border was investigated. The Bonneville Power Administration and BC Hydro serve as the United States Entity and the Canadian Entity, respectively, in administering the provisions of the Treaty. According to representatives of the Bonneville Power Administration, it is not considered likely that the delivery points for the Canadian Entitlement power could be changed to the Alaska-Canada border without

modification of the Treaty. Such action would require significant effort and has not been evaluated further.

Other Interconnection Alternatives

During the course of this study we became aware of two alternative Southeast Alaska – BC transmission interconnection concepts. These include a transmission line between Ketchikan and Prince Rupert using high voltage direct current (HVDC) technology and a possible overland transmission route between the Swan Lake transmission line and a connection point on the BC Hydro grid near Hyder. Neither of these alternatives was evaluated as part of this Export Study however, it may be useful to consider them in subsequent studies.