

# SWAN – TYEE INTERTIE ECONOMIC ANALYSIS

PREPARED FOR

*The FOUR DAM POOL*

*Power Agency*



PREPARED BY

**CAI** Commonwealth Associates, Inc.  
engineers • consultants • construction managers

March 2006

# TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>Introduction and Purpose</b> .....   | <b>1</b>  |
| <b>Methodology of Study</b> .....   | <b>2</b>  |
| <b>Annual Costs</b> .....   | <b>3</b>  |
| <i>Project Background</i> .....   | 3         |
| <i>Design Criteria</i> .....  | 4         |
| <i>Clearing Specifications</i> .....  | 9         |
| <i>Maps</i> .....   | 10        |
| <i>Key Features</i> .....   | 13        |
| <i>O&amp;M Program and Cost</i> .....   | 13        |
| <i>Catastrophic Failures and Cost</i> .....                                       | 17        |
| <b>Wrangell – Petersburg Load Resource Balance</b> .....                          | <b>20</b> |
| <i>Wrangell</i> .....   | 20        |
| <i>Petersburg</i> .....   | 21        |
| <i>Wrangell and Petersburg Combined</i> .....                                     | 23        |
| <i>Tyee Modeling</i> .....  | 25        |
| <b>Ketchikan Public Utilities Load Resource Balance</b> .....                     | <b>29</b> |
| <i>Load Forecast</i> .....  | 29        |
| <i>Generation Forecast</i> .....  | 30        |
| <i>Swan Lake Modeling</i> .....   | 31        |
| <b>Swan – Tyee Intertie Economic Model Results</b> .....                          | <b>36</b> |
| <i>Methodology and Assumptions</i> .....  | 36        |
| <i>Model Results</i> .....  | 38        |
| <i>Base Case</i> .....  | 39        |
| <i>Sensitivity #1</i> .....   | 44        |
| <i>Sensitivity #2</i> .....   | 48        |
| <i>Sensitivity #3</i> .....   | 52        |
| <i>Sensitivity #4</i> .....   | 56        |
| <i>Sensitivity #5</i> .....   | 60        |
| <b>Conclusions</b> .....  | <b>64</b> |
| <b>Appendix A – Converting Tyee CFS to kWh</b> .....                              | <b>65</b> |
| <b>Appendix B – Net Revenue and Net Present Value Results For All Cases</b> ..... | <b>68</b> |
| <i>Nominal Net Revenues For All Cases</i> .....                                   | 68        |
| <i>Net Present Values For All Cases</i> .....                                     | 69        |

## Introduction and Purpose

Commonwealth Associates, Inc (“CAI”) is pleased to present to the Four Dam Pool Power Agency (“FDPPA”) this report summarizing the economic analysis of the Swan – Tyee Intertie (“STI”) conducted by CAI in accordance with the Notice of Award from FDPPA dated November 30, 2005.

The Swan – Tyee Intertie is a 138-kilovolt (kV) transmission line proposed to run between the Lake Tyee Hydroelectric Project located approximately 40 miles southeast of Wrangell, Alaska, and the Swan Lake Hydroelectric Project located about 22 miles northeast of Ketchikan, Alaska. The Four Dam Pool Power Agency (“FDPPA”) located in Anchorage, Alaska will own and operate the STI.

The STI will be approximately 57 miles in length and is located in a remote mountainous area generally accessible only by air. Work completed to date on the STI includes line routing, line layout and design, initiation of structure purchase, right-of-way clearing and installation of a portion of the foundations. Construction is currently on hold awaiting additional funding and results of ongoing re-evaluation of the STI economics. To date, approximately \$55 million has been spent of the estimated total construction cost of \$110 million (2006 dollars).

The purpose of this economic analysis is to:

1. Estimate the annual operations and maintenance costs of the intertie.
2. Estimate the annual renewals and replacement costs associated with repairing damage from catastrophic failures.
3. Estimate the power flowing over the line and the resulting revenues to FDPPA.
4. Estimate the annual net revenue and the net present value of the above costs and revenues over the study period.

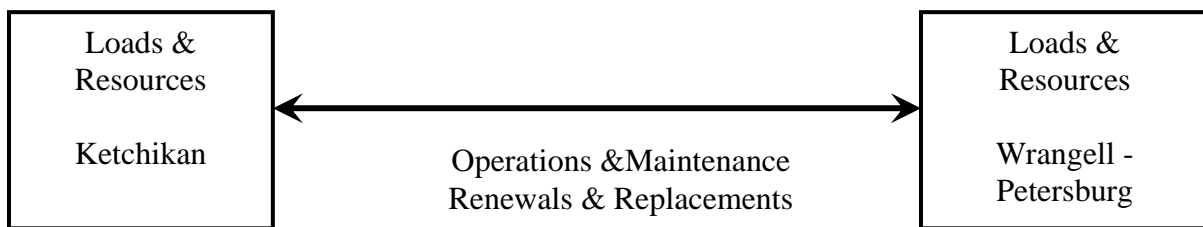
Those purposes have been achieved and this report presents the results of this economic analysis.

## Methodology of Study

The Lake Tyee Hydroelectric Project (“Tyee”) at the north end of the STI serves the loads of the Wrangell – Petersburg area. At this time, there is normally significant energy remaining in the Tyee reservoir after serving the Wrangell – Petersburg loads.

The Swan Lake Hydroelectric Project (“Swan”) at the south end of the line serves the loads of the Ketchikan area. While there is normally some excess energy at Swan after serving the Ketchikan loads there is much less than there is at Tyee. Any excess energy at Swan may be used by load growth over the study period. Additionally, low inflows at Swan Lake due to dry weather may reduce or eliminate excess energy at Swan.

In simplistic terms, this study can be thought of in the following way.



Whether or not power will flow over the line will depend upon the relative load/resource balance positions of the Wrangell – Petersburg area and the Ketchikan area. Multiple resources and loads in both areas must be considered.

This study went through the following steps to achieve its purposes.

1. Estimate the annual costs of the line.
2. Estimate the load resource balance at the Wrangell – Petersburg end of the line
3. Estimate the load resource balance at the Ketchikan end of the line.
4. Estimate the power that will flow over the line and the resulting revenues to FDPPA.
5. Evaluate these revenues and costs and determine the net present value.

*CAI believes that the assumptions used in this study and the forecasts and results of this study are reasonable. However, the results of actual operations may be significantly different from those forecast due to actual conditions or events. CAI has relied upon information provided by FDPPA, Wrangell, Petersburg, Ketchikan and others and, while CAI believes the information is reliable, it has not been independently verified.*

## *Project Background*

### **General Design**

The STI will be approximately 57 miles in length and is located in a remote mountainous area generally accessible only by air. The line is designed to carry a single conductor per phase. The conductor will generally be 397 kcmil AACSR/AW 30/7 (LarkSP) conductor at the lower elevations and 37 No. 8 Alumoweld conductor at the higher elevations and for the extremely long spans. The support structures for the line will be tubular steel. Tangent support structures will generally be Y-Type structures. At the higher elevations, a steel self-supporting H-type structure will be used. Dead-end and angle structures will generally be guyed single-pole (3 poles/structure) steel structures. Extremely long spans will be supported with an A-frame type structure, one per phase.

### **History of Project Design**

The design process for the STI has taken many years because of delays in funding and permitting.

Ketchikan Public Utilities (“KPU”) contracted with Raytheon (which later became the Washington Group) to provide engineering design services for the STI in 1994. A design review meeting held in October 1997 reported that the line design was essentially complete.

In December 2002, Power Engineers, Inc. (“POWER”) was contracted by KPU to perform a peer review of the design. The peer review:

1. Assessed the criteria used in the line design.
2. Discussed the applicability of the structures, wires and foundations for use on this specific line.
3. Provided recommendations based on POWER’s experience with the Tye Intertie line, which is located in the same geographical area.

In 2004, the project was transferred from KPU to the FDPPA. Prior to the transfer, FDPPA contracted with Dryden & LaRue, Inc. (“D&L”) to review the line design. Later, D&L was selected as the Engineer of Record for the project. Following a review of the design documents provided by the Washington Group and with consideration of the POWER peer review, D&L made some modifications to the design criteria and modified aspects of the design to improve constructability and performance. The project design based on the revised design criteria is

nearing completion; however, it is not complete and construction drawings have not been finalized. The project is currently on hold pending additional funding.

## *Design Criteria*

### **General**

Early stages of the design process included numerous studies to determine the appropriate routing, voltage level, structure type, conductor selection and design criteria. The routing of the line was influenced by environmental studies and was not selected solely on design merit.

The design process included consideration of meteorological and geotechnical studies along the route. The following studies were made available to CAI:

- September 1995, Meteorological Evaluation of the Proposed Swan Lake Intertie Route (Interim Report), KPU Contract No. 94-45, Richmond Meteorological Consulting, Atascadero, CA 93422
- December 1995, Transmission Line Conductor Selection Report, KPU Contract No. 94-51, Raytheon Infrastructure Services Incorporated
- February 1996, Transmission Line Structure Study Report, KPU Contract No. 94-51, Raytheon Infrastructure Services Incorporated
- July 1996, Geologic Reconnaissance Swan Lake to Shrimp Bay and Eagle Bay to Lake Tyee, Swan Lake – Lake Tyee Intertie Project, Dames & Moore
- September 1996, Study of Intertie Voltage Selection and Load Flow Analysis, Raytheon Infrastructure Services Incorporated
- August 1997, Geologic Reconnaissance Shrimp Bay to Eagle Bay, Swan Lake-Lake Tyee Intertie Project, Dames & Moore.

The peer review conducted by POWER in 2002 resulted in the following recommendations:

*It is recommended that the design be compared to the requirements of the 2002 edition of the NESC, and that it be brought into conformance with the 2002 edition that was issued on August 1, 2001, and became effective on January 28, 2002.*

*POWER recommends that the line designer investigate the capability of the micropile foundations to resist the moments caused by longitudinal unbalances of the nature experienced on the Tyee Intertie project.*

*POWER recommends that careful attention to detailing on the structures be observed to avoid “pockets” where water can stand and prevent the required wet-dry cycle on the steel.*

*This is an issue of enough importance that we recommend the line designer verify the line’s clearance performance under unbalanced ice dropping conditions. There were also survey inaccuracies on the Tyee line that worked to produce clearances that were less than design.*

*The high tension in the wire under heavy ice, compared to the longitudinal strength of the structure, is another factor leading POWER to recommend a second look at the longitudinal strength of the structures.*

*We recommend that the designer carefully consider the effects of longitudinal unbalance on the foundations. (Final Report Swan Lake-Lake Tyee Transmission Line Design Review, Power Engineers, December 2002)*

The peer review considered the appropriateness of the design criteria relative to NESC (Code) requirements and specific geographic and meteorological conditions. The peer review did not include a detailed review of the line layout (structure spotting) or specific detail design features (i.e., structures, foundations, hardware, etc.).

The Engineer of Record (D&L) has considered the peer review recommendations and, based upon the peer review and their own experience with lines in similar environment, has modified the design criteria to add more longitudinal strength to the towers. D&L has also made a number of changes to the layout of the line, the support structures and the foundations based upon their experience with lines located in SE Alaska.

### **Weather-related Design Criteria**

A summary of the design criteria developed by Raytheon Engineers & Constructors (as presented in a slide presentation, October 1997) follows along with a marked-up copy of the criteria developed by the current Engineer of Record, D&L.



## PROJECT REVIEW C. Detailed Design

### 1. Design Criteria

#### ❖ Loading Conditions Low altitude section

NESC: 0 degrees, 1/2" radial ice, 4 psf wind  
 Heavy Ice: 30 degrees F, 1.5" radial ice, no wind on conductors, 4 psf wind on structures  
 High Wind: 40 degrees F, no ice, 26 psf wind  
 Combined Snow/Wind: 30 degrees F, 1.47" radial ice and 4.9 psf wind equivalent for 3.3" radial wet snow  
 Low Temp: -5 degrees F, no wind, no ice  
 EDS: 40 degrees F, no ice, no wind  
 Hot Sag: 120 degrees F, no ice, no wind

#### High altitude section and Water Crossings

NESC, Heavy Ice, Combined Snow/Wind, Low Temp, EDS, Hot Sag: Same as low altitude  
 High Wind: 40 degrees F, no ice, 37 psf wind on conductors, 50 psf wind on structures  
 Extreme Snow/Ice: 20 degrees F, 1.72" radial ice equivalent to 3.86" radial wet snow, no wind

**Raytheon** Engineers &  
Constructors

12

## PROJECT REVIEW C. Detailed Design

### 1. Design Criteria (cont.)

#### ❖ Conductor Tensions

##### Low altitude section

16% RTS, final @ EDS  
 70% RTS, final @ heavy ice

##### High altitude section and Water Crossings

22% RTS, final @ EDS  
 70% RTS, final @ heavy ice  
 90% RTS, final @ extreme snow/ice

#### ❖ Safety Factors/Overload Capacity Factors- Loads

|              | NESC     | Heavy Ice | High Wind | Comb. Snow/<br>Wind | Extreme Snow/<br>Ice |
|--------------|----------|-----------|-----------|---------------------|----------------------|
| Vertical     | 1.5      | 1.1       | 1.1       | 1.1                 | 1.0                  |
| Transverse   | 2.5/1.65 | 1.1       | 1.1       | 1.1                 | 1.0                  |
| Longitudinal | 1.1      | 1.1       | 1.1       | 1.1                 | 1.0                  |

**Raytheon** Engineers &  
Constructors

13



## PROJECT REVIEW C. Detailed Design

### 1. Design Criteria

#### ❖ Loading Conditions

##### Low altitude section

NESC: 0 degrees, 1/2" radial ice, 4 psf wind  
 Heavy Ice: 30 degrees F, 1.5" radial ice, ~~no~~ <sup>4 psf</sup> wind on conductors, ~~25~~ <sup>47</sup> psf wind on structures

High Wind: 40 degrees F, no ice, ~~25~~ <sup>21.4</sup> psf wind ~~on structures~~ <sup>on conductors</sup>  
~~Combined Snow/Wind: 30 degrees F, 1.47" radial ice and 4.9 psf wind equivalent for 3.3" radial wet snow~~

Low Temp: -5 degrees F, no wind, no ice

EDS: 40 degrees F, no ice, no wind

Hot Sag: 120 degrees F, no ice, no wind

Unbalance Longitudinal: 30°F, 1/2" radial ice except one side of any one phase has no conductor, L = 6,000 lbs

##### High altitude section and Water Crossings

NESC, Heavy Ice, Combined Snow/Wind, Low Temp,

EDS, Hot Sag: Same as low altitude

High Wind: 40 degrees F, no ice, 37 psf wind on conductors, 50 psf wind on structures

~~Extreme Snow/Ice: 20 degrees F, 1.72" radial ice equivalent to 3.86" radial wet snow, no wind~~

Heavy Ice: 20°F, 1.75" radial ice, 4 psf wind on conductors, 47 psf wind on structure

Raytheon Engineers & Constructors

12

Unbalance Longitudinal: 30°F, 1" radial ice except one side of any one phase has no conductor, L = 18,000 lbs.

## PROJECT REVIEW C. Detailed Design

### 1. Design Criteria (cont.)

#### ❖ Conductor Tensions

##### Low altitude section

16% RTS, final @ EDS

70% RTS, final @ heavy ice

##### High altitude section and Water Crossings

22% RTS, final @ EDS

70% RTS, final @ heavy ice

90% RTS, final @ extreme snow/ice

#### ❖ Safety Factors/Overload Capacity Factors - Loads

|              | NESC     | Heavy Ice | High Wind | <del>Comb Snow/Wind</del> | <del>Extreme Snow/Ice</del> | Unbalance Longitudinal |
|--------------|----------|-----------|-----------|---------------------------|-----------------------------|------------------------|
| Vertical     | 1.5      | 1.1       | 1.1       | <del>1.1</del>            | <del>1.0</del>              | 1.1                    |
| Transverse   | 2.5/1.65 | 1.1       | 1.1       | <del>1.1</del>            | <del>1.0</del>              | 1.1                    |
| Longitudinal | 1.1      | 1.1       | 1.1       | <del>1.1</del>            | <del>1.0</del>              | 1.0                    |

Raytheon Engineers & Constructors

13

Revised 2004  
Dryden & Larue, Inc.

The basic design criteria for this line are considerably more stringent than standard code requirements. This is appropriate given the severe Southeast Alaska conditions, remoteness of the line and history of lines in the immediate area. The 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. This line has had the benefit of being reviewed by several engineering firms with extensive experience with lines constructed in similar terrain/climates, including the two lines that this project will interconnect.

The peer review conclusion in 2002 was that the line would generally meet the goal of “a slightly conservative design based on a basic 50 years recurrence period” with the following caveat: “an exception to the above conclusion was that the peer review considered the longitudinal loading to be less than they would recommend.”

The revised D&L criteria have increased this longitudinal loading, and the current suggested design appears to be based on criteria that do meet the goal of “a slightly conservative design based on a basic 50 years recurrence period.”

As stated in the peer review (*italics added for clarity*):

The structures are designed to withstand the 50-year RP (*Recurrence Period*) loads identified in the meteorological evaluation, and utilize strength and load factors (combined into an OCF) consistent with the requirements for a slightly conservative design to minimize failures. It should be noted again that the 50-year return period design is not a guarantee of a 50-year life, or that the loads will occur only once in the 50-year period. They merely indicate that the loads have only a 2 percent probability of being exceeded in each year, but that they have a 64 percent probability of being exceeded at least once during the 50 years (*45.5% probability of being exceeded at least once in a 30-year period*). (Final Report Swan Lake-Lake Tyee Transmission Line Design Review, Power Engineers, December 2002).

In conclusion, the STI project has the advantage of the experience gained from the operating history of both the Swan Lake (since 1985) and the Lake Tyee (since 1984) lines.

The loading criteria developed for the STI line are generally more conservative than the criteria used for the Swan Lake line and considerably more conservative than the original criteria used for the Tyee line.

Relative to standard weather-related loading (wind, ice, temperature) it is safe to say that the design criteria developed, reviewed and refined by a number of engineers with extensive line design experience in Southeast Alaska should result in a line that is more resilient than either of the other two lines it will interconnect.

## **Non-weather Design Considerations**

Factors that are most likely to result in line failure other than weather-related conditions and that are not directly related to standard weather loading criteria include the following:

- Tree strikes
- Landslides
- Avalanches
- Vandalism
- Design errors
- Manufacturing failures

Support structures are not designed to withstand forces caused by tree strikes, landslides or avalanches. The routing of the line provides the primary avoidance mechanism for landslides and avalanches. Attempts were made to route the line away from known slide areas; however, outside factors did not allow complete freedom of the line route. The majority of the line is not in an area prone to landslides and avalanche.

Vandalism is normally not a serious problem and is not predictable except perhaps from historical records. No information is available to indicate that vandalism is a serious issue in the area of the STI line. The line's remoteness should reduce the number of such incidents.

Design errors do occur, but the probability of design error causing a serious operation and maintenance issue is remote.

Manufacturing failures also occur, but are seen as low probability.

## ***Clearing Specifications***

A clearing and logging contract for the STI line was let in 2003. This contract generally required a varying width (100 to 200 foot) clear-cut following the proposed transmission line centerline. The clear cut was offset toward the uphill side to maximize its effectiveness. However, even a 200 foot width on steep slide slopes is not sufficient to eliminate all tree strikes. The clearing specification required that in addition to the clear cut all danger trees (any tree that could rotate about its base and strike the line) be removed. It is our understanding that danger trees were marked but were not removed in 2003. It is also our understanding that several sections of the line were being considered for relocation and that these portions were not cleared.

The current project schedule is based on construction being complete in 2008. It has been assumed that the remaining clearing and danger tree removals will be completed prior to the completion of construction. It has also been assumed that the portions of the right of way that were cleared in 2003 will be re-cleared as appropriate so that right-of-way maintenance will not be required for the first 3 to 5 years.

Following a clear cut, the first severe storm often takes out additional trees that were protected by the surrounding trees prior to the clear cut. This line has the advantage that much of the

clearing was completed in 2003, and the trees left standing at the edge of the clear cut will have weathered several seasons prior to actual line construction. 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 low altitude sections of the line will require clearing as often as every 3 to 5 years. The alders, prevalent in the low areas grow 5 feet or more a year. Above 500 feet, the conifers grow at a much slower rate, requiring less frequent clearing, perhaps every 10 to 12 years.

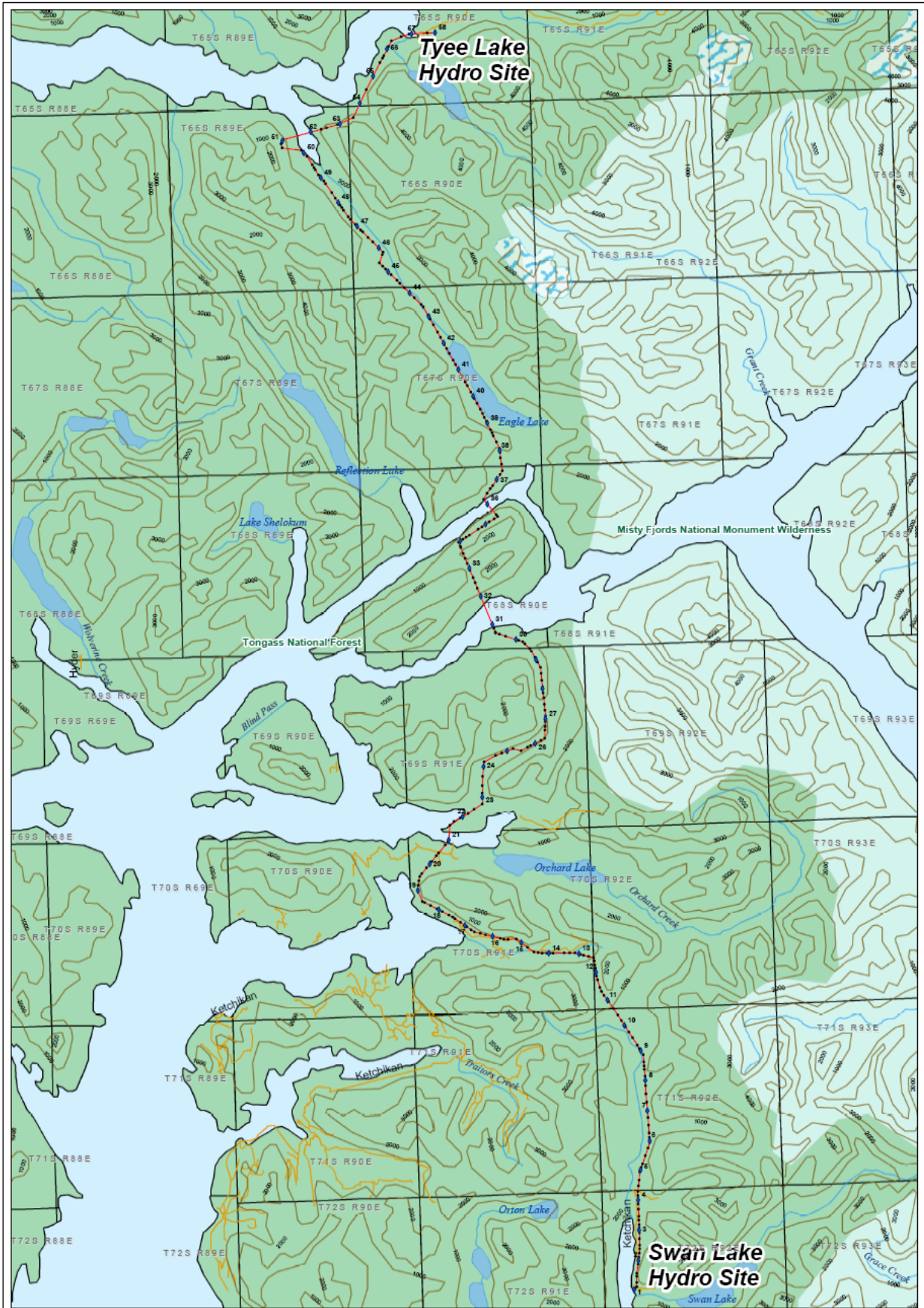
### ***Maps***

The following two pages include maps of the proposed line.









## ***Key Features***

Key features considered in evaluation of the potential 30-year O&M plan and budget include the following:

- Line design criteria
- Right-of-way clearing criteria
- Line routing (side hills and elevation)
- Terrain and climate
- Remoteness (helicopter access)
- Quantities; line length, structure sites, structure types
- History of similar lines

## ***O&M Program and Cost***

### **General**

The following proposed O&M program for the STI line is similar in scope to what is now being implemented on the Swan and Tyee transmission lines. The program outlined and the associated costs assume O&M for the STI line will be a stand-alone contract. However, some economies may be realized if a single O&M contract is let for all three lines as a group. The costs assume that the O&M contracts will be multi-year (2-3 years minimum) and that a two to three week line outage period will be available in the May through July period. It is recommended, and it has been assumed, that the work will be completed under three separate contracts:

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

The separation of these contracts should result in cost savings by making maximum use of specialized labor while at the same time making use of local expertise and labor.

### **Line Access**

Access to the line is a major cost item. Access 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 than one-half mile required travel between a landing site and a 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 unusable or a safety hazard.



Portions of the line that are located near water have a 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 STI line and distance from water was considered in the cost estimates.

### **Facility Inspection and Maintenance Program**

#### **A. Climbing Inspections**

The proposed O&M program is based on a climbing inspection of 15 structure sites each year. The 15 sites would be selected to include a minimum of one of each structure type on the line. The 15-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 and maintenance will include climbing each structure. In the case of multi-pole structures, each pole will be climbed. 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. Maintenance items requiring repair at the time of the climbing inspection include:

- Loose guys
- Missing or damaged cotter pins
- Loose or missing bolts, nuts and locknuts
- Damaged insulators
- Damaged guy and guy insulator hardware
- Damaged hardware
- Guy guards
- Dampers (fatigued, broken or missing)

Based on the maintenance history of the Swan Lake and 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.

## B. Visual (on ground) Inspection

Visual inspections include correcting minor items that can be accessed from 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 40 structure sites each year. The 40 sites would be selected to include a minimum of one from each structure type on the line. The 40-site rotation combined with the proposed climbing inspection (of 15 sites each year) would result in all structure types undergoing a detailed inspection (climbing or visual) every 5 years.

## C. 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.

## D. Maintenance Materials

Most materials used on the STI line 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 temporary spare structures sufficient to support the line for emergency repairs, conductor, hardware, insulators, foundation materials, compression dead-ends, guy wire, guy materials, dampers, armor rods, anchor rods and other minor materials.

CAI estimates the cost to maintain spare materials inventory, including material replacement, to be approximately \$20,000 every 5 years.

Repair of the following defects, if noted, during any of the above inspections is not included in the routine yearly maintenance program but would be corrected based on either cost-plus or a negotiated price with the contractor. A contingency is included to cover these costs.

- Dents, cracked welds
- Bent or pulled anchor rods
- Missing or damaged grout
- Foundations that are leaning or eroding
- Foundation welds

## E. Cost

Materials for routine maintenance will be from the spare parts maintenance supply established as part of the initial construction contract. Costs for the re-supply of the maintenance items are included in the O&M cost estimate.

The costs assume that the inspections will be completed when the line is de-energized and that it will be de-energized for a minimum of two to three weeks during the May through July period. The costs assume that the climbing, visual and helicopter inspection work described above will be let as one contract as is currently the practice. The contractor will furnish all labor, tools and access. Helicopter landing site will generally be no more than 2000' from structure sites.

Cost Summary by Function (2006 dollars)

*Climbing Inspection*

|                    |                      | <u>Years 1-7</u> | <u>Years 8+</u>  |
|--------------------|----------------------|------------------|------------------|
| Mobilization/demob |                      | \$ 12,000        | \$ 12,000        |
| Climb structures   | 15 @ \$6,000.00 each | \$ 90,000        | \$ 90,000        |
| Damper change out  |                      | \$ 0             | \$ 13,000        |
| Contingent sum     |                      | <u>\$ 30,000</u> | <u>\$ 30,000</u> |
|                    | Total                | \$132,000        | \$145,000        |

*Visual (on ground) Inspection*

|                    |                      |                  |
|--------------------|----------------------|------------------|
| Mobilization/demob |                      | \$ 10,000        |
| Visual Inspection  | 40 @ \$1,000.00 each | \$ 40,000        |
| Contingent sum     |                      | <u>\$ 10,000</u> |
|                    | Total                | \$60,000         |

*Helicopter Survey* \$15,000

**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.

*Thermographic Survey* \$18,000

**Right-of-way Clearing**

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. The maintenance clearing cost estimate is \$140,000 yearly starting in year three. The cost is based on completing approximately 15-20 % of the line length resulting in a complete clearing cycle every 5 to 7 years.

*Right-of-way Clearing*

\$140,000

## ***Catastrophic Failures and Cost***

### **Long-span Conductor Drop**

This situation has occurred on the Tyee Lake line when a compression dead-end failed. In this case, the span length was approximately 5,000 feet and the conductor was 37 No. 8 Alumoweld. It is assumed there is a probability of this happening on the STI line at least once in the line's 30-year life.

The cost for repairing long-span conductor drop can vary greatly, depending on the span. Steep canyon and water crossings could cost much more to repair than long-span valley crossings.

The cost for this type of repair will be between \$250,000 and \$400,000, depending upon the location. For the purposes of this study, the cost estimate assumes a cost of \$325,000 occurring at year 15.

### **Mudslide/Landslide/Avalanche**

Landslides and avalanches occur frequently in Southeast Alaska. Two towers on the Tyee line, three towers on the Snettisham line and one 3-pole structure on the Swan Lake line have been destroyed by slides since construction.

Given the "side hill" routing of the STI, it is reasonable to assume that a structure site will be impacted by a slide every 10 years. The cost for repair would be determined by many factors, such as, location, type of tower and whether the tower and foundation must be relocated.

The cost for this type of repair would be between \$350,000 and \$1,000,000. For the purposes of the cost estimate, an average cost of \$675,000 was used, occurring at 10-year intervals starting at year 5.

### **Tree Strikes**

Where the STI 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 4 to 6 years. The cost for this type of repair would be between \$50,000 and \$250,000. For purposes of the cost estimate, an average cost of \$150,000 was used, with an occurrence the first year and years 5, 15, 20 and 25.

**Table 1**  
**Projected Annual O&M and Catastrophic Failures Costs**  
**2006 Dollars**

|      | Operations and Maintenance |          |          |          |             |           |           |          |          |           | Catastrophic Failures |           |           |             | Total        |
|------|----------------------------|----------|----------|----------|-------------|-----------|-----------|----------|----------|-----------|-----------------------|-----------|-----------|-------------|--------------|
|      | Climbing                   | Visual   | Helo     | Thermo   | Materials   | ROW       | Insurance | Land Use | Admin.   | Sub Total | Cond.                 | Mud/Land  | Tree      | Sub Total   | Annual       |
|      | Inspect.                   | Inspect. | Survey   | Survey   | Replacement | Clearing  |           |          |          |           | Drop                  | Slide     | Strike    |             | Costs        |
| 2009 | \$132,000                  | \$60,000 | \$15,000 | \$18,000 |             |           | \$4,480   | \$31,950 | \$18,000 | \$279,430 |                       |           | \$150,000 | \$150,000   | \$429,430    |
| 2010 | \$132,000                  | \$60,000 | \$15,000 | \$0      |             |           | \$4,480   | \$31,950 | \$18,000 | \$261,430 |                       |           |           | \$0         | \$261,430    |
| 2011 | \$132,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$401,430 |                       |           |           | \$0         | \$401,430    |
| 2012 | \$132,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$401,430 |                       |           |           | \$0         | \$401,430    |
| 2013 | \$132,000                  | \$60,000 | \$15,000 | \$0      | \$20,000    | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$421,430 |                       |           |           | \$0         | \$421,430    |
| 2014 | \$132,000                  | \$60,000 | \$15,000 | \$18,000 |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$419,430 |                       | \$675,000 | \$150,000 | \$825,000   | \$1,246,430  |
| 2015 | \$132,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$401,430 |                       |           |           | \$0         | \$401,430    |
| 2016 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2017 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2018 | \$145,000                  | \$60,000 | \$15,000 | \$0      | \$20,000    | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$434,430 |                       |           | \$150,000 | \$150,000   | \$584,430    |
| 2019 | \$145,000                  | \$60,000 | \$15,000 | \$18,000 |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$432,430 |                       |           |           | \$0         | \$432,430    |
| 2020 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2021 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2022 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2023 | \$145,000                  | \$60,000 | \$15,000 | \$0      | \$20,000    | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$434,430 | \$325,000             | \$675,000 | \$150,000 | \$1,150,000 | \$1,584,430  |
| 2024 | \$145,000                  | \$60,000 | \$15,000 | \$18,000 |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$432,430 |                       |           |           | \$0         | \$432,430    |
| 2025 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2026 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2027 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2028 | \$145,000                  | \$60,000 | \$15,000 | \$0      | \$20,000    | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$434,430 |                       |           | \$150,000 | \$150,000   | \$584,430    |
| 2029 | \$145,000                  | \$60,000 | \$15,000 | \$18,000 |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$432,430 |                       |           |           | \$0         | \$432,430    |
| 2030 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2031 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2032 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2033 | \$145,000                  | \$60,000 | \$15,000 | \$0      | \$20,000    | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$434,430 |                       | \$675,000 | \$150,000 | \$825,000   | \$1,259,430  |
| 2034 | \$145,000                  | \$60,000 | \$15,000 | \$18,000 |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$432,430 |                       |           |           | \$0         | \$432,430    |
| 2035 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2036 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2037 | \$145,000                  | \$60,000 | \$15,000 | \$0      |             | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$414,430 |                       |           |           | \$0         | \$414,430    |
| 2038 | \$145,000                  | \$60,000 | \$15,000 | \$0      | \$20,000    | \$140,000 | \$4,480   | \$31,950 | \$18,000 | \$434,430 |                       |           |           | \$0         | \$434,430    |
|      |                            |          |          |          |             |           |           |          |          |           |                       |           |           |             | \$15,539,900 |

**Table 2**  
**Projected Annual O&M and Catastrophic Failures Costs**  
**Inflated Dollars – 2.5% Annual Inflation**

|      | Operations and Maintenance |           |          |          |             |           |           |          |          |           | Catastrophic Failures |             |             |             | Total               |
|------|----------------------------|-----------|----------|----------|-------------|-----------|-----------|----------|----------|-----------|-----------------------|-------------|-------------|-------------|---------------------|
|      | Climbing                   | Visual    | Helo.    | Thermo.  | Materials   | ROW       |           |          | Admin.   | Sub Total | Cond.                 | Mud/Land    | Tree        | Sub Total   | Annual              |
|      | Inspect.                   | Inspect.  | Survey   | Survey   | Replacement | Clearing  | Insurance | Land Use | Expenses |           | Drop                  | Slide       | Strike      |             | Costs               |
| 2009 | \$142,150                  | \$64,613  | \$16,153 | \$19,384 |             |           | \$4,824   | \$34,407 | \$19,384 | \$300,916 |                       |             | \$161,534   | \$161,534   | \$462,449           |
| 2010 | \$145,703                  | \$66,229  | \$16,557 |          |             |           | \$4,945   | \$35,267 | \$19,869 | \$288,570 |                       |             |             |             | \$288,570           |
| 2011 | \$149,346                  | \$67,884  | \$16,971 |          |             | \$158,397 | \$5,069   | \$36,148 | \$20,365 | \$454,181 |                       |             |             |             | \$454,181           |
| 2012 | \$153,080                  | \$69,582  | \$17,395 |          |             | \$162,357 | \$5,195   | \$37,052 | \$20,874 | \$465,536 |                       |             |             |             | \$465,536           |
| 2013 | \$156,907                  | \$71,321  | \$17,830 |          | \$23,774    | \$166,416 | \$5,325   | \$37,979 | \$21,396 | \$500,948 |                       | \$802,363   | \$178,303   | \$980,666   | \$1,481,614         |
| 2014 | \$160,829                  | \$73,104  | \$18,276 | \$21,931 |             | \$170,576 | \$5,458   | \$38,928 | \$21,931 | \$511,035 |                       |             |             |             | \$511,035           |
| 2015 | \$164,850                  | \$74,932  | \$18,733 |          |             | \$174,841 | \$5,595   | \$39,901 | \$22,480 | \$501,331 |                       |             |             |             | \$501,331           |
| 2016 | \$185,612                  | \$76,805  | \$19,201 |          |             | \$179,212 | \$5,735   | \$40,899 | \$23,042 | \$530,505 |                       |             |             |             | \$530,505           |
| 2017 | \$190,253                  | \$78,725  | \$19,681 |          |             | \$183,692 | \$5,878   | \$41,921 | \$23,618 | \$543,768 |                       |             |             |             | \$543,768           |
| 2018 | \$195,009                  | \$80,693  | \$20,173 |          | \$26,898    | \$188,284 | \$6,025   | \$42,969 | \$24,208 | \$584,260 |                       |             | \$201,733   | \$201,733   | \$785,993           |
| 2019 | \$199,884                  | \$82,711  | \$20,678 | \$24,813 |             | \$192,992 | \$6,176   | \$44,043 | \$24,813 | \$596,110 |                       |             |             |             | \$596,110           |
| 2020 | \$204,881                  | \$84,778  | \$21,195 |          |             | \$197,816 | \$6,330   | \$45,145 | \$25,434 | \$585,579 |                       |             |             |             | \$585,579           |
| 2021 | \$210,003                  | \$86,898  | \$21,724 |          |             | \$202,762 | \$6,488   | \$46,273 | \$26,069 | \$600,218 |                       |             |             |             | \$600,218           |
| 2022 | \$215,253                  | \$89,070  | \$22,268 |          |             | \$207,831 | \$6,651   | \$47,430 | \$26,721 | \$615,224 |                       |             |             |             | \$615,224           |
| 2023 | \$220,635                  | \$91,297  | \$22,824 |          | \$30,432    | \$213,027 | \$6,817   | \$48,616 | \$27,389 | \$661,037 | \$494,526             | \$1,027,092 | \$228,243   | \$1,749,861 | \$2,410,898         |
| 2024 | \$226,151                  | \$93,580  | \$23,395 | \$28,074 |             | \$218,352 | \$6,987   | \$49,831 | \$28,074 | \$674,443 |                       |             |             |             | \$674,443           |
| 2025 | \$231,804                  | \$95,919  | \$23,980 |          |             | \$223,811 | \$7,162   | \$51,077 | \$28,776 | \$662,529 |                       |             |             |             | \$662,529           |
| 2026 | \$237,599                  | \$98,317  | \$24,579 |          |             | \$229,406 | \$7,341   | \$52,354 | \$29,495 | \$679,092 |                       |             |             |             | \$679,092           |
| 2027 | \$243,539                  | \$100,775 | \$25,194 |          |             | \$235,141 | \$7,525   | \$53,663 | \$30,232 | \$696,069 |                       |             |             |             | \$696,069           |
| 2028 | \$249,628                  | \$103,294 | \$25,824 |          | \$34,431    | \$241,020 | \$7,713   | \$55,004 | \$30,988 | \$747,902 |                       |             | \$258,236   | \$258,236   | \$1,006,138         |
| 2029 | \$255,869                  | \$105,877 | \$26,469 | \$31,763 |             | \$247,045 | \$7,905   | \$56,379 | \$31,763 | \$763,071 |                       |             |             |             | \$763,071           |
| 2030 | \$262,265                  | \$108,524 | \$27,131 |          |             | \$253,222 | \$8,103   | \$57,789 | \$32,557 | \$749,590 |                       |             |             |             | \$749,590           |
| 2031 | \$268,822                  | \$111,237 | \$27,809 |          |             | \$259,552 | \$8,306   | \$59,234 | \$33,371 | \$768,330 |                       |             |             |             | \$768,330           |
| 2032 | \$275,542                  | \$114,018 | \$28,504 |          |             | \$266,041 | \$8,513   | \$60,714 | \$34,205 | \$787,538 |                       |             |             |             | \$787,538           |
| 2033 | \$282,431                  | \$116,868 | \$29,217 |          | \$38,956    | \$272,692 | \$8,726   | \$62,232 | \$35,060 | \$846,183 | \$1,314,765           | \$292,170   | \$1,606,935 | \$2,453,118 |                     |
| 2034 | \$289,492                  | \$119,790 | \$29,947 | \$35,937 |             | \$279,509 | \$8,944   | \$63,788 | \$35,937 | \$863,344 |                       |             |             |             | \$863,344           |
| 2035 | \$296,729                  | \$122,784 | \$30,696 |          |             | \$286,497 | \$9,168   | \$65,383 | \$36,835 | \$848,093 |                       |             |             |             | \$848,093           |
| 2036 | \$304,147                  | \$125,854 | \$31,464 |          |             | \$293,659 | \$9,397   | \$67,017 | \$37,756 | \$869,295 |                       |             |             |             | \$869,295           |
| 2037 | \$311,751                  | \$129,000 | \$32,250 |          |             | \$301,001 | \$9,632   | \$68,693 | \$38,700 | \$891,027 |                       |             |             |             | \$891,027           |
| 2038 | \$319,545                  | \$132,225 | \$33,056 |          | \$44,075    | \$308,526 | \$9,873   | \$70,410 | \$39,668 | \$957,378 |                       |             |             |             | \$957,378           |
|      |                            |           |          |          |             |           |           |          |          |           |                       |             |             |             | <u>\$24,502,065</u> |

# Wrangell – Petersburg Load Resource Balance

## Wrangell

### Load Forecast

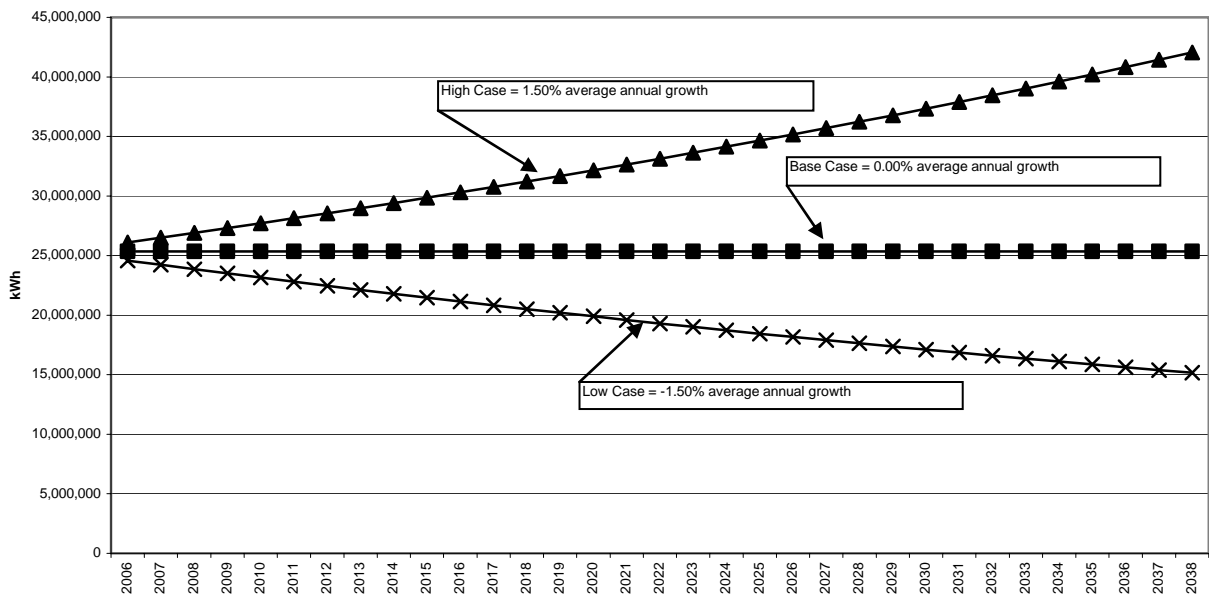
Three load growth cases were developed for Wrangell, a base case, a high-growth case and a low-growth case. In consultation with Wrangell representatives, the following average annual rates of growth were assumed for the three load forecasts.

**Table 3**  
**Wrangell Load Forecast**  
**Average Annual Rates of Growth**

| Forecast Case | Average Annual Rate of Growth |
|---------------|-------------------------------|
| Base Case     | 0.00%                         |
| High Case     | 1.50%                         |
| Low Case      | -1.50%                        |

Losses of 5% were added to this load forecast to arrive at a forecast of requirements at the generation level.

**Chart 1**  
**Wrangell Requirements Forecast**





## **Electric Heat Conversions**

A brief analysis was conducted of the potential conversions of Wrangell oil heated buildings to electric heat. It is expected that governmental buildings would be converted first. Oil heated homes would be likely to follow. It was estimated that approximately 30% of the homes eligible to convert would actually follow through and switch to electric heat. CAI did not make a specific estimate of the impact of the conversion of governmental buildings to electric heat. However, CAI expects that both the increased load of any converted governmental buildings as well as electrically heated homes would fit within the range of the high case forecast. Therefore, no additional changes to the forecast were made and it was concluded that the high forecast adequately represented the potential impact of electric heat conversions.

The load resulting from electric heat conversions may be served as interruptible load. If so, this reduces the probability of the high load forecast being realized and increases the relative probability of the average forecast being realized.

## **Generation Forecast**

Wrangell owns a small amount of diesel generation. After reviewing historical generation trends and discussions with Wrangell management, it was determined appropriate to assume 2,000 kWh of diesel generation each month of the forecast except June, when 600,000 kWh of diesel generation would be assumed. The remainder of Wrangell's load was served with the output of the Tyee plant.

## ***Petersburg***

### **Load Forecast**

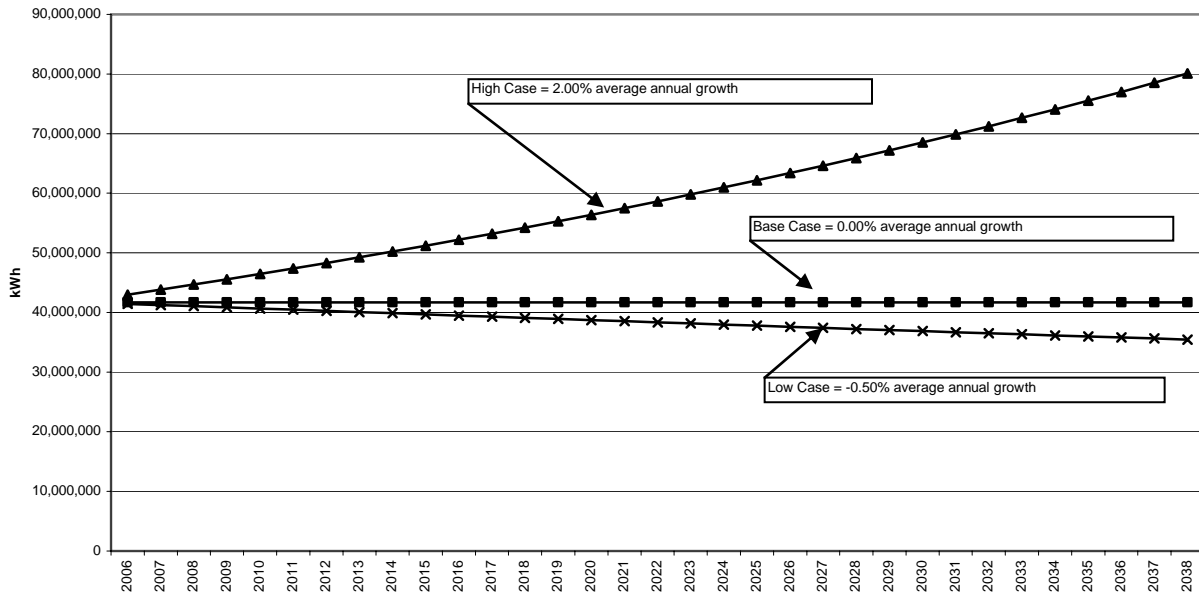
Three load growth cases were developed for Petersburg, a base case, a high-growth case and a low-growth case. In consultation with Petersburg management, the following average annual rates of growth were assumed for the three load forecasts.

**Table 4**  
**Petersburg Load Forecast**  
**Average Annual Rates of Growth**

| Forecast Case | Average Annual Rate of Growth |
|---------------|-------------------------------|
| Base Case     | 0.00%                         |
| High Case     | 2.00%                         |
| Low Case      | -0.50%                        |

Losses of 8.85% were added to this load forecast to arrive at a forecast of requirements at the generation level.

**Chart 2  
Petersburg Requirements Forecast**



**Electric Heat Conversions**

A brief analysis was conducted of the potential conversions of Petersburg oil heated buildings to electric heat. It is expected that governmental buildings would be converted first. Oil heated homes would be likely to follow. It was estimated that approximately 30% of the homes eligible to convert would actually follow through and switch to electric heat. CAI did not make a specific estimate of the impact of the conversion of governmental buildings to electric heat. However, CAI expects that both the increased load of any converted governmental buildings as well as electrically heated homes would fit within the range of the high case forecast. Therefore, no additional changes to the forecast were made and it was concluded that the high forecast adequately represented the potential impact of electric heat conversions.

The load resulting from electric heat conversions may be served as interruptible load. If so, this reduces the probability of the high load forecast being realized and increases the relative probability of the average forecast being realized.

**Generation Forecast**

Petersburg receives the output of the Blind Slough Hydroelectric Project. CAI examined historical Blind Slough output from 1996 through 2004. Average annual generation during that period was 11,601,978 kWh and this amount was assumed as the annual generation in the forecast. This annual amount was split into months using the average monthly generation from the same period.

Petersburg also owns some diesel generation. Historical diesel generation was examined for the 1996 through 2004 period. It was determined that the period 2002 – 2004 most accurately represented future diesel operation. Therefore, the average monthly diesel generation for the

period 2002 – 2004 was used for future years. The total assumed annual diesel generation was 879,461 kWh.

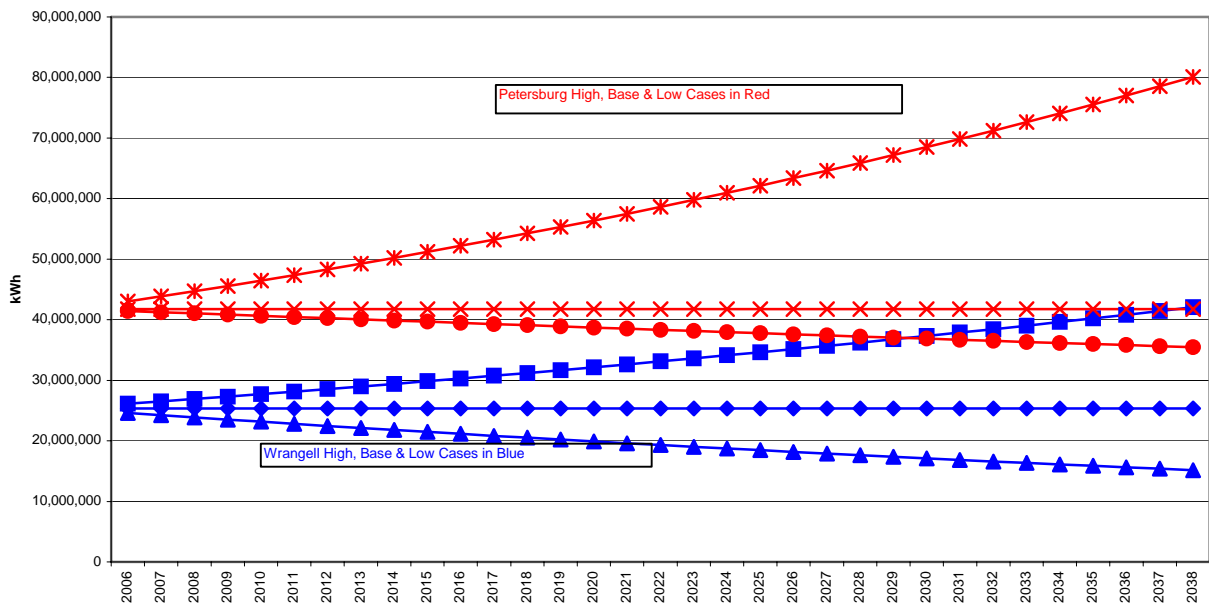
The remaining Petersburg load, after applying Blind Slough and the assumed diesel generation, was served with the output of the Tyee plant.

## Wrangell and Petersburg Combined

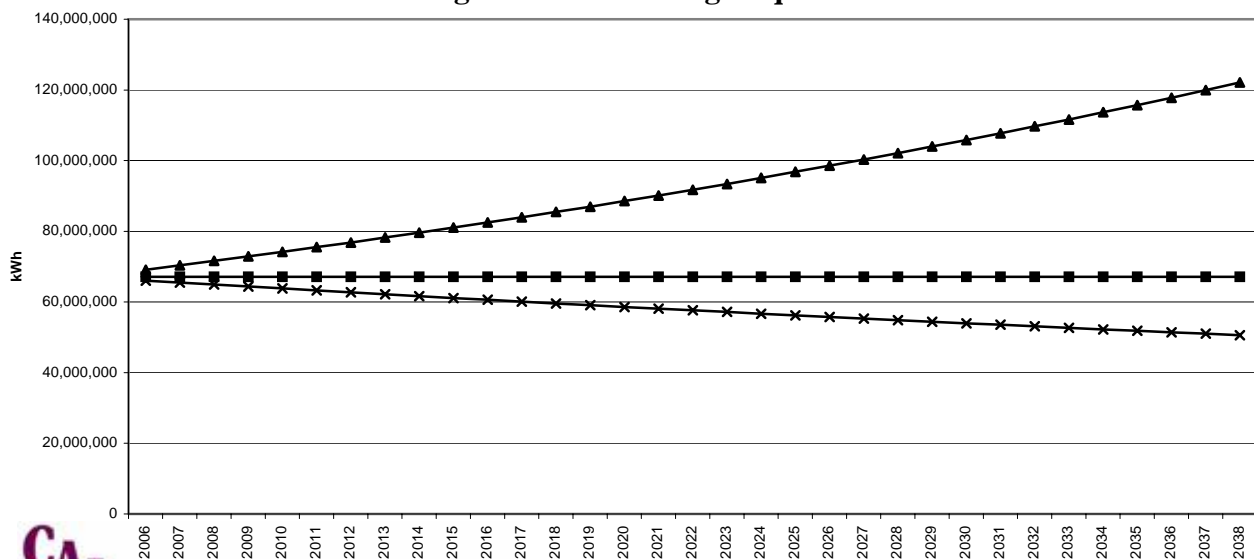
### Load Forecast

The next step in the analysis was to combine the Wrangell and Petersburg loads and generation. The following charts show the individual forecast cases for Wrangell and Petersburg as well as the combined forecasts.

**Chart 3  
Wrangell and Petersburg Requirements Forecasts**



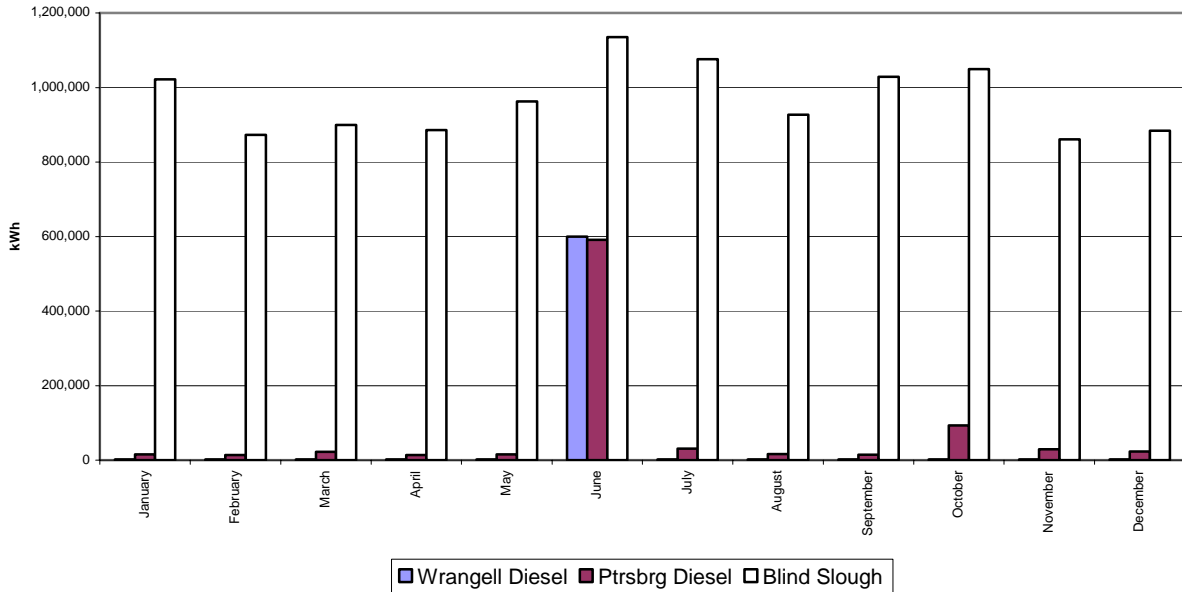
**Chart 4  
Combined Wrangell and Petersburg Requirements Forecasts**



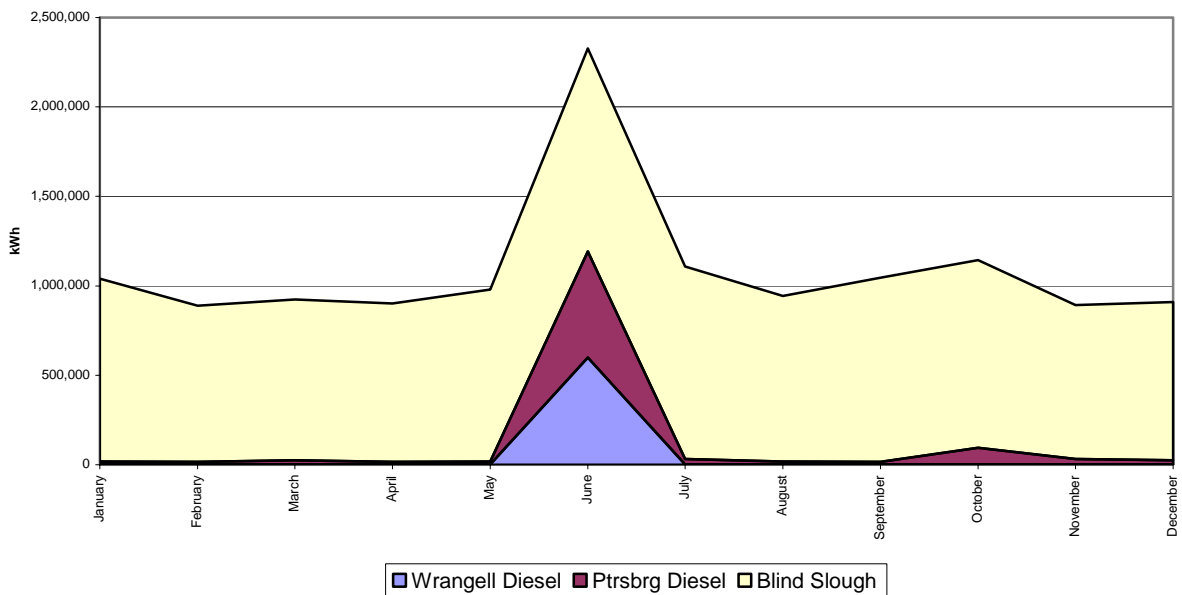
## Generation Forecast

The following charts show the Wrangell and Petersburg generation other than Tye.

**Chart 5**  
**Wrangell and Petersburg Generation**



**Chart 6**  
**Wrangell and Petersburg Combined Generation**



## *Tyee Modeling*

The Tyee project meets the remaining load of Wrangell and Petersburg after the use of their own resources. The goal of this modeling was to determine the energy remaining in the Tyee reservoir after serving the loads of Wrangell and Petersburg.

Reports provided to CAI documented the Tyee reservoir capacity as 52,400 acre-feet. Historical monthly inflow data was taken from Tyee Design Criteria documents. Table 5 shows the monthly inflow data for the period 1952 through 1978. The model used this data to represent actual monthly historical flows into the Tyee project. The model assumed the reservoir was full at the beginning of the analysis and used an average head of 1233'. A preliminary end-of-month reservoir level was then estimated using the following formula:

$$\text{Beg. Reservoir Level} + \text{Inflows} - \text{Generation} = \text{Preliminary Ending Reservoir}$$

If the ending reservoir level was greater than 52,400 acre-feet, then spill was assumed to bring the reservoir down to 52,400. This provided an ending reservoir level, which became the beginning reservoir level for the next month. In order to make these calculations, inflows in cubic-feet per second had to be converted to kWh. The ending reservoir level and the required generation also had to be converted to acre-feet and kWh. The formulas that were used to make these conversions are explained in Appendix A. That appendix also shows the available energy at Tyee from inflows alone both before and after serving Wrangell – Petersburg.

Later in the modeling, it was discovered that this methodology allowed the reservoir to be drawn down too rapidly and too deeply. There were cases where power transmitted over the STI drained the reservoir and there was not enough energy left at Tyee to serve Wrangell and Petersburg. This is not a realistic case, so additional constraints were added.

The first constraint was a “look ahead” function. If Wrangell – Petersburg loads over the next four months were going to use all the inflows plus drain the reservoir, then exports were prohibited in the current month.

The second constraint was a minimum reservoir level (greater than zero). This constraint was set such that power transmitted over STI never required the reservoir to be drawn down below a level that could generate 27,000,000 kWh.

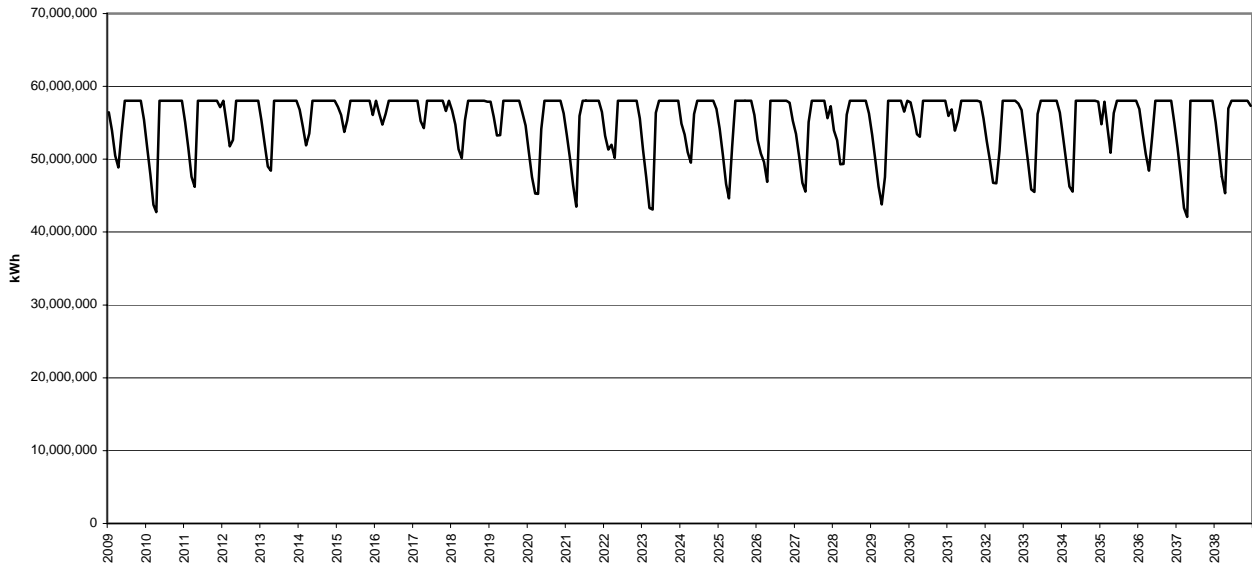
These two constraints worked together to ensure that other uses of Tyee power were never allowed to draw the reservoir down to such an extent that Wrangell – Petersburg loads could not be served by Tyee.

**Table 5**  
**Tye Lake Inflows (CFS)**  
**From Exhibit 1.2-5 of Tye Lake Contract 2145 Design Criteria**

| <u>Water Year</u> | <u>Oct</u> | <u>Nov</u> | <u>Dec</u> | <u>Jan</u> | <u>Feb</u> | <u>Mar</u> | <u>Apr</u> | <u>May</u> | <u>June</u> | <u>July</u> | <u>Aug</u> | <u>Sep</u> | <u>Average</u> |
|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|------------|------------|----------------|
| 1952              | 150        | 71         | 55         | 22         | 14         | 15         | 58         | 215        | 321         | 338         | 260        | 279        | 151            |
| 1953              | 325        | 114        | 44         | 25         | 16         | 21         | 53         | 303        | 338         | 244         | 170        | 230        | 158            |
| 1954              | 361        | 101        | 66         | 28         | 122        | 16         | 14         | 138        | 329         | 261         | 156        | 167        | 147            |
| 1955              | 242        | 198        | 111        | 51         | 30         | 21         | 39         | 129        | 328         | 301         | 345        | 231        | 170            |
| 1956              | 198        | 94         | 29         | 18         | 11         | 11         | 48         | 338        | 277         | 273         | 350        | 150        | 151            |
| 1957              | 192        | 132        | 133        | 31         | 14         | 13         | 42         | 236        | 371         | 268         | 158        | 198        | 150            |
| 1958              | 176        | 155        | 55         | 87         | 22         | 24         | 77         | 249        | 327         | 207         | 256        | 124        | 147            |
| 1959              | 475        | 113        | 84         | 34         | 20         | 25         | 55         | 214        | 376         | 395         | 225        | 177        | 184            |
| 1960              | 348        | 112        | 186        | 56         | 33         | 34         | 88         | 205        | 324         | 338         | 276        | 214        | 186            |
| 1961              | 453        | 111        | 104        | 62         | 53         | 37         | 87         | 196        | 371         | 276         | 285        | 209        | 188            |
| 1962              | 598        | 98         | 39         | 168        | 43         | 49         | 85         | 170        | 365         | 301         | 240        | 266        | 204            |
| 1963              | 251        | 157        | 218        | 127        | 101        | 30         | 49         | 181        | 306         | 245         | 96         | 256        | 168            |
| 1964              | 293        | 56         | 96         | 54         | 40         | 22         | 45         | 134        | 420         | 320         | 287        | 177        | 163            |
| 1965              | 295        | 91         | 66         | 74         | 37         | 34         | 64         | 138        | 340         | 294         | 148        | 97         | 141            |
| 1966              | 383        | 52         | 42         | 21         | 15         | 38         | 63         | 188        | 352         | 289         | 244        | 281        | 165            |
| 1967              | 195        | 110        | 42         | 30         | 21         | 16         | 19         | 240        | 464         | 287         | 221        | 363        | 168            |
| 1968              | 239        | 133        | 46         | 26         | 41         | 81         | 36         | 218        | 298         | 273         | 166        | 392        | 163            |
| 1969              | 196        | 108        | 32         | 11         | 10         | 9          | 60         | 253        | 400         | 268         | 224        | 140        | 143            |
| 1970              | 148        | 322        | 102        | 28         | 47         | 36         | 41         | 156        | 414         | 282         | 276        | 270        | 177            |
| 1971              | 229        | 138        | 51         | 34         | 13         | 13         | 33         | 162        | 362         | 263         | 269        | 176        | 146            |
| 1972              | 179        | 83         | 39         | 24         | 41         | 54         | 22         | 227        | 305         | 414         | 328        | 218        | 169            |
| 1973              | 151        | 73         | 31         | 48         | 20         | 19         | 45         | 198        | 327         | 282         | 277        | 234        | 143            |
| 1974              | 167        | 41         | 92         | 25         | 49         | 23         | 64         | 157        | 293         | 320         | 258        | 257        | 146            |
| 1975              | 510        | 101        | 42         | 31         | 15         | 18         | 26         | 113        | 291         | 414         | 235        | 192        | 167            |
| 1976              | 158        | 55         | 97         | 71         | 39         | 36         | 58         | 201        | 339         | 367         | 294        | 290        | 168            |
| 1977              | 242        | 162        | 126        | 43         | 87         | 28         | 86         | 126        | 451         | 195         | 175        | 159        | 157            |
| 1978              | 277        | 75         | 34         | 29         | 28         | 26         | 62         | 123        | 268         | 188         | 215        | 133        | 122            |
| <b>Average</b>    | 275        | 113        | 76         | 47         | 36         | 28         | 53         | 193        | 350         | 293         | 238        | 218        | 161            |
| <b>Maximum</b>    | 598        | 322        | 218        | 168        | 122        | 81         | 88         | 338        | 464         | 414         | 350        | 392        | 204            |
| <b>Minimum</b>    | 148        | 41         | 29         | 11         | 10         | 9          | 14         | 113        | 268         | 188         | 96         | 97         | 122            |

The model went through monthly calculations using the above formula. For each month, the beginning reservoir was estimated, inflows were added, generation and spill was subtracted and an ending reservoir level was calculated.

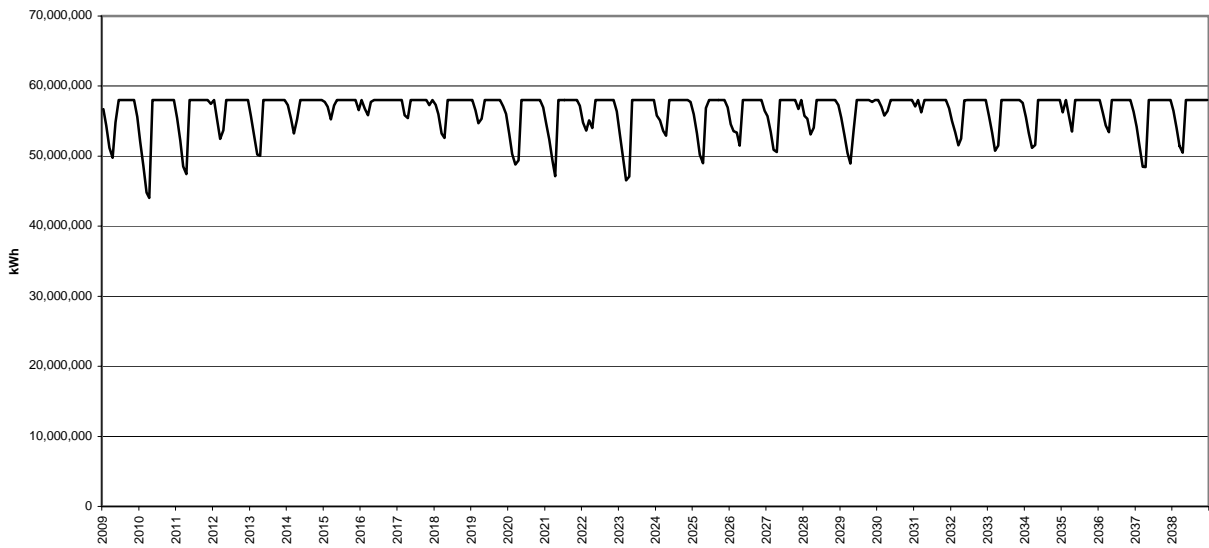
**Chart 7**  
**End of Month Tyee Reservoir Level Converted to kWh**  
**After Serving Wrangell – Petersburg, Before Any Other Uses**  
**Base-Case Loads, Historical Flows**



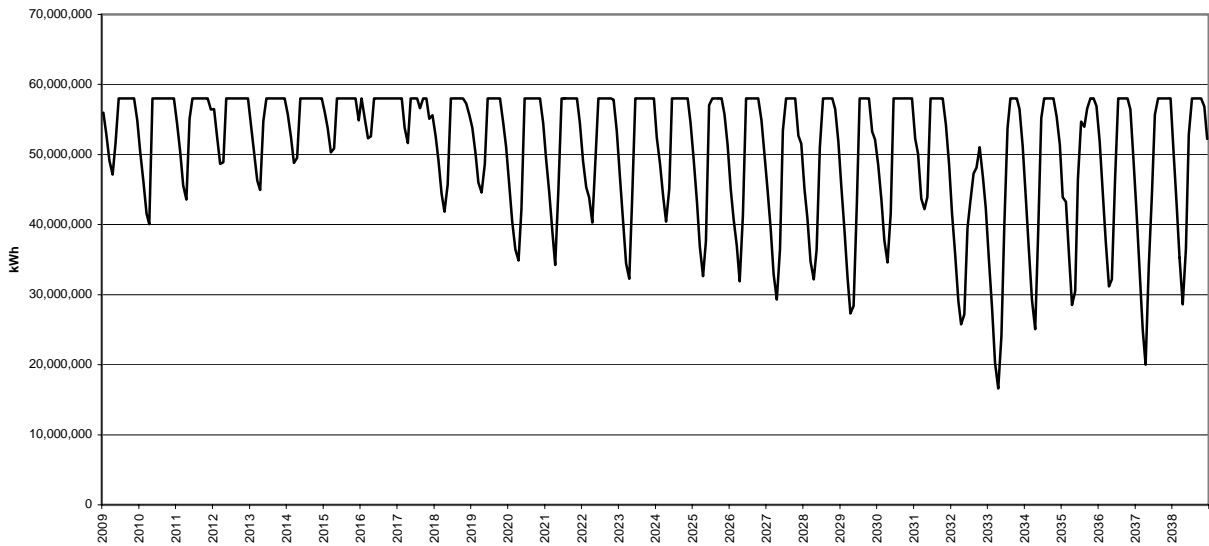
The above chart shows that there is plenty of energy left in the Tyee reservoir given the above assumptions. The reservoir never goes above 58 million kWh because above that spill will occur bringing the reservoir back down to the 58 million kWh level.



**Chart 8**  
**End of Month Tye Reservoir Level Converted to kWh**  
**After Serving Wrangell – Petersburg, Before Any Other Uses**  
**Low-Case Loads, Historical Flows**



**Chart 9**  
**End of Month Tye Reservoir Level Converted to kWh**  
**After Serving Wrangell – Petersburg, Before Any Other Uses**  
**High-Case Loads, Historical Flows**



## Ketchikan Public Utilities Load Resource Balance

### *Load Forecast*

Four load growth cases were developed for Ketchikan. First, a base case, high case and low case were developed using the following growth rates:

**Table 6**  
**Ketchikan Load Forecast**  
**Average Annual Rates of Growth**

| Forecast Case | Average Annual<br>Rate of Growth |
|---------------|----------------------------------|
| Base Case     | 0.80%                            |
| High Case     | 2.00%                            |
| Low Case      | 0.25%                            |

CAI was additionally asked to evaluate the potential impact of serving the load of cruise ships that dock at Ketchikan. After consulting with Ketchikan management as well as management at Juneau, it was determined that large ships would require 11 MW each and small ships would require 6 MW each. The Ketchikan piers can accommodate up to three large ships, however CAI was advised to assume that only one ship is being served at any time. Consequently, this analysis assumes 1 large ship would be in port taking 11 MW for 8 hours a day between May 5 and October 5 each year. Table 7 calculates the additional load that would be experienced based upon these assumptions.

**Table 7**  
**Estimated Cruise Ship Load**

| Month     | MW | Days | Hours<br>Per Day | Monthly<br>kWh |
|-----------|----|------|------------------|----------------|
| May       | 11 | 26   | 8                | 2,288,000      |
| June      | 11 | 30   | 8                | 2,640,000      |
| July      | 11 | 31   | 8                | 2,728,000      |
| August    | 11 | 31   | 8                | 2,728,000      |
| September | 11 | 30   | 8                | 2,640,000      |
| October   | 11 | 5    | 8                | 440,000        |
|           |    |      |                  | 13,464,000     |

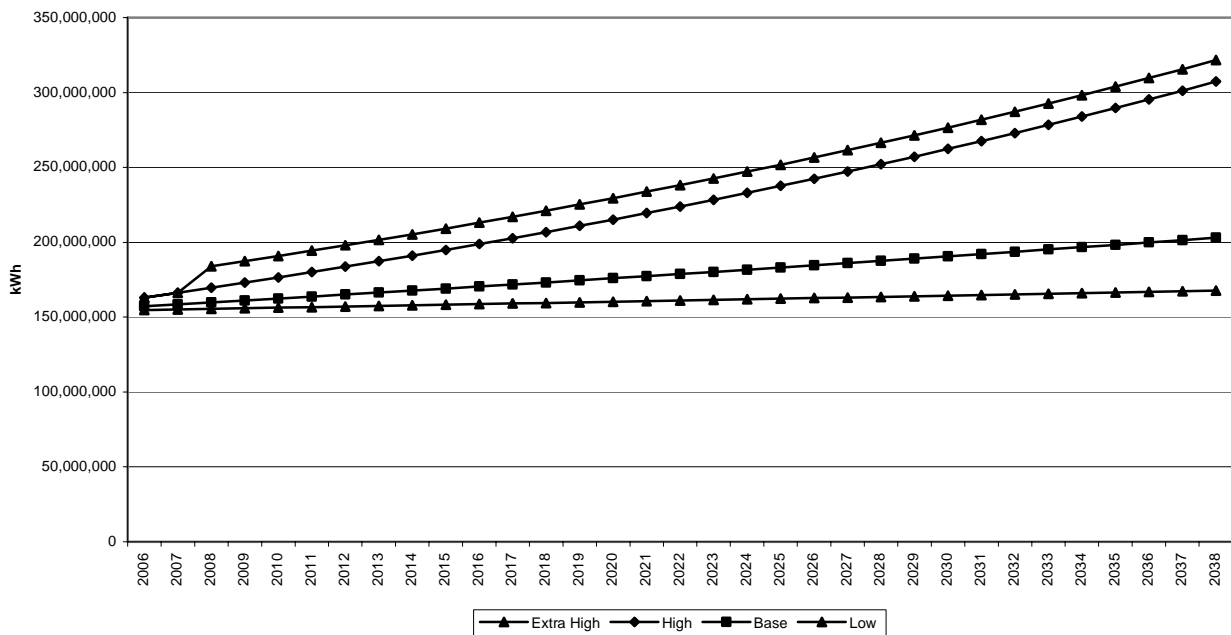
This additional cruise ship load was added to the Ketchikan high case to create a fourth load forecast case, referred to as the “Extra-High Case.” It should be noted that significant infrastructure work might be required within the Ketchikan system to serve these loads. The cost of that work has not been considered in this analysis.

The additional cruise ship load was not added to the other load forecast cases (base and low). If the cruise ship load occurred when other loads were running at base case or low case levels, the result would be that total load would correspond roughly to the high case. In other words, the high case forecast would represent the addition of cruise ship loads to the base or low case forecast.

This study assumes the additional cruise ship load will be served at interruptible rates.

Losses of 6.0% were added to the load forecast to develop a requirements forecast for Ketchikan. The following chart shows the four forecast cases.

**Chart 10**  
**Ketchikan Requirements Forecast Cases**  
**Annual kWh**



**Electric Heat Load**

As was the case in Wrangell – Petersburg, it was determined that the loads associated with any conversions to electric heat was adequately represented in the high and extra-high case forecasts. Again, if this load is served with interruptible rates the probability of the high or extra-high case is reduced and likely results are moved toward the average cases.

***Generation Forecast***

Ketchikan Public Utilities (“KPU”) owns three hydroelectric projects: Ketchikan, Beaver Falls and Silvis. KPU is considering upgrades to these projects that will increase their output. Additionally, Ketchikan may construct a new hydro project. **This study’s base case uses the output of the existing plants without the upgrades and does not include the output of any**

**new hydro projects.** Upgrades to KPU’s existing projects or the construction of new projects may affect the outcome of this study depending on where the project output is placed in the dispatch order. Table 8 shows the expected generation of each plant under minimum, average and maximum inflows as used in this study.

**Table 8**  
**Expected Annual Kilowatt-hour Generation**  
**Ketchikan Hydroelectric Projects**  
**Reflects No Increases Due To Upgrades and Modifications**

|              | Ketchikan  | Beaver Falls | Silvis     | Total      |
|--------------|------------|--------------|------------|------------|
| Min. Inflows | 14,957,600 | 33,017,000   | 9,595,100  | 57,569,700 |
| Avg. Inflows | 20,049,884 | 38,718,222   | 11,510,513 | 70,278,619 |
| Max. Inflows | 24,421,000 | 44,273,400   | 14,034,100 | 82,728,500 |

To arrive at generation under minimum inflows, the lowest annual generation during 1990 – 2005 was used. Maximum generation was based upon the highest annual generation during that period. Average annual generation was determined by first averaging all the January months, then averaging all the February months, etc through December. Then the 12 individual monthly averages were summed to arrive at the annual average generation.

Ketchikan also owns approximately 23 MW of diesel generation that is operated as required. The dispatch order used to serve Ketchikan’s load is first to use their hydro projects, then to use the output of Swan Lake as necessary and lastly to fill in with diesel generation as required. The modeling reflects this dispatch order.

### ***Swan Lake Modeling***

Historical flow data was difficult to find for Swan Lake. CAI was unable to find any data that showed actual inflows to the project. It was possible, however, to derive inflows from some of the project reports. These reports were available for 1997 through 2004.

Additionally, rainfall data was available for 1991 – 2004. Using regression analysis, a statistical relationship was defined between rainfall and inflows using the rainfall data and derived inflow data for 1997 – 2004. That relationship was then used to forecast inflows for 1991 – 1996 based on the available rainfall data. Table 9 below shows rainfall data for Ketchikan.

**Table 9**  
**Annual Rainfall in Inches**  
**Ketchikan, Alaska**

| Year | Rainfall |
|------|----------|
| 1991 | 151.0    |
| 1992 | 138.5    |
| 1993 | 119.7    |
| 1994 | 114.1    |
| 1995 | 107.6    |
| 1996 | 116.0    |
| 1997 | 164.8    |
| 1998 | 137.8    |
| 1999 | 204.9    |
| 2000 | 188.7    |
| 2001 | 189.1    |
| 2002 | 166.3    |
| 2003 | 185.2    |
| 2004 | 166.0    |

Average = 153.6

Table 9 demonstrates the significant variability in annual rainfall. The average annual rainfall for 1991 – 1996 is 124.5 inches. Compare that to the average for 1997 through 2004, which is 175.4. Individual years varied during this period from 107.6 inches in 1995 to nearly double that amount 204.9 inches in 1999. The high variability in rainfall leads to high variability in hydro output. Hydro output directly affects the economics of the STI.

Table 10 shows the derived and forecast inflow data for Swan Lake.

**Table 10**  
**Derived and Forecast Swan Inflow Data**  
**Acre-Feet**

|      | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    | Total   |                    |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--------------------|
| 1991 | 22,516 | 10,474 | 14,542 | 20,598 | 32,517 | 28,684 | 18,977 | 20,933 | 31,632 | 31,857 | 21,363 | 25,362 | 279,457 | Forecast<br>↑<br>↓ |
| 1992 | 21,007 | 9,772  | 13,568 | 19,218 | 30,338 | 26,762 | 17,706 | 19,530 | 29,512 | 29,722 | 19,931 | 23,663 | 260,729 |                    |
| 1993 | 18,738 | 8,716  | 12,102 | 17,142 | 27,060 | 23,871 | 15,793 | 17,420 | 26,324 | 26,511 | 17,778 | 21,106 | 232,561 |                    |
| 1994 | 18,062 | 8,402  | 11,665 | 16,523 | 26,084 | 23,009 | 15,223 | 16,792 | 25,374 | 25,555 | 17,137 | 20,345 | 224,171 |                    |
| 1995 | 17,277 | 8,037  | 11,159 | 15,805 | 24,951 | 22,010 | 14,562 | 16,062 | 24,272 | 24,445 | 16,392 | 19,461 | 214,432 |                    |
| 1996 | 18,291 | 8,509  | 11,814 | 16,733 | 26,415 | 23,302 | 15,416 | 17,005 | 25,696 | 25,879 | 17,354 | 20,603 | 227,017 |                    |
| 1997 | 25,456 | 25,966 | 14,131 | 34,802 | 34,244 | 33,118 | 23,665 | 17,714 | 26,051 | 33,894 | 17,610 | 52,855 | 339,506 | Derived<br>↑<br>↓  |
| 1998 | 12,464 | 14,824 | 7,140  | 16,431 | 20,159 | 13,607 | 6,247  | 34,120 | 23,899 | 37,612 | 9,849  | 17,626 | 213,978 |                    |
| 1999 | 23,804 | 8,593  | 19,919 | 22,095 | 57,602 | 44,888 | 27,515 | 24,124 | 23,912 | 43,900 | 27,674 | 22,004 | 346,030 |                    |
| 2000 | 8,952  | 4,986  | 22,556 | 23,530 | 40,006 | 36,321 | 37,664 | 33,272 | 35,502 | 22,357 | 26,303 | 13,294 | 304,743 |                    |
| 2001 | 31,107 | 9,467  | 11,310 | 20,282 | 33,747 | 41,933 | 29,986 | 28,217 | 57,067 | 29,590 | 28,914 | 20,026 | 341,646 |                    |
| 2002 | 17,425 | 8,086  | 16,441 | 23,287 | 49,031 | 45,276 | 25,743 | 35,163 | 38,357 | 36,016 | 24,152 | 28,673 | 347,651 |                    |
| 2003 | 42,621 | 7,061  | 20,111 | 18,700 | 33,629 | 26,473 | 12,043 | 13,116 | 50,086 | 44,080 | 21,094 | 35,795 | 324,809 |                    |
| 2004 | 41,816 | 15,748 | 19,919 | 27,172 | 25,678 | 17,814 | 8,777  | 3,602  | 31,220 | 40,680 | 37,618 | 39,114 | 309,158 |                    |

It was assumed that the Swan reservoir maximum capacity was 126,170 acre-feet. The model followed the dispatch order described earlier; first using Ketchikan’s own hydro projects, then Swan Lake to the extent it was available and required, and lastly relying on diesel to serve remaining load.

In each case, the model calculated the KPU hydro generation assuming average inflows. The model calculated the Swan Lake generation in the same manner as the Tyee generation was calculated. The Swan Lake inflows in Table 10 were considered one cycle of flows. These flows were used and the cycle was repeated through the life of the model.

The following Chart 11 shows the estimated generation of the KPU Hydro, Swan Lake and the diesel generation assuming historical flows and base case load growth.

**Chart 11**  
**Ketchikan Monthly Generation**  
**Base Load Forecast – Historical Inflows**

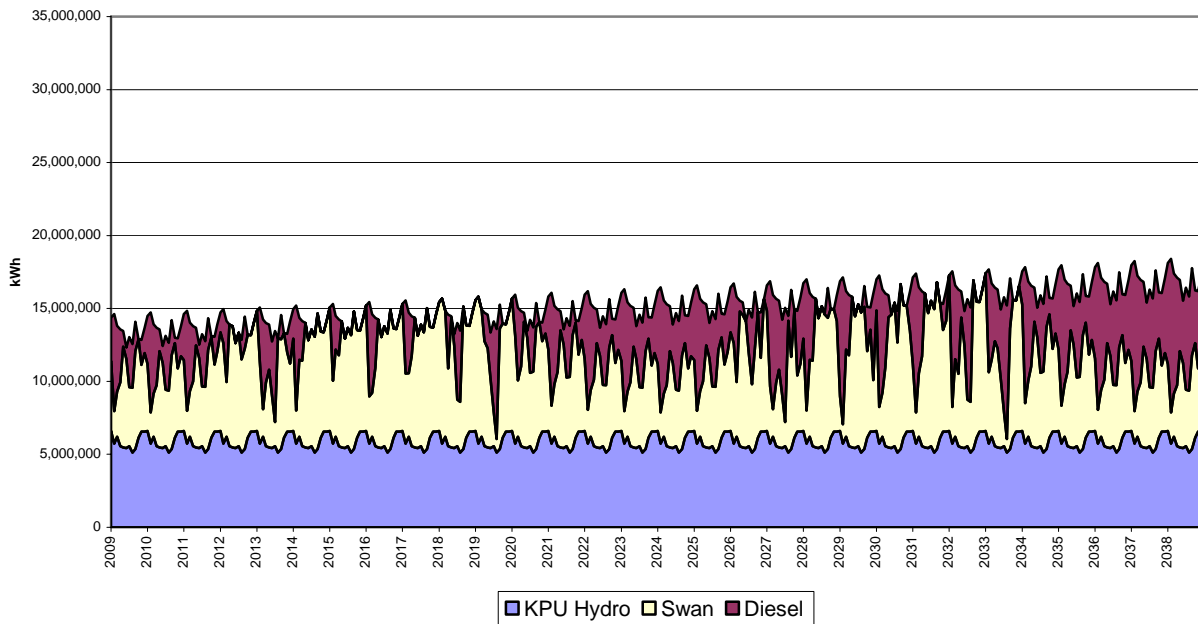
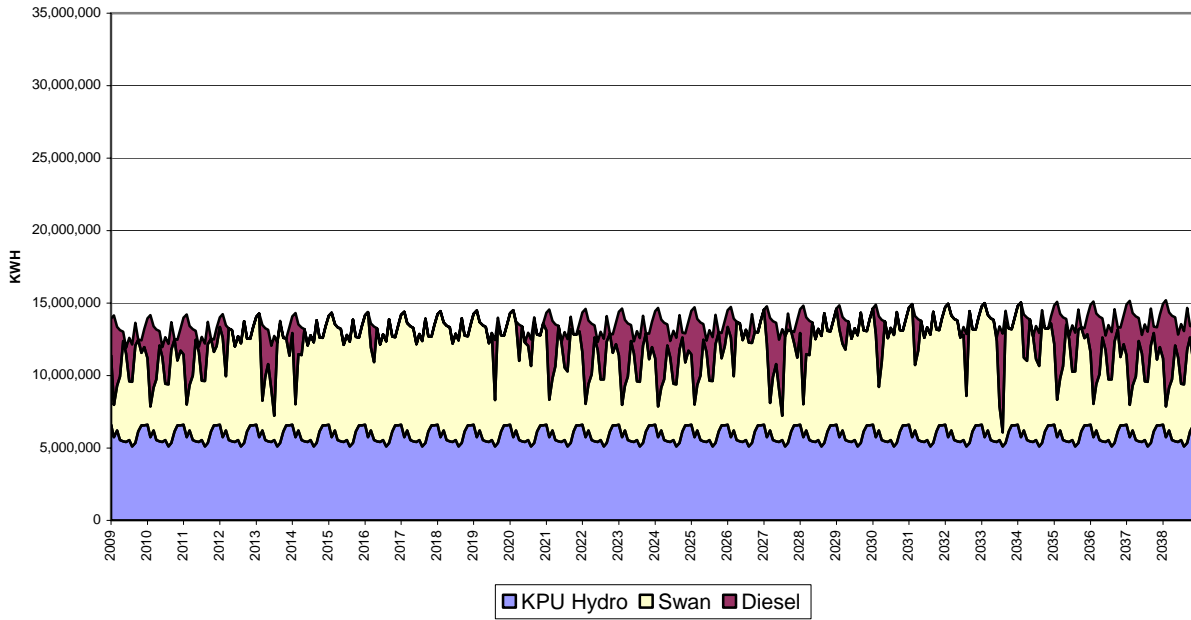


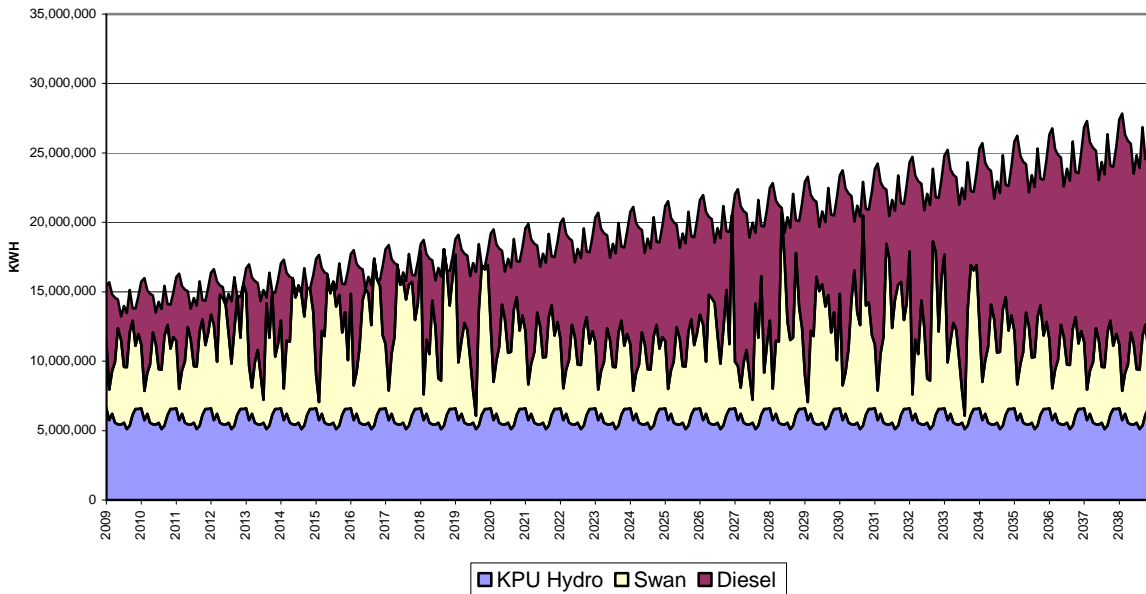
Chart 11 shows there is some diesel required in almost all years and significant diesel required in some years. There are years in the historical inflow cycle where inflows are low. This will reduce available generation from Swan Lake and increase the need for diesel. This is reflected in the above chart as years where there is lots of purple diesel generation being shown. Chart 12 below shows the situation when Ketchikan Loads match the low-case load forecast.

**Chart 12**  
**Ketchikan Monthly Generation**  
**Low Load Forecast – Historical Inflows**



In Chart 12, it is clear that lower loads have reduced the need for diesel generation. Chart 13, below, shows historical inflows and the high case forecast. Significantly, more diesel generation is needed to meet the higher loads.

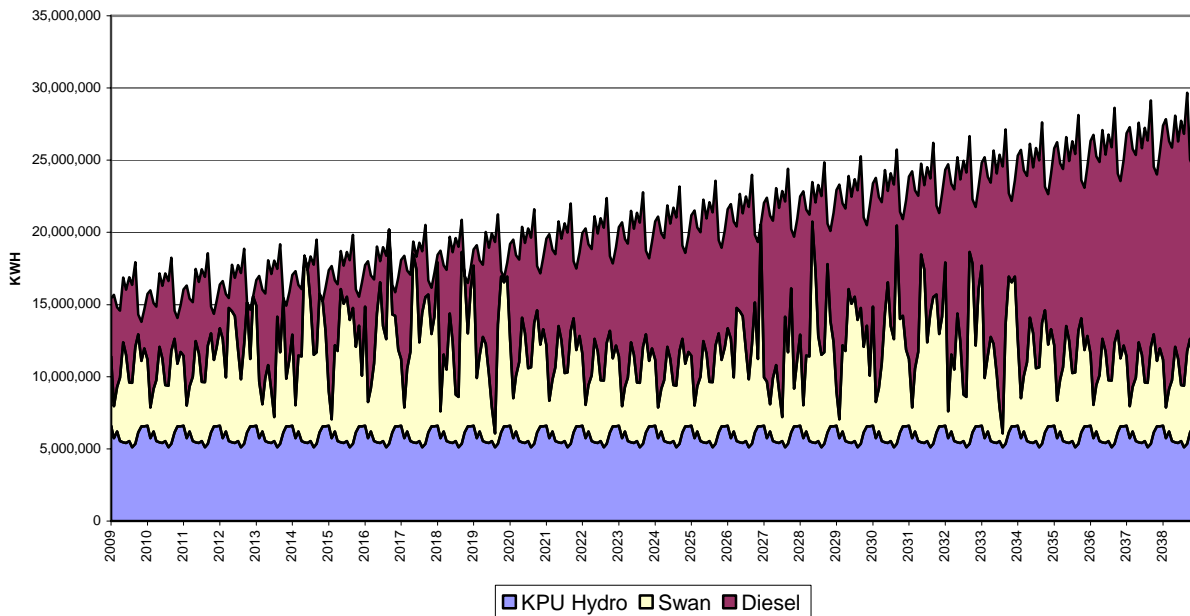
**Chart 13**  
**Ketchikan Monthly Generation**  
**High Case Forecast – Historical Inflows**





Lastly, Chart 14 shows the generation assuming the extra-high load forecast and historical flows.

**Chart 14**  
**Ketchikan Monthly Generation**  
**Extra-High Case Forecast – Historical Inflows**



The above charts demonstrate how the generation mix varies based upon the Ketchikan loads. The key thing to focus on in these charts is the amount of diesel generation. Diesel generation in Ketchikan can be displaced with Tye power transported over the STI; therefore, more diesel generation in Ketchikan is good for the economics of the STI. The greater the diesel generation in Ketchikan, the better the economics for the STI.

As the above charts show, there is some diesel generation required in all load growth cases.

Recall that the Tye modeling summarized in Chart 7 showed there was energy left in the Tye reservoir after serving Wrangell – Petersburg. **Diesel generation in Ketchikan and available energy at Tye means: (1) there is a need for power to displace diesel generation in Ketchikan, and, (2) there is power to meet that load in Tye. This creates the potential for positive economics for the Swan – Tye Intertie.** The next section of this report will evaluate whether or not exports from Tye to Ketchikan will be sufficient to cover the annual operating costs of the Swan – Tye Intertie.

## Swan – Tyee Intertie Economic Model Results

### *Methodology and Assumptions*

The first step in the model was to evaluate the amount of energy available at Tyee after serving the Wrangell – Petersburg loads. The results of that evaluation are shown in Charts 7 – 9 earlier in this report. Next, the model calculated the diesel generation required at Ketchikan. Those results are shown in Charts 11 – 14. The model then asked the question, “Is there sufficient energy at Tyee to displace some or all of the Ketchikan diesel generation?”

Available energy from Tyee was transported across the STI to Ketchikan. The STI capacity was limited to 16 MW, based upon previous power flow studies conducted by engineering consultants. Transmission losses were calculated at 2.1%. Power sent to Ketchikan was additionally limited such that power sent to Ketchikan would not force Wrangell – Petersburg to run their diesel generation to support Ketchikan.

Note that FDPPA receives revenue for power *delivered* to Ketchikan, not additional power *generated* at Tyee. This means FDPPA absorbs the cost of losses on the transmission.

There were six primary cases developed, a base case and five sensitivities. Table 11 below shows the key assumptions in these cases.

The highlighted cells in the table show the assumptions that vary from the base case. Sensitivities 1 – 3 vary the FDPPA rates that are charged for power flowing over the STI. Sensitivity #4 tests the impact of debt service and Sensitivity #5 tests the impact of upgrades to the Ketchikan hydro projects.

**Table 11  
Case Assumptions**

|  | <b>Base Case</b>           | <b>Sensitivity #1<sup>2</sup></b> | <b>Sensitivity #2<sup>3</sup></b> | <b>Sensitivity #3<sup>4</sup></b>                       | <b>Sensitivity #4<sup>5</sup></b> | <b>Sensitivity #5<sup>6</sup></b> |
|--|----------------------------|-----------------------------------|-----------------------------------|---|-----------------------------------|-----------------------------------|
| <b>Loads</b>                                   | All 4 cases <sup>1</sup>   | All 4 cases                       | All 4 cases                       | All 4 cases   | All 4 cases                       | All 4 cases                       |
| <b>Inflows</b>                                 | Historical                 | Historical                        | Historical                        | Historical  | Historical                        | Historical                        |
| <b>FDPPA Starting Rate: Firm/Interruptible</b> | \$0.064 / \$0.04           | \$0.068 / \$0.04                  | \$0.068 / \$0.04                  | A. Dashen & Assoc. Rates Extended / \$0.04              | \$0.064 / \$0.04                  | \$0.064 / \$0.04                  |
| <b>Rate Inflation: Firm/Interruptible</b>      | \$0.001 every 3 yrs / same | Flat / \$0.001 every 3 yrs.       | \$0.001 every 3 yrs / same        | A. Dashen & Assoc. Rates Extended / \$0.001 every 3 yrs | \$0.001 every 3 yrs / same        | \$0.001 every 3 yrs / same        |
| <b>Debt</b>                                    | Zero                       | Zero                              | Zero                              | Zero  | \$10 million @ 5.5% for 20 Years  | Zero                              |
| <b>Intertie Capacity</b>                       | 16 MW                      | 16 MW                             | 16 MW                             | 16 MW   | 16 MW                             | 16 MW                             |
| <b>Losses</b>                                  | 2.1%                       | 2.1%                              | 2.1%                              | 2.1%  | 2.1%                              | 2.1%                              |
| <b>KPU Generation</b>                          | No upgrades                | No upgrades                       | No upgrades                       | No upgrades   | No upgrades                       | 14 GWH KPU Upgrades               |

Footnotes:

1. "All 4 cases" refers to in Ketchikan, the low, base, high and extra-high cases; in Wrangell – Petersburg, the low, base and high cases.
2. Sensitivity #1 modeled an FDPPA firm rate that started at \$0.068 and did not increase and a non-firm rate that started at \$0.04 and increased \$0.001 every 3 years.
3. Sensitivity #2 modeled an FDPPA firm rate that started at \$0.068 and a non-firm rate that started at \$0.04, both of which increased \$0.001 every 3 years.
4. Sensitivity #3 used FDPPA firm rates that were developed in an earlier report by A. Dashen & Associates and extended for the number of years required for this study using the same methodology as Dashen used. Non-firm rates for this sensitivity started at \$0.04 and increased \$0.001 every 3 years.
5. Sensitivity #4 put the FDPPA rates back to where they were in the base case but included the debt service on \$10 million of borrowing at 5.5% for 20 years. This amounted to debt service costs of roughly \$782,000 per year.
6. Sensitivity #5 assumed that Ketchikan added 14 GWH of upgrades to their hydro projects and that this additional output was used before FDPPA power.

The individual rate assumptions for each case are shown below in Table XX.

**Table 12**  
**Rate Assumptions for Each Case**

| Year | Base Case,<br>Sensitivity #4,<br>Sensitivity #5 |               | Sensitivity #1 |               | Sensitivity #2 |               | Sensitivity #3 |               |
|------|---|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
|      | Firm  | Interruptible | Firm           | Interruptible | Firm           | Interruptible | Firm           | Interruptible |
| 2009 | \$0.064   | \$0.040       | \$0.068        | \$0.040       | \$0.068        | \$0.040       | \$0.068        | \$0.040       |
| 2010 | \$0.064   | \$0.040       | \$0.068        | \$0.040       | \$0.068        | \$0.040       | \$0.068        | \$0.040       |
| 2011 | \$0.064   | \$0.040       | \$0.068        | \$0.040       | \$0.068        | \$0.040       | \$0.068        | \$0.040       |
| 2012 | \$0.065   | \$0.041       | \$0.068        | \$0.041       | \$0.069        | \$0.041       | \$0.068        | \$0.041       |
| 2013 | \$0.065   | \$0.041       | \$0.068        | \$0.041       | \$0.069        | \$0.041       | \$0.068        | \$0.041       |
| 2014 | \$0.065   | \$0.041       | \$0.068        | \$0.041       | \$0.069        | \$0.041       | \$0.068        | \$0.041       |
| 2015 | \$0.066   | \$0.042       | \$0.068        | \$0.042       | \$0.070        | \$0.042       | \$0.068        | \$0.042       |
| 2016 | \$0.066   | \$0.042       | \$0.068        | \$0.042       | \$0.070        | \$0.042       | \$0.068        | \$0.042       |
| 2017 | \$0.066   | \$0.042       | \$0.068        | \$0.042       | \$0.070        | \$0.042       | \$0.068        | \$0.042       |
| 2018 | \$0.067   | \$0.043       | \$0.068        | \$0.043       | \$0.071        | \$0.043       | \$0.049        | \$0.043       |
| 2019 | \$0.067   | \$0.043       | \$0.068        | \$0.043       | \$0.071        | \$0.043       | \$0.050        | \$0.043       |
| 2020 | \$0.067   | \$0.043       | \$0.068        | \$0.043       | \$0.071        | \$0.043       | \$0.051        | \$0.043       |
| 2021 | \$0.068   | \$0.044       | \$0.068        | \$0.044       | \$0.072        | \$0.044       | \$0.051        | \$0.044       |
| 2022 | \$0.068   | \$0.044       | \$0.068        | \$0.044       | \$0.072        | \$0.044       | \$0.052        | \$0.044       |
| 2023 | \$0.068   | \$0.044       | \$0.068        | \$0.044       | \$0.072        | \$0.044       | \$0.053        | \$0.044       |
| 2024 | \$0.069   | \$0.045       | \$0.068        | \$0.045       | \$0.073        | \$0.045       | \$0.054        | \$0.045       |
| 2025 | \$0.069   | \$0.045       | \$0.068        | \$0.045       | \$0.073        | \$0.045       | \$0.055        | \$0.045       |
| 2026 | \$0.069   | \$0.045       | \$0.068        | \$0.045       | \$0.073        | \$0.045       | \$0.055        | \$0.045       |
| 2027 | \$0.070   | \$0.046       | \$0.068        | \$0.046       | \$0.074        | \$0.046       | \$0.056        | \$0.046       |
| 2028 | \$0.070   | \$0.046       | \$0.068        | \$0.046       | \$0.074        | \$0.046       | \$0.057        | \$0.046       |
| 2029 | \$0.070   | \$0.046       | \$0.068        | \$0.046       | \$0.074        | \$0.046       | \$0.058        | \$0.046       |
| 2030 | \$0.071   | \$0.047       | \$0.068        | \$0.047       | \$0.075        | \$0.047       | \$0.059        | \$0.047       |
| 2031 | \$0.071   | \$0.047       | \$0.068        | \$0.047       | \$0.075        | \$0.047       | \$0.060        | \$0.047       |
| 2032 | \$0.071   | \$0.047       | \$0.068        | \$0.047       | \$0.075        | \$0.047       | \$0.061        | \$0.047       |
| 2033 | \$0.072   | \$0.048       | \$0.068        | \$0.048       | \$0.076        | \$0.048       | \$0.062        | \$0.048       |
| 2034 | \$0.072   | \$0.048       | \$0.068        | \$0.048       | \$0.076        | \$0.048       | \$0.063        | \$0.048       |
| 2035 | \$0.072   | \$0.048       | \$0.068        | \$0.048       | \$0.076        | \$0.048       | \$0.064        | \$0.048       |
| 2036 | \$0.073   | \$0.049       | \$0.068        | \$0.049       | \$0.077        | \$0.049       | \$0.065        | \$0.049       |
| 2037 | \$0.073   | \$0.049       | \$0.068        | \$0.049       | \$0.077        | \$0.049       | \$0.066        | \$0.049       |
| 2038 | \$0.073   | \$0.049       | \$0.068        | \$0.049       | \$0.077        | \$0.049       | \$0.067        | \$0.049       |

The model then calculated the net cash flows for each year considering the annual O&M expenses, catastrophic expenses and the revenue from transmission. These annual cash flows were calculated for each case. After determining the annual net revenues for each case, the net present value was calculated. A discount rate of 5.5% was used to calculate the net present value.

***Model Results***

Appendix B shows the net revenue results and net present values for all cases. Here in the body of the report, each case will be reviewed individually.

**Base Case**

Tables 13 and 14 show the net revenue and net present value results for the base case.

**Table 13**  
**Nominal Net Revenues – Historical Flows**  
**Base Case Assumptions**  
**All Load Growth Scenarios**

|          |            | W/P Load/Generation |              |               |
|----------|------------|---------------------|--------------|---------------|
|          |            | Base/Hist           | High/Hist    | Low/Hist      |
| KPU Case | Base/Hist  | \$43,474,523        | \$22,643,807 | \$47,770,936  |
|          | High/Hist  | \$91,946,588        | \$47,293,323 | \$103,325,046 |
|          | Xhigh/Hist | \$100,252,959       | \$53,272,529 | \$114,177,800 |
|          | Low/Hist   | \$10,529,541        | \$10,529,541 | \$11,610,536  |

**Table 14**  
**Net Present Values of Net Revenues – Historical Flows**  
**Base Case Assumptions**  
**All Load Growth Scenarios**

|          |            | W/P Load/Generation |              |              |
|----------|------------|---------------------|--------------|--------------|
|          |            | Base/Hist           | High/Hist    | Low/Hist     |
| KPU Case | Base/Hist  | \$15,248,168        | \$10,080,731 | \$16,435,511 |
|          | High/Hist  | \$33,991,722        | \$21,799,808 | \$37,043,294 |
|          | Xhigh/Hist | \$38,821,737        | \$25,720,483 | \$42,753,763 |
|          | Low/Hist   | \$4,257,705         | \$4,257,705  | \$4,578,404  |

Looking at the first column of Table 13 above, where the Wrangell – Petersburg Load/Generation is Base/Hist, it can be seen that the revenues vary in line with the KPU load. The higher the load, the higher the revenue to the STI. This makes sense since greater load in Ketchikan means greater diesel generation, greater exports from Tyee over the STI and higher revenues to FDPPA. Moving to the right in the table, the revenues are lower, when the Wrangell – Petersburg loads are higher. This is because the higher Wrangell – Petersburg loads use more of the Tyee power and there is less available to be transported to Ketchikan to displace diesel generation. In the right hand column, when loads are low, revenues rise because there is more Tyee power available to be transported to Ketchikan.

Table 15 shows the detailed results when both Wrangell – Petersburg and KPU loads are at base load growth levels. Table 16 shows the detailed results when Wrangell – Petersburg loads are at base levels but KPU loads are at low levels.

**Table 15**  
**Detailed Case Results**  
**Base Case Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Base/Hist**

| Year              | KWH Power Deliveries |                |               |                        | Firm               | Interruptible      | Transmission Revenue |              |               | Total Expenses | Net Revenue  |
|-------------------|----------------------|----------------|---------------|------------------------|--------------------|--------------------|----------------------|--------------|---------------|----------------|--------------|
|                   | W/P << K             | Total W/P >> K | Firm W/P >> K | Interruptible W/P >> K | Transmission Price | Transmission Price | Total                | Firm         | Interruptible |                |              |
| 2009              | 0                    | 31,488,133     | 31,488,133    | 0                      | \$0.064            | \$0.040            | \$2,015,241          | \$2,015,241  | \$0           | \$462,449      | \$1,552,791  |
| 2010              | 0                    | 30,607,948     | 30,607,948    | 0                      | \$0.064            | \$0.040            | \$1,958,909          | \$1,958,909  | \$0           | \$288,570      | \$1,670,339  |
| 2011              | 0                    | 33,322,890     | 33,322,890    | 0                      | \$0.064            | \$0.040            | \$2,132,665          | \$2,132,665  | \$0           | \$454,181      | \$1,678,484  |
| 2012              | 0                    | 11,399,531     | 11,399,531    | 0                      | \$0.065            | \$0.041            | \$740,969            | \$740,969    | \$0           | \$465,536      | \$275,434    |
| 2013              | 0                    | 32,824,223     | 32,824,223    | 0                      | \$0.065            | \$0.041            | \$2,133,574          | \$2,133,574  | \$0           | \$1,481,614    | \$651,961    |
| 2014              | 0                    | 14,800,902     | 14,800,902    | 0                      | \$0.065            | \$0.041            | \$962,059            | \$962,059    | \$0           | \$511,035      | \$451,024    |
| 2015              | 0                    | 10,018,617     | 10,018,617    | 0                      | \$0.066            | \$0.042            | \$661,229            | \$661,229    | \$0           | \$501,331      | \$159,898    |
| 2016              | 0                    | 15,276,592     | 15,276,592    | 0                      | \$0.066            | \$0.042            | \$1,008,255          | \$1,008,255  | \$0           | \$530,505      | \$477,750    |
| 2017              | 0                    | 11,905,300     | 11,905,300    | 0                      | \$0.066            | \$0.042            | \$785,750            | \$785,750    | \$0           | \$543,768      | \$241,982    |
| 2018              | 0                    | 14,705,970     | 14,705,970    | 0                      | \$0.067            | \$0.043            | \$985,300            | \$985,300    | \$0           | \$785,993      | \$199,307    |
| 2019              | 0                    | 22,861,780     | 22,861,780    | 0                      | \$0.067            | \$0.043            | \$1,531,739          | \$1,531,739  | \$0           | \$596,110      | \$935,630    |
| 2020              | 0                    | 23,865,983     | 23,865,983    | 0                      | \$0.067            | \$0.043            | \$1,599,021          | \$1,599,021  | \$0           | \$585,579      | \$1,013,442  |
| 2021              | 0                    | 33,688,231     | 33,688,231    | 0                      | \$0.068            | \$0.044            | \$2,290,800          | \$2,290,800  | \$0           | \$600,218      | \$1,690,581  |
| 2022              | 0                    | 44,014,141     | 44,014,141    | 0                      | \$0.068            | \$0.044            | \$2,992,962          | \$2,992,962  | \$0           | \$615,224      | \$2,377,738  |
| 2023              | 0                    | 39,146,057     | 39,146,057    | 0                      | \$0.068            | \$0.044            | \$2,661,932          | \$2,661,932  | \$0           | \$2,410,898    | \$251,034    |
| 2024              | 0                    | 50,012,004     | 50,012,004    | 0                      | \$0.069            | \$0.045            | \$3,450,828          | \$3,450,828  | \$0           | \$674,443      | \$2,776,385  |
| 2025              | 0                    | 42,938,156     | 42,938,156    | 0                      | \$0.069            | \$0.045            | \$2,962,733          | \$2,962,733  | \$0           | \$662,529      | \$2,300,204  |
| 2026              | 0                    | 28,465,580     | 28,465,580    | 0                      | \$0.069            | \$0.045            | \$1,964,125          | \$1,964,125  | \$0           | \$679,092      | \$1,285,033  |
| 2027              | 0                    | 47,849,864     | 47,849,864    | 0                      | \$0.070            | \$0.046            | \$3,349,490          | \$3,349,490  | \$0           | \$696,069      | \$2,653,421  |
| 2028              | 0                    | 16,733,848     | 16,733,848    | 0                      | \$0.070            | \$0.046            | \$1,171,369          | \$1,171,369  | \$0           | \$1,006,138    | \$165,231    |
| 2029              | 0                    | 29,858,230     | 29,858,230    | 0                      | \$0.070            | \$0.046            | \$2,090,076          | \$2,090,076  | \$0           | \$763,071      | \$1,327,005  |
| 2030              | 0                    | 24,912,147     | 24,912,147    | 0                      | \$0.071            | \$0.047            | \$1,768,762          | \$1,768,762  | \$0           | \$749,590      | \$1,019,172  |
| 2031              | 0                    | 29,639,460     | 29,639,460    | 0                      | \$0.071            | \$0.047            | \$2,104,402          | \$2,104,402  | \$0           | \$768,330      | \$1,336,072  |
| 2032              | 0                    | 32,905,974     | 32,905,974    | 0                      | \$0.071            | \$0.047            | \$2,336,324          | \$2,336,324  | \$0           | \$787,538      | \$1,548,786  |
| 2033              | 0                    | 45,110,207     | 45,110,207    | 0                      | \$0.072            | \$0.048            | \$3,247,935          | \$3,247,935  | \$0           | \$2,453,118    | \$794,817    |
| 2034              | 0                    | 44,120,100     | 44,120,100    | 0                      | \$0.072            | \$0.048            | \$3,176,647          | \$3,176,647  | \$0           | \$863,344      | \$2,313,303  |
| 2035              | 0                    | 50,906,401     | 50,906,401    | 0                      | \$0.072            | \$0.048            | \$3,665,261          | \$3,665,261  | \$0           | \$848,093      | \$2,817,168  |
| 2036              | 0                    | 56,976,659     | 56,976,659    | 0                      | \$0.073            | \$0.049            | \$4,159,296          | \$4,159,296  | \$0           | \$869,295      | \$3,290,001  |
| 2037              | 0                    | 52,045,917     | 52,045,917    | 0                      | \$0.073            | \$0.049            | \$3,799,352          | \$3,799,352  | \$0           | \$891,027      | \$2,908,325  |
| 2038              | 0                    | 58,487,443     | 58,487,443    | 0                      | \$0.073            | \$0.049            | \$4,269,583          | \$4,269,583  | \$0           | \$957,378      | \$3,312,205  |
| Nominal Values    |                      | 980,888,289    | 980,888,289   | 0                      |                    |                    | \$67,976,588         | \$67,976,588 | \$0           | \$24,502,065   | \$43,474,523 |
| Net Present Value |                      |                |               |                        |                    |                    | \$24,378,634         | \$24,378,634 | \$0           | \$9,130,465    | \$15,248,168 |

**Table 16**  
**Detailed Case Results**  
**Base Case Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Low/Hist**

| Year              | KWH Power Deliveries |                   |                  |                           | Firm                  | Interruptible         | Transmission Revenue |              |               | Total        | Net           |
|-------------------|----------------------|-------------------|------------------|---------------------------|-----------------------|-----------------------|----------------------|--------------|---------------|--------------|---------------|
|                   | W/P << K             | Total<br>W/P >> K | Firm<br>W/P >> K | Interruptible<br>W/P >> K | Transmission<br>Price | Transmission<br>Price | Total                | Firm         | Interruptible | Expenses     | Revenue       |
| 2009              | 0                    | 26,282,440        | 26,282,440       | 0                         | \$0.064               | \$0.040               | \$1,682,076          | \$1,682,076  | \$0           | \$462,449    | \$1,219,627   |
| 2010              | 0                    | 26,706,110        | 26,706,110       | 0                         | \$0.064               | \$0.040               | \$1,709,191          | \$1,709,191  | \$0           | \$288,570    | \$1,420,621   |
| 2011              | 0                    | 26,308,702        | 26,308,702       | 0                         | \$0.064               | \$0.040               | \$1,683,757          | \$1,683,757  | \$0           | \$454,181    | \$1,229,576   |
| 2012              | 0                    | 5,773,513         | 5,773,513        | 0                         | \$0.065               | \$0.041               | \$375,278            | \$375,278    | \$0           | \$465,536    | (\$90,257)    |
| 2013              | 0                    | 21,657,343        | 21,657,343       | 0                         | \$0.065               | \$0.041               | \$1,407,727          | \$1,407,727  | \$0           | \$1,481,614  | (\$73,886)    |
| 2014              | 0                    | 11,376,196        | 11,376,196       | 0                         | \$0.065               | \$0.041               | \$739,453            | \$739,453    | \$0           | \$511,035    | \$228,418     |
| 2015              | 0                    | 0                 | 0                | 0                         | \$0.066               | \$0.042               | \$0                  | \$0          | \$0           | \$501,331    | (\$501,331)   |
| 2016              | 0                    | 4,087,031         | 4,087,031        | 0                         | \$0.066               | \$0.042               | \$269,744            | \$269,744    | \$0           | \$530,505    | (\$260,761)   |
| 2017              | 0                    | 0                 | 0                | 0                         | \$0.066               | \$0.042               | \$0                  | \$0          | \$0           | \$543,768    | (\$543,768)   |
| 2018              | 0                    | 0                 | 0                | 0                         | \$0.067               | \$0.043               | \$0                  | \$0          | \$0           | \$785,993    | (\$785,993)   |
| 2019              | 0                    | 4,492,304         | 4,492,304        | 0                         | \$0.067               | \$0.043               | \$300,984            | \$300,984    | \$0           | \$596,110    | (\$295,125)   |
| 2020              | 0                    | 5,578,802         | 5,578,802        | 0                         | \$0.067               | \$0.043               | \$373,780            | \$373,780    | \$0           | \$585,579    | (\$211,799)   |
| 2021              | 0                    | 20,418,852        | 20,418,852       | 0                         | \$0.068               | \$0.044               | \$1,388,482          | \$1,388,482  | \$0           | \$600,218    | \$788,264     |
| 2022              | 0                    | 29,204,546        | 29,204,546       | 0                         | \$0.068               | \$0.044               | \$1,985,909          | \$1,985,909  | \$0           | \$615,224    | \$1,370,685   |
| 2023              | 0                    | 28,188,242        | 28,188,242       | 0                         | \$0.068               | \$0.044               | \$1,916,800          | \$1,916,800  | \$0           | \$2,410,898  | (\$494,097)   |
| 2024              | 0                    | 34,817,151        | 34,817,151       | 0                         | \$0.069               | \$0.045               | \$2,402,383          | \$2,402,383  | \$0           | \$674,443    | \$1,727,940   |
| 2025              | 0                    | 29,146,607        | 29,146,607       | 0                         | \$0.069               | \$0.045               | \$2,011,116          | \$2,011,116  | \$0           | \$662,529    | \$1,348,587   |
| 2026              | 0                    | 9,630,158         | 9,630,158        | 0                         | \$0.069               | \$0.045               | \$664,481            | \$664,481    | \$0           | \$679,092    | (\$14,611)    |
| 2027              | 0                    | 28,996,466        | 28,996,466       | 0                         | \$0.070               | \$0.046               | \$2,029,753          | \$2,029,753  | \$0           | \$696,069    | \$1,333,684   |
| 2028              | 0                    | 13,340,212        | 13,340,212       | 0                         | \$0.070               | \$0.046               | \$933,815            | \$933,815    | \$0           | \$1,006,138  | (\$72,323)    |
| 2029              | 0                    | 5,513,572         | 5,513,572        | 0                         | \$0.070               | \$0.046               | \$385,950            | \$385,950    | \$0           | \$763,071    | (\$377,121)   |
| 2030              | 0                    | 9,835,108         | 9,835,108        | 0                         | \$0.071               | \$0.047               | \$698,293            | \$698,293    | \$0           | \$749,590    | (\$51,298)    |
| 2031              | 0                    | 5,517,634         | 5,517,634        | 0                         | \$0.071               | \$0.047               | \$391,752            | \$391,752    | \$0           | \$768,330    | (\$376,578)   |
| 2032              | 0                    | 4,822,824         | 4,822,824        | 0                         | \$0.071               | \$0.047               | \$342,420            | \$342,420    | \$0           | \$787,538    | (\$445,118)   |
| 2033              | 0                    | 13,460,481        | 13,460,481       | 0                         | \$0.072               | \$0.048               | \$969,155            | \$969,155    | \$0           | \$2,453,118  | (\$1,483,963) |
| 2034              | 0                    | 11,756,117        | 11,756,117       | 0                         | \$0.072               | \$0.048               | \$846,440            | \$846,440    | \$0           | \$863,344    | (\$16,904)    |
| 2035              | 0                    | 27,053,611        | 27,053,611       | 0                         | \$0.072               | \$0.048               | \$1,947,860          | \$1,947,860  | \$0           | \$848,093    | \$1,099,767   |
| 2036              | 0                    | 33,634,084        | 33,634,084       | 0                         | \$0.073               | \$0.049               | \$2,455,288          | \$2,455,288  | \$0           | \$869,295    | \$1,585,993   |
| 2037              | 0                    | 33,127,102        | 33,127,102       | 0                         | \$0.073               | \$0.049               | \$2,418,278          | \$2,418,278  | \$0           | \$891,027    | \$1,527,251   |
| 2038              | 0                    | 37,006,023        | 37,006,023       | 0                         | \$0.073               | \$0.049               | \$2,701,440          | \$2,701,440  | \$0           | \$957,378    | \$1,744,062   |
| Nominal Values    |                      | 507,731,229       | 507,731,229      | 0                         |                       |                       | \$35,031,606         | \$35,031,606 | \$0           | \$24,502,065 | \$10,529,541  |
| Net Present Value |                      |                   |                  |                           |                       |                       | \$13,388,170         | \$13,388,170 | \$0           | \$9,130,465  | \$4,257,705   |

Table 15 shows that over the 30 years of the study, 980,888,289 kWh were transported across the STI from Tyee to Ketchikan. Note that these flows increased and decreased through time with the cycle of assumed inflows. When inflows were high, less power would flow over the STI as KPU had lower needs for diesel generation and power to displace that generation. When inflows were low, more power flowed over the line.

Table 15 shows the results assuming base load growth in Ketchikan. In this case, there is no cruise ship load so there are no interruptible power deliveries. Cruise ship load only shows up in the extra-high load growth case. The table shows that FDPPA would receive almost \$70 million of transmission revenue over the life of the study and this would more than cover the \$24.5 million of annual expenses. The annual net revenues, in the right-hand column, range from a low of \$159,898 to a high of \$3.3 million.

Table 16 shows the results when lower load growth is assumed in Ketchikan. Less power is delivered over the STI, only 507,731,229 kWh. Revenue over the study period is \$35 million, yielding roughly \$10.5 million in net revenue. This scenario demonstrates that even though many of the individual years have negative results, the results are positive over the life of the study.

As explained earlier, these results are based on derived historical inflows. It is possible to run a sensitivity case to estimate what the results would be under extreme case inflows. Minimum and maximum inflows can be derived for both Tyee and Swan. The model can be run assuming that these extreme inflows repeat themselves every year of the study. Of course, it is highly unlikely that such flows would occur repeatedly in every year over 30 years. This does, however, allow the model to test the economic results in these extreme cases.

Table 17 shows these results. Other than inflows, the base case assumptions explained earlier are used. The economics are still positive in nearly two-thirds of the cases. The negative cases are where Wrangell – Petersburg loads are high and inflows are at minimum levels. In this case, there is insufficient water in Tyee to serve both Wrangell – Petersburg and to export power to Ketchikan; therefore, exports are curtailed. Results are also negative if Ketchikan loads are low and inflows are high because Ketchikan doesn't need much power in this case. Lastly, they are negative if Ketchikan loads are at base levels and inflows are at maximum levels for all 30 years. All other cases, 45 out of 72, are positive. These results demonstrate that given the assumptions made, the economics of the line are positive even under unrealistically extreme inflow conditions.



**Table 17**  
**Case Results – Extreme Flows**  
**Base Case Assumptions**

**Nominal Net Revenue-Historic Flows**

|                     |           | W/P Load/Generation |                |                |                |                |                |
|---------------------|-----------|---------------------|----------------|----------------|----------------|----------------|----------------|
|                     |           | Base/Max            | Base/Min       | High/Max       | High/Min       | Low/Max        | Low/Min        |
| KPU Load/Generation | Base/Avg  | \$35,369,774        | \$6,019,892    | \$30,827,973   | (\$20,584,266) | \$35,623,761   | \$23,260,873   |
|                     | Base/Max  | (\$6,712,231)       | (\$11,670,241) | (\$7,949,936)  | (\$24,502,065) | (\$6,712,231)  | (\$8,509,293)  |
|                     | Base/Min  | \$112,668,153       | \$7,256,721    | \$100,363,465  | (\$20,500,870) | \$113,758,874  | \$27,312,238   |
|                     | High/Avg  | \$124,706,949       | \$7,493,962    | \$99,148,447   | (\$20,561,904) | \$128,741,213  | \$27,433,037   |
|                     | High/Max  | \$89,875,093        | \$2,725,239    | \$69,507,605   | (\$22,668,295) | \$92,048,474   | \$20,684,771   |
|                     | High/Min  | \$179,287,957       | \$7,472,100    | \$141,309,941  | (\$20,410,897) | \$186,615,755  | \$27,405,570   |
|                     | XHigh/Avg | \$133,808,543       | \$6,833,803    | \$105,862,813  | (\$20,856,710) | \$138,342,164  | \$25,989,961   |
|                     | XHigh/Max | \$109,347,642       | \$4,151,242    | \$85,440,034   | (\$21,606,513) | \$112,130,090  | \$21,982,085   |
|                     | XHigh/Min | \$188,395,106       | \$7,096,357    | \$147,816,449  | (\$20,569,419) | \$196,012,110  | \$26,915,053   |
|                     | Low/Avg   | (\$5,325,945)       | (\$5,325,945)  | (\$6,000,211)  | (\$21,966,733) | (\$5,325,945)  | (\$5,325,945)  |
|                     | Low/Max   | (\$24,502,065)      | (\$24,502,065) | (\$24,502,065) | (\$24,502,065) | (\$24,502,065) | (\$24,502,065) |
|                     | Low/Min   | \$73,144,918        | \$6,731,995    | \$70,123,353   | (\$20,500,773) | \$73,351,231   | \$26,061,485   |

**Net Present Value of Net Revenues**

|                     |           | W/P Load/Generation |               |               |               |               |               |
|---------------------|-----------|---------------------|---------------|---------------|---------------|---------------|---------------|
|                     |           | Base/Max            | Base/Min      | High/Max      | High/Min      | Low/Max       | Low/Min       |
| KPU Load/Generation | Base/Avg  | \$10,555,498        | \$2,989,597   | \$9,519,816   | (\$6,350,184) | \$10,601,159  | \$7,825,433   |
|                     | Base/Max  | (\$5,103,627)       | (\$6,144,326) | (\$5,349,484) | (\$9,130,465) | (\$5,103,627) | (\$5,453,224) |
|                     | Base/Min  | \$42,109,152        | \$4,369,920   | \$39,331,759  | (\$6,084,593) | \$42,352,025  | \$11,005,239  |
|                     | High/Avg  | \$40,410,183        | \$4,278,042   | \$34,038,658  | (\$6,181,300) | \$41,396,519  | \$10,859,768  |
|                     | High/Max  | \$23,759,545        | \$369,815     | \$19,224,706  | (\$8,058,301) | \$24,172,836  | \$5,606,626   |
|                     | High/Min  | \$66,443,864        | \$4,449,276   | \$56,339,242  | (\$6,024,202) | \$68,352,985  | \$11,086,605  |
|                     | XHigh/Avg | \$45,123,457        | \$3,914,419   | \$37,763,818  | (\$6,377,091) | \$46,385,259  | \$10,070,216  |
|                     | XHigh/Max | \$32,726,002        | \$2,047,134   | \$27,262,027  | (\$7,100,889) | \$33,266,903  | \$7,773,611   |
|                     | XHigh/Min | \$70,999,768        | \$4,241,601   | \$59,995,263  | (\$6,143,292) | \$73,004,973  | \$10,839,873  |
|                     | Low/Avg   | (\$2,867,458)       | (\$2,867,458) | (\$3,007,429) | (\$7,584,839) | (\$2,867,458) | (\$2,867,458) |
|                     | Low/Max   | (\$9,130,465)       | (\$9,130,465) | (\$9,130,465) | (\$9,130,465) | (\$9,130,465) | (\$9,130,465) |
|                     | Low/Min   | \$29,156,839        | \$4,207,906   | \$28,510,053  | (\$6,096,993) | \$29,193,601  | \$10,489,190  |

**Sensitivity #1**

In Sensitivity #1, the starting FDPPA rates are increased slightly compared to the base case, but there is no escalation. Consequently, the overall FDPPA rate is lower in this sensitivity than in the base case and the economic results are a little lower.

**Table 18  
Nominal Net Revenues – Historical Flows  
Sensitivity #1 Assumptions  
All Load Growth Scenarios**

|          |            | W/P Load/Generation |                  |                 |
|----------|------------|---------------------|------------------|-----------------|
|          |            | <u>Base/Hist</u>    | <u>High/Hist</u> | <u>Low/Hist</u> |
| KPU Case | Base/Hist  | \$42,198,339        | \$22,323,484     | \$46,340,249    |
|          | High/Hist  | \$90,193,808        | \$47,245,627     | \$101,123,729   |
|          | Xhigh/Hist | \$98,643,299        | \$53,316,003     | \$112,100,930   |
|          | Low/Hist   | \$10,023,659        | \$10,023,659     | \$11,068,266    |

**Table 19  
Net Present Values of Net Revenues – Historical Flows  
Sensitivity #1 Assumptions  
All Load Growth Scenarios**

|          |            | W/P Load/Generation |                  |                 |
|----------|------------|---------------------|------------------|-----------------|
|          |            | <u>Base/Hist</u>    | <u>High/Hist</u> | <u>Low/Hist</u> |
| KPU Case | Base/Hist  | \$15,292,985        | \$10,313,225     | \$16,447,044    |
|          | High/Hist  | \$34,125,284        | \$22,270,930     | \$37,089,341    |
|          | Xhigh/Hist | \$39,012,249        | \$26,234,524     | \$42,851,841    |
|          | Low/Hist   | \$4,378,290         | \$4,378,290      | \$4,695,012     |

The detailed results of Table 20 and 21 also reflect economics that are slightly down from the base case. There are no significant changes in the extreme inflow cases shown in Table 22.

**Table 20**  
**Detailed Case Results**  
**Sensitivity #1 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Base/Hist**

| Year              | KWH Power Deliveries |                   |                  |                           | Firm                  | Interruptible         | Transmission Revenue |              |               | Total        | Net          |
|-------------------|----------------------|-------------------|------------------|---------------------------|-----------------------|-----------------------|----------------------|--------------|---------------|--------------|--------------|
|                   | W/P << K             | Total<br>W/P >> K | Firm<br>W/P >> K | Interruptible<br>W/P >> K | Transmission<br>Price | Transmission<br>Price | Total                | Firm         | Interruptible | Expenses     | Revenue      |
| 2009              | 0                    | 31,488,133        | 31,488,133       | 0                         | \$0.068               | \$0.040               | \$2,141,193          | \$2,141,193  | \$0           | \$462,449    | \$1,678,744  |
| 2010              | 0                    | 30,607,948        | 30,607,948       | 0                         | \$0.068               | \$0.040               | \$2,081,340          | \$2,081,340  | \$0           | \$288,570    | \$1,792,771  |
| 2011              | 0                    | 33,322,890        | 33,322,890       | 0                         | \$0.068               | \$0.040               | \$2,265,957          | \$2,265,957  | \$0           | \$454,181    | \$1,811,775  |
| 2012              | 0                    | 11,399,531        | 11,399,531       | 0                         | \$0.068               | \$0.041               | \$775,168            | \$775,168    | \$0           | \$465,536    | \$309,632    |
| 2013              | 0                    | 32,824,223        | 32,824,223       | 0                         | \$0.068               | \$0.041               | \$2,232,047          | \$2,232,047  | \$0           | \$1,481,614  | \$750,434    |
| 2014              | 0                    | 14,800,902        | 14,800,902       | 0                         | \$0.068               | \$0.041               | \$1,006,461          | \$1,006,461  | \$0           | \$511,035    | \$495,427    |
| 2015              | 0                    | 10,018,617        | 10,018,617       | 0                         | \$0.068               | \$0.042               | \$681,266            | \$681,266    | \$0           | \$501,331    | \$179,935    |
| 2016              | 0                    | 15,276,592        | 15,276,592       | 0                         | \$0.068               | \$0.042               | \$1,038,808          | \$1,038,808  | \$0           | \$530,505    | \$508,303    |
| 2017              | 0                    | 11,905,300        | 11,905,300       | 0                         | \$0.068               | \$0.042               | \$809,560            | \$809,560    | \$0           | \$543,768    | \$265,792    |
| 2018              | 0                    | 14,705,970        | 14,705,970       | 0                         | \$0.068               | \$0.043               | \$1,000,006          | \$1,000,006  | \$0           | \$785,993    | \$214,013    |
| 2019              | 0                    | 22,861,780        | 22,861,780       | 0                         | \$0.068               | \$0.043               | \$1,554,601          | \$1,554,601  | \$0           | \$596,110    | \$958,492    |
| 2020              | 0                    | 23,865,983        | 23,865,983       | 0                         | \$0.068               | \$0.043               | \$1,622,887          | \$1,622,887  | \$0           | \$585,579    | \$1,037,308  |
| 2021              | 0                    | 33,688,231        | 33,688,231       | 0                         | \$0.068               | \$0.044               | \$2,290,800          | \$2,290,800  | \$0           | \$600,218    | \$1,690,581  |
| 2022              | 0                    | 44,014,141        | 44,014,141       | 0                         | \$0.068               | \$0.044               | \$2,992,962          | \$2,992,962  | \$0           | \$615,224    | \$2,377,738  |
| 2023              | 0                    | 39,146,057        | 39,146,057       | 0                         | \$0.068               | \$0.044               | \$2,661,932          | \$2,661,932  | \$0           | \$2,410,898  | \$251,034    |
| 2024              | 0                    | 50,012,004        | 50,012,004       | 0                         | \$0.068               | \$0.045               | \$3,400,816          | \$3,400,816  | \$0           | \$674,443    | \$2,726,373  |
| 2025              | 0                    | 42,938,156        | 42,938,156       | 0                         | \$0.068               | \$0.045               | \$2,919,795          | \$2,919,795  | \$0           | \$662,529    | \$2,257,266  |
| 2026              | 0                    | 28,465,580        | 28,465,580       | 0                         | \$0.068               | \$0.045               | \$1,935,659          | \$1,935,659  | \$0           | \$679,092    | \$1,256,568  |
| 2027              | 0                    | 47,849,864        | 47,849,864       | 0                         | \$0.068               | \$0.046               | \$3,253,791          | \$3,253,791  | \$0           | \$696,069    | \$2,557,722  |
| 2028              | 0                    | 16,733,848        | 16,733,848       | 0                         | \$0.068               | \$0.046               | \$1,137,902          | \$1,137,902  | \$0           | \$1,006,138  | \$131,764    |
| 2029              | 0                    | 29,858,230        | 29,858,230       | 0                         | \$0.068               | \$0.046               | \$2,030,360          | \$2,030,360  | \$0           | \$763,071    | \$1,267,289  |
| 2030              | 0                    | 24,912,147        | 24,912,147       | 0                         | \$0.068               | \$0.047               | \$1,694,026          | \$1,694,026  | \$0           | \$749,590    | \$944,436    |
| 2031              | 0                    | 29,639,460        | 29,639,460       | 0                         | \$0.068               | \$0.047               | \$2,015,483          | \$2,015,483  | \$0           | \$768,330    | \$1,247,153  |
| 2032              | 0                    | 32,905,974        | 32,905,974       | 0                         | \$0.068               | \$0.047               | \$2,237,606          | \$2,237,606  | \$0           | \$787,538    | \$1,450,068  |
| 2033              | 0                    | 45,110,207        | 45,110,207       | 0                         | \$0.068               | \$0.048               | \$3,067,494          | \$3,067,494  | \$0           | \$2,453,118  | \$614,376    |
| 2034              | 0                    | 44,120,100        | 44,120,100       | 0                         | \$0.068               | \$0.048               | \$3,000,167          | \$3,000,167  | \$0           | \$863,344    | \$2,136,822  |
| 2035              | 0                    | 50,906,401        | 50,906,401       | 0                         | \$0.068               | \$0.048               | \$3,461,635          | \$3,461,635  | \$0           | \$848,093    | \$2,613,543  |
| 2036              | 0                    | 56,976,659        | 56,976,659       | 0                         | \$0.068               | \$0.049               | \$3,874,413          | \$3,874,413  | \$0           | \$869,295    | \$3,005,118  |
| 2037              | 0                    | 52,045,917        | 52,045,917       | 0                         | \$0.068               | \$0.049               | \$3,539,122          | \$3,539,122  | \$0           | \$891,027    | \$2,648,095  |
| 2038              | 0                    | 58,487,443        | 58,487,443       | 0                         | \$0.068               | \$0.049               | \$3,977,146          | \$3,977,146  | \$0           | \$957,378    | \$3,019,768  |
| Nominal Values    |                      | 980,888,289       | 980,888,289      | 0                         |                       |                       | \$66,700,404         | \$66,700,404 | \$0           | \$24,502,065 | \$42,198,339 |
| Net Present Value |                      |                   |                  |                           |                       |                       | \$24,423,450         | \$24,423,450 | \$0           | \$9,130,465  | \$15,292,985 |

**Table 21**  
**Detailed Case Results**  
**Sensitivity #1 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Low/Hist**

| Year              | KWH Power Deliveries |                |               |                        | Firm               | Interruptible      | Transmission Revenue |              |               | Total Expenses | Net Revenue   |
|-------------------|----------------------|----------------|---------------|------------------------|--------------------|--------------------|----------------------|--------------|---------------|----------------|---------------|
|                   | W/P << K             | Total W/P >> K | Firm W/P >> K | Interruptible W/P >> K | Transmission Price | Transmission Price | Total                | Firm         | Interruptible |                |               |
| 2009              | 0                    | 26,282,440     | 26,282,440    | 0                      | \$0.068            | \$0.040            | \$1,787,206          | \$1,787,206  | \$0           | \$462,449      | \$1,324,757   |
| 2010              | 0                    | 26,706,110     | 26,706,110    | 0                      | \$0.068            | \$0.040            | \$1,816,015          | \$1,816,015  | \$0           | \$288,570      | \$1,527,446   |
| 2011              | 0                    | 26,308,702     | 26,308,702    | 0                      | \$0.068            | \$0.040            | \$1,788,992          | \$1,788,992  | \$0           | \$454,181      | \$1,334,811   |
| 2012              | 0                    | 5,773,513      | 5,773,513     | 0                      | \$0.068            | \$0.041            | \$392,599            | \$392,599    | \$0           | \$465,536      | (\$72,937)    |
| 2013              | 0                    | 21,657,343     | 21,657,343    | 0                      | \$0.068            | \$0.041            | \$1,472,699          | \$1,472,699  | \$0           | \$1,481,614    | (\$8,914)     |
| 2014              | 0                    | 11,376,196     | 11,376,196    | 0                      | \$0.068            | \$0.041            | \$773,581            | \$773,581    | \$0           | \$511,035      | \$262,547     |
| 2015              | 0                    | 0              | 0             | 0                      | \$0.068            | \$0.042            | \$0                  | \$0          | \$0           | \$501,331      | (\$501,331)   |
| 2016              | 0                    | 4,087,031      | 4,087,031     | 0                      | \$0.068            | \$0.042            | \$277,918            | \$277,918    | \$0           | \$530,505      | (\$252,587)   |
| 2017              | 0                    | 0              | 0             | 0                      | \$0.068            | \$0.042            | \$0                  | \$0          | \$0           | \$543,768      | (\$543,768)   |
| 2018              | 0                    | 0              | 0             | 0                      | \$0.068            | \$0.043            | \$0                  | \$0          | \$0           | \$785,993      | (\$785,993)   |
| 2019              | 0                    | 4,492,304      | 4,492,304     | 0                      | \$0.068            | \$0.043            | \$305,477            | \$305,477    | \$0           | \$596,110      | (\$290,633)   |
| 2020              | 0                    | 5,578,802      | 5,578,802     | 0                      | \$0.068            | \$0.043            | \$379,359            | \$379,359    | \$0           | \$585,579      | (\$206,220)   |
| 2021              | 0                    | 20,418,852     | 20,418,852    | 0                      | \$0.068            | \$0.044            | \$1,388,482          | \$1,388,482  | \$0           | \$600,218      | \$788,264     |
| 2022              | 0                    | 29,204,546     | 29,204,546    | 0                      | \$0.068            | \$0.044            | \$1,985,909          | \$1,985,909  | \$0           | \$615,224      | \$1,370,685   |
| 2023              | 0                    | 28,188,242     | 28,188,242    | 0                      | \$0.068            | \$0.044            | \$1,916,800          | \$1,916,800  | \$0           | \$2,410,898    | (\$494,097)   |
| 2024              | 0                    | 34,817,151     | 34,817,151    | 0                      | \$0.068            | \$0.045            | \$2,367,566          | \$2,367,566  | \$0           | \$674,443      | \$1,693,123   |
| 2025              | 0                    | 29,146,607     | 29,146,607    | 0                      | \$0.068            | \$0.045            | \$1,981,969          | \$1,981,969  | \$0           | \$662,529      | \$1,319,441   |
| 2026              | 0                    | 9,630,158      | 9,630,158     | 0                      | \$0.068            | \$0.045            | \$654,851            | \$654,851    | \$0           | \$679,092      | (\$24,241)    |
| 2027              | 0                    | 28,996,466     | 28,996,466    | 0                      | \$0.068            | \$0.046            | \$1,971,760          | \$1,971,760  | \$0           | \$696,069      | \$1,275,691   |
| 2028              | 0                    | 13,340,212     | 13,340,212    | 0                      | \$0.068            | \$0.046            | \$907,134            | \$907,134    | \$0           | \$1,006,138    | (\$99,004)    |
| 2029              | 0                    | 5,513,572      | 5,513,572     | 0                      | \$0.068            | \$0.046            | \$374,923            | \$374,923    | \$0           | \$763,071      | (\$388,148)   |
| 2030              | 0                    | 9,835,108      | 9,835,108     | 0                      | \$0.068            | \$0.047            | \$668,787            | \$668,787    | \$0           | \$749,590      | (\$80,803)    |
| 2031              | 0                    | 5,517,634      | 5,517,634     | 0                      | \$0.068            | \$0.047            | \$375,199            | \$375,199    | \$0           | \$768,330      | (\$393,131)   |
| 2032              | 0                    | 4,822,824      | 4,822,824     | 0                      | \$0.068            | \$0.047            | \$327,952            | \$327,952    | \$0           | \$787,538      | (\$459,586)   |
| 2033              | 0                    | 13,460,481     | 13,460,481    | 0                      | \$0.068            | \$0.048            | \$915,313            | \$915,313    | \$0           | \$2,453,118    | (\$1,537,805) |
| 2034              | 0                    | 11,756,117     | 11,756,117    | 0                      | \$0.068            | \$0.048            | \$799,416            | \$799,416    | \$0           | \$863,344      | (\$63,928)    |
| 2035              | 0                    | 27,053,611     | 27,053,611    | 0                      | \$0.068            | \$0.048            | \$1,839,646          | \$1,839,646  | \$0           | \$848,093      | \$991,553     |
| 2036              | 0                    | 33,634,084     | 33,634,084    | 0                      | \$0.068            | \$0.049            | \$2,287,118          | \$2,287,118  | \$0           | \$869,295      | \$1,417,823   |
| 2037              | 0                    | 33,127,102     | 33,127,102    | 0                      | \$0.068            | \$0.049            | \$2,252,643          | \$2,252,643  | \$0           | \$891,027      | \$1,361,616   |
| 2038              | 0                    | 37,006,023     | 37,006,023    | 0                      | \$0.068            | \$0.049            | \$2,516,410          | \$2,516,410  | \$0           | \$957,378      | \$1,559,031   |
| Nominal Values    |                      | 507,731,229    | 507,731,229   | 0                      |                    |                    | \$34,525,724         | \$34,525,724 | \$0           | \$24,502,065   | \$10,023,659  |
| Net Present Value |                      |                |               |                        |                    |                    | \$13,508,755         | \$13,508,755 | \$0           | \$9,130,465    | \$4,378,290   |

**Table 22**  
**Case Results – Extreme Flows**  
**Sensitivity #1 Assumptions**

**Nominal Net Revenue-Historic Flows**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$33,891,497        | \$5,762,254     | \$29,578,873    | (\$20,373,724)  | \$34,128,087   | \$22,404,438   |
|                     | Base/Max  | (\$7,620,191)       | (\$12,297,644)  | (\$8,782,569)   | (\$24,502,065)  | (\$7,620,191)  | (\$9,305,502)  |
|                     | Base/Min  | \$110,690,105       | \$7,134,308     | \$99,027,420    | (\$20,264,375)  | \$111,723,382  | \$26,712,575   |
|                     | High/Avg  | \$121,186,406       | \$7,342,197     | \$96,767,581    | (\$20,331,029)  | \$125,032,458  | \$26,806,623   |
|                     | High/Max  | \$85,994,108        | \$2,231,696     | \$66,698,690    | (\$22,602,095)  | \$88,027,384   | \$19,613,074   |
|                     | High/Min  | \$176,316,204       | \$7,342,197     | \$139,837,364   | (\$20,171,676)  | \$183,341,020  | \$26,806,623   |
|                     | XHigh/Avg | \$130,315,349       | \$6,616,552     | \$103,512,212   | (\$20,674,970)  | \$134,661,363  | \$25,228,755   |
|                     | XHigh/Max | \$105,713,507       | \$3,796,239     | \$82,893,093    | (\$21,492,351)  | \$108,352,894  | \$21,256,036   |
|                     | XHigh/Min | \$185,439,891       | \$6,943,551     | \$146,365,967   | (\$20,355,304)  | \$192,754,545  | \$26,304,921   |
|                     | Low/Avg   | (\$5,800,352)       | (\$5,800,352)   | (\$6,436,430)   | (\$21,865,766)  | (\$5,800,352)  | (\$5,800,352)  |
|                     | Low/Max   | (\$24,502,065)      | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065) | (\$24,502,065) |
|                     | Low/Min   | \$72,148,456        | \$6,635,229     | \$69,296,886    | (\$20,264,375)  | \$72,340,638   | \$25,479,254   |

**Net Present Value of Net Revenues**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$10,397,270        | \$3,096,440     | \$9,410,571     | (\$6,198,948)   | \$10,439,804   | \$7,798,644    |
|                     | Base/Max  | (\$5,295,828)       | (\$6,279,682)   | (\$5,526,976)   | (\$9,130,465)   | (\$5,295,828)  | (\$5,623,915)  |
|                     | Base/Min  | \$42,330,953        | \$4,592,693     | \$39,682,778    | (\$5,903,055)   | \$42,561,984   | \$11,175,288   |
|                     | High/Avg  | \$40,034,951        | \$4,481,132     | \$33,902,187    | (\$6,006,912)   | \$40,982,800   | \$11,008,494   |
|                     | High/Max  | \$22,994,887        | \$318,046       | \$18,680,932    | (\$8,019,180)   | \$23,381,838   | \$5,435,099    |
|                     | High/Min  | \$66,672,764        | \$4,672,084     | \$56,886,565    | (\$5,840,469)   | \$68,518,284   | \$11,261,665   |
|                     | XHigh/Avg | \$44,770,088        | \$4,064,336     | \$37,649,217    | (\$6,239,685)   | \$45,993,691   | \$10,123,543   |
|                     | XHigh/Max | \$32,136,375        | \$2,086,782     | \$26,896,636    | (\$7,019,900)   | \$32,650,395   | \$7,764,761    |
|                     | XHigh/Min | \$71,244,621        | \$4,441,464     | \$60,559,137    | (\$5,978,858)   | \$73,186,687   | \$10,991,812   |
|                     | Low/Avg   | (\$2,926,588)       | (\$2,926,588)   | (\$3,058,818)   | (\$7,521,702)   | (\$2,926,588)  | (\$2,926,588)  |
|                     | Low/Max   | (\$9,130,465)       | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)  | (\$9,130,465)  |
|                     | Low/Min   | \$29,489,184        | \$4,429,786     | \$28,876,028    | (\$5,916,301)   | \$29,523,428   | \$10,649,412   |

**Sensitivity #2**

In Sensitivity #2, the FDPPA rates are higher than any of the other cases, so we would expect this case to have the best economic results of all. This is born out in tables 23 – 27 below.

**Table 23  
Nominal Net Revenues – Historical Flows  
Sensitivity #2 Assumptions  
All Load Growth Scenarios**

|          |            | W/P Load/Generation |                  |                 |
|----------|------------|---------------------|------------------|-----------------|
|          |            | <u>Base/Hist</u>    | <u>High/Hist</u> | <u>Low/Hist</u> |
| KPU Case | Base/Hist  | \$47,398,077        | \$25,398,251     | \$51,938,131    |
|          | High/Hist  | \$98,693,404        | \$51,513,775     | \$110,714,798   |
|          | Xhigh/Hist | \$106,909,412       | \$57,490,256     | \$121,546,125   |
|          | Low/Hist   | \$12,560,466        | \$12,560,466     | \$13,702,908    |

**Table 24  
Net Present Values of Net Revenues – Historical Flows  
Sensitivity #2 Assumptions  
All Load Growth Scenarios**

|          |            | W/P Load/Generation |                  |                 |
|----------|------------|---------------------|------------------|-----------------|
|          |            | <u>Base/Hist</u>    | <u>High/Hist</u> | <u>Low/Hist</u> |
| KPU Case | Base/Hist  | \$16,684,842        | \$11,224,477     | \$17,940,070    |
|          | High/Hist  | \$36,536,178        | \$23,646,949     | \$39,762,106    |
|          | Xhigh/Hist | \$41,365,867        | \$27,590,681     | \$45,496,554    |
|          | Low/Hist   | \$5,052,338         | \$5,052,338      | \$5,391,668     |

**Table 25**  
**Detailed Case Results**  
**Sensitivity #2 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Base/Hist**

| Year              | KWH Power Deliveries |                |               |                        | Firm               | Interruptible      | Transmission Revenue |              |               | Total Expenses | Net Revenue  |
|-------------------|----------------------|----------------|---------------|------------------------|--------------------|--------------------|----------------------|--------------|---------------|----------------|--------------|
|                   | W/P << K             | Total W/P >> K | Firm W/P >> K | Interruptible W/P >> K | Transmission Price | Transmission Price | Total                | Firm         | Interruptible |                |              |
| 2009              | 0                    | 31,488,133     | 31,488,133    | 0                      | \$0.068            | \$0.040            | \$2,141,193          | \$2,141,193  | \$0           | \$462,449      | \$1,678,744  |
| 2010              | 0                    | 30,607,948     | 30,607,948    | 0                      | \$0.068            | \$0.040            | \$2,081,340          | \$2,081,340  | \$0           | \$288,570      | \$1,792,771  |
| 2011              | 0                    | 33,322,890     | 33,322,890    | 0                      | \$0.068            | \$0.040            | \$2,265,957          | \$2,265,957  | \$0           | \$454,181      | \$1,811,775  |
| 2012              | 0                    | 11,399,531     | 11,399,531    | 0                      | \$0.069            | \$0.041            | \$786,568            | \$786,568    | \$0           | \$465,536      | \$321,032    |
| 2013              | 0                    | 32,824,223     | 32,824,223    | 0                      | \$0.069            | \$0.041            | \$2,264,871          | \$2,264,871  | \$0           | \$1,481,614    | \$783,258    |
| 2014              | 0                    | 14,800,902     | 14,800,902    | 0                      | \$0.069            | \$0.041            | \$1,021,262          | \$1,021,262  | \$0           | \$511,035      | \$510,227    |
| 2015              | 0                    | 10,018,617     | 10,018,617    | 0                      | \$0.070            | \$0.042            | \$701,303            | \$701,303    | \$0           | \$501,331      | \$199,972    |
| 2016              | 0                    | 15,276,592     | 15,276,592    | 0                      | \$0.070            | \$0.042            | \$1,069,361          | \$1,069,361  | \$0           | \$530,505      | \$538,856    |
| 2017              | 0                    | 11,905,300     | 11,905,300    | 0                      | \$0.070            | \$0.042            | \$833,371            | \$833,371    | \$0           | \$543,768      | \$289,603    |
| 2018              | 0                    | 14,705,970     | 14,705,970    | 0                      | \$0.071            | \$0.043            | \$1,044,124          | \$1,044,124  | \$0           | \$785,993      | \$258,131    |
| 2019              | 0                    | 22,861,780     | 22,861,780    | 0                      | \$0.071            | \$0.043            | \$1,623,186          | \$1,623,186  | \$0           | \$596,110      | \$1,027,077  |
| 2020              | 0                    | 23,865,983     | 23,865,983    | 0                      | \$0.071            | \$0.043            | \$1,694,485          | \$1,694,485  | \$0           | \$585,579      | \$1,108,906  |
| 2021              | 0                    | 33,688,231     | 33,688,231    | 0                      | \$0.072            | \$0.044            | \$2,425,553          | \$2,425,553  | \$0           | \$600,218      | \$1,825,334  |
| 2022              | 0                    | 44,014,141     | 44,014,141    | 0                      | \$0.072            | \$0.044            | \$3,169,018          | \$3,169,018  | \$0           | \$615,224      | \$2,553,794  |
| 2023              | 0                    | 39,146,057     | 39,146,057    | 0                      | \$0.072            | \$0.044            | \$2,818,516          | \$2,818,516  | \$0           | \$2,410,898    | \$407,618    |
| 2024              | 0                    | 50,012,004     | 50,012,004    | 0                      | \$0.073            | \$0.045            | \$3,650,876          | \$3,650,876  | \$0           | \$674,443      | \$2,976,433  |
| 2025              | 0                    | 42,938,156     | 42,938,156    | 0                      | \$0.073            | \$0.045            | \$3,134,485          | \$3,134,485  | \$0           | \$662,529      | \$2,471,957  |
| 2026              | 0                    | 28,465,580     | 28,465,580    | 0                      | \$0.073            | \$0.045            | \$2,077,987          | \$2,077,987  | \$0           | \$679,092      | \$1,398,896  |
| 2027              | 0                    | 47,849,864     | 47,849,864    | 0                      | \$0.074            | \$0.046            | \$3,540,890          | \$3,540,890  | \$0           | \$696,069      | \$2,844,821  |
| 2028              | 0                    | 16,733,848     | 16,733,848    | 0                      | \$0.074            | \$0.046            | \$1,238,305          | \$1,238,305  | \$0           | \$1,006,138    | \$232,167    |
| 2029              | 0                    | 29,858,230     | 29,858,230    | 0                      | \$0.074            | \$0.046            | \$2,209,509          | \$2,209,509  | \$0           | \$763,071      | \$1,446,438  |
| 2030              | 0                    | 24,912,147     | 24,912,147    | 0                      | \$0.075            | \$0.047            | \$1,868,411          | \$1,868,411  | \$0           | \$749,590      | \$1,118,821  |
| 2031              | 0                    | 29,639,460     | 29,639,460    | 0                      | \$0.075            | \$0.047            | \$2,222,960          | \$2,222,960  | \$0           | \$768,330      | \$1,454,629  |
| 2032              | 0                    | 32,905,974     | 32,905,974    | 0                      | \$0.075            | \$0.047            | \$2,467,948          | \$2,467,948  | \$0           | \$787,538      | \$1,680,410  |
| 2033              | 0                    | 45,110,207     | 45,110,207    | 0                      | \$0.076            | \$0.048            | \$3,428,376          | \$3,428,376  | \$0           | \$2,453,118    | \$975,258    |
| 2034              | 0                    | 44,120,100     | 44,120,100    | 0                      | \$0.076            | \$0.048            | \$3,353,128          | \$3,353,128  | \$0           | \$863,344      | \$2,489,783  |
| 2035              | 0                    | 50,906,401     | 50,906,401    | 0                      | \$0.076            | \$0.048            | \$3,868,886          | \$3,868,886  | \$0           | \$848,093      | \$3,020,794  |
| 2036              | 0                    | 56,976,659     | 56,976,659    | 0                      | \$0.077            | \$0.049            | \$4,387,203          | \$4,387,203  | \$0           | \$869,295      | \$3,517,908  |
| 2037              | 0                    | 52,045,917     | 52,045,917    | 0                      | \$0.077            | \$0.049            | \$4,007,536          | \$4,007,536  | \$0           | \$891,027      | \$3,116,508  |
| 2038              | 0                    | 58,487,443     | 58,487,443    | 0                      | \$0.077            | \$0.049            | \$4,503,533          | \$4,503,533  | \$0           | \$957,378      | \$3,546,155  |
| Nominal Values    |                      | 980,888,289    | 980,888,289   | 0                      |                    |                    | \$71,900,141         | \$71,900,141 | \$0           | \$24,502,065   | \$47,398,077 |
| Net Present Value |                      |                |               |                        |                    |                    | \$25,815,307         | \$25,815,307 | \$0           | \$9,130,465    | \$16,684,842 |

**Table 26**  
**Detailed Case Results**  
**Sensitivity #2 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Low/Hist**

| Year              | KWH Power Deliveries |                |               |                        | Firm               | Interruptible      | Transmission Revenue |              |               | Total Expenses | Net Revenue   |
|-------------------|----------------------|----------------|---------------|------------------------|--------------------|--------------------|----------------------|--------------|---------------|----------------|---------------|
|                   | W/P << K             | Total W/P >> K | Firm W/P >> K | Interruptible W/P >> K | Transmission Price | Transmission Price | Total                | Firm         | Interruptible |                |               |
| 2009              | 0                    | 26,282,440     | 26,282,440    | 0                      | \$0.068            | \$0.040            | \$1,787,206          | \$1,787,206  | \$0           | \$462,449      | \$1,324,757   |
| 2010              | 0                    | 26,706,110     | 26,706,110    | 0                      | \$0.068            | \$0.040            | \$1,816,015          | \$1,816,015  | \$0           | \$288,570      | \$1,527,446   |
| 2011              | 0                    | 26,308,702     | 26,308,702    | 0                      | \$0.068            | \$0.040            | \$1,788,992          | \$1,788,992  | \$0           | \$454,181      | \$1,334,811   |
| 2012              | 0                    | 5,773,513      | 5,773,513     | 0                      | \$0.069            | \$0.041            | \$398,372            | \$398,372    | \$0           | \$465,536      | (\$67,163)    |
| 2013              | 0                    | 21,657,343     | 21,657,343    | 0                      | \$0.069            | \$0.041            | \$1,494,357          | \$1,494,357  | \$0           | \$1,481,614    | \$12,743      |
| 2014              | 0                    | 11,376,196     | 11,376,196    | 0                      | \$0.069            | \$0.041            | \$784,958            | \$784,958    | \$0           | \$511,035      | \$273,923     |
| 2015              | 0                    | 0              | 0             | 0                      | \$0.070            | \$0.042            | \$0                  | \$0          | \$0           | \$501,331      | (\$501,331)   |
| 2016              | 0                    | 4,087,031      | 4,087,031     | 0                      | \$0.070            | \$0.042            | \$286,092            | \$286,092    | \$0           | \$530,505      | (\$244,413)   |
| 2017              | 0                    | 0              | 0             | 0                      | \$0.070            | \$0.042            | \$0                  | \$0          | \$0           | \$543,768      | (\$543,768)   |
| 2018              | 0                    | 0              | 0             | 0                      | \$0.071            | \$0.043            | \$0                  | \$0          | \$0           | \$785,993      | (\$785,993)   |
| 2019              | 0                    | 4,492,304      | 4,492,304     | 0                      | \$0.071            | \$0.043            | \$318,954            | \$318,954    | \$0           | \$596,110      | (\$277,156)   |
| 2020              | 0                    | 5,578,802      | 5,578,802     | 0                      | \$0.071            | \$0.043            | \$396,095            | \$396,095    | \$0           | \$585,579      | (\$189,484)   |
| 2021              | 0                    | 20,418,852     | 20,418,852    | 0                      | \$0.072            | \$0.044            | \$1,470,157          | \$1,470,157  | \$0           | \$600,218      | \$869,939     |
| 2022              | 0                    | 29,204,546     | 29,204,546    | 0                      | \$0.072            | \$0.044            | \$2,102,727          | \$2,102,727  | \$0           | \$615,224      | \$1,487,504   |
| 2023              | 0                    | 28,188,242     | 28,188,242    | 0                      | \$0.072            | \$0.044            | \$2,029,553          | \$2,029,553  | \$0           | \$2,410,898    | (\$381,344)   |
| 2024              | 0                    | 34,817,151     | 34,817,151    | 0                      | \$0.073            | \$0.045            | \$2,541,652          | \$2,541,652  | \$0           | \$674,443      | \$1,867,209   |
| 2025              | 0                    | 29,146,607     | 29,146,607    | 0                      | \$0.073            | \$0.045            | \$2,127,702          | \$2,127,702  | \$0           | \$662,529      | \$1,465,174   |
| 2026              | 0                    | 9,630,158      | 9,630,158     | 0                      | \$0.073            | \$0.045            | \$703,002            | \$703,002    | \$0           | \$679,092      | \$23,910      |
| 2027              | 0                    | 28,996,466     | 28,996,466    | 0                      | \$0.074            | \$0.046            | \$2,145,738          | \$2,145,738  | \$0           | \$696,069      | \$1,449,669   |
| 2028              | 0                    | 13,340,212     | 13,340,212    | 0                      | \$0.074            | \$0.046            | \$987,176            | \$987,176    | \$0           | \$1,006,138    | (\$18,962)    |
| 2029              | 0                    | 5,513,572      | 5,513,572     | 0                      | \$0.074            | \$0.046            | \$408,004            | \$408,004    | \$0           | \$763,071      | (\$355,066)   |
| 2030              | 0                    | 9,835,108      | 9,835,108     | 0                      | \$0.075            | \$0.047            | \$737,633            | \$737,633    | \$0           | \$749,590      | (\$11,957)    |
| 2031              | 0                    | 5,517,634      | 5,517,634     | 0                      | \$0.075            | \$0.047            | \$413,823            | \$413,823    | \$0           | \$768,330      | (\$354,508)   |
| 2032              | 0                    | 4,822,824      | 4,822,824     | 0                      | \$0.075            | \$0.047            | \$361,712            | \$361,712    | \$0           | \$787,538      | (\$425,827)   |
| 2033              | 0                    | 13,460,481     | 13,460,481    | 0                      | \$0.076            | \$0.048            | \$1,022,997          | \$1,022,997  | \$0           | \$2,453,118    | (\$1,430,121) |
| 2034              | 0                    | 11,756,117     | 11,756,117    | 0                      | \$0.076            | \$0.048            | \$893,465            | \$893,465    | \$0           | \$863,344      | \$30,121      |
| 2035              | 0                    | 27,053,611     | 27,053,611    | 0                      | \$0.076            | \$0.048            | \$2,056,074          | \$2,056,074  | \$0           | \$848,093      | \$1,207,982   |
| 2036              | 0                    | 33,634,084     | 33,634,084    | 0                      | \$0.077            | \$0.049            | \$2,589,824          | \$2,589,824  | \$0           | \$869,295      | \$1,720,530   |
| 2037              | 0                    | 33,127,102     | 33,127,102    | 0                      | \$0.077            | \$0.049            | \$2,550,787          | \$2,550,787  | \$0           | \$891,027      | \$1,659,760   |
| 2038              | 0                    | 37,006,023     | 37,006,023    | 0                      | \$0.077            | \$0.049            | \$2,849,464          | \$2,849,464  | \$0           | \$957,378      | \$1,892,086   |
| Nominal Values    |                      | 507,731,229    | 507,731,229   | 0                      |                    |                    | \$37,062,531         | \$37,062,531 | \$0           | \$24,502,065   | \$12,560,466  |
| Net Present Value |                      |                |               |                        |                    |                    | \$14,182,803         | \$14,182,803 | \$0           | \$9,130,465    | \$5,052,338   |



**Table 27**  
**Case Results – Extreme Flows**  
**Sensitivity #2 Assumptions**

**Nominal Net Revenue-Historic Flows**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$38,804,690        | \$7,800,146     | \$34,009,205    | (\$20,341,422)  | \$39,072,593   | \$26,020,079   |
|                     | Base/Max  | (\$5,719,180)       | (\$10,952,334)  | (\$7,025,260)   | (\$24,502,065)  | (\$5,719,180)  | (\$7,615,377)  |
|                     | Base/Min  | \$120,620,633       | \$9,117,684     | \$107,629,905   | (\$20,251,594)  | \$121,772,136  | \$30,324,864   |
|                     | High/Avg  | \$133,276,859       | \$9,367,154     | \$106,281,956   | (\$20,316,549)  | \$137,537,361  | \$30,451,195   |
|                     | High/Max  | \$96,374,868        | \$4,297,814     | \$74,872,355    | (\$22,556,532)  | \$98,667,853   | \$23,279,779   |
|                     | High/Min  | \$191,100,797       | \$9,345,292     | \$150,976,966   | (\$20,156,169)  | \$198,841,819  | \$30,423,729   |
|                     | XHigh/Avg | \$142,455,002       | \$8,597,924     | \$113,058,372   | (\$20,660,490)  | \$147,217,955  | \$28,768,998   |
|                     | XHigh/Max | \$116,406,811       | \$5,591,105     | \$91,346,803    | (\$21,477,456)  | \$119,311,229  | \$24,252,219   |
|                     | XHigh/Min | \$200,269,317       | \$8,907,086     | \$157,530,844   | (\$20,342,270)  | \$208,300,809  | \$29,851,540   |
|                     | Low/Avg   | (\$4,225,844)       | (\$4,225,844)   | (\$4,937,527)   | (\$21,811,657)  | (\$4,225,844)  | (\$4,225,844)  |
|                     | Low/Max   | (\$24,502,065)      | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065) | (\$24,502,065) |
|                     | Low/Min   | \$78,830,242        | \$8,563,601     | \$75,640,938    | (\$20,251,497)  | \$79,047,860   | \$29,001,563   |

**Net Present Value of Net Revenues**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$11,704,188        | \$3,708,827     | \$10,610,465    | (\$6,177,742)   | \$11,752,351   | \$8,821,263    |
|                     | Base/Max  | (\$4,878,060)       | (\$5,976,632)   | (\$5,137,514)   | (\$9,130,465)   | (\$4,878,060)  | (\$5,246,956)  |
|                     | Base/Min  | \$45,136,294        | \$5,177,165     | \$42,203,126    | (\$5,894,746)   | \$45,392,757   | \$12,199,695   |
|                     | High/Avg  | \$43,302,267        | \$5,078,724     | \$36,569,990    | (\$5,997,562)   | \$44,344,358   | \$12,044,412   |
|                     | High/Max  | \$25,649,271        | \$925,610       | \$20,860,670    | (\$7,992,931)   | \$26,085,325   | \$6,463,424    |
|                     | High/Min  | \$70,902,877        | \$5,261,191     | \$60,222,597    | (\$5,830,673)   | \$72,920,558   | \$12,286,142   |
|                     | XHigh/Avg | \$48,056,820        | \$4,646,842     | \$40,330,941    | (\$6,230,335)   | \$49,375,809   | \$11,112,652   |
|                     | XHigh/Max | \$34,927,157        | \$2,594,929     | \$29,205,376    | (\$7,010,018)   | \$35,491,254   | \$8,594,708    |
|                     | XHigh/Min | \$75,490,658        | \$5,017,869     | \$63,905,749    | (\$5,970,517)   | \$77,605,150   | \$11,997,291   |
|                     | Low/Avg   | (\$2,502,524)       | (\$2,502,524)   | (\$2,650,273)   | (\$7,490,206)   | (\$2,502,524)  | (\$2,502,524)  |
|                     | Low/Max   | (\$9,130,465)       | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)  | (\$9,130,465)  |
|                     | Low/Min   | \$31,428,583        | \$5,005,567     | \$30,745,729    | (\$5,907,925)   | \$31,467,360   | \$11,652,712   |

### Sensitivity #3

Sensitivity #3 uses the lowest rates of any of the model runs. These rates are derived from those used in a study conducted by A. Dashen & Associates dated August 9, 2002. The rates in that study went out to 2031. CAI extended those rates through 2038 using the same underlying assumptions as those used by Dashen. The results of this sensitivity run are shown in tables 28 – 32.

**Table 28**  
**Nominal Net Revenues – Historical Flows**  
**Sensitivity #3 Assumptions**  
**All Load Growth Scenarios**

|          |            | W/P Load/Generation |              |              |
|----------|------------|---------------------|--------------|--------------|
|          |            | Base/Hist           | High/Hist    | Low/Hist     |
| KPU Case | Base/Hist  | \$34,668,392        | \$16,771,315 | \$38,273,833 |
|          | High/Hist  | \$76,467,745        | \$38,487,898 | \$86,157,520 |
|          | Xhigh/Hist | \$85,358,761        | \$44,780,729 | \$97,352,896 |
|          | Low/Hist   | \$6,374,177         | \$6,374,177  | \$7,310,945  |

**Table 29**  
**Net Present Values of Net Revenues – Historical Flows**  
**Sensitivity #3 Assumptions**  
**All Load Growth Scenarios**

|          |            | W/P Load/Generation |              |              |
|----------|------------|---------------------|--------------|--------------|
|          |            | Base/Hist           | High/Hist    | Low/Hist     |
| KPU Case | Base/Hist  | \$12,730,066        | \$8,323,668  | \$13,717,507 |
|          | High/Hist  | \$29,323,152        | \$19,021,771 | \$31,905,324 |
|          | Xhigh/Hist | \$34,343,686        | \$23,055,243 | \$37,721,461 |
|          | Low/Hist   | \$3,139,798         | \$3,139,798  | \$3,420,004  |

Even with the much lower rates used in this sensitivity; the results continue to be positive in all cases. However, Table 30 shows that there are a few negative years in this case. This is the first time negative years have shown up in the run where both Wrangell – Petersburg and KPU are experiencing base load growth and this indicates the impact of the lower rates used in this sensitivity. However, the overall results continue to be positive.

In Table 32, which shows the extreme inflow cases, there are a couple more years with negative results but still no major swing. The majority of the extreme cases continue to be positive.

**Table 30**  
**Detailed Case Results**  
**Sensitivity #3 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Base/Hist**

| Year              | KWH Power Deliveries |                |               |                        | Firm               | Interruptible      | Transmission Revenue |              |               | Total Expenses | Net Revenue  |
|-------------------|----------------------|----------------|---------------|------------------------|--------------------|--------------------|----------------------|--------------|---------------|----------------|--------------|
|                   | W/P << K             | Total W/P >> K | Firm W/P >> K | Interruptible W/P >> K | Transmission Price | Transmission Price | Total                | Firm         | Interruptible |                |              |
| 2009              | 0                    | 31,488,133     | 31,488,133    | 0                      | \$0.068            | \$0.040            | \$2,141,193          | \$2,141,193  | \$0           | \$462,449      | \$1,678,744  |
| 2010              | 0                    | 30,607,948     | 30,607,948    | 0                      | \$0.068            | \$0.040            | \$2,081,340          | \$2,081,340  | \$0           | \$288,570      | \$1,792,771  |
| 2011              | 0                    | 33,322,890     | 33,322,890    | 0                      | \$0.068            | \$0.040            | \$2,265,957          | \$2,265,957  | \$0           | \$454,181      | \$1,811,775  |
| 2012              | 0                    | 11,399,531     | 11,399,531    | 0                      | \$0.068            | \$0.041            | \$775,168            | \$775,168    | \$0           | \$465,536      | \$309,632    |
| 2013              | 0                    | 32,824,223     | 32,824,223    | 0                      | \$0.068            | \$0.041            | \$2,232,047          | \$2,232,047  | \$0           | \$1,481,614    | \$750,434    |
| 2014              | 0                    | 14,800,902     | 14,800,902    | 0                      | \$0.068            | \$0.041            | \$1,006,461          | \$1,006,461  | \$0           | \$511,035      | \$495,427    |
| 2015              | 0                    | 10,018,617     | 10,018,617    | 0                      | \$0.068            | \$0.042            | \$681,266            | \$681,266    | \$0           | \$501,331      | \$179,935    |
| 2016              | 0                    | 15,276,592     | 15,276,592    | 0                      | \$0.068            | \$0.042            | \$1,038,808          | \$1,038,808  | \$0           | \$530,505      | \$508,303    |
| 2017              | 0                    | 11,905,300     | 11,905,300    | 0                      | \$0.068            | \$0.042            | \$809,560            | \$809,560    | \$0           | \$543,768      | \$265,792    |
| 2018              | 0                    | 14,705,970     | 14,705,970    | 0                      | \$0.049            | \$0.043            | \$722,063            | \$722,063    | \$0           | \$785,993      | (\$63,930)   |
| 2019              | 0                    | 22,861,780     | 22,861,780    | 0                      | \$0.050            | \$0.043            | \$1,138,517          | \$1,138,517  | \$0           | \$596,110      | \$542,407    |
| 2020              | 0                    | 23,865,983     | 23,865,983    | 0                      | \$0.051            | \$0.043            | \$1,207,619          | \$1,207,619  | \$0           | \$585,579      | \$622,040    |
| 2021              | 0                    | 33,688,231     | 33,688,231    | 0                      | \$0.051            | \$0.044            | \$1,728,206          | \$1,728,206  | \$0           | \$600,218      | \$1,127,988  |
| 2022              | 0                    | 44,014,141     | 44,014,141    | 0                      | \$0.052            | \$0.044            | \$2,293,137          | \$2,293,137  | \$0           | \$615,224      | \$1,677,913  |
| 2023              | 0                    | 39,146,057     | 39,146,057    | 0                      | \$0.053            | \$0.044            | \$2,070,826          | \$2,070,826  | \$0           | \$2,410,898    | (\$340,071)  |
| 2024              | 0                    | 50,012,004     | 50,012,004    | 0                      | \$0.054            | \$0.045            | \$2,685,645          | \$2,685,645  | \$0           | \$674,443      | \$2,011,201  |
| 2025              | 0                    | 42,938,156     | 42,938,156    | 0                      | \$0.055            | \$0.045            | \$2,340,129          | \$2,340,129  | \$0           | \$662,529      | \$1,677,601  |
| 2026              | 0                    | 28,465,580     | 28,465,580    | 0                      | \$0.055            | \$0.045            | \$1,574,147          | \$1,574,147  | \$0           | \$679,092      | \$895,055    |
| 2027              | 0                    | 47,849,864     | 47,849,864    | 0                      | \$0.056            | \$0.046            | \$2,689,162          | \$2,689,162  | \$0           | \$696,069      | \$1,993,093  |
| 2028              | 0                    | 16,733,848     | 16,733,848    | 0                      | \$0.057            | \$0.046            | \$953,829            | \$953,829    | \$0           | \$1,006,138    | (\$52,309)   |
| 2029              | 0                    | 29,858,230     | 29,858,230    | 0                      | \$0.058            | \$0.046            | \$1,728,792          | \$1,728,792  | \$0           | \$763,071      | \$965,721    |
| 2030              | 0                    | 24,912,147     | 24,912,147    | 0                      | \$0.059            | \$0.047            | \$1,464,834          | \$1,464,834  | \$0           | \$749,590      | \$715,244    |
| 2031              | 0                    | 29,639,460     | 29,639,460    | 0                      | \$0.060            | \$0.047            | \$1,769,476          | \$1,769,476  | \$0           | \$768,330      | \$1,001,146  |
| 2032              | 0                    | 32,905,974     | 32,905,974    | 0                      | \$0.061            | \$0.047            | \$1,996,245          | \$1,996,245  | \$0           | \$787,538      | \$1,208,707  |
| 2033              | 0                    | 45,110,207     | 45,110,207    | 0                      | \$0.062            | \$0.048            | \$2,779,711          | \$2,779,711  | \$0           | \$2,453,118    | \$326,593    |
| 2034              | 0                    | 44,120,100     | 44,120,100    | 0                      | \$0.063            | \$0.048            | \$2,761,691          | \$2,761,691  | \$0           | \$863,344      | \$1,898,346  |
| 2035              | 0                    | 50,906,401     | 50,906,401    | 0                      | \$0.064            | \$0.048            | \$3,237,074          | \$3,237,074  | \$0           | \$848,093      | \$2,388,981  |
| 2036              | 0                    | 56,976,659     | 56,976,659    | 0                      | \$0.065            | \$0.049            | \$3,680,835          | \$3,680,835  | \$0           | \$869,295      | \$2,811,541  |
| 2037              | 0                    | 52,045,917     | 52,045,917    | 0                      | \$0.066            | \$0.049            | \$3,416,115          | \$3,416,115  | \$0           | \$891,027      | \$2,525,088  |
| 2038              | 0                    | 58,487,443     | 58,487,443    | 0                      | \$0.067            | \$0.049            | \$3,900,603          | \$3,900,603  | \$0           | \$957,378      | \$2,943,225  |
| Nominal Values    |                      | 980,888,289    | 980,888,289   | 0                      |                    |                    | \$59,170,457         | \$59,170,457 | \$0           | \$24,502,065   | \$34,668,392 |
| Net Present Value |                      |                |               |                        |                    |                    | \$21,860,531         | \$21,860,531 | \$0           | \$9,130,465    | \$12,730,066 |

**Table 31**  
**Detailed Case Results**  
**Sensitivity #3 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Low/Hist**

| Year              | KWH Power Deliveries |                |               |                        | Firm               | Interruptible      | Transmission Revenue |              |               | Total Expenses | Net Revenue   |
|-------------------|----------------------|----------------|---------------|------------------------|--------------------|--------------------|----------------------|--------------|---------------|----------------|---------------|
|                   | W/P << K             | Total W/P >> K | Firm W/P >> K | Interruptible W/P >> K | Transmission Price | Transmission Price | Total                | Firm         | Interruptible |                |               |
| 2009              | 0                    | 26,282,440     | 26,282,440    | 0                      | \$0.068            | \$0.040            | \$1,787,206          | \$1,787,206  | \$0           | \$462,449      | \$1,324,757   |
| 2010              | 0                    | 26,706,110     | 26,706,110    | 0                      | \$0.068            | \$0.040            | \$1,816,015          | \$1,816,015  | \$0           | \$288,570      | \$1,527,446   |
| 2011              | 0                    | 26,308,702     | 26,308,702    | 0                      | \$0.068            | \$0.040            | \$1,788,992          | \$1,788,992  | \$0           | \$454,181      | \$1,334,811   |
| 2012              | 0                    | 5,773,513      | 5,773,513     | 0                      | \$0.068            | \$0.041            | \$392,599            | \$392,599    | \$0           | \$465,536      | (\$72,937)    |
| 2013              | 0                    | 21,657,343     | 21,657,343    | 0                      | \$0.068            | \$0.041            | \$1,472,699          | \$1,472,699  | \$0           | \$1,481,614    | (\$8,914)     |
| 2014              | 0                    | 11,376,196     | 11,376,196    | 0                      | \$0.068            | \$0.041            | \$773,581            | \$773,581    | \$0           | \$511,035      | \$262,547     |
| 2015              | 0                    | 0              | 0             | 0                      | \$0.068            | \$0.042            | \$0                  | \$0          | \$0           | \$501,331      | (\$501,331)   |
| 2016              | 0                    | 4,087,031      | 4,087,031     | 0                      | \$0.068            | \$0.042            | \$277,918            | \$277,918    | \$0           | \$530,505      | (\$252,587)   |
| 2017              | 0                    | 0              | 0             | 0                      | \$0.068            | \$0.042            | \$0                  | \$0          | \$0           | \$543,768      | (\$543,768)   |
| 2018              | 0                    | 0              | 0             | 0                      | \$0.049            | \$0.043            | \$0                  | \$0          | \$0           | \$785,993      | (\$785,993)   |
| 2019              | 0                    | 4,492,304      | 4,492,304     | 0                      | \$0.050            | \$0.043            | \$223,717            | \$223,717    | \$0           | \$596,110      | (\$372,393)   |
| 2020              | 0                    | 5,578,802      | 5,578,802     | 0                      | \$0.051            | \$0.043            | \$282,287            | \$282,287    | \$0           | \$585,579      | (\$303,291)   |
| 2021              | 0                    | 20,418,852     | 20,418,852    | 0                      | \$0.051            | \$0.044            | \$1,047,487          | \$1,047,487  | \$0           | \$600,218      | \$447,269     |
| 2022              | 0                    | 29,204,546     | 29,204,546    | 0                      | \$0.052            | \$0.044            | \$1,521,557          | \$1,521,557  | \$0           | \$615,224      | \$906,333     |
| 2023              | 0                    | 28,188,242     | 28,188,242    | 0                      | \$0.053            | \$0.044            | \$1,491,158          | \$1,491,158  | \$0           | \$2,410,898    | (\$919,740)   |
| 2024              | 0                    | 34,817,151     | 34,817,151    | 0                      | \$0.054            | \$0.045            | \$1,869,681          | \$1,869,681  | \$0           | \$674,443      | \$1,195,238   |
| 2025              | 0                    | 29,146,607     | 29,146,607    | 0                      | \$0.055            | \$0.045            | \$1,588,490          | \$1,588,490  | \$0           | \$662,529      | \$925,961     |
| 2026              | 0                    | 9,630,158      | 9,630,158     | 0                      | \$0.055            | \$0.045            | \$532,548            | \$532,548    | \$0           | \$679,092      | (\$146,544)   |
| 2027              | 0                    | 28,996,466     | 28,996,466    | 0                      | \$0.056            | \$0.046            | \$1,629,601          | \$1,629,601  | \$0           | \$696,069      | \$933,532     |
| 2028              | 0                    | 13,340,212     | 13,340,212    | 0                      | \$0.057            | \$0.046            | \$760,392            | \$760,392    | \$0           | \$1,006,138    | (\$245,746)   |
| 2029              | 0                    | 5,513,572      | 5,513,572     | 0                      | \$0.058            | \$0.046            | \$319,236            | \$319,236    | \$0           | \$763,071      | (\$443,835)   |
| 2030              | 0                    | 9,835,108      | 9,835,108     | 0                      | \$0.059            | \$0.047            | \$578,304            | \$578,304    | \$0           | \$749,590      | (\$171,286)   |
| 2031              | 0                    | 5,517,634      | 5,517,634     | 0                      | \$0.060            | \$0.047            | \$329,403            | \$329,403    | \$0           | \$768,330      | (\$438,927)   |
| 2032              | 0                    | 4,822,824      | 4,822,824     | 0                      | \$0.061            | \$0.047            | \$292,577            | \$292,577    | \$0           | \$787,538      | (\$494,961)   |
| 2033              | 0                    | 13,460,481     | 13,460,481    | 0                      | \$0.062            | \$0.048            | \$829,441            | \$829,441    | \$0           | \$2,453,118    | (\$1,623,677) |
| 2034              | 0                    | 11,756,117     | 11,756,117    | 0                      | \$0.063            | \$0.048            | \$735,872            | \$735,872    | \$0           | \$863,344      | (\$127,472)   |
| 2035              | 0                    | 27,053,611     | 27,053,611    | 0                      | \$0.064            | \$0.048            | \$1,720,305          | \$1,720,305  | \$0           | \$848,093      | \$872,212     |
| 2036              | 0                    | 33,634,084     | 33,634,084    | 0                      | \$0.065            | \$0.049            | \$2,172,846          | \$2,172,846  | \$0           | \$869,295      | \$1,303,551   |
| 2037              | 0                    | 33,127,102     | 33,127,102    | 0                      | \$0.066            | \$0.049            | \$2,174,349          | \$2,174,349  | \$0           | \$891,027      | \$1,283,322   |
| 2038              | 0                    | 37,006,023     | 37,006,023    | 0                      | \$0.067            | \$0.049            | \$2,467,980          | \$2,467,980  | \$0           | \$957,378      | \$1,510,602   |
| Nominal Values    |                      | 507,731,229    | 507,731,229   | 0                      |                    |                    | \$30,876,242         | \$30,876,242 | \$0           | \$24,502,065   | \$6,374,177   |
| Net Present Value |                      |                |               |                        |                    |                    | \$12,270,263         | \$12,270,263 | \$0           | \$9,130,465    | \$3,139,798   |

**Table 32**  
**Case Results – Extreme Flows**  
**Sensitivity #3 Assumptions**

**Nominal Net Revenue-Historic Flows**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$27,044,738        | \$2,270,163     | \$23,134,914    | (\$20,373,724)  | \$27,273,380   | \$16,594,114   |
|                     | Base/Max  | (\$9,158,032)       | (\$13,492,892)  | (\$10,250,794)  | (\$24,502,065)  | (\$9,158,032)  | (\$10,751,055) |
|                     | Base/Min  | \$95,379,740        | \$3,883,057     | \$84,707,060    | (\$20,264,375)  | \$96,324,568   | \$21,099,011   |
|                     | High/Avg  | \$103,573,627       | \$4,017,978     | \$81,779,829    | (\$20,331,029)  | \$107,019,911  | \$21,135,679   |
|                     | High/Max  | \$72,267,814        | (\$1,399,987)   | \$54,628,617    | (\$22,602,095)  | \$74,202,879   | \$13,597,656   |
|                     | High/Min  | \$152,510,974       | \$4,066,664     | \$120,451,216   | (\$20,171,676)  | \$158,741,570  | \$21,203,050   |
|                     | XHigh/Avg | \$112,592,448       | \$3,372,076     | \$88,444,166    | (\$20,674,970)  | \$116,524,888  | \$19,763,819   |
|                     | XHigh/Max | \$91,219,729        | \$1,142,900     | \$70,084,963    | (\$21,492,351)  | \$93,759,345   | \$16,894,629   |
|                     | XHigh/Min | \$161,535,947       | \$3,745,010     | \$126,912,754   | (\$20,355,304)  | \$168,053,753  | \$20,796,498   |
|                     | Low/Avg   | (\$8,041,336)       | (\$8,041,336)   | (\$8,632,104)   | (\$21,865,766)  | (\$8,041,336)  | (\$8,041,336)  |
|                     | Low/Max   | (\$24,502,065)      | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065) | (\$24,502,065) |
|                     | Low/Min   | \$61,404,376        | \$3,377,716     | \$58,765,453    | (\$20,264,375)  | \$61,590,590   | \$19,948,373   |

**Net Present Value of Net Revenues**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$8,113,810         | \$1,826,045     | \$7,229,208     | (\$6,198,948)   | \$8,154,891    | \$5,776,540    |
|                     | Base/Max  | (\$5,685,967)       | (\$6,591,135)   | (\$5,902,409)   | (\$9,130,465)   | (\$5,685,967)  | (\$5,995,253)  |
|                     | Base/Min  | \$37,025,810        | \$3,438,798     | \$34,641,248    | (\$5,903,055)   | \$37,234,146   | \$9,222,778    |
|                     | High/Avg  | \$34,114,679        | \$3,299,140     | \$28,750,968    | (\$6,006,912)   | \$34,942,335   | \$9,035,748    |
|                     | High/Max  | \$18,547,134        | (\$1,004,062)   | \$14,656,046    | (\$8,019,180)   | \$18,914,324   | \$3,321,980    |
|                     | High/Min  | \$58,377,325        | \$3,510,564     | \$49,948,117    | (\$5,840,469)   | \$59,988,369   | \$9,318,047    |
|                     | XHigh/Avg | \$38,805,705        | \$2,909,760     | \$32,464,417    | (\$6,239,685)   | \$39,902,717   | \$8,237,514    |
|                     | XHigh/Max | \$27,371,208        | \$1,177,089     | \$22,561,706    | (\$7,019,900)   | \$27,865,178   | \$6,261,155    |
|                     | XHigh/Min | \$62,910,850        | \$3,309,107     | \$53,593,169    | (\$5,978,858)   | \$64,617,322   | \$9,082,068    |
|                     | Low/Avg   | (\$3,681,224)       | (\$3,681,224)   | (\$3,803,380)   | (\$7,521,702)   | (\$3,681,224)  | (\$3,681,224)  |
|                     | Low/Max   | (\$9,130,465)       | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)  | (\$9,130,465)  |
|                     | Low/Min   | \$25,708,454        | \$3,268,972     | \$25,149,407    | (\$5,916,301)   | \$25,741,616   | \$8,726,121    |

### Sensitivity #4

In this sensitivity run, debt service is added to the costs that must be covered. There was no debt service in any of the other sensitivities or in the base case. It is assumed that \$10 million is borrowed and paid back in flat payments. The assumed interest rate is 5.5% and the term of the debt is 20 years. The results for this sensitivity are shown in table 33 – 37.

**Table 33**  
**Nominal Net Revenues – Historical Flows**  
**Sensitivity #4 Assumptions**  
**All Load Growth Scenarios**

|          |            | W/P Load/Generation |               |               |
|----------|------------|---------------------|---------------|---------------|
|          |            | Base/Hist           | High/Hist     | Low/Hist      |
| KPU Case | Base/Hist  | \$28,838,657        | \$8,007,941   | \$33,135,070  |
|          | High/Hist  | \$77,310,722        | \$32,657,457  | \$88,689,180  |
|          | Xhigh/Hist | \$85,617,093        | \$38,636,663  | \$99,541,934  |
|          | Low/Hist   | (\$4,106,325)       | (\$4,106,325) | (\$3,025,330) |

**Table 34**  
**Net Present Values of Net Revenues – Historical Flows**  
**Sensitivity #4 Assumptions**  
**All Load Growth Scenarios**

|          |            | W/P Load/Generation |               |               |
|----------|------------|---------------------|---------------|---------------|
|          |            | Base/Hist           | High/Hist     | Low/Hist      |
| KPU Case | Base/Hist  | \$7,583,645         | \$2,416,208   | \$8,770,988   |
|          | High/Hist  | \$26,327,199        | \$14,135,285  | \$29,378,771  |
|          | Xhigh/Hist | \$31,157,214        | \$18,055,960  | \$35,089,240  |
|          | Low/Hist   | (\$3,406,818)       | (\$3,406,818) | (\$3,086,119) |

It is clear that the debt service had an impact on the results. The annual costs have increased sufficiently such that when KPU loads are low, there is not enough revenue to cover the costs of the line and the overall economics are negative. However, the results are still strongly positive if KPU loads are at base level or above.

Table 35 shows that even though the results are positive over the entire study period, there is a string of 7 negative years in a row in the case where base load growth is assumed. Table 37 shows that now 36, or one-half, of the extreme inflow cases are negative. Clearly, debt service adds a significant additional burden to the economics of the STI.

**Table 35**  
**Detailed Case Results**  
**Sensitivity #4 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Base/Hist**

| Year              | KWH Power Deliveries |                   |                  |                           | Firm                  | Interruptible         | Transmission Revenue |              |               | Total        | Net          |
|-------------------|----------------------|-------------------|------------------|---------------------------|-----------------------|-----------------------|----------------------|--------------|---------------|--------------|--------------|
|                   | W/P << K             | Total<br>W/P >> K | Firm<br>W/P >> K | Interruptible<br>W/P >> K | Transmission<br>Price | Transmission<br>Price | Total                | Firm         | Interruptible | Expenses     | Revenue      |
| 2009              | 0                    | 31,488,133        | 31,488,133       | 0                         | \$0.064               | \$0.040               | \$2,015,241          | \$2,015,241  | \$0           | \$1,244,242  | \$770,998    |
| 2010              | 0                    | 30,607,948        | 30,607,948       | 0                         | \$0.064               | \$0.040               | \$1,958,909          | \$1,958,909  | \$0           | \$1,070,363  | \$888,546    |
| 2011              | 0                    | 33,322,890        | 33,322,890       | 0                         | \$0.064               | \$0.040               | \$2,132,665          | \$2,132,665  | \$0           | \$1,235,974  | \$896,690    |
| 2012              | 0                    | 11,399,531        | 11,399,531       | 0                         | \$0.065               | \$0.041               | \$740,969            | \$740,969    | \$0           | \$1,247,329  | (\$506,360)  |
| 2013              | 0                    | 32,824,223        | 32,824,223       | 0                         | \$0.065               | \$0.041               | \$2,133,574          | \$2,133,574  | \$0           | \$2,263,407  | (\$129,832)  |
| 2014              | 0                    | 14,800,902        | 14,800,902       | 0                         | \$0.065               | \$0.041               | \$962,059            | \$962,059    | \$0           | \$1,292,828  | (\$330,769)  |
| 2015              | 0                    | 10,018,617        | 10,018,617       | 0                         | \$0.066               | \$0.042               | \$661,229            | \$661,229    | \$0           | \$1,283,124  | (\$621,896)  |
| 2016              | 0                    | 15,276,592        | 15,276,592       | 0                         | \$0.066               | \$0.042               | \$1,008,255          | \$1,008,255  | \$0           | \$1,312,299  | (\$304,044)  |
| 2017              | 0                    | 11,905,300        | 11,905,300       | 0                         | \$0.066               | \$0.042               | \$785,750            | \$785,750    | \$0           | \$1,325,561  | (\$539,812)  |
| 2018              | 0                    | 14,705,970        | 14,705,970       | 0                         | \$0.067               | \$0.043               | \$985,300            | \$985,300    | \$0           | \$1,567,787  | (\$582,487)  |
| 2019              | 0                    | 22,861,780        | 22,861,780       | 0                         | \$0.067               | \$0.043               | \$1,531,739          | \$1,531,739  | \$0           | \$1,377,903  | \$153,836    |
| 2020              | 0                    | 23,865,983        | 23,865,983       | 0                         | \$0.067               | \$0.043               | \$1,599,021          | \$1,599,021  | \$0           | \$1,367,372  | \$231,649    |
| 2021              | 0                    | 33,688,231        | 33,688,231       | 0                         | \$0.068               | \$0.044               | \$2,290,800          | \$2,290,800  | \$0           | \$1,382,012  | \$908,788    |
| 2022              | 0                    | 44,014,141        | 44,014,141       | 0                         | \$0.068               | \$0.044               | \$2,992,962          | \$2,992,962  | \$0           | \$1,397,017  | \$1,595,945  |
| 2023              | 0                    | 39,146,057        | 39,146,057       | 0                         | \$0.068               | \$0.044               | \$2,661,932          | \$2,661,932  | \$0           | \$3,192,691  | (\$530,759)  |
| 2024              | 0                    | 50,012,004        | 50,012,004       | 0                         | \$0.069               | \$0.045               | \$3,450,828          | \$3,450,828  | \$0           | \$1,456,237  | \$1,994,592  |
| 2025              | 0                    | 42,938,156        | 42,938,156       | 0                         | \$0.069               | \$0.045               | \$2,962,733          | \$2,962,733  | \$0           | \$1,444,322  | \$1,518,411  |
| 2026              | 0                    | 28,465,580        | 28,465,580       | 0                         | \$0.069               | \$0.045               | \$1,964,125          | \$1,964,125  | \$0           | \$1,460,885  | \$503,240    |
| 2027              | 0                    | 47,849,864        | 47,849,864       | 0                         | \$0.070               | \$0.046               | \$3,349,490          | \$3,349,490  | \$0           | \$1,477,862  | \$1,871,628  |
| 2028              | 0                    | 16,733,848        | 16,733,848       | 0                         | \$0.070               | \$0.046               | \$1,171,369          | \$1,171,369  | \$0           | \$787,931    | \$383,438    |
| 2029              | 0                    | 29,858,230        | 29,858,230       | 0                         | \$0.070               | \$0.046               | \$2,090,076          | \$2,090,076  | \$0           | \$763,071    | \$1,327,005  |
| 2030              | 0                    | 24,912,147        | 24,912,147       | 0                         | \$0.071               | \$0.047               | \$1,768,762          | \$1,768,762  | \$0           | \$749,590    | \$1,019,172  |
| 2031              | 0                    | 29,639,460        | 29,639,460       | 0                         | \$0.071               | \$0.047               | \$2,104,402          | \$2,104,402  | \$0           | \$768,330    | \$1,336,072  |
| 2032              | 0                    | 32,905,974        | 32,905,974       | 0                         | \$0.071               | \$0.047               | \$2,336,324          | \$2,336,324  | \$0           | \$787,538    | \$1,548,786  |
| 2033              | 0                    | 45,110,207        | 45,110,207       | 0                         | \$0.072               | \$0.048               | \$3,247,935          | \$3,247,935  | \$0           | \$2,453,118  | \$794,817    |
| 2034              | 0                    | 44,120,100        | 44,120,100       | 0                         | \$0.072               | \$0.048               | \$3,176,647          | \$3,176,647  | \$0           | \$863,344    | \$2,313,303  |
| 2035              | 0                    | 50,906,401        | 50,906,401       | 0                         | \$0.072               | \$0.048               | \$3,665,261          | \$3,665,261  | \$0           | \$848,093    | \$2,817,168  |
| 2036              | 0                    | 56,976,659        | 56,976,659       | 0                         | \$0.073               | \$0.049               | \$4,159,296          | \$4,159,296  | \$0           | \$869,295    | \$3,290,001  |
| 2037              | 0                    | 52,045,917        | 52,045,917       | 0                         | \$0.073               | \$0.049               | \$3,799,352          | \$3,799,352  | \$0           | \$891,027    | \$2,908,325  |
| 2038              | 0                    | 58,487,443        | 58,487,443       | 0                         | \$0.073               | \$0.049               | \$4,269,583          | \$4,269,583  | \$0           | \$957,378    | \$3,312,205  |
| Nominal Values    |                      | 980,888,289       | 980,888,289      | 0                         |                       |                       | \$67,976,588         | \$67,976,588 | \$0           | \$39,137,931 | \$28,838,657 |
| Net Present Value |                      |                   |                  |                           |                       |                       | \$24,378,634         | \$24,378,634 | \$0           | \$16,794,988 | \$7,583,645  |



**Table 36**  
**Detailed Case Results**  
**Sensitivity #4 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Low/Hist**

| Year              | KWH Power Deliveries |                   |                  |                           | Firm                  | Interruptible         | Transmission Revenue |              |               | Total        | Net           |
|-------------------|----------------------|-------------------|------------------|---------------------------|-----------------------|-----------------------|----------------------|--------------|---------------|--------------|---------------|
|                   | W/P << K             | Total<br>W/P >> K | Firm<br>W/P >> K | Interruptible<br>W/P >> K | Transmission<br>Price | Transmission<br>Price | Total                | Firm         | Interruptible | Expenses     | Revenue       |
| 2009              | 0                    | 26,282,440        | 26,282,440       | 0                         | \$0.064               | \$0.040               | \$1,682,076          | \$1,682,076  | \$0           | \$1,244,242  | \$437,834     |
| 2010              | 0                    | 26,706,110        | 26,706,110       | 0                         | \$0.064               | \$0.040               | \$1,709,191          | \$1,709,191  | \$0           | \$1,070,363  | \$638,828     |
| 2011              | 0                    | 26,308,702        | 26,308,702       | 0                         | \$0.064               | \$0.040               | \$1,683,757          | \$1,683,757  | \$0           | \$1,235,974  | \$447,782     |
| 2012              | 0                    | 5,773,513         | 5,773,513        | 0                         | \$0.065               | \$0.041               | \$375,278            | \$375,278    | \$0           | \$1,247,329  | (\$872,051)   |
| 2013              | 0                    | 21,657,343        | 21,657,343       | 0                         | \$0.065               | \$0.041               | \$1,407,727          | \$1,407,727  | \$0           | \$2,263,407  | (\$855,680)   |
| 2014              | 0                    | 11,376,196        | 11,376,196       | 0                         | \$0.065               | \$0.041               | \$739,453            | \$739,453    | \$0           | \$1,292,828  | (\$553,375)   |
| 2015              | 0                    | 0                 | 0                | 0                         | \$0.066               | \$0.042               | \$0                  | \$0          | \$0           | \$1,283,124  | (\$1,283,124) |
| 2016              | 0                    | 4,087,031         | 4,087,031        | 0                         | \$0.066               | \$0.042               | \$269,744            | \$269,744    | \$0           | \$1,312,299  | (\$1,042,555) |
| 2017              | 0                    | 0                 | 0                | 0                         | \$0.066               | \$0.042               | \$0                  | \$0          | \$0           | \$1,325,561  | (\$1,325,561) |
| 2018              | 0                    | 0                 | 0                | 0                         | \$0.067               | \$0.043               | \$0                  | \$0          | \$0           | \$1,567,787  | (\$1,567,787) |
| 2019              | 0                    | 4,492,304         | 4,492,304        | 0                         | \$0.067               | \$0.043               | \$300,984            | \$300,984    | \$0           | \$1,377,903  | (\$1,076,918) |
| 2020              | 0                    | 5,578,802         | 5,578,802        | 0                         | \$0.067               | \$0.043               | \$373,780            | \$373,780    | \$0           | \$1,367,372  | (\$993,592)   |
| 2021              | 0                    | 20,418,852        | 20,418,852       | 0                         | \$0.068               | \$0.044               | \$1,388,482          | \$1,388,482  | \$0           | \$1,382,012  | \$6,470       |
| 2022              | 0                    | 29,204,546        | 29,204,546       | 0                         | \$0.068               | \$0.044               | \$1,985,909          | \$1,985,909  | \$0           | \$1,397,017  | \$588,892     |
| 2023              | 0                    | 28,188,242        | 28,188,242       | 0                         | \$0.068               | \$0.044               | \$1,916,800          | \$1,916,800  | \$0           | \$3,192,691  | (\$1,275,890) |
| 2024              | 0                    | 34,817,151        | 34,817,151       | 0                         | \$0.069               | \$0.045               | \$2,402,383          | \$2,402,383  | \$0           | \$1,456,237  | \$946,147     |
| 2025              | 0                    | 29,146,607        | 29,146,607       | 0                         | \$0.069               | \$0.045               | \$2,011,116          | \$2,011,116  | \$0           | \$1,444,322  | \$566,794     |
| 2026              | 0                    | 9,630,158         | 9,630,158        | 0                         | \$0.069               | \$0.045               | \$664,481            | \$664,481    | \$0           | \$1,460,885  | (\$796,404)   |
| 2027              | 0                    | 28,996,466        | 28,996,466       | 0                         | \$0.070               | \$0.046               | \$2,029,753          | \$2,029,753  | \$0           | \$1,477,862  | \$551,890     |
| 2028              | 0                    | 13,340,212        | 13,340,212       | 0                         | \$0.070               | \$0.046               | \$933,815            | \$933,815    | \$0           | \$787,931    | \$145,884     |
| 2029              | 0                    | 5,513,572         | 5,513,572        | 0                         | \$0.070               | \$0.046               | \$385,950            | \$385,950    | \$0           | \$763,071    | (\$377,121)   |
| 2030              | 0                    | 9,835,108         | 9,835,108        | 0                         | \$0.071               | \$0.047               | \$698,293            | \$698,293    | \$0           | \$749,590    | (\$51,298)    |
| 2031              | 0                    | 5,517,634         | 5,517,634        | 0                         | \$0.071               | \$0.047               | \$391,752            | \$391,752    | \$0           | \$768,330    | (\$376,578)   |
| 2032              | 0                    | 4,822,824         | 4,822,824        | 0                         | \$0.071               | \$0.047               | \$342,420            | \$342,420    | \$0           | \$787,538    | (\$445,118)   |
| 2033              | 0                    | 13,460,481        | 13,460,481       | 0                         | \$0.072               | \$0.048               | \$969,155            | \$969,155    | \$0           | \$2,453,118  | (\$1,483,963) |
| 2034              | 0                    | 11,756,117        | 11,756,117       | 0                         | \$0.072               | \$0.048               | \$846,440            | \$846,440    | \$0           | \$863,344    | (\$16,904)    |
| 2035              | 0                    | 27,053,611        | 27,053,611       | 0                         | \$0.072               | \$0.048               | \$1,947,860          | \$1,947,860  | \$0           | \$848,093    | \$1,099,767   |
| 2036              | 0                    | 33,634,084        | 33,634,084       | 0                         | \$0.073               | \$0.049               | \$2,455,288          | \$2,455,288  | \$0           | \$869,295    | \$1,585,993   |
| 2037              | 0                    | 33,127,102        | 33,127,102       | 0                         | \$0.073               | \$0.049               | \$2,418,278          | \$2,418,278  | \$0           | \$891,027    | \$1,527,251   |
| 2038              | 0                    | 37,006,023        | 37,006,023       | 0                         | \$0.073               | \$0.049               | \$2,701,440          | \$2,701,440  | \$0           | \$957,378    | \$1,744,062   |
| Nominal Values    |                      | 507,731,229       | 507,731,229      | 0                         |                       |                       | \$35,031,606         | \$35,031,606 | \$0           | \$39,137,931 | (\$4,106,325) |
| Net Present Value |                      |                   |                  |                           |                       |                       | \$13,388,170         | \$13,388,170 | \$0           | \$16,794,988 | (\$3,406,818) |



**Table 37**  
**Case Results – Extreme Flows**  
**Sensitivity #4 Assumptions**

**Nominal Net Revenue-Historic Flows**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$20,733,908        | (\$8,615,974)   | \$16,192,107    | (\$35,220,132)  | \$20,987,895   | \$8,625,007    |
|                     | Base/Max  | (\$21,348,097)      | (\$26,306,107)  | (\$22,585,802)  | (\$39,137,931)  | (\$21,348,097) | (\$23,145,159) |
|                     | Base/Min  | \$98,032,287        | (\$7,379,145)   | \$85,727,599    | (\$35,136,736)  | \$99,123,008   | \$12,676,372   |
|                     | High/Avg  | \$110,071,083       | (\$7,141,904)   | \$84,512,581    | (\$35,197,770)  | \$114,105,347  | \$12,797,171   |
|                     | High/Max  | \$75,239,227        | (\$11,910,627)  | \$54,871,739    | (\$37,304,161)  | \$77,412,608   | \$6,048,905    |
|                     | High/Min  | \$164,652,091       | (\$7,163,766)   | \$126,674,075   | (\$35,046,763)  | \$171,979,889  | \$12,769,704   |
|                     | XHigh/Avg | \$119,172,677       | (\$7,802,063)   | \$91,226,947    | (\$35,492,576)  | \$123,706,298  | \$11,354,095   |
|                     | XHigh/Max | \$94,711,776        | (\$10,484,624)  | \$70,804,168    | (\$36,242,379)  | \$97,494,224   | \$7,346,219    |
|                     | XHigh/Min | \$173,759,240       | (\$7,539,509)   | \$133,180,583   | (\$35,205,285)  | \$181,376,244  | \$12,279,187   |
|                     | Low/Avg   | (\$19,961,811)      | (\$19,961,811)  | (\$20,636,077)  | (\$36,602,599)  | (\$19,961,811) | (\$19,961,811) |
|                     | Low/Max   | (\$39,137,931)      | (\$39,137,931)  | (\$39,137,931)  | (\$39,137,931)  | (\$39,137,931) | (\$39,137,931) |
|                     | Low/Min   | \$58,509,052        | (\$7,903,871)   | \$55,487,487    | (\$35,136,639)  | \$58,715,365   | \$11,425,619   |

**Net Present Value of Net Revenues**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$2,890,975         | (\$4,674,926)   | \$1,855,293     | (\$14,014,707)  | \$2,936,636    | \$160,910      |
|                     | Base/Max  | (\$12,768,150)      | (\$13,808,849)  | (\$13,014,007)  | (\$16,794,988)  | (\$12,768,150) | (\$13,117,747) |
|                     | Base/Min  | \$34,444,629        | (\$3,294,603)   | \$31,667,236    | (\$13,749,116)  | \$34,687,502   | \$3,340,716    |
|                     | High/Avg  | \$32,745,660        | (\$3,386,481)   | \$26,374,135    | (\$13,845,823)  | \$33,731,996   | \$3,195,245    |
|                     | High/Max  | \$16,095,022        | (\$7,294,708)   | \$11,560,183    | (\$15,722,824)  | \$16,508,313   | (\$2,057,897)  |
|                     | High/Min  | \$58,779,341        | (\$3,215,246)   | \$48,674,719    | (\$13,688,725)  | \$60,688,462   | \$3,422,082    |
|                     | XHigh/Avg | \$37,458,934        | (\$3,750,104)   | \$30,099,295    | (\$14,041,614)  | \$38,720,736   | \$2,405,694    |
|                     | XHigh/Max | \$25,061,479        | (\$5,617,389)   | \$19,597,504    | (\$14,765,412)  | \$25,602,380   | \$109,088      |
|                     | XHigh/Min | \$63,335,245        | (\$3,422,922)   | \$52,330,740    | (\$13,807,815)  | \$65,340,450   | \$3,175,350    |
|                     | Low/Avg   | (\$10,531,980)      | (\$10,531,980)  | (\$10,671,952)  | (\$15,249,362)  | (\$10,531,980) | (\$10,531,980) |
|                     | Low/Max   | (\$16,794,988)      | (\$16,794,988)  | (\$16,794,988)  | (\$16,794,988)  | (\$16,794,988) | (\$16,794,988) |
|                     | Low/Min   | \$21,492,316        | (\$3,456,617)   | \$20,845,530    | (\$13,761,516)  | \$21,529,078   | \$2,824,667    |

## Sensitivity #5

Sensitivity #5, the last sensitivity, puts all but one of the assumptions back to where they were in the base case. The one difference is that it is assumed that Ketchikan goes forward with upgrades to their hydro projects and that these upgrades add 14 million kWh per year to the output of those projects. This will significantly reduce the diesel generation in Ketchikan, thereby reducing power traveling across the STI. Where there were 980 million kWh sent to Ketchikan from Tyee over the study period under base loads in the other model runs, in this sensitivity that drops to 632 million kWh.

Tables 38 – 42 show the results of this sensitivity.

**Table 38**  
**Nominal Net Revenues – Historical Flows**  
**Sensitivity #5 Assumptions**  
**All Load Growth Scenarios**

|                 |            | W/P Load/Generation |                  |                 |
|-----------------|------------|---------------------|------------------|-----------------|
|                 |            | <u>Base/Hist</u>    | <u>High/Hist</u> | <u>Low/Hist</u> |
| <b>KPU Case</b> | Base/Hist  | \$19,759,655        | \$6,517,641      | \$21,569,720    |
|                 | High/Hist  | \$78,944,586        | \$40,435,510     | \$88,846,714    |
|                 | Xhigh/Hist | \$90,190,856        | \$46,693,414     | \$102,351,633   |
|                 | Low/Hist   | (\$13,867,057)      | (\$13,867,057)   | (\$13,829,897)  |

**Table 39**  
**Net Present Values of Net Revenues – Historical Flows**  
**Sensitivity #5 Assumptions**  
**All Load Growth Scenarios**

|                 |            | W/P Load/Generation |                  |                 |
|-----------------|------------|---------------------|------------------|-----------------|
|                 |            | <u>Base/Hist</u>    | <u>High/Hist</u> | <u>Low/Hist</u> |
| <b>KPU Case</b> | Base/Hist  | \$4,837,628         | \$1,632,577      | \$5,254,705     |
|                 | High/Hist  | \$27,137,894        | \$17,409,852     | \$29,641,035    |
|                 | Xhigh/Hist | \$33,091,349        | \$21,541,741     | \$36,252,614    |
|                 | Low/Hist   | (\$5,646,519)       | (\$5,646,519)    | (\$5,639,820)   |

Table 41 shows that when KPU loads are low, there are very few years where STI revenues cover the annual costs.

**Table 40**  
**Detailed Case Results**  
**Sensitivity #5 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Base/Hist**

| Year              | KWH Power Deliveries |                |               |                        | Firm               | Interruptible      | Transmission Revenue |              |               | Total Expenses | Net Revenue  |
|-------------------|----------------------|----------------|---------------|------------------------|--------------------|--------------------|----------------------|--------------|---------------|----------------|--------------|
|                   | W/P << K             | Total W/P >> K | Firm W/P >> K | Interruptible W/P >> K | Transmission Price | Transmission Price | Total                | Firm         | Interruptible |                |              |
| 2009              | 0                    | 3,697,261      | 3,697,261     | 0                      | \$0.064            | \$0.040            | \$236,625            | \$236,625    | \$0           | \$462,449      | (\$225,824)  |
| 2010              | 0                    | 20,936,249     | 20,936,249    | 0                      | \$0.064            | \$0.040            | \$1,339,920          | \$1,339,920  | \$0           | \$288,570      | \$1,051,350  |
| 2011              | 0                    | 19,325,410     | 19,325,410    | 0                      | \$0.064            | \$0.040            | \$1,236,826          | \$1,236,826  | \$0           | \$454,181      | \$782,645    |
| 2012              | 0                    | 4,180,220      | 4,180,220     | 0                      | \$0.065            | \$0.041            | \$271,714            | \$271,714    | \$0           | \$465,536      | (\$193,821)  |
| 2013              | 0                    | 12,158,649     | 12,158,649    | 0                      | \$0.065            | \$0.041            | \$790,312            | \$790,312    | \$0           | \$1,481,614    | (\$691,301)  |
| 2014              | 0                    | 9,881,092      | 9,881,092     | 0                      | \$0.065            | \$0.041            | \$642,271            | \$642,271    | \$0           | \$511,035      | \$131,236    |
| 2015              | 0                    | 0              | 0             | 0                      | \$0.066            | \$0.042            | \$0                  | \$0          | \$0           | \$501,331      | (\$501,331)  |
| 2016              | 0                    | 0              | 0             | 0                      | \$0.066            | \$0.042            | \$0                  | \$0          | \$0           | \$530,505      | (\$530,505)  |
| 2017              | 0                    | 0              | 0             | 0                      | \$0.066            | \$0.042            | \$0                  | \$0          | \$0           | \$543,768      | (\$543,768)  |
| 2018              | 0                    | 0              | 0             | 0                      | \$0.067            | \$0.043            | \$0                  | \$0          | \$0           | \$785,993      | (\$785,993)  |
| 2019              | 0                    | 0              | 0             | 0                      | \$0.067            | \$0.043            | \$0                  | \$0          | \$0           | \$596,110      | (\$596,110)  |
| 2020              | 0                    | 6,372,145      | 6,372,145     | 0                      | \$0.067            | \$0.043            | \$426,934            | \$426,934    | \$0           | \$585,579      | (\$158,645)  |
| 2021              | 0                    | 23,035,024     | 23,035,024    | 0                      | \$0.068            | \$0.044            | \$1,566,382          | \$1,566,382  | \$0           | \$600,218      | \$966,163    |
| 2022              | 0                    | 32,856,750     | 32,856,750    | 0                      | \$0.068            | \$0.044            | \$2,234,259          | \$2,234,259  | \$0           | \$615,224      | \$1,619,035  |
| 2023              | 0                    | 31,167,259     | 31,167,259    | 0                      | \$0.068            | \$0.044            | \$2,119,374          | \$2,119,374  | \$0           | \$2,410,898    | (\$291,524)  |
| 2024              | 0                    | 40,534,696     | 40,534,696    | 0                      | \$0.069            | \$0.045            | \$2,796,894          | \$2,796,894  | \$0           | \$674,443      | \$2,122,451  |
| 2025              | 0                    | 34,333,285     | 34,333,285    | 0                      | \$0.069            | \$0.045            | \$2,368,997          | \$2,368,997  | \$0           | \$662,529      | \$1,706,468  |
| 2026              | 0                    | 16,530,268     | 16,530,268    | 0                      | \$0.069            | \$0.045            | \$1,140,588          | \$1,140,588  | \$0           | \$679,092      | \$461,497    |
| 2027              | 0                    | 38,816,059     | 38,816,059    | 0                      | \$0.070            | \$0.046            | \$2,717,124          | \$2,717,124  | \$0           | \$696,069      | \$2,021,055  |
| 2028              | 0                    | 16,760,590     | 16,760,590    | 0                      | \$0.070            | \$0.046            | \$1,173,241          | \$1,173,241  | \$0           | \$1,006,138    | \$167,103    |
| 2029              | 0                    | 18,590,918     | 18,590,918    | 0                      | \$0.070            | \$0.046            | \$1,301,364          | \$1,301,364  | \$0           | \$763,071      | \$538,294    |
| 2030              | 0                    | 18,987,352     | 18,987,352    | 0                      | \$0.071            | \$0.047            | \$1,348,102          | \$1,348,102  | \$0           | \$749,590      | \$598,512    |
| 2031              | 0                    | 17,655,022     | 17,655,022    | 0                      | \$0.071            | \$0.047            | \$1,253,507          | \$1,253,507  | \$0           | \$768,330      | \$485,176    |
| 2032              | 0                    | 23,256,538     | 23,256,538    | 0                      | \$0.071            | \$0.047            | \$1,651,214          | \$1,651,214  | \$0           | \$787,538      | \$863,676    |
| 2033              | 0                    | 30,143,750     | 30,143,750    | 0                      | \$0.072            | \$0.048            | \$2,170,350          | \$2,170,350  | \$0           | \$2,453,118    | (\$282,768)  |
| 2034              | 0                    | 31,828,078     | 31,828,078    | 0                      | \$0.072            | \$0.048            | \$2,291,622          | \$2,291,622  | \$0           | \$863,344      | \$1,428,277  |
| 2035              | 0                    | 42,123,646     | 42,123,646    | 0                      | \$0.072            | \$0.048            | \$3,032,902          | \$3,032,902  | \$0           | \$848,093      | \$2,184,810  |
| 2036              | 0                    | 45,361,251     | 45,361,251    | 0                      | \$0.073            | \$0.049            | \$3,311,371          | \$3,311,371  | \$0           | \$869,295      | \$2,442,076  |
| 2037              | 0                    | 41,780,671     | 41,780,671    | 0                      | \$0.073            | \$0.049            | \$3,049,989          | \$3,049,989  | \$0           | \$891,027      | \$2,158,962  |
| 2038              | 0                    | 51,915,589     | 51,915,589    | 0                      | \$0.073            | \$0.049            | \$3,789,838          | \$3,789,838  | \$0           | \$957,378      | \$2,832,460  |
| Nominal Values    |                      | 632,227,770    | 632,227,770   | 0                      |                    |                    | \$44,261,720         | \$44,261,720 | \$0           | \$24,502,065   | \$19,759,655 |
| Net Present Value |                      |                |               |                        |                    |                    | \$13,968,094         | \$13,968,094 | \$0           | \$9,130,465    | \$4,837,628  |

**Table 41**  
**Detailed Case Results**  
**Sensitivity #5 Assumptions – Historical Flows**  
**W/P=Base/Hist, KPU=Low/Hist**

| Year              | KWH Power Deliveries |                |               |                        | Firm               | Interruptible      | Transmission Revenue |              |               | Total Expenses | Net Revenue    |
|-------------------|----------------------|----------------|---------------|------------------------|--------------------|--------------------|----------------------|--------------|---------------|----------------|----------------|
|                   | W/P << K             | Total W/P >> K | Firm W/P >> K | Interruptible W/P >> K | Transmission Price | Transmission Price | Total                | Firm         | Interruptible |                |                |
| 2009              | 0                    | 0              | 0             | 0                      | \$0.064            | \$0.040            | \$0                  | \$0          | \$0           | \$462,449      | (\$462,449)    |
| 2010              | 0                    | 6,446,971      | 6,446,971     | 0                      | \$0.064            | \$0.040            | \$412,606            | \$412,606    | \$0           | \$288,570      | \$124,036      |
| 2011              | 0                    | 13,151,331     | 13,151,331    | 0                      | \$0.064            | \$0.040            | \$841,685            | \$841,685    | \$0           | \$454,181      | \$387,504      |
| 2012              | 0                    | 361,125        | 361,125       | 0                      | \$0.065            | \$0.041            | \$23,473             | \$23,473     | \$0           | \$465,536      | (\$442,063)    |
| 2013              | 0                    | 1,100,468      | 1,100,468     | 0                      | \$0.065            | \$0.041            | \$71,530             | \$71,530     | \$0           | \$1,481,614    | (\$1,410,083)  |
| 2014              | 0                    | 2,826,603      | 2,826,603     | 0                      | \$0.065            | \$0.041            | \$183,729            | \$183,729    | \$0           | \$511,035      | (\$327,306)    |
| 2015              | 0                    | 0              | 0             | 0                      | \$0.066            | \$0.042            | \$0                  | \$0          | \$0           | \$501,331      | (\$501,331)    |
| 2016              | 0                    | 0              | 0             | 0                      | \$0.066            | \$0.042            | \$0                  | \$0          | \$0           | \$530,505      | (\$530,505)    |
| 2017              | 0                    | 0              | 0             | 0                      | \$0.066            | \$0.042            | \$0                  | \$0          | \$0           | \$543,768      | (\$543,768)    |
| 2018              | 0                    | 0              | 0             | 0                      | \$0.067            | \$0.043            | \$0                  | \$0          | \$0           | \$785,993      | (\$785,993)    |
| 2019              | 0                    | 0              | 0             | 0                      | \$0.067            | \$0.043            | \$0                  | \$0          | \$0           | \$596,110      | (\$596,110)    |
| 2020              | 0                    | 0              | 0             | 0                      | \$0.067            | \$0.043            | \$0                  | \$0          | \$0           | \$585,579      | (\$585,579)    |
| 2021              | 0                    | 0              | 0             | 0                      | \$0.068            | \$0.044            | \$0                  | \$0          | \$0           | \$600,218      | (\$600,218)    |
| 2022              | 0                    | 0              | 0             | 0                      | \$0.068            | \$0.044            | \$0                  | \$0          | \$0           | \$615,224      | (\$615,224)    |
| 2023              | 0                    | 9,234,062      | 9,234,062     | 0                      | \$0.068            | \$0.044            | \$627,916            | \$627,916    | \$0           | \$2,410,898    | (\$1,782,981)  |
| 2024              | 0                    | 20,477,965     | 20,477,965    | 0                      | \$0.069            | \$0.045            | \$1,412,980          | \$1,412,980  | \$0           | \$674,443      | \$738,536      |
| 2025              | 0                    | 18,239,413     | 18,239,413    | 0                      | \$0.069            | \$0.045            | \$1,258,520          | \$1,258,520  | \$0           | \$662,529      | \$595,991      |
| 2026              | 0                    | 3,207,618      | 3,207,618     | 0                      | \$0.069            | \$0.045            | \$221,326            | \$221,326    | \$0           | \$679,092      | (\$457,766)    |
| 2027              | 0                    | 8,516,546      | 8,516,546     | 0                      | \$0.070            | \$0.046            | \$596,158            | \$596,158    | \$0           | \$696,069      | (\$99,911)     |
| 2028              | 0                    | 7,086,739      | 7,086,739     | 0                      | \$0.070            | \$0.046            | \$496,072            | \$496,072    | \$0           | \$1,006,138    | (\$510,066)    |
| 2029              | 0                    | 0              | 0             | 0                      | \$0.070            | \$0.046            | \$0                  | \$0          | \$0           | \$763,071      | (\$763,071)    |
| 2030              | 0                    | 0              | 0             | 0                      | \$0.071            | \$0.047            | \$0                  | \$0          | \$0           | \$749,590      | (\$749,590)    |
| 2031              | 0                    | 0              | 0             | 0                      | \$0.071            | \$0.047            | \$0                  | \$0          | \$0           | \$768,330      | (\$768,330)    |
| 2032              | 0                    | 0              | 0             | 0                      | \$0.071            | \$0.047            | \$0                  | \$0          | \$0           | \$787,538      | (\$787,538)    |
| 2033              | 0                    | 0              | 0             | 0                      | \$0.072            | \$0.048            | \$0                  | \$0          | \$0           | \$2,453,118    | (\$2,453,118)  |
| 2034              | 0                    | 0              | 0             | 0                      | \$0.072            | \$0.048            | \$0                  | \$0          | \$0           | \$863,344      | (\$863,344)    |
| 2035              | 0                    | 0              | 0             | 0                      | \$0.072            | \$0.048            | \$0                  | \$0          | \$0           | \$848,093      | (\$848,093)    |
| 2036              | 0                    | 11,846,078     | 11,846,078    | 0                      | \$0.073            | \$0.049            | \$864,764            | \$864,764    | \$0           | \$869,295      | (\$4,531)      |
| 2037              | 0                    | 23,069,153     | 23,069,153    | 0                      | \$0.073            | \$0.049            | \$1,684,048          | \$1,684,048  | \$0           | \$891,027      | \$793,021      |
| 2038              | 0                    | 26,578,098     | 26,578,098    | 0                      | \$0.073            | \$0.049            | \$1,940,201          | \$1,940,201  | \$0           | \$957,378      | \$982,823      |
| Nominal Values    |                      | 152,142,173    | 152,142,173   | 0                      |                    |                    | \$10,635,008         | \$10,635,008 | \$0           | \$24,502,065   | (\$13,867,057) |
| Net Present Value |                      |                |               |                        |                    |                    | \$3,483,946          | \$3,483,946  | \$0           | \$9,130,465    | (\$5,646,519)  |

**Table 42**  
**Case Results – Extreme Flows**  
**Sensitivity #5 Assumptions**

**Nominal Net Revenue-Historic Flows**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | \$6,692,164         | (\$3,506,336)   | \$4,296,361     | (\$23,706,028)  | \$6,798,395    | \$5,957,407    |
|                     | Base/Max  | (\$21,128,356)      | (\$21,546,611)  | (\$21,136,734)  | (\$24,502,065)  | (\$21,128,356) | (\$21,128,356) |
|                     | Base/Min  | \$85,005,228        | \$7,273,637     | \$78,246,601    | (\$20,498,554)  | \$85,324,315   | \$26,822,135   |
|                     | High/Avg  | \$101,275,105       | \$5,737,563     | \$79,861,523    | (\$21,456,660)  | \$104,868,272  | \$24,951,313   |
|                     | High/Max  | \$67,510,477        | (\$714,001)     | \$51,865,051    | (\$23,674,695)  | \$68,604,957   | \$15,532,538   |
|                     | High/Min  | \$163,065,627       | \$7,474,749     | \$129,188,789   | (\$20,500,446)  | \$169,179,877  | \$27,408,889   |
|                     | XHigh/Avg | \$113,289,496       | \$6,478,316     | \$89,101,467    | (\$20,957,955)  | \$117,503,777  | \$25,293,756   |
|                     | XHigh/Max | \$86,018,836        | \$951,028       | \$66,869,419    | (\$22,775,305)  | \$87,726,868   | \$17,941,649   |
|                     | XHigh/Min | \$173,820,291       | \$6,991,768     | \$137,005,391   | (\$20,665,919)  | \$180,133,812  | \$26,701,278   |
|                     | Low/Avg   | (\$24,502,065)      | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065) | (\$24,502,065) |
|                     | Low/Max   | (\$24,502,065)      | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065)  | (\$24,502,065) | (\$24,502,065) |
|                     | Low/Min   | \$44,565,500        | \$6,142,461     | \$43,432,985    | (\$20,559,234)  | \$44,603,613   | \$25,277,179   |

**Net Present Value of Net Revenues**

|                     |           | W/P Load/Generation |                 |                 |                 |                |                |
|---------------------|-----------|---------------------|-----------------|-----------------|-----------------|----------------|----------------|
|                     |           | <u>Base/Max</u>     | <u>Base/Min</u> | <u>High/Max</u> | <u>High/Min</u> | <u>Low/Max</u> | <u>Low/Min</u> |
| KPU Load/Generation | Base/Avg  | (\$935,329)         | (\$3,043,378)   | (\$1,448,587)   | (\$8,747,506)   | (\$916,950)    | (\$1,063,485)  |
|                     | Base/Max  | (\$8,507,598)       | (\$8,581,468)   | (\$8,509,030)   | (\$9,130,465)   | (\$8,507,598)  | (\$8,507,598)  |
|                     | Base/Min  | \$30,707,390        | \$4,246,461     | \$29,274,390    | (\$6,124,320)   | \$30,766,668   | \$10,623,737   |
|                     | High/Avg  | \$29,572,583        | \$2,664,195     | \$24,412,914    | (\$7,040,487)   | \$30,393,323   | \$8,662,514    |
|                     | High/Max  | \$15,150,340        | (\$1,740,259)   | \$11,786,958    | (\$8,719,569)   | \$15,350,883   | \$2,624,800    |
|                     | High/Min  | \$58,171,667        | \$4,415,968     | \$49,583,860    | (\$6,088,957)   | \$59,650,465   | \$11,048,982   |
|                     | XHigh/Avg | \$35,907,581        | \$3,590,816     | \$29,695,884    | (\$6,485,254)   | \$37,013,426   | \$9,575,108    |
|                     | XHigh/Max | \$22,501,507        | (\$241,298)     | \$18,295,774    | (\$8,092,921)   | \$22,818,640   | \$4,874,773    |
|                     | XHigh/Min | \$63,393,637        | \$4,167,189     | \$53,841,288    | (\$6,212,615)   | \$64,965,523   | \$10,719,572   |
|                     | Low/Avg   | (\$9,130,465)       | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)  | (\$9,130,465)  |
|                     | Low/Max   | (\$9,130,465)       | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)   | (\$9,130,465)  | (\$9,130,465)  |
|                     | Low/Min   | \$17,541,462        | \$3,716,888     | \$17,320,140    | (\$6,202,591)   | \$17,547,975   | \$9,848,886    |

## Conclusions

Reviewing all of the study results, CAI offers the following conclusions.

1. Using historical inflows and base case assumptions, the net revenue of the STI over 30 years is positive, as is the net present value. The revenues from providing power to Ketchikan to displace diesel generation are greater than the annual costs of the line. This is true regardless of the assumed load growth in Ketchikan or Wrangell – Petersburg.
2. These positive results do not mean that there will not be individual years or even groups of years in which revenues do not cover annual costs. However, over the 30 years reviewed in this study, the total net revenues were always positive in the base case.
3. There are factors that could mitigate the small number of negative results that occur. If power other than Tyee was wheeled across the STI, wheeling revenues could be used to offset STI annual expenses. If Tyee power not used to serve Ketchikan was exported to British Columbia or the Pacific Northwest, additional revenues would be available to offset STI costs.
4. If the annual revenues must cover debt service as well as annual operations and maintenance, the results are not as positive. In this case, total net revenues and net present values are negative if load growth in Ketchikan is low. Even in cases where the results are positive over the 30 years, there are still individual years or groups of years where revenues do not exceed costs thereby making it difficult to try to cover the additional costs of debt service.
5. If the output of the Ketchikan hydro projects is increased by 14 GWH through either upgrades or new projects and this increased output reduces diesel generation the total net revenues of the STI are negative when Ketchikan load growth is low.
6. If the model is run on extreme flow assumptions where minimum or maximum flows are assumed to occur every year of the 30-year study period, the majority of the results continue to be positive. With these extreme assumptions however, there are from one-third to one-half of the cases that are negative. This means that extreme conditions may influence the economic results of the line, but will not necessarily make the overall results negative.
7. It may be possible to fund renewals and replacements out of a common fund instead of treating them as annual expenses as this study has done. Use of such a fund may reduce the annual expenses and improve the economics of the line.



## Appendix A – Converting Tyee CFS to kWh

The following formula was used to convert Tyee flows in CFS as shown on Table 5 into kWh to determine energy remaining in the reservoir after serving Wrangell – Petersburg loads.

|   |  |  |  |
|---|--|--|--|
| Formula for converting CFS to kWh is $((1233 * \text{CFS} * 0.9) / 8.82) * 0.975 * 0.746 * \text{Hours}$ where: |  |  |  |
| the portion in blue is turning CFS into horsepower  |  |  |  |
| the portion in red is turning horsepower into kWh   |  |  |  |
| 1233 = average assumed head   |  |  |  |
| CFS = monthly inflows in CFS  |  |  |  |
| 0.9 = turbine efficiency  |  |  |  |
| 8.82 = the constant used for turning CFS into HP  |  |  |  |
| .975 = the generator efficiency   |  |  |  |
| .746 = the constant for converting horsepower to kw   |  |  |  |
| Hours are used to turn kw into kWh  |  |  |  |

Using these formulae, it is possible to estimate the generation available given certain levels of inflows. The following Table A-1 estimates the available generation from minimum inflows (assuming minimum inflows as shown in Table 5) as limited by the 22.5 MW turbine capacity. Next, the net base case loads of Wrangell – Petersburg are subtracted to determine the Tyee energy remaining after serving Wrangell – Petersburg.

**Table A-1  
Available Tyee Energy After Serving Wrangell – Petersburg Assuming Minimum Flows**

| Minimum Flows |       |           | Avail. Energy |            |            |            |            | Tyee Energy |   |
|---------------|-------|-----------|---------------|------------|------------|------------|------------|-------------|---|
| Month         | Hours | Min. Flow | CFS           | kWh        | As Limited | Combined   | Combined   | Net         | Tyee Energy Remaining After Serving W/P |
|               |       |           |               |            | By Turbine | W/P        | W/P        | W/P         |   |
|               |       |           |               |            | 22.5 MW    | Base Loads | Generation | Loads       |   |
| Jan           | 744   | 11        |               | 748,938    | 748,938    | 6,080,125  | 1,039,808  | 5,040,317   |   |
| Feb           | 672   | 10        |               | 614,964    | 614,964    | 5,282,206  | 888,728    | 4,393,479   |   |
| Mar           | 744   | 9         |               | 612,768    | 612,768    | 5,773,719  | 923,571    | 4,850,148   |   |
| Apr           | 720   | 14        |               | 922,446    | 922,446    | 5,069,829  | 901,395    | 4,168,434   |   |
| May           | 744   | 113       |               | 7,693,639  | 7,693,639  | 4,906,990  | 980,193    | 3,926,797   |   |
| Jun           | 720   | 268       |               | 17,658,253 | 16,200,000 | 4,660,511  | 2,326,501  | 2,334,010   |   |
| Jul           | 744   | 188       |               | 12,800,037 | 12,800,037 | 6,109,154  | 1,107,948  | 5,001,206   |   |
| Aug           | 744   | 96        |               | 6,536,189  | 6,536,189  | 7,072,168  | 944,469    | 6,127,699   |   |
| Sep           | 720   | 97        |               | 6,391,233  | 6,391,233  | 5,468,934  | 1,045,223  | 4,423,711   |   |
| Oct           | 744   | 148       |               | 10,076,625 | 10,076,625 | 5,164,174  | 1,144,567  | 4,019,607   |   |
| Nov           | 720   | 41        |               | 2,701,449  | 2,701,449  | 5,973,373  | 891,779    | 5,081,594   |   |
| Dec           | 744   | 29        |               | 1,974,474  | 1,974,474  | 5,517,439  | 909,256    | 4,608,182   |   |
|               | 8760  |           |               | 68,731,016 | 67,272,763 | 67,078,622 | 13,103,438 | 53,975,184  | 13,297,579                              |

This table tells us that there is enough energy in minimum inflows to serve Wrangell – Petersburg and have 13.3 million kWh left.

Table A-2 below goes through the same calculation assuming average inflows.

**Table A-2  
Available Tye Energy After Serving Wrangell – Petersburg Assuming Average Flows**

| Average Flows |       |      | Avail. Energy |             | Combined   |            | Net             |             | Tye Energy |
|---------------|-------|------|---------------|-------------|------------|------------|-----------------|-------------|------------|
|               |       | Avg. | As Limited    | Combined    | Combined   | Net        | Tye Energy      |             |            |
|               |       | Flow | By Turbine    | W/P         | W/P        | W/P        | Remaining After |             |            |
| Month         | Hours | CFS  | kWh           | 22.5 MW     | Base Loads | Generation | Loads           | Serving W/P |            |
| Jan           | 744   | 47   | 3,200,009     | 3,200,009   | 6,080,125  | 1,039,808  | 5,040,317       |             |            |
| Feb           | 672   | 36   | 2,213,871     | 2,213,871   | 5,282,206  | 888,728    | 4,393,479       |             |            |
| Mar           | 744   | 28   | 1,906,389     | 1,906,389   | 5,773,719  | 923,571    | 4,850,148       |             |            |
| Apr           | 720   | 53   | 3,492,117     | 3,492,117   | 5,069,829  | 901,395    | 4,168,434       |             |            |
| May           | 744   | 193  | 13,140,464    | 13,140,464  | 4,906,990  | 980,193    | 3,926,797       |             |            |
| Jun           | 720   | 350  | 23,061,151    | 16,200,000  | 4,660,511  | 2,326,501  | 2,334,010       |             |            |
| Jul           | 744   | 293  | 19,948,994    | 16,740,000  | 6,109,154  | 1,107,948  | 5,001,206       |             |            |
| Aug           | 744   | 238  | 16,204,302    | 16,204,302  | 7,072,168  | 944,469    | 6,127,699       |             |            |
| Sep           | 720   | 218  | 14,363,803    | 14,363,803  | 5,468,934  | 1,045,223  | 4,423,711       |             |            |
| Oct           | 744   | 275  | 18,723,459    | 16,740,000  | 5,164,174  | 1,144,567  | 4,019,607       |             |            |
| Nov           | 720   | 113  | 7,445,457     | 7,445,457   | 5,973,373  | 891,779    | 5,081,594       |             |            |
| Dec           | 744   | 76   | 5,174,483     | 5,174,483   | 5,517,439  | 909,256    | 4,608,182       |             |            |
|               | 8760  |      | 128,874,499   | 116,820,895 | 67,078,622 | 13,103,438 | 53,975,184      | 62,845,711  |            |

Assuming average inflows, there is enough energy in Tye to serve Wrangell – Petersburg and have 62.8 million kWh leftover.

Table A-3 goes through the same calculation assuming maximum inflows.

**Table A-3  
Available Tyee Energy After Serving Wrangell – Petersburg Assuming Maximum Flows**

| Maximum Flows |       |      |             |               |            |            |            |                 |
|---------------|-------|------|-------------|---------------|------------|------------|------------|-----------------|
|               |       |      |             | Avail. Energy |            |            |            |                 |
|               |       | Max. |             | As Limited    | Combined   | Combined   | Net        | Tyee Energy     |
|               |       | Flow |             | By Turbine    | W/P        | W/P        | W/P        | Remaining After |
| Month         | Hours | CFS  | kWh         | 22.5 MW       | Base Loads | Generation | Loads      | Serving W/P     |
| Jan           | 744   | 168  | 11,438,331  | 11,438,331    | 6,080,125  | 1,039,808  | 5,040,317  |                 |
| Feb           | 672   | 122  | 7,502,561   | 7,502,561     | 5,282,206  | 888,728    | 4,393,479  |                 |
| Mar           | 744   | 81   | 5,514,910   | 5,514,910     | 5,773,719  | 923,571    | 4,850,148  |                 |
| Apr           | 720   | 88   | 5,798,232   | 5,798,232     | 5,069,829  | 901,395    | 4,168,434  |                 |
| May           | 744   | 338  | 23,012,833  | 16,740,000    | 4,906,990  | 980,193    | 3,926,797  |                 |
| Jun           | 720   | 464  | 30,572,498  | 16,200,000    | 4,660,511  | 2,326,501  | 2,334,010  |                 |
| Jul           | 744   | 414  | 28,187,316  | 16,740,000    | 6,109,154  | 1,107,948  | 5,001,206  |                 |
| Aug           | 744   | 350  | 23,829,856  | 16,740,000    | 7,072,168  | 944,469    | 6,127,699  |                 |
| Sep           | 720   | 392  | 25,828,489  | 16,200,000    | 5,468,934  | 1,045,223  | 4,423,711  |                 |
| Oct           | 744   | 598  | 40,715,012  | 16,740,000    | 5,164,174  | 1,144,567  | 4,019,607  |                 |
| Nov           | 720   | 322  | 21,216,259  | 16,200,000    | 5,973,373  | 891,779    | 5,081,594  |                 |
| Dec           | 744   | 218  | 14,842,596  | 14,842,596    | 5,517,439  | 909,256    | 4,608,182  |                 |
|               | 8760  |      | 238,458,893 | 160,656,630   | 67,078,622 | 13,103,438 | 53,975,184 | 106,681,447     |

The calculation in all the above tables include only the energy coming from inflows, they do not include the energy from water already in the reservoir. When full, the reservoir holds enough water to generate approximately 58 million kWh. Therefore, that amount of energy could be added to the above calculations if it is assumed the reservoir starts out full.

## Appendix B – Net Revenue and Net Present Value Results For All Cases

### Nominal Net Revenues For All Cases

**Table B-1  
Nominal Net Revenue – All Cases**

| Base Case      |            | W/P Load/Generation |               |               | Sensitivity #1 |            | W/P Load/Generation |                |                |
|----------------|------------|---------------------|---------------|---------------|----------------|------------|---------------------|----------------|----------------|
|                |            | Base/Hist           | High/Hist     | Low/Hist      |                |            | Base/Hist           | High/Hist      | Low/Hist       |
| KPU Case       | Base/Hist  | \$42,877,000        | \$16,248,340  | \$47,770,936  | KPU Case       | Base/Hist  | \$42,198,339        | \$22,323,484   | \$46,340,249   |
|                | High/Hist  | \$81,781,467        | \$32,811,827  | \$96,702,222  |                | High/Hist  | \$90,193,808        | \$47,245,627   | \$101,123,729  |
|                | Xhigh/Hist | \$87,725,495        | \$37,311,023  | \$103,807,077 |                | Xhigh/Hist | \$98,643,299        | \$53,316,003   | \$112,100,930  |
|                | Low/Hist   | \$10,529,541        | \$10,529,541  | \$11,610,536  |                | Low/Hist   | \$10,023,659        | \$10,023,659   | \$11,068,266   |
| Sensitivity #2 |            | W/P Load/Generation |               |               | Sensitivity #3 |            | W/P Load/Generation |                |                |
|                |            | Base/Hist           | High/Hist     | Low/Hist      |                |            | Base/Hist           | High/Hist      | Low/Hist       |
| KPU Case       | Base/Hist  | \$47,398,077        | \$25,398,251  | \$51,938,131  | KPU Case       | Base/Hist  | \$34,668,392        | \$16,771,315   | \$38,273,833   |
|                | High/Hist  | \$98,693,404        | \$51,513,775  | \$110,714,798 |                | High/Hist  | \$76,467,745        | \$38,487,898   | \$86,157,520   |
|                | Xhigh/Hist | \$106,909,412       | \$57,490,256  | \$121,546,125 |                | Xhigh/Hist | \$85,358,761        | \$44,780,729   | \$97,352,896   |
|                | Low/Hist   | \$12,560,466        | \$12,560,466  | \$13,702,908  |                | Low/Hist   | \$6,374,177         | \$6,374,177    | \$7,310,945    |
| Sensitivity #4 |            | W/P Load/Generation |               |               | Sensitivity #5 |            | W/P Load/Generation |                |                |
|                |            | Base/Hist           | High/Hist     | Low/Hist      |                |            | Base/Hist           | High/Hist      | Low/Hist       |
| KPU Case       | Base/Hist  | \$28,838,657        | \$8,007,941   | \$33,135,070  | KPU Case       | Base/Hist  | \$19,759,655        | \$6,517,641    | \$21,569,720   |
|                | High/Hist  | \$77,310,722        | \$32,657,457  | \$88,689,180  |                | High/Hist  | \$78,944,586        | \$40,435,510   | \$88,846,714   |
|                | Xhigh/Hist | \$85,617,093        | \$38,636,663  | \$99,541,934  |                | Xhigh/Hist | \$90,190,856        | \$46,693,414   | \$102,351,633  |
|                | Low/Hist   | (\$4,106,325)       | (\$4,106,325) | (\$3,025,330) |                | Low/Hist   | (\$13,867,057)      | (\$13,867,057) | (\$13,829,897) |

*Net Present Values For All Cases*

**Table B-1  
Net Present Values For All Cases**

**Base Case**

|          |            | W/P Load/Generation |              |              |
|----------|------------|---------------------|--------------|--------------|
|          |            | Base/Hist           | High/Hist    | Low/Hist     |
| KPU Case | Base/Hist  | \$15,114,729        | \$8,669,390  | \$16,435,511 |
|          | High/Hist  | \$31,349,347        | \$17,710,471 | \$35,442,524 |
|          | Xhigh/Hist | \$35,271,501        | \$20,812,787 | \$39,830,960 |
|          | Low/Hist   | \$4,257,705         | \$4,257,705  | \$4,578,404  |

**Sensitivity #1**

|          |            | W/P Load/Generation |              |              |
|----------|------------|---------------------|--------------|--------------|
|          |            | Base/Hist           | High/Hist    | Low/Hist     |
| KPU Case | Base/Hist  | \$15,292,985        | \$10,313,225 | \$16,447,044 |
|          | High/Hist  | \$34,125,284        | \$22,270,930 | \$37,089,341 |
|          | Xhigh/Hist | \$39,012,249        | \$26,234,524 | \$42,851,841 |
|          | Low/Hist   | \$4,378,290         | \$4,378,290  | \$4,695,012  |

**Sensitivity #2**

|          |            | W/P Load/Generation |              |              |
|----------|------------|---------------------|--------------|--------------|
|          |            | Base/Hist           | High/Hist    | Low/Hist     |
| KPU Case | Base/Hist  | \$16,684,842        | \$11,224,477 | \$17,940,070 |
|          | High/Hist  | \$36,536,178        | \$23,646,949 | \$39,762,106 |
|          | Xhigh/Hist | \$41,365,867        | \$27,590,681 | \$45,496,554 |
|          | Low/Hist   | \$5,052,338         | \$5,052,338  | \$5,391,668  |

**Sensitivity #3**

|          |            | W/P Load/Generation |              |              |
|----------|------------|---------------------|--------------|--------------|
|          |            | Base/Hist           | High/Hist    | Low/Hist     |
| KPU Case | Base/Hist  | \$12,730,066        | \$8,323,668  | \$13,717,507 |
|          | High/Hist  | \$29,323,152        | \$19,021,771 | \$31,905,324 |
|          | Xhigh/Hist | \$34,343,686        | \$23,055,243 | \$37,721,461 |
|          | Low/Hist   | \$3,139,798         | \$3,139,798  | \$3,420,004  |

**Sensitivity #4**

|          |            | W/P Load/Generation |               |               |
|----------|------------|---------------------|---------------|---------------|
|          |            | Base/Hist           | High/Hist     | Low/Hist      |
| KPU Case | Base/Hist  | \$7,583,645         | \$2,416,208   | \$8,770,988   |
|          | High/Hist  | \$26,327,199        | \$14,135,285  | \$29,378,771  |
|          | Xhigh/Hist | \$31,157,214        | \$18,055,960  | \$35,089,240  |
|          | Low/Hist   | (\$3,406,818)       | (\$3,406,818) | (\$3,086,119) |

**Sensitivity #5**

|          |            | W/P Load/Generation |               |               |
|----------|------------|---------------------|---------------|---------------|
|          |            | Base/Hist           | High/Hist     | Low/Hist      |
| KPU Case | Base/Hist  | \$4,837,628         | \$1,632,577   | \$5,254,705   |
|          | High/Hist  | \$27,137,894        | \$17,409,852  | \$29,641,035  |
|          | Xhigh/Hist | \$33,091,349        | \$21,541,741  | \$36,252,614  |
|          | Low/Hist   | (\$5,646,519)       | (\$5,646,519) | (\$5,639,820) |