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April 24, 2015

Via Email
Original via Mail

British Columbia Utilities Commission
6th Floor, 900 Howe Street
Vancouver, BC
V6Z 2N3

Attention: Ms. Erica M. Hamilton, Commission Secretary

Dear Ms. Hamilton:

Re: FortisBC Energy Inc. (FEI)

Application for a Certificate of Public Convenience and Necessity (CPCN) for Approval of the Lower Mainland Intermediate Pressure (IP) System Upgrade (LMIPSU) Projects (the Application)

Errata to the Application Dated April 24, 2015

On December 19, 2014, FEI filed the Application referenced above (the Original Application). In accordance with the preliminary Regulatory Timetable established by Order G-1-15, on March 12, 2015, FEI filed its responses to Information Requests (IRs) No. 1. In the responses to IRs No. 1, FEI identified two items that require correction. FEI hereby submits this Errata filing reflecting the corrections, in two separate filings, (1) corrections required to the Application (Exhibit B-1), and (2) corrections to certain portions of Confidential Appendix E (Exhibit B-1-2) filed confidentially.

The IR responses in which FEI identified that corrections were required consist of:

- BCUC Confidential IR 1.5.3 (Exhibit B-4-1)
- BCUC IR 1.22.7 (Exhibit B-4)

The first correction results from the removal of costs associated with a transmission pig receiver and valving which are not associated with the Coquitlam Gate IP Project as identified in the response to BCUC Confidential IR 1.5.3. Correcting for the pig receiver and

valves which would be charged to the Coastal Transmission Project – Port Mann to Coquitlam Station Upgrade resulted in a reduction of as-spent costs to the Coquitlam Gate IP Project of $1.481 million. As a result of removing the pig receiver and valves cost from the Coquitlam Gate IP Project for Alternative 4, Alternative 5 and Alternative 6, the costs have declined by $1.171 million (2014), $1.311 million (2014$), and $1.202 million (2014$) respectively. FEI recalculated the financial impacts of this change for Alternatives 4, 5 and 6.

The reduction in the capital costs from the Application to the Errata in 2014$ is as follows:

- Alternative 4, 24 NPS at 2070 kPa is $1.171 million (2014$), from $176.004 million to $173.833 million;
- Alternative 5, 36 NPS at 1200 kPa is $1.311 million (2014$), from $205.448 million to $204.137 million; and,
- Alternative 6, 30 NPS at 2070 kPa is $1.202 million (2014$), from $201.282 million to $200.080 million.

While the results from the Errata show a decrease in the total costs compared to the Original Application, some line items in the Capital Spend Schedule 6 – Confidential Appendix E-1-1 (when summed) have increased in the Errata filing, while a couple of line items have decreased. The reason for this is that common general costs have been allocated based on costs that are specific to plant asset categories. Although, the direct spend in some categories have not changed their proportional share of the common costs have increased as a result of the decrease from removal of the pig receiver and valves.

The second correction results from the calculation of operational risk associated with the installation of the NPS 24 Alternative as identified in the response to BCUC IR 1.22.7. Table 3-3 in the Application has been revised in the Errata filing to align with FEI's response to BCUC IR 1.22.7 regarding the Operational Risk Reduction related to Alternative 4: Install NPS 24 Pipeline at 2070 kPa. The difference in the Remaining Operational Risk between Alternative 4 and Alternative 6 is reduced from $2.456 million in the Original Application to $2.104 million in the Revised Table in the Errata filing. This results in a reduction in the Present Value of the difference in the Remaining Operational Risk between Alternative 4 and Alternative 6 from $38.880 million to $33.307 million.

FEI has updated the affected tables, wording in the Application, and the relevant Appendices. Attachment A to this Errata filing contains blacklined versions to assist parties in identifying the revisions. Attachment B includes clean versions which parties may wish to insert in hardcopy binders. The following lists the revised pages:

Description	Revised Pages
Application, Section 1 Application	Pages 1, 7, 9
Application, Section 3 Coquitlam Gate IP	Pages 30, 35, 36, 38, 41, 43, 44, 45, 46, 95, 100
Application, Section 5 Project Cost and Accounting Treatment	Pages 137, 138
Application, Section 6 Overview of Environmental, Archaeological, Social-Economic Assessments and Provincial Government Energy Objectives	Page 147
Application, Section 9 Conclusion	Pages 185, 186, 187
Appendix E-1-1 - CONFIDENTIAL	All Pages; Live Spreadsheet
Appendix E-2-1 - CONFIDENTIAL	All Pages
Appendix E-2-2 - CONFIDENTIAL	All Pages
Appendix E-3-1 - CONFIDENTIAL	All Pages

The pages have been printed single-sided to facilitate insertion into the binder volumes, and can be inserted sequentially, keeping the current page in place and marking it with a stroke through to indicate it has been replaced.

If further information is required, please contact the undersigned.

Sincerely,

FORTISBC ENERGY INC.

Original signed by: Ilva Bevacqua

For: Diane Roy

Attachments

cc (email only): Registered Parties

Attachment A

BLACKLINED

1. APPLICATION

1.1 *SUMMARY OF APPROVALS SOUGHT*

FortisBC Energy Inc. (the Company or FEI), pursuant to sections 45 and 46 of the *Utilities Commission Act* (the Act), applies to the British Columbia Utilities Commission (BCUC or the Commission) for a Certificate of Public Convenience and Necessity (CPCN) to construct and operate two Intermediate Pressure (IP) pipeline segments in the Lower Mainland of British Columbia that will replace the existing pipeline segments (the Application). In particular, FEI seeks approval under sections 45 and 46 of the Act to:

1. Construct and operate a new Nominal Pipe Size (NPS) 30 IP pipeline operating at 2070 kPa between Coquitlam Gate Station and East 2nd & Woodland Station to upgrade and replace an existing NPS 20 IP pipeline operating at 1200 kPa (Coquitlam Gate IP Project[1]); and
2. Construct and operate a new NPS 30 IP pipeline operating at 1200 kPa between Fraser Gate Station and East Kent Avenue & Elliott Street to upgrade and replace an existing NPS 30 IP pipeline (Fraser Gate IP Project).

These two replacements are collectively referred to as the "Projects", and individually referred to as the "Project" as the context requires. The estimated capital cost for the Projects in As spent dollars, including Allowance for Funds Used During Construction (AFUDC) and including abandonment / demolition costs, is $262.184 million, consisting of $244.076 million for the Coquitlam Gate IP Project and $18.107 million for the Fraser Gate IP Project.

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FEI is also seeking Commission approval under sections 59-61 of the Act for deferral treatment of costs for preparing this Application, and therefore requests a new deferral account, entitled the "LMIPSU Application Costs deferral account". The LMIPSU Application costs would be included in Rate Base and amortized over a three year period commencing January 1, 2016. The Application costs include expenses for legal review, consultant costs[2], Commission costs and Commission approved intervener costs, and forecast costs to support the hearing process. The LMIPSU application costs will be recorded in a Non-Rate Base deferral account on a net-of-tax basis attracting a weighted average after tax cost of capital (WACC) return until December 31, 2015. The balance of the LMIPSU Application Costs deferral account as at December 31, 2015, is forecast to be $1.047 million.[3]

[1] In some Appendices completed by third parties and in some public information documents completed early in the planning phase, the Coquitlam Gate IP Project was referred to as the Metro IP Project; however the Metro IP includes both the Coquitlam Gate IP system and the Fraser Gate IP system whereas the Coquitlam Gate IP Project only includes the Coquitlam IP system.

[2] For assistance in answering information requests.

[3] Approximately $1.387 million on a before tax basis, this includes $80 thousand financing charges at the Company's weighted average cost of capital.

In order to eliminate the identified non-preventable corrosion risks associated with the Coquitlam Gate IP pipeline and address other capacity related constraints, FEI has evaluated a number of alternatives and has identified the preferred alternative to address the objectives identified for the Projects. The only solution which meets all of the stated objectives is replacement of the existing NPS 20, 1200 kPa Coquitlam Gate IP pipeline with a NPS 30 pipeline operating at 2070 kPa at a cost of $244.076 million (As spent dollars, including AFUDC and abandonment / demolition). This is further discussed in section 3.2 of this Application.

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The proposed Coquitlam Gate IP Project will:

- Eliminate the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency;
- Provide sufficient operational flexibility to permit planned maintenance and repair of the Fraser Gate IP pipeline;
- Provide full system resilience in conjunction with the Cape Horn to Coquitlam TP pipeline reinforcement, to fully supply the Coquitlam Gate IP pipeline and the Fraser Gate IP pipeline from either the Fraser Gate station or the Coquitlam Gate station on any day of the year and therefore reduce the potential consequences of a failure upstream, at, or downstream of either gate station; and
- Consider constructability, operational and safety factors, such as routing constraints, proximity to adjacent utilities and appropriate construction techniques, limiting interruption of flow of gas during construction and commissioning and allowing sufficient space to work around existing piping and components.

The two IP pipeline replacement Projects as proposed, in conjunction with other planned TP pipeline looping projects (identified as Cape Horn-Coquitlam, Nichol-Port Mann and Nichol-Roebuck in Figure 1-3) that have been identified as being required for either capacity and/or security of supply purposes and that are expected to be constructed as described in section 1.3, will significantly improve the resiliency of the natural gas system in the Lower Mainland. See Figure 1-3 for a high level view of the proposed IP projects and the planned TP projects.

- Total Capital Cost (As-spent dollars) excluding AFUDC but including abandonment and demolition cost is $248.863 million (including AFUDC the As spent cost is 262.184 million), and
- 2019 Average Cost of Service Impact - $0.129 / GJ.

For a typical FEI residential customer consuming 95 GJ per year in 2019, this would equate to approximately $12 per year and reflects an approximate increase of 3.36% on delivery margin or an approximate increase of 1.3% on the burner tip.[6]

The following table summarizes the total forecast capital and deferred costs for the projects:

Table 1-1: Summary of Forecast Capital & Deferred Costs ($millions)

Particular	2014$	As-Spent	AFUDC	Tax Offset	Total
Total Capital Cost	214.935	248.863	13.320		**262.184**
LMIPSU Development Cost	2.441	2.442	0.197	(0.635)	**2.004**
LMIPSU Application Cost	1.307	1.307	0.080	(0.340)	**1.047**
Total	**218.683**	**252.612**	**13.597**	**(0.975)**	**265.235**

Table 5-1 in section 5 presents a detailed summary of the costs by project and Table 5-2 provides the financial impacts associated with the completion of each of the two IP pipeline Projects, as well as a summary of the combined rate impacts. Both tables are based on detailed schedules for each pipeline segment as included in Appendix E-1.

The Company has identified a number of Project stakeholders, including residents, businesses, government entities and First Nations. Communications and consultations with the stakeholders with respect to the Projects have already taken place, and as outlined in section 7 (Public Consultation) FEI continues to consult with stakeholders regarding routing, the Project schedule, temporary construction space, Rights of Way (ROW), and public safety. Another series of public information sessions is planned prior to start of construction, with the goal of informing residents and the public about construction activities, traffic issues and mitigation strategies.

FEI is committed to continuing consultation with Project stakeholders and will continue to ensure that, as the Projects progress; stakeholders are kept informed and have ways to provide feedback to the Company.

The Projects will not involve Crown Land or any First Nations treaty land. However, during the preliminary stage of considering alternatives, as further explained in section 8 of this Application, the Company has informed First Nations about the Company's plan to construct

[6] Approximate burner tip impact calculated based on a Residential customer's annual bill of $922 as of January 1, 2015

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As described below, the only solution which meets the stated objectives is replacement of the existing NPS 20, 1200 kPa Coquitlam Gate IP pipeline with a NPS 30 pipeline operating at 2070 kPa at a cost of $244.076 million ((As-spent) including AFUDC and abandonment / demolition).

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3.2.1 Objectives and Requirements

The Coquitlam Gate IP pipeline has reliability, safety, and regulatory risks because of non-preventable pipeline corrosion and an unacceptable projected frequency of gas leaks. The capacity of the pipeline is not sufficient to backfeed the Fraser Gate IP pipeline to provide operational flexibility or resiliency to the Metro IP system. Thus, the objectives of the Coquitlam Gate IP Project are to:

1. Eliminate the elevated reliability, safety and regulatory risk (including the BC Oil and Gas Activities Act) posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism (i.e. corrosion beneath field applied coating at girth welds) and resulting unacceptable projected leak frequency (Pipeline Risk);
2. Provide sufficient operational flexibility to permit planned maintenance and repair of the Fraser Gate IP pipeline (Operational Flexibility);
3. Provide full system resilience in conjunction with the Cape Horn to Coquitlam TP pipeline reinforcement, to fully supply the Coquitlam Gate IP pipeline and the Fraser Gate IP pipeline from either the Fraser Gate station or the Coquitlam Gate station on any day of the year and therefore reduce the potential consequences of a failure upstream, at, or downstream of either gate station (System Resiliency); and
4. Address constructability, operational and safety factors, such as routing constraints, proximity to adjacent utilities and appropriate construction techniques, limiting interruption of flow of gas during construction and commissioning and allowing sufficient space to work around existing piping and components (Constructability).

For each alternative discussed below, the Company considered the advantages and disadvantages of the alternative in light of the objectives and requirements discussed above. Further, while some of the alternatives were constructible, where they did not sufficiently meet key objectives the Company considered these alternatives to be not feasible. Operational flexibility allowing for planned maintenance and repair is a critical requirement for continued safe, reliable and essential service to customers.

3.2.2 Alternatives Description

As part of its assessment of the Coquitlam Gate IP Project, FEI evaluated several alternatives.

The following alternatives, including preliminary capital cost screening, are discussed in further detail below. A table comparing the alternatives ability to meet the Coquitlam Gate IP Project

- It does not provide operational flexibility to the Metro IP system;
- It does not enhance resiliency of the Metro IP system;
- It does not mitigate the Metro IP system security of supply issues; and
- There are significant construction constraints associated with urban pipeline installation projects.

As discussed in section 3.1.2.3 the Company believes operational flexibility allowing for planned maintenance and repair is a critical requirement for continued safe, reliable and essential service to customers. This alternative does not provide the increased capacity necessary to facilitate planned outages for system work or provide system resiliency, therefore FEI has assessed this alternative not to be a prudent alternative, and consequently, not feasible.

3.2.2.4 Alternative 4 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 24 Pipeline Operating at 2070 kPa

This alternative has an AACE Class 4 Project Capital Cost Estimate $173.833 million in 2014 dollars[13].

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Instead of replacing the existing Coquitlam Gate IP pipeline in-kind, the same approach as outlined for that alternative could be adopted to replace the existing pipeline in its entirety with new larger diameter pipe (NPS 24) operating at an increased pressure (2070 kPa). Installing a larger capacity pipeline would result in some operational flexibility and resiliency for the Metro IP system. However, the level of increased capacity provided is insufficient to supply back feed capability for a Fraser Gate IP outage during the colder days of winter.

The capacity of a NPS 24 pipeline would be greater than the existing NPS 20 pipeline (larger diameter and higher operating pressure); therefore, upgrades would be necessary at Coquitlam Gate station to mechanical, civil and electrical infrastructure (pipe, valves, equipment and controls etc.) to facilitate the higher gas throughput from the TP network. Also, the pipeline would not connect directly with each of the intermediate offtake points along the pipeline route and with the NPS 30 Fraser Gate IP pipeline at East 2nd and Woodland station. Instead, shorter lateral offtake pipes would be upgraded for the higher pressure and longer lateral offtakes would be connected via small form factor buried IP/IP pressure regulating vault stations. At East 2nd and Woodland a new IP/IP pressure regulating station would be required to interface the NPS 24 Coquitlam Gate IP pipeline with the NPS 30 Fraser Gate IP pipeline.

Advantages:

- This approach would replace the entire length of the existing pipeline with new pipe and would therefore reduce the probability of leaks;

[13] The equivalent As-spent cost including abandonment/demolition cost but excluding AFUDC is $201.164 million: AFUDC of $10.927 million with the total cost being $212.091 million.

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- It would significantly reduce the risk of future corrosion related gas leaks;
- It would significantly reduce safety risks to the public, plant, property and FEI personnel as a result of leaks with potential gas migration and accumulation;
- It would minimize the risk of supply interruption to customers served by the Coquitlam Gate IP pipeline as a result of leaks;
- It has the third lowest capital cost compared to other alternatives; and
- It would provide operational flexibility to permit planned maintenance and repair of the Fraser Gate IP pipeline with minimum risk of customer service interruption by avoiding the use of a bypass; and
- It would supply the backfeed capacity to provide operational flexibility.

Disadvantages:

- There are significant construction constraints associated with urban pipeline installation projects;
- Due to the higher operating pressure, the pipeline would interface indirectly with the existing IP system via additional IP/IP pressure reducing stations, creating a more complex system to operate;
- It would require a significant upgrade to Coquitlam Gate station to facilitate the higher pipeline capacity compared to the NPS 20 in-kind pipeline and the NPS 36 pipeline; and
- It does not provide full resiliency to the Metro IP system during mid-winter or design day conditions.

Although the level of increased capacity provided is insufficient to supply backfeed capability for a Fraser Gate IP outage during the colder days of winter (it does not provide full system resiliency), this alternative meets the other objectives. Therefore, on this basis, the Company investigated this alternative further.

3.2.2.5 Alternative 5 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 36 Pipeline Operating at 1200 kPa

This alternative has an AACE Class 4 Project Capital Cost Estimate $204.137 million in 2014 dollars[14].

Instead of replacing the existing Coquitlam Gate IP pipeline in-kind, the same approach as outlined for that alternative could be adopted to replace the existing pipeline in its entirety with new larger diameter pipe (NPS 36) operating at the current 1200 kPa. Installing a larger capacity pipeline would result in some operational flexibility and resiliency for the Metro IP system and mitigate risk of outage to 123,500 of the 171,000 customers served by the Fraser Gate IP pipeline. However, even with the increased capacity due to the larger pipe diameter, it

[14] The equivalent as-spent cost including abandonment/demolition cost but excluding AFUDC is $236.702, AFUDC of $12.168 million with the total cost being $248.870 million.

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- It does not provide full resiliency to the Metro IP system and could result in a loss of supply to approximately 47,500 customers during the colder days of winter.

Since this alternative provides some operational flexibility and resiliency it has been included as an alternative in the financial analysis.

3.2.2.6 Alternative 6 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 30 Pipeline Operating at 2070 kPa

This alternative has an AACE Class 3 Project Capital Cost Estimate $200.080 million in 2014 dollars[15].

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Instead of replacing the existing Coquitlam Gate to 2nd & Woodland pipeline in-kind, a similar approach as outlined above could be adopted to replace the existing pipeline in its entirety with new larger diameter pipe operating at a higher pressure with sufficient capacity to establish full Metro IP system resiliency.

The capacity of a NPS 30 pipeline would be greater than the existing NPS 20 pipeline (larger diameter and higher operating pressure). Therefore, upgrades would be necessary at Coquitlam Gate to mechanical, civil and electrical infrastructure (pipe, valves, equipment and controls etc.) to facilitate the higher gas throughput from the TP network. Also, the pipeline would not connect directly with each of the intermediate offtake points along the pipeline route and with the NPS 30 Fraser Gate IP pipeline at East 2nd and Woodland station. Instead, shorter lateral offtake pipelines would be upgraded for the higher pressure, and longer lateral offtakes would be connected via small form factor buried IP/IP pressure regulating vault stations. At East 2nd and Woodland a new IP/IP pressure regulating station would be required to interface the new NPS 30 Coquitlam Gate IP pipeline with the existing NPS 30 Fraser Gate IP pipeline.

Advantages

- This approach would replace the entire length of the existing pipeline with new pipe and would therefore reduce the probability of leaks;
- It would significantly reduce the risk of future corrosion related gas leaks;
- It would significantly reduce safety risks to the public, plant, property and FEI personnel as a result of leaks with potential gas migration and accumulation;
- It would minimize the risk of supply interruption to customers served by the Coquitlam Gate IP pipeline as a result of leaks;
- It delivers the level of backfeed capacity considered necessary to provide operational flexibility and full system resiliency; and
- It provides the backfeed capacity to permit ongoing planned and unplanned maintenance and repair of the Fraser Gate IP pipeline (if required).

[15] The equivalent As-spent cost including abandonment/demolition cost but excluding AFUDC is $231.632 million, AFUDC of $12.444 million with the total cost being $244.076 million.

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Table 3-1: Coquitlam Gate IP Project Non-Financial Comparison

Alternatives		Objectives/Requirements				Overall Assessment
		Reduce Pipeline Risk	Provide Sufficient Operational Flexibility	Provide Full System Resiliency	Constructible	
1	Do Nothing	Does not meet Objective	Does not meet Objective[1]	Does not meet Objective	Not Applicable	Not Feasible
2	Rehabilitate Existing NPS 20	Partially meets Objective	Does not meet Objective[1]	Does not meet Objective	Meets Objective	Not Feasible
3	Replace Existing NPS 20 in kind	Meets Objective	Does not meet Objective[1]	Does not meet Objective	Meets Objective	Not Feasible
4	Replace with NPS 24 at 2070 kPa	Meets Objective	Meets Objective	Does not meet Objective[3]	Meets Objective	Feasible
5	Replace with NPS 36 at 1200 kPa	Meets Objective	Meets Objective	Does not meet Objective[4]	Meets Objective	Feasible
6	Replace with NPS 30 at 2070 kPa	Meets Objective	Meets Objective[2]	Meets Objective[2]	Meets Objective	Feasible
7	Replace with NPS 42 at 1200 kPa	Meets Objective	Meets Objective	Meets Objective	Does not meet Objective	Not Feasible

	Meets objective/feasible
	Partially meets objective
	Does not meet objective/not feasible

Notes:

(1) Requires a bypass any time maintenance or repair is required.

(2) Meets objective 365 days of the year.

(3) Under this alternative, a failure upstream, at, or downstream of the Fraser Gate Station during mid-winter conditions will impact up to 171,000 customers that could result in an economic impact in excess of $320 million.

(4) Under this alternative, a failure upstream, at, or downstream of the Fraser Gate Station during mid-winter conditions will impact up to 47,500 customers that could result in significant economic impact.

Objectives/Requirements:

1. Pipeline Risk: Eliminate the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency.

failure upstream, at, or downstream of the Fraser Gate Station would only result in outage and resulting economic impact for up to 47,500 of the 171,000 customers served by this pipeline. Since this alternative provides more operational flexibility and resiliency (compared to Alternative 4), and better meets the Project objectives and requirements, it has been included as an alternative in the financial analysis.

3.2.3.2 Financial Considerations

The financial evaluation considers both the capital cost[16] and the present value of increased operating costs associated with additional stations and increased pressure. FEI also undertook a financial operational risk evaluation which was added to the financial evaluation to determine the preferred alternative.

The financial analysis was completed for those alternatives that meet a significant portion of the Project objectives and requirements by the non-financial technical analysis. For purposes of evaluation, the capital cost estimates for the alternatives were developed to an AACE Class 4 level of project definition and are stated in 2014 dollars. The capital cost estimate for the NPS 30 pipeline was developed to an AACE International Recommended Practice No. 17R-97 Class 3 level of project definition.

The following Table 3-2 provides a summary of the financial comparison.

Table 3-2: Coquitlam Gate IP Project Financial Comparison

	Alternative 4 Install NPS 24 pipeline at 2070 kPa	Alternative 5 Install NPS 36 pipeline at 1200 kPa	Alternative 6 Install NPS 30 pipeline at 2070 kPa
AACE Estimate Accuracy	***Class 4***	***Class 4***	***Class 3***
Total Direct Capital Cost excl. AFUDC & includes Abandonment / Demolition (2014$millions)	173.833	204.137	200.080
Total Direct Capital Cost excl. AFUDC (As-spent $millions)	201.164	236.702	231.632
AFUDC (as spent $millions)	10.927	12.168	12.444
Total As-spent includes Abandonment / Demolition & AFUDC ($millions)	212.091	248.870	244.076
Annual incremental gross O&M (2014$millions)	0.055	0.020	0.055
Levelized Rate Impact – 60 Yr. ($ / GJ)	0.087	0.102	0.100
PV Incremental Cost of Service – 60 Yr. ($millions))	257.908	304.520	298.714

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[16] Includes project management, engineering, permits, materials procurement, construction, commissioning and contingency. For purposes of comparing alternatives, the development costs and application costs have been excluded from the capital costs in Table 3-2. These costs are the same in Alternative 4, 5 and 6 and are fully amortized before 2019 and do not impact the 2019 and 60 year average Levelized rate impact..

As shown in the above table, Alternative 4 (NPS 24 at 2070 kPa) is the least expensive compared to the other feasible alternatives with a total estimated capital cost of $201.164 million. The pipeline materials and construction costs are the largest components of the capital costs comprising 80 percent to 90 percent of the total. Therefore, the NPS 24, with the smallest diameter, is the least expensive pipeline to construct because of increased construction productivity and lower pipe steel costs. Detailed financial schedules for Alternative 4 are included in Confidential Appendix E-2-1.

Alternative 6 (NPS 30 at 2070 kPa) and Alternative 5 (NPS 36 at 1200 kPa) have similar capital cost estimates at $231.632 million and $236.702 million respectively. However since Alternative 5 has a higher cost and does not offer the system resilience of Alternative 6, no further analysis has been undertaken. Detailed financial schedules for Alternatives 6 and 5 are included in Confidential Appendices E-1-1 and E-2-2, respectively.

In addition to the financial evaluation, a calculation of the present value of operational risk was conducted on Alternatives 4 and 6 to determine the differential between the two alternatives in terms of a 60 year levelized cost when the impact of an operational risk reduction was taken into account. The present value of the operational risk was added to the present value of the cost of service to provide an overall present value comparison, which is summarized in Revised Table 3-3 below. Operational risk is a measure of loss-of-service impact, and is defined as the sum of the quantitative risk value of each pipeline section per year of operation, based on failure frequency per year and financial cost per event associated with the loss-of-service. The calculation of the annual risk reduction of $2.456 million associated with the proposed Alternative 6 is included in Appendix A-10. The calculation of the annual risk reduction associated with Alternative 4 is $0.352 million.

Table 3-3: Coquitlam Gate IP Project Financial and Operational Risk Comparison

		Alternative 4 Install NPS 24 Pipeline at 2070 kPa	Alternative 6 Install NPS 30 Pipeline at 2070 kPa
1	Potential Operational Risk Reduction Per Appendix A-10 (2014 $millions/year)	2.456	2.456
2[17]	Operational Risk Reduction (Coquitlam Gate IP Pipeline and Cape Horn to Coquitlam TP complete) (2014 $millions/year)	0.352	2.456
3	Operational Risk Reduction (%)	14.34%	100.0 %
4	Remaining Operational Risk (2014 $millions/year) (line 1-Line2)*	2.104	0
5	PV Remaining Operational Risk – 60 Yr[18] ($millions)	33.307	0
6	PV Incremental Cost of Service – 60 Yr ($millions)	257.908	298.714
7	PV Remaining Operational Risk + PV Incremental Cost of Service – 60 Yr ($millions)	291.215	298.714

** Based on potential operational risk in line 1*

[17] See section 3.1.3.4.

[18] PV Remaining Operational Risk – 60 Year was derived by applying the formula for the present value of an annuity to the annual remaining operational risk of $2.104 million using FEI's after tax weighted average cost of capital of 6.14%; PV = $2.456 x [(1 – (1 + k)$^{-n}$) / k] Where k = 6.14% and n = 60 years.

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As demonstrated in Revised Table 3-3 above, the difference in operational risk reduction for Alternative 6 compared to Alternative 4 is 85.66 percent.

Referring to line 5 of Revised Table 3-3, the benefit of the PV operational risk differential for a 60 year period utilizing the Company's 6.14 percent WACC for Alternative 6 compared to Alternative 4, was calculated to be $33.307 million.

Referring to line 7 of Revised Table 3-3, where the 60 year PV Incremental Cost of Service and PV Operational Risk are added, Alternative 6 is $7.499 million more than Alternative 4.

Based on an incremental cost of $.013 per GJ and an average annual consumption of 95GJ per residential customer, the annual cost difference between the two alternatives would be $1.24 per customer.

In summary, when taking into account the reduction in operational risk provided by Alternative 6 compared to Alternative 4, and that Alternative 6 is the only alternative which meets all of the stated objectives FEI has selected Alternative 6 as the preferred alternative.

3.2.4 Conclusion – Preferred Alternative

Through the financial and non-financial evaluation of various alternatives, the Company has determined that Alternative 6 (NPS 30 at 2070 kPa) is the preferred alternative and that it will satisfy all the objectives and requirements outlined in section 3.2.1 above.

Of the seven alternatives considered, the following three are the only viable alternatives that allow the Company to meet some or all of the Project objectives and requirements:

- Alternative 4: install a NPS 24 pipeline operating at 2070 kPa;
- Alternative 5: install a NPS 36 pipeline operating at 1200 kPa; and
- Alternative 6: install a NPS 30 pipeline operating at 2070 kPa.

Each of these alternatives will mitigate the reliability, safety and regulatory risk posed by the existing NPS 20 Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and unacceptable projected leak frequency. These alternatives also present practical pipeline replacement solutions that are constructible using modern standard pipeline installation techniques. However, only Alternative 6 meets all of the Coquitlam Gate IP Project objectives and requirements.

Alternative 6 has a capital cost that is $31.985 million (as-spent dollars) greater than Alternative 4 (NPS 24 at 2070 kPa). Alternative 4, similar to Alternative 6, would mitigate the integrity risks associated with the existing NPS 20 pipeline leaks. However, Alternative 4 would not fully meet the Coquitlam Gate IP Project objectives and requirements in terms of reliability, operational flexibility or resiliency of the current Metro IP system.

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An analysis of the PV of the 60 year cost of service shows that Alternative 4 is $40.806 million less than Alternative 6 and that the differential in terms of a 60 year Levelized Rate Impact between the two is $0.013 per GJ. Based on an average annual consumption of 95 GJ per residential customer, this would result in an annual cost difference between the two alternatives of $1.24 per customer.

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While financial considerations have a role when selecting the preferred alternative, one of the primary objectives of the Projects together is the elimination of both Fraser Gate IP and the Coquitlam Gate IP as single point-of-failure pipelines, and to improve overall system resilience through increased system reliability, flexibility, and redundancy. As noted in the Non-Financial and Financial comparison discussion, Alternative 6 is the alternative that meets all the objectives.

By reducing all of the operational risk, improving operational flexibility, and increasing system resiliency, for a relatively small incremental cost over Alternative 4, Alternative 6 is considered the most prudent and is a cost-effective solution when all factors are considered. On this basis, it has been selected as the preferred alternative.

3.3 *PROJECT DESCRIPTION*

In this section, FEI will describe the proposed Coquitlam Gate IP pipeline replacement in more detail, including information on components, schedule, resources requirements, and risks and management.

3.3.1 Introduction

The FEI system, which supplies natural gas to the Lower Mainland and Vancouver Island, is presented in Figure 3-3. It comprises TP and IP pipelines which are illustrated as green (TP) and red (IP) for clarity. The TP pipelines have dedicated Right of Way (ROW) easements which are located within shared utility corridors, and the IP pipelines, which operate at lower pressure, are generally located within road allowances.

The Coquitlam and Fraser Gate stations are the two interface points between the TP pipeline network and the lower pressure IP pipeline network which distributes gas throughout Metro Vancouver.

The existing NPS 20 Coquitlam Gate IP pipeline, which has experienced integrity issues as previously described in section 3.1, is also highlighted in Figure 3-3. This pipeline extends from Coquitlam Gate located at Como Lake & Mariner Way in Coquitlam to East 2nd & Woodland in Vancouver and is approximately 20 km in length. The Coquitlam Gate IP Project will involve the replacement of the existing NPS 20 IP pipeline which operates at 1200 kPa with a new NPS 30 IP pipeline which will operate at 2070 kPa.

The second step required the workshop participants to propose suitable measures to reduce the risk probability or consequence (risk treatment plans) for the risks that were ranked as extreme or high. To further support the treatment plan, the ability of the proposed measures to influence the risk score was also stated.

The results of the workshop show that none of the project risks were rated with a consequence rating of 5 (Catastrophic) together with a likelihood of A (Almost certain) or B (Likely). With the treatment plan, of the three project risks that were rated with a consequence rating of 5 and a likelihood of C (Moderate), two were reduced to a likelihood of D (unlikely) and one was reduced to consequence of 4 (Major) with a likelihood of D. As a result of the treatment plan, the number of risks rated as extreme was reduced from 11 to 4, and the number rated as high was reduced from 42 to 34. These details are presented in the full risk register in Confidential Appendix A-21.

3.4 *PROJECT COST ESTIMATE*

The Company prepared the Project cost estimate based on AACE Class 3 specifications, in accordance with the CPCN Guidelines. This section discusses:

- The Project cost estimate details; and
- The financial impacts.

3.4.1 Cost Estimate Details

The total capital cost of the Project, filed confidentially in Appendix E-3-1 is forecast to be $244.076 million in as spent dollars (including AFUDC of $12.444 million and abandonment/demolition costs of $4.168 million)[23].

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The Coquitlam Gate IP Project is larger in scale and more complex in detail compared to projects typically undertaken by the Company. To provide the necessary expertise FEI engaged WorleyParsons to assist with project engineering and estimating services and develop the pipeline routing, design and construction planning to the necessary level of project definition as prescribed by the AACE recommended practices. This collaborative approach ensured the estimating, forecasting, control and other processes used for the Project represent industry best practice.

This section will address the following:

- Estimate preparation plan;
- Basis of Estimate;

[23] Of the total $244.076 million dollars, $227.464 million of capital and $12.327 million of AFUDC is charged to Gas Plant in Service; $4.168 million abandonment / demolition costs plus $0.117 million of AFUDC is charged to Negative Salvage Deferral Account. The total AFUDC charged to Gas Plant in Service and to Negative Salvage Deferral Account is $12.444 million.

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GST it pays on its taxable purchases. As such, the tax does not represent a net cost to the Company. 2014 market prices have been used for the material supply and construction contracts.

3.4.1.4.1 PROJECT EXECUTION COST ESTIMATE SUMMARY

The Project total installed cost, including direct and indirect costs, is presented in Confidential Appendix E-3-1. The estimated capital cost of $231.632 million plus actual AFUDC (As-spent) will be used as the control budget until replaced by more detailed estimates, and cost reports will conform at a minimum to the level of detail as set out in Confidential Appendix E-3-1[24]. LMIPSU Development and LMIPSU Application deferred costs will be tracked separately and will be reported on as well.

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3.4.1.4.2 ESCALATION

An escalation rate of 4.5 percent per annum is used based on the ten year average escalation rates from Statistics Canada for industrial construction and line pipe from 2002 to 2012.

3.4.1.4.3 PROJECT CONTINGENCY AND MONTE CARLO ANALYSIS

FEI conducted a risk analysis of the project and has used the results of the analysis in determining the contingency.

The project contingency strategy used guidance from:

- AACE IR No. 40R-08 *"Contingency Estimating – General Principles"*;
- AACE IR No. 66R-11 *"Selecting Probability distribution Functions for Use in Cost and Schedule Risk Simulation Models"* (Rev. August 24, 2012); and
- WorleyParsons Guideline 002-000-PMW-266 (015251) PDP-0011 *"Cost Risk Analysis Guideline"* (Rev. March 6, 2013).

A two step approach was used to determine the Project contingency. The first step involved the use of predetermined guidelines to evaluate a single contingency value which was applied to the base cost estimate. This contingency was based on the expert opinion of the FEI and WorleyParsons engineering team combined with detailed knowledge of the project scope and risks. A flat percentage contingency was selected and applied to the estimate base cost (see Confidential Appendix A-23 – Basis of Estimate).

The second step involved a combined 'estimate risk assessment workshop' (different from the project risk workshop described in section 3.3.9.1) and 'quantitative risk analysis'. The workshop was led by a WorleyParsons facilitator and lead estimator. The quantitative risk analysis using the Monte Carlo method was conducted using @Risk software. The WorleyParsons Cost Risk Analysis report is attached in Confidential Appendix A-27. The Project

[24] Appendix E-3-1 includes an estimate of AFUDC of $12.444 million. Actual AFUDC will vary.

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5. PROJECT COSTS AND ACCOUNTING TREATMENT

5.1 SUMMARY OF CAPITAL COSTS, INCREMENTAL COST OF SERVICE AND AVERAGE LEVELIZED COST

Details of the Coquitlam Gate IP Project capital costs can be found in Confidential Appendix E-1-1, Schedule 6, and in Confidential Appendix E-3-1. Fraser Gate IP Project costs can be found in Confidential Appendix E-1-2, Schedule 6, and in Confidential Appendix E-3-2.

Based on the Projects' costs, Table 5-1 presents a summary of the total forecast project costs and Table 5-2 presents the financial impacts associated with the completion of each of the two IP pipeline Projects as well as a summary of the combined rate impacts. Both tables are based on detailed schedules for each pipeline segment as included in Confidential Appendices E-1-1 and E-1-2. The impact to customer rates in 2019 (when the asset enters rate base) is approximately $0.129 per GJ and levelized over the 60 year analysis period is approximately $0.107 per GJ. For a typical FEI residential customer consuming an average 95 GJ per year, in 2019, this would equate to approximately $12.25 per year. The annual impact to customers from the Coquitlam Gate IP Project in 2019 would be approximately $11.50 per year and from the Fraser Gate IP Project would be approximately $0.75 per year.

Table 5-1: Summary of Forecast Capital and Deferred Costs ($millions)

Particular	2014$	As-Spent	AFUDC	Tax Offset	Total
Coquitlam Gate IP Project	196.544	227.464	12.327		**239.792**
Fraser Gate IP Project	14.855	17.231	0.876		**18.107**
Total Addition to Plant	211.399	244.695	13.203		**257.899**
Abandonment/Demolition Costs[28]	3.536	4.168	0.117		**4.285**
Total Projects Capital Cost	214.935	248.863	13.320		**262.184**
LMIPSU Development Cost	2.441	2.442	0.197	(0.635)	**2.004**
LMIPSU Application Cost	1.307	1.307	0.080	(0.340)	**1.047**
Total	**218.683**	**252.612**	**13.597**	**(0.975)**	**265.235**

[28] Abandonment and demolition costs will be charged to the Negative Salvage Deferral Account in accordance with BCUC Order G-44-12

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Table 5-2: Financial Analysis of the Projects Reinforcements

AACE Class 3	Coquitlam Gate IP	Fraser Gate IP	Combined[29]
Total Charged to GPIS ($millions)	239.792	18.107	257.899
Abandonment / Demolition Costs ($millions)[30]	4.285	--	4.285
Total Capital Costs including Abandonment / Demolition ($millions)	244.077	18.107	262.184
2019 Rate Impact ($ / GJ)	0.121	0.008	0.129
Levelized Rate Impact 60 Years ($ / GJ)	0.100	0.007	0.107
Levelized Incremental Revenue Requirement ($millions)[31]	18.783	1.315	20.098
Incremental Revenue Requirement PV 60 Years ($millions)	298.714	21.654	320.368
Net Cash Flow NPV 60 Years ($millions)	2.449	0.303	2.752
2019 Incremental Rate Base ($millions)	240.811	17.937	258.748

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5.2 *ACCOUNTING TREATMENT*

Consistent with FEI's treatment of CPCNs, the capital costs of these two projects will be held in Work in Progress Attracting AFUDC until January 1 of the year following when they are in service. The projects are planned to be in service in October, 2018. On January 1, 2019 the projects costs will be transferred to Gas Plant in Service accounts and included in the Company's Rate Base.

5.2.1 Negative Salvage

Abandonment/demolition costs related to the existing 20" Coquitlam Gate IP pipeline, and Coquitlam Gate station will be charged to FEI's existing Negative Salvage Deferral Account in accordance with the approved treatment of these costs as approved in Order G-44-12. The abandonment / demolition costs are forecast to be $3.536 million (2014 dollars) or in as-spent dollars to be $4.285 million (including AFUDC of $0.117 million). These costs are identified in Confidential Appendix E-3-1.

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Charges for abandonment and demolition costs as well as the negative salvage provision are shown in Confidential Appendix E-1-1 Schedule 9 for the Coquitlam Gate IP Project and in Confidential Appendix E-1-2, Schedule 9 for the Fraser Gate IP Project (there are no abandonment or demolition costs for the Fraser Gate IP Project).

[29] Numbers in rows may not add exactly due to rounding.
[30] Abandonment and demolition costs will be charged to the Negative Salvage Deferral Account in accordance with BCUC Order G-44-12.
[31] Levelized Rate Impact for 60 Years x 187,832 TJ / 1,000; The volume of 187,832 TJ is from FEI's compliance filing for Common Rates, dated October 31, 2014, Appendix A, Schedule 5, Column 2, Row 28 (Total Non-Bypass Sales and Transportation Service Volumes.

The study makes several recommendations (based on industry best practices and applicable requirements of local regulations) to mitigate, manage and minimize potential, adverse effects and to monitor Projects' impacts as construction proceeds. Recommendations include compliance with municipal noise bylaws and limiting traffic access restrictions to businesses and residents as much as possible. The report also suggests that a Traffic Management Plan can address temporary disturbances to vehicular traffic that will, for short periods of time, reduce areas of residential and commercial on-street parking. Proposed mitigation activities to minimize any negative effects are contained in Section 3 of the report. Construction and Monitoring recommendations are outlined in Section 5 of the report.

Dillon also determined the construction of the Projects has the potential for positive employment impacts and will contribute to the local economy in the Lower Mainland, BC, Canada, and outside Canada, concluding that new jobs may be generated during the construction period. It also found economic spin-offs will be created, such as increased demand for local hospitality services (hotels and restaurants for employees working on the construction sites, etc.). FEI estimates the economic benefits (see Table 6-1) of the two upgrades will be as follows:

Table 6-1: Potential Economic Benefits

Coquitlam Gate IP *($millions – 2014 dollars)*

Cost ($000)	Lower Mainland	All BC (except Lower Mainland)	Canada (except BC)	Outside Canada	Sub-Total
Materials		1.668		31.698	33.367
Construction	107.311		45.990		153.301
Owner	13.412				13.412
Sub-Totals	**120.723**	**1.668**	**45.990**	**31.698**	**200.080**

Fraser Gate IP *($millions – 2014 dollars)*

Cost ($000)	Lower Mainland	All BC (except Lower Mainland)	Canada (except BC)	Outside Canada	Sub-Total
Materials		0.097		1.847	1.944
Construction	7.978		3.419		11.397
Owner	1.515				1.515
Sub-Totals	**9.493**	**0.097**	**3.419**	**1.847**	**14.856**

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The study concludes that with the adoption of the recommendations outlined in the socio-economic report, the Projects are not expected to have any negative, long-term effects on the socio-economic conditions in the study area. There are expected to be some positive socio-economic benefits to the regional area and the province resulting from the Projects. Additionally

The financial evaluation consists of the estimated capital cost and operating cost and their impact on the levelized rates and incremental cost of service.

The cost estimates represent the estimated total cost of each alternative including project management, engineering, permits, materials procurement, and construction and commissioning. The following Table 9-2 provides a summary of the financial evaluation conducted.

Table 9-2: Coquitlam Gate IP Project Financial Comparison

	Alternative 4 Install NPS 24 pipeline at 2070 kPa	Alternative 5 Install NPS 36 pipeline at 1200 kPa	Alternative 6 Install NPS 30 pipeline at 2070 kPa
AACE Estimate Accuracy	***Class 4***	***Class 4***	***Class 3***
Total Direct Capital Cost excl. AFUDC & includes Abandonment / Demolition (2014$millions)	173.833	204.137	200.080
Total Direct Capital Cost excl. AFUDC (As-spent $millions)	201.164	236.702	231.632
AFUDC (as spent $millions)	10.927	12.168	12.444
Total As-spent includes Abandonment / Demolition & AFUDC ($millions)	212.091	248.870	244.076
Annual incremental gross O&M (2014$millions)	0.055	0.020	0.055
Levelized Rate Impact – 60 Yr. ($ / GJ)	0.087	0.102	0.100
PV Incremental Cost of Service – 60 Yr. ($millions))	257.908	304.520	298.714

Increasing the capacity of the Coquitlam Gate IP pipeline to achieve full resiliency to the Metro IP system allows for mitigation of the estimated economic impacts associated with loss of service as well as provides an operational risk reduction of approximately $2.456 million per year.

A calculation of the present value of operational risk was conducted on Alternatives 4 and 6 since Alternative 5 has a higher cost and does not offer the system resilience of Alternative 6. This was completed to determine the differential between the two alternatives in terms of a 60 year Levelized cost when the impact of risk reduction was taken into account. The present value of the operational risk was added to the present value of the cost of service to provide an overall present value comparison, which is summarized in Revised Table 9-3. Operational risk is defined as the sum of the quantitative risk value of each pipeline section per year of operation, based on failure frequency per year and financial cost per event.

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Deleted: Table 9-3: Coquitlam Gate IP Project Financial and Operational Risk Comparison¶

Table 9-3: Coquitlam Gate IP Project Financial and Operational Risk Comparison

		Alternative 4 Install NPS 24 Pipeline at 2070 kPa	Alternative 6 Install NPS 30 Pipeline at 2070 kPa
1	Potential Operational Risk Reduction Per Appendix A-10 (2014 $millions/year)	2.456	2.456
2	Operational Risk Reduction (Coquitlam Gate IP Pipeline and Cape horn to Coquitlam TP complete) (2014 $millions/year)	0.352	2.456
3	Operational Risk Reduction (%)	14.34%	100.0 %
4	Remaining Operational Risk (2014 $millions/year)(line 1-Line2)*	2.104	0
5	PV Remaining Operational Risk – 60 Yr ($millions)	33.307	0
6	PV Incremental Cost of Service – 60 Yr ($millions)	257.908	298.714
7	PV Remaining Operational Risk + PV Incremental Cost of Service – 60 Yr ($millions)	291.215	298.714

** Based on potential operational risk in line 1*

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In summary, when taking into account the reduction in operational risk provided by Alternative 6 compared to Alternative 4, and that Alternative 6 is the only alternative which meets all of the stated objectives FEI has selected Alternative 6 as the preferred alternative. The estimated capital cost for the Coquitlam Gate IP Project in As spent dollars, including AFUDC and abandonment / demolition costs is $244.076 million.

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FEI evaluated a number of route options using a detailed route selection process. The overall objective of the routing process was to select the route option that minimizes potential impacts on the community, stakeholders and environment while meeting safety and construction requirements in an economical manner. The result is the preferred Coquitlam Gate IP pipeline route option which is presented in Table 9-4 relative to the existing pipeline route.

Table 9-4: Coquitlam Gate IP Project Selected Pipeline Route

Section	Existing NPS 20 Coquitlam IP route	Proposed NPS 30 Coquitlam IP route	Relative Position
1	Como Lake Avenue	Como Lake Avenue	Parallel in same road
2	Como Lake Avenue	Como Lake Avenue	Parallel in same road
3	Como Lake Avenue and Broadway	Como Lake Avenue and Broadway	Parallel in same road
4	Broadway	Broadway	Parallel in same road
5	Broadway	Broadway	Parallel in same road
6	Springer Avenue, Halifax Street, Brentlawn Drive, Lane adjacent to Brentwood Town Centre, Halifax Street, 2nd Avenue	Springer Avenue, Halifax Street, Highlawn Drive, Brentlawn Drive, Graveley Street	Parallel Street (offset one to two streets north)

Section	Existing NPS 20 Coquitlam IP route	Proposed NPS 30 Coquitlam IP route	Relative Position
7	East 2nd Avenue	East 1st Avenue	Parallel Street (offset one street north)

9.4 *LMIPSU PROJECTS SUMMARY*

A summary of the total forecast capital costs for the Projects, and 2019 average cost of service, is as follows:

- Total Capital Cost (As-spent dollars) excluding AFUDC but including abandonment and demolition cost is $248.863 million (including AFUDC the As spent cost is $262.184 million), and
- 2019 Average Cost of Service Impact - $0.129 / GJ.

For a typical FEI residential customer consuming 95 GJ per year in 2019, this would equate to approximately $12 per year and reflects an approximate increase of 3.36% on delivery margin or an approximate increase of 1.3% on the burner tip.[48]

The following Tables 9-5 and 9-6 summarize the total forecast capital and deferred costs for the Projects and the approximate average burner tip rate impacts:

Table 9-5: Summary of Forecast Capital & Deferred Costs ($millions)

Particular	2014$	As-Spent	AFUDC	Tax Offset	Total
Total Capital Cost	214.935	248.863	13.320		**262.184**
LMIPSU Development Cost	2.441	2.442	0.197	(0.635)	**2.004**
LMIPSU Application Cost	1.307	1.307	0.080	(0.340)	**1.047**
Total	**218.683**	**252.612**	**13.597**	**(0.975)**	**265.235**

Table 9-6: Summary of Approximate Rate Impacts ($/GJ)

Approximate Rate Impact	2019	60 Year Levelized Average
Coquitlam Gate IP Project	0.121	0.100
Fraser Gate IP Project	0.008	0.007
Total	**0.129**	**0.107**

[48] Approximate burner tip impact calculated based on a Residential customer's annual bill of $922 as of January 1, 2015

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Attachment B
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1. APPLICATION

1.1 *SUMMARY OF APPROVALS SOUGHT*

FortisBC Energy Inc. (the Company or FEI), pursuant to sections 45 and 46 of the *Utilities Commission Act* (the Act), applies to the British Columbia Utilities Commission (BCUC or the Commission) for a Certificate of Public Convenience and Necessity (CPCN) to construct and operate two Intermediate Pressure (IP) pipeline segments in the Lower Mainland of British Columbia that will replace the existing pipeline segments (the Application). In particular, FEI seeks approval under sections 45 and 46 of the Act to:

1. Construct and operate a new Nominal Pipe Size (NPS) 30 IP pipeline operating at 2070 kPa between Coquitlam Gate Station and East 2nd & Woodland Station to upgrade and replace an existing NPS 20 IP pipeline operating at 1200 kPa (Coquitlam Gate IP Project[1]); and
2. Construct and operate a new NPS 30 IP pipeline operating at 1200 kPa between Fraser Gate Station and East Kent Avenue & Elliott Street to upgrade and replace an existing NPS 30 IP pipeline (Fraser Gate IP Project).

These two replacements are collectively referred to as the "Projects", and individually referred to as the "Project" as the context requires. The estimated capital cost for the Projects in As spent dollars, including Allowance for Funds Used During Construction (AFUDC) and including abandonment / demolition costs, is $262.184 million, consisting of $244.076 million for the Coquitlam Gate IP Project and $18.107 million for the Fraser Gate IP Project.

FEI is also seeking Commission approval under sections 59-61 of the Act for deferral treatment of costs for preparing this Application, and therefore requests a new deferral account, entitled the "LMIPSU Application Costs deferral account". The LMIPSU Application costs would be included in Rate Base and amortized over a three year period commencing January 1, 2016. The Application costs include expenses for legal review, consultant costs[2], Commission costs and Commission approved intervener costs, and forecast costs to support the hearing process. The LMIPSU application costs will be recorded in a Non-Rate Base deferral account on a net-of-tax basis attracting a weighted average after tax cost of capital (WACC) return until December 31, 2015. The balance of the LMIPSU Application Costs deferral account as at December 31, 2015, is forecast to be $1.047 million.[3]

[1] In some Appendices completed by third parties and in some public information documents completed early in the planning phase, the Coquitlam Gate IP Project was referred to as the Metro IP Project; however the Metro IP includes both the Coquitlam Gate IP system and the Fraser Gate IP system whereas the Coquitlam Gate IP Project only includes the Coquitlam IP system.

[2] For assistance in answering information requests.

[3] Approximately $1.387 million on a before tax basis, this includes $80 thousand financing charges at the Company's weighted average cost of capital.

In order to eliminate the identified non-preventable corrosion risks associated with the Coquitlam Gate IP pipeline and address other capacity related constraints, FEI has evaluated a number of alternatives and has identified the preferred alternative to address the objectives identified for the Projects. The only solution which meets all of the stated objectives is replacement of the existing NPS 20, 1200 kPa Coquitlam Gate IP pipeline with a NPS 30 pipeline operating at 2070 kPa at a cost of $244.076 million (As spent dollars, including AFUDC and abandonment / demolition). This is further discussed in section 3.2 of this Application.

The proposed Coquitlam Gate IP Project will:

- Eliminate the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency;
- Provide sufficient operational flexibility to permit planned maintenance and repair of the Fraser Gate IP pipeline;
- Provide full system resilience in conjunction with the Cape Horn to Coquitlam TP pipeline reinforcement, to fully supply the Coquitlam Gate IP pipeline and the Fraser Gate IP pipeline from either the Fraser Gate station or the Coquitlam Gate station on any day of the year and therefore reduce the potential consequences of a failure upstream, at, or downstream of either gate station; and
- Consider constructability, operational and safety factors, such as routing constraints, proximity to adjacent utilities and appropriate construction techniques, limiting interruption of flow of gas during construction and commissioning and allowing sufficient space to work around existing piping and components.

The two IP pipeline replacement Projects as proposed, in conjunction with other planned TP pipeline looping projects (identified as Cape Horn-Coquitlam, Nichol-Port Mann and Nichol-Roebuck in Figure 1-3) that have been identified as being required for either capacity and/or security of supply purposes and that are expected to be constructed as described in section 1.3, will significantly improve the resiliency of the natural gas system in the Lower Mainland. See Figure 1-3 for a high level view of the proposed IP projects and the planned TP projects.

- Total Capital Cost (As-spent dollars) excluding AFUDC but including abandonment and demolition cost is $248.863 million (including AFUDC the As spent cost is 262.184 million), and
- 2019 Average Cost of Service Impact - $0.129 / GJ.

For a typical FEI residential customer consuming 95 GJ per year in 2019, this would equate to approximately $12 per year and reflects an approximate increase of 3.36% on delivery margin or an approximate increase of 1.3% on the burner tip.[6]

The following table summarizes the total forecast capital and deferred costs for the projects:

Table 1-1: Summary of Forecast Capital & Deferred Costs ($millions)

Particular	2014$	As-Spent	AFUDC	Tax Offset	Total
Total Capital Cost	214.935	248.863	13.320		**262.184**
LMIPSU Development Cost	2.441	2.442	0.197	(0.635)	**2.004**
LMIPSU Application Cost	1.307	1.307	0.080	(0.340)	**1.047**
Total	**218.683**	**252.612**	**13.597**	**(0.975)**	**265.235**

Table 5-1 in section 5 presents a detailed summary of the costs by project and Table 5-2 provides the financial impacts associated with the completion of each of the two IP pipeline Projects, as well as a summary of the combined rate impacts. Both tables are based on detailed schedules for each pipeline segment as included in Appendix E-1.

The Company has identified a number of Project stakeholders, including residents, businesses, government entities and First Nations. Communications and consultations with the stakeholders with respect to the Projects have already taken place, and as outlined in section 7 (Public Consultation) FEI continues to consult with stakeholders regarding routing, the Project schedule, temporary construction space, Rights of Way (ROW), and public safety. Another series of public information sessions is planned prior to start of construction, with the goal of informing residents and the public about construction activities, traffic issues and mitigation strategies.

FEI is committed to continuing consultation with Project stakeholders and will continue to ensure that, as the Projects progress; stakeholders are kept informed and have ways to provide feedback to the Company.

The Projects will not involve Crown Land or any First Nations treaty land. However, during the preliminary stage of considering alternatives, as further explained in section 8 of this Application, the Company has informed First Nations about the Company's plan to construct

[6] Approximate burner tip impact calculated based on a Residential customer's annual bill of $922 as of January 1, 2015

As described below, the only solution which meets the stated objectives is replacement of the existing NPS 20, 1200 kPa Coquitlam Gate IP pipeline with a NPS 30 pipeline operating at 2070 kPa at a cost of $244.076 million ((As-spent) including AFUDC and abandonment / demolition).

3.2.1 Objectives and Requirements

The Coquitlam Gate IP pipeline has reliability, safety, and regulatory risks because of non-preventable pipeline corrosion and an unacceptable projected frequency of gas leaks. The capacity of the pipeline is not sufficient to backfeed the Fraser Gate IP pipeline to provide operational flexibility or resiliency to the Metro IP system. Thus, the objectives of the Coquitlam Gate IP Project are to:

1. Eliminate the elevated reliability, safety and regulatory risk (including the BC Oil and Gas Activities Act) posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism (i.e. corrosion beneath field applied coating at girth welds) and resulting unacceptable projected leak frequency (Pipeline Risk);
2. Provide sufficient operational flexibility to permit planned maintenance and repair of the Fraser Gate IP pipeline (Operational Flexibility);
3. Provide full system resilience in conjunction with the Cape Horn to Coquitlam TP pipeline reinforcement, to fully supply the Coquitlam Gate IP pipeline and the Fraser Gate IP pipeline from either the Fraser Gate station or the Coquitlam Gate station on any day of the year and therefore reduce the potential consequences of a failure upstream, at, or downstream of either gate station (System Resiliency); and
4. Address constructability, operational and safety factors, such as routing constraints, proximity to adjacent utilities and appropriate construction techniques, limiting interruption of flow of gas during construction and commissioning and allowing sufficient space to work around existing piping and components (Constructability).

For each alternative discussed below, the Company considered the advantages and disadvantages of the alternative in light of the objectives and requirements discussed above. Further, while some of the alternatives were constructible, where they did not sufficiently meet key objectives the Company considered these alternatives to be not feasible. Operational flexibility allowing for planned maintenance and repair is a critical requirement for continued safe, reliable and essential service to customers.

3.2.2 Alternatives Description

As part of its assessment of the Coquitlam Gate IP Project, FEI evaluated several alternatives.

The following alternatives, including preliminary capital cost screening, are discussed in further detail below. A table comparing the alternatives ability to meet the Coquitlam Gate IP Project

- It does not provide operational flexibility to the Metro IP system;
- It does not enhance resiliency of the Metro IP system;
- It does not mitigate the Metro IP system security of supply issues; and
- There are significant construction constraints associated with urban pipeline installation projects.

As discussed in section 3.1.2.3 the Company believes operational flexibility allowing for planned maintenance and repair is a critical requirement for continued safe, reliable and essential service to customers. This alternative does not provide the increased capacity necessary to facilitate planned outages for system work or provide system resiliency, therefore FEI has assessed this alternative not to be a prudent alternative, and consequently, not feasible.

3.2.2.4 Alternative 4 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 24 Pipeline Operating at 2070 kPa

This alternative has an AACE Class 4 Project Capital Cost Estimate $173.833 million in 2014 dollars[13].

Instead of replacing the existing Coquitlam Gate IP pipeline in-kind, the same approach as outlined for that alternative could be adopted to replace the existing pipeline in its entirety with new larger diameter pipe (NPS 24) operating at an increased pressure (2070 kPa). Installing a larger capacity pipeline would result in some operational flexibility and resiliency for the Metro IP system. However, the level of increased capacity provided is insufficient to supply back feed capability for a Fraser Gate IP outage during the colder days of winter.

The capacity of a NPS 24 pipeline would be greater than the existing NPS 20 pipeline (larger diameter and higher operating pressure); therefore, upgrades would be necessary at Coquitlam Gate station to mechanical, civil and electrical infrastructure (pipe, valves, equipment and controls etc.) to facilitate the higher gas throughput from the TP network. Also, the pipeline would not connect directly with each of the intermediate offtake points along the pipeline route and with the NPS 30 Fraser Gate IP pipeline at East 2nd and Woodland station. Instead, shorter lateral offtake pipes would be upgraded for the higher pressure and longer lateral offtakes would be connected via small form factor buried IP/IP pressure regulating vault stations. At East 2nd and Woodland a new IP/IP pressure regulating station would be required to interface the NPS 24 Coquitlam Gate IP pipeline with the NPS 30 Fraser Gate IP pipeline.

Advantages:

- This approach would replace the entire length of the existing pipeline with new pipe and would therefore reduce the probability of leaks;

[13] The equivalent As-spent cost including abandonment/demolition cost but excluding AFUDC is $201.164 million: AFUDC of $10.927 million with the total cost being $212.091 million.

- It would significantly reduce the risk of future corrosion related gas leaks;
- It would significantly reduce safety risks to the public, plant, property and FEI personnel as a result of leaks with potential gas migration and accumulation;
- It would minimize the risk of supply interruption to customers served by the Coquitlam Gate IP pipeline as a result of leaks;
- It has the third lowest capital cost compared to other alternatives;
- It would provide operational flexibility to permit planned maintenance and repair of the Fraser Gate IP pipeline with minimum risk of customer service interruption by avoiding the use of a bypass; and
- It would supply the backfeed capacity to provide operational flexibility.

Disadvantages:

- There are significant construction constraints associated with urban pipeline installation projects;
- Due to the higher operating pressure, the pipeline would interface indirectly with the existing IP system via additional IP/IP pressure reducing stations, creating a more complex system to operate;
- It would require a significant upgrade to Coquitlam Gate station to facilitate the higher pipeline capacity compared to the NPS 20 in-kind pipeline and the NPS 36 pipeline; and
- It does not provide full resiliency to the Metro IP system during mid-winter or design day conditions.

Although the level of increased capacity provided is insufficient to supply backfeed capability for a Fraser Gate IP outage during the colder days of winter (it does not provide full system resiliency), this alternative meets the other objectives. Therefore, on this basis, the Company investigated this alternative further.

3.2.2.5 Alternative 5 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 36 Pipeline Operating at 1200 kPa

This alternative has an AACE Class 4 Project Capital Cost Estimate $204.137 million in 2014 dollars[14].

Instead of replacing the existing Coquitlam Gate IP pipeline in-kind, the same approach as outlined for that alternative could be adopted to replace the existing pipeline in its entirety with new larger diameter pipe (NPS 36) operating at the current 1200 kPa. Installing a larger capacity pipeline would result in some operational flexibility and resiliency for the Metro IP system and mitigate risk of outage to 123,500 of the 171,000 customers served by the Fraser Gate IP pipeline. However, even with the increased capacity due to the larger pipe diameter, it

[14] The equivalent as-spent cost including abandonment/demolition cost but excluding AFUDC is $236.702, AFUDC of $12.168 million with the total cost being $248.870 million.

- It does not provide full resiliency to the Metro IP system and could result in a loss of supply to approximately 47,500 customers during the colder days of winter.

Since this alternative provides some operational flexibility and resiliency it has been included as an alternative in the financial analysis.

3.2.2.6 Alternative 6 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 30 Pipeline Operating at 2070 kPa

This alternative has an AACE Class 3 Project Capital Cost Estimate $200.080 million in 2014 dollars[15].

Instead of replacing the existing Coquitlam Gate to 2nd & Woodland pipeline in-kind, a similar approach as outlined above could be adopted to replace the existing pipeline in its entirety with new larger diameter pipe operating at a higher pressure with sufficient capacity to establish full Metro IP system resiliency.

The capacity of a NPS 30 pipeline would be greater than the existing NPS 20 pipeline (larger diameter and higher operating pressure). Therefore, upgrades would be necessary at Coquitlam Gate to mechanical, civil and electrical infrastructure (pipe, valves, equipment and controls etc.) to facilitate the higher gas throughput from the TP network. Also, the pipeline would not connect directly with each of the intermediate offtake points along the pipeline route and with the NPS 30 Fraser Gate IP pipeline at East 2nd and Woodland station. Instead, shorter lateral offtake pipelines would be upgraded for the higher pressure, and longer lateral offtakes would be connected via small form factor buried IP/IP pressure regulating vault stations. At East 2nd and Woodland a new IP/IP pressure regulating station would be required to interface the new NPS 30 Coquitlam Gate IP pipeline with the existing NPS 30 Fraser Gate IP pipeline.

Advantages

- This approach would replace the entire length of the existing pipeline with new pipe and would therefore reduce the probability of leaks;
- It would significantly reduce the risk of future corrosion related gas leaks;
- It would significantly reduce safety risks to the public, plant, property and FEI personnel as a result of leaks with potential gas migration and accumulation;
- It would minimize the risk of supply interruption to customers served by the Coquitlam Gate IP pipeline as a result of leaks;
- It delivers the level of backfeed capacity considered necessary to provide operational flexibility and full system resiliency; and
- It provides the backfeed capacity to permit ongoing planned and unplanned maintenance and repair of the Fraser Gate IP pipeline (if required).

[15] The equivalent As-spent cost including abandonment/demolition cost but excluding AFUDC is $231.632 million, AFUDC of $12.444 million with the total cost being $244.076 million.

Table 3-1: Coquitlam Gate IP Project Non-Financial Comparison

	Alternatives	Objectives/Requirements				Overall Assessment
		Reduce Pipeline Risk	Provide Sufficient Operational Flexibility	Provide Full System Resiliency	Constructible	
1	Do Nothing	Does not meet Objective	Does not meet Objective[1]	Does not meet Objective	Not Applicable	Not Feasible
2	Rehabilitate Existing NPS 20	Partially meets Objective	Does not meet Objective[1]	Does not meet Objective	Meets Objective	Not Feasible
3	Replace Existing NPS 20 in kind	Meets Objective	Does not meet Objective[1]	Does not meet Objective	Meets Objective	Not Feasible
4	Replace with NPS 24 at 2070 kPa	Meets Objective	Meets Objective	Does not meet Objective[3]	Meets Objective	Feasible
5	Replace with NPS 36 at 1200 kPa	Meets Objective	Meets Objective	Does not meet Objective[4]	Meets Objective	Feasible
6	Replace with NPS 30 at 2070 kPa	Meets Objective	Meets Objective[2]	Meets Objective[2]	Meets Objective	Feasible
7	Replace with NPS 42 at 1200 kPa	Meets Objective	Meets Objective	Meets Objective	Does not meet Objective	Not Feasible

	Meets objective/feasible
	Partially meets objective
	Does not meet objective/not feasible

Notes:

(1) Requires a bypass any time maintenance or repair is required.

(2) Meets objective 365 days of the year.

(3) Under this alternative, a failure upstream, at, or downstream of the Fraser Gate Station during mid-winter conditions will impact up to 171,000 customers that could result in an economic impact in excess of $320 million.

(4) Under this alternative, a failure upstream, at, or downstream of the Fraser Gate Station during mid-winter conditions will impact up to 47,500 customers that could result in significant economic impact.

Objectives/Requirements:

1. Pipeline Risk: Eliminate the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency.

failure upstream, at, or downstream of the Fraser Gate Station would only result in outage and resulting economic impact for up to 47,500 of the 171,000 customers served by this pipeline. Since this alternative provides more operational flexibility and resiliency (compared to Alternative 4), and better meets the Project objectives and requirements, it has been included as an alternative in the financial analysis.

3.2.3.2 Financial Considerations

The financial evaluation considers both the capital cost[16] and the present value of increased operating costs associated with additional stations and increased pressure. FEI also undertook a financial operational risk evaluation which was added to the financial evaluation to determine the preferred alternative.

The financial analysis was completed for those alternatives that meet a significant portion of the Project objectives and requirements by the non-financial technical analysis. For purposes of evaluation, the capital cost estimates for the alternatives were developed to an AACE Class 4 level of project definition and are stated in 2014 dollars. The capital cost estimate for the NPS 30 pipeline was developed to an AACE International Recommended Practice No. 17R-97 Class 3 level of project definition.

The following Table 3-2 provides a summary of the financial comparison.

Table 3-2: Coquitlam Gate IP Project Financial Comparison

	Alternative 4 Install NPS 24 pipeline at 2070 kPa	Alternative 5 Install NPS 36 pipeline at 1200 kPa	Alternative 6 Install NPS 30 pipeline at 2070 kPa
AACE Estimate Accuracy	***Class 4***	***Class 4***	***Class 3***
Total Direct Capital Cost excl. AFUDC & includes Abandonment / Demolition (2014$millions)	173.833	204.137	200.080
Total Direct Capital Cost excl. AFUDC (As-spent $millions)	201.164	236.702	231.632
AFUDC (as spent $millions)	10.927	12.168	12.444
Total As-spent includes Abandonment / Demolition & AFUDC ($millions)	212.091	248.870	244.076
Annual incremental gross O&M (2014$millions)	0.055	0.020	0.055
Levelized Rate Impact – 60 Yr. ($ / GJ)	0.087	0.102	0.100
PV Incremental Cost of Service – 60 Yr. ($millions))	257.908	304.520	298.714

[16] Includes project management, engineering, permits, materials procurement, construction, commissioning and contingency. For purposes of comparing alternatives, the development costs and application costs have been excluded from the capital costs in Table 3-2. These costs are the same in Alternative 4, 5 and 6 and are fully amortized before 2019 and do not impact the 2019 and 60 year average Levelized rate impact..

As shown in the above table, Alternative 4 (NPS 24 at 2070 kPa) is the least expensive compared to the other feasible alternatives with a total estimated capital cost of $201.164 million. The pipeline materials and construction costs are the largest components of the capital costs comprising 80 percent to 90 percent of the total. Therefore, the NPS 24, with the smallest diameter, is the least expensive pipeline to construct because of increased construction productivity and lower pipe steel costs. Detailed financial schedules for Alternative 4 are included in Confidential Appendix E-2-1.

Alternative 6 (NPS 30 at 2070 kPa) and Alternative 5 (NPS 36 at 1200 kPa) have similar capital cost estimates at $231.632 million and $236.702 million respectively. However since Alternative 5 has a higher cost and does not offer the system resilience of Alternative 6, no further analysis has been undertaken. Detailed financial schedules for Alternatives 6 and 5 are included in Confidential Appendices E-1-1 and E-2-2, respectively.

In addition to the financial evaluation, a calculation of the present value of operational risk was conducted on Alternatives 4 and 6 to determine the differential between the two alternatives in terms of a 60 year levelized cost when the impact of an operational risk reduction was taken into account. The present value of the operational risk was added to the present value of the cost of service to provide an overall present value comparison, which is summarized in Revised Table 3-3 below. Operational risk is a measure of loss-of-service impact, and is defined as the sum of the quantitative risk value of each pipeline section per year of operation, based on failure frequency per year and financial cost per event associated with the loss-of-service. The calculation of the annual risk reduction of $2.456 million associated with the proposed Alternative 6 is included in Appendix A-10. The calculation of the annual risk reduction associated with Alternative 4 is $0.352 million.

Table 3-3: Coquitlam Gate IP Project Financial and Operational Risk Comparison

		Alternative 4 Install NPS 24 Pipeline at 2070 kPa	Alternative 6 Install NPS 30 Pipeline at 2070 kPa
1	Potential Operational Risk Reduction Per Appendix A-10 (2014 $millions/year)	2.456	2.456
2[17]	Operational Risk Reduction (Coquitlam Gate IP Pipeline and Cape Horn to Coquitlam TP complete) (2014 $millions/year)	0.352	2.456
3	Operational Risk Reduction (%)	14.34%	100.0 %
4	Remaining Operational Risk (2014 $millions/year) (line 1-Line2)*	2.104	0
5	PV Remaining Operational Risk – 60 Yr[18] ($millions)	33.307	0
6	PV Incremental Cost of Service – 60 Yr ($millions)	257.908	298.714
7	PV Remaining Operational Risk + PV Incremental Cost of Service – 60 Yr ($millions)	291.215	298.714

** Based on potential operational risk in line 1*

[17] See section 3.1.3.4.

[18] PV Remaining Operational Risk – 60 Year was derived by applying the formula for the present value of an annuity to the annual remaining operational risk of $2.104 million using FEI's after tax weighted average cost of capital of 6.14%; PV = $2.456 x [(1 – (1 + k)$^{-n}$) / k] Where k = 6.14% and n = 60 years.

As demonstrated in Revised Table 3-3 above, the difference in operational risk reduction for Alternative 6 compared to Alternative 4 is 85.66 percent.

Referring to line 5 of Revised Table 3-3, the benefit of the PV operational risk differential for a 60 year period utilizing the Company's 6.14 percent WACC for Alternative 6 compared to Alternative 4, was calculated to be $33.307 million.

Referring to line 7 of Revised Table 3-3, where the 60 year PV Incremental Cost of Service and PV Operational Risk are added, Alternative 6 is $7.499 million more than Alternative 4.

Based on an incremental cost of $.013 per GJ and an average annual consumption of 95GJ per residential customer, the annual cost difference between the two alternatives would be $1.24 per customer.

In summary, when taking into account the reduction in operational risk provided by Alternative 6 compared to Alternative 4, and that Alternative 6 is the only alternative which meets all of the stated objectives FEI has selected Alternative 6 as the preferred alternative.

3.2.4 Conclusion – Preferred Alternative

Through the financial and non-financial evaluation of various alternatives, the Company has determined that Alternative 6 (NPS 30 at 2070 kPa) is the preferred alternative and that it will satisfy all the objectives and requirements outlined in section 3.2.1 above.

Of the seven alternatives considered, the following three are the only viable alternatives that allow the Company to meet some or all of the Project objectives and requirements:

- Alternative 4: install a NPS 24 pipeline operating at 2070 kPa;
- Alternative 5: install a NPS 36 pipeline operating at 1200 kPa; and
- Alternative 6: install a NPS 30 pipeline operating at 2070 kPa.

Each of these alternatives will mitigate the reliability, safety and regulatory risk posed by the existing NPS 20 Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and unacceptable projected leak frequency. These alternatives also present practical pipeline replacement solutions that are constructible using modern standard pipeline installation techniques. However, only Alternative 6 meets all of the Coquitlam Gate IP Project objectives and requirements.

Alternative 6 has a capital cost that is $31.985 million (as-spent dollars) greater than Alternative 4 (NPS 24 at 2070 kPa). Alternative 4, similar to Alternative 6, would mitigate the integrity risks associated with the existing NPS 20 pipeline leaks. However, Alternative 4 would not fully meet the Coquitlam Gate IP Project objectives and requirements in terms of reliability, operational flexibility or resiliency of the current Metro IP system.

An analysis of the PV of the 60 year cost of service shows that Alternative 4 is $40.806 million less than Alternative 6 and that the differential in terms of a 60 year Levelized Rate Impact between the two is $0.013 per GJ. Based on an average annual consumption of 95 GJ per residential customer, this would result in an annual cost difference between the two alternatives of $1.24 per customer.

While financial considerations have a role when selecting the preferred alternative, one of the primary objectives of the Projects together is the elimination of both Fraser Gate IP and the Coquitlam Gate IP as single point-of-failure pipelines, and to improve overall system resilience through increased system reliability, flexibility, and redundancy. As noted in the Non-Financial and Financial comparison discussion, Alternative 6 is the alternative that meets all the objectives.

By reducing all of the operational risk, improving operational flexibility, and increasing system resiliency, for a relatively small incremental cost over Alternative 4, Alternative 6 is considered the most prudent and is a cost-effective solution when all factors are considered. On this basis, it has been selected as the preferred alternative.

3.3 *PROJECT DESCRIPTION*

In this section, FEI will describe the proposed Coquitlam Gate IP pipeline replacement in more detail, including information on components, schedule, resources requirements, and risks and management.

3.3.1 Introduction

The FEI system, which supplies natural gas to the Lower Mainland and Vancouver Island, is presented in Figure 3-3. It comprises TP and IP pipelines which are illustrated as green (TP) and red (IP) for clarity. The TP pipelines have dedicated Right of Way (ROW) easements which are located within shared utility corridors, and the IP pipelines, which operate at lower pressure, are generally located within road allowances.

The Coquitlam and Fraser Gate stations are the two interface points between the TP pipeline network and the lower pressure IP pipeline network which distributes gas throughout Metro Vancouver.

The existing NPS 20 Coquitlam Gate IP pipeline, which has experienced integrity issues as previously described in section 3.1, is also highlighted in Figure 3-3. This pipeline extends from Coquitlam Gate located at Como Lake & Mariner Way in Coquitlam to East 2nd & Woodland in Vancouver and is approximately 20 km in length. The Coquitlam Gate IP Project will involve the replacement of the existing NPS 20 IP pipeline which operates at 1200 kPa with a new NPS 30 IP pipeline which will operate at 2070 kPa.

The second step required the workshop participants to propose suitable measures to reduce the risk probability or consequence (risk treatment plans) for the risks that were ranked as extreme or high. To further support the treatment plan, the ability of the proposed measures to influence the risk score was also stated.

The results of the workshop show that none of the project risks were rated with a consequence rating of 5 (Catastrophic) together with a likelihood of A (Almost certain) or B (Likely). With the treatment plan, of the three project risks that were rated with a consequence rating of 5 and a likelihood of C (Moderate), two were reduced to a likelihood of D (unlikely) and one was reduced to consequence of 4 (Major) with a likelihood of D. As a result of the treatment plan, the number of risks rated as extreme was reduced from 11 to 4, and the number rated as high was reduced from 42 to 34. These details are presented in the full risk register in Confidential Appendix A-21.

3.4 *PROJECT COST ESTIMATE*

The Company prepared the Project cost estimate based on AACE Class 3 specifications, in accordance with the CPCN Guidelines. This section discusses:

- The Project cost estimate details; and
- The financial impacts.

3.4.1 Cost Estimate Details

The total capital cost of the Project, filed confidentially in Appendix E-3-1 is forecast to be $244.076 million in as spent dollars (including AFUDC of $12.444 million and abandonment/demolition costs of $4.168 million)[21].

The Coquitlam Gate IP Project is larger in scale and more complex in detail compared to projects typically undertaken by the Company. To provide the necessary expertise FEI engaged WorleyParsons to assist with project engineering and estimating services and develop the pipeline routing, design and construction planning to the necessary level of project definition as prescribed by the AACE recommended practices. This collaborative approach ensured the estimating, forecasting, control and other processes used for the Project represent industry best practice.

This section will address the following:

- Estimate preparation plan;
- Basis of Estimate;

[21] Of the total $244.076 million dollars, $227.464 million of capital and $12.327 million of AFUDC is charged to Gas Plant in Service; $4.168 million abandonment / demolition costs plus $0.117 million of AFUDC is charged to Negative Salvage Deferral Account. The total AFUDC charged to Gas Plant in Service and to Negative Salvage Deferral Account is $12.444 million.

GST it pays on its taxable purchases. As such, the tax does not represent a net cost to the Company. 2014 market prices have been used for the material supply and construction contracts.

3.4.1.4.1 PROJECT EXECUTION COST ESTIMATE SUMMARY

The Project total installed cost, including direct and indirect costs, is presented in Confidential Appendix E-3-1. The estimated capital cost of $231.632 million plus actual AFUDC (As-spent) will be used as the control budget until replaced by more detailed estimates, and cost reports will conform at a minimum to the level of detail as set out in Confidential Appendix E-3-1[22]. LMIPSU Development and LMIPSU Application deferred costs will be tracked separately and will be reported on as well.

3.4.1.4.2 ESCALATION

An escalation rate of 4.5 percent per annum is used based on the ten year average escalation rates from Statistics Canada for industrial construction and line pipe from 2002 to 2012.

3.4.1.4.3 PROJECT CONTINGENCY AND MONTE CARLO ANALYSIS

FEI conducted a risk analysis of the project and has used the results of the analysis in determining the contingency.

The project contingency strategy used guidance from:

- AACE IR No. 40R-08 *"Contingency Estimating – General Principles"*;
- AACE IR No. 66R-11 *"Selecting Probability distribution Functions for Use in Cost and Schedule Risk Simulation Models"* (Rev. August 24, 2012); and
- WorleyParsons Guideline 002-000-PMW-266 (015251) PDP-0011 *"Cost Risk Analysis Guideline"* (Rev. March 6, 2013).

A two step approach was used to determine the Project contingency. The first step involved the use of predetermined guidelines to evaluate a single contingency value which was applied to the base cost estimate. This contingency was based on the expert opinion of the FEI and WorleyParsons engineering team combined with detailed knowledge of the project scope and risks. A flat percentage contingency was selected and applied to the estimate base cost (see Confidential Appendix A-23 – Basis of Estimate).

The second step involved a combined 'estimate risk assessment workshop' (different from the project risk workshop described in section 3.3.9.1) and 'quantitative risk analysis'. The workshop was led by a WorleyParsons facilitator and lead estimator. The quantitative risk analysis using the Monte Carlo method was conducted using @Risk software. The WorleyParsons Cost Risk Analysis report is attached in Confidential Appendix A-27. The Project

[22] Appendix E-3-1 includes an estimate of AFUDC of $12.444 million. Actual AFUDC will vary.

5. PROJECT COSTS AND ACCOUNTING TREATMENT

5.1 SUMMARY OF CAPITAL COSTS, INCREMENTAL COST OF SERVICE AND AVERAGE LEVELIZED COST

Details of the Coquitlam Gate IP Project capital costs can be found in Confidential Appendix E-1-1, Schedule 6, and in Confidential Appendix E-3-1. Fraser Gate IP Project costs can be found in Confidential Appendix E-1-2, Schedule 6, and in Confidential Appendix E-3-2.

Based on the Projects' costs, Table 5-1 presents a summary of the total forecast project costs and Table 5-2 presents the financial impacts associated with the completion of each of the two IP pipeline Projects as well as a summary of the combined rate impacts. Both tables are based on detailed schedules for each pipeline segment as included in Confidential Appendices E-1-1 and E-1-2. The impact to customer rates in 2019 (when the asset enters rate base) is approximately $0.129 per GJ and levelized over the 60 year analysis period is approximately $0.107 per GJ. For a typical FEI residential customer consuming an average 95 GJ per year, in 2019, this would equate to approximately $12.25 per year. The annual impact to customers from the Coquitlam Gate IP Project in 2019 would be approximately $11.50 per year and from the Fraser Gate IP Project would be approximately $0.75 per year.

Table 5-1: Summary of Forecast Capital and Deferred Costs ($millions)

Particular	2014$	As-Spent	AFUDC	Tax Offset	Total
Coquitlam Gate IP Project	196.544	227.464	12.327		**239.792**
Fraser Gate IP Project	14.855	17.231	0.876		**18.107**
Total Addition to Plant	211.399	244.695	13.203		**257.899**
Abandonment/Demolition Costs[26]	3.536	4.168	0.117		**4.285**
Total Projects Capital Cost	214.935	248.863	13.320		**262.184**
LMIPSU Development Cost	2.441	2.442	0.197	(0.635)	**2.004**
LMIPSU Application Cost	1.307	1.307	0.080	(0.340)	**1.047**
Total	**218.683**	**252.612**	**13.597**	**(0.975)**	**265.235**

[26] Abandonment and demolition costs will be charged to the Negative Salvage Deferral Account in accordance with BCUC Order G-44-12

Table 5-2: Financial Analysis of the Projects Reinforcements

AACE Class 3	Coquitlam Gate IP	Fraser Gate IP	Combined[27]
Total Charged to GPIS ($millions)	239.792	18.107	257.899
Abandonment / Demolition Costs ($millions)[28]	4.285	--	4.285
Total Capital Costs including Abandonment / Demolition ($millions)	244.077	18.107	262.184
2019 Rate Impact ($ / GJ)	0.121	0.008	0.129
Levelized Rate Impact 60 Years ($ / GJ)	0.100	0.007	0.107
Levelized Incremental Revenue Requirement ($millions)[29]	18.783	1.315	20.098
Incremental Revenue Requirement PV 60 Years ($millions)	298.714	21.654	320.368
Net Cash Flow NPV 60 Years ($millions)	2.449	0.303	2.752
2019 Incremental Rate Base ($millions)	240.811	17.937	258.748

5.2 *ACCOUNTING TREATMENT*

Consistent with FEI's treatment of CPCNs, the capital costs of these two projects will be held in Work in Progress Attracting AFUDC until January 1 of the year following when they are in service. The projects are planned to be in service in October, 2018. On January 1, 2019 the projects costs will be transferred to Gas Plant in Service accounts and included in the Company's Rate Base.

5.2.1 Negative Salvage

Abandonment/demolition costs related to the existing 20" Coquitlam Gate IP pipeline, and Coquitlam Gate station will be charged to FEI's existing Negative Salvage Deferral Account in accordance with the approved treatment of these costs as approved in Order G-44-12. The abandonment / demolition costs are forecast to be $3.536 million (2014 dollars) or in as-spent dollars to be $4.285 million (including AFUDC of $0.117 million). These costs are identified in Confidential Appendix E-3-1.

Charges for abandonment and demolition costs as well as the negative salvage provision are shown in Confidential Appendix E-1-1 Schedule 9 for the Coquitlam Gate IP Project and in Confidential Appendix E-1-2, Schedule 9 for the Fraser Gate IP Project (there are no abandonment or demolition costs for the Fraser Gate IP Project).

[27] Numbers in rows may not add exactly due to rounding.
[28] Abandonment and demolition costs will be charged to the Negative Salvage Deferral Account in accordance with BCUC Order G-44-12.
[29] Levelized Rate Impact for 60 Years x 187,832 TJ / 1,000; The volume of 187,832 TJ is from FEI's compliance filing for Common Rates, dated October 31, 2014, Appendix A, Schedule 5, Column 2, Row 28 (Total Non-Bypass Sales and Transportation Service Volumes.

The study makes several recommendations (based on industry best practices and applicable requirements of local regulations) to mitigate, manage and minimize potential, adverse effects and to monitor Projects' impacts as construction proceeds. Recommendations include compliance with municipal noise bylaws and limiting traffic access restrictions to businesses and residents as much as possible. The report also suggests that a Traffic Management Plan can address temporary disturbances to vehicular traffic that will, for short periods of time, reduce areas of residential and commercial on-street parking. Proposed mitigation activities to minimize any negative effects are contained in Section 3 of the report. Construction and Monitoring recommendations are outlined in Section 5 of the report.

Dillon also determined the construction of the Projects has the potential for positive employment impacts and will contribute to the local economy in the Lower Mainland, BC, Canada, and outside Canada, concluding that new jobs may be generated during the construction period. It also found economic spin-offs will be created, such as increased demand for local hospitality services (hotels and restaurants for employees working on the construction sites, etc.). FEI estimates the economic benefits (see Table 6-1) of the two upgrades will be as follows:

Table 6-1: Potential Economic Benefits

Coquitlam Gate IP *($millions – 2014 dollars)*

Cost ($000)	Lower Mainland	All BC (except Lower Mainland)	Canada (except BC)	Outside Canada	Sub-Total
Materials		1.668		31.698	33.367
Construction	107.311		45.990		153.301
Owner	13.412				13.412
Sub-Totals	**120.723**	**1.668**	**45.990**	**31.698**	**200.080**

Fraser Gate IP *($millions – 2014 dollars)*

Cost ($000)	Lower Mainland	All BC (except Lower Mainland)	Canada (except BC)	Outside Canada	Sub-Total
Materials		0.097		1.847	1.944
Construction	7.978		3.419		11.397
Owner	1.515				1.515
Sub-Totals	**9.493**	**0.097**	**3.419**	**1.847**	**14.856**

The study concludes that with the adoption of the recommendations outlined in the socio-economic report, the Projects are not expected to have any negative, long-term effects on the socio-economic conditions in the study area. There are expected to be some positive socio-economic benefits to the regional area and the province resulting from the Projects. Additionally

The financial evaluation consists of the estimated capital cost and operating cost and their impact on the levelized rates and incremental cost of service.

The cost estimates represent the estimated total cost of each alternative including project management, engineering, permits, materials procurement, and construction and commissioning. The following Table 9-2 provides a summary of the financial evaluation conducted.

Table 9-2: Coquitlam Gate IP Project Financial Comparison

	Alternative 4 Install NPS 24 pipeline at 2070 kPa	Alternative 5 Install NPS 36 pipeline at 1200 kPa	Alternative 6 Install NPS 30 pipeline at 2070 kPa
AACE Estimate Accuracy	***Class 4***	***Class 4***	***Class 3***
Total Direct Capital Cost excl. AFUDC & includes Abandonment / Demolition (2014$millions)	173.833	204.137	200.080
Total Direct Capital Cost excl. AFUDC (As-spent $millions)	201.164	236.702	231.632
AFUDC (as spent $millions)	10.927	12.168	12.444
Total As-spent includes Abandonment / Demolition & AFUDC ($millions)	212.091	248.870	244.076
Annual incremental gross O&M (2014$millions)	0.055	0.020	0.055
Levelized Rate Impact – 60 Yr. ($ / GJ)	0.087	0.102	0.100
PV Incremental Cost of Service – 60 Yr. ($millions))	257.908	304.520	298.714

Increasing the capacity of the Coquitlam Gate IP pipeline to achieve full resiliency to the Metro IP system allows for mitigation of the estimated economic impacts associated with loss of service as well as provides an operational risk reduction of approximately $2.456 million per year.

A calculation of the present value of operational risk was conducted on Alternatives 4 and 6 since Alternative 5 has a higher cost and does not offer the system resilience of Alternative 6. This was completed to determine the differential between the two alternatives in terms of a 60 year Levelized cost when the impact of risk reduction was taken into account. The present value of the operational risk was added to the present value of the cost of service to provide an overall present value comparison, which is summarized in Revised Table 9-3. Operational risk is defined as the sum of the quantitative risk value of each pipeline section per year of operation, based on failure frequency per year and financial cost per event.

Table 9-3: Coquitlam Gate IP Project Financial and Operational Risk Comparison

		Alternative 4 Install NPS 24 Pipeline at 2070 kPa	Alternative 6 Install NPS 30 Pipeline at 2070 kPa
1	Potential Operational Risk Reduction Per Appendix A-10 (2014 $millions/year)	2.456	2.456
2	Operational Risk Reduction (Coquitlam Gate IP Pipeline and Cape horn to Coquitlam TP complete) (2014 $millions/year)	0.352	2.456
3	Operational Risk Reduction (%)	14.34%	100.0 %
4	Remaining Operational Risk (2014 $millions/year)(line 1-Line2)*	2.104	0
5	PV Remaining Operational Risk – 60 Yr ($millions)	33.307	0
6	PV Incremental Cost of Service – 60 Yr ($millions)	257.908	298.714
7	PV Remaining Operational Risk + PV Incremental Cost of Service – 60 Yr ($millions)	291.215	298.714

** Based on potential operational risk in line 1*

In summary, when taking into account the reduction in operational risk provided by Alternative 6 compared to Alternative 4, and that Alternative 6 is the only alternative which meets all of the stated objectives FEI has selected Alternative 6 as the preferred alternative. The estimated capital cost for the Coquitlam Gate IP Project in As spent dollars, including AFUDC and abandonment / demolition costs is $244.076 million.

FEI evaluated a number of route options using a detailed route selection process. The overall objective of the routing process was to select the route option that minimizes potential impacts on the community, stakeholders and environment while meeting safety and construction requirements in an economical manner. The result is the preferred Coquitlam Gate IP pipeline route option which is presented in Table 9-4 relative to the existing pipeline route.

Table 9-4: Coquitlam Gate IP Project Selected Pipeline Route

Section	Existing NPS 20 Coquitlam IP route	Proposed NPS 30 Coquitlam IP route	Relative Position
1	Como Lake Avenue	Como Lake Avenue	Parallel in same road
2	Como Lake Avenue	Como Lake Avenue	Parallel in same road
3	Como Lake Avenue and Broadway	Como Lake Avenue and Broadway	Parallel in same road
4	Broadway	Broadway	Parallel in same road
5	Broadway	Broadway	Parallel in same road
6	Springer Avenue, Halifax Street, Brentlawn Drive, Lane adjacent to Brentwood Town Centre, Halifax Street, 2nd Avenue	Springer Avenue, Halifax Street, Highlawn Drive, Brentlawn Drive, Graveley Street	Parallel Street (offset one to two streets north)

Section	Existing NPS 20 Coquitlam IP route	Proposed NPS 30 Coquitlam IP route	Relative Position
7	East 2nd Avenue	East 1st Avenue	Parallel Street (offset one street north)

9.4 *LMIPSU PROJECTS SUMMARY*

A summary of the total forecast capital costs for the Projects, and 2019 average cost of service, is as follows:

- Total Capital Cost (As-spent dollars) excluding AFUDC but including abandonment and demolition cost is $248.863 million (including AFUDC the As spent cost is $262.184 million), and
- 2019 Average Cost of Service Impact - $0.129 / GJ.

For a typical FEI residential customer consuming 95 GJ per year in 2019, this would equate to approximately $12 per year and reflects an approximate increase of 3.36% on delivery margin or an approximate increase of 1.3% on the burner tip.[44]

The following Tables 9-5 and 9-6 summarize the total forecast capital and deferred costs for the Projects and the approximate average burner tip rate impacts:

Table 9-5: Summary of Forecast Capital & Deferred Costs ($millions)

Particular	2014$	As-Spent	AFUDC	Tax Offset	Total
Total Capital Cost	214.935	248.863	13.320		**262.184**
LMIPSU Development Cost	2.441	2.442	0.197	(0.635)	**2.004**
LMIPSU Application Cost	1.307	1.307	0.080	(0.340)	**1.047**
Total	**218.683**	**252.612**	**13.597**	**(0.975)**	**265.235**

Table 9-6: Summary of Approximate Rate Impacts ($/GJ)

Approximate Rate Impact	2019	60 Year Levelized Average
Coquitlam Gate IP Project	0.121	0.100
Fraser Gate IP Project	0.008	0.007
Total	**0.129**	**0.107**

[44] Approximate burner tip impact calculated based on a Residential customer's annual bill of $922 as of January 1, 2015