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November 19, 2010

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

Attention: Ms. Erica M. Hamilton, Commission Secretary

Dear Ms. Hamilton:

Re: Terasen Gas Inc. - Fort Nelson Service Area (TG Fort Nelson) 2011 Revenue Requirements Application for Changes to the Revenue Stabilization Adjustment Mechanism ("RSAM") Rate Rider and Delivery Rates effective January 1, 2011 (the "Application")

Evidentiary Update and Interim Rates

On September 8, 2010, Terasen Gas filed the Application as referenced above. In accordance with the British Columbia Utilities Commission (the "Commission") Order No. G-149-10 setting out the Regulatory Timetable, on November 12, 2010 TG Fort Nelson filed its responses to Information Requests ("IRs") No. 1. Additionally, on November 12, 2010, TG Fort Nelson filed a letter requesting an amendment to the regulatory timetable to accommodate the filing of this Evidentiary Update. On November 15, 2010, the Commission issued Letter L-92-10 issuing an Amended Regulatory Timetable. In accordance with the Amended Regulatory Timetable, TG Fort Nelson respectfully submits this Evidentiary Update, including revised Financial Schedules, included as Appendix C.. As a result of this Evidentiary Update and the resulting proposed rates, TG Fort Nelson is also hereby requesting approval pursuant to section 89 of the *Utilities Commission Act* of interim rates effective January 1, 2011.

Evidentiary Update on the Muskwa River Crossing (the "Project")

In the Application, TG Fort Nelson identified further investigative work that was necessary to determine the most appropriate alternative to address the integrity of the Project. The investigative work, including site surveys, geotechnical evaluation and other related alternative evaluation studies, and the preparation of Class 3 cost estimates for the preferred alternatives is now largely complete.

The preliminary results of the work undertaken show that the HDD Peak to Peak Option, which was originally identified as the lowest cost and most desirable of the alternatives, has encountered a geotechnical condition which will result in a significant increase in the estimated cost and risks for this alternative. As a result, the Class 3 estimate for the HDD Peak to Peak Option is $4,087,100 (see Appendix A for the HDD Peak to Peak Option Class

3 Cost Estimate Report from Chinook Engineering Ltd., which includes the HDD Geotechnical Investigation Report from BCG Engineering Inc.).

As a result of this development, TG Fort Nelson has also undertaken further investigative work on the Intermediate Pressure Bridge Crossing ("IP Bridge Option"). This option consists of the reduction of the pipeline operating pressure to intermediate pressure by the installation of a pressure reducing station just south of the south bank of the Muskwa River, and then crossing the river utilizing the Muskwa River highway bridge. As with any of the alternatives, until all required permits and approvals are obtained there is some degree of risk that the IP Bridge Option construction will not be able to proceed as designed. The Class 3 estimate for the IP Bridge Option is $2,565,650 (See Appendix B for the IP Bridge Option Class 3 Cost Estimate Report from Chinook Engineering Ltd.).

Other feasible options that were considered included an aerial crossing, and various in-stream alternatives. The aerial crossing is not preferred due to the high capital cost of construction and the long-term maintenance costs. The in-stream alternatives, although generally lower cost, are not preferred due to environmental risk and the potential for long-term financial liability related to environmental issues. However, in the event that the necessary permits and approvals for the IP Bridge Option are not obtained, one of the in-stream alternatives would be the next preferred option.

In addition to a financial evaluation, TG Fort Nelson has evaluated and summarized the non-financial risks of the various options in Table 1 below. When evaluated without consideration of the cost, the two HDD alternatives are preferred, with the IP Bridge Option ranking next.

Table 1: Evaluation of Non-Financial Screening Analysis

Vulnerability	Weight	Owner	Alternative #1 HDD Peak to Peak		Alternative #2 HDD Low to High		Alternative #3 IP Bridge		Alternative #4 Open Cut w/o isolation		Alternative #5 Live Line Lowering		Alternative #6 Rip Rap Select Material Placement		Alternative #7 Rip Rap Cabled Concrete Mats		Alternative #8 Aerial Pipeline	
			Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Natural Hazards	10	Geotech	5	50	5	50	2	20	3	30	2	20	4	40	3	30	3	30
Construction Hazards	10	Geotech	1	10	1	10	4	40	3	30	3	30	4	40	4	40	3	30
Vandalism	10	Asset Mgmt	5	50	5	50	3	30	5	50	5	50	5	50	5	50	1	10
Safety	10	Asset Mgmt	5	50	5	50	3.5	35	4	40	2	20	2	20	2	20	3	30
Environmental	20	Env Affairs	5	50	4	40	4	40	1	10	1	10	2	20	2	20	3	30
Aesthetics	6	Comm Rel'ns	5	50	5	50	3	30	3	30	3	30	2	20	2	20	1	10
First Nations	8	Comm Rel'ns	5	50	5	50	5	50	3	30	3	30	3	30	3	30	1	10
Stakeholders	8	Comm Rel'ns	5	50	5	50	4	40	3	30	3	30	2	20	2	20	1	10
Land Issues	10	Property Svces	5	50	5	50	3	30	3	30	3	30	3	30	3	30	3	30
Operational Impact	8	Asset Mgmt	5	50	5	50	4	40	5	50	3	30	3	30	3	30	3	30
Totals	**100**			**460**		**450**		**355**		**330**		**280**		**300**		**290**		**220**
Ranking			**1**		**2**		**3**		**4**		**7**		**5**		**6**		**8**	

5	High value, best choice
4	Good value, better choice
3	Moderate value, good choice
2	Questionable value, cautious choice
1	Low value, questionable choice

Vulnerability Factors - Definitions	
Natural Hazards	Considers the vulnerability during operation of the built facilities to natural hazards including seismic impacts, bank stability, and river erosion.
Construction Hazards	Considers the vulnerability of the facilities during construction to natural hazards including seismic impacts, bank stability, river erosion, and subsurface materials.
Vandalism	Considers the susceptability and attraction the faciliites may have to vandalism.
Safety	Considers the risk to the public in the event of a pipeline failure, and the risk to the well-being of employees and contractors during construction and performing maintenance or repairs. Also considers the vulnerability to third party damage.
Environmental	Considers the impact during construction and operation of the facilities to the environment including environmentally sensitive areas at the project site and downstream.
Aesthetics	Considers the visual effect of the proposed facilities that may be observed by residents and visitors in the Project area.
First Nations	Considers the effect of the project on the cultural values, economic well being, and quality of life for First Nations citizens.
Stakeholders	Considers the effect of the project on the cultural values, economic well being, and quality of life for Fort Nelson citizens and river users.
Land Issues	Considers the ability to acquire and maintain access rights necessary for construction and operation of the built facilities, the amount of land that is necessary for construction and operation, and effect on local residents.
Operational Impact	Considers the impact to employees and contractors to complete maintenance and repairs and impact to Terasen's gas distribution system.

In consideration of both the cost estimates and the non-financial considerations, TG Fort Nelson has concluded that the IP Bridge Option is the preferred option at this time, and has included the Class 3 estimate for the IP Bridge Option in its Revised Financial Schedules. The total estimated cost related to the Project that has been included in the Revised Financial Schedules in Appendix C, is $3.016 million excluding Allowance for Funds Used During Construction ("AFUDC"), as summarized in Table 2 below.

Table 2: Estimated Costs for IP Bridge Option (before AFUDC)

Year	Amount	Description
2010	$300,000	Project development and alternative evaluation costs
2011	$2,565,650	Pipeline crossing installation
2012	$150,000	Site remediation and potential ongoing completion costs
Total	**$3,015,650**	

TG Fort Nelson believes that the Project is required to continue providing safe reliable service to the residents of Fort Nelson, that the financial and non-financial considerations have been and will continue to be thoroughly addressed throughout the life cycle of the Project, and that the estimated cost of the Project of $3.016 million should be approved for inclusion in rate base in October of 2011. As discussed in the Application, When TG Fort Nelson applies for 2012 rates, it will include its best estimate of the costs of the Muskwa River Crossing Project at that time, based on actuals to date and an estimate of any remaining expenditures.

Request for Approval of Interim Rates

The Evidentiary Update results in a revenue deficiency for 2011 of $315,000 (margin increase of 21.74 per cent) as compared to the revenue deficiency of $295,000 (margin increase of 20.37 per cent) as filed in the Application. The rates that result from this revenue deficiency are shown in Table 3 below.

Table 3: Schedule of Revised Rates[1]

Particulars	Tariff @ 2010 Rates	Less: RSAM Recovery Charge (in $/GJ)	Less: Average Cost of Gas	Delivery Margin	Margin Rate Increase	Add: Average Cost of Gas	Add: Revised RSAM Recovery Charge	Tariff @ Revised Rates Jan 1/11
Rate 1 Residential								
1st Blk ≤ 2 GJ $ / Month	$ 19.370	$ (0.070)	$ (11.570)	$ 7.730	$ 1.834	$ 11.570	$ 0.065	$ 21.199
2nd Blk Next 28 GJ $ / GJ	$ 7.821	$ (0.037)	$ (5.784)	$ 2.000	$ 0.410	$ 5.784	$ 0.033	$ 8.227
3rd Blk Excess of 30 GJ $ / GJ	$ 7.763	$ (0.037)	$ (5.784)	$ 1.942	$ 0.398	$ 5.784	$ 0.033	$ 8.157
Rate 2.1 General Service - Small Commercial								
1st Blk ≤ 2 GJ $ / Month	$ 34.410	$ (0.070)	$ (11.570)	$ 22.770	$ 5.211	$ 11.570	$ 0.065	$ 39.616
2nd Blk Next 298 GJ $ / GJ	$ 8.053	$ (0.037)	$ (5.784)	$ 2.232	$ 0.478	$ 5.784	$ 0.033	$ 8.527
3rd Blk Excess of 300 GJ $ / GJ	$ 7.982	$ (0.037)	$ (5.784)	$ 2.161	$ 0.463	$ 5.784	$ 0.033	$ 8.441
Rate 2.2 General Service - Large Commercial								
1st Blk ≤ 2 GJ $ / Month	$ 34.410	$ (0.070)	$ (11.570)	$ 22.770	$ 5.211	$ 11.570	$ 0.065	$ 39.616
2nd Blk Next 298 GJ $ / GJ	$ 8.053	$ (0.037)	$ (5.784)	$ 2.232	$ 0.478	$ 5.784	$ 0.033	$ 8.527
3rd Blk Excess of 300 GJ $ / GJ	$ 7.982	$ (0.037)	$ (5.784)	$ 2.161	$ 0.463	$ 5.784	$ 0.033	$ 8.441
Rate 25 Transportation Service								
1st Blk ≤ 20 GJ $ / GJ	$ 2.319	$ -	$ (0.113)	$ 2.206	$ 0.591	$ 0.113		$ 2.910
2nd Blk Next 260 GJ $ / GJ	$ 2.145	$ -	$ (0.113)	$ 2.032	$ 0.545	$ 0.113		$ 2.690
3rd Blk Excess of 280 GJ $ / GJ	$ 1.736	$ -	$ (0.113)	$ 1.623	$ 0.438	$ 0.113		$ 2.174
Minimum Delivery Charge per Month	$ 1,458.00			$ 1,458.00	$ 368.00			$ 1,826.00
Administration Charge	$ 202.00	$ -		$ 202.00	$ -			$ 202.00
RSAM Recovery Charge	$ 0.037	$ (0.037)	$ -	$ -		$ -	$ 0.033	$ 0.033
					25.2%			
Rate Class 2.3 - Natural Gas Vehicle Fuel Service								
1st Blk ≤ 2 GJ $ / Month	$ 33.99	$ -	$ (11.57)	$ 22.42	$ 5.66	$ 11.57	$ -	$ 39.65
2nd Blk Next 298 GJ $ / GJ	$ 8.539	$ -	$ (5.784)	$ 2.755	$ 0.695	$ 5.784	$ -	$ 9.234
3rd Blk Excess of 300 GJ $ / GJ	$ 8.469	$ -	$ (5.784)	$ 2.685	$ 0.677	$ 5.784	$ -	$ 9.146
Rate Class 3.1 / 3.2 - Industrial Service < 360,000 GJ per Year								
Delivery Charge								
1st Blk ≤ 20 GJ $ / GJ	$ 2.319	$ -	$ -	$ 2.319	$ 0.591	$ -		$ 2.910
2nd Blk Next 260 GJ $ / GJ	$ 2.145	$ -	$ -	$ 2.145	$ 0.545	$ -		$ 2.690
3rd Blk Excess of 280 GJ $ / GJ	$ 1.736	$ -	$ -	$ 1.736	$ 0.438	$ -		$ 2.174
Minimum Month Delivery Charge	$ 1,458.00			$ 1,458.00	$ 368.00			$ 1,826.00
Gas Cost Recovery Charge	$ 5.784		$ (5.784)	$ -	$ -	$ 5.784		$ 5.784
RSAM Rate Rider	$ 0.037	$ (0.037)		$ -	$ -	$ -	$ 0.033	$ 0.033
Rate Class 3.3 - Industrial Service ≥ 360,000 GJ per Year								
Delivery Charge								
1st Blk ≤ 20 GJ $ / GJ	$ 2.319	$ -	$ -	$ 2.319	$ 0.591	$ -		$ 2.910
2nd Blk Next 260 GJ $ / GJ	$ 2.145	$ -	$ -	$ 2.145	$ 0.545	$ -		$ 2.690
3rd Blk Excess of 280 GJ $ / GJ	$ 1.736	$ -	$ -	$ 1.736	$ 0.438	$ -		$ 2.174
Minimum Month Delivery Charge	$ 1,458.00			$ 1,458.00	$ 368.00			$ 1,826.00
Gas Cost Recovery Charge	$ 5.784		$ (5.784)	$ -		$ 5.784		$ 5.784
RSAM Rate Rider	$ 0.037	$ (0.037)		$ -		$ -	$ 0.033	$ 0.033

Based on the Amended Regulatory Timetable in Commission Letter L-92-10, a Commission Order approving permanent rates will not be issued in sufficient time for TG Fort Nelson to implement new permanent rates by January 1, 2011. Accordingly, pursuant to section 89 of the *Utilities Commission Act,* TG Fort Nelson seeks approval of the revised rates, set out in

[1] TG Fort Nelson does not have any customers in Rate Classes 2.3, 3.1, 3.2, 3.3

Table 3 above, on an interim basis, effective January 1, 2011. A draft form of the order sought is included in Appendix D.

If you require further information or have any questions regarding this submission, please contact the undersigned.

Yours very truly,

TERASEN GAS INC.

Original signed by:

Diane Roy

Attachments

cc: Registered Parties

Appendix A

HDD PEAK TO PEAK OPTION CLASS 3 COST ESTIMATE REPORT

TP168.3mm Muskwa River HDD Crossing

Class 3 Cost Estimate
(FID 32004)

Prepared for Terasen Gas Inc.
By David Bainbridge, P.Eng

0	10.11.18	Issued for Use	DGB	PT					
Rev.	Date (yy.mm.dd)	Issue	Originator	Checked	Discipline Lead	Project Lead	Engineering Manager	Project Manager	Client

CHINOOK Document	09-312-PL-15-01
Client Document No.	32004.1001
Revision No.	0
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Appendix B Muskwa River HDD Construction Plans
Appendix C Muskwa River HDD Cost Estimate WBS Summary
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Appendix E Entec Muskwa River HDD Design Report
Appendix F Muswka River HDD Project Schedule

1. Summary

1.1 Project Description

The 168mm O.D. Fort Nelson transmission lateral crosses the Muskwa River at kilometre post 17+300 and is presently at risk due to severe channel scour as the pipeline is exposed at the thalweg of the watercourse. Immediate action is required, as the risk to the pipeline has been classified as High according to the Terasen Geotechnical Hazards Database. After evaluation of a number of remediation options, this document summarizes the AACE Class 3 estimate for the primary option from the project FEED study: a 168mm O.D. peak to peak Horizontal Directional Drill (HDD) crossing of the Muskwa River to replace and abandon the existing crossing.

1.2 Cost Estimate Objectives

This cost estimate is advancement from the Class 4 cost estimate issued on September 3rd, 2010, contained within the document "32004.0901 Muskwa River Crossing FEED Study R1". The Class 4 estimate was completed prior to obtaining geotechnical boreholes to prove feasibility of a horizontal directional drill. The geological subsurface has now been mapped and the crossing is feasible by HDD but under special conditions: extensive and costly wash-over casing is necessary to complete the crossing; casing which was not accounted for in the Class 4 estimate as there was no justification to assume gravel layers were so extensive. Although feasible, the crossing is technically very challenging and high risk.

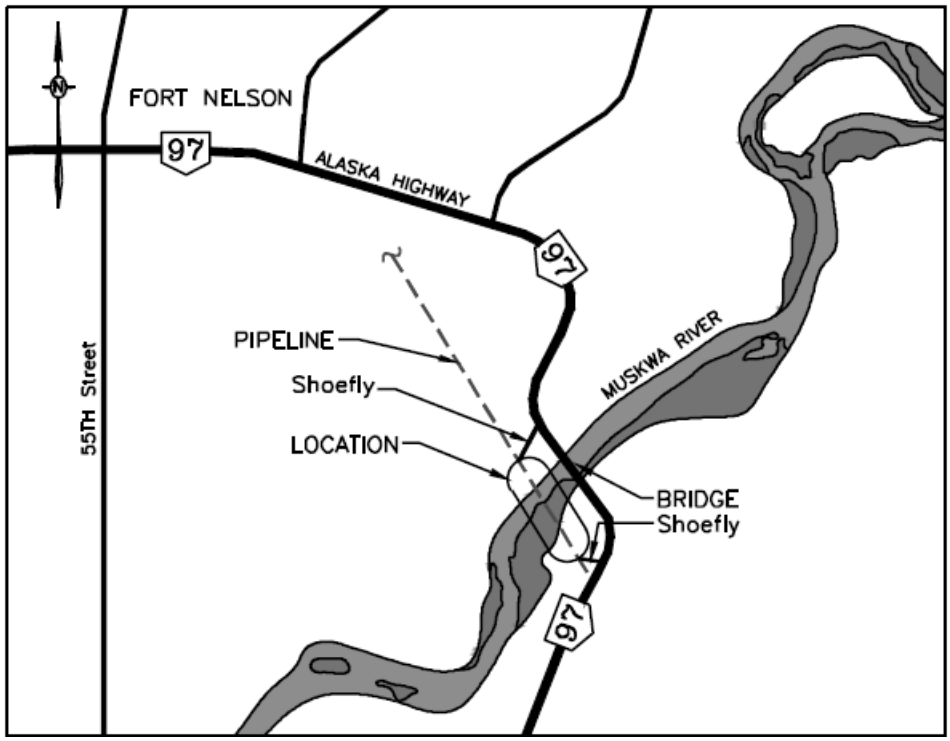
The objective of the Class 3 Cost Estimate is to provide cost information to Terasen Gas to be submitted to the British Columbia Utilities Commission in order for the remediation of the Muskwa River to be included in the yearly rate application. The objective includes:

- Summarize the present condition of the crossing and the present risks incident on the exposed pipe. Asset risks are described in detail in the "32004.0901 Muskwa River Crossing FEED Study R1" document dated September 3rd, 2010;
- Describe and evaluate the directional drill of the watercourse in terms of cost, constructability, risk, lands, schedule and environmental impact; and
- Summarize the replacement costs to an AACE Class 3 level.

1.3 Project Location

The Muskwa River crossing is located approximately 3 km (by road) southeast of Fort Nelson in British Columbia. The pipeline crosses the river about 75 m upstream of the Alaskan Highway (#97) bridge outside Fort Nelson. At the crossing location, the Muskwa River flows southwest to northeast and meanders irregularly. There is a slight bend in the channel at the crossing reach. An oxbow is located about 2.5 km downstream of the crossing. Figure 1 shows a location map of the watercourse crossing.

Figure 1: Location Map



2. Present Asset Condition

The crossing reach is mildly sloped (0.04%), relatively wide (180 m), and single-threaded. Considerable bank erosion on the north bank spans at least 200 m along the channel, crossing over the pipe. A large gravel and sand bar is located on the south bank, which is used for launching boats. On the southeast side of this bar, a topographic low is occupied during high flows, forming a high water channel.

A survey of the Muskwa River crossing was conducted on September 28th, 2008 by Midwest Surveys. The survey indicates that there is approximately 12 metres of exposed pipe on the north side of the channel, near the thalweg.

The river flow is constricted by the gravel bar attached to the south bank. The deepest part of a significant scour hole, that is about 1.2 m deeper than the average grade of the bed, is located 30 m upstream of the pipeline. The pipeline crosses this scour hole where it is about 0.7 m below the average bed grade. Depth of cover is generally shallow across the whole crossing, including under the south bank gravel and sand bar. The minimum depth of cover along the gravel bar is 0.36 m. This was the first depth of cover survey that has been conducted at this location. Wetted width of the channel is approximately 100 metres.

Bank erosion persists along the north bank, which is commensurate with the meandering channel plan and the existence of the large bar on the south bank that diverts the flow to the north. Scour at the channel north is also due to the effect of spiralling flow concentration on the outside edge of the meander.

Due to the river hydrology, it is expected that the section of exposed and unsupported pipe will continue to expand over time further adding to the risk to the pipeline. Eventually the exposed pipe will reach an unsupportable length and the pipe will yield with possible rupture.

3. Scope of Work

3.1 Stream Characteristics

The Muskwa River is within the McKenzie River basin in north-eastern British Columbia and has an assumed BC Riparian Class of S1-B; meaning the active flood plain is assumed to be a function of the stream channel dimensions (channel width is greater than 100m wide). As an S1 classified watercourse, the watercourse is ranked as having high fish and fish habitat value with the following riparian areas:

- Riparian Management Area of 70 m;
- Riparian Reserve Zone of 50 m; and
- Riparian Management Zone of 20 m.

The Muskwa River has a mean annual flow rate of 215 m^3/s based on Water Survey of Canada reporting.

In BC, detailed information regarding fish distribution and lake and stream information is available on Fish Wizard (BC Ministry of Forests 2007) and includes known presence of fish species of particular conservation concern as well as other sport, coarse, and forage fishes. Based on listed species in Fish Wizard, it is assumed the Muskwa River is classified as an S1 fish-bearing watercourse with a window for instream work from July 15th to August 15th.

3.2 Codes and Standards

Most recent revisions of the following industry design codes are applicable to the design of the horizontal directional drill of the watercourse.

- Canadian Standards Association (CSA) Z662, 'Oil and Gas Pipeline Systems'; and
- CSAZ245.1, 'Steel Line Pipe'.

3.3 Design Specifications

Pipe materials shall be specified according to parameters outlined in Figure 2.

Figure 2: Line Pipe Specifications

Specification	Muskwa River Crossing
Start Location	KP17.3
End Location	KP 17.9
Design Service	Sweet Dry Natural Gas
Outside Diameter	168.3 mm
Wall Thickness	7.11 mm
Drill Length	538 m
Total Pipeline Length	610 m
Material Code	CSA Z245.1
Material Grade	Gr. 290
Material Category	Cat II
MOP	7,960 kPa
Class Location	3
Design maximum stress	Design to 50% SMYS (Class 3) Allowable 72% SMYS (Class 1)
Seam	ERW
Design Temperature	-18 to +50 °C
Coatings	CSA 245.20/21 Shaw Bredero DPS
Joint Coating	Brush Grade Epoxy / HDD Heat Shrink Sleeve

3.4 Cost Estimate

The cost estimates was developed to AACE Recommended Practice No. 18R-97 and is considered a Class 3 estimates with the following tolerances: low -20%, high +30%.

Estimates are built based on resource loading; meaning the number of man hours and equipment is estimated based on detailed construction plans developed for the HDD of the watercourse and feasibility of the plans are proved through obtained geotechnical boreholes and geophysical mapping. Labour rates utilized in the estimate are an average of selected 2009 Fort St. John pipeline contractor rates. Construction plans are included in the Appendices.

A contingency of 15% has been added to account for miscellaneous services, materials, shipping and labour. No cost escalation factors were employed to account for accruals to be incurred in the future (i.e. inflationary / deflationary).

3.5 Schedule

The environmental impact of a HDD on the watercourse is limited as entry and exit pads are located outside of the river riparian zones, therefore fisheries timing windows do not limit the construction schedule. If the project is to commence at the start of 2011, the crossing can be installed and commissioned prior to October 15th, 2011.

A (high level) construction schedule is included in Appendix F.

3.6 Regulatory Approvals Commentary

In BC, the Provincial Water Act provides standards to reduce disturbance to aquatic habitat and fauna that may result from instream activity associated with petroleum road, or other petroleum or pipeline-related operations in British Columbia (British Columbia Ministry of Water, Land and Air Protection, MWLAP 2004a). In addition, timing windows set by the British Columbia Oil and Gas Commission (BC OGC 2005) describe acceptable timing for oil and gas project works in fish-bearing streams and are used as a tool to reduce adverse affects of construction-related disturbances to fish species during sensitive life-history stages. Best Management Practices (BMP) provided by the BC OGC (2004) outline the most favourable construction methods. Although somewhat flexible, any requested variation to the timing windows or BMPs may require a site-specific review to determine the level of sensitivity related to any particular work in-stream. Provincial and federal agencies (e.g., BC Ministry of Environment) may participate in such revisions or refinements. A review of the OGC BMP indicates that a trenchless crossing of the Muskwa River is the preferred option.

The Federal government, through Transport Canada and the Navigable Waters Protection Act (NWPA), provides for uninterrupted navigation of Canada's waterways. A HDD of the crossing will not disrupt navigation of the waterway.

The Federal government, through Fisheries and Oceans Canada (DFO), also has jurisdiction through the Fisheries Act over watercourses that may be affected temporarily or permanently, by crossing construction. The Fisheries Act prohibits the destruction of fish; harmful alteration, disruption, or destruction of fish habitat (HADD); and deposition of deleterious substances into water frequented by fish, or into places that may result in the deposition of deleterious substances into other water frequented by fish (sections 32, 35, and 36 of the Act, respectively). A HDD of the crossing will be fully contained outside the riparian boundaries of the watercourse therefore HADD will most likely not be incurred.

The pipeline is under the jurisdiction of the Oil & Gas Commission of British Columbia. Application will have to be made to the Commission by the routine process under the existing asset project certificate.

3.7 List of Consultation and Regulatory Approvals

The following lists all known permits required for the project. For an oil and gas project under the jurisdiction of the Oil and Gas Commission, the OGC acts as an entry point into the multi-ministry permit approval process through BC FrontCounter.

- Canada, Public Works and Government Services Canada (PWGSC):
    - Application and approval for the use of temporary workspace to access the job site.
- Canada, Department of Fisheries and Ocean (DFO)
    - Authorization under Section 35 (2) and 32 of the Fisheries Act and application for a Letter of Notification for the trenchless crossing of a fish-bearing watercourse.
- Canada, Transport Canada - Navigable Waters Protection Program
    - Authorization to cross a navigable waterway.
- British Columbia Ministry of Environment (MOE):
    - Permits required under appropriate sections of the Water Act for works in, or about a stream in BC;
    - Approval for temporary short-term use of water (Section 8 under the BC Water Act) and approval for work in and about a stream (Section 32);

- Authorization under the BC Environmental Management Act under appropriate sections for the management of waste generated by the project;
- Permits under Section 40 of the Wildlife Act if works results in the temporary closure to hunting, trapping and guide during a construction activity; and
- Consultation for any other restrictions due to rare or threatened wildlife or fauna.

- British Columbia Ministry of Integrated Land Management Bureau (ILMB):
  - Application of Occupation and Use of Crown land under the Land Act for the use of temporary workspace during construction;
- British Columbia Ministry of Forest and Range (MOFR):
  - Master License to Cut Agreement. A license to Cut for the clearing of temporary workspace;
  - Burning Reference Number - Forest Fire Prevention and Suppression Regulations for disposal of scrub and non-merchantable timber; and
  - Permitting for site cleaning / preparation.
- British Columbia Ministry of Tourism, Sport and the Arts (MTSA):
  - Heritage Conservation Act Clearance that no impacted sites exist within the project workspace.
- British Columbia Ministry of Transportation and Infrastructure (MOTI):
  - Permits related to access and road construction from BC MOTI, in addition to any access permits required from the BC MOFR and the BC OGC.
  - Application and approval for two temporary access road approaches off of Alaska Hwy #97 to access the job site.
- BC Oil and Gas Commission (OGC):

- Crossings not constructed to the standards outlined in the BC Environmental Protection and Management Regulation Guidebook (EPMR) are considered non-routine. A non-routine stream crossing deviates from the best management practices outlined within the EPMR Guidebook and requires a mitigation strategy or justification to be submitted as part of the additional application requirements; and

- The crossing by HDD of the Muskwa River is considered a crossing by best management practices and as such, would be an application by the routine process under the Oil and Gas Activities Act – Pipeline Regulations for a pipeline alteration or replacement. Work would be completed under the Terasen Gas Fort Nelson certificate.

- Northern Rockies Regional Municipality (NRRM):
  - Refuse permits; and
  - Weed control.

- Fort Nelson First Nations:
  - The Fort Nelson First Nations has been advised of the project and consultation activities will commence once the project crossing methodology is selected.

4. Horizontal Directional Drill Crossing

A trenchless technology, by horizontal directional drill (HDD), is the preferred selected crossing methodology from the project FEED study. Trenchless means to cross a watercourse without disturbing the in-stream portion of the crossing or the banks of the crossing. An HDD uses a slant drill to traverse under the watercourse and where practical also the stream approach slopes.

HDD is selected as a crossing methodology for any high fish and fish habitat crossings where suitable subsurface geology exists or where watercourses are likely to be under flowing conditions during construction.

HDD is selected as it allows for:

- No sediment release;
- No disturbance of streambed or banks;
- Maintains stream flow;
- Maintains fish passage;
- Maintains vegetative buffer on both sides of the watercourse;
- Not likely to result in HADD;
- Minimizes clean-up of bed and banks;
- Allows for a large construction window;
- Reduces reclamation activities; and
- Reduces long-term maintenance requirements.

4.1 Description of Work

A HDD of the Muskwa River would be approximately 538 metres in length based on the ‘peak to peak’ design layout shown in Appendix A.

Geotechnical investigation by subsurface boreholes and geophysical surveying, by combined seismic refraction and ground penetrating radar, has been completed at the crossing and results indicate the watercourse can successfully be crossed by HDD but the crossing will be technically very difficult, costly and will required the installation of extensive wash-over casing at both the entry and exit sides of the crossing. Results from the geotechnical investigation are summarized in BGC Engineering Ltd report 0093-090 (November 12, 2010) attached in Appendix D. HDD technical feasibility is summarized in the Entec Muskwa River HDD Design Report 430 (November 12, 2010). The reports describe two crossing options: a 'low to high' and a 'peak to peak' crossing.

For the purpose of this estimate, the 'peak to peak' crossing was selected as it has less environmental impact and eliminates the risk of a future wash out. Drilling lengths and casing requirements are similar between both options but it is unknown if approvals would be granted by authorities having jurisdiction to construct the crossing within the river channel for the 'low to high' option.

Borehole data is included in the BGC report and shows that along the proposed drill path compact dense well-graded gravel and sand will be encountered at entry, indicating that wash-over casings will be required at both the entry and exit locations of the drill. At the entry location, 136m of telescopic casing will be required. At the exit location, 67m of telescopic casing will be required. It will be a major undertaking to install the casing as installations to the indicated depths are a rarity for HDD crossings and if casing cannot be installed to adequate depths, the drill will most likely fail.

The drill is proposed to be completed by an intersect drill, meaning two rigs will drill from opposite sides of the river and meet at the halfway point. Overall the HDD is ranked by Entec in the top 1% of most costly drills in Western Canada.

Under the channel of the river, the drill path will encounter hard low plastic silts and has a high probability of success through this layer. This layer may contain cobbles and boulders that would always provide risk to any drilling activity.

4.2 Land Requirements

The pipeline alignment for the crossing will be located within the existing Alaska Highway easement. No new permanent right-of-way will be required to install the pipeline crossing. Some temporary workspace will be required outside of the road easement on BC Crown Lands.

The following temporary workspace is required in order to install a HDD:

- Approximately 0.45 hectares of total temporary workspace to facilitate access to and for the drilling work pad on the north bank (exit side). Temporary workspace is both within the Alaska Highway easement and on Crown Lands; and

- Approximately 0.45 hectares of total temporary workspace to facilitate access and for the drilling work pad on the south bank (entry side). Temporary workspace is all within the Alaska Highway easement and on Crown Lands.

Workspace land tenure is held by both the BC MOTI and BC Crown Lands (BC ILMB) and permissions must be sought from those authorities having jurisdiction.

4.3 Design Basis

The HDD design has been completed by Entec and the basis is explained in the report included in Appendix E.

4.4 Schedule

Upon project initiation, it will take approximately 6 months to design the crossing, procure materials and secure necessary permits, with all activities run concurrently. Total project duration is approximately 10 months. If the project commenced in mid-January of 2011, a drill could be installed by mid-October 2011. The crossing site would be reclaimed by the start of November 2011 with summer clean-up following the next year.

A 538m HDD of the watercourse will likely take approximately 43 days to mobilize, drill and pull back the line pipe. Site preparation, stringing and welding of the drill string and site cleanup will add another 17 days of construction time. The total construction of a HDD crossing of the Muskwa River is approximately 60 workdays.

The construction schedule is not limited by fish windows and could conceivably be completed in either the fall or winter construction periods.

4.5 Construction Plan

Preliminary and high-level construction plan would be as follows:

- Obtain geotechnical boreholes along the proposed drill path to confirm feasibility (*completed*);

- Once construction contract and regulatory approvals are in place, general contractor will mobilize to site;

- Contractor is to clear access into the site and project work pads; decking all merchantable wood for eventual shipping to the nearest accepting mill (minimal amounts estimated as it is not known if any mills in the area are presently accepting poplar for pulping). All scrub will most likely be able to be burned on-site;

- Contractor is to grade and prepare the drilling work pads and drill string layout areas. Rig matting may be required depending on surface water levels;

- Contractor will receive all materials, and string, weld and coat owner supplied line pipe to form the drill string. The drill string will be hydrostatically tested prior to pullback.

- HDD (sub)-contractor is to mobilize to site;

- HDD (sub)-contractor will mobilize and anchor augering equipment onto the drilling pad. Contractor will hammer in telescopic casing pipe into the ground using pneumatic compression to remove hammer spoils, welding each joint at interval until appropriate casing depths are achieved. Pile pounding equipment will move off the drilling pad. Casing pipe will allow the drilling rig to traverse the gravel layer.

- HDD (sub)-contractor will mobilize two drilling rigs – one onto the entry pad and the other to the exit pad. Rigs will be anchored to the site. Contractor will drill a pilot hole with each respective rig. The two drills will intersect at the approximate halfway point under the river. The entry drill will 'chase' the exit drill out of the pilot hole. The drill rig will pull-back the drill string with possible back-reaming;

- Contractor will gauge and hydrostatically test the drill string after installation. After testing, the pipe will be dewatered to specification;

- HDD (sub)-contractor will demobilize from site once pull-back is complete and pipe integrity confirmed;

- Contractor will add several joints of pipe to each end of the installed drill string to facilitate hot tie-ins;

- Terasen Gas tie-in crew will mobilize and using stopple fittings will tie-in and gasify the drill string; and

- Contractor will clean-up the work site and de-mobilize.

4.6 Construction Estimating Assumptions

The following assumptions, with regards to project construction, have been made for estimating purposes:

- Traffic Management – One full-time traffic control person shall be employed for the duration of construction to direct and manage heavy equipment and material load in / load out.

- Access – Two temporary access roads will be constructed off the Alaska Highway to access both the north and south bank drilling pads. Minimal clearing will be required to construct these access routes.

- Site Infrastructure – The pipeline contractor will mobilize a simple site office trailer with a small tool crib. Site infrastructure and rentals for the duration of construction include:

    - Two portable toilets; one for each bank of the river; and

    - Electrical generating set for office power requirements. (Drill rig will have independent power generating capabilities).

- Site Security – No provision has been made for overnight site security.

- Delivery of Materials - All materials shall be classified as “Free-On-Board” at each respective vendor or manufacturer’s location or depot. It shall be the contractor’s responsibility, unless otherwise indicated, to identify and contract for the requirements for the transportation of goods to site and their handling to specification.

- Delivery of drill string Pipe - A flat deck is capable of transporting 30 double-random joints of pipe. 50 joints are required which will require two flat deck deliveries. Transportation is assumed to be 12 hours at $250 / hr for driver and rig or $3000 per load.

- Delivery of 64mm crush for access and work pads – The estimate assumes all aggregate is locally available with a one hour delivery time at $165 / hr.

- Right-of-Way Construction Widths – are summarized in Appendix B. Total temporary workspace required is approximately 0.9 hectares.

- Erosion Control – Erosion control measures shall be installed before grading operations consisting of: silt fencing, straw bales and run-off prevention measures.

- Right-of-Way Clearing and Grubbing – The entire length of construction right-of-way will be cleared and grubbed including the removal of all trees, brush, and existing deadfall/ stumps. Based on review of aerial photography, this clearing work is assumed to be minimal and will be completed by excavator and dozer. No feller-bunchers are assumed to be required. It is assumed no merchantable timber exists within the construction right-of-way. All debris will be burned, chipped or dumped. Poplar to 1m in diameter exists within the drilling work pads. If an accepting mill is found, poplar will be felled, cut to specification and decked at indicated sites. No provision has been made for shipping of wood to the required mill.

- Right-of-Way Grading – Grading shall be completed for equipment travel and lay down of material. Minimal provision for topsoil conservation has been made as the soil subsurface will not be disturbed. Allowance has been made for minor soil stripping at the drilling work pads to create a working base.

- Grade Rock – Geotechnical investigation indicates no grade rock is present within working depths.

- Foreign Utilities – No foreign utilities have been identified. It is assumed safe clearance distances shall be maintained from any overhead powerlines and no special provisions are required. An old wood culvert has been identified on the north bank of the river. The drill will bypass this culvert at considerable distance and no special provisions for its crossing have been made.

- Welding – No provision for pipe replacement or repair has been estimated.

- Non-Destructive Examination – All circumferential welds shall be 100% inspected by radiography.

- Pipe Coatings – It is assumed that 0.5% of all delivered pipe surface area will require recoating based on handling damage.

- Pipe Bedding – All pipe tie-ins shall be sand embedded and capped with native material.

- Warning Signs – Signs shall be placed at the top of each bank indicating a pipeline crossing of the river.

- Test Leads - No provision for test leads has been estimated.

- Hydrostatic Testing – Testing shall occur on the drill string both pre-pullback and post-pullback to ensure pipeline integrity.

- Quality Control – Upon installing the pipeline, a gauge plate shall be run through the line to confirm the absence of any buckles, dents or wrinkles.

- Right-of-Way Clean up - Primary clean-up to be completed as soon as practical following construction with a small summer restoration crew to complete: reseeding, vegetation clean up, and seepage control the following year.

- Harmful Alteration, Disruption, or Destruction of fish habitat (HADD) – No disturbance of the riparian of the watercourse has been assumed. HADD costs are assumed not to be required.

- Construction Inspection – Inspection shall include one lead inspector, two drilling inspectors (working in 12 hour shifts) and one environmental inspector for the full duration of the construction.

- Horizontal Directional Drilling – HDD costs were prepared by Entec of Calgary, Alberta, including mobilization, casing installation, casing removal and demobilization. Entec's design report is attached in Appendix E.

4.7 Environmental Impacts

A HDD of the Muskwa River offers the benefit of not disrupting the in-stream, banks or riparian of the watercourse. Installation would employ all best management and construction practices.

A site specific Environmental Protection Plan is typically prepared for the project prior to construction and included in contract documents but no special requirements are foreseen outside of standard industry best practices.

4.8 Cost Estimate

Detailed cost estimate work breakdown summary sheet is included in Appendix C and the total installed cost estimate for a 538m long 'peak to peak' crossing of the Muskwa River by HDD is:

Lower Bound (-20%)	Mean	Upper Bound (+30%)
$ 3,269,680	$ 4,087,100	$ 5,313,230

The installed cost of the drill is $6,700 per meter (based on 610m of installed pipe), which would make it one of the top 1% of most costly drills installed in Western Canada as found by Entec.

Major risks of the HDD include:

- Inability to hammer casing pipe to required depths. If casing does not extend past the gravel stratigraphic layer, the drill most likely will not be successfully completed;
- Unknown subsurface conditions during drilling, such as the intersection of boulders, that reduce the probability of completing a successful drill; and
- A 'frac-out' midstream that requires significant clean-up effort. It is important to note that a drill may be completed while 'frac'ing' into a fish-bearing stream provided mitigation actions are implemented.

4.9 Class 4 to Class 3 Variations

The Class 4 estimate reported a mean cost of $1,643,200. The Class 3 mean estimate is $4,087,100 or an increase of $2,443,900 due to the following new information discovered during the feasibility analysis of the HDD:

- Significant depth of gravel has been discovered at the entry and exit locations requiring the installation of wash-over casing to install the HDD. Estimated cost to install the casing is $1,847,948 which comprises the majority of the deviation from the original Class 4 estimate. It was known from historical information that a gravel seam existed at the immediate subsurface of the drill but the depth of the seam is significantly more than originally predicted;
- The original peak to peak drill length was assumed to be a minimum length drill at 460m. This length has now increased to 538m or a 15% increase to allow navigation through favorable subsurface zones. This increases drilling and material costs and unit construction rates by 15% or roughly $143,000;
- Additional pipe lengths have been added to facilitate hot line tie-ins. The Class 4 estimate assumed 560m of total pipe was sufficient, which has been revised to 610m to transition from the drill entry and exit locations to the hot lines; and
- A 15% contingency was maintained from the Class 4 to the Class 3 estimate and if applied to the aforementioned cost increases, the result is approximately $320,000.

4.10 Included Costs

The following costs are included in the estimates:

- Aggregate materials including crush rock, sand and pit run gravel;
- Field contractor's labour, equipment, consumables, home office costs and profit;
- Engineering, procurement and construction management costs;
- Construction monitoring and inspection, material quality control inspection and environmental monitoring and inspection;
- Third party costs such as non-destructive examination (NDE), hydrovac services, surveying, pressure and water trucks, etc;
- All miscellaneous materials of construction and installation; and
- Contingency of 15% to cover miscellaneous items and unforeseen construction impacts.

4.11 Excluded Costs

The following costs are excluded from the estimates:

- Development costs to date, including geotechnical boreholes now completed (boreholes were included in the Class 4 estimate);
- Third party legal, environmental, public relations and land services or permits;
- Construction right-of-way acquisition costs or timber stumpage costs;
- Municipal or third party negotiations; and
- Harmonized Sales Tax on material, labour and services.

5. Estimate Methodology

5.1 Reference Documents

The estimates were developed using the information provided in the following documents:

- 32004.0901 Muskwa River Crossing FEED Study – Revision 1 (03Sept10);
- BGC Engineering Inc - Terasen Gas Stage 3 Hydrotechnical Risk Analysis of Selected Crossings in British Columbia, Report 0093-065-05 (31Dec08);
- BGC Engineering Inc - Terasen Gas Horizontal Directional Drilling Geotechnical Investigation for the Muskwa River Crossing, Report *0093-090* (12Nov10); and
- Entec Muswka River HDD Design Report, Document *430* (12Nov10).

5.2 Survey Drawings

Survey drawings were developed for the site by EDI of Fort Nelson, BC. Drawings were used as a base layer for all subsequent design drawings.

5.3 Detailed Engineering Drawings

The following detailed design and construction drawings were created to frame and support the cost estimating process:

- 32004.1004 Muskwa River HDD Design;
- 32004.1008 Muskwa River North Bank Clearing Plan;
- 32004.1009 Muskwa River North Bank Grading Plan;
- 32004.1010 Muskwa River North Bank Drill String Layout;
- 32004.1011 Muskwa River North Bank Remediation Plan;
- 32004.1012 Muskwa River South Bank Clearing Plan;
- 32004.1013 Muskwa River South Bank Grading Plan;

- 32004.1014 Muskwa River South Bank Drilling Rig Layout; and
- 32004.1015 Muskwa River South Bank Remediation Plan.

5.4 Unit Price Costs and Quantities

Unit price costs were estimated based on recent construction experience and consultations with local contractors.

Unit prices quantities were estimated using typical pipeline estimating methods for Canadian pipeline construction.

5.5 Pipeline Construction Execution

It was assumed that the pipeline work will be contracted in the following manner:

Construction:	Prime Pipeline Construction Contractor
NDE / ECDA:	Sub-contract to Prime Pipeline Contractor
HDD Contractor:	Sub-contract to Prime Pipeline Contractor
Project office:	One site Office located in Fort Nelson, BC.

Pipeline contractors' fees for the administration of sub-contracts are included in the estimate at the rate of 5%.

6. Feasibility and Risk

The success of a HDD is conditional upon the geotechnical subsurface conditions at the crossing location. In-situ geotechnical boreholes have been obtained and indicate good probability of success at full drilling depth through a layer of hard low plastic silts with varying fractions of clay, gravel and sand but potential mud circulation issues exist at the immediate subsurface (approximately 15.5 to 24.5m below the surface) due to a thick compact dense gravel layer. This thick gravel layer is not suitable for drilling.

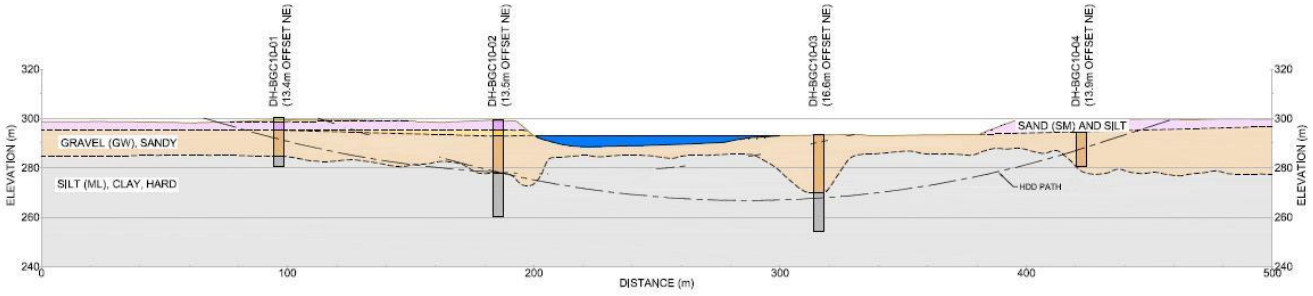
The gravel layer will cause drill borehole instabilities, collapse of the borehole and possible drilling fluid losses into the substrate. The presence of the gravel layer necessitates that wash-over casing be installed at both the entry and exit locations to mitigate the risk of inadequate wall support and excessive scour by the drilling mud circulation. At the entry, 136m of telescopic casing is required and at the exit, 67m of telescopic casing is required (to traverse the 15.5m to 24.5m deep gravel layer). The required casing lengths are technically very risky as they represent one of the longest casing installations in the last five years in Western Canada.

After casing installation, further technical complications are present as two drill rigs must drill the crossing from opposing sides of the river, intersecting at the halfway point. The intersection point is under the river which poses difficulties in aligning the leading edge of each drill string as tracking abilities are poor under surface water if equipment is unable to be lain out across the river.

All the technical challenges of a drilled crossing of the Muskwa River result in a per meter cost that is in the range of the most costly 1% of HDD crossings in Western Canada as described by Entec.

Additional comments on feasibility are included in the attached BGC Engineering geotechnical report attached in Appendix D and the Entec HDD design report in Appendix E. Figure 3 shows the interpreted stratigraphic subsurface by BGC Engineering Ltd from the attached report.

Figure 3: Interpreted Statigraphy



Other risks associated with the project are related to factors that are addressed by the detailed project execution plan, developed prior to construction, such as:

- Availability and experience of the contract crew for the duration of the construction;
- Variations from expected site conditions and access;
- Changes in expected market competitiveness; and
- Inability to drive casing to required depths to traverse the gravel layer.

The aforementioned points are some examples of factors or potential risks that could affect the construction schedule, overall productivity of construction and estimated material costs. The last point, inability to drive casing to required depths, may result in the complete failure of the drill and accrual of all costs without the successful completion of the project. The other risks should be successfully managed within the upper bound of the AACE Class 3 cost estimate (i.e +30%).

7. Summary

Remediation of the 168mm O.D. Fort Nelson transmission pipeline exposure at the Muskwa River is feasible by HDD based on geotechnical investigation but due to depth of discovered gravel, the crossing is more risky and more expensive than the previous Class 4 estimate. Class 3 cost is $ 4,087,100.

The discovered gravel seam requires significant casing at each end of the crossing and necessitates an intersect drill. The length of casing significantly increases the cost and risk to construct a HDD crossing of the Muskwa River rendering it one of the most costly and challenging to be attempted in Western Canada in recent history. There is significant risk the drill will fail and there exists the probability the full cost estimate value may be accrued without successfully completing the crossing if known drilling risks materialize.

I trust the above satisfies your requirements at this time and provides adequate details in estimating the construction costs and cost risks for crossing the Muskwa River by HDD.

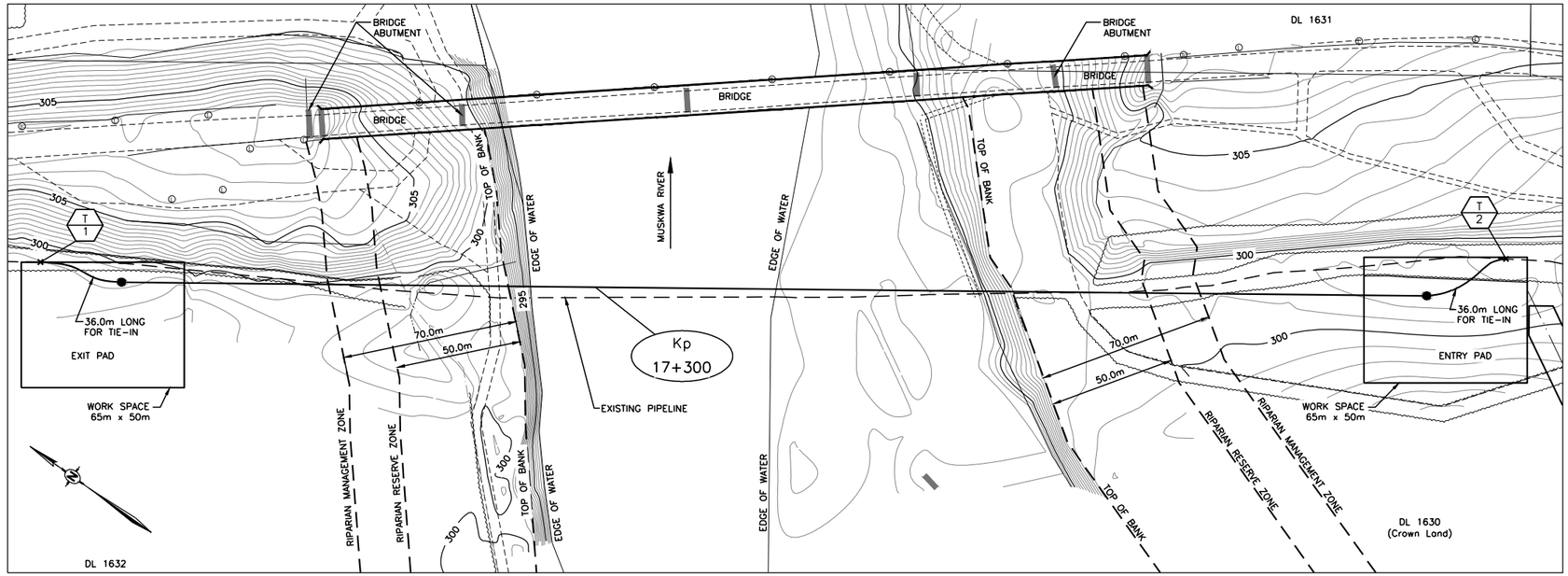
Sincerely,

18-Nov-2010

David Bainbridge, P.Eng
Pipeline Engineer
Chinook Engineering Ltd.

Appendix A

Muskwa River HDD Conceptual Drawing



PLAN
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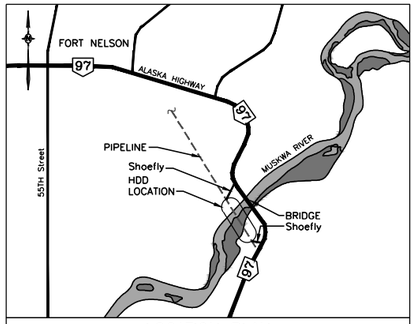


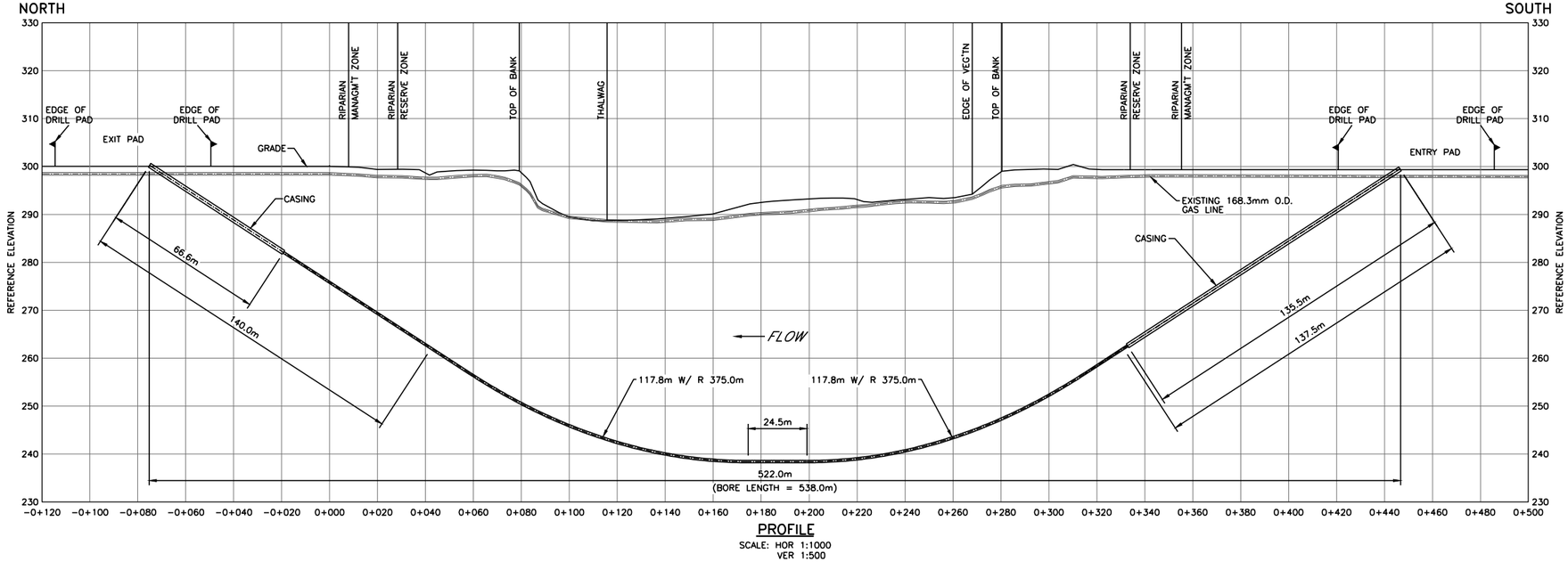
LOCATION PLAN
SCALE: N.T.S.

GENERAL LOCATION

KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

MATERIAL LIST

ITEM	QTY.	DESCRIPTION	REF. DWG.
1	610m	168.3mm X 7.11mm W.T., GR 290, CSA Z245.1,	---
		CAT II, DPS COATING, DBL RANDOM, ERW	



PROFILE
SCALE: HOR 1:1000
VER 1:500

CLASS LOCATION: 3
M.O.P. 7960 kPa

DESIGN NOTES

1. CROSSING SECTION – TEST PRESSURE
   MINIMUM = 11 144 kPa
   MAXIMUM = 15 000 kPa
   DURATION = 24 HOURS
2. DESIGN TEMPERATURE – M45C.

CONSTRUCTION NOTES

1. ALL WELDS, INCLUDING TIE-INS, SHALL BE NON-DESTRUCTIVELY INSPECTED FOR 100% OF CIRCUMFERENCE TO ACCEPTABLE CRITERIA OF WELD PROCEDURE (CSA), AND ALL RECORDS MAINTAINED.
2. ALL JOINT COATINGS SHALL BE PRE-HEATED, SANDBLASTED TO SSPC-10 AND COATED WITH ABRASION RESISTANT EPOXY.
3. JOINTS SHALL BE HOLIDAY TESTED BEFORE LOWERING AND REPAIRS UNDERTAKEN AND RE-INSPECTED.
4. PREBUILT SECTION SHALL BE HYDROSTATICALLY TESTED PRIOR TO INSTALLATION BY HDD.
5. SILT FENCING IS A SUITABLE SUBSTITUTE FOR A SOIL BERM.
6. CONDUCTIVITY TESTING SHALL BE COMPLETED POST INSTALLATION.

ISSUED FOR INTERNAL REVIEW 10-11-18

DRILL PROFILE DESIGNED BY ENTEC

CHINOOK ENGINEERING	A1	ISSUED FOR INTERNAL REVIEW	DAH	DGB	PT	10-11-18
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

Terasen Gas

ENGINEER SEAL

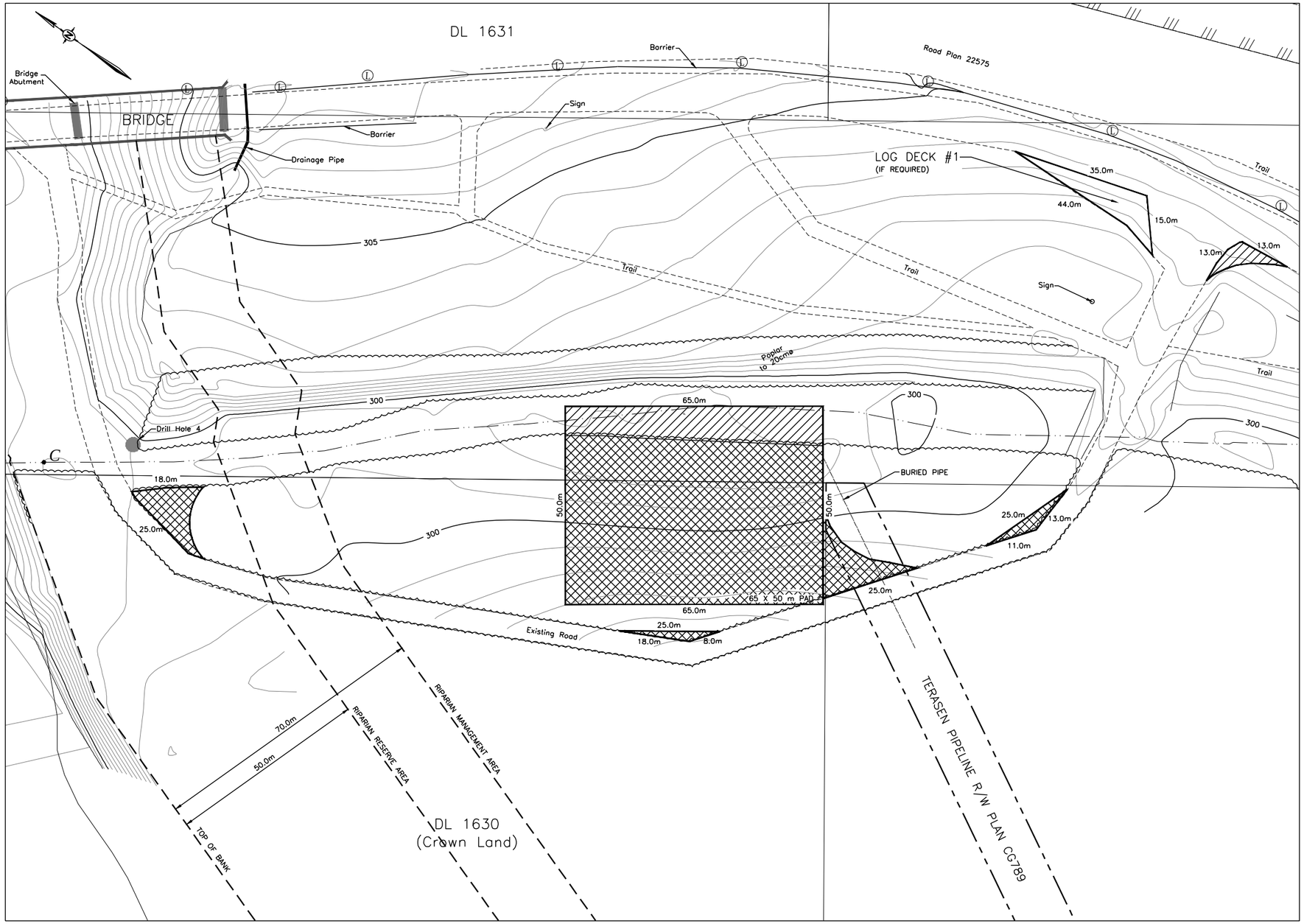
168.3mm TP – MUSKWA PIPELINE

HORIZONTAL DIRECTIONAL DRILL OF THE MUSKWA RIVER AT Kp 17+300
PLAN AND PROFILE

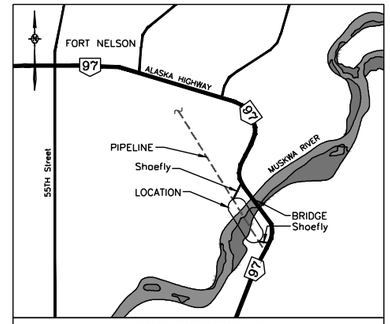
DRAWING NUMBER 32004-P-000-1000-A1

Appendix B

Muskwa River HDD Construction Plans



PLAN
SCALE: 1:500



LOCATION PLAN
SCALE: N.T.S.

GENERAL LOCATION

KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

CONSTRUCTION NOTES

1. FULL INDICATED AREAS SHALL BE CLEARED & GRUBBED.
2. ALL ADJACENT DANGER TREES SHALL BE REMOVED.
3. SALVAGEABLE TIMBER SHALL TRIMMED AND DECKED.
4. UNSALVAGEABLE TIMBER SHALL BE PILED AND BURNED OR DUMPED.
5. STEEP SLOPES SHALL BE FELLED BY HAND.

TIMBER VOLUMES

CONIFEROUS (m^3): TBD

DECIDUOUS (m^3): TBD

HARVESTING NOTES

1. TIMBER DESTINATION IS TBD.
2. OWNER SHALL OBTAIN LICENSE TO CUT.
3. DISTURBED AREA IS 0.387 HECTARES.

LEGEND

SCRUB TO BE CLEARED

POPLAR TIMBER TO BE DECKED (TO 80cm⌀)

CHINOOK ENGINEERING	A1	ISSUED FOR REVIEW	DAH	DB	–	10-10-26
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

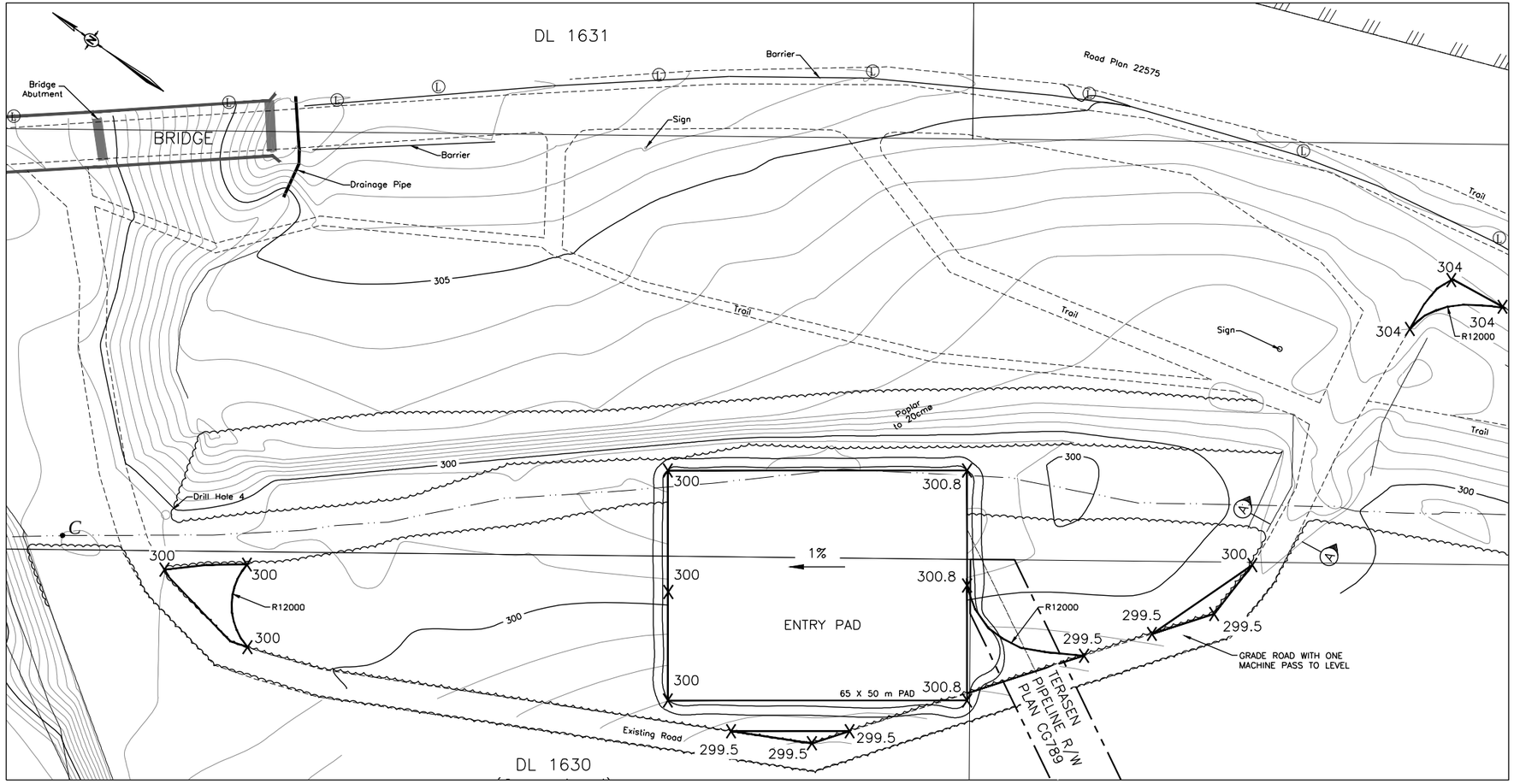
Terasen Gas

ENGINEER SEAL

168.3mm TP – MUSKWA PIPELINE

PRELIMINARY DESIGN
MUSKWA RIVER HDD
SOUTH BANK CLEARING PLAN

DRAWING NUMBER 32004-P-000-1008-A1



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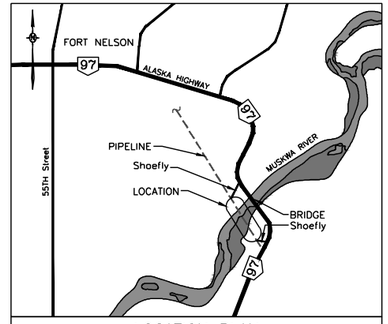


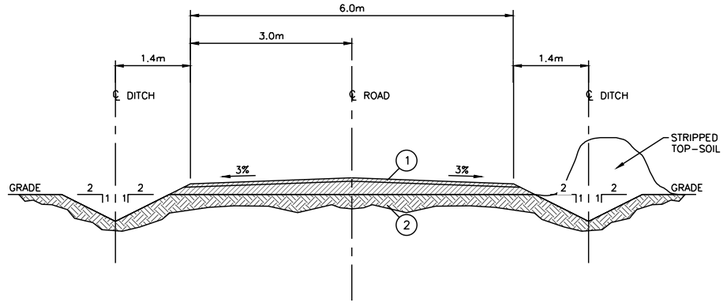
LOCATION PLAN
SCALE: N.T.S.

GENERAL LOCATION

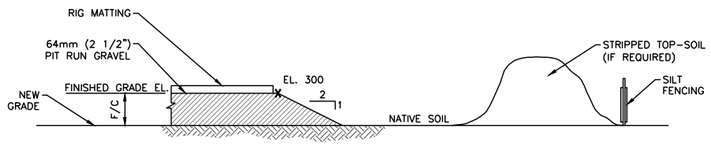
KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

CONSTRUCTION NOTES

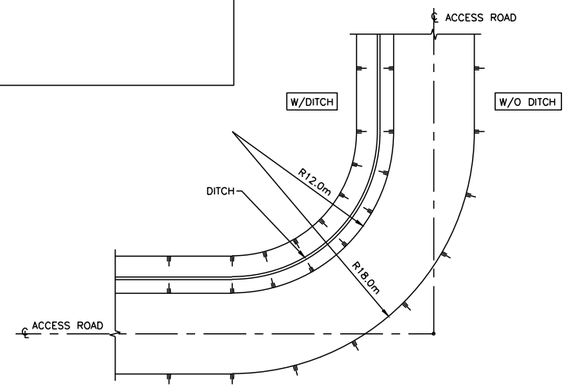
1. ALL TOP SOIL SHALL BE STRIPPED, STOCKPILED AND CONSERVED FOR RECLAMATION.
2. CROSSING OF BURIED UTILITIES SHALL BE BY PERMIT ONLY.
3. ACCESS ROADS SHALL BE CONSTRUCTED TO SECTION 'A'.
4. DRILLING WORK PAD SHALL BE CONSTRUCTED TO SECTION 'B'.
5. ACCESS ROAD TURNS/LETS SHALL BE CONSTRUCTED TO SECTION 'C'.



SECTION 'A'
TYPICAL ROAD SECTION
SCALE 1:15



SECTION 'B'
TYPICAL WORK PAD CROSS SECTION
SCALE 1:15



SECTION 'C'
ACCESS ROAD RADIUS OF CURVATURE
SCALE 1:5

(1) 64mm (2 1/2") CRUSHED GRAVEL BASE PLACED IN ONE LIFT OF 100mm TO 300mm THICK.

(2) BASE COURSE IS NATIVE SOIL OR COMMON FILL WHERE REQUIRED.

CHINOOK ENGINEERING	A1	ISSUED FOR REVIEW	DAH	DB	–	10-10-26
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

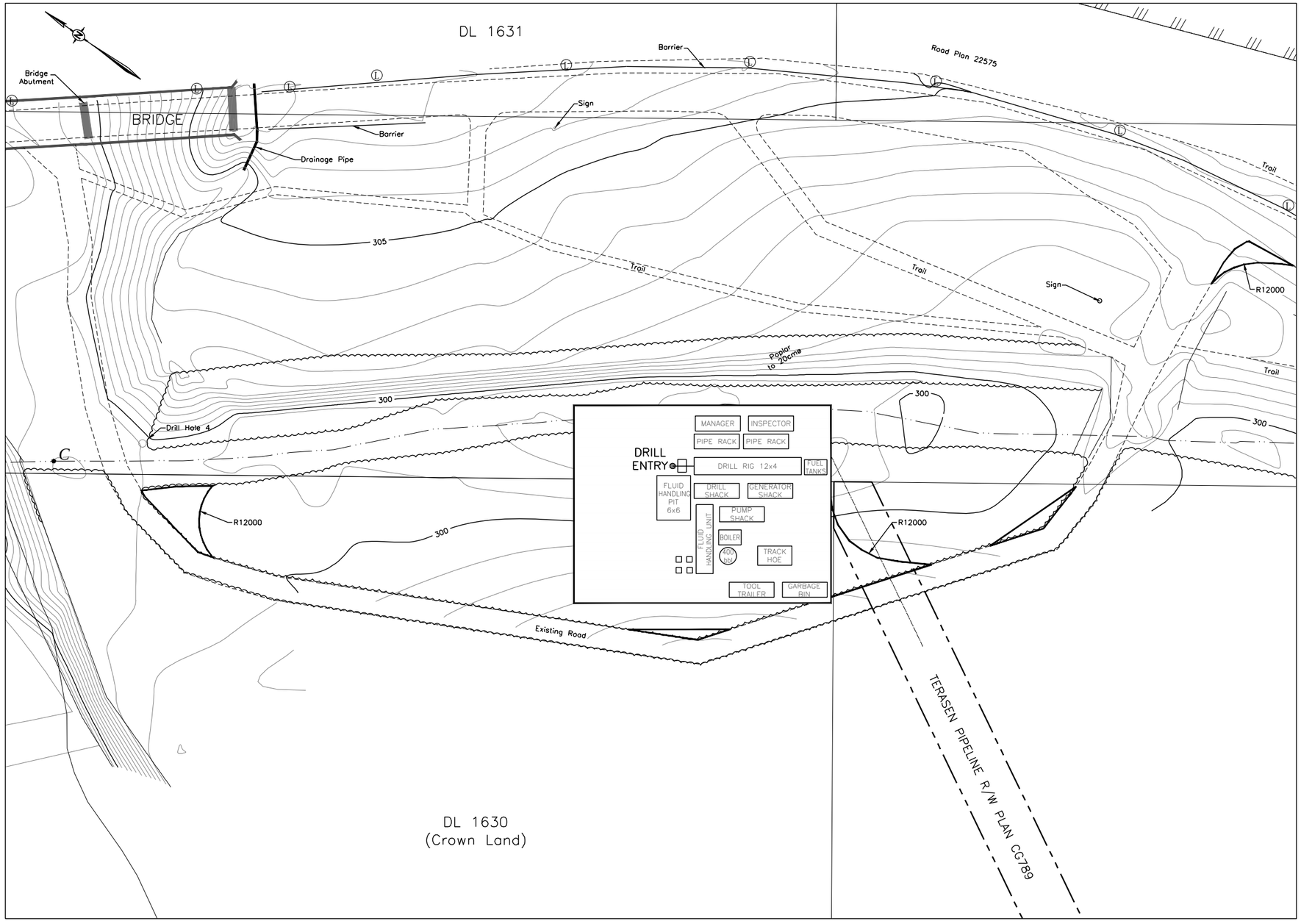
Terasen Gas

ENGINEER SEAL

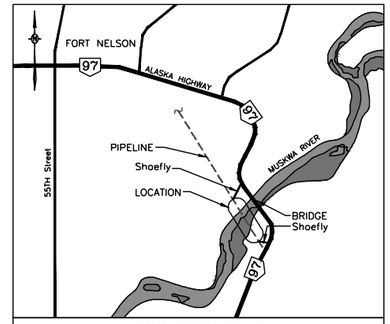
168.3mm TP – MUSKWA PIPELINE

PRELIMINARY DESIGN
MUSKWA RIVER HDD
SOUTH BANK GRADING PLAN

DRAWING NUMBER 32004-P-000-1009-A1



PLAN
SCALE: 1:500



LOCATION PLAN
SCALE: N.T.S.

GENERAL LOCATION

KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

CHINOOK ENGINEERING	A1	ISSUED FOR REVIEW	DAH	DB	–	10-10-26
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

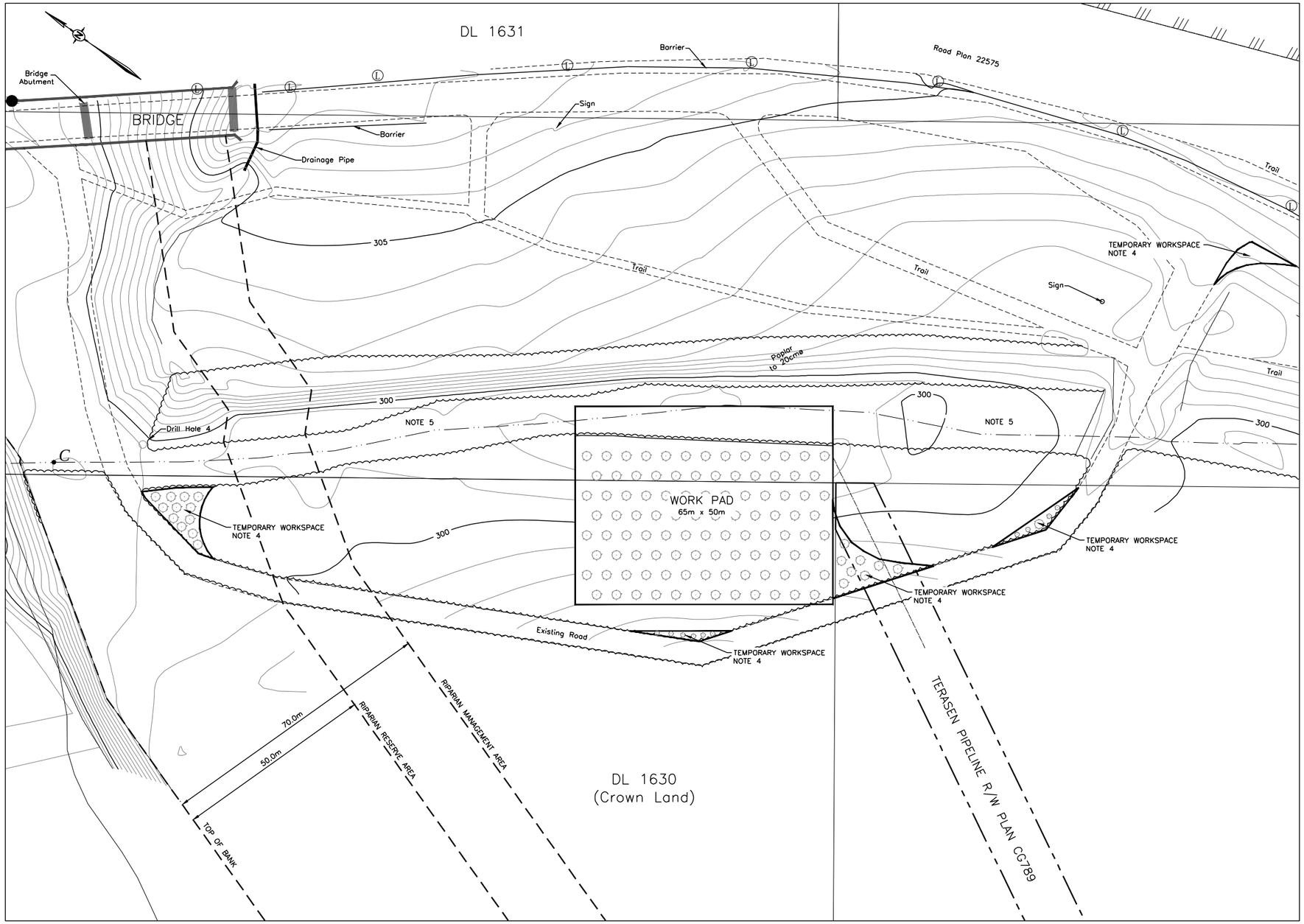
Terasen Gas

ENGINEER SEAL

168.3mm TP – MUSKWA PIPELINE

PRELIMINARY DESIGN
MUSKWA RIVER HDD
SOUTH BANK DRILL LAYOUT

DRAWING NUMBER 32004-P-000-1010-A1



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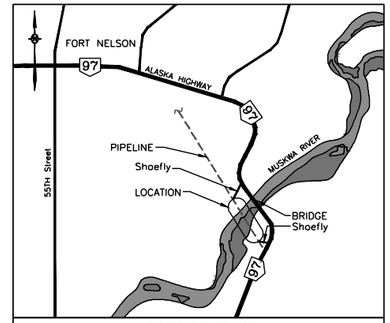


LOCATION PLAN
SCALE: N.T.S.

GENERAL LOCATION

KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

CONSTRUCTION NOTES

1. RECLAMATION SHALL RESTORE DISTURBED SURFACES AND CONTROL EROSION.
2. CLEAN UP SHALL OCCUR IMMEDIATELY AFTER CONSTRUCTION COMPLETION.
3. ALL WORKSPACES SHALL BE RE-GRADED TO ORIGINAL CONTOURS.
4. TEMPORARY WORKSPACES (5 LOCATIONS) & WORKPAD:
   - PIT RUN GRAVEL SHALL BE REMOVED AND DISPOSED OFF SITE
   - COMPACTED SUB-SOILS SHALL BE RIPPED BY MULTI-SHANK OR DISC TO 300mm DEPTH
   - TOP SOIL SHALL BE RESTORED
   - OFF R.O.W. AREA SHALL BE REPLANTED AND SLOPES SHALL BE WILLOW STAKED.
5. DISTURBED R.O.W. SHALL BE RE-SEEDED.

CHINOOK ENGINEERING	A1	ISSUED FOR REVIEW	DAH	DB	-	10-10-26
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

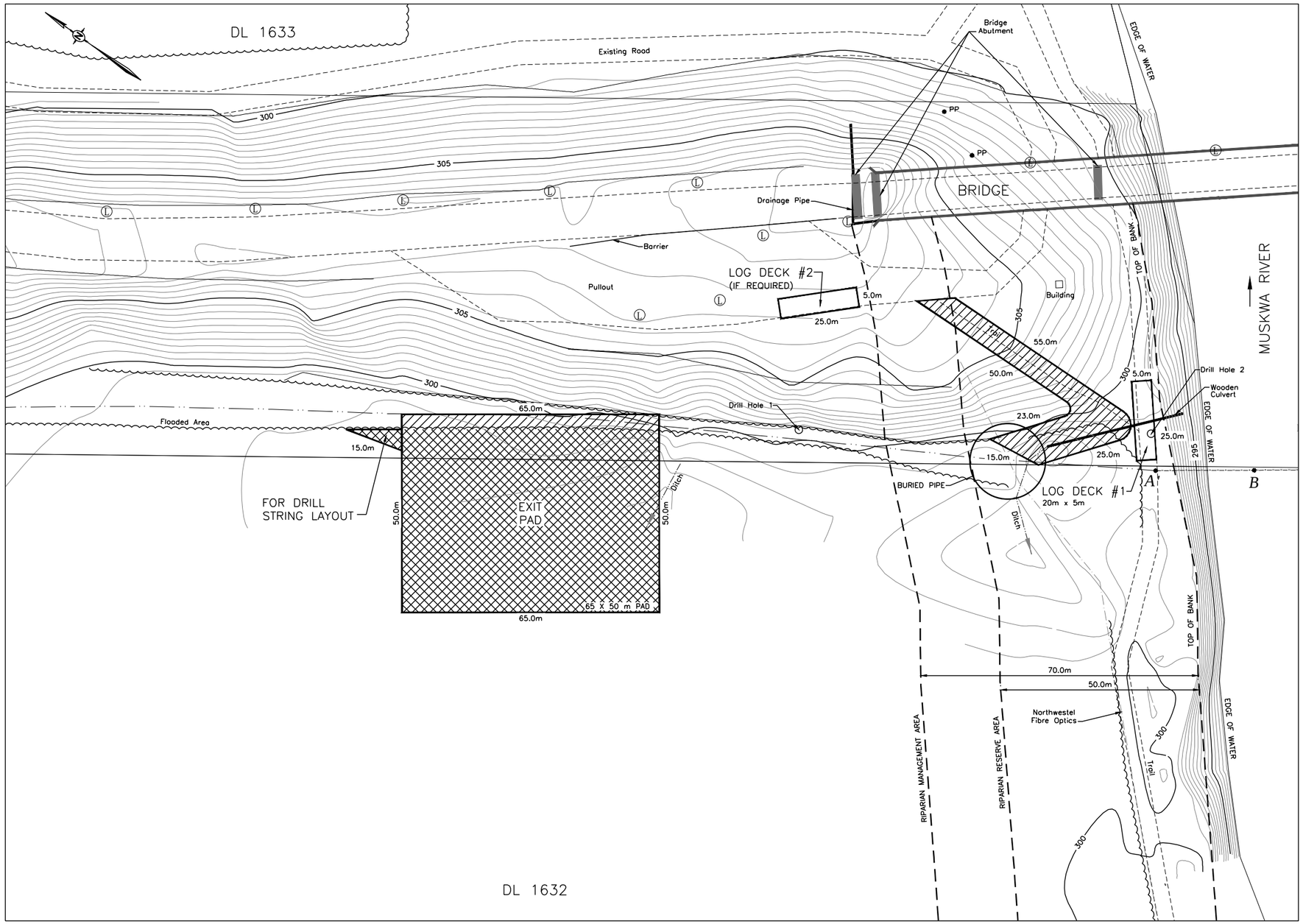
Terasen Gas

ENGINEER SEAL

168.3mm TP - MUSKWA PIPELINE

PRELIMINARY DESIGN
MUSKWA RIVER HDD
SOUTH BANK
SITE REMEDIATION PLAN

DRAWING NUMBER 32004-P-000-1011-A1



PLAN
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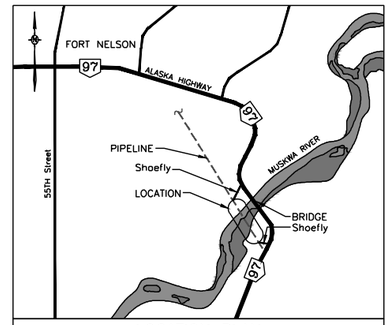


LOCATION PLAN
SCALE: N.T.S.

GENERAL LOCATION

KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

CONSTRUCTION NOTES

1. FULL INDICATED AREAS SHALL BE CLEARED & GRUBBED.
2. ALL ADJACENT DANGER TREES SHALL BE REMOVED.
3. SALVAGEABLE TIMBER SHALL TRIMMED AND DECKED.
4. UNSALVAGEABLE TIMBER SHALL BE PILED AND BURNED OR DUMPED.
5. STEEP SLOPES SHALL BE FELLED BY HAND.

TIMBER VOLUMES

CONIFEROUS (m^3): TBD
DECIDUOUS (m^3): TBD

HARVESTING NOTES

1. TIMBER DESTINATION IS TBD
2. OWNER SHALL OBTAIN LICENSE TO CUT.
3. DISTURBED AREA IS 0.379 HECTARES.

LEGEND

SCRUB TO BE CLEARED

POPLAR TIMBER TO BE DECKED (TO 1mø)

CHINOOK ENGINEERING	A1	ISSUED FOR REVIEW	DAH	DB	–	10-10-26
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

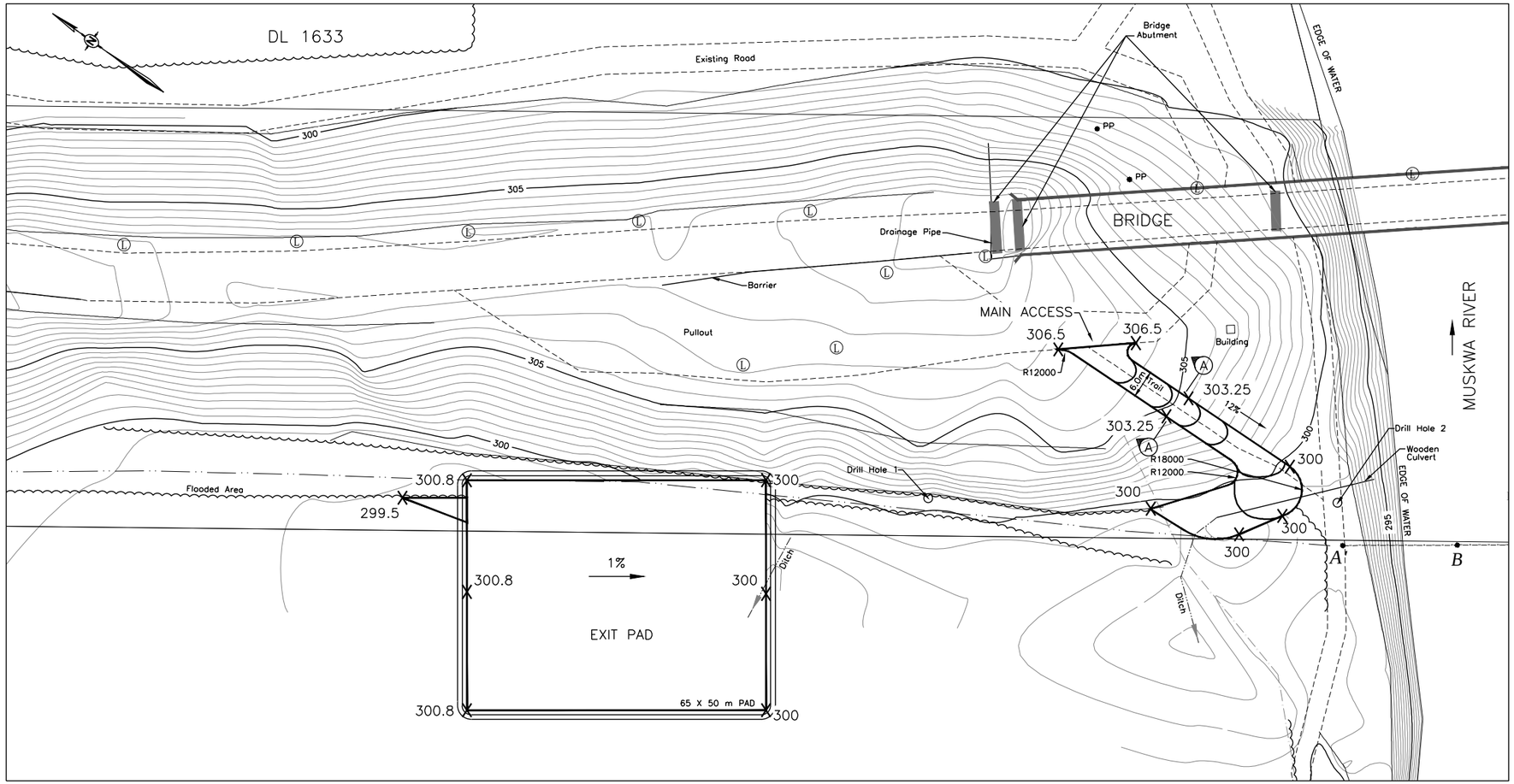
Terasen Gas

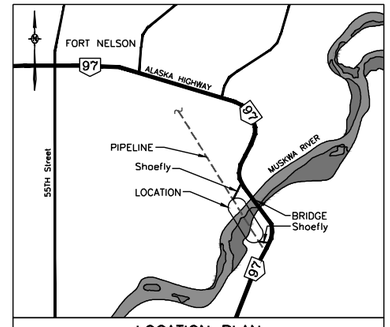
ENGINEER SEAL

168.3mm TP – MUSKWA PIPELINE

PRELIMINARY DESIGN
MUSKWA RIVER HDD
NORTH BANK CLEARING PLAN

DRAWING NUMBER 32004-P-000-1012-A1





LOCATION PLAN

SCALE: N.T.S.

GENERAL LOCATION

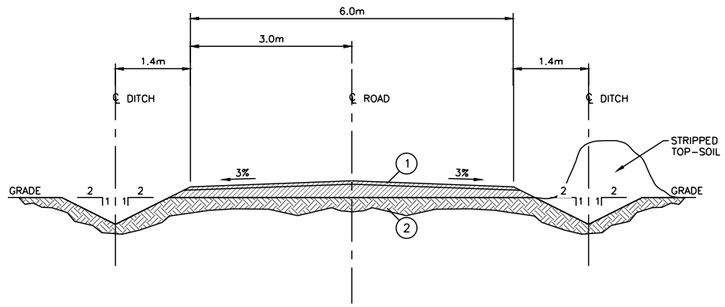
KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

CONSTRUCTION NOTES

1. ALL TOP SOIL SHALL BE STRIPPED, STOCKPILED AND CONSERVED FOR RECLAMATION.
2. CROSSING OF BURIED UTILITIES SHALL BE BY PERMIT ONLY.
3. ACCESS ROADS SHALL BE CONSTRUCTED TO SECTION 'A'.
4. DRILLING WORK PAD SHALL BE CONSTRUCTED TO SECTION 'B'.
5. ACCESS ROAD TURNS/LETS SHALL BE CONSTRUCTED TO SECTION 'C'.

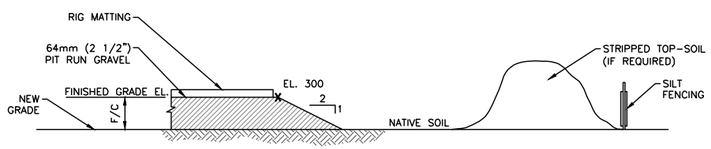
PLAN

SCALE: 1:500



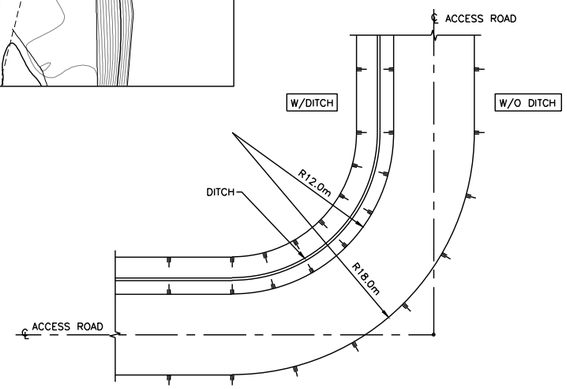
SECTION 'A'

TYPICAL ROAD SECTION
SCALE 1:15



SECTION 'B'

TYPICAL WORK PAD CROSS SECTION
SCALE 1:15



SECTION 'C'

ACCESS ROAD RADIUS OF CURVATURE
SCALE 1:5

(1) 64mm (2 1/2") CRUSHED GRAVEL BASE PLACED IN ONE LIFT OF 100mm TO 300mm THICK.

(2) BASE COURSE IS NATIVE SOIL OR COMMON FILL WHERE REQUIRED.

CHINOOK ENGINEERING	A1	ISSUED FOR REVIEW	DAH	DB	–	10-10-26
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

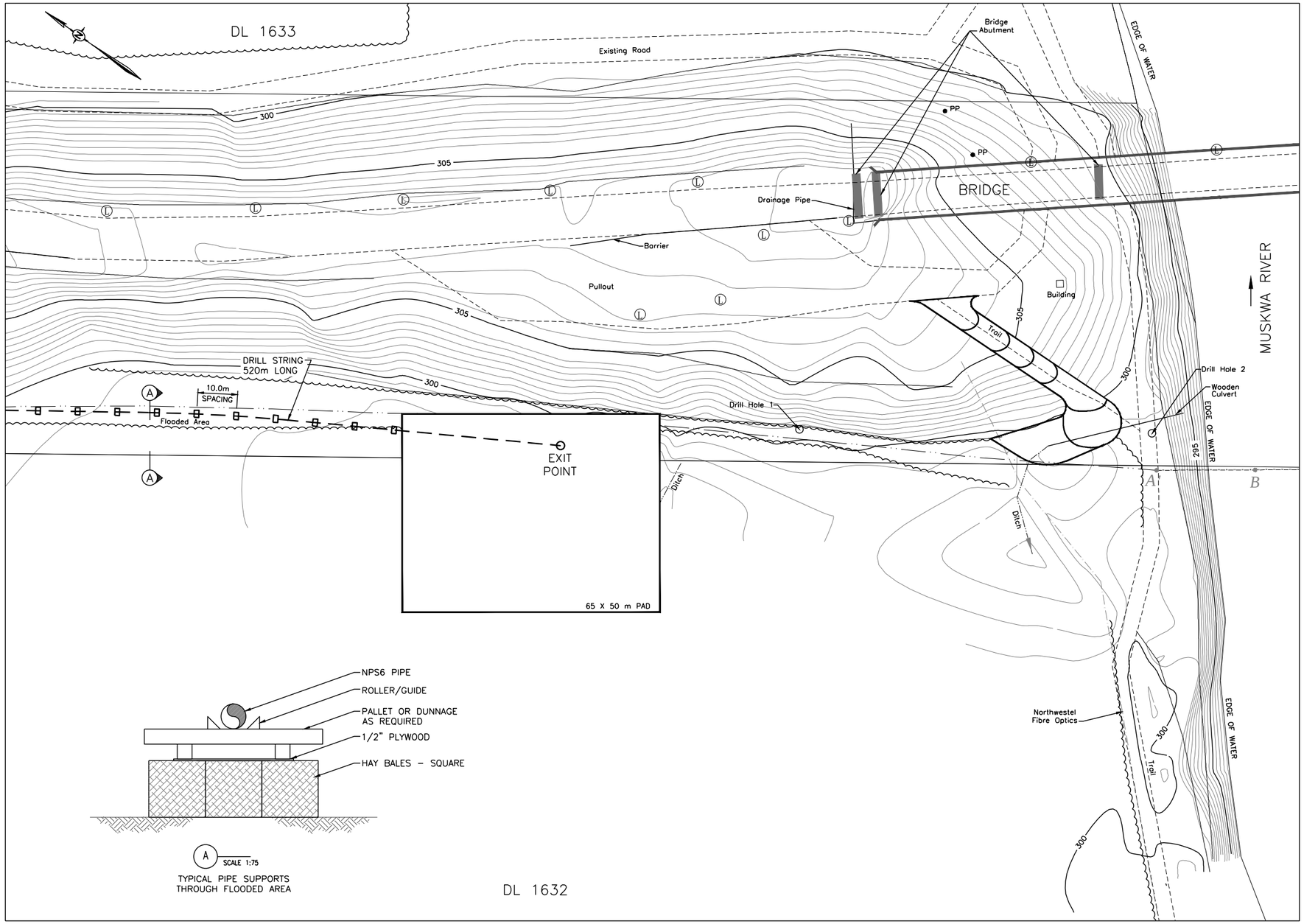
Terasen Gas

ENGINEER SEAL

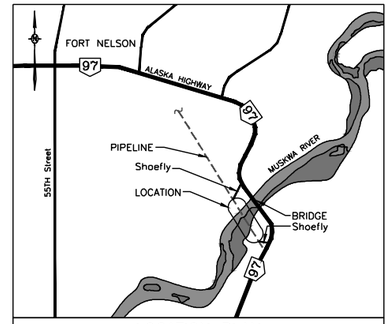
168.3mm TP – MUSKWA PIPELINE

PRELIMINARY DESIGN
MUSKWA RIVER HDD
NORTH BANK GRADING PLAN

DRAWING NUMBER 32004-P-000-1013-A1



PLAN
SCALE: 1:500



LOCATION PLAN
SCALE: N.T.S.

GENERAL LOCATION

KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

CONSTRUCTION NOTES

1. LAYOUT OF DRILL STRING SHALL BE TO A MAX RADIUS OF CURVATURE OF 600m.
2. DRILL STRING SUPPORT SPACING SHALL BE A MAXIMUM OF 10m.

CHINOOK ENGINEERING	A1	ISSUED FOR REVIEW	DAH	DB	-	10-10-26
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

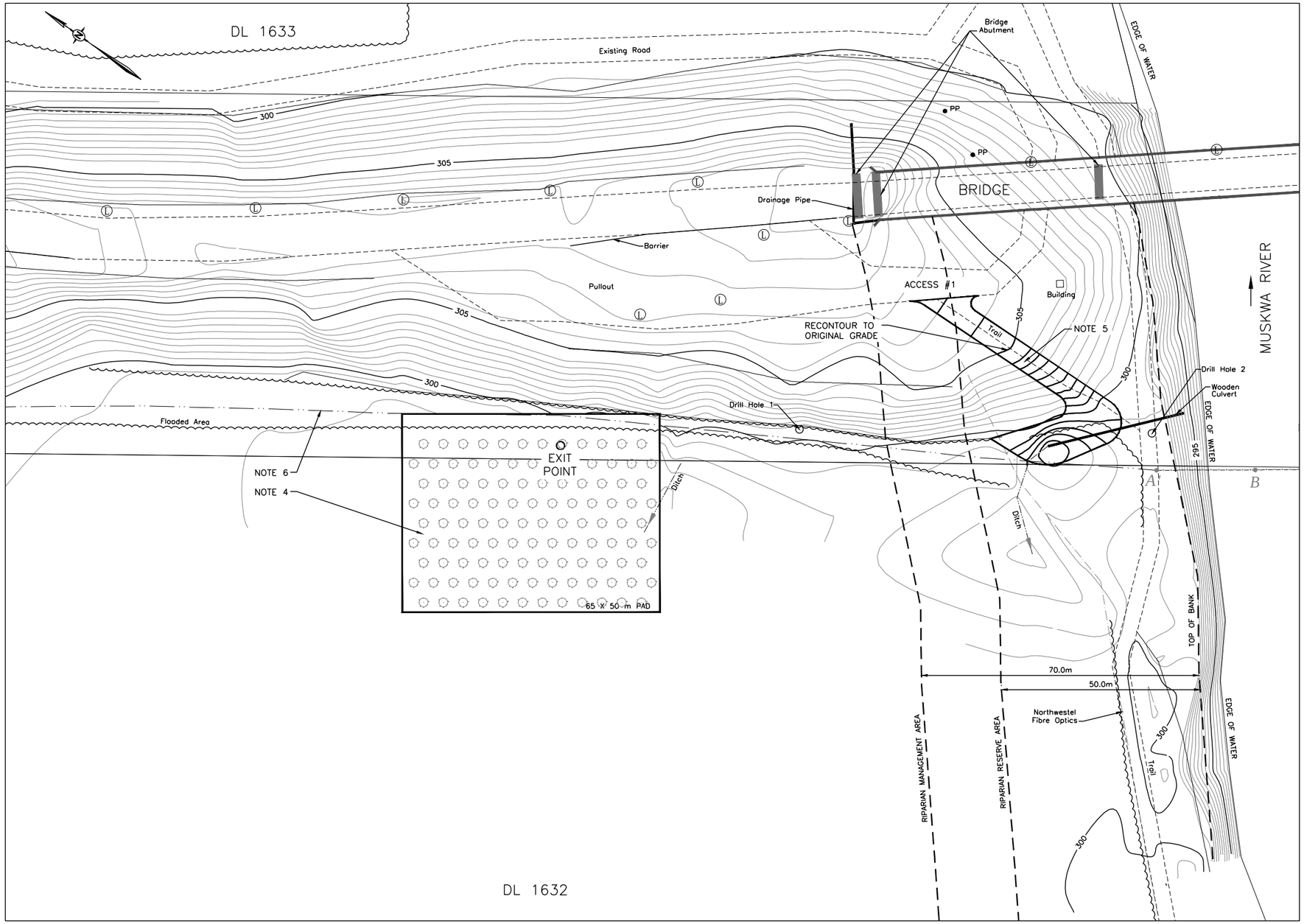
Terasen Gas

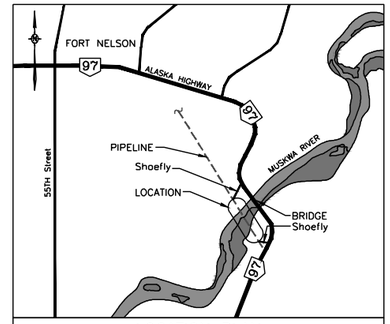
ENGINEER SEAL

168.3mm TP - MUSKWA PIPELINE

PRELIMINARY DESIGN
MUSKWA RIVER HDD
NORTH BANK DRILL STRING LAYOUT

DRAWING NUMBER 32004-P-000-1014-A1





LOCATION PLAN

SCALE: N.T.S.

GENERAL LOCATION

KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

CONSTRUCTION NOTES

1. RECLAMATION SHALL RESTORE DISTURBED SURFACES AND CONTROL EROSION.
2. CLEAN UP SHALL OCCUR IMMEDIATELY AFTER CONSTRUCTION COMPLETION.
3. ALL WORKSPACES SHALL BE RE-GRADED TO ORIGINAL CONTOURS.
4. HDD WORKPAD:
   - PIT RUN GRAVEL SHALL BE REMOVED AND DISPOSED OFF SITE
   - COMPACTED SUB-SOILS SHALL BE RIPPED BY MULTI-SHANK OR DISC TO 300mm DEPTH
   - TOP SOIL SHALL BE RESTORED
   - OFF R.O.W. AREA SHALL BE REPLANTED AND SLOPES SHALL BE WILLOW STAKED.
5. ACCESS #1:
   - PIT RUN GRAVEL SHALL BE STRIPPED AND DISPOSED OFF SITE.
6. DISTURBED R.O.W. SHALL BE RE-SEEDED.

PLAN

SCALE: 1:500

CHINOOK ENGINEERING	A1	ISSUED FOR REVIEW	DAH	DB	–	10-10-26
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

Terasen Gas

ENGINEER SEAL

168.3mm TP – MUSKWA PIPELINE

PRELIMINARY DESIGN
MUSKWA RIVER HDD
NORTH BANK
SITE REMEDIATION PLAN

DRAWING NUMBER 32004-P-000-1015-A1

Appendix C

Muskwa River HDD WBS Cost Estimate Summary

	PROJECT	Muskwa River - HDD	LENGTH (m)	610
	YEAR	2010	DIA. (mm)	168
	FROM	0+000	W.T. (mm)	11.00
	TO	0+610	S.M.Y.S.(grade)	290
			MAOP. (kPa)	7,960

SERVICES

CODE NO.	DESCRIPTION	COMMENTS	UNIT PRICE	NO, OF UNITS	CONSTRUCTION DOLLARS	REFERENCE
001	Base Lay Contract: Clearing & Grading	lump	$ 166,485.58	1	$ 166,486	Resource Worksheet
002	Base Lay Contract: Stringing	Unit Rate: $/m	$ 66.34	610	$ 40,468	Resource Worksheet
003	Base Lay Contract: Ditching	Unit Rate: $/m	$ 375.68	72	$ 27,049	Resource Worksheet
004	Base Lay Contract: Welding	Unit Rate: $/m	$ 304.22	610	$ 185,572	Resource Worksheet
005	Base Lay Contract: Back Fill / Clean-up	lump	$ 26,512.84	1	$ 26,513	Resource Worksheet
006	Base Lay Contract: Hydrotesting	Unit Rate: $/m	$ 120.54	610	$ 73,532	Resource Worksheet
007	Sub Contract: Hydrovac	lump	$ 8,977.50	1	$ 8,978	Superior City Quote
008	Sub Contract: NDT	Unit Rate: $/m	$ 9.06	610	$ 5,530	Cantech Quote
009	Sub Contract: HDD Casing Installation / Extraction	Unit Rate: $/m	$ 9,058.57	204	$ 1,847,948	Entec Quote
010	Sub Contract: HDD of Muskwa River	Unit Rate: $/m	$ 1,262.10	538	$ 679,010	Entec Quote
011	Base Lay Contract: Summer Cleanup	lump	$ 11,164.10	1	$ 11,164	Resource Worksheet
012			$ -		$ -	
013			$ -		$ -	
014	Unit Price Rate: Coating Repairs	m2	$ 250.00	15	$ 3,695	Estimate
015	Unit Price Rate: Traffic Control, Non-Permanent	incl in Base Lay	$ -		$ -	Estimate
016	Unit Price Rate: Weld Destructive Testing		$ 7,000.00		$ -	Estimate
017			$ -		$ -	Estimate
018	Unit Price Rate: Installation of electrical test leads	Unit Rate: $/ea	$ 1,200.00	2	$ 2,400	Estimate
019	Unit Price Rate: ROW Seeding	Unit Rate: $/m	$ 8.00	1,000	$ 8,000	Estimate
020	Unit Price Rate: Mud Removal and Disposal	Unit Rate: $/m3	$ 500.00	50	$ 25,000	Estimate
021	Unit Price Rate: Pipeline Sand Padding	Unit Rate: $/m3	$ 97.50	15	$ 1,463	Blue Canyon
022	Unit Price Rate: Road Aggregate Import	Unit Rate: $/m3	$ 105.00	500	$ 52,500	Blue Canyon
023	Unit Price Rate: Rip Rap D50 Import	Unit Rate: $/m3	$ 150.00		$ -	Blue Canyon
024	Unit Price Rate: Air drying pipeline	incl in Base Lay	$ -		$ -	Estimate
025	Unit Price Rate: Installation of warning signs	Unit Rate: $/ea	$ 150.00	6	$ 900	Estimate
026	Unit Price Rate: Installation of Ditch Plugs	Unit Rate: $/ea	$ -		$ -	Estimate
027	Mark ups: Material		$ -		$ -	Estimate
028	Mark ups: Third Party	Incl in Sub Cost	$ -		$ -	Estimate
029	Misc. Expenses		$ -		$ -	Estimate
	TOTAL CONSTRUCTION				**$ 3,166,205**	
					$ 5,190	**/ meter Construction**
	ENGINEERING & INSPECTION					
101	Design Engineering (EPCM)		$ 50,000	1	$ 50,000	Task Sheet
102	Land Services & Permitting		$ 20,000	1	$ 20,000	Task Sheet
103	Geotechnical Investigation (8 boreholes)	Sunk Development Cost	$ 132,000	-	$ -	BGC Engineering
104	Surveys	Unit Rate: $/day	$ 3.85	610	$ 2,349	Bennet Land Survey
105	Environmental Field Inspection				$ -	Estimate
106	Field Inspection & Pipeline QA	Unit Rate: $/day	$ 3,500	48	$ 168,021	Resource Worksheet
108	Gauge Pigging and Biocide Run		$ -	-	$ -	Estimate
109	Engineering Support during Construction	Unit Rate: $/day	$ 1,500	5	$ 7,500	Estimate
111	Shop Inspections		$ -	-	$ -	Estimate
112	Mill Inspections		$ -	-	$ -	Estimate
	TOTAL ENGINEERING & INSPECTION				**$ 247,870**	
	COMMISSIONING					
501	Engineering Commissioning Support	Unit Rate: $/day	$ 1,500	5	$ 7,500	Resource Worksheet
502	Terasen Gas Transmission Crew for Hot Tie-ins	Unit Rate: $/day	$ 12,855	3	$ 38,565	Resource Worksheet
503	Operating Procedures					
504	Training					
	TOTAL COMMISSIONING				**$ 46,065**	

MATERIALS

CODE NO.	DESCRIPTION	MATERIALS QUANTITY		UNIT PRICE		MATERIAL DOLLARS	WBS
301	Line Pipe (Z245.1)	610	m	$ 110	per m	$ 67,100	Quote
303	Line Pipe Coating - DPS	610	m	$ 30	per m	$ 18,300	Quote
303	Joint Coatings - Heat Shrink Sleeves	6	ea	$ 25	per ea	$ 147	Quote
303	Joint Coatings - HDD Heat Shrink Sleeves	45	ea	$ 53	per ea	$ 2,372	Quote
311	Cathodic Protection	0		$ -	-	$ -	
329	Buoyancy Control	0		$ -	-	$ -	
330	Valve Station Materials	0		$ -		$ -	
343	Pig Barrel Materials	0		$ -		$ -	
344	Induction Bends	0		$ -		$ -	
345	Corrosion Inhibition Chemicals	0		$ -		$ -	
350	Freight & Hauling - Pipe Haul	2	loads	$ 3,000	per load	$ 6,000	
399	Misc. Equipment	0		$ -		$ -	
	SUB-TOTAL					**$ 93,919**	
	PROVINCIAL SALES TAX					**$ -**	
	TOTAL MATERIALS					**$ 93,919**	

sub-total	**$ 3,554,000**	
CONTINGENCY (15%)	**$ 533,100**	
GRAND TOTAL	**$ 4,087,100**	
per m	**$ 6,700**	**/m**

Appendix D

BGC Engineering HDD Geotechnical Investigation for Muskwa River Crossing

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

TERASEN GAS INC.

HORIZONTAL DIRECTIONAL DRILLING GEOTECHNICAL INVESTIGATION FOR MUSKWA RIVER CROSSING

FINAL REPORT

PROJECT NO: 0093-090

DATE: November 12, 2010

DISTRIBUTION:

Terasen 3 copies

BGC 2 copies

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
#500-1045 Howe Street
Vancouver, B.C.
Canada V6Z 2A9
Tel: 604.684.5900
Fax: 604.684.5909

November 12, 2010
Project No. 0093-090

Mr. Paul Tassie
Terasen Gas Inc.
1150 Kalamalka Lake Rd
Vernon BC, V1T 6V2

Dear Mr. Tassie,

Re: Horizontal Directional Drilling Geotechnical Investigation for Muskwa River Crossing

Please find enclosed the above referenced report dated November 12, 2010. If you have any questions about this report, the project in general, or any other topic that we may be able to assist you with, please do not hesitate to contact us.

Yours sincerely,

BGC ENGINEERING INC.
per:

Dr. Alex Baumgard, P.Eng., P.Geo.
Senior Geotechnical / Environmental Engineer

AB/es

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES AND DRAWINGS

LIST OF APPENDICES

LIMITATIONS

BGC Engineering Inc. (BGC) prepared this document for the account of Terasen Gas Inc. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of document preparation. Any use which a third party makes of this document or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

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1.0 INTRODUCTION

1.1. Background

BGC Engineering Inc. (BGC) understands that Terasen Gas Inc. (Terasen) intends to replace the Muskwa River pipeline crossing, located approximately 2 km southeast of Fort Nelson, BC. A depth of cover survey conducted on September 28, 2008 found that the Fort Nelson Lateral (4") pipeline was exposed near the river thalweg. To reduce further risk to the pipe and service to the adjacent community, Terasen wishes to evaluate the feasibility of replacing the crossing by horizontal directional drilling (HDD) to a greater depth beneath the Muskwa River.

The proposed HDD route will parallel the existing pipeline route, crossing the Muskwa River approximately 70 m upstream of the Highway 97 Bridge. Two potential HDD options have been considered; one crossing the entire river channel from bank to bank (Option #1), while the other entering from a side bar within the south side of the channel and crossing to the north bank (Option #2). Both options are shown on Drawing 1, taken from RFP Q101853RDM, drawing numbers 32004-P-000-1000-R0 and 32004-P-000-1005-R0.

1.2. Scope of Work

The goal of this investigation is to evaluate the feasibility for conducting either of the approximately 350 m long (Option #1) or 260 m long (Option #2) HDD borepaths across the Muskwa River, from a geotechnical perspective. The results of the investigation will assist in providing geotechnical information to Terasen's pipeline designers as well as form part of a bidding information package for HDD contractors.

Authorization to proceed with the work was received from Terasen on June 18, 2010 under purchase order 4500033244.

In order to carry out this project and as part of the agreed upon scope of work, the following methodology was adopted:

1. Obtain geotechnical properties of soils with depth from boreholes and geophysical information.
2. Create an interpreted stratigraphic section along the proposed HDD right-of-way (RoW).

2.0 SITE INVESTIGATION

A detailed field investigation consisting of air-rotary drilling, mud-rotary drilling, and geophysics was conducted along the proposed HDD route and the existing Terasen pipeline Right-of-Way (RoW). Contractors from Geotech Drilling Services Ltd. based in Prince George, BC, and Frontier Geosciences Inc. based in North Vancouver, BC, were contracted to complete the drilling and geophysical surveys respectively.

On July 19, 2010, Dr. Alex Baumgard, P.Eng., P.Geo., and Evan Shih, M.Eng., E.I.T., conducted a site reconnaissance to assess the suitability of proposed drillhole locations and to determine optimal drill rig access routes. Prior to drilling, One Call Locators Canada Ltd., based in Fort St. John, BC, was contracted to locate all utilities at the drill sites. BC One Call was also contacted to provide confirmation that no additional registered utilities were present at the borehole sites.

2.1. Geotechnical Drilling Investigation

During the drilling investigation, Evan Shih, M.Eng., E.I.T., provided full-time basis site supervision and remained in daily contact with Dr. Alex Baumgard, P.Eng, P.Geo.

A total of four boreholes were drilled along the existing Terasen RoW from August 30th, 2010 to September 3rd, 2010 to complete the geotechnical drilling portion of the investigation. Locations of the boreholes are shown in Drawing 1 and the detailed borehole logs are provided in Appendix I.

Soil samples obtained from standard penetration testing (SPT) were logged using the visual soil and rock classification in accordance with Canadian industry standards (CFEM 2006). All soil samples were retained, and select samples were sent to a laboratory for soil index testing. The location of each borehole was surveyed upon completion by Can-am Geomatics BC.

2.1.1. DH-BGC10-1

DH-BGC10-1 is located approximately 90 m north from the north bank of the Muskwa River (Drawing 1). It was drilled on August 31st, 2010 and proceeded to a depth of 19.5 m without incident. SPT samples were taken at 1.5 m intervals along the full depth of the drillhole. The approximate depth of the water table on August 31st, 2010 was 6.7 m below the ground surface. Upon completion, the drillhole was filled with grout and sealed with a bentonite cap.

Soils encountered in DH-BGC10-1 consisted of a surficial layer of well-graded sands and gravels overlying a sequence of poorly-graded sand and silt to a depth of approximately 5 m. These in turn are underlain by a thick layer of gravel and sand with some interbedded cobbly zones to a depth of about 15.5 m. Between 15.5 m and the completion depth of 19.5m, very stiff to hard clayey silts were encountered.

2.1.2. DH-BGC10-2

DH-BGC10-2 is located on the north bank of the Muskwa River (Drawing 1). Drilling of DH-BGC10-2 commenced on August 31st and concluded on September 1st, 2010, after reaching a depth of 39.3 m. SPT samples were taken at 1.5 m intervals with the exception of some samples taken at 3 m intervals within the upper 8 m and the bottom 10 m of the drillhole. The approximate depth to the water table on August 31st, 2010 was 7.0 m below the ground surface. Upon completion, the drillhole was filled with grout and sealed with a bentonite cap.

Soils encountered in DH-BGC10-2 consisted of a surficial layer of poorly-graded sand and silt, underlain by a thick sequence of well-graded gravels with interbedded layers of sand to a depth of 21.5 m. These coarse-grained soils are underlain by a thick layer of silt and clay to the target depth of 39.3 m.

2.1.3. DH-BGC10-3

DH-BGC10-3 is located on a bar within the Muskwa River floodplain approximately 65 m north of the south bank (Drawing 1). DH-BGC10-3 was drilled from September 2nd to 3rd, 2010 to a final depth of approximately 39.3 m. SPT samples were taken at 1.5 m intervals with the exception of some samples taken at 3 m intervals between 10 and 20 m depth and from 33 to 39.3 m depth. The approximate depth to the water table on September 2nd, 2010 was 0.3 m below the ground surface. Upon completion, the drillhole was filled with grout and sealed with a bentonite cap.

Surficial soils encountered in DH-BGC10-3 consisted of well-graded gravel and sand. These units in turn overlie a thick sequence of gravel with some sand, occasionally interbedded by layers of well-graded gravelly sand, to an approximate depth of 23.5 m. Between 23.5 m and the completion depth of 39.3 m, hard, low-plastic silts with trace clay were encountered.

2.1.4. DH-BGC10-4

DH-BGC10-4 is located approximately 40 m south from the south bank of the Muskwa River (Drawing 1). It was drilled on August 30th, 2010 to an approximate depth of 19.1 m. At this depth, the drill bit became locked within the casing and unscrewed from the drill rods during reverse rotation by the operator. A decision was made to end the drillhole at this depth as significant effort would have been required to drill an additional 0.9 m to reach the originally proposed target depth of 20 m. The drill bit was retrieved from within the casing subsequent to abandoning the hole. SPT samples were taken at 1.5 m intervals along the full depth of the drillhole. The approximate depth to the water table on August 30th, 2010 was 6.4 m below the ground surface. Upon completion, the drillhole was filled with grout and sealed with a bentonite cap.

Soils encountered in DH-BGC10-4 consisted of a surficial layer of poorly-graded sand with some silt to a depth of 5 m. This unit overlies a layer of well-graded gravel with varying sand content, and occasional interbeds of well-graded sand, to a completion depth of 19.1 m.

2.2. Laboratory Testing

Laboratory testing was performed on select SPT samples by Golder Associates of Burnaby, BC. Grain size analyses and Atterberg Limits tests were completed to determine representative engineering properties of the soil. Sample depths are shown on the borehole logs found in Appendix I and the lab results are provided in Appendix II.

2.2.1. Grain Size Analysis

Grain size distributions for representative samples were determined in accordance with ASTM Standard D422. Table 1 presents a summary of the grain size analyses (illustrated in Figure 1) and the individual grain size distributions can be found in Appendix II.

Table 1. Grain Size Analysis Results

Borehole	Sample	Depth from (m)	Depth to (m)	Grain Size (%)			
				Gravel	Sand	Silt	Clay
DH-BGC10-1	SPT 8	11.4	11.9	64.0	31.6	4.4 (fines)	
	SPT 12	17.5	18.0	1.2	21.1	42.5	35.2
DH-BGC10-2	SPT 17	32.8	33.2	3.7	20.4	37.0	39.0
DH-BGC10-3	SPT 19	32.8	33.2	0.0	1.9	70.4	27.6
DH-BGC10-4	SPT 4	5.3	5.8	51.5	38.9	9.6 (fines)	

2.2.2. Atterberg Limits Test

Atterberg limits testing, in accordance with ASTM Standard D4318, were completed for selected fine grained samples. Table 2 presents a summary of the Atterberg limits tests (illustrated in Figure 2) and the individual plasticity plots can be found in Appendix II.

Table 2. Atterberg Limits Results

Borehole	Sample	Depth from (m)	Depth to (m)	Water Cont. (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Plasticity
DH-BGC10-1	SPT 12	17.5	18.0	18	44	16	28	CL
DH-BGC10-2	SPT 17	32.8	33.2	14	37	14	23	CL
DH-BGC10-3	SPT 19	32.8	33.2	17	34	16	18	CL

The results of the Atterberg limits test for the three fine-grained samples are shown graphically above in Figure 2. The fine-grained soils are classified as low-plastic silts based on their grain-size distributions but behave as intermediate plasticity clays based on the limit testing results. From an engineering perspective, these low-plastic silts should not pose significant problems such as volume expansion, or excessive caving provided that adequate wall support is maintained.

2.3. Geophysical Survey

The objective of the geophysical survey was to map the underlying soil stratigraphy between boreholes and under the Muskwa River along the proposed HDD path. The geophysics program consisted of two separate surveys: seismic refraction and ground-penetrating radar (GPR).

Seismic refraction surveying was used to map the geological conditions along the full proposed HDD path, and the depth to the river bottom. Seismic refraction delineates the underlying geology by creating an acoustic signal near the surface, then recording the echo of the signal after it has bounced off a geological boundary and returned to surface. The echoes occur at either rock or sediment boundaries if there is a significant difference between acoustic impedance, which is the product of the density of the unit and the speed of sound in the material, across the boundary. The depth to geological contacts and thickness of the underlying units can then be determined by multiplying half the elapsed travel-time between the signal source and return of the echo with the travel speed of the wave in the subsurface.

GPR was used to provide detailed surveys of the stratigraphy and to locate any possible buried objects at the proposed entry and exit points. GPR operates under similar principles as seismic refraction, except that electromagnetic energy is used instead of acoustic energy. High-frequency radio waves are transmitted into the ground and reflect off of buried objects or boundaries of soils with different dielectric constants. The reflected signals are recorded by a receiving antenna. As the signals used in GPR are higher-frequency than the acoustic signals used in seismic refraction, penetration depth of the GPR survey is lower. However, higher-resolution data is typically obtained.

In general, results from the seismic refraction survey conducted along the Muskwa River crossing corresponded well with the units observed at the specific borehole locations. The shallow and deep density transitions observed in the geophysics were found to correlate with the water table, and the unit interface between gravels and clayey silts respectively. The inferred contact between the gravel and silt units, shown in Drawing 1, is based solely on geophysical results. Further details on the geophysical surveys can be found in the Frontier report located in Appendix III.

GPR surveys were conducted in three separate survey areas: a southern survey area encompassing the Option #1 entry point, a mid survey area encompassing the Option #2

entry point, and a northern survey area encompassing both the Option #1 and #2 exit points. In general, no evidence of buried artifacts was observed in any of the survey areas. Due to the limited penetration depth of the GPR survey, little information was obtained in terms of soil stratigraphy. Survey profiles typically provided evidence of "shallow reflectors" and "deep reflectors" which were generally found to correspond to shallow horizons of siltier material and the water table respectively.

The geophysics report is provided in Appendix III. Seismic and GPR interpretations over both the land and water portion of the Muskwa River crossing are shown in Drawing 1.

2.4. Stratigraphy

The stratigraphy interpreted along the proposed HDD crossing, as shown in Drawing 1, is based on both borehole and geophysical data. On the northern side of the Muskwa River crossing, soils consist of a surficial layer of well-graded sand and gravel underlain by a thin layer of loose, poorly-graded sand and silt. The sand and silt layer is generally underlain by a thick layer of well-graded, compact to dense gravels with trace cobbles, trace silt, and sand content varying from "some sand" to "and sand". Occasional interbeds of well-graded sand were observed throughout the gravel unit, ranging in thickness from approximately 0.3 to 0.5 m. A thick layer of very stiff to hard, low-plastic silt underlies the gravel unit. The silt unit has a clay content varying from "clayey" to "and clay", sand content varying from "some sand" to "sandy", and trace gravel content.

Surficial materials below the Muskwa River itself consist of well-graded gravel and sand with trace cobbles. This unit overlies an approximately 5 m thick layer of well-graded, compact to dense gravels with some sand and trace cobbles. Interbedded layers of well-graded gravelly sand were encountered occasionally within the gravels. The gravel unit overlies a thick layer of hard, low-plastic silt with trace clay. These silts were generally stratified with thin interbeds of fine, poorly-graded sand, and intermediate-plasticity clay. Based on the geophysical data, possible relict channels appear to exist on both sides of the river channel and are visible as depressions within the clayey silt unit.

Stratigraphy on the south side of the Muskwa River crossing consists of a surficial layer of loose, poorly-graded sand with some silt. The sand layer is generally underlain by interbedded layers of compact, well-graded sands and gravels of varying consistency, with trace to some silt. This is consistent with the compact to dense gravel horizons observed both beneath and on the north side of the river. The hard clayey silt unit was not observed in the borehole on the south side of the river; however, it was delineated within seismic data to dip just below the extents of DH-BGC10-4. Drawing 1 presents an interpreted lithological cross section along the proposed HDD alignment.

3.0 DISCUSSION & RECOMMENDATIONS

Based on the geotechnical information collected, replacement of the existing pipeline crossing through HDD appears to be feasible, provided measures are taken as per the following recommendations. Subsurface materials at the proposed HDD crossing consist generally of compact to dense sands and gravels underlain by hard, low plastic silts with varying fractions of clay, sand and gravel. Conducting the entry and exit of the HDD through the sands and gravels could result in difficult drilling conditions such as inadequate wall support and loss of drilling fluid circulation. Difficult drilling conditions could be alleviated by using a large diameter casing through the sand and gravel units to the underlying silts.

The underlying silt layer is very competent with uncorrected SPT blow count (N) values averaging at 35. Beneath the north bank of the river, N values increase from 35 to 90 with depth. Due to the consistency of this soil layer, excessive caving, swelling and scour should not be an issue during drilling. Based on the projected borepath for HDD Option #1 and the interpreted stratigraphy along the HDD alignment, approximately 220 m of drilling would be conducted within the hard silts. Approximately 90 m of drilling would be conducted within the silts based on the projected borepath for HDD Option #2. In order to allow the majority of the HDD to be conducted within the hard silts and minimize the transition distance into the hard silt unit, it is recommended that the entry and exit angles of the finalized borepath be increased. No evidence of high plastic clays was found during this investigation.

As mentioned previously, the underlying silts encountered beneath the north bank and centre of the river were not encountered on the south side of the crossing (DH-BGC10-4). The stratigraphic contact found in Drawing 1 was interpreted primarily based on geophysical data; therefore, no physical evidence of the silt layer was observed on the south side of the crossing. Further subsurface investigations could be considered beneficial to prove this contact at the south side of the crossing, should Terasen so wish to delineate more accurately the materials at this point.

HDD Option #2 enters from a side bar located within the south side of the channel, as previously discussed. There is a potential for channel scour to occur throughout this area and may pose a risk to the pipe in the future. If Option #2 is pursued, deep burial of the pipe with channel armouring is recommended from the entry point to the south bank in order to reduce the risk of future exposure.

As the only nearby structure to the proposed HDD route is the existing Terasen Gas pipeline, which will be decommissioned as part of its replacement with the HDD, it is not anticipated that there will be any impact from dewatering or construction of the HDD.

Given the potential for hydraulic fracturing within the shallow gravels and the necessity for casing, BGC recommends that an HDD borepath designer be retained to evaluate the borepath and annular pressure, and to delineate the no drill zone in conjunction with the geotechnical information herein.

4.0 CLOSURE

We trust the above satisfies your requirements at this time and provides adequate details in support of conducting an HDD at this site. Should you have any questions or comments regarding this report, please do not hesitate to contact the undersigned.

Yours sincerely,

BGC ENGINEERING INC.
per:

Evan Shih, E.I.T.
Hydrotechnical/Geotechnical Engineer

Dr. Alex Baumgard, P.Eng, P.Geo
Senior Geotechnical/Environmental Engineer

REFERENCES

CFEM, 2006. Canadian Foundation Engineering Manual, Fourth Edition. Canadian Geotechnical Society, 488 p.

FIGURES AND DRAWINGS

Figure 1. Grain Size Curves from Selected Samples

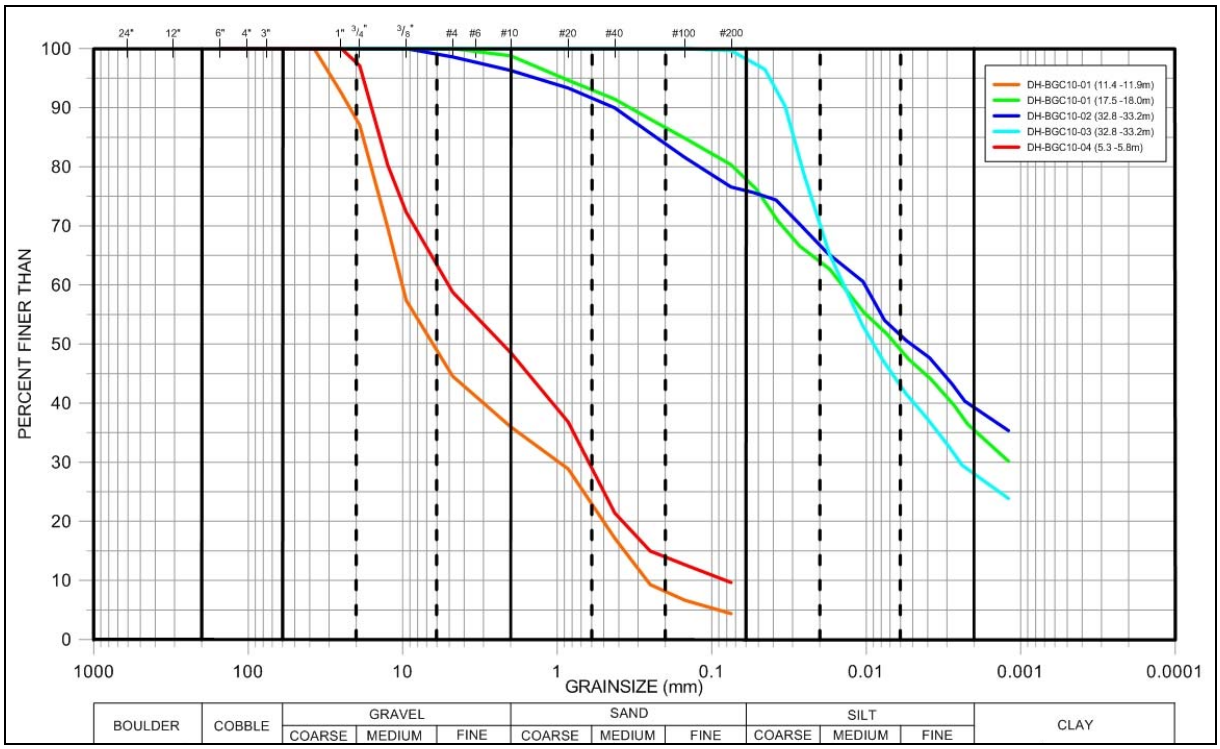
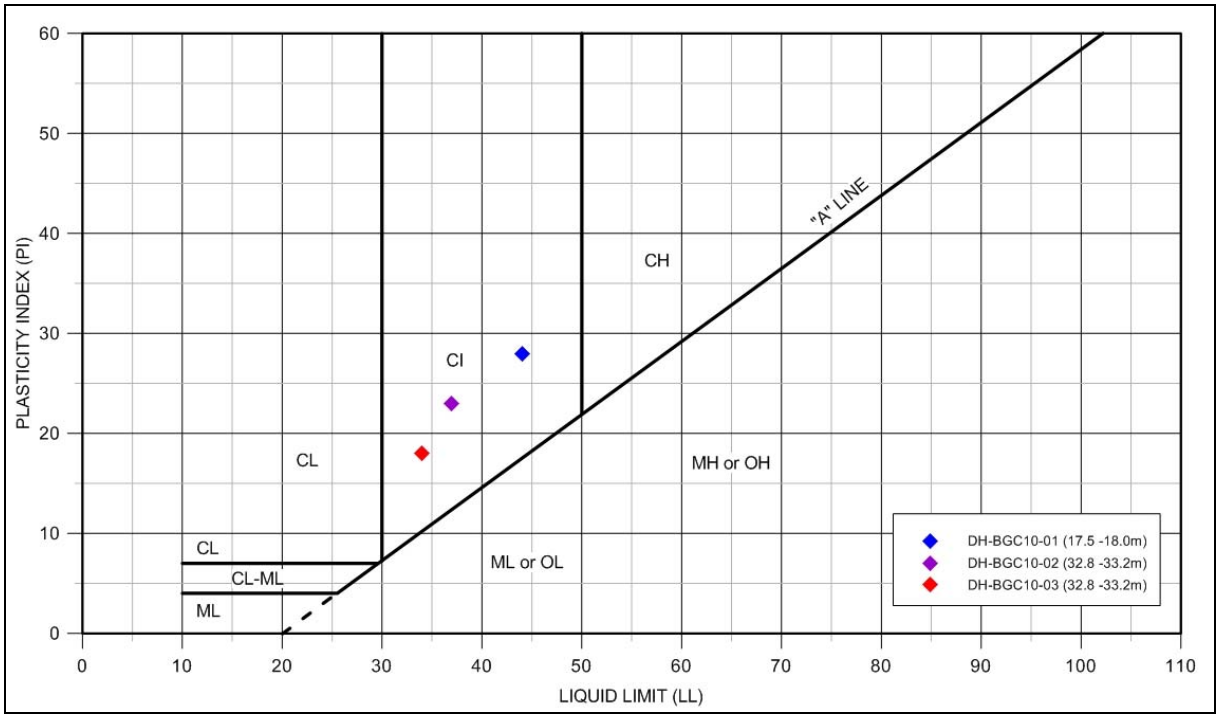


Figure 2. Plasticity of Selected Samples



APPENDIX I
BOREHOLE LOGS

DRILL HOLE # DH-BGC10-1

Location : Fort Nelson

Project No. : 0093-090

Survey Method : Differential GPS
Co-ordinates (m) : 519,480.E, 6,516,556.N
Ground Elevation (m) : 300.20
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air rotary
Core : N/A
Fluid : air
Casing : PQ **Cased To (m)** : 19.51

Start Date : 31 Aug 10
Finish Date: 31 Aug 10
Final Depth of Hole (m) : 19.51
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
0					SAND (SW) and Gravel Fine to coarse, trace silt, well-graded, compact, largest visible particle = 30mm, subrounded, brown, moist, no visible structure, no cementation.		
1		1					9 7 5
2					SAND (SM) and Silt Fine, poorly-graded, loose, largest visible particle < 1mm, dark brown, moist, no visible structure, no cementation.		
2		2					2 2 3
3							
4		3					2 2 3
5					SAND (SP) Fine to medium, trace fine gravel, poorly-graded, loose, largest visible particle = 2mm, brown, moist, no visible structure, no cementation.		
6		4			GRAVEL (GW) and Sand Fine to coarse, trace cobbles, trace silt, well-graded, compact to dense, largest visible particle = 40mm, subrounded, greyish brown, moist, no visible structure, no cementation. From 6.1m to 6.8m - Cobbley zone. Cobbles up to 10cm.		9 17 17
7		5			At 6.7m - Water table At 6.9m - SPT blow counts may be unrepresentative due to disturbance caused by drill air hammer.		9 7 7
8							

Su - kPa: 40, 80, 120, 160

VANE: FIELD PEAK ◆, REMOLD ◇; LAB ■, □

▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
★ % Fines

Core Recovery: 20, 40, 60, 80

Moisture Content & SPT N
W_P% W% W_L%
20, 40, 60, 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,480.E, 6,516,556.N
Ground Elevation (m) : 300.20
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air rotary
Core : N/A
Fluid : air
Casing : PQ **Cased To (m)** : 19.51

Start Date : 31 Aug 10
Finish Date: 31 Aug 10
Final Depth of Hole (m) : 19.51
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
8							
		6					4 14 18
9							
10		7					8 17 11
11					From 11.0m to 11.3m - Interbedded layer of SAND (SW), fine to coarse, gravelly, well-graded.		
		8					11 26 28
12					From 12.5m to 15.5m - Sand content reduces to "some sand"		
13		9					10 17 22
14							
		10					13 15 18
15							
16					SILT (ML) Clayey, some sand, trace fine to medium gravel, high plasticity, stiff to very stiff, grey, wet, no visible structure, no cementation.		

Su - kPa: 40, 80, 120, 160

VANE / FIELD / LAB: PEAK ◆ ■; REMOLD ◇ □; ★ % Fines; Core Recovery: 20, 40, 60, 80

▲ UC/2; △ Pocket Pen /2; DCT (blows/300mm); ● SPT (blows/300mm)

Moisture Content & SPT N: W_P% — W% — W_L%: 20, 40, 60, 80

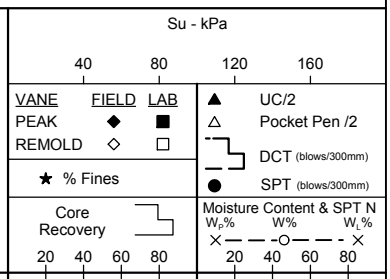
(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,480.E, 6,516,556.N
Ground Elevation (m) : 300.20
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air rotary
Core : N/A
Fluid : air
Casing : PQ **Cased To (m)** : 19.51

Start Date : 31 Aug 10
Finish Date: 31 Aug 10
Final Depth of Hole (m) : 19.51
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
16							5
		11					6
							9
17							
					From 17.5m to 19.5m - Consistency increases from "stiff to very stiff" to "hard".		7
		12					13
18							17
19							
		13					7
							14
							20
20					End of Drillhole at 19.5m Notes: 1. Upon completion, drillhole was backfilled with grout and capped with a bentonite plug. 2. SPTs conducted in coarse-grained soils may be artificially high due to the sampler bouncing on large gravel and cobbles. Discretion should be taken in the use of these values.		
21							
22							
23							
24							



Survey Method : Differential GPS
Co-ordinates (m) : 519,531.E, 6,516,483.N
Ground Elevation (m) : 299.30
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 31 Aug 10
Finish Date: 01 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
0					SAND (SM) and Silt Fine, poorly-graded, loose, largest visible particle < 1mm, dark brown, moist, no visible structure, no cementation.		
1							
2							
2		1					2 2 3
3							
4					SAND (SP) Fine to medium, poorly-graded, loose, largest visible particle = 2mm, brown, moist, no visible structure, no cementation.		
5					GRAVEL (GM) Fine to coarse, silty, some fine to medium sand, well-graded, compact, largest visible particle = 40mm, subrounded, dark brown, moist, no visible structure, no cementation.		
5		2					5 8 16
6							
7					GRAVEL (GW) Fine to coarse, some sand, trace to some silt, trace cobbles, well-graded, compact to dense, largest visible particle = 50mm, subrounded, brown, moist, no visible structure, no cementation. ▽ At 7.0m - Water table.		
8							

Su - kPa: 40, 80, 120, 160

VANE / FIELD / LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery: 20, 40, 60, 80

▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)

Moisture Content & SPT N
W_P% W% W_L%
20, 40, 60, 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,531.E, 6,516,483.N
Ground Elevation (m) : 299.30
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 31 Aug 10
Finish Date: 01 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
8							
		3					7 19 22
9					From 9.1m to 9.6m - Interbedded layer of SAND (SW), fine to coarse, some gravel to gravelly, well-graded.		
10		4					9 10 13
11					From 10.7 m to 11.0m - Interbedded layer of SAND (SW), fine to coarse, gravelly, well-graded.		
		5					11 9 12
12							
13		6					15 20 18
14							
		7			At 14.5m - SPT blow counts may be unrepresentative due to disturbance caused by drill air hammer.		4 3 5
15					From 14.9m - Trace cobbles.		
					From 15.5m - Sand content increase to "and sand".		
16							

Su - kPa: 40, 80, 120, 160
VANE / FIELD / LAB: PEAK ◆ ■; REMOLD ◇ □; ★ % Fines; Core Recovery: 20, 40, 60, 80
▲ UC/2; △ Pocket Pen /2; DCT (blows/300mm); ● SPT (blows/300mm)
Moisture Content & SPT N: W_P% × — W% —○— W_L% —×; 20, 40, 60, 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,531.E, 6,516,483.N
Ground Elevation (m) : 299.30
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 31 Aug 10
Finish Date: 01 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
16							10
		8					13
							13
17							
							13
		9					10
18							11
19							7
		10			At 19.1m - SPT was stopped after 20cm of penetration due to bouncing on cobbles.		45
20							
							21
		11					26
21							17
					SAND (SW) and Gravel Fine to coarse, well-graded, compact, largest visible particle = 40mm, subrounded, brown, wet, no visible structure, no cementation.		
22							
23							
		12					10
24							11

Su - kPa: 40, 80, 120, 160

VANE / FIELD / LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery: 20, 40, 60, 80

▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)

Moisture Content & SPT N
W_P% W% W_L%
20, 40, 60, 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,531.E, 6,516,483.N
Ground Elevation (m) : 299.30
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 31 Aug 10
Finish Date: 01 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
24							17
					SILT (ML) and Clay Sandy, trace gravel, high plasticity, very stiff to hard, grey, wet, no visible structure, no cementation.		
25							8
		13					13
							22
26							
							10
27		14					16
					From 27.0m to 39.3 - Consistency increases from "very stiff to hard" to "hard".		25
28							
							12
		15					19
							29
29							
							12
30		16					20
							26
31							
32							

Su - kPa
40 80 120 160
VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery
20 40 60 80
▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%
20 40 60 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,531.E, 6,516,483.N
Ground Elevation (m) : 299.30
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 31 Aug 10
Finish Date: 01 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
32							
33		17			From 33.2m to 33.7m - Some cobbles.		14 28 40
34							
35							
36		18					15 37 53
37							
38							
39		19					16 24 34
40					End of Drillhole at 39.3m Notes: 1. Upon completion, drillhole was backfilled with grout and capped with a bentonite plug.		

Su - kPa
40 80 120 160
VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery
20 40 60 80
▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%
20 40 60 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,531.E, 6,516,483.N
Ground Elevation (m) : 299.30
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 31 Aug 10
Finish Date: 01 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
40					2. Switched to mud rotary drilling methods (using only water) after a depth of 25.6m. 3. SPTs conducted in coarse-grained soils may be artificially high due to the sampler bouncing on large gravel and cobbles. Discretion should be taken in the use of these values.		
41							
42							
43							
44							
45							
46							
47							
48							

Su - kPa
40 80 120 160
VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery
20 40 60 80
▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%
20 40 60 80

Survey Method : Differential GPS
Co-ordinates (m) : 519,608.E, 6,516,378.N
Ground Elevation (m) : 293.40
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 02 Sep 10
Finish Date: 03 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
0					GRAVEL (GW) and Sand Fine to coarse, trace cobbles, well-graded, loose, largest visible particle = 200mm, rounded to subrounded, brown, wet, no visible structure, no cementation. At 0.3m - Water table		4 4 4
1		1					
2					SAND (SP) Fine to medium, some silt, trace to some gravel, poorly-graded, loose, subrounded, dark brown, wet, no visible structure, no cementation.		
		2			GRAVEL (GW) Fine to coarse, some sand, trace cobbles, well-graded, compact to dense, subrounded, brown, wet, no visible structure, no cementation.		2 9 10
3							
4		3					6 10 16
5							
6		4					4 24 28
7		5					6 8 13
8							

Su - kPa: 40, 80, 120, 160
VANE: FIELD / LAB — PEAK ◆ ■ — REMOLD ◇ □
★ % Fines
Core Recovery: 20, 40, 60, 80
▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%: 20, 40, 60, 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,608.E, 6,516,378.N
Ground Elevation (m) : 293.40
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 02 Sep 10
Finish Date: 03 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
8							
		6					9 13 19
9					From 9.1m to 9.6m - Cobbley zone.		
		7					6 18 25
10					From 10.4m to 10.8m - Interbedded layer of SAND (SW), fine to coarse, gravelly, well-graded.		
11							
12							
13		8			From 13.1m to 13.6m - Interbedded layer of SAND (SW) and Gravel, fine to coarse, well-graded.		7 10 18
14							
15							
16							

Su - kPa: 40, 80, 120, 160

VANE: FIELD / LAB — PEAK ◆ ■ — REMOLD ◇ □

★ % Fines

Core Recovery: 20, 40, 60, 80

▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)

Moisture Content & SPT N
W_P% W% W_L%
20, 40, 60, 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,608.E, 6,516,378.N
Ground Elevation (m) : 293.40
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 02 Sep 10
Finish Date: 03 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
16		9			At 16.0m - SPT was stopped after 25cm of penetration due to bouncing on cobbles.		15 50
17							
18					From 17.7m to 18.6m - Interbedded layer of SAND (SW), gravelly, fine to coarse, well-graded.		
19		10					28 25 24
20							
21		11					19 29 25
22		12					10 23 25
23							
24		13			SILT (ML) Trace clay, trace fine sand, trace gravel, low plasticity, hard, grey, wet,		6 13

Su - kPa
40 80 120 160
VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery
20 40 60 80
▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%
20 40 60 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,608.E, 6,516,378.N
Ground Elevation (m) : 293.40
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 02 Sep 10
Finish Date: 03 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
24					stratified, no cementation. Some interbedded layers of CLAY (CL), some silt, low plasticity to 10 cm thick.		21
25							
		14					9 12 18
26							
					From 26.1m to 32.2m - Some interbedded layers of SAND (SP), fine, trace silt, poorly graded. Trace interbedded layers of CLAY (CL). Average thickness of interbeds is 5cm.		
		15					7 13 20
27							
28							
		16					7 13 19
29							
		17					9 19 24
30							
31							
		18					11 17 23
32							

Su - kPa
40 80 120 160
VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery
20 40 60 80
▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%
20 40 60 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,608.E, 6,516,378.N
Ground Elevation (m) : 293.40
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 02 Sep 10
Finish Date: 03 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
32					From 32.2m to 39.3m - Some interbedded layers of CLAY (CL). No interbedded layers of SAND (SP). Average thickness of interbeds is 5cm.		
33		19					11 15 22
34							
35							
36		20					10 14 18
37							
38							
39		21					10 14 21
40					End of Drillhole at 39.3m Notes: 1. Upon completion, drillhole was backfilled with grout and capped with a bentonite plug.		

Su - kPa
40 80 120 160
VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery
20 40 60 80
▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%
20 40 60 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,608.E, 6,516,378.N
Ground Elevation (m) : 293.40
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air/mud rotary
Core : N/A
Fluid : air/water
Casing : PQ **Cased To (m)** : 39.32

Start Date : 02 Sep 10
Finish Date: 03 Sep 10
Final Depth of Hole (m) : 39.32
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm	Su - kPa: 40, 80, 120, 160 / VANE FIELD LAB / PEAK ◆ ■ / REMOLD ◇ □ / ★ % Fines / Core Recovery: 20, 40, 60, 80	▲ UC/2 / △ Pocket Pen /2 / DCT (blows/300mm) / ● SPT (blows/300mm) / Moisture Content & SPT N: W_P% W% W_L%: 20, 40, 60, 80
40					2. Switched to mud rotary drilling methods (using only water) after a depth of 25.6m. 3. SPTs conducted in coarse-grained soils may be artificially high due to the sampler bouncing on large gravel and cobbles. Discretion should be taken in the use of these values.				
41									
42									
43									
44									
45									
46									
47									
48									

DRILL HOLE # DH-BGC10-4

Location : Fort Nelson

Project No. : 0093-090

Survey Method : Differential GPS
Co-ordinates (m) : 519,666.E, 6,516,289.N
Ground Elevation (m) : 299.60
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air rotary
Core : N/A
Fluid : air
Casing : PQ **Cased To (m)** : 19.05

Start Date : 30 Aug 10
Finish Date: 30 Aug 10
Final Depth of Hole (m) : 19.05
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
0					SAND (SP) Fine to medium, some silt, poorly-graded, loose, largest visible particle = 1mm, rounded, brown, dry, stratified, no cementation.		
1		1					4 3 3
2							
		2			From 2.5m to 5.0m - Some interbedded layers of SAND (SW), fine to coarse, gravelly, some silt, well-graded.		2 4 3
3					At 3.5m - Becomes compact.		
4		3					2 6 6
5					SAND (SW) and Gravel Fine to coarse, trace to some silt, well-graded, compact, largest visible particle = 50mm, rounded to subrounded, brown, moist, no visible structure, no cementation.		4 9 14
6					At 6.4m - Water table ▽		
7		5					5 11 12
8							

Su - kPa: 40, 80, 120, 160

VANE / FIELD / LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery: 20, 40, 60, 80

▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)

Moisture Content & SPT N
W_P% W% W_L%
20, 40, 60, 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,666.E, 6,516,289.N
Ground Elevation (m) : 299.60
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air rotary
Core : N/A
Fluid : air
Casing : PQ **Cased To (m)** : 19.05

Start Date : 30 Aug 10
Finish Date: 30 Aug 10
Final Depth of Hole (m) : 19.05
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
8							
		6			GRAVEL (GW) Fine to coarse, some sand, trace to some silt, well-graded, compact, largest visible particle = 50mm, rounded to subrounded, brown, moist, no visible structure, no cementation.		17 7 9
9							
					SAND (SW) Fine to medium, gravelly, trace silt, well-graded, compact to dense, largest visible particle = 50mm, subrounded, brown, wet, no visible structure, no cementation.		
10		7					19 18 39
11					GRAVEL (GW) Fine to coarse, sandy, trace silt, well-graded, compact, largest visible particle = 50mm, subrounded, brown, wet, no visible structure, no cementation.		
		8					17 15 14
12							
13		9					6 13 15
14							
		10			At 14.5m - SPT blow counts may be unrepresentative due to disturbance caused by drill air hammer.		5 6 5
15							
16							

Su - kPa: 40, 80, 120, 160
VANE / FIELD / LAB: PEAK ◆ ■ ; REMOLD ◇ □ ; ★ % Fines ; Core Recovery 20 40 60 80
▲ UC/2 ; △ Pocket Pen /2 ; DCT (blows/300mm) ; ● SPT (blows/300mm)
Moisture Content & SPT N: W_P% W% W_L% ; 20 40 60 80

(Continued on next page)

Survey Method : Differential GPS
Co-ordinates (m) : 519,666.E, 6,516,289.N
Ground Elevation (m) : 299.60
Datum : UTM NAD 83
Dip (degrees from horizontal) : 90
Direction : N/A

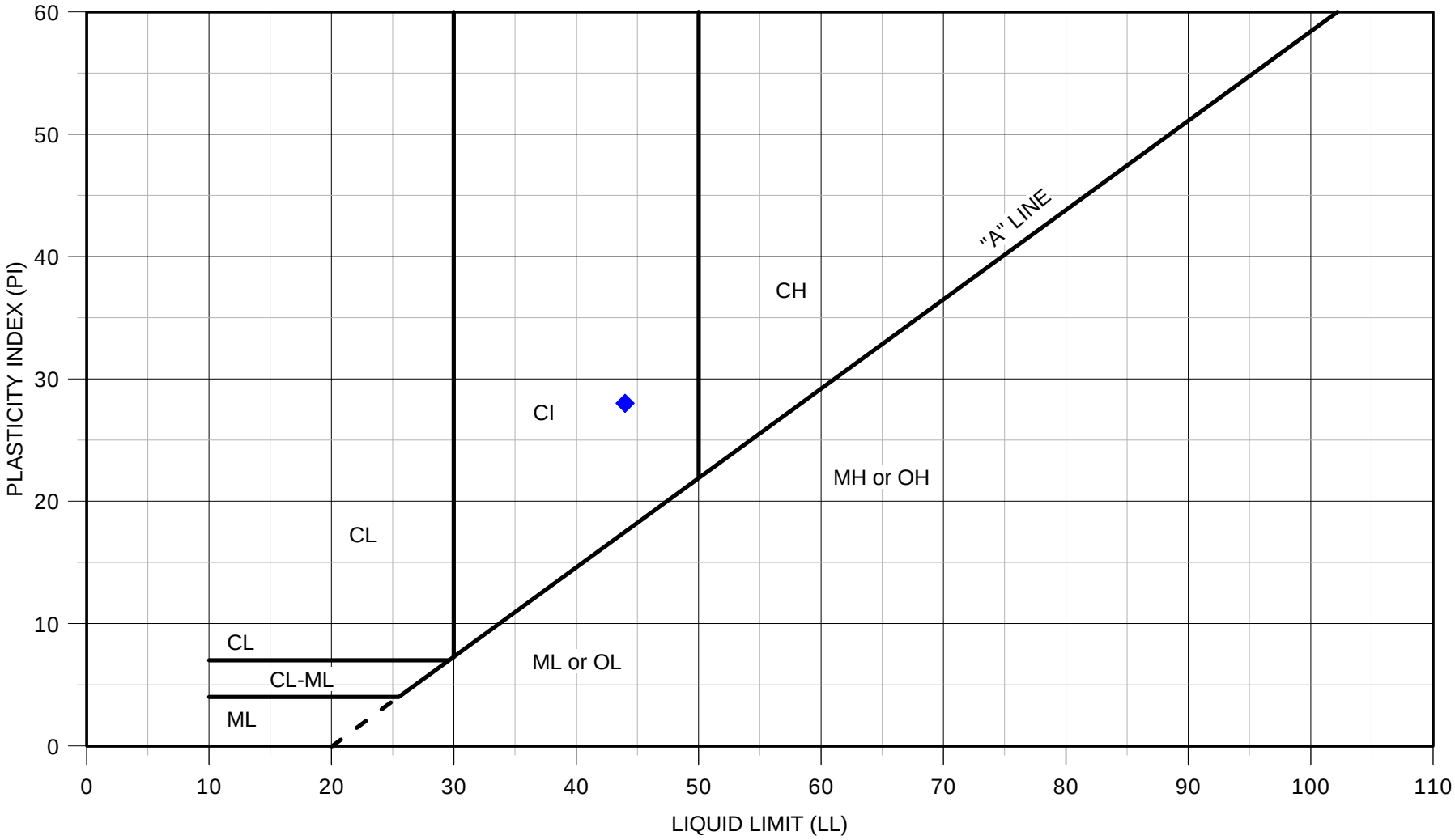
Drill Designation : N/A
Drilling Contractor : Geotech Drilling
Drill Method : air rotary
Core : N/A
Fluid : air
Casing : PQ **Cased To (m)** : 19.05

Start Date : 30 Aug 10
Finish Date: 30 Aug 10
Final Depth of Hole (m) : 19.05
Depth to Top of Rock (m) :
Logged by : ES
Reviewed by : TC

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	Instrument Details	SPT Blows per 150mm
16					At 16.0m - SPT blow counts may be unrepresentative due to disturbance caused by drill air hammer.		6
		11					8
							7
17					From 17.1m to 17.4m - Interbedded layer of SAND (SW), fine to coarse, gravelly, trace silt, well-graded.		
		12					13
							24
18							19
					From 18.3m to 19.1m - Cobbley zone.		
19					End of Drillhole at 19.1m Notes: 1. At 19.1m, drill bit unscrewed from drill rods and was lost down hole. Considerable effort was made to retrieve the drillbit without success. A decision was made to end the drillhole at this point. 2. Upon completion, drillhole was backfilled with grout and capped with a bentonite plug. 3. SPTs conducted in coarse-grained soils may be artificially high due to the sampler bouncing on large gravel and cobbles. Discretion should be taken in the use of these values.		
20							
21							
22							
23							
24							

Su - kPa
40 80 120 160
VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
★ % Fines
Core Recovery
20 40 60 80
▲ UC/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%
20 40 60 80

APPENDIX II
LABORATORY TESTING RESULTS



SCALE:	DATE:	DRAWN:	DESIGNED:	CHECKED:	APPROVED:
1:500	NOV 2010	AJ	AJ	ES	ES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: OFF SPECTRA MUSKWA HDD 2010

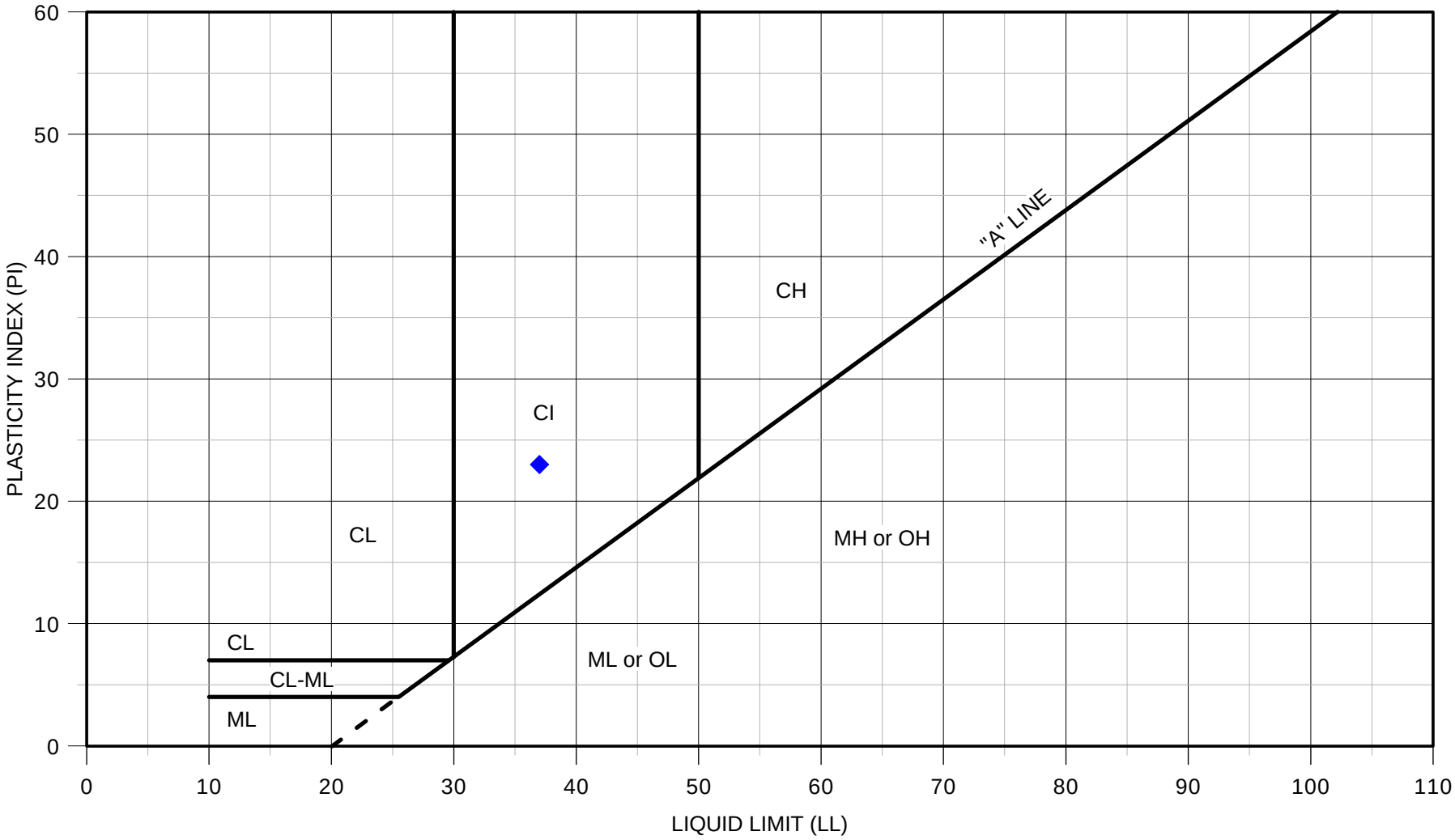
TITLE: ATTERBERG LIMITS LABORATORY RESULTS
DH-BGC10-01 (17.5 - 18.0m)

CLIENT: TERASEN GAS INC.

PROJECT No. 0093-090

FIG No. APPENDIX II
FIGURE 1

REV. A



SCALE:	DATE:	DRAWN:	DESIGNED:	CHECKED:	APPROVED:
1:500	NOV 2010	AJ	AJ	ES	ES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: OFF SPECTRA MUSKWA HDD 2010

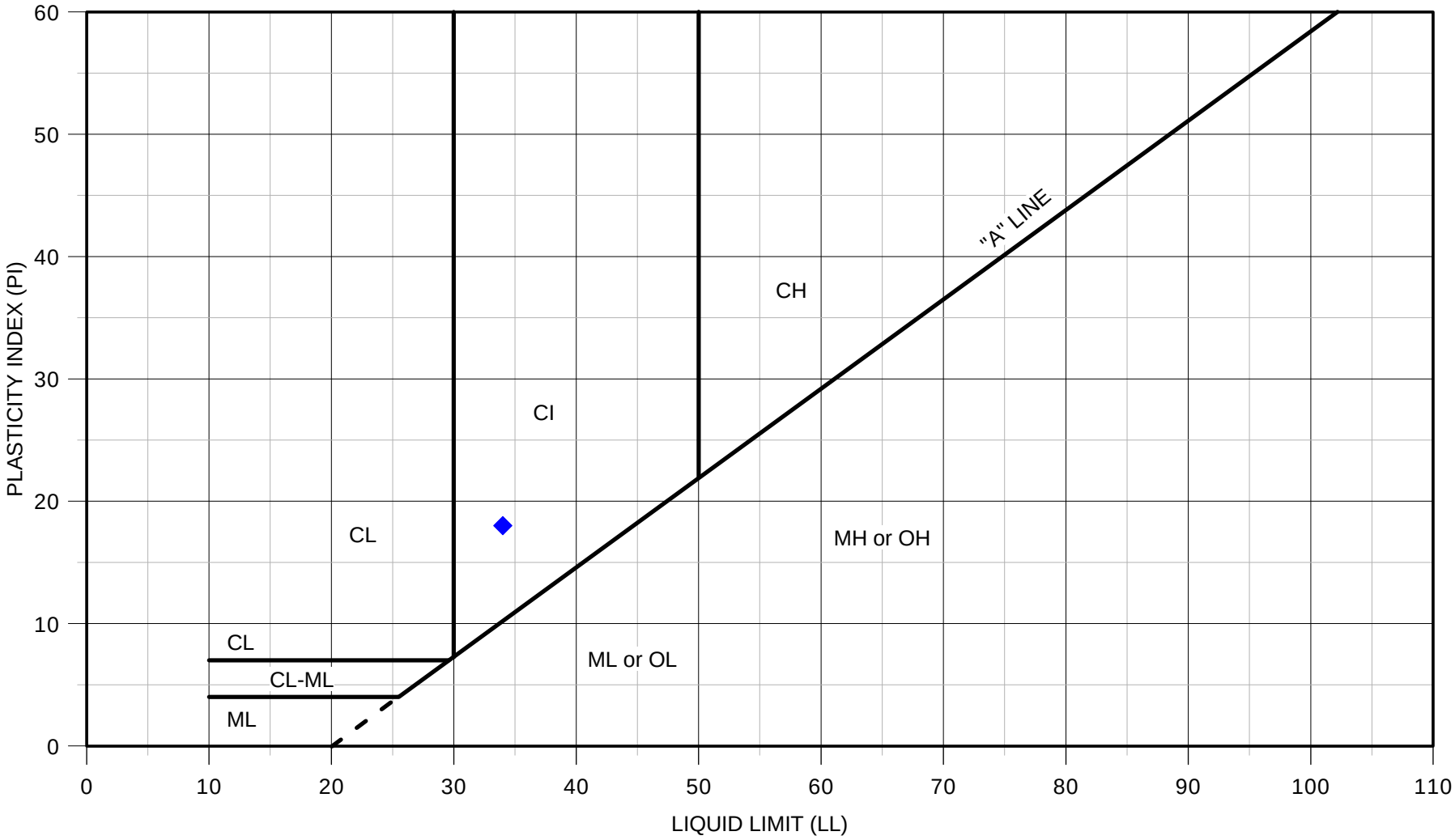
TITLE: ATTERBERG LIMITS LABORATORY RESULTS
DH-BGC10-02 (32.8 - 33.2m)

CLIENT: TERASEN GAS INC.

PROJECT No. 0093-090

FIG No. APPENDIX II
FIGURE 2

REV. A



SCALE:	DATE:	DRAWN:	DESIGNED:	CHECKED:	APPROVED:
1:500	NOV 2010	AJ	AJ	ES	ES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: OFF SPECTRA MUSKWA HDD 2010

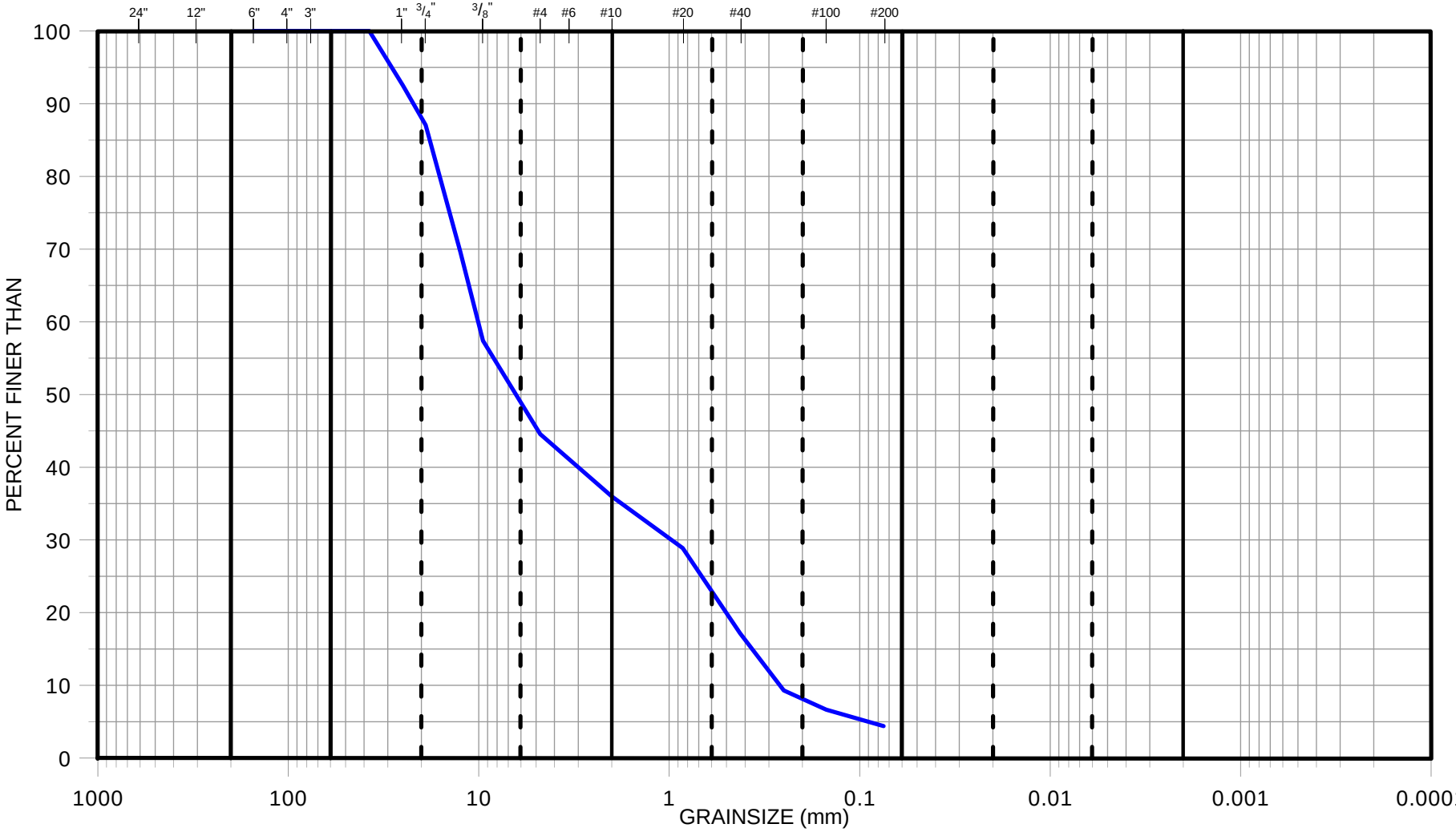
TITLE: ATTERBERG LIMITS LABORATORY RESULTS
DH-BGC10-03(32.8 - 33.2m)

CLIENT: TERASEN GAS INC.

PROJECT No.: 0093-090

FIG No.: APPENDIX II
FIGURE 3

REV.: A



BOULDER	COBBLE	GRAVEL			SAND			SILT			CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

SCALE:	DATE:	DRAWN:	DESIGNED:	CHECKED:	APPROVED:
NTS	NOV 2010	AJ	AJ	ES	ES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: OFF SPECTRA MUSKWA HDD 2010

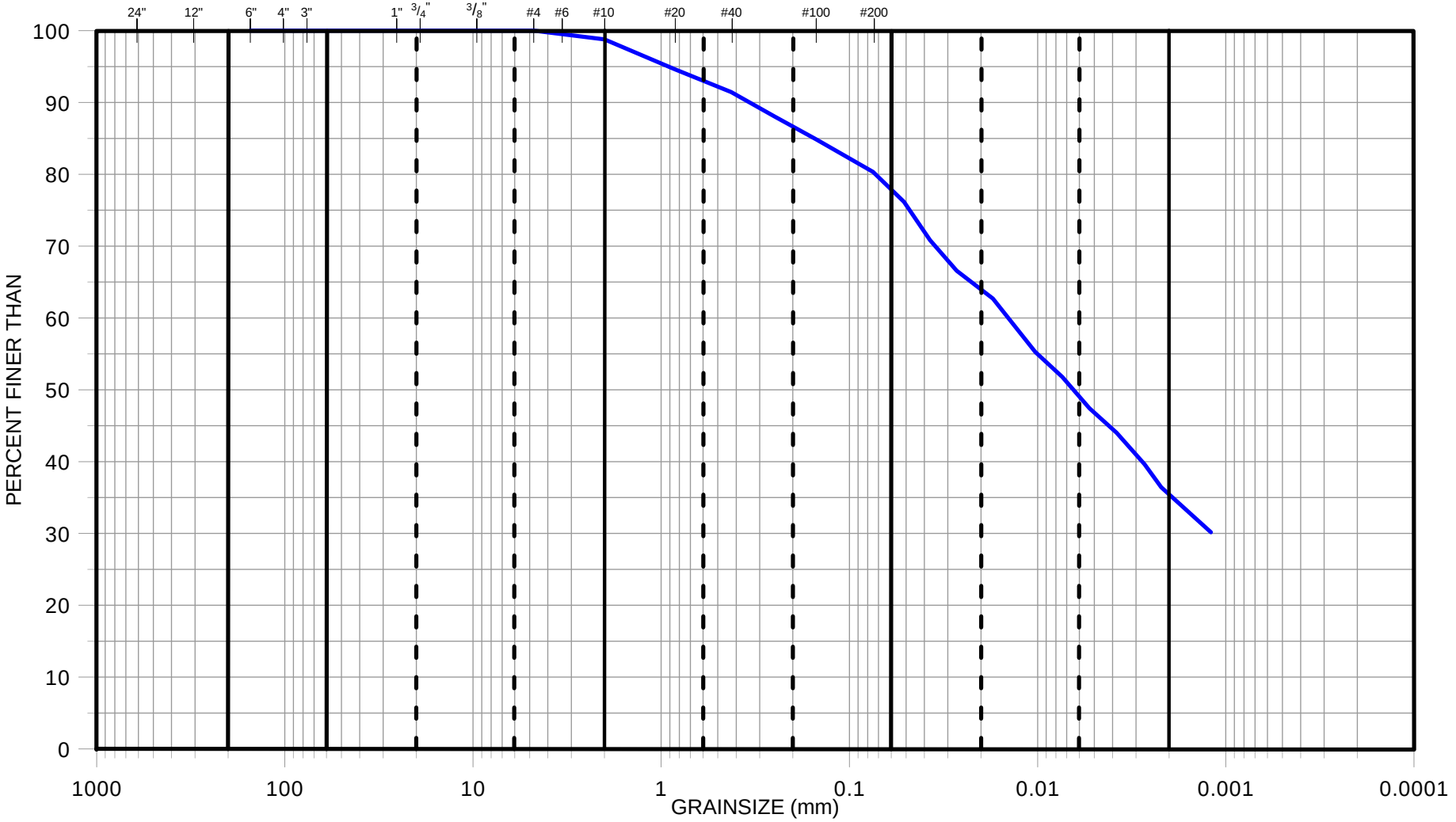
TITLE: GRAINSIZE LABORATORY RESULTS
DH-BGC10-01 (11.4 - 11.9m)

CLIENT: TERASEN GAS INC.

PROJECT No.: 0093-090

FIG No.: APPENDIX II
FIGURE 4

REV.: A



BOULDER	COBBLE	GRAVEL			SAND			SILT			CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

SCALE:	DATE:	DRAWN:	DESIGNED:	CHECKED:	APPROVED:
NTS	NOV 2010	AJ	AJ	ES	ES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: OFF SPECTRA MUSKWA HDD 2010

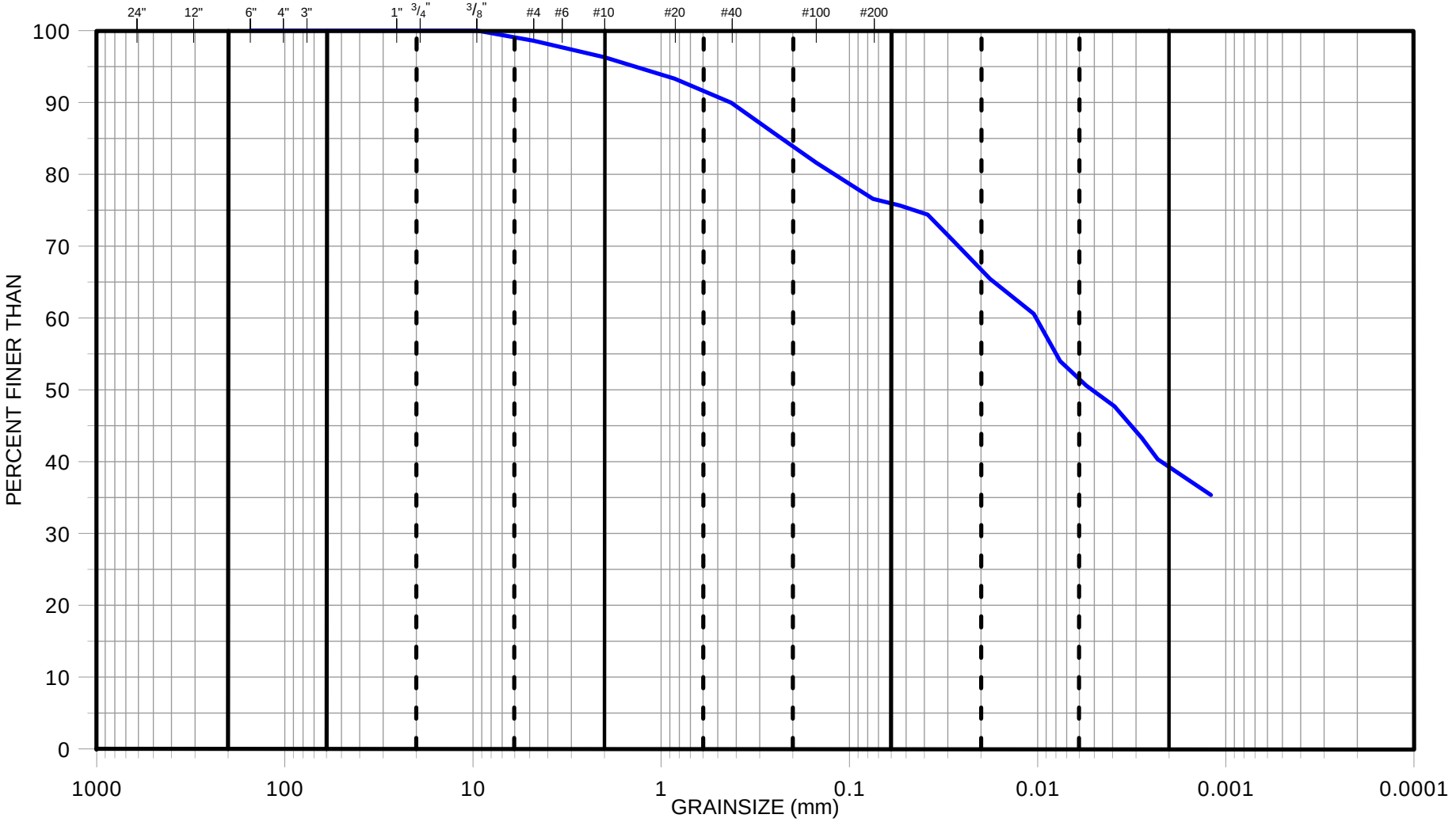
TITLE: GRAINSIZE LABORATORY RESULTS
DH-BGC10-01 (17.5 - 18.0m)

CLIENT: TERASEN GAS INC.

PROJECT No.: 0093-090

FIG No.: APPENDIX II
FIGURE 5

REV.: A



BOULDER	COBBLE	GRAVEL			SAND			SILT			CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

SCALE:	DATE:	DRAWN:	DESIGNED:	CHECKED:	APPROVED:
NTS	NOV 2010	AJ	AJ	ES	ES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: OFF SPECTRA MUSKWA HDD 2010

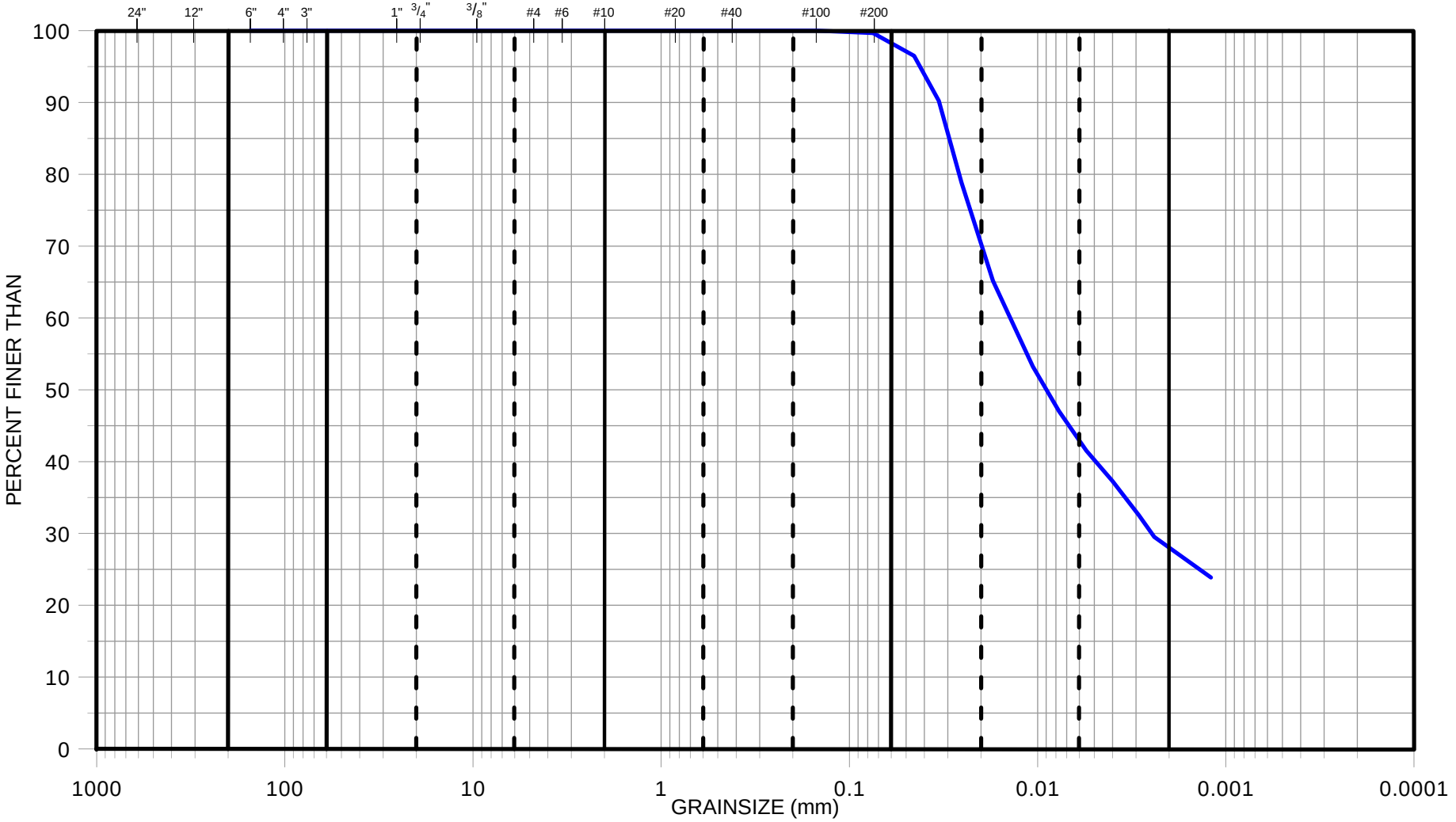
TITLE: GRAINSIZE LABORATORY RESULTS
DH-BGC10-02 (32.8 - 33.2m)

CLIENT: TERASEN GAS INC.

PROJECT No.: 0093-090

FIG No.: APPENDIX II
FIGURE 6

REV.: A



BOULDER	COBBLE	GRAVEL			SAND			SILT			CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

SCALE:	DATE:	DRAWN:	DESIGNED:	CHECKED:	APPROVED:
NTS	NOV 2010	AJ	AJ	ES	ES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: OFF SPECTRA MUSKWA HDD 2010

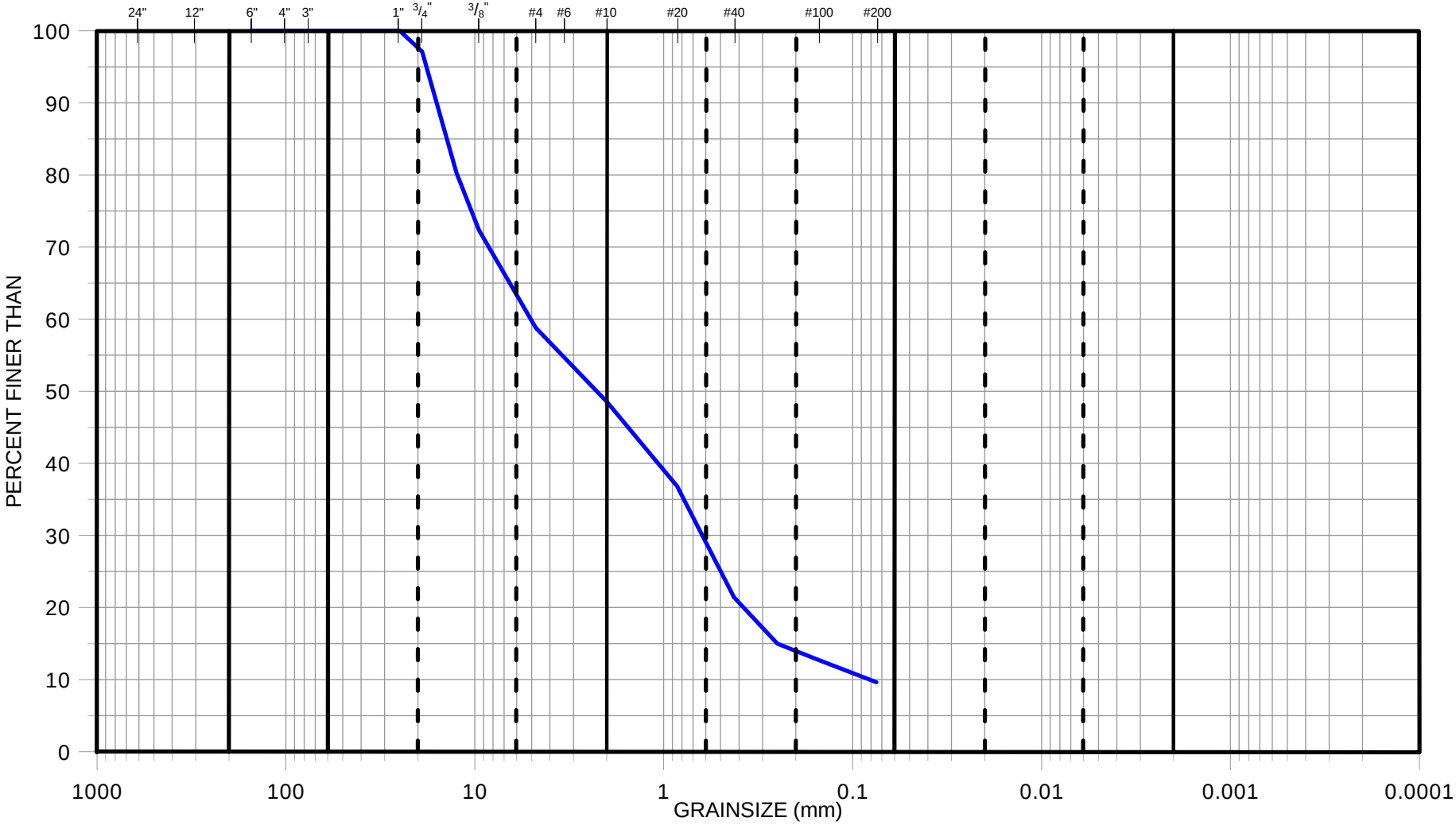
TITLE: GRAINSIZE LABORATORY RESULTS
DH-BGC10-03 (32.8 - 33.2m)

CLIENT: TERASEN GAS INC.

PROJECT No.: 0093-090

FIG No.: APPENDIX II
FIGURE 7

REV.: A



BOULDER	COBBLE	GRAVEL			SAND			SILT			CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	

SCALE:	DATE:	DRAWN:	DESIGNED:	CHECKED:	APPROVED:
NTS	NOV 2010	AJ	AJ	ES	ES

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

PROJECT: OFF SPECTRA MUSKWA HDD 2010

TITLE: GRAINSIZE LABORATORY RESULTS
DH-BGC10-04 (5.3 - 5.8m)

CLIENT: TERASEN GAS INC.

PROJECT No.: 0093-090

FIG No.: APPENDIX II
FIGURE 8

REV.: A

APPENDIX III
GEOPHYSICS REPORT

BGC ENGINEERING INC.

REPORT ON

SEISMIC REFRACTION AND GROUND PENETRATING RADAR INVESTIGATION

MUSKWA RIVER

GAS PIPELINE CROSSING

FORT NELSON, B.C.

by

Kevin Payne, P.Eng.

Russell A. Hillman, P.Eng.

September, 2010 **PROJECT FGI-1152**

Frontier Geosciences Inc. 237 St. Georges Avenue, North Vancouver, B.C., Canada V7L 4T4
Tel: 604.987.3037 Fax: 604.984.3074

CONTENTS

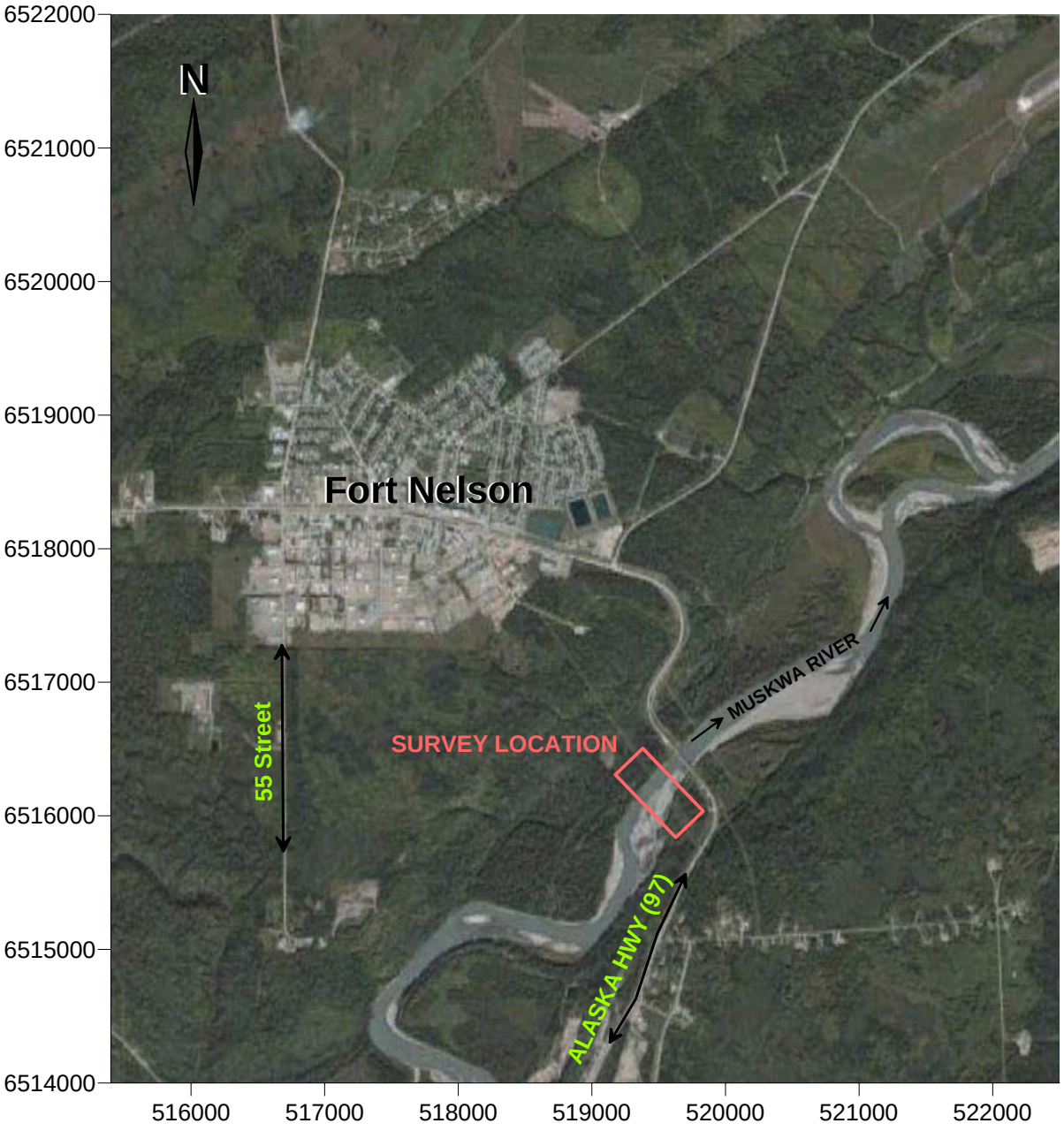
ILLUSTRATIONS

1. INTRODUCTION

In the period September 21 to September 25, 2010, Frontier Geosciences Inc. carried out a land and overwater seismic refraction geophysical survey for BGC Engineering Inc. at a proposed Terasen Gas Inc., Muskwa River pipeline crossing near Fort Nelson, B.C. The area of the proposed HDD borehole path near Fort Nelson is shown at 1:50,000 scale in the Survey Location Plan in Figure 1. A more detailed Site Plan illustrating the location of the proposed Muskwa River crossing is presented at 1:2,000 scale in Figure 2. Terasen Gas Inc. intends to replace the existing buried pipeline under the Muskwa River in 2011.

The seismic refraction surveying was carried out along the proposed borehole path in three segments. Land-based refraction surveying was carried out on both the northwest and southeast sides of the river. A third segment was completed across the Muskwa River. A combination of 24-channel and 48-channel spreads were used to profile the subsurface layering on the land-based surveying. A total of approximately 440 metres of land and overwater seismic refraction surveying was carried out in the investigation.

Ground Penetrating Radar (GPR) was carried out in order to provide high resolution geological and hazards mapping of both the entry and exit areas of the proposed borehole path. A total of approximately 1170 metres of GPR data was recorded on 30 traverses. The survey coverage consisted of three, approximate northeast-southwest grids with parallel lines spaced at 7.5 metre intervals and a single centreline across the grid, parallel to the existing gas pipeline.



0 1 2 3

KILOMETRES

BGC ENGINEERING INC. MUSKWA RIVER PIPELINE PROJECT		
GEOPHYSICAL SURVEY		
SURVEY LOCATION PLAN		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:50 000	FIG. 1

2. THE SEISMIC REFRACTION SURVEY METHOD

2.1 Land-based Refraction Survey

2.1.1 Equipment

The seismic refraction investigation was carried out using two Geometrics, Geode, 24 channel, signal enhancement seismographs and Mark Products Ltd., 48 Hz geophones. Geophone intervals along the multicored seismic cables were maintained at 5 metres in order to produce high resolution data on subsurface layering. Energy input was provided by small explosive charges buried in shallow, hand-excavated shotholes. The zero delay or instantaneous blasting caps in the explosive charges were detonated electrically with a Geometrics, HVB-1, high voltage, capacitor-type blaster.

2.1.2 Survey Procedure

For each spread, the seismic cable was stretched out in a straight line and the geophones implanted. Six separate 'shots' were then initiated: one at either end of the geophone array, two at intermediate locations along the seismic cable, and one off each end of the line to ensure adequate coverage of the basal layer. The shots were detonated individually and arrival times for each geophone were recorded digitally in the seismograph. Data recorded during field surveying operations was generally of good to excellent quality.

Throughout the survey, notes were recorded regarding seismic line positions in relation to topographic and geological features, and survey stations in the area. Relative elevations on the seismic lines were recorded by chain and inclinometer with absolute elevations taken from a profile of the site area by Terasen Gas Inc.

2.2 Overwater Refraction Survey

2.2.1 Equipment

The overwater seismic refraction surveying was carried out with two, land-based, Geode seismographs and geophones together with a water-borne shotgun energy source. The shotgun fired blank, 8 gauge shotgun shells into the water from a 16 ft (5m) jet boat. Shot initiation or zero time was established by metal-to-metal contact of a striking hammer contacting the firing pin of the shotgun. A Gisco seismic radio trigger in the survey boat was used to initiate recordings at the two, shore-based seismographs.

2.2.2 Survey Procedure

In operation, the 'shooting' boat drifted in-line with the recording stations and the shotgun source was detonated. The recording stations were automatically triggered by a radio link between the shooting vessel and recording seismographs. Accurate positioning of the shooting vessel was determined by Electronic-Distance measuring (EDM) reflections recorded from one of the known shoreline positions. With numerous shot locations spanning the breadth of the river, detailed travel time data was established similar to land-based operations.

2.3 Interpretive Method

The final interpretation of the land-based and overwater seismic data was arrived at using the method of differences technique. This method utilises the time taken to travel to a geophone from shotpoints located to either side of the geophone. Using the total time, a small vertical time is computed which represents the time taken to travel from the refractor up to the ground surface. This time is then multiplied by the velocity of each overburden layer to obtain the thickness of each layer at that point.

In overwater refraction interpretation, calculated depths to subsurface layering are determined from the water surface. The depths to sub-bottom refractors requires subtraction of the water column. The water depth information was recorded by overwater bathymetric surveying.

3. THE OVERWATER BATHYMETRY SURVEY

3.1 Equipment

The overwater bathymetric survey was completed with an ultra-miniature, Imagenex, Model 852-000-140 echo sounder. This transducer was operated and controlled by a laptop computer that also served as data storage for the reflection data recorded from the river bottom. The system was calibrated with respect to water temperature and water salinity and used a broadband output with a 675 kHz centre frequency. Positioning information was provided by a WAAS-enabled Garmin 76 GPS unit.

3.2 Survey Procedure and Positioning

The bathymetric transducer was placed in the water at a depth of 0.2 metres on the port side of the boat. The transducer location was chosen to facilitate the best operating environment for the transmission and reception of sound pulses. In operation, the source transducer pulsed about eight times a second. The pulses emitted from the transducer were reflected by the river bottom then digitally recorded and visually reviewed in real time on the high resolution display of the laptop computer. The digital record of the reflected signal was stored in the computer hard drive and was played back to interpret water depths.

The GPS system was comprised of a portable WAAS enabled Garmin 76 GPS receiver which attained an accuracy of less than 3 metres. The bathymetric data was correlated with the GPS data to accurately plot each pulse position to be contoured for final interpretation. The survey was carried out in good conditions, and the continuity and quality of the data were excellent.

4. THE GROUND PENETRATING RADAR SURVEY

4.1 Principles

Ground penetrating radar entails transmitting an electrical pulse into the subsurface by discharging electromagnetic energy from a transducer antenna. The transmitted pulse travels through the subsurface until it reaches a subsurface interface or embedded object. Depending on the electrical characteristics of the interface, a portion of the transmitted pulse is reflected back to the surface where it is detected by the receiver section of the same antenna. The depth of penetration is dependent upon the electrical properties of the soil and the antenna used. This survey used a 200 MHz antenna which has a maximum calculated depth of penetration of approximately 10 metres, in the anticipated dry to moist, coarse to fine-grained soils in the survey area.

4.2 Survey Equipment

The survey was carried out using a Geophysical Survey Systems Inc., SIR system 2, combined with antennas that operate at a frequency of 200 MHz. The system antennas are combined in one housing and are designed to slide over the ground surface without damage to the transducer. The system is operated by a portable control unit that allows visual field inspection of recorded data for immediate assessment.

4.3 Survey Procedure and Positioning

The system consists of combined transmitter and receiver antennas that are towed along a traverse. An additional odometer linked to the pulse triggering system ensures a constant 0.05 metre spatial sampling rate. While surveying, line distances were noted against known survey points in the field. Care was taken to ensure the radar antennas traversed the ground surface as smoothly as possible to ensure good coupling between the radar antennas and the ground surface. Field data were inspected for clarity and completeness before proceeding to the next survey line.

4.4 Data Post-processing Procedure

Each GPR record was exported, geocoded and imported into the SMT Kingdom software suite for filtering and horizons interpretation. Processing consisted of band-pass frequency filtering and amplitude recuperation to enhance reflections and diffractions within the records. Positioning was determined by notes and measurements obtained in the field. The processed and interpreted GPR sections were then exported as a post-processed colour scale radargram amplitude section with a vertical time scale (in nanoseconds) and an estimated depth scale. Converting the vertical axis to depth took into account the two-way travel time of the radar path and the expected velocity of the pulses through the earth materials.

5. GEOPHYSICAL RESULTS

5.1 General

The interpreted section for the combined land and overwater seismic traverses at the site are shown at a scale of 1:500 in Figures 3A and 3B in the Appendix. Ground surface profiles along the land-based refraction lines were determined by chain and inclinometer and referred to absolute elevations provided by Terasen Gas Inc. The river bottom configuration for the overwater refraction traverse was determined from bathymetric surveying.

The Ground Penetrating Radar Survey at the site detected continuous shallow reflectors and segments of deeper reflectors to depths of 6 to 7 metres. Representative GPR profile data for the North, Mudflats, and South Grids are illustrated in Figures 4 through 9 in the Appendix.

5.2 Discussion

5.2.1 Seismic Refraction

The seismic refraction data indicate there are three distinct velocity layers underlying the land-based segments of the interpreted section. There is a moderately thick surficial layer underlying the site area with compressional wave velocities varying from 250 m/s to 425 m/s. This layer is consistent with surface exposures, shothole and drillhole intersections of loose to compact, unsaturated Sand, Sand and Gravel, Sand and Silt and Gravel. The maximum interpreted thickness for this layer is approximately 8.5 metres.

Underlying the surficial layer is a thicker intermediate layer with velocities in the range 1370 m/s to 1700 m/s. This interpreted layer is consistent with drillhole intersections of saturated, loose to dense, Gravel and Sand, Sand and Gravel. Interpreted thicknesses for this intermediate layer vary from 3 metres below the Muskwa River to a maximum of 22 metres in the depression roughly centred at DH-BGC-10-3 and station 270SE.

The basal layer with velocities of 1790 m/s to 2170 m/s is consistent with stiff to very hard, Clay or Silt intersected in drillholes DH-BGC-10-1, DH-BGC-10-2 and DH-BGC-10-3. Drillhole DH-BGC-10-4 was put down to 19.1 m without intersecting the basal Clay/Silt horizon.

The surface of the basal Clay/Silt layer is generally flat-lying, however depressions underlying each shoreline may be related to scouring. A broader, flat depression is also evident from station 365 SE to the end of the seismic traverse.

5.2.2 Ground Penetrating Radar

5.2.2.1 North Grid

The north survey grid is characterized by two main reflectors. One shallow reflector is highlighted at approximately 30 to 60 nanoseconds (ns) and is attributed to a siltier horizon within the overburden. Using an average velocity of 0.040 m/ns for sand, this horizon is calculated to be approximately 1 to 2.5 m in depth. A shallow, siltier horizon was intersected at approximately 1.5 m depth in nearby drillhole DH-BGC-10-1. A second, deeper, discontinuous reflector is evident at approximately 100 to 150 ns. The depths to this deeper reflector are of the order of 5.5 to 7.2 m. This deeper reflector is believed to be the water table and is consistent with water table depths of 6.7 m and 7.0 m noted in drillholes DH-BGC-10-1 and DH-BGC-10-2, respectively.

5.2.2.2 Mudflats Grid

A shallow reflector was identified in the data and is highlighted from about 30 to 50 nanoseconds in the sections for lines 108 and 112. Using a velocity for wet silt and sand, the depths to this reflector range from 0.5 m to 2.5 metres. This reflector is attributed to a horizon of siltier material consistent with a sand/silt intersection at 1.5 m in nearby drillhole, DH-BGC-10-3.

A deeper reflector is evident in section 112, which is believed to be due to sandy or coarser materials below the overlying finer-grained materials. The average depth to this deeper horizon is calculated to be approximately 5 to 7 m, using an average velocity of 0.030 m/ns for water saturated sand.

There is a change in character of the GPR data at the southwest end of line 108. At this location, a number of hyperbolic diffraction patterns are evident in the data. These diffractions are present on several of the GPR traverses in this area and are likely caused by point sources such as large, wood debris or coarse boulders placed at this location. These

GPR signatures are consistent with the significant depression interpreted from the seismic refraction data at station 270 SE and confirmed by drillhole DH-BGC-10-3.

5.2.2.3 South Grid

The south grid is also characterized by two main reflectors. The first, shallower reflector is highlighted at approximately 10 to 75 nanoseconds on lines 103 and 107. Calculated to be approximately 0.3 m to 3.5 m in depth, this reflector is believed to be consistent with interbedded layers of finer-grained, siltier material intersected in drillhole DH-BGC-10-4.

A second deeper reflector is highlighted in the data at approximately 100 to 150 nanoseconds. Ranging in interpreted depths from 5 m to 7.5 m, this deeper event is interpreted as the water table surface in the South Grid area.

6. LIMITATIONS

The depths to subsurface boundaries derived from seismic refraction surveys are generally accepted as accurate to within fifteen percent of the true depths to the boundaries. In some cases, unusual geological conditions may produce false or misleading data points with the result that computed depths to subsurface boundaries may be less accurate. In seismic refraction surveying difficulties with a 'hidden layer' or a velocity inversion may produce erroneous depths. The first condition is caused by the inability to detect the existence of a layer because of insufficient velocity contrasts or layer thicknesses. A velocity inversion exists when an underlying layer has a lower velocity than the layer directly above it.

The GPR analyses and conclusions are based on data obtained from closely spaced lines. The GPR method provides an estimate of subsurface conditions only at the specific locations where lines were conducted and only to the depths penetrated, and within the accuracy of the method. These data are indirect and the interpreted features subjective in nature, with identified anomalies based on a visual assessment of the characteristic signatures in the data.

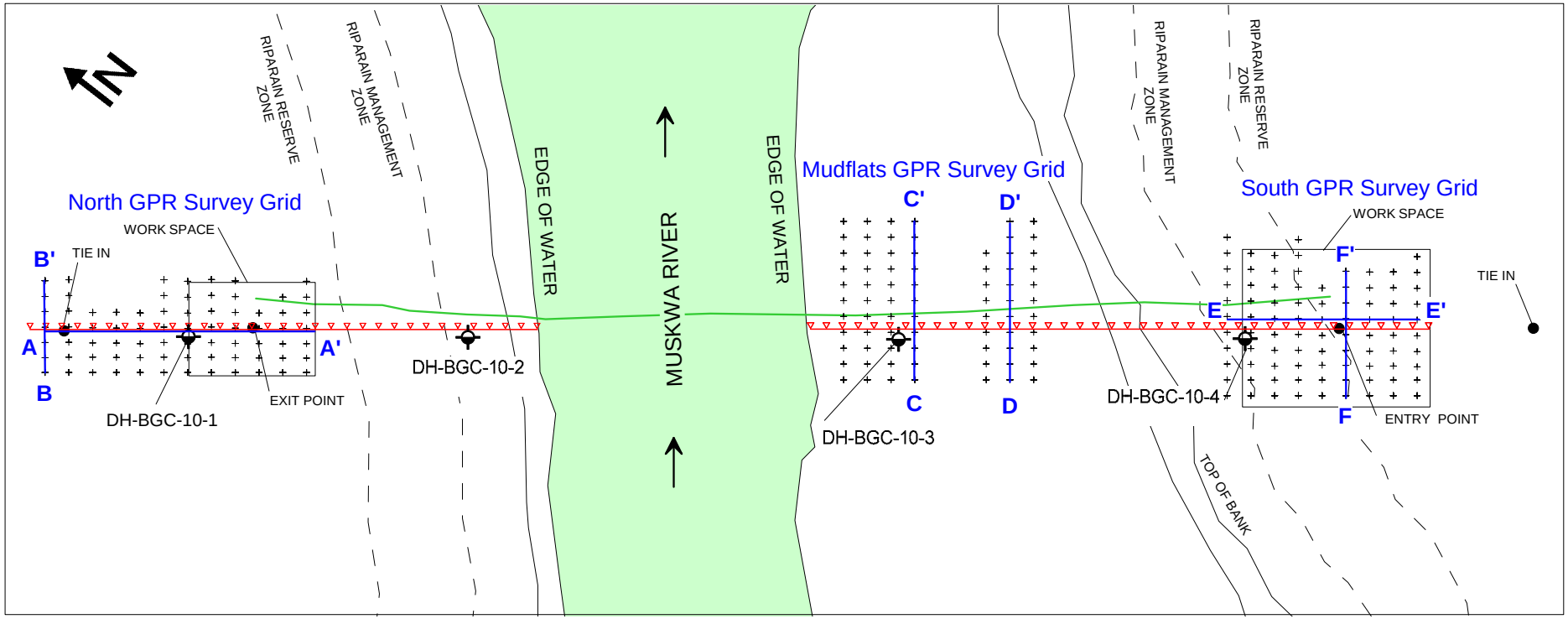
The depths to subsurface boundaries from Ground Penetrating Radar surveys are generally accepted as accurate to within ten percent of the true depths to the boundaries. Errors are largely due to uncertainty regarding the precise transit velocities in materials overlying the boundary. Geological boundaries determined from test pit or borehole investigations enable calculations of precise layer velocities and greater accuracies in determination of layer thicknesses and depths to subsurface boundaries.

The results are interpretive in nature and are considered to be a reasonably accurate representation of existing subsurface conditions within the limitations of the seismic refraction and ground penetrating radar methods.

For: Frontier Geosciences Inc.

Kevin Payne, P.Eng.

Russell A. Hillman, P.Eng



0 25 50 75 100

METRES

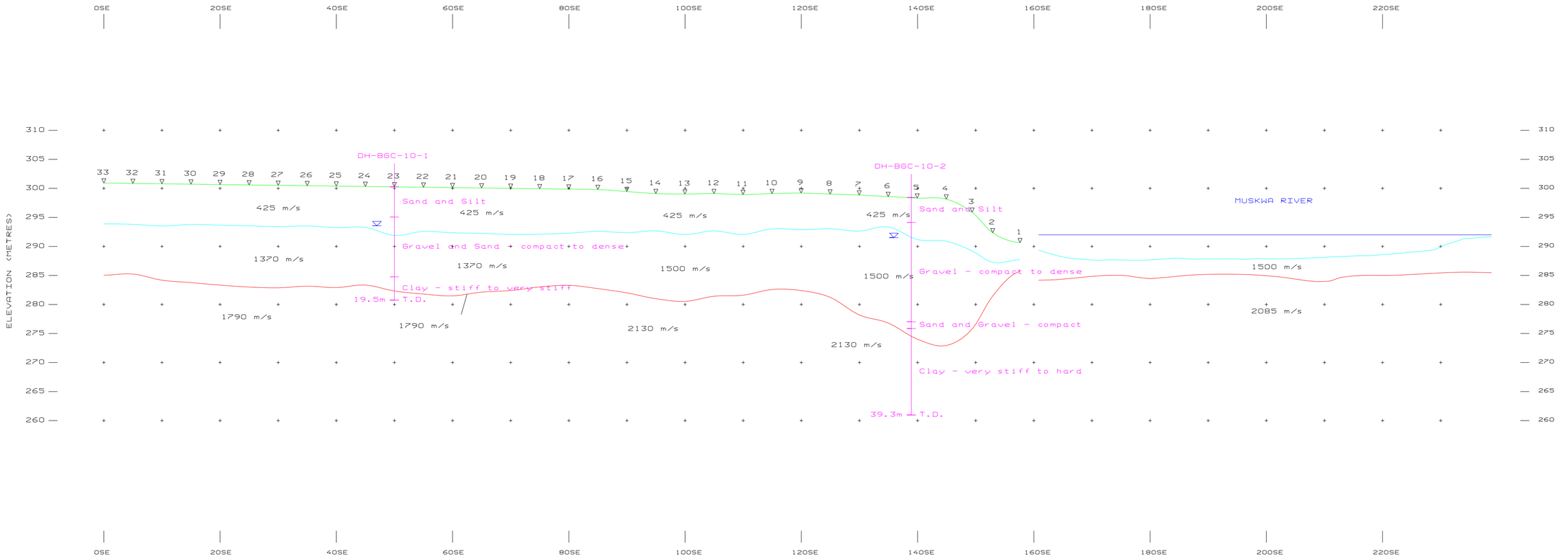
Seismic Refraction Survey Traverse

Existing Terasen Gas Pipeline

GPR Survey

Drillhole

BGC ENGINEERING INC. MUSKWA RIVER PIPELINE CROSSING		
GPR AND SEISMIC SURVEY		
SITE PLAN		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:2000	FIG. 2



SEISMIC LINE SL-1

INSTRUMENT: GEOMETRICS GEODE

BGC ENGINEERING INC.

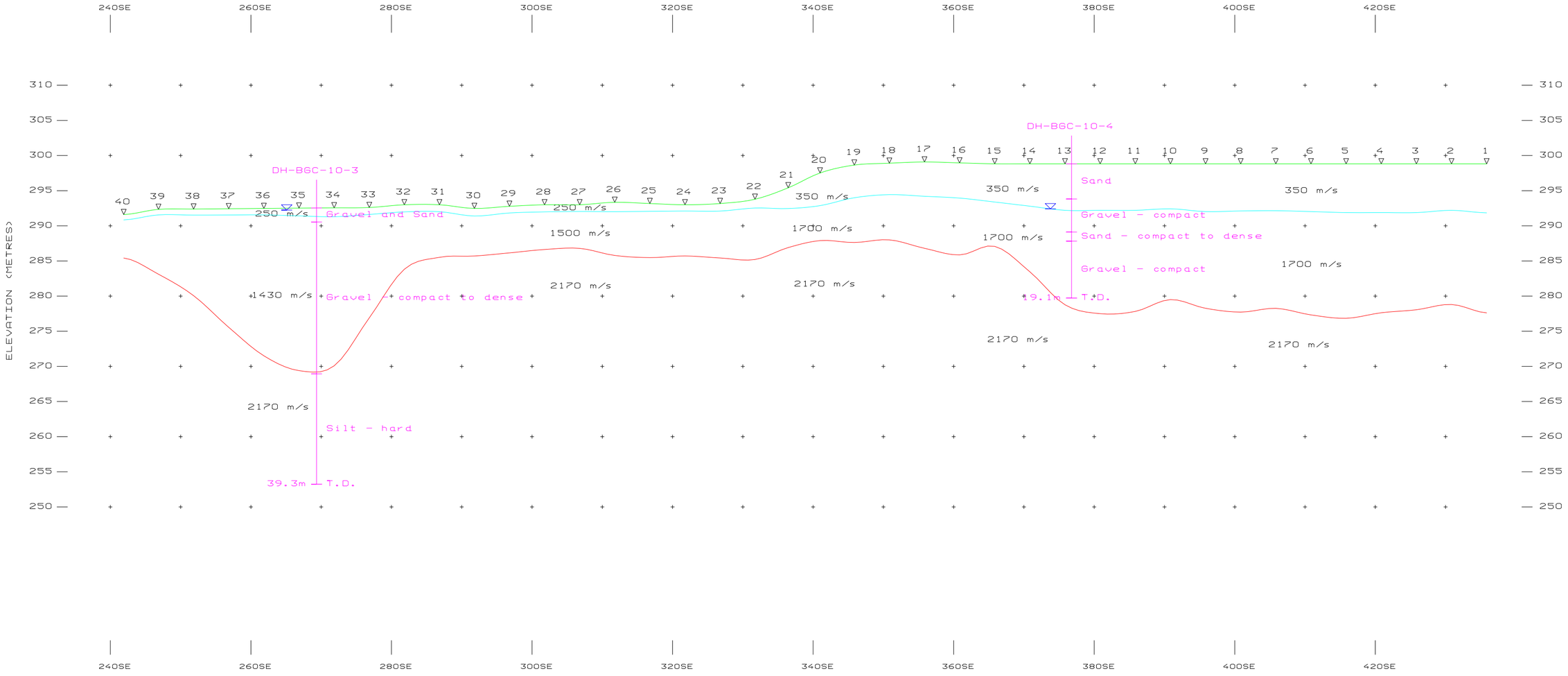
MUSKWA RIVER PIPELINE CROSSING

SEISMIC REFRACTION SURVEY

INTERPRETED DEPTH SECTION SL-1

FRONTIER GEOSCIENCES INC.

DATE: SEPT. 2010	SCALE 1:500	FIG. 3A



SEISMIC LINE SL-1

INSTRUMENT: GEOMETRICS GEODE

BGC ENGINEERING INC.

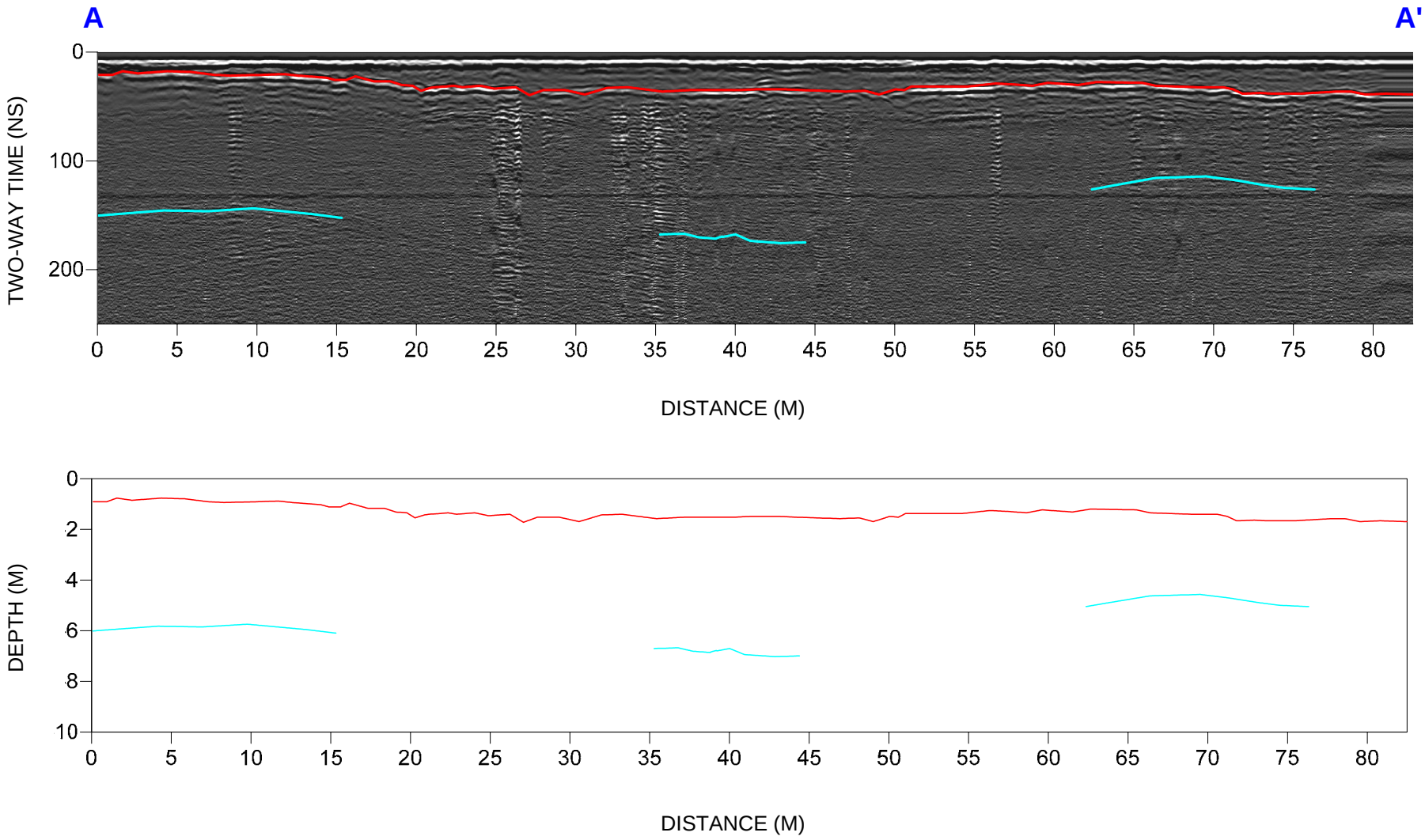
MUSKWA RIVER PIPELINE CROSSING

SEISMIC REFRACTION SURVEY

INTERPRETED DEPTH SECTION SL-1

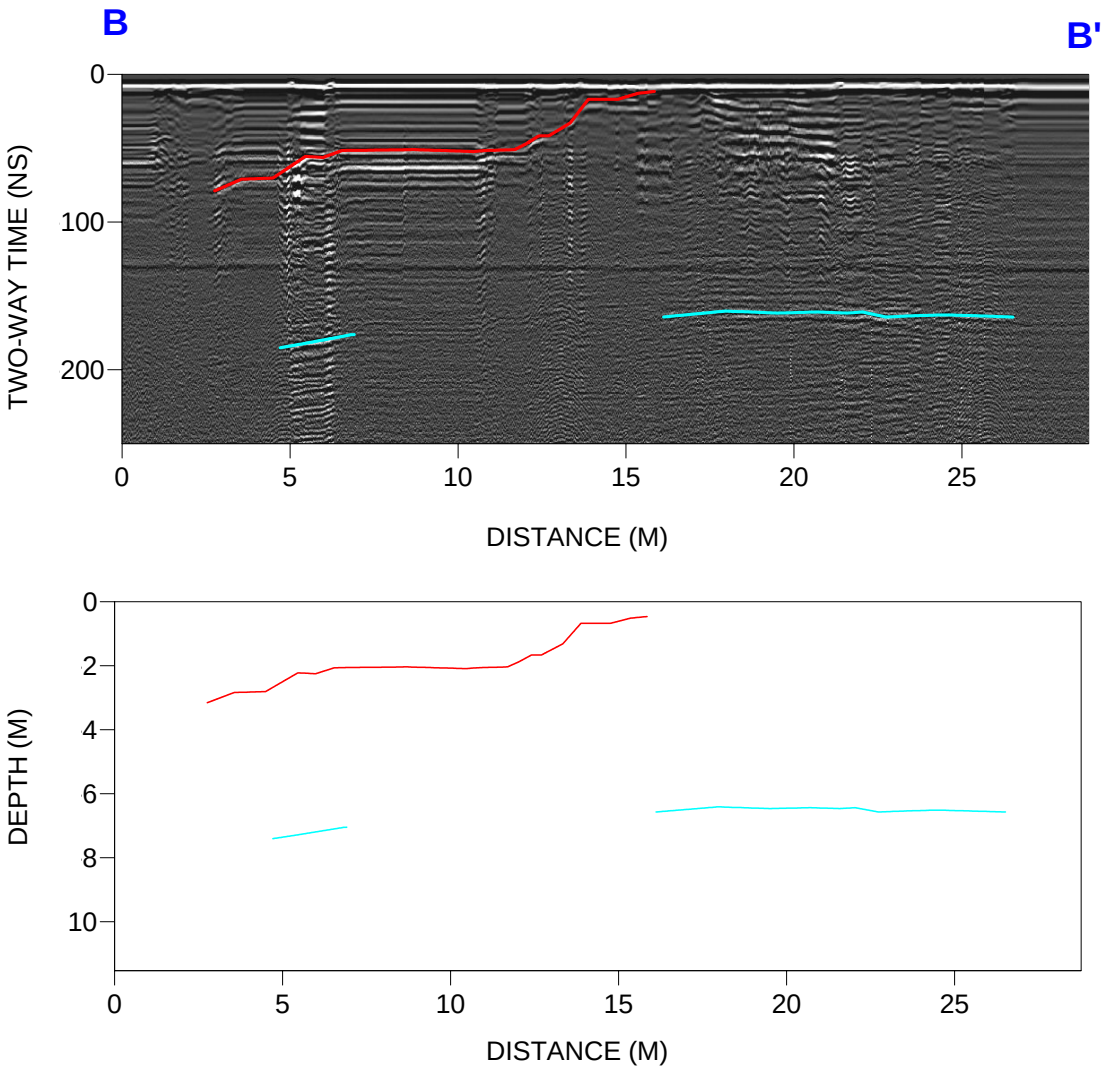
FRONTIER GEOSCIENCES INC.

DATE: SEPT. 2010	SCALE 1:500	FIG. 3B



GPR REFLECTORS

BGC ENGINEERING INC. MUSKWA RIVER PIPELINE CROSSING		
GPR SURVEY		
LINE 127 (NORTH GRID)		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:375	FIG.4



GPR REFLECTORS

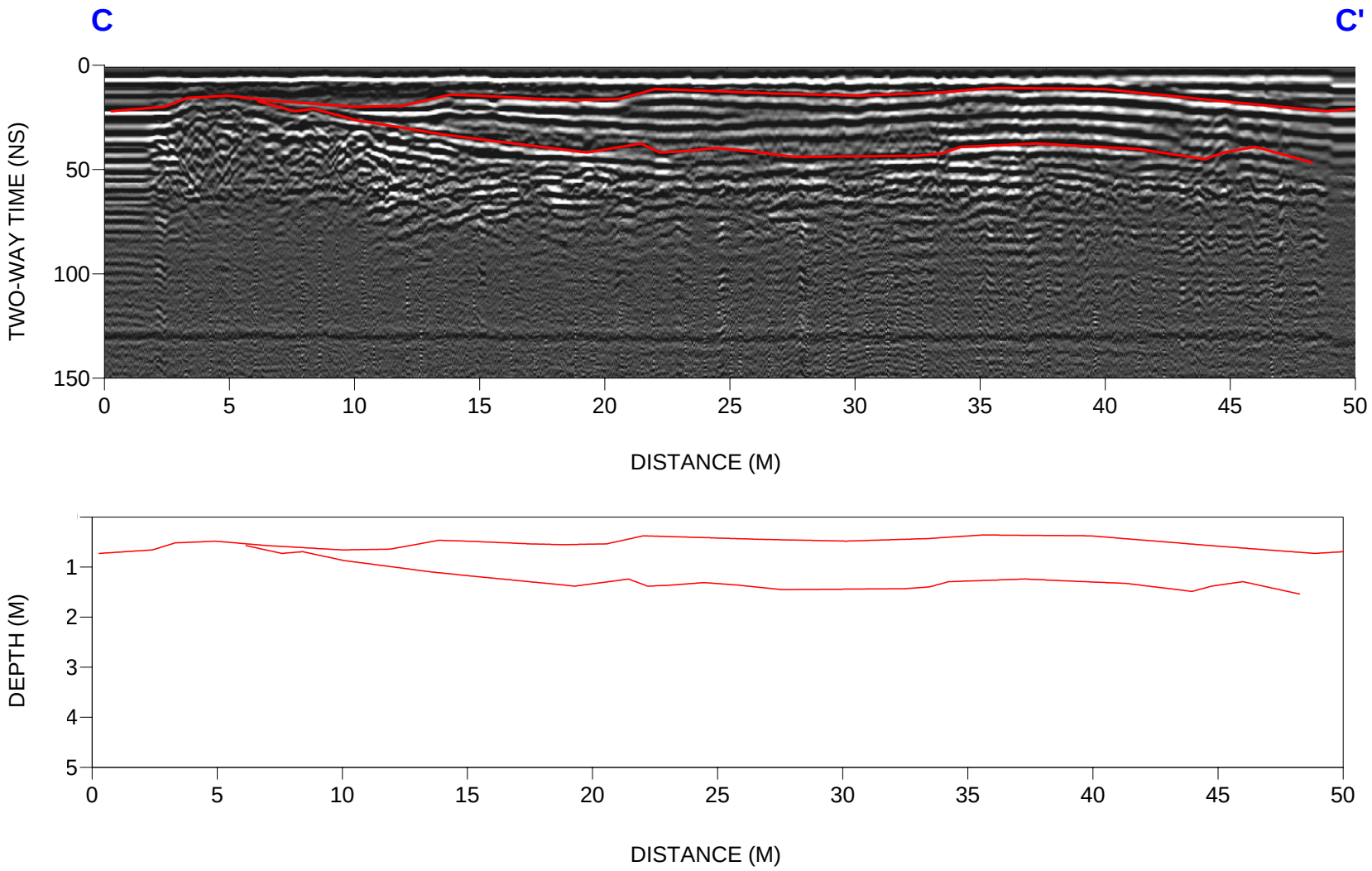
BGC ENGINEERING INC.
MUSKWA RIVER PIPELINE CROSSING

GPR SURVEY

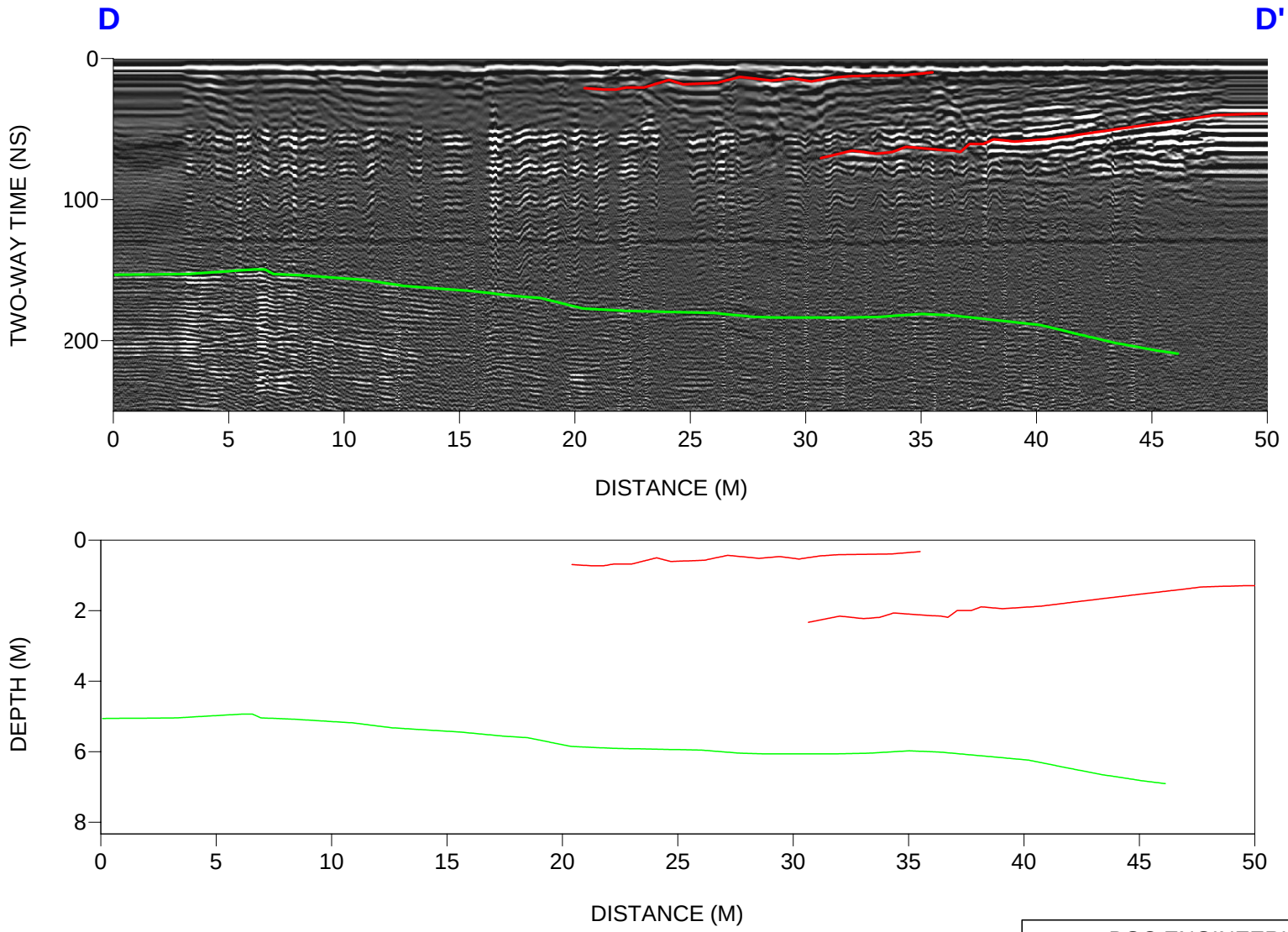
LINE 115 (NORTH GRID)

FRONTIER GEOSCIENCES INC.

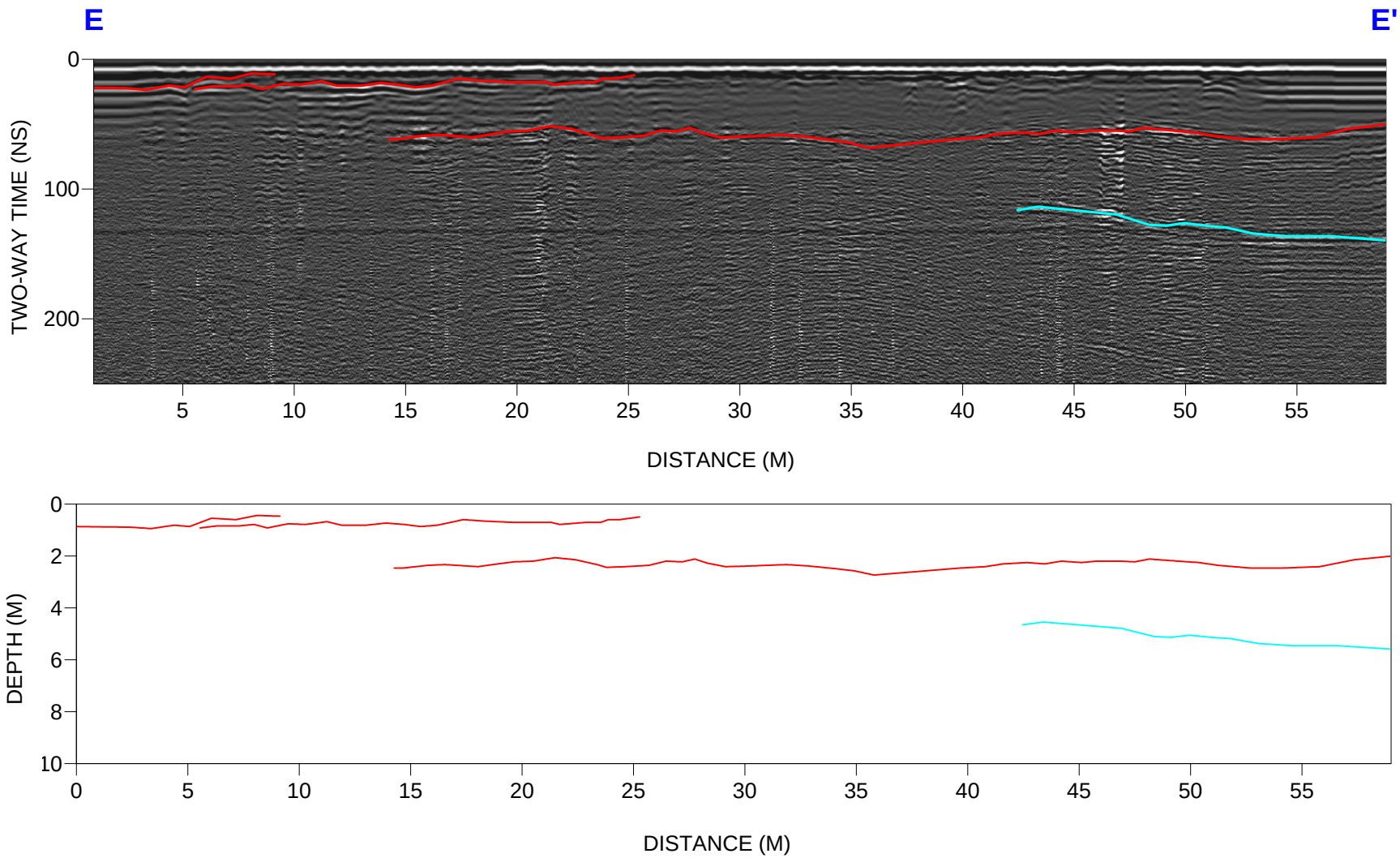
DATE: SEPT. 2010	SCALE 1:225	FIG.5



BGC ENGINEERING INC. MUSKWA RIVER PIPELINE CROSSING		
GPR SURVEY		
LINE 108 (MUDFLATS GRID)		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:250	FIG.6

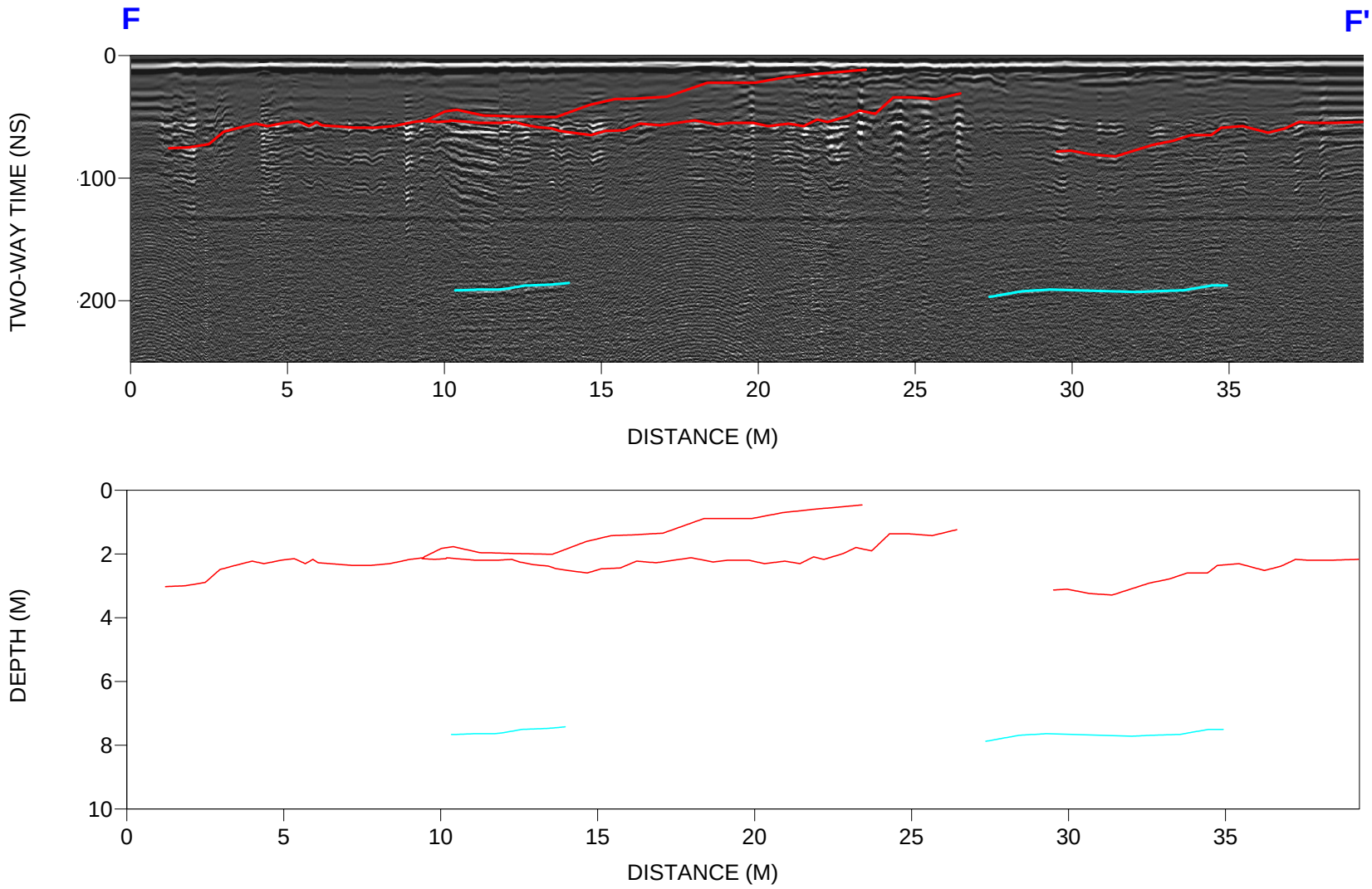


BGC ENGINEERING INC. MUSKWA RIVER PIPELINE CROSSING		
GPR SURVEY		
LINE 112 (MUDFLATS GRID)		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:275	FIG.7



GPR REFLECTORS

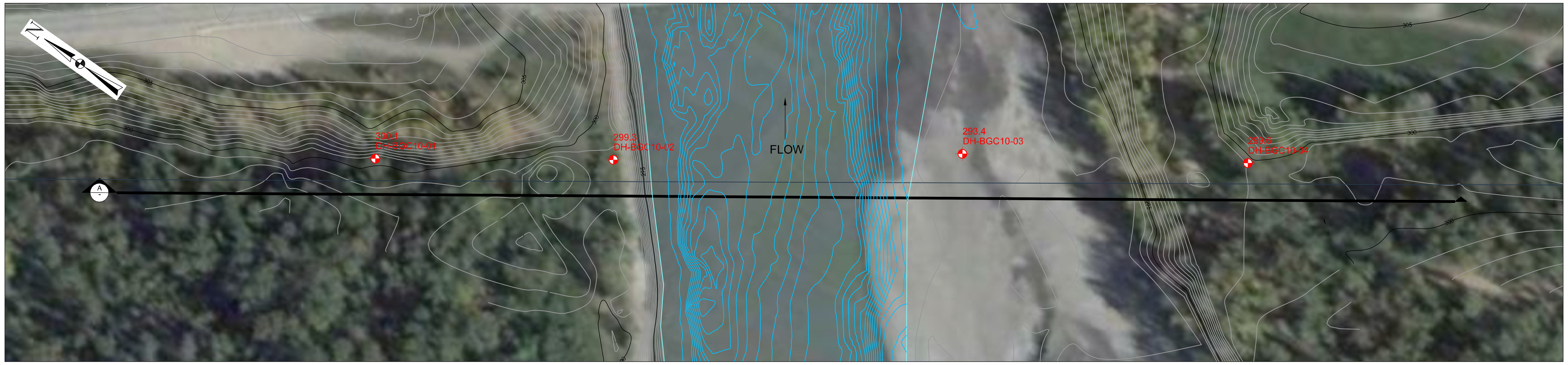
BGC ENGINEERING INC. MUSKWA RIVER PIPELINE CROSSING		
GPR SURVEY		
LINE 107 (SOUTH GRID)		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:275	FIG.8



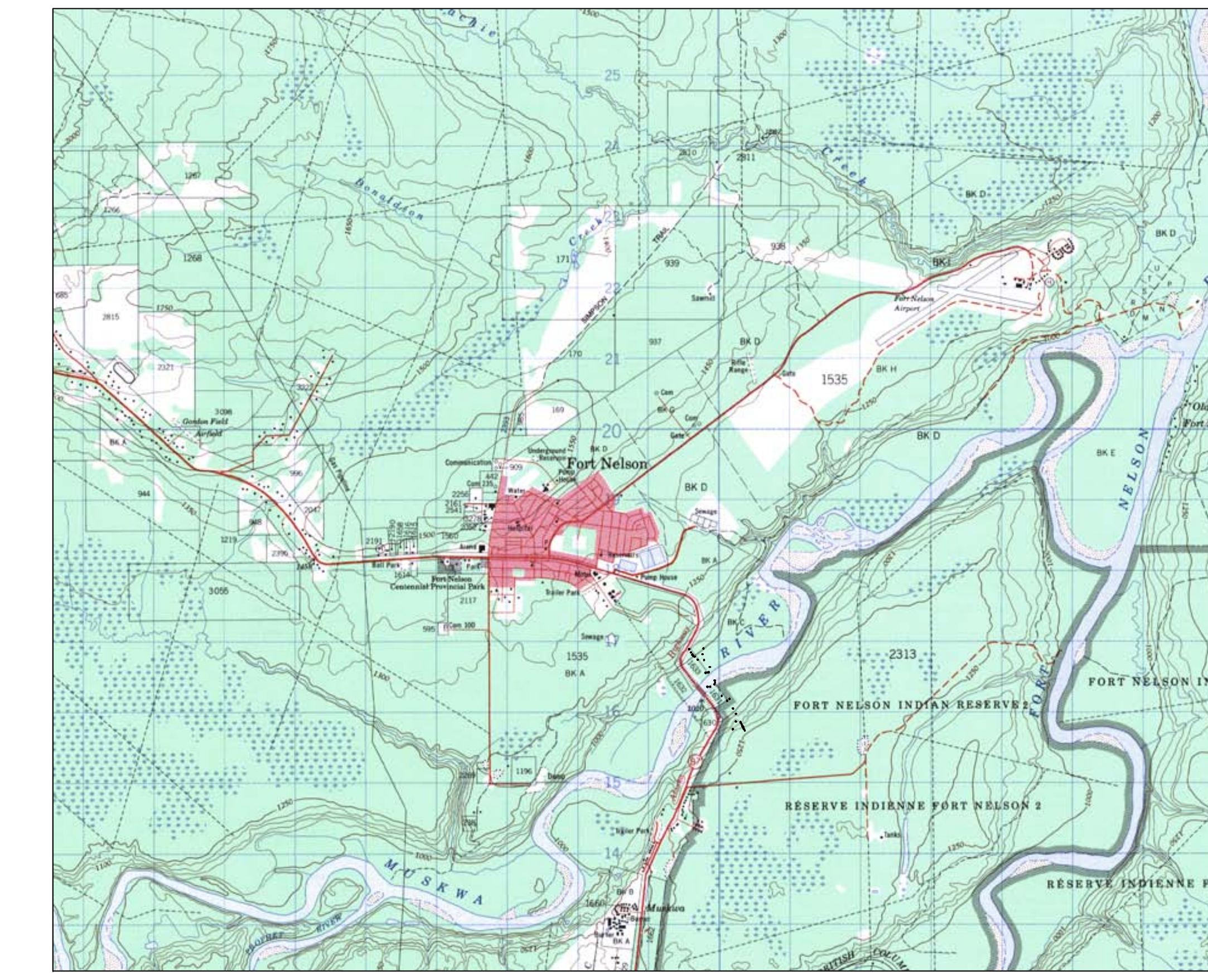
GPR REFLECTORS

BGC ENGINEERING INC. MUSKWA RIVER PIPELINE CROSSING		
GPR SURVEY		
LINE 103 (SOUTH GRID)		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:200	FIG.9

MUSKWA HDD ALIGNMENT PLAN



LOCATION MAP



STRATIGRAPHIC INTERPRETATION

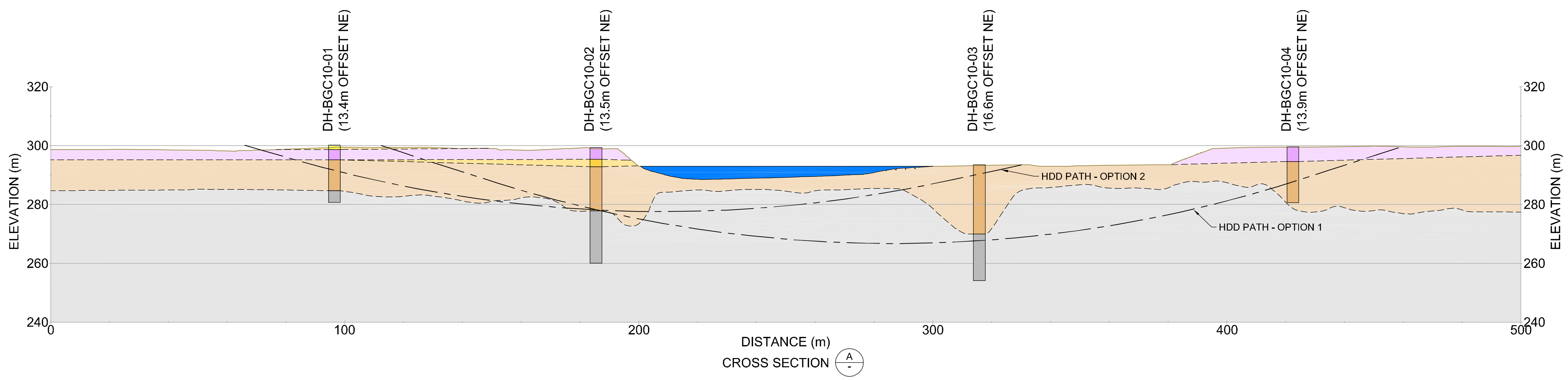
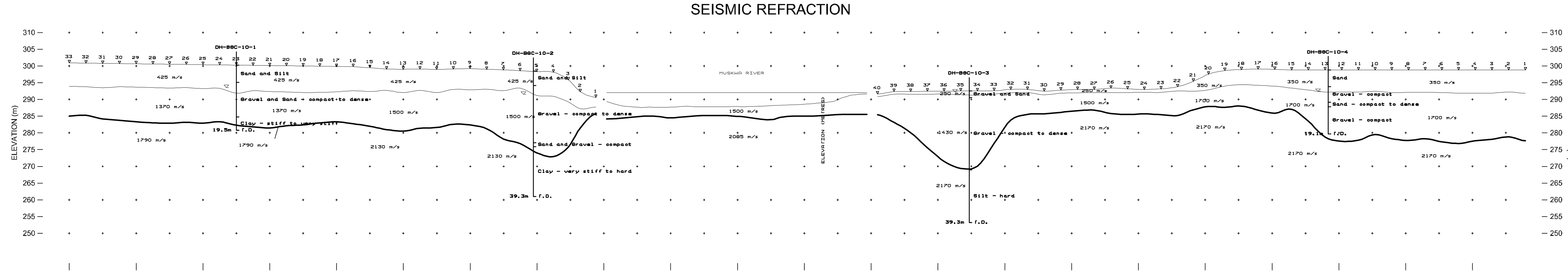


PHOTO 1: LOOKING UPSTREAM TOWARDS DRILL RIG OVER DH-BGC10-03.

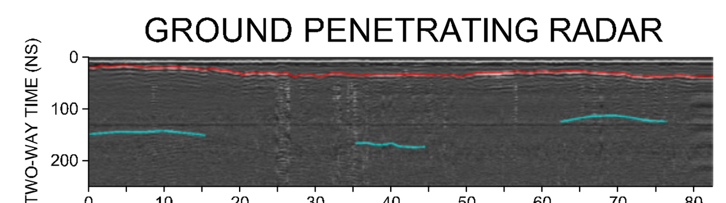
PHOTO 2: LOOKING NORTH AT PROPOSED CROSSING SITE FROM SOUTH BANK.

GEOPHYSICAL RESULTS

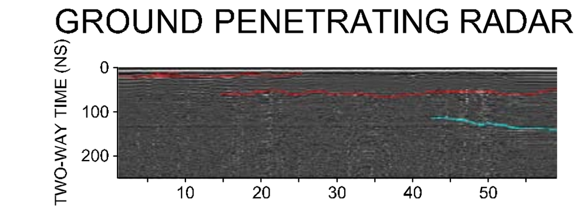
SEISMIC REFRACTION



GROUND PENETRATING RADAR



GROUND PENETRATING RADAR



LEGEND

STRATIGRAPHIC UNITS

BOREHOLE	INTERPRETED	
		SAND (SW) AND GRAVEL
		SAND (SM) AND SILT
		GRAVEL (GM), SILTY
		GRAVEL (GW), SANDY
		SILT (ML), CLAY, HARD

300.1 DH-BGC10-01 — DRILLHOLE

EXISTING GROUND SURFACE

INFERRED LITHOLOGICAL CONTACT (BASED ON GEOPHYSICS)

SHALLOW GPR REFLECTION

DEEP GPR REFLECTION

UTM NAD 83 Zone 10V

NOTES:

1. THIS DRAWING MUST BE INTERPRETED IN ACCORDANCE WITH BGC ENGINEERING INC. REPORT "HORIZONTAL DIRECTIONAL DRILLING GEOTECHNICAL INVESTIGATION FOR MUSKWA RIVER CROSSING" DATED NOV 2010.
2. SUBSURFACE STRATIGRAPHY IS ONLY KNOWN AT EACH INDIVIDUAL BOREHOLE LOCATION. EXTRAPOLATION OF STRATIGRAPHIC HORIZONS HAS BEEN CONDUCTED BETWEEN BOREHOLES AND ACTUAL THICKNESS AND LOCATIONS OF UNITS MAY VARY.
3. GEOTECHNICAL DATA HAS BEEN PROJECTED TO THE ALIGNMENT FROM THE BOREHOLE LOCATIONS AND GEOPHYSICAL RESULTS.
4. LITHOLOGICAL INTERPRETATION TOPOGRAPHY WAS TAKEN FROM A TOPOGRAPHIC SURVEY CONDUCTED BY CAN-AM GEOMATICS BC (SEPT. 1, 2010)

SCALE 1:1000

20m 0 20m 40m 60m

METRES

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:1000
DATE:	NOV 2010
DRAWN:	LS
DESIGNED:	ES
CHECKED:	ES
APPROVED:	AJB

PROFESSIONAL SEAL:

BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY

CLIENT: Terasen Gas

PROJECT: HORIZONTAL DIRECTIONAL DRILLING GEOTECHNICAL INVESTIGATION FOR MUSKWA RIVER CROSSING

TITLE: PLAN, PROFILE, AND GEOPHYSICAL RESULTS

PROJECT No.:	DWG No.:	REV.:
0093-090	01	A

Appendix E

Entec Muskwa River HDD Design Report

November 12, 2010

Terasen Gas Inc.
1150 Kalamalka Lake Road
Vernon, BC, CANADA
V1T 6V2
Phone: (250) 558-3131

Attn: Paul Tassie, P.Eng.
David Bainbridge, P.Eng.

Re: Muskwa River HDD Design Report

Engineering Technology Inc. (Entec) has been asked to provide Terasen Gas Inc. (Terasen) a design report for a potential Horizontal Directional Drilled (HDD) crossing of the Muskwa River near Fort Nelson, British Columbia. Two options have been considered: Option 1 entry point is located outside of the river channel; Option 2 entry point is located on a bench within the river channel.

Location

The potential crossing is located along Highway 97 slightly upstream of the bridge crossing of the Muskwa River. Coordinates for the river crossing location are approximately (6516425N, 519565E). Access to the entry location is directly off the highway along dirt/gravel access trails. Access to the exit location is directly off the highway and may be impeded by substantial wet or flooded areas. It is expected that access to both locations will require matting to protect ground conditions, existing utilities and to prevent equipment from sinking and/or getting stuck during construction.

Entry and exit work pads are required to be cleared and leveled prior to construction. Pads may need matting if conditions are wet or otherwise unstable. Each pad is sized 65 x 50-m to allow sufficient working room for the rig, track hoes, crew trucks etc.

Geology

As of this writing, BGC Engineering (BGC) of Vancouver has completed a geotechnical investigation consisting of soil interpretation through drilling and sampling along the proposed HDD path. A geophysical survey consisting of combined seismic refraction and ground penetrating radar (GPR) surveys has also been completed and results are currently being finalized. Preliminary data provided to Entec indicates substantial amounts of sandy gravel and gravelly sands along the proposed crossing alignment. Four boreholes were drilled: DH-BGC10-1 (nearest to the exit), DH-BGC10-2 (nearest to the river, exit side), DH-BGC10-3 (nearest to the river, entry side) and DH-BGC10-4 (nearest to the entry). BGC10-1 and BGC10-2 indicate, generally, upper sand layers and

a thick gravel layer underlain by stiff to hard, low plastic silts with the gravel/silt interface at 15.5-m and 24.4-m below ground respectively. DH-BGC10-3 indicates gravel underlain by hard silt material with the interface at 23.6-m below ground. DH-BGC10-4 indicates sand to an interface depth of 5-m with the remainder of the hole indicating gravel to its planned termination depth of 19-m. DH-BGC10-4 did not encounter the interface with the underlying silt within the planned borehole depth (taken as the proposed bore path depth plus an additional 10-m).

In general, the silt layers below the gravel appear suitable for drilling although there is the possibility of gravel, cobbles or boulders that could impede progress. The upper sand and gravel layers do not appear suitable for drilling and it is expected that these layers will need to be sealed off from the drill path with the use of steel surface casing. The required length of casing to isolate the drill path from gravel on exit is approximately 66.6-m and is likely to require telescoping with 762-mm and 609.9-mm diameter casing. For the purposes of determining feasibility, gravel depth near Option 1 entry has been estimated based on linear extrapolation of the gravel depths from DH-BGC10-2 and DH-BGC10-3. Required length of casing on the entry side is estimated at 135.7-m and would require telescoping similar to the exit with the addition of 914.4-mm and 1066.8-mm diameter casings. Option 2 entry casing length is estimated at 84.9-m based on the same linear extrapolation as previously stated and would likely require telescoped casing to 914.4-mm. It is possible that the depth of gravel is deeper than estimated and a longer casing could be required. At present, this length of casing is likely one of the four or five longest planned for a Canadian HDD in the past ten years. As with all casing being installed through gravel material, there is potential that casing cannot be driven to sufficient depth to isolate the drill path from the gravel deposit. In the event that the casing cannot be installed through the gravel and into geology suitable for drilling, it is unlikely that the crossing can be completed using the HDD method.

Design

HDD design is generally an iterative process taking into consideration pipe specifications (grade, diameter, wall thickness) operating and test conditions (maximum operating pressure, test pressure, temperature, test type – water or air pressure test) and any site specific considerations (other utilities, topography, right of way boundaries, geology etc.) Stress calculations are performed using formulas that conform to CSA z662-07 Section 4 and in certain cases Section 11. Additional calculations include pull force and stress as determined by the method detailed in PRCI document PR-227-9424 entitled “Installation of Pipelines by Horizontal Directional Drilling - Engineering Design Guide”. Buckling analysis and any pipe lifting design is completed using application of the method detailed in “Bending Moment Capacity of Pipes”, Hauch and Bai, Offshore Mechanical and Arctic Engineering, July 11-16, 1999. Two options have been proposed for the Muskwa River crossing: Option 1 is a drill from upper bench to upper bench with the entry located on the south side of the river; Option 2 is a drill with the entry on a bench within the channel on the south side of the river. As both options require the use of casing to isolate

the gravel layer on both sides of the crossing, an intersect drill is required to complete the pilot hole.

Option 1

Through analysis of the factors described above, a minimum allowable radius and a design radius have been established at 250-m and 375-m respectively, common to both options. Given the lengths of casings required to isolate the drill path from any gravel layers, the length of the drill path is approximately 538-m. The depth under the river is a minimum of approximately 43-m at the north bank and the depth increases toward the south edge of the river. Entry and exit side casings and launch angles are designed to accommodate an intersect drill. See attached drawing "430 - Muskwa River - Rev 0B-1-OPTION 1.pdf" and calculation summary "430-Muskwa River-Rev 0A-1-1-pull forces".

Annular pressure modeling has been completed for the given drill path design. This is a tool to be used during construction to gauge the effectiveness of hole cleaning as well as an indicator of potential problems such as borehole collapse or hydraulic fracturing. See attached annular pressure model "430-Muskwa River-Rev 0A-1-1-annular pressure". Maximum expected annular pressure is approximately 120-PSI.

Option 2

Option 2 is designed to launch from a lower bench within the river channel. There are several benefits to this design compared to Option 1: 50.5-m less surface casing is required to isolate the drill path from granular material, less fluid pressure will be exerted on the formation under the river (65-PSI compared to 110-PSI) and the crossing itself will be approximately 37-m shorter. Benefits of Option 1 over Option 2 include no work being undertaken with the channel, which would reduce exposure to environmental risk, no bank remediation is required and over the long term there is less exposure to risk of erosion exposing the pipe again.

Option 2 drill path has a total length of approximately 510-m. The intersect zone would occur at approximately 0+025-m along the Right-of-Way and the exit point would occur at approximately -0+247-m along the Right-of-Way. See attached drawing "430 - Muskwa River - Rev 0B-1-OPTION 2.pdf" and calculation summary "430-Muskwa River Option 2-Rev 0A-1-1-pull forces" and annular pressure model "430-Muskwa River Option 2-Rev 0A-1-1-annular pressure".

The intent of Option 2 was to investigate a potential shorter drill path that would lead to a more favorable schedule and construction cost. Based on the geo-technical investigations, the length of casings and overall length of the crossing is not substantially different from Option 1.

Feasibility

Two major concerns impact feasibility beyond those of the average HDD crossing of this length and pipe diameter: potential required casing lengths on entry and exit side and the associated requirement for an intersect drill.

Casing

While the length and scope of potential casing on the exit side is well within the abilities of the equipment and contractors, the Option 1 entry side casing is beyond what is typically associated with an HDD and would be the longest casing installed on a project with Entec involvement. The telescoped length of 135.7-m is estimated only and may change based on site conditions. As telescoping is planned before construction rather than as site conditions are determined, additional casing sizes and lengths may be required as a contingency in the event that the planned depths of each casing cannot be reached. For this reason, starting the entry casing with 1066.8-mm diameter would likely be required and should be discussed with the contractor. Due to the potential presence of gravel, cobbles and boulders at this location, it is possible that casing cannot be installed to a depth sufficient to isolate the drill path from unsuitable material for both Option 1 and 2.

Intersect

Intersect drills have been completed in various locations and geological settings around the world with success. Intersects require a high level of steering control and measurement accuracy both which may be compromised at this location. The transition from silt to clay in the region where the intersect would typically be planned for Option 1 could lead to steering control becoming difficult which could lead to multiple intersect attempts or a failure of the intersect. A large section of the drill path in the intersect zone is under the river which may prevent placement of on-surface tracking equipment. Without on-surface tracking equipment covering the intersect zone, the location of the steering tools will be calculated from measurements rather than from an actual measurement of the location from surface. The ability of the contractor to install on-surface tracking equipment will be influenced by river conditions (open water, partially or completely frozen) and permits allowing the placement of equipment within the river channel. Option 2 intersect zone would likely occur on land with good access and would not be subject to the same challenges as the Option 1 intersect.

Cost

Entec has collected and analyzed costs for HDD crossings for the past four years. The data collected has lead to a distribution of costs that can be used to supply cost estimates

for various crossings and cost estimate systems including AACE International Cost Estimate Classification System. The Muskwa River HDD base costs have been estimated at an accuracy that falls within the Class 3 estimate as described by AACE International RP No. 18R-97 (EPC for Process Industries). Additional casing costs have been estimated from recent tenders and compared to several past large scale casing installations and are considered to conform to the same requirements.

Option 1

Muskwa River base costs are estimated at $ 646,676 ± 20% ($ 129,335).

Casing costs are estimated as follows:

Installation/removal

406.4-mm (203-m centralizer): $ 1,000/m x 203-m = $ 203,300
609.6-mm (203-m): $ 1,300/m x 203-m = $ 263,900
762-mm (140-m) = $ 1,600/m x 140-m = $ 224,000
914.4-mm (70-m) = $ 2,000/m x 70-m = $ 140,000
1066.8-mm (40-m) = $ 2,500/m x 40-m = $ 100,000

Sub-total = $ 930,900

Welding

406.4-mm pipe welds: 68 hrs
609.6-mm: 102 hrs
762-mm: 84 hrs
914.4-mm: 48 hrs
1066.8-mm: 31.5 hrs
Excess (supports/centralizers/shoes etc.): 10%
Total time = 367 hrs

Sub-total = $150/hr x 367 hrs = $ 55,050

Rig Time

43 days = 1032 hrs
1032 hrs x $750/hr = $ 774,000

Total = $ 930,900 + $ 55,050 + $ 774,000 = $ 1,759,950± 20% ($ 351,990)

Base Cost + Casing Cost = $ 2,406,626 ± 20% ($ 481,325)

The total cost estimated for the Muskwa River Option 1 places it in the range of the most costly 1% of HDD crossing on a per meter basis.

Option 2

Muskwa River base costs are estimated at $ 613, 020 ± 20% ($ 122, 604).

Casing costs are estimated as follows:

Installation/removal

406.4-mm (152-m centralizer): $ 1,000/m x 152-m = $ 152,000
609.6-mm (152-m): $ 1,300/m x 152-m = $ 197,000
762-mm (80-m) = $ 1,600/m x 80-m = $ 128,000

Sub-total = $ 477,600

Welding

406.4-mm pipe welds: 52 hrs
609.6-mm: 78 hrs
762-mm: 49 hrs
Excess (supports/centralizers/shoes etc.): 10%
Total time = 197 hrs

Sub-total = $150/hr x 197 hrs = $ 29,550

Rig Time

27 days = 648 hrs
648 hrs x $750/hr = $ 486,600

Total = $ 477,600 + $ 29,550 + $ 486,600 = $ 963,600 ± 20% ($ 192,720)

Base Cost + Casing Cost = $ 1,576,620 ± 20% ($ 315,324)

The total cost estimated for the Muskwa River Option 2 places it in the range of the most costly 1% of HDD crossing on a per meter basis.

Conclusion

The Muskwa River HDD crossing near Fort Nelson is being investigated by Terasen as a potential option for replacement of the existing pipe line. The existing line and the replacement are located adjacent to the Highway 97 crossing of the Muskwa River. Geo-

technical investigations (on-going) have identified deep gravel layers that substantially impact the design, feasibility and cost of the proposed crossing. The crossing is designed with significant surface casings on both entry and exit sides of the crossing in order to isolate the drill path from gravel, cobbles and boulders. The requirement for casing at each end of the crossing necessitates an intersect drill with the zone of intersection occurring under the river for Option 1 and under the north approach for Option 2. The length of casing significantly increases the cost and risk to construct a crossing of the Muskwa River. Due to the significant costs and site specific risks associated with the crossing, alternate crossing methods should be fully investigated before a decision on crossing method is made.

If any questions or comments arise as a result of this document, please do not hesitate to contact Entec at 403-319-0443.

Sincerely,

Andrew Porter, P.Eng.
Engineering Coordinator

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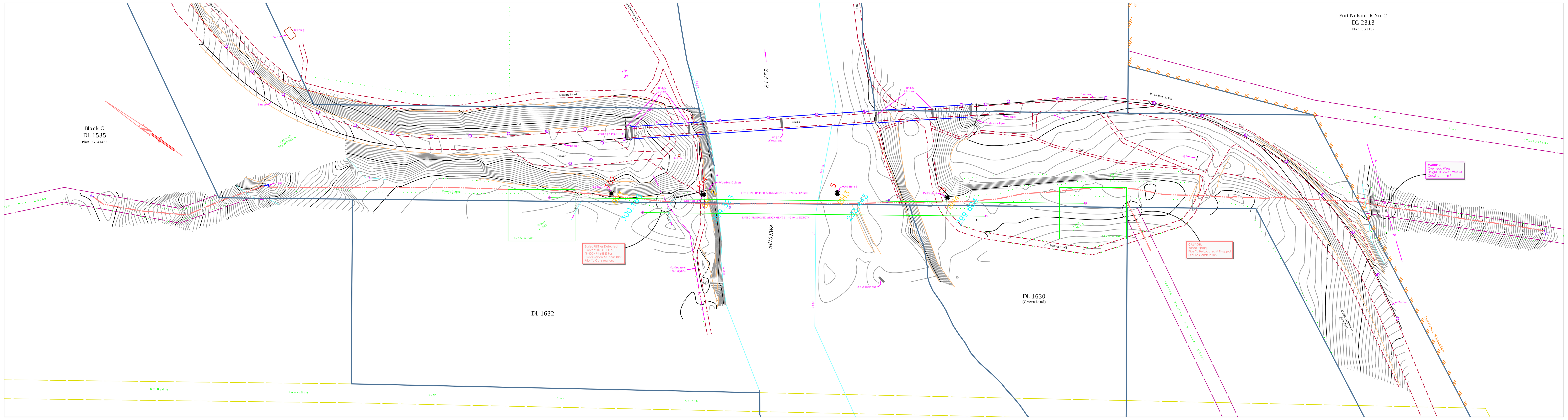

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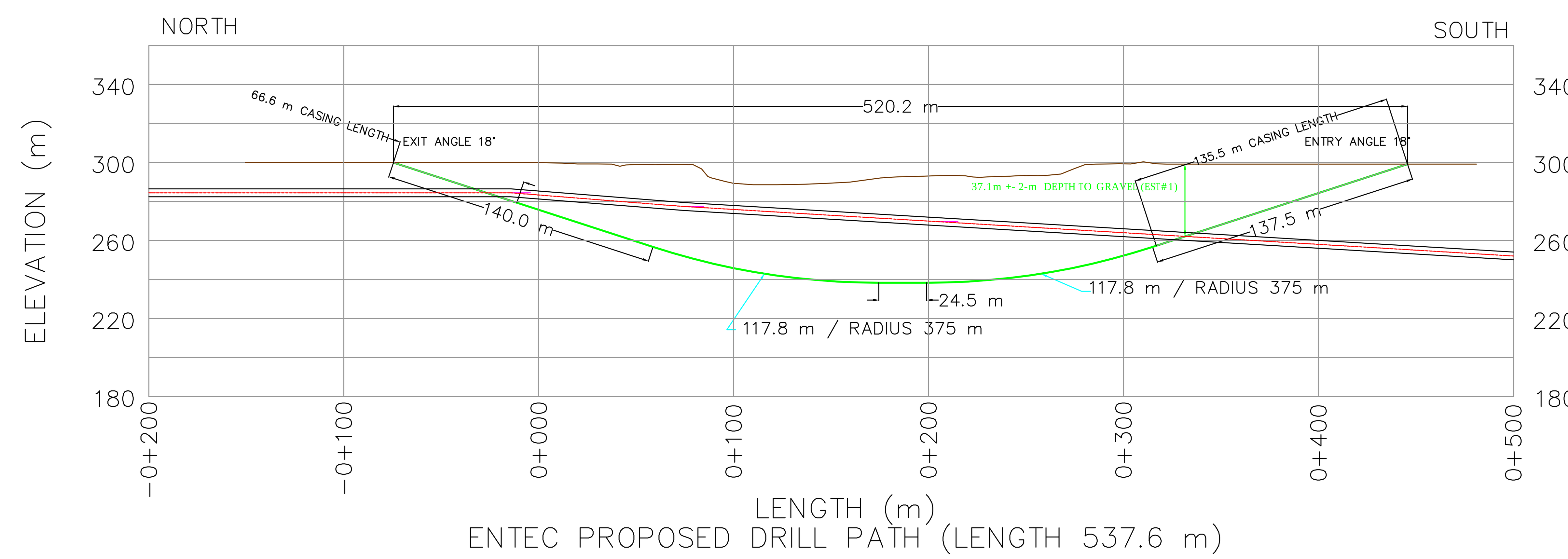

PROFILE VIEW SCALE H 1:2000 V 1:2000

NOTES

PERMIT

SEAL/STAMP

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430 MUSKWA REV0A – 1 – 1 – PULL FORCES W/ A/P	1	168.3 mm	7.11 mm	STEEL	290 MPa	7960 kPa	45°C	15000 kPa

REVISION LIST

NO.	DATE	REVISION DESCRIPTION	DR.	CHK.	APPR.
0A	2010/09/23	PRELIMINARY DESIGN	AP	AP	AP
0B	2010/11/11	GEOTECHNICAL INTERPRETATION AND CASING LENGTHS UPDATED	IR	AP	AP

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TERASEN GAS INC.
MUSKWA RIVER
HDD OPTION 1
MUSKWA RIVER BRIDGE

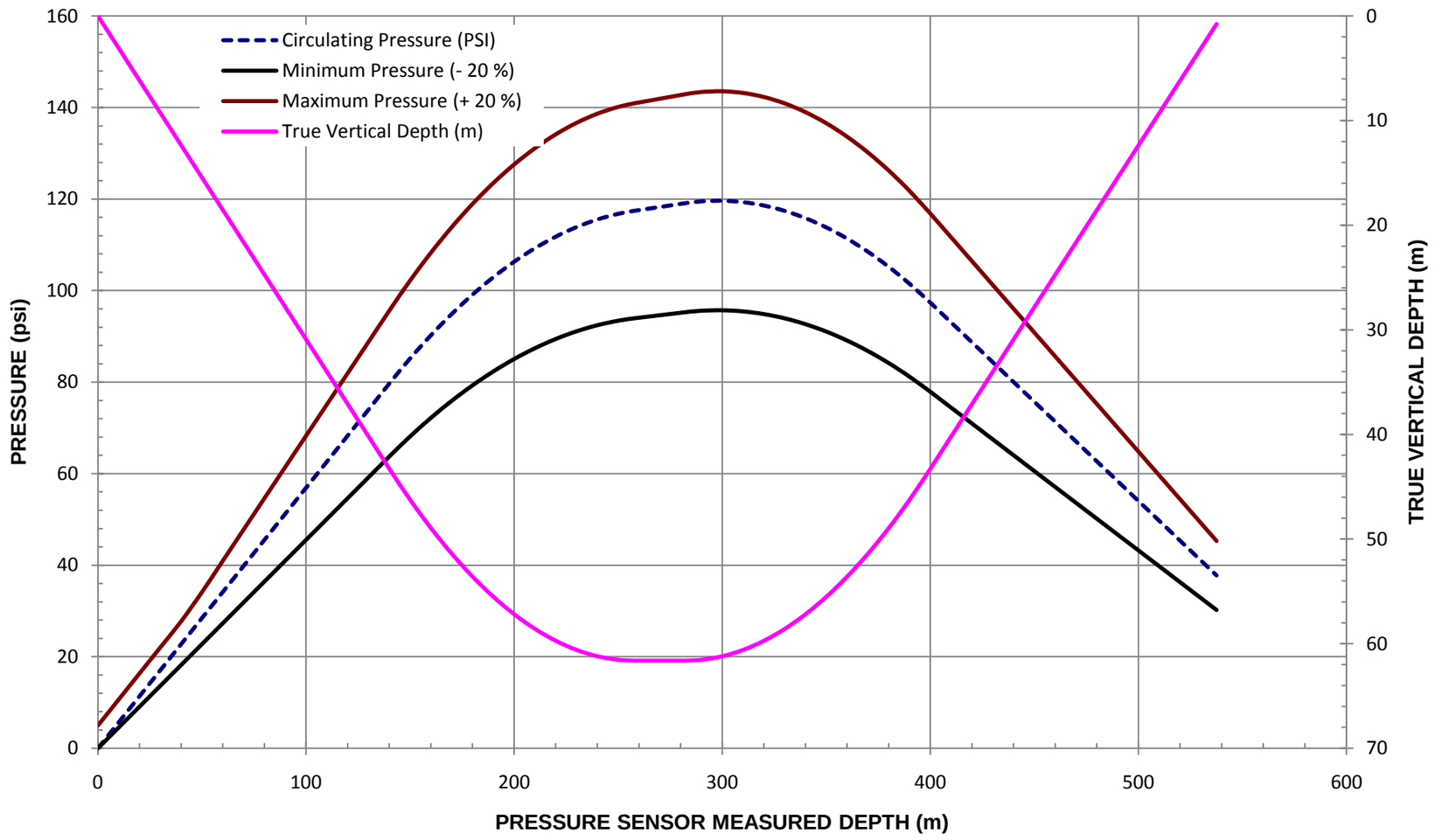
SHEET SIZE ARCH D
SCALE AS SHOWN
REV. 0B

DRAWING NUMBER: 430 TERASEN GAS MUSKWA RIVER
SHT.No. 1/1

PLOT SCALE: 1:1
SAVE NAME: 430 – MUSKWA RIVER – REV 0B-1.DWG

430-Muskwa River- Rev 0A-1-1-annular pressure

ANNULAR PRESSURE MODEL for **Muskwa River**
EXPECTED ANNULAR PRESSURE DURING THE **PILOT HOLE (9 7/8")**
AND DEPTH VS DRILL STEM LENGTH



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IMPORTANT:

APEGGA Engineering Permit No. P8649

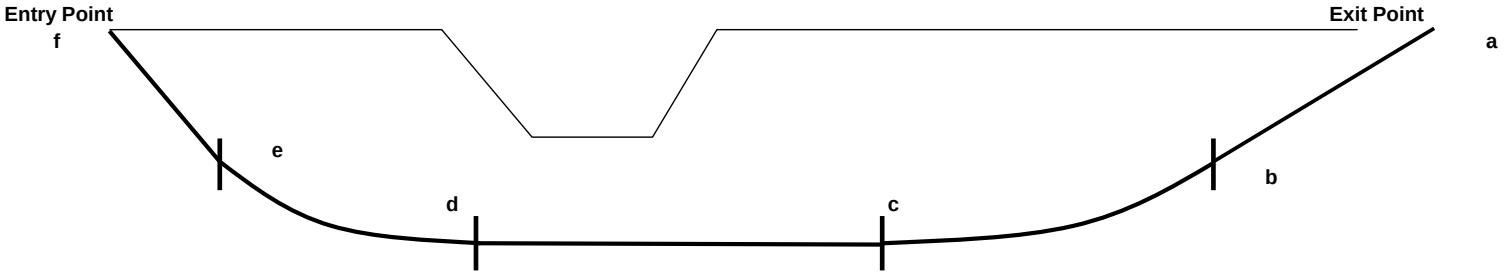
REV.	DATE	DESCRIPTION	DWG BY:
0A	03-Nov-10	1.42 m3/min., 1140 kg/m3	AP

SEAL/STAMP

PERMIT

430- Muskwa River Rev 0A-1-1-pull forces
28-Oct-10

Pipe OD	Pipe WT	Grade	Cat.	Length	T2	T1	MOP		Test Pressure		Min. Radius	Allowable Shear Stress Client Requirements OP	Client Requirements Test	CSA Requirements OP	CSA Requirements Test
(mm)	(mm)	(MPa)		(m)	(°C)	(°C)	(psi)	(kPa)	(psi)	(kPa)	(m)	(MPa)		(MPa)	
168.3	7.11	290	II	537.6	45	5	1154	7960	2175	15000	153	145	159.5	145.0	159.5



	Construction					Test Stress (post Pull-back)			Post Dewatering Pre Operation			Operation Stress		
	Load		Stress			Max. Shear Stress			Max. Shear Stress			Max. Shear Stress		
Location	(lbs)	(N)	(psi)	(MPa)	(% SA)	(psi)	(MPa)	(% SA)	(psi)	(MPa)	(% SA)	(psi)	(MPa)	(% SA)
Point A	4,992	22,287	895	6.17	4.25	12,380	85.4	53.52	0	0.0	0.00	7,612	52.5	36.19
Point B	9,201	41,077	879	6.06	4.18	13,890	95.8	60.04	305	2.1	1.32	11,689	80.6	55.58
Point C	12,662	56,526	4573	31.53	21.74	13,862	95.6	59.92	3797	26.2	16.41	15,354	105.9	73.01
Point D	13,770	61,472	1308	9.02	6.22	13,862	95.6	59.92	433	3.0	1.87	11,562	79.7	54.98
Point E	18,361	81,971	5064	34.92	24.08	13,890	95.8	60.04	3669	25.3	15.86	15,054	103.8	71.58
Point F	26,553	118,539	2388	16.46	11.35	13,955	96.2	60.32	4	0.0	0.02	11,990	82.7	57.01

	Hoop Buckling		Moment Capacity		
Location	Construction	PDPO	Construction	PDPO	Test
Point A					
Point B	CHECK	OK	OK	OK	OK
Point C	CHECK	OK			
Point D	CHECK	OK	OK	OK	OK
Point E	CHECK	OK			

CSA Z662-07 Standards	
4.7.1	OK
4.7.2.1	OK
4.8.3	OK
4.8.5	OK
11.8.4.4<11.8.4.5	OK

CSA Z662-07 Standards (Test)	
4.7.1	OK
4.7.2.1	OK
11.8.4.4<11.8.4.5	OK

REV.	DATE	DESCRIPTION	SEAL/STAMP	PERMIT
0A	28-Oct-10			

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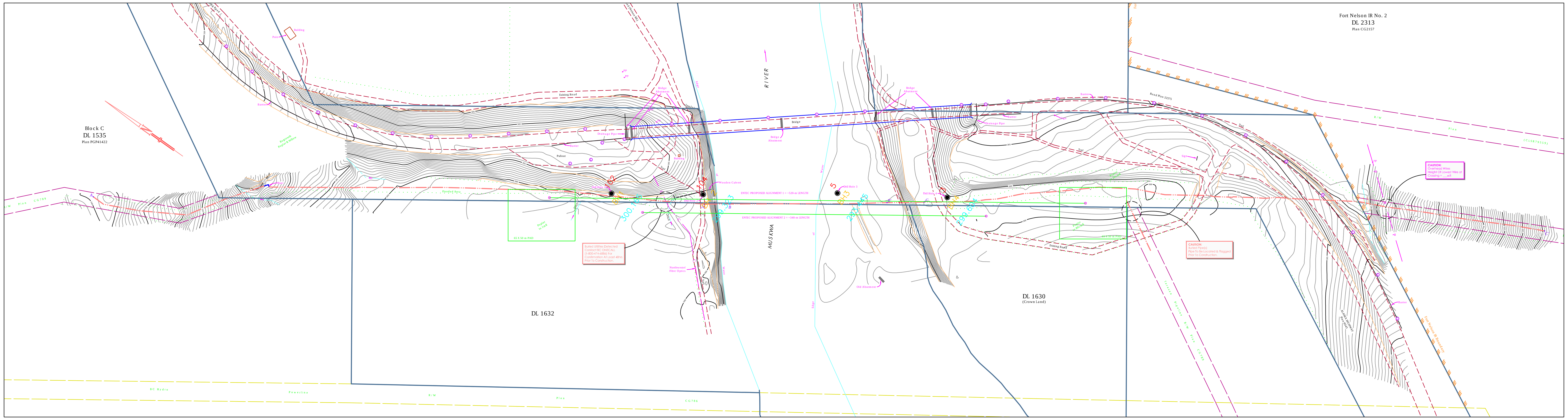

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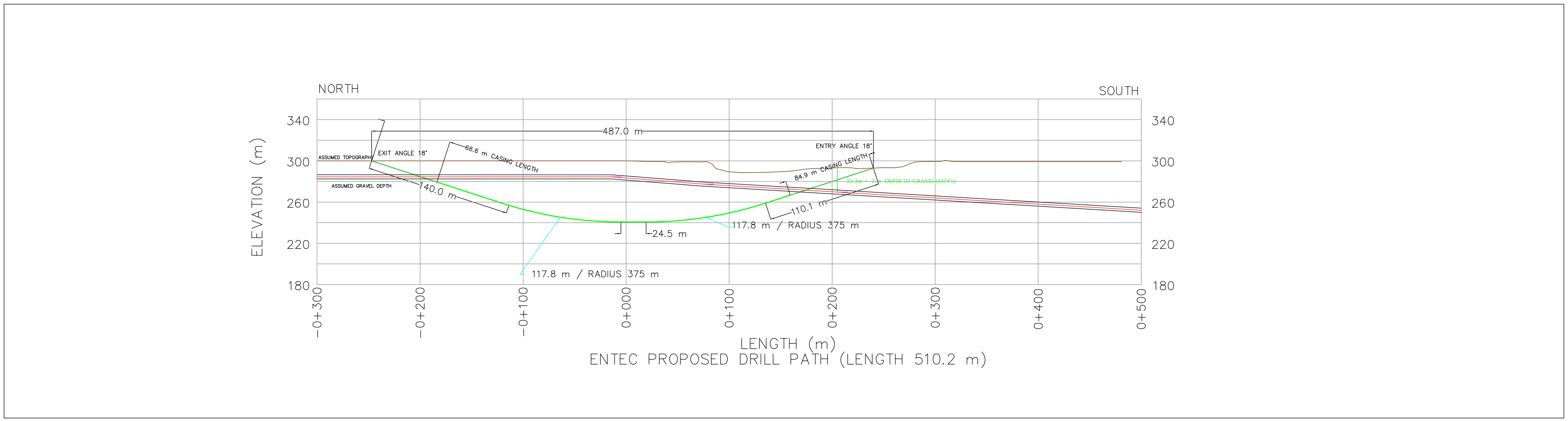

PROFILE VIEW SCALE H 1:2000 V 1:2000

NOTES

PERMIT

SEAL/STAMP

CALCULATION FILES	DESIGN SPECIFICATIONS							
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430 MUSKWA OPTION 2 REV0A - 1 - 1 - PULL FORCES W/ A/P	1	168.3 mm	7.11 mm	STEEL	290 MPa	7960 kPa	45°C	15000 kPa

REVISION LIST					
NO.	DATE	REVISION DESCRIPTION	DR.	CHK.	APPR.
0A	2010/09/23	PRELIMINARY DESIGN	AP	AP	AP
0B	2010/11/11	GEOTECHNICAL INTERPRETATION AND CASING LENGTHS UPDATED	IR	AP	AP

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TERASEN GAS INC.
MUSKWA RIVER
HDD OPTION 2
MUSKWA RIVER BRIDGE

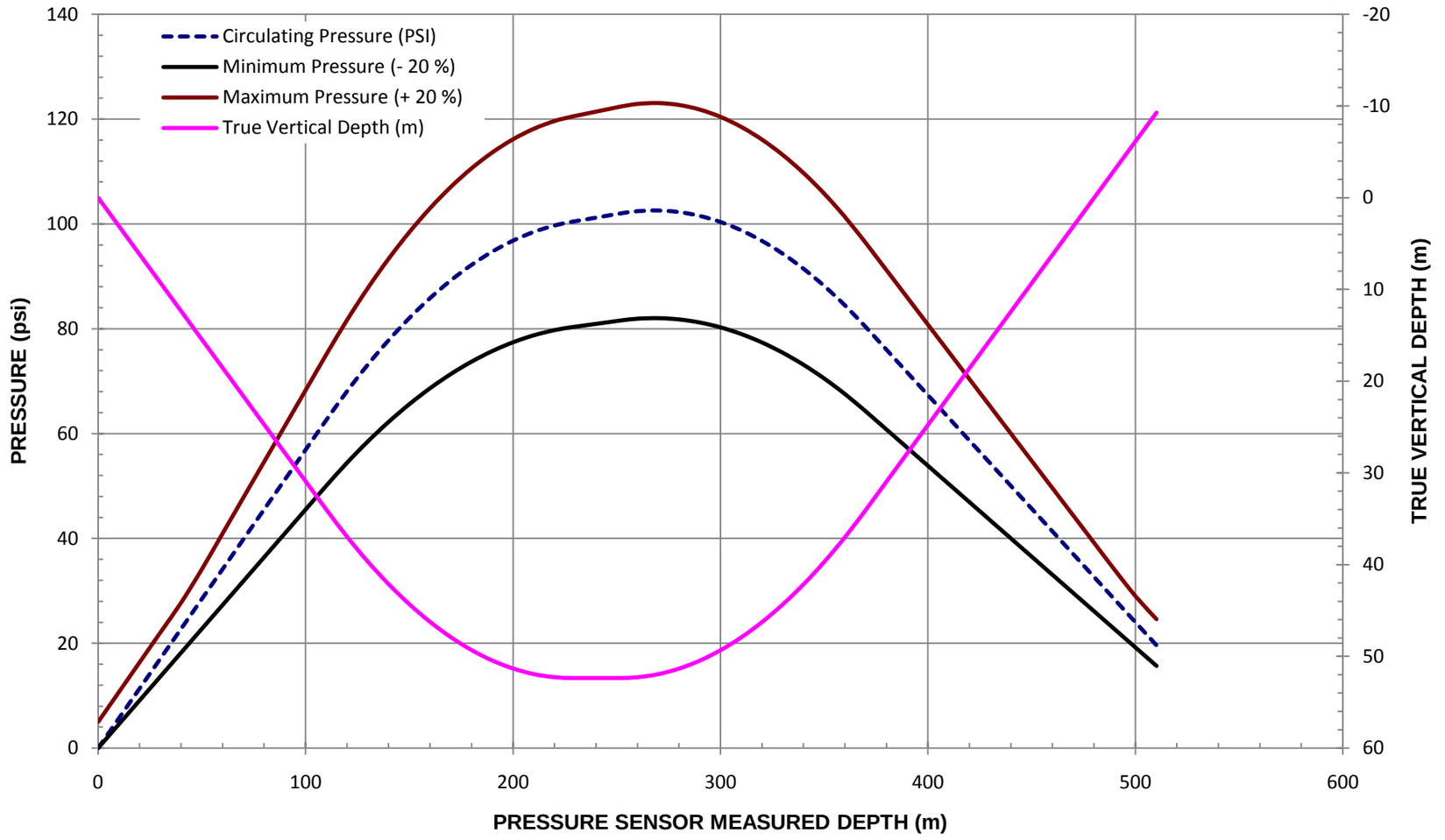
SHEET SIZE ARCH D
SCALE AS SHOWN
REV. 0B

DRAWING NUMBER: 430 TERASEN GAS MUSKWA RIVER
SHT.No. 1/1

PLOT SCALE: 1:1
SAVE NAME: 430 – MUSKWA RIVER – REV 0B-1.DWG

430-Muskwa River Option 2- Rev 0A-1-1-annular pressure

ANNULAR PRESSURE MODEL for **Muskwa River**
EXPECTED ANNULAR PRESSURE DURING THE **PILOT HOLE (9 7/8")**
AND DEPTH VS DRILL STEM LENGTH



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APEGGA Engineering Permit No. P8649

REV.	DATE	DESCRIPTION	DWG BY:
0A	03-Nov-10	1.42 m3/min., 1140 kg/m3	AP

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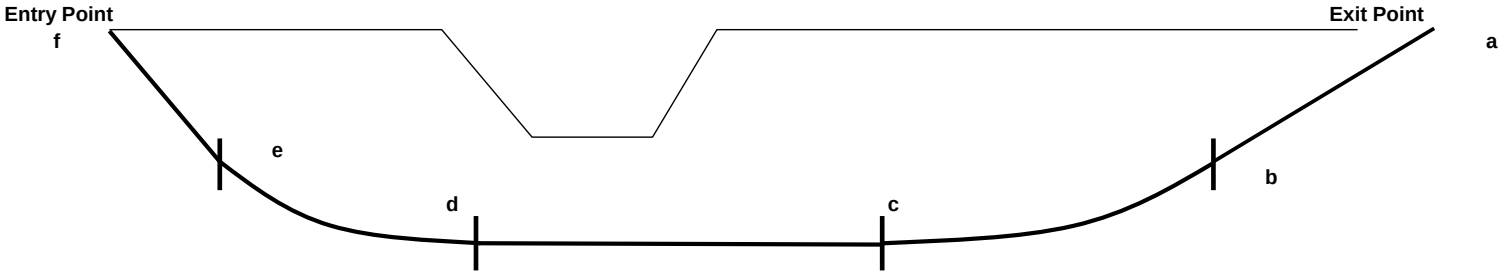
PERMIT

430- Muskwa River Option 2-Rev 0A-1-1-pull forces
28-Oct-10

Pipe OD	Pipe WT	Grade	Cat.	Length	T2	T1	MOP		Test Pressure		Min. Radius	Allowable Shear Stress Client Requirements OP	Client Requirements Test	CSA Requirements OP	CSA Requirements Test
(mm)	(mm)	(MPa)		(m)	(°C)	(°C)	(psi)	(kPa)	(psi)	(kPa)	(m)	(MPa)		(MPa)	
168.3	7.11	290	II	510.1	45	5	1154	7960	2175	15000	153	145	159.5	145.0	159.5



	Construction					Test Stress (post Pull-back)			Post Dewatering Pre Operation			Operation Stress		
	Load		Stress			Max. Shear Stress			Max. Shear Stress			Max. Shear Stress		
Location	(lbs)	(N)	(psi)	(MPa)	(% SA)	(psi)	(MPa)	(% SA)	(psi)	(MPa)	(% SA)	(psi)	(MPa)	(% SA)
Point A	4,737	21,147	849	5.85	4.04	12,380	85.4	53.52	0	0.0	0.00	7,612	52.5	36.19
Point B	7,752	34,608	680	4.69	3.23	13,988	96.4	60.47	240	1.7	1.04	11,754	81.0	55.89
Point C	11,369	50,756	4388	30.25	20.87	13,960	96.3	60.35	3733	25.7	16.13	15,354	105.9	73.01
Point D	12,477	55,702	1123	7.74	5.34	13,960	96.3	60.35	368	2.5	1.59	11,626	80.2	55.28
Point E	17,205	76,807	4891	33.73	23.26	13,988	96.4	60.47	3605	24.9	15.58	15,118	104.2	71.89
Point F	23,641	105,540	2068	14.26	9.83	14,040	96.8	60.69	4	0.0	0.02	11,990	82.7	57.01

	Hoop Buckling		Moment Capacity		
Location	Construction	PDPO	Construction	PDPO	Test
Point A					
Point B	CHECK	OK	OK	OK	OK
Point C	CHECK	OK			
Point D	CHECK	OK	OK	OK	OK
Point E	CHECK	OK			

CSA Z662-07 Standards	
4.7.1	OK
4.7.2.1	OK
4.8.3	OK
4.8.5	OK
11.8.4.4<11.8.4.5	OK

CSA Z662-07 Standards (Test)	
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4.7.2.1	OK
11.8.4.4<11.8.4.5	OK

REV.	DATE	DESCRIPTION	SEAL/STAMP	PERMIT
0A	28-Oct-10			

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Calgary, AB T2Z 4K6
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Appendix F

Muskwa River HDD Project Schedule

CLASS 3 COST ESTIMATE - PRELIMINARY PROJECT SCHEDULE

Project: Terasen Gas - Muskwa River HDD

Spread: HDD Installation

Length: 610 m

Resource		MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		DURATION	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
		Work Days															
DESIGN																	
	Preliminary Design	complete															
	Geotechnical Boreholes & Reporting	complete															
	Fisheries Application	5d															
	Final Design	15d															
PROCUREMENT																	
	Material RFQ	15d															
	Material PO	20d															
	Line Pipe Lead Times to Delivery	100d															
	Valve Lead Times to Delivery	-															
	Construction Contact - Bid Package	15d															
	Construction Contact - Bidding	30d															
	Construction Contact - Award	1d															
REGULATORY & STAKEHOLDER CONSULTATIONS																	
	Fort Nelson IR consultations	30d															
	OGC Permit Application	30d															
	DFO Application & Letter of Notification	90d															
	BC FrontCounter Application (land & timber)	60d															
CONSTRUCTION																	
	Construction	60d															
COMMISSION																	
	Hot Tie-ins & Gasification	3d															
OWNER ACCEPTANCE																	
	Project Close-out & Owner Acceptance	35d															

Owner Project Activity

Contractor Construction Activity

Appendix B
IP BRIDGE OPTION CLASS 3 COST ESTIMATE REPORT

TP168.3mm Muskwa River Bridge Crossing and Pressure Reduction Station

Class 3 Cost Estimate
(FID 32004)

Prepared for Terasen Gas Inc.
By David Bainbridge, P.Eng

0	10.11.18	Issued for Use	DGB	PT					
Rev.	Date (yy.mm.dd)	Issue	Originator	Checked	Discipline Lead	Project Lead	Engineering Manager	Project Manager	Client

CHINOOK Document	09-312-PL-15-01
Client Document No.	32004.1001
Revision No.	0
Page	1 of 32

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Appendices

Appendix A Muskwa River Bridge Crossing Conceptual Sketch
Appendix B CWMM Consulting Engineers Design Memorandum K6331 and Sketch
Appendix C Muskwa River Bridge Crossing Cost Estimate WBS Summary
Appendix D Terasen Gas Regulating Gate Station Scope and Cost Estimate
Appendix E Muswka River Bridge Crossing Project Schedule

1. Summary

1.1 Project Description

The 168mm O.D. Fort Nelson transmission lateral crosses the Muskwa River at kilometre post 17+300 and is presently at risk due to severe channel scour as the pipeline is exposed at the thalweg of the watercourse. Immediate action is required, as the risk to the pipeline has been classified as High according to the Terasen Geotechnical Hazards Database. After evaluation of a number of remediation options, this document summarizes the AACE Class 3 estimate for crossing the Muskwa River by a 168mm O.D. intermediate pressure distribution main hung on the underside of the existing Alaska Highway Bridge deck crossing the river and for a pressure reduction station (regulating gate station) on the south side of the river prior to the line crossing the bridge.

1.2 Cost Estimate Objectives

This cost estimate is advancement from the Class 4 cost estimate issued on September 3rd, 2010 contained within the document "32004.0901 Muskwa River Crossing FEED Study R1". The Class 4 estimate was completed as a screening study to evaluate different options to cross the watercourse. Crossing by horizontal directional drill (HDD) proved to be the most economic method but subsequent geotechnical boreholes discovered a large gravel seam which increased the HDD project cost by greater than two fold. A bridge crossing was the second preferred option from the FEED study. The bridge has been investigated for placement of the pipe on the underside of the deck using standard pipe hangers and deemed highly feasible from a site visit by CWMM Consulting Engineers (CWMM) of Kelowna, BC.

The objective of this Class 3 Cost Estimate is to provide cost information to Terasen Gas to be submitted to the British Columbia Utilities Commission in order for the remediation of the Muskwa River crossing to be included in the yearly rate application. The objective includes to:

- Summarize the present condition of the crossing and the present risks incident on the exposed pipe. Asset risks are described in detail in the "32004.0901 Muskwa River Crossing FEED Study R1" document dated September 3rd, 2010;

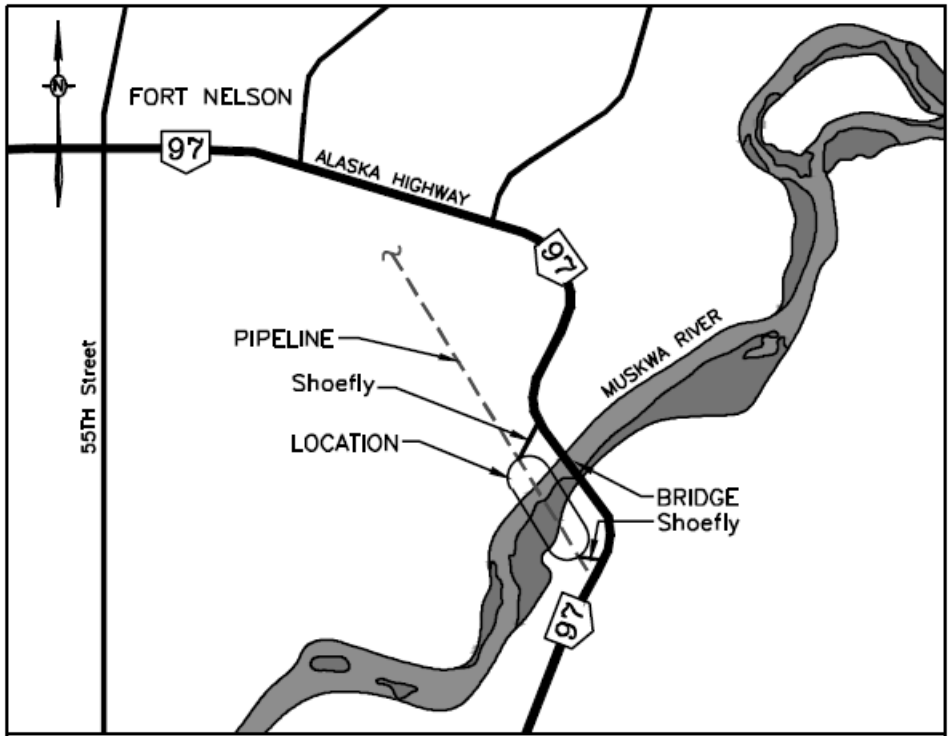
- Describe and evaluate the bridge crossing and regulating gate station in terms of cost, constructability, risk, lands, schedule and environmental impact; and

- Summarize the replacement costs to an AACE Class 3 level.

1.3 Project Location

The Muskwa River crossing is located approximately 3 km (by road) southeast of Fort Nelson in British Columbia. The pipeline crosses the river about 75 m upstream of the Alaskan Highway (#97) bridge outside Fort Nelson. At the crossing location, the Muskwa River flows southwest to northeast and meanders irregularly. There is a slight bend in the channel at the crossing reach. An oxbow is located about 2.5 km downstream of the crossing. Figure 1 shows a location map of the watercourse crossing.

Figure 1: Project Location Map



2. Present Asset Condition

The crossing reach is mildly sloped (0.04%), relatively wide (180 m), and single-threaded. Considerable bank erosion on the north bank spans at least 200 m along the channel, crossing over the pipe. A large gravel and sand bar is located on the south bank, which is used for launching boats. On the southeast side of this bar, a topographic low is occupied during high flows, forming a high water channel.

A survey of the Muskwa River crossing was conducted on September 28th, 2008 by Midwest Surveys. The survey indicates that there is approximately 12 metres of exposed pipe on the north side of the channel, near the thalweg.

The river flow is constricted by the gravel bar attached to the south bank. The deepest part of a significant scour hole, that is about 1.2 m deeper than the average grade of the bed, is located 30 m upstream of the pipeline. The pipeline crosses this scour hole where it is about 0.7 m below the average bed grade. Depth of cover is generally shallow across the whole crossing, including under the south bank gravel and sand bar. The minimum depth of cover along the gravel bar is 0.36 m. This was the first depth of cover survey that has been conducted at this location. Wetted width of the channel is approximately 100 metres.

Bank erosion persists along the north bank, which is commensurate with the meandering channel plan and the existence of the large bar on the south bank that diverts the flow to the north. Scour at the channel north is also due to the effect of spiralling flow concentration on the outside edge of the meander.

Due to the river hydrology, it is expected that the section of exposed and unsupported pipe will continue to expand over time further adding to the risk to the pipeline. Eventually the exposed pipe will reach an unsupportable length and the pipe will yield with possible rupture.

3. Scope of Work

3.1 Stream Characteristics

The Muskwa River is within the McKenzie River basin in north-eastern British Columbia and has an assumed BC Riparian Class of S1-B; meaning the active flood plain is assumed to be a function of the stream channel dimensions (channel width is greater than 100m wide). As an S1 classified watercourse, the watercourse is ranked as having high fish and fish habitat value with the following riparian areas:

- Riparian Management Area of 70 m;
- Riparian Reserve Zone of 50 m; and
- Riparian Management Zone of 20 m.

The Muskwa River has a mean annual flow rate of 215 m^3/s based on Water Survey of Canada reporting.

In BC, detailed information regarding fish distribution and lake and stream information is available on Fish Wizard (BC Ministry of Forests 2007) and includes known presence of fish species of particular conservation concern as well as other sport, coarse, and forage fishes. Based on listed species in Fish Wizard, it is assumed the Muskwa River is classified as an S1 fish-bearing watercourse with a window for instream work from July 15th to August 15th.

3.2 Codes and Standards

The most recent revisions of the following industry design codes are applicable to the design of the pipeline crossing of the watercourse by the existing bridge and to the regulating gate station.

- Canadian Standards Association (CSA) Z662-07, 'Oil and Gas Pipeline Systems';
- CSA Z245.1, 'Steel Line Pipe';
- CSA Z245.11, 'Steel Fittings';
- CSA Z245.12, 'Steel Flanges';

- CSA Z245.15, 'Steel Valves';
- CAN/CSA-S6-2006 Canadian Highway Bridge Design Code'; and
- BC Ministry of Transport Bridge Standards and Procedures Manual.

3.3 Design Specifications

Materials shall be specified according to parameters outlined in Figure 2.

Figure 2: Line Pipe Specifications

Specification	Muskwa River Crossing
Start Location	KP17.3
End Location	KP 18.1
Design Service	Sweet Dry Natural Gas
Bridge Crossing Pipe	
Pipe Specification	168.3 mm x 7.11mm WT CSA Z245.1, Gr. 290, Cat II, ERW
Pipeline Length	210 m
Coatings	Epoxy prime coat with aliphatic poly-urethane top coat
Joint Coating	Brush Grade Epoxy – Urethane.
Design Temperature	-45 to +50 °C
Relocation Pipe	
Pipe Specification	168.3 mm x 7.11mm WT CSA Z245.1, Gr. 290, Cat II, ERW
Pipeline Length	600 m
Coatings	CSA 245.20/21 Shaw Yellow Jacket
Joint Coating	Heat Shrink Sleeves
Design Temperature	-18 to +18 °C
Design Data	
MOP	1,379 kPa
Class Location	3
Design maximum stress	Design to 50% SMYS (Class 3) Allowable 72% SMYS (Class 1)

3.4 Cost Estimate

The cost estimates was developed to AACE Recommended Practice No. 18R-97 and is considered a Class 3 estimates with the following tolerances: low -20%, high +30%.

Estimates are built based on resource loading; meaning the number of man hours and equipment is estimated based on detailed construction and conceptual plans developed for the bridge crossing of the watercourse and feasibility of the plans were proved through a site investigation completed by CWMM Consulting Engineers. Labour rates utilized in the estimate are an average of selected 2009 Fort St. John pipeline contractor rates.

A contingency of 15% has been added to account for miscellaneous services, materials, shipping and labour. No cost escalation factors were employed to account for accruals to be incurred in the future (i.e. inflationary / deflationary).

3.5 Schedule

The environmental impact of a pipeline bridge crossing of the watercourse is limited as no in-stream or riparian disturbance is to occur, therefore fisheries timing windows do not limit the construction schedule. If the project is to commence at the start of 2011, the crossing can be installed and commissioned prior to October 15th, 2011.

A (high level) construction schedule is included in Appendix F.

3.6 Regulatory Approvals Commentary

In BC, the Provincial Water Act provides standards to reduce disturbance to aquatic habitat and fauna that may result from instream activity associated with petroleum road, or other petroleum or pipeline-related operations in British Columbia (British Columbia Ministry of Water, Land and Air Protection, MWLAP 2004a). In addition, timing windows set by the British Columbia Oil and Gas Commission (BC OGC 2005) describe acceptable timing for oil and gas project works in fish-bearing streams and are used as a tool to reduce adverse affects of construction-related disturbances to fish species during sensitive life-history stages. Best Management Practices (BMP) provided by the BC OGC (2004) outline the most favourable construction methods. Although somewhat flexible, any requested variation to the timing windows or BMPs may require a site-specific review to determine the level of sensitivity related to any particular work in-stream. Provincial and federal agencies (e.g., BC Ministry of Environment) may participate in such revisions or refinements. A review of the OGC BMP indicates that a bored crossing of the Muskwa River is the preferred option. A bridge crossing qualifies as a trenchless crossing but is considered a deviation and therefore is assessed under the non-routine process.

The Federal government, through Transport Canada and the Navigable Waters Protection Act (NWPA), provides for uninterrupted navigation of Canada's waterways. The bridge crossing will be at a higher elevation than the bridge box girders and will not disrupt navigation of the waterway.

The Federal government, through Fisheries and Oceans Canada (DFO), also has jurisdiction through the Fisheries Act over watercourses that may be affected temporarily or permanently, by crossing construction. The Fisheries Act prohibits the destruction of fish; harmful alteration, disruption, or destruction of fish habitat (HADD); and deposition of deleterious substances into water frequented by fish, or into places that may result in the deposition of deleterious substances into other water frequented by fish (sections 32, 35, and 36 of the Act, respectively). A bridge crossing will be fully contained outside of undisturbed riparian boundaries of the watercourse within the highway easement therefore no HADD is predicted.

The pipeline is under the jurisdiction of the Oil & Gas Commission of British Columbia. Application will have to be made to the Commission by the non-routine process under the existing asset project certificate.

3.7 List of Consultation and Regulatory Approvals

The following lists all known permits required for the project. For an oil and gas project under the jurisdiction of the Oil and Gas Commission, the OGC acts as an entry point into the multi-ministry permit approval process through BC FrontCounter.

- Canada, Public Works and Government Services Canada (PWGSC):
    - Application and approval to hang the pipe on the underside of the Alaska Highway Bridge over the Muskwa River; and
    - Application and approval to reroute the pipeline within the easement of the Alaska Highway easement.
- Canada Department of Fisheries and Ocean (DFO)
    - Authorization under Section 35 (2) and 32 of the Fisheries Act and application for a Letter of Notification for the trenchless crossing of a fish-bearing watercourse.
- Canada, Transport Canada - Navigable Waters Protection Program
    - Authorization to cross a navigable waterway.

- British Columbia Ministry of Environment (MOE):
    - Permits required under appropriate sections of the Water Act for works in, or about a stream in BC;
    - Approval for temporary short-term use of water (Section 8 under the BC Water Act) and approval for work in and about a stream (Section 32);
    - Authorization under the BC Environmental Management Act under appropriate sections for the management of waste generated by the project;
    - Permits under Section 40 of the Wildlife Act if works results in the temporary closure to hunting, trapping and guide during a construction activity; and
    - Consultation for any other restrictions due to rare or threatened wildlife or fauna.
- British Columbia Ministry of Integrated Land Management Bureau (ILMB):
    - Application of Occupation and Use of Crown land under the Land Act for the use of temporary workspace during construction, if required;
- British Columbia Ministry of Forest and Range (MOFR):
    - Master License to Cut Agreement. A license to Cut for the clearing of temporary workspace, if required;
    - Burning Reference Number - Forest Fire Prevention and Suppression Regulations for disposal of scrub and non-merchantable timber; and
    - Permitting for site cleaning / preparation.
- British Columbia Ministry of Tourism, Sport and the Arts (MTSA):
    - Heritage Conservation Act Clearance that no impacted sites exist within the project workspace.
- British Columbia Ministry of Transportation and Infrastructure (MOTI):

- Application and approval to reroute the pipeline within the easement of the Alaska Highway easement; and
- Permits related to access and road construction from BC MOTI, in addition to any access permits required from the BC MOFR and the BC OGC.

- BC Oil and Gas Commission (OGC):
  - Crossings not constructed to the standards outlined in the Environmental Protection and Management Regulation Guidebook (EPMR) are considered non-routine. A non-routine stream crossing deviates from the best management practices outlined within the EPMR Guidebook and requires a mitigation strategy or justification to be submitted as part of the additional application requirements; and
  - A crossing by bridge of the Muskwa River is considered a deviation from the best management practices and as such, would be an application by the non-routine process under the Oil and Gas Activities Act – Pipeline Regulations for a pipeline alteration or replacement. Work would be completed under the Terasen Gas Fort Nelson certificate.

- Northern Rockies Regional Municipality (NRRM):
  - Refuse permits; and
  - Weed control.

- Fort Nelson First Nations:
  - The Fort Nelson First Nations has been advised of the project and consultation activities will commence once the project crossing methodology is selected.

4. Pressure Regulating Gate Station & IP Bridge Crossing

4.1 Scope of Work

The existing Fort Nelson Gate Station is located at kp 19.0 of the Fort Nelson lateral just outside the town of Fort Nelson, north of the Muskwa River. The possibility exists of replacing and relocating the Gate Station to the south bank of the river and installing an intermediate pipeline bridge crossing of the Alaska Highway #97 Bridge of the Muskwa River. Project would consist of:

- Installing a new TP/IP Gate Station upstream of the bridge;
- Installing a new 210m long x 168mm O.D. bridge crossing on the Alaska Highway #97 Bridge of the Muskwa River;
- Installing quantity two - 168mm O.D. Emergency Shutdown Valves (ESDV) at both ends of the bridge crossing to isolate the crossing in the event of a bridge or pipeline failure;
- Install a new 200m long x 168mm O.D. pipeline connecting the new Gate Station to the bridge crossing on the south side of the bridge;
- Install a new 400m long x 168mm O.D. pipeline connecting the bridge crossing to the existing transmission pipeline on the north side of the bridge;
- Lower the operating pressure of the pipeline from the new TP/IP Gate Station to the existing Gate Station to 1,379 kPa (asset is presently operating at transmission pressure, 7,960 kPa); and
- Modify the existing Fort Nelson Gate Station to operate as an IP/DP regulating station with the existing TP/IP portion of the station to be decommissioned.

4.2 Land Requirements

The pipeline alignment for the crossing will be located within the existing Alaska Highway easement. No new permanent right-of-way will be required to install the pipeline crossing.

The following temporary workspace or land approvals are required in order to install a bridge crossing and new gate station in addition to utilization of existing pipeline right-of-way.

- Approvals with BC MOTI to install approximately 600 metres of new pipeline within the highway easement to access the bridge crossing and relocate back to the existing Terasen Gas pipeline right-of-way;
- Approvals with PWGSC - Bridge Authority to grant permission to hang a 210 metres IP168mm O.D. pipeline from the bridge deck; and
- Approvals with BC MOTI for a 20m x 30m site within the highway easement on the south bank of the river for the new TP/IP regulating station.

Workspace land tenure is held by both the PWGSC and BC MOTI and permissions must be sought from those authorities having jurisdiction.

4.3 Design Basis

The pipeline design basis is detailed in Section 3.3. The bridge crossing conceptual design has been completed by CWMM and the basis is explained in the design memorandum included in Appendix B.

4.4 Schedule

Upon project initiation, it will take approximately 7 months to design the crossing, procure materials and secure necessary permits, with all activities run concurrently. Total project duration is approximately 10 months. If the project commenced at the start of 2011, a bridge crossing and regulating station could be installed by the end of October 2011.

An 810m IP168mm O.D. pipeline including a 210m IP168mm O.D. bridge installation and regulating gate station construction will take approximately 50 days to complete.

No timing restrictions are known.

4.5 Construction Plan

Preliminary and high-level construction plan would be as follows:

- Contractor is to mobilize to site;

- Contractor is to clear all right-of-way and work sites of all vegetation, decking all merchantable wood for eventual hauling to the nearest accepting mill;

- Contractor is to grade and grub right-of-way and station sites;

- Contractor is to fabricate and install the new TP/IP regulating gate station on the uplands of the south bank of the river;

- Contractor is to install the new bridge crossing:

    - Contractor to erect parapet scaffolding suspended from the overhanging bridge deck to access the underside for approximately 125m, effectively creating a walkway above the wetted width of the river;

    - Contractor to use boom lift or aerial work platform to access the bridge deck above the river gravel bar for a span of approximately 85m;

    - Contractor to drill and install bridge supports and rollers on the underside of the bridge deck using either scaffolding above the wetted width or by boom lift above the gravel bar for access. Roller positions shall be surveyed into place to create a level crossing;

    - Contractor to string, weld and coat pipe section to be pulled into place through all bridge supports;

    - Contractor shall attach a dragline to the end of the pipe string and complete and engineered pull of the pipe into place. Cranes and side booms may be used to create acceptable bends within the pipe to allow the string to be pulled into the first pipe support under the bridge.

    - Contractor to night-cap bridge crossing pipe and expansion loops in preparation of pipeline tie-ins.

- Contractor will install the new IP168mm pipeline:

    - Contractor to commence installing the two pipeline sections at the bridge crossing tie-ins;

- Contractor shall excavate, string, weld, coat, lower and backfill owner supplied line pipe to install 200m of pipe on the south bank;
- Contractor shall excavate, string, weld, coat, lower and backfill owner supplied line pipe to install 600m of pipe on the north bank;
- Contractor will tie-in south pipeline to both the new station and bridge crossing;
- Contractor to cap new pipeline sections in preparation for Terasen Gas hot tie-ins.

- Terasen Gas tie-in crew will mobilize and using stopple fittings will tie-in and gasify the new pipeline and gate station;
- Terasen Gas to decommission the TP/IP portion of Fort Nelson Gate Station;
- Contractor will clean-up the work site and de-mobilize.

4.6 Construction Estimating Assumptions

The following assumptions, with regards to project construction, have been made for estimating purposes:

- Traffic Management – One full-time traffic control person shall be employed for the duration of construction to direct and manage heavy equipment and material load in / load out.
- Access – Two temporary access roads will be constructed off the Alaska Highway to access both the north and south bank bridge staging locations. Minimal clearing will be required to construct these access routes as they already occupy existing road pull-offs.
- Site Infrastructure – The pipeline contractor will mobilize a simple site office trailer, which includes a small tool crib. Site infrastructure and rentals for the duration of construction include:
  - Two portable toilets; one for each bank of the river.
  - Electrical generating set for office power requirements.
- Site Security – No provision has been made for overnight site security.

- Construction Safety – One full-time level-3 first-aid safety officer will be on-site for the full duration of construction due to the predicted number of labourers working on the project at any one time.

- Delivery of Materials - All materials shall be classified as “Free-On-Board” at each respective vendor or manufacturer’s location or depot. It shall be the contractor’s responsibility, unless otherwise indicated, to identify and contract for the requirements for the transportation of goods to site and their handling to specification.

- Delivery of drill string Pipe - A flat deck is capable of transporting approximately 30 double-random joints of pipe. 68 joints are required which will require three flat deck deliveries. Transportation is assumed to be 12 hours at $250 / hr for driver and rig or $3000 per load.

- Delivery of Aggregate – The estimate assumes all aggregate is locally available with a one hour delivery time at $165 / hr.

- Right-of-Way Construction Width – Total temporary workspace will be contained within the Alaska Highway easement and will require limited clearing and grading.

- Erosion Control – Erosion control measures shall be installed before grading operations consisting of: silt fencing, straw bales and run-off prevention measures.

- Right-of-Way Clearing and Grubbing – The entire length of construction right-of-way will be cleared and grubbed including the removal of all trees, brush, and existing deadfall/ stumps. Based on review of aerial photography, this clearing work is assumed to be minimal and will be completed by excavator. No feller-bunchers are assumed to be required. It is assumed no merchantable timber exists within the construction right-of-way although a mill may be located for pulping of cut poplar. All debris will be burned, chipped or dumped.

- Right-of-Way Grading – Grading shall be completed for equipment travel and lay down of material. Topsoil conservation shall be employed where pipe trench shall be excavated for pipe burial.

- Grade Rock – Geotechnical investigation indicates no grade rock is present within working depths.

- Foreign Utilities – No foreign utilities have been identified. It is assumed safe clearance distances shall be maintained from any overhead powerlines and no special provisions are required. Culverts are in place across the Alaska Highway at the bridge approaches; these culverts shall be crossed by open cut if they fall within the final pipeline alignment.

- Welding – No provision for pipe replacement or repair has been estimated.

- Non-Destructive Examination – All circumferential welds shall be 100% inspected by radiography.

- Pipe Coatings – It is assumed that 0.5% of all delivered pipe surface area will require recoating based on handling damage.

- Pipe Bedding – All buried pipe shall be sand embedded and capped with native material. If within the existing road base of the highway, road aggregate compacted to highways proctor standards shall be placed.

- Warning Signs – Signs shall be at the top of each bank indicating a pipeline crossing of the river.

- Test Leads - No provision for test leads has been estimated.

- Hydrostatic Testing – All piping installed shall be subject to a hydrostatic pressure test.

- Right-of-Way Clean up - Primary clean-up to be completed as soon as practical following construction with a small summer restoration crew to complete: reseeding, vegetation clean up, and seepage control the following year.

- Paving – No provision has been made for paving of any road surfaces damaged and disturbed during construction.

- Harmful Alteration, Disruption, or Destruction of fish habitat (HADD) – No disturbance of the riparian of watercourse is assumed. HADD compensation is assumed not to be required.

- Construction Inspection – Inspection shall include one lead inspector and one environmental inspector for the full duration of the construction. A river watch inspector shall be employed when the Contractor is working directly over the wetted width of the river.

- Regulating Gate Station – Station costs and scope were determined by Terasen Gas and are attached in Appendix D.

- Bridge Emergency Shutdown Valves – Automated shutdown valves shall be installed on each side of the bridge crossing. Valves shall close upon detection of: low pressure alarm, high pressure alarm or flow rate of change alarm; conditions which may indicate a line break. Valve and installation costs were provided by Terasen Gas based on recent experience. Both valves are estimated to be fabricated and installed for $150,000.

- Bridge Hangers and Crossing Installation – A conceptual design for the pipe support and hangers from the bridge deck was completed by CWMM Consulting Engineers of Kelowna, BC.

- Scaffolding - Based on discussions with scaffolding companies, the underside of the deck will be accessed by a combination of parapet suspension scaffolding and boom lifts or aerial work platforms working from below. Vendor quotes could not be completed in time for inclusion in this document so costs were developed from vendor discussions and scaled rental rates for standard scaffolding sections to account for the difficulty of installation.

4.7 Environmental Requirements

Construction will be completed to Terasen Gas and industry best management practices, including a river watch to ensure no deleterious materials are dropped or discharged in to the Muskwa River during bridge crossing installation.

4.8 Cost Estimate

Detailed cost estimate summary sheet is included in Appendix C and the total installed estimate for the crossing of the Muskwa River by bridge crossing and related facilities is:

Lower Bound (-20%)	Mean	Upper Bound (+30%)
$ 2,052,520	$ 2,565,650	$ 3,335,345

Major risks of the Bridge Crossing include:

- Approvals with the PWGSC for installing a bridge crossing;

- Safety during construction for erection of scaffolding and the use of aerial work platforms for installing the bridge hangers;

- Asset life of the existing bridge and need for replacement in the near future;

- Seismic design of the existing bridge and its ability to withstand a 1:2475 year event; and

- Working over a watercourse of high fisheries value and implementation of construction practices to eliminate the possibility of deleterious material being discharged into the river.

4.9 Class 4 to Class 3 Variations

The Class 4 estimate reported a mean cost of $ 2,214,900. The Class 3 mean estimate is $ 2,565,650 or an increase of $ 350,750 due to the following new information discovered during the feasibility analysis of the bridge crossing:

- Site investigation and feasibility assessment of the bridge crossing was completed by CWMM Consulting Engineers of Kelowna, BC. It was determined that the pipe must be hung from the outside edge of the concrete bridge deck resulting in more complex scaffolding erection and dismantling requirements. This change resulted in over half the increase in total cost;

- Regulating Gate Station costs decreased as it was determined that materials from the existing Fort Nelson TP/IP Gate Station could be reused at the new site. Reuse of these materials resulted in a savings of approximately $(50,000) from the Class 4 estimate; and

- It was determined that Emergency Shutdown Valves are required at the immediate periphery of each end of the bridge crossing. The addition of this requirement to the scope resulted in an increase of $150,000 from the Class 4 estimate or approximately half of the total increase.

4.10 Included Costs

The following costs are included in the estimates:

- Aggregate materials including crush rock, sand and pit run gravel;

- Field contractor's labour, equipment, consumables, home office costs and profit;

- Engineering, procurement and construction management costs;

- Construction monitoring and inspection, material quality control inspection and environmental monitoring and inspection;

- Third party costs such as non-destructive examination (NDE), hydrovac services, surveying, pressure and water trucks, etc;
- All miscellaneous materials of construction and installation; and
- Contingency of 15% to cover miscellaneous items and unforeseen construction impacts.

4.11 Excluded Costs

The following costs are excluded from the estimates:

- Development costs to date;
- Third party legal, environmental, public relations and land services or permits;
- Construction right-of-way acquisition costs or timber stumpage costs;
- Municipal or third party negotiations; and
- Harmonized Sales Tax on material, labour and services.

5. Estimate Methodology

5.1 Reference Documents

The estimates were developed using the information provided in the following documents:

- 32004.0901 Muskwa River Crossing FEED Study – Revision 1 (03Sept10);
- BGC Engineering Inc - Terasen Gas Stage 3 Hydrotechnical Risk Analysis of Selected Crossings in British Columbia, Report 0093-065-05 (31Dec08); and
- CWMM Consulting Engineers – Bridge Crossing Feasibility Memorandum K6331 (08Nov10).

5.2 Survey Drawings

Survey drawings were developed for the site by EDI of Fort Nelson, BC. Drawings were used as a base layer for all subsequent design drawings.

5.3 Detailed Engineering Drawings

The following detailed design and construction drawings were created to frame and support the cost estimating process:

- 32004.1003 Muskwa River Bridge Crossing Design; and
- CWMM Consulting Engineers Sketch SK-1 Muskwa River Bridge Crossing Cross-Section.

5.4 Unit Price Costs and Quantities

Unit price costs were estimated based on recent experience and consultations with local contractors.

Unit prices quantities were estimated using typical pipeline estimating methods for Canadian pipeline construction.

5.5 Pipeline Construction Execution

It was assumed that the pipeline work will be contracted in the following manner:

Construction:	Prime Pipeline Construction Contractor
Scaffolding Erection:	Sub-contract to Prime Pipeline Contractor
Non-Destructive Examination:	Sub-contract to Prime Pipeline Contractor
Project office:	One site Office located in Fort Nelson, BC

Pipeline contractors' fees for the administration of sub-contracts are included in the estimate at the rate of 5%.

6. Feasibility and Risk

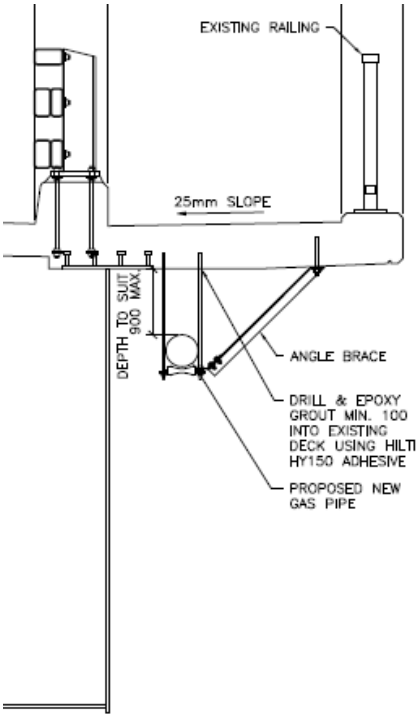
6.1 Design Feasibility

CWMM Consulting Engineers assessed the feasibility of hanging a pipeline from the Muskwa River bridge by the Alaska Highway at km 451.5. The memorandum is attached in Appendix B.

The highway bridge is comprised of five continuous twin steel box girders supporting a cast-in-place concrete deck. Deck substructure consists of concrete piers and abutments supported on piles. The bridge deck is 11.277m wide.

For a pipeline to be installed on the underside of the bridge deck, it would have to be installed on the east edge of the deck under the existing walkway. The pipeline would be suspended by conventional pipe rollers and supports as detailed in Figure 3. Support rods would be drilled, grouted and anchored into the deck. Total additional weight added to the bridge is minimal at 40 kg /m.

Figure 3: Typical Pipe Roller Support at Outer Edge of Bridge Deck by CWMM



Technically, hanging of a pipe from the underside of an overhanging bridge is a standard construction practice that has been completed safely throughout British Columbia on many bridge structures throughout the province.

6.2 Regulatory Risk

Numerous discussions have occurred with PWGSC pertaining to the acceptance of hanging a pipeline on the Muskwa River Alaska Highway Bridge. The Bridge Authority within PWGSC is presently opposed to the crossing due to the perceived risk of a natural gas pipeline on a highways bridge.

PWGSC has committed to reviewing the application and will consider granting approval for the crossing provided it meets all BC MOTI requirements for a bridge crossing by a pipeline.

The outcome and acceptance of the crossing by PWGSC is still unknown.

6.3 Seismic Risk

It is presently not known what seismic standard the Alaska Highway Bridge of the Muskwa River is designed to. Typically pipeline installations on bridges are designed to a 1:2475 year seismic event and it is generally assumed that the bridge does not meet this standard.

The Fort Nelson is a region of low seismicity and the bridge is deemed a low risk for earthquake damage by CWMM Consulting Engineers as described in the memorandum attached in Appendix B.

6.4 Environmental Risk

The greatest environmental risk posed by the installation of a bridge crossing by a pipeline is the possibility of deleterious material being discharged into the river inadvertently during installation. This risk is very manageable and is mitigated through control of contractor work practices and the use of mechanisms such as nets or sheeting.

6.5 Risk Closure

The crossing of the Muskwa River is highly feasible by bridge crossing but a number of factors that cannot be quantified still pose a risk to the successful installation and operation of the pipeline: regulatory approvals with PWGSC and acceptance of a lower seismic design criterion for the bridge.

7. Summary

Remediation of the 168mm O.D. Fort Nelson transmission pipeline exposure at the Muskwa River is feasible by bridge crossing based on site assessments and regulatory discussions. The Class 4 cost estimate is within 15% of the Class 3 cost estimate of $ 2,565,650.

I trust the above satisfies your requirements at this time and provides adequate detail in estimating the construction costs for crossing the Muskwa River by utilizing the existing Muskwa River Alaska Highway Bridge.

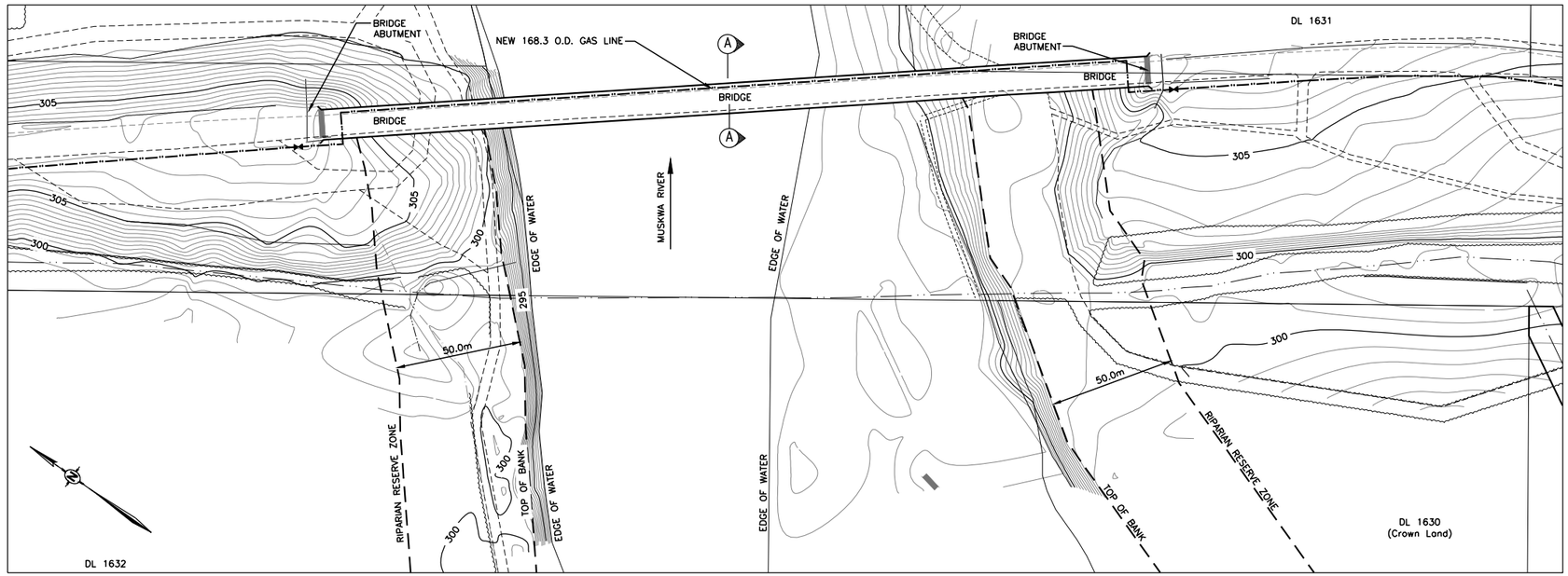
Sincerely,

18-Nov-2010

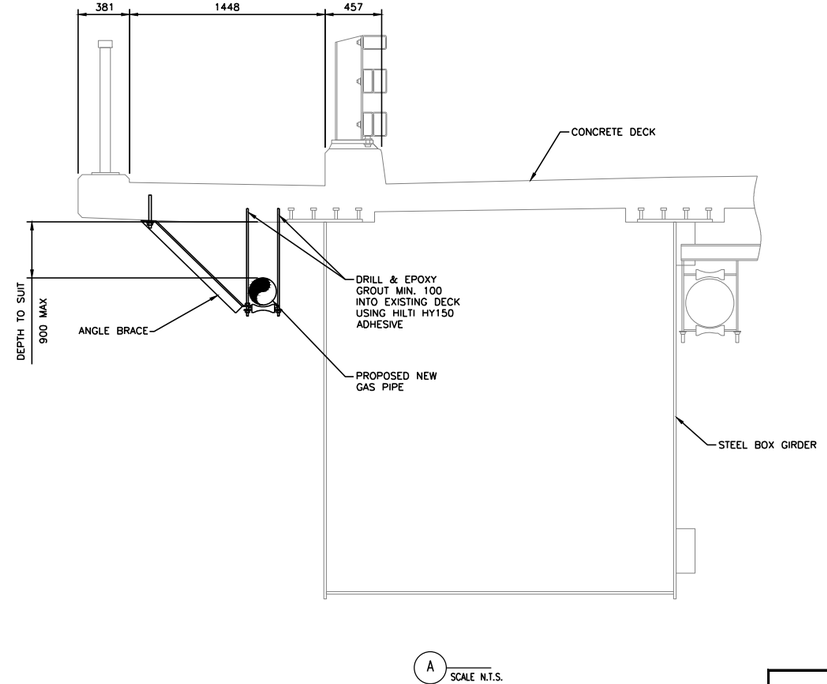
David Bainbridge, P.Eng
Pipeline Engineer
Chinook Engineering Ltd.

Appendix A

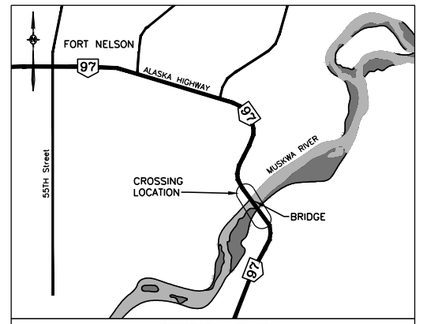
Muskwa River Bridge Crossing Conceptual Drawing



PLAN
SCALE: 1:1000



A SCALE N.T.S.



LOCATION PLAN

SCALE: N.T.S.

GENERAL LOCATION

KILOMETER POST:	17+300
NTS LAND LOCATION:	B-043-B / 094-J-15
UTM ZONE:	10N NAD83, N6516320.243, E519639.591

MATERIAL LIST

ITEM	QTY.	DESCRIPTION	REF. DWG.
1	810m	168.3mm X 7.11mm W.T., GR 290, CSA Z245.1,	---
		CAT II, DPS COATING, DBL RANDOM, ERW	

CLASS LOCATION: 3
OVERALL SAFETY FACTOR: 56%
M.O.P. 2068 kPa

DESIGN NOTES:

1. CROSSING SECTION – TEST PRESSURE
   MINIMUM = 3 000 kPa
   MAXIMUM = 5 000 kPa
   DURATION = 24 HOURS
2. DESIGN TEMPERATURE – M45C.

ISSUED FOR INTERNAL REVIEW 10-11-18

CHINOOK ENGINEERING	A1	ISSUED FOR INTERNAL REVIEW	DAH	DGB	PT	10-11-18
BY	No.	REVISION	DRAWN	DESIGNED	CHECKED	DATE(YY-MM-DD)
PREVIOUS DR. NO.-		SAP ID:		MICROFILMED		SCALE- AS SHOWN

Terasen Gas

ENGINEER SEAL

168.3mm TP – MUSKWA PIPELINE

PRELIMINARY DESIGN
BRIDGE CROSSING OF THE
MUSKWA RIVER AT Kp 17+300
PLAN AND PROFILE

DRAWING NUMBER 32004-P-000-1003-A1

Appendix B

CWMM Consulting Engineers Muskwa River Design Memorandum K6331 and Sketch

CWMM Consulting Engineers Ltd.

200-1854 Kirschner Road,
Kelowna, BC V1Y 4N6
Tel: (250) 868-2308
Fax: (250) 868-2374
Email: kelowna@cwmm.ca

November 8, 2010

Terasen Gas Inc. K3661
1150 Kalamalka Lake Rd
Vernon, B.C., V1T 6V2

Attention: Paul Tassie, P.Eng.

Dear Sirs:

Re: Muskwa River Bridge, Alaska Highway km 451.5, Fort Nelson, B.C.
Feasability Assessment for Gas Pipeline Installation

Introduction

CWMM Consulting Engineers Ltd. has been retained to provide a feasibility assessment for attaching a natural gas pipeline to the underside of the Muskwa River Bridge just outside of Fort Nelson, B.C. The purpose of this feasibility assessment is to determine the viability and most appropriate location for installing this natural gas pipeline to the underside of the bridge.

A site visit was conducted by Brendan Murtagh, an E.I.T. with CWMM, on November 3, 2010 in order to gather information for this assessment. A Terasen Gas drawing entitled *Preliminary Design Bridge Crossing of the Muskwa River,* as well as a topographical plan, and some recent drawings dated 2009 showing Rehabilitation measures for the bridge were made available to CWMM for reference. The following is a brief summary of our review and conclusions.

Site Description

The Muskwa River Bridge carries the Alaska Highway over the Muskwa River at approximately km 451.5 along the Alaska Highway. The bridge is made up of five spans of continuous twin steel box girders supporting a cast-in-place concrete deck, with a substructure consisting of concrete piers and abutments supported on piles. The bridge cross section consists of an 11.277m wide concrete deck, an approximate 8.534m wide roadway and an approximate 1.448m wide sidewalk, bearing on top of two box girders as shown on attached Sketch Sk1. The concrete deck roadway overhangs the box girder on the upstream side approximately 1.350m while the concrete deck sidewalk overhangs the box girder on the downstream side approximately 1.800m, with drain pipes penetrating both overhangs. The thickness of the concrete deck varies, but estimated as approximately 225mm between the girders, and thicker at the overhangs.

The two box girders have a clear space between of approximately 2.9m. Between these two box girders is an existing insulated water pipe, of unknown diameter, adjacent to the downstream girder, some electrical conduits adjacent to the upstream girder and maintenance traveler, supported by steel beam rails as shown in section 1, centered in between the box girders.

Feasibility Assessment

The proposed natural gas pipeline has a 168.3mm outer diameter with a 7.11mm wall thickness. The pipe material is to be grade 290 steel and to be operated at a pressure of 2.1 MPa. It is proposed to suspend the pipe from deck on the downstream side on conventional pipe roll supports, suspended from the deck above, as depicted on SK1, attached. The suspended rod supports would be galvanized and drilled and grouted with adhesive into the concrete deck. Alternatively, the pipe could be supported by galvanized steel brackets attached to the box girder itself. The pipe could either enter the structure through a sleeve in the existing abutment ballast wall, or by rising up the first pier adjacent to each abutment. In the former case, a transverse loop would be required at each abutment to accommodate expansion/contraction, while in the latter case the risers at the piers would permit sufficient longitudinal displacement to accommodate the necessary movement.

The Fort Nelson area is a region of low seismicity and therefore deemed to be of low risk for earthquake related damage. Nonetheless, the pipe supports can be braced transversely, as indicated, and a longitudinal anchor could be affixed at a suitable location near midspan to resist the minor longitudinal forces.

The bridge has ample clearance above high water, and the positioning of the gas pipeline would have no effect in terms of being susceptible to flood or debris issues. In addition, the location of the pipe beneath the downstream overhang ensures that there is no interference issue with the maintenance traveler.

The weight of the pipe is approximately 28 kg/m. When the minor weights of support components are added, the total loading is approximately 40 kg/m, which is relatively insignificant in relation to the dead and live loads carried by the structure.

It is worth noting that gas pipelines are located on many existing bridges, where environmental or cost reasons make other alternatives undesirable. Gas transmission pipelines are located on major structures in the Vancouver area where seismic vulnerability is much higher, including such examples as Patullo Bridge, Mission Bridge, Oak Street Bridge, Knight Street Bridge, and Ironworkers Memorial Bridge.

Summary and Conclusions

The proposed pipeline could be safely suspended from the Muskwa River Bridge with minimal impact to the structure. Issues relating to seismic resistance and flooding/debris impact would appear to be largely insignificant. By installing the pipe beneath the downstream overhang, the pipe would be protected and have minimal interference with routine maintenance issues. The bridge would provide a simple solution to enabling the pipe to cross the river in a cost effective manner without compromising the structural integrity of the bridge.

We trust this is satisfactory to you. Should you have any questions or comments, please do not hesitate to contact us.

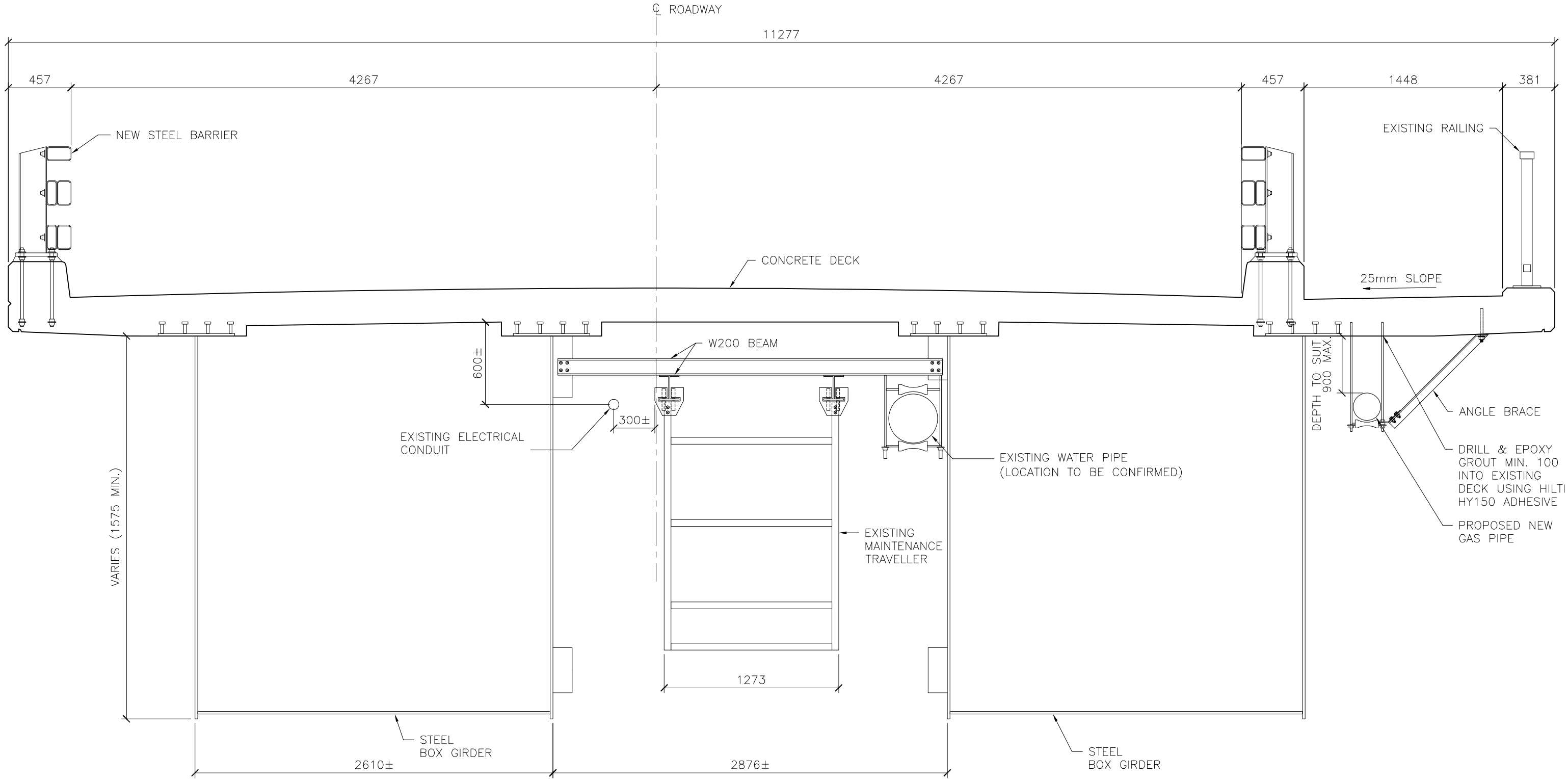
Sincerely,

CWMM Consulting Engineers Ltd.

Prepared by:

Don D. Bergman, M.Eng., P.Eng., Principal

Attachment: SK1



CWMM CONSULTING ENGINEERS LTD.
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e-mail: kelowna@cwmm.ca

TITLE: SECTION		SCALE: N.T..S.	REV.:
		DATE: NOV. 5, 2010	DWG. NO.: SK1
REF. DRAWING:		DRAWN: T.S.	
PROJECT: MUSKWA RIVER BRIDGE GAS PIPELINE ADDITION		PROJ. NO.: K3661	OF

Appendix C

Muskwa River Bridge Crossing WBS Cost Estimate Summary

	PROJECT	Muskwa River - Bridge Crossing & Station	LENGTH (m)	810
	YEAR	2010	DIA. (mm)	168
	FROM	0+000	W.T. (mm)	7.11
	TO	0+810	S.M.Y.S.(grade)	290
			MAOP. (kPa)	1,379

SERVICES

CODE NO.	DESCRIPTION	COMMENTS	UNIT PRICE	NO, OF UNITS	CONSTRUCTION DOLLARS	REFERENCE
401	PIPELINE Base Lay Contract: Clearing	lump	$ 87,180.98	1	$ 87,181	Resource Worksheet
402	PIPELINE Base Lay Contract: Grading	lump	$ 100,675.77	1	$ 100,676	Resource Worksheet
403	PIPELINE Base Lay Contract: Stringing	Unit Rate: $/m	$ 65.59	810	$ 53,125	Resource Worksheet
404	PIPELINE Base Lay Contract: Ditching	Unit Rate: $/m	$ 86.04	810	$ 69,695	Resource Worksheet
405	PIPELINE Base Lay Contract: Welding	Unit Rate: $/m	$ 429.60	810	$ 347,975	Resource Worksheet
406	PIPELINE Base Lay Contract: Back Fill & Cleanup	lump	$ 102,369.95	1	$ 102,370	Resource Worksheet
407	PIPELINE Base Lay Contract: Hydrotesting	Unit Rate: $/m	$ 50.37	810	$ 40,799	Resource Worksheet
408	Sub Contract: Hydrovac	Day Rate: $/d	$ 3,150.00	3	$ 9,450	Superior City Quote
409	Sub Contract: NDT	Unit Rate: $/m	$ 21.15	810	$ 17,132	Cantech Quote
410	STATION Site Preparation	lump	$ 30,000	1	$ 30,000	Terasen Quote
411	STATION Utility Services	lump	$ 59,000	1	$ 59,000	Terasen Quote
412	STATION Fabrication	lump	$ 26,000	1	$ 26,000	Terasen Quote
413	STATION Installation	lump	$ 99,000	1	$ 99,000	Terasen Quote
414	STATION Misc Services	lump	$ 27,000	1	$ 27,000	Terasen Quote
415	STATION Existing Decommission and Salvage	lump	$ 33,223	1	$ 33,223	Resource Worksheet
416	BRIDGE - Mobilization, Scafolding & Pickers	lump	$ 73,520	1	$ 73,520	Resource Worksheet
417	BRIDGE - Install Supports, Rollers & Pipe Pull	lump	$ 158,468	1	$ 158,468	Resource Worksheet
418	BRIDGE - ESDV Stations	lump	$ 75,000	2	$ 150,000	Terasen Quote
419	BRIDGE - Scaffold Dismantle & Demobilization	lump	$ 49,049	1	$ 49,049	Resource Worksheet
420	Unit Price Rate: Coating Repairs	m2	$ 50.00	75	$ 3,750	Estimate
421	Unit Price Rate: Traffic Control, Non-Permanent	incl in Base Lay	$ -		$ -	Estimate
422	Unit Price Rate: Weld Destructive Testing		$ -		$ -	Estimate
423	Unit Price Rate: Installation of electrical test leads	Unit Rate: $/ea	$ 1,200.00	4	$ 4,800	Estimate
424	Unit Price Rate: ROW Seeding	Unit Rate: $/m	$ 8.00	810	$ 6,480	Estimate
425	Unit Price Rate: 3/4 Minus Import	Unit Rate: $/m3	$ 135.00	250	$ 33,750	Blue Canyon Quote
426	Unit Price Rate: Pipeline Sand Padding	Unit Rate: $/m3	$ 97.50	250	$ 24,375	Blue Canyon Quote
427	Unit Price Rate: Road Aggregate Import	Unit Rate: $/m3	$ 105.00		$ -	Blue Canyon Quote
428	Unit Price Rate: Rip Rap D50 Import	Unit Rate: $/m3	$ 150.00		$ -	Blue Canyon Quote
429	Unit Price Rate: Air drying pipeline	incl in Base Lay	$ -		$ -	Estimate
430	Unit Price Rate: Installation of warning signs	Unit Rate: $/ea	$ 150.00	6	$ 900	Estimate
431	Unit Price Rate: Installation of Ditch Plugs	Unit Rate: $/ea	$ -		$ -	Estimate
432	Mark ups: Material		$ -		$ -	Estimate
433	Mark ups: Third Party	Incl in Sub Cost	$ -		$ -	Estimate
434	Misc. Expenses		$ -		$ -	
	TOTAL CONSTRUCTION				**$ 1,607,717**	
	ENGINEERING & INSPECTION					
101	PIPELINE Design Engineering (EPCM)		$ 37,000	1	$ 37,000	Task Sheet
102	PIPELINE Project Management		$ 20,000	1	$ 20,000	Task Sheet
103	STATION Design Engineering		$ 23,000	1	$ 23,000	Terasen Quote
104	STATION Project Management		$ 18,000	1	$ 18,000	Terasen Quote
105	Land Services & Permitting		$ 60,000	1	$ 60,000	Task Sheet
106	Surveys	Unit Rate: $/m	$ 4.97	810	$ 4,026	Bennet Land Survey
107	Environmental Field Inspection		$ -	-	$ -	Estimate
108	Field Inspection & Pipeline QA	Day Rate: $/d	$ 3,049	50	$ 152,447	Resource Worksheet
109	Gauge Pigging and Biocide Run		$ -	-	$ -	Estimate
110	Engineering Support for Construction	Day Rate: $/d	$ 1,500	10	$ 15,000	Estimate
111	Shop Inspections		$ -	-	$ -	Estimate
112	Mill Inspections		$ -	-	$ -	Estimate
	TOTAL ENGINEERING & INSPECTION				**$ 329,473**	
	COMMISSIONING					
501	Engineering Commissioning Support	Day Rate: $/d	$ 1,500	5	$ 7,500	Resource Worksheet
502	Terasen Gas Transmission Crew for Hot Tie-ins	Day Rate: $/d	$ 12,855	3	$ 38,565	Resource Worksheet
503	Operating Procedures					
504	Training					
	TOTAL COMMISSIONING				**$ 46,065**	

MATERIALS

CODE NO.	DESCRIPTION	MATERIALS QUANTITY		UNIT PRICE		MATERIAL DOLLARS	WBS
301	Line Pipe (Z662) - 168mm x 7.11mm WT Gr 290 w/ YJ	600	m	$ 110	/m	$ 66,000	Quote
301	Line Pipe (Z662) - 168mm x 7.11mm WT Gr 290 w/ Bare	210	m	$ 100	/m	$ 21,000	Estimate
303	Line Pipe Coating - Epoxy - Urethane	210	m	$ 65	/m	$ 13,650	Estimate
303	Joint Coatings - Heat Shrink Sleeves	50	ea	$ 25	/ea	$ 1,228	Quote
311	Joint Coatings - Epoxy Joint Kits	18	ea	$ 175	/ea	$ 3,063	Estimate
329	Cathodic Protection	0		$ -	-	$ -	
330	Buoyancy Control	0		$ -	-	$ -	
343	STATION: Valve Station Materials	1	ea	$ 26,000		$ 26,000	Terasen Quote
344	BRIDGE: Scaffolding Rentals	72	sections	$ 1,500	/ea	$ 108,000	Resource Worksheet
345	Induction Bends	0		$ -		$ -	
350	Freight & Hauling	3	loads	$ 3,000	pipe haul	$ 9,000	Resource Worksheet
399	Misc. Equipment	0		$ -		$ -	
	TOTAL MATERIALS					**$ 247,940**	
	PROVINCIAL SALES TAX					**$ -**	
	TOTAL MATERIALS					**$ 247,940**	
					sub-total	**$ 2,231,000**	
					CONTINGENCY (15%)	**$ 334,650**	
					GRAND TOTAL	**$ 2,565,650**	
					per m	**$ 3,167**	**/M**

Appendix D

Terasen Gas Regulating Gate Station Scope and Cost Estimate

Ft. Nelson TP/IP Station Relocation
Design and Equipment Assumptions

Prepared by: G. Oke
Nov. 8, 2010

Design Assumptions:

TP Inlet Pressure Design MOP:	6620 kPa (960 psig)
TP Inlet Minimum Design Pressure:	3000 kPa (435 psig)
IP Outlet Pressure Design MOP:	2070 kPa (300 psig)
IP Outlet Pressure Actual Setpoint:	1380 kPa (200 psig)
Flow Design Rate (20 year):	9000 m3/hr (317.8 MCFH)

Equipment:

Lineheater: The existing 1 milliion BTU/hr lineheater was installed in 1994 and an internal inspection was performed in 2005. It has secondary containment. We will re-use the lineheater.

Filter: The existing CFR 3-600 flanged filter will be re-used.

Pressure Regulation: The existing four Fisher 3-600, 399A regulators will not be re-used. These regulators were discontinued several years ago by Fisher, and parts and service are no longer provided. Fisher EZR or Mooney regulators will be suggested, depending on operational preference.

Ball valves: New ball valves will be installed at the new station.

Telemetry: Telemetry will not be installed since there is no measurement at this station.

Power: Power will be provided from a power pole 0.6 km from the bridge. Lighting will be installed in the station.

Ft. Nelson TP IP Station Relocation - Cost Estimate

STATION NAME: Ft. Nelson TP IP Station Relocation						
Location: Ft. Nelson				**Date: Nov. 8, 2010**		**Rev. #**
FID: 30002				**Estimated by: G. Oke**		
STATION ESTIMATE DETAIL						
		Estimate $ 000				
ENGINEERING						
- design: mech., civil, elect., site visits				12		
- drafting				9		
-purchasing				2		
Sub Totals				**23**		
PROJECT MANAGEMENT						
- consultants				0		
- M/E salary				11		
- COPE salary				1		
- expenses, travel				6		
- contingency @ ....%						
Sub Totals				**18**		
LANDS						
- land conveyancing - Spectra R/W				0		
- survey fees - BCLS				0		
- Land - 20 m x 30 m				50		
- working space agreements						
- contingency @ ....%						
Sub Totals				**50**		
SITE PREPARATION & RESTORATION						
- site prep., grading (not clearing)				2		
- access -				1		
- fencing -				25		
- select fill				0		
- final grading, select fill				2		
- retaining wall-				0		
- contingency @ ....%						
Sub Totals				**30**		
CIVIL & UTILITY SERVICES						
- geotechnical work, building permits				8		
- electrical - lighting				11		
- Hydro - 0.6 km to nearest pole, transformers				40		
- contingency @ ....%						
Sub Totals				**59**		
STATION MATERIALS						
- 5 x 2" ball valves 600 ANSI, WNRF				20		
- 9 x 4" ball valves 600 ANSI, WNRF				45		
- 1 MM btu/hr lineheater				0		
- 3" x 600 ANSI Filter				0		
- 4 x 3" EZR or Mooney Regulators, 600 ANSI				20		
- Pipe and Fittings (including pipe spools at existing stn.)				7		
-						
- consumables				1		
- contingency @ ....%						

Ft. Nelson TP IP Station Relocation - Cost Estimate

STATION NAME: Ft. Nelson TP IP Station Relocation							
Location: Ft. Nelson					**Date: Nov. 8, 2010**		**Rev. #**
FID: 30002					**Estimated by: G. Oke**		
Sub Totals					**93**		
PLANT FABRICATION							
- welder					10		
- welder's helper					5		
- painting					6		
- testing					2		
- NDI					2		
- shipping					1		
- contingency @ ....%							
Sub Totals					**26**		
PLANT INSTALLATION							
- inspector					2		
- const. labour & equipment					20		
- NDI					1		
- Building and foundations					60		
- mobile crane					1		
- commissioning					2		
- install pipe spools at existing TP/IP station					5		
-							
-							
-							
- travel & lodging					8		
Sub Totals					**99**		
TELEMETRY							
- electrical contractor					0		
-							
- electrical and grounding					0		
-							
-							
- contingency @ ....%							
Sub Totals					**0**		
-contingency					27		
TOTAL DIRECT COSTS					**425**		

Appendix E

Muskwa River Bridge Crossing Project Schedule

PRELIMINARY PROJECT SCHEDULE

Project: Terasen Gas - Muskwa River HDD

Spread: Bridge Crossing & Station Upgrades

Length: 810 m

Resource		MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		DURATION	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
		Work Days															
DESIGN																	
	Preliminary Design	5d															
	-	-															
	-	-															
	Final Design	30d															
PROCUREMENT																	
	Material RFQ	5d															
	Material PO	15d															
	Line Pipe Lead Times to Delivery	100d															
	Valve Lead Times to Delivery	100d															
	Construction Contact - Bid Package	15d															
	Construction Contact - Bidding	30d															
	Construction Contact - Award	1d															
REGULATORY & STAKEHOLDER CONSULTATIONS																	
	Fort Nelson IR consultations	60d															
	OGC Permit Application	30d															
	Federal Consultation and Applications	100d															
	BC FrontCounter Application (land & timber)	60d															
CONSTRUCTION																	
	Construction	50d															
COMMISSION																	
	Hot Tie-ins & Gasification	3d															
OWNER ACCEPTANCE																	
	Project Close-out & Owner Acceptance	20d															

Owner Project Activity

Contractor Construction Activity

Appendix C
REVISED FINANCIAL SCHEDULES

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 1.0

Revenue Requirment Summary ($000s)

November 19, 2010 Evidentiary Update

Line No.	Description	2009 Decision	2011 Forecast @ Existing Rates	Difference	Reference
	(1)	(2)	(3)	(4)	(5)
1		**a**	**b**	**c = b - a**	
2	**Revenue**				
3	Residential/Commercial	$ 5,854	$ 4,519	$ (1,335)	Section 9, Schedule 10.1
4	Transportation Service	41	108	67	Section 9, Schedule 10.1
5	**Total Revenue:**	**5,895**	**4,626**	**(1,269)**	
6	Less:				
7	Cost of Gas	4,476	3,179	(1,297)	Section 9, Schedule 10.1
8	**Gross Margin:**	**1,419**	**1,448**	**29**	
9					
10	**Cost of Service (excl. COG)**				
11	O&M	664	698	35	Section 9, Schedule 12.0 & 12.1
12	Property Tax	158	165	7	Section 9, Schedule 13.0
13	Depreciation	185	288	103	Section 9, Schedule 14.0
14	Amortization	6	71	66	Section 9, Schedule 14.0
15	Income Tax	59	81	22	Section 9, Schedule 15.0
16	Interest Expense	232	258	27	Section 9, Schedule 15.4
17	Other Revenue	(45)	(60)	(15)	Section 9, Schedule 11.0
18	Return on Equity	160	260	100	Section 9, Schedule 15.5
19	**Total Cost of Service:**	**1,419**	**1,763**	**344**	
20					
21	**Surplus/(Deficiency):**	**$ 0**	**$ (315)**	**$ (315)**	X-Ref - Section 9, Schedule 10.1
22					
23					
24	Revenue Deficiency (Surplus) as a % of Gross Margin			**21.74%**	
25	Revenue Deficiency (Surplus) as a % of Total Revenue			**6.80%**	X-Ref - Section 9, Schedule 10.1

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 2.0

Utility Rate Base ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual	2009 Decision	2010 Projected	2011 At Existing Rates	2011 Adjustment	2011 At Revised Rates	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	**Gross Plant in Service**							
2	GPIS Beginning of Year	$ 7,865	$ 7,965	$ 8,146	$ 8,809	$ -	$ 8,809	Section 9, Schedule 3.2
4	GPIS End of Year	8,146	8,300	8,809	12,107	-	12,107	Section 9, Schedule 3.2
5	GPIS Average Mid-Year Balance	8,005	8,132	8,477	10,458	-	10,458	
6								
7	CIAOC Beginning of Year	(1,179)	(1,159)	(1,271)	(1,271)	-	(1,271)	Section 9, Schedule 5.1
8	CIAOC End of Year	(1,271)	(1,159)	(1,271)	(1,271)	-	(1,271)	Section 9, Schedule 5.1
9	CIAOC Average Mid-Year Balance	(1,225)	(1,159)	(1,271)	(1,271)	-	(1,271)	
10								
11	**Accumulated Depreciation**							
12	GPIS Beginning of Year	(2,021)	(2,064)	(2,033)	(2,342)	-	(2,342)	Section 9, Schedule 4.2
14	GPIS End of Year	(2,033)	(2,271)	(2,342)	(2,630)	-	(2,630)	Section 9, Schedule 4.2
15	GPIS Average Mid-Year Balance	(2,027)	(2,167)	(2,238)	(2,486)	-	(2,486)	
16								
17	CIAOC Beginning of Year	429	554	452	541	-	541	Section 9, Schedule 5.1
18	CIAOC End of Year	453	576	541	570	-	570	Section 9, Schedule 5.1
19	CIAOC Average Mid-Year Balance	441	565	497	555	-	555	
20								
21	**Net Plant in Service, Mid-Year**	**$ 5,194**	**$ 5,371**	**$ 5,465**	**$ 7,256**	**$ -**	**$ 7,256**	
22								
23	Adjustment to 13 - Month Average	(84)	-	-	(666)	-	(666)	
24	Work In Progress, Not Attracting AFUDC	143	-	38	38	-	38	
26	Unamortized Deferred Charges	79	307	100	154	-	154	Section 9, Schedule 6.1
27	Cash Working Capital	(290)	(277)	(287)	48	5	54	Section 9, Schedule 7.0
28	Other Working Capital	13	3	3	3	-	3	Section 9, Schedule 8.0
29								
30	**Utility Rate Base**	**$ 5,055**	**$ 5,405**	**$ 5,320**	**$ 6,833**	**$ 5**	**$ 6,839**	X-Ref - Section 9, Schedule 9.0

TG FORT NELSON

2011 REVENUE REQUIREMENT AND RATES APPLICATION

Gas Plant in Service ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	CCA Class	Account No.	Opening Balance	Adjustments	Additions	AFUDC	Overhead Capitalized	Retirements	Closing Balance	Mid-year GPIS for Depreciation	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	**2009 ACTUAL**											
2	**Transmission**											
3	Land / Land Rights	land/rights	460-00/461-00	$ 9	$ -	$ (1)		$ -	$ -	$ 9		
4	Measuring & Regulating Structures	49	463-00	3	-	-		-	(3)	-		
5	Other Structures & Improvements	7	464-00	1	-	-		-	-	1		
6	Mains	49	465-00	715	-	-		-	(8)	706		
7	Measuring & Regulating Equipment	49	467-00	379	-	174		79	(63)	569		
8	Telemetering	49	467-10	5	-	-		-	-	5		
9	Communication Equipment	49	468-00	-	-	-		-	-	-		
10	**Total Transmission**			**1,111**	**-**	**174**		**79**	**(74)**	**1,290**		
11												
12	**Distribution**											
13	Land / Land Rights	land/rights	470-00/471-00	24	-	-		-	-	24		
14	Structures & Improvements	1	472-00	245	-	2		1	-	247		
15	Services	1	473-00	2,183	1	39		18	(45)	2,195		
16	House Regulators & Meter Installation	1	474-00	638	-	5		2	(18)	628		
17	Mains	1	475-00	1,926	-	35		16	(2)	1,976		
18	Compressed Natural Gas	8	476-00	-	-	-		-	-	-		
19	Measuring & Regulating Equipment	1	477-10/477-30	977	-	23		10	(9)	1,001		
20	Telemetering	1	477-20	13	-	-		-	-	13		
21	Meters	1	478-10	28	-	-		-	(4)	24		
22	**Total Distribution**			**6,034**	**1**	**104**		**47**	**(78)**	**6,108**		
23												
24	**General Plant**											
25	Land	land	480-00	1	-	-		-	-	1		
26	Frame Structures & Improvements	1	482-00	236	-	33		-	-	269		
27	Office Furniture & Equipment	8	483-00									
28	Computers - Hardware	45	483-10	182	-	-		-	-	182		
29	Computers - Software (non-infrastructure)	12	402-01	135	-	-		-	(6)	130		
30	Computers - Software (infrastructure/custom)	12	483-20	-	-	-		-	-	-		
31	Office Equipment	8	483-30	41						41		
32	Furniture	8	483-40	-	-	-		-	-	-		
33	Transportation Equipment	10	484-00	11	-	-		-	-	11		
34	Heavy Work Equipment	38	485-10/485-20	3	-	-		-	-	3		
35	Small Tools & Equipment	8	486-00	84	-	-		-	(1)	84		
36	Communication Equipment											
37	Telephone	8	488-10	27	-	-		-	-	27		
38	Radios	8	488-20	-	-	-		-	-	-		
39	**Total General Plant**			**720**		**33**		**-**	**(6)**	**747**		
40												
41	**Total**			**$ 7,865**	**$ 2**	**$ 312**		**$ 126**	**$ (158)**	**$ 8,146**		

Gas Plant in Service ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	CCA Class	Account No.	Opening Balance	Adjustments	Additions	AFUDC	Overhead Capitalized	Retirements	Closing Balance	Mid-year GPIS for Depreciation	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	**2010 PROJECTED**											
2	**Transmission**											
3	Land / Land Rights	land/rights	460-00/461-00	$ 9	$ -	$ -		$ -	$ -	$ 9		
4	Measuring & Regulating Structures	49	463-00	-	-	-		-	-	-		
5	Other Structures & Improvements	7	464-00	1	-	-		-	-	1		
6	Mains	49	465-00	706	-	-		-	-	706		
7	Measuring & Regulating Equipment	49	467-00	569	-	-		-	-	569		
8	Telemetering	49	467-10	5	-	-		-	-	5		
9	Communication Equipment	49	468-00	-	-	-		-	-	-		
10	**Total Transmission**			**1,290**	**-**	**-**		**-**	**-**	**1,290**		
11												
12	**Distribution**											
13	Land / Land Rights	land/rights	470-00/471-00	24	-	-		-	-	24		
14	Structures & Improvements	1	472-00	247	-	-		-	-	247		
15	Services	1	473-00	2,195	-	56		35	-	2,287		
16	House Regulators & Meter Installation	1	474-00	628	-	3		2	-	633		
17	Mains	1	475-00	1,976	-	62		39	-	2,076		
18	Compressed Natural Gas	8	476-00	-	-	-		-	-	-		
19	Measuring & Regulating Equipment	1	477-10/477-30	1,001	-	58		37	-	1,096		
20	Telemetering	1	477-20	13	-	-		-	-	13		
21	Meters	1	478-10	24	-	3		-	-	27		
22	**Total Distribution**			**6,108**	**-**	**182**		**113**	**-**	**6,403**		
23												
24	**General Plant**											
25	Land	land	480-00	1	-	-		-	-	1		
26	Frame Structures & Improvements	1	482-00	269	-	404		-	(44)	629		
27	Office Furniture & Equipment	8	483-00	-	-	-		-	-	-		
28	Computers - Hardware	45	483-10	182	-	-		-	-	182		
29	Computers - Software (non-infrastructure)	12	402-01	130	-	-		-	-	130		
30	Computers - Software (infrastructure/custom)	12	483-20	-	-	-		-	-	-		
31	Office Equipment	8	483-30	41	-	-		-	-	41		
32	Furniture	8	483-40	-	-	-		-	-	-		
33	Transportation Equipment	10	484-00	11	-	-		-	-	11		
34	Heavy Work Equipment	38	485-10/485-20	3	-	-		-	-	3		
35	Small Tools & Equipment	8	486-00	84	-	8		-	-	92		
36	Communication Equipment											
37	Telephone	8	488-10	27	-	-		-	-	27		
38	Radios	8	488-20	-	-	-		-	-	-		
39	**Total General Plant**			**747**		**412**		**-**	**(44)**	**1,115**		
40												
41	**Total**			**$ 8,146**	**$ -**	**$ 594**		**$ 113**	**$ (44)**	**$ 8,809**		

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 3.2

Gas Plant in Service ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	CCA Class	Account No.	Opening Balance	Adjustments	Additions	AFUDC	Overhead Capitalized	Retirements	Closing Balance	Mid-year GPIS for Depreciation	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	**2011 FORECAST**											
2	**Transmission**											
3	Land / Land Rights	land/rights	460-00/461-00	$ 9	$ -	$ -		$ -	$ -	$ 9	$ 9	X-Ref - Section 9, Schedule 4.2
4	Measuring & Regulating Structures	49	463-00	-	-	-		-	-	-	-	X-Ref - Section 9, Schedule 4.2
5	Other Structures & Improvements	7	464-00	1	-	-		-	-	1	1	X-Ref - Section 9, Schedule 4.2
6	Mains	49	465-00	706	-	2,866	152	-	(29)	3,695	2,201	X-Ref - Section 9, Schedule 4.2
7	Measuring & Regulating Equipment	49	467-00	569	-	-		-	-	569	569	X-Ref - Section 9, Schedule 4.2
8	Telemetering	49	467-10	5	-	-		-	-	5	5	X-Ref - Section 9, Schedule 4.2
9	Communication Equipment	49	468-00	-	-	-		-	-	-	-	X-Ref - Section 9, Schedule 4.2
10	**Total Transmission**			**1,290**	**-**	**2,866**	**152**	**-**	**(29)**	**4,279**	**2,785**	
11												
12	**Distribution**											
13	Land / Land Rights	land/rights	470-00/471-00	24	-	-		-	-	24	24	X-Ref - Section 9, Schedule 4.2
14	Structures & Improvements	1	472-00	247	-	-		-	-	247	247	X-Ref - Section 9, Schedule 4.2
15	Services	1	473-00	2,287	-	36		22	-	2,346	2,316	X-Ref - Section 9, Schedule 4.2
16	House Regulators & Meter Installation	1	474-00	633	-	3		2	-	638	635	X-Ref - Section 9, Schedule 4.2
17	Mains	1	475-00	2,076	-	61		37	-	2,175	2,126	X-Ref - Section 9, Schedule 4.2
18	Compressed Natural Gas	8	476-00	-	-	-		-	-	-	-	X-Ref - Section 9, Schedule 4.2
19	Measuring & Regulating Equipment	1	477-10/477-30	1,096	-	85		52	-	1,233	1,164	X-Ref - Section 9, Schedule 4.2
20	Telemetering	1	477-20	13	-	-		-	-	13	13	X-Ref - Section 9, Schedule 4.2
21	Meters	1	478-10	27	-	3		-	-	30	29	X-Ref - Section 9, Schedule 4.2
22	**Total Distribution**			**6,403**	**-**	**189**	**-**	**114**	**-**	**6,706**	**6,554**	
23												
24	**General Plant**											
25	Land	land	480-00	1	-	-		-	-	1	1	X-Ref - Section 9, Schedule 4.2
26	Frame Structures & Improvements	1	482-00	629	-	-		-	-	629	629	X-Ref - Section 9, Schedule 4.2
27	Office Furniture & Equipment	8	483-00	-						-	-	X-Ref - Section 9, Schedule 4.2
28	Computers - Hardware	45	483-10	182	-	-		-	-	182	182	X-Ref - Section 9, Schedule 4.2
29	Computers - Software (non-infrastructure)	12	402-01	130	-	-		-	-	130	130	X-Ref - Section 9, Schedule 4.2
30	Computers - Software (infrastructure/custom)	12	483-20	-	-	-		-	-	-	-	X-Ref - Section 9, Schedule 4.2
31	Office Equipment	8	483-30	41	-	-		-	-	41	41	X-Ref - Section 9, Schedule 4.2
32	Furniture	8	483-40	-	-	-		-	-	-	-	X-Ref - Section 9, Schedule 4.2
33	Transportation Equipment	10	484-00	11	-	-		-	-	11	11	X-Ref - Section 9, Schedule 4.2
34	Heavy Work Equipment	38	485-10/485-20	3	-	-		-	-	3	3	X-Ref - Section 9, Schedule 4.2
35	Small Tools & Equipment	8	486-00	92	-	8		-	-	100	96	X-Ref - Section 9, Schedule 4.2
36	Communication Equipment										-	X-Ref - Section 9, Schedule 4.2
37	Telephone	8	488-10	27	-	-		-	-	27	27	X-Ref - Section 9, Schedule 4.2
38	Radios	8	488-20	-	-	-		-	-	-	-	X-Ref - Section 9, Schedule 4.2
39	**Total General Plant**			**1,115**		**8**		**-**	**-**	**1,123**	**1,119**	
40												
41	**Total**			**$ 8,809**	**$ -**	**$ 3,062**	**$ 152**	**$ 114**	**$ (29)**	**$ 12,107**	**$ 10,458**	X-Ref - Section 9, Schedule 2.0

Accumulated Depreciation ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Account No.	Annual Depn Rate %	GPIS, Opening Balance	Acc Depn Opening Balance	Opening Adj	Depn Provision	Adjustments	Retirements	Disposal Costs	Proceeds on Disposal	Acc Depn Ending Balance	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	**2009 ACTUAL**												
2	**Transmission**												
3	Land / Land Rights	460-00/461-00	0.00%	$ 9	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
4	Measuring & Regulating Structures	463-00	3.00%	3	-	-	-	-	(3)	-	-	(3)	
5	Other Structures & Improvements	464-00	3.00%	1	(2)	-	-	-	-	-	-	(2)	
6	Mains	465-00	2.00%	715	24	-	12	-	(8)	-	-	27	
7	Measuring & Regulating Equipment	467-00	3.00%	379	52	-	11	-	(63)	-	-		
8	Telemetering	467-10	10.00%	5	(2)	-	1	-	-	-	-	(2)	
9	Communication Equipment	468-00	0.00%	-	-	-	-	-	-	-	-		
10	**Total Transmission**			**1,111**	**72**	**-**	**23**	**-**	**(74)**	**-**	**-**	**21**	
11													
12	**Distribution**												
13	Land / Land Rights	470-00/471-00	0.00%	24	-	-	-	-	-	-	-	-	
14	Structures & Improvements	472-00	3.00%	245	46	-	7	-	-	-	-	53	
15	Services	473-00	2.00%	2,183	719	-	40	-	(45)	-	-	714	
16	House Regulators & Meter Installation	474-00	3.57%	638	195	-	21	-	(18)	-	-	198	
17	Mains	475-00	2.00%	1,926	413	-	36	-	(2)	-	-	447	
18	Compressed Natural Gas	476-00	6.67%	-	(97)	-	-	-	-	-	-	(97)	
19	Measuring & Regulating Equipment	477-10/477-30	3.00%	977	223	-	27	-	(9)	-	-	241	
20	Telemetering	477-20	10.00%	13	11	-	1	-	-	-	-	12	
21	Meters	478-10	3.57%	28	5	-	1	-	(4)	-	-	2	
22	**Total Distribution**			**6,034**	**1,515**	**-**	**133**	**-**	**(78)**	**-**	**-**	**1,570**	
23													
24	**General Plant**												
25	Land	480-00	0.00%	1	0	-	-	-	-	-	-	0	
26	Frame Structures & Improvements	482-00	3.00%	236	172	-	7	-	-	-	-	178	
27	Office Furniture & Equipment	483-00	0.00%										
28	Computers - Hardware	483-10	20.00%	182	229	-	-	-	-	-	-	229	
29	Computers - Software	402-01	12.50%	135	12	-	1	-	(6)	-	-	7	
30	Office Equipment	483-30	5.00%	41	20	-	-	-	-			20	
31	Furniture	483-40	5.00%	-	-	-	-	-	-	-	-	-	
32	Transportation Equipment	484-00	15.00%	11	(26)	-	-	-	-	-	-	(26)	
33	Heavy Work Equipment	485-10/485-20	5.00%	3	(52)	-	-	-	-	-	-	(52)	
34	Small Tools & Equipment	486-00	5.00%	84	48	-	4	-	(1)	-	-	51	
35	Communication Equipment	488-00	5.00%	25	24	-	1	-	-			25	
36	Telephone	488-10	5.00%	-	-	-	-	-	-	-	-	-	
37	Radios	488-20	10.00%	2	8	-	-	-	-	-	-	8	
38	**Total General Plant**			**720**	**434**	**-**	**13**	**-**	**(6)**	**-**	**-**	**442**	
39													
40	**Total**			**$ 7,865**	**$ 2,021**	**$ -**	**171**	**$ -**	**$ (158)**	**$ -**	**$ -**	**$ 2,033**	

TG FORT NELSON

2011 REVENUE REQUIREMENT AND RATES APPLICATION

Accumulated Depreciation ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Account No.	Annual Depn Rate %	GPIS, Opening Balance	Depn Opening Balance	Opening Adj	Depn Provision	Adjustments	Retirements	Disposal Costs	Proceeds on Disposal	Depn Ending Balance	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	**2010 PROJECTED**												
2	**Transmission**												
3	Land / Land Rights	460-00/461-00	0.00%	$ 9	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
4	Measuring & Regulating Structures	463-00	4.27%	-	(3)	5	-	-	-	-	-	2	
5	Other Structures & Improvements	464-00	2.88%	1	(2)	-	0	-	-	-	-	(2)	
6	Mains	465-00	1.63%	706	27	4	12	-	-	-	-	43	
7	Measuring & Regulating Equipment	467-00	7.19%	569	-	33	41	-	-	-	-	74	
8	Telemetering	467-10	1.33%	5	(2)	-	0	-	-	-	-	(2)	
9	Communication Equipment	468-00	0.00%	-	-	-	-	-	-	-	-	-	
10	**Total Transmission**			**1,290**	**21**	**42**	**53**	**-**	**-**	**-**	**-**	**115**	
11													
12	**Distribution**												
13	Land / Land Rights	470-00/471-00	0.00%	24	-	-	-	-	-	-	-	-	
14	Structures & Improvements	472-00	3.60%	247	53	-	9	-	-	-	-	62	
15	Services	473-00	2.25%	2,195	714	39	49	-	-	-	-	802	
16	House Regulators & Meter Installation	474-00	5.21%	628	198	11	33	-	-	-	-	241	
17	Mains	475-00	1.89%	1,976	447	2	37	-	-	-	-	487	
18	Compressed Natural Gas	476-00	0.00%	-	(97)	-	-	-	-	-	-	(97)	
19	Measuring & Regulating Equipment	477-10/477-30	5.72%	1,001	241	7	57	-	-	-	-	305	
20	Telemetering	477-20	0.25%	13	12	-	0	-	-	-	-	12	
21	Meters	478-00	5.31%	24	2	1	1	-	-	-	-	5	
22	**Total Distribution**			**6,108**	**1,570**	**60**	**187**	**-**	**-**	**-**	**-**	**1,817**	
23													
24	**General Plant**												
25	Land	480-00	0.00%	1	0	-	-	-	-	-	-	0	
26	Frame Structures & Improvements	482-00	3.67%	269	178	-	10	-	(44)	(20)	-	124	
27	Office Furniture & Equipment	483-00	0.00%	-	-	-	-	-		-	-	-	
28	Computers - Hardware	483-10	20.00%	182	229	-	-	-	-	-	-	229	
29	Computers - Software	402-01	12.50%	130	7	-	16	-	-	-	-	23	
30	Office Equipment	483-30	6.67%	41	20	-	3	-	-	-	-	23	
31	Furniture	483-40	5.00%	-	-	(1)	-	-	-	-	-	(1)	
32	Transportation Equipment	484-00	6.16%	11	(26)	-	-	-	-	-	-	(26)	
33	Heavy Work Equipment	485-10/485-20	6.64%	3	(52)	-	0	-	-	-	-	(52)	
34	Small Tools & Equipment	486-00	5.00%	84	51	-	4	-	-	-	-	56	
35	Communication Equipment	488-00	6.67%		25	-	-	-		-	-	25	
36	Telephone	488-10	6.67%	27	-	-	2	-	-	-	-	2	
37	Radios	488-20	6.67%	-	8	-	-	-	-	-	-	8	
38	**Total General Plant**			**747**	**440**	**(1)**	**35**	**-**	**(44)**	**(20)**	**-**	**410**	
39													
40	**Total**			**$ 8,146**	**$ 2,033**	**$ 101**	**$ 274**	**$ -**	**$ (44)**	**$ (20)**	**$ -**	**$ 2,342**	

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 4.2

Accumulated Depreciation ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Account No.	Annual Depn Rate %	GPIS, Average Balance	Depn Opening Balance	Opening Adj	Depn Provision	Adjustments	Retirements	Disposal Costs	Proceeds on Disposal	Depn Ending Balance	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	**2011 FORECAST**												
2	**Transmission**												
3	Land / Land Rights	460-00/461-00	0.00%	$ 9	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Section 9, Schedule 3.2
4	Measuring & Regulating Structures	463-00	4.27%	-	2	-	-	-	-	-	-	2	Section 9, Schedule 3.2
5	Other Structures & Improvements	464-00	2.88%	1	(2)	-	0	-	-	-	-	(2)	Section 9, Schedule 3.2
6	Mains	465-00	1.63%	1,535	43	-	25	-	(29)	-	-	39	Section 9, Schedule 3.2
7	Measuring & Regulating Equipment	467-00	7.19%	569	74	-	41	-	-	-	-	115	Section 9, Schedule 3.2
8	Telemetering	467-10	1.33%	5	(2)	-	0	-	-	-	-	(2)	Section 9, Schedule 3.2
9	Communication Equipment	468-00	0.00%	-	-	-	-	-	-	-	-	-	Section 9, Schedule 3.2
10	**Total Transmission**			**2,119**	**115**	**-**	**66**	**-**	**(29)**	**-**	**-**	**152**	X-Ref - Section 9, Schedule 14.0
11													
12	**Distribution**												
13	Land / Land Rights	470-00/471-00	0.00%	24	-	-	-	-	-	-	-	-	Section 9, Schedule 3.2
14	Structures & Improvements	472-00	3.60%	247	62	-	9	-	-	-	-	71	Section 9, Schedule 3.2
15	Services	473-00	2.25%	2,316	802	-	52	-	-	-	-	854	Section 9, Schedule 3.2
16	House Regulators & Meter Installation	474-00	5.21%	635	241	-	33	-	-	-	-	274	Section 9, Schedule 3.2
17	Mains	475-00	1.89%	2,126	487	-	40	-	-	-	-	527	Section 9, Schedule 3.2
18	Compressed Natural Gas	476-00	0.00%	-	(97)	-	-	-	-	-	-	(97)	Section 9, Schedule 3.2
19	Measuring & Regulating Equipment	477-10/477-30	5.72%	1,164	305	-	67	-	-	-	-	372	Section 9, Schedule 3.2
20	Telemetering	477-20	0.25%	13	12	-	0	-	-	-	-	12	Section 9, Schedule 3.2
21	Meters	478-00	5.31%	29	5	-	2	-	-	-	-	6	Section 9, Schedule 3.2
22	**Total Distribution**			**6,554**	**1,817**	**-**	**202**	**-**	**-**	**-**	**-**	**2,019**	X-Ref - Section 9, Schedule 14.0
23													
24	**General Plant**												
25	Land	480-00	0.00%	1	0	-	-	-	-	-	-	0	Section 9, Schedule 3.2
26	Frame Structures & Improvements	482-00	3.67%	629	124	-	23	-	-	-	-	147	Section 9, Schedule 3.2
27	Office Furniture & Equipment	483-00	0.00%	-	-	-	-	-	-	-	-	-	Section 9, Schedule 3.2
28	Computers - Hardware	483-10	20.00%	182	229	-	-	-	-	-	-	229	Section 9, Schedule 3.2
29	Computers - Software	402-01	12.50%	130	23	-	16	-	-	-	-	40	Section 9, Schedule 3.2
30	Office Equipment	483-30	6.67%	41	23	-	3	-	-	-	-	25	Section 9, Schedule 3.2
31	Furniture	483-40	5.00%	-	(1)	-	-	-	-	-	-	(1)	Section 9, Schedule 3.2
32	Transportation Equipment	484-00	6.16%	11	(26)	-	-	-	-	-	-	(26)	Section 9, Schedule 3.2
33	Heavy Work Equipment	485-10/485-20	6.64%	3	(52)	-	0	-	-	-	-	(52)	Section 9, Schedule 3.2
34	Small Tools & Equipment	486-00	5.00%	96	56	-	5	-	-	-	-	60	Section 9, Schedule 3.2
35	Communication Equipment	488-00	6.67%	-	25	-	-	-	-	-	-	25	Section 9, Schedule 3.2
36	Telephone	488-10	6.67%	27	2	-	2	-	-	-	-	4	Section 9, Schedule 3.2
37	Radios	488-20	6.67%	-	8	-	-	-	-	-	-	8	Section 9, Schedule 3.2
38	**Total General Plant**			**1,119**	**410**	**-**	**49**	**-**	**-**	**-**	**-**	**459**	X-Ref - Section 9, Schedule 14.0
39													
40	**Total**			**$ 9,792**	**$ 2,342**	**$ -**	**$ 317**	**$ -**	**$ (29)**	**$ -**	**$ -**	**$ 2,630**	X-Ref - Section 9, Schedule 2.0

Contributions in Aid of Construction Continuity Schedules ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Opening Balance	Additions	Retirements	Ending Balance	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	**2009 Actual**					
2	Gross Contributions					
3	DSEP / GEAP	$ -	$ -	$ -	$ -	
4	Computer Software Tax Credit	-	-	-	-	
5	Other	1,179	92	-	1,271	
6	Total Gross Contributions	1,179	92	-	1,271	
7						
8	Accumulated Amortization					
9	Computer Software Tax Savings	-	-	-	-	
10	Other	(429)	(24)	-	(452)	
11	Total Accumulated Amortization	(429)	(24)	-	(452)	
12						
13	**Total 2009 Actual Net CIAOC**	**$ 750**	**$ 69**	**$ -**	**$ 819**	
14						
15	**2009 Decision**					
16	Gross Contributions					
17	DSEP / GEAP	$ 248	$ -	$ -	$ 248	
18	Computer Software Tax Credit	156	-	-	156	
19	Other	755	-	-	755	
20	Total Gross Contributions	1,159	-	-	1,159	
21						
22	Accumulated Amortization					
23	Computer Software Tax Savings	(156)	-	-	(156)	
24	Other	(398)	(22)	-	(420)	
25	Total Accumulated Amortization	(554)	(22)	-	(576)	
26						
27	**Total 2009 Decision Net CIAOC**	**$ 605**	**$ (22)**	**$ -**	**$ 583**	

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 5.1

Contributions in Aid of Construction Continuity Schedules ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Opening Balance	Additions	Retirements	Ending Balance	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	**2010 Projected**					
2	Gross Contributions					
3	DSEP / GEAP	$ -	$ -	$ -	$ -	
4	Computer Software Tax Credit	-	-	-	-	
5	Other	1,271	-	-	1,271	
6	Total Gross Contributions	1,271	-	-	1,271	
7						
8	Accumulated Amortization					
9	Computer Software Tax Savings	-	-	-	-	
10	Other	(452)	(89)	-	(541)	
11	Total Accumulated Amortization	(452)	(89)	-	(541)	
12						
13	**Total 2010 Projected Net CIAOC**	**$ 819**	**$ (89)**	**$ -**	**$ 730**	
14						
15	**2011 Forecast**					
16	Gross Contributions					
17	DSEP / GEAP	$ -	$ -	$ -	$ -	
18	Computer Software Tax Credit	-	-	-	-	
19	Other	1,271	-	-	1,271	
20	Total Gross Contributions	1,271	-	-	1,271	X-Ref - Section 9, Schedule 2.0
21						
22	Accumulated Amortization					
23	Computer Software Tax Savings	-	-	-	-	
24	Other	(541)	(29)	-	(570)	
25	Total Accumulated Amortization	(541)	(29)	-	(570)	X-Ref - Section 9, Schedule 2.0, 14.0
26						
27	**Total 2011 Forecast Net CIAOC**	**$ 730**	**$ (29)**	**$ -**	**$ 701**	

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 6.0

Deferred Charges ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Opening Balance	Adjustments	Gross Additions	Less Taxes	Net Additions	Amortization	Amortization	Closing Balance	Mid-Year Average	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	**2009 ACTUAL**										
2	Deferred Interest	$ 17	$ -	$ (18)	$ 5	$ (13)	$ -	$ -	$ 4	11	
3	Property Tax Deferral	18	-	(17)	5	(12)	(15)	-	(9)	5	
4	RSAM	246	-	(165)	101	(65)	-	(170)	12	129	
5	RSAM Interest	6	-	(1)		(1)	-	-	5	6	
6	GCRA	(129)	-	147	(44)	103	-	-	(26)	(77)	
7	ROE & Capital Structure Deferral			9		9			9	5	
8	IFRS Transitional Deferral										
9											
10	**Total 2009 ACTUAL**	**$ 159**	**$ -**	**$ (45)**	**$ 67**	**$ 22**	**$ (15)**	**$ (170)**	**$ (4)**	**$ 79**	
11											
12	**2009 Decision**										
13	Deferred Interest	$ (9)		$ -	$ -	$ -	$ 9	$ -	$ -	$ (5)	
14	Property Tax Deferral	15		-	-	-	(15)	-	-	7	
15	RSAM	276		(134)	40	(94)	-		182	229	
16	RSAM Interest	6		(0)	0	(0)	-	2	4	5	
17	GCRA	142		(203)	61	(142)	-	-	(0)	71	
18	ROE & Capital Structure Deferral								-	-	
19	IFRS Transitional Deferral								-	-	
20											
21	**Total 2009 Decision**	**$ 429**	**$ -**	**$ (337)**	**$ 101**	**$ (236)**	**$ (6)**	**$ 2**	**$ 186**	**$ 307**	

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 6.1

Deferred Charges ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Opening Balance	Adjustments	Gross Additions	Less Taxes	Net Additions	Amortization	Amortization	Closing Balance	Mid-Year Average	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	**2010 Projected**										
2	Deferred Interest	$ 4	$ -	$ (2)	$ 1	$ (1)	$ (9)	$ -	$ (6)	$ (1)	
3	Property Tax Deferral	(9)	-	-	-	-	9	-	-	(4)	
4	RSAM	12	-	52	(15)	37	-	(11)	38	25	
5	RSAM Interest	5	-	0	(0)	0	-	(0)	5	5	
6	GCRA	(26)	-	58	(16)	41	-	-	15	(6)	
7	ROE & Capital Structure Deferral	9		47	-	47			56	33	
8	IFRS Transitional Deferral			75	-	75			75	38	
9	Revenue Requirment Application			30	(9)	21			21	11	
10											
11	**Total 2010 Projected**	**$ (4)**	**$ -**	**$ 260**	**$ (39)**	**$ 220**	**$ (1)**	**$ (12)**	**$ 204**	**$ 100**	
12											
13	**2011 Forecast**										
14	Deferred Interest	$ (6)	$ -	$ -	$ -	$ -	$ 6	$ -	$ -	$ (3)	
15	Property Tax Deferral	-	-	-	-	-	-	-	-	-	
16	RSAM	38	-		-	-	-	(13)	25	32	
17	RSAM Interest	5	-		-	-		(2)	3	4	
18	GCRA	15	-	(21)	5	(15)	-	-	-	8	
19	ROE & Capital Structure Deferral	56		-		-	(56)		-	28	
20	IFRS Transitional Deferral	75		-		-			75	75	
21	Revenue Requirment Application	21					(21)			11	
22											
23	**Total 2011 Forecast**	**$ 204**	**$ -**	**$ (21)**	**$ 5**	**$ (15)**	**$ (71)**	**$ (14)**	**$ 104**	**$ 154**	X-Ref - Section 9, Schedule 2.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 7.0

Cash Working Capital ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual Normalized	2009 Decision	2010 Projected	2011 At Existing Rates	2011 Adjustment	2011 At Revised Rates	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Revenue Lead Days	34.9	34.7	34.9	38.5	0.0	38.5	Section 9, Schedule 7.2
2	Expense Lag Days	(37.2)	(37.6)	(37.0)	(32.1)	0.3	(31.9)	Section 9, Schedule 7.4
3	**Net (Lead) / Lag Days**	**(2.3)**	**(2.9)**	**(2.1)**	**6.3**	**0.3**	**6.6**	
4								
5	Cash Required for Operating Expenses	$ (33)	$ (51)	$ (31)	$ 91	$ 5	$ 97	
6	Minimum Cash Balance / Customer Deposits	(208)	(192)	(214)	-	-	-	
7								
8	Less Reserve for Bad Debts	(33)	(20)	(24)	(25)	-	(25)	
9	Withholdings from Employees	(16)	(15)	(18)	(18)	-	(18)	
10								
11	**Total Cash Working Capital**	**$ (290)**	**$ (277)**	**$ (287)**	**$ 48**	**$ 5**	**$ 54**	X-Ref - Section 9, Schedule 2.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 7.1

Lead Time from the Date of Payment to Receipt of Cash ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Revenue	Lead Days	Dollar Days	Reference
	(1)	(2)	(3)	(4)	(5)
1	**2009 Actual Normalized**				
2	Residential & Commercial	$ 5,009	34.6	$ 173,311	
3	Small Industrial	141	47.2	6,655	
4	**Total Sales / T-Service**	**5,150**	**34.9**	**179,966**	
5					
6	**Other Revenue**				
7	Late Payment Charge	22	26.7	587	
8	All Other	0	34.9	7	
9	Revenue from Service Work	10	41.9	411	
10	**Total**	**$ 5,182**	**34.9**	**$ 180,971**	
11					
12	**2009 Decision**				
13	Residential & Commercial	$ 5,854	34.6	$ 202,535	
14	Small Industrial	41	47.2	1,941	
15	**Total Sales / T-Service**	**5,895**	**34.7**	**204,476**	
16					
17	**Other Revenue**				
18	Late Payment Charge	27	26.7	724	
19	All Other	0	35.3	14	
20	Revenue from Service Work	17	41.9	716	
21	**Total**	**$ 5,939**	**34.7**	**$ 205,930**	

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 7.2

Lead Time from the Date of Payment to Receipt of Cash ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Revenue	Lead Days	Dollar Days	Reference
	(1)	(2)	(3)	(4)	(5)
1	**2010 Projected**				
2	Residential & Commercial	$ 4,576	34.6	$ 158,346	
3	Small Industrial	111	47.2	5,246	
4	**Total Sales / T-Service**	**4,688**	**34.9**	**163,592**	
5					
6	**Other Revenue**				
7	Late Payment Charge	28	26.7	751	
8	All Other	1	34.9	31	
9	Revenue from Service Work	15	41.9	620	
10	**Total**	**$ 4,731**	**34.9**	**$ 164,994**	
11					
12	**2011 Forecast at Existing Rates**				
13	Residential & Commercial	$ 4,519	38.3	$ 173,069	
14	Small Industrial	108	45.2	4,864	
15	**Total Sales / T-Service**	4,626	38.5	**177,933**	
16					
17	**Other Revenue**				
18	Late Payment Charge	38	38.3	1,465	
19	All Other	2	38.3	58	
20	Revenue from Service Work	20	38.3	757	
21	**Total**	**$ 4,686**	**38.5**	**$ 180,213**	
22					
23	**2011 Forecast at Revised Rates**				
24	Residential & Commercial	$ 4,811	38.3	$ 184,276	
25	Small Industrial	130	45.2	5,866	
26	**Total Sales / T-Service**	**4,941**	**38.5**	**190,142**	
27					
28	**Other Revenue**				
29	Late Payment Charge	38	38.3	1,465	
30	All Other	2	38.3	58	
31	Revenue from Service Work	20	38.3	757	
32	**Total**	**$ 5,001**	**38.5**	**$ 192,422**	X-Ref - Section 9, Schedule 7.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 7.3

Lag Time in Payment of Expenses ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Expense	Lag Days	Dollar Days	Reference
	(1)	(2)	(3)	(4)	(5)
1	**2009 Actual Normalized**				
2	Operating & Maintenance Expense	$ 658	19.3	$ 12,699	
3	Cost of Gas	3,764	40.7	153,191	
4					
5	Taxes other than income tax				
6	Property Taxes	157	4.0	628	
7	Goods & Service Tax (GST)	72	41.7	3,002	
8	S. S. Tax	247	43.8	10,819	
10	Carbon Tax	322	43.8	14,104	
11	Income Tax	21	15.2	319	
12	**Total Expense**	**$ 5,241**	**37.2**	**$ 194,762**	
13					
14	**2009 Decision**				
15	Operating & Maintenance Expense	$ 664	19.3	$ 12,807	
16	Cost of Gas	4,476	40.7	182,171	
17					
18	Taxes other than income				
19	Property Taxes	158	4.0	633	
20	Goods & Service Tax	278	41.7	11,608	
21	S. S. Tax	203	43.8	8,887	
22	Carbon Tax	426	43.8	18,648	
23	Income Tax	59	15.2	(790)	
24	**Total Expense**	**$ 6,264**	**37.6**	**$ 233,963**	

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 7.4

Lag Time in Payment of Expenses ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Expense	Lag Days	Dollar Days	Reference
	(1)	(2)	(3)	(4)	(5)
1	**2010 Projected**				
2	Operating & Maintenance Expense	$ 693	19.3	$ 13,375	
3	Cost of Gas	3,288	40.7	133,835	
4					
5	Taxes other than income				
6	Property Taxes	157	4.0	630	
7	Goods & Service Tax	118	41.7	4,933	
8	S. S. Tax	90	43.8	3,953	
9	Carbon Tax	512	43.6	22,310	
10	HST	356	41.7	14,860	
11	Income Tax	44	15.2	669	
12	**Total Expense**	**$ 5,259**	**37.0**	**$ 194,564**	
13					
14	**2011 Forecast at Existing Rates**				
15	Operating & Maintenance Expense	$ 698	25.5	$ 17,800	
16	Cost of Gas	3,179	40.2	127,779	
17					
18	Taxes other than income				
19	Property Taxes	165	2.0	330	
20	Carbon Tax	668	29.1	19,448	
21	HST	562	7.2	4,049	
22	Income Tax	(3)	15.2	(46)	
23	**Total Expense**	**$ 5,269**	**32.1**	**$ 169,361**	
24					
25					
26	Income Tax Expense	81	15.2	1,231	
27	**Total Expense at Revised Rates**	**$ 5,350**	**31.9**	**$ 170,592**	X-Ref - Section 9, Schedule 7.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 8.0

Other Working Capital - Inventories ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual	2009 Decision	2010 Projected	2011 Forecast	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	Pipe	$ 2	$ 2	$ 2	$ 2	
2	Fittings	10	1	1	1	
3	Regulators	-	-	-	-	
4	Supplies & Other	1	0	0	0	
5						
6	**Total Other Working Capital**	**$ 13**	**$ 3**	**$ 3**	**$ 3**	X-Ref - Section 9, Schedule 2.0

Utility Income and Earned Return ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual Normalized	2009 Decision	2010 Projected	2011 @ Existing Rates	Adjustment	2011 @ Revised Rates	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	**Average No. of Customers**	2,355	2,356	2,365	2,377		2,377	Section 9, Schedule 10.1
2								
3	**Energy Volumes (TJ)**							
4	Sales	552	554	537	549		549	Section 9, Schedule 10.1
5	Transportation Service	69	14	52	50		50	Section 9, Schedule 10.1
6	**Total Energy Volumes (TJ)**	**621**	**568**	**589**	**598**	**-**	**598**	
7								
8	**Utility Revenue**							
9	Sales - Existing Rates	$ 5,009	$ 5,492	$ 4,576	$ 4,519		4,519	Section 9, Schedule 10.1
10	- Increase	-	361			293	293	Section 9, Schedule 10.1
11	- % Increase						6.5%	
12	Transportation - Existing Rates	141	31	111	108		108	Section 9, Schedule 10.1
13	- Increase	-	10	-		22	22	
14	**Total Revenue**	**5,150**	**5,895**	**4,688**	**4,626**	**315**	**4,941**	
15	Cost of Gas Sold (including Gas Lost)	3,764	4,476	3,288	3,179		3,179	Section 9, Schedule 10.1
16	Gross Margin	1,386	1,419	1,399	1,448	315	1,763	
17	RSAM Revenue	(86)	-	52	-		-	
18	**Adjusted Gross Margin**	**1,300**	**1,419**	**1,451**	**1,448**	**315**	**1,763**	
19								
20	Operating & Maintenance Expense	658	664	693	698		698	Section 9, Schedule 12.0
21	Property Tax	157	158	157	165		165	Section 9, Schedule 13.0
22	Depreciation & Amortization Expense	162	191	187	360		360	Section 9, Schedule 14.0
23	Other Operating Revenue	(32)	(45)	(44)	(60)		(60)	Section 9, Schedule 11.0
24	**Total Utility Expenses**	**945**	**968**	**993**	**1,163**	**-**	**1,163**	
25								
26	Utility Income Before Income Tax	355	451	458	284	315	599	
27	Income Tax Expense	21	59	44	(3)	84	81	Section 9, Schedule 15.0
28								
29	**Earned Return**	**$ 334**	**$ 392**	**$ 414**	**$ 287**	**$ 231**	**$ 518**	X-Ref - Section 9, Schedule 15.0
30								
31	**Utility Rate Base**	**$ 5,055**	**$ 5,405**	**$ 5,320**	**$ 6,833**	**$ 5**	**$ 6,839**	Section 9, Schedule 2.0, 15.4
32								
33	**Return on Rate Base**	**6.60%**	**7.25%**	**7.77%**	**4.21%**		**7.58%**	Section 9, Schedule 15.5

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 10.0

Margin ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Average # of Customers	Volume (TJ)	Ave. Bundled Rate	Revenue	Ave. Cost of Gas	Cost of Gas	Ave. Margin	Margin	Ave. Increase	Increase / (Decrease)	Ave. Revised Sales Rate	Revised Revenue	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	**2009 Actual Normalized**													
2	**Sales**													
3	Residential	1,914.0	267.0	$ 8.956	$ 2,391.2	$ 6.779	$ 1,810.1	$ 2.176	$ 581.1					
4	General Service Rate 2.1	411.0	191.0	$ 9.313	$ 1,778.7	$ 6.810	$ 1,300.8	$ 2.502	477.9					
5	General Service Rate 2.2	28.0	94.0	$ 8.929	$ 839.3	$ 6.876	$ 646.3	$ 2.053	193.0					
6	**Total**	**2,353.0**	**552.0**		**5,009.2**		**3,757.2**		**1,252.0**					
7														
8	General Firm T-Service	2.0	69.0	$ 2.038	140.6	$ 0.097	6.7	$ 1.941	133.9					
9														
10	**Total**	**2,355.0**	**621.0**		**$ 5,149.8**		**$ 3,763.9**		**$ 1,385.9**					
11														
12	**2009 Decision**													
13	**Sales**													
14	Residential	1,915.0	270.5	$ 10.503	2,841.0	$ 8.077	2,184.9	$ 2.425	$ 656.1					
15	General Service Rate 2.1	411.0	195.0	$ 10.781	2,102.2	$ 8.080	1,575.5	$ 2.701	526.7					
16	General Service Rate 2.2	28.0	88.4	$ 10.299	910.4	$ 8.079	714.2	$ 2.220	196.2					
17	**Total**	**2,354.0**	**553.9**		**5,853.6**		**4,474.6**		**1,379.0**					
18														
19	General Firm T-Service	2.0	13.8	$ 2.985	41.1	$ 0.096	1.3	$ 2.889	39.8					
20														
21	**Total**	**2,356.0**	**567.7**		**5,894.7**		**4,475.9**		**$ 1,418.8**					

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 10.1

Margin ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Average # of Customers	Volume (TJ)	Ave. Bundled Rate	Revenue	Ave. Cost of Gas	Cost of Gas	Ave. Margin	Margin	Ave. Increase	Increase / (Decrease)	Ave. Revised Sales Rate	Revised Revenue	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	**2010 Projected**													
2	**Sales**													
3	Residential	1,923.0	256.6	$ 8.389	2,152.6	$ 6.094	1,563.6	$ 2.295	$ 588.9					
4	General Service Rate 2.1	412.0	187.9	$ 8.807	1,654.8	$ 6.159	1,157.2	$ 2.648	497.6					
5	General Service Rate 2.2	28.0	92.4	$ 8.328	769.2	$ 6.081	561.6	$ 2.247	207.5					
6	**Total**	**2,363.0**	**536.8**		**4,576.5**		**3,282.4**		**1,294.0**					
7														
8	General Firm T-Service	2.0	52.0	$ 2.139	111.1	$ 0.114	5.9	$ 2.025	105.2					
9														
10	**Total**	**2,365.0**	**588.8**		**$ 4,687.6**		**$ 3,288.3**		**$ 1,399.3**					
11														
12	**2011 Forecast**													
13	**Sales**													
14	Residential	1,932.0	263.4	$ 8.112	2,136.7	$ 5.784	1,523.5	$ 2.328	$ 613.2	$ 0.506	133.3	$ 8.618	2,270.1	
15	General Service Rate 2.1	415.0	190.8	$ 8.494	1,620.5	$ 5.784	1,103.5	$ 2.710	517.0	$ 0.589	112.4	$ 9.083	1,732.9	
16	General Service Rate 2.2	28.0	94.4	$ 8.068	761.5	$ 5.784	546.0	$ 2.284	215.6	$ 0.497	46.9	$ 8.564	808.4	
17	**Total**	**2,375.0**	**548.6**		**4,518.8**		**3,173.0**		**1,345.8**		**292.6**		**4,811.4**	X-Ref - Section 9, Schedule 1.0, 9.0
18														
19	General Firm T-Service	2.0	49.5	$ 2.172	107.6	$ 0.113	5.6	$ 2.059	102.0	$ 0.448	22.2	$ 2.619	129.8	X-Ref - Section 9, Schedule 1.0, 9.0
20														
21	**Total**	**2,377.0**	**598.1**		**$ 4,626.4**		**$ 3,178.6**		**$ 1,447.8**		**$ 314.8**		**$ 4,941.2**	X-Ref - Section 9, Schedule 1.0, 9.0
22														
23	**Total Deficiency / (Surplus)**										**$ 314.8**			
24														
25	**% Increase / (Decrease)**										**6.80%**			X-Ref - Section 9, Schedule 1.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 11.0

Other Revenue ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual	2009 Decision	2010 Projected	2011 Forecast	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	Late Payment Charge	$ 22	$ 27	$ 28	$ 38	
2						
3	Revenue form Service Work	10	17	15	20	
4						
5	All Other	0	0	1	2	
6						
7	**Total Other Revenue**	**$ 32**	**$ 45**	**$ 44**	**$ 60**	X-Ref - Section 9, Schedule 1.0, 9.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 12.0

Operating & Maintenance Expenses ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual	2009 Decision	2010 Projected	2011 Forecast	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	**RESOURCE VIEW**					
2	M&E Costs	$ 128	$ 145	$ 136	$ 141	
3	COPE Costs	55	53	63	68	
4	IBEW Costs	262	247	255	258	
5	**Total Labour Costs**	**445**	**444**	**455**	**467**	
6						
7	Vehicle Costs	65	59	54	61	
8	Employee Expenses	13	33	37	17	
9	Materials	14	23	29	14	
10	Computer Costs	24	24	31	34	
11	Fees & Administration Costs	57	62	60	60	
12	Contractor Costs	168	166	171	177	
13	Facilities	39	29	32	42	
14	Recoveries & Revenue	(41)	(49)	(62)	(56)	
15	HST Savings	-	-	(1)	(3)	
16	**Total Non-Labour Costs**	**339**	**346**	**351**	**345**	
17						
18	**Total Gross O&M Expenses**	**784**	**790**	**806**	**812**	
19						
20	Less Capitalized Overhead	(126)	(126)	(113)	(114)	
21						
22	**Total Net O&M Expenses**	**$ 658**	**$ 664**	**$ 693**	**$ 698**	X-Ref - Section 9, Schedule 1.0, 9.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 12.1

Operating & Maintenance Expenses ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual	2009 Decision	2010 Projected	2011 Forecast	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	**ACTIVITY VIEW**					
2	Distribution Supervision	$ 185	$ 182	$ 191	$ 192	
3	**Distribution Supervision Total**	**185**	**182**	**191**	**192**	
4						
5	Operation Centre - Distribution	124	124	128	129	
6	Asset Management - Distribution	21	20	22	22	
7	Preventative Maintenance - Distribution	42	30	43	44	
8	Distribution Operations - General	100	88	103	104	
9	Emergency Management	117	152	121	122	
10	**Distribution Operations Total**	**404**	**413**	**417**	**420**	
11						
12	Distribution Corrective - Meters	25	22	26	26	
13	Distribution Corrective - Propane	-	-	-	-	
14	Distribution Corrective - Leak Repair	21	21	22	22	
15	Distribution Corrective - Stations	12	11	12	12	
16	Distribution Corrective - General	5	7	5	5	
17	**Distribution Maintenance Total**	**63**	**61**	**65**	**66**	
18						
19	**Distribution Total**	**652**	**656**	**672**	**678**	
20						
21	Customer Contact - ABSU Contract	132	134	134	136	
22	**Customer Care Total**	**132**	**134**	**134**	**136**	
23						
24	Less: HST Savings	-	-	(1)	(3)	
25						
26	**Total Gross O&M Expense**	**784**	**790**	**806**	**812**	
27						
28	Less: Capitalized Overhead	(126)	(126)	(113)	(114)	
29						
30	**Total Net O&M Expenses**	**$ 658**	**$ 664**	**$ 693**	**$ 698**	X-Ref - Section 9, Schedule 1.0, 9.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 13.0

Property Tax ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual	2009 Decision	2010 Projected	2011 Forecast	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	General, School & Other	$ 103	$ 104	$ 102	$ 108	
2	1% in Lieu of General	54	54	55	58	
3						
4	**Total Property Tax**	**$ 157**	**$ 158**	**$ 157**	**$ 165**	X-Ref - Section 9, Schedule 1.0, 9.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 14.0

Depreciation & Amortization Expense ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual	2009 Decision	2010 Projected	2011 Forecast	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	**Depreciation Provision**					
2	Transmission	$ 23	$ 26	$ 53	$ 66	Section 9, Schedule 4.2
3	Distribution	133	146	187	202	Section 9, Schedule 4.2
4	General	14	35	35	49	Section 9, Schedule 4.2
5	**Total Depreciation Provision**	**171**	**207**	**274**	**317**	
6						
7	Less: Amortization of CIAOC	(24)	(22)	(89)	(29)	Section 9, Schedule 5.1
8						
9	**Total Depreciation Expense**	**147**	**185**	**186**	**288**	X-Ref - Section 9, Schedule 1.0, 15.1
10						
11	Amortization Expense	15	6	1	71	X-Ref - Section 9, Schedule 1.0, 15.1,
12						
13	**Total Depreciation & Amortization Expense**	**$ 162**	**$ 191**	**$ 187**	**$ 360**	X-Ref - Section 9, Schedule 9.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 15.0

Income Tax ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual Normalized	2009 Decision	2010 Projected	2011 @ Existing Rates	Adjustment	2011 @ Revised Rates	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Earned Return	$ 334	$ 392	$ 414	$ 287	$ 231	$ 518	Section 9, Schedule 9.0
2	Less: Interest on Debt	(222)	(232)	(215)	(258)	(0)	(258)	Section 9, Schedule 15.4
3	Add: Non-Tax Deductible Expense (Net)	17	6	3	74	-	74	Section 9, Schedule 15.1
4	Less: Timing Differences	(80)	(27)	(91)	(110)	-	(110)	Section 9, Schedule 15.1
5								
6	**Taxable Income after Tax**	**$ 49**	**$ 139**	**$ 111**	**$ (7)**	**$ 231**	**$ 223**	
7								
8	**Taxable Income**	**$ 70**	**$ 198**	**$ 155**	**$ (10)**	**$ 314**	**$ 304**	
9								
10	Income Tax Rate	30.0%	30.0%	28.5%	26.5%		26.5%	
11	1 - Current Tax Rate	70.0%	70.0%	71.5%	73.5%		73.5%	
12								
13	Income Tax							
14	Current	$ 21	$ 59	$ 44	$ (3)	$ 84	$ 81	X-Ref - Section 9, Schedule 1.0, 9.0
16		-	-	-	-		-	
17								
18	**Total Income Taxes**	**$ 21**	**$ 59**	**$ 44**	**$ (3)**	**$ 84**	**$ 81**	X-Ref - Section 9, Schedule 1.0, 9.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 15.1

Permanent & Timing Differences ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual	2009 Decision	2010 Projected	2011 Forecast	Reference
	(1)	(2)	(3)	(4)	(5)	(6)
1	**Permanent Differences**					
2	Non-tax Deductible Expenses	2	-	3	3	
3	Deferred Amortization Expenses	15	6	1	71	Section 9, Schedule 14.0
4	**Total Permanent Differences**	**$ 17**	**$ 6**	**$ 3**	**$ 74**	X-Ref - Section 9, Schedule 15.0
5						
6	**Timing Differences**					
7	Depreciation Expense	$ 147	$ 185	$ 186	$ 288	Section 9, Schedule 14.0
8	Amortization of Debt Issue Expenses for Accounting	2	1	4	4	
9	Debt Issue Costs / Discounts for Tax Purposes	(6)	-	(6)	(5)	
10	Capital Cost Allowance (CCA)	(153)	(166)	(190)	(311)	Section 9, Schedule 15.3
11	Cumulative Eligible Capital Allowance	-	-	-	-	
12	Overheads Capitalized for Tax Purposes	(39)	(47)	(48)	(49)	
13	Pension Reserve	(31)	-	(36)	(38)	
14	**Total Timing Differences**	**$ (80)**	**$ (27)**	**$ (91)**	**$ (110)**	Section 9, Schedule 15.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 15.2

Capital Cost Allowance Continuity ($000s)

November 19, 2010 Evidentiary Update

Line No.	Class	CCA Rate %	UCC Opening Balance	Opening Adjustments	UCC Opening Balance	Additions	1/2 Year Adjustment	Adjusted UCC	CCA	UCC Closing Balance	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(6)	(10)	(11)
1	**2009 Actual**										
2	1	4%	$ 3,206	$ (310)	$ 2,896	$ -	$ -	$ 2,896	$ (116)	$ 2,780	
3	2	6%	347		347	-	-	347	(21)	326	
4	8	20%	5	-	5	-	-	5	(1)	4	
5	10	30%	6	-	6	-	-	6	(2)	4	
6	13	manual	3	-	3	-	-	3	(1)	2	
7	3	5%	17	-	17	-	-	17	(1)	16	
8	6	10%	1	-	1	-	-	1	-	1	
9	1.3	6%	-	11	11	-	-	11	(1)	10	
10	47	8%	-	-	-		-	-	-	-	
11	51	6%	-	(1)	(1)	330	(165)	164	(10)	319	
12	50	55%	-	-	-	-	-	-	-	-	
13	7	15%	-	-	-	-	-	-	-	-	
14	49	8%	8	3	11	-	-	11	(1)	10	
15	12	100%	-	-	-	-	-	-	-	-	
16	**Total**		**$ 3,593**	**$ (297)**	**$ 3,296**	**$ 330**	**$ (165)**	**$ 3,461**	**$ (154)**	**$ 3,473**	
17											
18	**2009 Decision**										
19	1	4%	$ 3,219	$ -	$ 3,219	$ 277	$ (139)	$ 3,358	$ (134)	$ 3,362	
20	2	6%	347	-	347	-	-	347	(21)	326	
21	3	5%	17	-	17	-	-	17	(1)	16	
22	6	10%	1	-	1	-	-	1	-	1	
23	8	20%	29	-	29	11	(6)	34	(7)	33	
24	10	30%	8	-	8	-	-	8	(2)	6	
25	12	100%	-	-						-	
26	13	manual	1	-	1	-	-	1	(1)	(0)	
27	45	45%	1		1	-	-	1	-	1	
28	49	8%	6	-	6	-	-	6	-	6	
29	**Total**		**$ 3,629**	**$ -**	**$ 3,629**	**$ 288**	**$ (144)**	**$ 3,774**	**$ (166)**	**$ 3,752**	

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 15.3

Capital Cost Allowance Continuity ($000s)

November 19, 2010 Evidentiary Update

Line No.	Class	CCA Rate %	UCC Opening Balance	Opening Adjustments	UCC Opening Balance	Additions	1/2 Year Adjustment	Adjusted UCC	CCA	UCC Closing Balance	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(6)	(10)	(11)
1	**2010 Projected**										
2	1	4%	$ 2,780	$ -	$ 2,780	$ -	$ -	$ 2,780	$ (111)	$ 2,669	
3	2	6%	326	-	326	-	-	326	(20)	306	
4	8	20%	4	-	4	8	(4)	8	(2)	10	
5	10	30%	4	-	4	-	-	4	(1)	3	
6	13	manual	2	-	2	-	-	2	(1)	1	
7	3	5%	16	-	16	-	-	16	(1)	15	
8	6	10%	1	-	1	-	-	1	-	1	
9	1.3	6%	10	44	54	468	-	522	(31)	491	
10	47	8%	-	-	-	-	-	-	-	-	
11	51	6%	319	(232)	87	202	(101)	188	(11)	278	
12	50	55%	-	-	-	-	-	-	-	-	
13	7	15%	-	-	-	-	-	-	-	-	
14	49	8%	10	141	151	10	(5)	156	(12)	149	
15	12	0%	-	-	-	-	-	-	-	-	
16	**Total**		**$ 3,473**	**$ (47)**	**$ 3,425**	**$ 689**	**$ (110)**	**$ 4,003**	**$ (190)**	**$ 3,924**	
17											
18	**2011 Forecast**										
19	1	4%	$ 2,669	$ -	$ 2,669	$ -	$ -	$ 2,669	$ (107)	$ 2,562	
20	2	6%	306	-	306	-	-	306	(18)	288	
21	8	20%	10	-	10	8	(4)	14	(3)	15	
22	10	30%	3	-	3	-	-	3	(1)	2	
23	13	manual	1	-	1	-	-	1	(1)	(0)	
24	3	5%	15	-	15	-	-	15	(1)	14	
25	6	10%	1	-	1	-	-	1	-	1	
26	1.3	6%	491	-	491	-	-	491	(29)	462	
27	47	8%	-	-	-	-	-	-	-	-	
28	51	6%	278	-	278	193	(96)	374	(22)	448	
29	50	55%	-	-	-	-	-	-	-	-	
30	7	15%	-	-	-	-	-	-	-	-	
31	49	8%	149	-	149	2,927	(1,463)	1,613	(129)	2,947	
32	12	100%	-	-	-	-	-	-	-	-	
33	**Total**		**$ 3,924**	**$ -**	**$ 3,924**	**$ 3,127**	**$ (1,564)**	**$ 5,487**	**$ (311)**	**$ 6,740**	X Ref - Section 9, Schedule 15.1

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 15.4

Interest Expense ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	2009 Actual Normalized	2009 Decision	2010 Projected	2011 @ Existing Rates	Adjustment	2011 @ Revised Rates	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Utility Rate Base	$ 5,055	$ 5,405	$ 5,320	$ 6,833	$ 5	$ 6,839	Section 9, Schedule 2.0, 9.0
2								
3	Weighted average embedded cost of debt in the capital structure							
4	Long-term debt	4.180%	3.909%	3.845%	3.062%	-0.002%	3.060%	Section 9, Schedule 15.5
5	Unfunded debt	0.210%	0.376%	0.200%	0.716%	0.002%	0.717%	Section 9, Schedule 15.5
6	**Total**	**4.390%**	**4.285%**	**4.044%**	**3.778%**	**-0.001%**	**3.777%**	
7								
8	**Utility Interest Expense**	**$ 222**	**$ 232**	**$ 215**	**$ 258**	**$ (0)**	**$ 258**	X-Ref - Section 9, Schedule 1.0, 15.0

TG FORT NELSON Section 9

2011 REVENUE REQUIREMENT AND RATES APPLICATION Schedule 15.5

Return on Capital ($000s)

November 19, 2010 Evidentiary Update

Line No.	Particulars	Amount	Capitalization %	Embedded Cost %	Cost Component	Earned Return	Reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	**2009 Actual Normalized**						
2	Unfunded Debt	$ 250	4.95%	4.250%	0.210%	$ 11	
3	Long Term Debt	3,035	60.04%	6.962%	4.180%	211	
4	Common Equity	1,770	35.01%	6.312%	2.210%	112	
5	**Total**	**$ 5,055**	**100.00%**		**6.600%**	$ 334	
6							
7	**2009 Decision (Order No. G-172-08)**						
8	Unfunded Debt	$ 478	8.84%	4.250%	0.376%	$ 20	
9	Long Term Debt	3,035	56.15%	6.962%	3.909%	211	
10	Common Equity *	1,892	35.01%	8.470%	2.965%	160	
11	**Total**	**$ 5,405**	**100.00%**		**7.250%**	$ 392	
12							
13	**2010 Projected**						
14	Unfunded Debt	$ 250	4.70%	4.250%	0.200%	$ 11	
15	Long Term Debt **	2,942	55.30%	6.952%	3.845%	205	
16	Common Equity	2,128	40.00%	9.321%	3.729%	198	
17	**Total**	**$ 5,320**	**100.00%**		**7.773%**	$ 414	
18							
19	**2011 @ Existing Rates**						
20	Unfunded Debt	$ 1,087	15.91%	4.500%	0.716%	$ 49	
21	Long Term Debt **	3,013	44.09%	6.945%	3.062%	209	
22	Common Equity	2,733	40.00%	1.070%	0.428%	29	
23	**Total**	**$ 6,833**	**100.00%**		**4.206%**	$ 287	
24							
25	**2011 @ Revised Rates**						
26	Unfunded Debt Adjusted	$ 1,090	15.94%	4.500%	0.717%	$ 49	X-Ref - Section 9, Schedule 15.4
27	Long Term Debt **	3,013	44.06%	6.945%	3.060%	209	X-Ref - Section 9, Schedule 15.4
28	Common Equity	2,736	40.00%	9.500%	3.800%	260	X-Ref - Section 9, Schedule 1.0, 9.0
29	**Total**	**$ 6,839**	**100.00%**		**7.577%**	$ 518	X-Ref - Section 9, Schedule 1.0, 9.0

* ROE adjusted to 8.99% as per Commission Order No. G-158-09

** Long Term Debt as per TGI BCUC Order No. G-158-09; Schedule 65, Section 13, line 25

Appendix D
DRAFT ORDER

SIXTH FLOOR, 900 HOWE STREET, BOX 250
VANCOUVER, B.C. V6Z 2N3 CANADA
web site: http://www.bcuc.com

BRITISH COLUMBIA UTILITIES COMMISSION

ORDER NUMBER G-XX-XX

TELEPHONE: (604) 660-4700
BC TOLL FREE: 1-800-663-1385
FACSIMILE: (604) 660-1102

DRAFT ORDER

IN THE MATTER OF
the Utilities Commission Act, R.S.B.C. 1996, Chapter 473

and

An Application by Terasen Gas Inc. -
Fort Nelson Service Area
for Approval to Amend its Schedule of Rates

BEFORE:

(Date)

WHEREAS:

A. On September 8, 2010, TG Fort Nelson submitted its 2011 Revenue Requirements Application seeking approval to recover a revenue deficiency of $295 thousand through a permanent increase in its delivery rates, to decrease the RSAM rate rider, effective January 1, 2011, from $0.037/GJ by $0.004/GJ for a total rate rider of $0.033/GJ effective January 1, 2011; and

B. The Application also sought approval of a new rate base deferral account, 2011 RRA Costs Deferral; and

C. On September 30, 2010, the Commission issued Order No. G-149-10 establishing a Written Public Hearing Process and a Regulatory Timetable for review of the Application; and

D. On November 15, 2010, by Letter L-92-10, the Commission issued an amended Regulatory Timetable to include an Evidentiary Update; and

E. On November 19, 2010, TG Fort Nelson filed with the Commission an Evidentiary Update and, based on the Evidentiary Update requested approval of interim rates to recover a revenue deficiency of $315,000; and

F. The Commission has reviewed the Evidentiary Update and has concluded that the interim rates should be approved.

SIXTH FLOOR, 900 HOWE STREET, BOX 250
VANCOUVER, B.C. V6Z 2N3 CANADA
web site: http://www.bcuc.com

BRITISH COLUMBIA UTILITIES COMMISSION

ORDER NUMBER G-XX-XX

TELEPHONE: (604) 660-4700
BC TOLL FREE: 1-800-663-1385
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NOW THEREFORE pursuant to Section 89 of the *Utilities Commission Act*, the Commission orders as follows:

1. The Commission approves, on an interim basis, TG Fort Nelson to recover a revenue deficiency of $315,000 through an interim increase in its delivery rates, effective January 1, 2011, resulting in a margin increase of 21.74 per cent, a decrease in the RSAM rate rider from $0.037/GJ to $0.033/GJ, and revised rates as set out in the Evidentiary Update, Table 3.

2. TGI Fort Nelson is to provide notice of the interim rates to customers via a bill message, to be reviewed in advance by Commission Staff to confirm compliance with this Order.

3. TGI is to file amended interim Gas Tariff Rate Schedules for the Fort Nelson Service Area in accordance with this Order in a timely manner.

DATED at the City of Vancouver, In the Province of British Columbia, this day of <MONTH>, 20XX.

BY ORDER