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October 31, 2018

British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC
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Attention: Mr. Patrick Wruck, Commission Secretary and Manager, Regulatory Support

Dear Mr. Wruck:

Re: FortisBC Energy Inc. (FEI)

Application for Use of Lands under Sections 32 and 33 of the *Utilities Commission Act* (UCA) in the City of Coquitlam for the Lower Mainland Intermediate Pressure (IP) System Upgrade (LMIPSU) Projects – Coquitlam Gate IP Project (Project) (the Application)

FEI Evidence on Phase Two Issues

On June 28, 2018, FEI filed the Application noted above. In accordance with British Columbia Utilities Commission Order G-190-18 establishing the regulatory timetable for Phase Two of the proceeding, attached please find FEI's Evidence on Phase Two Issues.

If further information is required, please contact Ilva Bevacqua at 604-592-7664.

Sincerely,

FORTISBC ENERGY INC.

Original signed:

Diane Roy

Attachments

cc (email only): Registered Parties



FORTISBC ENERGY INC.

**Application Under Sections 32 and 33 of the
Utilities Commission Act for Use of Lands in the
City of Coquitlam
for the
Lower Mainland Intermediate Pressure System
Upgrade Projects
Coquitlam Gate IP**

Supplemental Evidence for Phase Two

**Submitted to the
British Columbia Utilities Commission**

October 31, 2018

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1. INTRODUCTION

On October 4, 2018, the British Columbia Utilities Commission (BCUC) issued Order G-190-18, establishing the regulatory timetable for Phase Two of the FEI Application Under Sections 32 and 33 for Use of Lands in the City of Coquitlam (City) for the Lower Mainland Intermediate Pressure System Upgrade (LMIPSU) Projects (Project) proceeding, including the filing of evidence on the Phase Two issues.

The evidence provided by FEI in this document relates to the two issues described as the “Phase Two” issues in Exhibit A-4, namely the City’s requirement with respect to the Project that:

- (i) FEI pave the entire width of a 5.5 kilometre segment of Como Lake Avenue and perform additional road remediation, beyond what would be required under the Operating Agreement between FEI and the City of Coquitlam dated January 7, 1957 (Operating Agreement) (Appendix A) and despite FEI’s construction being limited primarily to less than two lanes; and
- (ii) FEI remove, at its own cost, an approximate 380 metre segment of the nominal pipe size (NPS) 20 intermediate pressure (IP) gas line that has been approved by the BCUC to be abandoned in place.

The evidence is organized into the following sections:

- Section 2 provides evidence related to the City’s demand that FEI perform paving unrelated to any damage caused by the Project and includes:
 - An assessment of the existing road conditions of Como Lake Avenue;
 - The City’s technical specifications for paving;
 - A summary of the evolving paving and road remediation requirements sought from FEI by the City for the Project;
 - A description of FEI’s adjustments to its paving plans to accommodate the City’s requests;
 - A technical description of three paving and additional road remediation scenarios, including cost and schedule impacts; and
 - Rate impacts associated with each of the three paving and road remediation scenarios.
- Section 3 provides evidence related to the removal of the existing NPS 20 IP gas line. This includes, for removal of both the 380 metre segment and the entire 5.5 kilometre gas line along Como Lake Avenue through the City:
 - A description of the process that would be required to remove the existing NPS 20 IP gas line;

- 1 ○ Estimated removal schedules;
- 2 ○ Cost estimates for the removal; and
- 3 ○ Estimated allocation of costs under the Operating Agreement;
- 4 ○ Rate impacts associated with the removal both using the cost allocation
- 5 methodology under the Operating Agreement and if FEI was required to assume
- 6 all of the costs.

2. PAVING WORK FOR THE PROJECT

FEI's NPS 30 IP gas line trench construction activities will be confined to less than two lanes of Como Lake Avenue. Further, during the decommissioning and abandonment of the NPS 20 IP gas line, FEI will excavate a small 3 metre by 3 metre bell hole¹ approximately every 300 metres within a third lane.

Under section 8 of the Operating Agreement, FEI is required at its cost to reinstate the paving or surface on public property which it has disturbed in as good a state of repair as it was prior to its disturbance and in accordance with reasonable specifications, and subject to the supervision of, the Municipal Engineer.²

FEI is committed to repairing any damage to Como Lake Avenue resulting from the Project in accordance with the Operating Agreement, and in particular, in accordance with the City's Paving Specifications as described in Section 2.2 below.

In the sections below FEI describes:

1. The existing road condition on Como Lake Avenue;
2. The City's own technical specifications for paving;
3. The City's changing demands for paving for the Project;
4. Estimates that FEI has prepared for three different paving scenarios; and
5. The rate impacts of these three scenarios.

2.1 *BASELINE SURVEY OF EXISTING ROAD CONDITION*

FEI engaged WSP Canada Inc. (WSP) to undertake a pre-construction assessment of Como Lake Avenue between North Road (to the west side) and Pinnacle Street (to the east side) (representing the 5.5 kilometre length of the Project) and prepare a report (WSP Report) documenting the pre-construction conditions and existing roadway distresses along Como Lake Avenue (Appendix B). WSP has expertise in asset management, roadway infrastructure and pavement management. The WSP Report summarizes the pavement condition in the following statements (Appendix B, page 9):

¹ A bell hole is an enlarged hole other than a continuous trench, dug over and along the side of buried pipelines or in a trench to allow room for persons to perform maintenance-related work on the pipeline (i.e. coating repairs, welding connections, or pipe replacement).

² Exhibit B-1, Application, section 2.4, pages. 9-10. A copy of the Operating Agreement is included as Appendix A to this filing.

1 The results indicate that a significant percentage, an estimated 32 percent, of the
2 total pavement area along the length of the project has noticeable distresses
3 recorded in this survey.

4
5 The extent of the distressed pavement area would indicate that there likely many
6 sections [sic] where a full width rehabilitation treatment could be the best life
7 cycle cost approach to managing these pavements and coordinating the future
8 utility cut repairs. Many of these pavements would likely be rated as being in
9 “Fair” to “Poor” condition.

10
11 The curb lane pavements generally were observed to have more areas of fatigue
12 type distresses and medium or high severity distresses recorded. This would be
13 expected as these travel lanes typically experience more loading from heavier
14 vehicles, such as transit buses. The centre lane pavements in several sections
15 show areas of significant distresses, in addition to other low severity distresses
16 that were not recorded during this survey.

17
18 Typically, the service life of an arterial pavement will depend on the pavement
19 structure, sub-surface conditions, and traffic loading on the roadway; these items
20 were not assessed or evaluated during this survey. Depending on these factors,
21 the distresses evident in a pavement, and the level of service expectations of the
22 municipality, the typical service life of a municipal arterial pavement in the Lower
23 Mainland region can likely range between 12 to 40 plus years, with many arterial
24 pavements typically seeing rehabilitation cycles in the range of 20 to 30 years. A
25 more detailed structural and traffic loading assessment would be required to
26 determine recommended rehabilitation treatments and timing for the pavements
27 along this route.

28
29 In our opinion, based on the observed surface conditions of the pavements,
30 including the type, severity, and scope of distresses observed along Como Lake
31 Avenue and Spuraway Ave, several sections of these roadways will likely need a
32 full width rehabilitation treatment or extensive repairs within the next five to ten
33 years.

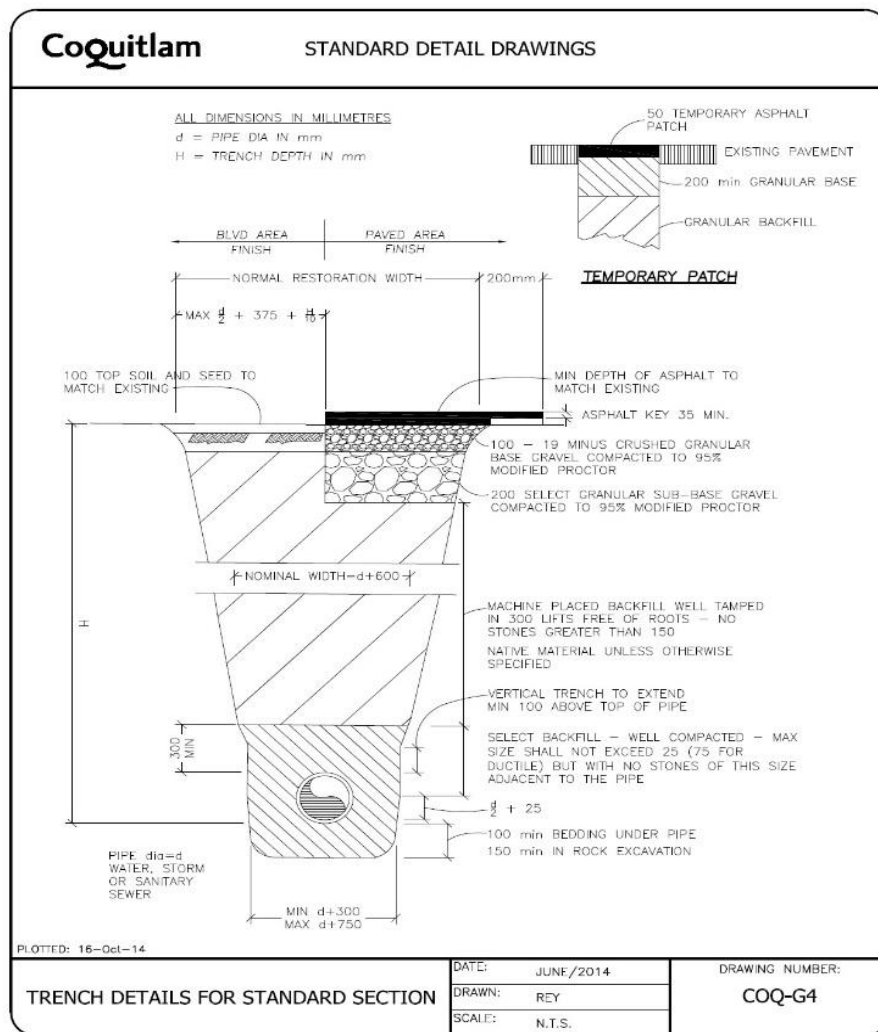
34
35 To summarize, the WSP Report confirms many existing pavement distresses especially in the
36 curb or outside lanes of Como Lake Avenue and Spuraway Avenue, and that several sections of
37 these roadways will likely need a full width rehabilitation treatment or extensive repairs within
38 the next five to ten years. As set out above, the NPS 30 IP gas line trench construction
39 activities will be confined to less than two lanes of Como Lake Avenue and decommissioning
40 and abandonment of the NPS 20 IP gas line will involve excavation of small bell holes
41 approximately every 300 metres within a third lane.

42 **2.2 THE CITY'S TECHNICAL SPECIFICATIONS FOR PAVING**

43 The City has developed its own specifications for paving and trenching. These technical
44 specifications are set out in in Figure Coq-G4 of the City's Supplementary Specifications Master

Municipal Construction Document dated March 2016 (City's Paving Specifications)³. The City's Paving Specifications are a supplemental specification to the Master Municipal Construction Document - 2009 Edition (often referred to as the "Platinum Book"). FEI considers the City's Paving Specifications for trenches, included as Figure 2-1 (reproduced as Appendix C), to be reasonable and by complying with these specifications, FEI would satisfy the requirements of the Operating Agreement. However, as described further below, the City's demands with respect to paving have expanded over time beyond the City's own specifications.

Figure 2-1: City Paving Specification for Trenches, COQ-G4 Specification to MMCD



³ <https://www.coquitlam.ca/docs/default-source/city-hall-files/Supplementary Specifications and Detailed Drawings to MMCD.pdf>, page 128 of pdf contains Figure Coq-G4.

1 The City's Paving Specifications describe requirements for paving restoration in City streets and
2 require that pavement restoration depth matches the existing asphalt depth for the width of the
3 trench, and a 35 millimetre depth for a width of 200 millimetres on either side of the trench (this
4 is referred to as the Asphalt Key) as detailed in Figure 2-1.

5 **2.3 INCREASING CITY DEMANDS FOR PAVING AND ROAD REMEDIATION**

6 Throughout the course of discussions with the City over the last two years, FEI submitted the
7 Main Construction Order (MCO) Engineering Alignment Drawings (Engineering Drawings) for
8 the City's input and feedback at the 30, 60 and 90 percent review stages⁴ prior to issuing the
9 Issued For Construction (IFC) version of the Engineering Drawings. The City requested
10 numerous requests for revisions to the Engineering Drawings and FEI incorporated many of
11 these requests into revisions at the 30, 60 and 90 percent review stages.⁵

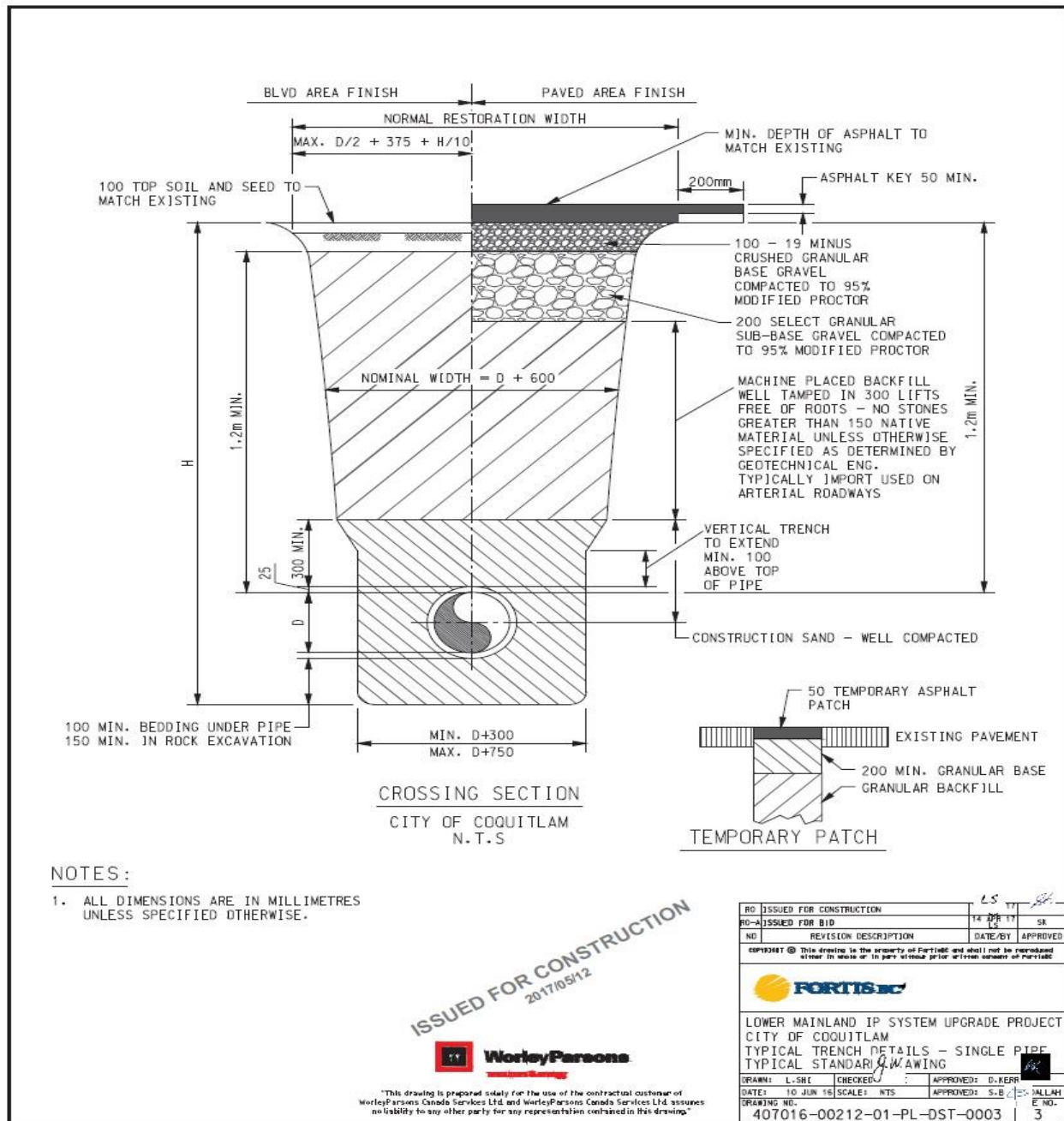
12 At the 30 percent review stage on October 12, 2016, the City increased its requirements for
13 pavement restoration beyond the City's Paving Specifications by requiring the depth of asphalt
14 restoration in the Asphalt Key to be increased from 35 millimetres to 50 millimetres. The City
15 provided a marked up copy of FEI's Engineering Drawings and set out its increased paving
16 requirements on a typical trench drawing (see Appendix D). As part of FEI's ongoing efforts to
17 obtain the City's approval of the Engineering Drawings , FEI increased the asphalt depth to 50
18 millimetres in the Asphalt Key on the portion of Como Lake Avenue that FEI anticipated would
19 be disturbed by the construction activities as shown below in Figure 2-2 (reproduced as
20 Appendix E).

⁴ Exhibit B-1, Application, section 4.3, page 14.

⁵ Exhibit B-1, Application, section 4.3, pages 14 and 15.

1

Figure 2-2: FEI IFC Drawing-Typical Trench Cross Section Drawing



2

3 On April 24 2017, FEI received the City's written comments on the 90 percent Engineering
4 Drawings, in which the City documented its requirement that all four lanes be repaved as a
5 precondition to FEI receiving approval of the Engineering Drawing (Please refer to Appendix F –
6 April 24 2017 City Comments – 90% Engineering Drawings).

7 In late 2017 and in early 2018, in an effort to resolve the outstanding issues with the City and to
8 obtain the permits and approvals necessary for the construction of the Project, FEI was

1 amenable to considering a contribution of \$3.2 million dollars toward the paving of Como Lake
2 Avenue from curb to curb in support of the City's objective to repair the subgrade below the
3 asphalt and completely repave Como Lake Avenue. The City's repair and paving would occur
4 after FEI had repaired and paved the damaged portion of Como Lake Avenue that resulted from
5 the Project. FEI was amenable to considering this contribution because FEI believed it would
6 be a means to obtaining approval of the Engineering Drawings and other permits and approvals
7 required by the City, and because FEI recognized that during the course of the Project, Como
8 Lake Avenue would be impacted by the trench construction associated with the NPS 30 IP gas
9 line, and excavation of bell holes to decommission and abandon the existing NPS 20 IP gas line
10 in place.

11 FEI understood that the City's objective was to not just repave all four lanes but to also repair
12 the subgrade (road base layer and replace the lower layers of asphalt) on Como Lake Avenue,
13 and that the cost for this work would be in excess of \$3.2 million⁶. FEI believed that the \$3.2
14 million would provide an acceptable contribution to the City's overall repair and paving
15 objectives for Como Lake Avenue which the City estimated to be \$6.2 million. Of this \$6.2
16 million, the City considered its share to be approximately \$3.0 million, which would include
17 repairing the subgrade (road base (gravel) and replacing the lower layer(s) of asphalt) and the
18 City providing the project management and delivery of this paving work.

19 However, at a meeting on June 5, 2018,⁷ the City informed FEI that rather than a financial
20 contribution, the City was conditioning approval of the Engineering Drawings on FEI agreeing to:

- 21 • pave the entire 14.0 metre width of the 5.5 kilometre section of Como Lake Avenue;
- 22 • perform road remediation (repair the subgrade below the asphalt) beyond the City's
23 Paving Specifications to replace 125 millimetres of subsurface materials and pavement
24 across all four lanes of Como Lake Avenue for an estimated total width of 14.0 metres
25 along the entire length of 5.5 kilometres of Como Lake Avenue; and
- 26 • provide the City a \$6.0 million letter of credit to secure performance of the work.

27
28 FEI believes that by requiring FEI to repair the entire subgrade and pave the entire width of the
29 5.5 kilometre segment of Como Lake Avenue, all without regard to the portion of Como Lake
30 Avenue actually damaged by the construction of the Project, the City is seeking to impose costs
31 on FEI beyond what is required under the Operating Agreement. The City's demand extends
32 well beyond the scope of work required to return the portion of Como Lake Avenue damaged by
33 the Project to as good of a condition as existed prior to the start of construction of the NPS 30 IP

⁶ The \$3.2 million had been an estimate from the City of Coquitlam to pave the top 50 millimetres of asphalt for four lanes.

⁷ Exhibit B-1, Application, page 17.

gas line. The road remediation and additional paving requirements over portions of Como Lake Avenue not impacted by the Project sought by the City would impose excessive costs on FEI's approximately one million natural gas customers throughout British Columbia.

As illustrated further below, the additional cost to FEI customers associated with remediating and paving the entire width of a 5.5 kilometre segment of Como Lake Avenue in excess of what is required under the Operating Agreement is approximately \$4.0 million.⁸

Accordingly, FEI believes that the City's requirement to remediate and repave Como Lake Avenue from curb to curb for the entire 5.5 kilometres is an attempt by the City to have the natural gas ratepayers of British Columbia subsidize the City's objective to rehabilitate Como Lake Avenue, and, in particular to repair damage that is unrelated to the damage caused by the Project.

2.4 PAVING SCENARIOS

Below FEI has outlined the costs and schedule impacts associated with three different scenarios. The scenarios are intended to demonstrate the implications associated with different road remediation and paving requirements.

The three scenarios are as follows:

1. **Scenario 1:** Paving and Restoration of the Trench and Asphalt Key (Operating Agreement and additional Asphalt Key depth);
2. **Scenario 2:** Paving Over and Repair of Four Lanes (City Demand); and
3. **Scenario 3:** Two Lane Paving (Scenario 1 with Additional Paving over Two Full Lanes).

2.4.1 Scenario 1: Paving and Restoration of the Trench and Additional Asphalt Key Depth

Scenario 1 satisfies FEI's obligations under the Operating Agreement and aligns with the City's Paving Specifications. It also includes an increase in the depth of the asphalt within the 200 millimetre Asphalt Key on either side of the trench from 35 millimetres to 50 millimetres (Agreed Expanded Paving Specifications). This scenario is based on FEI's expectation that the construction impact to pavement will be limited to the trench. The planned width of the trench is approximately 2.5 metres wide, which is less than the width of two lanes of roadway. In this scenario, the width of the trench is restored in accordance with the Agreed Expanded Paving Specifications. The restoration will be completed immediately following the installation of the NPS 30 IP gas line and before re-opening the road to general traffic. Therefore, this scenario

⁸ This amount represents the difference between the costs of Scenario 1 and Scenario 2 described below.

provides the least cost and is the least disruptive to the residents and businesses in the City and to those travelling through the community.

During the decommissioning and abandonment of the NPS 20 IP gas line, FEI would also excavate a small 3 metre by 3 metre bell hole approximately every 300 metres to abandon the NPS 20 IP gas line in place. As set out in Figure 2-3 below, FEI anticipates this work would have an impact on parts of an additional third lane. FEI would also repair damage caused by the decommissioning work in accordance with the Agreed Expanded Paving Specifications.

2.4.1.1 Technical Explanation

Under Scenario 1, the approximately 2.5 metres wide trench would be replaced with a full depth (125 millimetre) asphalt thickness comprised of two layers: a lower course layer that is 75 millimetres thick and an upper course layer that is 50 millimetres thick. Between each layer is an asphalt emulsion (tack coat). The Asphalt Key that is 200 millimetres wide on both sides of the trench width would be milled and paved to a depth of 50 millimetres. The total width of the restoration is equal to 2.9 metres (2.5 metres + 0.2 metres + 0.2 metres). Figures 2-3 and 2-4 illustrate Scenario 1.

Figure 2-3: Scenario 1: Cross Section Drawing

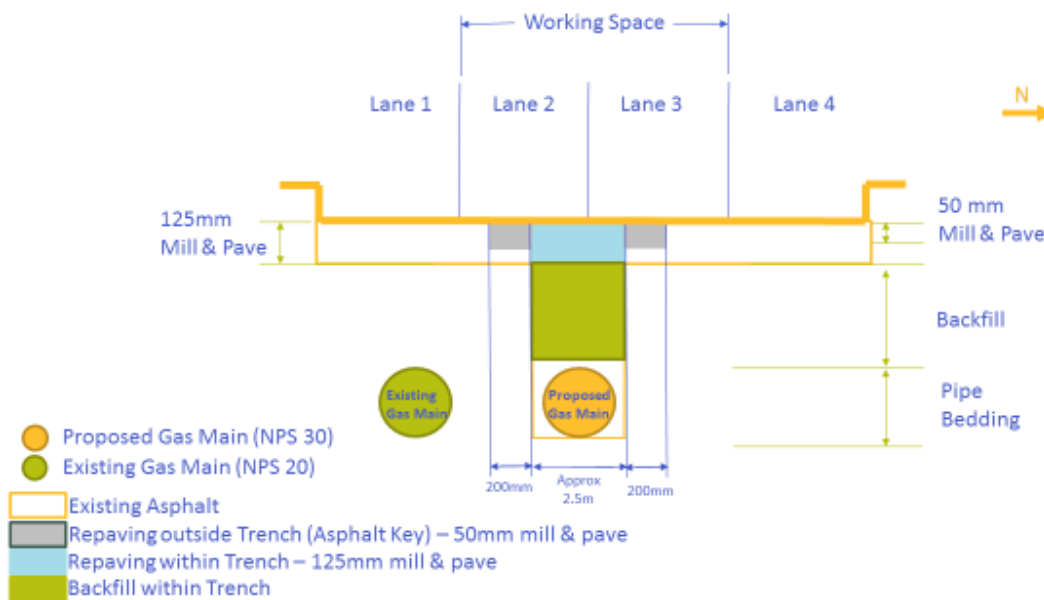
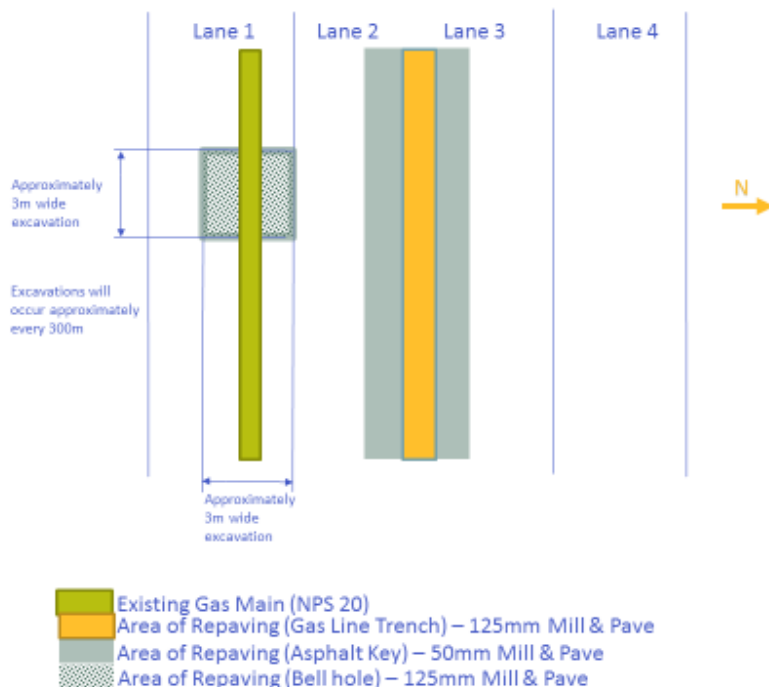


Figure 2-4: Scenario 1 Plan View Drawing



2.4.1.2 Cost Estimate, Schedule and Assumptions

The estimated capital cost of Scenario 1 is approximately \$601,000 and is based upon the schedule below in Table 2-1. The schedule for the paving activities (mill and pave) associated with the NPS 30 IP gas line construction (items 1 and 2 in Table 2-1) is based on the Traffic Management Plans (TMPs) forming part of the Final Agreement Terms and Conditions.⁹ The abandonment in place of the NPS 20 IP gas line (item 3 in Table 2-1) would be undertaken in 2020 and the schedule for the paving activities (mill and pave) will depend, in part, on the TMPs for the work.

Table 2-1: Scenario 1 Schedule Milestone Summary

Milestone	Forecasted Date
Start Paving Coquitlam	March 1, 2019
Complete Paving Coquitlam	September 30, 2019
Complete Bell Hole Paving Coquitlam	December 31, 2020

This estimate (Table 2-4 below) and schedule (Table 2-1 above) assumes the following:

⁹ BCUC Order G-158-18.

- Pavement gravels within the trench have not been included as an additional cost because they are consistent with every scenario and are accounted for in the construction line item of the Project budget;
- Restoration of the bell hole costs associated with the abandonment in place of the NPS 20 IP gas line have not been included as an additional cost because they are consistent with every scenario and are accounted for in the demolition line item of the Project budget;
- No additional mobilization of the contractor or additional traffic control is required to perform paving restoration as this work will be completed during the installation of the NPS 30 IP gas line and before re-opening the road to general traffic;
- Line painting and raised pavement markings are included; and
- Adjustment to all utility manhole frames and valve boxes belonging to the City Coquitlam and/or other agencies that are affected by the road works is included.

2.4.2 Scenario 2: Paving Over and Repair of Four Lanes (City Demand)

Scenario 2 exceeds FEI's obligations under the Operating Agreement and the Agreed Expanded Paving Specifications because it requires FEI to undertake restoration beyond areas which are expected to be damaged by the Project. In this scenario, FEI would perform road remediation beyond the Agreed Expanded Paving Specifications to replace 125 millimetres of subsurface materials and pavement across all four lanes of Como Lake Avenue for an estimated total width of 14.0 metres (over the entire length of 5.5 kilometres of Como Lake Avenue).

The remediation of Como Lake Avenue would be completed in stages over several years. FEI would complete the restoration of the trench and repaving over the trench and Asphalt Key immediately following the installation of the NPS 30 IP gas line and before re-opening the road to general traffic, which is estimated to be complete in September 2019. The decommissioning and abandonment of the NPS 20 IP gas line and restoration of the bell holes and repaving would be complete in December 2020. FEI would undertake the full depth curb to curb repair of the subgrade and paving (125 millimetres of subsurface materials and pavement) of Como Lake Avenue starting in June 2021 with an estimated completion date of August 2021. Access to the 5.5 kilometre stretch of Como Lake Avenue would be temporarily restricted while the work is completed. FEI has assumed that the paving contractor would complete the work in sections and close half of Como Lake Avenue at any given time. This scenario would be the highest cost and most disruptive to the residents and businesses in the City and to commuters travelling through the community.

During the decommissioning and abandonment of the NPS 20 IP gas line, FEI would also excavate a small 3 metre by 3 metre bell hole approximately every 300 metres to abandon the NPS 20 IP gas line in place. As set out in Figure 2-6 below, FEI anticipates this work would

- 1 have an impact on parts of an additional third lane. FEI would also repair damage caused by
2 the decommissioning work in accordance with the Agreed Expanded Paving Specifications.

3 **2.4.2.1 Technical Explanation**

- 4 Under Scenario 2, the entire surface of Como Lake Avenue would be replaced with a full depth
5 (125 millimetre) asphalt thickness comprised of two layers: a lower course layer that is 75
6 millimetres thick and an upper course layer that is 50 millimetres thick. Between each layer is an
7 asphalt emulsion (tack coat). The total width of the restoration is equal to 14 metres and taking
8 into account the 5.5 kilometre length, the total area paved would be approximately 85,000 m².
9 Figures 2-5 and 2-6 illustrate Scenario 2.

10 **Figure 2-5: Scenario 2: Cross Section Drawing**

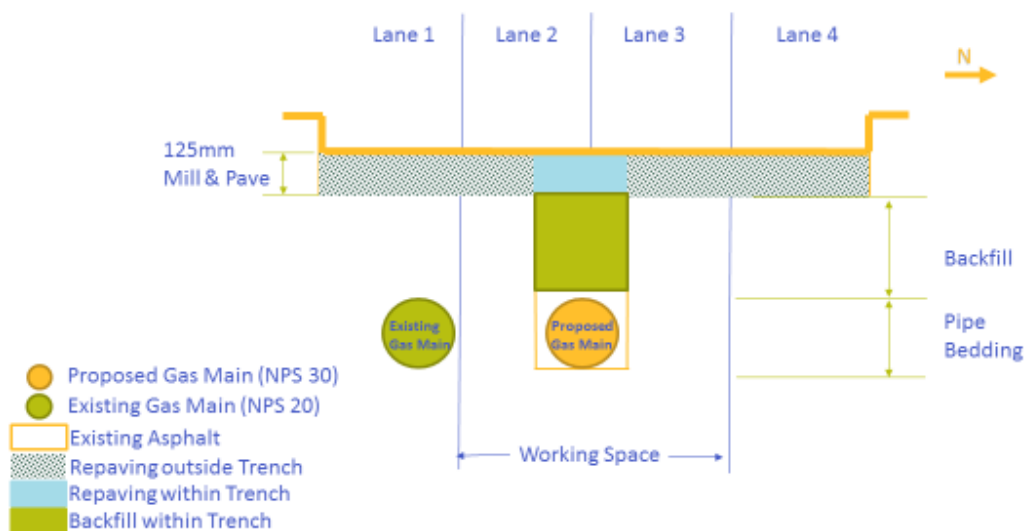
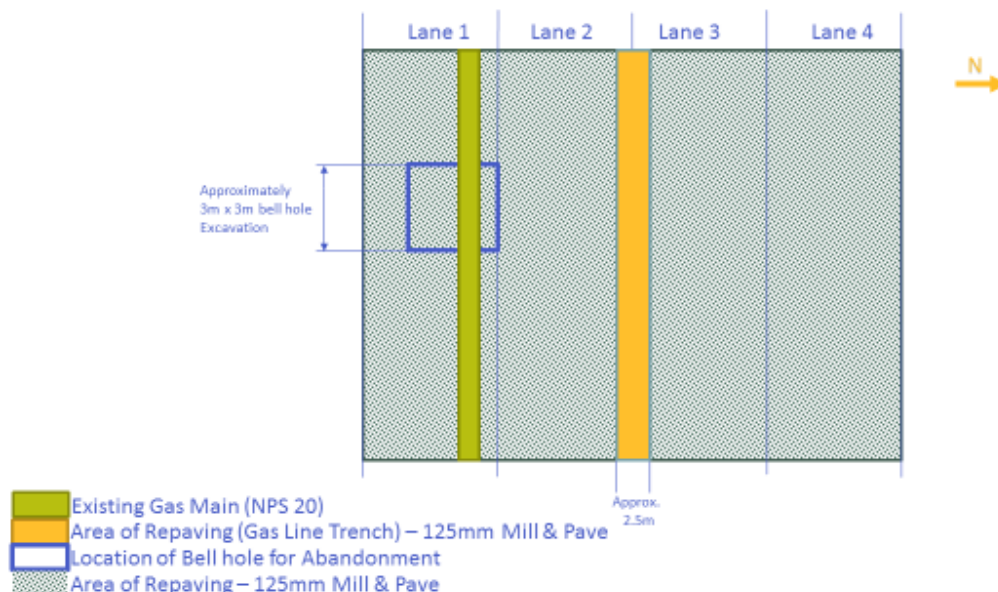


Figure 2-6: Scenario 2: Plan View Drawing



2.4.2.2 Cost Estimate, Schedule and Assumptions

The estimated capital cost of Scenario 2 is approximately \$4,573,000 and is based upon the schedule below in Table 2-2. The schedule for the paving activities (mill and pave) associated with the NPS IP 30 gas line construction (Items 1 and 2 in Table 2-2) is based upon the TMPs that form part of the Final Agreed Terms and Conditions.¹⁰ The abandonment in place of the NPS 20 IP gas line (item 3 in Table 2-2) will be undertaken in 2020 and the schedule will depend, in part, on the traffic management plans developed by FEI for review and acceptance by the City. Similarly, the schedule for the paving activities associated with the full curb to curb paving of all four lanes of Como Lake Avenue (items 4 and 5 in Table 2-2) would depend, in part, on the TMPs for the work.

Table 2-2: Scenario 2 Schedule Milestone Summary

Milestone	Forecasted Date
Start Trench Paving Coquitlam	March 1, 2019
Complete Trench Paving Coquitlam	September 30, 2019
Complete Bell Hole Paving Coquitlam	December 31, 2020
Start Full Depth Curb to Curb Paving Coquitlam	June 1, 2021
Complete Full Depth Curb to Curb Paving Coquitlam	August 31, 2021

¹⁰ BCUC Order, G-158-18.

This estimate (Table 2-4 below) and schedule (Table 2-2 above) assumes the following:

For the trench paving (occurring in 2019):

- Pavement gravels within the trench have not been included as an additional cost because they are consistent with every scenario and are accounted for in the construction line item of the Project budget;
- Restoration of the bell hole costs associated with the abandonment in place of the NPS 20 IP gas line have not been included as an additional cost because they are consistent with every scenario and are accounted for in the demolition line item of the Project budget;
- No additional mobilization of the contractor or additional traffic control is required to perform paving restoration as this work will be completed during the installation of the NPS 30 IP gas line and before re-opening the road to general traffic;
- Line painting and raised pavement markings are included; and
- Adjustment to all utility manhole frames and valve boxes belonging to the City Coquitlam and/or other agencies that are affected by the road works is included.

For the full depth curb to curb paving (would occur in 2021):

- Line painting and raised pavement markings are included;
- Adjustment to all utility manhole frames and valve boxes belonging to the City Coquitlam and/or other agencies that are affected by the road works is included;
- Mobilization of the paving contractor and additional traffic control is included; and
- Detection loops for traffic signals are included.

2.4.3 Scenario 3: Two Lane Paving (Scenario 1 with Additional Paving Over Two Full Lanes)

Scenario 3 involves paving the whole lane width for any lanes where part of the lane is damaged by the construction of the NPS 30 IP gas line¹¹. This scenario is similar to the approach FEI negotiated with the City of Vancouver and the City of Burnaby in respect of the construction of the NPS 30 IP gas line. In the City of Vancouver, where damage was limited to one lane, only one full lane width was repaved. Where damage occurred to two lanes, FEI paid for the cost to repave both lanes. In the City of Burnaby, where damage occurred as a result of

¹¹ Approximately 90 percent of the NPS 30 IP gas line trench construction is expected to impact two lanes, with the remaining portion expected to impact one lane. However, to simplify the calculation, FEI has estimated the paving and road restoration costs for two lanes.

the NPS 30 IP gas line construction, FEI paid to repave one or two lanes depending on the area impacted.

In this scenario, in the case of the City of Coquitlam, FEI would perform road remediation beyond the trench footprint to replace 50 millimetres of pavement across two lanes of Como Lake Avenue for an estimated total width of 7 metres (along the entire 5.5 kilometre length of Como Lake Avenue). This scenario shifts the paving seam to the edge of the lane. In this scenario, the paving of the full two lanes and restoration of the trench would be completed immediately following the installation of the NPS 30 IP gas line and before re-opening the road to general traffic. This scenario is more costly and slightly more disruptive to the residents and businesses in the City and to commuters travelling through the community than Scenario 1 as it will take more time to complete the paving and restoration work.

During the decommissioning and abandonment of the NPS 20 IP gas line, FEI would also excavate a small 3 metre by 3 metre bell hole approximately every 300 metres to abandon the NPS 20 IP gas line in place. As set out in Figure 2-8 below, FEI anticipates this work would have an impact on parts of an additional third lane. FEI would also repair damage caused by the decommissioning work in accordance with the Agreed Expanded Paving Specifications.

2.4.3.1 Technical Explanation

Under Scenario 3, the trench that is planned to be 2.5 metres wide would be replaced with a full depth (125 millimetre) asphalt thickness comprised of two layers: a lower course layer that is 75 millimetres thick and an upper course layer that is 50 millimetres thick and the remainder of the two lanes of Como Lake Avenue would be milled and paved to a depth of 50 millimetres. Between each layer is an asphalt emulsion (tack coat). Each lane is estimated to be 3.5 metres wide so the total width of paving is 7.0 metres (3.5 metres + 3.5 metres). Figures 2-7 and 2-8 illustrate Scenario 3.

Figure 2-7: Scenario 3: Cross Section Drawing

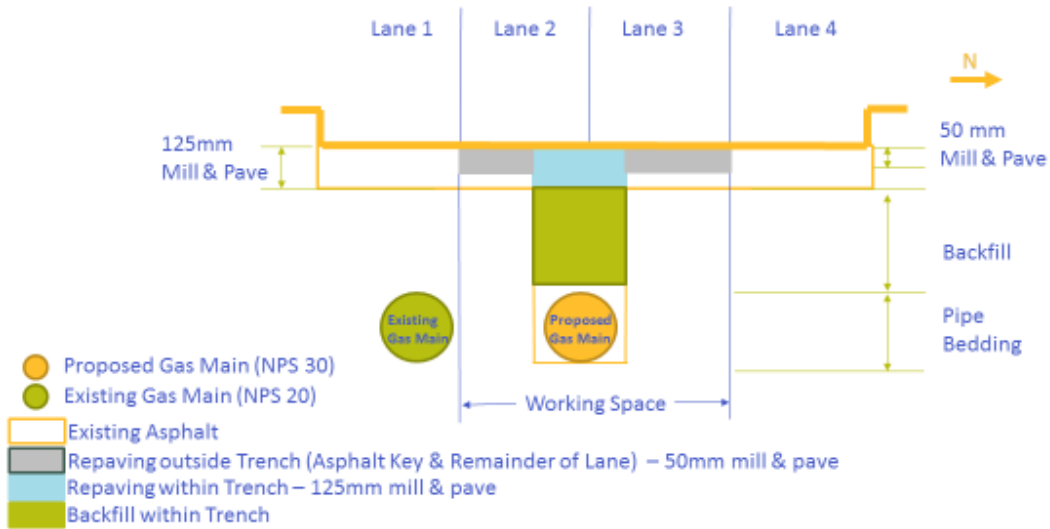
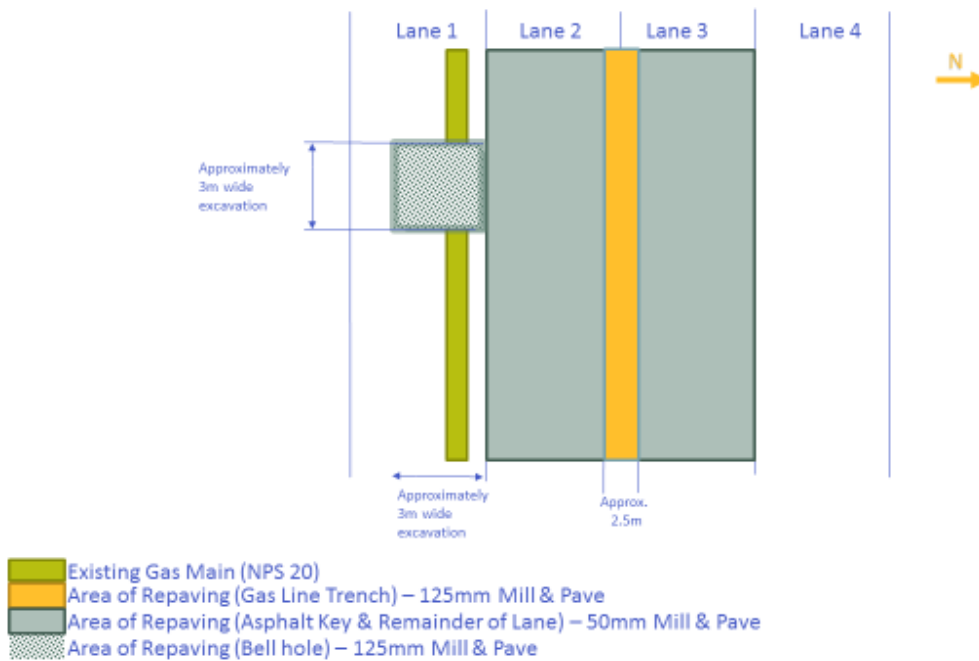


Figure 2-8: Scenario 3: Plan View Drawing



2.4.3.2 Cost Estimate

The estimated capital cost of Scenario 3 is approximately \$959,000 and is based upon the schedule below in Table 2-3. The schedule for the paving activities associated with the NPS 30 IP gas line construction (items 1 and 2 in Table 2-3) is based on the TMPs that form part of Final Agreement Terms and Conditions.¹² The schedule for the paving activities associated with the abandonment in place of the NPS 20 IP gas line (item 3) will be undertaken in 2020 and would depend, in part, on the TMPs for the work.

Table 2-3: Scenario 3 Schedule Milestone Summary

Milestone	Forecasted Date
Start Paving Coquitlam	March 1, 2019
Complete Paving Coquitlam	September 30, 2019
Complete Bell Hole Paving Coquitlam	December 31, 2020

This estimate (Table 2-4 below) and schedule (Table 2-3 above) assumes the following:

- Pavement gravels within the trench have not been included as an additional cost because they are consistent with every scenario and are accounted for in the construction line item of the Project budget;
- Restoration of the bell hole costs associated with the abandonment in place of the NPS 20 IP gas line have not been included as an additional cost because they are consistent with every scenario and are accounted for in the demolition line item of the Project budget;
- No additional mobilization of the contractor or additional traffic control is required to perform paving restoration as this work will be completed during the installation of the NPS 30 IP gas line and before re-opening the road to general traffic;
- Line painting and raised pavement markings are included; and
- Adjustment to all utility manhole frames and valve boxes belonging to the City Coquitlam and/or other agencies that are affected by the road works is included.

2.5 PAVING SCENARIO RATE IMPACTS

Based on the costs for each scenario, the following Table 2-4 provides the summarized cost of service and levelized rate impact results for each of the three scenarios:

¹² BCUC Order G-158-18.

Table 2-4: Summary of Cost of Service and Rate Impacts for Each Scenario

	Scenario 1	Scenario 2	Scenario 3
Capital Cost \$000's	\$601	\$4,573	\$959
Levelized Rate Impact \$ / GJ	\$0.000	\$0.002	\$0.000
Annualized Cost of Service \$000's	\$43	\$324	\$68
Present Value of Incremental Cost of Service for 50 Years \$000's	\$710	\$5,402	\$1,132

These results assume the following:

1. The capital cost additions are added to Rate Base on a mid-year basis in 2020 for Scenarios 1 and 3; and in 2021 for Scenario 2.
2. Capital structure, rate of return, depreciation and net salvage rates, property tax for 1% in lieu of, CCA rate, and income tax rate are per the 2018 Annual Review compliance filing¹³.
3. There are no incremental operating and maintenance expenses associated with the paving cost.

¹³ 2018 Annual Review Compliance filing dated January 19, 2018, Appendix A, Section 11, Schedule 26 – Return on Capital for capital structure and rates of return; Schedule 7.1 – Accumulated Depreciation Continuity Schedule for depreciation rate for distribution mains; Schedule 10 – Net Salvage Continuity Schedule for negative salvage rate for distribution mains; Schedule 24 – Income Taxes for income tax rate; and Schedule 25 – Capital Cost Allowance for CCA Class 51 CCA rate.

3. NPS 20 IP REMOVAL COST: COST ALLOCATION

The City has indicated that 380 metres of the abandoned NPS 20 IP gas line from the intersection of Como Lake Avenue and Clarke Road and North Road will conflict with a future municipal project and that it wants FEI to remove this portion of the gas line at FEI's cost. FEI is willing to remove this portion of the NPS 20 IP gas line, however its position remains that the cost of such removal should be allocated between FEI and the City in accordance with the Operating Agreement.

FEI has previously indicated its willingness to remove the 380 metres of the abandoned NPS 20 IP gas line. However, FEI has not agreed to the City's proposal that FEI bear the entire cost of this removal. In the City's letter dated September 20, 2018, the City suggests that FEI should remove the entire 5.5 kilometre length of the NPS 20 IP gas line in the future¹⁴. FEI is prepared to undertake the removal of any portion of the NPS 20 IP gas line, including either 380 metres or 5.5 kilometres in accordance with the Operating Agreement if the City exercises its rights under the Operating Agreement and requests such a removal.

The Operating Agreement gives the City the right to request that FEI remove abandoned pipe but also contains an allocation methodology that makes the City responsible for a portion of those removal costs.

Sections 4 and 5 of the Operating Agreement, quoted below, set out a cost allocation formula for situations where the City requires FEI to move a gas line. The formula contemplates the City being responsible for the cost, subject to an adjustment based on a portion of the *original book value* that changes over time:

4. Upon the written request of the Corporation or the Municipal Engineer on its behalf, the Company shall change the location (which in the case of pipe means any change of either or both of line and elevation) of any part of the said works on public property to some other reasonable location on public property, and shall carry out each such change with reasonable speed.

5. (a) If the part of the said works of which the location is changed as provided in paragraph 4 hereof was (i) installed as to both line and elevation in accordance with the approval or instructions of the Municipal Engineer, or (ii) was installed as to line in accordance with the approval or instructions of the Municipal Engineer and was laid at a depth of at least 18 inches under a roadway paved with at least two inches of concrete or asphalt, or (iii) was installed as to line in accordance with the approval of the Municipal Engineer and is being changed because its line is no longer satisfactory to the Corporation, the

¹⁴ Exhibit C1-7, page 3.

Corporation shall bear and pay to the Company the entire cost of the change less an amount equal to two (2) per cent of the installed value on the Company's books of any of the said part of the said works which the Company takes out of service as a result of the change multiplied by the number of years during which it has been in service.

(b) If the said part of the said works was not installed, or installed and laid, in one of the manners specified in clause (a) of this paragraph, the cost of such change shall be shared between the Corporation and the Company in such a manner as they may mutually agree and in default of agreement in such a manner as shall be settled by arbitration pursuant to the "Arbitration Act".¹⁵

As illustrated below in Section 3.4.3, applying the formula in section 5(a) of the Operating Agreement to an old gas line like the NPS 20 IP gas line, for which the original book value is much smaller than the removal cost, results in the City being responsible for most of the cost.

In the sections below FEI describes:

1. The complex scope of work associated with the removal of the NPS 20 IP gas line (for the 5.5 kilometre length from the outlet of Coquitlam Gate Station and North Road mostly located along Como Lake Avenue within the City, as well as the 380 metre segment);
2. The schedules associated with the removal of the NPS 20 IP gas line for both lengths of gas line;
3. Cost estimates associated with both lengths of gas line;
4. The application of the cost allocation formula in the Operating Agreement;
5. The removal costs that would be shared between FEI and the City using the Operating Agreement cost allocation formula and the impacts on the incremental cost of service and average rates; and
6. The removal costs and impacts on the incremental cost of service and average rates that would occur if the Operating Agreement cost allocation formula was not applied and FEI was required to assume all of the costs.

3.1 NPS 20 IP GAS LINE REMOVAL

Removal of the 5.5 kilometre length of the NPS 20 gas line would be a complex project. In general, the approach to remove the NPS 20 IP gas line would be similar to that required for the

¹⁵ Appendix A.

1 construction of a new large diameter gas line such as the NPS 30 IP gas line. However, instead
2 of installing new pipe in the open trench excavation, the exposed NPS 20 IP gas line would be
3 cut and sectioned into pieces so they can be safely removed from the trench and hauled offsite
4 for disposal. As such, any plan to execute the removal of the NPS 20 IP gas line would involve
5 the following main project components such as:

- 6 • Project management (including stakeholder engagement);
- 7 • Engineering procurement and construction management (EPCM);
- 8 • Permits and approvals;
- 9 • Property and right-of-way impact mitigation;
- 10 • Inspection during the construction process;
- 11 • Construction;
- 12 • Materials removal and disposal;
- 13 • Reinstatement and rehabilitation; and
- 14 • Project close out.

15
16 During the project planning phase, FEI would establish a project management team and
17 prepare a project execution plan which would, among other things, address safety and
18 environmental aspects and identify and mitigate project risks. An integral part of this process
19 would be stakeholder and community consultation and engagement, and acquisition of
20 necessary permits.

21 FEI would engage a multidisciplinary team comprised of internal and external resources to
22 assist FEI in executing a gas line removal project of this magnitude. Engineering services
23 support would include a detailed survey of the NPS 20 IP gas line route along Como Lake
24 Avenue, and generation of detailed drawings and construction specifications. Procurement
25 services support would be required to facilitate the construction Request for Proposal (RFP)
26 process. In addition, construction management services support would be required to manage
27 the onsite construction scope associated with mobilizing and managing the contractor until the
28 removal and disposal of the NPS 20 IP gas line and restoration and paving of the trench was
29 complete.

30 Construction activities to remove the NPS 20 IP gas line would require a third party contractor to
31 prepare the work areas and manage the construction process, including liaising with the City on
32 stakeholder, traffic and utility matters, similar to the construction of the NPS 30 IP gas line. The
33 construction process required to remove the abandoned NPS 20 IP gas line would require the
34 services of a contractor experienced in complex urban utility construction with the associated
35 safety, environment and traffic management expertise. The construction process would involve
36 the following stages:

- Indirect construction activities:
 - Mobilization and demobilization;
 - Security;
 - Trucking;
 - Supervision and administration; and
 - Maintenance and service of construction equipment; and
- Direct construction activities:
 - Front-end preparation;
 - Traffic control;
 - Engineering;
 - Exposure and locating of utilities;
 - Excavation;
 - De-coating the exposed abandoned pipe;
 - Cutting and sectionalizing the abandoned pipe;
 - Removal, hauling, and disposal of the abandoned pipe;
 - Backfill of the empty trench;
 - Paving and restoration; and
 - Clean-up.

3.1.1 5.5 Kilometre Removal Scope

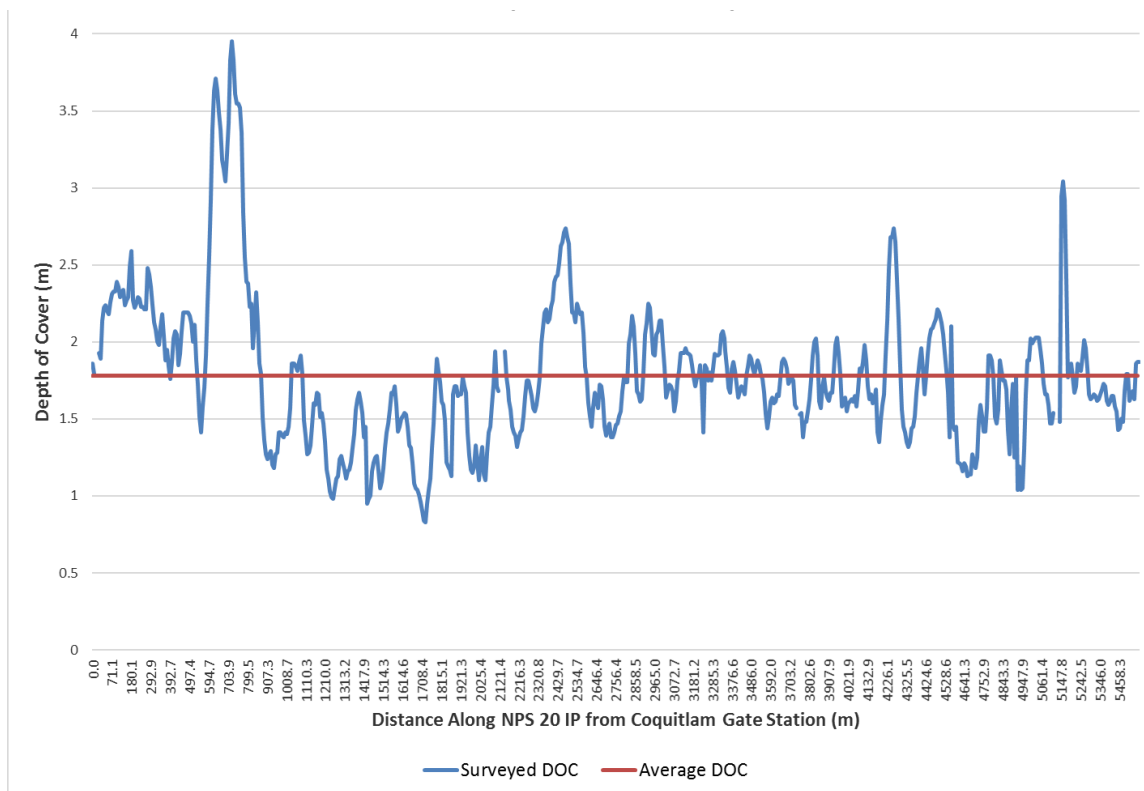
The NPS 20 IP gas line exits from Coquitlam Gate Station below ground onto Spuraway Avenue. An elbow fitting then turns the gas line through ninety degrees from where it travels west for approximately 5.5 kilometres along Como Lake Avenue until it enters the City of Burnaby at North Road. Between Coquitlam Gate Station and North Road the NPS 20 IP gas line is routed along the eastbound lanes of Como Lake Avenue.

The 1958 as-constructed record drawings for the NPS 20 IP gas line indicate that Como Lake Avenue was a newly constructed road at that time. Other notes on these drawings indicate that Como Lake Avenue would be under development for a period after the gas line was originally installed. These drawings also indicate that the minimum depth of cover at the time of installation was approximately 1.1 to 1.2 metres to the top of the NPS 20 IP gas line.

A depth of cover survey that was completed in 2012 for the 5.5 kilometres of the NPS 20 IP gas line indicates a depth of cover ranging from approximately 1 metre up to 4 metres (Figure 3-1). The average depth of cover along the 5.5 kilometre section is 1.78 metres as indicated by the red line in Figure 3-1.

1

Figure 3-1: NPS 20 IP Depth of Cover



2

3 The removal of the NPS 20 IP gas line will involve impacts to a number of existing third party
4 utility mains and service connections including buried water, sanitary and storm, and above
5 ground power and telecommunications. The NPS 30 IP gas line IFC Engineering Drawings
6 show the utility service connections that connect from the utility mains in Como Lake Avenue to
7 adjacent homes, business and commercial premises. FEI referred to these IFC Engineering
8 Drawings to review the details pertaining to the existing above-ground and buried utility
9 infrastructure that now exist in proximity to the NPS 20 IP gas line along Como Lake Avenue.
10 Because the utilities service both sides of Como Lake Avenue, they cross both the NPS 30 IP
11 gas line and the existing NPS 20 IP gas line.

12 FEI reviewed Project data to inform the scope, cost, and construction impacts resulting from
13 removal of the abandoned NPS 20 IP gas line after the new NPS 30 IP pipeline was constructed
14 and commissioned. Many third party utilities will be impacted and the critical outcomes of this
15 review include the following:

- 16 1. From Coquitlam Gate Station to Poirier Street, a section which is approximately 2.2
17 kilometres in length, there is an existing 300 millimetre diameter cast iron water main
18 and an existing 200 millimetre diameter cast iron water main that run parallel to the NPS
19 20 IP gas line on both sides. The offset between the water mains paralleling the NPS 20
20 IP gas line is such that the water mains would require removal in order to remove the
21 NPS 20 IP gas line;

2. From Poirier Street to Dogwood Street, a section that is approximately 2.6 kilometres in length, there is an existing 200 millimetre diameter cast iron water main that closely parallels the NPS 20 IP gas line. The water main may be difficult to protect during removal of the NPS 20 IP gas line and, therefore, may require removal prior to removal of the NPS 20 IP gas line and reinstatement thereafter;
3. At several locations, existing utility storm mains are parallel to the NPS 20 IP gas line and would be disturbed during removal of the NPS 20 IP gas line;
4. Between Dogwood Street and the intersection of Como Lake Avenue and Clarke Drive, the NPS 20 IP gas line passes under the south sidewalk along Como Lake Avenue. There is an existing overhead 60 kV transmission power line in this location that would severely restrict FEI's ability to access and remove the NPS 20 IP gas line;
5. At the major intersections such as Como Lake Avenue and Clarke Road, the density of large diameter utilities parallel to and crossing overhead the NPS 20 IP gas line will require significant effort and involve slow and challenging construction means and methods to successfully remove the NPS 20 IP gas line without impacting the operation of the adjacent utilities; and
6. There are approximately 850 utility service crossings of the NPS 20 IP gas line.

The construction process to remove the 5.5 kilometres of NPS 20 IP gas line would require the temporary isolation of at least two out of four lanes of traffic on Como Lake Avenue to facilitate the construction equipment and personnel that would undertake the necessary construction activities. Similar to the NPS 30 IP gas line, the NPS 20 IP gas line crosses 35 intersections along Como Lake Avenue between Mariner Way and North Road inclusive. The removal of the NPS 20 IP gas line would require an open cut construction method to expose and remove the gas line and therefore these intersections would be shut down and closed to all traffic. Of these 35 intersections, the following five are major north-south arterial road intersections:

1. Como Lake Avenue & Poirier Street;
2. Como Lake Avenue & Gatensbury Street;
3. Como Lake Avenue & Blue Mountain Street;
4. Como Lake Avenue & Clarke Road; and
5. Como Lake Avenue & North Road.

The City did not want these major intersections to be closed to traffic during construction of the NPS 30 IP gas line. The City's concerns were accounted for in FEI's construction execution plans and TMPs for the construction of the NPS 30 IP gas line. FEI plans to utilize trenchless crossing methodologies for the construction of the NPS 30 IP gas line at these five major arterial road intersections.

1 Unlike the construction of a new gas line, it would not be possible for FEI to utilize trenchless
2 construction methodologies to remove sections of the NPS 20 IP gas line from major
3 intersections. Instead, it would be necessary for FEI to open a trench along the full 5.5
4 kilometre length including at major intersections, which would incur significant traffic impacts
5 that would far exceed the traffic impacts associated with the construction of the NPS 30 IP gas
6 line.

7 The construction process to expose and remove the NPS 20 IP gas line would consist of open
8 trenching up to 500 metres at a time and to a width adequate to safely expose the gas line
9 without striking the NPS 20 IP pipe or damaging the gas line coal tar enamel protective coating
10 material. The NPS 20 IP gas line is coated in coal tar enamel that may contain low levels of
11 asbestos. This will require special handling and disposal techniques for cutting, handling and
12 disposal of this pipe to ensure that any material removed from the pipe is done in a controlled
13 process, and is collected and disposed of in a manner that protects workers and others from
14 potential asbestos exposure. As such, the construction process to expose the NPS 20 IP gas
15 line, manually remove the coal tar epoxy coating at certain locations to facilitate sectionalizing
16 the pipe, and then dispose of the removed coating material, and the coated pipe, would be very
17 slow.

18 In terms of construction duration, the NPS 30 IP gas line construction from Coquitlam Gate
19 Station to North Road is scheduled to be completed in 2019 and will include all construction
20 activities from initial contractor mobilization to final road restoration and paving. The
21 construction productivity required to meet this schedule is based on 10-hour working days for
22 six days per week carefully managed under the strict requirements of a TMP. FEI anticipates
23 that the NPS 20 IP gas line removal from Coquitlam Gate Station to North Road could also be
24 completed in one year if the same level of productivity to that scheduled for the NPS 30 IP gas
25 line construction can be achieved for the NPS 20 IP gas line removal. If the daily working
26 hours, working days per week, or TMP requirements were to be more restrictive, then the work
27 would take longer.

28 Project planning for the NPS 20 IP gas line removal has not been developed to the same level
29 as the NPS 30 IP gas line construction, which has 100 percent complete detailed design, IFC
30 construction work packages, and an approved TMP. Therefore, at this stage, it is not possible to
31 confirm the construction execution requirements to manage all potential construction challenges
32 and constraints. Detailed design work packages and construction execution plans would need
33 to account for, among other things, the adjacent water, sanitary, storm and power utilities that
34 parallel in proximity to the NPS 20 IP gas line between Coquitlam Gate Station and Como Lake
35 Avenue and permitting requirements of the respective utility owners. These undefined aspects
36 have the potential to extend the estimated construction schedule set out below in Table 3-1 of
37 Section 3.2.1.

38 Based on the above high-level analysis of the NPS 20 IP gas line removal, FEI anticipates that
39 scope and construction impacts would exceed those of the NPS 30 IP gas line installation.

3.1.2 380 Metre Removal Scope

The removal of 380 metres of NPS 20 IP gas line scope includes a section of the gas line that extends from the east side of the Como Lake Avenue and Clarke Road intersection west to North Road. Within the intersection, the gas line is located in the eastbound slow lanes under the south curb line. The NPS 30 IP gas line is routed from the median on the east side of the intersection diagonally across the east bound lanes and exits the intersection to the west in the east bound slow lane. The NPS 30 IP gas line will be installed trenchlessly and at a depth below the existing utilities including the NPS 20 IP gas line.

As the NPS 20 IP gas line exits the intersection to the west, the alignment jogs within the intersection via two forty-five degree elbows. Upon exiting the intersection, the gas line travels in a straight line along the southern edge of the eastbound slow lane towards North Road.

The construction removal process to expose, remove, and dispose of this section of gas line would be similar to that outlined for the 5.5 kilometres length above. The construction would require the Como Lake Avenue and Clarke Road intersection to be shut down for the duration of the removal process. There are numerous buried and above ground utilities parallel to the NPS 20 IP gas line which would be impacted by the removal process. North-south traffic would likely be fully restricted and unable to use the intersection during the removal work. In addition, depending on how many east-west lanes would be required to accommodate the gas line removal, east-west traffic could also be severely impacted.

FEI worked closely with the City to agree on the placement and extent of the NPS 30 IP construction equipment to support the trenchless construction at this intersection in order to minimize the traffic impacts. Compared to the NPS 30 IP gas line construction, the NPS 20 IP removal construction would not be able to utilize trenchless construction method which will therefore result in significantly greater traffic impacts.

The NPS 20 IP gas line removal from the Como Lake Avenue and Clarke Road intersection to North Road would occupy the eastbound lanes and require the shut down of these lanes to traffic use.

3.2 NPS 20 IP GAS LINE REMOVAL SCHEDULE

The earliest possible construction schedules for removal of the 5.5 kilometre and 380 metre sections of the NPS 20 IP gas line are included below.

3.2.1 NPS 20 IP Gas Line 5.5 Kilometre Removal Schedule

A construction milestone summary for removal of the 5.5 kilometre segment is presented in Table 3-1 below. If the NPS 20 IP gas line removal project is scheduled to occur directly after abandonment then there will be no need to grout the NPS 20 IP gas line during the abandonment process. FEI is currently planning to abandon in place the existing NPS 20 IP gas line in late 2020 according to the schedule below. Should the City request FEI to remove its

gas line after this timeframe, then the presence of grout in the NPS 20 IP gas line will complicate the removal process and slow the removal construction productivity.

Table 3-1: 5.5 Kilometre Removal Milestone Summary

Milestone	Forecasted Date
Completion of newly constructed NPS 30 IP gas line	Q4-2019
Completion of commissioning of NPS 30 IP gas line	Q4-2019
Conditioning of new NPS 30 IP gas line	Q1-2020
Transfer of stations from old NPS 20 IP gas line to new NPS 30 IP gas line	Q2-2020
Decommissioning of existing NPS 20 IP gas line ¹⁶	Q3-2020
Abandonment of NPS 20 IP gas line)	Q3/Q4-2020
Commence project to remove NPS 20 IP gas line	Q1 2021
Finalize detailed engineering, TMP, permitting, and construction contract etc.	Q3 2022
Commence construction to remove the ~ 5,500 metres of NPS 20 IP gas line	Q1 2023
Complete construction to remove the ~ 5,500 metres of NPS 20 IP gas line (including restoration and paving)	Q1 2024

3.2.2 NPS 20 IP Gas Line 380 Metre Removal Schedule

A construction milestone summary for removal of the 380 metre segment is presented in Table 3-2 below.

Table 3-2: 380 Metre Removal Milestone Summary

Milestone	Forecasted Date
Completion of newly constructed NPS 30 IP gas line	Q4-2019
Completion of commissioning of NPS 30 IP gas line	Q4-2019
Conditioning of new NPS 30 IP gas line	Q1-2020
Transfer of pressure regulating pit stations from old NPS 20 IP gas line to new NPS 30 IP gas line	Q2-2020
Decommissioning of existing NPS 20 IP gas line	Q3-2020
Abandonment of NPS 20 IP gas line	Q3/Q4-2020
Removal of 380 metres of NPS 20 IP gas line	Q3/Q4-2020
Restoration and paving of 380 metre trench	Q2/Q3-2021

¹⁶ This scenario does not include grouting of the decommissioned NPS 20 IP gas line.

3.3 NPS 20 IP GAS LINE REMOVAL COST ESTIMATE

FEI developed cost estimates for the following three NPS 20 IP gas line removal scenarios:

- 5.5 kilometre NPS 20 IP gas line removal cost estimate ungrouted;
- 5.5 kilometre NPS 20 IP gas line removal cost estimate grouted; and
- 380 metre NPS 20 IP gas line removal cost estimate.

3.3.1 5.5 Kilometre Removal Cost Estimate

FEI prepared an AACE Class 5 cost estimate for the removal of the 5.5 kilometres of NPS 20 IP gas line in an ungrouted and grouted condition. The main cost estimate components are detailed in Table 3-3. The construction component comprises the largest percentage of the total cost and was based on a semi-detailed bottom-up approach having consideration for the following removal construction considerations:

- General items;
- Environmental protection;
- Traffic Management;
- Preparations for removal crews;
- Primary removal operations;
- Removal operations complicated by intersections;
- Major utility conflicts;
- Incidental work;
- Surface restoration;
- Demobilization; and
- Contingencies.

Owners costs comprise project management, stakeholder engagement, permitting etc. and was set at approximately 15% of the estimated construction costs. EPCM includes external engineering, procurement, and construction management services and was also set at approximately 15% of the estimated construction costs. Property and right-of-way (ROW) includes costs related to temporary land required during construction and was set at approximately 1% of construction costs. Inspection includes onsite presence of multi-disciplinary inspection services throughout the construction process and was set at approximately 2% of construction costs. Contingency was set at 25% of the total estimate costs.

Table 3-3: 5.5 Kilometre Removal Cost Estimate Summary (UngROUTed)

Item	Description	\$ millions
1	Owners Costs	5.8
2	EPCM	5.4
3	Property and ROW	0.4
4	Inspection	0.7
5	Construction	36.0
6	Contingency	12.0
7	Total	60.3

The cost estimate for the removal of the 5.5 kilometres of NPS 20 IP gas line in a grouted condition was also developed utilizing the same basis of estimate as the ungrouted condition. The construction cost estimate was increased to account for the extra effort to remove the heavier pipe due to the presence of the grout material contained within. The other cost estimate line items were escalated to account for the slightly higher estimated construction cost. Overall the cost estimate to remove the NPS 20 IP gas line with grout is \$64 million, which is \$4 million more compared to the ungrouted cost estimate.

3.3.2 380 Metre Removal Cost Estimate

The cost estimate for the removal of the 380 metre segment of the NPS 20 IP gas line was developed utilizing the same basis of estimate as for the removal of the 5.5 kilometres of NPS 20 IP gas line and is summarized in Table 3-4.

Table 3-4: 380 Metre Removal Cost Estimate Summary (UngROUTed)

Item	Description	\$ millions
1	Project Management	0.8
2	EPCM	0.7
3	Property and ROW	0.1
4	Inspection	0.1
5	Construction	4.9
6	Contingency	1.6
7	Total	8.2

3.4 ALLOCATION OF COSTS UNDER THE OPERATING AGREEMENT

In order to determine the allocation of costs under the Operating Agreement, FEI first needs to determine the cost of the installation of the 5.5 kilometres of NPS 20 IP in 1957. Since FEI's records do not provide the level of detail necessary to determine the install cost of the NPS 20 gas line in 1957, FEI has prepared an estimate of the installation cost in current 2018\$ in section 3.4.1 below.

In section 3.4.2, FEI then explains and shows how the cost allocation formula from the Operating Agreement would be applied to the removal of the NPS 20 IP gas line.

In section 3.4.3, FEI presents a summary of the impacts on the incremental cost of service and average rates if costs of removal of the NPS 20 IP gas line are allocated in accordance with the Operating Agreement cost allocation methodology and if FEI is required to assume all of the costs.

3.4.1 NPS 20 IP Gas Line Installation Cost Estimate in Current Dollars (2018)

To determine the installed value of the NPS 20 IP gas line, FEI itemized the current NPS 30 IP budget estimate in sufficient detail to provide the granularity necessary for FEI to determine which budget components would not be relevant to gas line construction in 1957, and then applied appropriate factors and assumptions to the relevant budget components.

This approach resulted in an estimated cost that accounted for, among other things, the shorter gas line length (20 kilometres to 5.5 kilometres), smaller pipe diameter (NPS 30 to NPS 20), less onerous project requirements and higher construction productivity in 1957 due to minimal urban development and fewer existing utilities. The main assumptions FEI applied to this approach included:

1. The level of effort in terms of project management, stakeholder engagement, permitting, engineering etc. to execute a gas line construction project in 1957 compared to 2018 would be 10% to 30%;
2. No trenchless construction was utilized in the construction of the NPS 20 IP gas line in 1957;
3. Much of the front end preparation and sophisticated construction practices executed by modern utility contractors including safety, security, environmental, traffic management, and stakeholder requirements etc. would not have been required in 1957; and
4. Average construction productivity for the NPS 20 IP gas line would be 3 to 10 times faster in 1957 compared to the average construction productivity currently measured by FEI during the ongoing NPS 30 IP gas line construction.

From the above analysis FEI's cost estimate to construct the NPS 20 IP in 1957 is summarized in Table 3-5. A high and low estimate range is presented to account for the uncertainty associated with the assumptions.

Table 3-5: 1957 NPS 20 Installation Cost Estimate (2018 dollars)

Item	Description	High (\$ millions)	Low (\$ millions)
1	Project Management	1.0	1.0
2	EPCM	4.0	4.0
3	Permits and Approvals	0.4	0.4
4	Property and ROW	0.1	0.1

Item	Description	High (\$ millions)	Low (\$ millions)
5	Materials	2.0	2.0
6	Inspection	0.6	0.6
7	Pipeline Construction	15.0	5.0
8	Tie-In and Commissioning	0.0	0.0
9	Contingency	2.0	1.0
10	Total	25.1	14.1

3.4.2 Application of the Operating Agreement Cost Allocation Formula

In this section, FEI describes the cost allocation formula that determines how the City's contribution to removal under the Operating Agreement would be applied. FEI also provides the high and low estimate of the removal costs for 5.5 kilometre and 380 metre segments of the NPS 20 IP gas line and the resulting cost allocations.

The City's contribution to relocation under the Operating Agreement can be expressed as follows:

$$\text{Municipality's Contribution} = \text{CAC} - [2\% \times \text{COI} \times (\text{YC} - \text{YOI})]$$

Where:

- CAC is equal to total cost of the required alteration of the gas piping in the current year (this would include the cost of temporary works, bypasses etc., i.e. all inclusive)
- COI is equal to the total cost of the original installation for the portion of the gas system being impacted and that will be removed
- YC is equal to the current year in 4 digits
- YOI is equal to the Year of original installation in 4 digits

To determine the original installation cost, FEI:

- Estimated the cost of installing the existing system in the present day as described in Section 3.4.1.
- Used the Bank of Canada's Inflation Calculator to determine the equivalent COI from 2018\$ current dollars to 1957\$ deflated dollars.

Appendix G-1 through G-4 show the estimated cost for installing the NPS 20 IP gas line in 2018\$ and restated in 1957\$ using the Bank of Canada Inflation Calculator on the first page of each sub-appendix. The cost estimates are for the 5.5 kilometre segment and based on the high 2018\$ estimate of \$25.1 million or the low 2018\$ estimate of \$14.1 million. In sub-appendices G-2 and G-4 the high and low cost estimate for the 380 metre segment was derived by prorating

the cost for the 5.5 kilometre segment. For example, the high cost for the 380 metre segment is approximately \$1.7 million (380 metres / 5,500 metres x \$25.1 million).

Appendix G-5 provides FEIs calculations of removal costs in 2021 for the removal of 380 metres of the NPS 20 IP gas line and the removal costs in 2024 for the removal of 5.5 kilometres of the NPS 20 IP gas line.

The following table summarizes the results in Appendix G:

Table 3-6: Estimation of Original Cost, Number of Years Since Installation, Removal Costs and Cost Allocation

		High Cost		Low Cost	
		5.5 km	380 m	5.5 km	380 m
1	Original Installed Cost 2018\$ millions	\$25.1	\$1.7	\$14.1	\$1.0
2	Original Installed Cost 1957\$ millions	\$2.8	\$0.2	\$1.6	\$0.1
3	No. of Years: Year of Removal minus Year of Installation	67 Years	64 Years	67 Years	64 Years
4	Removal Costs 2021		\$9.4		\$9.4
5	Removal Costs 2024	\$77.5		\$77.5	
6	FEI's Allocation ¹⁷	\$3.8	\$0.2	\$2.1	\$0.1
7	City Allocation	\$73.7	\$9.2	\$75.4	\$9.3

As shown above, the City's contribution to removal costs for the NPS 20 IP gas line is expected to range from \$9.2 million to \$9.3 million for the 380 metre segment, and from \$73.4 million to \$75.7 million for the 5.5 kilometre segment.

3.4.3 Cost of Service and Rate Impacts for Removal of 380 metre and 5.5 kilometre Segments

The comparative consequences from the cost allocation under the Operating Agreement versus FEI bearing all the removal cost are shown in this section on the average rate (called Levelized Rate), as is the incremental cost of service effect measured by the Annualized Cost of Service and the Present Value of the incremental cost of service.

Costs and proceeds from the retirement and removal of depreciable gas plant in service are accounted in the net salvage deferral account.¹⁸

¹⁷ FEI's allocation is Original Installed Cost (Line 2) x 2% x Number of Years (Line 3). See also Appendix G.1 through G.4.

¹⁸ BCUC Order account-141-09 dated November 26, 2009, Appendix A, Page 13 of 110.

The tables in this section summarize the cost of removal impacts on FEI's incremental cost of service and the average rate impact (\$ / GJ) on FEI's approximately 1 million natural gas customers. The column headed "Operating Agreement" contains the results if FEI was responsible for a portion of the removal costs as calculated using the Operating Agreement cost allocation formula. The column headed "City Demand" contains the results if FEI had to be responsible for all of the removal costs of the NPS 20 IP gas line.

The following table shows the Annualized Cost of Service and the Present Value of the incremental Cost of Service and provides the ratio of the impact of the City's demand relative to the formula contained in the Operating Agreement.

Table 3-7: Summary of Scenarios Annualized Cost of Service and Present Value of Incremental Cost of Service

	Operating Agreement \$000's	City Demand \$000's
Annualized Cost of Service		
Remove 5.5 km, Estimated Original Cost of \$25.1 million 2018\$	\$204	\$4,198
Remove 380 m, Estimated Original Cost of \$1.8 million 2018\$	\$13	\$509
Remove 5.5 km, Estimated Original Cost of \$14.1 million 2018\$	\$115	\$4,198
Remove 380 m, Estimated Original Cost of \$1.0 million 2018\$	\$8	\$509
Present Value of Incremental Cost of Service		
Remove 5.5 km, Estimated Original Cost of \$25.1 million 2018\$	\$3,403	\$69,926
Remove 380 m, Estimated Original Cost of \$1.7 million	\$225	\$8,479
Remove 5.5 km, Estimated Original Cost of \$14.1 million 2018\$	\$1,912	\$69,926
Remove 380 m, Estimated Original Cost of \$1.0 million 2018\$	\$126	\$8,479

The following four tables summarize the:

- Levelized rate impact (\$ / GJ);
- Annualized cost of service; and
- Present value of the incremental revenue requirement for 50 years.

For all scenarios the annual Sales and T-Service volumes (non-bypass) is 196,021 TJ to derive the Levelized Rate and the Annualized Cost of Service. FEI's after-tax cost of capital is 5.61%, and is used to derive the Levelized Rate (\$ / GJ) and the Present Value of the Incremental Cost of Service.

Table 3-8: 5.5 kilometre Segment Removed \$25.1 million 2018\$; Comparison of Levelized Rates, Annualized Cost of Service & Present Value of Cost of Service

Line No.	Removal 5.5 km Segment	Operating Agreement	City Demand
----------	------------------------	---------------------	-------------

1	Levelized Rate \$ / GJ	\$0.001	\$0.021
2	Annualized Cost of Service \$000's	\$204	\$4,198
3	Present Value of Incremental Cost of Service \$000's	\$3,403	\$69,926

Table 3-9: 380 metre Segment Removed \$1.7 Million 2018\$; Comparison of Levelized Rates, Annualized Cost of Service & Present Value of Cost of Service

Line No.	Removal 380 m Segment	Operating Agreement	City Demand
1	Levelized Rate \$ / GJ	\$0.000	\$0.003
2	Annualized Cost of Service \$000's	\$13	509
3	Present Value of Incremental Cost of Service \$000's	\$225	\$8,479

Table 3-10: 5.5 kilometre Segment Removed \$14.1 Million 2018\$; Comparison of Levelized Rates, Annualized Cost of Service & Present Value of Cost of Service

Line No.	Removal 5.5 km Segment	Operating Agreement	City Demand
1	Levelized Rate \$ / GJ	\$0.001	\$0.021
2	Annualized Cost of Service \$000's	\$115	\$4,198
3	Present Value of Incremental Cost of Service \$000's	\$1,912	\$69,926

Table 3-11: 380 metre Segment Removed \$1.0 Million 2018\$; Comparison of Levelized Rates, Annualized Cost of Service & Present Value of Cost of Service

Line No.	Removal 380 m Segment	Operating Agreement	City Demand
1	Levelized Rate \$ / GJ	\$0.000	\$0.003
2	Annualized Cost of Service \$000's	\$8	\$509
3	Present Value of Incremental Cost of Service \$000's	\$126	\$8,479

The summary details in the tables above illustrate the large rate and cost of service impact on FEI's approximately one million natural gas customers throughout British Columbia that would result from the City's demand.

The removal of the 380 metre segment alone would have a rate impact of \$0.003 per GJ if the City was not required to make its contribution as prescribed under the Operating Agreement. For removal of the entire 5.5 kilometres of the NPS IP 20 gas line along Como Lake Avenue, the rate impact would be, \$0.021 per GJ (as compared to \$0.001 per GJ if the Operating Agreement cost allocation was applied).

4. CONCLUSION

The City's demands with respect to both paving and removal of the NPS 20 IP gas line are inconsistent with the Operating Agreement and would have significant implications for FEI and its customers.

The City's demand for curb to curb repaving is estimated by FEI to result in an additional capital cost of approximately \$4.0 million more than if FEI were to repair damaged pavement in accordance with the Operating Agreement and the Agreed Expanded Paving Specifications. The levelized rate impact of the City's curb to curb paving demand is estimated by FEI to be \$0.002 per GJ.

FEI has estimated a \$8.2 million (2018\$) capital cost should the City request that FEI remove a 380 metre segment of the NPS 20 IP gas line, provided this occurs before the line has been grouted. FEI is prepared to remove all or portions of the NPS 20 IP gas line if the City exercises its rights under the Operating Agreement to request such a removal, which has not occurred.

If the cost allocation formula under the Operating Agreement is applied to the removal of the 380 metre segment, FEI estimates that FEI's contribution to the capital cost would range from \$0.1 million to \$0.2 million, with an estimated levelized rate impact of \$0.000 per GJ. However, if the cost allocation formula was not applied, and FEI was required to pay for the entire cost of the removal of the gas line, FEI estimates that the cost to FEI would be \$9.4 million, with an estimated levelized rate impact of \$0.003 per GJ.

If the cost allocation formula under the Operating Agreement was applied to the removal of the 5.5 kilometres of the NPS 20 IP gas line along Como Lake Avenue, FEI estimates that FEI's contribution to the capital cost would range from \$2.1 million to \$3.8 million, with an estimated levelized rate impact of \$0.001 per GJ. However, if the cost allocation formula was not applied, and FEI was required to pay for the entire cost of the removal of the gas line, FEI estimates that the cost to FEI would be \$77.5 million, with an estimated levelized rate impact of \$0.021 per GJ.

Appendix A

CITY OF COQUITLAM OPERATING AGREEMENT

THIS AGREEMENT is made the 7th day of January,
1957

BETWEEN:

THE CORPORATION OF THE DISTRICT OF
COQUITLAM
(hereinafter called "the Corporation"),

OF THE ONE PART,

AND

BRITISH COLUMBIA ELECTRIC COMPANY
LIMITED
(hereinafter called "the Company"),

OF THE OTHER PART.

WHEREAS:

A. Section 3 of the "Gas Utilities Act" reads
as follows:

"3. Every gas utility which at the date when this Act comes into force is carrying on business as such in a municipality or area in unorganized territory shall in such municipality or area, and every gas utility to which a certificate of public convenience and necessity is thereafter granted under the "Public Utilities Act" shall in the municipality or area in unorganized territory mentioned in such certificate, be authorized and empowered to carry on, subject to the provisions of the "Public Utilities Act", its business as a gas utility, and, without limiting the generality of the foregoing, shall be authorized and empowered:-

- (a) To produce, generate, store, mix, transmit, distribute, deliver, furnish, sell, and take delivery of gas;
- (b) To construct, develop, renew, alter, repair, maintain, operate, and use real and personal property for any of the said purposes; and
- (c) To place, construct, renew, alter, repair, maintain, operate and use its pipes and other equipment and

appliances for mixing, transmitting, distributing, delivering, furnishing, and taking delivery of gas upon, along, across, over, or under any public street, lane, square, park, public place, bridge, viaduct, subway, or watercourse upon such conditions:-

- (1) In a municipality as the gas utility and the municipality may agree upon; and
- (ii) In unorganized territory as the Minister of Highways may approve."

B. The Company has obtained from the Public Utilities Commission of British Columbia a Certificate of Public Convenience and Necessity dated the 29th day of July, 1955 and approved by Order in Council made the 23rd day of August, 1955, which Certificate, inter alia, certifies that public convenience and necessity will require the construction and operation by the Company of a project for the supply of natural gas to the public for compensation in the area within the jurisdiction of the Corporation (hereinafter called "the Municipality"), among other places.

C. The parties desire to agree upon the conditions under which the Company may exercise in the Municipality its powers under the "Gas Utilities Act" and the Certificate of Public Convenience and Necessity referred to in Recital "B" hereof.

NOW THIS AGREEMENT WITNESSETH that the parties hereto have mutually agreed as follows:

1. The Corporation and the Company hereby agree that the conditions upon which the Company may, pursuant to the "Gas Utilities Act" and the said Certi-

ificate of Public Convenience and Necessity, place, construct, renew, alter, repair, maintain, remove, operate and use its pipes and other equipment and appliances for mixing, transmitting, distributing, delivering, furnishing and taking delivery of gas (which pipes and other equipment - including gas regulating vaults and vents therefrom and cathodic protection equipment - and appliances are hereinafter called "the said works") upon, along, across, over, or under any public street, lane, square, park, public place, bridge, viaduct, subway, or watercourse in the Municipality (all or any of which are hereinafter called "public property") shall be those set out in the paragraphs hereof numbered 2 to 17 and the Corporation hereby consents to the Company undertaking construction or work on or over any public property in the Municipality in compliance with such terms and conditions.

2. Subject to paragraph 3 hereof, before placing or constructing any of the said works on public property, or removing such works, the Company shall submit details thereof in writing to the Corporation's Municipal Engineer. Such details shall include plans and specifications showing the location, size and dimension of the said works. The Company shall not proceed with such placing, construction or removal of the said works until the Municipal Engineer shall have approved the proposed works, such approval not to be unreasonably withheld or delayed. If such approval is not acted upon within one (1) year then a new approval shall be obtained.

3. The Company may from time to time without

submitting details to or obtaining the approval of the Municipal Engineer but subject to paragraph 8 hereof

- (i) open up any public property for the purpose of carrying out repairs and maintenance to any part of the said works, and
- (ii) place and construct on public property gas service pipes (including valves) from its mains to the premises of its customers; but the Company shall place and construct such service pipes in accordance with any reasonable written instructions, either of general or particular application, that the Municipal Engineer may from time to time give to the Company and shall, if so required in writing by the Municipal Engineer, supply to the Municipal Engineer each month a list of addresses of premises to which service pipes shall have been so placed and constructed during the preceding month.

4. Upon the written request of the Corporation or the Municipal Engineer on its behalf, the Company shall change the location (which in the case of pipe means any change of either or both of line and elevation) of any part of the said works on public property to some other reasonable location on public property, and shall carry out each such change with reasonable speed.

5. (a) If the part of the said works of which the location is changed as provided in paragraph 4 hereof was (i) installed as to both line and elevation in accordance with the approval or instructions of the Municipal Engineer, or (ii) was installed as to line in accordance with the approval or instructions of the Municipal Engineer and was laid at a depth of at least 18 inches under a roadway paved with at least two inches of concrete or asphalt, or (iii) was installed as to line in accordance with the approval or instructions of the Municipal Engineer and is being changed because its line is no longer satisfactory to the Corporation, the Corporation shall bear and pay to the Company the entire cost of the change less an amount equal to two (2) per cent of the installed value on the Company's books of any of the said part of the said works which the Company takes out of service as a result of the change multiplied by the number of years during which it has been in service.

(b) If the said part of the said works was not installed, or installed and laid, in one of the manners specified in clause (a) of this paragraph, the cost of such change shall be shared between the Corporation and the Company in such manner as they may mutually agree and in default of agreement in such manner as shall be settled by arbitration pursuant to the "Arbitration Act".

6. Notwithstanding anything hereinbefore contained, if either party shall request the other party to make some temporary change in such other party's pipes, equipment, plant or appliances installed on, over, under or adjacent to, public property in order to facilitate the installation or construction of new pipes,

equipment, plant or appliances by the requesting party, such other party shall, if it reasonably can, carry out the change or alteration requested and shall charge the requesting party with the entire cost thereof.

7. Before the Corporation stops up or closes to the public for the benefit of some person or corporation other than the Corporation any public property it shall inquire of the Company in writing whether the Company has any of the said works on, over, or under, such public property. If within ten (10) days of receiving such inquiry the Company advises the Corporation in writing that it has any of the said works on, over, or under, such public property, the Corporation shall not so stop up or close such public property until the Company shall have agreed with such person or corporation for the removal, abandonment, or relocation, of the said works at the expense of such person or corporation.

8. The Company shall carry out all work done by it on public property pursuant to this agreement substantially in accordance with the details approved pursuant to paragraph 2 hereof (where applicable) and in a manner reasonably satisfactory to the Municipal Engineer, without undue delay, in a good and workmanlike manner, and so as to cause as little damage and obstruction as practicable, and shall reinstate the paving or surface on public property which it has disturbed in as good a state of repair as it was prior to its disturbance and in accordance with reasonable specifications laid down by, and subject to the supervision of, the Municipal Engineer. Except in the case of emergency work the time at which all work is carried out shall be subject to the

approval of the Municipal Engineer. The Municipal Engineer may require that he shall be given reasonable notice of the proposed time at which any work, other than emergency work, is to be carried out.

9. In the placing, construction, renewal, alteration, repair, maintenance, removal, operation and use of the said works the Company shall not destroy or damage the property of the Corporation except as it is authorized to do so by this agreement or by the Corporation; but, if at any time the Company does destroy or damage the property of the Corporation, the Company shall bear the cost of repairing the same in such manner as to leave the same in as good a state of repair as it was in prior to the doing of such destruction or damage and to the reasonable satisfaction of the Municipal Engineer.

10. If the Corporation shall destroy or damage any part of the said works on, over, or under, public property which was installed

- (i) before the date hereof and is deemed under paragraph 13 hereof to have been property placed, constructed, maintained and operated in accordance with this agreement, or
- (ii) after the date hereof either substantially in accordance with the plans and specifications approved by the Municipal Engineer under paragraph 2 hereof, or substantially in accordance with instructions given under paragraph 3 hereof, whichever is applicable,

the Corporation shall bear the cost of repairing the same in such manner as to leave the same in as good a state of repair as it was in prior to the doing of such destruction or damage and to the reasonable satisfaction of the Company. In all other cases the cost of repairing such destruction or damage shall be borne by the Company.

11. The Company agrees that it will indemnify and save the Corporation harmless against and from all loss, costs, damages, expenses, suits, demands, actions, claims and liabilities of every kind (other than such as are caused by or arise from any wilful act of the Corporation or act of the Corporation amounting to negligence on the part of the Corporation) caused by or arising out of the Company placing, constructing, renewing, altering, repairing, maintaining, removing, operating or using any of the said works upon, along, across, over or under any public property.

12. The parties hereto agree from time to time to execute such further assurances, approvals and consents as may be necessary to carry out the intent of this agreement.

13. The Corporation agrees that all the said works heretofore placed, constructed, maintained and operated within the Municipality shall be deemed to have been properly placed, constructed, maintained and operated in accordance with this agreement and that the Company may exercise its said powers in respect of them subject to the terms of this agreement so far as they are applicable thereto.

14. It is hereby mutually agreed that, in the event the Corporation does not have a Municipal

Engineer, the Municipal Clerk will act in the place and stead of the Municipal Engineer in respect of all matters pertaining to or arising out of this agreement.

15. The said works shall be placed, worked upon, or removed, in such manner as not to interfere with any pipe, conduit, wire, duct, manhole, drainage ditch, culvert, or any other structure which shall have been laid down in any public property by the Corporation or under the permission of the Corporation or by virtue of any charter granted by competent authority.

16. The said works and every part of them from time to time placed, constructed or maintained on any public property shall be and remain the property of the Company which shall be entitled at any time to remove the same subject to the terms of this agreement.

17. This agreement shall enure to the benefit of and be binding upon the parties hereto, their successors and assigns.

IN WITNESS WHEREOF the parties hereto have executed this agreement as of the day and year first above written.

The Corporate Seal of the Corporation was affixed hereto in the presence of:

"L. J. Christmas"

Reeve

"F. L. Pobst"

Clerk

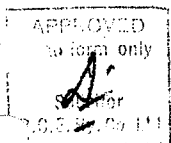
The Common Seal of the Company was affixed hereto in the presence of:

"H. L. Purdy"

Vice-President

"G. G. Woodward"

Secretary



BRITISH COLUMBIA ELECTRIC COMPANY LIMITED

MEMO FROM: R. R. Dodd

3rd April, 1957

TO: Messrs. P. W. Barchard, Our File: 111/56
 R. M. Bibbs, G. Hargreaves,
 K. F. Kangas, H. T. Libby,
 W. C. Mainwaring, C. A.
 Manson, J. L. McLean,
 H. J. Merilees, H. L. Purdy,
A. B. Robertson, E. H.
 Rohrer and O. E. Zwanzig

TR

RE: Corporation of the District of
 Coquitlam - Use of Streets for
Natural Gas Pipes

Enclosed herewith please find a copy of
 the agreement dated 7th January, 1957 entered into with
 the Corporation of the District of Coquitlam setting
 out the conditions under which we may use their streets
 for laying gas pipes.

This agreement is in the standard form and
 is identical to the Port Moody and Port Coquitlam ones.

The original certified copy together with
 the by-law approving this agreement is filed in the
 President's office and a true copy of the by-law with
 an executed copy of the agreement is available in the
 legal division file.

Robert Dodd

RRD:ls

Enclosure

Appendix B

**OCTOBER 26, 2018 PRE-CONSTRUCTION ROADWAY
CONDITION ASSESSMENT, COMO LAKE AVENUE**

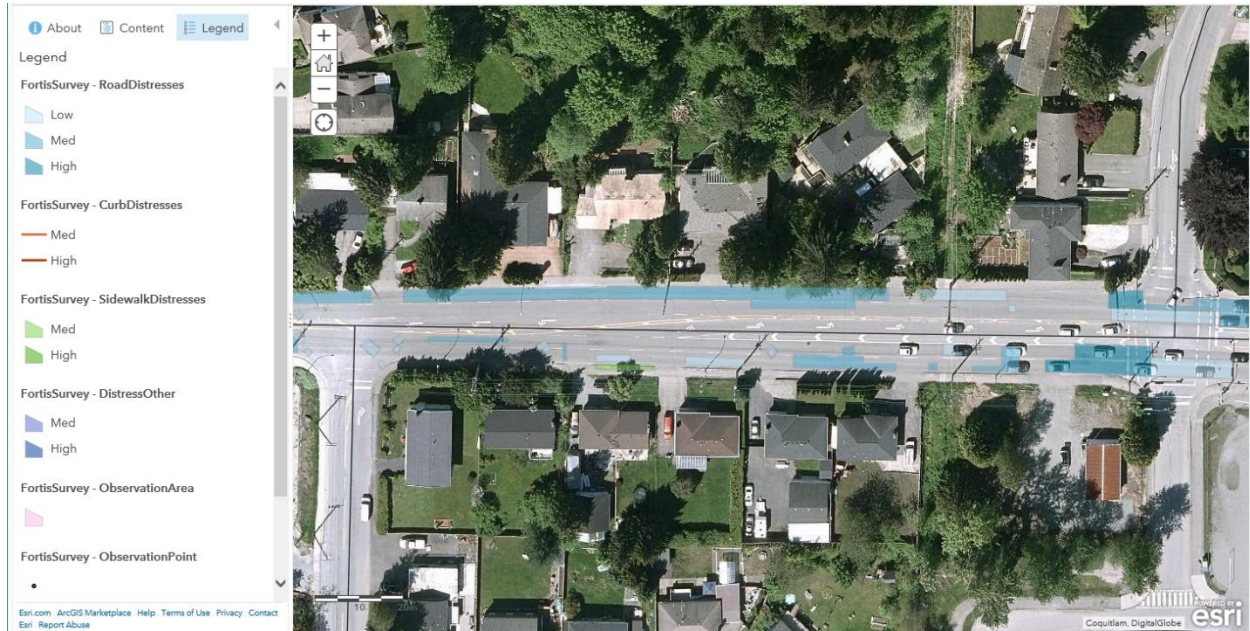
FORTISBC ENERGY INC. (FORTISBC)
REPORT NUMBER: 181-14254-00

PRE-CONSTRUCTION ROADWAY CONDITION ASSESSMENT

COMO LAKE AVENUE,
COQUITLAM, BC

FINAL REPORT

OCTOBER 26, 2018





PRE-CONSTRUCTION ROADWAY CONDITION ASSESSMENT

COMO LAKE AVENUE,
COQUITLAM

FORTISBC ENERGY INC. (FORTISBC)

FINAL REPORT

PROJECT NO.: 181-14254-00

CLIENT REF: 4500050737 - CHANGE ORDER #7 - LMIPSU PROJECT

DATE: OCTOBER 26, 2018

WSP
SUITE 1000 – 840 HOWE ST
VANCOUVER, BC

T: +1 604-685-9381
WSP.COM



October 26, 2018

Confidential

FortisBC Energy Inc
16705 Fraser Highway
Surrey, BC V4N 0E8

Attention: Bassam Saad, PhD, P.Eng.

Dear Madam/Sir:

Subject: Pavement Condition Survey – Como Lake Ave

Please find attached our Final Report on the findings of the roadway condition survey undertaken Oct 17-20, 2018

Please contact us if you need to further discuss the observations from this survey.

Yours sincerely,

A handwritten signature in blue ink, reading 'D. Manarin'.

Doug Manarin, P.Eng.
Senior Consultant, Asset Management
Planning & Advisory, Transportation

DM/dm
Encl.
cc:
WSP ref.:

REVISION HISTORY

FIRST ISSUE

2018-10-24	DRAFT FOR REVIEW			
Prepared by	Reviewed by			
Doug Manarin, P.Eng. Senior Consultant, Asset Management	Jaimie Sokalski, EIT EIT, Asset Management			
REVISION 1				
2018-10-26	FINAL REPORT			
Prepared by	Reviewed by	Approved By		
Doug Manarin, P.Eng. Senior Consultant, Asset Management	Kevin Worley, P.Eng. Consultant, Asset Management	David Smith, P.Eng. Business Unit Leader, Vancouver Region, Environment		
REVISION 2				
Prepared by	Reviewed by	Approved By		

SIGNATURES

PREPARED BY

  2018/10/26

<professional stamp, if applicable>

Doug Manarin, P.Eng.
Senior Consultant, Asset Management
Planning & Advisory, Transportation

Date

APPROVED¹ BY *(must be reviewed for technical accuracy prior to approval)*

David Smith, P.Eng.
Business Unit Leader, Vancouver Region
Environment

Date

WSP Canada Inc. prepared this report solely for the use of the intended recipient, FortisBC, in accordance with the professional services agreement. The intended recipient is solely responsible for the disclosure of any information contained in this report. The content and opinions contained in the present report are based on the observations and/or information available to WSP Canada Inc. at the time of preparation. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP Canada Inc. does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report. This limitations statement is considered an integral part of this report.

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Geomatics Imagery Data	Victor Ruiz Conde
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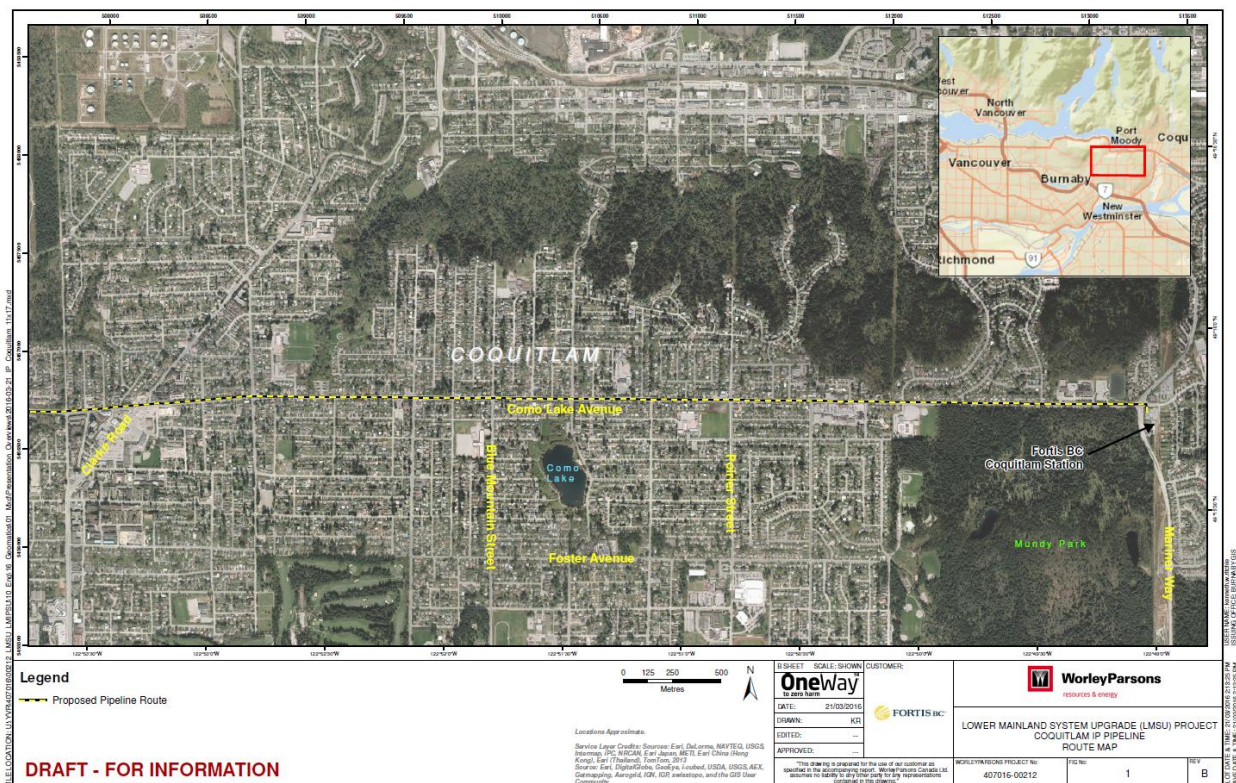
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APPENDICES

Appendix A	Condition Assessment Data
Appendix B	Dashboard Views

1.1 CONTEXT

This survey documented observed pre-existing roadway conditions in pavement areas next to the utility trench restoration zone required for this project as shown in Figure 1. This survey will also help clarify whether any post-utility construction pavement damage was likely a result of FortisBC construction activities or if it was related to pre-existing conditions within the right of way.



WSP reviewed the roadway infrastructure along Como Lake Avenue and Spuraway Avenue between North Road to the west and Pinnacle Street to the east. Adjacent roadways intersecting Como Lake Avenue were not inspected beyond the intersection areas connecting with the main corridor.

Pre-Construction Roadway Condition Assessment
Project No. 181-14254-00
FortisBC

1.2 INSPECTION METHODOLOGY

For this project, we utilized a manual visual site survey with WSP field staff to map the type, severity, and extent of observed distresses in the road allowance. These observations are supplemented with additional field photos of notable distresses.

WSP staff walked the length of the route and identified key distresses observed in the roadway and sidewalk areas that we could see from the safety of the sidewalks along the roadway. We undertook observations in each travel direction, walking along the south and the north sidewalks next to the surveyed roadway.

Staff recorded their observations in a mobile ArcGIS Collector application and digitized the approximate location and extent of the distresses on their mobile data collection device. The locations of the distresses were located using the underlying orthophotos of the roadway as location references and digitized on the screen of the device. The location and extent of the observed distresses were located based on the available resolution of the orthophotos, the ability to digitize the desired location on the mobile device, and observed field references. Therefore, the locations and measurements recorded in this survey are expected to be approximately located to within 1 meter of the noted distress area observed in the field by the condition assessment staff. A screen shot of the digitization feature is shown below.

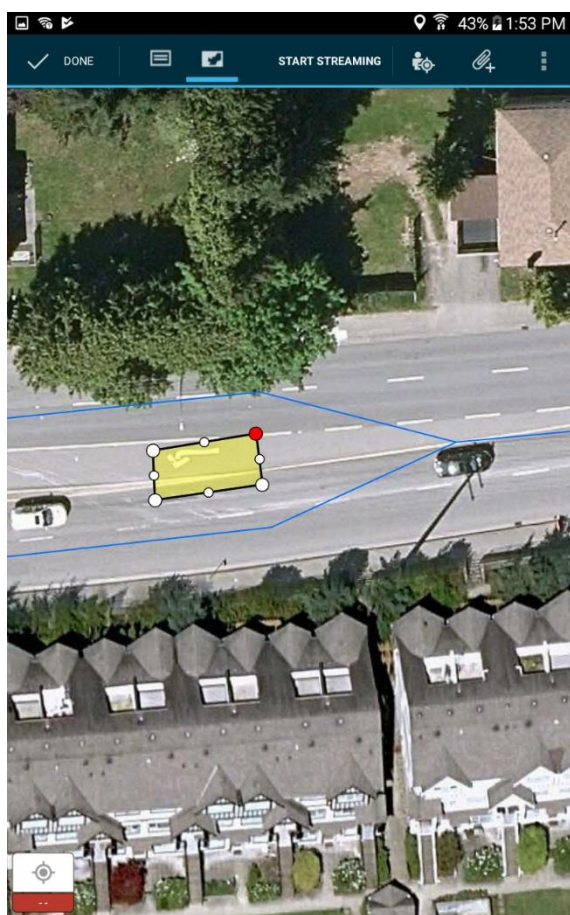


Figure 2 - Collector for ArcGIS – Example of Digitizing a Field Observation Area

This collected information provides a comprehensive map of the location of existing distresses and will help to identify areas where proposed utility works may be adjacent to existing pavement distresses, as shown in the figure below.



Figure 3 - Example of Digitized Distress Observations – Como Lake Ave from Montrose St to Thermal Dr

The findings of the survey, including associated photos of the distress, are provided in an ESRI geodatabase for future referencing and review of the pre-construction observations. This information can be referenced to detailed design drawings to provide additional information relating proposed utility works and existing condition observations.

1.3 DISTRESS ASSESSMENTS

We based this distress assessment survey on the *ASTM D-6433 Standard Practice for Roads and Parking Lot Pavement Condition Index Surveys*. We identified the following distresses that staff could visually observe in the roadway areas from the adjacent sidewalks:

Table 1 - Distress Assessment Details

ROADWAY AREA	DISTRESS	NOTES	SEVERITY TO COLLECT
Pavements	Alligator Fatigue Cracking	Alligator Cracking, Block Cracking, and Edge Cracking	Low / Medium / High
	Linear Cracking	Longitudinal and Transverse Cracking, Joint Reflection Cracking	Medium / High Unsealed Cracks > 10 mm (visual estimate) Sealed Cracks in Poor condition
	Distortion	Surface irregularities including Bumps and Sags, Corrugation, Depression, and Shoving that impact ride quality	Medium / High based on ride quality assessments

ROADWAY AREA	DISTRESS	NOTES	SEVERITY TO COLLECT
	Rutting	Identify where rutting is noticeable and impacting pavement performance	Medium / High Rut Depth > 13 mm (visual estimate)
	Patch or Utility Cut	Identify the location of patching that is less than full-lane width or existing patches / utility cuts	Low / Medium / High
Curbs	Broken	Areas where more than 100 mm of material is broken from the curb or interconnected cracking	Medium / High
	Cracked	Curbs where cracking is > 10 mm width	Medium / High
	Out of Elevation	Curb is horizontally or vertically displaced or misaligned > 50 mm	Medium / High
	Missing	Curb removed or not existing, including temporary asphalt patches	High
Sidewalks and Paths	Broken	Areas where more than 100 mm of material is broken from the surface or interconnected cracking > 10 mm	Medium / High
	Cracked	Surface where cracking is > 10 mm width	Medium / High
	Out of Elevation	Surface is horizontally or vertically displaced or misaligned > 50 mm	Medium / High
	Patching	Temporary patches or fillets in the surface	Medium / High
	Missing	Areas where sidewalk surface is missing	High

Where notable distresses or conditions were observed, the field staff made additional notes or attached photographs of the area to the observation record. Distresses for other infrastructure and other general observations were also recorded in the system.

These observations were entered in the Collector for ArcGIS mobile application and recorded in an ESRI geodatabase for future mapping and analysis of the condition survey findings.

1.4 CORRIDOR IMAGERY

In addition to the field observations, WSP also undertook a high-resolution geo-referenced imagery scan of the full length of the right of way in the work area. We utilized our Trimble MX7 vehicle mounted mobile imaging system to collect high-resolution (30 MP) 360-degree geo-referenced images. This system provides high-accuracy GNSS location referencing so that pre-construction field condition imagery can be accurately located in the future. This

provides an option to undertake additional post-processing of the imagery to further measure or extract features from this dataset if required in the future.

These images will be made available through an online website that can also integrate the distress observation records.

2 CONDITION ASSESSMENT FINDINGS

2.1 SUMMARY OF OBSERVATIONS

WSP staff undertook field condition assessment observations between October 17 and October 20, 2018. Right of way imagery for the corridor was collected on October 22, 2018.

Field results were reviewed using available orthophotos, street-level image mapping services, and photos collected by field staff. Adjustments were made to some recorded distress extents or distress classifications (type of distress, severity of distress) as part of our review of the collected data.

2.1.1 PAVEMENT DISTRESSES

The following table summarizes the recorded observations for the roadway pavement surfaces:

Table 2 - Pavement Distress Summary

DISTRESS	SEVERITY	COUNT	AREA (M2)
Alligator Fatigue Cracking	Low	29	3,879
Alligator Fatigue Cracking	Medium	34	3,791
Alligator Fatigue Cracking	High	9	889
Linear Cracking	Low	87	3,226
Linear Cracking	Medium	37	4,006
Patching and Utility Cuts	Low	227	4,844
Patching and Utility Cuts	Medium	69	715
Patching and Utility Cuts	High	14	58
Rutting	Medium	7	2,204
Distortions	Low	20	314
Distortions	Medium	33	1,244
Distortions	High	8	688
Other Distresses	Low	1	3
Other Distresses	Medium	1	9
Other Distresses	High	1	1
Total		577	25,871

The estimated total pavement area assessed during the survey is approximately 80,000 m2. Not all observed low severity distresses were collected, particularly rutting, linear cracking, and distortion type distresses.

2.1.2 CURB DISTRESSES

The following table summarizes the recorded observations for the curbs next to roadway surfaces:

Table 3 - Curb Distress Summary

DISTRESS	SEVERITY	COUNT	LENGTH (M)
Broken	Medium	10	8.9
Cracked	Medium	6	56.3
Out of Elevation	Medium	2	7.9
Missing	High	1	0.5
Other	Medium	1	3.2
Total		20	76.7

The estimated total curb length assessed during the survey is approximately 10,700 m. Low severity distresses observed were not collected.

2.1.3 SIDEWALK DISTRESSES

The following table summarizes the recorded observations for the sidewalk surfaces:

Table 4 – Sidewalk Summary

DISTRESS	SEVERITY	COUNT	AREA (M2)
Cracked	Medium	74	381.4
Cracked	High	1	9.9
Broken	Medium	4	6.0
Broken	High	1	3.3
Patching	Medium	1	2.0
Out of Elevation	High	2	11.4
Out of Elevation	Medium	24	200.9
Missing	High	1	2.0
Missing	Medium	1	1.0
Other	High	6	60.7
Other	Medium	2	37.0
Total		117	715.8

The estimated total sidewalk area assessed during the survey is approximately 19,000 m2. Low severity distresses observed were not collected.

2.1.4 OTHER DISTRESSES AND OBSERVATIONS

The following table summarizes the recorded observations for medians and other types of roadway infrastructure in the roadway area. Staff identified several point observations where damage or settlement was visible for numerous utility or junction boxes in the sidewalk areas:

Table 5 - Observations and Other Distress Summary

DISTRESS/OBSERVATION	SEVERITY	COUNT	AREA (M2)
Cracked	Medium	5	51.1
Broken	Medium	2	8.5
Observations (Area)	N/A	7	1,257.9
Observations (Point)	N/A	24	N/A
Total		38	1,317.4

Some of the observation areas noted in the records identify pavement areas where observed conditions may require repairs or rehabilitation to the roadway pavements.

2.2 ANALYSIS OF ASSESSMENT OBSERVATIONS

The results of the condition assessment survey were reviewed by our asset management staff who are experienced in roadway infrastructure and pavement management. The assessment of the infrastructure along the project extents is based on the recorded distress observations and the potential repair or rehabilitation options that may be suitable to address the items identified in this survey.

2.2.1 ROADWAY PAVEMENTS

The observed condition of the roadway pavements around the planned utility works varies throughout the extent of the project. The recorded distress observations can help identify areas where pavements could be considered as being in “Good”, “Fair” or “Poor” condition.

The following tables summarize the extent of the observed distresses through the full length of this roadway. The percentage of total pavement area with distresses is based on an estimated pavement area for this corridor of about 80,000 m² (5600 m centreline length by 14 m typical width).

Table 6 - Distresses as Percentage of Area, by Distress Type

DISTRESS TYPE	AREA (M2)	% TOTAL DISTRESS AREA	% OF TOTAL EST PAVEMENT AREA
Alligator Fatigue Cracking	8,559	33%	11%
Linear Cracking	7,232	28%	9%
Patching and Utility Cuts	5,617	22%	7%
Rutting	2,204	9%	3%
Distortions	2,247	9%	3%
Other Distresses	12	0%	0%

DISTRESS TYPE	AREA (M2)	% TOTAL DISTRESS AREA	% OF TOTAL EST PAVEMENT AREA
Total	25,871	100%	32%

Table 7 - Distresses as Percentage of Area, by Severity

DISTRESS SEVERITY	AREA (M2)	% TOTAL DISTRESS AREA	% OF TOTAL EST PAVEMENT AREA
Low	12,267	47%	15%
Medium	11,968	46%	15%
High	1,636	6%	2%
Total	25,871	100%	32%

The results indicate that a significant percentage, an estimated 32 percent, of the total pavement area along the length of the project has noticeable distresses recorded in this survey.

The extent of the distressed pavement area would indicate that there likely many sections where a full width rehabilitation treatment could be the best life cycle cost approach to managing these pavements and coordinating the future utility cut repairs. Many of these pavements would likely be rated as being in “Fair” to “Poor” condition.

The curb lane pavements generally were observed to have more areas of fatigue type distresses and medium or high severity distresses recorded. This would be expected as these travel lanes typically experience more loading from heavier vehicles, such as transit buses. The centre lane pavements in several sections show areas of significant distresses, in addition to other low severity distresses that were not recorded during this survey.

Typically, the service life of an arterial pavement will depend on the pavement structure, sub-surface conditions, and traffic loading on the roadway; these items were not assessed or evaluated during this survey. Depending on these factors, the distresses evident in a pavement, and the level of service expectations of the municipality, the typical service life of a municipal arterial pavement in the Lower Mainland region can likely range between 12 to 40 plus years, with many arterial pavements typically seeing rehabilitation cycles in the range of 20 to 30 years. A more detailed structural and traffic loading assessment would be required to determine recommended rehabilitation treatments and timing for the pavements along this route.

In our opinion, based on the observed surface conditions of the pavements, including the type, severity, and scope of distresses observed along Como Lake Avenue and Spuraway Ave, several sections of these roadways will likely need a full width rehabilitation treatment or extensive repairs within the next five to ten years.

We also reviewed the available “Last Year Paved” data published by the City of Coquitlam on their public mapping website, *QtheMap*. This data indicated that past repaving works were undertaken in lengths of multiple blocks. We have identified a series of uniform pavement segments based on the year paved and the observed distresses found in this survey. We reviewed these major pavement segments along the corridor to identify areas where the observed distress types and extents were similar. We utilized the collected condition data to analyse the information with an operational dashboard developed in our ArcGIS online toolset. The dashboard allows a quick review of how pavement sections have performed and how the existing distresses are distributed in these different areas.

An example of a dashboard summary is shown in the following figure.

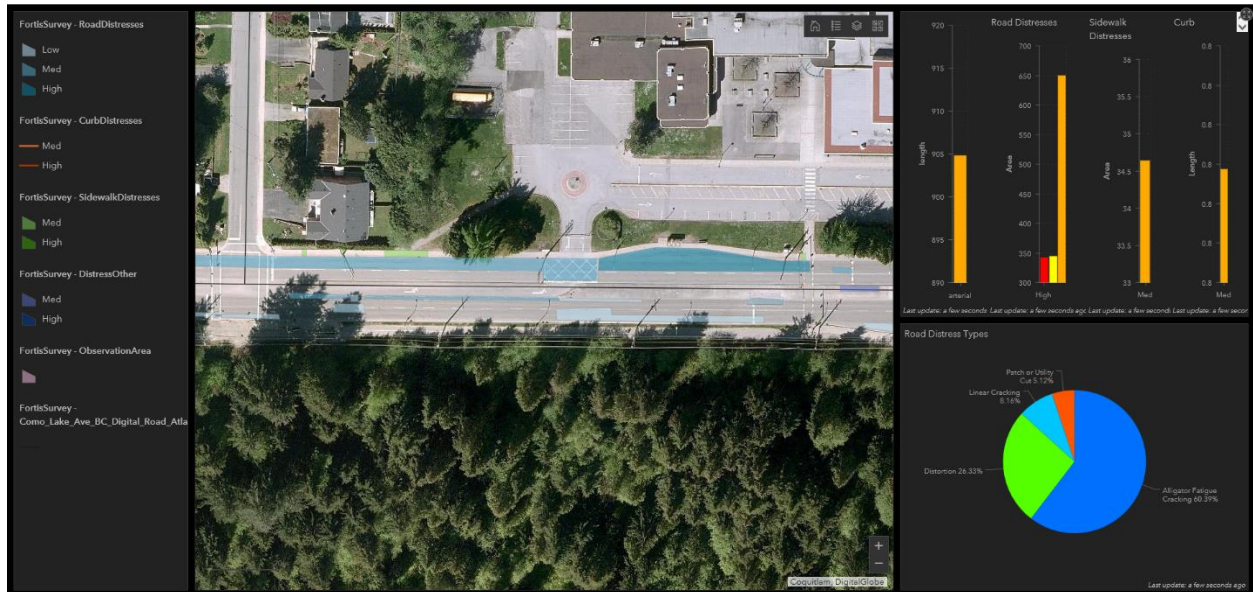


Figure 4 – Example of an Operational Dashboard from our Data Portal

We have included more detailed extracts of the Dashboard views for the extent of the project in Appendix B.

A summary of the observations for each of the identified uniform pavement segments is detailed in the following sections.

2.2.1.1 NORTH RD TO ROBINSON ST

The Coquitlam mapping system indicates that this section was last paved in 1989. We note that sections of the road between Clairmont St and Emerson St appear to have been repaved as part of recent transit system works and these dates have not been noted on the City mapping system. The majority of distresses observed in this section are rutting, patching and distortions. There are some areas of linear cracking and alligator cracking.



Figure 5 - Example of Alligator Cracking – North to Robinson

2.2.1.2 ROBINSON ST TO BLUE MOUNTAIN ST

The Coquitlam mapping system indicates that this section was last paved in 2006. The majority of distresses observed in this section are patching, linear cracking, and rutting. There are some areas of alligator cracking and distortions.



Figure 6 - Example of Patching – Robson to Blue Mountain



Figure 7 - Example of Patching at Banting St

2.2.1.3 BLUE MOUNTAIN ST TO GATENSBURY ST

The Coquitlam mapping system indicates that this section was last paved in 2004. The majority of distresses observed in this section are alligator cracking, patching, and distortions. There are some areas of linear cracking and rutting. The type and location of distresses observed would indicate that this section could be a candidate for a potential full width rehabilitation treatment.



Figure 8 – Example of Alligator Cracking – Near Blue Mountain St



Figure 9 - Example of Linear Cracking and Alligator Cracking Near Blue Mountain St



Figure 10 - Example of Alligator Cracking - Near Porter St



Figure 11 - Alligator Cracking and Patching Near Lillian St

2.2.1.4 GATENSBURY ST TO POIRIER ST

The Coquitlam mapping system indicates that this section was last paved in 2003. The majority of distresses observed in this section are patching, linear cracking, and alligator cracking. There are some areas of distortions and rutting. The type and location of distresses observed would indicate that this section could be a candidate for a potential full width rehabilitation treatment.



Figure 12 - Example of Patching at Regent St



Figure 13 - Example of Alligator Cracking Near Crestwood Dr



Figure 14 - Example of Alligator Cracking Near Wasco St



Figure 15 - Example of Distortion and Cracking Near Poirier St

2.2.1.5 POIRIER ST TO BAKER ST

The Coquitlam mapping system indicates that this section was last paved in 1965, although it is possible that this area has been repaved since that time. The vast majority of distresses observed in this section are linear cracking, and alligator cracking. There are some areas of patching, rutting, and distortions, along with further extents of low severity sealed linear cracking that was not recorded during the survey. The type and location of distresses observed would indicate that this section could be a candidate for a potential full width rehabilitation treatment.



Figure 16 - Example of Alligator Cracking at Prospect St



Figure 17 - Example of Alligator Cracking Near St Laurence St



Figure 18 - Example of Alligator Cracking at Thermal St



Figure 19 - Example of Alligator Cracking at Thermal St

2.2.1.6 BAKER ST TO MARINER WAY

The Coquitlam mapping system indicates that this section was last paved in 1962, although it is possible that this area has been repaved since that time. The vast majority of distresses observed in this section are alligator cracking, linear cracking, and patching. There are some areas of distortions, along with further extents of low severity sealed linear cracking that was not recorded during the survey. The type and location of distresses observed would indicate that this section could be a candidate for a potential full width rehabilitation treatment.



Figure 20 - Example of Alligator Cracking at Baker St



Figure 21 - Example of Alligator Cracking and Distortions East of Baker at Bus Stop

2.2.1.7 SPURAWAY AVENUE - MARINER WAY TO PINNACLE ST

The Coquitlam mapping system indicates that this section was last paved in 1962, although it is possible that this area has been repaved or partially repaved since that time. There is a large area of high severity alligator cracking in this section and other areas of patching. The type and location of distresses observed would indicate that this section could be a candidate for a potential full width rehabilitation treatment.



Figure 22 - Example of Alligator Cracking West of Pinnacle St

2.2.2 CURBS, SIDEWALKS, AND OTHER ROADWAY INFRASTRUCTURE

Based on the number and extent of distresses observed during this survey, the curbs, sidewalks, medians, and other roadway assets are generally considered to be in good condition.

Typically, most of the observed distresses in these assets is localized and is not extensive throughout the length of an asset segment. Overall, only a small percentage of the estimated asset extents had defects observed and recorded. Significant distresses were noted for less than 5% of the estimated sidewalk area, and less than 1% of the estimated curb length along the length of the utility project.

Repairs for most of these distresses, if deemed necessary, would likely be undertaken as localized repairs and would typically not require major rehabilitation.

Some examples of observed distresses are shown in the following photographs.



Figure 23 - Example of Sidewalk Out of Elevation (settled patch around pole)



Figure 24 - Example of Sidewalk Cracking - High (driveway crossing next to construction site)



Figure 25 - Example of a Cracked Curb



Figure 26 - Example of a Broken Median



Figure 27 - Example of Observation – Junction / Utility Box Lid Damaged / Settled

3 SUMMARY

The team from WSP completed a condition assessment of the roadway along the planned construction corridor for the FortisBC utility works. The location and assessment of existing distresses in the adjacent roadway infrastructure has been recorded in a spatial database.

The assessment has been based on visual observations of the surfaces of the roadway infrastructure along the route, and is further supported with a set of 360 degree images for the length of the route that were collected after the completion of the condition assessment survey.

This assessment provides documentation of the observed pre-construction conditions along this route. The findings from this assessment may help in the planning and coordination of future utility cut repairs and any associated repairs or rehabilitation to roadway infrastructure along the planned utility construction area.

APPENDIX

A CONDITION ASSESSMENT DATA

APPENDIX

Please refer to the submitted electronic datasets for the records of the condition survey findings.

The condition assessment dataset has been provided in an ESRI geodatabase file format and a simplified Google Earth KML format files for each of the data collection map layers.

The 360 degree imagery and route video has been provided via a web portal for access to these image files.

APPENDIX

B DASHBOARD VIEWS

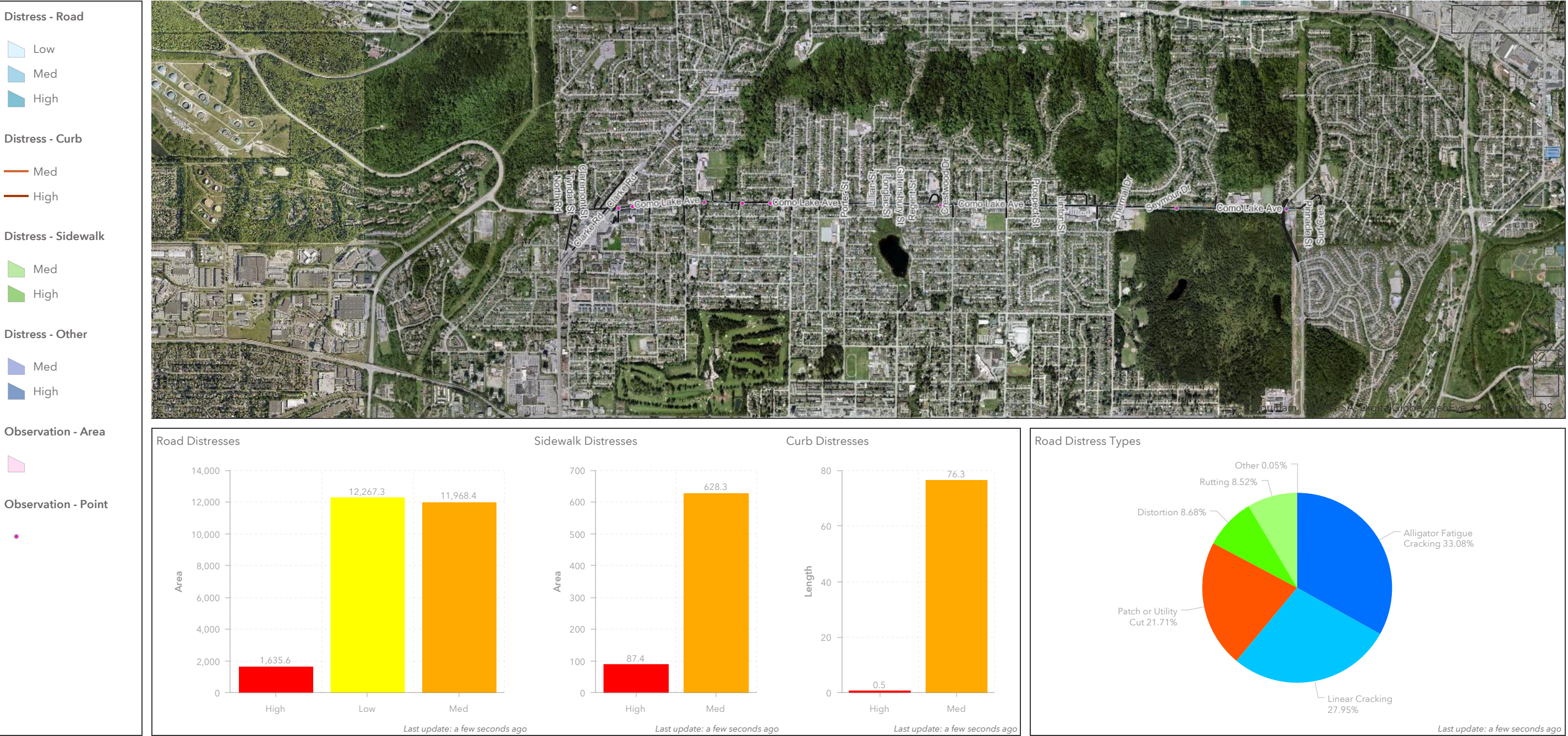
A large, white, stylized chevron graphic pointing downwards, located in the bottom-left corner of the page. It is composed of two overlapping triangular shapes, creating a sense of depth and movement.

APPENDIX

Please refer to the submitted PDF print outs of the Dashboard views for the extent of the project.

The attached sheets numbered 1 through 9 are ordered in sequence from West to East along the length of the survey area and represent a summary of the collected data in the area visible on each of the map extents.

Condition Data Dashboard - Overview All



Distress - Road

Low

Med

High

Distress - Curb

Med

High

Distress - Sidewalk

Med

High

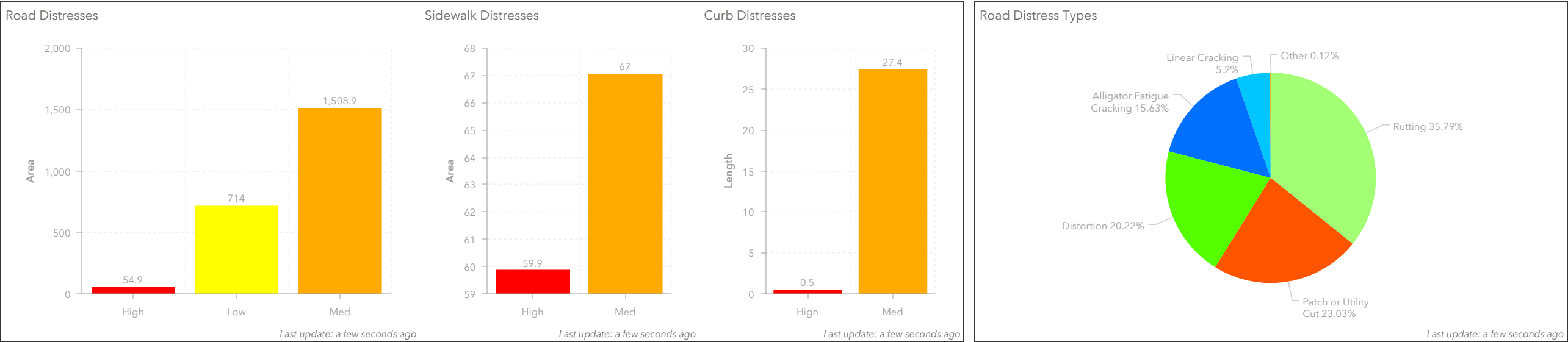
Distress - Other

Med

High

Observation - Area

Observation - Point



Distress - Road

Low

Med

High

Distress - Curb

Med

High

Distress - Sidewalk

Med

High

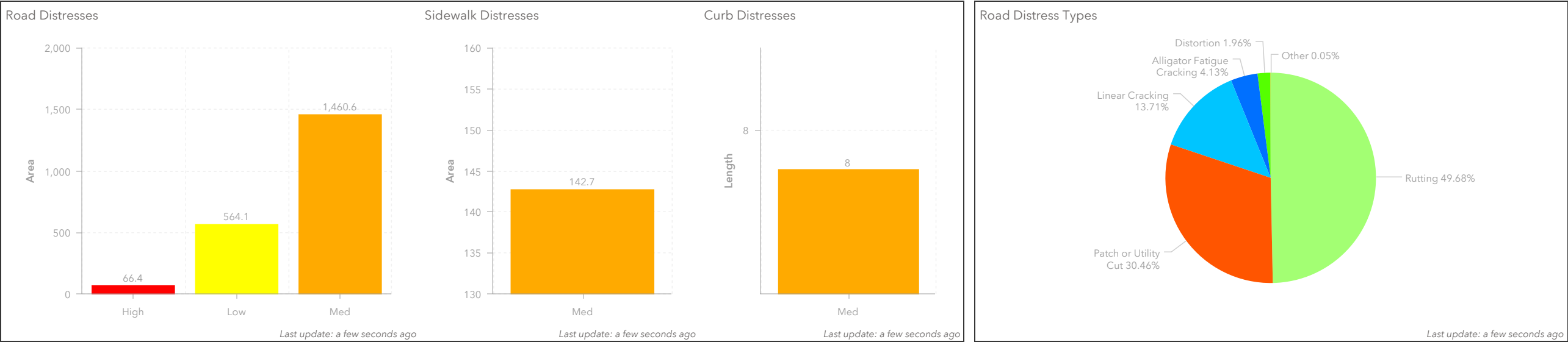
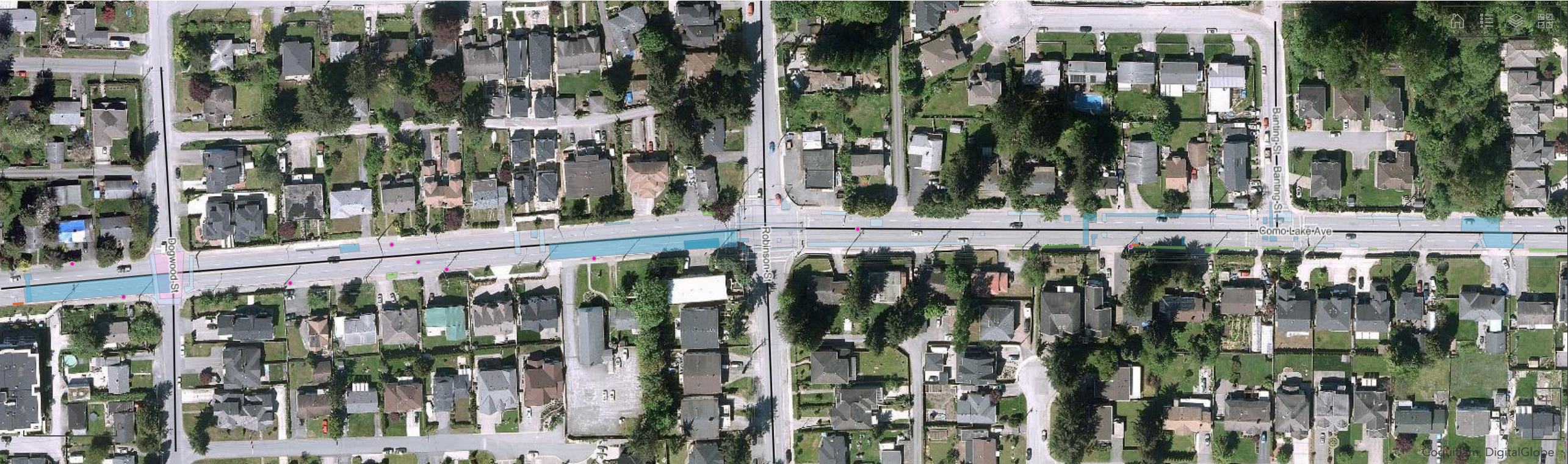
Distress - Other

Med

High

Observation - Area

Observation - Point

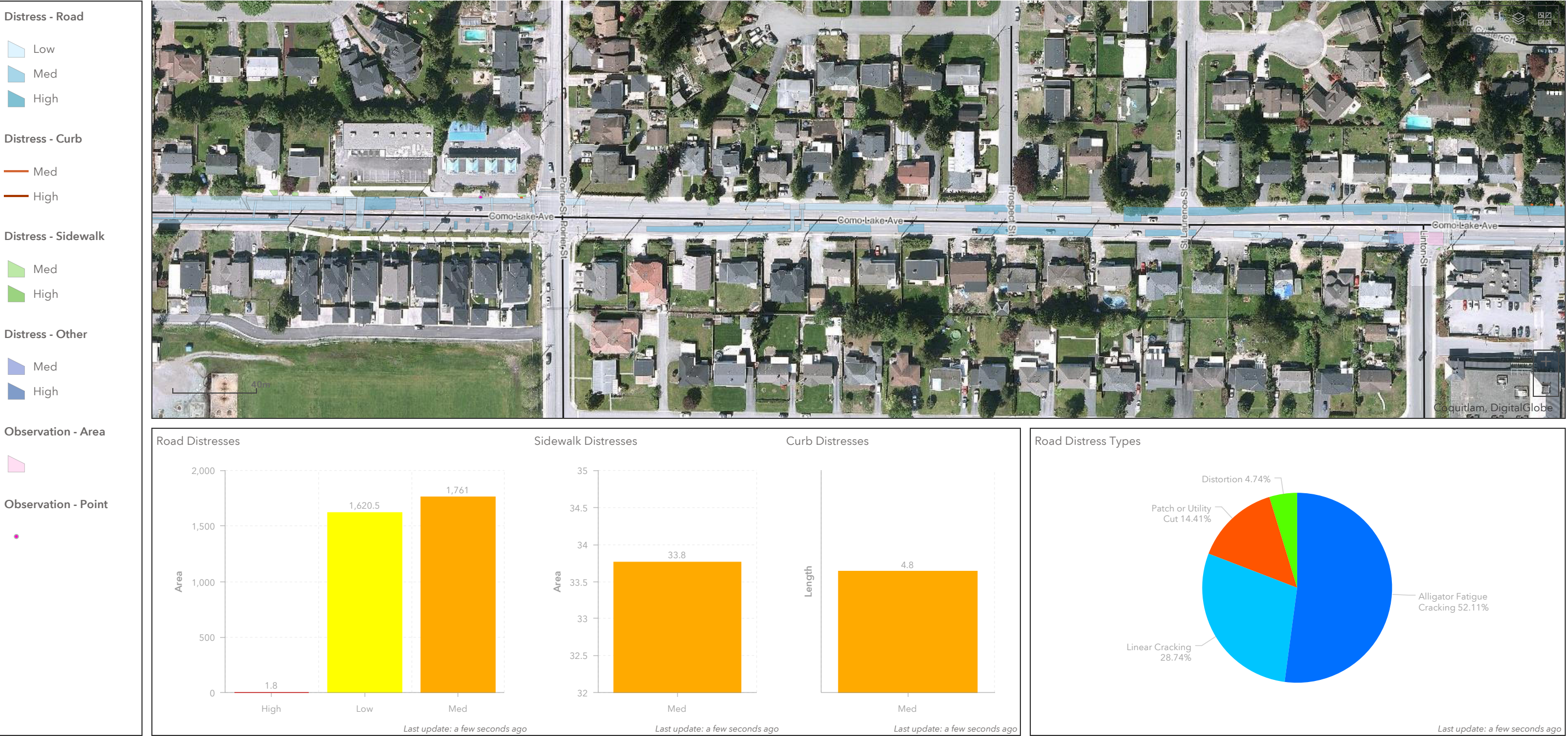


Condition Data Dashboard - Sheet 3









Distress - Road

Low

Med

High

Distress - Curb

Med

High

Distress - Sidewalk

Med

High

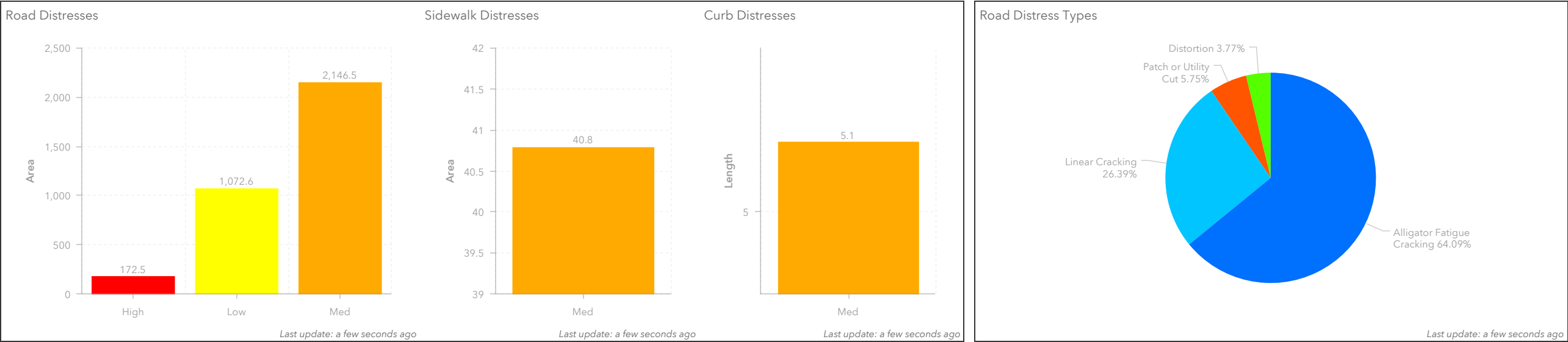
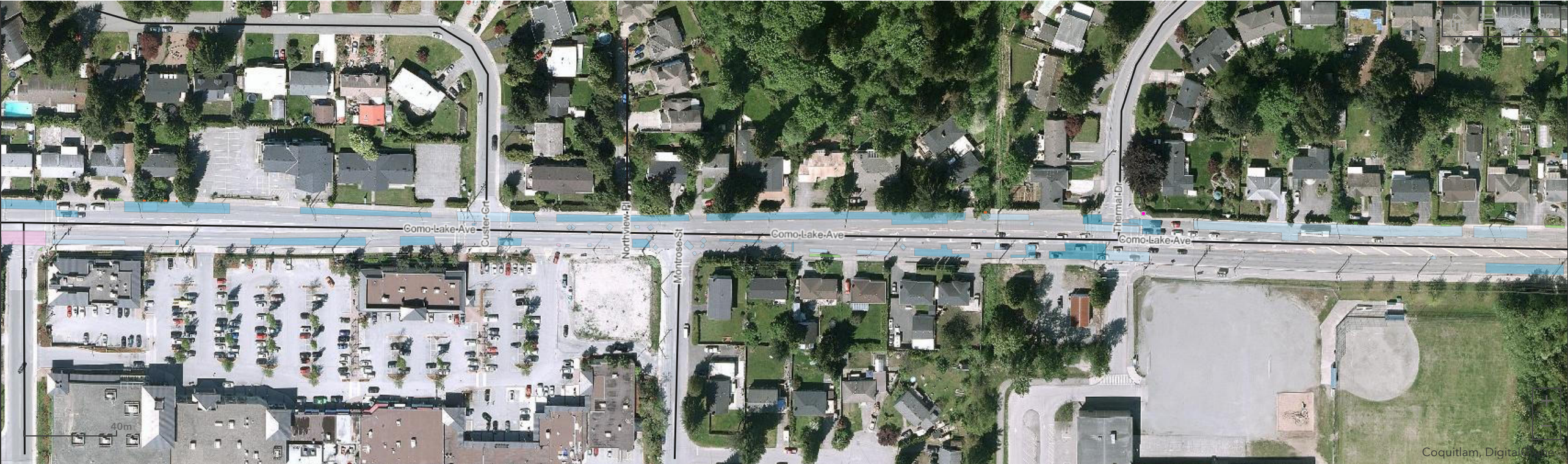
Distress - Other

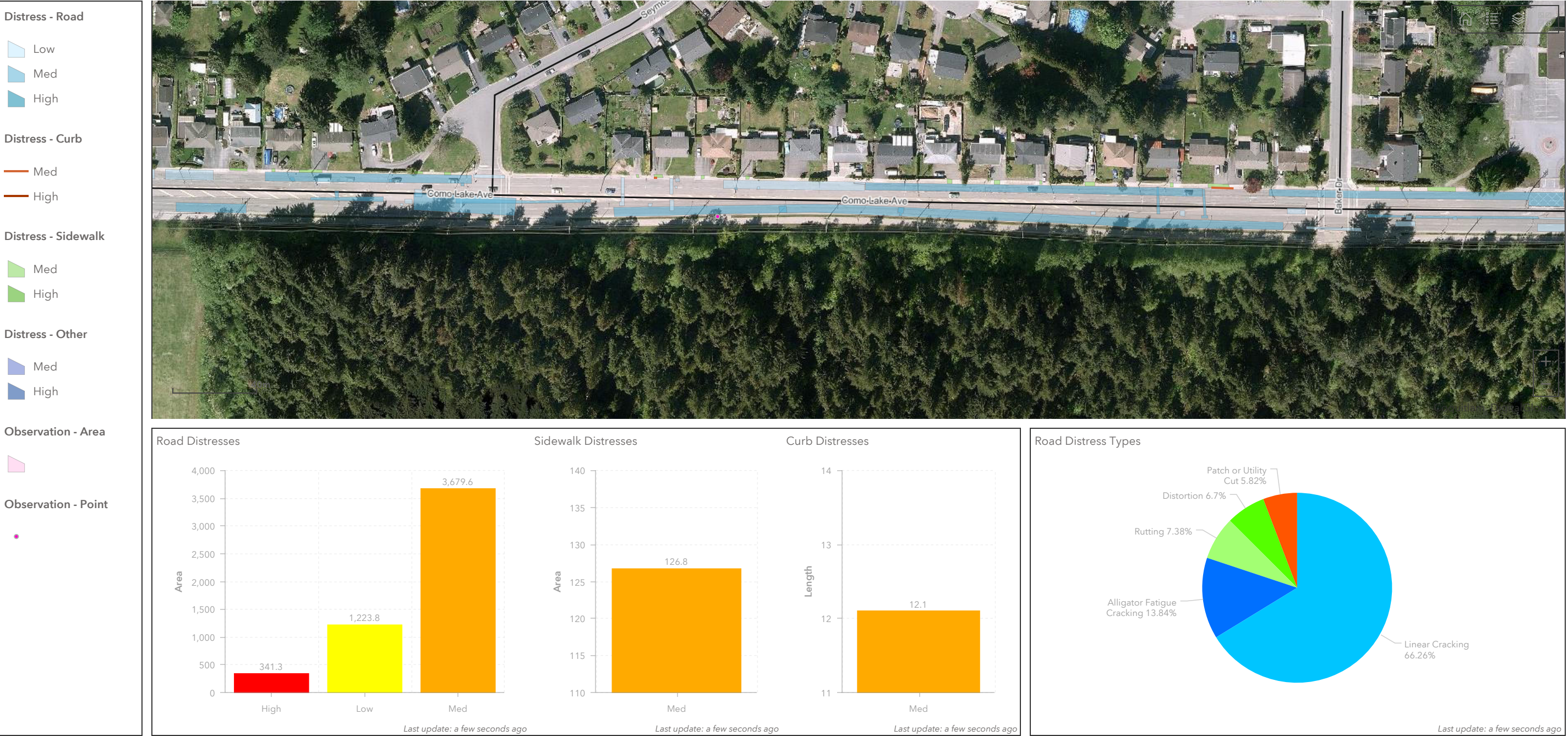
Med

High

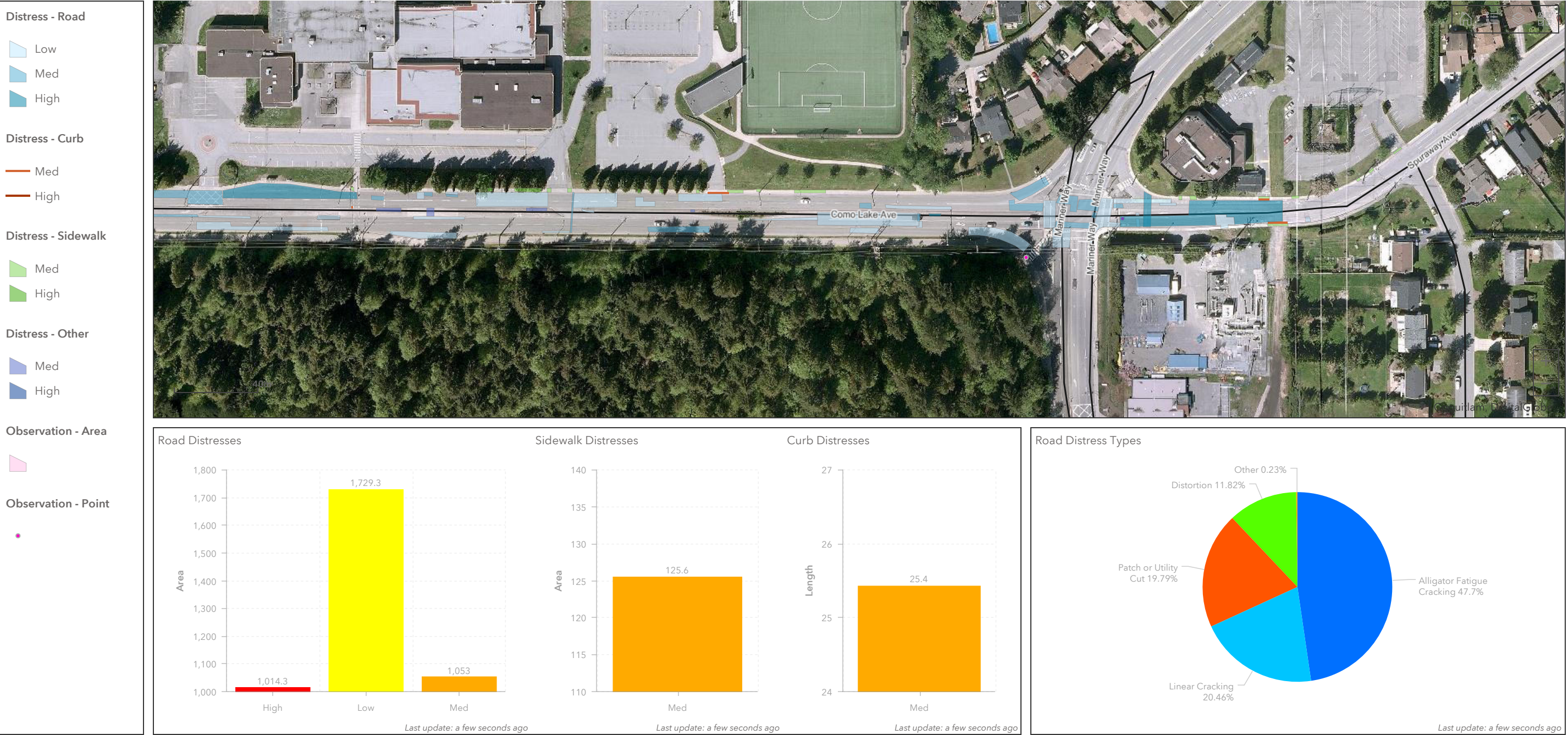
Observation - Area

Observation - Point





Condition Data Dashboard - Sheet 9



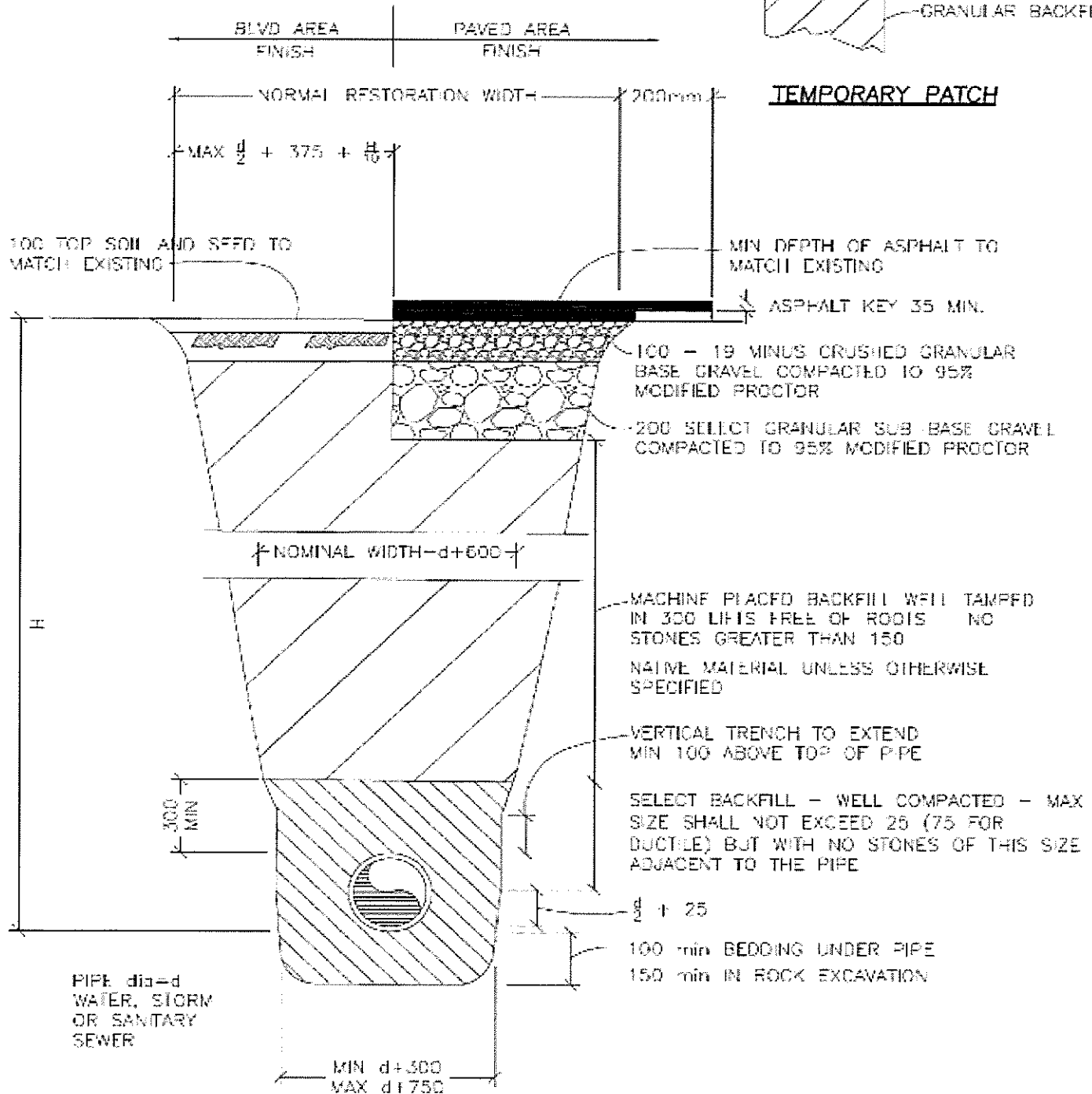
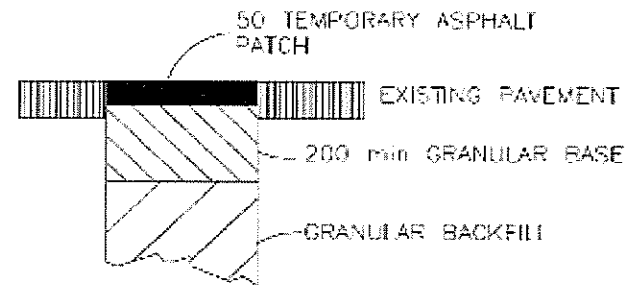
Appendix C

**CITY PAVING SPECIFICATION FOR TRENCHES, COQ-G4
SPECIFICATION TO MMCD**

ALL DIMENSIONS IN MILLIMETRES

d = PIPE DIA IN mm

H = TRENCH DEPTH IN mm



OTTFD: 16-Oct-14

TRENCH DETAILS FOR STANDARD SECTION

DATE: JUNE/2014

DRAWN: REY

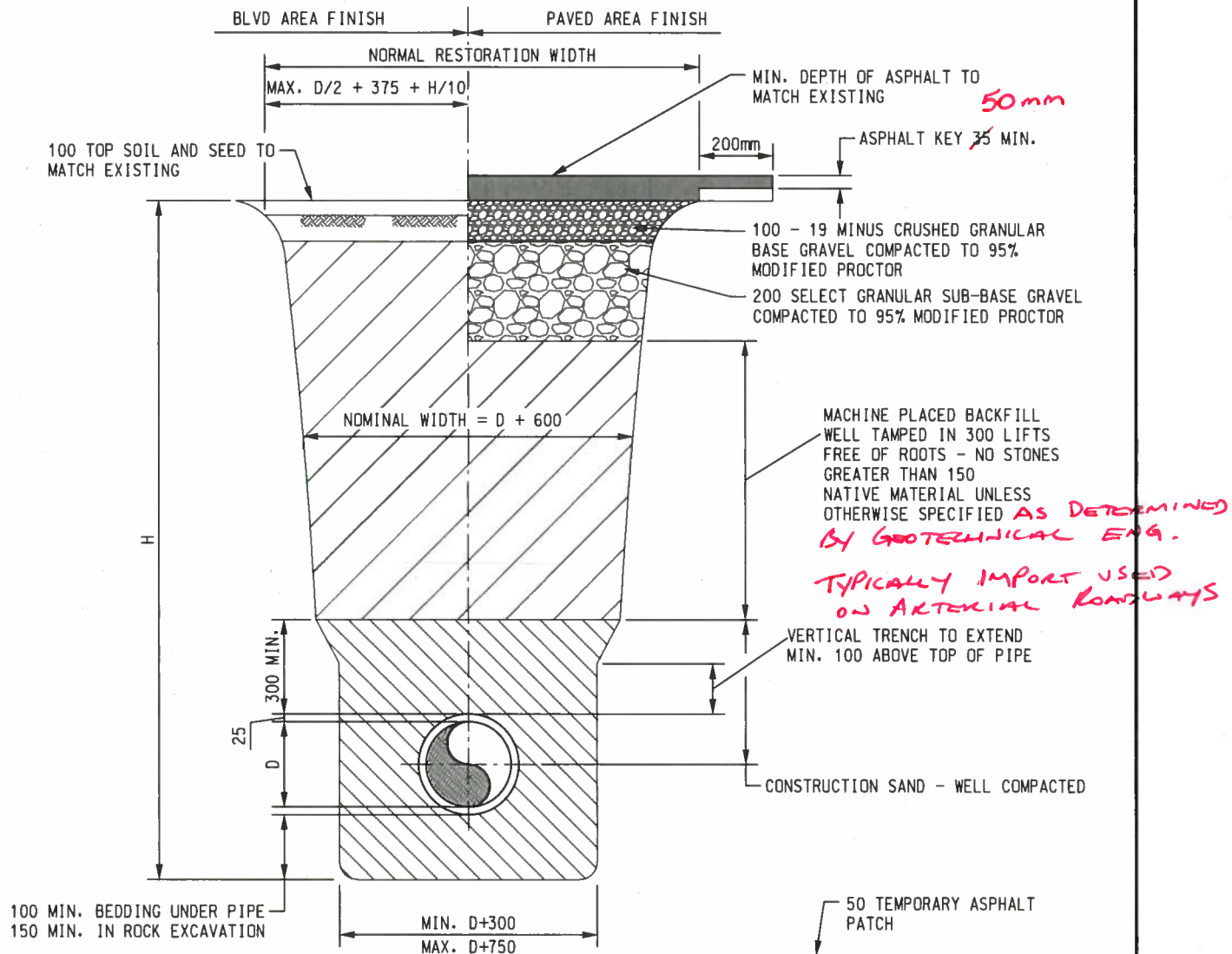
SCALE: N.T.S.

DRAWING NUMBER:

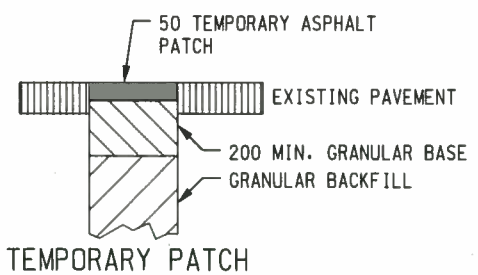
COQ-G4

Appendix D

**OCTOBER 12, 2016 CITY MARKED UP COPY OF THE 30
PERCENT REVIEW OF FEI ENGINEERING DRAWINGS**



CROSSING SECTION
CITY OF COQUITLAM
N.T.S



NOTES:





1. ALL DIMENSIONS ARE IN MILLIMETRES
UNLESS SPECIFIED OTHERWISE.

ISSUED FOR REVIEW
2016/08/31



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	ISSUED FOR CLIENT REVIEW	11 AUG 16 15	MF
	ISSUED FOR SQUAD CHECK	25 JUL 16 15	JW
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DRAWN: L.SHI	CHECKED: K.LE	APPROVED: D.KERR	
DATE: 10 JUN 16	SCALE: NTS	APPROVED: S.BEN-ABDALLAH	
DRAWING NO. 407016-00212-01-PL-DST-0003			PAGE NO. 3

Coquitlam Comments

A

MUNICIPALITY/ GOVERNING BODY/ OWNER REQUIREMENTS - TABLE B

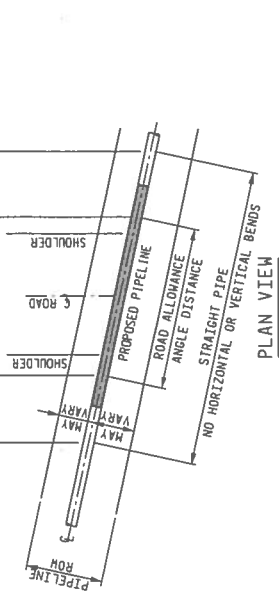
PIPELINE SEGMENT	MUNICIPALITY/ GOVERNING BODY/ OWNER	ACCESS ROAD/MUNICIPAL ROAD (DEVELOPED)		SET BACK (MINIMUM) (NOTE 3)
		MINIMUM COVER AT BAR-DITCH (m)	MINIMUM COVER AT ROAD CENTRELINE (m)	
COQUITLAM IP AND LATERALS	CITY OF COQUITLAM	0.75	1.2	
COQUITLAM IP AND LATERALS	CITY OF BURNABY	0.75	1.2	
COQUITLAM IP AND LATERALS	CITY OF VANCOUVER	0.75	1.2	
FRASER IP	CITY OF VANCOUVER	0.75	1.2	

NOTES:

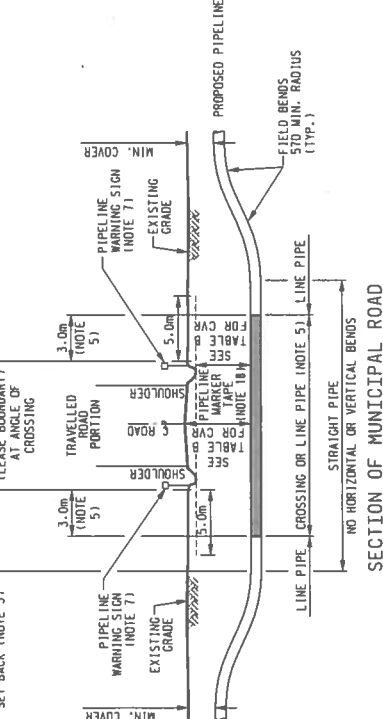
1. CONSTRUCT AND MAINTAIN THE CROSSING IN ACCORDANCE WITH CSA Z662 AND ALL APPLICABLE PROVINCIAL REGULATIONS, MUNICIPALITY REQUIREMENTS, INCLUDING THE APPLICABLE LMCD SUPPLEMENTARY SPECIFICATIONS, CROSSING APPROVAL CONDITIONS AND CONTRACT DOCUMENTS, FORTISBC STANDARDS AND FORTISBC CONSTRUCTION SPECIFICATIONS.
2. NOTIFY THE AUTHORITY HAVING JURISDICTION OVER THE ROAD AT LEAST FIVE (5) DAYS BEFORE BEGINNING WORK OR AS SPECIFIED IN THE CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMIT, ALLOWING THE AUTHORITY TO SEND A REPRESENTATIVE TO THE SITE DURING EXCAVATION AND CONSTRUCTION OF THE CROSSING.
3. CONSTRUCT THE CROSSING WITH NO VERTICAL OR HORIZONTAL BENDS WITHIN THE REQUIRED SET BACK AS NOTED IN TABLE B. THE SETBACK VALUES NOTED IN TABLE B ARE MEASURED PERPENDICULAR TO THE ROAD CENTRELINE.
4. DUE TO THE ABSENCE OF EXPLICIT SET-BACK REQUIREMENTS AT MUNICIPAL ROADS WITHIN THE VARIOUS MUNICIPALITIES, THE STRAIGHT-PIPE REQUIREMENTS AT MUNICIPAL ROAD CROSSINGS ARE BASED ON THE GOOD INDUSTRIES AND COUNTY OF VANCOUVER REQUIREMENTS. THE STRAIGHT-PIPE REQUIREMENTS AT MUNICIPAL ROAD CROSSINGS CAN BE ADJUSTED WITH PRIOR WRITTEN APPROVAL FROM THE ENGINEER ON RECORD.
5. REFER TO ALIGNMENT SHEET FOR CROSSING PIPE LENGTH AT EACH CROSSING. WHERE ROAD ALLOWANCE DOES NOT EXIST OR WHERE THE ROAD LIMITS CANNOT BE CLEARLY DETERMINED, THE CROSSING PIPE SHALL EQUAL BORE LENGTH (IF APPLICABLE).
6. THE WALL THICKNESS OF THE CROSSING PIPE IS EQUAL TO THE WALL THICKNESS OF THE LINE PIPE.
7. INSTALL PIPELINE WARNING SIGNS AS DIRECTED BY CONSTRUCTION MANAGER. REFER TO FORTISBC DRAWING 90000-Y-000-1000-RD FOR DETAILS.
8. HAVE THE STORED COPY OF CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMIT ON SITE.
9. CONSTRUCT THE CROSSING BY THE CONSTRUCTION METHOD SPECIFIED THE CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMIT.
10. IF THE CROSSING IS CONSTRUCTED BY CONVENTIONAL OPEN CUT METHOD, THE CONTRACTORS ARE TO FOLLOW THE MORE STRINGENT REQUIREMENTS OF FORTISBC GUIDELINE 1278 AND THE CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMIT. TRENCH BACKFILL MUST BE COMPACTED GRANULAR MATERIAL TO CITY SPECIFICATIONS FOR THE ENTIRE ROAD ALLOWANCE.
11. WHETHER CURRENTLY PAVED/TRAVELLED OR NOT, (REFER TO TYPICAL DWG. 407016-00021-01-PL-051-0001, 0002 AND 0003), THE MINIMUM DEPTH-OF-COVER (DOCC) SHALL MEET ALL MINIMUM DOCC REQUIREMENTS INCLUDING THE 1.2m DOCC FROM THE SUBGRADE AND THE VALUES IN TABLE B.
12. REFER TO IP PRELIMINARY HYDROSTATIC TEST PLAN FOR TEST PRESSURES.
13. THE DESIGN REQUIREMENTS SHALL ALSO BE MET FOR A MINIMUM DISTANCE OF 7.0m BEYOND THE TRAVELED SURFACE OF THE ROAD, MEASURED AT RIGHT ANGLES TO THE CENTRELINE OF THE TRAVELED SURFACE.
14. WHERE PRACTICAL, THE ROAD CROSSING SHALL BE MADE SO THAT THE ANGLE BETWEEN THE CENTRELINE OF THE ROAD BEING CROSSED AND THE CENTRELINE OF THE PROPOSED PIPELINE IS NOT LESS THAN 45° AND AS CLOSE TO 90° AS PRACTICAL.
15. REGULATION 18 IS IN PLACE PRIOR TO CONSTRUCTION.
16. CONTRACTOR MUST ENSURE A SITE-SPECIFIC TRAFFIC MANAGEMENT PLAN, DESIGNED IN ACCORDANCE WITH THE GOVERNING SUPPLY AND INSTALL PIPELINE MARKER TAPE OVER PIPELINE FOR WIDTH OF ROAD ALLOWANCE PLUS 5.0m MINIMUM ON BOTH SIDES OF THE ROAD, REFER TO TYPICAL DWG. 407016-00021-01-PL-051-0010 FOR DETAILS.
17. THIS TYPICAL ONLY APPLIES TO ROAD CROSSINGS AND NOT FOR PIPELINE INSTALLATION ALONG A ROAD ALLOWANCE.

SEE TABLE B FOR SET BACK (NOTE 3)

SEE TABLE B FOR SET BACK (NOTE 3)



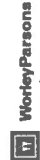
SEE TABLE B FOR SET BACK (NOTE 3)



PIPE SPECIFICATION - TABLE A

PIPE SPECIFICATION - TABLE A										
PIPE SEGMENT	PIPE TYPE	PIPE SIZE	OD	WT mm	PIPE SPECIFICATION					CATHODIC PROTECTION
								MCP	PIPE COATING	
COQUITLAM IP AND LATERALS	LINE PIPE	NPS 30	762	9.5	CSA 2245-1	GR-414	CAT II	DR API 5L	GR X60 PSL 2	YES
	CROSSING PIPE	NPS 30	762	9.5	CSA 2245-1	GR-414	CAT II	DR API 5L	GR X60 PSL 2	YES
FRASER IP	LINE PIPE	NPS 30	762	9.5	CSA 2245-1	GR-414	CAT II	DR API 5L	GR X60 PSL 2	YES
	CROSSING PIPE	NPS 30	762	9.5	CSA 2245-1	GR-414	CAT II	DR API 5L	GR X60 PSL 2	YES

ISSUED FOR REVIEW
20180801



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ISSUED FOR REVIEW	17	18	19	20
ISSUED FOR CLIENT REVIEW	17	18	19	20
ISSUED FOR ROAD OWNER	17	18	19	20
REVISION DESCRIPTION	DATE	BY	DATE	BY
1				
2				
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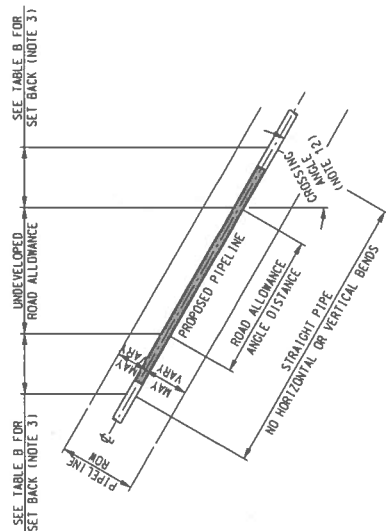
MUNICIPALITY/ GOVERNING BODY/ OWNER REQUIREMENTS - TABLE B

MUNICIPALITY/ GOVERNING BODY/ OWNER REQUIREMENTS - TABLE B

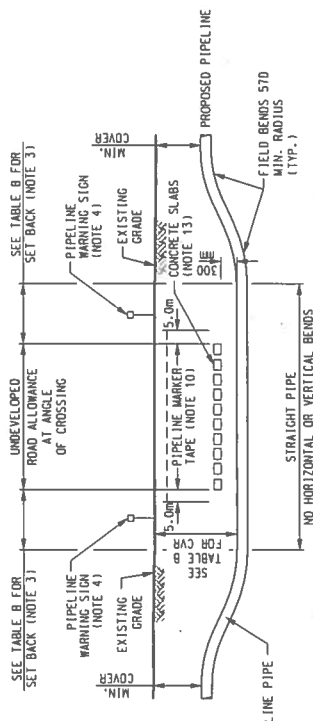
PIPELINE SEGMENT	MUNICIPALITY/ GOVERNING BODY/ OWNER	UNDEVELOPED LAND (COURSE DEVELOPMENT)		SET BACK (m)(MIN.) (NOTE 3)
		MINIMUM COVER AT ROAD CENTRELINE	(m)	
0+000 TO 5+572.6	CITY OF COQUITLAM	1-2	0 FROM ROAD ALLOWANCE BOUNDARY	
5+572.6 TO 15+981.9	CITY OF BURNABY	1-2	0 FROM ROAD ALLOWANCE BOUNDARY	
15+981.9 TO 19+840	CITY OF VANCOUVER	1-2	0 FROM ROAD ALLOWANCE BOUNDARY	

NOTES:

1. CONSTRUCT AND MAINTAIN THE CROSSING IN ACCORDANCE WITH CSA Z462 AND ALL APPLICABLE PROVINCIAL REGULATIONS, MUNICIPALITY REQUIREMENTS, CROSSING APPROVAL CONDITIONS AND CONTRACT DOCUMENTS. FORTISBC STANDARDS AND FORTISBC CONSTRUCTION SPECIFICATIONS NOTIFY THE AUTHORITY HAVING JURISDICTION OVER THE ROAD AT LEAST FIVE (5) DAYS BEFORE BEGINNING WORK OR AS SPECIFIED IN THE CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMIT.
2. ALLOWING THE AUTHORITY TO SEND A REPRESENTATIVE TO THE SITE DURING EXCAVATION AND CONSTRUCTION OF THE CROSSING.
3. CONSTRUCT THE CROSSING WITH NO VERTICAL OR HORIZONTAL BENDS WITHIN THE ROAD ALLOWANCE BOUNDARY. REFER TO TABLE B.
4. INSTALL PIPELINE WARNING SIGNS AS DIRECTED BY CONSTRUCTION MANAGER. REFER TO FORTISBC BACKFILL 90000-C-1000-1000-40 FOR DETAILS.
5. DRAPFILL THE EXCAVATED CROSSING FOR A MINIMUM OF 300mm LIFTS COMPACTED TO 95% STANDARD PROCTOR DENSITY.
6. SIGN THE SIGNED COPY OF CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMIT ON SITE.
7. CONSTRUCT THE CROSSING BY OPEN CUT METHOD UNLESS SPECIFIED OTHERWISE BY THE CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMIT.
8. ALL DEPTHS OF COVER APPLY FROM SUBSLOIL ELEVATION.
9. REFER TO IP PRELIMINARY HYDROSTATIC TEST PLAN FOR TEST PRESSURE.
10. SUPPLY AND INSTALL PIPELINE MARKER TAPE OVER PIPELINE FOR WIDTH OF ROAD ALLOWANCE PLUS 5.0m MINIMUM ON BOTH SIDES OF THE ROAD. REFER TO TYPICAL DWG. 407016-00212-01-PL-051-0010 FOR DETAILS.
11. THIS DRAWING IS APPLICABLE FOR BOTH COUTILAM IP AND FRASER IP LINES.
12. WHERE PRACTICAL, THE ROAD CROSSING SHALL BE MADE SO THAT THE ANGLE BETWEEN THE CENTRELINE OF THE ROAD BEING CROSSED, AND THE CENTRELINE OF THE PROPOSED PIPELINE IS NOT LESS THAN 45° AND AS CLOSE TO 90° AS PRACTICAL.
13. WHERE OTHER THAN 90°, FORTISBC AND THE CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMITING COUNCILS SHALL BE NOTIFIED OF THE ROAD CROSSING AND THE CROSSING AGREEMENT/ROAD AND RIGHT-OF-WAY PERMITING COUNCILS SHALL BE NOTIFIED OF THE ROAD CROSSING AS PER FORTISBC DRAWINGS 90000-C-100-100-R2 AND 90000-C-100-101-R2.
14. THIS SYMBOL ONLY APPLIES TO ROAD CROSSINGS AND NOT FOR PIPELINE INSTALLATION ALONG A ROAD ALLOWANCE.



PLAN VIEW



SECTION VIEW

PIPE SPECIFICATION - TABLE A

PIPE SEGMENT	PIPE TYPE	PIPE SIZE	DD	WT	PIPE SPECIFICATION		PIPE COATING	CATHODIC PROTECTION
COGULITUM JP AND LATERALS PASSED TO	LINE PIPE	NPS 30	762	9.5	CSA Z245.1 GR.414 C11 DR API 5L GR 360 PSL 2	FBE	YES	
	LINE PIPE	NPS 30	762	9.5	CSA Z245.1 GR.414 C11 DR API 5L GR 360 PSL 2	FBE	YES	
	LINE PIPE	NPS 30	762	9.5	CSA Z245.1 GR.414 C11 DR API 5L GR 360 PSL 2	FBE	YES	

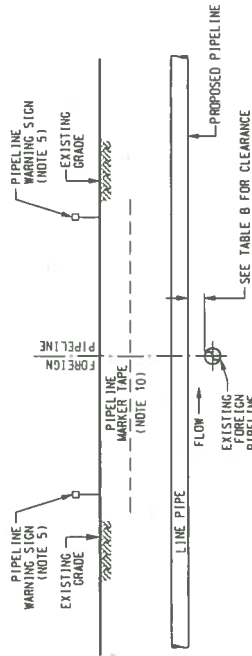
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2016/08/13



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202	ISSUED FOR REVIEW	815	816	817	818
203	ISSUED FOR REVIEW	819	820	821	

* Assume Horizontal Clearance
IS FROM EDGE OF PIPE TO EDGE
OF PIPE.



CROSS SECTION OF FOREIGN PIPELINE ROW

PIPE SPECIFICATION - TABLE A

PIPE SPECIFICATION TABLE A									
PIPE SEGMENT	PIPE TYPE	PIPE SIZE	OD	WT	PIPE SPECIFICATION		MCP	PIPE COATING	CATHODIC PROTECTION
COOUTILAM IP AND LATERALS FRASER IP	LINE PIPE	NPS 30	762	9.5	CSA Z245.1 GR.414 CAT 11	OR API 5L GR X60 PSL 2	2,070	FBE	YES
	LINE PIPE	NPS 30	762	9.5	CSA Z245.1 GR.414 CAT 11	OR API 5L GR X60 PSL 2	1,200	FBE	YES
	LINE PIPE	NPS 30	762	9.5	CSA Z245.1 GR.414 CAT 11	OR API 5L GR X60 PSL 2	1,200	FBE	YES
	LINE PIPE	NPS 30	762	9.5	CSA Z245.1 GR.414 CAT 11	OR API 5L GR X60 PSL 2	1,200	FBE	YES

CLEARANCE REQUIREMENTS - TABLE B

OWNER	CONSTRUCTION METHOD	HORIZONTAL CLEARANCE (mm) (MIN.)	VERTICAL CLEARANCE (mm) (MIN.)
CITY OF VANCOUVER	CONVENTIONAL OPEN CUT	1000	500
	JACKING OR BORING	1000	600
CITY OF BURNABY	CONVENTIONAL OPEN CUT	TBD	TBD
	JACKING OR BORING	TBD	TBD
CITY OF COQUITLAM	CONVENTIONAL OPEN CUT	TBD 1200	TBD 500
	JACKING OR BORING	TBD 1200	TBD 500
OTHER	CONVENTIONAL OPEN CUT	300	300
	JACKING OR BORING	600	600

NOTES:

1. CONSTRUCT AND MAINTAIN THE CROSSING IN ACCORDANCE WITH CSA Z662 AND ALL APPLICABLE PROVINCIAL REGULATIONS, MUNICIPAL REQUIREMENTS, CROSSING APPROVAL CONDITIONS AND CONTRACT DOCUMENTS.
2. NOTIFY THE FOREIGN COMPANY THAT OWNS THE EXISTING FACILITY AS SPECIFIED IN THE CROSSING AGREEMENT, ALLOWING THE AUTHORITY TO SEND A REPRESENTATIVE TO THE SITE DURING EXCAVATION AND CONSTRUCTION OF THE CROSSING.
3. MAINTAIN THE PIPELINE LOCATION AND DEPTH BEFORE EXPOSING THE PIPELINE. CONFIRM THE PIPELINE LOCATION BY GROUND HAND OR "HYDRO VAC" EXPOSURE.
4. MAINTAIN STRAIGHT PIPE FOR THE FULL WIDTH OF FOREIGN PIPELINE ROW WHILE MAINTAINING A MINIMUM CLEARANCE PER THE VALUE FROM TABLE B. CONFIRM CLEARANCE WITH FOREIGN PIPELINE COMPANY DURING CROSSING AGREEMENT. IF THE CLEARANCES IN TABLE B ARE NOT POSSIBLE TO OBTAIN, APPROVAL FROM THE ENGINEER ON RECORD MUST BE OBTAINED TO ENSURE THE PIPELINES ARE APPROPRIATELY PROTECTED FROM DAMAGE THAT CAN RESULT FROM PROXIMITY FROM OTHER UNDERGROUND FACILITIES.
5. INSTALL PIPELINE WARNING SIGNS AS DIRECTED BY CONSTRUCTION MANAGER, REFER TO FORTISBC DRAWING 90000-8-000-1000-RO FOR DETAILS.
6. HAVE THE SIGNED COPY OF THE CROSSING AGREEMENT ON SITE.
7. ALL DEPTHS OF COVER APPLY FROM SUBSOIL ELEVATION.
8. USE MINIMUM LEAD IF REQUIRED BY FOREIGN PIPELINE COMPANY.
9. USE MINIMUM CROSSING PROTECTION FOR ACCESS OVER FOREIGN PIPELINE DURING ENTIRE CONSTRUCTION PERIOD.
10. SUPPLY AND INSTALL PIPELINE MARKER TAPE IN ACCORDANCE WITH TYPICAL DWG. 407016-00212-01-PL-DST-0010.
11. VALIDATE CONDITIONS IN THE CROSSING AGREEMENT AS THEY TAKE PRECEDENCE IF THEY EXCEED REQUIREMENTS OF THIS DRAWING.
12. THIS DRAWING IS APPLICABLE FOR BOTH COQUITLAM IP & FRASER IP LINES, AND THE COQUITLAM IP LATERALS.
13. WITH PERMISSION OF THE FOREIGN PIPELINE COMPANY, CROSS OVER THE TOP OF THE PIPELINE IF THE DEPTH OF PIPELINE IS GREATER THAN THE VALUE CORRESPONDING TO THE MINIMUM PIPE DEPTH + MINIMUM CLEARANCE + PROPOSED PIPE DIAMETER.

ISSUED FOR REVIEW	BY: []	DATE: []	SA
ISSUED FOR CLIENT REVIEW	BY: []	DATE: []	SA
ISSUED FOR SUBMIT CHECK	BY: []	DATE: []	SA
REVISION DESCRIPTION	DATE: []	APPROVED: []	SA
<p>REVISION 01: This drawing is for review only and does not represent a final design. It is not to be used for construction or procurement of materials without the approval of the design engineer.</p>			
<p>FORTIS BC</p>			
<p>LOWER MAINLAND IP SYSTEM UPGRADE PROJECT CROSSING OVER FOREIGN PIPELINE TYPICAL STANDARD DRAWING</p>			
DESIGN: L. SHI	CHECKED: S. LEE	APPROVED: L. SHI	DATE: []
DRAWN: []	SCALE: 1:1	DATE: []	DATE: []
407016-00212-01-PL-DST-0039			34



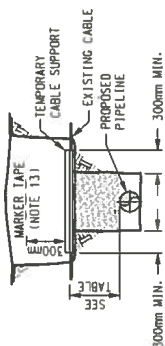
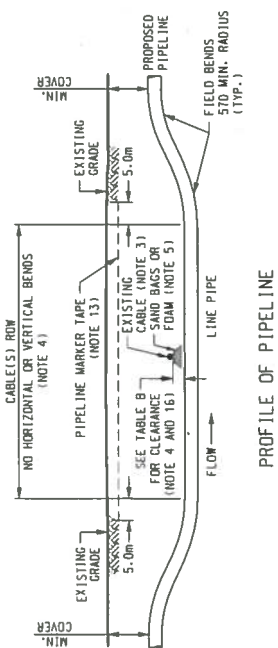
"This drawing is prepared solely for the use of the client and is not to be used for any other purpose without the written consent of WorleyParsons. It is the responsibility of the client to ensure that the drawing is used for the intended purpose and is not misused or reproduced in any form without the written consent of WorleyParsons."

CLEARANCE REQUIREMENT - TABLE B

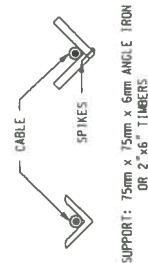
OWNER	FEATURE	CONSTRUCTION METHOD	HORIZONTAL CLEARANCE (mm) (MIN.) (NOTE 4 AND 16)	VERTICAL CLEARANCE (mm) (MIN.) (NOTE 4 AND 16)
CITY OF VANCOUVER	FIBRE OPTIC	ANY	1000	1000
	BURIED CABLE EXCEPT FIBRE OPTIC	CONVENTIONAL OPEN CUT	1000	500
	BURIED CABLE EXCEPT FIBRE OPTIC	JACKING OR BORING	1000	600
CITY OF BURBANK	BURIED CABLE EXCEPT FIBRE OPTIC	CONVENTIONAL OPEN CUT	TBD	TBD
	BURIED CABLE EXCEPT FIBRE OPTIC	JACKING OR BORING	TBD	TBD
	BURIED CABLE EXCEPT FIBRE OPTIC	CONVENTIONAL OPEN CUT	TBD / 1000	TBD 300
CITY OF COQUITLAM	BURIED CABLE EXCEPT FIBRE OPTIC	JACKING OR BORING	TBD 1000	TBD 600
	BURIED CABLE EXCEPT FIBRE OPTIC	CONVENTIONAL OPEN CUT	300	300
	BURIED CABLE EXCEPT FIBRE OPTIC	JACKING OR BORING	600	600

NOTES:

1. CONSTRUCT AND MAINTAIN THE CROSSING IN ACCORDANCE WITH CSA 7662 AND ALL APPLICABLE PROVINCIAL REGULATIONS, MUNICIPAL REGULATIONS, CROSSING APPROVAL CONDITIONS AND CONTRACT DOCUMENTS, FORTISBC STANDARDS AND FORTISBC CONSTRUCTION SPECIFICATIONS.
2. NOTIFY THE FOREIGN COMPANY THAT OWNS THE EXISTING FACILITY AS SPECIFIED IN THE CROSSING AGREEMENT, ALLOWING THE AUTHORITY TO SEND A REPRESENTATIVE TO THE SITE DURING EXCAVATION AND CONSTRUCTION OF THE CROSSING.
3. DETERMINE THE CROSSING LOCATION AND DEPTH BEFORE EXPOSING THE PIPELINE. CONFIRM THE LOCATION BY CAREFUL HAND OR HYDRO VAC EXPOSURE.
4. MAINTAIN THE MINIMUM CLEARANCE FOR THE FULL WIDTH OF FORECROWN WHILE MAINTAINING A MINIMUM CLEARANCE PER THE VALUE FROM TABLE B. CONFIRM CLEARANCE WITH THE FOREIGN FACILITY COMPANY DURING CROSSING AGREEMENT. IF THE CLEARANCES IN TABLE B ARE NOT POSSIBLE TO OBTAIN, APPROVAL FROM THE ENGINEER ON RECORD MUST BE OBTAINED TO ENSURE THE PIPELINES ARE APPROPRIATELY PROTECTED FROM DAMAGE THAT CAN RESULT FROM PROXIMITY FROM OTHER UNDERGROUND FACILITIES.
5. USE SACKBAGS OR FOAM, WHERE REQUIRED, TO MAINTAIN CLEARANCE BETWEEN THE NEWLY CONSTRUCTED PIPELINE AND EXISTING CABLE.
6. TEMPORARILY SUPPORT THE CABLE AS REQUIRED BY THE CABLE OWNER.
7. REMOVE TEMPORARY CABLE SUPPORTS AFTER COMPLETION OF CROSSING.
8. THE SLOUGHED CORPUS OF THE CROSSING AGREEMENT ON THE DATE OF THE CROSSING SHALL BE THE BASIS FOR THE CROSSING AND BE THE BASIS FOR THE EXCAVATED CROSSING AREA AND COMPACT TO THE DENSITY EQUAL TO THAT OF THE ADJACENT ORIGINAL MATERIAL.
9. ALL DEPTHS OF CORPUS APPLY FROM SUBSOIL ELEVATION.
10. WITH THE PERMISSION OF THE FOREIGN CABLE COMPANY, CROSS OVER THE TOP OF THE CABLE IF THE DEPTH OF THE CABLE IS GREATER THAN THE VALUE CORRESPONDING TO THE MINIMUM PIPE DEPTH + MINIMUM CLEARANCE + PROPOSED PIPE DIAMETER.
11. USE VEHICLE CROSSING PROTECTION FOR ACCESS OVER THE PIPELINE DURING ENTIRE CONSTRUCTION PERIOD.
12. MAINTAIN THE MINIMUM CLEARANCE FOR THE FULL WIDTH OF FORECROWN WHILE MAINTAINING A MINIMUM CLEARANCE PER THE VALUE FROM TABLE B. CONFIRM CLEARANCE WITH THE FOREIGN FACILITY COMPANY DURING CROSSING AGREEMENT. IF THE CLEARANCES IN TABLE B ARE NOT POSSIBLE TO OBTAIN, APPROVAL FROM THE ENGINEER ON RECORD MUST BE OBTAINED TO ENSURE THE PIPELINES ARE APPROPRIATELY PROTECTED FROM DAMAGE THAT CAN RESULT FROM PROXIMITY FROM OTHER UNDERGROUND FACILITIES.
13. THIS DRAWING IS APPLICABLE FOR COBOUTILAM P.Y. A FRASER PIPE LINES, AND THE COBOUTILAM P.Y. LATERALS.
14. THIS THIS DOES NOT APPLY FOR CROSSING THE BC HYDRO 230 KVM CABLES - REFER TO THE APPROPRIATE TYPICALS.



SECTION THROUGH PIPELINE TRENCH



SECTION THROUGH
TEMPORARY CABLE SUPPORT

PIPE SPECIFICATION - TABLE A

PIPE SEGMENT	PIPE TYPE	PIPE SIZE		DD mm	WT mm	PIPE SPECIFICATION								MOP RPO	PIPE COATING	CATHODIC PROTECTION
		NPS	30			762	915	CSA Z245-1	GR-414	CAT 11	DR API 5L	GR X60	PSL 2			
CORRODULUM IP AND LATERALS	LINE PIPE	NPS 30	762	30	762	915	CSA Z245-1	GR-414	CAT 11	DR API 5L	GR X60	PSL 2	2,070	FBE	YES	
	LINE PIPE	NPS 30	762	30	762	915	CSA Z245-1	GR-414	CAT 11	DR API 5L	GR X60	PSL 2	1,200	FBE	YES	
FRASER IP	LINE PIPE	NPS 30	762	30	762	915	CSA Z245-1	GR-414	CAT 11	DR API 5L	GR X60	PSL 2	1,200	FBE	YES	

ISSUED FOR REVIEW
2016/08/31

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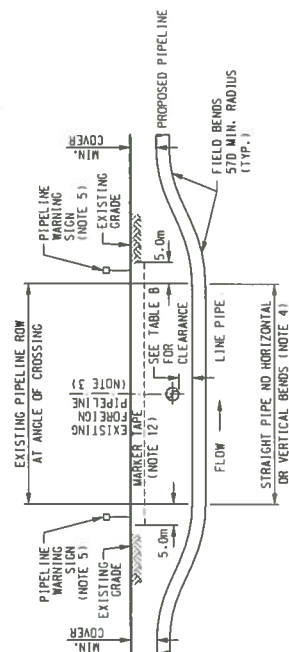
[illegible]

CLEARANCE REQUIREMENTS - TABLE B

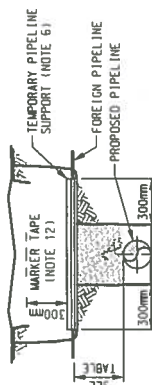
OWNER	CONSTRUCTION METHOD	HORIZONTAL CLEARANCE (mm / IN.)	VERTICAL CLEARANCE (mm / IN.)
CITY OF VANCOUVER	CONVENTIONAL OPEN CUT	1000	500
	JACKING DR BORING	1000	600
CITY OF BURBARY	CONVENTIONAL OPEN CUT	TBD	TBD
	JACKING DR BORING	TBD	TBD
CITY OF COQUITLAM	CONVENTIONAL OPEN CUT	TBD <i>1200</i>	TBD <i>500</i>
	JACKING DR BORING	TBD <i>1200</i>	TBD <i>500</i>
OTHER	CONVENTIONAL OPEN CUT	300	300
	JACKING DR BORING	600	600

NOTES:

1. CONSTRUCT AND MAINTAIN THE CROSSING IN ACCORDANCE WITH CSA 7662 AND ALL APPLICABLE PROVINCIAL REGULATIONS, MUNICIPAL REQUIREMENTS, CROSSING APPROVAL CONDITIONS AND CONTRACT DOCUMENTS, FORTISBC STANDARDS AND FORTISBC CONSTRUCTION SPECIFICATIONS.
2. NOTIFY THE FOREIGN COMPANY THAT OWNS THE EXISTING FACILITY AS SPECIFIED IN THE CROSSING AGREEMENT, ALLOWING THE AUTHORITY TO SEND A REPRESENTATIVE TO THE SITE DURING EXCAVATION AND CONSTRUCTION OF THE CROSSING.
3. DETERMINE THE PIPELINE CROSSING LOCATION AND DEPTH BEFORE THE PIPELINE. CONFIRM THE PIPELINE LOCATION BY CAREFUL HAND OR "HYDRO VAC" EXPOSURE.
4. MAINTAIN STRAIGHT PIPE FOR THE FULL WIDTH OF FOREIGN PIPELINE ROW WHILE MAINTAINING A MINIMUM CLEARANCE PER THE VALUE FROM TABLE B. CONFIRM CLEARANCE IN THE FOREIGN PIPELINE COMPANY DURING CROSSING AGREEMENT. IF THE CLEARANCES IN TABLE B ARE NOT POSSIBLE TO OBTAIN, ADVISE THE ENGINEER ON RECORD MUST BE NOTIFIED AND THE FOREIGN COMPANY MUST PROVIDE PROTECTION FROM DAMAGE TO THE PIPELINE.
5. INSTALL PIPELINE MARKING SIGNS AS DIRECTED BY CONSTRUCTION MANAGER, REFER TO TEMPORARILY DRAINING 90000-X-000-1000-90 FOR DETAILS.
6. TEMPORARILY SUPPORT THE FOREIGN PIPELINE AS REQUIRED BY THE FOREIGN PIPELINE COMPANY.
7. REMOVE TEMPORARY SUPPORT(S) AFTER CONSTRUCTION OF CROSSING.
8. HAVE THE SIGNED COPY OF THE CROSSING AGREEMENT ON SITE.
9. ALL DEPTHS OF COVER APPLY FROM SUBSOIL ELEVATION.
10. INSTALL TEST LEAD IF REQUIRED BY FOREIGN PIPELINE COMPANY.
11. USE VEHICLE CROSSING PROTECTION FOR ACCESS OVER FOREIGN PIPELINE DURING THE EXCAVATION PERIOD.
12. USE 100MM OR 150MM DIA. POLYETHYLENE MARKER TAPE IN ACCORDANCE WITH TYPICAL DWG. 001016-002124-01-01-0000.
13. VALIDATE CONDITIONS IN THE CROSSING AGREEMENT AS THEY TAKE PRECEDENCE IF THEY EXCEED REQUIREMENTS OF THIS DRAWING.
14. THIS DRAWING IS APPLICABLE FOR BOTH COOULTLAM IP & FRASER IP LINES, AND THE COOULTLAM IP LATERALS.



PROFILE OF PIPELINES



SECTION THROUGH PIPELINE TRENCH

PIPE SPECIFICATION - TABLE A

PIPE SEGMENT	PIPE TYPE	PIPE SIZE	OD	WT	PIPE SPECIFICATION		PIPE COATING	CATHODIC PROTECTION
					MM	KG		
COORINTILAM IP AND LATERALS	LINE PIPE	NPS 30	762	9.5	CSA Z245-1 GR 414 C11	DR API 5L DR 360 PSL 2	FBE	YES
	LINE PIPE	NPS 30	762	9.5	CSA Z245-1 GR 414 C11	DR API 5L DR 360 PSL 2	FBE	YES
ERASER IP	LINE PIPE	NPS 30	762	9.5	CSA Z245-1 GR 414 C11	DR API 5L DR 360 PSL 2	FBE	YES

WorleyParsons
infrastructure & energy

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NO	REVISION DESCRIPTION	DATE/TIME	APPROVED
1	ISSUED FOR REVIEW	31 AUG 16	SA
2	ISSUED FOR CLIENT REVIEW	11 AUG 16	MF
3	ISSUED FOR SOLID CASE	25 JUL 16	JU

FORTIS BC

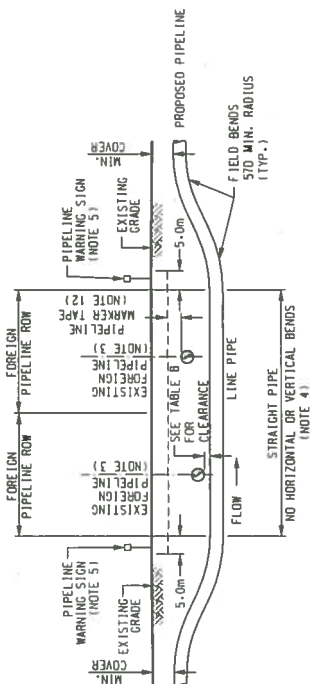
LOWER MAINLAND IP SYSTEM UPGRADE PROJECT
CROSSING UNDER FOREIGN PIPELINE
TYPICAL STANDARD DRAWING

NAME: L. SWI	CHECKED: K. LLE	APPROVED: J. K. KIRK
DATE: 18 JUN 16	SCALE: HTS	APPROVED: S. BEN-ABDALLAH
ROUTING NO.		SCALE NO.
407016-00212-01-PL-DST-0052		47

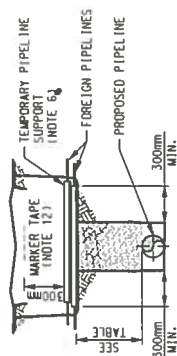
OWNER	CONSTRUCTION METHOD	HORIZONTAL CLEARANCE (mm) [MIN.]	VERTICAL CLEARANCE (mm) [MIN.]
CITY OF VANCOUVER	CONVENTIONAL OPEN CUT	1000	500
	JACKING DR BORING	1000	600
	CONVENTIONAL OPEN CUT	180	180
CITY OF BURBURY	JACKING DR BORING	180	180
	CONVENTIONAL OPEN CUT	180	500
	JACKING DR BORING	1200	500
CITY OF COQUITLAM	CONVENTIONAL OPEN CUT	180	180
	JACKING DR BORING	1200	500
	CONVENTIONAL OPEN CUT	300	300
OTHER	JACKING DR BORING	600	600

NOTES:

1. CONSTRUCT AND MAINTAIN THE CROSSING IN ACCORDANCE WITH CSA T662 AND ALL APPLICABLE PROVINCIAL REGULATIONS, MUNICIPAL REQUIREMENTS, CROSSING APPROVAL CONDITIONS AND CONTRACT DOCUMENTS, FORTISBC STANDARDS AND FORTISBC CONSTRUCTION SPECIFICATIONS.
2. NOTIFY THE FOREIGN COMPANY THAT OWNS THE EXISTING FACILITY AS SPECIFIED IN THE CROSSING AGREEMENT, ALLOWING THE AUTHORITY TO SEND A REPRESENTATIVE TO THE SITE DURING EXCAVATION AND CONSTRUCTION OF THE CROSSING.
3. DETERMINE THE PIPELINE CROSSING LOCATION AND DEPTH BEFORE THE PIPELINE. CONFIRM THE PIPELINE LOCATION BY CAREFUL HAND OR "HYDRO VAC" EXPOSURE.
4. MAINTAIN STRAIGHT PIPE FOR THE FULL WIDTH OF FOREIN PIPELINE ROW WHILE MAINTAINING A MINIMUM CLEARANCE PER THE VALUE FROM TABLE B. CONFIRM CLEARANCE WITH FOREIN PIPELINE COMPANY DURING CROSSING AGREEMENT. IF THE CLEARANCES IN TABLE B ARE NOT POSSIBLE TO OBTAIN, APPROVAL FROM THE ENGINEER ON RECORD MUST BE OBTAINED. RESULT FROM PROXIMITY FROM OTHER UNDERGROUND FACILITIES.
5. INSTALL PIPELINE WARNING SIGNS AS DIRECTED BY CONSTRUCTION MANAGER. REFER TO FORTISBC DRAWING 9000-0-100-100-RD FOR DETAILS.
6. TEMPORARILY SUPPORT THE FOREIN PIPELINE AS REQUIRED BY THE FOREIN PIPELINE COMPANY.
7. REMOVE TEMPORARY SUPPORT(S) AFTER CONSTRUCTION OF CROSSING.
8. HAVE THE SIGNED COPY OF THE CROSSING AGREEMENT ON SITE.
9. ALL DEPTHS OF COVER APPLY FROM SUBSOIL ELEVATION.
10. INSTALL TEST LEAD IF REQUIRED BY FOREIN PIPELINE COMPANY .
11. USE VEHICLE CROSSING PROTECTION FOR ACCESS OVER FOREIN PIPELINE DURING THE CONSTRUCTION PERIOD.
12. SUPPLY AND INSTALL PIPELINE MARKER TAPE TAPE IN ACCORDANCE WITH TYPICAL DWG. 9000-0-100-0-151-001.
13. EXCEED PROTECTIONS OF THIS DRAWING.
14. THIS DRAWING IS APPLICABLE FOR BOTH COMUTIAM IP & FRASER IP LINES., AND THE COMUTIAM IP LATRALS.



PROFILE OF FOREIGN PIPELINES



SECTION THROUGH PIPELINE TRENCH

PIPE SPECIFICATION - TABLE A

PIPE SEGMENT	PIPE TYPE	PIPE SIZE mm	OD	WT mm	PIPE SPECIFICATION		PIPE COATING	CATHODIC PROTECTION
					API	ASTM		
COGULITUM TP AND LATERALS	LINE PIPE	NPS 30	762	9.5	CSA Z245-1	GR 414 C11 DR API 5L CR 360 PSL 2	FBE	YES
	LINE PIPE	NPS 30	762	9.5	CSA Z245-1	GR 414 C11 DR API 5L CR 360 PSL 2	FBE	YES
COGULITUM ID	LINE PIPE	NPS 30	762	9.5	CSA Z245-1	GR 414 C11 DR API 5L CR 360 PSL 2	FBE	YES

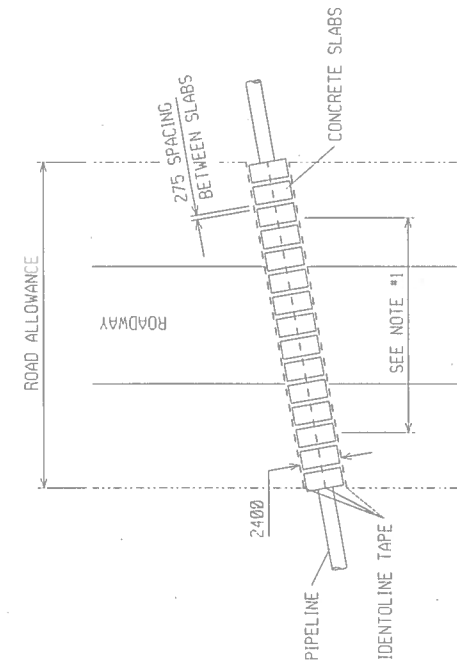
ISSUED FOR REVIEW
201610231



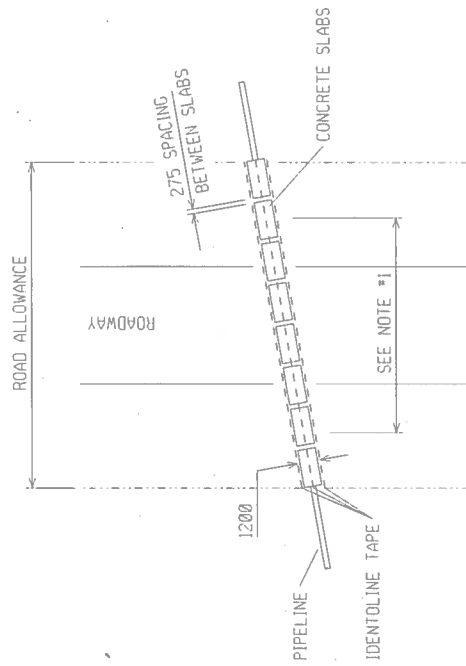
²² This drawing is prepared solely for the use of the contracted customer of *Interperson Canada Services Ltd* and *Interperson Canada Services Ltd* assumes no liability to any other party for any representation contained in this drawing.

13. NUMBER FOR REVIEW		14. DATE	15. BY
16. REVIEWER'S SIGNATURE		17. DATE	18. BY
19. NUMBER FOR STATUS CHECK		20. DATE	21. BY
22. REVIEWER'S SIGNATURE		23. DATE	24. BY
25. REVIEWER'S DESCRIPTION		26. REVIEWER'S APPROVAL	

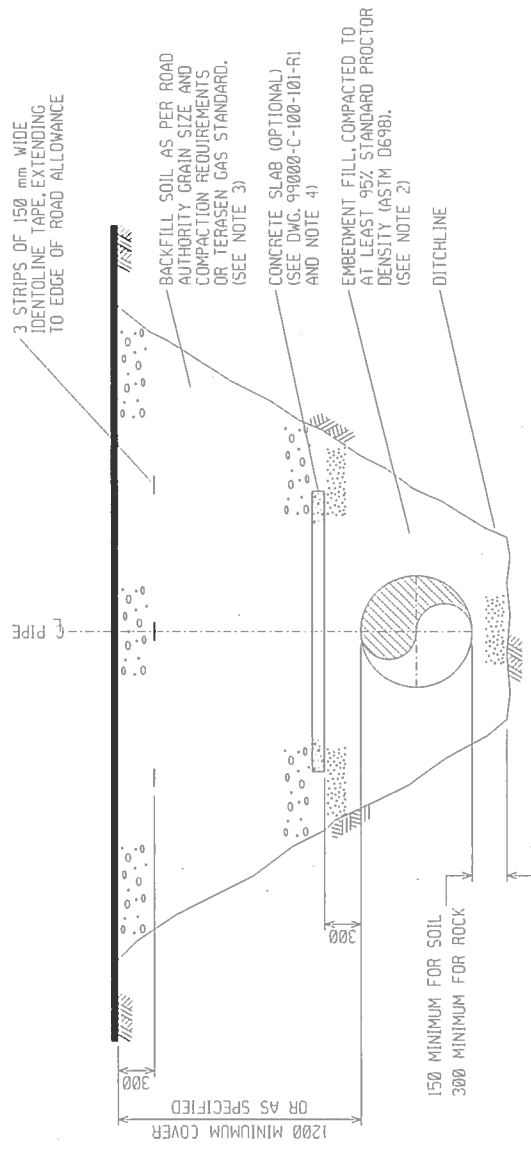
27. COMMENTS: This drawing is for the project's use and is not to be reproduced without the project manager's written approval. This drawing is for the project's use and is not to be reproduced without the project manager's written approval.



FOR 406 mm O.D. AND GREATER PIPELINES



FOR 324 mm O.D. AND SMALLER PIPELINES



TYPICAL TRENCH CROSS-SECTION

NOTES:

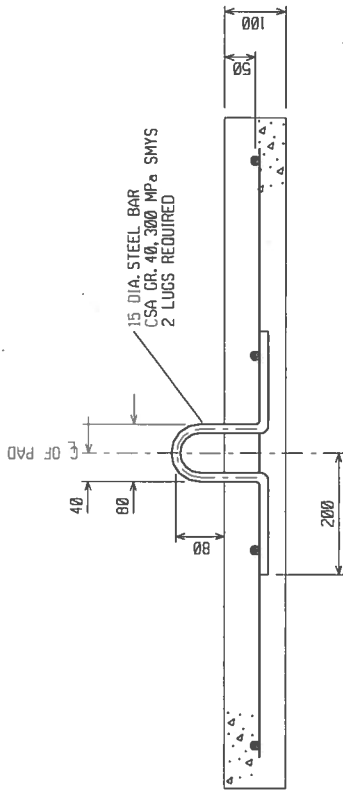
1. COMPACTED SELECT EMBEDMENT SOIL AND BACKFILL SHALL EXTEND Laterally BEYOND THE TRAVELLED PORTION OF THE ROAD TO AT LEAST THE INVERT OF THE ROAD DITCHES OR A DISTANCE EQUAL TO THE THICKNESS OF SOIL COVER OVER THE PIPE, WHICHEVER IS GREATEST.
2. EMBEDMENT SOIL SHALL CONSIST OF SELECT SAND WITH < 5% SILT CONTENT (PARTICLES FINER THAN 0.075 mm) COMPACTED TO AT LEAST 95% STANDARD PROCTOR DENSITY (ASTM D698) FOR ITS FULL THICKNESS. ALTERNATIVE EMBEDMENT SOIL MAY BE USED PROVIDED IT IS DETERMINED TO BE COMPATIBLE WITH THE PIPE COATING AND APPROVED BY A QUALIFIED BC GAS PROFESSIONAL ENGINEER PRIOR TO PLACEMENT.
3. BACKFILL SOIL SHALL MEET ROAD AUTHORITY GRAIN SIZE AND COMPACTION REQUIREMENTS OR TERASEN GAS STANDARD. TERASEN GAS STANDARD SHALL CONSIST OF 75 mm MINUS PITRUN SAND AND GRAVEL WITH < 5% SILT CONTENT (PARTICLES FINER THAN 0.075 mm) COMPACTED TO AT LEAST 98% STANDARD PROCTOR DENSITY (ASTM D698) FOR ITS FULL THICKNESS.
4. TOP OF SLAB SHOULD NOT APPEAR ABOVE THE INVERT OF ANY UTILITY WHICH CROSSES ABOVE THE PIPELINE.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
6. THIS DRAWING SHOULD NOT BE USED FOR THE PURPOSE OF MATERIAL QUANTITY ESTIMATES.

NOTE:

INTENDED FOR TRANSMISSION PRESSURE PIPELINES ONLY

OLD DWG. No. 90000-C-000-011-3-0

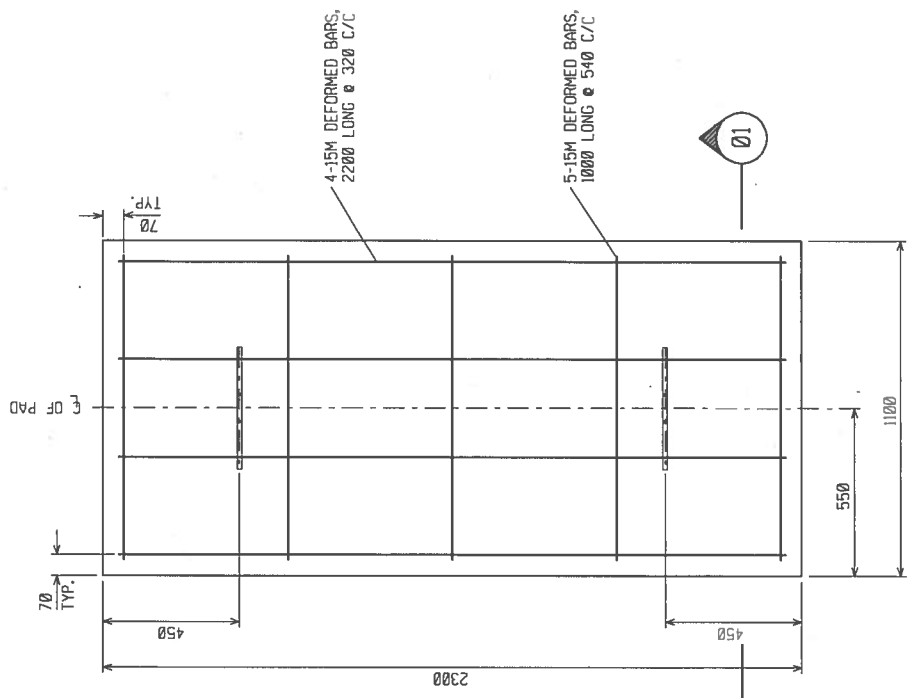
				CORPORATE			
				DRAWING SIGNED AND SEALED BY A.J. MITCHELL, P. ENG. 2004/0705			
				STANDARD OPEN-CUT ROAD CROSSING DETAILS			
				DRAWING NUMBER 99000-C-100-100-R2			
				ENGINEER SEAL			
				TERASEN Gas			
				A. MITCHELL			
				03-03-12			
				A. MITCHELL			
				03-06-27			
				CHECKED			
				DATE (YY-MM-DD)			
				SCALE - N.T.S.			
				MICROFILMED			
				DESIGNED			
				DRAWN			
				SAP ID:			
				REVISION			
				ADDED NOTE 6 CHANGED TITLE			
				SIGNED			
				SIGNED			
				BY			
				No.			
				PREVIOUS DR. NO. -			



Ø1


NOTES:

1. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 25 MPa AT 28 DAYS.
2. APPROXIMATE WEIGHT: 600 kg (1325 LB.)
3. OVERALL MEASUREMENTS MAY CHANGE DEPENDING ON SUPPLIER.
4. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.



PLAN

OLD DWG. No. CB-8865 AND
90000-C-000-012-3-0

CORPORATE										DRAWING SIGNED AND SEALED BY A.J. MITCHELL, P. ENG. 2004/07/05										DRAWING NUMBER 99000-C-100-101-R2									
										ENGINEER SEAL																			

Appendix E

**FEI IFC DRAWING – TYPICAL TRENCH CROSS SECTION
DRAWING**

Appendix F

APRIL 24, 2017 CITY 90 PERCENT REVIEW COMMENTS

From: Braley, Chad <cbraley@coquitlam.ca>
Sent: Monday, April 24, 2017 2:08 PM
To: Cardona, Marie (Vancouver)
Cc: DiPlacito, Joe (Vancouver)
Subject: RE: 90% Drawings for Fortis IP - Comments - Status?

Hi Marie,

Sorry for the delay in providing comments. The City has reviewed the provided 90% drawings and have the following comments:

General

- Restoration of Como Lake Avenue – it is our position that all 4 lanes will need to be repaved considering the impacts of the installation of the 30" gas line, replacement of water services and other utilities, and the decommissioning of the existing 20" gas line. We ask that the project include full width repaving of Como Lake Avenue.
- Provide details on the decommissioning of the existing gas main noting that the City of Coquitlam would like to see the existing gas main removed from the Como Lake Corridor once the new main has been put into service.

Poirier Street

- Due to the condition of the existing asphalt the City requires that once the construction has occurred the road should be milled 50mm and repaved from the west gutter to the centre of the road.
- A note should be put on the drawing indicating that the traffic signal infrastructure and City communication conduit must be field located to ensure there aren't any conflicts.

Robinson Street

- Due to the condition of the existing asphalt the City requires that once the construction has occurred the road should be milled 50mm and repaved from the west gutter to the centre of the road.
- Traffic signal loops at the Robinson/Como Lake intersection will be impacted by the proposed works. Traffic operations must be contacted before the loops are cut and to arrange the reinstallation (at FortisBC's expense).
- All lane and traffic control markings must be reinstated once the final lift of asphalt has been placed.
- The existing watermain on Robinson Street extends to Clarke and should be shown on the drawings to ensure there aren't any conflicts.

Como Lake Avenue

- As per previous discussions the drawings should detail cast iron watermain crossing which are required to be replaced with ductile iron. A standard crossing detail should be provided on the drawing.
- Provide construction note indicating that any copper water services cut to accommodate the construction must be replaced from the watermain to the curb stop at property line. The City requires that all copper water services are installed in one continuous piece.
- Pavement restoration drawings should be provided.
- Details showing the islands to be removed and replaced as part of the construction must be provided.
- The locations of traffic signal and communication duct being crossed will have to be field located to ensure there aren't any conflicts.

- Separate engineering drawings must be provided for any City infrastructure having to be relocated to accommodate the construction.
- For trenchless crossings the anticipated width and length of the entry and existing pits should be shown on the drawings as this will impact the amount of restoration required.
- Can the alignment be shifted slight to the south, near Longlac to provide additional separation from the sanitary main?
- Not all of the existing utilities are shown on page 18/94.
- Try to shift alignment south, west of Hailey to Banting to provide additional separation from the 600mm diameter storm sewer.
- The existing watermain west of Clarke Road is in conflict with the gas line. Provide drawings detailing the relocation.

Please let me know if you have any questions regarding the above information.

Thanks

Chad Braley, ASCT
 Manager, Capital Projects and Inspections
 Engineering & Public Works Department
 City of Coquitlam
 3000 Guildford Way, Coquitlam, BC V3B 7N2

Tel(604) 927-3513 Fax(604) 927-3505
 email cbraley@coquitlam.ca

From: Cardona, Marie (Vancouver) [<mailto:MARIE.CARDONA@advisian.com>]
Sent: Thursday, April 13, 2017 10:35 AM
To: Braley, Chad
Cc: DiPlacito, Joe (Vancouver)
Subject: 90% Drawings for Fortis IP - Comments - Status?

Hi Chad,

Just wanted to check on the status of the 90% drawing review. Will we be receiving them this week?

Thanks!
 Marie

From: Cardona, Marie (Vancouver)
Sent: March-23-17 5:54 PM
To: 'Braley, Chad'
Cc: DiPlacito, Joe (Vancouver)
Subject: RE: 90% Drawings for Fortis IP - Comments

Okay thank you Chad. Anything that can be done to expedite comments would be greatly appreciated as we are finalizing our IFBs now. ☺

From: Braley, Chad [<mailto:cbraley@coquitlam.ca>]
Sent: March-23-17 5:22 PM
To: Cardona, Marie (Vancouver)
Subject: RE: 90% Drawings for Fortis IP - Comments

Hi Marie,

I should have comments for you by the middle of next week. With spring break we have had a few staff members away.

Thanks

Chad Braley, ASCT
Manager, Capital Projects and Inspections
Engineering & Public Works Department
City of Coquitlam
3000 Guildford Way, Coquitlam, BC V3B 7N2

Tel(604) 927-3513 Fax(604) 927-3505
email cbraley@coquitlam.ca

From: Cardona, Marie (Vancouver) [<mailto:MARIE.CARDONA@advisian.com>]
Sent: Tuesday, March 21, 2017 1:50 PM
To: Braley, Chad
Subject: 90% Drawings for Fortis IP - Comments

Hi Chad,

Just following up on our 90% meeting on March 7th – can we expect to receive your formal comments on our 90% design package this week?

Thanks!
Marie

Marie Cardona
Regulatory and Permitting Advisor

Suite 500, Willingdon Park Phase 6, 4321 Still Creek Drive | Burnaby BC V5C 6S7
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*** Advisian Notice *** "This email is confidential. If you are not the intended recipient, you must not disclose or use the information contained in it. If you have received this email in error, please notify us immediately by return email and delete the email and any attachments. Any personal views or opinions expressed by the writer may not necessarily reflect the views or opinions of any company in the WorleyParsons Group of Companies.

Appendix G

ESTIMATED COST ESTIMATES

FEI LMIPSU
 COQUITLAM S. 32 / 33 APPLICATION
 PHASE 2: REMOVAL OF 5.5 KILOMETERS

1 Coquitlam Distance km.	5.5	
2 Estimated Installed Cost through Coquitlam	\$ 25,100,000	2018\$
3 Distance of Pipe to be Removed	5,500 metres	
4 Estimated Installed Cost for 5.5 km	\$ 25,100,000	2018\$
5 Bank of Canada Inflation Calculator	\$ 2,816,006	1957\$
6 Municipality Contribution	Removal Cost - [2% x Estimate of Original Cost x (Year of Removal - Original Year)]	
7 Expected Removal Cost	\$ 77,528,503	
8 Expected Year of Removal	2024	
9 Original Year of Installation	1957	
10 Difference	67	
11 Estimate of Original Cost using Bank of Canada	\$ 2,816,006	
12 FEI's Allocation of Removal Costs	\$ 3,773,448	Line 11 x 2% x Line 10
13 Coquitlam's Portion of Removal Costs	\$ 73,755,055	Line 7 - Line 12



Inflation Calculator

About the Calculator

The Inflation Calculator uses monthly consumer price index (CPI) data from 1914 to the present to show changes in the cost of a fixed "basket" of consumer purchases. These include food, shelter, furniture, clothing, transportation, and recreation. An increase in this cost is called inflation.

The calculator's results are based on the most recent month for which the CPI data are available. This will normally be about two months prior to the current month.

How to Use the Calculator

Enter any dollar amount, and the years you wish to compare, then click the **Calculate** button.

YEARS MUST BE IN THE RANGE 1914 - 2018. COMMAS AND SPACES CAN BE USED IN THE DOLLAR AMOUNT.

A "basket" of goods and services

...that cost:

\$ 25,100,000.00 in 2018

...would cost:

\$ 2,816,005.98 in 1957

Per cent change:

-88.78

Number of Years:

-61

Average Annual Rate of Inflation (%) / Decline in the Value of Money:

-3.52

CPI for first year:

(Sep 2018) 133.7

CPI for second year:

(Sep 1957) 15.0

2002 CPI = 100.0

Data Source: Statistics Canada, CONSUMER PRICE INDEXES FOR CANADA, MONTHLY (V41690973 series.)

Related Page

[Investment Calculator](#)

The Investment Calculator shows the effects of inflation on investments and savings.

FEI LMIPSU
 COQUITLAM S. 32 / 33 APPLICATION
 PHASE 2: REMOVAL OF 380 METERS

1	Coquitlam Distance km.	5.5	
2	Estimated Installed Cost through Coquitlam	\$ 25,100,000	2018\$
3	Distance of Pipe to be Removed	380 metres	
4	Estimated Installed Cost for 380 meters	\$ 1,734,182	2018\$
5	Bank of Canada Inflation Calculator	\$ 194,560	1957\$
6	Municipality Contribution	Removal Cost - [2% x Estimate of Original Cost x (Year of Removal - Original Year)]	
7	Expected Removal Cost	\$ 9,400,529	
8	Expected Year of Removal	2021	
9	Original Year of Installation	1957	
10	Difference	64	
11	Estimate of Original Cost using Bank of Canada	\$ 194,560	
12	FEI's Allocation of Removal Costs	\$ 249,037	Line 11 x 2% x Line 10
13	Coquitlam's Portion of Removal Costs	\$ 9,151,492	Line 7 - Line 12



Inflation Calculator

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The Inflation Calculator uses monthly consumer price index (CPI) data from 1914 to the present to show changes in the cost of a fixed "basket" of consumer purchases. These include food, shelter, furniture, clothing, transportation, and recreation. An increase in this cost is called inflation.

The calculator's results are based on the most recent month for which the CPI data are available. This will normally be about two months prior to the current month.

How to Use the Calculator

Enter any dollar amount, and the years you wish to compare, then click the **Calculate** button.

YEARS MUST BE IN THE RANGE 1914 - 2018. COMMAS AND SPACES CAN BE USED IN THE DOLLAR AMOUNT.

A "basket" of goods and services

...that cost:

\$ 1,734,182.00 in 2018

...would cost:

\$ 194,560.43 in 1957

Per cent change:

-88.78

Number of Years:

-61

Average Annual Rate of Inflation (%) / Decline in the Value of Money:

-3.52

CPI for first year:

(Sep 2018) 133.7

CPI for second year:

(Sep 1957) 15.0

2002 CPI = 100.0

Data Source: Statistics Canada, CONSUMER PRICE INDEXES FOR CANADA, MONTHLY (V41690973 series.)

Related Page

[Investment Calculator](#)

The Investment Calculator shows the effects of inflation on investments and savings.

FEI LMIPSU
 COQUITLAM S. 32 / 33 APPLICATION
 PHASE 2: REMOVAL OF 5.5 KILOMETERS

1 Coquitlam Distance km.	5.5	
2 Estimated Installed Cost through Coquitlam	\$ 14,100,000	2018\$
3 Distance of Pipe to be Removed	5,500 metres	
4 Estimated Installed Cost for 5.5 km	\$ 14,100,000	2018\$
5 Bank of Canada Inflation Calculator	\$ 1,581,900	1957\$
6 Municipality Contribution	Removal Cost - [2% x Estimate of Original Cost x (Year of Removal - Original Year)]	
7 Expected Removal Cost	\$ 77,528,503	
8 Expected Year of Removal	2024	
9 Original Year of Installation	1957	
10 Difference	67	
Estimate of Original Cost using Bank of Canada		
11 Inflation Calculator	\$ 1,581,900	
12 FEI's Allocation of Removal Costs	\$ 2,119,746	
13 Coquitlam's Portion of Removal Costs	\$ 75,408,757	



Inflation Calculator

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The Inflation Calculator uses monthly consumer price index (CPI) data from 1914 to the present to show changes in the cost of a fixed "basket" of consumer purchases. These include food, shelter, furniture, clothing, transportation, and recreation. An increase in this cost is called inflation.

The calculator's results are based on the most recent month for which the CPI data are available. This will normally be about two months prior to the current month.

How to Use the Calculator

Enter any dollar amount, and the years you wish to compare, then click the **Calculate** button.

YEARS MUST BE IN THE RANGE 1914 - 2018. COMMAS AND SPACES CAN BE USED IN THE DOLLAR AMOUNT.

A "basket" of goods and services

...that cost:

\$ 14,100,000.00 in 2018

...would cost:

\$ 1,581,899.78 in 1957

Per cent change:

-88.78

Number of Years:

-61

Average Annual Rate of Inflation (%) / Decline in the Value of Money:

-3.52

CPI for first year:

(Sep 2018) 133.7

CPI for second year:

(Sep 1957) 15.0

2002 CPI = 100.0

Data Source: Statistics Canada, CONSUMER PRICE INDEXES FOR CANADA, MONTHLY (V41690973 series.)

Related Page

Investment Calculator

The Investment Calculator shows the effects of inflation on investments and savings.

FEI LMIPSU
 COQUITLAM S. 32 / 33 APPLICATION
 PHASE 2: REMOVAL OF 380 METERS

1	Coquitlam Distance km.	5.5	
2	Estimated Installed Cost through Coquitlam	\$ 14,100,000	2018\$
3	Distance of Pipe to be Removed	380 metres	
4	Estimated Installed Cost for 380 meters	\$ 974,182	2018\$
5	Bank of Canada Inflation Calculator	\$ 109,295	1957\$
6	Municipality Contribution	Removal Cost - [2% x Estimate of Original Cost x (Year of Removal - Original Year)]	
7	Expected Removal Cost	\$ 9,400,529	
8	Expected Year of Removal	2021	
9	Original Year of Installation	1957	
10	Difference	64	
	Estimate of Original Cost using Bank of Canada		
11	Inflation Calculator	\$ 109,295	
12	FEI's Allocation of Removal Costs	\$ 139,898	Line 11 x 2% x Line 10
13	Coquitlam's Portion of Removal Costs	\$ 9,260,632	Line 7 - Line 12



Inflation Calculator

About the Calculator

The Inflation Calculator uses monthly consumer price index (CPI) data from 1914 to the present to show changes in the cost of a fixed "basket" of consumer purchases. These include food, shelter, furniture, clothing, transportation, and recreation. An increase in this cost is called inflation.

The calculator's results are based on the most recent month for which the CPI data are available. This will normally be about two months prior to the current month.

How to Use the Calculator

Enter any dollar amount, and the years you wish to compare, then click the **Calculate** button.

YEARS MUST BE IN THE RANGE 1914 - 2018. COMMAS AND SPACES CAN BE USED IN THE DOLLAR AMOUNT.

A "basket" of goods and services

...that cost:

\$ 974,182.00 in 2018

...would cost:

\$ 109,294.91 in 1957

Per cent change:

-88.78

Number of Years:

-61

Average Annual Rate of Inflation (%) / Decline in the Value of Money:

-3.52

CPI for first year:

(Sep 2018) 133.7

CPI for second year:

(Sep 1957) 15.0

2002 CPI = 100.0

Data Source: Statistics Canada, CONSUMER PRICE INDEXES FOR CANADA, MONTHLY (V41690973 series.)

Related Page

[Investment Calculator](#)

The Investment Calculator shows the effects of inflation on investments and savings.

		2021				2022				2023				2024	
	Total	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter
Spend Profile in 2018\$	\$ 60,375,000	\$ 439,394	\$ 439,394	\$ 878,788	\$ 878,788	\$ 878,788	\$ 878,788	\$ 878,788	\$ 878,788	\$ 439,394	\$ 11,415,470	\$ 14,269,338	\$ 14,269,338	\$ 439,394	\$ 439,394
Escalation Factor	4.50%	1.105927893	1.118369582	1.130951239	1.143674441	1.156540778	1.169551862	1.18270932	1.1960148	1.209469967	1.223076504	1.236836115	1.250750521	1.264871464	1.279002011
Spend Profile in As-Spent		\$ 485,938	\$ 491,405	\$ 993,866	\$ 1,005,047	\$ 1,016,354	\$ 1,027,788	\$ 1,039,351	\$ 525,522	\$ 13,806,668	\$ 17,452,492	\$ 17,648,833	\$ 17,847,382	\$ 555,755	\$ 555,755
Opening Balance		\$ -	\$ 489,347	\$ 991,066	\$ 2,005,811	\$ 3,046,054	\$ 4,112,279	\$ 5,204,979	\$ 6,324,655	\$ 6,942,608	\$ 20,943,555	\$ 38,812,357	\$ 57,129,603	\$ 75,903,808	\$ 75,903,808
Capital Spend	\$ 73,896,401	485,938	491,405	993,866	1,005,047	1,016,354	1,027,788	1,039,351	525,522	13,806,668	17,452,492	17,648,833	17,847,382	555,755	555,755
AFUDC Rate															
AFUDC	\$ 3,632,102	3,409	10,314	20,879	35,196	49,871	64,912	80,325	92,431	194,279	416,310	668,413	976,824	1,068,940	1,068,940
Closing Balance	77,528,503	\$ 489,347	\$ 991,066	\$ 2,005,811	\$ 3,046,054	\$ 4,112,279	\$ 5,204,979	\$ 6,324,655	\$ 6,942,608	\$ 20,943,555	\$ 38,812,357	\$ 57,129,603	\$ 75,903,808	\$ 77,528,503	\$ 77,528,503

	Total	2019				2020				2021			
		1st Quarter 1	2nd Quarter 2	3rd Quarter 3	4th Quarter 4	1st Quarter 5	2nd Quarter 6	3rd Quarter 7	4th Quarter 8	1st Quarter 9	2nd Quarter 10	3rd Quarter 11	4th Quarter 12
Spend Profile in 2018\$	\$8,062,499	\$ -	\$ 72,115	\$ 144,231	\$ 144,231	\$ 159,856	\$ 376,202	\$ 3,132,452	\$ 3,132,452	\$ 72,115	\$ 378,365	\$ 378,365	\$ 72,115
Escalation Factor	4.50%	1.01125	1.02262656	1.034131111	1.045765086	1.057529944	1.069427155	1.081458211	1.093624616	1.105927893	1.118369582	1.130951239	1.143674441
Spend Profile in As-Spent	\$	\$ -	\$ 73,747	\$ 149,154	\$ 150,832	\$ 169,053	\$ 402,321	\$ 3,387,616	\$ 3,425,727	\$ 79,754	\$ 423,152	\$ 427,912	\$ 82,476
Opening Balance	\$	\$ -	\$ -	\$ 74,264	\$ 225,506	\$ 380,560	\$ 556,139	\$ 969,085	\$ 4,394,066	\$ 7,905,481	\$ 8,096,720	\$ 8,636,450	\$ 9,188,546
Capital Spend	8,771,742	-	73,747	149,154	150,832	169,053	402,321	3,387,616	3,425,727	79,754	423,152	427,912	82,476
AFUDC Rate	5.61%	-	-	-	-	-	-	-	-	-	-	-	-
AFUDC	628,787	-	517	2,088	4,222	6,526	10,626	37,364	85,689	111,485	116,577	124,184	129,507
Closing Balance	9,400,529	\$ -	\$ 74,264	\$ 225,506	\$ 380,560	\$ 556,139	\$ 969,085	\$ 4,394,066	\$ 7,905,481	\$ 8,096,720	\$ 8,636,450	\$ 9,188,546	\$ 9,400,529