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August 23, 2017

Industrial Customers Group
c/o #301 – 2298 McBain Avenue
Vancouver, BC
V6L 3B1

Attention: Mr. Robert Hobbs

Dear Mr. Hobbs:

Re: FortisBC Inc. (FBC)

Project No. 1598911

Application for Community Solar Pilot Project

Response to the Industrial Customers Group (ICG) Information Request (IR) No. 2

On April 26, 2017, FBC filed the Application referenced above. In accordance with the British Columbia Utilities Commission Order G-114-17 setting out the Amended Regulatory Timetable for the review of the Application, FBC respectfully submits the attached response to ICG IR No. 2.

If further information is required, please contact Corey Sinclair at 250-469-8038.

Sincerely,

FORTISBC INC.

Original signed:

Diane Roy

Attachments

cc (email only): Commission Secretary
Registered Parties

1. Reference: Exhibit B-2, BCUC IR 1.1.2 and BCUC IR 1.9.7; Exhibit B-5, ICG 1.3.1

"However, due to timing, the CSPP was not included in the recommended resource portfolio contained in the Company's most recent Long-Term Electric Resource Plan (LTERP)."

"If the CSPP had to be considered within the criteria used in the LTERP to select the optimal set of resources to meet FBC's load, it would not be built."

"As such the resource evaluation principles of the FBC LTERP do not apply to the pilot project as this is not for general utility supply."

1.1 Please confirm that FortisBC considered solar energy as a resource option, albeit not in the recommended resource portfolio, at the time the LTERP was filed?

Response:

Confirmed. Solar is presented as a resource option in Section 8 of the LTERP and is described in further detail in the Resource Options Report, Section 3.3.3 of Appendix J.

1.2 If yes, please confirm that at the time the LTERP was filed, FortisBC expected that it would purchase solar energy if solar energy had been in the recommended resource portfolio?

Response:

Not confirmed. The purpose of the recommended resource portfolio in the 2016 LTERP is not to select resources that the Company expects to acquire, but to select an appropriate set of resources representing a portfolio that the Company could potentially acquire over time to meet potential future needs. Any individual resource within that portfolio must still be considered in light of FBC's actual requirements for additional resources. Therefore, even if portfolio C4, which dispatches solar in 2035, were to be the recommended resource portfolio, it would still be inappropriate to acquire that solar resource in 2017, well in advance of 2035 when it could potentially be needed.

The Company did not include obtaining any generation, even from those sources in the recommended resource portfolio, in the Action Plan found in Section 11 of the LTERP. The conclusion of the LTERP is that no new resources are needed at this time. As given in action item 3, FBC will continue to assess the Load Resource Balance on a periodic basis to see if any changes in resources might be required.

1.3 Please identify the criteria relevant to the CSPP that were used in the LTERP to select the optimal set of resources?

Response:

This question is quite broad considering that the primary purpose of the LTERP in its entirety is to evaluate supply scenarios composed of a set of varying resources. The attributes of each source of supply are discussed in Section 8.2.2 of the LTERP and are:

- The Technical Attributes;
- The Financial Attributes;
- The Environmental Attributes; and
- The Socio-Economic Attributes.

All of these criteria are relevant to the CSPP but not in the same way as they are used in the LTERP. In the LTERP they are used to evaluate the best resource options to meet general utility supply. However, the purpose of the CSPP is to gauge the interest in community solar, not to choose between competing resources.

Therefore, while the CSPP considers such attributes to answer questions such as where should a project be located or what should a project size be, they are not used to choose between this particular solar offering or an alternative form of generation. The CSPP, as a customer offering, is not directly relevant to the determination of resources, which is properly part of the LTERP.

1.4 Please explain that in FBC's opinion the criteria used in the LTERP to select the optimal set of resources to meet FBC's load do not apply to the CSPP and would apply to purchases from an identical solar energy facility constructed, operated and installed by a third party??

Response:

The criteria used in the LTERP do not apply in the same manner for the CSPP since the purpose of the CSPP is to gauge customer interest in a solar based offering, whereas power received from an identical solar energy facility constructed, operated and installed by a third party would be for general utility supply. Please refer to the response to ICG IR 2.1.3.

2. Reference: Exhibit B-2, BCUC IR 1.1.4

"While a competitive market exists for the construction and operation of generation facilities of all types,…."

2.1 Please confirm that in FortisBC's opinion a competitive market exists for the construction, operation and ownership of the CSPP?

Response:

Not confirmed. Please refer to the responses to ICG IRs 1.3.1, 1.3.3, 1.3.6, 1.3.7, 1.3.8 and 1.3.10, as well as the full sentence from which the words quoted in ICG IR 2.2.1 are taken:

> While a competitive market exists for the construction and operation of generation facilities of all types there is no reasonable prospect of a competitive alternative to the utility-customer relationship typified by the existing manner in which energy is produced and delivered to the retail customers of FBC, whether from existing resources or the addition of new resources, solar or otherwise.

The solar installation that FBC proposes in this Application is part of the generation, transmission and distribution system operated by FBC to offer 24/7 service to FBC end-use customers in FBC's service territory. There is not a competitive market in this regard in relation to the operation and ownership of the service.

With respect to specifically the *installation (*or construction) of the solar facility proposed in FBC's Application, as described on page 6 of the Application, FBC initiated a Request for Proposals (RFP) process to solicit bids from experienced solar PV contractors for the CSPP. FBC received proposals from three vendors and selected Skyfire Energy Inc. as the most experienced and lowest cost vendor. In that respect, there was competition.

2.2 Please comment on whether government policies have in the past determined whether utilities or participants in a competitive market have constructed and operated generation facilities?

In particular, have government policies directed that all new generation be constructed and operated by participants in a competitive market and that utilities investments, or at the very least BC Hydro investments, be restricted to upgrades to existing generation facilities?

Response:

This is a very broad question. The construction and operation of particular generation facilities have been informed by various factors which may vary by project, utility or other participant.

With respect to the particular question in the second paragraph of ICG IR 2.2.2, FBC assumes that this is intended to reflect Policy Action #13 from the BC Government's 2002 Energy Plan, "The private sector will develop new electricity generation, with BC Hydro restricted to improvements at existing plants."

This policy action was not repeated in the 2007 Energy Plan and was not reflected in subsequent policy, including the Site C initiative.

With respect to Policy Action #13 itself, FBC is a public utility but also a privately owned company. Policy Action #13 therefore did not serve as a restriction on it in any respect.

Further, Policy Action #13 was directed toward the development of IPP generation resources. The end-to-end service provided by FBC (and reflected in the CSPP) is an entirely different proposition than that contemplated by the 2002 Energy Plan, just as the transmission, distribution, and customer service functions of BC Hydro were not intended to be impacted by the policy direction that it contained.

2.3 If so, please comment on whether the same government policy would apply to the CSPP?

Response:

Please refer to the responses to ICG IRs 2.2.1 and 2.2.2. The Policy Action from the 2002 Energy Plan was not carried forward in the 2007 Energy Plan, was specific to the development of IPP generation only and applied only to BC Hydro. It does not apply to the CSPP.

2.4 Please comment on whether government policy support for IPPs has been a significant driver of the success of the IPP community in BC?

Response:

Government policy support for IPPs has contributed to the development of IPPs. The success of IPPs in BC has been dependent on numerous factors, of which one is government policy.

3. Reference: Exhibit B-2, BCUC IR 1.11.1

http://www.nrel.gov/docs/fy12osti/51664.pdf, pp. 16-17

"The average service life of 40 years for the solar PV panels was determined based on a published research on the degradation rate of photovoltaic modules and system3 completed by the National Renewable Energy Laboratory (NREL), which is a national laboratory of the US Department of Energy."

"A history of degradation rates using field tests reported in the literature during the last 40 years has been summarized."

"Finally, there may now be cumulative field experience to support long-term warranties, both because there are now products in the field for more than 25 years and because the average degradation rate still allows reasonable performance after 25 years."

3.1 Please identify where, in the referenced report, it states that a 40 year average service life is a reasonable assumption?

Response:

As discussed in the response to BCUC IR 1.11.1, the average service life of 40 years was determined based on the degradation rate of panels documented in the NREL report. Figure 5 of the NREL report (page 9) shows monocrystalline silicon (mono-Si) panels, which is the silicon technology proposed for the Project, has an average degradation rate of 0.5 percent per year. Furthermore, the authors of the NREL report consider failure occurs when the output of the solar panels is declined by more than 20 percent as seen in the Introduction of their report (page 1). Given an average degradation rate of 0.5 percent per year, the failure point of 20 percent output decline is expected to be reached before the 41st year, therefore, the average service life assumption of 40 years for the Project is considered to be reasonable. As indicated in the response to BCUC IR 1.11.1, the Project is a pilot and the degradation rate under the local environment will be monitored closely.

3.2 As the referenced report appears to be 5 years old, please provide more current references regarding the expected service life of the project's components.

Response:

A recent research article by NREL in 2016[1], published in the scientific journal of Progress in Photovoltaics by John Wiley & Sons (Wiley), found that solar panel modules made with

[1] D. C. Jordan et al, "Compendium of photovoltaic degradation rates", Progress in Photovoltaics:

crystalline silicon has a median degradation rate of approximately 0.40 percent per year and a mean of approximately 0.51 percent per year based on an analysis of 1,552 data points that can be considered as high quality measurements (e.g. data with multiple measurements for increased confidence and measurements that are generally similar at each measurement point, etc.). The result of this research is in reasonable agreement with the FBC's assumption of 0.5 percent degradation per year based on the NREL report referenced in BCUC IR 1.11.1.

To further support FBC's assumption of an average service life of 40 years for the mono-Si photovoltaic cells, provided below are extracts from websites and/or reports of some reputable American energy companies that specialize in solar technology. It can be seen that the useful life of solar PV modules as claimed by both companies is in reasonable agreement with the assumption made by FBC based on the NREL report, despite the difference in the basis of assumption:

1. SunPower Corporation is an American energy company that has designed and manufactured mono-Si photovoltaic cells since 1985. The company is majority owned by Total, the fourth largest publicly-listed energy company in the world. SunPower currently has a limited warranty for Commercial PV Modules[2] sold after May 1, 2015 for degradation of no more than 0.4 percent per year between the 5th and 25th year, which is better than the 0.5 percent per year degradation rate FBC used based on the NREL report.

   Furthermore, SunPower provides a publicly available technical white paper, titled "SunPower® Module 40-year Useful Life"[3], indicating that their field experience and experimental data supports an expectation that their panels should have a useful life exceeding 40 years.

2. SolarCity Corporation, founded in 2006 and a subsidiary of Tesla Inc. since 2016, specializes in solar energy services, and markets and installs residential and commercial solar panels in the US. SolarCity provides a publicly available white paper from their website, titled "SolarCity Photovoltaic Modules with 35 Year Useful Life"[4], indicating their experience for mono-Si panel modules is an annual module degradation rate of 0.5 to 0.6 percent per year and warrants a postulation of Useful Life of 35 years with a power output of 80 to 82.5 percent thereafter. The information provided by this SolarCity white paper is in reasonable agreement with the assumption made by FBC based on the NREL report.

Research and Application, 2016. It is to be noted the article is not provided as attachment as it is protected by copyright and only available to purchaser who, under the terms of the copyright, cannot be redistributed without permissions.

[2] https://global.sunpower.com/sites/international/files/media-library/warranties/wr-sp-warranty-2.0-legal-doc-en-row-com.pdf

[3] https://us.sunpower.com/sites/sunpower/files/media-library/white-papers/wp-sunpower-module-40-year-useful-life.pdf

[4] http://www.solarcity.com/newsroom/reports/solarcity-photovoltaic-modules-35-year-useful-life

The NREL report referenced in BCUC IR 1.11.1 shows that the degradation rates have improved when comparing installations prior to the year 2000 and those installed after the year 2000.

The above indicates that the life expectancy of solar panels is improving and supports FBC's assumption of a 40 year effective life for the solar panels in this Project. As indicated earlier in the response to BCUC IR 1.11.1, FBC emphasizes that the Project is considered as a pilot and the degradation rate under localized environment will be monitored closely.

4. Reference: Exhibit B-2, BCUC IR 1.13.2.1

4.1 Please explain whether FortisBC's solar rate options participate fully in any increased for FortisBC's transmission and distribution system infrastructure for the economic analysis provided in the referenced information request?

Response:

FBC interprets this question to be inquiring as to whether the CSPP rates will increase with general rate increases that are driven by transmission or distribution capital projects.

As the CSPP is structured, the CSPP rate remains capped regardless of general rate increases or their specific cause. CSPP participants will be exposed to any general rate increases for the portion of their consumption that is not met with the allocated share of the array output.

FBC recognizes that for Virtual Solar customers, load and generation are separated by distance and that the actual amount of energy delivered to the customer premise will be different than the amount billed under the standard tariff rate. However, in order for the CSPP to be considered "virtual solar", it should mimic the installation of roof-top solar to the extent possible. FBC considers that it would be detrimental to the Program to incorporate a separate charge for the transmission of energy from the array to the customer premise. The Company also notes that the Basic Charge, which will increase with general rate increases, is also collecting a portion of the allocated fixed costs related to distribution infrastructure.

5. Reference: Exhibit B-4, BCSEA IR 1.6.6 and BCSEA 1.22.1

"FBC's research suggests typical utility scale non-rooftop solar installations can range from $2-$3 USD per installed watt, or roughly $2.50 to $4.00 CAD per installed watt."

5.1 Please provide sources for such research and any installation specific costs per installed watt? For example, can FBC provide the costs per installed watt for any other solar installations in BC or Alberta? If so, please identify whether such installations are utility or non-utility installations?

Response:

FBC based its findings largely upon information available through the National Renewable Energy Laboratory (NREL), a government-owned national laboratory funded by the U.S. Department of Energy. Specifically, FBC used the report titled "U.S. Solar Photovoltaic System Cost Benchmark: Q1 2016".

The report is available using the following link:
https://www.nrel.gov/docs/fy16osti/66532.pdf

The information was confirmed using the following article from EnergySage:
http://news.energysage.com/how-much-does-the-average-solar-panel-installation-cost-in-the-u-s/

Comparing solar installations can be very difficult given that the quoted costs may have different inclusions or exclusions. For example, some quoted costs per installed watt may include rebates in their cost calculation or may exclude permitting costs.

In order to provide a utility comparison within the same region, FBC refers to the City of Nelson's Community Solar Garden Project. In its 2015 Project plan, Nelson Hydro estimated the cost per installed kW would range from $5 to $6 per installed kW, depending on the selected system size. The Project plan can be found here:
http://www.nelson.ca/assets/City~Services/Electrical~Services~Nelson~Hydro/Documents/EcoSave/Community%20Solar%20Garden%20Project%20Plan%20Rev%204.pdf

While FBC cannot confirm the final costs of the City of Nelson Community Solar Garden, the upfront cost per panel of approximately $940 is less than the expected $1,040 per panel (as per the Project plan), which suggests the actual costs were within budget.

5.2 Please explain whether the typical installed costs in the reference include the cost of land? Please obtain and provide a commercial estimate for the value of the land.

Response:

The data provided by the National Renewable Energy Laboratory includes land acquisition costs. In its report, land acquisition costs are included under "Soft Costs – Others" along with:

- permitting, inspection, and interconnection costs;
- sales tax;
- engineering, procurement, and construction costs;
- company overheads; and
- net profit.

For comparison, the City of Nelson Community Solar Garden, which has a rated output of 60kW, had an estimated cost of $301,628, approximately $5 per watt. FBC notes that Nelson Hydro utilized land that it currently owned and is therefore not considered in the estimated cost above.

FBC did not incur any incremental land acquisition costs related to the CSPP since the land had already been purchased for the Ellison substation. As the land is already owned, FBC did not obtain a commercial estimate for the value of the land. Although the commercial value may be different, the book value of the land is approximately $0.6 million based on the portion of the property (approximately 29,000 m^2) allocated to the CSPP (approximately 8,700 m^2).

6. Reference: Exhibit B-5, ICG IR 1.3.1

"In FBC service territory, FBC is the only entity that provides the fully bundled service described above to FBC's end-use customers. It is not presently feasible, legally or practically, for another third party to do so."

6.1 Please explain whether it is "presently feasible, legally or practically, for another third party" to construct, operate and own solar facilities in the FBC service territory and for FBC to purchase solar energy from the same third party and same facility? If so, could FBC then provide fully bundled service to end-use customers on the similar rate structures as proposed in this Application?

Response:

Please refer to the response to ICG IR 1.3.1.

As stated there, it may be that an IPP could operate (and construct and own) a solar power generating facility – the same as is the case with any other kind of generation facility – and seek to sell the power generated there to a utility, for distribution by the utility to its customers. If an IPP were to establish such a facility and seek to sell its output to FBC, FBC would evaluate whether it makes sense to purchase that output based on the same factors that it uses to evaluate such potential otherwise. Considerations that FBC would likely take into account in determining whether or not to purchase the power that the IPP was offering – whether derived from solar generation, hydroelectric, wind or otherwise – include reliability, price, interconnection location, etc. FBC's LTERP, which is currently before the Commission, includes solar generation among its resource options. However, the purpose of this Application is to gauge customer interest in a solar product offering as an option for customers. As such the resource evaluation principles of the FBC LTERP do not apply to the CSPP as this is not for general utility supply.

Given all the above, FBC has not examined the rate structures that could apply. However, it seems likely that if the Project were for general utility supply, it would simply be part of the resource stack used to serve customers generally using the rates charged for all other supply.

The question seems to suggest that FBC could create a special class of IPP from which it would purchase electricity and to resell directly to customers in community solar programs. FBC does not agree that third-party operation and ownership of dedicated community solar facilities provides an advantage to FBC customers, and there is no mechanism in the vertically integrated, fully bundled regulatory environment in British Columbia for FBC to develop and administer a rate to its retail customers based on the structure and cost profile of the generation assets of a third party.

7. Reference: Exhibit B-5, ICG IR 1.3.7

"With respect to specifically the installation of the solar facility proposed in FBC's Application, as described on page 6 of the Application, FBC initiated a Request for Proposals (RFP) process to solicit bids from experienced solar PV contractors for the pilot project. "

7.1 Please provide a copy of FortisBC's RFP.

Response:

Please refer to Attachment 7.1.

8. Reference: Exhibit B-5, ICG IR 1.4.2

"These locations were considered but were ultimately rejected for the purposes of the CSPP, largely due to lack of visibility. As discussed in the Application, "being part of a green community project" is a strong motivator among residential and commercial customers. It is improbable that these customers would feel a connection to the CSPP if they were unable to conveniently see the PV solar installation."

8.1 Please provide an estimate of the reduction in annual energy production of the proposed project location as compared to the a) the most favourable location in FortisBC's service territory, and b) on vacant land adjacent to the FortisBC's Kootenay Operations Center in Ooteschenia.

Response:

Based on feedback from SkyFire, using the PVsyst software, FBC offers the following:

- Lee Terminal – Given that Lee Terminal utilizes the same weather data as the Ellison Substation site, it is reasonable to expect that both sites would have similar annual output. While subject to detailed on-site analysis, SkyFire is of the opinion that a P50 estimated annual energy output for Lee Terminal is approximately 284 MWh.

- Kootenay Operations Center, Ootischenia – While subject to detailed on-site analysis, SkyFire is of the opinion that a P50 estimated annual energy output for the Ootischenia site is approximately 277.9 MWh.

9. Reference: Exhibit B-5, ICG IR 1.4.4

"As the inverters typically have a life 36 ranged from 10 to 20 years, FBC assumed replacement of three inverters for every five years, starting in Year 10 in the revised financial analysis."

9.1 Please confirm the project has 9 inverters in total. Has the cost of the spare inverter been included in the estimate? What other spare components have been included in the project estimate?

Response:

The proposed SkyFire design contains nine (9) inverters in total. FBC plans on purchasing an additional spare inverter. The cost of this spare has been included in the Project estimate.

No other spare components have been included in the Project estimate.

Attachment 7.1

(Provided in electronic format only due to
document size and in order to conserve paper)

Request for Proposal
Ellison Solar Generating Station Project

Date	Rev	Description	Created By	Reviewed by
2016-05-31	R0	Original Document	Anthony Bowes Ryan Corbett	Mark Warren Betsy Matamoros Aram Khalil-Pour

1. Summary and Background

1.1 FortisBC Inc. ("FortisBC") requests proposals ("Proposal") from qualified Proponents to Engineer, Procure, and Construct ("EPC") a turnkey Solar Generating Station (the "Work"). The successful Proponent will become the contractor ("Contractor"). The Project will be located at the FortisBC Ellison Substation property (2147 Pier Mac Way). Access to the proposed site will be from Lochrem Rd Kelowna BC shown in Figure 1. The approximate area that can be used is 2.56 acres (10,359m^2).

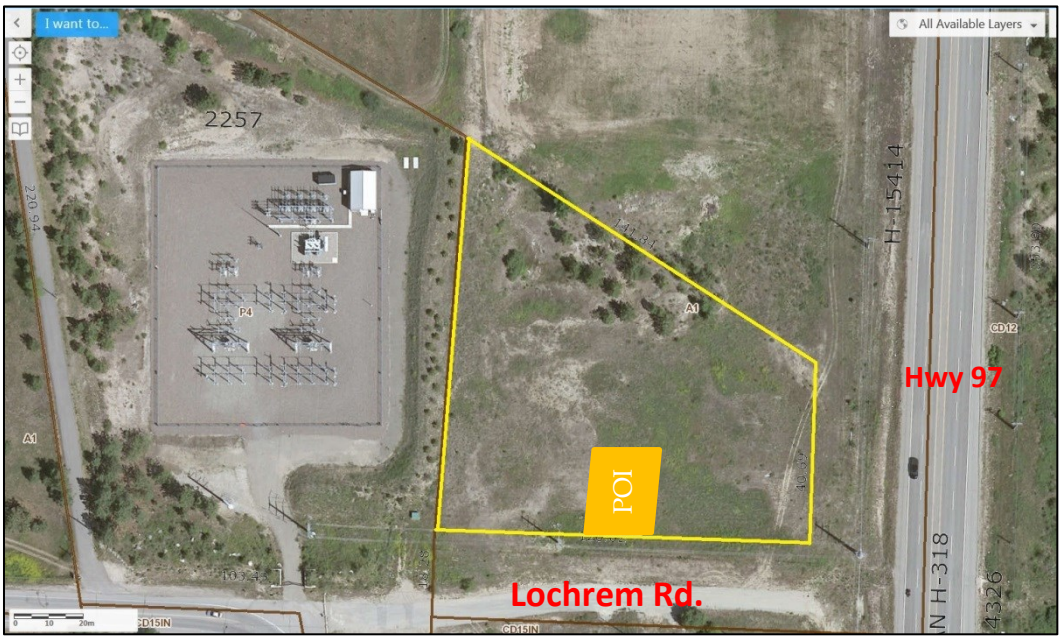


Figure 1: Proposed Ellison Solar Station Site

1.2 The scope of this project includes Engineer, Procure, and Construct ("EPC") of a 240kW DC Solar Generating Station. Concept drawings of the station are included in Appendix A: ELL Solar Station Concept Drawings.

(a) The station construction shall be divided into two phases of 120kW DC each.

(b) Pricing for each 120kW DC phase shall be provided as part of the proponents bid.

(c) FortisBC will reserve the right to only go forward with a single 120kW DC phase of the project.

(d) The proposal shall also include details on any further Solar development that the property could support.

1.3 The Point of Interconnection (POI) with FortisBC will be the secondary terminals of the 7.2kV/12.47kV:347/600V Three Phase transformer. The secondary conductors from the transformer to the main disconnect switch of the station shall be provided by the contractor.

1.4 The approximate location for the distribution transformer is highlighted in orange in Figure 1.

1.5 The Project completion date for each 120kW DC phase is to be within 6 months of FortisBC giving the "Notice to Proceed" for that given phase to the Contractor.

2. Proposal Details

2.1 This Request for Proposal represents the requirements for an open and competitive process. Proposals will be accepted until 2pm PST July 1, 2016. Any proposals received after this date and time will be returned to the sender. All proposals must be signed by an official agent or representative of the company submitting the proposal.

2.2 The proposal must consider all engineering procurement and construction efforts including meetings, correspondence, travel, documentation costs and any other criteria associated with meeting the project deliverables listed in this document. FortisBC will be reviewing the design and will provide comments to the Contractor as the design is developed. Rework based on comments submitted by FortisBC Engineering during the review process is to be included. Any rework required as the result of proceeding with work without the review and approval of FortisBC Engineering will be at the Contractor's cost.

2.3 If the organization submitting a proposal must outsource or contract any work to meet the requirements contained herein, this must be clearly stated in the proposal. Additionally, all costs included in proposals must be all-inclusive to include any outsourced or contracted work. Any proposals which call for outsourcing or contracting work must include a name and description of the organizations being contracted.

2.4 The proposal must be lump sum fixed pricing in Canadian funds. FortisBC expects that the total cost of the station will be less on a per kW basis than small residential installations.

2.5 All costs must be itemized to include an explanation of all fees and costs and formatted per the "FortisBC - EPC Cost Breakdown for Solar Station.xls" attached in the Request for Proposal email. A copy of the form can be found in Appendix E: FortisBC Cost Proposal Sheet.

2.6 Contract terms and conditions will be negotiated upon selection of the winning bidder for this RFP. All contractual terms and conditions will be subject to review by FortisBC and will include scope, budget, schedule, and other necessary items pertaining to the project. The general terms and conditions that FortisBC is proposing are included in Appendix F: FortisBC Terms and Conditions.

2.7 Proponents should provide the following items as part of their proposal for consideration:

- Description of experience in designing, procuring and constructing solar projects of a similar size and scale.
- Previous work: Proponents will be evaluated on examples of their work pertaining to solar projects and hosting as well as any client testimonials and references.
- Technical expertise and experience: Proponents must provide descriptions and documentation of staff technical expertise and experience.

Each proponent must submit 5 copies of their proposal to the address below by July 1, 2016 at 2pm PST:

FortisBC Inc.
2850 Benvoulin Rd,
Kelowna, BC V1W 2E3

3. Standards

3.1 Engineering and design principles must generally conform to the latest edition of the following standards:

(a) Current edition of the Canadian Electrical Code;

(b) All relevant IEEE (Institute of Electrical and Electronics Engineers) Standards and Guidelines;

(c) All relevant CSA Standards;

(d) All relevant NFPA standards;

(e) Current edition of BC Building Code; and

(f) FortisBC Standards listed at Appendix B: FortisBC Standards

3.2 All contractor supplied equipment shall be CSA or cUL certified.

3.3 For clarification on the application of standards contact FortisBC.

4. Project Deliverables

4.1 Introduction

(a) The scope of this project involves the construction of a new 240kW DC Solar Generating Station located at the FortisBC Ellison Substation property (Lochrem Rd Kelowna BC).

(b) The station construction shall be divided into two phases of 120kW DC each.

4.2 Provision of the new station will broadly involve:

(a) Site civil and structural works including the provision of a new road access point.

(b) All solar equipment including PV Panels, racking and structural support hardware for ground mounting

i) The proposals shall include cost estimates for both fixed-tilt and single axis tracking systems.

(c) All electrical components including inverters, cabling, service and distribution equipment, etc.

(d) 8ft chain linked fencing surrounding site.

4.3 Performance:

(a) The Solar Generating Station must be capable of generating an annual energy output of 1000kWh (AC)/kW of installed PV at the point of interconnection.

(b) The expected Solar Generating Station performance shall be highlighted in the proposal.

(c) FortisBC is seeking to minimize the total cost for the two phases of the project. FortisBC recognizes that the overall cost is affected by a number of factors including the location of the installation, the relative costs of required civil work and solar panel racking. FortisBC requests that the Contractor optimize these costs. FortisBC can accept lower overall performance at a lower cost, providing the Work meets the performance criteria identified in 4.3(a).

4.4 General Engineering and Design Work

(a) The Contractor shall complete all necessary design required to provide a fully functional, tested, and commissioned Solar Generating Station.

(b) All final documentation, and record drawings, are to be turned over and project to have major completion within 6 months of FortisBC giving the "Notice to Proceed".

(c) The Contractor will be the "Engineer of Record" (EOR) for the station and all work detailed in this scope document. The EOR must be licensed to practice in British Columbia (BC) and be a member of The Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) in good standing.

(d) The Station shall generally be designed in accordance with relevant standards.

(e) All drawings shall be prepared in logical format separating civil, electrical, layout etc. into different drawing sets.

(f) Drawing numbering to follow the FortisBC Substation Numbering format in section 7 of the included drafting standard (ES01.4-10.01) in Appendix B: FortisBC Standards.

4.5 Engineering work shall include but is not limited to:

(a) Review and comment on the SLD and work with FortisBC to establish an approved final SLD prior to proceeding with detailed design;

(b) Station layout design to suit the allocated land, provincial and municipal laws and requirements.

(c) Review of any adjacent existing infrastructure that maybe impacted or effected by the construction of the station, such as underground foreign utilities, pipelines, telecommunications, above ground utilities such as electrical transmission lines, cell towers etc. and include appropriate design measures needed to mitigate interference or workaround these facilities;

(d) Detailed civil and structural design as required;

(e) Detailed design for all electrical AC and DC systems (up to POI) to suit the present and future anticipated system.

(f) Any drawings and documentation to properly convey the design to FortisBC;

(g) Complete and issue for construction all drawings and documents required to complete the relevant construction packages, signed and sealed by the EOR;

(h) Development of test and commissioning plans and documentation;

4.6 Civil & Site

(a) All survey work shall be completed by the Contractor. For consistency and efficiency, it is preferred that the Contractor use FortisBC's nominated surveyor;

(b) The Contractor shall complete civil designs in accordance with the requirements of the sites Geotechnical Report (see Appendix C: Existing Site Technical Reports);

(c) Appropriate design measures shall be implemented to mitigate expected snow loading, wind loading, seismic activity and/or other foreseeable environmental conditions. These conditions should be documented and agreed to by FortisBC prior to detailed design.

(d) Complete detailed design for all civil site works, grading, drainage, perimeter fencing, structure/equipment foundations, etc. required to complete the station.

(e) Complete detailed design of cable trenches, underground ducts as needed; and;

(f) Prepare civil and site construction package.

4.7 Physical Construction

(a) Select all required equipment as required by the SLD;

(b) Complete detailed design of all PV equipment and structures required for the station;

i) The minimum height above ground for the lowest point of the PV panels shall be 1m to ensure clearance about the maximum snow depth.

ii) The distance between PV panel arrays shall be approximately 3m in order to allow ¾ ton truck access if required.

(c) Complete detailed design of all power distribution equipment and structures up to the POI

(d) Produce detailed bill of materials; and

(e) Prepare physical construction package.

4.8 Electrical and Communications

(a) Complete detailed design for the electrical requirements (PV panels, cabling, inverters, transformers and other equipment) for the station.

(b) Provisions for future communication system

i) The site shall provide a communications cabinet

ii) The contractor shall provide 120V power to the cabinet

iii) The communications cabinet shall be large enough to house future equipment such as a network switch, Ethernet cabling to each inverter, cellular modem, etc.

iv) Communications cabling to the inverters is not required at this time however the design should include conduit for communications to each inverter.

v) Proponents shall provide FortisBC with a list of available data points that can be brought into FortisBC system.

(c) Produce detailed bill of materials; and

(d) Prepare electrical and communications construction package.

4.9 Engineering Support during Construction

(a) Carry out bi-weekly reporting during the construction phase;

(b) Act as first point of contact with construction for clarification regarding any engineering, design or material issues;

(c) Ensure the construction generally conforms with the design and applicable engineering standards;

(d) Conduct regular project meetings;

(e) Keep a detailed deficiency list with any concerns or omissions noted during site visits; and

(f) Compile and update as-built drawings following construction period. Review with FortisBC, then issue approved as-built drawing package.

4.10 Commissioning Work and Documentation

(a) Any required commissioning or equipment acceptance documentation will be the responsibility of the Contractor. The proposed documentation shall be supplied to FortisBC for review prior to commissioning; and

(b) All commissioning work must be completed by the Contractor and is subject to inspection, review and approval by FortisBC.

4.11 FortisBC Engineering and Design Work

(a) The following tasks will be completed by FortisBC:

i) Review and approve designs at specific intervals during the design phase. These will typically involve: Preliminary IFR (35%), and before IFC ;

ii) Design of all electrical and civil facilities up to the POI as defined in section 1.3

iii) Provide geotechnical report; and

iv) Review drawings, calculations, and specifications that the Contractor provides as part of this Scope of Work.

5. Technical Documentation

5.1 Project Schedule

(a) The Contractor shall prepare a project schedule which shall be mutually agreed on.

(b) Dates may be negotiated upon presentation of the project schedule.

(c) Designs shall be reviewed and approved by FortisBC at specific intervals during the design phase. These will typically involve: Preliminary IFR (35%), and before IFC ;

(d) FortisBC review periods shall be identified with a minimum of 10 days for each item; and

(e) Milestones shall be identified (both Contractor and FortisBC).

5.2 Drawing List

(a) The EPC bid submittal shall include a preliminary list of all anticipated drawing creations or modifications. The preliminary drawing list must be agreed upon by both parties prior to award.

6. Engineering Expectations

6.1 FortisBC requires regular engineering project meetings. The intent of the meetings is to provide a forum to discuss issues and concerns surrounding the project.

6.2 Formal Document Submittals

(a) Document submittals must adhere to the following format:

i) Electronic: Upload to accessible FTP, SharePoint or USB thumb drive.

ii) Hard-Copy: Direct all documents to the FortisBC Project Manager.

iii) All design documents and drawings shall be submitted in their native format as well as in pdf form.

6.3 Engineering Deliverables

(a) Design Deliverables

i) Complete design package detailing all project documentation including:

1. Scope and estimate;
2. Project Schedule;
3. Design notes and calculations;
4. Studies and test reports;
5. Key correspondence and e-mails;
6. All required drawings;
7. Material Specifications;
8. Bill of Material;
9. Change orders; and
10. Meeting minutes

ii) Construction packages identified in Section 4

6.4 Procurement and Construction Deliverables

(a) The Contractor is responsible for:

i) Development of all procurement and construction related documents required by Section 7, 8 and 9 below;

ii) Drafting and completing all project as-builts. The final product as-built package shall be issued as follows:

1. Hardcopy of all signed off drawings used for field check (the person responsible for completing the as-builts shall sign and date each print);
2. Hardcopy of all IFC drawings;

3. Full sized hardcopy set of operational (as-built) drawings signed and sealed by the Contractor's EOR;
4. Drawings completed in AutoCAD formats;
5. Up to date station drawing list;

iii) Commissioning documentation, including signed test and commissioning sheets;

iv) Equipment manuals;

v) Detailed operating and maintenance procedures and manuals required for the safe and reliable operation of the facility.

(b) The final as-built package should be received from the Contractor no later than two weeks after station commissioning.

7. Procurement

7.1 Material procurement shall be the responsibility of the Contractor. The Contractor is responsible for:

(a) Specifying the materials and equipment on the station side of the POI;

i) PV Panels shall be Crystal Film type and limited to the following manufacturers:
1. Canadian Solar
2. REC Solar
3. SunPower

ii) Inverters shall be limited to the following manufacturers:
1. Fronius
2. SMA

iii) Inverters shall at minimum meet the following standards:
1. IEEE 1547
2. CAN/CSA C22.2 107.1-1

(b) Obtain approval from FortisBC before ordering major materials

(c) Maintaining consistency of material selection, types, and usage;

(d) Ordering all materials and equipment;

(e) Providing ongoing adequate review to ensure materials and equipment meet the intent of the design and providing reports on any conflicts to FortisBC;

(f) Tracking and shipping materials and equipment;

(g) Receiving, storing and protecting materials and equipment;

(h) Provide updates to the project schedule and expediting materials and equipment reports on a biweekly basis to FortisBC;

(i) Identifying and listing adequate spare parts (including general consumable items that might be used during commissioning and performance testing) and special tools for the completed project. FortisBC will determine what will be purchased.

(j) Provide pricing for extended warranties as follows:

i) PV Panels: 25 year

ii) Inverters: 10 year

(k) Provide pricing for service contracts for any PV equipment such as PV panels, DC components, Inverters etc.

7.2 FortisBC will review and comment on all materials and equipment specifications proposed prior to order. FortisBC will provide final approval to proceed with manufacture; however the Contractor will remain responsible for the proper selection and adequacy of the equipment usage and application in designs.

8. Construction

8.1 The Contractor shall be designated as Prime Contractor for the site.

8.2 The Contractor shall perform all work required to construct the station as detailed in the construction package developed for the project.

8.3 The Contractor shall also be responsible for scheduling and coordinating all activities during construction. Access to the site is possible via Lochrem Rd south of the property.

9. Permit Licenses and Approvals

9.1 The Contractor shall be responsible for obtaining and paying for all necessary Permits, Licenses and Approvals on behalf of FortisBC required for performance of the Work.

9.2 The Contractor shall at all times comply strictly with and completely satisfy and fulfill all requirements of all Permits, Licenses and Approvals and all Applicable Laws.

9.3 At least seven (7) days prior to submitting any application for any of the Permits, Licenses and Approvals to any of the Authorities Having Jurisdiction, the Contractor shall provide a copy of the application to the FortisBC and make such changes to the application as FortisBC may reasonable require prior to the Contractor submitting the application to the Authorities Having Jurisdiction.

9.4 Any and all direct communications between the Contractor and any Authority Having Jurisdiction shall be coordinated through FortisBC and FortisBC given prior opportunity to be present and participate in those communications. The Contractor during communications with the Authorities Having Jurisdiction shall not make any commitments on behalf of FortisBC without FortisBC's express prior written consent in each instance.

9.5 At no time shall any Contractor personnel discuss directly with any Authorities Having Jurisdiction, any and all requests for amendments or changes to any of the Permits, Licenses and Approvals previously obtained by the Owner. Any and all such requests shall be made to the Owner and not to the Authorities Having Jurisdiction.

10. Health & Safety

10.1 The Contractor shall provide a site specific Health and Safety Plan ("HSP") to FortisBC, at least 10 business days before mobilizing to Site. The HSP shall describe the approach to be taken in addressing the health and safety issues associated with this Project. The Project includes electrical safety, excavations, traffic, public safety and other risks, and therefore, the HSP must materially address these and other Project specific hazards.

10.2 The Contractor may not commence any work at Site until FortisBC has accepted the Contractor's HSP.

10.3 The Contractor shall at all times comply fully with the Contractor's HSP. The site representative ("Site Representative" will have the authority to stop work at any time, without penalty to FortisBC, if the Site Representative considers the Contractor is in non-compliance with the HSP or any other health and safety requirements, or is potentially endangering FortisBC staff working at the site, the public, or the integrity of nearby structures.

10.4 The Contractor shall clearly designate the area within which he is designated as Prime Contractor.

10.5 In addition to the above, the HSP must also contain the following:

(a) Address and site description (Map/Plot Plan)

(b) Route and time to nearest hospital (Map)

(c) Description of work to be done;

(d) Employee orientation and training;

(e) Visitor requirements;

(f) Personal Protective Equipment ("PPE") requirements and location of PPE for the site personnel;

(g) Tailgate, site safety meeting schedule and attendance records;

(h) Designation of responsibilities manager, supervisor, and other employees with defined responsibilities for Health and Safety;

(i) First aid requirements, location and contact information;

(j) Emergency contacts and procedures;

(k) Hazard ID process;

(l) Accident/Injury reporting and investigation procedures;

(m) Site security;

(n) List of safety equipment maintained on site and their locations; and

(o) When mobilized to Site, WorkSafeBC Notice of Project.

11. Environmental Management Plan

11.1 The Contractor shall perform the Work in accordance with the Environmental Management Plan ("EMP") which will consist of:

(a) The "FortisBC Generic Environmental Management Plan for Low to Medium Risk Projects" which is attached hereto as Appendix D: FortisBC Generic Environmental Management Plan for Low to Medium Risk Projects; and

(b) The Contractor's site specific Environmental Management Plans ("SSEMP").

11.2 The Contractor will submit a SSEMP for construction activities not specifically covered off in the FortisBC Generic EMP, at least 10 business days in advance of mobilizing to site for FortisBC review.

11.3 The Contractor shall bear the cost of providing and revising site specific plans as required. Revisions to the EMP may be required during the course of the work.

11.4 The Contractor may not commence any work on Site until FortisBC has accepted the Contractor's site specific EMP.

12. Security

12.1 Site security during construction shall be the responsibility of the Contractor.

13. Clean-Up

13.1 Subject to Section 14, the Contractor shall clean-up the Work Site and all other areas disturbed by Contractor's activities including:

(a) remove all equipment; and

(b) remove and dispose of construction materials, supplies, construction debris, waste, and security fencing (if any).

14. Restoration

14.1 The Contractor shall be responsible for repairing and restoring to original or better all existing properties, facilities, structures and other things affected in any way by the performance of the Work, including:

(a) Buildings, utilities or other structures;

(b) Roads and other forms of access;

(c) Concrete structures (including curbs) of any type or form, whether above or below grade;

(d) Paved areas to the standard required by Authorities Having Jurisdiction,

(e) Including replacement of temporary paving with permanent paving;

(f) Fencing and signage; and

(g) Landscaping.

15. Work by FortisBC

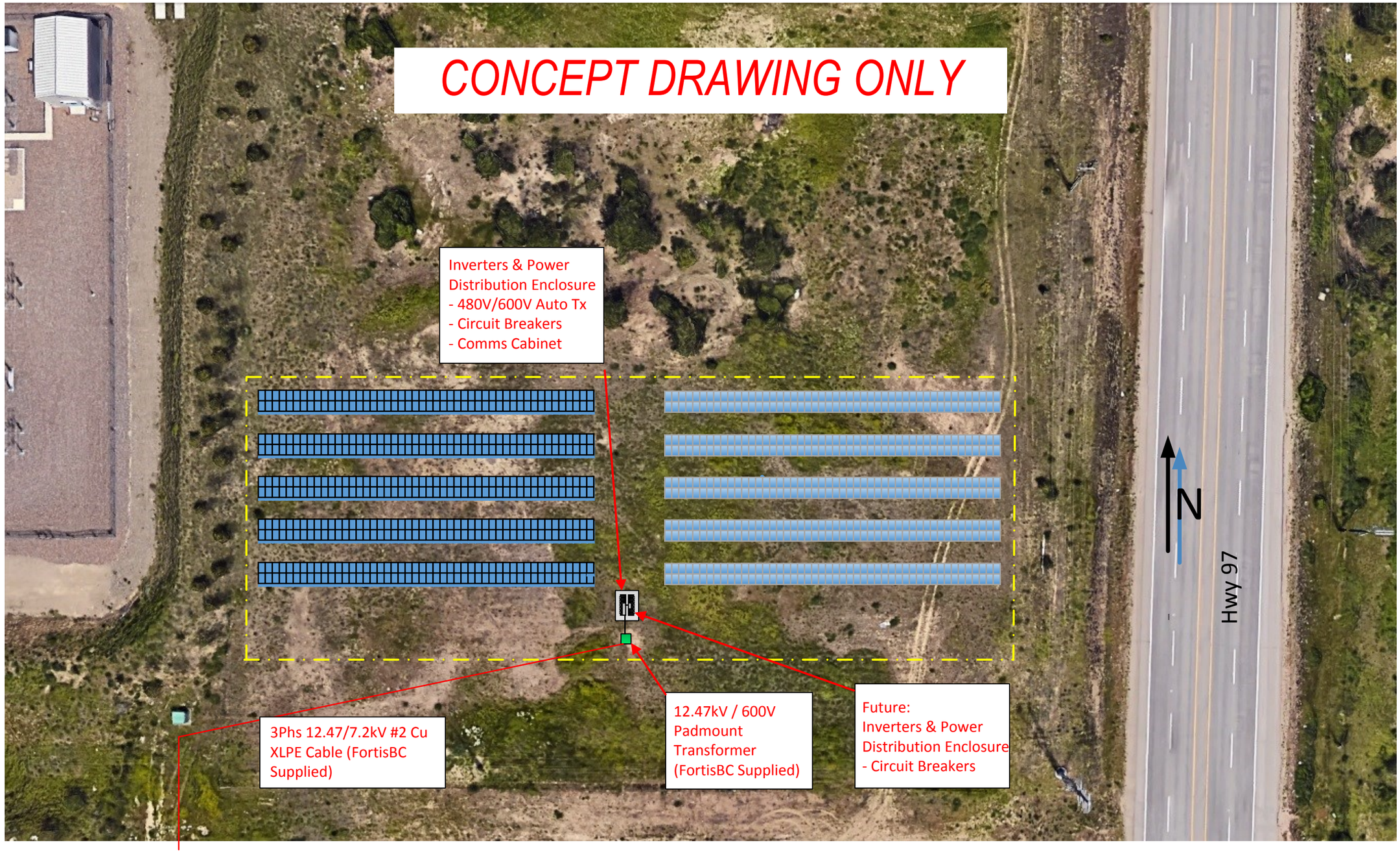
15.1 FortisBC will be responsible for providing the following:

(a) Arranging for the design and construction of the medium voltage system to the POI (includes distribution transformer).

(b) Tasks associated with any review of design per section 4.

Appendix A: ELL Solar Station Concept Drawings

CONCEPT DRAWING ONLY



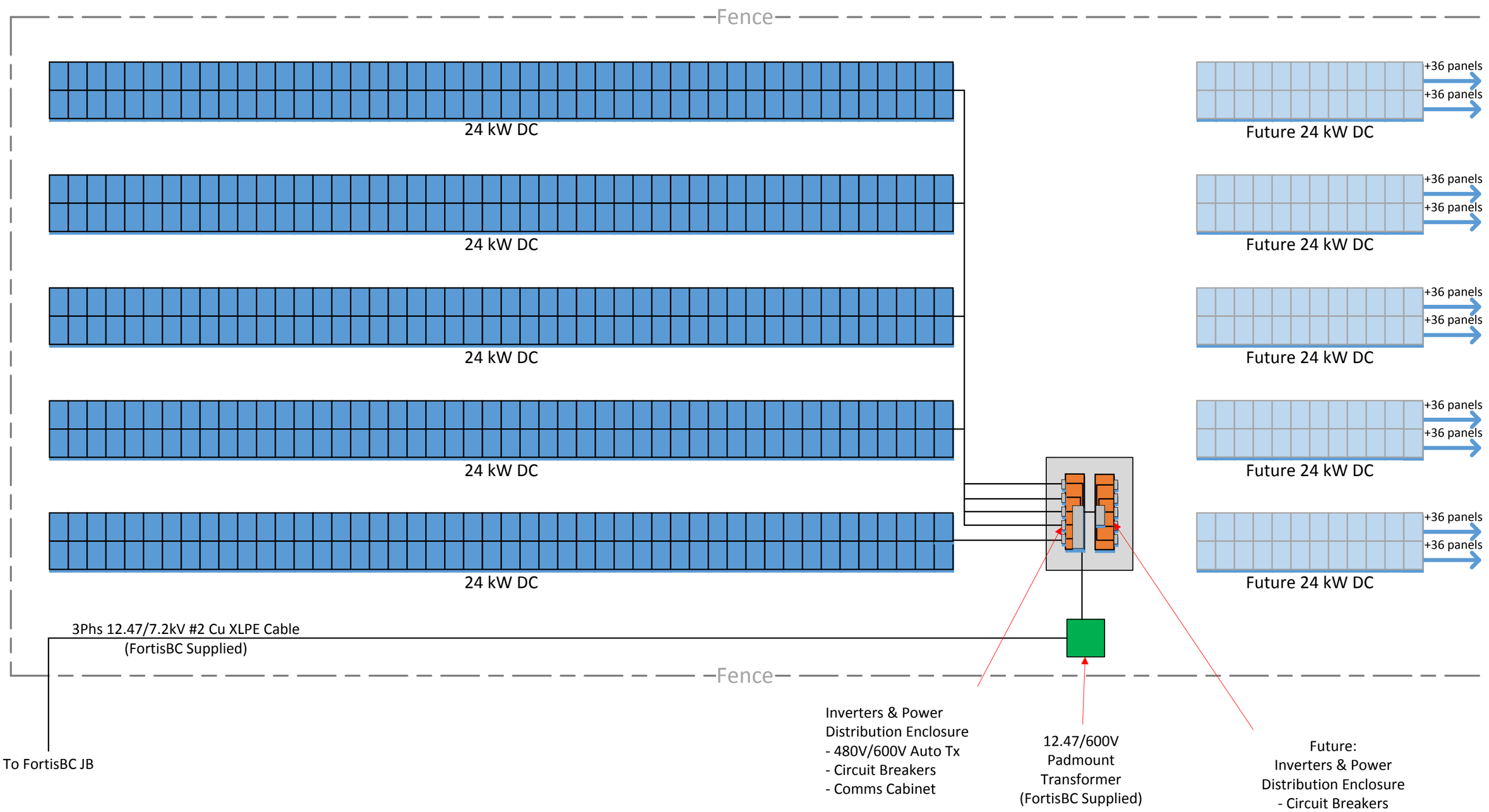
REV	DATE	BY	APP	DESCRIPTION		
					DRAWN BY	RC
					CHECKED BY	AWB
1	MAY 2016	AWB	AWB	RE-ORGANIZED LAYOUT TO CENTRALIZE POWER DISTRIBUTION	APPROVED BY	AWB
					DATE	MAY 2016

FORTIS BC™

16002341 – ELL SOLAR STATION
SITE LAYOUT CONCEPT

REV 1

CONCEPT DRAWING ONLY



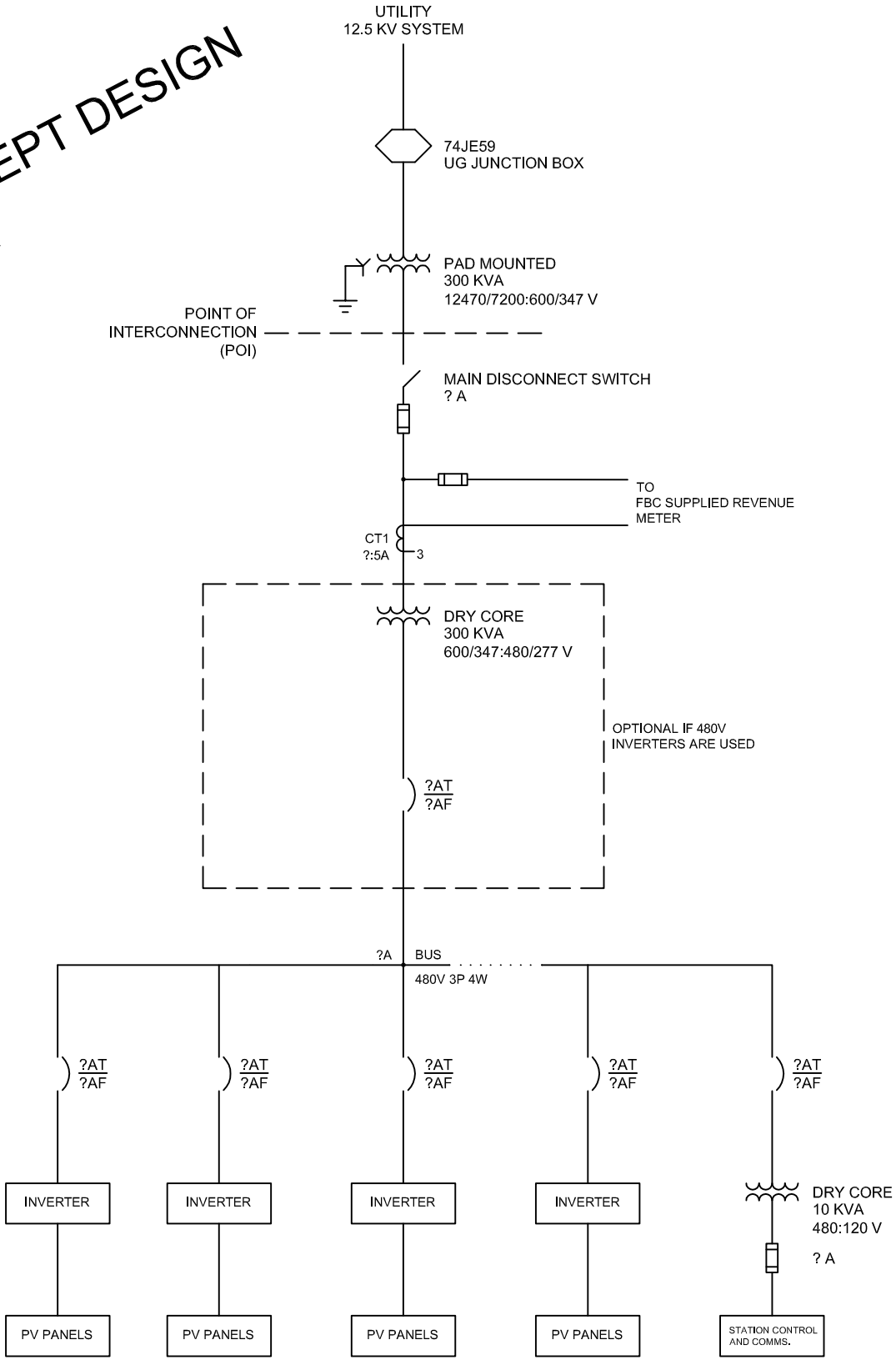
					DRAWN BY	RC
					CHECKED BY	AWB
1	MAY 2016	AWB	AWB	RE-ORGANIZED LAYOUT TO CENTRALIZE POWER DISTRIBUTION	APPROVED BY	AWB
REV	DATE	BY	APP	DESCRIPTION	DATE	MAY 2016

FORTIS BC™

16002341 – ELL SOLAR STATION ARCHITECTURE CONCEPT

REV 1

CONCEPT DESIGN ONLY



REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1	05/2016	AWB	RC	ADDED 480V OPTION AND STATION SERVICE XFMR	AWB	05/2016

DRAWN BY	AWB	05/16
CHECKED BY	RC	05/16
APPROVED BY	AWB	05/16

ELLISON SOLAR STATION
CONCEPT DRAWING
SINGLE LINE DIAGRAM

FORTIS BC

DRAWING No.	REV.
16002341–S1	1

Appendix B: FortisBC Standards

Station
Drafting Standards

SECTION 7 – DRAWING NUMBER SYSTEMS

Rev	Date	Initials	Description	Approved By
4	Mar/06	DMC	Issued for Internal Review	KLP
3	Feb/06	DMC	Issued for Internal Review	KLP
7	Nov/08	LES	Updated Mechanical, Supervisory & Manufacturers Standards numbering system	KLP
6	Jan/07	LES	Upgrade Standards and Changed ES# from ES01.0-10.01	KLP
5	Jun/06	KLP	Approved	CWK

7.0 Drawing Numbering Systems

7.1 Drawing Numbering System for Stations

A Typical Drawing Number 3-051-2000 would represent the following:

- The first “3’ digit denotes a substation, switching or terminal station; “4” denotes Transmission, “ES” denotes Engineering Standards.
- The next 3 digits “051” denotes station number (Generation 000 series Creston area 100 series, Boundary area 200 series, Okanagan area 300 series)
- Last four digits, example 2000 designates type of drawing from table e.g. 2000 in a Single Line Diagram

7.1 Drawing Numbering System for Stations (continued)

	CIVIL	MECHANICAL	ELECTRICAL	COMMUNICATIONS	SUPERVISORY	STANDARDS & MODULES	PRELIMINARY	MANUFACTURERS
	0001 - 0999	1000 - 1999	2000 – 2999	3000 - 3999	4000 - 4999	7000- 7999	8000 - 8999	9000 - 9999
X001 To X099	Location Plan Survey Plan Grading Plan & Sections Fencing Drawings	Bill of Materials General Arrangement Sections	2000 - Single Line/ Communication Block 2010 - Logic Drawings 2070 - Data Sheets	Power Line Carrier Diagram,	4000 – RTU 4001 – IDE 4002 - Power	MODULES: Changes for Modules applying to a specific station (use template)	8000-8009 SLD 8010-8049 Logic 8050-8059 Communication Block Diagrams 8060-8099 Other	Transformer
X100 To X199	Foundation Plan		AC Schematics Phasing	Telephone, All Auxiliary Equipment	Status 4100 – Schematic 4150 - Wiring		8100-8119 General Arrangement 8120-8149 Sections 8150-8199 Site, Civil, Survey	9100 Regulators, 9150 Miscellaneous
X200 To X299	Grounding Plan Conduit & Lighting Plan Trenching	Steel Plan Steel Structures	DC Schematics 2200-2229 Power Equipment 2230-2259 Relay, Fault Recording, Scada, Annunciation 2260-2299 I/O Points	Tele protection Shelves, Power Line Carrier	Control 4200 – Schematic 4250 – Wiring		8200-8209 Control Room Layouts 8210-8229 Panel-I/O Layouts 8230-8239 DC Supply 8240-8249 AC Supply 8250-8299 Other	Current Transformer
X300 To X399	Foundation Details Walls Oil Containment	Buildings	Plan of Control Building Panel Layouts	Security	Analog 4300 – Schematic 4350 – Wiring			Voltage Transformer
X400 To X499			Panel Wiring		Combination 4400 – Schematic 4450 - Wiring			Disconnect Switch, Cap switcher
X500 To X599		Material & Equipment List	Cable Schedules		4500-JMUX Cabinet, 4510-Shelf Layout			Breakers, Switchgears
X600 To X699			Station Service		4600-JMUX Wiring 4610-KOT Fibre Rings 4520-OK Fibre Rings 4630-KOT Fibre Terminations 4640-OK Fibre Terminations 4650-KOT System RAS 4670-OK System RAS			AC/DC Panels Chargers (station service)
X700 To X799					4700-MRTU/MOSCAD 4720-Microwave 4740-Satellite			Steel
X800 To X899					Positron (4800-4810) SCC (4820-4840)			Scada/RTU
X900 To X999	Sketch Sheets	Sketch Sheets	Sketch Sheets	Sketch Sheets	Sketch Sheets	Operational Single Line – Staging		Power Line Carrier PLC /Fibre

7.2 Drawing Numbering System for Modules

MODULAR NUMBERING SYSTEM

3- 5 O4 - 1 O25

- OO1 DRAWING NUMBER
- 0 BLANKING PLATE
- 1 MISCELLANEOUS
- 2 CONTROL
- 3 METERING
- 4 RELAYING
- 5 TAP/CAP MISCELLANEOUS
- 6 TELECOMMUNICATIONS

- OO MASTER PANEL
- O1 MODULAR SIZE
- TO
- 48 1-3/4" T0 84"

- 5 DRILLING
- 6 LAYOUT
- 7 AC SCHEMATICS
- 8 DC SCHEMATICS
- 9 WIRING

SIZE	NUMBER
1-3/4"	OO1
3-1/2"	OO2
5-1/4"	OO3
7"	OO4
8-3/4"	OO5
10-1/2"	OO6
12-1/4"	OO7
14"	OO8
15-3/4"	OO9
17-1/2"	O1O
19-1/4"	O11
21"	O12
22-3/4"	O13
24-1/2"	O14
26-1/4"	O15
28"	O16
29-3/4"	O17
31-1/2"	O18
33-1/4"	O19
35"	O20
36-3/4"	O21
38-1/2"	O22
40-1/4"	O23
42"	O24
43-3/4"	O25

Service and Metering Guide

Document No. 801-06 or CRL Document No. 1618

The latest version of this guide can be found at
fortisbc.com/electricity/customerservice/forhomes

Date	Rev.	Description	Reviewed/Checked	Approved
Jan 2016	7	Update pole-mounted services requirements, approved a new meter pedestal and instrument meters for overhead and underground services	David Walden Jesse Pickard	Devin Krenz

Note: All current revisions and additions are highlighted: GREY

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Disclaimer

Users of FortisBC Engineering and Construction Standards, including this guide, acknowledge to the following:

1. In accordance with FortisBC Engineering Practices and Policy, FortisBC Engineering and Construction Standards are developed and used only for FortisBC designs and construction and for FortisBC distribution facilities only.
2. Some of these standards may carry the name or logo of "Aquila", "Aquila Networks Canada", "UtiliCorp", "UtiliCorp Networks Canada", "UNC", "West Kootenay Power" or "WKP". Any such references are to be taken as a reference to FortisBC. By formal agreement between FortisBC, Aquila Networks Canada, UtiliCorp Networks Canada and West Kootenay Power, all standards with "Aquila Networks Canada", "UtiliCorp Networks Canada" or "West Kootenay Power" references refer to FortisBC.
3. FortisBC's expectation is that designs and construction by others (3rd Parties) for any electrical system or distribution facilities adjoining or attaching or otherwise affecting FortisBC distribution facilities shall, as a minimum, meet FortisBC Engineering and Construction Standards.
4. At the 3rd Party's request, FortisBC may provide copies of the FortisBC Engineering and Construction Standards to facilitate the awareness of minimum requirements to the 3rd Party. In the process of discussions with any 3rd Party, FortisBC may offer such information to illustrate this awareness.
5. Use of FortisBC Engineering and Construction Standards by any 3rd Party is done at the 3rd Party's own risk and liability.
6. Any copies of FortisBC Engineering and Construction Standards so provided are copyright protected and no further copies for any other use, modifications, amendments or changes are permitted.
7. FortisBC recommends that any 3rd Party retain the use of a professional engineer to assess the completeness of the 3rd Party's design and construction to meet the minimum requirements.
8. Review and/or comments by FortisBC on any 3rd Party design or construction does not relieve the 3rd Party from full responsibility and liability for the 3rd Party's design and construction.
9. By requesting and/or accepting copies of any FortisBC Engineering and Construction Standards, the 3rd Party automatically accepts the terms and conditions of this letter.

Introduction

This publication is for use by FortisBC's customers and various groups concerned with electrical installations within the FortisBC's electrical service area. The information within supersedes all information previously provided by FortisBC on the subject.

For more information with respect to the terms, conditions, rate schedules and specifications outlining customer and company responsibilities, please refer to the FortisBC Electric Tariff on our website at fortisbc.com/ElectricityTariff.

If you are planning an electrical installation, your earliest contact with FortisBC will help ensure that your installation will be satisfactory to both the British Columbia Safety Authority and FortisBC. To arrange an inspection of an installation, please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847).

All electrical installations must comply with the Canadian Electrical Code and all amending bulletins issued by the British Columbia Safety Authority and CSA. Installations cannot be connected before FortisBC takes receipt of the "Supply Authority" copy of an approved *Electrical Contractor Authorization & Declaration of Compliance* form or an approved *Certificate of Electrical Inspection*.

Installations will not be connected before the following steps have occurred:

- The customer taking responsibility for the service must notify FortisBC that the installation is ready for connection by calling **1-866-4FORTIS** (1-866-436-7847). At this time, the customer's billing information is to be provided.
- The "Supply Authority" copy of either the *Electrical Contractor Authorization & Declaration of Compliance* form or a *Certificate of Electrical Inspection* must be available to FortisBC crews and located at the job site (preferably in a waterproof envelope and placed inside the electrical meter socket) before connection will occur. FortisBC crews will take possession of the "Supply Authority" copy and retain it for our records.
- A "Job Site" copy of either the *Electrical Contractor Authorization & Declaration of Compliance* form or a *Certificate of Electrical Inspection* must also be on display at the work site. The "Job Site" copy of the form must be affixed to the structure receiving the electrical service. This form must be in plain view and will be left at the work site by FortisBC crews.

FortisBC cannot energize a service entrance or any equipment until its design, construction, location and application are acceptable to both the British Columbia Safety Authority and FortisBC.

1 General requirements

This section covers FortisBC's general requirements, which must be met before electrical service will be provided.

Note: All installations exceeding 200 amps require load figures to be submitted.

1.1 Non-standard services

1.1.1 Acceptance procedures

Whenever the requirements of this guide cannot be met, drawings must be submitted to your local FortisBC Customer Designer for approval. The required drawings should be submitted as early as possible, and before ordering or installation of any service entrance equipment or other associated equipment has taken place.

Note: Any approval on behalf of FortisBC is only for the service in question and is not a general approval for future services.

1.1.2 Drawings and specifications

A copy of equipment drawings, specifications and site plans are required by FortisBC for non-standard services. In some cases, a hand drawn sketch that clearly shows the layout and dimensions is all that is needed.

Submitted drawings must clearly show all equipment related to the revenue metering, including service entrance equipment and revenue metering enclosures. These drawings must show elevations and enclosures sizes. Drawings are to be submitted to your local FortisBC Customer Designer for approval. You will receive written notice that your service has been approved.

In the case of a dispute, FortisBC will not honor verbal conversations. You must have written approval by FortisBC for all non-standard services. Non-standard services that do not have the correct approvals will not be connected.

1.2 Meeting Canadian Electrical Code and amending bulletins issued by the British Columbia Safety Authority, CSA standards and associated regulations

FortisBC shall not connect an electrical customer's service to the electrical utility system unless the following conditions are met:

- Overhead Services - The conductor attachment point used to supply the customer's service is located so that the conductors maintain required clearances.
- The metering equipment and location is deemed acceptable.
- The customer's service panel covers are in place.

Note: All covers for an electrical service entrance box are to be in place such that there are no exposed conductors that could present a hazard.

- The customer's service is grounded.

  Note: Refer to section 10 of the Canadian Electrical Code for the requirements to ground a service.

- FortisBC has assurance from the customer that the installation is ready for connection and no obvious hazards should result.

  Note: FortisBC must, either verbally or in writing, receive assurance that the installation is ready for connection and no obvious hazards should result.

- FortisBC has received a copy of an approved *Contractor Authorization Form* or an approved *Certificate of Electrical Inspection*

  Note: These documents are required to have the permit number, Field Service Representative's name and telephone number, and the contractor's name and telephone number.

1.3 Customer instrumentation and fire alarms

Customer instrumentation including energy management circuits, relays, fire alarms, surge arrestors and step-down transformers must be connected on the load side of FortisBC's revenue metering. These customer circuits cannot be connected into FortisBC's revenue metering circuits and all equipment must be mounted independent of the enclosures reserved for FortisBC's use.

1.4 Electrical equipment room requirements

All electrical rooms or areas must comply with the following:

- Working Space - A minimum of 1 metre of clear working space by 2.2 metres high is required in front of all electrical equipment and to the sides and back where access is required (additional requirements are listed in Canadian Electrical Code Rule 2-308 and 2-312). Electrical rooms are not to be located in a bathroom, storage closet or stairway.

- Entrance/Exit - A minimum passageway of 1 metre wide by 2.2 metres high must be maintained as an entrance or exit from all electrical areas. (Additional requirements are listed in Canadian Electrical Code Rule 2-310)

- Hazardous Locations - Electrical equipment cannot be located in areas that are hazardous to anyone working, or to the equipment itself. This includes any area where moving machinery, dust, vibration, fumes, falling debris, corrosive vapours, water, and/or moisture are present.

- Illumination and Ventilation - All electrical rooms or areas must have adequate illumination and ventilation to carry out all work safely (as per Canadian Electrical Code Rules 2-314 and 2-318).

1.5 Service entrance equipment requirements

All service entrance equipment must comply with the following:

- Conductors - All service entrances must be designed and constructed such that metered and un-metered conductors are not run in the same conduit or raceway.

- Equipment - All service entrance equipment requires hinged doors or cover plates to cover all live electrical equipment. If hinged doors are used, they must open either left or right to not less than 110 degrees from the closed position for outer doors, and not less than 90 degrees from the closed position for inner doors. The only exception to the direction of opening is for horizontal mounted splitter boxes for which the doors must open downward. All cover plates shall be removable from the front. All hinged doors or cover plates that are ahead of the metering point require provisions for sealing. Barriers are required between all sections of the service entrance equipment, including metered and un-metered conductors and separate sections are to be reserved for the customer's use and for the use of FortisBC.

1.6 Modifications to existing services

If you are planning any modification or addition to your electrical system including increased load, please contact FortisBC by calling **1-866-4FORTIS** (1-866-436-7847). Early contact with FortisBC will help to ensure that any additions or changes are acceptable to both the British Columbia Safety Authority and FortisBC.

For the safety of all concerned, customers must contact FortisBC if they are planning to install any type of back-up power supply or transfer switch to ensure that the equipment is adequate and installed correctly. Auxiliary generating equipment must comply with the British Columbia Electrical Code.

To ensure accuracy of metering installations, only authorized contractors or FortisBC personnel trained pursuant to Industry Canada regulation S-A-01 (*Criteria for the Accreditation of Organizations to Perform Inspections Pursuant to the Electricity and Gas Inspection Act and the Weights and Measures Act*) are authorized to install, remove or handle revenue meters. Any or all costs and/or damages associated with removal, installation or handling of meters by unauthorized persons will be invoiced to the person(s) responsible.

1.7 Standard supply voltages

Table 1.1 Nominal Standard Secondary Voltage from Pole-mounted Transformers

Service Voltage	Phase/Wire	Maximum Transformer Size	Maximum Main Breaker Size
120/240	Single-phase, 3 wire	100kVA	600A*
120/208	Three-phase, 4 wire	300kVA (3 x 100kVA)	800A
347/600	Three-phase, 4 wire	300kVA (3 x 100kVA)	300A

***Connected load shall be no more than 480A.**

Table 1.2 Nominal Standard Secondary Voltage from Pad-mounted Transformers

Service Voltage	Phase/Wire	Maximum Transformer Size	Maximum Main Breaker Size
120/240	Single-phase, 3 wire	167kVA	600A
120/208	Three-phase, 4 wire	750kVA	2000A
347/600	Three-phase, 4 wire	2000kVA	2000A

1.8 Standard three-phase configuration

All three-phase services provided are three-phase three-element four-wire grounded wye systems with the neutral forming part of the metering circuit unless otherwise arranged and approved by FortisBC.

For more information on the availability of three-phase services, please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847).

1.9 Access to metering equipment

FortisBC staff must have access to all metering equipment for the purpose of changing, testing and reading. Where FortisBC is not given ready access to the metering equipment due to locked doors or gates a lock box and necessary keys must be installed. FortisBC will provide an on-site lock box to store the keys, FortisBC material number 519-1127. The preference is to have the lock box flush mounted in the building wall in close proximity to the access door and/or an authorized secure location. FortisBC is absolved of all liability if the lock box is damaged or stolen.

1.10 Services that do not require metering equipment

FortisBC requires that customer services be metered. However, services that draw less than 20 amps and have consistent power consumption may be eligible to be connected without metering equipment. For details, please see section 2.5: *Unmetered* Services.

If you think that your installation might qualify for an unmetered service, please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847) before any construction begins for more information.

1.11 Self-contained metering versus instrument metering

The maximum limits for a self-contained meter are:

- 200 amps per phase and/or
- 347 volts phase-to-ground

Any service exceeding these requirements will need to employ instrument metering.

Refer to section 4: *Self-contained Metering,* and section 5: *Instrument Metering* of this guide for further information.

Any requests for exceptions to these rules must follow the process outlined in section 1.1: *Non-Standard Services* of this guide.

1.12 Net metering

Net metering is permitted by FortisBC provided that installations meet the standards outlined in FortisBC's *Net Metering Interconnection Guidelines.* Prior to any work taking place, all customers wishing to become a part of FortisBC's net metering program must apply by submitting a completed *Application for Net Metering.* Once approved by FortisBC, a *Net Metering Interconnection Agreement* will be presented to the customer and the customer's service will be connected.

For more information on FortisBC's net metering program, please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847) or visit **fortisbc.com/electricity/customerservice/netmeteringprogram.**

1.13 Meter sockets

Meter sockets are CSA approved devices. As such, any additions (isolated neutral blocks, additional lugs, etc.) to the meter socket must be made with CSA approved kits supplied by the manufacturer of the device. Meter sockets with customer disconnect or circuit breaker is acceptable. Additions or modifications utilizing parts from a different manufacturer are not approved and void the CSA approval of the device.

CSA approved kits that are supplied by the manufacturer can be field installed. The kits are to contain a decal, which must be affixed to the meter socket, stating that it has been modified by a CSA approved kit. The device is then approved and may be used.

When more than one FortisBC revenue meter is installed at a single location, all meter sockets must be labeled with their correct civic address, as recorded on the *Electrical Contractor Authorization & Declaration of Compliance,* prior to connection. Labels are to be made of engraved lamacoid, and permanently affixed to the front of the meter socket.

1.13.1 Meter socket location & mounting

Meter sockets shall be located and mounted with respect to the following conditions:

- Level on both the horizontal and vertical planes.
- Installed at a height of 1.4 to 1.7 metres (4.5 to 5.5 feet) above finished grade or floor height, measured from the meter socket's centre point.

  Note: A mounting height of 1.5 metres (5 feet) is preferred.
- Located in a clean and readily accessible area, protected from vandalism and damage.
- Located in a non-hazardous area.

  Note: Meter sockets cannot be located in areas hazardous to anyone installing, working on, or reading the metering equipment. Hazardous locations are defined as any area involving moving machinery, dust, vibration, fumes, falling debris, corrosive vapours, water and/or moisture.
- In a location acceptable to the British Columbia Safety Authority and FortisBC.
- Conform to all of the applicable requirements outlined in this guide.

Under no circumstances are meters to be installed in carports, breezeways, or under sundecks or balconies. If the area is enclosed at a later date, the customer is responsible for all costs associated with relocating the meter to an accessible location.

On all new installations, meters and meter sockets must not be recessed into walls or obstructed in any way as to impede their removal, reading, testing and/or re-installation. All underground service conduit that is above finished grade is to be securely fastened to the serviced building's exterior, and must remain exposed and in plain sight. Refer to drawing M7 for further detail.

On indoor installations where meters and electrical equipment are located in a meter room, these meter rooms shall have a door to the exterior of the building at ground level.
On indoor installations, where an electrical closet or room has been approved, it must be located at ground level with a door accessible only from the building's exterior. This room must not be

accessible from other areas of the building. Each meter must be labeled with the correct civic address prior to connection.

In the event that a building expansion or renovation requires two or more services, please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847) for supply service details.

1.14 Service upgrades

Customers are required to apply for all service upgrades and to pay any applicable charges prior to construction. Connection fees are based on the size and type of connection and are usually applied to the customer's first bill. Additional charges will apply for line extensions and optional underground wiring. All service upgrades and service relocations are subject to approval by FortisBC. Please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847) for more information.

Note: Underground services may be required in certain areas due to local bylaws.

Note: Customers are responsible for any additional costs involved in extending or upgrading existing FortisBC services.

1.15 Multiple residential meters

FortisBC shall service each residential account type with only one meter whenever possible. Under certain circumstances FortisBC may approve a second meter, provided at least one of the following criteria is met:

- Addition or connection of a defined living space such as a suite or carriage house. The living space must meet the requirements of the Canadian Electric Code and be clearly indicated on the electrician's electrical affidavit.

- The second meter is at a different tariff rate, such as one residential and one commercial.

- The distance from the main panel to the outbuilding (subpanel) is greater than the following;
  - 200A Subpanel – 45m away
  - 100A Subpanel – 55m away
  - 60A Subpanel – 45m away

- The main service is already at the maximum size FortisBC offers and it is maxed out. For example a customer has a 120/240v 600A main panel and requires a 100A sub panel in their shop. Since FortisBC does not offer a 1phase 700A service, a second meter would be permitted.

The second meter must be labelled as per section 1.13 of this document.

1.16 Multiple Commercial / Industrial Meters

FortisBC will service Commercial and Industrial customers with one meter whenever possible. In the case where multiple meters are permitted on a Commercial / Industrial building per the Canadian Electrical Code, these meters should be grouped together in the same location on the

building. In the case where this is permitted, the areas of the building that are fed by these meters should be separated by a firewall.

2 Service requirements

2.1 Overhead services

FortisBC is required to maintain overhead clearances of 5.5 metres (18 feet) over public and commercial driveways and 4.5 metres (15 feet) over residential driveways. A service mast must be installed on all overhead services to facilitate these requirements, except where snow loading poses a hazard. All exceptions must be approved by FortisBC.
All service drops exceeding 30 metres (100 feet) require a service pole. Customers are responsible for the installation cost. Exceptions must receive written approval from the British Columbia Safety Authority and FortisBC.

For overhead services FortisBC will supply and install the service conductors to the service mast.

2.1.1 Pole-mounted services

FortisBC allows self-contained 240 volt, single-phase, 3-wire services up to and including 400 amps to be mounted on a customer-owned meter pole. For 400 amps installations, only the meter bases listed in subsection "For Single-Phase Services Between 200A - 400A" under section 5.3.1: Instrument Meter Socket Specifications are permitted.

Note: All pole services require approval from the British Columbia Safety Authority.

The customer will purchase and install a new utility pole that is fully commercially treated. For 200A services, the pole shall be a minimum of Class 4. For 400A services, the pole shall be a minimum of Class 3. The 400A meter pole may require an anchor based on FortisBC design review. The pole for both services shall be a minimum of 9.15 metres (30 feet) in length, and in compliance with the British Columbia Electrical Code. The customer will own and maintain this pole. To this pole, the customer will mount a meter socket in accordance with section 1.13: *Meter Sockets* of this guide.

FortisBC requires the customer to install the pole with a minimum set depth of 10% + 2 feet (30 feet pole would be set 5 feet deep). All line equipment on the meter pole shall be built with ¾" hardware. The customer shall test and treat the meter pole and shall retain a "Proof of Treatment" record that can be made available to the FortisBC representative upon request. If the meter pole is deemed unsafe to climb by FortisBC Operations, FortisBC reserves the right to disconnect the service until the customer pole is made safe at the customer's cost.

Overhead services supplying a meter pole must first contact a FortisBC service pole for road crossings.

Under no circumstances will customer-owned equipment be allowed on a FortisBC service pole.

All customer-owned equipment (meter sockets, circuit breakers, service panels, meter pole, etc.) is to be a minimum of 5 metres from any and all FortisBC poles.

Services with higher capacities will be considered on a case by case basis, please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847) for details.

Note: All wiring and equipment located on the customer's side of the meter is to be customer-owned, installed by the customer at the customer's expense, and in compliance with British Columbia Electrical Code.

2.2 Underground services

Customers are responsible for all underground locates, permits, duct, trench digging and backfilling in addition to the supply of fine, clean sand for duct protection. Site preparation must be performed to finished grade prior to installation and conform to FortisBC and all other applicable municipal, regional and provincial standards.

Note: Electrical, telephone and cable television services can occupy the same trench; however, there must be a separation of 300mm as per British Columbia Electrical Code.

If a road crossing is required, FortisBC will apply for the necessary permits from the Ministry of Transportation and/or local municipality. The customer is required to obtain an excavation permit.

All meter sockets for underground services must have a minimum rating of 200 amps. The customer is responsible for supplying and installing 76mm (3 inch) duct 1.1 metres (42 inches) below final grade from the point of supply to the meter socket. Rigid PVC or steel conduit must is to be installed between the meter socket and the bottom of the service trench. This conduit shall be securely fastened to the serviced building's exterior and, above finished grade, must remain exposed and in plain sight. An expansion joint must be installed above finished grade to accommodate ground movement. Refer to drawing M7 for further detail. Type DB2 conduit can be used for the remainder of the duct on private property. The duct layout shall have no more than three (3) 90° bends between the service connection point and the meter. This includes the 90° bend at the service box or transformer. When the total duct length exceeds 30m, the customer shall concrete cap the 90° bends. Refer to drawing F-20 for details on concrete capping the 90° bend. A polyvinyl pull-string must be placed in the duct for FortisBC to install the conductor at a later date.

Refer to the FortisBC *Specification for Installation of Underground Conduit Systems* for more information on civil work, available at fortisbc.com/Electricity/CustomerService/ForHomes.

For single-phase services up to 200 amps, FortisBC will supply and install the service conductors to the metering point. For single-phase services over 200 amps, and all three-phase installations, the customer supplies, installs and owns the duct and conductor.

2.2.1 Underground Service with an Overhead Point of Supply

Where the point of supply is an overhead riser/dip pole, the customer is responsible for supplying and installing duct up to and including 90 degree bend at the base of the pole. The 90 degree bend should be 76mm (3 inch) Rigid PVC. Alternatively, a DB2 PVC bend may be used, provided it is encased with a minimum of 50mm (2 inches) of concrete. Installed duct must be orientated away from vehicle traffic and be clear of obstructions on the pole. Concrete capping of the 90° bends may be required as referred to in section 2.2 of this document. Refer to drawing F-21 for further information on the duct orientation and concrete capping. A polyvinyl pull-string must be placed in the duct for FortisBC to install the conductor at a later date. A service charge for supplying and installing the remaining portion of the duct is the customer's responsibility.

2.2.2 Pedestal-mounted metering

Pedestal-mounted meter installations are permitted for no more than two separate services per pedestal. Meter pedestals are to be purchased, installed, owned and maintained by the customer. Each meter socket must be labeled with the correct civic address prior to connection. Pedestals are to be installed in a location that is readily accessible to FortisBC personnel and in accordance with the criteria outlined in section 1.13: *Meter Sockets* of this guide.

Only FortisBC approved meter pedestals are to be used. Please refer to the following list for details:

- **For installations composed of a single 200A service**
  Valid Manufacturing Ltd. Catalogue No. FMP-DB-200 (FortisBC Material No. 9990800)
  Thomas & Betts Catalogue No. PE2-CS (FortisBC Material No. 9990801)

- **For installations composed of two separate 200A services**
  Valid Manufacturing Ltd. Catalogue No. FMP-DB-400

- **For installations composed of a single 400A service**
  Contact FortisBC for review and approval

To complete the installation of the meter pedestal, please be aware of the following steps:

- FortisBC Material No. 9990800 and 9990810 meter pedestals are direct buried. A pour-in-place concrete collar surrounding the pedestal, measuring 150mm (6 inches) thick and 300mm (12 inches) deep, shall be poured at finished grade. Please see drawings M5 and M6 for details.

- FortisBC Material No. 9990801 meter pedestal is mounted on a pre-cast concrete base. The concrete base is supplied by Kon Kast, catalogue No. 1063 (FortisBC Material No. 7550550).

Additionally, if deemed necessary by FortisBC, vehicle protection bollards are to be installed at the customer's expense and to FortisBC specifications.

Note: FortisBC must be notified in the customer's *Service Request* of all pedestal-mounted meter installations.

Note: All wiring and equipment located on the customer's side of the meter is to be customer-owned, installed by the customer at the customer's expense, and in compliance with British Columbia Electrical Code.

2.3 Temporary services

An *Electrical Authorization Form* is required for temporary overhead service. This form is valid for 6 months and is subject to renewal by the British Columbia Safety Authority.

2.3.1 Overhead

Poles that are installed over 15 metres (50 feet) from the point of service must be guyed with a suitable downhaul, or properly braced. In most cases, FortisBC will install a conductor large enough to be transferred to the permanent service location on the building at a later date. The pole should be located as close as possible to the permanent service.

2.3.2 Underground

- Pad-mounted transformers - The contractor will install Teck or ACWU cable up to the transformer temporary access hole on the transformer apron. Sufficient spare cable must be provided as to allow FortisBC crews to connect to the transformer terminals (in most cases 2 metres is adequate). Spare cable should be protected from damage.

- In-ground service boxes - The contractor will install Teck or ACWU cable up to the service box leaving an open excavation at the service box no deeper than required to allow FortisBC personnel to enter service box from underneath. Sufficient spare cable must be provided as to allow FortisBC crews to connect to the transformer terminals; in most cases, 2 metres (6.5 feet) is adequate. Spare cable should be protected from damage.

  Note: Under no circumstances are contractors to access service boxes. This includes removing covers, or feeding cable into service boxes.

2.4 Unmetered services

Services that draw less than 20 amps and have consistent power consumption may be eligible to be connected without metering equipment. Applicants for unmetered services must submit a written request to FortisBC prior to any work taking place. The service must be connected to the source by FortisBC and it must meet all requirements of the British Columbia Electrical Code.

For an unmetered underground service, the customer is responsible for all civil work, duct and conductor up to the service connection point designated by FortisBC.

Please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847) before any construction begins for more information.

Note: Standard connection fees apply for each service.

2.5 Other service types

Services supplying single-phase loads, such as those for street lights, traffic lights, irrigation timers, water pumps or lift stations, may not have permanent structures on which to attach the meter socket. In these situations the meter must be installed in a self-supporting structure that is approved by FortisBC. The customer is responsible for the cost of the support structure. Refer to FortisBC drawings M1, M2, M3 and M4 for approved structures.

2.6 Location-specific requirements

2.6.1 Single-family residential

Meter sockets must be located within 1 metre (3.3 feet) of the corner nearest the point of supply and in accordance with the criteria outlined in section 1.13: *Meter Sockets* of this guide. If a supply is not available at the front of the building, or if any structures near the point of supply impede service installation or restrict access to FortisBC equipment, an alternate meter location will be designated by FortisBC. Similarly, alternate meter locations may also be designated for services located in areas of extreme snow levels or where locations provide unreasonable access to FortisBC equipment.

2.6.2 Duplexes, triplexes & fourplexes

Each residence in a duplex, triplex or fourplex is metered individually. This requires that each meter socket be labeled with the correct civic address prior to connection.
Duplexes, triplexes or fourplexes do not require meter rooms; however, meters must be installed according to the following:

- The meters are installed at the same location and in accordance with the criteria outlined in section 1.13: *Meter Sockets* of this guide.
- The meter location is at the corner nearest the point of supply.
- The meter socket is used and serviced with only one service conduit. Twin masts shall be approved by the British Columbia Safety Authority and FortisBC. For twin mast installations, the service conductors coming out of the mast shall be identified.
- The combined service size of the duplex, triplex or fourplex does not exceed 400 amps.

Meter sockets that are installed in conjunction with an underground service must:

- Accept a 76 mm (3 inch) service entrance duct.
- Have a wiring compartment at the service entrance that is separate from all customer compartments, and that includes a sealable and removable cover.
- Accept a 4/0 aluminum service conductor.

Any approved duplex, triplex or fourplex meter socket may be used for an overhead connection.

In the event that one resident requires a service upgrade, all associated costs will be the sole responsibility of that resident.

2.6.3 Mobile homes

2.6.3.1 Within mobile home parks

FortisBC will provide service to mobile home parks provided there is a centralized 600 amp maximum service location including individual disconnect switches and individual meters for each mobile home pad. The service size will not be increased unless the service is provided from such a centralized location.

2.6.3.2 Other locations

FortisBC will provide service to independent mobile homes provided a structurally sound mast is installed directly on the mobile home. The mast must be situated within 1 metre (3.3 feet) of the corner of the mobile home nearest the point of supply.

Acceptable alternatives are either new utility pole that is commercially treated, a minimum of Class 5, a minimum of 9.15 metres (30 feet) in length, and in compliance with the British Columbia Electrical Code, or a new 150mm by 150mm (6 inch by 6 inch) post secured to the mobile home by 1.6cm (5/8 inch) bolts at the top and bottom. In order to connect the service, the customer must also equip the wooden mast with a bolted clevis and insulator. In all cases, each meter must be labeled with the correct civic address prior to connection.

2.6.4 Apartments, condominiums and townhouses

This section applies to residential buildings having more than four meters.

All meters must be in a meter room located at ground level and only accessible from the building's exterior. A meter room with access to other areas of the building will be considered if access is to common areas such as hallways. If required, FortisBC will provide and install an on-site lock box as to provide access to the meter room. FortisBC is absolved of all liability if the lock box is damaged or stolen.

The meter room must meet all criteria outlined in section 1.4: *Electrical Equipment Room Requirements* of this guide.

In compliance with the British Columbia Safety Authority, a specially constructed meter closet or meter room with outside access only is considered to be within the building if it meets the following criteria:

- The closet or room meets all conditions outlined in section 1.4: *Electrical Equipment Room Requirements*.

- The closet or room is architecturally part of the building being serviced.
- The door of the closet or room can be readily opened by authorized personnel at all times and under all weather conditions.
- A permanent sign stating "Electrical Equipment Within – Keep Clear At All Times" is permanently affixed to the closet or room door. The lettering on the sign must be at least 50mm (2 inches) high, and is not to be hand written.
- The closet or room is heated to maintain a temperature of at least 10 degrees Celsius at all times.

2.7 Service modifications and upgrades

All meters must be installed and removed by FortisBC personnel. Customers should coordinate all service changes with FortisBC by making a local call to **1-866-4FORTIS** (1-866-436-7847) to avoid reconnection delays.

FortisBC will reconnect service to an existing building or installation under the following conditions:

- There have been no alterations or additions since the most recent permit was issued.
- The occupancy classification has not changed.
- The existing circuits are in safe condition and are adequate for the new service.
- The service has not been disconnected for more than 90 days.
- An electrical inspector authorizes the reconnection.
- An electrical contractor authorizes the reconnection.
- The building is classified as a multi-family dwelling where one dwelling was disconnected, the main service is still connected and re-inspection is not required.

3 Metering signals

3.1 Availability of metering signals

FortisBC will provide metering signals to customers upon request. These signals are in the form of energy (kWh) or reactive energy (kVARh) pulses for use as an energy management tool. Incremental costs incurred by FortisBC for providing these signals will be the responsibility of the customer.

Note: FortisBC will not supply an End-of-Interval (EOI) pulse under any circumstances.

3.2 How the process works

To request a quote for a metering signal, please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847). FortisBC will develop a cost breakdown and a list of available options for the *Metering Signal Service Offer*. The quote will clearly identify the technical issues, specifications and any other additional cost factors, which will be at the customer's expense and time to determine. All customer inquiries about their own equipment should be directed to the customer's own electrical or instrumentation personnel. FortisBC Metering Services does not provide technical assistance related to customer equipment or customer installation type of inquiries.

Once all the technical issues are covered off, FortisBC will forward the offer to the customer. This will include the quotation letter, a copy of *Technical Specifications - Schedule B*, a site schematic (if applicable), and a copy of *Conditions for Metering Signals - Schedule A*.

Upon receipt of the customer's acceptance, FortisBC will install the service as soon as possible.

The signal will be terminated in a PVC junction box to be attached to the meter socket. All equipment up to, and including this termination, will remain the property of FortisBC.

3.2.1 Additional costs for the customer

In addition to the quote received from FortisBC, the customer can expect to have additional expenses related to their metering signal service.

Some additional expenses are:

- Landline connections - Trenching, cable and GPR protection expenses may be required.
- Non-landline connections - RF communication equipment (i.e. spread spectrum radio, AC power supplies, etc.) expenses will apply.

3.2.1.1 Trenching and other costs

FortisBC personnel do not do any trenching beyond FortisBC's premise perimeter.

A site schematic is to be included with any quote where trenching is required. The site schematic will show the approximate location of where the FortisBC trench will meet FortisBC's premise perimeter. It is the customer's responsibility to trench from their equipment to this location. The amount of spare cable the customer needs to supply from this point will also be included on the drawing. This spare cable is the amount required to reach the metering signal service termination block within the FortisBC premises.

3.2.1.2 Ground potential rise protection (if applicable)

Ground Potential Rise (GPR) is a momentary electrical hazard which occurs in the relatively rare event of a line-to-ground fault. Resultant high currents passing through finite local ground resistance cause a rise in local ground potential with respect to remote earth ground. Conductors, such as metering signal service cables, can provide opportunities for the momentary GPR to drive a significant portion of the fault current along them towards remote ground. Isolated incoming remote grounds present a hazard to human life such that persons may provide a path between them and a locally elevated ground potential. Under these conditions, connected incoming grounds can explosively burn open or overheat, posing a significant hazard.

As a result of the dangers which exist, a GPR estimate needs to be conducted for each installation site to determine if a GPR situation does exist and to determine the estimated level of the GPR. If the GPR is of sufficient magnitude, special isolation equipment may be required. If additional isolation or protection equipment is required, it will be included in the quote. Grounding of landline cable sheaths shall only occur at the customer's end. It is the customer's responsibility to ensure that this occurs. FortisBC will isolate all cable sheaths from the customer's equipment related to this offer from the ground at our metering equipment location. The customer shall make all necessary arrangements to protect their equipment from Ground Potential Rise. GPR levels can change with time, as electrical system loading and ground system values change.

GPR is not an issue if the metering equipment is located within the customer's premise.
If the metering equipment is external to the customer's premises, a GPR estimate is required.

3.2.1.3 Sites utilizing non-landline communication options

The customer will oversee the mounting of the communication device in an approved Type-3R outdoor enclosure provided by the customer to the customer's structure located a minimum of 5 metres away from FortisBC's structure. A power source will be provided to the communication device via the load side of the metering point. The customer is responsible for the costs associated with the communication circuit's electricity consumption.

FortisBC cannot guarantee that good reception via any cellular, point-to-point radio or non-landline communication device exists at any site. As such, the customer agrees to this potential limitation by accepting the offer. Any communication circuit troubleshooting time, requiring a FortisBC *Field Metering Technologist* to stay on site over and above the time accounted for in the installation of this offer, will be billed to the customer separately.

The above costs do not include any procurement, design, installation, maintenance, material, or communication equipment costs from the metering signal termination box to the customer's equipment (communication circuit) at the time of install or in the future. These additional costs and the arrangements to carry them out are at the customer's expense and time, and are not included in the quoted prices. The installation of any equipment or cabling on FortisBC premises will have to be done in conjunction with the FortisBC *Field Metering Technologist* installing the service. Otherwise, additional costs may be added to this quote.

The typical lead time required for the installation will be four to six weeks if GPR isolation is not required, or eight to twelve weeks if GPR isolation equipment is required, from the receipt of the signed agreement and schedules.

3.3 Basic technical specifications

3.3.1 Basic digital pulse signal specifications

Output Signals	Watt-hour and/or VAR-hour
Type	Form C, KYZ, 3-wire dry type contact per signal
Voltage Ratings	120 Volts DC or Peak AC
Current Ratings	50 milliamps
Maximum Capacity	0.5 VA AC or DC continuous
Maximum Pulse Rate	10 pulses per second per channel
Operating Temperature	-40 degrees Celsius to +85 degrees Celsius
Operating Humidity	5% to 95% relative humidity, non-condensing

Note: End-of-Interval (EOI) pulses are not available.

Some of the following equipment and/or process compatibility issues can result with the use of digital pulse signals:

- Too many or not enough Wh or VARh pulses to monitor or operate customer equipment from pulse delays resulting in load monitoring skew.
- Mismatched rating specifications (listed above).
- Compatibility with customer equipment.

Note: Investigation and correction of these issues are the responsibility of the customer, and not FortisBC.

3.3.2 Communication specifications

The communication equipment enclosure is to be mounted directly to the customer's equipment enclosure. The communication circuit, equipment and enclosure are the responsibility of the customer. Any maintenance, repair, troubleshooting and modifications to the communication

equipment will require a FortisBC representative to be on-site. The customer is required to pay for all incurred costs by FortisBC for this service.

3.3.3 Ground potential rise protection specifications

GPR isolation will be assessed on a site-per-site basis. Ground Potential Rise is not an issue on circuits where isolation between the FortisBC metering signal service equipment and the customer's equipment is achieved via cellular, point-to-point radio or a common ground grid. Refer to section 3.1.5: *Ground Potential Rise Protection (if applicable)* of this guide for more information on GPR.

3.3.4 Basic metering signal service cable specifications

FortisBC recommends using minimum 5kV dielectric strength cable for isolation purposes on trenched cables. Use shielded cable specified for trenching applications, where applicable. All cable dielectric strength specifications must exceed the GPR level listed on the quote.

4 Self-contained metering

4.1 General

4.1.1 Current, voltage and load limits

The maximum limits for a self-contained meter are:

- 200 amps per phase and/or
- 347 volts phase-to-ground

Any service exceeding these requirements will need to employ instrument metering. Refer to section 5: *Instrument Metering* of this guide for further information. Any existing service found to fall within the instrument metering requirement guidelines will need to be converted to instrument metering at the customer's expense, or the service will be disconnected for safety reasons. Any requests for exceptions to these rules must follow the procedures outlined in section 1.1: *Non-Standard Services* of this guide.

4.1.2 Standard self-contained metering supply configurations

Table 4.1 Self-Contained Meter Configurations (up to 200A)

Voltage	Phase/Wire	Connection	Socket	Drawing	Remarks
120/240	Single-Phase, 3-Wire	-	4 JAW	Figure 4.1	
120/208	Two-Phase, 3-Wire	Network	5 JAW	Figure 4.2	Neutral 5th jaw at 9 o'clock.
120/240Δ	Three-Phase, 4-Wire	Delta	7 JAW	Figure 4.3	For maintenance purposes only.
120/208Y	Three-Phase, 4-Wire	Wye	7 JAW	Figure 4.4	
347/600Y	Three-Phase, 4-Wire	Wye	7 JAW	Figure 4.4	

4.2 Equipment location and mounting

It is the customer's responsibility to supply a meter socket complete with a screw type sealing ring for FortisBC's use that conforms to the latest edition of CSA Standard C22.2 No. 115: *Meter Mounting Devices*. Sockets with current bypass switches will not be accepted.

4.2.1 General requirements

The following requirements apply to all self-contained metering installations. Refer to section 4.2.3: *Self-Contained Metering Equipment Location and Mounting – Specific Requirements* of this guide for further guidelines regarding specific installations.

Meter sockets are to be located and mounted:

- As close as possible to the service box.
- In a clean, readily accessible area.
- Free of severe or continual vibration.
- Level on both the horizontal and vertical planes (buildings with sloping sides require special provision).
- In a location acceptable to the British Columbia Safety Authority and FortisBC.
- In a non-hazardous location – meter sockets cannot be located in areas hazardous to anyone installing, working on, or reading the metering equipment. Hazardous locations are defined as any area involving moving machinery, dust, vibration, fumes, falling debris, corrosive vapours, water and/or moisture.
- In accordance with all requirements of section 1: *General Requirements* of this guide.
- In accordance with all applicable requirements of section 4.2.3: *Self-Contained Metering Equipment Location and Mounting – Specific Requirements* of this guide.

4.2.2 Service-specific requirements

These requirements apply to the installation type listed and are in addition to the requirements listed under section 4.2.2: *Self-Contained Metering Equipment Location and Mounting – General Requirements* of this guide.

Single meter installations operating at or less than 240 volts line-to-line and up to 200 amps are to be:

- Self-contained and located outdoors.
- Connected on the line side of the service disconnect.

- Installed at a height of 1.4 to 1.7 metres (4.5 to 5.5 feet) above finished grade, measured from the meter socket's centre point. If the finished grade is to be completed at a future date, the customer must supply a platform to meet the height requirements prior to connection. The mounting height must be maintained within the specified range when a permanent structure such as a sundeck, patio or walkway is built in the clear access area of the meter.

  Note: A mounting height of 1.5 metres (5 feet) is preferred.

Single meter installations operating at greater than 240 volts line-to-line and up to 200 amps are to be:

- Self-contained and located indoors.
- Connected on the load side of the service disconnect.
- Installed at a height of 1.4 to 1.7 metres (4.5 to 5.5 feet) above floor height, measured from the meter socket's centre point.

  Note: A mounting height of 1.5 metres (5 feet) is preferred.

- Equipped with provisions for FortisBC to seal all service entrance equipment ahead of the revenue metering point.

Multiple meter installations (see *Figure 4.5: Multiple Meter Installation* for details) are to be:

- Located indoors.
- Grouped together.
- Connected on the load side of the sub-service disconnect for all voltages.
- Individually labeled with their civic address on all meter sockets and disconnects.
- Installed at a height of 1.4 to 1.7 metres (4.5 to 5.5 feet) above floor height, measured from the meter socket's centre point.

  Note: A mounting height of 1.5 metres (5 feet) is preferred.

- Equipped with provisions for FortisBC to seal all service entrance equipment ahead of the metering point.

The only exception to the above is duplex, triplex and fourplex installations, in which the meters may be located outdoors at a height of 1.4 to 1.7 metres (4.5 to 5.5 feet) above the finished grade, and connected on the line side of the service disconnect.

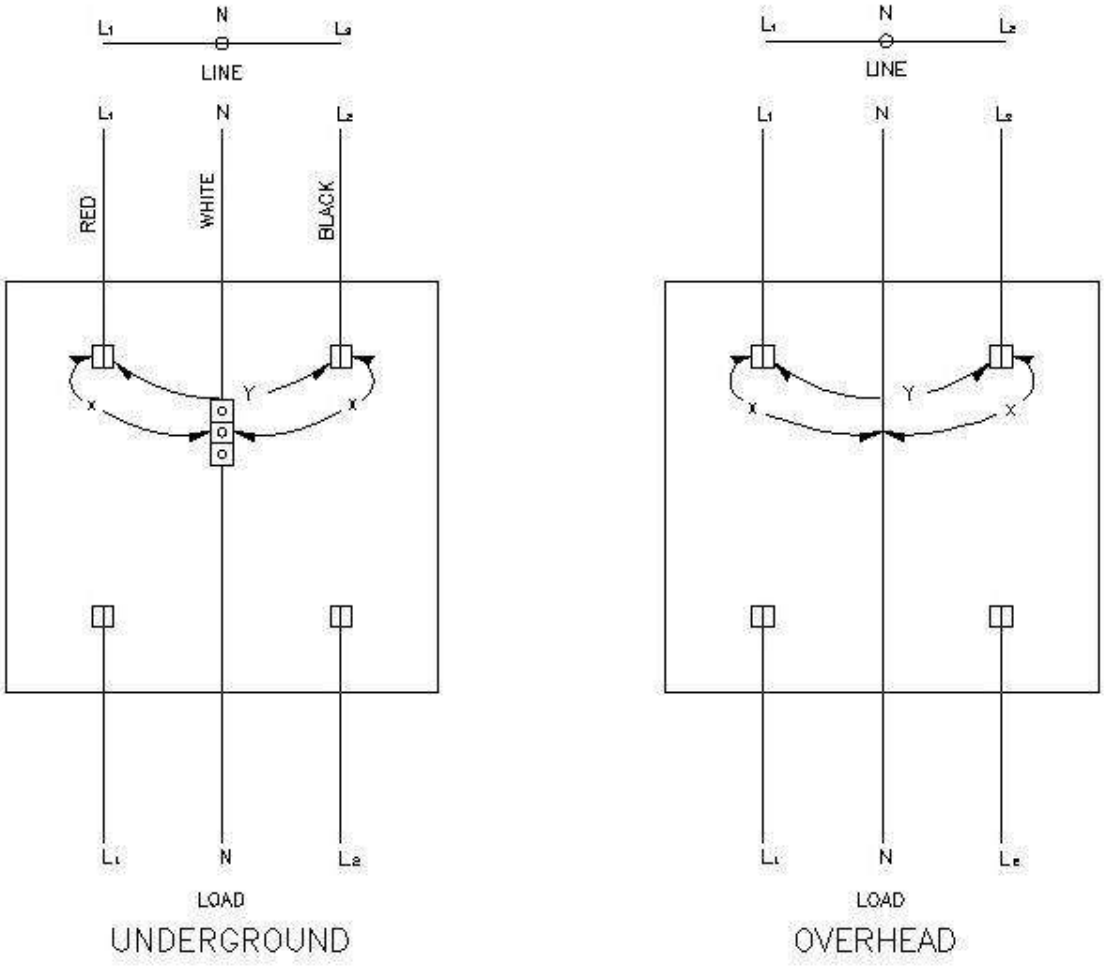
4.3 Connection of self-contained metering equipment

The customer is responsible to make all connections within the meter socket.

For all network and three-phase services, a neutral connection to the meter is required. The main service neutral shall be connected to the socket neutral lug from within the meter socket.
The only exception to this is when the meter socket is located on the load side of the service-disconnect. In this case, the neutral is not required for the customer's equipment; however, a tap, sized according to Table 16 of the Canadian Electrical Code and color coded green, must be run from the bonding point in the main service disconnect to the meter socket's isolated neutral block. The customer is to ensure that a white #12 AWG tickler wire is installed from the block to the socket neutral jaw.

All neutral connections after the main service disconnect must be isolated from ground (Canadian Electrical Code Rule 10-204-1d). In the case of meter sockets located after the main disconnect an isolated neutral block/connector must be used.

Figure 4.1 Single-Phase, Three-Wire Circuit, 120/240 Volts

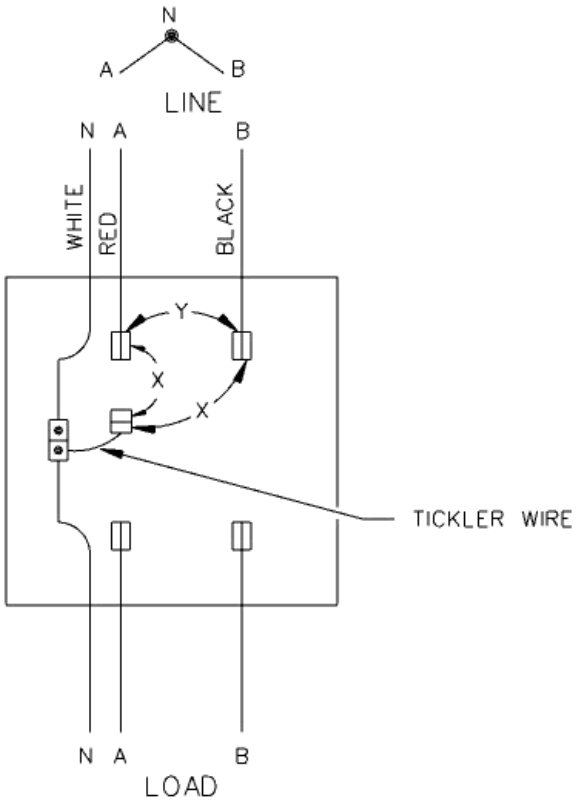


LINE VOLTAGE	MEASURED VOLTAGE	
	X	Y
120 / 240	120	240

NOTE:

1. SEE "CONNECTION OF SELF-CONTAINED METERING EQUIPMENT" SECTION

Figure 4.2 Three-Wire Network Circuit, 120/208 Volts

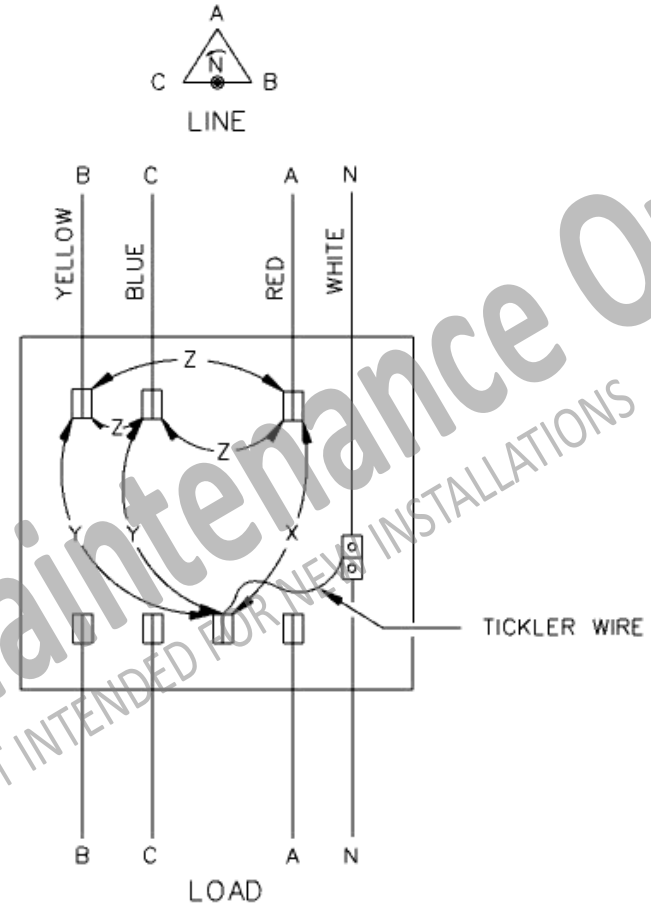


LINE VOLTAGE	MEASURED VOLTAGE	
	X	Y
120 / 208	120	208

NOTE:

1. SEE "CONNECTION OF SELF-CONTAINED METERING EQUIPMENT" SECTION

Figure 4.3 Three-Phase Four-Wire Delta Circuit, 120/240 Volts

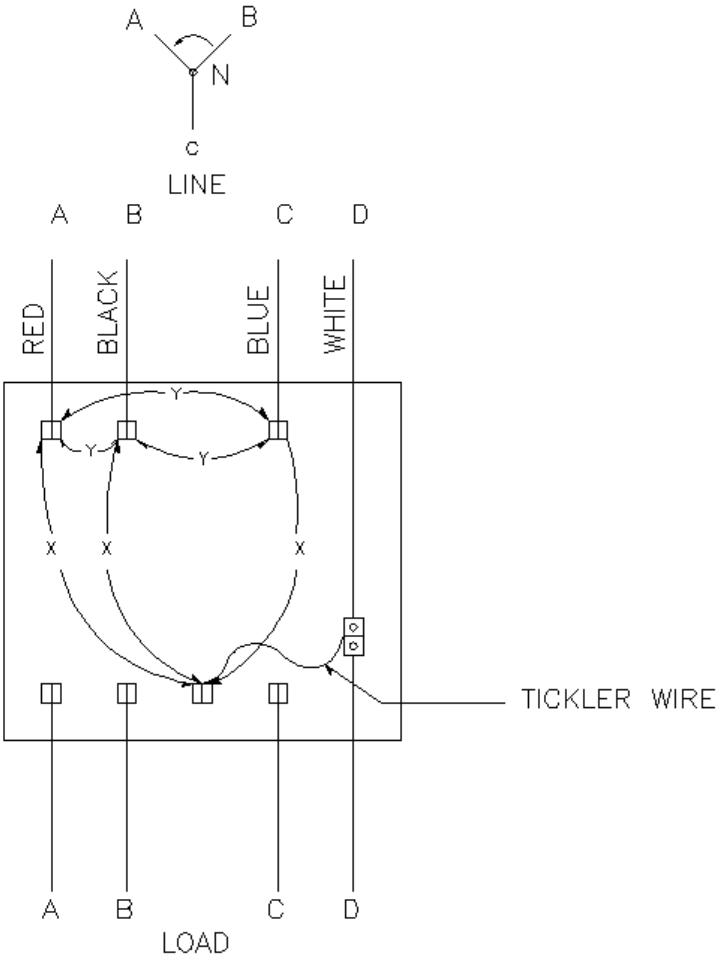


LINE VOLTAGE	MEASURED VOLTAGE		
	X	Y	Z
120 / 240	208	120	240

NOTE:

1. THIS SERVICE IS CONDITIONALLY AVAILABLE.
2. THE "HIGH LEG" MUST BE IN THE TOP RIGHT TERMINAL.
3. SEE "CONNECTION OF SELF-CONTAINED METERING EQUIPMENT" SECTION
4. LINE PHASE SEQUENCE DOES NOT EFFECT METERING.

Figure 4.4 Three-Phase Four-Wire Wye Circuit, 120/208 Volts, 347/600 Volts

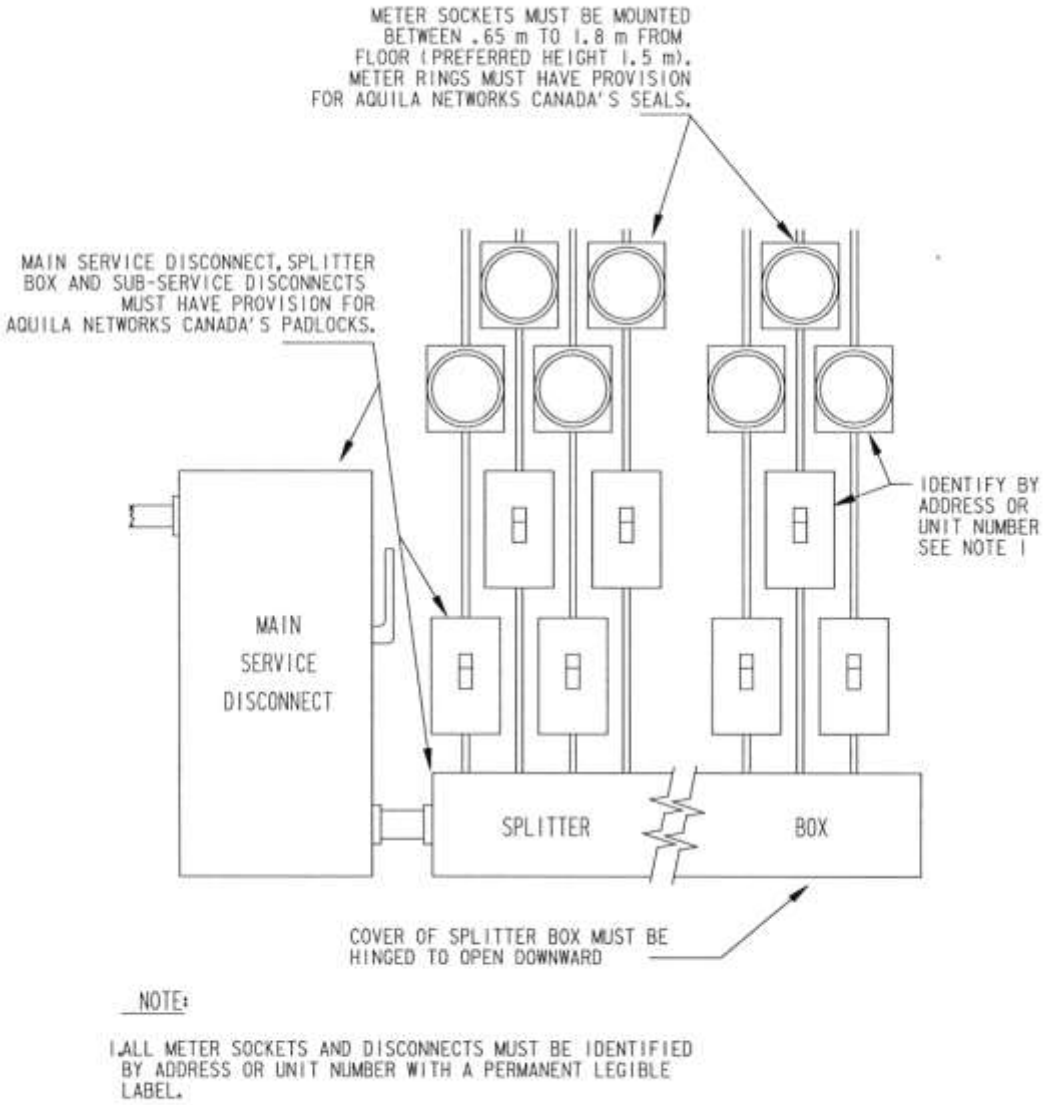


LINE VOLTAGE	MEASURED VOLTAGE	
	X	Y
120 / 240	120	208
347 / 600	347	600

NOTE:

1. SEE "CONNECTION OF SELF-CONTAINED METERING EQUIPMENT SECTION
2. LINEPHASE SEQUENCE DOES NOT EFFECT METERING

Figure 4.5 Multiple Meter Installation



5 Instrument metering

5.1 General

Instrument metering is required on all services:

- Exceeding 200 amps per phase and/or
- Where the nominal phase-to-ground voltage exceeds 347 volts

For all services that require instrument metering and are not metered at the supply transformer by FortisBC, the requirements in this section and section 5.2: *Instrument Metering Requirements* must be met, unless written approval is given by FortisBC (refer to section 1.1: *Non-Standard Services* of this guide).

Instrument metering requires that:

- The neutral conductor is present between the supply transformer or point of supply and the metering point for all three-phase four-wire wye systems.
- The neutral conductor must be grounded at the main service disconnect.
- After the main service disconnect, the neutral must always be isolated from ground.

  Note: The use of an isolated neutral block helps perform this function when the neutral is wired to a metering installation on the load side of the main service disconnect. Refer to Figure 5.4: *Service Entrance Connections, Instrument Metering* of this guide.

5.1.1 Single-phase, 200–400A, 240V, serving only one customer

The customer will supply and install an approved instrument meter socket (refer to section 5.3.1: *Instrument Meter Socket Specifications* of this guide) ahead of the main service disconnect. The instrument meter socket is to be located outdoors; however, under special circumstances, indoor installation may be allowed with the written approval of FortisBC (refer to section 1.1: *Non-Standard Services* of this guide). See section 5.2: *Instrument Metering Requirements* of this guide for further details and requirements.

5.1.2 Primary voltage service

Should the customer's service be considered primary voltage, FortisBC primary voltage revenue metering equipment must be installed on the line side of all customer-owned equipment.

For details, please contact FortisBC at **1-866-4FORTIS** (1-866-436-7847).

5.1.3 Pad-mounted transformers

At the customer's request FortisBC will supply and install the metering at the service transformer under the following conditions:

- The transformer serves only one customer.
- The service requirement exceeds 200 amps.

Note: The additional expenses associated with these installations are to be paid by the customer. If the above two conditions are not met, the customer must supply and install the metering according to the requirements of this section and section 5.2: *Instrument Metering Requirements*.

5.1.4 Overhead transformers

The customer must supply and install the metering according to the requirements of this section and section 5.2: *Instrument Metering Requirements*.

5.2 Instrument metering requirements

5.2.1 Supply of instrument metering equipment

The customer is required to supply the following:

- An approved instrument meter socket as specified in section 5.3.1: *Instrument Meter Socket Specifications* of this guide.
- An instrument transformer enclosure according to the specifications listed in section 5.3.2: *Current Transformer Enclosure Specifications* of this guide.
- A 32mm (1.25 inch) PVC or metal conduit between the instrument transformer enclosure and the meter socket.
- All hardware, buswork, termination and/or cable required for primary connections to the instrument transformers.

FortisBC will supply the following:

- Revenue meters.
- Instrument metering transformers.
- Fuse blocks and fuses for the potential circuit.

The instrument transformers will be made available to the customer by contacting FortisBC at **1-866-4FORTIS** (1-866-436-7847). Instrument transformers will be shipped to the customer via courier

or other arrangements will be made. The meter, fuses and fuse blocks will be installed by FortisBC personnel.

Note: Current transformers and revenue meters are the property of FortisBC and are supplied to the customer under the terms of FortisBC's *Electric Tariff*.

5.2.2 Instrument metering equipment location and installation requirements

Instrument metering equipment is required to be installed according to the following criteria:

- The instrument transformer enclosure is to be located indoors.
- The instrument meter socket is to be located outdoors; however, under special circumstances, indoor installation may be allowed with the written approval of FortisBC (refer to section 1.1: *Non-Standard Services* of this guide).
- Each metering enclosure must be bonded to the system ground.
- A maximum distance of 15 metres of 32mm (1.25 inch) PVC or metal conduit shall run between the meter socket and the instrument transformer enclosure.

  Note: This conduit shall have no more than four 90 degree bends, and shall be terminated with lock nuts and bushings except where thread hubs are supplied. If LB or similar conduit fittings are used, they must be sealable and clearly visible. Two polyvinyl pull-string must also be placed in the duct.

  Note: This conduit is for exclusive use of FortisBC. When it is necessary to route revenue metering secondary wires through compartments other than those reserved for FortisBC's use, a metal conduit or suitable metal raceway shall be installed through each compartment for the exclusive use of FortisBC.
- Securely mounted in a location protected from vandalism and damage, and that is satisfactory to both the British Columbia Safety Authority and FortisBC.
- To conform to all requirements of section 1: *General Requirements.*
- In a non-hazardous location – meter sockets and instrument transformer enclosures cannot be located in areas hazardous to anyone installing, working on, or reading the metering equipment. Hazardous locations are defined as any area involving moving machinery, dust, vibration, fumes, falling debris, corrosive vapours, water and/or moisture.
- Free of severe or continual vibration.

Instrument meter sockets shall be mounted:

- At a height of 1.4 to 1.7 metres (4.5 to 5.5 feet) above floor height, measured from the meter socket's centre point.

Note: A mounting height of 1.5 metres (5 feet) is preferred.

- Level on both the horizontal and vertical planes.

The customer will:

- Securely mount all current transformers.
- Securely mount an approved instrument metering socket (refer to section 5.3.1: *Instrument Meter Socket Specifications* of this guide).
- Securely mount an instrument transformer enclosure (refer to section 5.3.2: *Current Transformer Enclosure Specifications* of this guide).
- Securely install conduit between the instrument transformer enclosure and meter socket enclosure.

FortisBC will:

- Mount the fuse block and fuses.
- Connect the instrument transformer secondary(s) to the meter and fuse blocks.
- Supply and install the meter.

Instrument transformers are to be mounted in the following manner:

- Securely screwed to the back panel of the instrument transformer enclosure. All mounting holes on the instrument transformer must be utilized.
- The nameplates must be clearly visible when the enclosure is open.
- Current transformers shall be positioned with the primary polarity mark toward the source of supply and in an arrangement that will not obstruct access to the secondary terminals.
- Both current and potential transformers must be installed in a manner that makes them accessible and easily removable.

5.2.3 Connecting instrument metering equipment

The customer is responsible for making all connections to the current transformer primaries. These connections should be properly secured and conductors are to be routed and supported so that no stress is applied to the current transformers.

Where FortisBC supplies a three-phase four-wire wye service, the neutral bus bar must be run into the instrument transformer enclosure from the main service disconnect, and a hole is to be drilled

and tapped for a #10-32 screw. When insulated cable is used instead of a bus bar, an approved isolated neutral block must be provided on the neutral conductor (on one of parallel conductors) within the instrument transformer enclosure to facilitate the connection of the potential wire for the meter.

Unless written approval has been granted by FortisBC, all three-phase services will be supplied as three-phase four-wire grounded wye. Because of this, the grounding conductor required by Canadian Electrical Code Rule 10-204 shall be run from the X0 bushing of the supply transformer to the neutral terminal block in the main service disconnect, and also to the switchgear case ground. An insulated conductor of equivalent size is also to be run from the neutral terminal block to an isolated neutral block in the instrument transformer enclosure (refer to Figure 5.4: *Service Entrance Connections for Instrument Metering*). The grounding conductor to the instrument transformer enclosure shall be coded white to indicate the neutral reference for metering potential transformers.

FortisBC will make all connections to potential transformers, current transformer secondaries, fuse blocks and meters (refer to Figure 5.4: *Service Entrance Connections for Instrument Metering*).

5.3 Instrument metering equipment specifications

5.3.1 Instrument meter socket specifications

Only FortisBC approved instrument meter sockets are to be used. Please refer to the following list for details:

- **For single-phase services between 200A - 400A**
  4 Jaw, 120/240 Volt, Single-Phase, 3-Wire, Overhead/Underground Service
  Hydel Catalogue No. CT4-BC
  Thomas & Betts Catalogue No. JS4B-4STW

  4 Jaw, 120/240 Volt, Single-Phase, 3-Wire, c/w Breaker, Overhead Service
  Hydel Catalogue No. CT4-WSOH-BC

  4 Jaw, 120/240 Volt, Single-Phase, 3-Wire. c/w Breaker, Underground Service
  Hydel Catalogue No. CT4-WS-BC

- **For single-phase services over 400A**
  4 Jaw c/w Test Switch, 120/240 Volt, Single-Phase, 3-Wire
  Thomas & Betts Catalogue No. CT104-SWL
  Meter Device Catalogue No. 602-U3040C-4-610
- **For three-phase services**
  13 Jaw c/w Test Switch, 120/208, 347/600 Volt, Three-Phase Four-Wire Wye
  Thomas & Betts Catalogue No. CT113-SWL
  Meter Device Catalogue No. 602-U3040C-13-603

5.3.2 Current transformer enclosure specifications

Current transformer enclosures must meet the following criteria:

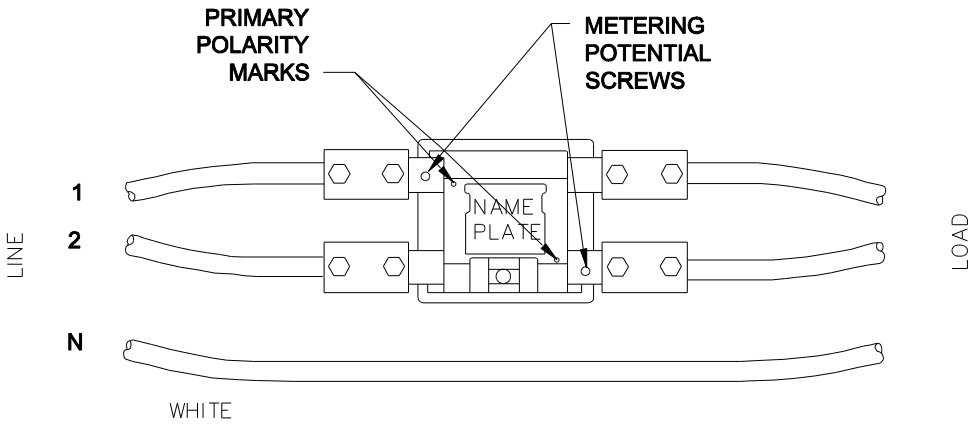
- A separate current transformer enclosure must be installed for each instrument metering service utilizing current transformers.
- All current transformer enclosures are to meet the appropriate specifications listed in Table 5.1: *Current Transformer Enclosure Specifications*.
- All current transformer enclosures must be equipped with a vertically hinged door, non-removable in the closed position, and with provisions for securing the door with a FortisBC 9mm-shackle padlock.

Table 5.1 Current Transformer Enclosure Specifications

Service Information			Enclosure Specifications				Current Transformer Requirements
Voltage	Phase/Wire	Size	H	W	D	Material Gauge	
120/240	Single-Phase, 3-Wire	200A-400A	610mm 24"	610mm 24"	254mm 10"	16	One 3-Wire Current Transformer
120/240	Single-Phase, 3-Wire	401A-600A	760mm 30"	760mm 30"	254mm 10"	16	One 3-Wire Current Transformer
120/208Y	Three-Phase, 4-Wire	200A-600A	760mm 30"	760mm 30"	254mm 10"	16	Three 2-Wire Current Transformers
120/208Y	Three-Phase, 4-Wire	601A-1200A	915mm 36"	915mm 36"	305mm 12"	14	Three 2-Wire Current Transformers
347/600Y	Three-Phase, 4-Wire	200A-1200A	915mm 36"	915mm 36"	305mm 12"	14	Three 2-Wire Current Transformers

Note: Enclosure dimensions are minimum requirements.

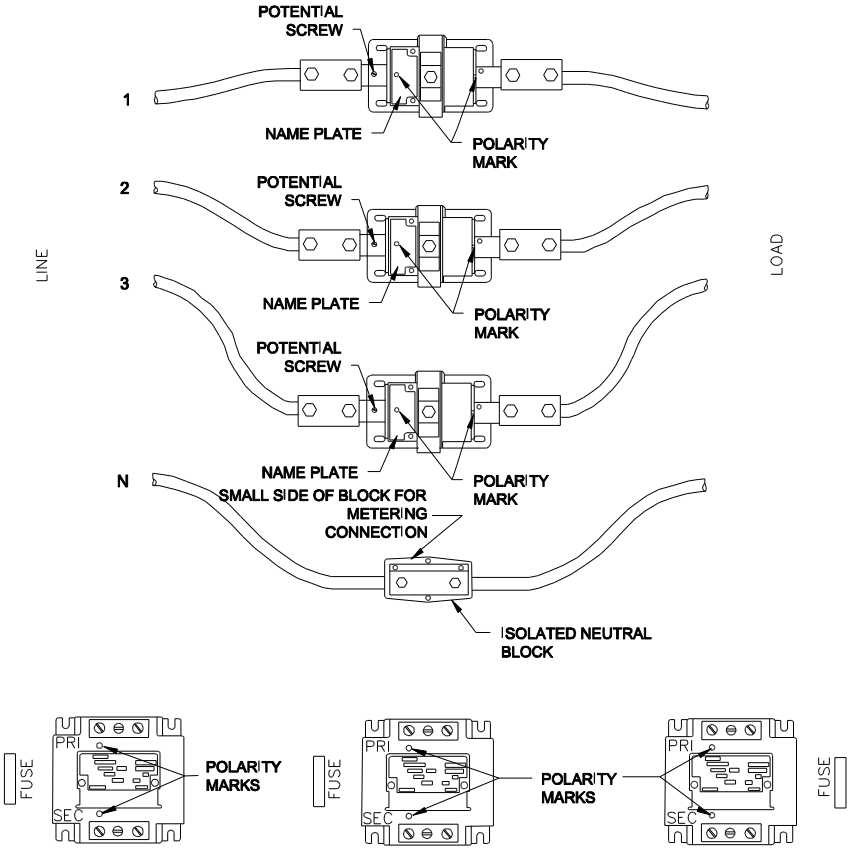
Figure 5.1 Single-Phase Instrument Transformer Enclosure Layout



NOTES:

1) LINE CONDUCTORS BOTH CONNECT TO THE SAME SIDE OF THE C.T..
2) NO CONNECTORS ARE REQUIRED TO THE NEUTRAL CONDUCTOR.

Figure 5.2 Three-Phase Instrument Transformer Enclosure Layout



NOTES:

1. PT'S AND FUSES WILL BE SUPPLIED BY FORTISBC AS REQUIRED

2. THE NEUTRAL CONDUCTOR MUST BE RUN INTO THE INSTRUMENT TRANSFORMER ENCLOSURE. THE CUSTOMER MUST INSTALL AN ISOLATED NEUTRAL BLOCK TO FACILITATE CONNECTION OF THE POTENTIAL WIRE FOR METERING.

3. IF LOAD AND LINE ARE REVERSED THE CT'S MUST BE REVERSED SO THAT THE POLARITY MARKS ARE ALWAYS ON THE LINE SIDE.

4. THE ISOLATED NEUTRAL BLOCK MUST BE INSULATED FROM THE ENCLOSURE AND CANNOT BE GROUNDED.

5. WHERE PARALLEL CONDUCTORS ARE USED FOR GREATER AMPACITY. ONLY ONE NEUTRAL CONDUCTOR NEED BE CONNECTED TO THE ISOLATED NEUTRAL BLOCK.

Figure 5.3 Instrument Transformer Metering Layout

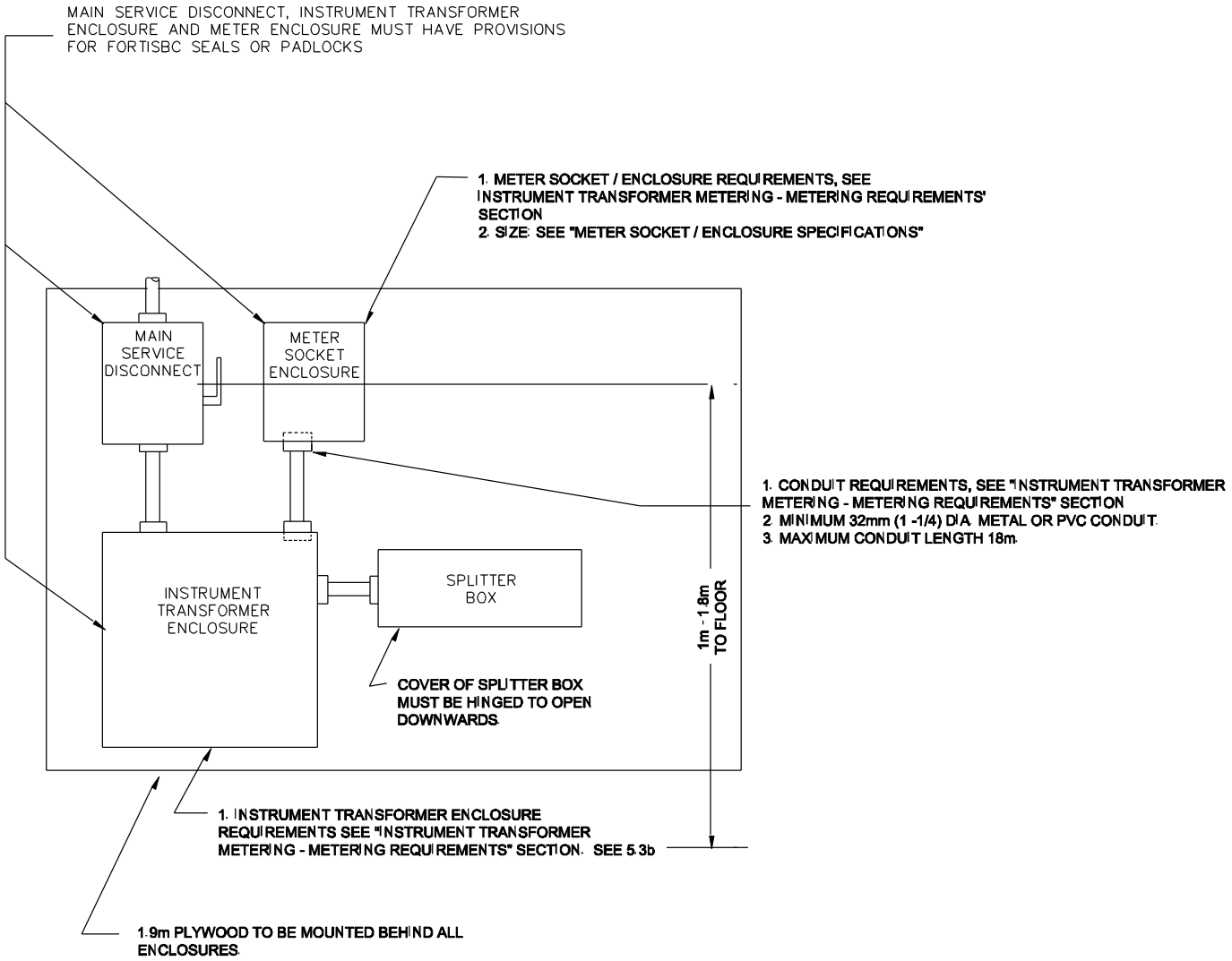


Figure 5.4 Service Entrance Connections for Instrument Metering

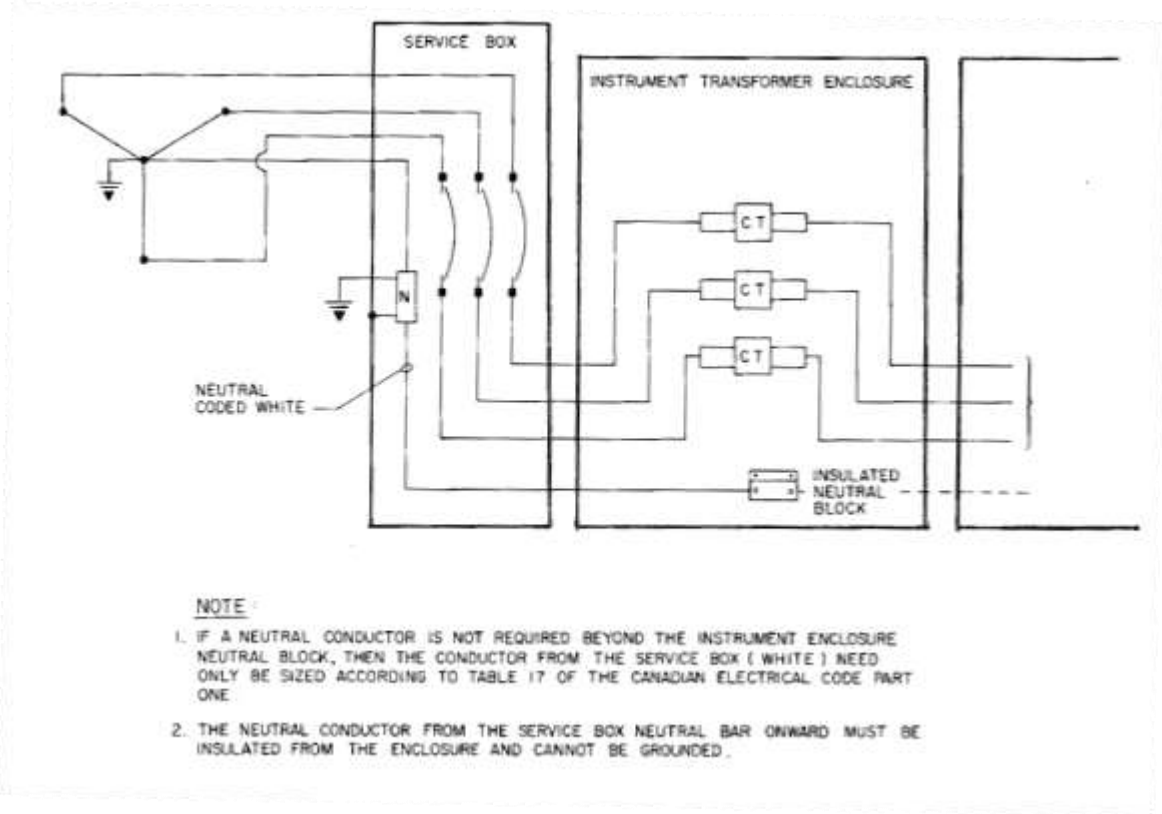
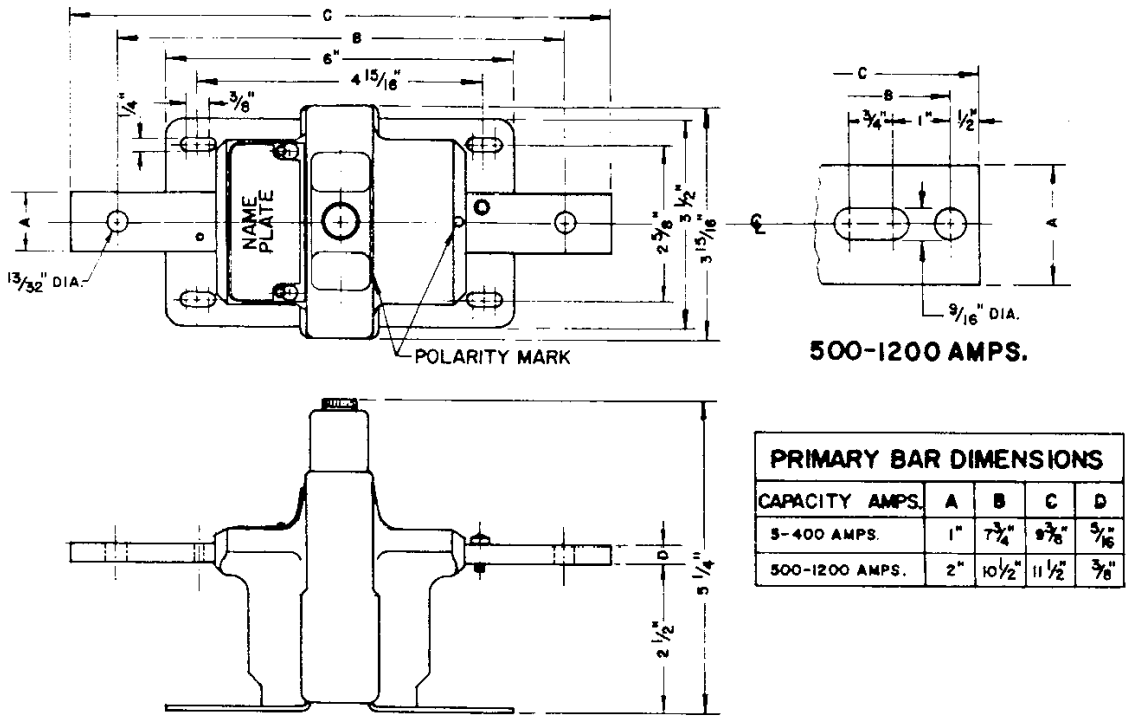


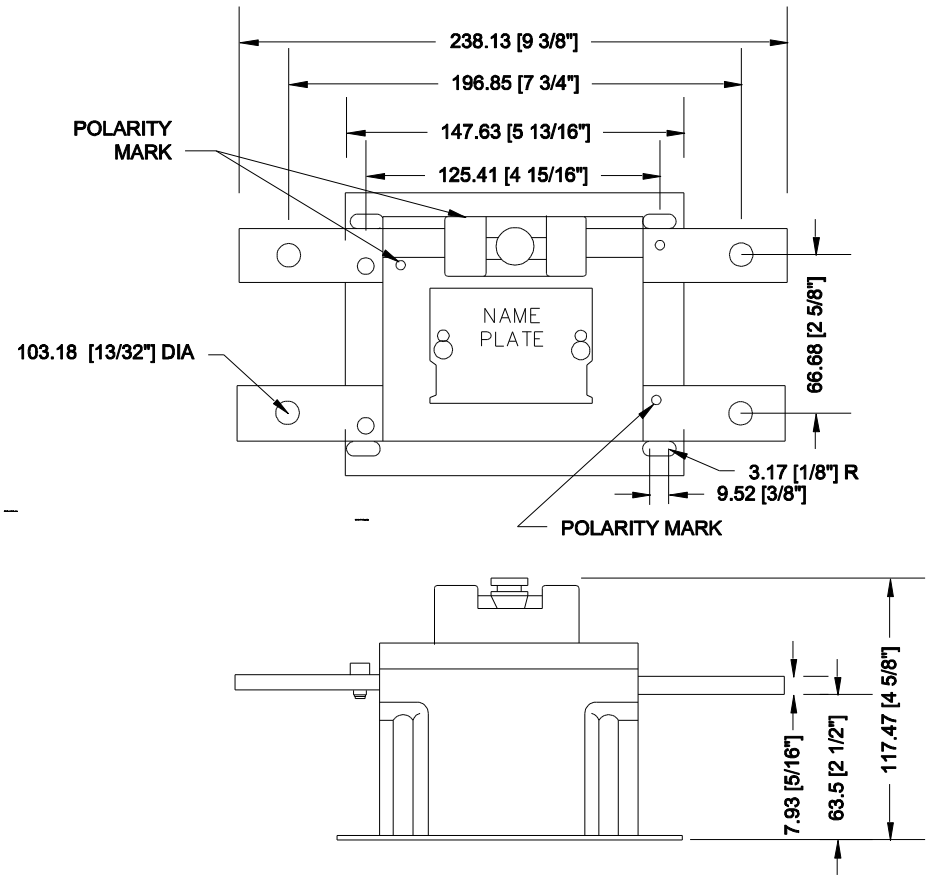
Figure 5.5 2-Wire Current Transformer Dimension Specifications



PRIMARY BAR DIMENSIONS				
CAPACITY AMPS.	A	B	C	D
5-400 AMPS.	1"	7 3/4"	9 3/8"	5/16"
500-1200 AMPS.	2"	10 1/2"	11 1/2"	3/8"

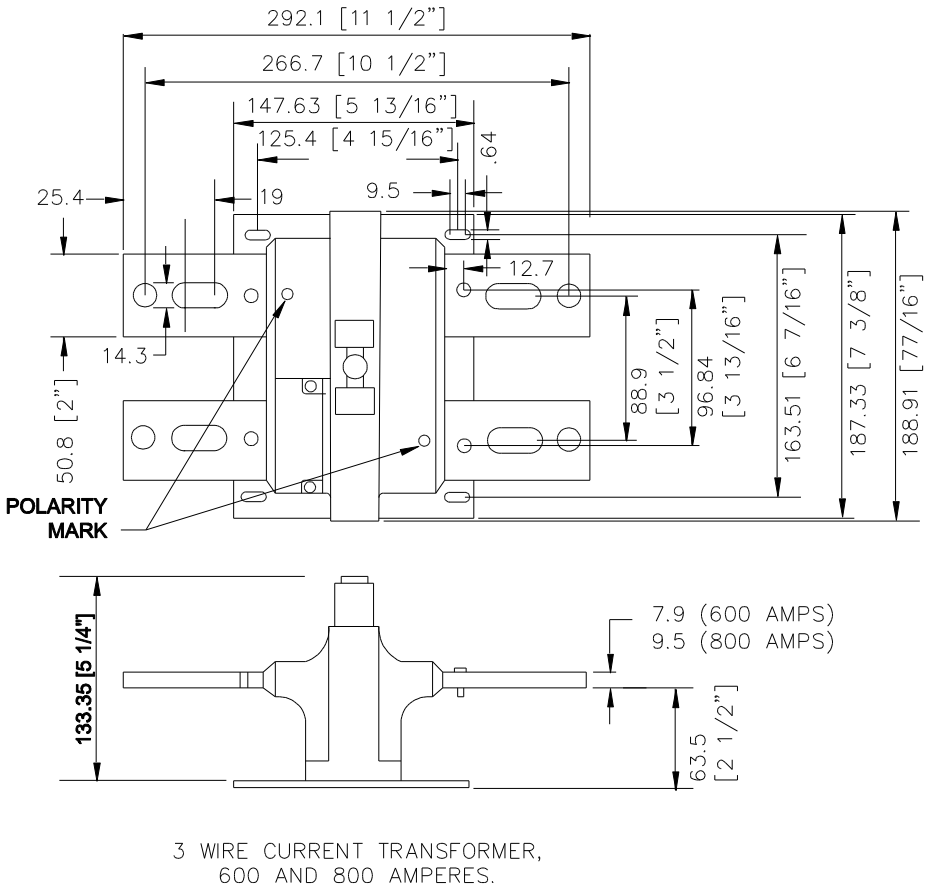
2 WIRE CURRENT TRANSFORMER,
5 TO 1200 AMPERES

Figure 5.6 3-Wire Current Transformer (400A Maximum) Dimension Specifications



3 WIRE CURRENT TRANSFORMER,
200 TO 400 AMPERES

Figure 5.7 3-Wire Current Transformer (600A Maximum) Dimension Specifications



3 WIRE CURRENT TRANSFORMER,
600 AND 800 AMPERES.

6 Glossary of terms

British Columbia Electrical Code - The Canadian Electrical Code as adopted by the Province of British Columbia, including all amending bulletins issued by the British Columbia Safety Authority.

Canadian Electrical Code - Canadian Electrical Code, Part I – *Safety Standard for Electrical Installations*. CSA C22.1-12 or latest edition.

CSA - Canadian Standards Association

Installed Capacity - The rated capacity, in kilovolt-amperes (kVA), of the FortisBC transformer supplying the service.

Instrument Meter Socket - A meter socket for the purpose of installing FortisBC's instrument meter and test switch. See “Meter Socket.”

Instrument Metering Transformers - High accuracy current or potential (voltage) transformers approved by Measurement Canada for revenue metering.

Instrument Metering Transformer Enclosure - The enclosure supplied and installed by the customer for the housing of instrument metering transformers.

Meter, Network Type - A two element meter designed for use on a three-wire network service obtained from two phase wires and a neutral from a three-phase 4-wire wye system.

Meter, Self-Contained - A meter rated for carrying the total current and full voltage of the circuit to be metered.

Meter, Transformer Type - A meter used in conjunction with instrument transformers.

Meter Base - See “Meter Socket.”

Meter Pedestal - A FortisBC approved meter mounting device that is self-supporting.

Meter Pole - A customer-owned utility pole, as per section 2.1: *Pole-mounted Services* of this guide, to which a pole-mounted service, and the associated FortisBC revenue metering equipment are installed.

Meter Socket - A meter mounting device, as per the British Columbia Electrical Code, used in conjunction with FortisBC's self-contained meter. Commonly referred to as a “Meter Base.”

Multiple Meter Installation - Any installation where a building has several meters fed from one service entrance, such as apartment buildings, shopping centers, office buildings, warehouse or light industrial complexes.

Net Metering - When a customer wishes to install their own FortisBC-approved generation facilities, FortisBC will install a bi-directional meter permitting customers to only be billed for their net consumption. Net consumption is defined as a customer's total consumption less their total generation in a given billing cycle as shown by a positive meter reading when the customer-owned generation facilities produce more electricity than the customer requires.

Service Disconnect - An approved metal enclosure or cabinet that houses either a service switch and fuses or a circuit breaker. The assembly's design must permit manual operation of the service switch or circuit breaker when the enclosure is closed. This is sometimes referred to as the main panel.

Service Entrance - The point of entry and termination of FortisBC's supply conductors and the location of the customer's main service disconnect.

Service, Temporary - Service for a limited period of time, generally less than one year (ie.: construction sites).

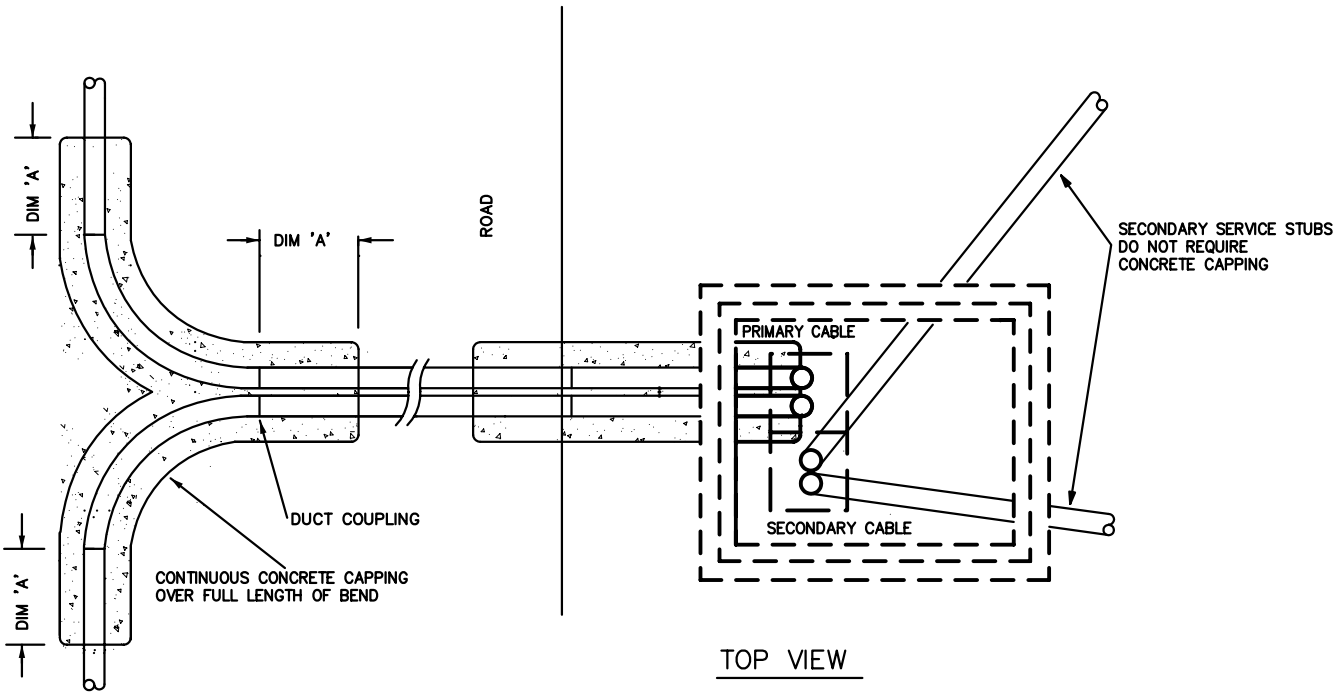
Service, Three-Phase Four-Wire Wye - Any service in which FortisBC supplies three phase conductors and a grounded neutral conductor to the service entrance.

Voltage, Primary - A nominal potential of 751 to 35,000 volts measured phase-to-phase.

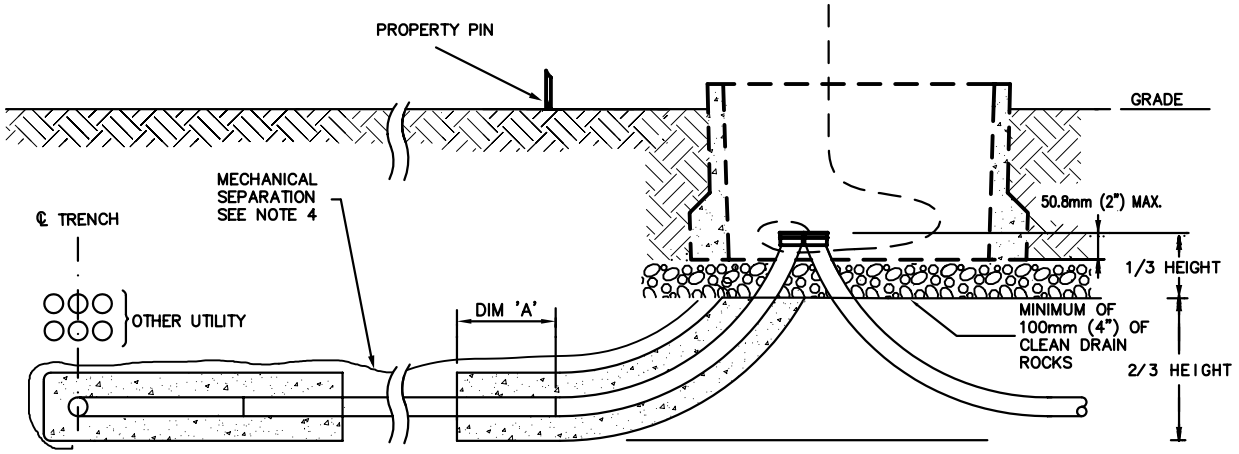
Voltage, Secondary - A nominal potential of 750 volts or less measured phase-to-phase.

7 Drawings

See Attached



TOP VIEW



SECTION VIEW

NOTES:

1 – UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWING ALL PVC SWEEPS, PRIMARY AND SECONDARY, EXCEPT SERVICE STUBS, TO BE CONCRETE CAPPED.

2 – DIMENSION 'A' TO BE 4 TIMES NOMINAL PIPE DIAMETER. FOR 100mm (4") DUCT DIM 'A' = 400mm (16")

3 – STREET LIGHT DUCT DOES NOT REQUIRE CONCRETE CAPPING

4 – MECHANICAL SEPARATION BETWEEN UTILITIES TO BE CONTINUOUS LAYER OF MINIMUM 6 MIL POLY SHEET OR 100mm (4") OF FINE CLEAN SAND

5 – CONCRETE ON ALL SWEEPS OR 90 DEGREE BENDS

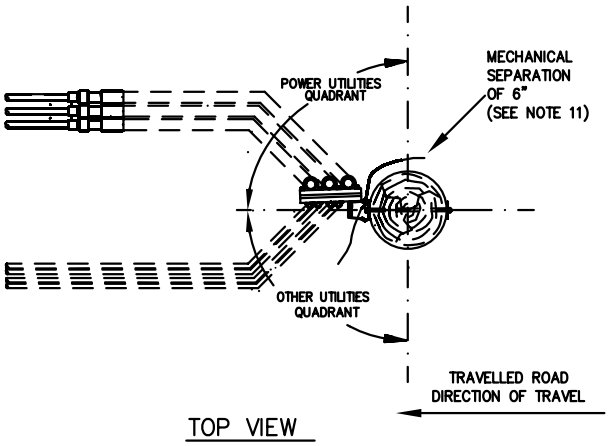
REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3	OCT/08	SW	NG	REMOVED PROPERTY LINE	BM	OCT/08
2	APR/08	DT	NG	UPDATE OWNERSHIP, MODIFIED NOTE 1	BMB	AP/08
1	JUN/04	NS	NS	MODIFIED CONDUIT CAPING & NOTE 2	FC	JUN/04

DRAWN BY		
CHECKED BY	NS	JUN/04
APPROVED BY	RS	JUN/04

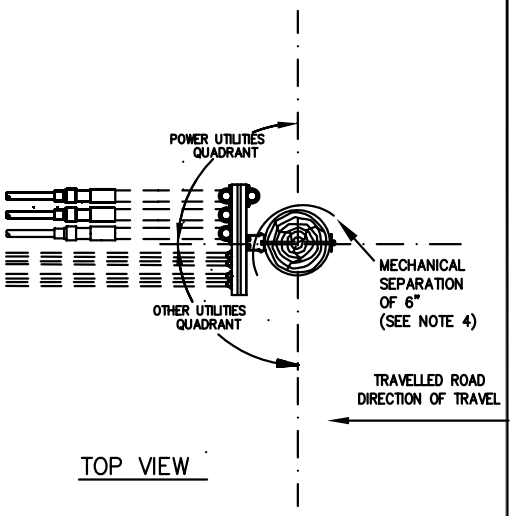
PLACEMENT OF FACILITIES
CONCRETE ENCASEMENT – BENDS

FORTISBC

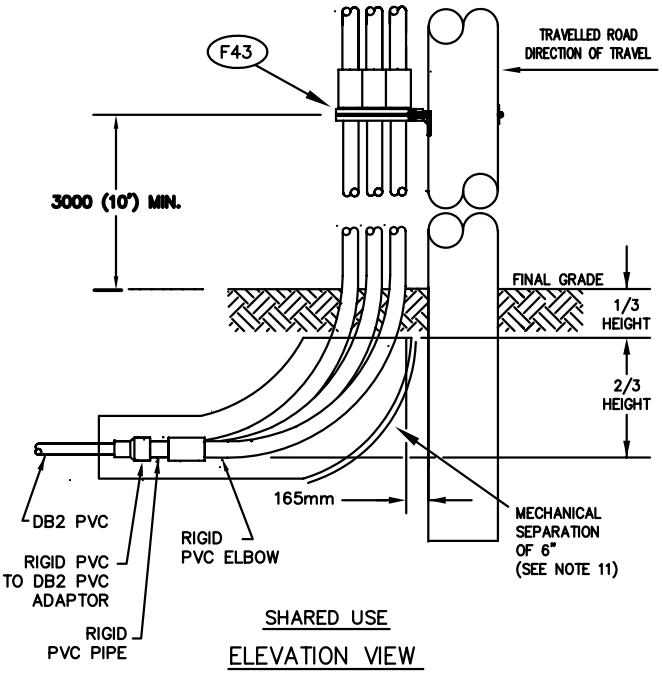
DRAWING No.	REV.
F–20	3



TOP VIEW

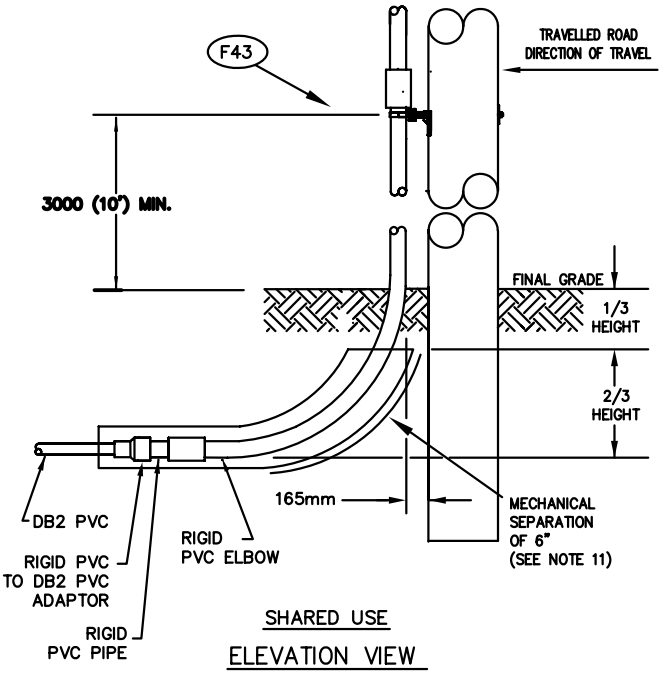


TOP VIEW



SHARED USE

ELEVATION VIEW



SHARED USE

ELEVATION VIEW

NOTES:

1 – VARIATION TO THIS ARRANGEMENT SHALL BE APPROVED BY FORTIS.

2 – DUCTS SHALL BE GROUPED AS CLOSELY AS POSSIBLE TO OTHER UTILITIES.

3 – BOLTS SHALL NOT BE TIGHTENED AS TO DEFORM THE DUCT.

4 – DUCTS SHALL NOT BE INCASED IN PHONE COMPANY CONCRETE PILASTER.

5 – PVC CONDUIT TO BE CONCRETE CAPPED. ALL DUCT TO BE PVC.

6 – POWER UTILITY'S QUADRANT MAY BE SWITCHED BY SPECIAL PERMISSION FROM FORTIS.

7 – CUT THE END OF THE BOLT FLUSH WITH THE POLE

8 – UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWING ALL PVC SWEEPS, PRIMARY AND SECONDARY TO BE CONCRETE CAPPED.

9 – STREET LIGHT DUCT DOES NOT REQUIRE CAPPING

10 – MECHANICAL SEPARATION BETWEEN UTILITIES TO BE CONTINUOUS LAYER OF MIN 6 MIL POLY SHEET OR 100 MM (4") OF FINE CLEAN SAND.

11 – ANY MECHANICAL SEPARATION TO KEEP CONCRETE MIN 6" FROM POLE

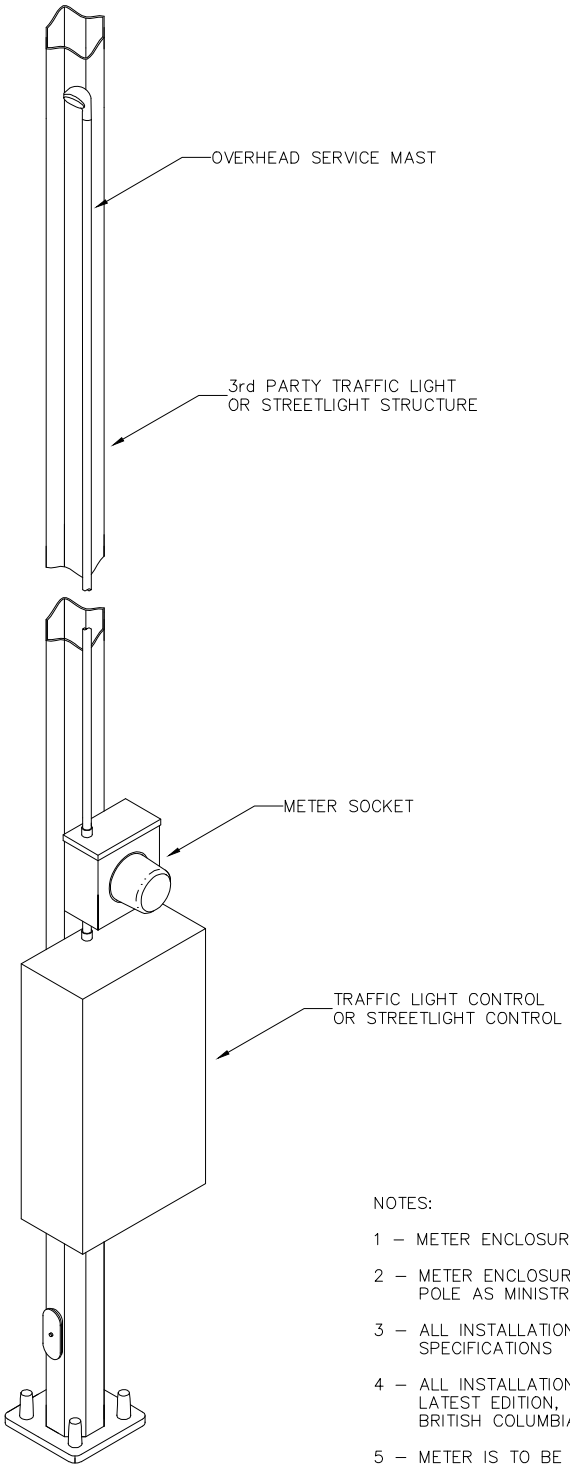
REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2	DEC 07	JC	NG	REVISED DWG, REMOVED NOTE 5, ADDED NOTES 8–11	BM	DEC/07
1	JUL 04		NS	REVISED NOTES 2/5, ADDED REF TO SINGLE DUCT APP	FC	JUL/04

DRAWN BY		
CHECKED BY	NS	JUL 02
APPROVED BY	RS	JUL 02

PLACEMENT OF FACILITIES
CONCRETE CAPPING – POLE RISER

FORTISBC

DRAWING No.	REV.
F–21	2



NOTES:

1 – METER ENCLOSURE MATERIALS SHALL BE NONOCORROSIVE

2 – METER ENCLOSURE SHALL BE MOUNTED ON THE SAME SIDE OF POLE AS MINISTRY OF TRANSPORTATION EQUIPMENT

3 – ALL INSTALLATIONS ARE AS PER MINISTRY OF TRANSPORTATION SPECIFICATIONS

4 – ALL INSTALLATIONS ARE AS PER CANADIAN ELECTRICAL CODE – LATEST EDITION, INCLUDING AMENDING BULLETINS ISSUED BY BRITISH COLUMBIA SAFETY AUTHORITY AND CSA

5 – METER IS TO BE ELECTRONIC RECEIVER/TRANSMITTER TYPE

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
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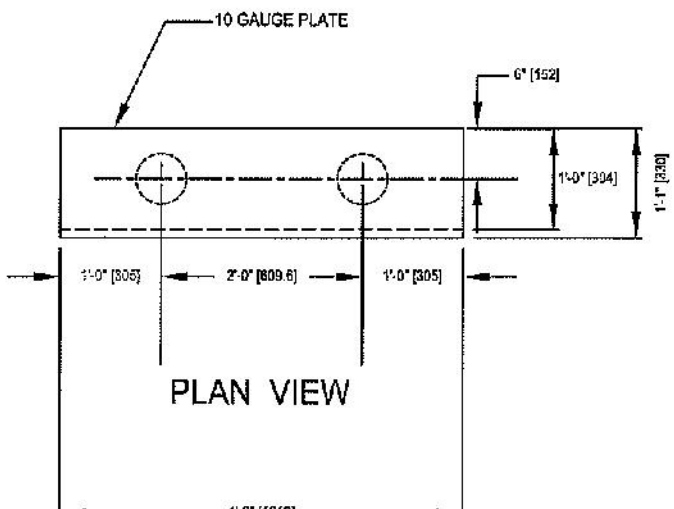
1	FEB/13	NW	AWB	REDRAWN; ADDED NOTES 3, 4 & 5; UPDATED BORDER	DCW	FEB/13

DRAWN BY	TBH	JUN/06
CHECKED BY	BM	OCT/06
APPROVED BY	CK	OCT/06

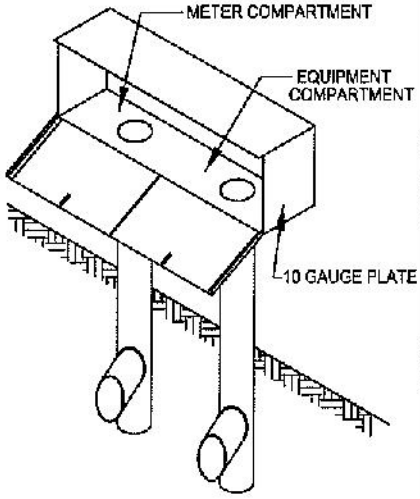
TRAFFIC LIGHT AND STREETLIGHT METERING OVERHEAD FEED
SHEET 1 OF 1

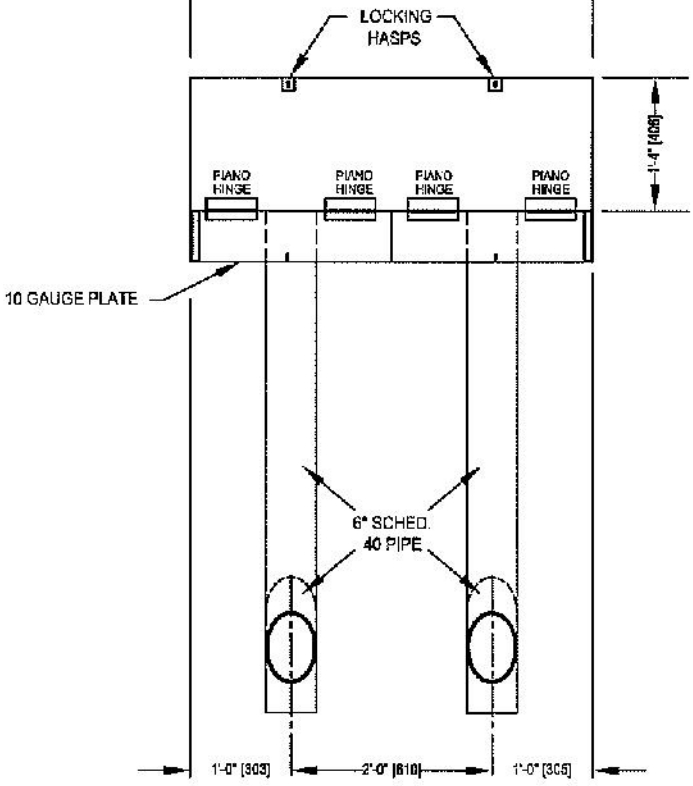
FORTIS BC

DRAWING No.	REV.
M1	1

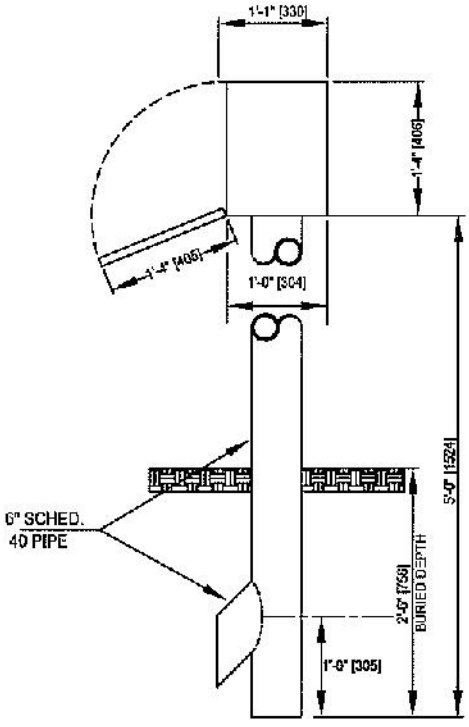


PLAN VIEW





FRONT VIEW



SIDE VIEW

NOTES:
1) ALL CONSTRUCTION DONE BY THE CUSTOMER MUST USE CSA APPROVED MATERIALS AND MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE AND PROVINCIAL STANDARDS.
2) BURIAL DEPTH OF THE ENCLOSURE IS 2.5 FEET OR 756mm
3)THIS ENCLOSURE TO BE USED FOR MUNICIPAL SERVICES, LIGHTING, AND IRRIGATION

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
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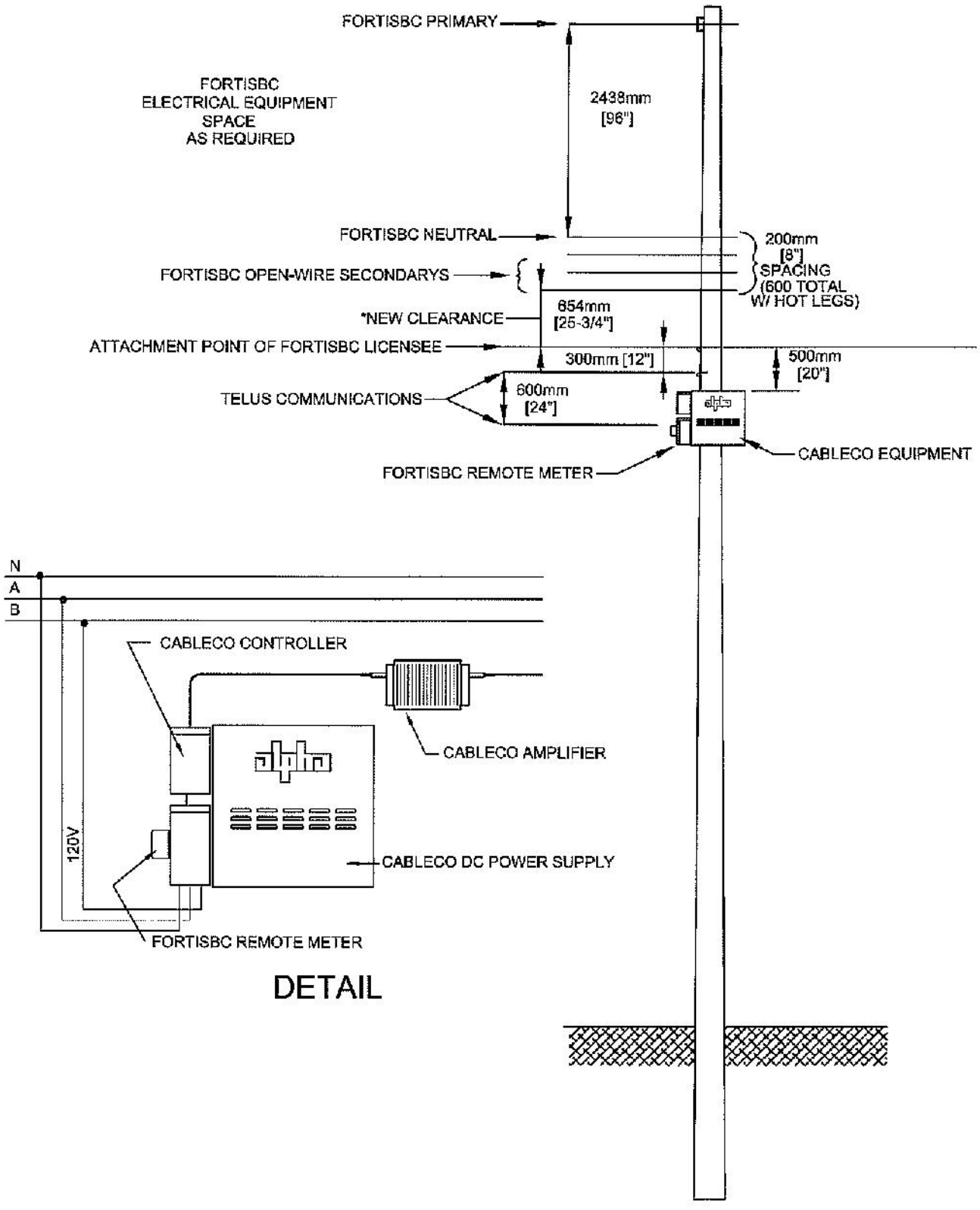
2						
1	JUN'06	TBH		ADDED GROUNDLINE DIMENSION, CHANGES TO DOOR(S)		

DRAWN BY	RB	OCT'84
CHECKED BY		Oct/06
APPROVED BY		

METER VAULT

FORTISBC

DRAWING No.	REV.
M2	0



DETAIL

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
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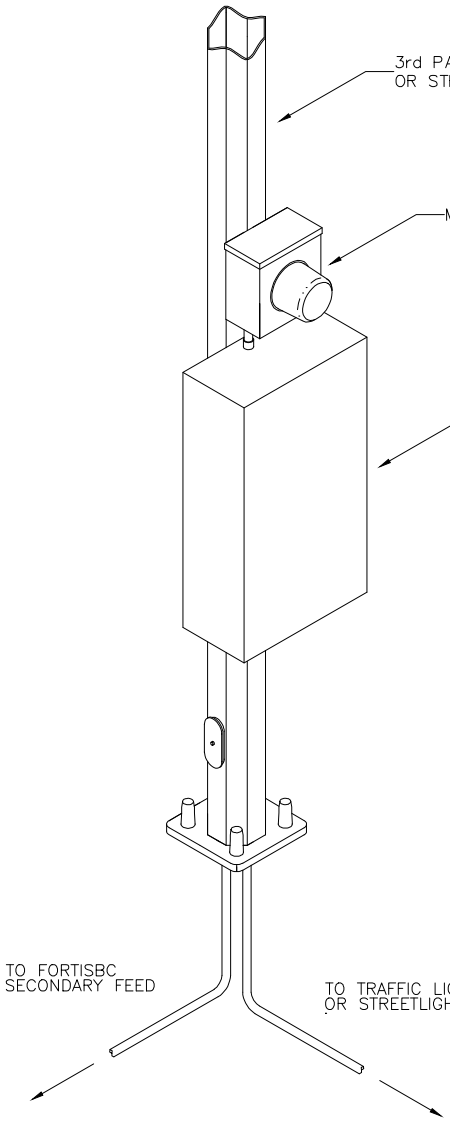
1						

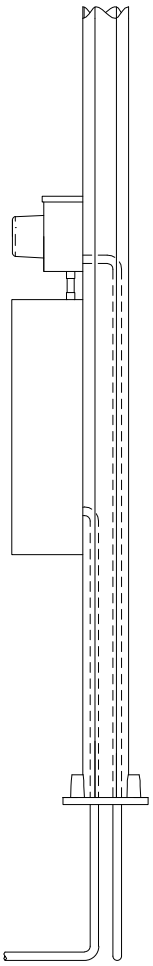
DRAWN BY	TBH	JUN'06
CHECKED BY	BWP	Oct/06
APPROVED BY	[illegible]	[illegible]

METER INSTALLATIONS
CABLE COMPANY EQUIPMENT

FORTISBC

DRAWING No.	REV.
M3	0





CONDUIT INSTALLATION DETAIL

NOTES:

1 – METER ENCLOSURE MATERIALS SHALL BE NON–CORROSIVE

2 – METER ENCLOSURE SHALL BE MOUNTED ON THE SAME SIDE OF POLE AS MINISTRY OF TRANSPORTATION EQUIPMENT

3 – ALL INSTALLATIONS ARE AS PER MINISTRY OF TRANSPORTATION SPECIFICATIONS

4 – ALL INSTALLATIONS ARE AS PER CANADIAN ELECTRICAL CODE – LATEST EDITION, INCLUDING AMENDING BULLETINS ISSUED BY BRITISH COLUMBIA SAFETY AUTHORITY AND CSA

5 – METER IS TO BE ELECTRONIC RECEIVER/ TRANSMITTER TYPE

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
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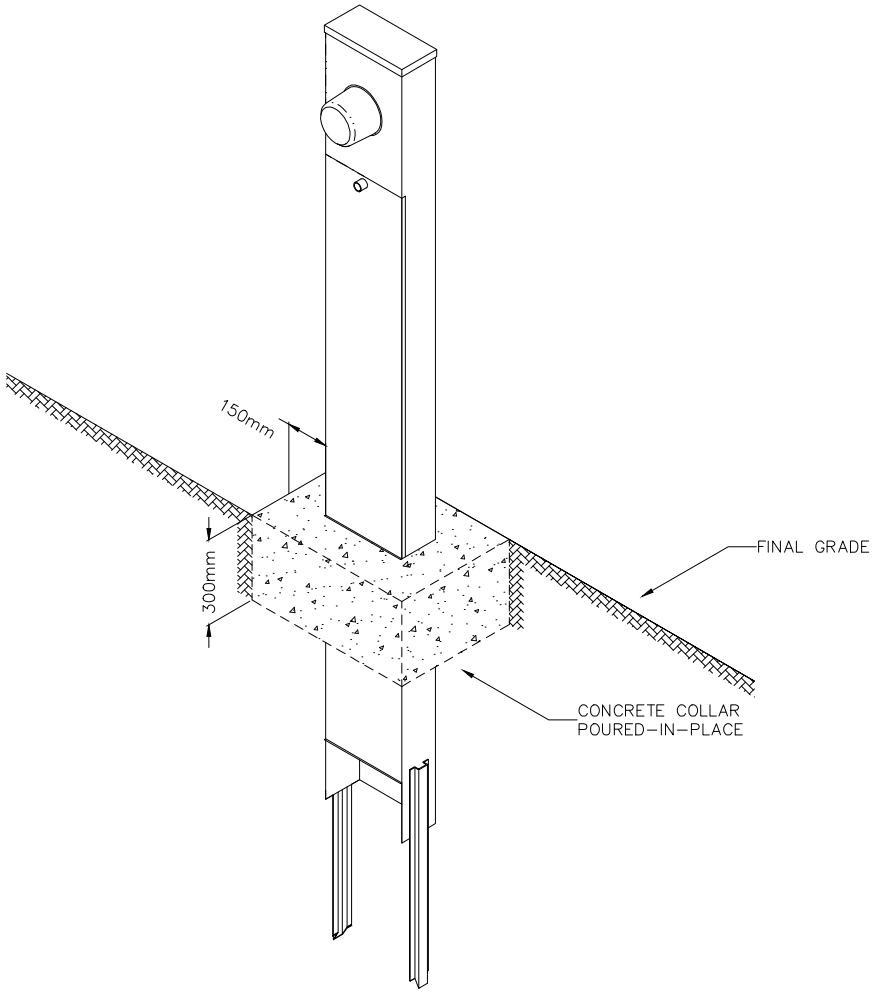
1	FEB/13	NW	AWB	REDRAWN; ADDED NOTES 3, 4 & 5; UPDATED BORDER	DCW	FEB/13

DRAWN BY	TBH	JUN/06
CHECKED BY	BM	OCT/06
APPROVED BY	CK	OCT/06

TRAFFIC LIGHT AND STREETLIGHT METERING UNDERGROUND FEED
SHEET 1 OF 1

FORTIS BC

DRAWING No.	REV.
M4	1



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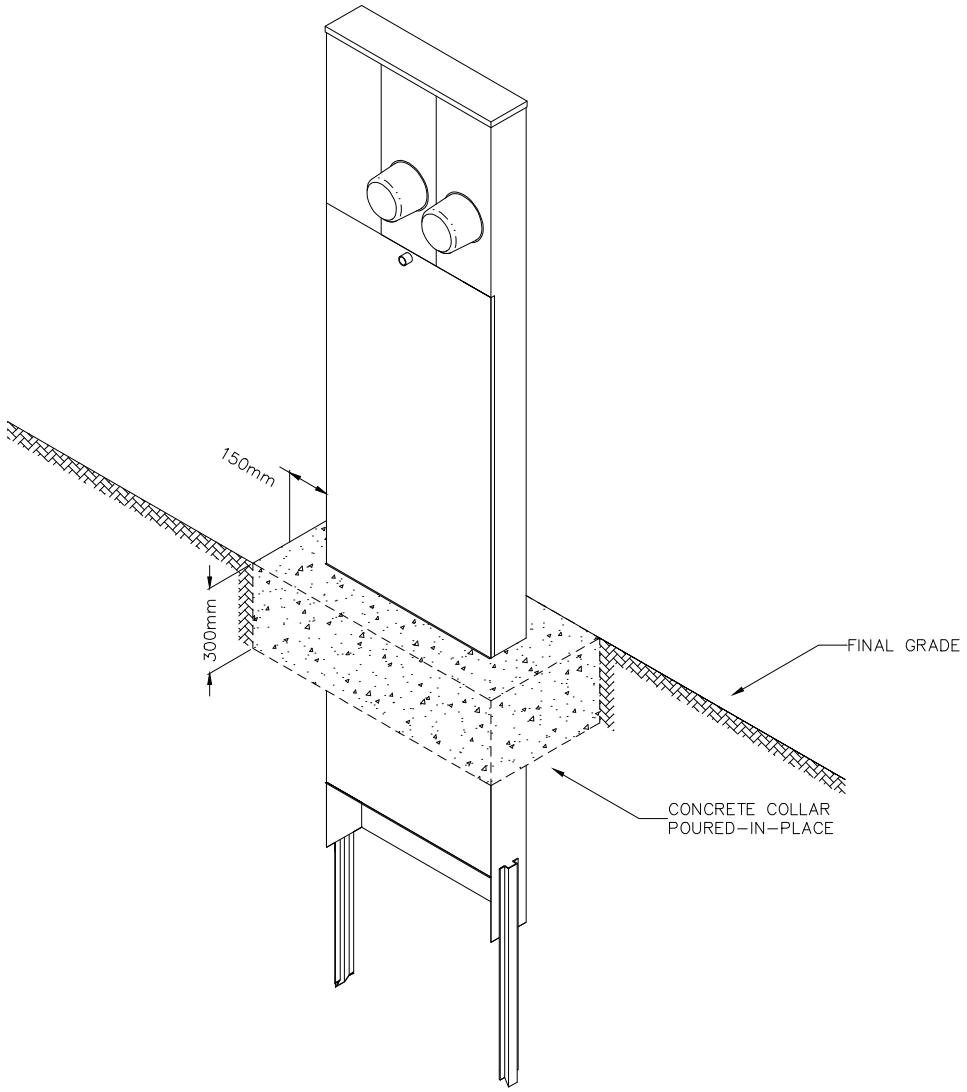
APPROVED BY	DCW	FEB/13

METER PEDESTAL
SINGLE
200A SERVICE
SHEET 1 OF 1

FORTIS BC

DRAWING No.	REV.
M5	0



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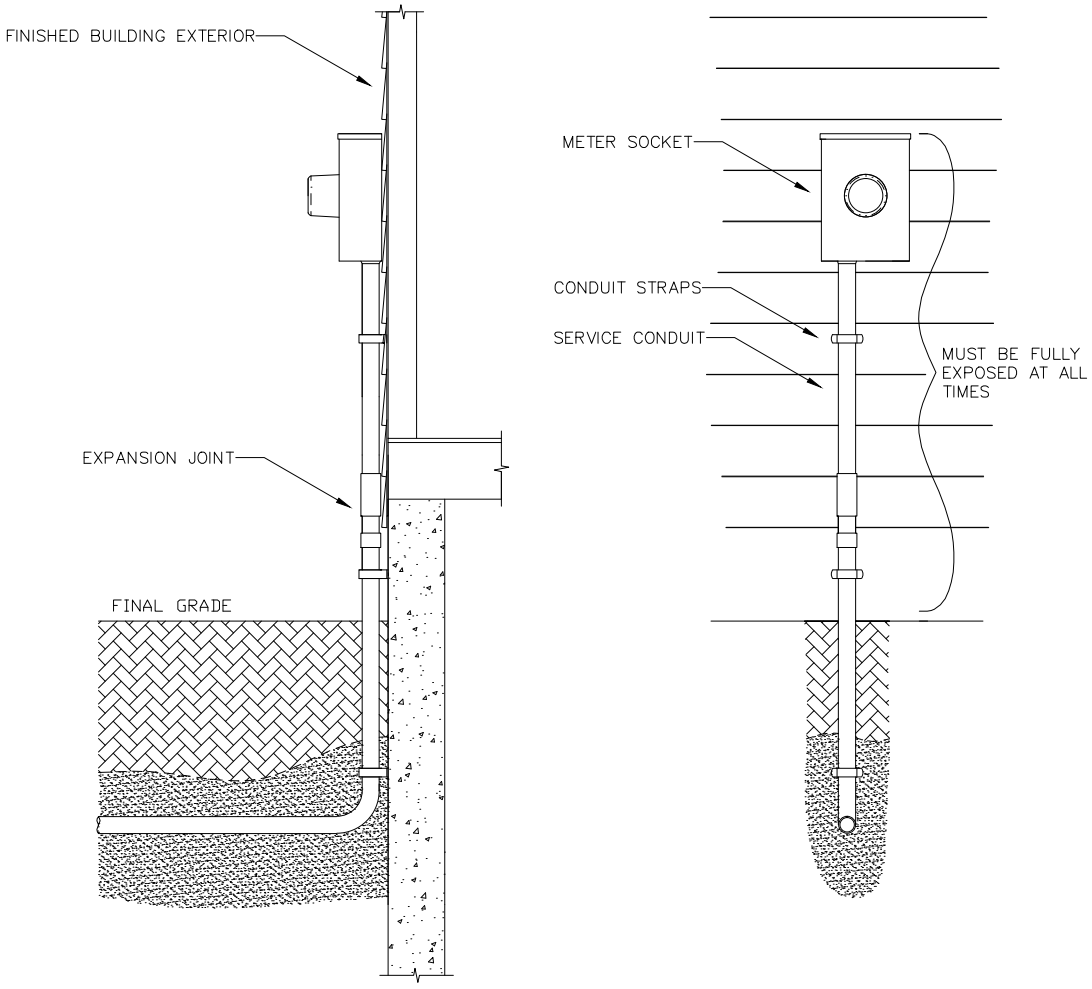
CHECKED BY	AWB	FEB/13
APPROVED BY	DCW	FEB/13

METER PEDESTAL
DUPLEX
200A SERVICE
SHEET 1 OF 1

FORTIS BC

DRAWING No.	REV.
M6	0



NOTES:

1 – ALL INSTALLATIONS ARE PER CANADIAN ELECTRICAL CODE – LATEST EDITION, INCLUDING AMENDING BULLETINS ISSUED BY BRITISH COLUMBIA SAFETY AUTHORITY AND CSA.

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CHECKED BY	AWB	FEB/13
APPROVED BY	DCW	FEB/13

METER SOCKET
UNDERGROUND SERVICE – RESIDENTIAL
MOUNTING DETAIL
SHEET 1 OF 1

FORTIS BC

DRAWING No.	REV.
M7	0

Specification for Installation of Underground Conduit Systems

DOCUMENT NO. 801-07

THE LATEST VERSION OF THIS GUIDE CAN BE FOUND AT
fortisbc.com/electricity/customerservice/forhomes

DATE	REV.	DESCRIPTION	REVIEWED/CHECKED	APPROVED
MARCH 2016	**3**	Revised document formatting and layout. Updated trenching details. Revised developer responsibilities. Updated standard drawings. Updated concrete products	DAVID WALDEN ROB FENTON	DEVIN KRENZ

Table of Contents

List of Tables

Table of Figures

Note: All current revisions and additions are highlighted:

1 Definitions

The following definitions shall apply to this document:

COMPANY shall mean FortisBC, or its duly authorized representatives.

CONTRACTOR shall mean a qualified constructor who holds a valid certificate issued by the Governing Authority. In the context of this document, the Contractor has been retained by, and is acting under the direction and authority of the Developer or their duly appointed representative to physically construct the underground distribution facilities as defined in the plans.

DEVELOPER shall mean the Registered Owner or Corporation, or its duly appointed representative(s), including their engineering consultant(s) and/or contractor(s), having an interest in the land on which the underground electrical system specified is being installed.

DEPOT shall mean a supplier's warehouse or storage yard, a Company storage yard or any other place or places designated by the Company as a material pick-up point.

GOVERNING AUTHORITY shall mean the British Columbia Safety Authority, City, Municipality, Regional District, Provincial Government Agency, First Nations Band or Federal Government Agency having jurisdiction over the work site.

PLANS shall mean the drawings, approved by the Governing Authority and issued by the Company, detailing the location and grades of conduit, pre-cast concrete boxes, and concrete pads or like structures required to be placed for the Company on a specific project.

PROPERTY OWNER shall mean the person(s) and/or entity (ies) named as the registered owner(s) of real property as registered on the property title with the Land Titles Office.

STANDARD DRAWINGS shall mean those drawings illustrating typical installations and/or specifying materials to be used.

UNDERGROUND ELECTRIC SYSTEM shall mean an underground network of underground electrical components used to supply and transfer electric power.

UNDERGROUND CIVIL SYSTEM shall mean the duct and structures referenced in Appendix B in which the electric system is installed in.

FIELD INSPECTIONS FORM – shall mean final document issued by FortisBC field inspector after civil work has been inspected.

2 References

- Joint Trenching Requirements for Shallow Utilities
- Joint Trenching Requirements for Shallow Utilities – Addendum A
- FortisBC Service and Metering Guide
- AASHTO HB-17 - Standard Specifications for Highway Bridges
- AASHTO M 306-10 - Standard Specifications for Drainage, Sewer, Utility and Related Castings

3 User Notifications

Use of FortisBC Engineering and Construction Standards.

a) In accordance with FortisBC Engineering Practices Policy, FortisBC Engineering and Construction Standards are developed and used only for FortisBC designs and construction, and only for FortisBC distribution facilities.

b) FortisBC Engineering and Construction Standards are copyright protected. Drawings and specification within this document, in whole or in part, shall not be copied, modified, amended nor changed without written consent from FortisBC.

c) Use of FortisBC Engineering and Construction Standards by any Developer is done at the Developer's own risk and liability.

d) These standards may carry the name or logo of "West Kootenay Power", "UtiliCorp Networks Canada" or "Aquila Networks Canada". Any such references shall be taken as reference to "FortisBC".

e) FortisBC expects that construction by others for any electrical system or distribution facility adjoining, attaching, or otherwise affecting FortisBC distribution facilities shall meet or exceed FortisBC Engineering and Construction Standards.

f) FortisBC recommends that the Developer retain a professional engineer to coordinate and assess the completeness of the overall project design and/or construction to ensure that it meets the requirements as defined by this document and those of other parties involved. Overall project design and/or construction includes, but is not limited to, underground electrical distribution facilities, underground sanitary sewer installations, underground storm sewer installations, underground water distribution and irrigation facilities, underground cable television facilities, underground natural gas facilities, underground telephone facilities, underground fiber optic cable installations, legal survey requirements, required permits, etc.

g) Review and/or comment on the overall project designs and/or constructions by FortisBC does not relieve the Developer from full responsibility and liability for designs and/or constructions produced by themselves or on their behalf.

h) By requesting and/or accepting copies of any FortisBC Engineering and Construction Standards, the Developer automatically accepts the terms and conditions of this letter.

4 Scope

This specification describes the materials to be used, the standard of work required, and the responsibility of the Developer in the construction of the underground electrical system.

These standards in no way imply that the Developer is allowed to construct anything other than what he or she is authorized to do in the FortisBC design package or as otherwise instructed by the FortisBC local representative.

These Standards shall not be used for work other than for FortisBC as this document only applies to the FortisBC system. For installations that involve other utilities, the developer shall carry out work under their standards and specification.

5 Responsibility of Developer

- The Developer must construct FortisBC shallow electric utilities in compliance with this document.

- Where the Developer retains a Contractor to construct the underground civil system, the responsibilities outlined herein will remain with the Developer. The developer is responsible to verify the qualifications of their retained contractor and must be prepared to provide documentation of said qualifications at the request of FortisBC.

- Where there is any question regarding the interpretation of these standards, or where information may be lacking, it is incumbent upon the Developer or his representative to contact the local FortisBC representative for a written explanation.

- The Developer must obtain the latest revision of this document and the Company stamped **APPROVED FOR CONSTRUCTION** plans before commencing work**. Any work undertaken on the basis of supplied "preliminary information" is done so at the risk and responsibility of the Developer. Extra costs may result if not working from "approved for construction" drawings and information.**

- The Developer shall comply with all requirements of the Governing Authority as to the manner in which all work is done. This means that all conduit, grounding, bonding and transformer pads are to be installed under the direct on-site supervision of a Field Service Representative (FSR) as per **Safety Standards Act ELECTRICAL SAFETY REGULATION (B.C. Reg 100/2004).** The on-site installation crew must be led by a certified FSR who must be present at all times that work is being performed.

- The Developer shall be fully responsible for proper coordination of the project including the provision of sufficient lead times for submission and approval of plans, field inspections, testing, and energization of the system.

- The Developer shall be responsible for all costs associated with:
  a) Purchase and installation of all materials necessary to install the civil system as specified in the Standard Drawings and Plans.
  b) Transportation of all materials supplied by the Company from the designated depots to the job site, and the return of surplus materials to the depots unless otherwise directed by the Company.
  c) Replacement of any materials lost or damaged after receipt of them.
  d) Supply of materials such as gravel, sand, pre-cast or poured in place material, forming lumber and other miscellaneous construction items.

e) All machine and hand excavations necessary for placing conduit, pre-cast concrete boxes, concrete pads, and other facilities as may be required in the standard drawings and plans.

- In all locations the Developer shall be responsible to minimize damage and restore all damaged pavement, sidewalks, curbs, gutters, developed or undeveloped areas to the satisfaction of the Property Owner(s) and the Governing Authority.

- Prior to excavation, the Developer shall:
  a) Comply with all regulatory requirements of the Governing Authority.
  b) Consult with the owners of buildings, retaining walls, poles, lamp standards, landscaping or any other structures which may be endangered by the work, and provide adequate support or measures necessary to protect those items to the satisfaction of the owner and the Governing Authority.

- After civil construction has been completed the Developer shall provide “as-built” information clearly noted in red on one of the FortisBC drawings. FortisBC will not issue a final “Field Inspection” with signoff or schedule electrical installation until “as-built” plans have been received by the Company.

- The Developer shall guarantee all grades. Any discrepancies between design and actual grades discovered during the final inspection shall be corrected by the Developer at the Developer's expense.

- The Developer shall be responsible for determining whether road cuts will be allowed by the Governing Authority. The Developer shall be responsible for any additional costs associated with boring or tunneling under road.

- Survey pins displaced by the Developer shall be reinstalled within 60 days by a legal surveyor at the Developer’s expense. Final approval cannot be granted by FortisBC until survey pins have been established.

- The Developer shall be responsible for maintaining the backfilled excavation until all settlement has ceased.

- The Developer shall maintain open excavations at his or her own liability and expense, and shall also be fully responsible to minimize hazards to people and property while trenches are open.

- When FortisBC facilities are to be installed jointly in the same trench with the facilities of telephone, cable, gas or any other utility, it is a responsibility of the Developer to ensure coordination is maintained with the respective parties. (See Appendix B for more details.)

- The Developer shall ensure that the minimum physical separations are maintained between FortisBC facilities and the facilities of other Utilities such as telephone, cable television, gas, water, sewer, fiber optic, etc. The Developer shall ensure that facility separations meet or exceed the requirements of all parties involved.

- The Developer shall ensure the installation of the underground civil system resembles the plans. Any changes or alterations to the plan must be approved by the company. These changes shall be reflected on "As-Built" drawings submitted to the company upon the completion of the underground civil system.

6 Safety Precautions

- The Developer shall ensure compliance with BC Occupational Health and Safety (OHS) Regulations, Workers' Compensation Act and other applicable Standards, Codes and Regulations.

- Knowing what underground facilities are buried in or near your dig jobsite is essential if deadly, dangerous, or destructive accidents are to be avoided. The best way to find out what is buried on your dig site and which areas you must avoid when digging, call **1 800 474 6886** or log a ticket at www.bconecall.ca .

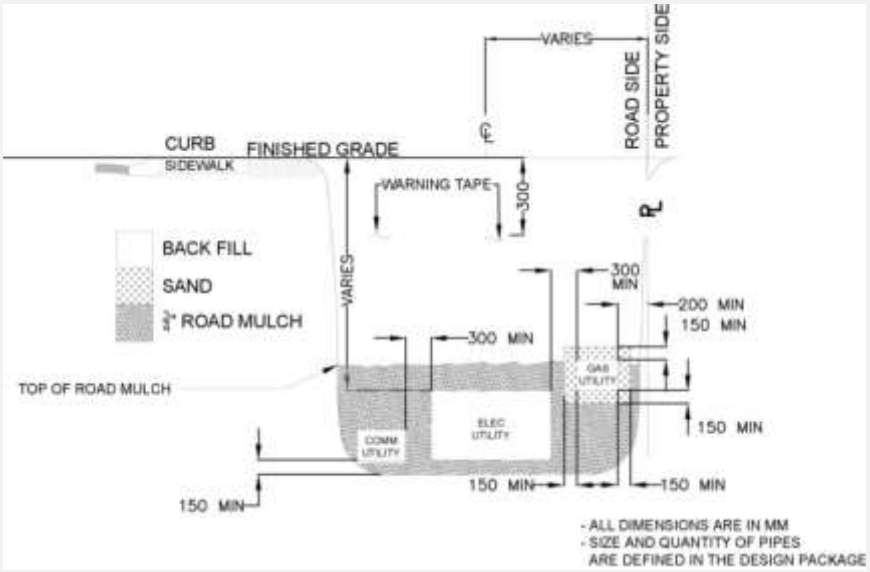
- If civil work is required on or near structures containing energized cables, the Developer shall give FortisBC 48 hour notice to arrange for a qualified Company representative to be on site during the excavation.

7 Joint Trenching

- The Developer shall ensure that the minimum physical separations are maintained between FortisBC facilities and the facilities of other Utilities such as telephone, cable television, gas, water, sewer, fiber optic, etc. For details refer to "Joint Trenching Requirements for shallow utilities" and "Joint Trenching Requirements for shallow utilities – Addendum A". Figure 1 of this document specifies FortisBC's minimum requirements; it should however be noted that other Utilities may specify separations that exceed those of FortisBC. The Developer shall ensure that facility separations meet or exceed the requirements of all parties involved.

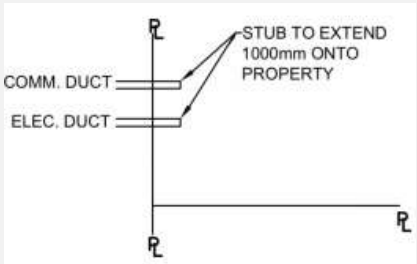
- Figures below only apply to the FortisBC Electric service territory.

Figure 1: Joint Trenching



- Service stubs at property line to be installed as per below

Figure 2: Service Stubs



8 Excavation and Trenching

Backfilling - shall not be performed until a Company inspector has approved the phase of the project to be backfilled. Refer to Section 15 of this document. If native fill is specified it shall mean excavated material free of organic material and rock larger than 150 mm in diameter. Frozen material shall not be used as backfill.

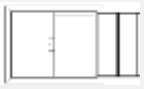
- 150mm of road mulch shall surround the utility facilities unless noted otherwise. Road mulch shall be ¾" minus Type 1, 20mm sieve per MMCD Section 31-05-17-2.7 Granular Pipe, Bedding and Surround Material.
- Under freezing conditions, backfill material shall be dry. Where no suitable backfill material is available all ducts shall be encased in concrete.
- There shall be 300mm horizontal separation between electrical duct and other facilities.
- Underground warning tape shall be installed 300 mm below finished grade. Only red plastic tape bearing the words "CAUTION BURIED ELECTRIC LINE" shall be used.
- All backfilling and compaction shall be done to the satisfaction and acceptance of FortisBC and the Governing Authority, and shall be subject to inspection at all times.
- Road crossings shall be excavated at right angles to the road.

9 Source of Materials

- FortisBC reserves the right to specify material manufacturers in order to ensure the quality of materials installed.
- The supply of conduit, fittings, pre-cast concrete products and grounding materials shall be the Developer's responsibility.

9.1 Pre-Cast Concrete Boxes, Vaults and Lids

Table 1: Common Structure Reference Numbers

Description	Kon Kast Part No.	SOCP Part No.	FortisBC Item No.	Assembly or Structure No.	H-20/HS-20 Impact rating	Reference Image
Service Box	1060	1100	755-0501	1590	N/A	
Service Box Lid	1061	1101			Group B	
Single Phase Junction Box	1031	1105	755-0506	1591	N/A	
Single Phase Junction Box Lid	1037	1106	755-0611		Group B	
58" x 58" Civil Box	1021	1120	755-0509	1592	N/A	
58" x58" Civil Box Lid - Two Door	1025	1122	755-0612		Group B	
58" x58" Civil Box Lid - One Piece	1025S	N/A	-		Group B	

Description	Kon Kast Part No.	SOCP Part No.	FortisBC Item No.	Assembly or Structure No.	H-20/HS-20 Impact rating	Reference Image
832 Junction Box	1032	1125	755-0560	1594	N/A	
832 Junction Box Lid - Three Door	1033	1126			Group B	
832 Junction Box Lid - One Piece	1033S	1127	-		Group B	
Single Phase Transformer Box	1031	1105	755-0506	1593	N/A	
Single Phase Transformer Box Lid	1038	1107	755-0602		N/A	
Street Light Base	1045	1132	755-0206	1416	N/A	
	1050	-			N/A	
	935	1134	755-0210	1418	N/A	
		1133	755-0207	1417	N/A	

Description	Kon Kast Part No.	SOCP Part No.	FortisBC Item No.	Assembly or Structure No.	H-20/HS-20 Impact rating	Reference Image
Switching Cubicle Box	1066	1129	755-0562	1595	N/A	
Switching Cubicle Box Lid	1066ELA	-	755-0619		Group B	
Precast Pad 3 Phase Transformer 500kVA and Less	1058D	1113	755-0507	1597	N/A	
3 Phase Transformer above 500kVA Deep Box	1066	-	755-0562	1596	N/A	
3 Phase Transformer above 500kVA Deep Box Lid	-	1130	755-0623		N/A	
3 Phase Transformer above 500kVA Precast Pad	1058B	-	-		N/A	
Vehicle Bollard	1080	-	755-0100	1589	N/A	

9.1.1 Loading Standards

Structure lids shall comply with AASHTO H-20/HS-20 rating. For details refer to Section 3 of "AASHTO HB-17 Standard Specifications for Highway Bridges" and "AASHTO M306-10 - Standard Specifications for Drainage, Sewer, Utility and Related Castings"

- Group A – Structure Design to include a 30% impact factor (dynamic load). Structure application to be limited to:
  - Roadway
  - Highway
  - Highway on/off ramps

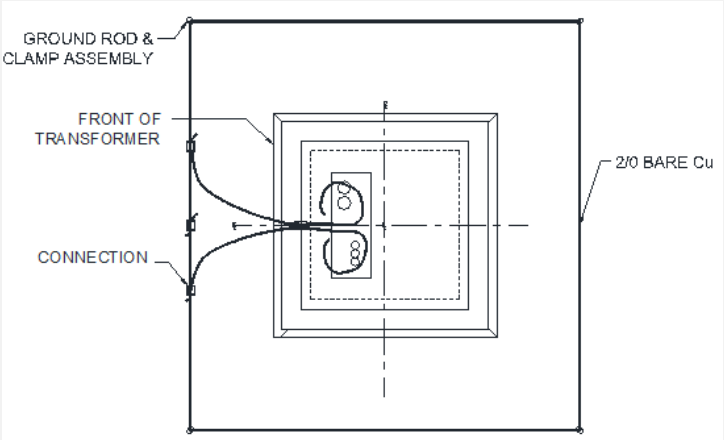
- Group B – Structure Design with no impact factor (static load). Structure application to be limited to:
  - Sidewalks
  - Boulevard
  - Driveway
  - Alleyway
  - Green space

9.2 Grounding

Table 2: Common Grounding Reference Numbers

Description	Manufacturer	Manufacturer Part No.	FortisBC Item No.
Cable, #2/0 stranded copper, soft drawn, bare	General Cable (BICC)/Nexans/Prysmian Cables and Systems	-	531-0202
Cable, #2/0 stranded copper, soft drawn, poly covered RW90, 600 volts	General Cable (BICC)/Nexans/Prysmian Cables and Systems	-	531-1122
Connector, copper, wrench installed, #2/0 copper to #2/0 copper	Burndy	GXW26C26	553-0629
Connector, copper, wrench installed, #2/0 copper to 3/4" ground rod	Burndy	GXW29C58	553-0626
Rod, ground, copperbonded, plain, 3/4" x 6’	Erico	3406CC	557-1308
	Hubbell	613460	
	Hydel	C613460	
Cable, #4 stranded copper, soft drawn, bare, for welding or bonding	BICC Cable	166470	539-0602
	Carol Brand	1777	

Figure 3: Grounding Detail



9.3 Conduit and Fittings

- The developer shall supply incidental construction materials such as PVC solvent weld, grout, sand and gravel appropriate for the construction method and conduit material.

Table 3: Common Conduit Component Reference Numbers

Description	Manufacturer	Manufacturer Part No.	FortisBC Item No.
Pipe			
Conduit, 2", rigid PVC, 10ft length, bell end	Ipex	32120	632-3058
Conduit, 3", rigid PVC, 10ft length, bell end	Ipex	32130	632-3056
	Royal Pipe Systems	CON10030	
Conduit, 4", rigid PVC, 10ft length, bell end	Ipex	32140	632-3051
	Royal Pipe Systems	CON10040	
Conduit, 2", DB2, 20ft length, bell end	Ipex	08226 (gray)	632-3020
		08221 (white)	
	Royal Pipe systems	11080	
Conduit, 3", DB2, 20ft length, bell end	Ipex	08245 (white)	632-3030
		08234 (gray)	
	Royal Pipe Systems	11090	
Conduit, 4", DB2, 20ft length, bell end	Ipex	08241 (white)	632-3040
		08245 (gray)	
	Royal Pipe Systems	11110	
End Bell Fittings			
End bell, for 3" DB2	Ipex	29062	632-3443
End bell, for 4" DB2	Ipex	29064	632-3640
	Canron West P	UPC#13068	
End bell, socket molded, for 3" rigid PVC	Ipex	77328	632-3453
End bell, socket molded, for 4" rigid PVC	Ipex	77330	632-3454
Couplers			
Coupler, DB2, 2"	Ipex	29001	632-3120
	Royal Pipe Systems	SWC02	
Coupler, DB2, 3"	Ipex	29002	632-3130
	Royal Pipe Systems	SWC03	

Description	Manufacturer	Manufacturer Part No.	FortisBC Item No.
Coupler, DB2, 4”	Ipex	29004	632-3140
	Royal Pipe Systems	SWC04	
Coupler, rigid PVC, 2”	Ipex	77006	632-3172
Coupler, rigid PVC, 3”	Ipex	77008	632-3173
Coupler, rigid PVC, 4”	Ipex	77010	632-3174
Sweeps			
Sweep, 90 degree, DB2, 2”, 24” radius	Ipex	29091	632-3220
	Royal Pipe Systems	90B2X24	
Sweep, 90 degree, DB2, 3”, 36” radius	Ipex	29093	632-3230
	Royal Pipe Systems	90B3X24	
Sweep, 90 degree, DB2, 4”, 36” radius	Ipex	29095	632-3240
	Royal Pipe Systems	90B4X36	
Sweep, 90 degree, rigid PVC, 2”, 24” radius	Ipex	69257	632-3352
Sweep, 90 degree, rigid PVC, 3”, 36” radius	Ipex	69261	632-3353
Sweep, 90 degree, rigid PVC, 4”, 36” radius	Ipex	69267	632-3354
Adapters			
Adapter, rigid PVC to DB2, 2”	Ipex	ARIG20 or 29181	632-3455
Adapter, rigid PVC to DB2, 3”	Ipex	29182	632-3459
Adapter, rigid PVC to DB2, 4"	Ipex	29184	632-3457
Miscellaneous			
Tape, underground warning, CAUTION BURIED ELECTRIC LINE, red tape with black lettering, 6” wide, heavy duty polyethylene 4.0 mil thick	Alarmaline	1000RG	492-0102
	Allen Systems	10571415	
	Brady	91296	
	Stranco Inc.	AL6100RE	
	Terra	BT61052	
	Top Tape and Label	PUWT-604	
Polyester Measure/Pulling Tape 3/4" x 3.000" (19.1 mm x 914m)	GreenLee	4437-10447	

10 Conduit Installation

- Conduit shall not be installed below –10 °C temperature because of the high risk of duct damage and/or coupling separation.

- Conduit shall not be installed into any existing FortisBC infrastructure without a qualified Company representative on site. Modification of conduit entrance to structures, pads, buildings, etc., shall be pre-approved by FortisBC.

- Conduit terminating at buildings shall be installed in accordance with the latest version of **CSA standard C22.3 – No. 7, "Underground Systems"**, requiring that the ducts be adequately sealed, drained, graded or vented to prevent entry of gas or water, either from the outside surface or through the ducts.

- Unless otherwise noted, all conduits for secondary shall be 100 mm.

- Conduit shall enter, exit, and be located in pre-cast concrete boxes and concrete pads in accordance with the following Standard Drawings (see Appendix B for details).

Table 4: List of Facility Installation Standards

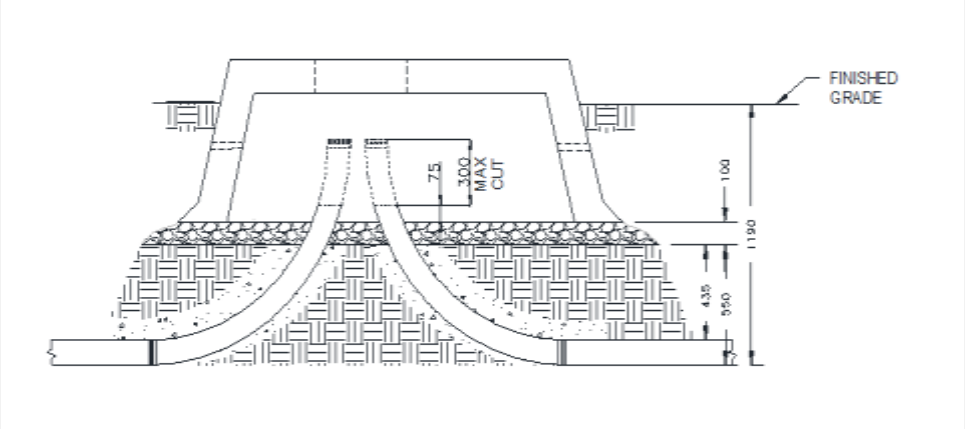
FortisBC Structure No.	Description
1203	Typ. Residential Subdivision Design
1204	Padmount Equipment Right of Way Requirements
1206	Padmount Equipment General Requirements
1214	Underground Road Crossings
1216	Trench Details
1342	Riser Pole Transition Details
1416	Three Foot Base for Street lighting
1417	Highway, Collector and Arterial Type C-1, Controller Base
1418	Highway, Collector and Arterial Five Foot Concrete Base Type C, for Street Lighting
1590	Concrete Service box Civil
1591	Single Phase 200A 15/25 kV Junction Civil
1592	58” x 58” Civil Box
1593	1 Phase Low Profile Pad-mount Transformer
1594	3 Phase Junction Vault (200A) 15/25 kV 832 Style
1595	15 kV Pre-cast switch Cubicle Base
1596	3 Phase Transformer base larger than 500 KVA
1597	Pre-cast 3 phase transformer base 500 kVA or less
1598	Above Grade 200A Junction

- **All conduit terminated in full sized deep junction boxes shall be terminated with preformed end bells, grouted into place. All others shall be capped.**

- **Conduit terminating in side walls of junction and transformer boxes shall leave at right angles to the box wall for a minimum distance of 1 meter before being formed into the trench configuration.**
- All terminated conduit shall be capped (but not sealed) and shall be marked with lot number and or duct designation. All conduits shall have Polyester Measure/Pulling Tape 3/4" x 3.0" (19.1 mm x 914m) installed. The pulling tape shall have a minimum tensile strength of 11,000 N. It is permitted to reuse Pulling Tape but it must be one continuous piece.

- All conduits shall extend at least 50 mm and no more than 100 mm above drain rock or finished grade.

Figure 4: *Conduit Termination*



11 Installing Duct Using Direction Drilling

- When the project calls for cable duct to be installed via direction drilling the contractor must use Schedule 80 High Density Polyethylene smooth walled Duct. This duct must be red in colour throughout the entire thickness of the duct.
- The installation must use permanent markers at surface level to indicate electrical conductors buried below. The permanent markers shall be cast iron plates with hazard wording that are set into the concrete at a distance of 3m apart or as directed by FortisBC.
- The direction drill design and installation must be approved through the FortisBC Non-Standard Approval process. Please contact the FortisBC designer for further information.

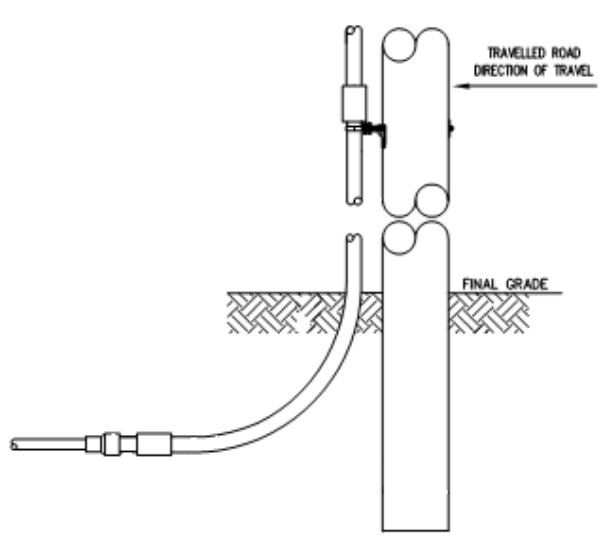
12 Pole Risers

- Conduit bends shall be installed at the base of poles designated as riser poles on the plans. These bends shall be located on the quadrant of the pole as illustrated in Standard Structure Drawing No. 1342 (see Appendix A).
- All conduit bends shall be located to permit the use of standoff brackets on the pole.
- The Developer shall install appropriately sized 90^{o} sweeps terminating at the base of the riser pole; these shall be capped and identified, but not sealed.

- FortisBC shall supply and install conduit up the riser structure when the underground electrical system installed by the Developer is connected to the FortisBC distribution system. In other words, the Developer shall not be required to supply nor install conduit up the pole when the underground system being installed connects to FortisBC's overhead primary facilities.

- On customer owned[1] secondary services over 200A, or any three phase secondary services, the Developer shall supply the duct required to run up the pole. FortisBC shall install this customer owned conduit up the pole.

Figure 5: *Riser Pole Detail*



[1] Refer to the FortisBC Service and Metering Guide available at www.fortisbc.com for more information on demarcation between customer and FortisBC owned and maintained facilities.

13 Drainage of Pre-Cast Boxes

- The Developer shall ensure that drain holes in all pre-cast boxes are clear and free draining (open), and are positioned or oriented at the lowest point of grade.

- Where water drains are required, the Developer shall provide a means of drainage to storm sewers or catch basins as indicated on the standard plans and drawings. Such drain systems shall meet the approval of the Company and the Governing Authority. Out-fall shall be proven prior to boxes being placed.

14 Concrete and Grout

- All concrete, reinforced or not, shall meet the requirements of the current edition of the Canadian Standards Association standard CSA-A23.1-00, "Concrete Materials and Methods of Concrete Construction".

- Concrete shall be sulphate resistant, Type 50, 3000 psi (20 MPA) minimum 28 day compressive strength.

- Air entraining agents shall be between 4-7% of final product, and shall conform to the requirements of ASTM International standard ASTM C260-01, "Standard Specification for Air-Entraining Admixtures for Concrete".

- Calcium chloride accelerators shall not be used in the pour. Alternate accelerators might be used, subject to FortisBC approval.

- Grout or mortar shall be prepared as per the manufacturer's instructions.

- All conduit sweeps except street lights shall be encased in concrete in accordance with the following Standard Drawings.

Table 5: List of Facilities Placement Standards

FortisBC Drawing No.	Description
F-20	Placement of Facilities; Concrete Encasement - Bends
F-21	Placement of Facilities; Concrete Capping - Pole Riser
F-23	Placement of Facilities; Concrete Capping - Deep Box Entry
G-23	Ground Rod Assembly

- Concrete capping shall be formed in place and finished to a minimum thickness of 100 mm Maximum thickness shall not exceed 200 mm

15 Inspection of Installations

Inspection by FortisBC shall take place at the following construction phases. Note that survey evidence must be in place before an inspection can occur.

A) **Trenching** – After ducts are installed, prior to backfill or concrete capping

- Proper horizontal spacing between utility ducts
- Proper trench depth
- Concrete encase all horizontal bends
- Primary ducts are on the primary side of the transformer pad
- Secondary ducts are on the secondary side of the transformer pad

B) **Structure Grounding** – After ground rods and counter poise connections have been made, prior to backfill

- Concrete encase all vertical bends into transformer pads and secondary boxes
- Ground grids/rods installed as per FortisBC structure standards
- Grounding wire is inside box

C) **Duct Work** – During installation of pull strings

- Pull rope and bell ends on all ducts
- Ducts are in good shape
- Ducts not too high or too low relative to drain rock

D) **Curb/Boulevard** – Upon completion of the curb installation or boulevard grading and road paving

- Top of Junction Boxes are at the proper elevation, per appendix B.
- Lids are not damaged
- Concrete box is in good shape
- Drain holes are opened and have drain rock underneath
- Drain rock in place within open bottom structures
- Eye bolts on ends are turned so eye (not nut) is inside the box (2 at each end)
- Grounding wire is inside box
- Street light base is in good shape
- Street light bolts are straight and have nuts
- Trench is properly backfilled (including behind street light bases)

E) **Completion** – After conduit system and structures have been installed and is ready for electrical construction

- Pull rope and bell ends on all ducts
- Boxes to be swept or vacuumed out prior to electrical installation or deficiency resolution

After any inspection, all openings in boxes must be covered with securely fastened 1/2" plywood

15.1 Development Owner/Service Provider Constructed Subdivision Inspections

- FortisBC will have access and the right to inspect the conduit system at any point/phase in its construction.

Appendix A – Field Inspection Form

Field Inspections

Developer _____

Site Address _____

Contractor _____ Site Foreman _____

SAP WO # _____ FortisBC Inspector _____

◯ Accepted ◯ Rejected

Overhead Inspection List

Structures and Anchors

- ☐ Framing (to standard)
- ☐ Setting (depth / raked)
- ☐ Backfill (tamped)
- ☐ Correct class
- ☐ Anchor depth
- ☐ Anchor location and rod angle
- ☐ Guy tension
- ☐ Guy guards
- ☐ Insulators
- ☐ Right of way clearing
- ☐ Offset

Equipment

- ☐ Correct mounting
- ☐ Connections / lead size
- ☐ Bird proofed
- ☐ Grounding
- ☐ Cutout & arrestor
- ☐ Clearance

Protection

- ☐ Cutout rating
- ☐ Fuse link rating
- ☐ Mounting & grounding

Wire

- ☐ Size
- ☐ Sag
- ☐ Sleeves

Underground Inspection List

Trench and Conduit

- ☐ Trench depth
- ☐ Trench offset
- ☐ Trench condition
- ☐ Sand bed
- ☐ Correct duct installed
- ☐ Duct spacing
- ☐ Sanding / Backfill
- ☐ Compaction
- ☐ Warning tape
- ☐ String blown / duct / capped
- ☐ As Built

Structures

- ☐ Pad / box alignment
- ☐ Pad / box grade
- ☐ Box / pad grounding
- ☐ Proper offset / easement
- ☐ Backfilled
- ☐ Access
- ☐ Covers / lids
- ☐ Correct pad / base
- ☐ Property pins

Street Lights

- ☐ Base alignment
- ☐ Base grade
- ☐ Correct base size

Additional Comments:

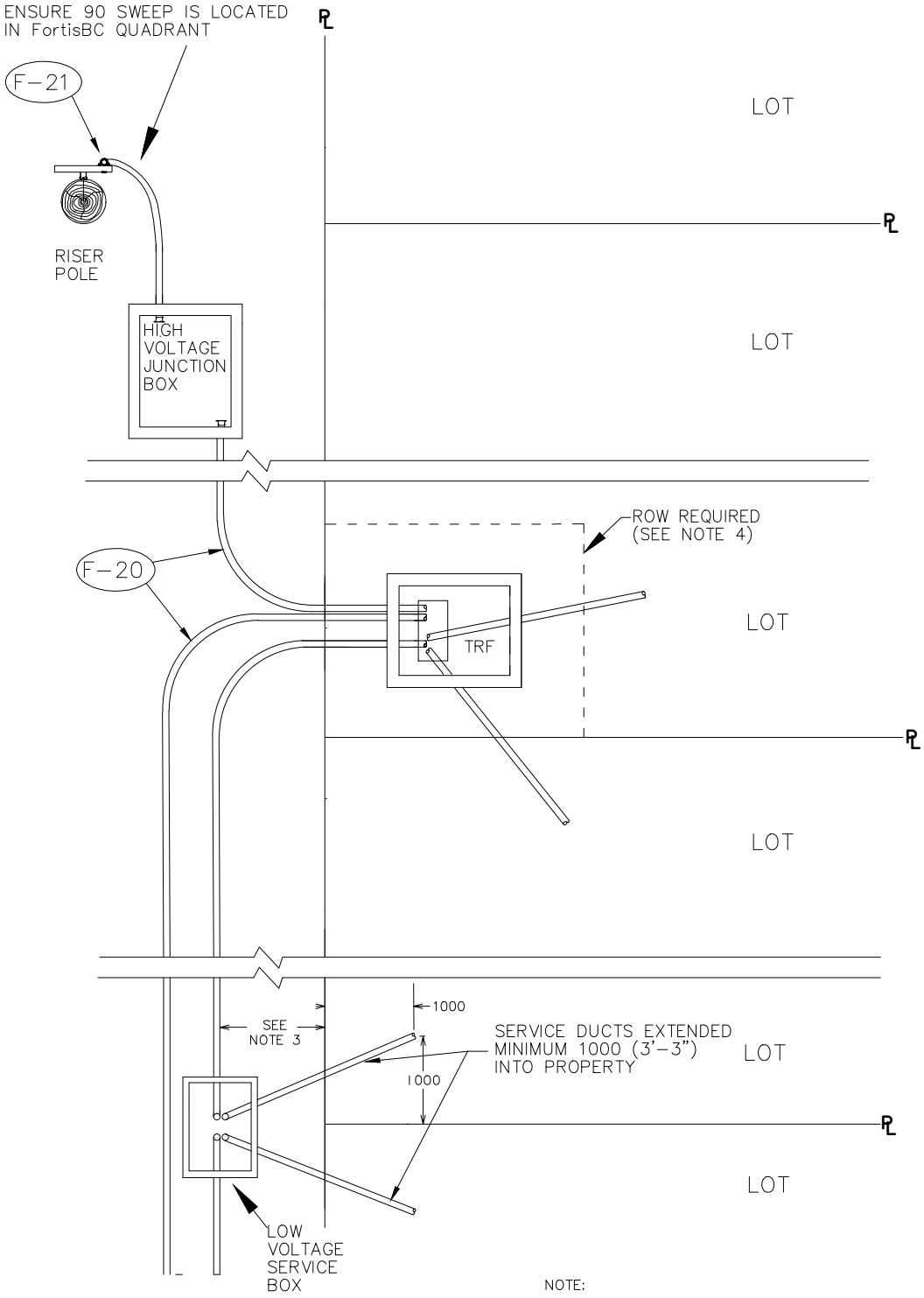
O/H Inspection Acceptance Date _____ By: _____

URD Inspection Acceptance Date _____ By: _____

One copy to file / One copy to site / One copy to Inspector

Printed - 10-12-15 2:02 PM

Appendix B – Structure and Assembly Details



NOTE:

1 – TRANSFORMER PAD TO BE PLACED IN THE CENTER OF ROW

2 – UNLESS OTHERWISE INDICATED ALL DIMENSIONS ARE IN MILLIMETRES

3 – DISTANCE OF TRENCH FROM PROPERTY LINE VARIES TO CONFORM TO LOCAL REGULATIONS

4 – REFER TO STR. 1204 FOR ROW REQUIREMENTS

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

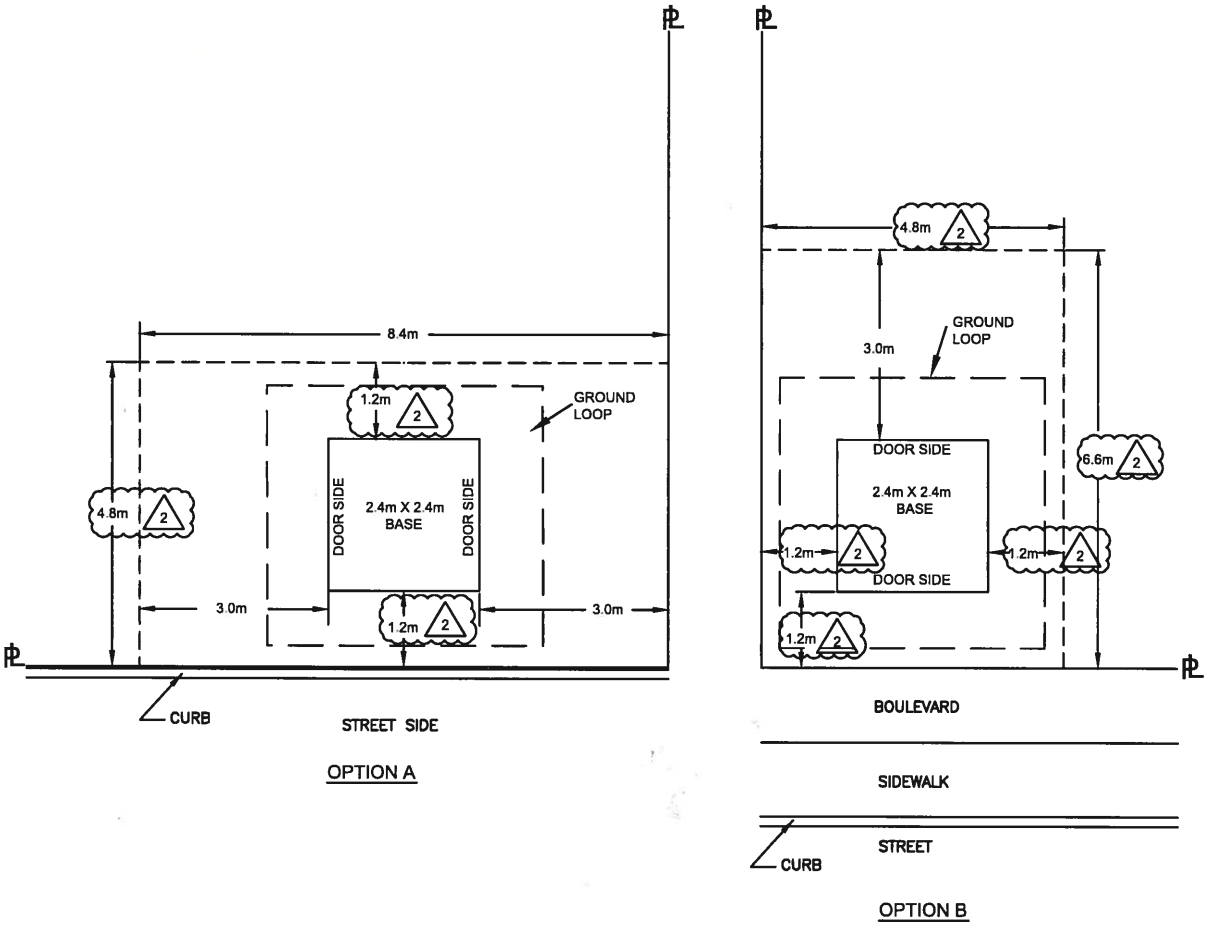
REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4	JUL/15	DCW	DK	MODIFIED NOTE 4 – REFER TO STR. 1204	DCW	JUL/15
3	NOV/08	S.W.	NG	MODIFIED NOTE 4	BMB	NOV/08
2	MAR 08	SW	NG	REVISED DRAWING UPDATED OWNERSHIP	BMB	MAR 08
1	JAN 05	NS	NS	ADDED ASSEMBLY F-20, REFER TO STANDOFF BRACKET	RS	JAN 05

DRAWN BY		
CHECKED BY	NS	DEC 03
APPROVED BY	RS	DEC 03

UNDERGROUND EQUIPMENT STRUCTURE
TYP. RESIDENTIAL SUBDIVISION DESIGN
PLAN VIEW
SHEET 1 OF 1

FORTIS BC

DRAWING No.	REV.
1203	4



NOTES:

1) OPTION A, DOORS NOT FACING STREETSIDE FOR HIGH TRAFFIC INSTALLATIONS
2) OPTION B, DOOR FACING STREET FOR NON TRAFFIC INSTALLATIONS
3) OPTION B – ANY STREET SIDE FENCE IS TO BE GATED, NOT TO RESTRICT ACCESS. NO FIXED STRUCTURE TO EXIST WITHIN A 3 METER CLEAR ZONE OF THE OPERATING DOORS.
4) LOCATE ALL SWITCHERS AS INDICATED IN CSA UNDERGROUND SYSTEMS 3.2.2
5) LOCATE OIL FILLED SWITCHERS AS INDICATED IN C.E.C. 26–014 DIELECTRIC LIQUID–FILLED EQUIPMENT.
6) GROUND LOOP BURRIED 1M AWAY FROM EDGE OF EQUIPMENT.
7) IF REQUIRED BY PROJECT, 6m WIDE ACCESS ROW TO BE MEASURED FROM EDGE OF EQUIPMENT.

△2

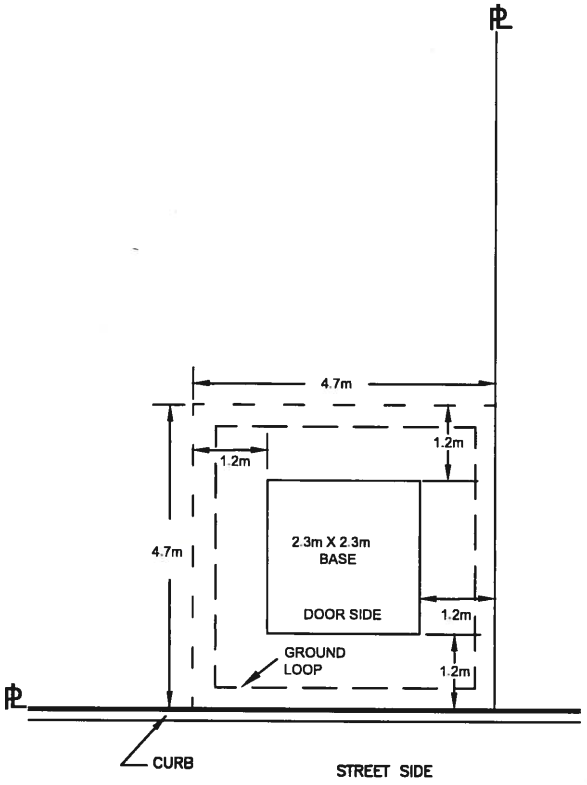
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2014-09-10

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2	JUL/14	SM	MM	ADDED NOTES 3 , 4, 5, 6, 7 & GENERAL REVISION	DCW	Sept/14
1	FEB 09	SR	NG	UPDATED DIMENSIONS	BMB	FEB 09

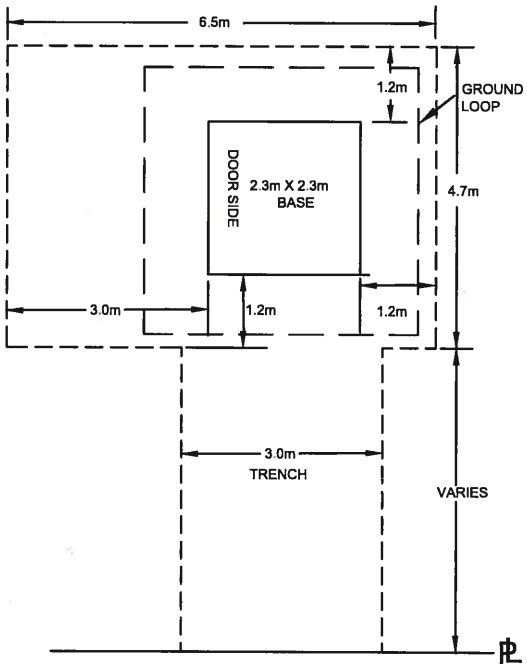
DRAWN BY	SS	JULY 07	UNDERGROUND EQUIPMENT STRUCTURE SWITCHER AND PRIMARY METER ROW PLAN VIEW SHEET 1 OF 5
CHECKED BY	HDB	DEC 11	
APPROVED BY			

FORTIS BC

DRAWING No.	REV.
1204	2



OPTION A



OPTION B

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2014-09-10

NOTES:

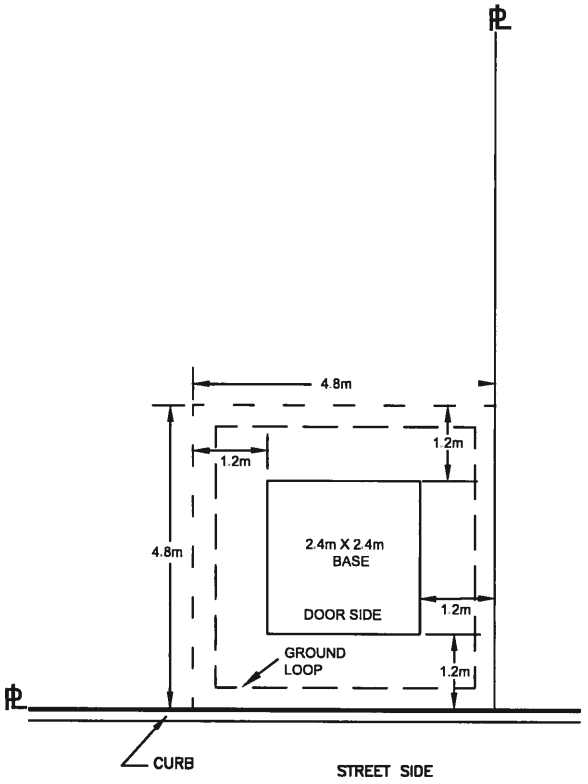
1) OPTION A, DOORS FACING STREETSIDE
2) OPTION A – ANY STREET SIDE FENCE IS TO BE GATED, NOT TO RESTRICT ACCESS. NO FIXED STRUCTURE TO EXIST WITHIN A 3 METER CLEAR ZONE OF THE OPERATING DOORS.
3) OPTION B, DOORS FACING 3M LONG OPERATING ZONE (ON PRIVATE PROPERTY)
4) LOCATE ALL TRANSFORMERS AS INDICATED IN CSA UNDERGROUND SYSTEMS 3.2.2
5) LOCATE ALL TRANSFORMERS AS INDICATED IN C.E.C. 26-240. FORTISBC PADMOUNT DISTRIBUTION TRANSFORMERS ARE TYPICALLY PROTECTED WITH AN INTERNAL CURRENT LIMITING FUSE & EQUIPPED WITH A PRESSURE RELIEF DEVICE
6) GROUND LOOP BURIED 1M AWAY FROM EDGE OF EQUIPMENT.
7) IF REQUIRED BY PROJECT, 6m WIDE ACCESS ROW TO BE MEASURED FROM EDGE OF EQUIPMENT.

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1						

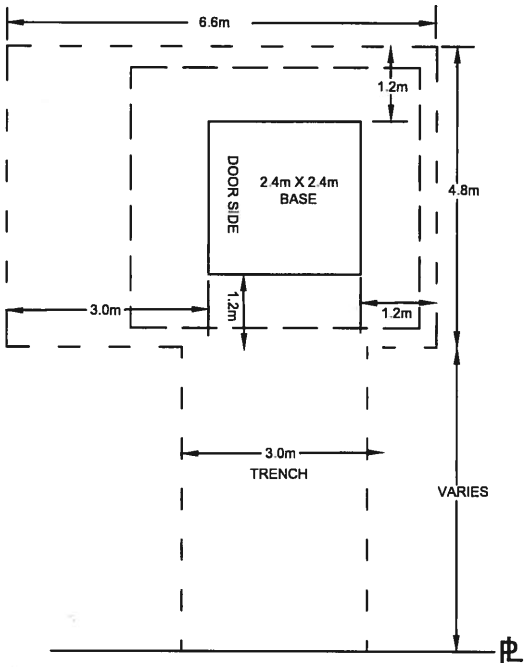
DRAWN BY	SM	JULY 14	UNDERGROUND EQUIPMENT STRUCTURE
CHECKED BY	NW	Sept/14	3PH TRANS 500kVA OR LESS ROW
APPROVED BY	DCW	Sept/14	PLAN VIEW
			SHEET 2 OF 5

FORTIS BC

DRAWING No.	REV.
1204	0



OPTION A



OPTION B

NOTES:

1) OPTION A, DOORS FACING STREETSIDE
2) OPTION A – ANY STREET SIDE FENCE IS TO BE GATED, NOT TO RESTRICT ACCESS. NO FIXED STRUCTURE TO EXIST WITHIN A 3 METER CLEAR ZONE OF THE OPERATING DOORS.
3) OPTION B, DOORS FACING 3M LONG OPERATING ZONE (ON PRIVATE PROPERTY)
4) LOCATE ALL TRANSFORMERS AS INDICATED IN CSA UNDERGROUND SYSTEMS 3.2.2
5) LOCATE ALL TRANSFORMERS AS INDICATED IN C.E.C. 26–240. FORTISBC PADMOUNT DISTRIBUTION TRANSFORMERS ARE TYPICALLY PROTECTED WITH AN INTERNAL CURRENT LIMITING FUSE & EQUIPPED WITH A PRESSURE RELIEF DEVICE
6) GROUND LOOP BURIED 1M AWAY FROM EDGE OF EQUIPMENT.
7) IF REQUIRED BY PROJECT, 6m WIDE ACCESS ROW TO BE MEASURED FROM EDGE OF EQUIPMENT.

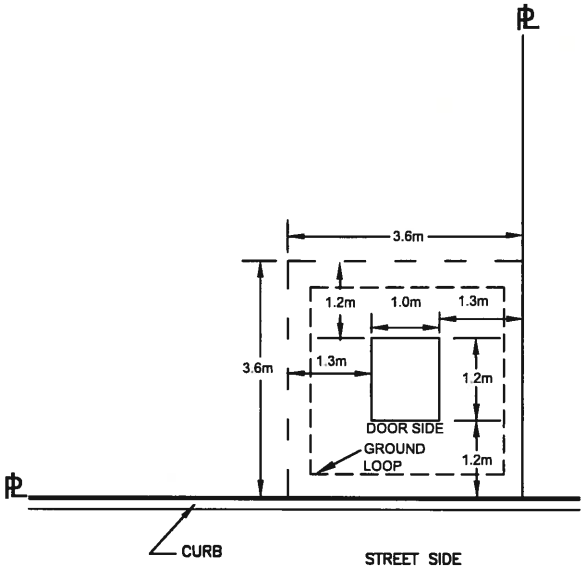
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2014-09-10

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1						

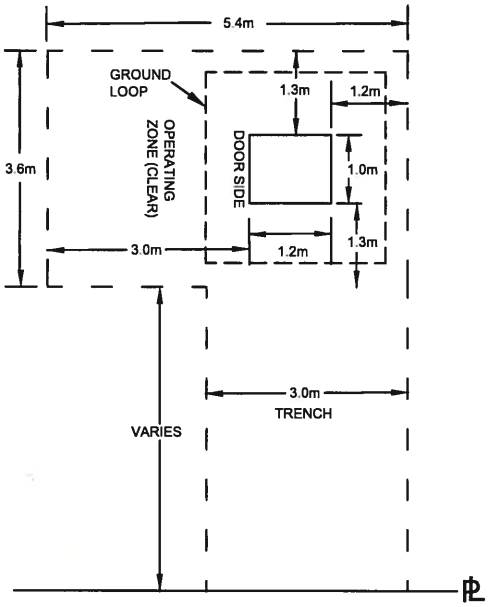
DRAWN BY	SM	JUL/14	UNDERGROUND EQUIPMENT STRUCTURES
CHECKED BY		Sept/14	3PH TRANS OVER 500kVA ROW
APPROVED BY		Sept/14	PLAN VIEW
			SHEET 3 OF 5

FORTIS BC

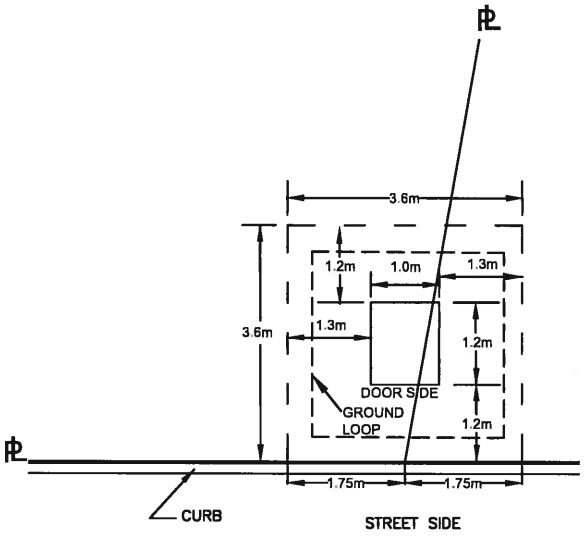
DRAWING No.	REV.
1204	0



OPTION A



OPTION C



OPTION B

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2014-09-10

NOTES:

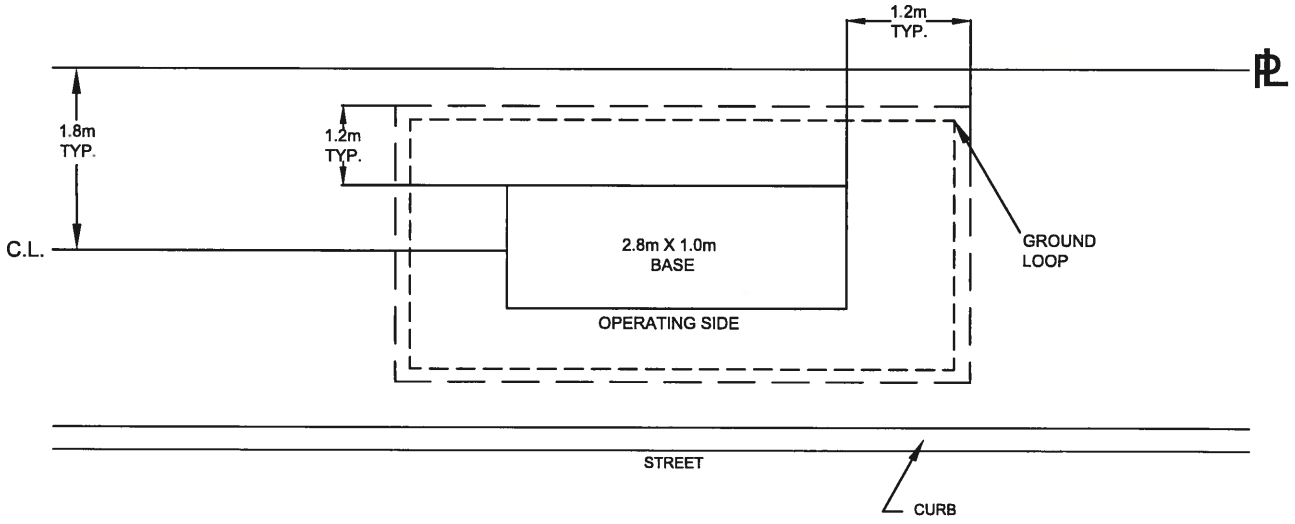
1) OPTION A, DOORS FACING STREETSIDE
2) OPTION B, DOORS FACING STREETSIDE (R/W SPLIT ON TWO PROPERTIES)
3) OPTION A & B – ANY STREET SIDE FENCE IS TO BE GATED, NOT TO RESTRICT ACCESS. NO FIXED STRUCTURE TO EXIST WITHIN A 3 METER CLEAR ZONE OF THE OPERATING DOORS.
4) OPTION C, DOORS FACING 3M LONG OPERATING ZONE (ON PRIVATE PROPERTY)
5) LOCATE ALL TRANSFORMERS AS INDICATED IN CSA UNDERGROUND SYSTEMS 3.2.2
6) LOCATE ALL TRANSFORMERS AS INDICATED IN C.E.C. 26-240. FORTISBC PADMOUNT DISTRIBUTION TRANSFORMERS ARE TYPICALLY PROTECTED WITH AN INTERNAL CURRENT LIMITING FUSE & EQUIPPED WITH A PRESSURE RELIEF DEVICE
7) GROUND LOOP BURIED 1m AWAY FROM EDGE OF EQUIPMENT.
8) IF REQUIRED BY PROJECT, 6m WIDE ACCESS ROW TO BE MEASURED FROM EGDE OF EQUIPMENT.

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1						

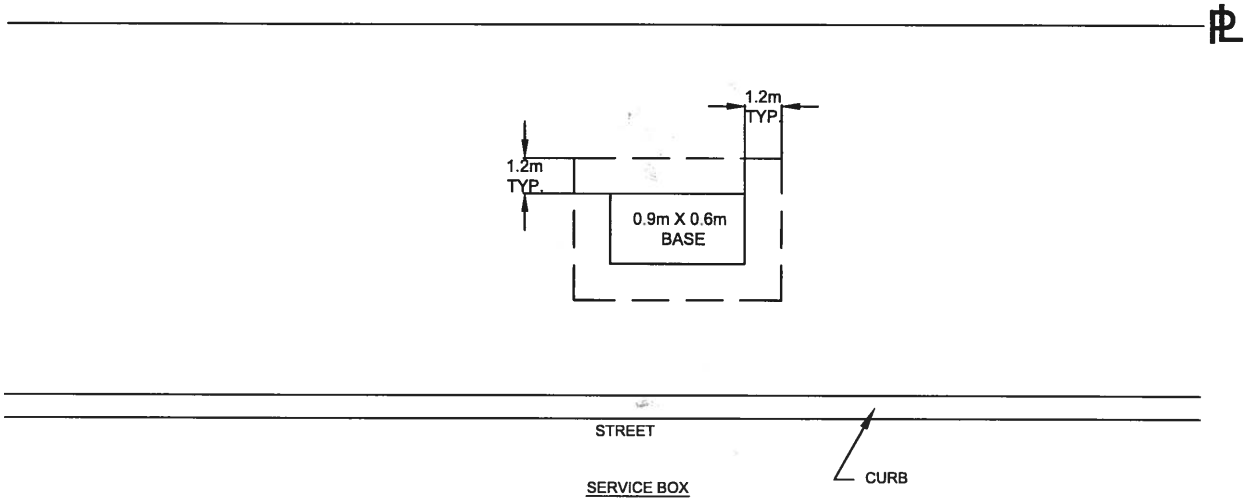
DRAWN BY	SM	JULY 14	UNDERGROUND EQUIPMENT STRUCTURE
CHECKED BY	NA	Sept/14	1PH TRANSFORMER ROW
APPROVED BY	DCW	Sept/14	PLAN VIEW
			SHEET 4 OF 5

FORTIS BC

DRAWING No.	REV.
1204	0



3PH JUNCTION BOX



SERVICE BOX

NOTES:

1) NO FIXED STRUCTURE TO EXIST WITH 3m CLEAR ZONE OF OPERATING SIDE.
2) LOCATION OF JUNCTION BOX COULD VARY DEPENDING ON PROJECT REQUIREMENTS.
3) GROUND LOOP BURIED 1m AWAY FROM EDGE OF JUNCTION BOX.
4) ROW SHALL BE AT LEAST 1.2m AWAY FROM EDGE OF EQUIPMENT

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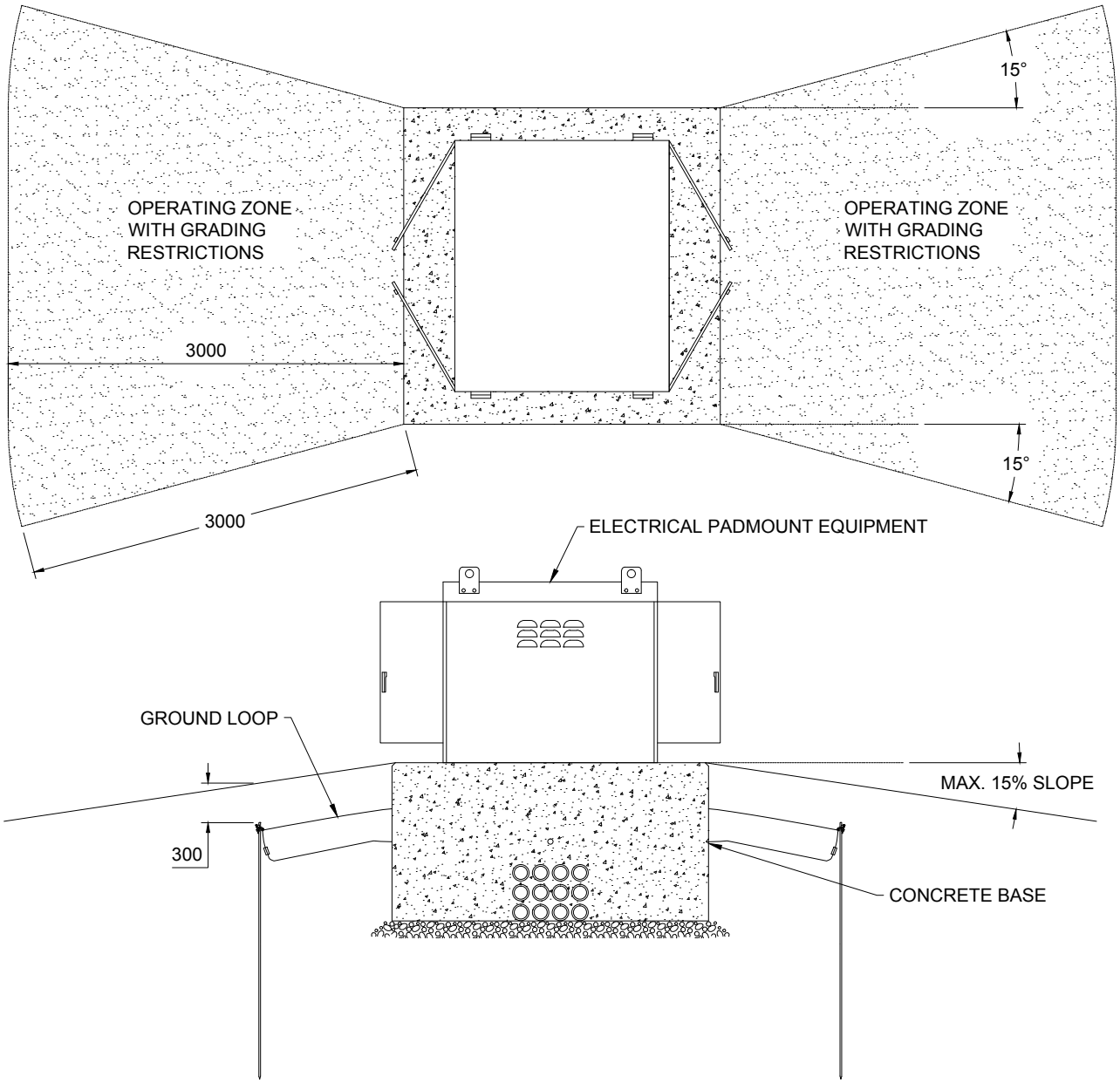
2014-09-10

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1						

DRAWN BY	SM	JUL/14	UNDERGROUND EQUIPMENT STRUCTURE
CHECKED BY		Sept/14	TYPICAL JUNCTION/SERVICE BOX
APPROVED BY	DCW	Sept/14	PLAN VIEW
			SHEET 5 OF 5

FORTIS BC

DRAWING No.	REV.
1204	0



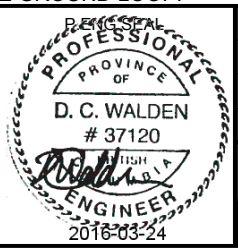
NOTES:

1. THIS STRUCTURE APPLIES TO ALL PADMOUNT EQUIPMENT. IN THE CASE WHERE THE EQUIPMENT HAS ONLY ONE SET OF DOORS, OPERATING ZONE AND GRADING REQUIREMENTS ONLY APPLY TO THAT SIDE.
2. LANDSCAPE GRADE WITHIN THE OPERATING ZONE OF PADMOUNT EQUIPMENT MUST NOT EXCEED ±15%. REQUIRED FOR SAFE FOOTING WHEN OPERATING THE EQUIPMENT.
3. THE SLOPE MUST NEVER EXPOSE THE GROUND LOOP.

REVISION DATE	JAN/16	
AUTHOR	DCW	DEC/15
CHECKED	DK	JAN/16
APPROVED	DK	JAN/16

DESCRIPTION OF CHANGE:

GENERAL REVISION OF FORMAT



ORIGINAL ISSUE		
AUTHOR		
CHECKED	NS	JUN/02
APPROVED	FC	JUN/02

FORTIS BC

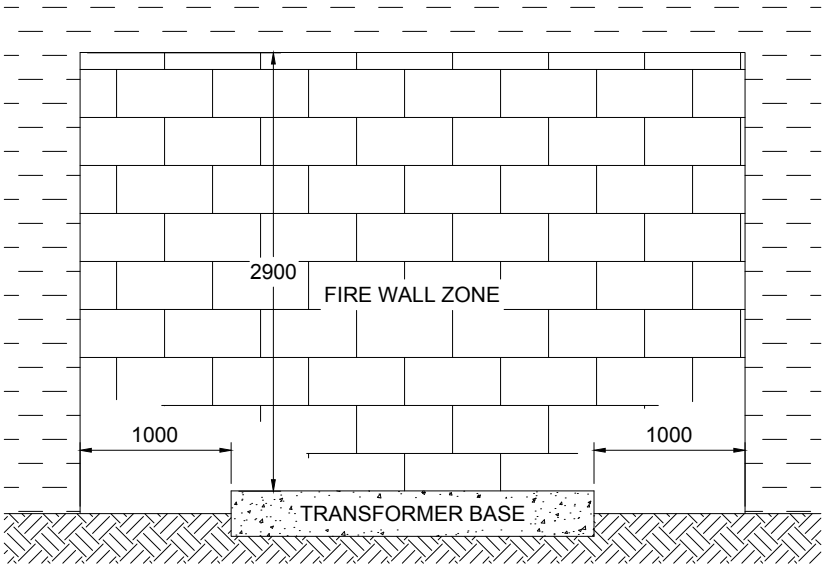
UNDERGROUND EQUIP STRUCTURES

PADMOUNT EQUIP GENERAL REQ

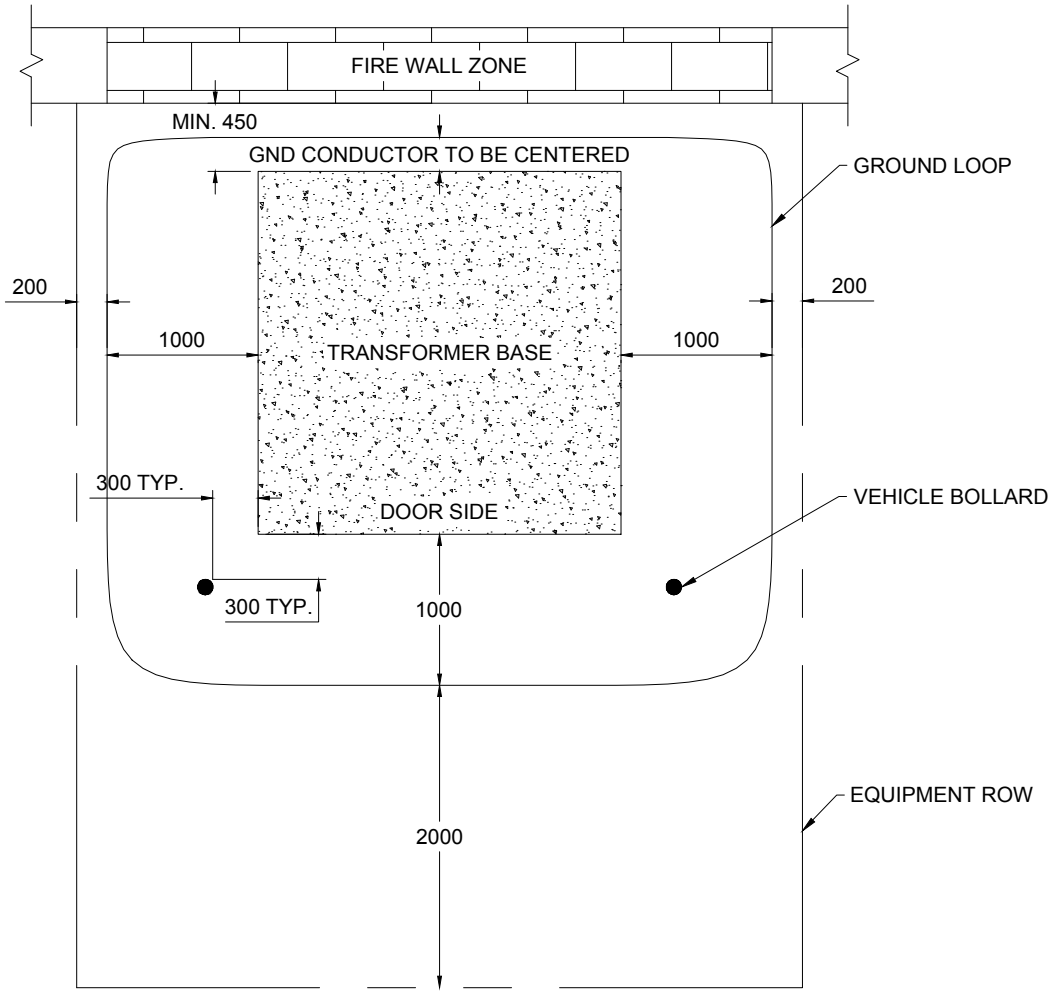
GRADING OF LANDSCAPE

SHEET 1 OF 5

DRAWING No.	REV.
1206	4



FRONT VIEW



TOP VIEW

NOTE:

1. DIMENSIONS IN mm.
2. STR. SHALL ONLY BE USED WHEN 1m OFF BACK OF TRANS. PAD IS NOT AVAILABLE.
3. FIREWALL ZONE SHALL MEET THE REQUIREMENTS OF CEC 26.242. MUST BE NON-FLAMMABLE SURFACE.

REVISION DATE	JAN/16	
AUTHOR	DCW	DEC/15
CHECKED	DK	JAN/16
APPROVED	DK	JAN/16

DESCRIPTION OF CHANGE:

REMOVED SIDES AND ROOF FROM FIREWALL

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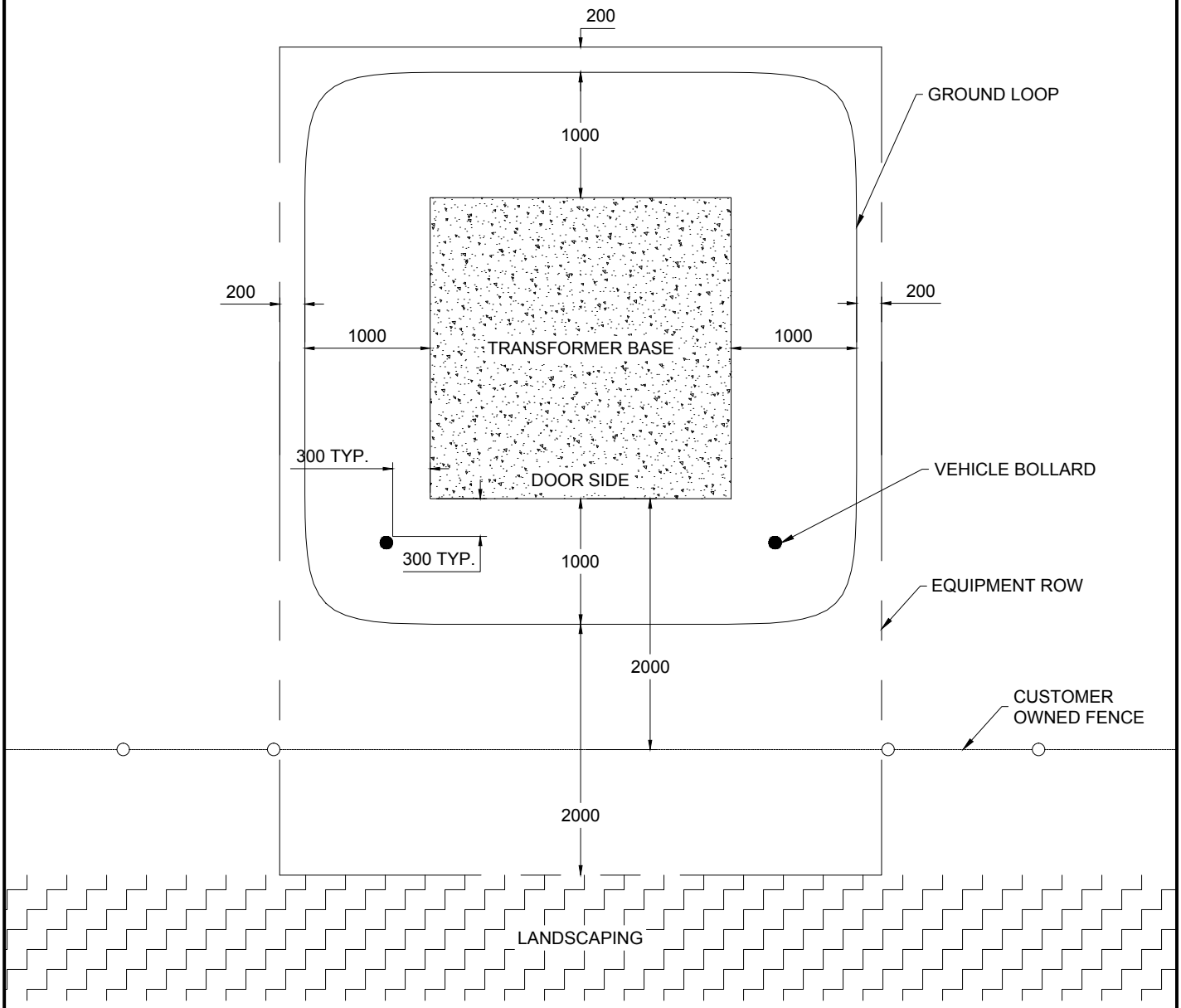
2016-03-24

ORIGINAL ISSUE		
AUTHOR	NS	DEC/03
CHECKED	NS	DEC/03
APPROVED	FC	DEC/03

FORTIS BC

UNDERGROUND EQUIP. STR.
PADMOUNT EQUIPMENT GEN. REQ.
3PH TRANS. W. FIREWALL
SHEET 2 OF 5

DRAWING No.	REV.
1206	5



NOTE:

1. DIMENSIONS IN mm.
2. NO METALLIC OBJECTS SUCH AS FENCES OR GATES ARE PERMITTED WITHIN 2.0m OF THE TRANSFORMER BASE UNLESS EFFECTIVELY ISOLATED FROM EARTH AS SHOWN IN STRUCTURE 1206 SHEET 5.
3. THE CUSTOMER MUST PROVIDE FORTISBC ACCESS TO THE TRANSFORMER IF ANY FORM OF BARRIER IS INSTALLED, IE. FENCE. NO PERMANENT PORTION OF THIS STRUCTURE IS PERMITTED WITHIN THE RIGHT-OF-WAY.
4. NO LANDSCAPING IS PERMITTED WITHIN THE RIGHT-OF-WAY. FORTISBC RESERVES THE RIGHT REMOVE ANY LANDSCAPING PLACED BY THE CUSTOMER WITHIN THE RIGHT-OF-WAY.
5. VEHICLE BOLLARDS ARE REQUIRED FOR ALL 3PH TRANSFORMERS. MAY BE REQUIRED FOR 1PH TRANSFORMERS.

REVISION DATE	JAN/16	
AUTHOR	DCW	DEC/15
CHECKED	DK	JAN/16
APPROVED	DK	JAN/16

DESCRIPTION OF CHANGE:
REMOVED FIREWALL INFORMATION
WHICH IS NOW SHOWN ON SHEET 2

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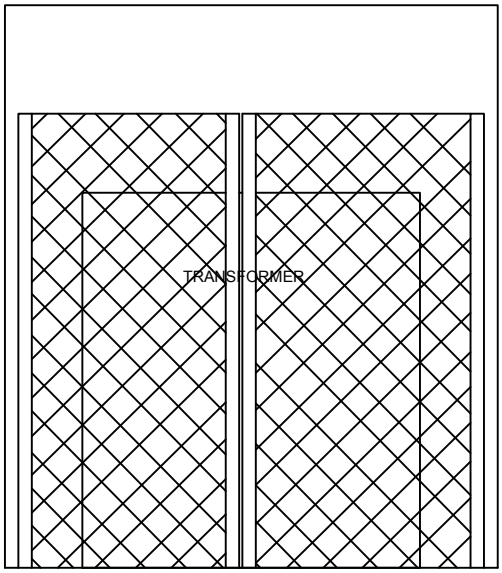
2016-03-24

ORIGINAL ISSUE		
AUTHOR	NS	DEC/03
CHECKED	NS	DEC/03
APPROVED	FC	DEC/03

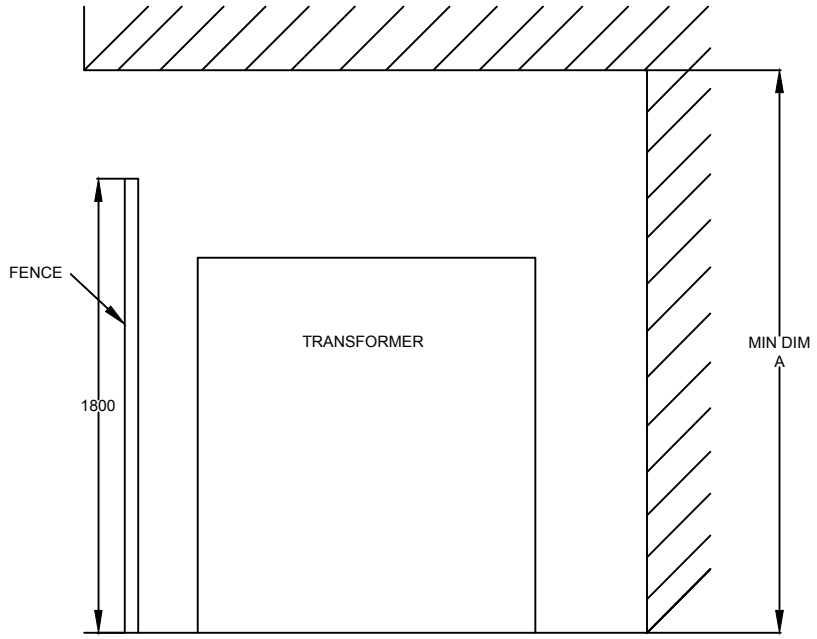
FORTIS BC

UNDERGROUND EQUIP. STR.
PADMOUNT EQUIPMENT GEN. REQ.
PADMOUNT TRANS. TYP. REQ'S
SHEET 3 OF 5

DRAWING No.	REV.
1206	8

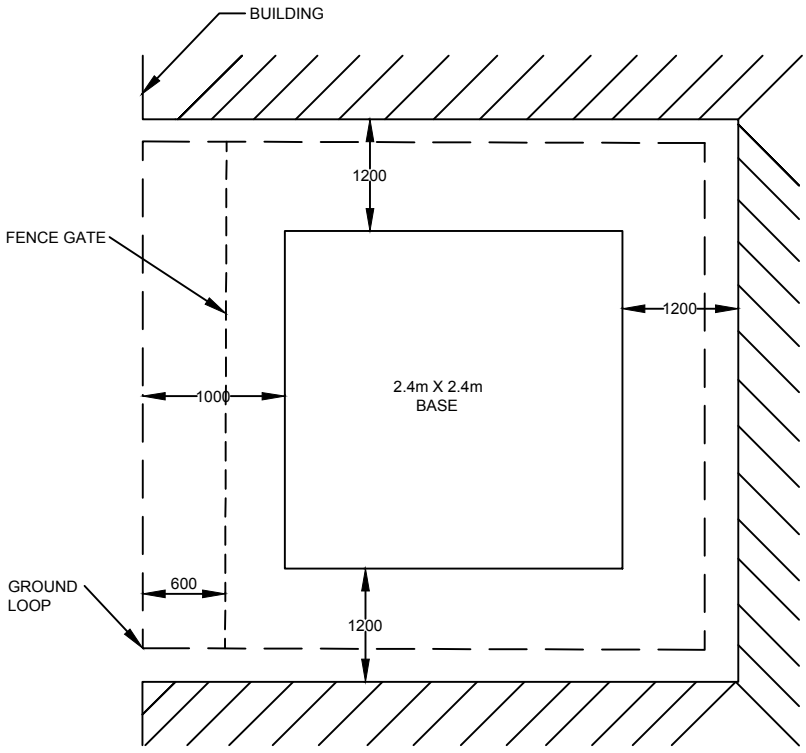


FRONT VIEW



SIDE VIEW

	DIMENSION A
UPTO 300kVA	5.0m
500kVA TO 2500kVA	8.3m



PLAN VIEW

NOTES:

1. DIMENSIONS IN mm UNLESS INDICATED OTHERWISE.
2. GROUND LOOP TO BE BURIED 1m AWAY FROM EQUIPMENT.
3. GATE SHALL ALLOW FULL ACCESS TO FONT OF TRANSFORMER. GATE SHALL NOT INHIBIT CRANE ACCESS.
4. GATE SHALL BE BONDED TO EQUIPMENT GROUND.
5. THIS STRUCTURE SHALL ONLY BE USED IF THERE IS 14.5m OF UNOBSTRUCTED SPACE IN FRONT OF THE TRANSFORMER CAVITY. MEASURING FROM THE EDGE OF THE BUILDING. REQUIRED FOR CRANE ACCESS.
6. ANY OTHER CONFIGURATION REQUIRE FBC APPROVAL.

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2016-03-24

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
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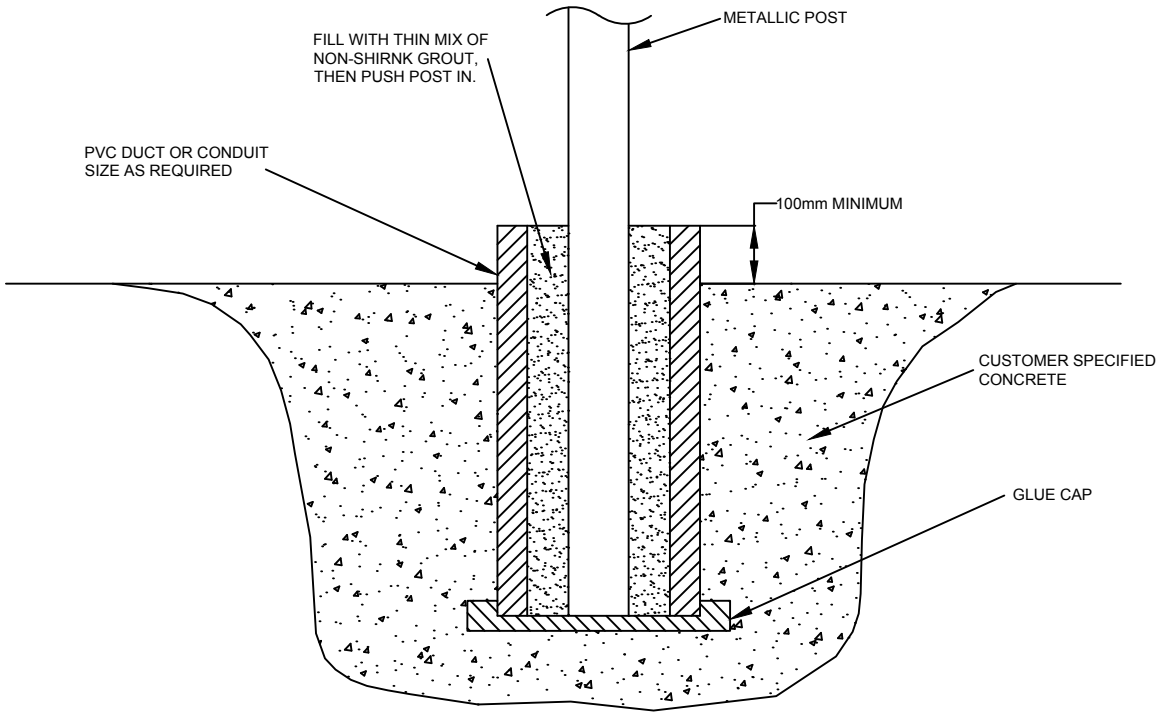
DRAWN BY	SM	JUL/14
CHECKED BY	DK	SEP/14
APPROVED BY	DCW	SEP/14

UNDERGROUND EQUIPMENT STRUCTURE
PADMOUNT EQUIPMENT GENERAL REQ.
ZERO SETBACK BUILDING TRANSFORMER
SHEET 4 OF 5

FORTIS BC

DRAWING No.	REV.
1206	0



PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
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2016-03-24

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
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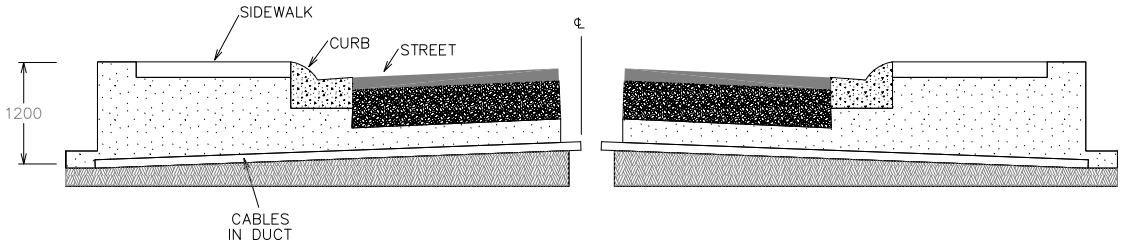
DRAWN BY	SM	JUL/14
CHECKED BY	DK	SEP/14
APPROVED BY	DCW	SEP/14

UNDERGROUND EQUIPMENT STRUCTURES
PADMOUNT EQUIPMENT GENERAL REQ
ISOLATION OF METAL FENCE
SHEET 5 OF 5

FORTIS BC

DRAWING No.	REV.
1206	0



STREET CROSSING DESIGN
MONOLITHIC CURB & SIDEWALK

NOTE:

1. BACKFILL UNDER THE ROADWAY SHALL CONSIST OF COMPACTED SAND FILL, OR AS REQUIRED BY THE MUNICIPAL AUTHORITY OR DEVELOPER
2. NOMINAL BURIAL DEPTH IS 1.2m
3. DESIGNER MAY SPECIFY CONCRETE INCASEMENT ON FEEDER CLASS CROSSINGS

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
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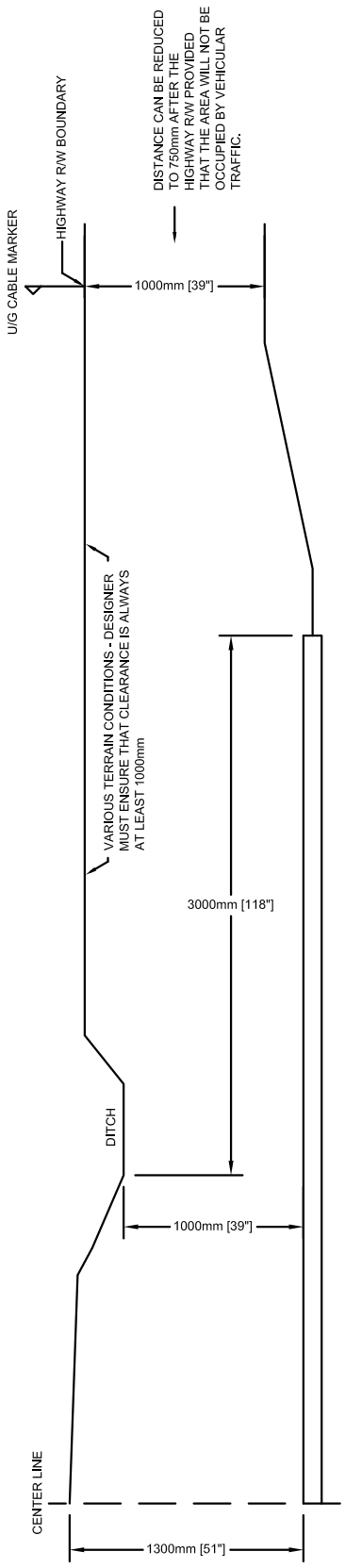
1	FEB'08	TD	NG	REDRAWN, REMOVE NOTES 1 AND 4, ADDED NOTE 3	BMB	FEB/08

DRAWN BY	NS	SEPT'02
CHECKED BY	FC	SEPT'02
APPROVED BY	FC	SEPT'02

UNDERGROUND DISTRIBUTION
ROAD CROSSINGS

FORTISBC

DRAWING No.	REV.
1214	1



1. SEAL BOTH ENDS OF THE DUCT WITH SEALER PRIOR TO BACKFILLING.
2. DUCT/CABLING WILL BE PLACED ON A 152.4mm THICK LAYER OF SAND AND WILL BE COVERED WITH 152.4mm OF SAND. ABOVE THIS WILL BE NATIVE SOIL.
3. CROSSINGS WILL BE MADE AT 90 DEGREE ANGLES TO THE HIGHWAY.
4. ALL BORED DUCTS WILL BE 151.6mm DIAMETER.
5. RED BURIAL TAPE WILL BE PLACED HALF WAY BETWEEN THE DUCT/CABLE AND FINISHED GRADE.

SHEET 1 OF 2

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
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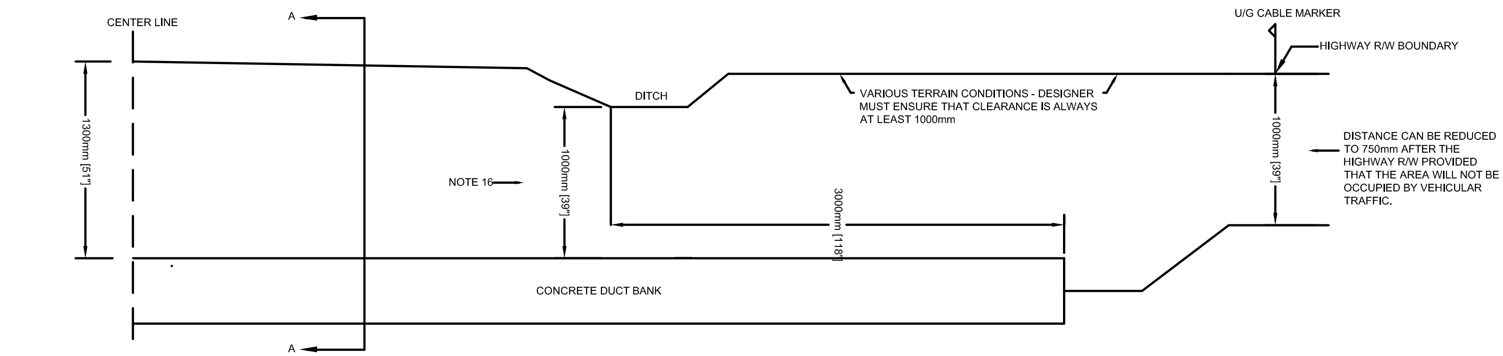
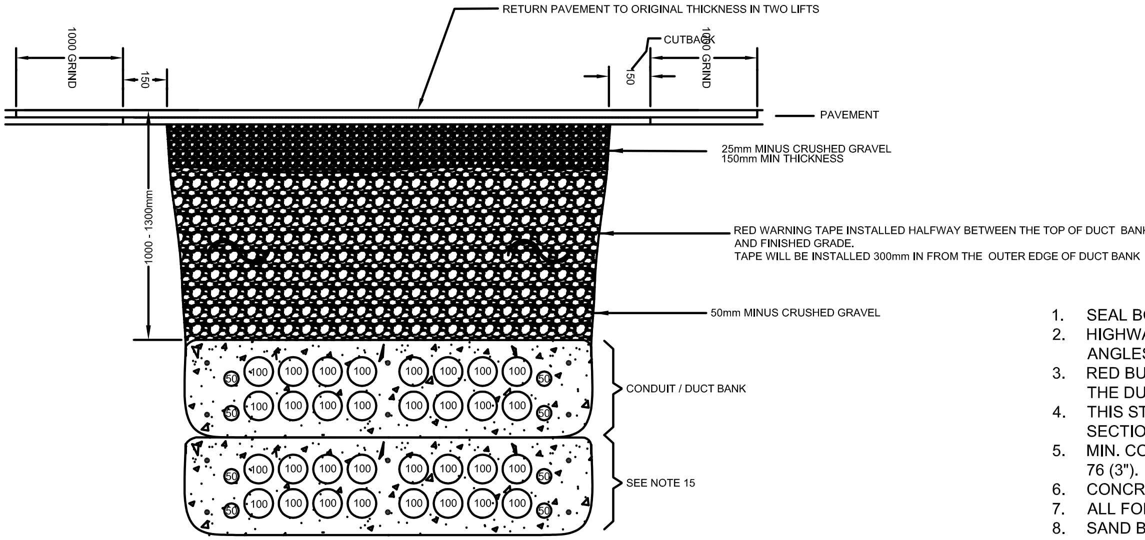
DRAWN BY	AR	NOV/08
CHECKED BY	DMc	NOV/08
APPROVED BY	IF	NOV/08

EXISTING UG HIGHWAY CROSSING

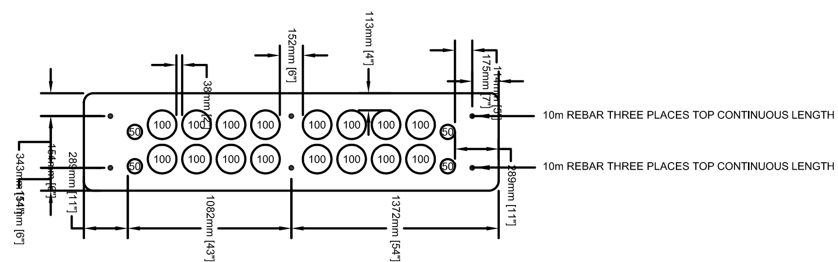
FORTISBC

DRAWING No.	REV.
1214	0





SECTION VIEW A–A
NOT TO SCALE



CONDUIT / DUCT BANK

1. SEAL BOTH ENDS OF THE DUCT PRIOR TO BACKFILLING.
2. HIGHWAYS CROSSINGS WILL BE MADE AT 90 DEGREE ANGLES TO THE HIGHWAY.
3. RED BURIAL TAPE WILL BE PLACED HALF WAY BETWEEN THE DUCT/CABLE AND FINISHED GRADE.
4. THIS STANDARD WILL CONFORM TO MOT UTILITY MANUAL SECTION 11 AND 13 UNLESS OTHERWISE NOTED
5. MIN. CONCRETE COVER OVER CONDUIT AND REBAR TO BE 76 (3").
6. CONCRETE TO BE FORMED AND POURED.
7. ALL FORMS ARE TO BE REMOVED BEFORE BACKFILL.
8. SAND BEDDING IN TRENCH MAY BE USED AS BOTTOM FORM ONLY IF CLEAN AND LEVEL.
9. FORTISBC BC TO INSPECT FORM AND REINFORCEMENT BEFORE POUR
10. 25 MPa CONCRETE WILL BE USED
11. MAINTAIN A MINIMUM 25mm (1") CONCRETE BETWEEN ALL CONDUITS WITH SPECIAL ATTENTION PAID TO INNER BEND RADIUS
12. COMMERCIALLY MANUFACTURED CONDUIT SPACERS SHALL BE USED TO MAINTAIN CONDUIT HORIZONTAL CLEARANCE FOR CONCRETE INFILTRATION.
13. SPACERS SHALL NOT BE CLOSER THAN 300mm TO JOINTS AND AT INTERVALS NOT TO EXCEED 2.4M.
14. BACKFILL SHALL BE PLACED IN LAYERS NOT EXCEEDING 150mm AND EACH LAYER WILL BE COMPACTED TO A MINIMUM OF 95% PROCTOR DENSITY AND THE FINAL 300mm WILL BE COMPACTED TO 100%.
15. SHOULD MORE THAN 16 CONDUITS BE NEEDED A DUPLICATE DUCT BANK WILL BE PLACED DIRECTLY BELOW THE ORIGINAL ONE.
16. 1m MINIMUM CLEARANCE IS NEEDED EVERYWHERE WITHIN THE HIGHWAYS R/W.

SHEET 2 OF 2

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
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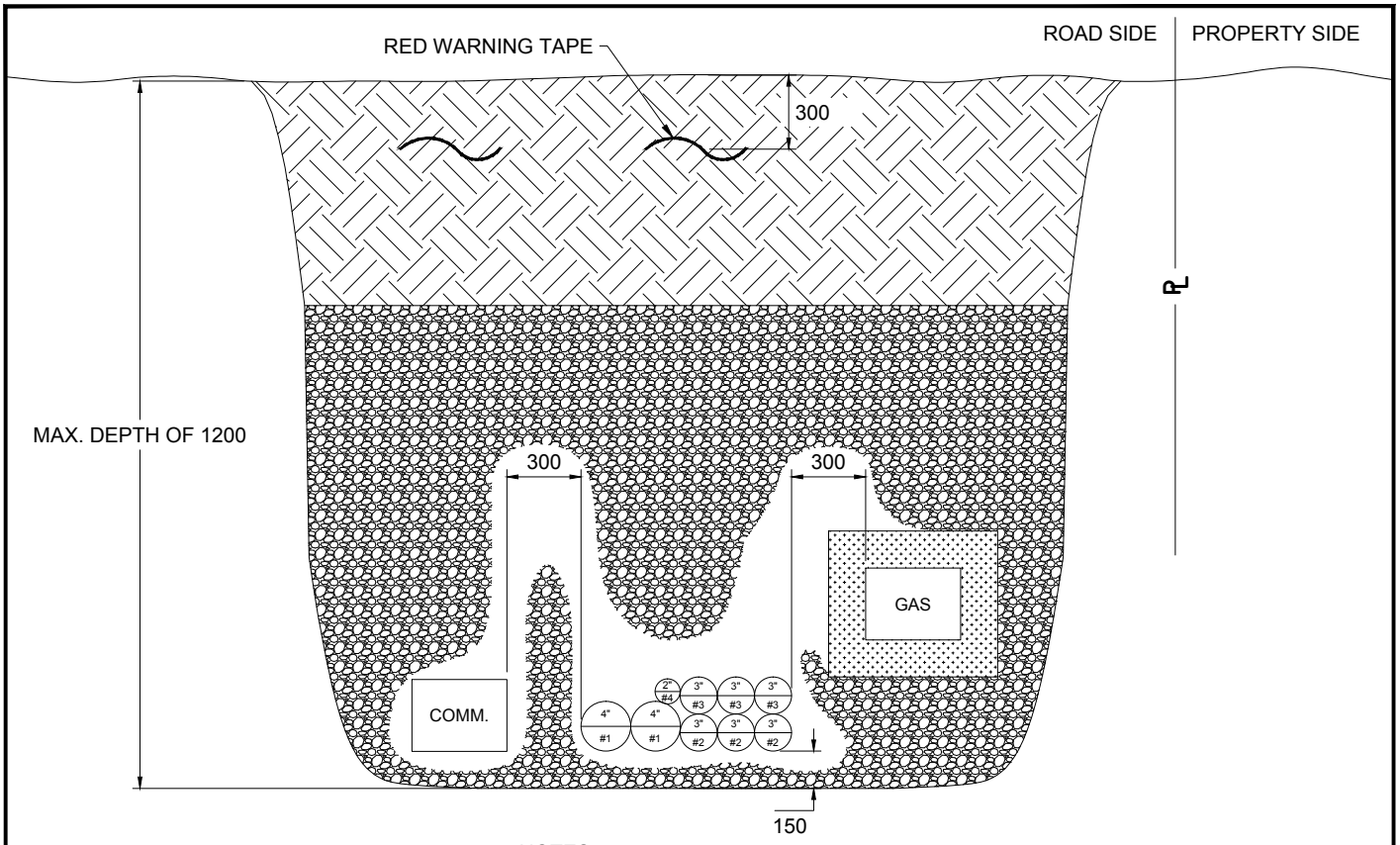
1						

DRAWN BY	AR	NOV/08
CHECKED BY	DMc	NOV08
APPROVED BY	IF	NOV/08

NEW UG HIGHWAY CROSSING

FORTISBC

DRAWING No.	REV.
1214	0



NOTES:

1. ALL DIMENSIONS IN MILLIMETERS.
2. DRAWINGS DO NOT APPLY TO ROAD CROSSINGS. REFER TO STRUCTURE 1214.
3. TRENCH DEPTH IS DETERMINED FROM ROAD GRADE.
4. SIZE AND QUANTITY OF DUCTS MAY VARY FROM DRAWING AS REQUIRED IN DESIGN.
5. DRAWING SHOWS PREFERRED ORIENTATION OF PRIMARY, SECONDARY AND STREET LIGHT DUCT WITHIN TRENCH.
6. ELECTRICAL DUCT SHALL BE ON PROPERTY SIDE OF COMM. DUCT.
7. PREFERRED MINIMUM DEPTH OF ELECTICAL DUCT IS 900mm.
8. ABSOLUTE MINIMUM DEPTH OF ELECTRICAL DUCT IS:
   - 8.1. 600mm WITHOUT ADDITIONAL PROTECTION.
   - 8.2. 450mm WITH MECHANICAL PROTECTION ABOVE DUCT. MECHANICAL PROTECTION SHALL CONSIST OF POURED OR SLAB CONCRETE AT LEAST 50mm THICK.
4. $\frac{3}{4}$" ROAD MULCH SURROUNDING ELECTRICAL DUCT SHALL BE TYPE 1, 20mm SIEVE PER SECTION 31-05-17-2.7 OF THE MMCD.
5. MINIMUM HORIZONTAL DISTANCE OF 300mm MUST BE MAINTAINED BETWEEN ELECTRICAL DUCT OF OTHER UTILITIES.
6. MINIMUM VERTICAL SEPARATION AT CROSSINGS SHALL BE
   - 6.1. 150mm ELECTRICAL DUCT TO COMM. DUCT
   - 6.2. 300mm ELECTRICAL DUCT TO GAS LINE
   - 6.3. DISTANCES MAY BE REDUCED PROVIDED APPROVED BARRIERS ARE USED.
7. ELECTRICAL DUCTS SHALL HAVE 150mm $\frac{3}{4}$" ROAD MULCH BELOW DUCT BANK AND AT LEAST 150mm ABOVE DUCT BANK.
8. RED MARKER TAPE SHALL BE PLACED ABOVE ELECTRICAL DUCT.
9. TRENCH MUST BE SMOOTH AND LEVEL TO REDUCE STRESS ON DUCT.
10. THIS STRUCTURE REFERS TO FORTISBC ELECTRIC SPECIFIC REQUIREMENTS. REFER TO THE APPLICABLE STANDARDS FROM EACH UTILITY AS REQUIRED.
11. REFER TO THE "JOINT TRENCHING REQUIREMENTS FOR SHALLOW UTILITIES" WHERE APPLICABLE.
12. TRENCH ALIGNMENT SHALL BE DETERMINED BASED ON THE REQUIREMENTS LAID OUT BY THE AUTHORITIES HAVING JURISDICTION OF THE SITE. TYPICAL ALIGNMENT IS 1.8m OFF PL.

HATCH LEGEND

- CLEAN NATIVE SOIL
- 3/4" MINUS ROAD MULCH
- SAND

PIPE NUMBER LEGEND

- #1: 4" DUCT WITH 3 PHASE PRIMARY
- #2: 3" DUCT WITH 1 PHASE PRIMARY
- #3: 3" DUCT WITH 1 PHASE SECONDARY
- #4: 2" DUCT WITH STREET LIGHT CONDUCTOR

REVISION DATE	AUGUST 2015	
AUTHOR	DCW	AUG/15
CHECKED	DK	AUG/15
APPROVED	DCW	AUG/15

DESCRIPTION OF CHANGE:
ALIGN STR WITH JOINT TRENCH DOCUMENT
CHANGE FROM SAND TO 3/4" MULCH COVER

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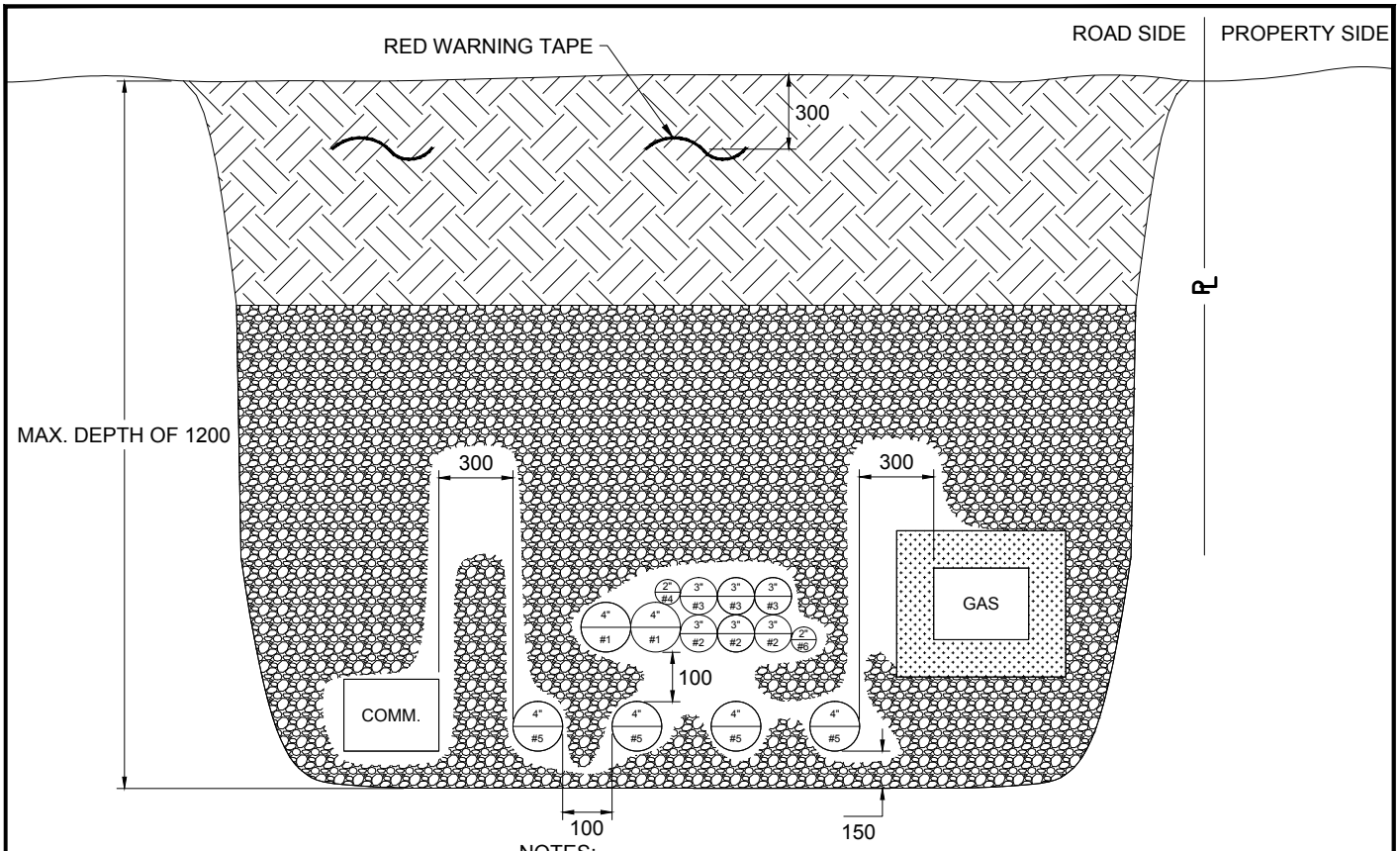
2016-02-24

ORIGINAL ISSUE		
AUTHOR		
CHECKED	NS	SEP/03
APPROVED	RS	SEP/03

FORTIS BC

UNDERGROUND EQUIPMENT STRUCTURES
TRENCH DETAILS
ELECTRICAL DISTRIBUTION W/O FEEDER
SHEET 1 OF 2

DRAWING No.	REV.
1216	5



NOTES:

1. ALL DIMENSIONS IN MILLIMETERS.
2. DRAWINGS DO NOT APPLY TO ROAD CROSSINGS. REFER TO STRUCTURE 1214.
3. TRENCH DEPTH IS DETERMINED FROM ROAD GRADE.
4. SIZE AND QUANTITY OF DUCTS MAY VARY FROM DRAWING AS REQUIRED IN DESIGN.
5. DRAWING SHOWS PREFERRED ORIENTATION OF PRIMARY, SECONDARY AND STREET LIGHT DUCT WITHIN TRENCH.
6. ELECTRICAL DUCT SHALL BE ON PROPERTY SIDE OF COMM. DUCT.
7. PREFERRED MINIMUM DEPTH OF ELECTICAL DUCT IS 900mm.
8. ABSOLUTE MINIMUM DEPTH OF ELECTRICAL DUCT IS:
   - 8.1. 600mm WITHOUT ADDITIONAL PROTECTION.
   - 8.2. 450mm WITH MECHANICAL PROTECTION ABOVE DUCT. MECHANICAL PROTECTION SHALL CONSIST OF POURED OR SLAB CONCRETE AT LEAST 50mm THICK.
4. $\frac{3}{4}$" ROAD MULCH SURROUNDING ELECTRICAL DUCT SHALL BE TYPE 1, 20mm SIEVE PER SECTION 31-05-17-2.7 OF THE MMCD.
5. MINIMUM HORIZONTAL DISTANCE OF 300mm MUST BE MAINTAINED BETWEEN ELECTRICAL DUCT OF OTHER UTILITIES.
6. MINIMUM VERTICAL SEPARATION AT CROSSINGS SHALL BE
   - 6.1. 150mm ELECTRICAL DUCT TO COMM. DUCT
   - 6.2. 300mm ELECTRICAL DUCT TO GAS LINE
   - 6.3. DISTANCES MAY BE REDUCED PROVIDED APPROVED BARRIERS ARE USED.
7. ELECTRICAL DUCTS SHALL HAVE 150mm $\frac{3}{4}$" ROAD MULCH BELOW DUCT BANK AND AT LEAST 150mm ABOVE DUCT BANK.
8. RED MARKER TAPE SHALL BE PLACED ABOVE ELECTRICAL DUCT.
9. TRENCH MUST BE SMOOTH AND LEVEL TO REDUCE STRESS ON DUCT.
10. THIS STRUCTURE REFERS TO FORTISBC ELECTRIC SPECIFIC REQUIREMENTS. REFER TO THE APPLICABLE STANDARDS FROM EACH UTILITY AS REQUIRED.
11. REFER TO THE "JOINT TRENCHING REQUIREMENTS FOR SHALLOW UTILITIES" WHERE APPLICABLE.
12. TRENCH ALIGNMENT SHALL BE DETERMINED BASED ON THE REQUIREMENTS LAID OUT BY THE AUTHORITIES HAVING JURISDICTION OF THE SITE. TYPICAL ALIGNMENT IS 1.8m OFF PL.

HATCH LEGEND

- CLEAN NATIVE SOIL
- 3/4" MINUS ROAD MULCH
- SAND

PIPE NUMBER LEGEND

- #1: 4" DUCT WITH 3 PHASE PRIMARY
- #2: 3" DUCT WITH 1 PHASE PRIMARY
- #3: 3" DUCT WITH 1 PHASE SECONDARY
- #4: 2" DUCT WITH STREET LIGHT CONDUCTOR
- #5: 4" DUCT WITH 1 PHASE FEEDER
- #6: 2" DUCT WITH FEEDER NEUTRAL

REVISION DATE		
AUTHOR		
CHECKED		
APPROVED		

DESCRIPTION OF CHANGE:

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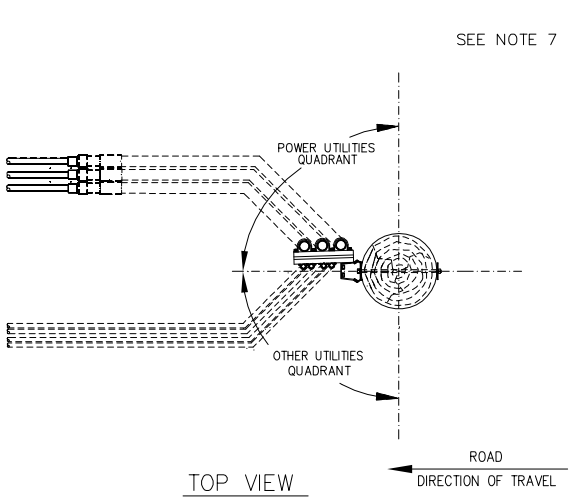
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-02-24

ORIGINAL ISSUE		
AUTHOR	DCW	AUG/15
CHECKED	DK	AUG/15
APPROVED	DCW	AUG/15

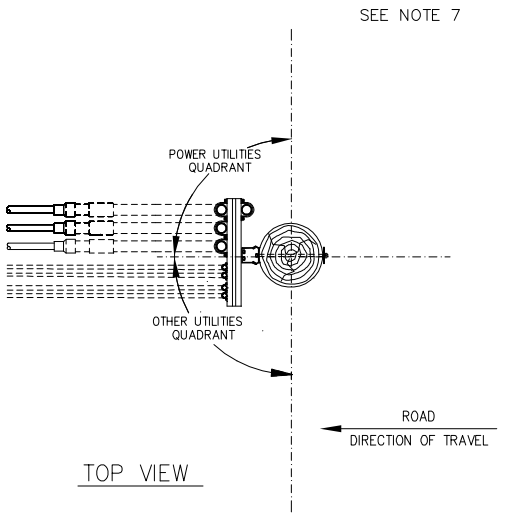
FORTIS BC

UNDERGROUND EQUIPMENT STRUCTURES
TRENCH DETAILS
ELECTRICAL DISTRIBUTION WITH FEEDER
SHEET 2 OF 2

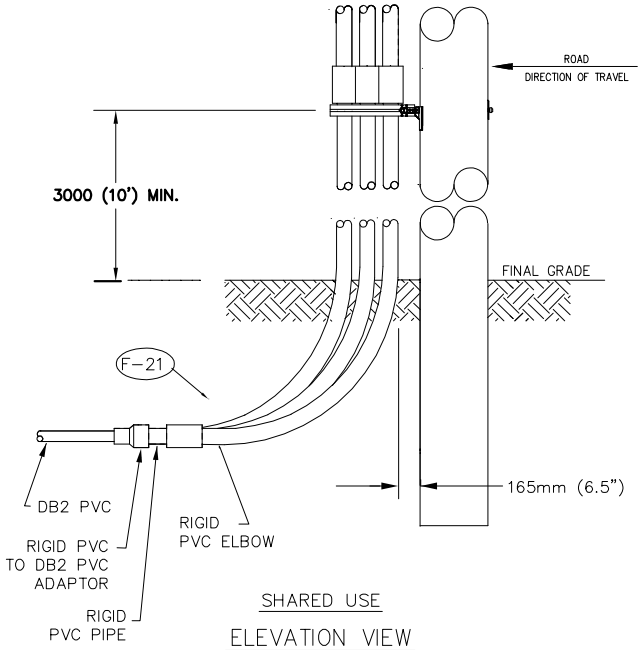
DRAWING No.	REV.
1216	0



TOP VIEW

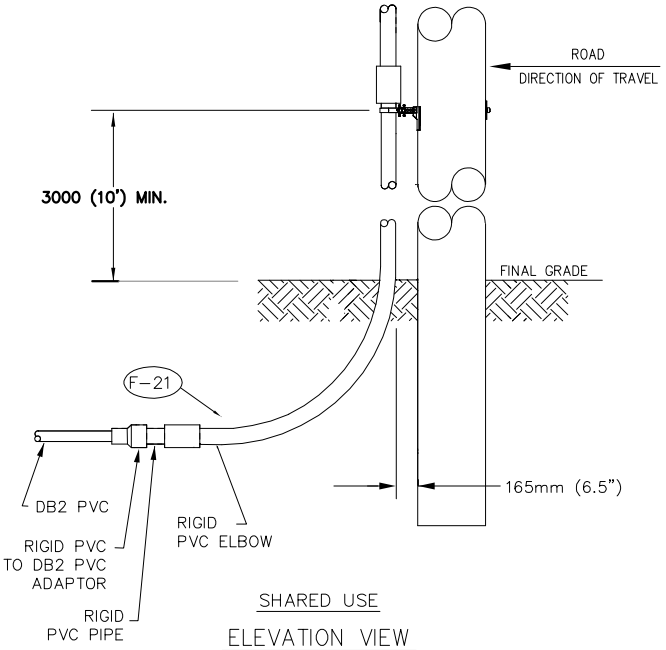


TOP VIEW



SHARED USE

ELEVATION VIEW



SHARED USE

ELEVATION VIEW

NOTES:

1 – VARIATION TO THIS ARRANGEMENT SHALL BE APPROVED BY FORTIS.

2 – DUCTS SHALL BE GROUPED AS CLOSELY AS POSSIBLE TO OTHER UTILITIES.

3 – BOLTS SHALL NOT BE TIGHTENED AS TO DEFORM THE DUCT.

4 – DUCTS SHALL NOT BE ENCASED IN PHONE COMPANIES CONCRETE PILASTER.

5 – POWER UTILITY DUCT SHALL NORMALLY BE LOCATED IN QUADRANT OPPOSITE NEAREST TRAFFIC FLOW.

6 – PVC CONDUIT TO BE CONCRETE CAPPED. ALL DUCT TO BE PVC.

7 – THE POWER UTILITIES QUADRANT MAY BE SWITCHED BY SPECIAL PERMISSION FROM FORTIS.

8 – CUT THE END OF THE BOLT FLUSH WITH THE POLE.

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2	JUN/12	NJI	BV	UPDATED BORDER/GENERAL REVISION	DCW	DEC/12
1	JUN/07	SS	BM	REVIEW STANDOFF HIGH, SEPER. POLE ADD NOTE 8	IF	JUN/07

DRAWN BY	NS	JUN/05
CHECKED BY	NS	JUN/05
APPROVED BY	RS	JUN/05

RISERS AND UNDERGROUND STRUCTURES
RISER FOR SINGLE OR MULTY DUCT
GENERAL ARRANGEMENT
SHEET 1 OF 1

FORTIS BC

DRAWING No.	REV.
1342	2

Fortis — Bill of Material — 2012/02/13

Structure # 1342 — POLE RISER FOR MULTI DUCT ENTRANCE

ASSEMBLY REF #			ITEM #	Item #	UI	-1	-2	-3	-4	Description
F43			1	5132612		1	1	1	1	BOLT, MACHINE, GALV, 3/4" X 12",
F43			2	5132614		1	1	1	1	BOLT, MACHINE, GALV, 3/4" X 14",
F43			3	5132616		1	1	1	1	BOLT, MACHINE, GALV, 3/4" X 16"
F43			4	5132618		1	1	1	1	BOLT, MACHINE, GALV, 3/4" X 18",
F43			5	5138401		4	4	4	4	BOLT, LAG, GALVANIZED, 1/2" X 4",
F43			6	5142206		4	4	4	4	WASHER, SQ, 3 X 3 X 1/4, 13/16 HOLE
F43			7	5142603		4	4	4	4	WASHER, SPRING LOCK, DOUBLE 3/4
F43			8	5890450		4	4	4	4	BRACKET, ALUMINUM, STANDOFF
F43			9	5890456		4	4	4	4	BRACKET, T SLOT, 4 WAY, 24 INCHES LONG
F43			10	6311109		8		12		STRAP, KIT, GALV, FOR 3",
F43			11	6311110			8		12	STRAP, KIT, GALV, FOR 4",

1

REMARKS:

1. 1342-1 for single 3 inch duct entrance with provision for 1 extra conduit
2. 1342-2 for single 4 inch duct entrance with provision for 1 extra conduit
3. 1342-3 for multi duct entrance with provision for 3-3 inch duct
4. 1342-4 for multi duct entrance with provision for 3-4 inch duct
5. Order additional length of T-Slots as required.
   24" item 589-0456
   36" item 589-0457
   48" item 589-0458
6. Order appropriate DB2 to Rigid PVC adaptor as required;
   1.- Item 632-3455 is for 2" applications
   2.- Item 632-3459 is for 3" applications
   3.- Item 632-3457 is for 4" applications

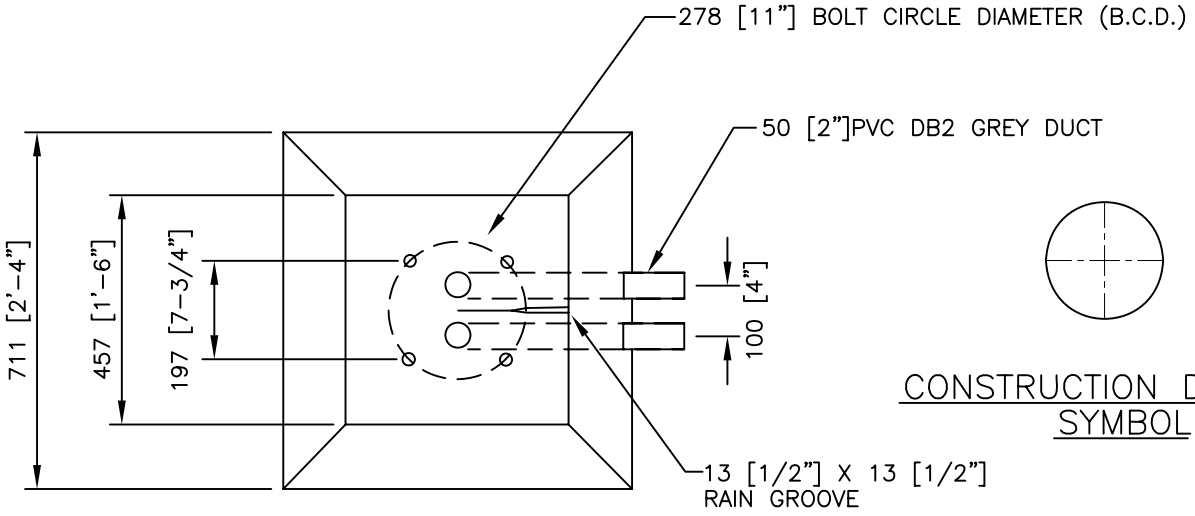
REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1	JUN/12	NJI	BV	UPDATED T-SLOT BRACKET, STANDARDIZED STANDOFFS	DCW	DEC/12

DRAWN BY	FAB	
CHECKED BY	FAB	
APPROVED BY	FAB	

RISERS AND UNDERGROUND STRUCTURES
RISER FOR SINGLE OR MULTI DUCT
BILL OF MATERIAL
BOM SHEET 1 OF 1

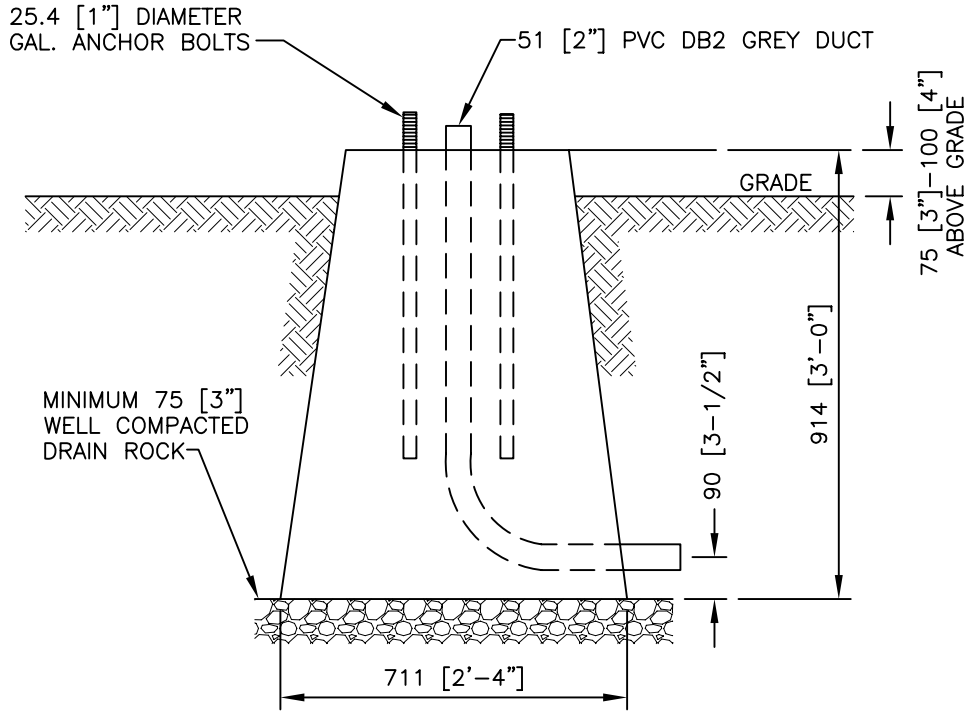
FORTIS BC

DRAWING No.	REV.
1342	1



CONSTRUCTION DRAWING SYMBOL

TOP VIEW



SECTION VIEW

NATIVE FILL

25mm [1"] CLEAN DRAIN ROCK

5mm [3/16"] SCREENED SAND COMPACTED

FILL REQUIRED BY TELCO OR CABLE

NOTES:

1) MAXIMUM POLE HEIGHT, 9mx2.4m [30'x8']

2) FOR POLE MOUNTING – RESIDENTIAL

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3	OCT/07	S.W.	NG	ADDED RESIDENTIAL TO TEXT BOX	BMB	OCT 07
2	FEB/07	CLG	BM	REDRAWN AND ADD NOTE 2	I.F.	JUL/07
1	SEP/03		N.S.	ADDED NOTE 1, AND CONSTRUCTION SYMBOL	R.S.	MAY/05

DRAWN BY		SEP/03
CHECKED BY	N.S.	SEP/03
APPROVED BY	F.C.	SEP/03

THREE FOOT BASE
FOR STREET LIGHTING "RESIDENTIAL"

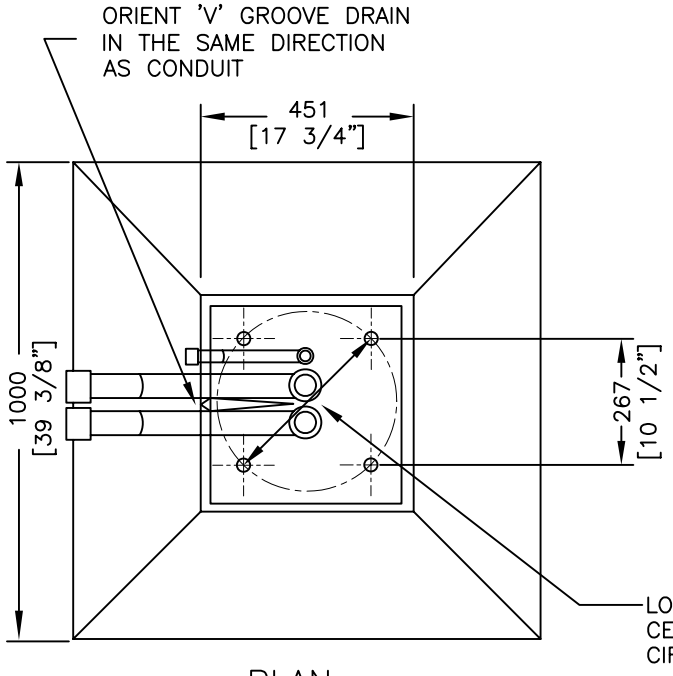
FORTISBC

DRAWING No.	REV.
1416	3

Fortis	Bill of Material	2007/10/20
Structure # 1416	CIVIL, PAD, STREET LIGHT BASE	

Item #	UI	-1	Description
7550206		1	BASE, STREET LIGHT, CONCRETE

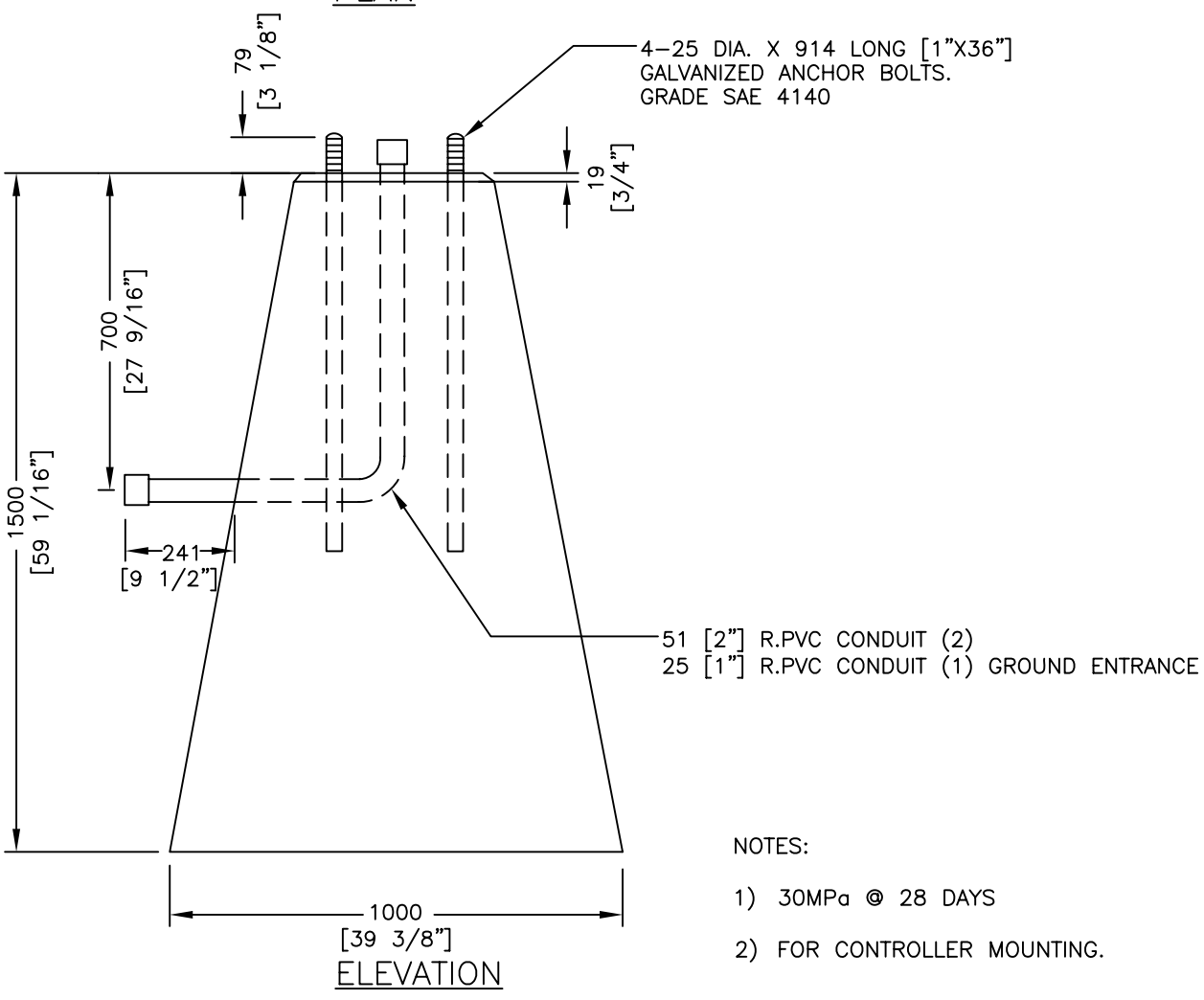
REMARKS:
1. Does not meet MMCD requirements for highways and arterial, collector, roadways.
Use for residential roadways only



PLAN

BOLT CIRCLE DIAMETER=380 [14.96"]

CONSTRUCTION DRAWING SYMBOL



ELEVATION

NOTES:

1) 30MPa @ 28 DAYS

2) FOR CONTROLLER MOUNTING.

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1	OCT/07	S.W.	NG	ADDED DESCRIPTION TO TEXT BOX AND GRD ENTRANCE	BMB	OCT 07

DRAWN BY	SW	APR/07
CHECKED BY	B.M.	05/07
APPROVED BY	I.F.	06/07

HIGHWAY, COLLECTOR AND ARTERIAL
TYPE C-1, CONCRETE
CONTROLLER BASE

FORTISBC

DRAWING No.	REV.
1417	1

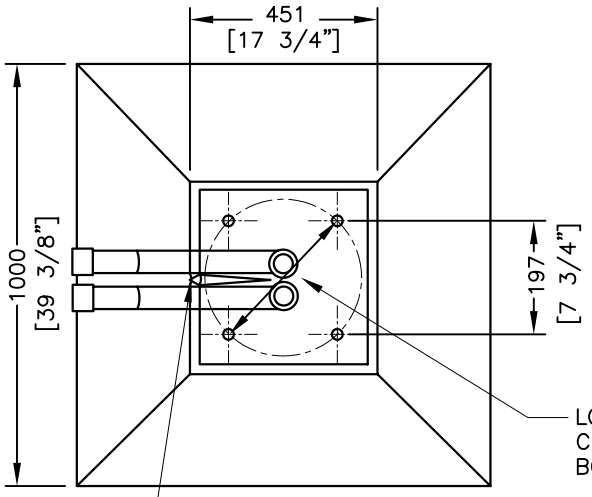
Fortis	Bill of Material	2007/10/20
Structure # 1417	CIVIL, STREET LIGHT CONTR BASE, TYPE C-1	

Item #	UI	-1	Description
7550207		1	BASE,HIGH AND ROAD WAYS LIGHTING,TYPE C1

REMARKS:

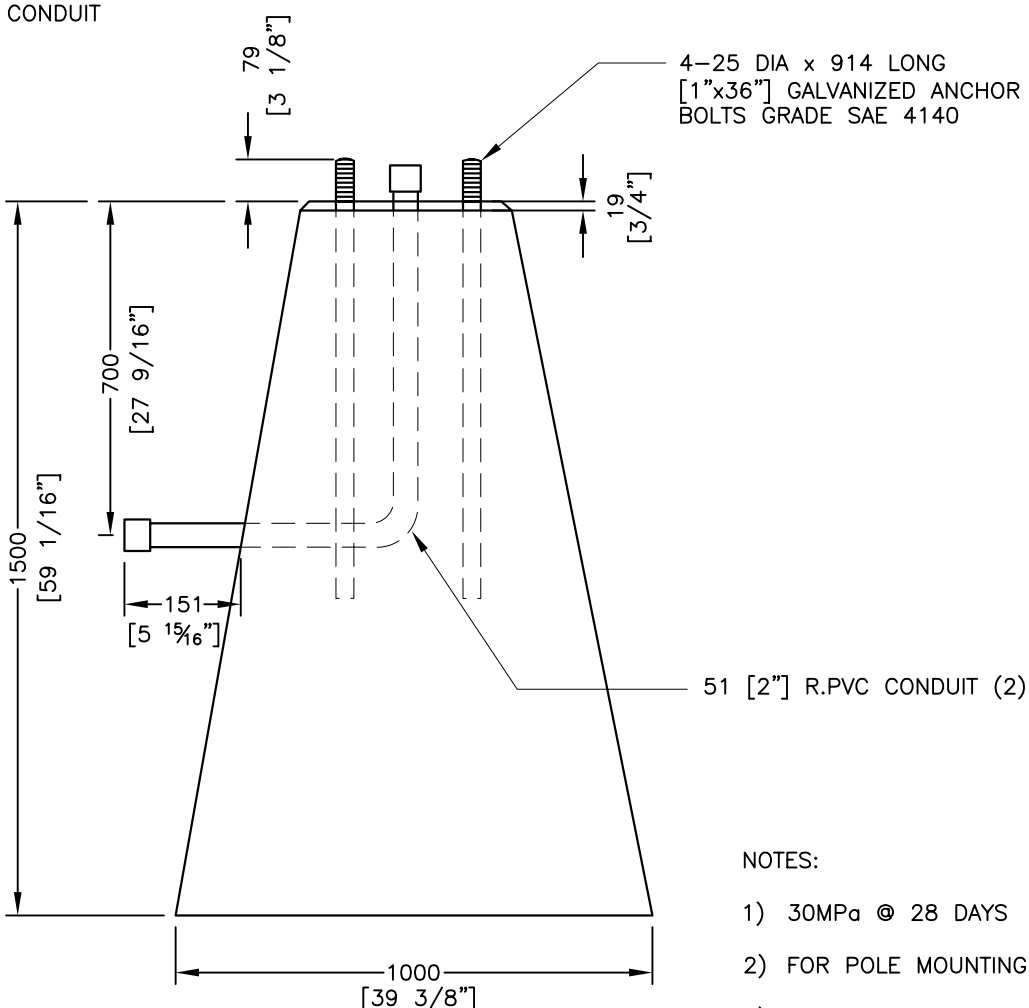
1. The base is used for mounting street lighting controller s1407
2. Meets MMCD requirements for highways, collector and arterial roadways

BOLT CIRCLE
DIAMETER = 280 [11"]



PLAN

CONSTRUCTION DRAWING SYMBOL



ELEVATION

NOTES:

1) 30MPa @ 28 DAYS
2) FOR POLE MOUNTING – ARTERIAL
3) MAXIMUM POLE HEIGHT 11m [33']

REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1	OCT/07	S.W.	NG	ADDED DESCRIPTION TO TEXT BOX	BM	OCT/07

DRAWN BY	SW	APR/07	HIGHWAY, COLLECTOR AND ARTERIAL
CHECKED BY	B.M.	05/07	FIVE FOOT CONCRETE BASE
APPROVED BY	I.F.	06/07	TYPE C
			FOR STREET LIGHTING

FORTISBC

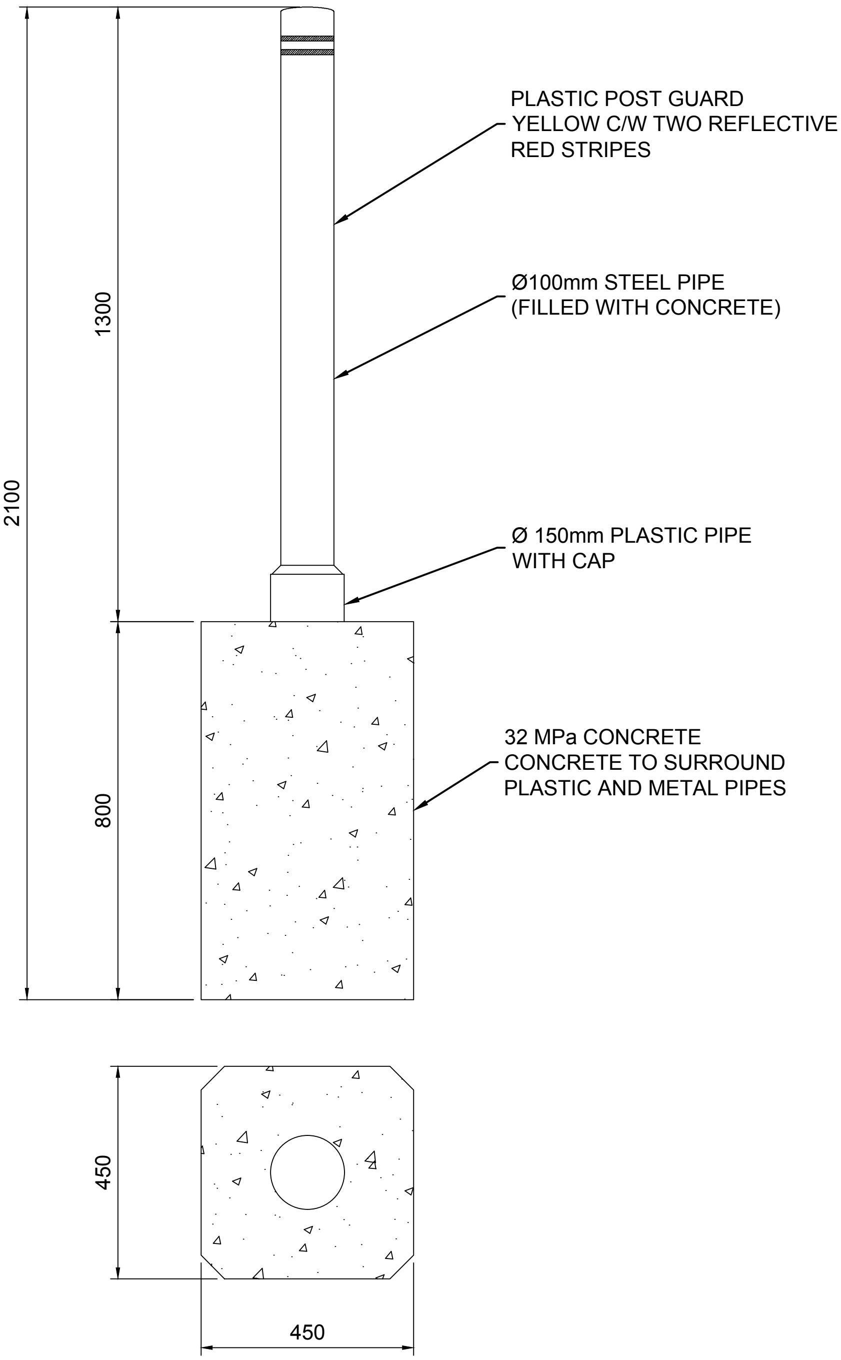
DRAWING No.	REV.
1418	1

Fortis	Bill of Material	2007/10/28
Structure # 1418	CIVIL, STREET LIGHT BASE, TYPE C	

Item #	UI	-1	Description
7550210		1	BASE,HIGH&ROAD WAYS POLEMOUNTING,TYPEC

REMARKS:

1. The maximum pole height mounted on this base is 11 meters (33 feet)
2. Meets MMCD requirements for highway, collector and arterial roadways.



NOTES:

1. THE PLASTIC PIPE OR CONDUIT AND CAP MUST BE INSTALLED TO INSULATE THE PIPE AND THUS PREVENT TRANSFER OF DANGEROUS TOUCH POTENTIAL IN THE EVENT OF THE FAULT.
2. PLASTIC CAP SHALL BE GLUED TO PLASTIC PIPE OR CONDUIT WITH CEMENT TO FORM A WATERPROOF JOINT
3. BOLLARDS SHALL BE PLACED SO AS NOT TO OBSTRUCT ANY DOORS NOR RESTRICT THE OPERATION OF THE UNIT.
4. ALL DIMENSIONS ARE IN MILLIMETERS.
5. PRECASE CONCRETE BASE TO BE 6X6–6/6 RE–ENFORCEMENT MESH.
6. APPROXIMATE WEIGHT: 440 kg

REVISION DATE		
AUTHOR		
CHECKED		
APPROVED		
DESCRIPTION OF CHANGE:		
CHANGED TO PRECAST BOLLARD		

P.ENG SEAL
PROFESSIONAL
PROVINCE OF
D. C. WALDEN
37120
ENGINEER
2016-02-24

ORIGINAL ISSUE		
AUTHOR	SW	SEPT/08
CHECKED	NG	SEPT/08
APPROVED	BM	SEPT/08

FORTIS BC

UNDERGROUND STRUCTURES
VEHICLE PROTECTION
DETAILED DIMENSIONS OF BOLLARD
SHEET 1 OF 1

DRAWING No.	REV.
1589	1

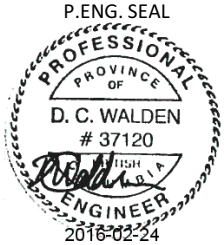
BOM #	SAP Mat #	UI	-1	Description
1	7550100		1	BOLLARD, 1.3M ABOVE GRD, 100MM DIA.

REMARKS:

1. **1589-1 is a precast bollard with yellow plastic high visibility cover.**
2. **FortisBC material number 7550100 is available at Kon Kast under part number 1080.**
3. **Revision changes shown in bold red.**

REVISION DATE		
AUTHOR		
CHECKED		
APPROVED		
DESCRIPTION OF CHANGE:		

P.ENG. SEAL

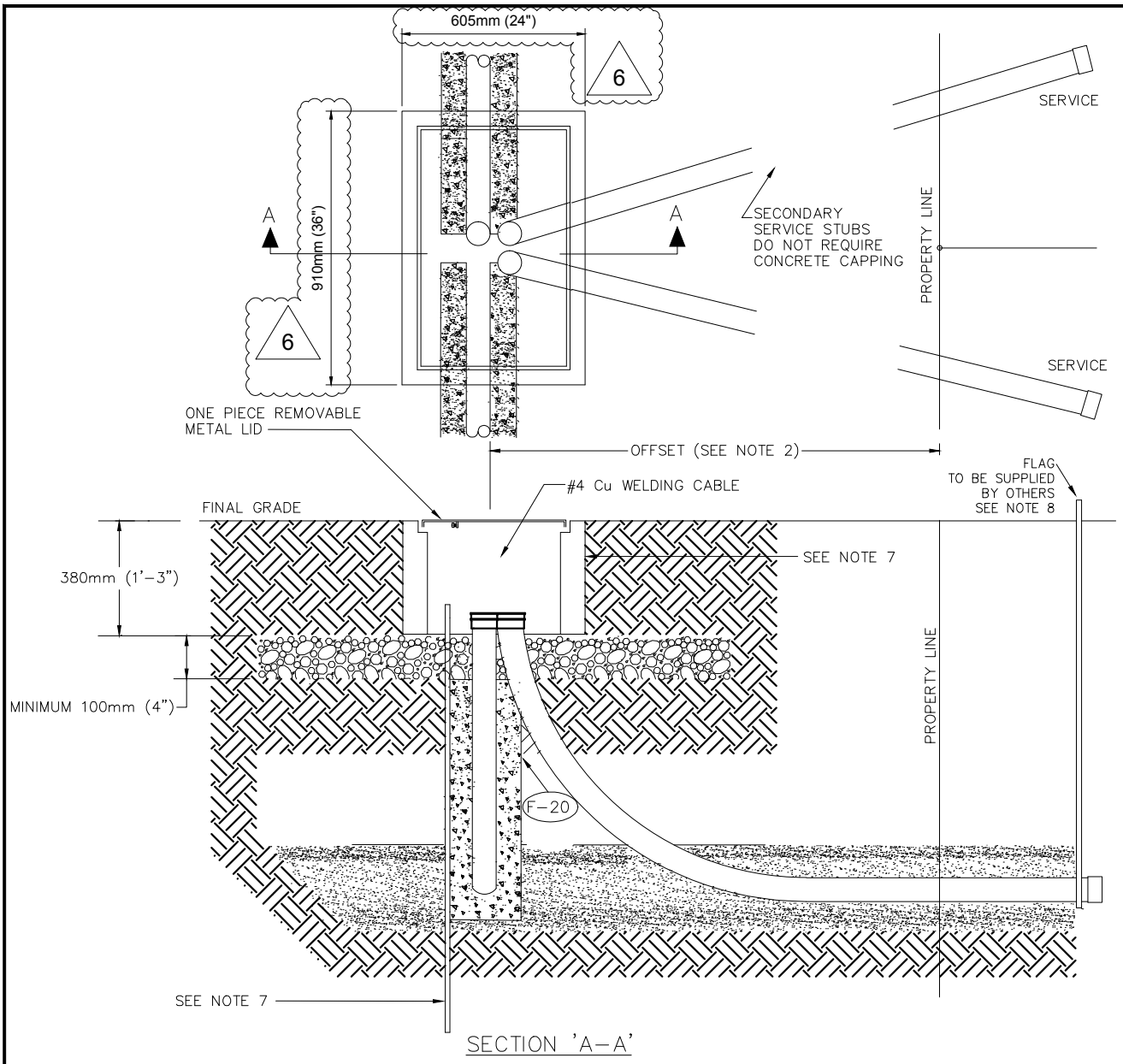


ORIGINAL ISSUE		
AUTHOR		
CHECKED		
APPROVED		

FORTIS BC

UNDERGROUND STRUCTURES
VEHICLE PROTECTION
BILL OF MATERIAL
BOM SHEET 1 OF 1

DRAWING No.	REV
1589	0



SECTION 'A-A'

NATIVE FILL

25mm (1") CLEAN DRAIN ROCK

ROAD MULCH 6

NOTE:

1 – CENTER CONDUITS IN BOX. BOX MAY BE PLACED OFFSET FROM CENTER TO AVOID CONFLICT WITH OTHER UTILITIES UPON APPROVAL FROM INSPECTOR.

2 – STANDARD CONDUIT OFFSET PER DESIGN DRAWING OR LOCAL AUTHORITY

3 – FOR LEVEL GRADES, BOX TO BE SET SO THAT LID IS 50mm (2")–80mm (3") ABOVE FINAL GRADE OR FLUSH IN SIDEWALK

4 – EXTEND CONDUIT 50mm (2") ABOVE TOP OF FILL INSIDE BOX

5 – PVC CONDUIT SHALL BE CONCRETE CAPPED AS PER ASSEMBLY F-20

6 – USE PENTA HEAD BOLTS TO SECURE LID

7 – CABLE MARKER 22.2mm x 2.62m (7/8"x8') PVC OR 50.8mm x 131.2mm (2"x 4') WOOD STAKE PAINTED RED

8 – CONDUIT SHALL BE INSTALLED WITH END BELL, CAPPED AND MARKED (IDENTIFIED BY LOT NO.)

6 9 – ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN.

REVISION DATE	FEB/16	
AUTHOR	JAS	NOV/15
CHECKED	JMS	NOV/15
APPROVED	DK	FEB/16

DESCRIPTION OF CHANGE:

ADDED NOTE 9. ADDED BOX DIMENSIONS.

ADDED SHEET 2

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. C. WALDEN # 37120

2016-03-24

ORIGINAL ISSUE		
AUTHOR		
CHECKED	NS	MAY/02
APPROVED	FC	MAY/02

FORTIS BC

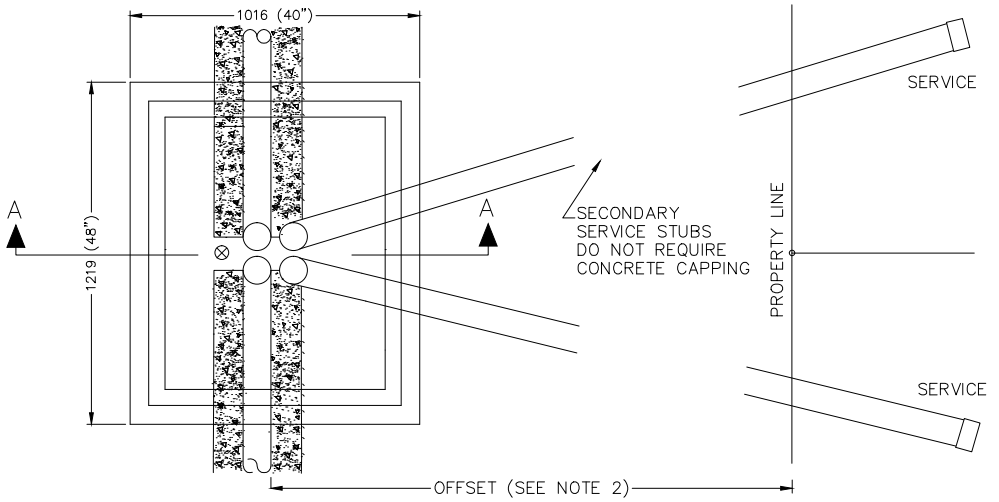
UNDERGROUND STRUCTURES

CONCRETE SERVICE BOX

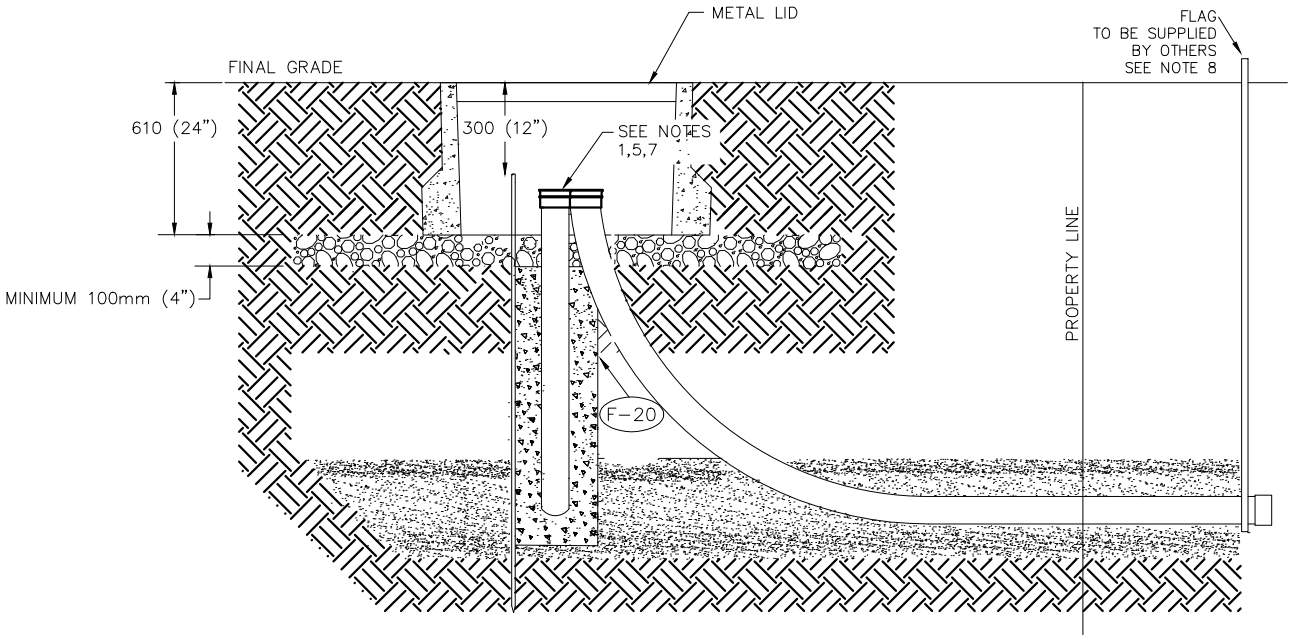
SMALL SERVICE BOX

SHEET 1 OF 2

DRAWING No.	REV.
1590	6



PLAN VIEW



SECTION 'A–A'

NOTE:

1 – CENTER CONDUITS IN BOX. BOX MAY BE PLACED OFFSET FROM CENTER TO AVOID CONFLICT WITH OTHER UTILITIES UPON APPROVAL FROM INSPECTOR.

2 – STANDARD CONDUIT OFFSET PER DESIGN DRAWING OR LOCAL AUTHORITY

3 – FOR LEVEL GRADES, BOX TO BE SET SO THAT LID IS 50mm (2")–80mm (3") ABOVE FINAL GRADE OR FLUSH IN SIDEWALK

4 – EXTEND CONDUIT 50mm (2") ABOVE TOP OF FILL INSIDE BOX

5 – PVC CONDUIT SHALL BE CONCRETE CAPPED AS PER ASSEMBLY F–20

6 – USE PENTA HEAD BOLTS TO SECURE LID

7 – CABLE MARKER 22.2mm x 2.62m (7/8"x8') PVC OR 50.8mm x 131.2mm (2"x 4') WOOD STAKE PAINTED RED

8 – CONDUIT SHALL BE INSTALLED WITH END BELL, CAPPED AND MARKED (IDENTIFIED BY LOT NO.)

9 – ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN.

NATIVE FILL

25mm (1") CLEAN DRAIN ROCK

ROAD MULCH

REVISION DATE		
AUTHOR		
CHECKED		
APPROVED		

DESCRIPTION OF CHANGE:

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	JAS	NOV/15
CHECKED	JMS	NOV/15
APPROVED	DK	FEB/16

FORTIS BC

UNDERGROUND STRUCTURES
CONCRETE SERVICE BOX
LARGE SERVICE BOX
SHEET 2 OF 2

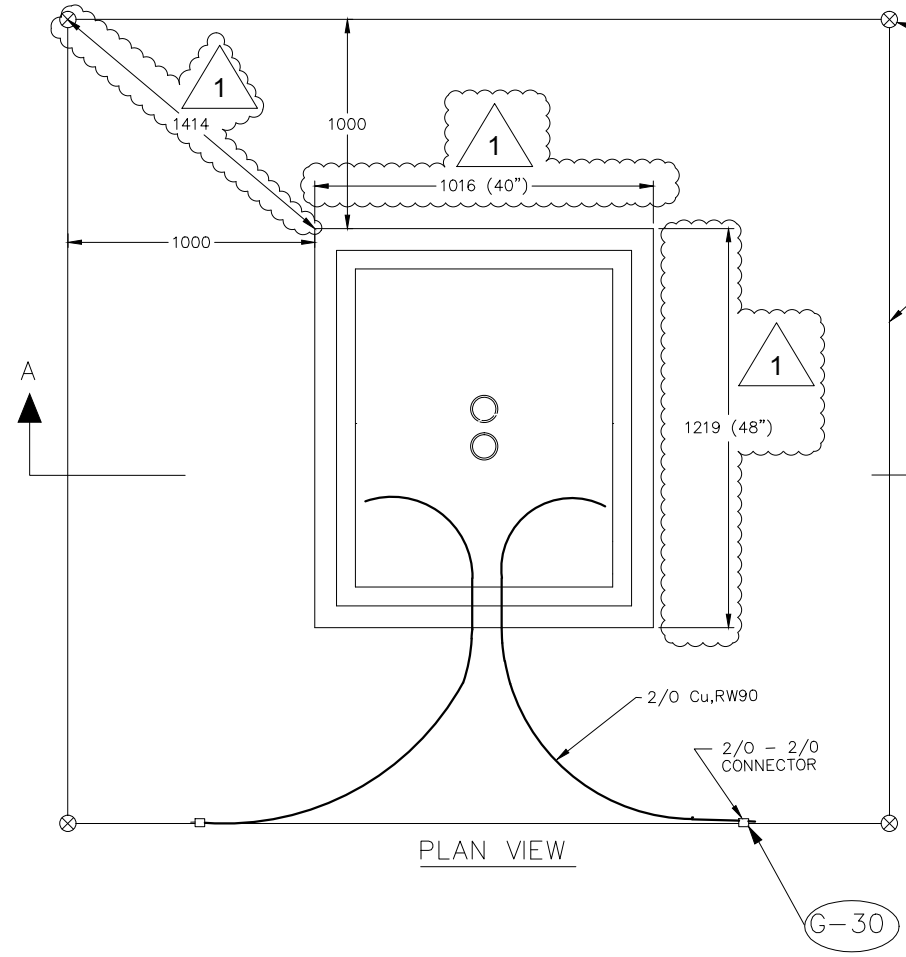
DRAWING No.	REV.
1590	0

BOM #	SAP Mat #	UI	-1	-3	Description
	5571308		1	**1**	ROD, GROUND, COPPERBONDED, PLAIN 3/4"
	7550501		1		VAULT, CONCRETE, SERVICE BOX
	7550506			**1**	**BOX-TRANSF.SUPPORT- 48X40X24 C/W UNISTRUT**
	7550611			**1**	**LID-PLATE-STEEL-RECESSED-48X 40**

REMARKS:

1. **For use with structure 1501.**
2. **1590-1 is intended for typical service box installations.**
3. **1590-3 is intended for installations where service wire design requires a double run of conductors for the main feed and/or any branches.**
4. **1590-1 and 1590-3 are designed to meet H20/HS20 Group B loading as described in the FortisBC Civil Binder. Not intended for roadway application. Refer to the FortisBC Civil Binder for further clarification.**
5. **Revision changes shown in bold red.**

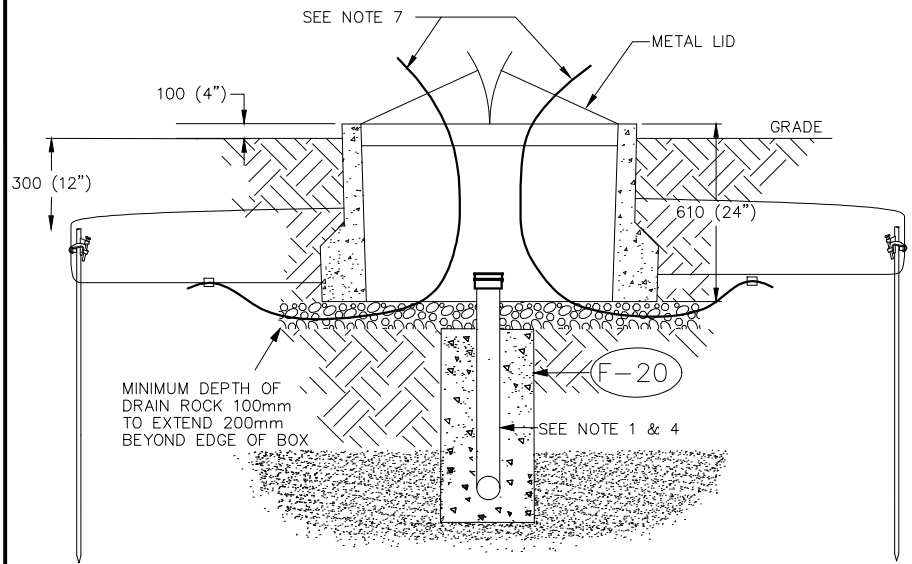
REVISION DATE	FEB/16		P.ENG. SEAL	ORIGINAL ISSUE		UNDERGROUND STRUCTURES CONCRETE SERVICE BOX CIVIL STRUCTURE BOM SHEET 1 OF 1
AUTHOR	JAS	NOV/15	PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. C. WALDEN # 37120 2016-03-24	AUTHOR		
CHECKED	JMS	NOV/15		CHECKED		
APPROVED	DK	FEB/16		APPROVED		
DESCRIPTION OF CHANGE: ADD -3 OPTION.				FORTIS BC	DRAWING No.	REV
					1590	2



PLAN VIEW

NOTE:

1. CENTER CONDUITS IN BOX. BOX MAY BE PLACED OFFSET FROM CENTER TO AVOID CONFLICT WITH OTHER UTILITIES UPON APPROVAL FROM INSPECTOR
2. STANDARD CONDUIT OFFSET PER DESIGN DRAWING OR LOCAL AUTHORITY
3. EXTEND CONDUIT 50mm (2") ABOVE TOP OF FILL INSIDE BOX
4. PVC CONDUIT SHALL BE CONCRETE CAPPED AS PER ASSEMBLY F-20
5. FOR ELECTRICAL, SEE STRUCTURE 1511-1512
6. CONDUIT SHALL BE INSTALLED WITH END BELL, CAPPED AND MARKED/IDENTIFIED
7. EQUAL LENGTH SECTIONS OF 2/0 RW90 INSULATED COPPER
8. (1) ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN.



SECTION 'A-A'

NATIVE FILL

25mm (1") CLEAN DRAIN ROCK

ROAD MULTCH (1)

REVISION DATE	FEB/16	
AUTHOR	JAS	NOV/15
CHECKED	JMS	NOV/15
APPROVED	DK	FEB/16

DESCRIPTION OF CHANGE:

ADDED DIMENSIONS TO DRAWING

PROFESSIONAL ENGINEER SEAL
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SW	JUL/08
CHECKED	NG	JUL/08
APPROVED	BM	JUL/08

UNDERGROUND STRUCTURES
1Ø JUNCTION BOX
CIVIL GENERAL ARRANGEMENT
SHEET 1 OF 1

FORTIS BC

DRAWING No.	REV.
1591	1

BOM #	SAP Mat #	UI	-1	Description
	5310202	M	13	WIRE, COPPER, STR, SD BARE, 2/0
	5311122	M	8	CONDUCTOR, STR CU, 2/0 POLY, 600 VOLTS
	5530626		4	CONNECT, 3/4 CU TO 2/0 COND.
	5530629		3	CONNECT, 2/0 CU COND.
	5571308		4	ROD, GROUND, COPPERBONDED, PLAIN 3/4"
	7550506		1	BOX-TRANSF. SUPPORT- 48 X 40 X 24 C/W UNISTRUT
	7550611		1	LID-PLATE-STEEL-RECESSED-48 X 40.

REMARKS:

1. **To be used with 1511 and 1512.**
2. **1591-1 is designed to meet H20/HS20 Group B loading as described in the FortisBC Civil Binder. Not intended for roadway application. Refer to the ForitsBC Civil Binder for further clarification.**
3. **Revision changes shown in bold red.**

REVISION DATE	FEB/16	
AUTHOR	JAS	NOV/15
CHECKED	JMS	NOV/15
APPROVED	DK	FEB/16

DESCRIPTION OF CHANGE:
ADDED NOTE 2.

P.ENG. SEAL

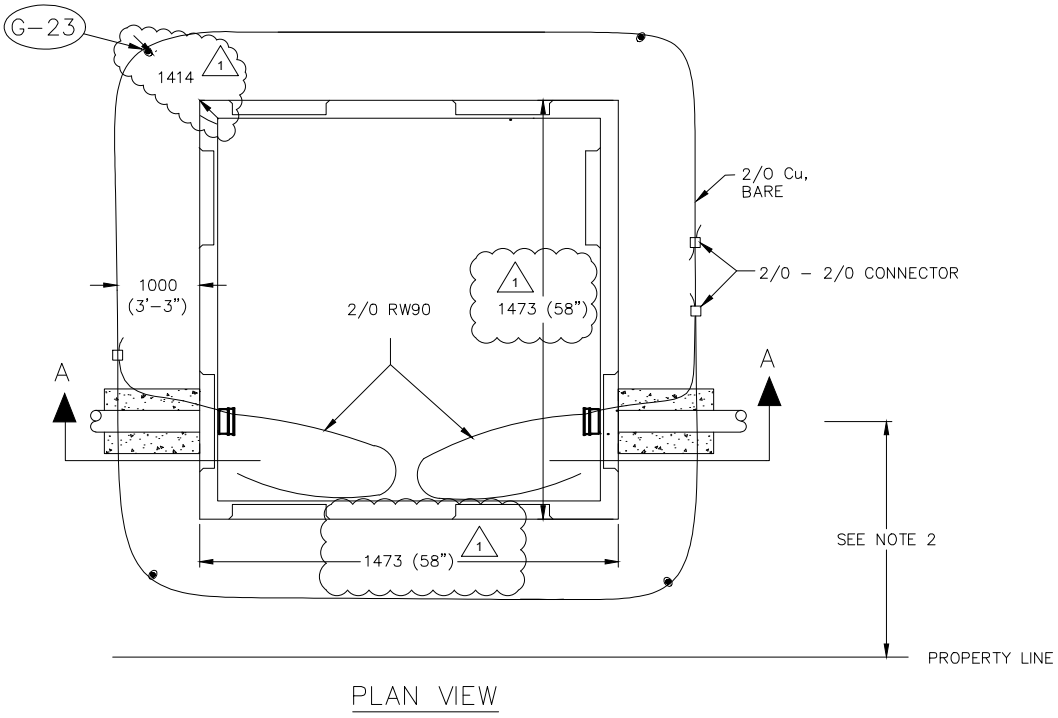
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SW	JUL/08
CHECKED	NG	JUL/08
APPROVED	BM	JUL/08

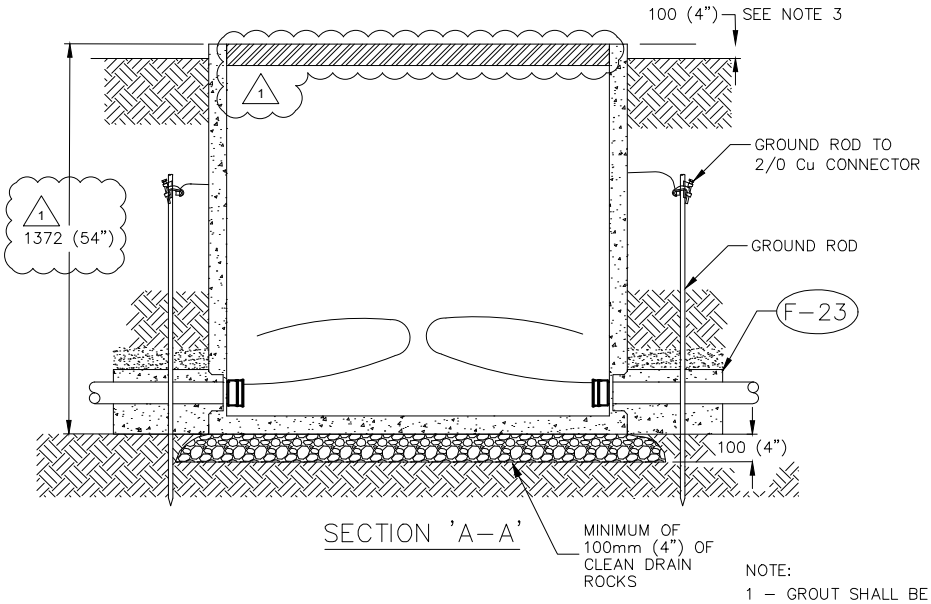
FORTIS BC

UDERGROUND STRUCTURES
1ϕ JUNCTION/LARGE SERVICE BOX
BILL OF MATERIAL
BOM SHEET 1 OF 1

DRAWING No.	REV
1591	1



PLAN VIEW



SECTION 'A–A'

NATIVE FILL

25mm (1") CLEAN DRAIN ROCK

ROAD MULCH

CONCRETE

STEEL

NOTE:

1 – GROUT SHALL BE USED TO ENSURE ADEQUATE SEAL BETWEEN DUCT AND BOX

2 – STANDARD CONDUIT OFFSET PER DESIGN DRAWING OR LOCAL AUTHORITY

3 – FOR LEVEL GRADES, BOX TO BE SET SO THAT LID IS 100mm ABOVE FINAL GRADE OR FLUSH IN SIDEWALK

4 – FOR PVC DUCT ONLY, END BELLS TO BE FLUSH WITH BOX

5 – CONDUIT SHALL BE INSTALLED WITH BELL END, CAPPED AND MARKED/IDENTIFIED

6 – PVC CONDUIT SHALL BE CONCRETE CAPPED AS PER ASSEMBLY F-23

7 – GROUND ROCK SHALL EXTEND 200mm BEYOND THE OUTSIDE OF BOX

1 8 – ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN.

REVISION DATE	FEB/16	
AUTHOR	SW	JUL/14
CHECKED	DCW	FEB/16
APPROVED	DK	FEB/16

DESCRIPTION OF CHANGE:

GENERAL REVISION

ADD DIM, ADD NOTE 8, UPDATE HATCH DESCRIP.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SW	JAN/08
CHECKED	NG	JAN/08
APPROVED	BMB	MAY/08

FORTIS BC

UNDERGROUND STRUCTURES

58" X 58" CIVIL BOX

CIVIL GENERAL ARRANGEMENT

SHEET 1 OF 1

DRAWING No.	REV.
1592	1

BOM #	SAP Mat #	UI	-2	Description
	5310202	M	16	WIRE, CU STR, 2/0, BARE, SOFT DRAWN,
	5311122	M	8	CONDUCTOR,CU STR,2/0 POLY,600V, RW90,
	5530626		4	CONNECTOR, 3/4 CU GRD ROD TO 2/0 CU
	5530629		3	CONNECTOR, 2/0 TO 2/0 CU
	5571308		**4**	**ROD, GROUND, COPPERBONDED, PLAIN 3/4"ROD**
	7550509		1	BOX-CONCRETE PULL-58X58X54 C/W UNISTRUTS
	7550612		1	LID-PLATE STEEL-RECESSED-58X 58.

REMARKS:

1. **To be used with 1533.**
2. **1592-2 is designed to meet H20/HS20 Group B loading as described in the FortisBC Civil Binder. Not intended for roadway application. Refer to the FortisBC Civil Binder for further clarification.**
3. **Revision changes shown in bold red.**

REVISION DATE	FEB/16	
AUTHOR	SM	AUG/14
CHECKED	DCW	FEB/16
APPROVED	DK	FEB/16

DESCRIPTION OF CHANGE:
CHANGED GND ROD NUMBER
ADDED NOTE 2.

P.ENG. SEAL

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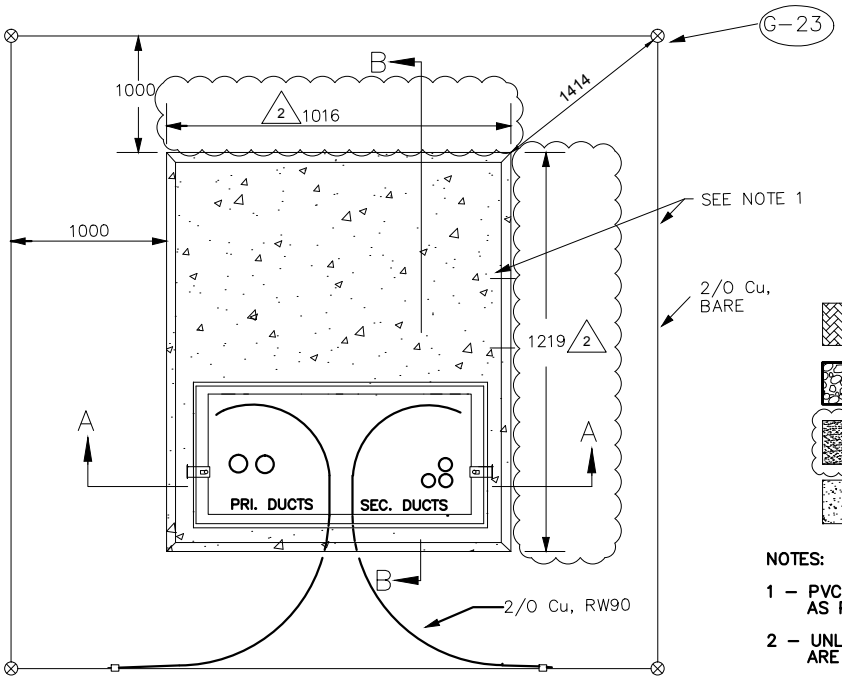
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SM	JUL/14
CHECKED		
APPROVED		

FORTIS BC

UNDERGROUND STRUCTURES
58” X 58” CIVIL BOX
BILL OF MATERIALS
BOM SHEET 1 OF 1

DRAWING No.	REV
1592	1



PLAN VIEW

NATIVE FILL

25mm (1") CLEAN DRAIN ROCK

ROAD MULCH 2

CONCRETE

NOTES:

1 – PVC CONDUIT SHALL BE CONCRETE CAPPED AS PER ASSEMBLY F-20

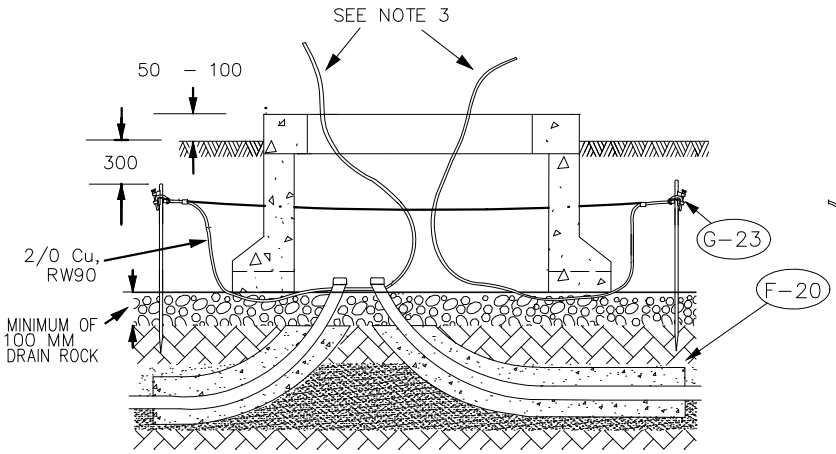
2 – UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

3 – ENSURE MINIMUM OF 1.5' OF EXCESS GROUND WIRE ABOVE PAD.

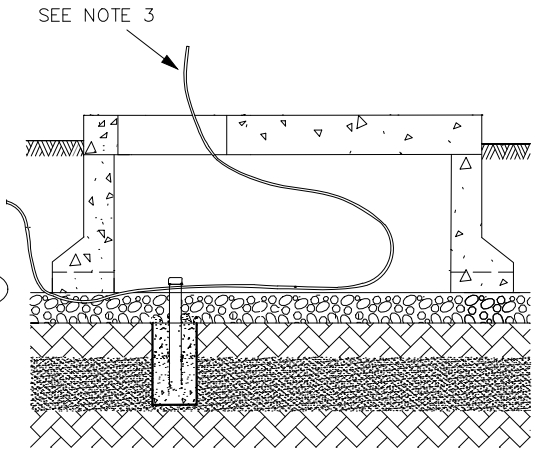
4 – TRANSFORMER ALIGNMENT NEEDS TO BE CONFIRMED WITH FORTIS BC CIVIL INSPECTOR

5 – TRANSFORMER PAD 1219 X 1016 mm

6 – ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN. 2



SECTION 'A-A'



SECTION 'B-B'

REVISION DATE	FEB/16	
AUTHOR	SM	JUL/14
CHECKED	DCW	FEB/16
APPROVED	DK	FEB/16
DESCRIPTION OF CHANGE:		
GENERAL REVISION		
ADD DIMENSIONS, MODIFY NOTES		

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR		
CHECKED	NS	SEP/02
APPROVED	FC	SEP/02

FORTIS BC

UNDERGROUND STRUCTURES
1Ø LOW PROFILE TRANSFORMER
CIVIL GENERAL ARRANGEMENT
SHEET 1 OF 1

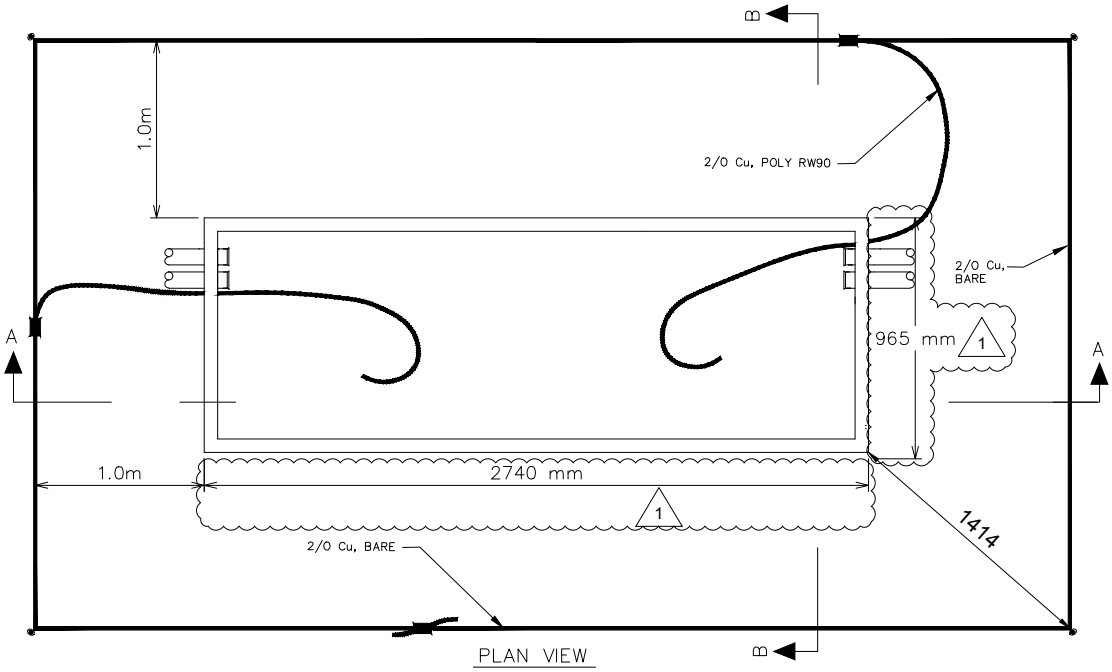
DRAWING No.	REV.
1593	2

BOM #	SAP Mat #	UI	-1	Description
	5310202	**M**	**13**	**WIRE, CU STR, 2/0, BARE, SOFT DRAWN,**
	5311122	M	8	CONDUCTOR,CU STR,2/0 POLY,600V, RW90,
	5530626		4	CONNECTOR, 3/4 CU GRD ROD TO 2/0 CU
	5530629		3	CONNECTOR, 2/0 TO 2/0 CU
	5571308		**4**	**ROD, GROUND, COPPERBONDED, PLAIN 3/4"ROD**
	7550506		1	BOX-TRANSF.SUPPORT- 48X40X24C/W UNISTRUT
	7550602		1	LID-CONCRETE #1038 48 X 40LESS METAL FIL

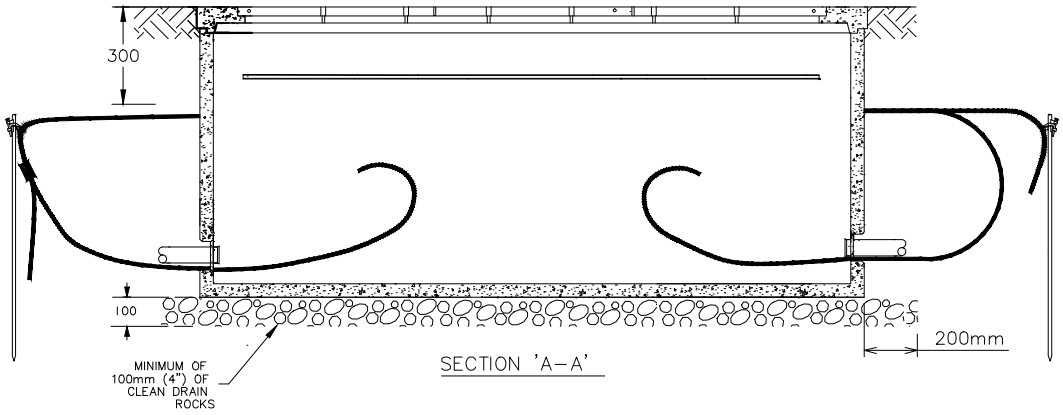
REMARKS:

1. **1593-1 is not intended for vehicle loading. It is only intended to support the equipment places on it.**
2. **Revision changes shown in bold red.**

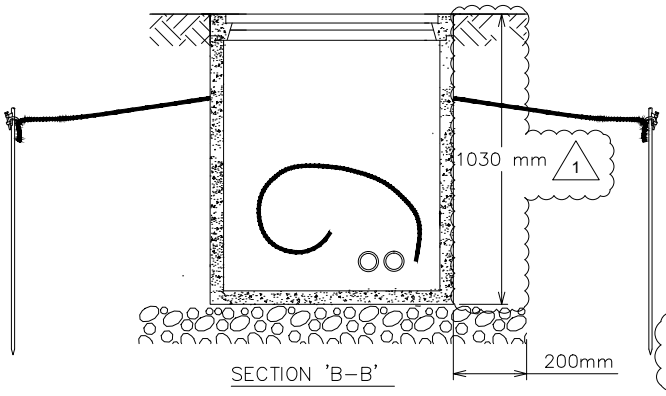
REVISION DATE	FEB/16		P.ENG. SEAL	ORIGINAL ISSUE			UNDERGROUND STRUCTURES
AUTHOR	SM	AUG/14	PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. C. WALDEN # 37120 2016-03-24	AUTHOR	SM	JUL/14	1ϕ LOW PROFILE PADMOUNT TRAN
CHECKED	DCW	FEB/16		CHECKED			BILL OF MATERIALS
APPROVED	DK	FEB/16		APPROVED			BOM SHEET 1 OF 1
DESCRIPTION OF CHANGE: CHANGED GND ROD NUMBER ADDED NOTE 1. INCREASED LENGTH OF 2/0.				FORTIS BC			DRAWING No. 1593 / REV 1



PLAN VIEW



SECTION 'A–A'



SECTION 'B–B'

NOTE:

1 – GROUT SHALL BE USED TO ENSURE ADEQUATE SEAL BETWEEN DUCT AND BOX

2 – FOR LEVEL GRADES, BOX TO BE SET SO THAT LID IS 100mm ABOVE FINAL GRADE OR FLUSH IN SIDEWALK

3 – FOR PVC DUCT, BELL ENDS TO BE FLUSH WITH BOX

4 – FOR 3 PHASE JUNCTION VAULT BILL OF MATERIALS ORDER STR 1536/1537

⚠1 5 – ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN.

REVISION DATE	FEB/16	
AUTHOR	SM	JUL/14
CHECKED	DCW	FEB/16
APPROVED	DK	FEB/16
DESCRIPTION OF CHANGE:		
GENERAL REVISION		
ADD DIMENSIONS		

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
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37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SW	DEC/07
CHECKED	NG	JAN/08
APPROVED	BMB	JAN/08

FORTIS BC

UNDERGROUND STRUCTURES
3Ø JUNCTION VAULT (200A)
15/25kV 832 STYLE (CIVIL)
SHEET 1 OF 1

DRAWING No.	REV.
1594	1

BOM #	SAP Mat #	UI	-1	Description
	5310202	M	17	WIRE, CU STR, 2/0, BARE, SOFT DRAWN,
	5311122	M	10	CONDUCTOR,CU STR,2/0 POLY,600V, RW90,
	5530626		4	CONNECTOR, 3/4 CU GRD ROD TO 2/0 CU
	5530629		3	CONNECTOR, 2/0 TO 2/0 CU
	5571308		**4**	**ROD, GROUND, COPPERBONDED, PLAIN 3/4"ROD**
	7550560		1	VAULT, 832 JUNCTION, C/W COLLAR

REMARKS:

1. **1594-1 is designed to meet H20/HS20 Group B loading as described in the FortisBC Civil Binder. Not intended for roadway application. Refer to the FortisBC Civil Binder for further clarification.**
2. **Revision changes shown in bold red.**

REVISION DATE	FEB/16		
AUTHOR	SM	AUG/14	
CHECKED	DCW	FEB/16	
APPROVED	DK	FEB/16	

DESCRIPTION OF CHANGE:
CHANGED GND ROD NUMBER
ADDED NOTE 1.

P.ENG. SEAL

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
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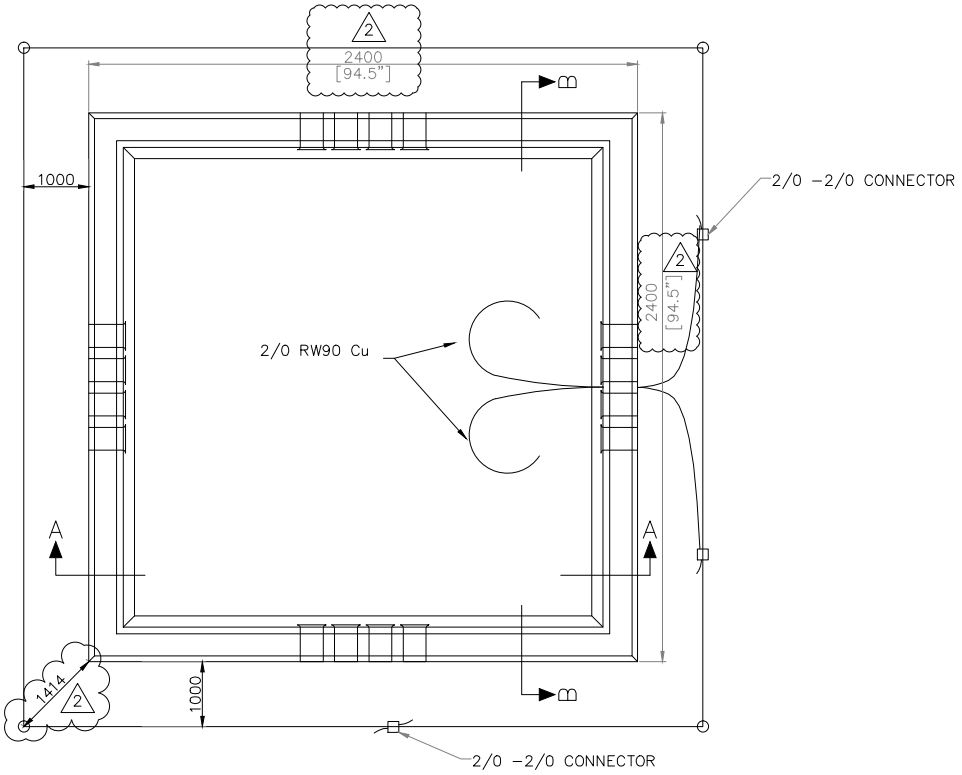
37120
2016-03-24

ORIGINAL ISSUE			
AUTHOR	SM	JUL/14	
CHECKED			
APPROVED			

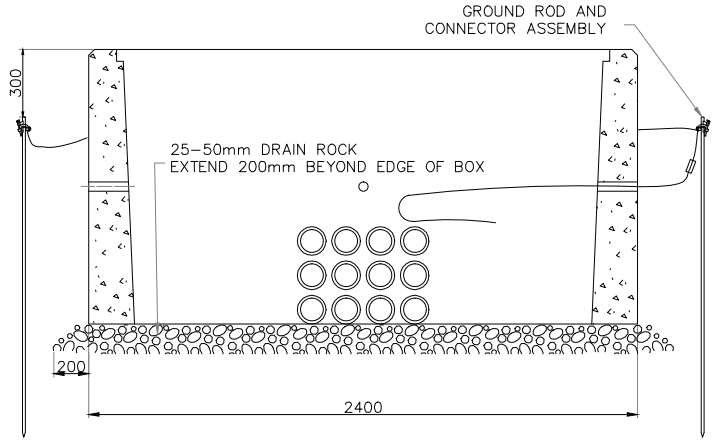
FORTIS BC

UNDERGROUND STRUCTURES
3ϕ JUNCTION VAULT (200A)
BILL OF MATERIALS
BOM SHEET 1 OF 1

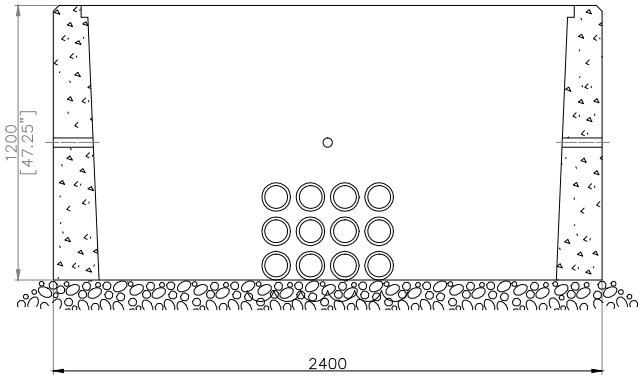
DRAWING No.	REV
1594	1



PLAN VIEW



SECTION A–A



SECTION B–B
(GROUNDING NOT SHOWN FOR CLARITY)

2 1. ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN.

REVISION DATE	FEB/16	
AUTHOR	JAS	SEP/15
CHECKED	JMS	SEP/15
APPROVED	DK	FEB/16
DESCRIPTION OF CHANGE:		
GENERAL REVISION		
ADD NOTE 1		

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PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SW	JAN/08
CHECKED		
APPROVED		

FORTIS BC

UNDERGROUND STRUCTURES
PADMOUNT SWITCHER BASE
CIVIL GENERAL ARRANGEMENT
SHEET 1 OF 1

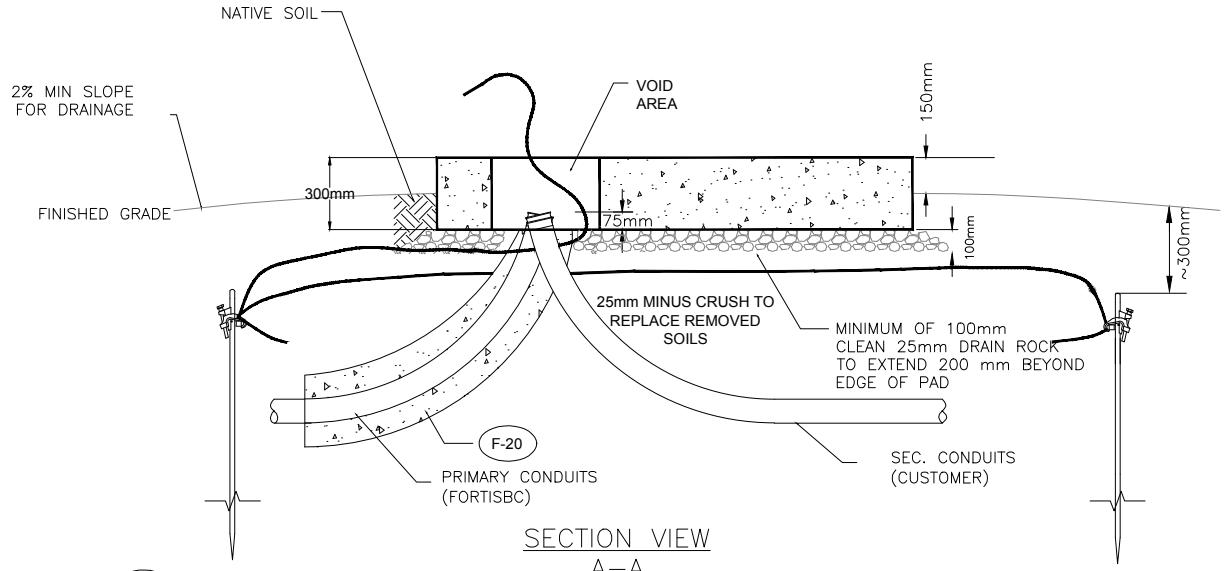
DRAWING No.	REV.
1595	2

BOM #	SAP Mat #	UI	-2	-3	-4	-4	-5	Description
	5310202	**M**	**20**	**20**	**20**	**20**	**20**	**WIRE, CU STR, 2/0, BARE, SOFT DRAWN,**
	5311122	M	10	10	10	10	10	CONDUCTOR, CU STR, 2/0 POLY, 600V, RW90,
	5530626		4	4	4	4	4	CONNECTOR, 3/4 CU GRD ROD TO 2/0 CU
	5530629		3	3	3	3	3	CONNECTOR, 2/0 TO 2/0 CU
	5571308		**4**	**4**	**4**	**4**	**4**	**ROD, GROUND, COPPERBONDED, PLAIN 3/4"**
	7550616		1					ADAPTOR PLATE 25KV AIS HUBBELL SWITCH
	7550617			1				ADAPTOR PLATE 15KV AIS HUBBELL SWITCH
	7550618				1			ADAPTOR PLATE 15/25KV COOPER VFI SWITCH
	7550619					1		ADAPTOR PLATE 15/25KV ELASTIMOLD SWITCH
	7550621						1	ADAPTOR PLATE 15/25KV PADMOUNT PRIM.
	7550562		1	1	1	1	1	PULL BOX, PRECAST, 2.4M X 2.4M X 1.2M

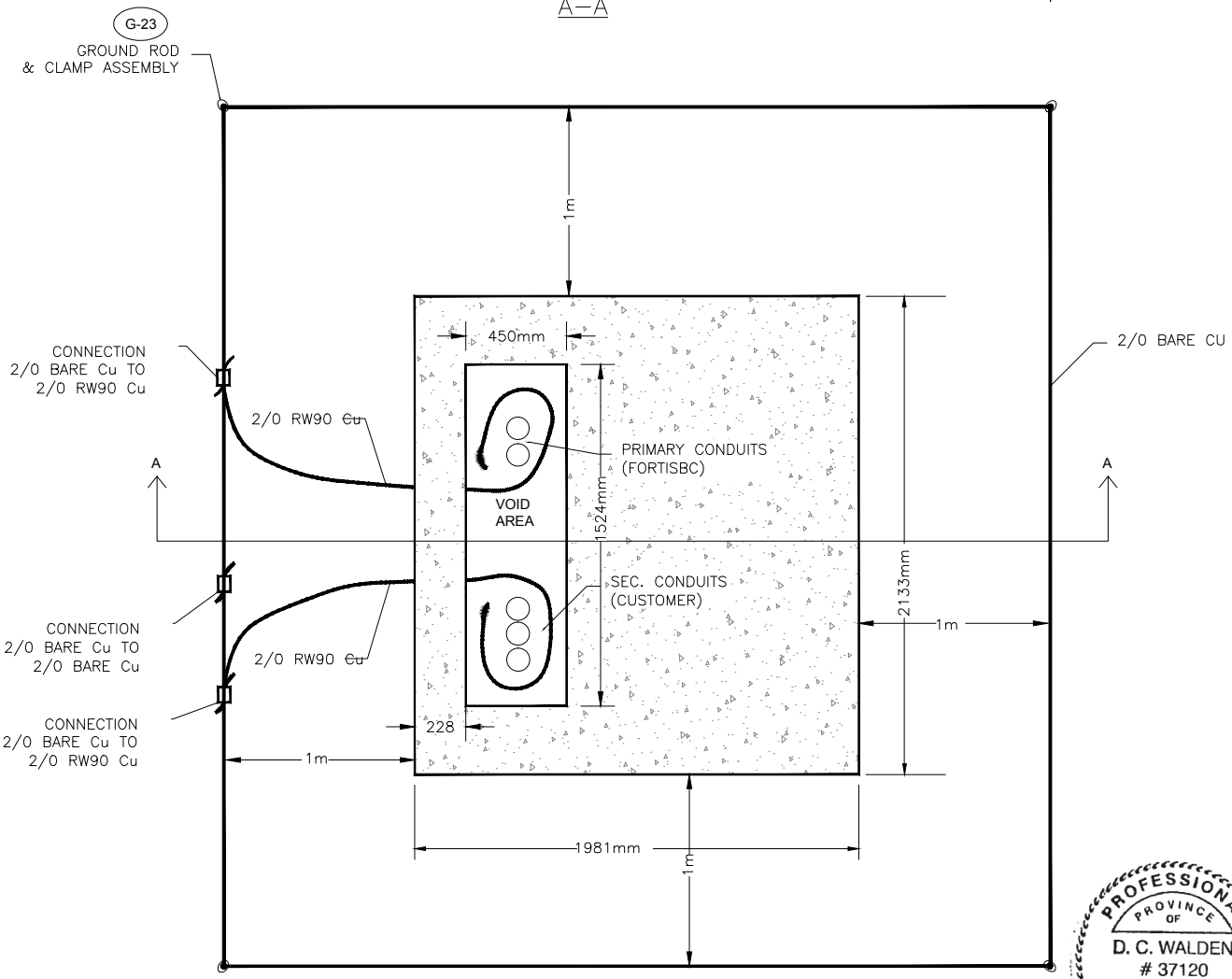
REMARKS:

1. **1595-2 is for 25kV AIS Hubbell or AIS S&C Switch**
2. **1595-3 is for 15kV AIS Hubbell Switch**
3. **1595-4 is for 15/25kV COOPER VFI Switch**
4. **1595-5 is for 15/25kV Elastimold Switch**
5. **1595-6 is for 15/25kV Primary Meter**
6. **1595-1, 1595-2, 1595-3, 1595-4, 1595-5 and 1595-6 are not intended for vehicle loading. They are only intended to support the equipment placed on it.**
7. **Revision changes shown in bold red.**

REVISION DATE	FEB/16		P.ENG. SEAL	ORIGINAL ISSUE			UNDERGROUND STRUCTURES PADMOUNT SWITCHER BASE BILL OF MATERIAL SHEET 1 OF 1
AUTHOR	JAS	OCT/15	PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. C. WALDEN # 37120 2016-03-24	AUTHOR	FAB		
CHECKED	JMS	OCT/15		CHECKED			
APPROVED	DK	FEB/16		APPROVED			
DESCRIPTION OF CHANGE: REVISED GND ROD AND INCREASE CABLE LENGTH ADDED NOTE 6.				FORTIS BC			DRAWING No. 1595 / REV 1



SECTION VIEW
A–A



PLAN VIEW

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

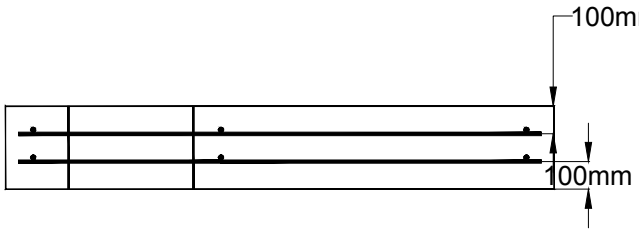
REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1	DEC/14	DE	MK	UPDATED BORDER AND SHEET NUMBERING	DCW	AUG/15

DRAWN BY	N.G	SEP/08
CHECKED BY	RBM	SEP/08
APPROVED BY	BM	SEP/08

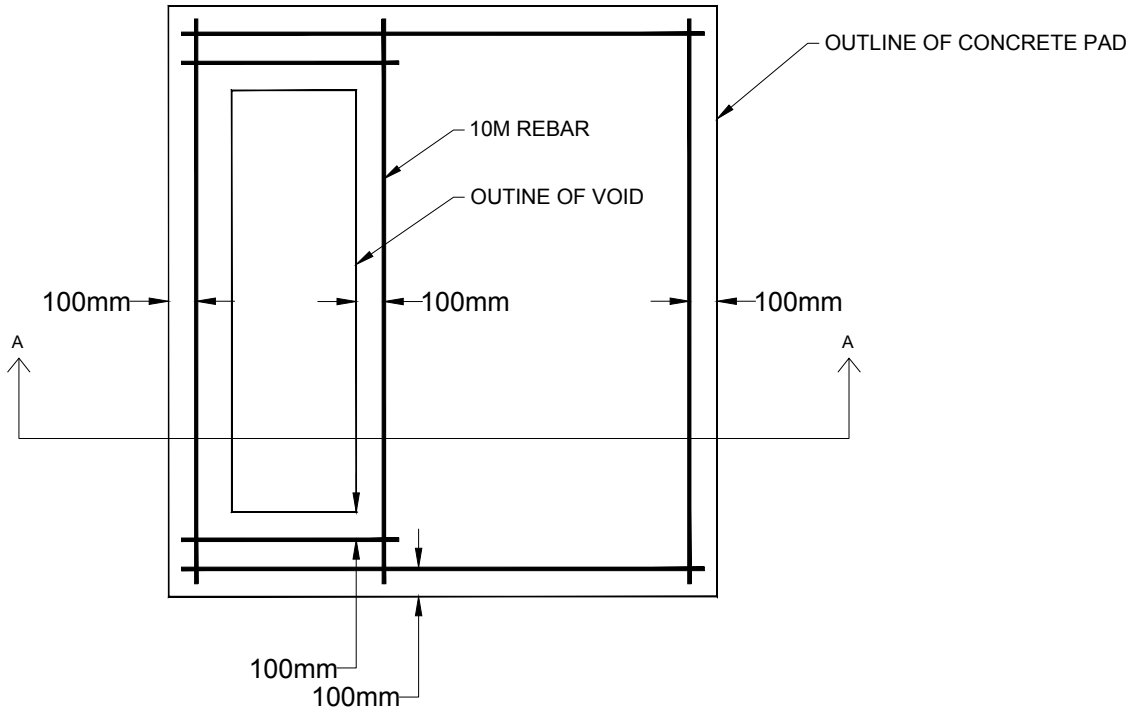
UNDERGROUND STRUCTURES
3 PH TRANS (>500KVA) BASE
POUR IN PLACE GROUNDING
SHEET 1 OF 3

FORTIS BC

DRAWING No.	REV.
1596	1



REINFORCING STEEL LAYOUT
SECTION VIEW A–A



REINFORCING STEEL LAYOUT
PLAN VIEW

NOTES:

1. ALL REBAR SHALL BE MIN 10M
2. CONCRETE COVER OVER STEEL SHALL BE 75mm MINIMUM
3. STEEL REBAR MAY BE SUBSTITUTED WITH 150 X 150mm 6 GAUGE GALVANIZED MESH PROVIDED 2 LAYERS ARE INSTALLED AT THE SAME SPACING AS REBAR
4. TIE REBAR AT ALL INTERSECTIONS
5. ALL DISTURBED MATERIAL BELOW PAD MUST BE REPLACED WITH 25mm MINUS CRUSHED ROCK AND MACHINE COMPACTED IN LIFTS NOT TO EXCEED 200mm
6. CONCRETE SHALL HAVE A MINIMUM STRENGTH OF 28 MPa
7. FOR PLACEMENT OF TRANSFORMER, REFER TO 1206 SHT 2 OF 3
8. CUSTOMER TO CONFIRM PAD MEASUREMENTS WITH FORTISBC PRIOR TO INSTALLATION
9. REFER TO STR 1514 FOR ELECTRICAL DETAILS

REVISION DATE	FEB/16	
AUTHOR	DE	DEC/14
CHECKED	DCW	FEB/16
APPROVED	DK	FEB/16
DESCRIPTION OF CHANGE: UPDATE BORDER		

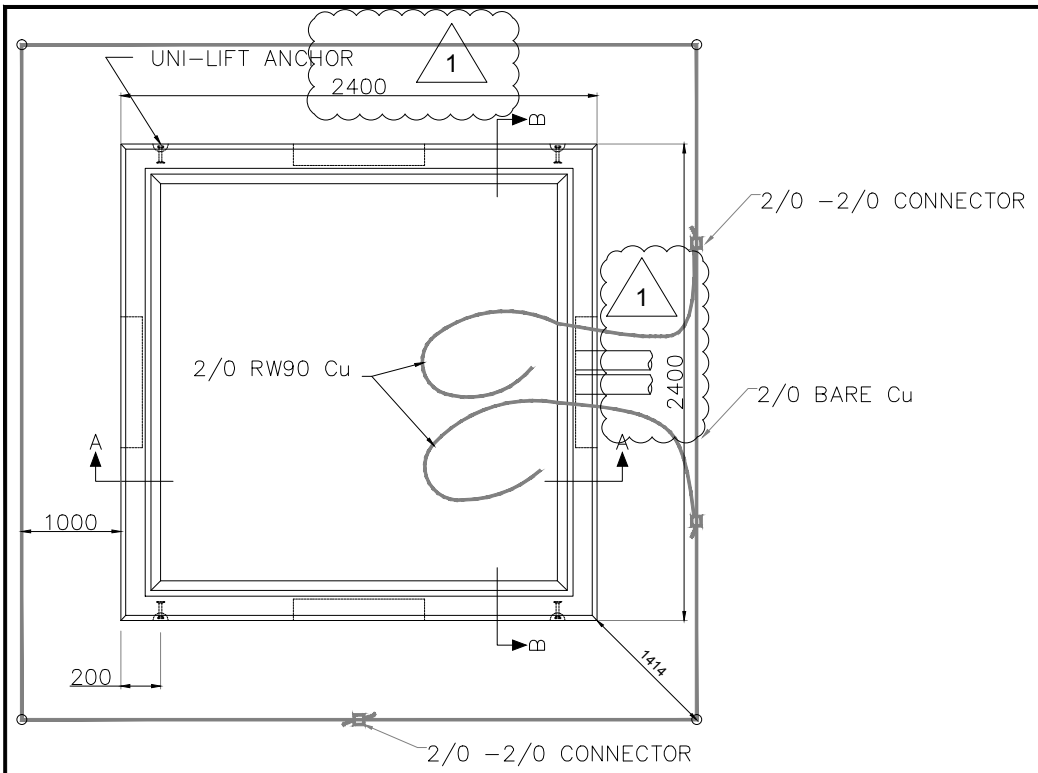
PROFESSIONAL ENGINEER SEAL
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	NG	SEP/08
CHECKED	RBM	SEP/08
APPROVED	BM	SEP/08

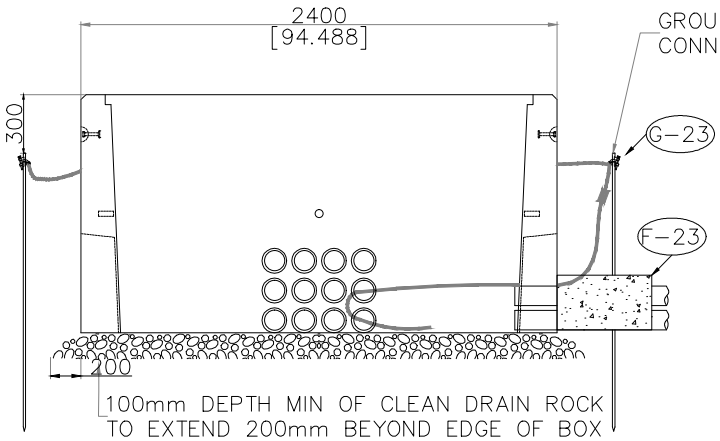
FORTIS BC

UNDERGROUND STRUCTURES
3Ø TRANS (>500kVA) BASE
POUR IN PLACE BASE DIMENSIONS
SHEET 2 OF 3

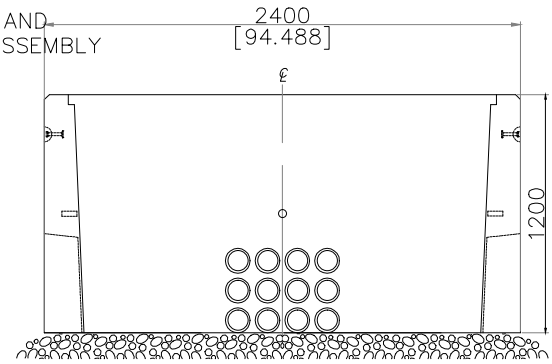
DRAWING No.	REV.
1596	1



PLAN VIEW



SECTION A-A



SECTION B-B

NOTE:

1 - GROUT SHALL BE USED TO ENSURE ADEQUATE SEAL BETWEEN DUCT AND BOX.

2 - FOR LEVEL GRADES, BOX TO BE SET SO THAT LID IS 100mm ABOVE FINAL GRADE.

3 - FOR PVC DUCT ONLY, BELL ENDS TO BE FLUSH WITH BOX

4 - FOR ELECTRICAL DETAILS, REFER TO DSM SECTION 1514

1 5 - ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN.

REVISION DATE	FEB/16	
AUTHOR	MK	AUG/15
CHECKED	DCW	FEB/16
APPROVED	DK	FEB/16

DESCRIPTION OF CHANGE:
REPLICATED THE DRAWING FROM SHEET 3 OF STRUCTURE 1595

PROFESSIONAL ENGINEER SEAL
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	FAB	SEPT/06
CHECKED	BM	APRL/07
APPROVED	IF	APR/07

FORTIS BC

UNDERGROUND STRUCTURES
3 PH TRANS (>500KVA) BASE
DEEP POUR BASE
SHEET 3 OF 3

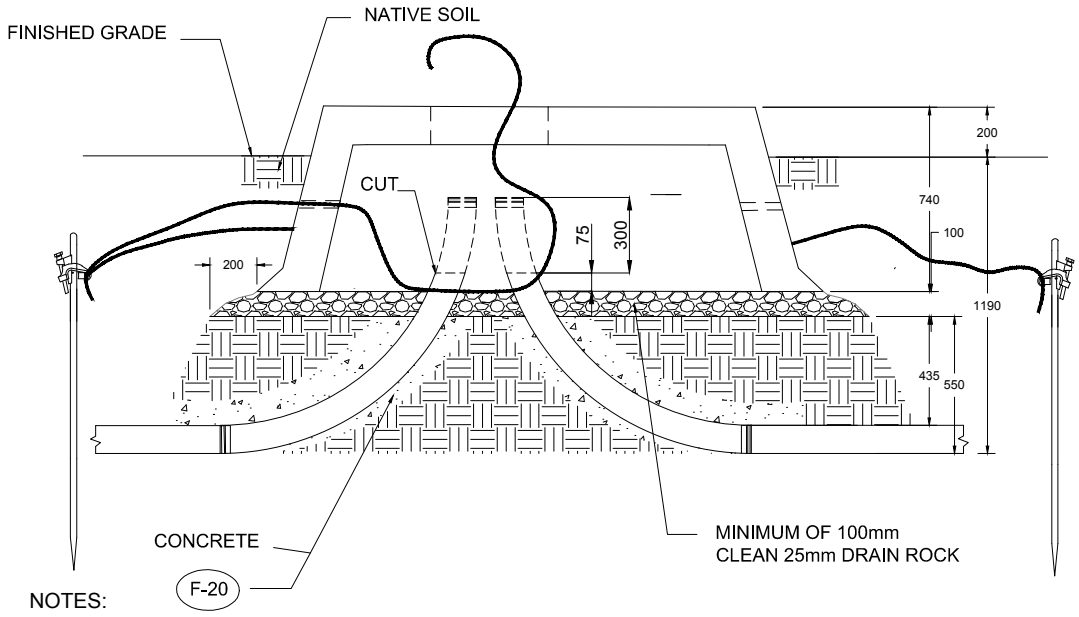
DRAWING No.	REV.
1596	1

BOM #	SAP Mat #	UI	-1	-2	Description
1	5310202	M	17	**20**	WIRE, CU STR, 2/0, BARE, SOFT DRAWN
2	5311122	M	6	**10**	CONDUCTOR,CU STR,2/0 POLY,600V, RW90,
3	5530626		4	**4**	CONNECTOR, 3/4 CU GRD ROD TO 2/0 CU
4	5530629		3	**3**	CONNECTOR, 2/0 TO 2/0 CU
5	**5571308**		**4**	**4**	**ROD, GROUND, COPPERBONDED, PLAIN 3/4"ROD**
6	**7550623**			**1**	**ADAPTERLID,2350x2350,750-3000KVA TRANS**
7	**7550562**			**1**	**PULL BOX, PRECAST, 2.4M X 2.4M X 1.2M**

Remarks:

1. **1596-1 is for concrete transformer base which may be poured on site or precast.**
2. **1596-2 is for deep pour transformer base. To be used with transformers larger than 1000kVA.**
3. **1596-1 & 1596-2 not intended for vehicle loading. They are only intended to support the equipment placed on it.**
4. **Revision changes are shown in bold red.**

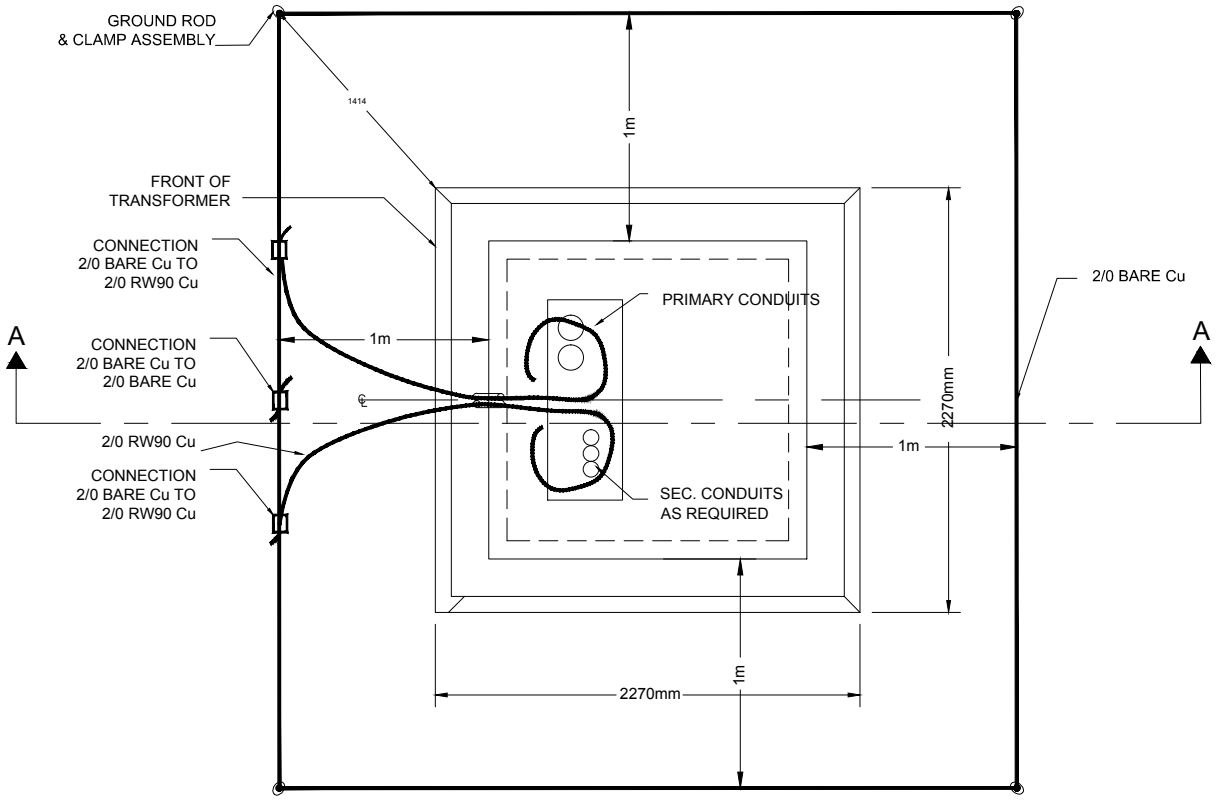
REVISION DATE	AUG/15		P.ENG. SEAL	ORIGINAL ISSUE	UNDERGROUND STRUCTURES 3 PH TRANS (>500KVA) BASE BILL OF MATERIALS BOM SHEET 1 OF 1
AUTHOR	MK	AUG/15		AUTHOR	
CHECKED	DCW	FEB/16		CHECKED	
APPROVED	DK	FEB/16		APPROVED	
DESCRIPTION OF CHANGE: ADDED STRUCTURE 1596-2			PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. C. WALDEN # 37120 2016-03-24	FORTIS BC	DRAWING No.: 1596 REV: 1



NOTES:

1. APPROXIMATELY 300MM [1FT] OF CONDUIT WILL NEED TO BE CUT OFF INSIDE THE VAULT.
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED.
3. ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN. (4)

SECTION A-A



PLAN VIEW

REVISION DATE	FEB/16	
AUTHOR	NP	DEC/15
CHECKED	JP	DEC/15
APPROVED	DK	FEB/16

DESCRIPTION OF CHANGE:

ADDED NOTE 3

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SW	MAR/08
CHECKED	NG	APR/08
APPROVED	BMB	APR/08

FORTIS BC

UNDERGROUND STRUCTURES
PRE-CAST 3Ø TRANS BASE
500kVA OR LESS
SHEET 1 OF 1

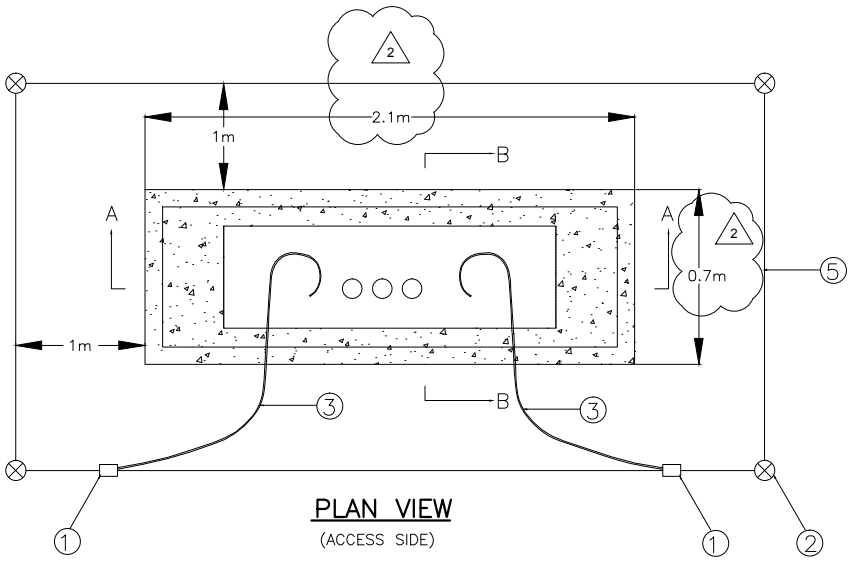
DRAWING No.	REV.
1597	4

BOM #	SAP Mat #	UI	-1	Description
	5310202	M	16	WIRE, CU STR, 2/0, BARE, SOFT DRAWN,
	5311122	M	8	CONDUCTOR,CU STR,2/0 POLY,600V, RW90,
	5530626		4	CONNECTOR, 3/4 CU GRD ROD TO 2/0 CU
	5530629		3	CONNECTOR, 2/0 TO 2/0 CU
	5571308		4	ROD, GROUND, COPPERBONDED, PLAIN 3/4"ROD
	7550507		1	PAD, PRECAST CONCRETE, TRANS, 75-500KVA

REMARKS:

1. **This structure not intended for vehicle loading. It is only intended to support the equipment placed on it.**
2. **Revision changes shown in bold red.**

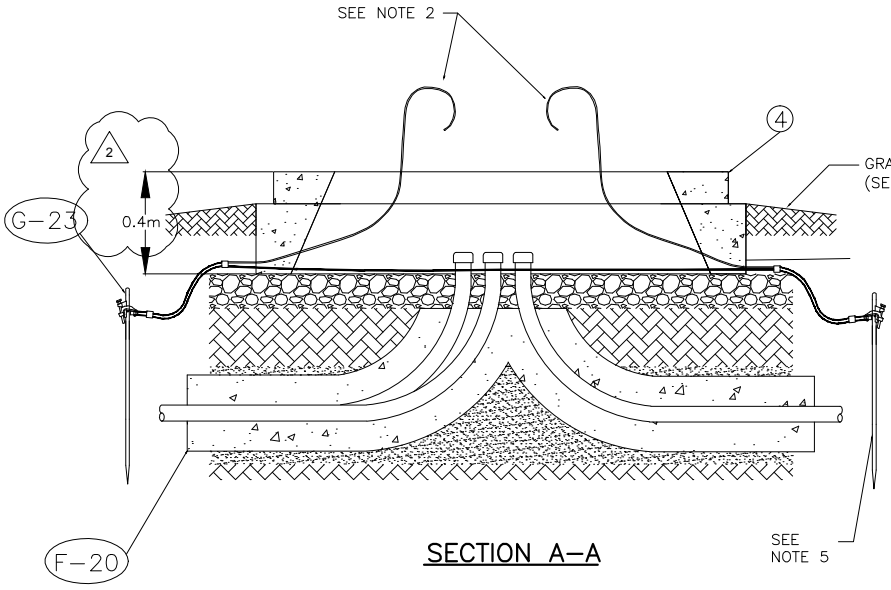
REVISION DATE	FEB/16		P.ENG. SEAL	ORIGINAL ISSUE			UNDERGROUND STRUCTURES PRE-CAST 3ϕ TRANS BASE BILL OF MATERIALS BOM SHEET 1 OF 1
AUTHOR	JAS	DEC/15	PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. C. WALDEN # 37120 2016-03-24	AUTHOR	SM	MAR/08	
CHECKED	JMS	DEC/15		CHECKED	NG	APR/08	
APPROVED	DK	FEB/16		APPROVED	BMB	APR/08	
DESCRIPTION OF CHANGE: ADDED NOTE 1.				FORTIS BC			DRAWING No. 1597 / REV 1



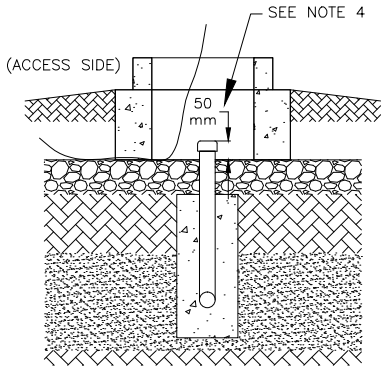
PLAN VIEW
(ACCESS SIDE)

HATCH DETAIL

- CONCRETE
- NATIVE FILL (FINAL GRADE)
- 25mm (1") CLEAN DRAIN ROCK
- ROAD MULCH



SECTION A–A



SECTION B–B

NOTES:

1 – SLOPE GRADE AWAY FROM BASE FOR DRAINAGE

2 – ENSURE A MINIMUM OF 1200 MM (4') OF EXCESS GROUND WIRE ABOVE PAD

3 – REFER TO ELECTRICAL DRAWING 1543 FOR ELECTRICAL DETAILS

4 – CONDUIT SHALL BE CAPPED, MARKED AND IDENTIFIED "TO DIRECTION". CENTER CONDUIT IN OPENING AND EXTEND CONDUIT 50 MM (2") ABOVE TOP OF FILL INSIDE BASE

5 – GROUND RODS TO BE 300 MM (12") BELOW FINISHED GRADE.

6 – CONCRETE ENCASE BENDS AS PER F–20

2 7 – ENGINEERING AND DESIGN OF THE PRECAST CONCRETE BASE/VAULT DONE BY THE MANUFACTURER. MANUFACTURER OWNS LIABILITY ASSOCIATED WITH CONCRETE BASE/VAULT DESIGN.

ITEM LIST:

1. 2/0–2/0 Cu CONNECTOR
2. GROUND ROD/CLAMP ASSEMBLY
3. 2/0 POLY COVERED Cu
4. PRECAST CONCRETE BASE
5. 2/0 BARE Cu

REVISION DATE	FEB/16	
AUTHOR	JAS	DEC/15
CHECKED	JMS	DEC/15
APPROVED	DK	FEB/16

DESCRIPTION OF CHANGE:
UPDATED BORDER
ADDED NOTE 7

APPROVED SEAL
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SS	JAN/08
CHECKED	NG	SEPT/08
APPROVED	BMB	SEPT/08

FORTIS BC

UNDERGROUND STRUCTURES
ABOVE GRADE 200A JUNCTION
CIVIL GENERAL ARRANGEMENT
SHEET 1 OF 1

DRAWING No.	REV.
1598	2

BOM #	SAP Mat #	UI	-1	Description
	5310202	M	**16**	WIRE, CU STR, 2/0, BARE, SOFT DRAWN,
	5311122	M	**8**	CONDUCTOR,CU STR,2/0 POLY,600V, RW90,
	5530626		4	CONNECTOR, 3/4 CU GRD ROD TO 2/0 CU
	5530629		3	CONNECTOR, 2/0 TO 2/0 CU
	5571308		**4**	**ROD, GROUND, COPPERBONDED, PLAIN 3/4"ROD**
	7550504		1	BASE, PRECAST FOR ABOVE GROUND 3 PHASE

REMARKS:

1. **1598-1 is the base foundation for standard structure 1543 (Above Grade 200A Junction)**
2. **This structure not intended for vehicle loading. It is only intended to support the equipment placed on it.**
3. **Revision changes shown in bold red.**

REVISION DATE	FEB/16		
AUTHOR	JAS	DEC/15	
CHECKED	JMS	DEC/15	
APPROVED	DK	FEB/16	

DESCRIPTION OF CHANGE:
UPDATED GND ROD.
ADDED NOTE 2.

P.ENG. SEAL

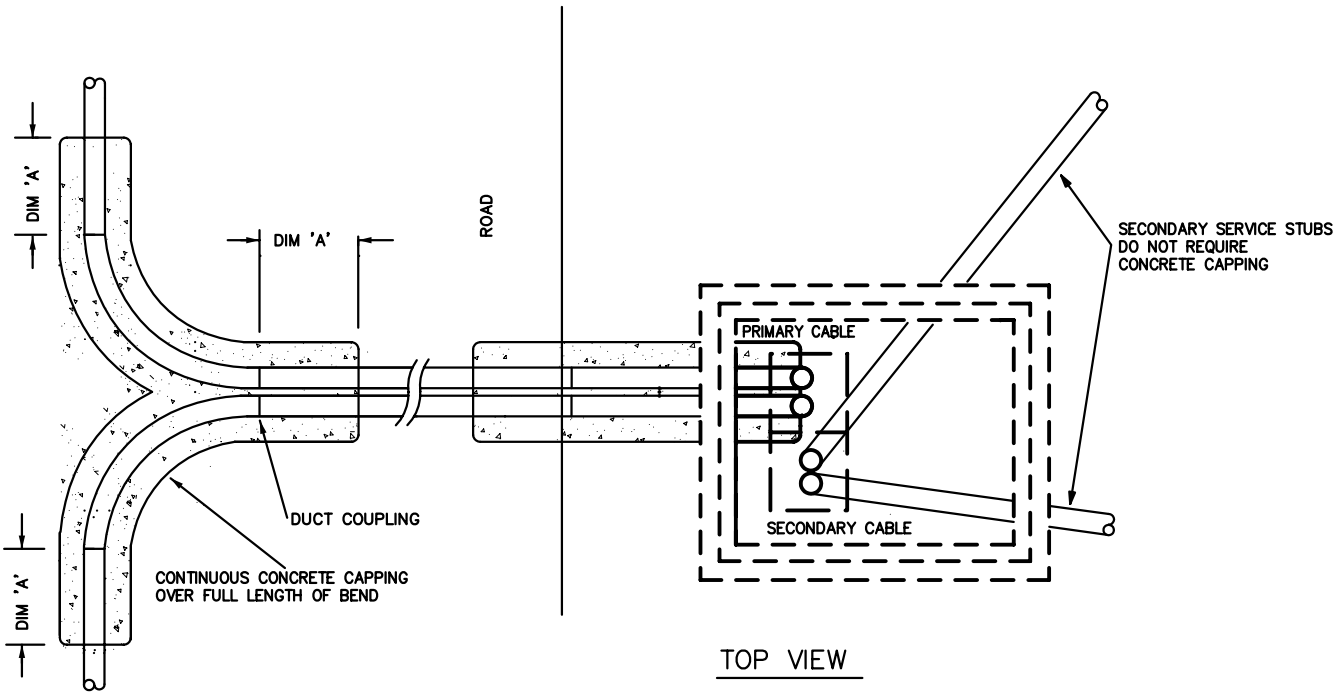
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. C. WALDEN
37120
2016-03-24

ORIGINAL ISSUE		
AUTHOR	SS	JAN/08
CHECKED	NG	SEPT/08
APPROVED	BMB	SEPT/08

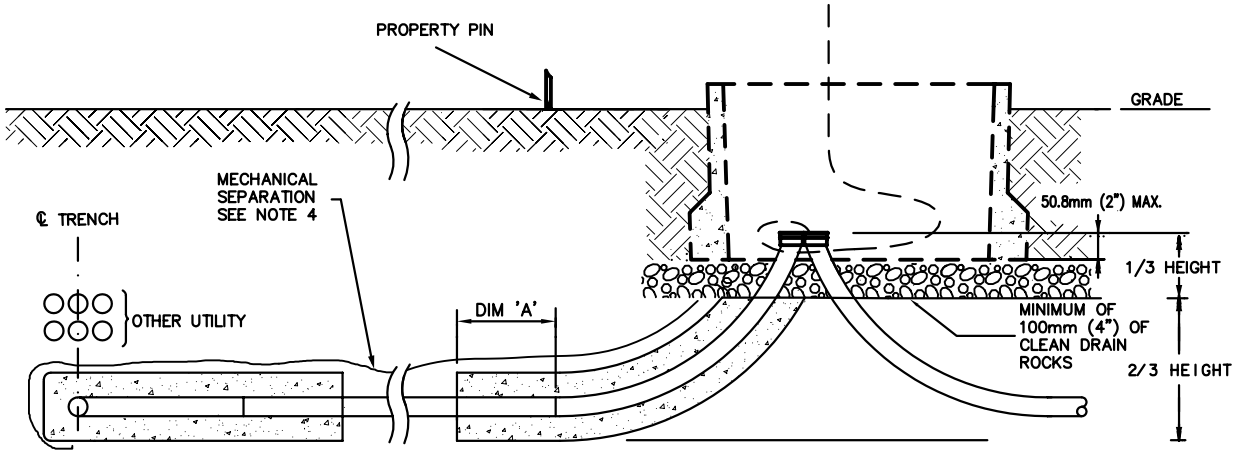
FORTIS BC

UNDERGROUND STRUCTURES
ABOVE GRADE 200A JUNCTION
BILL OF MATERIALS
BOM SHEET 1 OF 1

DRAWING No.	REV
1598	1



TOP VIEW



SECTION VIEW

NOTES:

1 – UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWING ALL PVC SWEEPS, PRIMARY AND SECONDARY, EXCEPT SERVICE STUBS, TO BE CONCRETE CAPPED.

2 – DIMENSION 'A' TO BE 4 TIMES NOMINAL PIPE DIAMETER. FOR 100mm (4") DUCT DIM 'A' = 400mm (16")

3 – STREET LIGHT DUCT DOES NOT REQUIRE CONCRETE CAPPING

4 – MECHANICAL SEPARATION BETWEEN UTILITIES TO BE CONTINUOUS LAYER OF MINIMUM 6 MIL POLY SHEET OR 100mm (4") OF FINE CLEAN SAND

5 – CONCRETE ON ALL SWEEPS OR 90 DEGREE BENDS

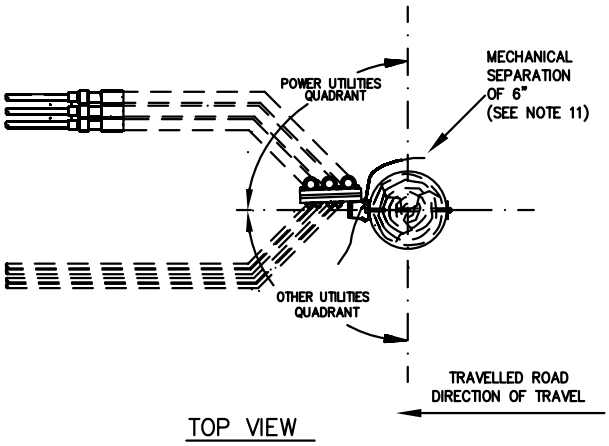
REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3	OCT/08	SW	NG	REMOVED PROPERTY LINE	BM	OCT/08
2	APR/08	DT	NG	UPDATE OWNERSHIP, MODIFIED NOTE 1	BMB	AP/08
1	JUN/04	NS	NS	MODIFIED CONDUIT CAPING & NOTE 2	FC	JUN/04

DRAWN BY		
CHECKED BY	NS	JUN/04
APPROVED BY	RS	JUN/04

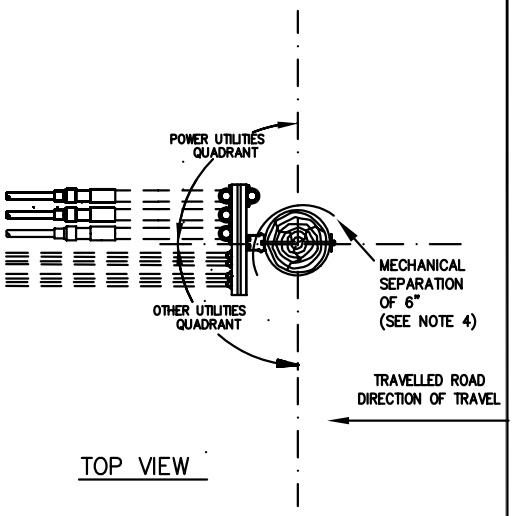
PLACEMENT OF FACILITIES
CONCRETE ENCASEMENT – BENDS

FORTISBC

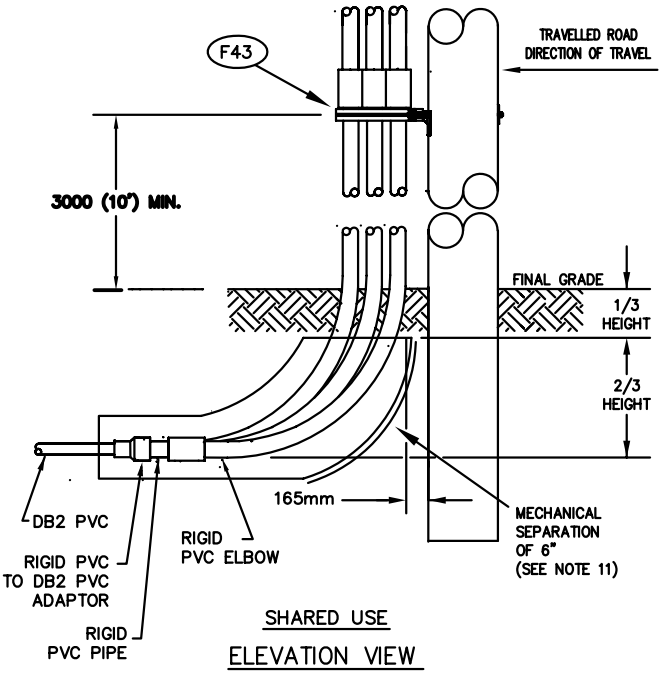
DRAWING No.	REV.
F–20	3



TOP VIEW

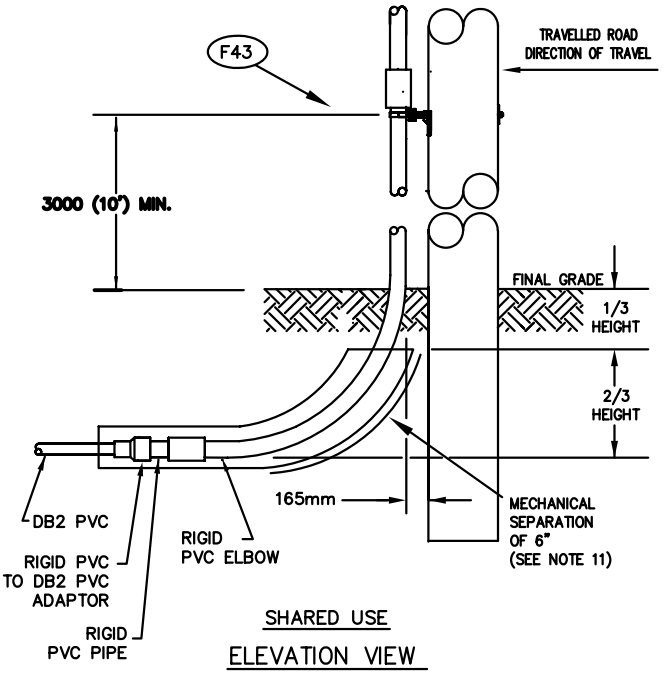


TOP VIEW



SHARED USE

ELEVATION VIEW



SHARED USE

ELEVATION VIEW

NOTES:

1 – VARIATION TO THIS ARRANGEMENT SHALL BE APPROVED BY FORTIS.

2 – DUCTS SHALL BE GROUPED AS CLOSELY AS POSSIBLE TO OTHER UTILITIES.

3 – BOLTS SHALL NOT BE TIGHTENED AS TO DEFORM THE DUCT.

4 – DUCTS SHALL NOT BE INCASED IN PHONE COMPANY CONCRETE PILASTER.

5 – PVC CONDUIT TO BE CONCRETE CAPPED. ALL DUCT TO BE PVC.

6 – POWER UTILITY'S QUADRANT MAY BE SWITCHED BY SPECIAL PERMISSION FROM FORTIS.

7 – CUT THE END OF THE BOLT FLUSH WITH THE POLE

8 – UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWING ALL PVC SWEEPS, PRIMARY AND SECONDARY TO BE CONCRETE CAPPED.

9 – STREET LIGHT DUCT DOES NOT REQUIRE CAPPING

10 – MECHANICAL SEPARATION BETWEEN UTILITIES TO BE CONTINUOUS LAYER OF MIN 6 MIL POLY SHEET OR 100 MM (4") OF FINE CLEAN SAND.

11 – ANY MECHANICAL SEPARATION TO KEEP CONCRETE MIN 6" FROM POLE

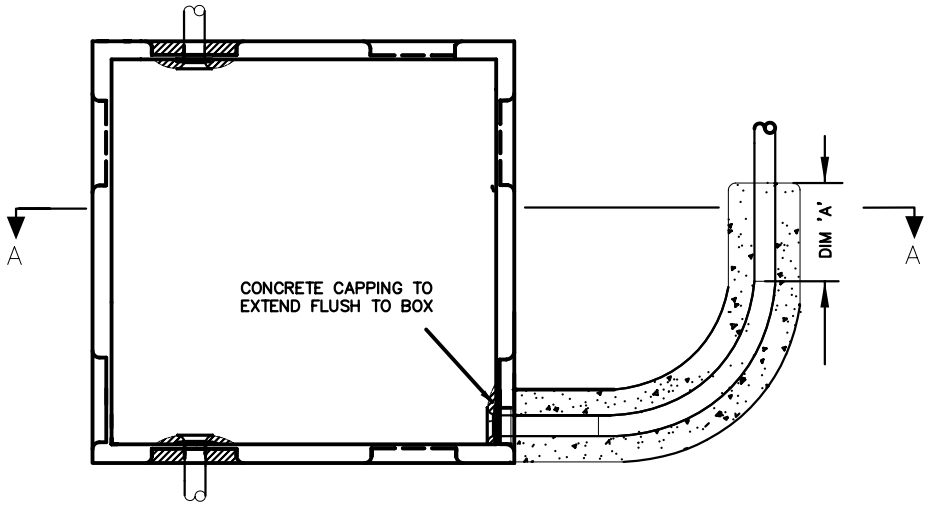
REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2	DEC 07	JC	NG	REVISED DWG, REMOVED NOTE 5, ADDED NOTES 8–11	BM	DEC/07
1	JUL 04		NS	REVISED NOTES 2/5, ADDED REF TO SINGLE DUCT APP	FC	JUL/04

DRAWN BY		
CHECKED BY	NS	JUL 02
APPROVED BY	RS	JUL 02

PLACEMENT OF FACILITIES
CONCRETE CAPPING – POLE RISER

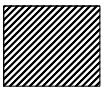
FORTISBC

DRAWING No.	REV.
F–21	2

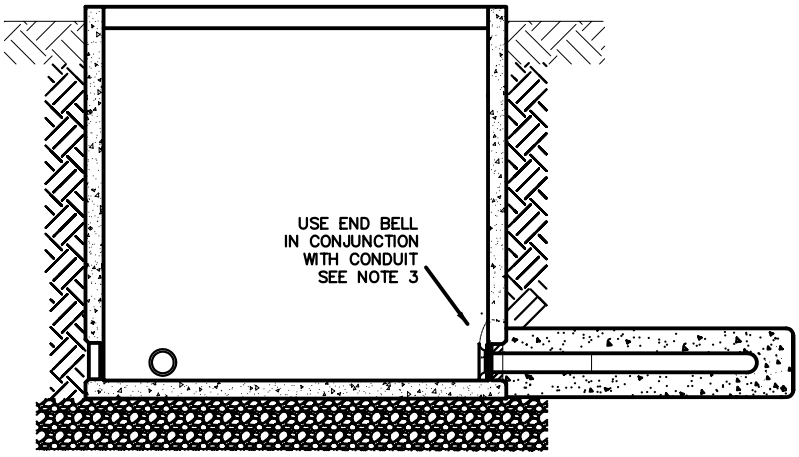


PLAN VIEW

HATCH DETAIL



GROUT



SECTION 'A–A'

NOTES:

1 – UNLESS OTHERWISE NOTED ON THE CONSTRUCTION DRAWING ALL PVC SWEEPS, PRIMARY AND SECONDARY, TO BE CONCRETE CAPPED.

2 – MECHANICAL SEPARATION BETWEEN UTILITIES TO BE CONTINUOUS LAYER OF MINIMUM 6 MIL POLY SHEET OR 100mm (4") OF FINE CLEAN SAND.

3 – BELL END SHOULD BE FLUSH OR NOT EXCEED 2" PAST BOX WALL

4 – DIMENSION 'A' TO BE 4 TIMES NOMINAL PIPE DIAMETER.
FOR 100mm (4") DUCT DIM 'A' = 400mm (16")

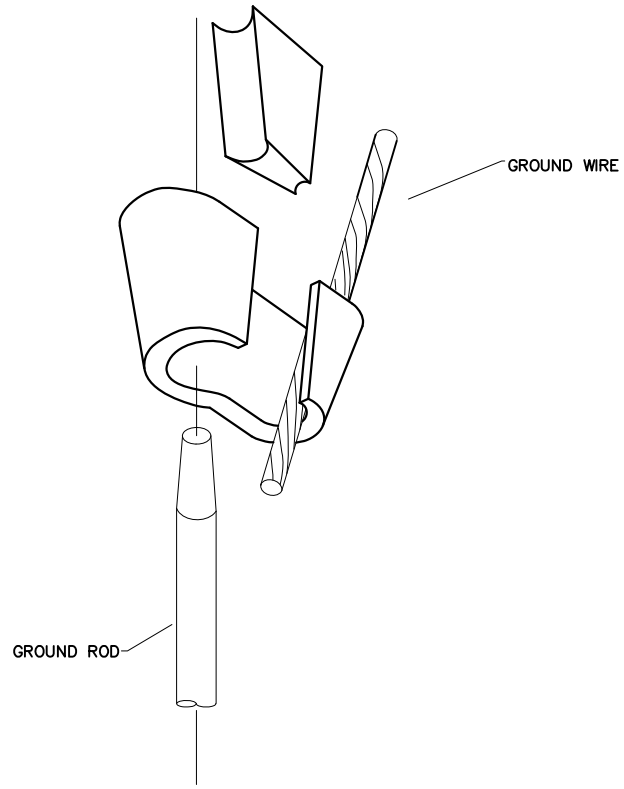
REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3	OCT/08	SW	NG	CHANGED CONDUIT PLACEMENT	BM	OCT/08
2	MAR 08	SW	NG	DELETED JUNCTION BAR	BMB	MAR/08
1	NOV 07	JC	JC	REVISED DRAWING/ADDED NOTES 3 AND 4	BM	NOV/07

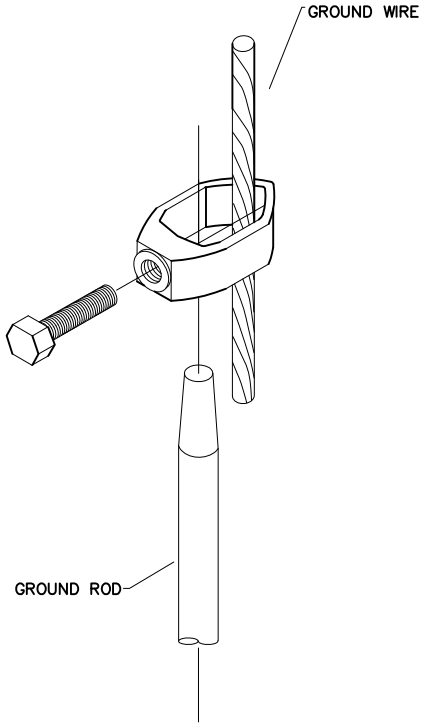
DRAWN BY		
CHECKED BY	NS	DEC/04
APPROVED BY	RS	DEC/04

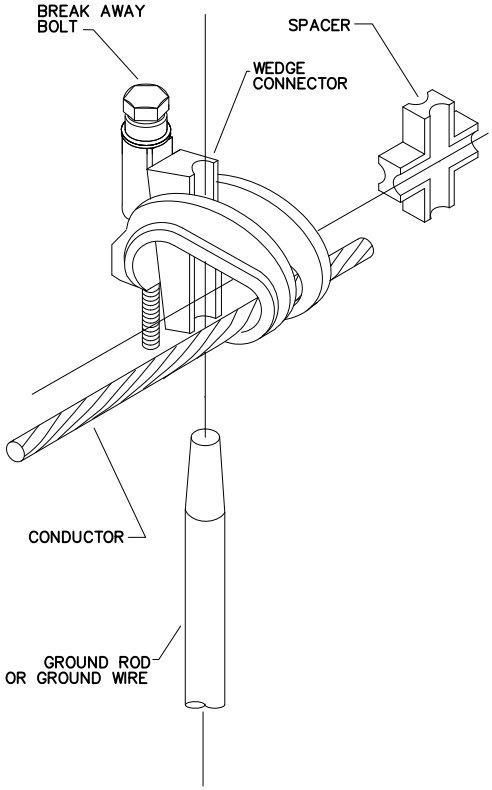
PLACEMENT OF FACILITIES
CONCRETE CAPPING – DEEP
BOX ENTRY

FORTISBC

DRAWING No.	REV.
F–23	3







REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3	JUL/09	BD	BD	GENERAL REVISION	AK	JUL/09
2	FEB'08	TD	NG	ADDED CONNECTOR FOR SERVICE BOX	BMB	FEB/08
1	NOV'04	NS	NS	ADDED ALTERNATIVE GROUND CONNECTOR	FC	NOV'04

DRAWN BY		
CHECKED BY	NS	JAN'02
APPROVED BY	FC	JAN'02

GROUND ROD ASSEMBLY

FORTISBC

DRAWING No.	REV.
G–23	3

Appendix C: Existing Site Technical Reports

Golder Associates Ltd.

220 - 1755 Springfield Road
Kelowna, British Columbia, Canada V1Y 5V5
Telephone (250) 860-8424
Fax (250) 860-9874

REPORT ON

GEOTECHNICAL INVESTIGATION PROPOSED ELLISON SUBSTATION WEST PORTION OF LOT 2, SECTION 23, TOWNSHIP 23, ODYD, PLAN 2257, QUAIL RIDGE BOULEVARD, KELOWNA, BC

Submitted to:

FortisBC Inc.
2850 Benvoulin Road
Kelowna, BC V1W 2E3

DISTRIBUTION:

1 Copy - FortisBC Inc.
1 Copy - Golder Associates Ltd.

June 8, 2007 07-1440-0108 (1000)

Golder Associates Ltd.

220 - 1755 Springfield Road
Kelowna, British Columbia, Canada V1Y 5V5
Telephone (250) 860-8424
Fax (250) 860-9874

June 8, 2007

07-1440-0108 (1000)

FortisBC Inc.
2850 Benvoulin Road
Kelowna, BC V1W 2E3

Attention: Mr. Ed Robinson, P.Eng.

RE: GEOTECHNICAL INVESTIGATION
PROPOSED ELLISON SUBSTATION
WEST PORTION OF LOT 2, SECTION 23, TOWNSHIP 23, ODYD, PLAN 2257,
QUAIL RIDGE BLVD., KELOWNA, BC

Dear Sir:

As requested, Golder Associates Ltd. (Golder) has carried out a geotechnical investigation at the above referenced site (see Figure 1). The purpose of the investigation was to determine the subsurface soil and groundwater conditions. Based on our interpretation of this information, comments and recommendations pertaining to the geotechnical aspects of design and construction of the proposed substation are provided herein.

It should be noted that the scope of this report is limited to the geotechnical assessment of the proposed substation and does not include any investigations, analytical testing or assessments of possible soil and groundwater contamination, archeological or biological considerations or sediment control measures.

This report should be read in conjunction with "***Important Information and Limitations of This Report***" which is appended following the text. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

1.0 METHODOLOGY

The field work was carried out on May 15, 2007. At this time, eight test pits were advanced to depths ranging from about 1.0 to 2.7 m below the existing ground surface using a track-mounted excavator. The test pits were backfilled with spoil material and nominally compacted. The approximate locations of the test pits are shown on Figure 1.

The field work was carried out by a member of our geotechnical staff who located the test pits on site, visually examined and logged the subsurface conditions encountered, and collected representative soil samples for laboratory testing as described below.

Laboratory testing consisted to grain size analyses, soil sulphate and resistivity tests. The sulphate tests were conducted by Caro Environmental Services. The resistivity measurements were conducted in accordance with ASTM G57 standard. The measurements were performed using a standard Miller soil-box test fixture and ABEM SAS-300C resistivity meter.

The results of the grain size analyses are presented on Figure 2. The sulphate and resistivity test results are presented in Section 4.0.

2.0 SITE CONDITIONS

The site about 2.1 hectares in area is located north of Lochrem Road and Quail Ridge Boulevard. Observations indicate the site is an abandoned gravel pit. Review of the historic air photographs appears to indicate the gravel pit operations commenced sometime before 1969 and was terminated around 1990.

Observations indicate the central and east section of the former pit has a hummocky appearance which appears to be either end-dumped miscellaneous fill and/or stockpiles of processed material. The west section of the pit is relatively flat with small end-dumped fill consisting of cobbles and boulders, re-cycled asphalt and concrete. The cut slopes along the west side of this area lies at about 1.5 horizontal to 1 vertical (measured from horizontal) for a vertical height of about 10 m below the undisturbed ground surface to the west.

Except for minor raveling of localized steep slope sections, further observations did not indicate any major geotechnical hazards within the abandoned pit such as slope instability and/or rolling rock.

3.0 SUBSURFACE CONDITIONS

Detailed descriptions of the subsurface conditions encountered in the test pits are presented on the attached Record of Test Pit log sheets following the text of this report. It should be noted that there were variations in the soil conditions between and with depth at individual test pit locations. Similar or greater variations in subsurface conditions may occur between or beyond the test pits.

Except for Test pit 07-4, the remaining test pits encountered about 0.4 to 1.7 m of loose to compact fill consisting predominately of sand and gravel mixed with rootlets, silt cobbles and pieces of asphalt.

The fill in Test pits 07-1, 07-2, 07-6, 07-7 and 07-8 was followed by a layer of loose to compact sand and gravel. The sand and gravel layer in Test pits 07-2 and 07-7 ranged from about 0.1 to 1.1 m thick. Test pits 07-1, 07-6 and 07-8 were terminated in the granular layer at depths between 2.3 and 2.7 m below the existing ground surface.

The above sand and gravel layer in Test pits 07-3, 07-4, 07-5 and 07-7 was underlain by dense to very dense silty sand and gravel containing cobbles. These test pits were terminated in this deposit at depths between 1.0 and 1.9 m below the existing ground surface.

Groundwater seepage was encountered with TP07-4 and TP07-7 at depths of 1.4 and 1.8 m below the existing ground surface, respectively. It is important to note that groundwater seepage is subject to seasonal variation with the highest volumes likely occurring during the late spring/early summer months or during periods of sustained precipitation.

4.0 LABORATORY TEST RESULTS

4.1 Sulphate Test Results

The following table summarizes the results of the sulphate tests conducted by Caro Environmental Services.

Test pit No.	Sample Depth, m	Percent Soluble Sulphates
TP07-1	0.8	<0.005
TP07-4	1.6	<0.005
TP07-6	0.5	<0.005

4.2 Resistivity Test Results

Test pit No.	Depth, m	Sample Condition	Resistivity, Ohm-m
TP07-2	1.2	As received	2,630
		Lab saturated	749
TP07-3	1.0	As received	312
		Lab saturated	52.5

5.0 GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

5.1 Site Preparation

5.1.1 Stripping

It is recommended that any existing vegetation, surficial organic soils and fill materials be completely subexcavated from beneath the various structures located within the proposed substation as well as from beneath the roadways and parking areas. Based on the test pit results, the depth of subexcation is expected to range from about 0.4 to 1.7 m. However, it should be noted that locally thicker deposits of deleterious materials could be encountered in areas not investigated by the test pits.

5.1.2 Grade Fill

Grade fill should consist of 150 mm minus pit run sand and gravel having less than 8 percent passing the 0.075 mm sieve size. Some onsite granular spoil material may be suitable for use as grade fill but it should be inspected and approved by experienced geotechnical personnel prior to its use.

All grade fill should be placed in horizontal lifts not exceeding 300 mm in loose thickness and should be compacted to 95 percent of modified Proctor maximum dry density (ASTM D1557).

Prior to placing the grade fill, it is recommended that the exposed subgrade be proof-rolled using large vibratory drum roller under the supervision of experienced geotechnical personnel. Soft or loose areas should be subexcavated and replaced using grade fill as described above.

Grade fill placed on sloping ground should be keyed into the slope in a continuous series of steps, extended a minimum of 1.0 m width into the natural slope. This treatment will minimize the risk of a potential weak zone or slip plane between the fill and native slope soils. It is anticipated that most of the material from the stepped excavation can be incorporated in the adjoining fill section.

No organic soils or frozen material should be placed in the fill section. In addition, fill should not be placed on the foundation subgrade or on fill if these surfaces are frozen. Fill materials should also not be placed into ponded water or excessively wet soil or fill surfaces or on surfaces covered with snow.

It is recommended that the fill surfaces should be crowned or sloped during and after construction to avoid ponding of water.

5.1.3 Cut and Fill Slopes

It is recommended that temporary cut slopes in the soils observed at the site be developed at angles no steeper then 1.5 horizontal to 1 vertical for dry conditions. Steeper slopes may be considered provided suitable shoring is used.

Permanent cut and un-reinforced fill soil slopes should be constructed at angles no steeper than 2 horizontal to 1 vertical. These slopes should be provided with a suitable vegetative cover to minimize potential saturation and subsequent surface sloughing or raveling.

5.1.4 Dewatering

Should any groundwater seepage be encountered in the excavations, it is our opinion that it can be controlled using conventional sump pump techniques.

5.2 Foundation Design

Excluding any surficial organic soils and existing fill, the various structures within the proposed substation can be supported on conventional strip and/or spread footings founded on the native loose to compact sand and gravel layer or dense to very dense silty sand and gravel deposits. Alternatively, the various structures can be founded on structural grade fill placed and compacted as described above. The following table summarizes the allowable bearing pressures for the various subgrade conditions.

Foundation Subgrade	Allowable Bearing Pressure, kPa
Loose to compact Sand and Gravel	145
Dense to very dense silty Sand and Gravel	195
Compacted Granular Fill	145

Provided that the foundation materials are not loosened or disturbed, it is anticipated that foundations designed for this bearing pressure will be subject to settlement of less than 25 mm. The minimum footing widths should be in accordance with the B.C. Building Code requirements.

Based on a freezing index of 268.4 degree-days Celsius for the Kelowna area, it is recommended that exterior footings or footings in unheated areas be provided a minimum soil cover of 750 mm for frost protection purposes.

Based on the test pit results and our experience in the general area, the site classification for seismic response is site class "D".

It is recommended that grade supported floor slabs be founded on an under-slab base course consisting of at least 100 mm of 19 mm minus crushed gravel having less than 5 percent passing the 0.075 mm sieve. This material should be placed and compacted to 95 percent of modified Proctor maximum dry density (ASTM D1557). The slab on grade should be structurally separate from all foundation elements and should include a cross joint system to control post construction cracking.

If construction commences during cold weather conditions, all exposed footings and slabs should be protected from freezing. Under no circumstances should footings or slabs be placed on frozen material.

The sulphate test results indicate the soil types present at the site have very low to low potential to induce sulphate attack on concrete in contact with these soils. As such, Type 10 Portland cement should be used in concrete mixes as per CSA A23.1.

5.3 Retaining and Below Grade Walls

For design purposes, walls located below grade that can not tolerate or are restrained from movements should be designed considering a coefficient of earth pressure at rest of 0.45. Retaining walls that can tolerate deflections of 25 mm in 3.0 m of wall height may be designed using a coefficient of active earth pressure of 0.3. A soil unit weight of 20 kN/m^3 can be used in the design calculations. Any surcharge loading within a distance

equal to the height of the wall should be included in the determination of total earth pressure loading. This would include any loads from footings that may be located within this zone, parked vehicles or transient loads from vehicle traffic.

Free draining backfill should be placed behind the foundation and/or retaining walls and a positive drainage system should be provided behind the walls to prevent possible build up of hydrostatic pressures. This material should be compacted using only lightweight compaction equipment.

5.4 Roadways/Parking Areas

For the roadways subject to light traffic and parking areas, it is recommended the following pavement structure be considered. If the roadways are subject to heavy truck traffic, it is recommended that the asphalt thickness be increased to 75 mm.

Asphalt	50 mm
Crushed Gravel Base	150 mm
Pitrun Subbase	0 mm

It is expected that the subgrade conditions beneath the roadways and parking areas will consist of either native sand and gravel deposits or engineered granular fill. As such, pitrun subbase is not required. However, prior to placing the crushed gravel base coarse layer, it is recommended that the exposed subgrade be proof-rolled using large vibratory drum roller. Soft or loose areas should be subexcavated and replaced using grade fill as described above.

5.5 Site and Subsurface Drainage

It is recommended that site grading during and after completion of construction be such that surface water is not ponded on site. The water should be collected and disposed of in an approved manner.

Based on the test pit results, collected surface water flows can be disposed of on site by using a system of drywells and/or rockpits as well as perforated storm sewer pipes located in the sand and gravel deposits. All disposal areas should be at least 5 m away from any structural elements.

6.0 INSPECTION AND TESTING

A review of the final plans and specifications by Golder is recommended to confirm that they incorporate the geotechnical aspects of the site and project. It is also recommended that provisions be made for experienced geotechnical personnel to inspect and approve the exposed subgrade soils for foundations construction and granular fill placement. Further, it is recommended that in situ field density test be carried out in any fill placed to confirm that satisfactory compaction is being achieved.

7.0 CLOSURE

We trust the foregoing provides the information you require at this time. Should you have any questions, please do not hesitate to contact this office.

Yours very truly,

GOLDER ASSOCIATES LTD.

Heather McLeod, E.I.T.
Geotechnical Engineering Group

Gerald Imada, P.Eng.
Associate & Senior Geotechnical Engineer

Encl
GI/kc

http://capws/p724091fortisbc2substationskelowna/reports/wp_final/report ellison substn june 8-07.doc

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

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IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

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Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. in the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

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RECORD OF TEST PITS

May 15, 2007 07-1440-0108

Test Pit No.	Depth (m)	Description	Sample/ Depth (m)
TP07-1	0.0 - 0.6	Loose to compact brown mixed **SAND** and **GRAVEL** with rootlets, some silt. **(FILL)**	Sa1, 0.2-0.3m
	0.6 – 2.3	Loose to compact brown gravelly **SAND** grading to **SAND** and **GRAVEL**.	Sa2, 0.6-0.9m
TP07-2	0.0 – 0.5	Compact brown mixed **SAND** and **GRAVEL** with rootlets. **(FILL)**	
	0.5 – 0.6	Compact to loose brown silty **SAND**, some gravel.	
	0.6 – 2.3	Loose to compact brown gravelly **SAND** grading to **SAND** and **GRAVEL** with cobbles and occasional sand lenses.	Sa1, 1.2m Sa2, 2.3m
TP07-3	0.0 – 0.4	Compact brown mixed **SAND** and **GRAVEL** with some rootlets. **(FILL)**	
	0.4 – 1.0	Dense to very dense grey silty **SAND** and **GRAVEL** with cobbles.	Sa1, 0.8-1.0m
TP07-4	0.0 – 1.4	Compact to loose brown gravelly **SAND** grading to **SAND** and **GRAVEL** with cobbles.	Sa1, 0.8-0.9m
	1.4 – 1.6	Dense to very dense grey silty **SAND** and **GRAVEL** with cobbles. Minor groundwater seepage at 1.4 m.	Sa2, 1.6m
TP07-5	0.0 – 0.5	Loose to compact brown mixed **SAND** and **GRAVEL**, trace rootlets and pieces of asphalt. **(FILL)**	
	0.5 – 1.2	Dense to very dense grey silty **SAND** and **GRAVEL** with cobbles.	Sa1, 1.1-1.2m

RECORD OF TEST PITS			
May 15, 2007			07-1440-0108
Test Pit No.	**Depth (m)**	Description	**Sample/ Depth (m)**
TP07-6	0.0 – 0.5	Loose to compact brown mixed **SAND** and **GRAVEL** with cobbles and rootlets. **(FILL)**	
	0.5 – 2.7	Loose light brown **SAND**, trace to some silt and occasional gravel.	Sa1, 0.5m Sa2, 2.7m
TP07-7	0.0 - 0.6	Compact to loose brown mixed **SAND** and **GRAVEL. (FILL)**	
	0.6 – 1.7	Compact to loose brown gravelly **SAND** grading to **SAND** and **GRAVEL** with cobbles.	Sa1, 0.6-1.2m
	1.8 – 1.9	Dense to very dense grey silty **SAND** and **GRAVEL** with cobbles. Moderate groundwater seepage at 1.8 m.	Sa2, 1.8m
TP07-8	0.0 – 1.0	Loose brown mixed **SAND** and **GRAVEL,** trace rootlets and asphalt pieces. **(FILL)**	
	1.0 - 1.7	Loose brown mixed **SAND** and **GRAVEL** and cobbles. **(FILL)**	
	1.7 – 2.5	Compact to loose brown gravelly **SAND** grading to **SAND** and **GRAVEL** with cobbles.	Sa1, 1.7-1.9m

Note: Unless noted above, groundwater seepage was not encountered in the test pits at the time the field investigation was conducted.

LEGEND

TP07-1 — TESTPIT LOCATION

SITE BOUNDARY

PROPERTY LINES

NOTE

1) ALL FEATURES ARE **APPROXIMATE.**

REFERENCES

1) CITY OF KELOWNA WEBSITE.

40 0 40

SCALE METRES

PROJECT

FORTISBC
FUTURE SUBSTATION
KELOWNA, B.C.

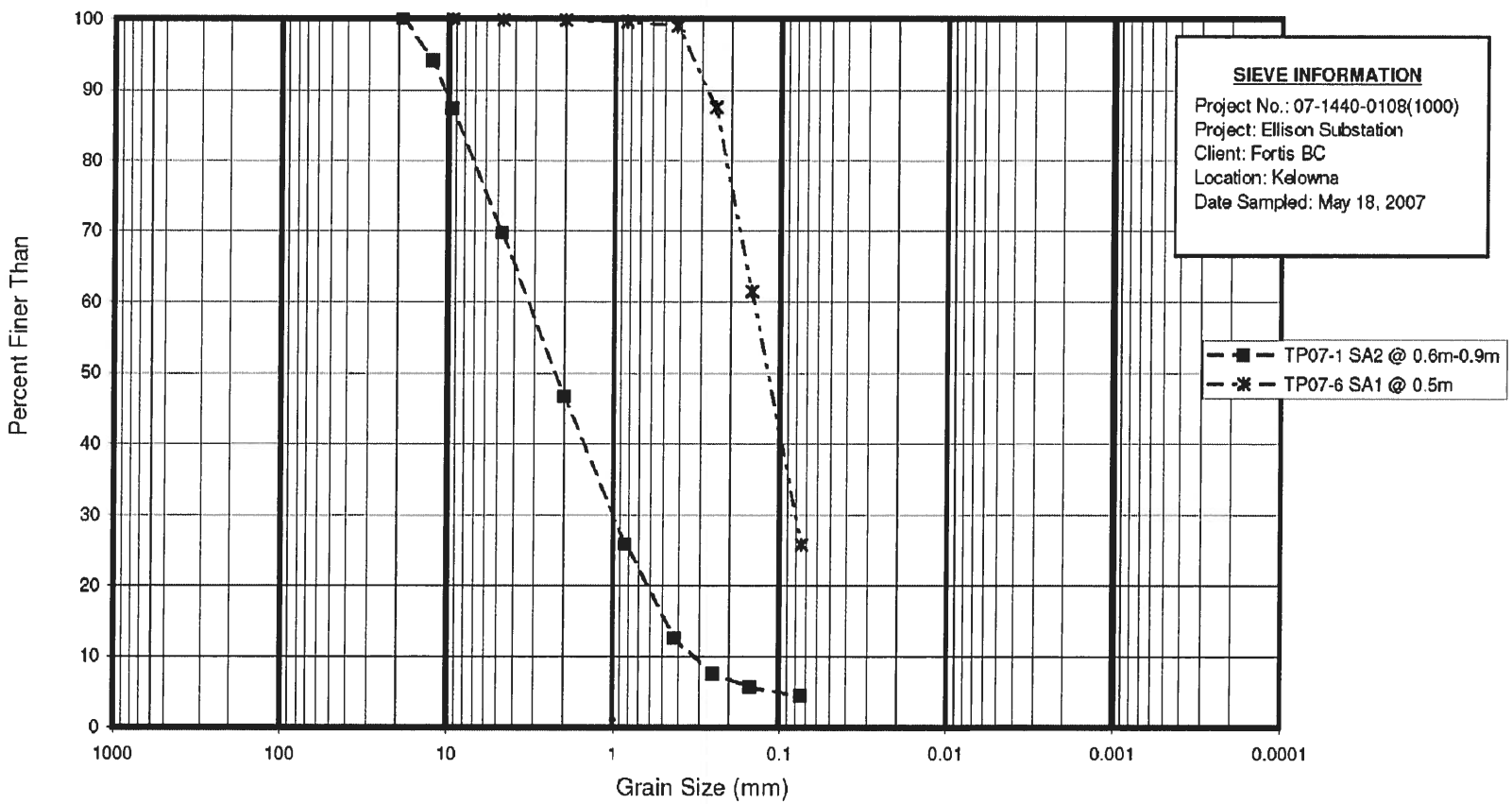
TITLE

TESTPIT LOCATION PLAN

Golder Associates
Kelowna, BC

PROJECT No. 07-1440-0108(1000)			FILE No0714400108_1000_1-2.dwg	
DESIGN	GI	8/JUNE/07	SCALE 1:2,000	REV. 0
CADD	JG	8/JUNE/07		
CHECK			FIGURE: 1	
REVIEW				

N:\Active\2007\1440 - Kelowna\07-1440-0108 FortisBC Future Sub\Drafting\Task 1000\CAD\ Drawing file: 0714400108_1000_1-2.dwg Jun 08, 2007 - 10:34am



Boulders	Cobbles	Gravel			Sand			Silt			Clay
		Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine	

PROJECT

FORTISBC
FUTURE SUBSTATION
KELOWNA, B.C.

TITLE

SIEVE ANALYSIS
(TP07-1 & TP07-6)

Golder Associates
Kelowna, BC

PROJECT No. 06-1440-0108(1000)			FILE No0714400108_1000_1-2.dwg	
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CADD	JG	8/JUNE/07		
CHECK			**FIGURE:2**	
REVIEW				

REPORT COVER SHEET

TABLE OF CONTENTS

This report was prepared by Ian B.K. Simpson, P.Eng. and Esmond K.F. Chow, P.Eng.

July 25, 2010

1 SUMMARY AND SCOPE

The objectives of the work described in this report were to measure the in-service ground impedance of Ellison Substation after connection of the distribution lines and to investigate the effect Ellison may have on a nearby Water Well installation.

2 REFERENCES

References are referred to in the text by numbers in square brackets, e.g. [2], corresponding with the numbered list below:

1. "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System", IEEE Std 81-1983.
2. "IEEE Guide for Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems", IEEE Std 81.2-1991.
3. Ground-it Consulting Ltd. Project 4499 report, "Ellison Substation Ground Grid Design", April 2008.
4. Ground-it Consulting Ltd. Project 4552 report, "Ellison Substation Ground Grid Measurements", September 2009.
5. "IEEE Guide for Safety in AC Substation Grounding", IEEE Std 80-2000.

3 DISCLAIMER

This report concerns grounding measurements related to the Ellison Substation and nearby Glenmore-Ellison Improvement District Water Well installation. It was prepared by Ground-it.com Consulting Ltd. for FortisBC and others involved with the operation of these facilities. The material in it reflects Ground-it's best judgment in light of the information available to Ground-it at the time of preparation. Any use which a third party not involved with these facilities, makes of this report, or any reliance on it or decisions to be made based on it, are the responsibility of such third parties. Ground-it accepts no responsibility for damages, if any, suffered by such third party as a result of decisions made or actions based on this report.

4 BACKGROUND

The Ellison Substation is a new 138 kV substation located north of Kelowna, B.C. The present 138 kV supply is from Duck Lake substation (DUC), which is about 6 km away, through the 61 line. A second transmission line will be constructed from Sexsmith Substation to the south. Ellison supplies power into the local 25 kV distribution network.

FortisBC advised that a fault on the 61 line will be cleared by the LEE 46 line protection in approximately 0.55 second. This is taken to be the backup protection for Ellison because most 138 kV faults inside Ellison would be cleared more quickly.

The zero impedance ground fault level for a single-line-to-ground fault is 6700 amps.

Ground-it went to the site before any excavation or construction work was started and measured the soil resistivity. Using the measured soil resistivity, they designed a ground grid that met step and touch potential safety requirements for the above parameters. The design and measurements are described in [3].

When Ellison was being constructed, the ground resistance and touch potentials were measured as a stand-alone ground grid before anything was connected[4]. The measured resistance was 1.5 Ω. It had been calculated to be 1.24 Ω in [3]. The higher measured value was applied to the design models and it was verified that the GPR would not be excessive and step and touch potentials would still be within tolerable limits. The measured touch potentials were also found to be within tolerable limits.

5 WORK COMPLETED

Ground-it went to the site on June 17, 2010. Ground impedance and step and touch potential measurements were carried out at Ellison. Ground circulating current and step and touch potential measurements were carried out at the nearby Glenmore-Ellison Improvement District (GEID) Water Well and pump house

This report was prepared on July 26, 2010.

5.1 Ground Impedance Measurement

Ellison was in operation at the time and is always connected to the distribution lines. From experience, the neutral conductor of the distribution system network can present a relatively low impedance. This is due to many ground electrodes connected to the distribution neutral. Each consumer service has a ground electrode of some type and there are ground rods at some of the distribution poles. Measurement of the impedance of distribution neutral networks has shown that the impedance is usually less than 1 Ω.

A high current test method was used rather than a portable grounding tester, although a check reading was taken with a portable instrument, because a portable tester may not function well when measuring a low value ac impedance, particularly if there is a high level of 60 Hz “noise” and possible bonds to remote grounds.

The fall-of-potential (FOP) test method described in [1 & 2] was used. In applying this method, a current return (C2) electrode is located some distance from the ground grid and used to inject a test current into the ground grid. The potential rise of the grid is measured with reference to a potential reference (P2) electrode also located at some distance from the ground grid. The measured impedance is obtained by dividing the potential rise by the test current.

The IEEE [2] recommends that the C2 electrode be located at least 6.5 times the dimension of the ground electrode, away from it. In the conventional FOP measurement, the P2 electrode is moved along a line between the ground electrode and the C2. If the measured impedance is plotted against the distance from the substation, a classical curve should be obtained in which the correct impedance is given by a flat central part of the curve where the P2 is out of the influence of both the ground grid and the C2. Also, when the grid is small compared with the distance to the C2, it can be shown mathematically that the correct impedance will be measured at a distance of 61.8% of the distance from the substation to the C2.

If the conventional FOP method is used and the impedance is relatively low, typically less than about 1 Ω, significant error can be introduced through inductive coupling between the test leads run out for the C2 and P2. The current in the C2 lead induces a voltage in the P2 that increases the reading. This effect is even apparent with portable testers that claim to use “reversing dc” because the frequency of the “reversing dc” is relatively high, for example 128 Hz and the inductive coupling at the fundamental frequency (128 Hz) is significant. It does not help much to space the test leads far apart, because the coupling does not decrease linearly with the increased spacing.

For the above reasons, an existing metal culvert, along Quail Ridge Blvd. 905 metres south of Ellison, was used as C2. Metal culverts often form excellent C2 electrodes, because they are like long large diameter ground rods laid horizontally and are not connected to any other metallic system.

For the first measurement, the P2 probe was taken out in south direction towards the C2. A second measurement was done by moving the P2 probe back to 70 metre location and then taking it along Quail Ridge Blvd. in a westerly direction approximately orthogonal to the C2, to minimize the error due to test lead coupling. With this arrangement, the fall-of-potential plot will become asymptotic towards the true ground impedance.

The distances for both were measured from the centre of the Ellison south gate, first by pacing and from 20 metres on, using a GPS receiver.

The measurement configuration is shown in Figure 2. The equipment was set up at the corner of Quail Ridge Blvd. Red lines show the C1 lead to the fence at Ellison main gate and to the C2 (culvert). Green lines show the P1 lead to the fence and P2 traverses towards the C2 and orthogonal to the C2 direction.

The test results are listed in Table 2 and plotted in Figure 6 and Figure 7.

A small portable generator was used to generate the test current. The current level was controlled through a Variac and switch box containing a bridge rectifier and filter capacitor for the dc test. The ac frequency was changed from 60 Hz by varying the generator speed. The current was measured with an RCC 507 true RMS digital ammeter that has averaging and holding features. The potentials were measured with a PCSU1000 digital oscilloscope.

The PCSU1000 is a computer based oscilloscope that operates from the USB port of a computer. A ThinkPad laptop was used to power it and read the results. The software provided with the PCSU1000 includes a FFT that extracts the frequency components of a waveform. This enables extracting a 50 or 70 Hz signal even in the presence of large levels of 60 Hz signal. Another digital multimeter was used for the dc potential measurements. A low-pass filter was used to minimize ac noise for the dc measurements. It consists of a simple R-C network with two stages having 10 k-Ω resistors and 5 µF capacitors to ground. The filter requires that the signal be measured for more than 2 seconds to fully charge the capacitors.

Figure 1 shows a FFT plot for the reading taken when the P2 probe was located 100 metres along the traverse towards C2. The numbers at the top of the plot are instrument range settings. The numbers at the bottom show the cursor locations. In the plot, the frequency cursor (red dotted line) is at 51.27 Hz and the amplitude cursor (blue dotted line) is at –11.40 dBV. The 60 Hz signal is clearly shown by the spike to the right. This can be checked in the field by moving the frequency cursor. The 180 Hz 3rd harmonic can also be seen to the far right. From recent measurement experience, the 3rd harmonic stray voltage on ground grids tied to distribution systems is often at a similar level to the 60 Hz stray voltage.

The data for each measurement was saved to disk in the laptop and used later to determine the measured impedance. The following is part of the 325 data points stored for the measurement in Figure 1. The left column is the data point number. The middle column is the frequency in kHz and the right column is the voltage measured in dBV. dBV is the amplitude of the voltage in decibels relative to 1 volt.

```
80    0.0488      -39.7
81    0.0494      -32.8
82    0.0500      -14.3
83    0.0507      -11.2
84    0.0513      -17.1
85    0.0519      -34.4
```

In this case the peak of the test signal is –11.2 dBV at the measurement frequency of 50.7 Hz. dBV can be converted to volts as follows: $V = 10^{\frac{dBV}{20}}$. A spreadsheet was used to calculate the voltage at the measurement frequency and the 60 Hz level. The 60 Hz level in Figure 1 is +6.1 dBV = 2.02 volts. These values are not exactly the same as those shown in Figure 1.

The best resolution and accuracy is obtained by using the highest range possible without allowing the 60 Hz spike to project beyond the top of the screen. The USB Scope software has an auto-ranging feature that is always used to set the highest range before doing the FFT analysis.

Figure 1 FFT Output from USB Oscilloscope for 100 metre Point on Traverse Towards C2

The FOP traverse was done using a test frequency of about 51 Hz to avoid errors from the 60 Hz and other signal voltages on the ground grid. The measurement traverses were terminated when the readings became almost constant at a distance of about 400 metres for both the traverse towards C2 and orthogonal to C2. Measurements were then done using 68/69 Hz and dc and the DET2/2 grounding tester (for the orthogonal traverse only).

The dc test was done with the normal current direction and with the potential reversed, because the current must be applied for more than 2 seconds and there is an electrolytic charging effect of the metal to soil interface. Buried wire forming the ground grid and other buried metal, forms an electrolytic cell where it contacts the soil. Application of dc tends to charge up the cell and cause a drifting potential. Due to drifting effects, the dc measurement is rather approximate and could have an error of ±10%. There is usually a large dc offset before any signal is applied and this was removed using the relative feature of the voltmeter. The table of results records the average of the normal and reverse polarity readings.

For the measurement with the P2 probe taken out in the direction towards the C2. the correct impedance will not be measured at a distance of 61.8% of the distance from Ellison to the C2, because of the low impedance connection to remote grounds through the distribution network. Computer modeling can be used to show that the correct impedance is closer to Ellison. If the plot shown for the orthogonal traverse is taken to be correct and the 51 Hz impedance is about 0.14 Ω, the correct value for the traverse towards C2 would be at about 90 metres or 10% of the distance. There is also probably as significant error in this measurement due to inductive coupling between the current and potential test leads.

For the measurement with the P2 probe taken out in the direction orthogonal to the C2 direction, some measured values at shorter distances were higher than those at larger distances, because the probe may be close to objects bonded to Ellison through the distribution neutral. As shown in Figure 7, all measured 51 Hz impedances are lower than 0.16 Ω. Taking the average between 51 and 69 Hz at the furthest distance, the 60 Hz impedance is about 0.163 Ω.

As the furthest readings may have been affected by objects bonded back to Ellison through the distribution neutral, it is prudent to scale the result up to the highest reading that was obtained, which is at

148 metres 0.153 Ω vs 0.134 Ω at 426 metres, or an increase of 14%. The measured 60 Hz impedance is then 0.186 Ω.

The difference between the dc, 51 Hz and 68/69 Hz impedance readings indicates an inductive component in the ground impedance which is due to the inductance of neutral and ground conductors to remote locations. Part of this is likely the ground conductor run with the 61 line from DUC. The dc resistance of 0.033 Ω is much lower than the ac impedance, because there is no added reactance in the dc measurement.

Figure 2 Ground Impedance Measurement Configuration

5.2 Step and Touch Potential Measurement

Step and touch potentials were measured using the same equipment and current injection as was used for the fall-of-potential impedance measurement.

To measure a touch potential, the P1 and P2 leads connected to the USB Scope, were extended to the measurement location. They were first both attached to the nearby object, for example, the fence ground

riser. Test current was applied and it was confirmed that the measured potential was negligible, indicating no stray inductive or capacitive pick-up problems that are possible due to the amount of test lead laid out. A ground rod was then inserted through the crushed rock into the soil about 1 metre from the fence. The P1 lead was left on the object and P2 was connected to the rod and a measurement taken. For a step potential measurement, a second rod was inserted 1 metre further away and the P1 lead was moved to it.

Ten locations were measured. 10 touch and 5 step potentials were recorded. The test results are listed in Table 3. The step and touch potential measurements at the GEID Water Well installation are referenced to the Water Well ground system, which will have a different GPR than Ellison.

The results were scaled up to a ground fault current of 6700 amps, which is understood to be the ultimate ground fault current. The highest touch potential is a transferred touch potential of 370 volts at the padmount transformer at the Water Well building. The tolerable touch potential for native soil in the summer is 769 volts [3]. The transferred touch potential is well within that limit. Tolerable step potentials are higher than the touch potentials and none of the measured step potentials exceeded 82 volts.

Step and touch potentials at other locations are lower. Around Ellison, the highest is 309 volts at the maximum swing of the west main gate. It was noted that there is a metal culvert buried under this location. It will reduce the soil potential and therefore increase the touch potential, because much of the culvert is buried away from the ground grid. There is crushed rock over the area and the tolerable touch potential for crushed rock areas is 836 volts [3].

Touch potentials are well within the tolerable limits, because, while the design allowed for the return path through the neutral on the 138 kV line, it did not make any allowance for the connections to the distribution system neutral network. The distribution system neutral network presents another low ground impedance connected in parallel.

5.3 Circulating Ground Current Measurement

Circulating ground current measurements were taken at the GEID Water Well installation across the road from Ellison. A test current was applied to the Ellison ground grid using the same injection circuit and equipment as for the ground impedance and step and touch potential measurements. The circulating currents were measured using a clip-on ammeter as current transformer and the USB Oscilloscope.

A socket had been fitted to a general purpose Kyoritsu Kew Snap Model 2903 clip-on ammeter. The ammeter is a passive device with mechanical analogue meter movement. The leads from the CT in the ammeter were identified and calibration tests showed that the ac voltage measured at the leads, was related to the current flowing through the jaws. More extensive tests on the calibration after doing the field measurements showed that the ratio changes to some extent with current level. Test were done using from 120 mA to 1.2 amps and the ratio varied from about 128 to 124 mV/A. The ratio appeared to stabilize at about 128 mV/A when the current is low and less than 0.6 amps. This may be due to diodes used in the meter that have non-linear conduction at low levels of current and present a varying burden to the CT. All measurements were well below 120 mA. Therefore a ratio of 128 mV/A was used in Table 1 and assumed to hold for frequencies close to 60 Hz such as 50 or 70 Hz.

The ammeter could only be attached to three significant ground leads that might conduct fault current from Ellison to the Water Well casing, pump or piping. Unfortunately the main cable to the submersible pump in the well has too large a diameter for the ammeter to be clipped around it.

The procedure used was to clip the ammeter around a conductor, inject the test current into Ellison ground grid at about 50 Hz, record the injected current and measure the voltage spectrum obtained from the ammeter with the USB Oscilloscope plugged into the ammeter. The readings were designated W1, W2 and W3.

Using W1 as an example, the FFT spectrum of the clip-on ammeter voltage read for the current flowing through the Flow Meter ground was –83.9 dBV at 49.4 Hz for an injected current of 2.019 amps.

-83.9 dBV is equivalent to 0.0638 mV. Using the ammeter calibration of 128 mV/A it is equivalent to 0.498 mA flowing through the wire in the ammeter jaws. For 6700 amps at Ellison, the current would be 1.653 amps. This reading is very small and at the limit of what can be detected by the equipment used. It is close to the background noise level.

The other two readings were higher. All readings are listed in Table 1.

Table 1 Ground Current Measurements at Water Well Near Ellison Scaled to 6700 A Fault Current

#	60 Hz residual milli-volts	Applied current amps	Frequency Hz	CT voltage dBV	CT voltage mV	Current for fault Amps	Location
W1	0.034	2.019	49	-83.9	0.064	1.65	Cable to flow meter
W2	16.2	2.023	51	-62.2	0.776	20.08	Cable to surge relief valve
W3	0.269	2.012	51	-38.7	11.61	302.2	Ground conductor to well casing

It is unknown whether the main electrical cable to the submerged pump provides a ground path or not. As stated, the cable diameter is too large to fit the clip-on CT around. It is a large diameter TECK cable which usually contains an internal ground wire. The sheath also provides a path for ground currents. As a worst case, it could be assumed that the cable ground and sheath conduct the same current (302 A) as the ground wire to the well casing.

It is valid to sum the currents. The total current to ground at the Water Well installation is then 626 amps. As this lasts for the fault duration of 0.55 second, it should not be damaging and is probably below the level of a ground fault at the submerged pump motor.

A drawing of the Water Well casing shows that it extends 248.7 ft. deep and would therefore perform as a resistance ground rod and attract a portion of the Ellison ground fault current.

6 ZONE OF INFLUENCE

Telus require completion of a “ZOI” form. The form requires a number of entries. The information for the following entries is not available to Ground-it:

Substation Number
In-Service Date
Legal Land Description
Substation Phone # and HVI Protection Type Used
Communication Services (e.g. Telephone, Data, T1)

This information should be filled in by FortisBC.

The following information is provided by Ground-it. Figures in **bold** can be inserted in the Telus form:

6.1 Basic Information

Power Company: FortisBC

Substation Name: Ellison

6.2 Ground Grid Area

Grid model coordinates are from x = 3 to x = 80 and y = 0 to y = 67. Dimension is 77 x 67 = **5159 m^2**. This ignores two small projections at the vehicle gates.

6.3 Ground Grid Resistance

The ground grid resistance was calculated in [3] to be 1.24 Ω in the summer and to remain about the same in winter due to the depth of burial. The measured stand-alone resistance [4] was 1.49 Ω. The measured 60 Hz impedance for the in-service grid bonded to external grounds through the distribution neutral network as on June 17, 2010, is **0.19 Ω**.

6.4 Fault Current

The maximum ground fault current is **6700 amps**.

6.5 X/R Ratio and GPR

The X/R ratio for the maximum fault is not known as it depends on system expansion that is still to be planned. A worst case **X/R = 20** should be used.

The **RMS GPR** is taken as the measured in-service ground impedance of 0.19 Ω times the maximum fault current of 6700 amps, which is **1273 volts**.

Peak GPR was calculated in accordance with equations in [1]. Page 84 gives equation (75) for the fault current wave when the fault is initiated at the time that gives maximum dc offset.

$$i_f(t) = \sqrt{2}E \cdot Y_{ac}\left[e^{\frac{-t}{T_a}} - \cos(\omega t)\right]$$

Ta	dc offset time constant = X/(120πR)	=	0.053052 for X/R = 20	
Yac	equivalent ac system admittance in mhos		=	0.084092 mho
E	Line to neutral voltage =	138000/√3	=	79674 volts
ω	Frequency in radians/sec	=	60 x 2π =	376.99

Yac is the system fault impedance inverted. The system fault impedance is E/fault current = 79674/6700 = 11.89 Ω. Yac = 1/11.89.

The fault current was calculated for intervals of 0.0005 second. The peak after 0.008 second (about ½ cycle) is 17549 amps.

The current wave was multiplied by the measured impedance of 0.19 Ω to produce the plot in Figure 3. For this calculation, it is assumed that the measured impedance is a pure resistance. It is known that there is some reactance in the measured impedance, as there is a change in impedance with frequency between 50 and 70 Hz, but it cannot be reliably quantified.

The peak voltage in Figure 3 after 0.008 second is **3334 volts**. This is **V peak asymmetric**.

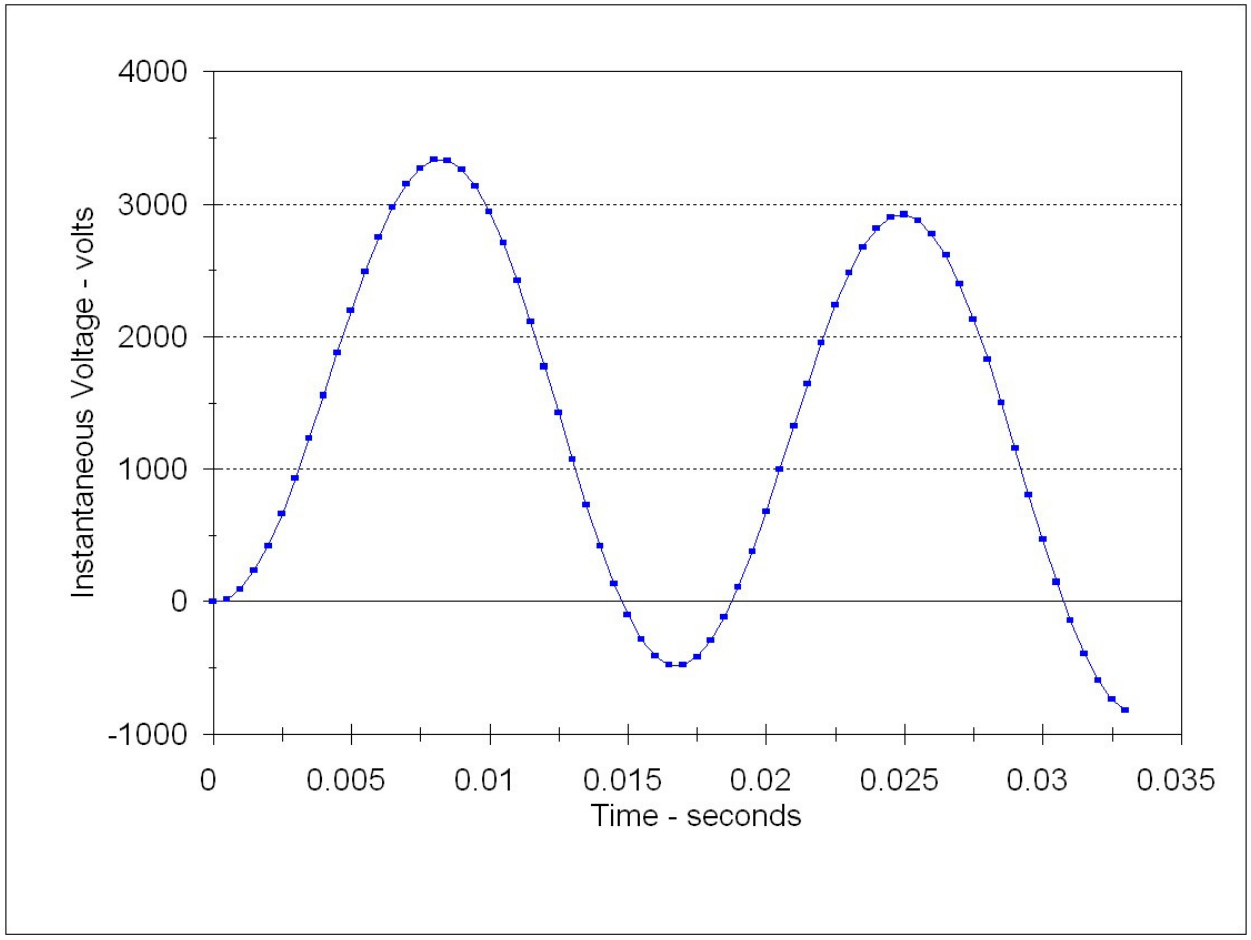

Figure 3 Plot of Instantaneous GPR for X/R = 20 and If = 6700 A

6.6 Zone of Influence & Restricted Zone

The Zone of Influence is an area where the absolute potential rise of the soil exceeds 300 volts. The Restricted Zone is the area where it exceeds 1000 volts.

The zones were determined using the ground grid electrode model developed during the grid design phase [3]. The GPR is set to 1273 volts. The grid alone has a calculated resistance to ground of 1.2423 Ω. When connected to the distribution network, the impedance decreases to 0.19 Ω. To have the correct GPR of 1273 volts, the current injected into the ground by the modelled grid is 1273/1.2423 = 1024.7 amps.

Figure 4 shows the 1000 volt absolute potential contour line around the ground grid. Absolute potential is the soil potential relative to remote ground. The area inside the contour is the Restricted Zone. It touches the corners of the grid and extends about 3 metres at the sides. The **Restricted Zone** is therefore within **3 metres** from the edge of the ground grid.

Figure 5 shows the 300 volt absolute contour. The Zone of Influence is inside this contour. The small dots in Figure 5 are 5 metres apart. The contour is therefore about 14 x 5 = 70 metres from the edge of the grid along the long sides, 65 metres along the short sides and about 57 metres at the corners. The **Zone of Influence** should be set at the greatest distance which is **70 metres** from the edge of the grid.

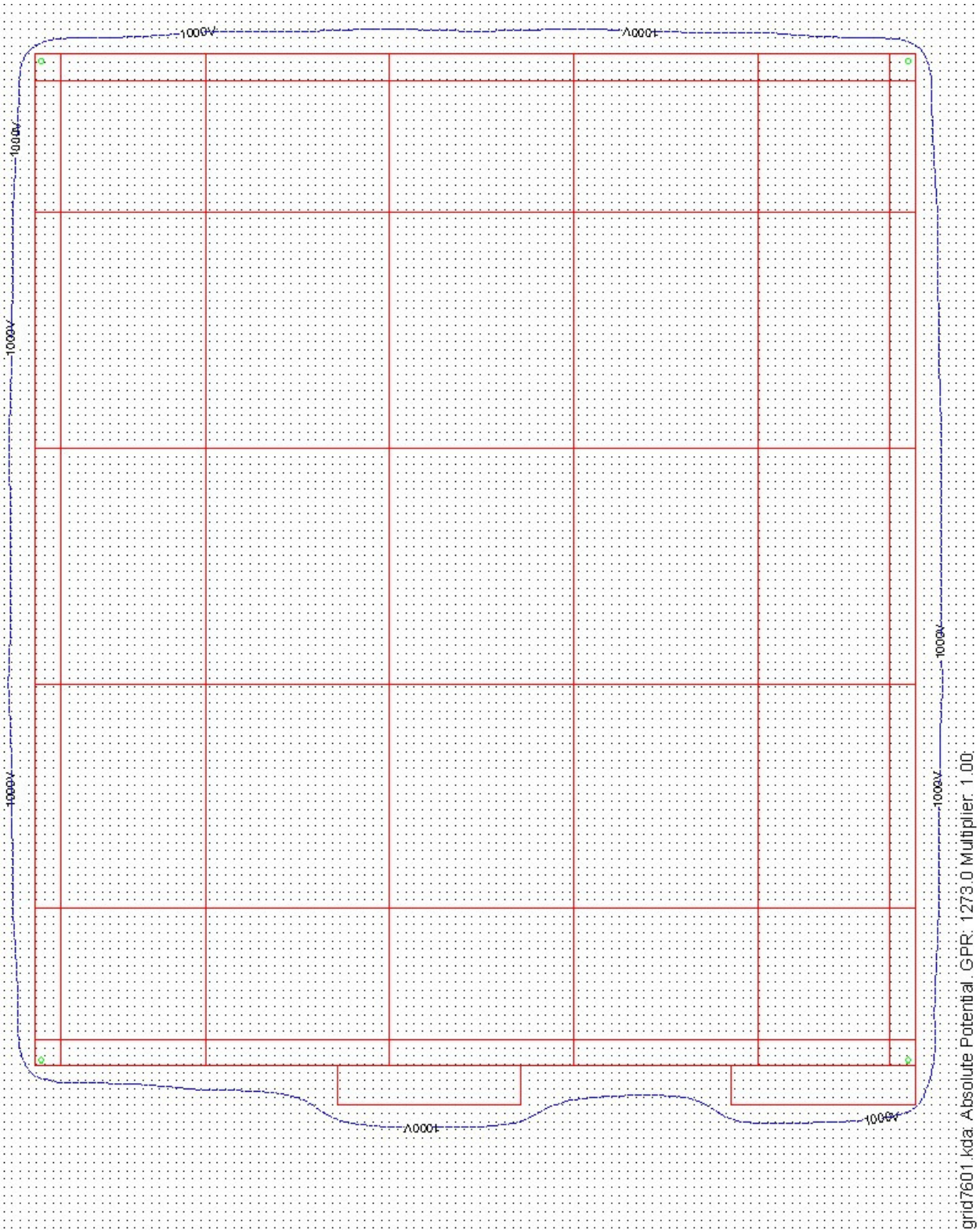

Figure 4 Restricted Zone – 1000 volt Contour

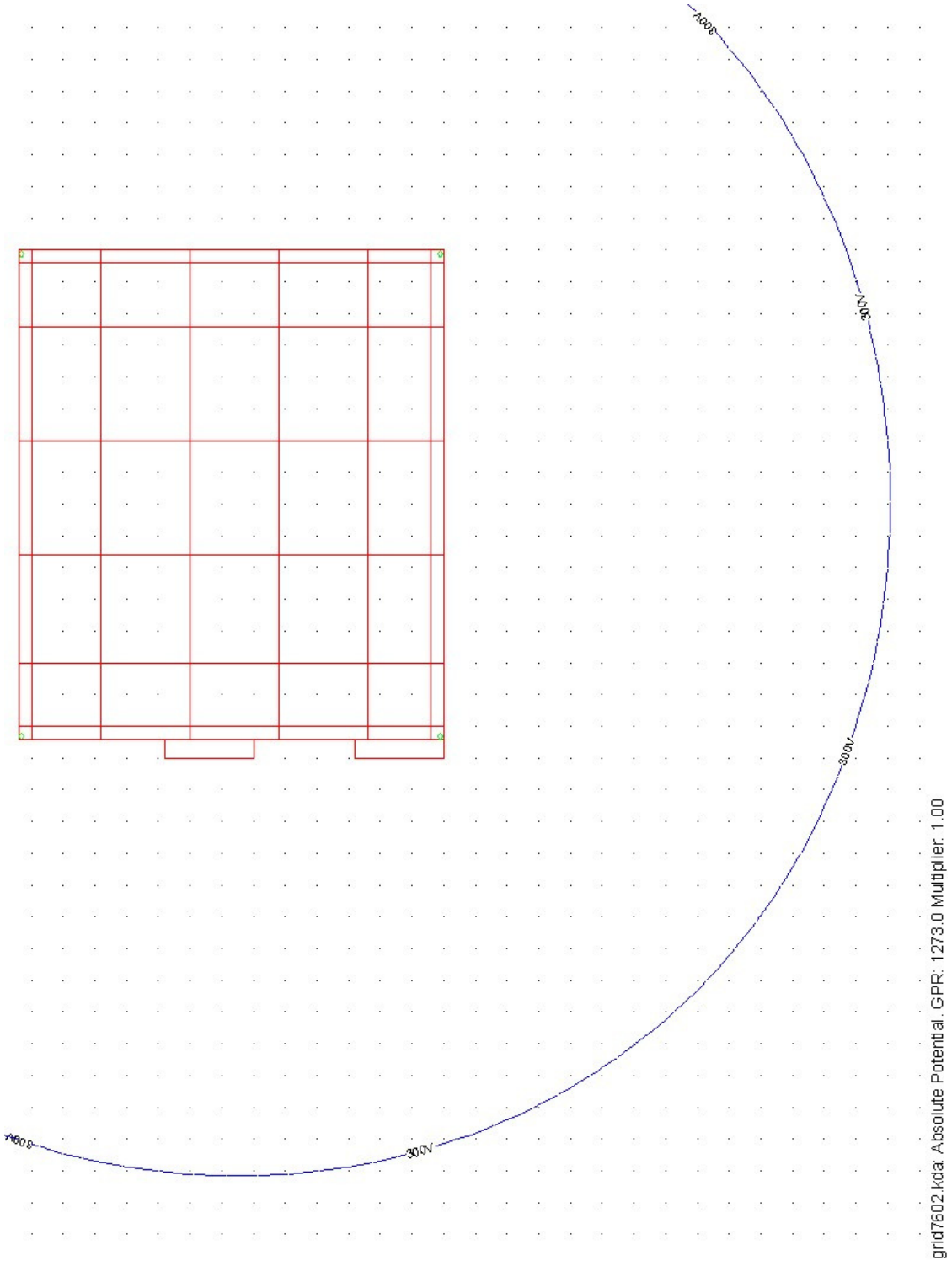

Figure 5 Zone of Influence – 300 volt Contour

Table 2 Ground Impedance Measurement Results

MEASURED ON: June 17, 2010.

CONDITIONS: Overcast. 17 deg C. 68% RH.

DESCRIPTION: Fall-of-potential impedance at Ellison Substation. C1 and P1 are main gate ground risers. Distances and angles measured using hand-held GPS receiver. C2 is a metal culvert 870 metres south of the Substation at an angle of 187 degrees true. Final P2 location was 398 metres south from the Substation at an angle of 173 degrees true for the P2 route towards C2. The angle between the C2 and final P2 location is 14 degrees. Final P2 location was 426 metres west from the Station at an angle of 261 degrees true for the P2 route orthogonal to C2. The angle between the C2 and final P2 location is 74 degrees. Both P2 routes are along Quail Ridge Blvd. See diagram.

EQUIPMENT: Current source 450 watt Honda generator with mechanical speed change for 53 to 70 Hz operation. Current measured by RCC 507 True RMS multimeter with averaging feature. AC potentials measured by PCSU1000 digital storage oscilloscope. DC potentials measured by Fluke 8050A digital multimeter. Check rading with Megger DET2/2.

#	P2 GPS DISTANCE metres	RESIDUAL POTENTIAL 60 Hz volts	CURRENT amps	FREQUENCY Hz	OSCILLOSCOPE POTENTIAL dbV	P2 POTENTIAL volts	MEASURED IMPEDANCE ohms	---REMARKS---
1	1	0.39	2.051	51	-27.0	0.045	0.022	Paced distance used
2	2	0.36	2.055	51	-27.9	0.040	0.020	Paced distance used
3	3	0.42	2.031	51	-25.7	0.052	0.026	Paced distance used
4	5	0.72	2.036	51	-24.4	0.060	0.030	Paced distance used
5	10	1.26	2.021	51	-19.1	0.111	0.055	Paced distance used
6	21	1.62	2.023	51	-17.2	0.138	0.068	GPS measured distance
7	30	1.80	2.001	51	-15.3	0.172	0.086	GPS measured distance
8	50	1.68	2.013	51	-13.7	0.207	0.103	GPS measured distance
9	70	1.80	2.010	51	-12.1	0.248	0.124	GPS measured distance. Last common point for both P2 routes
10	97	2.02	1.998	51	-11.2	0.275	0.138	GPS measured distance
11	147	2.19	1.999	51	-10.1	0.313	0.156	GPS measured distance
12	198	2.72	2.004	51	-8.5	0.376	0.188	GPS measured distance
13	248	3.16	1.994	51	-7.0	0.447	0.224	GPS measured distance
14	298	2.54	2.009	51	-7.9	0.403	0.200	GPS measured distance
15	349	2.26	1.996	51	-5.4	0.537	0.269	GPS measured distance
16	398	2.26	1.994	51	-6.4	0.479	0.240	GPS measured distance. Last point of the P2 route towards C2
17	398	2.26	1.991	51	-5.7	0.519	0.261	GPS measured distance. Last point of the P2. Narrow spectrum.
18	398	1.00	2.761	68	-0.7	0.923	0.334	GPS measured distance. Last point of the P2 route towards C2
19	398	-0.236	2.191	dc		0.066	0.030	GPS measured distance. Last point of the P2 route towards C2
20	97	2.63	1.961	51	-12.9	0.226	0.115	GPS measured distance. P2 is orthogonal to C2.
21	148	3.16	2.048	51	-10.1	0.313	0.153	GPS measured distance
22	197	2.37	2.021	51	-11.1	0.279	0.138	GPS measured distance. Near light post
23	248	2.37	2.027	51	-11.7	0.260	0.128	GPS measured distance. Near Quail Ridge Gas Station
24	299	2.92	2.036	51	-10.7	0.292	0.143	GPS measured distance
25	347	2.19	2.020	51	-11.1	0.279	0.138	GPS measured distance. Near small electrical building
26	426	2.82	2.009	51	-11.4	0.269	0.134	GPS measured distance. Last point of the P2 route orthogonal to C2
27	426	2.54	2.411	69	-6.7	0.462	0.192	GPS measured distance. Last point of the P2 route orthogonal to C2
28	426	-0.232	2.222	dc		0.073	0.033	GPS measured distance. Last point of the P2 route orthogonal to C2
29				DET-2/2			0.11	GPS measured distance. Last point of the P2 route orthogonal to C2

Notes

1 dbV is decibels relative to 1 volt.

Table 3 Step and Touch Potential Measurement Results

T = Touch Potential and S = Step Potential

	RESIDUAL POTENTIAL	CURRENT	FREQUENCY	OSCILLOSCOPE POTENTIAL	P2 POTENTIAL	Touch/Step potentials. Scaled to amps 6700.0	
	60 Hz volts	amps	Hz	dbV	volts	volts	
T1	0.841	2.007	47	-19.1	0.111	370.3	Padmount transformer at well
S1	0.389	1.996	51	-32.3	0.024	81.5	Padmount transformer at well
T2	0.484	2.015	51	-31.7	0.026	86.5	Well chamber lid
T3	0.138	2.018	51	-39.2	0.011	36.4	Vent Fan
T4	0.115	2.012	53	-35.4	0.017	56.6	Vent pipe
T5	0.263	2.002	51	-27.9	0.040	134.8	South gate max swing of east gate
T6	0.603	2.002	51	-20.7	0.092	308.8	South gate max swing of west gate. Over metal culvert
T7	0.130	2.006	51	-32.7	0.023	77.4	South West fence corner
S2	0.162	2.007	51	-34.0	0.020	66.6	South West fence corner
T8	0.162	2.009	51	-36.8	0.014	48.2	North West fence corner
S3	0.180	2.004	51	-33.4	0.021	71.5	North West fence corner
T9	0.146	1.998	51	-38.4	0.012	40.3	South East fence corner
S4	0.070	2.000	51	-39.1	0.011	37.2	South East fence corner
T10	0.106	1.992	52	-34.8	0.018	61.2	North East fence corner
S5	0.108	2.002	51	-35.9	0.016	53.7	North East fence corner

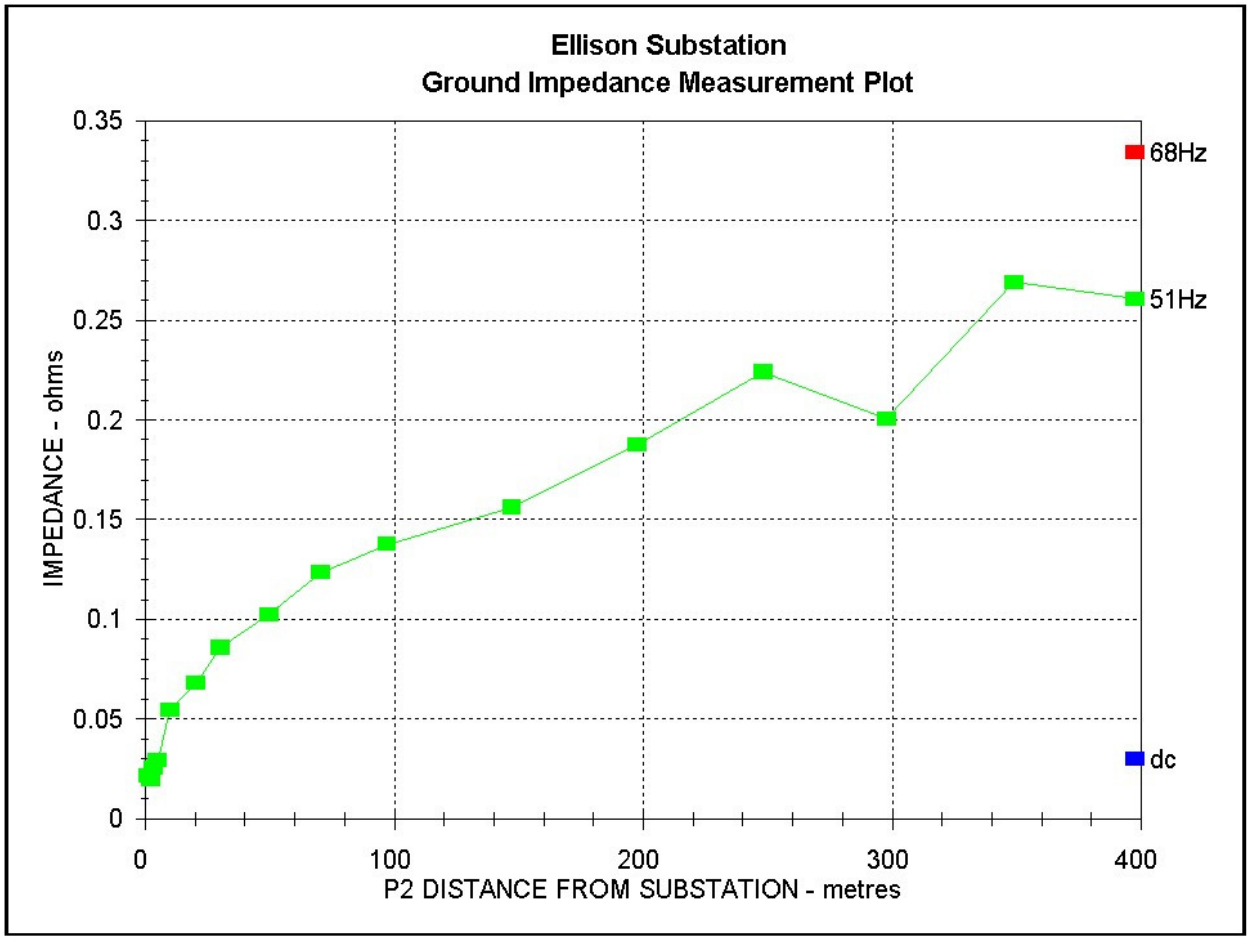

Figure 6 Plot of FOP Measurement with P2 Towards C2

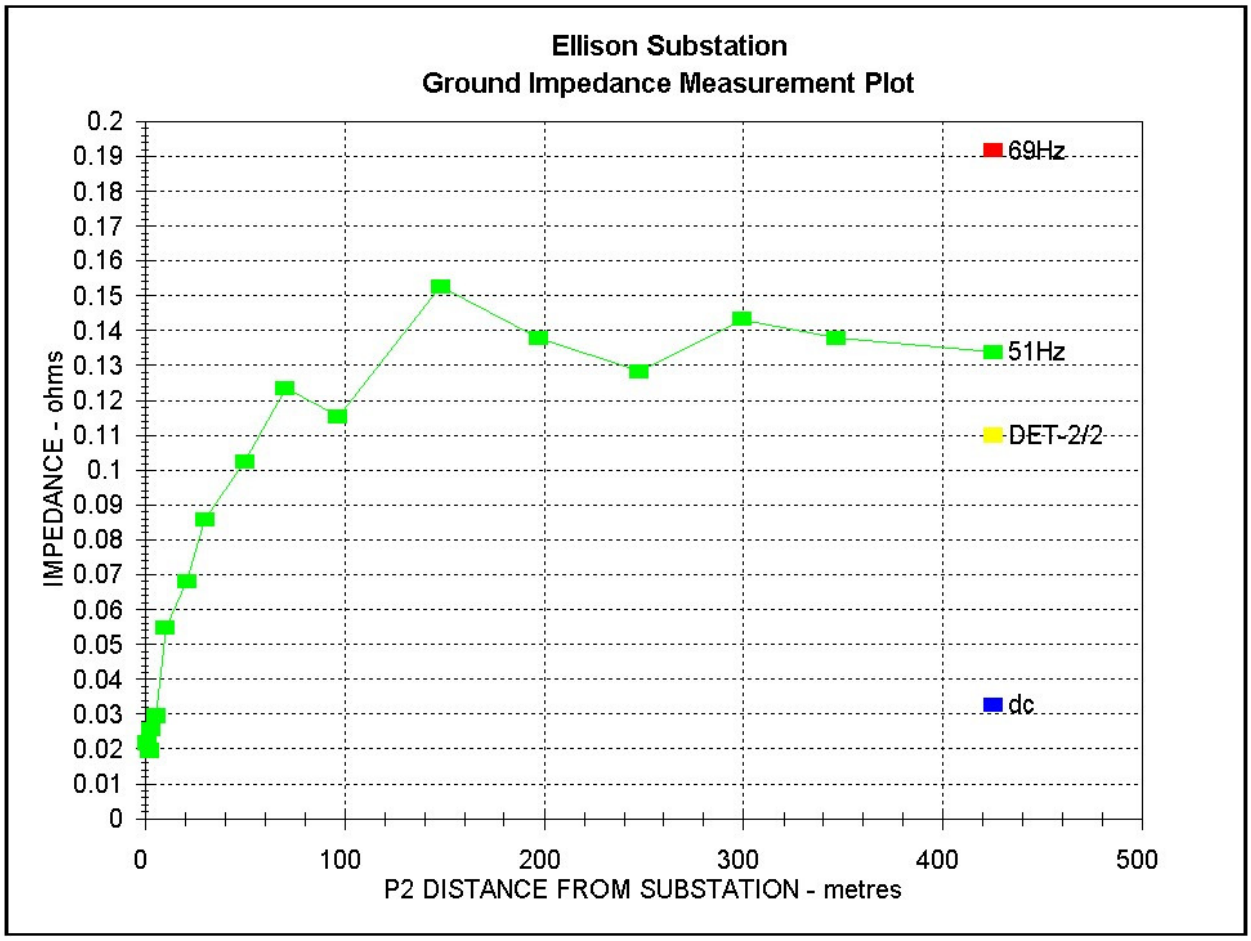

Figure 7 Plot of FOP Measurement with P2 Orthogonal to C2

Appendix D: FortisBC Generic Environmental Management Plan for Low to Medium Risk Projects

FortisBC Energy Inc.
Generic Environmental Management Plan
Low to Medium Risk Projects

April 15, 2011

Prepared for:

FortisBC Energy Inc.
16705 Fraser Highway
Surrey, British Columbia
V3S 2X7 Canada

Prepared by:

Westland Resource Group
203–830 Shamrock Street
Victoria, British Columbia
V8X 2V1 Canada

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Figures

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CONTACT LIST

Emergency Contacts

Contact	Contact #
FortisBC (gas) Internal Resource Management (IRM) Dispatch	1-866-221-3322
Provincial Emergency Program (PEP)	1-800-663-3456
DFO Spill Reporting line	1-800-465-4336
RCMP/Ambulance/Fire	911
Ministry of Environment Conservation Officer	1-877-952-7277
BC Safety Authority Safety Manager (Gas)	1-866-566-7233
BC Oil and Gas Commission	1-866-663-3456
FortisBC (gas) Environmental Affairs	
Leslie Kristoff	604-592-7680 (office) 604-842-7188 (cell)
Jennifer Robertson	604-576-7129 (office) 604-839-6952 (cell)

Project Specific Contacts

Title	Name	Contact #
FortisBC (gas) Project Manager		
Contractor Representatives		
Project Manager		
Site Superintendent (if different than above)		
Environmental Monitor (if applicable)		
Others		

1.0 INTRODUCTION

1.1 Corporate Information

FortisBC Energy Inc. [FortisBC (gas)], a subsidiary of Fortis Inc., is a leading provider of energy and utility services in western Canada. FortisBC (gas) is one of the largest distributors of natural gas in British Columbia, serving approximately 96% of the province's natural gas customers, including residential areas and businesses.

The FortisBC (gas) system is divided into three service areas in British Columbia, including the Lower Mainland, Vancouver Island, and Whistler (Figure 1).

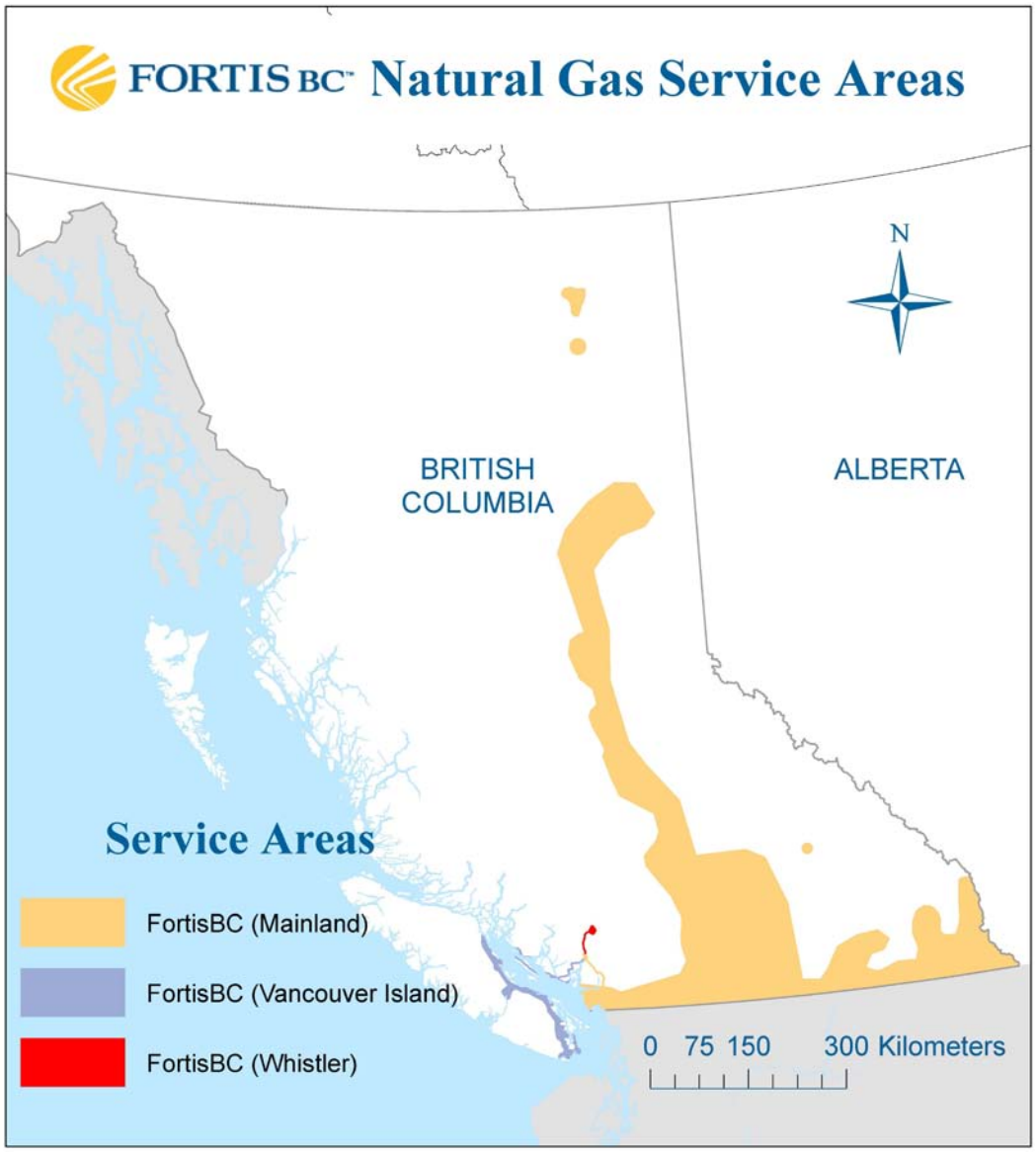

Figure 1. Map of FortisBC (gas) British Columbia service area.

Environmental responsibility

The FortisBC (gas) commitment to the environment extends throughout the company. From water, land and air, FortisBC (gas) is committed to supporting community growth, sustainability and environmental protection. FortisBC (gas) maintains its environmental commitments through several established work practices including:

- training of employees to be aware of and meet their responsibilities for environmental protection,
- integrating environmental protection measures into all elements of our business,
- communicating openly with stakeholders about the effects of our activities, and respond promptly to their concerns,
- working with industry associations, governments and other stakeholders to establish standards for the environment appropriate for our business, and
- using resources efficiently and effectively.

1.2 Scope of Environmental Management Plan

This Environmental Management Plan applies to contractors hired by FortisBC (gas) to undertake small and medium sized projects, which do not require an application to the British Columbia Utilities Commission for a Certificate of Public Convenience and Necessity (projects under $5 million). Specifically, this EMP is designed for use on projects with low and medium risk activities (*i.e.,* routine pipeline and facility maintenance works) as defined by FortisBC (gas). For high risk activities (*i.e.,* working in around streams) site specific Environmental Protection Plans (EPPs) that outline project- and site-specific management of environmental risks may be required. Some small to medium projects may include elements that are high in environmental risk, such as the use of excavation equipment to install culvert crossings of fish bearing streams. Table 1 summarizes contractor work categories with low, medium, and high environmental risks.

Topics included in this EMP include:

- general environmental management during work,
- hazardous materials and management,
- waste management and disposal,
- erosion and sediment control,
- working in and around ditches and watercourses,
- working in and around terrestrial natural areas, and
- environmental incidents and spills.

Table 1. Contractor environmental risk levels

Contractor category	Environmental Risk
Consultants (non-physical work)	
Engineering	Low
IT consultants	Low
Environmental support	High
Geotechnical and environmental consultants	Low
Field Contractors (construction on gas system)	
Mains and Services and System Improvement construction	High
Pipeline construction	High
Backhoe and tracked excavation equipment	High
Cutting and replacing pavement	High
Traffic control	Low
Hydrovac	High
Welding	Medium
Other construction field contractors	High
Field contractors (operations and maintenance)	
Vegetation management and right of way clearing	High
Leak survey	High
Helicopter service	Low
Other operations and maintenance field contractors	High
Facility Contractors	
Janitorial	Low
Electrical	Low
HVAC	High
Window washing	Low
Landscaping and grounds maintenance	High
Other facility contractors	Medium

Works that may require preparation of site specific EPPs include:

- working in and around natural areas (*i.e.*, agricultural land, forested land, or designated parcels of protected land),
- working in and around streams,
- working in an area with species at risk,
- working in and around wetland areas, and
- working in or around contaminated sites.

2.0 GENERAL ENVIRONMENTAL MANAGEMENT DURING WORK

2.1 Permits and Notifications

Some projects require work in or near sensitive aquatic and terrestrial ecosystems, and therefore require appropriate regulatory permits or notifications. In the event that projects require environmental permitting, such documents will be obtained by FortisBC (gas) project managers or distribution planners prior to project commencement and will be kept onsite.

NOTE: The Oil and gas Commission (OGC) may be responsible for issuing permits related to work in and around natural areas and streams for intermediate and transmission pipelines.

It is the responsibility of the contractor to follow all requirements of environmental permits issued or approved by federal or provincial regulatory agencies, and to keep copies of all permits and authorizations on site at all times.

Typical permits, authorizations, and notifications for construction works are outlined below.

Watercourses

Works in and around streams may be regulated federally by Fisheries and Oceans Canada (DFO), the British Columbia Ministry of Environment (MoE), and the Oil and Gas Commission (OGC). The provincial legislation relevant to works in and around streams is the *Water Act* (Section 9). In some regions, approvals obtained through the Riparian Areas Regulation will also be required. Federally, the *Fisheries Act* may apply to works in and around fish bearing streams.

When fording watercourses, ensure that the appropriate approvals and notifications are in place from the DFO, MoE and/or OGC. When possible, adhere to the appropriate fisheries timing windows if there is risk of disrupting sensitive fish life stages (i.e., spawning).

Drilling

The ground water protection measures in the *Water Act* are relevant to drilling wells in relation to deep anode beds, ground water monitoring wells, and geotechnical drilling prior to directional drilling.

Natural areas

The following permits **may be required** when working in and around natural areas. Contact FortisBC (gas) Environmental Affairs or a qualified environmental professional to discuss

potential permit requirements as these requirements are often project specific and can change at any time.

- In a designated area, and environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) or *British Columbia Assessment Act* may be required.
- In a national wildlife area, a permit is required under the Wildlife Area Regulations to remove soil, damage, destroy, or remove a plant, or carry on any commercial or industrial activity.
- On forested land, permits (Licence to Cut) from the British Columbia Ministry of Forests and Range (*Forest Act, Forest and Range Practices Act*, and *Private Managed Forest Land Act*) or the OGC may be required.
- If agricultural land is within the Agricultural land Reserve (ALR), a permit may be required form the Agricultural land Commission (ALC) or the OGC to undertake works.
- On agricultural land, with unharvested crops or crops laying on it, permits form the ALC or OGC must be obtained before vehicles are allowed on the land.
    - In addition, a written agreement must be in place with the land owner with respect to access and compensation.
- On agricultural land, a permit from the regional board or municipal council may be required to import or remove soil or fill from a site.
    - In addition, written approval must be received from the ALC and a written agreement in place with the land owner.

NOTE: If the Contractor is working in an environmentally sensitive area, near a watercourse, or a natural area, and no environmental permits have been provided by FortisBC (gas) as part of the work package, the Contractor must contact the FortisBC (gas)Project Manager before beginning construction to determine whether permits are required.

Timing Windows

The environmental agencies (DFO, MoE, and Environment Canada) determine any fisheries or wildlife timing windows that may apply to the proposed work (i.e., salmon spawning, bird nesting, etc). When possible, works should be timed to avoid these sensitive timing windows.

2.2 Communication

Minimizing risks to the environment requires maintaining excellent communication between Contractors and FortisBC (gas) and its agents.

The contractor will communicate any aspects of the project that potentially pose a risk to the environment to the FortisBC (gas) Project Manager, Owner’s Representative, or the assigned

Environmental Monitor. The FortisBC (gas) Project Manager or Owner's Representative will maintain communication with FortisBC (gas)'s Environmental Affairs Department in case of incidents, or to obtain advice to reduce risks to the environment.

If unforeseen changes in environmental conditions (*i.e.*, slope instability, flooding) occur on the project site, the contractor will contact the responsible FortisBC (gas) representative for guidance. The contractor will notify the FortisBC (gas) Project Manager or the Project's Environmental Monitor (if applicable) in advance of any work of moderate to high environmental risk.

All environmental incidents must be reported to Environmental Affairs within three business days of the incident by submission of the *Spill/Environmental Incident* reporting form (see Appendix A).

2.3 Potable Water Protection

If the potential for impacting on a potable water source/well exists, FortisBC (gas) and/or the Contractor will take all precautions necessary to avoid impacting on the water source/well. If required, a qualified professional will be contracted to:

- develop mitigation strategies,
- undertake water sampling, testing, and analyses (pre and post construction), and
- develop a suspension of service plan in the event of impacts to the well and/or water supply system.

2.4 Artesian Well Protection

Note: The measures outlined below are applicable to drilling projects.

FortisBC (gas) or the Contractor, dependant on the contract language, will search the Land and Resources Data Warehouse, the Ministry of Environment (MoE) Water Stewardship Division's BC Water Resources Atlas, and/or the WELLS Database, where appropriate to determine if there are any artesian wells in close proximity to the drilling location.

All efforts will be made to avoid locations with potential conflicts. If an artesian well is unexpectedly encountered, the Contractor must ensure that the well is sealed according to the British Columbia *Water Act* and the Ground Water Protection Regulation (including the Code of Practice for Construction, Testing, Maintenance, Alteration and Closure of Wells in British Columbia) and that any sediment laden water is directed away from nearby watercourses and storm sewers, where possible.

If sediment laden water enters a watercourse or storm sewer this must be handled as an environmental incident/spill. Additional information on water management and/or erosion and sediment control measures can be found in this document.

2.5 Wildfire Prevention and Suppression

Contractors will ensure they are aware of the *Wildfire Act* and regulations and understand their responsibilities under this legislation. Many of FortisBC (gas) Gas' operations are classified as "industrial activities" or "high risk" activities under the *Wildfire Act* and regulation and therefore must conform to statutory requirements. Contractors may be required to prepare a Fire Prevention and Suppression Plan (FPSP) or undertake a wildfire hazard assessment if they are undertaking industrial or high risk activities. In addition to the FPSP and the assessment, the Contractor must ensure that all equipment, apparatus, and materials are maintained in a manner to reduce the likelihood of starting a fire on or adjacent to the site, that the site is maintained in a manner that prevents any fire from spreading off the site, and that they are prepared to act in the event of a fire starting.

Immediately report all fires, operational or otherwise, to 911 if it is a residential/urban fire or to the local Ministry of Forests or to 1-800-663-5555 or cellular *5555 and to the FortisBC (gas) representative.

3.0 HAZARDOUS MATERIALS MANAGEMENT

3.1 Common hazardous materials

A hazardous substance includes any product, substance, or mixture thereof that is declared to be harmful, hazardous, toxic, controlled, restricted, or prohibited under any federal or provincial environmental law. The use, storage, manufacture, transportation, handling, or release of hazardous materials into the environment are prohibited, controlled, and regulated under federal and provincial environmental laws.

The occurrence of hazardous waste is not anticipated during the course of regular works. However, it should be noted that absorbent materials or soils saturated with oil or gasoline are classified as special waste. Soils and/or other materials contaminated by petroleum products, chemicals, or other undesirable materials will be cleaned up according to the manufacturer's instructions and to regulatory standards. Contaminated soils will be excavated, treated on-site, or hauled off-site to accepted treatment/disposal area. Provincial Hazardous Waste Regulations, with respect to storage, land filling, and disposal of materials, will have to be adhered to by FortisBC (gas) employees and its contractors.

In the event of discovery of hazardous waste on site, the contractor will immediately notify the FortisBC (gas) Project Manager and proceed to remedy the situation in consideration of the health and safety of employees, the public, and the protection of the environment.

A hazardous substance may be any one of the following:

- Dangerous goods (see Transportation of Dangerous Goods Regulations).
- A substance that, if discharged into water or onto land or emitted into the air, would substantially alter or impair the usefulness of the environment (see *Environmental Management Act*, s. 1).
- A substance that is a controlled or restricted product.
- A substance that if it entered the environment in a certain quantity or concentration or under conditions would or could:
    - have an immediate or long-term harmful effect on the environment or its biological diversity,
    - constitute a danger to the environment on which life depends, or
    - constitute a danger to human life or health (see *Canadian Environmental Protection Act*, 1999, s. 64).

Potentially hazardous materials often used during projects include:

- Diesel fuel,
- Hydraulic oil, and
- Engine coolant.

The uses of potentially hazardous materials (*i.e.,* diesel fuel) are necessary for the operation of equipment and vehicles used for regular maintenance and construction by a variety of contractors. Volumes of these fluids will be minimized on site to the capacity of the equipment in use. Excess fluids will be stored offsite and delivered on an as needed basis.

3.2 Risk Identification

Some projects will require use of machinery (*i.e.*, small trucks, tandem-axle vehicles, and brushers) that use fuels, lubricating oils, and hydraulic fluids. These fluids can negatively impact terrestrial and aquatic environments and must be carefully managed. All equipment will be kept in excellent working order and will be regularly inspected for fluid leaks.

Activities with increased risk of release of hazardous materials include:

- refuelling of machinery;
- improper storage of hazardous materials;
- equipment breakdown, and
- accidents.

Before a contractor can begin work transporting, processing, or disposing of hazardous waste, the contractor must have the necessary qualifications, skills, permits and expertise to safely perform the contracted operations and must be confirmed to be reputable.

3.3 Measures

Containment and storage

Any fuel or lubricants are stored on site must have secondary containment capable of holding 110% of the contents of the container. This may be achieved through the use of double-walled storage tanks or by constructing a polyethylene-lined containment berm under tanks. Fuel storage and containment areas must be covered with polyethylene tarps to prevent the accumulation of rainwater. Containment areas must be inspected regularly and pumped out for off-site disposal if water accumulates.

Transport

The transportation of hazardous materials will occur with appropriate equipment and signage and will follow Transportation of Dangerous Goods Regulations.

Vehicle servicing/fuelling

The following procedures for vehicle servicing and fuelling will be followed:

- Care is taken not to overfill any vehicle or equipment fuel tanks.
- Fuelling of equipment and refilling field containers will be carried out at least 30 m from water bodies or wetlands.
- No vehicles or equipment will be serviced or refuelled in riparian areas at any time.
- Equipment with hydraulic fittings must be free of leaks and inspected daily.
- Hazardous materials must be labelled according to the Transportation of Dangerous Goods (TDG) regulations.
- Appropriate containers must be used for the storage of fuel or lubricants.
- Equipment operators will use sealable hazardous waste containers for disposal of such items as oil containers, grease tubes, and used absorbent pads. The contractor will dispose of these items at a facility that processes hazardous materials.

4.0 WASTE MANAGEMENT AND DISPOSAL

4.1 Common activities

Regular project works will generate garbage and waste from common materials use. Garbage and waste is defined as all non-hazardous litter, waste, and refuse for disposal associated with construction or maintenance activity.

In the event that unanticipated waste is generated during project construction, or if hazardous materials are discovered, the contractor will immediately contact the FortisBC (gas) Environmental Representative for appropriate containment and disposal measures.

4.2 Risk identification

Common work related sources of waste generation include:

- tool and parts packaging,
- food wrappers and scraps;
- fluid containers (i.e., oils, antifreeze), and
- construction waste and garbage (*i.e.,* wooden pallets, plastics)

The *Environmental Management Act* prohibits the introduction of waste into the environment, unless with a permit, approval order, or regulation. The *Indian Act* prohibits the disposal or burning of waste on native lands without a permit. Waste and litter have a negative impact on the environment and may injure fish and wildlife species, livestock, pets, and people if not handled properly. The contractor will identify potential sources of waste generation and will confirm with a FortisBC (gas) representative the appropriate containment and disposal procedures.

4.3 Measures

Any solid wastes generated during work on project sites and requiring disposal off site will need approval from the local landfill operator prior to disposal. Local landfills may have specific restrictions regarding the types of waste they accept. FortisBC (gas) employees and their contractors are required to comply with these procedures. All food wastes will be removed from project sites on a daily basis to prevent any wildlife attraction.

Contractors will handle, store, transport, and dispose of garbage and waste in accordance with all applicable statutes, regulations, bylaws, permits, codes, licenses, and orders. Contractors will:

- Provide on-site garbage collection facilities for the disposal or recycling of lightweight materials.

- Collect and store waste in appropriate containers and, and using appropriate methods, transport them to an authorized transfer, landfill, or recycling site.
- The transfer, landfill, or recycling site must be authorized by the appropriate federal, provincial, regional, municipal, or First Nations authorities.

Cleanup and restoration

Contractors will maintain a clean work site and restore project areas after project completion including:

- Upon completing construction and after each maintenance activity, Contractors will return the affected work and surrounding area to as close to original condition as is practicable.
- Dispose of blasting refuse such as dynamite containers, cartridges, and caps using locations and methods approved by the explosives inspector from Natural Resources Canada (NRCan).
- Collect all methanol, ethylene glycol, and water contaminated by freezing depressants in tanks to prevent them from entering natural bodies of water or being buried on-site and dispose of as hazardous waste.
- During cleanup, remove and dispose of all construction garbage and waste including:
  - spent welding rods,
  - PE shavings from butt fusions,
  - wood skids,
  - shoring,
  - scrap pipe, and
  - drums.
- If waste is to be burned, check for and meet all open burning smoke control regulations and bylaws. See the Open Burning and Smoke Control Regulation in the *Environmental Management Act*.

5.0 EROSION AND SEDIMENT CONTROL

5.1 Common activities involving soil handling

Common project activities that have potential to cause soil erosion and sediment transport include material excavation, transport, and stockpiling, vegetation removal, and operating equipment on slopes with soils exposed to rain and strong winds.

Erosion is the process of soil particles becoming detached and transported by means of wind, water, or ice. Conditions most likely to produce erodible soil are steep topography, surface water drainage or ground water seepage, vegetation removal, ground disturbance, and extreme weather. Soil particles, also referred to as sediment, are easily suspended in water, and in excessive amounts can be hazardous to aquatic life.

Site specific erosion and sediment control planning may be required where aspects of the project have the potential to introduce sediments to watercourses supporting fish or amphibian species.

5.2 Risk identification

Soil erosion and sediment transport may occur during the construction, operation, or maintenance any gas line, facility, access road, or other related activity on erodible soil. When practicable, the Contractor will modify construction techniques to avoid erodible areas, minimize grade changes requiring excessive cuts and fills, and employ appropriate erosion and sediment control measures. Where work is required on erodible soil, a site-specific Erosion and Sediment Control (ESC) Plan may be required.

The Contractor will communicate with the FortisBC (gas) Project Manager and/or FortisBC (gas) Environmental Affairs in regards to appropriate erosion and sediment control measures.

5.3 Measures

The general goals of erosion and sediment control include but are not limited to:

- prevent soil erosion on areas of the project site affected by work practices,
- control the movement and deposition of sediment associated with work on the project site, and
- to ensure water quality leaving the work area on the project site is comparable to background levels.

Erosion and sediment control measures should be installed before starting any activities that may result in sediment mobilization. General works that may increase the risk of erosion or sediment transfer include access construction, clearing and grading, excavation, cleanup and restoration.

Access

The following measures will apply to minimize erosion risks associated with access to the work area:

- Use existing roadways, bridges, and culverts where possible,
- Minimize access points,
- Construct access roads out of suitable, non-erodible material,
- Use work pads if required, and incorporate erosion and sediment control measures on approaches to creek crossings (*i.e.*, bridges or culverts).

Clearing and grading

The following measures will apply during works requiring clearing of vegetation, and grading to prepare work sites:

- Clearing of vegetation will occur as late as possible before initiating construction activities. Note that vegetation clearing may be restricted during the Migratory Bird nesting season.
- Use equipment that will minimize surface disturbance, silt compaction, and topsoil loss. This includes use of low ground pressure track or tires, small trenchers, trenchless technology, ploughs, and hand digging.
- Hand clear vegetation in areas that do not require grading.
- Terrace across steep slopes to restrict the need for deep cuts.
- Restrict root grubbing to the trench line on erodible soils to maintain soil cohesion and minimize erosion.
- When grubbing, use a root or brush rake to reduce surface disturbance and topsoil loss.
- Restrict grading to the greatest extent possible (*i.e.*, pipeline right-of-way and temporary work space only).
- Develop a surface water control plan if required.
- Divert clean water around the construction area where possible.
- Construct sediment settling ponds if required.
- Pump sediment-laden water to stable vegetated areas for infiltration to the ground and ensure that sediment laden water does not enter a watercourse or storm sewer system.

Excavation

The following measures will apply to works requiring excavation.

- A project-specific soil management plan may be required in cases where excavation of soil presents moderate or high environmental risks (*i.e.*, contaminated soils, agricultural soils).

- Minimize the area of disturbance.
- Cover the stockpiles with mulch or other materials (*i.e.,* tarps) if they will be left exposed for long periods of time or if the weather conditions warrant extra precautions.
- Backfill as quickly as possible after lowering-in and testing, compacting the subsoil in lifts, and spreading any remaining spoil over the trench area before replacing the topsoil.
- Remove any excess spoil from the area.

Cleanup and restoration

Contractors will adhere to the following measures if works required disturbance or excavation of soils:

- Spread salvaged topsoil over the stripped areas.
- Delay replacing the topsoil in wet weather or high wind until the weather is more favourable.
- Revegetate the disturbed area as soon as possible after construction, with a regionally appropriate seed mix.
- Scarify the soil to create micro-sites for revegetation (*e.g.*, running cleat tracks perpendicular to the slope.
- Use broadcast or hydroseed seeding methods to ensure even application of seed.
- During winter cleanup operations, manually revegetate by hydroseeding or using seed mats, with a quick growth crop, such as rye grass, to foster early growth and slope stability.
- Follow-up work may have to be scheduled to complete restoration if initial seeding was during an unfavourable time of year.
- If necessary, restrict access to reseeded areas until the vegetation re-establishes itself.
- Remove any remaining non-biodegradable sediment and erosion control measures (*i.e.,* silt fence) once the site is stable.

General erosion and sediment control measures

Existing site conditions should be considered when planning and implementing erosion and sediment control measures. There are several methods of preventing erosion and managing sediment including surface protection, water filtration, water retention, and using slope breaks.

Surface protection

Surface protection mechanisms prevent erosion by covering the surface of erodible soil with a physical protective layer. Examples of materials that can be used include:

- tarps
- polyethylene or geotextile coverings,
- erosion control blankets (i.e., straw, jute, or coconut matting, seeded or unseeded),
- water (i.e., spray surface soil to keep down dust if wind erosion is a concern),
- mulch,
- hydroseed with or without tactifier and seed, and
- work pads (Table 2).

Table 2. Work pad categories

Material	Comments
Sand	May not be acceptable in agricultural soil. Requires a large amount for good bearing strength.
Gravel	May not be acceptable in agricultural soil. Has a high bearing strength.
Hog fuel	Prohibited within 30 m of surface water due to leachable organic compounds. Inexpensive material.
Wood chips	Not permitted near fish bearing waters. Inexpensive material.
Corduroy logs	Railway ties or creosoted timbers are not permitted. Green logs not permitted near fish bearing waters. Expensive material. Has a high bearing strength.
Geotextile fabric	Can greatly help bearing strength, eases removal of work pad materials, and prevents mixing of topping material and native soil. Permanent placement may not be acceptable.
Interlocking work pads (Steel, concrete, wood)	If access area is small, interlocking pads can create an access route. The pad type can prevent mixing of soil layers.

Filtration

Filtration mechanisms aid in the removal of sediment from dirty water. Examples of filtration techniques and equipment that may be used include:

- filter fabric (*i.e.,* silt fences),
- clean rock check dams, and
- catch basin inserts or covers (*i.e.*, silt sacks), and dewatering bags.

Water Retention

Water retention mechanisms hold dirty water, thus decreasing its velocity, adding in the removal of sediment from the water. Examples of water retention techniques that may be used include sediment settlement ponds and water tanks.

Slope Breaks

Slope break mechanisms decrease the length of the slope that water continuously travels along by breaking the slope into shorter sections. This method decreases the speed of the flowing water, thereby decreasing erosion potential and aiding in the removal of sediment from the water. Examples of slope breaks that may be used include:

- trench breakers,
- diversion berms or water bars,
- lined or grassed swales,
- check dams,
- fiber rolls or wattles (i.e., staw or coconut materials) installed mid slope.

6.0 WORKING IN AND AROUND DITCHES AND WATERCOURSES

6.1 Pre-planning of work

Projects that require work in or around ditches and watercourse will require appropriate environmental permitting and measures to protect fish and fish habitat. Ditches and watercourses have the potential to support a wide variety of aquatic life including fish, amphibians and species at risk. If the fish-bearing status of a ditch or watercourse is unknown, it should be considered a default fish bearing stream until proven otherwise.

Site specific EPPs may be required for works associated with ditches and watercourses. The contractor will communicate with the FortisBC (gas) Project Manager and/or FortisBC (gas) Environmental Affairs in regards to appropriate measures to protect fish and fish habitat.

6.2 Risk Identification

Common project activities that have the potential to produce risks to the existing conditions (*i.e.,* water quality, fish and fish habitat) of ditches or watercourses include but are not limited to:

- watercourse crossings (*i.e.,* culverts, clearspan bridges),
- removal of riparian vegetation,
- temporary water diversions,
- upslope earth works (*i.e.,* excavations, clearing and grubbing), and
- working near water during inclement weather conditions.

6.3 Measures

Riparian areas

Riparian areas are usually vegetated, and connected or immediately adjacent to the banks of a watercourse or waterbody. Several key measures should be followed when working in or near riparian areas including:

- Contractor may be asked to prepare a site specific EPP that outlines measures to minimize disturbance of the riparian areas during works.
- Any disturbance of existing stream bank vegetation will be as minimal as possible and no stream banks will be impacted during work.
- Riparian zones will be clearly marked in the field using survey tape prior to initiation of clearing.
- Work in riparian areas may require permits or authorizations and detailed work plans which should be obtained prior to any work occurring in these areas.

General Best Management Practices

Contractors will adhere to the following Best Management Practices to prevent and mitigate potential risks to fish and fish habitat during instream works:

- If work is in or adjacent to drainage, work will be carried out during favourable weather and low flow conditions. Work will be pursued to completion as quickly as possible once started.
- Machinery will work from the dry stream channel, top of bank, road or bridge surface. No machinery will be required in a wetted stream channel.
- Disturbance to existing vegetation will be minimized as much as possible.
- The Contractor will work in a manner that minimizes the risk of introducing silt, sediment, sediment laden water, or any other deleterious substances into drainages, floodplains, ravines or storm sewer systems.
- Sediment and erosion control materials will be readily available on-site and implemented where appropriate. If proposed works have the potential for erosion, sediment and erosion control measures such as silt fence, gravel berms, check dams, sediment settling ponds, catch basin silt sacks, *etc*., will be installed prior to start-up. When excavating immediately adjacent to drainages, silt fence will be installed along the top of drainage bank.
- Sediment-laden water will be contained and filtered on-site or pumped to a stable vegetated area for infiltration to ground. Alternately, sediment-laden water could be pumped to sanitary sewers or removed from the site via pumper truck.
- Spoil excavated from the trench line will either be stockpiled in a stable location for use as backfill or trucked off-site. Excavated material will be placed away from the drainage during work. Spoil stockpiled for more than a day will be covered with polyethylene sheeting and surrounded with silt fence. If moderate to heavy rain is forecast at any time during construction, all spoil piles will be covered with polyethylene sheeting.
- Once ditching and pipe installation has commenced, work will be pursued to completion as quickly as possible to allow for backfilling. The extent of ditch line left open will be minimized as much as possible.
- Rock, riprap or other materials placed on the banks or within the active channel or floodplain of the drainage, will be inert, and free of silt, overburden, debris or other substances deleterious to aquatic life.
- Fill materials will be inert, free of contaminants and placed so that they will not gain entry into any drainage, floodplain, ravine or storm sewer system. Bark mulch, hog fuel or other wood waste material will not be used within 30 m of any drainage.
- There will be no use of treated wood products in any construction below the high water mark of the stream channel.

- Equipment and machinery will be in good operating condition, free of leaks or excess oil and grease. Equipment refuelling or servicing will be undertaken a minimum of 30 m from any drainage.
- All disturbed areas will be graded and stabilized following construction. Disturbed areas will be seeded, revegetated or sodded with native and regionally appropriate species as soon as possible following construction.
- Any disturbed stream bank areas will be protected from surface erosion by:
  - hydroseeding with a heavy mulch, tactifier, and seed mix;
  - installing erosion blankets; and/or
  - placing native sod.

7.0 WORKING IN AND AROUND NATURAL AREAS

7.1 Definition

Natural areas are areas of land with minimal human occupancy including but not limited to:

- agricultural land,
- forested land, and
- designated areas (*i.e.,* parks or conservation areas).

These areas often contain high biodiversity and require the application of extra environmental protection measures.

7.2 Risk Identification

The potential risks associated with working in and around natural areas include:

- interfering with the land owners' or leaser's use of the land,
- ground disturbance leading to erosion and sediment generation,
- reduced soil productivity,
- spread of noxious weeds (*i.e.*, invasive plants),
- full or partial removal of vegetation and associated values including:
  - fisheries,
  - timber,
  - recreation,
  - scenery,
  - biodiversity,
  - riparian and aquatic habitat,
  - wildlife and wildlife habitat,
  - wilderness,
  - water use and water quality,
  - botanical forest products,
  - heritage and culture, and archaeology.

7.3 Measures

When working in and around natural areas, FortisBC (gas) and the Contractor will seek to minimize environmental impact. A project specific EPP may be required that outlines measures to minimize risks to the natural area. Contractors will adhere to the following environmental protection measures whenever possible and applicable:

Generic (applies to all natural areas)

- Make appropriate modifications to construction techniques to avoid disturbance of natural areas.
- Avoid rutting by tracked or tired vehicles.
- Create openings in spoil piles and continuous pipe sections to allow the passage of surface water, vehicles, equipment, livestock, and wildlife.
- Use work pads in areas where the soil cannot support the excavation equipment or where soil compaction may take place.
- Give landowners and occupants advance notice if blasting is to occur.
    - Use blasting mats to prevent damage from fly-rock.
    - Immediately collect fly-rock and dispose of it at a rock pile with landowner approval.
- Prevent the establishment or spread of invasive plants/noxious weeds by:
    - Checking vehicles and clothing prior to entering the RoW. Inspecting the undercarriage and tires of all vehicles and removing any plant material or large clumps of soil found. Also check all clothing and boots for plant parts and seeds (pay attention to pant cuffs). Bag the plant part and dispose of in the garbage.
    - Once on the RoW, inspecting the undercarriages of vehicles regularly and removing any plant material found. Leave plant parts on the RoW or bag the plant part and dispose of it in the garbage.
    - Prior to exiting the RoW, inspecting the undercarriage and tires of all vehicles and removing any plant material or large clumps of soil found. Also, check clothing and boots for plant parts and seeds (pay attention to pant cuffs). Leave plant parts/soil on the RoW or bag it and dispose of it in the garbage.
    - Steam cleaning (at designated cleaning stations) of equipment may be required if mud tracking or digging equipment has excessive soil adhering to the equipment.
    - Minimizing unnecessary soil disturbance during RoW access.
    - Preventing vehicles from moving freely between infested and non-infested area.
    - Reporting invasive plant/noxious weed infestations to the FortisBC (gas) Representative

Agricultural land

When working on agricultural land, a site specific plan may be developed and implemented by FortisBC (gas) and the Contractor to minimize the risks on the agricultural productivity of the land and meet regulatory requirements and landowner agreements.

8.0 ENVIRONMENTAL INCIDENTS AND SPILLS

8.1 Definition of Environmental Incidents and Spills

An environmental incident is an accident or deleterious event that has caused or has the potential to cause harm to the environment. These events include, but are not limited to:

- damage to fish and/or fish habitat,
- damage to wildlife and/or wildlife habitat,
- the discovery or disturbance of an archaeological or heritage site, and
- spills.

A spill is an unauthorized release or discharge of a substance that is not immediately contained and has the potential to harm human health or the environment.

8.2 Activities with risk of causing environmental incidents

Vegetation clearing activities on a ROW that have the potential to cause environmental incidents include but are not limited to:

- equipment crossing streams,
- unauthorized removal of riparian vegetation,
- unauthorized removal of vegetation (i.e., shrubs) during the breeding bird nesting window between March 15 and August 15. The federal *Migratory Birds Convention Act* (MBCA), and provincial *Wildlife Act* prohibit the destruction, or disturbance of active bird nests, and
- equipment refuelling or breaking down resulting in spills of hazardous or deleterious substances onto land or water.

8.3 Measures

Contract requirements

Contractors will follow best practices as identified by FortisBC (gas) and outlined in contract documents. If unforeseen changes in environmental conditions (*i.e.*, slope instability, flooding) occur on the right of way or project site, the contractor will contact the responsible FortisBC (gas) representative for guidance. No unauthorized vegetation clearing or brushing will occur on or off the right of way or project site.

Spill prevention

Contractors will identify potential hazards (*i.e.,* refuelling equipment on a slope), determine the level of risk for activities that could result in a spill, and take measures to reduce the potential of a spill. All efforts will be taken to minimize the risk of spills, including:

- Maintenance of equipment on the right of way or project site will occur in manner that prevents spills to the environment.
- Absorbent pads will be placed underneath areas of the equipment or vehicles that require maintenance.
- Contractors will ensure that any equipment left on the right of way or project site overnight are secure and any fluid (*i.e.,* oil, engine coolant) containers are locked within the equipment.
- Before operation of equipment, operators will check for leaks and hydraulic hose connections for excess lubricants.
- All fuels and lubricants brought onto the right of way or project site will be stored in properly labelled containers and used in a manner that avoids potential spills.

Spill kits

Spill kits must be available in every vehicle and piece of equipment operating on the right of way or project site. All spill kits must be fully stocked and restocked as soon as possible if used. Example contents of a spill kit may include but are not limited to:

- 2 each - 10' Oil Only Socks
- 15 each - Polypropylene Sorbent Pads (oil only) 18" x 18" x 3/8"
- 2 each - 10 Quart Cellulose Sorbent Material, Oil Only
- 1 each - Barrier Ribbon, Yellow "Caution Do Not Enter"
- 1 each - Poly Disposal Bags (45 gallon drum size, minimum 6 mil)
- 1 each - Blank Labels for Plastic Bags
- 1 each - Plastic Bag Tie
- 1 each - Epoxy Plug Compound (hydrocarbon compatible)
- 1 each Spill Kit Container Marked "Spill Response Kit"

8.4 Environmental incident and spill response and reporting

In the event that an environmental incident or spill occurs the response procedures should be followed. Note that the following information was adopted from FortisBC (gas)procedures for spill reporting, response, and cleanup.

Step 1. Ensure personal and public safety.

- Stop work in the vicinity of the incident/spill immediately.
- If required, tend to injuries and causalities.
- Secure the site (*e.g.*, stop traffic and cordon off immediate danger area).
- Assess the situation to determine magnitude of the incident and degree of response required.
- If the incident involves a spill:
  - Isolate the spill.
  - Remove or eliminate all ignition sources if spill is a flammable substance.
  - Refer to the Material Safety Data Sheet (MSDS) to obtain specific response information on the spilled substance to identify risk and determine best method of containment and cleanup.
  - Follow appropriate emergency procedures for responding to spills.
  - Initiate evacuation procedures if required.
- Request assistance as required based on the magnitude of the incident/spill. Either contact the services individually:
  - **police** for evacuation and traffic and crowd control,
  - **fire department** for fire fighting, vapour dispersion, and first aid,
  - **ambulance** for injuries and first aid, and
  - **company support** for labour, equipment, technical assistance, and situation management.

  OR

  - contact FortisBC (gas) Emergency Services at 1-800-663-9911 and identify emergency assistance required (police, fire, and ambulance).
  - Provide an initial report of the incident/spill as soon as incident/spill response allows (see Step 2).

Step 2. Report internally.

- Report all spills to the FortisBC (gas) representative.
  - The Contractor will determine the level of reporting with assistance from FortisBC (gas) if required. A report is triggered by the material type, volume, and/or location of an incident.
  - See Table 3: *Spill Reporting Thresholds* for internal reporting levels of commonly used substances. If a spilled material or liquid is not defined in Table 3, refer to environmental legislation for spill reporting requirements, if necessary contact Environmental Affairs.

- Complete Form 1458 *Spill/Environmental Incident Report* (see Appendix A) and submit to Environmental Affairs within three business days of the spill.

Table 3. Spill Reporting Thresholds

Substance	External Report	Internal Report
Hydraulic oil	100 litres or more	More than 5 litres
Engine oil	100 litres or more	More than 5 litres
Lube oil	100 litres or more	More than 5 litres
Waste oil	25 litres or more	More than 5 litres
Diesel oil	100 litres or more	More than 5 litres
Gasoline	100 litres or more	More than 5 litres
Engine coolant	5 litres or more	More than 1 litre
Solvents	100 litres or more	More than 5 litres
Contaminated soils	25 kg or more	Free product/strong odour/discoloration
Any other substance	Contact environmental affairs	More than 5 litres

Note: When any **spill enters into a waterway** it must be immediately reported to the Provincial Emergency Program (PEP) at **1-800-663-3456** and Fisheries and Oceans Canada (DFO) at **1-800-465-4336**.

Step 3. Report externally.

- When a spill exceeds the externally reportable quantities (see Table 3: *Spill Reporting Thresholds)*:
  - Report the spill to the Provincial Emergency Program (PEP) at 1-800-663-3456.
  - Report the spill to FortisBC (gas) Environmental Affairs.
- When any amount of the spill enters or has the potential to enter a waterway, or an incident has the potential to impact a waterway, fish, or fish habitat:
  - Report to the Provincial Emergency Program (PEP) at **1-800-663-3456**.
  - Report to the Department of Fisheries and Oceans, Canada at **1-800-465-4336**.
  - Report to FortisBC (gas) Environmental Affairs.
- When an incident injures or causes the death of wildlife, the wildlife remains the property of the Crown (Province of BC).
  - Reported the incident immediately to the FortisBC (gas) Representative and FortisBC (gas) Environmental Affairs.
- When an environmental incident or spill involves a fire, fatality, serious injury, explosion, or may be a health hazard:
  - Report to FortisBC (gas) representative and FortisBC (gas) Environmental Affairs.
  - Report to the WorkSafeBC if an employee has been seriously injured or if there is an employee fatality.

- When the spill involves an unplanned natural gas or propane release:
    - Immediately report to FortisBC (gas) emergency number at 1-800-663-9911 and the FortisBC (gas) representative.
- When a substance is being transported or stored, there is a spill, and the spill exceeds the reportable quantity (See **Table 3**: *Spill Reporting Thresholds*), or there is a fire, or there is damage to the container:
    - The Contractor must submit to Transport Canada within 30 days of the occurrence.
    - Copies of the *Dangerous Occurrence Report* form can be downloaded from the Transport Canada website http://www.tc.gc.ca/pdf/16-0013.pdf.

Step 4. Control and contain the incident/spill.

In case of a spill:

- Protect yourself.
    - Carry out actions only if they can be performed without incurring personal injury or exposure.
    - Use the appropriate personal protective equipment as per the MSDS.
- Control the spill.
    - Monitor the spill site to determine the extent of the spill.
    - If appropriate, approach from upwind.
    - Stop or control the leak if it is safe to do so.
- Contain the spill.
    - Contain land spills (*e.g.*, by dyking and isolating the spill).
    - Contain water spills (*e.g.*, by booming using oil wick pads or booms).
    - Block the liquid flow to any culverts, drains, ditches, watercourses, or environmentally sensitive areas.
- Clean up the spill and site.
    - Absorb small spills (less than 25 gallons or 100 litres) with sorbent material and pads.
- Spill kits are designed to handle spill up to 100 litres (25 US gal.). Do not attempt to clean up larger spills without assistance.

If the case of an incident involving fish or fish habitat:

- attempt to stop or contain the cause of the incident using some of the following techniques:
    - Hazardous Material Spill – stop the spill at source by shutting off or diverting the flow away from the fish habitat. Recover as much of the spilled material as possible
    - Watercourse bank collapse – stabilize the bank by grading to a stable angle, or by removing weight, to prevent further collapse or destabilization.

- Siltation – remove silt from construction site runoff using diversion berms, silt fencing, straw bales with filter cloth, or sedimentation weirs.

- Count and record any visible fish mortalities, collect all dead fish into a container, and keep written record of the on-site activities.

  If the case of an incident causing the death of wildlife on a public roadway:
  - the animal carcass should be moved from the roadway, if it is safe to do so.

Step 5. Dispose of wastes and spill debris

- **Do not burn any waste that may be contaminated.** Dispose of waste in accordance with proper disposal procedures. Arrange for waste disposal using an approved hazardous waste contractor.
- Place all contaminated waste materials (i.e., sorbent pads, booms) and contaminated soil in plastic bags and seal them. Place the bags in 200 litre (45 gallon) steel drums, seal them with lids, and label the drums identifying the contents.
- If material must be stored prior to disposal, store the drums away from heat, sparks, flame, water, and protect from rain.
- Ensure shipment of the hazardous waste is documented using a BC Waste Manifest (Provincial Government form MOE 04-1917 06/99). Contaminated material (*i.e.*, soil, sorbent pads, and booms) must be shipped as hazardous waste and documented using a Waste Manifest.

Step 6. Ensure spill kits are replenished.

- Refer to Section 8.3 for recommended spill kit contents.

8.5 Spill/environmental incident reporting form

See Appendix A for a FortisBC (gas) *Spill/Environmental Incident* reporting form. This form must be completed for all internally and externally reportable spills, and be provided to the FortisBC (gas) Project Manager and Environmental Affairs personnel within three (3) business days.

REFERENCES

British Columbia Ministry of Environment. *A Users' Guide to Working in and around Water: Understanding the Regulation under British Columbia's Water Act*. Accessible online at: http://www.env.gov.bc.ca/wsd/water_rights/cabinet/working_around_water.pdf. Accessed October 6, 2010.

British Columbia Ministry of Water, Land, and Air Protection. 2004. *Standards and Best Practices for Instream Works.* Accessible online at: http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf. Accessed October 6, 2010.

Appendices

Appendix A

Spill/Environmental Incident Reporting Form

Spill/environmental incident report

FORTIS BC™

Report completed by	Telephone number

Incident location

Address of incident	☐ Urban ☐ Rural ☐ Remote

Facility name	Exact location where incident occurred

Distance to nearest residence or potential receptor (e.g. lake, river, stream, wetlands, ditch, etc.)

Incident description

Date of incident (Yr/Mth/Day)	Time ☐ am ☐ pm	External parties in attendance ☐ Police ☐ MOE ☐ Media ☐ Other (specify): ☐ Fire ☐ DFO ☐ Environment Canada

Person in charge at time of incident or person who discovered incident	Company name	Phone number

Type of incident (check as many as apply)

☐ spill ☐ impact to fish and/or its habitat ☐ impact to wildlife and/or its habitat ☐ archaeological disturbance

Name of spilled material

Type of material spilled ☐ Liquid ☐ Solid ☐ Gas	Quantity spilled ☐ litres ☐ kilos ☐ other (specify):

P.I.N./UN number	WHMIS Classification	Concentration of material/chemical

Facility involved

☐ line pipe ☐ compressor station ☐ regulator/meter station
☐ LNG ☐ other related facility (specify):

Equipment involved (check as many as apply)

☐ pipe ☐ pump ☐ instrumentation
☐ valve ☐ tank ☐ barrel
☐ pressure relief device ☐ fitting ☐ other (specify):
☐ pressure vessel ☐ compressor

Potential impact on environment

☐ Marine ☐ Groundwater ☐ Lake/wetland ☐ River/stream/ditch ☐ Land ☐ Atmosphere

Weather conditions

Temp ☐ °F ☐ °C	Wind direction	Rain: ☐ light ☐ moderate ☐ heavy	Snow: ☐ light ☐ moderate ☐ heavy	☐ Clear	☐ Other (specify):

Wind speed

☐ None ☐ Light breeze ☐ Gusty ☐ Strong

Reporting actions/external agencies contacted

Agency	Contact name	Telephone number	Date (Yr/Mth/Day)	Time	Agency Log No.
☐ Provincial Emergency Program (PEP)					
☐ Ministry of Environment (MOE)					
☐ Department of Fisheries & Oceans (DFO)					
☐ Oil and Gas Commission					
☐ Transport Canada					
☐ Other (specify):					

Incident response

Describe nature and extent of injuries, damage, or environmental impact/threat

Action taken to control spill/incident

Suspected cause of incident

Describe how release clean-up material will be contained, stored, and deposited

Additional information

Site Sketch (insert electronic attachments below)

Note dimensions, crop/vegetation, landmarks such as roads, fences, structures and potential receptor (lake, river, stream, ditch, etc.). If possible, provide a photograph. Please indicate orientation of photograph with respect to sketch. Indicate low lying areas (sloughs).

N

☐ am
☐ pm

Contact person (signature) | Date (Yr/Mth/Day) | Time

Copies to: **EHS** and the **Asset Owner within 3 business days**; Original: keep with o**riginator** and their **Business Manager**

Appendix E: FortisBC Cost Proposal Sheet

Appendix F: FortisBC Terms and Conditions

1. GENERAL

1.1. FortisBC (as defined on the face of the Purchase Order) has accepted a quotation ("Quotation") to do certain work (the "Work") from the Contractor (described as the Vendor in the Purchase Order) the details of which are attached to the Purchase Order and in any addenda issued by FortisBC and these Terms and Conditions.

1.2. The Terms and Conditions, the Quotation and the Scope of Work are all attached to the Purchase Order and collectively form the Contract Documents.

2. REPRESENTATIVES

2.1. Following the award of the Work to the Contractor, each party shall notify the other of its named representative. The Contractor's representative shall be available on the site when the Work is being performed.

2.2. FortisBC's representative shall be identified on the Purchase Order.

2.3. Any written notices required to be given to a party under the Purchase Order shall be delivered to the party's representative.

2.4. The parties' respective representatives shall have the authority to transmit information and instructions to one another and to act on behalf of and bind their respective parties.

3. TERM

This Purchase Order shall commence on the date set out on the Purchase Order (the "Commencement Date") and shall be deemed terminated and the Contractor discharged from any further obligation to perform services on the earlier of the date when the Work has been performed, accepted and approved by FortisBC (the "Termination Date") and the termination date identified on the Purchase Order (the "Scheduled Completion Date").

4. SCHEDULE

4.1. Upon receipt of a notice of award of the Purchase Order, the Contractor shall forthwith and within the time limits and critical dates, if any, specified in the Purchase Order (the "Completion Date"), commence the Work and deliver the goods in accordance with the approved schedule (the "Schedule").

4.2. Time shall be deemed to be of the essence of the Purchase Order.

5. FAILURE TO MAINTAIN SCHEDULE

5.1. The Contractor shall begin the Work as defined in the specifications attached to or as set out in the Purchase Order in accordance with Section 4 above. The

Contractor shall carry the Work forward expeditiously in accordance with the listed milestones in the Schedule identified therein. The Contractor shall ensure that at all times the Work is being performed in compliance with the Schedule.

5.2. The Contractor's failure to commence the Work as required by the Schedule and actively prosecute the Work in accordance with the Schedule and the Purchase Order will constitute a material and fundamental breach of the Purchase Order. In the event of any such failure, FortisBC may, at no additional cost, in addition to any other remedies it may have, require the Contractor to work overtime or extra shifts, or to provide such additional labour, as in FortisBC's opinion may be necessary, or to cooperate with a third party in such manner as in FortisBC's opinion may be necessary, to remedy such failure.

5.3. If the Work is delayed beyond critical dates identified and defined in the Schedule, as a result of an act or a failure to act by the Contractor, its agents, employees or subcontractors, and FortisBC suffers damages or incurs costs as a result of that delay, the Contractor shall be solely responsible to FortisBC for all those costs and damages incurred or suffered in addition to any costs incurred by the Contractor in expediting the Work.

5.4. If for reasons covered in Section 5.3 above the Contractor is unable to comply with the Schedule agreed upon by the parties hereto, FortisBC may, in its sole and absolute discretion, in addition to the remedies afforded in Section 5.3:

(a) approve a revised delivery Schedule; or

(b) request shipment via air or expedited routing to minimize delay; or

(c) terminate the Purchase Order without damages or penalty for default without further liability to the Contractor.

5.5. Any party anticipating a delay shall notify the other party as soon as possible with full particulars. Both parties shall make every reasonable effort to mitigate or overcome the effects of any anticipated delay.

6. CHANGE OF THE COMPLETION DATE

6.1. The Completion Date set out on the Purchase Order and any critical dates identified in the Schedule of the Work will be changed only where, in the opinion of FortisBC, the Contractor is entitled to an extension of time by reason of:

(a) FortisBC's failure to provide the permits, and/or access that are specifically required by the Purchase Order to be furnished by FortisBC, provided that the Contractor can demonstrate to the satisfaction of FortisBC that such failure, caused or causes a significant delay in the Work or in the provision of goods;

(b) delay occurring in the progress of the Work or the provision of goods as a result of the act or neglect of FortisBC or its representatives, or that of other vendors;

(c) restrictions by governmental or regulatory authorities which were not reasonably foreseeable at the time of execution of the Purchase Order;

(d) an extension of time granted by FortisBC pursuant to a written Change Order; or

(e) Force Majeure.

6.2. If the Contractor is entitled to an extension of time pursuant to Section 6.1, the Completion Date or critical dates defined in the Schedule will be extended by the equivalent number of calendar days the Contractor is actually prevented from progressing pursuant to the Schedule, but only if the Contractor gives written notice to FortisBC within two (2) calendar days of the first occurrence of the event, stating in full the reason for such delay, the length of the delay, all the facts and circumstances relating to the delay, and a request for a change to the critical dates or the Completion Date. In the event of a continuing cause of delay, written notices as aforesaid shall be delivered to FortisBC every seven (7) calendar days following the delivery of the first such notice, until the end of the period of delay. If the Contractor fails to provide the notices as aforesaid, the Contractor shall be deemed to have agreed that the Contractor could nevertheless complete the Work within the original Schedule and no extension of time or any additional compensation whatsoever shall be granted for such delays.

6.3. If there is any delay caused or attributable to FortisBC or the other vendors, then the Contractor shall immediately take all reasonable steps to mitigate the cost to FortisBC of the Work and the goods under this Purchase Order. FortisBC may, without cost, suspend part or all of the Work under this Purchase Order until the Work can again be performed efficiently, effectively and without delay. No commission, including an allowance for loss of productivity, impact costs, supervision, overhead, interest expense, consequential damages or profit is to be charged or allowed for on account of such delay.

7. FORCE MAJEURE

7.1. "Force Majeure" means any one or more of the following events:

(a) war or hostilities;

(b) riot or civil commotion;

(c) earthquake, major flood not foreseeable in the area of the site, forest fire or suspensions of work ordered by the Ministry of Forests, or other natural physical disaster preventing the performance of the Work;

(d) strike or lock-out or other industrial action provided it is by all workers in the industry affected by the strike or lock-out and against all employers in that industry in British Columbia; and

(e) government embargo,

provided, however, that any such event is a major disabling event or circumstance in relation to the normal operations of the party concerned as a whole which is beyond the reasonable control of the party directly affected and results in a material delay, interruption or failure by such party in carrying out its duties, covenants or obligations under the Purchase Order. Lack of money, financing or credit to resolve such contingencies will not be deemed an event of Force Majeure.

7.2. The mere shortage of labour, materials, supplies, or equipment, shall not constitute Force Majeure unless caused by circumstances which are themselves Force Majeure. Lack of funds or other financial cause specific to the Contractor shall not be construed as Force Majeure. If either party to the Purchase Order is prevented from, or delayed in, performing any of its obligations under the Purchase Order by Force Majeure, then it shall within two (2) days of the commencement of such circumstances notify the other party of the circumstances constituting the Force Majeure and of the obligation and performance of which is thereby delayed or prevented, and the party giving the notice shall thereupon be excused the performance or punctual performance, as the case may be, of such obligation for so long as the circumstances of prevention or delay continue. The provision of written notice by the Contractor as aforesaid is a condition precedent to any claim for extra time or for delay in completion as a result of the Force Majeure.

7.3. Without limiting any other rights of FortisBC under any other provision of the Purchase Order, if the suspension of Work exceeds a period of either fourteen (14) consecutive days or thirty (30) cumulative days as a result of Force Majeure, either party shall have the option to terminate the Purchase Order on giving the other party written notice to that effect, provided however that the Contractor shall not be entitled to so terminate if FortisBC elects to pay the Contractor a mutually agreeable standby rate or, failing agreement, the Contractor's reasonable direct costs, for the time of the Force Majeure beyond the fourteen (14) consecutive days or thirty (30) cumulative days until the end of such reasonable period as may be determined by FortisBC.

7.4. In the event of termination pursuant to Section 7.3, FortisBC will pay the Contractor for that portion of the Work completed or Goods delivered to the date of termination based on the unit prices set out in the Purchase Order, as applicable.

8. WORK CHANGES

8.1. The FortisBC representative may require the Contractor to perform any additions to or revisions of the Work which are within the scope of the Purchase Order and to make any deletions to the Work. If FortisBC's representative requires such Work changes, the parties' representatives shall agree on any equitable adjustment of the amount to be paid for the Work Changes and the time within which the Work Changes and the Work are to be performed, and, failing such agreement, FortisBC's representative shall establish in writing, any equitable adjustment of the amount to be paid for the Work changes or the time within which the Work or Work changes are to be performed.

8.2. Any dispute as to the equitable adjustment established shall be resolved in accordance with Section 24 below.

9. EXTRA WORK

9.1. The FortisBC representative may require the Contractor to perform work that is in addition to the Scope of Work and results in an increase to the cost of the Work ("Extra Work").

9.2. Prior to the commencement of the any Extra Work, the details of the Extra Work shall be discussed and mutually agreed upon in writing by the parties. Failing agreement, the FortisBC representative may direct the Contractor, in writing, to proceed with such Extra Work which is within the general scope of the type of Work required by the Contractor or required to properly complete the Work, in which case the Contractor shall perform such Extra Work. Any dispute as to the Extra Work shall be resolved in accordance with Section 24 below.

9.3. Extra work shall be paid at the hourly rate outlined in the Purchase Order, or if none has been set out then at a rate to be mutually agreed upon prior to commencing the Extra Work. Failing agreement as to cost the parties will resolve the matter in accordance with Section 24.

9.4. FortisBC shall not accept any claim made by the Contractor for Extra Work unless the Contractor has complied with Sections 9.2 and 9.3 above.

10. TERMS OF PAYMENT

10.1. Subject to any equitable adjustment, FortisBC shall pay the Contractor an amount approved by the FortisBC representative as set out in the Purchase Order for performance of the Work in accordance with these Terms and Conditions.

10.2. The Contractor shall submit an itemized invoice, when the Work has been completed, to the FortisBC representative, which at a minimum shall include:

(a) lump sum price or unit prices as quoted in the Quotation;

(b) any additional services at the hourly rates as set out in the Purchase Order or as mutually agreed upon between parties;

(c) a detailed description of the Work;

(d) any Extra Work at the hourly rates as set out in the Purchase Order or as mutually agreed upon between parties;

(e) any spare parts (where appropriate);

(f) applicable Federal Goods and Services Tax ("GST") and British Columbia Provincial Sales Tax ("PST");

(g) FortisBC's Work order number, if applicable;

(h) complete address of the location of the Work being invoiced or where the Goods were delivered; and

(i) copies of all delivery slips for Goods.

10.3. FortisBC shall verify the invoice and approve it for payment. Subject to the following, and Section 10.5 below payment of the approved invoices shall be made by FortisBC to the Contractor within thirty (30) days of receipt by FortisBC. Subject to the *Builders' Lien Act* of British Columbia, FortisBC shall retain a Builders' Lien holdback from each and every invoice until fifty five (55) days after the earliest of:

(a) the issuance of the first Certificate of Completion; or

(b) completion, abandonment or termination of the head contract,

and then, if no liens have been filed, will release to the Contractor any unpaid balance of the holdback monies.

10.4. The Contractor shall remit the PST to the British Columbia Minister of Finance in accordance with all laws and regulations.

10.5. FortisBC reserves the right, in its sole and absolute discretion, to withhold fifteen percent (15%) of the lump sum price subject to satisfactory inspection of the Work or the goods by FortisBC. Should inspection not be satisfactory, the Contractor shall be responsible, at its sole cost, to:

(a) redo the Work; and/or

(b) repair or replace and install defective or non-conforming goods.

If inspections made are satisfactory to FortisBC, payment of the holdback will be made within thirty (30) days of the inspection date.

10.6. FortisBC shall pay to the Contractor the applicable GST provided that the invoices that the Contractor provides to FortisBC include the following:

(a) sufficient information to identify the Contractor's name or trade name;

(b) the Contractor's GST registration number;

(c) sufficient information to identify the reporting period when the GST, in respect of the goods and services being provided by the Contractor, was paid or become payable and the amount of GST paid or payable;

(d) sufficient information to identify the name of FortisBC; and

(e) sufficient information to specifically identify the nature of the goods and services being provided and invoiced.

10.7. FortisBC shall not be responsible for any GST or PST other than as specified above. The Contractor agrees to hold FortisBC harmless from and against any order, penalty, interest or tax that may be exercised or levied against FortisBC as a result of the failure or delay of the Contractor to file any return or information required by any law, ordinance or regulation. Without limiting the generality of the foregoing, FortisBC shall have no liability or responsibility for the payment of any penalty or interest assessed or levied against the Contractor as a result of the failure of the Contractor to charge, collect or remit the GST or PST as required under all applicable laws.

11. EQUIPMENT & MATERIALS OF FORTISBC

All plant, equipment and materials provided by FortisBC to the Contractor shall remain the property of FortisBC and the Contractor shall be responsible for the safe care, handling, custody and proper maintenance of them.

12. EQUIPMENT & MATERIALS OF CONTRACTOR

The Contractor shall not remove from the site or sites any plant, equipment and materials necessary to perform the Work without the consent of FortisBC's representative.

13. QUALITY OF EQUIPMENT & MATERIALS

13.1. The Contractor shall ensure that all equipment and materials meet the requirements of the Purchase Order and are free and clear of any and all encumbrances and liens. The Contractor shall store and maintain the equipment and materials to be incorporated into the Work in a manner that will preserve their quality and fitness. The Contractor may not vary materials from those specified in the Purchase Order or Scope of Work unless FortisBC's representative has given prior written approval.

13.2. The Contractor shall cooperate fully with FortisBC's representative to enable FortisBC's representative to conduct proper inspections or testing of the Work performed. On receiving written notice, the Contractor shall remove and replace any Work which FortisBC's representative considers to be unfit for the purpose intended or not to be in accordance with the Purchase Order and if the Contractor fails to do so, FortisBC may remove and replace the Work or any part thereof at the Contractor's expense.

13.3. Any inspection and/or expediting by FortisBC shall in no event relieve the Contractor from its responsibilities and liabilities under the Purchase Order, and FortisBC does not either expressly or by implication waive any rights it may have under the Purchase Order or at law, as a consequence of any inspection or expediting performed under this Section.

14. MAINTENANCE OF RECORDS

The Contractor shall keep full and detailed records respecting the Work performed for at least one year after completion of the Work on the site and the Contractor shall permit FortisBC to inspect and audit these records at all reasonable times.

15. TERMINATION FOR DEFAULT

15.1. If the Contractor:

(a) commits an act of bankruptcy;

(b) is unable to continually and consistently do the Work or supply the goods to meet the requirements of the Purchase Order;

(c) materially fails to maintain the production and delivery Schedule required to meet the critical dates; or

(d) materially breaches or fails to observe or perform any of the obligations or conditions of this Purchase Order,

then the Contractor shall be deemed to have breached this Purchase Order and FortisBC may give the Contractor written notice setting forth the nature of the breach and stating its intention to terminate this Purchase Order unless such breach has been remedied by the Contractor within seven (7) days from the date of delivery of such notice.

15.2. If such breach has not been rectified within such seven (7) day period FortisBC shall thereafter have the right, at its sole discretion and without prejudice to any other right or remedy, to terminate this Purchase Order at any time thereafter on two (2) days notice. If the aforesaid breach despite all reasonable efforts is not capable of being remedied within such seven (7) day period but the Contractor has taken all reasonable actions to remedy same within such period and thereafter diligently and continuously takes all reasonable actions, then FortisBC

shall not exercise its right to terminate the Purchase Order so long as the Contractor continues to perform the Work in an expeditious manner and in accordance with the Schedule. If, notwithstanding all reasonable efforts the Contractor is unable to perform the Work in accordance with the Schedule, then FortisBC may in its discretion terminate this Purchase Order on seven (7) days notice at any time thereafter.

15.3. Upon delivery of a notice to terminate in accordance with Section 15.2:

(a) FortisBC shall pay for that portion of the Work completed and goods delivered, which as of the date of termination, has been accepted;

(b) the Contractor shall be liable to and pay FortisBC for the actual and reasonable costs incurred by FortisBC for purchasing from a third party goods in substitution for the goods that the Contractor had not delivered as of the date of termination; and

(c) any amounts previously paid to the Contractor in excess of the amount calculated above shall be immediately refunded without interest to FortisBC,

and upon FortisBC making a payment to the Contractor for the Work pursuant to this Section, the Purchase Order shall thereupon terminate and the Contractor shall have no further cause of action or right against FortisBC in respect of the termination of this Purchase Order or otherwise.

15.4. Nothing set forth in this Section 15 shall limit or prejudice any right or remedy FortisBC may have against the Contractor in respect of the breach of this Purchase Order by the Contractor and the termination thereof. Further, all warranties under the Purchase Order shall survive any termination of the Purchase Order.

16. TERMINATION FOR CONVENIENCE

16.1. FortisBC may, at any time without cause and at its sole discretion, terminate this Purchase Order by giving notice in writing to the Contractor.

16.2. If FortisBC terminates this Purchase Order in accordance with this Section 16:

(a) FortisBC shall pay for that portion of the Work done which, as of the date of termination, has been accepted; and

(b) FortisBC shall be responsible for reimbursing the Contractor, at cost, for all reasonable monies or liability costs incurred by the Contractor, as of the time that notice of cancellation is received by the Contractor, to its subcontractors for their services and which could not reasonably have been avoided or mitigated through reasonable efforts, but excluding any such costs or liabilities for which the Contractor will be or has already

been reimbursed as part of the compensation paid to the Contractor pursuant to Section 16.2(a).

16.3. Any payments made by FortisBC prior to the date of termination in excess of those required by the foregoing shall be refunded without interest to FortisBC. If FortisBC satisfies its obligations hereunder, the Contractor shall have no further cause to action or right against FortisBC in respect of the termination of this Purchase Order or otherwise.

16.4. If this Purchase Order is terminated for convenience, the Contractor shall use all reasonable efforts to mitigate the costs for which FortisBC is or may be liable pursuant to Section 16.2, including without limitation assisting FortisBC to sell any or all goods for which FortisBC acquires title pursuant to Section 16.2.

16.5. The Contractor shall provide FortisBC with all of the information and details relating to the mitigation of amounts for which FortisBC may be liable to the Contractor as a result of termination for convenience, and the Contractor shall reimburse FortisBC those amounts actually recovered by the Contractor as a result of such mitigation. FortisBC shall have the right to audit, including all rights incidental to an audit, to confirm the amounts to which it is entitled by the mitigation efforts of the Contractor.

17. INSURANCE

17.1. The Contractor, at its own expense, shall, prior to commencing the performance of the Contractor's obligations hereunder, obtain and keep in full force and effect until the Agreement is fully performed and for a period of eighteen (18) months thereafter, the following insurance:

(a) Automobile Liability on all vehicles used by the Contractor in connection with this Purchase Order in the minimum amount of $2 million per occurrence in respect of bodily injury, death and property damage;

(b) Commercial General Liability having a minimum inclusive limit, including personal injury and property damage, of at least $2 million per occurrence. Such insurance shall include Contractual Liability, Owners/Contractors Protective Liability, Products/Completed Operations Liability and Employers Liability and Cross Liability and shall name the FortisBC as an additional insured;

(c) an installation floater insuring the Work described herein against all risks of physical loss or damage for which the Contractor may be responsible. This policy shall remain in full force and effect throughout the duration of the term of this Purchase Order; and

(d) any other coverages required by law.

17.2. The Contractor shall provide proof of the coverage required above upon request by FortisBC. The coverage shall provide that such coverages cannot be cancelled, reduced or amended adversely without thirty (30) days prior written notice from the applicable insurer directly to FortisBC. All amounts set forth herein for insurance coverages are described in Canadian dollars.

17.3. This Section shall in no way limit the obligation of the Contractor herein or excuse the Contractor from performance of the same. Any bankruptcy, insolvency or failure of any insurer of the Contractor or the Contractor's subcontractors to pay claims shall in no way limit the Contractor's obligations here.

18. WORKER'S COMPENSATION INSURANCE

18.1. Within five (5) days of award, the Contractor shall provide FortisBC with written proof of Workers' Compensation insurance coverage in accordance with the statutory requirements in British Columbia for all its employees engaged in performing the Work herein.

18.2. The Contractor shall comply with the British Columbia *Workers' Compensation Act* and regulations thereto and shall pay all assessments, compensation and all other amounts required to be paid thereunder.

18.3. If the Contractor fails to pay any such assessment, compensation or other amounts when due, FortisBC may make such payment on behalf of the Contractor but will not be obliged to do so.

18.4. The Contractor shall reimburse FortisBC the amount of such payment upon demand, or FortisBC may deduct the amount from any payment then or thereafter due to the Contractor under the Purchase Order.

19. INDEMNIFICATION

19.1. The Contractor shall indemnify and hold FortisBC and the directors, officers, agents and employees thereof harmless from and against any actions, claims, damages, costs and expenses including without limitation all applicable solicitors' fees and disbursements, investigation expenses, adjusters' fees and disbursements whatsoever which may be brought against or suffered by FortisBC or which FortisBC may incur, sustain or pay arising out of or in connection with:

(a) any injury to or the death of any and all persons;

(b) damages, destruction or loss to or of any and all property whether real or personal;

(c) restoration and/or remediation for any environmental damage sustained and all penalties, fines or other costs associated therewith; and

(d) any act, omission, default or representation, negligent or otherwise, of the Contractor, its employees, agents and subcontractors;

in any way incidental to the Work or this Purchase Order.

19.2. The Contractor shall and does hereby indemnify and save harmless FortisBC from all statutory liens filed on any of FortisBC's real property arising in respect of the goods provided or the Work done by the Contractor hereunder or any of its subcontractors.

19.3. The Contractor shall defend any such claims or suits provided that FortisBC shall have the right at its option to participate in the defence of such claims or suits and in such events the Contractor shall pay FortisBC's cost for defending such claims or suits.

19.4. These indemnities shall survive the termination of this Purchase Order.

20. SAFETY & SECURITY

20.1. The Contractor shall be responsible for the protection and security of the Work and the protection and safety of all persons performing the Work on the site. The Contractor shall comply with all safety procedures required by FortisBC.

20.2. At the request of FortisBC, the Contractor shall cause each of its employees engaged in the performance of the Work to obtain and provide to FortisBC a Consent for Disclosure of Criminal Record Information from the Royal Canadian Mounted Police and such further information regarding such employee's criminal record as may be requested by FortisBC.

20.3. FortisBC may, in its sole and absolute discretion, require the Contractor to remove any of the Contractor's employees from the performance of the Work and to replace such employee with another employee acceptable to FortisBC.

21. REPRESENTATIONS AND WARRANTIES

21.1. The Contractor represents and warrants that:

(a) the Contractor and all employees it assigns to perform the Work possess the necessary qualifications, knowledge, skills, expertise and experience and agrees to perform the Work herein to the highest professional standards;

(b) the Contractor shall, at all times during the term of the Purchase Order, act in the best interest of FortisBC and shall perform the Work in a competent, workmanlike and professional manner using due care and diligence;

(c) the Contractor shall act with integrity and use the highest ethical standards in performing the Work hereunder and it shall not, in any way,

directly or indirectly compromise the reputation or image of FortisBC; and

(d) in performing the Work, the Contractor shall comply with all applicable laws, orders, regulations, ordinances, standards, codes and other rules, licences and permits of all lawful authorities.

21.2. The Contractor further warrants that all equipment and materials covered by the Purchase Order are new and free and clear of any and all encumbrances and liens.

21.3. The Contractor warrants and guarantees that the Work and Work product and/or goods is and are free from all defects arising from faulty materials, installation or workmanship for a warranty period (the "Warranty Period") which shall be twelve (12) months measured from the Completion Date.

21.4. If during the Warranty Period, FortisBC discovers any Work which fail to conform to this Purchase Order, including the specifications, or which contain any defects or deficiencies in workmanship (collectively and individually a "Non-conformance"), then FortisBC shall promptly after such discovery notify the Contractor of such Non-conformance. FortisBC and the Contractor shall jointly investigate any such Non-conformance in an effort, in good faith, to determine the cause thereof, provided that such investigation shall not unreasonably delay any repair or replacement of the Work. If the parties are unable to agree upon whether a Non-conformance exists within ten (10) days of the date of the discovery of such Non-conformance, either party shall have the right to request that the matter be mediated or arbitrated, and the right and the obligation to proceed with mediation or arbitration in accordance with Section 24.

21.5. The Contractor shall be responsible, at no cost to FortisBC, to provide such additional services as may be necessary to remedy any defects or deficiencies in the Work caused by the negligent act or omission of the Contractor or by the failure to perform the Work in accordance with the provisions of this Purchase Order provided that in no event shall the Contractor be responsible or liable for consequential damages to FortisBC or its employees, agents, affiliates or other consultants.

21.6. The Contractor represents that it has knowledge of and understands all Environmental Laws applicable to the Work.

21.7. The Contractor warrants that it will take all measures in the performance of the Work to prevent unacceptable disturbance or damage to the environment or, to minimise any such disturbance or damage in accordance with all Environmental Laws. For the purposes of the foregoing, "unacceptable disturbance or damage" means disturbance or damage which is contrary to or in excess of that allowed by Environmental Laws or applicable permits, approvals and orders, or damage or disturbance which may comply with Environmental Laws but is in excess of that

which would necessarily occur through the use of good construction practices employed by environmentally sensitive contractors in the province of British Columbia.

21.8. The Contractor warrants that it will immediately advise the FortisBC representative if any of the Work has been deliberately or inadvertently performed in a manner contrary to this Purchase Order.

21.9. "Environmental Laws" means all applicable statutes, regulations, ordinances, by-laws and codes and all international treaties and agreements, now or hereafter in existence in Canada (whether federal, provincial or municipal) relating to the protection and preservation of the environment, occupational health and safety, product safety, product liability or Hazardous Substances; including without limitation the *Environmental Management Act*, S.B.C. 2003, c.53 and the *Canadian Environmental Protection Act*, S.C. 1999, c. 33;

21.10. "Hazardous Substance" means collectively any:

(a) waste as that term is defined in and determined under the *Environmental Management Act*;

(b) toxic substance or prohibited substance, as those terms are defined in the *Canadian Environmental Protection Act* (Canada);

(c) dangerous goods as defined in the *Transportation of Dangerous Goods Act* (Canada), including, without limitation, radioactive materials; or

(d) substance, as that term is defined in the *Canadian Environmental Protection Act* (Canada), which does or could:

(i) harm or endanger the health, safety or welfare of persons;

(ii) interfere with the enjoyment of, or cause damage to, life or property;

(iii) harm or endanger the health of animal life;

(iv) pollute the environment, as that term is defined in the *Canadian Environmental Protection Act* (Canada).

21.11. The Contractor warrants that all goods covered by this Purchase Order will conform to the specifications or other description furnished or specified by FortisBC and the FortisBC representative, and will be fit and sufficient for the purposes intended (a purpose of which the Contractor acknowledges and admits that it has been notified of and is aware), merchantable, of good material and workmanship and free from defects.

21.12. These warranties are in addition to any and all warranties of the Contractor arising by question of law and nothing contained herein shall be construed as limiting or restricting such warranties.

21.13. These representations and warranties shall survive the termination of this Purchase Order.

22. OWNERSHIP

The Contractor acknowledges and agrees that FortisBC has and shall have proprietary rights in all information and documentation supplied to the Contractor by FortisBC or arising from the performance of the Work including, without limitation, finished drawings, rough drawings, correspondence, notes, calculations and other work in progress and shall surrender any of such materials that may be in its possession to FortisBC at any time upon the request of FortisBC or at the expiry or earlier termination of this Purchase Order.

23. CONFIDENTIALITY

23.1. All information or documentation received by the Contractor relating to the business, trade secrets, operations, finance, affairs, technologies, systems or activities of FortisBC which is disclosed or is otherwise made available to the Contractor in the course of or for the purposes of performance of the Work ("Confidential Information") shall be deemed to be confidential and proprietary to FortisBC. Except as otherwise provided herein, the Contractor shall not directly or indirectly disclose any such Confidential Information to any third party without the prior written consent of FortisBC. Such consent is not required where the third party is another contractor or consultant retained by FortisBC for the purposes of the Purchase Order and to the extent that such disclosure is necessary for the proper performance of this Purchase Order or to the extent that such disclosure is required by law.

23.2. Notwithstanding the foregoing, the Contractor may use such Confidential Information in the preparation for and conduct of submissions to regulatory agencies or governmental authorities.

23.3. The obligation of confidentiality set out above shall not apply to material, data or information which is known to the Contractor prior to their receipt thereof, which is generally available to the public or which has been obtained from a third party which has the right to disclose the same.

23.4. The confidentiality covenants of the Contractor herein shall survive the termination of this Purchase Order.

24. DISPUTES

24.1. Where any dispute arises out of or in connection with this Purchase Order, including failure of the parties to reach agreement hereunder, the parties agree to

try to resolve the dispute by participating in a structured mediation conference with a mediator under the National Arbitration Rules of the ADR Institute of Canada Inc.

24.2. If the parties fail to resolve the dispute through mediation, the unresolved dispute shall be referred to, and finally resolved or determined by arbitration under the National Arbitration Rules of the ADR Institute of Canada Inc. Unless the parties agree otherwise the arbitration will be conducted by a single arbitrator.

24.3. The arbitrator shall issue a written award that sets forth the essential findings and conclusions on which the award is based. The arbitrator will allow discovery as required by law in arbitration proceedings.

24.4. If the arbitrator fails to render a decision within thirty (30) days following the final hearing of the arbitration, any party to the arbitration may terminate the appointment of the arbitrator and a new arbitrator shall be appointed in accordance with these provisions. If the parties are unable to agree on an arbitrator or if the appointment of an arbitrator is terminated in the manner provided for above, then any party to this Purchase Order shall be entitled to apply to a judge of the British Columbia Supreme Court to appoint an arbitrator and the arbitrator so appointed shall proceed to determine the matter mutatis mutandis in accordance with the provisions of this Section.

24.5. The arbitrator shall have the authority to award:

(a) money damages;

(b) interest on unpaid amounts from the date due;

(c) specific performance; and

(d) permanent relief.

24.6. The costs and expenses of the arbitration, but not those incurred by the parties, shall be shared equally, unless the arbitrator determines that a specific party prevailed. In such a case, the non-prevailing party shall pay all costs and expenses of the arbitration, but not those of the prevailing party.

24.7. The parties will continue to fulfill their respective obligations pursuant to this Purchase Order during the resolution of any dispute in accordance with this Section 24.

25. SUBCONTRACTING

25.1. No subcontracting of any of the Work shall be permitted without the prior written consent of FortisBC which consent may be arbitrarily withheld. Nothing contained in these Terms and Conditions shall be construed as creating any contractual relationship between FortisBC and the subcontractor.

25.2. Notwithstanding FortisBC's consent to the subcontracting of any of the Work, no subcontracting of any Work shall relieve the Contractor from its obligations and responsibilities to FortisBC pursuant to this Purchase Order.

26. ASSIGNMENT

The Contractor shall not assign its rights or obligations under this Purchase Order without the prior written consent of FortisBC, which consent may be arbitrarily withheld. FortisBC may assign this Purchase Order without the consent of the Contractor.

27. ENVIRONMENT

The Contractor shall take all measures in the performance of the Work to minimize disturbance or damage to the environment.

28. LAW

This Purchase Order shall be governed by and construed in accordance with the laws of the Province of British Columbia.

29. TIME

Time is of the essence in this Purchase Order.

30. ENUREMENT

This Purchase Order shall be for the benefit of and be binding upon FortisBC and the Contractor and their respective successors and permitted assigns.

31. AMENDMENTS

31.1. The Purchase Order embodies the entire agreement between the parties and supersedes all communications, negotiations and agreements, either written or oral, relating to the Work that were made prior to the date of execution of the Purchase Order. The Purchase Order contains all the representations, warranties, covenants, agreements, conditions and understandings between the parties with respect to the subject matter of the Purchase Order and there are no other representations, warranties, covenants, agreements, conditions or understandings with respect to the Purchase Order that are not contained herein.

31.2. The Contractor hereby represents and warrants that in entering into the Purchase Order it has not and does not rely upon any previous representation of FortisBC, consultant, or any employee, director, officer, servant, consultant or agent of FortisBC, whether express or implied, or upon any inducement or agreement of any kind or nature.

31.3. The Purchase Order may only be amended by written agreement, signed by both parties.

32. CONFLICT AND INTERPRETATION

32.1. If there is a conflict between any of the documents that are included in, or incorporated by reference in the Purchase Order and these terms and conditions, the order of priority of documents from highest to lowest shall be:

(a) Change Orders;

(b) Revised Drawings;

(c) Revised Data Sheets;

(d) Supplemental Terms and Conditions;

(e) Terms and Conditions;

(f) All other attachments to this Purchase Order;

(g) Letter of Award issued to the Contractor;

(h) Technical Specifications

(i) Drawings and other data provided by the Contractor.

32.2. Later dated documents shall govern over earlier dated documents of the same type.

33. COMPLIANCE WITH FORTISBC POLICIES

The Contractor must read and become familiar with all of FortisBC's current policies, procedures and standards posted on the following site:

https://extranet.fortisbc.com/sites/fbccontractorinfo

Username: fbccontractor
Password: Contract1

and the Contractor must comply with FortisBC's current policies, procedures and standards throughout the term of the Purchase Order; and ensure that all of the Contractor's employees, subcontractors, vendors, suppliers, consultants, agents and workers comply with the terms of this section, and be liable for any failure thereby.

SUPPLEMENTAL TERMS AND CONDITIONS TO THE

TERMS AND CONDITIONS OF ORDER – CONSTRUCTION

These supplemental terms and conditions shall amend, supplement, be read with and form part of the Terms and Conditions of Order – Construction ("**Terms and Conditions**"). Where there is conflict between these Supplemental Terms and Conditions and Terms and Conditions, these Supplemental Terms and Conditions shall take precedence.

1. Section 17 (Insurance), shall be amended by deleting Section 17.1 in its entirety and replacing it with the following:

   17.1. The Contractor, at its own expense, shall, prior to commencing the performance of the Contractor's obligations hereunder, obtain and keep in full force and effect until the Agreement is fully performed and for a period of eighteen (18) months thereafter, the following insurance:

   (a) Automobile Liability on all vehicles used by the Contractor in connection with this Purchase Order in the minimum amount of $2 million per occurrence in respect of bodily injury, death and property damage;

   (b) Commercial General Liability having a minimum inclusive limit, including personal injury and property damage, of at least $5 million per occurrence. Such insurance shall include Contractual Liability, Owners/Contractors Protective Liability, Products/Completed Operations Liability and Employers Liability and Cross Liability and shall name the FortisBC as an additional insured;

   (c) an installation floater insuring the Work described herein against all risks of physical loss or damage for which the Contractor may be responsible. This policy shall remain in full force and effect throughout the duration of the term of this Purchase Order; and

   (d) any other coverages required by law.

2. Section 18 (Worker's Compensation Insurance) shall be replaced with the following:

   "**18. WORKER'S COMPENSATION INSURANCE AND PRIME CONTRACTOR DESIGNATION**

"18.1 The Contractor and everyone employed by or through the Contractor shall comply strictly at all times with the workers compensation requirements of all authorities having jurisdiction, including without limitation all applicable statutory and other requirements relating to workers compensation and workers compensation insurance. Prior to commencing the Work, prior to release of any holdbacks and prior to final payment, the Contractor shall provide evidence of compliance by the Contractor and its subcontractors with the requirements of the province of British Columbia with respect to workers' compensation insurance including payments and assessments due thereunder. At any time during the term of the Purchase Order, when requested by FortisBC, the Contractor shall provide evidence of such compliance by it and its subcontractors.

18.2 Sections 18.3 and 18.4 apply if the scope of the Work requires the Contractor to be the "prime contractor" at the FortisBC site at which the Work is to be performed or the Contractor is generally in control of the Work and the FortisBC site at which the Work is to be performed.

18.3 For purposes of:

(a) the *Workers Compensation Act*, R.S.B.C. 1996, c.492, and any amendments or successors thereto, including by the *Workers Compensation (Occupational Health and Safety) Amendment Act, 1998,* S.B.C. 1998, c. 50 (collectively the "**WCB Act**"), including but not limited to Section 118; and

(b) the regulations, including the Occupational Health & Safety Regulation of the Province of British Columbia, B.C. Regulation 296/97, and any amendments or successors thereto (collectively the "**WCB Regulation**"), including but not limited Sections 20.1A, 20.2, 20.3, and 23.4 of Industry/Activity Specific Requirements, Parts 20-33, from and after the date that the Contractor commences its Work on any portion of the Work site and becomes the dominant contractor generally in control of such portion of the Work and site, the Contractor agrees to and shall be the "prime contractor" for that portion of the Work and site, and in respect to that portion of the Work and site shall comply with all requirements of the WCB Act and WCB Regulation, including but not limited to the following:

    (i) ensuring that the activities of employers, workers and other persons at the workplace, including FortisBC, FortisBC's Representative, consultant, other contractors and everyone

engaged by or through any of them relating to occupational health and safety are coordinated;

(ii) doing everything that is reasonably practicable to establish and maintain a system or process that will ensure compliance with the WCB Act and the WCB Regulation in respect of the workplace;

(iii) delivering the notice of project where required by Section 20.2 of the WCB Regulation to the Workers Compensation Board of British Columbia; and

(iv) complying with the obligations of a "prime contractor" for a multiple-employer workplace required by Section 118 of the WCB Act and prescribed by Sections 20.3 and 23.4 of the WCB Regulation.

18.4 The term "prime contractor", as used herein, has the same meaning as in the WCB Act. If the Workers Compensation Board of British Columbia refuses to recognize or accept the Contractor as the "prime contractor" under the WCB Act in accordance with the foregoing and, instead, requires FortisBC to deliver a notice of project in accordance with Section 20.2 of the WCB Regulation or to otherwise fulfil the obligations imposed on FortisBC under the WCB Act or WCB Regulation either as owner or as "prime contractor", then as between FortisBC and the Contractor with respect to the part of the Work and Site for which the Contractor was to have been the 'prime contractor' in accordance with the foregoing but for the refusal of the Workers Compensation Board or the WCB Act or WCB Regulation to accept the Contractor as the 'prime contractor,' it is hereby agreed that the Contractor shall be responsible to FortisBC, and to those for whom the Contractor would have become responsible if the Contractor had been designated as the 'prime contractor,' for fulfilling the obligations, duties and liabilities imposed on FortisBC pursuant to the WCB Act and WCB Regulation, all in the same manner, to the same extent and for the same purposes as if there were no other contractors engaged by or through FortisBC for the Work and the Contractor itself delivered the notice of project and undertook the obligations of a 'prime contractor'. The Contractor shall indemnify and save FortisBC harmless from liability which FortisBC incurs or may incur to the Workers Compensation Board or to third parties arising out of the Contractor's failure to comply with the foregoing."

3. A new Section 34 (Environmental Management Plan) shall be added with the following:

"34. ENVIRONMENTAL MANAGEMENT PLAN

34.1 Unless and to the extent FortisBC's representative expressly directs otherwise, this Section 34 applies if the Contractor or any of its officers, directors, employees, agents, representatives or subcontractors are required, on an permanent basis, during the term of the Purchase Order to be on, or near the vicinity of, any FortisBC site for the purposes of the performance of the Work.

34.2 The Contractor is responsible at each Work site to ensure adequate environmental protection and the Contractor must prepare, develop and implement its own Environmental Management Plan (the "**Contractor EMP**") or the follow the Generic Environmental Management Plan provided by FortisBC (the "**Generic EMP**"). If the Contractor elects to use the Contractor EMP, the Contractor must provide FortisBC with a copy of the Contractor EMP for review and comment within five (5) days of the award of the Work.

34.3 The Contractor shall, at its own cost, comply strictly with the policies and requirements of FortisBC contained in this Purchase Order and the Contractor EMP or Generic EMP, as applicable, and shall strictly enforce those policies and requirements among all workers, subcontractors and suppliers.

34.4 The Contractor shall provide every subcontractor with a copy of both these Supplemental Terms and Conditions and the Contractor EMP or Generic EMP, as applicable, and shall bind each subcontractor to comply strictly with all provisions of both. Before any worker is allowed to perform any part of the Work, whether such worker is engaged by or through the Contractor or its subcontractor, the Contractor shall ensure that the worker reviews and is familiar with the requirements of this Purchase Order and the Work being performed.

34.5 Whenever reporting is required by the Contractor EMP or Generic EMP, as applicable, the Contractor shall also report such matters to FortisBC's representative.

34.6 The Contractor shall be solely responsible for all costs associated with complying with the policies and requirements set out in the Contractor EMP or Generic EMP, as applicable.

34.7 The Contractor shall be solely responsible and liable for any and all impairment or damage caused to the environment by, or related to, the Contractor's performance of the Work. The Contractor shall indemnify

and hold FortisBC harmless from any and all damages, costs and expenses incurred by FortisBC, including without limitation, with regard to statutory requirements, obligations, assessments, penalties and fines, related to any damage or impairment caused to the environment by, or related to, the Contractor's or its subcontractors' performance of the Work or the construction activities of the Contractor or its subcontractors.

34.8 The Contractor shall at all times have at the FortisBC site or sites and available for immediate deployment sufficient and adequate equipment and materials, and sufficient adequately trained personnel, to respond immediately and properly to any environmental incident, including but not limited to any environmental incident which may cause damage to the environment, the discharge of any deleterious substance into any body of water or the environment, or result in the possibility of charges, penalties, fines or assessments levied against the Contractor, its subcontractors or FortisBC.

34.9 FortisBC or the FortisBC representative may direct the Contractor to immediately suspend all Work on a FortisBC site or sites that is contravening the Contractor EMP or Generic EMP, as applicable, or the terms and conditions of permits, licences and approvals (or both, as the case may be), including, but not limited to:

(a) the release of deleterious substances into the environment;

(b) activities which appear to be an infraction of any environmental regulations, requirements, permits or approvals;

(c) physical degradation of the environment; or

(d) imminent risk of any such events.

34.10 If the Work is suspended, the Contractor shall not resume the Work without the prior approval of FortisBC. Approval may be conditional upon demonstrations to the satisfaction of FortisBC, and all authorities having jurisdiction, that the Contractor has taken appropriate steps, and instituted sufficient safeguards, to prevent a repeat of such incidents. The Contractor will not be entitled to additional time or monetary compensation for suspension delays under this Section 34.10.

34.11 Any review of the Contractor EMP, providing the Generic EMP or environmental monitoring activities and inspection by, or on behalf of, FortisBC shall not relieve the Contractor of its sole responsibility for the

performance of the Work in accordance with the terms of this Purchase Order, the terms and conditions of permits, licences, approvals and authorizations and all laws and regulations.

34.12 If the Contractor elects to use the Contractor EMP, FortisBC reserves the right to require the Contractor to revise and resubmit the Contractor EMP prior to commencement of the Work or during the performance of the Work if, in the opinion of FortisBC, the Contractor EMP as submitted is inadequate to ensure compliance with the requirements of the Purchase Order.

34.13 If the Contractor elects to use the Generic EMP, FortisBC reserves the right to revise the Generic EMP prior to commencement of the Work or during the performance of the Work if, in the opinion of FortisBC, the Generic EMP as provided is inadequate to ensure compliance with the requirements of the Purchase Order.

34.14 By reviewing the Contractor EMP, FortisBC shall in no way assume responsibility or liability for the Contractor EMP. Further, FortisBC shall in no way assume responsibility or liability for the Contractor's non-compliance with the requirements of the Contractor EMP or applicable legislation and regulations.

34.15 By providing the Generic EMP, FortisBC shall in no way assume responsibility or liability for the Generic EMP, the Contractor must satisfy itself that the Generic EMP is in compliance with all environmental legislation and regulations with respect to the Work. Further, FortisBC shall in no way assume responsibility or liability for the Contractor's non-compliance with the requirements of the Generic EMP or applicable legislation and regulations."

4. A new Section 35 (Contractor Safety Plan) shall be added with the following:

"35. CONTRACTOR SAFETY PLAN

35.1 Unless and to the extent FortisBC's representative expressly directs otherwise, this Section 35 applies if the Contractor or any of its officers, directors, employees, agents, representatives or subcontractors are required, on a permanent basis, during the term of the Purchase Order to be on, or near the vicinity of, any FortisBC site for the purposes of the performance of the Work.

35.2 The Work shall be carried out in accordance with the Occupational Health

and Safety Regulations of the British Columbia Worker's Compensation Board and all other applicable rules, regulations and requirements of all authorities having jurisdiction. The Contractor shall also be responsible for providing first aid facilities and trained personnel on each site for all personnel that are employed by or through the Contractor and prior to the commencement of the Work must provide FortisBC with a copy of a Health and Safety Plan ("**HSP**") which materially addresses the health and safety concerns with respect to the Work and the sites where the Work will be undertaken. The Contractor must provide FortisBC with a copy of the HSP for review and comment within five (5) days of the award of the Work.

35.3 FortisBC reserves the right to require the Contractor to revise and resubmit its HSP prior to commencement of the Work or during the performance of the Work if, in the opinion of FortisBC, the HSP as submitted is inadequate to ensure compliance with the requirements of the Purchase Order.

35.4 By reviewing the HSP, FortisBC shall in no way assume responsibility or liability for the HSP. Further, FortisBC shall in no way assume responsibility or liability for the Contractor's non-compliance with the requirements of its HSP or applicable legislation and regulations.

35.5 The Contractor shall provide every subcontractor with a copy of the HSP and shall bind each subcontractor to comply strictly with all provisions of the HSP."

5. A new Section 36 (Items of Geological, Historical or Archaeological Interest or Value) shall be added with the following:

"**36. ITEMS OF GEOLOGICAL, HISTORICAL OR ARCHAEOLOGICAL INTEREST OR VALUE**

All fossils, coins, articles of value or antiquity, remains, structures and other things of geological, archaeological or historical interest or value discovered on any FortisBC site shall, as between FortisBC and the Contractor, be deemed the property of FortisBC. The Contractor shall immediately inform FortisBC's Representative of the discovery of any of the foregoing and shall take all reasonable precautions, including all precautions directed by the FortisBC's Representative, to protect, preserve or dispose of the same, including but not limited to the prevention of further damage, unauthorized removal or theft of the same."

6. A new Section 37 (Utilities) shall be added with the following:

"**37. UTILITIES**

37.1. It shall be the sole responsibility of the Contractor to make its own investigations as to the presence, location and type of all existing piping, utilities, structures, appurtenances and service connections which may be affected by the Work.

37.2. The Contractor shall be solely responsible for and accept all risk in connection with all damage to piping, utilities, structures, appurtenances and service connections connected to the Work."

7. A new Section 38 (Return Data Process) shall be added with the following:

"**38. RETURN DATA PROCESS**

38.1 This document sets the requirements for the data to be submitted to FortisBC in order to receive notification to proceed with construction and in order to receive final acceptance of the project.

38.2 The following are not acceptable:

a) Hand sketches
b) Cut and paste drawings, tables etc.
c) Documents with white out and scratch out marks
d) Profiles, drawings etc. not to the appropriate scale
e) Any markings on data that makes it difficult to distinguish from original.

38.3 If the design data is insufficient it will be returned to the Contractor for correction.

38.4 Design data/As Built Drawings are to include:

a) Completed Design Engineering Checklist
b) Construction Prints and/or Structure List
c) Equipment Documentation

8. A new Section 39 (Union Shop) shall be added with the following:

"**39. UNION SHOP**

In order to comply with Clause 20.02 of FortisBC's collective bargaining

agreement with the International Brotherhood of Electrical Workers, all Contractors and their subcontractors performing core work on FortisBC property or facilities must be union shops recognized by the B.C Federation of Labour.

If the successful Contractor for this Work has a collective agreement with a union, that Contractor will be required to provide documentation of that agreement. In addition, if the successful Contractor intends to use subcontractors for any portion of the Work, the Contractor is required to make the FortisBC aware of who their subcontractors will be and whether the subcontractors are union affiliated.

9. A new Section 40 (Effect of Supplemental Conditions) shall be added with the following:

"**40. EFFECT OF SUPPLEMENTAL CONDITIONS**

The Contractor acknowledges the clauses herein contained are specific to negotiations related to the Work and do not appear in FortisBC's standard Terms and Conditions of Order - Construction and FortisBC may decide, in its discretion, not to include such clauses in any other contracts with the Contractor."