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June 27, 2023

Preliminary Market Survey of Potential Substation Sites – Willoughby, Langley

To Whom It May Concern:

For your review, enclosed is a market survey of potential sites in Willoughby within the City of Langley *(known as the "Search Boundary")*. ***The primary purpose of this market survey is to illustrate potential sites for a substation. All research was completed by desktop and by utilizing 3rd party sources. We have not directly contacted property owners and did not confirm that the potential sites presented are available "For Sale".***

Nine (9) potential sites were found within the Search Boundary which meets or partially meets the parameters of:

- *Area: Approximately 220,000 sq.ft. (~ 5.05 Acres)*
- *Property Dimensions: Approximately 400 feet by 550 feet*
- *Acceptable egress/ingress on three sides for 230kV and 25kV cables.*
- *Central to the substation's load serving area*

It is not known at this time whether the properties presented meets the remaining parameters including:

1) Constructible, **2)** Acceptable to Stakeholders, **3)** Environmentally Acceptable, **4)** Seismically Acceptable.

The majority of potential sites presented herein are commercial and/or public-use in nature, while predominantly residential sites were intentionally omitted as it is highly unlikely that residential sites would be acceptable to stakeholders due to the housing supply and affordability conditions. An additional assumption we have made is that the construction of an underground substation on public-use space (similar to the future West End Substation) is a feasible alternative.

Included in the enclosed list of Potential Sites are parks, schools, and public lands that may have a current zoning of higher density residential use and may be valued based on recently ***transacted multi-family residential land values ranging from $180 to $200 per sq.ft. of land***.

A preliminary research and analysis within the Search Boundary indicate ***commercial lands to have sold for $80 to upwards of $130 per sq.ft. of land*** *[For more details, please refer to Schedule "A" Recent Commercial Sale Transactions].* A search of recent sale transactions results in four sales which are ~ 2 acres and are smaller in size to our required search parameter of ~5 acres. These sales are a reliable indication of value for smaller sites and it is fair to expect that a larger site of 5-acres may garner a price on the lower end of the value range ($ per sq.ft.) due to economies of scale.

Please let us know if there are any questions or would like to discuss further.

Thank you,

Acquisitions and Sales, Real Estate Services, Properties

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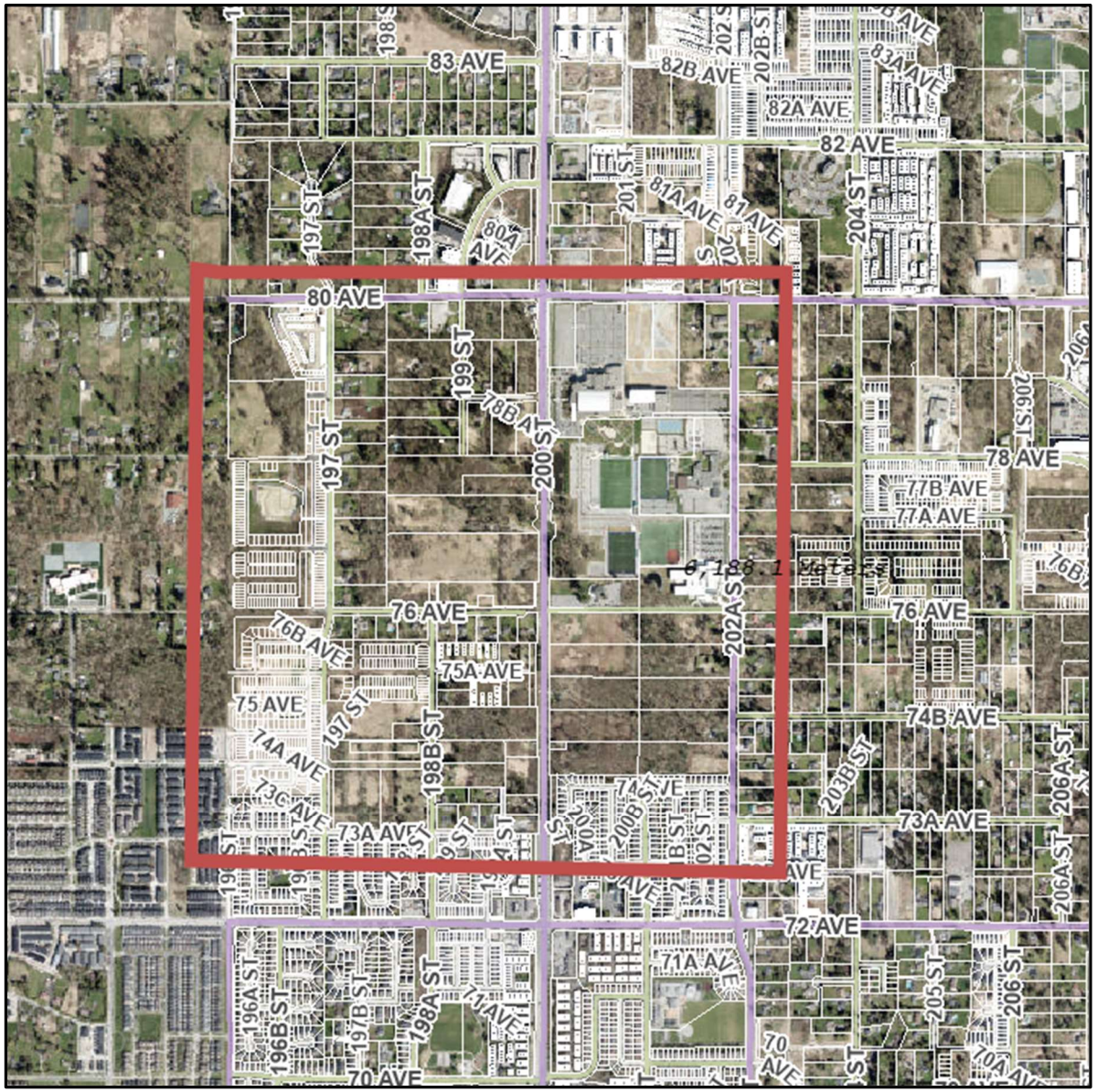
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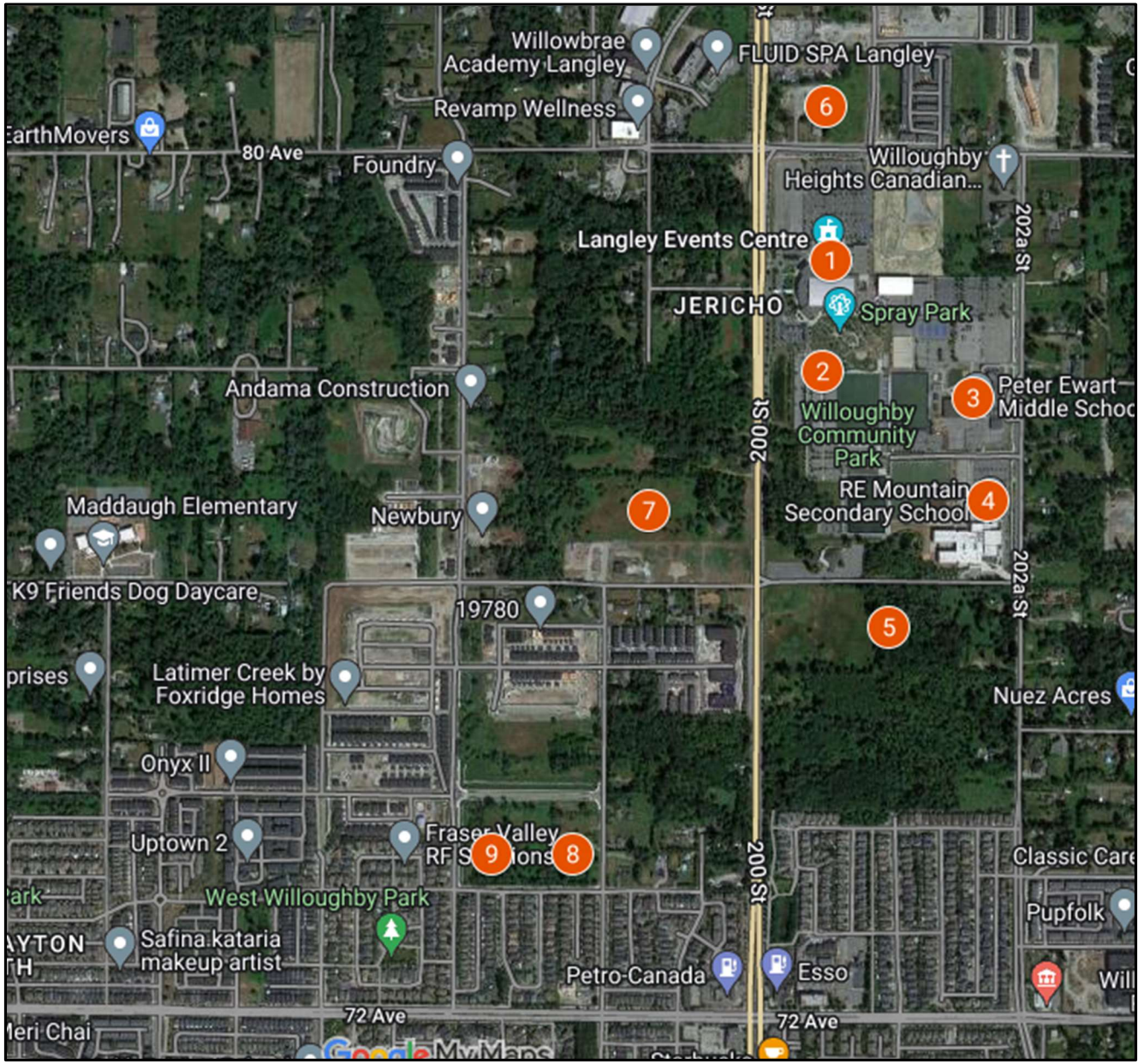
Map 1: Map of Search Boundary

(Outlined in Red)



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Map 2: Map of Potential Sites



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List of Potential Sites

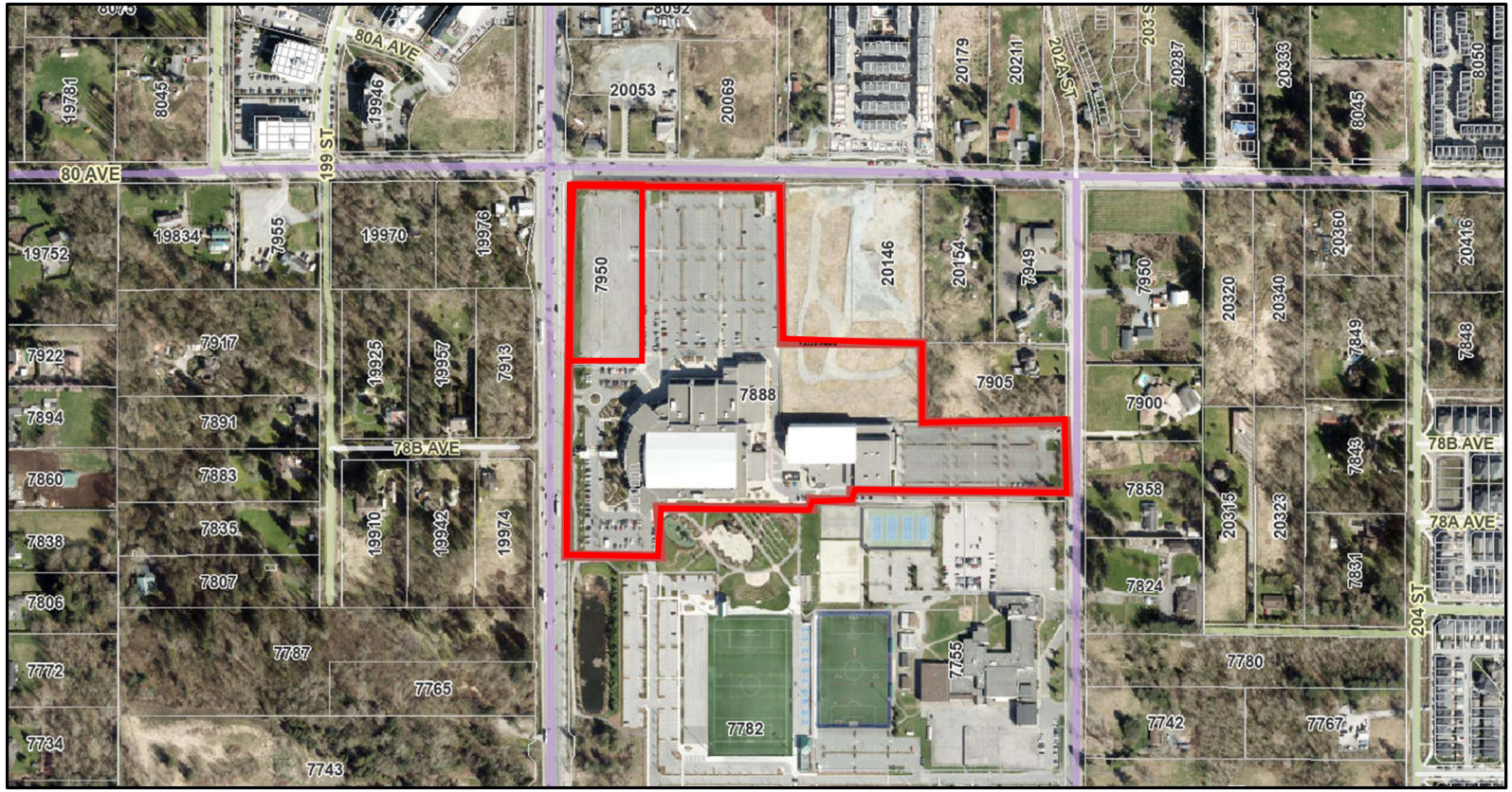
Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
1	7888 200 Street, Langley 7950 200 Street, Langley	223,376	Three	630 ft by 560 ft	023-242-680 031-167-993	Rectangular / Irregular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Langley Events Centre. Consists of large buildings with large surface parking lot area and appears to have significant excess lands.
2	7782 200 Street, Langley	1,332,500	Four	1100 ft by 1360 ft	031-168-001	Rectangular / Irregular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Willoughby Community Park
3	7755 202A Street, Langley	493,099	Three	830 ft by 780 ft	029-820-405	Rectangular	P-1; MIN 1858M - INSTITUTIONAL	Peter Ewart Middle School with surface parking lot area and soccer field
4	7633 202A Street, Langley	468,270	Three	780 ft by 780 ft	029-820-413	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	RE Mountain Secondary School with surface parking lot area.
5	7570 200 Street, Langley 7536 200 Street, Langley 7591 202A Street, Langley 7541 202A Street, Langley	863,794.80	Three	550 ft by 1550 ft	012-058-599 012-058-611 012-058-581 010-053-611	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Three vacant residential lots and one lot having a residential building.
6	20069 80 Ave, Langley 20053 80 Ave, Langley 20011 80 Ave, Langley 8092 200 Street, Langley	368,953.20	Three	570 ft by 650 ft	005-436-460 005-436-443 009-720-197 006-555-926	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Vacant lot and industrial commercial lands with several buildings.
7	7687 200 Street, Langley 7635 198B Street, Langley 19979 76 Ave, Langley	773,756	Two	1300 ft by 630 ft	028-571-002 031-684-009 031-684-017	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL CD-146; COMPREHENSIVE DEVELOPMENT ZONE CD-146	Vacant lands predominantly treed.
8	Vacant Lands	215,186	Three	400 ft by 530 ft	031-185-843	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Vacant lands predominantly treed, adjacent to Site 9.
9	Vacant Lands	237,402	Three	401 ft by 530 ft	031-185-827 031-185-835	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Vacant lands predominantly treed, adjacent to Site 8.

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Site 1:

7888 and 7950 200 Street, Langley

(Langley Events Centre)



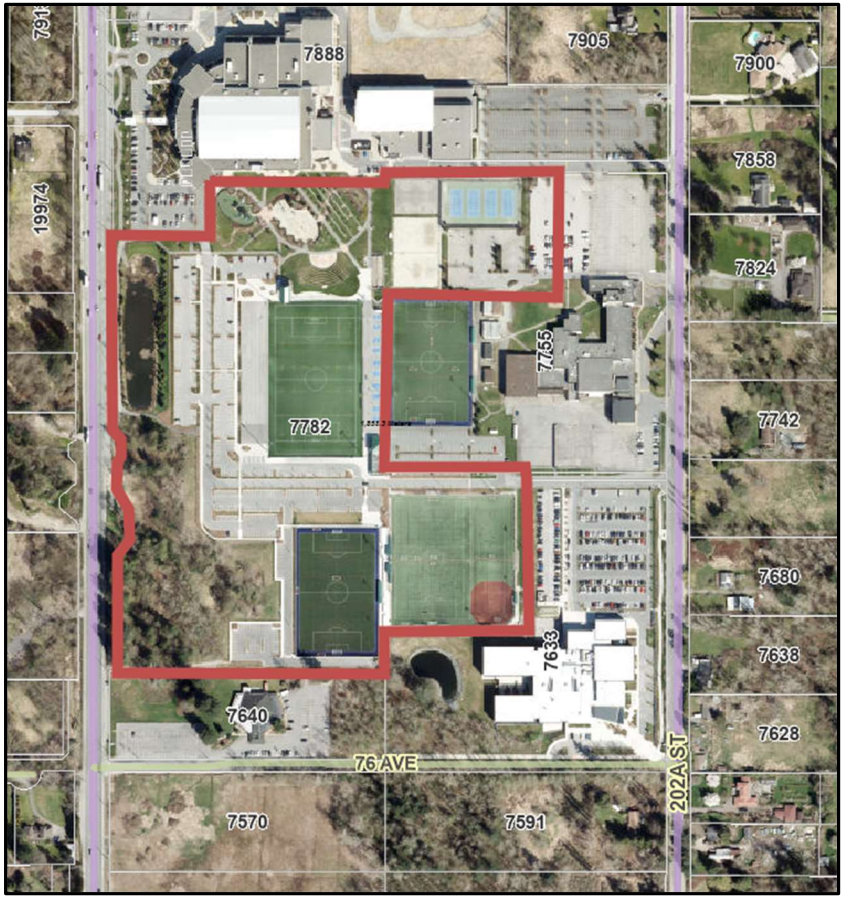
Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
1	7888 200 Street, Langley 7950 200 Street, Langley	223,376	Four	630 ft by 560 ft	023-242-680 031-167-993	Rectangular / Irreggular	MIN 8094M - SUBURBAN RESIDENTIAL	Langley Events Centre. Consists of large buildings with large surface parking lot area and appears to have significant excess lands.

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Site 2:

7782 200 Street, Langley

(Willoughby Community Park)



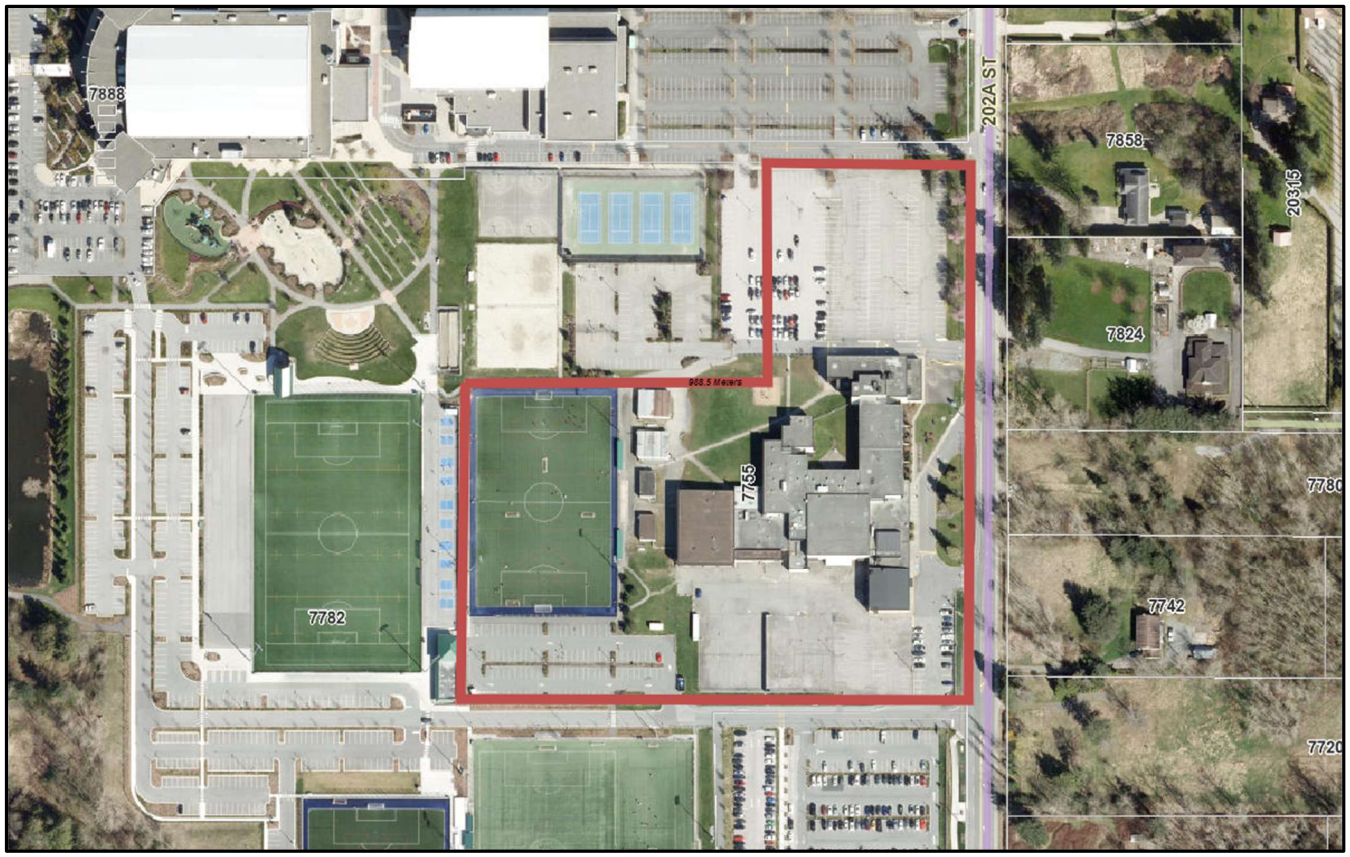
Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
2	7782 200 Street, Langley	1,332,500	Four	1100 ft by 1360 ft	031-168-001	Rectangular / Irreggular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Willoughby Community Park

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Site 3:

7755 202A Street, Langley

(Peter Ewart Middle School)



Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
3	7755 202A Street, Langley	493,099	Three	830 ft by 780 ft	029-820-405	Rectangular	P-1; MIN 1858M - INSTITUTIONAL	Peter Ewart Middle School with surface parking lot area and soccer field

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Site 4:

7633 202A Street, Langley

(R.E. Mountain Secondary School)



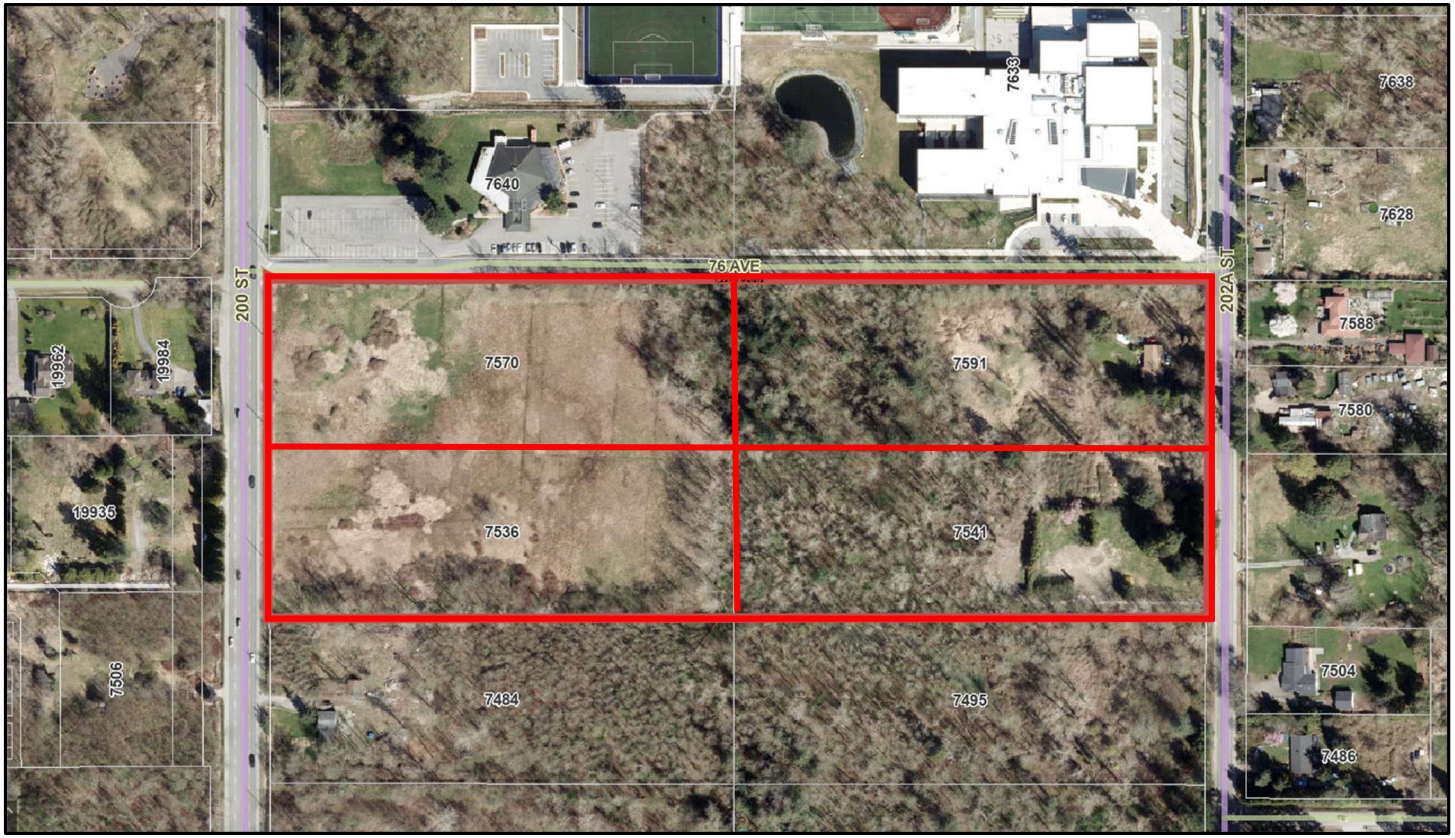
Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
4	7633 202A Street, Langley	468,270	Three	780 ft by 780 ft	029-820-413	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	RE Mountain Secondary School with surface parking lot area.

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Site 5:

7570 and 7536 200 Street, Langley

7591 and 7541 202A Street, Langley



Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
5	7570 200 Street, Langley 7536 200 Street, Langley 7591 202A Street, Langley 7541 202A Street, Langley	863,794.80	Three	550 ft by 1550 ft	012-058-599 012-058-611 012-058-581 010-053-611	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Three vacant residential lots and one lot having a residential building.

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Site 6:

20069, 20053, 20011 80 Ave, Langley and 8092 200 Street, Langley



Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
6	20069 80 Ave, Langley 20053 80 Ave, Langley 20011 80 Ave, Langley 8092 200 Street, Langley	368,953.20	Three	570 ft by 650 ft	005-436-460 005-436-443 009-720-197 006-555-926	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Vacant lot and industrial commercial lands with several buildings.

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Site 7:

7687 200 Street, 7635 198B Street, 19979 76 Avenue, Langley



Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
7	7687 200 Street, Langley 7635 198B Street, Langley 19979 76 Ave, Langley	773,756	Two	1300 ft by 630 ft	028-571-002 031-684-009 031-684-017	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL CD-146; COMPREHENSIVE DEVELOPMENT ZONE CD-146	Vacant lands predominantly treed.

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Site 8:

73A Ave and 198B Street, Langley



Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
8	Vacant Lands	215,186	Three	400 ft by 530 ft	031-185-843	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Vacant lands predominantly treed, adjacent to Site 9.

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Site 9:

73A Ave and 197 Street, Langley



Site No.	Municipal Address	Approx Size (SF)	Egress/ Ingress - Three Sides?	Dimensions (Ft)	PID	Shape / Dimensions	Zoning	Notes and Comments
9	Vacant Lands	237,402	Three	401 ft by 530 ft	031-185-827 031-185-835	Rectangular	SR-2; MIN 8094M - SUBURBAN RESIDENTIAL	Vacant lands predominantly treed, adjacent to Site 8.

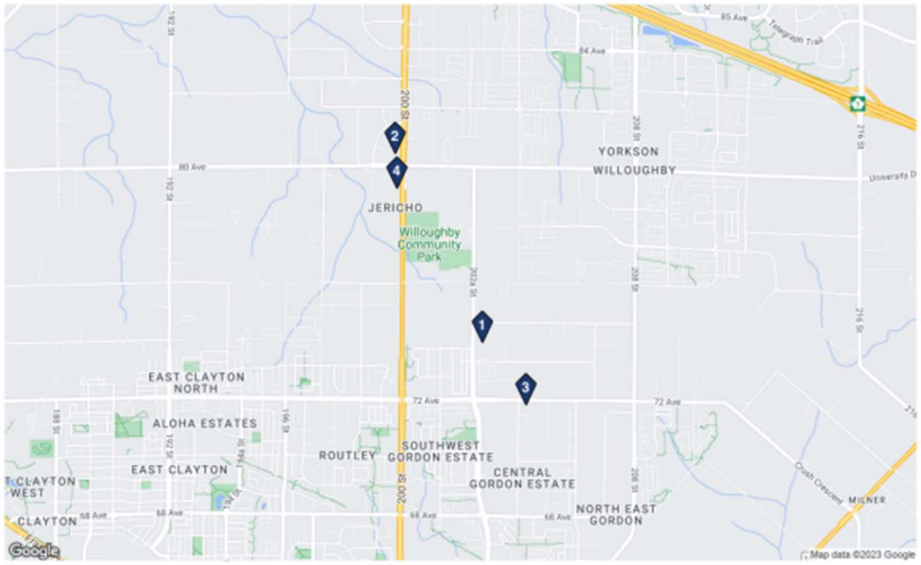
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Schedule “A” - Recent Commercial Sale Transactions

Sale Comps Map & List Report

Sale Comparables	Avg. Cap Rate	Avg. Price/SF	Avg. Vacancy At Sale
4	-	$109	-

SALE COMPARABLES LOCATIONS



SALE COMPARABLES SUMMARY STATISTICS

Sales Attributes	Low	Average	Median	High
Sale Price	$6,450,000	$9,868,818	$9,650,000	$13,725,270
Price Per SF	$80	$109	$112	$132
Cap Rate	-	-	-	-
Time Since Sale in Months	7.0	11.0	11.5	14.0

Property Attributes	Low	Average	Median	High
Building SF	-	-	-	-
Floors	-	-	-	-
Typical Floor	-	-	-	-
Vacancy Rate at Sale	-	-	-	-
Year Built	-	-	-	-
Star Rating	★★★★★	★★★★★ 2.0	★★★★★ 2.0	★★★★★

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Sale Comps Map & List Report

	Property Name - Address	Property Type	Yr Built	Size	Vacancy	Sale Date	Sale Price	Sale Price/Area	Sale Cap Rate
1	7402 202A St Langley, BC V2Y 1V4	Land ★★★★★	-	2.38 AC	-	2022-10-24	$13,725,270	$5,766,965/AC	-
2	200th St Langley, BC V2Y 0J8	Land ★★★★★	-	2.0 AC	-	2022-07-29	$10,800,000	$5,400,000/AC	-
3	20434 72 AVE Langley, BC V2Y 1T2	Land	-	1.84 AC	-	2022-04-29	$6,450,000	$3,505,452/AC	-
4	7913 200 St Langley, BC V2Y 1S3	Land ★★★★★	-	1.97 AC	-	2022-03-24	$8,500,000	$4,314,731/AC	-

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Schedule “A” - Recent Commercial Sale Transactions

1 **7913 200 St** — **SOLD**

Langley, BC V2Y 1S3
Sale on - for $8,500,000 ($4,314,720.81/AC) - Research Complete
Residential Land of 1.97 AC (85,813 SF)





Buyer & Seller Contact Info

Recorded Buyer:	**1259732 B.C. Ltd.**	Recorded Seller:	**1230572 B.C. Ltd.**
True Buyer:	**Essence Properties** 3950 191st St Surrey, BC (778) 574-0777	True Seller:	-
Buyer Type:	**Developer/Owner-RGNL**		
		Listing Broker:	**Marine Vista Realty** **Paul Tan** (778) 998-6870

Transaction Details — ID: 5959594

Sale Date:	**24-03-2022**	Sale Type:	**Investment**
Escrow Length:	-	Land Area:	**1.97 AC (85,813 SF)**
Sale Price:	**$8,500,000-Confirmed**	Proposed Use:	**Single Family Development, Single Family Residence**
Price/AC Land Gross:	**$4,314,720.81 ($99.05/SF)**		
Zoning:	**SR2**		
Financing:	**Down payment of $2,500,000.00 (29.4%)** **$6,000,000.00 from National Bank of Canada; Acquisition & Development loan type**		
Legal Desc:	**Lot 9 Plan NWP43906 Part1 NE Section 22 Township 8 Land District 36 Except Plan 83638**		
	PID: 007-152-361		
Document No:	**CA9804064**		

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Page 3

7913 200 St — **SOLD**
Residential Land of 1.97 AC (85,813 SF) (con't)

Transaction Notes

The plot of land on 200th St in Langley, BC was sold for $8,500,000 on March 24th, 2022. The property transferred from the operator of 1230572 B.C. Ltd. to Essence Properties.

The sale details were confirmed by Paul Tan of Marine Vista Realty. The listing broker would not confirm the details for future development of this plan. There was no mention of a buyer representative.

As per public records, this sale was financed for $6,000,000 provided by the National Bank of Canada.

Current Land Information — ID: 12724268

Zoning:	**SR2**	Proposed Use:	**Single Family Development/Single Family Residence**
Density Allowed:	-	Land Area:	**1.97 AC (85,813 SF)**
Number of Lots:	-	On-Site Improv:	-
Max # of Units:	-	Lot Dimensions:	-
Units per Acre:	-	Owner Type:	**Developer/Owner-RGNL**
Improvements:	-		
Legal Desc:	**Lot 9 Plan NWP43906 Part1 NE Section 22 Township 8 Land District 36 Except Plan 83638**		

Location Information

Metro Market:	**Vancouver**
Submarket:	**Surrey/Langley/Surrey/Langley**
County:	**Greater Vancouver**

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Schedule “A” - Recent Commercial Sale Transactions

2 **200th St** — **SOLD**

Langley, BC V2Y 0J8
Sale on - for $10,800,000 ($5,400,000.00/AC) - Research Complete
Commercial Land of 2 AC (87,120 SF)





Buyer & Seller Contact Info

Recorded Buyer:	**1281083 B.C. LTD.**	Recorded Seller:	**1110057 B.C. LTD.**
True Buyer:	**Lorval Developments** 9785 201 St Langley, BC V1M 3E7 (672) 879-9949	True Seller:	-
Buyer Type:	**Other - Private**		
Buyer Broker:	**No Buyer Broker on Deal**	Listing Broker:	**No Listing Broker on Deal**

Transaction Details — ID: 6125291

Sale Date:	**29-07-2022**	Sale Type:	**Investment**
Escrow Length:	-	Land Area:	**2 AC (87,120 SF)**
Sale Price:	**$10,800,000-Full Value**	Proposed Use:	-
Price/AC Land Gross:	**$5,400,000.00 ($123.97/SF)**		
Zoning:	**CD-57**	Percent Improved:	-
		Total Value Assessed:	**$10,080,000 in 2022**
		Improved Value Assessed	-
		Land Value Assessed:	**$10,080,000**
		Land Assessed/AC:	**$5,040,000**

Financing: **Down payment of $10,800,000.00 (100.0%)**
Off-Site Improv: **Cable, Curb/Gutter/Sidewalk, Electricity, Gas, Irrigation, Sewer, Streets, Telephone, Water**
Parcel No: **026-056-879**
Document No: **CB118468**
Sale History: **Sold for $10,800,000 on 2022-07-29**
Sold for $4,920,000 on 2017-05-17

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200th St — **SOLD**
Commercial Land of 2 AC (87,120 SF) (con't)

Transaction Notes

The 2 AC land parcel on North West corner of 200 st and 80 Ave in Langley was sold on July 29 2022 for a total consideration of $10,800,000.
The parcel transferred from 1110057 BC Ltd to 1281083 BC Ltd, subsidiary of Lorval Developments. No application for redevelopment has been filed with the city yet.
No information regarding financing was found via public records.

Current Land Information — ID: 9834048

Zoning:	**CD-57**	Proposed Use:	-
Density Allowed:	-	Land Area:	**2 AC (87,120 SF)**
Number of Lots:	-	On-Site Improv:	-
Max # of Units:	-	Lot Dimensions:	-
Units per Acre:	-	Owner Type:	**Other - Private**
Improvements:	-		

Off-Site Improv: **Cable, Curb/Gutter/Sidewalk, Electricity, Gas, Irrigation, Sewer, Streets, Telephone, Water**

Location Information

Metro Market: **Vancouver**
Submarket: **Surrey/Langley/Surrey/Langley**
County: **Greater Vancouver**

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Schedule "A" - Recent Commercial Sale Transactions

3 **7402 202A St** — **SOLD**
Langley, BC V2Y 1V4
Sale on - for $13,725,270 ($5,766,920.17/AC) - Research Complete
Residential Land of 2.38 AC (103,673 SF)





Buyer & Seller Contact Info

Recorded Buyer:	**1149329 B.C. Ltd.**	Recorded Seller:	**QRD (Jericho Hill) Holdings Inc.**
True Buyer:	**Kamel, Mohamed** **Mohamed Kamel** 3420 Barmond Ave Richmond, BC V7E 1A3 (604) 272-2412	True Seller:	**Quarry Rock Developments** **Chris Seto** 5489-5589 Byrne Rd Burnaby, BC V5J 3J1 (604) 699-8000
Buyer Type:	**Individual**	Seller Type:	**Developer/Owner-RGNL**
		Listing Broker:	**Frontline Real Estate Services** **Justin Mitchell** (604) 687-8300 **Adam Lawrence** (604) 495-8794

Transaction Details — ID: 6220710

Sale Date:	**24-10-2022**	Sale Type:	**Investment**
Escrow Length:	-	Land Area:	**2.38 AC (103,673 SF)**
Sale Price:	**$13,725,270-Full Value**	Proposed Use:	**Single Family Development, Single Family Residence**
Price/AC Land Gross:	**$5,766,920.17 ($132.39/SF)**		
Zoning:	**CD-124**		
Financing:	**Down payment of $10,225,270.00 (74.5%)** **$3,500,000.00 from MortEq Lending Corp.:: 5.55%,: due in 15 yrs; Acquisition & Development loan type**		
Off-Site Improv:	**Cable, Curb/Gutter/Sidewalk, Electricity, Gas, Irrigation, Sewer, Streets, Telephone, Water**		
Document No:	**CB298153**		

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7402 202A St — **SOLD**
Residential Land of 2.38 AC (103,673 SF) (con't)

Transaction Notes

The 2.38 acre site located at 7402 202A St in Langley, BC transferred in an investment sale on October 24th, 2022 for $13,725,270. The property transferred from Quarry Rock Developments to Mohamed Kamel. The site is currently zoned Comprehensive Development (CD-124).

No development applications have been filed at this time.

CoStar was able to verify the transaction details above by cross-referencing public records provided by the land registry office. Additionally, according to public records, MortEq Lending Corp. provided financing in the amount of $3,500,000 at prime + 5.55%.

Justin Mitchell and Adam Lawrence from Frontline Real Estate Services brokered this deal.

Current Land Information — ID: 13830806

Zoning:	**CD-124**	Proposed Use:	**Single Family Development/Single Family Residence**
Density Allowed:	-	Land Area:	**2.38 AC (103,673 SF)**
Number of Lots:	-	On-Site Improv:	-
Max # of Units:	-	Lot Dimensions:	-
Units per Acre:	-	Owner Type:	**Individual**
Improvements:	-		
Legal Desc:	**Lot 2 Plan NWP80849 Section 23 Township 8 Land District 36**		
Off-Site Improv:	**Cable, Curb/Gutter/Sidewalk, Electricity, Gas, Irrigation, Sewer, Streets, Telephone, Water**		

Location Information

Metro Market:	**Vancouver**
Submarket:	**Surrey/Langley/Surrey/Langley**
County:	**Greater Vancouver**

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Schedule “A” - Recent Commercial Sale Transactions

4 **20434 72 AVE** **SOLD**

Langley, BC V2Y 1T2
Sale on - for $6,450,000 ($3,505,434.78/AC) - Research Complete
Residential Land of 1.84 AC (80,150 SF)





Buyer & Seller Contact Info

Recorded Buyer:	**1359056 B.C. Ltd.**	Recorded Seller:	**1116005 B.C. Ltd.**
True Buyer:	**Quarry Rock Developments** 5489-5589 Byrne Rd Burnaby, BC V5J 3J1 (604) 699-8000	True Seller:	**Apna Group** 8433 132 St Surrey, BC V3W 4N8 (604) 621-7700
Buyer Type:	**Developer/Owner-RGNL**	Seller Type:	**Other - Private**

Transaction Details ID: 6298544

Sale Date:	**29-04-2022**	Sale Type:	**Investment**
Escrow Length:	**-**	Land Area:	**1.84 AC (80,150 SF)**
Sale Price:	**$6,450,000-Full Value**	Proposed Use:	**Hold for Development**
Price/AC Land Gross:	**$3,505,434.78 ($80.47/SF)**		

Zoning: **MIN 8094M**

Financing: **Down payment of $1,150,000.00 (17.8%)**
$5,300,000.00 from Private Lender:: 20.00%,

Legal Desc: **LOT 11, PLAN NWP68056, PART NE1/4, SECTION 14, TOWNSHIP 8, NEW WESTMINSTER LAND DISTRICT**
Document No: **CA9893208**

Transaction Notes

This 1.84-acre land parcel located at 20434 72 Ave. in Langley, BC sold in an investment sale on April 29, 2022. The price of the sale has been verified through public record documents for $6,450,000 or approximately $3,505,434 per acre. The property transferred from the Apna Group to Quarry Rock Developments.

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20434 72 AVE **SOLD**
Residential Land of 1.84 AC (80,150 SF) (con't)

Current Land Information ID: 13889046

Zoning:	**MIN 8094M**	Proposed Use:	**Hold for Development**
Density Allowed:	**-**	Land Area:	**1.84 AC (80,150 SF)**
Number of Lots:	**-**	On-Site Improv:	**-**
Max # of Units:	**-**	Lot Dimensions:	**-**
Units per Acre:	**-**	Owner Type:	**Developer/Owner-RGNL**
Improvements:	**-**		

Legal Desc: **LOT 11, PLAN NWP68056, PART NE1/4, SECTION 14, TOWNSHIP 8, NEW WESTMINSTER LAND DISTRICT**

Location Information

Metro Market: **Vancouver**
Submarket: **Surrey/Langley/Surrey/Langley**
County: **Greater Vancouver**

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From: Alder, Kootenay <Kootenay.Alder@stantec.com>
Sent: 2024, October 15 11:50 AM
To: Randt, David; Hansen, Adrian; Hepple, Robert; Chwaklinski, David
Cc: Duffy, Paul; McIntyre, Adam; Trudel, Tyler
Subject: [External] Stantec Geotechnical Factual Data Report - Campbell Heights Property Assessment Site 14 - Draft Issued for Review
Attachments: rpt_123317336_bch_campbell_heights_factual_revA.pdf

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Hi All,

Please see attached Stantec's draft Geotechnical Factual Data Report for the Campbell Heights Property Assessment - Site 14 project, issued for BC Hydro's review and comments.

The finalized report will be issued following receipt of any comments from BC Hydro.

If you have any questions or concerns, please do not hesitate to reach out to myself and the Stantec project team cc'd above.

Regards,
Kootenay Alder EIT
Geotechnical Engineer

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Please consider the environment before printing this email.

Geotechnical Factual Data Report

Campbell Heights Property Assessment - Site 14

DRAFT

Stantec

Prepared for:
BC Hydro

October 15, 2024

Prepared by:
Stantec Consulting Ltd.

Project/File:
123317336

Stantec Consulting Ltd.

Revision	Date	Description
A	October 15, 2024	Draft, issued for review

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The conclusions in the Report titled Geotechnical Factual Data Report: Campbell Heights Property Assessment - Site 14 are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from BC Hydro (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

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1 Introduction

BC Hydro (BCH) has engaged Stantec Consulting Ltd. (Stantec) to provide geotechnical consulting services in support of the Campbell Heights Property Assessment – Site 14 project, herein referred to as 'the Project'. Stantec has prepared this report for BCH to summarize the factual geotechnical data for the Project.

This report should be read in conjunction with the Statement of General Conditions presented in **Appendix A**.

1.1 Project Understanding

Based on BCH Request for Proposal (RFP) 17635, we understand that BCH is evaluating candidate properties for the future development of a new 200 MVA substation to service the South Surrey and Langley areas. The candidate properties are within the Campbell Heights neighbourhood of the Township of Langley, British Columbia.

This report pertains to Site 14, which is one of BCH's candidate properties and is located between 196 Street and 197A Street, and between 30 Avenue and 31A Avenue. We understand that Site 14 was selected as a candidate property for further assessment based on a high-level review undertaken by BCH. BCH requires an assessment of subsurface conditions, seismic conditions, foundation design considerations, and a qualitative geotechnical risk assessment to progress the evaluation of Site 14 prior to property acquisition. Details about the substation layout, final grading, proposed infrastructure, and loading have not been provided to Stantec and are currently unknown.

Per BCH RFP 17635, the key objectives of the property assessment are as follows:

- Identification of the potential for adverse impacts to the property due to a seismic event, including unacceptable post-seismic displacements and/or failure resulting from any of the seismically induced mechanisms such as liquefaction, strain softening and or unacceptable amplification of seismic loading, etc.
- Identification of potential geohazards at the property including flooding and landslides.
- Identification of site preparation (i.e., cuts and fills) and ground improvement requirements in order for the site to be used as a substation.

The results of the geotechnical site assessment are presented separately.

1.2 Scope of Work

The work described in this report was carried out in accordance with our proposal letter ("Campbell Heights Property Assessment – Site 14", dated July 18, 2024), email correspondence from BCH with suggested geotechnical site investigation changes on July 22, 2024, and the terms of the BCH RFP

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17635 Geotechnical Engineering and Geohazard Services Master Services Agreement. Stantec's scope of work for this Geotechnical Factual Data Report included the following:

- Review of existing Project information and available geotechnical and geological information for the Project site.
- Site reconnaissance with BCH, Stantec, and Stantec's drilling subcontractor.
- Obtaining permits to unload and load geotechnical site investigation equipment within the road right-of-way.
- A geotechnical site investigation consisting of:
    - Two (2) auger boreholes to a target depth of 15 m with Standard Penetration Testing (SPT) carried out at 1.5 m intervals.
    - Seismic Cone Penetration Tests with concurrent soil Resistivity measurements (RSCPT) near both auger boreholes and advanced to a maximum depth of 30 m or until practical equipment refusal.
    - Installing standpipe piezometers within the auger boreholes to monitor the groundwater levels at the Project site.
- Geotechnical and chemical laboratory testing of select samples collected during the geotechnical site investigation.
- Preparation of this report.

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2 Site Description and Geology

2.1 Physical Setting

The Project site, identified as ‘Site 14’, is situated between 196 Street and 197A Street, and between 30 Avenue and 31A Avenue in the Township of Langley, BC, within the Fraser Lowland physiographic sub-region of the greater Georgia Depression physiographic region (Holland, 1976).

The Township of Langey’s interactive mapping tool, GeoSource (Township of Langley, 2024), shows that the Project site is approximately 13 acres in area, within Lots 9 and 11 of Plan NWP 1168, and is rectangular in shape. The site is currently undeveloped and vegetated with second growth forest. Surrounding land use generally consists of residential and agricultural properties.

The existing ground surface elevation at Site 14 is between approximately El. 47 m and 49 m geodetic at the west and east sides of the site, respectively.

2.2 Geological Setting

Based on the published Geological Survey of Canada Map 1484A, Surficial Geology of New Westminster (Armstrong and Hickock, 1980), the surficial soils at the site consist of geological unit Se (Pleistocene – Sumas Drift sediments): outwash, ice-contact, and deltaic deposits consisting of raised proglacial deltaic gravel and sand up to 40 m thick.

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3 Geotechnical Site Investigation

Stantec carried out a geotechnical site investigation field program consisting of utility locating, drilling of two (2) auger boreholes (BH24-01 and BH24-02) with in-situ testing and standpipe piezometer installation, and two RSCPT soundings located near the auger borehole locations (RSCPT24-01 and RSCPT24-02). A borehole location plan that shows the approximate locations of the auger boreholes and RSCPT soundings is provided in **Appendix B**.

3.1 Site Reconnaissance and Preparation

BCH, Stantec, and our drilling subcontractor carried out a site reconnaissance on August 21, 2024, to select and confirm access to the borehole locations, and identify any potential geohazards. The borehole locations were selected to minimize tree clearing requirements and to avoid the need for fence removals, waterway crossings, or the construction of new access trails. During the site reconnaissance, the parties also identified trees that could obstruct equipment access to borehole locations or that could be potentially hazardous to the geotechnical site investigation personnel.

Stantec retained Central Valley Tree and Arborist Services Ltd. (Central Valley) of Abbotsford, BC to remove potentially hazardous trees and branches that were obstructing equipment access routes. BCH obtained approval from the Township of Langley prior to the tree and branch removal work. Two standing dead trees were removed near BH24-01, one live tree was removed near BH24-02, and various tree limbs were trimmed along the access trail to BH24-02. Central Valley carried out the tree and branch clearing work on September 6, 2024.

3.2 Property Access and Permits

BCH negotiated with the Township of Langley to obtain access to the site and receive permission to carry out the geotechnical site investigation and tree clearing.

Boreholes BH24-01 and BH24-02 were accessed via existing trails that originated near 196 Street at 31A Avenue and near 197A Street at 30 Avenue, respectively. For borehole BH24-01, the geotechnical site investigation equipment was unloaded and loaded in a clearing beyond the south end of 196 Street.

At the time of the reconnaissance, the trail entrance near 197A Street at 30 Avenue was blocked by concrete barriers, which would impede access to BH24-02. For this reason, Stantec obtained a Highway Use Permit (HUP HG002218) from the Township of Langley on September 6, 2024, in order to unload and load geotechnical site investigation equipment in the 30 Avenue right-of-way.

A rubber-tracked John Deere 323D Skid Steer was used to temporarily re-locate the concrete barriers positioned at the trail access point near the intersection of 30 Avenue and 197A Street. The concrete barriers were returned to their original position after completion of the geotechnical site investigation.

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3.3 Field Program

3.3.1 Utility Locating

In advance of the geotechnical site investigation, Stantec submitted requests to BC One Call, Dig Shaw, and Metro Vancouver to obtain information on existing utilities in the vicinity of the proposed borehole locations. Prior to drilling, Stantec retained the services of a utility locating subconsultant, Quadra Utility Locating Ltd. (Quadra) of Port Coquitlam, BC, to review available information on existing utilities and to carry out a survey of existing subsurface utilities at the site prior to finalizing the borehole locations. Quadra carried out the on-site survey of existing utilities on September 6, 2024, using electromagnetic (EM) and ground penetrating radar (GPR) utility locating methodologies.

3.3.2 Drilling, Sampling, and In-Situ Testing

The auger boreholes and RSCPT soundings were completed between September 9 and 11, 2024. A summary of the borehole and RSCPT locations, existing ground surface elevations, and termination depths is provided in **Table 3-1**.

Table 3-1 Borehole Summary

Borehole ID	Dates	Northing [1] (m)	Easting [1] (m)	Approximate Ground Surface Elevation [2] (m)	Termination Depths (m)
BH24-01	September 9, 2024	5433903	523338	48	16.6
BH24-02	September 11, 2024	5433791	523505	49	15.1
RSCPT24-01	September 10, 2024	5433903	523336	48	1.4
RSCPT24-01A	September 10, 2024	5433903	523337	48	6.2, 14.0
RSCPT24-02	September 11, 2024	5433794	523504	49	1.9

Notes:

1. Borehole and RSCPT coordinates collected using handheld GPS device and are accurate to approximately +/- 5 m.
2. Ground surface elevations estimated using Township of Langley ArcGIS 1 m contour map (2018) open data and are approximate.

The geotechnical site investigation was carried out under the full-time supervision of a Stantec geotechnical engineer who located the boreholes, observed the drilling and testing operations, classified the soils encountered, prepared field records, and collected soil samples for laboratory testing.

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3.3.2.1 Auger Boreholes

Geotechnical auger borehole drilling was carried out by Mud Bay Drilling Ltd. (Mud Bay), a subsidiary of ConeTec Investigations Ltd. (ConeTec). The drilling was completed using a truck-mounted GT8 6x6 drill rig.

Borehole drilling commenced using the solid-stem auger drilling methodology in general accordance with American Society for Testing and Materials (ASTM) standard D1452. However, this methodology was abandoned at approximately 2.3 m and 0.8 m depth below the ground surface in boreholes BH24-01 and BH24-02, respectively, due to borehole collapse. Mud Bay subsequently switched to the hollow-stem auger drilling methodology to advance the boreholes to the target depth.

Hollow-stem auger drilling was carried out in general accordance with ASTM standard D6151, using approximately 110 mm inner diameter (ID) hollow-stem auger flights. Due to the presence of sandy and gravelly soils, Mud Bay chose to advance the hollow-stem augers without utilizing a plug at the bottom of the augers. Instead, 44 mm outer diameter (OD) drill rods (AWJ size) were used during drilling to prevent soil from rising through the inside of the hollow-stem augers.

Mud Bay initially attempted hollow-stem auger drilling without using any water or drilling fluid within the auger-casing. Approximately 300 mm to 450 mm of heave occurred inside the hollow-stem augers at 4.3 m and 4.7 m depth below the ground surface in BH24-01 and BH24-02, respectively. Subsequently, Mud Bay introduced water to the inside of the hollow-stem auger-casing to maintain positive head at the bottom of the hole to mitigate further heave.

Standard Penetration Tests (SPTs) were performed in both boreholes, either after removing the solid-stem augers from the borehole or through the inside of the hollow-stem auger-casing. The SPTs were carried out at approximately 1.5 m depth intervals in general accordance with ASTM D1586, using a 51 mm OD, un-lined split spoon sampler. Upon reaching the desired test interval, the split spoon sampler was connected to 44 mm OD (AWJ size) drilling rods, lowered to the base of the borehole, and driven into the ground using a 63.5 kg automatic safety hammer, falling from a height of 760 mm. Blow counts were recorded for penetration intervals of 150 mm during the testing, up to a maximum of four consecutive intervals (i.e., maximum 600 mm test). The SPT N-values are the cumulative blows for the second and third 150 mm penetration (for a total 300 mm of penetration) and are reported on the Borehole Records.

Soil and groundwater conditions, results of the laboratory classification and index testing, borehole backfilling, and standpipe installation details are shown on the Borehole Records in **Appendix C**. Soil descriptions in the Borehole Records are in general accordance with ASTM D2487 and D2488 for the Unified Soil Classification System (USCS).

3.3.2.2 Resistivity Seismic Cone Penetration Testing (RSCPT)

RSCPT soundings were carried out as per BCH RFP 17635 and email correspondence from BCH. The RSCPT soundings were located within approximately 3 m (horizontal distance) of the boreholes.

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The RSCPTs were carried out in accordance with ASTM D5778 and ASTM D7400/D7400-19 using a 15 cm^2 stainless steel piezocone, with additional shear wave velocity and soil resistivity measuring equipment, attached to 36 mm OD rods. The piezocone was advanced into the ground at a rate of approximately 2 cm/s using a 14-ton drill rig head cylinder attached to the truck mounted GT8 6x6 drill rig. All RSCPT soundings were terminated by ConeTec short of the target depth due to excessive rod flex caused by the presence of coarse-grained granular soils.

At the location of RSCPT24-01, the soils within approximately 0.9 m of the ground surface were drilled out prior to initiating the RSCPT sounding, which was subsequently terminated due to excessive rod flex at approximately 1.4 m depth below ground surface.

The drill rig was repositioned approximately 1 m from the initial test location, and the sounding was re-attempted as RSCPT24-01A. At this new location, ConeTec drilled out the soils within approximately 5.9 m of the existing ground surface and installed casing to provide support to the RSCPT rods. The RSCPT sounding was advanced from approximately 5.9 m to 6.2 m depth, at which point ConeTec terminated the sounding due to very high cone tip resistance. Subsequently, ConeTec drilled out the coarse-grained granular soils and installed additional support casing from approximately 6.2 m to 13.5 m depth below the ground surface. The RSCPT24-01 sounding resumed below 13.5 m depth but was terminated due to excessive rod flex at approximately 14.0 m depth. Further advancement of the RSCPT24-01 sounding was not attempted due to the soil conditions encountered.

Sounding RSCPT24-02 was carried out near BH24-02. The sounding was advanced to approximately 1.9 m depth, at which point excessive rod flex occurred. Further advancement of this RSCPT sounding was not attempted due to the similarity in soil conditions and resistance to penetration encountered at BH24-01.

Pore pressure dissipation tests were conducted in all soundings. Shear wave velocity measurements were taken at select depths in soundings RSCPT24-01 and -02.

The RSCPT data is provided along with additional details in ConeTec's report in **Appendix D**. It should be noted that the RSCPT coordinates collected by ConeTec (using a consumer grade GPS device in datum WGS84/UTM 10 North), provided in ConeTec's report, do not agree with the coordinates collected by Stantec (as presented in **Table 3-1**) and have not been verified by Stantec.

3.4 Standpipe Piezometers and Borehole Closure

Standpipe piezometers were installed after the completion of drilling in boreholes BH24-01 and BH24-02. The standpipes consisted of 50 mm diameter PVC Schedule 40 pipe with a slotted section (screen) at the bottom. The screened length was 4.5 m and 3.0 m in BH24-01 and BH24-02, respectively.

Soil sloughing was observed in both boreholes after removing the hollow-stem auger flights. BH24-01 sloughed below approximately 9.4 m depth, and BH24-02 sloughed below approximately 7.9 m depth. Coated bentonite pellets were used to backfill the boreholes over a length of approximately 0.3 m between the sloughed soils and the bottom of the standpipe piezometers. Filter sand was used to backfill

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the borehole annulus and extended approximately 0.3 m above the top of the screen. Bentonite pellets were used to backfill the boreholes above the filter sand.

Flush-mount protective well covers were installed at the ground surface and sealed with concrete for both standpipe piezometers.

Standpipe piezometer installation details are summarize in **Table 3-2** and presented on the borehole records in **Appendix C**. A summary of the groundwater depth readings is also provided in **Table 3-2.**

Table 3-2 Standpipe Piezometer Summary and Groundwater Depths

Borehole ID	Standpipe Installation Date	Ground Surface Elevation[1] (m)	Screen Depth Interval (m)	Groundwater Depth (m)	
				September 9 / 11, 2024[2]	October 4, 2024
BH24-01	September 9, 2024	48	4.6 – 9.1	4.1	4.2
BH24-02	September 11, 2024	49	4.6 – 7.6	4.6	5.0

Notes:

1. Ground surface elevations estimated using 1 m contour map (2018) open data from GeoSource (Township of Langley, 2024) and are approximate.
2. Initial water level measurements taken following standpipe piezometer installation (i.e., depth measurements taken the day of standpipe installation).

The boreholes were backfilled in accordance with the *BC Groundwater Protection Regulation*.

3.5 Laboratory Testing

The objective of the Stantec laboratory testing program was to aid in the classification of the representative, disturbed soil samples and to measure pertinent soil parameters. The tests included natural moisture content and particle size distribution tests. In general, geotechnical laboratory testing was performed in accordance with applicable ASTM test procedures and/or laboratory equipment manufacturer's recommended test procedures.

Chemical tests were carried out on select soil samples at the Bureau Veritas laboratory in Burnaby, BC.

A summary of the laboratory testing is included in **Table 3-3**.

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Table 3-3 Laboratory Testing Summary

Test	Test Procedure	Number of Tests Performed
Moisture Content	ASTM D2216	2
Particle Size Distribution	ASTM D6913	7
Soluble pH	BCMOE BCLM Mar2005 m	6
Soluble Conductivity	SM 23 2510 B m	6
Soluble Chloride	SM 23 4500-Cl- E m	6
Soluble Sulphate	SM 23 4500-SO42- E m	6

3.5.1 Natural Moisture Content

Natural Moisture Content tests were performed on select samples, with emphasis on silt or silty samples, in accordance with ASTM D2216. The results of the moisture content tests are presented on the Borehole Records in **Appendix C**.

3.5.2 Particle Size Distribution

Particle size distribution tests were completed in accordance with ASTM D6913 using select soil samples. The results of the particle size distribution tests are presented on the Borehole Records in **Appendix C** and on the test reports in **Appendix E**.

3.5.3 Chemical Tests of Soils

Chemical tests including pH, electrical conductivity, chloride, and sulphate content were carried out on six soil samples from the boreholes. The chemical test results are presented in **Appendix E**.

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4 Closure

This report was prepared for the exclusive use of BC Hydro for specific application to the Campbell Heights Property Assessment – Site 14 project. Use of this report is subject to the Statement of General Conditions included in **Appendix A**. It is the responsibility of BC Hydro, who is identified as "the Client" within the Statement of General Conditions, to review the conditions and notify Stantec should any of them not be satisfied.

We trust that this report meets your present requirements. If you have any questions or require additional information, please contact the undersigned.

Regards,

STANTEC CONSULTING LTD.

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5 References

1. Holland, S.S. (1976). *Landforms of British Columbia, A Physiographic Outline.* Bulletin 48. The Government of the Province of British Columbia
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3. Township of Langley (2024). *GeoSource*. Retrieved from Maps: https://www.tol.ca/en/connect/maps.aspx.

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Appendix A Statement of General Conditions

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STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This professional work product ("hereinafter referred to as the Report") has been prepared for the sole benefit of the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance, or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

BASIS OF THIS REPORT: This Report relates solely to the site-specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The information, opinions, conclusions and/or recommendations made in this Report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time the scope of work was conducted and do not take into account any subsequent changes. If the proposed site-specific project differs or is modified from what is described in this Report or if the site conditions are altered, this Report is no longer valid unless Stantec is requested by the Client to review and revise the Report to reflect the differing or modified project specifics and/or the altered site conditions. This Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose or site, and any unauthorized use or reliance is at the recipient's own risk.

STANDARD OF CARE: Preparation of this Report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

PROVIDED INFORMATION: Stantec has assumed all information received from the Client and third parties in the preparation of this Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this Report are based on site conditions encountered by Stantec at the time of the scope of work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in-situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this Report or encountered at the test and/or sample locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the Report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or subsurface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec geotechnical engineers, sufficiently ahead of initiating the next project stage (e.g., property acquisition, tender, construction, etc.), to confirm that this Report completely addresses the elaborated project specifics and that the contents of this Report have been properly interpreted. Specialty quality assurance services (e.g., field observations and testing) during construction are a necessary part of the evaluation of subsurface conditions and site work. Site work relating to the recommendations included in this Report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

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Appendix B Borehole Location Plan

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LEGEND

- BOREHOLE LOCATION
- PROPERTY / LEGAL LINE
- GROUND CONTOUR (2018)

SCALE IN METRES

0 25 50 75 100

1:1500

Stantec

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2024/10/08 4:58 PM By: Loewen, Caroline

Sources

Project Information

Project No.:	123317336
Scale:	1:400
Date:	2024-OCT-04
Drawn by:	C. LOEWEN
Checked by:	K. ALDER

Project Location

TOWNSHIP OF LANGLEY, BRITISH COLUMBIA

Client/Project

BC HYDRO

CAMPBELL HEIGHTS PROPERTY ASSESSMENT - SITE 14

TITLE

BOREHOLE SITE PLAN

Figure No.

1

Appendix C Borehole Records

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BOREHOLE RECORD

BH24-01

CLIENT: **BC Hydro**
PROJECT: **Campbell Heights Site Assessment - Site 14**
LOCATION: **Lots 9 & 11, Sec. 22, Twsp. 7, NWD, Township of Langley, BC**
DATE BORED: **September 9, 2024**

BH COORDINATES [UTM10] 5433903N 523338E
PROJECT NO. : **123317336**
BH ELEVATION: **48m**
DATUM: **Geodetic**
WATER LEVEL: **4.2 m on October 4, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE	OTHER TESTS / REMARKS
0	48.0	TOPSOIL: brown silty sand with gravel, trace wood debris and rootlets, moist		SS	01	300	8	Solid-stem auger drilling from 0.0 m to 2.3 m
	47.4	Dense brown poorly graded SAND (SP-SM) with silt and gravel - dry to moist		SS	02	375	35	Sieve at 0.8 m G 44% S 49% Fines 7%
2	46.2	Dense grey poorly graded SAND (SP) with gravel - trace silt - dry to moist		SS	03	300	30	Borehole sloughed from 1.0 to 2.3 m depth after removing solid-stem augers. Hollow-stem auger drilling below 2.3 m depth.
4		- moist to wet below 3.8 m		SS	04	200	39	
	43.4	Compact to very dense grey poorly graded SAND (SP) - trace to with silt - trace gravel - wet		SS	05	400	25	300 mm - 450 mm of heave observed in hollow stem auger after drilling to 4.3 m depth. Water used inside hollow stem augers below 4.3 m. Sieve at 5.3 m G 2% S 95% Fines 3%
7				SS	06	400	50	
9				SS	07A	235	56	
				SS	07B	265		

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 48 47 46 45 44 43 42 41 40 39 38

DRAFT

▽ Water Level Observed During Drilling
▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: ConeTec/Mud Bay Drilling
Drilling Method: Solid/Hollow-Stem Auger
Completion Depth: 16.6 m

Logged By: DP
Reviewed By: AM

Printed Oct 8 2024 16:52:38 STANTEC GEO 2016 123317336_BOREHOLE_LOGS_20241003.GPJ MASTER1.GDT 10/8/24

BOREHOLE RECORD

BH24-01

CLIENT: **BC Hydro**
PROJECT: **Campbell Heights Site Assessment - Site 14**
LOCATION: **Lots 9 & 11, Sec. 22, Twsp. 7, NWD, Township of Langley, BC**
DATE BORED: **September 9, 2024**

BH COORDINATES [UTM10] 5433903N 523338E
WATER LEVEL: **4.2 m on October 4, 2024**

PROJECT NO. : **123317336**
BH ELEVATION: **48m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
10		Compact to very dense grey poorly graded SAND (SP) - trace to with silt - trace gravel - wet		SS	08	500	60	Sieve at 9.9 m G S Fines 7% 85% 8%		38
11										37
12				SS	09	600	70			36
13				SS	10	450		Sieve at 13.0 m G S Fines 1% 94% 5%		35
14										34
15				SS	11	325	18			33
16	31.4			SS	12	0	14	No recovery for SS-12 due to inferred gravel obstructing sampler.		32
17		Borehole BH24-01 terminated at 16.6 m								31
18										30
19										29
20										28

83 blows / 300 mm penetration >>

DRAFT

Water Level Observed During Drilling
Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: ConeTec/Mud Bay Drilling
Drilling Method: Solid/Hollow-Stem Auger
Completion Depth: 16.6 m

Logged By: DP
Reviewed By: AM

Printed Oct 8 2024 16:52:38 STANTEC GEO 2016 123317336_BOREHOLE_LOGS_20241003.GPJ MASTER1.GDT 10/8/24

Stantec

BOREHOLE RECORD

BH24-02

CLIENT: **BC Hydro**

PROJECT: **Campbell Heights Site Assessment - Site 14**

LOCATION: **Lots 9 & 11, Sec. 22, Twsp. 7, NWD, Township of Langley, BC**

DATE BORED: **September 11, 2024**

BH COORDINATES [UTM10] 5433791N 523505E

PROJECT NO. : **123317336**

BH ELEVATION: **49m**

DATUM: **Geodetic**

WATER LEVEL: **5.0 m on October 4, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE	OTHER TESTS / REMARKS
0	49.0							
	48.4	TOPSOIL: brown silty sand, trace gravel, trace organics, wood debris, and rootlets, moist		SS	01	150	13	Solid-stem auger drilling from 0.0 m to 0.8 m depth.
1		Compact to dense brown poorly graded SAND (SP) - trace to with gravel - trace silt - dry to moist		SS	02	300	13	Borehole sloughed from 0.0 m to 0.8 m depth after removing solid-stem augers. Hollow-stem auger drilling below 0.8 m depth.
2								
3				SS	03	350	35	Sieve at 2.3 m G 43% S 52% Fines 5%
4				SS	04	250	40	
	44.1							300 mm - 450 mm of heave observed in hollow stem auger after drilling to 4.7 m depth. Water used inside hollow stem augers below 4.7 m.
5		Very dense brown well graded SAND (SW-SM) with silt and gravel - moist to wet		SS	05	375	50	Sieve at 5.3 m G 17% S 77% Fines 6%
6	42.8							
		Compact to very dense grey poorly graded SAND (SP) - trace to with silt - trace gravel - moist to wet						
7				SS	06	300	21	
8		- wet below 8.4 m						
				SS	07	350	32	
9								
10								

UNDRAINED SHEAR STRENGTH, Cu (kPa)

LABORATORY TEST ▲ FIELD VANE TEST ◆

POCKET PEN. ★ POCKET SHEAR VANE ◘

50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

SPT (N-value) BLOWS/0.3m

Water Content (%) and Blow Count

10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m)

49 48 47 46 45 44 43 42 41 40 39

DRAFT

▽ Water Level Observed During Drilling

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: ConeTec/Mud Bay Drilling

Drilling Method: Solid/Hollow-Stem Auger

Completion Depth: 15.1 m

Logged By: DP

Reviewed By: AM

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BOREHOLE RECORD

BH24-02

CLIENT: **BC Hydro**
PROJECT: **Campbell Heights Site Assessment - Site 14**
LOCATION: **Lots 9 & 11, Sec. 22, Twsp. 7, NWD, Township of Langley, BC**
DATE BORED: **September 11, 2024**

BH COORDINATES [UTM10] 5433791N 523505E
PROJECT NO. : **123317336**
BH ELEVATION: **49m**
DATUM: **Geodetic**
WATER LEVEL: **5.0 m on October 4, 2024**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE	OTHER TESTS / REMARKS
10		Compact to very dense grey poorly graded SAND (SP) - trace to with silt - trace gravel - moist to wet		SS	08	475	32	Sieve at 9.9 m G 0% S 94% Fines 6%
11								
12				SS	09	300	13	
13								
14				SS	10	350	26	
15	33.9			SS	11A	460	50	
				SS	11B	65		
		Borehole BH24-02 terminated at 15.1 m.						
16								
17								
18								
19								
20								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 39 38 37 36 35 34 33 32 31 30 29

DRAFT

▽ Water Level Observed During Drilling
▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: ConeTec/Mud Bay Drilling
Drilling Method: Solid/Hollow-Stem Auger
Completion Depth: 15.1 m

Logged By: DP
Reviewed By: AM

Printed Oct 8 2024 16:52:41 STANTEC GEO 2016 123317336_BOREHOLE_LOGS_20241003.GPJ MASTER1.GDT 10/8/24

Appendix D ConeTec RSCPT Report

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PRESENTATION OF SITE INVESTIGATION RESULTS

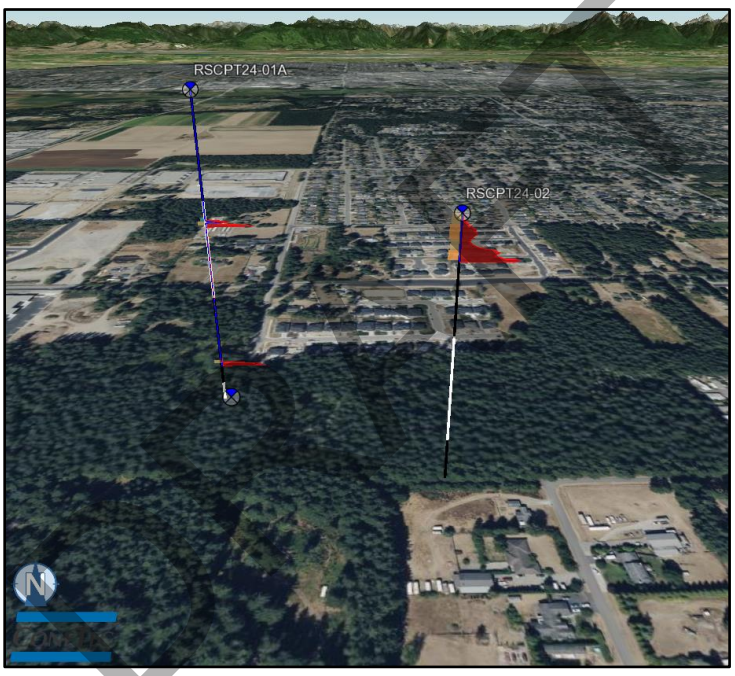
197A Street – 30 Ave, Langley

Prepared for:

Stantec Consulting Ltd.

ConeTec Job No: 24-02-28291

Project Start Date: 2024-09-10
Project End Date: 2024-09-11
Report Date: 2024-10-02



Prepared by:

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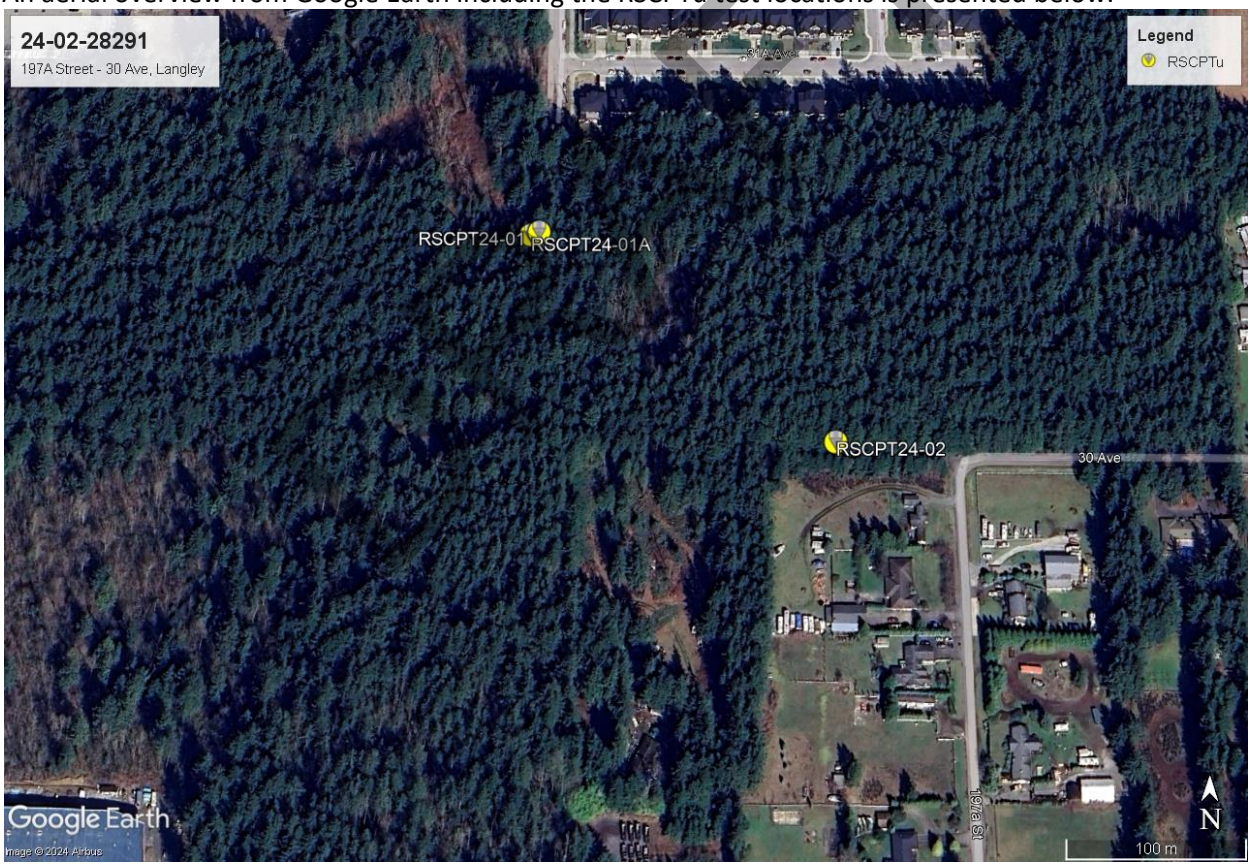
Introduction

The enclosed report presents the results of the site investigation program conducted by ConeTec Investigations Ltd. for Stantec Consulting Ltd. near 197A St and 30th Ave, Langley, BC. The program consisted of 3 resistivity seismic cone penetration tests (RSCPTu) with shear wave velocity measurements. Please note that this report, which also includes all accompanying data, are subject to the 3rd Party Disclaimer and Client Disclaimer that follow in the 'Limitations' section of this report.

Project Information

Project	
Client	Stantec Consulting Ltd.
Project	197A Street - 30 Ave, Langley
ConeTec project number	24-02-28291

An aerial overview from Google Earth including the RSCPTu test locations is presented below.



Rig Description	Deployment System	Test Type
Truck mounted drill rig (GT8)	14 ton rig cylinder	RSCPTu

Coordinates		
Test Type	Collection Method	EPSG Number
RSCPTu	Consumer grade GPS	32610

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (bar)
898:T1500F15U35	898	15	225	1500	15	35
Cone 898 was used for all CPTu soundings.						

Cone Penetration Test (CPTu)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Tip and sleeve data offset	0.1 meter This has been accounted for in the CPT data files.
Additional plots	• Resistivity plots • Advanced plots with Ic, Su, phi and N1(60)Ic • Seismic shear wave velocity plots

Calculated Geotechnical Parameter Tables	
Additional information	The Normalized Soil Behaviour Type Chart based on Q_{tn} (SBT Q_{tn}) (Robertson, 2009) was used to classify the soil for this project. A detailed set of calculated CPTu parameters have been generated and are provided in Excel format files in the release folder. The CPTu parameter calculations are based on values of corrected tip resistance (q_t) sleeve friction (f_s) and pore pressure (u_2). Effective stresses are calculated based on unit weights that have been assigned to the individual soil behaviour type zones and hydrostatic conditions were assumed. Soils were classified as either drained or undrained based on the Q_{tn} Normalized Soil Behaviour Type Chart (Robertson, 2009). Calculations for both drained and undrained parameters were included for materials that classified as silt mixtures (zone 4).

DRAFT

Closure

Thank you for the opportunity to work on this project. The equipment used and the field procedures followed complied with current accepted practice standards.

ConeTec Investigations Ltd.

Permit Number: 1002866

Report prepared by:



Alecxyne Cabaong, GIT (AB)

Report reviewed by:

James Greig, P.Eng.

DRAFT

Limitations

3rd Party Disclaimer

This report titled “197A Street - 30 Ave, Langley”, referred to as the (“Report”), was prepared by ConeTec for Stantec Consulting Ltd. The Report is confidential and may not be distributed to or relied upon by any third parties without the express written consent of ConeTec. Any third parties gaining access to the Report do not acquire any rights as a result of such access. Any use which a third party makes of the Report, or any reliance on or decisions made based on it, are the responsibility of such third parties. ConeTec accepts no responsibility for loss, damage and/or expense, if any, suffered by any third parties as a result of decisions made, or actions taken or not taken, which are in any way based on, or related to, the Report or any portion(s) thereof.

Client Disclaimer

ConeTec was retained by Stantec Consulting Ltd. to collect and provide the raw data (“Data”) which is included in this report titled “197A Street - 30 Ave, Langley”, which is referred to as the (“Report”). ConeTec has collected and reported the Data in accordance with current industry standards. No other warranty, express or implied, with respect to the Data is made by ConeTec. In order to properly understand the Data included in the Report, reference must be made to the documents accompanying and other sources referenced in the Report in their entirety. Any analysis, interpretation, judgment, calculations and/or geotechnical parameters (collectively “Interpretations”) included in the Report, including those based on the Data, are outside the scope of ConeTec’s retainer and are included in the Report as a courtesy only. Other than the Data, the contents of the Report (including any Interpretations) should not be relied upon in any fashion without independent verification and ConeTec is in no way responsible for any loss, damage or expense resulting from the use of, and/or reliance on, such material by any party.

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Cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd., a subsidiary of ConeTec.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and two geophone sensors for recording seismic signals. All signals are amplified and measured with minimum sixteen-bit resolution down hole within the cone body, and the signals are sent to the surface using a high bandwidth, error corrected digital interface through a shielded cable.

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 millimeters diameter over a length of 32 millimeters with tapered leading and trailing edges) located at a distance of 585 millimeters above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All ConeTec piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is six millimeters thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. ConeTec's calibration criteria also meets or exceeds those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

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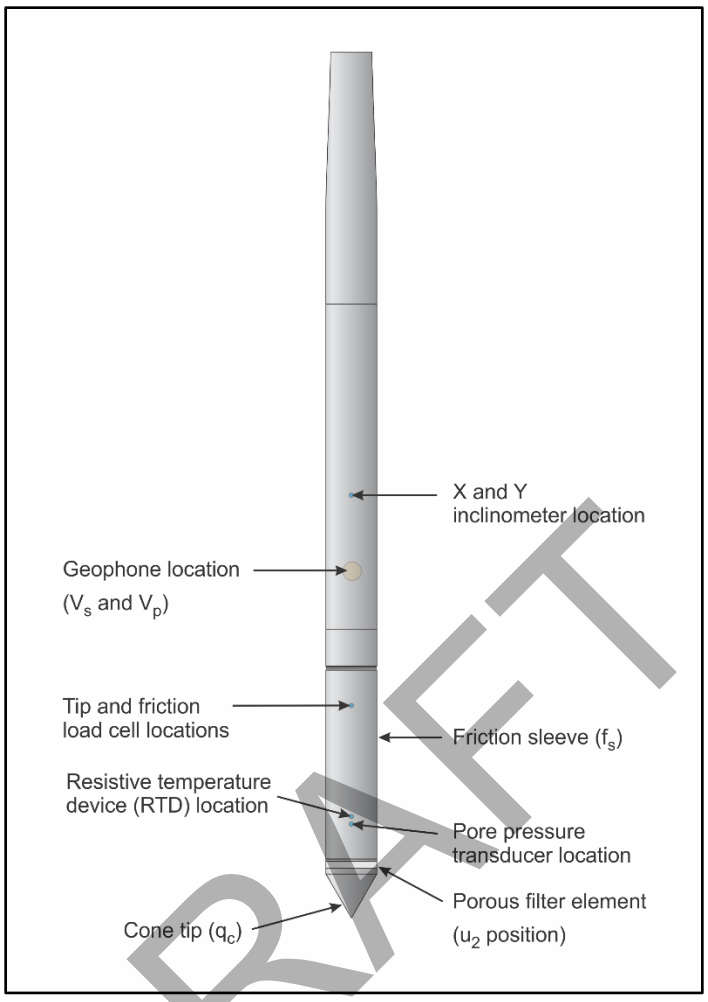


Figure CPTu. Piezocone Penetrometer (15 cm^2)

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The ConeTec data acquisition systems consist of a Windows based computer and a signal interface box and power supply. The signal interface combines depth increment signals, seismic trigger signals and the downhole digital data. This combined data is then sent to the Windows based computer for collection and presentation. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording interval is 2.5 centimeters; custom recording intervals are possible.

The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to ConeTec's CPTu operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of two centimeters per second, within acceptable tolerances. Typically one meter length rods with an outer diameter of 38.1 millimeters are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to ConeTec's cone penetration testing procedures:

- Each filter is saturated in silicone oil under vacuum pressure prior to use
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson et al. (1986) and Robertson (1990, 2009). It should be noted that it is not always possible to accurately identify a soil behaviour type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behaviour type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al. (1986):

$$q_t = q_c + (1\text{-}a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for ConeTec probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all ConeTec piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

DRAFT

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of files with calculated geotechnical parameters were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the methods used is also included in the data release folder.

For additional information on CPTu interpretations and calculated geotechnical parameters, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014), Mayne and Peuchen (2012) and Mayne et al. (2023).

References

ASTM D5778-20, 2020, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM International, West Conshohocken, PA. DOI: 10.1520/D5778-20.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, “Cone Penetration Testing in Geotechnical Practice”, Blackie Academic and Professional.

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Mayne, P.W., 2014, “Interpretation of geotechnical parameters from seismic piezocone tests”, CPT’14 Keynote Address, Las Vegas, NV, May 2014.

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Robertson, P.K., 1990, “Soil Classification Using the Cone Penetration Test”, Canadian Geotechnical Journal, Volume 27: 151-158. DOI: 10.1139/T90-014.

Robertson, P.K., 2009, “Interpretation of cone penetration tests – a unified approach”, Canadian Geotechnical Journal, Volume 46: 1337-1355. DOI: 10.1139/T09-065.

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The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

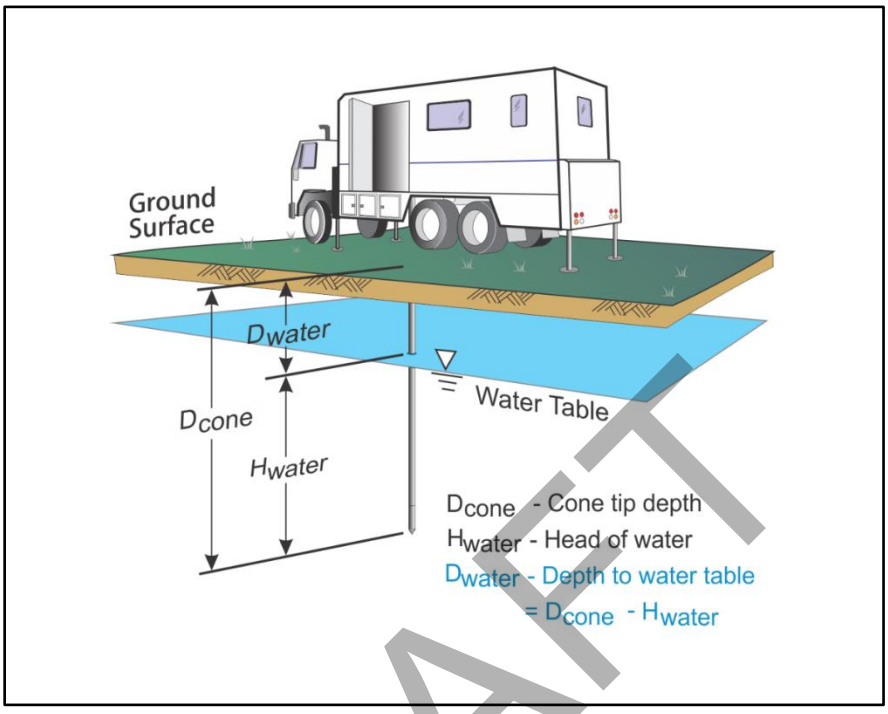


Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behaviour.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

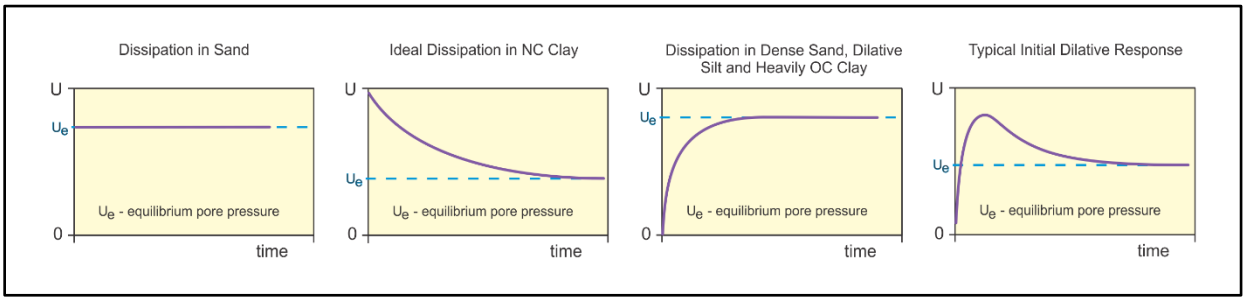


Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve in Figure PPD-2.

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In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby, 1991 showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby, 1991)

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby, 1991), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

References

Teh, C.I., and Houlsby, G.T., 1991, “An analytical study of the cone penetration test in clay”, Geotechnique, 41(1): 17-34. DOI: 10.1680/geot.1991.41.1.17.

DRAFT

To determine the electrical resistivity of the soil (the inverse of electrical conductivity), resistivity measurements are performed in conjunction with piezocone penetration testing (RCPTu) using a resistivity cone. An illustration of the resistivity piezocone penetrometer is presented in Figure RCPTu.

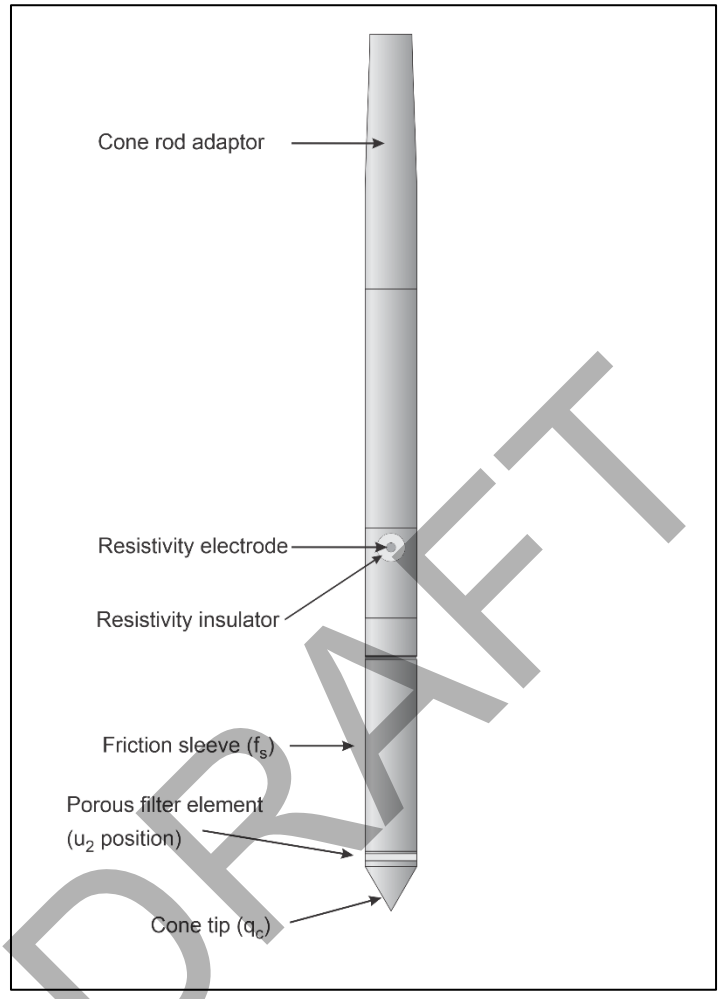


Figure RCPTu. Resistivity piezocone penetrometer (15 cm^2)

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The resistivity cone has a single, wear resistant, 8 mm diameter stainless steel electrode set within a 25 mm diameter Delrin plastic insulator. The measurement of resistivity is confined to the region of soil in contact with the electrode and the cone body just beyond the boundary of the insulator. The configuration of the electrode provides vertical resolution of resistivity changes of approximately 25 mm.

The electrical resistance is determined by measuring the voltage drop and current applied across the soil in contact with the electrode and cone body. A 960 hertz alternating current source is used to avoid polarization of the electrode. Polarization is the process where ions accumulate at the electrode thus increasing the measured resistance.

Electrical resistance is not a material property, it is a function of the resistivity of the material being measured, and the electrode configuration. To convert from resistance (ohm) to resistivity (ohm-m) a lab calibration is necessary. Resistivity cones are calibrated in a water tank with solutions of known resistivity. The resistance across the electrode and ground is measured in the various solutions and a calibration

curve is generated. It is necessary to assume that the calibration factors determined in the homogeneous isotropic medium do not vary significantly as the cone is advanced into the ground through soil.

Prior to the start of a test, the procedures described in the cone penetration test section are followed and the resistivity output is verified using various resistors. The resistivity measurements are recorded on a continuous basis at the same time as the tip, friction, and pore pressure measurements. Due to the vertical offset between the cone tip and the electrode, resistivity data is not available for the last 0.275 meters of each profile.

The resistivity of soil is for the most part influenced by the resistivity of the pore fluid, which in turn is a measure of the groundwater chemical composition. Electrical conduction in saturated sandy soils is largely by electrolytic conduction in the pore fluid whereas for clayey soils, ion exchange contributes significantly within the soil skeleton. Resistivity measurements will increase as the saturation of the soil decreases. For additional information on resistivity cone penetration testing, refer to Campanella and Weemees (1990).

Resistivity CPTu plots are presented in the relevant appendix.

References

Campanella, R.G. and Weemees, I., 1990, “Development and Use of an Electrical Resistivity Cone for Groundwater Contamination Studies”, Canadian Geotechnical Journal, Vol. 27 No. 5: 557-567. DOI: 10.1139/T90-071.

DRAFT

Shear wave velocity (Vs) testing is performed in conjunction with the piezocone penetration test (SCPTu) in order to collect interval velocities. For some projects seismic compression wave velocity (Vp) testing is also performed.

ConeTec's 15 cm^2 piezocone penetrometers are manufactured with one horizontally active geophone (28 hertz) and one vertically active geophone (28 hertz). Both geophones are rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip. The vertically mounted geophone is more sensitive to compression waves; however, it is often affected by the compression wave travelling through the cone rods.

Shear waves are typically generated by using an impact hammer horizontally striking a beam that is held in place by a normal load. In some instances, an auger source or an imbedded impulsive source may be used for both shear waves and compression waves. The hammer and beam act as a contact trigger that initiates the recording of the seismic wave traces. For impulsive devices an accelerometer trigger may be used. The traces are recorded in the memory of the cone using a fast analog to digital converter. The seismic trace is then transmitted digitally uphole to a Windows based computer through a signal interface box for recording and analysis. An illustration of the shear wave testing configuration is presented in Figure SCPTu-1.

DRAFT

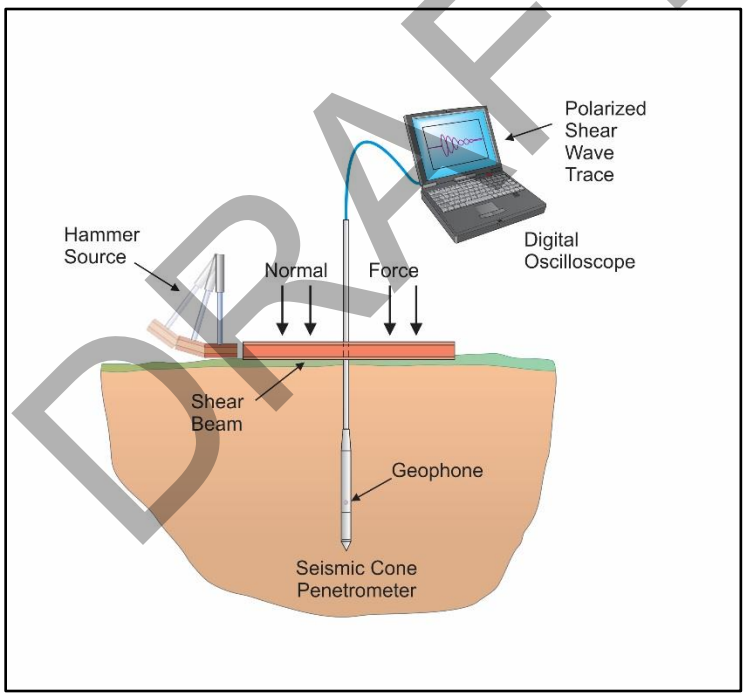


Figure SCPTu-1. Illustration of the SCPTu system

All testing is performed in accordance to ConeTec's SCPTu operating procedures which are in general accordance with the current ASTM D5778 and ASTM D7400 standards.

Prior to the start of a SCPTu sounding, the procedures described in the Cone Penetration Test section are followed. In addition, the active axis of the geophone is aligned parallel to the beam (or source) and the horizontal offset between the cone and the source is measured and recorded.

Prior to recording seismic waves at each test depth, cone penetration is stopped and the rods are decoupled from the rig to avoid transmission of rig energy down the rods. Typically, five wave traces for each orientation are recorded for quality control and uncertainty analysis purposes. After reviewing wave traces for consistency the cone is pushed to the next test depth (typically one meter intervals or as requested by the client). Figure SCPTu-2 presents an illustration of a SCPTu test.

For additional information on seismic cone penetration testing refer to Robertson et al. (1986).

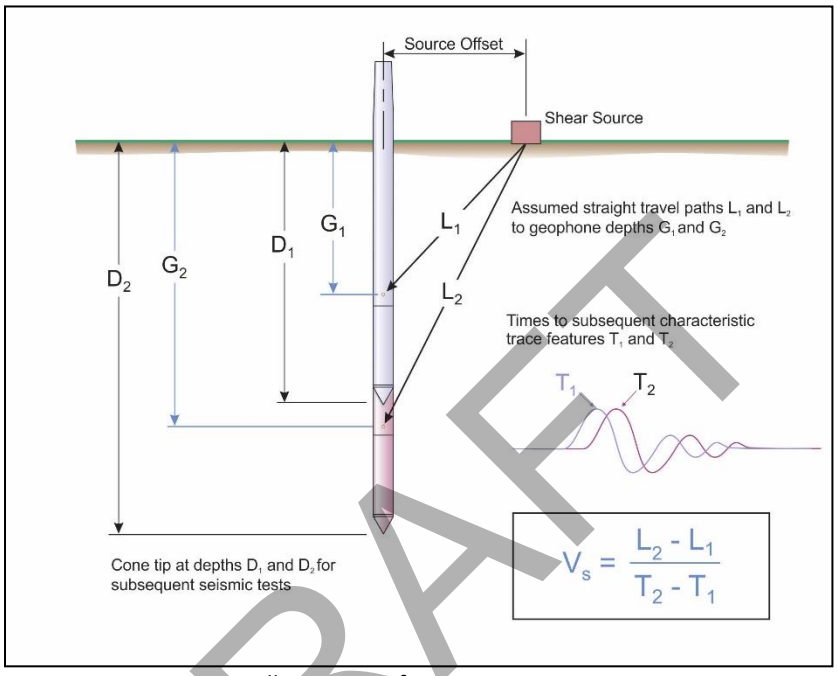


Figure SCPTu-2. Illustration of a seismic cone penetration test

For the determination of interval travel times the wave traces from all depths are displayed in analysis software. The results of the interval picks are supplied in the relevant appendix of this report. Standard practice for ConeTec is to record five wave traces for each source direction at each test depth. Outlier impacts are identified in the field and the impacts are repeated. For the final wave trace profile, the traces are stacked in the time domain to display a single average trace.

Determination of the shear wave interval velocities are performed by visually picking a common feature (e.g. the first characteristic peak, trough, or crossover) on all of the trace depths and taking the difference in ray path divided by the time difference between features at subsequent depths. The same process is used for compression waves, however the first break is most commonly used for selecting an arrival time. For velocity calculation, the ray path is defined as the straight-line distance from the seismic source to the geophone, accounting for beam offset, source depth and geophone offset from the cone tip.

In some cases, usually for shear wave velocity testing, more than one characteristic marker may be used. If there is an overlap between different sets of characteristic markers, then the average time value for those sets of interval times is applied to the determination of velocity.

Ideally, all depths are used for the determination of the velocity profile. However, an interval may be skipped if there is some ambiguity or quality concern with a particular depth, resulting in a larger interval.

DRAFT

Tabular results and SCPTu plots are presented in the relevant appendix.

The average shear wave velocity to a depth of thirty meters (V_{s30}) has been calculated and provided for all applicable soundings using an equation presented in Crow et al. (2012).

$$V_{s30} = \frac{\text{total thickness of all layers (30m)}}{\sum(\text{layer traveltimes})}$$

The layer travel times refers to the travel times propagating in the vertical direction, not the measured travel times from an offset source.

References

ASTM D5778-20, 2020, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM International, West Conshohocken, PA. DOI: 10.1520/D5778-20.

ASTM D7400/D7400M-19, 2019, "Standard Test Methods for Downhole Seismic Testing", ASTM International, West Conshohocken, PA. DOI: 10.1520/D7400_D7400M-19.

Crow, H.L., Hunter, J.A., Bobrowsky, P.T., 2012, "National shear wave measurement guidelines for Canadian seismic site assessment", GeoManitoba 2012, Sept 30 to Oct 2, Winnipeg, Manitoba.

Robertson, P.K., Campanella, R.G., Gillespie D and Rice, A., 1986, "Seismic CPT to Measure In-Situ Shear Wave Velocity", Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8: 791-803. DOI: 10.1061/(ASCE)0733-9410(1986)112:8(791).

DRAFT

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Resistivity Cone Penetration Test Plots
- Advanced Cone Penetration Test Plots
- Seismic Cone Penetration Test Plots
- Seismic Cone Penetration Test Shear Wave (Vs) Tabular Results
- Seismic Cone Penetration Test Shear Wave (Vs) Traces
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots
- Description of Methods for Calculated CPT Geotechnical Parameters

DRAFT

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

DRAFT

CONETEC

Job No:	24-02-28291
Client:	Stantec Consulting Ltd.
Project:	197A Street - 30 Ave, Langley
Start Date:	2024-09-10
End Date:	2024-09-11

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Cone Area (cm^2)	Assumed Phreatic Surface[1] (m)	Final Depth (m)	Northing[2] (m)	Easting[2] (m)	Refer to Notation Number
RSCPT24-01	24-02-28291_RS01	2024-09-10	898:T1500F15U35	15		1.425	5433913	523333	3, 4
RSCPT24-01A	24-02-28291_RS01A	2024-09-10	898:T1500F15U35	15	4.1	13.950	5433911	523328	5
RSCPT24-02	24-02-28291_RS02	2024-09-11	898:T1500F15U35	15		1.875	5433790	523508	3

1. The assumed phreatic surface was based on pore pressure dissipation tests, unless otherwise noted. Hydrostatic conditions were assumed for the calculated parameters.
2. Coordinates were collected with a consumer grade GPS device in datum WGS84/UTM Zone 10 North.
3. No clear phreatic surface was detected.
4. No seismic was reported due to the shallow refusal.
5. The material from 13.525m to 13.700m is potentially disturbed due to auger drilling.

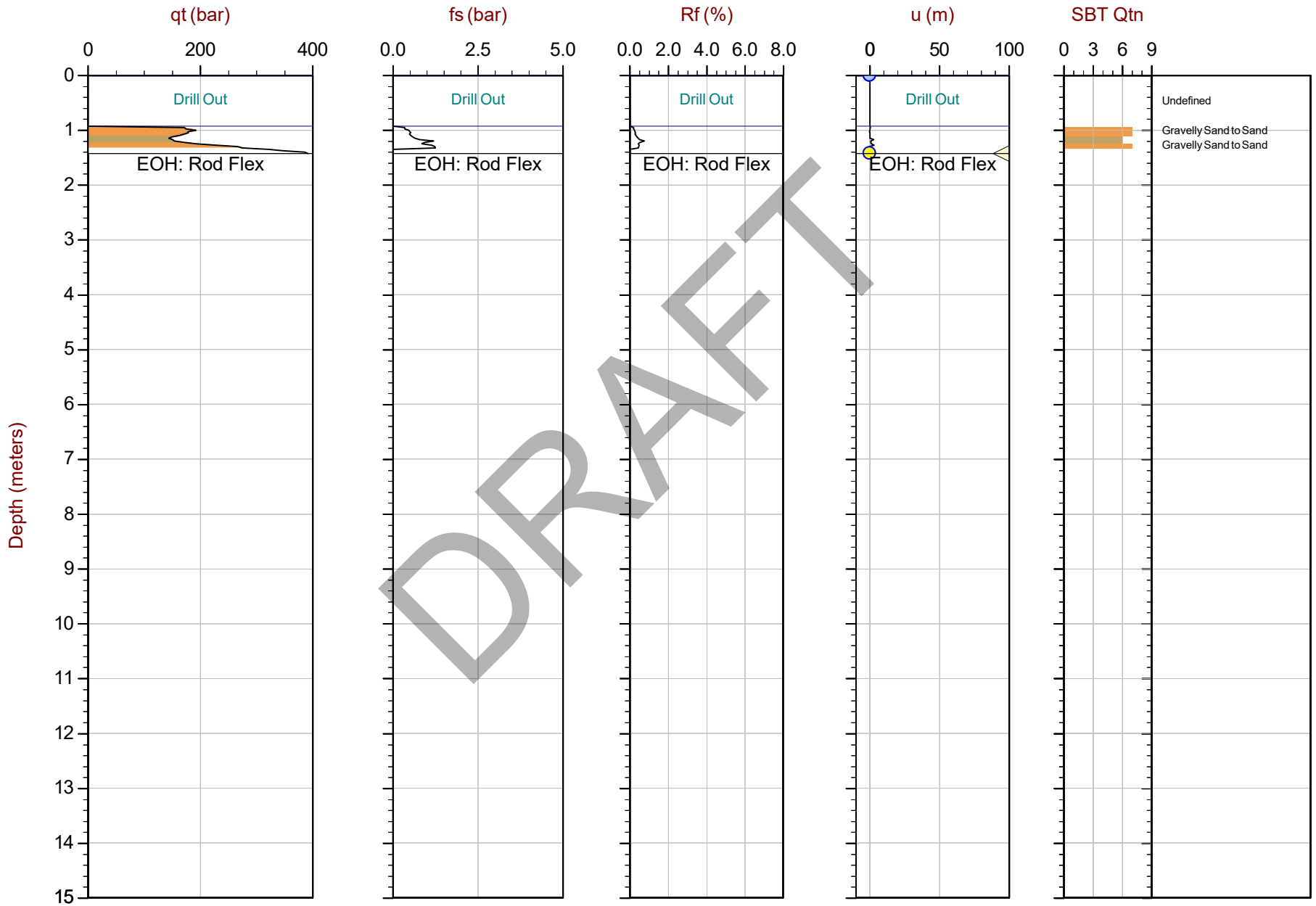
DRAFT

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 09:28
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 1.425 m / 4.68 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433913m E: 523333m
Sheet No: 1 of 1

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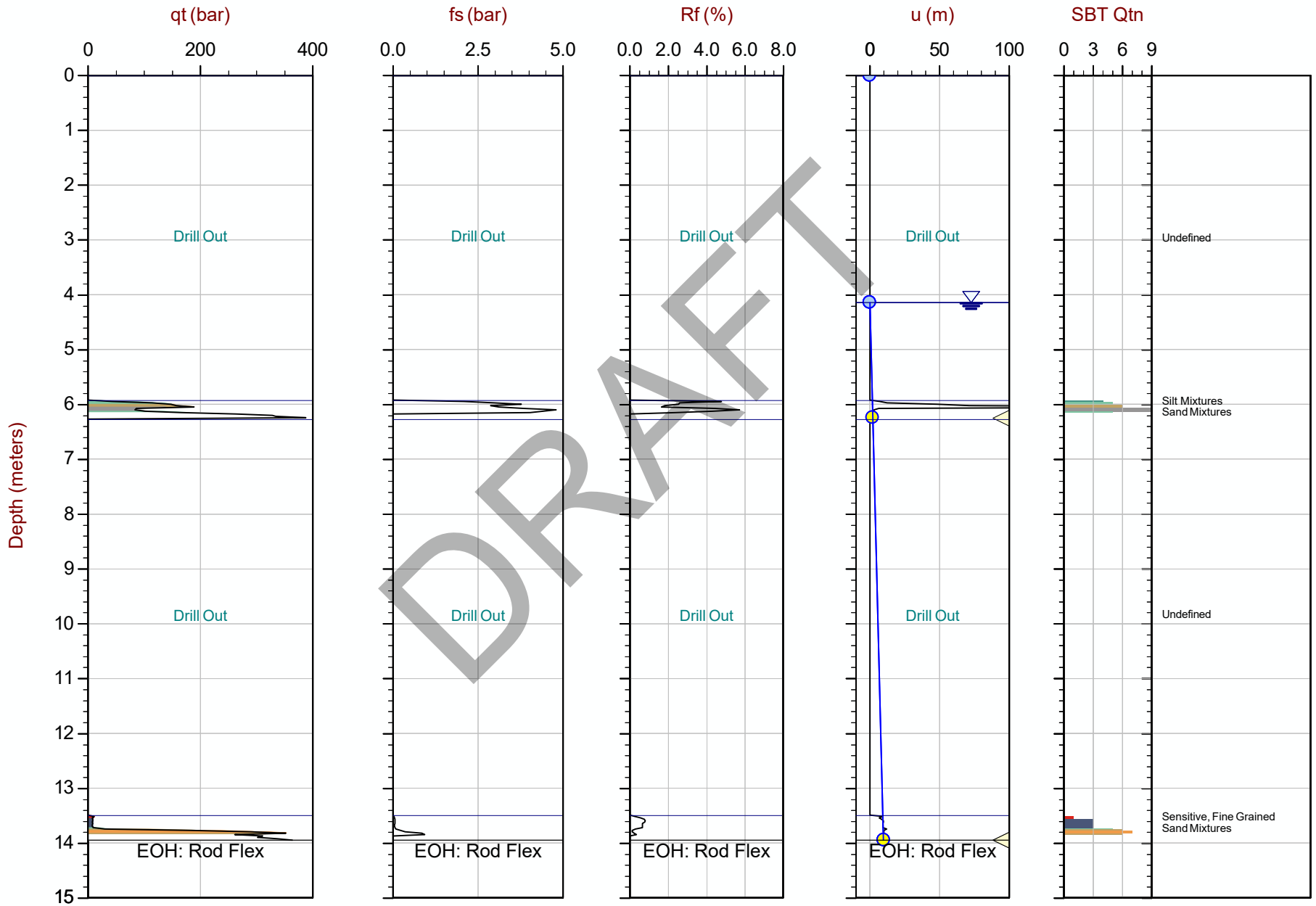
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 10:09
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01A
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 13.950 m / 45.77 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS01A.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433911 m E: 523328 m
Sheet No: 1 of 1

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

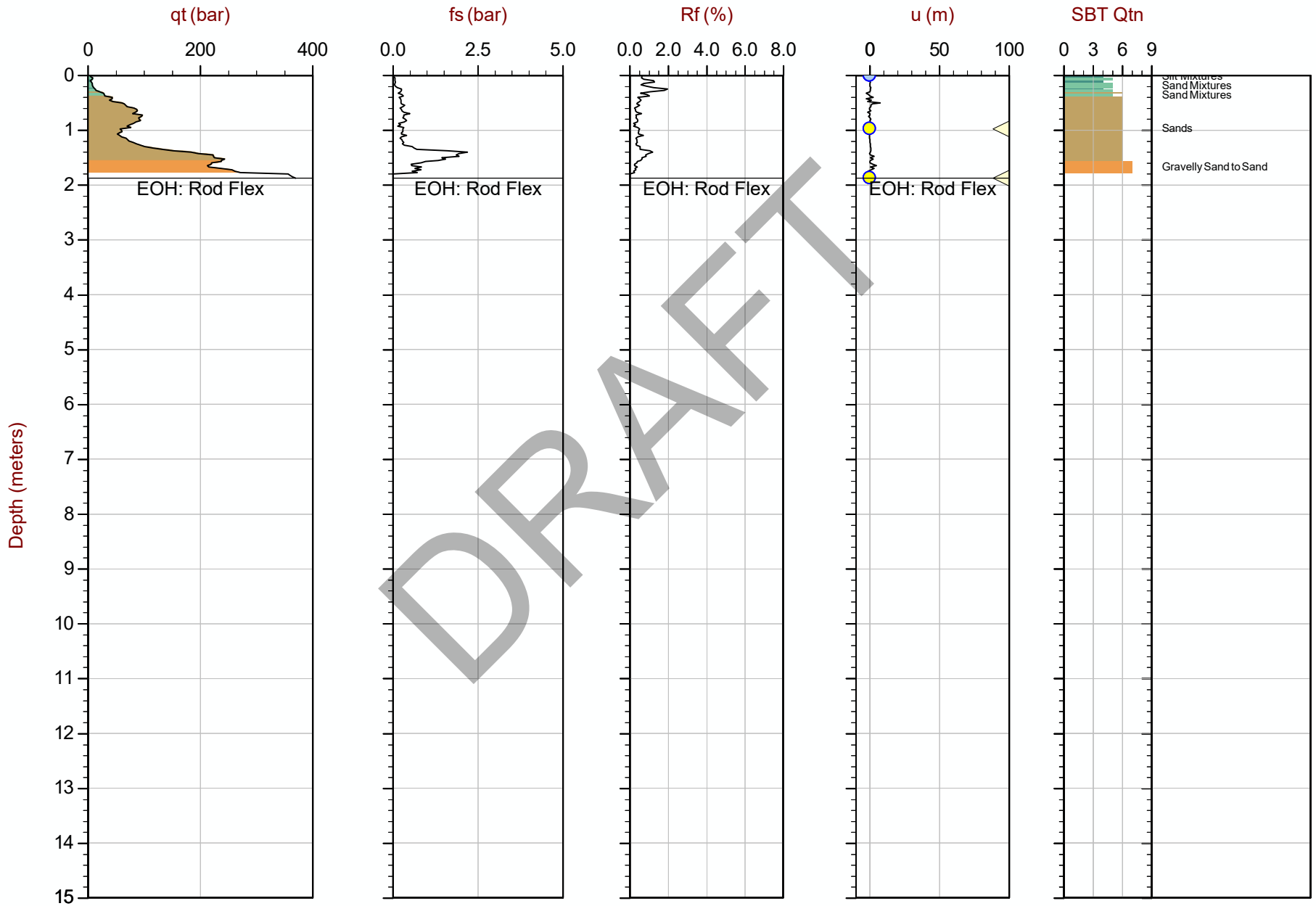
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-11 14:15
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-02
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 1.875 m / 6.15 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433790m E: 523508m
Sheet No: 1 of 1

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Resistivity Cone Penetration Test Plots

DRAFT

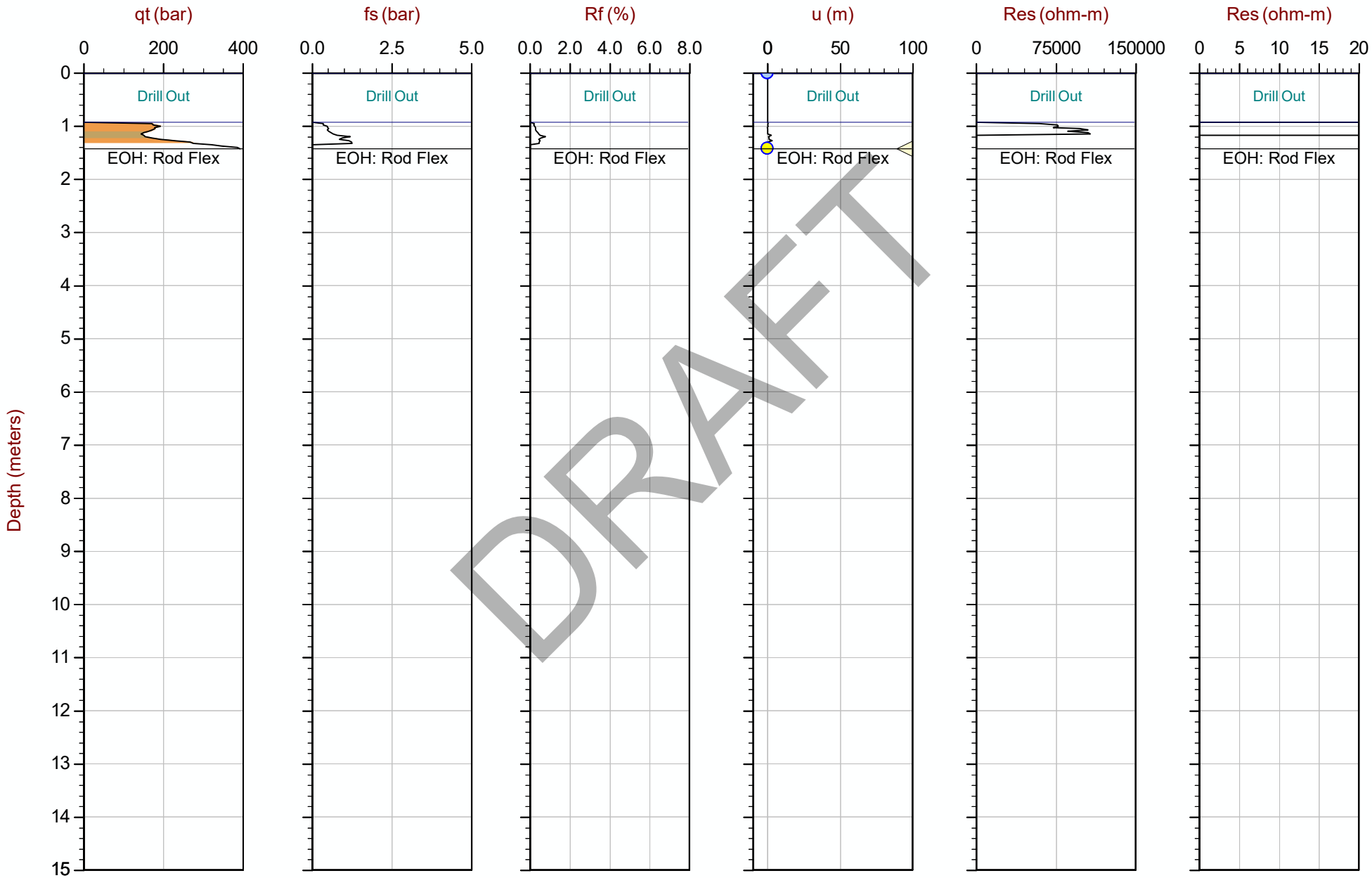
CONETEC

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 09:28
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 1.425 m / 4.68 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433913m E: 523333m
Sheet No: 1 of 1

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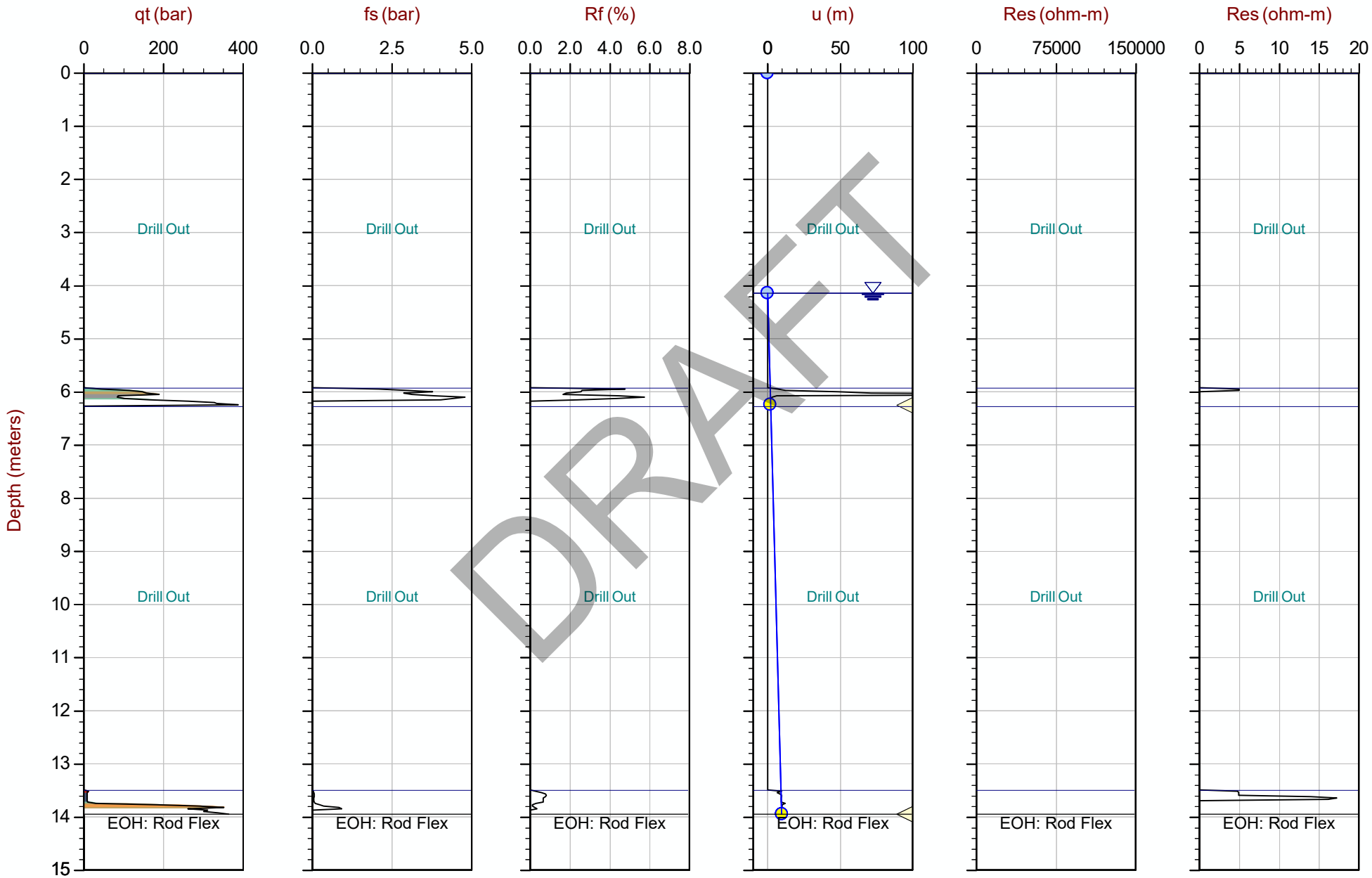
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 10:09
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01A
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 13.950 m / 45.77 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS01A.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433911 m E: 523328 m
Sheet No: 1 of 1

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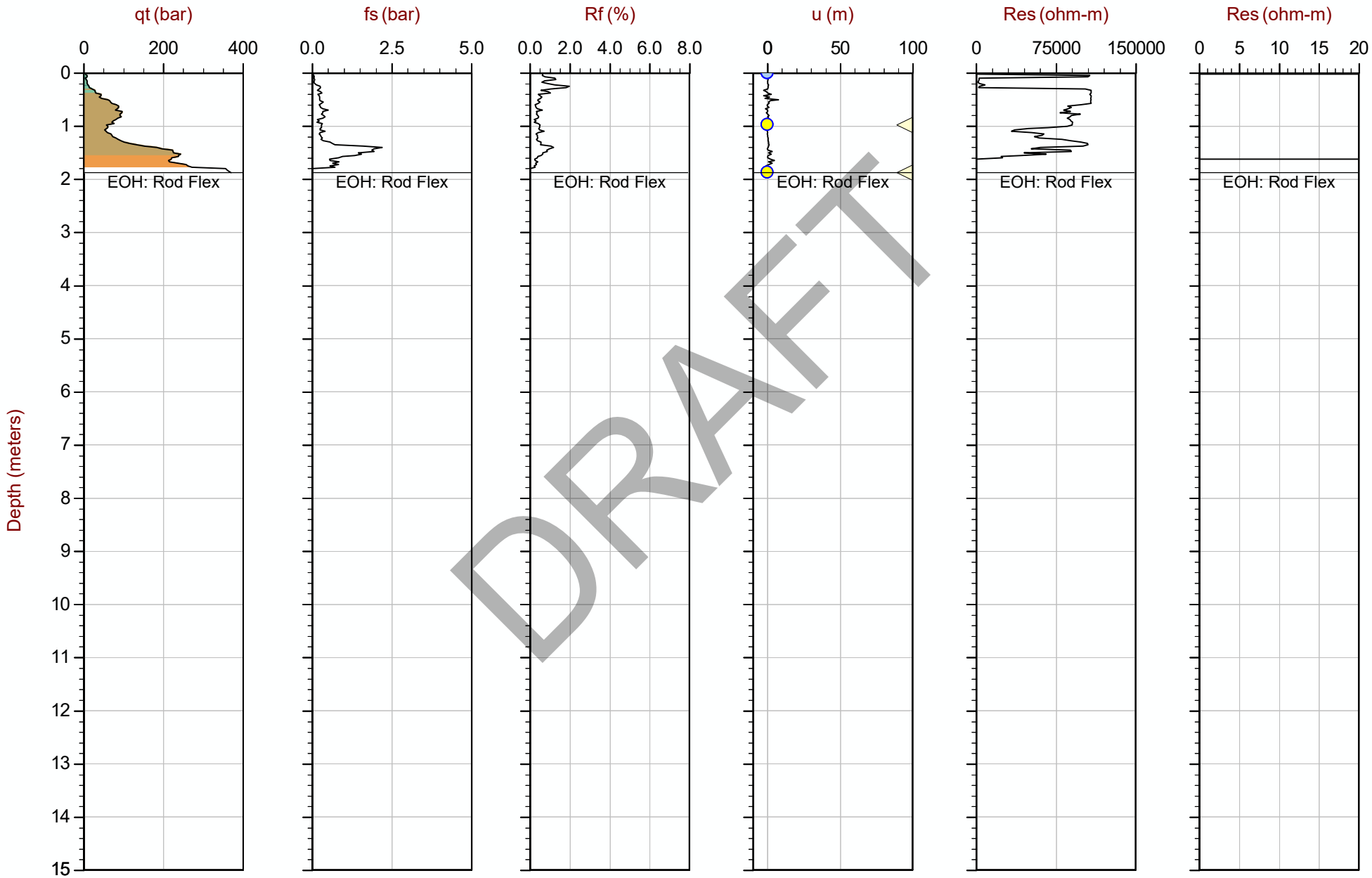
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-11 14:15
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-02
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 1.875 m / 6.15 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433790m E: 523508m
Sheet No: 1 of 1

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Advanced Cone Penetration Plots

DRAFT

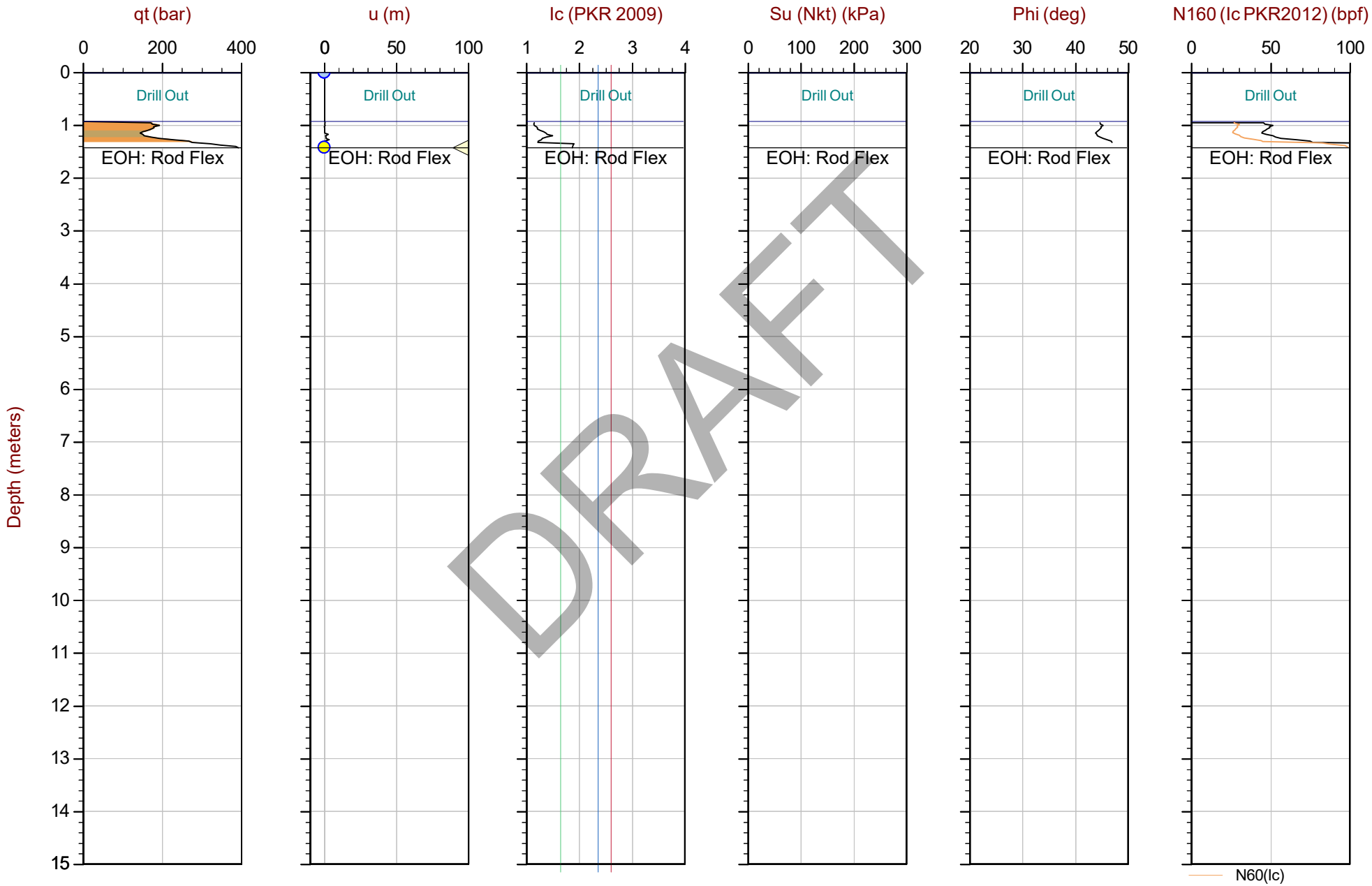
CONETEC

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 09:28
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 1.425 m / 4.68 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
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Sheet No: 1 of 1

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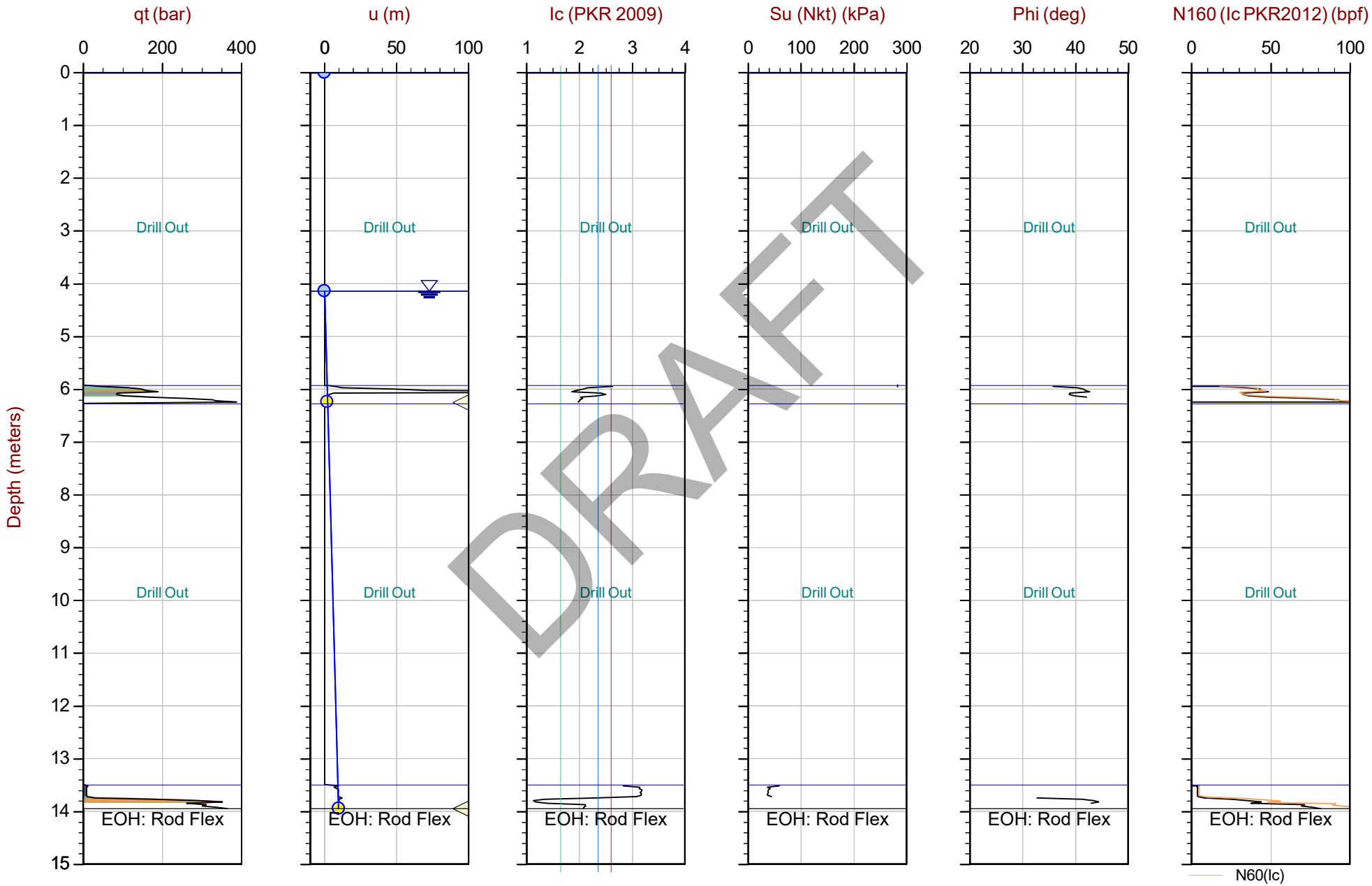
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 10:09
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01A
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 13.950 m / 45.77 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS01A.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433911 m E: 523328m
Sheet No: 1 of 1

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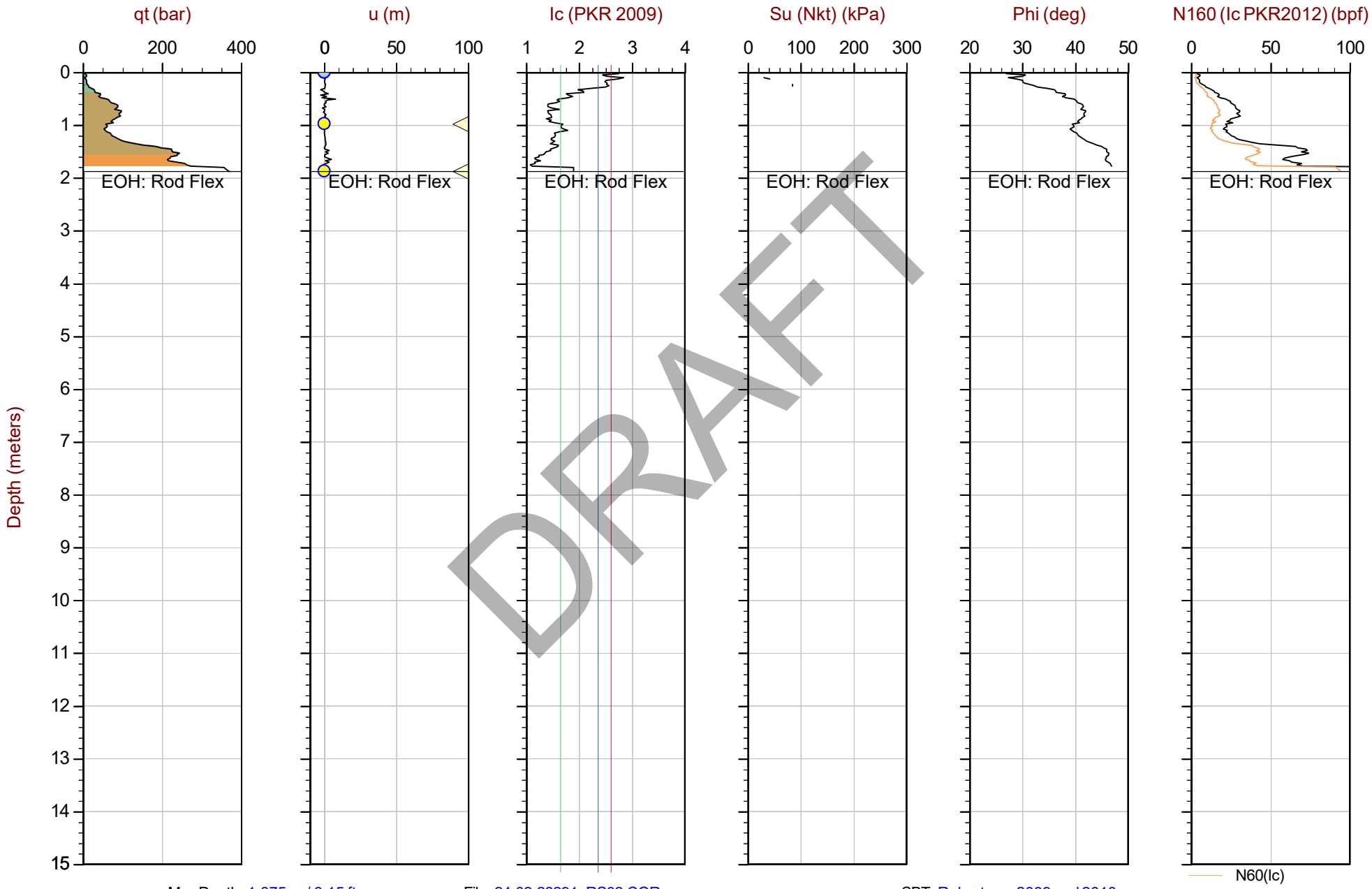
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CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-11 14:15
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-02
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 1.875 m / 6.15 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433790m E: 523508m
Sheet No: 1 of 1

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Plots

DRAFT

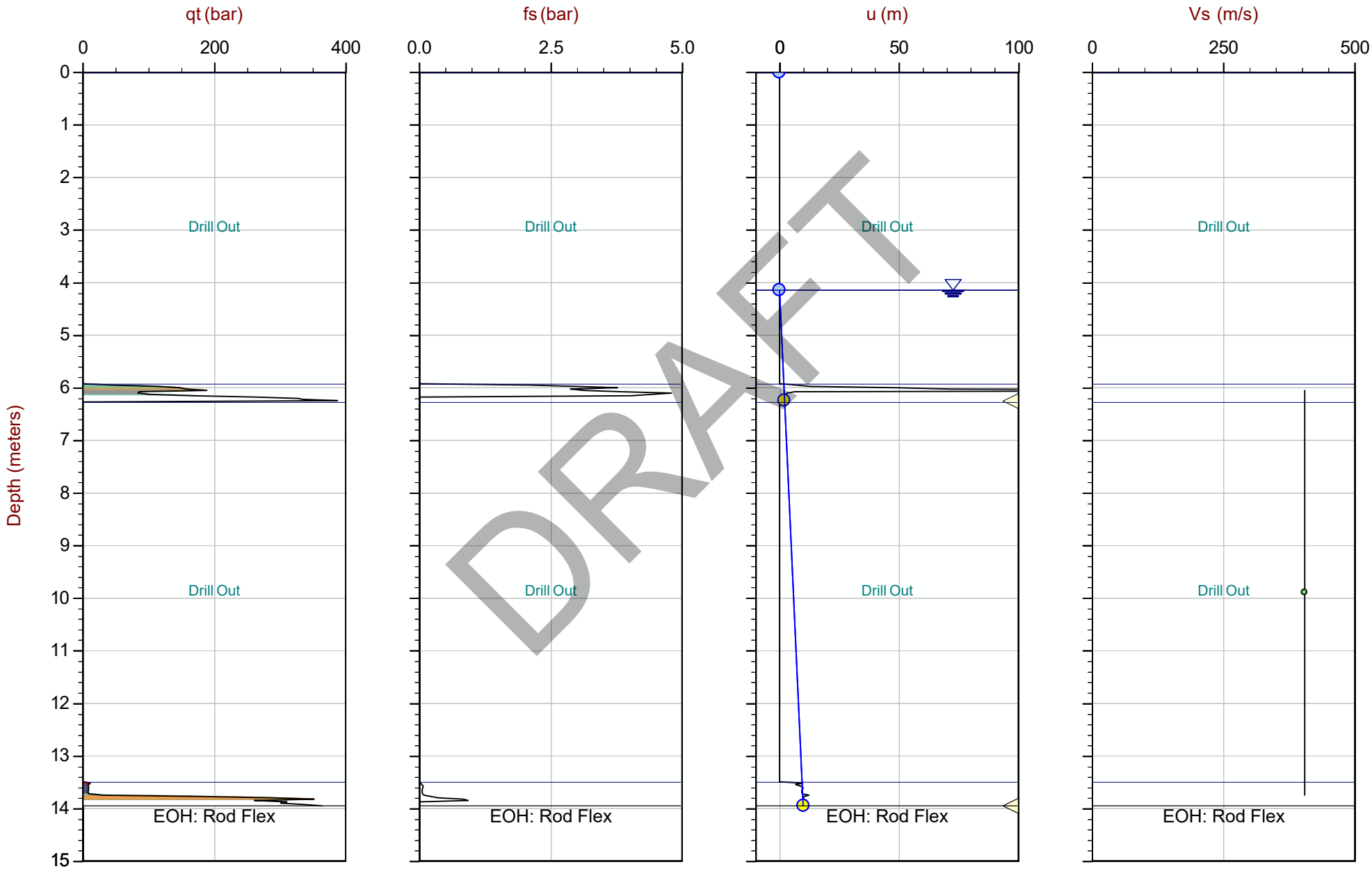
CONETEC

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 10:09
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01A
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 13.950 m / 45.77 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS01A.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433911 m E: 523328 m
Sheet No: 1 of 1

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

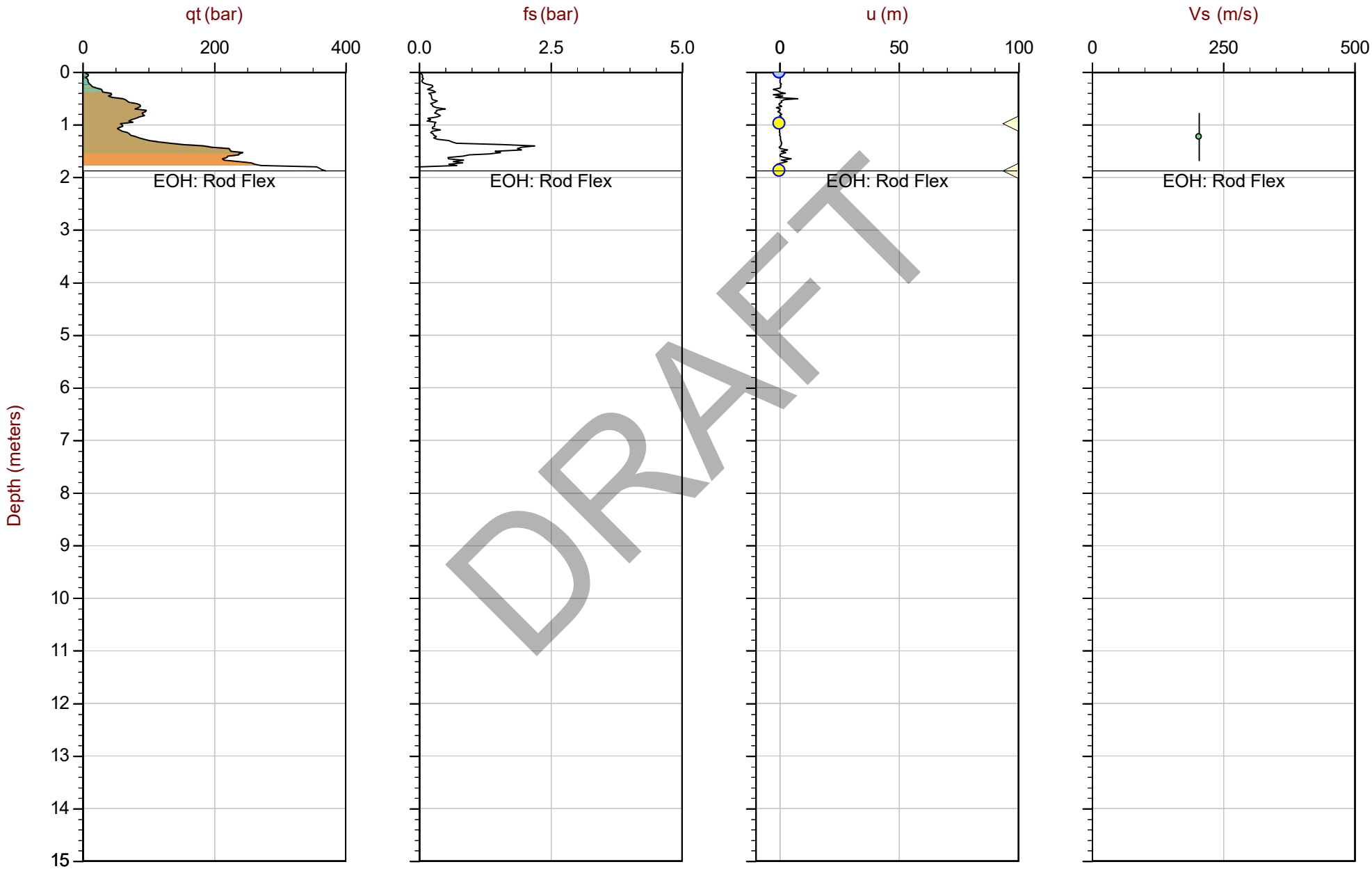
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CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-11 14:15
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-02
Cone: 898:T1500F15U35 Area=15 cm²



DRAFT

Max Depth: 1.875 m / 6.15 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-02-28291_RS02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5433790m E: 523508m
Sheet No: 1 of 1

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Shear Wave (Vs) Tabular Results

DRAFT

Job No:	24-02-28291
Client:	Stantec Consulting Ltd.
Project:	197A Street - 30 Ave, Langley
Sounding ID:	RSCPT24-01A
Date:	2024-09-10
Seismic Source:	Beam
Seismic Offset (m):	1.00
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
6.25	6.05	6.13			
13.95	13.75	13.79	7.65	18.90	405

DRAFT

Job No:	24-02-28291
Client:	Stantec Consulting Ltd.
Project:	197A Street - 30 Ave, Langley
Sounding ID:	RSCPT24-02
Date:	2024-09-11
Seismic Source:	Beam
Seismic Offset (m):	1.00
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
0.98	0.78	1.27			
1.88	1.68	1.96	0.69	3.37	204

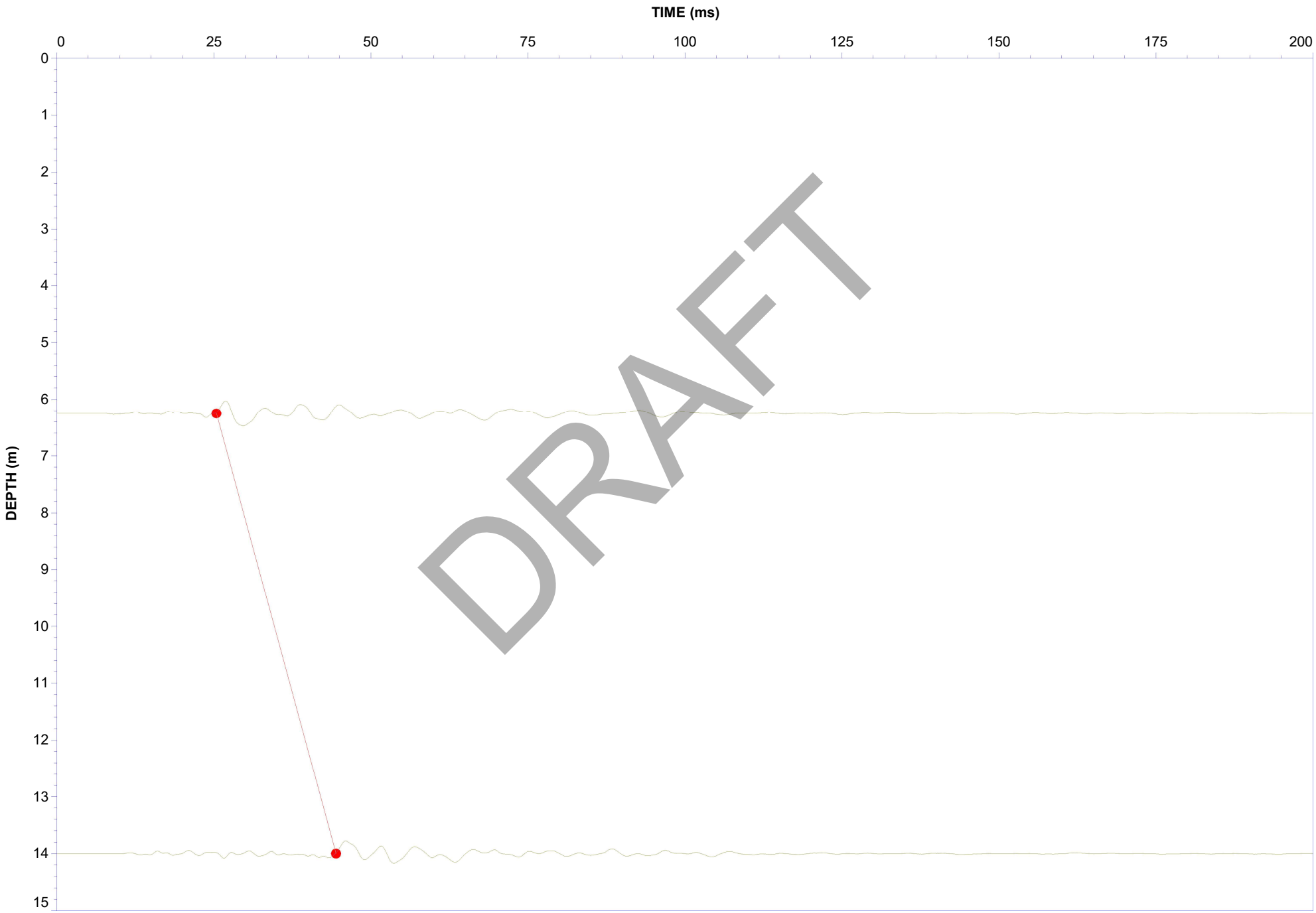
DRAFT

Seismic Cone Penetration Test Shear Wave (Vs) Traces

DRAFT

CONETEC

Job No: 24-02-28291 | Client: Stantec Consulting Ltd. | Project: 197A Street - 30 Ave, Langley | Sounding ID: RSCPT24-01A | Filter: None
Date: 2024-09-10 | Analysis: S Wave - Geo X



Job No: 24-02-28291
Date: 2024-09-11

Client: Stantec Consulting Ltd.
Analysis: S Wave - Geo X

Project: 197A Street - 30 Ave, Langley

Sounding ID: RSCPT24-02

Filter: 0-400 Hz



DRAFT

Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

DRAFT

Job No:	24-02-28291
Client:	Stantec Consulting Ltd.
Project:	197A Street - 30 Ave, Langley
Start Date:	2024-09-10
End Date:	2024-09-11

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (m)	$U_{initial}$ (m)	U_{max} (m)	U_{min} (m)	U_{final} (m)	Observed Equilibrium Pore Pressure U_{eq} (m)	Assumed Phreatic Surface (m)	Refer to Notation Number
RSCPT24-01	24-02-28291_RS01	15	80	1.425	0.2	0.2	-1.1	0.0	0.0		
RSCPT24-01A	24-02-28291_RS01A	15	270	6.250	2.6	2.7	1.7	2.1	2.1	4.1	
RSCPT24-01A	24-02-28291_RS01A	15	170	13.950	10.0	10.0	9.9	10.0	10.0	4.0	
RSCPT24-01A	24-02-28291_RS01A	15	125	13.950	10.5	10.6	4.4	10.0	10.0	4.0	
RSCPT24-02	24-02-28291_RS02	15	145	0.975	0.5	0.5	-5.8	0.0	0.0		
RSCPT24-02	24-02-28291_RS02	15	200	1.875	3.6	3.8	-1.8	0.0	0.0		

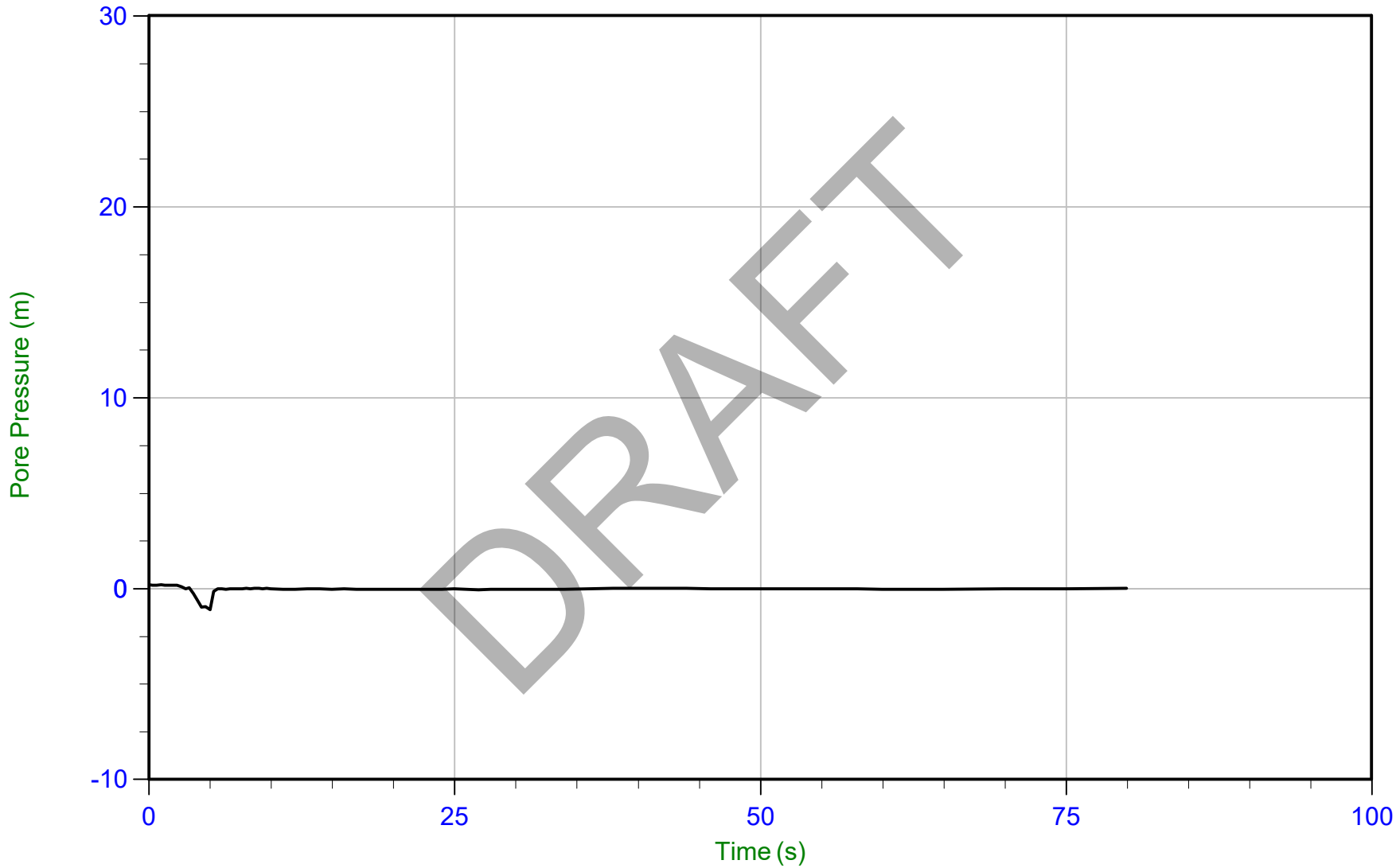
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CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 09:28
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01
Cone: 898:T1500F15U35 Area=15 cm²



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Trace Summary:

Filename: 24-02-28291_RS01.PPF2
Depth: 1.425 m / 4.675 ft
Duration: 80.0 s

u Min: -1.1 m
u Max: 0.2 m
u Final: 0.0 m

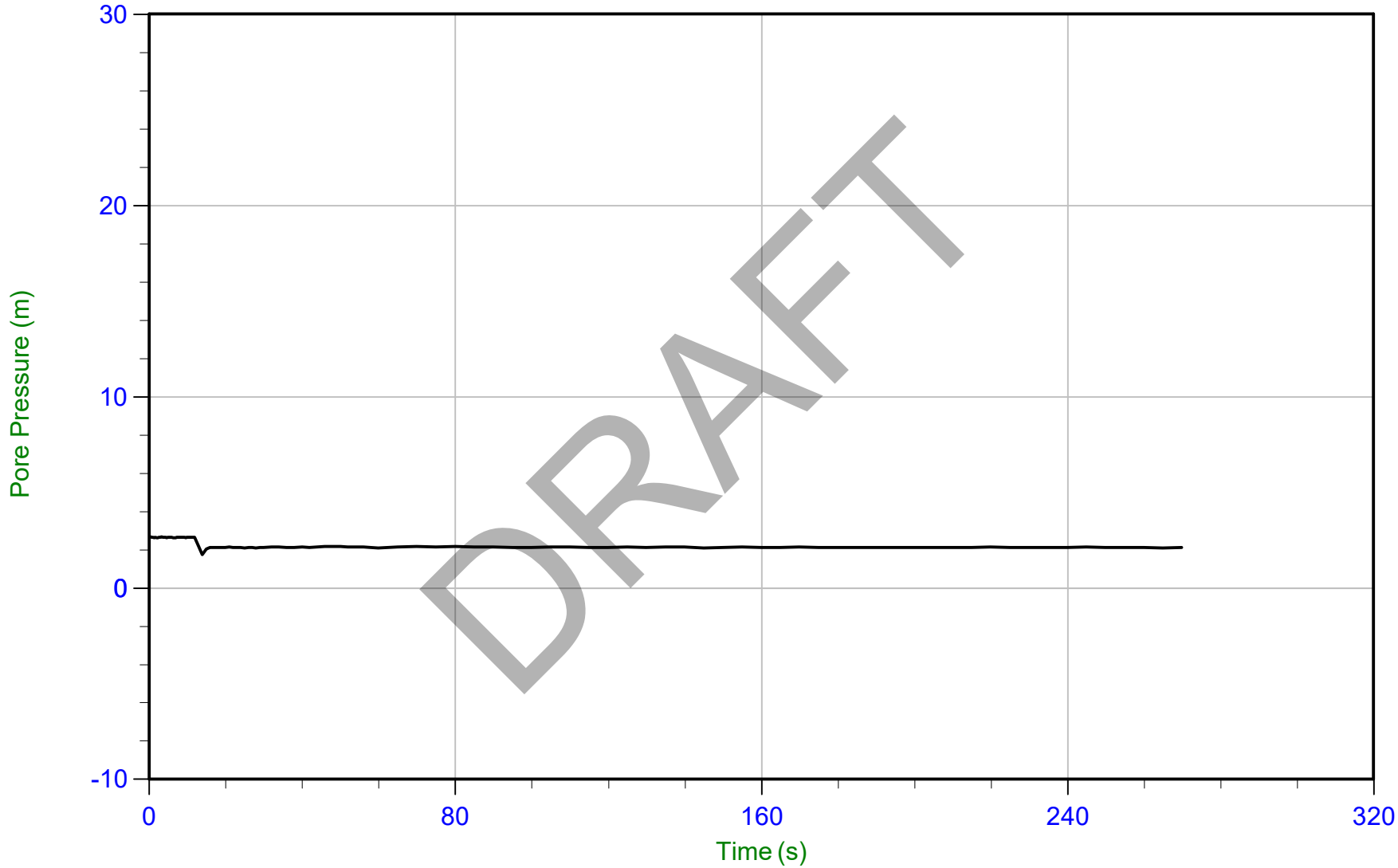
WT: 1.4 m / 4.7 ft
Ueq: 0.0 m

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 10:09
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01A
Cone: 898:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 24-02-28291_RS01A.PPF2
Depth: 6.250 m / 20.505 ft
Duration: 270.0 s

u Min: 1.7 m
u Max: 2.7 m
u Final: 2.1 m

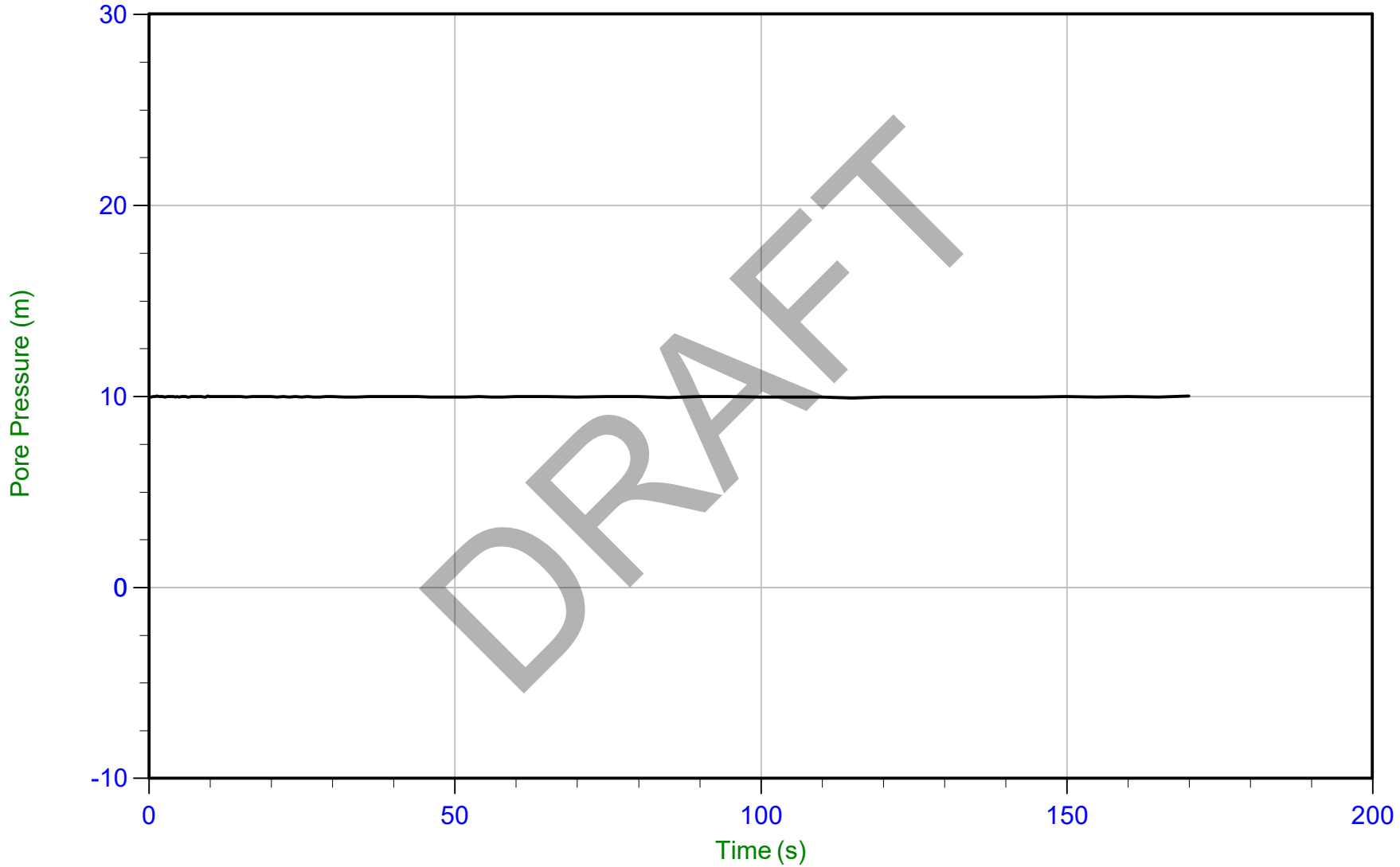
WT: 4.1 m / 13.6 ft
Ueq: 2.1 m

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 10:09
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01A
Cone: 898:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 24-02-28291_RS01A.PPF2
Depth: 13.950 m / 45.767 ft
Duration: 170.0 s

u Min: 9.9 m
u Max: 10.0 m
u Final: 10.0 m

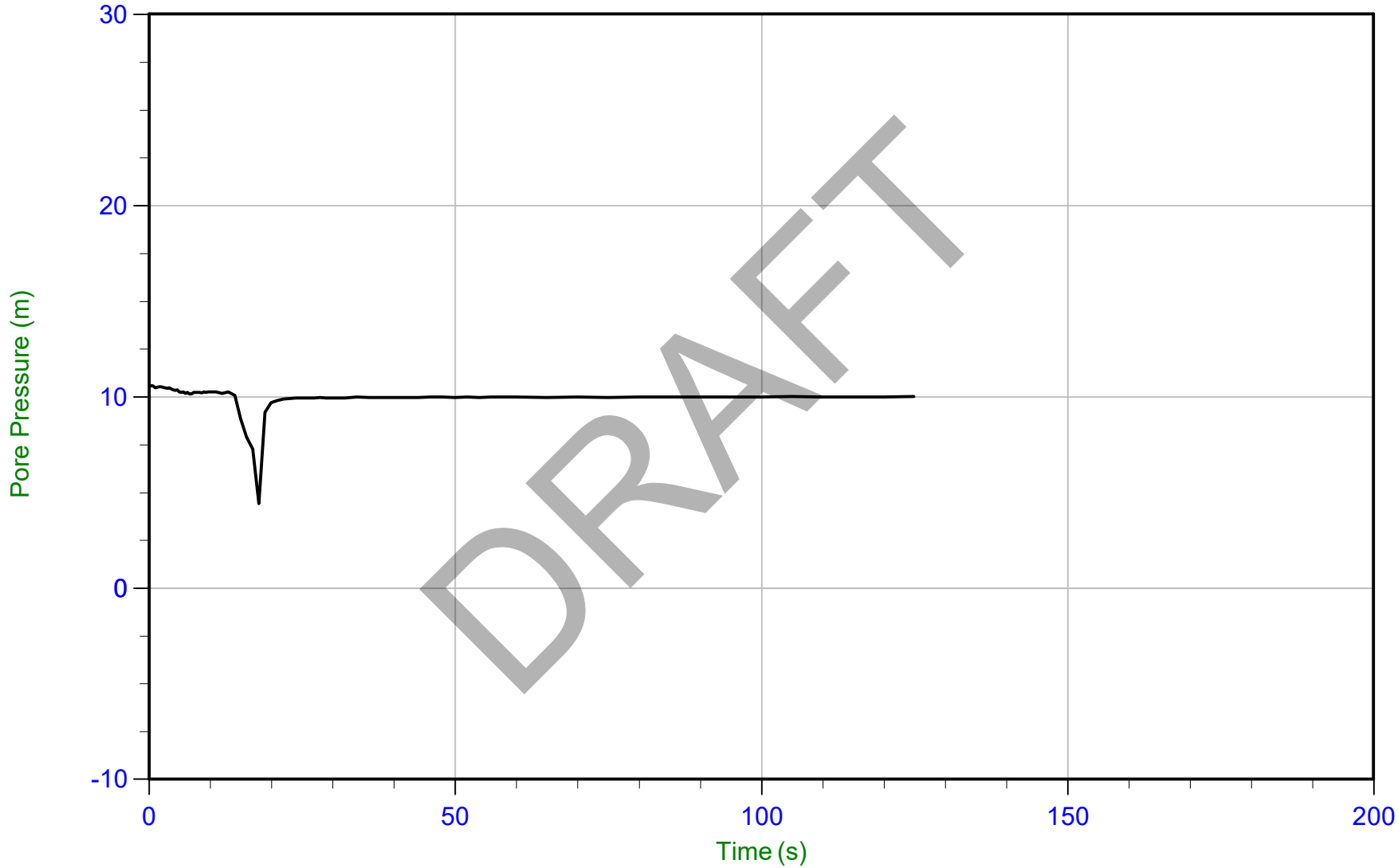
WT: 4.0 m / 13.0 ft
Ueq: 10.0 m

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-10 10:09
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-01A
Cone: 898:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 24-02-28291_RS01A.PPF2
Depth: 13.950 m / 45.767 ft
Duration: 125.0 s

u Min: 4.4 m
u Max: 10.6 m
u Final: 10.0 m

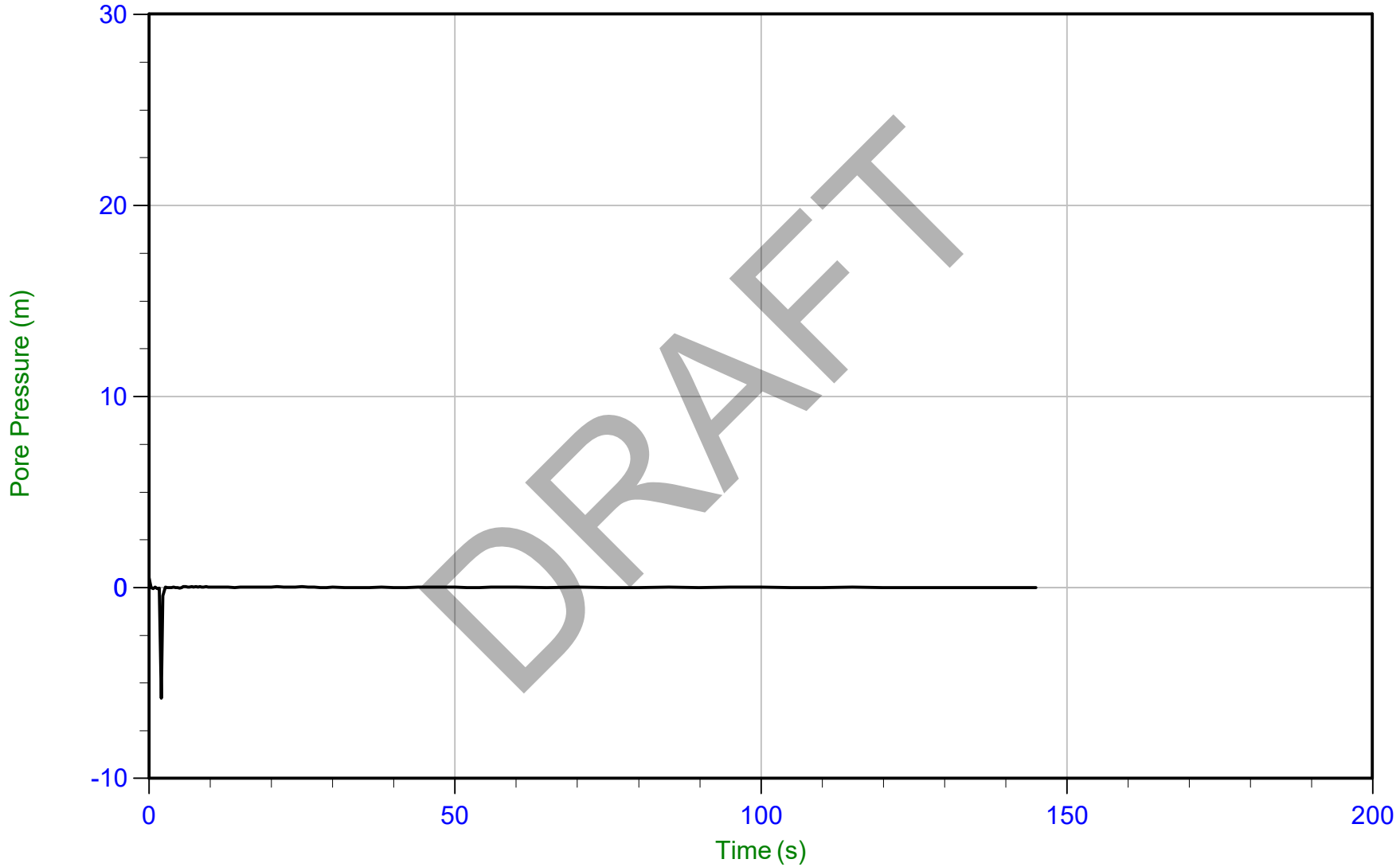
WT: 4.0 m / 13.0 ft
Ueq: 10.0 m

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-11 14:15
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-02
Cone: 898:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 24-02-28291_RS02.PPF2
Depth: 0.975 m / 3.199 ft
Duration: 145.0 s

u Min: -5.8 m
u Max: 0.5 m
u Final: -0.0 m

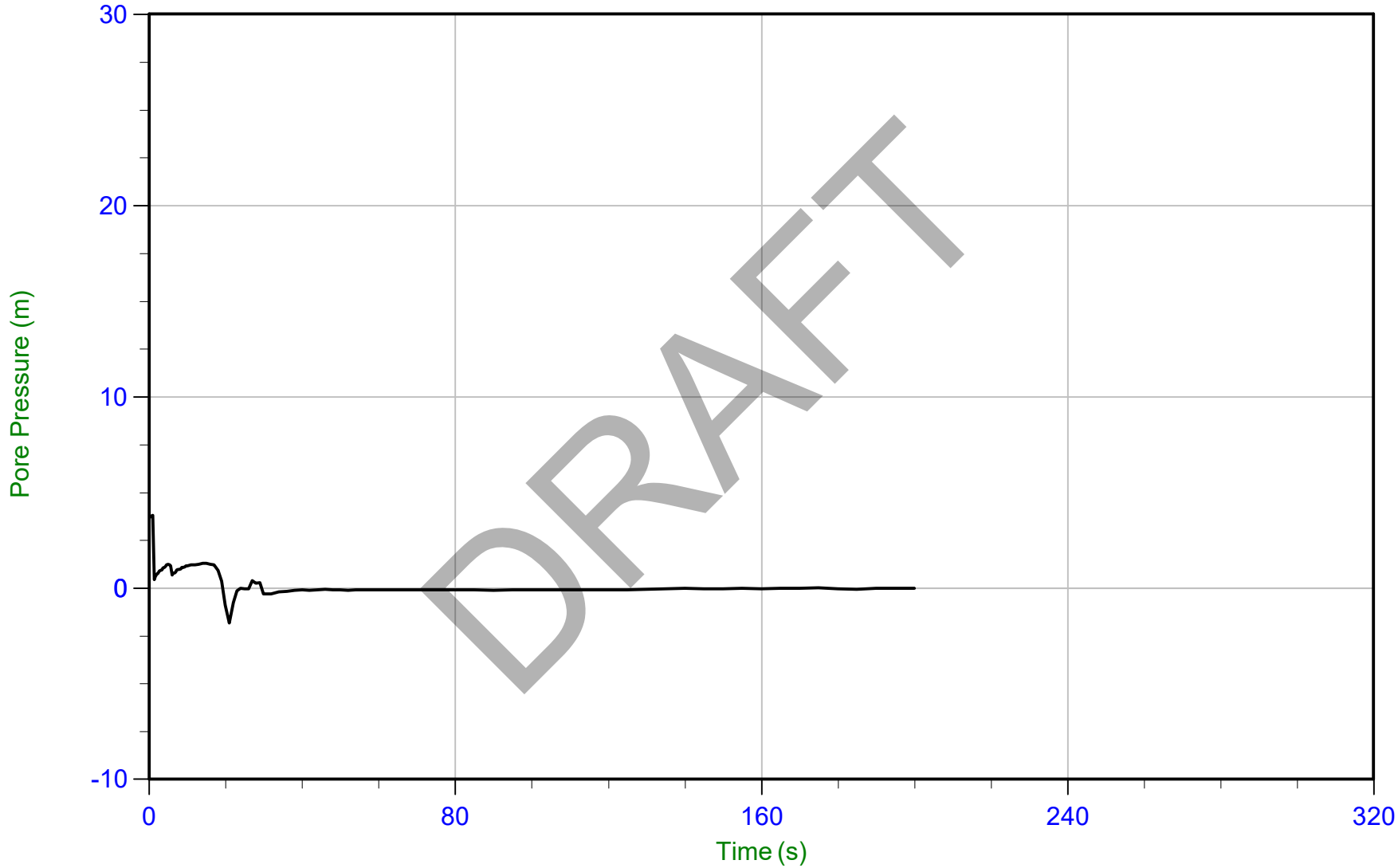
WT: 1.0 m / 3.2 ft
Ueq: 0.0 m

CONETEC

Stantec

Job No: 24-02-28291
Date: 2024-09-11 14:15
Site: 197A St 30 Ave, Langley

Sounding: RSCPT24-02
Cone: 898:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 24-02-28291_RS02.PPF2
Depth: 1.875 m / 6.152 ft
Duration: 200.0 s

u Min: -1.8 m
u Max: 3.8 m
u Final: -0.0 m

WT: 1.9 m / 6.2 ft
Ueq: 0.0 m

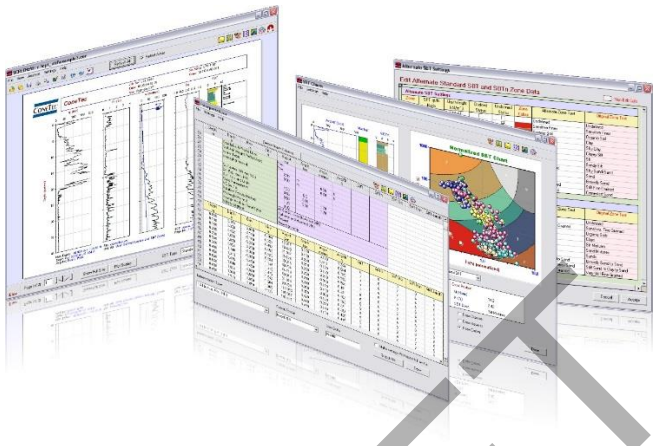
Description of Methods for Calculated CPT Geotechnical Parameters

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CALCULATED CPT GEOTECHNICAL PARAMETERS

A Detailed Description of the Methods Used in ConeTec's CPT Geotechnical Parameter Calculation and Plotting Software



Revision SZW-Rev 18

Revised February 10, 2023
Prepared by Jim Greig, M.A.Sc, P.Eng (BC, AB, ON)

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Limitations

The geotechnical parameter output was prepared specifically for the site and project named in the accompanying report subject to objectives, site conditions and criteria provided to ConeTec by the client. The output may not be relied upon by any other party or for any other site without the express written permission of ConeTec Group (ConeTec) or any of its affiliates. For this project, ConeTec has provided site investigation services, prepared factual data reporting and produced geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

To understand the calculations that have been performed and to be able to reproduce the calculated parameters the user is directed to the basic descriptions for the methods in this document and the detailed descriptions and their associated limitations and appropriateness in the technical references cited for each parameter.

ConeTec's Calculated CPT Geotechnical Parameters as of February 10, 2023.

ConeTec's CPT parameter calculation and plotting routine provides a tabular output of geotechnical parameters based on current published CPT correlations and is subject to change to reflect the current state of practice. Due to drainage conditions and the basic assumptions and limitations of the correlations, not all geotechnical parameters provided are considered applicable for all soil types. The results are presented only as a guide for geotechnical use and should be carefully examined for consideration in any geotechnical design. Reference to current literature is strongly recommended. ConeTec does not warranty the correctness or the applicability of any of the geotechnical parameters calculated by the program and does not assume liability for any use of the results in any design or review. For verification purposes we recommend that representative hand calculations be done for any parameter that is critical for design purposes. The end user of the parameter output should also be fully aware of the techniques and the limitations of any method used by the program. The purpose of this document is to inform the user as to which methods were used and to direct the end user to the appropriate technical papers and/or publications for further reference.

The geotechnical parameter output was prepared specifically for the site and project named in the accompanying report subject to objectives, site conditions and criteria provided to ConeTec by the client. The output may not be relied upon by any other party or for any other site without the express written permission of ConeTec Group (ConeTec) or any of its affiliates.

The CPT calculations are based on values of tip resistance, sleeve friction and pore pressures considered at each data point or averaged over a user specified layer thickness (e.g., 0.20 m). Note that q_t is the tip resistance corrected for pore pressure effects and q_c is the recorded tip resistance. The corrected tip resistance (corrected using u_2 pore pressure values) is used for all calculations. Since all ConeTec cones have equal end area friction sleeves pore pressure corrections to sleeve friction, f_s, are not performed.

Corrected tip resistance: $q_t = q_c + (1-a) \cdot u_2$ (consistent units are required)

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure from behind the tip (u_2 position)
a is the Net Area Ratio for the cone (typically 0.80 for ConeTec cones)

The total stress calculations are based on soil unit weight values that have been assigned to the Soil Behavior Type (SBT) zones, from a user defined unit weight profile, by using a single uniform value throughout the profile, through unit weight estimation techniques described in various technical papers or from a combination of these methods. The parameter output files indicate the method(s) used.

Effective vertical overburden stresses are calculated using the total stress and equilibrium pore pressure (u_{eq} or u_o) values derived from an assumed hydrostatic distribution of pore pressures below the water table or from a user defined equilibrium pore pressure profile (typically obtained from CPT dissipation tests) or a combination of the two. For over water projects the stress effects of the column of water above the mudline are taken into account as is the appropriate unit weight of water. How this is done depends on where the instruments are zeroed (i.e. on deck or at the mudline). The parameter output files indicate the method(s) used.

A majority of parameter calculations are derived from or driven by results based on material types as determined by the various soil behavior type charts depicted in Figures 1 through 6. The parameter output files indicate the method(s) used.

The Soil Behavior Type classification chart shown in Figure 1 is the classic non-normalized SBT Chart developed at the University of British Columbia and reported in Robertson, Campanella, Gillespie and Greig (1986). Figure 2 shows the original normalized (linear method) SBTn chart developed by Robertson (1990). The Bq classification charts

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shown in Figures 3a and 3b incorporate pore pressures into the SBT classification and are based on the methods described in Robertson (1990). Many of these charts have been summarized in Lunne, Robertson and Powell (1997). The Jefferies and Davies SBT chart shown in Figure 3c is based on the techniques discussed in Jefferies and Davies (1993) which introduced the concept of the Soil Behavior Type Index parameter, I_c. Take note that the I_c parameter developed by Robertson and Fear (1995) and Robertson and Wride (1998) is similar in concept but uses a slightly different calculation method than that defined by Jefferies and Davies (1993) as the latter incorporates pore pressure in their technique through the use of the Bq parameter. The normalized Qtn SBT chart shown in Figure 4 is based on the work by Robertson (2009) utilizing a variable stress ratio exponent, n, for normalization based on a slightly modified redefinition and iterative approach for I_c. The boundary curves drawn on the chart are based on the work described in Robertson (2010).

Figure 5 shows a revised 1986 SBT Chart presented to CPT'10 by Robertson (2010b). It is known as the Updated non-normalized Soil Behavior Chart (also referred to as the Rev SBT Chart (PKR2010) in our output files). This chart was produced to be more in line with all post-1986 Robertson charts having the same 9 soil type zones, a $\log_{10}$ axis for friction ratio, R_f in this case, and a unitless tip resistance axis.

Figure 6 shows a revised behavior based chart by Robertson (2016) depicting contractive-dilative zones. As the zones represent material behavior rather than soil gradation ConeTec has chosen a set of zone colors that are less likely to be confused with material type colors from previous SBT charts. These colors differ from those used by Dr. Robertson. A green palette was selected for the dilative (desirable) side of the chart and a red palette for the contractive side of the chart.

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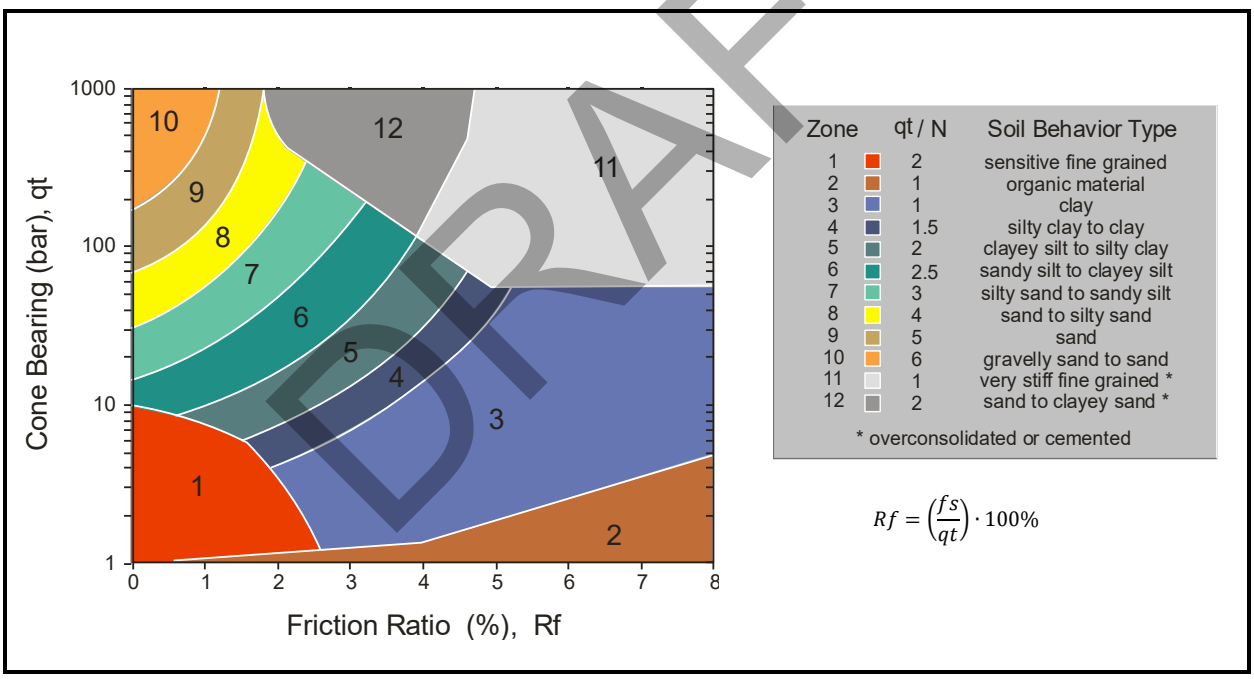


Figure 1. Non-normalized Soil Behavior Type Classification Chart (SBT)

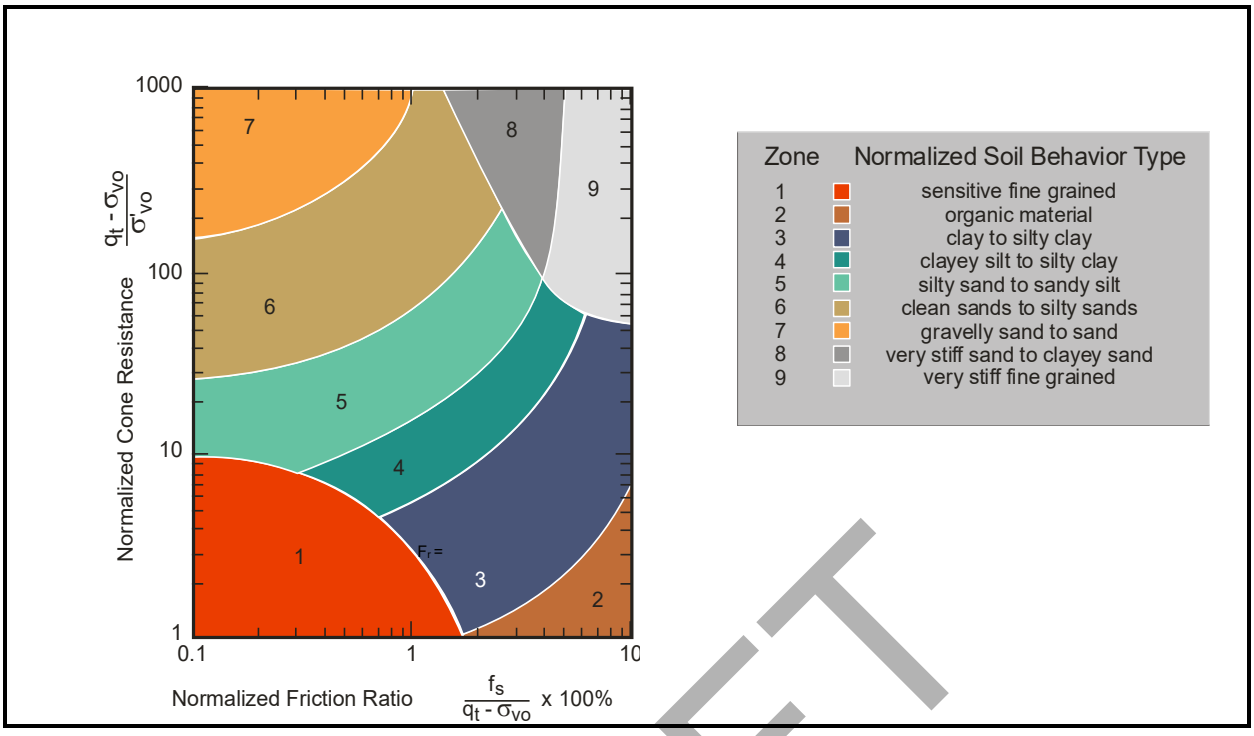


Figure 2. Normalized Soil Behavior Type Classification Chart (SBTn)

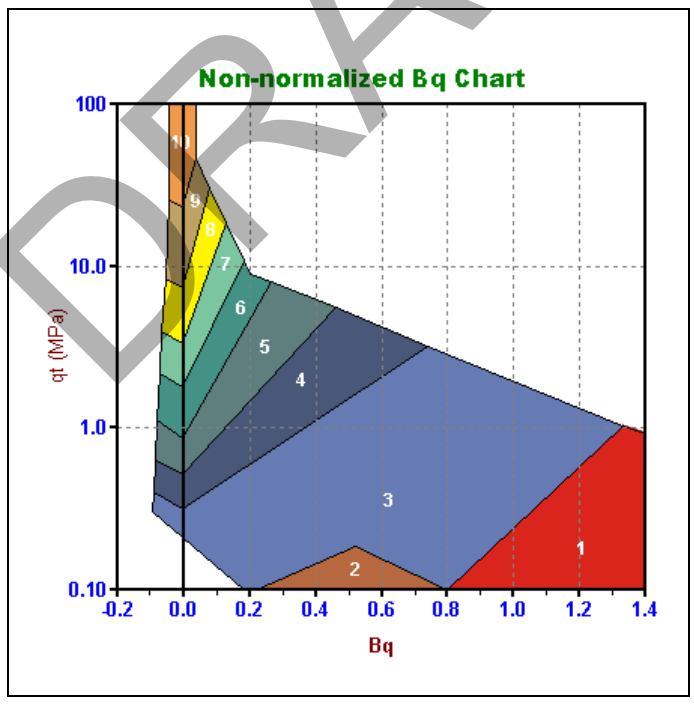


Figure 3a. Alternate Soil Behavior Type Chart (SBT Bq): q_t - B_q

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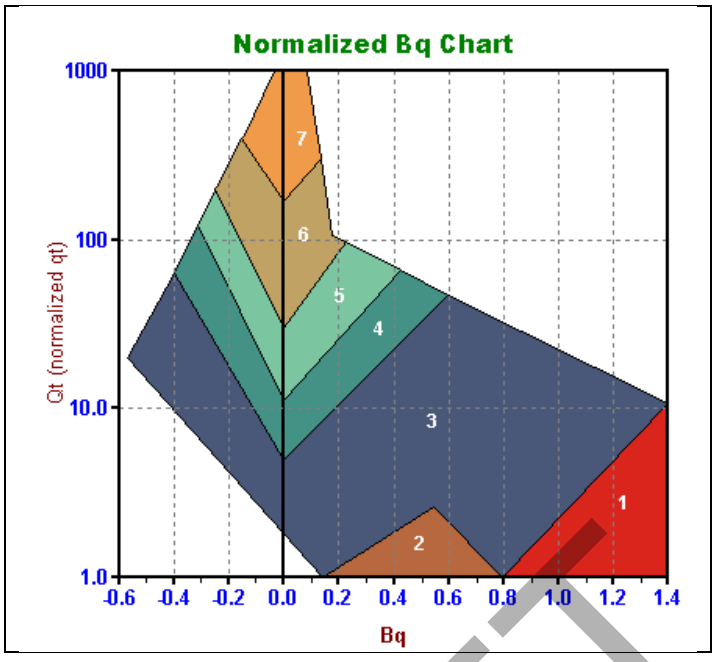


Figure 3b. Alternate Soil Behavior Type Charts (SBT Bqn): Q_t-B_q

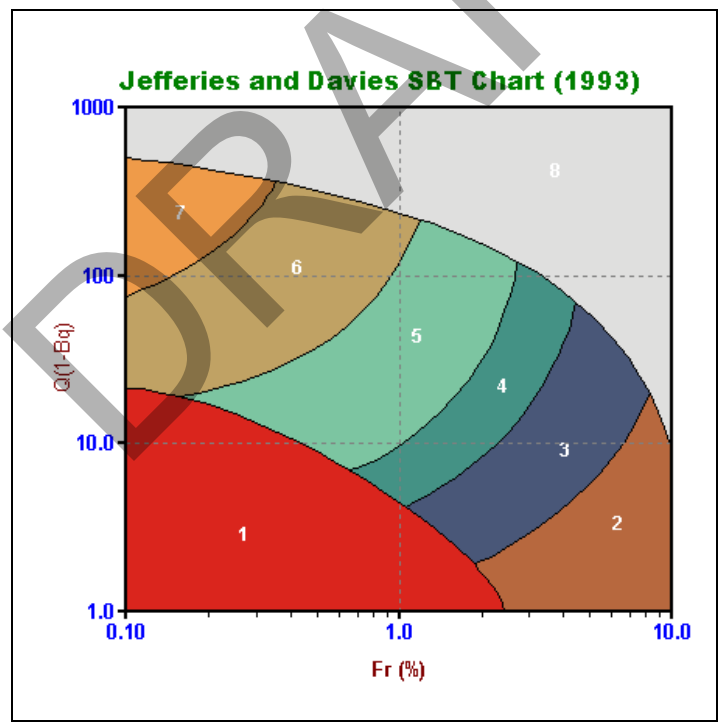


Figure 3c. Alternate Soil Behavior Type Charts: $Q(1-B_q)$ - F_r

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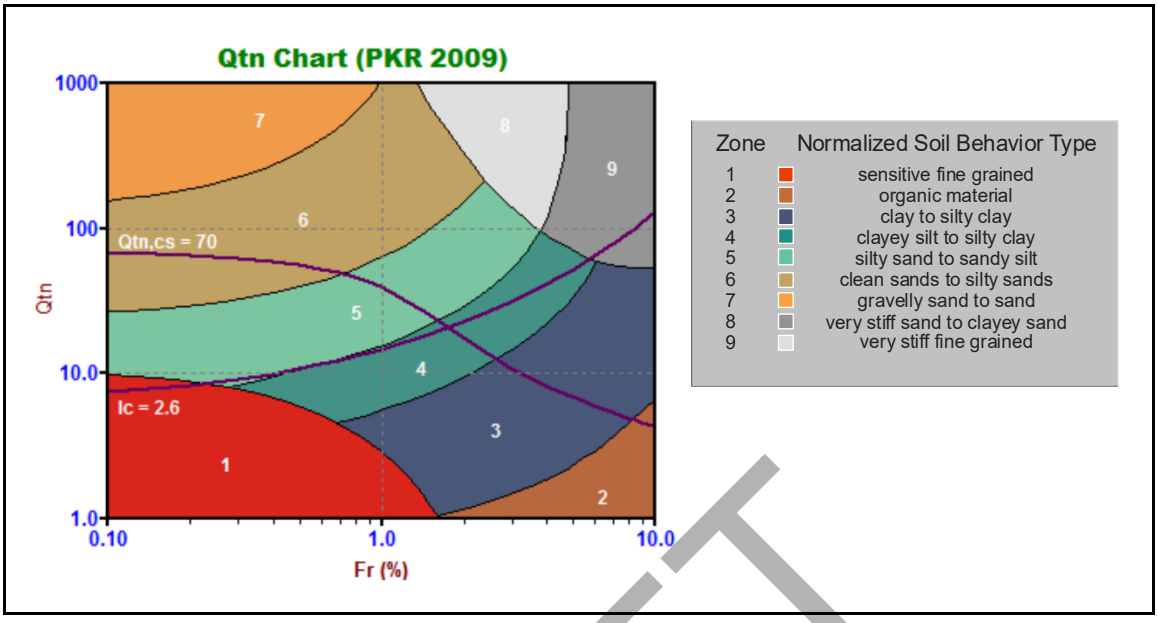


Figure 4. Normalized Soil Behavior Type Chart using Q_{tn} (SBT Qtn)

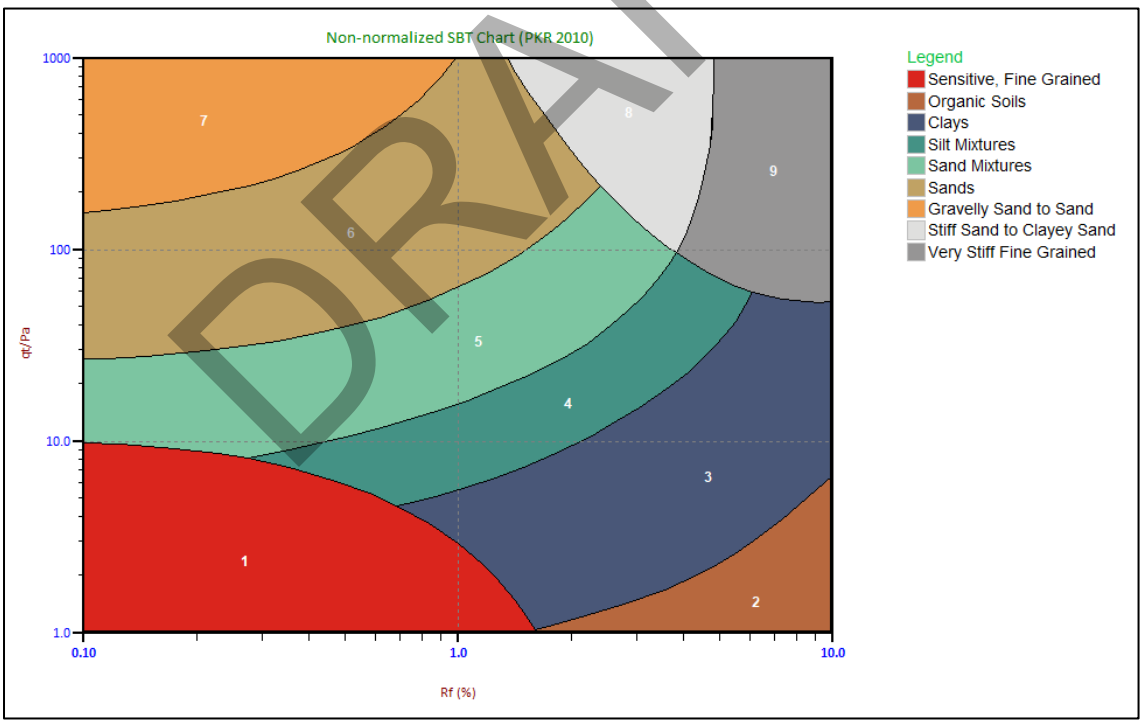


Figure 5. Non-normalized Soil Behavior Type Chart (2010)

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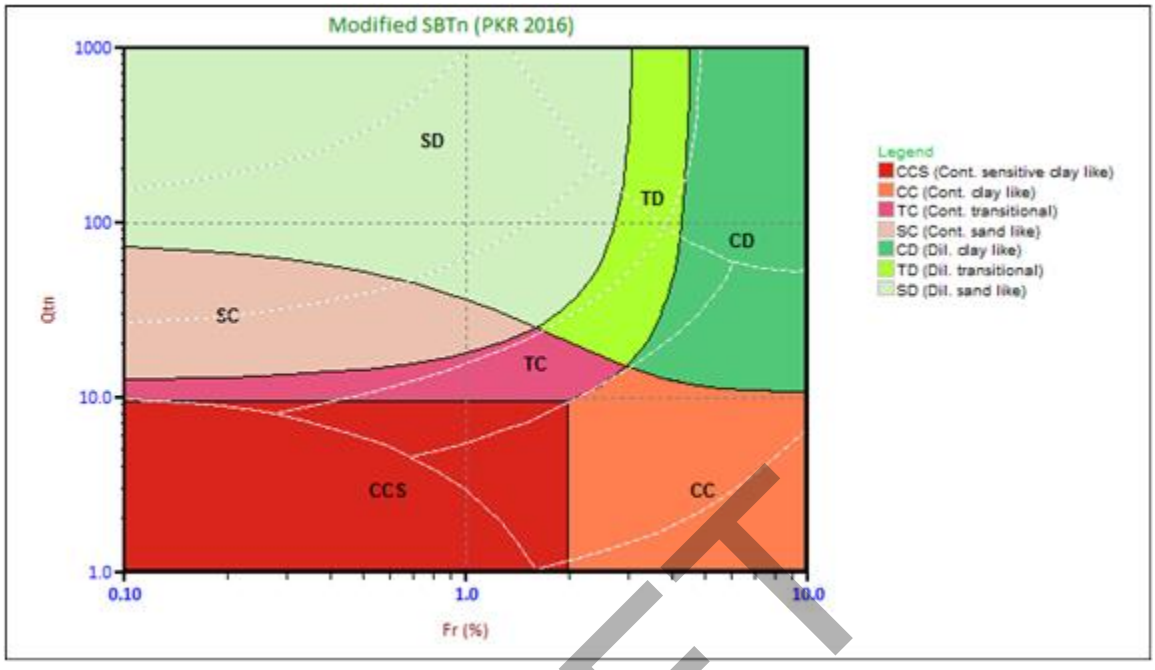


Figure 6. Modified SBTn Behavior Based Chart

Details regarding the geotechnical parameter calculations are provided in Tables 1a and 1b. The appropriate references cited are listed in Table 2. Non-liquefaction specific parameters are detailed in Table 1a and liquefaction specific parameters are detailed in Table 1b.

Where methods are based on charts or techniques that are too complex to describe in this summary, we recommend that the user refer to the cited material. Specific limitations for each method are described in the cited material.

Where the results of a calculation/correlation are deemed *'invalid'* the value will be represented by the text strings "-9999", "-9999.0", the value 0.0 (Zero) or an empty cell. Invalid results will occur because of (and not limited to) one or a combination of:

1. Invalid or undefined CPT data (e.g., drilled out section or data gap).

2. Where the calculation method is inappropriate, for example, drained parameters in a material behaving in an undrained manner (and vice versa).

3. Where input values are beyond the range of the referenced charts or specified limitations of the correlation method.

4. Where pre-requisite or intermediate parameter calculations are invalid.

The parameters selected for output from the program are often specific to a particular project. As such, not all of the calculated parameters listed in Tables 1and 1a may be included in the output files delivered with this report.

The output files are typically provided in Microsoft Excel XLS, XLSX or CSV format. The ConeTec software has several options for output depending on the number or types of calculated parameters desired or those specifically contracted for by the client. Each output file is named using the original file base name (from the .COR file) followed

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by a three or four character indicator of the output set selected (e.g. BSC, TBL, NLI, NL2, IFI, IFI2, IFI3) and possibly followed by an operator selected suffix identifying the characteristics of the particular calculation run.

Table 1a. CPT Parameter Calculation Methods – Non liquefaction Parameters

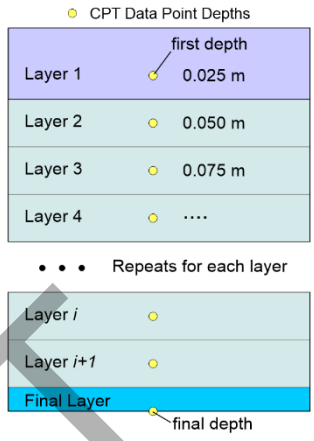
Reference Notes: CK* - Common Knowledge, U* - Unpublished

Calculated Parameter	Description	Equation	Ref
Depth	Mid Layer Depth *(where calculations are done at each point then Mid Layer Depth = Recorded Depth)*	*[Depth (Layer Top) + Depth (Layer Bottom)]/ 2.0*	CK*
Elevation	Elevation of Mid Layer is based on the sounding collar elevation supplied by the client or through a site survey In Sweden a variation of elevation is used where the elevation increases with depth. We refer to this as inverse elevation.	Elevation = Collar Elevation – Depth InverseElevation = Collar Elevation + Depth	CK* N/A
Avg qc	Averaged recorded tip value (q_c)	$Avgqc = \frac{1}{n}\sum_{i=1}^{n} q_c$ *n=1 when calculations are done at each point*	CK*
Avg qt	Averaged corrected tip (q_t) where: $q_t = q_c + (1-a)\cdot u_2$ Averaged q_t is not calculated using the average q_c and averaged u values. Averaged q_t is based on the average of the q_t values calculated at each data point.	$Avgqt = \frac{1}{n}\sum_{i=1}^{n} q_t$ *n=1 when calculations are done at each point*	1
Avg fs	Averaged sleeve friction (f_s) No pore pressure corrections are applied to f_s.	$Avgfs = \frac{1}{n}\sum_{i=1}^{n} fs$ *n=1 when calculations are done at each point*	CK*
Avg Rf	Averaged friction ratio (R_f) where friction ratio is defined as: $R_f = 100\% \cdot \frac{fs}{q_t}$	$AvgRf = 100\% \cdot \frac{Avgfs}{Avgqt}$ *not an average of individual R_f values*	CK*
Avg u	Averaged dynamic pore pressure *(u)*	$Avgu = \frac{1}{n}\sum_{i=1}^{n} u_i$ *n=1 when calculations are done at each point*	CK*
Avg Res	Averaged Resistivity (this data is not always available since it is a specialized test requiring an additional module)	$AvgRes = \frac{1}{n}\sum_{i=1}^{n} Resistivity_i$ *n=1 when calculations are done at each point*	CK*
Avg UVIF	Averaged UVIF ultra-violet induced fluorescence (this data is not always available since it is a specialized test requiring an additional module)	$AvgUVIF = \frac{1}{n}\sum_{i=1}^{n} UVIF_i$ *n=1 when calculations are done at each point*	CK*
Avg Temp	Averaged Temperature (this data is not always available)	$AvgTemp = \frac{1}{n}\sum_{i=1}^{n} Temperature_i$ *n=1 when calculations are done at each point*	CK*
Avg Gamma	Averaged Gamma Counts (this data is not always available since it is a specialized test requiring an additional module)	$AvgGamma = \frac{1}{n}\sum_{i=1}^{n} Gamma_i$ *n=1 when calculations are done at each point*	CK*
SBT	Soil Behavior Type as defined by Robertson et al 1986 (often referred to as Robertson and Campanella, 1986)	See Figure 1	1, 5
SBTn	Normalized Soil Behavior Type as defined by Robertson 1990 (linear normalization using Q_t, now referred to as Q_{t1})	See Figure 2	2, 5

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Calculated Parameter	Description	Equation	Ref
SBT-Bq	Non-normalized Soil Behavior type based on non-normalized tip resistance and the B_q parameter	See Figure 3a	1, 2, 5
SBT-Bqn	Normalized Soil Behavior type based on normalized tip resistance (Q_t, now called Q_{t1}) and the B_q parameter	See Figure 3b	2, 5
SBT-JandD	Soil Behavior Type as defined by Jeffries and Davies	See Figure 3c	7
SBT Qtn	Soil Behavior Type as defined by Robertson (2009) using a variable stress ratio exponent for normalization based on $I_{c\ (PKR\ 2009)}$	See Figure 4	15
Modified Non-normalized SBT Chart SBT (PKR2010)	This is a revised version of the simple 1986 non-normalized SBT chart (presented at CPT '10). The revised version has been reduced from 12 zones to 9 zones to be similar to the normalized Robertson charts. Other updates include a dimensionless tip resistance normalized to atmospheric pressure, q_t/P_a, on the vertical axis and a log scale for non-normalized friction ratio, R_f, along the horizontal axis.	See Figure 5	33
Modified SBTn (contractive /dilative)	Modified SBTn chart as defined by Robertson (2016) indicating zones of contractive/dilative behavior. Note that ConeTec displays the chart with colors different from Robertson. ConeTec's colors were chosen to avoid confusion with soil type descriptions.	See Figure 6	30
Unit Wt.	Unit Weight of soil determined from one of the following user selectable options: 1) uniform value 2) value assigned to each SBT zone 3) value assigned to each SBTn zone 4) value assigned to SBTn zone as determined from Robertson and Wride (1998) based on q_{c1n} 5) values assigned to SBT Qtn zones 6) values based on Robertson updated non-normalized Soil Behavior Type Chart (2010b) 6) Mayne f_s (sleeve friction) method 7) Robertson and Cabal 2010 method 8) user supplied unit weight profile The last option may co-exist with any of the other options.	See references	3, 5, 15, 21, 24, 29, 33

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Calculated Parameter	Description	Equation	Ref
TStress σ_v	Total vertical overburden stress at Mid Layer Depth *A layer is defined as the averaging interval specified by the user where depths are reported at their respective mid-layer depth.* For data calculated at each point layers are defined using the recorded depth as the mid-point of the layer. Thus, a layer starts half-way between the previous depth and the current depth unless this is the first point in which case the layer start is at zero depth. The layer bottom is half-way from the current depth to the next depth unless it is the last data point. Defining layers affects how stresses are calculated since the unit weight attributed to a data point is used throughout the entire layer. This means that to calculate the stresses the total stress at the top and bottom of a layer are required. The stress at mid layer is determined by adding the incremental stress from the layer top to the mid-layer depth. The stress at the layer bottom becomes the stress at the top of the subsequent layer. Stresses are NOT calculated from mid-point to mid-point. For over-water work the total stress due to the column of water above the mid line is taken into account where appropriate.	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ *where* γ_i is layer unit weight h_i is layer thickness 	CK*
EStress σ_v'	Effective vertical overburden stress at mid-layer depth.	$\sigma_v' = \sigma_v - u_{eq}$	CK*
Equil u u_{eq} or u_0	Equilibrium pore pressures are determined from one of the following user selectable options: 1) hydrostatic below the water table 2) user supplied profile 3) combination of those above When a user supplied profile is used/provided a linear interpolation is performed between equilibrium pore pressures defined at specific depths. If the profile values start below the water table then a linear transition from zero pressure at the water table to the first defined pointed is used. Equilibrium pore pressures may come from dissipation tests, adjacent piezometers or other sources. Occasionally, an extra equilibrium point ("assumed value") will be provided in the profile that does not come from a recorded value to smooth out any abrupt changes or to deal with material interfaces. These "assumed" values will be indicated on our plots and in tabular summaries.	For the hydrostatic option: $u_{eq} = \gamma_w \cdot (D - D_{wt})$ where u_{eq} is equilibrium pore pressure γ_w is the unit weight of water D is the current depth D_{wt} is the depth to the water table	CK*
K_0	Coefficient of earth pressure at rest, K_0.	$K_O = (1 - \sin\Phi') OCR^{\sin\Phi'}$	17
C_n	Overburden stress correction factor used for $(N_1)_{60}$ and older CPT parameters.	$C_n = (P_a/\sigma_v')^{0.5}$ where $0.0 < C_n < 2.0$ *(user adjustable, typically ranging from 1.7 to 2.0)* P_a *is atmospheric pressure (100 kPa)*	4, 12

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Calculated Parameter	Description	Equation	Ref
C_q	Overburden stress normalizing factor.	$C_q = 1.8 / [0.8 + (\sigma_v'/P_a)]$ where *$0.0 < C_q < 2.0$ (user adjustable)* *P_a is atmospheric pressure (100 kPa)* *Robertson and Wride define C_q to be the same as C_n. The Olson definition above is used in the program.*	3, 12
N_{60}	SPT N value at 60% energy calculated from q_t/N ratios assigned to each SBT zone. This method has abrupt N value changes at zone boundaries.	*See Figure 1*	5
$(N_1)_{60}$	SPT N_{60} value corrected for overburden pressure.	$(N_1)_{60} = C_n \bullet N_{60}$	4
$N_{60}I_c$	SPT N_{60} values based on the I_c parameter, as defined by Robertson and Wride 1998 (3), or by Robertson 2009 (15).	$(q_t/P_a)/ N_{60} = 8.5 (1 – I_c/4.6)$ $(q_t/P_a)/ N_{60} = 10^{(1.1268 – 0.2817Ic)}$ P_a being atmospheric pressure	3, 5 15, 31
$(N_1)_{60}I_c$	SPT N_{60} value corrected for overburden pressure (using N_{60} I_c). User has 3 options.	*1) $(N_1)_{60}Ic = C_n \bullet (N_{60} I_c)$* 2) $q_{c1n}/ (N_1)_{60}I_c = 8.5 (1 – I_c/4.6)$ 3) $(Q_{tn})/ (N_1)_{60}I_c = 10^{(1.1268 – 0.2817Ic)}$	4 5 15, 31
S_u or S_u (N_{kt})	Undrained shear strength based on q_t S_u factor N_{kt} is user selectable.	$Su = \frac{qt - \sigma_v}{N_{kt}}$	1, 5
S_u or S_u (N_{du}) or S_u ($N_{\Delta u}$)	Undrained shear strength based on pore pressure S_u factor $N_{\Delta u}$ is user selectable.	$Su = \frac{u_2 - u_{eq}}{N_{\Delta u}}$	1, 5
D_r	Relative Density determined from one of the following user selectable options: 1) Ticino Sand 2) Hokksund Sand 3) Schmertmann (1978) 4) Jamiolkowski (1985) - All Sands 5) Jamiolkowski et al (2003) (various compressibilities, K_o)	See reference (methods 1 through 4) Jamiolkowski et al (2003) reference	5 14
PHI ϕ	Friction Angle determined from one of the following user selectable options (methods 1 through 4 are for sands and method 5 is for silts and clays): 1) Campanella and Robertson 2) Durgunoglu and Mitchel 3) Janbu 4) Kulhawy and Mayne 5) NTH method (clays and silts)	See appropriate reference	5 5 5 11 23
Delta U/q_t $\Delta u/q_t$ du/q_t	Differential pore pressure ratio (older parameter used before B_q was established)	$= \frac{\Delta u}{qt}$ *where:* $\Delta u = u - u_{eq}$ *and u = dynamic pore pressure* *u_{eq} = equilibrium pore pressure*	39

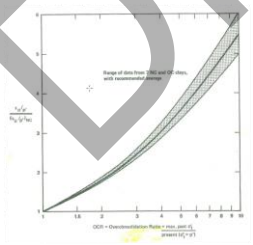
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Calculated Parameter	Description	Equation	Ref
B_q	Pore pressure parameter	$Bq = \frac{\Delta u}{qt - \sigma_v}$ where: $\Delta u = u - u_{eq}$ *and u = dynamic pore pressure* *u_{eq} = equilibrium pore pressure*	1, 2, 5
Net q_t or qtNet	Net tip resistance (used in many subsequent correlations)	$qt - \sigma_v$	36
q_e or qE or q_E	Effective tip resistance (using the dynamic pore pressure u_2 and not equilibrium pore pressure)	$q_t - u_2$	36
qeNorm	Normalized effective tip resistance	$\frac{qt - u_2}{\sigma_v'}$	36
Q_t or Norm: Qt or Q_{t1}	Normalized q_t for Soil Behavior Type classification as defined by Robertson (1990) using a linear stress normalization. Note this is different from Q_{tn}. This parameter was renamed to Q_{t1} in Robertson, 2009. Without normalization limits this parameter calculates to very high unrealistic values at low stresses.	$Qt = \frac{qt - \sigma_v}{\sigma_v'}$	2, 5, 15
F_r or Norm: Fr	Normalized Friction Ratio for Soil Behavior Type classification as defined by Robertson (1990)	$Fr = 100\% \cdot \frac{fs}{qt - \sigma_v}$	2, 5
Q(1-B_q) Q(1-B_q) + 1	Q(1-B_q) grouping as suggested by Jefferies and Davies for their classification chart and the establishment of their I_c parameter. Later papers added the +1 term to the equation.	$Q \cdot (1 - Bq)$ $Q \cdot (1 - Bq) + 1$ *where Bq is defined as above and Q is the same as the normalized tip resistance, Q_{t1}, defined above*	6, 7, 34
q_{c1}	Normalized tip resistance, q_{c1}, using a fixed stress ratio exponent, n (this method has stress units)	$q_{c1} = q_t \cdot (Pa/\sigma_v')^{0.5}$ where: P_a = atmospheric pressure	21
q_{c1} (0.5)	Normalized tip resistance, q_{c1}, using a fixed stress ratio exponent, n (this method is unit-less)	$q_{c1}(0.5) = (q_t/P_a) \cdot (Pa/\sigma_v')^{0.5}$ where: P_a = atmospheric pressure	5
q_{c1} (C_n)	Normalized tip resistance, q_{c1}, based on C_n (this method has stress units)	$q_{c1}(Cn) = C_n * q_t$	5, 12
q_{c1} (C_q)	Normalized tip resistance, q_{c1}, based on C_q (this method has stress units)	$q_{c1}(Cq) = C_q * q_t$ (some papers use q_c)	5, 12
q_{c1n}	normalized tip resistance, q_{c1n}, using a variable stress ratio exponent, n (where n=0.0, 0.70, or 1.0) (this method is unit-less)	$q_{c1n} = (q_t / P_a)(P_a/\sigma_v')^n$ where: P_a = atm. Pressure and n varies as described below	3

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Calculated Parameter	Description	Equation	Ref
I_c or Ic (RW1998)	Soil Behavior Type Index as defined by Robertson and Wride (1997, 1998) for estimating grain size characteristics and providing smooth gradational changes across the SBTn chart. Ic(RW1998) is different from that of Jefferies and Davies (7) and is different from Ic(PKR2009).	$I_c = [(3.47 - \log_{10}Q)^2 + (\log_{10} Fr + 1.22)^2]^{0.5}$ *Where:* $Q = \left(\frac{qt - \sigma_v}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *Or* $Q = q_{c1n} = \left(\frac{qt}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *depending on the iteration in determining I_c* *And Fr is in percent* *P_a = atmospheric pressure* *n has the following distinct values:* *0.5, 0.75 and 1.0* *and is determined in an iterative manner based on the resulting I_c in each iteration* *Note that NCEER replaced 0.75 with 0.70*	3, 4, 5 10
I_c (PKR 2009)	Soil Behavior Type Index, I_c (PKR 2009) is based on a variable stress ratio exponent n, which itself is based on I_c (PKR 2009). An iterative calculation is required to determine I_c (PKR 2009) and its corresponding n (PKR 2009).	*I_c (PKR 2009) =* *$[(3.47 - \log_{10}Q_{tn})^2 + (1.22 + \log_{10}F_r)^2]^{0.5}$*	15
n (PKR 2009)	Stress ratio exponent n, based on I_c (PKR 2009). An iterative calculation is required to determine n (PKR 2009) and its corresponding I_c (PKR 2009).	*n (PKR 2009) = 0.381 (I_c) + 0.05 (σ_v'/P_a) – 0.15*	15
Q_{tn} (PKR 2009)	Normalized tip resistance using a variable stress ratio exponent based on I_c (PKR 2009) and n (PKR 2009). An iterative calculation is required to determine Q_{tn} (PKR 2009).	*$Q_{tn} = [(qt - \sigma_v)/P_a](P_a/\sigma_v')^n$* *where P_a = atmospheric pressure (100 kPa)* *n = stress ratio exponent described above*	15
FC	Apparent fines content (%)	*$FC=1.75(Ic^{3.25}) - 3.7$* *$FC=100$ for $I_c > 3.5$* *$FC=0$ for $I_c < 1.26$* *FC = 5% if $1.64 < I_c < 2.6$ AND $F_r<0.5$*	3
I_c Zone	This parameter is the Soil Behavior Type zone based on the I_c parameter (valid for zones 2 through 7 on SBTn or SBT Qtn charts)	$I_c < 1.31$ Zone = 7 $1.31 < I_c < 2.05$ Zone = 6 $2.05 < I_c < 2.60$ Zone = 5 $2.60 < I_c < 2.95$ Zone = 4 $2.95 < I_c < 3.60$ Zone = 3 $I_c > 3.60$ Zone = 2	3
CD	The contractive / dilative boundary on Robertson's Modified SBTn (contractive/dilative) Chart shown in Figure 6 above. The boundary is marked as CD = 70 on the chart in the relevant paper. Similar to the $Q_{tn,cs}$ = 70 line in Figure 4.	$CD = 70 = (Q_{tn} - 11)(1 + 0.06F_r)^{17}$ lower bound of CD = 60: $CD = 60 = (Q_{tn} - 9.5)(1 + 0.06F_r)^{17}$	30

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Calculated Parameter	Description	Equation	Ref
I_B	Hyberbolic fit defining the boundary between SBT soil types proposed by Schneider as a better fit than the I_c circles. I_B = 32 represents the boundary for most sand like soils. I_B = 22 represents the upper boundary for most clay like soils. The region between I_B=22 and I_B=32 is the "transitional soil" zone.	$I_B = 100\ (Q_{tn} + 10) / (70 + Q_{tn} F_r)$	30
State Param or State Parameter or ψ	The state parameter index, ψ, is defined as the difference between the current void ratio, e, and the critical void ratio, e_c. Positive ψ - contractive soil Negative ψ - dilative soil This is based on the work by Been and Jefferies (1985) and Plewes, Davies and Jefferies (1992) This method uses mean normal stresses based on a uniform value of K_0 or a calculated K_0 using methods described elsewhere in this document	See reference	6, 8
Yield Stress σ_p'	Yield stress is calculated using the following methods 1) General method 2) 1st order approximation using q_tNet (clays) 3) 1st order approximation using Δu_2 (clays) 4) 1st order approximation using q_e (clays) 5) Based on Vs	All stresses in kPa 1) $\sigma_p' = 0.33 \cdot (q_t - \sigma_v)^{m'} \cdot (\sigma_{atm}/100)^{1-m'}$ where $m' = 1 - \frac{0.28}{1 + (I_c / 2.65)^{25}}$ 2) $\sigma_p' = 0.33 \cdot (q_t - \sigma_v)$ 3) $\sigma_p' = 0.54 \cdot (\Delta u_2)$ $\Delta u_2 = u_2 - u_0$ 4) $\sigma_p' = 0.60 \cdot (q_t - u_2)$ 5) $\sigma_p' = (Vs/4.59)^{1.47}$	19 20 20 20 18
OCR OCR(JS1978) YSR(Mayne2014) YSR (qtNet) YSR (deltaU) YSR (qe) YSR (Vs) OCR (PKR2015)	Over Consolidation Ratio based on 1) Schmertmann (1978) method involving a plot plot of S_u/σ_v' /($S_u/\sigma_v')_{NC}$ and OCR  2) based on Yield stresses described above 3) approximate version based on qtNet 4) approximate version based on Δu 5) approximate version based on effective tip, q_e 6) approximate version based on shear wave velocity, V_s and σ_v' 7) based on Qt	1) requires a user defined value for NC Su/P_c' ratio 2 through 5) *based on yield stresses* 6) YSR (Vs) = $\sigma_p'(Vs) / \sigma_v'$ 7) OCR = $0.25 \cdot (Qt)^{1.25}$	9 19 20 20 20 18 32
Es/qt	Intermediate parameter for calculating Young's Modulus, E, in sands. It is the Y axis of the reference chart. Note that Figured 5.59 from reference 5, Lunne, Robertson and Powell, (LRP) has an error. The X axis values are too high by a factor of 10. The plot is based on Baldi's (not Bellotti as cited in	Based on Figure 5.59 in the reference	5, 37

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Calculated Parameter	Description	Equation	Ref
	LRP) original Figure 3 where the X axis is: $\frac{q_c}{\sqrt{\sigma_v'}}$ (both in kPa) with a range of 200 to 3000. Figure 5.59 from LRP shows a dimensionless form of the equation, q_{c1}, displaying the same range of values. Figure 5.59's X axis uses $q_{c1} = \left(\frac{q_c}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^{0.5}$ The two expressions are not the same: they differ by a factor of $\frac{\sqrt{P_a}}{P_a}$. With P_a taken to be 100 kPa the factor is 1/10. Substituting typical values of 200 bar (20000 kPa) for q_c and 225 kPa for σ_v' one gets: 20000 / 15 = 1333.33 for Bellotti's axis and $(200/1)(100/225)^{0.5}$ = 200 * (10/15) = 133.3 for LRP's axis (noting that P_a = 1 bar) showing a factor of 10 difference.		
Es or E_s Young's Modulus E	Young's Modulus based on the work done in Italy. There are three types of sands considered in this technique. The user selects the appropriate type for the site from: a) OC Sands b) Aged NC Sands c) Recent NC Sands Each sand type has a family of curves that depend on mean normal stress. The program calculates mean normal stress and linearly interpolates between the two extremes provided in the E_s/q_t chart. E_s is evaluated for an axial strain of 0.1%.	Mean normal stress is evaluated from: $\sigma_m' = \frac{1}{3}(\sigma_v' + \sigma_h' + \sigma_h')$ where σ_v'= vertical effective stress σ_h'= horizontal effective stress *and* $\sigma_h = K_o \cdot \sigma_v'$ with K_o assumed to be 0.5	5
Delta U/TStress $\Delta u / \sigma_v$	Differential pore pressure ratio with respect to total stress	$= \frac{\Delta u}{\sigma_v}$ *where:* $\Delta u = u - u_{eq}$	39
Delta U/EStress, P Value, Excess Pore Pressure Ratio $\Delta u/\sigma_v'$	Differential pore pressure ratio with respect to effective stress. Key parameter (P, Normalized Pore Pressure Parameter, Excess Pore Pressure Ratio) in the Winckler et. al. static liquefaction method.	$= \frac{\Delta u}{\sigma_v'}$ *where:* $\Delta u = u - u_{eq}$	25, 25a
Su/EStress S_u/σ_v'	Undrained shear strength ratio with respect to vertical effective overburden stress using the S_u (N_{kt}) method	= *Su* (N_{kt}) / σ_v'	9, 23
Vs or V_s	Recorded shear wave velocities (not estimated). The shear wave velocities are typically collected over 1 m depth intervals. Each data point over the relevant depth range is assigned the same V_s value.	recorded data	27
Vp or V_p	Recorded compression wave (or P wave) velocities (not estimated). The P wave velocities are typically collected over 1 m depth intervals. Each data point over the relevant depth range is assigned the same V_p value.	recorded data	27

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Calculated Parameter	Description	Equation	Ref
V_{s30} V_{s100}	The average shear wave velocity of the near surface materials to a depth of 30 m (100 ft). It is based on the sum of all travel times through all layers in the top 30m (100 ft). V_{s100} is the same calculation as V_{s30} except down to a depth of 100 feet.	$V_{s30} = \frac{total\ thickness\ of\ all\ layers\ to\ 30\ m}{\Sigma\left(\frac{layer\ thickness}{layer\ shear\ wave\ velocity}\right)}$ $V_{s30} = \frac{total\ thickness\ of\ all\ layers\ to\ 30\ m}{\Sigma\ (layer\ travel\ times)}$	38
G_{max}	G_{max} determined from SCPT shear wave velocities (not estimated values). Note that seismic data (V_s) is collected over set depth intervals (typically 1 meter). Each data point over the test segment is assigned the same V_s value. Since soil density changes with depth, slightly different G_{max} values may be calculated over the test depth interval.	$G_{max} = \rho V_s^2$ where ρ is the mass density of the soil determined from the estimated unit weights at each test depth	27
qtNet/G_{max}	Net tip resistance ratio with respect to the small strain modulus G_{max} determined from SCPT shear wave velocities (not estimated values)	$= (qt - \sigma_v) / G_{max}$ where $G_{max} = \rho V_s^2$ and ρ is the mass density of the soil determined from the estimated unit weights at each test depth	15, 28, 30
qUlt	A site specific and client specific parameter for estimating the limiting stress for "crane walk" accessibility	$q_{ult} = CraneWalkFactor \cdot S_u$ Where: *CraneWalkFactor* is client provided	U*
Estimated G_o	Estimated value for small strain shear modulus	$G_o = 0.0188[10^{(0.55Ic + 1,68)}](q_t - \sigma_v)$	15
Estimated E_{25}	Estimated value for Young's Modulus, E, at a 25% working load	$E_{25} = \alpha_E$ (qtNet) where $\alpha_E = 0.015[10^{(0.55Ic + 1,68)}]$	15
k_{SBT}	Estimated soil permeability derived from Soil Behavior Type (SBT) Chart I_c values.	For $1.0 < I_c \leq 3.27$: $k = 10^{(0.952 - 3.04Ic)}$ in m/s For $3.27 < Ic < 4.0$: $k = 10^{(-4.52 - 1.37Ic)}$ in m/s	35
M or D' Constrained Modulus	Constrained Modulus based on 1) Robertson, M 2) Mayne, D'	1) Robertson $M = \alpha_M (q_t - \sigma_v)$ $I_c > 2.2$ (fine grained) $\alpha_M = Qt$ when $Qt < 14$ $\alpha_M = 14$ when $Qt > 14$ $Ic < 2.2$ (coarse grained) $\alpha_M = 0.0188\ [10^{(0.55Ic + 1.68)}]$ $D' = \alpha_D (qt - \sigma_v)$ where $\alpha_D = 5$	32 23

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Table 1b. CPT Parameter Calculation Methods – Liquefaction Parameters

Calculated Parameter	Description	Equation	Ref
K_{SPT} or K_s	Equivalent clean sand factor for $(N_1)60$	$K_{SPT} = 1 + ((0.75/30) \bullet (FC - 5))$	10
K_{CPT} or K_c (RW1998)	Equivalent clean sand correction for q_{c1N}	$K_{cpt} = 1.0$ for $I_c \leq 1.64$ $K_{cpt} = f(I_c)$ for $I_c > 1.64$ (see reference) $K_c = -0.403\ I_c^4 + 5.581\ I_c^3 - 21.63 I_c^2 + 33.75\ I_c - 17.88$	3, 10
K_c (PKR 2010)	Clean sand equivalent factor to be applied to Q_{tn}	$K_c = 1.0$ for $I_c \leq 1.64$ $K_c = -0.403\ I_c^4 + 5.581\ I_c^3 - 21.63 I_c^2 + 33.75\ I_c - 17.88$ for $I_c > 1.64$	16
$(N_1)_{60cs}I_C$	Clean sand equivalent SPT $(N_1)_{60}I_c$. User has 3 options.	1) $(N_1)_{60cs}Ic = \alpha + \beta((N_1)_{60}I_c)$ 2) $(N_1)_{60cs}Ic = K_{SPT} * ((N_1)_{60}I_c)$ 3) $(q_{c1ncs})/(N_1)_{60cs}I_c = 8.5\ (1 - I_c/4.6)$ FC ≤ 5%: $\alpha = 0,\ \beta = 1.0$ FC ≥ 35% $\alpha = 5.0,\ \beta = 1.2$ 5% < FC < 35% $\alpha = exp[1.76 - (190/FC^2)]$ $\beta = [0.99 + (FC^{1.5}/1000)]$	10 10 5
q_{c1ncs}	Clean sand equivalent q_{c1n}	$q_{c1ncs} = q_{c1n} \bullet K_{cpt}$	3
$Q_{tn,cs}$ (PKR 2010)	Clean sand equivalent for Q_{tn} described above - Q_{tn} being the normalized tip resistance based on a variable stress exponent as defined by Robertson (2009)	$Q_{tn,cs} = Q_{tn} \cdot K_c$ (PKR 2016)	16
Su(Liq)/ESv or $S_u(Liq)/\sigma_v'$	Liquefied shear strength ratio as defined by Olson and Stark	$\frac{S_u(Liq)}{\sigma_v'} = 0.03 + 0.0143(q_{c1})$ Note: σ_v' and s_v' are synonymous	13
Su(Liq)/ESv or $S_u(Liq)/\sigma_v'$ (PKR 2010)	Liquefied shear strength ratio as defined by Robertson (2010)	$\frac{S_u(Liq)}{\sigma_v'}$ Based on a function involving $Q_{tn,cs}$	16
S_u (Liq) (PKR 2010)	Liquefied shear strength derived from the liquefied shear strength ratio and effective overburden stress	$S_u(Liq) = \sigma_v' \cdot \left(\frac{S_u(Liq)}{\sigma_v'}\right)$	16
Cont/Dilat Tip	Contractive / Dilative q_{c1} Boundary based on $(N_1)_{60}$	$(\sigma_v')_{boundary} = 9.58 \times 10^{-4}\ [(N_1)_{60}]^{4.79}$ q_{c1} is calculated from specified q_t(MPa)/N ratio	13
CRR	Cyclic Resistance Ratio (for Magnitude 7.5)	$q_{c1ncs} < 50$: $CRR_{7.5} = 0.833\ [q_{c1ncs}/1000] + 0.05$ $50 \leq q_{c1ncs} < 160$: $CRR_{7.5} = 93\ [q_{c1ncs}/1000]^3 + 0.08$	10
Kg or K_g	Small strain Stiffness Ratio Factor, K_g	$[G_{max}/q_t]/[q_{c1n}{}^{-m}]$ m = empirical exponent, typically 0.75	26

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Calculated Parameter	Description	Equation	Ref
K_g*	Revised K_g factor extended to fine grained soils (Robertson).	$K_g^* = (G_o / q_n)(Q_{tn})^{0.75}$ where q_n is the net tip resistance = $q_t - \sigma_v$	30
SP Distance	State Parameter Distance, Winckler static liquefaction method	Perpendicular distance on Q_{tn} chart from plotted point to state parameter Ψ = -0.05 curve	25
URS NP Fr	Normalized friction ratio point on Ψ = -0.05 curve used in SP distance calculation		25
URS NP Q_{tn}	Normalized tip resistance (Q_{tn}) point on Ψ = -0.05 curve used in SP Distance calculation		25

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Table 2. References

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29	Robertson, P.K and Cabal, K.L., 2010, "Estimating soil unit weight from CPT", Proceedings of the 2nd International Symposium on Cone Penetration Testing (CPT '10), Huntington Beach, California.
30	Robertson, P.K., 2016, "Cone penetration test (CPT)-based soil behaviour type (SBT) classification system – an update", Canadian Geotechnical Journal, July 2016.
31	Robertson, P.K., 2012, "Interpretation of in-situ tests – some insights", Mitchell Lecture, ISC'4, Recife, Brazil.
32	Robertson, P.K., Cabal, K.L. 2015, "Guide to Cone Penetration Testing for Geotechnical Engineering", 6th Edition.
33	Robertson, P.K., 2010b, "Soil behaviour type from CPT: an update", Proceedings of the 2nd International Symposium on Cone Penetration Testing (CPT '10), Huntington Beach, California.
34	Been, K., Romero, S., Obermeyer, J. and Hebeler, G., 2012, "Determining in situ state of sand and silt tailings from the CPT", Tailings and Mine Waster 2012, 325-333.
35	Robertson, P.K., 2010, "Estimating in-situ soil permeability from CPT & CPTu", Proceedings of the 2nd International Symposium on Cone Penetration Testing (CPT '10), Huntington Beach, California.
36	Mayne, P.W., Cargill, E. and Greig, J., 2023, "The Cone Penetration Test: A CPT Design Parameter Manual", ConeTec Group
37	Baldi, G., Bellotti, R., Ghionna,V., Jamiolkowski, M. and Lo Presti, D. 1989. Modulus of sands from CPTs and DMTs. *Proc. Intl. Conf. on Soil Mechanics & Foundation Engineering*, Vol. 1 (ICSMFE, Rio de Janeiro), Balkema, Rotterdam: 165–170. www.issmge.org
38	Crow, H.L, Hunter, J.A. and Bobrowsky, P.T., 2012, "National shear wave measurement guidelines for Canadian seismic site assessment", Proceedings of GeoManitoba 2012, the 65th Canadian Geotechnical Conference.
39	Campanella, R.G., Robertson, P.K., Gillespie, D., 1982, "Cone penetration testing in deltaic soils", Canadian Geotechnical Journal, 20: 23-35.

DRAFT

Appendix E Laboratory Test Results

DRAFT

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Grain Size Analysis

ASTM D6913

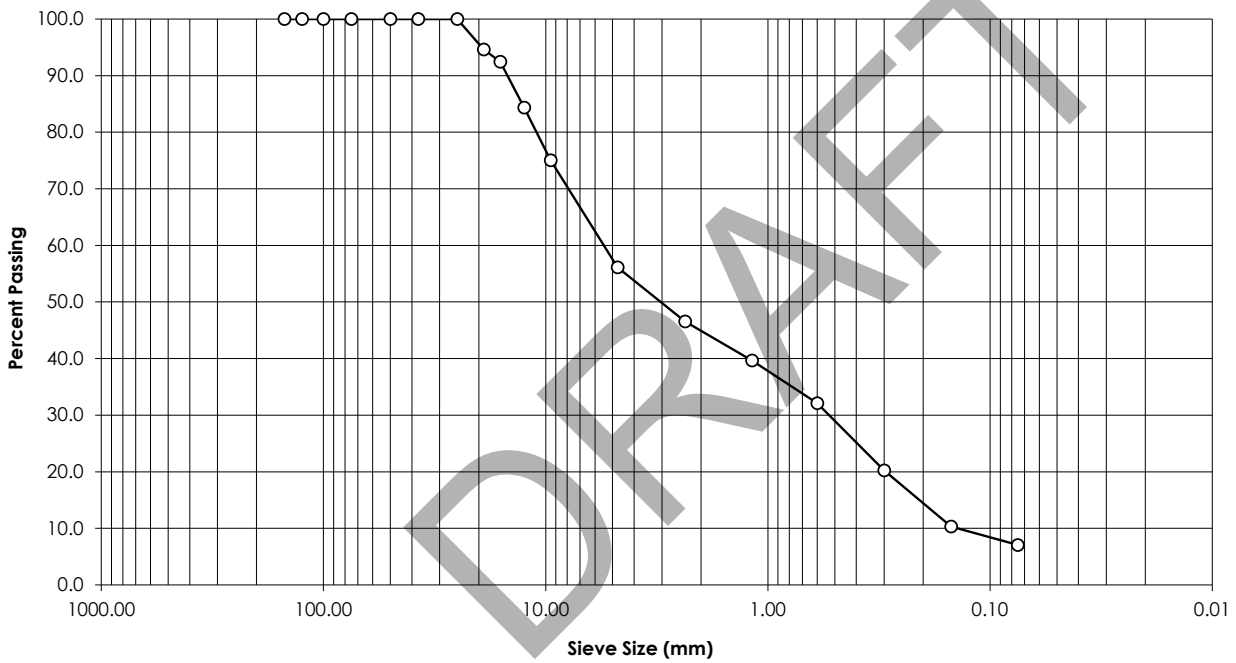
Client: BC Hydro
Project Name: Campbell Heights Site Assessment
-
Project No: 123317336.200.800

OFFICE
4515 Central Blvd.
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
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Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

SAMPLE No.: BH24-01, SS-2, 0.76m-1.37m
SOURCE: -
TESTED BY: PS, FG

DATE RECEIVED: September 13, 2024
DATE TESTED: September 27, 2024
SAMPLE DESCRIPTION: poorly graded SAND with silt and gravel, (SP-SM)



DRAFT

Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**100.0**	-	-
25.0	**100.0**	-	-
19.0	**94.6**	-	-
16.0	**92.5**	-	-
12.5	**84.3**	-	-
9.5	**75.1**	-	-
4.75	**56.1**	-	-
2.36	**46.5**	-	-
1.18	**39.6**	-	-
0.600	**32.1**	-	-
0.300	**20.2**	-	-
0.150	**10.3**	-	-
0.075	**7.1**	-	-

Cobble:	-	D_{10}:	0.14
Gravel:	43.9%	D_{30}:	0.56
Sand:	49.1%	D_{60}:	5.84
Fines:	7.0%	C_U:	40.61
		C_C:	0.37

Comments: The available minimum test sample size did not meet the requirement of ASTM D6913/D6913M - 17, section 10.2. Nominal Maximum Size Opening of 19.0mm and 25.4mm, require 1.3kg and 3kg minimum test sample size, respectively.

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.

Reviewed by:

Wil de Castro, AScT

Stantec

Grain Size Analysis

ASTM D6913

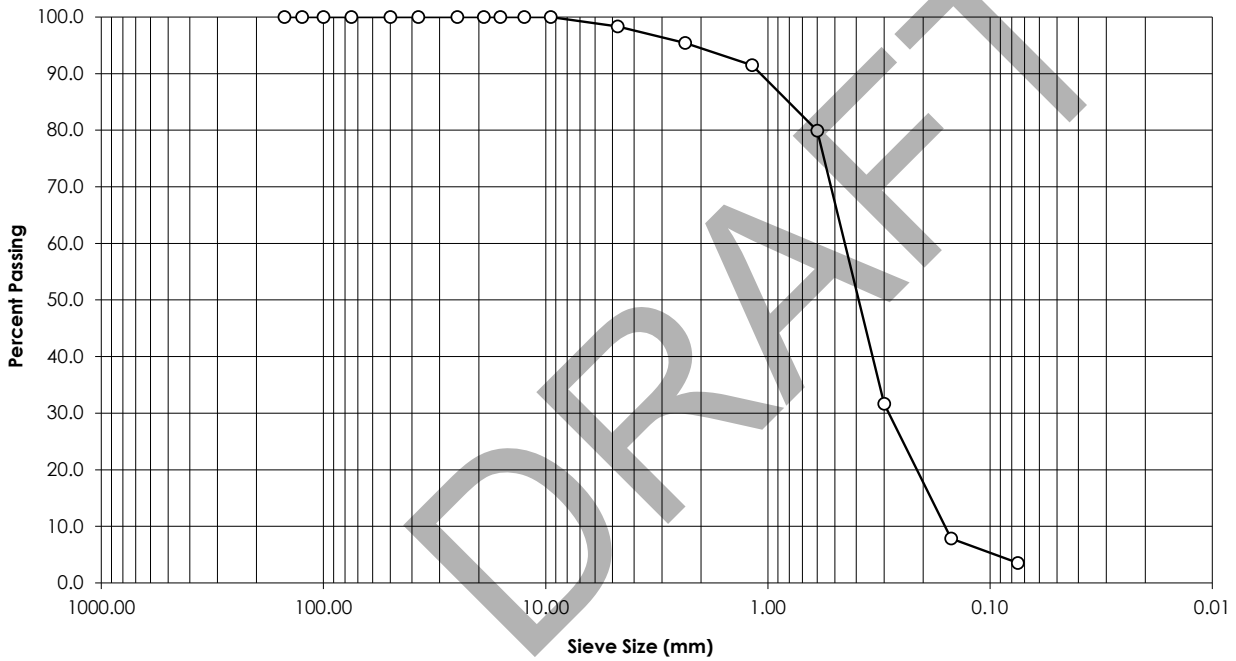
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Project Name: Campbell Heights Site Assessment
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Project No: 123317336.200.800

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Tel: (604) 436-3014

SAMPLE No.: BH24-01, SS-5, 5.33m-5.94m
SOURCE: -
TESTED BY: PS, FG

DATE RECEIVED: September 13, 2024
DATE TESTED: September 27, 2024
SAMPLE DESCRIPTION: poorly graded SAND, (SP)



DRAFT

Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**100.0**	-	-
25.0	**100.0**	-	-
19.0	**100.0**	-	-
16.0	**100.0**	-	-
12.5	**100.0**	-	-
9.5	**100.0**	-	-
4.75	**98.3**	-	-
2.36	**95.4**	-	-
1.18	**91.5**	-	-
0.600	**79.9**	-	-
0.300	**31.7**	-	-
0.150	**7.9**	-	-
0.075	**3.5**	-	-

Cobble:	-	D_{10}:	0.18
Gravel:	1.7%	D_{30}:	0.29
Sand:	94.8%	D_{60}:	0.51
Fines:	3.5%	C_U:	2.88
		C_C:	0.97

Comments:

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Reviewed by:

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Stantec

Grain Size Analysis

ASTM D6913

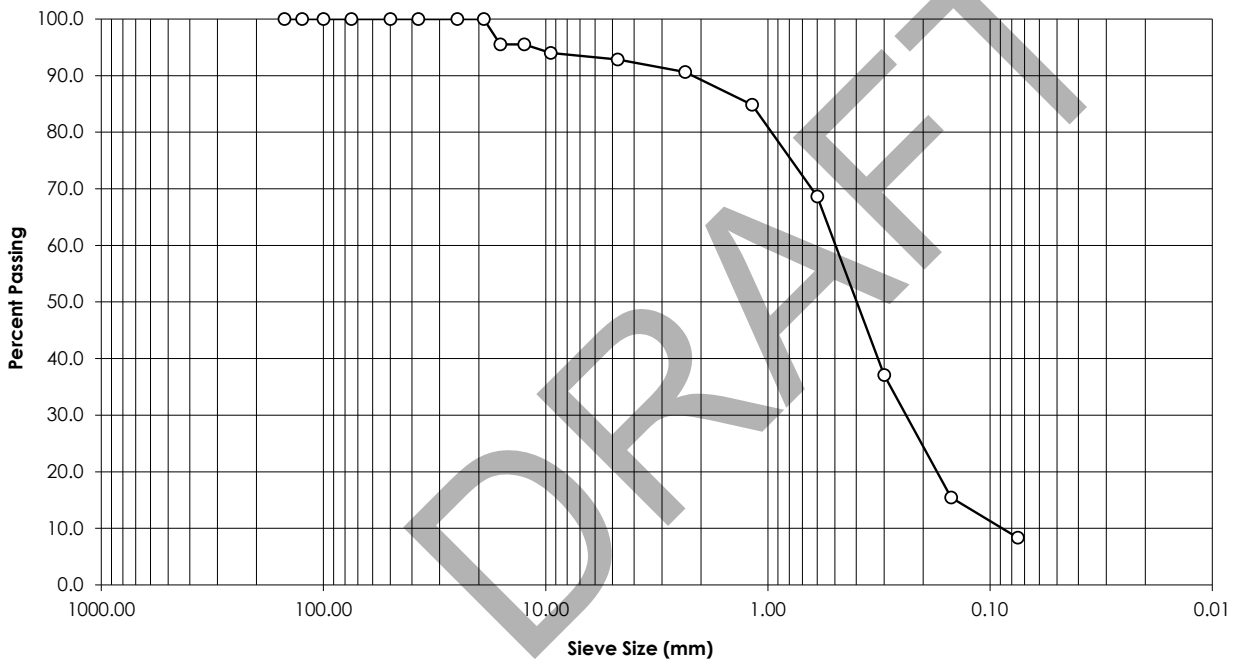
Client: BC Hydro
Project Name: Campbell Heights Site Assessment
-
Project No: 123317336.200.800

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Tel: (604) 436-3014

SAMPLE No.: BH24-01, SS-8, 9.91m-10.52m
SOURCE: -
TESTED BY: PS, FG

DATE RECEIVED: September 13, 2024
DATE TESTED: September 27, 2024
SAMPLE DESCRIPTION: poorly graded SAND with silt, (SP-SM)



DRAFT

Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**100.0**	-	-
25.0	**100.0**	-	-
19.0	**100.0**	-	-
16.0	**95.5**	-	-
12.5	**95.5**	-	-
9.5	**94.0**	-	-
4.75	**92.8**	-	-
2.36	**90.6**	-	-
1.18	**84.8**	-	-
0.600	**68.7**	-	-
0.300	**37.1**	-	-
0.150	**15.4**	-	-
0.075	**8.3**	-	-

Cobble:	-	D_{10}:	0.10
Gravel:	7.2%	D_{30}:	0.26
Sand:	84.5%	D_{60}:	0.53
Fines:	8.3%	C_U:	5.50
		C_C:	1.34

Comments:

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.

Reviewed by:

Wil de Castro, AScT

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Grain Size Analysis

ASTM D6913

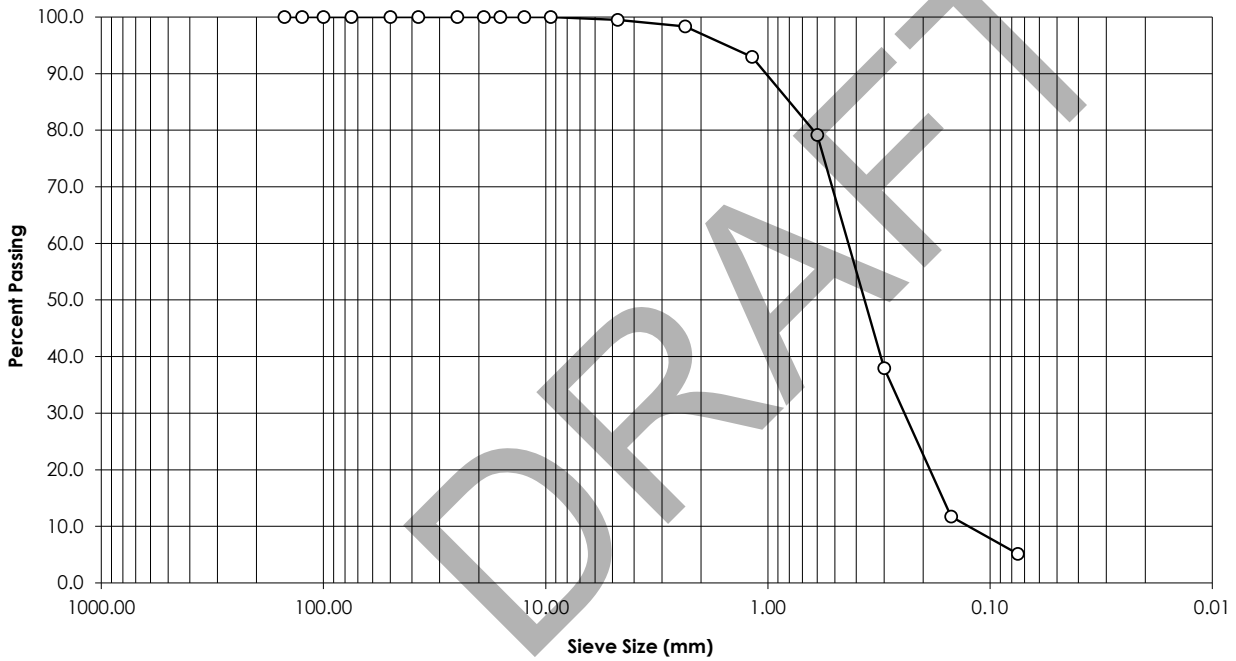
Client: BC Hydro
Project Name: Campbell Heights Site Assessment
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SAMPLE No.: BH24-01, SS-10, 12.95m-13.56m
SOURCE: -
TESTED BY: PS, FG

DATE RECEIVED: September 13, 2024
DATE TESTED: September 27, 2024
SAMPLE DESCRIPTION: poorly graded SAND with silt, (SP-SM)



DRAFT

Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**100.0**	-	-
25.0	**100.0**	-	-
19.0	**100.0**	-	-
16.0	**100.0**	-	-
12.5	**100.0**	-	-
9.5	**100.0**	-	-
4.75	**99.5**	-	-
2.36	**98.4**	-	-
1.18	**93.0**	-	-
0.600	**79.2**	-	-
0.300	**37.9**	-	-
0.150	**11.7**	-	-
0.075	**5.1**	-	-

Cobble:	-	D_{10}:	0.14
Gravel:	0.5%	D_{30}:	0.27
Sand:	94.4%	D_{60}:	0.49
Fines:	5.1%	C_U:	3.60
		C_C:	1.11

Comments:

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Grain Size Analysis

ASTM D6913

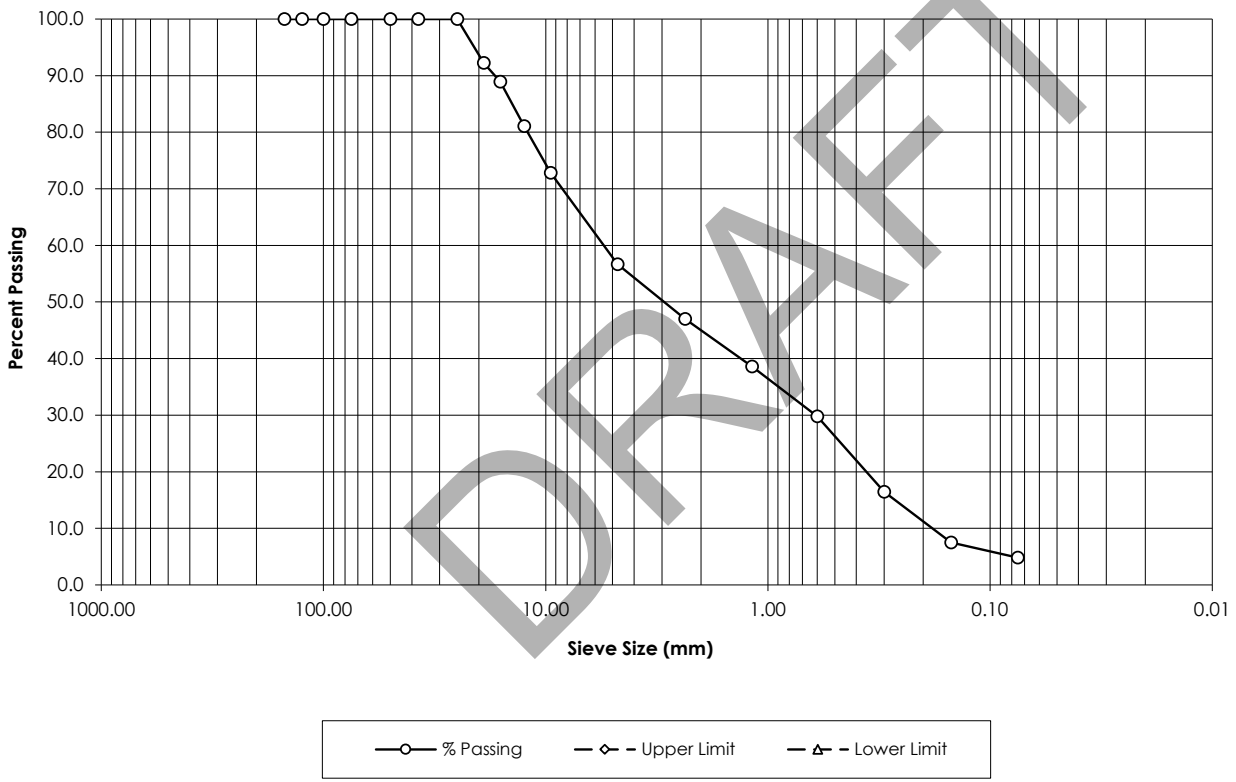
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SAMPLE No.: BH24-02, SS-3, 2.29m-2.90m
SOURCE: -
TESTED BY: PS, FG

DATE RECEIVED: September 13, 2024
DATE TESTED: September 27, 2024
SAMPLE DESCRIPTION: poorly graded SAND with gravel, (SP)



DRAFT

Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**100.0**	-	-
25.0	**100.0**	-	-
19.0	**92.2**	-	-
16.0	**88.9**	-	-
12.5	**81.1**	-	-
9.5	**72.8**	-	-
4.75	**56.6**	-	-
2.36	**47.0**	-	-
1.18	**38.6**	-	-
0.600	**29.8**	-	-
0.300	**16.5**	-	-
0.150	**7.5**	-	-
0.075	**4.8**	-	-

Cobble:	-	D_{10}:	0.21
Gravel:	43.4%	D_{30}:	0.62
Sand:	51.8%	D_{60}:	5.84
Fines:	4.8%	C_U:	28.46
		C_C:	0.32

Comments: The available minimum test sample size did not meet the requirement of ASTM D6913/D6913M - 17, section 10.2. Nominal Maximum Size Opening of 19.0mm and 25.4mm, require 1.3kg and 3kg minimum test sample size, respectively.

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.

Reviewed by:

Wil de Castro, AScT

Stantec

Grain Size Analysis

ASTM D6913

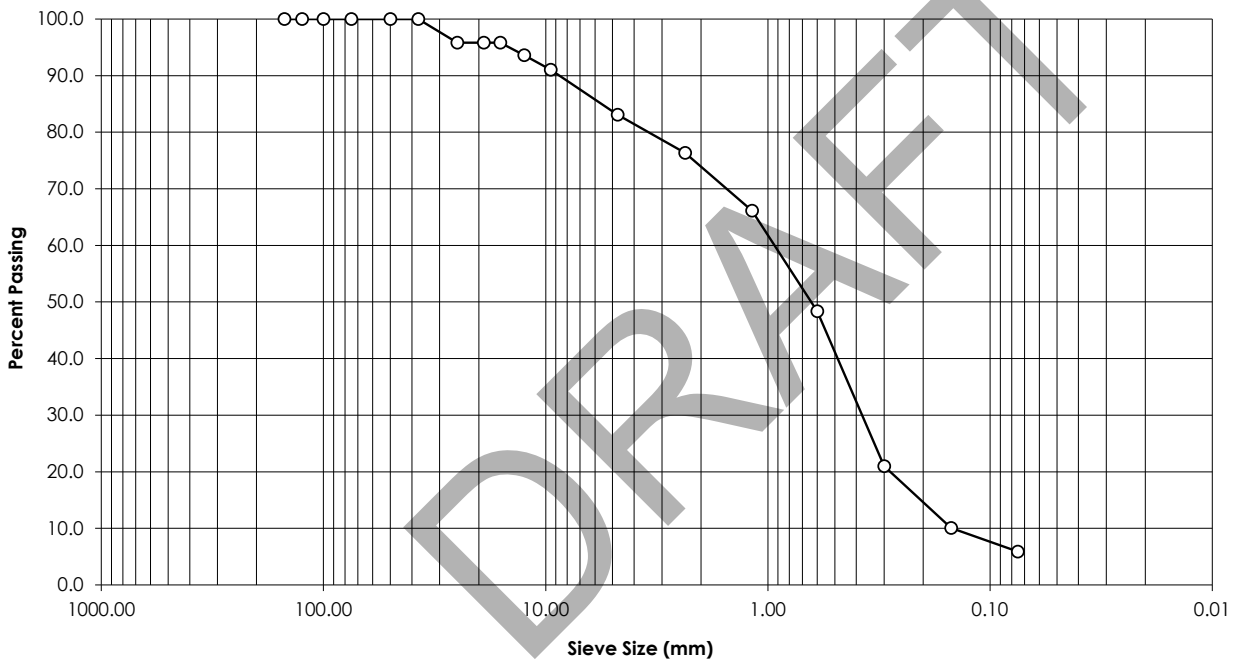
Client: BC Hydro
Project Name: Campbell Heights Site Assessment
-
Project No: 123317336.200.800

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Burnaby, BC
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Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
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Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

SAMPLE No.: BH24-02, SS-5, 5.33m-5.94m
SOURCE: -
TESTED BY: PS

DATE RECEIVED: September 13, 2024
DATE TESTED: September 27, 2024
SAMPLE DESCRIPTION: well graded SAND with silt and gravel, (SW-SM)



DRAFT

Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**100.0**	-	-
25.0	**95.8**	-	-
19.0	**95.8**	-	-
16.0	**95.8**	-	-
12.5	**93.6**	-	-
9.5	**91.1**	-	-
4.75	**83.1**	-	-
2.36	**76.3**	-	-
1.18	**66.1**	-	-
0.600	**48.3**	-	-
0.300	**21.0**	-	-
0.150	**10.1**	-	-
0.075	**5.9**	-	-

Cobble:	-	D_{10}:	0.15
Gravel:	16.9%	D_{30}:	0.43
Sand:	77.2%	D_{60}:	1.00
Fines:	5.9%	C_U:	6.72
		C_C:	1.23

Comments: The available minimum test sample size did not meet the requirement of ASTM D6913/D6913M - 17, section 10.2. Nominal Maximum Size Opening of 19.0mm and 25.4mm, require 1.3kg and 3kg minimum test sample size, respectively.

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Reviewed by:

Wil de Castro, AScT

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Grain Size Analysis

ASTM D6913

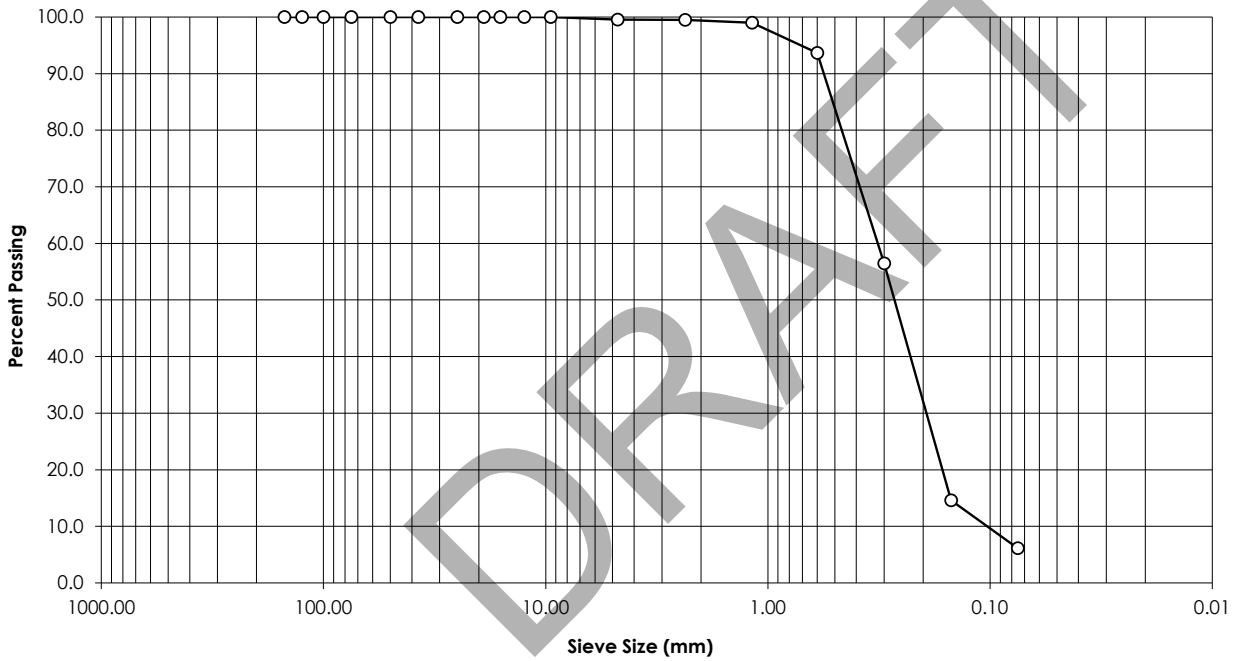
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SAMPLE No.: BH24-02, SS-8, 9.91m-10.52m
SOURCE: -
TESTED BY: PS

DATE RECEIVED: September 13, 2024
DATE TESTED: September 27, 2024
SAMPLE DESCRIPTION: poorly graded SAND with silt, (SP-SM)



DRAFT

Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
50.0	**100.0**	-	-
37.5	**100.0**	-	-
25.0	**100.0**	-	-
19.0	**100.0**	-	-
16.0	**100.0**	-	-
12.5	**100.0**	-	-
9.5	**100.0**	-	-
4.75	**99.6**	-	-
2.36	**99.5**	-	-
1.18	**99.0**	-	-
0.600	**93.7**	-	-
0.300	**56.4**	-	-
0.150	**14.6**	-	-
0.075	**6.1**	-	-

Cobble:	-	D_{10}:	0.12
Gravel:	0.4%	D_{30}:	0.23
Sand:	93.5%	D_{60}:	0.34
Fines:	6.1%	C_U:	2.86
		C_C:	1.34

Comments:

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.

Reviewed by:

Wil de Castro, AScT

Bureau Veritas Job #: C476862
Report Date: 2024/10/03

STANTEC CONSULTING LTD
Client Project #: 123317336
Site Location: -
Your P.O. #: 123317336
Sampler Initials: WDC

RESULTS OF CHEMICAL ANALYSES OF SOIL

Bureau Veritas ID		CWM337		CWM338	CWM339		
Sampling Date		2024/09/10		2024/09/10	2024/09/10		
COC Number		92321		92321	92321		
	UNITS	BH24-01, SS-3, 2.29m - 2.90m	RDL	BH24-01, SS-6, 6.86m - 7.47m	BH24-01, SS-10, 12.95m - 13.56m	RDL	QC Batch
ANIONS							
Soluble Sulphate (SO4)	mg/L	<20	20	<20	<20	20	B547337
Calculated Parameters							
Soluble Sulphate (SO4)	mg/kg	<6.2	6.2	<6.0	<6.0	6.0	B540124
Soluble Parameters							
Soluble Conductivity	uS/cm	106	5.0	70.2	115	5.0	B547806
Soluble pH	pH	5.91	N/A	6.51	7.03	N/A	B546760
Saturation %	%	30.9	N/A	29.9	29.9	N/A	B546723

RDL = Reportable Detection Limit
N/A = Not Applicable

Bureau Veritas ID		CWM340		CWM341		CWM342		
Sampling Date		2024/09/10		2024/09/10		2024/09/10		
COC Number		92321		92321		92321		
	UNITS	BH24-02, SS-2, 0.76m - 1.37m	RDL	BH24-02, SS-6, 6.86m - 7.47m	RDL	BH24-02, SS-9, 11.43m - 12.04m	RDL	QC Batch
ANIONS								
Soluble Sulphate (SO4)	mg/L	<20	20	<20	20	<20	20	B547337
Calculated Parameters								
Soluble Sulphate (SO4)	mg/kg	<6.9	6.9	<6.0	6.0	<6.1	6.1	B540124
Soluble Parameters								
Soluble Conductivity	uS/cm	56.7	5.0	84.9	5.0	73.3	5.0	B547806
Soluble pH	pH	6.26	N/A	7.14	N/A	7.71	N/A	B546760
Saturation %	%	34.6	N/A	29.9	N/A	30.6	N/A	B546723

RDL = Reportable Detection Limit
N/A = Not Applicable

DRAFT

Bureau Veritas Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Bureau Veritas Job #: C476862
Report Date: 2024/10/03

STANTEC CONSULTING LTD
Client Project #: 123317336
Site Location: -
Your P.O. #: 123317336
Sampler Initials: WDC

RESULTS OF CHEMICAL ANALYSES OF SOIL

Bureau Veritas ID		CWM342		
Sampling Date		2024/09/10		
COC Number		92321		
	UNITS	**BH24-02, SS-9, 11.43m - 12.04m Lab-Dup**	**RDL**	**QC Batch**
ANIONS				
Soluble Sulphate (SO4)	mg/L	<20	20	B547337
Soluble Parameters				
Soluble Conductivity	uS/cm	73.9	5.0	B547806
Soluble pH	pH	7.72	N/A	B546760
Saturation %	%	30.6	N/A	B546723

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

DRAFT

Bureau Veritas Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

From: Chwaklinski, David
Sent: 2024, March 04 4:12 PM
To: Gadhok, Satwant; Wong, Daniel (BCH); Lee, Johnson; Armstrong, Tyler
Cc: Maloney, Tracy; Manurung, Cynthia; Chwaklinski, David; Zeng, Ken; Jiang, Kally
Subject: approximate size for 230/69/25 kV station for Willoughby
Attachments: CAMP-E05-SK002-2_R0A_Option 2 _revised_for_60 kV.pdf; CAMP-E05-SK002-2_R0A_Option 2.pdf

Willoughby Substation property requirements

Recently, Station Planning noted that the requirements for Willoughby and Campbell Heights stations have changed, and a 60 kV yard is to be added to the original plan of 230 kV 25 kV.

To date Planning has not provided a consolidated one-line diagram that includes 230 kV/ 60 kV /25 kV sections. This makes it difficult to determine the appropriate size of a property required.
However, Planning has provided a One-Line for the 230 kV/25 kV station that includes provisions for 2 initial and 4 ultimate 230 kV line positions a 6- breaker ring bus and up to 24- 25 kV feeder positions. Stations electrical has developed conceptual layouts based on this One-Line. This is identified as CAMP-E05_SK0002-2 (attached).

A careful review of the layout, CAMP-E05-SK00002-2, along with the one-line diagram as well as 60 kV installations at other stations suggests a solution. If we look at the CAMP-E05-SK00002-2 the initial stage work is shown in red. If this portion of the work is mirror imaged across a line (shown in Blue) on the attached sketch it appears that this layout could accommodate the following:

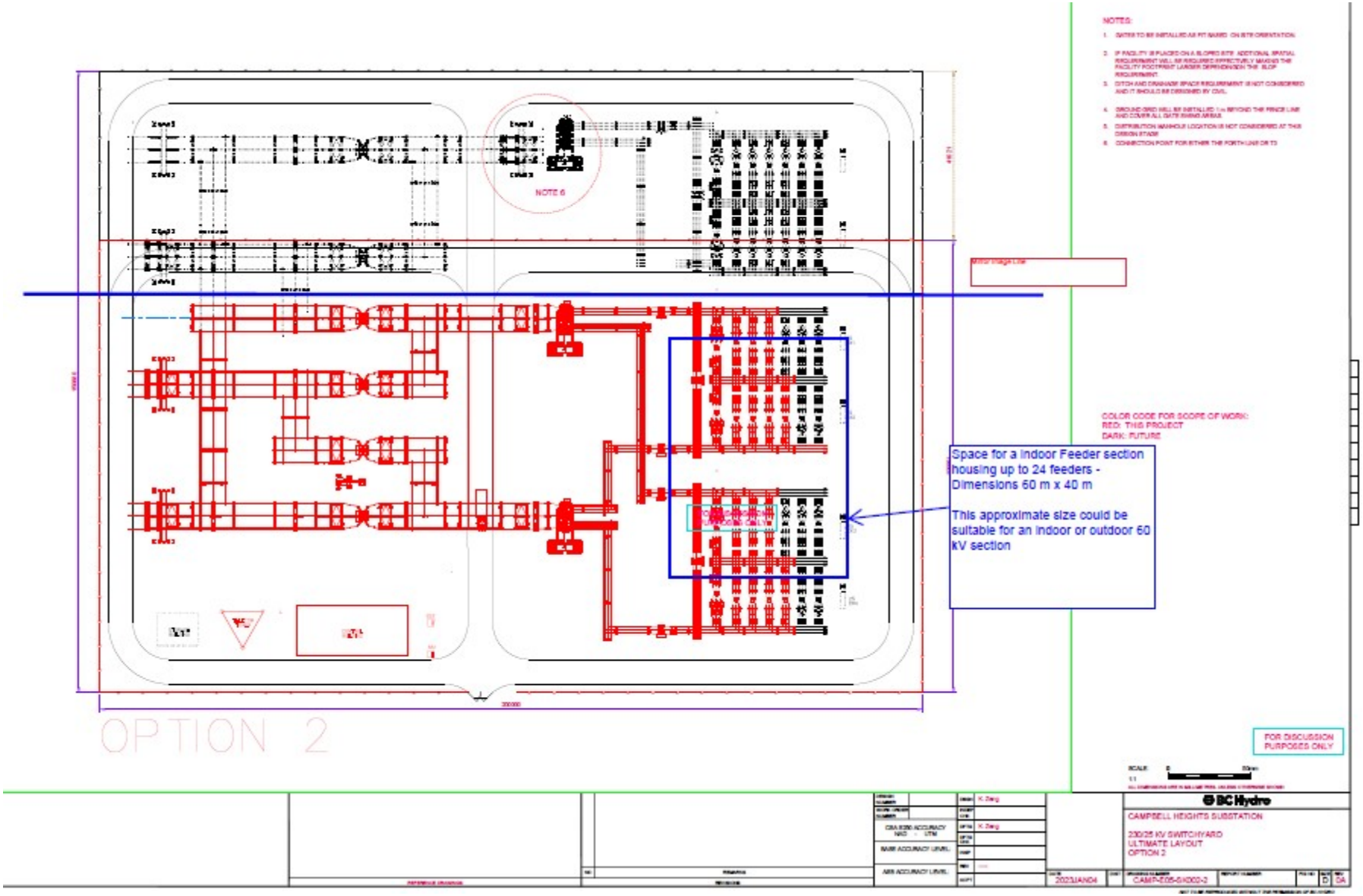
- 4 - 230 kV line positions
- 2 – 230 kV/69 kV transformers
- 2 – 230 kV/25 kV transformers
- 1 – 8 to 12 - 230 kV breaker ring
- 1 – control building and telecommunications tower
- 1 – 25 kV indoor feeder building with 24 feeders
- 1 – 60 kV indoor GIS building or;
- 1 – 60 kV outdoor structure

The size of property required for this would be approximately 240 m x 220 m (52,800 m^2) or 787ft x 721 ft (568,000 SF).

Please note this is a rough layout has not been reviewed by electrical design or planning. This is a rough calculation intended to guide the discussion with planning and initial talks with Township of Langley. I believe that this would be the largest space that would be required and it could be reduced when the one-line is available and the electrical design team has some time to optimize the design

Please let me know if you have any questions.

Ken and Kally, I have sent this to you as you will likely be dealing with this in the next while for Campbell Heights and Willoughby



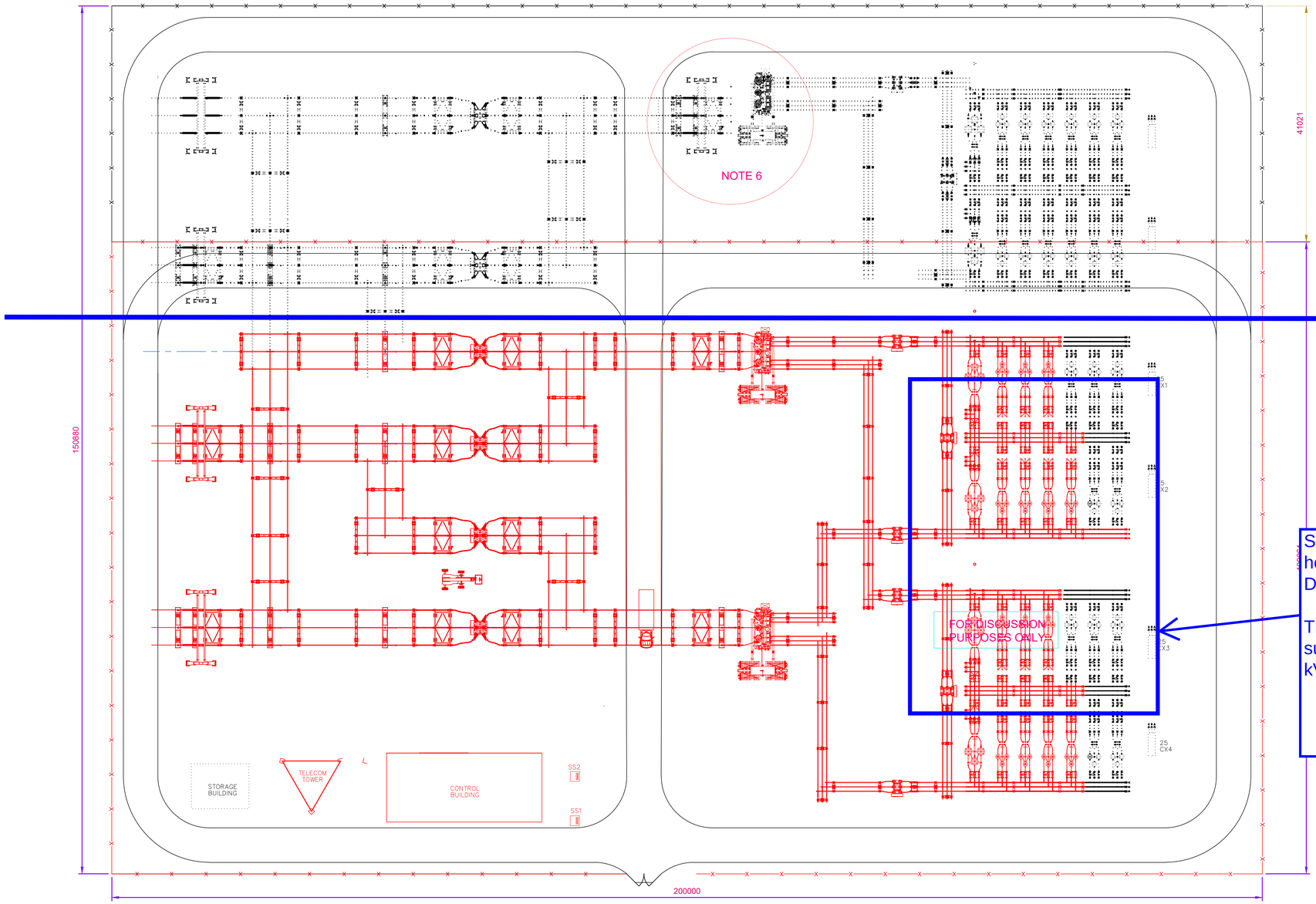
David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE
6. CONNECTION POINT FOR EITHER THE FORTH LINE OR T3



Space for a indoor Feeder section housing up to 24 feeders - Dimensions 60 m x 40 m

This approximate size could be suitable for an indoor or outdoor 60 kV section

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK: FUTURE

OPTION 2

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 0 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

DESIGN NUMBER		DSGN	K. Zeng
WORK ORDER NUMBER		INDEP CHK	
CSA S250 ACCURACY NAD - UTM		DFTG	K. Zeng
BASE ACCURACY LEVEL:		DFTG CHK	
ASB ACCURACY LEVEL:		INSP	
		REV	-----
		ACPT	

BC Hydro

CAMPBELL HEIGHTS SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 2

NO	REMARKS

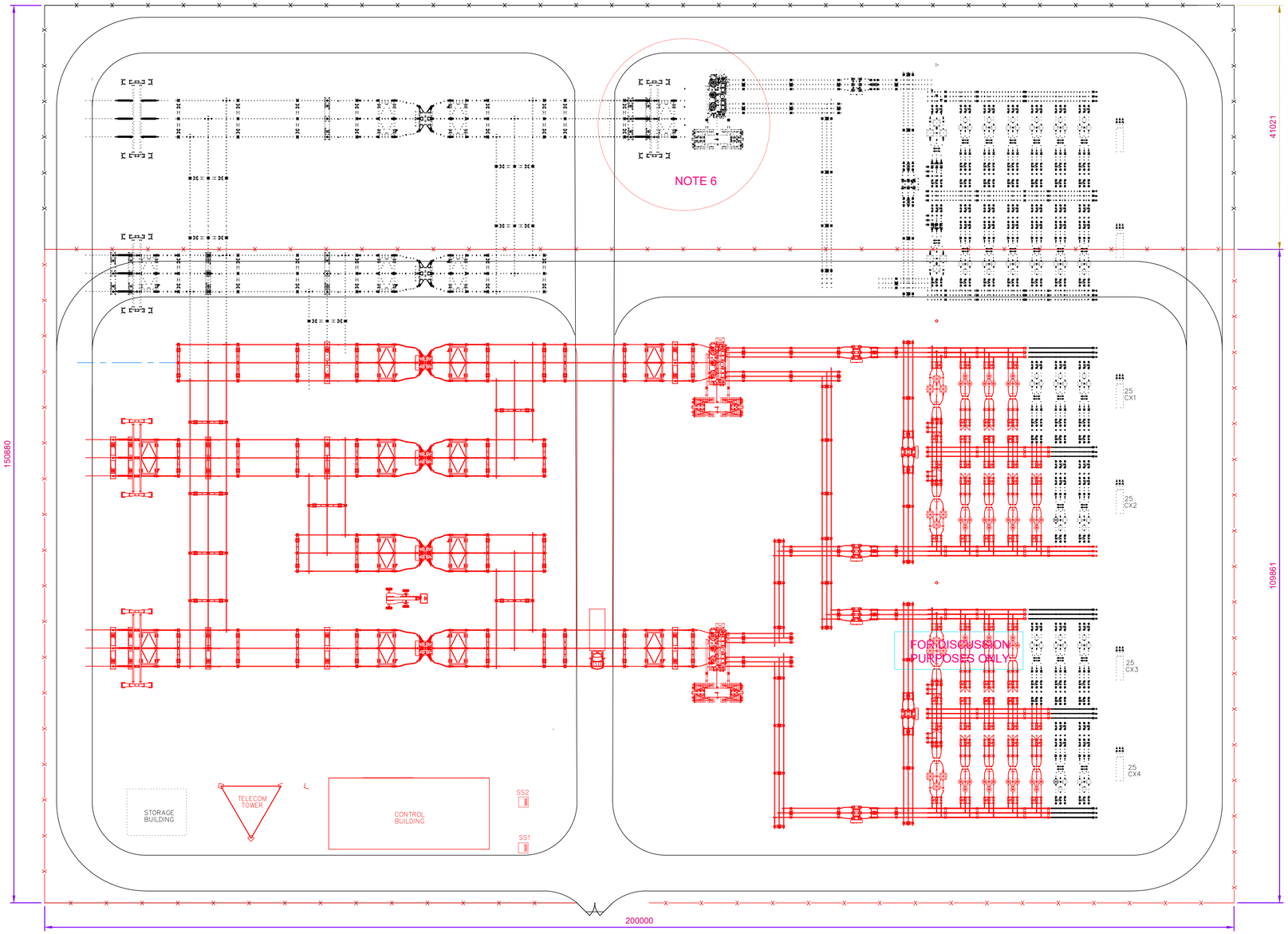
REFERENCE DRAWINGS

REVISIONS

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2023JAN04		CAMP-E05-SK002-2			D	0A

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C:\Users\kenzeng\OneDrive - BC Hydro\Projects\CAMP_Campell Heights Langley\CAMP-E05-SK002-R0A - MB-idea.dwg
Drawing Unit = Metric (4)
Plotted by:
14/02/24 11:42 AM



OPTION 2

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE
6. CONNECTION POINT FOR EITHER THE FORTH LINE OR T3

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK: FUTURE

FOR DISCUSSION
PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng
DFTG CHK	
INSP	
REV	-----
ACPT	

BC Hydro

CAMPBELL HEIGHTS SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 2

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2023JAN04		CAMP-E05-SK002-2			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

C:\Users\kenzeng\OneDrive - BC Hydro\Projects\CAMP_Campell Heights Langley\CAMP-E05-SK002-R0A - MB-idea.dwg
Drawing Unit = Metric (4)
Plotted by: Ken Zeng
1/4/2024 11:42 AM

From: Chwaklinski, David
Sent: 2024, September 16 3:57 PM
To: Jiang, Kally
Cc: Chwaklinski, David; Hepple, Robert
Subject: Bosa property Confirmation
Attachments: Bosa_Kang_Property.pdf

Hi Kally, I have reviewed the Bosa property and confirmed that the Bosa parcels are 7508 196th St. and 7528 194th St. The Kang property is 7451 196th St. These are shown in the attached PDF. Please revise your layout so that there are two options to consider. Option 1 is to reverse the layout you showed me so that the 25 kV yard is on the Kang property and the 60 kV yard is on the eastern portion of the Bosa Property . Option 2 is to leave the 25 kV at the top and use cables to connect the 60 kV Yard located on the west portion of the Bosa property to the 230/60 kV transformers that will be located on the Kang Property.

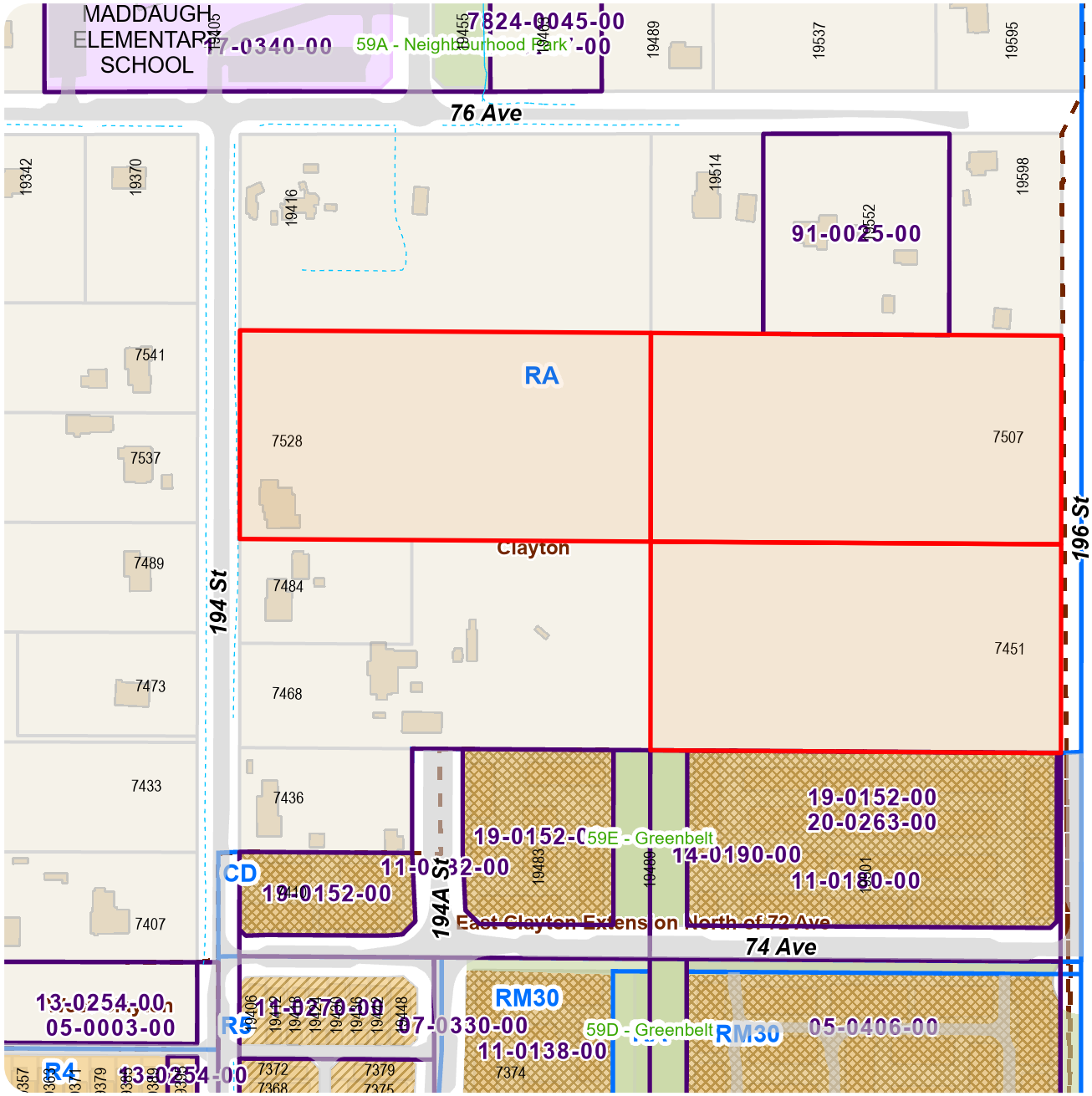
Please let me know if you need any more clarification.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
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Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com

City of Surrey Mapping Online System



Legend

Water Courses
- Creek
- Ditch
- Road Surface
- Dev Apps - All
- Zoning Boundaries

East Clayton Extension North of 72 Ave
- 6-10 u.p.a. Low Density
- 10-15 u.p.a. Medium Density
- 15-25 u.p.a. Medium-High Density
- Public Open Space/Park
- Secondary Plan Boundaries

Buildings (labels)

Building
- Other
- School

Bosa and Kang Property

Scale: 1:3,000

The data provided is compiled from various sources and is NOT warranted as to its accuracy or sufficiency by the City of Surrey. This information is provided for information and convenience purposes only. Lot sizes, legal descriptions and encumbrances must be confirmed at the Land Title Office. Use and distribution of this map is subject to all copyright and disclaimer notices at cosmos.surrey.ca

0 0.02 0.04 0.08 0.12
km

Map created on: 2024-09-12

From: Lee, Dylan
Sent: 2025, January 13 5:10 PM
To: Sherevkulov, Dmitry; Cormier, Matthew
Cc: Hepple, Robert; Chwaklinski, David
Subject: FW: [External] Willoughby Substation Geotechnical Investigation
Attachments: Willoughby Substation Geotechnical Investigation 01132025.pdf

Hi Matt, Thanks for putting this proposed test hole plan so quickly. If you can please proceed with a BC 1 Call, that would be great. I am curious where the Fortis Line on 196th Street is located and how much off set we have before we have to daylight their line.

Dmitry, there are some follow up actions we could use your help with:

- For 7528 194 Street (BOSA) we are planning to drill beside the house in the back (AH25-C). We spoke with Tyler Lowe and his delegate Ryan on site about this; and they are amenable to allowing us to drill at this location. However, this will require crossing a septic connection line and it's close to the septic tank. We requested the septic tank design to confirm we can safely drive over the line and to confirm the tank limits. If you can follow up with Ryan at BOSA on this, that would be great. We are planning to do a locate here prior to drilling and depending on the septic drawings. But we may decide to move the hole or delete the hole depending on locates, and timing. Please check with Ryan to confirm if there are blackout days where the tenant would prefer us to not to drill given the proximity to the building.
- For 7507 196 street (BOSA) we are planning to drill outside the road allowance outside the shoulder (AH25-B). The BOSA team (Ryan and Tyler) seem amenable to prepping the site for us to level the grade and install a small gravel pad so we don't have to work near the road and hopefully will not have conflict with a nearby Fortis main – it would also make things run faster so we can attempt to target 3 test holes for the day we have the auger drill truck. It was mentioned they may be able to do this at their cost or it could be an item that is dealt with during negotiation with final property sale. Can you please reach out to your BOSA lead contact to see if they can facilitate this scope for us (Ryan and Tyler are aware of the scope and waiting to hear back from us and their management) and to see if there are cost impacts in final negotiation? There could be cost savings for us in the Geotech program if the gravel pad and clearing was completed as that mean we may not need traffic control and permits from the City.
- For 7468 194 Street (KOOL) we are planning to drill off the gravel driveway (see AH25-A) towards the barn out back from the primary resident building. The owner was not home when we were on site but I did speak with the realtor and told him we will follow up with him once we have a plan. Can you please forward the proposed test hole location to the owner and realtor to review and confirm if there are any known buried services in that area.

The expected drilling date is in the first week of Feb. Matt will give us a firm date after confirmation with the driller. For the HA test holes (shallow hand auger test holes), that will be completed on a different date from the truck mounted auger drilling. The owners can expect Klohn geotechnical staff to be on these properties for a full day to hand dig the HA days. Matt will confirm dates at a later time for that investigation.

Thank you,

_____

Dylan Lee, P. Eng. | Senior Geotechnical Engineer, Transmission Lines Engineering

BC Hydro
7th Floor - 6911 Southpoint Drive, A02
Burnaby, BC V3N 4X8

P 604 528 2318
M 604 809 2666
E dylan.lee@bchydro.com

bchydro.com

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From: Cormier, Matthew
Sent: 2025, January 13 3:25 PM
To: Lee, Dylan
Subject: [External] Willoughby Substation Geotechnical Investigation

Don't click on links or open attachments unless you trust the sender and are expecting the link or attachment. If you suspect this message to be phishing, please report it by clicking the Report Message button in the Outlook toolbar and select "Phishing."

Hi Dylan,

I've put together the following planview figure for the planned drill hole and hand auger locations for the Willoughby Substation.

Please let me know if you have any comments.

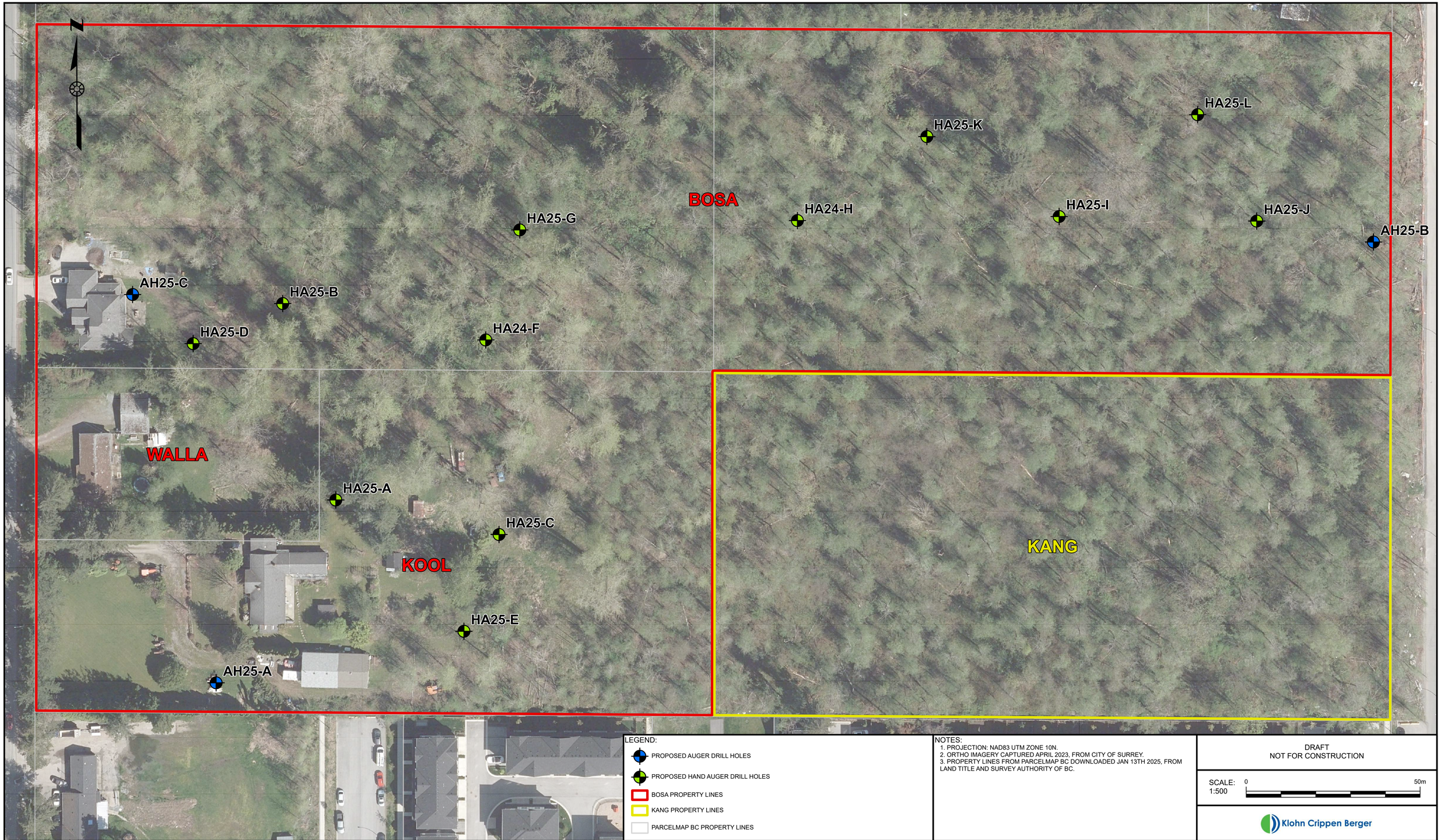
Thanks
Matt

Matthew Cormier, P.Eng.
Geological Engineer

Klohn Crippen Berger 500-2955 Virtual Way, Vancouver BC V5M 4X6, CANADA
T +1 604 251 8557 | C +1 778 229 9241 | mcormier@klohn.com | www.klohn.com

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If you have received this e-mail in error, please delete the original message.



LEGEND:

- PROPOSED AUGER DRILL HOLES
- PROPOSED HAND AUGER DRILL HOLES
- BOSA PROPERTY LINES
- KANG PROPERTY LINES
- PARCELMAP BC PROPERTY LINES

NOTES:
1. PROJECTION: NAD83 UTM ZONE 10N.
2. ORTHO IMAGERY CAPTURED APRIL 2023, FROM CITY OF SURREY.
3. PROPERTY LINES FROM PARCELMAP BC DOWNLOADED JAN 13TH 2025, FROM LAND TITLE AND SURVEY AUTHORITY OF BC.

DRAFT
NOT FOR CONSTRUCTION

SCALE: 1:500 (0 – 50m)

Klohn Crippen Berger

BC Hydro

P10600A140
WILLOUGHBY SUBSTATION

GEOTECHNICAL SITE INVESTIGATION PLAN

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	M. CORMIER
INDEP CHK	
DFTG	A. WIEBE
DFTG CHK	K. WHITLOCK
INSP	
REV	
ACPT	

NO	REMARKS

REFERENCE DRAWINGS

REVISIONS

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
13JAN2025				01	D	

Z:\P\BC\HCEO\P10600A140 BCH - Willoughby Substation Geotechnical Investigation\400 Drawings\GIS\02_Mapping\ArcGISPro Main\Willoughby Substation\Willoughby Substation.aprx
Drawing Units: Metric
Layout: Layout1
1/13/2025 3:17 PM

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From: Chwaklinski, David
Sent: 2024, June 27 9:14 AM
To: Clark, Heather; Singh, Ajitpal; Simpson, Lauren; Chaisson, Rob; Steels, Craig; Chan, David Y.M.; Watson, Stephen; Meshkinfar, Shokooh; Piscociu, Mihai; del Barrio, Romy
Cc: Chwaklinski, David
Subject: FW: Property Acquisition for various projects Willoughby
Attachments: TM544_Goldstream_Site_19.pdf; TM544_Goldstream_Site_21.pdf; TM544_Goldstream_Site_1.pdf; TM544_Goldstream_Site_15.pdf

Hi folks, I had Photogrammetry prepare some contour maps of the sites we were interested in. It looks like only Site 15 is still in the running but you may find a use for the other images.

Design team please have a look at the map for Alternative 15 specifically. I will be touching base with the PM shortly to get a better understanding of where we are with the properties and ill get back to you.

Ajitpal, please forward on to anyone on the project team I may have missed if you think it necessary. Thanks

---

From: Urosevic, Dusanka
Sent: Tuesday, June 25, 2024 3:41 PM
To: Chwaklinski, David
Subject: RE: Property Acquisition for various projects Willoughby

David,

Attached are detail maps for properties.

For this one I am displaying 2m Contour. The scale is smaller so it is too busy for 0.5 m.

Thanks
Dusanka

Dusanka Urosevic (CP1280) Photogrammetrist
Quality & Geomatics, Integrated Planning

BC Hydro

6911 Southpoint Drive, 8th floor
Burnaby, BC V3N 4X8

P 604 528 2325
E dusanka.urosevic@bchydro.com

To make an internal BC Hydro Geomatics request click here

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, June 21 4:50 PM
To: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Subject: RE: Property Acquisition for various projects Willoughby

Thanks Very Much Dusanka. I look forward to getting the individual maps from you1

From: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Sent: Friday, June 21, 2024 2:29 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Property Acquisition for various projects Willoughby

Hi David,

Attached id overview map of Goldstream properties.

I am creating contour files (hopefully it will be completed over weekend) and will start on detail maps on Monday.

Thanks
Dusanka

Dusanka Urosevic (CP1280) Photogrammetrist
Quality & Geomatics, Integrated Planning

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6911 Southpoint Drive, 8th floor
Burnaby, BC V3N 4X8

P 604 528 2325
E dusanka.urosevic@bchydro.com

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, June 20 2:52 PM
To: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Subject: RE: Property Acquisition for various projects Willoughby

Campbell Heights is less urgent as I think we have a property lined up. The mapping would be confirmation information only. Goldstream is something still up in the air.

From: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Sent: Thursday, June 20, 2024 2:50 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Property Acquisition for various projects Willoughby

I started on the cadastral data, but I can start on that instead of Campbell Heights. I have everything for Campbell sites, just need detail maps.
Dusanka

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, June 20 2:47 PM
To: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Property Acquisition for various projects Willoughby

Thank you! Much appreciated.

If you have not started could you please start on the Goldstream mapping although Alternate 17 is now off the table.

From: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Sent: Thursday, June 20, 2024 1:54 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Property Acquisition for various projects Willoughby

Hi David,

Attached is revised Overview and 3 sites property detail map.

Dusanka

Dusanka Urosevic (CP1280) Photogrammetrist
Quality & Geomatics, Integrated Planning

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Burnaby, BC V3N 4X8

P 604 528 2325
E dusanka.urosevic@bchydro.com

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, June 20 10:10 AM
To: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Property Acquisition for various projects

Hi Dusanka, Thanks for this. For your information things have changed a bit. For Willoughby, please delete Alternate 14 a, 14 c, 17 a and 17 b. Also please change alternate 16 to Alternate 18. There are no changes to the Campbell heights alternatives

---

From: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Sent: Wednesday, June 19, 2024 2:31 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Property Acquisition for various projects

Hi David,

Attached is overview maps for Willoughby and Campbell Heights properties.

I am creating contours and will send you detail map for each site once completed.

Please review the site numbers, it looks like these are repeating and let me know if you would like to change site numbers.

I am downloading cadastre for VI sites and will send the maps once completed

Thanks
Dusanka

Dusanka Urosevic (CP1280) Photogrammetrist
Quality & Geomatics, Integrated Planning

BC Hydro
6911 Southpoint Drive, 8th floor
Burnaby, BC V3N 4X8

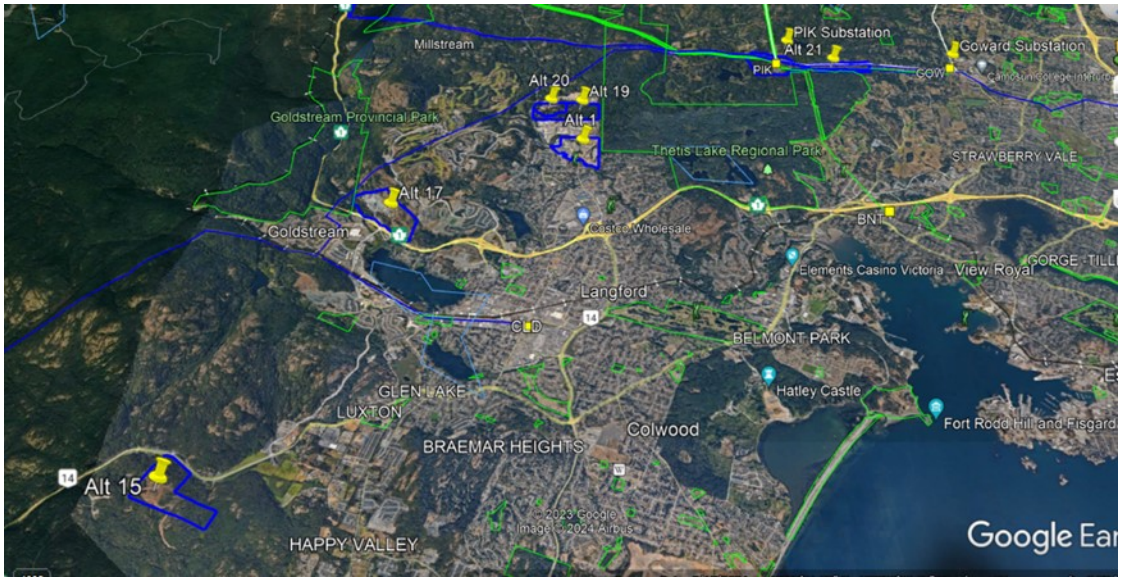
P 604 528 2325
E dusanka.urosevic@bchydro.com

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, June 10 4:16 PM
To: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Property Acquisition for various projects

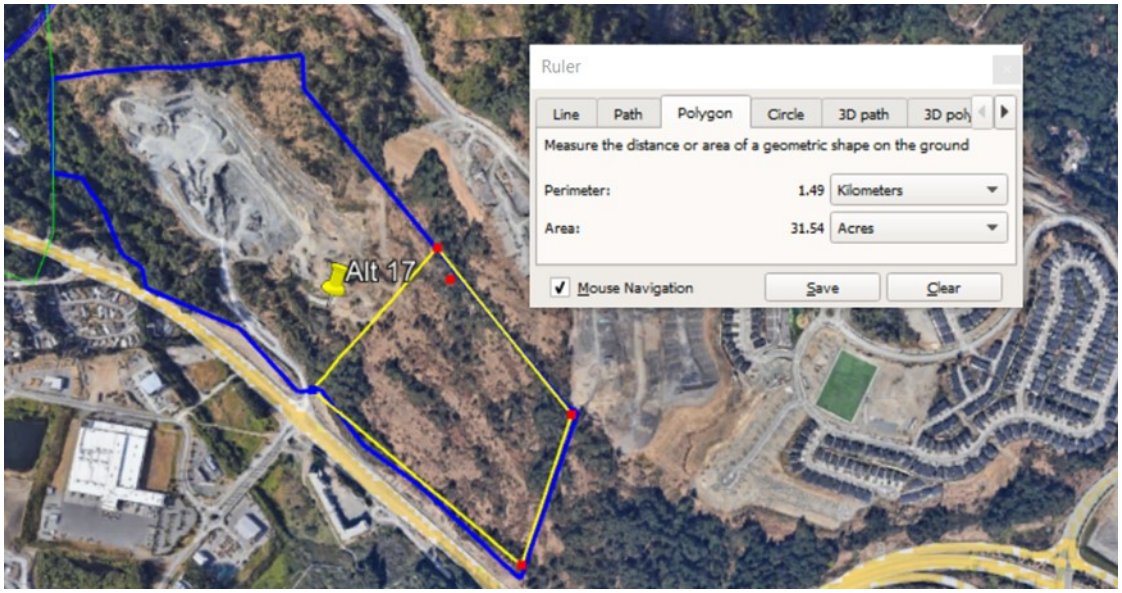
HI Dusanka, Please see the general mapping for Goldstream and the areas of interest below. The properties are listed in order of preference with the first image being a general area map.



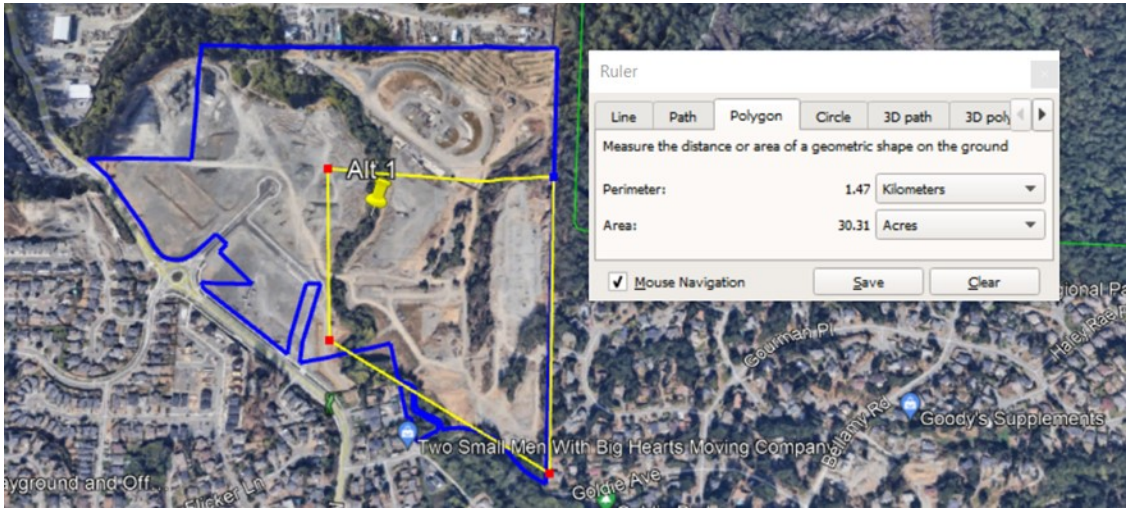
Alternative 19 – 2001 Millstream Road (PID 024-710-270)



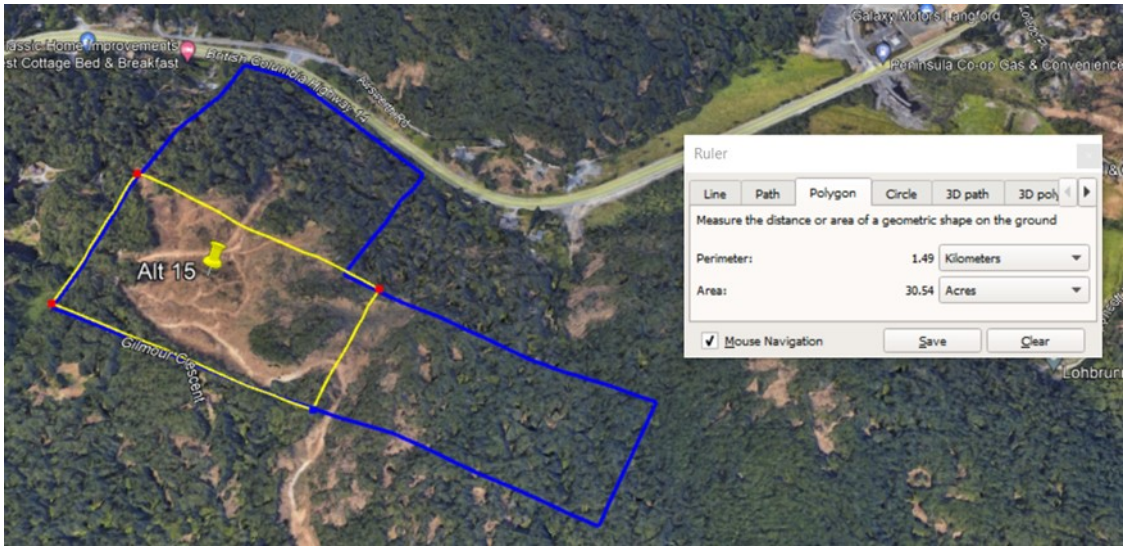
Alternative 17 – 2800 & 2820 Amy Road (PID 024-550-469 & 027-219-851)



Alternative 1 – 2207 Millstream Road (PID 017-612-675)



Alternative 15 - 3021, 3005 Sooke Rd and 3261 Woodruff Rd (PID 001-703-374/251/277)



I have attached the KMZ file for Willoughby. The properties we are interested in are alternate 15 (Near Trans Canada Highway), and alternates 14 B and 14D. There may be another parcel at 78th and 195B which I show below:



This is a last minute addition.

For Campbell Heights we are focused on two properties from the Township of Langley

They are shown as Alternate 14 and 15 (Shown in Blue). Alternate 8 is a possibility but Alt 14 seems to be the most realistic as TOL is willing to sell it to BCH.

I know I asked for Surrey City Center as well but that project is a bit in Flux right now. I will let you know more when you return.

From: Urosevic, Dusanka <Dusanka.Urosevic@bchydro.com>
Sent: Friday, June 7, 2024 8:56 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Property Acquisition for various projects

Hi David,

I am working on a few property mapping request for you.

Do you have closer locations for Township of Langley - Willoughby substation?
and Location for 1L143 Goldstream?

I will do mapping for 196 ST/32 AV mapping. I have 2017 Lidar for Lover Mainland and I will also request city of Surrey Lidar. I will see if Township of Langley have any Lidar that they want to share. This might take some times to get though.

Please pass the locations of the interested properties directly to me.

I will be on vacation next week and will continue after my return on June 17.

Thanks
Dusanka

Dusanka Urosevic (CP1280) Photogrammetrist
Quality & Geomatics, Integrated Planning

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Burnaby, BC V3N 4X8

P 604 528 2325
E dusanka.urosevic@bchydro.com

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LEGEND

Cadastral Boundaries

Preliminary Block Selection Location

Contour Index/Intermediate

DIGITAL ORTHOPHOTO MAP
UTM ZONE 10, NAD83
NTS SHEET REFERENCE: 92G

MAPPING SOURCES:

ORTHO: BING IMAGE
CONTOUR: GEO BC 2018/2019 LIDAR; CONTOUR INTERVAL 2 m

BC GOVERNMENT CADASTRE VARIABLE ACCURACY.

125 0 125 250 m

SCALE AS IS

DSGN		BC Hydro	ENGINEERING GEOMATICS SERVICES
INDEP CHK			
DFTG	DU		
DFTG CHK			
INSP			
REV			
ACPT			

TM0544 GOLDSTREAM
PREFERRED PROPERTIES
SITE 1

DATE Jun 20, 2024 | DISTR'N | DWG NO CAD TM-0544 - SITE 1 | R 0

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LEGEND

Cadastral Boundaries

Preliminary Block Selection Location

Contour Index/Intermediate

DIGITAL ORTHOPHOTO MAP
UTM ZONE 10, NAD83
NTS SHEET REFERENCE: 92G

MAPPING SOURCES:

ORTHO: BING IMAGE
CONTOUR: GEO BC 2018/2019 LIDAR; CONTOUR INTERVAL 2 m

BC GOVERNMENT CADASTRE VARIABLE ACCURACY.

150 0 150 300 m

SCALE AS IS

DSGN			
INDEP CHK			
DFTG	DU		
DFTG CHK			
INSP			
REV			
ACPT			

BC Hydro ENGINEERING
GEOMATICS SERVICES

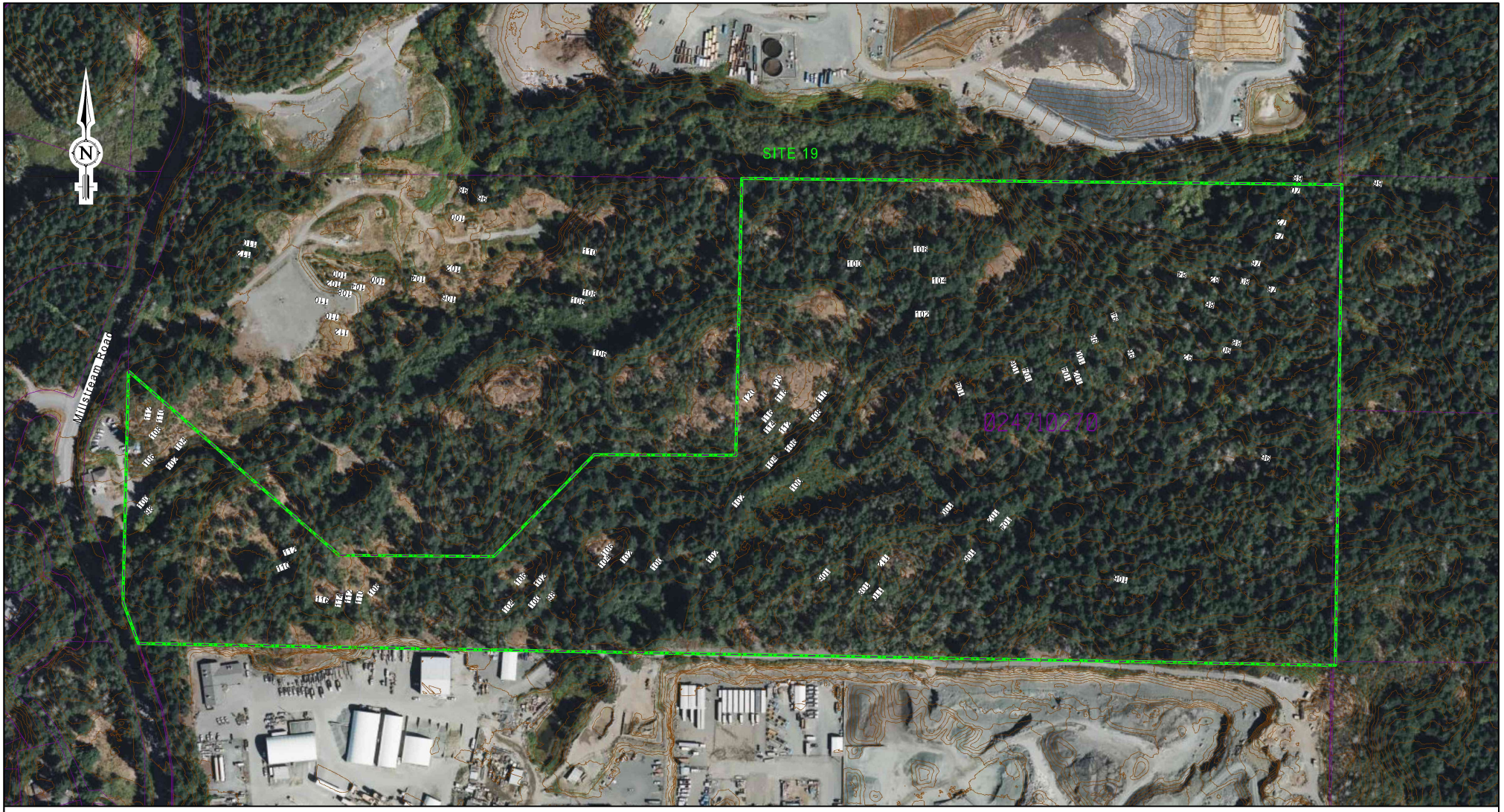
TM0544 GOLDSTREEM
PREFERRED PROPERTIES
SITE 15

DATE Jun 20, 2024 DISTR

DWG NO TM-0544 - SITE 15 R 0
CAD

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LEGEND

Cadastral Boundaries

Preliminary Block Selection Location

Contour Index/Intermediate

DIGITAL ORTHOPHOTO MAP
UTM ZONE 10, NAD83
NTS SHEET REFERENCE: 92G

MAPPING SOURCES:

ORTHO: BING IMAGE
CONTOUR: GEO BC 2018/2019 LIDAR; CONTOUR INTERVAL 2 m

BC GOVERNMENT CADASTRE VARIABLE ACCURACY.

100 0 100 200 m

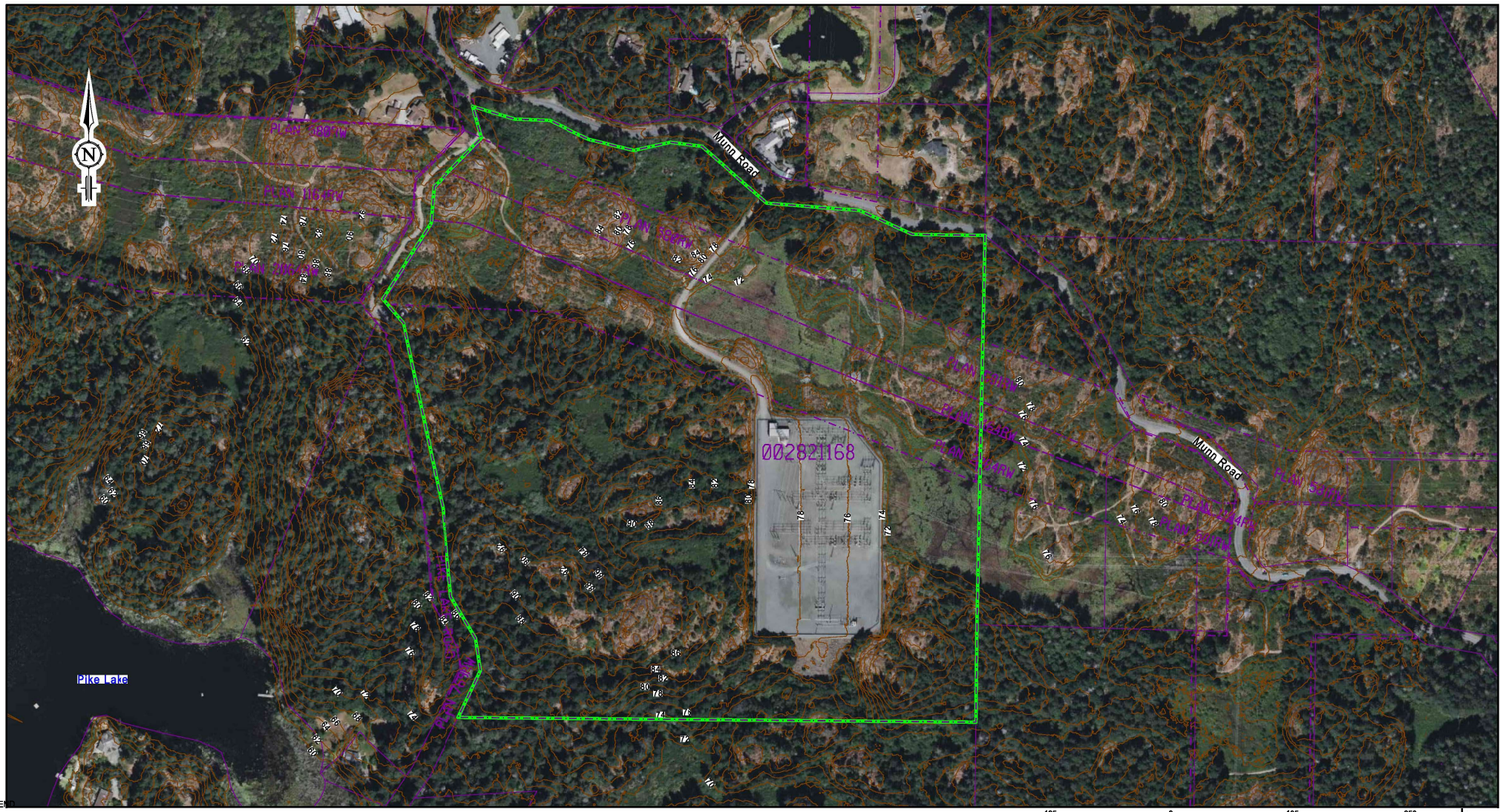
SCALE AS IS

DSGN		BC Hydro	ENGINEERING GEOMATICS SERVICES
INDEP CHK			
DFTG	DU		
DFTG CHK			
INSP			
REV			
ACPT			

TM0544 GOLDSTREAM
PREFERRED PROPERTIES
SITE 19

DATE Jun 20, 2024 | DISTR | DWG NO TM-05144-SITE 19 | CAD | R 0

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N
Munn Road
Munn Road
Pike Lake
002821168
PLAN 38811
PLAN 38811
PLAN 38811

From: Chwaklinski, David
Sent: 2024, September 17 1:21 PM
To: Hepple, Robert
Cc: Chwaklinski, David
Subject: FW: TM0592 - Willoughby Heights Sub, Alt 20
Attachments: WIB-E05-SK004-Outdoor 230 +GIS 60n25-To Fit Bosa Property-20240719.pdf; WIB-E05-SK003-Option 3-Outdoor 230 +GIS 60n25-To Fit Qualico Property-20240719.pdf

Robert, please see the e-mail from Kally to us from back in July. She notes her concerns with the Bosa property (I already informed her that the house on the lot is irrelevant to our discussions). I point out that they did not have accurate dimensions at the time and used 100 m when it is 325 ft (99.974 m) according to the legal plan. I also note that this requires the use of GIS for the 25 kV and 60 kV and the terminal positions are shown going overhead across lots 10 and 11. I have asked if we can conduct a layout with 230 entering from 194th and 196th but that will still require GIS for 60 and 25. I have asked if there is a way to make the 230 kV connection using cables to the terminal positions as shown or if there is another way to layout the terminal positions for simpler cable connections. I don't see any way that we can make the 60 kV or 25 kV AIS on the Bosa Property.

Also, for completeness I included her layout for the Qualico parcel. But that seems to be Moot now.

From: Jiang, Kally
Sent: Tuesday, September 17, 2024 11:56 AM
To: Chwaklinski, David
Subject: FW: TM0592 - Willoughby Heights Sub, Alt 20

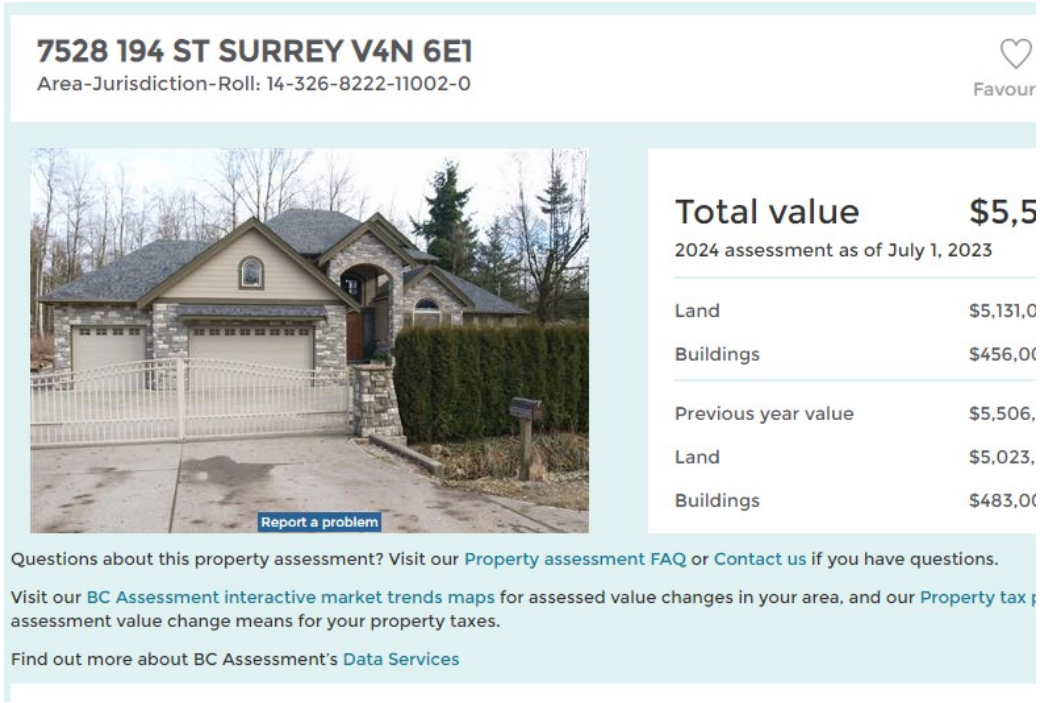
FYI as requested.

From: Jiang, Kally
Sent: 2024, July 19 4:51 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: TM0592 - Willoughby Heights Sub, Alt 20

Good afternoon, All,

The station layout has been barely fitted onto the Bosa's properties of 100m x 391m lot. This Alternative 20 is not preferable from Station Electrical Design perspective with the reasons below.

1. The 100m width is extremely tight for layout.
2. How the 230kV transmission Lines enter the station would be a concern.
3. The connection between 230kV bus ring would be very long and costly.
4. The high voltage power cables run from TX to both 60/25kV GIS buildings would be complicated and costly.
5. Low voltage cables run from switchyard to the control building would be quite long and costly.
6. There is a beautiful house on Bosa's property of 7528 194 ST SURREY as picture below. It was built in year 2003 and relatively new. What a regret and waste if we have to demolish the house to build our station on the lot.



I also looked into the Qualico property further. The station layout could be squeezed onto that property as attached Option 3. Compare these two options, the layout on Qualico's property is much better than the one on Bosa's properties.

Hope above info helps and have a great weekend!
Kally

Kally Jiang (She/Her/Hers) | P. Eng.

Senior Engineer, Electrical Design
Stations Division, Transmission Engineering

BC Hydro
6911 Southpoint Drive, E06th Floor
Burnaby, B.C. V3N 4X8

T 604 528 2605
F 604 528 1600
E Kally.Jiang@bchydro.com

bchydro.com

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, July 18 9:56 AM
To: Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: FW: TM0592 - Willoughby Heights Sub, Alt 20

Hi Kally, a new set of properties has arisen for consideration. Please refer to the e-mail string below. The two properties together are 100 m wide by 391 m long. Can you have a quick look and see whether we could accommodate all the requirements on this parcel> That would dbe the 4 linepositions, the 25 kV section and potentially a 69 kV section? Can you respond back directly to Robert, Dmitry as well as me? I will be on vacation for two weeks so will not be able to respond after mid day tomorrow.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Wednesday, July 17, 2024 2:12 PM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Cc: Chan, David Y.M. <David.Chan@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: TM0592 - Willoughby Heights Sub, Alt 20

Hi Dmitry,
We will need planning and engineering to look at it.
Problem that I see is that there is not two areas of access.
We are landlocked.

But let's brighter minds than mine make that decision.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
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C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Sent: 2024, July 17 1:12 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Chan, David Y.M. <David.Chan@bchydro.com>
Subject: TM0592 - Willoughby Heights Sub, Alt 20

Hi Robert,

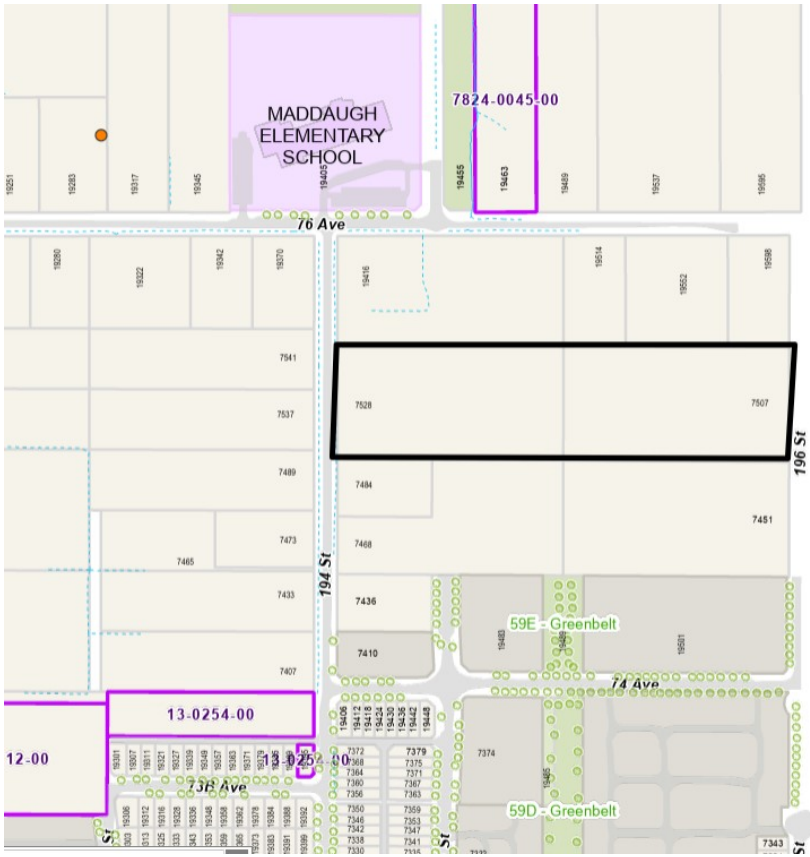
I have an update regarding Alternative 20. I spoke to both owners today and looks like both will be willing to sell at the right price. Here are the details of our conversation:

1) 7451 196 ST SURREY – private owner, wants to develop a townhouse. The owner will talk to the rest of the owners to see what price may work for them. I expect it to be $3M+ per acre.

2) 7507 196 ST SURREY – owned by Bosa Properties, they also own a property to the west (7528 194 ST SURREY). I spoke to the Director of Acquisitions and Bosa is currently talking to someone who is

seriously interested in buying both properties. The price they are looking to get for both is $2.5-$3M per acre. Bosa is interested in selling both lots, less interested in selling only one. From the design perspective, is it feasible to build a substation on such a long narrow lot (just over 9 acres) fronting 196 St and 194 St? Please refer to the snip below.

If it is feasible then we should probably pursue the 2 Bosa lots instead and act fast.



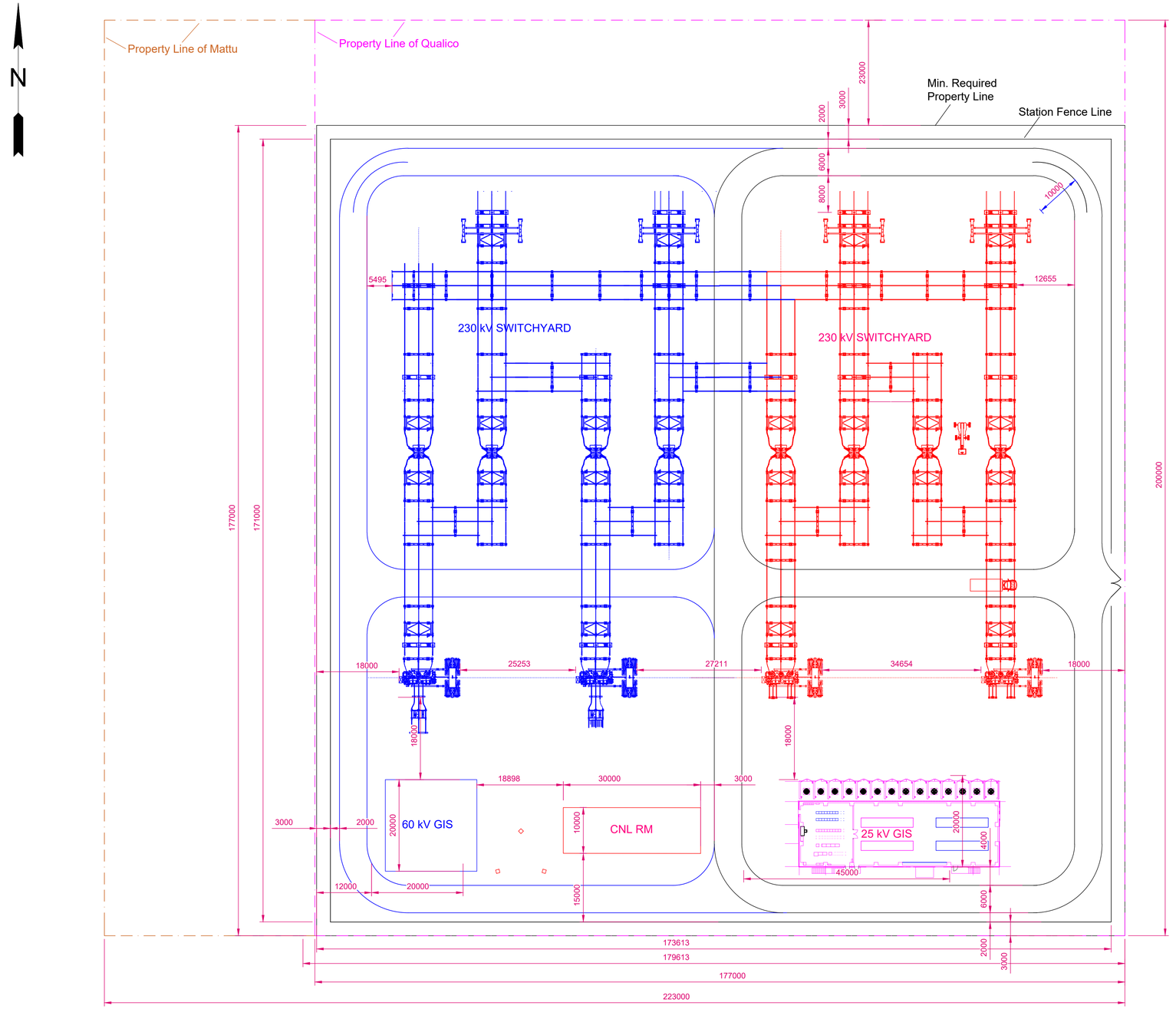
Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604 623 3566
M 604 690 9836
E dmitry.sherevkulov@bchydro.com

bchydro.com

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NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO | REMARKS | REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K.JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024JUL10		WIB-E05-SK003-Option 2			D	0A

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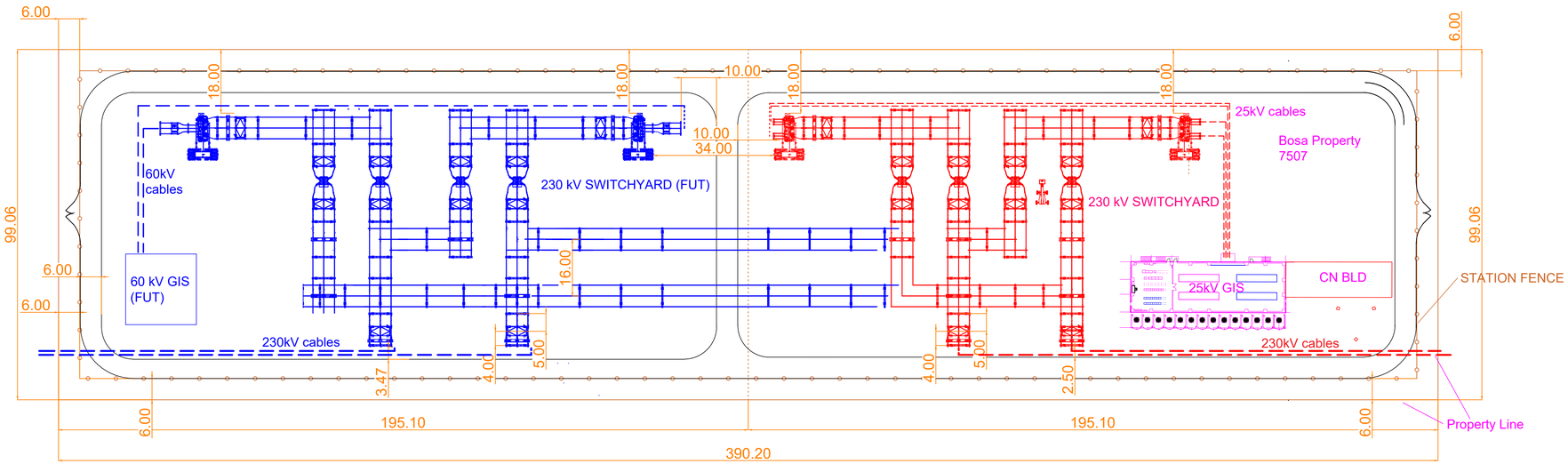
C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240705-Qualico\3rd set\WIB-E05-SK003-Option 3-2-Outdoor 230 +GIS 60in25-To Fit Qualico Property-20240710.dwg
Drawing Unit = Metric (4)
Model Space, 1:1
7/15/2024 4:03 PM

N

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE



FOR DISCUSSION
PURPOSES ONLY

C:\Users\kjiang\OneDrive - BC Hydro\P25 Projects1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240916-New for Bosa\7-WIB-E05-SK006-Op5-Outdoor AIS-To Fit Bosa+Kang Properties-20240918.dwg
Drawing Unit = Metric (4)
LWMS: Model_V1
9/19/2024 3:16 PM

REFERENCE DRAWINGS	NO	REMARKS	DESIGN NUMBER		DSGN K. JIANG
			WORK ORDER NUMBER		INDEP CHK
			CSA S250 ACCURACY NAD - UTM		DFTG K. JIANG
			BASE ACCURACY LEVEL:		DFTG CHK
			ASB ACCURACY LEVEL:		INSP
		REVISIONS			REV K. ZENG
					ACPT

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP19		WIB-E05-SK006-OP7			D	0

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From: Chwaklinski, David
Sent: 2025, February 10 3:29 PM
To: Hepple, Robert
Cc: Chwaklinski, David
Subject: FW: Willoughby Geotech Investigation Draft report

Hi Robert, I have communicated with Dylan regarding getting a draft report on the drilling activities at Willoughby. He tells me the absolute earliest we could get the draft report is Feb 19th. He can provide an assessment as soon as he sees the draft report but it wont be any earlier than the 19th. but

---

From: Lee, Dylan
Sent: Monday, February 10, 2025 2:57 PM
To: Chwaklinski, David
Subject: RE: Willoughby Geotech Investigation Draft report

Hi David,

Hope your holiday went well. I did badger KCB this morning and got a response a few minutes ago. Matt can commit to getting me a draft report by mid next week (19th at the earliest). The draft report will not include laboratory soil sampling results as those samples will take some time to test and transcribe to report format. I can make my draft assessment based on the draft factual results (visual descriptors and SPT values) when I receive the draft next week. We are not going to get a draft report any sooner (one to two weeks after field program to get draft report and logs is already consider expedited). Our original date of agreement with KCB was to get the draft report before the end of Feb as it was mentioned that falls within the decision timeline. As you know we couldn't have move these dates any earlier due to driller's availability and there was a lag with coordinating with the land owner for planning works until there was signed agreement.

Unfortunately, you are going to have to push this another week for the due diligence decision.

Informally I have been made aware of the ground conditions during the program and they are consistent with my desktop assessment.

Feel free to call if you want to chat further.

Thanks
Dylan

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2025, February 10 2:41 PM
To: Lee, Dylan <Dylan.Lee@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Willoughby Geotech Investigation Draft report

Hi Dylan, I understand the site investigation went pretty well. I know Robert has asked you this already but now he is asking me to f=lean on you to get a draft version of the report by the 14th so we can make our due diligence decision. Can you badger KCB to see if they can get at least some form of draft to us by that date? Thanks

From: Hepple, Robert
Sent: 2025, January 29 2:17 PM
To: Chan, David Y.M.
Cc: Sherevkulov, Dmitry; Parmar, Surinder; Chwaklinski, David
Subject: FW: Willoughby New Substation Project (TM-0637) - Kick Off Meeting
Attachments: Bosa-Kool-Walia_2025-01-29.pdf; WIB-E05-SK006-Outdoor AIS-To Fit Bosa-Kool Properties_2025-01-29.pdf

David and Surinder,
Conceptually WIB substation project is feasible without Walia property.
I would expect to revise this layout in Definition Construction phase.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
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C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

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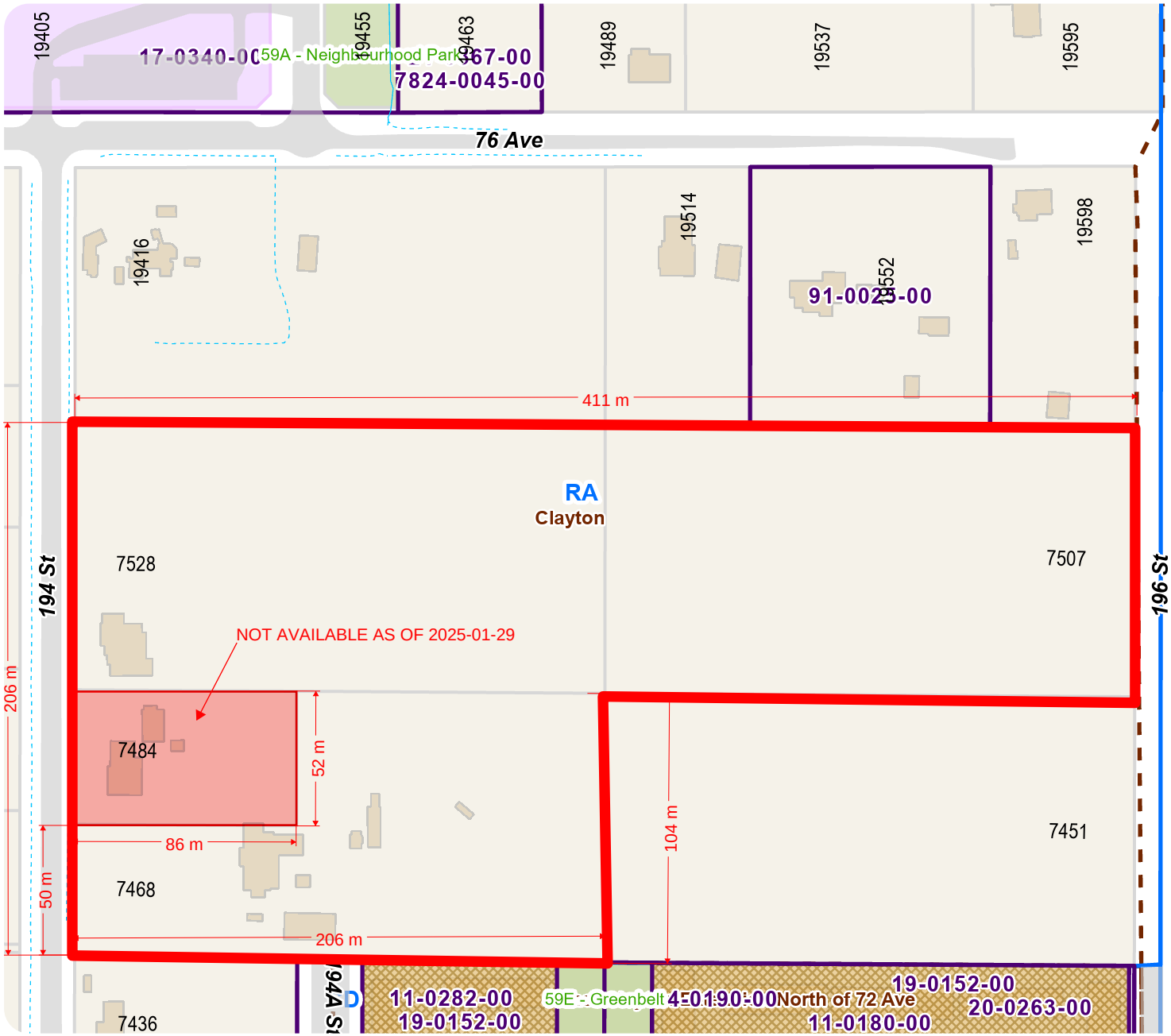
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hussien/Robert – conceptually, I can see that fitting the revised station general arrangement into the (reduced by W&S property) property envelope still remains feasible (attached revised).

Regards,

Dmitri Sydorov PE, P.Eng | Sr. Engineer,T-Stations Engineering
Office: 604.528.1519

City of Surrey Mapping Online System



Bosa-Kool-Walia

Scale: 1:2,209

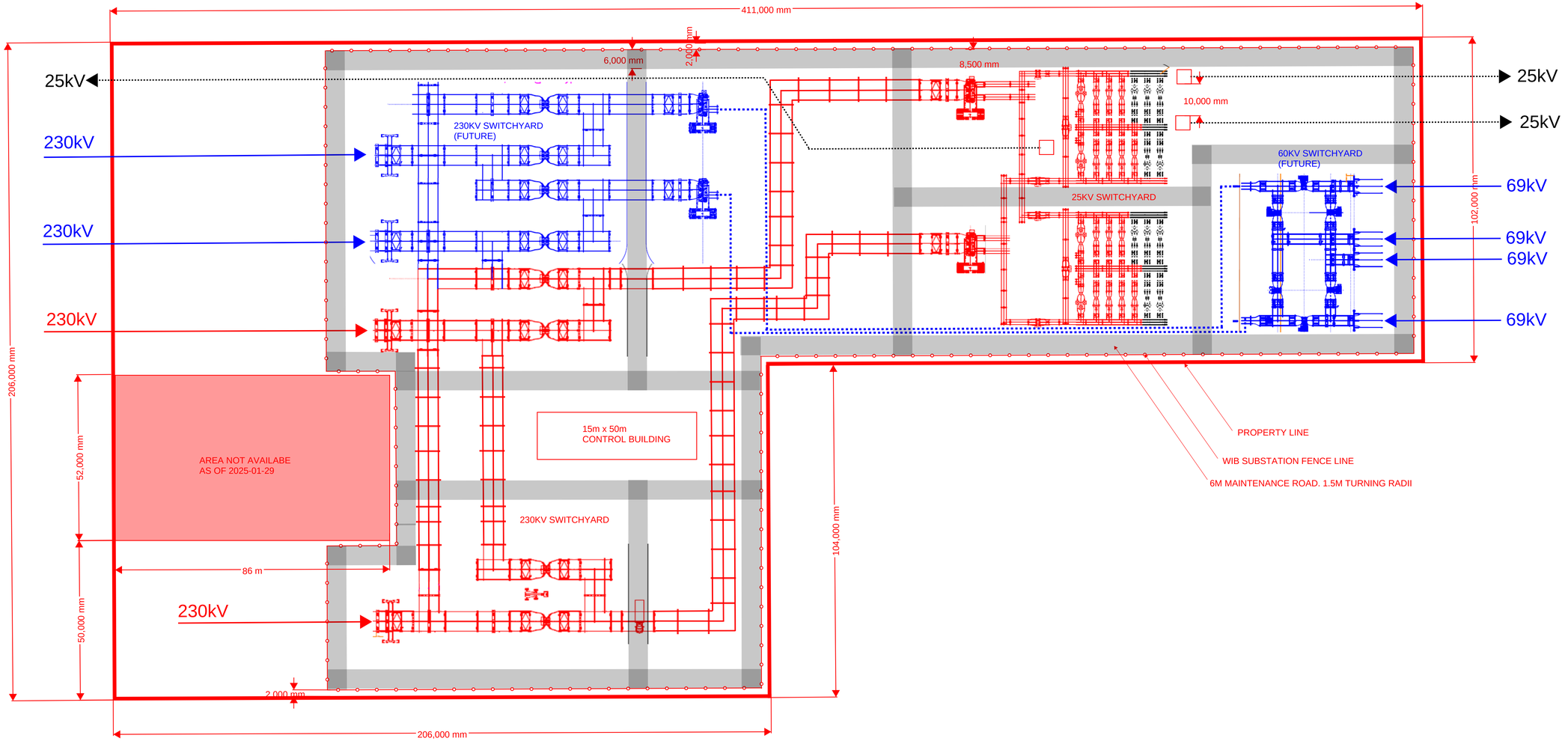
The data provided is compiled from various sources and is NOT warranted as to its accuracy or sufficiency by the City of Surrey.
This information is provided for information and convenience purposes only. Lot sizes, legal descriptions and encumbrances must be confirmed at the Land Title Office. Use and distribution of this map is subject to all copyright and disclaimer notices at cosmos.surrey.ca

0 0.01 0.03 0.05 0.08
km

Map created on: 2024-12-05

80 m

N



NOTES

1. GENERAL ARRAGMENT DESIGN BASED ON THE FEEDBACK RECEIVED FROM TRANSMISSION LINE AND DISTRIBUTION PROJECT LEADS IN TERMS OF 230KV, 60KV, 25KV SUBSTATION ENTRY/EXIST.

DESIGN NUMBER		DSGN	D. SYDOROV	BC Hydro	
WORK ORDER NUMBER		INDEP CHK		WILLOUGHBY SUBSTATION	
CSA S250 ACCURACY NAD - UTM		DFTG	TBD	230/60/25 KV SWITCHYARD ULTIMATE LAYOUT	
		DFTG CHK			
BASE ACCURACY LEVEL:		INSP			
		REV	M. BALEA		
ASB ACCURACY LEVEL:		ACPT			
		DATE	2025JAN29	DRAWING NUMBER: WIB-E05-SK006-OP2	REPORT NUMBER:
		DIST		FIG NO	SIZE D / REV 0

From: Hepple, Robert
Sent: 2024, September 19 2:18 PM
To: Parmar, Surinder
Cc: Chwaklinski, David; Jiang, Kally
Subject: FW: Willoughby Property - WIB - Bosa Property
Attachments: WIB-E05-SK006-Op1-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.pdf

Hi Surinder,
I know you would like to purchase all 4 parcels for future BCH purposes but the engineering Team would be remis if we did not mention that Kally has a layout with the Kang property and the eastern Bosa property that works.
Please see attached layout.
We would not need the western Bosa property or it could be purchased for future battery installation.
In that case we would not need parcel #4.
Let me know your thoughts.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
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W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Jiang, Kally
Sent: 2024, September 19 2:04 PM
To: Hepple, Robert
Cc: Chwaklinski, David
Subject: RE: Willoughby Property - WIB - Bosa Property

Hi, Robert,

Thanks for the updates! I stopped working on station layouts for the Bosa-Kang Property until getting further notice from you and David.

Regards,
Kally

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, September 19 12:12 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>
Subject: FW: Willoughby Property - WIB - Bosa Property

David/Kally,
Please stop work on station layouts for the Bosa-Kang Property.
If properties is successful in acquiring all 4 parcels, we would have a traditional layout with room to spare.
I will keep you informed.
Robert,

Robert Hepple P.Eng.

Project Manager, Stations
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6911 Southpoint Drive, B02
C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Sent: 2024, September 19 11:46 AM
To: Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>

Cc: Pradhan, Anil <Anil.Pradhan@bchydro.com>
Subject: FW: Willoughby Property - WIB - Bosa Property

Gents:

See string of emails below.

In summary – we have IP management consent to buy the Parcel #4 (south-west of Bosa) along with our earlier plan to buy Parcels 1, 2 and 3.

I will leave it with our Properties SMEs to review/decide on when to approach the owners of Parcel 3 and Parcel 4 owner and start these negotiations.

Let me know if any questions/clarifications that you need from me.



Surinder Parmar, P.Eng., PMP
BC Hydro
6911 Southpoint Drive

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M 604.561.2702
E Surinder.Parmar@bchydro.com

bchydro.com

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From: Kumar, Ajay <Ajay.Kumar@bchydro.com>
Sent: 2024, September 19 11:19 AM
To: Parmar, Surinder <Surinder.Parmar@bchydro.com>; Holland, Melissa <Melissa.Holland@bchydro.com>
Cc: Kelly, Neil <Neil.Kelly@bchydro.com>
Subject: RE: Willoughby Property - WIB - Bosa Property

Hi Surinder,

Thanks for the update. I am supportive of acquiring Parcel 4.

Regards,

Ajay

From: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Sent: 2024, September 16 3:05 PM
To: Holland, Melissa <Melissa.Holland@bchydro.com>; Kumar, Ajay <Ajay.Kumar@bchydro.com>
Cc: Kelly, Neil <Neil.Kelly@bchydro.com>
Subject: Willoughby Property - WIB - Bosa Property

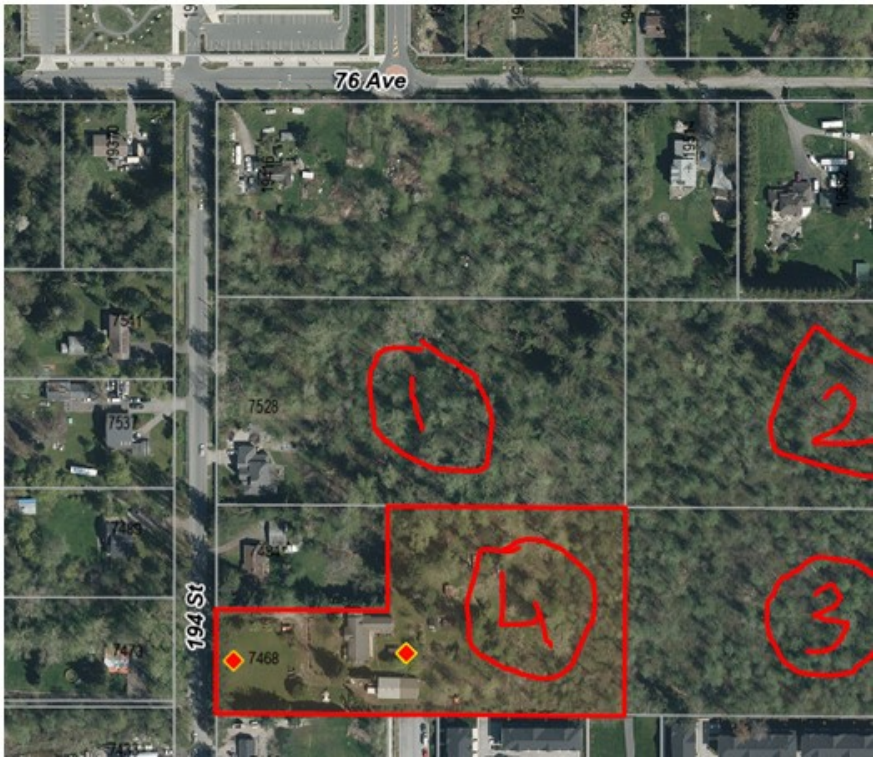
Melissa / Ajay: Quick heads up to both of you so that you are upto speed on the latest.

See the Map below

Properties marked 1 and 2 are owned by Bosa. Each property is around 4.766 Acres. Total Bosa property = 9.5 acres.

With Al's consent – we have a tentative agreement with Bosa to buy these two parcels for $20.5M (around $2.15M / acre).

Properties team will be drawing up agreement with Bosa and get it signed off in the next week or so.



Next steps:

- With the Bosa deal almost made, Properties will be talking with the owner of Parcel 3 (Mr Kang), who also owns the 4.766 acre parcel.
- We are hoping to have the deal made for a similar $2M to $2.2M per acre range.
- Hopefully in the next week or so, we will find out how successful we are going to be in making deal with Mr Kang.

Assuming we have these 3 parcels (around 14.3 acres) we should be able to build our outdoor substation (which requires min 12 acres) .

Ajay:

This is a question for you.

In the figure above – Parcel 4 is currently up for sale also.

Since onetime you had mentioned to Neil, that IP may be looking to install battery banks in the future - I think it will be good idea for BCH to try to secure this parcel also.

This will give us lot of flexibility to accommodate any future plans that IP may have for this area.

What are your thoughts on that?

If you agree, we can ask Properties to approach the owner of Parcel 4 also and secure it – of course, we will be trying to make a deal for similar $/acre that we are agreeing with Bosa.

Surinder Parmar, P.Eng., PMP
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M 604.561.2702
E Surinder.Parmar@bchydro.com

bchydro.com

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From: Chan, David Y.M. <David.Chan@bchydro.com>
Sent: 2024, September 13 3:16 PM
To: Leonard, Allan <Allan.Leonard@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks Al and great call on going back at $20M first.

We will now work with the team and Bosa to prepare the Purchase and Sale Agreement.

Regards,

David

David Y. M. Chan | Manager – Acquisitions and Sales

Real Estate Services, Properties

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604-623-3998
M 604-328-8678
E david.chan@bchydro.com

bchydro.com

From: Leonard, Allan <Allan.Leonard@bchydro.com>
Sent: 2024, September 13 2:31 PM
To: Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks Tony – I am comfortable with the $20.5M offer and agree that it would be a good acquisition for the reasons outlined below.

Thanks David – good outcome.

AL

From: Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>
Sent: 2024, September 13 2:02 PM
To: Chan, David Y.M. <David.Chan@bchydro.com>; Leonard, Allan <Allan.Leonard@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Al,

I support accepting the counteroffer of $20.5M or $2.15M per acre. It's a reasonable price and within the realm of market value.

We are not considering expropriation at this stage, but I wanted you to be aware of the following:

Under an expropriation scenario, despite any appraisal evidence a taking authority submits to the courts to defend it position, we have seen recent examples where the Courts have gone out of their way to side with the landowner. In addition to exposure to additional compensation as part of a court ruling, this are potential hundreds of thousands of dollars that would be incurred as part of the expropriation process.

Having the Bosa property under contract, would provide additional leverage with adjacent owners in future negotiations and likely lead to an expedited timeframe for land acquisition for this project.

Regards,

Tony

_____

Tony S.C. Lee | Senior Manager, Real Estate Services, Properties

P 604 623 3773
M 604 838 1020
E tony.lee@bchydro.com

Smart about power in all we do.

From: Chan, David Y.M. <David.Chan@bchydro.com>
Sent: 2024, September 13 10:39 AM
To: Leonard, Allan <Allan.Leonard@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Hi Al,

My contact (Director of Acquisitions) at Bosa phoned me and we spent some time discussing BC Hydro's counter offer.

As anticipated, he wanted to counter at $21,000,000 and I said no, that won't work. He has replied to my email countering at $20,500,000 or $2.15M per acre.

Please let me know your thoughts/instructions.

Regards,

David

David Y. M. Chan | Manager – Acquisitions and Sales

Real Estate Services, Properties

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333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

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M 604-328-8678
E david.chan@bchydro.com

bchydro.com

From: Leonard, Allan <Allan.Leonard@bchydro.com>
Sent: 2024, September 13 9:09 AM
To: Chan, David Y.M. <David.Chan@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks David

From: Chan, David Y.M. <David.Chan@bchydro.com>
Sent: 2024, September 13 9:08 AM
To: Leonard, Allan <Allan.Leonard@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks Al, I'll counter at $2.1M per acre or $20M and report back.

Regards,

David

David Y. M. Chan | Manager – Acquisitions and Sales

Real Estate Services, Properties

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333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604-623-3998
M 604-328-8678
E david.chan@bchydro.com

bchydro.com

From: Leonard, Allan <Allan.Leonard@bchydro.com>
Sent: 2024, September 13 8:55 AM
To: Chan, David Y.M. <David.Chan@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks David, Given the original offer and counteroffer of $1.8M and $2.4M, wondering why we wouldn't go back at $2.1M as it would see both parties adjust by $300K/acre?

AL

From: Chan, David Y.M. <David.Chan@bchydro.com>
Sent: 2024, September 13 8:35 AM
To: Leonard, Allan <Allan.Leonard@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: WIB - Bosa Property

Hello everyone,

After our meeting yesterday afternoon, I wrote to Bosa and they replied shortly after.

I provide details below and the map attached.

Bosa Properties (2 parcels – 9.53 acres)	Dates	Offer Amounts
First contact	July 17, 2024	
BC Hydro Business Case Approved	August 26, 2024	
BC Hydro Initial Offer at Appraised Value	September 5, 2024	$17.5M or $1.8M per acre
Bosa Counter Offer	September 6, 2024	$22.9M or $2.4M per acre
BC Hydro Counter Offer (per our meeting)	September 12, 2024	$19.1M or $2M per acre
Bosa Counter Offer	September 12, 2024	$22M or $2.3M per acre
BC Hydro Proposed Counter Offer	**September 13, 2024**	**$21M or $2.2M per acre**

Based on interactions and negotiations to date, I believe Bosa will agree to $21M or $2.2M per acre ($400K per acre/23% over appraised value). I believe this is good price for BC Hydro's substation use.

The Kang property to the south is 4.766 acres, appraised at $8.1M or $1.7M per acre. If we project a similar per acre value for its acquisition or $8M-$10M, the site could be assembled at around $30M.

Please let me know your thoughts.

I am seeking your approval to respond to Bosa at $21M or $2.2M per acre.

Thank you everyone for your iput.

David

_____

David Y. M. Chan | Manager – Acquisitions and Sales

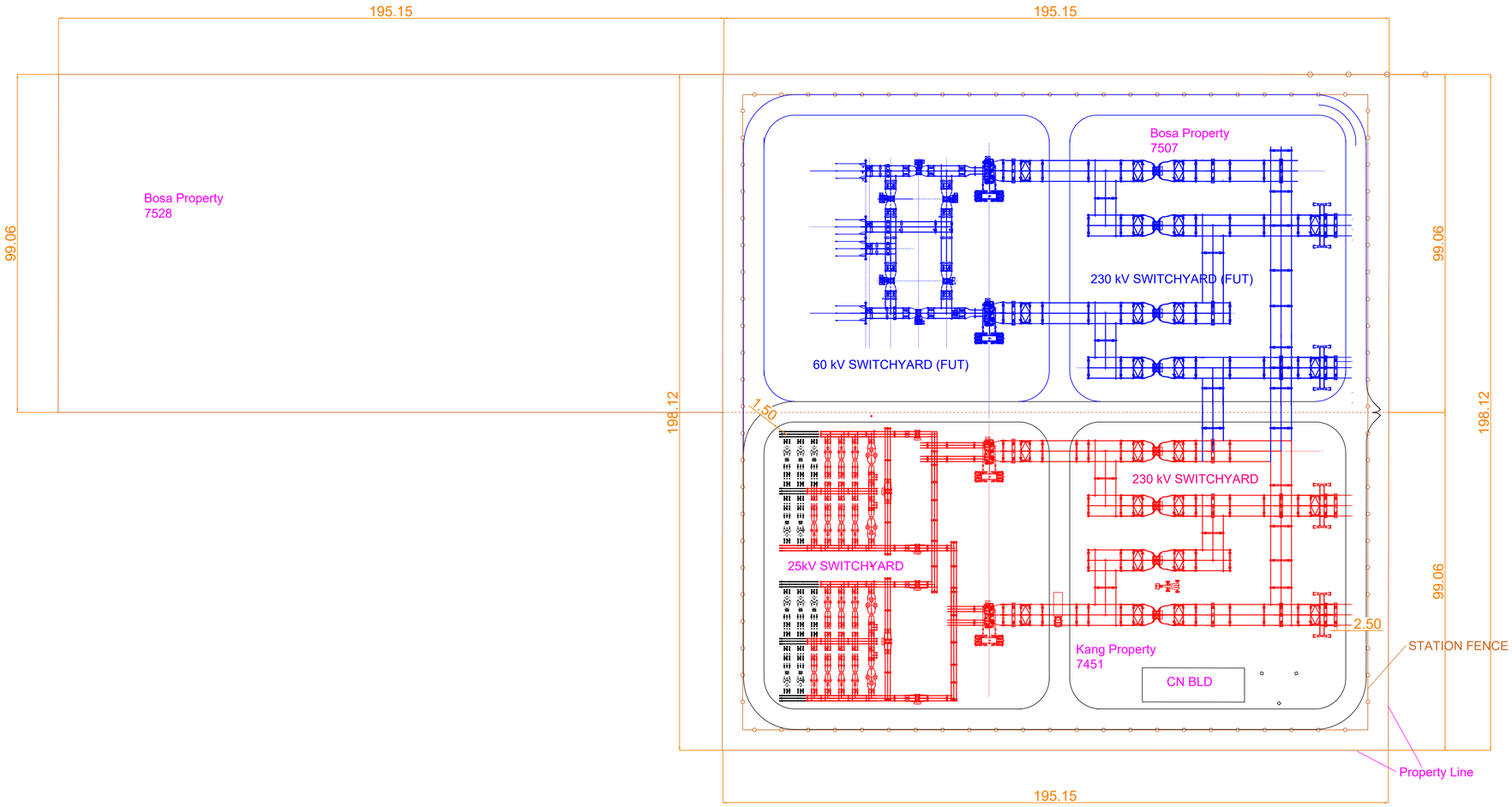
Real Estate Services, Properties

BC Hydro
333 Dunsmuir St, 12th floor
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P 604-623-3998
M 604-328-8678
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N



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP16		WIB-E05-SK006-OP1			D	0

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C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240913-New for Bosa+Kang\WIB-E05-SK006-Opb-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.dwg
Drawing Unit = Metric (4)
JIANG, KAI
9/16/2024 4:30 PM

From: Chwaklinski, David
Sent: 2024, March 08 4:27 PM
To: Gadhok, Satwant; Simpson, Lauren; Armstrong, Tyler; Lee, Johnson; Manurung, Cynthia
Cc: Chwaklinski, David
Subject: FW: Willoughby/Campbell heights Substation Layouts
Attachments: CAMP-E05-SK003(2024-03-05_OneLIne)--Tight_R0B-All-GIS-INDOOR.pdf

Hi folks, I have an early layout plan for a GIS station where the transformers are outside and the 230 kV, 69 kV and 25 kV switchgear is located within their own buildings. There is a significant reduction in the space required. We are meeting on Tuesday to discuss this further an to consider outdoor GIS. I hope to have some more information by the end of next week. I am not sure about getting an estimate any time soon however. Hopefully we can generate that once the sketches are complete.

Please note that we are treating Campbell Heights and Willoughby as the same requirements for the time being. Once we get a bit more settled we will create a separate set of sketches for Willoughby

---

From: Zeng, Ken
Sent: Friday, March 8, 2024 4:10 PM
To: Chwaklinski, David
Cc: Jiang, Kally ; Fajber, William ; Carr, Arthur ; Khan, Jahangir
Subject: RE: Willoughby/Campbell heights Substation Layouts

David/Artur,
Thanks for the HSY reference.
Based on HSY and the space needed for an 8-CB 230kV indoor GIS and its cabling/termination, the ideal layout for a green field all GIS type layout might look like the attached, but could be smaller and the 230kV incoming lines space and orientation might not work for current concept.

In general, compared with the all-open low profile type, the all indoor-GIS type takes less than half of the property size.

We need outdoor GIS dimensions to see how it will look. I do not think there is a big difference.

Regards
Ken

From: Carr, Arthur <Arthur.Carr@bchydro.com>
Sent: 2024, March 08 10:27 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>

Cc: Jiang, Kally <Kally.Jiang@bchydro.com>; Fajber, William <Will.Fajber@bchydro.com>; Zeng, Ken <Ken.Zeng@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

Dave,

I'm going to say for 69kV, the size of an indoor GIS system is comparable to an outdoor AIS system but this is not true for the higher voltages such as 230kV.

For comparison purposes, I suggest you look at what was built at HSY in 2013 (7 Bay indoor 230kV GIS system). For Campbell Heights, it looks like we would need to have a building large enough for an 8 bay system but only build out 4 bays at this time. It would be a bit more complex in the future to build the GIS out to the full 8 bays compared to an AIS system but still doable.

Arthur.

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, March 08 9:49 AM
To: Carr, Arthur <Arthur.Carr@bchydro.com>; Zeng, Ken <Ken.Zeng@bchydro.com>
Cc: Jiang, Kally <Kally.Jiang@bchydro.com>; Fajber, William <Will.Fajber@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

No, the intent is to stay AIS but given that the availability of suitable properties is very low I am just thinking out loud if you will of how to make it work. For an AIS 230/69/25 station we need about 10 acres. There are almost no properties that large near the load center and the ones that exist have been tagged for residential development which means big dollars even if we could purchase. There are some smaller properties of 4 to 6 acres that may be available but I need to understand how much space is required if we use GIS equipment. The township made it clear that they are not in favour of an AIS station in their residential area so I am considering all options at this time.

From: Carr, Arthur <Arthur.Carr@bchydro.com>
Sent: Friday, March 8, 2024 9:23 AM
To: Zeng, Ken <Ken.Zeng@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Jiang, Kally <Kally.Jiang@bchydro.com>; Fajber, William <Will.Fajber@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

Are we considering 25kV indoor MVGIS for this project?

Going from a fully AIS design to a fully GIS design is extreme on both ends of the spectrum (biggest area and lowest cost versus smallest area and highest cost).

Arthur.

From: Zeng, Ken <Ken.Zeng@bchydro.com>
Sent: 2024, March 08 9:02 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>

Cc: Carr, Arthur <Arthur.Carr@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>; Fajber, William <Will.Fajber@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

Hi David,
Based on the rough sketch I've attached (the first PDF), which reflects the latest one-line diagram (the second PDF), it appears that we'll need a 190m x 175m fenced yard for the substation. I recommend focusing our search on properties that can accommodate this size, rather than looking for a larger property.

If you have a specific property in mind with approximate dimensions and orientation, we can develop a layout that fits into it. This will allow us to determine which portions could utilize GIS (indoor or outdoor). It's important to have a physical idea of both the HV line incoming and LV line outgoing orientation from a system perspective. For instance, could we consider a layout comprising 230kV outdoor, 25kV indoor GIS, and 60kV outdoor GIS.

Equipment might be able to provide some samples from vendors for outdoor GIS, for 230 and 60kV. I did a few projects with 60kV, 25kV indoor GIS, or Hybrid only and I have never done an outdoor GIS.

We are all in the office on Tuesday and Thursday as required by the department.

Regards,
Ken

From: Fajber, William <Will.Fajber@bchydro.com>
Sent: 2024, March 07 5:29 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Zeng, Ken <Ken.Zeng@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Carr, Arthur <Arthur.Carr@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

It is mostly correct, although it is complicated.

We have used outdoor GIS at BC Hydro– one of the early versions was installed at HSY. It had some issues but nothing related to being outside.
We have also installed pieces of outdoor GIS recently, except that we call it hybrid breakers instead of outdoor GIS. We have that at Ingledow and Meridian in the 500 KV yard, and a new 230kv one at Camosun. We also have a small 138 KV GIS installation at Douglas Rd.

I would say that the opinions from the equipment team are mixed. An analogy would be whether you park a car on the street or park a car in the garage. If your card never leaves the garage, you would expect that it will last longer without the exposure from the elements. But it doesn't mean that you should not have a car that drives on the street.

As recently as yesterday, there is discussion about outdoor GIS as a possibility for use at Lougheed substation and Scott Rd. substation. That application is different than the ones above. It is potentially a very small footprint. The importance factor of the switch yard is lower in that a grid level station. And it is small enough that if the GIS needed to be disassembled, scaffolding and shrink wrapping can be applied to provide a clean work environment. Since it is outdoor, a mobile crane can reach everything pretty easily.

CIGRE reports that there are three times more problems with outdoor GIS than indoor GIS. That number came from their published reports on reliability. However, three times a very small number is still a small number.

And we have to consider whether the risk would outweigh the advantages of a small footprint. I am generally supportive of the idea.

I note that a small indoor 60 kV GIS in a building has almost the same footprint as an 60kv air insulated compact structure such as Newell, so it is less compelling. However an outdoor GIS would still have to be some distance from the fenceline, while a building could be at the edge of the property.

I will loop in Arthur in this conversation.

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, March 07 4:20 PM
To: Zeng, Ken <Ken.Zeng@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Fajber, William <Will.Fajber@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Willoughby/Campbell heights Substation Layouts

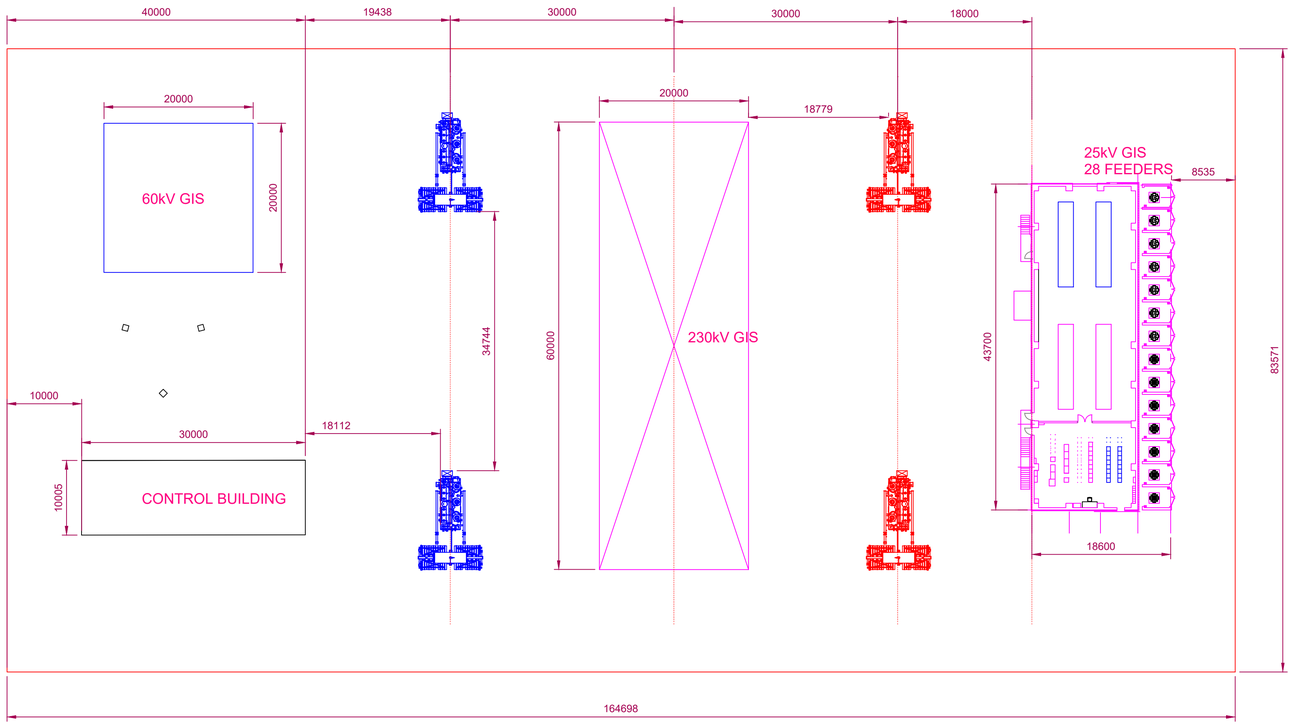
Ken and Kally, in a meeting with Township of Langley today they noted that properties suitable for a full outdoor station are few and far between, I am wondering if there is a middle ground between a full outdoor station and an indoor station. Can you also consider what decrease in property sizes would be (if any) if we considered an outdoor GIS station. I will set up a meeting for next week to discuss in more detail. Which days do you come into the office. I think this meeting will be better face to face.

Will my recollection in talking to you some years ago is that we don't use outdoor GIS due to reliability. Im not sure If that is correct but if you could comment on it I would appreciate it.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK/BLUE: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng
DFTG CHK	
INSP	
REV	K. JIANG
ACPT	

BC Hydro

CAMPBELL HEIGHTS SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT ALL GIS-INDOOR

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024MAR07		CAMP-002-E05-SK003B			D	0A

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\\bchydro.adroot.bchydro.bc.ca\DATA\Engineering\Transmission\Stations\Projects\TM-0539\Campbell Heights and Willoughby\CAMP-E05-SK003\[2024-03-05_OneLine]~Tight_RGB.dwg
Drawing Unit = Metric (4)
Plotted: 5 Mar 2024 - 4:05 PM

From: Wong, Felix
Sent: 2024, January 18 5:20 PM
To: Chwaklinski, David
Subject: Fwd: Willoughby and Campbell Heights PA - 200 MVa or 400 MVa

FYI

Begin forwarded message:

> **From:** "Lin, Lynn" <Lynn.Lin@bchydro.com>
> **Date:** January 18, 2024 at 5:10:16 PM PST
> **To:** "Wong, Felix" <Felix.Wong2@bchydro.com>
> **Cc:** "Parmar, Surinder" <Surinder.Parmar@bchydro.com>, "Pradhan, Anil" <Anil.Pradhan@bchydro.com>
> **Subject: FW: Willoughby and Campbell Heights PA - 200 MVa or 400 MVa**
>
> Hi Felix,
>
> Campbell Heights Substation (CBS) and Willoughby Substation (WIB) are both outdoor 230/25kV substations with an ultimate capacity of 200MVA. The SNs for these two property purchase projects are SN5080 and SN5096. Please refer to the SNs for ultimate one lines and detailed requirements. The SNs will be issued soon.
>
> Thanks,
>
> Lynn
>
> ---
>
> **From:** Wong, Felix <Felix.Wong2@bchydro.com>
> **Sent:** 2024, January 18 4:43 PM
> **To:** Lin, Lynn <Lynn.Lin@bchydro.com>
> **Cc:** Parmar, Surinder <Surinder.Parmar@bchydro.com>
> **Subject:** Willoughby and Campbell Heights PA - 200 MVa or 400 MVa
>
> Good Afternoon
>
> During our project meeting today our Project engineer brought up a question about both Wiloughby and Campbell Heights substations.
> Can I get a confirmation that we are still expecting them to be 200MWa stations and not 400MWa stations?

It will be extremely difficult to take this unknown into the next phase.

Based on some of our evaluation there is a lot that will skew the search and even the approach for both indoor or outdoor based on the available properties.

Can you and your team please confirm?
Thanks for your time and help

Felix Wong
Project Manager
Generation Project Delivery

BC Hydro
6911 Southpoint Drive, B02
Burnaby, B.C. V3N 4X8

Office: 604.528.2641
Mobile: 604.828.7199
Fax: 604.528.2635
Email: felix.wong2@bchydro.com

bchydro.com

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, January 18 4:12 PM
To: Wong, Felix <Felix.Wong2@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Cc: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Lee, Johnson <Johnson.Lee@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Willoughby and Campbell Heights PA - 200 MVa or 400 MVa

Hi Felix as I noted in our meeting today, Ajitpal told me that Planning is suggesting that they may require Surrey Central to be a 400 MVa station as opposed to a 200 MVa station. I am wondering if this same requirement may be put on the Willoughby or Campbell Heights stations. If there is any consideration to make either station a 400 MVa station, now is the time to factor that into our property search. Based on the 4 line positions Planning has requested they may be unconsciously backdoor planning for an ultimate 400 MVa station. Based on the current one line (4 line positions) the additional property requirements may not need be more than 25% to 40% larger than our current search. We will need Electrical to confirm that based on a one line, however.

Another consideration is will we consider indoor stations for these two? Based on what we heard from Tyler a lot of the area we are looking at is designated for housing and Langley and surrey are probably going to ask for indoor stations. I don't have any hard data on the difference

between and outdoor vs an indoor station but I would suggest that discounting land costs it could be a as much as a $200 million dollar premium for a 400 MVa station and not that much less for 200 MVa.

We can ask the estimating team for some base information on this if you need that data.

If you can confirm one way or the other if we need to plan for 400 MVa and Indoor station that would be appreciated. I can then discuss with electrical for new layouts.

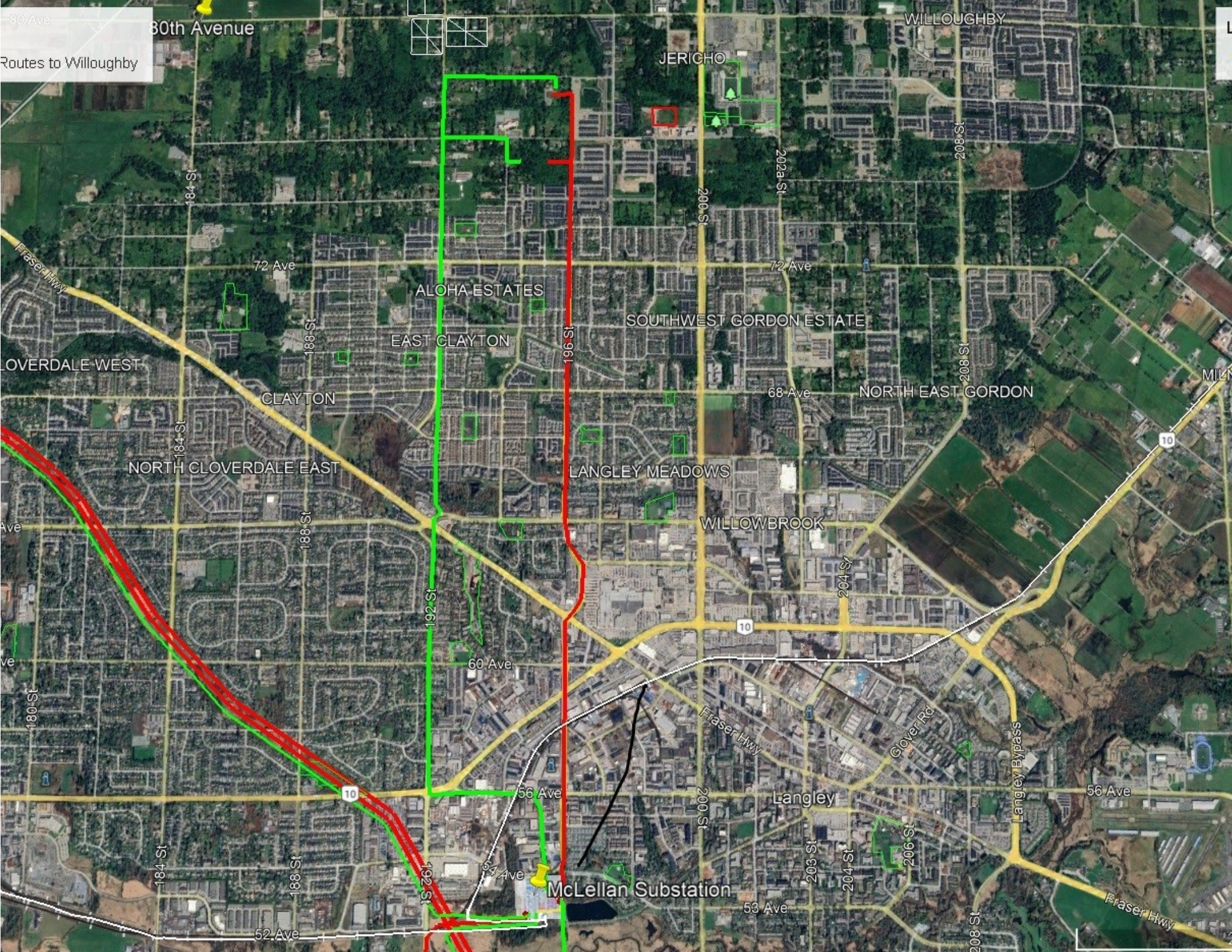
I will finalize my work package by adding in some $ for Survey and photogrammetry to develop contour mapping of our three or for preferred sites for the next stage.

Let me know if you have any other questions or concerns. Thanks

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com


Routes to Willoughby
80 Ave
30th Avenue
JERICHO
WILLOUGHBY
184 St
202a St
200 St
208 St
Fraser Hwy
72 Ave
ALOHA ESTATES
SOUTHWEST GORDON ESTATE
EAST CLAYTON
188 St
196 St
LOVERDALE WEST
CLAYTON
68 Ave
NORTH EAST GORDON
NORTH CLOVERDALE EAST
LANGLEY MEADOWS
WILLOWBROOK
192 St
204 St
60 Ave
180 St
10
Glover Rd
Langley Bypass
56 Ave
Langley
206 St
203 St
McLellan Substation
53 Ave
52 Ave

From: Chwaklinski, David
Sent: 2024, September 18 10:25 AM
To: Fajber, William; Balea, Marian; Stewart, Dennis
Cc: Chwaklinski, David
Subject: Potential Senior review of a Willoughby substation layout.
Attachments: WIB-E05-SK006-Op2-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.pdf; WIB-E05-SK006-Op1-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.pdf; WIB-E05-SK004-Outdoor 230 +GIS 60n25-To Fit Bosa Property-20240719.pdf; Bosa_Kang_Property.pdf

Gentlemen, we are working on Layouts for the Willoughby Substation and we have run into a small problem. Senior management made a decision to purchase a property before engineering had completed a review to determine if it was viable. We need to determine if it is feasible to construct a station on the Bosa properties alone (7528 and 7507 in the attached Bosa_Kang pdf) or do we need to purchase the Kang property as well to make it work. We know that if we use part of the Bosa property and the Kang property we can make it work although there would be egress issues for distribution (see SK006-Op1). We can make partial use of all the properties (See SK006_Op2) but it is not efficient use of space. So now management wants to know if we can avoid purchasing the Kang property and we need to revisit SK004 and rework it using cables and other methods to get T/L in and D/L out. Kally is currently doing this but is insisting a Senior Peer review. I agree a peer review is necessary, but I am hoping to avoid a major review exercise as we are only trying to determine if it is possible at this time. I don't want to interfere with your prerogative of senior review but as Kally is very focused on the standard layout SK006 Op1 I want to make sure that you understand what I am trying to accomplish when she asks for your input. If you have any questions or concerns, please let me know. Thanks.

Ps if I have crossed the line here please accept my apologies, as I said I am not trying to interfere in your role but to make sure we are doing the appropriate level of work at the appropriate time

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com

From: Chwaklinski, David
Sent: 2024, October 07 10:52 AM
To: Lee, Dylan
Cc: Chwaklinski, David
Subject: Preparing for Confirmatory Geotechnical Investigation for Willoughby Substation
Attachments: Bosa_Kang_Kool_properties.pdf

Hi Dylan, just got off the weekly project call for Willoughby. The PM tells me that there is a tentative sale agreement for the Bosa properties, and they are working on negotiating with two other properties adjacent to the Bosa properties. As part of our due diligence the PM wants to conduct a confirmatory investigation on all the properties. I understand that once the conditional agreement is signed BCH has 90 days, plus a 30 day extension to make a decision. It is expected that the agreement with Bosa may be signed as early as this week but more likely at the end of the month. Given that can you begin looking into a scope of work for a confirmatory Investigation with the possibility of adding work at the other two properties should a conditional agreement be signed in close order? The Bosa properties are

7507 196 street and 7528 194 street Surrey
PID: 012-828-670, 012-828-696
The other properties are:
Kang
7451 196th St. Surrey
PID: 012-828-661

Kool
7468 194 St Surrey
PID: 001-787-993

I have included an excerpt of the COSMOS mapping system showing the area.

Have a look and then we should discuss our options.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com

From: Zhang, Fan
Sent: 2024, February 22 9:21 AM
To: Lin, Lynn; Pradhan, Anil; Zou, Ming; Shafi, Shehzad; Kwan, John
Cc: Guite, Mike; Burt, Ed
Subject: RE: Follow up: Willoughby and Campbell Height transmission interconnection
Attachments: RE: Campbell Heights and Willoughby Substations

Hi Everyone,

Thank you for your attendance. Please see my notes for our meeting from February 15th, 2024.

Topic 1: MLN Substation fourth 230 kV circuit

- The team discussed the attached email. There are three 230 kV line positions in the one-line that are independent. A fourth 230 kV line position that would be shared with a transformer.
- The location marked by the blue circle would be acceptable to Transmission Planning on the condition that BCH will not be installing MLN T4.
- Currently no need has been identified to install MLN T4, based on current forecasts or on current placemat projects.
- The team agrees that since there's no current need for MLN T4, we can place the fourth 230 kV line position at the blue circle. We assume MLN T4 will not be installed. This would be the high-level transmission solution to interconnect Willoughby and Campbell Heights Substations with N-1 transmission supply.
- Once the fourth 230 kV line position is allocated at the blue circle, it will not be possible to upgrade MLN Substation to include MLN T4. The (230 kV portion of the) substation will have reached its ultimate size.
- The team discussed the four 230 kV circuits that will be allocated for Willoughby and Campbell Heights Substations. The team agrees that the transmission circuits will be positioned such that no single breaker failure would result in loss of both circuits to a substation (e.g., no single breaker failure will result in the loss of both 230 kV circuits to Willoughby Substation). The team agrees that the transmission circuits can be positioned such that a single breaker failure would result in loss of one circuit to both substations (e.g., a single breaker failure results in the loss of one 230 kV circuit to Willoughby and one 230 kV circuit to Campbell Heights).
- The team agrees that Stations Planning and Transmission Planning will issue their scope notes at the same time. Drafts will be sent to each other for comment prior to issuing scope note.
- Stations Planning scope note is already in draft.
- At this stage, the team would request planning allowance based on the underground option (expected to be the costlier option).

Topic 2: Property for the future Willoughby and Campbell Height Substations

- At this time, the plan for Willoughby and Campbell Height Substation does not include a 60 kV switchyard.
- Properties is currently looking at land for these two substations.
- The team discussed if we should ask Properties to also look at land that is large enough to fit a 60 kV switchyard at both substations.
- It is challenging to determine how much land a 60 kV switchyard would require at Willoughby and Campbell Heights Substations without creating a new one-line, which will be a lot of effort.
- The team agrees that we will need to bring Ajay into this discussion to endorse the idea. (Post-meeting update: this idea was discussed with Ajay and he does agree that we should bring forward the option for 60 kV).

- Stations Planning will submit the update to CIPD to include the station property size requirements that would allow future 60 kV service at the Willoughby and Campbell Heights Substations. The request is also to update the station property selection Structured Decision Making Matrix, with the ability to accommodate future 60 kV service being one of the selection criteria identified by CIPD.

Please let me know if there's anything you'd like to add or correct.

Thank you,
Fan

Fan Zhang
Transmission Planning

BC Hydro
Edmonds A03
Smart about power in all we do.

-----Original Appointment-----
From: Zhang, Fan
Sent: 2024, February 13 12:53 PM
To: Zhang, Fan; Lin, Lynn; Pradhan, Anil; Zou, Ming; Shafi, Shehzad; Kwan, John
Cc: Guite, Mike; Burt, Ed
Subject: Follow up: Willoughby and Campbell Height transmission interconnection
When: 2024, February 15 2:30 PM-3:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: EDMA03, Mtg Rm 1 -Teams Room

Hi Everyone,

I set up this meeting to discuss Transmission Planning's comments on the 3 line terminals at MLN.

Thank you,
Fan

Fan Zhang
Transmission Planning

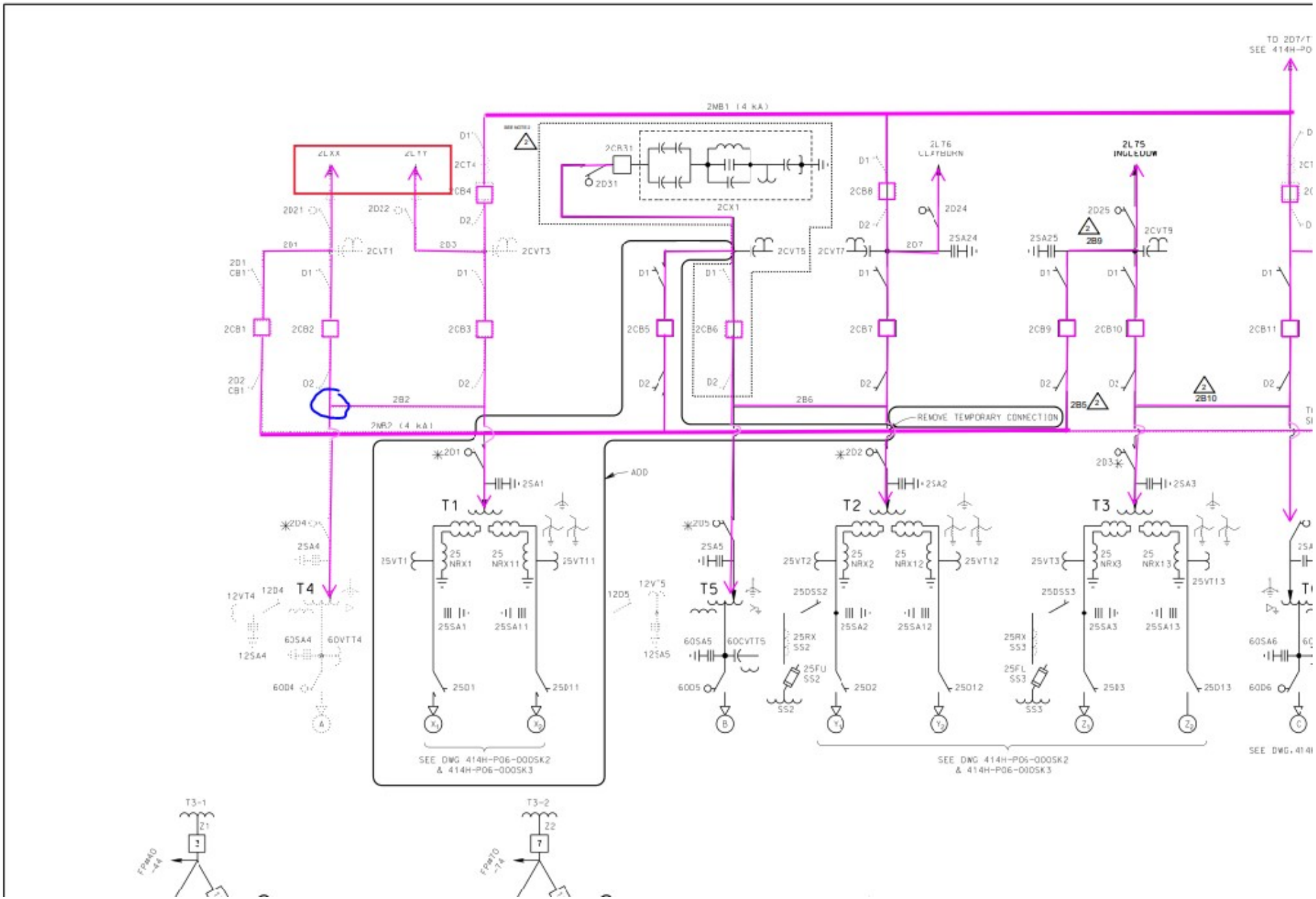
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From: Zhang, Fan
Sent: 2024, February 14 11:45 AM
To: Lin, Lynn
Cc: Zou, Ming; Kwan, John; Shafi, Shehzad
Subject: RE: Campbell Heights and Willoughby Substations

Hi Lynn,

We took a look at the one-line you sent us. Does Stations Planning have any plans for MLN T4?

We are considering having the fourth 230 kV circuit where MLN T4 is located (blue circle), but that assumes BCH has no plans to put in MLN T4. What are your thoughts?



Thank you,
Fan

Fan Zhang
Transmission Planning

BC Hydro
Edmonds A03
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From: Lin, Lynn <Lynn.Lin@bchydro.com>
Sent: 2024, February 13 9:54 AM
To: Kwan, John <John.Kwan@bchydro.com>
Cc: Zhang, Fan <Fan.Zhang@bchydro.com>
Subject: FW: Campbell Heights and Willoughby Substations

Hi John,

Please see the MLN one line attached for your reference.

Thanks,

Lynn

From: Lin, Lynn
Sent: 2024, February 13 9:52 AM
To: Pradhan, Anil <Anil.Pradhan@bchydro.com>; Guite, Mike <Mike.Guite@bchydro.com>; Burt, Ed <Ed.Burt@bchydro.com>; Zhang, Fan <Fan.Zhang@bchydro.com>; Shafi, Shehzad <Shehzad.Shafi@bchydro.com>
Cc: Zou, Ming <Ming.Zou@bchydro.com>
Subject: RE: Campbell Heights and Willoughby Substations

Hi all,

Thanks for attending the meeting and sharing your valuable opinions. The brief summary of the meeting discussion regarding the Campbell Heights and Willoughby Substations construction projects is as follows:

1. Up to three 230kV line positions can be added at MLN. please see the MLN one line sketch attached. TP will study the transmission solution for Campbell Heights Substation and Willoughby Substation and inform SP. Fan will provide the timeline of the study after the meeting.
2. The construction of transmission lines/cables supplying Campbell Heights Substation and Willoughby Substation will not be included in the work scope of the Campbell Heights Substation construction project and the Willoughby Substation construction project.

3. Expansion of MLN will be necessary and included in the Campbell Heights Substation construction project if additional 230kV line positions are added at MLN to supply Campbell Heights Substation and Willoughby Substation, as requested by TP.

Please feel free to add your comments.

Thanks,

Lynn
-----Original Appointment-----
From: Lin, Lynn
Sent: 2024, January 25 3:55 PM
To: Lin, Lynn; Pradhan, Anil; Guite, Mike; Burt, Ed; Zhang, Fan; Zou, Ming
Cc: Shafi, Shehzad
Subject: Campbell Heights and Willoughby Substations
When: 2024, February 07 9:30 AM-11:00 AM (UTC-08:00) Pacific Time (US & Canada).
Where: EDMB02, Meeting Room 5

Hi all,

I would like to invite you to a meeting that has been called to discuss the transmission solution for Campbell Heights Substation (CBS) and Willoughby Substation (WIB), along with related topics.

Thanks,

Lynn

From: Pradhan, Anil <Anil.Pradhan@bchydro.com>
Sent: 2024, January 24 3:29 PM
To: Guite, Mike <Mike.Guite@bchydro.com>; Burt, Ed <Ed.Burt@bchydro.com>
Cc: Zou, Ming <Ming.Zou@bchydro.com>; Lin, Lynn <Lynn.Lin@bchydro.com>; Zhang, Fan <Fan.Zhang@bchydro.com>
Subject: RE: Campbell Heights and Willoughby Substations

Hi Mike:

Thank you for your response. I will organize a meeting to discuss further on this topic. SGS stands for Stations Growth and Sustainment, it's our department name led by Ed Burt. Thanks.

Regards,

Anil

From: Guite, Mike <Mike.Guite@bchydro.com>
Sent: 2024, January 24 2:49 PM
To: Pradhan, Anil <Anil.Pradhan@bchydro.com>; Burt, Ed <Ed.Burt@bchydro.com>
Cc: Zou, Ming <Ming.Zou@bchydro.com>; Lin, Lynn <Lynn.Lin@bchydro.com>; Zhang, Fan <Fan.Zhang@bchydro.com>
Subject: RE: Campbell Heights and Willoughby Substations

Thanks Anil,

Please go ahead and book some time with us to discuss the Langley/Surrey plan in greater detail. My outlook calendar is up-to-date.

With today's announcement from the BCUC rejecting the Lower Mainland Reactive Power Project we may have some of our area plans also having to change, and could impact our plans here also.

I have a few comments/questions:

- Yes, I agree we have to update Copperleaf and the Investment Summary to include the transmission component to each of the substation plans. I'm unclear why we would want to raise these as separate projects, because one without the other would not make any sense. Precedent from prior projects is that a new substation project includes the transmission to interconnect that substation.

- Do we have the prospective station locations for both Campbell Heights and for Willoughby? I'm not clear on how you arrived at the 22km distance. We can help look at prospective costs to factor in to the site selection decision making. I agree that if we can select sites that are closer to McLellan we will save considerable transmission costs; once we see the proposed sites we can offer some additional feedback and this can be weighed against the other site selection factors.

- These almost certainly will be underground cables. The Project Delivery cost estimates for 230kV cables back in 2019 was at $9.6M/km (2L146); however this has grown on our 2L51 partial replacement project to $20M/km (but we don't expect it will go that high for these greenfield projects). For reference when we build VCCT we were at $5M/km, and that included drilling under False Creek and the Mount Pleasant Sub interconnection costs.

- I tend to agree that a stronger system design would be to supply the new stations from the McLellan bus, especially seeing as we plan to add the 500kV step-down also. We would likely run into system loading issues trying to loop these off 2L76; that former 360kV line from Rosedale to Ingledow is already heavily chopped and loaded; we will create future problems for ourselves if we keep trying to hang more load off it. Some diagrams of ultimate station layout would be helpful.

- Sorry, I don't know what the SGS stands for… is that the code for one of the proposed new substations?

Regards,
Mike

From: Pradhan, Anil <Anil.Pradhan@bchydro.com>
Sent: 2024, January 24 2:01 PM
To: Burt, Ed <Ed.Burt@bchydro.com>; Guite, Mike <Mike.Guite@bchydro.com>
Cc: Zou, Ming <Ming.Zou@bchydro.com>; Lin, Lynn <Lynn.Lin@bchydro.com>; Zhang, Fan <Fan.Zhang@bchydro.com>
Subject: Campbell Heights and Willoughby Substations

Hi Ed/Mike:

As you know we are working Campbell Heights and Willoughby 230/25kV, 200MVA substations in Langley area. The ISD is in F2032. They also have transmission components. In order to coordinate among us (SP &TP) we had a meeting this morning and following is the summary.

1. During Placemat session there was an understanding that these 2 substations will get 230kV supply by looping in 2L76. However, now, considering the locations of the substations TP has requested SP to consider supply from MLN. It requires 4 line positions in MLN 230kV bus and substation extension. **SP is looking into its feasibility. It will also increase the stations scope and cost.**
2. In the SGS capital plan, only cost of the stations scope has been included considering there will be separate transmission projects to connect these stations- this was an understanding during Placemat session. Now, we found that there is no separate transmission line projects in capital plan to connect these two stations. **This issue needs to be discussed and resolved as soon as possible.**

If we connect these stations with 230kV cables (~22km), the transmission cost will be substantially more than the substation cost. Please suggest how we can move forward. Thanks.

Regards,

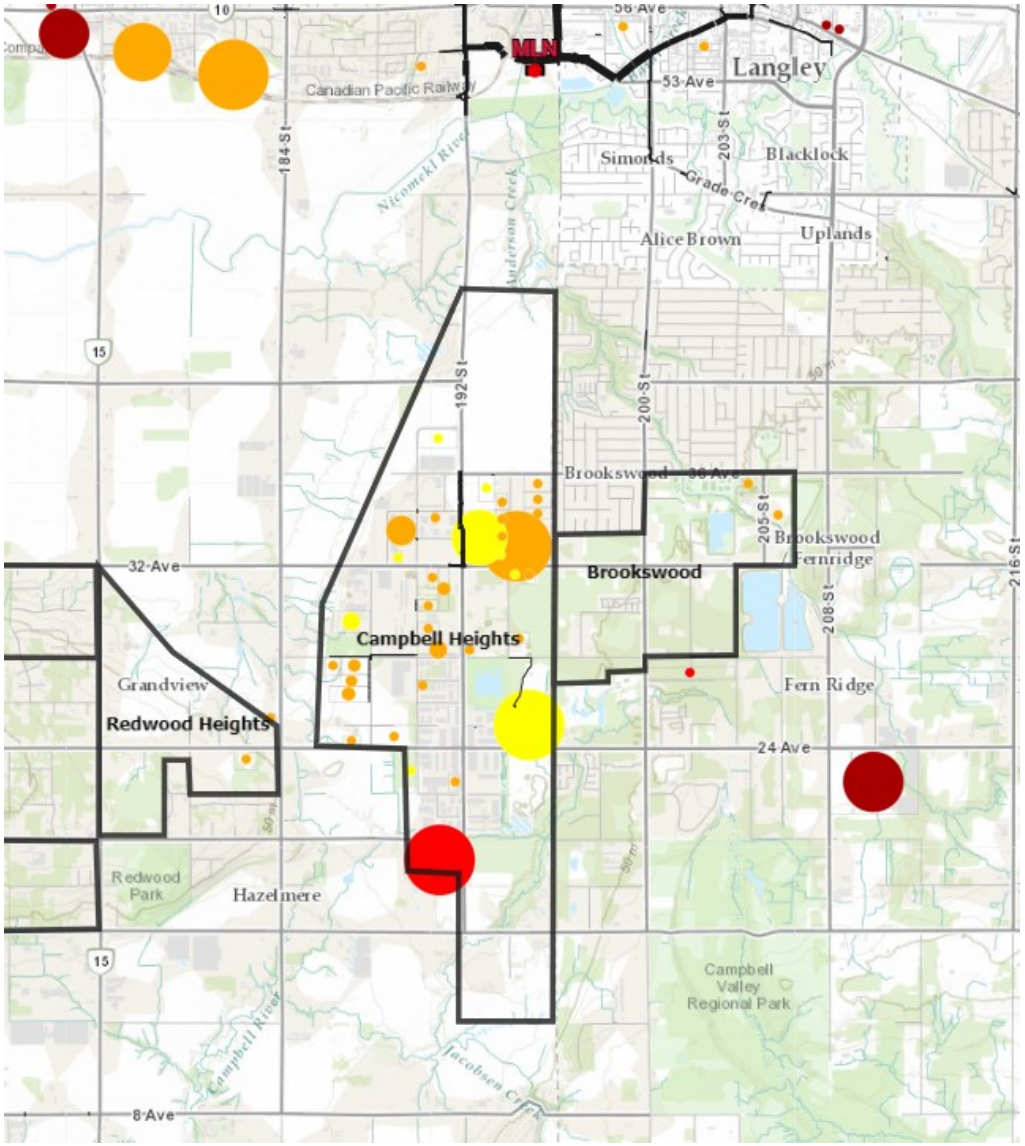
Anil

From: Manurung, Cynthia
Sent: 2023, December 05 5:13 PM
To: Chwaklinski, David
Cc: Ellis, Aaron
Subject: RE: Load growth Mapping for Campbell Heights/Willoughby

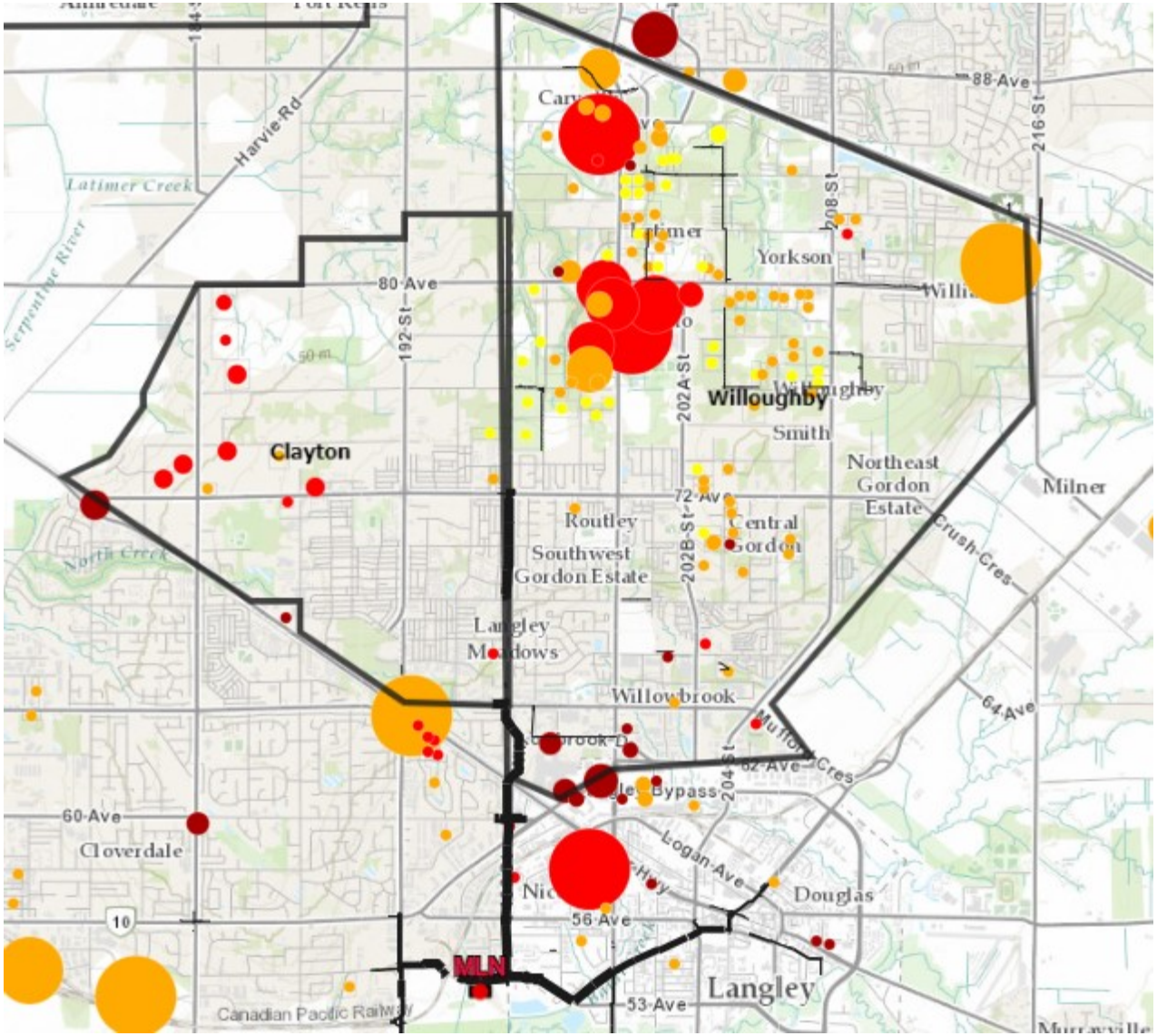
Hi David,

196 St is the border between Surrey and Langley. Campbell Heights neighborhood is within City of Surrey jurisdiction.

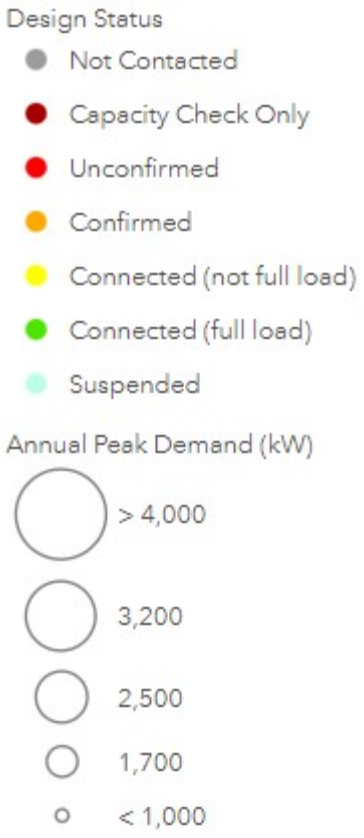
- Campbell Heights (CBM) substation service area is planned to support growth in Campbell Heights, Brookswood, and support Redwood Heights.



- Willoughby (WLB) substation service area is planned to support growth in Willoughby and Clayton


Harvie Rd
Latimer Creek
Serpentine River
88 Ave
216 St
208 St
Latimer
Yorkson
80 Ave
192 St
202A St
Willoughby
Smith
Clayton
Northeast Gordon Estate
Milner
72 Ave
Routley
Southwest Gordon Estate
202B St
Central Gordon
Crush Cres
North Creek
Langley Meadows
Willowbrook
64 Ave
Mufford Cres
62 Ave
204 St
Bypass
60 Ave
Cloverdale
Logan Ave
Douglas
10
56 Ave
MLN
Langley
53 Ave
Canadian Pacific Railway

Legend:



Cynthia Manurung, P.Eng
Regional Distribution Planner – Surrey/Langley/White Rock

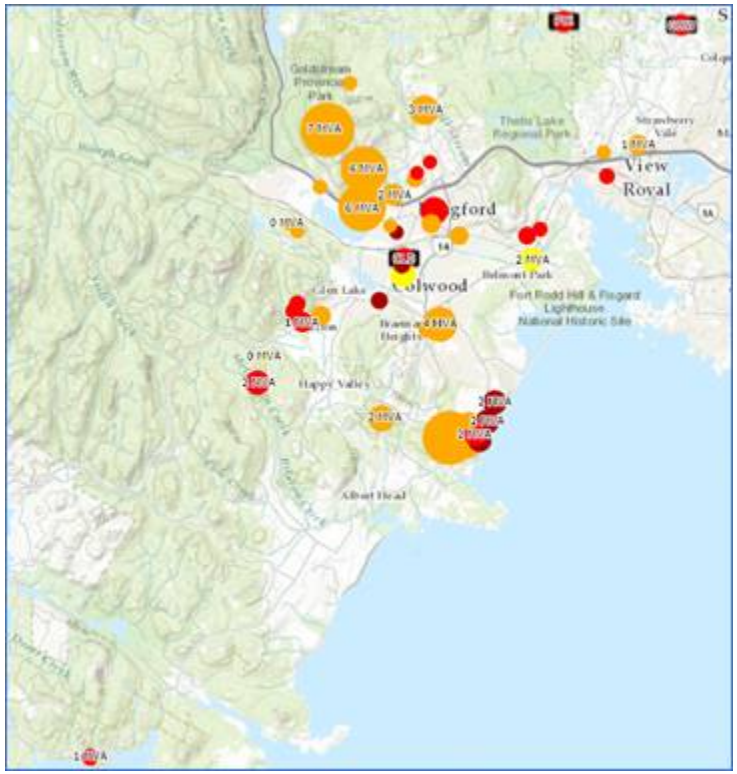
M 604 812 4322

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2023, December 05 11:26 AM
To: Manurung, Cynthia <Cynthia.Manurung@bchydro.com>
Cc: Ellis, Aaron <Aaron.Ellis@bchydro.com>
Subject: Load growth Mapping for Campbell Heights/Willoughby

Good Morning Cynthia, I am the PE for the New Willoughby and Campbell Heights substations and I am coming to you as you are shown as the FV West Distribution planner. If this is not the case could you let me know who I should be talking to?

This morning a question came up related to the siting of the stations and the projected load growth in the langley area. It was pointed out that while the Campbell Heights load growth information is noted to be in the Langley area the actual substation (Campbell Heights) is located in Surrey. This could cause some challenges in stakeholder engagement when we ultimately talk to Surrey about constructing the station along the lines of " why are you building in surrey when the load is in langley?". Is it possible to get a map of some sort showing the potential load growth in the both areas similar to the map below which is for Goldstream? This would make it much easier for us to conduct our stakeholder engagement if we can show that most of the load increase is on the Surrey side of the border.



If you could provide this for the Campbell Heights and Willoughby areas it would be very helpful. If you have any questions please give me a call. Thanks

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnection

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M **778 833 3740**
E david.chwaklinski@bchydro.com

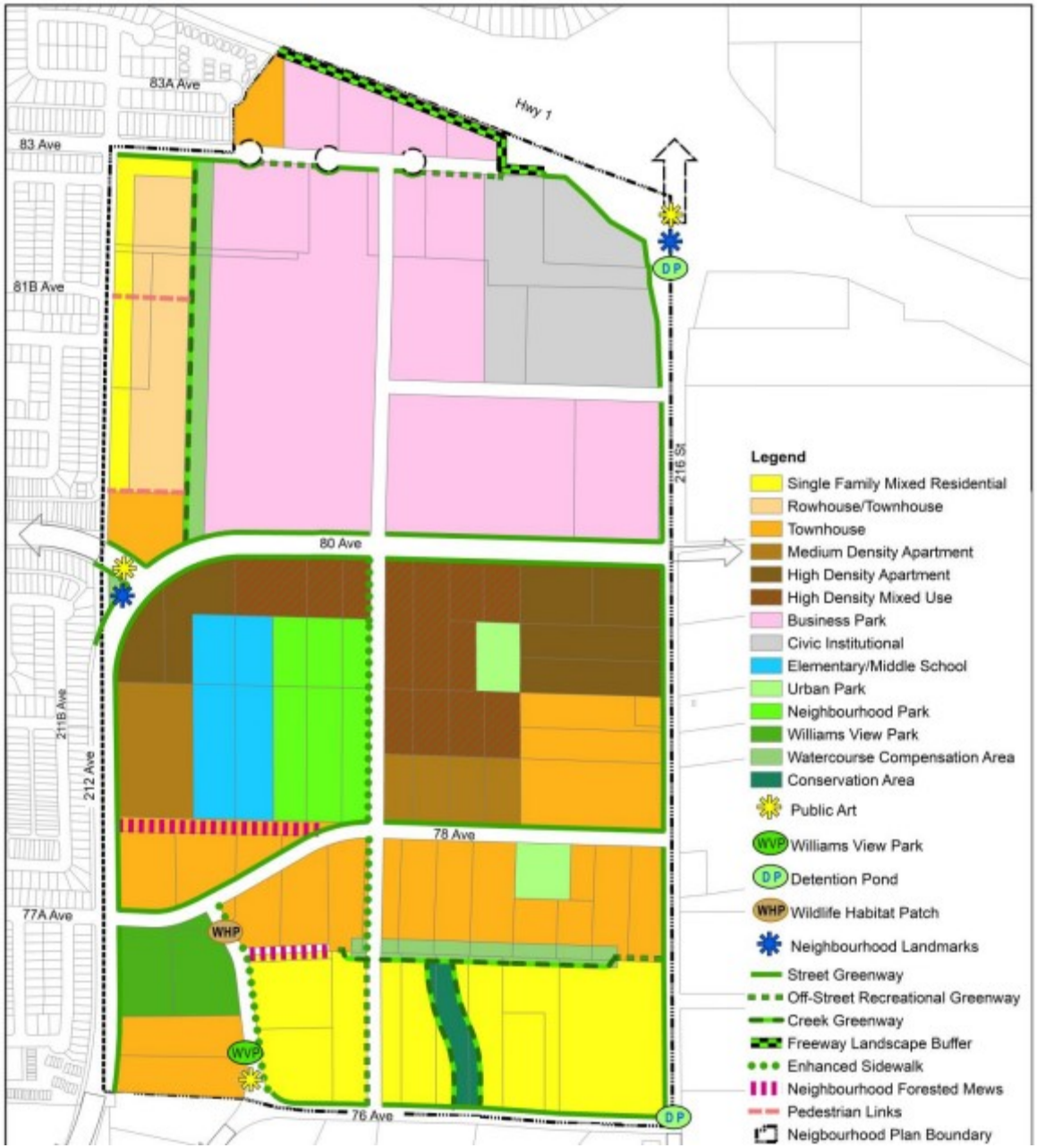
From: Nick Hosseinzadeh <nhosseinzadeh@tol.ca>
Sent: 2024, May 22 11:22 AM
To: Hepple, Robert
Cc: Sherevkulov, Dmitry; Chwaklinski, David
Subject: RE: [EXTERNAL] CONFIDENTIAL Willoughby Substation Site Alternatives

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Hi Robert,

Thanks for sharing. The Township would strongly recommend against the site proposed. It is square in a neighbourhood plan that is currently going under revisions to increase densities. As outlined in the below chart, it would significantly compromise the neighbourhood plan, and would constitute a significant lost opportunity to provide housing stock. This plan is proceeding for final adoption this summer, as well.

Map 2 | Integrated Neighbourhood Concept



From: Hepple, Robert Robert.Hepple@bchydro.com
Sent: Wednesday, May 22, 2024 9:04 AM
To: Nick Hosseinzadeh
Cc: Sherevkulov, Dmitry ; Chwaklinski, David
Subject: [EXTERNAL] CONFIDENTIAL Willoughby Substation Site Alternatives

Hello Nick,
Attached are the sites under consideration.
Please treat this information as CONFIDENTIAL.
We need 12 acres close to the Willoughby area load.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Nick Hosseinzadeh <nhosseinzadeh@tol.ca>
Sent: 2024, May 21 3:01 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: [External] Willoughby Substation

Hi Robert,

As per our conversation, if you can provide some detail of the addresses for the Willoughby potential locations that would be appreciated, in confidence, of course.

Nick Hosseinzadeh
Intergovernmental Relations

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From: Cormier, Matthew <MCormier@klohn.com>
Sent: 2025, January 31 1:36 PM
To: Matthew Brock; Lee, Dylan
Cc: Sherevkulov, Dmitry; Will Markey; Chwaklinski, David; Ryan Lowe
Subject: RE: [External] RE: Willoughby Substation Geotechnical Investigation - BOSA property
Attachments: Willoughby Substation Geotechnical Investigation 01302025.pdf

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Hi Matt,

See attached updated site investigation figure.

Thanks
Matt

Matthew Cormier, P.Eng.
Geological Engineer

Klohn Crippen Berger 500-2955 Virtual Way, Vancouver BC V5M 4X6, CANADA
T +1 604 251 8557 | C +1 778 229 9241 | mcormier@klohn.com | www.klohn.com

ISO 9001 ▪ ISO 14001 ▪ ISO 45001

If you have received this e-mail in error, please delete the original message.

From: Matthew Brock
Sent: January 30, 2025 2:07 PM
To: Cormier, Matthew ; Lee, Dylan
Cc: Sherevkulov, Dmitry ; Will Markey ; Chwaklinski, David ; Ryan Lowe
Subject: RE: [External] RE: Willoughby Substation Geotechnical Investigation - BOSA property

Matt, thanks for the update. Will let the tenant know of the schedule below.

I understand AH25-C may be moving based on attached. If so, can you please provide an updated site plan indicating the new location.

Best,

Matt

--
Matthew Brock
Director, Acquisitions
O: 604.299.1363 | C: 778.886.7440

From: Cormier, Matthew <MCormier@klohn.com>
Sent: Thursday, January 30, 2025 2:04 PM
To: Lee, Dylan <Dylan.Lee@bchydro.com>; Matthew Brock <mbrock@bosaproperties.com>
Cc: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Will Markey <wmarkey@bosaproperties.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Ryan Lowe <rlowe@bosaproperties.com>
Subject: RE: [External] RE: Willoughby Substation Geotechnical Investigation - BOSA property

Hi Matt,

I realize I haven't responded with a time. I anticipate it will be around 2 pm on Feb 5th and we'll be around the whole day Feb 6th.

We are going to start with the hole on the other side of the property off of 196 St and then moving over to the adjacent property, and if we have time we'll drill AH25-C.

On Feb 6th, we are using hand tools so there shouldn't be any noise, but our staff will be walking in the woods around the property all day.

Thanks

Matt
Matthew Cormier, P.Eng.
Geological Engineer

Klohn Crippen Berger 500-2955 Virtual Way, Vancouver BC V5M 4X6, CANADA
T +1 604 251 8557 | C +1 778 229 9241 | mcormier@klohn.com | www.klohn.com

ISO 9001 ▪ ISO 14001 ▪ ISO 45001

If you have received this e-mail in error, please delete the original message.

From: Lee, Dylan <Dylan.Lee@bchydro.com>
Sent: January 22, 2025 4:28 PM
To: Matthew Brock <mbrock@bosaproperties.com>
Cc: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Will Markey <wmarkey@bosaproperties.com>; Cormier, Matthew <MCormier@klohn.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Ryan Lowe <rlowe@bosaproperties.com>
Subject: RE: [External] RE: Willoughby Substation Geotechnical Investigation - BOSA property

Thanks Matt for getting back. Yup, Understood you are only commenting on the BOSA properties. We have engaged the owner owners for test holes outside BOSA's land.

Matt C., can you please let me know if you have a rough time when you will tackle the test hole (AH-25C) by the dwelling. I understand this one might be time dependent and we will probably save this for last.

Cheers
Dylan

_____

Dylan Lee, P. Eng. | Senior Geotechnical Engineer, Transmission Lines Engineering

BC Hydro
7th Floor - 6911 Southpoint Drive, A02
Burnaby, BC V3N 4X8

P 604 528 2318
M 604 809 2666
E dylan.lee@bchydro.com

bchydro.com

Smart about power in all we do.

From: Matthew Brock <mbrock@bosaproperties.com>
Sent: 2025, January 22 4:02 PM

To: Lee, Dylan <Dylan.Lee@bchydro.com>
Cc: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Will Markey <wmarkey@bosaproperties.com>; Cormier, Matthew <MCormier@klohn.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Ryan Lowe <rlowe@bosaproperties.com>
Subject: [External] RE: Willoughby Substation Geotechnical Investigation - BOSA property

You don't often get email from mbrock@bosaproperties.com. Learn why this is important

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Dylan, confirming the dates for Feb 5 & 6. The tenant is curious on the schedule/times as they are trying to be absent for any loud periods.

Best,

Matt

--
Matthew Brock
Director, Acquisitions
O: 604.299.1363 | C: 778.886.7440

From: Matthew Brock
Sent: Monday, January 20, 2025 10:06 AM
To: Lee, Dylan <Dylan.Lee@bchydro.com>
Cc: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Will Markey <wmarkey@bosaproperties.com>; Cormier, Matthew <MCormier@klohn.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Ryan Lowe <rlowe@bosaproperties.com>
Subject: RE: Willoughby Substation Geotechnical Investigation - BOSA property

Hi Dylan, nice to meet you.

Back to you shortly on confirmation for the dates but don’t anticipate any issues, and will confirm if we have any septic design drawings.

Just wanted to point out the plan shows the Bosa Properties lines in Red, but we only own the northern 2 lots at 7507 196th and 7528 194 st. The lots labeled ‘Walla’ and ‘Kool’ in the red outline are outside of our ownership, so we can’t sign off on those drill locations.

Best,

Matt

--
Matthew Brock
Director, Acquisitions
O: 604.299.1363 | C: 778.886.7440

From: Ryan Lowe <rlowe@bosaproperties.com>
Sent: Friday, January 17, 2025 11:15 AM
To: Lee, Dylan <Dylan.Lee@bchydro.com>; Will Markey <wmarkey@bosaproperties.com>; Matthew Brock <mbrock@bosaproperties.com>
Cc: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Cormier, Matthew <MCormier@klohn.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Willoughby Substation Geotechnical Investigation - BOSA property

Hey Dylan,
Including our acquisitions team.

We'll review the below and get back to you ASAP.

Have a great weekend.

😊

--
Ryan Lowe,

Operations Manager, IPP

Bosa Properties
1201 - 838 West Hastings St
Vancouver, BC V6C 0A6

Mobile 604. 619. 4073

From: Lee, Dylan <Dylan.Lee@bchydro.com>
Sent: Friday, January 17, 2025 11:00 AM
To: Ryan Lowe <rlowe@bosaproperties.com>
Cc: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Cormier, Matthew <MCormier@klohn.com>; Chwaklinski, David

<David.Chwaklinski@bchydro.com>
Subject: Willoughby Substation Geotechnical Investigation - BOSA property

Hi Ryan,

Thanks for meeting us on site with Matt and I the other day. I have attached Matt's plan on where we will be targeting our geotechnical investigation (AH series indicates machine auger drilling and the HA series indicate the hand auger).
We are planning to be drill on Feb 5 for the machine dig, and Feb 6 for the hand digging. Please let us know if those dates work with the tenants and that they should keep the access along the driveway to the backyard clear.

With regards to the test hole off of 196th street, I have been given a directive not to utilize BOSA for land clearing and pad building work. We will be doing our test hole just off the road shoulder. Thanks for the offer though.

Can you please check with the tenant or your record if you have the septic design beside the dwelling as we want to check if it's suitable to drive over the connection and the extent of the tank. We may decide to relocate the test hole AH25-C after review and locates of the connection.

Matt (1 778 229 9241) is also CC'd to this email, in case you need to reach out to him directly closer to the date.

Thanks

_____

Dylan Lee, P. Eng**.** | Senior Geotechnical Engineer, Transmission Lines Engineering

BC Hydro
7th Floor - 6911 Southpoint Drive, A02
Burnaby, BC V3N 4X8

P 604 528 2318
M 604 809 2666
E dylan.lee@bchydro.com

bchydro.com

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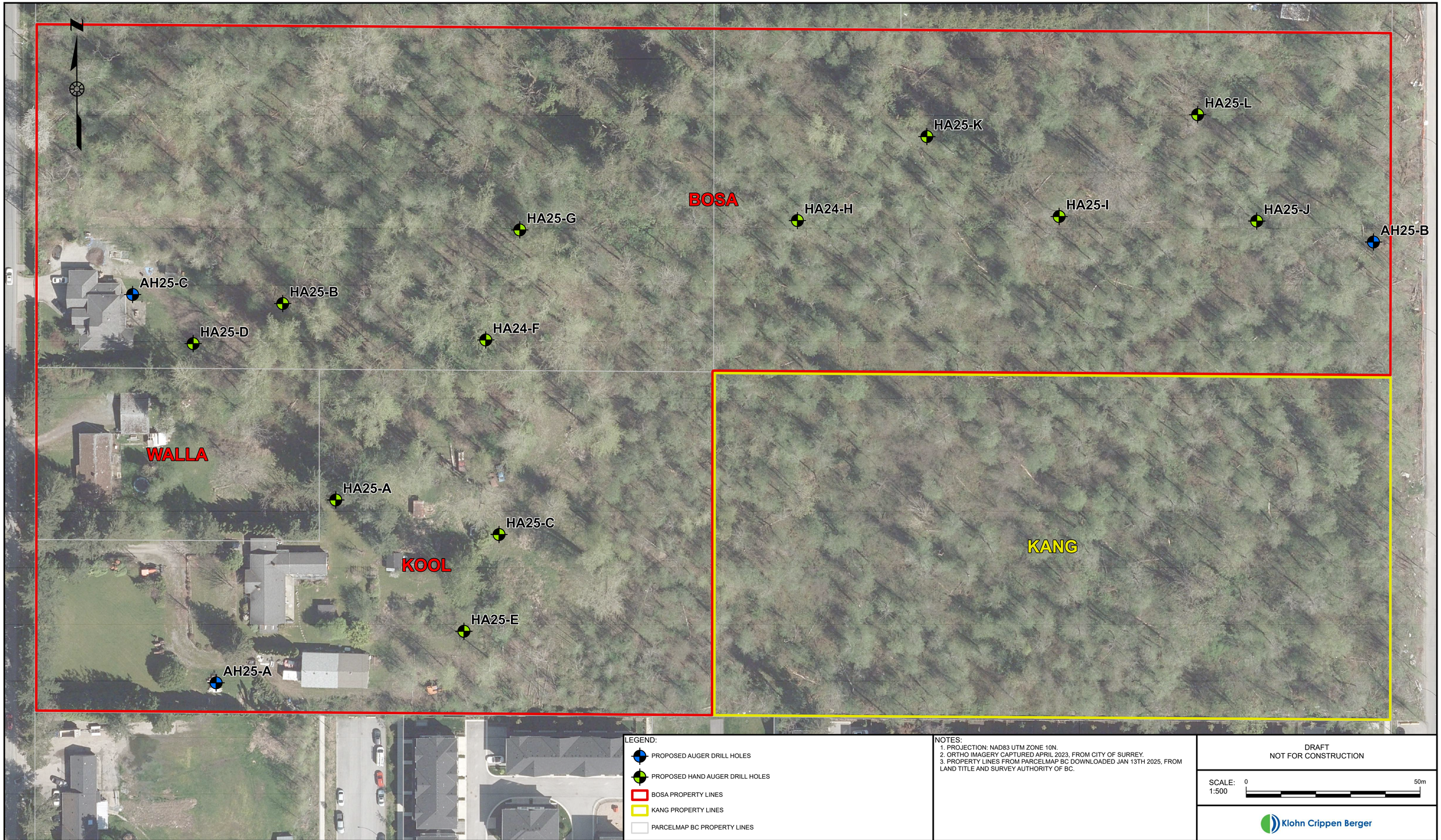
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LEGEND:

- PROPOSED AUGER DRILL HOLES
- PROPOSED HAND AUGER DRILL HOLES
- BOSA PROPERTY LINES
- KANG PROPERTY LINES
- PARCELMAP BC PROPERTY LINES

NOTES:
1. PROJECTION: NAD83 UTM ZONE 10N.
2. ORTHO IMAGERY CAPTURED APRIL 2023, FROM CITY OF SURREY.
3. PROPERTY LINES FROM PARCELMAP BC DOWNLOADED JAN 13TH 2025, FROM LAND TITLE AND SURVEY AUTHORITY OF BC.

DRAFT
NOT FOR CONSTRUCTION

SCALE: 1:500 (0 – 50m)

Klohn Crippen Berger

BC Hydro

P10600A140
WILLOUGHBY SUBSTATION

GEOTECHNICAL SITE INVESTIGATION PLAN

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	M. CORMIER
INDEP CHK	
DFTG	A. WIEBE
DFTG CHK	K. WHITLOCK
INSP	
REV	
ACPT	

NO	REMARKS

REFERENCE DRAWINGS

REVISIONS

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
13JAN2025				01	D	

Z:\P\BC\HCEO\P10600A140 BCH - Willoughby Substation Geotechnical Investigation\400 Drawings\GIS\02_Mapping\ArcGISPro Main\Willoughby Substation\Willoughby Substation.aprx
Drawing Units: Metric
Layout: Layout1
1/13/2025 3:17 PM

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

From: Chwaklinski, David
Sent: 2024, December 12 2:26 PM
To: Lee, Dylan
Cc: Hansen, Adrian; Hepple, Robert; Chwaklinski, David
Subject: RE: [External] RE: Willoughby Substation

Dylan, we will only be investigating one location and that will occur after a conditional purchase agreement is in place. We would only make on conditional agreement at a time. Based on everything I have heard to date we will be investigating the Bosa/Kool Property. IF that changes we will need to pivot in short order (but I doubt it). If it is determined that other properties need to be investigated that would be a separate mobilization (unlikely). If we need to spend the $80 k it would be available however, lets focus on a single site at this time.

From: Lee, Dylan
Sent: Thursday, December 12, 2024 9:22 AM
To: Chwaklinski, David
Cc: Hansen, Adrian
Subject: FW: [External] RE: Willoughby Substation

Hi David,

See cost break down below:

If we do Group 1 and 2 together (same mobilization): $43.3k all in ($22k per group)

If we do each group separately (different mobilization): $40k per Group, so two Group different mobilization is $80 k.
There might be some cost savings (ex. I am not entirely sure we need 10 hours of traffic control for this scope but we are planning for it until we can confirm site access and whether we will be off the road).

Let me know if the project can approve the 80k amount as I am thinking one can only do one group at a time due to property agreement constraints.

Cheers
Dylan

From: Cormier, Matthew <MCormier@klohn.com>
Sent: 2024, December 11 5:08 PM

To: Lee, Dylan <Dylan.Lee@bchydro.com>
Subject: RE: [External] RE: Willoughby Substation

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Hi Dylan,

To be honest, your costs don't really decrease much from what's shown. The auger, traffic management, and lab testing costs wouldn't change. I assumed 2 people for a half or 1 person for a full day for test pitting and reduced some of the drill log and report hours assuming they're separate reports. Unfortunately they don't really cut in half because your field time and sub-contractor costs don't change for the scope which is the real cost driver.

The most cost effective way would be to do a truck mounted hole at each site in one day. That has significant efficiencies for the cost of the project.

Let me know which way you want me to go and I'll put in a formal proposal.

Prepared By: **M. Cormier**

	PROJECT BUDGET WORK BREAKDOWN STRUCTURE (WBS)			Project Manager/ Geotechnical Engineer (E3) M. Cormier	Project (Senior) Reviewer (E7) A. Aboutalebi	Junior Geotechnical Engineer (E2) J. Mah	GIS Technician (T2) A. Weibe	Total Hours	KCB Labour Fees	KCB Expe
			Fee per hour:	$158	$270	$140	$110			
				Hours	Hours	Hours	Hours			
01	Project Management		Subtotals:	4	0	0	0	4	$632.00	
	Subtask 01 (Level 3)	Project Management		4				4	$632.00	
02	Geotechnical Investigation		Subtotals:	34	7	76	3	120	$18,232.00	$3,5
	Subtask 01 (Level 3)	Initial Site Visit		4				4	$632.00	$
	Subtask 02 (Level 3)	Field Prep and Coordination		12		4		16	$2,456.00	
	Subtask 03 (Level 3)	Field Investigation		2		24		26	$3,676.00	$5
	Subtask 04 (Level 3)	Soil Logs and Laboratory Testing		4	2	16		22	$3,412.00	$2,9
	Subtask 05 (Level 3)	Draft Geotechnical Factual Report		8	4	24	2	38	$5,924.00	
	Subtask 06 (Level 3)	Final Geotechnical Factual Report		4	1	8	1	14	$2,132.00	
TOTALS				38	7	76	3	124	$18,864.00	$3,5

Matthew Cormier, P.Eng.
Geological Engineer

Klohn Crippen Berger 500-2955 Virtual Way, Vancouver BC V5M 4X6, CANADA
T +1 604 251 8557 | C +1 778 229 9241 | mcormier@klohn.com | www.klohn.com

ISO 9001 ▪ ISO 14001 ▪ ISO 45001

If you have received this e-mail in error, please delete the original message.

From: Lee, Dylan <Dylan.Lee@bchydro.com>
Sent: December 11, 2024 2:28 PM
To: Cormier, Matthew <MCormier@klohn.com>
Subject: RE: [External] RE: Willoughby Substation

Thanks Matt but can you include the cost for just one Group please. For the augering just assume a full day. We can do more than one auger hole in areas where we can get easy access.

Cheers
Dylan

From: Cormier, Matthew <MCormier@klohn.com>
Sent: 2024, December 11 12:08 PM
To: Lee, Dylan <Dylan.Lee@bchydro.com>
Subject: [External] RE: Willoughby Substation

Don't click on links or open attachments unless you trust the sender and are expecting the link or attachment. If you suspect this message to be phishing, please report it by clicking the Report Message button in the Outlook toolbar and select "Phishing."

Hi Dylan,

Thanks for the call yesterday and going over the scope with me. Based on our discussion, I've updated the high level project cost and have included a screenshot of our budget breakdown below which is inclusive of both proposed site (Group 1 and Group 2). The assumptions for this budget are as follows, but these will need to be confirmed with the drillers:

- 1 day of auger drilling on the gravel shoulder of the road to complete a single 15 m auger hole at each site (half day per hole). I've assumed $14,000 for the drilling but this will need to be confirmed with Geotech (I haven't gotten them to update their quote yet).
- Traffic Management Plans, Permit submissions, and traffic control for the auger scope (one 10hr day on site).

- Assuming both drill holes will be completed during the same mobilization (i.e. same day).
- 1 day for handaugers/ shovel test pits for both sites (half day each). I've include costs for 2 junior engineers to do the handauger/shovel test pits for safety purposes and reducing the physical workload for that if you're okay with that.
- Assuming hand auger/testpits will be completed during the same day for both sites.
- Lab testing to be completed only on samples recovered from the auger drilling.
- 1 geotechnical factual report which encompasses both sites (no separate reports).

Prepared By: **M. Cormier**

	PROJECT BUDGET WORK BREAKDOWN STRUCTURE (WBS)			Project Manager/ Geotechnical Engineer (E3) M. Cormier	Project (Senior) Reviewer (E7) A. Aboutalebi	Junior Geotechnical Engineer (E2) J. Mah	GIS Technician (T2) A. Weibe	Total Hours	KCB Labour Fees	KCB Exp
			Fee per hour:	$158	$270	$140	$110			
				Hours	Hours	Hours	Hours			
01	Project Management		Subtotals:	4	0	0	0	4	$632.00	
	Subtask 01 (Level 3)	Project Management		4				4	$632.00	
02	Geotechnical Investigation		Subtotals:	34	7	100	3	144	$21,592.00	$3,
	Subtask 01 (Level 3)	Initial Site Visit		4				4	$632.00	
	Subtask 02 (Level 3)	Field Prep and Coordination		12		4		16	$2,456.00	
	Subtask 03 (Level 3)	Field Investigation		2		32		34	$4,796.00	$
	Subtask 04 (Level 3)	Soil Logs and Laboratory Testing		4	2	24		30	$4,532.00	$2,
	Subtask 05 (Level 3)	Draft Geotechnical Factual Report		8	4	32	2	46	$7,044.00	
	Subtask 06 (Level 3)	Final Geotechnical Factual Report		4	1	8	1	14	$2,132.00	
TOTALS				38	7	100	3	148	$22,224.00	$3,

Please let me know if you have any changes to the scope presented and I can formalize a proposal for you.

Thanks
Matt

Matthew Cormier, P.Eng.
Geological Engineer

Klohn Crippen Berger 500-2955 Virtual Way, Vancouver BC V5M 4X6, CANADA
T +1 604 251 8557 | C +1 778 229 9241 | mcormier@klohn.com | www.klohn.com

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-----Original Appointment-----
From: Lee, Dylan <Dylan.Lee@bchydro.com>
Sent: December 10, 2024 12:12 PM
To: Lee, Dylan; Cormier, Matthew
Subject: Willoughby Substation
When: December 10, 2024 4:00 PM-4:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Hi Matt,

Thanks for sending me the estimate. Let's talk it through. Hopefully this time works. If not feel free to suggest a timeslot.

Microsoft Teams Need help?

Join the meeting now

Meeting ID: 239 863 963 212

Passcode: XU9WQ2Q6

Dial in by phone

+1 604-343-0415,,487067686# Canada, Vancouver

Find a local number

Phone conference ID: 487 067 686#

For organizers: Meeting options | Reset dial-in PIN

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-BCHydroDisclaimerID5.2.8.1541

From: Hepple, Robert
Sent: 2024, May 28 8:05 AM
To: Sherevkulov, Dmitry; Chan, David Y.M.; Parmar, Surinder; Chwaklinski, David; Simpson, Lauren
Subject: RE: Alternative Willoughby Locations
Attachments: Willoughby Final 4 Options.jpg

Dmitry,
Let's replace it with the first property and see what we can do with it.
Robert

From: Sherevkulov, Dmitry
Sent: 2024, May 27 2:15 PM
To: Hepple, Robert ; Chan, David Y.M. ; Parmar, Surinder ; Chwaklinski, David ; Simpson, Lauren
Subject: RE: Alternative Willoughby Locations

Hi Robert,

The second property below is off the table now. There is an Option to Purchase on the title and according to the document the option can be exercised until November 2025.

Regarding the ALR property, it also has an Option to Purchase registered on the title. However, it expired in March 2024 and it is unclear whether the Purchaser is proceeding with an acquisition. I will find out when I contact the owner.

_____

Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604 623 3566
M 604 690 9836
E dmitry.sherevkulov@bchydro.com

bchydro.com

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From: Sherevkulov, Dmitry
Sent: 2024, May 22 3:04 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

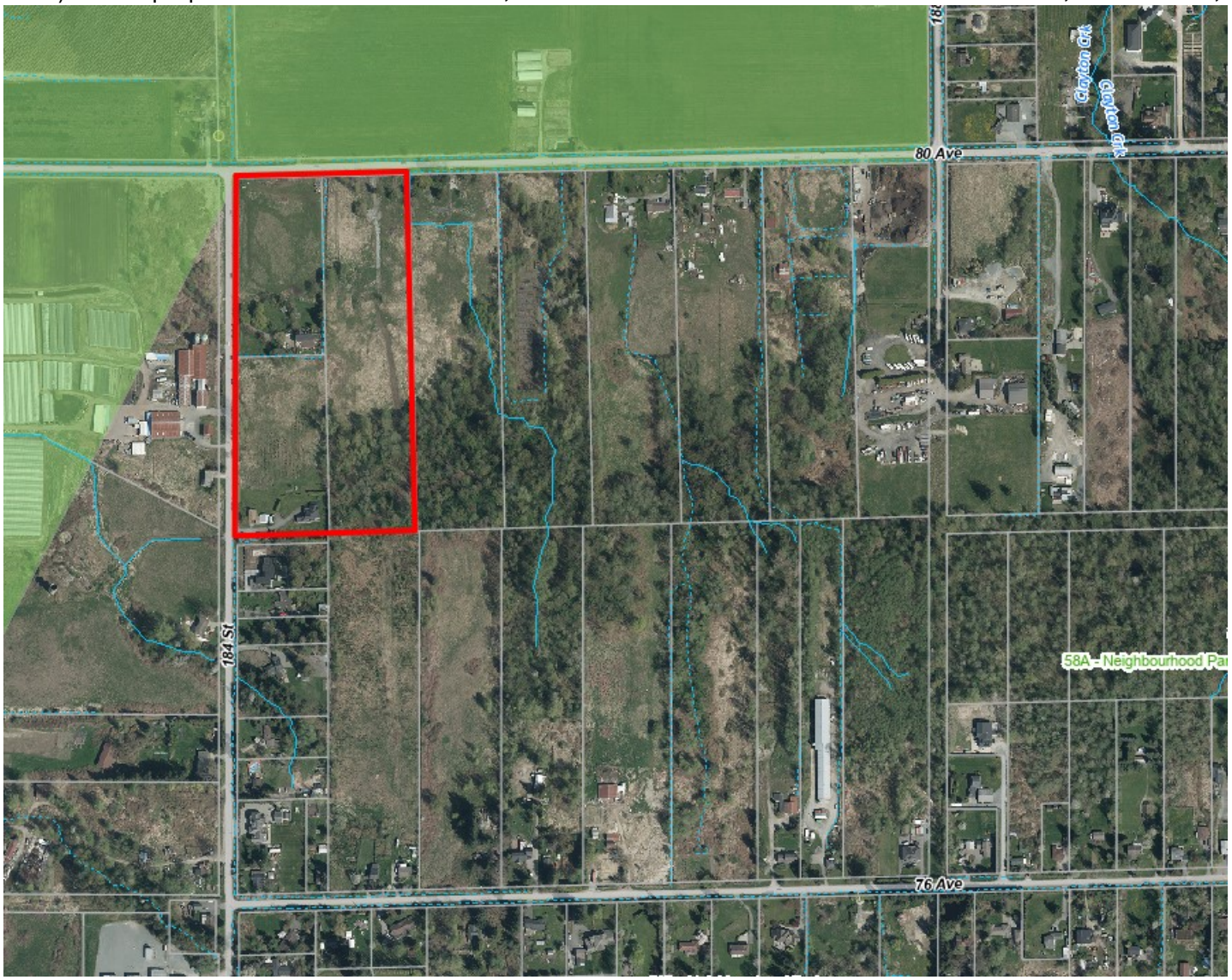
Hi Robert,

There are a couple of options I found in this area. The problem is that most properties north of 80Ave are in ALR. Also, this area has numerous creeks. Tyler previously identified 4 options at 192St & 80Ave, properties on the west side of 192St have multiple creeks so only east of 192St is suitable. However, it would require an assembly of 5-6 lots.

1) Two properties near 184St and 76Ave – 10 acre and 8 acres. PID: 010-996-001, 010-996-028



2) Three properties near 184St and 80Ave, 4.7 acres + 4.9 acres + 9.5 acres. PID: 002-904-977, 011-175-842, 011-175-869



Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

BC Hydro
333 Dunsmuir St, 12th floor
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E dmitry.sherevkulov@bchydro.com

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From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, May 22 2:23 PM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Dmitry,
Attached is a map indicating the area we should focus on.
See if you can find 10 to 12 acres with minimum assembly.
We can include it in our site tour.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Sent: 2024, May 22 1:02 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Hi Robert,

Sounds good, I will search for another alternative in that area.

_____

Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604 623 3566
M 604 690 9836
E dmitry.sherevkulov@bchydro.com

bchydro.com

Smart about power in all we do.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, May 22 12:22 PM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: Alternative Willoughby Locations

Dmitry,
Nick from ToL is not supportive on land over by the University on the east side where we had identified the Realtor Joe Varing site.
Let's look on west of 196th along 80th ave to identify 12 acres of non-ALR land.
Lauren please delete the Varing site as an alternative.

Robert

Robert Hepple P.Eng.

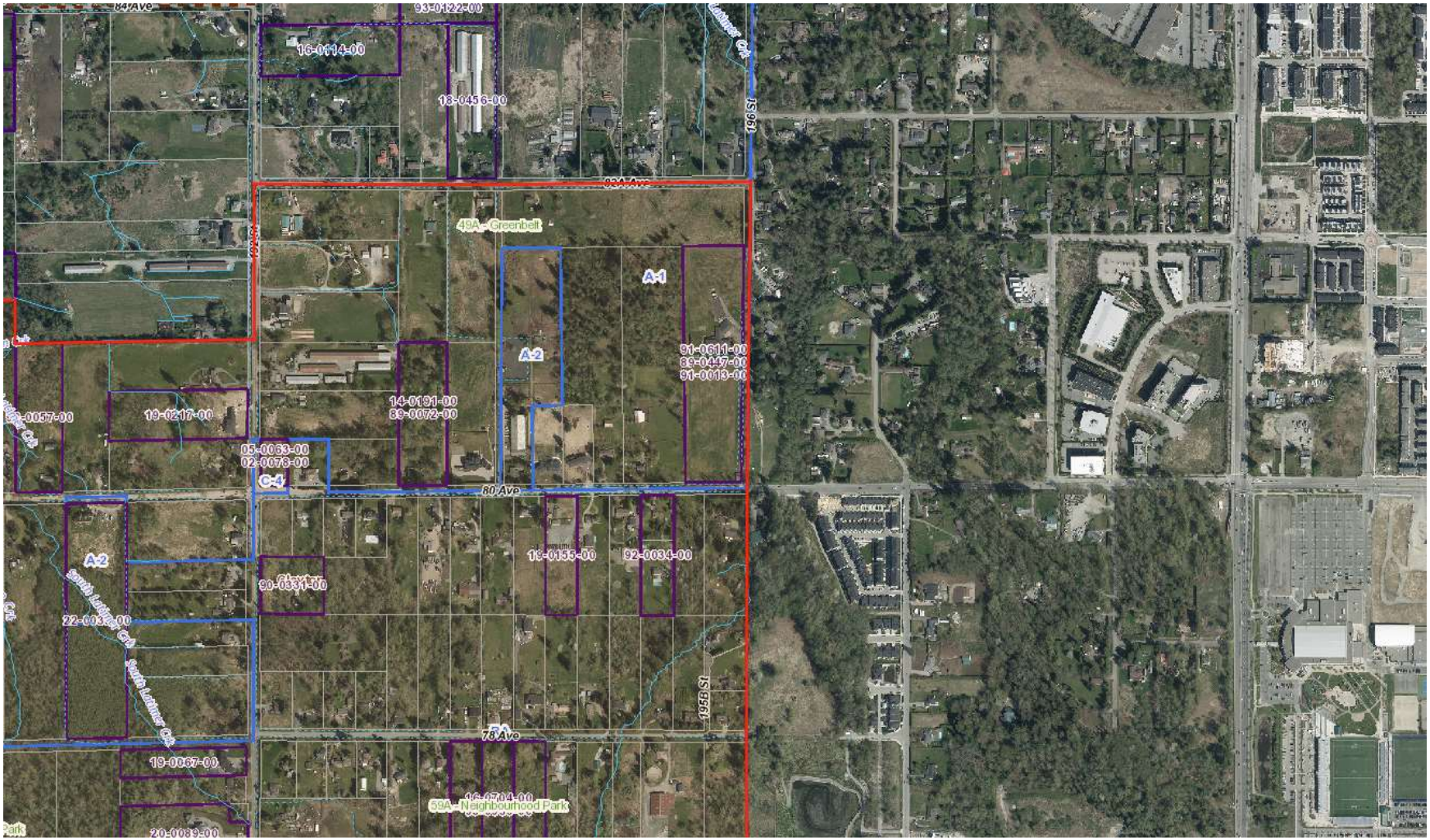
Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

Smart about power in all we do.

From: Nick Hosseinzadeh <nhosseinzadeh@tol.ca>
Sent: 2024, May 22 12:13 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: [External] As discussed

As discussed, best bet may likely be on the Surrey side of the border.
As you can see, there are many large, undeveloped parcels ranging from 2.5-10 acres in size just down 80th Ave across the Surrey border.
Although they are generally acreages / being farmed today, they are NOT within the ALR. This is future, currently unserviced, future development land.
Additionally, land values in N Clayton were ~$2.5MM/A-$3MM/A a couple years ago. Compared to ~$6MM/A+ in Willougby where neighbourhood services have been installed.


84 Ave
93-0122-00
16-0114-00
18-0456-00
196 St
49A - Greenbelt
A-1
A-2
91-0611-00
89-0447-00
91-0013-00
14-0191-00
89-0072-00
19-0217-00
05-0063-00
02-0078-00
C-4
80 Ave
A-2
19-0155-00
92-0084-00
90-0331-00
22-0033-00
South Ladner Crk
195B St
78 Ave
19-0067-00
59A - Neighbourhood Park
20-0089-00


tions
PKP
HRD
ANNIEDALE
PORT KELLS
CARVOLTH
JERICHO
EAST CLAYTON NORTH
Willoughby ALR 1
Option 2
Option 3
Option 4
Art's Nursery Garden & Home
Cineplex Cinemas Langley
Extreme Air Park
MVP Athletic Supplies Ltd
Langley Events Centre
Willoughby Community Park
Honeybee Centre
Fraser Hwy
Harvie Rd
88 Ave
92 Ave
96 Ave
86 Ave
80 Ave
72 Ave
200 St
202a St
192 St
184 St
Golden Ears Wy

From: Jiang, Kally
Sent: 2024, September 16 4:35 PM
To: Chwaklinski, David
Cc: Hepple, Robert
Subject: RE: Bosa property Confirmation
Attachments: WIB-E05-SK006-Op1-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.pdf; WIB-E05-SK006-Op2-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.pdf

Hi, Dave,

As requested, please check attached options for info and let me know if there is any concern.

Thanks,
Kally

From: Chwaklinski, David
Sent: 2024, September 16 3:57 PM
To: Jiang, Kally
Cc: Chwaklinski, David ; Hepple, Robert
Subject: Bosa property Confirmation

Hi Kally, I have reviewed the Bosa property and confirmed that the Bosa parcels are 7508 196th St. and 7528 194th St. The Kang property is 7451 196th St. These are shown in the attached PDF. Please revise your layout so that there are two options to consider. Option 1 is to reverse the layout you showed me so that the 25 kV yard is on the Kang property and the 60 kV yard is on the eastern portion of the Bosa Property . Option 2 is to leave the 25 kV at the top and use cables to connect the 60 kV Yard located on the west portion of the Bosa property to the 230/60 kV transformers that will be located on the Kang Property.

Please let me know if you need any more clarification.

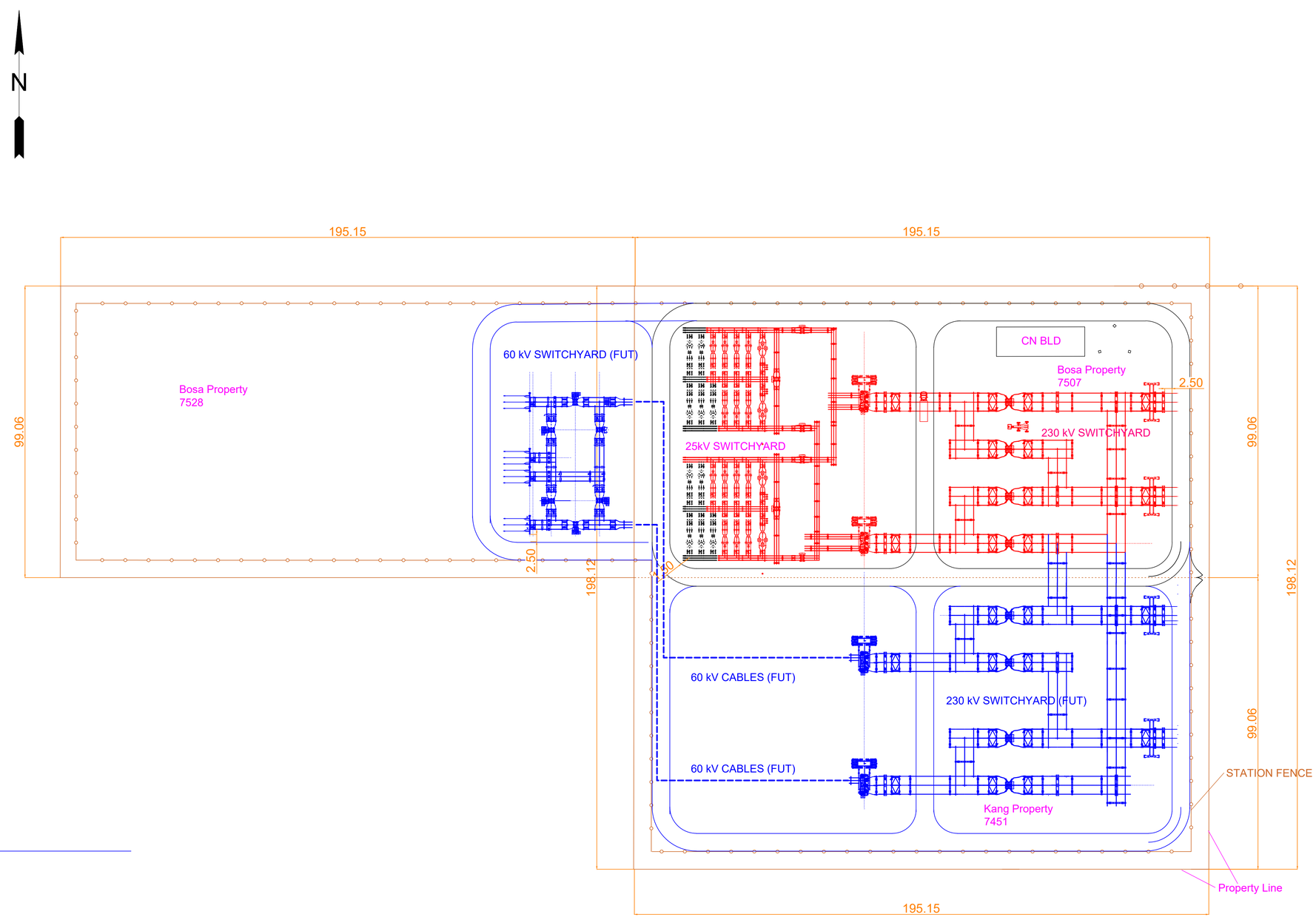
David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

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E david.chwaklinski@bchydro.com

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE



COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIP\D2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240913-New for Bosa+Kang\WIB-E05-SK006-Op5-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.dwg
Drawing Unit = Metric (4)
JIANG, KAI
9/16/2024 4:30 PM

REFERENCE DRAWINGS

NO	REMARKS
	REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

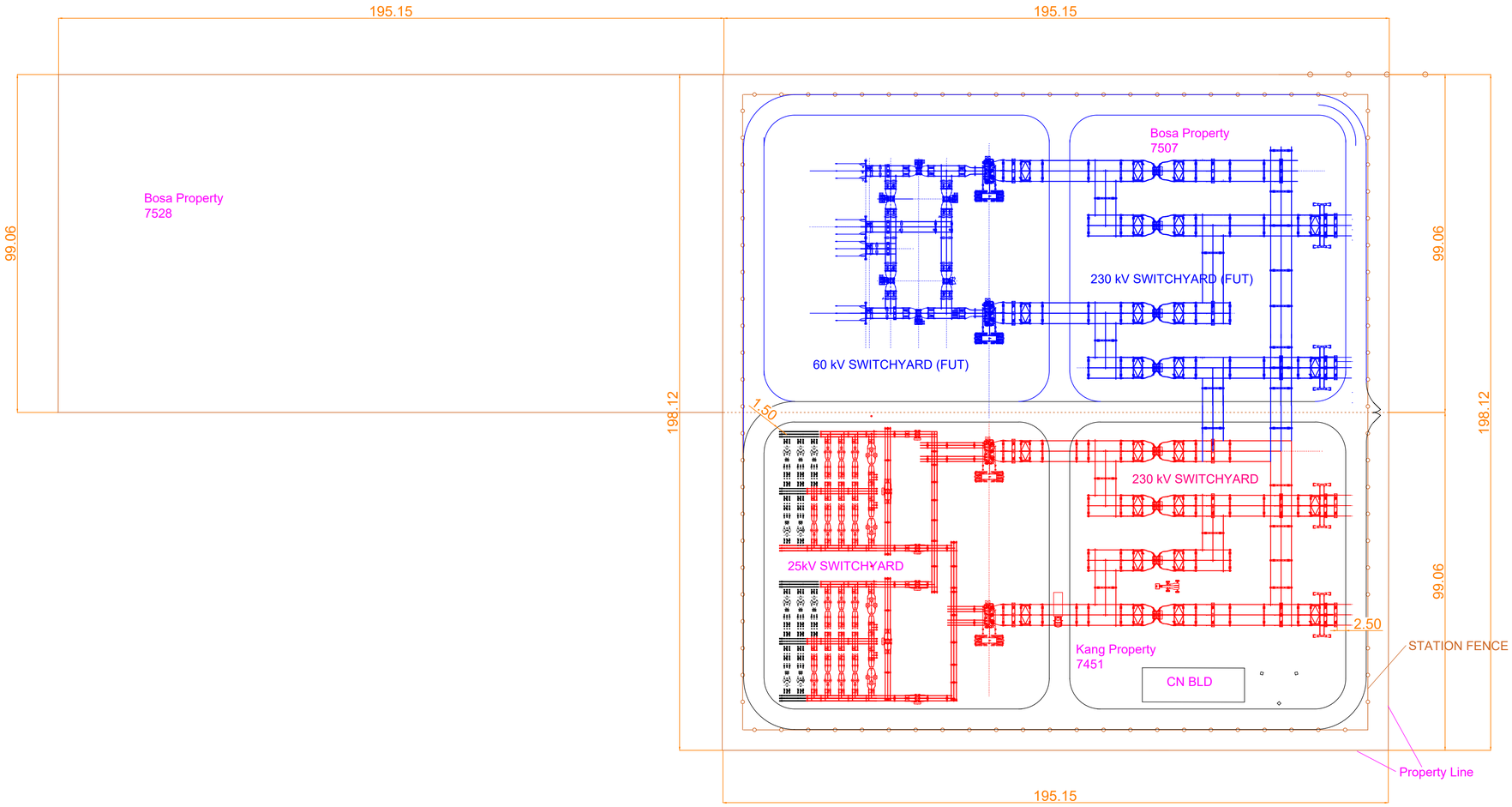
WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP16		WIB-E05-SK006-OP2			D	0

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N



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP16		WIB-E05-SK006-OP1			D	0

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C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240913-New for Bosa+Kang\WIB-E05-SK006-Opb-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.dwg
Drawing Unit = Metric (4)
JIANG, KAI
9/16/2024 4:30 PM

From: Chwaklinski, David
Sent: 2024, December 12 8:46 AM
To: Steels, Craig
Cc: Chwaklinski, David
Subject: RE: Property Purchase Projects - Draft Transmission Line route memos

All the properties are relevant as listed. I need you to reevaluate your routing discussion. While the request is for overhead I need you to address the issue of U/G routing if O/H is not practical. This specifically applies to Willoughby as it is not likely we can get O/H to the station efficiently AS we discussed in the pas there are practical U/G routs up 192 and 196th. Campbell heights smay be simpler for O/H provided crossing the existing lines can be managed. If not then we need to discuss U/G as well. The key message then is where to transition? Inside or outside the station. Again we don't need to solve the routing just provide practical suggetstions. I would only include the Connection to Fleetwood as an optional rout rather than primary because it looks as if management (Surinder) has locked on to MLN as the supply point

From: Steels, Craig
Sent: Tuesday, December 10, 2024 12:53 PM
To: Chwaklinski, David
Subject: RE: Property Purchase Projects - Draft Transmission Line route memos

Hi David,

I sent you a meeting invite for Thursday.

Please take a look at Wolloughby and Campbell heights drafts and comment. I think I sent these to you a while back. I'm not sure which properties are still relevant.

Kind regards,

Craig Steels, P.Eng. | Consultant, Transmission Lines Engineering, BC Hydro

C 825 437 6575 craig.steels@bchydro.com

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: Tuesday, December 10, 2024 12:35 PM

To: Steels, Craig <Craig.Steels@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Property Purchase Projects - Draft Transmission Line route memos

Hi Craig, can you tell me when you will have a draft ready for the transmission assessment memos for Campbell Heights and Willoughby? I am working on my report and I want to make sure that I am not making any incorrect statements. As well I am getting some pressure regarding determining if the alignment ROW for 1l146 for Goldstream is large enough to accept a second and third 230 Line. Have you had any luck with that? In a meeting this morning it looks as if we are shifting towards Alternate 1 for Goldstream. We discussed T/L routing and the possibility of avoiding new ROW through Thetis Lake park. I doubt we can unless the 1L146 ROW is wide enough. I would like to chat with you about this but I wont be available today or tomorrow. Will you have some time on Thursday? I have a doctor appointment that will occupy me until about 11:00 but any time after that should be good. Please let me know. thanks

From: Crockett, Shawn
Sent: 2024, October 10 2:11 PM
To: Hepple, Robert; Chwaklinski, David; Berisso, Hussien
Cc: Manurung, Cynthia; Zeng, Ken; Zhang, Michael
Subject: RE: Quick question: new WIB & CBS stations

Hi All,

Thanks for helping me get up to speed on these projects.
One item I've heard that some existing stations have challenges with are egress routes constrained by environmental sensitive areas, properly lines, other land use, etc. Distribution ductbanks need to extend several kilometers and branch out in multiple directions to reach load centers. There is always risk of certain area blocking or constraining the ductbank. I also totally understand the challenge of finding a suitable property and mitigating the highest risks in priority to others (and D egress could be one of the lower priorities).

I don't want to offend anyone by being over basic here – just passing on experiences of my colleagues. For my own learning about the Stations side of the business, if anyone has a document outlining strategy or risk management for property selection, I would definitely appreciate that!

Thanks,
Shawn

From: Hepple, Robert
Sent: 2024, October 08 2:48 PM
To: Chwaklinski, David ; Berisso, Hussien
Cc: Crockett, Shawn ; Awan, Yasir ; Szutoo, Raymond ; Manurung, Cynthia ; Zeng, Ken ; Nazer, Mohammad
Subject: RE: Quick question: new MLN T lines ??

Thank you, David for your response.
I will forward it to the T&D design team.
We will focus on securing the property before getting into design details.
Otherwise we waste budget and spin our wheels.
Robert
Robert Hepple P.Eng.

Project Manager, Stations

Capital Infrastructure Project Delivery
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C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, October 08 9:07 AM
To: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Quick question: new MLN T lines ??

Hussien, I am not clear on what you are asking here. It appears to me that Shawn is identifying what is being done and is not asking for anything. I am fully aware of the issue of duct bank proximity and the potential for derating if they are too close. While we take this into consideration during the property search, we are limited as to the properties available and ultimately to how we can bring transmission and distribution in and out. Detailed coordination of T and D design will need to occur as soon as the property is selected. This will require D planning and engineering to be involved much earlier than they typically are.

From: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Sent: Tuesday, October 8, 2024 7:36 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: FW: Quick question: new MLN T lines ??

Hi David,

Below comments are crucial to capture and coordinate before the SNS are issued.

Regards,

Hussien Berisso, MSc, P. Eng | Project Engineer Specialist, Stations Project Engineering

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E: hussien.berisso@bchydro.com

bchydro.com

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From: Crockett, Shawn <Shawn.Crockett@bchydro.com>
Sent: 2024, October 07 4:25 PM
To: Berisso, Hussien <Hussien.Berisso@bchydro.com>; Awan, Yasir <Yasir.Awan@bchydro.com>; Zeng, Ken <Ken.Zeng@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Szutoo, Raymond <Raymond.Szutoo@bchydro.com>; Lam, Anthony <Anthony.Lam@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Zhang, Michael <Michael.Zhang@bchydro.com>; Vrecko, Bradley <bradley.vrecko@bchydro.com>; Nazer, Mohammad <Mohammad.Nazer@bchydro.com>; Manurung, Cynthia <Cynthia.Manurung@bchydro.com>
Subject: RE: Quick question: new MLN T lines ??

Hi All,

D Planning has yet to release scope notes (I understand all disciplines waiting Stations Planning Official release of scope notes to release theirs).
Yasir in T-Line Eng is looking into including an item in SNs for T Eng to coordinate with D Eng about thermal de-rating of cables.

Having underground T lines too close will de-rate both T and D lines. On the T side, there is also an MRS component. BCH Executive are keenly aware of capacity constraints D feeders (particularly thermal ampacity limitations at station egress points).

D planning reached out to D-Eng to help coordinate the new 230kV lines being added to MLN to connect the new stations especially if the new T-lines will connect to MLN underground. Moreover, there is TM-006 plus another F25 D project connecting new D feeders to MLN as well as new egress ductbanks. Coordination will be essential.

Thanks,
Shawn

From: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Sent: 2024, October 07 10:20 AM
To: Awan, Yasir <Yasir.Awan@bchydro.com>; Crockett, Shawn <Shawn.Crockett@bchydro.com>; Zeng, Ken <Ken.Zeng@bchydro.com>

Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Szutoo, Raymond <Raymond.Szutoo@bchydro.com>; Lam, Anthony <Anthony.Lam@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Quick question: new MLN T lines ??

Hi,

These projects are currently in property purchase phase. @Zeng, Ken is a station designer working on a layout for a property purchase.

@Crockett, Shawn Yes, we are considering underground options if we proceed with the second property for TM-0593 (Campbell Heights). We'll keep you updated once the property acquisition is complete. If you have any concerns at this stage, please let us know.

Regards,

Hussien Berisso, MSc, P. Eng | Project Engineer Specialist, Stations Project Engineering

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From: Awan, Yasir <Yasir.Awan@bchydro.com>
Sent: 2024, October 04 3:28 PM
To: Crockett, Shawn <Shawn.Crockett@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Berisso, Hussien <Hussien.Berisso@bchydro.com>; Szutoo, Raymond <Raymond.Szutoo@bchydro.com>; Lam, Anthony <Anthony.Lam@bchydro.com>
Subject: RE: Quick question: new MLN T lines ??

Hi Shawn,

Thanks for reaching out. Hussein Berisso is the PE and Robert Hepple is the PM. There was a resource request which we have already responded to but haven't heard from the project team since. I had sent an email to Hussein a couple of weeks ago with no response. Your questions below are best answered by Robert and Hussein and I have copied them here. Project numbers are TM-0637 and TM-0632. Scope Note ID's are 5077 & 5078.

Regards,
Yasir

From: Crockett, Shawn <Shawn.Crockett@bchydro.com>
Sent: 2024, October 04 2:39 PM
To: Awan, Yasir <Yasir.Awan@bchydro.com>; Szutoo, Raymond <Raymond.Szutoo@bchydro.com>; Lam, Anthony <Anthony.Lam@bchydro.com>
Subject: Quick question: new MLN T lines ??

Hi Transmission Eng Team Leads,

What is the project status of the ~4 new 230kV T lines connecting MLN to the two newly proposed stations (Campbell Heights and Willoughby)?

- How many projects will there be and what TY-##s?
- Have any of the projects kicked off yet or are they still with Planning?
    - Note: I am writing same email to T-Planning
- What stage/phase are they in?
- Who are the PE and PM?

D-Planning asked me to find out and suggested one or more projects were currently weighing UG vs OH egress options for the T-lines.

The reason I am asking is to ensure EARLY coordination with existing and new (TM-006 + other project being kicked off in F26) distribution egress ductbanks. Key driver for these stations are maxed out distribution feeders so the last thing we want is to be forced into derating D feeders (thereby decreasing the value of the new stations from day 1).

Thanks,
Shawn

From: Chwaklinski, David
Sent: 2024, January 25 12:10 PM
To: Simpson, Lauren; Wong, Felix; Lee, Johnson; Evans, Jen
Cc: Chwaklinski, David
Subject: RE: Re: TM-0592 - Willoughby SDM
Attachments: 200 MVA Station Layout Drawings _Campbell Heights and Willoughby; CAMP-E05-SK002-1_R0A_Option 1A.pdf; CAMP-E05-SK002-2_R0A_Option 2.pdf; CAMP-E05-SK002-1_R0A_Option 1.pdf

Hi Lauren, I had to do a bit of digging to sort this out. Back in December I asked Engineering to provide an estimate of the increased size (from the original station layout) that would meet the requirements of a 4 line positions and a six breaker ring. In my discussions with Dennis Stewart, he suggested the dimensions of 176 m x 242 m (see attached e-mail) which was included in the SDM table. I was supposed to update the SDM when I received a revised Layout. I received the revised layout in early January but never got around to updating the property requirements. Engineering has provided 3 layouts (attached) for consideration. They are roughly the same size but with a different configuration. Based on these layouts my recommendations is to search for a property with the approximate dimensions of 171 m x 216 m or 36,936 m^2. This should give us the ability to fit any of the three alternative layouts on the site with enough cushion around the property for any setbacks for slopes or landscaping that the city may require. I would caution however that this assumes that we can fit the 4 line positions as laid out by engineering. If this must change due to site constraints it may change things. This will apply to the Campbell Heights station as well.

Let me know if you wish to discuss further. I can update the SDM to reflect this revision

---

From: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Sent: Thursday, January 25, 2024 10:24 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: FW: Re: TM-0592 - Willoughby SDM

Hi David,

I was just reviewing email and I need you to confirm the Station size for Willoughby

In your email below you note a minimum **32,136 m^2** based on 206 m x 156 m based on the new layout. We currently have **42,492 m^2** in the SDM with a note that this needs to be confirmed with electrical (4 line 6 breaker ring station)

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, January 11 12:01 PM
To: Simpson, Lauren <Lauren.Simpson@bchydro.com>; Armstrong, Tyler <Tyler.Armstrong@bchydro.com>

Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Wong, Felix <Felix.Wong2@bchydro.com>
Subject: RE: Re: TM-0592 - Willoughby SDM

Hi everyone. For some background Planning initially said they need a site of about 221,00 SF or 20, 500 M^2. This was not based on a prepared layout but on some educated guesswork. The engineering group reviewed the one line and came up with a layout of approximately 213.5 m x 123.5m (26, 367 m^2). This was not confirmed with the planners who noted the layout did not include the 2 extra line positions and 2 extra breakers they requested. This size was used in our initial evaluations of the properties (See line 20 of the SVA table). After engineering developed a new layout, the space required was increase to a minimum 32,136 m^2 based on 206 m x 156 m. These dimensions include an 8.0 m buffer around the fence line. This can be seen in Line 22 of the SVA table. We have decided to carry both sets of dimensions in case a higher level tells us to not go with Plannings wishes.

So having provided the background I had a look at the alternate properties 10 and 11. As considered individually 10 and 11 are too small for an outdoor station based on both sets of requirements (not long enough for either layout). If we added the property directly to the North of Property 10 that would provide a site of approximately 242 m x 181 m or 43621 m^2 . This is more than enough for our requirements based on the latest layout drawing provided by Engineering .

For Property 11 if about 70 m could be acquired this would allow us to build the station based on the most recent layout.

If property 10 and 11 could be combined then there would be more than enough property 301 m x 180 m or 54180 m^2 for the station although as previously mentioned Langley ay object to losing the roadway of 78 B ave.

I hope this helps

From: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Sent: Tuesday, January 9, 2024 9:28 AM
To: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Re: TM-0592 - Willoughby SDM

Yes this would be a better option. David please let Tyler know if we should add the adjacent properties.

From: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>
Sent: 2024, January 09 9:21 AM
To: Simpson, Lauren <Lauren.Simpson@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Re: TM-0592 - Willoughby SDM

If they are too small we could add the adjacent properties in the image below if that helps. Let me know.



Regards,

_____

Tyler Armstrong | Property Representative – Acquisitions and Sales

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M 604 230 0187
E tyler.armstrong@bchydro.com

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From: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Sent: 2024, January 09 9:17 AM
To: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Re: TM-0592 - Willoughby SDM

Thanks Tyler,

David can you confirm if Properties 10 and 11 are of sufficient size individually. Also if you concur we can merge prop 8 and 9.

Cheers, Lauren

From: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>
Sent: 2024, January 09 9:01 AM
To: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Re: TM-0592 - Willoughby SDM

Hi Lauren,

I think there is some confusion on the property dimensions for 10 & 11

- # 10 and #11 measure about 599ftx 450 feet each, which I thought was within our requirements.
- I agree #8 & #9 can be merged.
- I will address the missing fields today.

Regards,

_____

Tyler Armstrong | Property Representative – Acquisitions and Sales

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From: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Sent: 2024, January 08 1:41 PM
To: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>
Subject: Re: TM-0592 - Willoughby SDM

Hi Tyler,

I reviewed the Willoughby SDM today. It looks like all we need is to populate some of the new fields that we added before the holiday. Once you have updated the remaining fields we can have a project meeting to rank the properties.

I was also wondering if:

- We can merge Prop 8 and 9 – they are undersized individually but look to be good candidates if merged
- We can merge Prop 10 and 11 - they are undersized individually but look to be good candidates if merged. There is an road running between these properties which could preclude merging. Please advise
- Properties 1, 2, 3 and 4 are all associated with the Langley event centre complex and adjacent schools. I think these can reasonably be excluded.

Thanks, Lauren

Lauren Simpson (she/her) PMP, RPBio | Commercial Manager, CIPD

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E lauren.simpson@bchydro.com

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From: Chwaklinski, David
Sent: 2023, December 14 2:11 PM
To: Khan, Jahangir; Zeng, Ken
Cc: Wong, Felix; Chwaklinski, David
Subject: 200 MVA Station Layout Drawings _Campbell Heights and Willoughby
Attachments: CAMP-E05-SK001-R00.pdf; Campbell Heights One line.pdf

Thanks for meeting with me this afternoon gentlemen. To summarize the meeting, I have requested that Transmission Engineering (Stations design) prepare a new station layout for the 230/25 kV distribution stations based on the one line I have attached. The one line includes provision for up to 4 – 230 kV line positions and a 6-breaker ring. This is different from the original assumption of two, line positions and 4 breakers. We have the layout for that design.

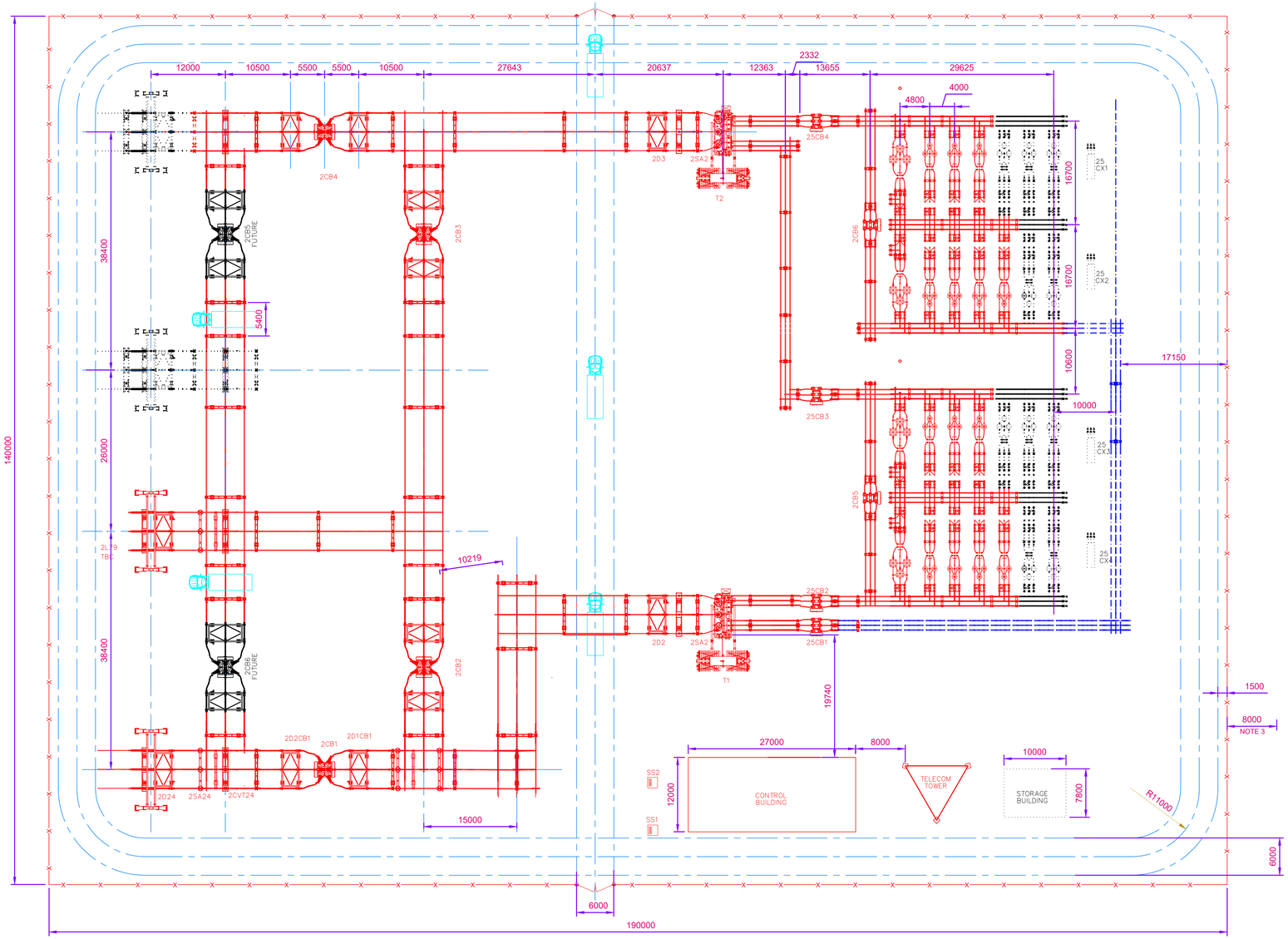
Based on discussions with Dennis Stewart we think that adding 20 m to the length and 50 m to the width to the layout in hand would be sufficient for the larger station. To be conservative I have added 10% to those dimensions giving us a potential property size of 176 m x 242 m. As we are advancing the property purchase project with a plan to complete the bulk of our review by the end of March 2024 I am asking for your team to a) provide a high-level review of our estimated property size to confirm if stations believe it to be sufficient and to b) provide a new layout based on the attached one line. My request is that you provide the high-level review of the estimate and confirm back to me via e-mail in mid January and provide the new layout by the end of March. As discussed, you need time to review your workload and resources and you will provide me with an estimated date of when you can provide my two asks before the end of December. If there are any errors in my summary, please let me know and we can clarify as soon as possible.

I have asked that planning provide the most up to date one line drawing. I don't expect it to change from what I have attached but I will inform you ASAP if it does change. Thanks again.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

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E david.chwaklinski@bchydro.com



OPTION 1

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE: THIS PROJECT(CABLE OR AIR BUS OPTION)
DARK: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 0 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng
DFTG CHK	
INSP	
REV	D.STEWART/ M.BALEA
ACPT	

BC Hydro

CAMPBELL HEIGHTS SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 1

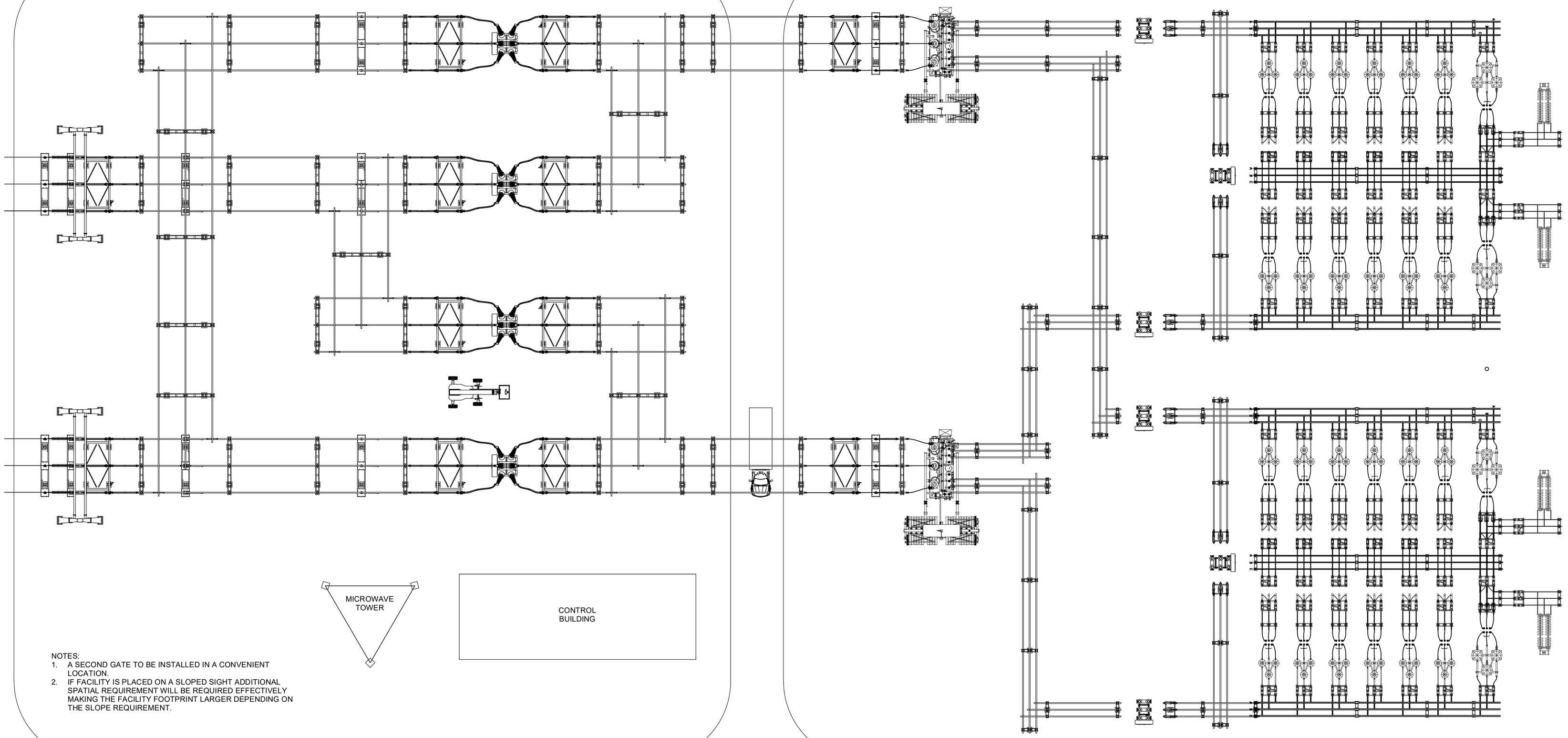
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2024 JAN 04		CAMP-E05-SK002-1			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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Drawing Unit = Metric (d)
Plot Scale = 1:1
14/02/2024 11:44 AM

198500

110000



NOTES:
1. A SECOND GATE TO BE INSTALLED IN A CONVENIENT LOCATION.
2. IF FACILITY IS PLACED ON A SLOPED SIGHT ADDITIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDING ON THE SLOPE REQUIREMENT.

SCALE: 1:250 0 10m

DISCLAIMER:
THIS DRAWING HAS BEEN PREPARED BY BC HYDRO STATIONS ENGINEERING FOR THE SOLE PURPOSE OF DEVELOPING A CONSENSUS LAYOUT AND REQUIRES VETTING BY ALL STAKEHOLDERS PRIOR TO INSTALLATION. THIS DRAWING AND FEATURES ARE BASED ON PRELIMINARY INFORMATION ONLY AND SHOULD NOT BE CONSTRUED AS FINAL LOCATIONS OR DIMENSIONS. FINAL LOCATION AND DIMENSIONS OF THIS DRAWING WILL BE DEPENDANT ON FINAL DESIGN AND CONSTRUCTION DETAILS.

NO	DRAWING NUMBER	DRAWING TITLE
REFERENCE DRAWINGS		

NO	REMARKS
REVISIONS	

FOR DISCUSSION PURPOSES ONLY

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	D. STEWART
INDEP CHK	
DFTG	D. STEWART
DFTG CHK	
INSP	
REV	M. BALEA
ACPT	

BC Hydro

CAMPBELL HEIGHTS SUBSTATION

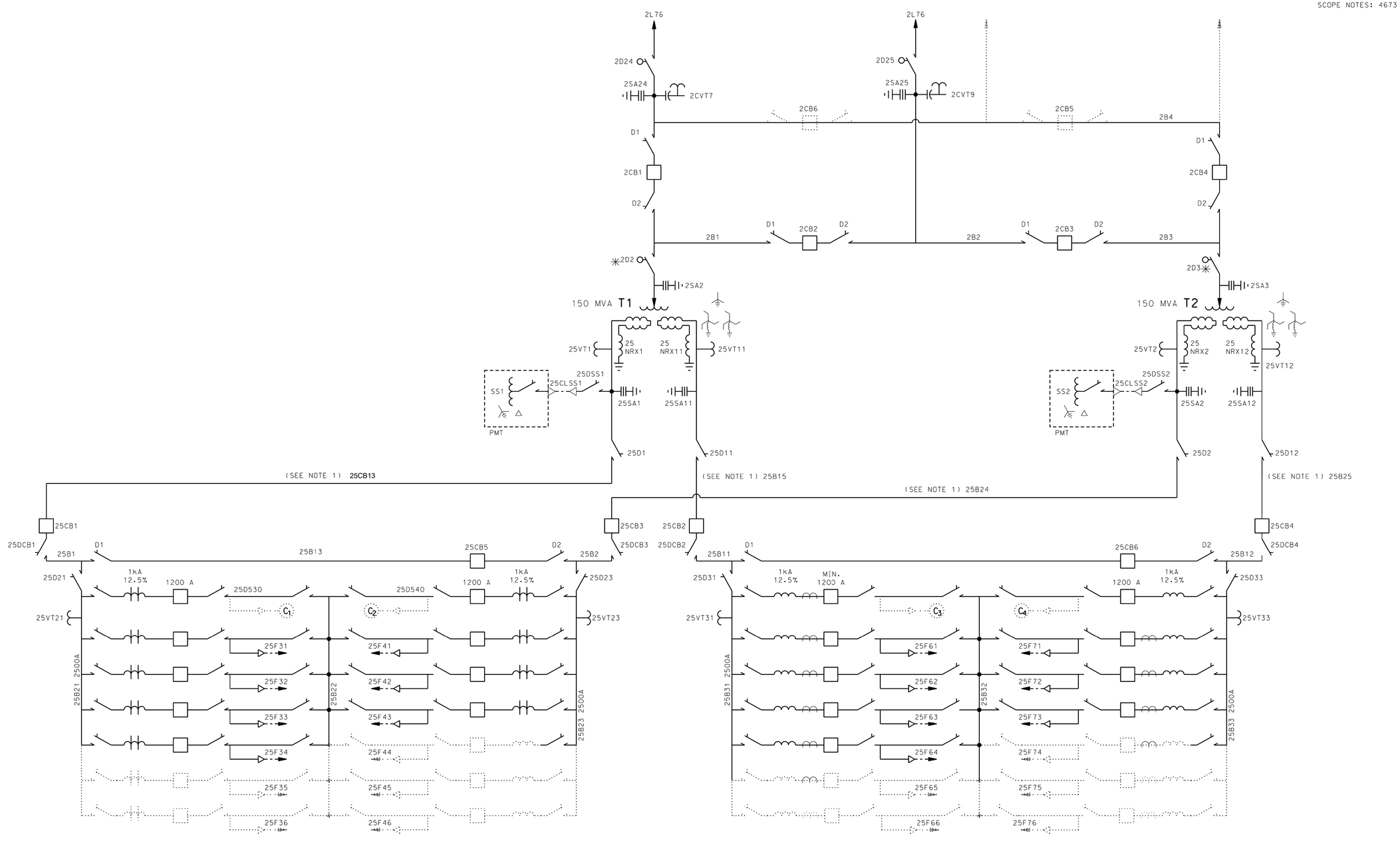
230/25 SWITCHYARDS
PROPOSED ULTIMATE ARRANGEMENT
PRE-NEEDS STAGE
PLAN

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
9 JUN 2023		CAMP-E05-SK001			D	-

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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Drawing Unit = Metric
Z: ST5104R
06-Jun-2023 10:00 AM

SCOPE NOTES: 4673



*QUICK BREAK ATTACHMENT

RATINGS OF MAJOR EQUIPMENT:

2B1, 2B2 BUS RATING 2000 A
2CB1, 2CB2, 2CB3, 2CB4 2000 A
25CB1, 25CB2, 25CB3, 25CB4, 25CB5, 25CB6 2500 A
THE REST OF 25 KV CIRCUIT BREAKERS 1200 A

NOTE:

1. CABLE OR BUS WILL BE DETERMINED BY ENGINEERING IN THE DETAILED DESIGN. IF BUS WILL BE USED, THE CAPACITOR MIGHT BE NEEDED IN THIS LOCATION.

NO	DATE	DWN	PLN	CHK	REV	ACPT
2						
1						

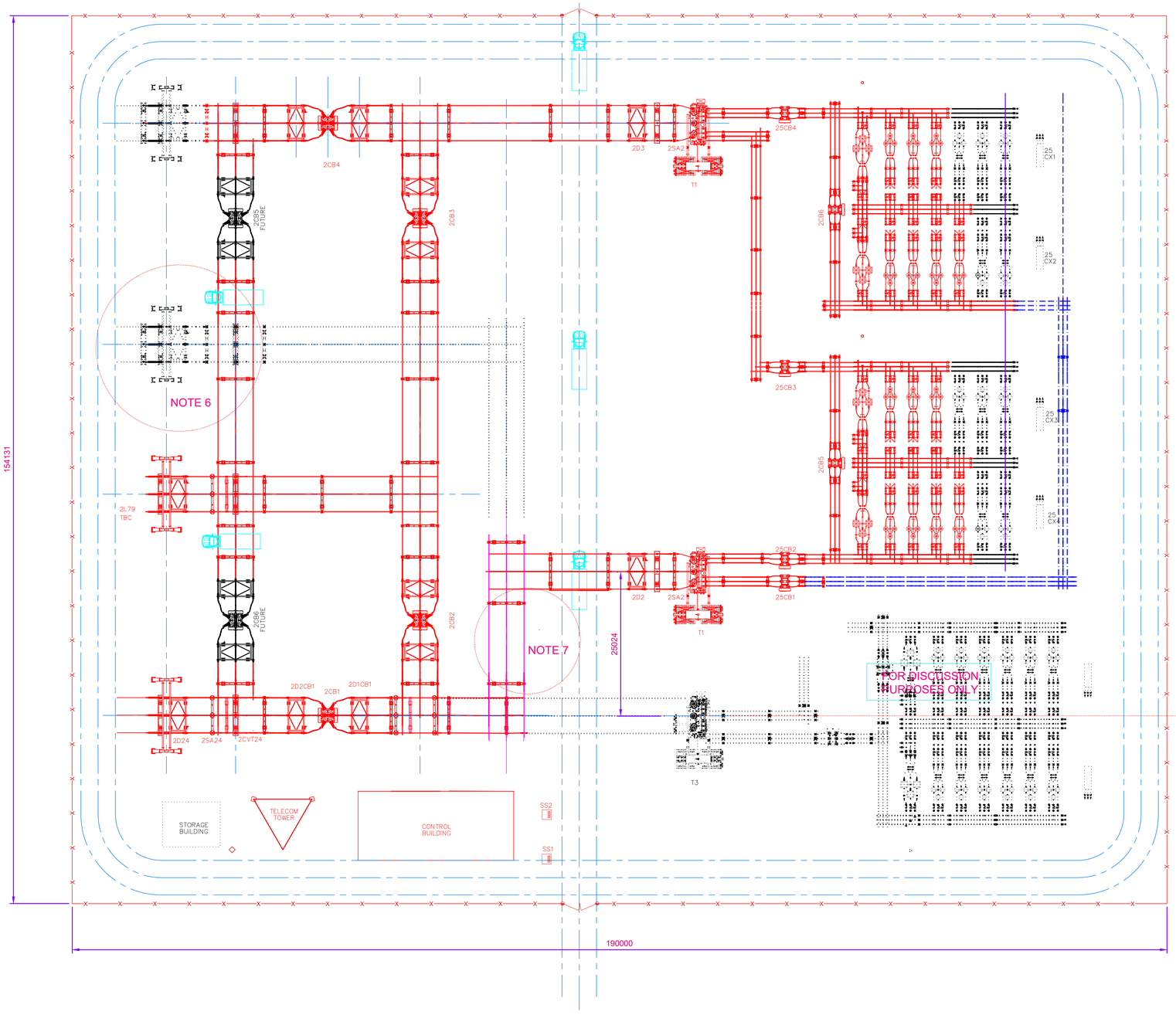
REVISIONS

DRAWN KLR
PLANNED LL
CHECKED
REVIEWED
ACCEPTED

BC Hydro
SUBSTATIONS GROWTH AND SUSTAINMENT

CAMPBELL HEIGHTS (CLH)
230/25 KV
ONE-LINE DIAGRAM
2032 STAGE

DATE 18 SEP 23 | SHEET 1 | DWG NO XXX-P06-SK1 | R 0



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE
6. CONNECTION POINT FOR EITHER THE FORTH LINE OR T3
7. SWITCH CONNECTION WHEN T3 IS INSTALLED

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng
DFTG CHK	
INSP	
REV	-----
ACPT	

BC Hydro

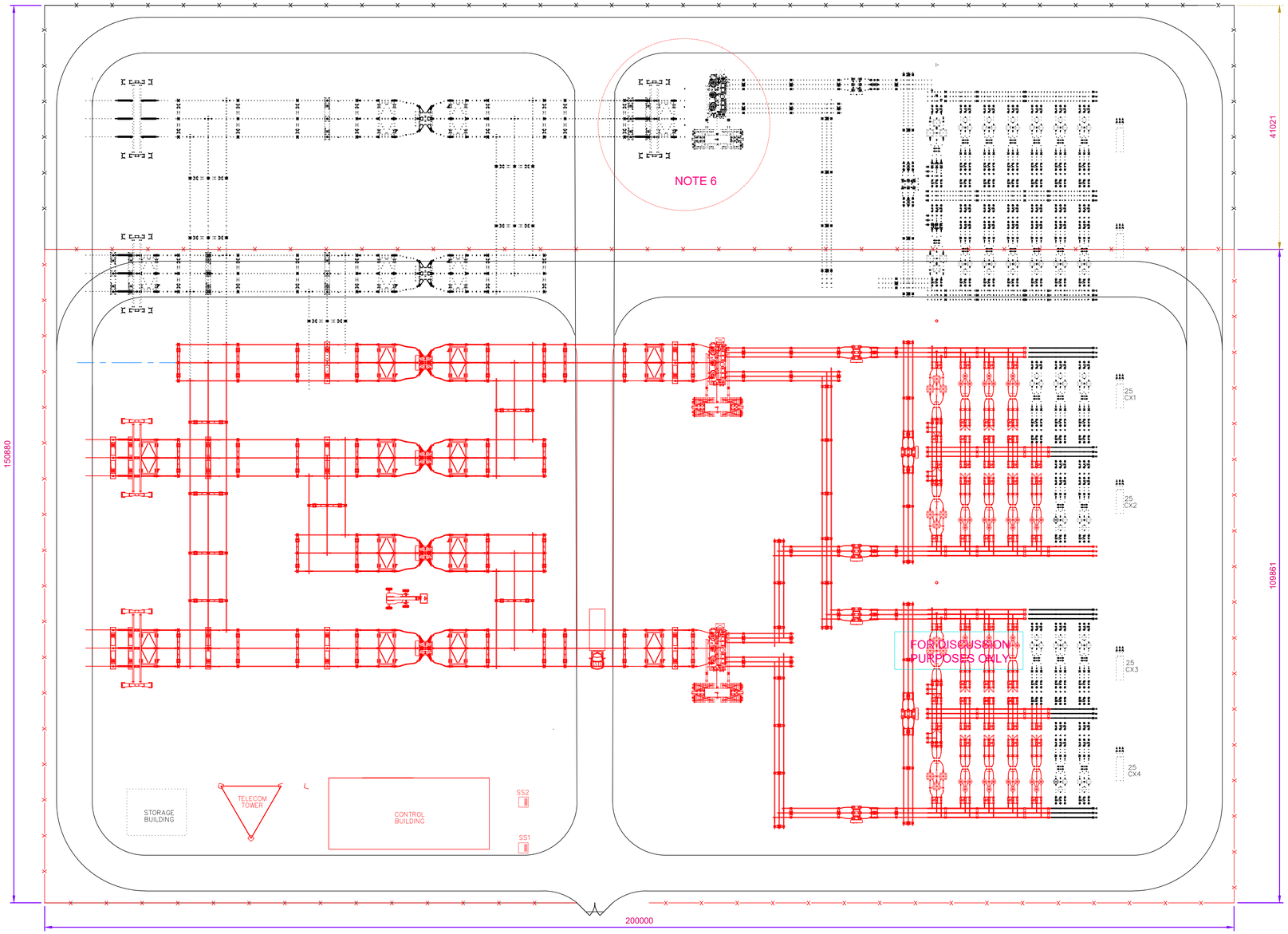
CAMPBELL HEIGHTS SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 1a

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV.
2023JAN04		CAMP-E05-SK002-1a			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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2SC5 - Kris
1/4/2024 2:55 PM



OPTION 2

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK: FUTURE

FOR DISCUSSION
PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng
DFTG CHK	
INSP	
REV	-----
ACPT	

BC Hydro

CAMPBELL HEIGHTS SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 2

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2023JAN04		CAMP-E05-SK002-2			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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Drawing Unit = Metric (4)
Plotted by: Ken Zeng
1/4/2024 11:42 AM

From: Jiang, Kally
Sent: 2024, March 27 12:17 PM
To: Chwaklinski, David
Cc: Zeng, Ken; Khan, Jahangir
Subject: RE: Relabelling Campbell Heights Drawings for Willoughby
Attachments: WIB-E05-SK002-1_R0A_Option 1.pdf; WIB-E05-SK002-1_R0A_Option 1A.pdf

Hi, Dave,

Please check attached for info and let me know if ther is any concern.

Thanks,
Kally

From: Chwaklinski, David
Sent: 2024, March 25 9:51 AM
To: Jiang, Kally
Cc: Zeng, Ken ; Khan, Jahangir ; Chwaklinski, David
Subject: RE: Relabelling Campbell Heights Drawings for Willoughby

Thanks Kally, Can you also update the two attached sketches for WIB. These would be the “Original” 200 MVa layout without the 6o kV section. This will allow us to track the changes in the sizes we are considering. Thanks

---

From: Jiang, Kally <Kally.Jiang@bchydro.com>
Sent: Friday, March 22, 2024 4:17 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Zeng, Ken <Ken.Zeng@bchydro.com>; Khan, Jahangir <Jahangir.Khan@bchydro.com>
Subject: RE: Relabelling Campbell Heights Drawings for Willoughby

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Thanks,
Kally

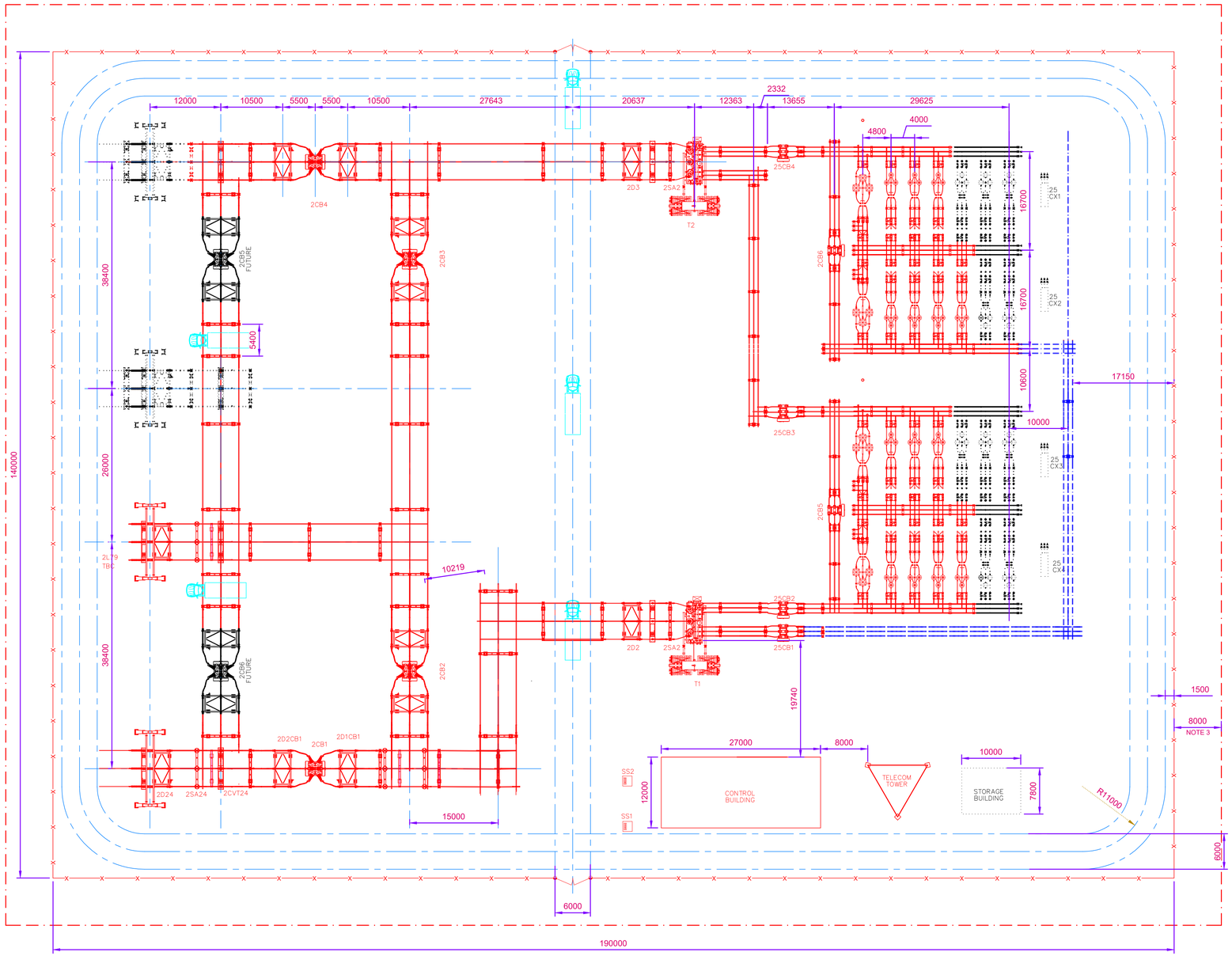
From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, March 21 4:12 PM
To: Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Relabelling Campbell Heights Drawings for Willoughby

Hi Kally, are you able to relabel the drawings that were created for Campbell Heights for Willoughby? I would like to add the preliminary layouts to the workspace with the crrect names.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com



OPTION 1

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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COLOR CODE FOR SCOPE OF WORK:
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BLUE: THIS PROJECT(CABLE OR AIR BUS OPTION)
DARK: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 0 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO | REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng
DFTG CHK	
INSP	
REV	D STEWART / M.BALEA
ACPT	

BC Hydro

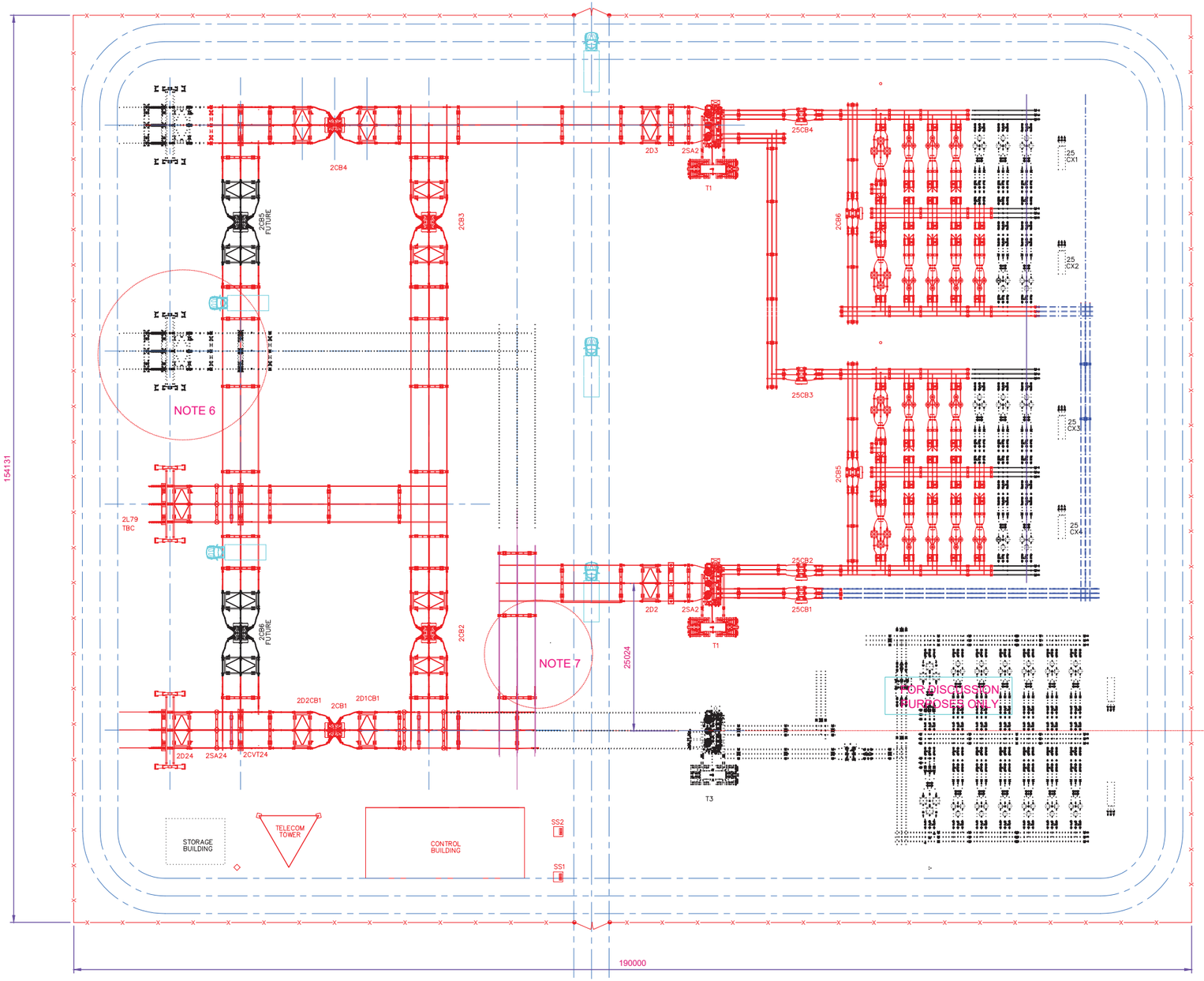
WILLOUGHBY SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 1

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024 JAN 04		WIB-E05-SK002-1			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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AutoCAD 2024 x64
3/27/2024 11:56 AM



NOTES:

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FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER		DSGN	K. Zeng
WORK ORDER NUMBER		INDEP CHK	
CSA S250 ACCURACY NAD - UTM		DFTG	K. Zeng
		DFTG CHK	
BASE ACCURACY LEVEL:		INSP	
ASB ACCURACY LEVEL:		REV	-----
		ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 1a

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2023JAN04		WIB -E05-SK002-1a			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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Drawing Unit = Metric (4)
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1/4/2024 2:55 PM

From: Jiang, Kally
Sent: 2024, March 27 12:17 PM
To: Chwaklinski, David
Cc: Zeng, Ken; Khan, Jahangir
Subject: RE: Relabelling Campbell Heights Drawings for Willoughby
Attachments: WIB-E05-SK002-1_R0A_Option 1.pdf; WIB-E05-SK002-1_R0A_Option 1A.pdf

Hi, Dave,

Please check attached for info and let me know if ther is any concern.

Thanks,
Kally

From: Chwaklinski, David
Sent: 2024, March 25 9:51 AM
To: Jiang, Kally
Cc: Zeng, Ken ; Khan, Jahangir ; Chwaklinski, David
Subject: RE: Relabelling Campbell Heights Drawings for Willoughby

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---

From: Jiang, Kally <Kally.Jiang@bchydro.com>
Sent: Friday, March 22, 2024 4:17 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Zeng, Ken <Ken.Zeng@bchydro.com>; Khan, Jahangir <Jahangir.Khan@bchydro.com>
Subject: RE: Relabelling Campbell Heights Drawings for Willoughby

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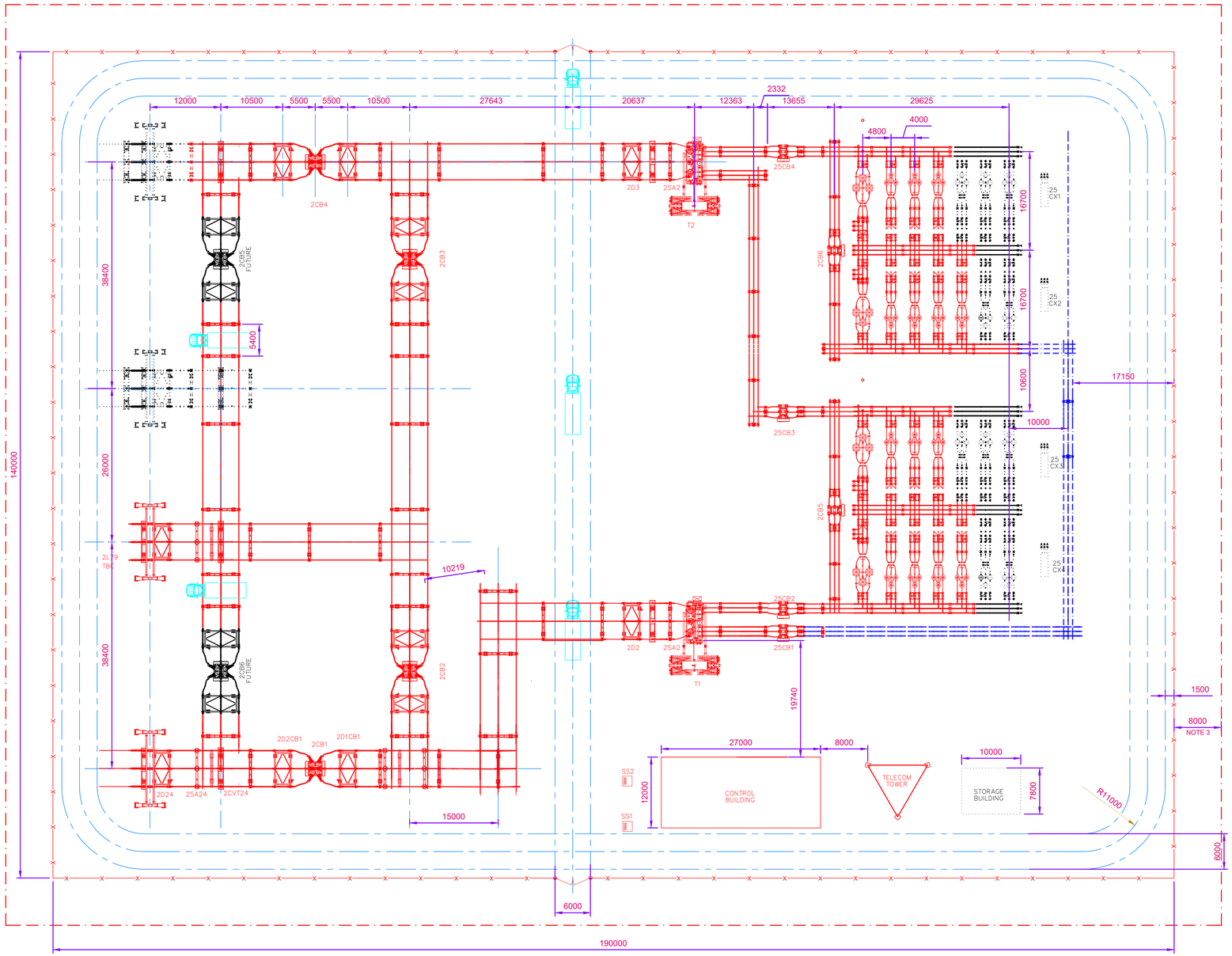
From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, March 21 4:12 PM
To: Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
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David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com



OPTION 1

NOTES:

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DARK: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 0 50mm

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REFERENCE DRAWINGS

NO | REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng
DFTG CHK	
INSP	
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BC Hydro

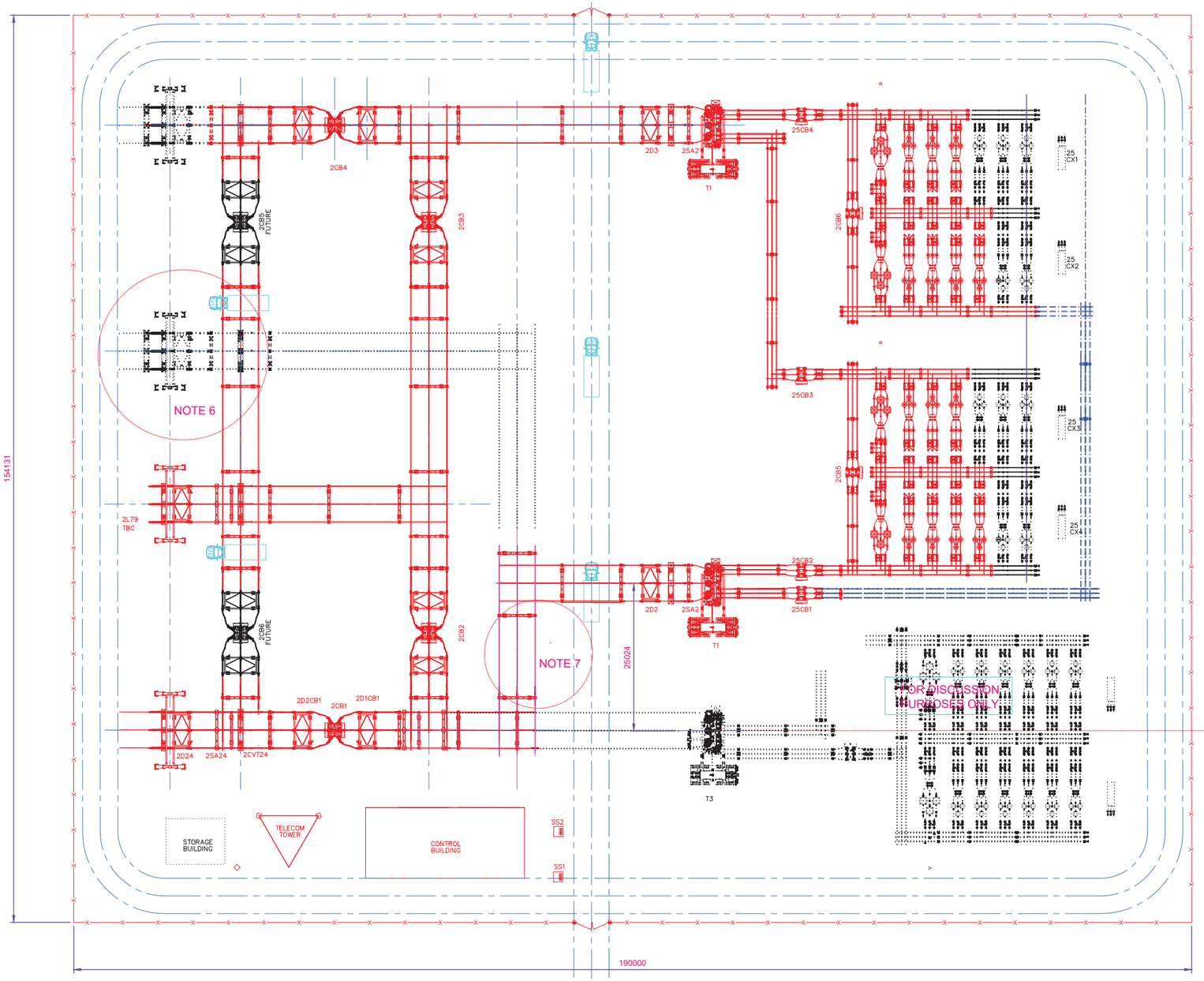
WILLOUGHBY SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 1

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024 JAN 04		WIB-E05-SK002-1			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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3/27/2024 11:56 AM



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7. SWITCH CONNECTION WHEN T3 IS INSTALLED

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DARK: FUTURE

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SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER		DSGN	K. Zeng
WORK ORDER NUMBER		INDEP CHK	
CSA S250 ACCURACY NAD - UTM		DFTG	K. Zeng
		DFTG CHK	
BASE ACCURACY LEVEL:		INSP	
ASB ACCURACY LEVEL:		REV	-----
		ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/25 KV SWITCHYARD
ULTIMATE LAYOUT
OPTION 1a

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2023JAN04		WIB -E05-SK002-1a			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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Drawing Unit = Metric (4)
2500 x 1676
1/4/2024 2:55 PM

From: Chwaklinski, David
Sent: 2024, April 08 11:02 AM
To: Hepple, Robert R
Cc: Parmar, Surinder; Chwaklinski, David
Subject: RE: TM0502 Willoughby and TM0593 Campbell Heights
Attachments: Willoughby_Search_April_8_2024.jpg; Willoughby Search March 27-2024.kmz; TM0593_Campbell_PreferredProperties_20240405.kmz; TM0592_Willoughby_PreferredProperties_20240405.kmz; Willoughby Property Acquisition - Background for discussion with Township of Langley.; RE: Load growth Mapping for Campbell Heights/Willoughby; Campbell_Heights_Search_Area.jpg

Hi Robert, attached, please find the preferred property KMZ's for Campbell Heights and Willoughby. I have also included an email from Cynthia Manurung that included the load growth projection maps for both areas. Finally, I in included some images showing the overall picture for Willoughby and Campbell Heights. Let me know if I can provide any more information.

From: Hepple, Robert R
Sent: Friday, April 5, 2024 12:25 PM
To: Chwaklinski, David
Cc: Parmar, Surinder
Subject: TM0502 Willoughby and TM0593 Campbell Heights

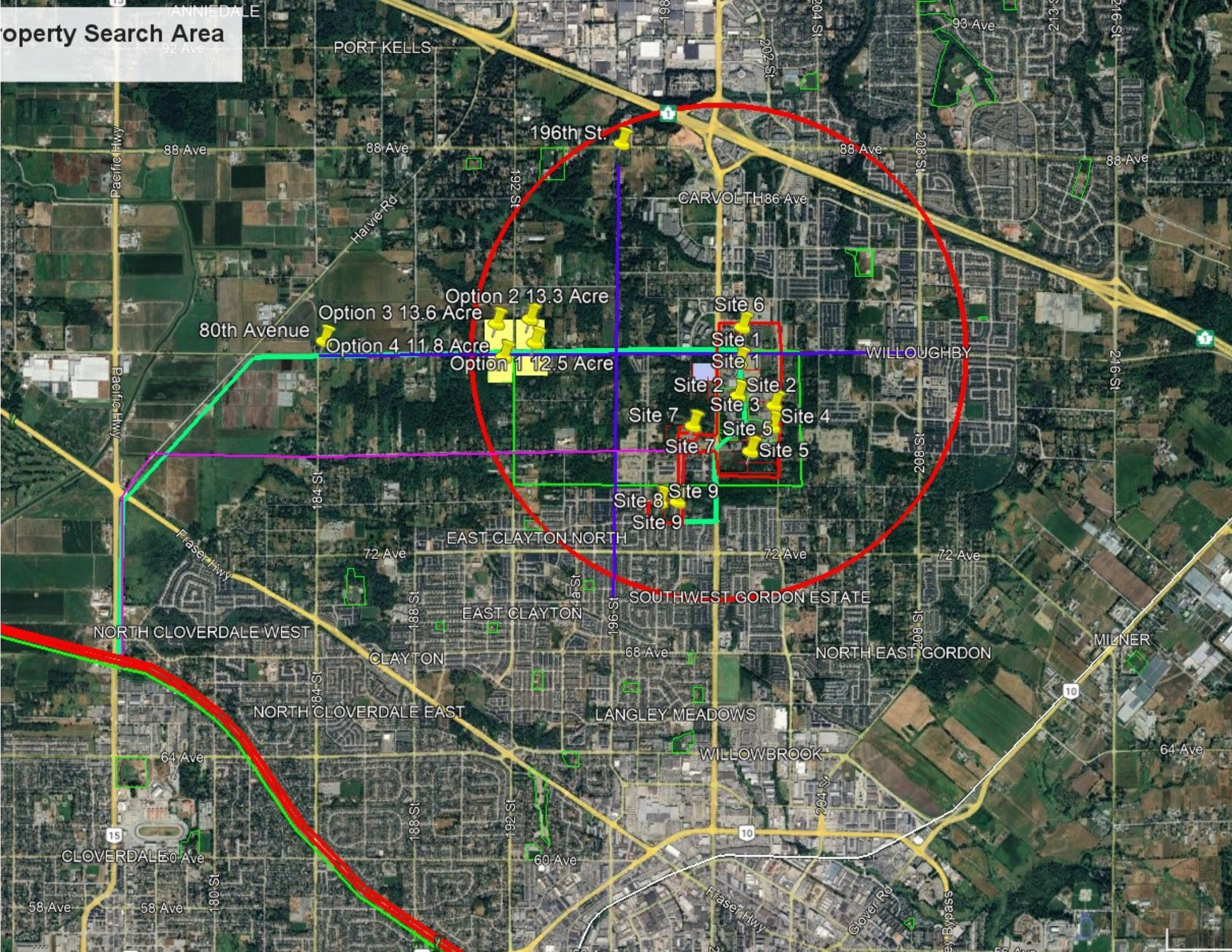
Hi Dave,
Looks like my request for Google Maps did not require approval and Telus is starting to download now.
So KMZ files would be great.
Can I also request the Distribution maps for the above two projects?
I am seeing land to the west of the load centres and want to see the Distribution system.

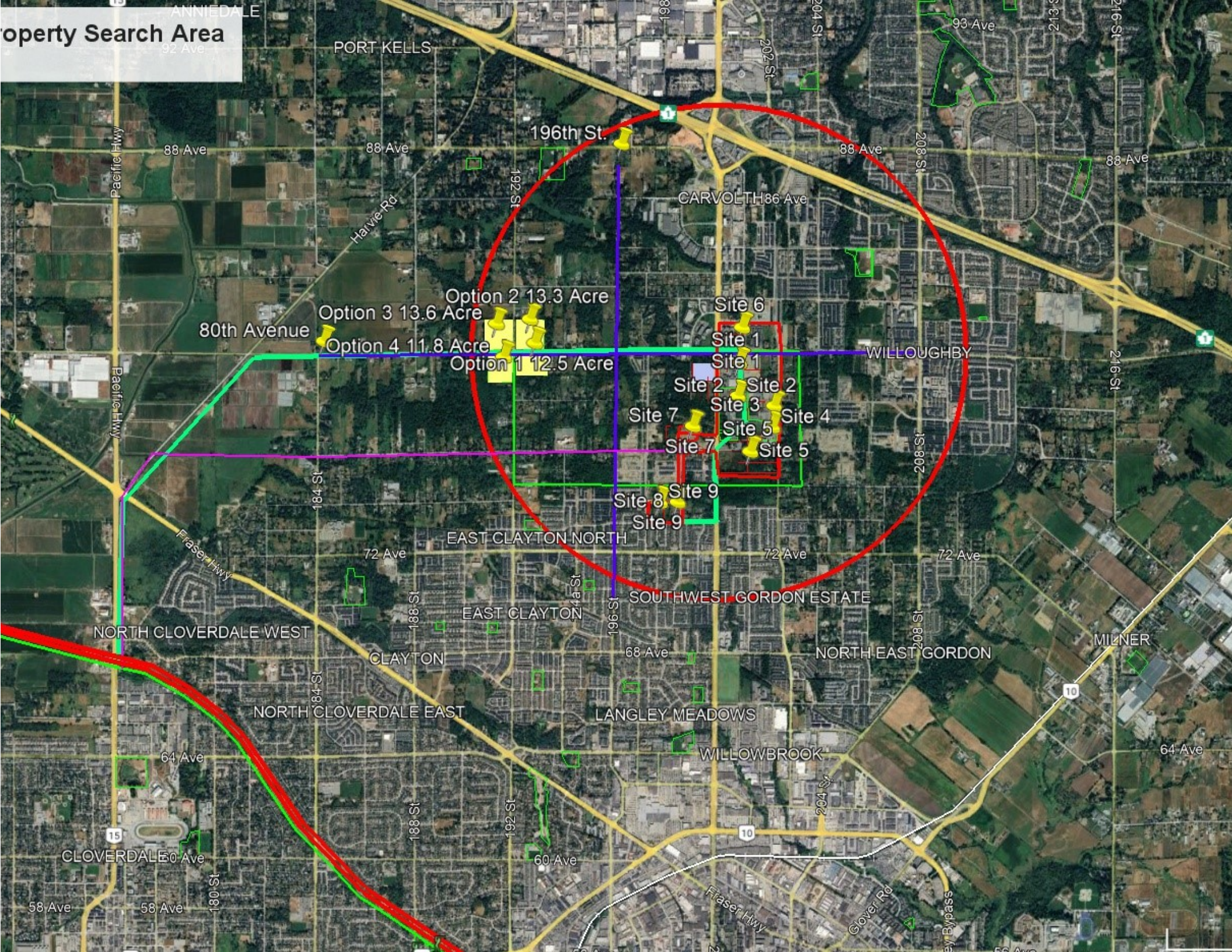
Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 925.967.5880
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

Smart about power in all we do.


roperty Search Area
ANNIEDALE
92 Ave
PORT KELLS
196th St.
88 Ave
Pacific Hwy
Harve Rd
192 St
CARVOLTH
86 Ave
202 St
204 St
208 St
93 Ave
213 St
216 St
Option 2 13.3 Acre
Option 3 13.6 Acre
80th Avenue
Option 4 11.8 Acre
Option 1 12.5 Acre
Site 6
Site 1
Site 1
WILLOUGHBY
Site 2
Site 2
Site 3
Site 4
Site 7
Site 5
Site 7
Site 5
Site 9
Site 8
Site 9
184 St
EAST CLAYTON NORTH
72 Ave
Fraser Hwy
188 St
EAST CLAYTON
SOUTHWEST GORDON ESTATE
NORTH CLOVERDALE WEST
CLAYTON
68 Ave
NORTH EAST GORDON
MILNER
NORTH CLOVERDALE EAST
LANGLEY MEADOWS
WILLOWBROOK
64 Ave
CLOVERDALE
60 Ave
180 St
58 Ave
Glover Rd
Fraser Hwy
10
15


roperty Search Area
ANNIEDALE
92 Ave
PORT KELLS
196th St.
88 Ave
Pacific Hwy
Harve Rd
192 St
CARVOLTH
86 Ave
202 St
204 St
208 St
93 Ave
213 St
216 St
Option 2 13.3 Acre
Option 3 13.6 Acre
80th Avenue
Option 4 11.8 Acre
Option 1 12.5 Acre
Site 6
Site 1
Site 1
WILLOUGHBY
Site 2
Site 2
Site 3
Site 4
Site 7
Site 5
Site 7
Site 5
Site 9
Site 8
Site 9
184 St
EAST CLAYTON NORTH
72 Ave
Fraser Hwy
188 St
EAST CLAYTON
SOUTHWEST GORDON ESTATE
NORTH CLOVERDALE WEST
CLAYTON
68 Ave
NORTH EAST GORDON
MILNER
NORTH CLOVERDALE EAST
LANGLEY MEADOWS
WILLOWBROOK
64 Ave
CLOVERDALE
60 Ave
180 St
58 Ave
Glover Rd
Fraser Hwy
10
15

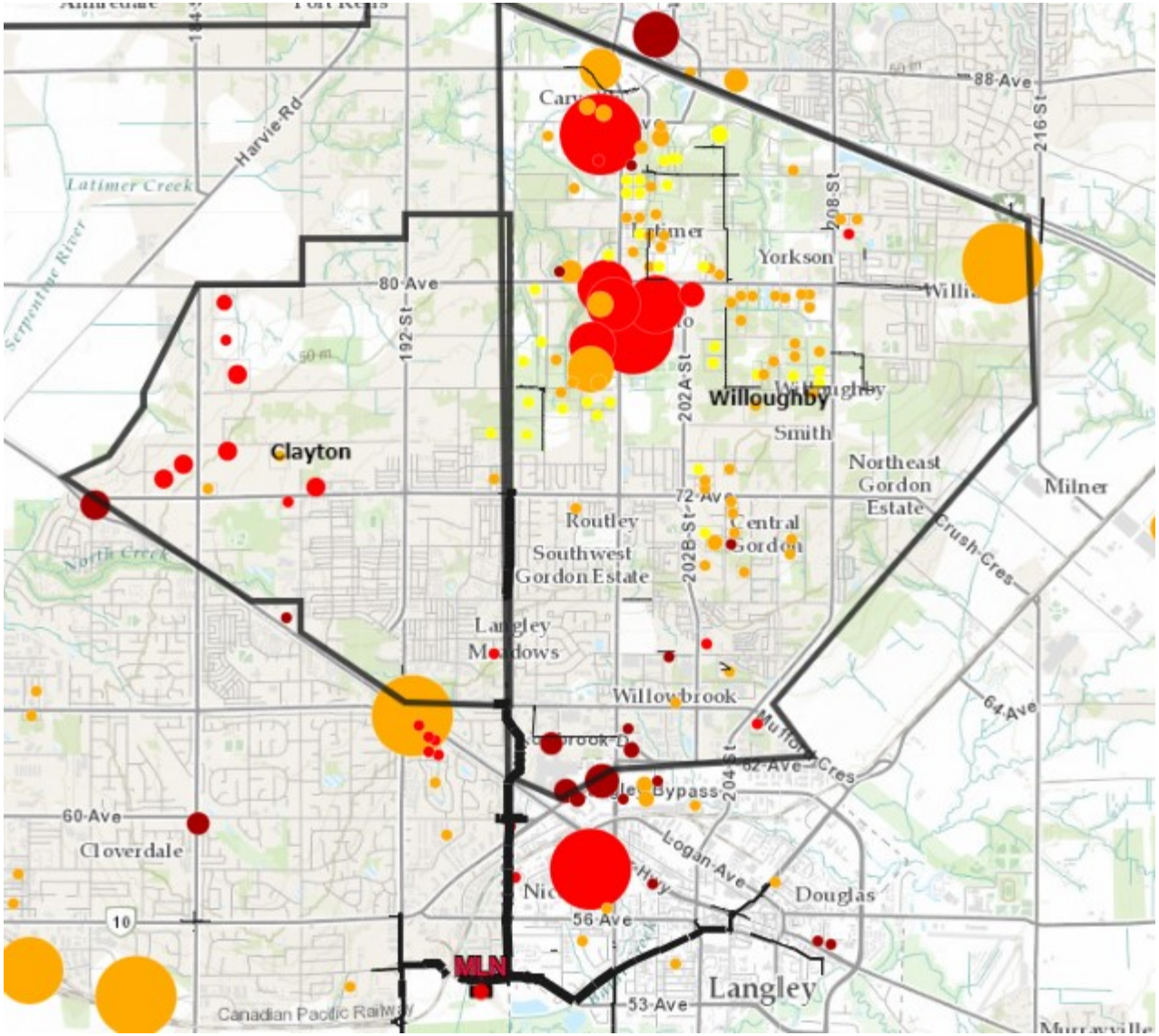

Untitled Map
Write a description for your map.
Legend
Buddhist Vihara Society in BC
Feature 1
Option
Option
SP Earthmovers
The Campus Hub
Azure Properties Group, Sivia House
Option 2 13.3 Acre
n 3 13.6 Acre
80 Ave
Option 1 12.5 Acre
Google Earth
Image Landsat / Copernicus
N
700 ft
192 St
Plant nursery
Option 4 11.8 Acre
192 St


Untitled Map
Write a description for your map.
Legend
Alt
Feature 1
Feature 2
Feature 3
Mercana Furniture and Decor
Tim Hortons
Silver Icing
Jax & Lennon
Van Gogh Designs
Bothwell-Accurate
32 Ave
Alternate 8
194 St
Google Earth
Image Landsat / Copernicus
Robust Transport Services
1000 ft
N
Alternate 7
Freshslice Pizza
A&W Canada
192 St
Tim Hortons
Latimer Park
27 Ave

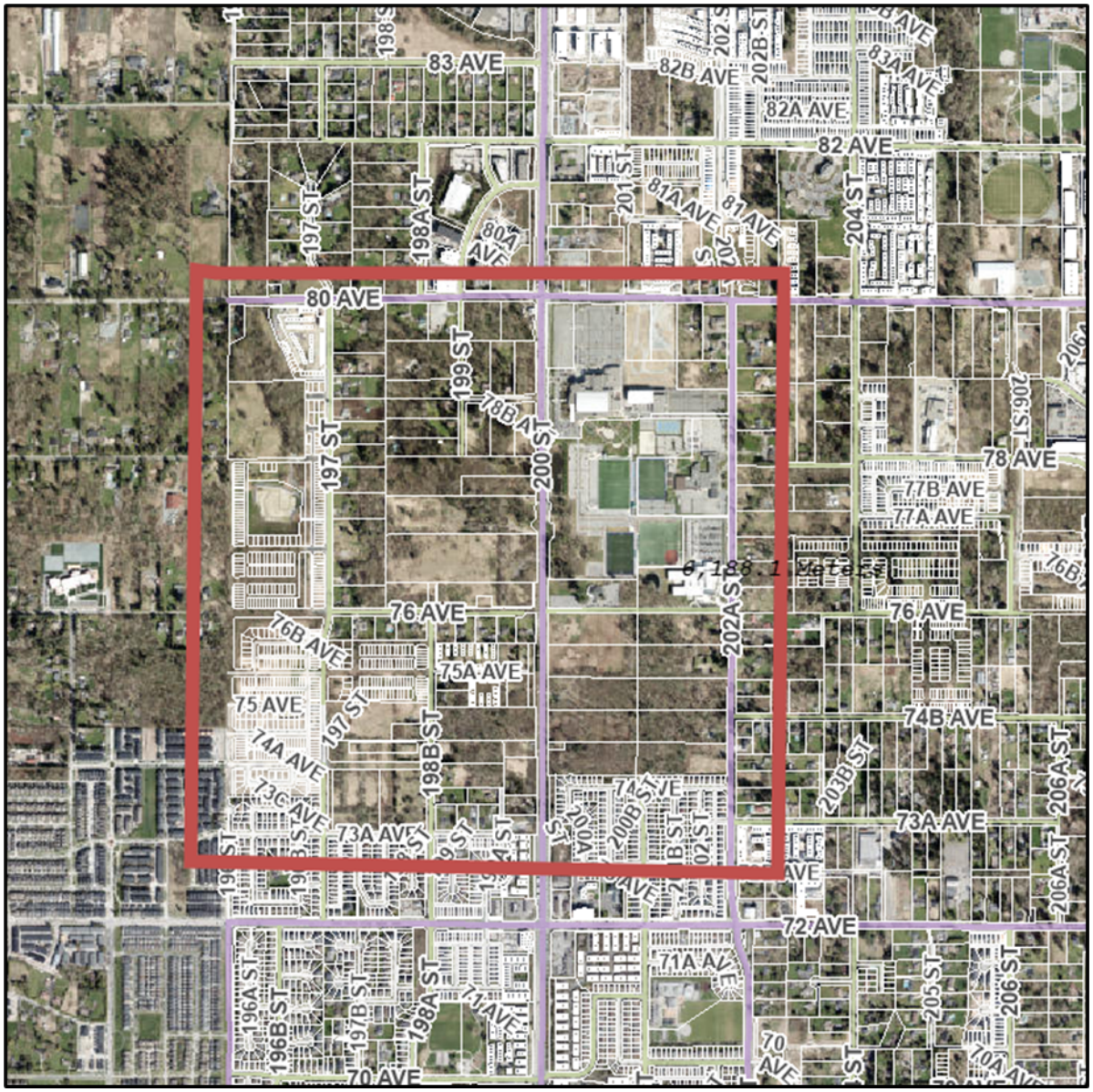
From: Chwaklinski, David
Sent: 2024, January 25 2:41 PM
To: Lee, Johnson; Simpson, Lauren; Wong, Felix; Armstrong, Tyler
Cc: Chwaklinski, David
Subject: Willoughby Property Acquisition - Background for discussion with Township of Langley.
Attachments: TM-0592 Project Intro and Meeting Request_2024-01.docx

Importance: High

On December 5th, 2023, Planning provided the map below that shows the expected future load growth areas in Willoughby. As you can see the bulk of the growth in Willoughby is centered around 200th below 80th avenue. These planning estimates are based on known and expected development in the Willoughby area of Langley.



Based on the map above the Planning preferred load center for Willoughby is geographically located approximately around 200th and 76th avenue. This information was used to develop the preferred area for a substation. The preferred boundaries are shown in the map below (roughly a 1200 m circle around the geographical center). These boundaries are based on initial review of developed sites and the requirement to keep distribution costs as low as practical. The further from the center of load the more cost incurred in developing the Distribution system.



There was a question this morning as to the possibility of placing the new station in other areas away from the load center. To be brief it will be challenging (but not impossible) for the following reasons:

- The boundary between Surrey and Langley is 196th st. This does not give very much room to look at proerties to the west as it is unlikley Surrey wants to host a station that primarily supplies Langley (we had the same discussion for Campbell Heights).

- North of the Freeway is not practical as as this would require two 230 kV crossings of the Trans Canada highway to supply the station as there is no 230 KV supply North of the Highway. It would also require multiple highway crossings for distribution to get to the load center. The costs would add up very quickly and introduce the challenge of working with MOTI to cross the highway.
- Moving further to the east is possible however the further east we go the further away the potential transmission connection gets which requires longer Rights of Way. If the station must move to the east it might work out that a Tap station could be combined for Willoughby and Campbell Heights stations but this would require a new double circuit ROW around the east side and through the south of Langley City
- Moving to the South brings us closer to Willowbrook which might require an Indoor station to fit in one of the Commercial/Industrial Properties

Finally on to Cost, I had conversations with Nasim Shoja and Man-Hin lo of the project estimating team this afternoon. I asked them about the latest estimates for various versions of outdoor, indoor and Underground substations. Please keep in mind that these are Conceptual Level esitmates at best with accuracy of +100%/-35% so they should only be considered as order of magnitude estiamtes only. There also is some variability to be expected because the Indoor and underground station estimates are for 400 MVa stations as opposed to 200 MVa which we expect Willoughby and Campbell Heights to be.

200 MVa Outdoor station $225,000,000 to $250,000,000
400 MVa Indoor station $415,000,000 to $456,000,000
400 MVa Underground station $600,000,000 to $650,000,000

Please note that these estimates do not include bare land costs. Note that these are not official numbers and should not be distributed externally. They should only be used in preparing for a question as to why we are not going indoor or undergroound.

I make one observation regarding locating an outdoor vs Indoor station for Willoughby. If the Langley City load is factored in does it suggest that locating an indoor station expandable to 400 MVa to serve the load of the entire area make sense?

I hope this helps in your preparation for any meetng with the Township of Langley. Let me know if you have any quesitons.

Also I have attached a marked up copy of your draft letter for consideration.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com

BC Hydro
Power smart

February 1, 2024

Departments of Community Development and Engineering
Township of Langley
20338 – 65 Avenue
Langley, BC V2Y 3J1
Sent by email: cdinfo@tol.ca, enginfo@tol.ca

Hello,

Langley is one of the fast-growing areas in Lower Mainland. Langley area is presently supplied by three substations – Port Kells (PKL), Harvey Road (HRD) and McLellan (MLN) substations. PKL and HRD are at their ultimate capacities and we're currently upgrading MLN to meet the area load growth and customers' requirement. We're seeing a need for a new substation to supply load in the Langley area as there will be no capacity available in the existing substations to supply the new area loads in around the next 10 years.

Willoughby Substation
One of the areas with significant growth is the community of Willoughby within the Township of Langley. We are looking to acquire a property for a 200MVA substation to service the growth expected in this area. This substation will take the higher voltage 230kV transmission power down to 25kV distribution to provide power to the community. The substation needs to be as close to the load centre as possible around the intersection of 200 Street and 80th Avenue and be around ~~43,000m²~~37,000 m² (399,000~~463,000~~ sq. ft.). We looked at the Willoughby Community Plan and noted the dense residential and commercial zoning plans for the areas being consider~~ation~~. Preferably, we rather not take property slated for dense residential development from the market and are open to other areas. However, we also have limits with regards to the distance away from the load centre and other operational considerations.

Commented [CD1]: Please note that this reduction in size is based on the three alternate layouts I received January 4th but forgot to update the SDM table with.

Request for meeting to discuss
We would like to meet with Community Planning and Engineering to discuss sites for a new substation to service Willoughby community growth around middle of February. Please contact me at johnson.lee@bchydro.com to arrange a mutually convenient time with our project team.

Sincerely,

Johnson Lee
Stakeholder Engagement Advisor

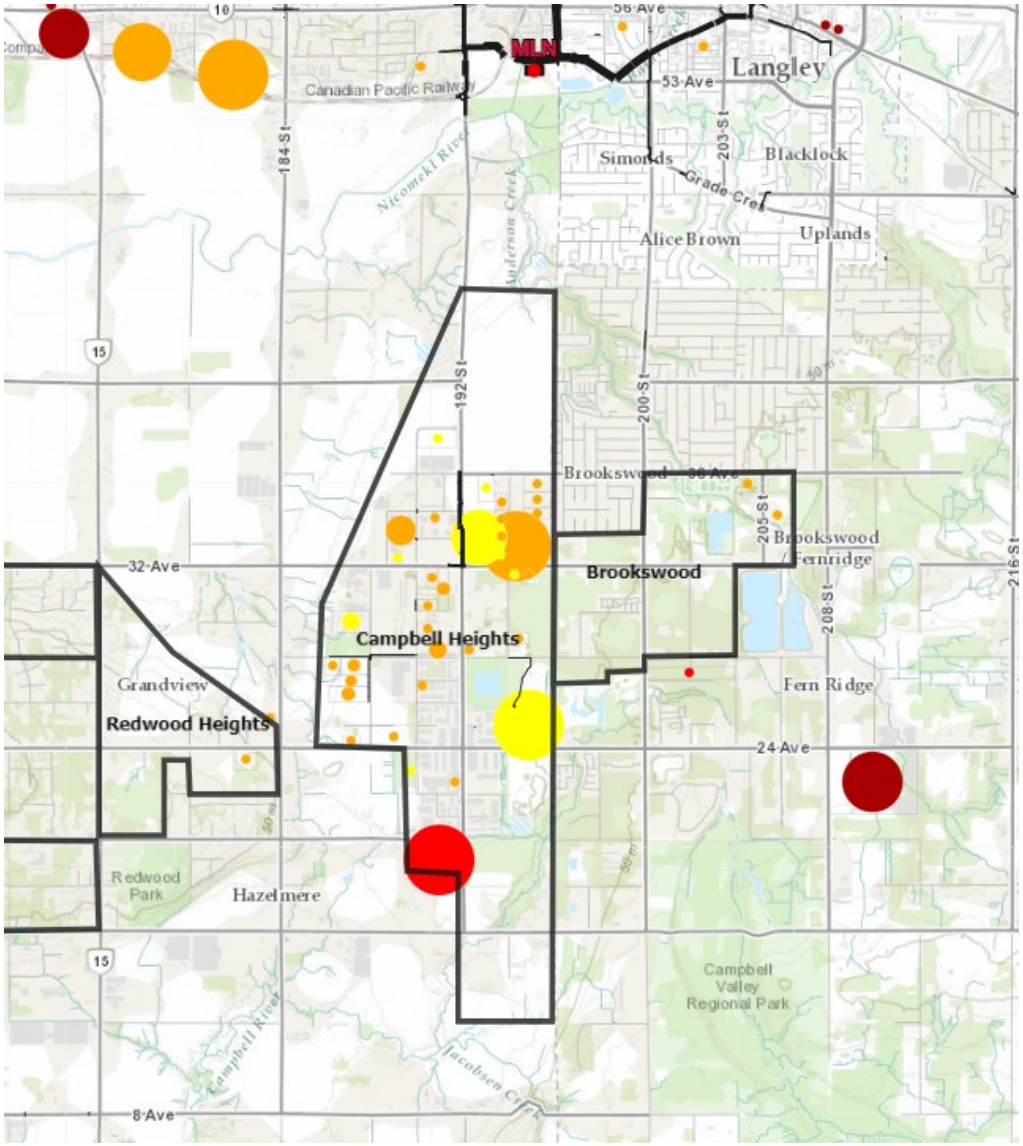
CC: Felix Wong, Project Manager, Willoughby Substation Acquisition Project
Sabrina Locicero, Community Relations Lower Mainland

From: Manurung, Cynthia
Sent: 2023, December 05 5:13 PM
To: Chwaklinski, David
Cc: Ellis, Aaron
Subject: RE: Load growth Mapping for Campbell Heights/Willoughby

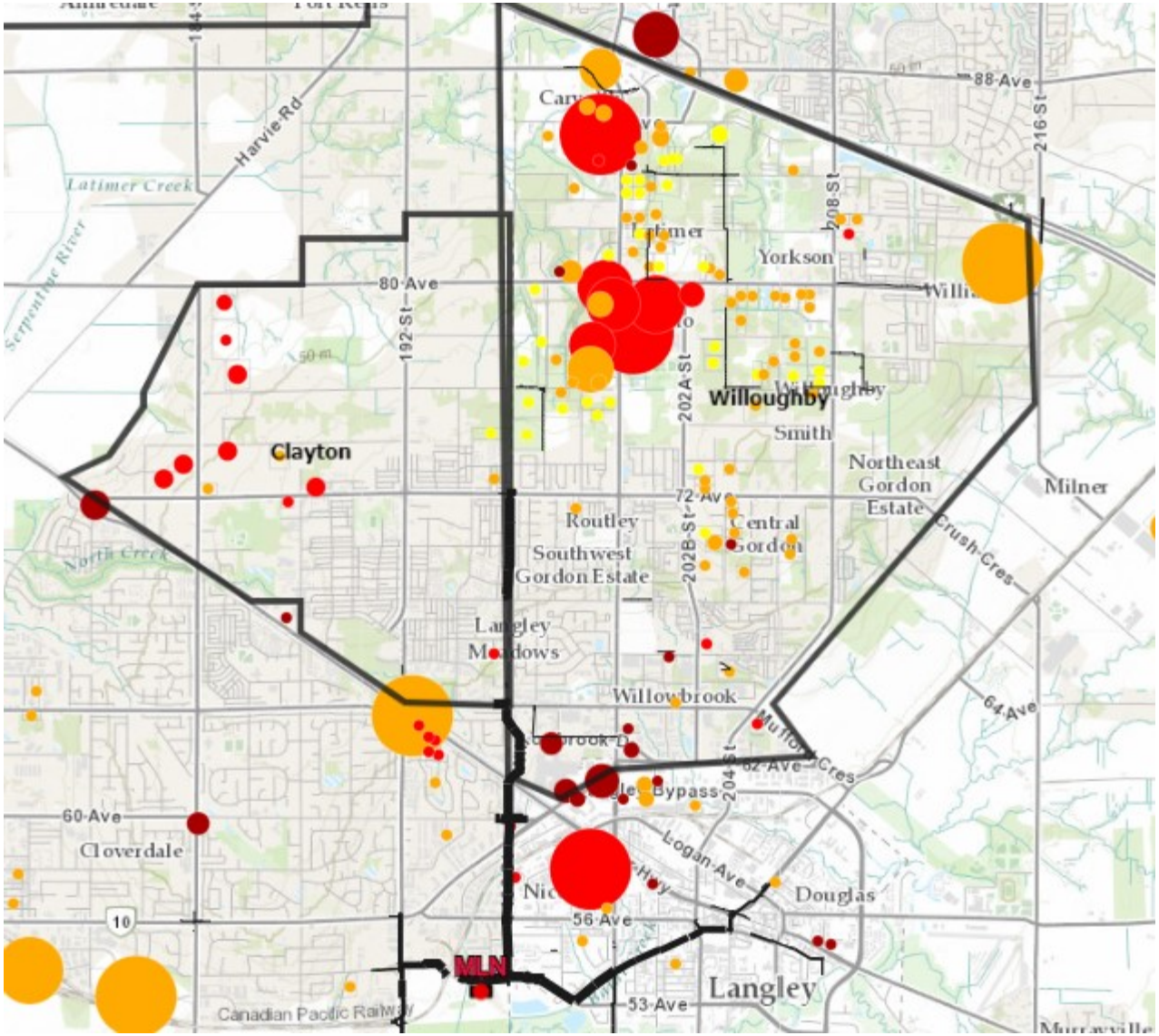
Hi David,

196 St is the border between Surrey and Langley. Campbell Heights neighborhood is within City of Surrey jurisdiction.

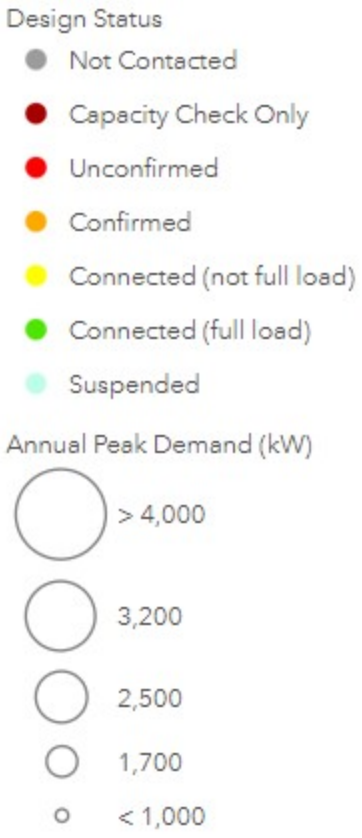
- Campbell Heights (CBM) substation service area is planned to support growth in Campbell Heights, Brookswood, and support Redwood Heights.



- Willoughby (WLB) substation service area is planned to support growth in Willoughby and Clayton


Harvie Rd
Latimer Creek
Serpentine River
88 Ave
216 St
208 St
Latimer
Yorkson
80 Ave
192 St
202A St
Willoughby
Smith
Clayton
Northeast Gordon Estate
Milner
72 Ave
Routley
Southwest Gordon Estate
202B St
Central Gordon
Crush Cres
North Creek
Langley Meadows
Willowbrook
64 Ave
62 Ave
Mufford Cres
204 St
Bypass
60 Ave
Cloverdale
Logan Ave
Douglas
10
56 Ave
MLN
Langley
53 Ave
Canadian Pacific Railway

Legend:



Cynthia Manurung, P.Eng
Regional Distribution Planner – Surrey/Langley/White Rock

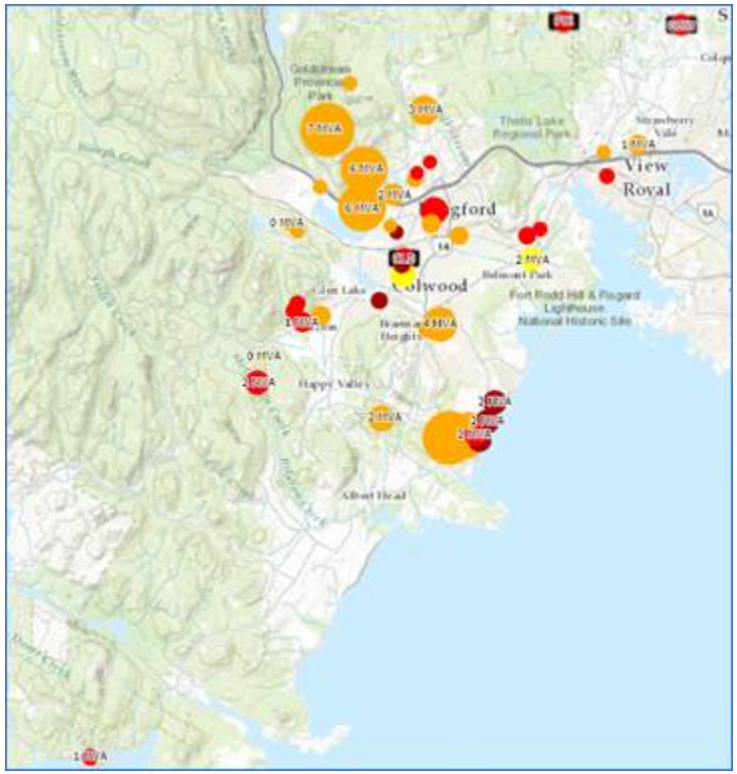
M 604 812 4322

Smart about power in all we do.

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2023, December 05 11:26 AM
To: Manurung, Cynthia <Cynthia.Manurung@bchydro.com>
Cc: Ellis, Aaron <Aaron.Ellis@bchydro.com>
Subject: Load growth Mapping for Campbell Heights/Willoughby

Good Morning Cynthia, I am the PE for the New Willoughby and Campbell Heights substations and I am coming to you as you are shown as the FV West Distribution planner. If this is not the case could you let me know who I should be talking to?

This morning a question came up related to the siting of the stations and the projected load growth in the langley area. It was pointed out that while the Campbell Heights load growth information is noted to be in the Langley area the actual substation (Campbell Heights) is located in Surrey. This could cause some challenges in stakeholder engagement when we ultimately talk to Surrey about constructing the station along the lines of " why are you building in surrey when the load is in langley?". Is it possible to get a map of some sort showing the potential load growth in the both areas similar to the map below which is for Goldstream? This would make it much easier for us to conduct our stakeholder engagement if we can show that most of the load increase is on the Surrey side of the border.

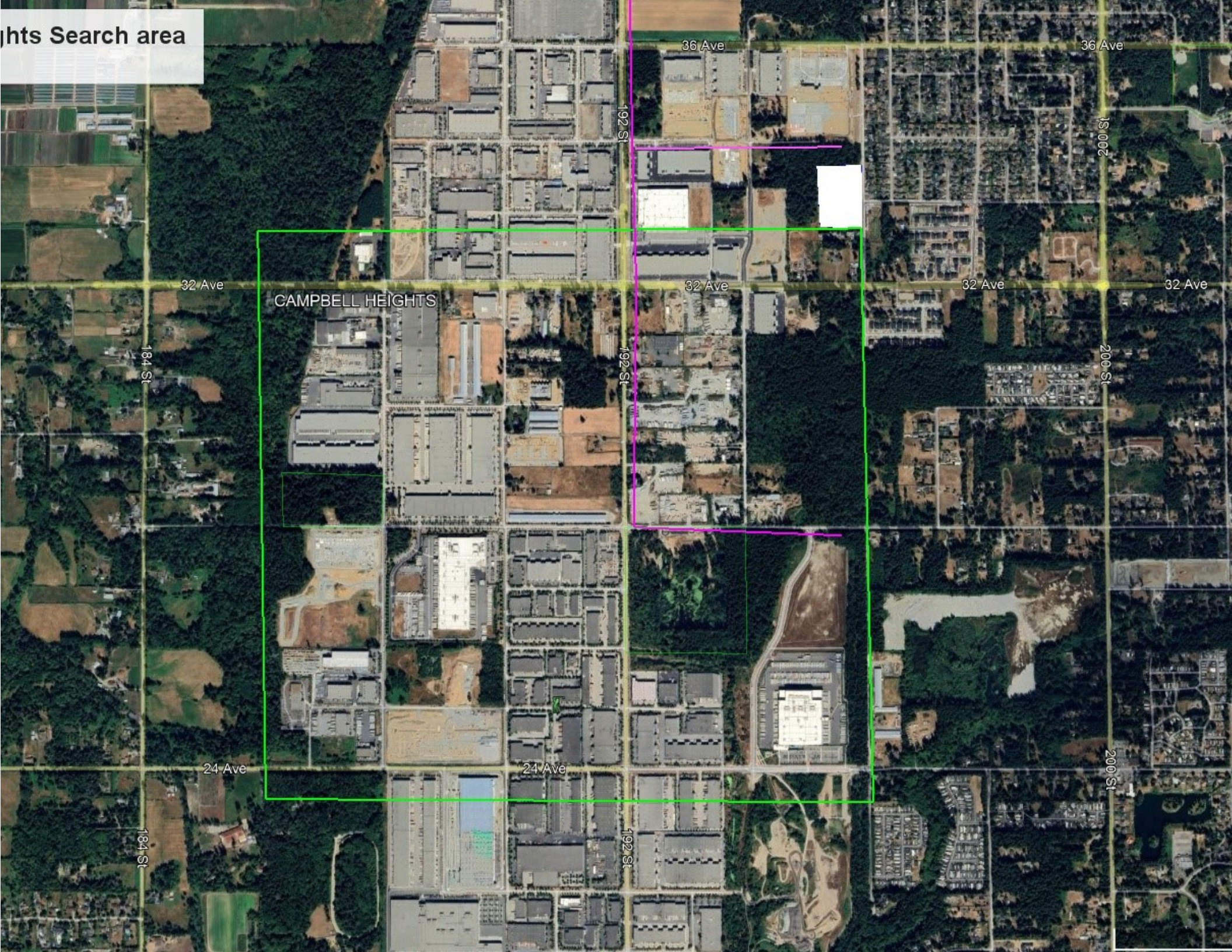


If you could provide this for the Campbell Heights and Willoughby areas it would be very helpful. If you have any questions please give me a call. Thanks

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnection

BC Hydro
6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M **778 833 3740**
E david.chwaklinski@bchydro.com


ghts Search area
36 Ave
36 Ave
192 St
200 St
32 Ave
CAMPBELL HEIGHTS
32 Ave
32 Ave
32 Ave
184 St
192 St
200 St
24 Ave
24 Ave
184 St
192 St
200 St

From: Brady, Karen
Sent: 2024, October 01 4:41 PM
To: Evans, Jen; van Oort, Harry; Heritage
Cc: Chaisson, Rob; Knighton, Mykol
Subject: RE: TM-0592 - ALT 20 - Bosa - Kang UPDATED AGAIN - ENV screening
Attachments: Willoughby High Level Arch Review V8 TM0592.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Jen

Please see attached for the high-level review of ALT20. It was pretty fast to do since it's adjacent to the previous property. Please note that for the previous memo (V7), the historic sites information was omitted. This was my oversight. The Archaeology Branch has now removed all the historic site data from its online web application and I didn't catch that. It's available, but from a different online web application. Regardless, it shouldn't factor into the review, but thought you should know.

Cheers, Karen.

_____

Karen Brady | Environmental Professional (Heritage)

BC Hydro
P 778-256-5770

From: Evans, Jen
Sent: 2024, October 01 3:34 PM
To: van Oort, Harry ; Heritage ; Brady, Karen
Cc: Chaisson, Rob
Subject: FW: TM-0592 - ALT 20 - Bosa - Kang UPDATED AGAIN - ENV screening

Hi everyone,

We've been requested to review TM-0592 Alternative 20 (Bosa, Kang) property again. We reviewed the Bosa-Kang property shown in the attached Bosa-Kang jpg. The new request is to add in the Kool property to the southwest (shown in the attached Picture 1 image). Revised Alt 20 kmz is attached.

Charge code: TM0592 1410 A01H

Please let me know if the addition changes the results of the internal environmental screening or not.

Thanks,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

Smart about power in all we do.

From: Evans, Jen
Sent: 2024, September 17 3:05 PM
To: van Oort, Harry <Harry.vanOort@bchydro.com>; Brady, Karen <Karen.Brady@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>; Heritage <Heritage@bchydro.com>
Subject: FW: TM-0592 - ALT 20 - Bosa - Kang UPDATED KMZ File - ENV screening

UPDATED KMZ here – please screen both properties outlined in red and yellow. Thanks.

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro

6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

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From: Evans, Jen
Sent: 2024, September 16 4:02 PM
To: van Oort, Harry <Harry.vanOort@bchydro.com>; Brady, Karen <Karen.Brady@bchydro.com>
Cc: Heritage <Heritage@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: TM-0592 - ALT 20 - Bosa - Kang KMZ File - ENV screening

Hi Karen and Harry,

Are you both able to conduct a high level internal screening for Alternative 20, KMZ attached?

Spreadsheet for input is here: https://ppm.bchydro.bc.ca/projects/TM-0592/ProjectDocuments/Project_Management/1_IDN/Project_Plan/TM-0592_Willoughby_SDM_2024-05-30.xlsx

Charge code: TM0592 1410 A01H

Let me know if you have any questions or concerns. Thanks,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022

E jen.evans@bchydro.com

bchydro.com

Smart about power in all we do.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, September 16 2:20 PM
To: Evans, Jen <Jen.Evans@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>; Archibald Carson, Corry <Corry.Archibald@bchydro.com>
Cc: Wu, Bill <Bill.Wu@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Bosa - Kang KMZ File

All,
Here is a .kmz file for the subject property.
Please initiate an environmental and heritage desk top screening for these properties.
More work will be done, if we close on the purchase.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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Memo

To: Jen Evans, Rob Chaisson, Harry van Oort

From: Karen Brady

CC: Mykol Knighton

Date: October 1, 2024

RE: Willoughby, Langley – Property Screenings (TM-0592)

1. Project Location

The memo addresses one possible Project location within the City of Surrey.

BC Hydro has requested a high-level archaeology review of one property within the City of Surrey, as outlined in Table 1, below. The property is also known as the Kool Property (ALT 20).

Property	Address
1	Near 7465 194 Street, Surrey, BC

2. Methods and Objectives

This review consists of a brief review of the Provincial Heritage Register, accessed via the Remote Access to Archaeological Data (RAAD) website application as well as the online BC Register of Historic Places. The objective of the review is two-fold:

a. to identify any recorded archaeological sites within, or near, the property listed above, and
b. determine whether the archaeological sites are of sufficient scientific significance to impede development of the property.

This review does not include an assessment of archaeological potential – the likelihood that archaeological sites may be encountered but simply to indicate whether sites of a particular type, such as human burials or other sites of high scientific significance have been recorded within or near the property listed above.

3. Results

The results of the review indicate that no archaeological sites have been recorded within, or near, the property listed in Table 1. One archaeological site – the Binning Site – is located at the intersection of 192 Street and 84 Avenue, in Surrey, approximately 1.8 km to the northwest. The site was recorded in 1963 when a large boulder bowl was identified. The area surrounding the discovery is considered to have potential for other archaeological materials. The site has "legacy" status within the Provincial Heritage Register and is not automatically protected by the Heritage Conservation Act.

Three historical sites – all historical structures – are located southwest of the Kool property. One historical site – comprised of a historical-era building – is located at 7412 192 Street, in Surrey. The building has been registered at DjRq-121 and consists of the Bolivar Barn, constructed ca. 1920. The other two structures (DgRq-120 and DgRq-149) are located at 7381 192 Street. These consist of the Edward Armstrong Barn and Edward Armstrong House, respectively. Both structures were built in 1920.

4. Recommendations

This cursory review indicates that no archaeological sites have been recorded within, or near, the property listed in Table 1. As this review does not include an assessment of archaeological potential, it is recommended that further archaeological work, such as Heritage Screening, be conducted once the initial SDM has been completed.

5. Closure

I trust this memo provides you with the information you require. If you have any questions, do not hesitate to contact me.



Figure 1. Location of property near 7465 194 Street, Surrey, BC (TM-0592).

From: Brady, Karen
Sent: 2024, September 17 7:36 PM
To: Evans, Jen; van Oort, Harry
Cc: Chaisson, Rob; Heritage; Knighton, Mykol
Subject: RE: TM-0592 - ALT 20 - Bosa - Kang UPDATED KMZ File - ENV screening
Attachments: Willoughby High Level Arch Review V7 TM0592.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hello All

Please find the Arch Review Memo attached.

Thanks, Karen.

_____

Karen Brady | Environmental Professional (Heritage)

BC Hydro
P 778-256-5770

From: Evans, Jen
Sent: 2024, September 17 3:05 PM
To: van Oort, Harry ; Brady, Karen
Cc: Chaisson, Rob ; Heritage
Subject: FW: TM-0592 - ALT 20 - Bosa - Kang UPDATED KMZ File - ENV screening

UPDATED KMZ here – please screen both properties outlined in red and yellow. Thanks.

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

Smart about power in all we do.

From: Evans, Jen
Sent: 2024, September 16 4:02 PM
To: van Oort, Harry <Harry.vanOort@bchydro.com>; Brady, Karen <Karen.Brady@bchydro.com>
Cc: Heritage <Heritage@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: TM-0592 - ALT 20 - Bosa - Kang KMZ File - ENV screening

Hi Karen and Harry,

Are you both able to conduct a high level internal screening for Alternative 20, KMZ attached?

Spreadsheet for input is here: https://ppm.bchydro.bc.ca/projects/TM-0592/ProjectDocuments/Project_Management/1_IDN/Project_Plan/TM-0592_Willoughby_SDM_2024-05-30.xlsx

Charge code: TM0592 1410 A01H

Let me know if you have any questions or concerns. Thanks,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

Smart about power in all we do.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, September 16 2:20 PM
To: Evans, Jen <Jen.Evans@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>; Archibald Carson, Corry <Corry.Archibald@bchydro.com>
Cc: Wu, Bill <Bill.Wu@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Bosa - Kang KMZ File

All,
Here is a .kmz file for the subject property.
Please initiate an environmental and heritage desk top screening for these properties.
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Robert

Robert Hepple P.Eng.

Project Manager, Stations
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W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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Memo

To: Jen Evans, Rob Chaisson, Harry van Oort

From: Karen Brady

CC: Mykol Knighton

Date: September 17, 2024

RE: Willoughby, Langley – Property Screenings (TM-0592)

1. Project Location

The memo addresses one possible Project location within the City of Surrey.

BC Hydro has requested a high-level archaeology review of one property within the City of Surrey, as outlined in Table 1, below. The property is also known as the Bosa-Kang Property.

Property	Address
1	Near 7537 194 Street, Surrey, BC

2. Methods and Objectives

This review consists of a brief review of the Provincial Heritage Register, accessed via Remote Access to Archaeological Data (RAAD) website application. The objective of the review is two-fold:

a. to identify any recorded archaeological sites within, or near, the property listed above, and
b. determine whether the archaeological sites are of sufficient scientific significance to impede development of the property.

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The results of the review indicate that no archaeological sites have been recorded within, or near, the property listed in Table 1. One archaeological site – the Binning Site – is located at the intersection of 192 Street and 84 Avenue, in Surrey, approximately 1.8 km to the northwest. The site was recorded in 1963 when a large boulder bowl was identified. The area surrounding the discovery is considered to potential for other archaeological materials. The site has "legacy" status within the Provincial Heritage Register and is not automatically protected by the Heritage Conservation Act.

4. Recommendations

This cursory review indicates that no archaeological sites have been recorded within, or near, the property listed in Table 1. As this review does not include an assessment of archaeological potential, it is recommended that further archaeological work, such as Heritage Screening, be conducted once the initial SDM has been completed.

5. Closure

I trust this memo provides you with the information you require. If you have any questions, do not hesitate to contact me.



Figure 1. Location of property near 7537 194 Street, Surrey, BC (TM-0592).

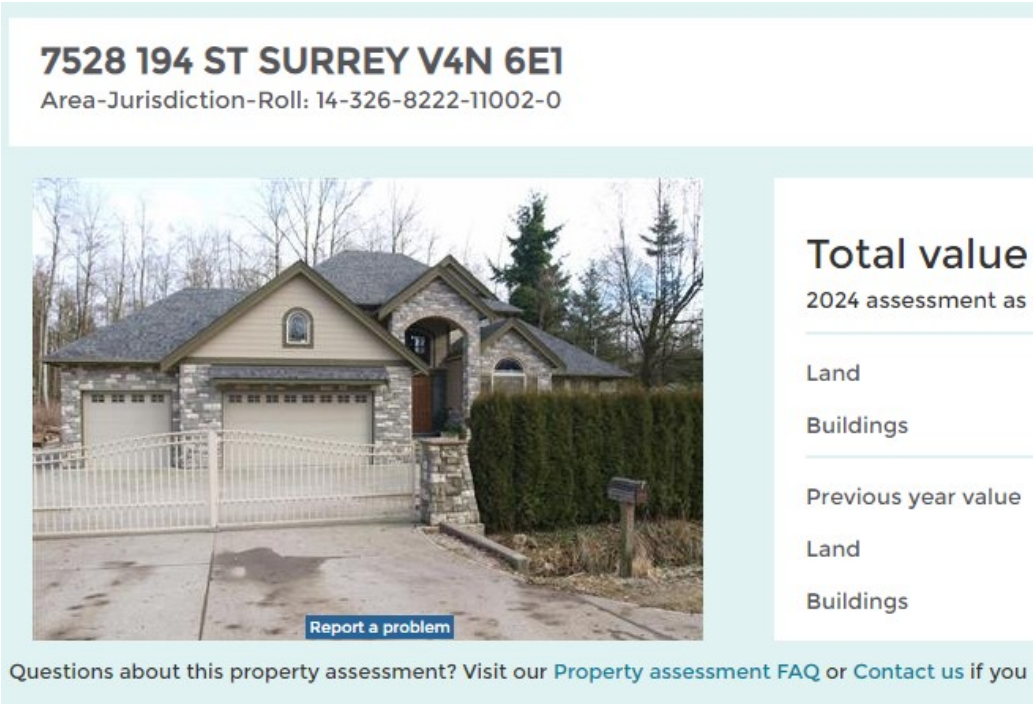
From: Jiang, Kally
Sent: 2024, July 19 4:51 PM
To: Chwaklinski, David; Hepple, Robert; Sherevkulov, Dmitry
Subject: RE: TM0592 - Willoughby Heights Sub, Alt 20
Attachments: WIB-E05-SK004-Outdoor 230 +GIS 60n25-To Fit Bosa Property-20240719.pdf; WIB-E05-SK003-Option 3-Outdoor 230 +GIS 60n25-To Fit Qualico Property-20240719.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Good afternoon, All,

The station layout has been barely fitted onto the Bosa's properties of 100m x 391m lot. This Alternative 20 is not preferable from Station Electrical Design perspective with the reasons below.

1. The 100m width is extremely tight for layout.
2. How the 230kV transmission Lines enter the station would be a concern.
3. The connection between 230kV bus ring would be very long and costly.
4. The high voltage power cables run from TX to both 60/25kV GIS buildings would be complicated and costly.
5. Low voltage cables run from switchyard to the control building would be quite long and costly.
6. There is a beautiful house on Bosa's property of 7528 194 ST SURREY as picture below. It was built in year 2003 and relatively new. What a regret and waste if we have to demolish the house to build our station on the lot.



I also looked into the Qualico property further. The station layout could be squeezed onto that property as attached Option 3. Compare these two options, the layout on Qualico's property is much better than the one on Bosa's properties.

Hope above info helps and have a great weekend!
Kally

Kally Jiang (She/Her/Hers) | P. Eng.
Senior Engineer, Electrical Design
Stations Division, Transmission Engineering

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6911 Southpoint Drive, E06th Floor
Burnaby, B.C. V3N 4X8

T 604 528 2605
F 604 528 1600
E Kally.Jiang@bchydro.com

bchydro.com

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, July 18 9:56 AM
To: Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: FW: TM0592 - Willoughby Heights Sub, Alt 20

Hi Kally, a new set of properties has arisen for consideration. Please refer to the e-mail string below. The two properties together are 100 m wide by 391 m long. Can you have a quick look and see whether we could accommodate all the requirements on this parcel> That would dbe the 4 linepositions, the 25 kV section and potentially a 69 kV section? Can you respond back directly to Robert, Dmitry as well as me? I will be on vacation for two weeks so will not be able to respond after mid day tomorrow.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Wednesday, July 17, 2024 2:12 PM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Cc: Chan, David Y.M. <David.Chan@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: TM0592 - Willoughby Heights Sub, Alt 20

Hi Dmitry,
We will need planning and engineering to look at it.
Problem that I see is that there is not two areas of access.
We are landlocked.
But let's brighter minds than mine make that decision.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
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C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Sent: 2024, July 17 1:12 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Chan, David Y.M. <David.Chan@bchydro.com>
Subject: TM0592 - Willoughby Heights Sub, Alt 20

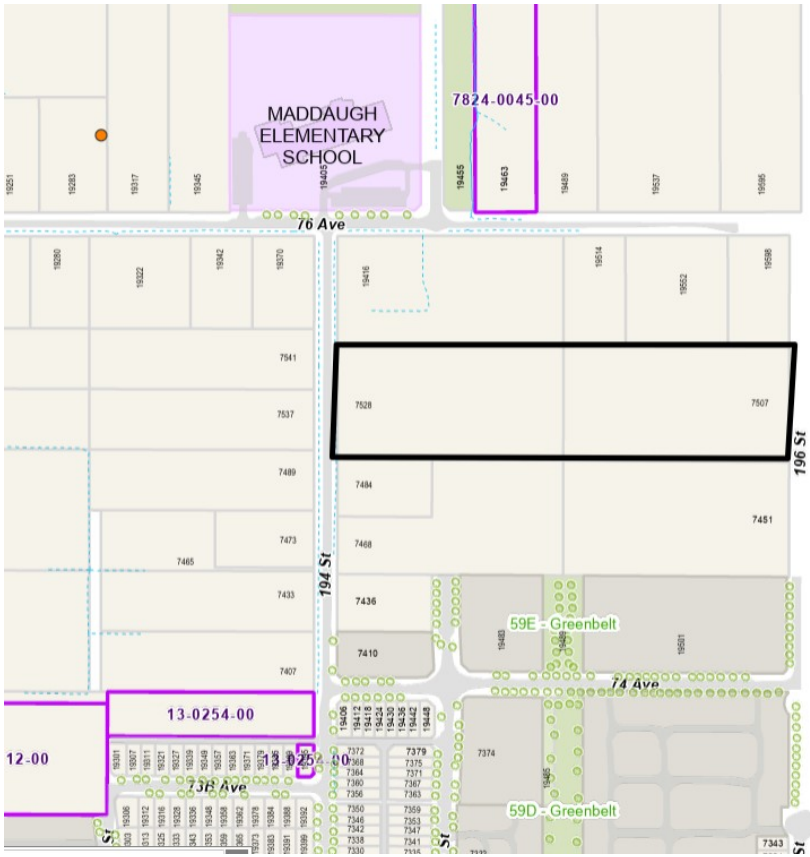
Hi Robert,

I have an update regarding Alternative 20. I spoke to both owners today and looks like both will be willing to sell at the right price. Here are the details of our conversation:

1) 7451 196 ST SURREY – private owner, wants to develop a townhouse. The owner will talk to the rest of the owners to see what price may work for them. I expect it to be $3M+ per acre.

2) 7507 196 ST SURREY – owned by Bosa Properties, they also own a property to the west (7528 194 ST SURREY). I spoke to the Director of Acquisitions and Bosa is currently talking to someone who is seriously interested in buying both properties. The price they are looking to get for both is $2.5-$3M per acre. Bosa is interested in selling both lots, less interested in selling only one. From the design perspective, is it feasible to build a substation on such a long narrow lot (just over 9 acres) fronting 196 St and 194 St? Please refer to the snip below.

If it is feasible then we should probably pursue the 2 Bosa lots instead and act fast.



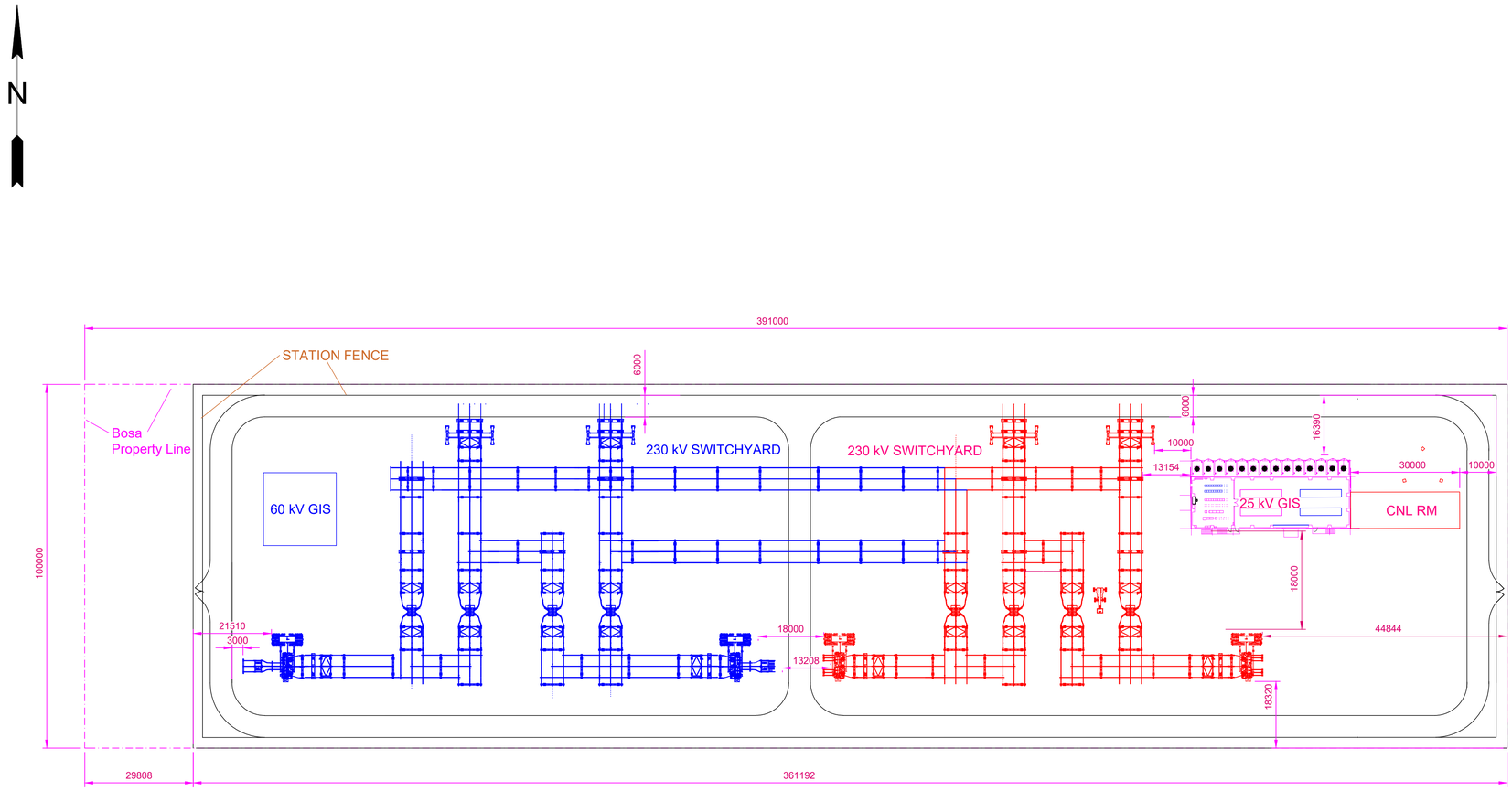
Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604 623 3566
M 604 690 9836
E dmitry.sherevkulov@bchydro.com

bchydro.com

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NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K.JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

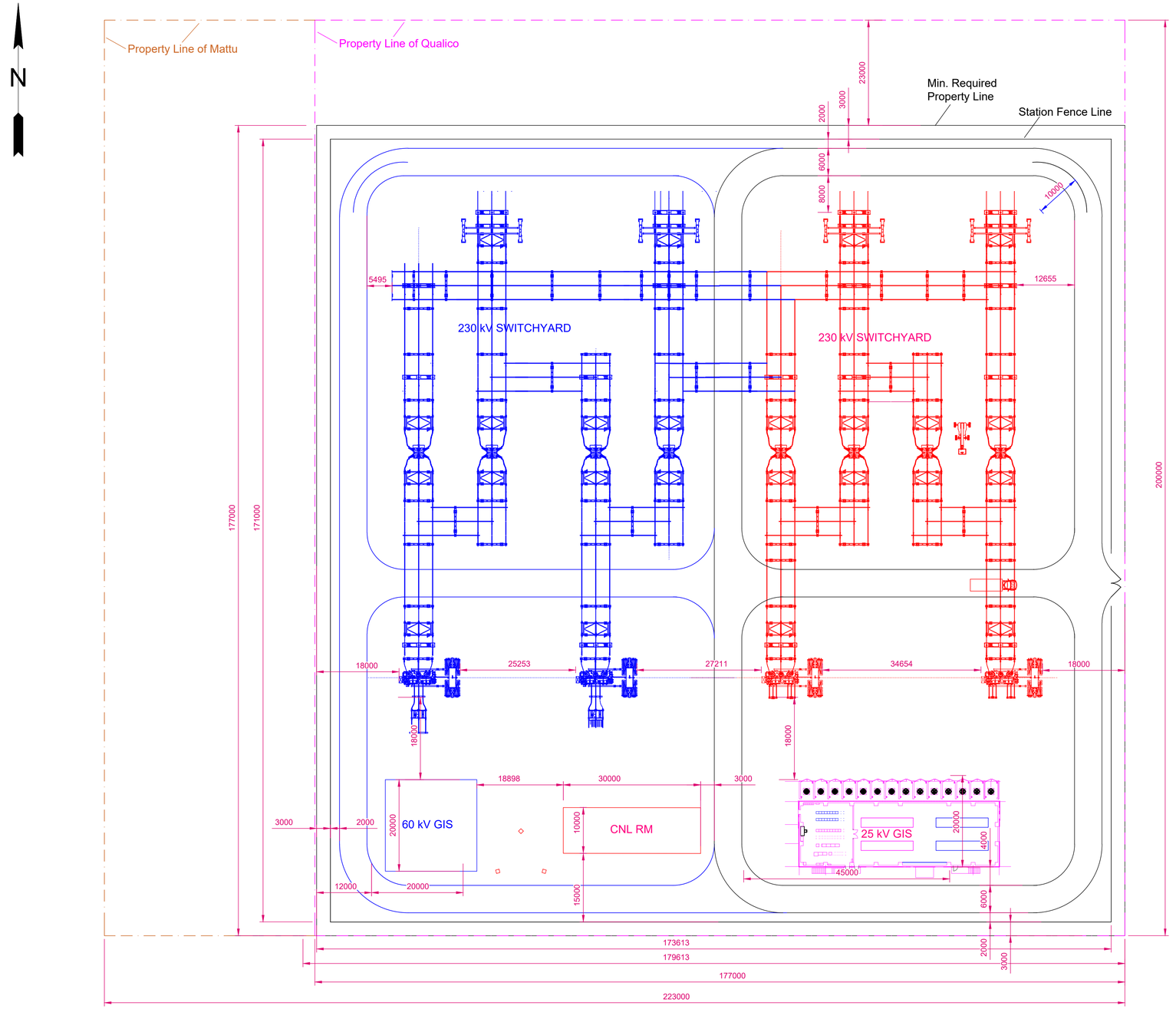
WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024JUL19		WIB-E05-SK004			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

C:\Users\kjang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240718-Bosa\WIB-E05-SK004-Option 1-Outdoor 230 +GIS 60n25-To Fit Bosa Property-20240715.dwg
Drawing Unit = Metric (4)
Width: 44.0
2/19/2024 4:15 PM



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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COLOR CODE FOR SCOPE OF WORK:
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FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO | REMARKS | REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K.JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024JUL10		WIB-E05-SK003-Option 2			D	0A

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C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240705-Qualico\3rd set\WIB-E05-SK003-Option 3-2-Outdoor 230 +GIS 60in25-To Fit Qualico Property-20240710.dwg
Drawing Unit = Metric (4)
Model Space, 1:1
7/15/2024 4:03 PM

From: Chwaklinski, David
Sent: 2025, February 13 10:29 AM
To: Hepple, Robert
Cc: Chwaklinski, David
Subject: RE: TM-0592 WIB Property Purchase

As I have not been directly involved in the McLellan project I can only provide this information

Four new 230 kV line positions are being created at McLellan Substation. It is expected that they will be used to supply the future Willoughby and Campbell Heights Substations. Willoughby will be connected via underground cables terminated either within or near the McLellan Station. The details have not been finalized at this time. Campbell Heights is expected to be connected via overhead Transmission to the McLellan line positions.

From: Hepple, Robert
Sent: Thursday, February 13, 2025 10:17 AM
To: Chwaklinski, David
Subject: RE: TM-0592 WIB Property Purchase

How is it connected to the MLN substation?
This is the language I need

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2025, February 13 10:15 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: TM-0592 WIB Property Purchase

I would say that “The project initially assumed that the connection point was to be a Tap connection somewhere along 2L076. Following initial investigation of target properties a decision was made by “???????” that Willoughby would be connected to McLellan Substation.”

My understanding was that Surinder was involved in the decision, but I don’t know any more than that.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Thursday, February 13, 2025 10:06 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: TM-0592 WIB Property Purchase

Hi David,
I thought so.
So what is the correct language to insert?
Robert

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2025, February 13 10:01 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: TM-0592 WIB Property Purchase

H Robert. That was the initial assumption before someone made the decision to connect at McLellan.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Thursday, February 13, 2025 8:34 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: FW: TM-0592 WIB Property Purchase

Wrong David,
Can you confirm the point of interconnection?
Robert

From: Hepple, Robert
Sent: 2025, February 13 8:22 AM
To: Qin, Martin L <Martin.Qin2@bchydro.com>
Cc: Chan, David Y.M. <David.Chan@bchydro.com>
Subject: TM-0592 WIB Property Purchase

Hi Martin and David,
I have been reviewing a report authored by Andrew in IR on our WIB property purchase.
In the report he makes the following statement;

“Transmission connection for the new substation will likely be loop-in loop-out of the existing 2L76 line (this will be confirmed by Transmission Planning).”

Is this correct?

Robert

Robert Hepple P.Eng.

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E Robert.Hepple@BCHydro.com

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From: Berdusco, Jeff
Sent: 2024, June 24 9:21 AM
To: Evans, Jen; van Oort, Harry
Cc: Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review - UPDATED site plan

Follow Up Flag: Follow up
Flag Status: Flagged

Good morning Jen,

My notes from our chat say Alt 8 and 15 were cancelled for Campbell Heights…..only was supposed to review 14.

I have it completed, and can send it anytime, but Harry and I would just have to look at it together quickly.

Can you confirm 15 is a go

J

From: Evans, Jen
Sent: Monday, June 24, 2024 9:02 AM
To: Berdusco, Jeff ; van Oort, Harry
Cc: Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review - UPDATED site plan

Hi Jeff,

I can’t find wildlife comments on Alternative 15 – anything to add for this property?

Let me know. Thanks,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

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M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

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From: Berdusco, Jeff <Jeff.Berdusco@bchydro.com>
Sent: 2024, June 19 10:09 AM
To: van Oort, Harry <Harry.vanOort@bchydro.com>; Evans, Jen <Jen.Evans@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review - UPDATED site plan

Hi Jen,

Harry and I have met and decided on a response. I have attached our 3 working documents but also populated your excel sheets. Please let me know if there is anything else to look at.

As Harry mentions, it would be great to be involved in some type of ranking for the different properties. From an enviro prospective, there certainly are a few that rise and a few that get pushed down due to our results.

Thanks!

J

From: van Oort, Harry <Harry.vanOort@bchydro.com>
Sent: Tuesday, June 18, 2024 11:02 AM
To: Evans, Jen <Jen.Evans@bchydro.com>; Berdusco, Jeff <Jeff.Berdusco@bchydro.com>; Brady, Karen <Karen.Brady@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review - UPDATED site plan

Hi Jen

I just went over this with Jeff and he will provide updated screening info.

When it comes time to rank the properties, please loop me in as the weighting of screening values isn't necessarily straighforward.

Thanks

H

From: Evans, Jen <Jen.Evans@bchydro.com>
Sent: 2024, June 18 9:31 AM
To: Berdusco, Jeff <Jeff.Berdusco@bchydro.com>; Brady, Karen <Karen.Brady@bchydro.com>
Cc: van Oort, Harry <Harry.vanOort@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review - UPDATED site plan

Thanks Jeff for pointing out the error – please find attached UPDATED site plan for the new Qualico site from the PM.

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

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From: Berdusco, Jeff <Jeff.Berdusco@bchydro.com>
Sent: 2024, June 18 7:48 AM
To: Evans, Jen <Jen.Evans@bchydro.com>; Brady, Karen <Karen.Brady@bchydro.com>
Cc: van Oort, Harry <Harry.vanOort@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review

Hi Jen, No problem.

However before I spend time on this…….I overlayed the KMZ file and its over top of the Alt 17 that we screened last week.

Can you confirm this new alternative (Red polygon) is the same boundary as the previous Alt 17 (blue polygon)



From: Evans, Jen <Jen.Evans@bchydro.com>
Sent: Monday, June 17, 2024 3:21 PM
To: Brady, Karen <Karen.Brady@bchydro.com>; Berdusco, Jeff <Jeff.Berdusco@bchydro.com>
Cc: van Oort, Harry <Harry.vanOort@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: TM-0592 Willoughby Additional Alternative for high level review

Hi Karen and Jeff,

We have been given an additional property to screen for TM-0592 Willoughby – please see attached kmz.

BC Hydro charge code: TM0592 1410 A01H

Thanks in advance,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

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P 604-528-7897
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E jen.evans@bchydro.com

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From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, June 17 10:45 AM
To: Evans, Jen <Jen.Evans@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Lee, Johnson <Johnson.Lee@bchydro.com>
Subject: Willoughby Current 4 Alternatives

Hi Jen and Rob,
Here is the KMZ file for Willoughby.
As discussed in our project meeting, we are not considering Alt 17A & 17B any further, as the Owner (Qualico) wants to develop these properties.
Qualico has offered instead, what I am calling Option 8.1 acres.
Lauren can you please identify this option it in your SVA file? I suspect it will be Alt. 18 but you decide.
Qualico is requesting a Term Sheet, as a precursor to an Option Agreement, which we will prepare.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
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C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: van Oort, Harry
Sent: 2024, June 18 10:02 AM
To: Evans, Jen; Berdusco, Jeff; Brady, Karen
Cc: Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review - UPDATED site plan

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Jen

I just went over this with Jeff and he will provide updated screening info.

When it comes time to rank the properties, please loop me in as the weighting of screening values isn't necessarily straighforward.

Thanks

H

From: Evans, Jen
Sent: 2024, June 18 9:31 AM
To: Berdusco, Jeff ; Brady, Karen
Cc: van Oort, Harry ; Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review - UPDATED site plan

Thanks Jeff for pointing out the error – please find attached UPDATED site plan for the new Qualico site from the PM.

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

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E jen.evans@bchydro.com

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Smart about power in all we do.

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Sent: 2024, June 18 7:48 AM
To: Evans, Jen <Jen.Evans@bchydro.com>; Brady, Karen <Karen.Brady@bchydro.com>
Cc: van Oort, Harry <Harry.vanOort@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review

Hi Jen, No problem.

However before I spend time on this…….I overlayed the KMZ file and its over top of the Alt 17 that we screened last week.

Can you confirm this new alternative (Red polygon) is the same boundary as the previous Alt 17 (blue polygon)



From: Evans, Jen <Jen.Evans@bchydro.com>
Sent: Monday, June 17, 2024 3:21 PM
To: Brady, Karen <Karen.Brady@bchydro.com>; Berdusco, Jeff <Jeff.Berdusco@bchydro.com>
Cc: van Oort, Harry <Harry.vanOort@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: TM-0592 Willoughby Additional Alternative for high level review

Hi Karen and Jeff,

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BC Hydro charge code: TM0592 1410 A01H

Thanks in advance,

Jen

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

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From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, June 17 10:45 AM
To: Evans, Jen <Jen.Evans@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Lee, Johnson <Johnson.Lee@bchydro.com>
Subject: Willoughby Current 4 Alternatives

Hi Jen and Rob,
Here is the KMZ file for Willoughby.
As discussed in our project meeting, we are not considering Alt 17A & 17B any further, as the Owner (Qualico) wants to develop these properties.
Qualico has offered instead, what I am calling Option 8.1 acres.
Lauren can you please identify this option it in your SVA file? I suspect it will be Alt. 18 but you decide.
Qualico is requesting a Term Sheet, as a precursor to an Option Agreement, which we will prepare.
Robert

Robert Hepple P.Eng.

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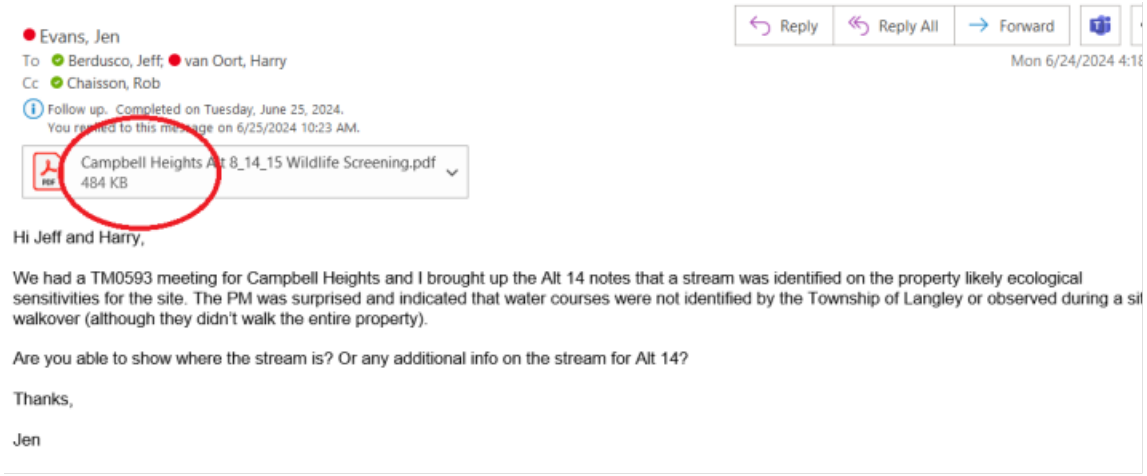
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From: Berdusco, Jeff
Sent: 2024, June 25 12:01 PM
To: Evans, Jen; van Oort, Harry
Cc: Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14

Follow Up Flag: Follow up
Flag Status: Flagged

Sorry no

The email sent previously asking Harry and I (on June 24 at 16:18) about a stream that bisects Alt 14 specifically referred to Campbell Heights.



So for clarity, that is the Alternative I adjusted our assessment for.

Alternate 14d for Willoughby is another discussion! 😊

FWIW, Alt 14d for Willoughby has a stream nearby, but does not bisect the property.

Please call the cell if you would like to discuss any time.

Jeff

From: Evans, Jen
Sent: Tuesday, June 25, 2024 11:39 AM
To: Berdusco, Jeff ; van Oort, Harry
Cc: Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14

Hi Jeff,

Just want to ensure we're taking about the same site. The priority site of interest is Alt 14d shown in the attached.

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

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P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

Smart about power in all we do.

From: Berdusco, Jeff <Jeff.Berdusco@bchydro.com>
Sent: 2024, June 25 10:29 AM
To: Evans, Jen <Jen.Evans@bchydro.com>; van Oort, Harry <Harry.vanOort@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14

Ok, updated.

Please let me know if that works?

J

From: Evans, Jen <Jen.Evans@bchydro.com>
Sent: Tuesday, June 25, 2024 11:08 AM
To: Berdusco, Jeff <Jeff.Berdusco@bchydro.com>; van Oort, Harry <Harry.vanOort@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14

Ok thanks Jeff. Yes please update the comments.

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

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Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

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From: Berdusco, Jeff <Jeff.Berdusco@bchydro.com>
Sent: 2024, June 25 9:23 AM
To: Evans, Jen <Jen.Evans@bchydro.com>; van Oort, Harry <Harry.vanOort@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14

Hi Jen,
Its a limitation to the desktop screening. The treed property certainly looks like riparian, or a stream goes through and is possibly connected to the Latimer Pond area.

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M 778-873-7022
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Cc: Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14
Attachments: Campbell Heights Alt _14 Wildlife Screening.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Ok, updated.

Please let me know if that works?

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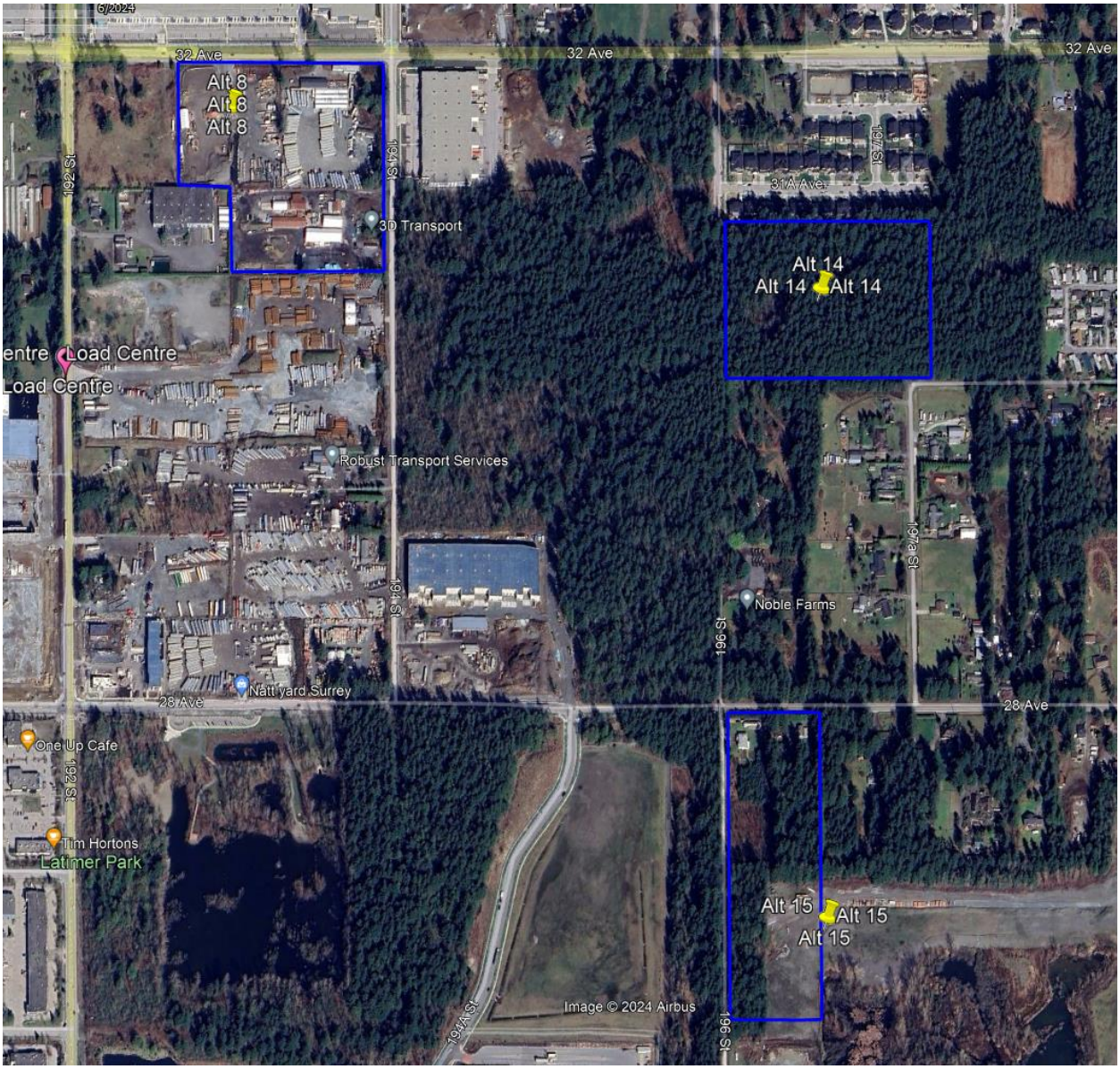
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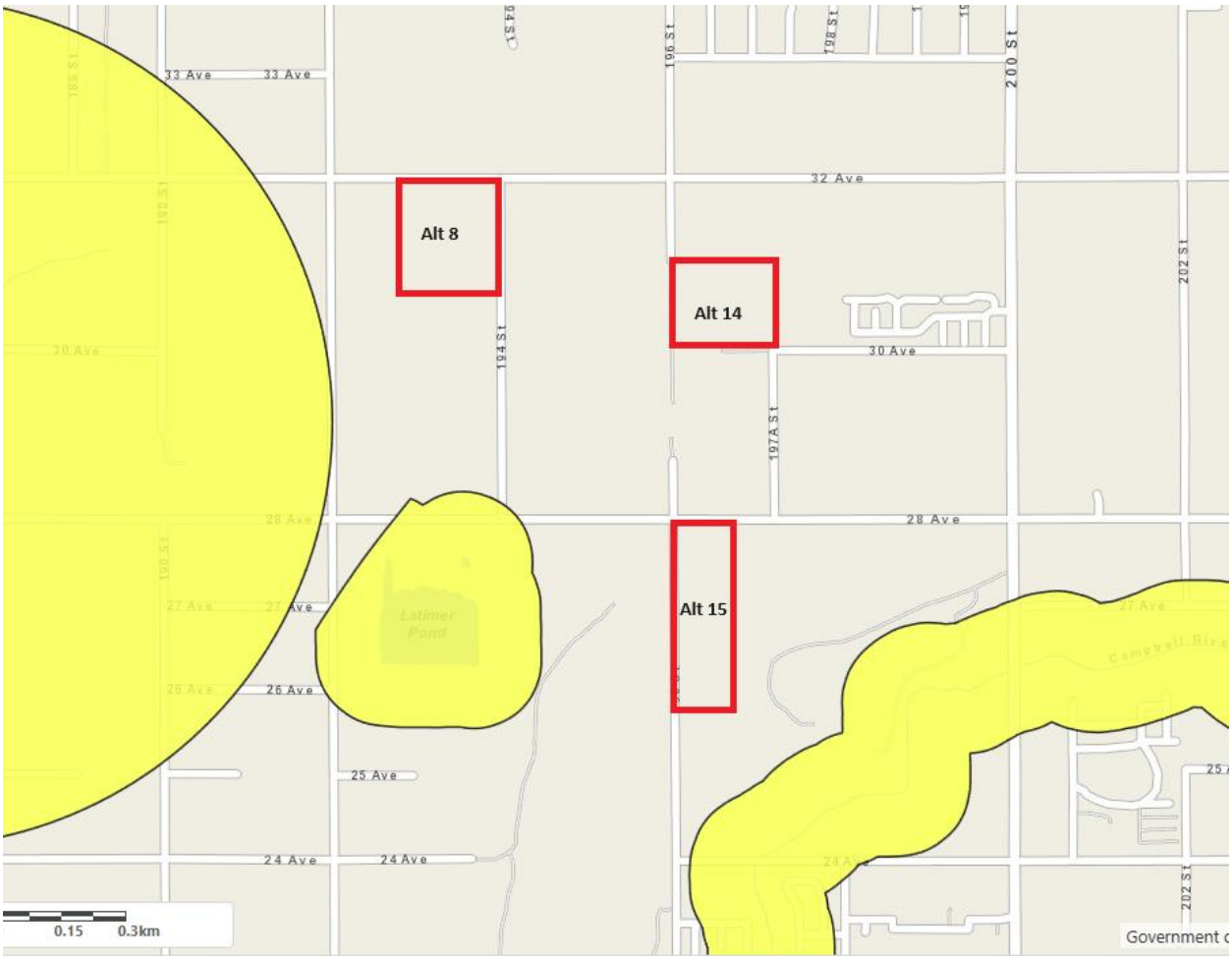
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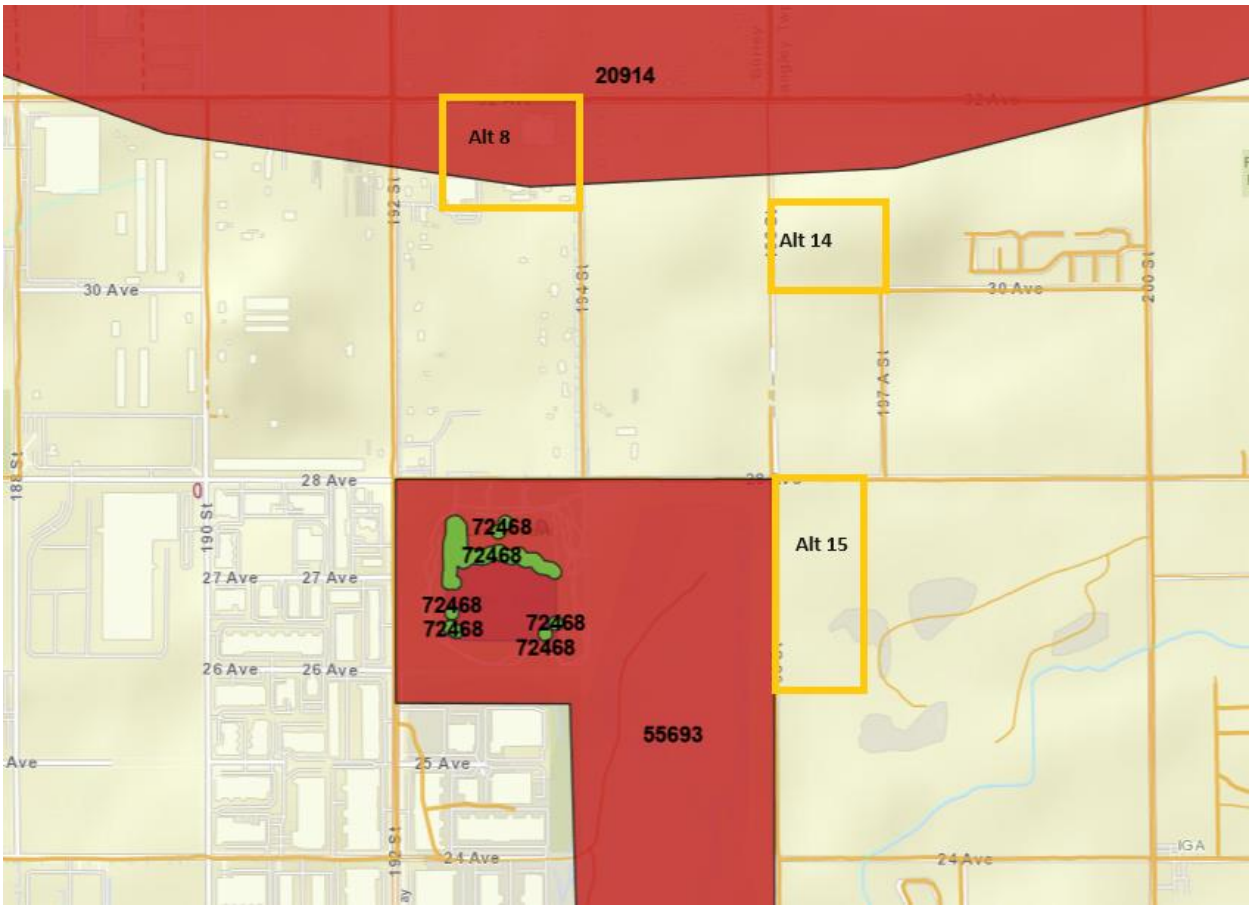
Critical Habitat			Comment	Alt 14	Comment	Alt 15	Comment
Presence of Critical Habitat	% coverage			0			
Presence of Garry Oak Ecosystem	Y/N			N			
Mature Forest	% coverage			100			
Presence of Old Growth Forest	% coverage			0			
Presence of Wetland	% coverage			0	Potential Risk: Stream may bisect the property. Field verification required to elliminate risk.		



Campbell Heights Google Earth Image



Campbell Heights Critical Habitat Information



Campbell Heights CDC information: Alt 8 inside Mountain Beaver CH. Alt 15 Next to Northern Red Legged Frog.

No documented occurrences for Alt 14, however the property is 100% treed and a large stream bisects the property. Its likely there will be ecological sensitives to consider which would rank this property low from an Environmental standpoint.

From: Berdusco, Jeff
Sent: 2024, June 25 9:23 AM
To: Evans, Jen; van Oort, Harry
Cc: Chaisson, Rob
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Follow Up Flag: Follow up
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Sent: 2024, June 25 12:38 PM
To: Evans, Jen; van Oort, Harry
Cc: Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14

Follow Up Flag: Follow up
Flag Status: Flagged

Yes, I updated Campbell Heights Alt 14 today and that lines up with the KMZ file in your last email.

Cheers,

J

From: Evans, Jen
Sent: Tuesday, June 25, 2024 1:19 PM
To: Berdusco, Jeff ; van Oort, Harry
Cc: Chaisson, Rob
Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14

Ok no worries Jeff. My mistake - these properties are really blending!

You are correct! It is TM0593 Campbell Heights Alt 14 – outlined on the attached. This is the property that was rechecked and the comments updated – correct?

Jen

_____

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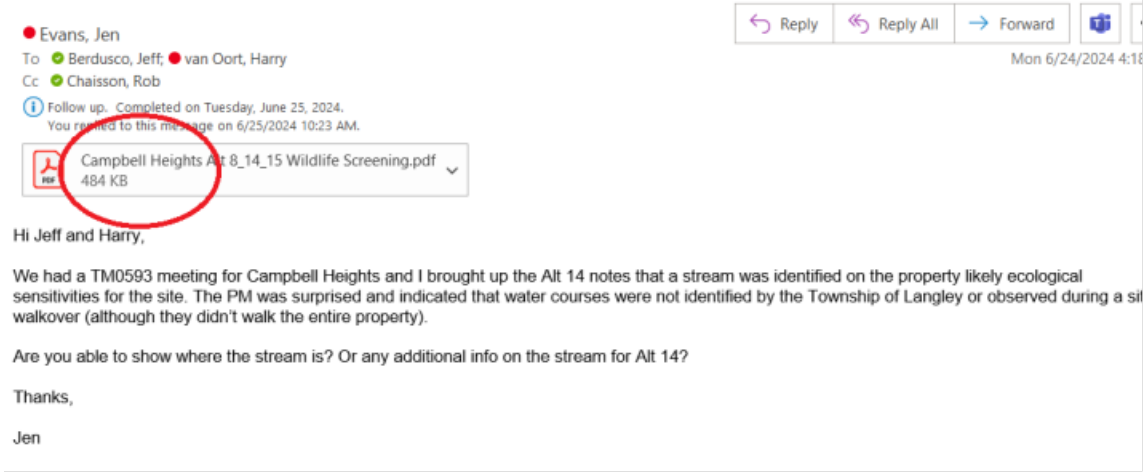
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Subject: RE: TM-0592 Willoughby Additional Alternative for high level review -Alt 14

Sorry no

The email sent previously asking Harry and I (on June 24 at 16:18) about a stream that bisects Alt 14 specifically referred to Campbell Heights.


Reply | Reply All | Forward

Evans, Jen
To Berdusco, Jeff; van Oort, Harry
Cc Chaisson, Rob
Mon 6/24/2024 4:18
Follow up. Completed on Tuesday, June 25, 2024.
You replied to this message on 6/25/2024 10:23 AM.
Campbell Heights Alt 8_14_15 Wildlife Screening.pdf
484 KB

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Are you able to show where the stream is? Or any additional info on the stream for Alt 14?

Thanks,

Jen

So for clarity, that is the Alternative I adjusted our assessment for.

Alternate 14d for Willoughby is another discussion! 😊

FWIW, Alt 14d for Willoughby has a stream nearby, but does not bisect the property.

Please call the cell if you would like to discuss any time.

Jeff

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Hi Jeff,

Just want to ensure we're taking about the same site. The priority site of interest is Alt 14d shown in the attached.

Jen

_____

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Jen

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From: Hepple, Robert
Sent: 2024, June 10 2:38 PM
To: Sherevkulov, Dmitry
Cc: Chan, David Y.M.; Chwaklinski, David; Parmar, Surinder
Subject: RE: TM0592- Willoughby Heights - Properties in West Clayton for BC Hydro
Attachments: Qualico Offer 8.1 Acres.jpg

Hi David and Dmitry,
I propose we meet with them and explore an Option to Purchase the 78th Ave. property with the provision that we can also be successful in purchase the 8 acres to the south.
Let's see what they want for the 8.1 acres and what they know about the property to the south.
Can you set up a meeting please ?
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Sherevkulov, Dmitry
Sent: 2024, June 10 2:09 PM
To: Hepple, Robert

Cc: Chan, David Y.M.
Subject: TM0592- Willoughby Heights - Properties in West Clayton for BC Hydro

Hi Robert,

Please see the email from Qualico below.

Qualico plans to develop the two lots on 76 Ave. Properties on 80 Ave will be used as a storm pond to service surrounding development in the drainage catchment (both have an Option to Purchase on the title).

Other properties available for sale are listed below and only the first one could be suitable given its size.

Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604 623 3566
M 604 690 9836
E dmitry.sherevkulov@bchydro.com

bchydro.com

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From: Nathan Hildebrand <nathan.hildebrand@qualico.com>
Sent: 2024, June 10 10:19 AM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Cc: Eric Zhu <eric.zhu@qualico.com>
Subject: [External] Properties in West Clayton for BC Hydro

You don't often get email from nathan.hildebrand@qualico.com. Learn why this is important

Don't click on links or open attachments unless you trust the sender and are expecting the link or attachment. If you suspect this message to be phishing, please report it by clicking the Report Message button in the Outlook toolbar and select "Phishing."

Dmitry,

Circling back to our discussion of last week. This is confirming that Qualico is not interested in selling 18535 or 18477/18497 76th Avenue. These are part of our main development lands in West Clayton. 18478 80th Avenue is part of a purchase agreement we have with the owner to provide the needed storm pond to service all of the properties in this drainage catchment.

We do own land in North East Clayton to the east which could also service this area in the future. We may be willing to discuss selling the following properties if they work for your organization:

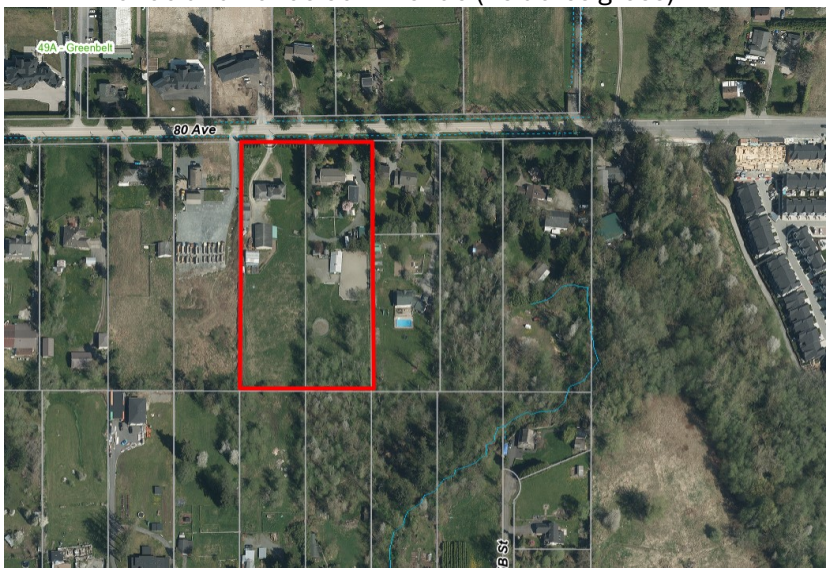
- 19526 and 19570 78th Avenue (~8.1 acres gross)



- 19317 and 19345 76th Avenue (~5 acres gross)



- 19490 and 19498 80th Avenue (~5 acres gross)



Take a look and if you would like to discuss, give me a call.

Thanks

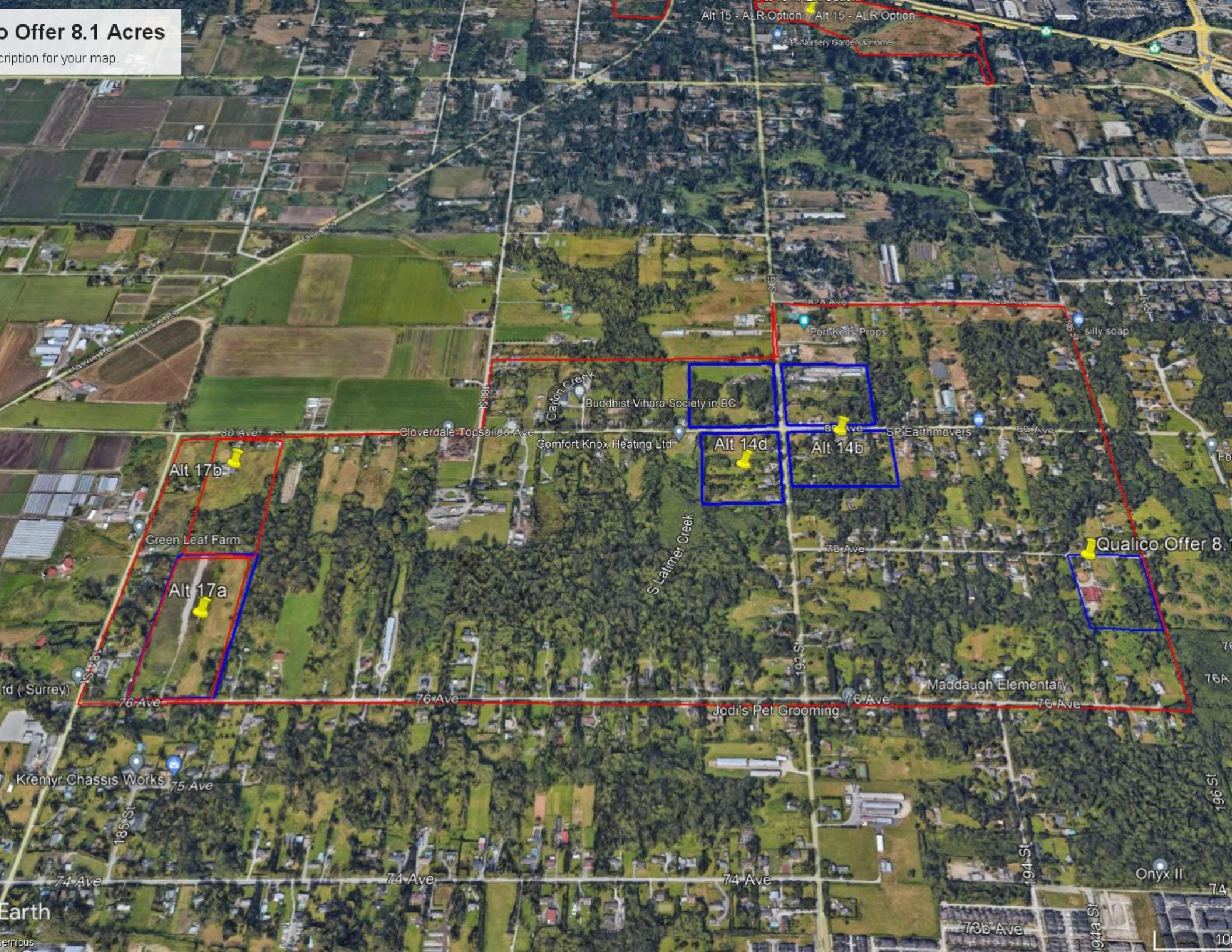
Nathan Hildebrand
Vice President

QUALICO communities

#201 – 6525 177B Street
Surrey, BC, V3S 5N4

Direct: 604 579 0421
Cell: 604 562 8665
Email: nathan.hildebrand@qualico.com

Qualico.com


o Offer 8.1 Acres
cription for your map.
Alt 15 - ALR Option
Alt 15 - ALR Option
Port Kells Props
silly soap
Clayton Creek
Buddhist Vihara Society in BC
Cloverdale Topsoil
Comfort Knox Heating Ltd
SP Earthmovers
Alt 14d
Alt 14b
Alt 17b
Green Leaf Farm
Alt 17a
S Latimer Creek
Qualico Offer 8.1
Maddaugh Elementary
Jodi's Pet Grooming
Kremyr Chassis Works
Onyx II
80 Ave
78 Ave
76 Ave
75 Ave
74 Ave
73b Ave
184 St
185 St
192 St
194 St
196 St

From: Hepple, Robert
Sent: 2024, June 10 2:38 PM
To: Sherevkulov, Dmitry
Cc: Chan, David Y.M.; Chwaklinski, David; Parmar, Surinder
Subject: RE: TM0592- Willoughby Heights - Properties in West Clayton for BC Hydro
Attachments: Qualico Offer 8.1 Acres.jpg

Hi David and Dmitry,
I propose we meet with them and explore an Option to Purchase the 78th Ave. property with the provision that we can also be successful in purchase the 8 acres to the south.
Let's see what they want for the 8.1 acres and what they know about the property to the south.
Can you set up a meeting please ?
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

Smart about power in all we do.

From: Sherevkulov, Dmitry
Sent: 2024, June 10 2:09 PM
To: Hepple, Robert

Cc: Chan, David Y.M.
Subject: TM0592- Willoughby Heights - Properties in West Clayton for BC Hydro

Hi Robert,

Please see the email from Qualico below.

Qualico plans to develop the two lots on 76 Ave. Properties on 80 Ave will be used as a storm pond to service surrounding development in the drainage catchment (both have an Option to Purchase on the title).

Other properties available for sale are listed below and only the first one could be suitable given its size.

Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604 623 3566
M 604 690 9836
E dmitry.sherevkulov@bchydro.com

bchydro.com

Smart about power in all we do.

From: Nathan Hildebrand <nathan.hildebrand@qualico.com>
Sent: 2024, June 10 10:19 AM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Cc: Eric Zhu <eric.zhu@qualico.com>
Subject: [External] Properties in West Clayton for BC Hydro

You don't often get email from nathan.hildebrand@qualico.com. Learn why this is important

Don't click on links or open attachments unless you trust the sender and are expecting the link or attachment. If you suspect this message to be phishing, please report it by clicking the Report Message button in the Outlook toolbar and select "Phishing."

Dmitry,

Circling back to our discussion of last week. This is confirming that Qualico is not interested in selling 18535 or 18477/18497 76th Avenue. These are part of our main development lands in West Clayton. 18478 80th Avenue is part of a purchase agreement we have with the owner to provide the needed storm pond to service all of the properties in this drainage catchment.

We do own land in North East Clayton to the east which could also service this area in the future. We may be willing to discuss selling the following properties if they work for your organization:

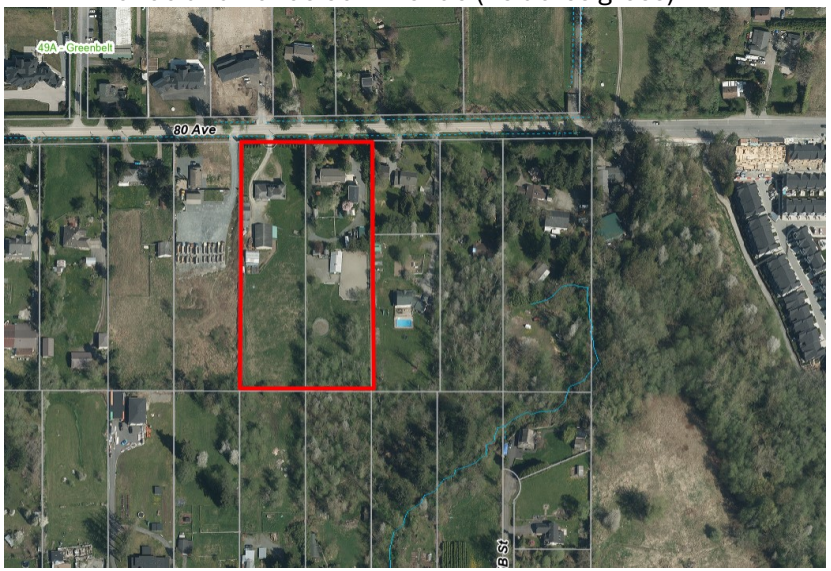
- 19526 and 19570 78th Avenue (~8.1 acres gross)



- 19317 and 19345 76th Avenue (~5 acres gross)



- 19490 and 19498 80th Avenue (~5 acres gross)



Take a look and if you would like to discuss, give me a call.

Thanks

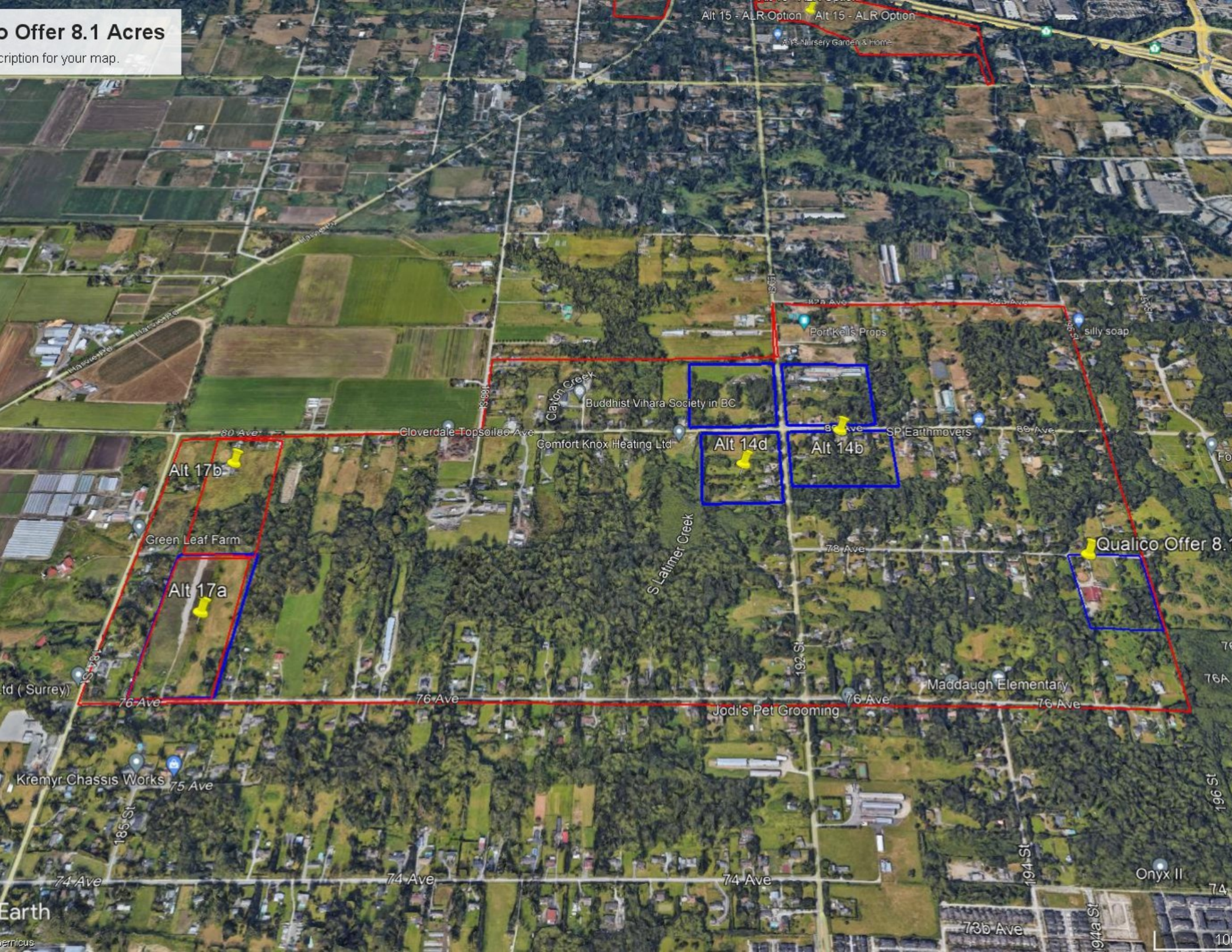
Nathan Hildebrand
Vice President

QUALICO communities

#201 – 6525 177B Street
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Direct: 604 579 0421
Cell: 604 562 8665
Email: nathan.hildebrand@qualico.com

Qualico.com


o Offer 8.1 Acres
cription for your map.
Alt 15 - ALR Option
Alt 15 - ALR Option
Port Kells Props
silly soap
Clayton Creek
Buddhist Vihara Society in BC
Cloverdale Topsoil
Comfort Knox Heating Ltd
SP Earthmovers
Alt 14d
Alt 14b
Alt 17b
Green Leaf Farm
Alt 17a
S Latimer Creek
Qualico Offer 8.1
Maddaugh Elementary
Jodi's Pet Grooming
Kremyr Chassis Works
Onyx II
80 Ave
78 Ave
76 Ave
75 Ave
74 Ave
73b Ave
184 St
185 St
192 St
194 St
196 St

From: Jiang, Kally
Sent: 2024, July 10 6:26 PM
To: Chwaklinski, David
Cc: Parmar, Surinder; Hepple, Robert
Subject: RE: TM-0592 Willoughby Project Qualico Land Purchase
Attachments: WIB-E05-SK003-Option 2-Outdoor 230 +GIS 60n25-To Fit Qualico Property-20240710.pdf

Hi, Dave,

Please check attached sketch for details and let me know if there is any concern.

Thanks,
Kally

From: Chwaklinski, David
Sent: 2024, July 10 10:58 AM
To: Jiang, Kally
Cc: Parmar, Surinder ; Hepple, Robert ; Chwaklinski, David
Subject: RE: TM-0592 Willoughby Project Qualico Land Purchase

Thank You Kally, I notice that you fit it with the line positions heading to the West. I understand why you did that but we will probably require them to go north. My thoughts are that we would construct part of the station with two line positions and the 25 kV section initially and if necessary expand in the future. TO do so we would need to obtain additional land to the west. This is currently under consideration. Please see the attached mapping.



Ultimately, to use the Qualicao property we would also need the Mattu property to the west. When combined (if it happens) the properties would be 223 m wide by 188 m deep. Can you redo the layout so that the line positions exit to the north and the 3rd and 4th line positions and associated 230 kV buswork (and the 60 kV yard) are future?

This will give us a good understanding of how we can best move forward.

This would also apply to the collection of properties to the south listed as Dhoot and Ngo although the line positions would need to exit southwards. The initial key is to determine what an interim statin would look like with provision for expansion. If you have any questions please let me know.

From: Jiang, Kally <Kally.Jiang@bchydro.com>
Sent: Monday, July 8, 2024 6:05 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Parmar, Surinder <Surinder.Parmar@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: RE: TM-0592 Willoughby Project Qualico Land Purchase

Hi, Dave,

I worked out a sketch as attached for the option which with 230 kV outdoor and 25 kV / 60 kV indoor equipment arrangement. It seems like the property of 177 m by 200 m offered by Qualico just big enough for this arrangement. I didn't try the other option with 230 kV outdoor and 25kV indoor GIS arrangement since the 230kV outdoor arrangement dominates the space requirement and 60kV GIS won't save space significantly.

Thanks,

Kally

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, July 04 10:59 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: TM-0592 Willoughby Project Qualico Land Purchase

Gentlemen, previously we had prepared some layouts based on various options such as 230/25 AIS (no 60 kV), 230/60/25 AIS, and 230/60/25 GIS indoor. I have attached them for consideration. Based on Surinder's comments I believe we can place a 230/25 AIS station on the 177.0 m x 200 m (~ 8 Acre Parcel) from Qualico. Please review WIB-E05-SK002-1_R0A Option 1 for details. This would include four 230 kV line positions. If we go GIS we can certainly fit the 60 kV section on the site although with the layout shown it assumed Underground line connections. Please refer to the three GIS layouts for more information. I will ask electrical to develop a layout using 4 -230 outdoor line positions and room for Indoor 25 kV GIS and one with 25 kV and 60 kV GIS for discussion purposes.

If you look at WIB-E05-SK001-Option 1 you can see how we could construct the initial phase of the project with two 230 line positions and the 25 kV AIS section on a portion of the property say 110 m x 200 m and then we could expand in the future to include the two extra line positions and the 60 kV section. I would suggest expanding to the West if possible although the creek on the property may be problematic. We would need to carefully consider at which end of the property the 230 lines come in and where the distribution would go out but I think as a first stage the Qualico property will suffice.

Kally, can you develop a new layout that uses 230 kV outdoor equipment and 25 kV indoor and a second one with 230 outdoor and 25 kV and 60 kV indoor equipment to see if it would fit on the 177 m by 200 m Qualico propertry?

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Thursday, July 4, 2024 10:24 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Subject: RE: TM-0592 Willoughby Project Qualico Land Purchase

David,
No not at this time. Surinder view is that the 60kV switching station is in the future. If and when it is a requirement, we will assemble more land at that time.
Robert

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, July 04 10:17 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: TM-0592 Willoughby Project Qualico Land Purchase

Robert, can you confirm if the 60 kV section is still part of the requirements? This will have a significant impact on what we can do.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Thursday, July 4, 2024 9:54 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Subject: TM-0592 Willoughby Project Qualico Land Purchase

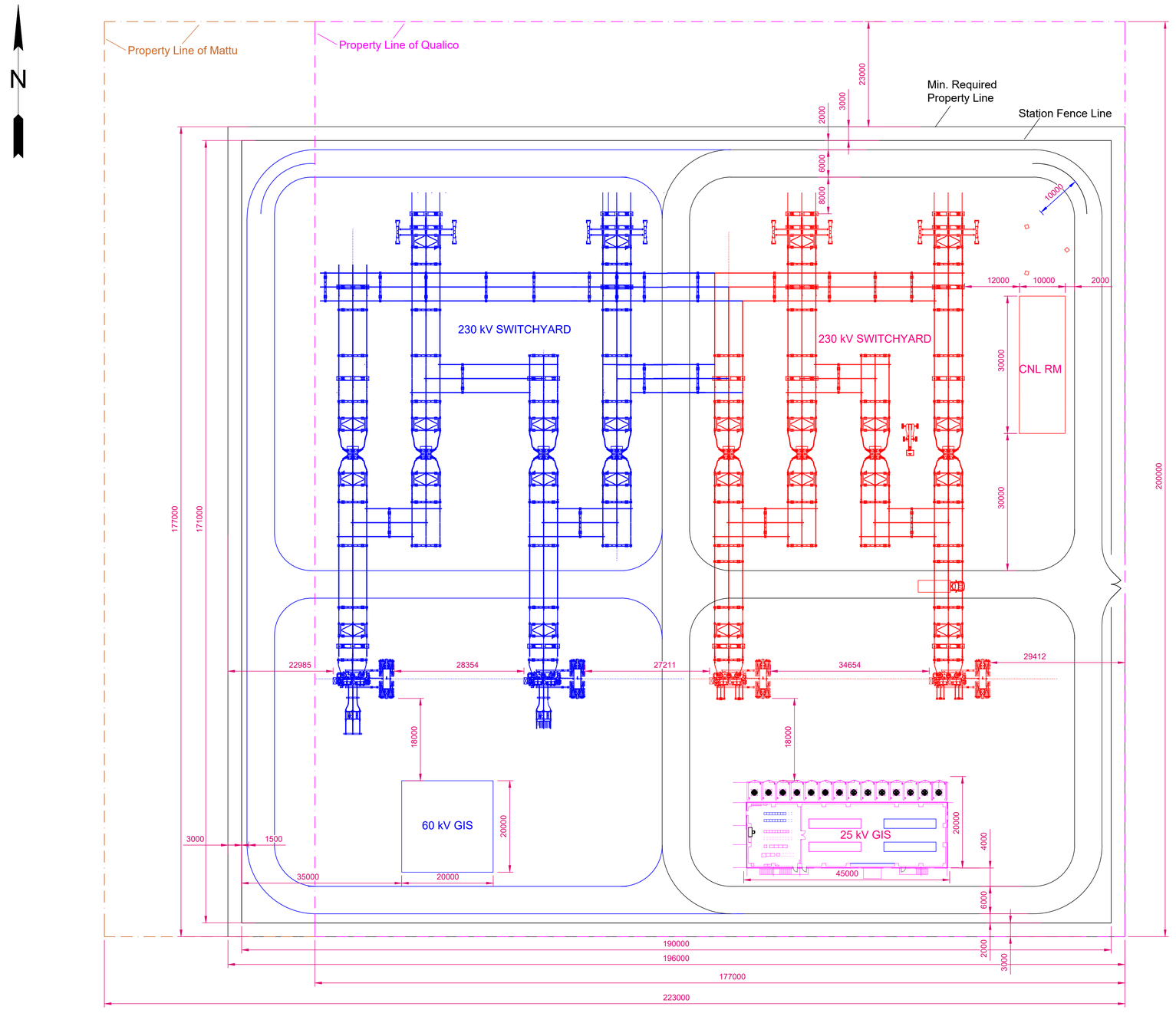
Hi David,
Further to my voice mail, can you have stations engineering look at a layout, that may incorporate an indoor switchyard, on the attached Qualico 8-acre site?
It will help us decide that if we can not assemble additional property we could still go ahead with the 8-acres purchase from Qualico.
Thank you,
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K.JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024JUL10		WIB-E05-SK003-Option 2			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CJPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240705-Qualico\2 set\WIB-E05-SK003-Outdoor 230 +GIS 60\25-To Fit Qualico Property-20240710.dwg
Drawing Unit = Metric (4)
Layout: A1 - L
7/10/2024 4:19 PM

From: Berdusco, Jeff
Sent: 2024, June 07 2:17 PM
To: Evans, Jen; van Oort, Harry; Brady, Karen
Cc: Chaisson, Rob
Subject: RE: TM0592 Willoughby property review UPDATED KMZ

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Jen,

Just working through these last few requests.

Can you confirm the habitat requirements have changed to a simple %Overlap with Critical or Sensitive Habitat and % Forested?

Just want to make sure I'm looking at the correct excel sheet!

J

From: Evans, Jen
Sent: Monday, June 3, 2024 1:12 PM
To: Berdusco, Jeff ; van Oort, Harry ; Brady, Karen
Cc: Chaisson, Rob
Subject: FW: TM0592 Willoughby property review UPDATED KMZ

Hi,

Please use this UPDATED kmz file and please enter info into this excel sheet here:

TM-0592_Willoughby_SDM_2024-05-30.xlsx (bchydro.bc.ca)

Thanks,

Jen

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

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From: Evans, Jen
Sent: 2024, June 03 11:08 AM
To: Berdusco, Jeff <Jeff.Berdusco@bchydro.com>; van Oort, Harry <Harry.vanOort@bchydro.com>; Brady, Karen <Karen.Brady@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: TM0592 Willoughby property review

Hi All,

Three additional properties have been identified as potential alternatives for BC Hydro property purchase. We have been asked to conduct a high level Wildlife and Heritage reviews for the properties.

A kmz file is attached showing Alternative 14, 15 and 17.

The SDM link is here for input: https://ppm.bchydro.bc.ca/projects/TM-0592/ProjectDocuments/Forms/AllItems.aspx?RootFolder=%2fprojects%2fTM%2d0592%2fProjectDocuments%2fProject%5fManagement%2f1%5fIDN%2fProject%5fPlan&FolderCTID=0x01200008B64CF36F7FF14297FFFE66C15B991B

Select the TM-0592 Willoughby SVA Analysis 2023-11-14 Excel file

Charge code: TM0592 1410 A01H

Thanks so much,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

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From: Brady, Karen
Sent: 2024, October 24 9:25 AM
To: Evans, Jen
Cc: Heritage; Chaisson, Rob
Subject: RE: TM-0592 Willoughby Property

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Jen

I think the most prudent thing to say would be that BC Hydro has checked the provincial databases and that no archaeological sites or heritage properties are registered for the subject property. And other than that, no archaeological assessment has been undertaken to date as that will be decided if/when a property is selected.

I think that should be safe enough.

Thanks, Karen.

_____

Karen Brady | Environmental Professional (Heritage)

BC Hydro
P 778-256-5770

From: Evans, Jen
Sent: 2024, October 22 5:32 PM
To: Brady, Karen
Cc: Heritage ; Chaisson, Rob
Subject: FW: TM-0592 Willoughby Property

Hi Karen,

In the email below, IR has requested high level Heritage info to share with FN regarding a property BC Hydro is considering to purchase – Alt 20. I've attached the internal high level results for Alt 20 here.

Please let me know what/if info can be shared externally with First Nations.

Thanks,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

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From: Wanamaker-Briggs, Andrew <Andrew.Wanamaker-Briggs@bchydro.com>
Sent: 2024, October 22 11:42 AM
To: Chaisson, Rob <Rob.Chaisson@bchydro.com>; Evans, Jen <Jen.Evans@bchydro.com>
Cc: Archibald Carson, Corry <Corry.Archibald@bchydro.com>
Subject: TM-0592 Willoughby Property

Hi Both,

I've confirmed with Properties that IR will share the Bosa property location with First Nations once the Conditional Purchase Agreement is signed. IR would send a future update to FNs with the other property locations as they come under contract.

As we update FNs it would be ideal to share high level environmental info, such as heritage recommendations. Are you able to share your findings/recommendations from the studies on the Alt 20 properties?

Please and thanks,
Andrew

Andrew Wanamaker-Briggs (he/him) **|** Indigenous Relations Coordinator, Southwest Region
P (604) 841-2845
E Andrew.Wanamaker-Briggs@bchydro.com

BC Hydro
6911 Southpoint Dr, 10th Floor
Burnaby, BC V3N 4X8
bchydro.com

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Sent from the unceded traditional territory of
the Coast Salish peoples, including the Musqueam,
Squamish and Tsleil-Waututh First Nations

From: Brady, Karen
Sent: 2023, December 04 8:29 AM
To: Evans, Jen; Heritage
Cc: Chaisson, Rob
Subject: RE: TM0592 Willoughby, Langley - Property Screenings

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Jen

Can you please clarify the address?

19979 &6 Ave. Langley

It's Column J.

Thanks, Karen.

_____

Karen Brady | Environmental Professional (Heritage)

BC Hydro
P 778-256-5770

From: Evans, Jen
Sent: 2023, November 27 3:24 PM
To: Heritage
Cc: Chaisson, Rob
Subject: TM0592 Willoughby, Langley - Property Screenings

Hi Heritage,

Would you be able to provide assistance with reviewing 7 properties on the attached (Properties 1 through 7) with respect to line 29 on the attached:

- Presence of Registered Burial site

The purpose is to support an analysis of a single viable alternative.

Charge code is TM0592 1000 A00A

Please reach out to myself or Rob (cc'd here) if you have any questions.

Thanks,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

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From: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Sent: 2023, November 24 10:18 AM
To: Evans, Jen <Jen.Evans@bchydro.com>
Subject: Property Screenings

Hi Jen.
Please see the TM0592 Wiloughby SDM spreadsheet attached. It appears to include 7 potential properties for Environmental Screening. Please prioritize this over Goldstream. Call if you would like to discuss.

Thanks
Rob

Rob Chaisson
Environmental Risk Manager
Project Environmental Risk Management

BC Hydro
6911 Southpoint Drive
Burnaby, BC V3N 4X8

P 604.528.3450
M 778.988.5220
E Rob.Chaisson@bchydro.com

From: Brady, Karen
Sent: 2023, December 06 11:01 AM
To: van Oort, Harry; Chaisson, Rob; Heritage; Evans, Jen
Cc: Knighton, Mykol
Subject: RE: TM0592 Willoughby, Langley - Property Screenings
Attachments: Copy of TM-0592_Willoughby_SVA_Analysis_2023-11-14 plus arch.xlsx; Willoughby High Level Arch Review TM0592.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hello All

Please find attached the completed spreadsheet and brief memo summarizing the results and, importantly, the limitations of the review.

I hope this meets everyone's needs.

I should have the Goldstream review ready this afternoon.

Thanks, Karen.

_____

Karen Brady | Environmental Professional (Heritage)

BC Hydro
P 778-256-5770

From: van Oort, Harry
Sent: 2023, December 04 2:52 PM
To: Chaisson, Rob ; Brady, Karen ; Heritage
Cc: Evans, Jen
Subject: RE: TM0592 Willoughby, Langley - Property Screenings

I think it supposed to be:

7687 200 St., 7635 198B St., 19979 76 Ave. Langley

From: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Sent: 2023, December 04 9:59 AM
To: Brady, Karen <Karen.Brady@bchydro.com>; Heritage <Heritage@bchydro.com>
Cc: Evans, Jen <Jen.Evans@bchydro.com>; van Oort, Harry <Harry.vanOort@bchydro.com>
Subject: RE: TM0592 Willoughby, Langley - Property Screenings

Hi Karen.
You can check with Harry as he has already completed the review for the Willoughby properties.

From: Brady, Karen <Karen.Brady@bchydro.com>
Sent: 2023, December 04 8:29 AM
To: Evans, Jen <Jen.Evans@bchydro.com>; Heritage <Heritage@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM0592 Willoughby, Langley - Property Screenings

Hi Jen

Can you please clarify the address?

19979 &6 Ave. Langley

It's Column J.

Thanks, Karen.

_____

Karen Brady | Environmental Professional (Heritage)

BC Hydro
P 778-256-5770

From: Evans, Jen <Jen.Evans@bchydro.com>
Sent: 2023, November 27 3:24 PM
To: Heritage <Heritage@bchydro.com>

Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: TM0592 Willoughby, Langley - Property Screenings

Hi Heritage,

Would you be able to provide assistance with reviewing 7 properties on the attached (Properties 1 through 7) with respect to line 29 on the attached:

- Presence of Registered Burial site

The purpose is to support an analysis of a single viable alternative.

Charge code is TM0592 1000 A00A

Please reach out to myself or Rob (cc'd here) if you have any questions.

Thanks,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro
6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

Smart about power in all we do.

From: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Sent: 2023, November 24 10:18 AM
To: Evans, Jen <Jen.Evans@bchydro.com>
Subject: Property Screenings

Hi Jen.

Please see the TM0592 Wiloughby SDM spreadsheet attached. It appears to include 7 potential properties for Environmental Screening. Please prioritize this over Goldstream. Call if you would like to discuss.

Thanks
Rob

_____

Rob Chaisson
Environmental Risk Manager
Project Environmental Risk Management

BC Hydro
6911 Southpoint Drive
Burnaby, BC V3N 4X8

P 604.528.3450
M 778.988.5220
E Rob.Chaisson@bchydro.com

Memo

To: Jen Evans, Rob Chaisson, Harry van Oort

From: Karen Brady

CC: Mykol Knighton

Date: December 6, 2023

RE: Willoughby, Langley – Property Screenings (TM-0592)

1. Project Location

The project is in the Township of Langley with specific properties bound by 197 Street to the west, 82 Avenue to the north, 75 Avenue to the south, and 202A Avenue to the east (Figure 1).

2. Scope of Work

BC Hydro has requested a high-level archaeology review of 16 properties within the Township of Langley, as outlined in Table 1, below.

Property	Address	Property	Address
1	7888 200th Street	9	7541 202A Street
2	7950 200th Street	10	20069 80 Avenue
3	7782 200 Street	11	20053 80 Avenue
4	7755 202A Street	12	20011 80 Avenue
5	7633 202A Street	13	8092 200 Street
6	7570 200 Street	14	7687 200 Street
7	7536 200 Street	15	7635 198B Street
8	7591 202A Street	16	19979 76 Avenue

3. Methods and Objectives

This review consists of a brief review of the Provincial Heritage Register, accessed via Remote Access to Archaeological Data (RAAD) website application. The objective of the review is two-fold:

a. to identify any recorded archaeological sites within, or near, the properties listed above, and
b. determine whether the archaeological sites, if present, are of sufficient scientific significance to impede development of the property.

This review does not include an assessment of archaeological potential – the likelihood that archaeological sites may be encountered – but simply to indicate whether sites of a particular type, such as human burials or other sites of high scientific significance have been recorded within or near the properties listed above.

4. Results

The results of the review indicate that no archaeological sites have been recorded within, or near, the properties listed in Table 1. One archaeological site – comprised of a historical-era building – is located at 7967 197 Street, in Langley. The building has been registered at DjRq-155 and consists of the Rizun Residence. It has been restored and is now incorporated into a condominium development.

5. Recommendations

This cursory review indicates that no archaeological sites have been recorded within, or near, the properties listed in Table 1. As this review does not include an assessment of archaeological potential, it is recommended that an further archaeological work, such as a Heritage Screening, be conducted once the initial SDM has been completed.

6. Closure

I trust this memo provides you with the information you require. If you have any questions, do not hesitate to contact me.



Figure 1. Location of Willoughby, Langley Property Screenings (TM-0592).

Similar											
	Select a property for purchase that meets the requirments for the efficient development of a 230										
Criteria	**Units**	Alternate 1 - Property 1	Alternate 2 - Property 2	Alternate 3 - Property 3	Alternate 4 - Property 4	Alternate 5 - Property 5	Alternate 6 - Property 6	Alternate 7 - Property 7	Alternate 8 - Property 8	Alternate 9 - Property 9	Alternate 10
		7888,7950 200th st. Langley	7782 200 St. Langley	7755 202A St. Langley	7633 202A St. Langley	7570,7536 200 St, 7591,7541 202A St. Langley	20069,20053, 20011 80Ave, 8092 200 St. Langley	7687 200 St., 7635 198B St., 19979 76 Ave. Langley	Vacant Lands (?), Langley	Vacant Lands (?), Langley	
Distribution access restricted by waterway	Y/N										
Zoned appropriately											
Viable RoW for Transmission	Y/N										
Free sides for access/egress of t/d (>2 Min)	ea										
Appropriate size of Site (Min Size - 20625 m^2 or 221900 SF)	m^2	20,709	123,539	45716	43414	80084	34206	71737	19950	22010	
Preferred Minimum Length of short Sides (>115 m)	y/n										
Property Aspect Ratio (Between 1:75:1 and 1:1)	y/n										
Max 3% slope	Y/N										
Seismic risk (Liquifaction/Amplification)	Risk rating										
Total Area:Usable Area	$M^2/M^2 < 2$										
Presence of Critical Habitat	% coverage										
Presence of Garry Oak Ecosystem	Y/N										
Presence of Old Growth Forest	% coverage										
Presence of Wetland	% coverage										
Contaminated site?	Y/N										
Presence of Registered Burial site	Y/N	N	N	N	N	N	N	N	no address	no address	
Greenfield	Y/N										
Permitting	Y/N										

From: van Oort, Harry
Sent: 2023, November 28 1:34 PM
To: Evans, Jen
Cc: Chaisson, Rob
Subject: RE: TM0592 Willoughby, Langley - Property Screenings

Follow Up Flag: Follow up
Flag Status: Flagged

Thanks Jen!

From: Evans, Jen
Sent: 2023, November 28 1:10 PM
To: van Oort, Harry
Cc: Chaisson, Rob
Subject: RE: TM0592 Willoughby, Langley - Property Screenings

Hi Harry,

Agreed – I found this difficult as well. I used the Township of Langley geosource map at the same time as Google Earth maps to determine the property boundaries.

Here is a link to the map site I used:

https://geosource.tol.ca/

I found it useful since it also showed wetland/creek areas.

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

BC Hydro

6911 Southpoint Drive E-11
Burnaby, BC V3N 4X8

P 604-528-7897
M 778-873-7022
E jen.evans@bchydro.com

bchydro.com

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From: van Oort, Harry <Harry.vanOort@bchydro.com>
Sent: 2023, November 28 12:21 PM
To: Evans, Jen <Jen.Evans@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: RE: TM0592 Willoughby, Langley - Property Screenings

Hi Jen and Rob

When I punch in the addresses I get a pin on the street, but its hard for me to know exactly where the property boundaries are – can you send me maps?

From: Evans, Jen <Jen.Evans@bchydro.com>
Sent: 2023, November 27 2:27 PM
To: van Oort, Harry <Harry.vanOort@bchydro.com>
Cc: Chaisson, Rob <Rob.Chaisson@bchydro.com>
Subject: TM0592 Willoughby, Langley - Property Screenings

Hi Harry,

Would you be able to provide assistance with reviewing 7 properties on the attached (Properties 1 through 7) with respect to lines 24-27 on the attached:

- Presence of Critical Habitat
- Presence of Garry Oak Ecosystem
- Presence of Old Growth Forest
- Presence of Wetland

The purpose is to support an analysis of a single viable alternative.

Charge code is TM0592 1000 A00A

Please reach out to myself or Rob (cc'd here) if you have any questions.

Thanks,

Jen

_____

Jen Evans, B.Sc., P.Ag | Senior Environmental Coordinator, Environment

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Burnaby, BC V3N 4X8

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M 778-873-7022
E jen.evans@bchydro.com

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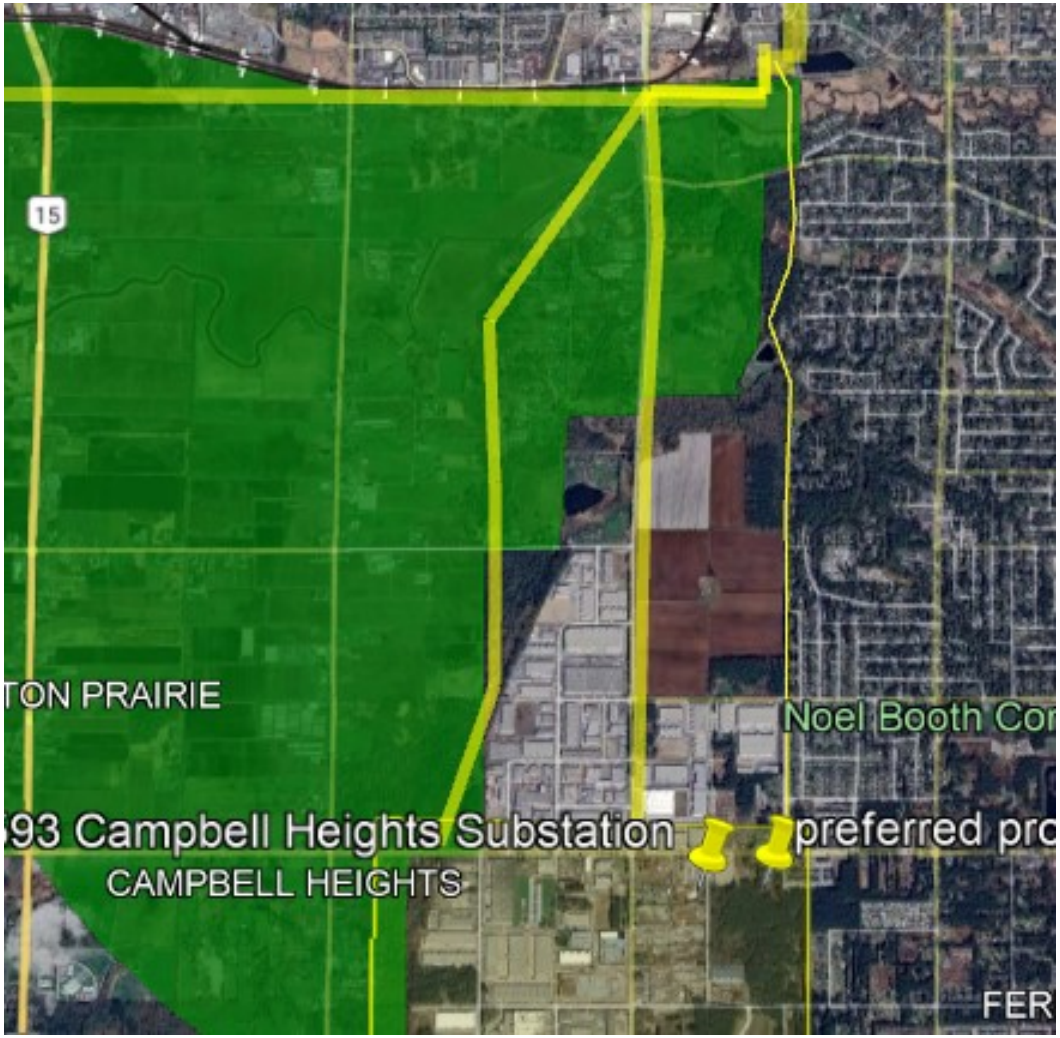
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From: Steels, Craig
Sent: 2024, September 24 12:55 PM
To: Randt, David; Chwaklinski, David
Subject: RE: TM-0593 Campbell Heights Conceptual Design meeting
Attachments: alr_boundary_for_google_earth.kmz

Hi David C,

I found that there's a kmz available for the ALR (attached). I will just make a mention of it in the memo, in the context that it may be easier to route overhead lines within the ALR since they are compatible land uses, and since that land is held out from development, the property owners are not giving up development potential when overhead lines are put on their property. The west-most proposed route I originally had is within the ALR and might be able to build an overhead line. The newly identified location is outside of the ALR and overhead lines are likely blocked by dense urbanization.

I asked Himanshu for high-level cost of 230 kV overhead double-circuit steel poles (he said $1.8M to $2.0M per km) and for u/g (waiting to hear back on that one). We may not put that in the memo (up to you) but it's good to have.



Kind regards,

Craig Steels, P.Eng. | Consultant, Transmission Lines Engineering, BC Hydro

C 825 437 6575 craig.steels@bchydro.com

From: Randt, David
Sent: Tuesday, August 13, 2024 10:05 AM
To: Steels, Craig ; Chwaklinski, David
Subject: RE: TM-0593 Campbell Heights Conceptual Design meeting

Craig,

That is no problem – let me know when the memo is ready for my input. I will be able to provide input after September 2nd.

Can you send me the lines .kmz?

Regards,
David

ON LEAVE AUGUST 15 to SEPTEMBER 2 (INCLUSIVE)

David Randt, M.Eng., P.Eng., PMP
Contractor
Senior Geotechnical Engineer, Transmission Line Engineering

BC Hydro
M 604-835-6880
E David.Randt@bchydro.com

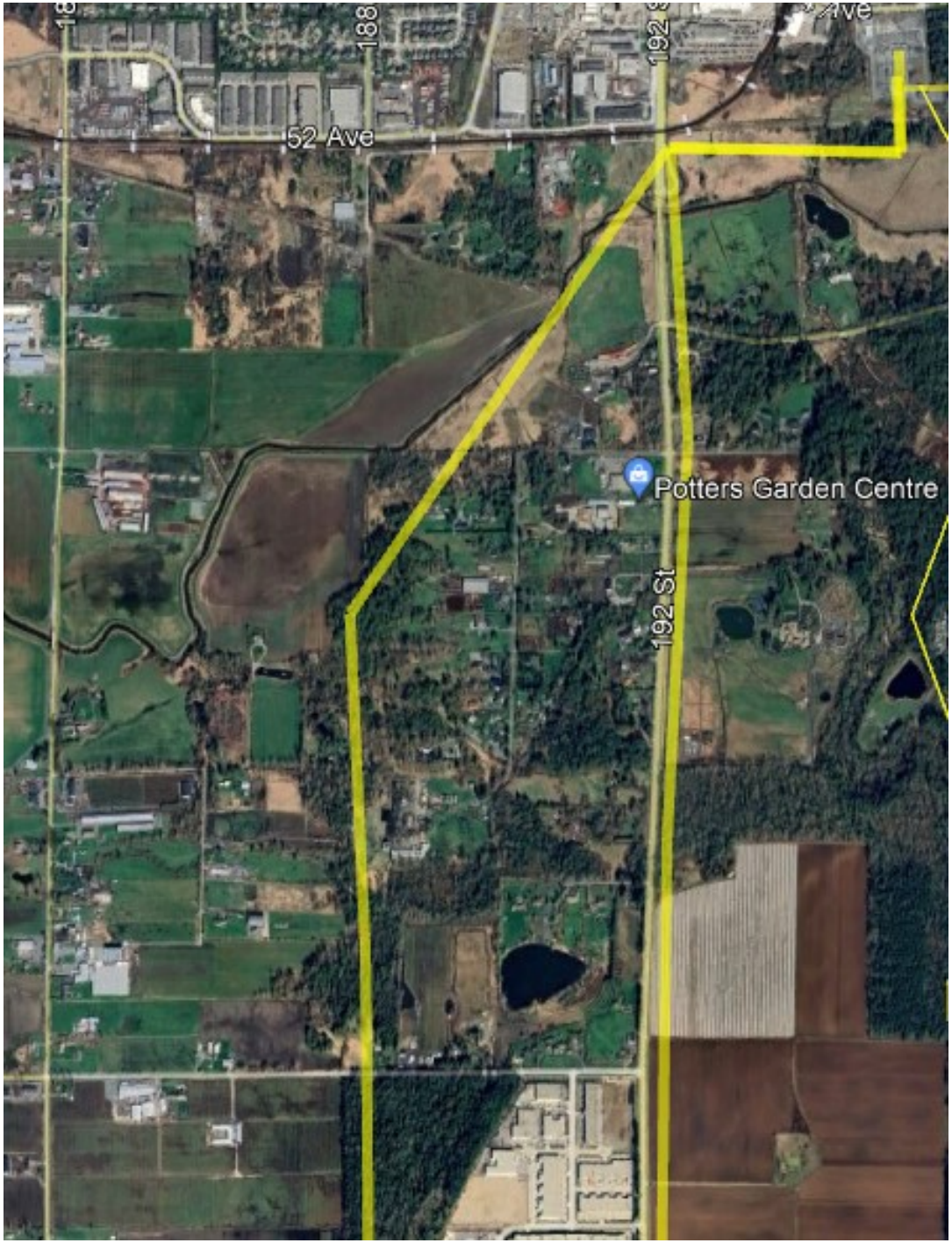
From: Steels, Craig <Craig.Steels@bchydro.com>
Sent: Tuesday, August 13, 2024 9:57 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Randt, David <David.Randt@bchydro.com>
Subject: RE: TM-0593 Campbell Heights Conceptual Design meeting

Hi David and David,

As we discussed in the meeting, you want a memo with a high-level yes/no type assessment of feasibility of connecting overhead transmission to the preferred substation site. As mentioned, the Campbell heights location looks to be the best out of all of the substation addition projects and I can see it is yes. I will make a short memo with screenshots of the three conceptual routes below.

David Randt:

Could you please provide a few paragraphs about foundations for double-circuit steel pole?


52 Ave
Potters Garden Centre
192 St

Kind regards,

Craig Steels, P.Eng. | Consultant, Transmission Lines Engineering, BC Hydro

C 825 437 6575 craig.steels@bchydro.com

-----Original Appointment-----
From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: Monday, May 27, 2024 11:45 AM
To: Chwaklinski, David; Kadivar, Amin; Randt, David; Steels, Craig; Zeng, Ken
Cc: Samani, Sam
Subject: TM-0593 Campbell Heights Conceptual Design meeting
When: Tuesday, August 13, 2024 9:30 AM-10:00 AM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Hi Folks I would like to meet to discuss the Campbell heights property purchase Conceptual Design Stage. I have already sent out the design plan, the work package and the Charge codes. I want to discuss the properties we will be looking at and how we will supply the power to the future substation. I have a short agenda

Agenda
Introductions
Discuss project and properties under consideration.
Discuss schedule and deliverables
Update on tasks

I have made this a recurring meeting every two weeks until we reach the end of the stage.
I think a half hour is suitable for this. I understand everyone is busy so not everyone can make every meeting. I woud appreciate it if you could let me know if you cant make it so we can move on quickly.

Please let me know if you have any questions or concerns. Thanks

---

Microsoft Teams Need help?

Join the meeting now

Meeting ID: 218 489 966 967

Passcode: EFaJyy

Dial in by phone

+1 604-343-0415,,378773346# Canada, Vancouver

Find a local number

Phone conference ID: 378 773 346#

For organizers: Meeting options | Reset dial-in PIN

Do NOT send or post NERC CIP-related confidential files in Teams. Share only necessary information via screenshare in Teams meetings when there is a valid business reason to do so. For additional information, contact your respective CIP Compliance Teams.

_____

From: Sydorov, Dmitri D
Sent: 2025, January 17 10:36 AM
To: Berisso, Hussien
Cc: Chwaklinski, David; Hepple, Robert; Sydorov, Dmitri D; Zhang, Michael; Manurung, Cynthia; Hou, Terri
Subject: RE: WIB and CBS Location
Attachments: Bosa-Kool-Walia.pdf

Hussien – similar request: who is a DIS Lead for WIB project? Task: 25kV outside the WIB fence lead to identify his/her preference for 25kV feeders' location options on the attachment for (task:) sub layout to accommodate.

_____
Dmitri Sydorov PE, P.Eng | Sr. Engineer,T-Stations Engineering
Office: 604.528.1519
_____

From: Zhang, Michael
Sent: 2025, January 17 10:27 AM
To: Manurung, Cynthia ; Khan, Jahangir ; Sydorov, Dmitri D ; Hou, Terri
Cc: Berisso, Hussien ; Chwaklinski, David ; Hepple, Robert
Subject: RE: WIB and CBS Location

Cynthia, Terri and I have discussed her draft scope for substation egress outside the substation. it appears the internal layout proposals and egress draft were not aligned.
I suggest distribution team meet with Dmitri brainstorming it.

Thanks,
Michael

From: Manurung, Cynthia <Cynthia.Manurung@bchydro.com>
Sent: 2025, January 17 9:34 AM
To: Khan, Jahangir <Jahangir.Khan@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Hou, Terri <Terri.Hou@bchydro.com>; Zhang, Michael <Michael.Zhang@bchydro.com>
Cc: Berisso, Hussien <Hussien.Berisso@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: RE: WIB and CBS Location

Thank you everyone and welcome to Hydro, Dmitri.
As the layout design is being finalized, please also consider 25kV line entries.

@Zhang, Michael can you pls review the attached and work with Dmitri to see how the 25kV lines enter WIB? Pls reach out to Terri for the overall distribution system plan.

Cynthia Manurung, P.Eng
Regional Distribution Planning Specialist – Fraser Valley

M 604 812 4322

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From: Khan, Jahangir <Jahangir.Khan@bchydro.com>
Sent: 2025, January 17 8:45 AM
To: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Hou, Terri <Terri.Hou@bchydro.com>; Manurung, Cynthia <Cynthia.Manurung@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Subject: RE: WIB and CBS Location

Happy Friday everyone,
Dmitri has kindly accepted a lot of projects from Ken. As he has indicated below, there is a lot to catch up for him.

Please allocate sufficient time for Dmitri to settle in. We are under huge resource crunch.
Cheers,

Jahangir Khan | Team Lead,T-Stations Engineering
Tel: 604-528-2910 (D), 604-314-7083 (M)

From: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Sent: 2025, January 17 8:41 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Hou, Terri <Terri.Hou@bchydro.com>; Manurung, Cynthia <Cynthia.Manurung@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Khan, Jahangir <Jahangir.Khan@bchydro.com>; Berisso, Hussien

<Hussien.Berisso@bchydro.com>
Subject: RE: WIB and CBS Location

Hi all,

I'm a new hire of the BC Hydro with accesses, for example, access to the CADD folder for redlines submission still being set-up/pending. I've never been involved in WIB project until yesterday morning. The latest layout files (attached) I received from Ken Zeng are incomplete in-terms of 230kV and 60kV lines entries into the new substation for alignment with the WIB layout design. I was in-contact yesterday with the WIB TL lead for (Martin L Qin) to identify options for line entries (attached e-mail). Once this step is done, me and Marian will produce the better layout design which will surely fit into attached property envelope file, and then I will re-submit the redlines for re-drafting as per my leadership instructions. This is all that I can provide at this point.

Kind regards,

_____
Dmitri Sydorov PE, P.Eng | Sr. Engineer,T-Stations Engineering
Office: 604.528.1519

_____

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2025, January 17 8:23 AM
To: Hou, Terri <Terri.Hou@bchydro.com>; Manurung, Cynthia <Cynthia.Manurung@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Subject: RE: WIB and CBS Location

Terri,
As stated in an earlier email, Dmitri is working on a layout for the Bosa/Kool/Walia property.
This is part of our Due Diligence for the property purchase.
As soon as he is finished, I will send you a copy for your approval and comments.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Hou, Terri <Terri.Hou@bchydro.com>
Sent: 2025, January 17 8:12 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Manurung, Cynthia <Cynthia.Manurung@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Subject: RE: WIB and CBS Location

Hi Robert,

WIB please.

Regards,
Terri

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2025, January 17 8:11 AM
To: Manurung, Cynthia <Cynthia.Manurung@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Hou, Terri <Terri.Hou@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Subject: RE: WIB and CBS Location

For WIB, CBS or MLN?

From: Manurung, Cynthia <Cynthia.Manurung@bchydro.com>
Sent: 2025, January 16 3:03 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Hou, Terri <Terri.Hou@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Subject: RE: WIB and CBS Location

Thanks Rob. We are finalizing the Scope Note for the distribution egress plan and would like to know where the feeder section is going to be located. If you have a rough layout, can you send us a copy?

Cynthia Manurung, P.Eng
Regional Distribution Planning Specialist – Fraser Valley

M 604 812 4322

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From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2025, January 16 2:54 PM
To: Manurung, Cynthia <Cynthia.Manurung@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Hou, Terri <Terri.Hou@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Subject: RE: WIB and CBS Location

Cynthia,
Dmitri Sydorov is working on the layout with Marian Balea.
Here are the properties.
We are under Conditional Purchase Agreements with Bosa and Kool.
We are offering on Walia.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Manurung, Cynthia <Cynthia.Manurung@bchydro.com>
Sent: 2025, January 16 2:44 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>

Cc: Hou, Terri <Terri.Hou@bchydro.com>
Subject: WIB and CBS Location

Hi Robert and David, I heard that properties have been selected for both WIB and CBS. Can you share the location for both properties?

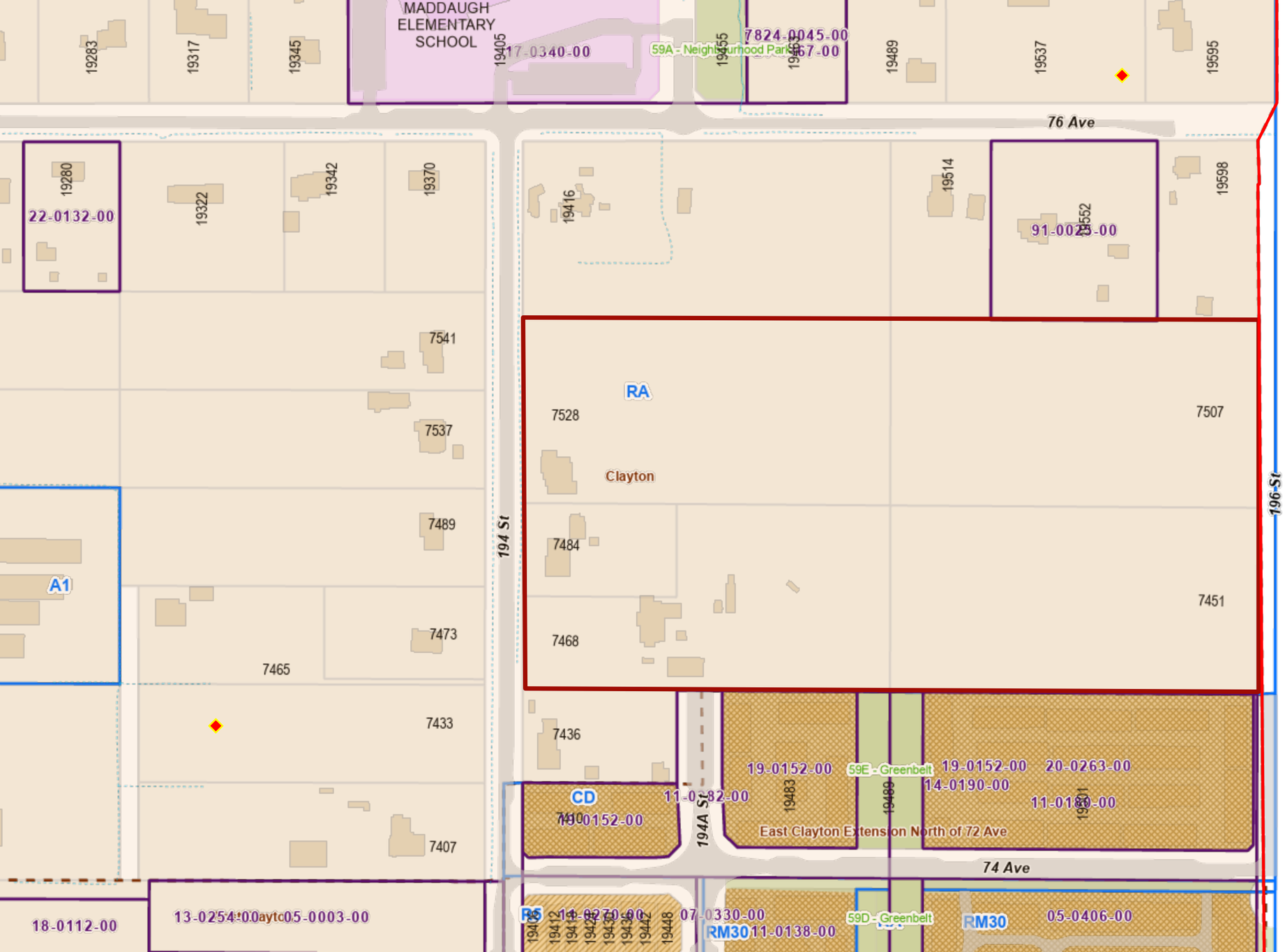
Also, can you share the substation layout for both substations? We need the layout to determine the distribution duct bank plan. Lynn suggested to reach out to the PE for drawing but I don't know who that is.

Cynthia Manurung, P.Eng
Regional Distribution Planning Specialist – Fraser Valley

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E cynthia.manurung@bchydro.com
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MADDAUGH ELEMENTARY SCHOOL
19283
19317
19345
19405
17-0340-00
59A - Neighbourhood Park
19455
19467
7824-0045-00
19489
19537
19595
76 Ave
19280
22-0132-00
19322
19342
19370
19416
19514
19552
91-0025-00
19598
7541
7537
7489
A1
7473
7465
7433
7407
RA
7528
7507
Clayton
7484
7451
7468
194 St
196 St
7436
19-0152-00
59E - Greenbelt
19-0152-00
20-0263-00
14-0190-00
11-0190-00
19483
19489
19501
CD
11-0182-00
194A St
East Clayton Extension North of 72 Ave
74 Ave
18-0112-00
13-0254-00
05-0003-00
RM30
07-0330-00
11-0138-00
59D - Greenbelt
RM30
05-0406-00

From: Parmar, Surinder
Sent: 2024, October 30 11:45 AM
To: Chan, David Y.M.; Hepple, Robert
Cc: Sherevkulov, Dmitry; Chwaklinski, David
Subject: RE: Willoughby Alt 20 - 7484 - 174th St. Surrey
Attachments: FW: Willoughby Property - WIB - Bosa Property

David:

See the attachment and email string in which IP agreed that if possible – let us get that Kool property also along with Kang and Bosa.

Short answer is: IP will like to have additional property for the future plans of using the battery banks at these sites.

Surinder Parmar, P.Eng., PMP
BC Hydro
6911 Southpoint Drive

P 604.528.7731
M 604.561.2702
E Surinder.Parmar@bchydro.com

bchydro.com

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From: Chan, David Y.M.
Sent: 2024, October 30 11:05 AM
To: Hepple, Robert ; Parmar, Surinder
Cc: Sherevkulov, Dmitry ; Chwaklinski, David
Subject: RE: Willoughby Alt 20 - 7484 - 174th St. Surrey

An explanation of what has changed and why the Project is acquiring Kool and the small property will be required, because this was not presented or discussed with Al when we received approvals to assemble the Bosa site, which were the Bosa properties and Kang.

Regards,

David

David Y. M. Chan | Manager – Acquisitions and Sales

Real Estate Services, Properties

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604-623-3998
M 604-328-8678
E david.chan@bchydro.com

bchydro.com

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, October 30 10:58 AM
To: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: FW: Willoughby Alt 20 - 7484 - 174th St. Surrey

Hello Surinder,
Here is the information you asked for on the small property next to Kool. The address is 7484 – 174th St. Surrey BC.
Dmitry and David C are putting a memo together for Al L requesting approval to offer over appraised value at $8M.
Kool is stating his bottom line is $9M. So with Al's approval, we should be to reach agreement somewhere in between.
Robert

Robert Hepple P.Eng.

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W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Sent: 2024, October 30 10:46 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: Willoughby Alt 20 - small property

Hi Robert,

I attached the title for the small property next to Kool. It's owned by an individual and the title shows the last transfer of ownership was in 2024 at $2.2M. However, it is not a market sale, the transfer price is exactly the same as assessed value so most likely they inherited it. The value was declared for tax purposes. I think the market value for this property is a little higher than $2.2M.

_____

Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

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333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604 623 3566
M 604 690 9836
E dmitry.sherevkulov@bchydro.com

bchydro.com

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From: Parmar, Surinder
Sent: 2024, September 19 11:46 AM
To: Lee, Tony S.C. (BCH); Chan, David Y.M.; Sherevkulov, Dmitry; Hepple, Robert
Cc: Pradhan, Anil
Subject: FW: Willoughby Property - WIB - Bosa Property

Gents:

See string of emails below.

In summary – we have IP management consent to buy the Parcel #4 (south-west of Bosa) along with our earlier plan to buy Parcels 1, 2 and 3.

I will leave it with our Properties SMEs to review/decide on when to approach the owners of Parcel 3 and Parcel 4 owner and start these negotiations.

Let me know if any questions/clarifications that you need from me.



Surinder Parmar, P.Eng., PMP
BC Hydro
6911 Southpoint Drive

P 604.528.7731
M 604.561.2702
E Surinder.Parmar@bchydro.com

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From: Kumar, Ajay <Ajay.Kumar@bchydro.com>
Sent: 2024, September 19 11:19 AM
To: Parmar, Surinder <Surinder.Parmar@bchydro.com>; Holland, Melissa <Melissa.Holland@bchydro.com>
Cc: Kelly, Neil <Neil.Kelly@bchydro.com>
Subject: RE: Willoughby Property - WIB - Bosa Property

Hi Surinder,

Thanks for the update. I am supportive of acquiring Parcel 4.

Regards,

Ajay

From: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Sent: 2024, September 16 3:05 PM
To: Holland, Melissa <Melissa.Holland@bchydro.com>; Kumar, Ajay <Ajay.Kumar@bchydro.com>
Cc: Kelly, Neil <Neil.Kelly@bchydro.com>
Subject: Willoughby Property - WIB - Bosa Property

Melissa / Ajay: Quick heads up to both of you so that you are upto speed on the latest.

See the Map below

Properties marked 1 and 2 are owned by Bosa. Each property is around 4.766 Acres. Total Bosa property = 9.5 acres.

With Al's consent – we have a tentative agreement with Bosa to buy these two parcels for $20.5M (around $2.15M / acre).

Properties team will be drawing up agreement with Bosa and get it signed off in the next week or so.



Next steps:

- With the Bosa deal almost made, Properties will be talking with the owner of Parcel 3 (Mr Kang), who also owns the 4.766 acre parcel.
- We are hoping to have the deal made for a similar $2M to $2.2M per acre range.
- Hopefully in the next week or so, we will find out how successful we are going to be in making deal with Mr Kang.

Assuming we have these 3 parcels (around 14.3 acres) we should be able to build our outdoor substation (which requires min 12 acres) .

Ajay:

This is a question for you.

In the figure above – Parcel 4 is currently up for sale also.

Since onetime you had mentioned to Neil, that IP may be looking to install battery banks in the future - I think it will be good idea for BCH to try to secure this parcel also.

This will give us lot of flexibility to accommodate any future plans that IP may have for this area.

What are your thoughts on that?

If you agree, we can ask Properties to approach the owner of Parcel 4 also and secure it – of course, we will be trying to make a deal for similar $/acre that we are agreeing with Bosa.

Surinder Parmar, P.Eng., PMP
BC Hydro
6911 Southpoint Drive

P 604.528.7731
M 604.561.2702
E Surinder.Parmar@bchydro.com

bchydro.com

Smart about power in all we do.

From: Chan, David Y.M. <David.Chan@bchydro.com>
Sent: 2024, September 13 3:16 PM
To: Leonard, Allan <Allan.Leonard@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks Al and great call on going back at $20M first.

We will now work with the team and Bosa to prepare the Purchase and Sale Agreement.

Regards,

David

David Y. M. Chan | Manager – Acquisitions and Sales

Real Estate Services, Properties

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604-623-3998
M 604-328-8678

E david.chan@bchydro.com

bchydro.com

From: Leonard, Allan <Allan.Leonard@bchydro.com>
Sent: 2024, September 13 2:31 PM
To: Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks Tony – I am comfortable with the $20.5M offer and agree that it would be a good acquisition for the reasons outlined below.

Thanks David – good outcome.

AL

From: Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>
Sent: 2024, September 13 2:02 PM
To: Chan, David Y.M. <David.Chan@bchydro.com>; Leonard, Allan <Allan.Leonard@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Al,

I support accepting the counteroffer of $20.5M or $2.15M per acre. It's a reasonable price and within the realm of market value.

We are not considering expropriation at this stage, but I wanted you to be aware of the following:

Under an expropriation scenario, despite any appraisal evidence a taking authority submits to the courts to defend it position, we have seen recent examples where the Courts have gone out of their way to side with the landowner. In addition to exposure to additional compensation as part of a court ruling, this are potential hundreds of thousands of dollars that would be incurred as part of the expropriation process.

Having the Bosa property under contract, would provide additional leverage with adjacent owners in future negotiations and likely lead to an expedited timeframe for land acquisition for this project.

Regards,

Tony

_____

Tony S.C. Lee | Senior Manager, Real Estate Services, Properties

P 604 623 3773
M 604 838 1020
E tony.lee@bchydro.com

Smart about power in all we do.

From: Chan, David Y.M. <David.Chan@bchydro.com>
Sent: 2024, September 13 10:39 AM
To: Leonard, Allan <Allan.Leonard@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Hi Al,

My contact (Director of Acquisitions) at Bosa phoned me and we spent some time discussing BC Hydro's counter offer.

As anticipated, he wanted to counter at $21,000,000 and I said no, that won't work. He has replied to my email countering at $20,500,000 or $2.15M per acre.

Please let me know your thoughts/instructions.

Regards,

David

David Y. M. Chan | Manager – Acquisitions and Sales

Real Estate Services, Properties

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333 Dunsmuir St, 12th floor
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P 604-623-3998
M 604-328-8678
E david.chan@bchydro.com

bchydro.com

From: Leonard, Allan <Allan.Leonard@bchydro.com>
Sent: 2024, September 13 9:09 AM
To: Chan, David Y.M. <David.Chan@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks David

From: Chan, David Y.M. <David.Chan@bchydro.com>
Sent: 2024, September 13 9:08 AM
To: Leonard, Allan <Allan.Leonard@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks Al, I'll counter at $2.1M per acre or $20M and report back.

Regards,

David

David Y. M. Chan | Manager – Acquisitions and Sales

Real Estate Services, Properties

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333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604-623-3998
M 604-328-8678
E david.chan@bchydro.com

bchydro.com

From: Leonard, Allan <Allan.Leonard@bchydro.com>
Sent: 2024, September 13 8:55 AM
To: Chan, David Y.M. <David.Chan@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: WIB - Bosa Property

Thanks David, Given the original offer and counteroffer of $1.8M and $2.4M, wondering why we wouldn't go back at $2.1M as it would see both parties adjust by $300K/acre?

AL

From: Chan, David Y.M. <David.Chan@bchydro.com>
Sent: 2024, September 13 8:35 AM
To: Leonard, Allan <Allan.Leonard@bchydro.com>; Dunn, Hilary <Hilary.Dunn@bchydro.com>; Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Kelly, Neil <Neil.Kelly@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: WIB - Bosa Property

Hello everyone,

After our meeting yesterday afternoon, I wrote to Bosa and they replied shortly after.

I provide details below and the map attached.

Bosa Properties (2 parcels – 9.53 acres)	Dates	Offer Amounts
First contact	July 17, 2024	
BC Hydro Business Case Approved	August 26, 2024	
BC Hydro Initial Offer at Appraised Value	September 5, 2024	$17.5M or $1.8M per acre
Bosa Counter Offer	September 6, 2024	$22.9M or $2.4M per acre
BC Hydro Counter Offer (per our meeting)	September 12, 2024	$19.1M or $2M per acre
Bosa Counter Offer	September 12, 2024	$22M or $2.3M per acre
BC Hydro Proposed Counter Offer	**September 13, 2024**	**$21M or $2.2M per acre**

Based on interactions and negotiations to date, I believe Bosa will agree to $21M or $2.2M per acre ($400K per acre/23% over appraised value). I believe this is good price for BC Hydro's substation use.

The Kang property to the south is 4.766 acres, appraised at $8.1M or $1.7M per acre. If we project a similar per acre value for its acquisition or $8M-$10M, the site could be assembled at around $30M.

Please let me know your thoughts.

I am seeking your approval to respond to Bosa at $21M or $2.2M per acre.

Thank you everyone for your iput.

David

David Y. M. Chan | Manager – Acquisitions and Sales

Real Estate Services, Properties

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604-623-3998
M 604-328-8678
E david.chan@bchydro.com

bchydro.com

From: Chwaklinski, David
Sent: 2025, January 13 10:21 AM
To: Yu, Lily; Khan, Jahangir
Cc: Hepple, Robert; Balea, Marian; Chwaklinski, David
Subject: RE: Willoughby and Campbell Heights property Purchase - replacement for Ken and Kally
Attachments: WIB-E05-SK006-Op1-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.pdf; WIB-E05-SK006-Op2-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.pdf; Bosa-Kool-Walia.pdf; Bosa-Kool-Walia-Kang.pdf

Importance: High

Good morning Lily and Jahangir. I am following up on my e-mail from Mid December where I requested a new designer be assigned to my projects. As both Ken and Kally have moved on, I need to have a new electrical designer assigned for the final bit of effort for Willoughby and Campbell Heights substation property acquisition. The main effort is to develop a revised layout for Willoughby. We have a layout based on Bosa and Kang property. (See SK006 Option 1 and 2) Since those were completed by Kally, we have pivoted to a new set of properties called Bosa-Kool- Walia (see attached) that needs a layout.

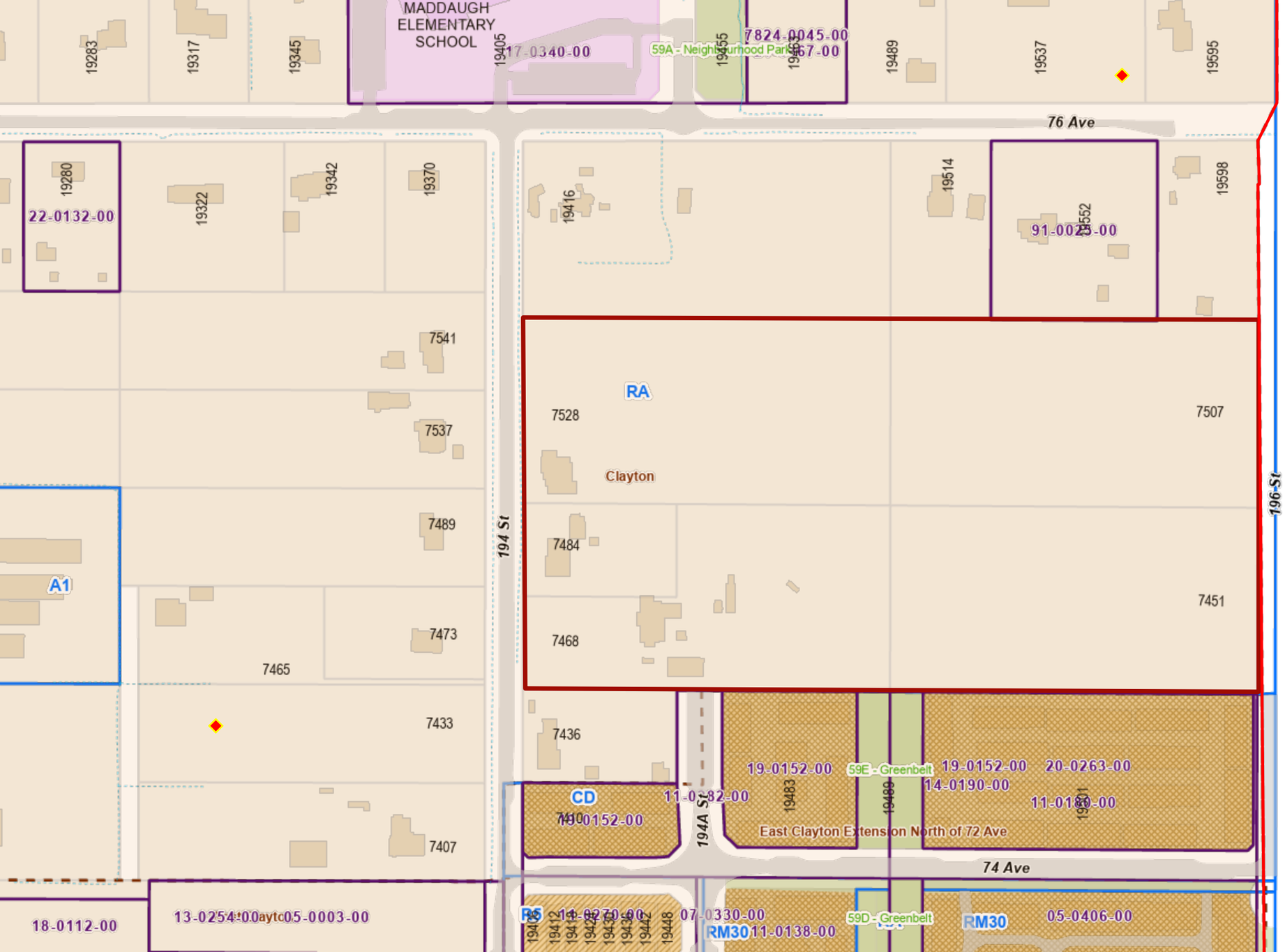
At this time, our intention is to take the Bosa-Kang layout and revise it (Mirror image if you will) to fit on the Bosa-Kool-Walia property. I need that quickly as we are finalizing property acquisition, but we can't complete until we have a workable layout. Please note, it does not have to be the final layout as we expect that at some point we will obtain the Kang property and the layout will be able to be optimized (See Bosa-Kool-Walia-Kang).

Can you please provide me with a new designer or if you can convince Kally or Ken to help us through this next bit of effort I would appreciate it. If you could let me know who the designer will be and copy Robert Hepple I would appreciate it. FYI I am on vacation from Jan 15 to February 5th so Robert will deal with the designers in my absence. Please let me know if you have any questions.

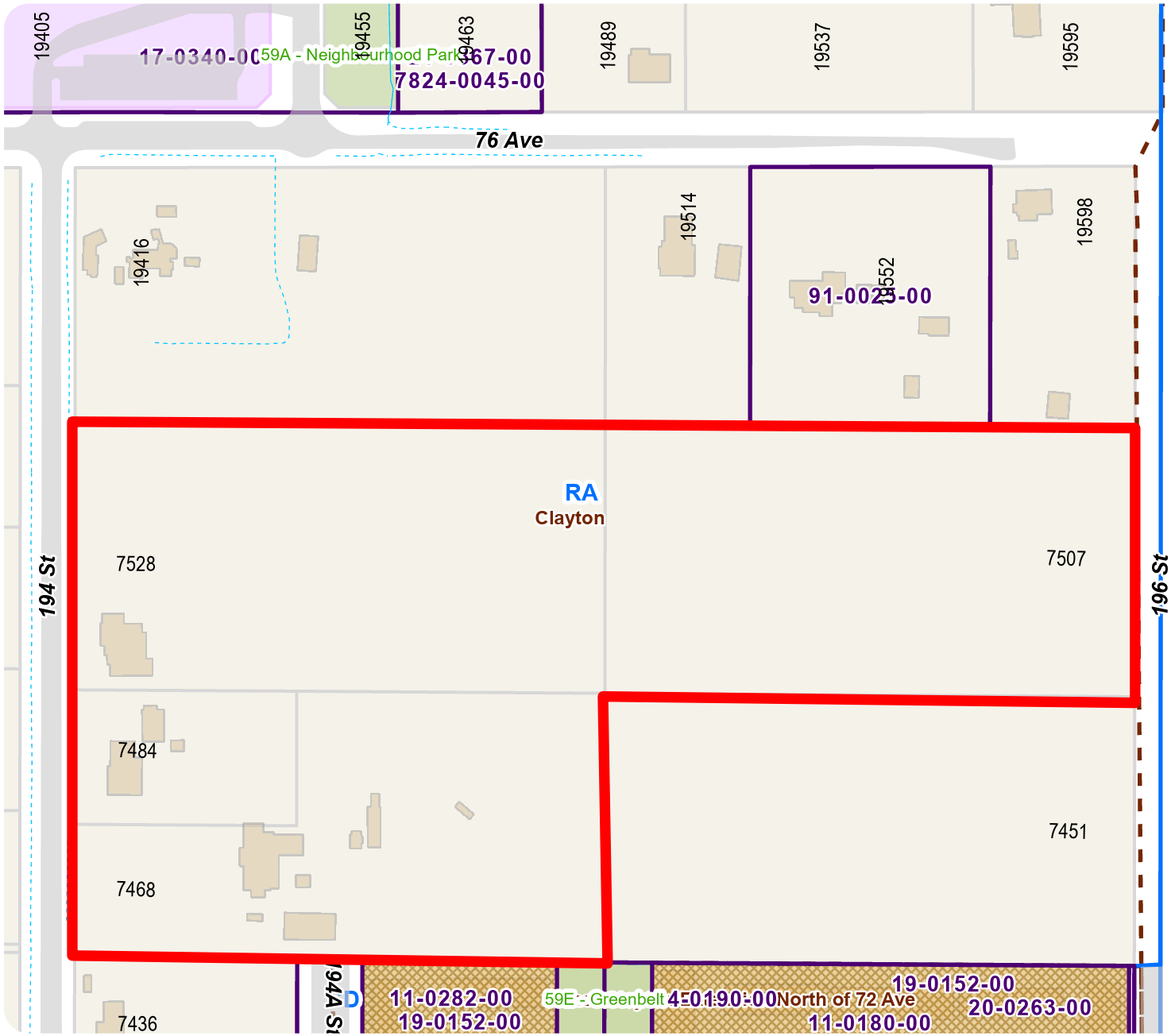
Marian I am copying you as you reviewed the electrical memos and will presumably review any layout.

From: Chwaklinski, David
Sent: Friday, December 13, 2024 11:22 AM
To: Yu, Lily ; Khan, Jahangir
Cc: Hepple, Robert ; Chwaklinski, David
Subject: Willoughby and Campbell Heights property Purchase - replacement for Ken and Kally

Good morning Lily and Jahangir, I recently found out that Ken and Kally are moving on to new roles and wont be able to support me in the property purchase projects. Can you tell me who might be assigned in their place? I have received a request to develop a new layout for the Willoughby property and I would like to discuss with a designer. Thanks


MADDAUGH ELEMENTARY SCHOOL
19283
19317
19345
19405
17-0340-00
59A - Neighbourhood Park
19455
19467
7824-0045-00
19489
19537
19595
76 Ave
19280
22-0132-00
19322
19342
19370
19416
19514
19552
91-0025-00
19598
7541
7537
7489
A1
7473
7465
7433
7407
RA
7528
7507
Clayton
7484
7451
7468
194 St
196 St
7436
19-0152-00
59E - Greenbelt
19-0152-00
20-0263-00
14-0190-00
11-0190-00
19483
19489
19501
CD
11-0182-00
194A St
East Clayton Extension North of 72 Ave
74 Ave
18-0112-00
13-0254-00
05-0003-00
RM30
07-0330-00
11-0138-00
59D - Greenbelt
RM30
05-0406-00

City of Surrey Mapping Online System



Bosa-Kool-Walia

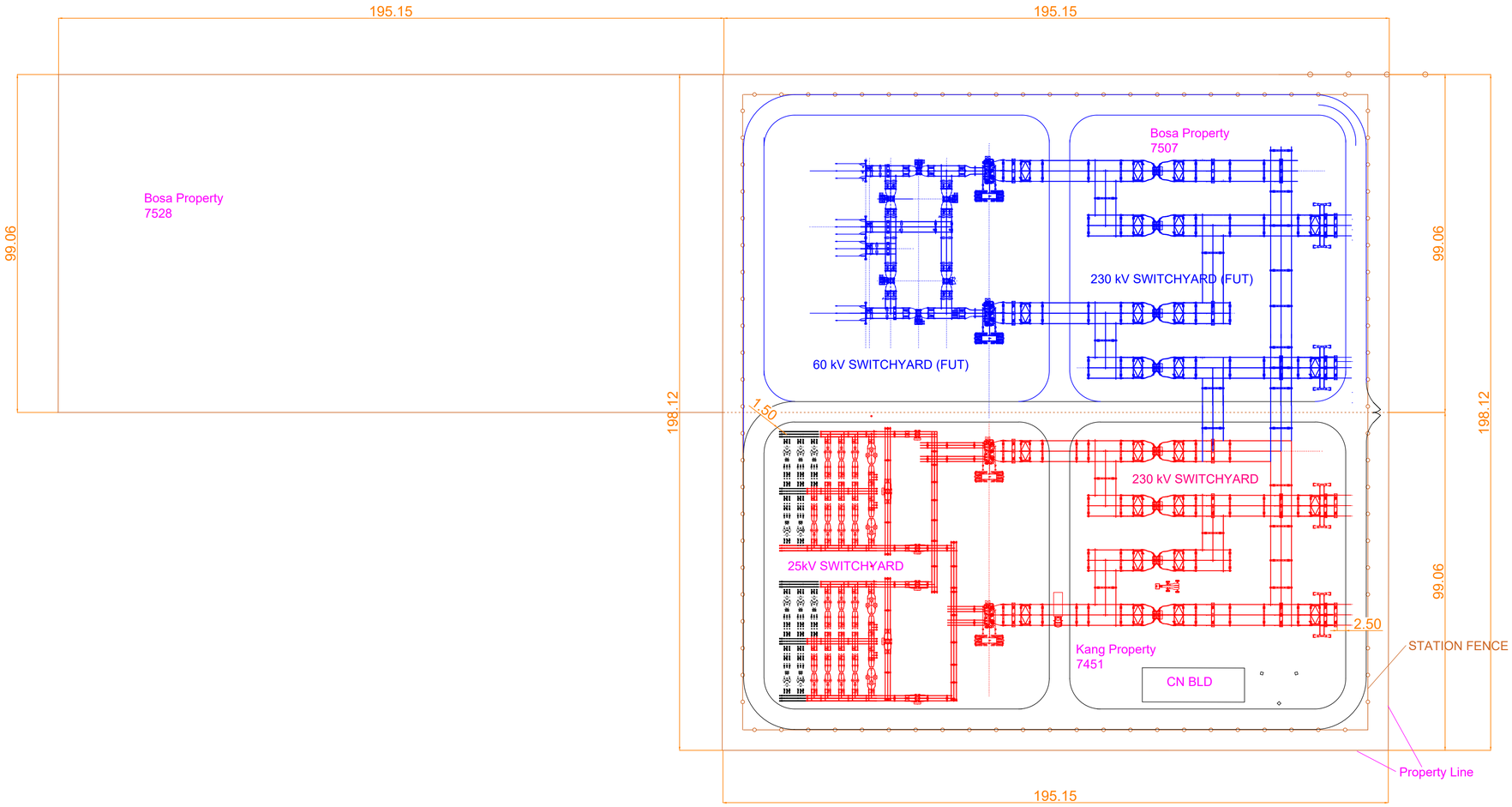
Scale: 1:2,209

The data provided is compiled from various sources and is NOT warranted as to its accuracy or sufficiency by the City of Surrey.
This information is provided for information and convenience purposes only. Lot sizes, legal descriptions and encumbrances must be confirmed at the Land Title Office. Use and distribution of this map is subject to all copyright and disclaimer notices at cosmos.surrey.ca

0 0.01 0.03 0.05 0.08
km

Map created on: 2024-12-05

N



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

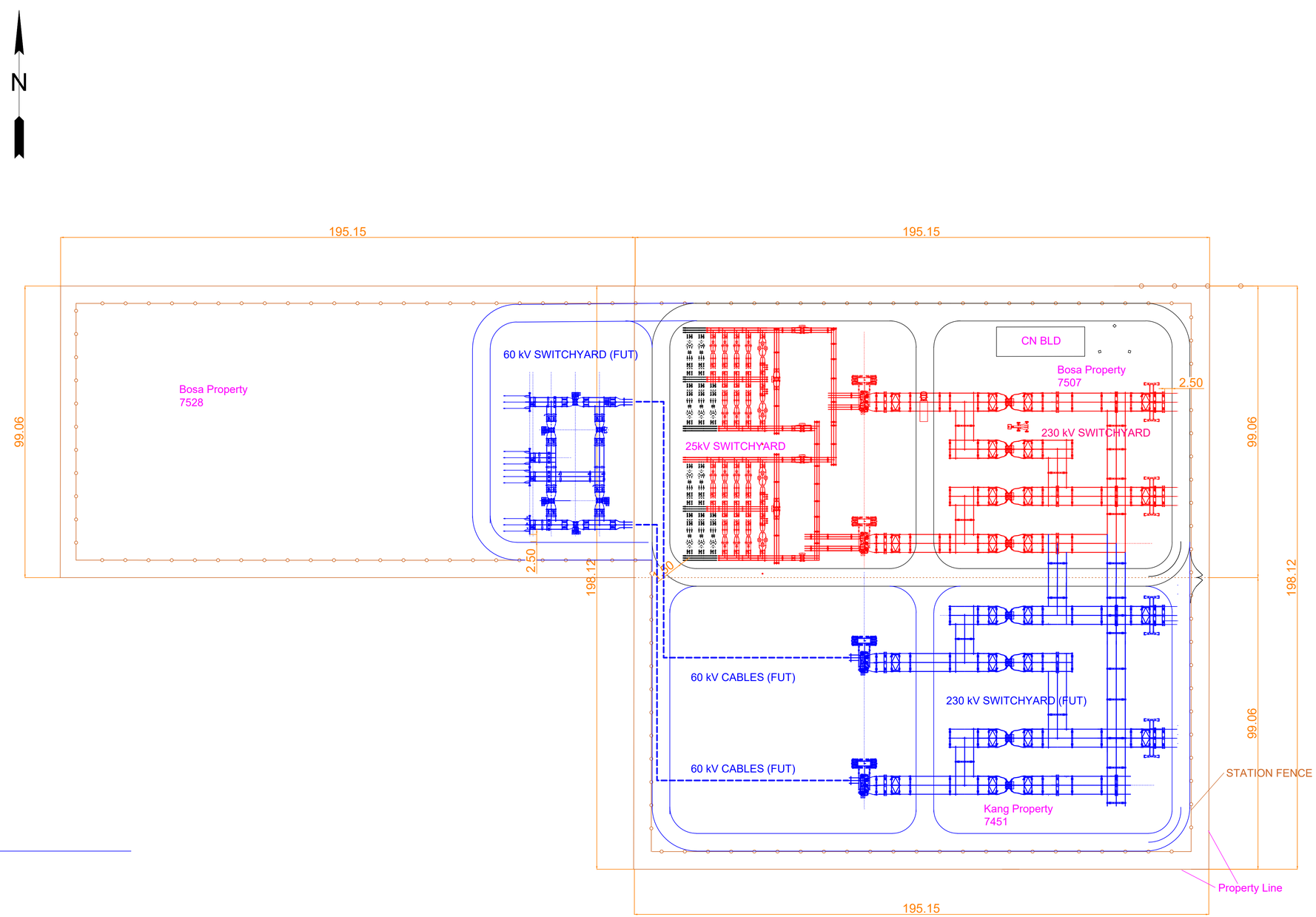
DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP16		WIB-E05-SK006-OP1			D	0

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C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240913-New for Bosa+Kang\WIB-E05-SK006-Opb-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.dwg
Drawing Unit = Metric (4)
JIANG, KAI
9/16/2024 4:30 PM

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIP\D2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240913-New for Bosa+Kang\WIB-E05-SK006-Op5-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.dwg
Drawing Unit = Metric (4)
JIANG, KAI
9/16/2024 4:30 PM

REFERENCE DRAWINGS

NO	REMARKS
	REVISIONS

DESIGN NUMBER		DSGN	K. JIANG
WORK ORDER NUMBER		INDEP CHK	
CSA S250 ACCURACY NAD - UTM		DFTG	K. JIANG
		DFTG CHK	
BASE ACCURACY LEVEL:		INSP	
ASB ACCURACY LEVEL:		REV	K. ZENG
		ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP16		WIB-E05-SK006-OP2			D	0

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From: Hepple, Robert
Sent: 2025, February 21 7:49 AM
To: Chwaklinski, David; Lee, Dylan
Cc: Chan, David Y.M.
Subject: RE: Willoughby Confirmatory Investigation - draft Report

Yes, I agree.

From: Chwaklinski, David
Sent: 2025, February 20 3:17 PM
To: Hepple, Robert ; Lee, Dylan
Cc: Chan, David Y.M. ; Chwaklinski, David
Subject: RE: Willoughby Confirmatory Investigation - draft Report
Importance: High

Hi Robert. I have reviewed KCB's draft factual report and Dylan's summary. Based on the data I see no reason not to proceed with completion of the purchase of the Bosa and Kool properties. I recommend that David Chan proceed with the completion while Dylan makes the minor revisions to his memo and KCB revise their report.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Thursday, February 20, 2025 2:40 PM
To: Lee, Dylan <Dylan.Lee@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>
Subject: FW: Willoughby Confirmatory Investigation - draft Report

Hi Dylan,
A couple of catches.
Please exclude the Walia property as an area of interest.
Correct the spelling of the Walia property.
Thank you,
Robert

Robert Hepple P.Eng.

Project Manager, Stations

Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

Smart about power in all we do.

From: Lee, Dylan <Dylan.Lee@bchydro.com>
Sent: 2025, February 20 2:35 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>
Subject: RE: Willoughby Confirmatory Investigation - draft Report

Hi David,

Please sign so I can file.
No significant geotechnical concerns. Please review summary points.
Let me know if you have any questions.

Thanks
Dylan

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2025, February 20 2:23 PM
To: Lee, Dylan <Dylan.Lee@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Willoughby Confirmatory Investigation - draft Report

Hi Dylan, have you received the draft report from KCB yet?

From: Chwaklinski, David
Sent: 2025, October 09 10:49 AM
To: Sydorov, Dmitri D
Cc: Chwaklinski, David; Kelly, Katrina
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hi Dmitri, FYI BC Hydro has obtained the Walia property for the Willoughby Substation. Your WIB_E05-SK006-Op1 that was included in the e-mail below is being used as the baseline Layout until the final piece of the property picture is obtained. I will be placing the Option 1 drawing in the workspace for permanent record. Can you please provide me with the CADD versions so I can add them to the file as well? Thanks

---

From: Sydorov, Dmitri D
Sent: Thursday, February 13, 2025 11:41 AM
To: Berisso, Hussien ; Hepple, Robert ; Chwaklinski, David
Cc: Balea, Marian ; Sydorov, Dmitri D ; Khan, Jahangir ; Qin, Martin L ; Hou, Terri
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hussien/Robert/David – as requested, please see attached drafted versions of the ne WIB general arrangement inside considered property envelope.
TL and DIS substation entry/exit for this stage was coordinated on my end with TL and DIS leads.

Regards,

_____
Dmitri Sydorov PE, P.Eng | Sr. Engineer,T-Stations Engineering
Office: 604.528.1519
_____

From: Berisso, Hussien
Sent: 2025, February 10 10:00 AM
To: Khan, Jahangir ; Hepple, Robert
Cc: Sydorov, Dmitri D ; Balea, Marian ; Jelenici, Flori ; Armstrong, Mazana ; Parmar, Surinder ; Groves, Christa
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Thank you, Jahangir, for confirming Dmitri will continue working on the WIB construction project. As you may be aware, I am working with other station team on this project, and so far, I am pleased with progress by the team. Dmitri has already completed the electrical section of the DP, Amin/Civil has completed both DB

& DP contributions for Civil scope. Equipment & Mechanical are also on track to complete. The deadline for the EOI/RFSQ and RFP is currently set for March and Sep 2025, respectively.

Thank you for your understanding. We do appreciate your team's support.

Regards,

Hussien Berisso, MSc, P. Eng | Project Engineer Specialist, Stations Project Engineering

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M: 604.862.9081
E: hussien.berisso@bchydro.com

bchydro.com

Smart about power in all we do.

From: Khan, Jahangir <Jahangir.Khan@bchydro.com>
Sent: 2025, February 10 9:31 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Berisso, Hussien <Hussien.Berisso@bchydro.com>
Cc: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Balea, Marian <Marian.Balea@bchydro.com>; Jelenici, Flori <Flori.Jelenici@bchydro.com>; Armstrong, Mazana <Mazana.Armstrong@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Morning everyone
Thanks for your kind attention to our resourcing concerns. Appreciate reaching out directly and sharing more information.

I understand that the current work on the WIB Construction projects is mostly around preparing EOI, RFP etc. The design input needs to be very high-level. More importantly, the deadline is not imminent, and we have several months to complete this task.

With this, I am happy to bring Dmitri back into project. Hope Marian will be able to support. Only request is, please provide as much calendar flexibility as possible.
Best,

_____
Jahangir Khan | Team Lead,T-Stations Engineering

Tel: 604-528-2910 (D), 604-314-7083 (M)

From: Armstrong, Mazana <Mazana.Armstrong@bchydro.com>
Sent: 2025, February 04 10:00 AM
To: Parmar, Surinder <Surinder.Parmar@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Khan, Jahangir <Jahangir.Khan@bchydro.com>; Berisso, Hussien <Hussien.Berisso@bchydro.com>
Cc: Balea, Marian <Marian.Balea@bchydro.com>; Jelenici, Flori <Flori.Jelenici@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hi Surinder,

Sure, let me circle back with my team leads and we will get back to you.

Thanks,

Mazana

Mazana Armstrong, Ph.D., P.Eng., SMIEEE | Division Manager, Transmission Stations Engineering

P 604 528 3328
M 604 968 6986
E mazana.armstrong@bchydro.com

From: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Sent: 2025, February 04 8:56 AM
To: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Khan, Jahangir <Jahangir.Khan@bchydro.com>; Berisso, Hussien <Hussien.Berisso@bchydro.com>; Armstrong, Mazana <Mazana.Armstrong@bchydro.com>
Cc: Balea, Marian <Marian.Balea@bchydro.com>; Jelenici, Flori <Flori.Jelenici@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Mazana:

We need to have a discussion on this as soon as possible.

As you know the Executive is looking us to advance the EPC RFP for the Construction project.

Since this is not our normal project delivery method, we need Engineering support to complete the deliverables.

So please let us know asap who from TE will be helping Hussien in producing the needed Engineering deliverables for the RFP.

Surinder Parmar, P.Eng., PMP
BC Hydro
6911 Southpoint Drive

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M 604.561.2702
E Surinder.Parmar@bchydro.com

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From: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Sent: 2025, February 04 8:36 AM
To: Khan, Jahangir <Jahangir.Khan@bchydro.com>; Berisso, Hussien <Hussien.Berisso@bchydro.com>
Cc: Balea, Marian <Marian.Balea@bchydro.com>; Jelenici, Flori <Flori.Jelenici@bchydro.com>; Armstrong, Mazana <Mazana.Armstrong@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Jahangir – all clear and understood on my end.
Thanks.

_____
Dmitri Sydorov PE, P.Eng | Sr. Engineer,T-Stations Engineering
Office: 604.528.1519

_____

From: Khan, Jahangir <Jahangir.Khan@bchydro.com>
Sent: 2025, February 04 8:33 AM
To: Berisso, Hussien <Hussien.Berisso@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Cc: Balea, Marian <Marian.Balea@bchydro.com>; Jelenici, Flori <Flori.Jelenici@bchydro.com>; Armstrong, Mazana <Mazana.Armstrong@bchydro.com>;

Parmar, Surinder <Surinder.Parmar@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Morning Hossien
The report you attached is for the Purchase project (TM-0592). My concern is about the construction/turnkey project (TM-0637).

If the scope of turnkey work is now changed, please resubmit or amend the resource request. Previously, Marian was assigned to support the RFSQ.

@Sydorov, Dmitri D: Please pause your work on the WIB (& CBS) construction project TM-0637 (& TM-0632). Work on the property projects (TM-0593 and TM-0592) continues.

PS: We are facing dire resource crunch. Appreciate your understanding.
Cheers,

_____
Jahangir Khan | Team Lead,T-Stations Engineering
Tel: 604-528-2910 (D), 604-314-7083 (M)

_____

From: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Sent: 2025, February 03 3:42 PM
To: Khan, Jahangir <Jahangir.Khan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Balea, Marian <Marian.Balea@bchydro.com>; Jelenici, Flori <Flori.Jelenici@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hi Jahangir,

The station electrical contribution for the property purchase project is nearly complete with signed Electrical memo attached. However, there have been some changes to the property, prompting Dmitri to revise the conceptual layout according to the updated property line we're considering acquiring. As a result, there's not much remaining for Station Engineering on this project.

For the construction project, CIPD has requested that internal engineering proceed with developing the design plan and design basis for FEAS, which will be used in the procurement process (RFSQ and RFP). Detailed design will be handled in DEF, which will be under the scope of the EPC contractor. Additionally, I've been asked to prepare the WPDT for FEAS and will be requesting estimates from Station Electrical and other relevant disciplines. The decision on who will prepare the detailed specifications for the RFP has not been made yet, but most of the information developed in FEAS will serve as the foundation.

@Parmar, Surinder & @Hepple, Robert please add if I may have missed anything.

Regards,

Hussien Berisso, MSc, P. Eng | Project Engineer Specialist, Stations Project Engineering

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M: 604.862.9081
E: hussien.berisso@bchydro.com

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From: Khan, Jahangir <Jahangir.Khan@bchydro.com>
Sent: 2025, February 03 3:05 PM
To: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Cc: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Balea, Marian <Marian.Balea@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hi Hussien
I understand you have engaged Dmitri on this project and various design activities are on the go.

In the rush of transitioning Ken's projects to Dmitri, we may have missed the blurry line between the Property Purchase project vs. the Construction project.

I realized this is the Construction project. As such, I need to make you aware that Dmitri is not officially assigned to this resource yet, Marian is.

This is mentioned in the resourcing pages WIB and CBS. On top of that, this is a turnkey project. Our involvement on design tasks should ideally be zero – that applies for Dmitri.



Please consult with Marian and discuss with the PM as appropriate.
Thanks.

_____
Jahangir Khan | Team Lead,T-Stations Engineering
Tel: 604-528-2910 (D), 604-314-7083 (M)
_____

From: Khan, Jahangir
Sent: 2025, January 28 3:25 PM
To: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Cc: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hi Hussein
I would prefer not to go for OT if at all possible. Please let me know if this is extremely time-sensitive. This project is going on for multiple years, so struggling to understand the drivers for the OT need and urgency.
Cheers,

_____
Jahangir Khan | Team Lead,T-Stations Engineering
Tel: 604-528-2910 (D), 604-314-7083 (M)
_____

From: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Sent: 2025, January 28 3:20 PM
To: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Cc: Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Khan, Jahangir <Jahangir.Khan@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hussien – to work on WIB Preliminary Design Basis and Design Plan this/next week I may require your approval for me to work over the weekends overtime. Since I'll be away to GLN Feb 4-5 things are getting very busy to meet the next week deadline.

Please advise.

_____
Dmitri Sydorov PE, P.Eng | Sr. Engineer,T-Stations Engineering
Office: 604.528.1519
_____

From: Berisso, Hussien <Hussien.Berisso@bchydro.com>
Sent: 2025, January 28 3:13 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>
Subject: FW: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hi Robert,

Can you give Dmitri access to the Willoughby - Substation Construction - Home PPM site?

Regards,

Hussien Berisso, MSc, P. Eng | Project Engineer Specialist, Stations Project Engineering

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From: Berisso, Hussien
Sent: 2025, January 16 2:23 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Balea, Marian <Marian.Balea@bchydro.com>; Sydorov, Dmitri D <Dmitri.Sydorov@bchydro.com>; Kadivar, Amin <Amin.Kadivar@bchydro.com>; Majdzadeh, Fariborz <Fariborz.Majdzadeh@bchydro.com>; Sweet, Michael <Michael.Sweet@bchydro.com>; Cui, Philip <Philip.Cui@bchydro.com>; Bhanot, Jay <Jay.Bhanot@bchydro.com>; Duff, Gord <Gord.Duff@bchydro.com>; Qin, Martin L <Martin.Qin2@bchydro.com>; Mai, Karl <Karl.Mai@bchydro.com>; Mojebi-Mogharrar, Fariborz <fariborz.mojebi@bchydro.com>; Barnett, Garry <Garry.Barnett2@bchydro.com>; Duff, Gord <Gord.Duff@bchydro.com>; Lee, Dylan <Dylan.Lee@bchydro.com>; Lepiten, Ramon <Ramon.Lepiten@bchydro.com>; Zhang, Sam <Sam.Zhang@bchydro.com>; Rochwerger, Guilherme G <Guilherme.Rochwerger@bchydro.com>; Wen, Guoqiang <Guoqiang.Wen@bchydro.com>; Leite, Paulo <Paulo.Leite@bchydro.com>; Szutoo, Raymond <Raymond.Szutoo@bchydro.com>
Cc: Ma, Eddie <Eddie.Ma@bchydro.com>; Diallo, Boubacar <Boubacar.Diallo@bchydro.com>; Jelenici, Flori <Flori.Jelenici@bchydro.com>; Graham, Danny <Danny.Graham@bchydro.com>; Wilson, Sandra <Sandra.Wilson@bchydro.com>; Zabeti, Ped <Ped.Zabeti@bchydro.com>; Lin, Lynn <Lynn.Lin@bchydro.com>; Hansen, Adrian <Adrian.Hansen@bchydro.com>; Constantino, Marte <Marte.Constantino@bchydro.com>
Subject: RE: Willoughby New Substation Project (TM-0637) - Kick Off Meeting

Hi Team,

Thank you all for attending the WIB Construction project (TM-0637) Project Engineering Kick-off meeting. As discussed, this project will be executed using Engineering Procurement and Construction (EPC) project delivery method. At this stage, the engineering focus is on completing the preliminary design basis and design plan to support the EPC contractor qualification process by identifying key questions necessary for evaluating a qualified EPC contractor. Please review the relevant scope for your discipline and add your inputs in the design basis (important requirements in a high level for this stage). Kindly proved this by **Feb 14, 2025.**

I will be on AV from **Jan 17-24**, during this time if you have any questions, please reach out to @Hepple, Robert.

Charge code:

Willoughby Construction Project	TM0592 1560 CONS

The following documents are attached:

- Preliminary Design Basis
- Design Plan
- Investment Summary
- Issued Station Planning Scopenotes (Please review the latest Scopenotes for your respective discipline under SN5078, some SNs are still blank or in Draft form)
- Slides from kick-off meeting

Regards,

Hussien Berisso, MSc, P. Eng | Project Engineer Specialist, Stations Project Engineering

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-----Original Appointment-----
From: Berisso, Hussien
Sent: 2025, January 10 1:33 PM
To: Berisso, Hussien; Hepple, Robert; Balea, Marian; Sydorov, Dmitri D; Kadivar, Amin; Majdzadeh, Fariborz; Sweet, Michael; Cui, Philip; Bhanot, Jay; Duff, Gord; Qin, Martin L; Mai, Karl; Mojebi-Mogharrar, Fariborz
Cc: Ma, Eddie; Diallo, Boubacar; Jelenici, Flori; Rochwerger, Guilherme G; Zhang, Sam; Graham, Danny; Barnett, Garry; Wilson, Sandra; Lepiten, Ramon; Zabeti, Ped; Lin, Lynn; Lee, Dylan; Hansen, Adrian; Szutoo, Raymond; Leite, Paulo; Constantino, Marte; Wen, Guoqiang
Subject: Willoughby New Substation Project (TM-0637) - Kick Off Meeting
When: 2025, January 16 11:00 AM-12:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Hi All,

This is a kick-off meeting for a new Willoughby substation construction project (TM-0637). Finding a time that works for everyone is challenging, but please make an effort to attend.

Willoughby - Substation Construction - Home
https://ppm.bchydro.bc.ca/projects/TM-0637/ProjectDocuments/Project_Management/1_IDN/Communication/TM-0637_Investment_Summary.pdf

---

Microsoft Teams Need help?

Join the meeting now

Meeting ID: 231 744 371 001

Passcode: mV3cA9Pj

Dial in by phone

+1 604-343-0415,,74411442# Canada, Vancouver

(888) 525-4968,,74411442# Canada (Toll-free)

Find a local number

Phone conference ID: 744 114 42#

For organizers: Meeting options | Reset dial-in PIN

Do NOT send or post NERC CIP-related confidential files in Teams. Share only necessary information via screenshare in Teams meetings when there is a valid business reason to do so. For additional information, contact your respective CIP Compliance Teams.

From: Chwaklinski, David
Sent: 2024, April 16 4:41 PM
To: Simpson, Lauren; Hepple, Robert; Armstrong, Tyler
Cc: Chwaklinski, David; Chaisson, Rob
Subject: RE: Willoughby Property Search

Good afternoon all. I have been reviewing the four parcels around 192nd and 80th. Of course, it is more complicated than it looks. Based on google earth all the sites have an average crossfall of between 5% to 7% (approximate) with some very steep sections. The elevation change appears to be from 9 to 17 m across the sites depending. While not ideal the properties are large enough we could likely develop a substation on all of them

Based on Surrey Maps COSMOS, Option two has 5 parcels to consolidate, the most buildings (active barns) but no apparent watercourse. Option 1 has about 6 properties to consolidate with the most residences but no apparent watercourses. Option 4 has four properties to consolidate (with residences) and has either ditching or streams that feed into south Latimer creek. The property boundary may touch south Latimer creek. Option 3 has the fewest parcels to consolidate with only two residences, but it appears to have a creek cutting across two of the three parcels and bounding one of the parcels.

Based on what I have seen if we can address the water course issue, I would choose Option 3 to go ahead with purely from a site development aspect. If the watercourse is a no go, I would recommend we go with Option 4 as it appears that the watercourses may be surface ditching only and we may be able to deal with them easier than a registered watercourse. Failing that I would go with option 1 as the properties do not look like they are “high end” ranches and there are no watercourses shown. I know I did not pick one, but this is the best I can do without more investigation in to the environmental aspects.

I will be out of the office tomorrow but will be available for discussion on Thursday.

From: Simpson, Lauren
Sent: Tuesday, April 16, 2024 11:41 AM
To: Hepple, Robert ; Armstrong, Tyler ; Chwaklinski, David
Subject: RE: Willoughby Property Search

We can carry these alternatives into CONC. I think We just need a decision now so David can finalize his report and you can complete the SoO.
We already have Alt 13.

For now I have added the following to the SDM table:

- Alternative 14 = one of the 4 ToL options
- Alternate 15 = ALR

An enviro screening can be conducted on Alt 14 and 15 in CONC.

This means we are carrying 6 alternatives into CONC. Unless we received feed back from the City regarding the other alternatives (5, 10, 11 & 13)??

Please advise.

Thanks, Lauren

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, April 16 10:57 AM
To: Simpson, Lauren <Lauren.Simpson@bchydro.com>; Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Willoughby Property Search

Lauren,
We will add it now as David Chan and Surinder agree to approach City of Surrey with our finding and request to re-zone.
We will carry it into Conceptual.
I am also asking Tyler about Alternative 13. Can we carry this into Conceptual as well?

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
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W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Sent: 2024, April 16 10:52 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Willoughby Property Search

To confirm.

- David will select one of the four options on 80th and 192.
    - No enviro screening is required? If this is the case there is a risk that the selected property has some enviro restrictions.

- We will add the ALR site once we receive confirmation from the City of Surrey or now?

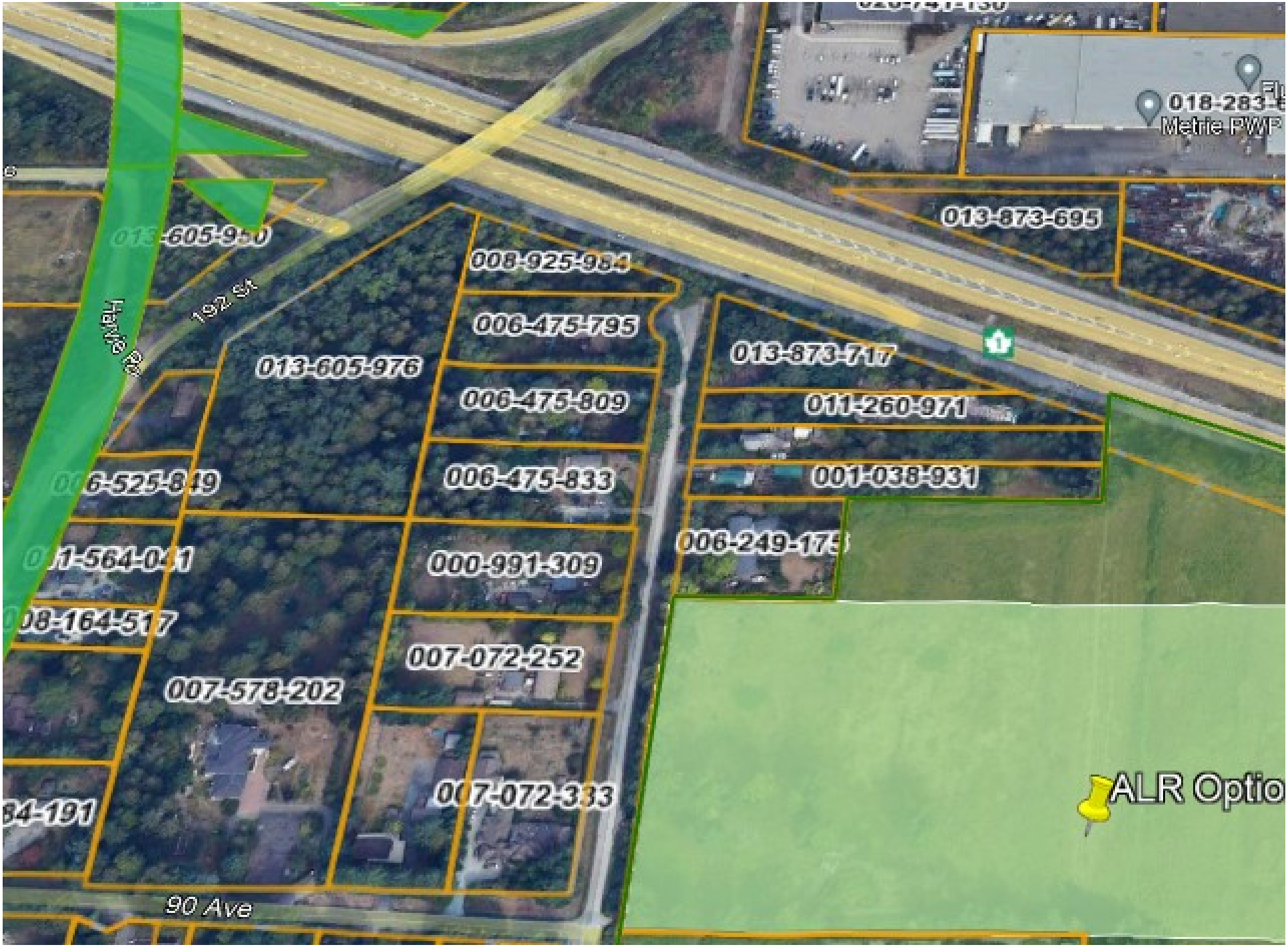
From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, April 16 10:31 AM
To: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Willoughby Property Search

Tyler,
Good let's add the ALR site.
David just stopped by my desk and he will look at the 4 sites and choose one.
How about adding Alternate 13 the our list to go into Conceptual?

From: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>
Sent: 2024, April 16 10:22 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Willoughby Property Search

Yes, that's what David Chan said as much when I asked him about the process with non farm use in ALR this morning. I looked at the site and I only see one viable parcel that would make sense for us as the others are landlocked.

See below roughly 12 acre.


018-283-
Metrie PWP
013-873-695
008-925-984
006-475-795
192 St
Hayden
013-605-976
006-475-809
013-873-717
011-260-971
006-475-833
001-038-931
000-991-309
007-072-252
007-578-202
007-072-333
ALR Optio
90 Ave

Regards,

_____

Tyler Armstrong | Property Representative – Acquisitions and Sales

BC Hydro
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From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, April 16 9:44 AM
To: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Willoughby Property Search

Hi Tyler,
Yes, I agree with your proposal with one exception.
Surinder wants us to go to the City of Surrey and show them the ALR site and ask if they would be willing to re-zone it.
Do you agree?

Robert Hepple P.Eng.

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From: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>
Sent: 2024, April 16 9:05 AM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Willoughby Property Search

Nick from ToL informed me this morning that the site near the highways is a detention pond and the surrounding areas are owned by a developer who has received approval for an office building. Therefore, we are back to considering the 192/80th intersection as the most likely option.

I suggest conducting a quick desktop study on all four corners to determine if there are any environmental concerns on one corner more than the others. We could choose the corner on the northwest (Option 4) with the least parcels as our primary option if the environmental conditions are favorable. Then, we could select one of the other corners (Option 2 or 4) with the least amount of parcels and a decent desktop environment as a backup option. Option 1 has the most parcels and therefore should be considered last.

Robert, I'll defer to you to confirm with the group if this is a reasonable course of action to take. If so, we need to update the SDM with our options.


LS_CADD Overlay
3/2024
006-845-878
Meewen Farms
006-845-720
006-845-835
006-845-860
Option 3 13.6 Acre
006-845-851
010-750-029
010-750-045
80 Ave
80 Ave
80 Ave
Comfort Knox Heating Ltd
192 St
007-791-887
Option 1 12.5 A
005-951-704
005-951-712
002-136-864
Option 4 11.8 Acre
003-370-879

Regards,

_____

Tyler Armstrong | Property Representative – Acquisitions and Sales

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M 604 230 0187
E tyler.armstrong@bchydro.com

bchydro.com

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From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, April 15 3:20 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Armstrong, Tyler <Tyler.Armstrong@bchydro.com>
Cc: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Willoughby Property Search

Tyler is waiting for ToL confirmation

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, April 15 1:30 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Armstrong, Tyler <Tyler.Armstrong@bchydro.com>
Cc: Simpson, Lauren <Lauren.Simpson@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Willoughby Property Search

Robert or Tyler, can you identify the properties we are adding?

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Monday, April 15, 2024 9:40 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Simpson, Lauren

<Lauren.Simpson@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Cc: Gadhok, Satwant <Satwant.Gadhok@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Subject: RE: Willoughby Property Search

David,
We will look at only one of the properties at 192nd and 80th but add two more identified in our discussions with Township of Langley.
Tyler will get us new clean KMZ maps showing locations.
I will forward these 3 locations to Anil Pradhan who will run them by transmission and distribution planning to get their feedback.
We will need their feedback before moving to Conceptual
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
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W 604.528.3433
E Robert.Hepple@BCHydro.com

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, April 15 9:34 AM
To: Armstrong, Tyler <Tyler.Armstrong@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Chaisson, Rob <Rob.Chaisson@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Willoughby Property Search

Good morning, everyone. Has a decision been made as to adding the four properties identified near 192nd and 80th to the list of properties we are going to evaluate in Conceptual? Or are we going to go forward with the four options currently identified in the SDM table? I would like to finalize my design plan and get it signed off if possible.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

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6911 Southpoint Drive, E08
Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com

From: Jiang, Kally
Sent: 2024, September 12 10:50 AM
To: Chwaklinski, David
Cc: Steels, Craig; Kadivar, Amin; Lee, Dylan; Hepple, Robert; Berisso, Hussien
Subject: RE: Willoughby Sub - New layout required
Attachments: WIB-E05-SK005-Op5-Outdoor AIS-To Fit Qualico+Mattu Properties-20240912.pdf

Hi, Dave,

As requested, please check attached option 5 for details. The layout is based on minimum dimension requirements and 10 meter more would be required to fit all AIS design in this case.

Thanks,
Kally

From: Chwaklinski, David
Sent: 2024, September 11 4:55 PM
To: Jiang, Kally
Cc: Steels, Craig ; Kadivar, Amin ; Lee, Dylan ; Hepple, Robert ; Berisso, Hussien ; Chwaklinski, David
Subject: RE: Willoughby Sub - New layout required

Thanks Kally. I was looking at your Option 4 that shows four line positions, the 25 kV and 60 kV as AIS. As you note it does not fit on the Qualico and Panhandle properties, but it looks very much like the layout you created using GIS for the 60 kV and 25 KV sections overlaid on the Qualico and Mattu properties. I did some quick calculations and if we include Mattu and provide a 15 m set back from the creek center there would be about 197 m width. With that I believe it may be possible to install a Full AIS station on the three properties. Can you please revisit that option and show it as AIS? I think we should consider this at least. I would include your original layout for reference, but I am having troubles accessing my files right now. I will be in the office tomorrow if you wish to discuss further.

Hussien, FYI.

From: Jiang, Kally <Kally.Jiang@bchydro.com>
Sent: Wednesday, September 11, 2024 4:03 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Steels, Craig <Craig.Steels@bchydro.com>; Kadivar, Amin <Amin.Kadivar@bchydro.com>; Lee, Dylan <Dylan.Lee@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: RE: Willoughby Sub - New layout required

Hi, Dave,

As our discussions, I checked all AIS design based on the Panhandle and Qualico properties. These properties are not big enough for all AIS design. Please see attached Option 3 & 4 for details.

Thanks,
Kally

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, September 03 8:22 AM
To: Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Steels, Craig <Craig.Steels@bchydro.com>; Kadivar, Amin <Amin.Kadivar@bchydro.com>; Lee, Dylan <Dylan.Lee@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: RE: Willoughby Sub - New layout required

Thanks Kally, I would like to meet with you to discuss in more detail to see if there is a solution. I will check your calendar and get beack to you.

From: Jiang, Kally <Kally.Jiang@bchydro.com>
Sent: Friday, August 30, 2024 4:08 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Steels, Craig <Craig.Steels@bchydro.com>; Kadivar, Amin <Amin.Kadivar@bchydro.com>; Lee, Dylan <Dylan.Lee@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: RE: Willoughby Sub - New layout required

Good afternoon, David,

I tried very hard to squeeze the equipment into the Panhandle property 19595. Unfortunately, it is not sufficient for AIS arrangement. It is very tight even for all GIS equipment. Please see attached sketches for details.

Thanks and have a nice long weekend,
Kally

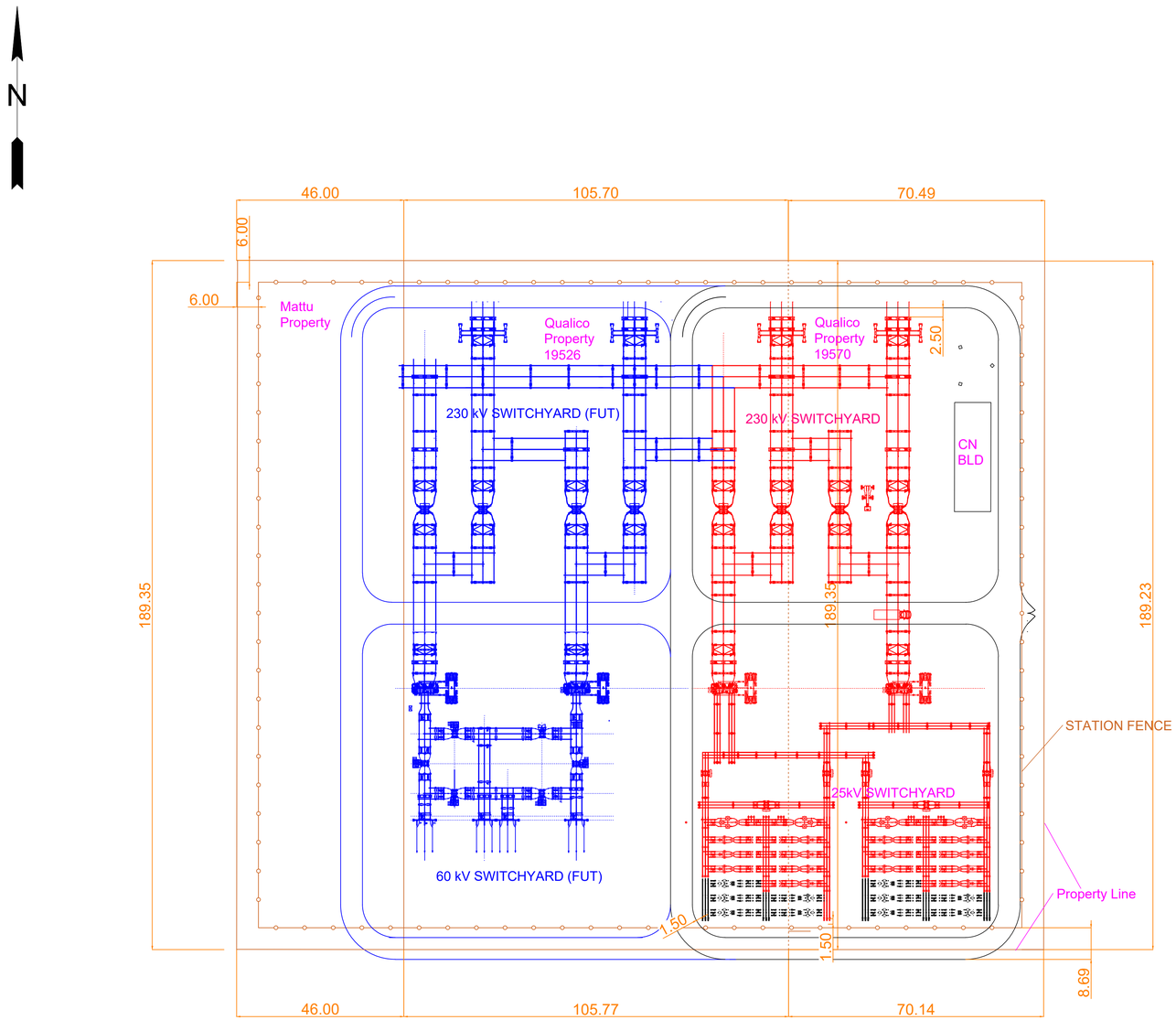
From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, August 22 9:54 AM
To: Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Steels, Craig <Craig.Steels@bchydro.com>; Kadivar, Amin <Amin.Kadivar@bchydro.com>; Lee, Dylan <Dylan.Lee@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Willoughby Sub - New layout required

HI Kally, I have been asked by the PM to have a new Willoughby station layout prepared over the land parcels shown outlined in Red in the attached map. Can you please have a look and see what you can do? The concept is for the 2 - 230 kV line positions and transformers to be located on the “panhandle” portion of the property (19595). In your layout, please consider that the 2 future line positions and 60 kV section could go on to the parcel 19537 directly to the west of 19595 if it became available. Please review the map and one line and then develop your layout. If there any issues or questions please don’t hesitate to get in touch with me. Have a look and let me know when you think you can deliver this. Thanks

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

BC Hydro
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Burnaby, BC V3N 4X8

M 778 833 3740
E david.chwaklinski@bchydro.com



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240912-New for Qualico\WIB-E05-SK005-Op5-Outdoor AIS-To Fit Qualico+ Properties-20240912.dwg
Drawing Unit = Metric (4)
JIANG, KAI, Y
9/12/2024 10:45 AM

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP12		WIB-E05-SK005-OP5			D	0

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From: Chwaklinski, David
Sent: 2024, June 04 10:08 AM
To: Zou, Ming; Kwan, John
Cc: Hepple, Robert; Chwaklinski, David
Subject: WIlloughby and Campbell Heights Property Purchase

Hi Ming and John, I am looking into the Transmission Supply for two new stations, Willoughby (North of Langley City) and Campbell Heights (Southwest of Langley City). Is there a Transmission Planning one line for the supply of these stations?

Initially I assumed that it would be some form of Tap (Split the circuit) off 2L076 but recently I have heard that it is being considered to supply out of McLellan for both which would mean four new line positions. It may be that supply from Fleetwood makes more sense from a transmission perspective. Has your team developed any concepts for this future supply?

I understand it may be early for you but these decisions could have a large impact on our property selection.

I appreciate any insight you can provide.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
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E david.chwaklinski@bchydro.com

From: Armstrong, Tyler
Sent: 2024, March 27 11:49 AM
To: Chwaklinski, David; Chan, David Y.M.; Gadhok, Satwant; Lee, Johnson
Cc: Manurung, Cynthia; Pradhan, Anil; Lin, Lynn
Subject: RE: Willoughby Substation - Updated property search area
Attachments: Willoughby Search March 27-2024.kmz

Hello everyone,

I've reviewed the area map and overlaid ALR, watercourses, etc. Based on the size of the property we need, I believe it makes sense to target the intersection of 192nd and 80th. This location is squarely on the Surrey side, as the Langley side does not have sufficient sized properties and has watercourse issues.

I understand that this area is on the perimeter of the area map David shared (top left corner of the green box), but I believe it offers us four good options with:

- Sufficient egress on two sides
- Located on main arterial roads for distribution
- No apparent watercourse or ALR issues
- Agricultural and acreage homes should trade at significantly lower prices than the high-density properties we previously considered.

Please let me know your thoughts on targeting this 80th & 192nd intersection.

MAP: KMZ File attached


LS_CADD Overlay
3/2024
006-845-878
Meewen Farms
006-845-720
006-845-835
006-845-860
Option 3 13.6 Acre
006-845-851
010-750-029
010-750-045
80 Ave
80 Ave
80 Ave
Comfort Knox Heating Ltd
192 St
007-791-887
Option 1 12.5 A
005-951-704
005-951-712
002-136-864
Option 4 11.8 Acre
003-370-879

Regards,

_____

Tyler Armstrong | Property Representative – Acquisitions and Sales

BC Hydro
333 Dunsmuir St, 12th floor
Vancouver, BC V6B 5R3

P 604 623 3778
M 604 230 0187
E tyler.armstrong@bchydro.com

bchydro.com

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From: Chwaklinski, David
Sent: 2024, March 26 4:19 PM
To: Armstrong, Tyler ; Chan, David Y.M. ; Gadhok, Satwant ; Lee, Johnson
Cc: Manurung, Cynthia ; Pradhan, Anil ; Lin, Lynn
Subject: Willoughby Substation - Updated property search area

Based on our discussion this afternoon I have updated the property search area for Willoughby based on a 2.0 km radius around the preferred load center of 80th avenue and 200th street. Previously Distribution wanted the station within a 1.0 km square box centered on the load center. As we have discovered it will be a challenge to obtain approx. 10 acres where distribution wants it, and we probably need to look around 196th street along and north of 80th. It is not ideal for distribution, but we need to find a workable property.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
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E david.chwaklinski@bchydro.com

From: Chwaklinski, David
Sent: 2025, August 05 3:51 PM
To: Sherevkulov, Dmitry; Kelly, Katrina
Cc: Parmar, Surinder; Chaisson, Rob; Wanamaker-Briggs, Andrew; Chan, David Y.M.; Chwaklinski, David
Subject: RE: Willoughby Substation - Walia property

I see no value in conducting any more pre purchase investigations other than to determine if the site is contaminated. Geotechnically the site will be the same as the surrounding sites we have information on. The risks for this property will be the same as identified for the other properties. Regardless of what is found we need this site to make a whole station and we will have to deal with what is found. The Contamination is the only concern which could impact the price we pay.

From: Sherevkulov, Dmitry
Sent: Tuesday, August 5, 2025 2:54 PM
To: Kelly, Katrina
Cc: Parmar, Surinder ; Chaisson, Rob ; Wanamaker-Briggs, Andrew ; Chan, David Y.M. ; Chwaklinski, David
Subject: Willoughby Substation - Walia property

Hi team,

We reengaged the property owner of the highlighted site in yellow below and now they indicated they would like to sell. The address is 7484 194 St Surrey, PID: 008-131-554.

Since we have completed all site investigations for the surrounding properties do we still need to do the same for the property below? I am wondering if we should include a 90-day subject removal period in the purchase agreement?

Katrina/Surinder: the purchase price is expected to be within $3,000,000 – do we have funding for it? I've met the owner last week and they are waiting for the offer. We should be able to sign the agreement around September and close before the end of the year. Please advise on the funding/chargecode.



Dmitry Sherevkulov | Property Representative
Acquisitions and Sales

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P 604 623 3566

M 604-690-9836
E dmitry.sherevkulov@bchydro.com

bchydro.com

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From: Zeng, Ken
Sent: 2024, March 08 4:10 PM
To: Chwaklinski, David
Cc: Jiang, Kally; Fajber, William; Carr, Arthur; Khan, Jahangir
Subject: RE: Willoughby/Campbell heights Substation Layouts
Attachments: CAMP-E05-SK003(2024-03-05_OneLIne)--Tight_R0B-All-GIS-INDOOR.pdf

David/Artur,
Thanks for the HSY reference.
Based on HSY and the space needed for an 8-CB 230kV indoor GIS and its cabling/termination, the ideal layout for a green field all GIS type layout might look like the attached, but could be smaller and the 230kV incoming lines space and orientation might not work for current concept.

In general, compared with the all-open low profile type, the all indoor-GIS type takes less than half of the property size.

We need outdoor GIS dimensions to see how it will look. I do not think there is a big difference.

Regards
Ken

From: Carr, Arthur
Sent: 2024, March 08 10:27 AM
To: Chwaklinski, David
Cc: Jiang, Kally ; Fajber, William ; Zeng, Ken
Subject: RE: Willoughby/Campbell heights Substation Layouts

Dave,

I'm going to say for 69kV, the size of an indoor GIS system is comparable to an outdoor AIS system but this is not true for the higher voltages such as 230kV.

For comparison purposes, I suggest you look at what was built at HSY in 2013 (7 Bay indoor 230kV GIS system). For Campbell Heights, it looks like we would need to have a building large enough for an 8 bay system but only build out 4 bays at this time. It would be a bit more complex in the future to build the GIS out to the full 8 bays compared to an AIS system but still doable.

Arthur.

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, March 08 9:49 AM
To: Carr, Arthur <Arthur.Carr@bchydro.com>; Zeng, Ken <Ken.Zeng@bchydro.com>

Cc: Jiang, Kally <Kally.Jiang@bchydro.com>; Fajber, William <Will.Fajber@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

No, the intent is to stay AIS but given that the availability of suitable properties is very low I am just thinking out loud if you will of how to make it work. For an AIS 230/69/25 station we need about 10 acres. There are almost no properties that large near the load center and the ones that exist have been tagged for residential development which means big dollars even if we could purchase. There are some smaller properties of 4 to 6 acres that may be available but I need to understand how much space is required if we use GIS equipment. The township made it clear that they are not in favour of an AIS station in their residential area so I am considering all options at this time.

From: Carr, Arthur <Arthur.Carr@bchydro.com>
Sent: Friday, March 8, 2024 9:23 AM
To: Zeng, Ken <Ken.Zeng@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Jiang, Kally <Kally.Jiang@bchydro.com>; Fajber, William <Will.Fajber@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

Are we considering 25kV indoor MVGIS for this project?

Going from a fully AIS design to a fully GIS design is extreme on both ends of the spectrum (biggest area and lowest cost versus smallest area and highest cost).

Arthur.

From: Zeng, Ken <Ken.Zeng@bchydro.com>
Sent: 2024, March 08 9:02 AM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Cc: Carr, Arthur <Arthur.Carr@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>; Fajber, William <Will.Fajber@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

Hi David,
Based on the rough sketch I've attached (the first PDF), which reflects the latest one-line diagram (the second PDF), it appears that we'll need a 190m x 175m fenced yard for the substation. I recommend focusing our search on properties that can accommodate this size, rather than looking for a larger property.

If you have a specific property in mind with approximate dimensions and orientation, we can develop a layout that fits into it. This will allow us to determine which portions could utilize GIS (indoor or outdoor). It's important to have a physical idea of both the HV line incoming and LV line outgoing orientation from a system perspective. For instance, could we consider a layout comprising 230kV outdoor, 25kV indoor GIS, and 60kV outdoor GIS.

Equipment might be able to provide some samples from vendors for outdoor GIS, for 230 and 60kV. I did a few projects with 60kV, 25kV indoor GIS, or Hybrid only and I have never done an outdoor GIS.

We are all in the office on Tuesday and Thursday as required by the department.

Regards,

Ken

From: Fajber, William <Will.Fajber@bchydro.com>
Sent: 2024, March 07 5:29 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Zeng, Ken <Ken.Zeng@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Carr, Arthur <Arthur.Carr@bchydro.com>
Subject: RE: Willoughby/Campbell heights Substation Layouts

It is mostly correct, although it is complicated.

We have used outdoor GIS at BC Hydro– one of the early versions was installed at HSY. It had some issues but nothing related to being outside.
We have also installed pieces of outdoor GIS recently, except that we call it hybrid breakers instead of outdoor GIS. We have that at Ingledow and Meridian in the 500 KV yard, and a new 230kv one at Camosun. We also have a small 138 KV GIS installation at Douglas Rd.

I would say that the opinions from the equipment team are mixed. An analogy would be whether you park a car on the street or park a car in the garage. If your card never leaves the garage, you would expect that it will last longer without the exposure from the elements. But it doesn't mean that you should not have a car that drives on the street.

As recently as yesterday, there is discussion about outdoor GIS as a possibility for use at Lougheed substation and Scott Rd. substation. That application is different than the ones above. It is potentially a very small footprint. The importance factor of the switch yard is lower in that a grid level station. And it is small enough that if the GIS needed to be disassembled, scaffolding and shrink wrapping can be applied to provide a clean work environment. Since it is outdoor, a mobile crane can reach everything pretty easily.

CIGRE reports that there are three times more problems with outdoor GIS than indoor GIS. That number came from their published reports on reliability. However, three times a very small number is still a small number.

And we have to consider whether the risk would outweigh the advantages of a small footprint. I am generally supportive of the idea.

I note that a small indoor 60 kV GIS in a building has almost the same footprint as an 60kv air insulated compact structure such as Newell, so it is less compelling. However an outdoor GIS would still have to be some distance from the fenceline, while a building could be at the edge of the property.

I will loop in Arthur in this conversation.

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, March 07 4:20 PM
To: Zeng, Ken <Ken.Zeng@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Fajber, William <Will.Fajber@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: Willoughby/Campbell heights Substation Layouts

Ken and Kally, in a meeting with Township of Langley today they noted that properties suitable for a full outdoor station are few and far between, I am wondering if there is a middle ground between a full outdoor station and an indoor station. Can you also consider what decrease in property sizes would be (if

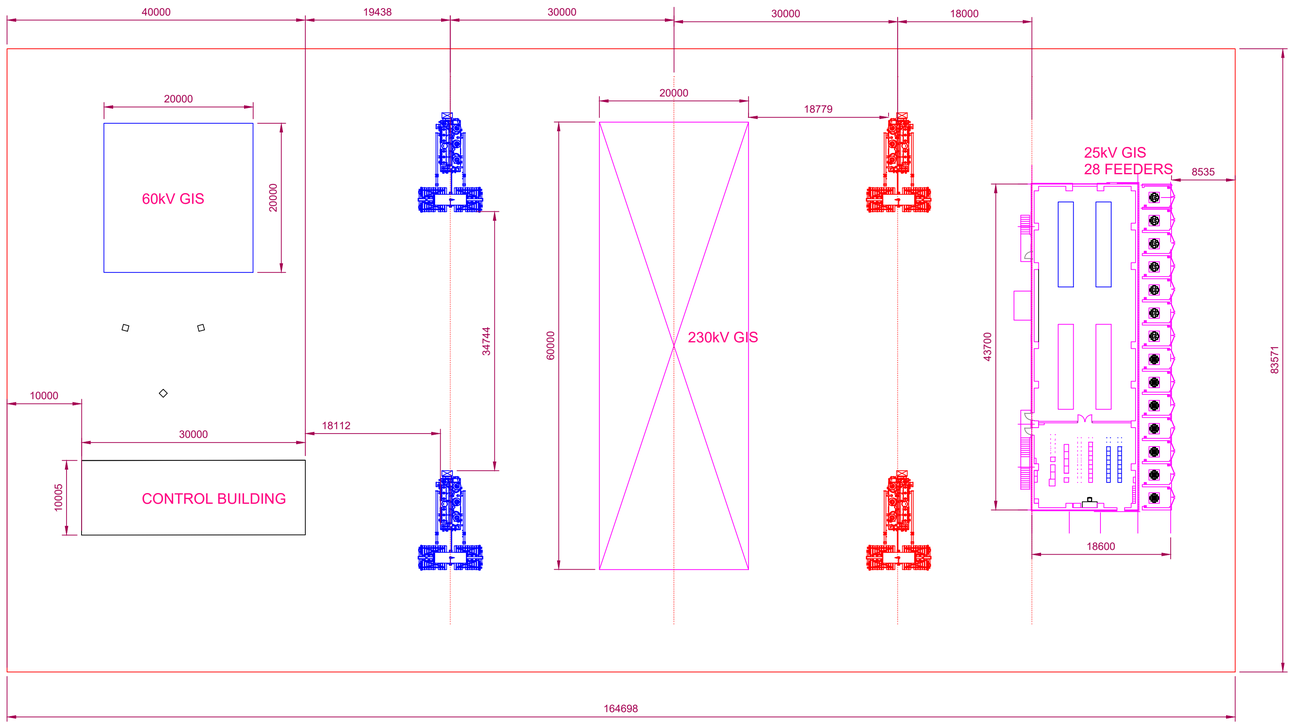
any) if we considered an outdoor GIS station. I will set up a meeting for next week to discuss in more detail. Which days do you come into the office. I think this meeting will be better face to face.

Will my recollection in talking to you some years ago is that we don't use outdoor GIS due to reliability. Im not sure If that is correct but if you could comment on it I would appreciate it.

David Chwaklinski, P. Eng., FEC., PMP | Project Engineer Specialist
Lines and Interconnections

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E david.chwaklinski@bchydro.com



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK/BLUE: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng
DFTG CHK	
INSP	
REV	K. JIANG
ACPT	

BC Hydro

CAMPBELL HEIGHTS SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT ALL GIS-INDOOR

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024MAR07		CAMP-002-E05-SK003B			D	0A

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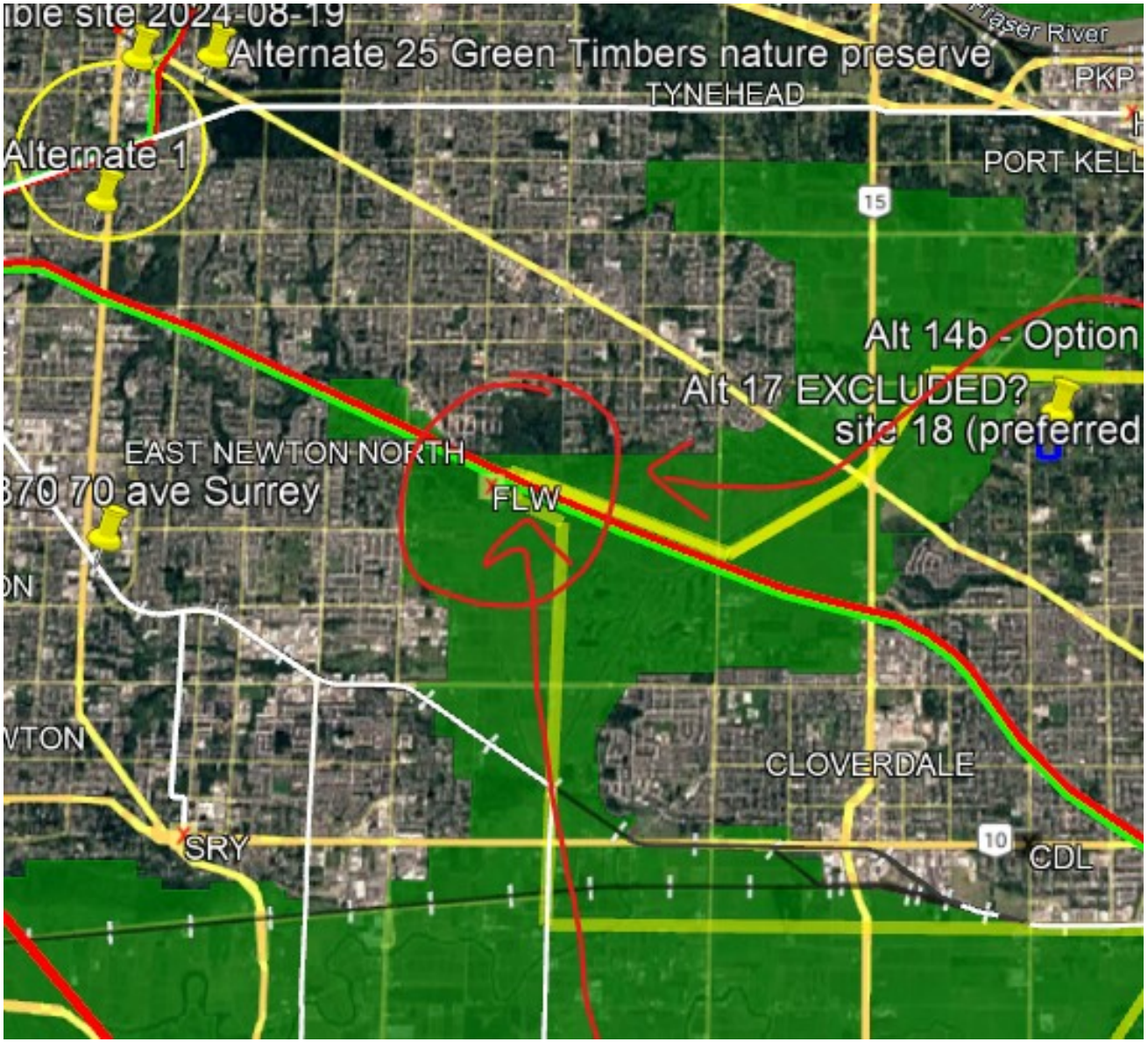
\\bchydro.adroot.bchydro.bc.ca\DATA\Engineering\Transmission\Stations\Projects\TM-0539\Campbell Heights and Willoughby\CAMP-E05-SK003\[2024-03-05_OneLine]~Tight_RGB.dwg
Drawing Unit = Metric (4)
Plotted: 5 Mar 2024 - 4:05 PM

From: Steels, Craig
Sent: 2024, September 24 1:03 PM
To: Chwaklinski, David
Cc: Mathur, Himanshu
Subject: substation addition projects

Hi David,

If I were to guess what would be a reasonably achievable overhead routing for transmission, I would say within the ALR since overhead lines and agriculture are compatible land uses, while dense urbanization is not.

I would put the Campbell heights and Willoughby substations close to the edge of the ALR and route overhead lines through Fleetwood sub where there is already an in-out 230 kV connection of 2L074 and 2L075. I guess we don't have that kind of power of suggestion.



Kind regards,

Craig Steels, P.Eng. | Consultant, Transmission Lines Engineering, BC Hydro

C 825 437 6575 craig.steels@bchydro.com

From: Hepple, Robert
Sent: 2024, September 17 1:46 PM
To: Parmar, Surinder
Cc: Sherevkulov, Dmitry; Chwaklinski, David
Subject: TM0592 - WIB Substation, Alt 20, Bosa-Kang Properties
Attachments: WIB-E05-SK004-Outdoor 230 +GIS 60n25-To Fit Bosa Property-20240719.pdf

Surinder,
Prior to the meeting with Al, I informed you and Neil that the Bosa property was the least desirable of our 3 alternatives from a technical perspective.
My choices were Qualico-Ngo-Dhoot 1st, Alt 14b 2nd and Bosa- Kang 3rd.
I found my email from Kally Jiang and in it she explains why Bosa-Kang is too narrow and would require the 230kV lines to enter the station from both the east and west directions.
It would require underground bus to connect which would be costly and an operational/maintenance challenge.
She was also showing indoor 60kv and 25kV GIS which drives up the cost.
I have asked David and Kally to re-look at the layout to see if adding Kang makes a difference.
Before we approach Kang, I am recommending we pause and have an engineering review of this property, after we have tried new layouts.
I forgot about the new house on the 7528 194th Surrey parcel.
I wonder if Mathew Brock forgot about it? How can he sell both parcels for $20.5M with a $5.5M house on the western parcel?
Let's check it out. Dmitry is there an encumbrance on the property in favor of the homeowner?
I will get back to you after David and Kally have re-looked at the station layout, so we can schedule a presentation from engineering.
Robert

Robert Hepple P.Eng.

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W 604.528.3433
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Web: BCHydro.com

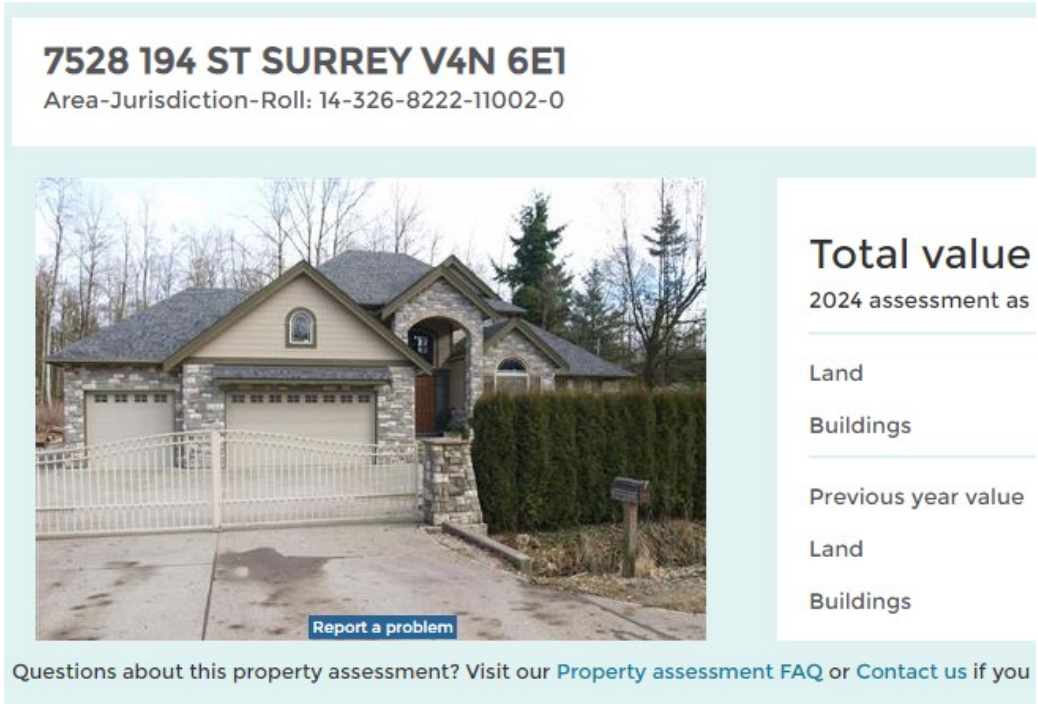
Smart about power in all we do.

From: Jiang, Kally
Sent: 2024, July 19 4:51 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Subject: RE: TM0592 - Willoughby Heights Sub, Alt 20

Good afternoon, All,

The station layout has been barely fitted onto the Bosa's properties of 100m x 391m lot. This Alternative 20 is not preferable from Station Electrical Design perspective with the reasons below.

1. The 100m width is extremely tight for layout.
2. How the 230kV transmission Lines enter the station would be a concern.
3. The connection between 230kV bus ring would be very long and costly.
4. The high voltage power cables run from TX to both 60/25kV GIS buildings would be complicated and costly.
5. Low voltage cables run from switchyard to the control building would be quite long and costly.
6. There is a beautiful house on Bosa's property of 7528 194 ST SURREY as picture below. It was built in year 2003 and relatively new. What a regret and waste if we have to demolish the house to build our station on the lot.



Kally Jiang (She/Her/Hers) | P. Eng.
Senior Engineer, Electrical Design
Stations Division, Transmission Engineering

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bchydro.com

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From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, July 18 9:56 AM
To: Jiang, Kally <Kally.Jiang@bchydro.com>
Cc: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: FW: TM0592 - Willoughby Heights Sub, Alt 20

Hi Kally, a new set of properties has arisen for consideration. Please refer to the e-mail string below. The two properties together are 100 m wide by 391 m long. Can you have a quick look and see whether we could accommodate all the requirements on this parcel> That would dbe the 4 linepositions, the 25 kV section and potentially a 69 kV section? Can you respond back directly to Robert, Dmitry as well as me? I will be on vacation for two weeks so will not be able to respond after mid day tomorrow.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Wednesday, July 17, 2024 2:12 PM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Cc: Chan, David Y.M. <David.Chan@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: TM0592 - Willoughby Heights Sub, Alt 20

Hi Dmitry,
We will need planning and engineering to look at it.
Problem that I see is that there is not two areas of access.
We are landlocked.
But let's brighter minds than mine make that decision.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
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C 925.967.5880
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Sent: 2024, July 17 1:12 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Chan, David Y.M. <David.Chan@bchydro.com>
Subject: TM0592 - Willoughby Heights Sub, Alt 20

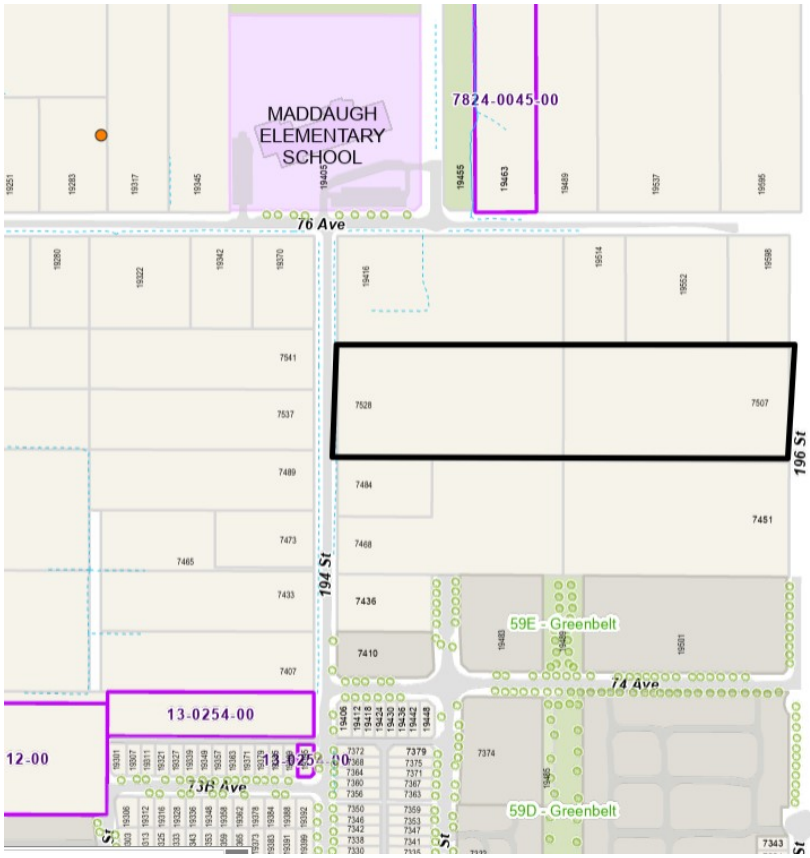
Hi Robert,

I have an update regarding Alternative 20. I spoke to both owners today and looks like both will be willing to sell at the right price. Here are the details of our conversation:

1) 7451 196 ST SURREY – private owner, wants to develop a townhouse. The owner will talk to the rest of the owners to see what price may work for them. I expect it to be $3M+ per acre.

2) 7507 196 ST SURREY – owned by Bosa Properties, they also own a property to the west (7528 194 ST SURREY). I spoke to the Director of Acquisitions and Bosa is currently talking to someone who is seriously interested in buying both properties. The price they are looking to get for both is $2.5-$3M per acre. Bosa is interested in selling both lots, less interested in selling only one. From the design perspective, is it feasible to build a substation on such a long narrow lot (just over 9 acres) fronting 196 St and 194 St? Please refer to the snip below.

If it is feasible then we should probably pursue the 2 Bosa lots instead and act fast.



Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

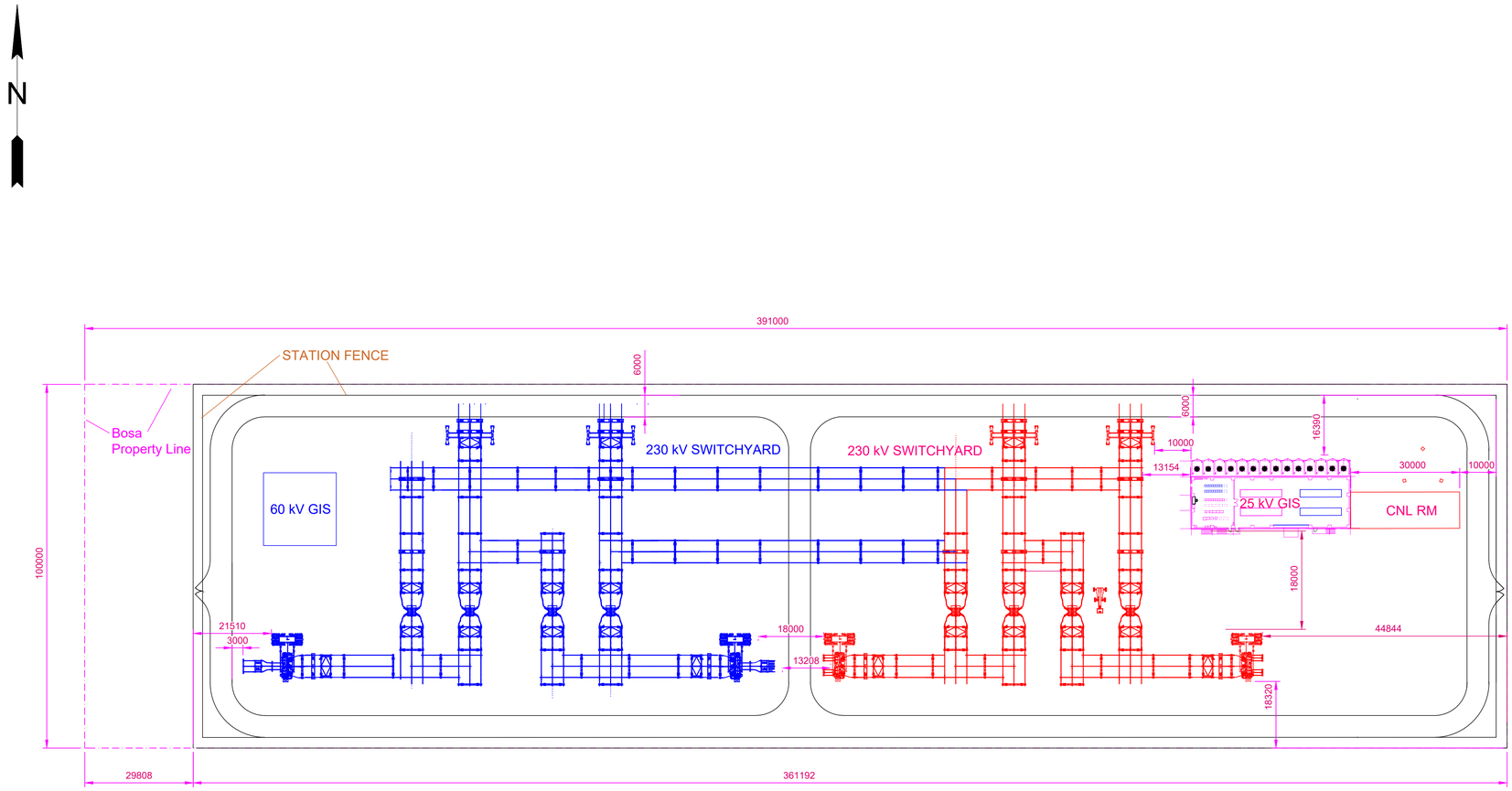
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P 604 623 3566
M 604 690 9836

E dmitry.sherevkulov@bchydro.com

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NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K.JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024JUL19		WIB-E05-SK004			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

C:\Users\kjang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240718-Bosa\WIB-E05-SK004-Option 1-Outdoor 230 +GIS 60n25-To Fit Bosa Property-20240715.dwg
Drawing Unit = Metric (4)
Width: 44.0
2/19/2024 4:15 PM

From: Chwaklinski, David
Sent: 2024, May 30 3:10 PM
To: Liu, Feng; Jiang, Kally; Lee, Dylan; Steels, Craig
Cc: Chwaklinski, David
Subject: TM-0592 Updated property Information
Attachments: Willoughby Final 4 Options.kmz; Willoughby Final 4 Options.jpg

Hi team, I have received the updated property Information for Willoughby. Please see the map and the KMZ files for your use. It looks as if the PM wants to change the naming of the alternates but He hasn't formalized it yet. When it is done I will update you.

From: Hepple, Robert
Sent: Thursday, May 30, 2024 2:14 PM
To: Simpson, Lauren ; Sherevkulov, Dmitry ; Chwaklinski, David ; Chan, David Y.M. ; Parmar, Surinder ; Lee, Johnson
Subject: RE: Alternative Willoughby Locations

Hello Everyone,
I would like to call Option 1 the ALR property and work the naming as we move south.
I have cleaned up the KMZ and .jpg and think I have it right.
Dmitry do you agree?
Robert

From: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Sent: 2024, May 30 1:49 PM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Revise KMZ attached

From: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Sent: 2024, May 30 1:42 PM
To: Simpson, Lauren <Lauren.Simpson@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Hepple, Robert

<Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Sorry, I mean vice versa, they should be on the east side, not west.
The west side has multiple creeks.

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E dmitry.sherevkulov@bchydro.com

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From: Sherevkulov, Dmitry
Sent: 2024, May 30 1:41 PM
To: Simpson, Lauren <Lauren.Simpson@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Option 3 and 4 (Alt 14a and 14b) should be on the west side of 192 St. The east side has multiple creeks and these properties are not suitable.

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From: Simpson, Lauren <Lauren.Simpson@bchydro.com>
Sent: 2024, May 30 1:26 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Hi All,

Please find attached a KMZ with the 4 alternatives under consideration. Please note:

- the new property provided most recently by Dmitry is **Alt 17**.
- The two option on 80 Ave and 192 are **Alt 14a and 14b.**
- The ALR parcel is **Alt 15**

I believe this reflects the most recent discussions but Dmitry please confirm.

Cheers, Lauren

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, May 30 12:38 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Yes, I do. I think your final map includes the wrong parcel

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Thursday, May 30, 2024 12:32 PM
To: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Yes, David
It is the property Dmitry Identified as Option 1 which is immediately south of Option 2.
Do you have his email?
Robert

From: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Sent: 2024, May 30 12:04 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Robert, I am wondering if I have missed something. The map you attached seems to include the property that Dmitry identified as Option two (three parcels) located at 184th and 80th. My recollection is that this property is off the table and we should be considering the Option 1 located at 184th and 76th (two parcels. Can you please clarify? I want to show the properties to the engineering team this afternoon and I want to make sure I am giving them the correct informations.

From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: Tuesday, May 28, 2024 8:05 AM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Dmitry,
Let's replace it with the first property and see what we can do with it.
Robert

From: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Sent: 2024, May 27 2:15 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Hi Robert,

The second property below is off the table now. There is an Option to Purchase on the title and according to the document the option can be exercised until November 2025.

Regarding the ALR property, it also has an Option to Purchase registered on the title. However, it expired in March 2024 and it is unclear whether the Purchaser is proceeding with an acquisition. I will find out when I contact the owner.

_____

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M 604 690 9836
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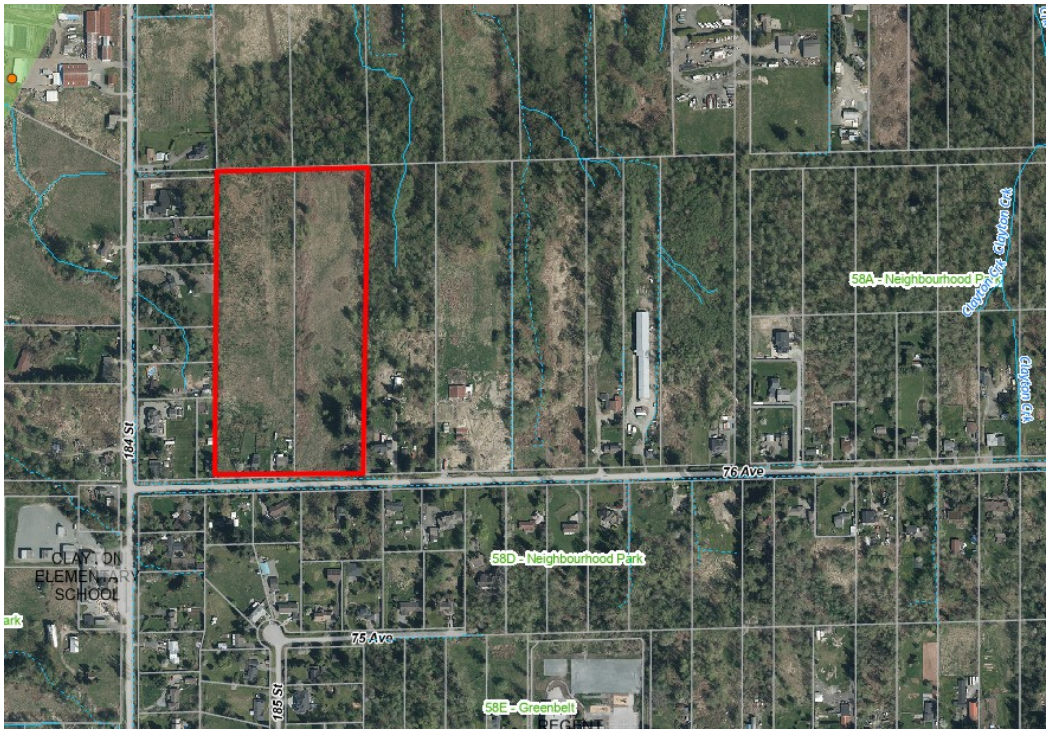
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From: Sherevkulov, Dmitry
Sent: 2024, May 22 3:04 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

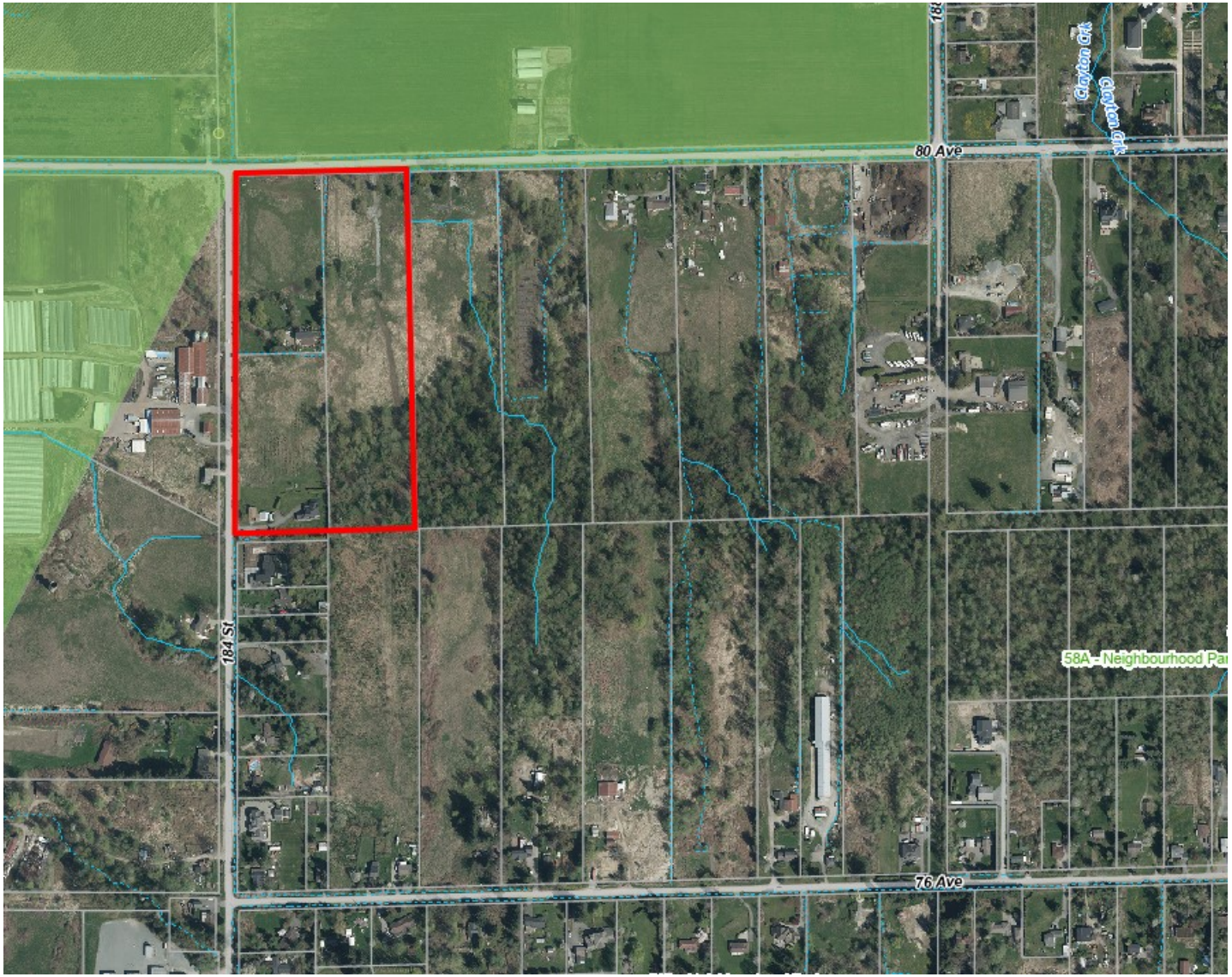
Hi Robert,

There are a couple of options I found in this area. The problem is that most properties north of 80Ave are in ALR. Also, this area has numerous creeks. Tyler previously identified 4 options at 192St & 80Ave, properties on the west side of 192St have multiple creeks so only east of 192St is suitable. However, it would require an assembly of 5-6 lots.

1) Two properties near 184St and 76Ave – 10 acre and 8 acres. PID: 010-996-001, 010-996-028



2) Three properties near 184St and 80Ave, 4.7 acres + 4.9 acres + 9.5 acres. PID: 002-904-977, 011-175-842, 011-175-869



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From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, May 22 2:23 PM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Dmitry,
Attached is a map indicating the area we should focus on.
See if you can find 10 to 12 acres with minimum assembly.
We can include it in our site tour.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
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W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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From: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>
Sent: 2024, May 22 1:02 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: RE: Alternative Willoughby Locations

Hi Robert,

Sounds good, I will search for another alternative in that area.

_____

Dmitry Sherevkulov | Property Representative – Acquisitions and Sales

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From: Hepple, Robert <Robert.Hepple@bchydro.com>
Sent: 2024, May 22 12:22 PM
To: Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Parmar, Surinder <Surinder.Parmar@bchydro.com>; Chwaklinski, David <David.Chwaklinski@bchydro.com>; Simpson, Lauren <Lauren.Simpson@bchydro.com>
Subject: Alternative Willoughby Locations

Dmitry,
Nick from ToL is not supportive on land over by the University on the east side where we had identified the Realtor Joe Varing site.
Let's look on west of 196th along 80th ave to identify 12 acres of non-ALR land.
Lauren please delete the Varing site as an alternative.
Robert

Robert Hepple P.Eng.

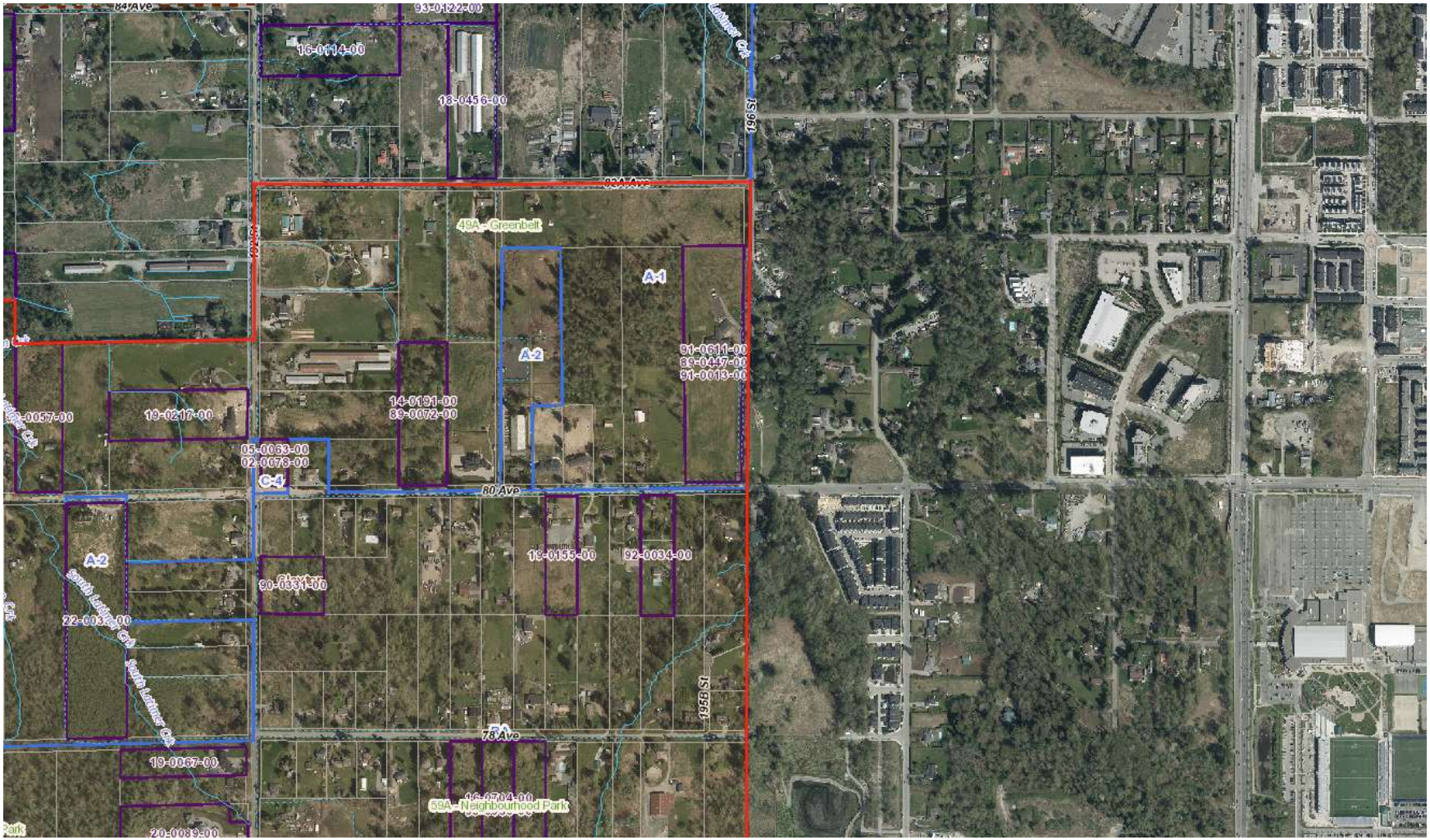
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E Robert.Hepple@BCHydro.com

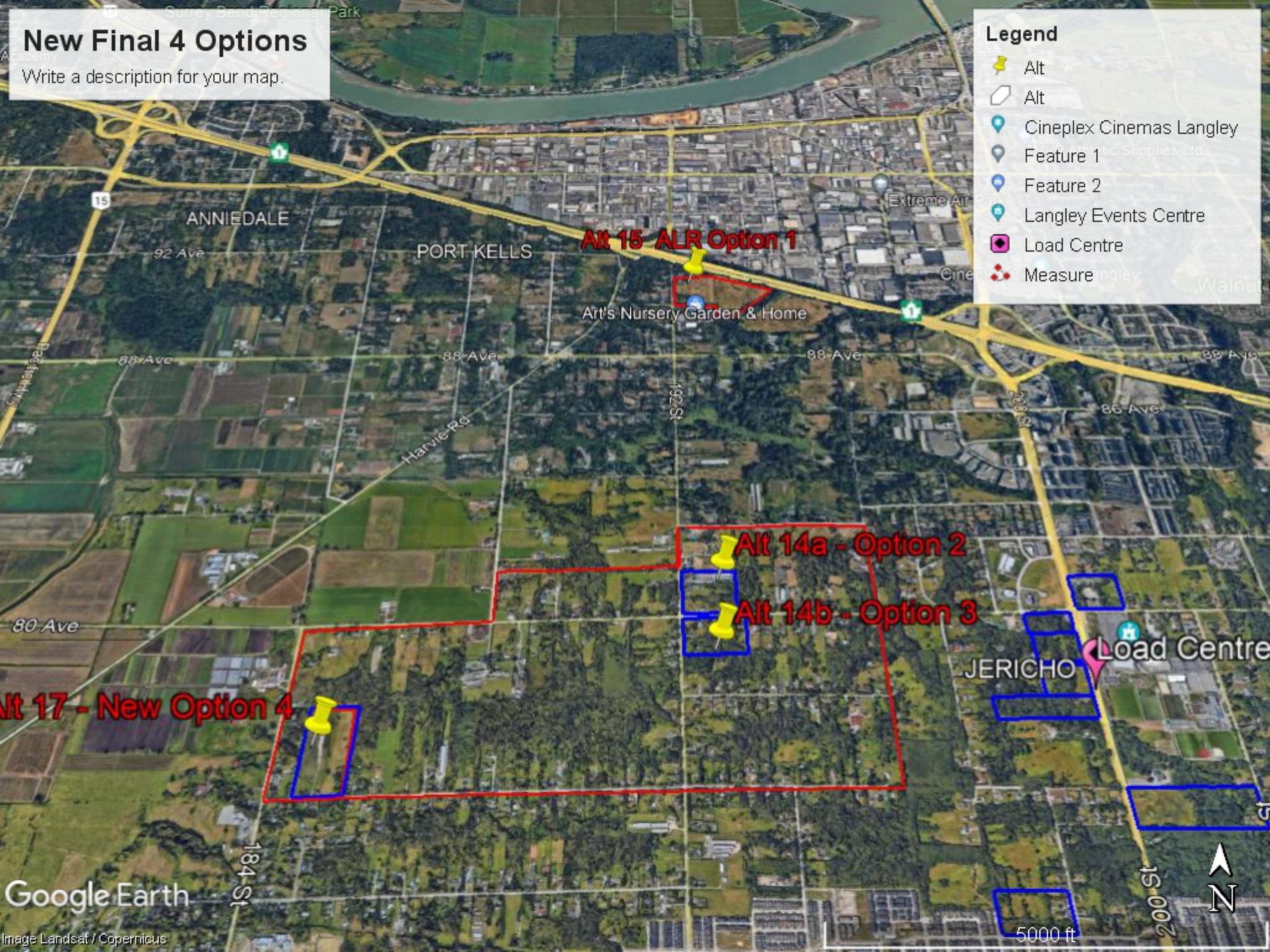
Web: BCHydro.com

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From: Nick Hosseinzadeh <nhosseinzadeh@tol.ca>
Sent: 2024, May 22 12:13 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Subject: [External] As discussed

As discussed, best bet may likely be on the Surrey side of the border.
As you can see, there are many large, undeveloped parcels ranging from 2.5-10 acres in size just down 80th Ave across the Surrey border.
Although they are generally acreages / being farmed today, they are NOT within the ALR. This is future, currently unserviced, future development land.
Additionally, land values in N Clayton were ~$2.5MM/A-$3MM/A a couple years ago. Compared to ~$6MM/A+ in Willougby where neighbourhood services have been installed.


84 Ave
93-0122-00
16-0114-00
18-0456-00
196 St
49A - Greenbelt
A-1
A-2
91-0611-00
89-0447-00
91-0013-00
14-0191-00
89-0072-00
19-0217-00
05-0063-00
02-0078-00
C-4
80 Ave
A-2
19-0155-00
92-0084-00
90-0331-00
South Ladner Crk
22-0033-00
195B St
78 Ave
19-0067-00
59A - Neighbourhood Park
20-0089-00


New Final 4 Options
Write a description for your map.
Legend
Alt
Alt
Cineplex Cinemas Langley
Feature 1
Feature 2
Langley Events Centre
Load Centre
Measure
Alt 15 ALR Option 1
Alt 14a - Option 2
Alt 14b - Option 3
Alt 17 - New Option 4
ANNIEDALE
PORT KELLS
JERICHO
Art's Nursery Garden & Home
Load Centre
92 Ave
88 Ave
80 Ave
86 Ave
192 St
184 St
200 St
Harvie Rd
Google Earth
Image Landsat / Copernicus
5000 ft
N

From: Beauchamp, Colin
Sent: 2025, December 03 2:19 PM
To: Kelly, Katrina
Subject: TM-0637 MLN to WIB 230kV Routing

Katrina - As requested, we have completed our preliminary 230kV routing study for 2 potential 230kV transmission lines connecting the expanded MLN substation to the new WIB substation. We examined potential overhead routes and potential underground routes.

OVERHEAD – We examined approximately 7 potential overhead routes that appeared to have the most direct path to WIB as well as the most space available for overhead circuits. We have saved the overhead route kmz file on the PPM workspace at this link. Although some portions of the routes were excellent for overhead 230kV, every route combination seemed to have at least one and often many restricted areas that did not seem to have enough space for a new overhead 230kV right-of-way (ROW). We produced an Adobe PDF file with our field observations and this file is also saved to the PPM link above. It is our preliminary conclusion that there does not seem to be enough space to existing buildings (homes, garages and business buildings) to fit 2 new 230kV overhead circuits without acquiring and removing some of the structures. The overhead transmission design team may find alternative routes that could work and/or they may find it advantageous to acquire the necessary private property rights to make the required additional space available for an overhead solution.

UNDERGROUND - We examined approximately 10 potential underground routes that appeared to have the most direct path to WIB as well as the most space available for underground circuits. We have saved the underground route kmz file on the PPM workspace at the same link as above. It does appear that feasible options exist to route the new 230kV underground circuits between MLN and WIB. We suggest discussing the findings of the underground examination with you in a Teams meeting to expand on the nuances of each route combination. Below are some high level comments that may be overridden by further detailed analysis completed by the transmission cable team once they begin a more detailed examination.

1. The Eastern 196 street route with potential skytrain bottleneck avoidance options appears to be the option with the most open space in several sections. It does, however, pass through a quite congested zone near the Fraser Highway crossing and Willoughby Mall area. We suggested a couple bypass options for this congested area. Some of these options would require new ROW on some private parcels on parking lots. The 196St option also requires a slight jog onto a private parcel or two to get around the railway overpass. The underground Fortis gas lines did a similar jog around and under the overpass.

2. For the Northern half of the route, the 194St and 194A St corridor looks quite promising and it has significantly less traffic for constructability. This middle corridor also has several open multiuse pathway zones and greenspace zones that seem wide open at the moment and would appear well-suited for an underground utility. Once construction is complete we could repair the pathway and complete minor landscaping to restore these areas to their original recreational use. The paved pathways are vehicle accessible so they would provide good long term access to these sections of our underground circuits for maintenance.

3. The Western 192 St option looks like it may have enough space for one or two underground circuits but it does have several congested areas, and particularly around the crossing of Fraser Highway and 64 Ave where there is considerable Skytrain construction underway. The cable team would need to examine this option closely to determine if there is enough space for our 230kV circuit(s).

Once we select our preferred routing of the transmission lines we might want to re-examine the WIB station design and particularly the 230kV termination points, particularly now that we have acquired the 7484 property. It might be advantageous to adjust the 230kV terminations to line up with the 194A St roadway and the southern greenspace route(s).

Contact me if you have any questions about this preliminary routing we completed.

Colin Beauchamp, RPF | Forester, Construction Services

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Baseline	**Similar**						
Problem:	Preferred (property is feasible - No significant concerns)	Select a property for					
	Possible (potential concerns/issues but property may still be feasible)	**Legend**					
	Exclude (potential significant concerns property unlikely to be feasible)						**See comments below**
Project Objective	**Criteria**	**Units**	Alternative 14b	Alternative 14d	Alternative 15 - ALR	Alternate 18	Alternate 12 - Property 10 &11
Rank				wetland on property and not large enough	Option to purchase		Not desirable - planned residential and 78B Ave is btw properties
Comments			undeveloped, older homes.	for sale signs noted on property. Property is not considered suitable due to water feature which reduces the usable size	an Option to Purchase registered on the title (expired in March 2024). Dmitry talked to owner beginning of June and they expressed interest in selling a portion of the property (12 acres). Waiting for response	qualico owned parcel with adjacent private parcels	
Civic			(SE corner of 192 St and 80 Ave)	(SW corner of 192 St and 80 Ave)	9010 192 ST SURREY	- 19526 78th Ave and 19570 78th Ave, ~8.1 acres gross, owned by Qualico - 19537 76th Ave & 19595 76th Ave – privately owned	19957 78B & 19925, 19974,19942,19910 78B Ave,
PID			005-951-704, 005-951-712, 002-229-561, 005-951-721, 003-370-879, 003-370-887	007-791-887, 002-136-864, 002-136-813, 018-738-745	portion of 003-179-184	011-988-959, 011-988-967 (optional: 002-401-436, 002-401-428, 005-545-048)	007-152-345, 007-152-353, 007-152-361, 007-152-388, 004-875-109, 007-152-370
	Lat / Long						
	Ownership type		Private		Private		Private
	Assessed value				7.2M		71.8 m
	Title review						
Optimize Location	Zoning (Township of Langley map)				ALR		SR-2

	Agricultural Land Reserve	Y/N					N
	Suitable adjacent properties (if undersized)						
	Distribution access restricted by waterway	Y/N					N
	Viable RoW for Transmission	Y/N					
Maximize Constructability	Free sides for access/egress of t/d (>2 Min)	ea	Y		Y		3
	Station size	m^2	55,278		53803		50,234
	Absolute station size (Min Size - 26378 m^2 or 284,480 SF) based on 2 230 kV	>26,378 m2	Y		Y		Y
	Min size 200 m x 210 m or 42,000 m2 - includes provision for up to 4 - 230 kV	>40,950 m2	Y		Y		Y
	Length of short side		228		164		301
	Preferred Minimum Length of short Sides (>115 m)	Y/N	Y 228		Y 164		Y 301 m
	Preferred Minimum Length of short Sides (>170 m)		Y 228		n 164		Y 181 m
	Property Aspect Ratio (Between 1:75:1 and 1:1) Note this is likely only relevant if the property is less than 1.25 times size of minimum size criteria.	Y/N	1.04		1.96		Y 1.65
Site characteristics							
	Max 3% slope	Y/N	5-7%		1%		1%
	Seismic risk (Liquifaction/Amplification)	Risk rating					Low Seismic Site Class F assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam
	Total Area:Usable Area	$M^2/M^2 < 2$					
	Watercourse running through property	Y/N	Y				
Minimize Environmental Impacts							
	Critical Habitat	species					
	Presence of Critical Habitat	% coverage	100 (IMAP BC CH barn owl)	100 (IMAP BC CH barn owl)	30 (IMAP BC CH barn owl)	50 (Barn Owl)	
	Presence of Garry Oak Ecosystem	Y/N	N	N	N	N	

	Mature Forest		50%	15%	15%		
	Presence of Old Growth Forest	% coverage	0%	0%		30	
	Presence of Wetland	% coverage	0%	0%	Stream with riparian buffer bisects property	0	
	Contaminated site?	Y/N	N	N	N	N	N
	Contaminated Site Registry		no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius
	Presence of Registered Burial/pertroglyph site	Y/N	N	N	N	N	N
	Greenfield	Y/N					
	Permitting	Y/N					
	Enviro Comments						
	Google Earth Notes		Based on google earth all the sites have an average crossfall of between 5% to 7% (approximate) with some very steep sections. The elevation change appears to be from 9 to 17 m across the sites depending. While not ideal the properties are large				Private residences
							Transmission path is assumed to be double circuit monopole
	Stakeholder feedback		In surrey, not discussion with city yet. Likely toc		Unlikely to have property removed from ALR. Might require offsetting 2		

						Now selling Multi-family Development (exclude likely)		
Alternate 5 - Property 5	Alternate 6 - Property 6	Alternate 1 -Property 1	Alternate 2 - Property 2	Alternate 3 - Property 3	Alternate 4 - Property 4	Alternate 7 - Property 7	Alternate 8 - Property 8	Alternate 9 - Property 9
City does not support a station along 200th	City does not support a station along 200th	Exclude - current use	Exclude - current use	Exclude - current use	Exclude - current use	Exclude - already in pre-sale	Too small - created new alternative 13	Too small - created new alternative 13
7570,7536 200 St, 7591,7541 202A St. Langley	20069,20053, 20011 80Ave, 8092 200 St. Langley	7888,7950 200th st. Langley	7782 200 St. Langley	7755 202A St. Langley	7633 202A St. Langley	7687 200 St., 7635 198B St., 19979 &6 Ave. Langley	73A Ave, 198B Street Langley	73A Ave 197 Street
012-058-599, 012-058-611, 012-058-581, 010-053-611	006-555-926, 005-436-443, 005-436-460, 009-720-197	023-242-680,031-167-993	031-168-001	029-820-405	029-820-413	028-571-002,031-684-009,031-684-017	031-185-843	031-185-827, 031-185-835
49 08' 24.36"N 122 39' 53.82"W	49 08' 56.65"N 122 39' 59.55"W	49 08' 51.05"N 122 40' 03.36"W	49 08' 33.27"N 122 40' 01.02"W	49 08' 35.43"N 122 39' 47.98"W	49 08' 29.88"N 122 39' 45.84"W	49 08' 30.74"N 122 40' 17.23"W	49 08' 10.10"N 122 40' 22.81"W	49 08' 11.21"N 122 40' 30.12"W
Private	Private	Municipal	Municipal	Municipal	Municipal	Private (Hayer Group)	Private	Private
40M	46M	NA	NA	NA	NA	144M	13.3M	1.1M
PURCHASE Registration Number: CB350763 Registration Date and Time: 2022-11-23 15:06 Registered Owner: BIG SKY	OF WAY Registration Number: CA6428623 Registration Date and Time: 2017-11-07 13:11 Registered Owner: THE CORPORATION	NA	NA	NA	NA	Multiple charges on ti	Nature:OPTION TO PURCHASE Registration Number:CA8422764 Registration Date and Time:2020-09-11 11:32 Registered	NOTICE OF INTEREST, BUILDERS LIEN ACT (S.3(2)), SEE CA1864433 FILED 2011-01-11 THIS TITLE MAY BE AFFECTED BY A PERMIT UNDER PART 14 OF THE LOCAL
SR-2	SR-2	NA	NA	NA	NA	SR-2	SR-2	SR-2

N	N	N	N	N	N	N		
	Y - would need to add 4 properties to north, to east is new townhouse devel.						Y- Prop 9	Y - Prop 8
N	N	N	Possible	N	N	N	N	N
Y - 7.7 km	Y 6.75 km	Y - 70 km	Y - 7.25 km	Y - 7.7 kn	Y - 7.7 km	& - 8.0 km	Y - 8.9 km	Y -8.9 km
33	3	3	3	2	43	3	3	3
80084	34206	20,709	123,539	45716	43414	71737	19950	22010
Y	Y	N	Y	Y	Y	Y	N	N
Y	N	N	Y	Y	Y	Y	N	N
168	Y 116 m	parcels not large enough	Y in wooded area	and field areas insufficient	and field areas insufficient	Y 188 m	Y 122 m	Y 142 m
Y	Y 116 m	N - Individual unused parcels not large enough	Y in wooded area	N - School - parking and field areas insufficient	N - School - parking and field areas insufficient	Y 188 m	Y 122 m	Y 142 m
N 168 m	N 116 m	tbd	N wooded area	N - School - parking and field areas insufficient	N - School - parking and field areas insufficient	Y 188	N 122	N 142
N 2.79	Y 1.62	N/A Individual Parcels not sufficient	Y wooded area	N - School - parking and field areas insufficient	N - School - parking and field areas insufficient	Y 1.89	Y 1.31	Y 1.13
less than 2%	less than 3%	less than 4%	overall 10% but with gullies and steep sections.	TBC	TBC	4.50%	1%	1%
Low Seismic Site Class F assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam	Low Seismic Site Class F assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam	Low Seismic Site Class D assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam	Low Cd- Site Class D assumed Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam with minor	Low Seismic Site Class F assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam	Low Seismic Site Class F assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam	Low Seismic Site Class F assumed Cd (Va.b)- Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to	Low Seismic Site Class F assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam	Low Seismic Site Class F assumed Cd- Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam with minor sand and silt
est 0.9	est 0.8	est .4	est 0.1	est 0.3	est 0.2			
0	0	0	0	0	0	0	0	0
N	N	N	N	N	N	N	N	N

0	0	0	0	0	0	0	20	20
40	0	0	20	0	15	20	0	0
0	0	0	7	0	7	0	0	0
N	N	N	N	N	N	N	N	N
no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius
N	N	N	N	N	N	N	N	N
			Yes		Yes			
			FAA assoc wetland.		FAA assoc wetland.			
undeveloped lands	Undeveloped land/ home/business	Langely Events Centre and parking lot - Likely not worth pursuing. Need to determine which part of parcel is under consideration as property area in summary seems to be much less than measured on map.	Wiloughby Community Park - This is a school/community park and is likely not worth pursuing	Peter Ewart Middle School - This is a school/community park and is likely not worth pursuing	Mountain Secondary School - This is a school/community park and is likely not worth pursuing	Now selling Multi-family Development (exclude likely)	undeveloped lands if combined with parcel 9 may be adequate	undeveloped lands if combined with parcel 8 may be adequate
Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole
City of Langley does not support a station along 200th	City of Langley does not support a station along 200th							

See comments below, properties expanded	**See comments below, properties expanded**	**See comments below**						
Alternate 10 - Property 10	Alternate 11 - Property 11	Alternate 13 - Property 8 & 9	Alternative 14a	Alternative 14c	Alternative 16	Alternative 17a	Alternative 17b	
City does not support a station along 200th	City does not support a station along 200th	City does not support a station along 200th	Owner not interested in selling	brand new home on site. Owner not interested.	Neighbourhood plan has this site identified for townhouses	Owned by qualico who plans to develop lands	Owned by qualico who plans to develop lands	
						Owned by qualico	option to purchase. Owned by qualico	
7913 200th, 19957 78B & 19925 78B Ave, 19976 80 AVE, 19970 80th Ave	19974,19942,19910 78B Ave, 7787 200th St, 7765 200th	73A Ave, 198B & 197 Street Langley	8105 192 ST, 8059 192 ST, 8035 192 ST (NE corner of 192 St and 80 Ave)	(NW corner of 192 St and 80 Ave)	21555 78 AVE, 7865 216 ST, 21489 78 AVE, 7879 216 ST	184 St and 76 Ave		83 Ave and 200 St
006-499-121, 002-379-708, 007-152-345, 007-152-353, 007-152-361	007-152-388, 004-875-109, 007-152-370, 006-475-248, 006-475-264	031-185-827, 031-185-835, 031-185-843	011-946-954, 004-413-385, 010-750-029, 010-750-045, 004-092-767	006-845-878, 006-845-860, 006-845-851	004-417-275, 008-822-158, 008-822-174, 004-406-290	010-996-001, 010-996-028		007-096-496
49 08' 47.45"N 122 40' 10.97"W	49 08' 43.46"N 122 40' 10.69"W							
Private (ESSENCE PRO	Private	Private	Private		Private			
64.8M	46M	14.4 m	13.6M		19.5M			
Legal Notations NOTICE OF INTEREST, BUILDERS LIEN ACT (S.3(2)), SEE CB444040 FILED 2023-01-25	NA							6.7
SR-2	SR-2	SR-2				ALR		

N	N	N						
Y - Prop 11	Y- Prop 10							
N	N							
Y 7.1 km	Y 7.1 km							
3	3		Y			Y		
45,600	63,480	42050	55,278		45,778	77,076		45029
Y	Y	Y	Y		Y	Y		
Y	Y	Y	Y		Y	Y		
138	139	252	228			197		
Y 138	Y 139	Y 252 m	Y 228			Y 197		
N 138	N 139	N 167 m	Y 228			Y 197		
Y 1.29	Y 1.29	Y 1.5	1.04			1.98		
1%	1%	1%	5-7%			5 -10%		
Low Seismic Site Class F assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam	Low Seismic Site Class F assumed Cd-Capilano Sediments, Raised Marine, deltaic, and fluvial depo: marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam							
						Est 0.9		
			Y			N		
		0	100 (IMAP BC CH barn owl)	100 (IMAP BC CH barn owl)		100 (barn owl)		
		N	N	N				

		20	40%	15%		5%		
		0	0	0				
		0	0	0				
N	N	N	N	N		N	N	
no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	no sites listed within 0.5 km radius		no sites listed within 0.5 km radius	no sites listed within 0.5 km radius	
N	N	N	N	N		N	N	
private residences, if combined with 11 could be adequate	private residences, if combined with 10 could be adequate	undeveloped lands	Based on google earth all the sites have an average crossfall of between 5% to 7% (approximate) with some very steep sections. The elevation change appears to be from 9 to 17 m across the sites depending. While not ideal the properties are large					
Transmission path is assumed to be double circuit monopole	Transmission path is assumed to be double circuit monopole							
City of Langley does not support a station along 200th	City of Langley does not support a station along 200th	City of Langley does not support a station along 200th	In surrey, not discussion with city yet. Likely too		Nick from ToL "The Township would strongly recommend against the site proposed. It is square in a neighbourhood plan that is currently going under revisions to increase densities. As outlined in the below chart, it would significantly compromise the neighbourhood plan, and would constitute a significant lost opportunity to provide housing stock. This plan is proceeding for final adoption this summer"			

BC Hydro
Power smart

TM-0592 WIB Property Acquisition Project

Willoughby Substation 414V

Structured Decision Making Support Report

Site Selection Analysis

Prepared for: Robert Hepple, Project Manager STATIONS

Prepared by:

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Revision	Date	Description
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Individual	Department	Contribution
Dylan Lee, P.Eng.	Transmission Lines Engineering	Geotechnical Analysis
Craig Steels, P.Eng.	Transmission Lines Engineering	Transmission Analysis
Kally Jiang, P.Eng.	Transmission Stations Engineering	Electrical Layout Analysis
Amin Kadivar P.Eng.	Transmission Stations Engineering	Civil Analysis

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Appendix B	Willoughby Substation – Civil Memo
Appendix C	TM0592 Willoughby Sub Geotechnical Desktop
Appendix D	TM0592 Willoughby Substation Property Purchase Overhead Transmission Assessment

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Executive Summary

Due to load growth in the Willoughby area of the Township of Langley a new 230/69/25 kV 200 MVa outdoor AIS substation is to be constructed. Currently BC Hydro does not have any suitable properties for the new station. The TM-0592 Property Acquisition project is to search out and find a suitable property to purchase for the substation. This report summarizes the engineering review of the properties evaluated. Due to the dynamic nature of the current property market this report will only be able to consider properties under consideration at the time of writing. It is possible that the site selected will not be covered by this report however the information contained within will help guide the ultimate selection.

At the time of writing, offers to purchase have been made on a set of properties currently owned by Bosa Developments. Project Management is also requesting that additional adjacent properties be purchased to ensure sufficient space is available to fully develop the most efficient station layout while preserving land for future expansion if necessary. It is not known at this time if the sales will be completed and therefore this report does not make any specific recommendation as to the appropriate property for purchase.

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1 Introduction

Due to load growth in the Willoughby area of the Township of Langley, a new substation is required. Currently, BC Hydro has no vacant properties on which to construct a new station. On November 1st, 2023, project TM-0592 was initiated to find and purchase a property to develop a new 230/25 kV 200 MVA ultimate Outdoor Air Insulated Switchgear (AIS) substation with provision for a future 60 kV yard. The station is specified as AIS due to the general rural nature of the area, although this could be changed depending on the properties available for purchase.

This report summarizes the engineering evaluations of the properties considered during the conceptual phase of the project. Initially, twenty-two (22) sites were identified as potential locations for a new station. After initial screening, the list was reduced to four (4) sites. As the project advanced some sites were dropped and others added for consideration. The following sections will discuss the properties and the various findings.

The engineering team evaluated a number of factors for each site including transmission ingress, distribution egress, proximity to load center, size of the property, potential electrical layouts, constructability issues and geotechnical conditions among other factors. This evaluation was by nature a high-level investigation with a prime focus of eliminating unsuitable sites. Due to the dynamic nature of the current property market, this report will only consider properties under consideration at the time of writing. It is possible that the site ultimately selected will not be covered by this report, however the information contained within will guide the ultimate selection.

This report does not include any evaluation of Environmental or First Nations concerns nor any financial considerations as these are covered by other groups.

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2 Background

Langley is one of the fast-growing areas in Lower Mainland. It is situated within Fraser River to the North, 0 Avenue to the South, 196 Street to the West and 272 Street to the East. Three substations serve the Langley area, Port Kells (PKL), Harvey Road (HRD) and McLellan (MLN) substations. PKL and HRD are 60/25kV substations, and they are at their ultimate capacities of 100MVA in Winter and 79MVA in Summer. MLN is a 230/25kV, 200MVA (Winter)/158MVA (Summer) substation and being upgraded to 400MVA (Winter)/315MVA (Summer) with 30 feeder positions in F2030 to meet the area load growth and customers' requirement. By F2033, most of the augmented capacity and feeder positions at MLN will be used up based on Langley placemat and there will be no capacity and feeder positions available in the existing substations to supply the new area loads.

The Township of Langley (TOL) includes the Willoughby neighbourhood which bounds the City of Surrey at 196th street. Areas of service include, Willoughby, Carvolth, Milner, Willowbrook and parts the City of Langley. Development has been rapid around the 200th St. corridor and the load growth along with electrification upgrades are expected to outstrip supply by 2033. Due to electrification and the rapid growth along the 200th St corridor, the additional load increase in Willoughby area will be about 48MVA by F2033 and 130+MVA beyond F2033. To meet that demand a new substation is needed in the Willoughby area by 2032. It is proposed that a property for a new 230/69/25 kV 200 MVA station be purchased as soon as possible to meet this date.

Currently, BC Hydro has no surplus properties to use for a new station. In order to meet the timeline of the new substation, a piece of property suitable for a 230/69/25kV, 200MVA outdoor AIS substation needs to be purchased as soon as possible in a location near the load center as identified by Distribution Planning (See Figure 1)

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and as close as possible to the existing 230kV transmission supply out of McLellan Substation. Two new 230 kV line positions will be installed at McLellan station as part of another project to supply the new Willoughby Substation. Transmission routing is part of the substation project and not part of the property purchase project although potential routing will be considered in the site selection analysis. The report summarizes the high-level review of the various properties evaluated for the purchase for the new substation. Due to the dynamic nature of the current property market this report will only be able to consider properties under consideration at the time of writing. There is a moderate risk that the

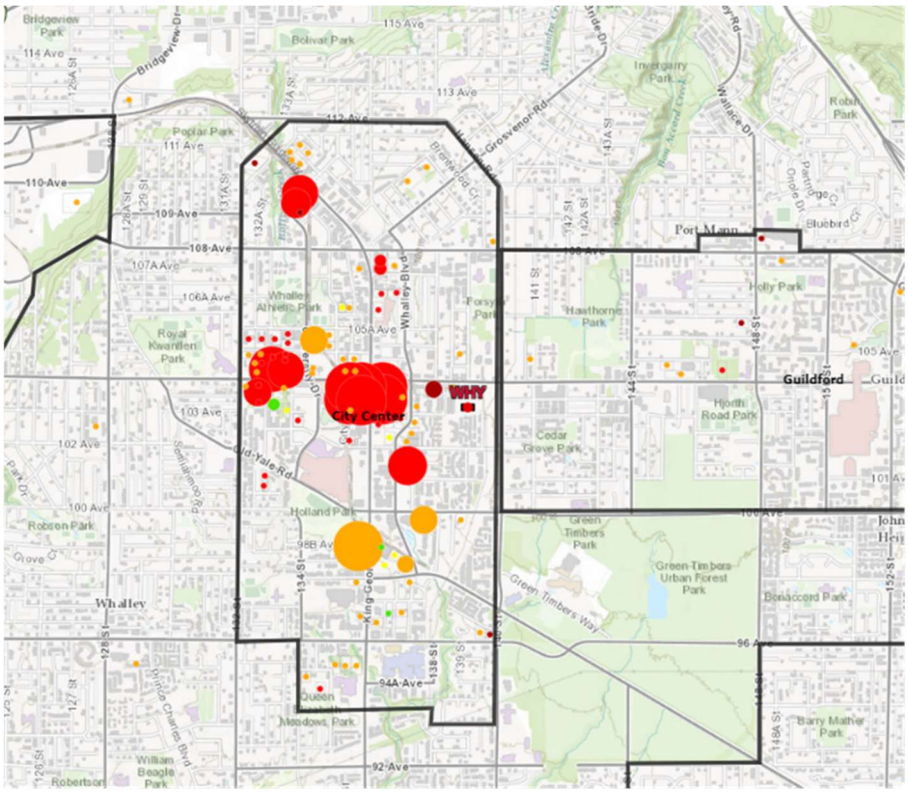


Figure 1 Distribution Load Map

properties evaluated may not be available for purchase and other properties considered will not be covered by this report. As of the writing of this report an offer to buy has been made for a set of properties owned by Bosa developments. Additional properties will be needed to provide a site large enough for the new station. While the sales have not been finalized it is assumed that the purchase will be ultimately successful. Should the purchase not be successful the

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information contained in this report can be used as a baseline for assessing other options.

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3 Properties Reviewed

As noted above the initial choice of sites was reduced to four for further evaluation. Those four are listed below as:

- Alternate 14B is a 12.5 Acre assembly of five residential (5) properties located at the intersection of 80th Avenue and 192nd St in Surrey.



Figure 2 Location of Alt 14B

- Alternate 18 a 8.15 Acre assembly of two properties owned by the Qualico Development group. The parcel is located at the intersection of 78th Avenue and 195B street. An additional separate private parcel of 2.22 acres directly west of Alternate 18 would need to be considered to allow full development of the site.



Figure 3 Location of Alt 18

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- Alternate 19 is a 10.9 Acre assembly of three private properties at the intersection of 76th Avenue and the incomplete extension of 196th street.



Figure 4 Location of Alt 19

These parcels are directly south and abutting the Qualico properties of Alternate 18. A fourth parcel directly west of this assembly might be required to allow full development of the site.

- Alternate 20 is a 9.5 Acre assembly of two parcels owned by the Bosa Development group. Additional privately held parcels directly south of the Bosa parcels would need to be added to fully develop the ultimate station layout. Currently, the two parcels to the south-west of the Bosa assembly are being considered to allow the full development of a substation.



Figure 5 Location of Alt 20

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The next sections will describe the alternatives in more detail and summarize the findings of the engineering team.

3.1 Alternate 14B

3.1.1 Current Use

Currently, Alternate 14B is a collection of residential parcels with single family homes on large lots. Some of the parcels may be used for hobby farms or left fallow.

3.1.2 Electrical Assessment

The electrical design team has a “typical” layout for a 200 MVa Air Insulated Distribution station. This typical layout is 110.0 m x 198.5 m requires approximately 21,505 m^2 or about 5.3 Acres of land. This allows for a control building, 2-230/25 kV transformers, two line positions and up to 24 feeders. Station Planning has requested that the new stations in the lower mainland have a provision for future expansion by adding space for additional line positions and provision for a 60 kV section. As part of the analysis of other sites, the electrical design team has developed a number of layouts with this level of equipment which includes a control room, 4 -230 kV line positions, 2-230/25 kV 150 MVa transformers, 2 – 230/60 kV 150 MVa transformers and 4 - 60 kV line positions.

The layout has a minimum dimension of 181 m x 196 m or 35,476 m^2 or approximately 8.7 Acres. No specific layout was prepared for Alternate 14B as it was considered a lower priority alternate given that the sites were not actively for sale and it would require an assembly of multiple properties when other properties were actively for sale. The overall site is sufficiently large to accommodate the layout required by Planning. For more information refer to the electrical memo in Appendix A.

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3.1.3 Civil Assessment

As this site was not considered a primary site to assess, the level of investigation was limited to preliminary site grading and access considerations. The site is located at the corner of 192nd street and 80th Avenue and access is considered to be good. The site has a general slope of approximately 6% from east to west. An analysis by the Civil team indicates that approximately 40,000 m^3 of cut and 80,000 m^3 of fill would be required to fully level the site for use as a substation. For more information refer to Appendix B

3.1.4 Geotechnical Assessment

This alternative was not directly assessed in the geotechnical review as it was a lower priority as it was not one of the favoured sites. The review however did discuss the geotechnical conditions of the general area and noted that reasonable soil conditions with moderate seismic risk could be expected for alternate 14B. It was noted that if this alternative was to be considered a more thorough review would need to be undertaken with a dedicated field program before it could be recommended as a viable alternative. For more information refer to Appendix C

3.1.5 Transmission Assessment

The alternative was only considered at a high level as the site was not considered to be a leading alternative. O/H routes were plotted along a number of paths using Google Earth however ultimately it was determined that like all other sites under review, the most likely routes were underground from McLellan along 192nd and 196th streets to the local area and from there minor rerouting of the 196th street path along 197th street and 80th avenue would bring the line to the site. For more information refer to Appendix D

3.1.6 Suitability for use as a substation

As other sites were actively for sale this site was considered a lower priority for review it only received a cursory examination from the various disciplines. Based on the level of review, the general site conditions and proximity to the load center this site would possibly be suitable for a substation however more investigation would be required before a final decision could be made.

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3.2 Alternate 18

3.2.1 Current Use

Alternate 18 is a two-parcel assembly owned by Qualico Developments. Currently the site holds residences and farm buildings. It is being held until financial conditions for development improve.

3.2.2 Electrical Assessment

As noted in Section 3.1.2 the preferred size for the required development is 181 m x 196 m or 35,476 m^2 or approximately 8.7 Acres. The site currently is not large enough for the ultimate development but is large enough for a first stage. If the station is expanded in the future, the property to the west would need to be obtained. A second scenario would be if the parcels directly south that comprise Alternate 19 were obtained, the full station could be easily accommodated. However, a decision on this path would need to be made before final design of the initial stage begins so as to make the most efficient use of the properties. Finally, a third scenario would be to develop a GIS station on the two Qualico parcels. This is not preferred due to costs and is noted only to provide all options for consideration in the event additional properties cannot be obtained. For more information refer to the electrical memo in Appendix A.

3.2.3 Civil Assessment

The site is generally flat east to west with an average slope of 4.7% running north to south. Site development to bring the site to an average grade of 3% would require approximately 22,700 m^3 of cut and 45,300 m^3 of fill. Access is less favourable for this site as 196th Street has not been extended and the only access is from the frontage on 78th Avenue. The city of Surrey or the Township of Langley may require completion of 196th as part of the project construction cost. There is a creek to the west on the property not owned by Qualico that could complicate the full development of the site if it is obtained. High water flows in the creek could introduce flooding or erosion of the substation. Environmental setbacks could reduce the available area such that the station is not viable and runoff from the station could potentially contaminate the creek. These conditions would need to be carefully considered before development of the substation. For more information refer to Appendix B

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3.2.4 Geotechnical Assessment

The geotechnical team conducted a desktop review of the area with added attention to some of the sites. Alternative 18 was included in the review. The site is in the Clayton area of Surrey. The surface soils in this area were assessed by reviewing the stratigraphy observed during ground well installation in the area and reviewing the Geologic Survey of Canada Map 148A. The surface soils are comprised of Capilano Sediments with Vashon Drift or Pre-Vashon tills below. These surface deposits consist of marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam with minor sand and silt usually less than 3 m thick but up to 30 m depth in areas. Below this layer can be found Pre-Vashon till deposits. The static ground water table in the area varies between 18 m and 53 m below surface grade and there is potential for parts of the groundwater to be part of a pressurized Aquifer. The seismic site classification is likely to be site class C or D and liquefaction is not expected. As the expected foundations for the substation would likely be shallow footings there does not appear to be any major issue in developing this site for a substation. A more detailed confirmatory exploration program consisting of two or three augered drill holes and seismic cone penetration testing is recommended before a final decision on purchase of the site is completed. For more information refer to Appendix C

3.2.5 Transmission Assessment

For this site, a review of potential Overhead line routes was conducted. O/H routes were plotted along a number of paths using Google Earth and it was determined the only viable route for O/H would be along 196th street. This would be a challenge as much of 196th street serves newer residential areas, and the corridor is not very wide nor is it continuous. The only solution would be a double circuit monopole however Transmission planning is not comfortable with this due to reliability issues with both circuits supplying the station on the same set of structures. Ultimately it was determined that like all other sites the most likely routes were underground from McLellan generally along 192nd and 196th streets to the local area and from there minor rerouting of the 192nd street path along

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78th Avenue to bring the line to the site. For more information refer to Appendix D

3.2.6 Suitability as a substation

Based on the review by each discipline, the general site conditions and proximity to the load center this site would be suitable for a substation provided additional lands can be obtained to develop the ultimate station. However as noted in section 3.2.4 a confirmatory geotechnical investigation is recommended prior to final purchase of the site.

3.3 Alternate 19

3.3.1 Current Use

Alternate 19 is a three parcel assembly of private properties at the corner of 76th Avenue and 196th street in Surrey. This assembly is directly south and abutting Alternate 18. The assembly is currently occupied by private homes. Much of the land has been cleared in the past and some of the land has naturally revegetated with some second growth forest.

3.3.2 Electrical Assessment

As noted in Section 3.1.2 the preferred size for the required development is 181 m x 196 m or 35,476 m^2 or approximately 8.7 Acres. The Alternate 19 assembly at 44,122 m2 (10.9 Acres) is large enough for the ultimate site development based on the layouts prepared by electrical design. If Alternate 19 were reduced to two of the three parcels (assuming the third was not available) it would be necessary to obtain other lands to complete the ultimate station. This could be managed by purchasing Alternate 18 directly to the North. As noted in Section 3.2.3 a decision on purchasing Alternate 18 would need to be confirmed before design of the station to ensure an efficient design. As with Alternate 18, a third scenario would be to develop a GIS station on the two Alternate 19 parcels. This is not preferred due to costs and is noted only to provide all options in the event

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additional properties cannot be obtained. For more information refer to the electrical memo in Appendix A.

3.3.3 Civil Assessment

The site is generally flat with a slope of approximately 2.5% from east to west. No significant cut or fill is required to level the site. Access is less favourable as like Alternate 18, 196th is not complete and access is only available from 76th Avenue which is a single lane road at the parcel frontage. The creek noted in section 3.2.3 is not expected to be a concern as it is further west than at Alternate 18 however it would need to be investigated further if this property is selected for purchase. For more information refer to Appendix B

3.3.4 Geotechnical Assessment

Due to the proximity of Alternate 19 to Alternate 18 the general conditions listed in section 3.2.4 would apply to this site as well. For more information refer to Appendix C

3.3.5 Transmission Assessment

Due to the proximity of Alternate 19 to Alternate 18 the general conditions listed in section 3.2.5 would apply to this site as well except that diversion of the transmission route would be along 76th Avenue rather than 78th Avenue. For more information refer to Appendix D

3.3.6 Suitability as a substation

Based on the review by each discipline, the general site conditions and proximity to the load center this site would be suitable for a substation with some caveats. The potential costs to extend 76th Avenue and 196th street to improve access as well as the potential impact of the creek to the west of the site would need to be studied and as noted on section 3.2.4 a confirmatory geotechnical investigation is recommended prior to final purchase of the site.

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3.4 Alternate 20

3.4.1 Current Use

Alternate 20 is a five-parcel assembly consisting of two lots owned by Bosa properties, and three parcels owned by individuals. The final assembly is not determined as not all the private owners are willing to sell. The Bosa properties are available and an offer to purchase was made by BC Hydro. Two of the other lots are under negotiation with the third owner holding out. Currently all the lots are occupied with at least one home and potentially farm buildings or left naturally vegetated.

3.4.2 Electrical Assessment

As noted in Section 3.1.2 the preferred size for the required development is 181 m x 196 m or 35,476 m^2 or approximately 8.7 Acres. For this site, the initial property configuration only consisted of the two Bosa Properties with total dimensions of 390.3 m x 99.05 m. This complicated the design as the site was very long and narrow. The layout developed (WIB-E05-SK004 R0A) was an inefficient layout which included indoor 25 kV and 60 kV Gas Insulated Switchgear (GIS) sections and outdoor 230 kV bus and transformers. The layout required transmission connections on the North boundary. This would have required ROW across private properties. This is not an optimal solution, and the acquisition of adjacent properties was looked at.

The first adjacent property considered was the private parcel to the south and east of the Bosa lands A number of layouts were considered culminating in WIB-E05-SK006-Op2. This layout located the outdoor 230 kV yard and four transmission terminals on the east side of the assembly and the Air insulated (AIS) 25 kV yard on the western portion of the eastern Bosa property with the future AIS 60 kV yard located on the western Bosa property. This layout requires cables to supply the 60 kV yard and while it makes better use of the property it is still not optimal. What it did prove was that a substation could be constructed if an additional adjacent parcel were purchased along with the Bosa property. Since that layout was completed the focus of additional property has been on adding the parcel on the southwest boundary of the Bosa properties as that owner is willing to sell the land. A revised layout will be prepared for the new assembly however it will not be ready for the completion of this report. The new

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layout will effectively be a mirror image of the WIB-E05-SK002-Op2 and will show the site comprising Bosa, Kool and Walia properties can host a substation however as noted previously it will not be optimal.

It is understood that efforts to purchase the parcel to the east of the Kool site will continue and if it becomes available a more efficient station layout will be able to be prepared. For more information refer to the electrical memo in Appendix A.

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3.4.3 Civil Assessment

The site has a general slope of 4% from east to west. Some cut and fill work will be required to level the site to an average of 3% grade. Volumes are 13000 m^3 of cut and 27000 m^3 of fill. Access is better than the Alternate 18 and 19 as 196th while only a single lane fronting the Bosa Property does extend to full width of the site. 194th extends past the full frontage of the site and there is a spur road called 194a St that reaches the southern boundary of the site. There are no water courses near the site. For more information refer to Appendix B

3.4.4 Geotechnical Assessment

Due to the proximity of Alternate 19 to Alternate 18 the general conditions listed in section 3.2.4 would apply to this site as well. However, as the site is under offer to purchase, BC Hydro will be conducting a due diligence geotechnical investigation prior to completion of the purchase. The results of the investigation will not be known before completion of this report. For more information refer to Appendix C

3.4.5 Transmission Assessment

Due to the proximity of Alternate 20 to Alternate 18 and 19 the general conditions listed in section 3.2.5 would apply to this site as well except, that the diversion

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from 192nd would occur along 76th avenue and194th St. For more information refer to Appendix D

3.4.6 Suitability for use as a Substation

Based on the review by each discipline, the general site conditions, and proximity to the load center, this site would be suitable for a substation with some caveats. While an electrical layout will be prepared for the Bosa/Kool/Walia properties it won't be ready for this report. However, it is expected to be a mirror image of that prepared for the Bosa/Kang property as the assemblies are both the same size. As shown for Bosa/Kang layout, a station could be constructed on the assembly but would not be an efficient design. If the Kang property could be purchased a much more efficient layout could be prepared for the site. However, if it is not available the Bosa/Kool/Walia site would be suitable for a station. As noted, offers to purchase the Bosa and Kool properties have been made and a confirmatory geotechnical investigation is being prepared in the event that purchase agreements are completed.

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4 Conclusions

The project team investigated several potential sites for the new Willoughby substation. The original selection of 22 sites was reduced to four sites for this stage of the project. The sites were Alternate 14B, Alternate 18, Alternate 19, and Alternate 20. Alternate 14B and Alternate 19 would require assembly by BC Hydro and for this reason they are less preferable. Alternate 18 and 20 were leading as both were assemblies held by developers who were willing to sell. While neither site was large enough on its own for the ultimate substation the project team determined it was likely that adjacent properties could be purchased to make up the required lands.

The team reviewed all the properties and determined that there were no major technical issues that would prevent the development of a substation subject to a confirmatory Geotechnical investigation for each site. Before the project team investigations were complete, senior management made a decision to make an offer on the Bosa properties of Alternate 20 based on the reasonable price and its availability. Purchase negotiations continue at the time writing and further offers have been made for adjacent properties. It is expected that Alternate 20 will be selected provided the Geotechnical investigation scheduled for January 2025 does not find a disqualifying condition.

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Appendix A
Electrical Memo - Willoughby Substation (WIB) Property Purchase Project

https://ppm.bchydro.bc.ca/projects/TM-0592/ProjectDocuments/Design/1_IDN/Electrical%20Memo-Willoughby%20Substation%20(WIB)%20Property%20Purchase%20Project%20-%20Signed.pdf

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Appendix B
Willoughby Substation – Civil Memo

https://ppm.bchydro.bc.ca/projects/TM-0592/ProjectDocuments/Design/1_IDN/Willoughby%20Substation%20-%20Civil%20Memo.pdf

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Appendix C
TM0592 Willoughby Sub Geotechnical Desktop

https://ppm.bchydro.bc.ca/projects/TM-0592/ProjectDocuments/Design/1_IDN/TM0592_Willoughby%20Sub_Geotechnical_desktop.pdf

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Appendix D
TM0592 Willoughby Substation Property Purchase Overhead Transmission Assessment

https://ppm.bchydro.bc.ca/projects/TM-0592/ProjectDocuments/Design/1_IDN/TM-0592%20Willoughby%20Substation%20Property%20Purchase%20Overhead%20Transmission%20Assessment.docx

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TM-0592 Willoughby Substation

GIS Discussion

ATTENDEES:	Kally Jiang – Stations Electrical Ken Zeng - Stations Electrical Fariborz Mojebi - Equipment	David Chwaklinski – Project Engineering Arthur Carr – Equipment T/L Will Fajber – Stations Principal Eng
ABSENT:		
LOCATION:	EDM_E06_Room 1	
MEETING DATE:	12 March 2024 10:00 to 11:00	

ITEM #	ITEM DESCRIPTION

1	**General**
	• This meeting is to discuss options to an Outdoor Air Insulated Substati0n for Willoughby and or Campbell Heights
	• The Langley area of Willoughby is being heavily developed and a new 200 MVa substation is required by 2032
	• Planning wants to include a 60 kV section as well as the 200 MVa 25 kV feeder section
	• Initial layouts indicate a land requirement for this type of facility to be approximately 41,000 m^2 or 441,000 Sf (4.1 Ha or 10.1 acres)
	• There are very few properties of this size in the load area. Other factors influencing this are:
	  ○ The preferred area is heavily dedicated to Residential development and very expensive
	  ○ Township of Langley does not want an AI Station in the residential area or fronting on 200th street
	  ○ The city boundary between Surrey and Langley at 196th St. restricts movement to the west
	  ○ The area west of 196th is mostly covered by the Agricultural Land Reserve
	  ○ South of the area is the City of Langley with limited locations to place a station

4	**Options** • Stations electrical has developed a layout for an outdoor station CAMP-002-E05 SK003 which is the basis of our property search • I have asked SE to develop a high level layout based on Indoor GIS for the 230, 60 and 25 kV components, They provided CAMP-002_E05_SK003B. This requires a land area of about 18,000 m2 or 4.4 acres • One question I had is what if any reductions could be made by using Outdoor GIS? • The rational is that outdoor GIS would not require a building to house the equipment potentially reducing costs.
5	**Discussion**

	• David outlines the project and noted, that while the plan is to find a property large enough to construct an outdoor AIS station he was looking for alternatives in case a suitable property was not available • Noted that KZ had provided a rough layout of a station with indoor 230 kV GIS, 69 kV GIS, and 25 kV MVGIS with four outdoor transformers and a control building that was less than half the size required for an outdoor AIS • DC asked in general is there any significant cost difference between outdoor GIS and Indoor GIS • Arthur noted that Horsey 230 kV GIS is indoor and the building is very simple, Steel framing with Steel Cladding and limited ventilation equipment. In his words "the most complex thing about it is the Bridge Crane" • AC noted that the 230 kV GIS can operate normally at 30 deg C • AC noted the 25 kV MVGIS would be the same as any other 25 kV MVGIS • AC noted that 69 kV GIS is the same footprint as outdoor GIS • AC noted that 72.5 KV non GIS breakers are very expensive ($200 k to $400 k in todays dollars) • It appears that there would be minimal cost savings for outdoor vs indoor GIS (Buildings only) • We discussed the location and viewed the Google Earth mapping of the areas we are looking at. • KZ noted that cost of transmission would be a factor. • Noted that if we could move west of the load center T cost would reduce but D costs increase and if we move east past Willoughby area both T and D costs would increase. • If we can find a large parcel to the west, it may still be possible to use O/H transmission. • If the station is close to the load center, it most likely will mean cables to supply T • DC asked who could provide information on the GIS equipment cos • AC assigned Fariborz to be the point person for equipment. • He will work with DC, KJ and KZ on developing equipment costs including transformers • DC will talk to estimating to get information on similar stations with 25 kV MVGIS and 230 Connection to try and develop some numbers for comparison for the Willoughby team • DC noted he would be meeting with planning today to determine if 69 kV is required at Willoughby as there is no industrial load to serve • DC noted that Campbell Heights does require 69 kV and the cost information would be used for both stations • AC noted that costs are likely to escalate seriously by the time the stations are in service. • DC noted that this information is to be used for a comparison based on today dollars and would not be relied on past that. • DC asked Fariborz when he might be able to provide the equipment cost information and he noted he would try for March 22nd. • Will F noted that land taxation costs were becoming an issue with BCH and it may be a consideration to go with GIS for the long term benefit of the company (Lower initial land costs, lower taxation vs higher initial equipment and

	construction costs) • WF also noted that earlier there had been discussions about supplying 69 kV to the Campbell heights area from Nicomekl and Mclellan stations. This would remove he 69 kV requirement entirely • Will discuss in meeting with Planning.

NEXT MEETING	

Recorded by: David Chwaklinski

TM-0592 Willoughby Substation Property Purchase Project

Conceptual Design

	Feng Liu (Civil) Hussien Berisso (PE _substation)	David Chwaklinski (Project Engineering) Dylan Lee (Geotech) Kally Jiang (electrical)
ABSENT:	Craig Steels (T O/H)	
LOCATION:	Teams Meeting	
MEETING DATE:	11-14-2024; 1:30 – 2.00	

Project Details:	Current Stage: Conceptual	Actuals to date:	Approved Budget:
Est Completion:	Conceptual: April 14 ,2025	Project ISD: May 31, 2031	

ITEM #	ITEM DESCRIPTION	LEAD/ACTION
1	**Project Overview**	**LEAD**
	• This project is the property purchase for the future Willoughby Substation . • Project Name: Willoughby Substation property Purchase Project (WSPPP) • Workspace has been set up. Team to upload documents consistently and use naming conventions as specified on Workspace •	ACTION
2	**Meeting Purpose**	**LEAD**
	• This is an update meeting to discuss changes or progress from the last Activities • General Update • Hazard log development • Conceptual Design report - inputs	ACTION

	○ Geotechnical design memo ○ Electrical design Memo ○ Civil design memo ○ Transmission design memo • General Discussion re: team needs • Wrap up •	
3	**Discussion**	**LEAD**
	Discussion • Funding for conceptual design stage was released in early may • Conceptual Completion is early April 14, 2025. • Effective completion for design is Dec 31, 2024, when all documentation needs to be complete • Schedule ○ Hazard log September 27th, 2024. ○ Discipline memos September 15, 2024. ○ Draft Conceptual Design Report Sept 27, 2024. ○ Final Conceptual Design Report Dec 31, 2024. • General • Station Code is confirmed as WIB • There have been some changes in the proposed sites due to information provided by property owners. Alternative 14B • Alternate 14B consists of six (6) privately held properties at the corner of 80th Ave and 192nd St. in the Clayton area of Surrey. The PID's are PID 005-951-704, 003-370-879, 005-951-712, 002-229-561, 005-951-721 and 003-370-887. Civic address is 7954 192nd St., 7914 192nd St., 19234 80th Ave., 19276 80th Ave., 19296 80th Ave. and 19324 80th Ave. The land slopes from east to west at a grade of approximately 8 %. The land is occupied by homes and in some areas is heavily treed with the remainder covered in brush. A 25 kV distribution line runs along 80th avenue. • Currently it looks as if the largest parcel holder may be willing to sell. If a conditional agreement to purchase can be reached with this parcel it may nudge the other parcel owners into a willing to sell position • Discussions are ongoing Alternative 18 Alternate 18 is a privately held assembly of two parcels owned by Qualico developments and a private parcel owned by the Mattu	ACTION

family. The Qualico parcels are PID 011—988-959 and 011-988-967 with Civic address 19570 78th Ave. and 19526 78th Ave. Combined the parcels aggregate to 8.15 acres. This would be large enough for the initial stage but to complete the ultimate more property would be required. An addition of the Mattu parcel to the west would allow the ultimate station to be constructed. The Mattu parcel is PID 005-545-048 at 19510 78th Ave. Distribution lines of unknown voltage run on 78th Ave.

Alternate 19

Alternate 19 consists of a three individually owned parcels directly south of the Qualico parcels. The PIDs are 002-401-428, 002-401-436 and 009-360-158 with Civic addresses 19595 76th Ave., 19537 76th Ave and 19489 76th Ave. respectively. The sites are home sites and have houses and barns and are partially cleared with tress and shrubbery. The sites are generally flat with decent access. Distribution lines of unknown voltage run on 76th Ave.

Alternate 20
Alternate 20 consists of two properties owned by Bosa Properties and three properties to the south of the Bosa Properties. Initially the Bosa properties were not considered as they were too narrow to meet the requirements. Senior management made a decision to make an offer to purchase the Bosa properties due to the small difference between asking price and market valuation.
Subsequent to that offer management has directed the team to attempt to purchase additional properties directly south of Bosa to provide sufficient room for an AIS station

- Currently with the offer to purchase Alt 20 is the preferred alternative with alt 18 and 19 as backups.
- Moving forward most of our effort will be focused on developing the due diligence required to complete the purchase of Alt 20.

Overhead

- New – nothing has changed from the previous meeting with the new parcel as all the sites are within the same general area.
- It has been confirmed that supply will be from McLellan and Ken Zeng has prepared a layout to account for additional line positions. Hussien Berriso is the assigned PE for the Substation project. He is working woth Ken, Transmission planning and Distribution planning to determined the best way to egress T lines out of the station without impacting distribution.
- Craig noted that it may be difficult to supply with O/H due to the development along the major streets.

Geotechnical

- New – nothing has changed from the previous meeting as all the

	sites are in the same general area. • Dylan Lee Is meeting with Klohn to discuss potential Geotech investigation scope for WIlloughby. He has asked to discuss this with Boas and would like a contact person. David to check with PM • . Electrical • New – nothing has changed from the previous meeting as all the sites are in the same general area. • Kally has prepared multiple layouts for the consolidated parcels and we have an acceptable layout. Kally has prepared a draft memo outlining her work on the layouts prepared to date.. • These layouts include Alternatives that include AIS and GIS 60 kV and 25 kV sections. This was done to proved out the concept for each site and not necessarily to be considered as viable alternatives. For Alternate 20 aggregate parcel any configuration could be constructed. Civil • Feng has prepared his memo outlining access and development issues for the alternatives. David has asked that he update the mapping to include the complete Alt 20 Parcels. • . .	
4	**Outstanding items**	
	•	

NEXT MEETING	Date;11-28-2024 Time; 2:30-3:00 Location, MS teams Meeting

Recorded by: David Chwaklinski
(Printed Name)

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TM-0592 WIB Property Acquisition Project

Willoughby Substation 414V

Structured Decision Making Support Report

Site Selection Analysis

Prepared for: Robert Hepple, Project Manager STATIONS

Prepared by:

David Chwaklinski, P. Eng.
Project Engineer Specialist, Estimating and Project Engineering

Reviewed by:

Hussien Berisso, P.Eng.
Project Engineer Specialist, Estimating and Project Engineering

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Report Metadata

Header:	TM-0592 WIB Property Acquisition Project
Subheader:	Willoughby Substation 414V
Title:	Structured Decision Making Support Report
Subtitle:	Site Selection Analysis
Report Number:	414V-TER-00001
Revision:	0
Confidentiality:	BC Hydro Internal
Date:	2025 Apr 01
Volume:	1 of 1
Prepared for:	Robert Hepple, Project Manager STATIONS
Prepared by:	David Chwaklinski, P. Eng.
Title:	Project Engineer Specialist, Estimating and Project Engineering
Checked by:	Hussien Berisso, P.Eng.
Title:	Project Engineer Specialist, Estimating and Project Engineering
Reviewed by:	Hussien Berisso, P.Eng.
Title:	Project Engineer Specialist, Estimating and Project Engineering
Related Facilities:	
Additional Metadata:	

Revisions

Revision	Date	Description
0	2025 Jan	Initial release
1	2025 Apr	Revised Overhead Memo included

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The authors would like to acknowledge the following for their contribution to the engineering and content of this report.

Individual	Department	Contribution
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Amin Kadivar P.Eng.	Transmission Stations Engineering	Civil Analysis

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Executive Summary

Due to load growth in the Willoughby area of the Township of Langley a new 230/69/25 kV 200 MVa outdoor AIS substation is to be constructed. Currently BC Hydro does not have any suitable properties for the new station. The TM-0592 Property Acquisition project is to search out and find a suitable property to purchase for the substation. This report summarizes the engineering review of the properties evaluated. Due to the dynamic nature of the current property market this report will only be able to consider properties under consideration at the time of writing. It is possible that the site selected will not be covered by this report however the information contained within will help guide the ultimate selection.

At the time of writing, offers to purchase have been made on a set of properties currently owned by Bosa Developments. Project Management is also requesting that additional adjacent properties be purchased to ensure sufficient space is available to fully develop the most efficient station layout while preserving land for future expansion if necessary. It is not known at this time if the sales will be completed and therefore this report does not make any specific recommendation as to the appropriate property for purchase.

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1 Introduction

Due to load growth in the Willoughby area of the Township of Langley, a new substation is required. Currently, BC Hydro has no vacant properties on which to construct a new station. On November 1st, 2023, project TM-0592 was initiated to find and purchase a property to develop a new 230/25 kV 200 MVA ultimate Outdoor Air Insulated Switchgear (AIS) substation with provision for a future 60 kV yard. The station is specified as AIS due to the general rural nature of the area, although this could be changed depending on the properties available for purchase.

This report summarizes the engineering evaluations of the properties considered during the conceptual phase of the project. Initially, twenty-two (22) sites were identified as potential locations for a new station. After initial screening, the list was reduced to four (4) sites. As the project advanced some sites were dropped and others added for consideration. The following sections will discuss the properties and the various findings.

The engineering team evaluated a number of factors for each site including transmission ingress, distribution egress, proximity to load center, size of the property, potential electrical layouts, constructability issues and geotechnical conditions among other factors. This evaluation was by nature a high-level investigation with a prime focus of eliminating unsuitable sites. Due to the dynamic nature of the current property market, this report will only consider properties under consideration at the time of writing. It is possible that the site ultimately selected will not be covered by this report, however the information contained within will guide the ultimate selection.

This report does not include any evaluation of Environmental or First Nations concerns nor any financial considerations as these are covered by other groups.

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2 Background

Langley is one of the fast-growing areas in Lower Mainland. It is situated within Fraser River to the North, 0 Avenue to the South, 196 Street to the West and 272 Street to the East. Three substations serve the Langley area, Port Kells (PKL), Harvey Road (HRD) and McLellan (MLN) substations. PKL and HRD are 60/25kV substations, and they are at their ultimate capacities of 100MVA in Winter and 79MVA in Summer. MLN is a 230/25kV, 200MVA (Winter)/158MVA (Summer) substation and being upgraded to 400MVA (Winter)/315MVA (Summer) with 30 feeder positions in F2030 to meet the area load growth and customers' requirement. By F2033, most of the augmented capacity and feeder positions at MLN will be used up based on Langley placemat and there will be no capacity and feeder positions available in the existing substations to supply the new area loads.

The Township of Langley (TOL) includes the Willoughby neighbourhood which bounds the City of Surrey at 196th street. Areas of service include, Willoughby, Carvolth, Milner, Willowbrook and parts the City of Langley. Development has been rapid around the 200th St. corridor and the load growth along with electrification upgrades are expected to outstrip supply by 2033. Due to electrification and the rapid growth along the 200th St corridor, the additional load increase in Willoughby area will be about 48MVA by F2033 and 130+MVA beyond F2033. To meet that demand a new substation is needed in the Willoughby area by 2032. It is proposed that a property for a new 230/69/25 kV 200 MVA station be purchased as soon as possible to meet this date.

Currently, BC Hydro has no surplus properties to use for a new station. In order to meet the timeline of the new substation, a piece of property suitable for a 230/69/25kV, 200MVA outdoor AIS substation needs to be purchased as soon as possible in a location near the load center as identified by Distribution Planning (See Figure 1)

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and as close as possible to the existing 230kV transmission supply out of McLellan Substation. Two new 230 kV line positions will be installed at McLellan station as part of another project to supply the new Willoughby Substation. Transmission routing is part of the substation project and not part of the property purchase project although potential routing will be considered in the site selection analysis. The report summarizes the high-level review of the various properties evaluated for the purchase for the new substation. Due to the dynamic nature of the current property market this report will only be able to consider properties under consideration at the time of writing. There is a moderate risk that the

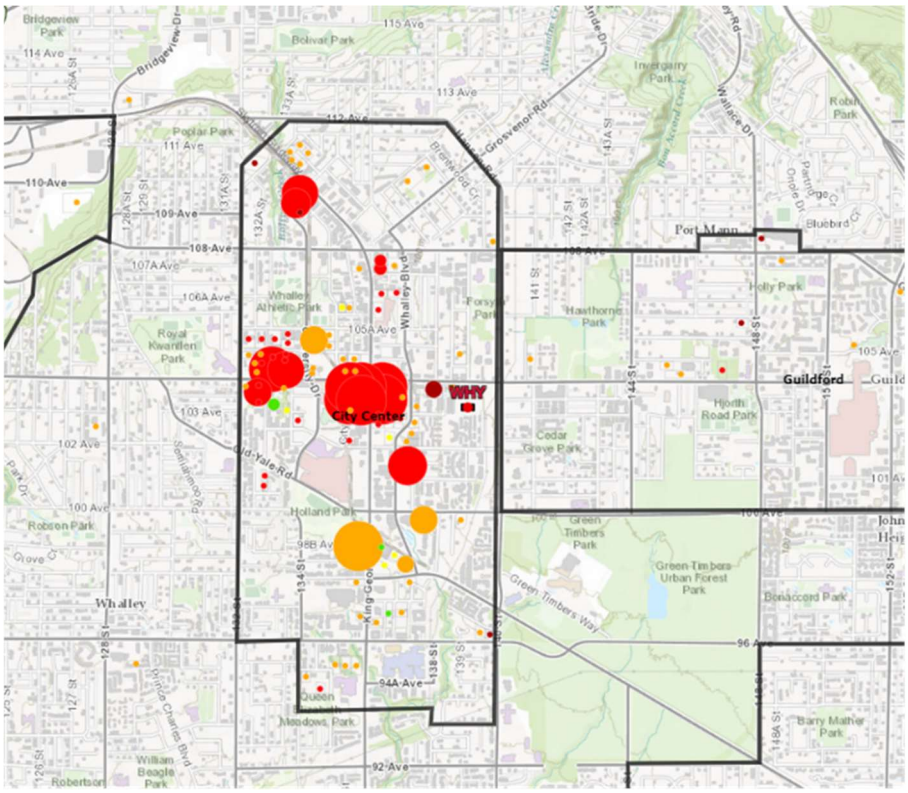


Figure 1 Distribution Load Map

properties evaluated may not be available for purchase and other properties considered will not be covered by this report. As of the writing of this report an offer to buy has been made for a set of properties owned by Bosa developments. Additional properties will be needed to provide a site large enough for the new station. While the sales have not been finalized it is assumed that the purchase will be ultimately successful. Should the purchase not be successful the

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information contained in this report can be used as a baseline for assessing other options.

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3 Properties Reviewed

As noted above the initial choice of sites was reduced to four for further evaluation. Those four are listed below as:

- Alternate 14B is a 12.5 Acre assembly of five residential (5) properties located at the intersection of 80th Avenue and 192nd St in Surrey.



Figure 2 Location of Alt 14B

- Alternate 18 a 8.15 Acre assembly of two properties owned by the Qualico Development group. The parcel is located at the intersection of 78th Avenue and 195B street. An additional separate private parcel of 2.22 acres directly west of Alternate 18 would need to be considered to allow full development of the site.



Figure 3 Location of Alt 18

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- Alternate 19 is a 10.9 Acre assembly of three private properties at the intersection of 76th Avenue and the incomplete extension of 196th street.



Figure 4 Location of Alt 19

These parcels are directly south and abutting the Qualico properties of Alternate 18. A fourth parcel directly west of this assembly might be required to allow full development of the site.

- Alternate 20 is a 9.5 Acre assembly of two parcels owned by the Bosa Development group. Additional privately held parcels directly south of the Bosa parcels would need to be added to fully develop the ultimate station layout. Currently, the two parcels to the south-west of the Bosa assembly are being considered to allow the full development of a substation.



Figure 5 Location of Alt 20

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The next sections will describe the alternatives in more detail and summarize the findings of the engineering team.

3.1 Alternate 14B

3.1.1 Current Use

Currently, Alternate 14B is a collection of residential parcels with single family homes on large lots. Some of the parcels may be used for hobby farms or left fallow.

3.1.2 Electrical Assessment

The electrical design team has a “typical” layout for a 200 MVa Air Insulated Distribution station. This typical layout is 110.0 m x 198.5 m requires approximately 21,505 m^2 or about 5.3 Acres of land. This allows for a control building, 2-230/25 kV transformers, two line positions and up to 24 feeders. Station Planning has requested that the new stations in the lower mainland have a provision for future expansion by adding space for additional line positions and provision for a 60 kV section. As part of the analysis of other sites, the electrical design team has developed a number of layouts with this level of equipment which includes a control room, 4 -230 kV line positions, 2-230/25 kV 150 MVa transformers, 2 – 230/60 kV 150 MVa transformers and 4 - 60 kV line positions.

The layout has a minimum dimension of 181 m x 196 m or 35,476 m^2 or approximately 8.7 Acres. No specific layout was prepared for Alternate 14B as it was considered a lower priority alternate given that the sites were not actively for sale and it would require an assembly of multiple properties when other properties were actively for sale. The overall site is sufficiently large to accommodate the layout required by Planning. For more information refer to the electrical memo in Appendix A.

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3.1.3 Civil Assessment

As this site was not considered a primary site to assess, the level of investigation was limited to preliminary site grading and access considerations. The site is located at the corner of 192nd street and 80th Avenue and access is considered to be good. The site has a general slope of approximately 6% from east to west. An analysis by the Civil team indicates that approximately 40,000 m^3 of cut and 80,000 m^3 of fill would be required to fully level the site for use as a substation. For more information refer to Appendix B

3.1.4 Geotechnical Assessment

This alternative was not directly assessed in the geotechnical review as it was a lower priority as it was not one of the favoured sites. The review however did discuss the geotechnical conditions of the general area and noted that reasonable soil conditions with moderate seismic risk could be expected for alternate 14B. It was noted that if this alternative was to be considered a more thorough review would need to be undertaken with a dedicated field program before it could be recommended as a viable alternative. For more information refer to Appendix C

3.1.5 Transmission Assessment

The alternative was only considered at a high level as the site was not considered to be a leading alternative. O/H routes were plotted along a number of paths using Google Earth however ultimately it was determined that like all other sites under review, the most likely routes were underground from McLellan along 192nd and 196th streets to the local area and from there minor rerouting of the 196th street path along 197th street and 80th avenue would bring the line to the site. For more information refer to Appendix D

3.1.6 Suitability for use as a substation

As other sites were actively for sale this site was considered a lower priority for review it only received a cursory examination from the various disciplines. Based on the level of review, the general site conditions and proximity to the load center this site would possibly be suitable for a substation however more investigation would be required before a final decision could be made.

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3.2 Alternate 18

3.2.1 Current Use

Alternate 18 is a two-parcel assembly owned by Qualico Developments. Currently the site holds residences and farm buildings. It is being held until financial conditions for development improve.

3.2.2 Electrical Assessment

As noted in Section 3.1.2 the preferred size for the required development is 181 m x 196 m or 35,476 m^2 or approximately 8.7 Acres. The site currently is not large enough for the ultimate development but is large enough for a first stage. If the station is expanded in the future, the property to the west would need to be obtained. A second scenario would be if the parcels directly south that comprise Alternate 19 were obtained, the full station could be easily accommodated. However, a decision on this path would need to be made before final design of the initial stage begins so as to make the most efficient use of the properties. Finally, a third scenario would be to develop a GIS station on the two Qualico parcels. This is not preferred due to costs and is noted only to provide all options for consideration in the event additional properties cannot be obtained. For more information refer to the electrical memo in Appendix A.

3.2.3 Civil Assessment

The site is generally flat east to west with an average slope of 4.7% running north to south. Site development to bring the site to an average grade of 3% would require approximately 22,700 m^3 of cut and 45,300 m^3 of fill. Access is less favourable for this site as 196th Street has not been extended and the only access is from the frontage on 78th Avenue. The city of Surrey or the Township of Langley may require completion of 196th as part of the project construction cost. There is a creek to the west on the property not owned by Qualico that could complicate the full development of the site if it is obtained. High water flows in the creek could introduce flooding or erosion of the substation. Environmental setbacks could reduce the available area such that the station is not viable and runoff from the station could potentially contaminate the creek. These conditions would need to be carefully considered before development of the substation. For more information refer to Appendix B

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3.2.4 Geotechnical Assessment

The geotechnical team conducted a desktop review of the area with added attention to some of the sites. Alternative 18 was included in the review. The site is in the Clayton area of Surrey. The surface soils in this area were assessed by reviewing the stratigraphy observed during ground well installation in the area and reviewing the Geologic Survey of Canada Map 148A. The surface soils are comprised of Capilano Sediments with Vashon Drift or Pre-Vashon tills below. These surface deposits consist of marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam with minor sand and silt usually less than 3 m thick but up to 30 m depth in areas. Below this layer can be found Pre-Vashon till deposits. The static ground water table in the area varies between 18 m and 53 m below surface grade and there is potential for parts of the groundwater to be part of a pressurized Aquifer. The seismic site classification is likely to be site class C or D and liquefaction is not expected. As the expected foundations for the substation would likely be shallow footings there does not appear to be any major issue in developing this site for a substation. A more detailed confirmatory exploration program consisting of two or three augered drill holes and seismic cone penetration testing is recommended before a final decision on purchase of the site is completed. For more information refer to Appendix C

3.2.5 Transmission Assessment

For this site, a review of potential Overhead line routes was conducted. O/H routes were plotted along a number of paths using Google Earth and it was determined the only viable route for O/H would be along 196th street. This would be a challenge as much of 196th street serves newer residential areas, and the corridor is not very wide nor is it continuous. The only solution would be a double circuit monopole however Transmission planning is not comfortable with this due to reliability issues with both circuits supplying the station on the same set of structures. Ultimately it was determined that like all other sites the most likely routes were underground from McLellan generally along 192nd and 196th streets to the local area and from there minor rerouting of the 192nd street path along

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78th Avenue to bring the line to the site. For more information refer to Appendix D

3.2.6 Suitability as a substation

Based on the review by each discipline, the general site conditions and proximity to the load center this site would be suitable for a substation provided additional lands can be obtained to develop the ultimate station. However as noted in section 3.2.4 a confirmatory geotechnical investigation is recommended prior to final purchase of the site.

3.3 Alternate 19

3.3.1 Current Use

Alternate 19 is a three parcel assembly of private properties at the corner of 76th Avenue and 196th street in Surrey. This assembly is directly south and abutting Alternate 18. The assembly is currently occupied by private homes. Much of the land has been cleared in the past and some of the land has naturally revegetated with some second growth forest.

3.3.2 Electrical Assessment

As noted in Section 3.1.2 the preferred size for the required development is 181 m x 196 m or 35,476 m^2 or approximately 8.7 Acres. The Alternate 19 assembly at 44,122 m2 (10.9 Acres) is large enough for the ultimate site development based on the layouts prepared by electrical design. If Alternate 19 were reduced to two of the three parcels (assuming the third was not available) it would be necessary to obtain other lands to complete the ultimate station. This could be managed by purchasing Alternate 18 directly to the North. As noted in Section 3.2.3 a decision on purchasing Alternate 18 would need to be confirmed before design of the station to ensure an efficient design. As with Alternate 18, a third scenario would be to develop a GIS station on the two Alternate 19 parcels. This is not preferred due to costs and is noted only to provide all options in the event

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additional properties cannot be obtained. For more information refer to the electrical memo in Appendix A.

3.3.3 Civil Assessment

The site is generally flat with a slope of approximately 2.5% from east to west. No significant cut or fill is required to level the site. Access is less favourable as like Alternate 18, 196th is not complete and access is only available from 76th Avenue which is a single lane road at the parcel frontage. The creek noted in section 3.2.3 is not expected to be a concern as it is further west than at Alternate 18 however it would need to be investigated further if this property is selected for purchase. For more information refer to Appendix B

3.3.4 Geotechnical Assessment

Due to the proximity of Alternate 19 to Alternate 18 the general conditions listed in section 3.2.4 would apply to this site as well. For more information refer to Appendix C

3.3.5 Transmission Assessment

Due to the proximity of Alternate 19 to Alternate 18 the general conditions listed in section 3.2.5 would apply to this site as well except that diversion of the transmission route would be along 76th Avenue rather than 78th Avenue. For more information refer to Appendix D

3.3.6 Suitability as a substation

Based on the review by each discipline, the general site conditions and proximity to the load center this site would be suitable for a substation with some caveats. The potential costs to extend 76th Avenue and 196th street to improve access as well as the potential impact of the creek to the west of the site would need to be studied and as noted on section 3.2.4 a confirmatory geotechnical investigation is recommended prior to final purchase of the site.

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3.4 Alternate 20

3.4.1 Current Use

Alternate 20 is a five-parcel assembly consisting of two lots owned by Bosa properties, and three parcels owned by individuals. The final assembly is not determined as not all the private owners are willing to sell. The Bosa properties are available and an offer to purchase was made by BC Hydro. Two of the other lots are under negotiation with the third owner holding out. Currently all the lots are occupied with at least one home and potentially farm buildings or left naturally vegetated.

3.4.2 Electrical Assessment

As noted in Section 3.1.2 the preferred size for the required development is 181 m x 196 m or 35,476 m^2 or approximately 8.7 Acres. For this site, the initial property configuration only consisted of the two Bosa Properties with total dimensions of 390.3 m x 99.05 m. This complicated the design as the site was very long and narrow. The layout developed (WIB-E05-SK004 R0A) was an inefficient layout which included indoor 25 kV and 60 kV Gas Insulated Switchgear (GIS) sections and outdoor 230 kV bus and transformers. The layout required transmission connections on the North boundary. This would have required ROW across private properties. This is not an optimal solution, and the acquisition of adjacent properties was looked at.

The first adjacent property considered was the private parcel to the south and east of the Bosa lands A number of layouts were considered culminating in WIB-E05-SK006-Op2. This layout located the outdoor 230 kV yard and four transmission terminals on the east side of the assembly and the Air insulated (AIS) 25 kV yard on the western portion of the eastern Bosa property with the future AIS 60 kV yard located on the western Bosa property. This layout requires cables to supply the 60 kV yard and while it makes better use of the property it is still not optimal. What it did prove was that a substation could be constructed if an additional adjacent parcel were purchased along with the Bosa property. Since that layout was completed the focus of additional property has been on adding the parcel on the southwest boundary of the Bosa properties as that owner is willing to sell the land. A revised layout will be prepared for the new assembly however it will not be ready for the completion of this report. The new

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layout will effectively be a mirror image of the WIB-E05-SK002-Op2 and will show the site comprising Bosa, Kool and Walia properties can host a substation however as noted previously it will not be optimal.

It is understood that efforts to purchase the parcel to the east of the Kool site will continue and if it becomes available a more efficient station layout will be able to be prepared. For more information refer to the electrical memo in Appendix A.

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3.4.3 Civil Assessment

The site has a general slope of 4% from east to west. Some cut and fill work will be required to level the site to an average of 3% grade. Volumes are 13000 m^3 of cut and 27000 m^3 of fill. Access is better than the Alternate 18 and 19 as 196th while only a single lane fronting the Bosa Property does extend to full width of the site. 194th extends past the full frontage of the site and there is a spur road called 194a St that reaches the southern boundary of the site. There are no water courses near the site. For more information refer to Appendix B

3.4.4 Geotechnical Assessment

Due to the proximity of Alternate 19 to Alternate 18 the general conditions listed in section 3.2.4 would apply to this site as well. However, as the site is under offer to purchase, BC Hydro will be conducting a due diligence geotechnical investigation prior to completion of the purchase. The results of the investigation will not be known before completion of this report. For more information refer to Appendix C

3.4.5 Transmission Assessment

Due to the proximity of Alternate 20 to Alternate 18 and 19 the general conditions listed in section 3.2.5 would apply to this site as well except, that the diversion

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from 192nd would occur along 76th avenue and194th St. For more information refer to Appendix D

3.4.6 Suitability for use as a Substation

Based on the review by each discipline, the general site conditions, and proximity to the load center, this site would be suitable for a substation with some caveats. While an electrical layout will be prepared for the Bosa/Kool/Walia properties it won't be ready for this report. However, it is expected to be a mirror image of that prepared for the Bosa/Kang property as the assemblies are both the same size. As shown for Bosa/Kang layout, a station could be constructed on the assembly but would not be an efficient design. If the Kang property could be purchased a much more efficient layout could be prepared for the site. However, if it is not available the Bosa/Kool/Walia site would be suitable for a station. As noted, offers to purchase the Bosa and Kool properties have been made and a confirmatory geotechnical investigation is being prepared in the event that purchase agreements are completed.

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4 Conclusions

The project team investigated several potential sites for the new Willoughby substation. The original selection of 22 sites was reduced to four sites for this stage of the project. The sites were Alternate 14B, Alternate 18, Alternate 19, and Alternate 20. Alternate 14B and Alternate 19 would require assembly by BC Hydro and for this reason they are less preferable. Alternate 18 and 20 were leading as both were assemblies held by developers who were willing to sell. While neither site was large enough on its own for the ultimate substation the project team determined it was likely that adjacent properties could be purchased to make up the required lands.

The team reviewed all the properties and determined that there were no major technical issues that would prevent the development of a substation subject to a confirmatory Geotechnical investigation for each site. Before the project team investigations were complete, senior management made a decision to make an offer on the Bosa properties of Alternate 20 based on the reasonable price and its availability. Purchase negotiations continue at the time writing and further offers have been made for adjacent properties. It is expected that Alternate 20 will be selected provided the Geotechnical investigation scheduled for January 2025 does not find a disqualifying condition.

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Appendix A
Electrical Memo - Willoughby Substation (WIB) Property Purchase Project

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Willoughby Substation Property Purchase Project

Electrical Evaluation

Memo Number	Revision	Information Security Classification
000-TEM-00088	0	BC Hydro Internal

To:	David Chwaklinski, Project Engineer Specialist, Lines and Interconnections	**Date**	2024 Dec 17
From:	Kally Jiang, Sr. Engineer, Electrical Design		
Copy:	[Comments]		

Related Facilities	Willoughby Substation

1 Purpose

The purpose of this memo is to provide information to the project team to support a decision to purchase property to construct a new BC Hydro Willoughby Substation in Township of Langley load center. The memo summarizes and documents the process of site selection and the physical electrical layouts developed based on the selected parcels to support carrying on the purchase.

2 Introduction

Load growth in the Willoughby area of the Township of Langley requires the development of a new 200 MVA substation (WIB) in the area. Currently there are no BC Hydro owned properties available to serve as a station site. The objectives of this project are to purchase a suitable property for the future development of a 200 MVA substation to serve the Willoughby area and future development in the Clayton district of Surrey.

3 Background

During Needs phase eleven (11) properties were initially identified as potentially suitable. Some properties were consolidated with others to make a total of thirteen (13) alternatives for

consideration. An SDM table was prepared with initial screening criteria and the number of properties was narrowed down to three (3) for further investigation. At the late date during negotiations towards purchasing, another parcel has been added as the furth one for evaluation.

4 General

Transmission Stations Engineering had been involved to provide engineering support for this property purchase project. Stations Electrical Design has developed high-level 2D ultimate layouts when carrying on design. The layout design is based on all potential available properties and the Conceptual design is based on following four (4) parcels (See maps for details on Attachment 1) to support the selecting of the most suitable property for purchase.

1. **Alternative 14B**

   Alternate 14B consists of six (6) privately held properties at the corner of 80th Ave and 192nd St. in the Clayton area of Surrey. The land slopes from east to west at a grade of approximately 8 %. The land is occupied by homes and in some areas is heavily treed with the remainder covered in brush. A 25 kV distribution line runs along 80th avenue.

2. **Alternative 18**

   Alternate 18 is a privately held assembly of two parcels owned by Qualico developments and a private parcel owned by the Mattu family. It is located at the corner of 78th Ave and 196th St. Combined the parcels aggregate to 8.15 acres. This would be large enough for the initial stage but to complete the ultimate more property would be required. An addition of the Mattu parcel to the west would allow the ultimate station to be constructed. Distribution lines of unknown voltage run on 78th Ave.

3. **Alternate 19**

   Alternate 19 consists of a three individually owned parcels directly south of the Qualico parcels at concern of 76th Ave and 196th St. The sites are home sites and have houses and barns and are partially cleared with tress and shrubbery. The sites are generally flat with decent access. Distribution lines of unknown voltage run on 76th Ave.

4. **Alternate 20 and 20a**

   On July 17, 2024, a new set of properties has been taken into consideration as Alternate 20. It consists of two adjacent long narrow lots, 7507 196 ST and 7528 194 ST in Surrey. The two parcels are owned by Bosa Properties. Bosa is interested in selling both lots, less interested in selling only one. BCH has made an offer to purchase both properties on Sep. 17, 2024, although alone the lots do not provide for an efficient station layout. From a stations design perspective, the Bosa lots on their own are not a recommended option. After making an offer to purchase the Bosa properties, a layout design was requested to consider Alternate 20a using Bosa properties and the two other potential properties adjacent and South of the Bosa properties. See maps on Attachment 1 and Emails on Attachment 4 for details.

5 Scope of Work for the New Willoughby Substation

The new 230/25kV outdoor or indoor substation, designated as Willoughby Substation (WIB), will be constructed on the property acquired. The initial stage capacity of the substation is 100MVA, with provisions for future expansion to 200MVA and to add a 60 kV yard at some time in the future. As shown in the Appendix 2 – Station Planning One Line, the scope includes the following:

- **Initial Stage**
  - Installation of an outdoor or indoor 230kV ring bus with four (4) circuit breakers, two (2) transformer positions, and two (2) 230kV line positions.
  - Installation of two (2) 230/25kV, 150MVA transformers T1 and T2 with dual secondary windings.
  - Installation of two (2) 50MVA, 25kV air-insulated (AIS) outdoor feeder sections, each with nine (9) feeder positions with incoming line CBs and sectionalized CB.
  - Construction of a control building and other associated infrastructure.
  - Installation of station service, protection & control (P&C), civil, mechanical, and other related station facilities.
  - Construction of a duct bank extending from the feeder section to the nearest distribution manhole, either inside or near the station boundary.
  - Installation of a grounding system, lightning shield wires cable trench and conduit system.

  To provide power to the new Willoughby Substation, two (2) new 230kV transmission lines will be constructed from nearby substations. The solution will be based on recommendations from Transmission Planning, Transmission Line Planning and Design.

- **Ultimate Stage**
  - Installation of an expanding 230kV ring bus by adding four (4) circuit breakers.
  - Installation of two (2) 230/60kV transformers T3 and T4.
  - Installation of ten (10) 25kV air-insulated (AIS) outdoor indoor feeder positions similar to the feeders installed at initial stage.
  - Installation of an outdoor or indoor 60kV ring bus with six (6) circuit breakers, two (2) transformer positions, and four (4) 60kV line positions.

Two (2) new extra 230kV transmission lines will be constructed from nearby substations to the new Willoughby Substation. The solution will be based on recommendations from Transmission Planning, Transmission Line Planning and Design.

6 Electrical Design Consideration

Many options were explored as requested. Principles for electrical design are as below:

- Latest applicable standards are conformed for design.
- Minimum distance between a driven vehicle and the high voltage bus: 2.5m for 230kV, 1.5m for 25kV.
- Minimum corridor between the perimeter fence and any switchyard equipment: 6m.
- 20m separation between transformers.
- 18m separation from transformer edges to all buildings and property lines.
- 6m separation from station service transformer to Control Building.
- Minimum 6m wide access roads.
- Minimum 6m between substation perimeter fences and property lines for drainage and grounding.
- Minimum 10m turning radius within the substation.
- 27m turning radius for main access roads into substation for transformer transportation.

7 Assumptions And References

The Willoughby (WIB) Substation electrical layout design is based on the following assumptions:

- All electrical conceptual layouts design hereby serve for evaluate property feasibility only.
- All related transmission line entrance supports the current electrical design layouts and will coordinate with Transmission Lines when carry on further design stages.
- The electrical conceptual design for Willoughby substations is based on draft Station Planning One-Line as shown on Attachment 2 that provided on March 06, 2024, by Project Engineer, David Chwaklinski.
- The 230kV ring bus layout spacing is designed according to BC Hydro standard ES44-C0280.
- The future 60kV ring bus layout spacing is based on NKL 60kV Ring Bus layout DWG 414K-E05-00002.
- The 25kV feeder section design is in line with BC Hydro standard ES44-C0186.
- The control building size is based on the size of MLE new control building, as shown on drawing 472R-E05-10041 with some margin in the total length.
- The orientation and positioning of the 230 and 60 kV lines will be determined by Transmission Planning.
- The orientation and positioning of 25kV feeder will be determined with input from Distribution. The location of the first distribution manhole is not yet determined.
- It is assumed that the transmission line egress will be via cable until Transmission's final confirmation.

- 27m turning radius for main access roads into substation for transformer transportation could be met.

8 Electrical Design Layouts and Recommendations

A number of various electrical layouts were explored to try and fit the required equipment onto the parcels identified. In some cases, a combination of AIS and GIS were required to fit the equipment. While the Project called for AIS only it was important to show that for some property assemblies the only way to develop the site was to include GIS. After review by the project team and updates to the Properties, some preferred layouts were selected to consider. The selected a few electrical design layouts are shown on Attachment 3.

Based on all the layouts, Alternative 18 is considered the most feasible and recommended option. It should be noted that there is a creek running through part of the property to the west of Alt 18 that could impact the overall layout of the station.

Alternate 20 will not be suitable without the addition of additional properties to the south or a switch to a GIS station configuration. It is understood that an offer to purchase has been made although the final decisions could take some time to finalize. Alt 20 on its own won't be suitable to develop a substation based on BCH current standards and practices. It is also understood that further negotiations are being conducted with property owners directly south of the Bosa property to obtain an assembly that will be large enough for any conceivable layout. See maps on Attachment 1 and Emails on Attachment 4 for details.

At the time of writing this Memo, the properties listed above under section 4 were actively being reviewed. The purchasing process to obtain parcels #3 and #4 for the Alternate 20a is on going. Due to the dynamic nature of property acquisition, changes to the parcels may occur which will not be captured in this memo.

9 Attachments

See Pages 7 to 17 for details.

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Prepared by:

Kally Jiang
2024-12-17

Kally Jiang, P.Eng, Sr. Engineer
Stations Design - Electrical

2024-12-17
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
K. H JIANG
38218
1002449

Checked by:

2024-12-17

Ken Zeng, P.Eng, Sr. Engineer
Stations Design - Electrical

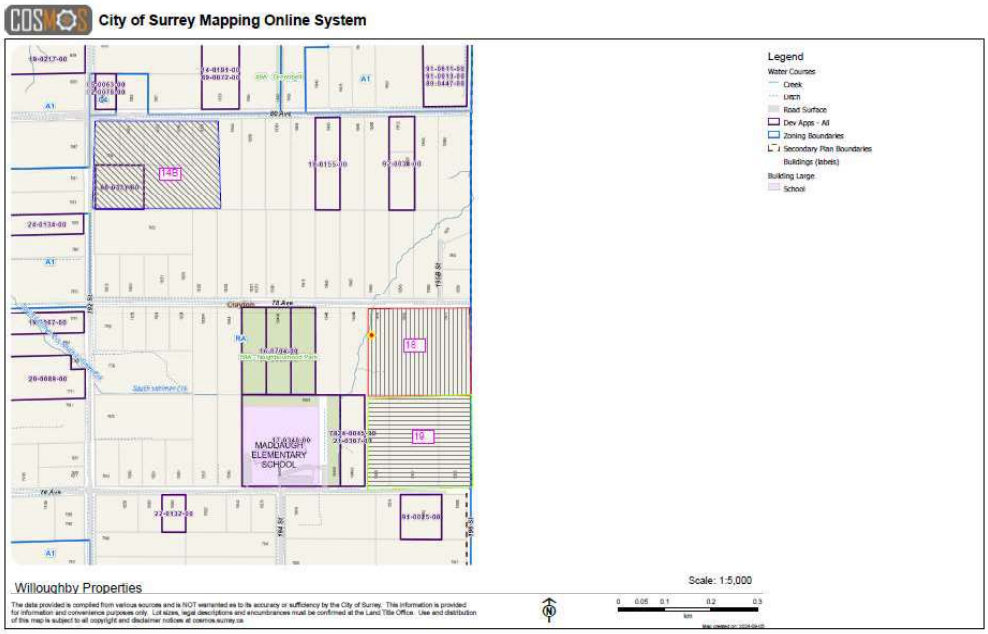
Accepted by:

2024-12-17

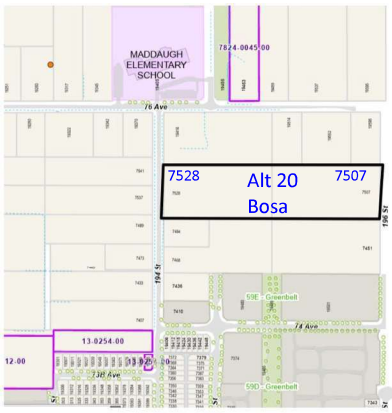
David Chwaklinski, P.Eng,
Project Engineer Specialist
Lines and Interconnections

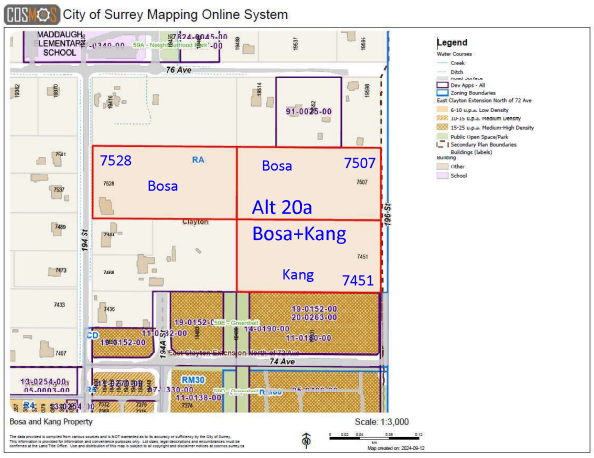
1002449
2025-01-09

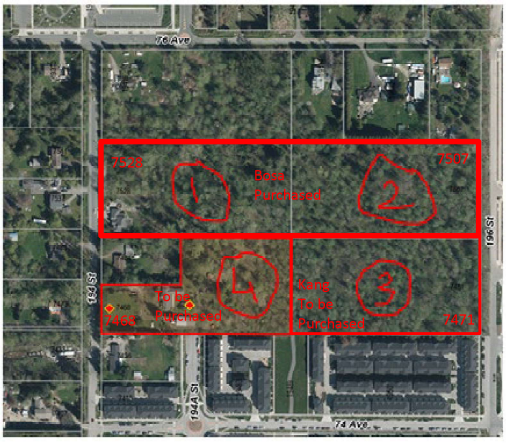
Attachment 1 – Map for the Alternate Properties



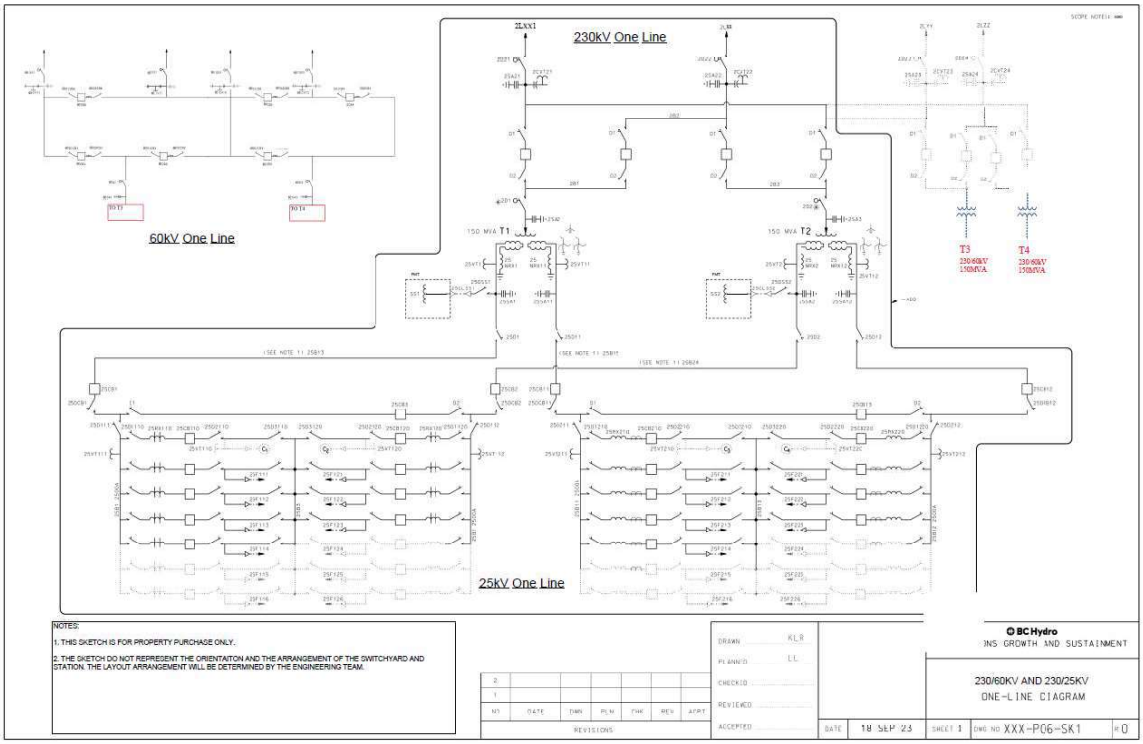






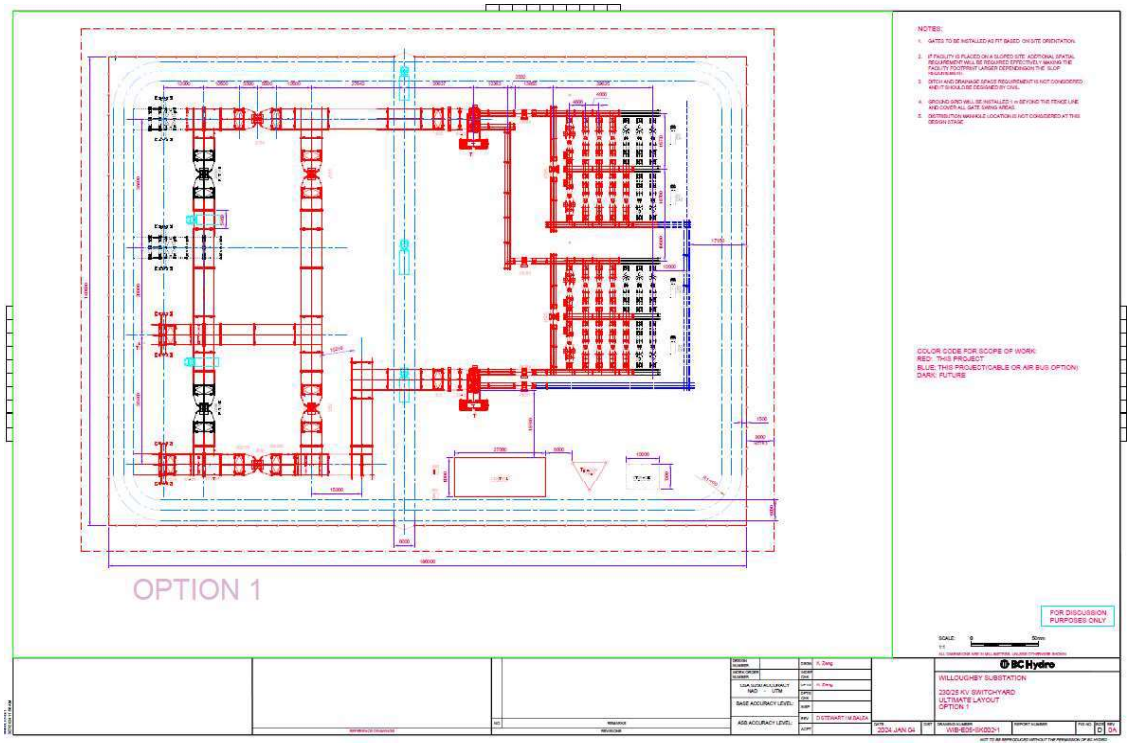


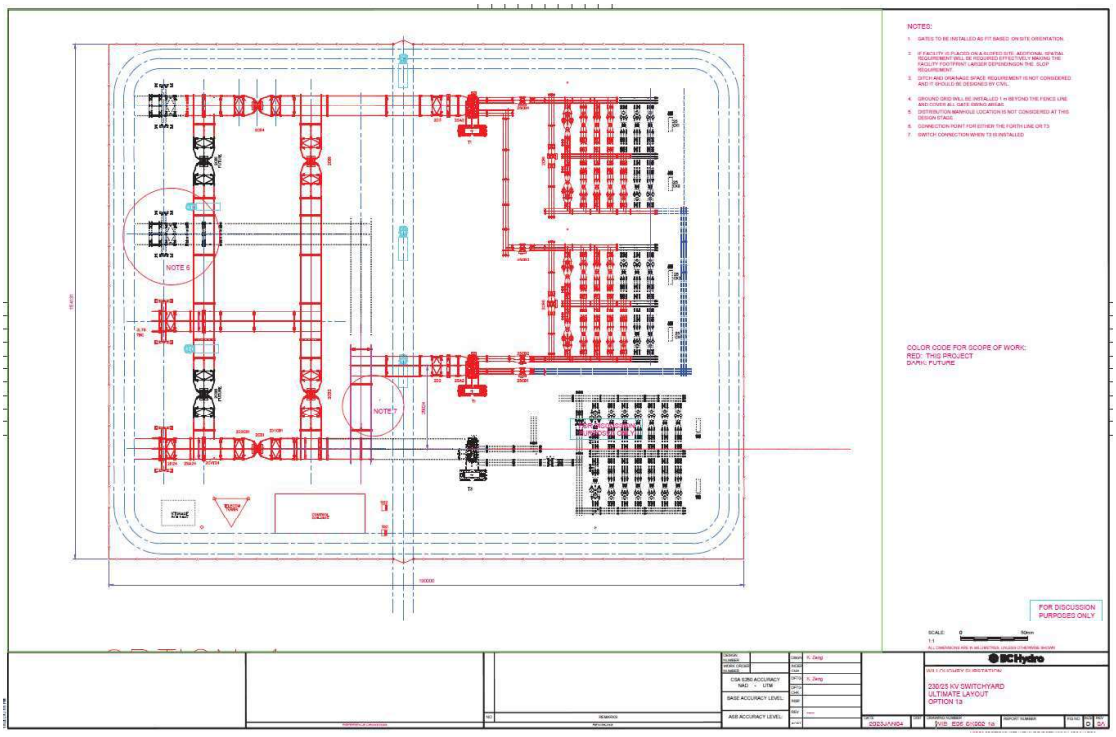
Attachment 2 – Station Planning One-Line



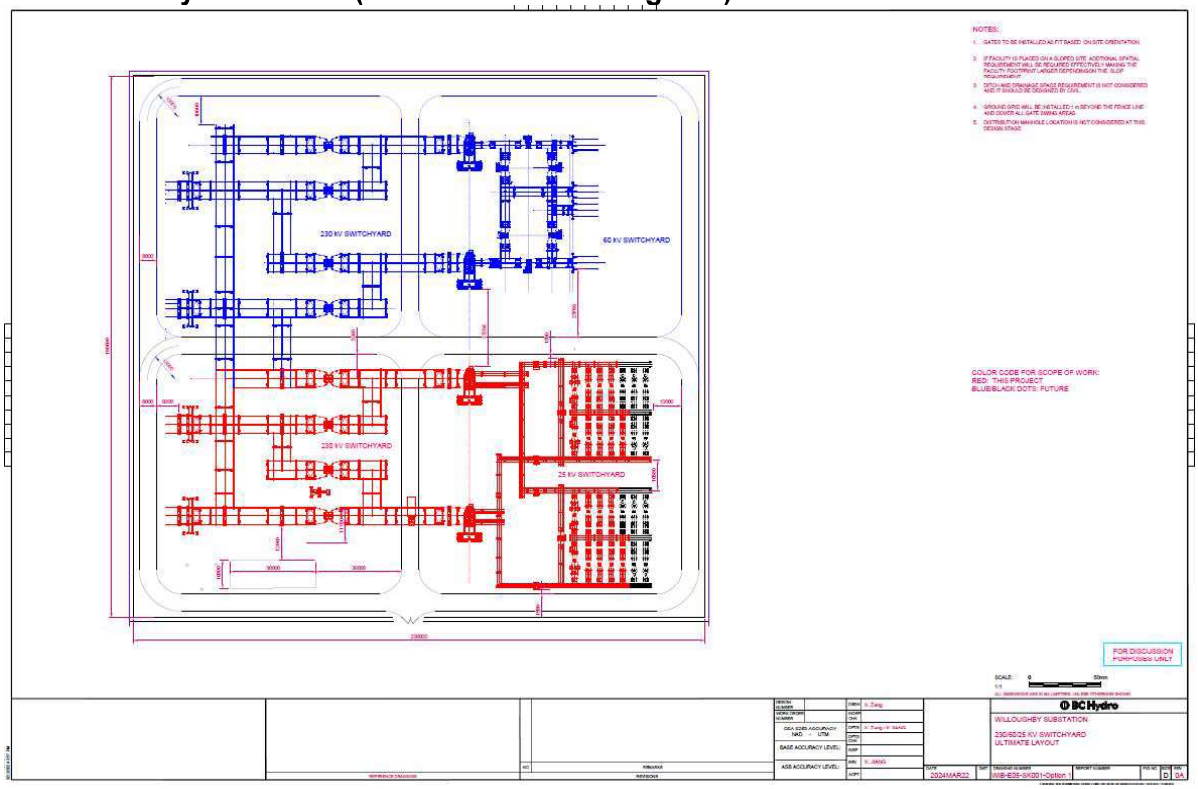
Attachment 3 – Station Electrical Layouts

General Layout for Original AIS (Air Insulated Switchgears) Without 60kV

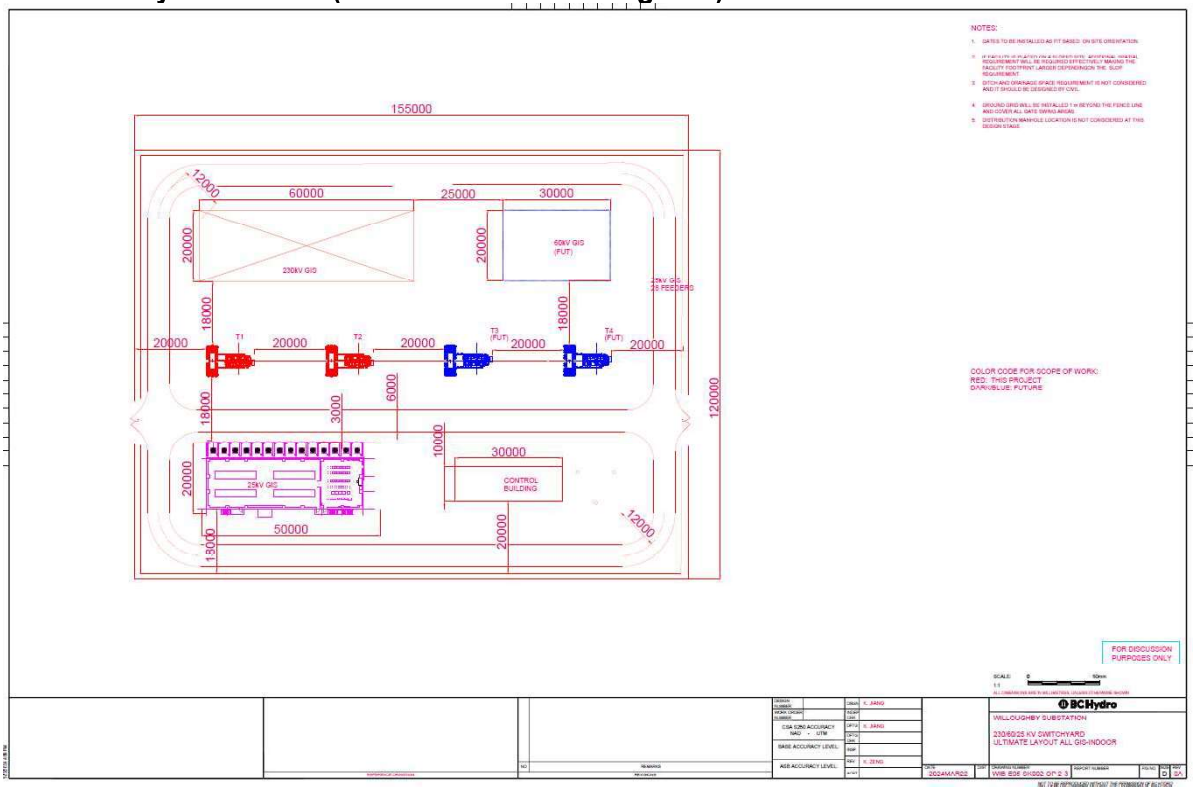




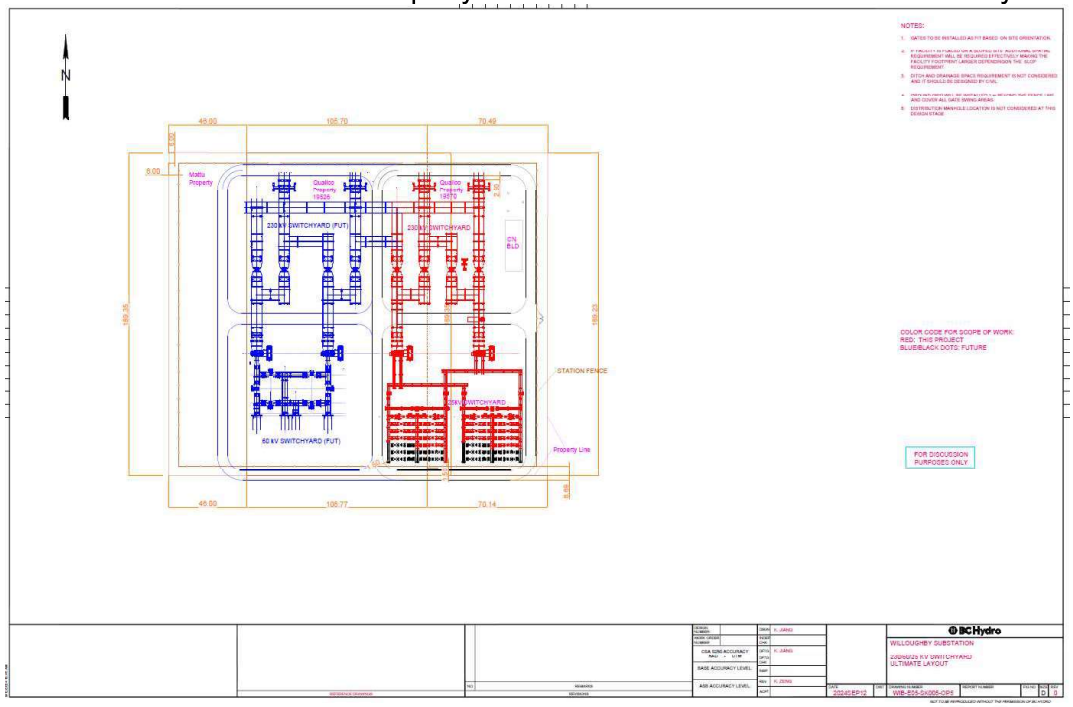
- **General Layout for AIS (Air Insulated Switchgears)**



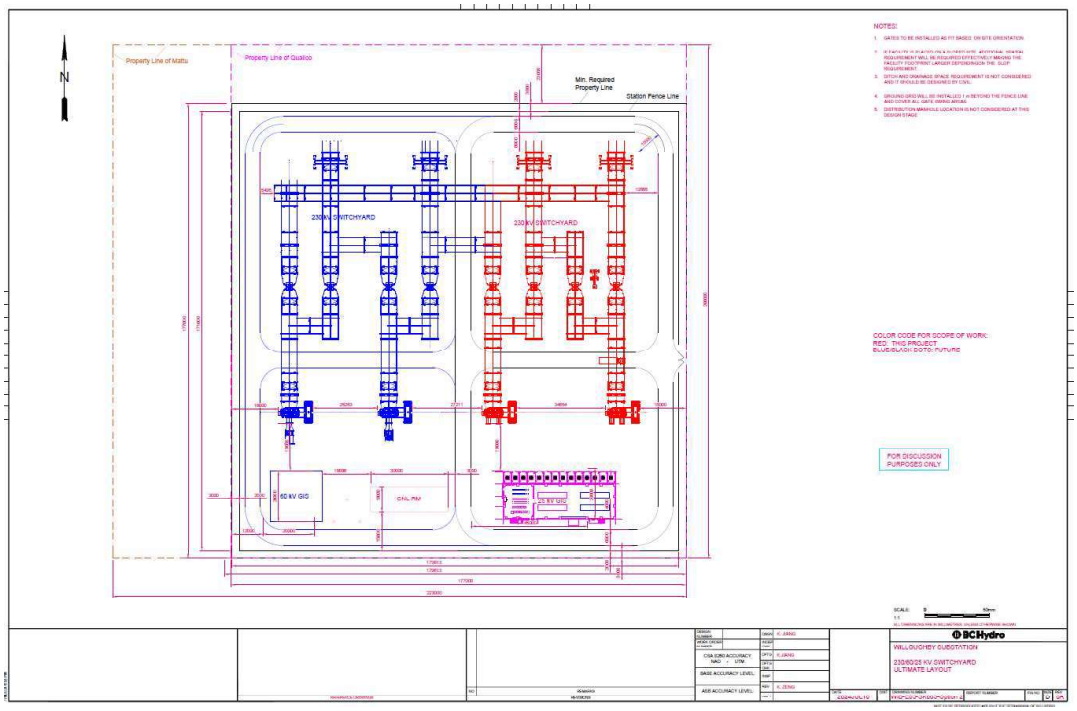
- **General Layout for GIS (Gas Insulated Switchgears)**



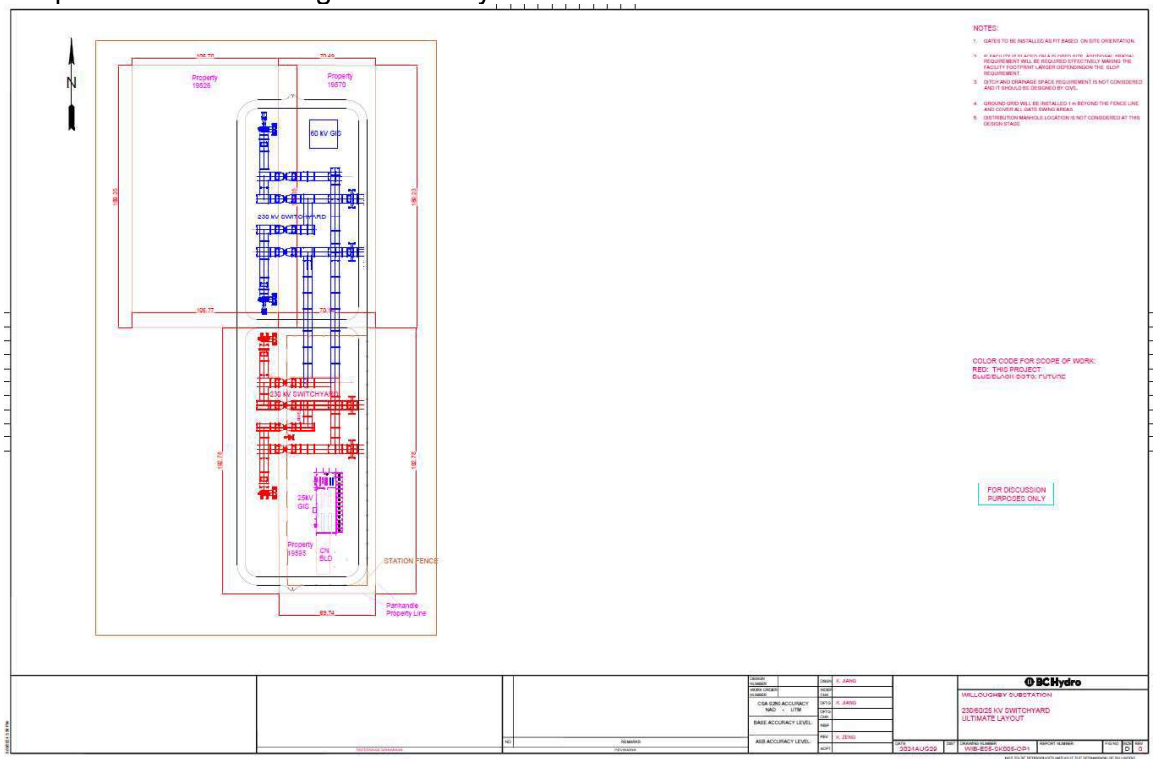
- **Alternate 14B –** Property is not easy to be acquired, no layout had been created.
- **Alternate 18 –** extra Mattu Property + 10 meters would be needed for AIS layout.



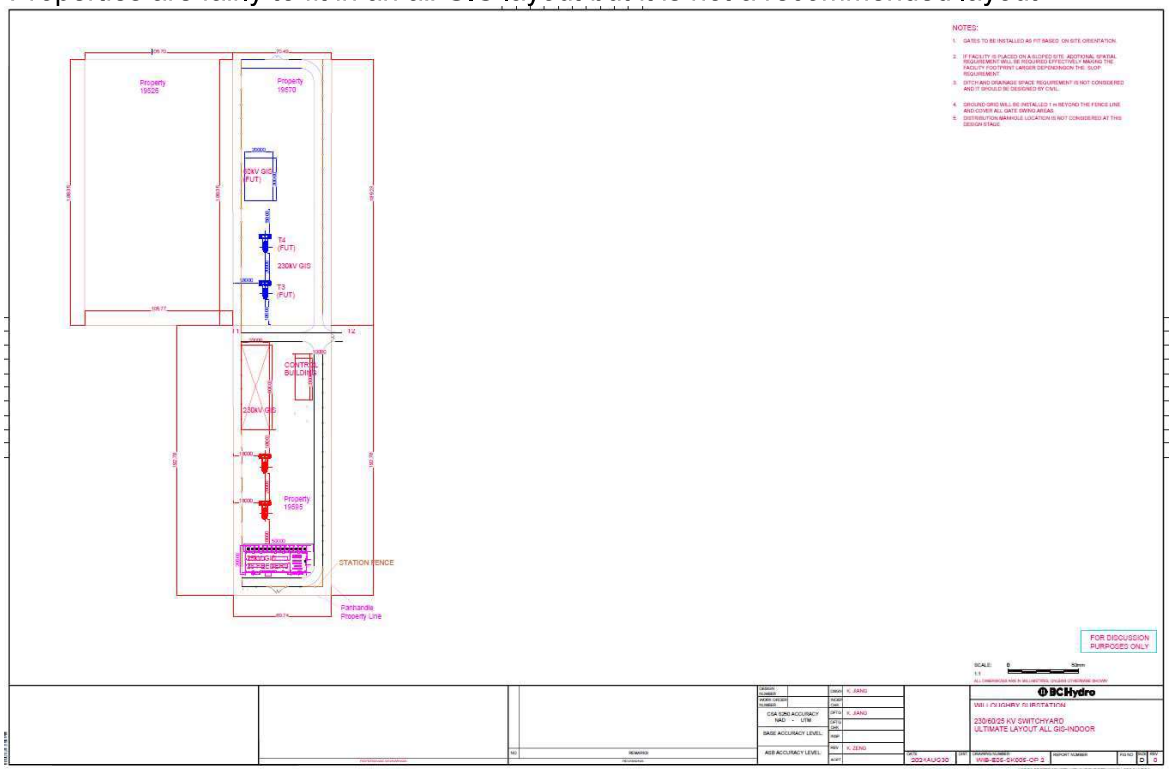
It is just possible to squeeze in Alt 18, Qualico Property for an AIS+GIS combined layout.



- **Alternative 18 + 19 (Partial, one Property names Panhandle or Ngo)**
  Properties are not enough for AIS layout.

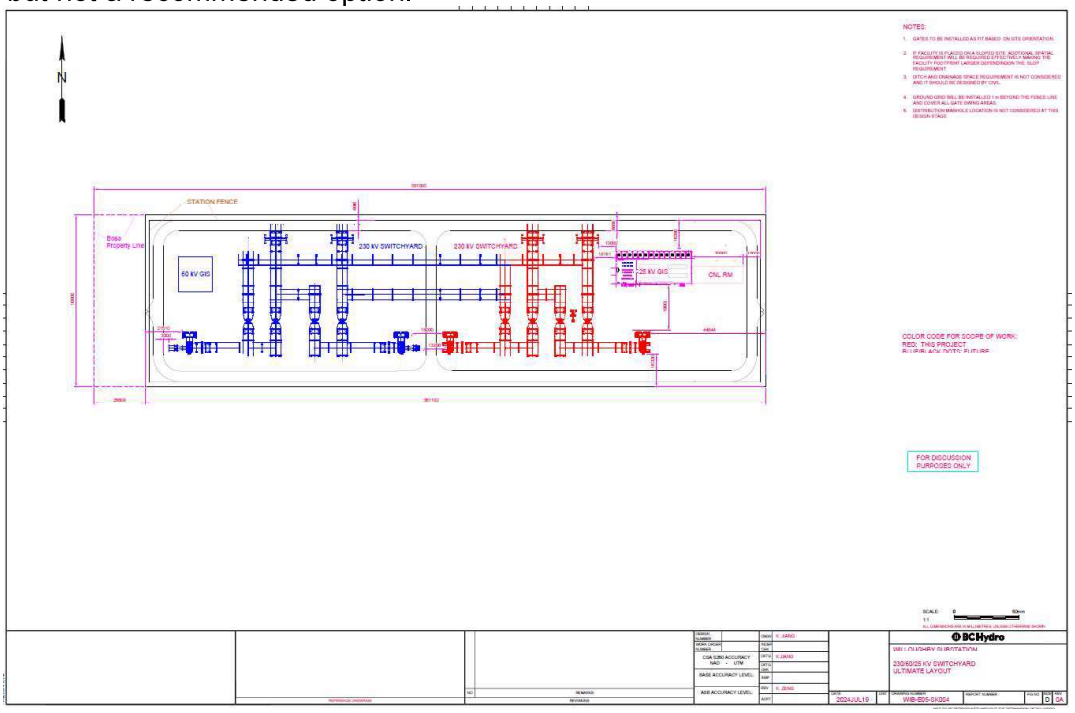


Properties are fairly to fit in an all GIS layout but it is not a recommended layout.

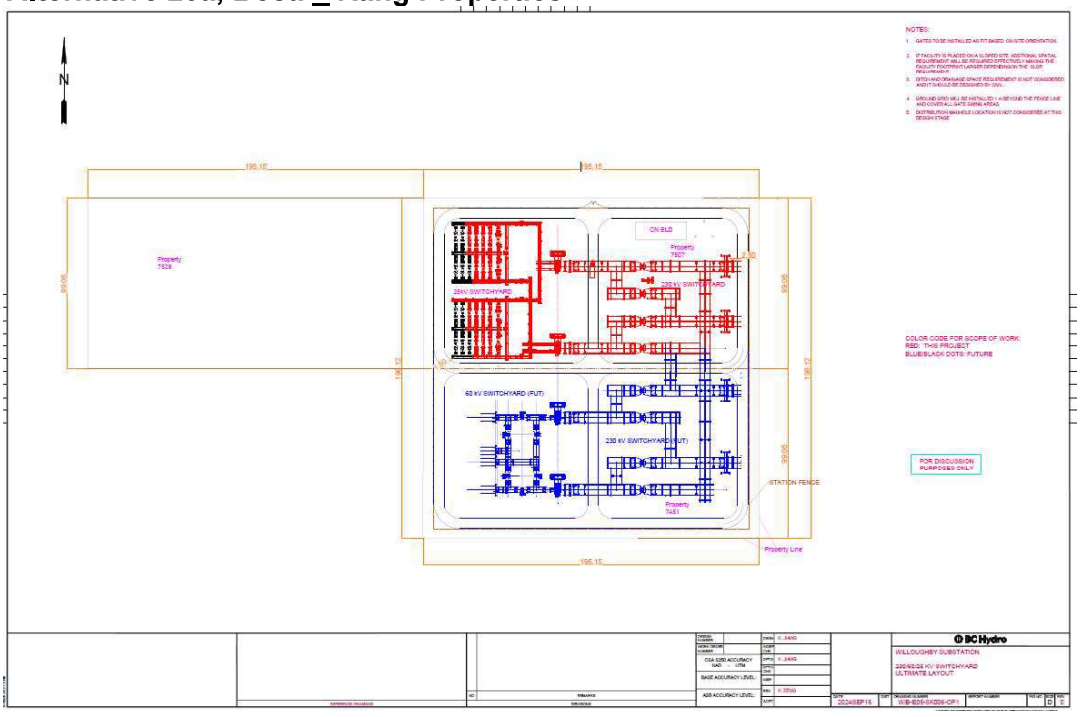


- **Alternate 19 -** It is not easy to acquire both properties, no layout had been created.

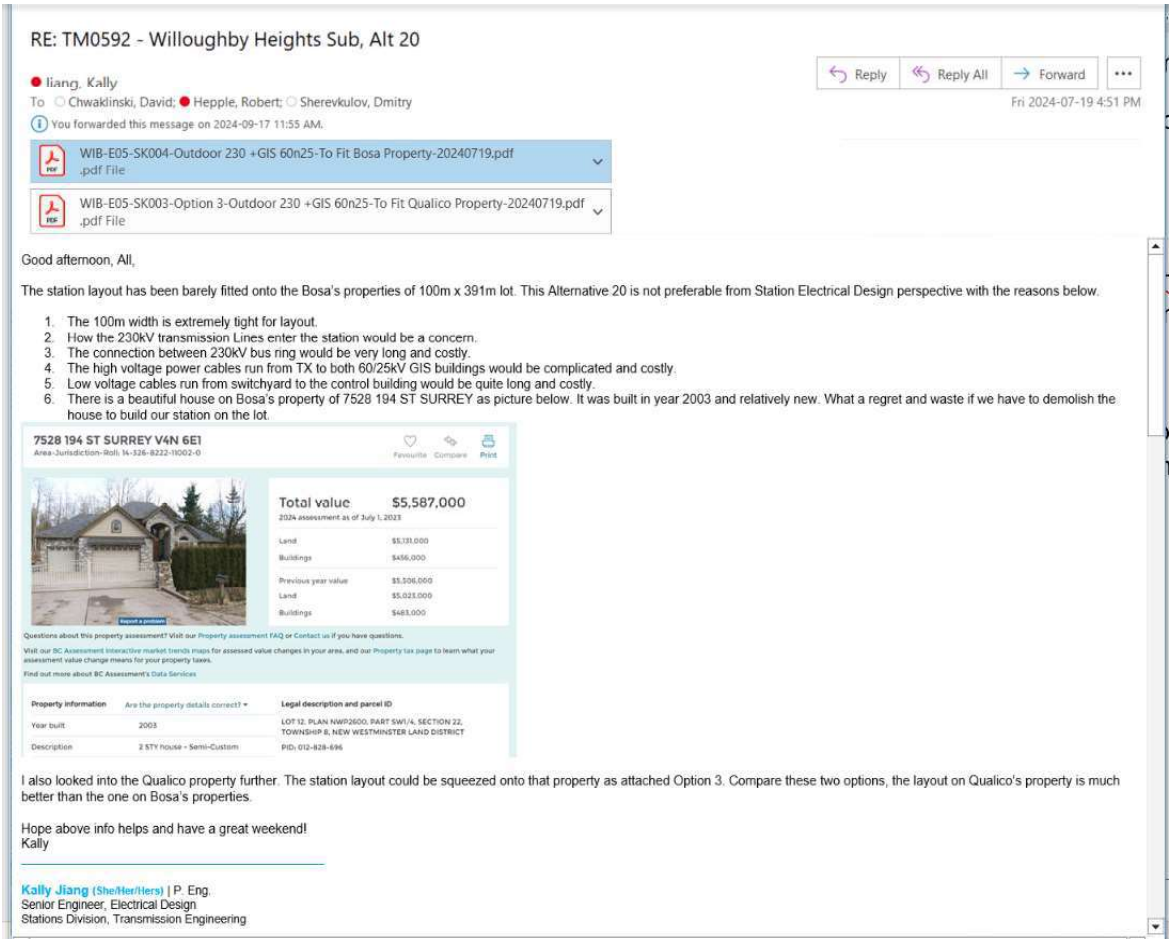
- **Alternate 20, Bosa Property**
  Property is not enough for AIS layout. It may be possible to squeeze in an AIS+GIS layout but not a recommended option.



- **Alternative 20a, Bosa _ Kang Properties**



Attachment 4-1 – Information related to Alternative 20, Bosa Property



RE: TM0592 - Willoughby Heights Sub, Alt 20

Reply | Reply All | Forward | ...

● liang, Kally
To ○ Chwaklinski, David; ● Hepple, Robert; ○ Sherevkulov, Dmitry
Fri 2024-07-19 4:51 PM

You forwarded this message on 2024-09-17 11:55 AM.

WIB-E05-SK004-Outdoor 230 +GIS 60n25-To Fit Bosa Property-20240719.pdf
.pdf File

WIB-E05-SK003-Option 3-Outdoor 230 +GIS 60n25-To Fit Qualico Property-20240719.pdf
.pdf File

Good afternoon, All,

The station layout has been barely fitted onto the Bosa's properties of 100m x 391m lot. This Alternative 20 is not preferable from Station Electrical Design perspective with the reasons below.

1. The 100m width is extremely tight for layout.
2. How the 230kV transmission Lines enter the station would be a concern.
3. The connection between 230kV bus ring would be very long and costly.
4. The high voltage power cables run from TX to both 60/25kV GIS buildings would be complicated and costly.
5. Low voltage cables run from switchyard to the control building would be quite long and costly.
6. There is a beautiful house on Bosa's property of 7528 194 ST SURREY as picture below. It was built in year 2003 and relatively new. What a regret and waste if we have to demolish the house to build our station on the lot.

I also looked into the Qualico property further. The station layout could be squeezed onto that property as attached Option 3. Compare these two options, the layout on Qualico's property is much better than the one on Bosa's properties.

Hope above info helps and have a great weekend!
Kally

Kally Jiang (She/Her/Hers) | P. Eng.
Senior Engineer, Electrical Design
Stations Division, Transmission Engineering

RE: Bosa property Confirmation

Reply | Reply All | Forward | ...

○ Hepple, Robert
To ○ Jiang, Kally; ○ Chwaklinski, David
Tue 2024-09-17 9:16 AM

Kally,
We bought the Bosa property. We may buy the Kang property if needed.
Can you please layout the substation using all the Bosa property and then inform me if we need the Kang property for an Ultimate arrangement?
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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Attachment 4-2 – Information related to Alternate 20a, Bosa+Kang Properties

From: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Sent: 2024, September 19 2:26 PM
To: Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Chwaklinski, David <David.Chwaklinski@bchydro.com>; Jiang, Kally <Kally.Jiang@bchydro.com>
Subject: RE: Willoughby Property - WIB - Bosa Property

Thanks Robert – that is good news.

That said, we got Ajay's approval for extra land for the future plans that IP may have like the battery storage etc).

I will still try to purchase the parcel 4. If we have issues in making the deal, then may be we can rethink.

Surinder Parmar, P.Eng., PMP
BC Hydro
6911 Southpoint Drive

P 604.528.7731
M 604.561.2702
E Surinder.Parmar@bchydro.com

bchydro.com

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FW: Willoughby Property - WIB - Bosa Property

Reply | Reply All | Forward

Hepple, Robert
To Parmar, Surinder
Cc Chwaklinski, David; Jiang, Kally
Thu 2024-09-19 2:18 PM
You forwarded this message on 2024-09-19 4:49 PM.

WIB-E05-SK006-Op1-Outdoor AIS-To Fit Bosa+Kang Properties-20240916.pdf
2 MB

Hi Surinder,
I know you would like to purchase all 4 parcels for future BCH purposes but the engineering Team would be remis if we did not mention that Kally has a layout with the Kang property and the eastern Bosa property that works.
Please see attached layout.
We would not need the western Bosa property or it could be purchased for future battery installation.
In that case we would not need parcel #4.
Let me know your thoughts.
Robert

Robert Hepple P.Eng.

Project Manager, Stations
Capital Infrastructure Project Delivery
BC Hydro
6911 Southpoint Drive, B02
C 360.410.2244
W 604.528.3433
E Robert.Hepple@BCHydro.com

Web: BCHydro.com

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RE: Willoughby Property - WIB - Bosa Property

Reply | Reply All | Forward | ...

Hepple, Robert
To Parmar, Surinder
Cc Chwaklinski, David; Jiang, Kally

Thu 2024-09-19 2:28 PM

From: Parmar, Surinder <Surinder.Parmar@bchydro.com>
Sent: 2024, September 19 11:46 AM
To: Lee, Tony S.C. (BCH) <Tony.Lee@bchydro.com>; Chan, David Y.M. <David.Chan@bchydro.com>; Sherevkulov, Dmitry <Dmitry.Sherevkulov@bchydro.com>; Hepple, Robert <Robert.Hepple@bchydro.com>
Cc: Pradhan, Anil <Anil.Pradhan@bchydro.com>
Subject: FW: Willoughby Property - WIB - Bosa Property

Gents:

See string of emails below.

In summary – we have IP management consent to buy the Parcel #4 (south-west of Bosa) along with our earlier plan to buy Parcels 1, 2 and 3.

I will leave it with our Properties SMEs to review/decide on when to approach the owners of Parcel 3 and Parcel 4 owner and start these negotiations.

Let me know if any questions/clarifications that you need from me.



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Appendix B
Willoughby Substation – Civil Memo

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Willoughby Substation Property Purchase Project

Civil Evaluation

Memo Number	Revision	Information Security Classification
000-TEM-00092	0	BC Hydro Internal

To:	David Chwaklinski, Project Engineer	**Date**	2024 Sep 12
From:	Feng Liu, Sr. Engineer		
Copy:	[Comments]		

Related Facilities	Willoughby Substation

1 Introduction

Load growth in the Willoughby area of the Township of Langley requires the development of a new 200 MVa distribution substation (WIB) in the area. Currently there are no BC Hydro owned properties available to serve as a station site. The objectives of this project are to purchase a suitable property for the future development of a 200 MVa substation to serve the Willoughby area and future development in the Clayton district of Surrey.

2 Background

The project team selected several potential sites located near 200th avenue. After further review and evaluation, four (4) sites were identified as potentially suitable.

The sites are identified as follows:

Alternative 14B

Alternate 14B consists of six (6) privately held properties at the corner of 80th Ave and 192nd St. in the Clayton area of Surrey. The PID's are PID 005-951-704, 003-370-879, 005-951-712, 002-229-561, 005-951-721 and 003-370-887. Civic address is 7954 192nd St., 7914 192nd St., 19234 80th Ave., 19276 80th Ave., 19296 80th Ave. and 19324 80th Ave.



Site map – Alternative 14B

Alternative 18

Alternate 18 is a privately held assembly of two parcels owned by Qualico developments and a private parcel. The Qualico parcels are PID 011—988-959 and 011-988-967 with Civic address 19570 78th Ave. and 19526 78th Ave. Combined the parcels aggregate to 8.15 acres.



Site map – Alternative 18

Alternative 19

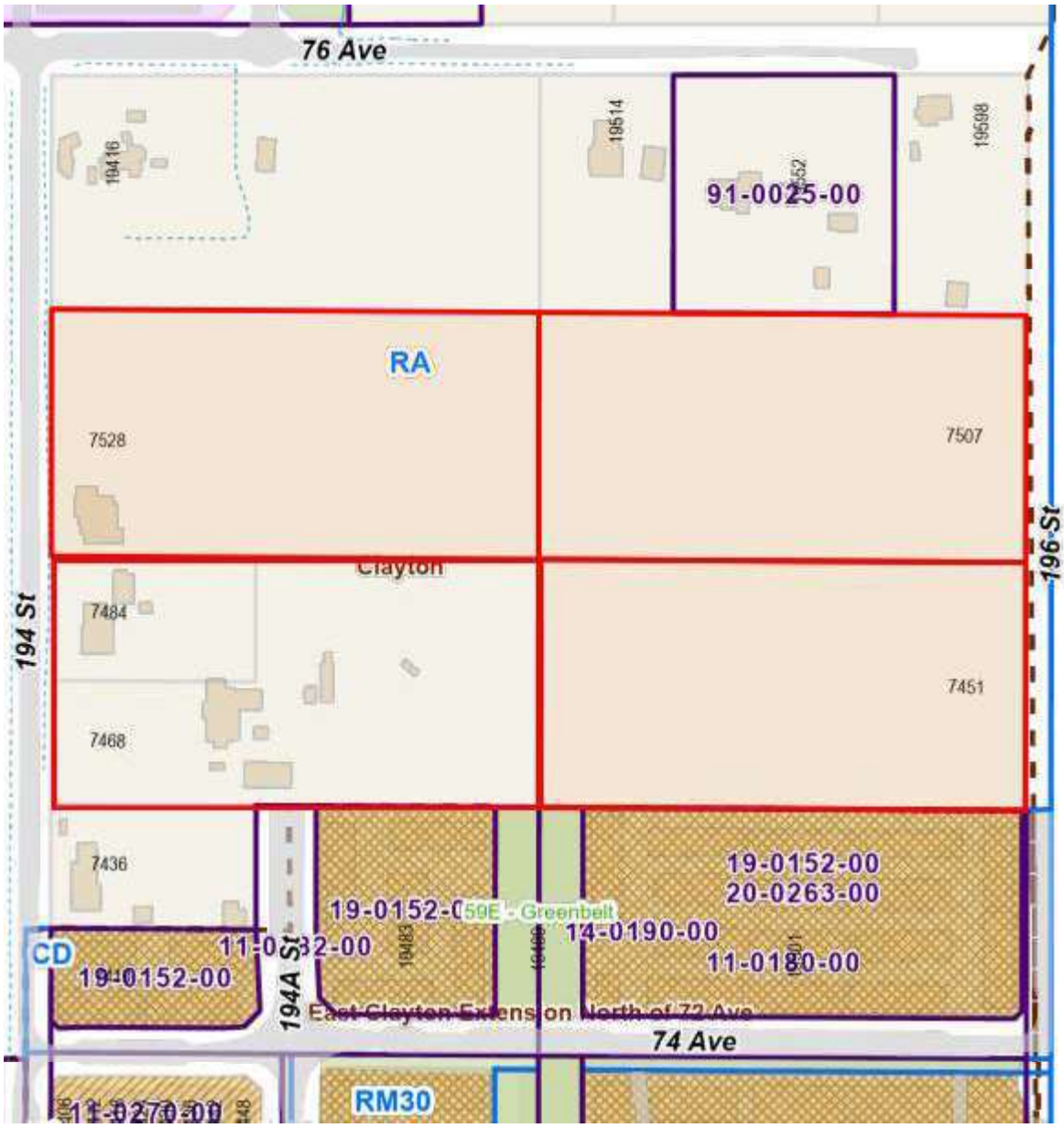
Alternate 19 consists of a three individually owned parcels directly south of the Qualico parcels. The PIDs are 002-401-428, 002-401-436 and 009-360-158 with Civic addresses 19595 76th Ave., 19537 76th Ave and 19489 76th Ave.



Site map – Alternative 19

Alternative 20

Alternate 20 originally consisted of three properties, two parcels owned by Bosa developments and a private parcel located at south of the Bosa properties. Since the initial assessment two additional properties have been added to Alt 20. The Bosa parcels are PID 012-828-696 and 012-828-670 with Civic address 7528 194th St. and 7507 196th Ave. The PIDs and Civic addresses for the private parcels under consideration are PID 012-828-661, 7451 196th St, PID 008-131-554, 7484 194th St and PID 001-787-993, 7468 194th St.



Site map – Alternative 20

At the time of writing, the properties listed above were actively being reviewed. Due to the dynamic nature of property acquisition changes to the parcels may occur which will not be captured in this memo.

3 Geographic Evaluation

Alternative 14B

The natural slope of the land is approximately 6% from east to west, and 6% from south to north. Cut and fill work is required to reduce the slope to 3%. The estimated volume of cut and fill is shown in the table below.

Volume of cut	Volume of fill
40000 m^3	80000 m^3

Geotechnical analysis is required to assess the soil and ground conditions.

Alternative 18

The land is almost flat from east to west, with a natural slope of approximately 4.7% from south to north. Cut and fill work is required to reduce the slope to 3%. The estimated cut and fill volumes are shown in the table below.

Volume of cut	Volume of fill
22700 m^3	45300 m^3

There is a creek located to the west of the site. This has a negative impact on the location of the future substation. The creek may increase the likelihood of flooding, potentially damaging the substation. Runoff from the substation may potentially contaminate the creek, leading to environmental concerns. Geotechnical analysis is required to assess the soil and ground conditions.

Alternative 19

The land is approximately flat from east to west, with a natural slope of approximately 2.5% from south to north. No significant cut and fill work is required for this site.

Like Alternative 18, the same creek is located west of the Alternative 19 site. This has a negative impact on the location of the future substation. The creek may increase the likelihood of flooding, potentially damaging the substation. Runoff from the substation may potentially contaminate the creek, leading to environmental concerns. Geotechnical analysis is required to assess the soil and ground conditions.

Alternative 20

BC Hydro management team has made an offer to purchase the Bosa properties and to negotiated with other landowners in the vicinity. The natural slope of the land is approximately

4% from east to west, and 2.5% from north to south. Cut and fill work is required to reduce the slope to 3%. The estimated volume of cut and fill is shown in the table below.

Volume of cut	Volume of fill
13000 m^3	27000 m^3

Geotechnical analysis is required to assess the soil and ground conditions.

4 Access Evaluation

Alternative 14B

The land is located at the corner of 80th Avenue and 192nd Street. Both 80th Ave and 192nd St are city roads, so there is adequate space for large construction and maintenance vehicles. The access point could be at 192nd St and 80th Ave.

Alternative 18

The land is located south of 78th Avenue. 78th Avenue is a dead-end narrow lane. The substation requires access for large construction and maintenance vehicles. This can be challenging on a narrow lane, which does not have sufficient space for these vehicles. Dead-end street limits construction and maintenance traffic, making it difficult to access the substation.

Alternative 19

Like Alternative 18, Alternative 19 also has limited access. The land is located north of 76th Avenue. 76th Avenue is a dead-end narrow lane, limiting construction and maintenance vehicles, making access to the substation difficult.

Alternative 20

The land is located between 194th St and 196th Street on the south side of 76th Ave. A 200m x 200m substation can be installed on this land. The substation includes a 25kV switchyard, 60kV switchyard, 230kV switchyard and a control building. 194th St, 196th St and 76th Ave are all city roads, so there is adequate space for large construction and maintenance vehicles. The access points can be located at 194th St and 196th St.

5 Conclusion

Alternative 14B

The land has a natural land slope of 6%, with large earthwork (cut and fill) requirements. The site's advantageous positioning at the intersection of two city roads ensures adequate access for large construction and maintenance vehicles, enhancing its operational feasibility.

Alternative 18

The land requires a moderate amount of cut and fill. However, its proximity to a creek poses negative impacts and potential environmental concerns. Additionally, the site is located on a dead-end narrow lane, making access challenging for construction and maintenance activities.

Alternative 19

The land has a favorable natural slope of 2.5%, with no significant earthwork (cut and fill) required, indicating a more straightforward construction process. However, similar to Alternative 18, it is also located near a creek. The dead-end narrow lane access further complicates the logistics of construction and ongoing maintenance.

Alternative 20

The land requires a moderate amount of cut and fill, which is less extensive than that of Alternative 14B and 18. Its location between two city roads provides adequate space for large vehicle access, facilitating easier construction and maintenance.

In summary, Alternative 14B and Alternative 20 emerge as the most favorable options due to their accessible locations and manageable earthwork requirements. Alternative 18 and Alternative 19 are hampered by access challenges and potential environmental impacts (proximity to a creek). Therefore, it is recommended to prioritize Alternative 14B and Alternative 20 for further development considerations.

Attachments

- Attachment A – Willoughby Properties Map



willoughby properties.pdf



Bosa_Kang_Property.pdf

AI

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Prepared by:

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Stations Design - Civil



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Stations Design - Civil

Accepted by:

David Chwaklinski, P.Eng,
Project Engineer

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Appendix C

TM0592 Willoughby Sub Geotechnical Desktop

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Proposed Willoughby Substation

Preliminary Desktop Geotechnical Assessment

TM0592

Memo Number	Revision	Information Security Classification
000-TEM-00095	0	BC Hydro Internal

To:	David Chwaklinski	**Date**	2024 Dec 19
From:	Dylan Lee		
Copy:	Shokooh Meshkinfar		

Related Facilities	Proposed Willoughby Substation

1 Introduction

As requested by David Chwaklinski, P.Eng., FEC., PMP, Project Engineer Specialist, the Geotechnical Section of the Transmission Civil Department carried out a desktop level preliminary geotechnical assessment of a potential site for the proposed new Willoughby Substation in Surrey. At the time of this report several sites in Surrey and Township of Langley have been or currently undergoing consideration for property purchase. The following properties are discussed in this memo: Alternative 20 (Bosa, Kang, Kool) properties 7528/7468 194 Street and 7507/7451 196 Street. Alternative 18 (Qualico) properties 19526/19570 78th Avenue and Alternative 19 (Qualico) properties 19537/19595/19489 76th Avenue, Surrey. Alternative 14B was also under consideration but not formally assessed in this memorandum. Alternative 14B consists of 7954 192nd Street, 7914 192nd Street, 19234 80th Ave, 19276 80th Avenue, 19296 80th Avenue and 19324 80th Ave.

The key geotechnical considerations for substation development are soil characterization to determine if unfavorable soft/loose soils exist on this site which may warrant special foundation design or significant ground improvement works; if geohazard issues (landslide, flooding, settlement, etc.) exist on the property; identify potential civil works (clearing, road construction, excavation, and regrading) required for the substation development; and identify potential impacts from surrounding third party works. The purpose of this assessment is to screen for these hazards and determine if there are significant geotechnical challenges with developing on these sites.

This desktop level assessment is limited to publicly available data sources acquired through the City of Surrey and Township of Langley's Geographic Information System, Province of British Columbia Groundwater wells inventory, Google Earth, review of nearby BC Hydro and third-party

building structures, and surficial geology mapping. A field reconnaissance was not completed at part of this original scope.

2 Geotechnical Assessment

2.1 Site Characterization and Background

An overview map of the properties discussed in the Clayton area is shown in Figure 2-1.



Figure 2-1: Key Map Google Earth

Alternative 20 (Bosa, Kang, Kool)

The properties are rectangular and include four lots: northwest Lot 46002, northeast Lot 46000, southwest Lot 46003, and southeast Lot 45999. The lots are fronting 194 Street or 196 Street Avenue which are classified local sub-urban roads. All four lots are zoned as suburban residential – urban reserve.

According to historical air photos dating back to 1949 to 2023[1] and hill shade LIDAR surfaces between 2009 and 2003, the following land use features were noted for each lot:

Northwest Lot 46002 (7528 194 Street, Surrey**,** LOT 12 SECTION 22 TOWNSHIP 8 PLAN NWP2600 NWD Part SW 1/4**),** lot size 19,329 sq meters:

- No additional historical buildings are apparent except for the main residential building located on the southwest corner of the lot fronting 194 street.
- A small section of land around the building has been cleared and grassed. The remaining portion of land on the property has remain undeveloped and heavily vegetated.
- The ground natural slopes northwest at approximately 3 percent but is nearly flat within the northwest quadrant of the property. Site drainage may be poor where the grade is near flat.

Northeast Lot 46000 (7507 196 Street, Surrey**,** LOT 9 SECTION 22 TOWNSHIP 8 PLAN NWP2600 NWD Part SW 1/4**),** lot size 19,319 sq meters:

- This property appears undeveloped and heavily treed. No historical buildings or veg clearing work observed in the historical photos.
- The ground naturally slopes down to the northeast at approximately 2 percent.

Northeast Lot 46003 (7468 194 Street, Surrey**,** LOT 13 SECTION 22 TOWNSHIP 8 PLAN NWP2600 NWD Part E ½ of SW ¼, except PLAN PCL A EXP PL 15559**),** lot size 15,286 sq meters:

- This property has been subdivided in 1957, and the rectangular plot of land (7484 194 Street) has been developed into a residential dwelling and no longer part of Lot 46003.
- There is a main residential building and a large stand-alone shed located in the southwest corner of the lot. Smaller auxiliary sheds, cars and containers are spread across the property.

[1] Accessed through the City of Surrey Mapping Online System (2024 July 8)

- The southwest corner of the lot front 194 Street has been cleared and grassed. The remaining portion of the property remains vegetated and treed.
- Significant redevelopment was observed to the south (a new lane road 194A street, green belt and townhouse development).
- The ground naturally slopes down to the northwest at approximately 1 percent.

Northeast Lot 45999 (7451 196 Street, Surrey**,** LOT 8 SECTION 22 TOWNSHIP 8 PLAN NWP2600 NWD**),** lot size 19,319 sq meters:

- This property appears undeveloped and heavily treed. No historical buildings or veg clearing work observed in the historical photos.
- The ground naturally slopes down to the north and northeast at approximately 2 percent.

Alternative 18 and 19 (Qualico) Properties

The properties are rectangular and include four lots: northwest Lot 45946, northeast Lot 45947, southwest Lot 45949, and southeast Lot 45948. The lots are fronting 78th Avenue or 76 Avenue which are classified local sub-urban roads. All four lots are zoned as suburban residential – urban reserve.

According to historical air photos dating back to 1949 to 2023[2] and hill shade LIDAR surfaces between 2009 and 2003, the following land use features were noted for each lot:

Northwest Lot 45946 (19526 78th avenue, Surrey, LOT 9 BLOCK 3 SECTION 22 TOWNSHIP 8 PLAN NWP1067 NWD PART NW 1/4), lot size 20,033 sq meters**:**

- Multiple detached buildings existed on the north half of the property. Throughout the years the buildings have been demolished and replaced.
- Current building footprints include a main residential building on the northwest corner of the lot; possible caretaker building and garage at the centre of the lot; and a large standalone barn at the west centre of the lot. Historical buildings since demolished were located between the caretaker building and the barn.
- Northeast corner of the lot had been used for agriculture.
- Possible horse pen is located south of the main residential building.
- The gravel lot south of the barn may have been an additional pen, historically.

[2] Accessed through the City of Surrey Mapping Online System (2024 July 8)

- Natural trees and uncleared areas are located along the southern extent of the property line and on the southeast corner of the lot.
- There are soil stockpiles on the east centre and the southwest corner of the lot.
- There is a possible interceptor swale and pond on the north side of the greenbelt at the southeast corner of the lot. This has possibly been infilled.
- No licensed ground water wells[3] recorded in the provincial groundwater well inventory.
- The ground naturally slopes downward to the north between 3 to 4 percent gradient.
- Latimer Creek runs south to north between 40 m to 80m from the western property line.

Northeast Lot 45947 (19570 78th avenue, Surrey, LOT 10 BLOCK 3 SECTION 22 TOWNSHIP 8 PLAN NWP1067 NWD**),** lot size 13,310 sq meters**:**

- No additional historical buildings on this lot are apparent except for the main residential building on the northwest corner of the lot.
- The north third of the lot has been cleared with selective use for agriculture and garden use.
- The remaining two-third of the lot on the south remain undeveloped and naturally vegetated.
- There exists a minor swale to the east of main building and possibly infilled.
- There exists a possible pond that has been infilled at the treeline.
- There exist possible soil stockpiles at the treeline and on the east side of the cleared lot.
- No licensed ground water wells[3] recorded in the provincial groundwater well inventory.
- The ground naturally slopes downward to the northeast at between 5 to 6 percent.
- There is a large townhouse complex being proposed to the east.

Southwest 45950 (19489 76 Avenue, Surrey**,** LOT 13 BLOCK 3 SECTION 22 TOWNSHIP 8 PLAN NWP1067 NWD Part E 1/2**),** lot size 10,217 sq meters**:**

- Historical building that appeared to be a standalone shed was located on the east property line, approximately 53 m north of the south property line. This building appeared demolished at the current time. There is a main residential dwelling located on the southeast quadrant fronting 76th avenue.

[3] It is possible a groundwell was installed on this lot but not shown in the groundwater inventory.

- The south half of the property had been cleared of vegetation in the past for agriculture and garden use.
- The remaining north portion of the lot remains undeveloped and mostly overgrown.
- The ground naturally slopes down to the north at approx. 2 percent.
- Currently surrounded by rural residential development on adjacent lands.
- There used to exist a man-made stormwater detention pond on the west property line, 100m north of the south property line. The pond appeared to be filled in.
- There is an unlicensed ground well located approximately 40 m north of the south property line.

South Lot 45949 (19537 76 Avenue, Surrey**,** LOT 12 BLOCK 3 SECTION 22 TOWNSHIP 8 PLAN NWP1067 NWD**),** lot size 20,417 sq meters**:**

- No additional historical buildings are apparent except for the main residential building and shed near the centre of the lot.
- The entire property had been cleared of vegetation in the past for agriculture and garden use.
- The remaining portion of the lot is undeveloped and mostly overgrown.
- The ground naturally slopes down to the north at approx. 4 percent.
- Currently surrounded by rural residential development on adjacent lands.
- There is an unlicensed ground well located north of the building.

Southeast Lot 45948 (19595 76 Avenue, Surrey**,** LOT 12 BLOCK 3 SECTION 22 TOWNSHIP 8 PLAN NWP1067 NWD**),** lot size 13,488 sq meters:

- No additional historical buildings are apparent except for the main residential building and shed near the southern portion of the lot.
- The southern half of property had been cleared of vegetation and mainly grassed.
- The north half of the lot is heavily vegetated and undeveloped.
- The ground naturally slopes down to the northeast at approx. 6 percent.
- Currently surrounded by rural residential development to the north and west; except to the east where this is recent townhouse development.
- There is an unlicensed ground well located north of the building.

3 Surficial Geology and Groundwater

According to Geological Survey of Canada Map 1484A, the surficial soils at all sites under assessment consist of Capilano Sediments (Cd), marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam with minor sand and silt normally less than 3 m thick but up to 30 m thick containing marine shells. Possible thin veneer of Ca, raised marine beach poorly sorted sand to grave, in upland areas sediments. At greater depths, Vashon Drift Tills (Va,b) and Pre-vashon till deposits (PVa-h) are likely to exist. The soft clay unit also known as the Fort Langley Formation (FLa-e) which is glacial and deltaic in nature exists south of all the sites towards City of Langley.

Licensed and unlicensed ground water wells have been installed in this region to service residential dwellings and farming needs. An illustration of historic ground wells in proximity to the sites are shown in Figure 3-1 and Figure 3-2. Soil stratigraphy and static groundwater for each well are summarized in Table 3-1 and Table 3-2 for Alternative 20 and Alternative 18/19, respectively. Based on the soil stratigraphy from the ground water wells, the main geological units encountered are Cd, Marine and glacio marine stoney till-like soils, underlain by mainly PVf, pre-vashon Seimahmoo till consisting of glaciofluvial, glaciomarine, and glaciolacustrine deposits. It is likely some thickness of Vashon Drift Till (Va,b) exists between Cd and PVf given some of the soil descriptive indicating hard pan till was observed. The Pre-vashon drift soils are generally interpreted as the sediments that are deposited in front of the glacier as the ice sheet advances and then overridden by the glaciers. PVf soils are typically well draining coarse soils that is likely to contain an established aquifer. The Fort Langley Formation (FLa-e) is likely absent at all these sites since the location is further upland from the glacial basin and at the boundary of where the Fla-e was deposited; however, this can not be totally discounted as the soil logs are not detailed enough.

Due to the fine grained and stiff nature of the upper soil units observed in the Cd, the soils are generally not conducive of drainage (poor permeability). There is potential for limited and isolated sand and gravel units with the Cd as indicated in two of the water wells east and south of the Alternative 18. The Cd can generally be considered as an aquitard in this area. The ground wells were installed with screen depths that penetrate Cd and were set inside the well draining sand and gravel soil units of PVf. The static groundwater table has been observed between 18 m (60 ft) and 53 m (175 ft) for groundwater wells installed between 34 m (111 ft) and 92 m (303 ft) screen depth for all the sites under consideration. This may suggest the aquifer may be pressurized as the static water rises within the aquitard Cd soil unit and above PVf. The fluctuation in groundwater is not completely well understood based on the limited information available and in the absence of a hydrological study that is beyond the scope of this report; however, the following reasons may explain the difference in groundwater:

- There are multiple water bearing aquifers within PVf unit. The higher elevation static groundwater table may correspond to a pressurized aquifer as the screen depths for the shallow wells are targeted within the upper strata of the PVf; while the lower elevation static ground water corresponds to a less or unpressurized aquifer as the screen depths for the deeper wells are targeted much lower in the soil strata compared to the shallow wells; or,
- There is only a single aquifer within PVf and the groundwater has changed over time indicating the aquifer had been depleting. The deeper wells with the deeper groundwater table were observed to be installed approximately one to two decades after the shallow wells were installed.

Given the extensive historic groundwater well use in this region before the 90's, the latter theory is likely more plausible given the chronological installation of the groundwater wells resulting in deeper wells and lower groundwater table through time.

Table 3-1: Alternative 20 Properties - Groundwater wells Lithology and groundwater

Well 58737 (ft)	**Well 15844 (ft)**
0-1 Subsoil	0-50 Not recorded
1-15 hard pan stoney	50-81 till
15-45 till	81-101 tight sand and gravel
45-49 sandy soil	101-108 grey clay
49-174 boulder and till	108-142 tight sand and gravel
174-195 damp till	142-147 hard pan
195-235 till wet with sand lenses	147-158 sand, and silt 158+ clay and till
Static water – 155ft	*Static water – 140 ft*
Screen Interval – N/A *Bottom of casing 235*	*Screen Interval – N/A* *Bottom Casing @ 297*

Figure 3-1 (bottom): Groundwater wells (BC Water Resources Atlas)

Alternative 20 Properties



Table 3-2: Alternative 18 and 19 Properties - Groundwater wells Lithology and groundwater

Well 23863 (ft)	**Well 30989 (ft)**	**Well 74141 (ft)**	**Well 74140 (ft)**	**Well 7419 (ft)**
0-103 Till	0-20 Stoney grey clay boulder	1-17 brown clay to grey clay	2-10 brown clay and gravel	0-2 Top soil
113-111 Clay	20-44 Cemented gravel	17-39 till and boulders	10-48 Till and boulders	2-15 Brown Clay
111-114 Till	44-85 stoney grey till	39-43 dry sand and gravel	48-147 Clay and gravel to sand and gravel	15-47 Till and cobbles
114-123 Sand and Gravel	85-104 Clay	43-120 sandy to hard packed till	147-228 Water bearing till/sand and gravel	47-53 Stoney clay
123 -127 fine sand and gravel	104-115 Sand medium gravel	120-192 sand and gravel		53-150 Gravels and cobbles, layer of clay
	115-121 Coarse sand, grey clay	192-303 Till		150-177 Hard packed silt and sand
		303-306 sand and gravel		177-186 Water bearing sand and gravel
Static water – 60ft	*Static water – 80 ft*	*Static water – 175 ft*	*Static water – 138 ft*	*Static water – 136 ft*
Screen Interval 122-127, Bottom of casing 127	*Screen Interval 110-115, Bottom Casing @ 111*	*Screen interval 199-306, Bottom Casing @ 303*	*No screen, Bottom Casing @227*	*No screen, Bottom Casing @186*



Figure 3-2 (left): Groundwater wells (BC Water Resources Atlas)

Alternative 18 and 19 Properties

4 Discussions

The information provided in this desktop study indicates that Alternative 18,19, and 20 properties are considered feasible for substation development and there are no significant geotechnical concerns at any of the properties being considered for purchase based on this screening level assessment. We would expect properties nearby of the studied sites that similar conditions exist based on surficial geology mapping, terrain, and groundwater well logs.

Shallow foundation for substation development for *Alternative 18, 19, and 20 properties* is considered feasible if constructed below frost depth (minimum 450 mm depth). No deep ground improvement works are required with exception of general site prep works that include clearing, grubbing, and stripping to expose the shallow native till-like soils. The actual depth of stripping to expose suitable subgrade will depend on site specific conditions ascertain from future site investigative works. The upper till-like soils are likely over consolidated and not prone to long term settlement unless subject to significant long term and excessive surcharge. The native fine grained, cohesive till-like, organic free soils may be rehandled and reused for non-structural loading use such as general landscape fill if moisture controlled and compacted with appropriate

compaction method such as sheepsfoot roller. Stringent erosion and sediment control measures using sediment tanks, sediment ponds, swales, gravel pads, and erosion control mattings will be required during construction to manage runoff and effluents on this site due to large scale civil works and soil disturbance expected for this development. Road improvement works adjacent to the properties will likely be required to facilitate the construction and maintenance equipment for the substation; and transmission/distribution assets. There may be additional civil constraints from nearby re-development (townhouse development and greenways) that may impact the substation development. It is assumed site servicing will be through external infrastructures and a groundwater well for domestic use will not be required.

Natural geotechnical hazards (flooding, liquefaction, and landslides) are unlikely to exist on this site. There are no classified drainage water courses on the properties and the land are not subject to flooding based on the City of Surrey's Hazard Lands Development Permit Area. The gentle gradient on this site suggest that re-levelling works would be minimal; hence the final grades may be supported by short landscape retaining walls or using stable slope configuration.

Foundation settlement risks are possible if the footings are designed with excessive loads or the site is significantly surcharged due to fine grained compressible (clay) soils at this site. A detailed site investigation will be required to ascertain suitable bearing capacity and expected settlement for the footings.

The seismic site class on these properties is likely a Site Class C or D as defined in the 2020 National Building Code and based on Soil Hazard Map of the Lower Mainland of the lower mainland of British Columbia for assessing the earthquake hazard due to lateral ground shaking[4]. The sites are considered to have very low susceptibility to liquefaction based on recent micro-zonation mapping[5] of the lower mainland; however, there can be local soil conditions that may not be captured in the mapping. This will need to be confirmed in a subsequent detailed geotechnical investigation. Buildings in the generally vicinity (ex. townhouses, residential dwelling), including BC Hydro's Fraser Valley Operation Centre approximately 1 km away, were constructed using conventional shallow footings without structurally tied and/or ground improvement works, suggesting the soils are competent.

[4] Monahan, Patrick, 2005. Soil hazard map of the lower mainland of British Columbia for assessing earthquake hazard due to lateral ground shaking

[5] A. Javanbakht, S.r.,, Adhikari, M.Salsabili, A. Bilson Darko, S., Molnar, 2024. MVSMMP Map 03, Level 1-2 Liquefaction Susceptibility Map

Due to the poor draining soils at Alternative 18 to 20 and the proximity of Latimer Creek at Alternative 18, an appropriately sized storm water management system (water detention system) and oil water separator system is recommended for the substation development. It is very likely any storm runoff from the site will discharge into a municipal storm system which then drains into Latimer Creek or natural watercourses. Significant changes to natural flow regimes into Latimer Creek can have significant impacts downstream (ex. erosion, landslide, loss of natural habitat and vegetation, etc.).

For Alternative 20 and portions of land in Alternative 18 and 19, there are historical land residential/light farming use that may result in the following non-exhaustive risks:

- Oil tanks,
- Buried demolished building foundation,
- Buried septic systems,
- Unlicensed groundwater well,
- Buried irrigation systems,
- Buried contaminated soils or building material,
- Reclamation, and deleterious soils (stockpiled or buried), and last but not least,
- Buried stormwater system that are filled with compressible sediments (ponds and swales)

Alternative 20 properties on Lot 45999 and Lot 46000 appear undeveloped and are unlikely to have pre-existing non-natural imported fill or buried infrastructures; however, this should be confirmed at a later time through detailed discussions with the landowner and subsequent geotechnical investigation.

5 Recommendations

We recommend engaging with the landowners to identify whether these risks exist, completing shallow test pits and drill holes to estimate stripping requirements and soil class, and facilitating an utility locate (electromagnetic and ground penetration radar) where necessary. Soil sampling and testing for contaminated soils is recommended. It may be favorable to rehandle and stockpile deleterious soils on the property should there be sufficient real-estate with the proposed substation development.

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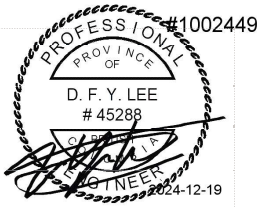
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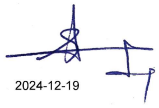
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Appendix D
TM0592 Willoughby Substation Property Purchase
Overhead Transmission Assessment

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TM-0592 Willoughby Substation Property Purchase Overhead Transmission Assessment

Engineering Memo

Subtitle

Memo Number	Revision	Information Security Classification
414V-TEM-00002	0	BC Hydro Internal

To:	David Chwaklinski, Project Engineer	Date	2025 Mar 04
From:	Craig Steels, Consultant, BC Hydro		
Copy:	[Comments]		

Related Facilities

1 Background

Refer to statement of needs document ID 5096. From that document:

Willoughby is a fast-growing area of the Township of Langley which is presently supplied by MLN substation. MLN will have no station capacity and feeder positions available after F2032. A new substation is required by F2032 in the area to meet the future load growth and electrification needs.In order to meet the timeline of a new substation, a piece of property suitable for 230/25kV, 200MVA outdoor substation needs to be purchased as soon as possible.

2 Statement of Needs Overhead Transmission Requirements

The statement of needs document lists the overhead transmission requirements as follows:

The property should have acceptable egress/ingress on at least three sides for 230kV transmission lines and 25kV distribution feeders.

3 Transmission Planning ScopeNotes

None.

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4 Details

4.1 Substation connection(s)

The new substation will be connected to Maclellan substation (MLN).

4.2 Circuit Requirements

Two 230 kV connections are required between the new substation and MLN. Provision for two future 230 kV circuits has been requested by Transmission planning however other than provision for line terminal space in the station no route analysis is conducted as part of this memo.

5 Prospective Properties and Routing Options

A Google Earth screenshot of the project location is below. The target properties are located North of MLN. Prospective properties are shown with Google Earth pins. The red areas on the map are high-density areas where routing overhead transmission lines is unlikely.

Transmission planning has indicated a desire to connect at MLN and not to route overhead to the west to FLW. Due to the dense urbanization between the target area and MLN, overhead transmission is unlikely and underground transmission cables are likely required. The most direct route appears to be along 196th street.

At the time of this memo, there are three properties under consideration: alternative 14b, alternative 18, and alternative 20. They are shown as google earth pins in figure 1 below, along with a yellow box for the load centre.

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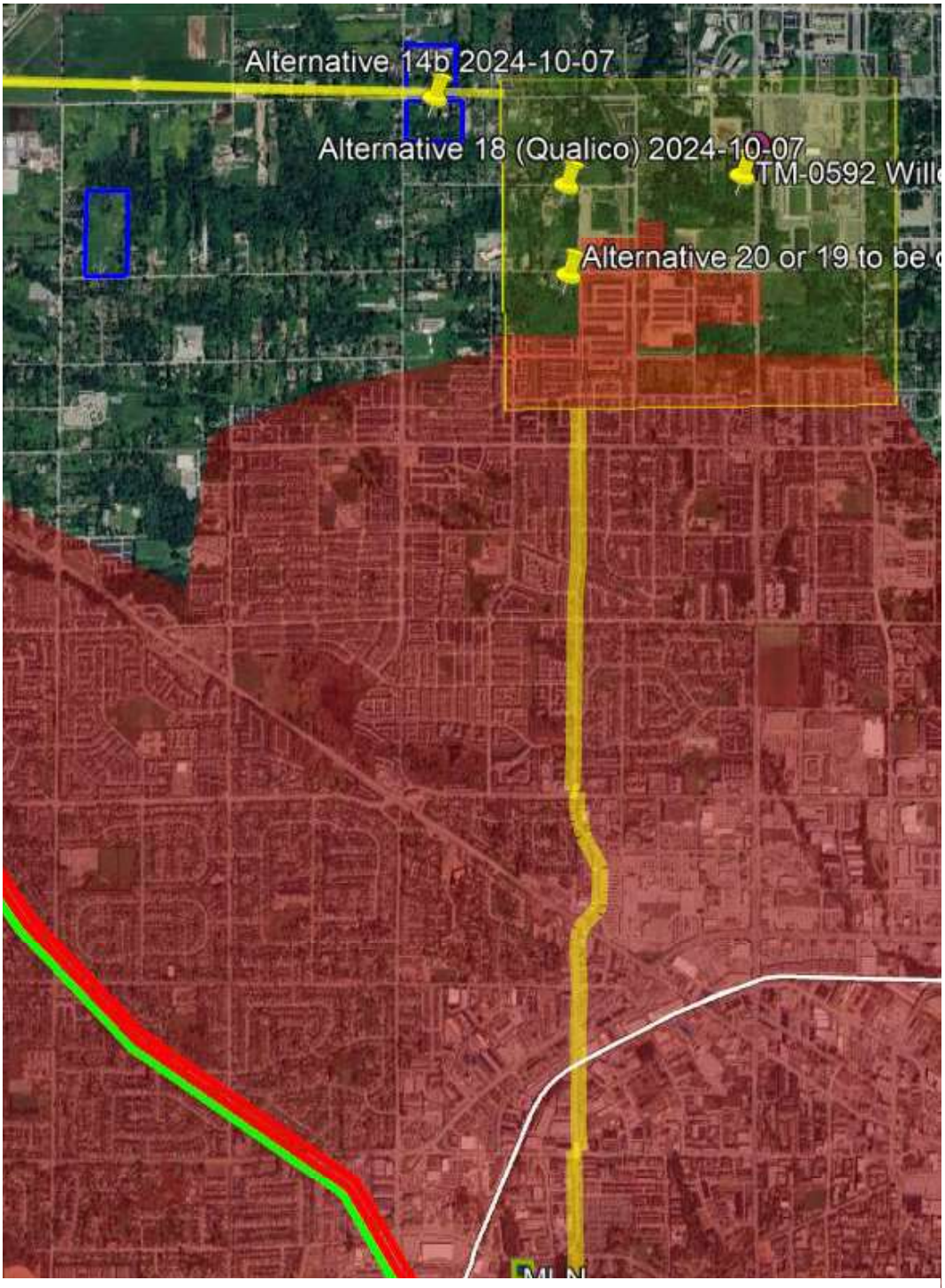


Figure 1 Project Area with Prospetive property pins, possible route to MLN in yellow, and high-density development shown with red shading

The proposed property/properties as of this memo are:

5.1 Alternative 14b

5.1.1 Location description

The property is located at 80th avenue and 192nd street. It appears generally flat.

5.1.2 Ingress/Egress for transmission circuits

This property appears to be open on all sides and to have the best potential overhead transmission access of all the properties considered.

5.1.3 Notes

- This property is close to the Agricultural Land Reserve to the North and the West.
- This option appears to be the most favourable from an overhead lines perspective provided a tap connection to 2L075 or connection to Fleetwood Substian is considered as shown in figure 2 below. Note that this would require crossing 2 x 500 kV circuits and 1 x 230 kV circuit.
- This property likely meets the requirement for overhead transmission and distribution connections outlined in the statement of needs document listed in section 2 above.
- If the connection to McLellan is not reconsidered Underground transmission cables will likely be required to route to MLN.

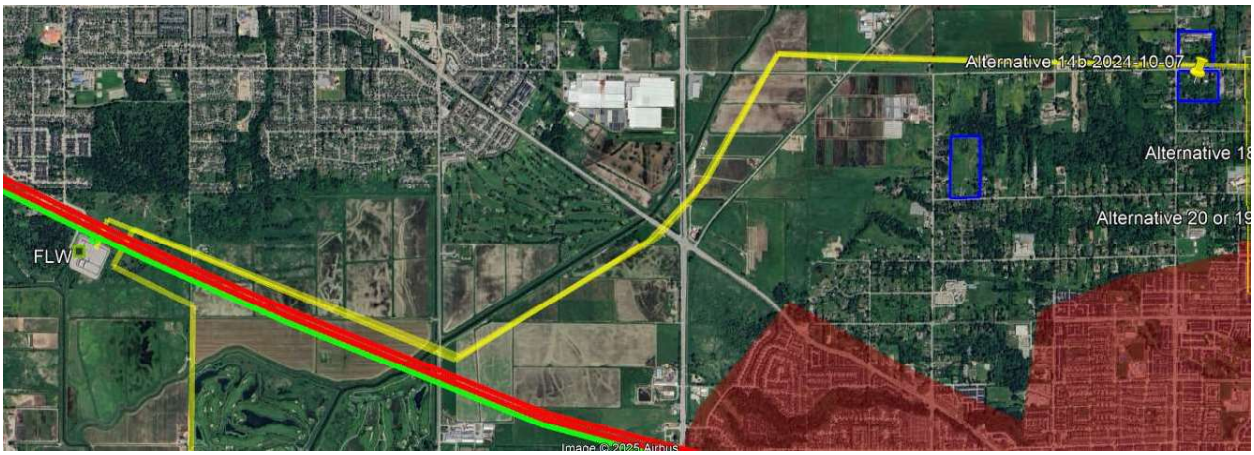


Figure 2 Possible Overhead Transmission route to FLW or 2L027 through the Agricultural Land Reserve

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Figure 3 Alt 14 Location

5.2 Alternative 18

5.2.1 Location description

The property is located at 78th avenue and 196th street. It appears flat.

5.2.2 Ingress/Egress for transmission circuits

It appears that overhead transmission connections may be possible on the North, East, South, West side(s).

5.2.3 Notes

- This property appears to be blocked on the east side by high-density housing.
- Maddaugh Elementary School is on the SW side

- This property does not likely meet the requirement for overhead transmission and distribution connections outlined in the statement of needs document listed in section 2 above. Underground transmission cables will likely be required to route to MLN.



Figure 4 Alt 18 and Alt 20 Location

5.3 Alternative 20

5.3.1 Location description

The property is located at 76th avenue and 196th street. It appears flat.

5.3.2 Ingress/Egress for transmission circuits

It appears that overhead transmission connections may be possible on the North, and West side.

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5.3.3 Notes

- This property appears to be “hemmed in” by high-density housing development on the East and South sides, and Maddaugh Elementary School on the NW side.
- Overhead transmission connections (and any additional overhead connections) may not be possible.
- This property does not likely meet the requirement for overhead transmission and distribution connections outlined in the statement of needs document listed in section 2 above. Underground transmission cables will likely be required to route to MLN.

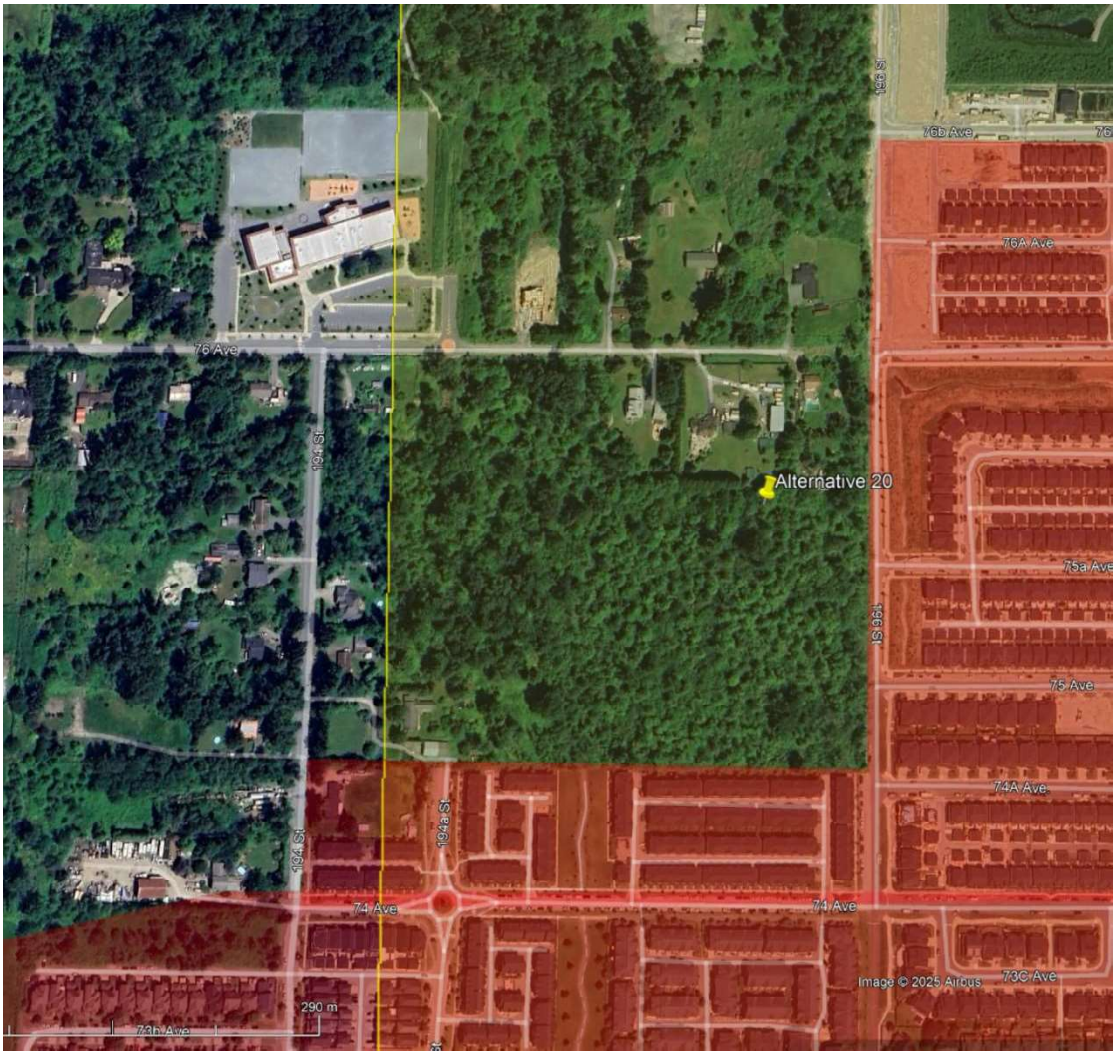


Figure 5 Alt 20 Location

6 Conclusion

The area between McLellan substation and the service area is highly-densified. This makes transmission routing difficult. Underground cables are likely required but overhead options should still be considered.

The most likely transmission routes are along major corridors: 192nd street, 196th street, 200 street. Crossings include CPKC railway and 60L007MLN/60L008MLN which run in the same corridor, as well as the future SkyTrain extension. Project experience on these circuits in Langley for Surrey Langley Skytrain project indicates that the soil is weak/sensitive clay which may pose some difficulty for foundations construction for tall overhead transmission structures. Geotech team should be consulted early on.

A transmission connection from McLellan on 196th to alternatives 18 or 20 may be difficult for two lines. 192nd may be a better route for at least one circuit making site 14B preferable over 19/20 which is hemmed in by on-going development and more restricted roads/ paths passing through the area to the south and east. Alternative 20 is not accessible from the south, east or north due to existing housing and the proximity of Maddaugh Elementary School. Alternative 18 is partially blocked on the west by Maddaugh Elementary School, is blocked on the east by housing, and is likely to be become blocked to the south by future housing development. Alternative 14b is the most accessible site as it is not blocked on any side by high-density housing, although it may become so in future.

A more likely overhead connection is to Fleetwood (FLW) substation rather than McLellan (MLN) substation, but Transmission Planning has indicated the connection shall be to McLellan substation. Albertative 14b gives the best possibility for a future connection to FLW in case that is considered for more inter-connectivity of the system.

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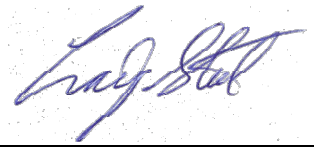
any information, product or process disclosed, described or recommended in this memo.

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Prepared by:



Craig Steels, P.Eng, Overhead Lines Engineer, BC Hydro



Checked by:

Himanshu Mathur

Himanshu Mathur, P.Eng, Team Lead, Overhead Lines, BC Hydro

Reviewed by:

Himanshu Mathur

Himanshu Mathur, P.Eng, Team Lead, Overhead Lines, BC Hydro

Accepted by:



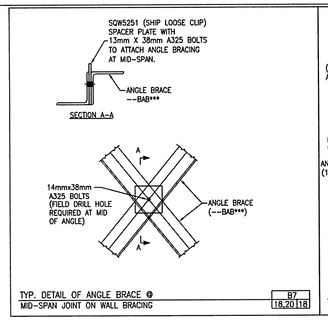
David Chwaklinsky, Project Engineer, BC Hydro

Secondary Part Schedule

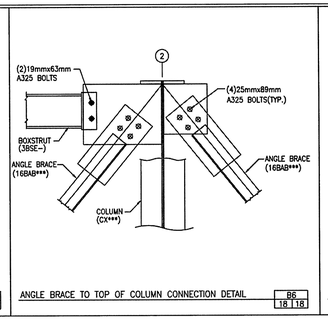
Mark	Part	Thick.	Depth	Lap	Detail
G8	08Z2007615EEF0	1.85	216		WS01H2,WSR004
G24	08Z1911614KKF0	2.01	216		WS01H2,WSR004,WS01K2
G10	08Z2007616EEF0	1.73	216		WS01H2,WSR004
G11	08Z2009715EEF0	1.85	216		WS01H2
G25	08Z2001714KKF0	2.01	216		WS01H2,WS01K2
G13	08Z2009716EEF0	1.73	216		WS01H2
G14	00408ZS200761410	2.01	216		WS01H2,WSR004
H2	00308JS0311217	1.52	216		WS20F9
H3	DHC03112217	0.00	216		WS21D7
J2	0040BJS0404417	1.52	216		WS20B2,WS20H2

◯ Framed Opening Locations

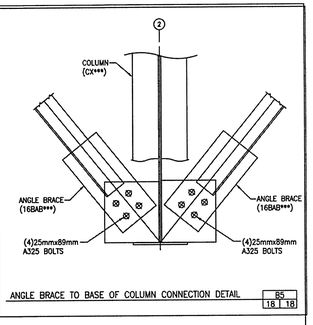
Id	Width	Height	Sill Ht.	Frame	To	Dimen.
F01	1200	400	4085	3	Jamb-L	2195
F01	1200	400	4085	4	Jamb-L	1015
F01	1200	400	4085	5	Jamb-L	1135
F01	1200	400	4085	1	Jamb-L	1900
F01	1200	400	4085	2	Jamb-L	2075



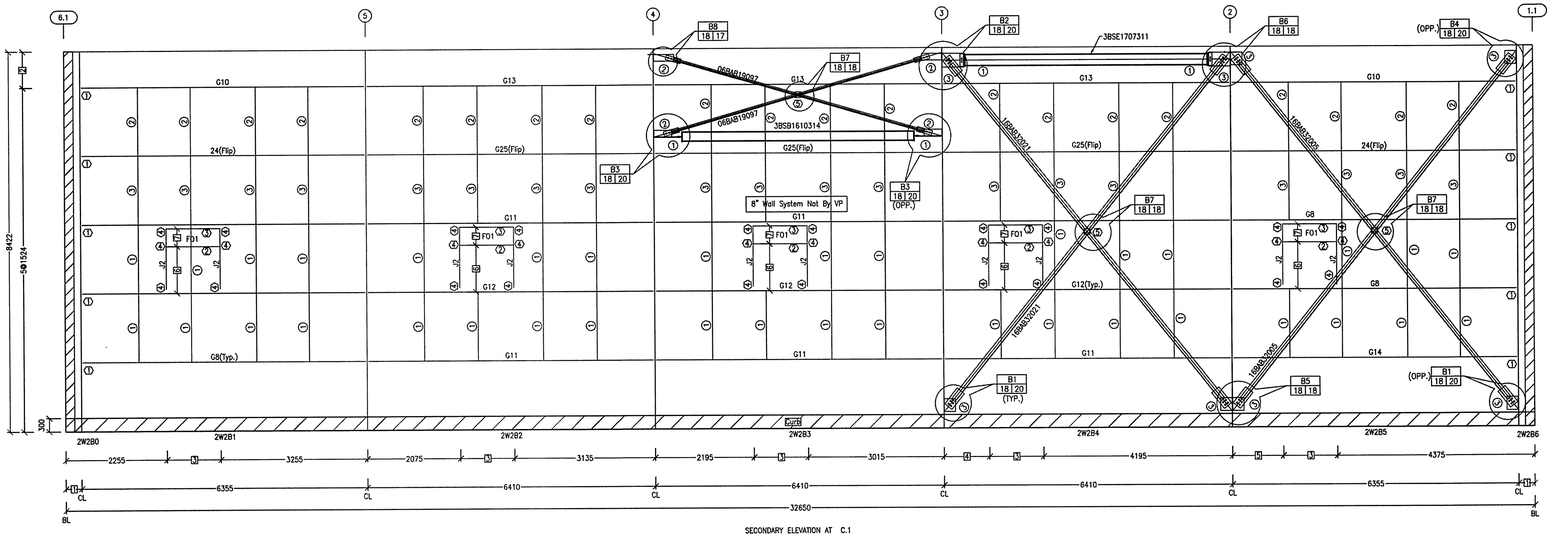
TYP. DETAIL OF ANGLE BRACE @ MID-SPAN JOINT ON WALL BRACING — B7 | 18,20|18



ANGLE BRACE TO TOP OF COLUMN CONNECTION DETAIL — B6 | 18 | 18



ANGLE BRACE TO BASE OF COLUMN CONNECTION DETAIL — B5 | 18 | 18



SECONDARY ELEVATION AT C.1

Id	Width	Height	Sill Ht.	Frame	To	Dimen.
7	400					
6	1037					
5	1135					
4	1015					
3	1200					
2	802					
1	355					

Dimension Key ◯ Part Mark Key

Bracing Part Schedule

	Part	Qty	Length	Detail
5	045SP050020050	1	5293	B3 (Ref page:20)
4	PG1	4	6071	B3,B8 (Ref page:17,20)
3	H3	3	9662	B1,B6 (Ref page:20)
2	H2	2	9735	B4,B5,B6 (Ref page:20)
1	GFA106	1	16BAB31112	

◯ Framed Opening Locations

Id	Qty	Mark No	Spacing
1	35	CPBB050108	1524
2	20	CPBC050306	1524
3	20	CPBA041110	1524

See SED: BRR004,BRR005,BRR006

Rod and Strut Bolts

Id	Qty	Grade	Bolt Diam.	Bolt Length	PartNo
1	2	A325	19	63	0097284
2	2	A325	25	89	0097288
3	4	A325	25	89	0097288

Shape Name = Substation, Wall = 2

1. UNLESS NOTED, USE 1/2 X 1 1/2 A325-N BOLT (49080) AND NUT (47120) W/O WASHERS. SNUG TIGHTEN BOLTS FOR ALL SECONDARY CONNECTIONS.
2. FLANGE BRACES ARE AN INTEGRAL PART OF THE STABILITY OF THE STRUCTURAL SYSTEM AND MUST BE PROPERLY INSTALLED PRIOR TO ERECTION OF WALL AND ROOF SHEETS.
3. REMOVAL OR ALTERATION OF ANY COMPONENT IS PROHIBITED.

THE VP ENGINEER'S SEAL APPLIES ONLY TO THE WORK PRODUCT OF VP AND DESIGN AND PERFORMANCE REQUIREMENTS SPECIFIED BY VP. THE VP ENGINEER'S SEAL DOES NOT APPLY TO THE PERFORMANCE OR DESIGN OF ANY OTHER PRODUCT OR COMPONENT FURNISHED BY VP EXCEPT TO ANY DESIGN OR PERFORMANCE REQUIREMENTS SPECIFIED BY VP.

THIS DRAWING, INCLUDING THE INFORMATION HEREON, REMAINS THE PROPERTY OF VP BUILDINGS. IT IS PROVIDED SOLELY FOR ERECTING THE BUILDING DESCRIBED IN THE APPLICABLE PURCHASE ORDER AND SHALL NOT BE MODIFIED, REPRODUCED OR USED FOR ANY OTHER PURPOSE WITHOUT PRIOR WRITTEN APPROVAL OF VP BUILDINGS.

THE GENERAL CONTRACTOR AND/OR ERECTOR IS SOLELY RESPONSIBLE FOR ACCURATE GOOD QUALITY WORKMANSHIP IN ERECTING THIS BUILDING IN ACCORDANCE WITH THIS DRAWING, DETAILS REFERENCED IN THIS DRAWING, ALL APPLICABLE VP BUILDINGS ERECTION GUIDES, AND INDUSTRY STANDARDS PERTAINING TO PROPER ERECTION, INCLUDING THE CORRECT USE OF TEMPORARY BRACING.

VP Buildings
3200 Players Club Circle Memphis TN 38125

REV	DATE	BY	DESCRIPTION
0	11/09/2016	VP	AS CONSTRUCTED

NTS

11/5/2014 14:08:32

SECONDARY ELEVATION AT C.1

BUILDER	LoadPath Industrial Inc.
CUSTOMER	BC Hydro
LOCATION	Victoria, British Columbia
PROJECT	Horsey Substation – 230kV GIS Building
BUILDERS POF	VP Quote #140190 Rev2
FILENAME:	FT- Horsey Substation Revised 14-06-10 Rev2

VP BUILDINGS VARCO PRUDEN — A BlueScope Steel Company — VPC VERSION: 2014.1d — a division of BlueScope Buildings North America, Inc.

JOBNO 14-011720-01 | DATE 11/12/2014 | DRAWN/CHECK STS DKR | PAGE 18

C. W. WALKER — 19278 — PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — 4.12.18

ACCEPTED
Without relieving the Contractor from any obligations under the contract
Name: A. Lepage
Date: 2018 Nov 06
Siemens Canada Ltd.

The seal and signature of the undersigned on this drawing certifies that the design information contained in these drawings accurately reflects the original design and the material design changes made during construction, that were brought to the undersigned's attention. These drawings are intended to incorporate addenda, change orders and other material design changes, but not necessarily all site instructions.
The undersigned does not warrant or guarantee, nor accept any responsibility for the accuracy or completeness of the as-constructed information supplied by others contained in these drawings, but does, by sealing and signing, certify that the as constructed information, if accurate and complete, provides an as-constructed system which substantially complies in all material respects with the original design intent.

HORSEY SUBSTATION

230kV GIS BUILDING
SECONDARY ELEVATION AT C.1

REF#	DRAWING NUMBER	TITLE

REFERENCE DRAWINGS

REF#	DRAWING NUMBER	TITLE

REFERENCE DRAWINGS

NO	REMARKS	DATE	DESIGNED	INDEP CHK	DFTG	DFTG CHK	INSP	REV	ACPT
0	VARCO PRUDEN – REVISED AS RECORDED	2018-11	AL	KJ	DF				

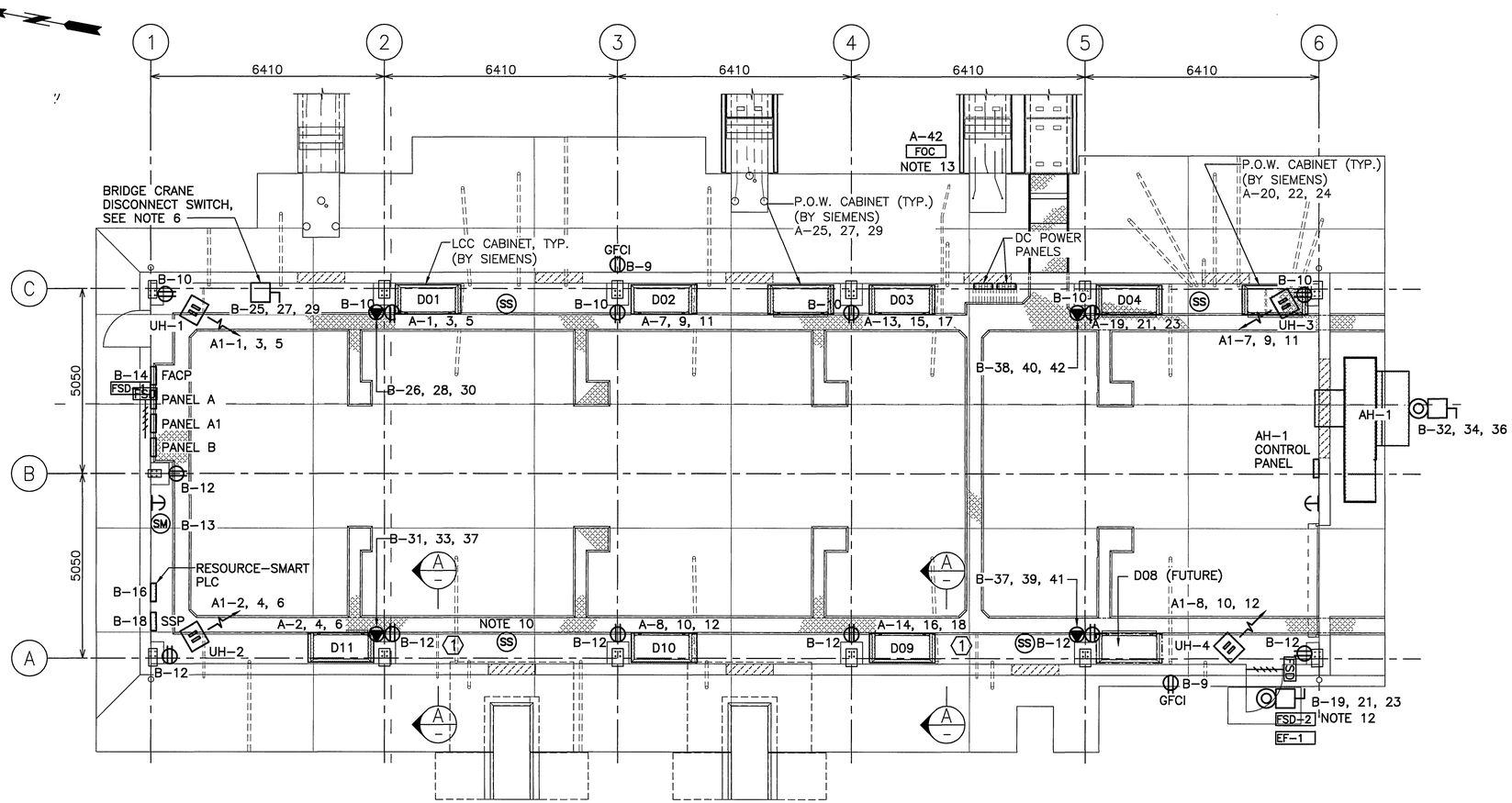
REVISIONS

DIST	DWG NO	SIZE	R
26	552-C05-00308-020	D	0

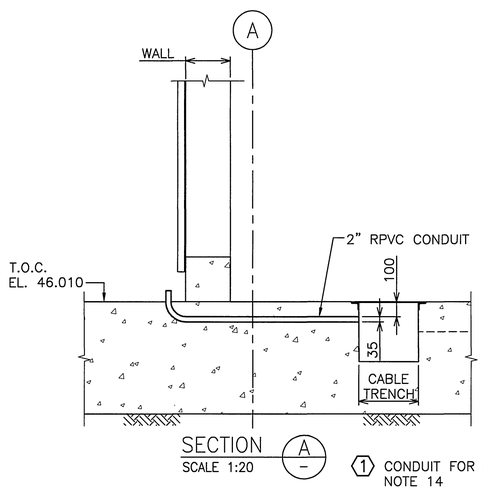
NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

D

Issued for Record Drawing



PLAN
SCALE 1:75



SECTION A
SCALE 1:20

1 CONDUIT FOR OIL RESERVOIR MONITORING NOTE 14

BILL OF MATERIALS FOR SPECIAL ITEMS

ITEM	QTY	DESCRIPTION
1	1	DILO SF6 NETWORK MONITOR, PART No. 3–026–R114
2	4	DILO SF6 AIR SENSOR, PART No. 3–026–R115
3	5	25 m LONG DILO NETWORK LINES PART 3–026–97
4	2	TERMINATING RESISTORS (SUPPLIED WITH DILO SF6 NETWORK MONITOR) NOTE 11
5	1	RUSSELLSTOLL 100A, 3ø MALE PLUG, PART No. DS1416MP000, NOTE 9
6	4	RUSSELLSTOLL FEMALE RECEPTACLE WITH ANGLE ADAPTER AND JUNCTION BOX, PART No. DF1416FRABO, FOR DILO L057 SF6 GAS SERVICE TRUCK

RECORD ISSUE
Seal and signature subject to record drawing declaration.
Reference: E500–A0010

NOTES:

1. DIMENSIONS ARE SHOWN IN MILLIMETRES.
2. ALL CIRCUITS TO LCC AND POW CABINETS TO BE INSTALLED IN CABLE TRENCHES.
3. ALL CONTROL CABLES TO BE INSTALLED IN STEEL EMT CONDUIT OR PVC CONDUIT EMBEDDED IN THE FLOOR SLAB, TO BE DIMENSIONED AND FIELD–RUN BY CONTRACTOR.
4. CIRCUIT TO LCC CABINETS TO BE TERMINATED TO TERMINAL BLOCKS IN CABINETS. REFER TO SIEMENS DRAWINGS FOR DETAILS.
5. REFER TO DRAWING 552–E05–01131 FOR DETAILS OF AC FEEDER CIRCUITS TO LCC AND POW CABINETS.
6. MOUNT 1.5 METRE ABOVE FLOOR. RUN BRIDGE CRANE FEEDER TO DOWNSHOP CONDUCTORS.
7. POWER CABLES TO BUILDING SERVICES TO BE SURFACE MOUNTED TECK CABLE.
8. NOTCH TRENCH COVER PLATES TO SUIT TECK CABLES RUN UP WALL BETWEEN PANELS AND CABLE TRENCH.
9. MALE PLUG TO BE INSTALLED ON EXTENSION CORD SUPPLIED WITH DILO SF6 GAS SERVICE CART.
10. MOUNT SF6 AIR SENSORS 500 ABOVE FLOOR. CONNECT THE AIR SENSORS TO THE SF6 NETWORK MONITOR USING NETWORK LINES AS SHOWN IN THE DILO OPERATING MANUAL.
11. REMOVE TERMINATING RESISTORS FROM NETWORK MONITOR PANEL AND INSTALL IN THE TWO "END" AIR SENSORS.
12. PROVIDE A SIZE 0 STARTER FOR EF–1 WITH AUXILIARY CONTACTS TO OPERATE FSD–1 AND FSD–2 WHEN FAN STARTS. MOUNT STARTER FOR SMOKE EXHAUST FAN EF–1 1500 mm ABOVE FLOOR. SEE MECHANICAL VENTILATION AND HEATING DRAWING 552–M05–00034 AND SPEC. SECTION 23 34 00.
13. FIBRE OPTIC CALIBRATOR PROVIDED AND INSTALLED BY BC HYDRO.
14. WIRING FOR OIL RESERVOIR MONITORING BY BC HYDRO.
15. LCC, POW AND DC PANELS TO BE BONDED. SEE DETAIL 14 ON DRAWING 552–E05–01133 AS EXAMPLE.

LEGEND:

- 120VAC 15A DUPLEX RECEPTACLE
- GFCI — 120VAC 15A DUPLEX RECEPTACLE WITH GROUND FAULT INTERRUPTOR IN WEATHERPROOF BOX.
- 208VAC 40A THREE–PHASE RECEPTACLE, SEE BILL OF MATERIALS ITEM 6.
- DISCONNECT SWITCH
- MOTOR C/W DISCONNECT SWITCH, E.G. EF–1
- SM — SF6 GAS LEAK MONITOR PANEL, SEE BILL OF MATERIALS ITEM 1.
- SS — SF6 GAS LEAK AIR SENSOR, SEE BILL OF MATERIALS ITEM 2.
- ELECTRIC UNIT HEATER
- EF–X — SMOKE EXHAUST FAN
- FSD–X — FIRE SMOKE DAMPER
- 1 — 35 mm CONDUIT FOR OIL RESERVOIR MONITORING, SEE SECTION A
- FOC — FIBRE OPTIC CALIBRATOR, NOTE 13
- FACP — FIRE ALARM CONTROL PANEL
- CRANE EMERGENCY STOP BUTTON
- SSP — SECURITY SYSTEM PANEL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — JOHN W. WOODCOCK

SCALE 1:20 — 400 0 400 800 1200 1600
NOTE: ALL DIMENSIONS ARE IN MILLIMETRES

SCALE 1:75 — 1 0 1 2 3 4 5 METRES
NOTE: ALL DIMENSIONS ARE IN MILLIMETRES

SIEMENS
BPR — INTEGRITY AND IMAGINATION IN ENGINEERING
Klohn Crippen Berger

BCHydro

HORSEY SUBSTATION

230 kV GIS BUILDING
ELECTRICAL SERVICES PLAN

REF#	DRAWING NUMBER	TITLE
2	552–C05–01131	BREAKER SCHEDULE – PANEL A
1	552–C05–00287	FOUNDATION SLAB PLAN

REFERENCE DRAWINGS

NO	REMARKS	DATE	DESIGNED	INDEP CHK	DFTG	DFTG CHK	INSP	REV	ACPT
1	RECORD DRAWING	2018–JAN	J. WOODCOCK	MR	PK				
0	ISSUED FOR CONSTRUCTION								

REVISIONS

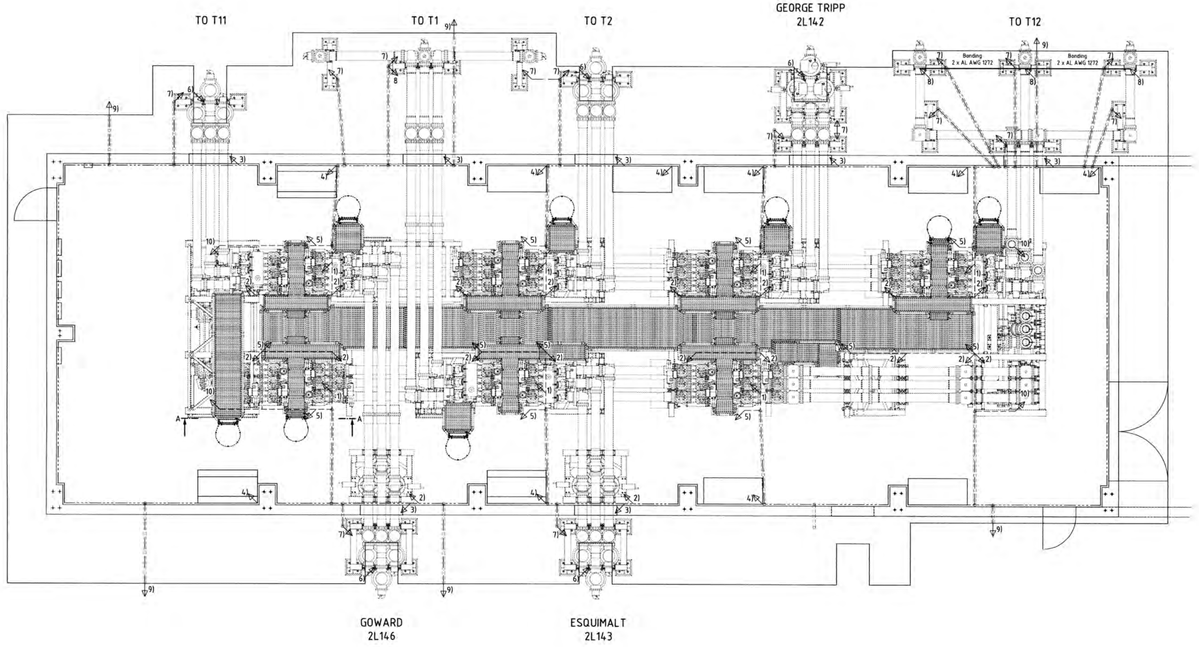
DSGN	R. JONES
INDEP CHK	J. WOODCOCK
DFTG	RW
DFTG CHK	
INSP	
REV	
ACPT	

ORIGINAL SEALED BY J.W. WOODCOCK 2014–11–18

DATE 2014–NOV — DISTR

DWG NO 552–E05–01129 — SIZE D — R 1

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LEGEND

————	flat copper 50x5 mm	(delivered by SIEMENS Germany)
—·—·—	copper cable 2x120 mm²	(delivered by SIEMENS Germany)
— — —	copper cable 2x120 mm²	(delivered by SIEMENS Canada)
—··—··—	earthing ring, e.g. flat copper 50x5 mm	(delivered by SIEMENS Canada)
:::::::	tube Ø80 mm in the foundation	(delivered and installed by civil contractor)

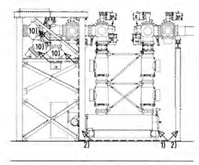
CONNECTION TYPES

1)	connection to the circuit breaker copper cable 2x120 mm²	(delivered by SIEMENS Germany)
2)	connection to the indoor steel structure flat copper 50x5 mm	(delivered by SIEMENS Germany)
3)	connection to the wall frame flat copper 50 x 5 mm	(delivered by SIEMENS Germany)
4)	connection to the local control cubicle copper cable 1x120 mm²	(delivered by SIEMENS Germany)
5)	connection to the walkway copper cable 1x120 mm²	(delivered by SIEMENS Germany)
6)	connection to the cable module copper cable 2x120 mm²	(delivered by SIEMENS Germany)
7)	connection to the outdoor steel structure copper cable 2x120 mm²	(delivered by SIEMENS Germany)
8)	connection to the bonding copper cable 2x120 mm²	(delivered by SIEMENS Germany)
9)	connection to the main earthing system	(delivered by SIEMENS Canada)
10)	connection to the busbar flat copper 50x5 mm	(delivered by SIEMENS Germany)

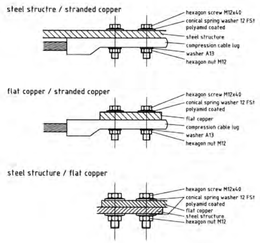
Thermal design of earthing conductors :

fault current	50 kA
max. fault duration	1 s
max. temperature of earth conductor	300°C

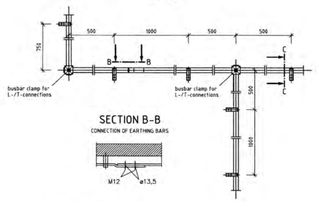
SECTION A-A



TYPICAL EARTHING CONNECTIONS
NOT TO SCALE

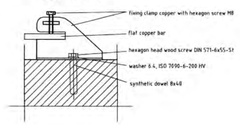


FIXING OF FLAT COPPER
NOT TO SCALE

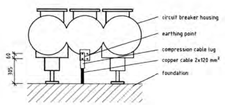


SECTION B-B
CONNECTION OF EARTHING BARS

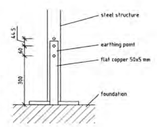
SECTION C-C



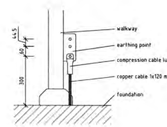
DETAIL FOR CONNECTION TYPE 1
NOT TO SCALE



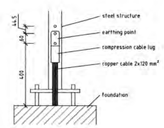
DETAIL FOR CONNECTION TYPE 2
NOT TO SCALE



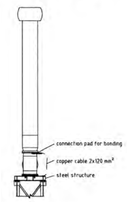
DETAIL FOR CONNECTION TYPE 5
NOT TO SCALE



DETAIL FOR CONNECTION TYPE 7
NOT TO SCALE



DETAIL FOR CONNECTION TYPE 8
(not to scale)



THIS EARTHING PLAN ONLY SHOWS THE MEASURES FOR THE EARTHING OF THE HIGH VOLTAGE EQUIPMENT

FOR EARTHING ONLY!

DO NOT SCALE WORKING DIMENSIONS

AS BUILT

Rev	Remarks	Date	Name
R1	as built	24.08.2017	Lu
R0	as built	25.11.2016	Lu
C	(out of supply added	21.08.2014	Lu
B	modification according to new GIS layout	14.04.2014	Lu
A	building updated	11.09.2012	Lu

1:10	n	-	/
BC Hydro Horsey 230 kV		8DN9-Switchgear 230 kV	
	Date 06.06.2012 Drawn Lutwig Appr. D. Jahn Note	Plan View and Details Earthing Plan	
	Siemens AG	(0) E50115 - A7807 - V131 - R1	Sheet 1/1

REF#	DRAWING NUMBER	TITLE
		REFERENCE DRAWINGS

REF#	DRAWING NUMBER	TITLE
		REFERENCE DRAWINGS

NO	REMARKS	DATE	DESIGNED	INDEP CHK	DFTG	DFTG CHK	INSP	REV	ACPT
0	SNC LAVALIN T&D - 507842: REVISED AS RECORDED	2017-10		RY	AQ	JH			

REVISIONS

HORSEY SUBSTATION

230kV SWITCHGEAR
EARTHING PLAN
PLAN VIEW AND DETAILS

DWG NO 552-E05-02191 | SIZE D | R 0

ACCEPTED
Without Relieving the Contractor from any obligations under the contract
Name: R. YOUSSEFI
Date: 2017 OCT
SNC-LAVALIN T&D

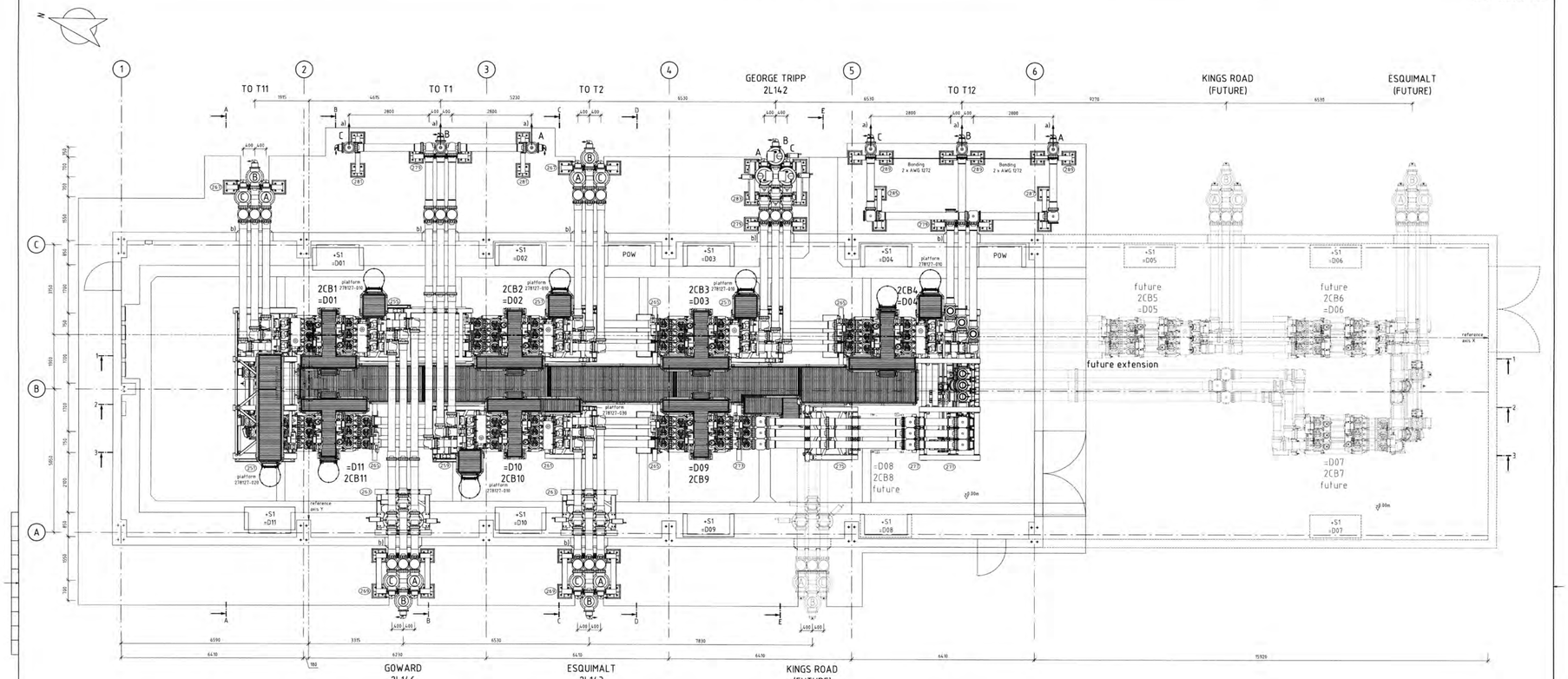
The *seal* and signature of the undersigned on this drawing certifies that the design information contained in these drawings accurately reflects the original design and the material design changes made during construction, that were brought to the undersigned's attention. These drawings are intended to incorporate addenda, change orders and other material design changes, but not necessarily all site instructions.

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Issued for Record Drawing

NOT TO BE REPRODUCED WITHOUT PERMISSION

3AC 60Hz, 253kV, Ia= 50kA



a) maximum 1 kN static conductor tension
maximum 3 kN short circuit force

b) Direc wall sealing (drawing E50115-W0152-B321)

(xxx) The number within the ellipse is equivalent to the steel-drawing-number:

E50115 - A7807 - Bxxx

AS BUILT

Rev	Remarks	Date	Name
R1	as built	24.08.2017	Lu
J	additional platforms	02.06.2017	Lu
RO	as built	25.11.2016	Lu
I	as marked	02.06.2014	Lu
H	steel structures and walkway added	18.04.2014	Lu
G	one additional bay (304), GIL connection for feeder T1 (LO70) and T12 (LO64), VT for feeder George Tripp (LO93)	14.10.2013	Lu
F	steel structures added	11.09.2012	Lu
E	future building updated	06.08.2012	Lu
D	building updated	05.07.2012	Lu
C	building modified according to customer requirements customer bay designation added	06.06.2012	Lu
B	GIS modified (1-pole busbar)	10.05.2012	Lu
A	GIS modified (according to single line diagram)	29.03.2012	Lu

Scale 1:50			/

BC Hydro
Horsey 230 kV

8DN9-Switchgear
230 kV

Dsn. 08.02.2012
Drawn [Lo/Ber]
Appr. [Lakra]
Date [ ]

Plan View

Location Diagram

Siemens AG (0) E50115 - A7807 - V021 - R1

Sheet 1/1

HORSEY SUBSTATION

230kV SWITCHGEAR
LOCATION LAYOUT
PLAN VIEW

DATE | DWG NO | SIZE E | R 0

NOT TO BE REPRODUCED WITHOUT PERMISSION

MINIMUM CLEARANCES IN AIR
acc. to IEC 61936-1

Conductor-Conductor (mm)	Conductor-Earth (mm)		
2100	2100	Rated Voltage	253 kV
		Rated Lightning Impulse Withstand Voltage	1050kV
		Rated Switching Impulse Withstand Voltage	– kV

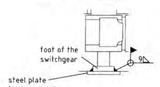
In accordance with the standard IEC 61936-1 Chapter 3.2.1 it is obligatory for the user to comply all requirements which concern an enclosed electrical operating area.

Reference Drawing:		
(E)	E50115-A7807-S005	Single Line Diagram
(E)	E50115-A7807-V023	Sections 1-1, 2-2, 3-3
(D)	E50115-A7807-V025	Section A-A, B-B, C-C
(D)	E50115-A7807-V027	Section D-D, E-E
(1)	E50115-W0152-B321	Wall sealing

Building according to customer's drawing number: APM0150-E35-000

DO NOT SCALE WORKING DIMENSIONS

Fixing of the circuit breaker
not to scale



REF#	DRAWING NUMBER	TITLE

REFERENCE DRAWINGS

NO	REMARKS	DATE	DESIGNED	INDEP CHK	DFTG	DFTG CHK	INSP	REV	ACPT
0	SNC LAVALIN T&D - 507842: REVISED AS RECORDED	2017-10		RY	AQ	JH			

REVISIONS

ACCEPTED
Without Relieving the Contractor from any obligations under the contract
Name: R. YOUSSEFI
Date: 2017 OCT

SNC-LAVALIN T&D

The seal and signature of the undersigned on this drawing certifies that the design information contained in these drawings accurately reflects the original design and the material design changes made during construction, that were brought to the undersigned's attention. These drawings are intended to incorporate addenda, change orders and other material design changes, but not necessarily all site instructions.

The undersigned does not warrant or guarantee, nor accept any responsibility for the accuracy or completeness of the as-constructed information supplied by others contained in these drawings, but does, by sealing and signing, certify that the as-constructed information, if accurate and complete, provides an as-constructed system which substantially complies in all material respects with the original design intent.

HORSEY SUBSTATION

230 kV SWITCHGEAR
LOCATION LAYOUT
PLAN VIEW

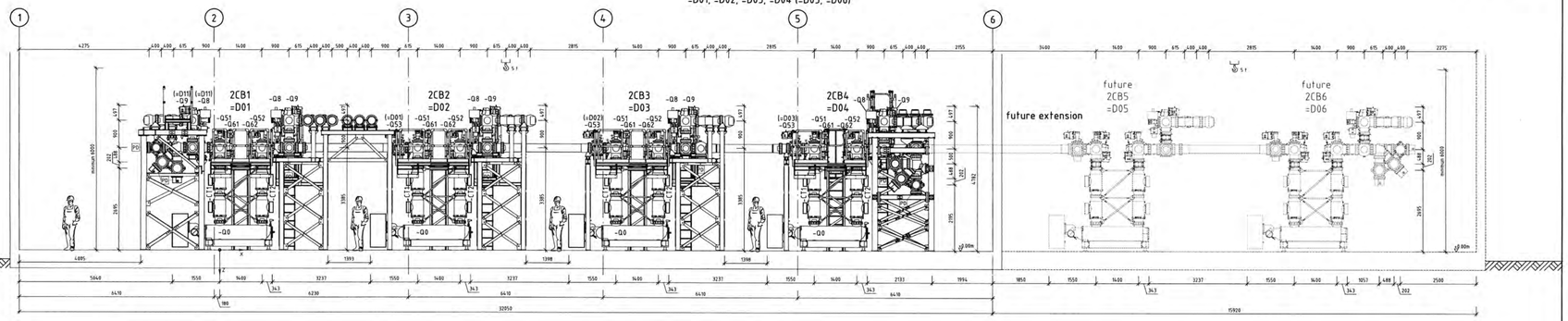
DISTR | DWG NO 552-E05-02250 | SIZE D | R 0

NOT TO BE REPRODUCED WITHOUT PERMISSION

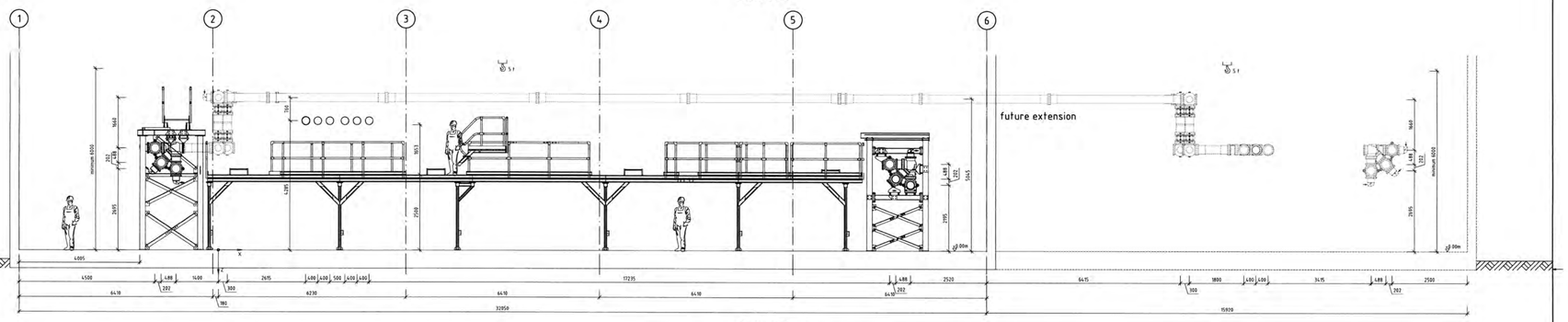
Issued for Record Drawing

3AC 60Hz; 253kV; Ia= 50kA

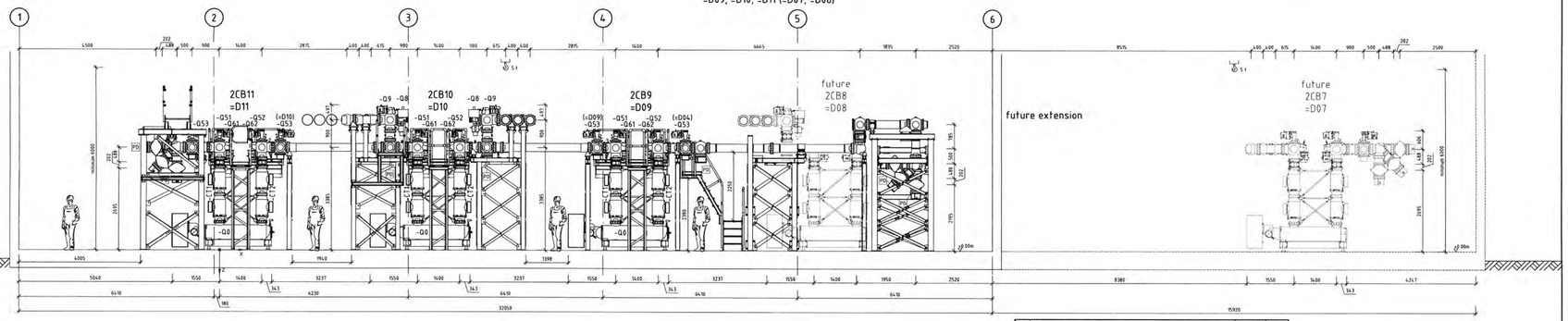
Section 1-1
=D01, =D02, =D03, =D04 (=D05, =D06)



Section 2-2



Section 3-3
=D09, =D10, =D11 (=D07, =D08)



DO NOT SCALE WORKING DIMENSIONS

PD partial discharge monitoring sensor

* viewing window

Rev	Remarks	Date	Name
R1	as built	24.08.2017	Lu
H	additional platforms	02.06.2017	Lu
RR	as built	25.11.2016	Lu
G	grid lines added, overhead clearance section 2-2 added	02.06.2016	Lu
F	steel structures and walkway added	10.04.2015	Lu
E	one additional bay =D04, GIN connection for feeder T11 (=D11) and T12 (=D04), VT for feeder George Tripp (=D03)	14.10.2013	Lu
D	steel structures added, reference designation CT, VT changed	11.09.2012	Lu
C	building modified according to customer requirements; crane height added customer bay designation added, PD sensors marked, viewing windows marked	06.06.2012	Lu
B	GIS modified (1-pole busbar)	18.05.2012	Lu
A	GIS modified (according to single line diagram)	29.03.2012	Lu

AS BUILT

BC Hydro
Horsey 230 kV

BDN9-Switchgear
230 kV

Sections 1-1, 2-2, 3-3

Location Diagram

Siemens AG (E) E50115 - A7807 - V023 - R1

Sheet 1-1

HORSEY SUBSTATION

230kV SWITCHGEAR
LOCATION LAYOUT
SECTIONS 1-1, 2-2, 3-3

DWG NO 552-E05-02251

SIZE E R 0

ACCEPTED
Without Relieving the Contractor from any obligations under the contract
Name: R. YOUSSEFI
Date: 2017 OCT

SNC-LAVALIN T&D

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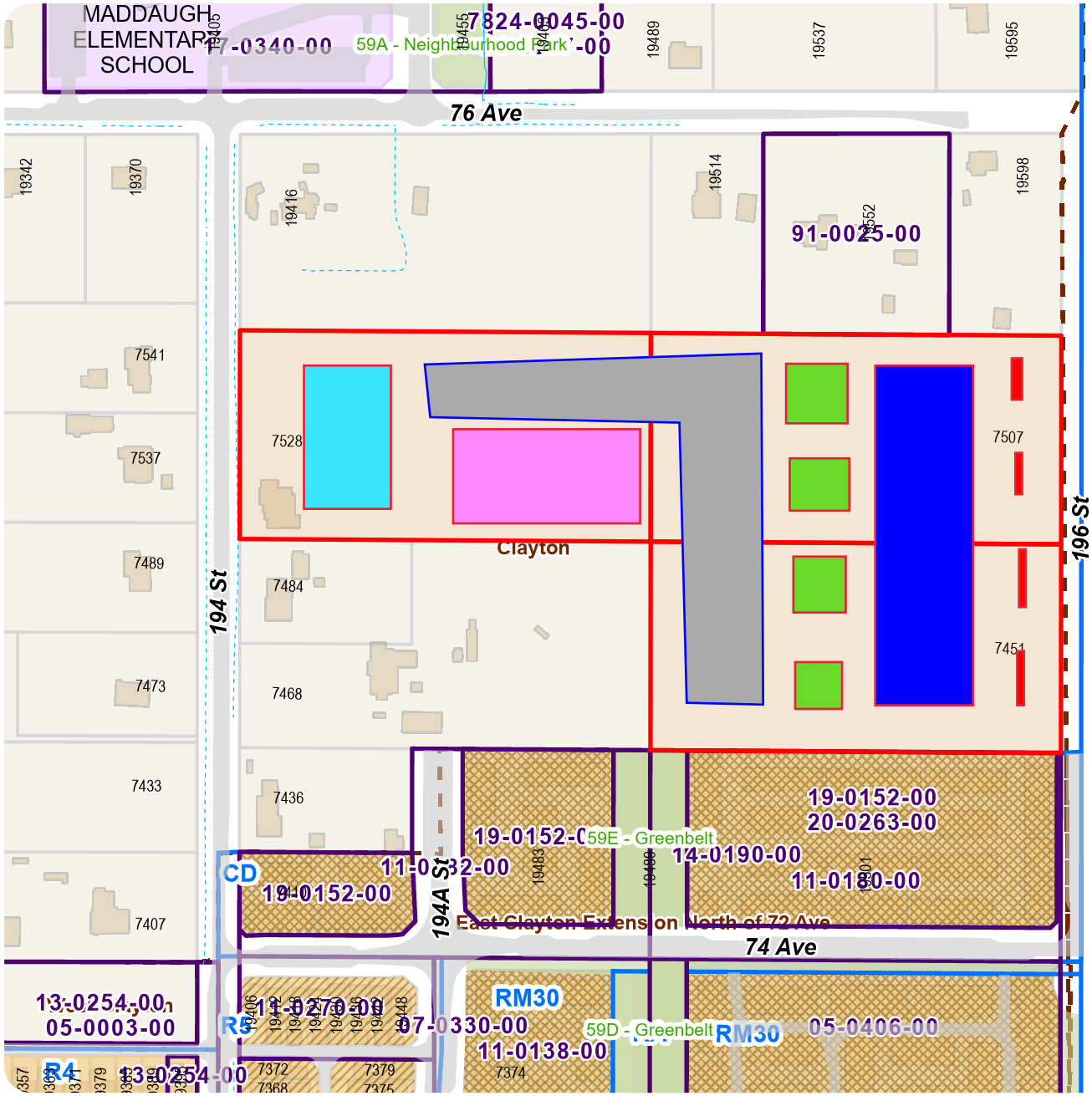
REF#	DRAWING NUMBER	TITLE
REFERENCE DRAWINGS		

NO	REMARKS	DATE	DESIGNED	INDEP CHK	DFTG	DFTG CHK	INSP	REV	ACPT
0	SNC LAVALIN T&D - 507842: REVISED AS RECORDED	2017-10		RY	AQ	JH			
REVISIONS									

NOT TO BE REPRODUCED WITHOUT PERMISSION

Issued for Record Drawing

City of Surrey Mapping Online System



Legend

Water Courses
- Creek
- Ditch
- Road Surface
- Dev Apps - All
- Zoning Boundaries

East Clayton Extension North of 72 Ave
- 6-10 u.p.a. Low Density
- 10-15 u.p.a. Medium Density
- 15-25 u.p.a. Medium-High Density
- Public Open Space/Park
- Secondary Plan Boundaries

Buildings (labels)

Building
- Other
- School

Bosa and Kang Property

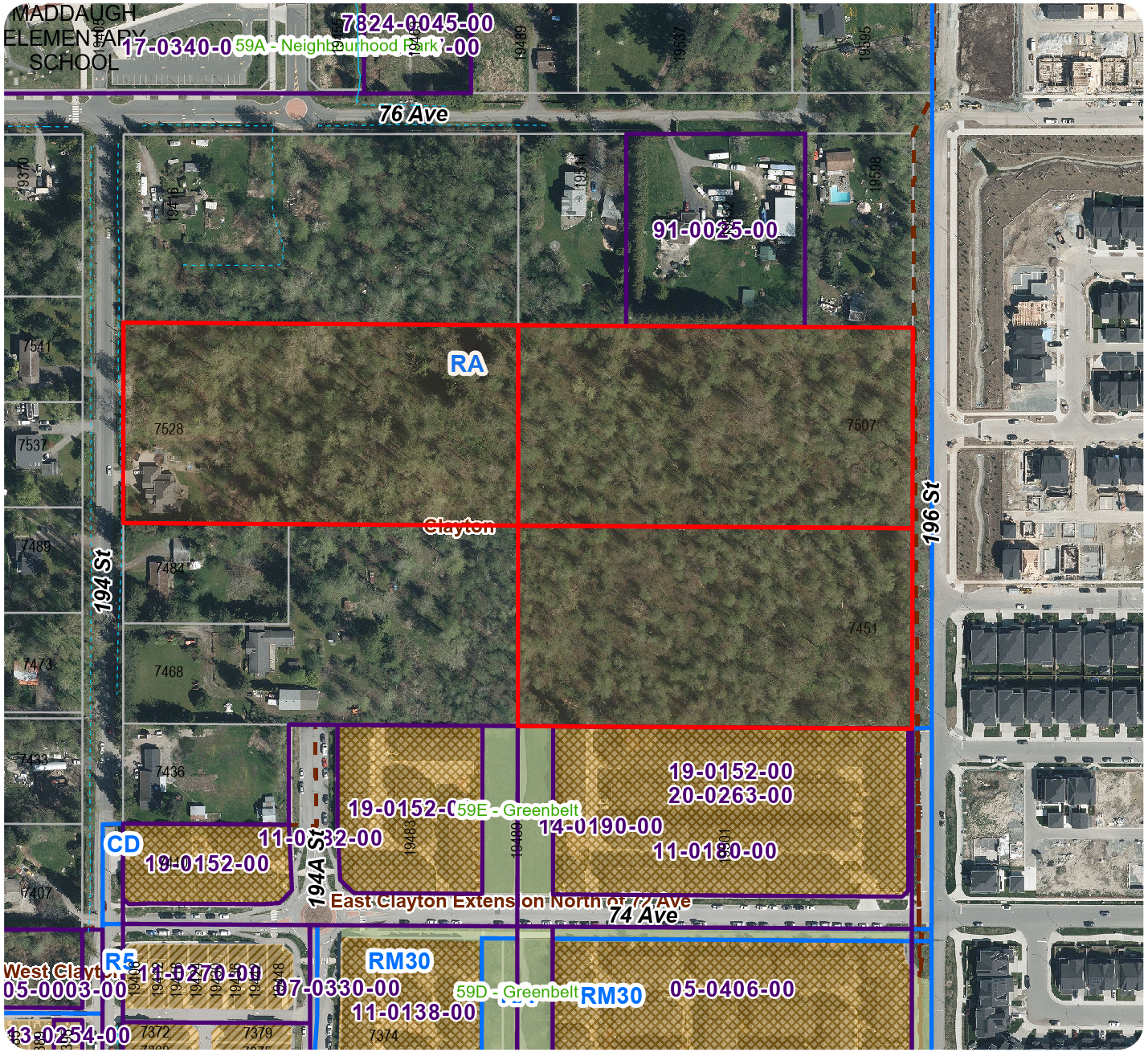
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0 0.02 0.04 0.08 0.12
km

Map created on: 2024-09-12

City of Surrey Mapping Online System



Legend

Water Courses
- Creek
- Ditch

Road Names1000_4000

Dev Apps - All

Zoning Boundaries

East Clayton Extension North of 72 Ave
- 6-10 u.p.a. Low Density
- 10-15 u.p.a. Medium Density
- 15-25 u.p.a. Medium-High Density
- Public Open Space/Park

Secondary Plan Boundaries

Buildings (labels)

Bosa and Kang Property-Ortho

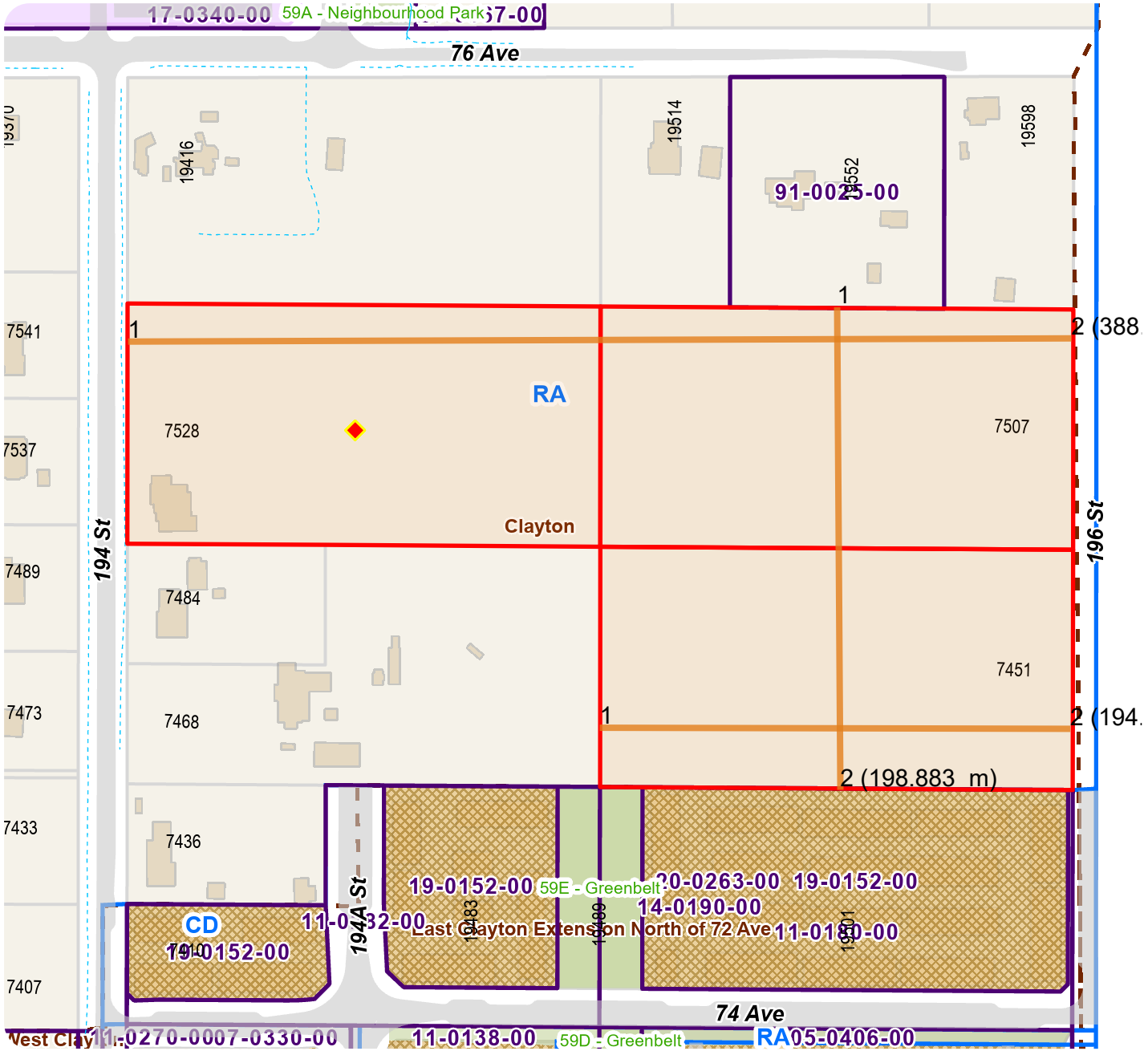
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km

Map created on: 2024-09-12

City of Surrey Mapping Online System



Legend

Water Courses
- Creek
- Ditch
- Road Surface
- Dev Apps - All
- Zoning Boundaries

East Clayton Extension North of 72 Ave
- 10-15 u.p.a. Medium Density
- 15-25 u.p.a. Medium-High Density
- Public Open Space/Park
- Secondary Plan Boundaries
- Buildings (labels)

Building
- Other

Bosa and Kang Property-Dimension

Scale: 1:2,500

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0 0.01 0.03 0.06 0.09 km

Map created on: 2024-09-12

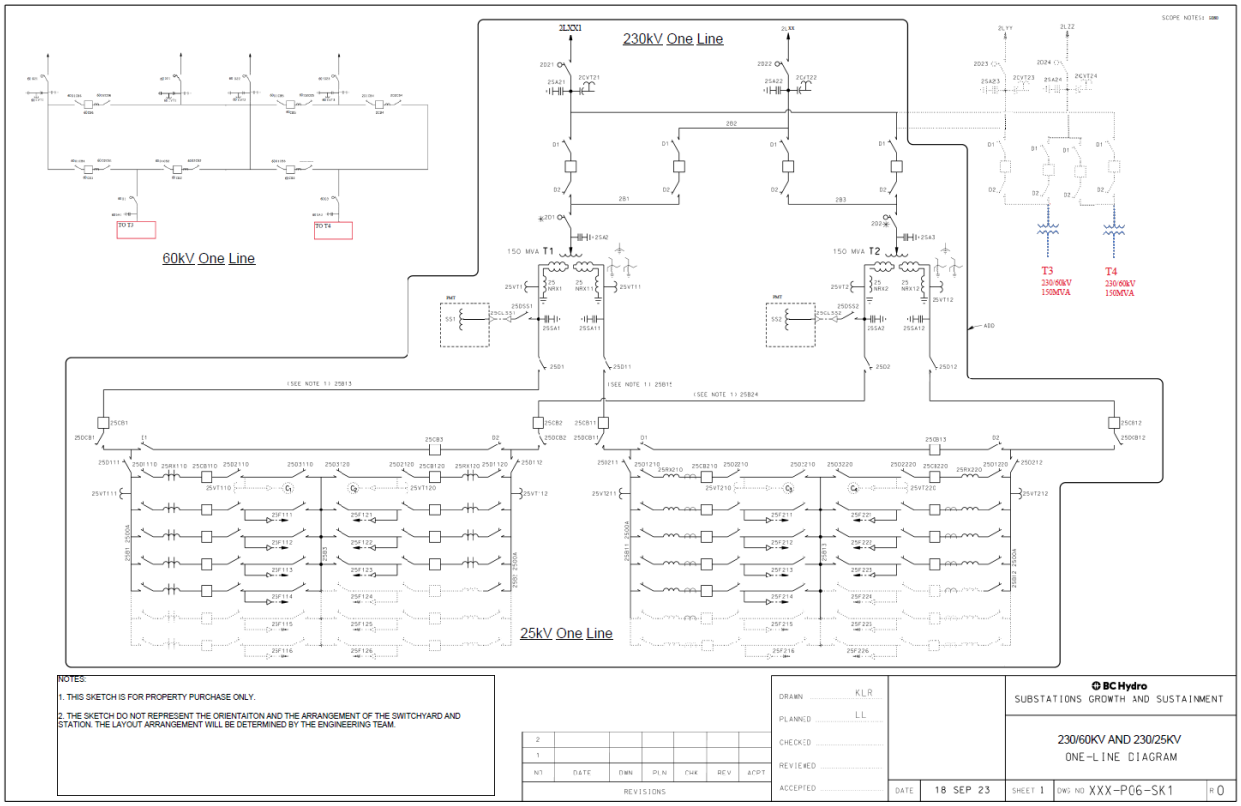
Campbell Heights (CBS) & Willoughby(WIB) Subtations

Electrical Design Considerations for Conceptual Options

Assumptions

The layouts were designed with the following assumptions:

- All electrical conceptual layout design serves for property purchase only.
- All related transmission line entrance supports the current electrical design layouts and will coordinate with Transmission Lines when carry on further design stages.
- The electrical conceptual design for both Campbell Heights and Willoughby subsations are based on the following attached Planning One-Line for Campbell Heights subsation provided on March 06, 2024 by PE, David Chwaklinski.



Options

Two layout options were explored, option 1 is based on air insulated switchyard (AIS) design and option 2 is conducted upon indoor gas insulated switchgear (GIS) for 230kV/60kV/25kV and leave transformers to be installed in the outdoor switchyard.

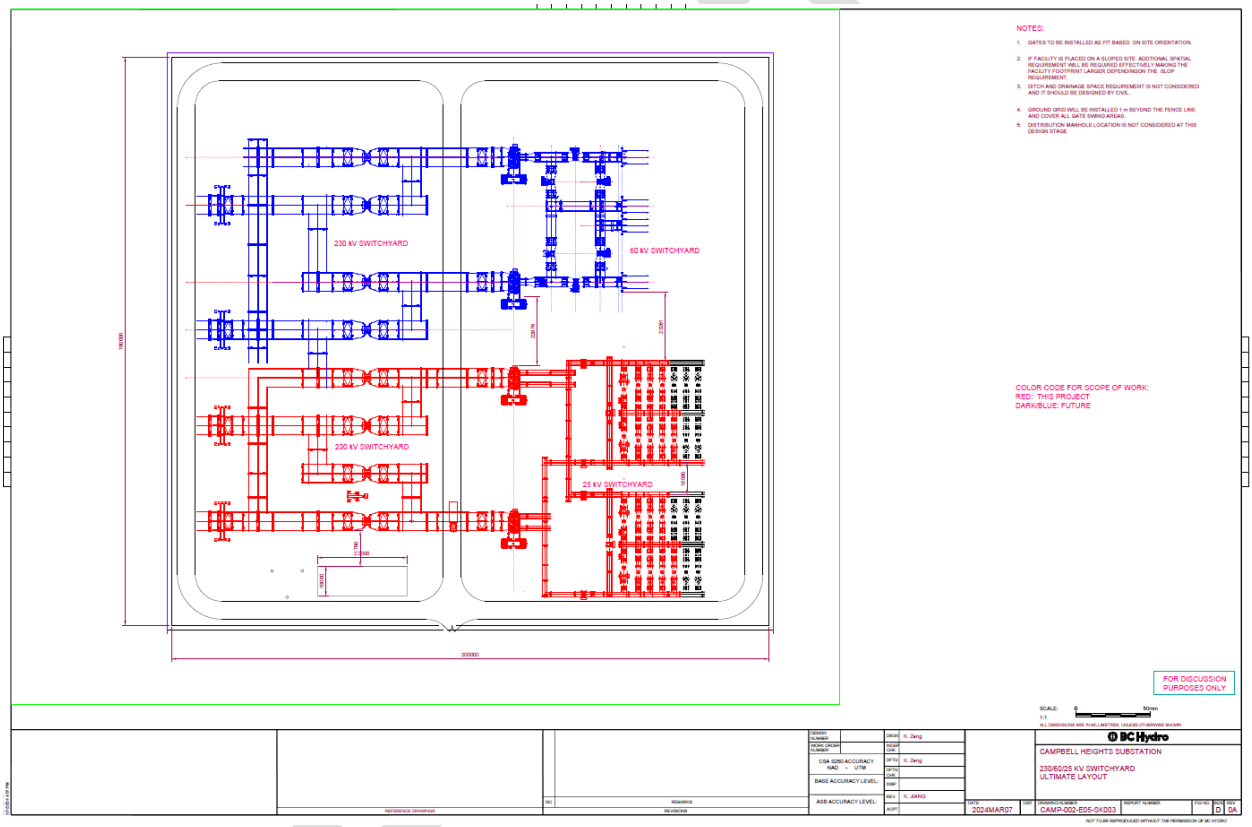
Both options comprise of 230kV/60kV/25kV switchyars, a control building, and outdoor power and station service transformers. The station service equipment, batteries, P&C panels and Telecomm equipment will be located in the control building. The control building will also include a washroom and a mechanical room**.** Key features include:

- Latest applicable standards are conformed for design
- 20m separation between transformer edges
- 18m separation from transformer edges to all buildings and property lines.
- 6m separation from station service transformer to Control Building
- 15m separation between 230kV GIS and 60 kV GIS and Control buildings
- Minimum 2.5m between edges of the road and 230kV bus
- Minimum 1.5m between edges of the road and 60kV/25kv bus
- Minimum 6m wide access roads
- Minimum 10m turning radius within substation
- 27m turning radius for main access roads into substation for transformer transportation

DRAFT

Option 1: AIS Layout Design.

This option utilizes the outdoor switchyard. The layout design sketch created by Ken Zeng attached below applies to both Campbell Height and Willoughby substation conceptual design.



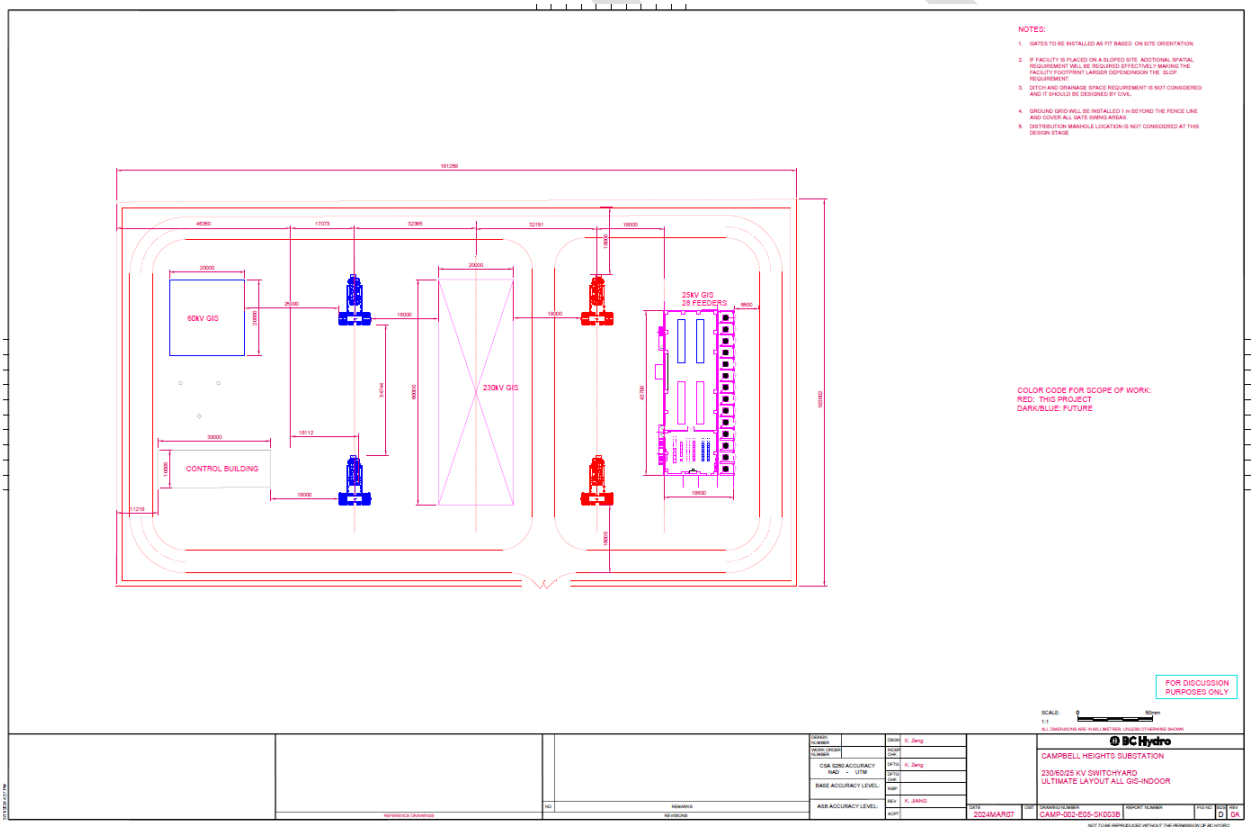
Option 1-AIS design layout sketch for both CBS and WIB

Option 2: GIS Layout Design.

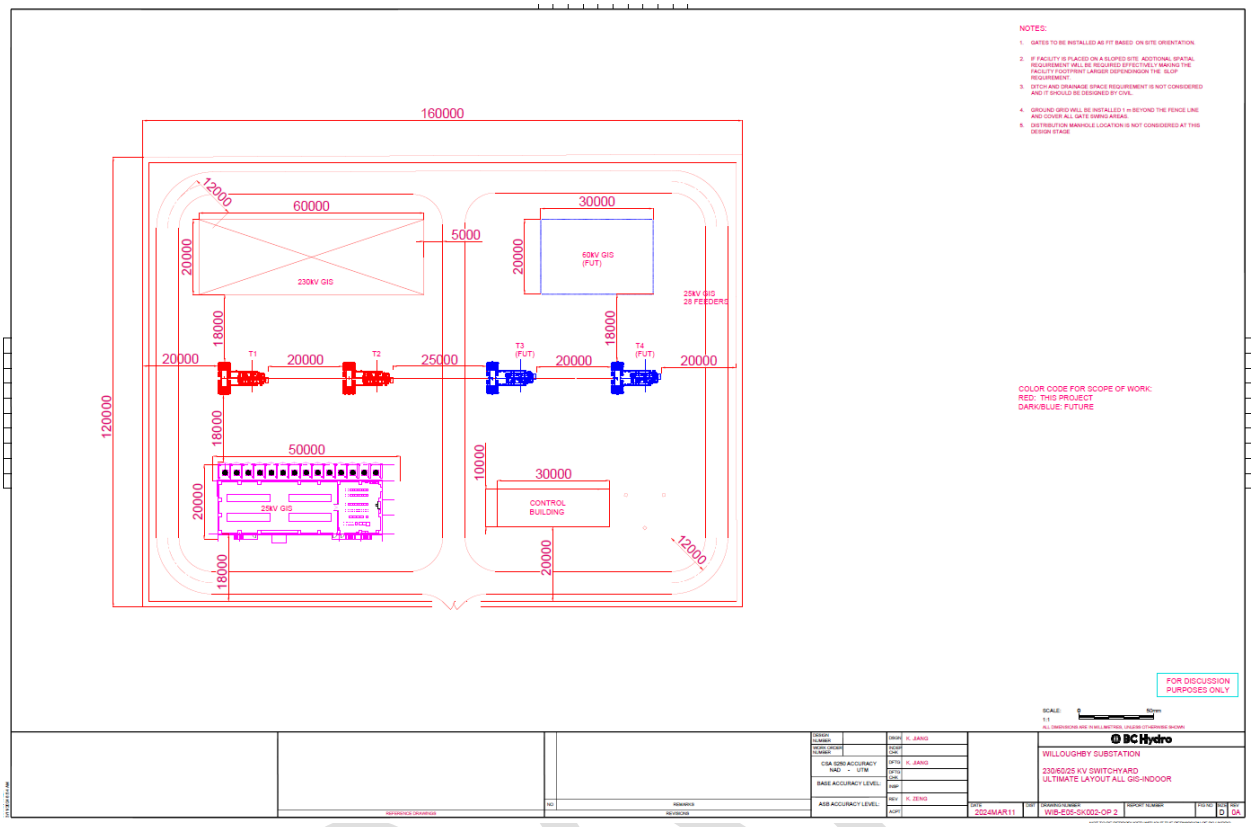
The 230kV and 60kV indoor GIS buildings consist of two floors, with the basement floor designated for cable entry and terminations while the main ground floor is designated for the GIS equipment and local station service panels.

The 25kV indoor GIS feeder building will consist of three floors, with the basement floor designated for cable entry and terminations while the main ground / second floors are designated for the GIS equipment for the 28 fedders / local station service panels.

The option 2 has been explored with 3 sketches as shown below for CBS and WIB.

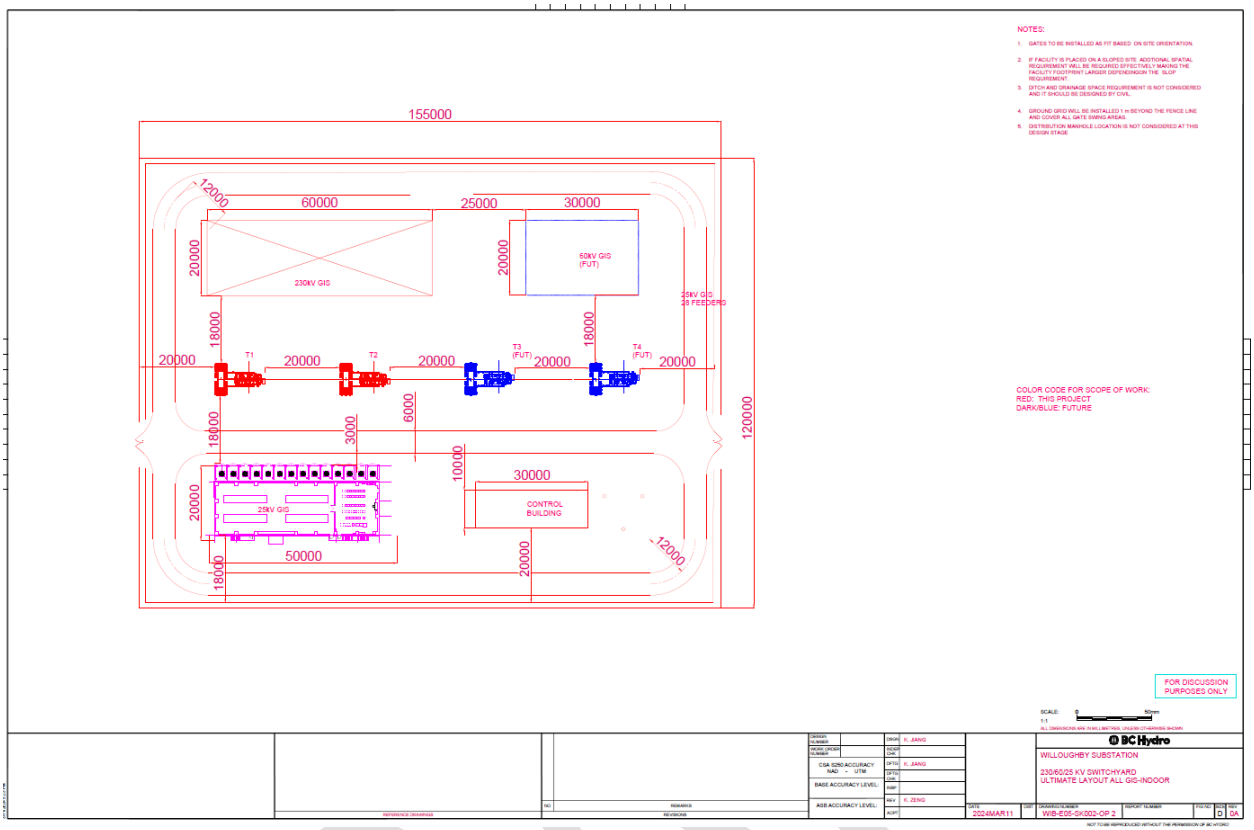


Option 2-1-GIS Layout Design



Option 2-2-GIS Layout Design

DRAFT

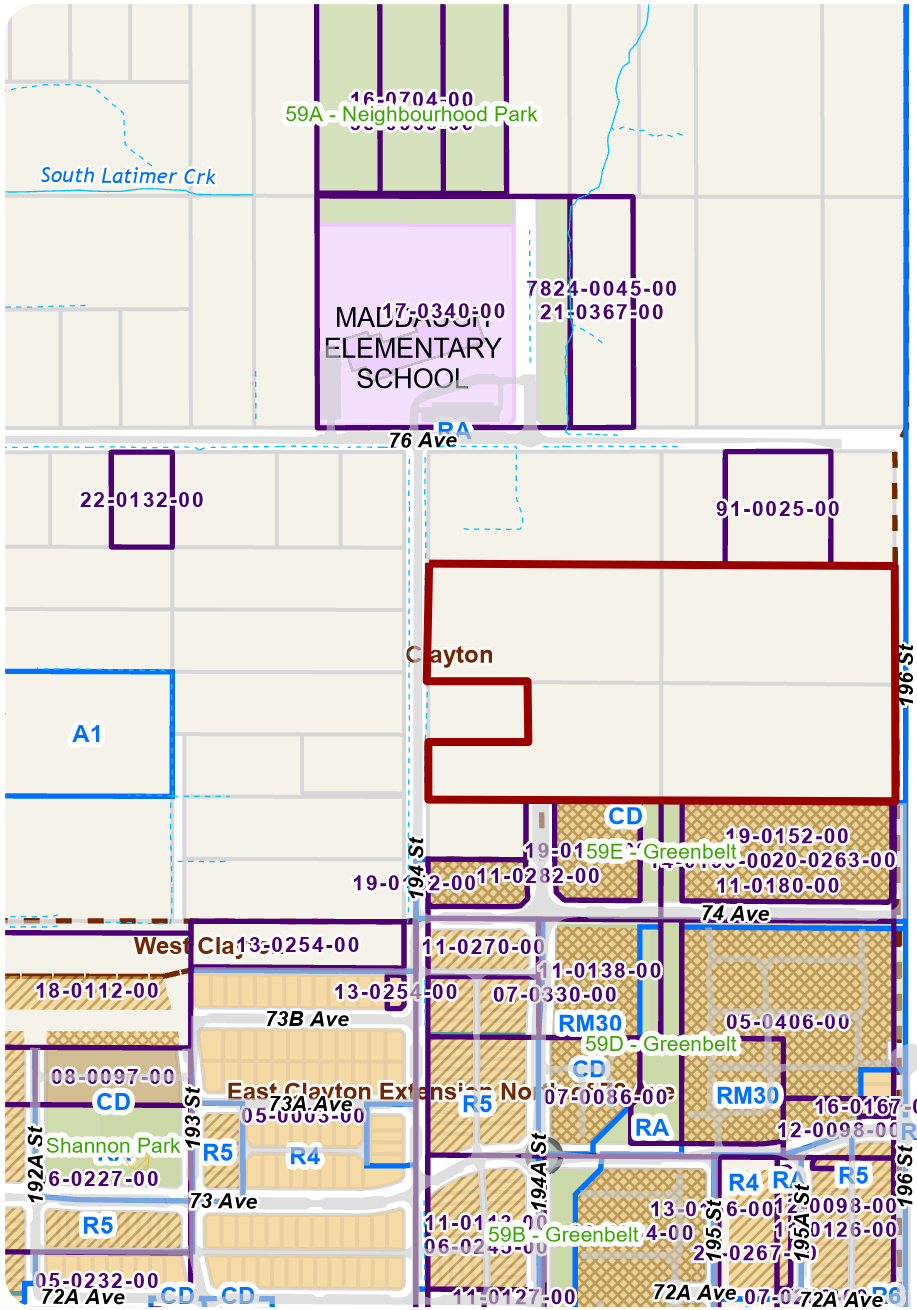


Option 2-3-GIS Layout Design

Summary

Investigation during further design statges will be required to determine the cost benefit on both options.

City of Surrey Mapping Online System



Legend

Water Courses
- Creek
- Ditch

Park Playgrounds
- Playground
- Road Surface
- Dev Apps - All
- Zoning Boundaries

East Clayton Extension North of 72 Ave
- 6-10 u.p.a. Low Density
- 10-15 u.p.a. Medium Density
- 15-25 u.p.a. Medium-High Density
- 22-45 u.p.a. High Density
- Public Open Space/Park
- Special Setback, Landscaping Buffers or Corridors
- Traffic Circle
- Secondary Plan Boundaries
- Buildings (labels)

Building Large
- School

Bosa, Kang, Kool

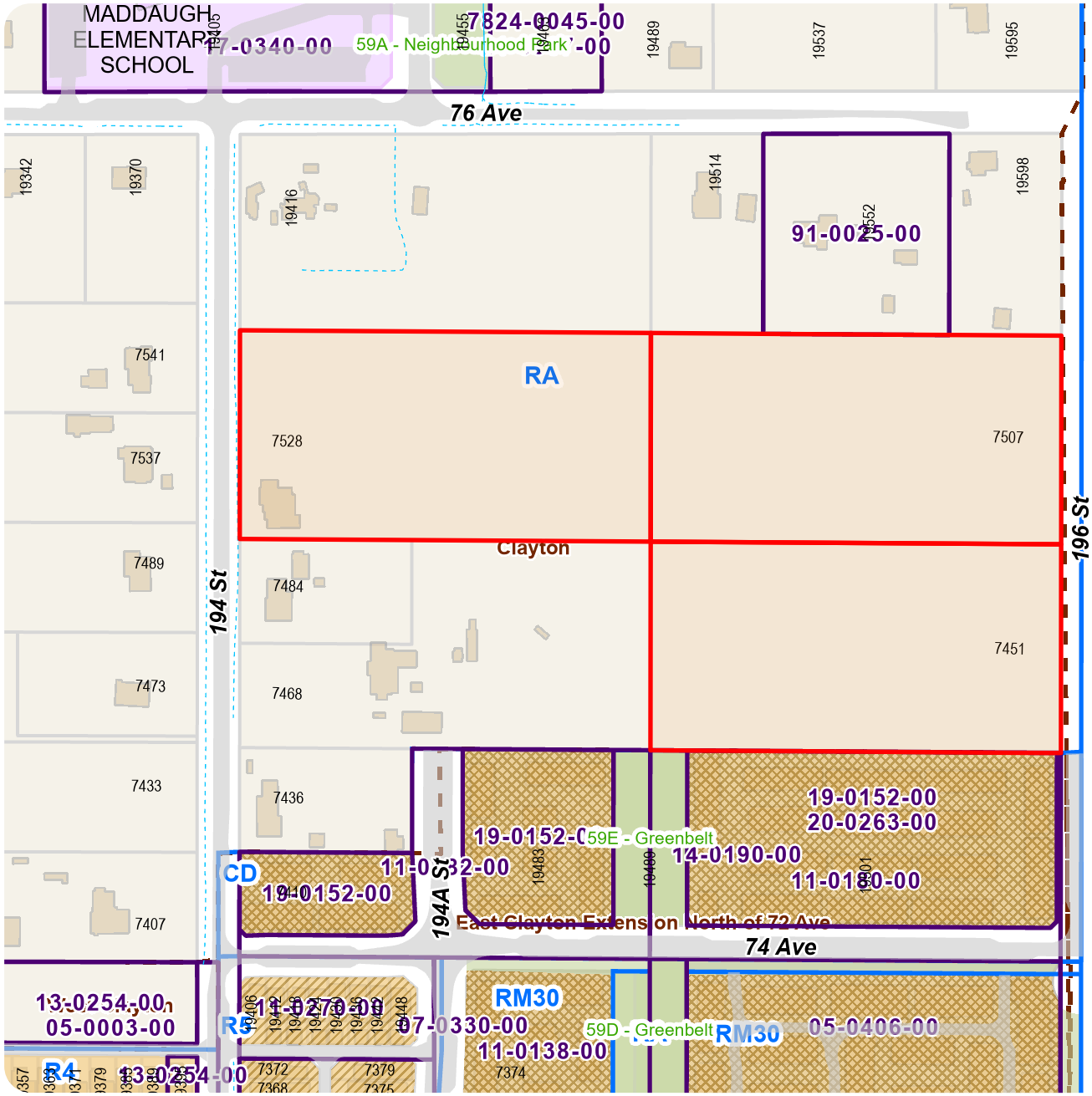
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0 0.04 0.09 0.17 0.26
km

Map created on: 2024-10-15

City of Surrey Mapping Online System



Legend

Water Courses
- Creek
- Ditch
- Road Surface
- Dev Apps - All
- Zoning Boundaries

East Clayton Extension North of 72 Ave
- 6-10 u.p.a. Low Density
- 10-15 u.p.a. Medium Density
- 15-25 u.p.a. Medium-High Density
- Public Open Space/Park
- Secondary Plan Boundaries

Buildings (labels)

Building
- Other
- School

Bosa and Kang Property

Scale: 1:3,000

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0 0.02 0.04 0.08 0.12
km

Map created on: 2024-09-12



CAPITAL PROJECT INFRASTRUCTURE DELIVERY

SMALL CAPITAL PROJECT BUSINESS CASE

(COMBINED STATEMENT OF OBJECTIVES AND BUSINESS CASE) FOR THE IMPLEMENTATION PHASE

FOR EXPENDITURE AUTHORIZATION REQUEST (EAR)

WILLOUGHBY PROPERTY PURCHASE PROJECT

TM-0592

TX902958

31-JULY-2024

PROJECT SPONSOR: CHARLOTTE MITHA

PROJECT INITIATOR: MAUREEN DASCHUK

PROJECT MANAGER: ROBERT HEPPLE

Disclaimer

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(b) The intellectual or other property rights of any person or party in, or

(c) The merchantability, safety, or fitness for purpose of, any information, product or process disclosed, described, or recommended in this report.

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Document Author:

Version	Author	Role
1	Lauren Simpson	Commercial Manager

Documentation History:

Version	Reason for Version	Date
1	Business Case for Implementation phase	2024-Jul-31

Approval

This Small Capital Business Case (SCBC) is approved and complies with the Project Management and Management & Accounting Policies and Procedures of BC Hydro.

Robert Hepple is appointed Project Manager with authority and responsibility in accordance with the Project Management Policies and Procedures of BC Hydro, Capital Infrastructure Project Delivery and Engineering.

An IR Adequacy of Consultation Assessment will be completed before subject conditions are removed to finalize the property purchase.

Prepared by:	Robert Hepple Project Manager	Aug 13, 2024 Date
Reviewed by:	Surinder Parmar Project Independent Reviewer Manager, Capital Projects	Aug 13, 2024 Date
Approved by:	Al Leonard EVP Capital Infrastructure Project Delivery	Date
Approved by:	Maureen Daschuk Project Initiator EVP Integrated Planning	Date
Approved by:	Charlotte Mitha Project Sponsor EVP Operations	Date

To be completed by Finance

FAAP Approver: _____

Only for **EAR Exempt** CIPD projects <$500k where the Statement of Objectives (SoO) is used in place of SCBC and where an EAR form is not prepared by Finance

*This is a property purchase project and this approval approach is approved by the Electrification Steering Committee

Thesis Statement

Project Forecast Cost Table ($M)[1]

Costs to Date*	Latest EAR Approved Funding		Current Phase Incremental Request		Total Request (Approved Funding)		Total Project Forecast	
	Expected	Authorized	Expected	Authorized	Expected	Authorized	Expected	Authorized
$0.12	$0.65	$0.65	$37.9	$40.9	$38.6	$41.6	$38.6	$41.6

*Costs as of Jun 30, 2024.

The purpose of this business case is to request Implementation phase funding for the Willoughby Property Purchase Project (the **Project**).The funding request for this phase includes an expected amount of $37.9M and an authorized amount of $40.9 million, and is required to initiate negotiations on conditional property purchase agreements, undertake due diligence and finalize property acquisition. The Project's in-service date is October 31, 2026.

The objective of the Project is to purchase a 12-acre property in the Willoughby area of Surrey and Langley. This will enable the construction of a new outdoor 230/60kV and 230/25kV, 200MVA (ultimate[2]) switching and distribution substation to be built as part of a future project. The Project will secure a suitable location to ensure station capacity can meet customers' requirements and support the load growth in the area.

Due to the limited availability of large properties and the lack of interest from landowners to sell, the Project needs to initiate negotiations now to meet the Project's In-Service Date. The Project has identified two feasible locations with available parcels and where multiple parcels could be assembled.

The business case seeks approval to negotiate conditional property purchase agreements, as necessary, to assemble a minimum of 12 acres for the new Willoughby substation. The funding request is estimated based on a unit cost of $3 million / acre for a total of $36 million. A $3 million Special Reserve has been included to cover cost escalation in the purchase price and $1.91 million has been estimated for internal costs and other closing costs.

Due diligence investigations will be completed in the Implementation phase once a conditional offer to purchase has been negotiated and signed. BC Hydro would not remove subject conditions and finalize the purchase until the due diligence investigation and the corresponding Property Due Diligence checklist has been completed.

Project Background and Drivers

A.1 Description of Problem

A new Willoughby substation (**WIB**) is required in Langley to meet the customers' load requirements and to support load growth and the electrification plan for the area after F2033. There are no BC Hydro owned properties in the area to serve as a station location and this Project is required to

[1] Excludes asset value writeoffs, if any. Values may not add up due to rounding

[2] The ultimate capacity is the future final capacity of the substation.

procure a suitable property to meet the planned timeline for the future substation build. To meet this timeline, a property suitable for an ultimate 230/60kV & 230/25kV, 200MVA outdoor switching and distribution substation (WIB substation) needs to be purchased as soon as possible.

The Willoughby area of Surrey and Langley is growing rapidly due to electrification and city developments (see **Figure 1**). This area is presently supplied by three substations, Port Kell (**PKL**), Harvey Road (**HRD**) and McLellan (**MLN**) substations. PKL and HRD are 60/25kV substations, and are at their ultimate capacities of 100MVA in Winter and 79MVA in Summer. MLN is a 230/25kV, 200MVA (Winter) / 158MVA (Summer) substation and being upgraded to 400MVA (Winter) / 315MVA (Summer) with 42 feeder positions in F2030.

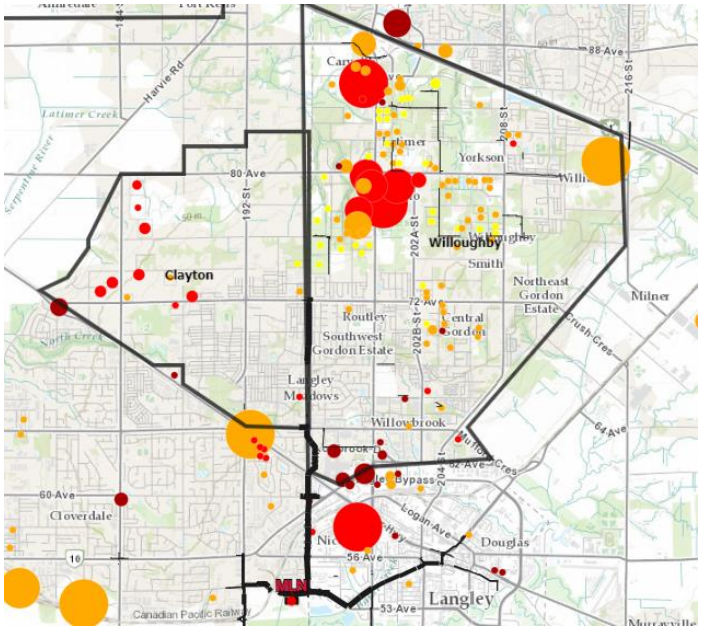


Figure 1 Willoughby Load Growth Map

Based on the present load forecast, the load in the Willoughby area will increase by approximately 48MVA by F2033. After the planned upgrade of MLN, capacity will be sufficient to meet the areas load requirements until F2033. With projections for additional load of more than 130MVA in the Willoughby area beyond F2033, a new substation will be required in the area to meet this future load growth.

The size of the property was determined based on the ultimate requirement for a 200MVA outdoor WIB substation. Based on the proposed WIB station layout, a minimum property size of 42,000 square meters (10.3 acres) is required for the 230/25 kV substation, with provision of 2 acres for a 230/60kV switching station. The ultimate WIB station will require four 230kV line positions; a minimum of eight 230 kV breakers; two 230/25 kV 150 MVA transformers; two 230/60 kV 150 MVA transformers; twenty-four 25 kV feeder positions; and a 60 kV section that includes six 60 kV breaker rings[3].

[3] Willoughby Design Plan - WIB-E05-SK001-Option 1

Project Alternatives

The Project team investigated over 22 properties to identify suitable locations that could be acquired for the future WIB substation (Appendix C). The Project team also contacted the City of Surrey and the Township of Langley to inquire if they own lands that might be suitable, and both responded that they do not have any land available in the Willoughby area. Some properties were excluded from consideration due to existing or planned use, general unsuitability based on engineering and environmental screenings, feedback from the City of Langley and unfavourable initial communications with landowners. The results provided two viable locations, as described below.

Qualico Group

The Qualico Group of properties is centred around two Qualico owned parcels (PID 011-988-959, 011-988-967) located at 19526 78th Avenue and 19570 78th Avenue in Surrey. These two parcels provide eight acres of land (see Appendix D, Figure 2). BC Hydro has initiated discussions with Qualico and has sent a draft non-binding letter of intent. Appraisals of these two parcels have been initiated.

The additional acreage required for the substation can be acquired from a property owner to the west or multiple property owners to the south. BC Hydro has contacted all three of the landowners to the south and they have all indicated that they are willing to sell. Appraisals have been initiated for one of the properties to the south (PID: 002-401-428 Owned by the Ngo family. Both the Qualico and Ngo appraisals have been received.

This group of properties provides additional flexibility as three or four of the properties located to the south of the Qualico parcels could be assembled, if BC Hydro cannot negotiate a conditional property purchase agreement with Qualico.

Bosa Group

The Bosa Group of properties is centred around two Bosa owned properties (PID: 012-828-670, 012-828-696) located at 7507 196 Street and 7528 194 Street in Surrey. These two parcels provide 9.5 acres of land (see Appendix D, Figure 3), but the linear configuration prohibits development of the substation without additional parcels to the north or south. BC Hydro has initiated discussions with Bosa and they are willing to sell, but they currently have a letter of interest (LoI) from another party, which they accepted. Bosa has not acted on accepting the LoI until they see the offer from BC Hydro. That is why timing is of the essence for this finding to be approved.

The additional acreage required for the substation can be acquired from the property owner to the south. BC Hydro has made contact with this property owner and they are willing to sell and have requested that BC Hydro submit a conditional property purchase agreement for consideration.

Investment Recommendation

Due to the limited availability of suitable properties in the area and the requirement to assemble properties to achieve the required minimum of 12 acres, the Project team recommends proceeding with the negotiations to purchase properties within the Qualico and Bosa groups, immediately while these properties are still available. The Project team has confirmed that the properties meet the requirements for the future WIB substation and has estimated the upper limit of the potential purchase price based on early communications with the property owners.

Once negotiations have progressed with either Qualico or Bosa to a point where the signing of a conditional purchase agreement is likely, the Project team will begin negotiations with the adjacent

landowners to work towards assembling a minimum of the required 12-acres. The Project team will remain in the Conceptual stage and will draw on Conceptual (OMA) funding until a conditional offer to purchase has been signed with all property owners associated with the 12-acre assembled property. Once those are signed, the Project will be advanced into the Implementation phase, and due diligence investigations will be performed in the Implementation phase.

There is a risk that BC Hydro will be unable to purchase all the properties to assemble the required acreage. However, the proposed locations provide multiple options and conditional purchase agreements will be made to manage the risk.

Project Risk Management

Key Investment and Project Delivery Risks[4]

Risk ID	Consequence Type	Risk Event Description	Risk Status	Risk and Response Summary	Risk Level	Residual Risk Level	Residual Risk Zone
12	Financial Loss	Risk that an indoor station is required	Identified	Due to the size requirement for a 230/60 kV switching station, there is a risk that a suitably sized property is not available for a reasonable price, which may require an indoor station design to reduce the station size. This risk is accepted.	10.5	10.5	Zone 3 - Executives
11	Financial Loss	Risk that there are a limited number of suitable properties	Identified	Due to the size of the property required to accommodate the 230/60 kV switching station, there is a risk that a limited number of properties are available, which could result in a higher purchase price. The treatment plan is investigate all potential properties and locations, investigate alternate layouts to minimize the size required and consider an indoor station design if the property cost is prohibitive.	9.5	9	Zone 2 - Initiators
5	Financial Loss	Risk that negotiations take too long	Identified	Due to the duration of the Project and the competitive real estate market there is a risk that a property becomes unavailable (is sold) during the project lifecycle, which may result in schedule delays and increased costs to find an alternate property. The treatment plan is to scale the project to shorten the project duration, request IMP funding to negotiate with multiple owners, and initiate discussions with the property owners before suitability has been confirmed.	8.5	8	Zone 2 - Initiators
13	Financial Loss	Risk that properties cannot be assembled	Identified	Due to the size of the station required, there is a risk that BC Hydro will be unable to assemble all the properties required, which could result in stranded assets. The treatment plan is to negotiate agreements that are conditional upon BC Hydro's ability to assemble the required land.	9.5	9	Zone 2 - Initiators
14	Financial Loss	Risk that load does not materialize	Identified	Due to the project being based on forecasted loads, there is a risk that the load may not materialize, which may result in the project not being required. The treatment plan is the confirm with Planning that the load forecast has not changed.	8	7	Zone 1 – Project Manager

[4] Table is focused on key risks that could impact the decision to invest in the Project or those that could change the recommended alternative/option. Additional Project risks are reflected in the Project Risk Register.

Project Summary

A.2 Scope

Project

The objective of the Project is to purchase (or assemble) a minimum of 12-acres of property in the Willoughby area of Surrey/Langley to allow a new ultimate 230/60kV and230/25kV, 200MVA outdoor substation to be built as part of a future project. The Project's objective is to purchase properties at a suitable location to ensure the station's capacity can meet customers' requirements and support load growth in the area.

Current Phase/Stage:

- Conceptual Stage:
  - Identify suitable locations for the future WIB substation and confirm availability from the landowner.
  - The project will advance directly into the Implementation phase once negotiations of a conditional property purchase agreement are completed in the Conceptual Stage.

Schedule

The Project is utilizing the Atypical PPM scaling model and will commence directly to the Implementation Phase.

The target dates for milestone events for the Project are:

Date	Description	PPM Milestone UID
December 31, 2024	Feasibility Design stage and Definition phase complete	2.01, 2.02
October 30, 2026	Project ISD	1.01
January 22, 2027	Project Completion & Evaluation Report Signed & Accepted	3.08
April 15, 2027	Project Financial Close	3.58

A.3 Project Cost

1.1.1 Funding Request and Project Cost Forecast

TM-0592		
Willoughby Property Purchase	**EAC**	
Current Funding Request	**Project Cost**	**% of overall**
INI Phase	**-**	**0%**
Initiation Phase	-	0%
IDN Phase	**646,032**	**2%**
IDN Phase Needs Stage	100,000	0%
IDN Phase Conceptual Stage	546,032	1%
IDN Phase Feasibility Stage	-	**0%**
DEF Phase	**-**	**0%**
IMP Phase	**37,908,000**	**91%**
Project Mgmt	600,000	1%
Engineering Design	-	0%
Construction and Contract Mgmt	-	0%
Environment	-	0%
Properties	250,000	1%
Indigenous Relations	-	0%
Procurement and QA	-	0%
Supply/Install	-	0%
Property Purchase and Tax	37,058,000	89%
Subtotal Directs	**38,554,032**	**93%**
Contingency		0%
Subtotal with Contingency	**38,554,032**	**93%**
Loadings:		
Capital Overhead	-	0%
Interest During Construction	-	0%
Total Expected Amount (P50)	**38,554,032**	**93%**
Project Reserve	3,000,000	7%
Total Authorized Amount (P90)	**41,554,032**	100%
	Expected (P50)	**Authorized (P90)**
Previous Amount	**646,032**	**646,032**
Incremental Funding Request	**37,908,000**	**40,908,000**

Cost information is based on initial discussions with property owners and their expectation of a purchase price of up to $3M/acre.

Any dismantling costs associated with the properties being purchased through this Project will be estimated and included in the future WIB Substation Construction Project.

1.1.2 Capital Plan Variance

The net capital amount from the F25 to F34 Power System Capital plan for the WIB Property purchase project is $24.9 million. The Project capital EAC is estimated based on the expected purchase price and property transfer tax.

A	B	C = B-A
Capital Plan Amount A	**Project Capital EAC B**	**Variance**
$24.9 million	**~$37.9 million**	**$13.0 million**

The difference between the Capital Plan and the Project Capital EAC is due to the current market conditions resulting in a highly competitive real estate market.

Post-Project Incremental Costs and/or Savings

There are no post-project incremental operating costs or savings.

Appendix A Project Initiator's Statement of Summary Requirements

A.4 Safety, Security (Critical Infrastructure Protection) and Confidentiality Requirements

- Incorporate Safety by Design (to be incorporated in the Construction project)
- Review any applicable MRS standards.

A.5 Maintenance and Operational Requirements

- Project User Requirements: User requirements to be developed upon funding approval.

A.6 Indigenous Relations Business Strategy Requirements

With the intention of gaining First Nations' support for the project through relationship building, listed below are Aboriginal Relations Business Strategy Requirements expected to be delivered by this project:

- To be developed during Definition phase upon funding approval

A.7 Project Initiator's Design Requirements

The Project Initiator has the following high level Design Requirements for the project:

- Project is seeking funds for property purchase(s) for an ultimate station layout for the WIB Substation project.

A.8 Project Initiator's Interim Decision Requirements

The Project Initiator requires the following items, in addition to the above requirements, for the current project phase(s)/Stage(s). The list includes the Project Initiator's requirement for approval, acceptance, or permission to proceed for each item.

- Provide IP planner and IP Director project updates at least once every 3 months.

Appendix B Gating Plan

This project will utilize the soft paper gate process.

Appendix C List of Properties Considered and Dismissed as Non-Viable

Property PID	Justification for exclusion
023-242-680, 031-167-993	The existing use as community centre (Langley Events Centre) makes this property undesirable for development as a substation.
031-168-001	The existing use as a community park (Willoughby Community Park) makes this property undesirable for development as a substation.
029-820-405	The existing use as a community school (Peter Ewart Middle School) makes this property undesirable for development as a substation.
029-820-413	The existing use as a community school (Mountain Secondary School) makes this property undesirable for development as a substation.
012-058-599, 012-058-611, 012-058-581, 010-053-611	Township of Langley does not support a new substation along 200th Ave.
006-555-926, 005-436-443, 005-436-460, 009-720-197	This property is too small for the proposed substation and multiple properties would need to be added to the north making this location undesirable for development as a substation.
028-571-002, 031-684-009, 031-684-017	This property is in pre-sale as a multi-family development.
031-185-843	This property is too small for the proposed substation. New alternatives 13 was created by merging alternative 8 and 9.
031-185-827, 031-185-835	This property is too small for the proposed substation. New alternatives 13 was created by merging alternative 8 and 9.
006-499-121, 002-379-708, 007-152-345, 007-152-353, 007-152-361	Township of Langley does not support a new substation along 200th Ave.
007-152-388, 004-875-109, 007-152-370, 006-475-248, 006-475-264	Township of Langley does not support a new substation along 200th Ave.
007-152-345, 007-152-353, 007-152-361, 007-152-388, 004-875-109, 007-152-370	Township of Langley does not support a new substation along 200th Ave.

031-185-827, 031-185-835, 031-185-843	Township of Langley does not support a new substation along 200th Ave.
011-946-954, 004-413-385, 010-750-029, 010-750-045, 004-092-767	The owner is not interested in selling.
006-845-878, 006-845-860, 006-845-851	There is a new home on this parcel and the owner is not interested in selling.
007-791-887, 002-136-864, 002-136-813, 018-738-745	The property is not large enough and there is a wetland present.
005-951-704, 005-951-712, 002-229-561, 005-951-721, 003-370-879, 003-370-887	Property would require assembly of 6 private parcels. Significant difficulty was encountered attempting to contact landowners, suggesting assembly of all 6 parcels is unlikely.
003-179-184	There is an option to purchase on this property.
004-417-275, 008-822-158, 008-822-174, 004-406-290	Too far from the load centre and the neighbourhood plan has this location identified for townhouses .
010-996-001, 010-996-028	Owned by Qualico who plans to develop lands and is not interested in selling.
011-175-869, 011-175-877	Owned by Qualico who plans to develop lands and is not interested in selling.

Appendix D Figures

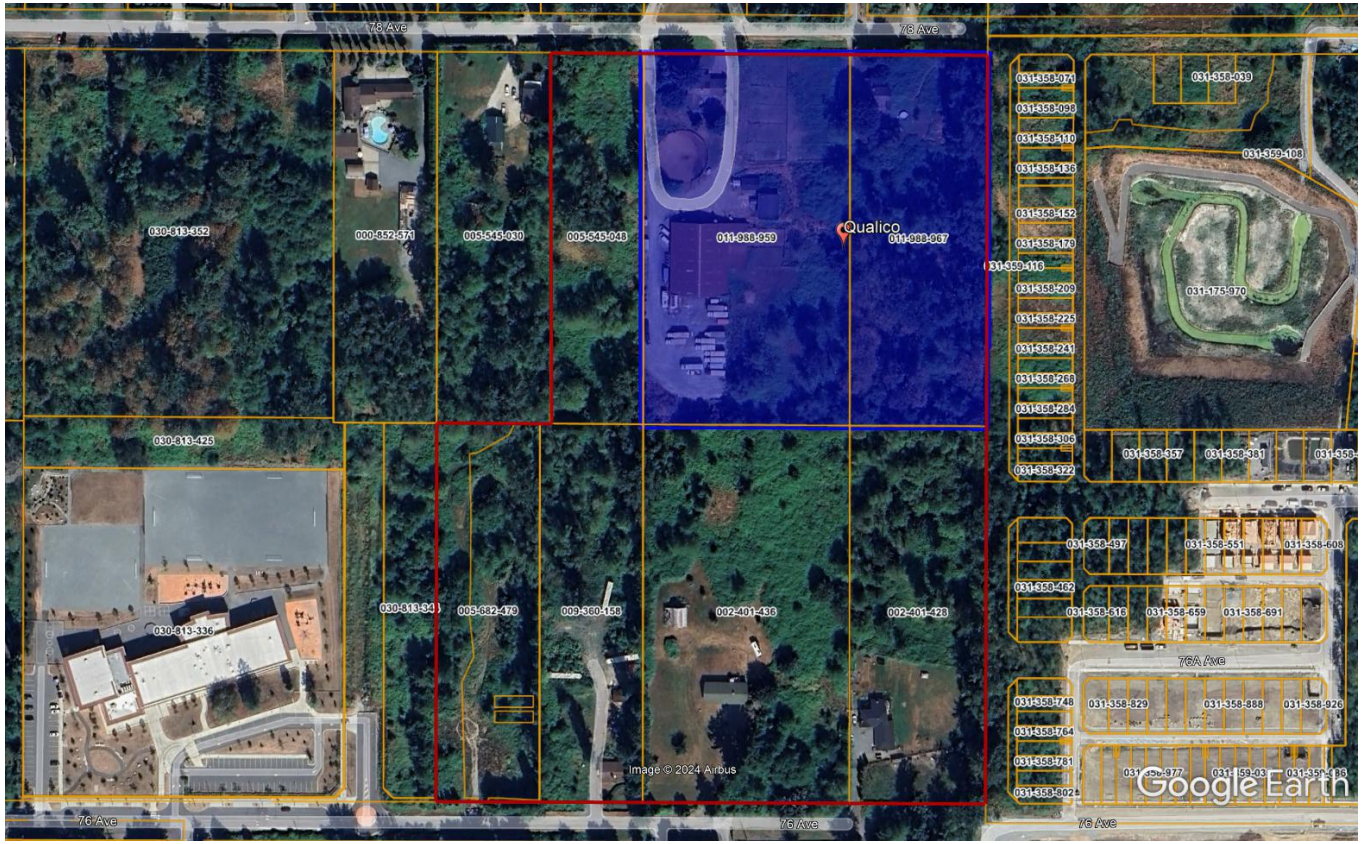


Figure 2. Qualico group of properties (red), with Qualico owned parcels identified (blue).

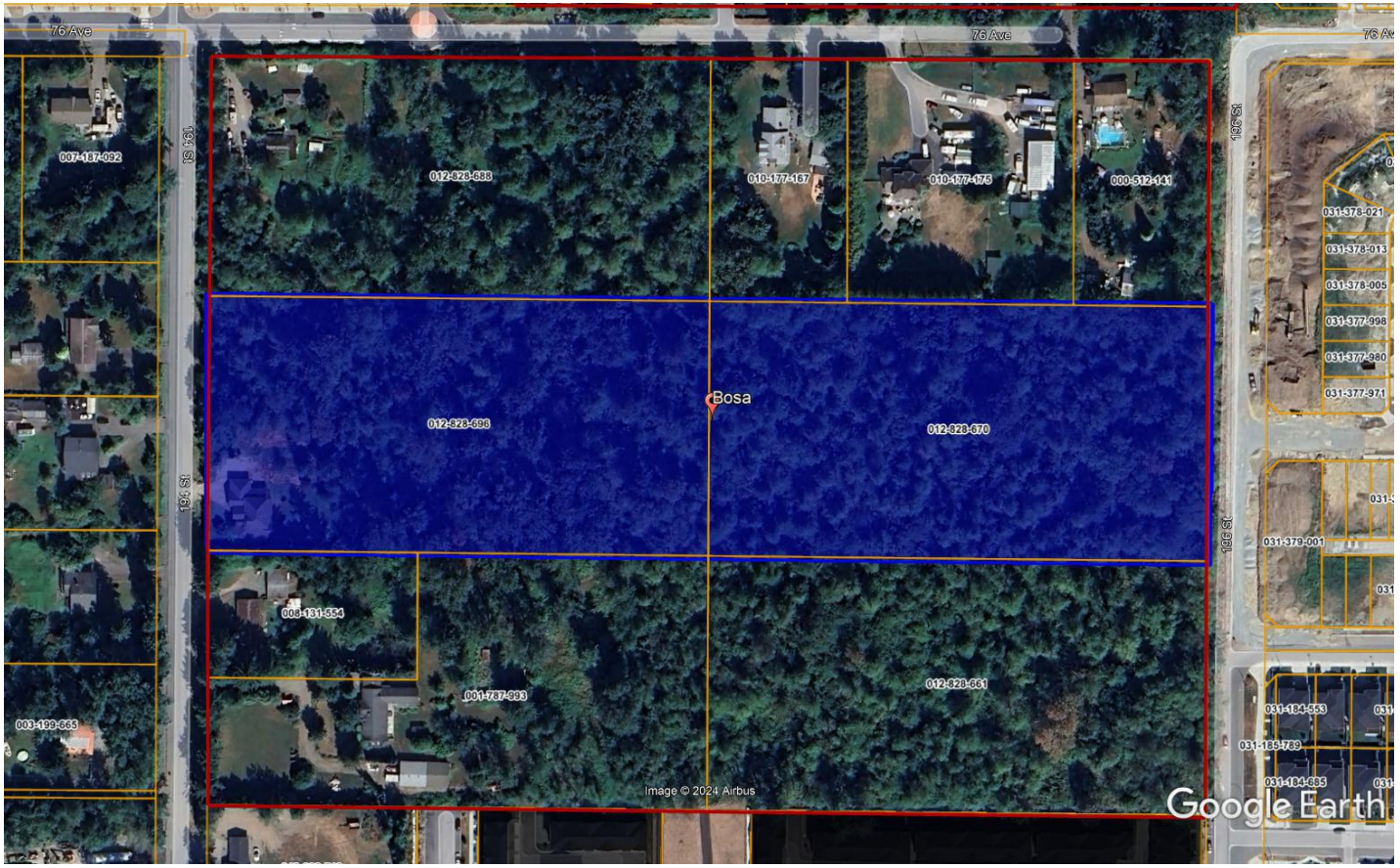


Figure 3. Bosa group of properties (red), with Bosa owned parcels identified (blue).

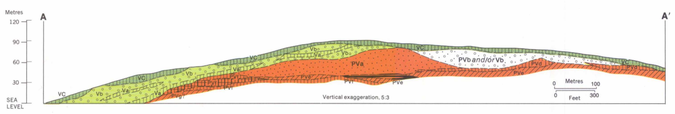
GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

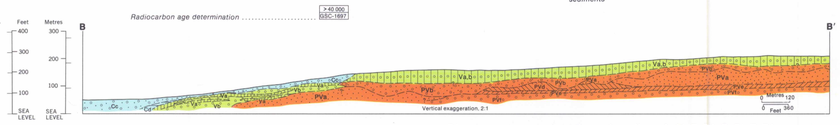
LEGEND

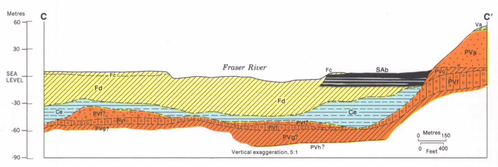
For detailed lithology of cross-sections, see table of lithologic units on reverse

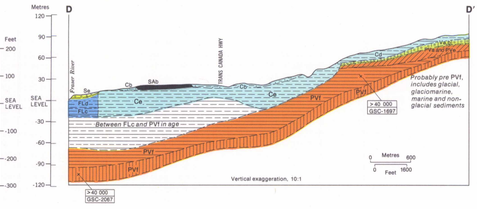
Glacial sediments | Glacial and glacio-fluvial sediments | Glaciofluvial sediments; mainly gravel | Glaciofluvial sediments | Glaciofluvial sediments; mainly sand | Glaciofluvial and glacio-marine sediments | Marine sediments; offshore beach and intertidal | Glaciomarine and/or marine sediments | Glaciomarine sediments | Fluvial sediments | Fluvial sediments with inter-bedded organic sediments | Glacial, glaciofluvial, glacio-lacustrine, glaciomarine sediments | Glaciolacustrine and glacio-marine sediments

Radiocarbon age determination ..... > 40 000 GSC-1897









Diagrammatic cross-sections along lines A-A′, B-B′, C-C′, D-D′

123°00′ 55′ 50′ 45′ 40′ 35′ 122°30′ — 49°20′ — 15′ — 10′ — 05′ — 49°00′

LEGEND

QUATERNARY

POSTGLACIAL

SALISH SEDIMENTS

SAa — *Landfill* including sand, gravel, till, crushed stone, and refuse

SAb-e — *Bog, swamp, and shallow lake deposits:* SAb, *lowland peat up to 14 m thick, in part overlying* Fb, c; SAc, *lowland peat up to 1 m thick underlying* Fb *(up to 2 m thick);* SAd, *lowland organic sandy loam to clay loam 15 to 45 cm thick overlying* SAg *and* Fd; SAe, *upland peat up to 8 m or more thick*

SAf, g — *Marine shore sediments (beach deposits):* SAf, *sand to sandy loam up to 2 m thick overlying estuarine, fossiliferous, fine sand and clayey silt, 10 to 185 m thick (Fe of Lithologic Units and Environments of Deposition);* SAg, *medium to coarse sand and gravel up to 8 m thick*

SAh-k — *Lowland and mountain stream deltaic, channel fill, and overbank sediments:* SAh, *lowland stream channel fill and overbank sandy loam to clay loam, also organic sediments up to 8 m thick;* SAj, *mountain stream marine deltaic medium to coarse gravel and minor sand up to 15 m or more thick;* SAj, *mountain stream channel fill sand and gravel up to 8 m thick;* SAk, *lowland stream channel fill sand to gravel and minor silt and clay up to 5 m thick*

FRASER RIVER SEDIMENTS

Fa-d — *Deltaic and distributary channel fill sediments overlying and cutting estuarine sediments and overlain in part of the area by overbank sediments:* Fa, *channel deposits, fine to medium sand and minor silt occurring along present day river channels;* Fb, *overbank sandy to silt loam up to 2 m thick overlying 15 m or more of* Fd; Fc, *overbank silty to silt clay loam normally up to 2 m thick overlying 15 m or more of* Fd; Fd′, *deltaic and distributary channel fill (includes tidal flat deposits) sandy to silt loam, 10 to 40 m thick interbedded fine to medium sand and minor silt beds; may also contain organic and fossiliferous material*

POSTGLACIAL AND PLEISTOCENE

SA-C — *Marine shore and fluvial sand up to 8 m thick,* Cb *in part has been reworked and redeposited by lowland streams* (SAh)

PLEISTOCENE

SUMAS DRIFT

Sa-e — *Outwash, ice-contact, and deltaic deposits:* Sa, *outwash sand and gravel up to 30 m thick;* Sb, *ice-contact gravel and sand containing till lenses and clasts of glaciomarine stony clayey silt, 2 to 5 m thick overlying* FLc, d; Sc, *ice-contact gravel and sand containing till lenses and clasts of glaciomarine stony clayey silt, 2 to 5 m thick overlying* FLb, e; Sd, *ice-contact gravel and sand containing till lenses and clasts of glaciomarine stony clayey silt, more than 5 m thick;* Se, *raised proglacial deltaic gravel and sand up to 40 m thick*

FORT LANGLEY FORMATION

FLa-e — *Glacial and deltaic sediments:* FLa, *lodgment and flow till with sandy loam matrix containing clasts of* FLc; FLb, *outwash and ice-contact gravel and sand containing clasts of* FLa, c; FLc, *glaciomarine stony clayey silt to silty sand 8 to 90 m thick, commonly thinly bedded and containing marine shells;* FLd, *marine silty clay to fine sand commonly containing marine shells;* FLe, *proglacial deltaic gravel and sand*

CAPILANO SEDIMENTS *(Chronologically equivalent to Sumas Drift and Fort Langley Formation, see Lithologic Units and Environments of Deposition)*

Ca-e — *Raised marine, deltaic, and fluvial deposits:* Ca, *raised marine beach, spit, bar, and lag veneer, poorly sorted sand to gravel (except in bar deposits) normally less than 1 m thick but up to 8 m thick, mantling older sediments and containing fossil marine shell casts up to 175 m above sea level;* Cb, *raised beach medium to coarse sand 1 to 5 m thick containing fossil marine shell casts;* Cc, *raised deltaic and channel fill medium sand to cobble gravel up to 15 m thick deposited by proglacial streams and commonly underlain by silty to silty clay loam;* Cd, *marine and glaciomarine stony (including till-like deposits) to stoneless silt loam to clay loam with minor sand and silt normally less than 3 m thick but up to 30 m thick, containing marine shells. These deposits thicken from west to east.* Ce, *mainly marine silt loam to clay loam with minor sand, silt, and stony glacio-marine material (see* Cd), *up to 60+ m thick. In many of the upland areas sediments mapped as* Cc *and* Cd *are mantled by a thin veneer (less than 1 m) of* Ca

VASHON DRIFT AND CAPILANO SEDIMENTS

VC — *Glacial drift including: lodgment and minor flow till, lenses and interbeds of substratified glaciofluvial sand to gravel, and lenses and interbeds of glacio-lacustrine laminated stony silt; up to 25 m thick but in most places less than 8 m thick (correlates with* Va, b); *overlain by glaciomarine and marine deposits similar to* Cd *normally less than 3 m but in places up to 10 m thick. Marine derived lag gravel normally less than 1 m thick containing marine shell casts has been found mantling till and glaciomarine deposits up to 175 m above sea level; above 175 m till is mantled by bouldery gravel that may be in part ablation till, in part colluvium, and in part marine shore in origin*

VASHON DRIFT

Va,b — *Till, glaciofluvial, glaciolacustrine, and ice-contact deposits:* Va, *lodgment till (with sandy loam matrix) and minor flow till containing lenses and interbeds of glaciolacustrine laminated stony silt;* Vb, *glaciofluvial sandy gravel and gravelly sand outwash and ice-contact deposits*

PRE-VASHON DEPOSITS

PVa-h — *Glacial, nonglacial, and glaciomarine sediments:* PVa, *Quadra fluvial channel fill and floodplain deposits, crossbedded sand containing minor silt and gravel lenses and interbeds;* PVb, *Quadra(?) glaciofluvial deposits, deltaic, and crossbedded sand to gravel (may be in part* Vb*);* PVc, *Quadra marine interbedded fine sand to clayey silt believed to be off shore equivalents of* PVa; PVd, *Coquitlam till, glaciomarine (?); and glaciolacustrine deposits;* PVe, *Cowichan Head fluvial, organic colluvial, and bog and swamp sediments;* PVf, *Semiahmoo till, glacio-fluvial, glaciomarine, and glaciolacustrine deposits;* PVg, *Highbury fluvial and bog and swamp deposits;* PVh, *Westlynn glaciofluvial sandy gravel*

UNDIVIDED PRE-VASHON DEPOSITS

UPV — *Till, glaciofluvial, glaciolacustrine, fluvial, marine, and organic sediments*

TERTIARY

T — *Tertiary bedrock including sandstone, siltstone, shale, conglomerate, and minor volcanic rocks; where bedrock is not at the surface it is overlain by glacial deposits and colluvium*

PRE-TERTIARY

PT — *Mesozoic bedrock including granitic and associated rock types; where bedrock is not at the surface it is overlain by glacial deposits and colluvium*

Note: Except in areas mapped as PT *and* T, *the Quaternary deposits are normally more than 10 m thick and may be up to 300+ m thick. The materials at the surface are underlain by older deposits as illustrated in the legend and table of formations*

**Unit used only in cross-section*

Geological boundary, mainly gradational .....

Area of recorded landslides ..... RS

Area of recorded flooding (except the Fraser River floodplain) ..... RF

Geology by J.E. Armstrong 1949-1952, 1973-1975, W.L. Brown 1949-1950, S.R. Hicock 1974, 1976

Additional information from E.C. Halstead 1954-1975; Province of British Columbia Soils Survey 1956-1965

For bedrock geology see GSC Memoir 335 by J.A. Roddick

Compiled by J.E. Armstrong and S.R. Hicock 1976

Geological cartography by R.S. Hill, Geological Survey of Canada

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Base-map assembled by the Geological Survey of Canada from maps published at the same scale by the Surveys and Mapping Branch in 1976, 1977

Copies of the topographical edition of these maps may be obtained from the Canada Map Office, Department of Energy, Mines and Resources, Ottawa

Approximate magnetic declination 1978, 22° 23′ East decreasing 4.2′ annually

Elevations in feet above mean sea level

Copies of this map may be obtained from the Geological Survey of Canada
601 Booth Street, Ottawa, Ontario K1A 0E8
3303 - 33rd Street, N.W., Calgary, Alberta T2L 2A7
100 West Pender Street, Vancouver, B.C. V6B 1R8

INDEX MAP

MAP 1484A
SURFICIAL GEOLOGY
NEW WESTMINSTER
WEST OF SIXTH MERIDIAN
BRITISH COLUMBIA

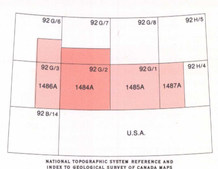
Scale 1:50,000

Kilometres 1 0 1 2 3 4 Kilometres
Miles 1 0 1 2 Miles

Universal Transverse Mercator Projection

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MAP 1484A
NEW WESTMINSTER
BRITISH COLUMBIA

This map has been produced from a scanned version of the original map
Reproduction par numérisation d'une carte sur papier

1484A

Project Title:	Willoughby Property Purchase		
SAP Project #:	TM-0592	**Project Manager:**	Robert Hepple

1. Project data

1.1. Standard References

Project Phase(s)/Stage(s):	IDN - Conceptual Design
Originating Organization:	Substations Growth & Sustainment
Project Initiator:	Maureen Daschuk
Project Sponsor:	Charlotte Mitha
Project Manager:	Robert Hepple
Program Manager:	N/A

1.2. Statement of Objectives Revision History

Phase/Stage	Revision #	Key Changes Made	Date
Conceptual Design & Business Case Appendix	0		

1.3. Project Background

Langley is one of the fast-growing areas in the Lower Mainland. Load growth in the north Langley area requires the development of a new 230/25kV, 200MVA outdoor substation by F2032 to meet future load growth. Currently there are no BCH owned properties available to serve as a station site.

The Langley area is presently supplied by three substations, Port Kell (PKL), Harvey Road (HRD) and McLellan (MLN). PKL and HRD are at their ultimate capacities of 100MVA in Winter and 79MVA in Summer. MLN is being upgraded to 400MVA in Winter and 315MVA in Summer, however, by F2033 most of the augmented capacity will be used. Therefore, a new substation, particularly in the Willoughby area where the load is growing rapidly, is required by F2032 to meet the future load growth.

The objective of the TM-0592 Project is to purchase at least 48,560 M^2 (12.0 acres) of suitable property, at a reasonable distance from the Willoughby distribution load center and two transmission connections from MLN, to allow a 230/25kV, 200 MVA ultimate outdoor substation and a future 230/60kV switching station to be built.

2. Project Initiator's Statement of Summary Requirements

2.1. Statement(s) of the business problem or opportunity and the required response

Problem

- A new substation is required in the Willoughby area to support load growth and the electrification plan for the area after F2033. There are no BC Hydro owned properties in the area to serve as a station location.

Required Response

- Purchase a suitable property for the future development of an ultimate 230/25kV, 200 MVA outdoor substation and a 230/60kV switching station in the Willoughby area.

2.2. Safety, Security (Critical Infrastructure Protection) and Confidentiality Requirements

- The site must be safe for construction, operation/ maintenance and for public.

2.3. Maintenance and Operational Requirements

- Property must be large enough to fit a 230/25kV, 200 MVA substation and a 230/60kV switching station, based on the SC-1 model. Initial property size requirements are approximately 48,560 M^2 or 250 M x 194 M (12.0 acres).
- Ensure the internal roads at the site will provide sufficient access to equipment and buildings for repair and maintenance purposes.
- Ensure suitable access to the station is available.

2.4. Indigenous Relations Business Strategy Requirements

With the intention of gaining First Nations' support for the project through relationship building, listed below are Indigenous Relations' business strategy requirements expected to be delivered by this project:

- Building a new substation triggers the duty to consult.
- The level of effort for the property acquisition will be low but the level of effort for the new substation will likely be high (new substations are typically high-impact projects). The level of incremental impact may change depending on the location chosen.

2.5. Project Initiator's Design Requirements

The Project Initiator has the following high level Design Requirements for the project:

- Consider orientations of the station layout to make the best possible use of the site while ensuring the future ultimate layout is not compromised including transmission and distribution supply.
- Reasonable proximity to viable transmission supply.
- Reasonable proximity to the load center for distribution.
- Adequate egress/ingress for 25kV, 60kV and 230kV cables. Access to 3 sides of the substation is preferred.

2.6. Project Initiator's Interim Decision Requirements

The Project Initiator requires the following items, in addition to the above requirements, for the current project phase(s)/Stage(s). The list includes the Project Initiator's requirement for approval, acceptance, or permission to proceed for each item.

- None identified currently.

3. Project Manager's Proposed Summary Objectives to Achieve Requirements

3.1. Scope Objectives

Project

- Purchase a suitable property for the future development of an ultimate 230/25kV, 200 MVA outdoor substation and a 230/60kV switching substation in the Willoughby area.

Options to be considered:

Three alternative properties of the 16 identified have been shortlisted using the SDM for further investigation. Other properties may be identified the Concepts Phase. Consultation with all stakeholders will be conducted in the Concepts phase. For the current phase, the optional properties are identified as:

- Option One – Alternative 14
  - PID 006-845-851,006-845-860,006-845-878
  - NW Corner of 192 St & 80 Ave. Langley
- Option Two – Alternative 15, ALR Property
  - PID Portion of 003-179-184
  - North of 88th Ave and 192 St. Surrey
- Option Three – Alternative 16, Joe Varing Property
  - PID 004-417-275, 008-822-158, 008-822-174, 004-406-290, 001-971-860
  - SE Corner of 78th Ave & 216 St Langley

Current Phase/Stage –

- Conduct various studies intended to confirm the suitability of each property and provide enough information so that a single property and a backup can be selected to take forward with a recommendation to purchase in the next phase.

3.2. Schedule Objectives

Project

The target dates for milestone events for the project are:

Date	Description	PPM Milestone UID
04 Feb 2026	IDN Feasibility + DEF Complete	2.01, 2.02
30 Oct 2026	ISD	1.01
22 January 2027	Project Complete & Evaluation Report Signed & Accepted	3.08
15 April 2027	Project Financial Close	3.58

Current Phase/Stage

The dates for milestone events for this phase/stage are:

Date	Description	PPM Milestone UID
14 April 2025	IDN – Conceptual Design Stage Complete	3.01

3.3. Cost Objectives

Current Phase/Stage -

- The total expected cost for this phase/stage of the project is $499K
- The total project funding to the end of this phase/stage of the project is an Expected Cost of $612K

4. Approvals

Robert Hepple is appointed Project Manager with authority and responsibility in accordance with the Project Management Policies and Procedures of BC Hydro, Capital Infrastructure Project Delivery and Engineering.

Accepted by:	Robert Hepple Project Manager	04-30-2024 Date
Reviewed[1] by:	Surinder Parmar, Team Lead, Stations, PD	30 Apr 2024 Date
Initiator:	Maureen Daschuk EVP, Integrated Planning	May 13, 2024 Date
Sponsor:	Charlotte Mitha EVP, Operations	May 13, 2024 Date

To be completed by Finance

FAAP Approver: _____

*Only for **EAR Exempt** CIPD projects <$500k where SoO used in place of Business Case and where an EAR form is not prepared by Finance*

[1] For compliance with PPM Practices.

BC Hydro
Power smart

Proposed Willoughby Substation

Preliminary Geotechnical Investigation – Property Acquisition

TM0592

Memo Number	Revision	Information Security Classification
414V-TEM-00001	0	BC Hydro Internal

To: David Chwaklinski **Date** 2025 Mar 04

From: Dylan Lee

Copy: Robert Hepple, David Chan

Related Facilities	Proposed Willoughby Substation

1 Introduction

As requested by the Project Team, BC Hydro completed an initial geotechnical investigation for the proposed Willoughby Substation site as part of the due diligence study for property purchases. The properties under consideration are Bosa properties on 7528 194th street and 7507 196th Street and Kool's property on 7468 194 Street.

The memorandum should be read in conjunction with BC Hydro's previous preliminary desktop geotechnical assessment issued on December 19, 2024 (Memo# 000-TEM-00095). BC Hydro retained Klohn Crippen Berger (KCB) to plan and implement a limited geotechnical investigation to produce a geotechnical factual report. The purpose of this limited geotechnical investigation was to prove the ground conditions are consistent with the desktop assessment and that there are no significant geotechnical risks on the property acquisition of the site for the purpose of substation development.

The final factual geotechnical report is appended to this memorandum as Appendix A. A summary of the factual geotechnical data report and our assessment of these results are presented in this memorandum. These results should not be solely used for the design of substation foundation and civil work cost estimates.

2 Summary and Discussion

Key items from the factual geotechnical report (Appendix A) and the undersigned limited field reconnaissance on February 10th, 2025 are described as follows:

- Machine solid stem auger hole was drilled to approximate 14 m to refusal on the Kool's property indicating the soil consisted generally of silt (till-like) with Standard Penetration Test (SPT) values between 31 to 15 within this formation; however, very limited soft silt encountered between 6.1 to 8.2 m depth (SPT is zero) and minor amount of sand and gravel were encountered. Refusal at 14 m was due to a suspected boulder erratic at this depth. Based on this result, the Site Class is D and not considered susceptible to liquefaction. Two other augerholes were planned on the other properties but were not completed due to surface refusal (concrete rumble) or conflict with unknown utilities. The soil encountered in the augerhole is consistent with the soil logged in historical groundwater wells in the surrounding area (see referenced geotechnical desktop study) and matches with the expected Capilano Sediments (marine/glaciomarine stoney silt loam to clay loam) also known as ice age sediments in the regional surficial geology map.

- Twelve hand auger holes were completed across all properties up to 0.9 m depth and indicated the soils comprised of very limited top soil up to 400 mm deep and underlain by wet to moist silt and clay. Due to the poor draining conditions near surface water or groundwater was perched within the upper soil unit. This watertable is considered perched and do not reflect the permanent ground water at deeper depth as determined by nearby groundwater wells. The surface and near surface water is likely to vary across the site depending on drainage and topographic conditions.

- There are areas where the land is waterlogged at the time of field reconnaissance because of the poor draining soils and nearly flat grade. The only noted municipal drainage features are ditches that run along 194th St and 76th Avenue. Significant vegetation removal and hardscaping (placement of gravel) will increase runoff off the property which can negatively impact neighbouring properties and local storm drainage works. An engineered storm water management and erosion sediment control plan will be required during temporary construction and at permanent configuration. These works may include sedimentation ponds, perimeter swales, site drainage services, holding tanks, rain gardens, etc; which are widely practice in this area are part of land redevelopment. Infiltration pits (rock pits, dry wells, etc) are unlikely to be suitable for the site.

- Due the nature of the native surficial fine grained soils and perched water conditions, immediate gravel placement or vegetation cover is recommended to avoid exposing the bare subgrade soils to direct rain rainfall and ponding. Saturated and trafficking directly on this soil will likely result in soil softening and rutting; potentially rendering the soil unsuitable for landscape and structural loading.

- Laboratory testings confirmed there are minor lenses of silty sand within the clay loam Capilano Sediments and that the fine grained soils encountered is generally low to intermediate plasticity silty clay.

- There are known septic fields and tanks behind the main dwellings on the properties. The fields and tanks will need to be decommissioned; and overexcavation/soil replacement will be required if constructing structures over these locations.

- Based on the limited site reconnaissance and desktop study, it wasn't apparent there were historical ponds on the properties. What was widely practiced in the surrounding area historically prior to water service connection was the construction of small ponds on the properties to supplement groundwater wells for domestic water consumption, and to manage site drainage. Although not observed during the site reconnaissance and desktop study, we cannot completely discount the possibility one may have existed and was simply backfilled. Historical ponds pose settlement potential and bearing issues due to soft sediments that accumulate at the bottom and the potential poor backfill soils.

- There was limited potential fill that was imported to the property. Particularly, at BOSA's property 7528 194 Street, Surrey at the driveway, it was determined through the fact that an auger hole could not be drilled (immediate refusal), that concrete rubble underlain the driveway. The concrete rubble may need to be removed depending on land use requirements.

- At the rear of Kool's property 7468 194 Street, Surrey, previous vegetation clearing, spur roads, and storage of old vehicles including an excavator was observed. The particular land use at the rear of the property is questionable but can be assumed at this time that it was a storage area for equipment and vehicles. Based on the current grades is similar to interpreted original grades and from surficial hand test holes, we do not anticipate significant imported fill in this area.

The site is considered suitable for substation development using shallow foundation construction. Excavation depth to suitable foundation subgrade may vary across the site. It is recommended a comprehensive test pitting and drilling geotechnical investigation with cone penetration testing is completed to target ground condition where the station equipment and foundation are planned in order to determine bearing resistance, excavation depth to suitable subgrade and stripping depth requirements. Very soft soils at near surface may result in ground settlement if not identified and removed. The very soft clay layer encountered between 6.10 m and 10.67 m encountered in the drilling program should be further characterized to understand spatial extent and to determine if surcharging will cause excessive settlement. Soil percolation testing may be completed to support site drainage works and oil containment system designs; however, based on the soil encountered in this investigation we expect the soil to be consider near impervious. The discussion and recommendations as per the geotechnical desktop study are considered valid upon review of the investigation results.

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Prepared by:

Dylan Lee, P.Eng. Geotechnical Engineer

Accepted by:

David Chwaklinski P.Eng., FEC., PMP,
Project Engineer Specialist

Appendix A – KCB Geotechnical Data Report

Klohn Crippen Berger

BC Hydro
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Willoughby Substation Preliminary Geotechnical Investigation



Geotechnical Data Report

Rev. 0

CANADA BEST MANAGED COMPANIES Platinum member

ISO 9001 14001 45001

P10600A140

February 2025

February 28, 2025

BC Hydro
6911 Southpoint Dr.
7th Floor
Burnaby, BC
V3N 4X8

Dylan Lee, P.Eng.
Senior Geotechnical Engineer, Transmission Lines Engineering

Dear Mr. Lee:

Willoughby Substation Preliminary Geotechnical Investigation
Geotechnical Data Report
Rev. 0

Klohn Crippen Berger Ltd. (KCB) is pleased to submit our Geotechnical Data Report for the preliminary site investigation carried out for the proposed Willoughby Substation located in the City of Surrey.

This report presents the results from the site investigation carried out from February 5th to 6th, 2025.

Yours truly,

KLOHN CRIPPEN BERGER LTD.
B.C. Permit to Practice No. 1000171

Matthew Cormier, P.Eng.
Geological Engineer

MC/JM

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Willoughby Substation Preliminary Geotechnical Investigation

Geotechnical Data Report

Rev. 0

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CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of BC Hydro (Client) for the specific application to the Willoughby Substation Preliminary Geotechnical Investigation Project, and it may not be relied upon by any other party without KCB's written consent.

KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied. The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report. The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time. KCB should be consulted regarding the interpretation or application of the findings in the report. The report contains information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.

The test hole data indicate subsurface conditions at the specific locations where samples were obtained or where in-situ tests were conducted, and only at the time they were obtained and to the depths penetrated. The samples and tests cannot be relied upon to accurately reflect the nature and extent of variations in strata and material parameters that may exist between sampling or testing locations.

1 INTRODUCTION

BC Hydro (BCH) has retained Klohn Crippen Berger Ltd. (KCB) to provide geotechnical consulting services as part of the Willoughby Substation – Phase 1 Geotechnical Investigation Project under KCB's Master Services Agreement (MSA) for Geotechnical Engineering and Geohazard Services (Reference #: RFP 17635) with BC Hydro (effective March 4th, 2024).

BCH wished to undertake a geotechnical investigation at a greenfield site, located within 76 Avenue, 74 Avenue, 194 Street, and 196 Street in the City of Surrey in the Bosa and Kool properties, to perform a screening level assessment prior to completing property acquisition for the proposed new substation. The project locations and proposed property acquisition is shown in Figure 1.1.

This report summarises the preliminary geotechnical information collected during the investigation program and geotechnical conditions expected to be encountered throughout the project site.

Figure 1.1 Phase 1 Geotechnical Investigation Project Location (Land Title and Survey Authority of BC 2025)



2 REVIEW OF AVAILABLE GEOTECHNICAL DATA

BCH carried out a preliminary desktop geotechnical assessment of the site location in 2019. The assessment consisted of reviewing information from the BCH, City of Surrey and the Township of Langley, Geological Survey of Canada, Google Earth, Province of British Columbia, and information from nearby building structures. Lithology review of wells installed within the site location indicated the presence of clays, gravel, sand, and till soils.

3 SITE INVESTIGATION

3.1 Scope of Work

An initial site visit was completed on January 10th, 2025 with representatives from BCH and KCB to identify the requirements for the geotechnical investigation and access constraints. KCB's site investigation program consisted of three (3) proposed auger holes advanced using an auger drill rig and twelve (12) hand auger holes conducted from February 5th to 6th, 2025.

The locations of the test holes are indicated on a Site Investigation Plan and can be found in Appendix I.

3.2 Utility Locates

KCB conducted a BC One Call (Ticket Number: 20250211803) prior to the site investigation. The ticket response indicated asset owners, BCH, FortisBC, Telus, and Rogers. There were no conflicts with the asset holders identified in the working area. KCB engaged a utility locating sub-contractor, Quadra Utility Locating, of Port Coquitlam, BC, to conduct utility locating services prior to drilling. An anomalous signature was identified at AH25-B, which ran adjacent to a large extent of the southbound gravel shoulder of 196 Street (see Appendix II for photos). AH25-B could not be relocated further west into the wooded area as it was inaccessible by the truck mounted drill rig. After discussion with BCH, AH25-B was removed from the drilling program.

The properties of Kool and Bosa contained local electrical, gas, and water connections to City services on 194 Street. Each property also contained their own septic system located within the property. The Bosa property's septic system is located about 10 m east of the edge of the gravel driveway. The Kool property's septic system is located directly to the east of the house, below the concrete patio.

3.3 Traffic Control

Inline Traffic Services Ltd. of Coquitlam, BC, prepared the traffic management plan prior to the drilling investigation and provided traffic control services during the auger drilling program.

3.4 Auger Drilling

Geotech Drilling Services Ltd., of Delta, BC, was retained by KCB to perform the geotechnical auger drilling work on February 5th, 2025 for the purpose of investigating the subsurface conditions prior to property acquisition by BCH. Three drill holes were attempted within the Bosa and Kool properties with only one drill hole successfully being drilled to the target depth. Auger hole AH25-01 was completed to a depth of 13.56 m in the Kool property near the southern property line. Auger hole AH25-B, located along 196 Street near the eastern Bosa property line, was eliminated in the field due to a located potential utility. Auger hole AH25-02, located in the Bosa property near 194 Street, was terminated at a depth of 0.15 m due to repeated refusal within the granular driveway surface as there was suspected random concrete fill within the driveway.

The auger drill holes were carried out using a B54 truck mounted drill rig. The auger flights used in the investigation were a hollow stem auger in 1.52 m (5') length with an inside diameter (I.D.) of 108 mm (4.25"). Depth measurements were taken from the ground surface, and the stratigraphy was logged by KCB's field engineer. Drilling was advanced in 1.52 m (5') runs.

Soil sampling was conducted by KCB at approximate 1.52 m (5') intervals from soils recovered by the Standard Penetration (SPT) split spoon sampler. SPT's were conducted in accordance with ASTM D1586. The SPT consists of driving a standard 51 mm (2") outside diameter (O.D.), 610 mm (2') long split spoon sampler into the soil using and automatic trip hammer with a mass of 6.5 kg (140 lbs) and a drop height of 762 mm (2.5'). The number of hammer blows are recorded for each 0.15 m (0.5') of sampler penetration. The number of hammer blows required to advance the sampler every 0.15 m (0.5') was recorded up to 0.6 m (24") depth of advancement.

SPTs were carried out every 1.52 m (5') for AH25-01, except for SPT-07, which was carried out at an auger refusal depth of 13.41 m (44"). The soils recovered in the SPT split spoon sampler were visually classified and subsequently sampled by KCB for further classification and laboratory testing. Disturbed soil samples were placed in plastic bags, sealed, and transported to KCB's Vancouver laboratory for index testing. The completed drill hole was backfilled with auger cuttings from 13.56 m to 0.65 m, bentonite chips from 0.65 m to 0.15 m, and additional auger cuttings from 0.15 m to surface. in accordance with the BC Groundwater Protection Regulation.

Drill rig information is summarised in Table 3.1, and the SPT hammer calibration information is presented in Appendix III. Coordinates were collected using a cellphone GPS. Drill hole locations are summarised in Table 3.2 and drill hole logs are presented in Appendix IV.

Table 3.1 Summary of Drill Rig Information

Drill Rig Model	Drill Rig ID	Hammer ID	Calibration Date
B54	DR002	SPT015	September 10, 2024

Table 3.2 Summary of Auger Drill Hole Locations

Auger Hole ID	Corresponding Property	Northing (m)	Easting (m)	Termination Depth (m)
AH25-01	Kool	5442872.58	523037.31	13.56
AH25-02	Bosa	5442990.20	522984.31	0.15
AH25-B	Bosa	5442991.84	523375.25	Eliminated due to potential utility locates.

3.5 Hand Augering

KCB field engineers carried out hand augering on February 6th, 2025 using an Edelman hand auger rented from Hoskin Scientific. Hand augering was chosen in these locations due to the limited access in a moderately wooded area which would not be accessible to a drill rig without significant clearing and grubbing. Hand augering was advanced in runs of about 0.18 m up to refusal depth. The soils recovered by the hand auger were only visually classified.

Coordinates were collected using a cellphone GPS. Hand auger hole locations are summarised in Table 3.3, and hand auger logs are presented in Appendix IV.

Table 3.3 Summary of Hand Auger Hole Locations

Auger Hole ID	Northing (m)	Easting (m)	Termination Depth (m)
HA25-01	5442933.86	523069.15	0.72
HA25-02	5442889.52	523098.51	0.90
HA25-03	5442927.32	523101.27	0.72
HA25-04	5442982.58	523022.27	0.90
HA25-05	5442993.84	523056.5	0.72
HA25-06	5442975.16	523109.1	0.72
HA25-07	5443011.87	523114.05	0.90
HA25-08	5443056.79	523222.54	0.90
HA25-09	5443030.05	523208.79	0.72
HA25-10	5443035.96	523291.19	0.90
HA25-11	5443022.52	523269.36	0.72
HA25-12	5443008.32	523327.77	0.72

3.6 Laboratory Testing

Collected soil samples from the auger drilling investigation were transported to the KCB laboratory in Vancouver, BC. The soil laboratory tests carried out by KCB are summarised in Table 3.4. Laboratory test results can be found in Appendix IV.

Table 3.4 Summary of Laboratory Tests

Test Name	Number of Tests	ASTM Standard
Moisture Content	5	ASTM D2216
Washed Sieve	1	ASTM D6913 and ASTM D1140
Atterberg Limits	3	ASTM D4318
Hydrometer	2	ASTM D7928

1. Hydrometer tests include a washed sieve on soils greater than 0.075 mm.

4 SUBSURFACE CONDITIONS

4.1 Soil Conditions

The soil descriptions provided in this report are based on commonly accepted methods of classification, more specifically, Modified Unified Soil Classification System (USCS) from ASTM D2487 and identification employed in geotechnical practice. Classification and identification of soil involves judgment, and KCB does not guarantee descriptions as exact but infers accuracy to the extent that is common in current geotechnical practice. The locations of stratigraphic boundaries indicated in the test hole logs are inferred from the limited data; the location of these boundaries may not be exact. These boundaries may also represent transitions from one soil type to another and should not necessarily be regarded as the location of a precise or planar contact between different geological materials.

The surficial soils at the site consist primarily of low to intermediate plasticity silty clays and low plasticity silts mixed with small amounts of sands and gravels. These fine grained soils were typically stiff to very stiff, although very soft silty clay was encountered from the depths of 6.10 m to 10.67 m at AH25-01 where the split spoon sampler was able to penetrate 0.6 m under the weight of the steel rods and sample without requiring blows from the hammer. Silty sand was then encountered from 12.19 m at AH25-01 up to the termination depth of 13.56 m where the auger encountered refusal on a suspected cobble or boulder. Table 4.1 summarises the typical conditions encountered during the investigation.

Table 4.1 Typical Ground Conditions Encountered During Geotechnical Investigation

Soil Type	USCS Classification	Properties	Comments
Topsoil	-	▪ Clayey and occasional sandy with grass, rootlets, and roots. ▪ Brown to dark brown.	▪ Up to 0.36 m thick.
Clay	CL to CI	▪ Clay to silty clay, trace sand, trace gravel, trace organic soil. ▪ Stiff to very stiff from 0.30 m to 6.10 m. Very soft from 6.10 m to 10.7 m. ▪ Ranges from brown, grey, and tan.	▪ Up to 12.01 m thick. ▪ Encountered from 0.18 m to 12.19 m depth.
Silt	ML	▪ Some clay to clayey, trace sand to sandy, and trace to some gravel. ▪ Very soft to very stiff, moist. ▪ Ranges from brown, grey, and tan.	▪ Up to 0.72 m thick. ▪ Encountered from 0.18 m up to 0.90 m depth.
Sand	SM	▪ Silty, some gravel and trace cobbles. ▪ Poorly graded. ▪ Grey to greyish tan.	▪ Encountered at 12.19 m to the termination depth at 13.56 m in AH25-01.

4.2 Water Level Observations

Water was visually observed and measured in several hand auger holes with depths ranging from about 0.05 m to 0.60 m. Within the vicinity of HA25-04, frozen standing water was visible at the ground surface. Water was also observed during auger drilling at AH25-01 below a depth of about 1.52 m, but the depth was not confirmed due to time limitations with the drilling program. Measured water depths from ground surface are summarised in Table 4.2

Table 4.2 Measured Water Levels

Auger Hole ID	Northing (m)	Easting (m)	Water Depth (m)
HA25-01	5442933.86	523069.15	0.30
HA25-03	5442927.32	523101.27	0.36
HA25-04	5442982.58	523022.27	0.05
HA25-05	5442993.84	523056.5	0.05
HA25-06	5442975.16	523109.1	0.29
HA25-08	5443056.79	523222.54	0.15
HA25-10	5443035.96	523291.19	0.60
HA25-11	5443022.52	523269.36	0.14
HA25-12	5443008.32	523327.77	0.18

5 CLOSING

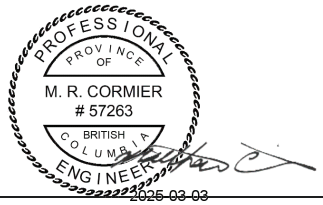
We trust this geotechnical Data report meets your requirements. Should you have any questions or concerns, regarding this report, please do not hesitate to contact the undersigned.

KLOHN CRIPPEN BERGER LTD.
B.C. Permit to Practice No. 1000171

Prepared by:



Jordan Mah, E.I.T.
Geotechnical Engineer



Matthew Cormier, P.Eng.
Geological Engineer

Reviewed by:



Alireza Aboutalebi, P.Eng.
Senior Geotechnical Engineer

REFERENCES

BC Hydro. (BCH). 2019. Proposed Willoughby Substation Preliminary Desktop Geotechnical Assessment TM0592.

Land Title and Survey Authority of BC. 2025. “ParcelMap BC” Accessed January 13, 2025.

APPENDIX I

Site Investigation Plan



APPENDIX II

ConeTec SPT Hammer Calibration Information

Job No: 24-02-28326
Client: Geotech Drilling Services Ltd
Project: Geotech SPTe Calibration
Start Date: 2024-09-10
End Date: 2024-09-10

Borehole ID: BH24-01
Rig: DR002
Hammer: SPT015

STANDARD PENETRATION TEST ENERGY MEASUREMENT RESULTS

Test Start Depth (ft)	Date	Instrumented Rod Type	Instrumented Rod Area (cm^2)	Rod String Type	Strain Gauge #1 Serial No.[1]	Strain Gauge #2 Serial No.[1]	Accelerometer #1 Serial No.[1]	Accelerometer #2 Serial No.[1]	Recorded Blow Counts 0"-6"	Recorded Blow Counts 6"-12"	Recorded Blow Counts 12"-18"	Recorded Blow Counts 18"-24"	N (Blow Counts)[2]	Number of Blows Analyzed[2]	Average Max Force (kN)	Average Max Energy (kN-m)	Average Energy Transfer Ratio (FV) (%)	Standard Deviation of ETR (%)	Refer to Notation Number
0.0	2024-09-10	AWJ	7.61	AWJ	505AWJ1	505AWJ2	K5741	K11801	4	9	11	14	20	20	132.4	0.399	84.1	1.9	
0.0	2024-09-10	AWJ	7.61	AWJ	505AWJ1	505AWJ2	K5741	K11801	4	12	12	21	24	24	129.6	0.406	85.5	2.4	
0.0	2024-09-10	AWJ	7.61	AWJ	505AWJ1	505AWJ2	K5741	K11801	5	10	12	24	22	22	125.2	0.411	86.5	2.1	
Average[3]:															**129.1**	**0.405**	**85.4**		
Standard Deviation[3]:															**3.0**	**0.005**	**1.0**		

1. Strain gauge and accelerometer calibration records are provided in the data release folder.
2. Blow counts from the first and last 6" were not included.
3. Average and standard deviation are calculated using averaged data from SPT hammer blows from the 6" to 18" interval (ie. N value) from all sampling depths tested.

APPENDIX III

Photograph Summary

Appendix III
Photograph Summary

Photo 1: AH25-B, Anomalous Signature Detected During Utility Locates



Photo 2: Auger Drilling at AH25-01



Photo 3: AH25-01 SPT-01 (1.52 m to 2.13 m)



Photo 4: AH25-01 SPT-02 (3.05 m to 3.66 m)



Photo 5: AH25-01 SPT-03 (4.57 m to 5.18 m)



Photo 6: AH25-01 SPT-04 (6.10 m to 6.71 m)



Photo 7: AH25-01 SPT-05 (7.62 m to 8.23 m)



Photo 8: AH25-01 SPT-06 (10.67 m to 11.28 m)



Photo 9: AH25-01 SPT-07 (13.41 m to 14.02 m)



Photo 10: AH25-02 Drilling Location

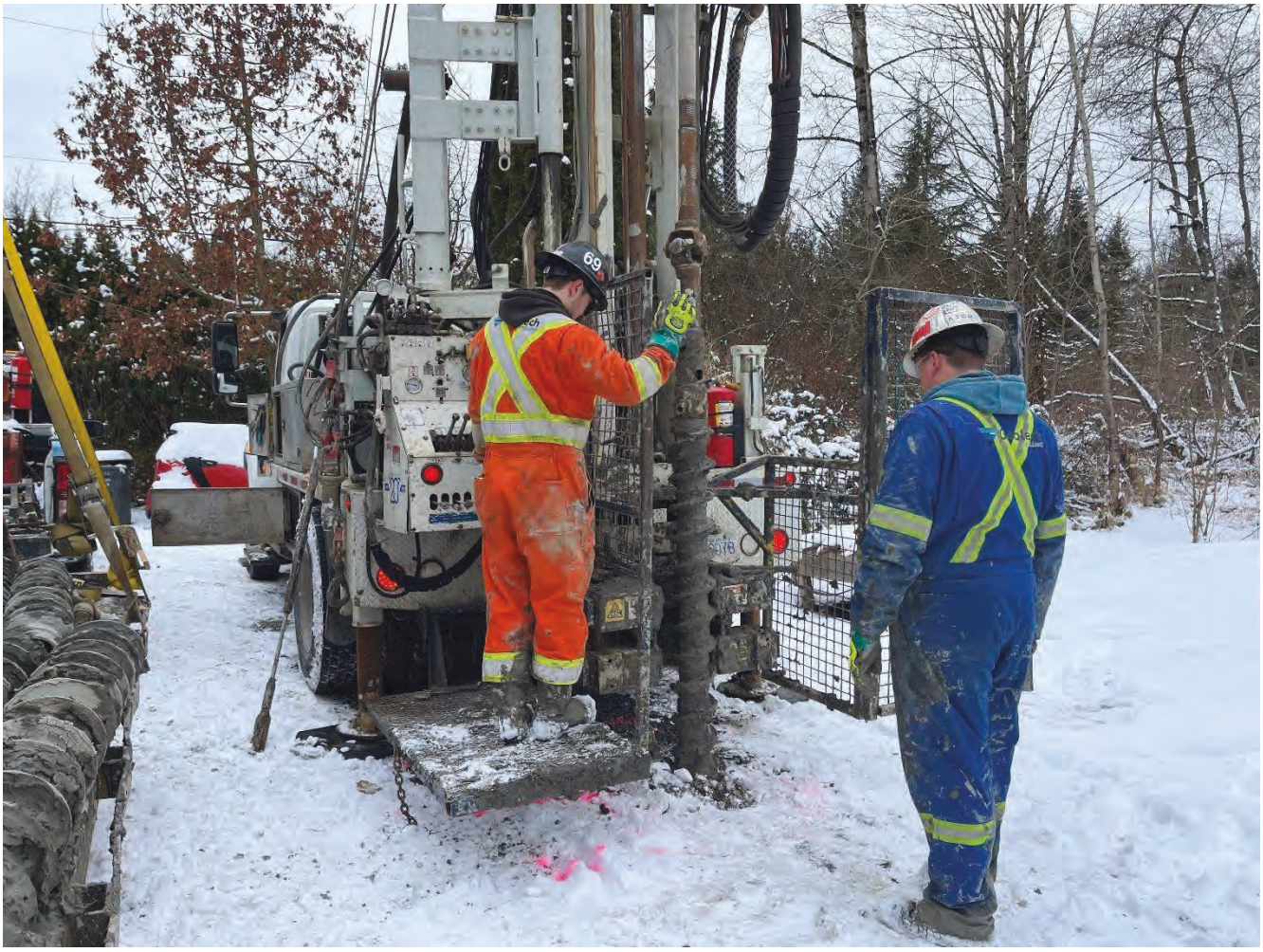


Photo 11: AH25-02 Concrete Fragments Recovered During Drilling



Photo 12: HA25-01 Run 1 (0 m to 0.18 m)



Photo 13: HA25-01 Run 2 (0.18 m to 0.36 m)



Photo 14: HA25-01 Run 3 (0.36 m to 0.54 m)



Photo 15: HA25-01 Run 4 (0.54 m to 0.72 m)



Photo 16: HA25-02 Run 1 (0 m to 0.18 m)



Photo 17: HA25-02 Run 2 (0.18 m to 0.36 m)



Photo 18: HA25-02 Run 3 (0.36 m to 0.54 m)



Photo 19: HA25-02 Run 4 (0.54 m to 0.72 m)



Photo 20: HA25-02 Run 5 (0.72 m to 0.90 m)



Photo 21: HA25-03 Run 1 (0 m to 0.18 m)



Photo 22: HA25-03 Run 2 (0.18 m to 0.36 m)



Photo 23: HA25-03 Run 3 (0.36 m to 0.54 m)



Photo 24: HA25-03 Run 4 (0.54 m to 0.72 m)



Photo 25: HA25-04 Run 1 (0 m to 0.18 m)



Photo 26: HA25-04 Run 2 (0.18 m to 0.36 m)



Photo 27: HA25-04 Run 3 (0.36 m to 0.54 m)



Photo 28: HA25-04 Run 4 (0.54 m to 0.72 m)



Photo 29: HA25-04 Run 5 (0.72 m to 0.90 m)



Photo 30: HA25-05 Run 1 (0 m to 0.18 m)



Photo 31: HA25-05 Run 2 (0.18 m to 0.36 m)



Photo 32: HA25-05 Run 3 (0.36 m to 0.54 m)



Photo 33: HA25-05 Run 4 (0.54 m to 0.72 m)



Photo 34: HA25-06 Run 1 (0 m to 0.18 m)



Photo 35: HA25-06 Run 2 (0.18 m to 0.36 m)



Photo 36: HA25-06 Run 3 (0.36 m to 0.54 m)



Photo 37: HA25-06 Run 4 (0.54 m to 0.72 m)



Photo 38: HA25-07 Run 1 (0 m to 0.18 m)



Photo 39: HA25-07 Run 2 (0.18 m to 0.36 m)



Photo 40: HA25-07 Run 3 (0.36 m to 0.54 m)



Photo 41: HA25-07 Run 4 (0.54 m to 0.72 m)



Photo 42: HA25-07 Run 5 (0.72 m to 0.90 m)



Photo 43: HA25-08 Run 1 (0 m to 0.18 m)



Photo 44: HA25-08 Run 2 (0.18 m to 0.36 m)



Photo 45: HA25-08 Run 3 (0.36 m to 0.54 m)



Photo 46: HA25-08 Run 4 (0.54 m to 0.72 m)



Photo 47: HA25-08 Run 5 (0.72 m to 0.90 m)



Photo 48: HA25-09 Run 1 (0 m to 0.18 m)



Photo 49: HA25-09 Run 2 (0.18 m to 0.36 m)



Photo 50: HA25-09 Run 3 (0.36 m to 0.54 m)



Photo 51: HA25-09 Run 4 (0.54 m to 0.72 m)



Photo 52: HA25-10 Run 1 (0 m to 0.18 m)



Photo 53: HA25-10 Run 2 (0.18 m to 0.36 m)



Photo 54: HA25-10 Run 3 (0.36 m to 0.54 m)



Photo 55: HA25-10 Run 4 (0.54 m to 0.72 m)



Photo 56: HA25-10 Run 5 (0.72 m to 0.90 m)



Photo 57: HA25-11 Run 1 (0 m to 0.18 m)



Photo 58: HA25-11 Run 2 (0.18 m to 0.36 m)



Photo 59: HA25-11 Run 3 (0.36 m to 0.54 m)



Photo 60: HA25-11 Run 4 (0.54 m to 0.72 m)



Photo 61: HA25-12 Run 1 (0 m to 0.18 m)



Photo 62: HA25-12 Run 2 (0.18 m to 0.36 m)



Photo 63: HA25-12 Run 3 (0.36 m to 0.54 m)



Photo 64: HA25-12 Run 4 (0.54 m to 0.54 m)



APPENDIX IV

Drill Hole and Hand Auger Logs

Klohn Crippen Berger

DRILL HOLE LOG

AH25-01

Project Number:	P10600A140	Northing:	5442872.6 m	Easting:	523037.3 m
Project:	Willoughby Substation Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 05, 2025	Date Finished:	Feb 05, 2025

Drilling Company:	Geotech Drilling Services Ltd.
Drilling Method:	Auger, Hollow Stem

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
1					0.3	TOPSOIL, clayey, grass, brown, moist.	
						CLAY (CI), silty (low plasticity), some fine to medium sand, intermediate plasticity, stiff to very stiff, greyish brown, WC > PL.	
2	SPT-01		2-12-19 (31) 100%				
3	SPT-02		2-4-19 (23) 100%				
4						From 4.57 m to 6.10 m: trace fine to coarse sand, trace fine gravel.	
5	SPT-03		2-3-12 (15) 100%				
6					6.1		
	SPT-04		0-0-0 (0) 100%			From 6.10 m to 6.71 m: SPT-04 self-weight penetration.	
7						CLAY (CI), silty (low plasticity), intermediate plasticity, very soft, grey, WC > PL.	
	SPT-05		0-0-0 (0) 100%			From 7.62 m to 8.23 m: SPT-05 self-weight penetration.	
8						From 7.62 m to 10.67 m: trace fine to medium sand.	
9							
10							

Su (kPa)

VANE PEAK ◆ FIELD ◆ LAB ■ (top scale) ▲ UC/2

REMOLD ◊ FIELD ◊ LAB □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X--------O-------X

50 100 150

25 50 75

Klohn Crippen Berger

DRILL HOLE LOG

AH25-01

Project Number:	P10600A140	Northing:	5442872.6 m	Easting:	523037.3 m
Project:	Willoughby Substation Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 05, 2025	Date Finished:	Feb 05, 2025

Drilling Company: Geotech Drilling Services Ltd.

Drilling Method: Auger, Hollow Stem

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					10.7	From 7.62 m to 10.67 m: trace fine to medium sand.	
11	SPT-06		6-7-8 (15) 75%		10.7	CLAY (CL), low plasticity, stiff, grey, WC ~ PL.	
12					12.2	SAND (SM), fine to coarse, silty, some fine to coarse gravel (subrounded to subangular), poorly graded, grey to greyish tan, moist.	
13	SPT-07		50 25%		13.6	At 13.56 m: SPT refusal - likely on boulder or cobble. Drill hole terminated at 13.6 m. 1) Terminated due to auger refusal on boulder or cobble. 2) SPT blow counts for the last 150 mm (6") were not recorded. 3) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 4) Auger drilling was carried out by Geotech Drilling Services Ltd. of Delta, BC using a B54 truck mounted drill rig. 5) Auger drill hole was backfilled with auger cuttings and bentonite chips.	
14							
15							
16							
17							
18							
19							
20							

Su (kPa)

	FIELD	LAB	
VANE PEAK	◆	■	▲ UC/2 (top scale)
REMOLD	◊	□	△ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50	100	150
25	50	75

Klohn Crippen Berger

DRILL HOLE LOG

AH25-02

Project Number:	P10600A140 Willoughby Substation	Northing:	5442990.2 m	Easting:	522984.3 m
Project:	Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 05, 2025	Date Finished:	Feb 05, 2025

Drilling Company:	Geotech Drilling Services Ltd.
Drilling Method:	Auger, Hollow Stem

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
0					0.2	GRAVEL and SAND (GP/SP), fine to coarse, poorly graded, subrounded, greyish brown, moist, large pieces of concrete. [FILL]	
						Drill hole terminated at 0.2 m.	
						1) Terminated due to repeated auger refusal at the surface.	
						2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m.	
						3) Auger drilling was carried out by Geotech Drilling Services Ltd. of Delta, BC using a B54 truck mounted drill rig.	

Su (kPa)

VANE FIELD LAB (top scale)

PEAK ◆ ■ ▲ UC/2

REMOLD ◊ □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50 100 150

25 50 75

Klohn Crippen Berger

DRILL HOLE LOG

HA25-01

Project Number:	P10600A140 Willoughby Substation	Northing:	5442933.9 m	Easting:	523069.2 m
Project:	Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025
Drilling Company:	N/A				
Drilling Method:	Hand Auger				

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.2	TOPSOIL, clayey, grass, rootlets, brown, moist.	
						SILT (ML), sandy (fine to coarse), low plasticity, tan to grey, moist, some rootlets.	
					0.7	Drill hole terminated at 0.7 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	

Su (kPa)

VANE FIELD LAB (top scale)

PEAK ◆ ■ ▲ UC/2

REMOLD ◊ □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X--------O-------X

50 100 150

25 50 75

1 2 3 4 5

Klohn Crippen Berger

DRILL HOLE LOG

HA25-02

Project Number:	P10600A140 Willoughby Substation	Northing:	5442889.5 m	Easting:	523098.5 m
Project:	Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025
Drilling Company:	N/A				
Drilling Method:	Hand Auger				

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.2	TOPSOIL, clayey, grass, rootlets, brown, moist.	
					0.5	CLAY (CL-ML), silty, trace fine to coarse sand, low plasticity, brown, WC > PL, trace organic soil.	
					0.9	SILT (ML), sandy (fine to coarse), some clay, low plasticity, light brown, moist.	
1						Drill hole terminated at 0.9 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	
2							
3							
4							
5							

Su (kPa)

	FIELD	LAB	
VANE PEAK	◆	■	(top scale) ▲ UC/2
REMOLD	◊	□	△ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X--------O-------X

50	100	150
25	50	75

Klohn Crippen Berger

DRILL HOLE LOG

HA25-03

Project Number:	P10600A140	Northing:	5442927.3 m	Easting:	523101.3 m
Project:	Willoughby Substation Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025

Drilling Company: N/A

Drilling Method: Hand Auger

Su (kPa)
VANE FIELD LAB (top scale)
PEAK ◆ ■ ▲ UC/2
REMOLD ◊ □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)
Wp % W % WL %
X--------O-------X

50 100 150
25 50 75

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.2	TOPSOIL, clayey, grass, rootlets, brown, moist.	
						SILT (ML), sandy (fine to coarse), low plasticity, tan to grey/brown, moist, some organic soil.	
					0.7	From 0.54 m to 0.72 m: colour transitions to tan to grey.	
						Drill hole terminated at 0.7 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	

1
2
3
4
5

Klohn Crippen Berger

DRILL HOLE LOG

HA25-04

Project Number:	P10600A140	Northing:	5442982.6 m	Easting:	523022.3 m
Project:	Willoughby Substation Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025

Drilling Company: N/A

Drilling Method: Hand Auger

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
						TOPSOIL, clayey, grass, rootlets, dark brown, moist to wet.	
					0.4	SILT (ML), sandy (fine to coarse), low plasticity, tan to brown, wet.	
					0.5	SILT (ML), clayey, some fine to coarse sand, low plasticity, light to dark brown, wet.	
					0.9	From 0.72 m to 0.90 m: colour transitions to grey to tan.	
1						Drill hole terminated at 0.9 m.	
						1) Terminated due to auger refusal.	
						2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m.	
2						3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm.	
						4) Hand auger hole was backfilled with auger cuttings.	
3							
4							
5							

Su (kPa)

VANE FIELD LAB (top scale)

PEAK ◆ ■ ▲ UC/2

REMOLD ◊ □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50 100 150

25 50 75

Klohn Crippen Berger

DRILL HOLE LOG

HA25-05

Project Number:	P10600A140 Willoughby Substation	Northing:	5442993.8 m	Easting:	523056.5 m
Project:	Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025
Drilling Company:	N/A				
Drilling Method:	Hand Auger				

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.2	TOPSOIL, clayey, grass, roots, rootlets, brown, wet.	
					0.4	SILT (ML), sandy (fine to coarse), low plasticity, brown, wet, rootlets.	
						SILT (ML), clayey, low plasticity, grey to tan, wet.	
					0.7	Drill hole terminated at 0.7 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	
1							
2							
3							
4							
5							

Su (kPa)

VANE FIELD LAB (top scale)

PEAK ◆ ■ ▲ UC/2

REMOLD ◊ □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X--------O-------X

50 100 150

25 50 75

Klohn Crippen Berger

DRILL HOLE LOG

HA25-06

Project Number:	P10600A140	Northing:	5442975.2 m	Easting:	523109.1 m
Project:	Willoughby Substation Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025

Drilling Company: N/A

Drilling Method: Hand Auger

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.2	TOPSOIL, sandy, some clay, some silt, grass, roots, brown, moist.	
					0.4	SILT (ML), sandy (fine to coarse), trace gravel, low plasticity, brown, wet, trace organic soil.	
						SILT (ML), clayey, trace sand, low plasticity, grey to tan, wet.	
					0.7	From 0.54 m to 0.72 m: trace gravel.	
						Drill hole terminated at 0.7 m.	
						1) Terminated due to auger refusal.	
						2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m.	
						3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm.	
						4) Hand auger hole was backfilled with auger cuttings.	

Su (kPa)

VANE FIELD LAB (top scale)

PEAK ◆ ■ ▲ UC/2

REMOLD ◊ □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50 100 150

25 50 75

1

2

3

4

5

Klohn Crippen Berger

DRILL HOLE LOG

HA25-07

Project Number:	P10600A140 Willoughby Substation	Northing:	5443011.9 m	Easting:	523114.0 m
Project:	Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025

Drilling Company: N/A

Drilling Method: Hand Auger

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.2	TOPSOIL, clayey, grass, rootlets, light brown to brown, moist.	
						SILT (ML), sandy (fine to coarse), low plasticity, light brown, moist, some organic soil.	
						From 0.36 m to 0.54 m: clayey.	
						From 0.54 m to 0.72 m: some fine to coarse gravel.	
					0.9	Drill hole terminated at 0.9 m.	
						1) Terminated due to auger refusal.	
						2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m.	
						3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm.	
						4) Hand auger hole was backfilled with auger cuttings.	
1							
2							
3							
4							
5							

Su (kPa)

	FIELD	LAB	
VANE			(top scale)
PEAK	◆	■	▲ UC/2
REMOLD	◊	□	△ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50	100	150
25	50	75

Klohn Crippen Berger

DRILL HOLE LOG

HA25-08

Project Number:	P10600A140 Willoughby Substation	Northing:	5443056.8 m	Easting:	523222.5 m
Project:	Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025

Drilling Company: N/A

Drilling Method: Hand Auger

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.2	TOPSOIL, clayey, grass, rootlets, darkbrown, wet.	
						CLAY (CL-ML), silty, trace fine to coarse sand, low plasticity, grey to tan, WC > PL.	
						From 0.54 m to 0.90 m: trace silt.	
					0.9	Drill hole terminated at 0.9 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	

Su (kPa)

VANE FIELD LAB (top scale)

PEAK ◆ ■ ▲ UC/2

REMOLD ◊ □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50 100 150

25 50 75

1

2

3

4

5

Klohn Crippen Berger

DRILL HOLE LOG

HA25-09

Project Number:	P10600A140 Willoughby Substation	Northing:	5443030.0 m	Easting:	523208.8 m
Project:	Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025
Drilling Company:	N/A				
Drilling Method:	Hand Auger				

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.4	TOPSOIL, clayey, grass, rootlets, brown, moist.	
					0.7	SILT (ML) and SAND (SM), low plasticity, fine to coarse sand, some fine to coarse gravel, light brown, moist.	
1						Drill hole terminated at 0.7 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	
2							
3							
4							
5							

Su (kPa)

	FIELD	LAB	
VANE PEAK	◆	■	(top scale) ▲ UC/2
REMOLD	◊	□	△ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50	100	150
25	50	75

Klohn Crippen Berger

DRILL HOLE LOG

HA25-10

Project Number:	P10600A140	Northing:	5443036.0 m	Easting:	523291.2 m
Project:	Willoughby Substation Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025

Drilling Company: N/A

Drilling Method: Hand Auger

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.4	TOPSOIL, grass, rootlets, reddish brown, moist.	
					0.9	CLAY (CL-ML), silty, trace fine to coarse sand, low plasticity, grey to tan, WC > PL.	
1						Drill hole terminated at 0.9 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	
2							
3							
4							
5							

Su (kPa)

	FIELD	LAB	
VANE PEAK	◆	■	▲ UC/2 (top scale)
REMOLD	◊	□	△ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50	100	150
25	50	75

Klohn Crippen Berger

DRILL HOLE LOG

HA25-11

Project Number:	P10600A140	Northing:	5443022.5 m	Easting:	523269.4 m
Project:	Willoughby Substation Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025

Drilling Company: N/A

Drilling Method: Hand Auger

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.0	TOPSOIL, clayey, grass, rootlets, brown, moist.	
					0.2	SAND and SILT (SM), fine to coarse, low plasticity silt, poorly graded, light brown, moist.	
						SILT (ML), sandy (fine to coarse), low plasticity, tan to grey, moist.	
					0.7	Drill hole terminated at 0.7 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	

Su (kPa)

VANE FIELD LAB (top scale)

PEAK ◆ ■ ▲ UC/2

REMOLD ◊ □ △ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

X- - - - - - - -O- - - - - - -X

50 100 150

25 50 75

1 2 3 4 5

Klohn Crippen Berger

DRILL HOLE LOG

HA25-12

Project Number:	P10600A140 Willoughby Substation	Northing:	5443008.3 m	Easting:	523327.8 m
Project:	Preliminary Geotechnical Investigation	Ground Elevation:	m	Logged By:	JM/NL
Location:	Surrey, BC	Datum:	NAD83 UTM Zone 10N	Reviewed by:	MC
Client:	BC Hydro	Date Started:	Feb 06, 2025	Date Finished:	Feb 06, 2025
Drilling Company:	N/A				
Drilling Method:	Hand Auger				

DEPTH (m)	SAMPLE NUMBER	TOTAL CORE RECOVERY (%)	SPT BLOWS PER 0.15 m / RECOVERY (%)	LITHOLOGY SYMBOL	DEPTH / ELEVATION	DESCRIPTION OF MATERIALS	INSTRUMENT/ BACKFILL DETAILS
					0.2	TOPSOIL, clayey, grass, rootlets, dark brown, moist.	
						CLAY (CL-ML), silty, trace fine to coarse sand, low plasticity, grey to tan, WC > PL.	
						From 0.54 m to 0.72 m: trace coarse gravel.	
					0.7	Drill hole terminated at 0.7 m. 1) Terminated due to auger refusal. 2) Coordinates were collected using a cell phone GPS with an accuracy of +/- 5 m. 3) Hand augering was carried out using an Edelman hand auger. Sample spoon size = 50 mm. 4) Hand auger hole was backfilled with auger cuttings.	

Su (kPa)

	FIELD	LAB	
VANE PEAK	◆	■	(top scale) ▲ UC/2
REMOLD	◊	□	△ P.PEN/2

⊕ % Fines ● SPT N (bottom scale)

Wp % W % WL %

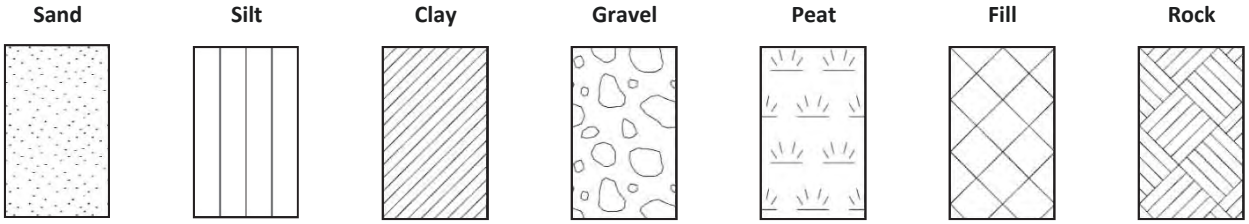
X--------O-------X

50	100	150
25	50	75

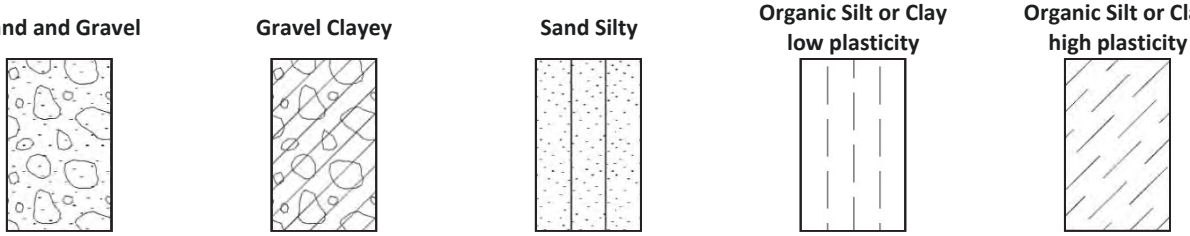
Klohn Crippen Berger

SYMBOLS AND TERMS FOR SOIL DESCRIPTION AND TEST HOLE LOGS

Basic Symbols



Symbol Variations – Examples [1]



Classification by Particle Size

Name		Size Range (mm) [2]	U.S. Standard Sieve Size Retained	U.S. Standard Sieve Size Passing
Boulders		> 300	12 inch	-
Cobbles		75 – 300	3 inch	12 inch
Gravel:	coarse	19 – 75	0.75 inch	3 inch
	fine	4.75 - 19	No. 4	0.75 inch
Sand:	coarse	2 – 4.75	No. 10	No. 4
	medium	0.425 - 2	No. 40	No. 10
	fine	0.075 - 0.425	No. 200	No. 40
Fines (Silt or Clay) [3]		< 0.075	-	No. 200

Proportion of Minor Components by Weight [4]

and	35-50%
y / ey	20-35%
some	10-20%
trace	0-10%

Particle Shape

Flat	Width/thickness >3
Elongated	Length/width >3

Density of Granular Soils

Description	SPT N [5]	SPT $(N_1)_{60}$ [6]
Very Loose	0-4	0-3
Loose	4-10	3-8
Compact	10-30	8-25
Dense	30-50	25-42
Very Dense	>50	<42

Consistency of Cohesive Soils

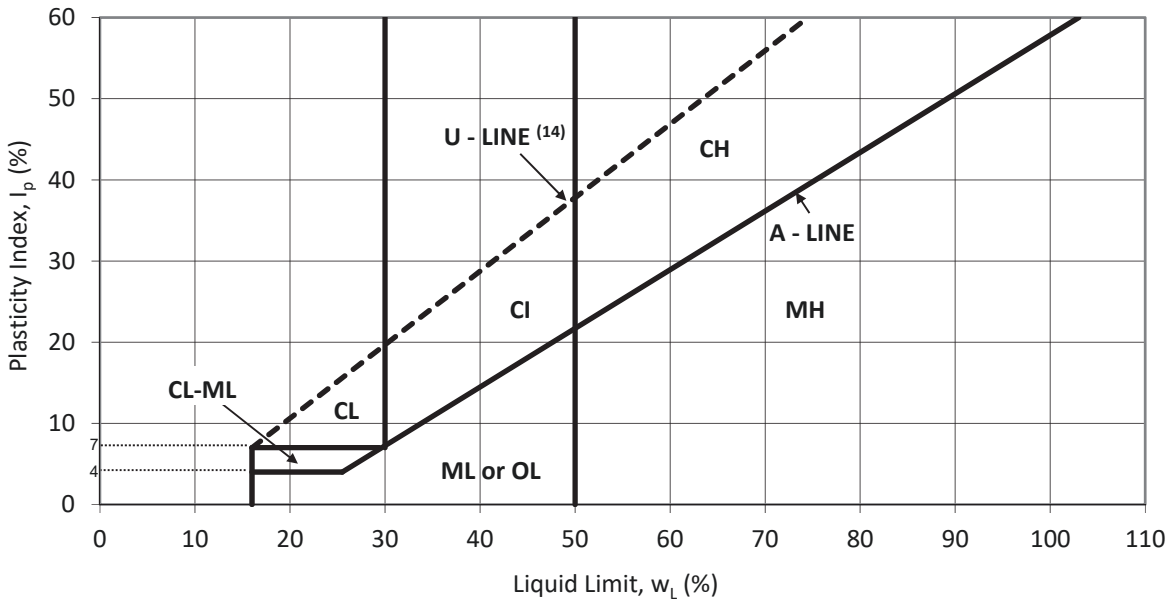
Description	S_U [7] (kPa) [3]	S_U [7] (ksf) [8]	SPT N [9]
Very Soft	< 12	< 0.25	< 2
Soft	12 - 25	0.25 - 0.5	2 - 4
Firm	25 - 50	0.5 - 1	4 - 8
Stiff	50 - 100	1 - 2	8 - 15
Very Stiff	100 - 200	2 - 4	15 - 30
Hard	> 200	>4	> 30

[1] Only selected examples of the possible variations or combinations of the basic symbols are illustrated.
[2] Approximate SI conversion.
[3] Fines are classified as silt or clay on the basis of Atterberg limits (refer to plasticity chart).
[4] Example: SAND, silty, trace of gravel = sand with 20% to 35% silt and up to 10% gravel by weight.
[5] Standard Penetration Test (SPT) blow count (uncorrected) after Terzaghi and Peck, 1948.
[6] SPT blow count, based on above N value corrected to 60% hammer efficiency and 96 kPa (1.0 ton/ft^2) effective overburden pressure, after Skempton, 1986.
[7] Undrained shear strength can be estimated by vane (gives S_u), pocket penetrometer (gives unconfined compressive strength, i.e. 2 S_u), or unconfined compression test (gives 2 S_u).
[8] ksf = 1000 pounds per square foot = 0.5 tsf (ton/ft^2) = approximately 0.5 kg/cm^2.
[9] Very approximate correlation with SPT blow counts after Terzaghi and Peck, 1948.

Plasticity of Cohesive Soils [10]		
Description	Silt	Clay
High	w_L [11] > 50	w_L > 50
Medium	-	30 < w_L < 50
Low	w_L < 50	w_L < 30
Non-Plastic	NP [12]	-

Sensitivity of Cohesive Soils [13]	
Description	Undisturbed Strength / Remoulded Strength
High	> 8
Medium	4 to 8
Low	< 4

Plasticity Chart



Classification of Ground Ice [15]			
Group		Subgroup	
Symbol	Description	Symbol	Description
N	Ice not visible by unaided eye	Nf	Poorly bonded or friable
		Nbn	Well bonded, no excess ice
		Nbe	Well bonded, excess ice
V	Visible ice less than 25 mm thick	Vx	Individual ice crystals or inclusions
		Vc	Ice coatings on soil particles
		Vr	Random of irregularly oriented ice
		Vs	Stratified or distinctly oriented ice
ICE	Visible ice greater than 25 mm thick	ICE + (soil type)	Ice with soil inclusions
		ICE	Ice without soil inclusions

[10] This plasticity classification conforms to the Unified Soil Classification System (USCS) and the ASTM D-2487 plasticity chart, except for the addition of an intermediate category for clay, where the liquid limit is between 30% and 50% (CI). Under ASTM and USCS, all clays with a liquid limit less than 50% are classified as low plasticity (CL).
[11] W_L = Liquid Limit (%)
[12] NP = Non-Plastic (silts only)
[13] Dimensionless ratio
[14] "U" Line marks typical upper limit. "A" Line divides clay from silts and organic silts.
[15] For soil descriptions, estimate percentage of ground ice based on volume after National Research Council of Canada, 1963.

Test Types [16]

AH	Auger hole - machine or hand auger, no SPT or thin-walled tube samples taken.	DH	Drill Hole - typical drilling methods include tricone, percussion, wash boring, machine auger with SPT or thin-walled tube samples and coring.
BK	Becker hammer drill hole pair - both open and closed test at the same location.	SCPT	Seismic cone penetration test with pore pressure measurements.
BOC	Becker hammer drill hole - open casing, sampled.	TP	Test pit - machine or hand dug.
BPT	Becker penetration test - closed casing.	VST	Vane shear test.
CPT	Cone penetration test with pore pressure measurements.		
DCT	Dynamic cone penetration test.		

In Situ Tests or Downhole Instrumentation [17]

BM	Benchmark	PT	Permeability test
DMT	Dilatometer test	PZ	Piezometer
IN	Inclinometer	SW	Shear wave velocity test
PMT	Pressuremeter test		

Laboratory and/or Field Tests [18]

S_u	Undrained shear strength, measured by: [19]	●	Standard Penetration Test (SPT) blow count, uncorrected (N)
♦	Field Vane (peak)	○	W (%) In situ moisture content
◊	Field Vane (remoulded)	X – –	w_P (%)Plastic Limit
■	Lab Vane (peak)	– – X	w_L (%) Liquid Limit
□	Lab Vane (remoulded)		Becker penetration test blow counts, closed casing
▲	Unconfined Compression		Becker penetration test blow counts, open casing
Δ	Pocket Penetrometer	▼ or ▽	Water level, measured on date and from piezometer indicated on log

Other Laboratory Tests [20]

CD	Consolidated, drained triaxial test	GSD	Grain size distribution (by sieve or hydrometer)
CUP	Consolidated, undrained triaxial test with pore pressure measurements	MDR	Moisture-density relationship (i.e. standard or modified Proctor test)
CUCY	Consolidated, undrained triaxial test with cyclic loading	ORG	Organic content
UU	Unconsolidated, undrained triaxial test	OED	Oedometer consolidation test
UC	Unconfined (uniaxial) compression test	RD	Relative density (also known as density index)
DS	Direct shear test	GS	Specific gravity
DSS	Direct simple shear test	K	Permeability
		UW	Unit weight

[16] Test type abbreviation is typically followed by a two-part number indicating year and chronological sequence of test. *Example: CPT15-1 indicates the first cone penetration test at a particular site in 2015.*
[17] In situ test or downhole instrumentation abbreviations are typically shown in brackets following the appropriate test type designation. *Example: DH15-1(PZ) indicates a piezometer was installed in drill hole 15-1.*
[18] These symbols are for laboratory and/or field test results shown on the test hole log.
[19] Vane gives S_u, pocket penetrometer and unconfined compression tests give $2S_u$, so results are divided by 2 for plotting on log.
[20] Where other laboratory test results are available but not shown on the test hole log, the applicable abbreviation appears under the heading *"Other Tests"* on the log.

APPENDIX V

Laboratory Test Results

WATER CONTENT OF SOIL
(ASTM D2216)

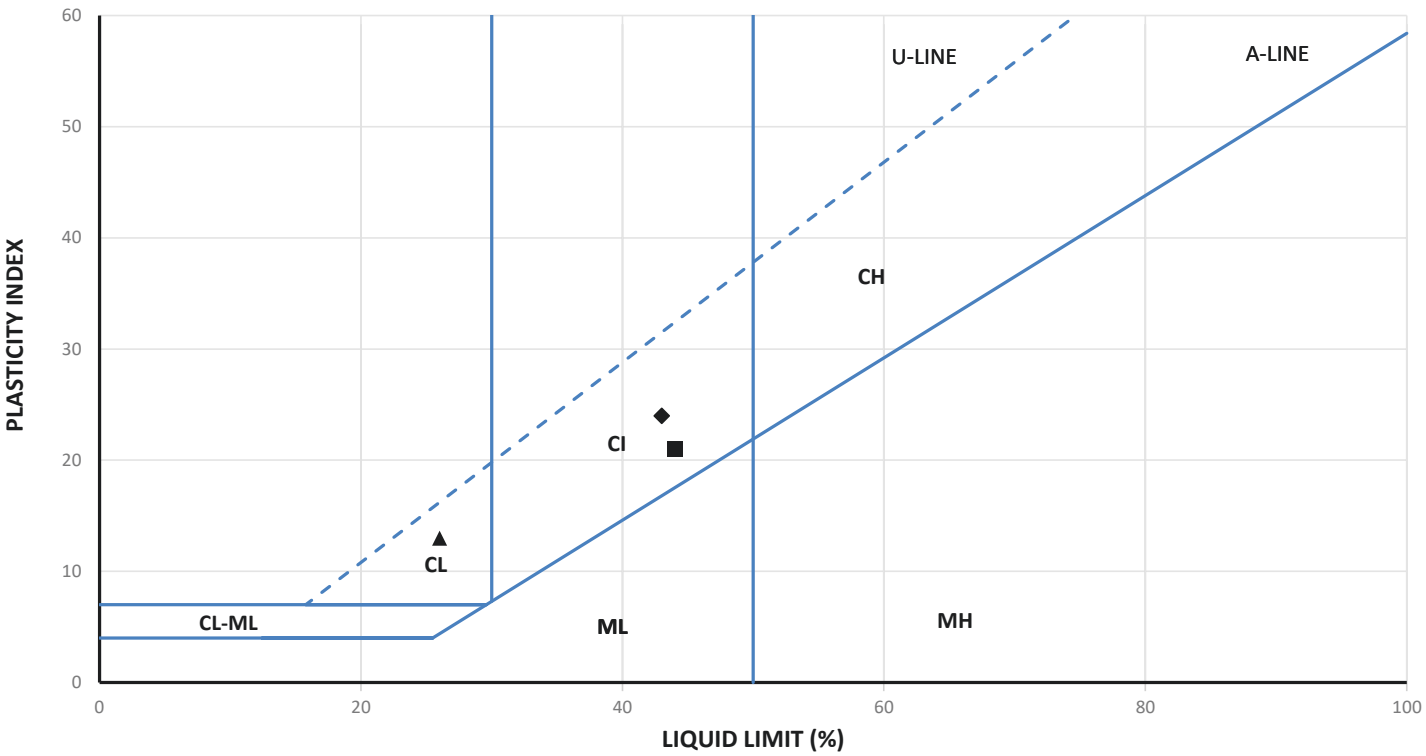
Borehole Number	Sample Number	Depth (m)	Wet Weight + Tare (g)	Dry Weight + Tare (g)	Tare (g)	Water Weight (g)	Total Dry Weight (g)	Water Content (%)	Remarks
AH25-01	SPT-01	1.5	407.88	357.69	193.42	50.19	164.27	**30.6**	
AH25-01	SPT-02	3.1	428.58	364.71	160.45	63.87	204.26	**31.3**	
AH25-01	SPT-04	6.1	256.80	211.90	90.80	44.90	121.10	**37.1**	
AH25-01	SPT-06	10.7	249.72	228.91	92.39	20.81	136.52	**15.2**	
AH25-01	SPT-07	13.4	491.38	466.92	177.92	24.46	289.00	**8.5**	

Klohn Crippen Berger

PROJECT NAME	Willoughby Substation Preliminary Geotechnical Investigation		
PROJECT NO.	P10600A140		
LOCATION	Surrey, BC		
DATE	2025-02-24		
TESTED BY	SBrekkaas	CHECKED BY	JGarfias

ATTERBERG LIMITS

(ASTM D4318)

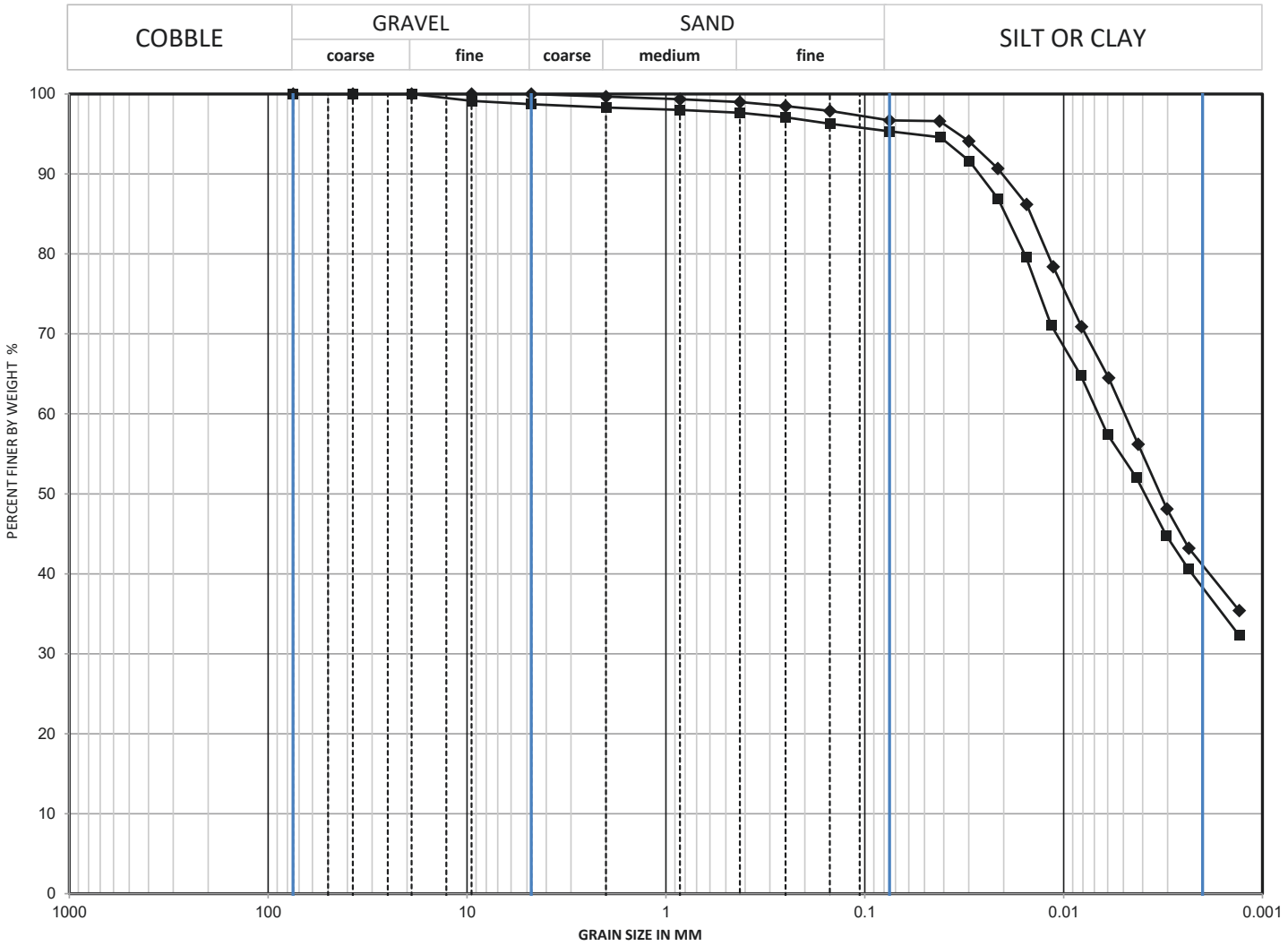


	Borehole ID	Sample ID	Depth (m)	LL	PL	PI	MC (%)	Fines (%)	Classification	Remarks
■	AH25-01	SPT-01	1.5	44	23	21	30.6		CI	
◆	AH25-01	SPT-04	6.1	43	19	24	37.1		CI	
▲	AH25-01	SPT-06	10.7	26	13	13	15.2		CL	

Klohn Crippen Berger

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DATE	2025-02-24		
TESTED BY	SBrekkaas	CHECKED BY	JGarfias

GRAIN SIZE DISTRIBUTION



	BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	D100	D60	D30	D10	CU	CC	% GRAVEL	% SAND	%FINES	
■	AH25-01	SPT-03	4.6	19.00	0.01					1.3	3.4	95.3	
◆	AH25-01	SPT-05	7.6	4.75	0.00					0.0	3.3	96.7	
▲													
●													
—													

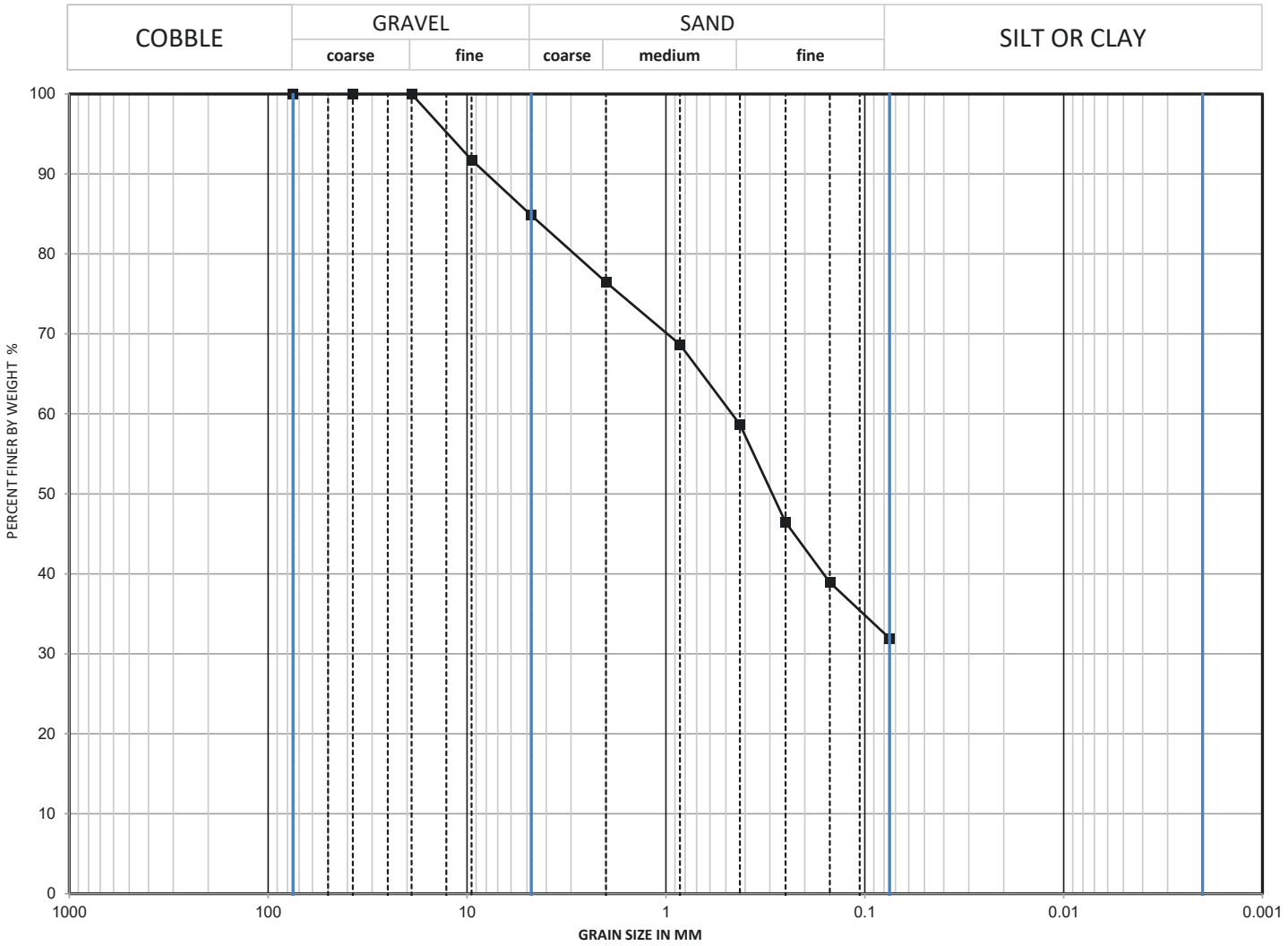
	BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	MC%	LL	PL	PI	%SILT	% CLAY	REMARKS / SAMPLE DESCRIPTION
■	AH25-01	SPT-03	4.6					57.0	38.3	
◆	AH25-01	SPT-05	7.6					55.6	41.1	
▲										
●										
—										

Klohn Crippen Berger

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PROJECT NO.	P10600A140		
LOCATION	Surrey, BC		
DATE	2025-02-24		
TEST BY	SBrekkaas	CHECKED BY	JGarfias

Comparison Curve: as instructed by project team.

GRAIN SIZE DISTRIBUTION



	BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	D100	D60	D30	D10	CU	CC	% GRAVEL	% SAND	%FINES	
■	AH25-01	SPT-07	13.4	19.0	0.5					15.2	52.9	31.9	
◆													
▲													
●													
—													

	BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	MC%	LL	PL	PI	%SILT	% CLAY	REMARKS / SAMPLE DESCRIPTION
■	AH25-01	SPT-07	13.4	8.5						46.24g rock retained on 3/4" removed per project instructions
◆										
▲										
●										
—										

Klohn Crippen Berger

PROJECT NAME	Willoughby Substation Preliminary Geotechnical Investigation		
PROJECT NO.	P10600A140		
LOCATION	Surrey, BC		
DATE	2025-02-24		
TEST BY	SBrekkaas	CHECKED BY	JGarfias

BC Hydro
Power smart

January 7, 2025

Dear Neighbour,

The Surrey/Langley region is one of Canada's fastest-growing communities, and we're making sure our energy system grows with it. To ensure we continue delivering clean and renewable power to your community, we're planning to build a new substation in the Clayton area of Surrey in the coming years.

What we're doing

We need to build a new outdoor substation to supply power to rapidly growing communities like Clayton in Surrey and Willoughby in Langley. To connect it to the existing network, we'll also build power lines linking it to McLellan Substation to the south.

Once complete, the new substation will help power up to 35,000 more homes in the region.

Where the new substation will be built

The new facility will be located south of 76 Avenue, between 194 and 196 streets (please see the map on page 2).

We looked at several alternate sites for the substation and this site was chosen due to its size and suitability.

Planning and design is just getting underway. The exact size of the substation and the transmission routes have yet to be determined.

Project timeline

We're in the very early stages of the substation project. **Construction is not expected to begin until late 2027 at the earliest.** As with any large project, the timeline may change due to unforeseen circumstances.

We're beginning geotechnical studies in **January 2026** to help inform design of the station. This includes soil testing and some brush trimming to make space for workers and equipment.

What to expect

Starting mid-January, crews will be in the field performing activities to support our early planning and design work. These include:

- Brush trimming to allow safe access for geotechnical work.
- Ground and soil testing.

The early vegetation and geotechnical work will take about six weeks to complete.

- Work will typically take place Monday to Saturday between 7:00 a.m. and 10:00 p.m.
- There may be increased noise or vibrations where work is taking place.
- No road closures are planned for this early work.

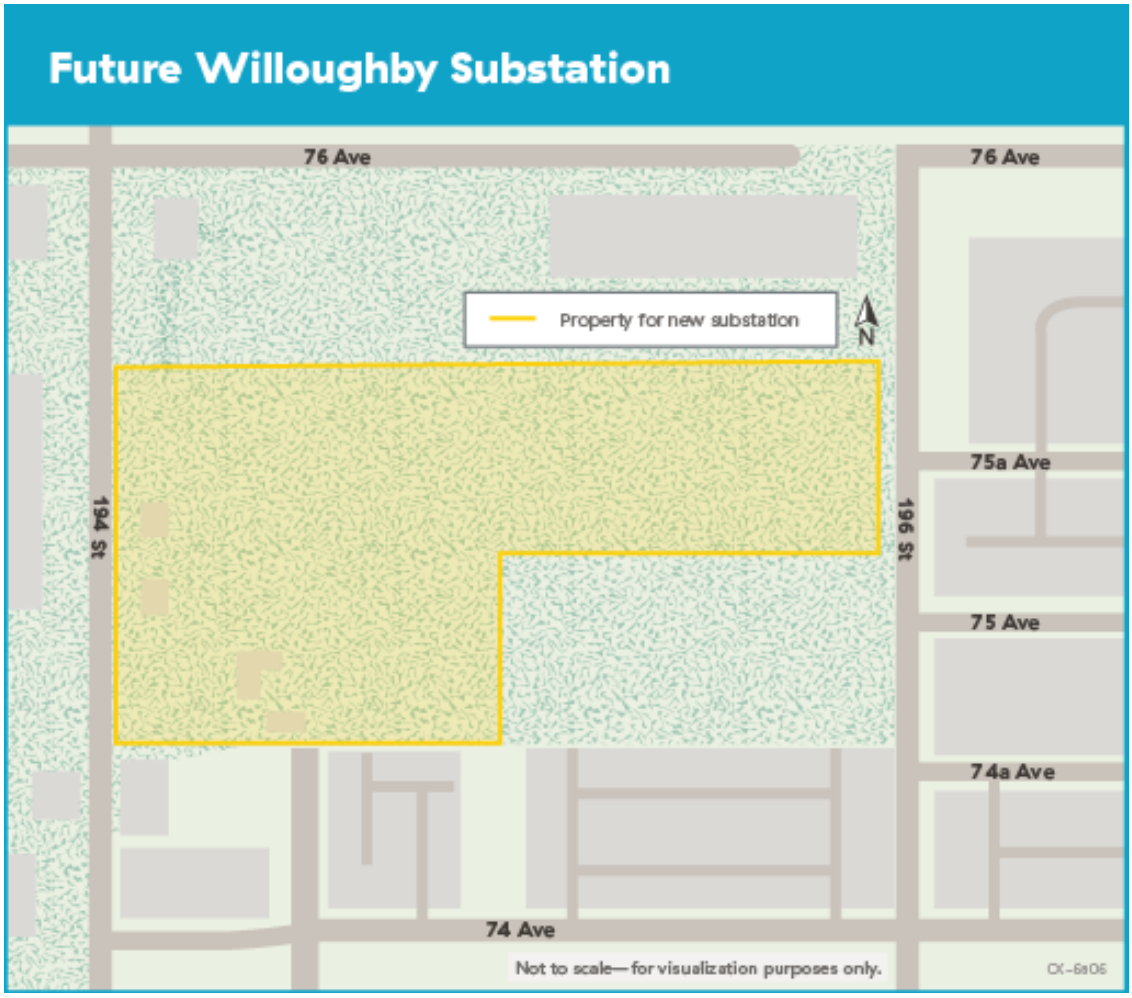
Questions
We understand this new substation will bring changes to the area, and we'll keep you informed throughout the process.

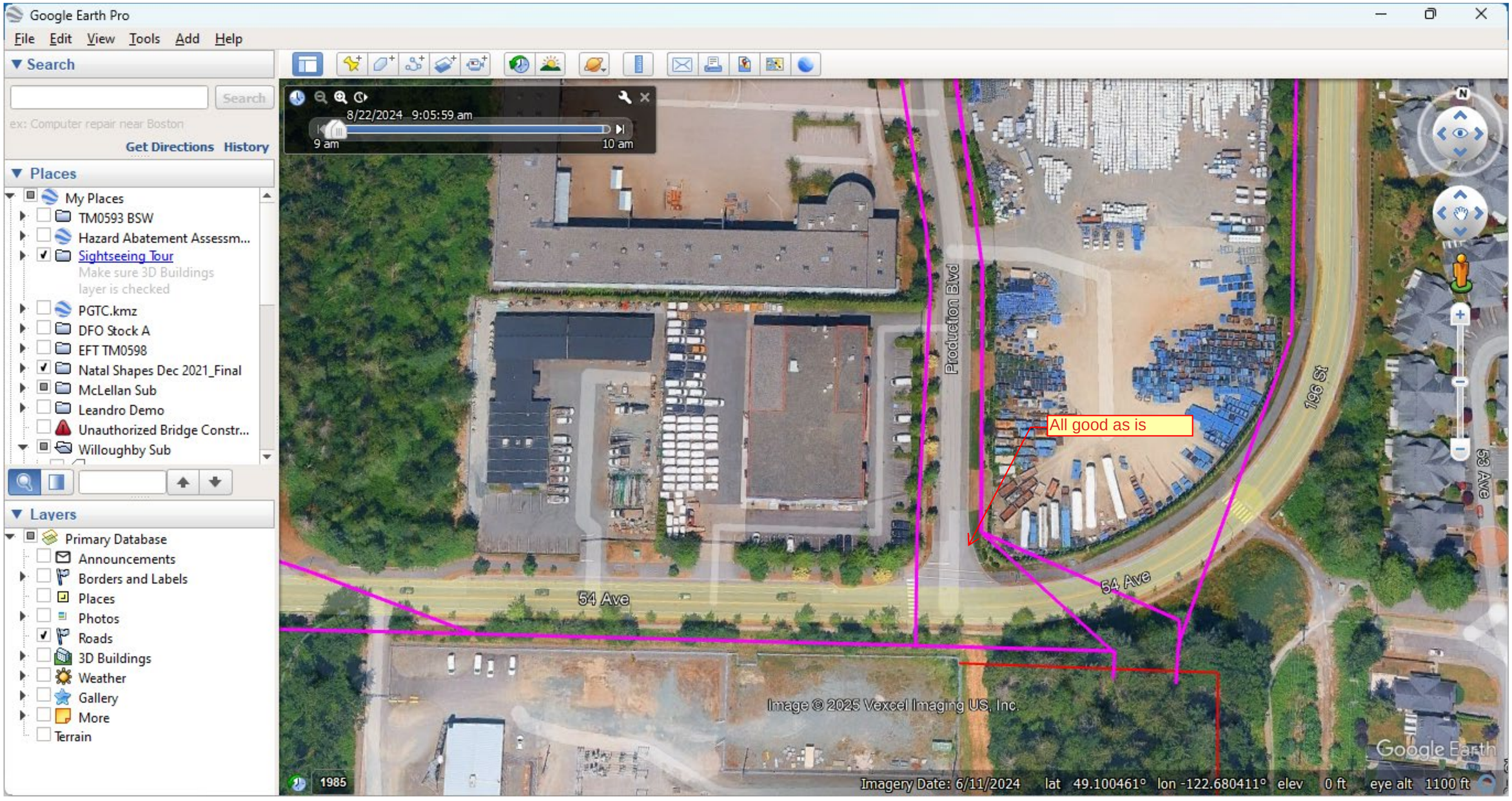
For more information about this project, please visit bchydro.com/willoughbysub.

If you have any questions, please do not hesitate to contact me at projects@bchydro.com or call 1 866 647 3334.

Sincerely,

Denise Hayes-McCoy
Stakeholder Engagement Advisor




Google Earth Pro
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ex: Computer repair near Boston
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54 Ave
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196 St

55 A Ave

55 Ave

Should be ok as this is a low extension.

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- DFO Stock A
- EFT TM0598
- Natal Shapes Dec 2021_Final
- McLellan Sub
- Leandro Demo
- Unauthorized Bridge Constr...
- Willoughby Sub

Layers

- Primary Database
  - Announcements
  - Borders and Labels
  - Places
  - Photos
  - Roads
  - 3D Buildings
  - Weather
  - Gallery
  - More
  - Terrain

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56 Ave

56 Ave

56 Ave

Both side appear ok. Some Distr to move.

Production Blvd

196 St

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  - Willoughby Sub

▼ Layers

- Primary Database
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  - Borders and Labels
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Good

Landmark Way

56 Ave

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56 Ave

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ex: Computer repair near Boston

Get Directions History

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  - DFO Stock A
  - EFT TM0598
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  - McLellan Sub
  - Leandro Demo
  - Unauthorized Bridge Constr...
  - Willoughby Sub

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  - 3D Buildings
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  - Gallery
  - More
  - Terrain

8/22/2024 9:05:59 am

9 am 10 am

All good

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Google Earth

1985

Imagery Date: 6/11/2024 lat 49.104406° lon -122.686117° elev 0 ft eye alt 1100 ft

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ex: Computer repair near Boston

Get Directions History

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    Make sure 3D Buildings layer is checked
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8/22/2024 9:05:59 am

9 am 10 am

10

192 St

56 Ave

All ok here.

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Imagery Date: 6/11/2024 lat 49.104124° lon -122.690223° elev 0 ft eye alt 1100 ft

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Get Directions History

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8/22/2024 9:05:59 am

9 am 10 am

192 St

Very close building corner. NOT ENOUGH SPACE FOR 230kV ROW.

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Imagery Date: 6/11/2024 lat 49.103174° lon -122.690371° elev 0 ft eye alt 1100 ft

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8/22/2024 9:05:59 am

9 am 10 am

Very close building corner. NOT ENOUGH SPACE FOR 230kV ROW.

54 Ave

54 Ave

192 Frontage Rd

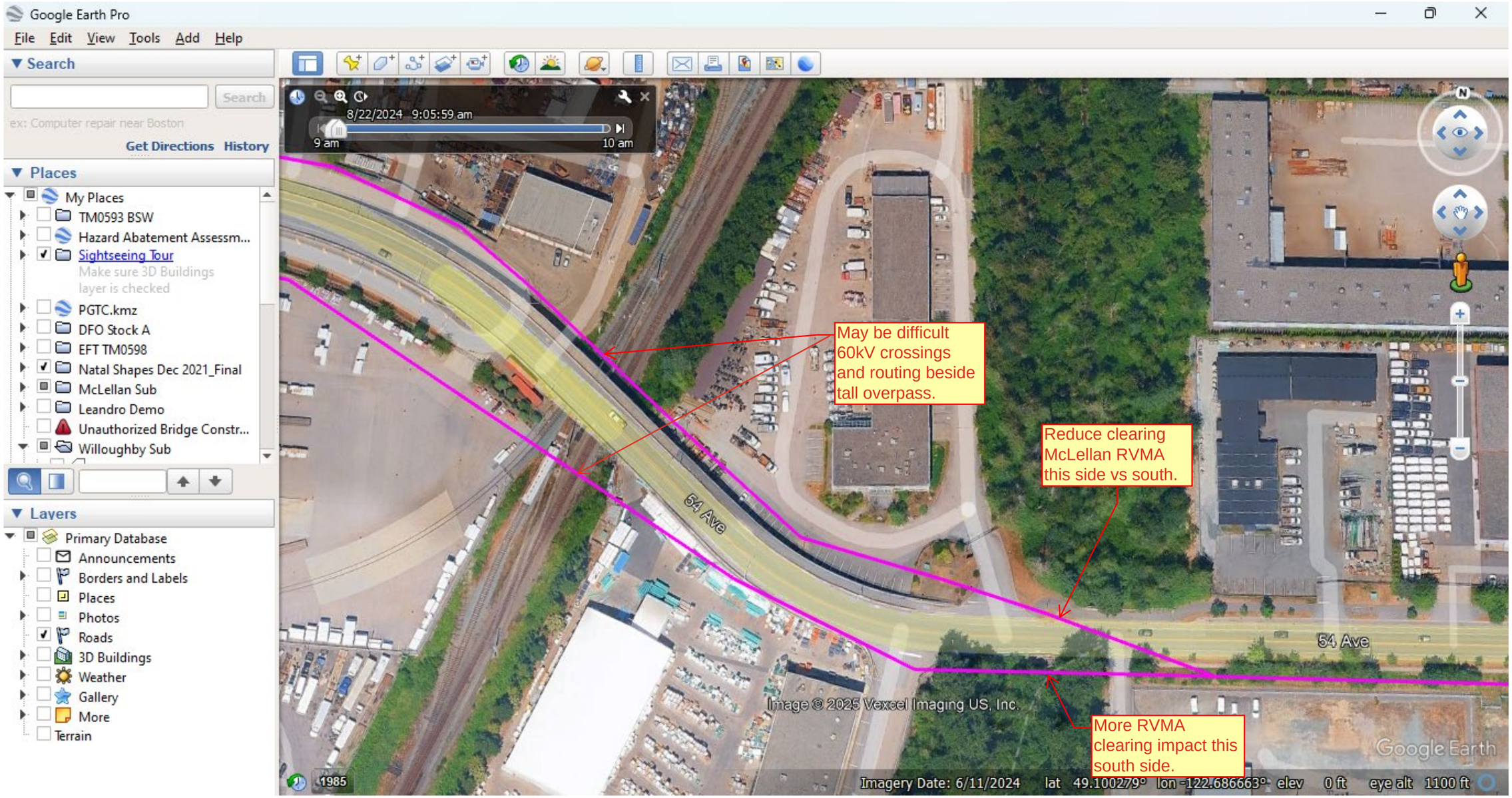
192 St

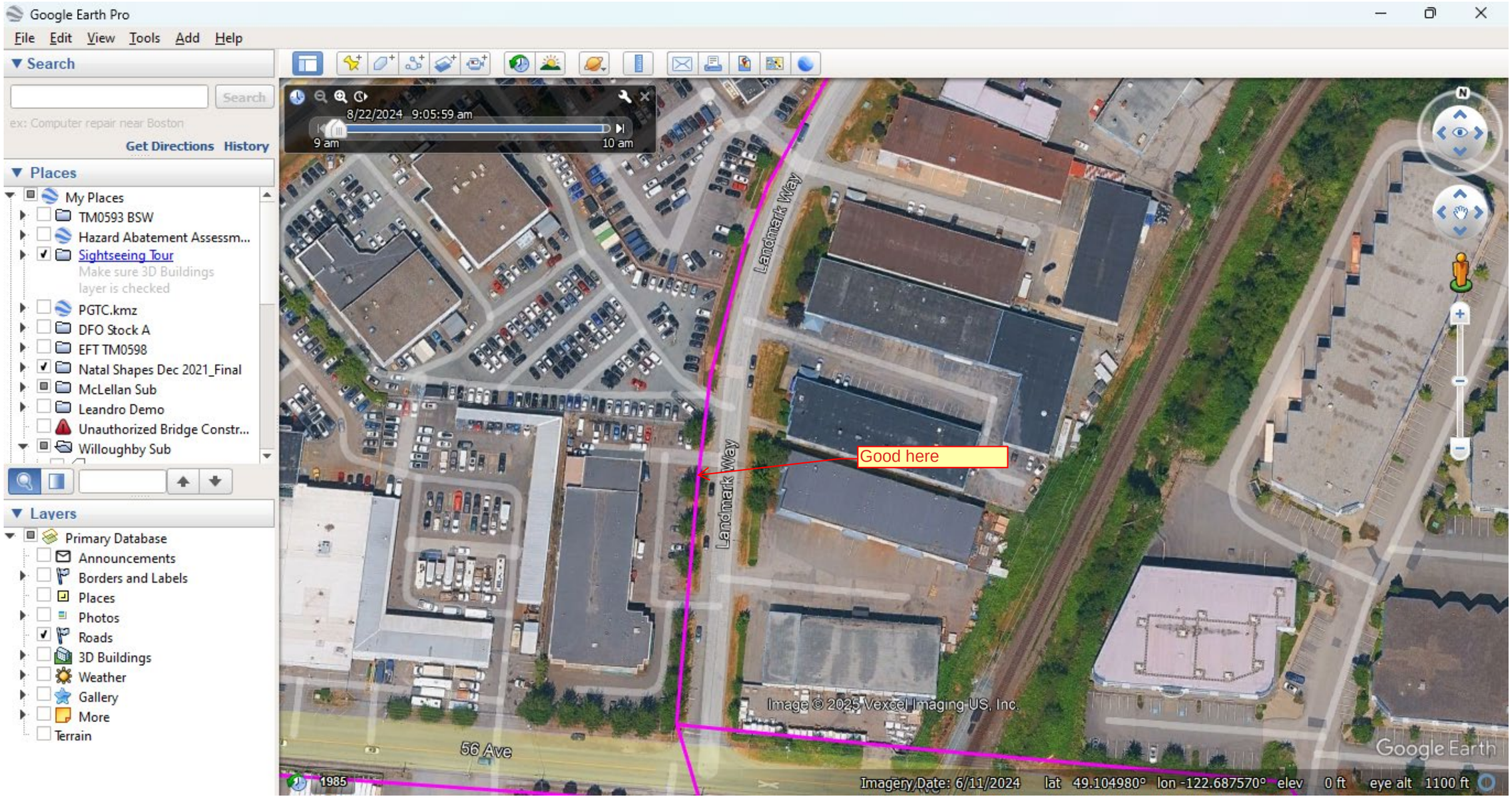
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Imagery Date: 6/11/2024 lat 49.101489° lon -122.690054° elev 0 ft eye alt 1100 ft


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Leandro Demo
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8/22/2024 9:05:59 am
9 am
10 am
May be difficult 60kV crossings and routing beside tall overpass.
Reduce clearing McLellan RVMA this side vs south.
More RVMA clearing impact this south side.
54 Ave
Image © 2025 Vexcel Imaging US, Inc.
Google Earth
1985
Imagery Date: 6/11/2024 lat 49.100279° lon -122.686663° elev 0 ft eye alt 1100 ft


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ex: Computer repair near Boston
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8/22/2024 9:05:59 am
9 am
10 am
Landmark Way
Good here
56 Ave
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ex: Computer repair near Boston

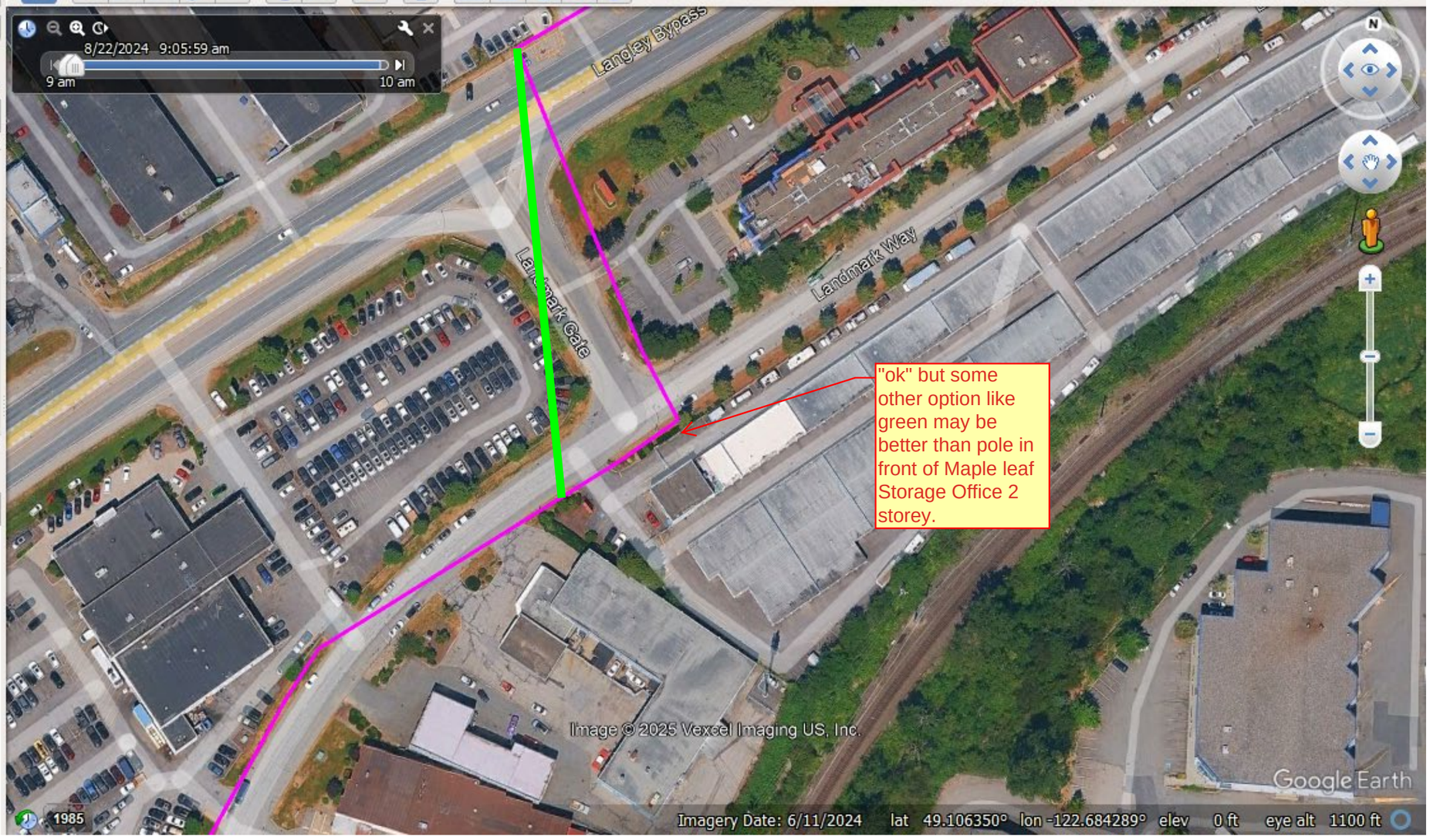
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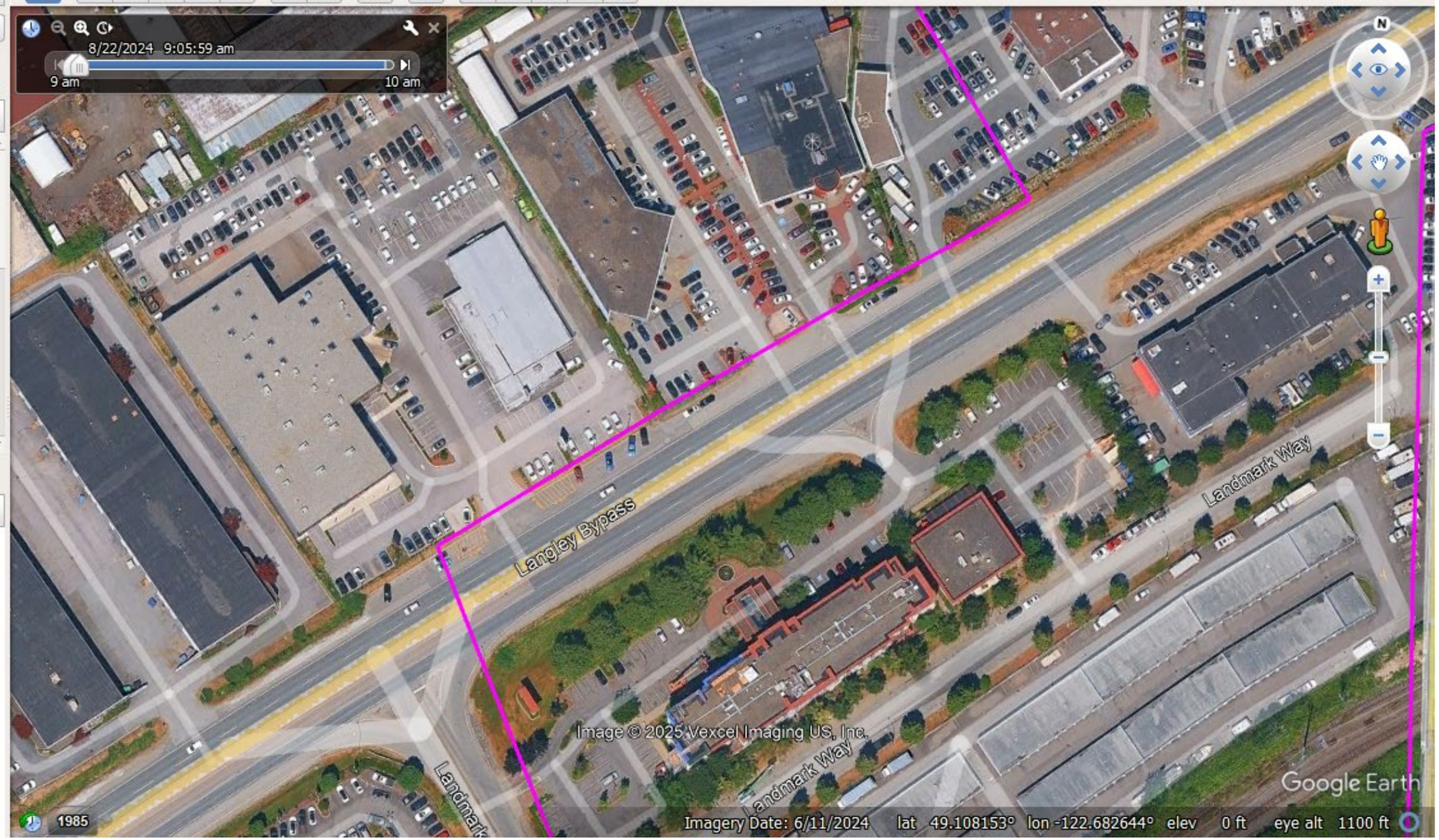
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  - Hazard Abatement Assessm...
  - Sightseeing Tour
    Make sure 3D Buildings layer is checked
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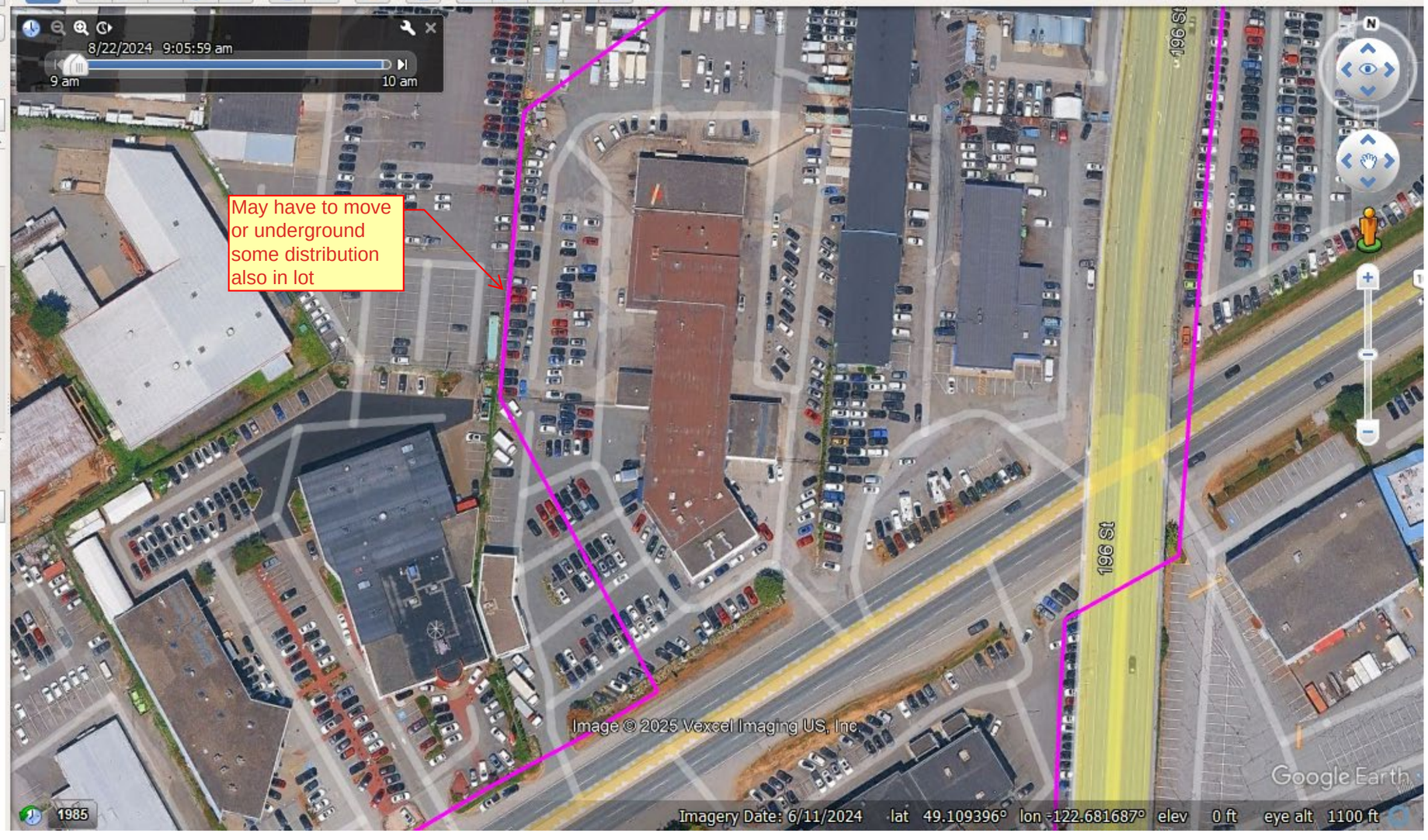
Get Directions History

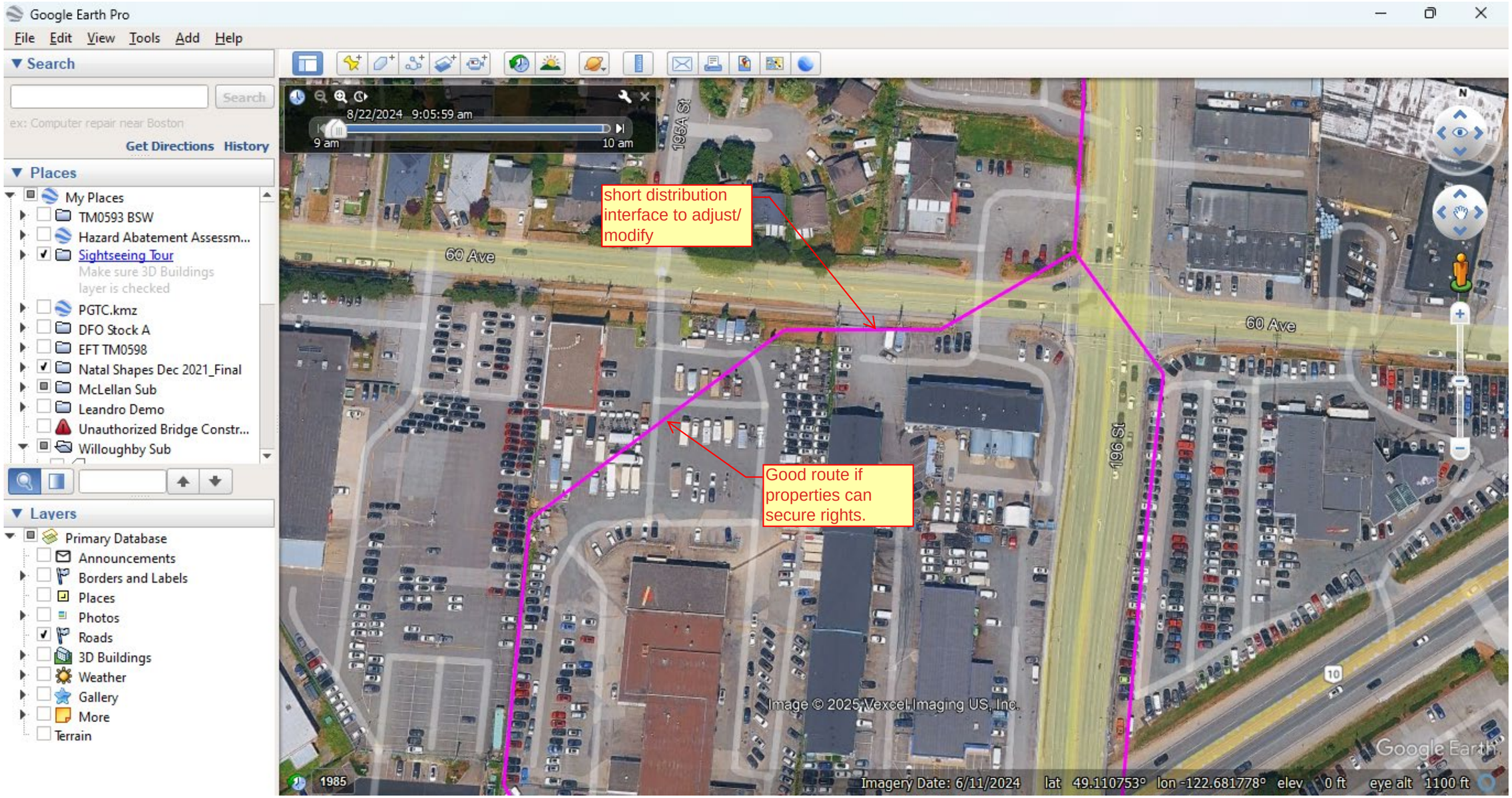
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- My Places
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  - Hazard Abatement Assessm...
  - Sightseeing Tour
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  - PGTC.kmz
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8/22/2024 9:05:59 am
9 am
10 am
short distribution interface to adjust/ modify
Good route if properties can secure rights.
60 Ave
196A St
196 St
10
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Google Earth
1985
Imagery Date: 6/11/2024 lat 49.110753° lon -122.681778° elev 0 ft eye alt 1100 ft

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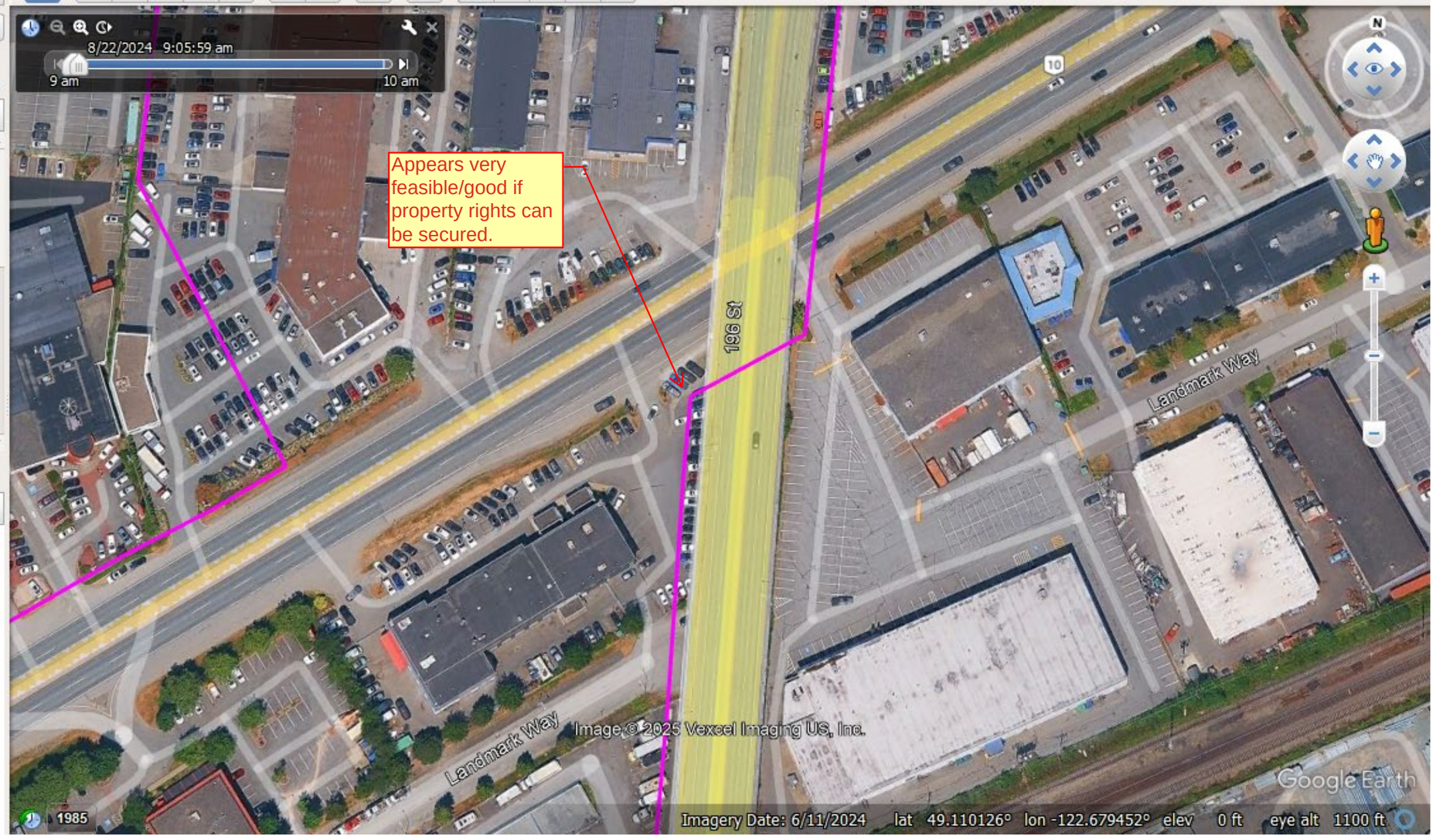
Get Directions History

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  Make sure 3D Buildings layer is checked
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8/22/2024 9:05:59 am

9 am 10 am

Landmark Way

Landmark Way

196 St

Narrow space here. May not have 12-13m ROW required against building for OH.

N

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ex: Computer repair near Boston

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8/22/2024 9:05:59 am

9 am 10 am

196 St

Production Way

N

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8/22/2024 9:05:59 am

9 am 10 am

Close to building here. May not have 12-13m OH ROW.

Close to buildings. May not have 12-13m for 230kV OH ROW.

56 Ave

56 Ave

56 Ave

Production Blvd

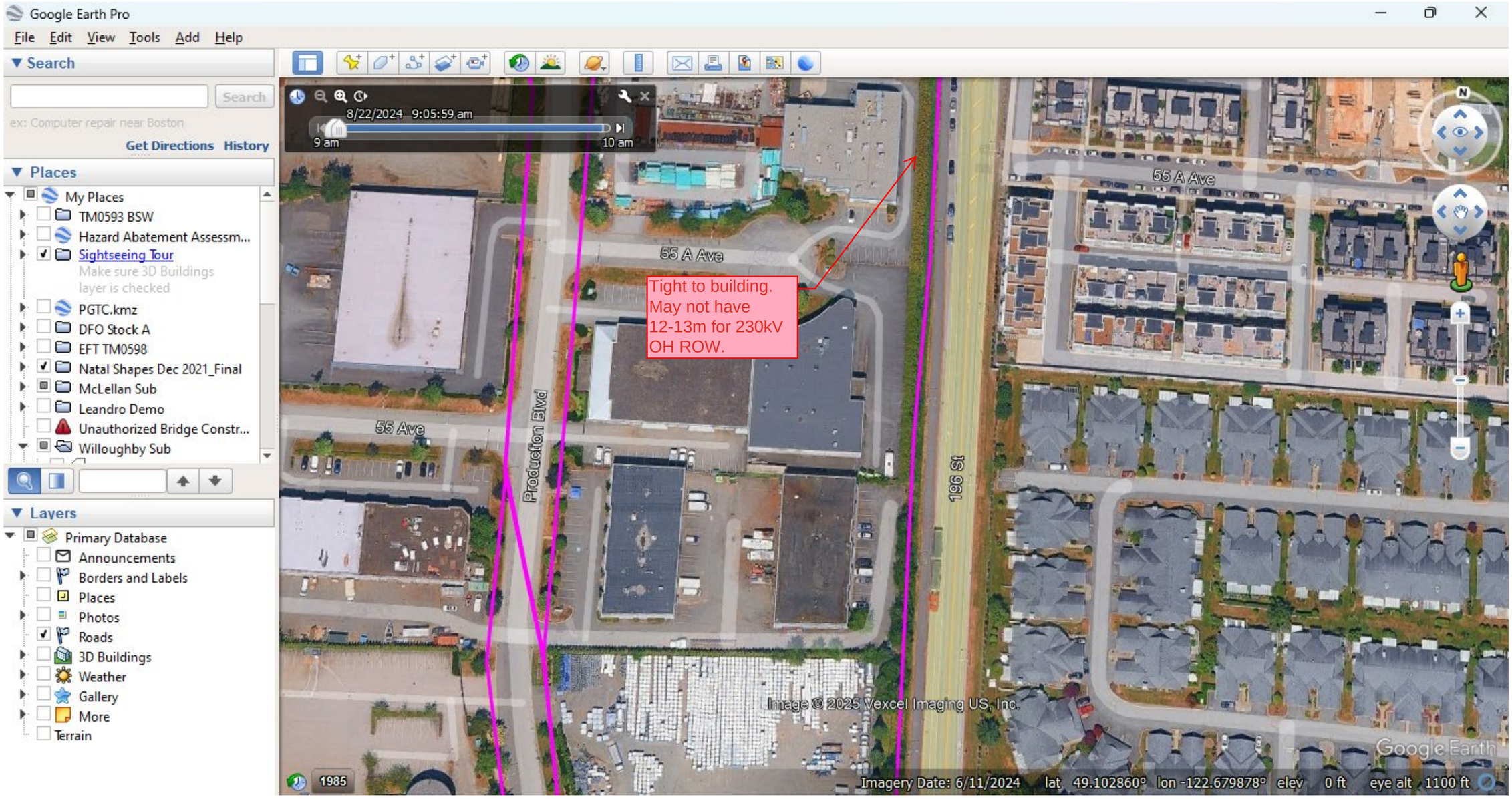
199 St

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ex: Computer repair near Boston
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Terrain
8/22/2024 9:05:59 am
9 am
10 am
55 A Ave
55 Ave
Production Blvd
196 St
Tight to building.
May not have
12-13m for 230kV
OH ROW.
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8/22/2024 9:05:59 am

9 am 10 am

Production Blvd

196 St

53 Ave

54 Ave

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8/22/2024 9:05:59 am

9 am 10 am

Close to building. Will not have 12-13m ROW for 230kV O/H

From sheet 6 above

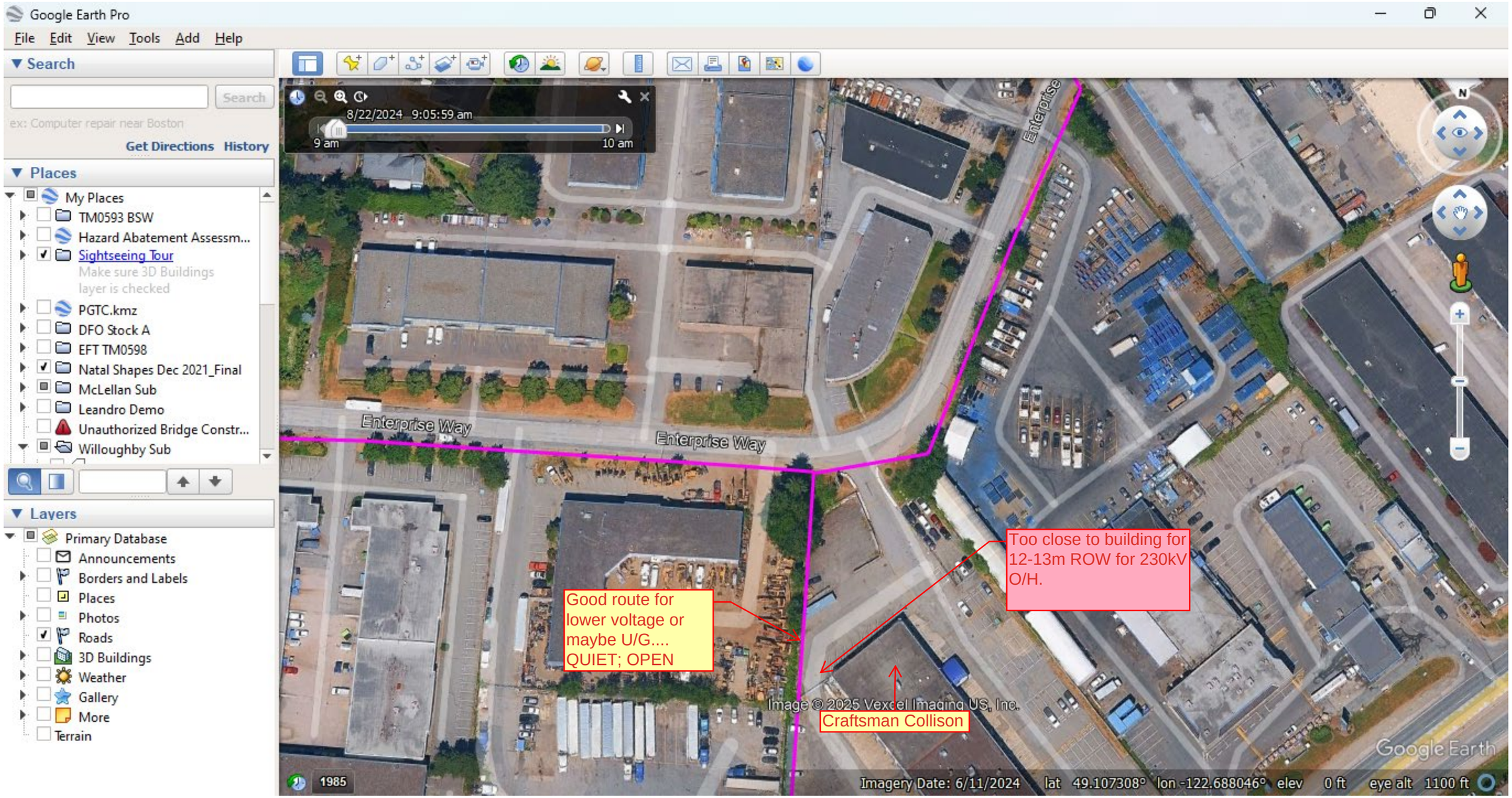
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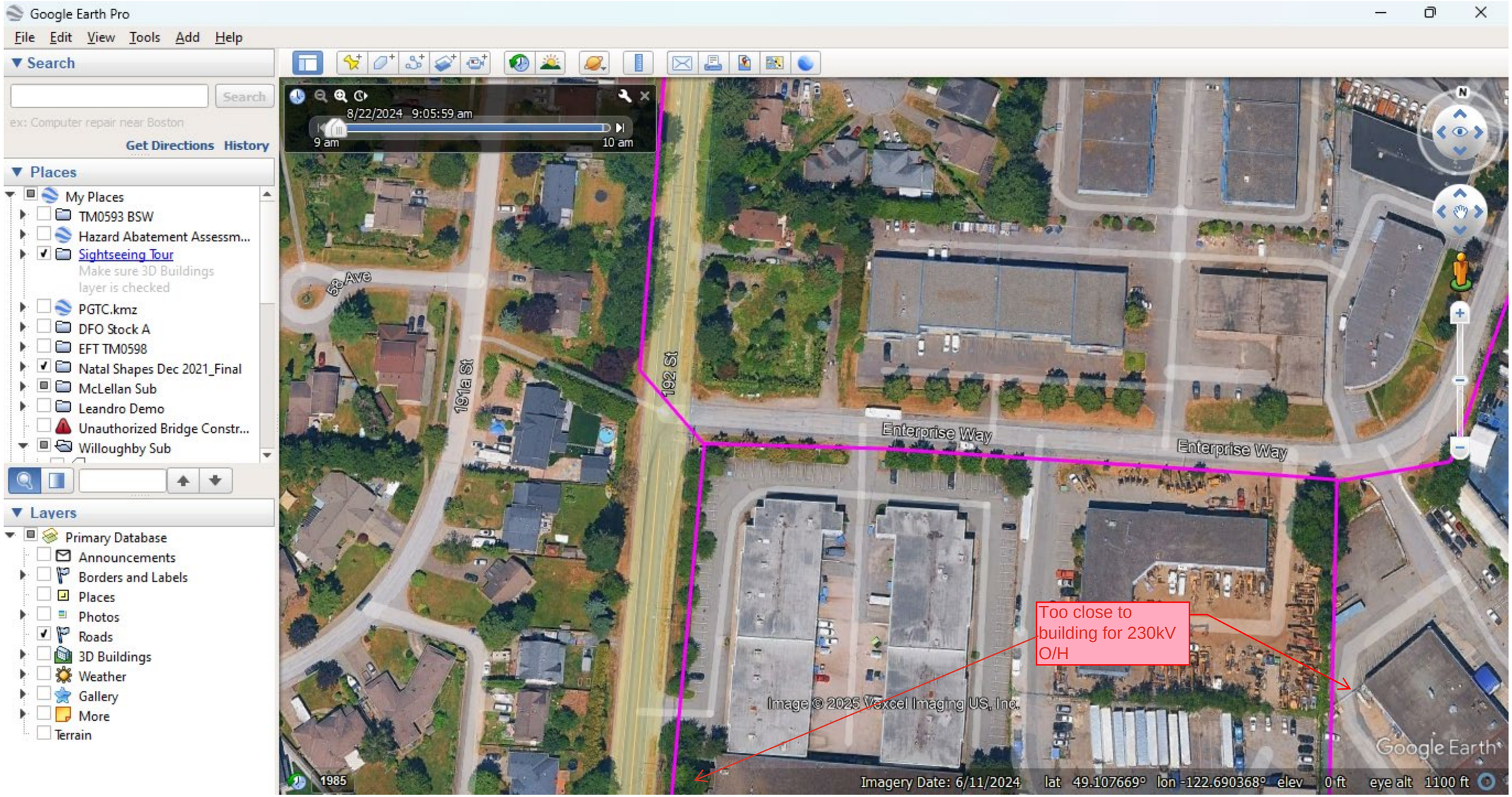
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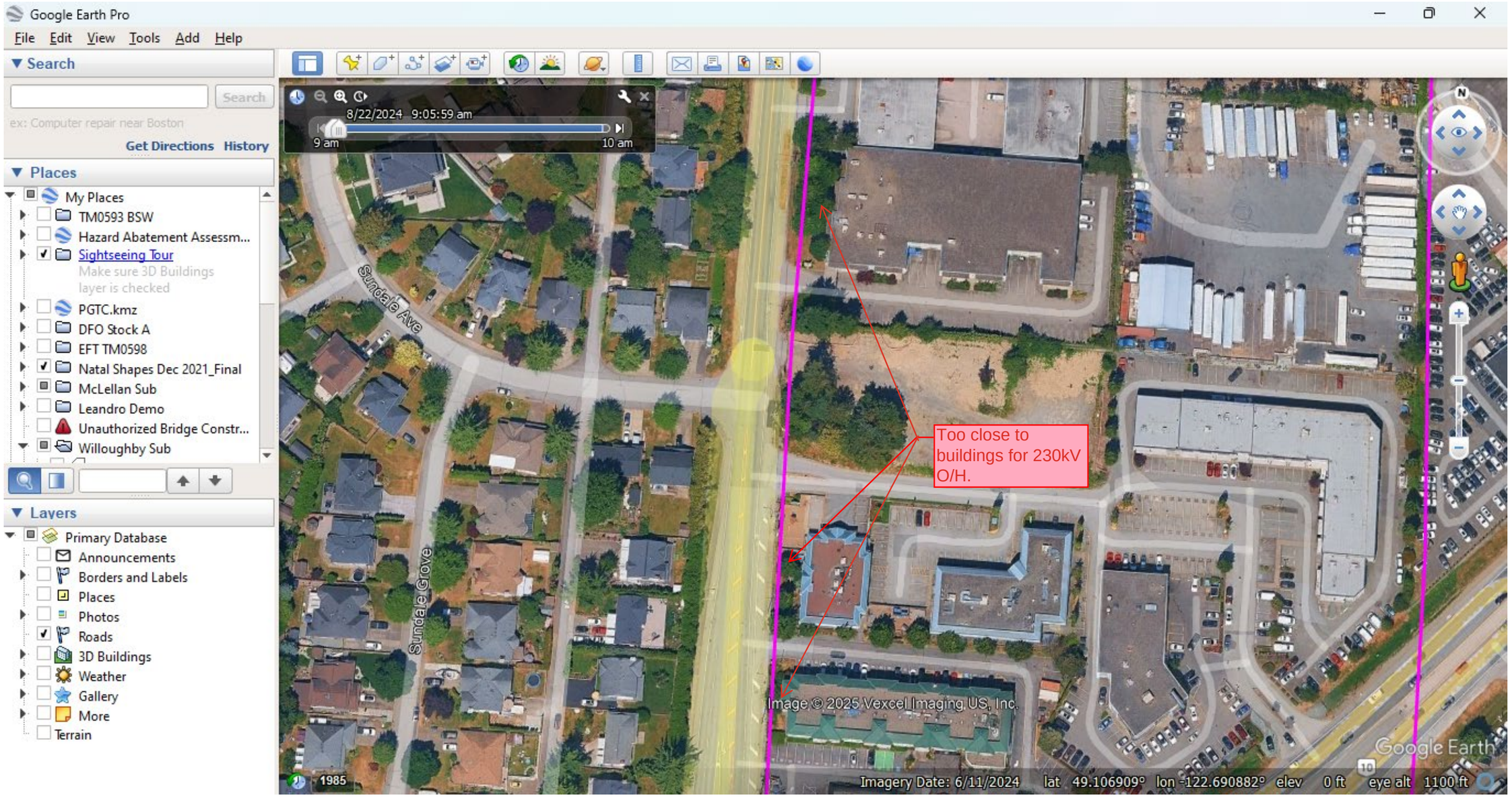
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Imagery Date: 6/11/2024 lat 49.106146° lon -122.687435° elev 0 ft eye alt 1100 ft


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ex: Computer repair near Boston
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8/22/2024 9:05:59 am
9 am
10 am
Enterprise Way
Enterprise Way
Enterprise
Good route for lower voltage or maybe U/G.... QUIET; OPEN
Too close to building for 12-13m ROW for 230kV O/H.
Craftsman Collison
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Google Earth
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Imagery Date: 6/11/2024 lat 49.107308° lon -122.688046° elev 0 ft eye alt 1100 ft


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9 am
10 am
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191a St
192 St
Enterprise Way
Enterprise Way
Too close to building for 230kV O/H
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10 am
Sundale Ave
Sundale Grove
Too close to buildings for 230kV O/H.
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Imagery Date: 6/11/2024 lat 49.106909° lon -122.690882° elev 0 ft eye alt 1100 ft

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8/22/2024 9:05:59 am

9 am 10 am

Too close to building for 230kV O/H

10

56 Ave

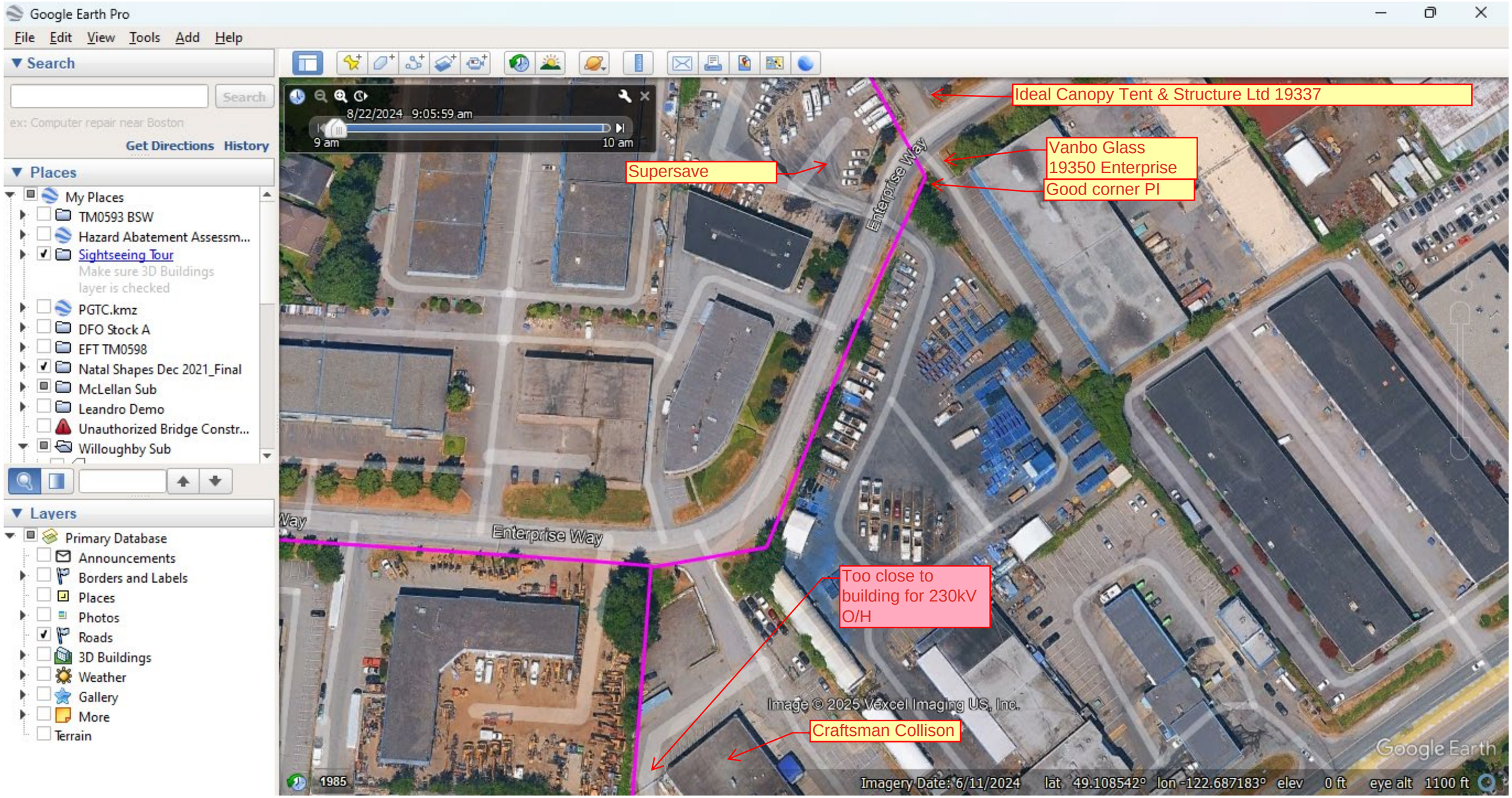
192 St

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10 am
Ideal Canopy Tent & Structure Ltd 19337
Vanbo Glass
19350 Enterprise
Good corner PI
Supersave
Enterprise Way
Too close to building for 230kV O/H
Craftsman Collison
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Imagery Date: 6/11/2024 lat 49.108542° lon -122.687183° elev 0 ft eye alt 1100 ft

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ex: Computer repair near Boston

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- Unauthorized Bridge Constr...
- Willoughby Sub

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Terrain

8/22/2024 9:05:59 am

9 am 10 am

Current distribution line along back line already to move/ underground in parking lot

Looks quite good. Quiet parking lot

This PI and property rights is important for this option

Good PI

Enterprise Way

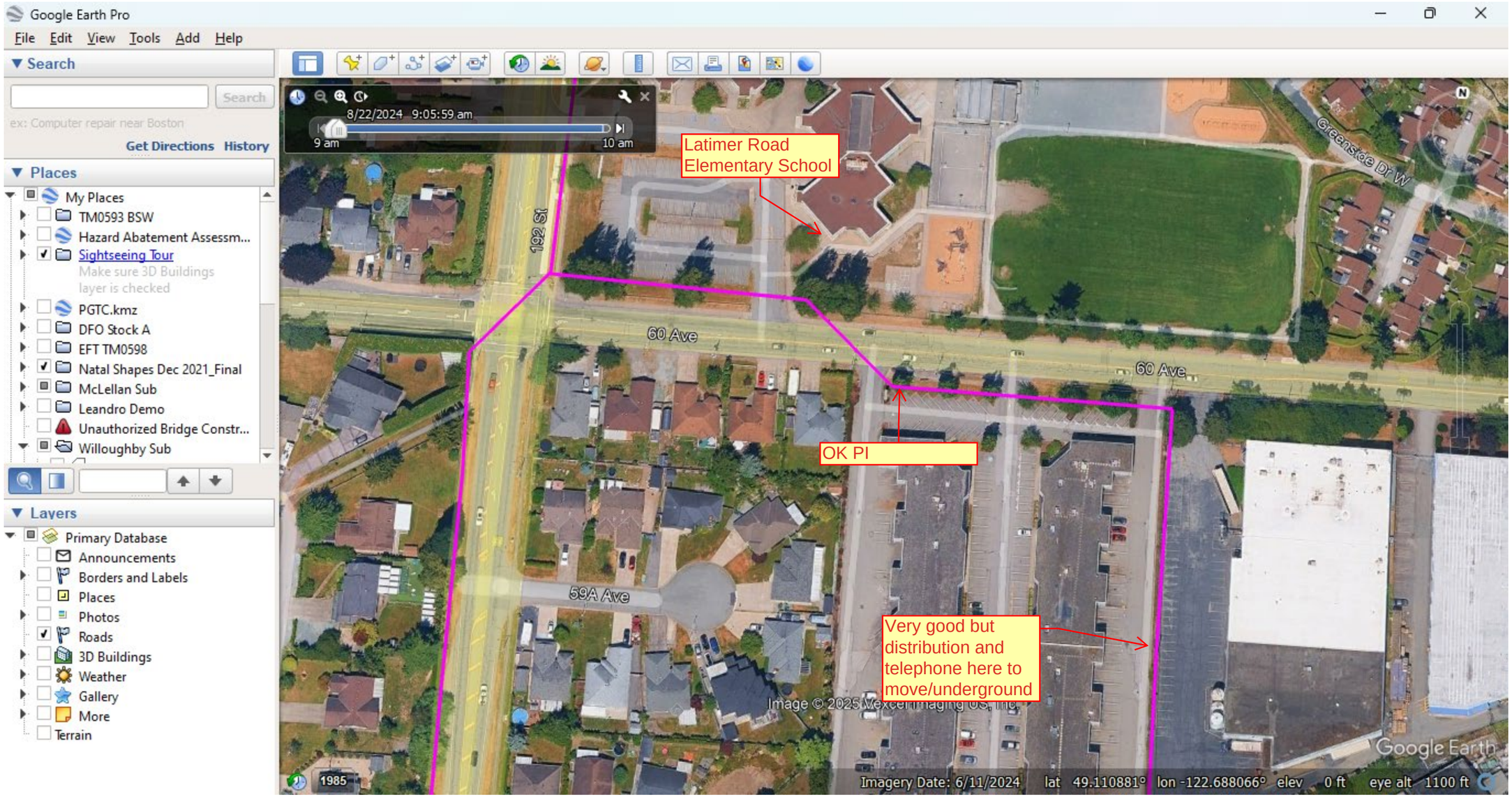
Enterprise Way

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Sightseeing Tour
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8/22/2024 9:05:59 am
9 am
10 am
Latimer Road Elementary School
192 St
60 Ave
60 Ave
Greenside Dr W
OK PI
59A Ave
Very good but distribution and telephone here to move/underground
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8/22/2024 9:05:59 am

9 am 10 am

191a St

192 St

59 Ave

58 Ave

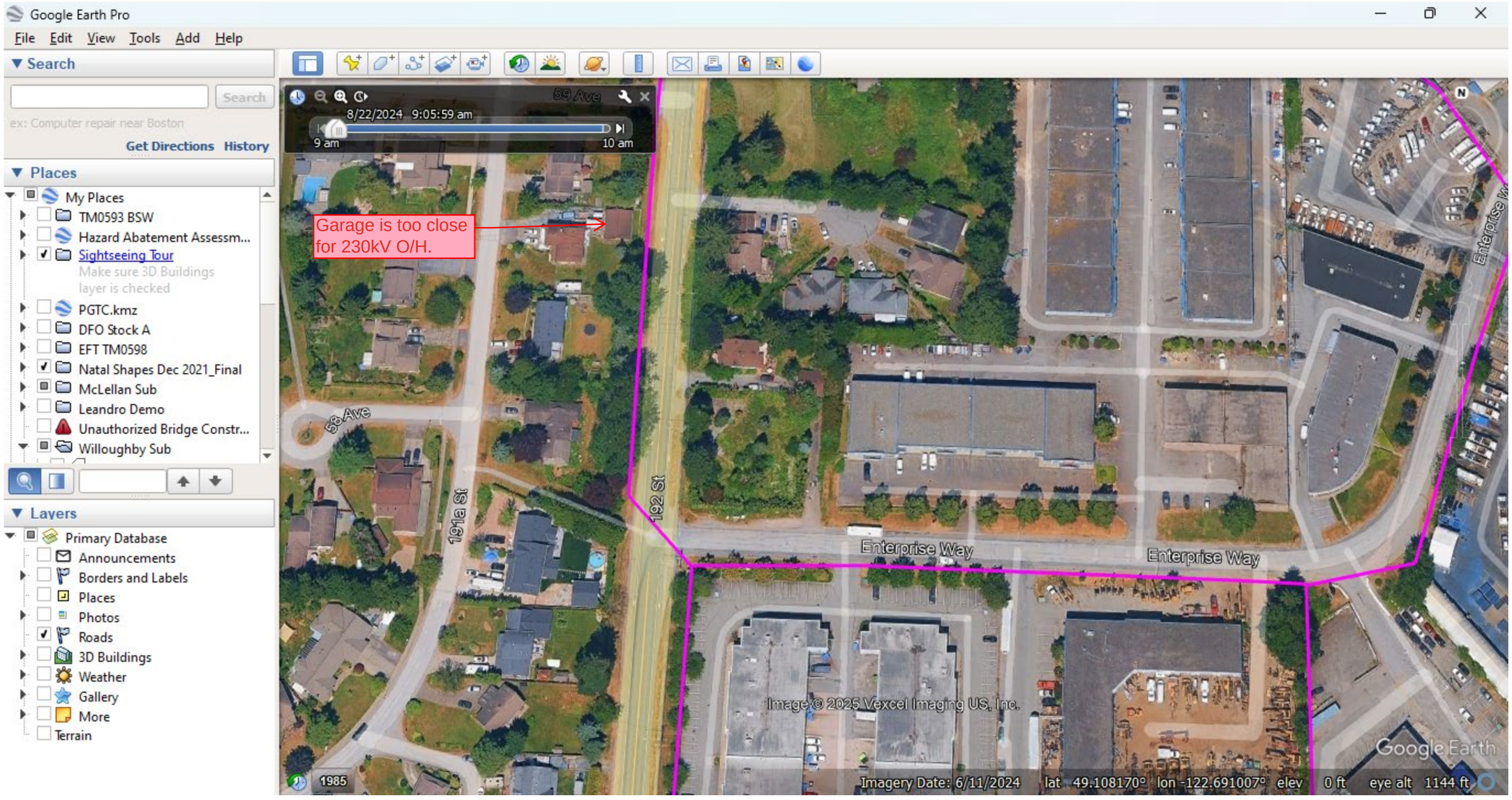
Garage is too close for 230kV O/H ROW. And East side of 192 St also tight to houses for O/H 230kV.

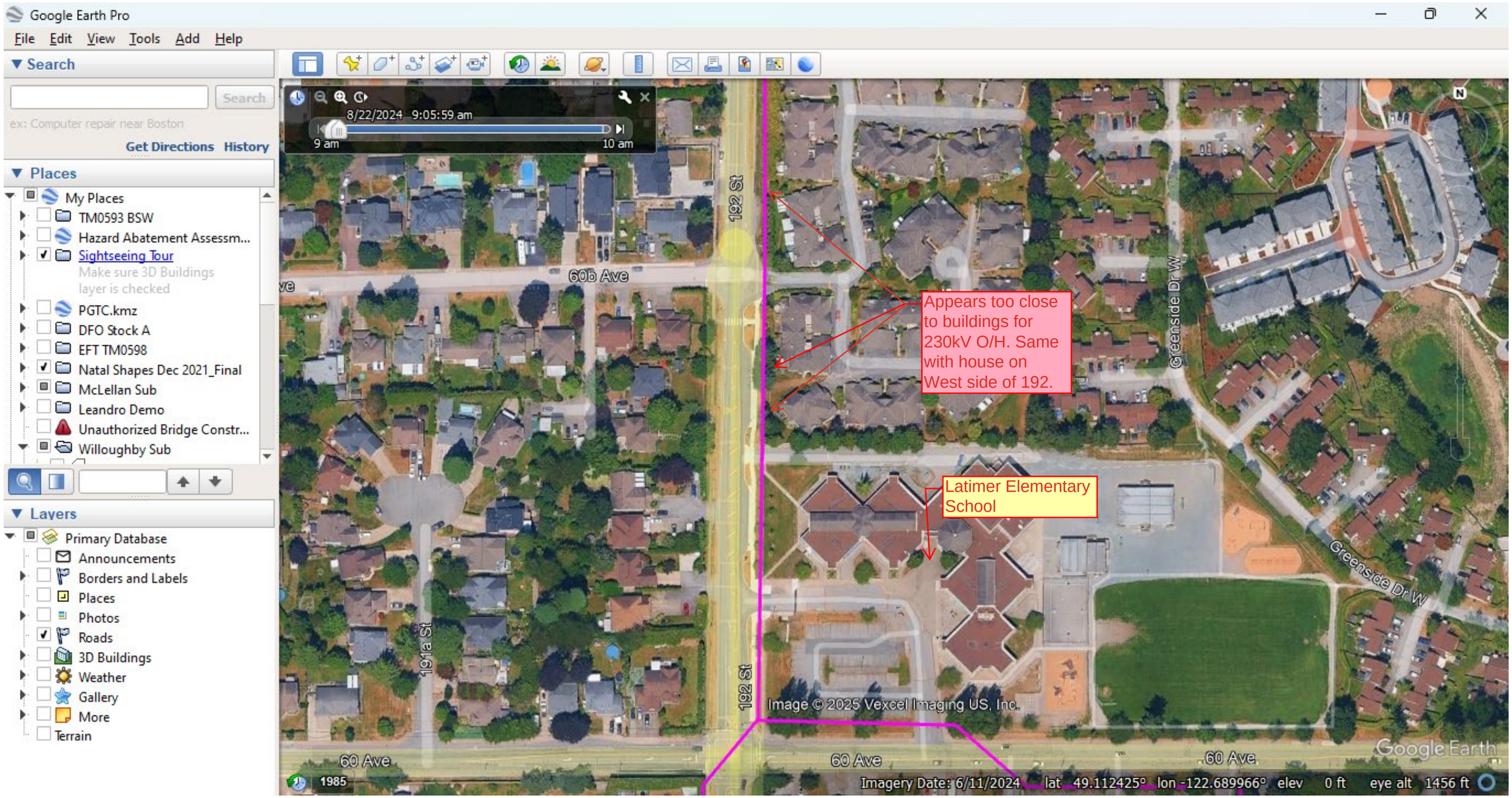
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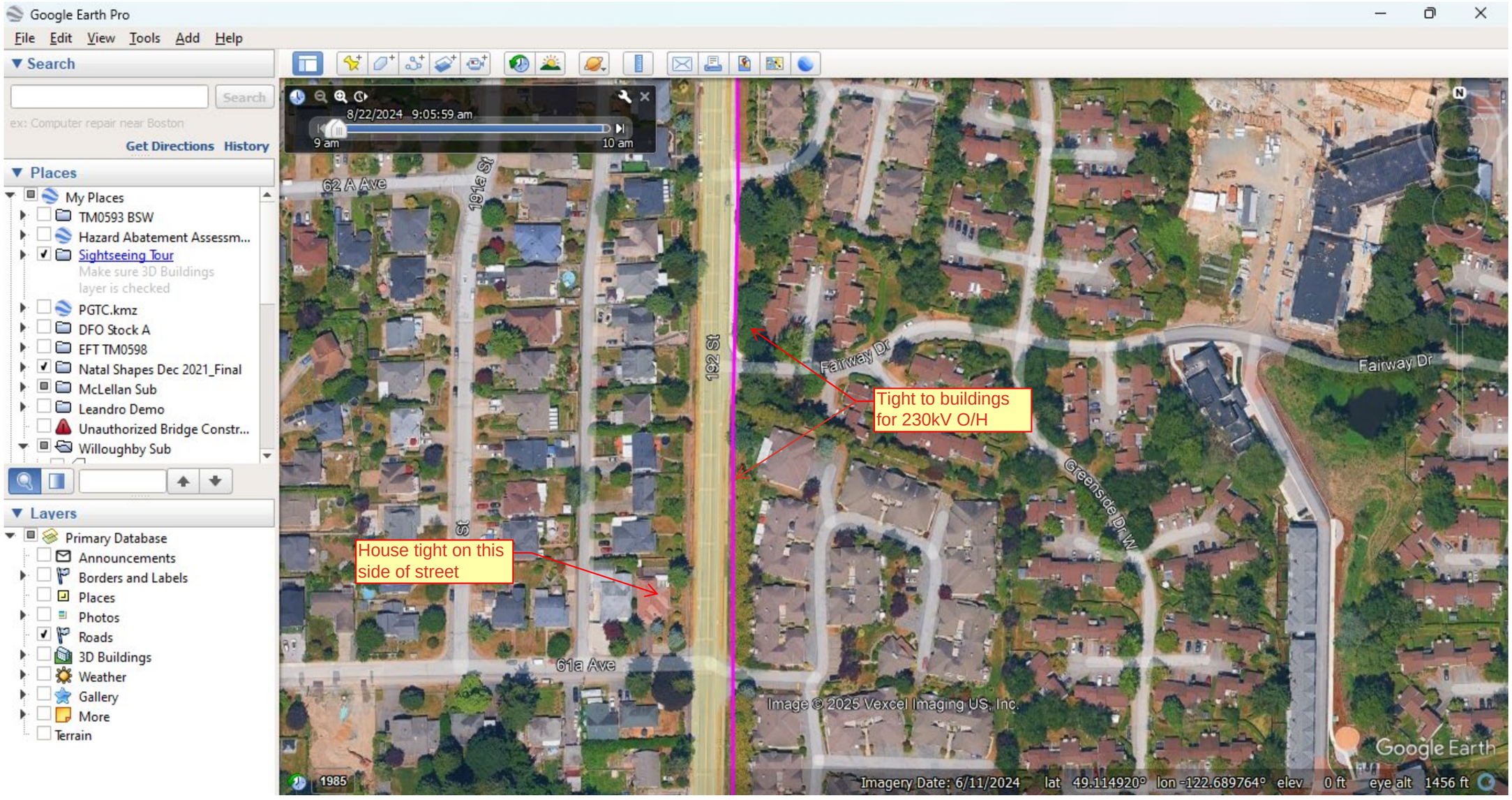
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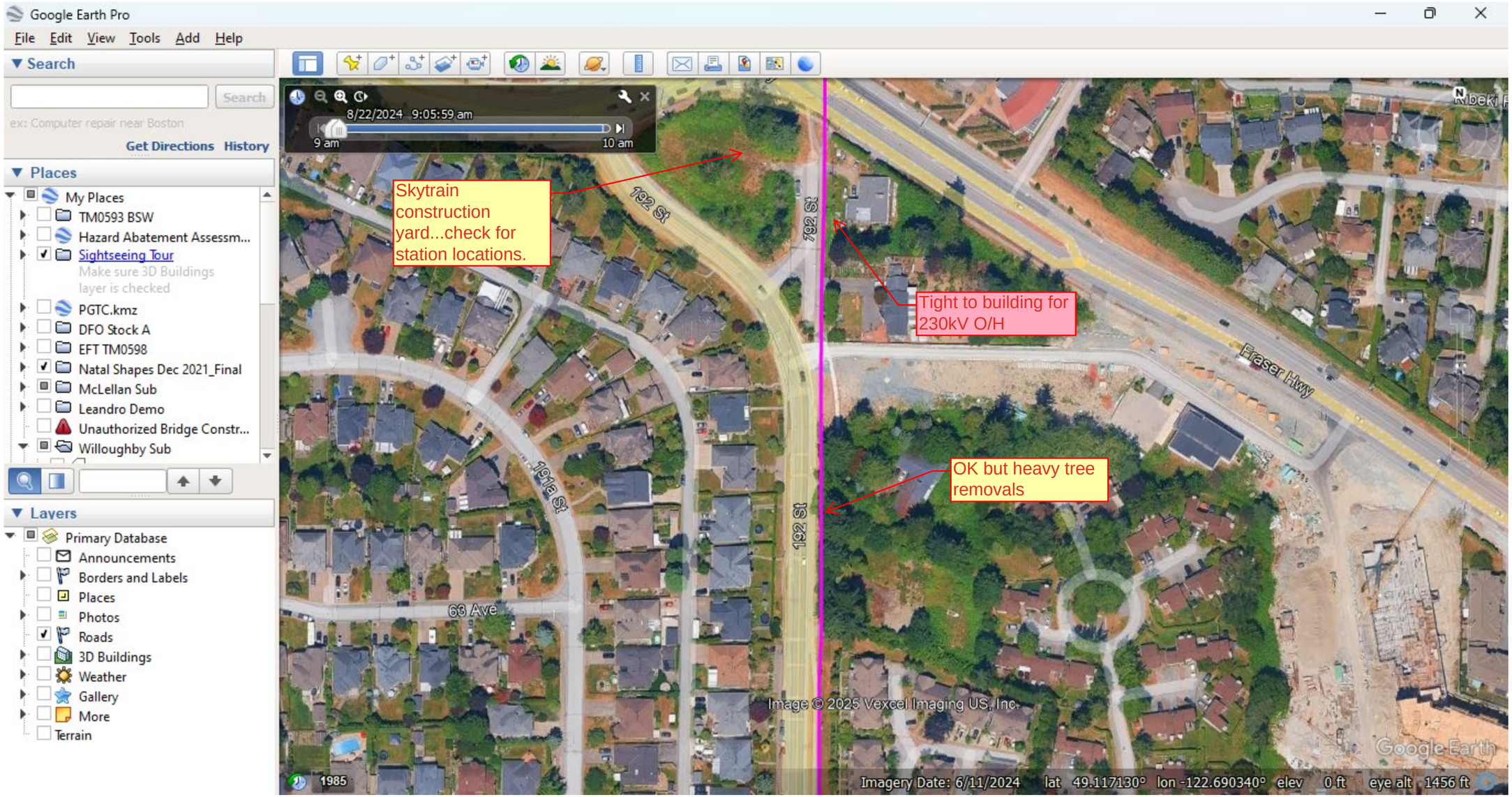
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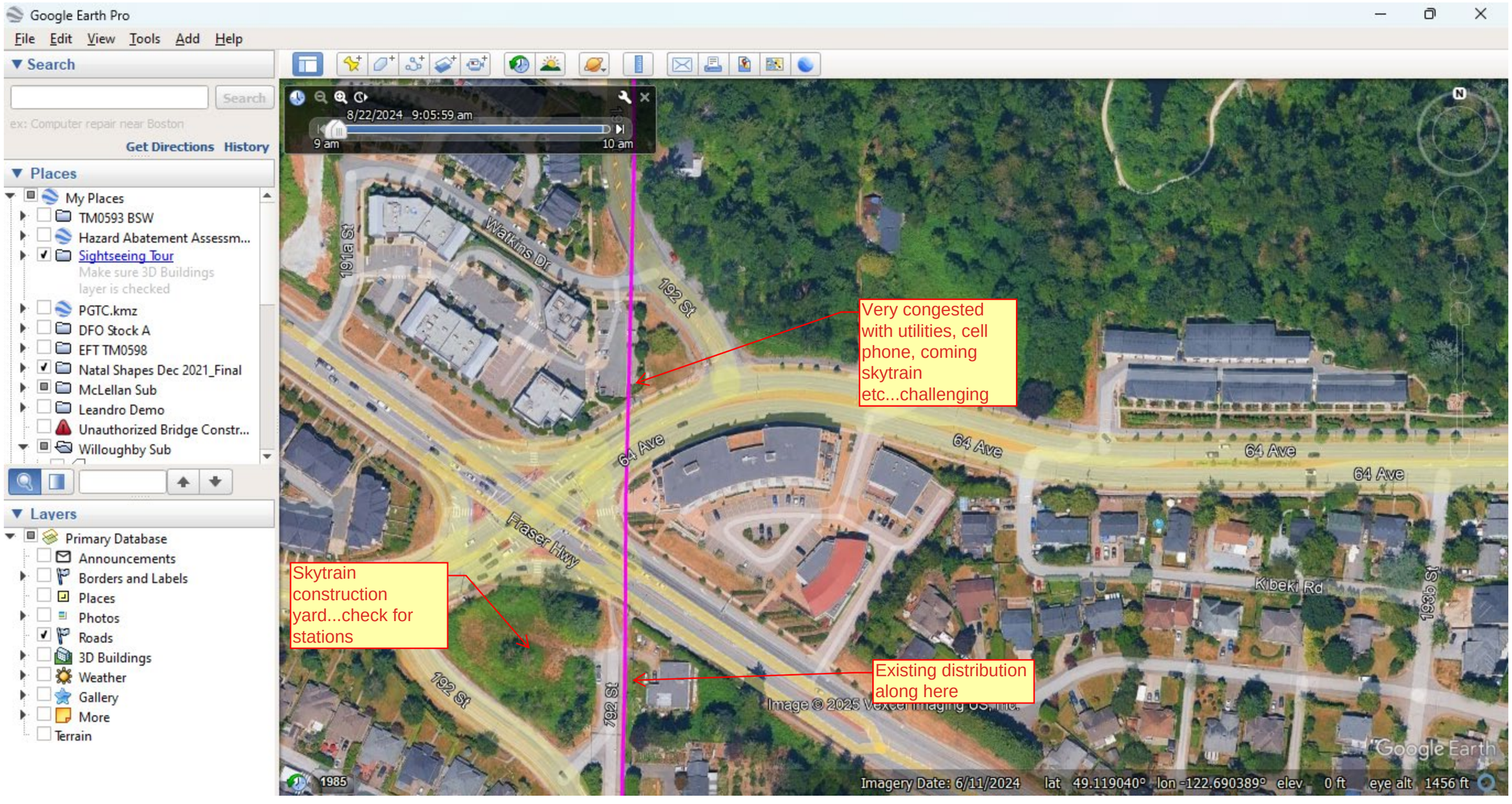
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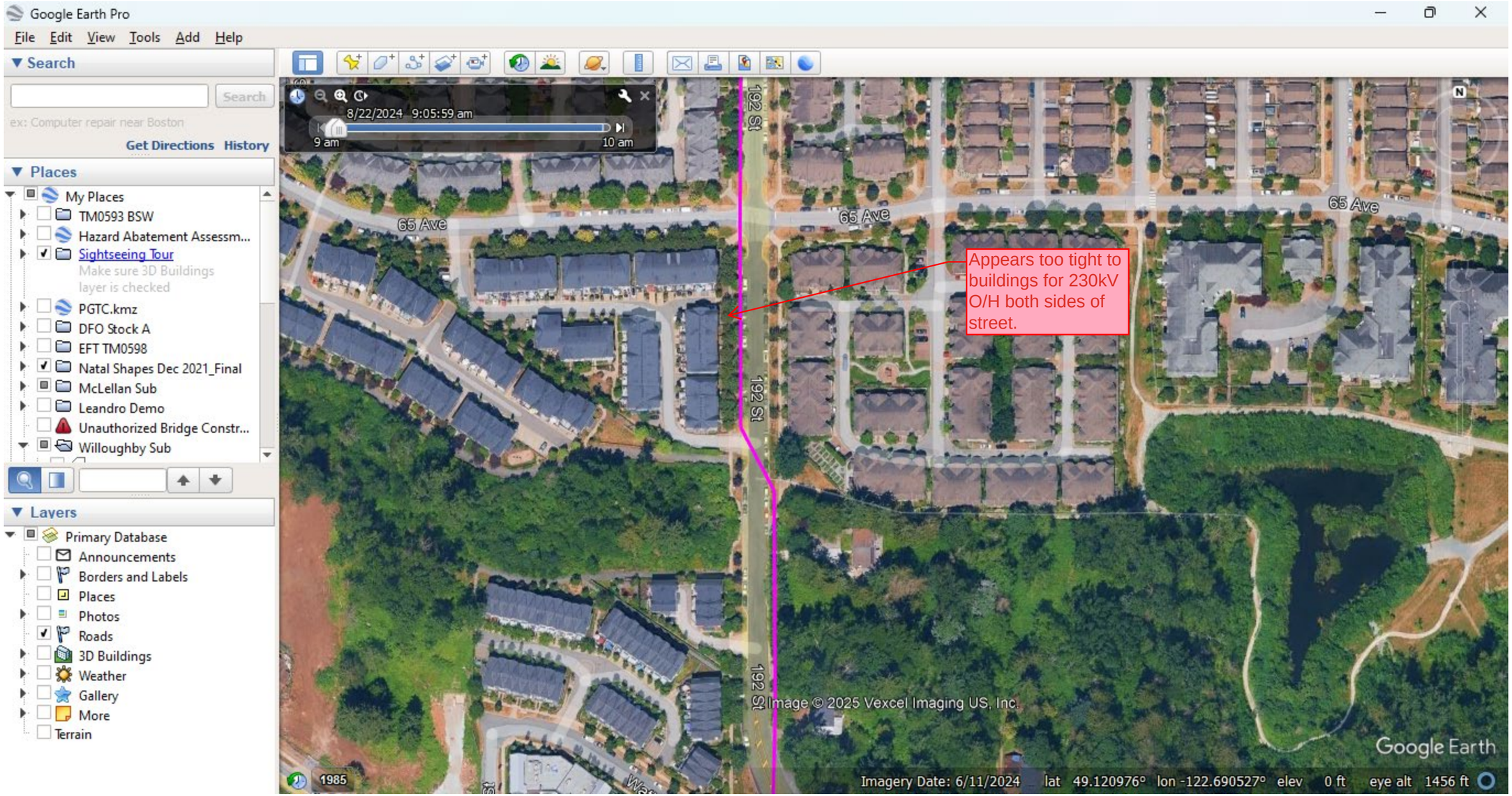

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9 am
10 am
Garage is too close for 230kV O/H.
59 Ave
58 Ave
191a St
192 St
Enterprise Way
Enterprise Way
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Imagery Date: 6/11/2024 lat 49.108170° lon -122.691007° elev 0 ft eye alt 1144 ft

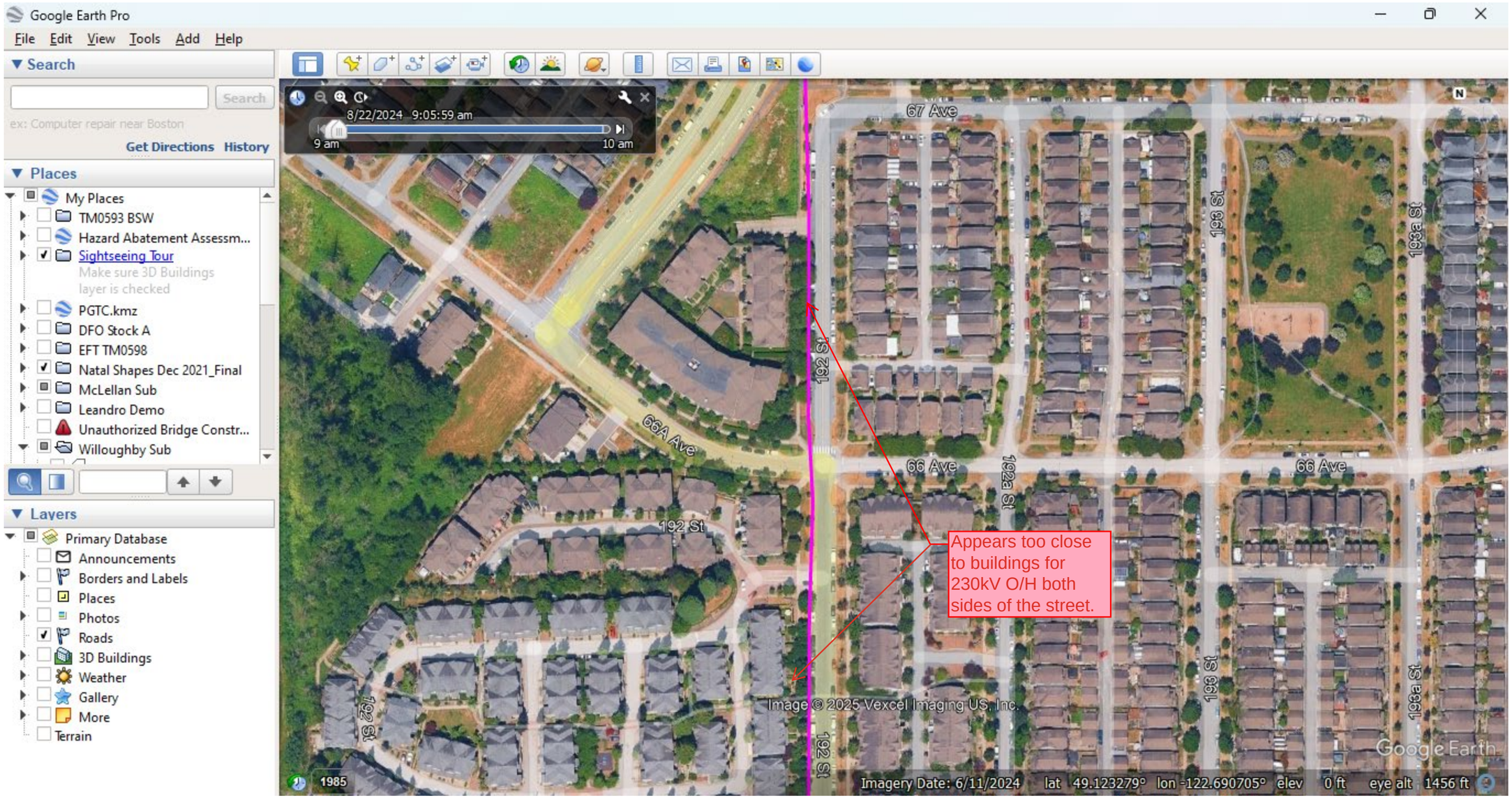

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8/22/2024 9:05:59 am
9 am
10 am
192 St
60b Ave
Greenside Dr W
Appears too close to buildings for 230kV O/H. Same with house on West side of 192.
Latimer Elementary School
191a St
192 St
60 Ave
60 Ave
60 Ave
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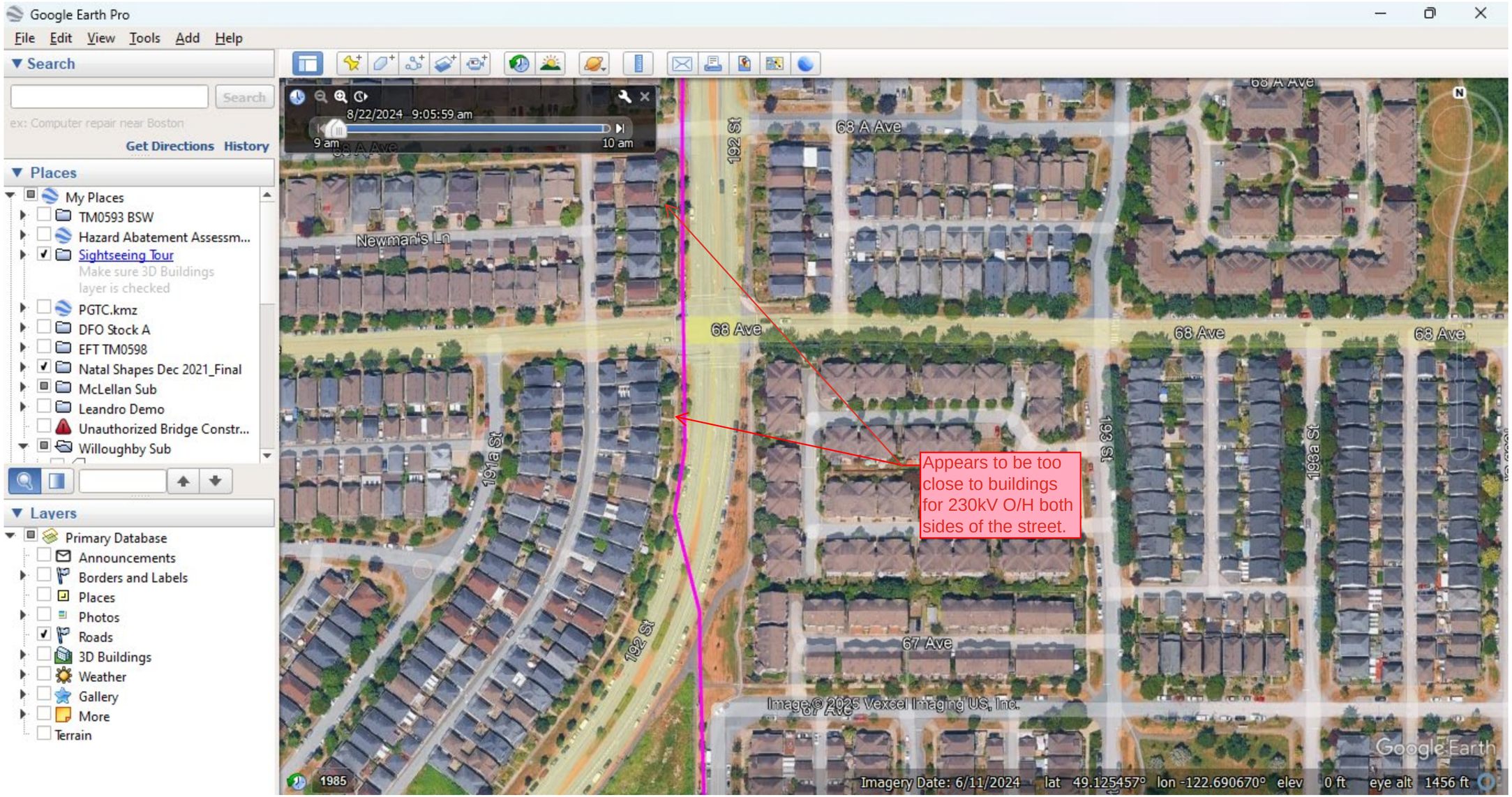

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Terrain
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9 am
10 am
62 A Ave
191a St
192 St
Fairway Dr
Fairway Dr
Greenside Dr W
Tight to buildings for 230kV O/H
House tight on this side of street
61a Ave
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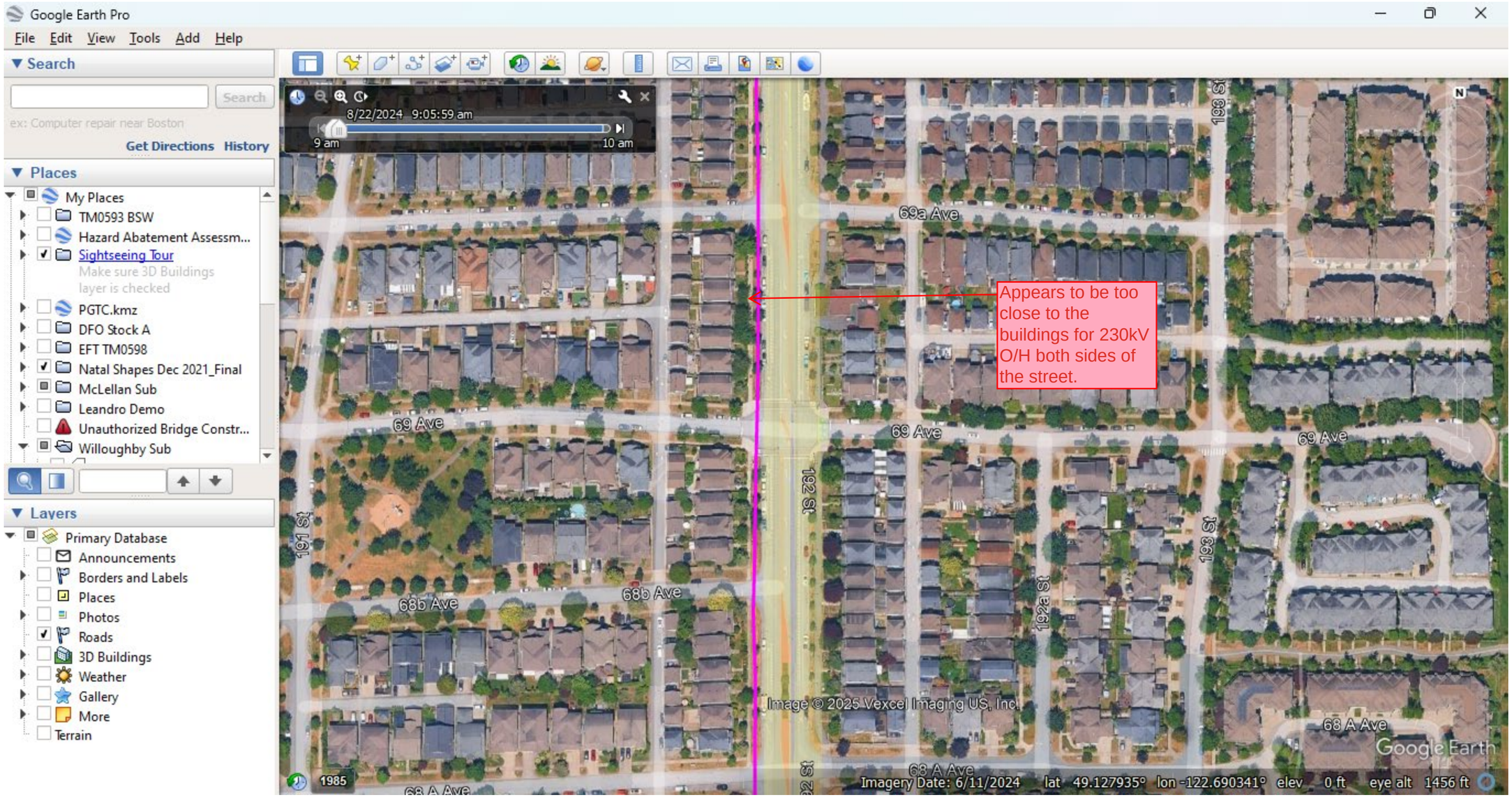

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8/22/2024 9:05:59 am
9 am
10 am
Skytrain construction yard...check for station locations.
192 St
191a St
66 Ave
Tight to building for 230kV O/H
Fraser Hwy
OK but heavy tree removals
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9 am
10 am
191a St
Watkins Dr
192 St
64 Ave
Fraser Hwy
Kibeki Rd
193b St
Very congested with utilities, cell phone, coming skytrain etc...challenging
Skytrain construction yard...check for stations
Existing distribution along here
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9 am
10 am
192 St
65 Ave
Appears too tight to buildings for 230kV O/H both sides of street.
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Terrain
8/22/2024 9:05:59 am
9 am
10 am
67 Ave
66A Ave
66 Ave
192 St
192a St
193 St
193a St
Appears too close to buildings for 230kV O/H both sides of the street.
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8/22/2024 9:05:59 am
9 am
10 am
68 A Ave
Newman's Ln
192 St
68 Ave
193 St
191a St
193a St
132 St
67 Ave
Appears to be too close to buildings for 230kV O/H both sides of the street.
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9 am
10 am
Appears to be too close to the buildings for 230kV O/H both sides of the street.
69a Ave
69 Ave
68b Ave
68 A Ave
191 St
192 St
192a St
193 St
193 St
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8/22/2024 9:05:59 am

9 am 10 am

71 Ave

192 St

192a St

193 St

Fisher Dr

191 St

70 Ave

192 St

70 Ave

70 Ave

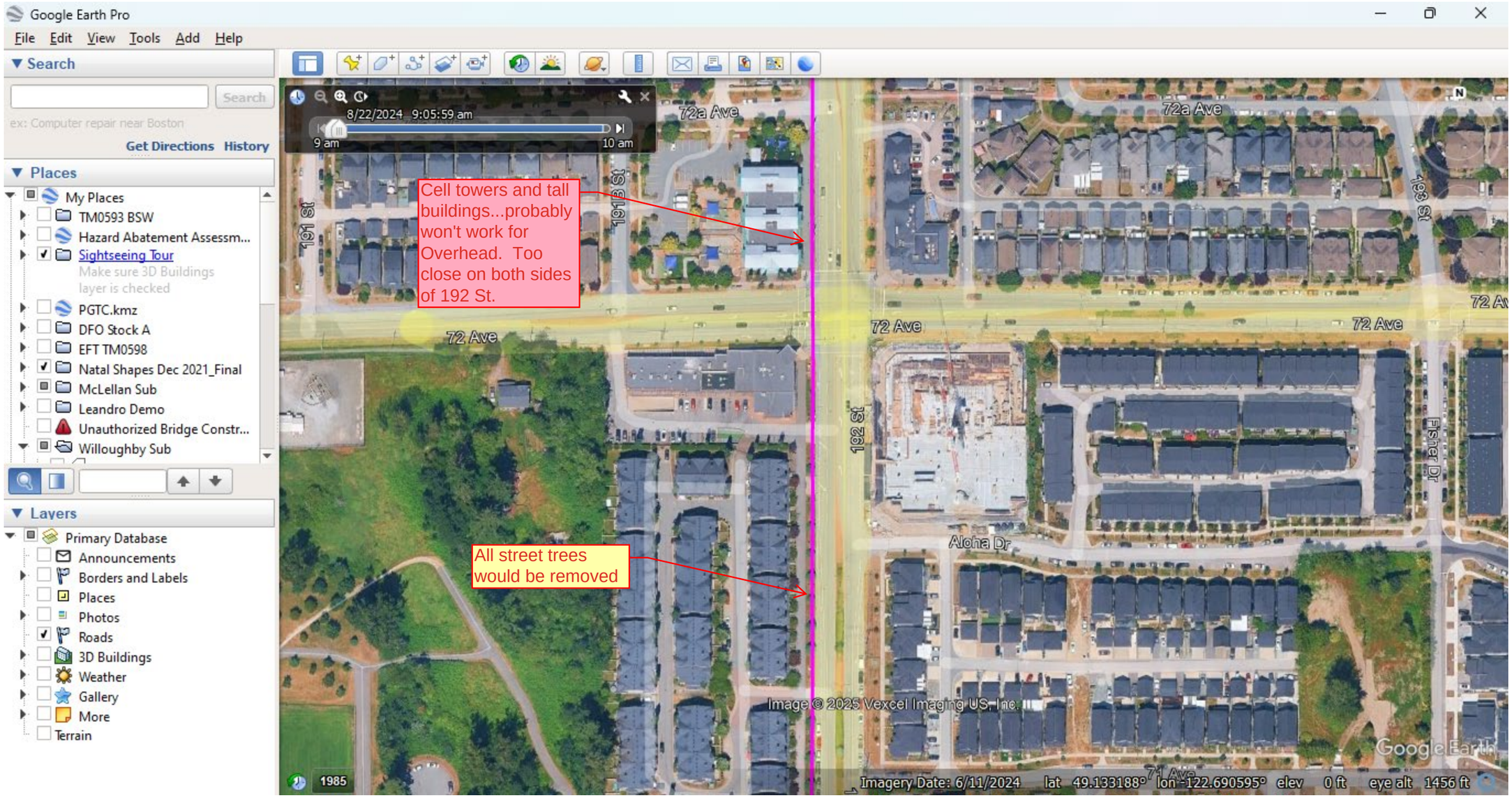
193 St

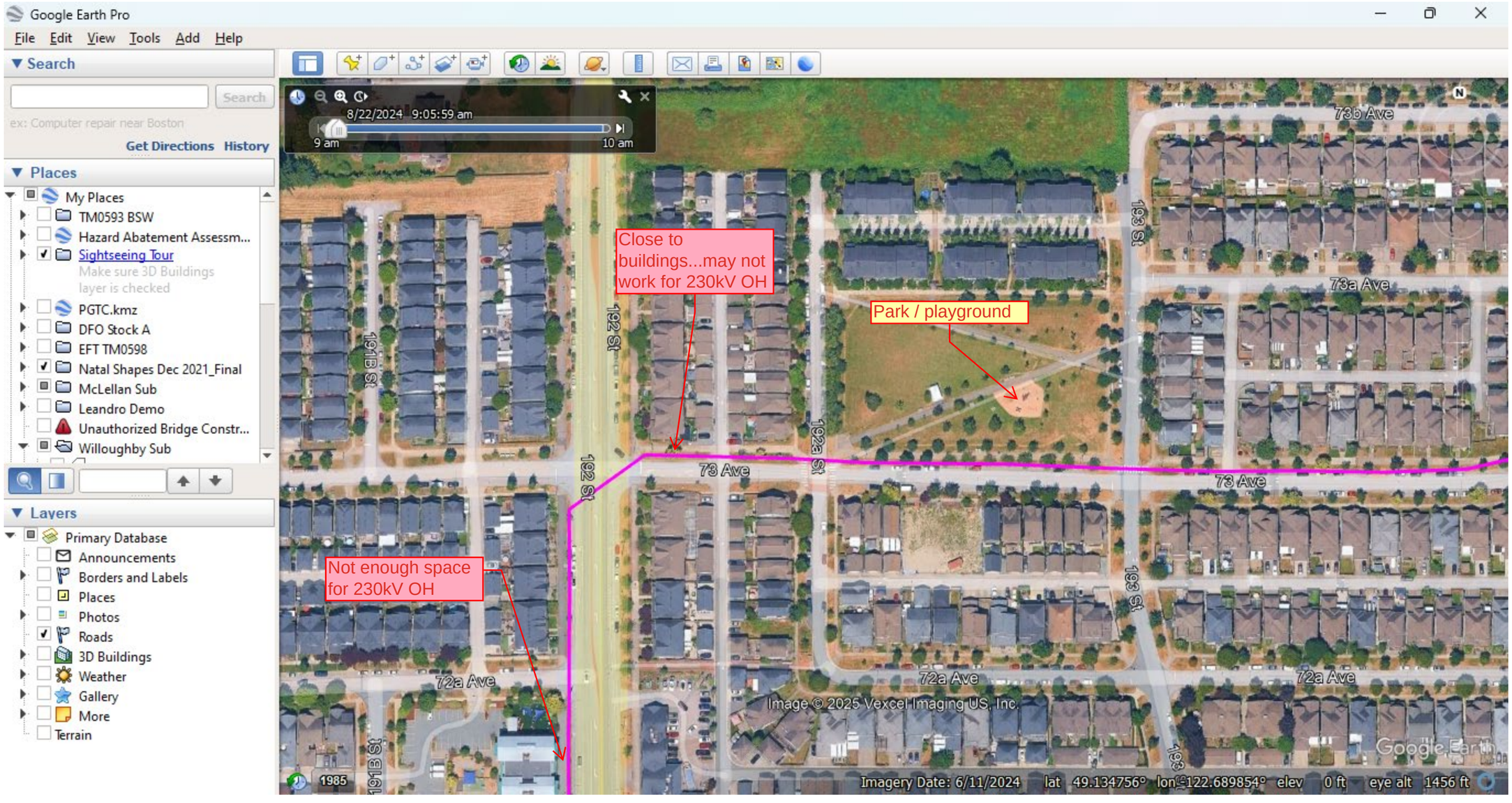
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9 am
10 am
Cell towers and tall buildings...probably won't work for Overhead. Too close on both sides of 192 St.
All street trees would be removed
72a Ave
191 St
191a St
193 St
72 Ave
192 St
Aloha Dr
Fisher Dr
71 Ave
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9 am
10 am
Close to buildings...may not work for 230kV OH
Park / playground
Not enough space for 230kV OH
73b Ave
73a Ave
73 Ave
72a Ave
193 St
192 St
191B St
192a St
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8/22/2024 9:05:59 am

9 am 10 am

73b Ave

73a Ave

194a St

194 St

73 Ave

72a Ave

195 St

195A St

Houses probably too close and won't work as O/H...both sides of 194St

Excellent O/H and U/G alignment thru these areas

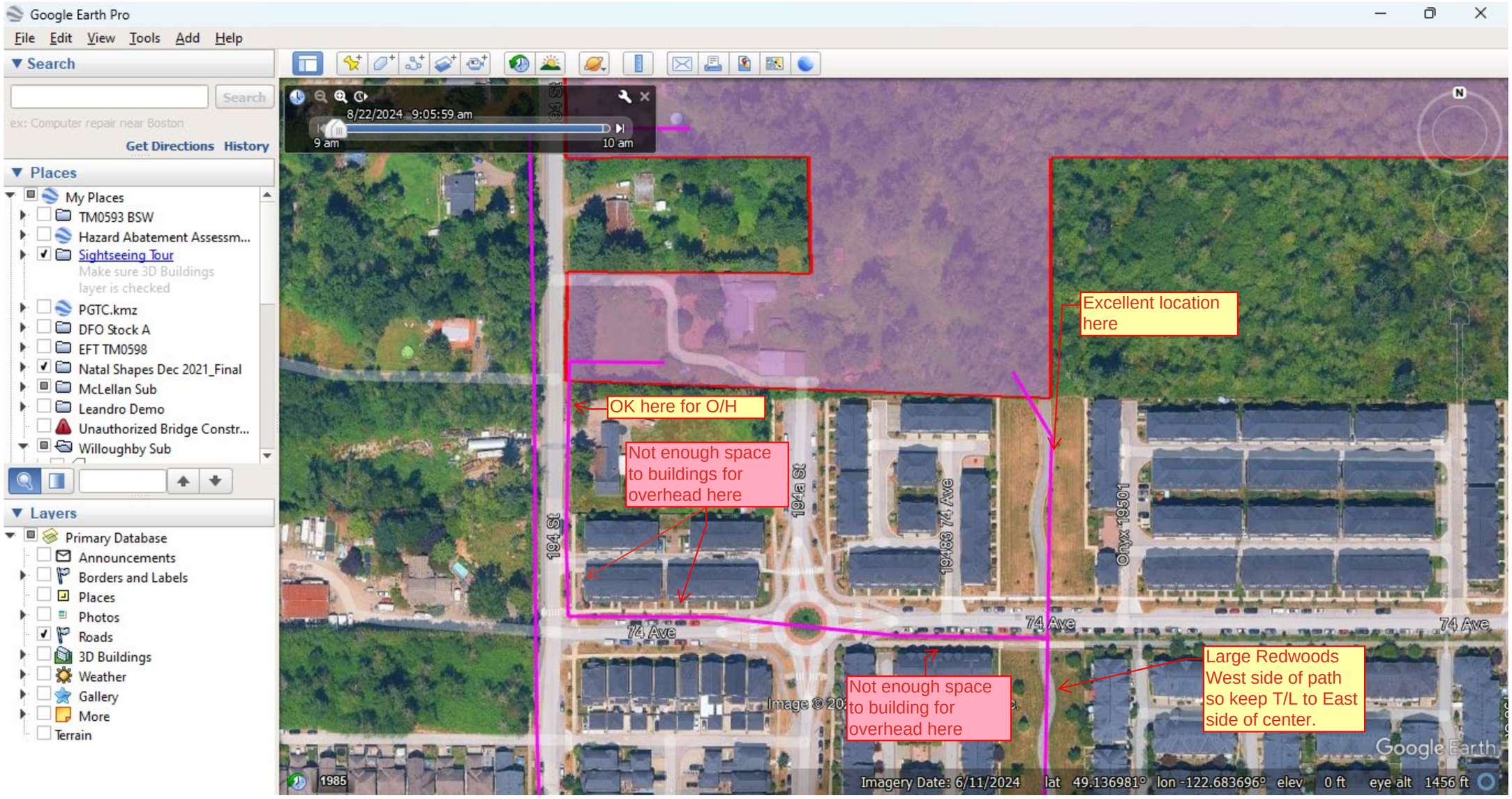
Excellent O/H or UG

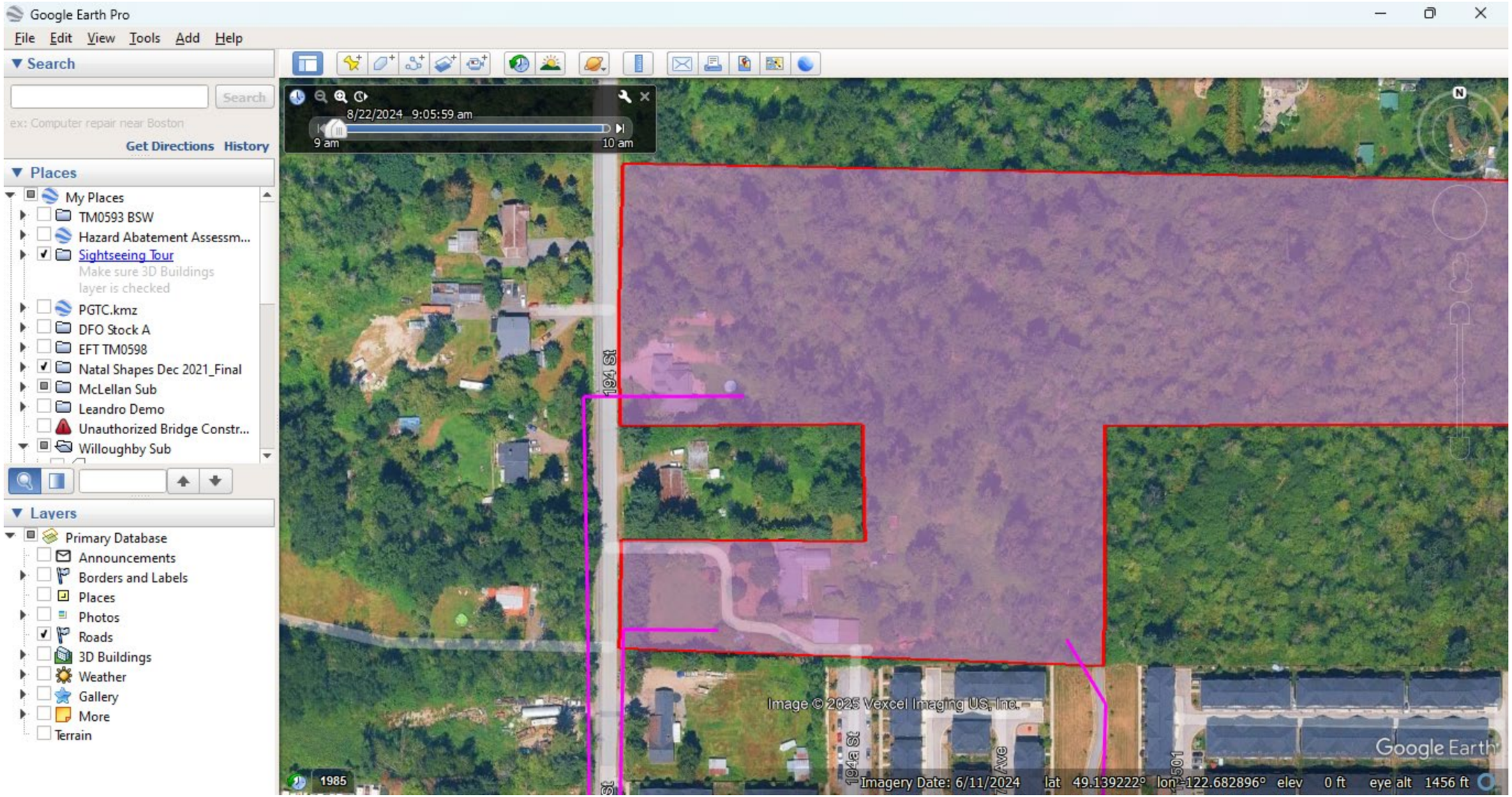
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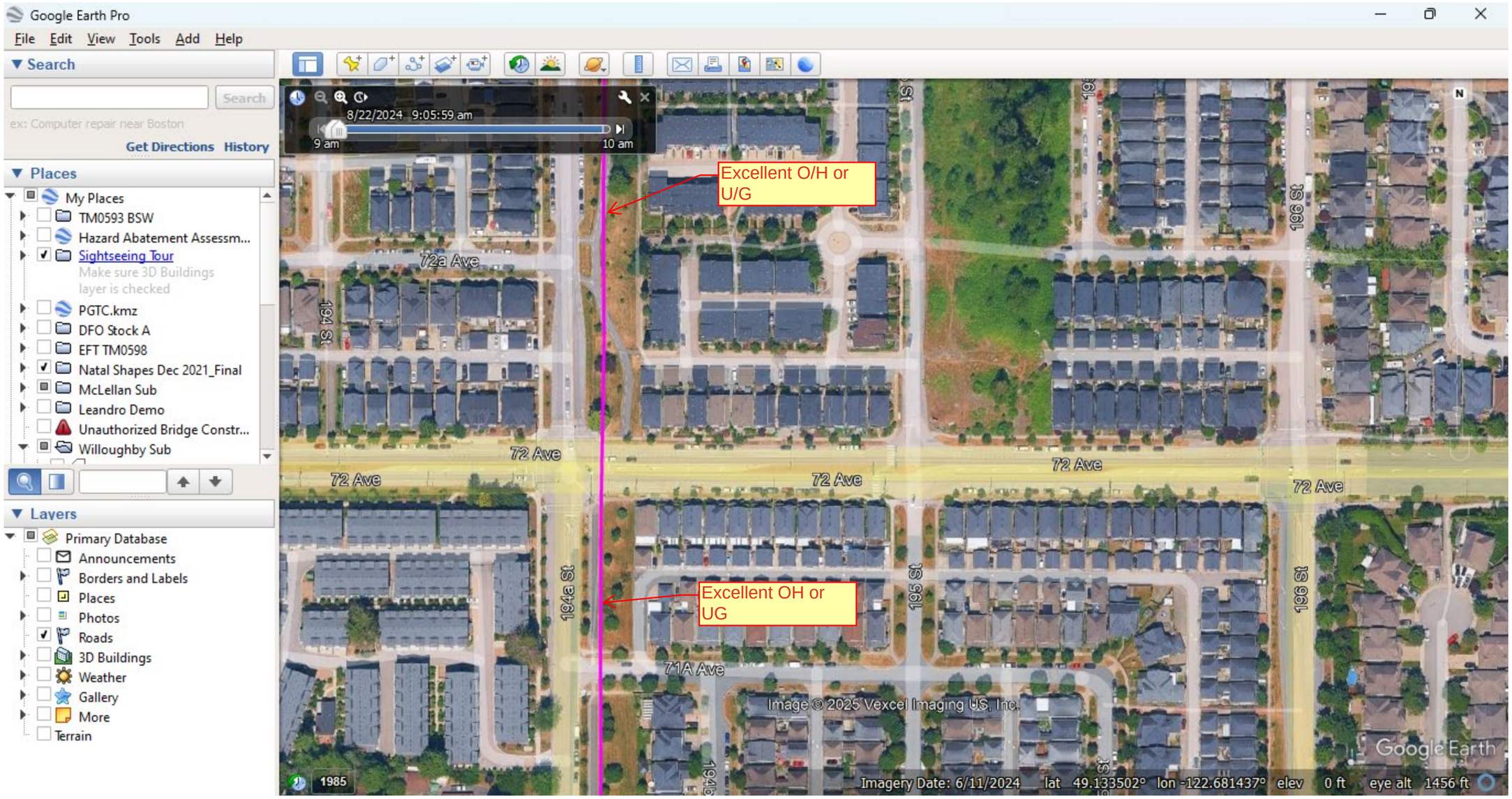
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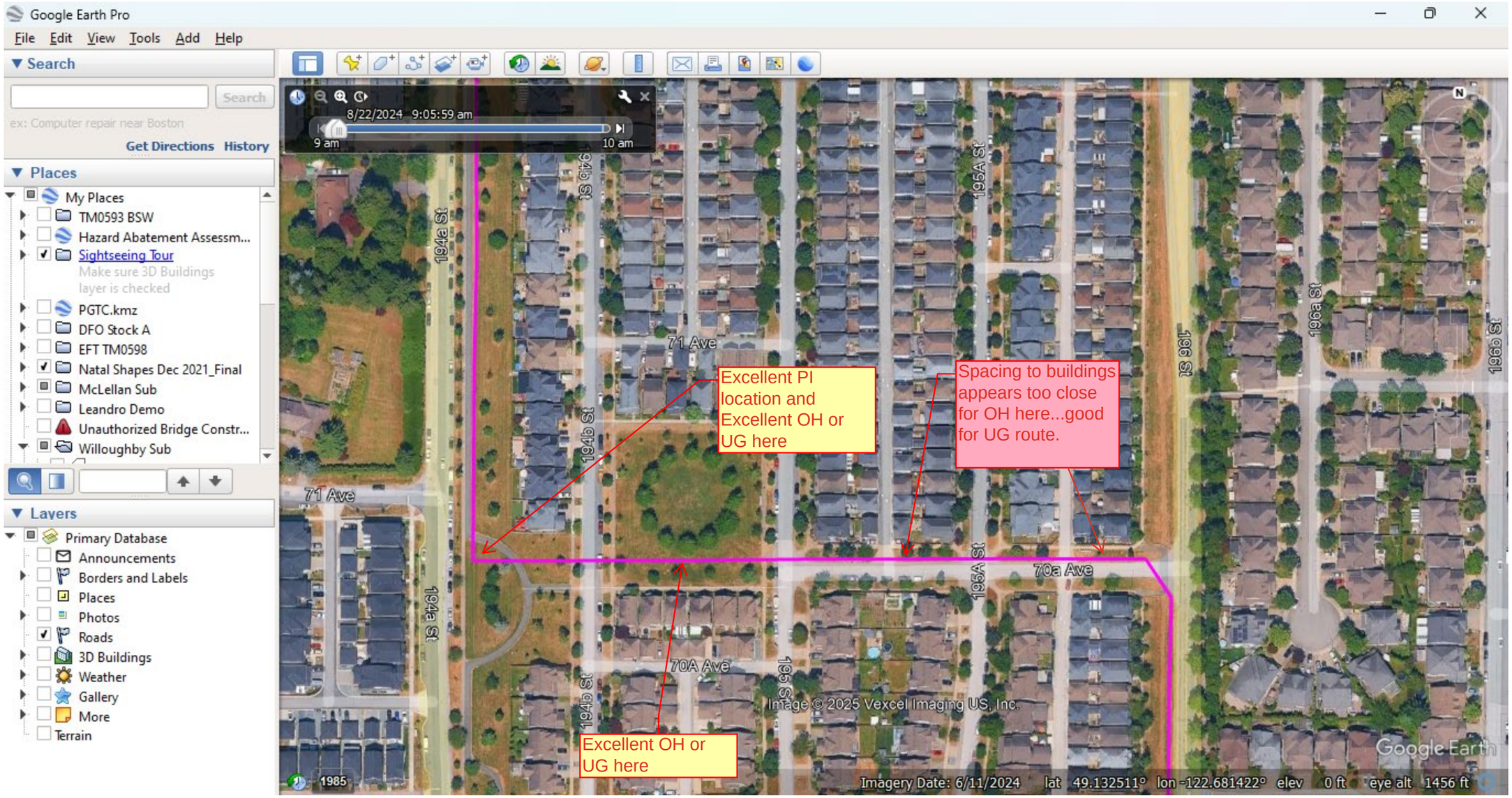
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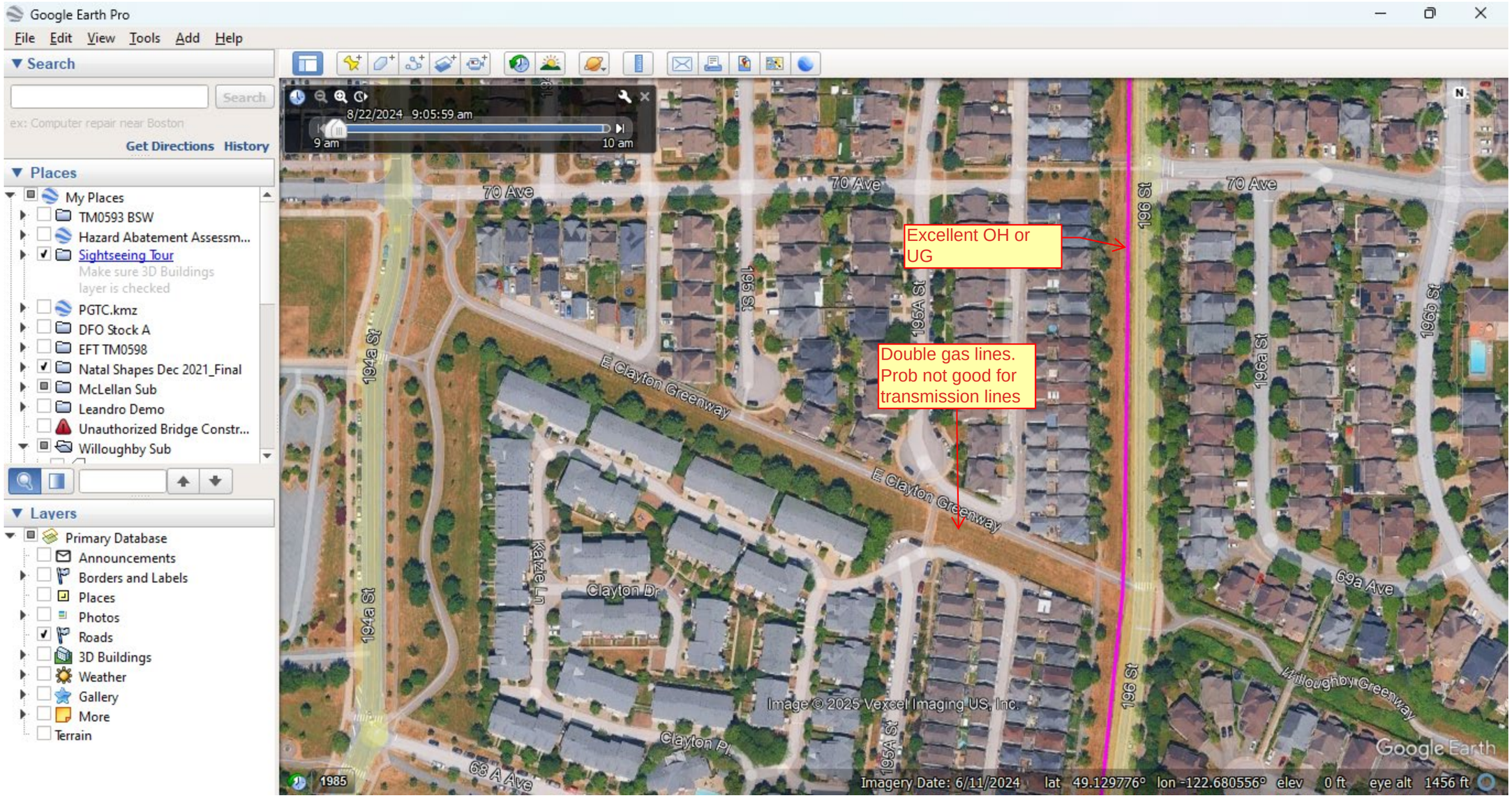
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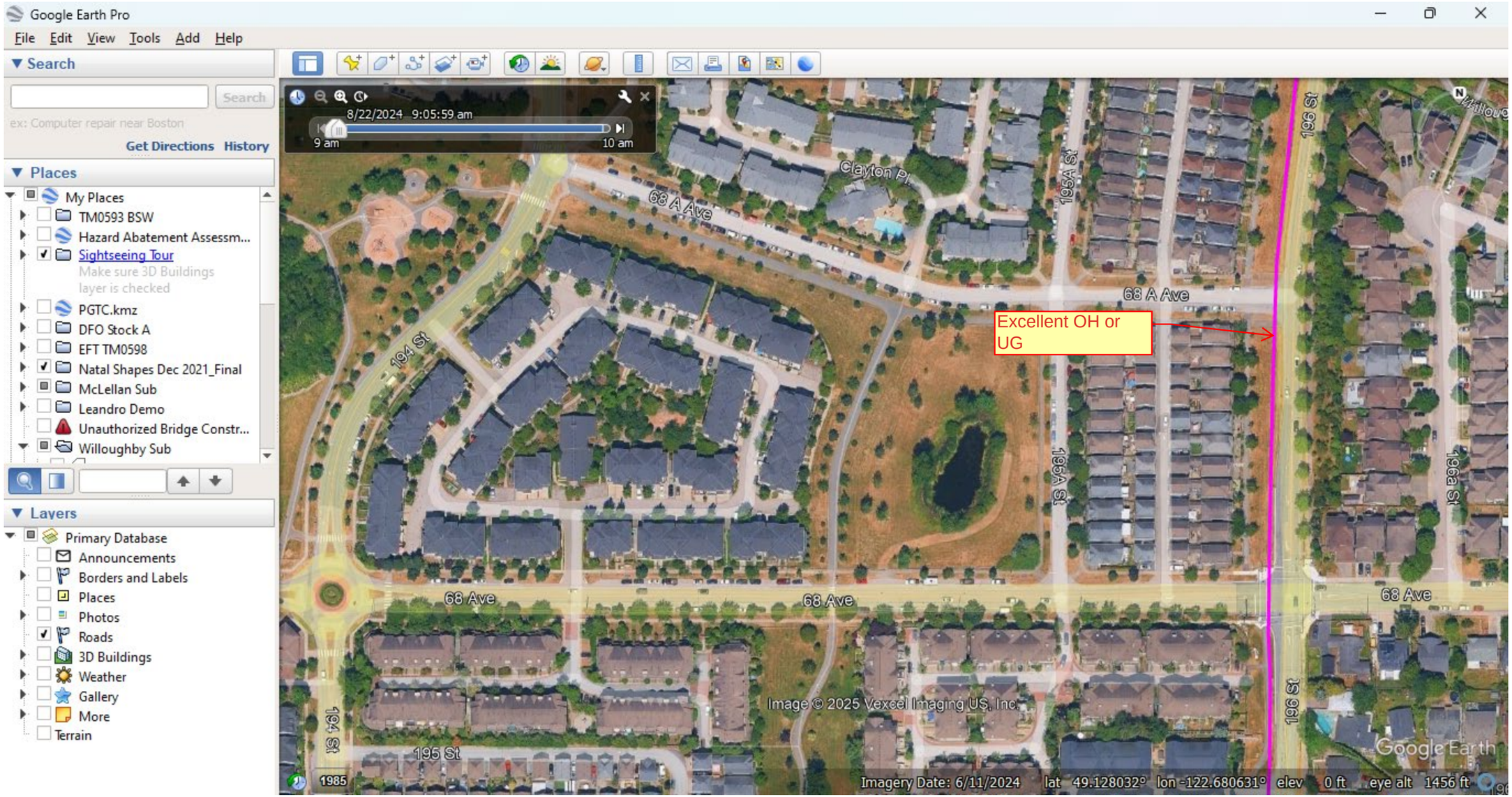

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8/22/2024 9:05:59 am
9 am
10 am
Excellent location here
OK here for O/H
Not enough space to buildings for overhead here
Not enough space to building for overhead here
Large Redwoods West side of path so keep T/L to East side of center.
194 St
194a St
194a St
19483 74 Ave
Onyx 19501
74 Ave
74 Ave
74 Ave
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Google Earth
1985
Imagery Date: 6/11/2024 lat 49.136981° lon -122.683696° elev 0 ft eye alt 1456 ft


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File Edit View Tools Add Help
Search
Search
ex: Computer repair near Boston
Get Directions History
Places
My Places
TM0593 BSW
Hazard Abatement Assessm...
Sightseeing Tour
Make sure 3D Buildings layer is checked
PGTC.kmz
DFO Stock A
EFT TM0598
Natal Shapes Dec 2021_Final
McLellan Sub
Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
Layers
Primary Database
Announcements
Borders and Labels
Places
Photos
Roads
3D Buildings
Weather
Gallery
More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
194 St
N
Image © 2025 Vexcel Imaging US, Inc.
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Imagery Date: 6/11/2024 lat 49.139222° lon -122.682896° elev 0 ft eye alt 1456 ft


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Sightseeing Tour
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Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
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Announcements
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Roads
3D Buildings
Weather
Gallery
More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
Excellent O/H or U/G
Excellent OH or UG
72a Ave
72 Ave
71A Ave
194 St
194a St
195 St
196 St
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Google Earth
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Imagery Date: 6/11/2024 lat 49.133502° lon -122.681437° elev 0 ft eye alt 1456 ft


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Get Directions History
Places
My Places
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Hazard Abatement Assessm...
Sightseeing Tour
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Natal Shapes Dec 2021_Final
McLellan Sub
Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
Layers
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3D Buildings
Weather
Gallery
More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
Excellent PI location and Excellent OH or UG here
Spacing to buildings appears too close for OH here...good for UG route.
Excellent OH or UG here
71 Ave
70A Ave
70a Ave
194a St
194b St
195A St
196 St
196a St
196b St
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Google Earth
1985
Imagery Date: 6/11/2024 lat 49.132511° lon -122.681422° elev 0 ft eye alt 1456 ft


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My Places
TM0593 BSW
Hazard Abatement Assessm...
Sightseeing Tour
Make sure 3D Buildings layer is checked
PGTC.kmz
DFO Stock A
EFT TM0598
Natal Shapes Dec 2021_Final
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Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
Layers
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Announcements
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Gallery
More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
Excellent OH or UG
Double gas lines. Prob not good for transmission lines
70 Ave
194a St
195 St
195A St
196 St
196a St
196b St
E Clayton Greenway
Katzie Ln
Clayton Dr
Clayton Pl
68 A Ave
69a Ave
Willoughby Greenway
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Google Earth
1985
Imagery Date: 6/11/2024 lat 49.129776° lon -122.680556° elev 0 ft eye alt 1456 ft


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Places
My Places
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Sightseeing Tour
Make sure 3D Buildings layer is checked
PGTC.kmz
DFO Stock A
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Natal Shapes Dec 2021_Final
McLellan Sub
Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
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More
Terrain
8/22/2024 9:05:59 am
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10 am
Clayton Pl
68 A Ave
195A St
196 St
Excellent OH or UG
194 St
68 Ave
195 St
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Imagery Date: 6/11/2024 lat 49.128032° lon -122.680631° elev 0 ft eye alt 1456 ft

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ex: Computer repair near Boston

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Places

My Places
- TM0593 BSW
- Hazard Abatement Assessm...
- Sightseeing Tour
  Make sure 3D Buildings layer is checked
- PGTC.kmz
- DFO Stock A
- EFT TM0598
- Natal Shapes Dec 2021_Final
- McLellan Sub
- Leandro Demo
- Unauthorized Bridge Constr...
- Willoughby Sub

Layers

Primary Database
- Announcements
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- Places
- Photos
- Roads
- 3D Buildings
- Weather
- Gallery
- More
- Terrain

8/22/2024 9:05:59 am

9 am 10 am

Excellent OH or UG

Existing OH D line East side of Rd

195 St

67a Ave

66A Ave

66 Ave

194 St

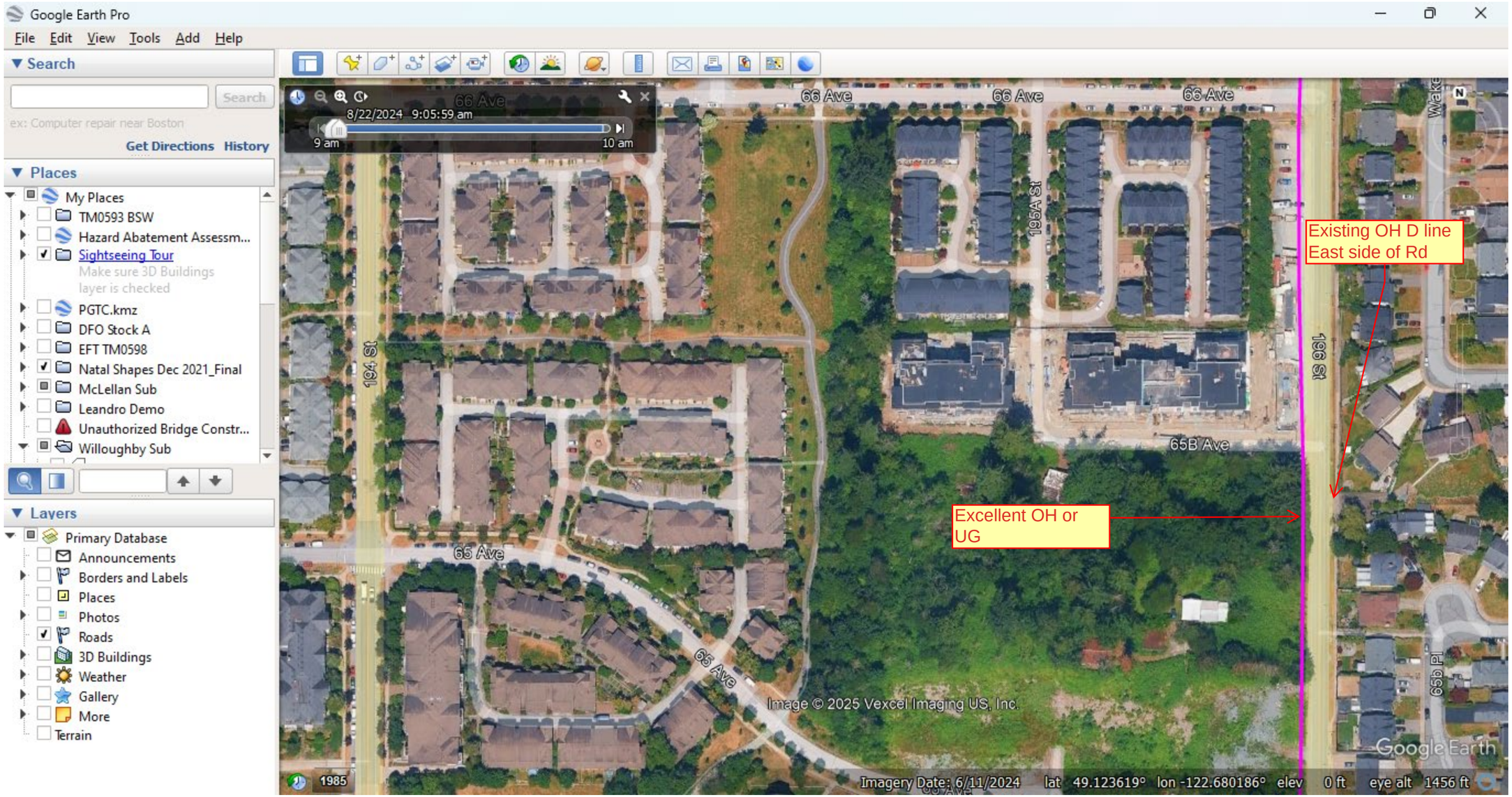
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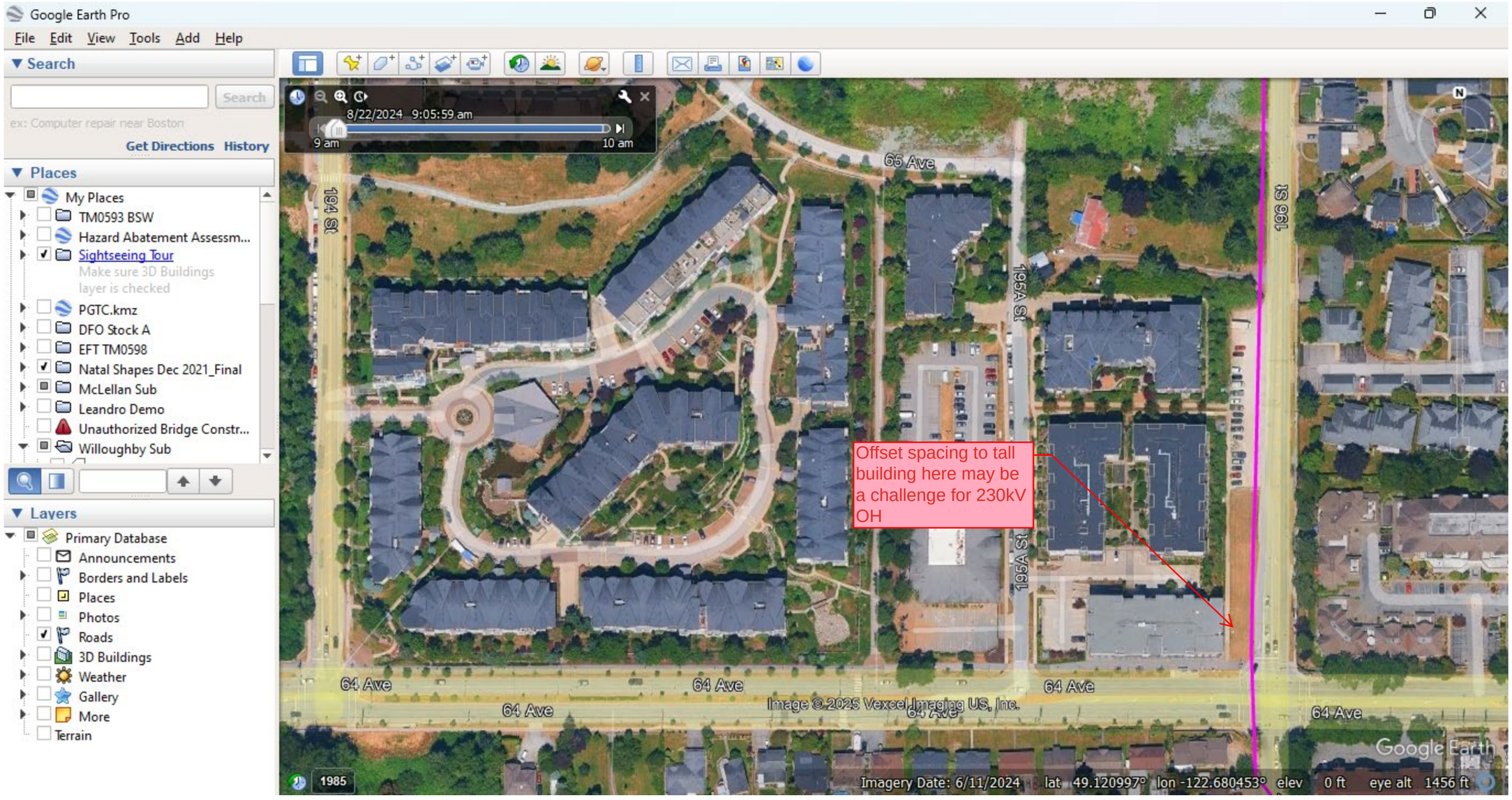
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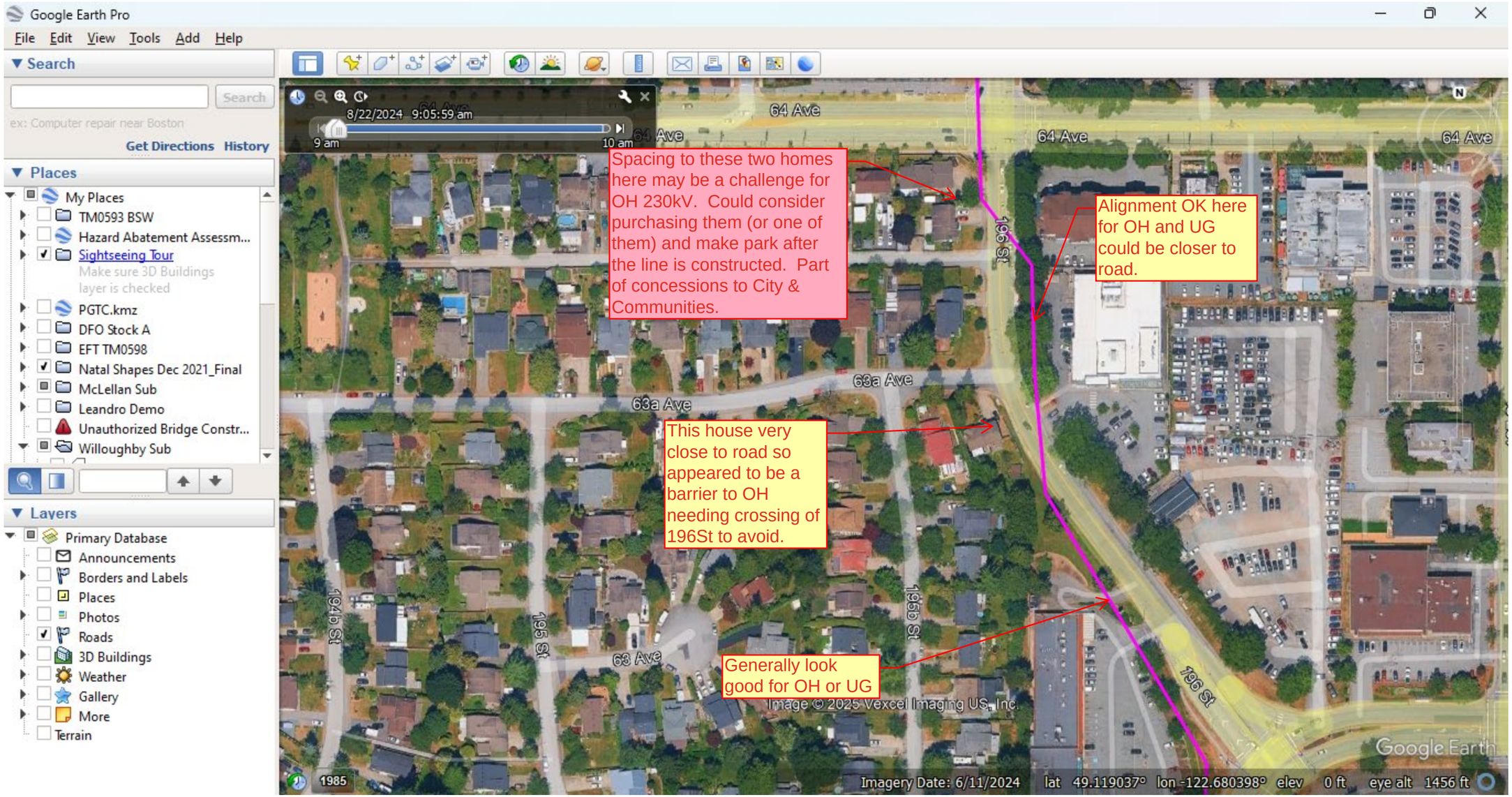
Google Earth

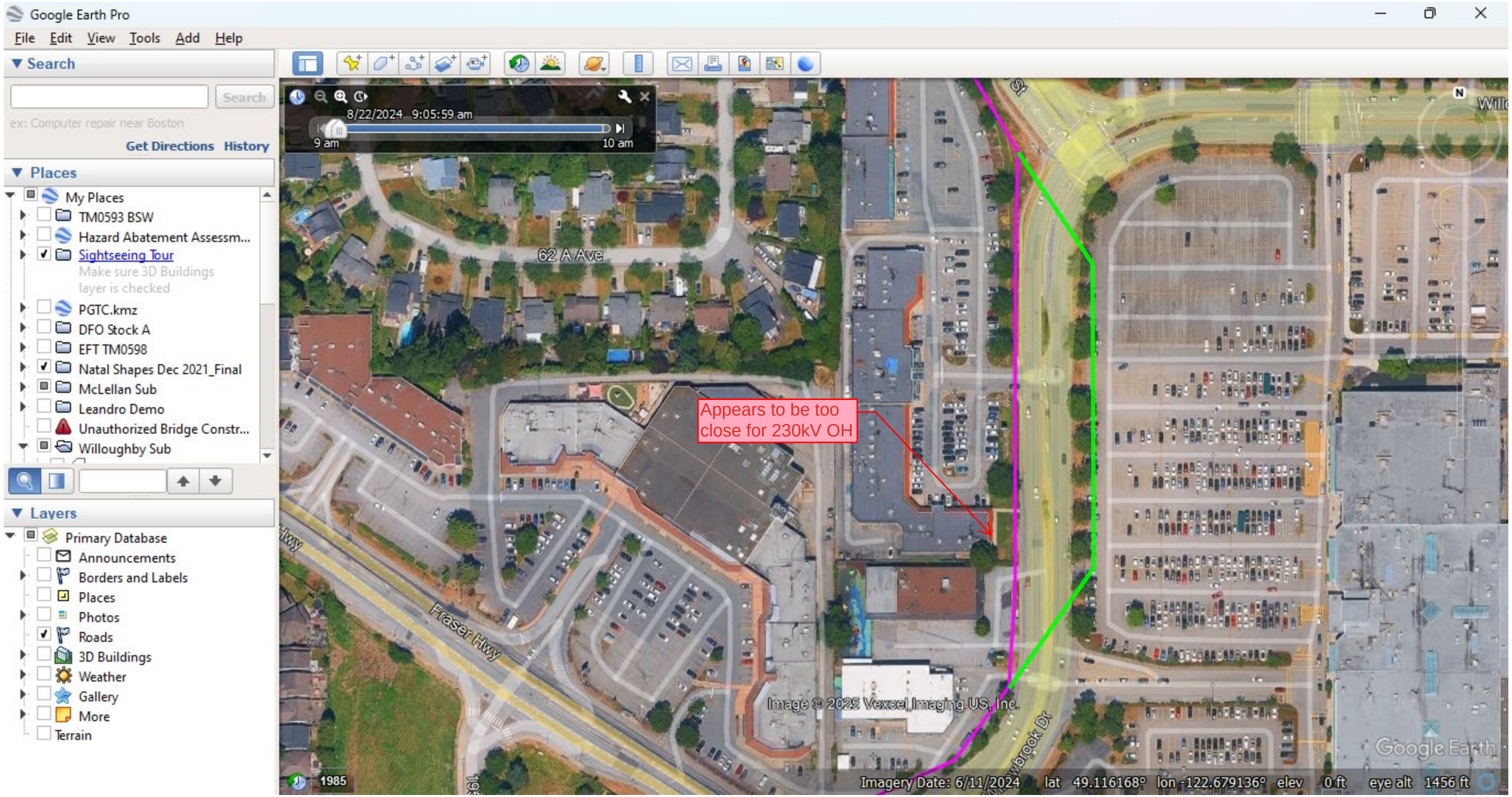
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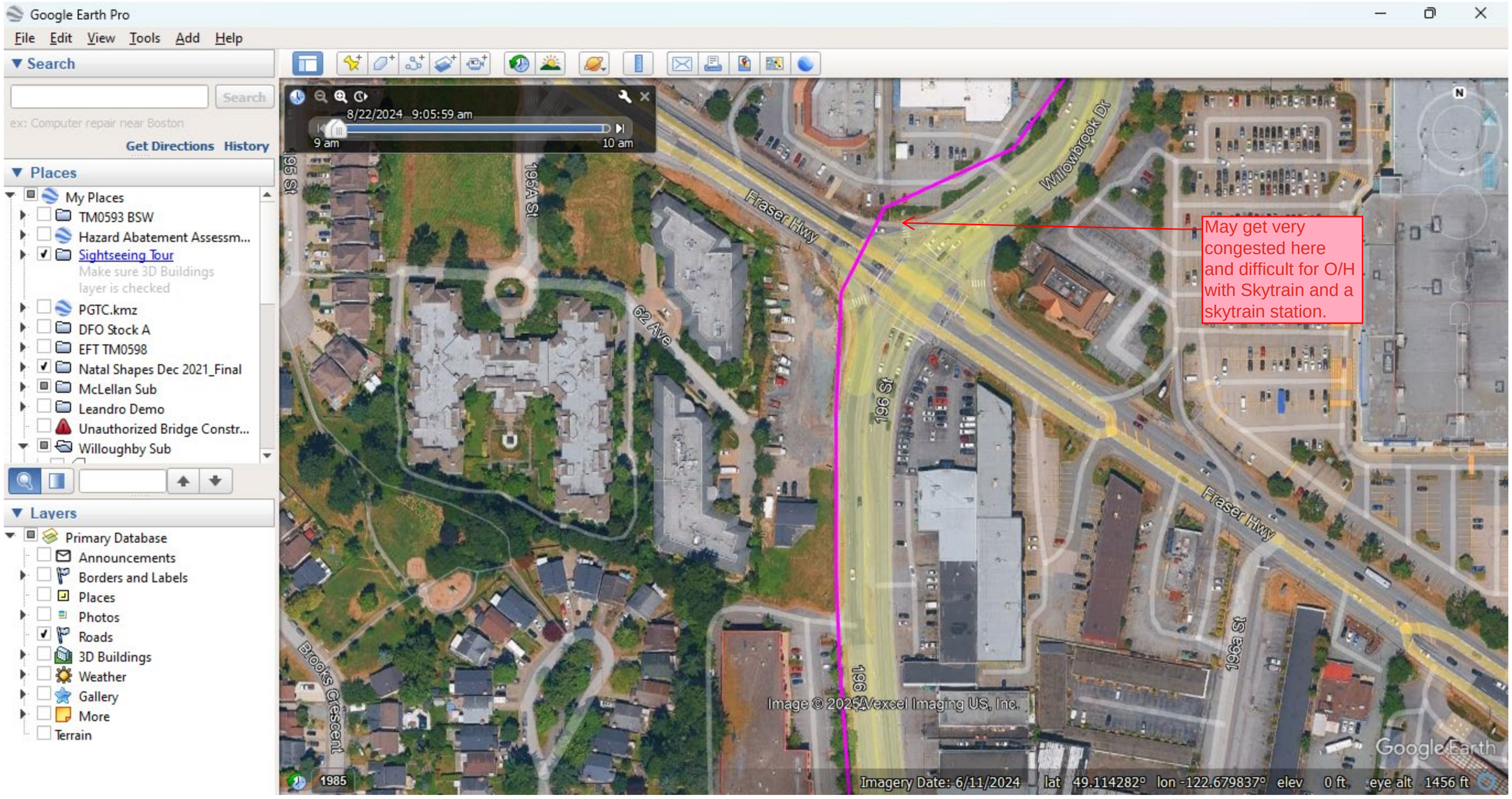
Imagery Date: 6/11/2024 lat 49.126015° lon -122.681686° elev 0 ft eye alt 1456 ft


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File Edit View Tools Add Help
Search
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ex: Computer repair near Boston
Get Directions History
Places
My Places
TM0593 BSW
Hazard Abatement Assessm...
Sightseeing Tour
Make sure 3D Buildings layer is checked
PGTC.kmz
DFO Stock A
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Natal Shapes Dec 2021_Final
McLellan Sub
Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
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More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
66 Ave
66 Ave
66 Ave
66 Ave
195A St
196 St
194 St
65B Ave
65 Ave
65 Ave
69 Pl
Existing OH D line
East side of Rd
Excellent OH or
UG
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Imagery Date: 6/11/2024 lat 49.123619° lon -122.680186° elev 0 ft eye alt 1456 ft


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Sightseeing Tour
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DFO Stock A
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McLellan Sub
Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
Layers
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More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
65 Ave
194 St
195A St
199 St
Offset spacing to tall building here may be a challenge for 230kV OH
64 Ave
64 Ave
64 Ave
64 Ave
64 Ave
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Google Earth
1985
Imagery Date: 6/11/2024 lat 49.120997° lon -122.680453° elev 0 ft eye alt 1456 ft


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Sightseeing Tour
Make sure 3D Buildings layer is checked
PGTC.kmz
DFO Stock A
EFT TM0598
Natal Shapes Dec 2021_Final
McLellan Sub
Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
Layers
Primary Database
Announcements
Borders and Labels
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3D Buildings
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Gallery
More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
Spacing to these two homes here may be a challenge for OH 230kV. Could consider purchasing them (or one of them) and make park after the line is constructed. Part of concessions to City & Communities.
Alignment OK here for OH and UG could be closer to road.
This house very close to road so appeared to be a barrier to OH needing crossing of 196St to avoid.
Generally look good for OH or UG
64 Ave
63a Ave
63 Ave
194b St
195 St
195c St
196 St
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Google Earth
1985
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Hazard Abatement Assessm...
Sightseeing Tour
Make sure 3D Buildings layer is checked
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DFO Stock A
EFT TM0598
Natal Shapes Dec 2021_Final
McLellan Sub
Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
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Gallery
More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
62 A Ave
Appears to be too close for 230kV OH
Fraser Hwy
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Imagery Date: 6/11/2024 lat 49.116168° lon -122.679136° elev 0 ft eye alt 1456 ft


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Places
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TM0593 BSW
Hazard Abatement Assessm...
Sightseeing Tour
Make sure 3D Buildings layer is checked
PGTC.kmz
DFO Stock A
EFT TM0598
Natal Shapes Dec 2021_Final
McLellan Sub
Leandro Demo
Unauthorized Bridge Constr...
Willoughby Sub
Layers
Primary Database
Announcements
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Weather
Gallery
More
Terrain
8/22/2024 9:05:59 am
9 am
10 am
195A St
62 Ave
Fraser Hwy
Willowbrook Dr
196 St
Brooks Crescent
May get very congested here and difficult for O/H with Skytrain and a skytrain station.
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Imagery Date: 6/11/2024 lat 49.114282° lon -122.679837° elev 0 ft eye alt 1456 ft

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Search

ex: Computer repair near Boston

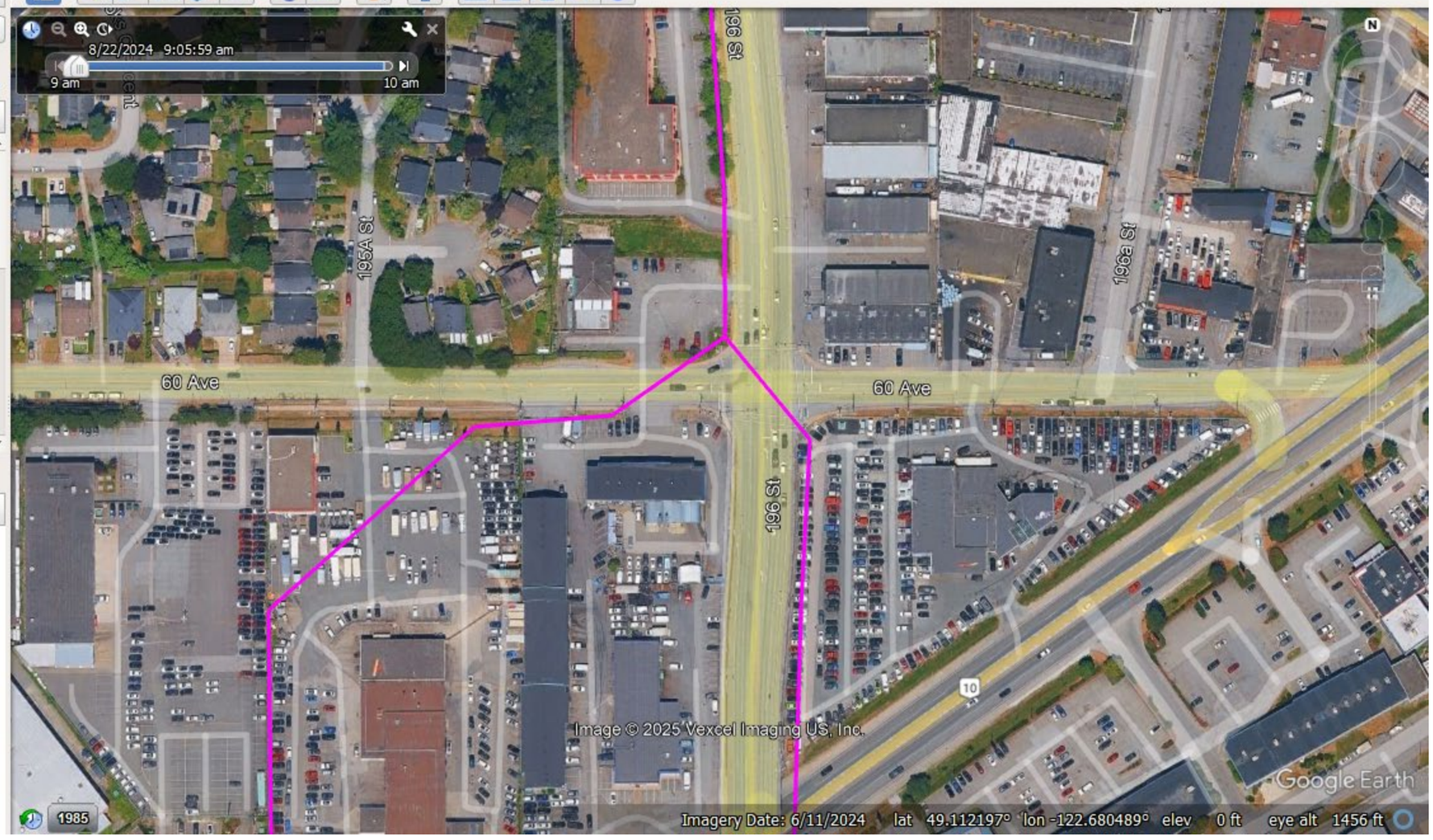
Get Directions History

▼ Places

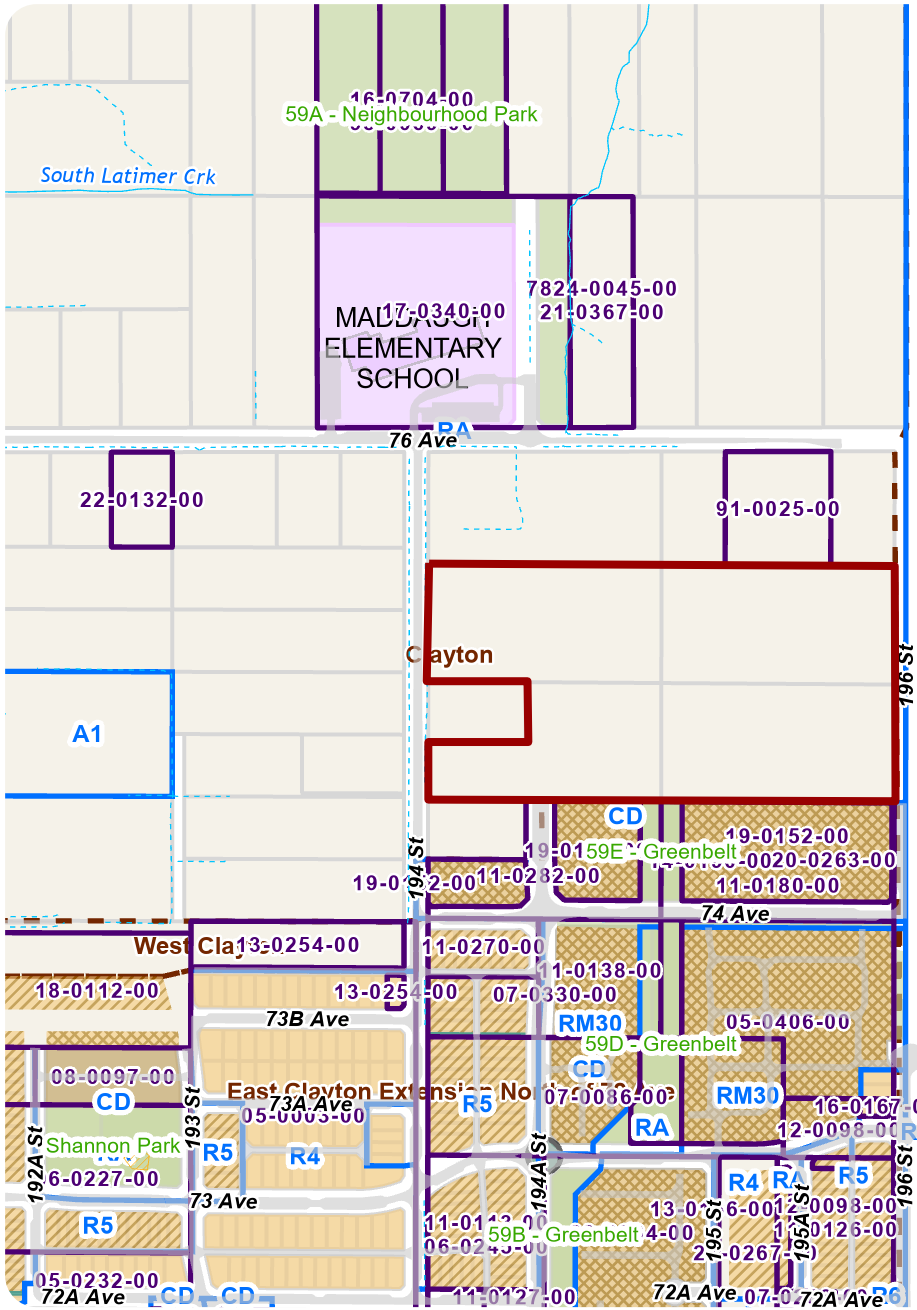
- My Places
  - TM0593 BSW
  - Hazard Abatement Assessm...
  - Sightseeing Tour
    Make sure 3D Buildings layer is checked
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  - Natal Shapes Dec 2021_Final
  - McLellan Sub
  - Leandro Demo
  - Unauthorized Bridge Constr...
  - Willoughby Sub

▼ Layers

- Primary Database
  - Announcements
  - Borders and Labels
  - Places
  - Photos
  - Roads
  - 3D Buildings
  - Weather
  - Gallery
  - More
  - Terrain



City of Surrey Mapping Online System



Legend

Water Courses
- Creek
- Ditch

Park Playgrounds
- Playground
- Road Surface
- Dev Apps - All
- Zoning Boundaries

East Clayton Extension North of 72 Ave
- 6-10 u.p.a. Low Density
- 10-15 u.p.a. Medium Density
- 15-25 u.p.a. Medium-High Density
- 22-45 u.p.a. High Density
- Public Open Space/Park
- Special Setback, Landscaping Buffers or Corridors
- Traffic Circle
- Secondary Plan Boundaries
- Buildings (labels)

Building Large
- School

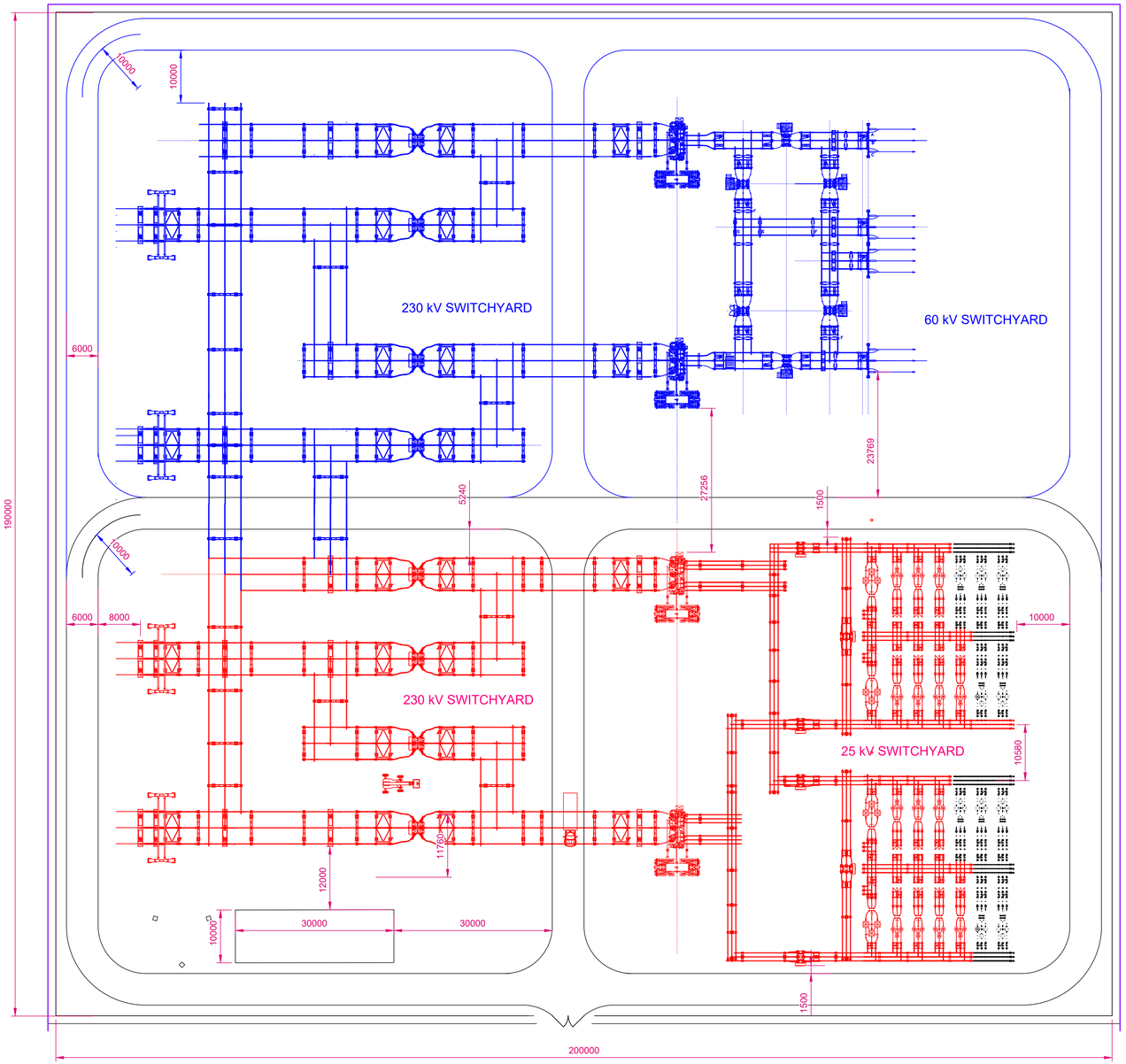
Bosa, Kang, Kool

Scale: 1:6,323

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0 0.04 0.09 0.17 0.26
km

Map created on: 2024-10-15



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. Zeng
INDEP CHK	
DFTG	K. Zeng / K.JIANG
DFTG CHK	
INSP	
REV	K. JIANG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

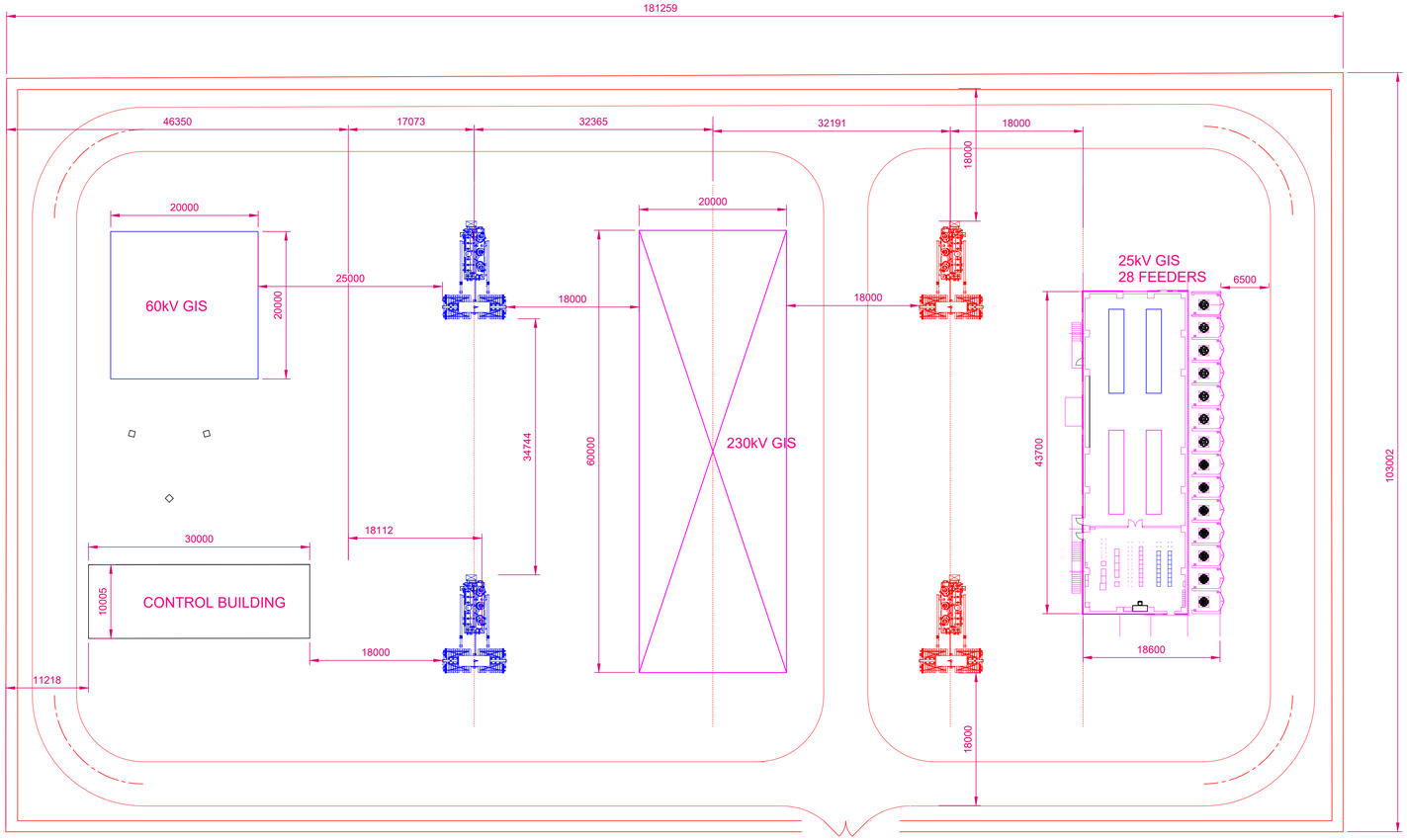
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2024MAR22		WIB-E05-SK001-Option 1			D	0A

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Drawing Unit = Metric (4)
JIANG, KAI, Yu
3/22/2024 4:57 PM

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE



COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK/BLUE: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 0 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

DESIGN NUMBER		DSGN	K. Zeng
WORK ORDER NUMBER		INDEP CHK	
CSA S250 ACCURACY NAD - UTM		DFTG	K. Zeng / K.JIANG
BASE ACCURACY LEVEL:		DFTG CHK	
ASB ACCURACY LEVEL:		INSP	
		REV	K. JIANG
		ACPT	

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

BC Hydro

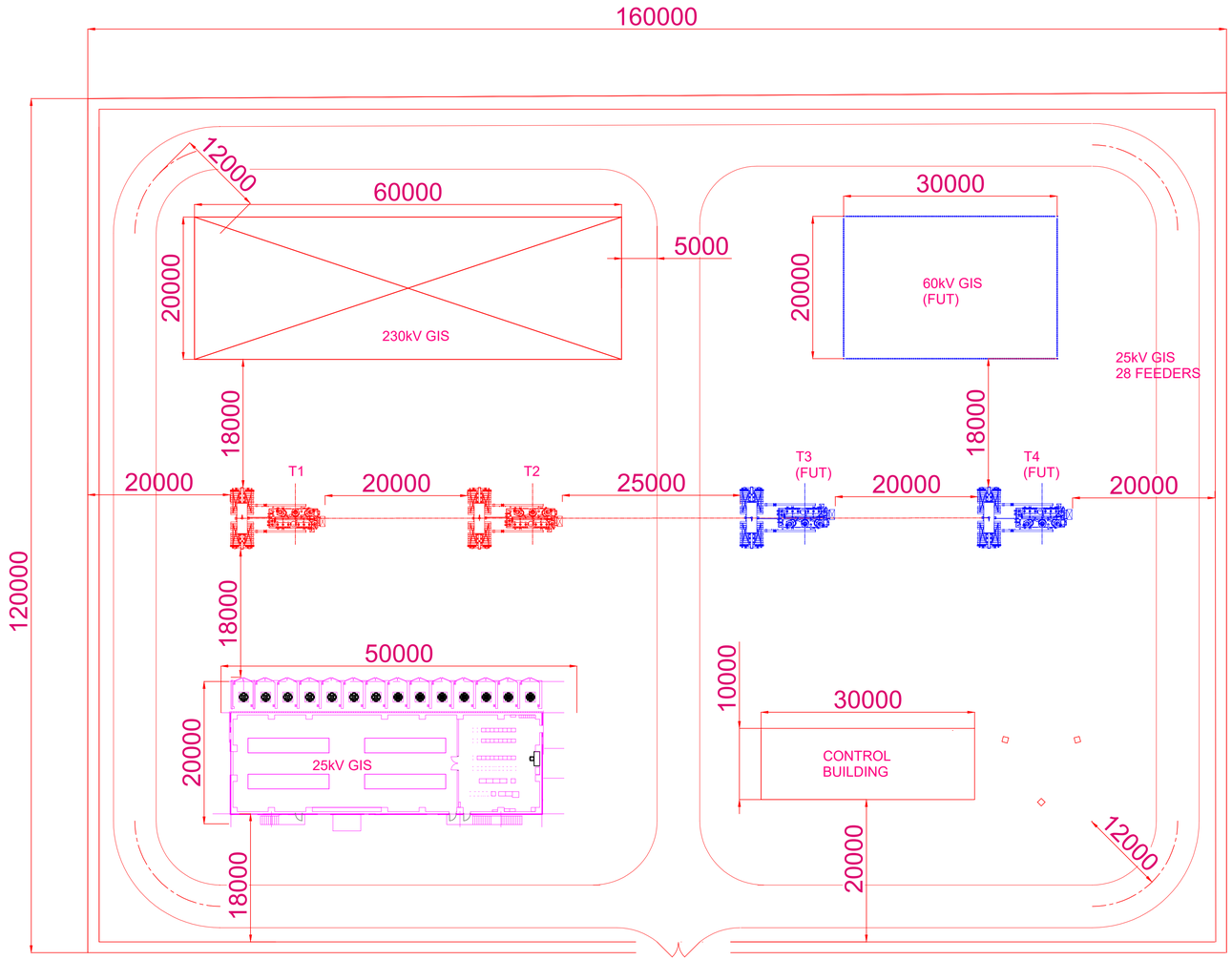
WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT ALL GIS-INDOOR

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
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JAMES KU Jr.
3/22/2024 4:04 PM



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK/BLUE: FUTURE

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SCALE: 1:1 0 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO | REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
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DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

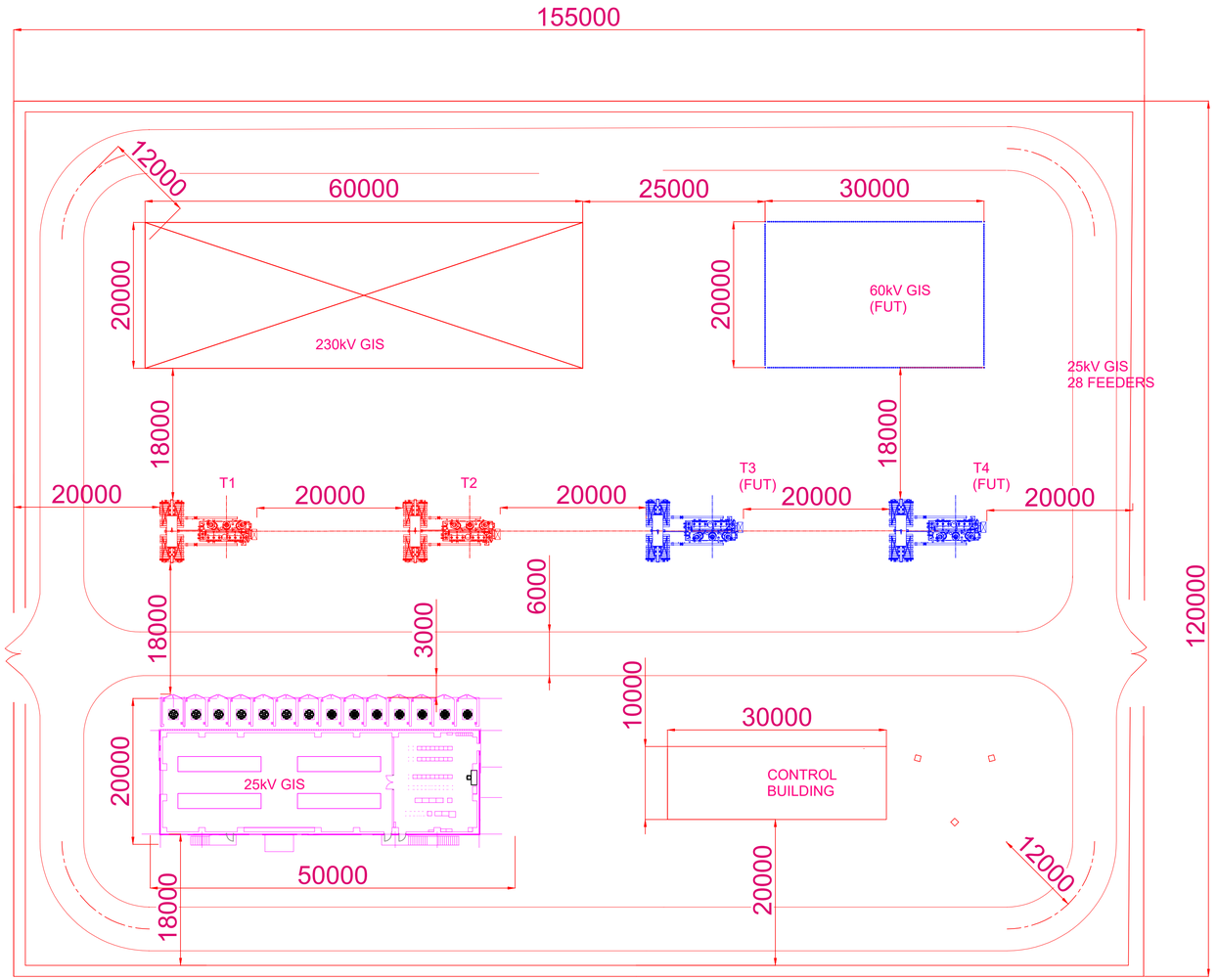
WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT ALL GIS-INDOOR

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
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3/22/2024 4:07 PM



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
DARK/BLUE: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 0 50mm
1:1
ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
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BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

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DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

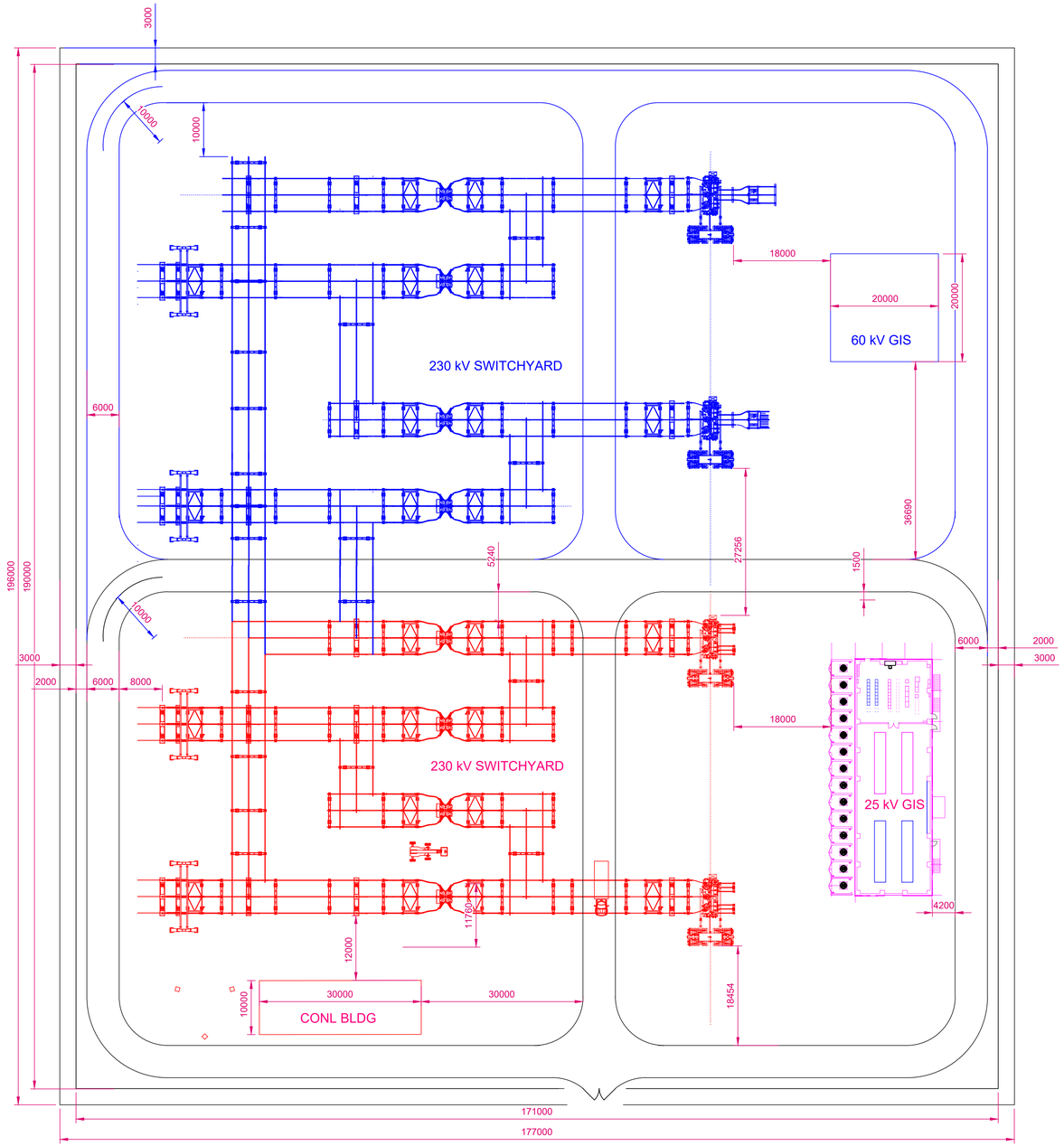
WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT ALL GIS-INDOOR

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
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Drawing Unit = Metric (4)
JAVS - AM - V
3/22/2024 4:09 PM



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
3. DITCH AND DRAINAGE SPACE REQUIREMENT IS NOT CONSIDERED AND IT SHOULD BE DESIGNED BY CIVIL.
4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 — 0 — 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K.JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

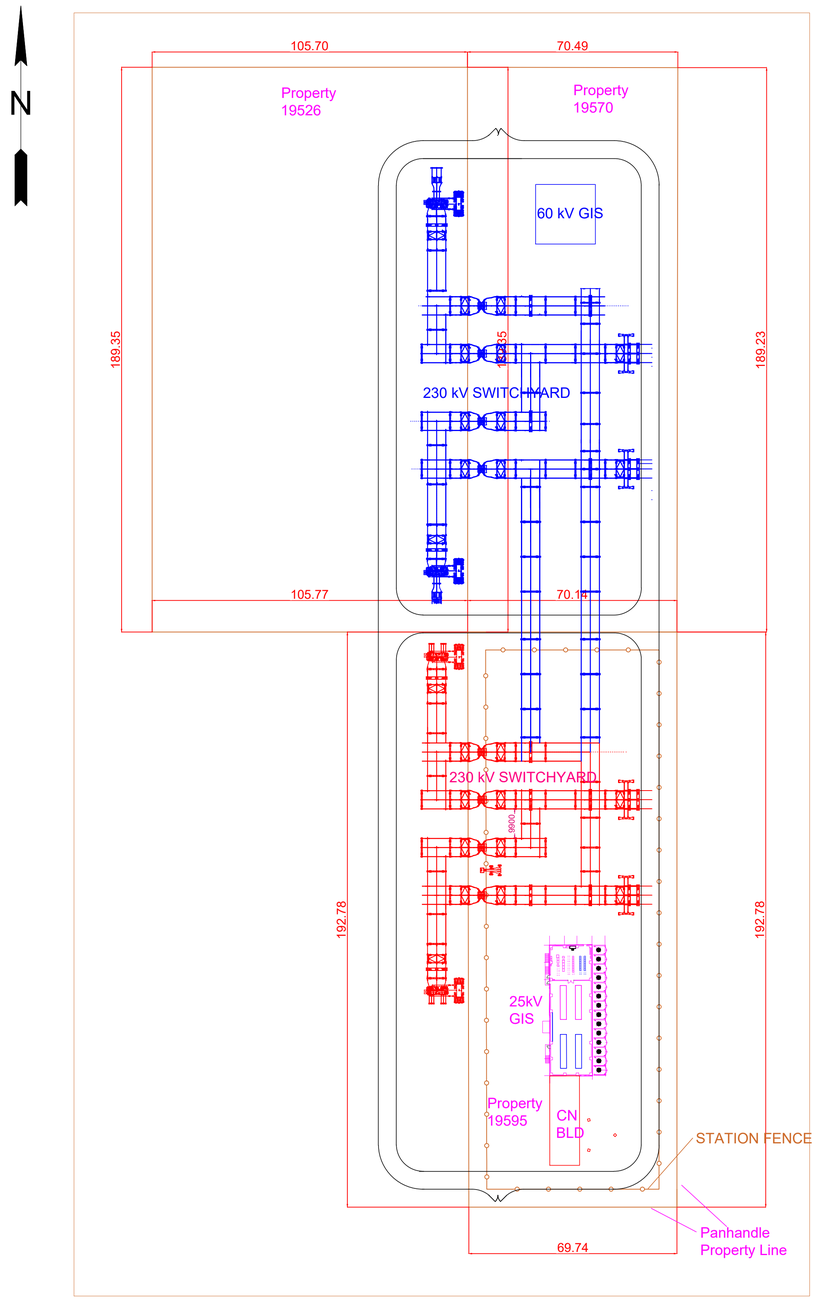
WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024JUL08		WIB-E05-SK003-Option 1			D	0A

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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Drawing Unit = Metric (4)
JIANG, KAI
7/8/2024 5:48 PM



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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4. GROUND GRID WILL BE INSTALLED 1 m BEYOND THE FENCE LINE AND COVER ALL GATE SWING AREAS.
5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

C:\Users\kjiang\OneDrive - BC Hydro\F2S Projects\1-CIP\D\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240829-Panhandle-19595\Sketches\WIB-E05-SK005-Option 1-Outdoor 230 +GIS 60n25-To Fit Panhandle Property-2024082.dwg
Drawing Unit = Metric (4)
JIANG, KAI
8/30/2024 3:58 PM

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

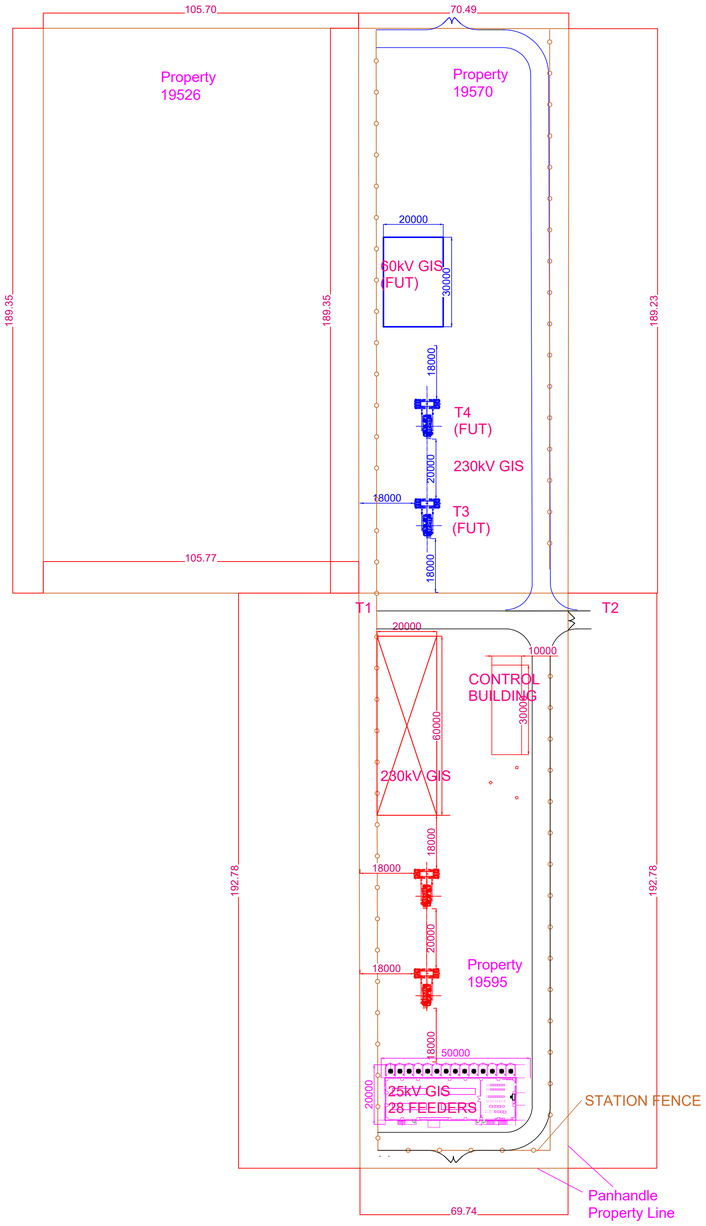
BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
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NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO



NOTES:

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2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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FOR DISCUSSION PURPOSES ONLY

SCALE: 1:1 0 50mm

ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE SHOWN

REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

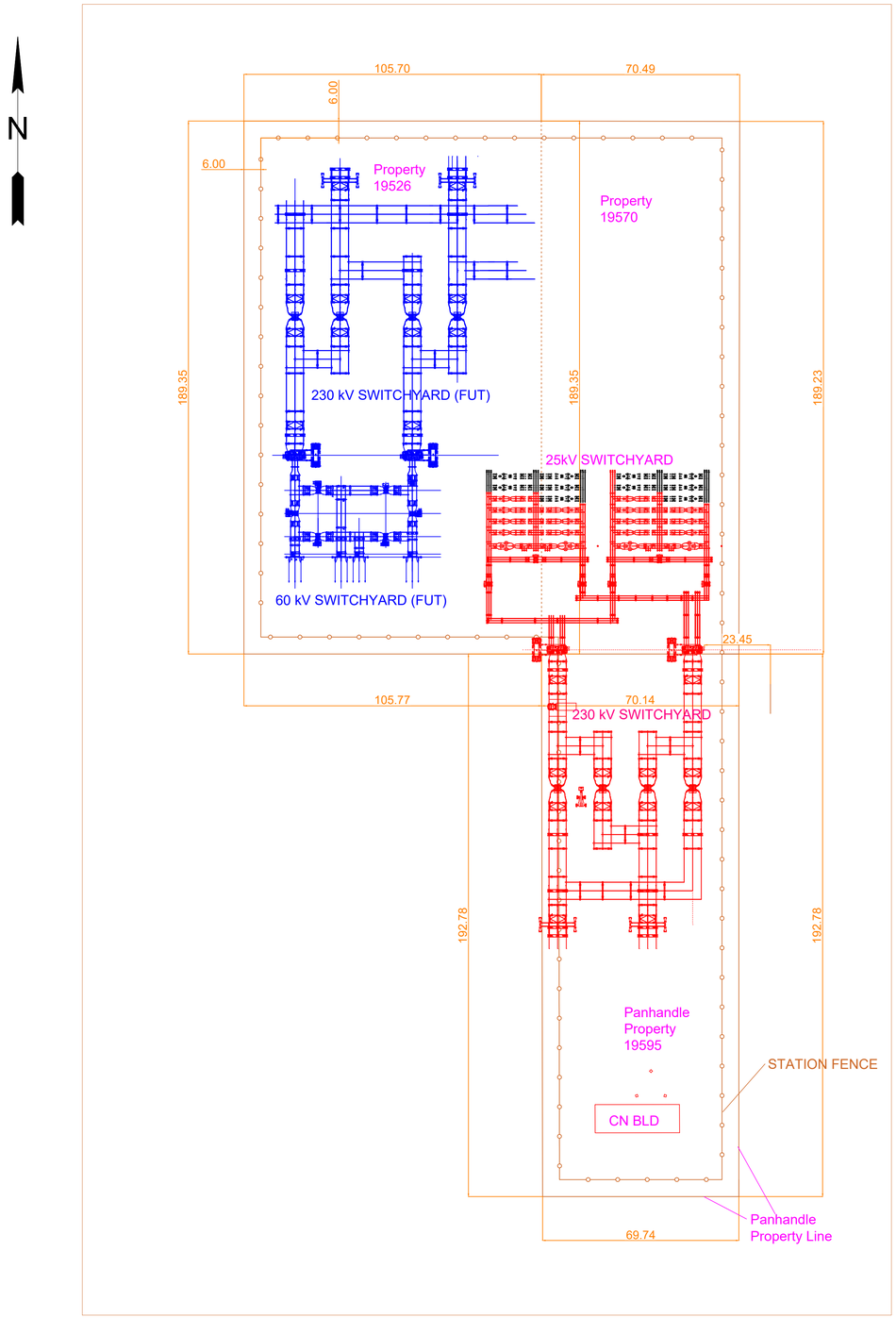
WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT ALL GIS-INDOOR

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024AUG30		WIB-E05-SK005-OP 2			D	0

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

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JIANG, KAI, K
8/30/2024 3:59 PM



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240911-Panhandle-19595 - Second set\Sketches\WIB-E05-SK005-Option 1-Outdoor 230 +GIS 60n25-To Fit Panhandle Property-2024082.dwg
Drawing Unit = Metric (d)
JANG, Kelvin Y.
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REFERENCE DRAWINGS

NO	REMARKS
	REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

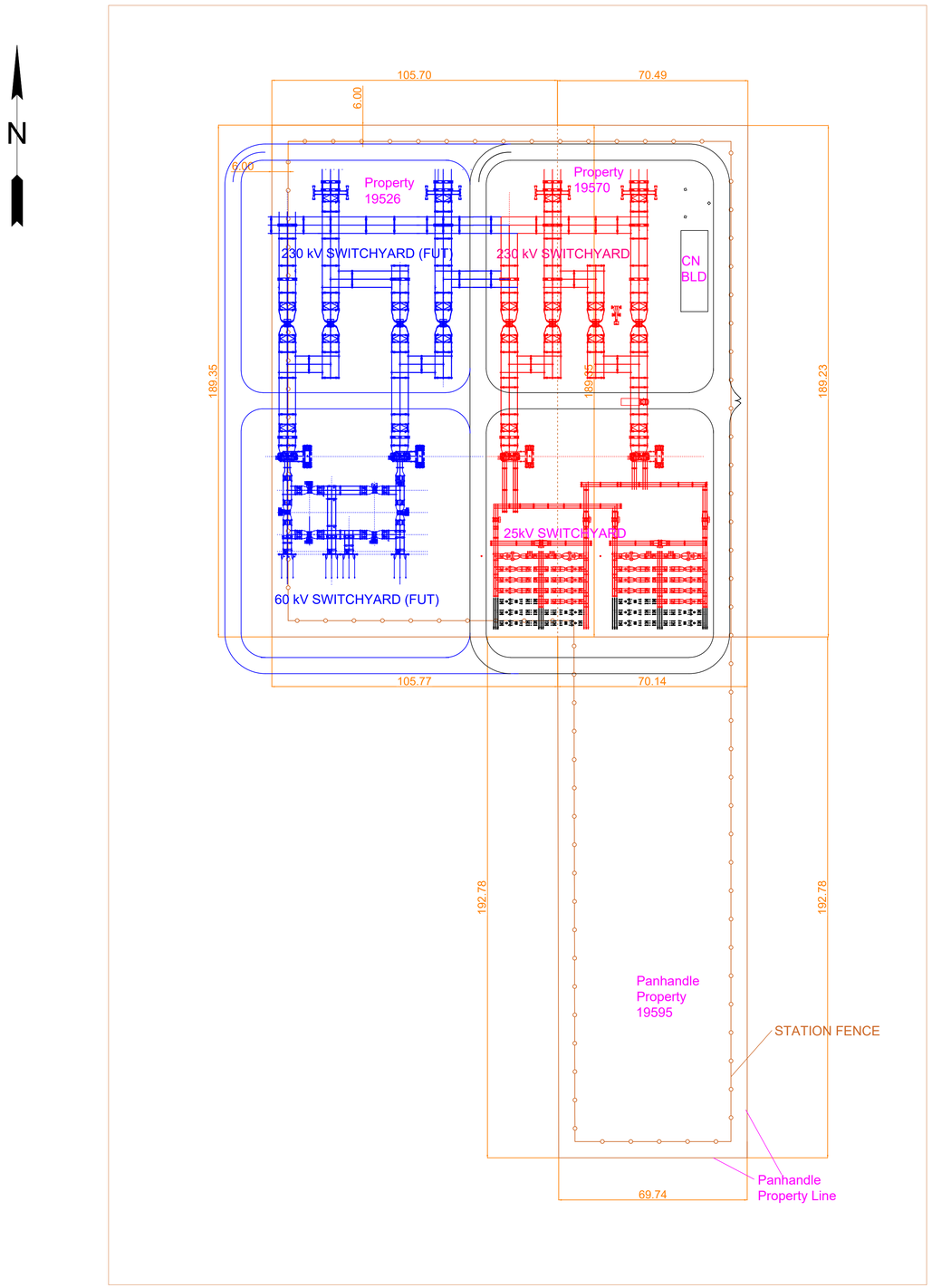
BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP11		WIB-E05-SK005-OP3			D	0

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO



NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE

FOR DISCUSSION PURPOSES ONLY

C:\Users\kjiang\OneDrive - BC Hydro\F25 Projects\1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240911-Panhandle-19566 - Second set\Sketches\WIB-E05-SK005-Option 1-Outdoor 230 +GIS 60in25-To Fit Panhandle Property-20240829.dwg
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JIANG, KAI X
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REFERENCE DRAWINGS

NO	REMARKS

REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
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BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	K. JIANG
INDEP CHK	
DFTG	K. JIANG
DFTG CHK	
INSP	
REV	K. ZENG
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

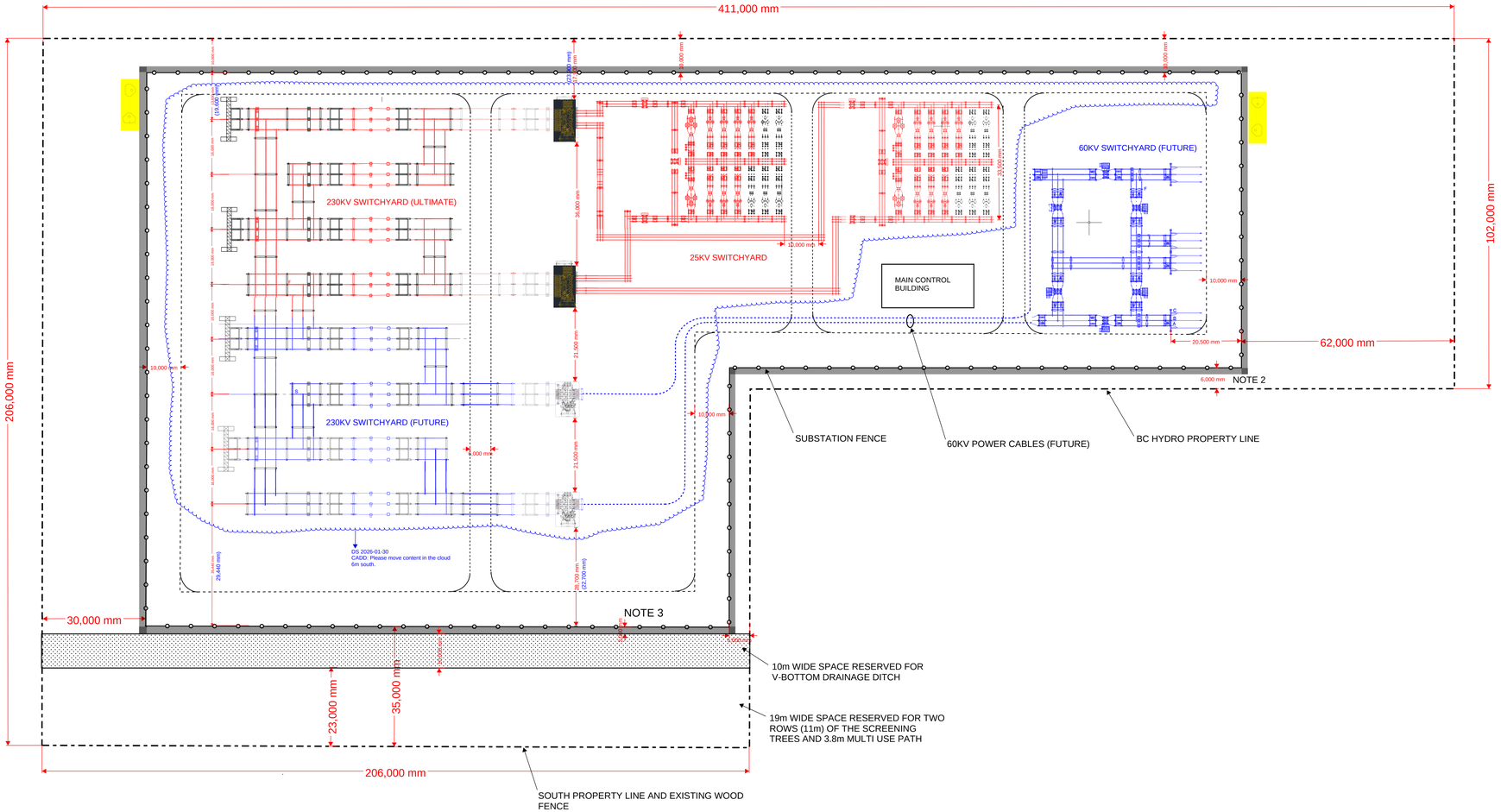
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NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

N

NOTES:

1. GENERAL ARRANGEMENT DESIGN BASED ON THE FEEDBACK RECEIVED FROM TRANSMISSION LINE AND DISTRIBUTION PROJECT LEADS IN TERMS OF 230 kV, 60 kV, 25 kV SUBSTATION ENTRY/EXIST.
2. DISTANCE BETWEEN THE SUBSTATION FENCE LINE AND PROPERTY LINE SHOULD BE KEPT 6.0 METERS
3. 2m ALLOTED OUTSIDE SUBSTATION PERIMETER FENCE FOR GROUND GRID OUTSIDE PERIMETER LOOP AND 3000 Ohm INSULATING GRAVEL.



SCALE: 1:750

0 50,000 mm 50m

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Drawing Unit = Metric (4)
ARCH_D.CTT
2/13/2025 1:57 PM

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		REFERENCE DRAWINGS

NO	REMARKS
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	REVISIONS

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	D. SYDOROV
INDEP CHK	
DFTG	KST
DFTG CHK	
INSP	
REV	M. BALEA
ACPT	

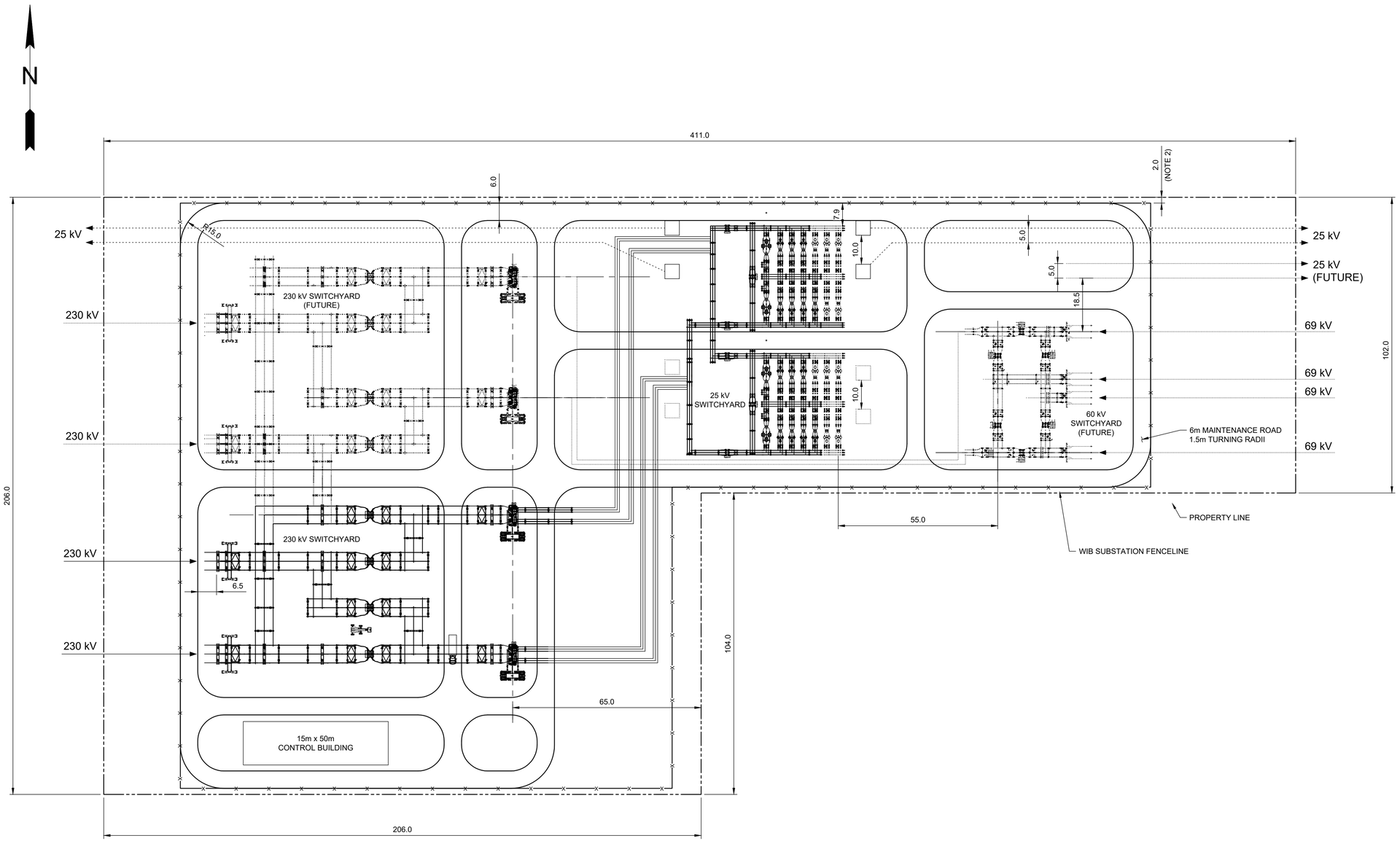
BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 kV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2026JAN30		WIB-E05-SK006			D	0

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO



NOTES:

1. GENERAL ARRANGEMENT DESIGN BASED ON THE FEEDBACK RECEIVED FROM TRANSMISSION LINE AND DISTRIBUTION PROJECT LEADS IN TERMS OF 230 kV, 60 kV, 25 kV SUBSTATION ENTRY/EXIST.
2. DISTANCE BETWEEN THE SUBSTATION FENCE LINE AND PROPERTY LINE SHOULD BE KEPT 2.0 METERS MINIMUM

SCALE: 1:750 — 0 — 50m

NO	DRAWING NUMBER	DRAWING TITLE
REFERENCE DRAWINGS		

NO	REMARKS
0	
REVISIONS	

DESIGN NUMBER	
WORK ORDER NUMBER	
CSA S250 ACCURACY NAD - UTM	
BASE ACCURACY LEVEL:	
ASB ACCURACY LEVEL:	

DSGN	D. SYDOROV
INDEP CHK	
DFTG	KST
DFTG CHK	
INSP	
REV	M. BALEA
ACPT	

BC Hydro

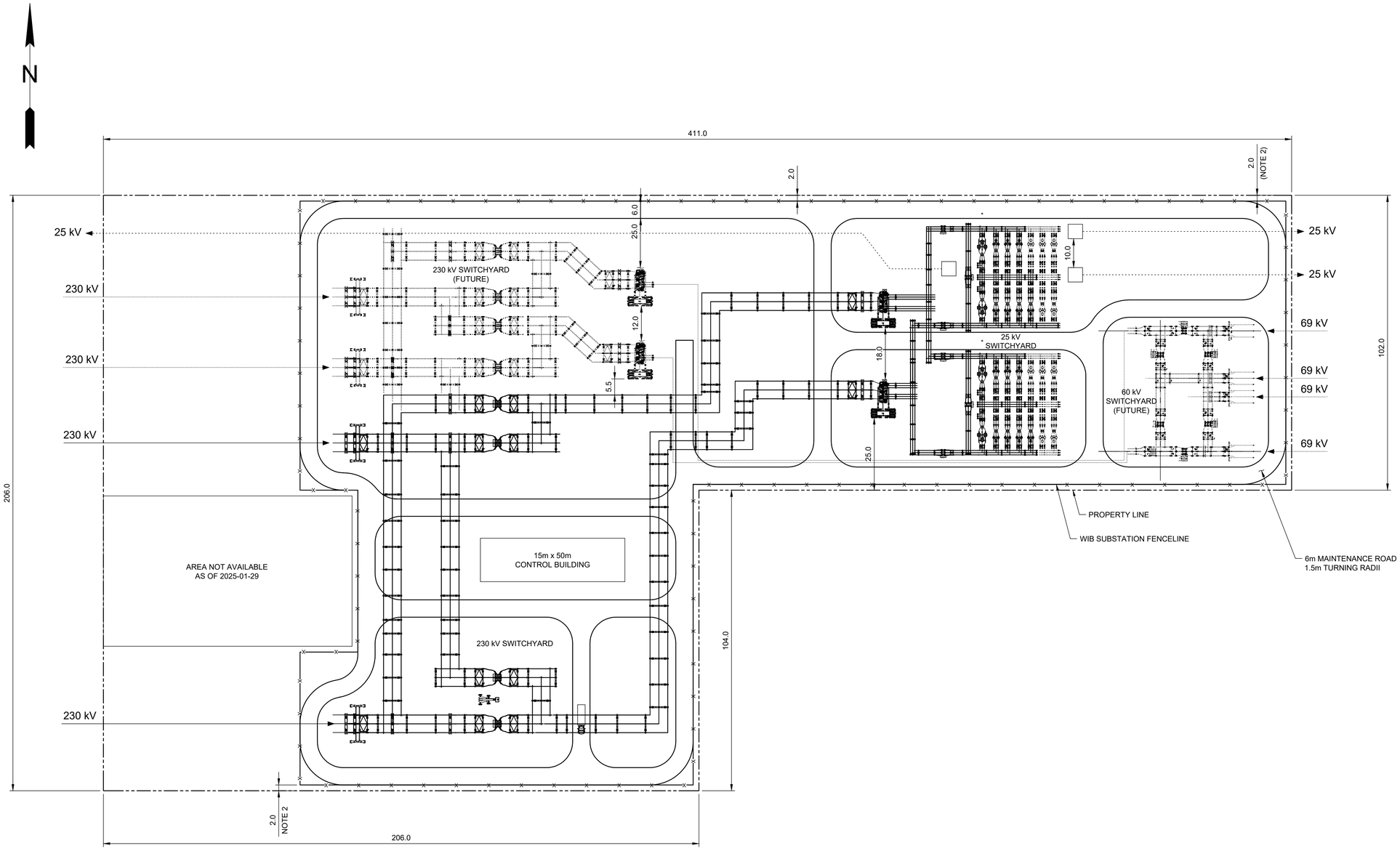
WILLOUGHBY SUBSTATION

230/60/25 kV SWITCHYARD
ULTIMATE LAYOUT
OPTION 1

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
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Drawing Unit = Metric (4)
ANSI D (22" x 34")
2/13/2025 1:52 PM

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO



NOTES:

1. GENERAL ARRANGEMENT DESIGN BASED ON THE FEEDBACK RECEIVED FROM TRANSMISSION LINE AND DISTRIBUTION PROJECT LEADS IN TERMS OF 230 kV, 60 kV, 25 kV SUBSTATION ENTRY/EXIST.
2. DISTANCE BETWEEN THE SUBSTATION FENCE LINE AND PROPERTY LINE SHOULD BE KEPT 2.0 METERS MINIMUM

SCALE: 1:750 0 50m

NO	DRAWING NUMBER	DRAWING TITLE
REFERENCE DRAWINGS		

NO	REMARKS
0	
REVISIONS	

DESIGN NUMBER
WORK ORDER NUMBER
CSA S250 ACCURACY NAD - UTM
BASE ACCURACY LEVEL:
ASB ACCURACY LEVEL:

DSGN	D. SYDOROV
INDEP CHK	
DFTG	KST
DFTG CHK	
INSP	
REV	M. BALEA
ACPT	

BC Hydro

WILLOUGHBY SUBSTATION

230/60/25 kV SWITCHYARD
ULTIMATE LAYOUT
OPTION 2

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
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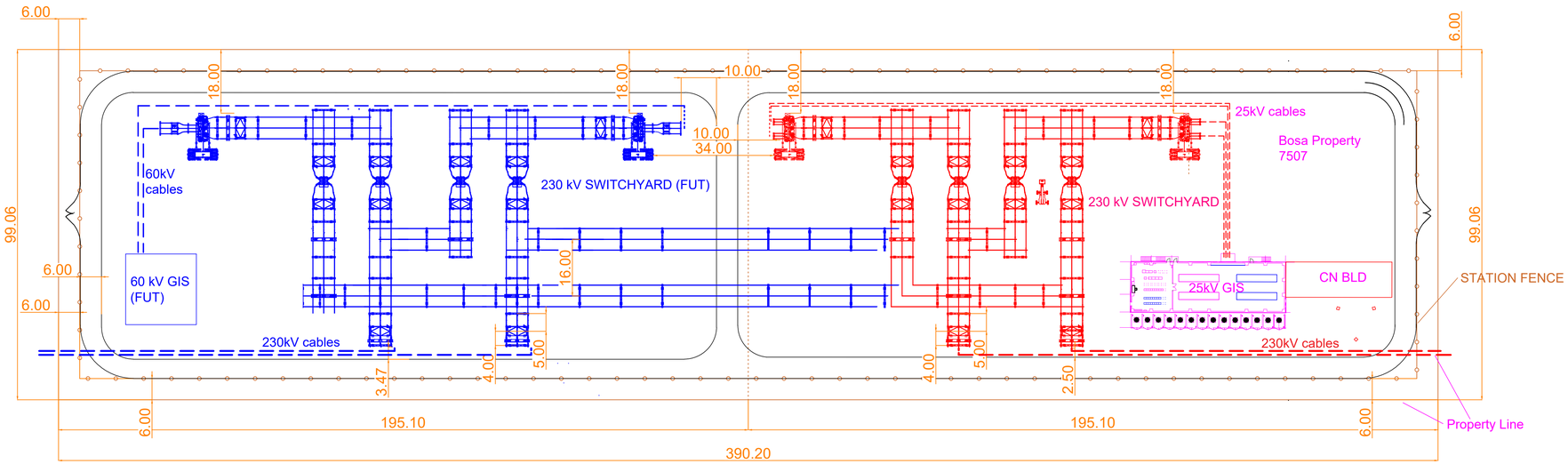
NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

N

NOTES:

1. GATES TO BE INSTALLED AS FIT BASED ON SITE ORIENTATION.
2. IF FACILITY IS PLACED ON A SLOPED SITE ADDTIONAL SPATIAL REQUIREMENT WILL BE REQUIRED EFFECTIVELY MAKING THE FACILITY FOOTPRINT LARGER DEPENDINGON THE SLOP REQUIREMENT.
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5. DISTRIBUTION MANHOLE LOCATION IS NOT CONSIDERED AT THIS DESIGN STAGE

COLOR CODE FOR SCOPE OF WORK:
RED: THIS PROJECT
BLUE/BLACK DOTS: FUTURE



FOR DISCUSSION
PURPOSES ONLY

C:\Users\kjiang\OneDrive - BC Hydro\P25 Projects1-CIPD\2023-11-21_Willoughby Purchase Project\Design\Conceptual\20240916-New for Bosa\7-WIB-E05-SK006-Op5-Outdoor AIS-To Fit Bosa+Kang Properties-20240918.dwg
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LWMS: Model_V1
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			ASB ACCURACY LEVEL:		INSP
		REVISIONS			REV K. ZENG
					ACPT

BC Hydro

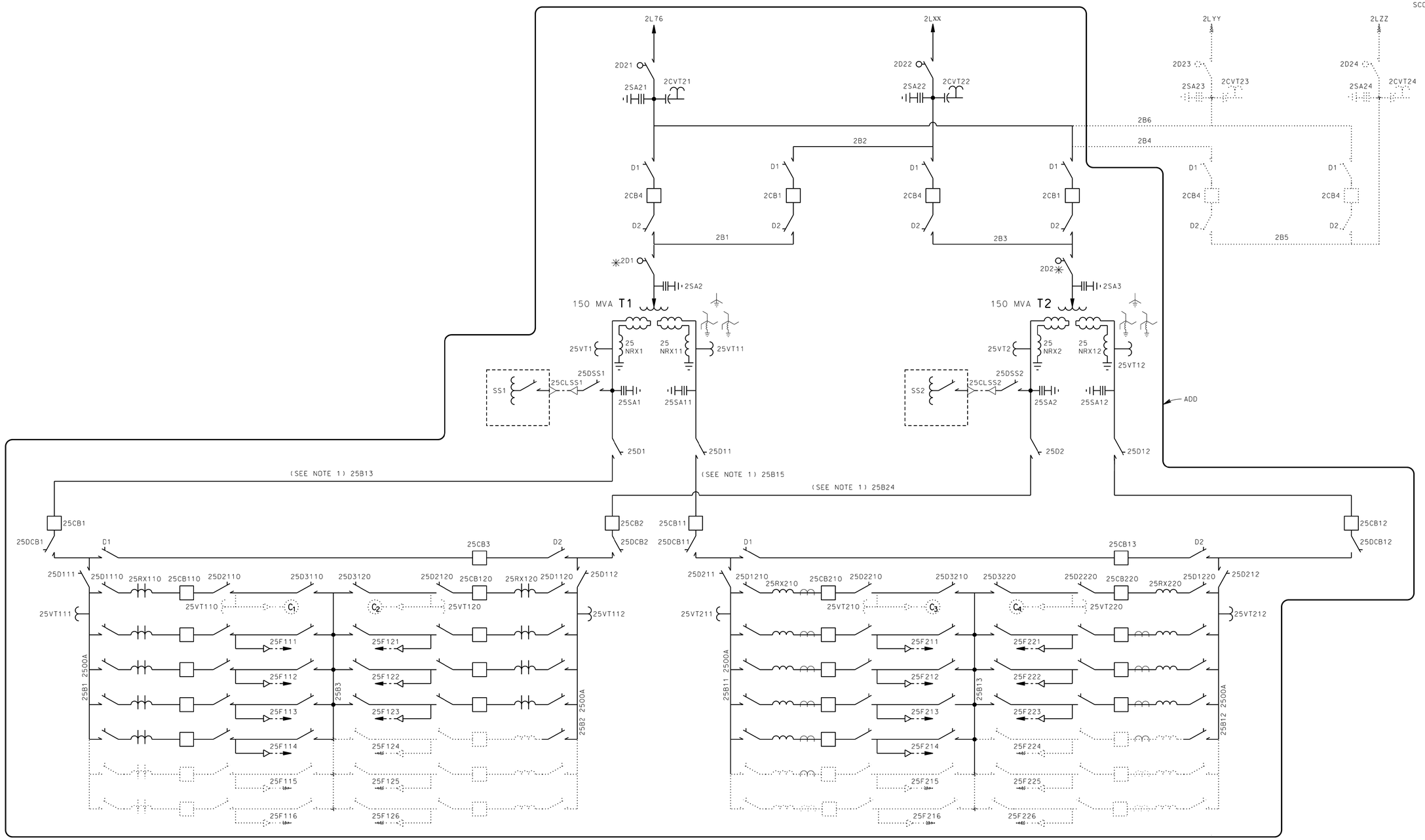
WILLOUGHBY SUBSTATION

230/60/25 KV SWITCHYARD
ULTIMATE LAYOUT

DATE	DIST	DRAWING NUMBER	REPORT NUMBER	FIG NO	SIZE	REV
2024SEP19		WIB-E05-SK006-OP7			D	0

NOT TO BE REPRODUCED WITHOUT THE PERMISSION OF BC HYDRO

SCOPE NOTES: 5078



✳QUICK BREAK ATTACHMENT

RATINGS OF MAJOR EQUIPMENT:

2B1, 2B2 BUS RATING 2000 A
2CB1, 2CB2, 2CB3, 2CB4 2000 A
25CB1, 25CB2, 25CB3, 25CB4, 25CB5. 25CB6 2500 A
THE REST OF 25 KV CIRCUIT BREAKERS 1200 A

NOTE:

1. CABLE OR BUS WILL BE DETERMINED BY ENGINEERING IN THE DETAILED DESIGN. IF BUS WILL BE USED, THE CAPACITOR MIGHT BE NEEDED IN THIS LOCATION.

NO	DATE	DWN	PLN	CHK	REV	ACPT
2						
1						

REVISIONS

DRAWN KLR
PLANNED LL
CHECKED
REVIEWED
ACCEPTED

BC Hydro
SUBSTATIONS GROWTH AND SUSTAINMENT

WILLOUGHBY (WIB)
230/25 KV
ONE-LINE DIAGRAM
2032 STAGE

DATE 18 SEP 23 | SHEET 1 | DWG NO XXX-P06-SK1 | R 0