APPENDIX C

Geotechnical Engineering Review and Assessment: (Mountain Institution)
Appendix a: Mountain Institution - Gates 7, 8, 9 & 104
Appendix b: Mountain Institution - Seismic Design Criteria
Appendix c: Mountain Institution - Soil Logs from AMEC Wheeler Forster Envir/Infra
Appendix d: Mountain Institution - Standard Field Inspection Requirements8

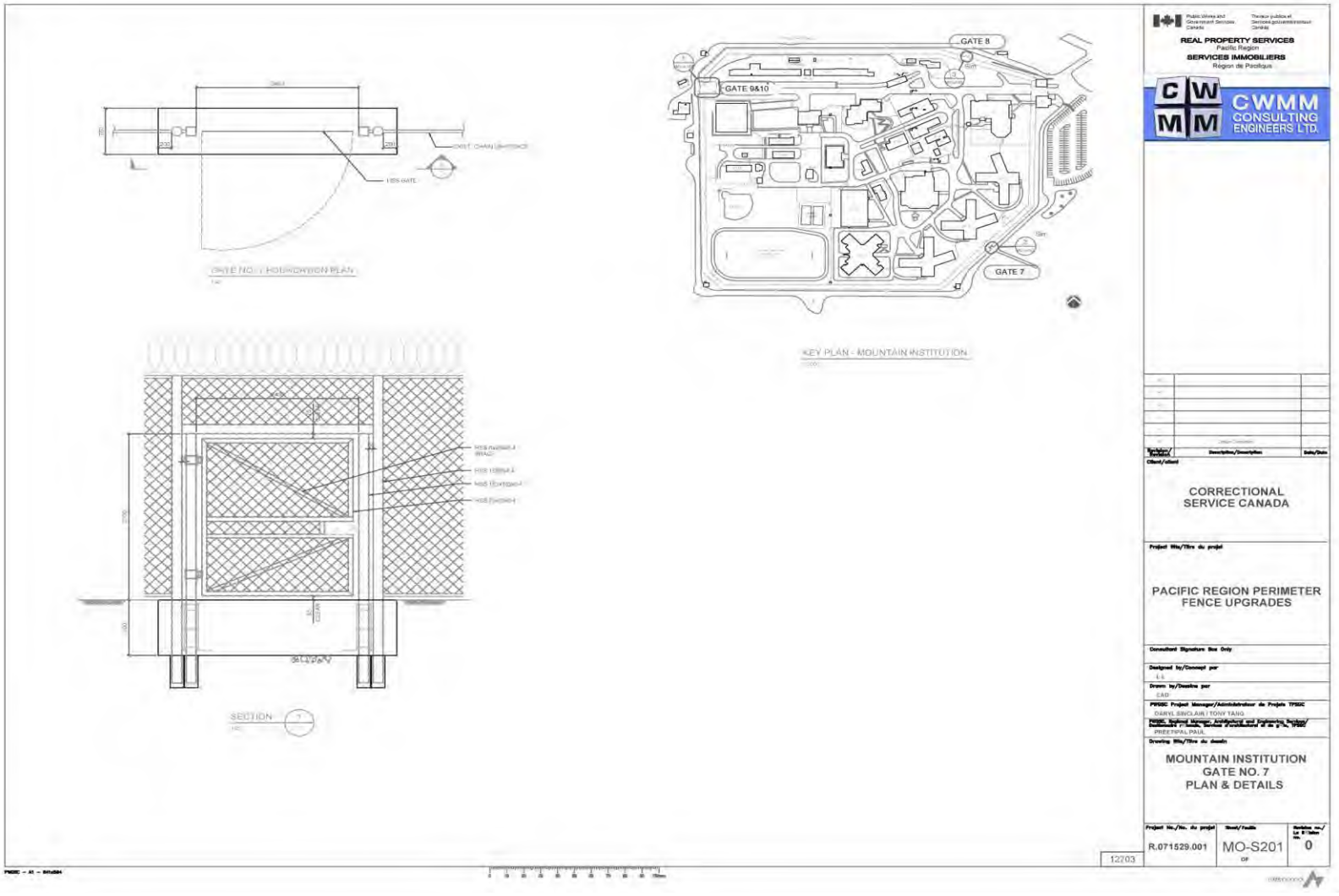
JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "A"

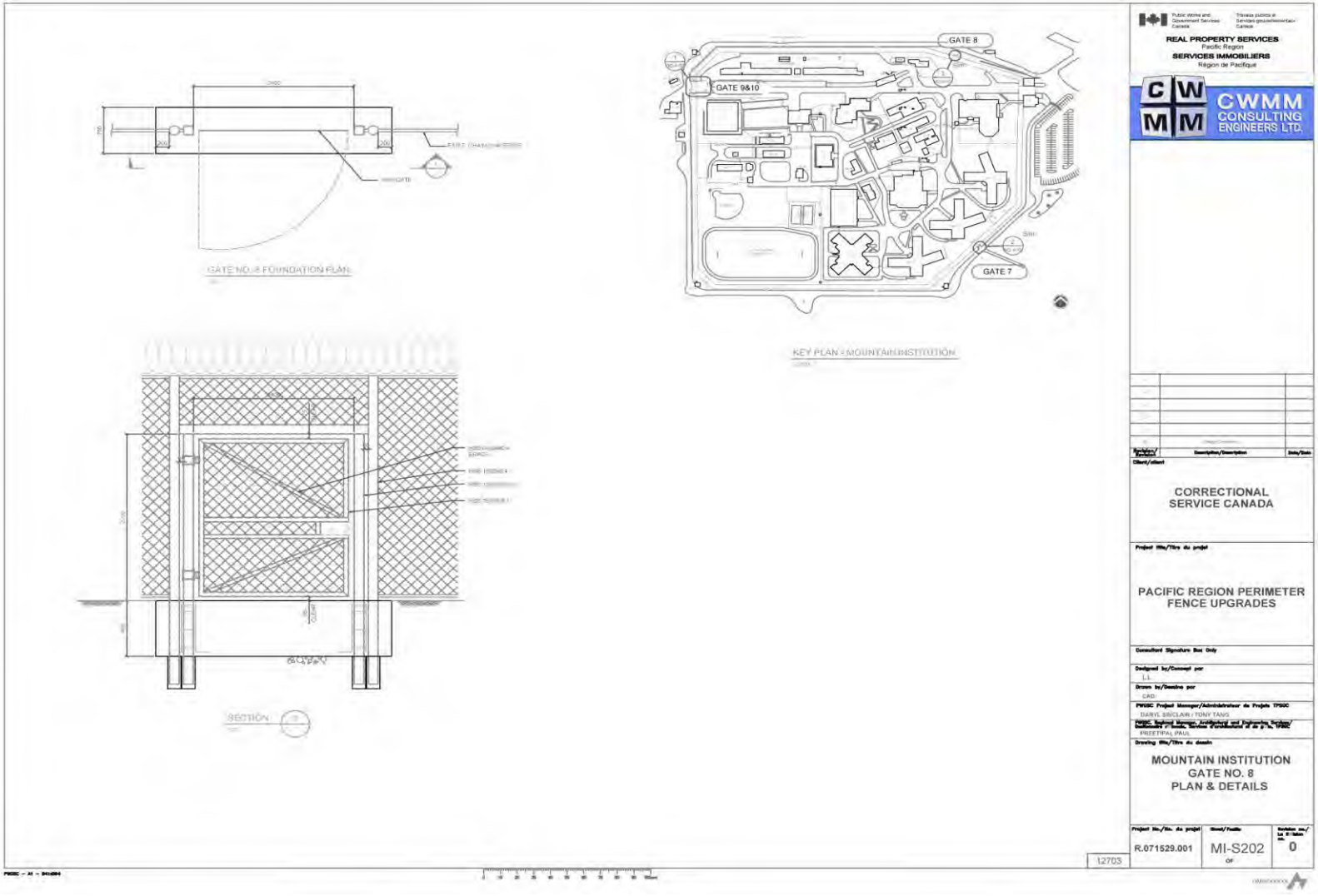
PROPOSED PERIMETER FENCE AND GATES UPGRADES
MOUNTAIN INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

GATES NO. 7, 8, 9 & 10 PLAN AND DETAIL
(MOUNTAIN INSTITUTION)

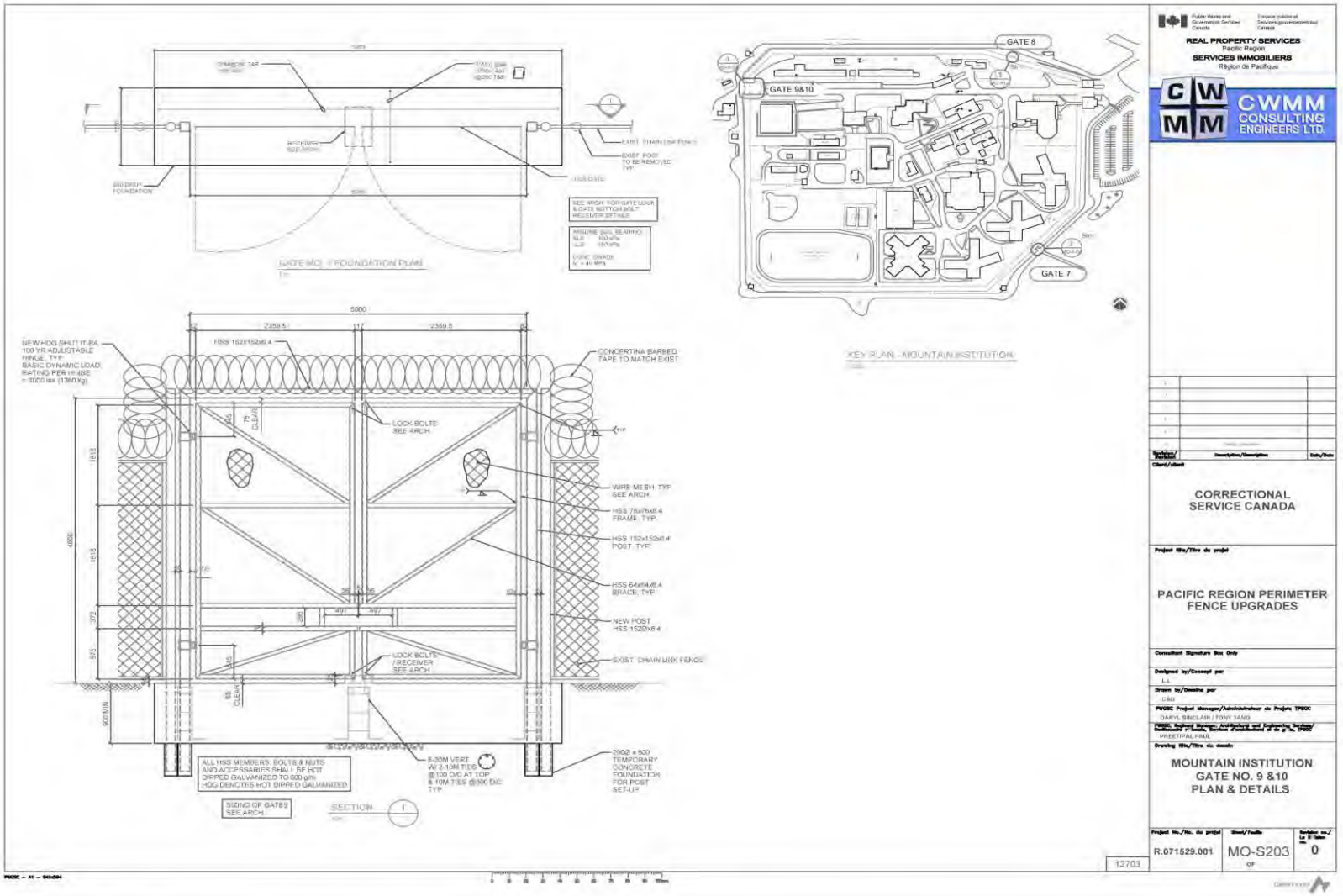
Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com



JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 7 Plan and Detail (Mountain Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Mountain Institution, 4732 Cemetery Road, Agassiz, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555B – Appendix "A"	



JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 8 Plan and Detail (Mountain Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Mountain Institution, 4732 Cemetery Road, Agassiz, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555B – Appendix "A"	



JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 9 & 10 Plan and Detail (Mountain Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Mountain Institution, 4732 Cemetery Road, Agassiz, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555B – Appendix "A"	

JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "B"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MOUNTAIN INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

SEISMIC DESIGN CRITERIA

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 franç ais (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

November 08, 2018

Site: 49.2637 N, 121.8342 W User File Reference: Canadian Mountain Institution

Requested by: , Jecth Consultants

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.247	0.369	**0.465**	0.448	**0.390**	**0.248**	**0.158**	**0.058**	**0.020**	**0.209**	**0.311**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.052	0.119	0.167
Sa(0.1)	0.079	0.180	0.251
Sa(0.2)	0.106	0.235	0.323
Sa(0.3)	0.107	0.233	0.317
Sa(0.5)	0.089	0.199	0.275
Sa(1.0)	0.049	0.118	0.168
Sa(2.0)	0.028	0.070	0.104
Sa(5.0)	0.0067	0.020	0.034
Sa(10.0)	0.0026	0.0073	0.012
PGA	0.045	0.103	0.144
PGV	0.055	0.140	0.205

References

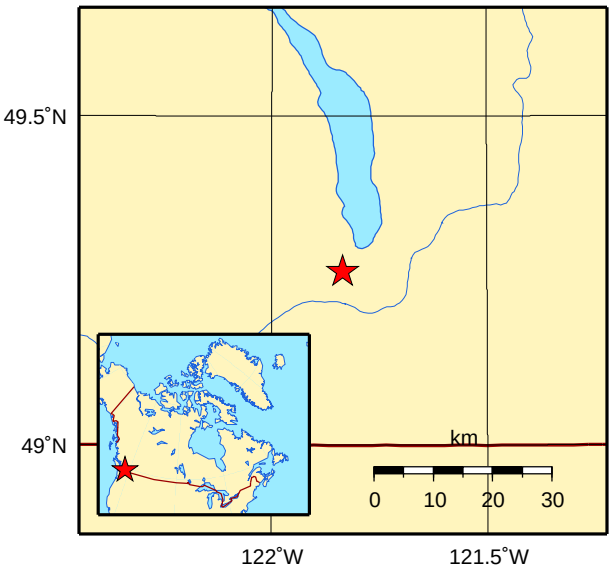
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français

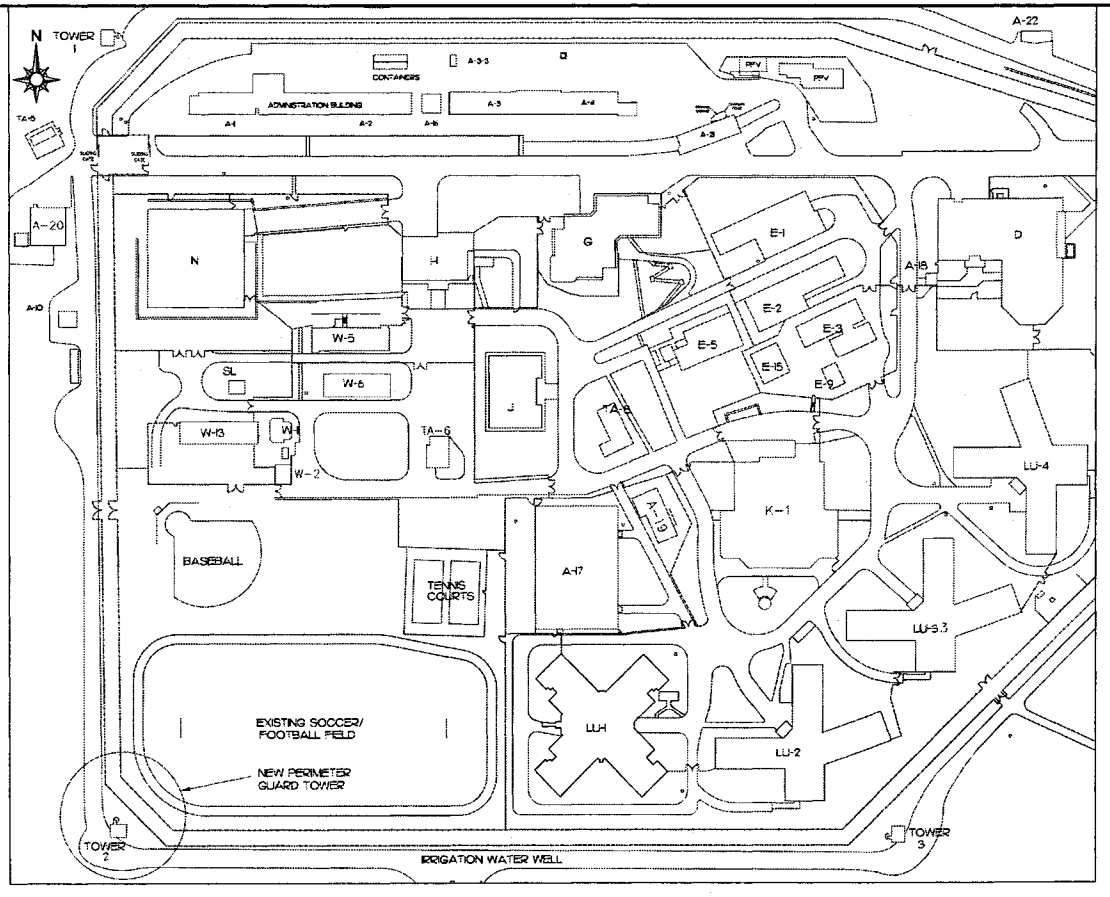


APPENDIX "C"

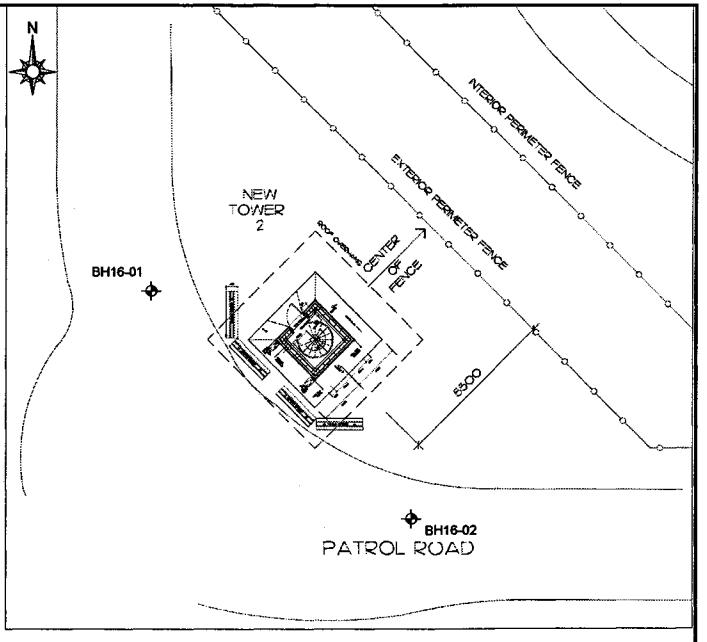
PROPOSED PERIMETER FENCE AND GATES UPGRADES
MOUNTAIN INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

SOIL LOGS FROM AMEC WHEELER FORSTER
ENVIRONMENT & INFRASTRUCTURE

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com



MOUNTAIN INSTITUTE SITE PLAN
NTS



PERIMETER GUARD TOWER SITE PLAN
1:250

LEGEND

APPROXIMATE LOCATION OF BOREHOLE

NOTE:
SOURCES: DWG R.079756.001, ARCHITECTURAL AND SITE 2015-12-04
DRAWING DETAILS SHOWN ARE APPROXIMATE ONLY

amec foster wheeler
Environment & Infrastructure

CLIENT AND LOGO:
PUBLIC WORKS & GOVERNMENT SERVICES CANADA

Amec Foster Wheeler
Environment & Infrastructure
Unit 110, 18568 - 96 Avenue, Surrey, BC V4N 3P9
Tel. 1-604-295-8657 Fax 1-604-295-8658

DWN BY:	EDS
CHKD BY:	RF
DATUM:	NAD 83
PROJECTION:	UTM Zone 10U
SCALE:	AS SHOWN

PROJECT: GEOTECHNICAL ASSESSMENT
MOUNTAIN MEDIUM INSTITUTION
MISSION, BC

TITLE: BOREHOLE LOCATION PLAN

DATE:	MAR 2016
PROJECT NO:	KA21139.200
REV. NO:	A
FIGURE NO:	02

C:\Users\enzo.dalsanto\Documents\- Projects Current\KA21139 Mission-Mountain Guard Towers\Drafting\CAD\KA21139.200-02.dwg - 02 - Mar. 21, 2016 6:26pm - enzo.dalsanto

BOREHOLE BH16-01

STARTED: 01/03/2016 **FINISHED:** 02/03/2016

METHOD: Sonic

LOCATION: Coords & elevation based on Google Earth Imagery

COORDINATES (m): N 5457359 E 584538

DEPTH (m)	SPT BLOWS PER 152mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH Elev. 19 m+/-	DESCRIPTION OF MATERIALS
					0.0	FILL- Asphalt (80mm+/-) over, sand & gravel, some silt, compact, moist, light brown
					0.6 / 18.4	FILL- silty sand & gravel, compact/stiff, moist, brown
					0.9 / 18.1	FILL- boulder/gravel, trace sand, silty to trace silt, angular, very dense, moist to wet, brown/whitish lense - inferred as shotrock fill
1	50-50mm (R)					- (R) effective SPT refusal
2						
3	1 1 1		G		2.9 / 16.1	PEAT, amorphous, some fibrous, very soft, wet, dark brown
4			G		4.0 / 15.0	SILT to sandy SILT, soft, wet, grey - low plasticity
5	2 2 2	28.6	G		4.7 / 14.3	SAND, f-m grained, trace silt, loose, wet, grey
			G		5.5 / 13.5	silty SAND/sandy SILT, loose/soft, wet, grey - non plastic
6	18 27 10 5		G		6.1 / 12.9	sandy GRAVEL, compact, wet, grey and rust brown lenses
7			G		7.6 / 11.4	GRAVEL, subround, some sand, trace silt, loose, wet
8			G		8.2 / 10.8	silty SAND & GRAVEL, compact, wet, grey
9	6 4 4		G		8.8 / 10.2	GRAVEL/sandy GRAVEL, interlayered, subround, trace silt, loose, wet
10						

WELL INSTALLTION DETAILS

Su (kPa)
20 60 100 140 180
FIELD VANE PEAK ▲ P PEN/2 ⊙ TORVANE ▽
■ SPT N ◆ DCPT N Blows/0.3 m
W_p% W% W_L%
10 30 50 70 90

N-GEO-CONVERT-COORD-AFW-TORVANE-BH KA21139.200.MOUNTAIN BH LOG.V00.GPJ ALL-1.GDT 3/21/16

amec foster wheeler

AMEC FOSTER WHEELER
Environment & Infrastructure
18568 - 96 Avenue, Unit 110
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21139.200
PROJECT: New Guard Tower
LOCATION: Mountain Institute, Agassiz, BC
LOGGED BY: EDS **REVIEWED BY:** RF
SHEET 1 OF 4 **BOREHOLE No. BH16-01**

BOREHOLE BH16-01

STARTED: 01/03/2016 **FINISHED:** 02/03/2016

METHOD: Sonic

LOCATION: Coords & elevation based on Google Earth Imagery

COORDINATES (m): N 5457359 E 584538

DEPTH Elev. 19 m+/-

DEPTH (m)	SPT BLOWS PER 152mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DESCRIPTION OF MATERIALS
11					GRAVEL/sandy GRAVEL, interlayered, subround, trace silt, loose, wet *(continued)*
					11.6
					7.4 silty SAND & GRAVEL, compact-dense, moist, grey
12			G		
					12.2
	25 40 81		G		6.8 GRAVEL/sandy GRAVEL, interlayered, subround, trace silt, loose, wet
			G		12.6
					6.4 silty SAND & GRAVEL, compact-dense, moist, grey
13					6.2 CLAY, silty, soft to firm, grey - intermediate to high plasticity
			G		
14					
15			G		
	3 3 4				
16					
17			G		
					17.7
					1.3 SAND, f-m grained, trace silt, compact, wet, grey - some fine or coarser sand gradation lensing - - trace thin silty lenses
18		13.3	G		
19			G		
20					

WELL INSTALLATION DETAILS

Su (kPa)
20 60 100 140 180

FIELD VANE PEAK ▲ P PEN/2 ⊙ TORVANE ▽

■ SPT N ◆ DCPT N Blows/0.3 m

W_P% W% W_L%
10 30 50 70 90

7 8 5 20 32 37 7 35 25 36 24 23

N-GEO-CONVERT-COORD-AFW-TORVANE-BH KA21139.200.MOUNTAIN BH LOG.V00.GPJ ALL-1.GDT 3/21/16

amec foster wheeler

AMEC FOSTER WHEELER
Environment & Infrastructure
18568 - 96 Avenue, Unit 110
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21139.200

PROJECT: New Guard Tower

LOCATION: Mountain Institute, Agassiz, BC

LOGGED BY: EDS **REVIEWED BY:** RF

BOREHOLE BH16-01

STARTED: 01/03/2016 **FINISHED:** 02/03/2016

METHOD: Sonic

LOCATION: Coords & elevation based on Google Earth Imagery

COORDINATES (m): N 5457359 E 584538

DEPTH Elev. 19 m+/-

DESCRIPTION OF MATERIALS

DEPTH (m)	SPT BLOWS PER 152mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DESCRIPTION OF MATERIALS
	16 17 20				SAND, f-m grained, trace silt, compact, wet, grey - some fine or coarser sand gradation lensing - - trace thin silty lenses *(continued)*
21		3.8	G		
			G		
22					
23					
24			G		
	12 22 8				
25					
26		54.9	G		
					26.8 -7.8 silty SAND, compact, wet, grey
27			G		27.4 -8.4 SAND, f-m grained, trace silt, compact, wet, grey - some fine or coarser sand gradation lensing - - trace thin silty lenses
	3 4 8				
28					
29		4.8	G		
30					

WELL INSTALLTION DETAILS

Su (kPa)
20 60 100 140 180
FIELD VANE PEAK ▲ P PEN/2 ⊙ TORVANE ▽
■ SPT N ◆ DCPT N Blows/0.3 m
W_P% W% W_L%
10 30 50 70 90

24 3 21 20 11 20 15 16 9 19 12 20

N-GEO-CONVERT-COORD-AFW-TORVANE-BH KA21139.200.MOUNTAIN BH LOG.V00.GPJ ALL-1.GDT 3/21/16

amec foster wheeler

AMEC FOSTER WHEELER
Environment & Infrastructure
18568 - 96 Avenue, Unit 110
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21139.200
PROJECT: New Guard Tower
LOCATION: Mountain Institute, Agassiz, BC
LOGGED BY: EDS **REVIEWED BY:** RF
SHEET 3 OF 4 **BOREHOLE No. BH16-01**

BOREHOLE BH16-01

STARTED: 01/03/2016 **FINISHED:** 02/03/2016

METHOD: Sonic

LOCATION: Coords & elevation based on Google Earth Imagery

COORDINATES (m): N 5457359 E 584538

DEPTH Elev. 19 m+/-

DEPTH (m)	SPT BLOWS PER 152mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DESCRIPTION OF MATERIALS	WELL INSTALLTION DETAILS
30	1 3 3		G6		SAND, f-m grained, trace silt, compact, wet, grey - some fine or coarser sand gradation lensing - - trace thin silty lenses *(continued)*	
30.9 / -11.9					End of BH - casing installed with bentonite/cement fill	

Su (kPa): 20 60 100 140 180

FIELD VANE PEAK ▲ P PEN/2 ⊙ TORVANE ▽

■ SPT N ◆ DCPT N Blows/0.3 m

W_P% W% W_L%

10 30 50 70 90

24 22 (G6)

AMEC FOSTER WHEELER
Environment & Infrastructure
18568 - 96 Avenue, Unit 110
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21139.200

PROJECT: New Guard Tower

LOCATION: Mountain Institute, Agassiz, BC

LOGGED BY: EDS **REVIEWED BY:** RF

SHEET 4 OF 4 **BOREHOLE No. BH16-01**

N-GEO-CONVERT-COORD-AFW-TORVANE-BH KA21139.200.MOUNTAIN BH LOG.V00.GPJ ALL-1.GDT 3/21/16

BOREHOLE BH16-02

STARTED: 01/03/2016 **FINISHED:** 01/03/2016

METHOD: Sonic

LOCATION: Coords & elevation based on Google Earth Imagery

COORDINATES (m): N 5457347 E 584547

DEPTH Elev. 19 m+/-

DEPTH (m)	DESCRIPTION OF MATERIALS
0.5	FILL- Asphalt (90mm+/-) over, sand & gravel, some silt, compact, moist, light brown
18.5	FILL- silty sand & gravel, compact/stiff, moist, brown
18.2	TOPSOIL (buried), organic silt, sandy, firm, dark brown
1.1	
17.9	FILL- boulders/gravel, trace sand, silty to trace silt, angular, very dense, moist to wet, brown/whitish lense - inferred as shotrock fill
0.8	
2.7	
16.3	PEAT, amorphous, some fibrous, very soft, wet, dark brown
3.0	
16.0	End of BH - standpipe piezometer installed

Su (kPa)
20 60 100 140 180
FIELD VANE PEAK ▲ P PEN/2 ⊙ TORVANE ▽
■ SPT N ◆ DCPT N Blows/0.3 m
W_P% W% W_L%
10 30 50 70 90

amec foster wheeler

AMEC FOSTER WHEELER
Environment & Infrastructure
18568 - 96 Avenue, Unit 110
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21139.200
PROJECT: New Guard Tower
LOCATION: Mountain Institute, Agassiz, BC
LOGGED BY: EDS **REVIEWED BY:** RF
SHEET 1 OF 1 **BOREHOLE No. BH16-02**

N-GEO-CONVERT-COORD-AFW-TORVANE-BH KA21139.200.MOUNTAIN BH LOG.V00.GPJ ALL-1.GDT 3/21/16

JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "D"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MOUNTAIN INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

STANDARD FIELD INSPECTION REQUIREMENTS

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

Geotechnical Engineering Field Review and Inspection Requirements
BC Building Code 2012

Based on the BC Building Code 2012, the following Design and field review must be completed by JECTH Consultants Inc. (Geotechnical in Record, **GIR)** such that Letter of Compliance (Schedule "C") required by local municipality for Occupancy Permit can be issued.

7.0 Geotechnical - Temporary

7.1 Excavation

7.1.1 Foundation

Excavation depth more than 4 ft. must be certified by GIR as required by WorkSafe BC ☐

7.1.2 Buildings and Structures

Buildings and Structures within the 1H:1V stress influence line from the bottom of Excavation must be reviewed and approved by GIR ☐

7.1.3 Trench

Excavation for underground utilities for depth more than 4 ft. must be reviewed and approved by GIR ☐

7.1.4 Underground Utilities

All underground utilities (both on-site and off-site) within and along the site perimeter must be identified both on drawing and physical on site prior to any foundation excavation and slope excavation. ☐

7.2 Shoring

7.2.1 Vertical Shoring

Vertical Shoring must be design by GIR to ensure excavation perimeter is stable during foundation excavation before placement of perimeter backfill. ☐

7.2.2 Temporary Shoring

Temporary Shoring such as sheetpile and shotcrete with tie back anchors or other vertical features must be inspected by GIR ☐

7.2.3 Shoring Method

Shoring method such as sheetpile and shotcrete with tie-back anchors wall must be carried out under the supervision of GIR ☐

7.2.4 Underground Utilities

All underground utilities (both on-site and off-site) within and along the site perimeter must be identified both on drawing and physical on site prior to any foundation excavation and shoring work. ☐

7.3 Underpinning

7.3.1 Pre-Excavation

Pre-excavation inspection and Review must be conducted by both Structural and Geotechnical Engineers (both Geotechnical Engineers from the adjacent structures and GIR) prior to underpinning excavation. ☐

7.3.2 Monitoring Survey

Survey monitoring points must be installed at the underpinning building(s) and/any movement sensitive Structural Component before foundation excavation. The survey monitoring system must be conducted prior to any site activities and submit to GIR. ☐

7.3.3 Structural Inspection

Structural Inspection and photographs must be carried out prior to foundation excavation for future records and reference by Structural Engineer retained by either owner of adjacent property or subject property owner. ☐

7.4 Temporary Construction Dewatering

7.4.1 Perched groundwater and Surface Drainage

For perched groundwater and surface Drainage by precipitation, conventional pump can be used to maintain the site in relatively dry condition. □

7.4.2 Well point

Well point and other measure of temporary dewatering will be required if high groundwater level (actual ground water table) is encountered □

8.0 Geotechnical - Permanent

8.1 Bearing Capacity of Foundation Subgrade Soil ☐

8.1.1 Foundation Subgrade Excavation

Review exposed foundation subgrade excavation and ensure that all remove all unsuitable soil/material until suitable bearing subgrade is exposed ☐

8.1.2 Foundation Subgrade Protection

In the event that the exposed foundation subgrade soil is sensitive to moisture, foundation subgrade might be protected by a layer granular soil such as crushed gravel due to wet condition and construction traffic. A lean concrete can be used instead of crushed gravel. ☐

8.1.3 Structural FILL

Review Structural Fill if over-excavated or raise of grade is required. Compaction Density test must be conducted by Certified Laboratory and submit to GIR. ☐

8.2 Geotechnical - Deep Foundation

8.2.1 Piling Inspection

Full time piling inspection such as timber and steel pile etc must be conducted by GIR. All piling record for refusal must be available to review such that the pile capacity can be certified. ☐

8.2.2 Sheetpile Installation

Sheetpile installation as temporary / permanent support must be installed and inspected by Geotechnical Engineer ☐

8.3 Engineering FILL

8.3.1 Structural FILL

Structural Fill (imported or non-native material) at and below the proposed foundation elevation must be compacted to density as specified by GIR and must be certified by qualified soil laboratory / testing company ☐

8.3.2 Underslab FILL

Underslab fill density must also be tested prior to placement of slab-on-grade concrete to the specified density as required by GIR. ☐

8.4 Slope Stability and Seismic Load

8.4.1 Slope Stability

Evaluate the slope stability along the site and building perimeter for both seismic and static design conditions according to APEBC Guidelines dated November 2010. ☐

8.4.2 Subsurface Stability

Subsurface stability under seismic condition such as densification specified by GIR and tieing of footing structurally must be accommodated by Structural Engineer in Record ☐

8.4.3 Seismic Design Criteria

The acceleration velocity design must be based on Nation Resources of Canada Seismic Hazard Criteria. ☐

8.5 Backfill

8.5.1 Backfill Material

Backfill material for foundation perimeter must be well drained granular soil, such as crushed gravel with waterproof membrane for below grade structure ☐

8.5.2 Sensitive Structure

If sensitive structure is founded on the Backfill material such as Sand and Gravel compaction density as specified by GIR of the backfill material must be tested by certified testing company ☐

8.6 Permanent Dewatering

8.6.1 Foundation Drainage

For convention foundation drainage, perforated PVC pipe will be used to collect any surface gravity drained to city's storm system migrated and natural groundwater to a sump then ☐

8.6.2 Storm System

If City's storm system is higher than the sump elevation, pumping system must be installed with dual-pump and alarm system and may be with backup generator when power is unavailable during adverse conditions. Mechanical and Civil Engineer must be retained to design the system. ☐

8.6.3 Perforated Drainage

Underslab perforated drainage perforated PVC will be installed to improve the foundation drainage if groundwater table is higher than the slab elevation either seasonally or permanently ☐

8.6.4 Tanking

Tanking is also an option when the pumping system might not be capable to drain all below groundwater or foundation drainage system is not installed. Envelop Consultants must be retained for this option ☐

8.6.5 Retention Tank

Retention Tank with control valve may be required due to City's storm system limitation. Civil Engineer must be retained. ☐

8.7 Permanent Underpinning

8.7.1 Underpinning Loading

All underpinning loading must be reviewed and approved by Structural Engineer and GIR. ☐

8.7.2 Separation and Drainage

Bond separation and drainage (above and below grade) at the interface of the underpinning area must be reviewed to ensure no water migrate to the underpinning structure. Envelop Consultant must be retained. ☐

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT
PROPOSED PERIMETER FENCE AND GATES UPGRADES

AT
MOUNTAIN INSTITUTION
4732 CEMETERY ROAD
AGASSIZ, BC

FOR

CWMM CONSULTING ENGINEERS LTD.

PREPARED BY

JECTH CONSULTANTS INC.

JOB NO.: 218C555B

DATE: NOVEMBER 30, 2018

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT PROPOSED PERIMETER FENCE AND GATES UPGRADES MOUNTAIN INSTITUTION, 4732 CEMETERY ROAD, AGASSIZ, BC

1.0 INTRODUCTION

1.1 AUTHORIZATION

As authorized by CWMM Consulting Engineers Ltd. on October 22, 2018, JECTH Consultants Inc. (JCI) has carried out a Geotechnical Engineering Review and Assessment for the proposed Perimeter Fence and Gates Upgrade project, Mountain Institution which is located at 4732 Cemetery Road, Agassiz, BC as shown in Figure MO 01 – Site Location Plan.

1.2 METHODOLOGY

The Geotechnical Engineering Assessment and Review includes:

- Reviewed of available Structural Plan for the Gates
- Obtained the Surficial Geological Map from Geological Canada.
- Reviewed available Geotechnical Report for a Guard Tower construction at the Mountain Institution.
- Conducted a site reconnaissance by our site staff at the subject site.
- Assessed the available subsurface soil conditions and profile based on desktop review and our local experience within the close vicinity of the subject site.
- Communicated with Institution staff and Structural Engineer.
- This report is prepared according to JECTH Consultants Inc. Proposal P218 -551 dated October 10, 2018.

1.3 OBJECTIVE

This Geotechnical Engineering Report summarizes our findings and provides Geotechnical Engineering Comments and Recommendations for the foundation design and construction of the Gates and Fence upgrade for existing perimeter security fences of the Institution Compound.

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1.4 DESIGN DRAWING

This report is prepared based on the Design Drawings prepared by CWMM which received by our office on October 9, 2018. Any revision of the plan must be informed to JECTH Consultants Inc.

3.0 SITE LOCATION AND CONDITION

The Mountain Institution is located at about 7 Km. west to the Town of Agassiz, Chilliwack, BC as shown in Figure MO 01 – Site Location Plan. It is situated on a slightly sloping topography with the toe of mountain near the north west edge of the Institution. The majority area of the institution is situated on a flood plain. The drop of gradient from the north to the south is estimated at about 1% to 2%.

The Institution can be accessed by the Cemetery Road from the east of the compound. The institution is surrounded with perimeter fences. Utility buildings and car parks outside the security fences are situated at the east of the compound.

A site reconnaissance was taken on October 31, 2018 around the perimeter security fences by our site staff. The reconnaissance at the proposed gates upgrade locations and local nearby area indicate there is no apparent subsidence of ground, nor any distress of asphalt surface along the surrounding access road. Water can be observed at a small stream to the south of the institution culvert during a rainy day at the time of visit. Level of water is estimated at about 1.5 m. to 2.0 m. below road grade. At such the groundwater table likely occur at this elevation along the south side of the institution.

The perimeter fence is a double fence system with an outer and inner fence for security purpose. Gravel is observed at a corridor between the fences.

4.0 PROPOSED GATES UPGRADE

Based on a Site Plan supplied by CWMM Consulting Engineers as shown in Figure MO 03, there will be 4 nos. of gates to be installed around the existing perimeter fences. The gates are either new gates, or replace existing gates as an upgrade as listed in the following:

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Gate No.	Location	Gate Usage
7	South East Perimeter	Maintenance Vehicle
8	North East Perimeter	Maintenance Vehicle
9	North West Corner	Emergency Vehicle
10	North West Corner	Emergency Vehicle

The structural details of the Gates are enclosed in Appendix "A" – Gates Upgrade for Mountain Institution for ease of reference.

Gates for vehicle passage will have foundation design for transient vehicle load from Trucks and Fire Trucks. JCI estimate an equivalent surcharge load of 15 KPa for vehicle loading will be sufficient for the transient live load design.

5.0 SUBSURFACE SOIL CONDITIONS

Based on available Geological Map as shown in MO 03 – Geological Map, the Mountain Institution is situated in between 2 geological formation namely Fraser River Sediments and Salish Sediments. The former is a floodplain composed of Sand, SILT and Sand and Gravel Deposit from the Fraser River. The later is localized Bog and Swap deposit formed by shallow lakes at the surface of Fraser River Deposit.

It is anticipated the Institution compound is immediate underlain with soft SILT, loose SAND or Organic Soil. Sand and Gravel can be occur in deeper soil stratum which is common in Agassiz Area.

A geotechnical report for a guard tower construction at South West corner of the Institution is available for review from Public Work Department (PWGSC). The report for the Guard Tower geotechnical investigation dated March 23, 2016 was issued by Amec Foster Wheeler Environmental & Infrastructure who was the geotechnical consultant for the guard tower project.

The investigation involve 2 nos. of auger holes for possible pile foundation for the guard tower. Based on the finding of the report, the following subsurface soil condition were found at the auger hole locations in the following table:

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Depth (m)	Soil	Remark
0 - 3	Sand and Gravel FILL	Dense
3 - 4	PEAT	Very Soft
4 - 6	SAND and SILT Layer	Liquefiable
6 - 13	Sand and Gravel	Compact to Dense
13 - 18	CLAY	High Plasticity
18 - 20	Compact SAND	Compact to Dense

The occurrence of 1 m. of PEAT below the SAND and Gravel FILL indicate the original PEAT from a possible shallow lake beside the stream was either not complete removed or was not stripped at during the past site preparation of the institution.

Groundwater was occurred at 2 m. depth below grade within the SAND and Gravel FILL.

Site reconnaissance at the northwest corner of the institution for a close-by proposed clinic Building near Gate 9 and 10 identify Colluvium soil. The Colluvium composed of SAND and SILT with fracture rocks which is likely originated from gravity slide from the mountain. The area is not covered by drilling investigation for the guard tower.

A present construction of pipeline is being carried at the south side of the site near proposed Gate 7. JCI has been informed by PWGSC site staff that excavation of the pipeline is at 22 m. below grade and without encounter bedrock. The information from the staff do in consistence with the finding from the site exploration of the guard tower.

Stockpiles of SAND and Gravel was observed during the site reconnaissance. It is believed the SAND and Gravel dug out from the construction are the SAND and Gravel FILL at the surface of the Site.

In conclusion, the site is found on man-made SAND and Gravel FILL, underlain with Fraser River Deposit at the south side of the site and Colluvium at the north side at site location near mountain toe.

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6.0 GEOTECHNICAL FOUNDATION DESIGN

Due to light structural loading of a steel fence and gate superstructure, the gate foundation can be conventional shallow stripped and pad footing found on the dense Sand and Gravel FILL. Bearing resistance will be mainly provided from the top 3 m. thick Sand and Gravel FILL as the PEAT immediate underlain it with practically no strength at all.

At the North West corner where Gate 9 and 10 situated, the Sand and Gravel FILL probably underlain with Colluvium which will have better bearing resistance than PEAT. However, stress influence from the Gate Structure will be minimal and will not have significant disturbance in term of stress and settlement for the Colluvium Soil.

An allowable bearing capacity of 75 KPa for SLS design and ultimate bearing capacity of 120 KPa for ULS design are recommended. The minimum depth of footing should be at least 0.5 m. below surface for frost protection. In the case that soil subgrade modulus is used for design of the footing, a modulus subgrade reaction at 8,000 KN / m^3 can be used for the analysis.

By assume the PEAT is already consolidated under the weight of top 3 m. SAND and Gravel FILL in the past and the Gate is a relatively light loading structure, Settlement of the footing will be in the order of 25 mm. Settlement will likely completed during construction period. Differential settlement of the footings will be minimal.

It is recommended that the foundation subgrade to be prepared by re-compaction of the existing SAND and Gravel to 100% Standard Proctor Density at the gates location. Groundwater will likely below foundation subgrade if construction is carried out in dry season. In the case groundwater occur, temporary de-watering will be necessary for the foundation preparation work by introduction of temporary sump nearby with depth lower than the foundation subgrade.

7.0 SEISMIC DESIGN

Due to presence of 2 m. liquefiable SAND and SILT between 4 m. to 6 m. depth and with the presence of PEAT, the site is considered has a medium risk of liquefaction under strong earthquake, and likely classified as Class F which required site specific spectrum analysis.

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However, due to light loading nature of a steel gate structure, and the gate locations are underlain with 3 m. of dense SAND and Gravel FILL, it can be re-classified as **Class E for soft soil** in accordance to Table 4.1.8.4 A of BC Building Code 2012

Peak Ground Acceleration (PGA) and Spectrum acceleration for 2% probability of exceedance in 50 years can be obtained from Resource Canada for a **Class C** site in NBCC 2015 as follow:

Site Co-ordinate: Longitude 49.264^{o} North, Longitude 121.834^{o} West

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	Sa(5.0)	Sa(10.0)	PGA
0.465 g.	0.390 g.	0.248 g.	0.158 g.	0.058 g.	0.020 g.	0.209 g.

A copy of the search result from Resource Canada is enclosed in Appendix B - Seismic Design Criteria for ease of reference.

For seismic design for a Class E Site, the following Fa and Fv values are interoperated from Table 4.1.84 B and 4.1.8.4 C respectively from Building Code.

	Sa (0.2)	Sa (0.2)	Sa (0.2)
	0.25 g.	0.5 g.	0.465 g.
Fa	2.1	1.4	**1.50**

	Sa (1.0)	Sa (1.0)	Sa (1.0)
	0.2 g.	0.3 g.	0.248 g.
Fv	2.0	1.9	**1.95**

Based on the linear interpretation, of the obtained Fa and Fv respectively are 1.50 and 1.95 for **Class E** site.

Seismic Bearing Capacity can be taken for a $^{1}/_{3}$ increase of ultimate bearing capacity (in this case 160 KPa) with anticipation of short duration of Earth Quake.

Liquefaction of the site is likely due the presence of liquefiable SAND below the PEAT in shallow depth. The dense SAND and Gravel above the loose SAND will prevent punching shear failure of the gates and gate footing under liquefaction. Post liquefaction horizontal movement will likely within 1 m. at area with Colluvium soil near the

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mountain toe. Post earthquake horizontal movement will exceeding 1m, or up to 2 m. at area with the presence of PEAT immediate below the SAND and Gravel FILL.

8.0 GEOTECHNICAL ENGINEERING FIELD REVIEW

JECTH Consultants Inc. will provide Field Review (Geotechnical Engineering) according to the 2012 BC Building Code and Letter of Assurance (Schedule "B") as well as municipality requirements.

The following general field reviews (Require 48 hour notification) are required prior to and during construction stage (see also Appendix "D" - Standard Geotechnical Inspection Requirements).

The general contractor or PWGSC must inform JECTH Consultants Inc for site inspection as required by Local Municipality for the followings:

- Temporary Construction Drainage (if required)
- Foundation Bearing Capacity (confirmation and Certification)
- Compaction of Structural FILL.
- Perimeter backfill (Material requirements, compaction and Drainage)
- Other site inspections as specified in BC Building Code 2012
- Unforeseen subsurface soil and groundwater conditions as encountered prior to, during and after construction stage.

Other Geotechnical Engineering technical requirements and in-situ testing will be performed by certified laboratory/testing company and will be reviewed by JECTH Consultants Inc. during construction stage.

Specific Site Geotechnical Engineering issues must be addressed by JECTH Consultants Inc. prior to and during construction stage.

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9.0 FINAL FOUNDATION DESIGN REVIEW

JECTH Consultants Inc. should be given an opportunity to review the followings:

1. The detail and final Structural Engineering Drawing must be reviewed by JECTH Consultants Inc. prior to Building Permit Application such that the above comments and recommendations can be confirmed and modified.

2. Any other Electrical and Mechanical as well as Civil Engineering and Landscape Architect Drawings, if likely affect the foundation design and construction, must be reviewed and approved by JECTH Consultants Inc.

3. A consultant coordination meeting must be arranged prior to Building Permit Application or prior to construction start such that all design team members can confirm all design parameters for the project.

4. JECTH Consultants Inc. will review the exposed subsurface soil and groundwater conditions prior to and during construction stage. It is possible that the Geotechnical recommendations provided in this report be modified due to unforeseen circumstances and change in subsurface soil as well as groundwater condition.

10.0 FIELD INSPECTIONS AND PRE-CONSTRUCTION MEETING

A pre-construction meeting must be organized between the site superintendent/contractor representatives and JECTH Consultants Inc. at a minimum of two weeks before **any site construction activities** such that appropriate field work can be carried out.

JECTH Consultants Inc. must be notified (48 hours) of all fieldwork prior to any site work in particular before site clearing, stripping and preparation. This will allow JECTH Consultants Inc. to provide final comments for the project with respect to Geotechnical Engineering.

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APPENDIX D

Geotechnical Engineering Review and Assessment: (Mission Institution)
Appendix a: Mission Institution - Gates 12, 13 & 14
Appendix b: Mission Institution - Seismic Design Criteria
Appendix c: Mission Institution - Soil Logs from AMEC Wheeler Forster Envir/Infra
Appendix d: Mission Institution - Standard Field Inspection Requirements

JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "A"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MISSION INSTITUTION
8751 STAVE LAKE STREET, MISSION, BC

GATES NO. 12, 13 & 14 PLAN AND DETAIL
(MISSION INSTITUTION)

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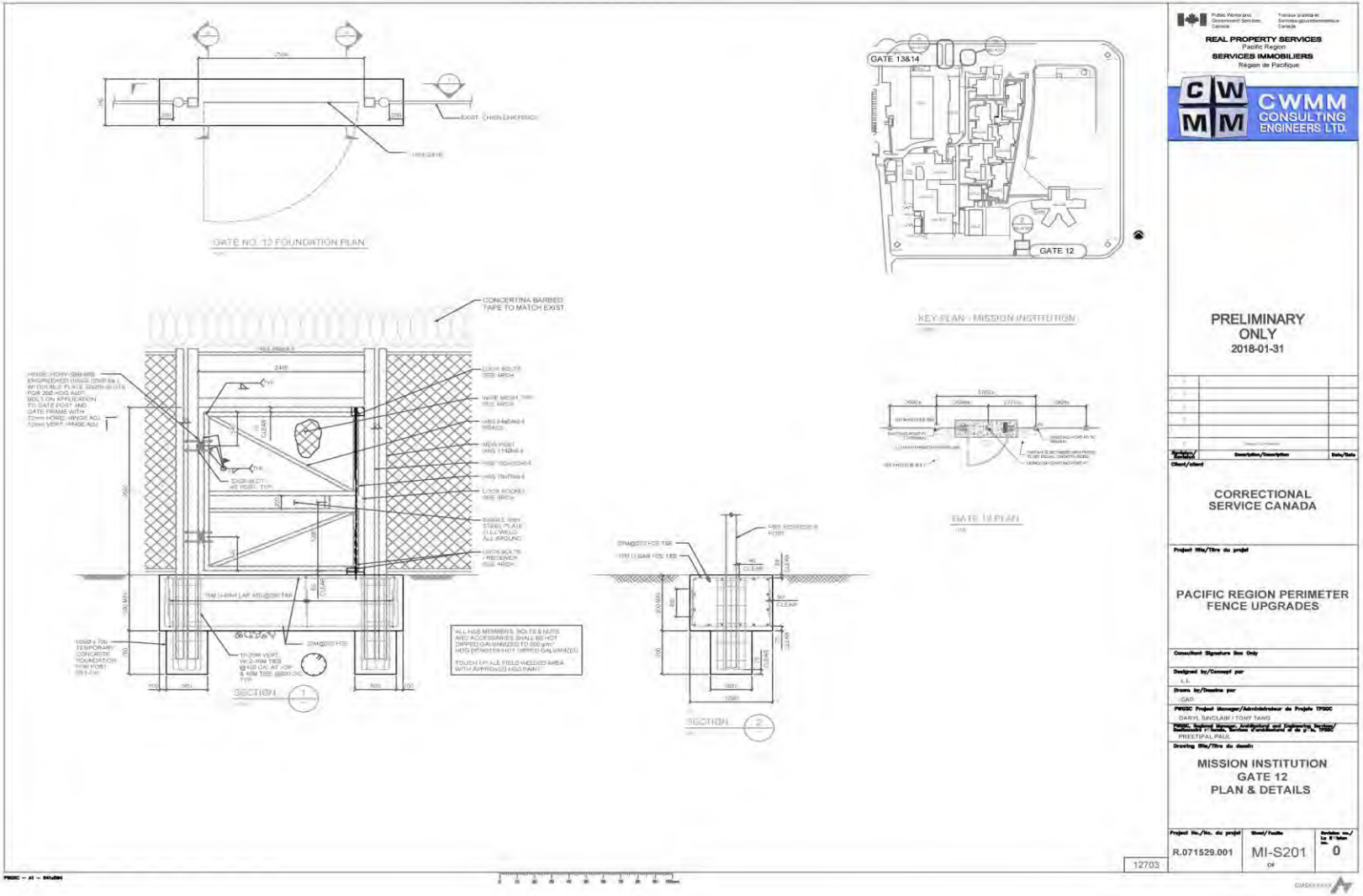
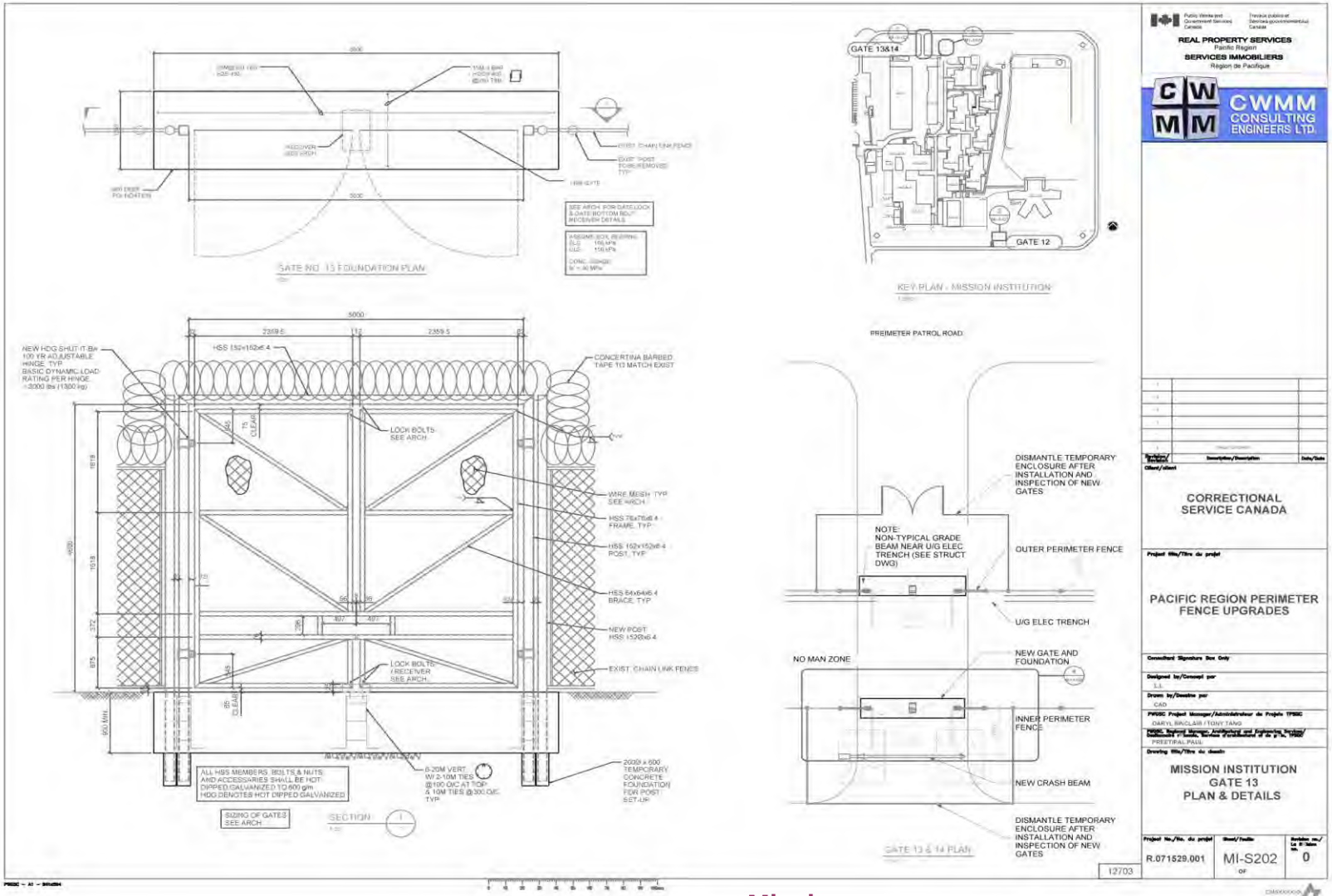


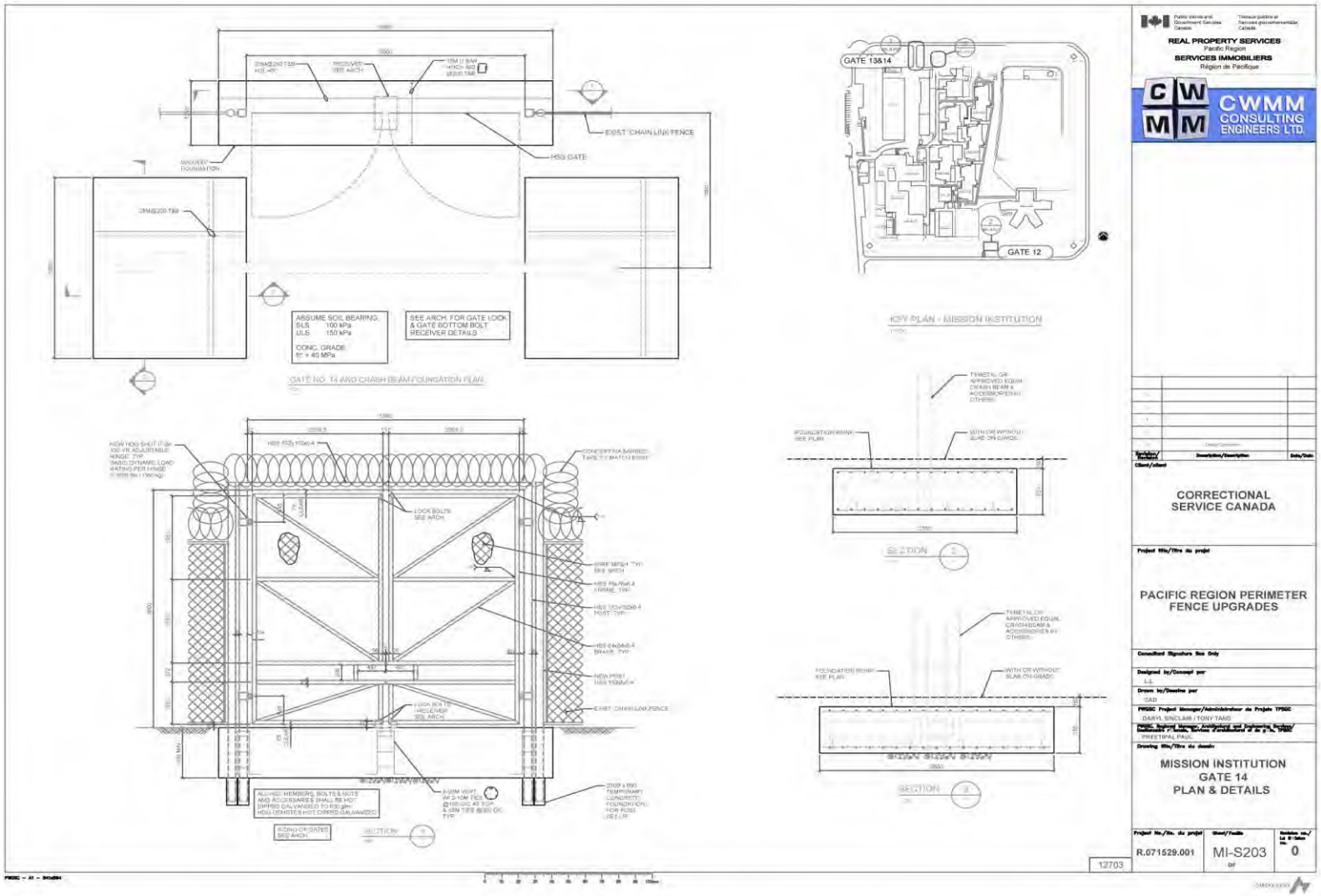
Mission

JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 12 Plan and Detail (~~Mountain~~ Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Mission Institution, 8751 Stave Lake Street, Mission, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555C – Appendix "A"	



Mission

JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 13 Plan and Detail (~~Mountain~~ Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Mission Institution, 8751 Stave Lake Street, Mission, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555C – Appendix "A"	



Mission

JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 14 Plan and Detail (~~Mountain~~ Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Mission Institution, 8751 Stave Lake Street, Mission, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555C – Appendix "A"	

JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "B"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MISSION INSTITUTION
8751 STAVE LAKE STREET, MISSION, BC

SEISMIC DESIGN CRITERIA

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 franç ais (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

November 08, 2018

Site: 49.1641 N, 122.2855 W User File Reference: Mission Institution

Requested by: , Jecth Consultants

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.335	0.507	**0.634**	0.620	**0.541**	**0.323**	**0.201**	**0.068**	**0.024**	**0.279**	**0.413**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.074	0.165	0.229
Sa(0.1)	0.113	0.252	0.349
Sa(0.2)	0.147	0.323	0.444
Sa(0.3)	0.147	0.321	0.438
Sa(0.5)	0.121	0.276	0.380
Sa(1.0)	0.064	0.155	0.221
Sa(2.0)	0.035	0.091	0.134
Sa(5.0)	0.0081	0.024	0.040
Sa(10.0)	0.0031	0.0086	0.014
PGA	0.062	0.140	0.194
PGV	0.074	0.190	0.277

References

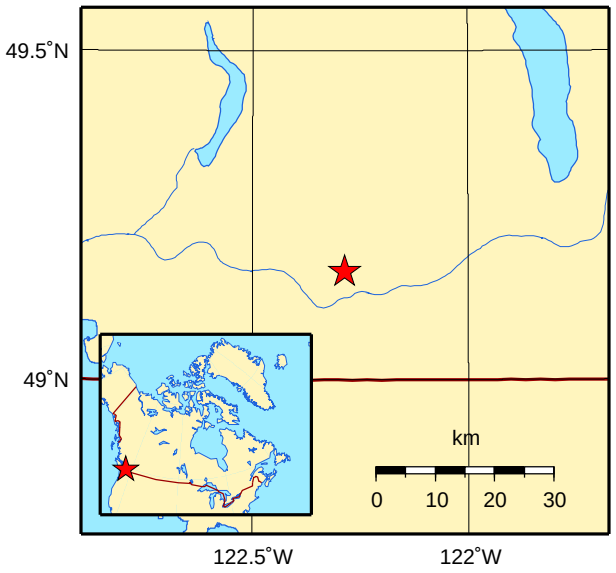
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "C"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
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8751 STAVE LAKE STREET, MISSION, BC

SOIL LOGS FROM AMEC WHEELER FORSTER ENVIRONMENT & INFRASTRUCTURE

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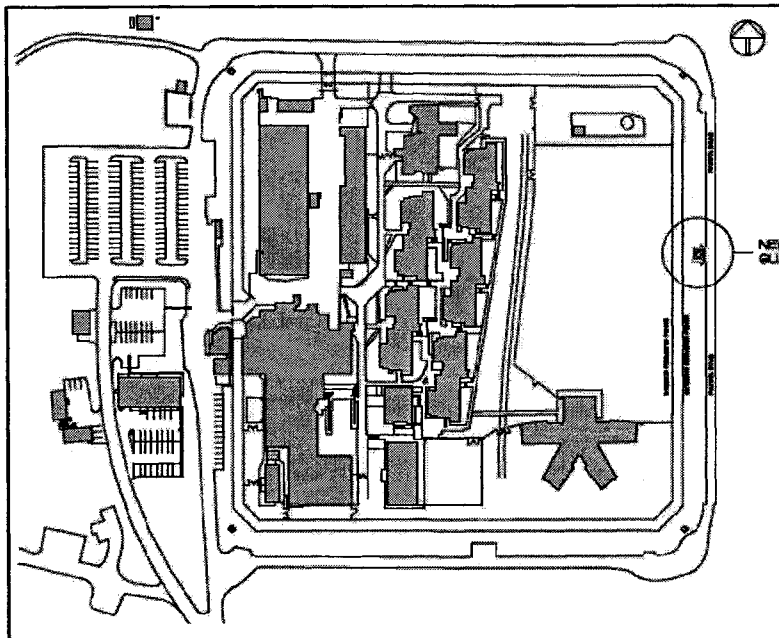
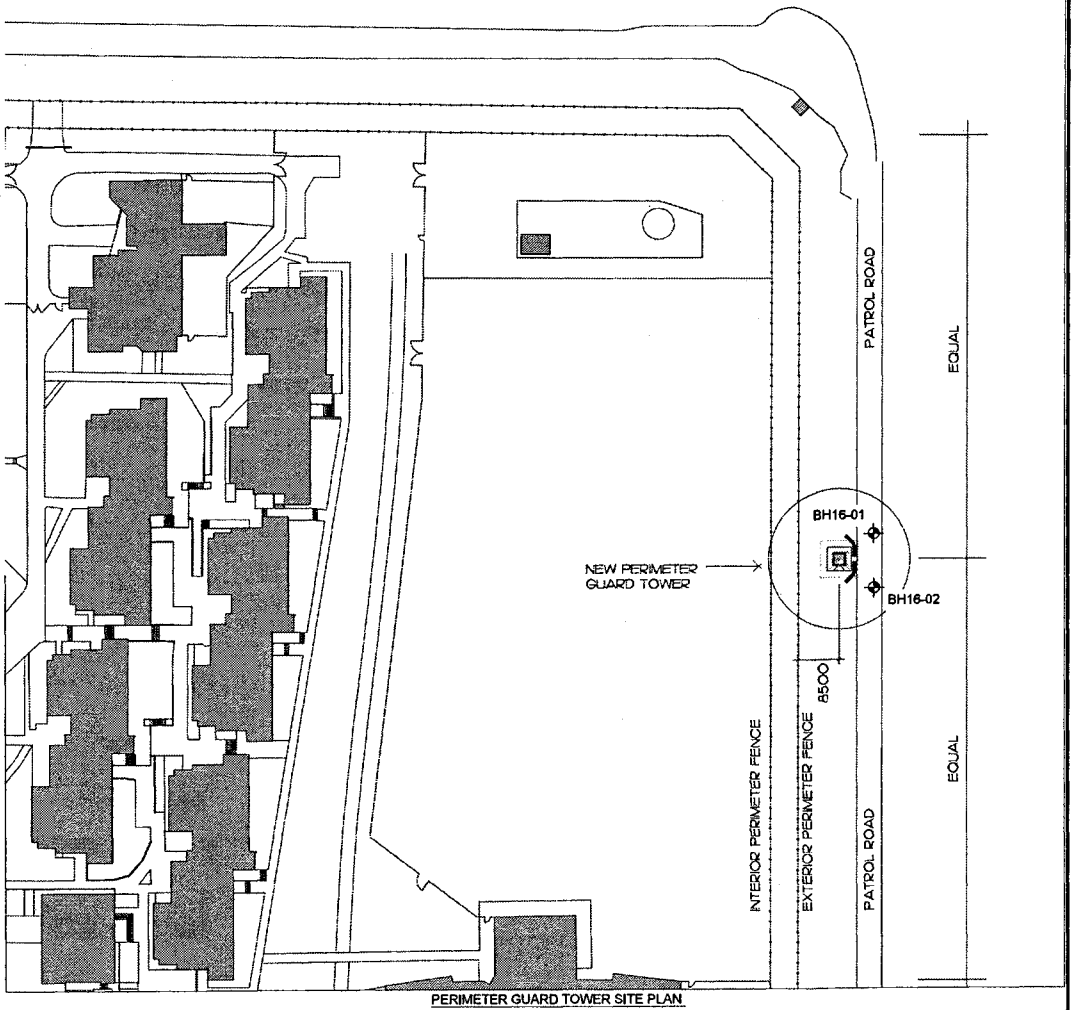


MISSION INSTITUTE SITE PLAN
NTS



PERIMETER GUARD TOWER SITE PLAN
1:1000

LEGEND

APPROXIMATE LOCATION OF BOREHOLE

NOTE:
SOURCES: DWG R.079746.001, ARCHITECTURAL AND SITE 201-12-04
DRAWING DETAILS SHOWN ARE APPROXIMATE ONLY

amec foster wheeler
Environment & Infrastructure

CLIENT AND LOGO:
PUBLIC WORKS & GOVERNMENT SERVICES CANADA

Amec Foster Wheeler
Environment & Infrastructure
Unit 110, 18568 - 96 Avenue, Surrey, BC V4N 3P9
Tel. 1-604-295-8657 Fax 1-604-295-8658

DWN BY:	EDS
CHK'D BY:	RF
DATUM:	NAD 83
PROJECTION:	UTM Zone 10U
SCALE:	AS SHOWN

PROJECT: GEOTECHNICAL ASSESSMENT
MISSION MEDIUM INSTITUTION
MISSION, BC

TITLE: BOREHOLE LOCATION PLAN

DATE:	MAR 2016
PROJECT NO:	KA21139.100
REV. NO:	A
FIGURE NO:	02

C:\Users\enzo.dalsanto\Documents\- Projects Current\KA21139 Mission-Mountain Guard Towers\Drafting\CAD\KA21139.100-02.dwg - 02 - Mar. 21, 2016 6:04pm - enzo.dalsanto

BOREHOLE BH16-01

STARTED: 03/03/2016 **FINISHED:** 03/03/2016

METHOD: Continous Flight Auger

LOCATION: Coords & elevation based on Google Earth Imagery

COORDINATES (m): N 5445976 E 552003

DEPTH (m)	DEPTH Elev. 141 m+/-	DESCRIPTION OF MATERIALS
	0.5	FILL- Asphalt (50mm+/-) over, sand, some gravel, trace silt, compact, moist, light brown
	140.5	TOPSOIL (buried), organic silt, sandy, firm, dark brown
	0.5 / 140.5	**SILT**, trace to some clay & fine sand, firm to soft, moist to wet, grey/brown - low plasticity
	1.5	
	139.5	silty SAND/sandy SILT, trace gravel, compact, moist-wet, grey trace brown - non plastic
	4.0	
	137.0	GLACIAL TILL, silty sand, some gravel, dense to very dense, moist, grey
	4.6	
	136.4	End of Borehole - Auger Refusal

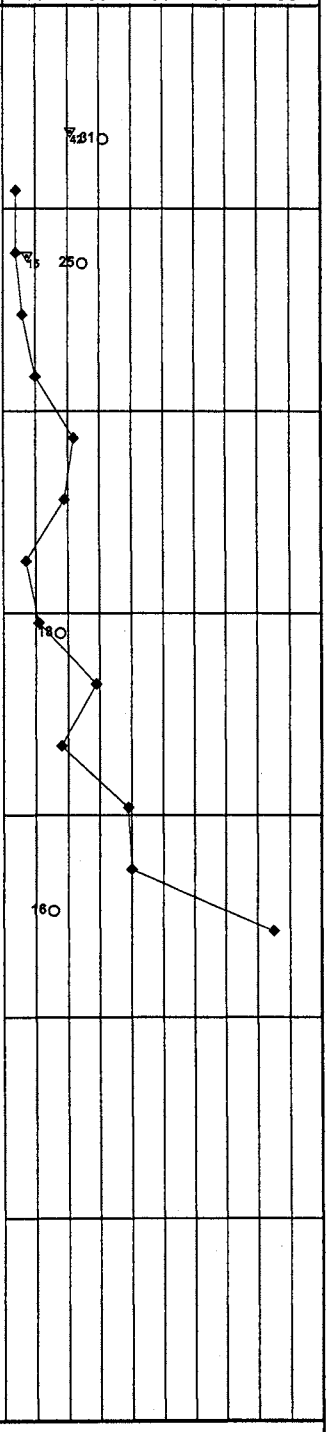
SPT BLOWS PER 152mm | % Fines < No. 200 | SAMPLE TYPE AND NUMBER | SYMBOL | WELL INSTALLTION DETAILS

Su (kPa): 20 60 100 140 180

FIELD VANE PEAK ▲ P PEN/2 ⊙ TORVANE ▽

■ SPT N ◆ DCPT N Blows/0.3 m

W_P% W% W_L%: 10 30 50 70 90



N-GEO-CONVERT-COORD-AFW-TORVANE-BH KA21139.100.MISSION BH LOG.V01.GPJ ALL-1.GDT 5/19/16

amec foster wheeler

AMEC FOSTER WHEELER
Environment & Infrastructure
18568 - 96 Avenue, Unit 110
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21139.100

PROJECT: Proposed New Guard Tower

LOCATION: Mission Institute, Mission, BC

LOGGED BY: EDS **REVIEWED BY:** RF

SHEET 1 OF 1 **BOREHOLE No. BH16-01**

BOREHOLE BH16-02

STARTED: 03/03/2016 **FINISHED:** 03/03/2016

METHOD: Continous Flight Auger

LOCATION: Coords & elevation based on Google Earth Imagery

COORDINATES (m): N 5445971 E 552003

DEPTH (m)	SPT BLOWS PER 152mm	% Fines < No. 200	SAMPLE TYPE AND NUMBER	SYMBOL	DEPTH Elev. 141 m+/-	DESCRIPTION OF MATERIALS
					0.4	FILL- Asphalt (50mm+/-) over, sand, some gravel, trace silt, compact, moist, light brown
					140.6	FILL- silty sand to silt, compact/stiff, moist to wet, brown
					0.7	
					140.3	TOPSOIL (buried), organic silt, sandy, firm, dark brown
					0.8	
					140.2	SILT, trace clay & organic inclusion, soft to very soft, wet, grey/brown - low plasticity
					1.7	
	wh 2 1 2				139.3	SILT, clayey, low plasticity, soft, wet, grey - low plasticity
					2.3	
					138.7	silty SAND/sandy SILT, trace gravel, compact, wet, grey trace brown - non plastic
	10 13 11 29	40.2				
	9 14 16 26				5.0	
					136.0	GLACIAL TILL, silty sand, some gravel, dense to very dense, moist, grey - weathered stone last 100mm of SPT
		26.9				
	30 61 R				6.4	- (R) effective SPT refusal
					134.6	End of Borehole - Auger Refusal

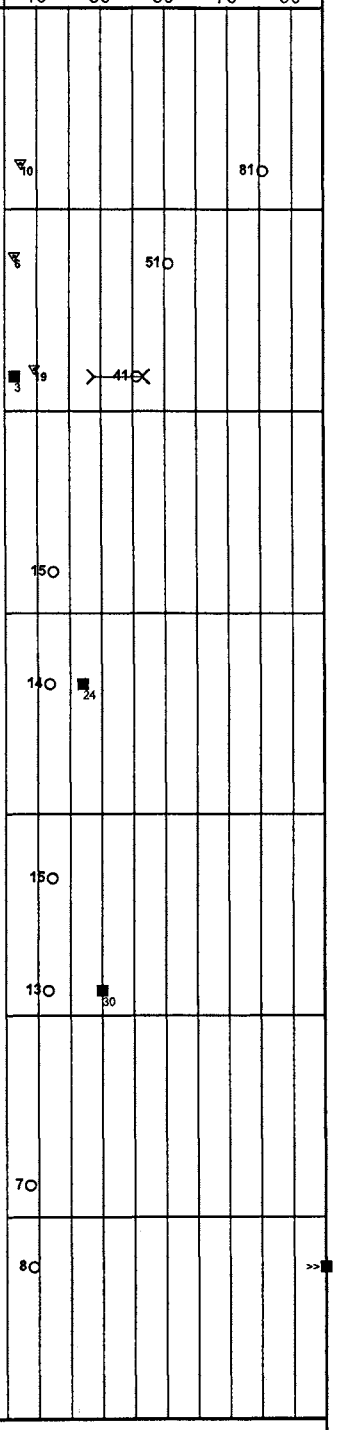
WELL INSTALLATION DETAILS

Su (kPa): 20 60 100 140 180

FIELD VANE PEAK ▲ P PEN/2 ⊙ TORVANE ▽

■ SPT N ◆ DCPT N Blows/0.3 m

W_P% W% W_L%: 10 30 50 70 90



amec foster wheeler

AMEC FOSTER WHEELER
Environment & Infrastructure
18568 - 96 Avenue, Unit 110
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21139.100

PROJECT: Proposed New Guard Tower

LOCATION: Mission Institute, Mission, BC

LOGGED BY: EDS **REVIEWED BY:** RF

SHEET 1 OF 1 **BOREHOLE No. BH16-02**

N-GEO-CONVERT-COORD-AFW-TORVANE-BH KA21139.100.MISSION BH LOG.V01.GPJ ALL-1.GDT 5/19/16

JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "D"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MISSION INSTITUTION
8751 STAVE LAKE STREET, MISSION, BC

STANDARD FIELD INSPECTION REQUIREMENTS

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

Geotechnical Engineering Field Review and Inspection Requirements
BC Building Code 2012

Based on the BC Building Code 2012, the following Design and field review must be completed by JECTH Consultants Inc. (Geotechnical in Record, **GIR)** such that Letter of Compliance (Schedule "C") required by local municipality for Occupancy Permit can be issued.

7.0 Geotechnical - Temporary

7.1 Excavation

7.1.1 Foundation

Excavation depth more than 4 ft. must be certified by GIR as required by WorkSafe BC ☐

7.1.2 Buildings and Structures

Buildings and Structures within the 1H:1V stress influence line from the bottom of Excavation must be reviewed and approved by GIR ☐

7.1.3 Trench

Excavation for underground utilities for depth more than 4 ft. must be reviewed and approved by GIR ☐

7.1.4 Underground Utilities

All underground utilities (both on-site and off-site) within and along the site perimeter must be identified both on drawing and physical on site prior to any foundation excavation and slope excavation. ☐

7.2 Shoring

7.2.1 Vertical Shoring

Vertical Shoring must be design by GIR to ensure excavation perimeter is stable during foundation excavation before placement of perimeter backfill. ☐

7.2.2 Temporary Shoring

Temporary Shoring such as sheetpile and shotcrete with tie back anchors or other vertical features must be inspected by GIR ☐

7.2.3 Shoring Method

Shoring method such as sheetpile and shotcrete with tie-back anchors wall must be carried out under the supervision of GIR ☐

7.2.4 Underground Utilities

All underground utilities (both on-site and off-site) within and along the site perimeter must be identified both on drawing and physical on site prior to any foundation excavation and shoring work. ☐

7.3 Underpinning

7.3.1 Pre-Excavation

Pre-excavation inspection and Review must be conducted by both Structural and Geotechnical Engineers (both Geotechnical Engineers from the adjacent structures and GIR) prior to underpinning excavation. ☐

7.3.2 Monitoring Survey

Survey monitoring points must be installed at the underpinning building(s) and/any movement sensitive Structural Component before foundation excavation. The survey monitoring system must be conducted prior to any site activities and submit to GIR. ☐

7.3.3 Structural Inspection

Structural Inspection and photographs must be carried out prior to foundation excavation for future records and reference by Structural Engineer retained by either owner of adjacent property or subject property owner. ☐

7.4 Temporary Construction Dewatering

7.4.1 Perched groundwater and Surface Drainage

For perched groundwater and surface Drainage by precipitation, conventional pump can be used to maintain the site in relatively dry condition. □

7.4.2 Well point

Well point and other measure of temporary dewatering will be required if high groundwater level (actual ground water table) is encountered □

8.0 Geotechnical - Permanent

8.1 Bearing Capacity of Foundation Subgrade Soil ☐

8.1.1 Foundation Subgrade Excavation

Review exposed foundation subgrade excavation and ensure that all remove all unsuitable soil/material until suitable bearing subgrade is exposed ☐

8.1.2 Foundation Subgrade Protection

In the event that the exposed foundation subgrade soil is sensitive to moisture, foundation subgrade might be protected by a layer granular soil such as crushed gravel due to wet condition and construction traffic. A lean concrete can be used instead of crushed gravel. ☐

8.1.3 Structural FILL

Review Structural Fill if over-excavated or raise of grade is required. Compaction Density test must be conducted by Certified Laboratory and submit to GIR. ☐

8.2 Geotechnical - Deep Foundation

8.2.1 Piling Inspection

Full time piling inspection such as timber and steel pile etc must be conducted by GIR. All piling record for refusal must be available to review such that the pile capacity can be certified. ☐

8.2.2 Sheetpile Installation

Sheetpile installation as temporary / permanent support must be installed and inspected by Geotechnical Engineer ☐

8.3 Engineering FILL

8.3.1 Structural FILL

Structural Fill (imported or non-native material) at and below the proposed foundation elevation must be compacted to density as specified by GIR and must be certified by qualified soil laboratory / testing company ☐

8.3.2 Underslab FILL

Underslab fill density must also be tested prior to placement of slab-on-grade concrete to the specified density as required by GIR. ☐

8.4 Slope Stability and Seismic Load

8.4.1 Slope Stability

Evaluate the slope stability along the site and building perimeter for both seismic and static design conditions according to APEBC Guidelines dated November 2010. ☐

8.4.2 Subsurface Stability

Subsurface stability under seismic condition such as densification specified by GIR and tieing of footing structurally must be accommodated by Structural Engineer in Record ☐

8.4.3 Seismic Design Criteria

The acceleration velocity design must be based on Nation Resources of Canada Seismic Hazard Criteria. ☐

8.5 Backfill

8.5.1 Backfill Material

Backfill material for foundation perimeter must be well drained granular soil, such as crushed gravel with waterproof membrane for below grade structure ☐

8.5.2 Sensitive Structure

If sensitive structure is founded on the Backfill material such as Sand and Gravel compaction density as specified by GIR of the backfill material must be tested by certified testing company ☐

8.6 Permanent Dewatering

8.6.1 Foundation Drainage

For convention foundation drainage, perforated PVC pipe will be used to collect any surface gravity drained to city's storm system migrated and natural groundwater to a sump then ☐

8.6.2 Storm System

If City's storm system is higher than the sump elevation, pumping system must be installed with dual-pump and alarm system and may be with backup generator when power is unavailable during adverse conditions. Mechanical and Civil Engineer must be retained to design the system. ☐

8.6.3 Perforated Drainage

Underslab perforated drainage perforated PVC will be installed to improve the foundation drainage if groundwater table is higher than the slab elevation either seasonally or permanently ☐

8.6.4 Tanking

Tanking is also an option when the pumping system might not be capable to drain all below groundwater or foundation drainage system is not installed. Envelop Consultants must be retained for this option ☐

8.6.5 Retention Tank

Retention Tank with control valve may be required due to City's storm system limitation. Civil Engineer must be retained. ☐

8.7 Permanent Underpinning

8.7.1 Underpinning Loading

All underpinning loading must be reviewed and approved by Structural Engineer and GIR. ☐

8.7.2 Separation and Drainage

Bond separation and drainage (above and below grade) at the interface of the underpinning area must be reviewed to ensure no water migrate to the underpinning structure. Envelop Consultant must be retained. ☐

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT
PROPOSED PERIMETER FENCE AND GATES UPGRADES

AT
MISSION INSTITUTION
8751 STAVE LAKE STREET
MISSION, BC

FOR

CWMM CONSULTING ENGINEERS LTD.

PREPARED BY

JECTH CONSULTANTS INC.

JOB NO.: 218C555C

DATE: NOVEMBER 30, 2018

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT PROPOSED PERIMETER FENCE AND GATES UPGRADES MISSION INSTITUTION, 8751 STAVE LAKE STREET, MISSION, BC

1.0 INTRODUCTION

1.1 AUTHORIZATION

As authorized by CWMM Consulting Engineers Ltd. on October 22, 2018, JECTH Consultants Inc. (JCI) has carried out a Geotechnical Engineering Review and Assessment for the proposed Perimeter Fence and Gates Upgrade project, Mountain Institution which is located at 8751 Stave Lake Streeet, Mission, BC as shown in Figure MI 01 – Site Location Plan.

1.2 METHODOLOGY

The Geotechnical Engineering Assessment and Review includes:

- Reviewed of available Structural Plan for the Gates
- Obtained the Surficial Geological Map from Geological Canada.
- Reviewed available Geotechnical Report for a Guard Tower construction at the Mission Institution.
- Conducted a site reconnaissance by our site staff at the subject site.
- Assessed the available subsurface soil conditions and profile based on desktop review and our local experience within the close vicinity of the subject site.
- Communicated with Institution staff and Structural Engineer.
- This report is prepared according to JECTH Consultants Inc. Proposal P218 -551 dated October 10, 2018.

1.3 OBJECTIVE

This Geotechnical Engineering Report summarizes our findings and provides Geotechnical Engineering Comments and Recommendations for the foundation design and construction of the Gates and Fence upgrade for existing perimeter security fences of the Institution Compound.

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1.4 DESIGN DRAWING

This report is prepared based on the Design Drawings prepared by CWMM which received by our office on October 9, 2018. Any revision of the plan must be informed to JECTH Consultants Inc.

3.0 SITE LOCATION AND CONDITION

The Mission Institution is located at about 500 m. west to Steve Lake Street near the intersection between Stave Lake Street and Dewdney Trunk Road in Mission, BC. as shown in Figure MI 01 – Site Location Plan. It is bounded by Steve Lake Street to the east, and an access Road both to the west and South.

The institution compound is situated on a slightly sloping topography with sloping down from North West to South East direction with a drop of gradient at about 2%. The building area within the Institution compound is on the higher ground at western portion of Site. The area is believed constructed by FILL to create a level ground for most of the buildings. Football fields and a single building complex are situated at lower ground at eastern portion of Site.

The Institution can be accessed by an access road with entrance from both Stave Lake Street from the west and Ferndale Avenue from the north. The institution is surrounded with perimeter fences. Utility buildings and car parks outside the security fences are situated at the west of the compound.

A site reconnaissance was taken on November, 2018 around the perimeter security fences by our site staff. The reconnaissance at the proposed gates upgrade locations and local nearby area indicate there is no apparent subsidence of ground, nor any distress of asphalt surface along the surrounding access road. Water can be observed at a ditch beside an access road surrounding the compound.

The perimeter fence is a double fence system with an outer and inner fence for security purpose. Gravel is observed at a corridor between the fences.

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4.0 PROPOSED GATES UPGRADE

Based on a Site Plan supplied by CWMM Consulting Engineers as shown in Figure MI 03, there will be 3 nos. of gates to be installed around the existing perimeter fences. The gates are either new gates, or replace existing gates as an upgrade as listed in the following:

Gate No.	Location	Gate Usage
12	South Perimeter	Maintenance Vehicle
13	North Perimeter	Emergency Vehicle
14	North Perimeter	Emergency Vehicle

The structural details of the Gates are enclosed in Appendix "A" – Gates Upgrade for Mission Institution for ease of reference.

Gates for vehicle passage will have foundation design for transient vehicle load from Trucks and Fire Trucks. JCI estimate an equivalent surcharge load of 15 KPa for vehicle loading will be sufficient for the transient live load design.

5.0 SUBSURFACE SOIL CONDITIONS

Based on available Geological Map as shown in MI 02 – Geological Map, the Mission Institution is situated in between 2 geological formation namely Suma Drifts (Sf) deposit and Salish Sediments. The former is a glacial deposit composed of dense Silty SAND (Till-like Soil). The later is localized Bog and Swap deposit formed by shallow lakes at the surface on a plain.

It is anticipated the Institution compound is immediate underlain with shallow presence of Till-like soil. Soft Organic Soil can also be occur if the area is within the geological formation of shallow lake Deposit.

A geotechnical report for a guard tower construction at East Perimeter of the Institution is available for review from Public Work Department (PWGSC). The report for the Guard Tower geotechnical investigation dated June 2, 2016 was issued by Amec, Foster, Wheeler Environmental & Infrastructure who was the geotechnical consultant for the guard tower project.

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The investigation involve 2 nos. of auger holes for foundation investigation for the guard tower. Based on the finding of the report, the following subsurface soil condition were found at the auger hole locations in the following table:

Depth (m)	Soil	Remark
0 - 0.5	Sand FILL	Compact
0.5 - 4	SILT	Soft to firm
4 - 6	Silty SAND (Glacial TILL)	Dense

Groundwater was occurred at 1 m. ± depth below grade within the native soft SILT.

Discussion with PWGSC staff during a Site reconnaissance on November 1, 2018 indicate the construction of a single complex building at South East portion of the Institution compound involve 'digging up soft clay to 12 ft. (4m) and backfill a lot of FILL'. It is believed that the building complex (near Gate 12) is found on FILL which replaced at least 4 m. of soft SILT in the area. Since the previous drilling location is also close to this building complex, the presence of soft SILT overlain dense Till-like Soil can be concluded for the area.

6.0 GEOTECHNICAL FOUNDATION DESIGN

Due to presence of 4 m. thick soft SILT at immediate shallow depth, the Gate Footing have to found on man-made gravel pad which will provide bearing resistance for Gate foundation.

The gate foundation can be conventional shallow stripped and pad footing found on a Structural FILL granular pad composed of compacted 75 mm. minus SAND and Gravel. Depth of the granular pad will be at least 1 m. deeper than the underside of Footing with extent of granular pad at about 1 m beyond the foundation footprint.

An allowable bearing capacity of 50 KPa for SLS design and ultimate bearing capacity of 75 KPa for ULS design are recommended. The minimum depth of footing should be at least 0.5 m. below surface for frost protection. In the case that soil subgrade modulus is used for design of the footing, a modulus subgrade reaction at 4,500 KN / m^3 can be used for the analysis.

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By assume the SILT is already consolidated under the weight of top 0.5 m. SAND in the past and the Gate is a relatively light loading structure, Settlement of the footing will be in the order of 25 mm. Settlement will likely completed during construction period. Differential settlement of the footings will be minimal.

It is recommended that the Structural FILL granular pad to be prepared by compaction 75 mm. minus SAND and Gravel to 100% Standard Proctor Density at the gates location. Groundwater will likely occur during construction. Temporary de-watering will be necessary for the site preparation work of construction of granular pad. Introduction of temporary de-watering sump nearby during granular pad construction is recommended.

7.0 SEISMIC DESIGN

Due to presence of 4 m. non-liquefiable SILT near surface with underlain of dense TILL-like soil, the site is considered low risk to liquefaction and can be classified as Class E with soft soil in accordance to Table 4.1.8.4 A of BC Building Code 2012.

Peak Ground Acceleration (PGA) and Spectrum acceleration for 2% probability of exceedance in 50 years can be obtained from Resource Canada for a **Class C** site in NBCC 2015 as follow:

Site Co-ordinate: Longitude 49.164^{o} North, Longitude 122.289^{o} West

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	Sa(5.0)	Sa(10.0)	PGA
0.634 g.	0.541 g.	0.323 g.	0.201 g.	0.068 g.	0.024 g.	0.279 g.

A copy of the search result from Resource Canada is enclosed in Appendix B - Seismic Design Criteria for ease of reference.

For seismic design for a Class E Site, the following Fa and Fv values are interoperated from Table 4.1.84 B and 4.1.8.4 C respectively from Building Code.

	Sa (0.2)	Sa (0.2)	Sa (0.2)
	0.5g	0.75g.	0.634 g.
Fa	1.4	1.1	**1.24**

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	Sa (1.0)	Sa (1.0)	Sa (1.0)
	0.3 g	0.4 g	0.323 g.
Fv	1.9	1.7	**1.89**

Based on the linear interpretation, of the obtained Fa and Fv respectively are **1.24** and **1.89** for **Class E** site.

Seismic Bearing Capacity can be taken for a $^{1}/_{3}$ increase of ultimate bearing capacity (in this case 100 KPa) with anticipation of short duration of Earthquake event. Liquefaction of the site is unlikely due the presence of non liquefiable SILT in vicinity depth of the proposed gate footings.

8.0 GEOTECHNICAL ENGINEERING FIELD REVIEW

JECTH Consultants Inc. will provide Field Review (Geotechnical Engineering) according to the 2012 BC Building Code and Letter of Assurance (Schedule "B") as well as municipality requirements.

The following general field reviews (Require 48 hour notification) are required prior to and during construction stage (see also Appendix "D" - Standard Geotechnical Inspection Requirements).

The general contractor or PWGSC must inform JECTH Consultants Inc for site inspection as required by Local Municipality for the followings:

- Temporary Construction Drainage (if required)
- Foundation Bearing Capacity (confirmation and Certification)
- Compaction of Structural FILL.
- Perimeter backfill (Material requirements, compaction and Drainage)
- Other site inspections as specified in BC Building Code 2012
- Unforeseen subsurface soil and groundwater conditions as encountered prior to, during and after construction stage.

Other Geotechnical Engineering technical requirements and in-situ testing will be performed by certified laboratory/testing company and will be reviewed by JECTH Consultants Inc. during construction stage.

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Specific Site Geotechnical Engineering issues must be addressed by JECTH Consultants Inc. prior to and during construction stage.

9.0 FINAL FOUNDATION DESIGN REVIEW

JECTH Consultants Inc. should be given an opportunity to review the followings:

1. The detail and final Structural Engineering Drawing must be reviewed by JECTH Consultants Inc. prior to Building Permit Application such that the above comments and recommendations can be confirmed and modified.

2. Any other Electrical and Mechanical as well as Civil Engineering and Landscape Architect Drawings, if likely affect the foundation design and construction, must be reviewed and approved by JECTH Consultants Inc.

3. A consultant coordination meeting must be arranged prior to Building Permit Application or prior to construction start such that all design team members can confirm all design parameters for the project.

4. JECTH Consultants Inc. will review the exposed subsurface soil and groundwater conditions prior to and during construction stage. It is possible that the Geotechnical recommendations provided in this report be modified due to unforeseen circumstances and change in subsurface soil as well as groundwater condition.

12.0 FIELD INSPECTIONS AND PRE-CONSTRUCTION MEETING

A pre-construction meeting must be organized between the site superintendent/contractor representatives and JECTH Consultants Inc. at a minimum of two weeks before **any site construction activities** such that appropriate field work can be carried out.

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JECTH Consultants Inc. must be notified (48 hours) of all fieldwork prior to any site work in particular before site clearing, stripping and preparation. This will allow JECTH Consultants Inc. to provide final comments for the project with respect to Geotechnical Engineering.

13.0 CLOSURE

We trust this report meets your immediate requirements. If you have any questions regarding this report, please do not hesitate to contact the undersigned @ 604-299-6617.

JECTH Consultants Inc.

December 5, 2018

Ivan Chu, P.Eng.

Attachments; List of Figures

Figure MI 01 – Site Location Plan
Figure MI 02 – Geological Map
Figure MI 03 – Site Plan

List of Appendixes

Appendix "A" – Gates No. 12, 13, and 14 Plan and Detail (Mission Institution)
Appendix "B" – Seismic Design Criteria
Appendix "C" – Soil Logs from Amec, Foster, Wheeler Environmental & Infrastructure
Appendix "D" – Standard Field Inspection Requirements

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APPENDIX E

Geotechnical Engineering Review and Assessment: (Mission Institution)
Appendix a: Matsqui Institution - Gates Gates 20, 21, 22, 22A & 44
Appendix b: Matsqui Institution - Seismic Design Criteria
Appendix c: Matsqui Institution
- Soil Logs from AMEC Wheeler Forster Envir/Infra
- Soil Logs from Golder & Assoc.
- Soil Logs from Stantec Consulting
- Soil Logs from Klohn Crippen Berger
Appendix d: Matsqui Institution - Standard Field Inspection Requirements

JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "A"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MATSQUI INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

GATES NO. 20, 21, 22, 22A & 44 PLAN AND DETAIL
(MATSQUI INSTITUTION)

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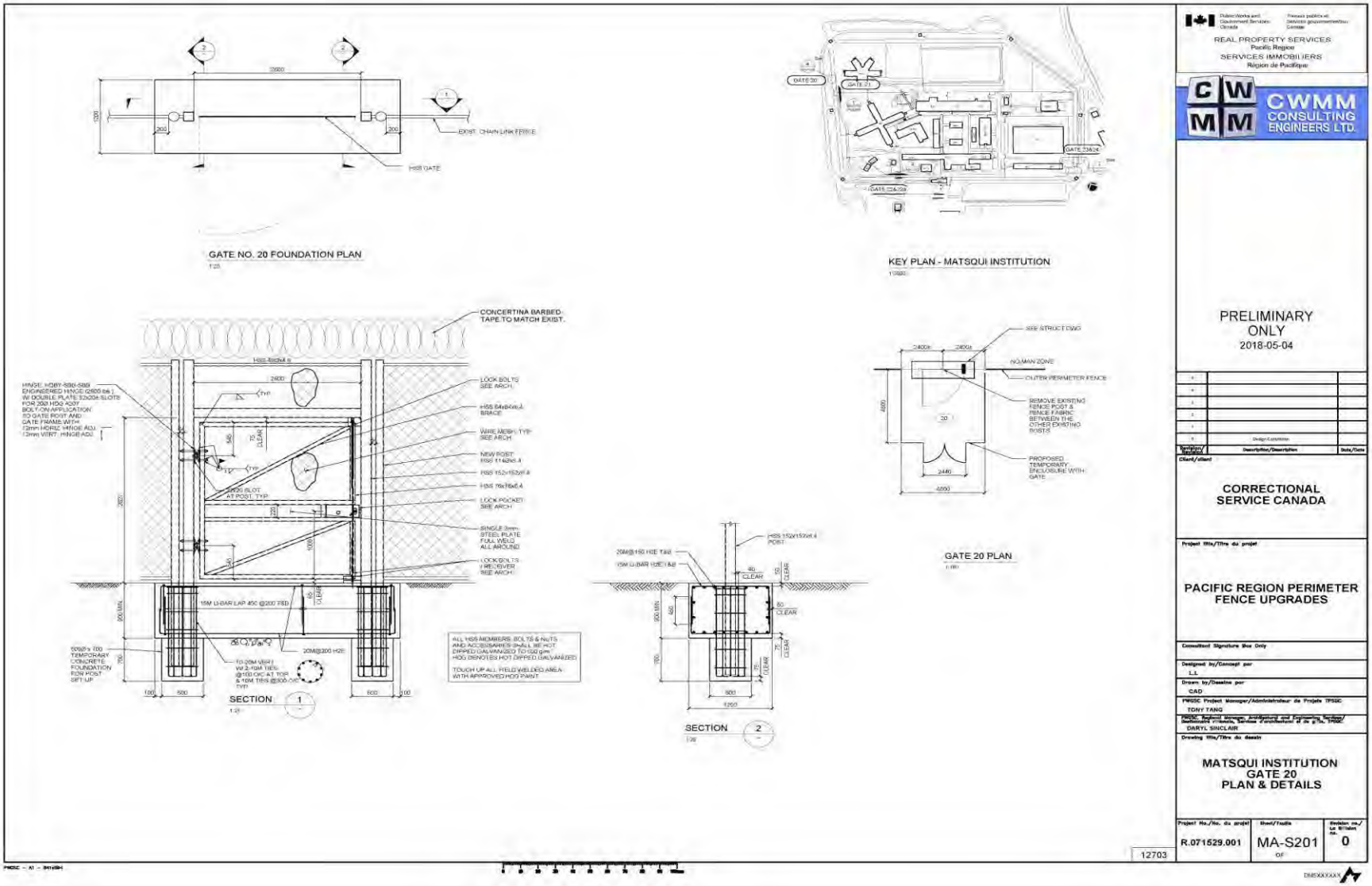
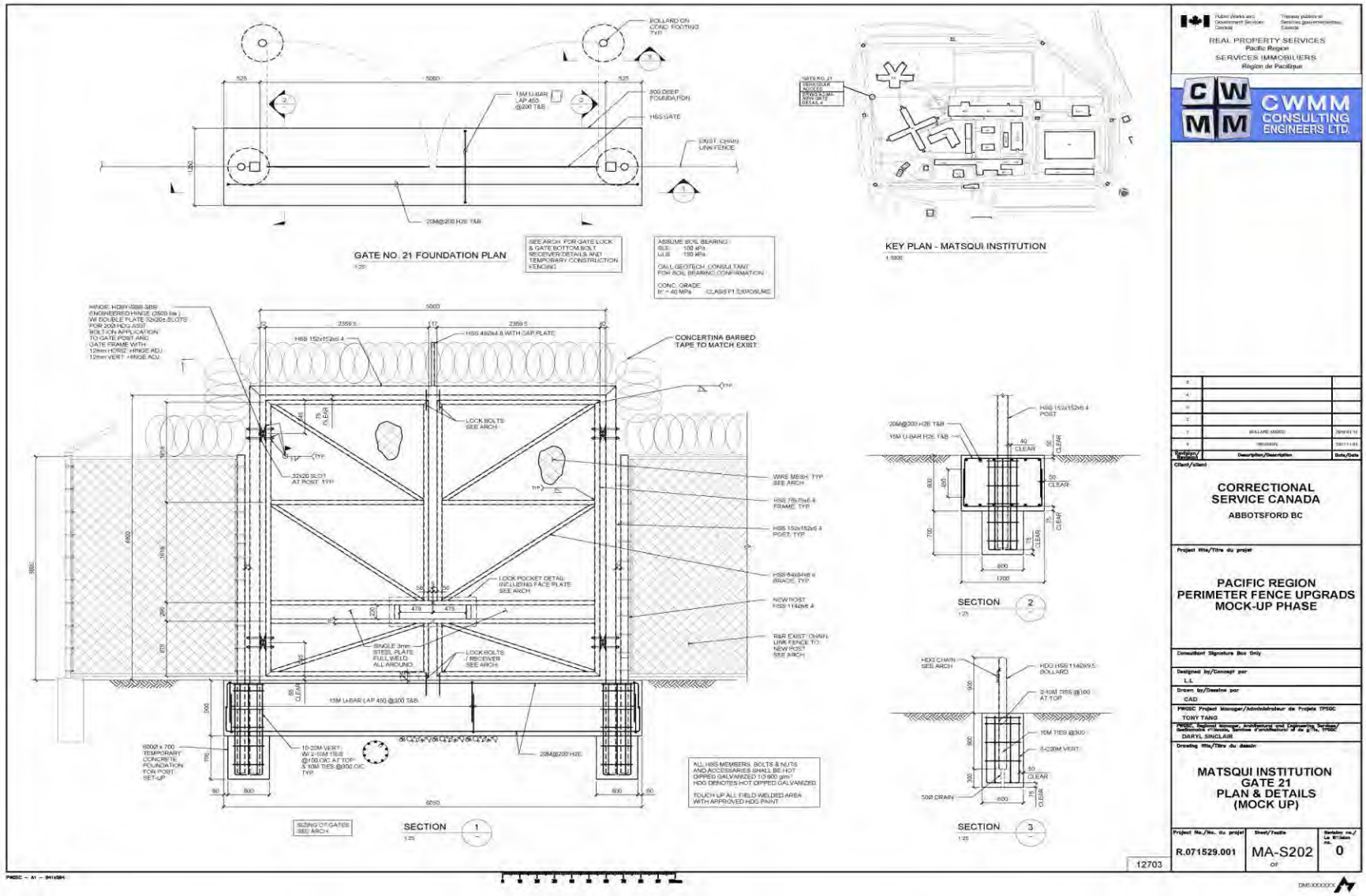


JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 20 Plan and Detail (Matsqui Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Matsqui Institution, 33344 King Road, Abbotsford, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555D – Appendix "A"	



JECTH Consultants Inc.

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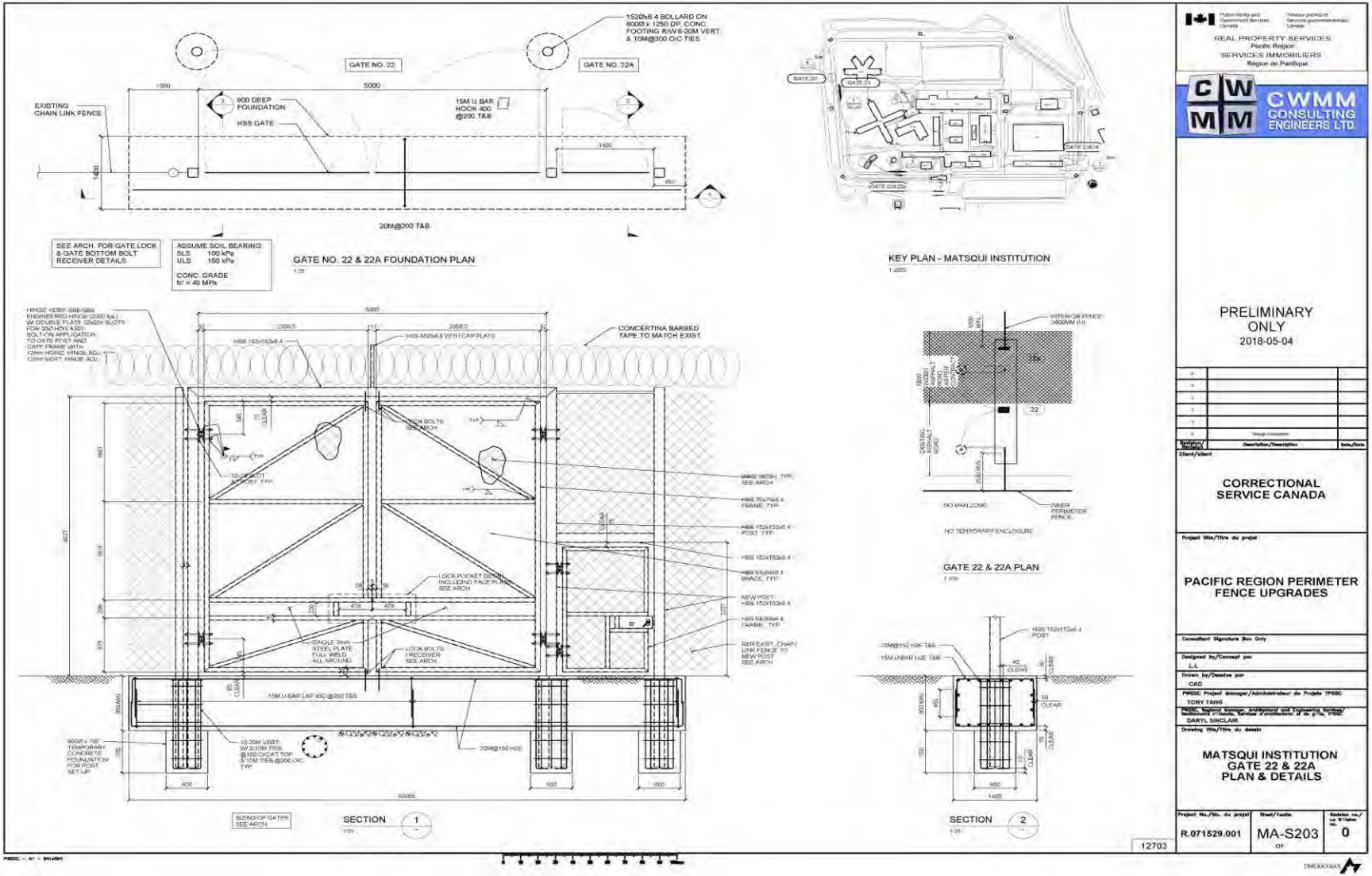
Burnaby, B.C. V5C 6P3

Phone: (604) 299-6617

Gate No. 21 Plan and Detail (Matsqui Institution)
Proposed Perimeter Fence and Gates Upgrades
Matsqui Institution, 33344 King Road, Abbotsford, BC
Client: CWMM Structural Engineers Consulting

Prepared by: FC	SCALE Not to scale
Chk. HKM	Date: Nov. 2018
Dwg. No.: 218C555D – Appendix "A"	



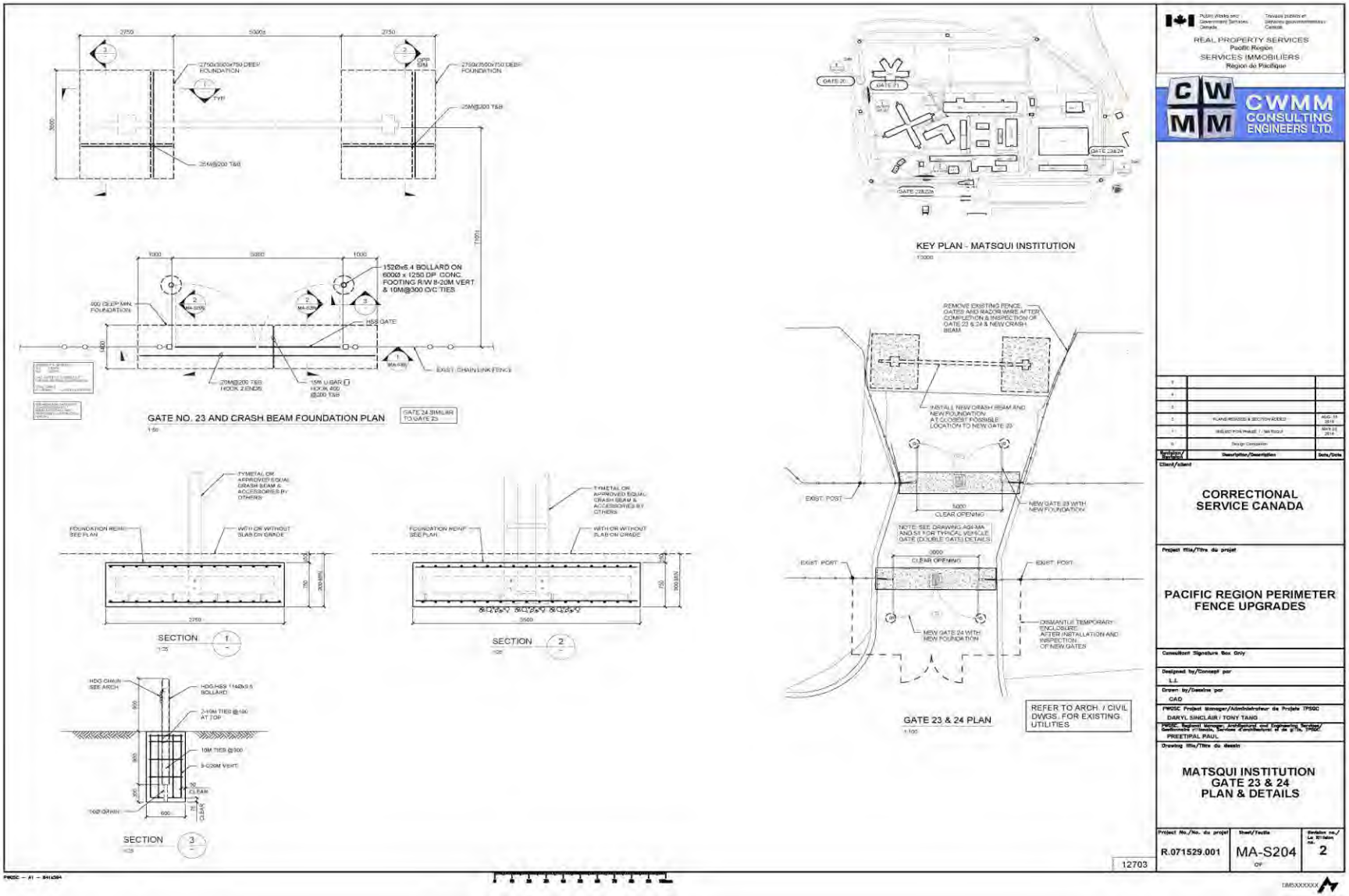
JECTH Consultants Inc.

Suite 208-3823 Henning Drive
Burnaby, B.C. V5C 6P3

Phone: (604) 299-6617

Gate No. 22 & 22A Plan and Detail (Matsqui Institution)
Proposed Perimeter Fence and Gates Upgrades
Matsqui Institution, 33344 King Road, Abbotsford, BC
Client: CWMM Structural Engineers Consulting

Prepared by: FC	SCALE Not to scale
Chk. HKM	Date: Nov. 2018
Dwg. No.: 218C555D – Appendix "A"	



JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 23 & 24 Plan and Detail (Matsqui Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Matsqui Institution, 33344 King Road, Abbotsford, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC SCALE Not to scale Chk. HKM Date: Nov. 2018 Dwg. No.: 218C555D – Appendix "A"

APPENDIX "B"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MATSQUI INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

SEISMIC DESIGN CRITERIA

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

November 09, 2018

Site: 49.0272 N, 122.304 W User File Reference: Matsqui Insitutioin

Requested by: , Jecth Consultants

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.371	0.561	**0.702**	0.685	**0.596**	**0.349**	**0.214**	**0.072**	**0.025**	**0.308**	**0.446**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.083	0.185	0.256
Sa(0.1)	0.128	0.282	0.389
Sa(0.2)	0.164	0.359	0.491
Sa(0.3)	0.163	0.355	0.484
Sa(0.5)	0.133	0.304	0.419
Sa(1.0)	0.069	0.169	0.240
Sa(2.0)	0.038	0.098	0.143
Sa(5.0)	0.0085	0.025	0.042
Sa(10.0)	0.0031	0.0090	0.015
PGA	0.070	0.156	0.215
PGV	0.081	0.207	0.301

References

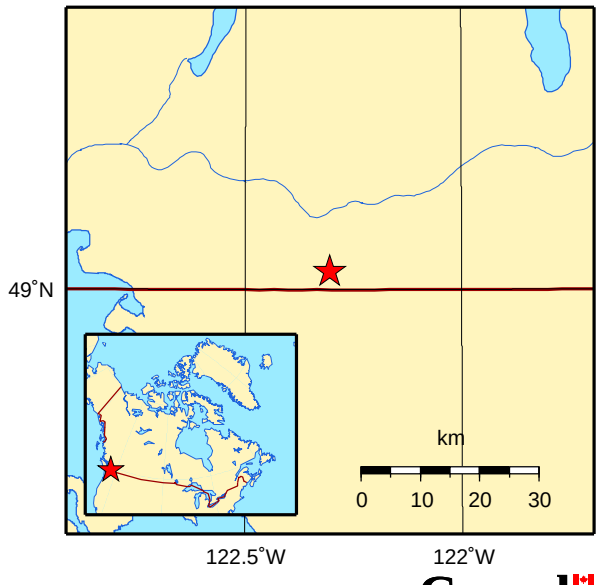
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



Natural Resources Canada Ressources naturelles Canada

Canada

APPENDIX "C"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MATSQUI INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

C1 - SOIL LOGS FROM BRAUN GEOTECHNICAL 2015

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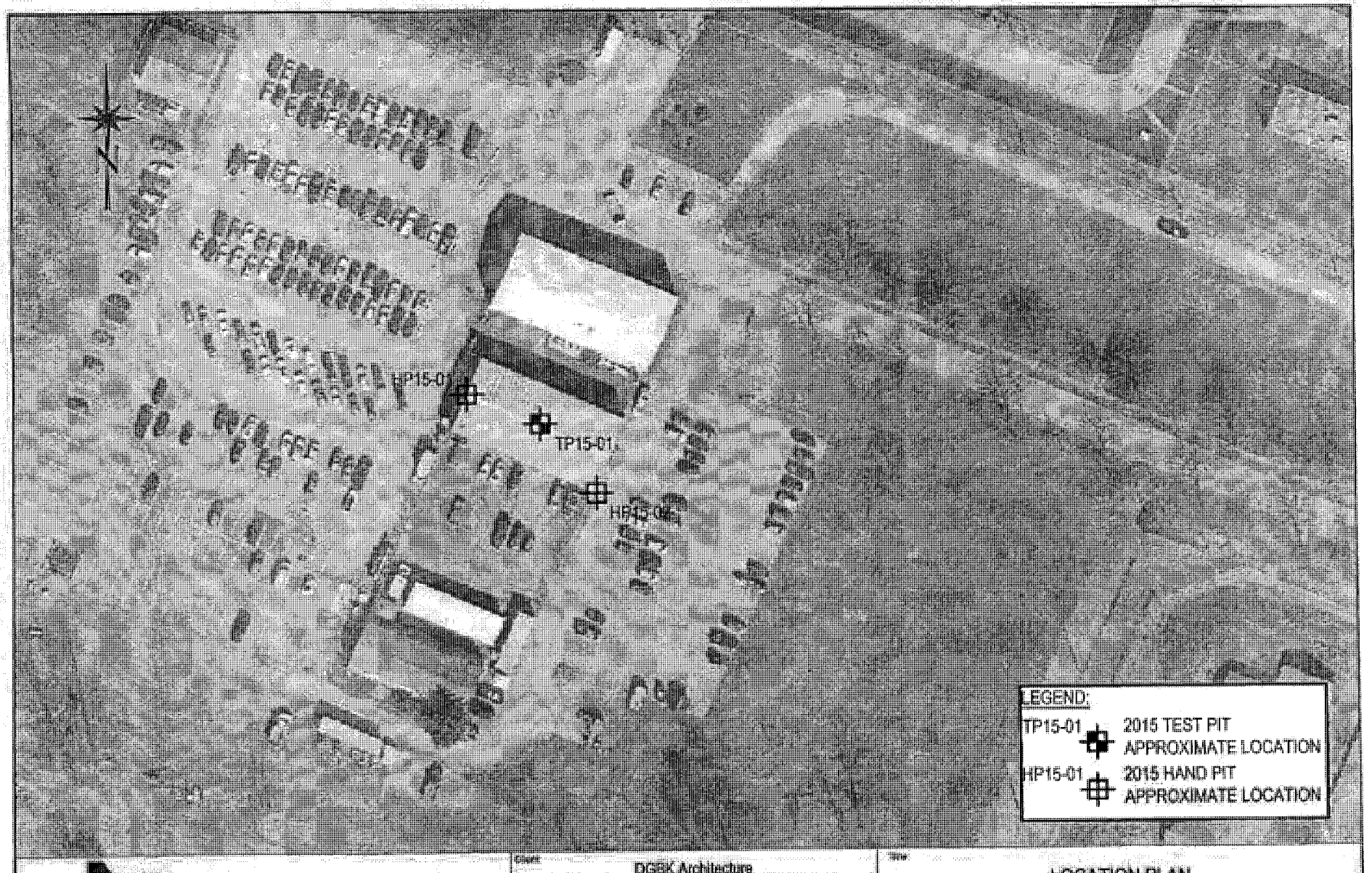
BRAUN GEOTECHNICAL LTD.

Client: DGBK Architecture				Title: KEY PLAN			
Project: A15 CORCAN Warehouse Upgrade and Freezer Addition Matsqui Institution, Abbotsford							
Project no.: 15-6516	Drawn: EV	Design: HD	Checked: JW	Date: September 15, 2015	Scale: 1:4000	Drawing no.: 15-6516-KP	



BRAUN GEOTECHNICAL LTD.

Client: DGBK Architecture

Project: A15 CORCAN Warehouse Upgrade
Matsqui Institution, Abbotsford

Title: LOCATION PLAN

Project no.	Drawn	Design	Checked	Date	Scale	Drawing no.
15-6516	EV	HD	JW	September 15, 2015	1:1000	15-6516-01

BRAUN GEOTECHNICAL LTD.

Client	DGBK Architecture
Project	Proposed Freezer Addition Matsqui Institution, Abbotsford
Title	LOCATION PLAN

Project no.	Drawn	Designed	Checked	Date	Scale	Drawing no.
15-6516	EV	HD	JW	September 15, 2015	1:1000	15-6516-02

Test Pit Log: TP15-01

File: 15-6516
Project: A15 CORCAN Warehouse Upgrade
Client: DGBK Architecture
Location: Matsqui Instituition, Abbotsford

BRAUN GEOTECHNICAL LTD.

Depth (ft)	Depth (m)	Thickness (mm)	Sample	Soil Description	Sample #	Water Cont.	Remarks
0	0	75		ASPHALT			
		75		grey-brown, damp, compact, 19mm minus SAND and GRAVEL, trace silt (BASE)			
1			O	brown, damp, compact SAND, some gravel, trace to some silt, occasional cobbles (FILL) - wooden block at 0.9m	S1		
2							
3	1						
4				grey, damp, compact SAND, trace to some gravel, trace silt			
5			O		S2		
6				End of Test Pit @ 1.7m			
7	2						
8							
9							
10	3						

Equipment: Tracked Compact Excavator
Sampling Method: Lump Sample

Datum: Ground Surface
Water Depth: Not Encountered

Logged By: EV
Exploration Date: August 25, 2015
Dwg No.: 15-6516-TP01
Page: 1 of 1

Test Pit Log: TP15-02

File: 15-6516
Project: Proposed Freezer Addition
Client: DGBK Architecture
Location: Matsqui Instituition, Abbotsford

BRAUN GEOTECHNICAL LTD.

Depth (ft)	Depth (m)	Thickness (mm)	Sample	Soil Description	Sample #	Water Cont.	Remarks
0	0			brown, damp, firm SILT, some sand, trace organics, trace rootlets (TOPSOIL)			
1				brown, damp, compact, silty SAND			
2			O		S1		
3	1						
4				grey, damp, compact SAND, trace to some gravel, trace silt, occasional cobbles/ boulders			
5			O		S2		
6							
7	2						
			O		S3		
8				End of Test Pit @ 2.3m			
9							
10	3						

Equipment: Tracked Compact Excavator
Sampling Method: Lump Sample

Datum: Ground Surface
Water Depth: Not Encountered

Logged By: EV
Exploration Date: August 25, 2015
Dwg No.: 15-6516-TP02
Page: 1 of 1

Hand Pit Log: HP15-01

File: 15-6516
Project: A15 CORCAN Warehouse Upgrade
Client: DGBK Architecture
Location: Matsqui Instituition, Abbotsford

BRAUN GEOTECHNICAL LTD.

Depth	Thickness (mm)	Sample	Soil Description	Sample #	Water Cont.	Remarks
0 ft / 0 m	75		ASPHALT			
	75		ASPHALT			
	100		grey-brown, damp, compact, 19mm minus SAND and GRAVEL, trace silt (BASE)			
1			brown, damp, compact SAND, some gravel, trace to some silt, occasional cobbles (FILL) - occasional grey sand interlayers			
2						
3						
1						
4						
5						
			grey, damp, compact SAND, some gravel, trace silt, occasional cobbles			
			End of Hand Pit @ 1.7m			
6						
2						
7						
8						
9						
3						
10						

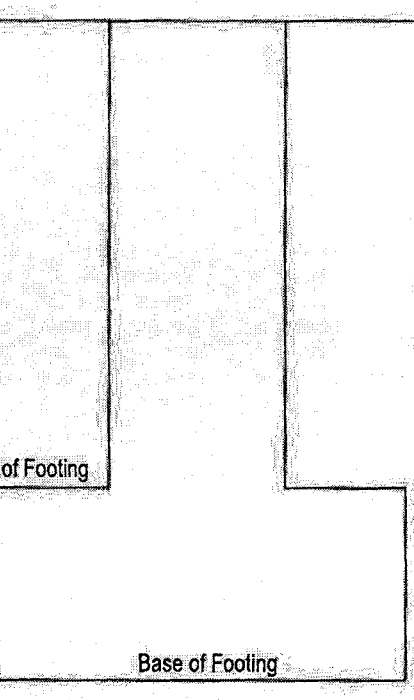


Diagram of Approximate Footing Depth
Horizontal NTS

Equipment: Tracked Compact Excavator
Sampling Method: Lump Sample

Datum: Ground Surface
Water Depth: Not Encountered

Logged By: EV
Exploration Date: August 25, 2015
Dwg No.: 15-6516-HP01
Page: 1 of 1

Hand Pit Log: HP15-02

File: 15-6516
Project: A15 CORCAN Warehouse Upgrade
Client: DGBK Architecture
Location: Matsqui Instituition, Abbotsford

BRAUN GEOTECHNICAL LTD.

Depth (ft / m)	Thickness (mm)	Sample	Soil Description	Sample #	Water Cont.	Remarks
0 / 0	75		ASPHALT			
	100		grey-brown, damp, compact, 19mm minus SAND and GRAVEL, trace silt (BASE)			
1			brown, damp, compact SAND, some gravel, trace to some silt, occasional cobbles (FILL) - occasional grey sand interlayers			
3 / 1			End of Hand Pit @ 0.9m			
10 / 3						

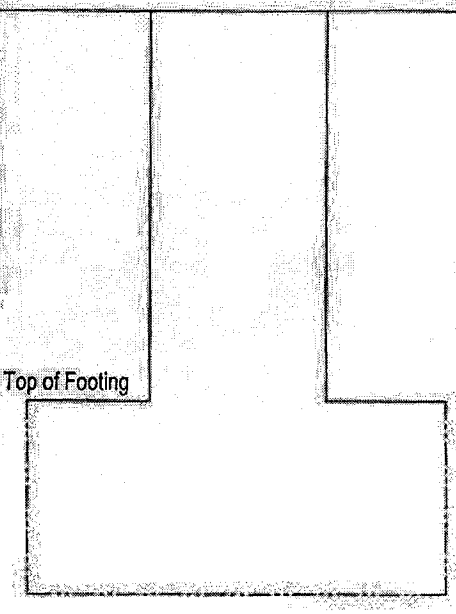


Diagram of Approximate Footing Depth
Horizontal NTS

Equipment: Tracked Compact Excavator
Sampling Method: Lump Sample

Datum: Ground Surface
Water Depth: Not Encountered

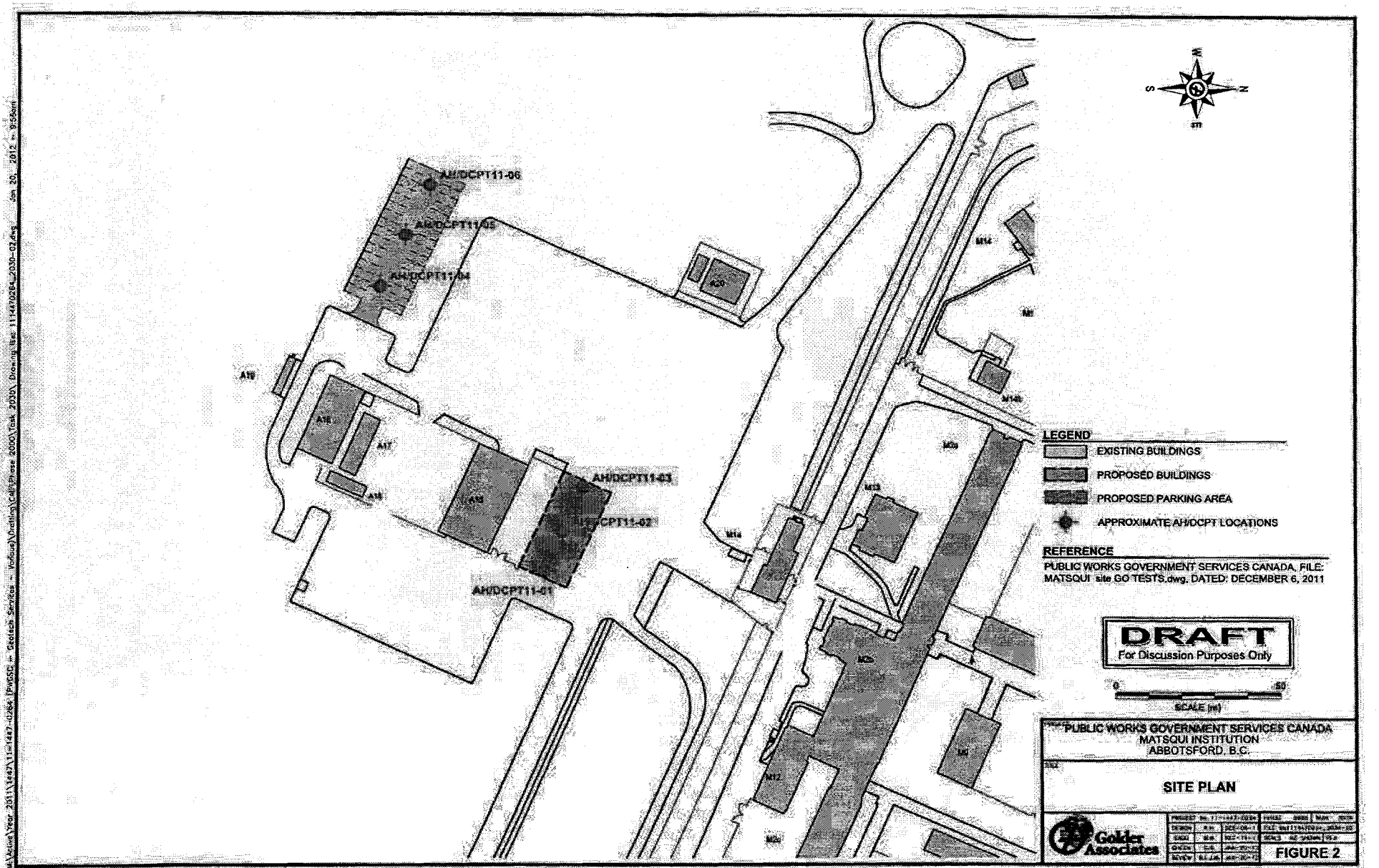
Logged By: EV
Exploration Date: August 25, 2015
Dwg No.: 15-6516-HP02
Page: 1 of 1

APPENDIX "C"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MATSQUI INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

C2 - SOIL LOG FROM GOLDER & ASSOCIATES LTD. 2012

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com


AH/DCPT11-06
AH/DCPT11-05
AH/DCPT11-04
AH/DCPT11-03
AH/DCPT11-02
AH/DCPT11-01
A19
A18
A17
A16
A15
A20
M14
M5
M14b
M9a
M13
M14
M8
M12
M11
LEGEND
EXISTING BUILDINGS
PROPOSED BUILDINGS
PROPOSED PARKING AREA
APPROXIMATE AH/DCPT LOCATIONS
REFERENCE
PUBLIC WORKS GOVERNMENT SERVICES CANADA, FILE: MATSQUI site GO TESTS.dwg, DATED: DECEMBER 6, 2011
DRAFT
For Discussion Purposes Only
0
50
SCALE (m)
PUBLIC WORKS GOVERNMENT SERVICES CANADA
MATSQUI INSTITUTION
ABBOTSFORD, B.C.
SITE PLAN
Golder Associates
FIGURE 2

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-01

SHEET 1 OF 1

LOCATION: See Figure 2.
N: ~5430578 E: ~550821
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DATUM: Local

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10⁻³ 10⁻⁴ 10⁻⁵ 10⁻⁶)	WATER CONTENT PERCENT Wp [— ○ W —] Wl NP - Non-Plastic (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0	Track Mounted Auger Drill Solid Stem Auger	Ground Surface		0.00									
1		Firm, moist, brown CLAYEY SILT, trace sand and gravel. [FILL]			1	AS							No Groundwater Seepage Encountered in Open Hole.
2				1.83	2	AS						M	
3		Compact to dense, moist, grey SAND, trace to some gravel, trace silt with possible cobbles.			3	AS					End of Dynamic Cone Penetration Test.		
4													
5		End of Augerhole.		4.88									
6													
7													
8													
9													
10													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

DRAFT

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-02

SHEET 1 OF 1

DATUM: Local

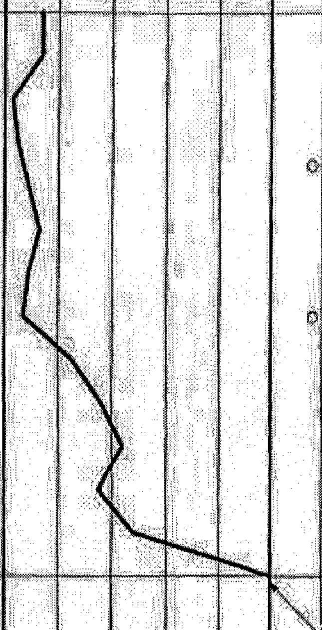
LOCATION: See Figure 2.
N: ~5430583 E: ~550807
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT Wp ├──○W──┤ Wl, NP - Non-Plastic (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0	Track Mounted Auger Drill; Solid Stem Auger	Ground Surface									
		Soft to firm, moist, brown CLAYEY SILT, trace sand and gravel.		0.00	1	AS			○		
1		Loose to compact, moist, grey SAND, trace silt and gravel.		0.76	2	AS			○	M	No Groundwater Seepage Encountered In Open Hole.
2		Compact to dense, moist, grey SAND, some gravel to gravelly, trace silt.		1.60	3	AS			○	M	
3					4	AS					
4		End of Augerhole.		3.96				End of Dynamic Cone Penetration Test.			
5											
6											
7											
8											
9											
10											



DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN **DRAFT**

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-03

SHEET 1 OF 1

LOCATION: See Figure 2.
N: ~5430586 E: ~550794
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DATUM: Local

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-4} 10^{-5} 10^{-6} 10^{-7})	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
		Ground Surface		0.00				SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊟ U - ○ (20 40 60 80)	WATER CONTENT PERCENT: Wp I—○W—I Wl; NP - Non-Plastic (10 20 30 40)		
0	Track Mounted Auger Drill; Solid Stem Auger	Loose to compact, moist, brown SILT, some sand and gravel. [possible FILL]			1	AS			14		Soil Cuttings.
1		Compact, moist, grey SAND and GRAVEL, trace silt.		0.91	2	AS				M	No Groundwater Seepage Encountered in Open Hole.
2		Compact to dense, moist, grey SAND, trace to some gravel, trace silt.		1.52	3	AS					Screen Filter Sand
3		End of Augerhole.		3.05				End of Dynamic Cone Penetration Test.			
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

DRAFT

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-04

SHEET 1 OF 1

LOCATION: See Figure 2.
N: ~5430530 E: ~550753
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

DATUM: Local

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²)	WATER CONTENT PERCENT Wp I—⊖W—I Wl NP - Non-Plastic (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0	Track Mounted Auger Drill. Solid Stem Auger.	Ground Surface											
		Firm, moist, brown CLAYEY SILT, trace fine sand, gravel and organics (wood/roots). [FILL]		0.00	1	AS							
1		Compact, moist, grey, gravelly SAND to SAND and GRAVEL, trace silt. [possible FILL]		0.76	2	AS							No Groundwater Seepage Encountered in Open Hole.
2		Compact, moist, grey SAND and GRAVEL, trace silt.		1.52	3	AS							
3		No recovery. Possible Cobbles.		3.05									
4		End of Augerhole.		3.96				End of Dynamic Cone Penetration Test.					
5													
6													
7													
8													
9													
10													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

DRAFT

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-05

SHEET 1 OF 1

LOCATION: See Figure 2.
N: -5430539 E: -550733
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DATUM: Local

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-6} 10^{-7} 10^{-8})	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q- ●, U- ○) (20 40 60 80)	WATER CONTENT PERCENT Wp I—○W—I Wl, NP - Non-Plastic (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0		Ground Surface											
	Track Mounted Auger Drill; Solid Stem Auger	Loose, moist, brown SILT and SAND, trace gravel and organics (roots). [FILL]		0.00	1	AS							No Groundwater Seepage Encountered in Open Hole.
1													
		Loose, moist, brown, sandy SILT, trace to some gravel with fragments of brick. [FILL]		1.52	2	AS							
2													
3					3	AS							
		Compact to dense, moist, grey SAND and GRAVEL, trace silt.		2.66	4	AS							
4													
		End of Augerhole.		4.57				End of Dynamic Cone Penetration Test.					
5													
6													
7													
8													
9													
10													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

DRAFT

File:\\ACTIVE\YEAR 2011\1447\11-1447-0264 (PWCG - GEOTECH SERVICES - VARIOUS)\GINT DATABASE\11-1447-0264 (2030).GPJ Odot Form.GC FOREHOLE (AUTO) Template:GC REGION TEMPLATE BETA 1.GDT Library:GC REGION LIBRARY.GLB CreatedIn 01/26/12

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-06

SHEET 1 OF 1

LOCATION: See Figure 2.
N: ~5430537 E: ~550720
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DATUM: Local

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-4} 10^{-5} 10^{-6} 10^{-7}) / WATER CONTENT PERCENT (Wp, W, Wl; NP - Non Plastic) (10 20 30 40)	ADDITIONAL LAB TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0		Ground Surface		0.00							
1	Thick Mounded Auger Drill / Solid Stem Auger	Loose, moist, brown, sandy SILT, trace gravel and organics (roots).			1	AS					
2					2	AS					
3		Loose, wet, brown, sandy SILT, some gravel with possible cobbles at about 3.96 m.		3.05	3	AS					Water level observed in open hole during drilling
4		End of Augerhole.		3.96				End of Dynamic Cone Penetration Test.			
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

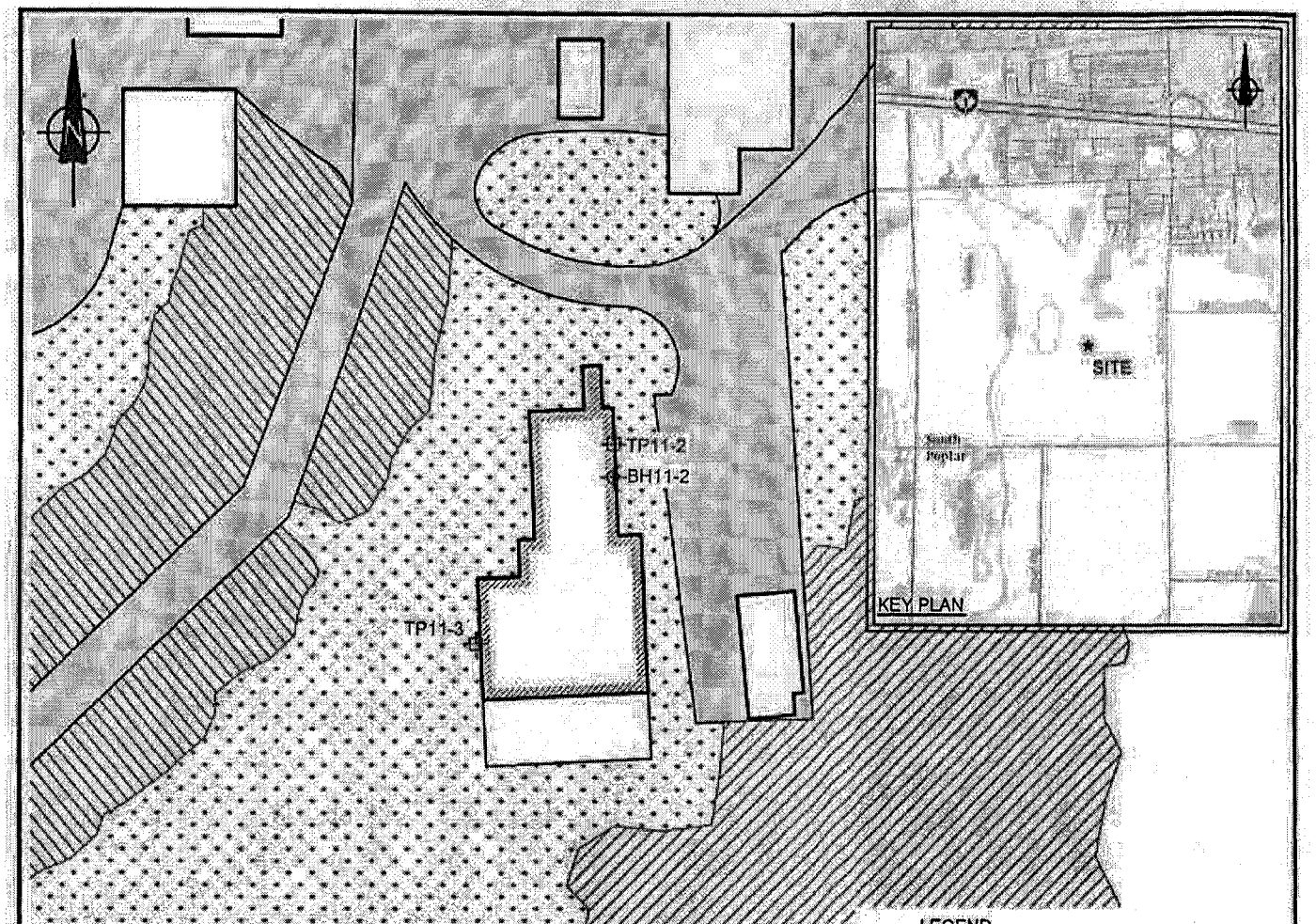
DRAFT

APPENDIX "C"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MATSQUI INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

C3 – SOIL LOG FROM STANTEC CONSULTING 2011

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com



LEGEND

- PROPOSED BUILDING
- EXISTING BUILDINGS
- PAVED AREA
- TREED AREA
- GRASS AREA
- TEST PIT LOCATIONS
- OPEN HOLE AND BECKER PENETRATION TEST LOCATIONS

SCALE IN METRES

0 10 20 30 40 50

1:1000

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

TEST HOLE LOCATION PLAN

GEOTECHNICAL SITE ASSESSMENT

MATSQUI 20 MAN BUILDING

33344 KING ROAD, ABBOTSFORD

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Job No.:	123310756
Scale:	1:1000
Date:	17-Nov-11
Dwn. By:	SS
App'd By:	JP

Dwg. No.: 1

Stantec

R:\2011\Stantec\123310756_man_matsquivasd\123310756 D01 R0_TestHoleLocationPlan.dwg PRINTED: Nov 23, 2011

BOREHOLE RECORD

BH11-1

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756

PROJECT 20 Men Living Inmate Building — DATUM

LOCATION 33344 King Road, Abbotsford — ELEVATION

DRILLING DATE Nov. 7, 2011 — DRILLING CO. Foundex Explorations Ltd. — DRILLING METHOD Becker Hammer

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	TP		GRASS over brown/reddish brown sandy SILT, trace organics, clay and gravel (Tosoil), firm				
	ML		Reddish brown sandy SILT, trace clay, firm to stiff				
1	SP		Brown/grey fine to medium SAND, trace gravel, loose		GS	1	
			-some gravel below				
			-coarse sand below				
2	GP		Grey fine to medium SAND and GRAVEL, trace silt, compact to dense		GS	2	
3							
4			-some gravel below		GS	3	
5							
6			-some moist below				
7			-wet				

□ Insitu Shear Vane (kPa) ■ Bounce Chamber Reading (kPa)
△ Pocket Penetrometer (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● BPT Field Blows, blows/0.3m
10 20 30 40 50 60 70 80 90

DEPTH (ft)

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov. 16, 2011

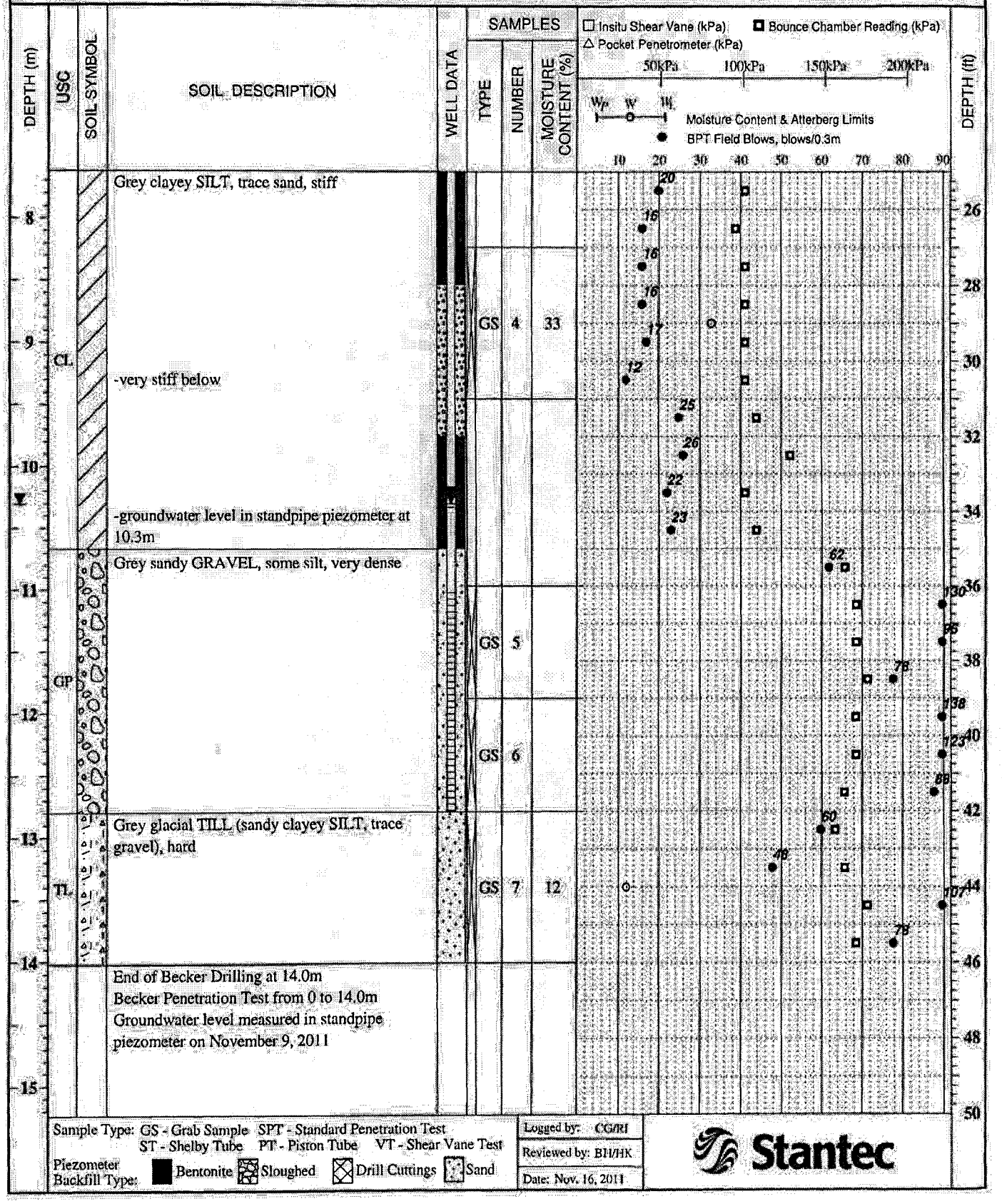
Stantec

BOREHOLE RECORD

BH11-1 cont'd

CLIENT Public Works and Government Services Canada
PROJECT 20 Men Living Inmate Building
LOCATION 33344 King Road, Abbotsford
DRILLING DATE Nov. 7, 2011 DRILLING CO. Foundex Explorations Ltd. DRILLING METHOD Becker Hammer

PROJECT No. 123310756
DATUM
ELEVATION



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov. 16, 2011

Stantec

BOREHOLE RECORD

BH11-2

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756

PROJECT 20 Men Living Inmate Building — DATUM — NORTHING 5430178

LOCATION 33344 King Road, Abbotsford — ELEVATION — EASTING 551166

DRILLING DATE Nov. 8, 2011 — DRILLING CO. Foundex Explorations Ltd. — DRILLING METHOD Becker Hammer

DEPTH (m)	USC SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	TP	GRASS over brown/reddish brown sandy SILT, some organics, trace clay (Topsoil), firm			
	ML	Reddish brown sandy SILT, trace clay, firm to stiff			
1		Grey SAND, some gravel, trace silt, loose	GS	1	
		-gravelly, compact below			
2					
3			GS	2	
	SP	-dense below			
4		-gravelly, trace cobbles below	GS	3	
5		-some sandy silt layers from 5.1 to 5.8m	GS	4	
6			GS	5	
7	GP	Grey SAND and GRAVEL, some silt, very dense			

□ Insitu Shear Vane (kPa) ■ Bounce Chamber Reading (kPa)

△ Pocket Penetrometer (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L

Moisture Content & Atterberg Limits

● BPT Field Blows, blows/0.3m

10 20 30 40 50 60 70 80 90

DEPTH (ft)

0 2 4 6 8 10 12 14 16 18 20 22 24

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI

Reviewed by: BH/IK

Date: Nov. 16, 2011

Stantec

BOREHOLE RECORD

BH11-2 cont'd

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756
PROJECT 20 Men Living Inmate Building — DATUM — NORTHING 5430178
LOCATION 33344 King Road, Abbotsford — ELEVATION — EASTING 551166
DRILLING DATE Nov. 8, 2011 — DRILLING CO. Foundex Explorations Ltd. — DRILLING METHOD Becker Hammer

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
8			Grey SAND and GRAVEL, some silt, very dense	GS	6	
9	CL		Grey sandy clayey SILT, some gravel, very stiff to hard	GS	7	14
10	TIL		Grey glacial TILL (sandy clayey SILT, some gravel), hard	GS	8	12
11				GS	9	
12			End of Becker Drilling at 11.9m Hole sealed with Bentonite from 1.2 to 1.8m, 3.0 to 4.3m and 10.4 to 11.6m. Becker Penetration Test from 0.7 to 14.0m			
13						
14						
15						

□ Insitu Shear Vane (kPa) ■ Bounce Chamber Reading (kPa)
△ Pocket Penetrometer (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● BPT Field Blows, blows/0.3m
10 20 30 40 50 60 70 80 90

DEPTH (ft)

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test
Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov. 16, 2011

Stantec

TEST PIT RECORD

TP11-1

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756

PROJECT 20 Men Living Inmate Building — DATUM

LOCATION 33344 King Road, Abbotsford, BC — ELEVATION

EXCAVATION DATE Nov. 9, 2011 — CONTRACTOR Backhoes Unlimited — EXCAVATION METHOD Test Pit

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	TP		GRASS over brown/reddish brown sandy SILT, trace organics, clay and gravel (Topsoil), firm	GS	1	30
	ML		Reddish brown sandy SILT, trace clay, firm to stiff	GS	2	31
1	SP		Brown/grey fine to medium SAND, trace gravel, loose	GS	3	
			-some gravel below	GS	4	
				GS	5	
			- coarse sand below	GS	6	
2	GP		Grey fine to medium SAND and GRAVEL, trace silt, compact to dense	GS	7	
				GS	8	
				GS	9	
3			End of Test Pit at 2.6m No seepage encountered in test pit			
4						
5						
6						
7						

Insitu Shear Vane (kPa) ☐ Remoulded Shear Vane (kPa)
Pocket Penetrometer (kPa) ✕ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa
W_p W W_l
Moisture Content & Atterberg Limits
Standard Penetration Test, blows/0.3m
10 20 30 40 50 60 70 80 90

DEPTH (ft) 0 2 4 6 8 10 12 14 16 18 20 22 24

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov 15, 2011

Stantec

TEST PIT RECORD

TP11-2

CLIENT Public Works and Government Services Canada PROJECT No. 123310756

PROJECT 20 Men Living Inmate Building DATUM

LOCATION 33344 King Road, Abbotsford, BC ELEVATION

EXCAVATION DATE Nov. 9, 2011 CONTRACTOR Backhoes Unlimited EXCAVATION METHOD Test Pit

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	TP		GRASS over brown/reddish brown sandy SILT, some organics, trace clay (Topsoil), firm	GS	1	46
	ML		Reddish brown sandy SILT, trace clay, firm to stiff	GS	2	37
1	SP		Grey SAND, some gravel, trace silt, loose	GS	3	
			-gravelly, compact below	GS	4	
				GS	5	
				GS	6	
2				GS	7	
				GS	8	
3			End of Test Pit at 2.4m No seepage encountered in test pit			
4						
5						
6						
7						

□ Insitu Shear Vane (kPa) ■ Remoulded Shear Vane (kPa)

△ Pocket Penetrometer (kPa) ✕ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits

● Standard Penetration Test, blows/0.3m

10 20 30 40 50 60 70 80 90

DEPTH (ft) 0 2 4 6 8 10 12 14 16 18 20 22 24

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CGWI

Reviewed by: BH/HK

Date: Nov 15, 2011

Stantec

TEST PIT RECORD

TP11-3

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756
PROJECT 20 Men Living Inmate Building — DATUM
LOCATION 33344 King Road, Abbotsford, BC — ELEVATION
EXCAVATION DATE Nov. 9, 2011 — CONTRACTOR Backhoes Unlimited — EXCAVATION METHOD Test Pit

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)
0	TP	GRASS over brown/reddish brown sandy SILT, trace organics (Topsoil), firm	GS	1	39
	ML	Reddish brown sandy SILT, trace clay, stiff to very stiff	GS	2	30
1	SM	Grey/light brown silty SAND, trace gravel, compact to dense	GS	3	
	GP	Grey/light brown medium SAND and GRAVEL, trace silt, compact	GS	4	
2		-some gravel to gravelly below	GS	5	
			GS	6	
			GS	7	
3		End of Test Pit at 2.4m No seepage encountered in test pit			
4					
5					
6					
7					

□ Insitu Shear Vane (kPa) ■ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits

● Standard Penetration Test, blows/0.3m

10 20 30 40 50 60 70 80 90

DEPTH (ft) 0 2 4 6 8 10 12 14 16 18 20 22 24

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov 15, 2011

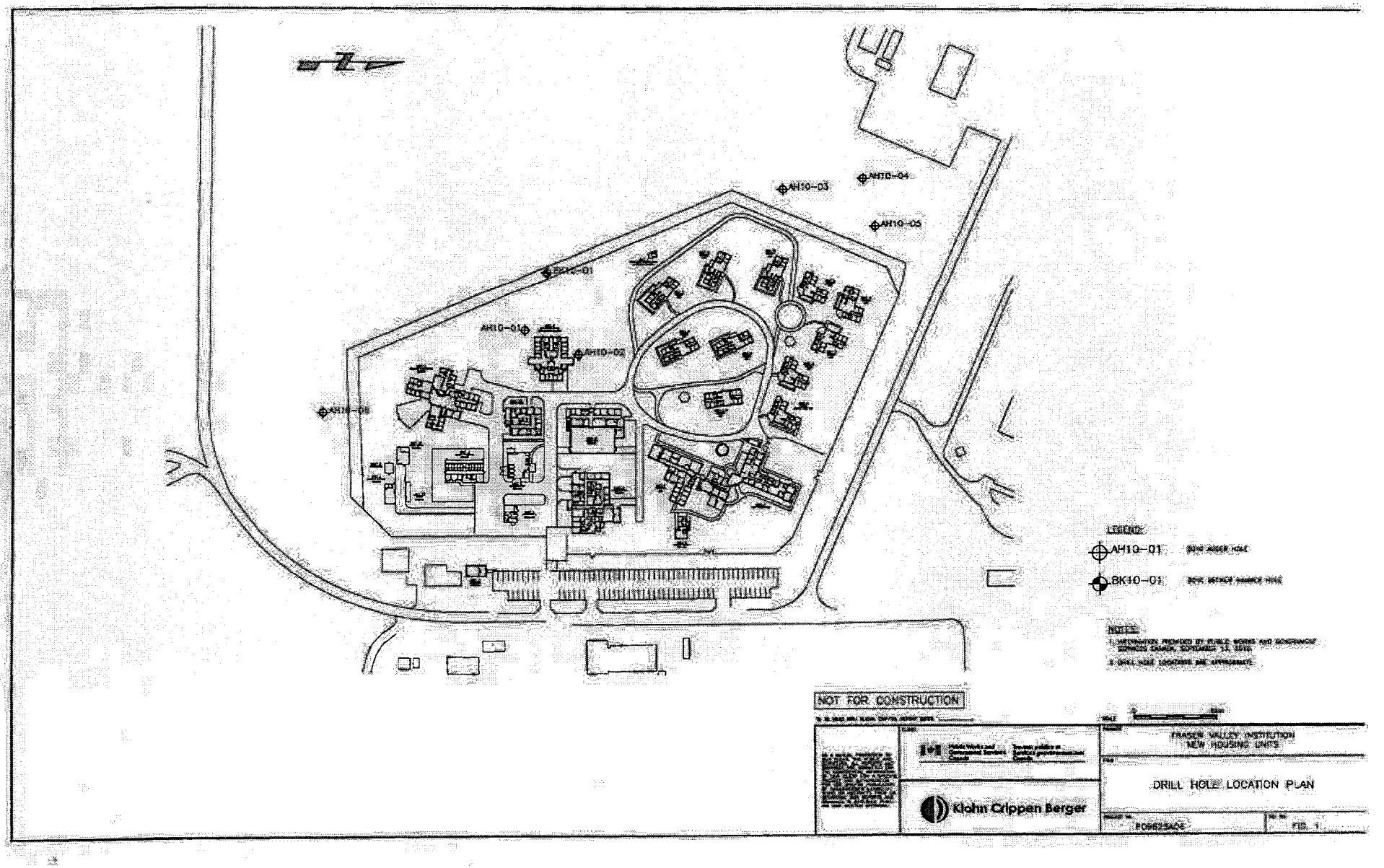
Stantec

APPENDIX "C"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MATSQUI INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

C4 – SOIL LOG FROM KLOHN CRIPPEN BERGER 2010

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com


AH10-03
AH10-04
AH10-05
BK10-01
AH10-01
AH10-02
AH10-06
LEGEND:
AH10-01
BK10-01
NOTES:
NOT FOR CONSTRUCTION
Klohn Crippen Berger
FRASER VALLEY INSTITUTION
NEW HOUSING UNITS
DRILL HOLE LOCATION PLAN
FIG. 1

Klohn Crippen Berger

SYMBOLS AND TERMS
FOR SOIL DESCRIPTION AND TEST HOLE LOGS

BASIC SYMBOLS

SYMBOL VARIATIONS - EXAMPLES[1]

CLASSIFICATION BY PARTICLE SIZE				
		Size Range		
			U.S. Standard Sieve Size	
Name		(mm)[3]	Retained	Passing
Boulders		> 200	8 inch	-
Cobbles		75 - 200	3 inch	8 inch
Gravel:	coarse	19 - 75	0.75 inch	3 inch
	fine	5 - 19	No. 4	0.75 inch
Sand:	coarse	2 - 5	No. 10	No. 4
	medium	0.4 - 2	No. 40	No. 10
	fine	0.075 - 0.4	No. 200	No. 40
Fines (Silt or Clay)[4]		< 0.075	-	No. 200

PROPORTION OF MINOR COMPONENTS BY WEIGHT[2]	
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]		SPT N[9]
	(kPa)[3]	(ksf)[8]	
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) Example: SAND, silty, trace of gravel = sand with 20% to 35% silt and up to 10% gravel, by weight.
(3) Approximate metric conversion.
(4) Fines are classified as silt or clay on the basis of Atterberg limits (refer to Plasticity Chart).
(5) Standard Penetration Test (SPT) blow count (uncorrected), after Terzaghi and Peck, 1948.
(6) Standard Penetration Test blow count, based on above N value corrected to 60% hammer efficiency and 96 kPa (1.0 ton/ft²) 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/ft²) = approximately 0.5 kg/cm².
(9) Very approximate correlation with Standard Penetration Test blow counts, after Terzaghi and Peck, 1948.

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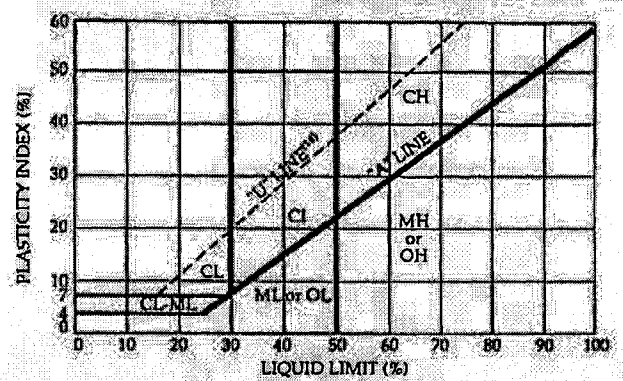
SYMBOLS AND TERMS
FOR SOIL DESCRIPTION AND TEST HOLE LOGS

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	
Description	Undisturbed Strength[13] / Remoulded Strength
High	> 8
Medium	4 to 8
Low	< 4

PLASTICITY CHART FOR SOILS PASSING NO. 40 SIEVE[10]



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 or 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 clays from silts and organic soils.
(15) For soil descriptions, estimate percentage of ground ice based on volume, after National Research Council of Canada, 1963.

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SYMBOLS AND TERMS
FOR SOIL TEST HOLE LOGS

TEST TYPES[1]

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 - *both open and closed test at the same location.*
BKS	Becker hammer drill hole - *open casing, sampled.*
BPT	Becker penetration test - *closed casing.*
TP	Test pit - *machine or hand dug.*
CPT	Electric cone penetration test with pore pressure measurements.
DCT	Dynamic cone penetration test.
VST	Vane shear test.
AH	Auger hole - *machine or hand auger, no SPT or thin-walled tube samples taken.*

IN SITU TESTS OR DOWNHOLE INSTRUMENTATION[2]

BM	Benchmark
DMT	Dilatometer test
IN	Inclinometer
PMT	Pressuremeter test
PT	Permeability test
PZ	Piezometer
SW	Shear wave velocity test

LABORATORY AND/OR FIELD TESTS[3]

S_u Undrained shear strength, measured by:[4]

- ◆ Field Vane (peak)
- ◇ Field Vane (remoulded)
- ■ Lab Vane (peak)
- □ Lab Vane (remoulded)
- ▲ Unconfined Compression
- △ Pocket penetrometer

- ● Standard Penetration Test (SPT) blow count, uncorrected (N)
- ○ W% In situ moisture content
- × W_P% Plastic limit
- × W_L% Liquid limit
- Becker penetration test blow counts, closed casing
- Becker penetration test blow counts, open casing
- ▼ or ▽ Water level, measured on date and from piezometer indicated on log

OTHER LABORATORY TESTS[5]

CD	Consolidated, drained triaxial test
CUP	Consolidated, undrained triaxial test with pore pressure measurements
CUCY	Consolidated, undrained triaxial test with cyclic loading
UU	Unconsolidated, undrained triaxial test
UC	Unconfined (uniaxial) compression test
DS	Direct shear test
DSS	Direct simple shear test
GSD	Grain size distribution *(by sieve or hydrometer)*
MDR	Moisture-density relationship *(i.e. standard or modified Proctor test)*
ORG	Organic content
OED	Oedometer consolidation test
RD	Relative density *(also known as density index)*
GS	Specific gravity
K	Permeability
UW	Unit Weight

(1) Test type abbreviation is typically followed by a two-part number indicating year and chronological sequence of test. Example: CPT93-1 indicates the first electric cone penetration test at a particular site in 1993.
(2) In situ test or downhole instrumentation abbreviations are typically shown in brackets following the appropriate test type designation. Example: DH93-1(PZ) indicates a piezometer was installed in drill hole 93-1.
(3) These symbols are for laboratory and/or field test results shown on the test hole log.
(4) Vane gives S_u. Pocket penetrometer and unconfined compression tests give 2 S_u, so results are divided by 2 for plotting on log.
(5) 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.

TEST HOLE LOG

STARTED: Nov 2, 2010 **FINISHED:** Nov 2, 2010

DRILL METHOD: Solid Stem Auger

GROUND ELEV. (m):

COORDINATES (m):

DYNAMIC CONE PENETRATION TEST

Rod O.D.: Shoe O.D.:

Hammer Weight: 140 lb Height Drop: 30 inches

● SPT N ★% FINES △ P.PEN/2 (psi) DCPT (blows/0.3m)

W_P% W% W_L%

20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					0.2 SILT (ML) trace sand, soft, brown, moist, rootlets.	
		Grab	S1		SAND (SP) medium to coarse, some gravel, trace silt; compact, sub-angular to sub-rounded light brown to grey, moist, largest observed size 50 mm.	
1					0.9 SAND and GRAVEL (SP-GP) trace to some silt, dense, sub-angular to sub-rounded, grey, wet, largest observed size 50 mm; poor recovery from 1.2 m (~50 to 30%).	
2						
					2.6 CLAY (CL) trace sand with increasing gravel with depth, very stiff to hard, grey, moist, blocky, moderate cementation, no dilatancy, poor recovery from 2.6 m to 3.0 m (~50 to 30%). (TILL)	
3		Grab	S2			
		Grab	S3			
4					4.6	
5					End of Hole at 4.6 m	
6					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC.	
7					2) Solid Stem Auger hole terminated at 4.6m depth. DCPT terminated at 2.7m depth.	
8						
9						
10						

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PROJECT NO.: P09625 A06

PROJECT: Fraser Valley Institute Inmate Housing

LOCATION: Abbotsford, BC

LOGGED BY: VL **CHECKED BY:**

SHEET 1 **OF** 1 **HOLE NO.:** AH10-01

KCB_DCT-SI 2010-11-02_09 INVESTIGATION - R2 METRIC.GPJ KC_DATA.GDT 12/10/10

TEST HOLE LOG

STARTED: Nov 2, 2010 **FINISHED:** Nov 2, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: | Shoe O.D.:
Hammer Weight: 140 lb | Height Drop: 30 inches
● SPT N ★% FINES | DCPT (blows/0.3m)
△ P.PEN/2 (psi)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
0					0.1 CLAY (CL) trace sand, soft, brown, moist, rootlets.	
		Grab	S1		CLAY (CL) trace gravel, very stiff to hard, light brown to grey, moist, blocky, moderate cementation, no dilatancy.	
1		Grab	S2			
2					2.1 CLAY (CL) trace sand and gravel, very stiff to hard, grey, moist to dry, blocky, moderate cementation, no dilatancy. (TILL)	
3		Grab	S3			
4		Grab	S4		@3.9m: Hard Drilling	
5						
6		Grab	S5		6.1 End of Hole at 6.1 m	
7					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC. 2) Solid Stem Auger hole terminated at 6.1m depth. DCPT terminated at 3.9m depth.	
8						
9						
10						

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 **OF** 1 **HOLE NO.:** AH10-02

TEST HOLE LOG

STARTED: Nov 2, 2010 **FINISHED:** Nov 2, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: Shoe O.D.:
Hammer Weight: 140 lb Height Drop: 30 inches
● SPT N ★% FINES △ P.PEN/2 (psi) DCPT (blows/0.3m)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					0.2 SILT (ML) trace sand, soft, brown, moist, rootlets.	
1		Grab	S1		SILT (ML) trace gravel, firm, light brown to grey, moist, blocky, moderate cementation, no dilatancy, largest observed size 50 mm.	
		Grab	S2		1.1 ORGANIC SILT (OL) trace sand, plasticity, soft, dark brown, moist, organics are amorphous to fine fibrous. 1.5	
2		Grab	S3		SAND (SP) fine, trace silt, poorly graded, loose, sub-rounded to sub-angular, brown, moist, trace rootlets. 2.3	
		Grab	S4		CLAY (CL) trace gravel and sand, firm, dark to light brown, moist, blocky, moderate cementation, no dilatancy. 3.0	
3					CLAY (CL) trace gravel and sand, very stiff to hard, light brown to grey, moist, blocky, moderate cementation, no dilatancy. (TILL)	
4		Grab	S5			
5		Grab	S6		@5.2m to 5.8 m: Poor recovery (~50%) @5.5m: Hard Drilling 5.8	
6					End of Hole at 5.8 m	
7					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC. 2) Solid Stem Auger hole terminated at 5.8 m depth. DCPT terminated at 3.8m depth.	
8						
9						
10						

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 **OF** 1 **HOLE NO.:** AH10-03

K:\SI_DCT-SI 2010-11-02-03\INVESTIGATION - R2 METRIC.GPJ KC_DATA.GDT 12/9/10

TEST HOLE LOG

STARTED: Nov 2, 2010 **FINISHED:** Nov 2, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					SILT (ML) trace sand, soft, brown, moist, rootlets.	
0.3					SILT (ML) some sand, trace gravel, firm, brown, moist, trace rootlets.	
0.9		Grab	S1		SAND (SP) medium to coarse, trace to some gravel, trace silt, compact, brown to grey, moist.	
1		Grab	S2			
2		Grab	S3		@2.1m: Poor Recovery (~30-50%), wet	
3		Grab	S4			
		Grab	S5			
4.0					CLAY (CL) sandy to trace sand, trace fine gravel, trace clay, very stiff to hard, brown to grey, moist, blocky, largest observed size 50 mm. (TILL)	
4		Grab	S6			
5		Grab	S7			
6		Grab	S8			
6.6					End of Hole at 6.6 m	
7					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC. 2) Solid Stem Auger hole terminated at 6.6m depth. DCPT terminated at 6.0m depth.	
8						
9						
10						

DYNAMIC CONE PENETRATION TEST

Rod O.D.: | Shoe O.D.:
Hammer Weight: 140 lb | Height Drop: 30 inches
● SPT N ✱% FINES
△ P.PEN/2 (psi)
DCPT (blows/0.3m)

W_P% — W% — W_L%
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 **OF** 1 **HOLE NO.:** AH10-04

KCBL_DCT-SI 2010-11-02_03 INVESTIGATION - R2 METRIC.GPJ KC_DATA.GDT 12/10/10

TEST HOLE LOG

STARTED: Nov 3, 2010 **FINISHED:** Nov 3, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: | Shoe O.D.:
Hammer Weight: 140 lb | Height Drop: 30 inches
● SPT N ★% FINES | DCPT (blows/0.3m)
▲ P.PEN/2 (psi)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					0.2 SILT (ML) trace sand, soft, brown, moist, rootlets	
		Grab	S1		ORGANIC SILT (OS) trace sand and gravel, firm, brown, moist.	
					0.9	
1		Grab	S2		SAND (SP) fine to medium, some gravel, trace silt, loose, grey, moist to wet, largest observed size 70 m.	
2		Grab	S3		@2.6m to 3.0 m: Poor Recovery (50%)	
3						
4		Grab	S4		@4.0m to 4.6m: Poor Recovery (30-50%), wet	
					4.6	▼
		Grab	S5		SILT (ML) trace sand and gravel, soft, light brown to grey, wet.	
5					5.0	
		Grab	S6		SAND (SP) medium to coarse, some gravel, trace silt, compact, grey, wet.	
6					@5.5m to 6.1m: Poor Recovery (~30%)	
		Grab	S7		@6.6m to 7.2m: Poor Recovery (~30%)	
7					7.2	
		Grab	S8		SILT (ML) sandy, trace gravel, very stiff to hard, light brown to grey, wet.	
					7.6	
8					CLAY (CL) sandy, trace gravel with depth, very stiff to hard, grey, moist to dry. (TILL)	
		Grab	S9		@8.8m to 12.1m: Hard Drilling	
9					@9.1m to 10.7m': Poor Recovery (~10-30%)	
10						

Continued Next Page

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 OF 2 **HOLE NO.:** AH10-05

TEST HOLE LOG

STARTED: Nov 3, 2010 **FINISHED:** Nov 3, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: | Shoe O.D.:
Hammer Weight: 140 lb | Height Drop: 30 inches
● SPT N ★% FINES
△ P.PEN/2 (psi)
DCPT (blows/0.3m)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
11		Grab	S10			
		Grab	S11		@11.6m to 12.2m: Poor Recovery (~50-60%)	
12					12.2	
					End of Hole at 12.2 m	
13					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC.	
14					2) Solid Stem Auger hole terminated at 9.1m depth. DCPT terminated at 10.6m depth.	
15					3) 1.5" diameter PVC standpipe installed to 7.1m depth and completed with flush mount surface monument.	
16					4) Water level measured November 29, 2010 at 4.48m depth.	
17						
18						
19						
20						

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 2 OF 2 **HOLE NO.:** AH10-05

KCBL_OCT-SI 2010-11-02_03 INVESTIGATION - R2 METRIC.GPJ KC_DATA.GDT 12/10/10

TEST HOLE LOG

STARTED: Nov 3, 2010 **FINISHED:** Nov 3, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DEPTH (m) | SPT BLOWS PER 0.15m | SAMPLE TYPE | SAMPLE No. | SYMBOL | INSTRUMENT | DETAILS

DESCRIPTION OF MATERIALS

0.1 TOPSOIL

SAND (SP) gravely, very loose to loose, maximum size observed 50 mm, rounded to sub-rounded, brown to grey, moist.

Grab S1

Grab S2

@2.6m to 3.0m: Poor Recovery (~30%)

Grab S3

@4.3m to 4.6m: Poor Recovery (~30%)

4.9

CLAY (ML) some gravel to gravely at depth, gravel is rounded to sub-rounded, stiff to hard, brown to grey at depth, moist to wet, maximum size observed 50 mm. (TILL)

Grab S4

@5.0m to 9.1m: Hard Drilling

Grab S5

@7.0m to 7.6m: Poor recovery (~10-20%)

@7.6m to 9.1m: Poor Recovery (~10-30%)

Grab S6

9.1

End of Hole at 9.1 m

1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack.

Continued Next Page

DYNAMIC CONE PENETRATION TEST

Rod O.D.: | Shoe O.D.:

Hammer Weight: 140 lb | Height Drop: 30 inches

● SPT N ★ % FINES
△ P.PEN/2 (psi)
DCPT (blows/0.3m)

W_P% W% W_L%
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 OF 2 **HOLE NO.:** AH10-06

KCBL_DCT-SI_2010-11-02_03_INVESTIGATION+R2_METRIC.GPJ_KC_DATA.GDT_12/10/10

TEST HOLE LOG

STARTED: Nov 3, 2010 **FINISHED:** Nov 3, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: Shoe O.D.:
Hammer Weight: 140 lb Height Drop: 30 inches
● SPT N ★% FINES △ P.PEN/2 (psi) DCPT (blows/0.3m)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
11					BC. 2) Solid Stem Auger hole terminated at 12.2m depth. DCPT terminated at 4.6m depth. 3) 1.5" diameter PVC standpipe installed to 7.1m depth and completed with flush mount surface monument. 4) Water level measured November 29, 2010 at 6.08m depth.	
12						
13						
14						
15						
16						
17						
18						
19						
20						

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 2 **OF** 2 **HOLE NO.:** AH10-06

KCBL_DCT.GI 2010-11-02_GI INVESTIGATION - R2 METRIC.GPJ KCB_DATA.GDT 12/10/10

BECKER TEST HOLE LOG

STARTED: Nov 29, 2010 **FINISHED:** Nov 29, 2010

DRILL RIG MODEL: Becker Hammer

GROUND ELEV. (m):

COORDINATES (m):

Casing O.D.: CLOSE ENDED (blows/0.3m)

Hammer Energy: 11 kJ max. rated — OPEN ENDED (blows/0.3m)

★ % FINES — BOUNCE PRESS (kPa)

W_P% × – – – o – – – × W_L%

20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					SAND (SP) brown, some gravel. (ROAD FILL)	
		Grab	G1		0.9	
1					SAND (SP) some gravel, occasional cobbles, trace silt, greyish brown colour, dry.	
					1.8	
2		Grab	G2		SAND and GRAVEL (SP-GP) some cobbles, light brown, dry. Becomes more difficult to drill through. Broken rock fragments in drill cuttings. Drill kicks sideways at 2.5 m and needs to be repositioned.	
		Grab	G3			
3					3.4	
					SILT ML) some fine sand to sandy, trace to some fine gravel, light brown, very stiff. (TILL)	
					4.0	
4		Grab	G4		SILT (ML) trace sand, trace gravel, light grey, very stiff to hard. (TILL)	
					4.6	
					CLAY (CL) trace sand, medium plasticity, light grey, dry to moist, very stiff to hard. (TILL)	
5						
6		Grab	G5			
7					7.6	
		Grab	G6		CLAY (CL) some sand, some gravel, moist, grey, very stiff to hard. (TILL)	
8					8.2	
					CLAY (CL) grey, dry, very stiff to hard. (TILL)	
		Grab	G7			
9						
10						

Continued Next Page

Klohn Crippen Berger

PROJECT NO.: P09625 A06

PROJECT: Fraser Valley Institute Inmate Housing

LOCATION: Abbotsford, BC

LOGGED BY: AP **CHECKED BY:**

BECKER TEST HOLE LOG

STARTED: Nov 29, 2010 **FINISHED:** Nov 29, 2010
DRILL RIG MODEL: Becker Hammer
GROUND ELEV. (m):
COORDINATES (m):

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					10.4	
		Grab	G8		CLAY (CL) sandy, trace gravel, grey, moist, very stiff to hard. (TILL)	
11					11.0 CLAY (CL) trace to some sand, trace fine gravel, dry, very stiff to hard. (TILL)	
					11.9	
12					End of Becker Drill Hole at 11.9 m	
					1) Drill hole was conducted using a truck-mounted Becker Hammer drill operated by Foundex Explorations of Surrey, BC.	
13					2) Closed Becker hole terminated at 9.1m depth. Open Becker hole terminated at 11.9m depth.	
14						
15						
16						
17						
18						
19						
20						

BECKER PENETRATION TEST

Casing O.D.: CLOSED ENDED (blows/0.3m)
Hammer Energy: 11 kJ max. rated: OPEN ENDED (blows/0.3m)
* % FINES: BOUNCE PRESS (kPa)

W_P% × ---- o ---- × W_L%
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: AP **CHECKED BY:**
SHEET 2 OF 2 **HOLE NO.:** BK10-01

APPENDIX "D"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MATSQUI INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

STANDARD FIELD INSPECTION REQUIREMENTS

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

Geotechnical Engineering Field Review and Inspection Requirements
BC Building Code 2012

Based on the BC Building Code 2012, the following Design and field review must be completed by JECTH Consultants Inc. (Geotechnical in Record, **GIR)** such that Letter of Compliance (Schedule "C") required by local municipality for Occupancy Permit can be issued.

7.0 Geotechnical - Temporary

7.1 Excavation

7.1.1 Foundation

Excavation depth more than 4 ft. must be certified by GIR as required by WorkSafe BC ☐

7.1.2 Buildings and Structures

Buildings and Structures within the 1H:1V stress influence line from the bottom of Excavation must be reviewed and approved by GIR ☐

7.1.3 Trench

Excavation for underground utilities for depth more than 4 ft. must be reviewed and approved by GIR ☐

7.1.4 Underground Utilities

All underground utilities (both on-site and off-site) within and along the site perimeter must be identified both on drawing and physical on site prior to any foundation excavation and slope excavation. ☐

7.2 Shoring

7.2.1 Vertical Shoring

Vertical Shoring must be design by GIR to ensure excavation perimeter is stable during foundation excavation before placement of perimeter backfill. ☐

7.2.2 Temporary Shoring

Temporary Shoring such as sheetpile and shotcrete with tie back anchors or other vertical features must be inspected by GIR ☐

7.2.3 Shoring Method

Shoring method such as sheetpile and shotcrete with tie-back anchors wall must be carried out under the supervision of GIR ☐

7.2.4 Underground Utilities

All underground utilities (both on-site and off-site) within and along the site perimeter must be identified both on drawing and physical on site prior to any foundation excavation and shoring work. ☐

7.3 Underpinning

7.3.1 Pre-Excavation

Pre-excavation inspection and Review must be conducted by both Structural and Geotechnical Engineers (both Geotechnical Engineers from the adjacent structures and GIR) prior to underpinning excavation. ☐

7.3.2 Monitoring Survey

Survey monitoring points must be installed at the underpinning building(s) and/any movement sensitive Structural Component before foundation excavation. The survey monitoring system must be conducted prior to any site activities and submit to GIR. ☐

7.3.3 Structural Inspection

Structural Inspection and photographs must be carried out prior to foundation excavation for future records and reference by Structural Engineer retained by either owner of adjacent property or subject property owner. ☐

7.4 Temporary Construction Dewatering

7.4.1 Perched groundwater and Surface Drainage

For perched groundwater and surface Drainage by precipitation, conventional pump can be used to maintain the site in relatively dry condition. □

7.4.2 Well point

Well point and other measure of temporary dewatering will be required if high groundwater level (actual ground water table) is encountered □

8.0 Geotechnical - Permanent

8.1 Bearing Capacity of Foundation Subgrade Soil ☐

8.1.1 Foundation Subgrade Excavation

Review exposed foundation subgrade excavation and ensure that all remove all unsuitable soil/material until suitable bearing subgrade is exposed ☐

8.1.2 Foundation Subgrade Protection

In the event that the exposed foundation subgrade soil is sensitive to moisture, foundation subgrade might be protected by a layer granular soil such as crushed gravel due to wet condition and construction traffic. A lean concrete can be used instead of crushed gravel. ☐

8.1.3 Structural FILL

Review Structural Fill if over-excavated or raise of grade is required. Compaction Density test must be conducted by Certified Laboratory and submit to GIR. ☐

8.2 Geotechnical - Deep Foundation

8.2.1 Piling Inspection

Full time piling inspection such as timber and steel pile etc must be conducted by GIR. All piling record for refusal must be available to review such that the pile capacity can be certified. ☐

8.2.2 Sheetpile Installation

Sheetpile installation as temporary / permanent support must be installed and inspected by Geotechnical Engineer ☐

8.3 Engineering FILL

8.3.1 Structural FILL

Structural Fill (imported or non-native material) at and below the proposed foundation elevation must be compacted to density as specified by GIR and must be certified by qualified soil laboratory / testing company ☐

8.3.2 Underslab FILL

Underslab fill density must also be tested prior to placement of slab-on-grade concrete to the specified density as required by GIR. ☐

8.4 Slope Stability and Seismic Load

8.4.1 Slope Stability

Evaluate the slope stability along the site and building perimeter for both seismic and static design conditions according to APEBC Guidelines dated November 2010. ☐

8.4.2 Subsurface Stability

Subsurface stability under seismic condition such as densification specified by GIR and tieing of footing structurally must be accommodated by Structural Engineer in Record ☐

8.4.3 Seismic Design Criteria

The acceleration velocity design must be based on Nation Resources of Canada Seismic Hazard Criteria. ☐

8.5 Backfill

8.5.1 Backfill Material

Backfill material for foundation perimeter must be well drained granular soil, such as crushed gravel with waterproof membrane for below grade structure ☐

8.5.2 Sensitive Structure

If sensitive structure is founded on the Backfill material such as Sand and Gravel compaction density as specified by GIR of the backfill material must be tested by certified testing company ☐

8.6 Permanent Dewatering

8.6.1 Foundation Drainage

For convention foundation drainage, perforated PVC pipe will be used to collect any surface gravity drained to city's storm system migrated and natural groundwater to a sump then ☐

8.6.2 Storm System

If City's storm system is higher than the sump elevation, pumping system must be installed with dual-pump and alarm system and may be with backup generator when power is unavailable during adverse conditions. Mechanical and Civil Engineer must be retained to design the system. ☐

8.6.3 Perforated Drainage

Underslab perforated drainage perforated PVC will be installed to improve the foundation drainage if groundwater table is higher than the slab elevation either seasonally or permanently ☐

8.6.4 Tanking

Tanking is also an option when the pumping system might not be capable to drain all below groundwater or foundation drainage system is not installed. Envelop Consultants must be retained for this option ☐

8.6.5 Retention Tank

Retention Tank with control valve may be required due to City's storm system limitation. Civil Engineer must be retained. ☐

8.7 Permanent Underpinning

8.7.1 Underpinning Loading

All underpinning loading must be reviewed and approved by Structural Engineer and GIR. ☐

8.7.2 Separation and Drainage

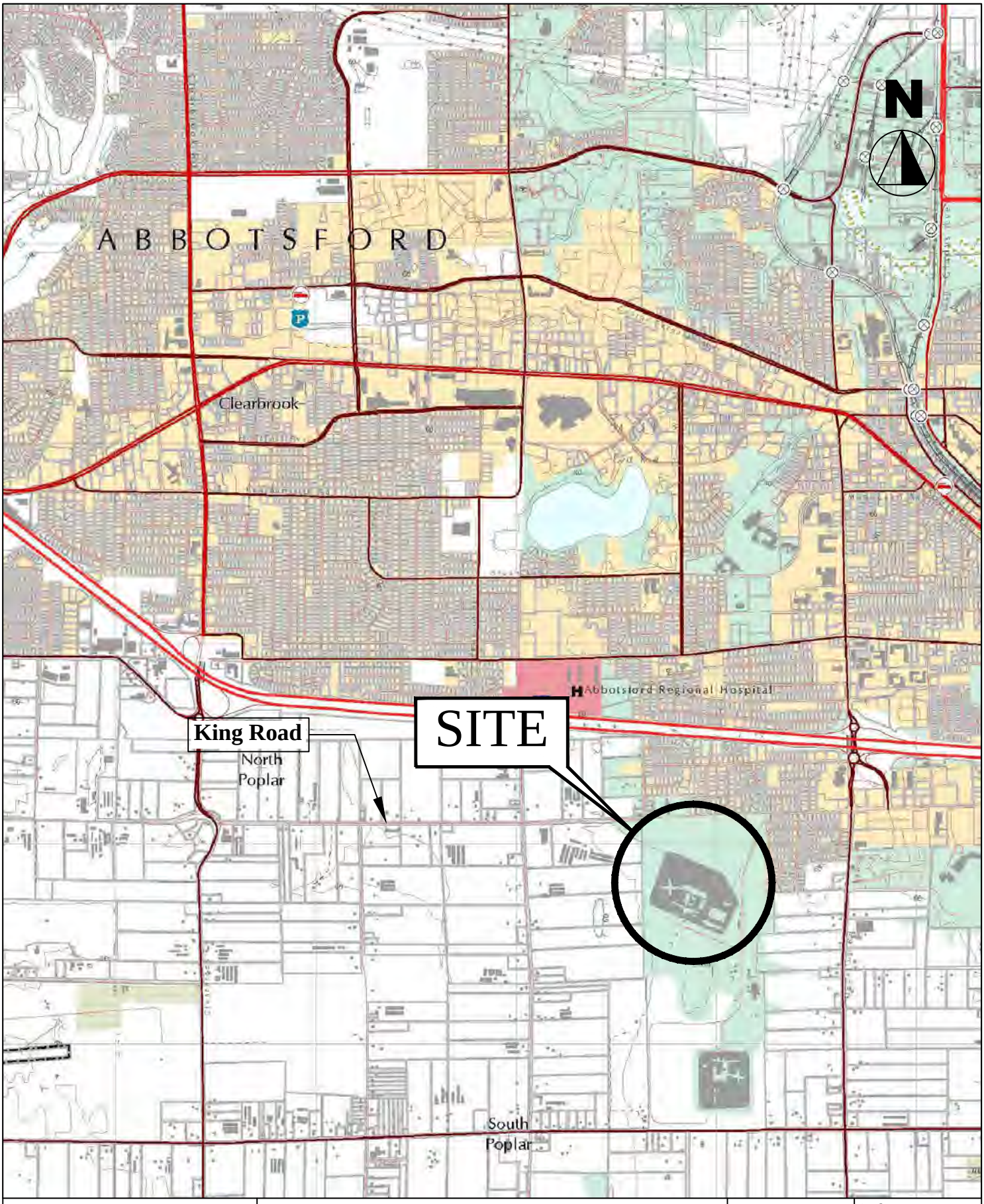
Bond separation and drainage (above and below grade) at the interface of the underpinning area must be reviewed to ensure no water migrate to the underpinning structure. Envelop Consultant must be retained. ☐

FIGURES

PROPOSED PERIMETER FENCE AND GATES UPGRADES
MATSQUI INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

LIST OF FIGURES

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com



JECTH Consultant Inc.

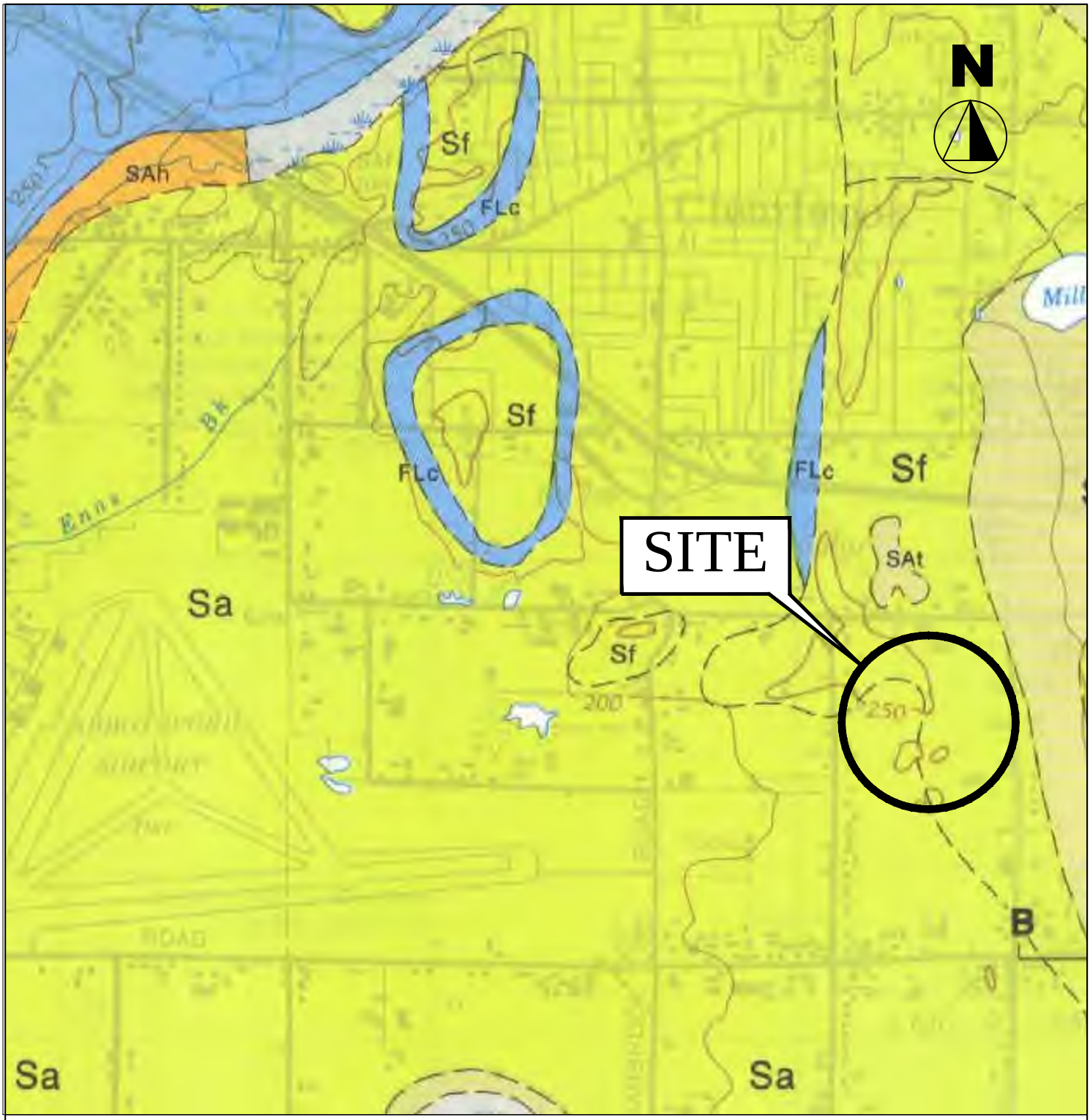
Suite 208, 3832 Henning Drive
Burnaby, B.C. V5C 8P3

Phone: 299-6617 Fax: 299-6641

Site Location Plan

Pacific Region Perimeter Fence Upgrades
Matsqui Institution, King Road, Abbotsford, BC
Client: CWMM Consulting Engineers Ltd.

Drawn By: IC	Scale: NTS
Check by: HKM	Date November 2018
Dwg no: 218C555 - MA 01	



SUMAS DRIFT

Sa,e,i

Recessional glaciofluvial deposits: Sa, *recessional channel and floodplain deposits laid down by proglacial streams; gravel and sand up to 40 m thick, normal range of thickness 5-25 m;* Se, *proglacial deltaic gravel and sand up to 10 m thick;* Si, *similar to* Sa *except that it is pitted outwash*

JECTH Consultant Inc.

Suite 208, 3832 Henning Drive
Burnaby, B.C. V5C 8P3

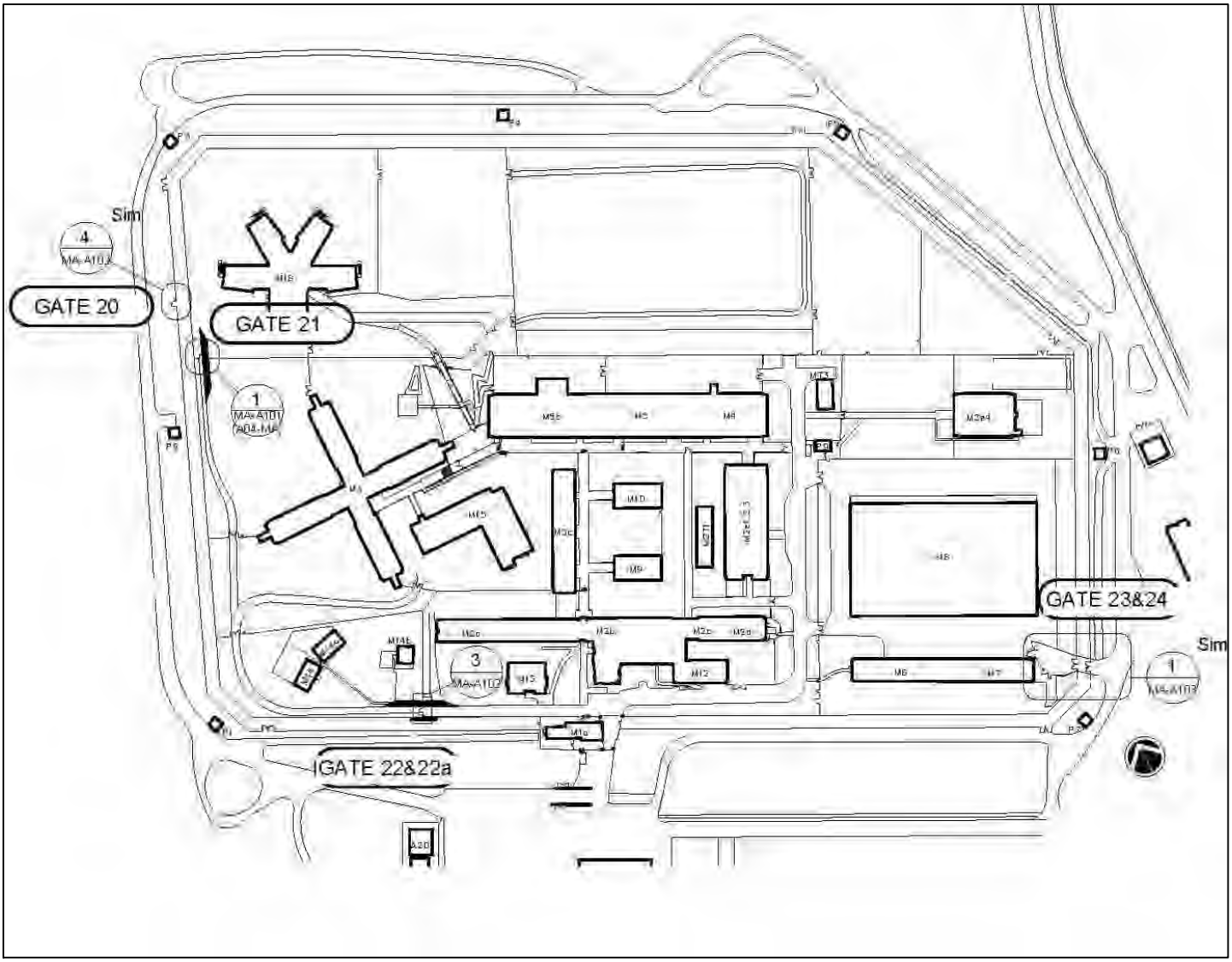
Phone: 299-6617 Fax: 299-6641

Geological Map

Pacific Region Perimeter Fence Upgrades
Matsqui Institution, King Road, Abbotsford, BC
Client: CWMM Consulting Engineers Ltd.

Drawn By:	Scale:
IC	NTS
Check by:	Date
HKM	November 2018

Dwg no: 218C555 - MA 02



JECTH Consultant Inc. Suite 208, 3832 Henning Drive Burnaby, B.C. V5C 8P3 Phone: 299-6617 Fax: 299-6641	**Site Plan** **Pacific Region Perimeter Fence Upgrades** **Matsqui Institution, King Road, Abbotsford, BC** **Client: CWMM Consulting Engineers Ltd.**	Drawn By: IC	Scale: NTS
		Check by: HKM	Date November 2018
		Dwg no: 218C555 - MA 03	

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT
PROPOSED PERIMETER FENCE AND GATES UPGRADES

AT
MATSQUI INSTITUTION
33344 KING ROAD
ABBOTSFORD, BC

FOR

CWMM CONSULTING ENGINEERS LTD.

PREPARED BY

JECTH CONSULTANTS INC.

JOB NO.: 218C555D

DATE: NOVEMBER 30, 2018

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT PROPOSED PERIMETER FENCE AND GATES UPGRADES MATSQUI INSTITUTION, 33344 KING RD, ABBOTSFORD, BC

1.0 INTRODUCTION

1.1 AUTHORIZATION

As authorized by CWMM Consulting Engineers Ltd. on October 22, 2018, JECTH Consultants Inc. (JCI) has carried out a Geotechnical Engineering Review and Assessment for the proposed Perimeter Fence and Gates Upgrade project, Matsqui Institution which is located at 33344 King Road, Abbotsford, BC as shown in Figure MA 01 – Site Location Plan.

1.2 METHODOLOGY

The Geotechnical Engineering Assessment and Review includes:

- Reviewed of available Structural Plan for the Gates
- Obtained the Surficial Geological Map from Geological Canada.
- Reviewed available Geotechnical Report for Building Construction at the Institution and nearby Area.
- Conducted a site reconnaissance by our site staff at the subject site.
- Assessed the available subsurface soil conditions and profile based on desktop review and our local experience within the close vicinity of the subject site.
- Communicated with Institution staff and Structural Engineer.
- This report is prepared according to JECTH Consultants Inc. Proposal P218 -551 dated October 10, 2018.

1.3 OBJECTIVE

This Geotechnical Engineering Report summarizes our findings and provides Geotechnical Engineering Comments and Recommendations for the foundation design and construction of the Gates and Fence upgrade for existing perimeter security fences of the Institution Compound.

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1.4 DESIGN DRAWING

This report is prepared based on the Design Drawings prepared by CWMM which received by our office on October 9, 2018. Any revision of the plan must be informed to JECTH Consultants Inc.

3.0 SITE LOCATION AND CONDITION

The Matsqui Institution is located at south of King Road and about 1 City Block to the south west from the intersection between King Road and McCallum Road intersection. The Matsqui Institution is one of the three Institutions (Matsqui, Fraser Valley and Pacific Institution) in the area.

The Institution is bounded by King Road to the North, an access Road (for all 3 Institutions at the area) to the east, the Fraser Valley Institution to the south and Farmland to the west. The topography of the Site is generally level.

The Institution can be accessed by an access road from the King Road. The Institution compound is surrounded by a double steel security fence along perimeter. Inside Partition fences which separate the Institution compound into different area are also observed. The entrance security building is located at the south of the Institution compound. Utility buildings and car parking area are located further south from the entrance security building, across an access road in between the Matsqui Institution and Fraser Valley Institution.

A site reconnaissance was taken by our site staff on November 20, 2018 around the perimeter security fences, as well as Partition fences inside Institution compound. The reconnaissance at the proposed gates upgrade locations and local nearby area indicate there is no apparent subsidence of ground, nor any distress of asphalt surface along the surrounding access road.

Topography of the Site is generally level. There is no sign of water in ditches along the access road during the day of Site Reconnaissance in fine weather.

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4.0 PROPOSED GATES UPGRADE

Based on a Site Plan supplied by CWMM Consulting Engineers as shown in Figure MI 03, there will be 5 nos. of gates to be installed around the existing perimeter fences. The gates are either new gates, or replace existing gates as an upgrade as listed in the following:

Gate No.	Location	Gate Usage
20	West Perimeter	Maintenance Vehicle
21	Inside Partition Fence	Vehicle
22 & 22a	Combine Vehicle Fence and Pedestrian Fence (inside Partition Fence)	Vehicle and Pedestrian
23	S.E. corner of Perimeter Fence	Emergency Vehicle
24	S.E. corner of Perimeter Fence	Emergency Vehicle

Gate No. 21 has already been completed before the site visit. The structural details of the Gates are enclosed in Appendix "A" – Gates Upgrade for Matsqui Institution for ease of reference.

Gates for vehicle passage will have foundation design for transient vehicle load from Trucks and Fire Trucks. JCI estimate an equivalent surcharge load of 15 KPa for vehicle loading will be sufficient for the transient live load design.

5.0 SUBSURFACE SOIL CONDITIONS

Based on available Geological Map as shown in MA 02 – Geological Map, the Matsqui Institution is situated in Suma Drifts (Sa) deposit and should be underlain with SAND and Gravel at shallow surface and further underlain by Glacial Deposit composed of dense Till-like soil.

There are several geotechnical report available for review for building construction in the nearby Fraser Valley Institution and a recent construction report at Gate 21 of the Matsqui Institution. A lists of the report are in the followings:

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1. Geotechnical Report by Braun Geotechnical at the Fraser Valley Institution dated September 15, 2015 for a warehouse upgrade project east to the Institution.
2. Draft Geotechnical Report by Golder & Associate Ltd dated January 20, 2012 for building construction at Fraser Valley Institution. Location of investigation was at the parking Area to the south the Matsqui Security Building.
3. Geotechnical Report by Stantec Consulting dated December 1, 2011 for Building investigation in Fraser Valley Institution.
4. Geotechnical Report by Klohn Crippen Berger dated November 2 and 29, 2010 for 3 nos. of Buildings in Fraser Valley Institution.
5. Construction Report, Gate 21 Mock up, Matsqui Institution dated January 30, 2018 by Amec Foster Wheeler Environmental & Infrastructure.

The construction report by Amec Foster Wheeler identify compact SAND and Gravel at foundation subgrade during foundation construction of Gate 21.

The year 2015 Braun Report utilized test pitting for geotechnical investigation. All other reports using auger holes and DCPT for investigation to the depth of 4 m to 5 m below existing grade. All auger holes encountered refusal at depth between 4 m to 5 m, probably due to presence of cobbles.

In order to reach deeper soil stratum that cannot obtain in auger , Stantec and Klohn Crippen Berger used Becker Hammer equipment to reach 14 m depth. The main purpose to reach a deeper soil stratum by a stronger equipment than auger in order to establish Site Class for seismic building design.

In general, the site and nearby area have minor FILL at about 1 m at the surface and underlain by a compact to dense SAND and Gravel, and further underlain by dense Till-like Soil composed by Glacial Deposit. Groundwater was measured at 4.48 m depth by a standpipe installed by Klohn Crippen Berger.

The depth of FILL can be varied from location to location. A few of the auger holes and test pits of previous investigation obtained FILL up to 3 m. It is believed that the existing level topography of the Institution was made level by past site preparation. Previous soft native organic soil was removed and replaced with SAND and Gravel excavated in nearby area. The localized deep FILL area are likely backfill of culvert and low lying drainage ditches in previous farmland before the construction of the Institution.

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All the reviewed soil logs are listed in Appendix "C" - Soil Logs by other for ease of reference.

After review all the soil logs and report conclusion by the above geotechnical report references, it is our opinion that the proposed light weight gate structure will only affected by the compact SAND and Gravel (either Fill or native material) at shallow depth.

For simplicity of presentation in this report, the general soil profile in the area can be simplified in the following table:

Depth (m)	Soil	Remark
0 - 1	Silty Sand and Gravel FILL	Compact
1 - 4	SAND and Gravel	Compact to Dense
4 - 14	Glacial Soil Deposit composed of Dense Silty SAND, cobbles or stiff Sandy SILT (Till-like Soil)	Dense to very dense

Groundwater is likely below 4 m depth and with local Perched water at FILL /Native Soil interface.

Discussion with PWGSC site staff during a Site reconnaissance on November 20, 2018 indicate the previous constructions within the area encountered shallow presence of SAND and Gravel.

6.0 GEOTECHNICAL FOUNDATION DESIGN

Due to presence of compact SAND and Gravel FILL and compact to dense native SAND and Gravel at shallow depth, the Gate Footing have to found on either FILL and Native material which will provide bearing resistance for Gate foundation.

The gate foundation can be conventional shallow stripped and pad footing found on either SAND and Gravel FILL or native SAND and Gravel.

An allowable bearing capacity of 100 KPa for SLS design and ultimate bearing capacity of 150 KPa for ULS design are recommended. The minimum depth of footing should be at least 0.5 m. below surface for frost protection. In the case that soil

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subgrade modulus is used for design of the footing, a modulus subgrade reaction at 10,000 KN / m^3 can be used for the analysis.

Long term settlement of the footing will be in the order of 25 mm. Settlement will likely completed during construction period. Differential settlement of the footings will be minimal. In the case that the footing found on SAND and Gravel FILL, the material will require re-compaction to 100% Standard Proctor Density at the gates location.

Groundwater will unlikely occur during construction. In the case that perched water is encountered, temporary de-watering will be necessary for the site preparation work for re-compaction and foundation construction by introduction of temporary de-watering sump.

7.0 SEISMIC DESIGN

The Braun Report support a site Class C for seismic design which recommended both by Stantec and Klohn Crippen Berger reports. The Golder & Associates recommend a Site Class D in the drafted report.

Our opinion consider a **Site Class D** (for dense soil) which is more suitable for the gates upgrade project due to varying soil strength of compact SAND and Gravel at shallow depth.

Peak Ground Acceleration (PGA) and Spectrum acceleration for 2% probability of exceedance in 50 years can be obtained from Resource Canada for a **Class C** site in NBCC 2015 as follow:

Site Co-ordinate: Longitude 49.027^o North, Longitude 122.304^o West

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	Sa(5.0)	Sa(10.0)	PGA
0.702g	0.569g	0.349g	0.214g	0.072g	0.025g	0.308g

A copy of the search result from Resource Canada is enclosed in Appendix "B" - Seismic Design Criteria for ease of reference.

Due to presence of compact to dense SAND and Gravel vicinity depth below proposed shallow gate footing, the Site Classification to be a **Class D Site for dense soil** in accordance to Table 4.1.8.4 A of BC Building Code 2012. The following Fa and Fv

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values are interpolated from Table 4.1.84 B and 4.1.8.4 C respectively from Building Code to apply for a Class D Site.

	Sa (0.2)	**Sa (0.2)**	**Sa (0.2)**
	0.5g	0.75g.	0.702 g.
Fa	1.2	1.1	**1.12**

	Sa (1.0)	**Sa (1.0)**	**Sa (1.0)**
	0.3 g	0.4 g	0.323 g.
Fv	1.2	1.1	**1.15**

Based on the linear interpretation, of the obtained Fa and Fv respectively are **1.12** and **1.15** for **Class D** site.

Seismic Bearing Capacity can be taken for a $^{1}/_{3}$ increase of ultimate bearing capacity (in this case 200 KPa) with anticipation of short duration of Earthquake event. Liquefaction of the site is unlikely due the presence of non liquefiable compact to dense SAND and Gravel in vicinity depth of the proposed gate footings.

8.0 GEOTECHNICAL ENGINEERING FIELD REVIEW

JECTH Consultants Inc. will provide Field Review (Geotechnical Engineering) according to the 2012 BC Building Code and Letter of Assurance (Schedule "B") as well as municipality requirements.

The following general field reviews (Require 48 hour notification) are required prior to and during construction stage (see also Appendix "D" - Standard Geotechnical Inspection Requirements).

The general contractor or PWGSC must inform JECTH Consultants Inc for site inspection as required by Local Municipality for the followings:

- Temporary Construction Drainage (if required)
- Foundation Bearing Capacity (confirmation and Certification)
- Compaction of Structural FILL.
- Perimeter backfill (Material requirements, compaction and Drainage)
- Other site inspections as specified in BC Building Code 2012

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- Unforeseen subsurface soil and groundwater conditions as encountered prior to, during and after construction stage.

Other Geotechnical Engineering technical requirements and in-situ testing will be performed by certified laboratory/testing company and will be reviewed by JECTH Consultants Inc. during construction stage.

Specific Site Geotechnical Engineering issues must be addressed by JECTH Consultants Inc. prior to and during construction stage.

9.0 FINAL FOUNDATION DESIGN REVIEW

JECTH Consultants Inc. should be given an opportunity to review the followings:

1. The detail and final Structural Engineering Drawing must be reviewed by JECTH Consultants Inc. prior to Building Permit Application such that the above comments and recommendations can be confirmed and modified.

2. Any other Electrical and Mechanical as well as Civil Engineering and Landscape Architect Drawings, if likely affect the foundation design and construction, must be reviewed and approved by JECTH Consultants Inc.

3. A consultant coordination meeting must be arranged prior to Building Permit Application or prior to construction start such that all design team members can confirm all design parameters for the project.

4. JECTH Consultants Inc. will review the exposed subsurface soil and groundwater conditions prior to and during construction stage. It is possible that the Geotechnical recommendations provided in this report be modified due to unforeseen circumstances and change in subsurface soil as well as groundwater condition.

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10.0 FIELD INSPECTIONS AND PRE-CONSTRUCTION MEETING

A pre-construction meeting must be organized between the site superintendent/contractor representatives and JECTH Consultants Inc. at a minimum of two weeks before **any site construction activities** such that appropriate field work can be carried out.

JECTH Consultants Inc. must be notified (48 hours) of all fieldwork prior to any site work in particular before site clearing, stripping and preparation. This will allow JECTH Consultants Inc. to provide final comments for the project with respect to Geotechnical Engineering.

11.0 CLOSURE

We trust this report meets your immediate requirements. If you have any questions regarding this report, please do not hesitate to contact the undersigned @ 604-299-6617.

JECTH Consultants Inc.

N. C. CHU PROFESSIONAL ENGINEER

December 6, 2018

Ivan Chu, P.Eng.

Attachments: List of Figures

Figure MA 01 – Site Location Plan
Figure MA 02 – Geological Map
Figure MA 03 – Site Plan

List of Appendixes

Appendix "A" – Gates No. 20, 21, 22, 22A, 23 and 24 Plan and Detail (Matsqui Institution)
Appendix "B" – Seismic Design Criteria
Appendix "C" – C1 - Soil Log from Braun Geotechnical. 2015
C2- Soil Log from Golder & Associates Ltd. 2012
C3 - Soil Log from Stantec Consulting. 2011
C4 -Soil Log from Klohn Crippen Berger 2010
Appendix "D" – Standard Field Inspection Requirements

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APPENDIX F

Geotechnical Engineering Review and Assessment: (Pacific Institution)
Appendix a: Pacific Institution - Gates Gates 15, 16, 17 & 18
Appendix b: Pacific Institution - Seismic Design Criteria
Appendix c: Matsqui Institution
- Soil Logs from AMEC Wheeler Forster Envir/Infra
- Soil Logs from Golder & Assoc.
- Soil Logs from Stantec Consulting
- Soil Logs from Klohn Crippen Berger
Appendix d: Pacific Institution - Standard Field Inspection Requirements

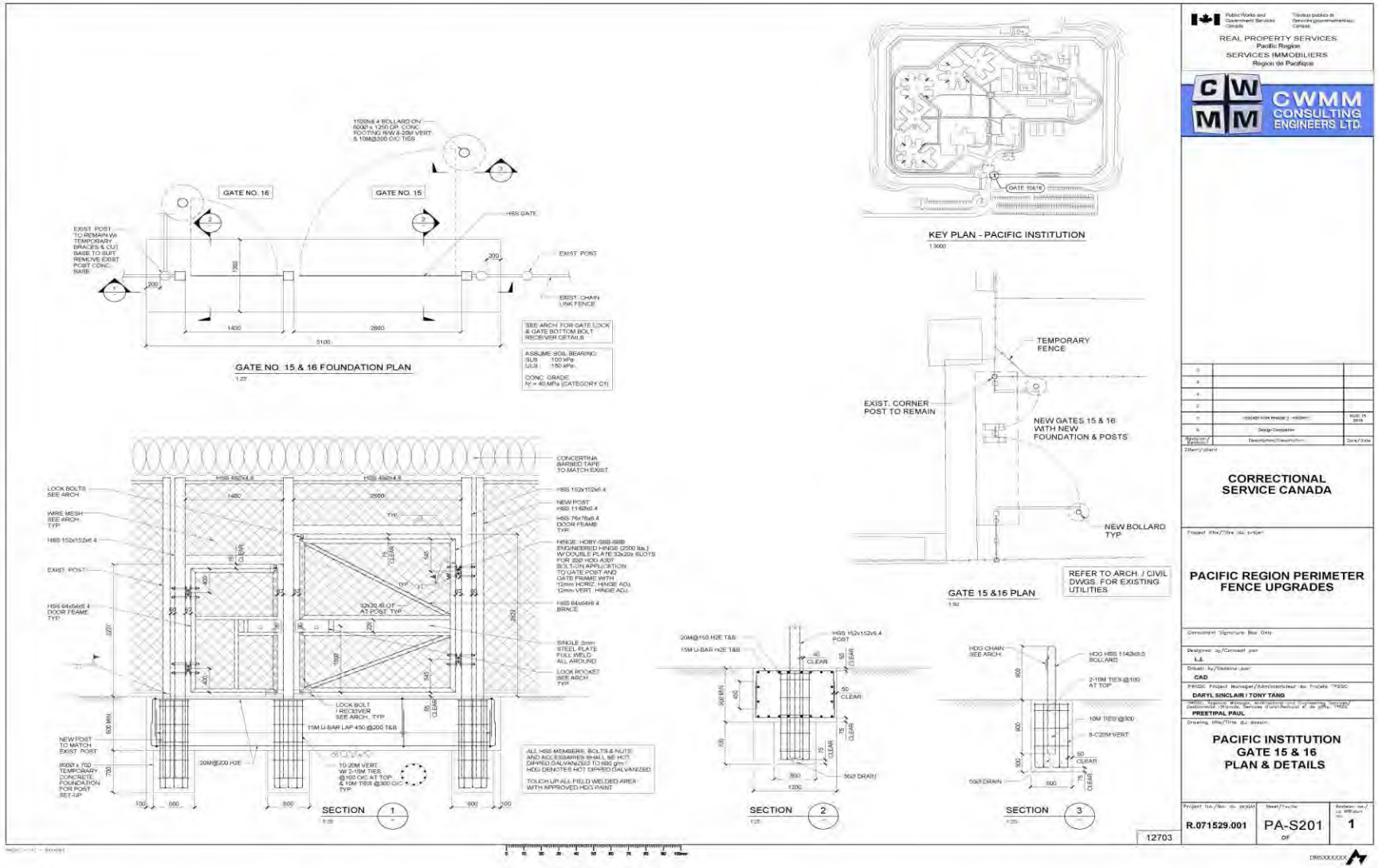
JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "A"

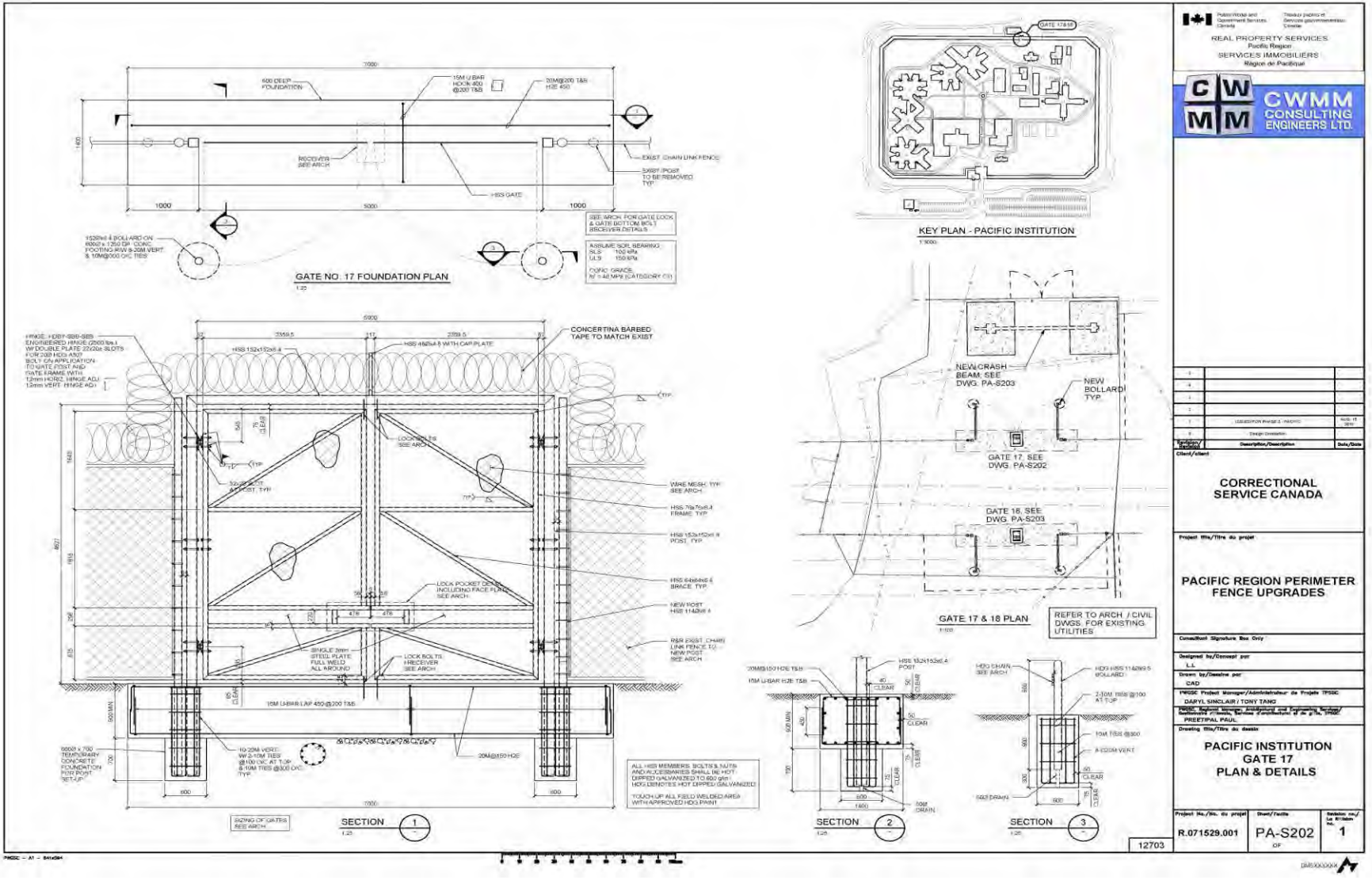
PROPOSED PERIMETER FENCE AND GATES UPGRADES
PACIFIC INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

GATES NO. 15, 16, 17 & 18 PLAN AND DETAIL
(PACIFIC INSTITUTION)

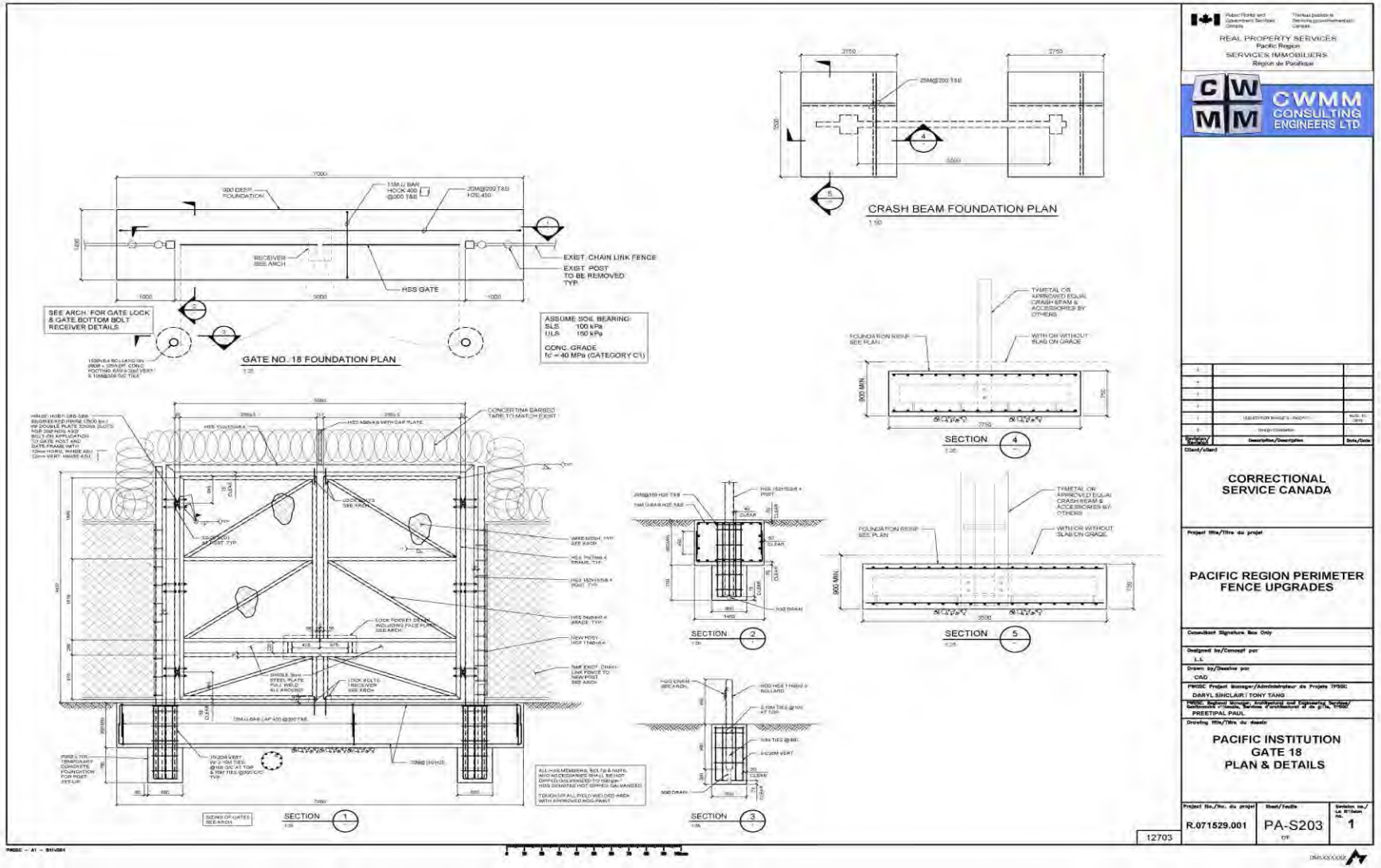
Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com



JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 15 & 16 Plan and Detail (Pacific Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Pacific Institution, 33344 King Road, Abbotsford, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555E – Appendix "A"	



JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 17 Plan and Detail (Pacific Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Pacific Institution, 33344 King Road, Abbotsford, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC Chk. HKM SCALE Not to scale Date: Nov. 2018 Dwg. No.: 218C555E – Appendix "A"



JECTH Consultants Inc. Suite 208-3823 Henning Drive Burnaby, B.C. V5C 6P3 Phone: (604) 299-6617	**Gate No. 18 Plan and Detail (Pacific Institution)** **Proposed Perimeter Fence and Gates Upgrades** **Pacific Institution, 33344 King Road, Abbotsford, BC** **Client: CWMM Structural Engineers Consulting**	Prepared by: FC	SCALE Not to scale
		Chk. HKM	Date: Nov. 2018
		Dwg. No.: 218C555E – Appendix "A"	

JECTH Consultants Inc.
Geotechnical & Environmental Engineers

APPENDIX "B"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
PACIFIC INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

SEISMIC DESIGN CRITERIA

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

November 09, 2018

Site: 49.019 N, 122.3027 W User File Reference: Pacific Institution

Requested by: , Jecth Consultants

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.374	0.565	**0.706**	0.689	**0.598**	**0.350**	**0.214**	**0.072**	**0.025**	**0.310**	**0.447**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.084	0.186	0.258
Sa(0.1)	0.129	0.284	0.391
Sa(0.2)	0.165	0.360	0.494
Sa(0.3)	0.163	0.356	0.486
Sa(0.5)	0.133	0.305	0.421
Sa(1.0)	0.069	0.169	0.241
Sa(2.0)	0.038	0.098	0.143
Sa(5.0)	0.0085	0.025	0.042
Sa(10.0)	0.0031	0.0090	0.015
PGA	0.070	0.157	0.216
PGV	0.081	0.208	0.302

References

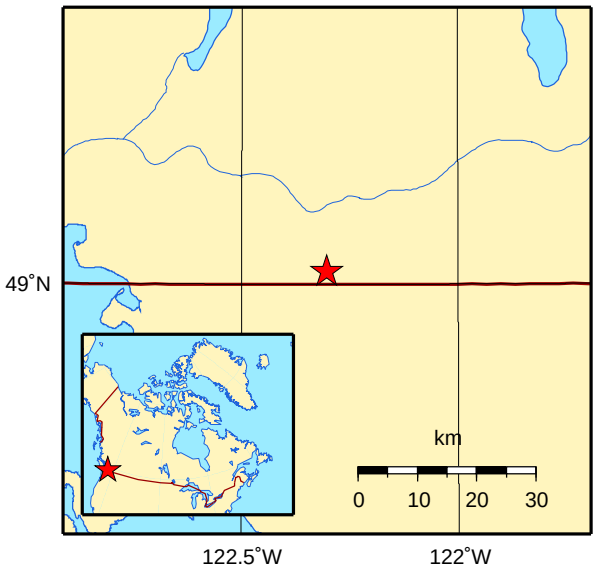
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



APPENDIX "C"

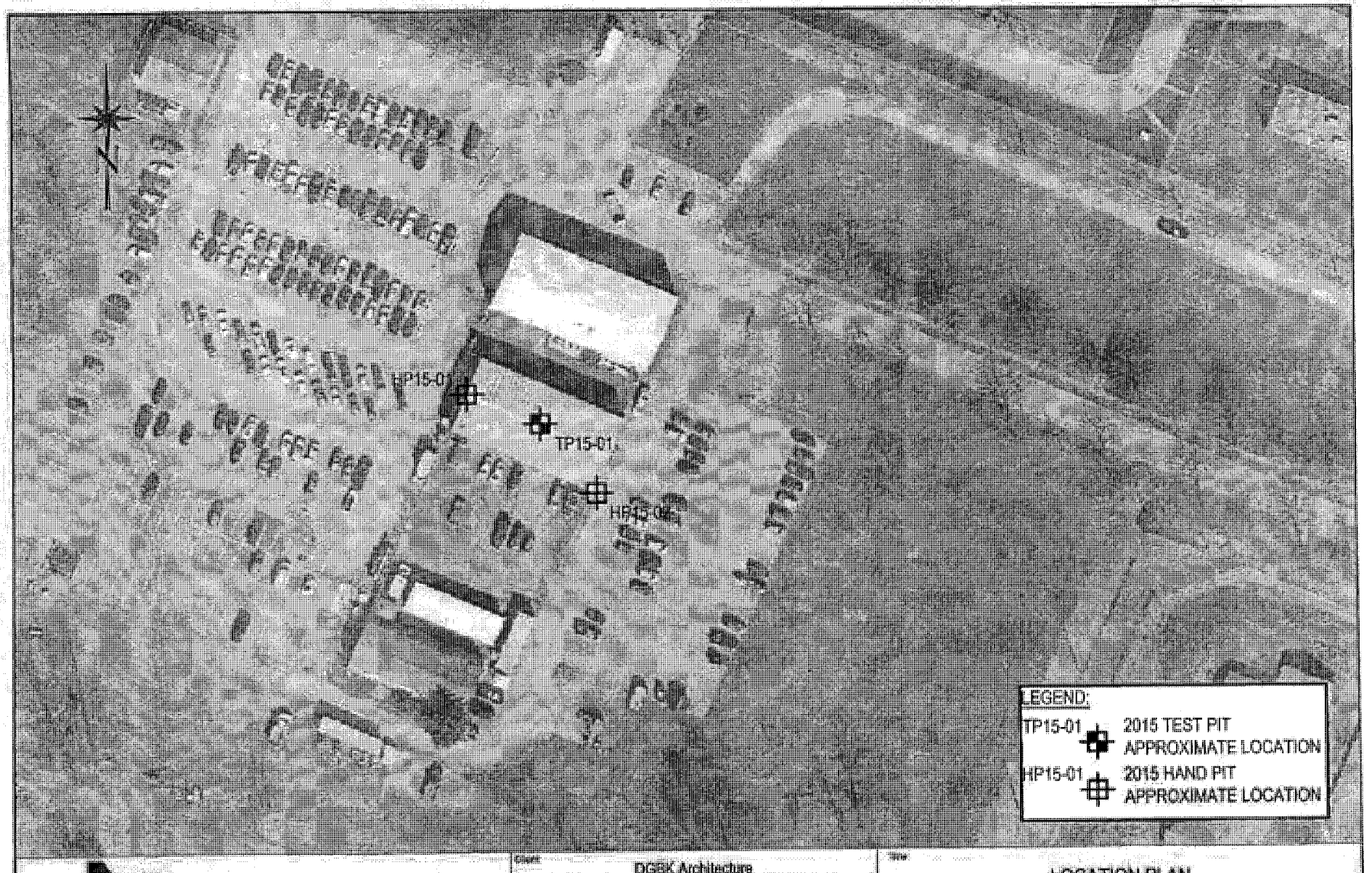
PROPOSED PERIMETER FENCE AND GATES UPGRADES
PACIFIC INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

C1 - SOIL LOGS FROM BRAUN GEOTECHNICAL 2015

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

BRAUN GEOTECHNICAL LTD.

Client: DGBK Architecture				Title: KEY PLAN			
Project: A15 CORCAN Warehouse Upgrade and Freezer Addition Matsqui Institution, Abbotsford							
Project no.: 15-6516	Drawn: EV	Design: HD	Checked: JW	Date: September 15, 2015	Scale: 1:4000	Drawing no.: 15-6516-KP	



BRAUN GEOTECHNICAL LTD.

Client: DGBK Architecture

Project: A15 CORCAN Warehouse Upgrade
Matsqui Institution, Abbotsford

Title: LOCATION PLAN

Project no.	Drawn	Design	Checked	Date	Scale	Drawing no.
15-6516	EV	HD	JW	September 15, 2015	1:1000	15-6516-01

BRAUN GEOTECHNICAL LTD.

Client	DGBK Architecture
Project	Proposed Freezer Addition Matsqui Institution, Abbotsford
Title	LOCATION PLAN

Project no.	Drawn	Designed	Checked	Date	Scale	Drawing no.
15-6516	EV	HD	JW	September 15, 2015	1:1000	15-6516-02

Test Pit Log: TP15-01

File: 15-6516
Project: A15 CORCAN Warehouse Upgrade
Client: DGBK Architecture
Location: Matsqui Instituition, Abbotsford

BRAUN GEOTECHNICAL LTD.

Depth (ft)	Depth (m)	Thickness (mm)	Sample	Soil Description	Sample #	Water Cont.	Remarks
0	0	75		ASPHALT			
		75		grey-brown, damp, compact, 19mm minus SAND and GRAVEL, trace silt (BASE)			
1			O	brown, damp, compact SAND, some gravel, trace to some silt, occasional cobbles (FILL) - wooden block at 0.9m	S1		
2							
3	1						
4				grey, damp, compact SAND, trace to some gravel, trace silt			
5			O		S2		
6				End of Test Pit @ 1.7m			
7	2						
8							
9							
10	3						

Equipment: Tracked Compact Excavator
Sampling Method: Lump Sample

Datum: Ground Surface
Water Depth: Not Encountered

Logged By: EV
Exploration Date: August 25, 2015
Dwg No.: 15-6516-TP01
Page: 1 of 1

Test Pit Log: TP15-02

File: 15-6516
Project: Proposed Freezer Addition
Client: DGBK Architecture
Location: Matsqui Instituition, Abbotsford

BRAUN GEOTECHNICAL LTD.

Depth (ft)	Depth (m)	Thickness (mm)	Sample	Soil Description	Sample #	Water Cont.	Remarks
0	0			brown, damp, firm SILT, some sand, trace organics, trace rootlets (TOPSOIL)			
1				brown, damp, compact, silty SAND			
2			O		S1		
3	1						
4				grey, damp, compact SAND, trace to some gravel, trace silt, occasional cobbles/ boulders			
5			O		S2		
6							
7	2						
			O		S3		
8				End of Test Pit @ 2.3m			
9							
10	3						

Equipment: Tracked Compact Excavator
Sampling Method: Lump Sample

Datum: Ground Surface
Water Depth: Not Encountered

Logged By: EV
Exploration Date: August 25, 2015
Dwg No.: 15-6516-TP02
Page: 1 of 1

Hand Pit Log: HP15-01

File: 15-6516
Project: A15 CORCAN Warehouse Upgrade
Client: DGBK Architecture
Location: Matsqui Instituition, Abbotsford

BRAUN GEOTECHNICAL LTD.

Depth	Thickness (mm)	Sample	Soil Description	Sample #	Water Cont.	Remarks
0 ft / 0 m	75		ASPHALT			
	75		ASPHALT			
	100		grey-brown, damp, compact, 19mm minus SAND and GRAVEL, trace silt (BASE)			
1			brown, damp, compact SAND, some gravel, trace to some silt, occasional cobbles (FILL) - occasional grey sand interlayers			
2						
3						
1						
4						
5						
			grey, damp, compact SAND, some gravel, trace silt, occasional cobbles			
			End of Hand Pit @ 1.7m			
6						
2						
7						
8						
9						
3						
10						

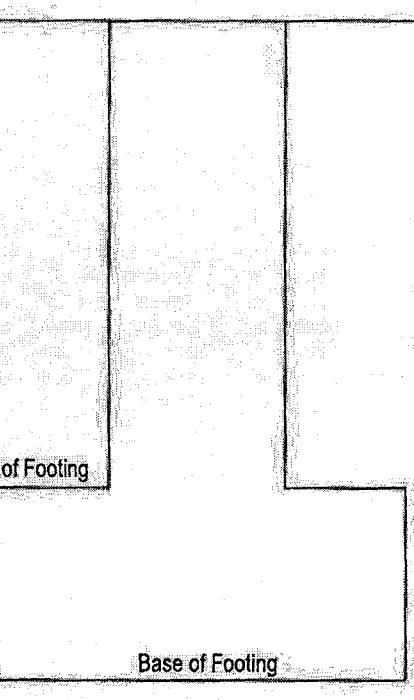


Diagram of Approximate Footing Depth
Horizontal NTS

Equipment: Tracked Compact Excavator
Sampling Method: Lump Sample

Datum: Ground Surface
Water Depth: Not Encountered

Logged By: EV
Exploration Date: August 25, 2015
Dwg No.: 15-6516-HP01
Page: 1 of 1

Hand Pit Log: HP15-02

File: 15-6516
Project: A15 CORCAN Warehouse Upgrade
Client: DGBK Architecture
Location: Matsqui Instituition, Abbotsford

BRAUN GEOTECHNICAL LTD.

Depth (ft / m)	Thickness (mm)	Sample	Soil Description	Sample #	Water Cont.	Remarks
0 / 0	75		ASPHALT			
	100		grey-brown, damp, compact, 19mm minus SAND and GRAVEL, trace silt (BASE)			
1			brown, damp, compact SAND, some gravel, trace to some silt, occasional cobbles (FILL) - occasional grey sand interlayers			
3 / 1			End of Hand Pit @ 0.9m			
10 / 3						

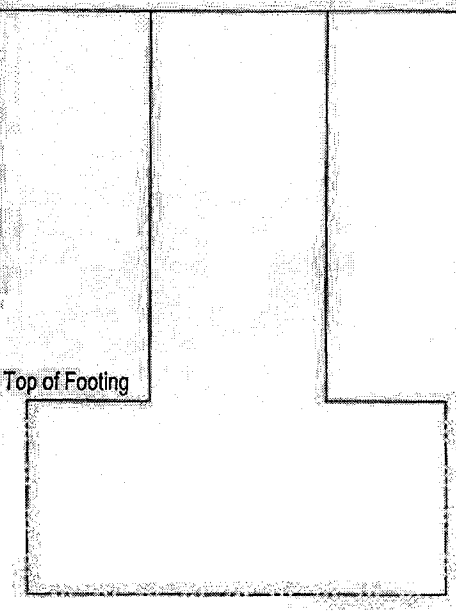


Diagram of Approximate Footing Depth
Horizontal NTS

Equipment: Tracked Compact Excavator
Sampling Method: Lump Sample

Datum: Ground Surface
Water Depth: Not Encountered

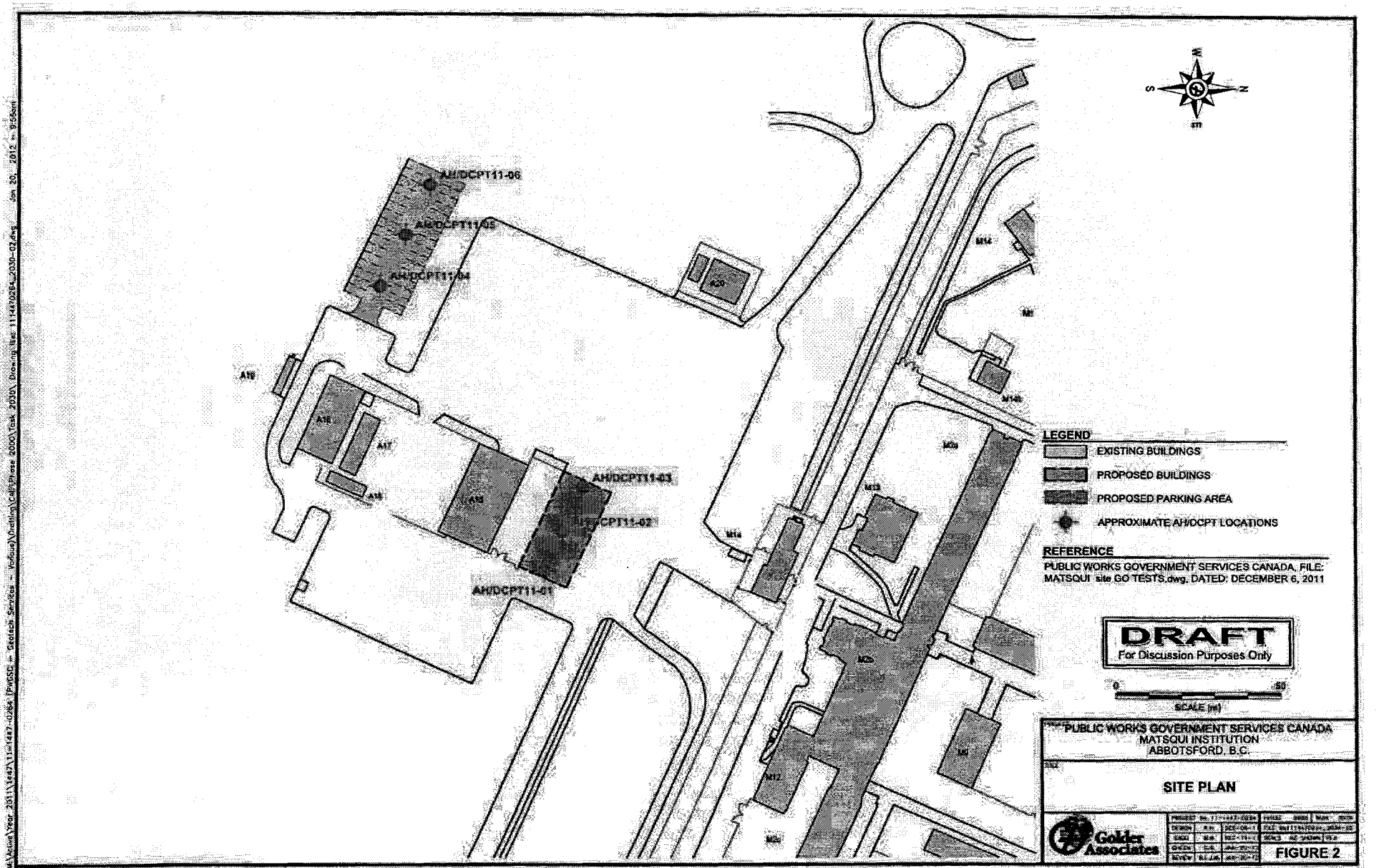
Logged By: EV
Exploration Date: August 25, 2015
Dwg No.: 15-6516-HP02
Page: 1 of 1

APPENDIX "C"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
PACIFIC INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

C2 - SOIL LOG FROM GOLDER & ASSOCIATES LTD. 2012

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com


AH/DCPT11-06
AH/DCPT11-05
AH/DCPT11-04
AH/DCPT11-03
AH/DCPT11-02
AH/DCPT11-01
A19
A18
A17
A16
A15
A20
M14
M5
M14b
M9a
M13
M14
M8
M12
M11
LEGEND
EXISTING BUILDINGS
PROPOSED BUILDINGS
PROPOSED PARKING AREA
APPROXIMATE AH/DCPT LOCATIONS
REFERENCE
PUBLIC WORKS GOVERNMENT SERVICES CANADA, FILE: MATSQUI site GO TESTS.dwg, DATED: DECEMBER 6, 2011
DRAFT
For Discussion Purposes Only
0
50
SCALE (m)
PUBLIC WORKS GOVERNMENT SERVICES CANADA
MATSQUI INSTITUTION
ABBOTSFORD, B.C.
SITE PLAN
Golder Associates
FIGURE 2

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-01

SHEET 1 OF 1

LOCATION: See Figure 2.
N: ~5430578 E: ~550821
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DATUM: Local

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10⁻³ 10⁻⁴ 10⁻⁵ 10⁻⁶)	WATER CONTENT PERCENT Wp [— ○ W —] Wl NP - Non-Plastic (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0	Track Mounted Auger Drill Solid Stem Auger	Ground Surface		0.00									
1		Firm, moist, brown CLAYEY SILT, trace sand and gravel. [FILL]			1	AS							No Groundwater Seepage Encountered in Open Hole.
2				1.83	2	AS						M	
3		Compact to dense, moist, grey SAND, trace to some gravel, trace silt with possible cobbles.			3	AS					End of Dynamic Cone Penetration Test.		
4													
5		End of Augerhole.		4.88									
6													
7													
8													
9													
10													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

DRAFT

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-02

SHEET 1 OF 1

DATUM: Local

LOCATION: See Figure 2.
N: ~5430583 E: ~550807
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

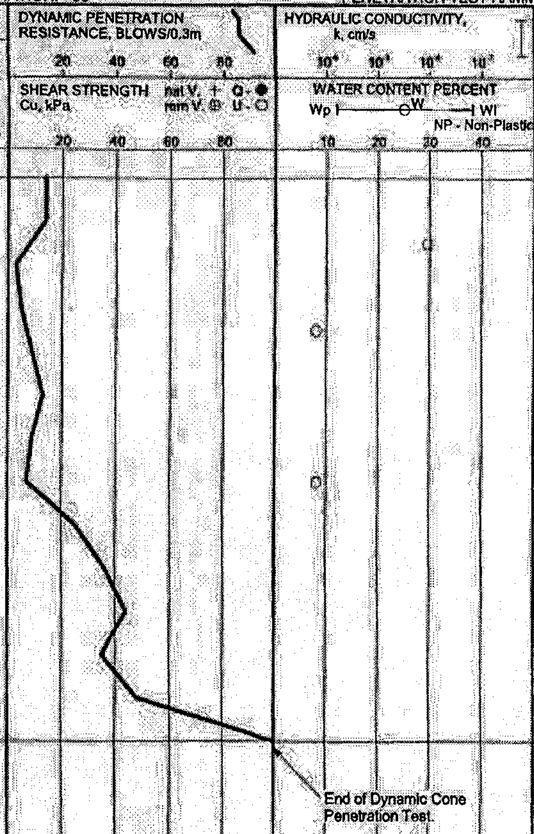
DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

BORING METHOD: Track Mounted Auger Drill, Solid Stem Auger

DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0	Ground Surface						
	Soft to firm, moist, brown CLAYEY SILT, trace sand and gravel.	0.00	1	AS			
1	Loose to compact, moist, grey SAND, trace silt and gravel.	0.76	2	AS		M	No Groundwater Seepage Encountered In Open Hole.
2	Compact to dense, moist, grey SAND, some gravel to gravelly, trace silt.	1.60	3	AS		M	
3			4	AS			
4	End of Augerhole.	3.96					



DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN
DRAFT

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-03

SHEET 1 OF 1

LOCATION: See Figure 2.
N: ~5430586 E: ~550794
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DATUM: Local

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-4} 10^{-5} 10^{-6} 10^{-7})	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
		Ground Surface		0.00				SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊟ U - ○ (20 40 60 80)	WATER CONTENT PERCENT: Wp I—○W—I Wl; NP - Non-Plastic (10 20 30 40)		
0	Track Mounted Auger Drill; Solid Stem Auger	Loose to compact, moist, brown SILT, some sand and gravel. [possible FILL]			1	AS			14		Soil Cuttings.
1		Compact, moist, grey SAND and GRAVEL, trace silt.		0.91	2	AS				M	No Groundwater Seepage Encountered in Open Hole.
2		Compact to dense, moist, grey SAND, trace to some gravel, trace silt.		1.52	3	AS					Screen Filter Sand
3		End of Augerhole.		3.05				End of Dynamic Cone Penetration Test.			
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

DRAFT

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-04

SHEET 1 OF 1

LOCATION: See Figure 2.
N: ~5430530 E: ~550753
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

DATUM: Local

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10⁻⁵ 10⁻⁴ 10⁻³ 10⁻²)	WATER CONTENT PERCENT Wp I—⊖W—I Wl NP - Non-Plastic (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0	Track Mounted Auger Drill. Solid Stem Auger.	Ground Surface											
		Firm, moist, brown CLAYEY SILT, trace fine sand, gravel and organics (wood/roots). [FILL]		0.00	1	AS							
1		Compact, moist, grey, gravelly SAND to SAND and GRAVEL, trace silt. [possible FILL]		0.76	2	AS							No Groundwater Seepage Encountered in Open Hole.
2		Compact, moist, grey SAND and GRAVEL, trace silt.		1.52	3	AS							
3		No recovery. Possible Cobbles.		3.05									
4		End of Augerhole.		3.96				End of Dynamic Cone Penetration Test.					
5													
6													
7													
8													
9													
10													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

DRAFT

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-05

SHEET 1 OF 1

LOCATION: See Figure 2.
N: -5430539 E: -550733
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DATUM: Local

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-6} 10^{-7} 10^{-8})	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q- ●, U- ○) (20 40 60 80)	WATER CONTENT PERCENT Wp I—○W—I Wl, NP - Non-Plastic (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0		Ground Surface											
	Track Mounted Auger Drill; Solid Stem Auger	Loose, moist, brown SILT and SAND, trace gravel and organics (roots). [FILL]		0.00	1	AS							No Groundwater Seepage Encountered in Open Hole.
1													
		Loose, moist, brown, sandy SILT, trace to some gravel with fragments of brick. [FILL]		1.52	2	AS							
2													
3					3	AS							
		Compact to dense, moist, grey SAND and GRAVEL, trace silt.		2.66	4	AS							
4													
		End of Augerhole.		4.57				End of Dynamic Cone Penetration Test.					
5													
6													
7													
8													
9													
10													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

DRAFT

File:\\ACTIVE\YEAR 2011\1447\11-1447-0264 (PWCG - GEOTECH SERVICES - VARIOUS)\GINT DATABASE\11-1447-0264 (2030).GPJ Odot Form.GC FOREHOLE (AUTO) Template:GC REGION TEMPLATE BETA 1.GDT Library:GC REGION LIBRARY.GLB CreatedIn 01/26/12

PROJECT No.: 11-1447-0264/2030

RECORD OF AUGERHOLE: AH/DCPT11-06

SHEET 1 OF 1

LOCATION: See Figure 2.
N: ~5430537 E: ~550720
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DATUM: Local

DRILLING DATE: November 28, 2011
DRILLING CONTRACTOR: Downrite Drilling Ltd.

INCLINATION: -90°

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-4} 10^{-5} 10^{-6} 10^{-7}) / WATER CONTENT PERCENT (Wp, W, Wl; NP - Non Plastic) (10 20 30 40)	ADDITIONAL LAB TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0		Ground Surface		0.00							
1	Thick Mounded Auger Drill / Solid Stem Auger	Loose, moist, brown, sandy SILT, trace gravel and organics (roots).			1	AS					
2					2	AS					
3		Loose, wet, brown, sandy SILT, some gravel with possible cobbles at about 3.96 m.		3.05	3	AS					Water level observed in open hole during drilling
4		End of Augerhole.		3.96				End of Dynamic Cone Penetration Test.			
5											
6											
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AN
CHECKED: DEN

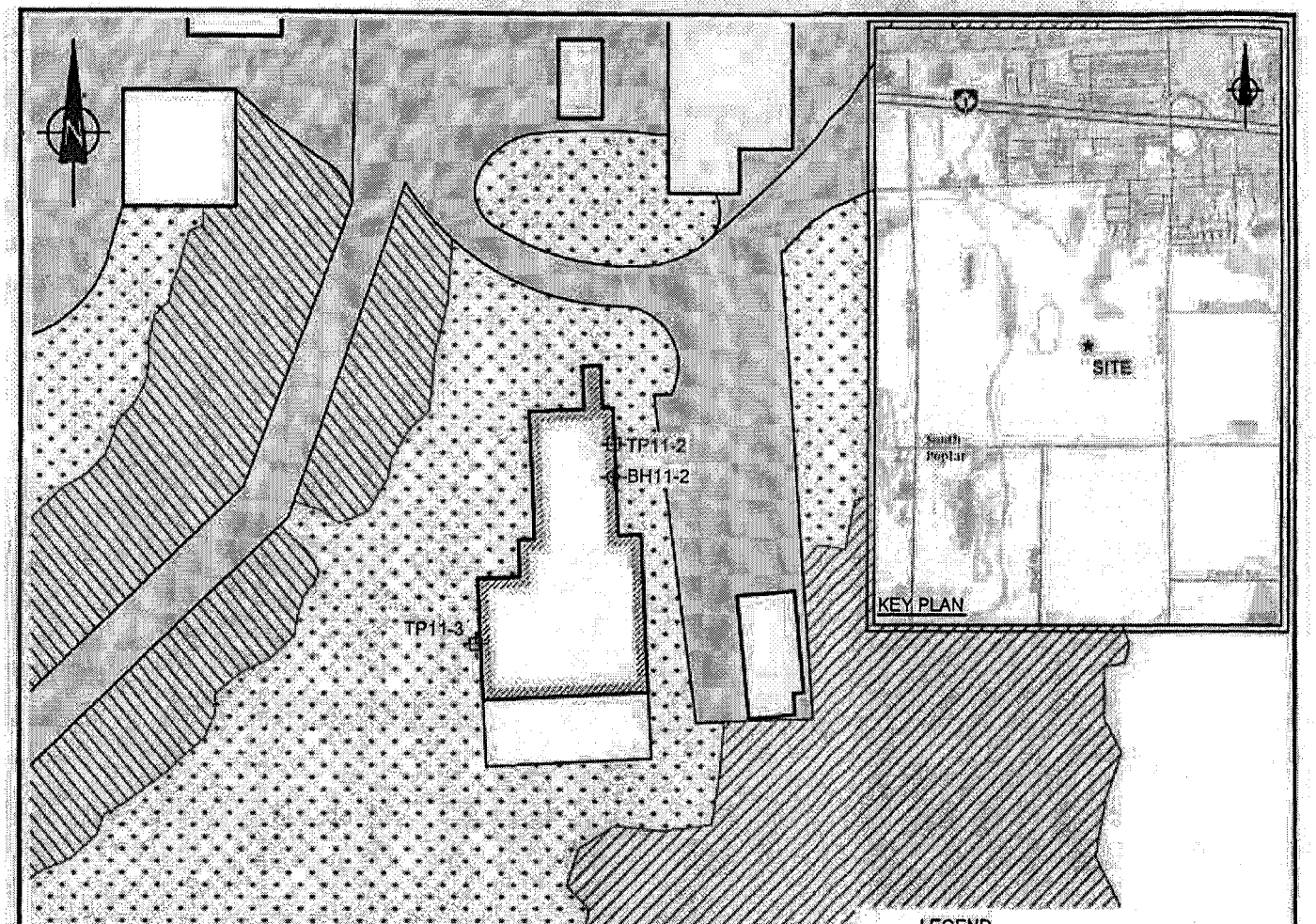
DRAFT

APPENDIX "C"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
PACIFIC INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

C3 – SOIL LOG FROM STANTEC CONSULTING 2011

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com



LEGEND

- PROPOSED BUILDING
- EXISTING BUILDINGS
- PAVED AREA
- TREED AREA
- GRASS AREA
- TEST PIT LOCATIONS
- OPEN HOLE AND BECKER PENETRATION TEST LOCATIONS

SCALE IN METRES

0 10 20 30 40 50

1:1000

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

TEST HOLE LOCATION PLAN

GEOTECHNICAL SITE ASSESSMENT

MATSQUI 20 MAN BUILDING

33344 KING ROAD, ABBOTSFORD

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Job No.:	123310756
Scale:	1:1000
Date:	17-Nov-11
Dwn. By:	SS
App'd By:	JP

Dwg. No.: 1

Stantec

R:\2011\Stantec\123310756_man_matsquivasd\123310756 D01 R0_TestHoleLocationPlan.dwg PRINTED: Nov 23, 2011

BOREHOLE RECORD

BH11-1

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756

PROJECT 20 Men Living Inmate Building — DATUM

LOCATION 33344 King Road, Abbotsford — ELEVATION

DRILLING DATE Nov. 7, 2011 — DRILLING CO. Foundex Explorations Ltd. — DRILLING METHOD Becker Hammer

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	TP		GRASS over brown/reddish brown sandy SILT, trace organics, clay and gravel (Tosoil), firm				
	ML		Reddish brown sandy SILT, trace clay, firm to stiff				
1	SP		Brown/grey fine to medium SAND, trace gravel, loose		GS	1	
			-some gravel below				
			-coarse sand below				
2	GP		Grey fine to medium SAND and GRAVEL, trace silt, compact to dense		GS	2	
3							
4			-some gravel below		GS	3	
5							
6			-some moist below				
7			-wet				

□ Insitu Shear Vane (kPa) ■ Bounce Chamber Reading (kPa)
△ Pocket Penetrometer (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● BPT Field Blows, blows/0.3m
10 20 30 40 50 60 70 80 90

DEPTH (ft)

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov. 16, 2011

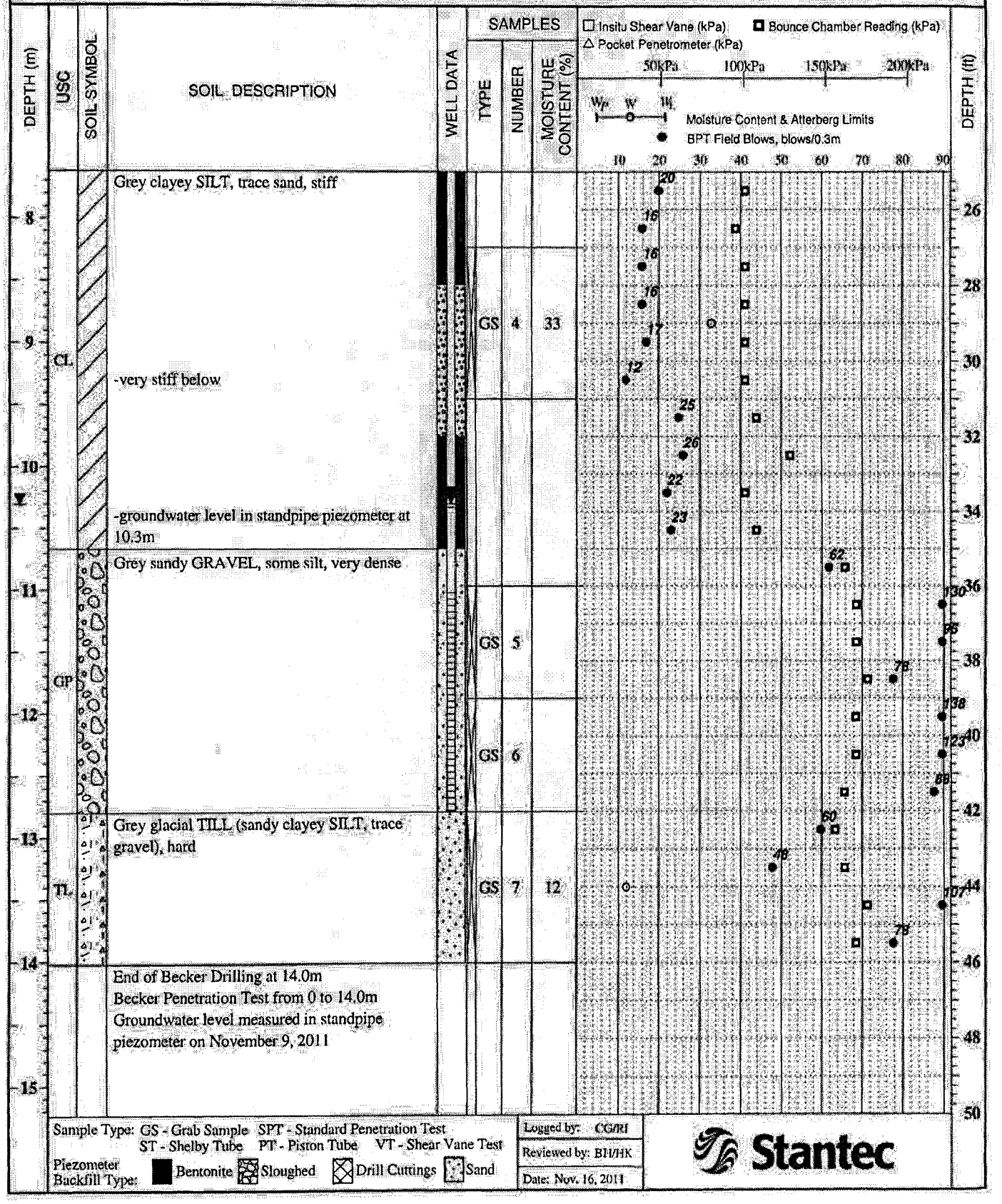
Stantec

BOREHOLE RECORD

BH11-1 cont'd

CLIENT Public Works and Government Services Canada
PROJECT 20 Men Living Inmate Building
LOCATION 33344 King Road, Abbotsford
DRILLING DATE Nov. 7, 2011 DRILLING CO. Foundex Explorations Ltd. DRILLING METHOD Becker Hammer

PROJECT No. 123310756
DATUM
ELEVATION



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov. 16, 2011

Stantec

BOREHOLE RECORD

BH11-2

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756

PROJECT 20 Men Living Inmate Building — DATUM — NORTHING 5430178

LOCATION 33344 King Road, Abbotsford — ELEVATION — EASTING 551166

DRILLING DATE Nov. 8, 2011 — DRILLING CO. Foundex Explorations Ltd. — DRILLING METHOD Becker Hammer

DEPTH (m)	USC SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	TP	GRASS over brown/reddish brown sandy SILT, some organics, trace clay (Topsoil), firm			
	ML	Reddish brown sandy SILT, trace clay, firm to stiff			
1		Grey SAND, some gravel, trace silt, loose	GS	1	
		-gravelly, compact below			
2					
3			GS	2	
	SP	-dense below			
4		-gravelly, trace cobbles below	GS	3	
5		-some sandy silt layers from 5.1 to 5.8m	GS	4	
6			GS	5	
7	GP	Grey SAND and GRAVEL, some silt, very dense			

□ Insitu Shear Vane (kPa) ■ Bounce Chamber Reading (kPa)

△ Pocket Penetrometer (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L

Moisture Content & Atterberg Limits

● BPT Field Blows, blows/0.3m

10 20 30 40 50 60 70 80 90

DEPTH (ft)

0 2 4 6 8 10 12 14 16 18 20 22 24

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI

Reviewed by: BH/IK

Date: Nov. 16, 2011

Stantec

BOREHOLE RECORD

BH11-2 cont'd

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756
PROJECT 20 Men Living Inmate Building — DATUM — NORTHING 5430178
LOCATION 33344 King Road, Abbotsford — ELEVATION — EASTING 551166
DRILLING DATE Nov. 8, 2011 — DRILLING CO. Foundex Explorations Ltd. — DRILLING METHOD Becker Hammer

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
8			Grey SAND and GRAVEL, some silt, very dense	GS	6	
9	CL		Grey sandy clayey SILT, some gravel, very stiff to hard	GS	7	14
10	TIL		Grey glacial TILL (sandy clayey SILT, some gravel), hard	GS	8	12
11				GS	9	
12			End of Becker Drilling at 11.9m Hole sealed with Bentonite from 1.2 to 1.8m, 3.0 to 4.3m and 10.4 to 11.6m. Becker Penetration Test from 0.7 to 14.0m			
13						
14						
15						

□ Insitu Shear Vane (kPa) ■ Bounce Chamber Reading (kPa)
△ Pocket Penetrometer (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● BPT Field Blows, blows/0.3m
10 20 30 40 50 60 70 80 90

DEPTH (ft)

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test
Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov. 16, 2011

Stantec

TEST PIT RECORD

TP11-1

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756

PROJECT 20 Men Living Inmate Building — DATUM

LOCATION 33344 King Road, Abbotsford, BC — ELEVATION

EXCAVATION DATE Nov. 9, 2011 — CONTRACTOR Backhoes Unlimited — EXCAVATION METHOD Test Pit

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	TP		GRASS over brown/reddish brown sandy SILT, trace organics, clay and gravel (Topsoil), firm	GS	1	30
	ML		Reddish brown sandy SILT, trace clay, firm to stiff	GS	2	31
1	SP		Brown/grey fine to medium SAND, trace gravel, loose	GS	3	
			-some gravel below	GS	4	
				GS	5	
			- coarse sand below	GS	6	
2	GP		Grey fine to medium SAND and GRAVEL, trace silt, compact to dense	GS	7	
				GS	8	
				GS	9	
3			End of Test Pit at 2.6m No seepage encountered in test pit			
4						
5						
6						
7						

Insitu Shear Vane (kPa) ☐ Remoulded Shear Vane (kPa)
Pocket Penetrometer (kPa) ✕ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa
W_p W W_l
Moisture Content & Atterberg Limits
Standard Penetration Test, blows/0.3m
10 20 30 40 50 60 70 80 90

DEPTH (ft) 0 2 4 6 8 10 12 14 16 18 20 22 24

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov 15, 2011

Stantec

TEST PIT RECORD

TP11-2

CLIENT Public Works and Government Services Canada PROJECT No. 123310756

PROJECT 20 Men Living Inmate Building DATUM

LOCATION 33344 King Road, Abbotsford, BC ELEVATION

EXCAVATION DATE Nov. 9, 2011 CONTRACTOR Backhoes Unlimited EXCAVATION METHOD Test Pit

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)
0	TP		GRASS over brown/reddish brown sandy SILT, some organics, trace clay (Topsoil), firm	GS	1	46
	ML		Reddish brown sandy SILT, trace clay, firm to stiff	GS	2	37
1	SP		Grey SAND, some gravel, trace silt, loose	GS	3	
			-gravelly, compact below	GS	4	
				GS	5	
				GS	6	
2				GS	7	
				GS	8	
3			End of Test Pit at 2.4m No seepage encountered in test pit			
4						
5						
6						
7						

□ Insitu Shear Vane (kPa) ■ Remoulded Shear Vane (kPa)

△ Pocket Penetrometer (kPa) ✕ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits

● Standard Penetration Test, blows/0.3m

10 20 30 40 50 60 70 80 90

DEPTH (ft) 0 2 4 6 8 10 12 14 16 18 20 22 24

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CGWI

Reviewed by: BH/HK

Date: Nov 15, 2011

Stantec

TEST PIT RECORD

TP11-3

CLIENT Public Works and Government Services Canada — PROJECT No. 123310756
PROJECT 20 Men Living Inmate Building — DATUM
LOCATION 33344 King Road, Abbotsford, BC — ELEVATION
EXCAVATION DATE Nov. 9, 2011 — CONTRACTOR Backhoes Unlimited — EXCAVATION METHOD Test Pit

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)
0	TP	GRASS over brown/reddish brown sandy SILT, trace organics (Topsoil), firm	GS	1	39
	ML	Reddish brown sandy SILT, trace clay, stiff to very stiff	GS	2	30
1	SM	Grey/light brown silty SAND, trace gravel, compact to dense	GS	3	
	GP	Grey/light brown medium SAND and GRAVEL, trace silt, compact	GS	4	
2		-some gravel to gravelly below	GS	5	
			GS	6	
			GS	7	
3		End of Test Pit at 2.4m No seepage encountered in test pit			
4					
5					
6					
7					

□ Insitu Shear Vane (kPa) ■ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits

● Standard Penetration Test, blows/0.3m

10 20 30 40 50 60 70 80 90

DEPTH (ft) 0 2 4 6 8 10 12 14 16 18 20 22 24

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
Reviewed by: BH/HK
Date: Nov 15, 2011

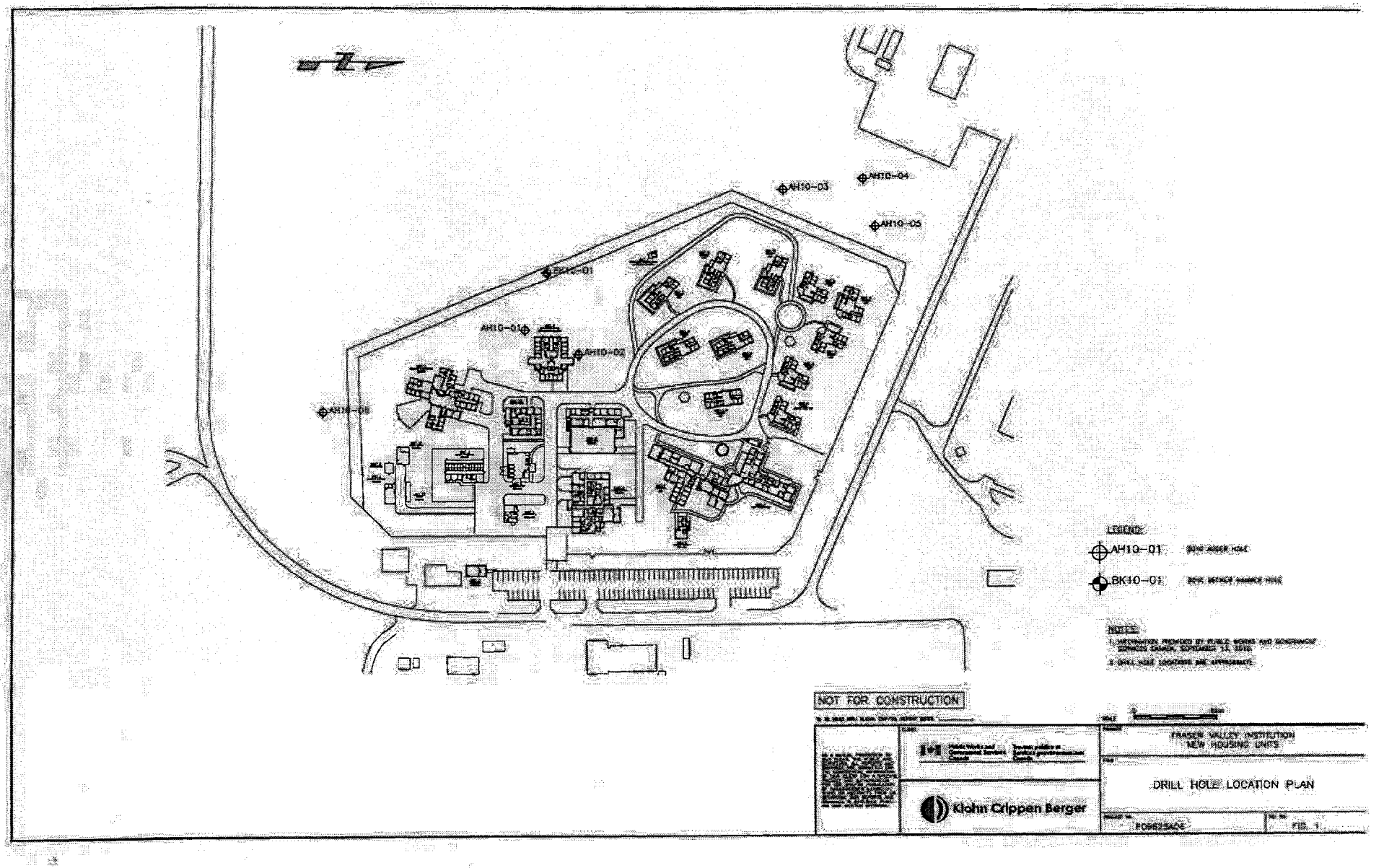
Stantec

APPENDIX "C"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
PACIFIC INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

C4 – SOIL LOG FROM KLOHN CRIPPEN BERGER 2010

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com


AH10-03
AH10-04
AH10-05
BK10-01
AH10-01
AH10-02
AH10-06
LEGEND:
AH10-01
BK10-01
NOTES:
NOT FOR CONSTRUCTION
Klohn Crippen Berger
FRASER VALLEY INSTITUTION
NEW HOUSING UNITS
DRILL HOLE LOCATION PLAN
FIG. 1

Klohn Crippen Berger

SYMBOLS AND TERMS
FOR SOIL DESCRIPTION AND TEST HOLE LOGS

BASIC SYMBOLS

SYMBOL VARIATIONS - EXAMPLES[1]

CLASSIFICATION BY PARTICLE SIZE				
		Size Range		
			U.S. Standard Sieve Size	
Name		(mm)[3]	Retained	Passing
Boulders		> 200	8 inch	-
Cobbles		75 - 200	3 inch	8 inch
Gravel:	coarse	19 - 75	0.75 inch	3 inch
	fine	5 - 19	No. 4	0.75 inch
Sand:	coarse	2 - 5	No. 10	No. 4
	medium	0.4 - 2	No. 40	No. 10
	fine	0.075 - 0.4	No. 200	No. 40
Fines (Silt or Clay)[4]		< 0.075	-	No. 200

PROPORTION OF MINOR COMPONENTS BY WEIGHT[2]	
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]		SPT N[9]
	(kPa)[3]	(ksf)[8]	
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) Example: SAND, silty, trace of gravel = sand with 20% to 35% silt and up to 10% gravel, by weight.
(3) Approximate metric conversion.
(4) Fines are classified as silt or clay on the basis of Atterberg limits (refer to Plasticity Chart).
(5) Standard Penetration Test (SPT) blow count (uncorrected), after Terzaghi and Peck, 1948.
(6) Standard Penetration Test blow count, based on above N value corrected to 60% hammer efficiency and 96 kPa (1.0 ton/ft²) 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/ft²) = approximately 0.5 kg/cm².
(9) Very approximate correlation with Standard Penetration Test blow counts, after Terzaghi and Peck, 1948.

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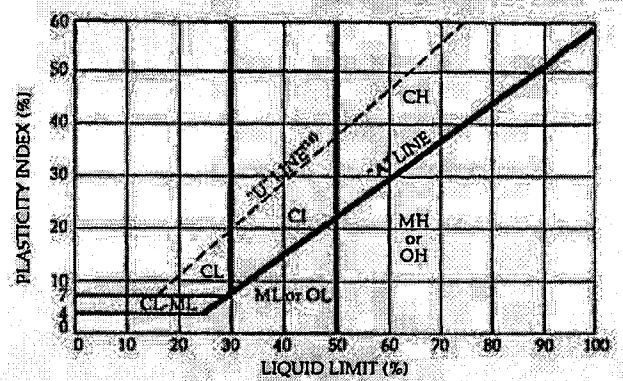
SYMBOLS AND TERMS
FOR SOIL DESCRIPTION AND TEST HOLE LOGS

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	
Description	Undisturbed Strength[13] / Remoulded Strength
High	> 8
Medium	4 to 8
Low	< 4

PLASTICITY CHART FOR SOILS PASSING NO. 40 SIEVE[10]



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 or 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 clays from silts and organic soils.
(15) For soil descriptions, estimate percentage of ground ice based on volume, after National Research Council of Canada, 1963.

Klohn Crippen Berger

SYMBOLS AND TERMS
FOR SOIL TEST HOLE LOGS

TEST TYPES[1]

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 - *both open and closed test at the same location.*
BKS	Becker hammer drill hole - *open casing, sampled.*
BPT	Becker penetration test - *closed casing.*
TP	Test pit - *machine or hand dug.*
CPT	Electric cone penetration test with pore pressure measurements.
DCT	Dynamic cone penetration test.
VST	Vane shear test.
AH	Auger hole - *machine or hand auger, no SPT or thin-walled tube samples taken.*

IN SITU TESTS OR DOWNHOLE INSTRUMENTATION[2]

BM	Benchmark
DMT	Dilatometer test
IN	Inclinometer
PMT	Pressuremeter test
PT	Permeability test
PZ	Piezometer
SW	Shear wave velocity test

LABORATORY AND/OR FIELD TESTS[3]

S_u Undrained shear strength, measured by:[4]

- ◆ Field Vane (peak)
- ◇ Field Vane (remoulded)
- ■ Lab Vane (peak)
- □ Lab Vane (remoulded)
- ▲ Unconfined Compression
- △ Pocket penetrometer

- ● Standard Penetration Test (SPT) blow count, uncorrected (N)
- ○ W% In situ moisture content
- × W_P% Plastic limit
- × W_L% Liquid limit
- Becker penetration test blow counts, closed casing
- Becker penetration test blow counts, open casing
- ▼ or ▽ Water level, measured on date and from piezometer indicated on log

OTHER LABORATORY TESTS[5]

CD	Consolidated, drained triaxial test
CUP	Consolidated, undrained triaxial test with pore pressure measurements
CUCY	Consolidated, undrained triaxial test with cyclic loading
UU	Unconsolidated, undrained triaxial test
UC	Unconfined (uniaxial) compression test
DS	Direct shear test
DSS	Direct simple shear test
GSD	Grain size distribution *(by sieve or hydrometer)*
MDR	Moisture-density relationship *(i.e. standard or modified Proctor test)*
ORG	Organic content
OED	Oedometer consolidation test
RD	Relative density *(also known as density index)*
GS	Specific gravity
K	Permeability
UW	Unit Weight

(1) Test type abbreviation is typically followed by a two-part number indicating year and chronological sequence of test. Example: CPT93-1 indicates the first electric cone penetration test at a particular site in 1993.
(2) In situ test or downhole instrumentation abbreviations are typically shown in brackets following the appropriate test type designation. Example: DH93-1(PZ) indicates a piezometer was installed in drill hole 93-1.
(3) These symbols are for laboratory and/or field test results shown on the test hole log.
(4) Vane gives S_u. Pocket penetrometer and unconfined compression tests give 2 S_u, so results are divided by 2 for plotting on log.
(5) 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.

TEST HOLE LOG

STARTED: Nov 2, 2010 **FINISHED:** Nov 2, 2010

DRILL METHOD: Solid Stem Auger

GROUND ELEV. (m):

COORDINATES (m):

DYNAMIC CONE PENETRATION TEST

Rod O.D.: Shoe O.D.:

Hammer Weight: 140 lb Height Drop: 30 inches

● SPT N ★% FINES △ P.PEN/2 (psi) DCPT (blows/0.3m)

W_P% W% W_L%

20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					0.2 SILT (ML) trace sand, soft, brown, moist, rootlets.	
		Grab	S1		SAND (SP) medium to coarse, some gravel, trace silt; compact, sub-angular to sub-rounded light brown to grey, moist, largest observed size 50 mm.	
1					0.9 SAND and GRAVEL (SP-GP) trace to some silt, dense, sub-angular to sub-rounded, grey, wet, largest observed size 50 mm; poor recovery from 1.2 m (~50 to 30%).	
2						
					2.6 CLAY (CL) trace sand with increasing gravel with depth, very stiff to hard, grey, moist, blocky, moderate cementation, no dilatancy, poor recovery from 2.6 m to 3.0 m (~50 to 30%). (TILL)	
3		Grab	S2			
		Grab	S3			
4					4.6	
5					End of Hole at 4.6 m	
6					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC.	
7					2) Solid Stem Auger hole terminated at 4.6m depth. DCPT terminated at 2.7m depth.	
8						
9						
10						

Klohn Crippen Berger

PROJECT NO.: P09625 A06

PROJECT: Fraser Valley Institute Inmate Housing

LOCATION: Abbotsford, BC

LOGGED BY: VL **CHECKED BY:**

SHEET 1 **OF** 1 **HOLE NO.:** AH10-01

KCB_DCT-SI 2010-11-02_09 INVESTIGATION - R2 METRIC.GPJ KC_DATA.GDT 12/10/10

TEST HOLE LOG

STARTED: Nov 2, 2010 **FINISHED:** Nov 2, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: | Shoe O.D.:
Hammer Weight: 140 lb | Height Drop: 30 inches
● SPT N ★% FINES | DCPT (blows/0.3m)
△ P.PEN/2 (psi)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
0					0.1 CLAY (CL) trace sand, soft, brown, moist, rootlets.	
		Grab	S1		CLAY (CL) trace gravel, very stiff to hard, light brown to grey, moist, blocky, moderate cementation, no dilatancy.	
1		Grab	S2			
2					2.1 CLAY (CL) trace sand and gravel, very stiff to hard, grey, moist to dry, blocky, moderate cementation, no dilatancy. (TILL)	
3		Grab	S3			
4		Grab	S4		@3.9m: Hard Drilling	
5						
6		Grab	S5		6.1 End of Hole at 6.1 m	
7					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC. 2) Solid Stem Auger hole terminated at 6.1m depth. DCPT terminated at 3.9m depth.	
8						
9						
10						

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 **OF** 1 **HOLE NO.:** AH10-02

TEST HOLE LOG

STARTED: Nov 2, 2010 **FINISHED:** Nov 2, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: Shoe O.D.:
Hammer Weight: 140 lb Height Drop: 30 inches
● SPT N ★% FINES △ P.PEN/2 (psi) DCPT (blows/0.3m)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					0.2 SILT (ML) trace sand, soft, brown, moist, rootlets.	
1		Grab	S1		SILT (ML) trace gravel, firm, light brown to grey, moist, blocky, moderate cementation, no dilatancy, largest observed size 50 mm.	
		Grab	S2		1.1 ORGANIC SILT (OL) trace sand, plasticity, soft, dark brown, moist, organics are amorphous to fine fibrous. 1.5	
2		Grab	S3		SAND (SP) fine, trace silt, poorly graded, loose, sub-rounded to sub-angular, brown, moist, trace rootlets. 2.3	
		Grab	S4		CLAY (CL) trace gravel and sand, firm, dark to light brown, moist, blocky, moderate cementation, no dilatancy. 3.0	
3					CLAY (CL) trace gravel and sand, very stiff to hard, light brown to grey, moist, blocky, moderate cementation, no dilatancy. (TILL)	
4		Grab	S5			
5		Grab	S6		@5.2m to 5.8 m: Poor recovery (~50%) @5.5m: Hard Drilling 5.8	
6					End of Hole at 5.8 m	
7					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC. 2) Solid Stem Auger hole terminated at 5.8 m depth. DCPT terminated at 3.8m depth.	
8						
9						
10						

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 **OF** 1 **HOLE NO.:** AH10-03

K:\SI_DCT-SI 2010-11-02-03\INVESTIGATION - R2 METRIC.GPJ KC_DATA.GDT 12/9/10

TEST HOLE LOG

STARTED: Nov 2, 2010 **FINISHED:** Nov 2, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					SILT (ML) trace sand, soft, brown, moist, rootlets.	
0.3					SILT (ML) some sand, trace gravel, firm, brown, moist, trace rootlets.	
0.9		Grab	S1		SAND (SP) medium to coarse, trace to some gravel, trace silt, compact, brown to grey, moist.	
1		Grab	S2			
2		Grab	S3		@2.1m: Poor Recovery (~30-50%), wet	
3		Grab	S4			
		Grab	S5			
4.0					CLAY (CL) sandy to trace sand, trace fine gravel, trace clay, very stiff to hard, brown to grey, moist, blocky, largest observed size 50 mm. (TILL)	
4		Grab	S6			
5		Grab	S7			
6		Grab	S8			
6.6					End of Hole at 6.6 m	
7					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC. 2) Solid Stem Auger hole terminated at 6.6m depth. DCPT terminated at 6.0m depth.	
8						
9						
10						

DYNAMIC CONE PENETRATION TEST

Rod O.D.: | Shoe O.D.:
Hammer Weight: 140 lb | Height Drop: 30 inches
● SPT N ✱% FINES
△ P.PEN/2 (psi)
DCPT (blows/0.3m)

W_P% — W% — W_L%
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 **OF** 1 **HOLE NO.:** AH10-04

KCBL_DCT-SI 2010-11-02_03 INVESTIGATION - R2 METRIC.GPJ KC_DATA.GDT 12/10/10

TEST HOLE LOG

STARTED: Nov 3, 2010 **FINISHED:** Nov 3, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: | Shoe O.D.:
Hammer Weight: 140 lb | Height Drop: 30 inches
● SPT N ★% FINES | DCPT (blows/0.3m)
▲ P.PEN/2 (psi)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					0.2 SILT (ML) trace sand, soft, brown, moist, rootlets	
		Grab	S1		ORGANIC SILT (OS) trace sand and gravel, firm, brown, moist.	
					0.9	
1		Grab	S2		SAND (SP) fine to medium, some gravel, trace silt, loose, grey, moist to wet, largest observed size 70 m.	
2		Grab	S3		@2.6m to 3.0 m: Poor Recovery (50%)	
3						
4		Grab	S4		@4.0m to 4.6m: Poor Recovery (30-50%), wet	
					4.6	▼
		Grab	S5		SILT (ML) trace sand and gravel, soft, light brown to grey, wet.	
5					5.0	
		Grab	S6		SAND (SP) medium to coarse, some gravel, trace silt, compact, grey, wet.	
6					@5.5m to 6.1m: Poor Recovery (~30%)	
		Grab	S7		@6.6m to 7.2m: Poor Recovery (~30%)	
7					7.2	
		Grab	S8		SILT (ML) sandy, trace gravel, very stiff to hard, light brown to grey, wet.	
					7.6	
8					CLAY (CL) sandy, trace gravel with depth, very stiff to hard, grey, moist to dry. (TILL)	
		Grab	S9		@8.8m to 12.1m: Hard Drilling	
9					@9.1m to 10.7m': Poor Recovery (~10-30%)	
10						

Continued Next Page

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 OF 2 **HOLE NO.:** AH10-05

TEST HOLE LOG

STARTED: Nov 3, 2010 **FINISHED:** Nov 3, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: | Shoe O.D.:
Hammer Weight: 140 lb | Height Drop: 30 inches
● SPT N ★% FINES
△ P.PEN/2 (psi)
DCPT (blows/0.3m)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
11		Grab	S10			
		Grab	S11		@11.6m to 12.2m: Poor Recovery (~50-60%)	
12					12.2	
					End of Hole at 12.2 m	
13					1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack, BC.	
14					2) Solid Stem Auger hole terminated at 9.1m depth. DCPT terminated at 10.6m depth.	
15					3) 1.5" diameter PVC standpipe installed to 7.1m depth and completed with flush mount surface monument.	
16					4) Water level measured November 29, 2010 at 4.48m depth.	
17						
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19						
20						

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 2 OF 2 **HOLE NO.:** AH10-05

KCBL_OCT-SI 2010-11-02_03 INVESTIGATION - R2 METRIC.GPJ KC_DATA.GDT 12/10/10

TEST HOLE LOG

STARTED: Nov 3, 2010 **FINISHED:** Nov 3, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DEPTH (m) | SPT BLOWS PER 0.15m | SAMPLE TYPE | SAMPLE No. | SYMBOL | INSTRUMENT | DETAILS

DESCRIPTION OF MATERIALS

0.1 TOPSOIL

SAND (SP) gravely, very loose to loose, maximum size observed 50 mm, rounded to sub-rounded, brown to grey, moist.

Grab S1

Grab S2

@2.6m to 3.0m: Poor Recovery (~30%)

Grab S3

@4.3m to 4.6m: Poor Recovery (~30%)

4.9

CLAY (ML) some gravel to gravely at depth, gravel is rounded to sub-rounded, stiff to hard, brown to grey at depth, moist to wet, maximum size observed 50 mm. (TILL)

Grab S4

@5.0m to 9.1m: Hard Drilling

Grab S5

@7.0m to 7.6m: Poor recovery (~10-20%)

@7.6m to 9.1m: Poor Recovery (~10-30%)

Grab S6

9.1

End of Hole at 9.1 m

1) Drill hole was conducted using a truck-mounted auger drill operated by Downrite Drilling of Chilliwack.

Continued Next Page

DYNAMIC CONE PENETRATION TEST

Rod O.D.: | Shoe O.D.:

Hammer Weight: 140 lb | Height Drop: 30 inches

● SPT N ★ % FINES
△ P.PEN/2 (psi)
DCPT (blows/0.3m)

W_P% W% W_L%
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 1 OF 2 **HOLE NO.:** AH10-06

KCBL_DCT-SI_2010-11-02_03_INVESTIGATION+R2_METRIC.GPJ_KC_DATA.GDT_12/10/10

TEST HOLE LOG

STARTED: Nov 3, 2010 **FINISHED:** Nov 3, 2010
DRILL METHOD: Solid Stem Auger
GROUND ELEV. (m):
COORDINATES (m):

DYNAMIC CONE PENETRATION TEST
Rod O.D.: Shoe O.D.:
Hammer Weight: 140 lb Height Drop: 30 inches
● SPT N ★% FINES △ P.PEN/2 (psi) DCPT (blows/0.3m)
W_P% W% W_L%
20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
11					BC. 2) Solid Stem Auger hole terminated at 12.2m depth. DCPT terminated at 4.6m depth. 3) 1.5" diameter PVC standpipe installed to 7.1m depth and completed with flush mount surface monument. 4) Water level measured November 29, 2010 at 6.08m depth.	
12						
13						
14						
15						
16						
17						
18						
19						
20						

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: VL **CHECKED BY:**
SHEET 2 **OF** 2 **HOLE NO.:** AH10-06

KCBL_DCT.GI 2010-11-02_GI INVESTIGATION - R2 METRIC.GPJ KCB_DATA.GDT 12/10/10

BECKER TEST HOLE LOG

STARTED: Nov 29, 2010 **FINISHED:** Nov 29, 2010

DRILL RIG MODEL: Becker Hammer

GROUND ELEV. (m):

COORDINATES (m):

Casing O.D.: CLOSE ENDED (blows/0.3m)

Hammer Energy: 11 kJ max. rated — OPEN ENDED (blows/0.3m)

★ % FINES — BOUNCE PRESS (kPa)

W_P% × – – – o – – – × W_L%

20 40 60 80

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					SAND (SP) brown, some gravel. (ROAD FILL)	
		Grab	G1		0.9	
1					SAND (SP) some gravel, occasional cobbles, trace silt, greyish brown colour, dry.	
					1.8	
2		Grab	G2		SAND and GRAVEL (SP-GP) some cobbles, light brown, dry. Becomes more difficult to drill through. Broken rock fragments in drill cuttings. Drill kicks sideways at 2.5 m and needs to be repositioned.	
		Grab	G3			
3					3.4	
					SILT ML) some fine sand to sandy, trace to some fine gravel, light brown, very stiff. (TILL)	
					4.0	
4		Grab	G4		SILT (ML) trace sand, trace gravel, light grey, very stiff to hard. (TILL)	
					4.6	
					CLAY (CL) trace sand, medium plasticity, light grey, dry to moist, very stiff to hard. (TILL)	
5						
6		Grab	G5			
7					7.6	
		Grab	G6		CLAY (CL) some sand, some gravel, moist, grey, very stiff to hard. (TILL)	
8					8.2	
					CLAY (CL) grey, dry, very stiff to hard. (TILL)	
		Grab	G7			
9						
10						

Continued Next Page

Klohn Crippen Berger

PROJECT NO.: P09625 A06

PROJECT: Fraser Valley Institute Inmate Housing

LOCATION: Abbotsford, BC

LOGGED BY: AP **CHECKED BY:**

BECKER TEST HOLE LOG

STARTED: Nov 29, 2010 **FINISHED:** Nov 29, 2010
DRILL RIG MODEL: Becker Hammer
GROUND ELEV. (m):
COORDINATES (m):

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					10.4	
		Grab	G8		CLAY (CL) sandy, trace gravel, grey, moist, very stiff to hard. (TILL)	
11					11.0 CLAY (CL) trace to some sand, trace fine gravel, dry, very stiff to hard. (TILL)	
					11.9	
12					End of Becker Drill Hole at 11.9 m	
					1) Drill hole was conducted using a truck-mounted Becker Hammer drill operated by Foundex Explorations of Surrey, BC.	
13					2) Closed Becker hole terminated at 9.1m depth. Open Becker hole terminated at 11.9m depth.	
14						
15						
16						
17						
18						
19						
20						

BECKER PENETRATION TEST

Casing O.D.: CLOSED ENDED (blows/0.3m)
Hammer Energy: 11 kJ max. rated: OPEN ENDED (blows/0.3m)
* % FINES: BOUNCE PRESS (kPa)

W_P% × ---- o ---- × W_L%
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09625 A06
PROJECT: Fraser Valley Institute Inmate Housing
LOCATION: Abbotsford, BC
LOGGED BY: AP **CHECKED BY:**
SHEET 2 OF 2 **HOLE NO.:** BK10-01

APPENDIX "D"

PROPOSED PERIMETER FENCE AND GATES UPGRADES
PACIFIC INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

STANDARD FIELD INSPECTION REQUIREMENTS

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

Geotechnical Engineering Field Review and Inspection Requirements
BC Building Code 2012

Based on the BC Building Code 2012, the following Design and field review must be completed by JECTH Consultants Inc. (Geotechnical in Record, **GIR)** such that Letter of Compliance (Schedule "C") required by local municipality for Occupancy Permit can be issued.

7.0 Geotechnical - Temporary

7.1 Excavation

7.1.1 Foundation

Excavation depth more than 4 ft. must be certified by GIR as required by WorkSafe BC ☐

7.1.2 Buildings and Structures

Buildings and Structures within the 1H:1V stress influence line from the bottom of Excavation must be reviewed and approved by GIR ☐

7.1.3 Trench

Excavation for underground utilities for depth more than 4 ft. must be reviewed and approved by GIR ☐

7.1.4 Underground Utilities

All underground utilities (both on-site and off-site) within and along the site perimeter must be identified both on drawing and physical on site prior to any foundation excavation and slope excavation. ☐

7.2 Shoring

7.2.1 Vertical Shoring

Vertical Shoring must be design by GIR to ensure excavation perimeter is stable during foundation excavation before placement of perimeter backfill. ☐

7.2.2 Temporary Shoring

Temporary Shoring such as sheetpile and shotcrete with tie back anchors or other vertical features must be inspected by GIR ☐

7.2.3 Shoring Method

Shoring method such as sheetpile and shotcrete with tie-back anchors wall must be carried out under the supervision of GIR ☐

7.2.4 Underground Utilities

All underground utilities (both on-site and off-site) within and along the site perimeter must be identified both on drawing and physical on site prior to any foundation excavation and shoring work. ☐

7.3 Underpinning

7.3.1 Pre-Excavation

Pre-excavation inspection and Review must be conducted by both Structural and Geotechnical Engineers (both Geotechnical Engineers from the adjacent structures and GIR) prior to underpinning excavation. ☐

7.3.2 Monitoring Survey

Survey monitoring points must be installed at the underpinning building(s) and/any movement sensitive Structural Component before foundation excavation. The survey monitoring system must be conducted prior to any site activities and submit to GIR. ☐

7.3.3 Structural Inspection

Structural Inspection and photographs must be carried out prior to foundation excavation for future records and reference by Structural Engineer retained by either owner of adjacent property or subject property owner. ☐

7.4 Temporary Construction Dewatering

7.4.1 Perched groundwater and Surface Drainage

For perched groundwater and surface Drainage by precipitation, conventional pump can be used to maintain the site in relatively dry condition. □

7.4.2 Well point

Well point and other measure of temporary dewatering will be required if high groundwater level (actual ground water table) is encountered □

8.0 Geotechnical - Permanent

8.1 Bearing Capacity of Foundation Subgrade Soil ☐

8.1.1 Foundation Subgrade Excavation

Review exposed foundation subgrade excavation and ensure that all remove all unsuitable soil/material until suitable bearing subgrade is exposed ☐

8.1.2 Foundation Subgrade Protection

In the event that the exposed foundation subgrade soil is sensitive to moisture, foundation subgrade might be protected by a layer granular soil such as crushed gravel due to wet condition and construction traffic. A lean concrete can be used instead of crushed gravel. ☐

8.1.3 Structural FILL

Review Structural Fill if over-excavated or raise of grade is required. Compaction Density test must be conducted by Certified Laboratory and submit to GIR. ☐

8.2 Geotechnical - Deep Foundation

8.2.1 Piling Inspection

Full time piling inspection such as timber and steel pile etc must be conducted by GIR. All piling record for refusal must be available to review such that the pile capacity can be certified. ☐

8.2.2 Sheetpile Installation

Sheetpile installation as temporary / permanent support must be installed and inspected by Geotechnical Engineer ☐

8.3 Engineering FILL

8.3.1 Structural FILL

Structural Fill (imported or non-native material) at and below the proposed foundation elevation must be compacted to density as specified by GIR and must be certified by qualified soil laboratory / testing company ☐

8.3.2 Underslab FILL

Underslab fill density must also be tested prior to placement of slab-on-grade concrete to the specified density as required by GIR. ☐

8.4 Slope Stability and Seismic Load

8.4.1 Slope Stability

Evaluate the slope stability along the site and building perimeter for both seismic and static design conditions according to APEBC Guidelines dated November 2010. ☐

8.4.2 Subsurface Stability

Subsurface stability under seismic condition such as densification specified by GIR and tieing of footing structurally must be accommodated by Structural Engineer in Record ☐

8.4.3 Seismic Design Criteria

The acceleration velocity design must be based on Nation Resources of Canada Seismic Hazard Criteria. ☐

8.5 Backfill

8.5.1 Backfill Material

Backfill material for foundation perimeter must be well drained granular soil, such as crushed gravel with waterproof membrane for below grade structure ☐

8.5.2 Sensitive Structure

If sensitive structure is founded on the Backfill material such as Sand and Gravel compaction density as specified by GIR of the backfill material must be tested by certified testing company ☐

8.6 Permanent Dewatering

8.6.1 Foundation Drainage

For convention foundation drainage, perforated PVC pipe will be used to collect any surface gravity drained to city's storm system migrated and natural groundwater to a sump then ☐

8.6.2 Storm System

If City's storm system is higher than the sump elevation, pumping system must be installed with dual-pump and alarm system and may be with backup generator when power is unavailable during adverse conditions. Mechanical and Civil Engineer must be retained to design the system. ☐

8.6.3 Perforated Drainage

Underslab perforated drainage perforated PVC will be installed to improve the foundation drainage if groundwater table is higher than the slab elevation either seasonally or permanently ☐

8.6.4 Tanking

Tanking is also an option when the pumping system might not be capable to drain all below groundwater or foundation drainage system is not installed. Envelop Consultants must be retained for this option ☐

8.6.5 Retention Tank

Retention Tank with control valve may be required due to City's storm system limitation. Civil Engineer must be retained. ☐

8.7 Permanent Underpinning

8.7.1 Underpinning Loading

All underpinning loading must be reviewed and approved by Structural Engineer and GIR. ☐

8.7.2 Separation and Drainage

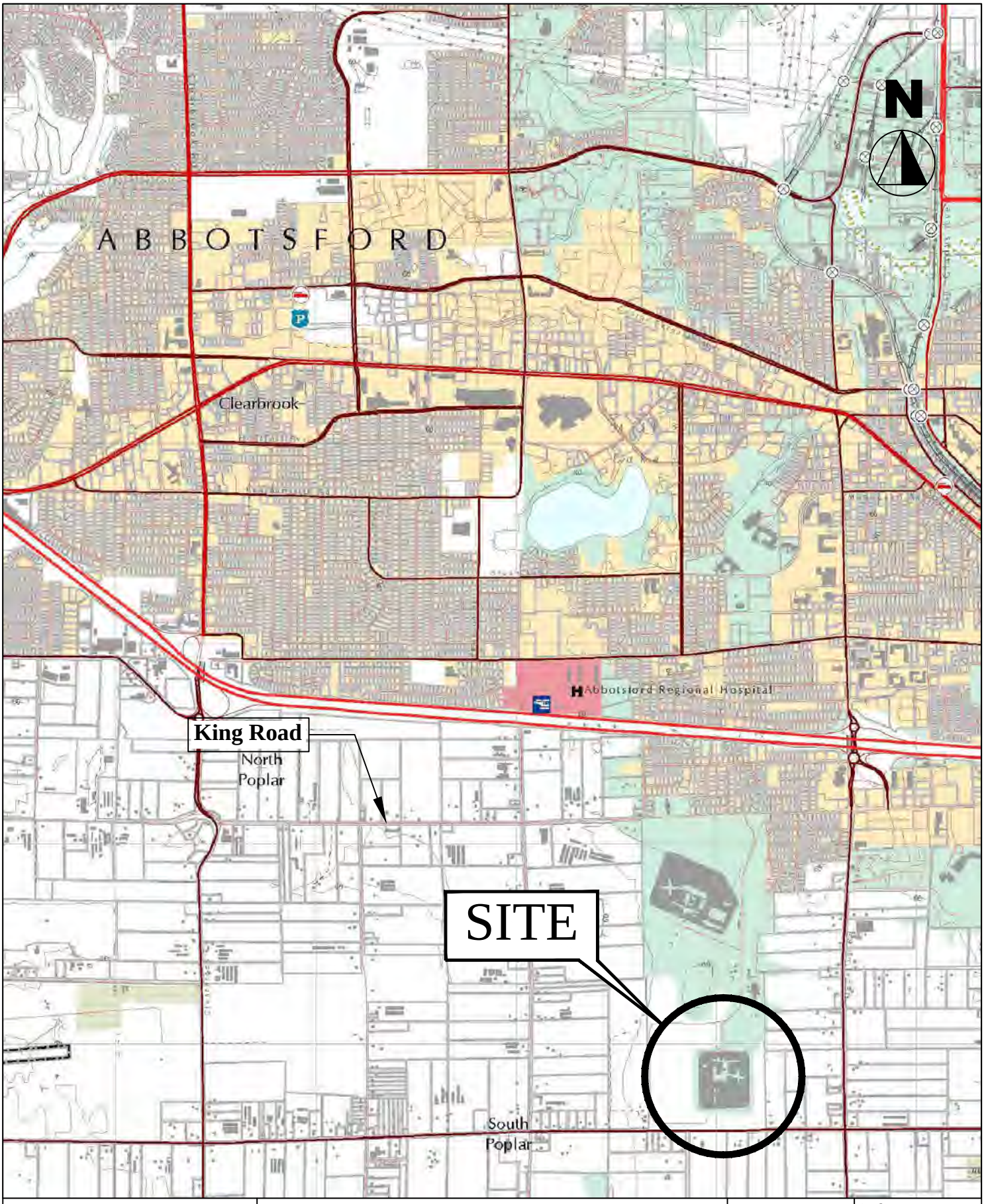
Bond separation and drainage (above and below grade) at the interface of the underpinning area must be reviewed to ensure no water migrate to the underpinning structure. Envelop Consultant must be retained. ☐

FIGURES

PROPOSED PERIMETER FENCE AND GATES UPGRADES
PACIFIC INSTITUTION
33344 KING ROAD, ABBOTSFORD, BC

LIST OF FIGURES

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com



JECTH Consultant Inc.

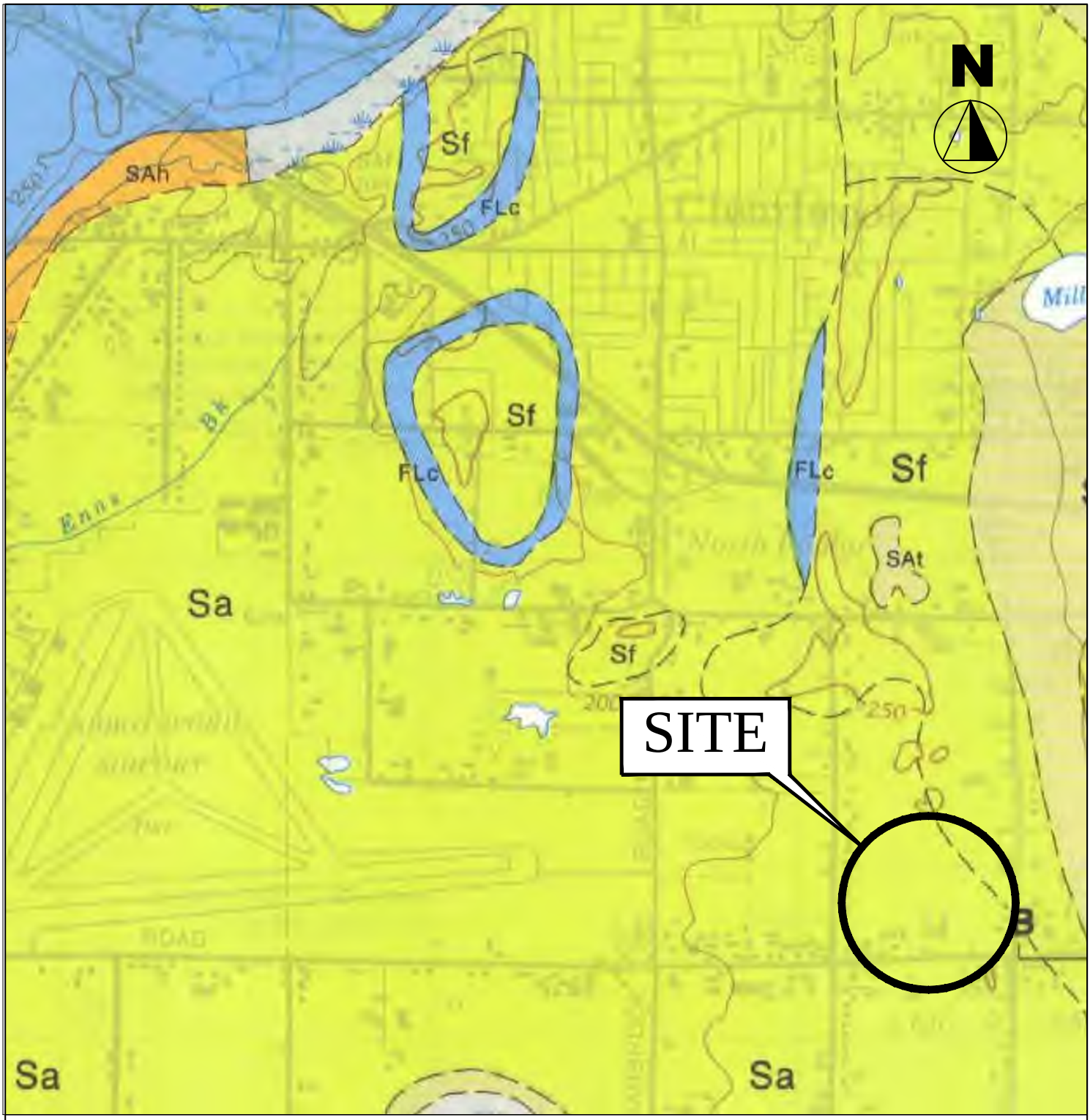
Suite 208, 3832 Henning Drive
Burnaby, B.C. V5C 8P3

Phone: 299-6617 Fax: 299-6641

Site Location Plan

Pacific Region Perimeter Fence Upgrades
Pacific Institution, Abbotsford, BC
Client: CWMM Consulting Engineers Ltd.

Drawn By: IC	Scale: NTS
Check by: HKM	Date November 2018
Dwg no: 218C555 - PA 01	



Sa,e,i

SUMAS DRIFT

Recessional glaciofluvial deposits: Sa, *recessional channel and floodplain deposits laid down by proglacial streams; gravel and sand up to 40 m thick, normal range of thickness 5-25 m;* Se, *proglacial deltaic gravel and sand up to 10 m thick;* Si, *similar to* Sa *except that it is pitted outwash*

JECTH Consultant Inc.

Suite 208, 3832 Henning Drive
Burnaby, B.C. V5C 8P3

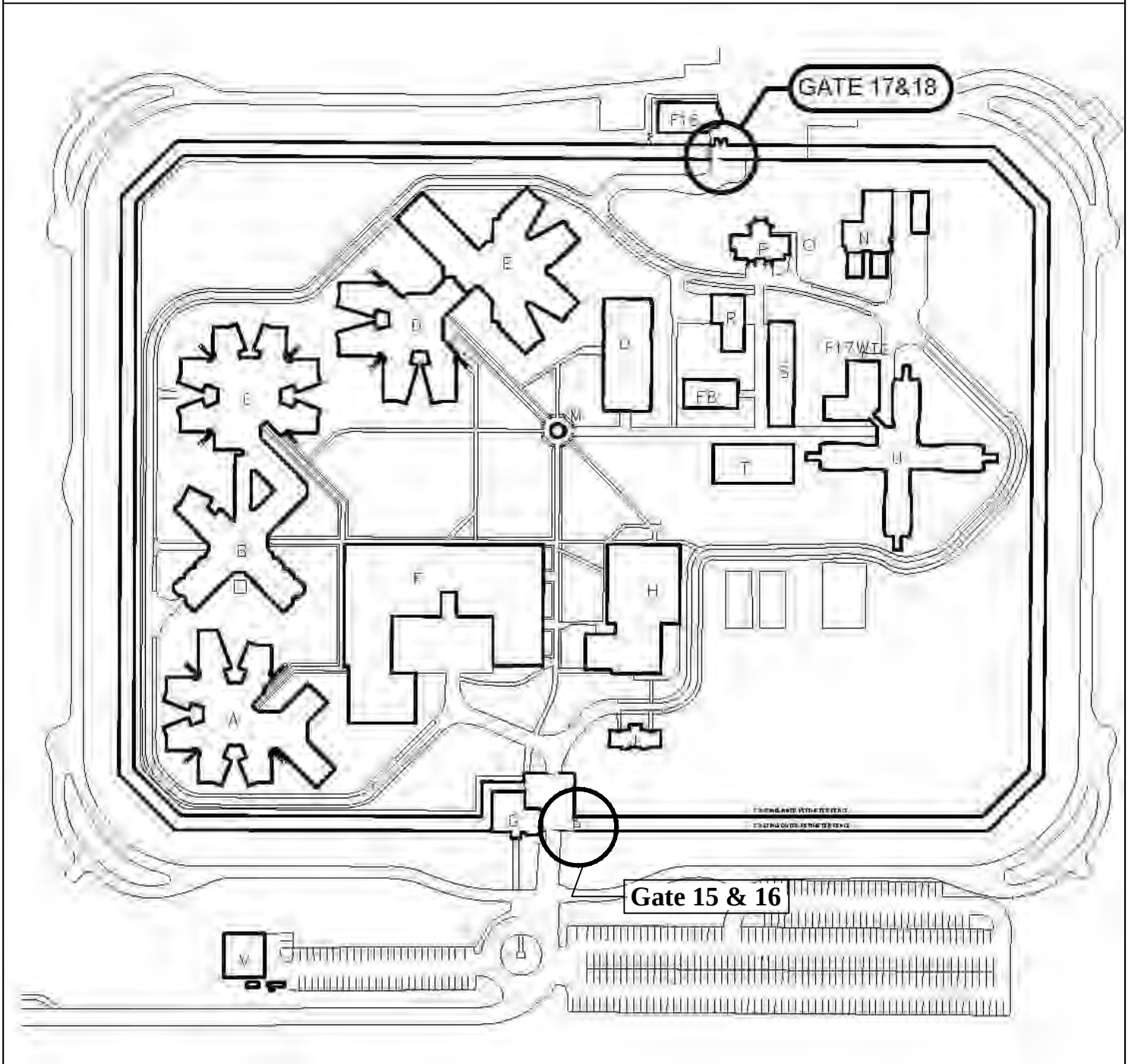
Phone: 299-6617 Fax: 299-6641

Geological Map

Pacific Region Perimeter Fence Upgrades
Pacific Institution, Abbotsford, BC
Client: CWMM Consulting Engineers Ltd.

Drawn By:	Scale:
IC	NTS
Check by:	Date
HKM	November 2018

Dwg no: 218C555 - PA 02



JECTH Consultant Inc. Suite 208, 3832 Henning Drive Burnaby, B.C. V5C 8P3 Phone: 299-6617 Fax: 299-6641	**Site Plan** **Pacific Region Perimeter Fence Upgrades** **Pacific Institution, Abbotsford, BC** **Client: CWMM Consulting Engineers Ltd.**	Drawn By: IC	Scale: NTS
		Check by: HKM	Date November 2018
		Dwg no: 218C555 - PA 03	

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT
PROPOSED PERIMETER FENCE AND GATES UPGRADES

AT
PACIFIC INSTITUTION
33344 KING ROAD
ABBOTSFORD, BC

FOR

CWMM CONSULTING ENGINEERS LTD.

PREPARED BY

JECTH CONSULTANTS INC.

JOB NO.: 218C555E

DATE: NOVEMBER 30, 2018

Suite 208-3823 Henning Drive, Burnaby, BC, V5C 6P3, Phone: 604-299-6617, Email: jecth@jecth.com

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT PROPOSED PERIMETER FENCE AND GATES UPGRADES PACIFIC INSTITUTION, 33344 KING RD, ABBOTSFORD, BC

1.0 INTRODUCTION

1.1 AUTHORIZATION

As authorized by CWMM Consulting Engineers Ltd. on October 22, 2018, JECTH Consultants Inc. (JCI) has carried out a Geotechnical Engineering Review and Assessment for the proposed Perimeter Fence and Gates Upgrade project, Pacific Institution which is located at 33344 King Road, Abbotsford, BC as shown in Figure PA 01 – Site Location Plan.

1.2 METHODOLOGY

The Geotechnical Engineering Assessment and Review includes:

- Reviewed of available Structural Plan for the Gates
- Obtained the Surficial Geological Map from Geological Canada.
- Reviewed available Geotechnical Report for Building Construction at the Institution and nearby Area.
- Conducted a site reconnaissance by our site staff at the subject site.
- Assessed the available subsurface soil conditions and profile based on desktop review and our local experience within the close vicinity of the subject site.
- Communicated with Institution staff and Structural Engineer.
- This report is prepared according to JECTH Consultants Inc. Proposal P218 -551 dated October 10, 2018.

1.3 OBJECTIVE

This Geotechnical Engineering Report summarizes our findings and provides Geotechnical Engineering Comments and Recommendations for the foundation design and construction of the Gates and Fence upgrade for existing perimeter security fences of the Institution Compound.

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1.4 DESIGN DRAWING

This report is prepared based on the Design Drawings prepared by CWMM which received by our office on October 9, 2018. Any revision of the plan must be informed to JECTH Consultants Inc.

3.0 SITE LOCATION AND CONDITION

The Pacific Institution is located at north of Huntington Road and about 1 City Block to the west from the intersection between Hungtington Road and McCallum Road intersection. The Pacific Institution is one of the three Institutions (Matsqui, Fraser Valley and Pacific Institution) in the area.

The Institution is bounded by Fraser Institution to the North, an access Road (for all 3 Institutions at the area) to the west, Huntington Road to the south and Farmland to the east.

The Institution can be accessed by an access road from the King Road. The Institution compound is surrounded by a double steel security fence along perimeter. A parking lot is located at the south of the Institution compound.

A site reconnaissance was taken by our site staff on November 20, 2018 around the perimeter security fences. The reconnaissance at the proposed gates upgrade locations and local nearby area indicate there is no apparent subsidence of ground, nor any distress of asphalt surface along the surrounding access road.

Topography of the Site is generally level. There is no sign of water in ditches along the access road during the day of Site Reconnaissance in fine weather.

4.0 PROPOSED GATES UPGRADE

Based on a Site Plan supplied by CWMM Consulting Engineers as shown in Figure MI 03, there will be 4 nos. of gates to be installed around the existing perimeter fences. The gates are either new gates, or replace existing gates as an upgrade as listed in the following:

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Gate No.	Location	Gate Usage
15	South Perimeter	Maintenance Vehicle
16	South Fence	Passenger
17	North Perimeter	Emergency Vehicle
18	North Perimeter	Emergency Vehicle

The structural details of the Gates are enclosed in Appendix "A" – Gates Upgrade for Pacific Institution for ease of reference.

Gates for vehicle passage will have foundation design for transient vehicle load from Trucks and Fire Trucks. JCI estimate an equivalent surcharge load of 15 KPa for vehicle loading will be sufficient for the transient live load design.

5.0 SUBSURFACE SOIL CONDITIONS

Based on available Geological Map as shown in PA 02 – Geological Map, the Pacific Institution is situated in Suma Drifts (Sa) deposit and should be underlain with SAND and Gravel at shallow surface and further underlain by Glacial Deposit composed of dense Till-like soil.

There are several geotechnical report available for review for building construction in the nearby Fraser Valley Institution. A lists of the report are in the followings:

1. Geotechnical Report by Braun Geotechnical at the Fraser Valley Institution dated September 15, 2015 for a warehouse upgrade project east to the Institution.
2. Draft Geotechnical Report by Golder & Associate Ltd dated January 20, 2012 for building construction at Fraser Valley Institution. Location of investigation was at the parking Area to the south the Matsqui Security Building.
3. Geotechnical Report by Stantec Consulting dated December 1, 2011 for Building investigation in Fraser Valley Institution.
4. Geotechnical Report by Klohn Crippen Berger dated November 2 and 29, 2010 for 3 nos. of Buildings in Fraser Valley Institution.

The year 2015 Braun Report utilized test pitting for geotechnical investigation. All other reports using auger holes and DCPT for investigation to the depth of 4 m to 5 m

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below existing grade. All auger holes encountered refusal at depth between 4 m to 5 m, probably due to presence of cobbles.

In order to reach deeper soil stratum that cannot obtain in auger , Stantec and Klohn Crippen Berger used Becker Hammer equipment to reach 14 m depth. The main purpose to reach a deeper soil stratum by a stronger equipment than auger in order to establish Site Class for seismic building design.

In general, the site and nearby area have minor FILL at about 1 m at the surface and underlain by a compact to dense SAND and Gravel, and further underlain by dense Till-like Soil composed by Glacial Deposit. Groundwater was measured at 4.48 m depth by a standpipe installed by Klohn Crippen Berger.

The depth of FILL can be varied from location to location. A few of the auger holes and test pits of previous investigation obtained FILL up to 3 m. It is believed that the existing level topography of the Institution was made level by past site preparation. Previous soft native organic soil was removed and replaced with SAND and Gravel excavated in nearby area. The localized deep FILL area are likely backfill of culvert and low lying drainage ditches in previous farmland before the construction of the Institution.

All the reviewed soil logs are listed in Appendix 'C' - Soil Logs by other for ease of reference.

After review all the soil logs and report conclusion by the above geotechnical report references, it is our opinion that the proposed light weight gate structure will only affected by the compact SAND and Gravel (either Fill or native material) at shallow depth.

For simplicity of presentation in this report, the general soil profile in the area can be simplified in the following table:

Depth (m)	Soil	Remark
0 - 1	Silty Sand and Gravel FILL	Compact
1 - 4	SAND and Gravel	Compact to Dense
4 - 14	Glacial Soil Deposit composed of Dense Silty SAND, cobbles or stiff Sandy SILT (Till-like Soil)	Dense to very dense

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Groundwater is likely below 4 m depth and with local Perched water at FILL /Native Soil interface.

Discussion with PWGSC site staff during a Site reconnaissance on November 20, 2018 indicate the previous constructions within the area encountered shallow presence of SAND and Gravel.

6.0 GEOTECHNICAL FOUNDATION DESIGN

Due to presence of compact SAND and Gravel FILL and compact to dense native SAND and Gravel at shallow depth, the Gate Footing have to found on either FILL and Native material which will provide bearing resistance for Gate foundation.

The gate foundation can be conventional shallow stripped and pad footing found on either SAND and Gravel FILL or native SAND and Gravel.

An allowable bearing capacity of 100 KPa for SLS design and ultimate bearing capacity of 150 KPa for ULS design are recommended. The minimum depth of footing should be at least 0.5 m below surface for frost protection. In the case that soil subgrade modulus is used for design of the footing, a modulus subgrade reaction at 10,000 KN / m^3 can be used for the analysis.

Long term settlement of the footing will be in the order of 25 mm. Settlement will likely completed during construction period. Differential settlement of the footings will be minimal. In the case that the footing found on SAND and Gravel FILL, the material will require re-compaction to 100% Standard Proctor Density at the gates location.

Groundwater will unlikely occur during construction. In the case that perched water is encountered, temporary de-watering will be necessary for the site preparation work for re-compaction and foundation construction by introduction of temporary de-watering sump.

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7.0 SEISMIC DESIGN

The Braun Report support a site Class C for seismic design which recommended both by Stantec and Klohn Crippen Berger reports. The Golder & Associates recommend a Site Class D in the drafted report.

Our opinion consider a **Site Class D** (for dense soil) which is more suitable for the gates upgrade project due to varying soil strength of compact SAND and Gravel at shallow depth.

Peak Ground Acceleration (PGA) and Spectrum acceleration for 2% probability of exceedance in 50 years can be obtained from Resource Canada for a **Class C** site in NBCC 2015 as follow:

Site Co-ordinate: Longitude 49.019^{o} North, Longitude 122.303^{o} West

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	Sa(5.0)	Sa(10.0)	PGA
0.706g	0.598g	0.350g	0.214g	0.072g	0.025g	0.310g

Due to presence of compact to dense SAND and Gravel vicinity depth below proposed shallow gate footing, the Site Classification to be a **Class D Site for dense soil** in accordance to Table 4.1.8.4 A of BC Building Code 2012. The following Fa and Fv values are interpolated from Table 4.1.84 B and 4.1.8.4 C respectively from Building Code to apply for a Class D Site.

	Sa (0.2)	Sa (0.2)	Sa (0.2)
	0.5g	0.75g.	0.706 g.
Fa	1.2	1.1	**1.12**

	Sa (1.0)	Sa (1.0)	Sa (1.0)
	0.3 g	0.4 g	0.350 g.
Fv	1.2	1.1	**1.15**

Based on the linear interpretation, of the obtained Fa and Fv respectively are **1.12** and **1.15** for **Class D** site.

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Seismic Bearing Capacity can be taken for a $^1/_3$ increase of ultimate bearing capacity (in this case 200 KPa) with anticipation of short duration of Earthquake event. Liquefaction of the site is unlikely due the presence of non liquefiable compact to dense SAND and Gravel in vicinity depth of the proposed gate footings.

8.0 GEOTECHNICAL ENGINEERING FIELD REVIEW

JECTH Consultants Inc. will provide Field Review (Geotechnical Engineering) according to the 2012 BC Building Code and Letter of Assurance (Schedule "B") as well as municipality requirements.

The following general field reviews (Require 48 hour notification) are required prior to and during construction stage (see also Appendix "D" - Standard Geotechnical Inspection Requirements).

The general contractor or PWGSC must inform JECTH Consultants Inc for site inspection as required by Local Municipality for the followings:

- Temporary Construction Drainage (if required)
- Foundation Bearing Capacity (confirmation and Certification)
- Compaction of Structural FILL.
- Perimeter backfill (Material requirements, compaction and Drainage)
- Other site inspections as specified in BC Building Code 2012
- Unforeseen subsurface soil and groundwater conditions as encountered prior to, during and after construction stage.

Other Geotechnical Engineering technical requirements and in-situ testing will be performed by certified laboratory/testing company and will be reviewed by JECTH Consultants Inc. during construction stage.

Specific Site Geotechnical Engineering issues must be addressed by JECTH Consultants Inc. prior to and during construction stage.

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9.0 FINAL FOUNDATION DESIGN REVIEW

JECTH Consultants Inc. should be given an opportunity to review the followings:

1. The detail and final Structural Engineering Drawing must be reviewed by JECTH Consultants Inc. prior to Building Permit Application such that the above comments and recommendations can be confirmed and modified.

2. Any other Electrical and Mechanical as well as Civil Engineering and Landscape Architect Drawings, if likely affect the foundation design and construction, must be reviewed and approved by JECTH Consultants Inc.

3. A consultant coordination meeting must be arranged prior to Building Permit Application or prior to construction start such that all design team members can confirm all design parameters for the project.

4. JECTH Consultants Inc. will review the exposed subsurface soil and groundwater conditions prior to and during construction stage. It is possible that the Geotechnical recommendations provided in this report be modified due to unforeseen circumstances and change in subsurface soil as well as groundwater condition.

10.0 FIELD INSPECTIONS AND PRE-CONSTRUCTION MEETING

A pre-construction meeting must be organized between the site superintendent/contractor representatives and JECTH Consultants Inc. at a minimum of two weeks before **any site construction activities** such that appropriate field work can be carried out.

JECTH Consultants Inc. must be notified (48 hours) of all fieldwork prior to any site work in particular before site clearing, stripping and preparation. This will allow JECTH Consultants Inc. to provide final comments for the project with respect to Geotechnical Engineering.

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JECTH Consultants Inc.
Geotechnical & Environmental Engineers

11.0 CLOSURE

We trust this report meets your immediate requirements. If you have any questions regarding this report, please do not hesitate to contact the undersigned @ 604-299-6617.

JECTH Consultants Inc.

Dec 6, 2018.

Ivan Chu, P.Eng.

Attachments: List of Figures

Figure PA 01 – Site Location Plan
Figure PA 02 – Geological Map
Figure PA 03 – Site Plan

List of Appendixes

Appendix "A" – Gates No. 15, 16, 17 and 18 Plan and Detail (Pacific Institution)
Appendix "B" – Seismic Design Criteria
Appendix "C" – C1 - Soil Log from Braun Geotechnical. 2015
C2- Soil Log from Golder & Associates Ltd. 2012
C3 - Soil Log from Stantec Consulting. 2011
C4 -Soil Log from Klohn Crippen Berger 2010
Appendix "D" – Standard Field Inspection Requirements

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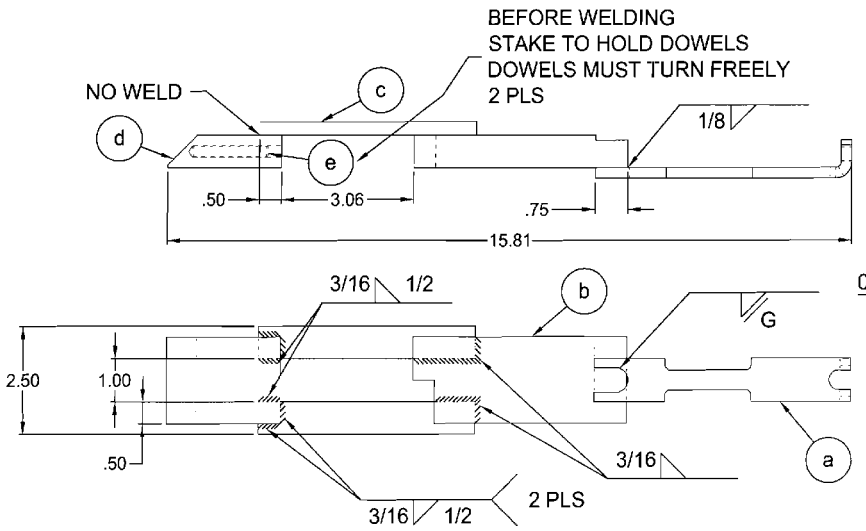
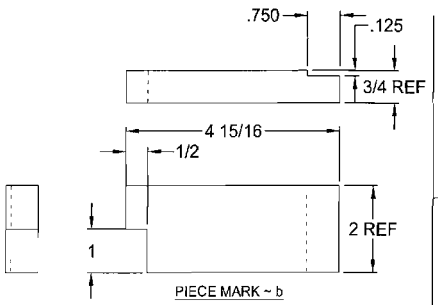
APPENDIX G

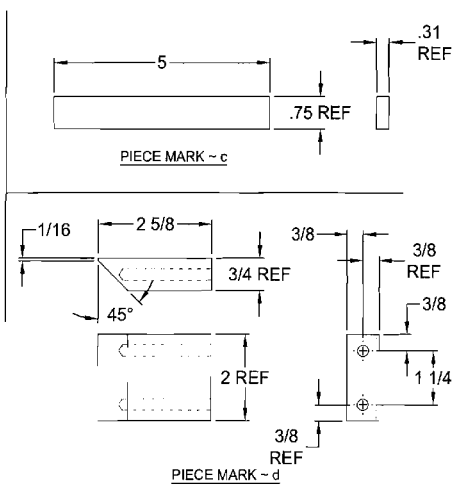
CREMONE BOLT SHOP DRAWINGS

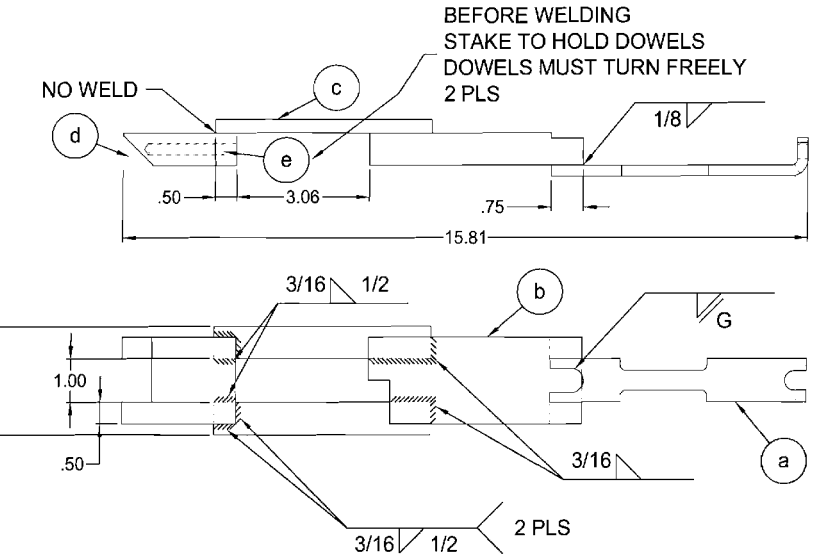
Latchbolt Extension Assembly Drawing.
Active Cremone Bolt 3800 HM Series.
3800 HM Series exploded view.



010-1672-500
LHSB







010-1672-300
LHRB

TEMPLATE NUMBER:

BILL OF MATERIAL

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001	010-0019-100	1	a	SPRING BOLT TAIL # 60				
002V	30320964	1	b	3/4 X 2 CR FLAT X	CR	4	.938	
003V	30320506	2	c	5/16 X 3/4 CR FLAT X	CR	5	.000	
004V	30320964	1	d	3/4 X 2 CR FLAT X	CR	2	.625	
005	002-5001-003	2	e	DOWEL PIN 1/4 X 1 3/4				

RECORD SET

REMOVE ALL BURRS AND BREAK SHARP EDGES

NO.	REVISIONS	DWN	CHKD	DATE
M	REDRAWN, RAW MATL WAS 010-1240-600, 012-2023-001, 010-1240-800 ECN 12-082	RA		4-9-12

BSIZE 3

WELD FINISH
1. NO FINISH
2. REMOVE WELD SPATTER
3. REMOVE WELD SPATTER SAND THE WELD
4. SMOOTH FINISH
5. SPECIAL:

PRODUCT FINISH
D. REMOVE BURR WHERE INDICATED THUS. REMOVE LOOSE MILL SCALE, EXCESSIVE OIL, DIRT, RUST AND OTHER FOREIGN MATERIALS.
- ☐ APPLY ONE COAT OXIDE PRIMER
- ☐ HOT DIP GALVANIZE
- ■ ZINC PLATE
- ☐ SPECIAL

NEXT ASSEMBLY: CREMONE
CLEAR OPENING WIDTH:
CLEAR OPENING HEIGHT:

DO NOT SCALE
ALL DIMENSIONS IN INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS ±1/32
2 PLACE DECIMAL ±.015
3 PLACE DECIMAL ±.005
ANGULAR ±1/2°

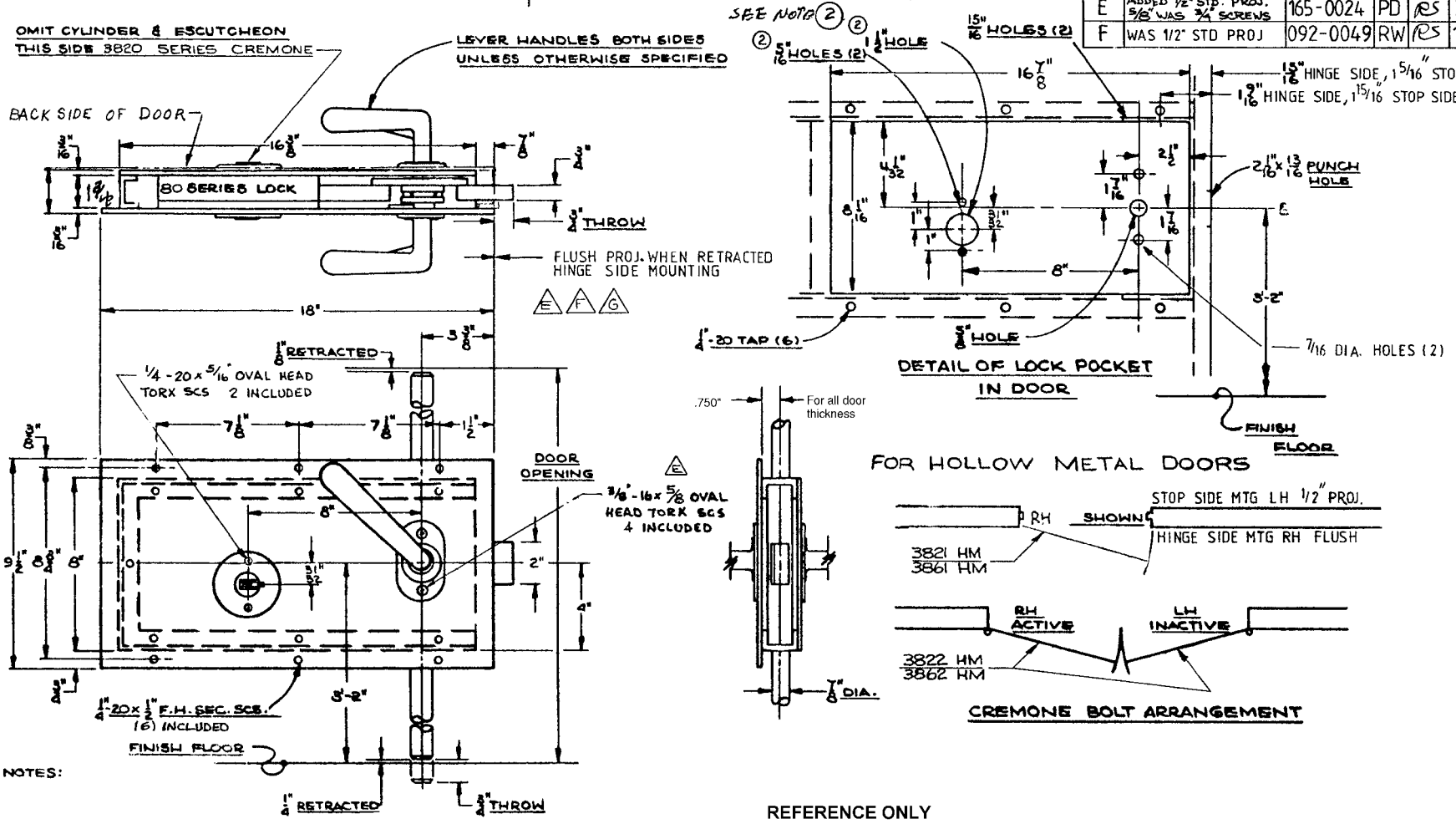
DETENTION EQUIPMENT by FOLGER ADAM SAN ANTONIO, TEXAS

DESCRIPTION: LATCHBOLT EXT ASY, LH 60 CREMONE 1/2
PROJECT NAME:
DRAWN BY: SJ
CHECKED BY:
DATE: 4-16-04
PROJECT NUMBER:
QTY.
DRAWING NUMBER: 010-1672-300
SHT 1 of 1

REFERENCE ONLY

LTR.	REVISIONS	E. C. O	BY	APPV	DATE
G	CORRECTED PROJECTION, CLARIFY HINGE & STOP SIDE DIM & APPLICATION	165-0021	PB	RS	1-7-91

LTR.	REVISION	E. C. O.	BY	APP.	DATE
D	DWG NO. WAS 1030	092-0037	SS	RS	7-23-86
E	ADDED 1/2" STD. PROJ. 5/8" WAS 3/4" SCREWS	165-0024	PD	RS	3-5-87
F	WAS 1/2" STD PROJ	092-0049	RW	RS	10-26-88



REFERENCE ONLY

NOTES:

(2) THESES HOLES ARE FOR KEYING BOTH SIDES ONLY ~ # 3861 & 3862

LTR	REVISION	E.C.O.	BY	APP.	DATE
H	1" WAS 31/32".	MINOR	RGC		7/23/96

DOOR & FRAME PREPARATION TOLERANCES UNLESS OTHERWISE SHOWN

FRACTIONS	± 1/32
TWO PLACE DECIMAL (.XX)	± .015
THREE PLACE DECIMAL (.XXX)	± .005
ANGLES	± 1/2°

SOUTHERN FOLGER DETENTION EQUIPMENT CO.
4634 S. Presa Street
San Antonio, Texas 78223
Phone: 210-533-1231 Fax: 210-533-2211
Security Hardware & Detention Equipment

DO NOT SCALE - ALL DIMENSIONS IN INCHES. DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE. REFER TO CATALOG FOR STANDARD AND OPTIONAL FEATURES. DOOR AND FRAME MANUFACTURERS ARE RESPONSIBLE FOR PROVIDING ADEQUATE CONSTRUCTION OR REINFORCEMENTS FOR PROPER INSTALLATION OF HARDWARE SHOWN. TOLERANCES SHOWN ARE FOR CUTOUTS.

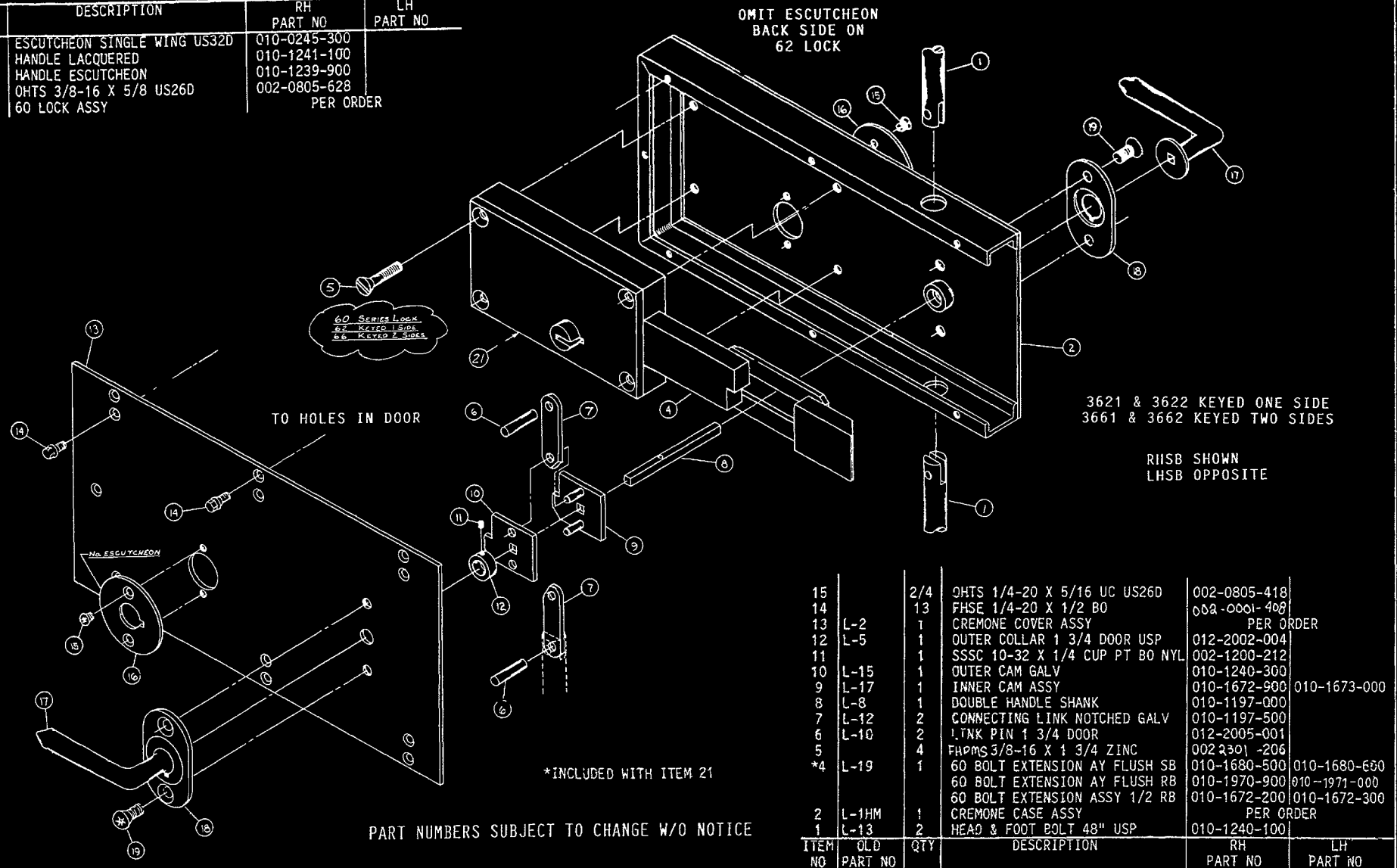
DRAWN BY: D. WOLZ	DATE: 12-28-61	REF. REPAIR PART DWG.	
CHECKED BY: W. Donna	APP. BY:	093-0165-003	

DRAWING TITLE

ACTIVE CREMONE BOLT 3800 HM SERIES

REPLACES OLD DRAWING NO. 1030	DRAWING NO. 092-0165-003

ITEM NO	OLD PART NO	QTY	DESCRIPTION	RH PART NO	LH PART NO
16	ESC-1	1/2	ESCUTCHEON SINGLE WING US32D	010-0245-300	
17	L-28	2	HANDLE LACQUERED	010-1241-100	
18	L-27	2	HANDLE ESCUTCHEON	010-1239-900	
19		4	OHTS 3/8-16 X 5/8 US26D	002-0805-628	
21		1	60 LOCK ASSY	PER ORDER	



*INCLUDED WITH ITEM 21

PART NUMBERS SUBJECT TO CHANGE W/O NOTICE

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14		13	FHSE 1/4-20 X 1/2 BO	002-0001-408	
13	L-2	1	CREMONE COVER ASSY	PER ORDER	
12	L-5	1	OUTER COLLAR 1 3/4 DOOR USP	012-2002-004	
11		1	SSSC 10-32 X 1/4 CUP PT BO NYL	002-1200-212	
10	L-15	1	OUTER CAM GALV	010-1240-300	
9	L-17	1	INNER CAM ASSY	010-1672-900	010-1673-000
8	L-8	1	DOUBLE HANDLE SHANK	010-1197-000	
7	L-12	2	CONNECTING LINK NOTCHED GALV	010-1197-500	
6	L-10	2	LINK PIN 1 3/4 DOOR	012-2005-001	
5		4	FHPMS 3/8-16 X 1 3/4 ZINC	002 2301 -206	
*4	L-19	1	60 BOLT EXTENSION AY FLUSH SB	010-1680-500	010-1680-600
			60 BOLT EXTENSION AY FLUSH RB	010-1970-900	010-1971-000
			60 BOLT EXTENSION ASSY 1/2 RB	010-1672-200	010-1672-300
2	L-1HM	1	CREMONE CASE ASSY	PER ORDER	
1	L-13	2	HEAD & FOOT BOLT 48" USP	010-1240-100	
ITEM NO	OLD PART NO	QTY	DESCRIPTION	RH PART NO	LH PART NO

REV NO	DESCRIPTION	BY & DATE	ECO
H	UPDATE PART NUMBER	JLW 7-10-97	MINOR
G	CHANGED PICTORALLY REMOVED ITEM 3 & 20 UPDATED B/M	R BK 8/14/98	165-0028
F	UPDATED B/M	11/3/97	165-0042
E	UPDATED DRWG & BOM	JN 5-18-07	093-0005
D	UPDATED DWG.	JR 11/14/05	093-0006
C	UPDATED DWG	KC 5-4-01	093-0003
B	RELEASED	DF 8-2-00	EN81066
A	ADDED PART & DWG NUMBERS	RK 4-7-81	—

REVISIONS

MATERIAL SEE CHART
RAW MAT'L PART NO —
FINISH PRIMER
REMOVE ALL BURRS & BREAK SHARP EDGES
CHK'D DATE 4-6-81
APP'D DATE 4-7-81
PROJ NO

SOUTHERN FOLGER DETENTION EQUIPMENT CO.
4634 S. Presa Street Phn:210-533-1231
San Antonio, Tx. 78223 Fax:210-533-2211

TITLE: 3600 HM SERIES ACTIVE CREMONE ASSY FOR HOLLOW METAL DOORS
SCALE — PAGE 1 OF 1
DWG SIZE D DWG NO 093-0165-001

APPENDIX H

TYMETAL TCRB-4 MANUAL CRASH RATED BEAM

Index of Crash Beam locations.
Three photos.
Three product drawings.

PWGSC / CSC

R.071529.001 - Various Institutions:

Perimeter Fence Upgrades

Tymetal Corp Crash Beams

Locations;

33344 King Rd, Abbotsford

Matsqui Institution 1 Crash Beam

Pacific Institution 1 Crash Beam

8751 Stave Lake Street, Mission

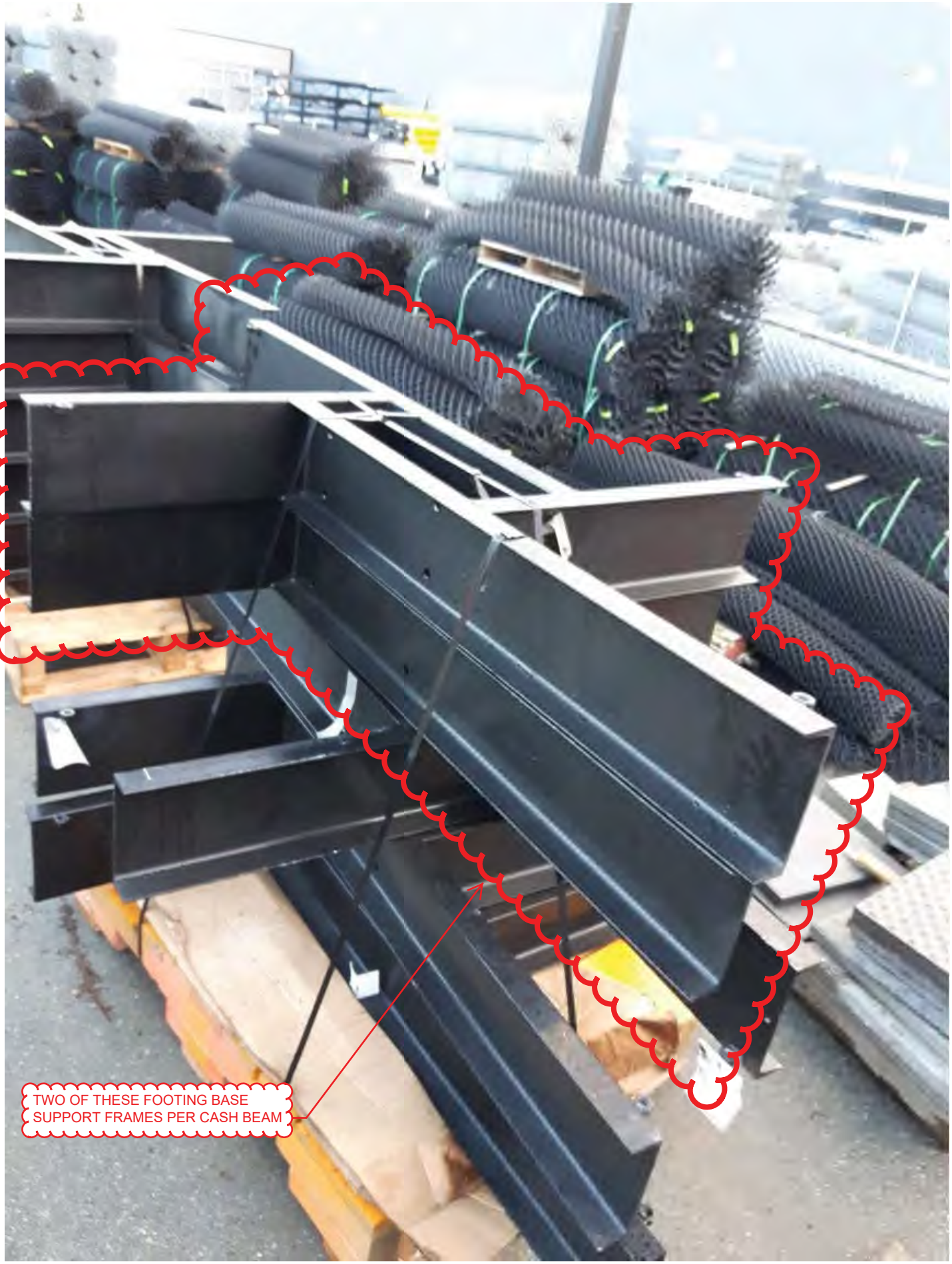
Mission Institution 1 Crash Beam

4732 Cemetary Rd, Agassiz

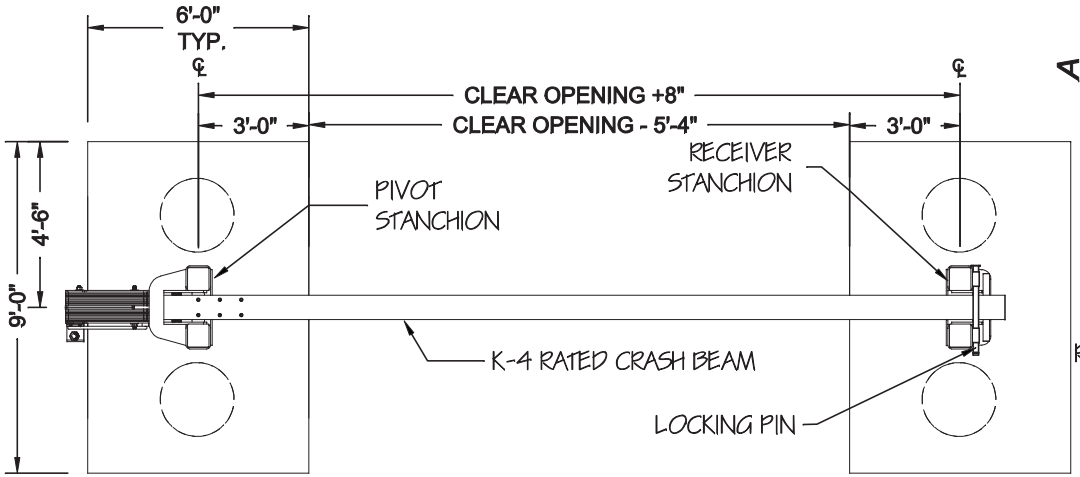
Kent Institution 1 Crash Beam

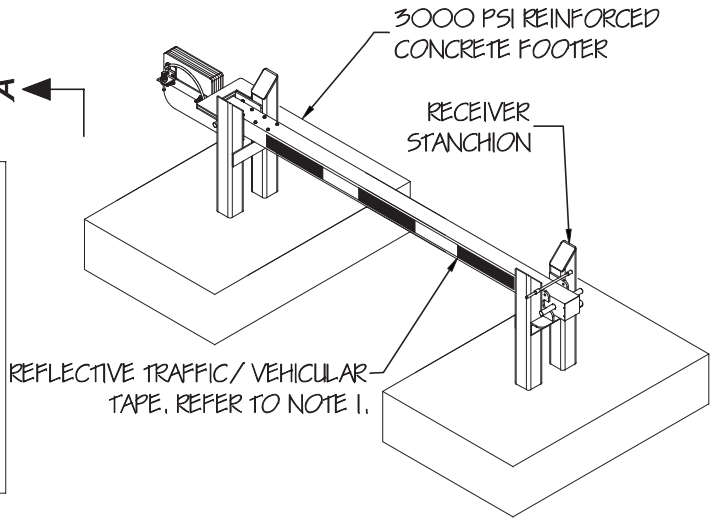
Mountain Institution 1 Crash Beam


ONE ARM PER CRASH BEAM


TWO OF THESE FOOTING BASE
SUPPORT FRAMES PER CASH BEAM


ONE SET OF THESE CRASH
BEAM POSTS PER CRASH BEAM



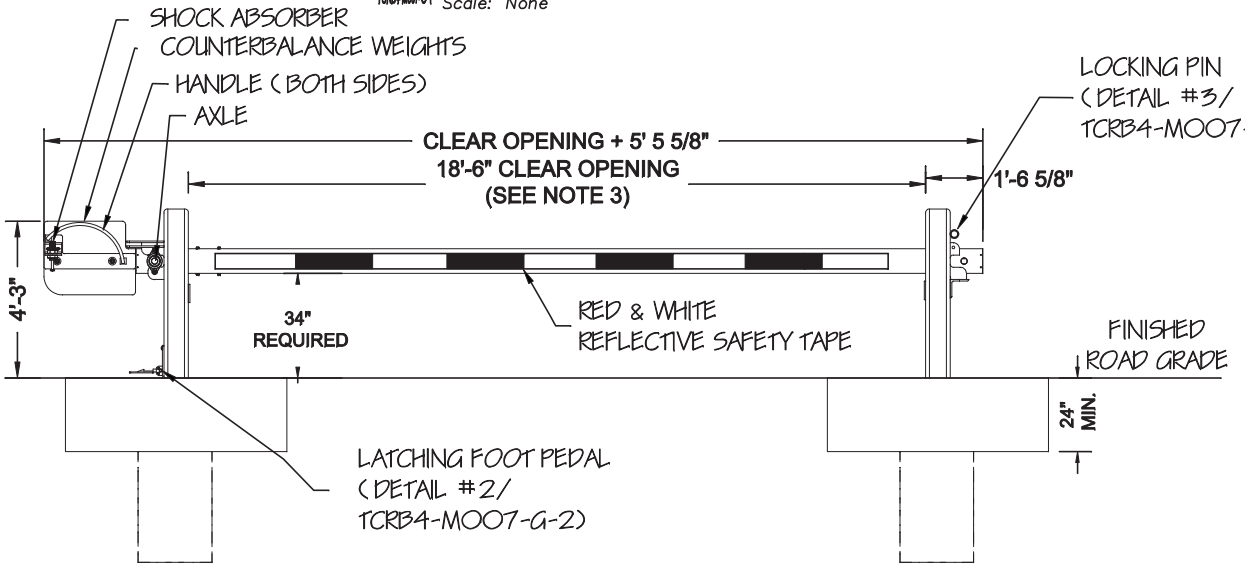


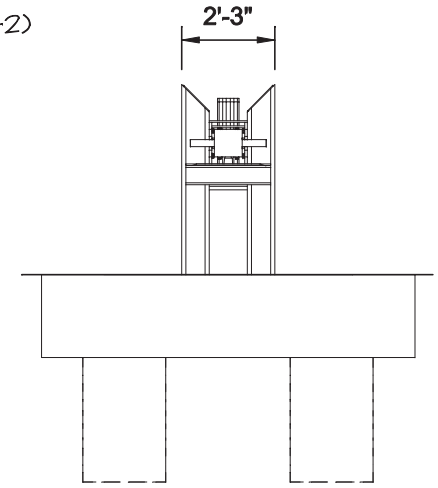
A

A

1 PLAN VIEW
TCRB4-M007-G-1 Scale: None

APPROVED





2 ELEVATION
TCRB4-M007-G-1 Scale: None

3 VIEW A-A
TCRB4-M007-G-1 Scale: None

NOTES:
1. CRASH BEAM IS POWDER COATED WHITE WITH SHOP APPLIED REFLECTIVE TRAFFIC/VEHICULAR TAPE, RED AND WHITE, ALTERNATING, WEATHERPROOF. TAPE WILL BE FHWA - MUTCD COMPLIANT. BY TYMETAL, BOTH INBOUND AND OUTBOUND SIDES.
2. STANCHIONS ARE COATED WITH ZINC ENRICHED PRIMER AND PAINTED BLACK.
3. CLEAR OPENING IS DEFINED BETWEEN STANCHIONS (8" TUBE TO 8" TUBE)
4. WEIGHT PLATE LAYOUT VARIES WITH CLEAR OPENING. EXTENSIONS MAY BE REQUIRED ON LARGER OPENINGS.

APPROVAL (To be completed by customer):

Name (PRINT): _____

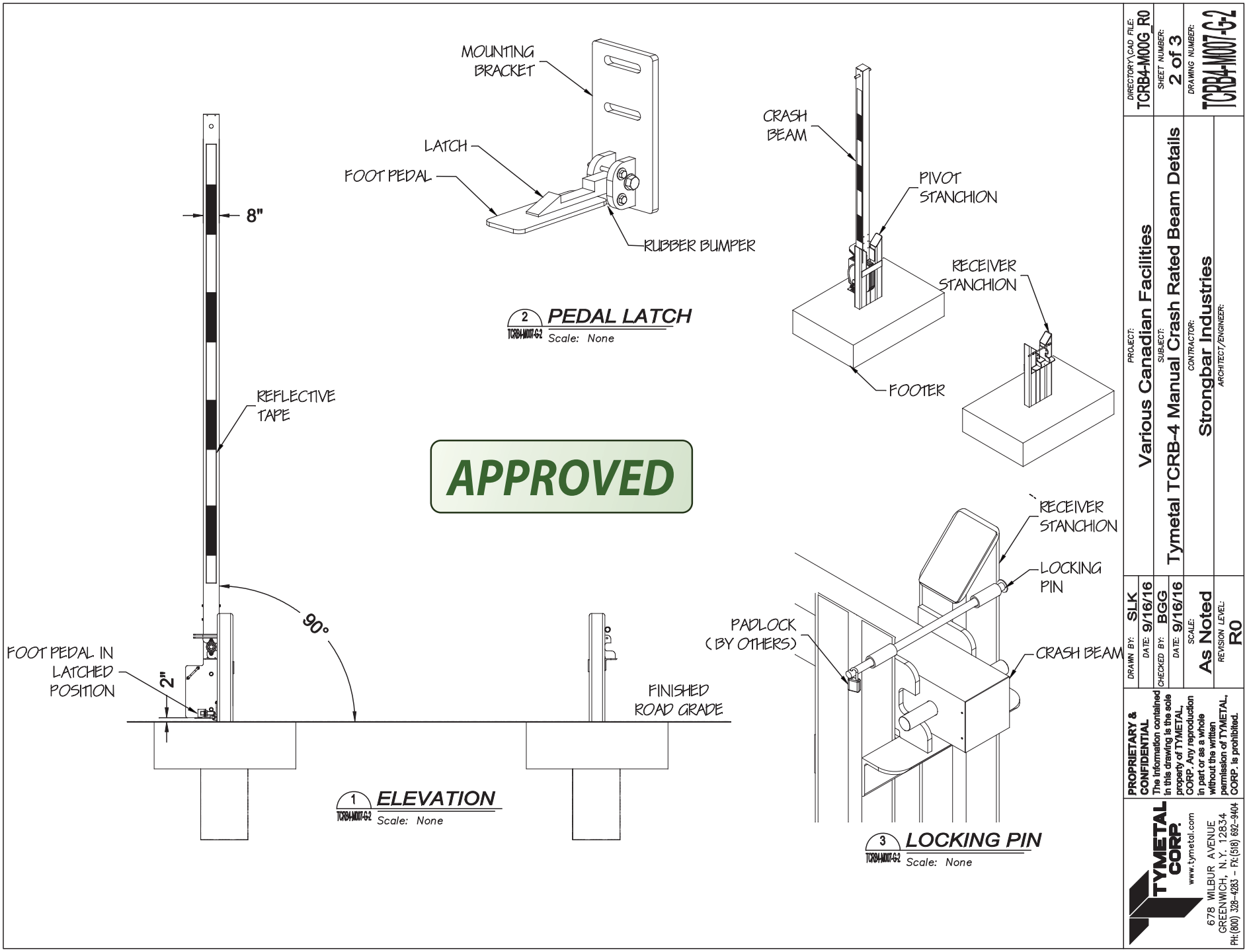
Signature: _____ Date: _____

DIRECTORY\CAD FILE: TCRB4-M00G_R0
SHEET NUMBER: 1 of 3
DRAWING NUMBER: TCRB4-M007-G-1

PROJECT: Various Canadian Facilities
SUBJECT: Tymetal TCRB-4 Manual Crash Rated Beam
CONTRACTOR: Strongbar Industries
ARCHITECT/ENGINEER:

DRAWN BY: SLK DATE: 9/16/16
CHECKED BY: BGG DATE: 9/16/16
SCALE: As Noted
REVISION LEVEL: R0

TYMETAL CORP.
www.tymetal.com
678 WILBUR AVENUE
GREENWICH, N.Y. 12834
PH:(800) 328-4283 - FX:(518) 692-9404



PROJECT: Various Canadian Facilities

SUBJECT: Tymetal TCRB-4 Manual Crash Rated Beam Details

CONTRACTOR: Strongbar Industries

ARCHITECT/ENGINEER:

DIRECTORY\CAD FILE: TCRB4-M00G_R0

SHEET NUMBER: 2 of 3

DRAWING NUMBER: TCRB4-M007-G-2

DRAWN BY:	SLK	
DATE:	9/16/16	
CHECKED BY:	BGG	
DATE:	9/16/16	
SCALE:	As Noted	
REVISION LEVEL:	R0	

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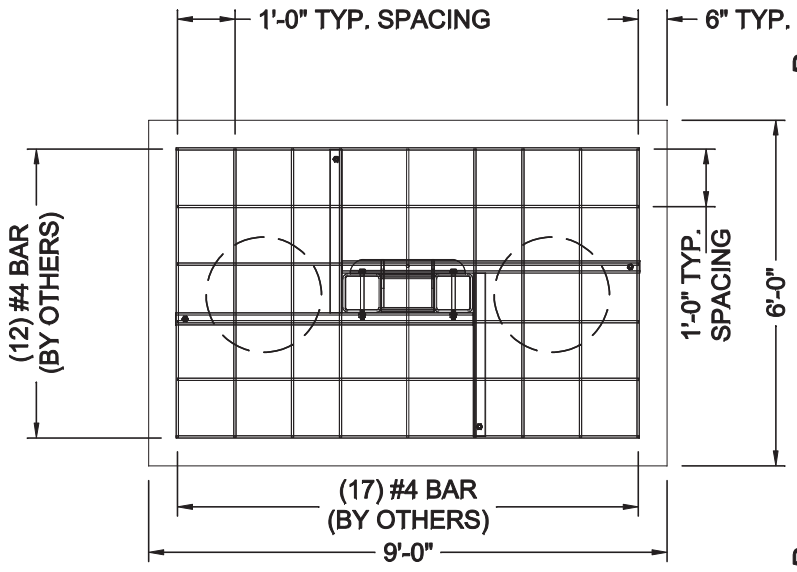
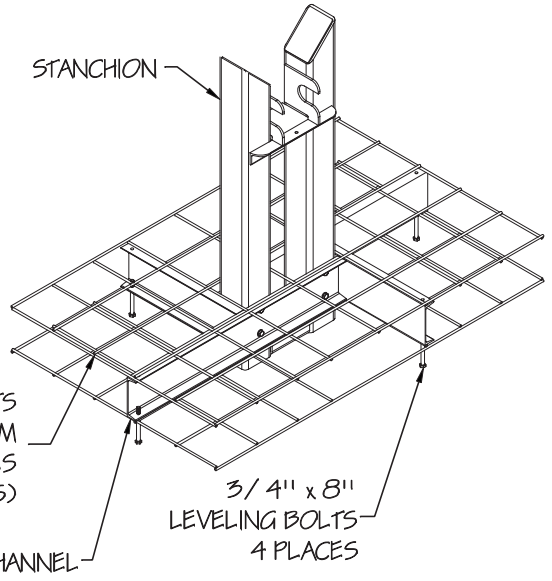
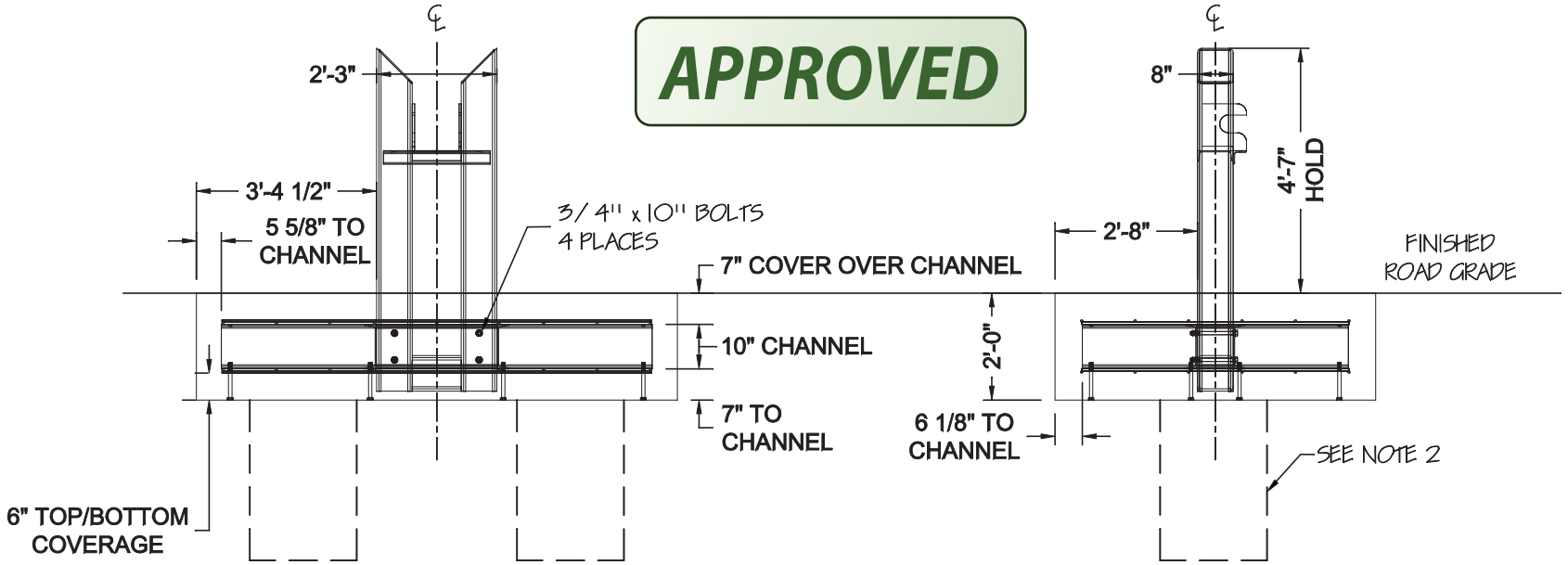


1 PLAN VIEW
TCRB4-M007-G-3 Scale: None



APPROVED



2 ELEVATION
TCRB4-M007-G-3 Scale: None

3 VIEW B-B
TCRB4-M007-G-3 Scale: None

NOTES:
1. FOUNDATIONS SHOWN ARE BASED ON AVERAGE SOIL AND SITE CONDITIONS. FOUNDATIONS MUST BE IN ACCORDANCE WITH ALL LOCAL CODES, AND SHOULD BE REVIEWED BY A LOCAL ENGINEER.

2. PIERS REQUIRED IN AREAS WHERE FROST LINE IS BELOW FOUNDATIONS.

3. TYMETAL RECOMMENDS ALL SITE CONDITIONS AND IN SITU SOILS BE REVIEWED BY A QUALIFIED ENGINEER. MINIMUM SOIL BEARING CAPACITY OF 940 psf AND BACKFILL COMPACTION TO A DENSITY OF NOT LESS THAN 95% MAXIMUM DRY DENSITY ARE REQUIRED. TYMETAL WILL NOT BE RESPONSIBLE FOR FAILED GATE OPERATIONS CAUSED BY UNSTABLE SOIL CONDITIONS.

DIRECTORY\CAD FILE: TCRB4-M00G_R0
SHEET NUMBER: 3 of 3
DRAWING NUMBER: TCRB4-M007-G-3
PROJECT: Various Canadian Facilities
SUBJECT: Tymetal TCRB-4 Stanchion Footings
CONTRACTOR: Strongbar Industries
ARCHITECT/ENGINEER:
DRAWN BY: SLK DATE: 9/16/16
CHECKED BY: BGG DATE: 9/16/16
SCALE: As Noted
REVISION LEVEL: R0

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APPENDIX I

PRE-RENOVATION HAZARDOUS BUILDING MATERIALS ASSESSMENT
CORRECTIONAL SERVICE CANADA (CSC) –PACIFIC REGION
PERIMETER FENCE AND GATE UPGRADES

Public Services and Procurement Canada | Services publics et Approvisionnement Canada

PRE-RENOVATION HAZARDOUS BUILDING MATERIALS ASSESSMENT
CORRECTIONAL SERVICE CANADA (CSC) – PACIFIC REGION
PERIMETER FENCE AND GATE UPGRADES

DST Project Number: 2003897

Client Project Number: R.071529.001

Report prepared for:

Public Services and Procurement Canada, Environmental Services
Services Publics et Approvisionnement Canada, Services environnementaux
219 - 800 Burrard Street,
Vancouver, BC,
V6Z 0B9

Report prepared by:

DST Consulting Engineers Inc., a Division of Englobe
Unit B – 4125 McConnell Drive
Burnaby, B.C.
V5A 3J7

EXECUTIVE SUMMARY

DST Consulting Engineers Inc. (DST), a Division of Englobe, was retained by Public Services and Procurement Canada (PSPC) on behalf of Correctional Service Canada (CSC), to conduct a pre-renovation hazardous building materials assessment in preparation of modifications to select perimeter fences and gates at Kent and Mountain Institutions in Agassiz, BC, Mission Medium Institution in Mission, BC, and Matsqui and Pacific Institutions in Abbotsford, BC, herein referred to as the Subject Site(s).

The purpose of the assessment was to identify hazardous materials, limited to include asbestos-containing materials (ACMs), lead containing paints (LCPs) and/or lead-containing building materials, and silica in preparation for select fence and gate modifications as follows:

- Kent Institution: Gates 1, 2, 4 & 7.
- Mountain Institution: Gates 8, 9, & 10.
- Mission Medium Institution: Gates 12, 13, & 14.
- Pacific Institution: Gates 17 & 18.
- Matsqui Institution: Gates 20, 23, & 24.

All work was performed in accordance with the requirements of the Canada Labour Code, Part II Canada Occupational Health and Safety Regulations (COHSR) and the British Columbia Occupational Health and Safety Regulation (BC Reg. 296/97), as amended to the date of this report.

Based on DST's visual assessment and on the analyses of collected samples, hazardous building materials were identified at the Subject Site(s). A summary of findings and recommendations is presented below. It should be noted that this summary is subject to the same restrictions and limitations as presented in Section 5.0 (Assessment Limitations) and Section 8.0 (Closure) of this report. The information provided is to be read in conjunction with the remainder of this report.

Executive Summary Tables 1 to 5: Summary of Findings

Table 1 Kent Institution - Gates 1, 2, 4 & 7

Hazardous Building Material	Description
Asbestos-Containing Materials (ACMs)	No ACMs were identified at the Subject Site.
Lead	**Coatings and/or paints containing > 600 ppm were identified at the Subject Site.**
Silica	**Sources of silica were identified in the concrete bollard and fence post foundations at the Subject Site.**

Table 2 Mountain Institution - Gates 8, 9, & 10

Hazardous Building Material	Description
Asbestos-Containing Materials (ACMs)	No ACMs were identified at the Subject Site.
Lead	**Coatings and/or paints containing > 600 ppm were identified at the Subject Site.**
Silica	**Sources of silica were identified in the concrete bollard, driveway below the swing gate, and fence post foundations at the Subject Site.**

Table 3 Mission Medium Institution - Gates 12, 13, & 14

Hazardous Building Material	Description
Asbestos-Containing Materials (ACMs)	No ACMs were identified at the Subject Site.

Hazardous Building Material	Description
Lead	**Coatings and/or paints containing > 600 ppm were identified at the Subject Site.**
Silica	**Sources of silica were identified in the concrete driveway leading to the gate structure and fence post foundations at the Subject Site.**

Table 4 Pacific Institution - Gates 17 & 18

Hazardous Building Material	Description
Asbestos-Containing Materials (ACMs)	No ACMs were identified at the Subject Site.
Lead	No LCPs containing coatings > 600 ppm were identified at the Subject Site.
Silica	**Sources of silica were identified in the concrete driveway at the gate and fence post foundations at the Subject Site.**

Table 5 Matsqui Institution - Gates 20, 23, & 24

Hazardous Building Material	Description
Asbestos-Containing Materials (ACMs)	No ACMs were identified at the Subject Site.
Lead	No LCPs containing coatings > 600 ppm were identified at the Subject Site.
Silica	**Sources of silica were identified in the concrete driveway at the gate and fence post foundations at the Subject Site.**

General findings, and general recommendations are provided in Section 6.0 and Section 7.0 of this report, respectively. Detailed findings and recommendations pertaining to the identified hazardous materials identified at each of the Subject Sites are provided in Appendix 1 to 5 of this report, as follows:

- Appendix 1 - Kent Institution: Gates 1, 2, 4 & 7.
- Appendix 2 - Mountain Institution: Gates 8, 9, & 10.
- Appendix 3 - Mission Medium Institution: Gates 12, 13, & 14.
- Appendix 4 - Pacific Institution: Gates 17 & 18.
- Appendix 5 - Matsqui Institution: Gates 20, 23, & 24.

Abbreviations

ACGIH – American Conference of Governmental Industrial Hygienists

ACM – Asbestos-containing material

AIHA - American Industrial Hygiene Association

BC - British Columbia

COHSR - Canada Occupational Health and Safety Regulations

CSC - Correctional Service Canada

EMSL – EMSL Canada Inc.

EPA – Environmental Protection Agency

HUD - Housing and Urban Development

LCP – lead-containing paint

mg/Kg – Milligram per Kilogram

NVLAP – National Voluntary Laboratory Accreditation Program

OEL – Occupational Exposure Limit

PPM – Parts Per Million

PLM – Polarized light microscopy

PSPC – Public Services and Procurement Canada

SWP – Safe Work Practice

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Appendix 1 – Kent Institution - Findings and Recommendations, and Site Drawings Illustrating Asbestos and Lead Sample Point Locations

Appendix 2 – Mountain Institution - Findings and Recommendations, and Site Drawings Illustrating Asbestos and Lead Sample Point Locations

Appendix 3 – Mission Medium Institution - Findings and Recommendations, and Site Drawings Illustrating Asbestos and Lead Sample Point Locations

Appendix 4 – Pacific Institution - Findings and Recommendations, and Site Drawings Illustrating Asbestos and Lead Sample Point Locations

Appendix 5 – Matsqui Institution - Findings and Recommendations, and Site Drawings Illustrating Asbestos and Lead Sample Point Locations

Appendix 6 - Analytical Laboratory Reports for Asbestos and Lead Samples

Appendix 7 - Applicable Regulations and Guidelines

1.0 INTRODUCTION

DST Consulting Engineers Inc. (DST), a Division of Englobe, was retained by Public Services and Procurement Canada (PSPC) on behalf of Correctional Service Canada (CSC), to conduct a pre-renovation hazardous building materials assessment in preparation of modifications to select perimeter fences and gates at Kent and Mountain Institutions in Agassiz, BC, Mission Medium Institution in Mission, BC, and Matsqui and Pacific Institutions in Abbotsford, BC, herein referred to as the Subject Site(s).

The purpose of the assessment was to identify hazardous materials, limited to include asbestos-containing materials (ACMs), lead containing paints (LCPs) and/or lead-containing building materials, and silica in preparation for select fence and gate modifications as follows:

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- Matsqui Institution: Gates 20, 23, & 24.

All work was performed in accordance with the requirements of the Canada Labour Code, Part II Canada Occupational Health and Safety Regulations (COHSR) and the British Columbia Occupational Health and Safety Regulation (BC Reg. 296/97), as amended to the date of this report.

The site work was conducted by Aaron Enquist, PAg, EPt, on September 21, 22, and 23, 2020.

2.0 BACKGROUND

DST understands that the fencing at the respective correctional institutions were constructed during a time when hazardous building materials were commonly or potentially used in construction. As such, and in accordance with the COHSR and Part 20, Section 20.112, *Hazardous Materials* of BC Reg. 296/97, as amended pertaining to the identification of hazardous building materials prior to renovation, PSPC commissioned this assessment.

2.1 Previous Report(s)

No previous reports were available for this project.

3.0 SCOPE OF WORK AND METHODOLOGY

This report has been prepared in preparation for upcoming fence modifications. The survey was destructive in nature. The subject fencing materials at each of the Subject Site(s) were examined to determine the presence of suspect ACMs, lead (including LCPs), and silica.

Representative samples of suspect ACMs and suspect LCPs were collected and were sent to a qualified laboratory for asbestos and lead content analysis.

Sources of silica were identified through visual inspection.

Site work was conducted in general compliance with the requirements of the COHSR, BC Occupational Health and Safety Regulation 296/97, and DST's Safe Work Practices (SWPs).

3.1 Asbestos-Specific Analysis and Sampling Methodologies

The presence of asbestos in federal workplaces and pertaining to federally regulated workers is governed by the COHSR. According to the COHSR, ACM means:

- Any article that is manufactured and contains 1% or more asbestos (by weight) at the time of manufacture, or any material that contains 1% or more asbestos when tested in accordance with accepted methods.

The presence of asbestos in the workplace in British Columbia pertaining to provincially regulated workers is governed by BC Reg. 296/97. According to the current version of BC Reg. 296/97, ACM means:

- Any material containing at least 0.5% asbestos, or vermiculite insulation with any asbestos.

As both federally regulated workers and provincially regulated workers (e.g., contractors) are expected to carry out work activities within the Subject Site(s), and as the provincial regulations have a more stringent definition of ACM, and generally include the requirements noted in the COHSR, this assessment was conducted to meet the requirements of BC Reg. 296/97.

Where observed, samples were collected from each "homogenous application" of suspected ACMs (materials suspected to contain asbestos that are uniform in material type, colour, texture application and estimated installation date) that are anticipated to be impacted through the fence modifications.

Samples were submitted to EMSL Canada Inc. (EMSL) in Vancouver, BC for analysis of asbestos content using polarized light microscopy (PLM) with dispersion staining, in accordance with the United States Environmental Protection Agency (EPA) 600/R-93/116 analytical method "Asbestos (bulk) by PLM." EMSL's analytical laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

The number of samples collected for each homogenous application of a suspected ACM was based on the recommendations provided in the BC Asbestos Guide, along with the assessor's experience and understanding of the consistency of the observed building material applications.

When asbestos is detected in concentrations greater than half of one percent in one of the samples within a set that was collected to represent a "homogenous application" of a particular material (or detected in any concentration, in a set of samples collected for applications of vermiculite), the entire sample set, and the entire application of that material is then considered to be an ACM.

In addition to the above, a "positive stop" option was used during the laboratory analysis of the building material samples submitted for asbestos analysis. The "positive stop" option is utilized by the laboratory when asbestos is detected at a concentration of greater than half of one percent in one of the samples within a set that was collected to represent a "homogenous application" of that material (or in any concentration, for vermiculite). At this point, further analysis of subsequent samples within the set is deemed to be unnecessary (as the entire set will be considered an ACM, per above), and the remainder of the samples within the set are not analyzed.

4.0 RISK ASSESSMENT METHODOLOGY

4.1 Evaluation of Condition and Accessibility of Identified Asbestos-Containing Material

Through the asbestos exposure risk assessment, DST evaluated the condition and accessibility of ACM based on the PSPC Asbestos Management Standard, effective June 5, 2017. A summary of the applicable criteria is provided in the following subsections.

4.1.2 Condition

In evaluating the condition of friable ACMs other than mechanical insulation (e.g., spray-applied as fireproofing, thermal insulation, or texture, decorative or acoustic finishes), the following criteria apply:

GOOD
Surface of material shows no significant signs of damage, deterioration, or delamination. Up to one percent visible damage to surface is allowed within range of **GOOD**. Evaluation of sprayed

fireproofing requires the assessor to be familiar with the irregular surface texture typical of sprayed asbestos products. **GOOD** condition includes un-encapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed, and encapsulated fireproofing or texture finishes where the encapsulation has been applied after the damage or fallout occurred.

FAIR
FAIR condition is not utilized or considered as a valid criterion in the evaluation of sprayed fireproofing, sprayed insulation, or texture coat finishes.

POOR
Sprayed materials show signs of damage, delamination, or deterioration. More than 1% damage to surface of hazardous building material spray. In observation areas, where damage exists in isolated locations, both GOOD and POOR condition may be reported. The extent or percentage of each condition will be recorded on the assessor's reassessment form.
The evaluation of ACM spray applied as fireproofing, non-mechanical thermal insulation, or texture, decorative or acoustic finishes that are present above ceilings, may be limited by the number of observations made, and by building components such as ducts or full height walls that obstruct the above ceiling observations. BC Reg. 296/97 requires Moderate Risk operations for the removal of all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling.

Mechanical Insulation
In evaluating the condition of ACM mechanical insulation (on boilers, breeching, ductwork, piping, tanks, equipment etc.) the following criteria are used:

GOOD
Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where the jacketing has minor surface damage (i.e., scuffs or stains), but the jacketing is not penetrated.

FAIR
Minor penetration damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that has never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges should be minor to none.

POOR
Original insulation jacket is missing, damaged, deteriorated or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.
The evaluation of ACM mechanical insulation may be limited by the number of observations made and building components such as ducts or full height walls that obstruct observations. In these circumstances, it is not possible to observe each foot of mechanical insulation from all angles.

Non-Friable Materials
Non-friable ACMs generally have little potential to release airborne fibres, even when damaged by mechanical breakage. However, some non-friable materials, i.e., exterior asbestos cement products, may have deteriorated so that the binder no longer effectively contains the asbestos fibres. In such cases of significantly deteriorated non-friable material, the material will be treated as a friable product.

4.1.3 Accessibility

The accessibility of building materials known or suspected of being hazardous was rated according to the following criteria:

Access (A)
Areas of the building within reach of all building users. Includes areas such as gymnasiums, workshops, and storage areas where activities of the building users may result in disturbance of hazardous building material not normally within reach from floor level.

Access (B)
Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder. Includes: frequently entered pipe chases, tunnels and service areas or areas within reach from a fixed ladder or catwalk, i.e., tops of equipment, mezzanines.

Access (C) Exposed
Areas of the building above 8 ft. where use of a ladder is required to reach the hazardous building material. Only refers to hazardous building material materials that are exposed to view, from the floor or ladder, without removing or opening other building components such as ceiling tiles, or service access doors or hatches. Does not include infrequently accessed service areas of the building.

Access (C) Concealed
Areas of the building which require the removal of a building component, including lay-in ceilings and access panels into solid ceiling systems. Includes rarely entered crawl spaces, attic spaces, etc. Observations are limited to the extent visible from the access points.

Access (D)
Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc. where renovation of the ceiling, wall or equipment, etc., is required to reach the hazardous building material. Evaluation of the condition and extent of hazardous building material is limited or impossible, depending on the assessor's ability to visually examine the materials in Access D.

Given the exposure hazards associated with asbestos, additional categories for ACM debris are provided below.

Debris from Friable ACM

The presence of fallen friable ACM is noted separately from the friable ACM source (sprayed fireproofing, thermal insulation, texture, decorative or acoustic finishes or mechanical insulation) and is referred to as debris.

Debris from Damaged Non-Friable ACM

The presence of debris from damaged non-friable ACM, is reported separately from the non-friable ACM source. Only fallen non-friable ACM that has become friable, is reported as debris.

ACM Debris Above Ceilings

The identification of the exact location or presence of debris on the top of ceiling tiles is limited by the number of observations made and the presence of building components such as ducts or full height walls that obstruct observations. Workers are advised to be watchful for the presence of debris prior to accessing, or working in proximity to, mechanical insulation or above ceiling areas of buildings with hazardous building material, regardless of the reported presence or absence of debris Industry standard typically require Moderate Risk Asbestos Abatement operations for the removal of all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling.

4.2 Evaluation of Condition and Accessibility of Identified Lead

For general lead-containing materials (e.g. solder used on copper domestic pipes; electrical equipment/wiring; batteries [e.g., emergency exit signage batteries]; lead sheeting [e.g., x-ray rooms]; vent and pipe flashings), condition evaluation is based on function. If function is compromised, the material would be considered in “poor” condition and would likely require replacement. Given that the exposure hazards with such replacements are typically low and/or simplistic to control, evaluation pertaining to such material is not conducted or discussed herein.

4.2.1 Lead-Containing Paint

The criteria for condition evaluation pertaining to LCPs described herein are generally based on the United States Housing and Urbana Development (HUD) 2012 *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.*

When evaluation the conditions of LCPs, an attempt should be made to determine whether the deterioration is due to a moisture problem or some other existing building deficiency.

“**Poor**” surfaces are considered to be a hazard and should be correct. “**Fair**” surfaces should be repaired but are not yet considered to be a hazard; if not repaired, they should be monitored

frequently. "**Good/intact**" surfaces should be monitored to ensure that they remain in a nonhazardous condition.

In addition, the presence of paint debris must be considered in evaluation condition. Given the variety of paint uses, there are many applications that can have a tendency for the paint to "wear" from the surface slowly, over an extended period of time. Conditions where paint has worn from a surface are worth noting for maintenance discussions (i.e., related to re-coating the surfaces should, for example. The coating provide weather protection), however, in the absence of loose paint chip debris/dust, such conditions would not represent a potential exposure situation related to lead.

The condition evaluation criteria for LCPs are summarized in Table 2.0, below.

Table 6: Lead-Containing Paint Condition Categories

Type of Building Component[1]	Total Area of Deteriorated Paint on Each Component		
	Good/Intact	Fair[2]	Poor[3]
Exterior components with large surface areas	Entire surfaces is intact	Less than or equal to 10 ft^2	More than 10 ft^2
Interior components with large surface areas (walls, ceilings, floors, doors)	Entire surfaces is intact	Less than or equal to 2 ft^2	More than 2 ft^2
Interior and exterior components with small surface areas (window sills, baseboards, soffits, trim)	Entire surfaces is intact	More than 10% of the total surface area of the component	More than 10% of the total surface area of the component

NOTES:
[1] Building components in this table refers to each individual components or side of building, not the combined surface area of all similar components in a room (e.g., a wall with 1 square foot of deteriorated paint is in "fair" condition, even if the other three walls in a room are intact).
[2] Surfaces in "**fair**" condition should be repaired and/or monitored but are not considered to be "lead-containing paint hazards".
[3] Surfaces in "**poor**" condition are considered to be "lead-containing paint hazards" and should be addressed through abatement or interim controls.

4.3 Silica

For silica sources, (e.g. materials containing silica), condition evaluation is based on function. If the function is compromised, the material would be considered in “poor” condition and would likely require replacement.

5.0 LIMITATIONS OF ASSESSMENT

In preparation of this report, DST used professional judgment based on experience. The work was conducted in accordance with generally accepted professional standards. DST relied on information gathered during the site investigations and laboratory analytical reports.

This report reflects the observations made within accessed portions of the Subject Site(s) and the results of analyses performed on specific materials sampled during the assessment. Analytical results reflect the sampled materials at the specific sample locations.

Sampling was conducted pertaining to suspected ACMs and suspected LCPs only. The assessment for the presence of silica was visual in nature and was conducted pertaining to readily visible surfaces within accessible spaces.

5.1 Asbestos

If encountered during renovation activities, any suspected ACMs not identified within this report should be presumed to contain asbestos and handled as such until otherwise proven, through analytical testing.

5.2 Lead

If encountered during renovation activities, any suspected LCPs not identified within this report should be presumed to contain lead and handled as such until otherwise proven, through analytical testing.

With respect to paint, samples of suspected LCPs were collected within the Subject Site(s) only from surfaces of major paint applications where visually different paint colours and/or types were identified. Although the surfaces where samples were collected may be covered with more than one coat of paint, the paint samples are described by the surface (visible) colour only.

Attempts were made to represent all layers of paint in the samples collected. As analytical results are referenced to the surface paint colour only, the lead content of all painted surfaces similar to that represented by the surface paint colour will be presumed to be the same, regardless of differing sub surface paints, if any.

5.3 Silica

Visual assessment for the presence of silica-containing materials within the Subject Site(s) was conducted in accessible areas. Additional silica-containing materials may be present in inaccessible areas including, but not limited to, underground installations.

6.0 RESULTS

The results of our assessment are provided in Appendix 1 to 5. The Appendices contain the following (where applicable):

- Separate sections with written summaries of findings pertaining to each identified hazardous building material, including the following:
    - Listing of suspect materials observed
    - Tables that provide summaries of the sample types, locations, and analytical results
    - Interpretations of observations and/or sample analytical results
- Information pertaining to condition evaluation of identified hazardous building materials
- Recommendations for identified hazardous building materials found to be in “non-compliant” condition (e.g., damaged ACMs, damaged LCPs, etc.), where applicable
- Plan drawings for the buildings/structures, which include locations of the samples collected during this assessment, and locations of identified hazardous building materials (where practical).
- Copies of the analytical certificates for samples collected and analyzed at all of the sites are provided in Appendix 7.

7.0 RECOMMENDATIONS

Building-specific recommendations pertaining to the identified hazardous building materials that require action through the fence modifications are provided in Appendix 1 to 5. General recommendations pertaining to management of identified hazardous building materials in in their current condition and state are provided below.

7.1 Lead

When lead-containing paints within the Subject Site(s) are to be disturbed and/or removed, including in instances where paint chip debris is removed and/or paint debris is created (e.g., preparing surfaces for re-painting), ensure compliance with the following:

- Exposure protection requirements of the COHSR and BC Reg. 296/97, including the provisions of the Lead Guideline.

- Transportation and disposal requirements of BC Reg. 63/88.
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation.

Ultimately, the Contractor is responsible to review the work tasks required and the ways in which materials (including those coated with paints that may contain lead in varying concentrations) will be impacted, as well as the individuals that will be present in the immediate vicinity of the work (i.e., potential for high-risk individuals) in order to determine the appropriate personal protective equipment (PPE—including respirators and protective clothing), containment and/or decontamination measures and work procedures that should be followed to protect workers from lead exposure.

7.2 Silica

In their current condition, (i.e., good condition), the identified silica-containing materials can be managed in place.

If silica-containing materials are to be removed or destructively altered (drilled, chipped, abraded, etc.), ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97, as amended (0.025 mg/m^3).

This would include, but not be limited to, the following:

- Providing workers with respiratory protection.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with facilities to properly wash prior to exiting the work area.
- Providing dust control to mitigate the potential for renovation dust to escape from the work area into public and/or adjacent areas.

8.0 CLOSURE

This report is intended for PSPC and their Client, i.e., CSC use only. Any use of this document by a third party, or any reliance on or decisions made based on the findings described in this report, are the sole responsibility of such third parties, and DST Consulting Engineers Inc. accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions conducted based on this report. No other warranties are implied or expressed.

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the client. The sampling program included asbestos bulk sampling and paint chip sampling in select representative areas for laboratory

analysis. Note, however, that no scope of work, no matter how exhaustive, can guarantee to identify all contaminants. This report therefore cannot warranty that all building conditions are represented by those identified at specific locations.

Recommendations, when included, are made in good faith, and are based on several successful experiences.

Note also that standards, guidelines, and practices related to environmental investigations may change with time. Those which were applied at the time of this investigation may be obsolete or unacceptable at a later date.

Any comments given in this report on potential remediation problems and possible methods are intended only for the guidance of the designer. The scope of work may not be sufficient to determine all the factors that may affect construction, clean-up methods and/or costs. Contractors bidding on this project or undertaking clean-ups should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the conditions may affect their work.

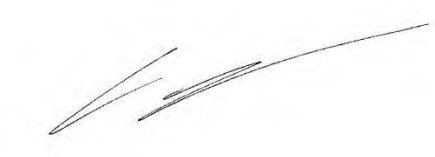
Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the client.

We hope the information presented in this document meets your current requirements. If you have any questions, or require additional information please contact us at your convenience.

Yours truly,

DST Consulting Engineers Inc.

Report Prepared By:



Aaron Enquist, PAg, EPt
Environmental Technologist

Report Reviewed By:

Lance Pizzariello, M.Sc., C.E.T., A.Sc.T., EP
Director, Western Region - BC

APPENDIX 1 – KENT INSTITUTION
FINDINGS, RECOMMENDATIONS AND SITE PLAN
GATES 1, 2, 4 & 7

APPENDIX 1

FINDINGS AND RECOMMENDATIONS
KENT INSTITUTION – AGASSIZ, BC

The results of the assessment for each of the considered hazardous materials at the Subject Site are provided in the following sub-sections. A plan drawing of the Subject Site, which include locations of the samples collected during this assessment, is attached to this Appendix.

A copy of the certificate of analysis provided by EMSL Canada Inc. for the suspected ACM samples submitted as part of this assessment is attached in Appendix 6.

A copy of the certificate of analysis provided by Bureau Veritas Laboratories for the suspected Lead samples submitted as part of this assessment is attached in Appendix 6.

ASBESTOS-CONTAINING MATERIALS (ACMs)

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of the results of suspected ACM samples analyzed through the current assessment, **ACMs were not at the Subject Site.**

A summary of the materials sampled, sample point locations and analytical results are provided in Table A1-1, below.

Table A1-1 Suspected ACM Sample Collection and Analysis Summary for Kent Institution

Building Material	Sample Number	Sample Area	Sample Location within Area	Result (%, Type of Asbestos)
Vinyl Covering – Black	2003897-Kent-1A	Kent - Gate 4	Concrete Bollard	None Detected
Vinyl Covering – Black	2003897-Kent-1B	Kent - Gate 4	Concrete Bollard	None Detected
Vinyl Covering – Black	2003897-Kent-1C	Kent - Gate 4	Concrete Bollard	None Detected

LEAD

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of the results of suspected lead-containing paint samples analyzed through the current assessment, **paints containing > 600 ppm were identified within the Subject Site.**

At the time of the survey the LCPs were judged to be in **GOOD** condition, posing a **LOW RISK** of exposure to persons adjacent to the LCPs.

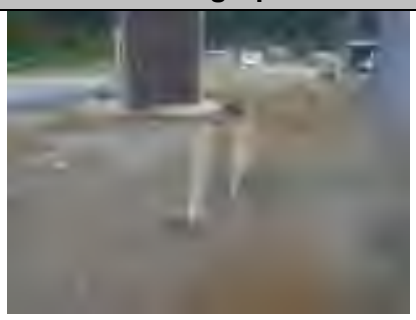
A summary of the materials sampled, sample point locations and analytical results are provided in Table A1-2, below.

Table A1-2 Suspected Lead-Containing Paint Sample Collection and Analysis Summary for Kent Institution

Building Material	Sample Number	Sample Area	Sample Location within Area	Result Lead Parts Per Million (ppm)
Yellow Paint	2003897-Kent-L1	Gate 1 & 2	Water Hydrant Pipe	3,970
Red and Yellow Paint	2003897-Kent-L2	Gate 1 & 2	Hydro Line Bollard	112,000
Yellow Paint	2003897-Kent-L3	Gate 4	Concrete Bollard	25,000

Table A1-3 Summary of Identified LCPs Containing >600 ppm Lead – Kent Institution

Identified Lead Paint Description		Photograph
Yellow Paint on water hydrant pipe		
Paint Colour	Yellow	
Substrate	Metal	
Location & Extent	Gate 1 & 2	
Lead Content (ppm)	3,970	
Condition	Good	
Access	A	

Identified Lead Paint Description		Photograph
Red and Yellow Paint on hydro line bollard.		
Paint Colour	Red & Yellow	
Substrate	Metal	
Location & Extent	Gate 1 & 2	
Lead Content (ppm)	112,000	
Condition	Good	
Access	A	
Identified Lead Paint Description		**Photograph**
Yellow Paint on concrete bollard		
Paint Colour	Yellow	
Substrate	Concrete	
Location & Extent	Gate 1 & 2	
Lead Content (ppm)	25,000	
Condition	Good	
Access	A	

RECOMMENDATIONS

When lead-containing equipment/materials within the Subject Site are to be disturbed and/or removed, including in instances where paint chip debris is removed and/or paint debris is created (e.g., preparing surfaces for re-painting), ensure compliance with the following:

- Exposure protection requirements of the COHSR and BC Reg. 296/97, including the provisions of the Lead Guideline.
- Transportation and disposal requirements of BC Reg. 63/88.
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation.

Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding).

Airborne lead dust or fumes should not exceed the COHSR and BC Reg. 296/97 eight-hour occupational exposure limit (OEL) of 0.05 mg/m^3 during the removal of paints and products containing any concentration of lead. The use of personal protective equipment is recommended to reduce the potential for over-exposure to lead dust. This can be achieved by:

- Providing workers with protective clothing and personal protective equipment or devices as necessary to protect them against the hazards to which the worker may be exposed.
- Providing workers with adequate and training in the care and use of clothing, equipment or device before wearing or using such items.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with washing facilities with clean water, soap and individual towels to properly wash prior to exiting the work area.

To avoid the inhalation of lead, it is essential to have the following control methods in place:

- Engineering controls.
- Work practices and hygiene practices.
- Respirators and personal protective equipment.
- Training.

Using an arc welder or oxyacetylene torch on steel that is coated with lead-containing paint can create hazardous lead fumes and is prohibited by section 12.115 of BC Reg. 296/97. In addition, the following information is provided in the BC Lead Guide:

- Welding or torch cutting of paints or coatings on metal can create very high concentrations of airborne lead fumes. Torch cutting structural steel, coated with paint containing as little as 130 mg/kg (equivalent to ppm) lead, can release airborne levels of lead as high as 0.8 mg/m^3 (16 times the exposure limit).

Given this information and that the analytical detection limit for lead paint analysis is in the order of 90 ppm (not significantly different than 130 ppm, which, per above, may release airborne lead levels 16 times the exposure limit), any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person.

Ultimately, the Contractor is responsible to review the work tasks required and the ways in which materials (including those coated with paints that may contain lead in varying concentrations) will be impacted, as well as the individuals that will be present in the immediate vicinity of the work (i.e., potential for high-risk individuals) in order to determine the appropriate personal protective equipment (PPE—including respirators and protective clothing), containment and/or decontamination measures and work procedures that should be followed to protect workers from lead exposure.

Toxicity Characteristic Leachate Procedure (TCLP) must be performed on identified LCPs with a concentration of lead > 600 ppm to facilitate proper disposal of lead-containing wastes.

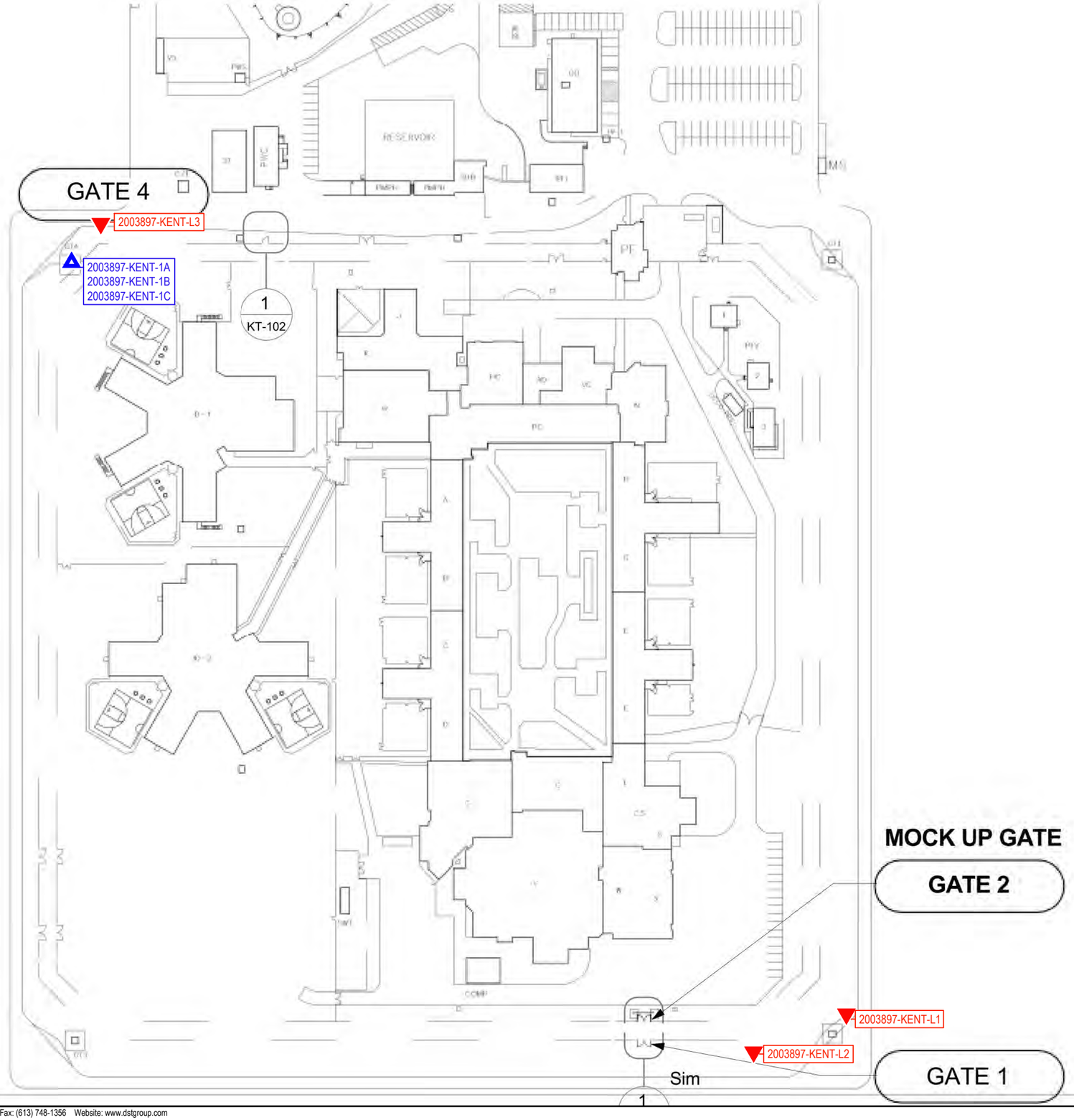
SILICA

Silica is expected to be present in the concrete bollard and fence post foundations at the Subject Site.

RECOMMENDATIONS

When silica-containing materials are to be removed or destructively altered, ensure a site-specific risk assessment and exposure control program are developed to ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97 (0.025 mg/m^3). This may include, but not be limited to, the following:

- Providing workers with respiratory protection.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with facilities to properly wash prior to exiting the work area.
- Providing dust control to mitigate the potential for demolition dust to escape from the work area into public and/or adjacent areas.



DST consulting engineers
a division of Englobe

Note

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. Base plan provided by client.

Legend

- Approximate asbestos sample location
- Approximate lead sample location

Revision	Date	Issue	Approval
0	10/26/2020	Original	

Client
Public Services and Procurement Canada

Site
Kent Institution, Agassiz, BC

Report Title
Hazardous Materials Assessment

Drawing Title
Kent Institution
Sample Location Plan

Designed By	Scale
A.E.	NTS
Drawn By	**Date**
K.M.	October 2020
Approved By	**Project No.**
	02003897.000

Figure No.
1

Drawing: 1 Kent Institution.dwg Folder: C:\DST\02003897.000 Abbotsford and Agassiz BC\2020 Hazmat Assessment\DWGs Monday, October 26, 2020 @ 07:24 by Kris Morin

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

APPENDIX 2 – MOUNTAIN INSTITUTION
FINDINGS, RECOMMENDATIONS AND SITE PLAN
GATES 8, 9, & 10

APPENDIX 2

FINDINGS AND RECOMMENDATIONS
MOUNTAIN INSTITUTION – AGASSIZ, BC

The results of the assessment for each of the considered hazardous materials at the Subject Site are provided in the following sub-sections. A plan drawing of the Subject Site, which include locations of the samples collected during this assessment, is attached to this Appendix.

A copy of the certificate of analysis provided by EMSL Canada Inc. for the suspected ACM samples submitted as part of this assessment is attached in Appendix 6.

A copy of the certificate of analysis provided by Bureau Veritas Laboratories for the suspected Lead samples submitted as part of this assessment is attached in Appendix 6.

ASBESTOS-CONTAINING MATERIALS (ACMs)

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use), **ACMs were not identified within the Subject Site.**

Lead-Containing Materials (LCMs)

Based on our observations of building construction (estimated vintage of exterior finishes and uniformity of building material use) and on our interpretations of the results of suspected lead-containing paint samples analyzed through the current assessment, **paints containing > 600 ppm were identified at the Subject Site.**

At the time of the survey the LCPs were judged to be in **GOOD to FAIR** condition, posing a **LOW to MODERATE RISK** of exposure to persons adjacent to the LCPs.

A summary of the materials sampled, sample point locations and analytical results are provided in Table A2-1, below.

Table A2-1 Suspected Lead-Containing Paint Sample Collection and Analysis Summary for Mountain Institution

Building Material	Sample Number	Sample Area	Sample Location within Area	Result Lead Parts Per Million (ppm)
Yellow Paint	2003897-Mtn-L4	Gate 8	Concrete Bollard	27,500
Orange Paint	2003897-Mtn-L5	Gates 9 & 10	Metal Swing Gate	53,600

Table A2-2 Summary of Identified LCPs Containing >600 ppm Lead – Mountain Institution

Identified Lead Paint Description		Photograph
Yellow Paint on concrete bollard		
Paint Colour	Yellow	
Substrate	Concrete	
Location & Extent	Gate 8	
Lead Content (ppm)	27,500	
Condition	Fair	
Access	A	
Identified Lead Paint Description		**Photograph**
Orange Paint on swing gate		
Paint Colour	Orange	
Substrate	Metal	
Location & Extent	Gates 9 & 10	
Lead Content (ppm)	53,600	
Condition	Good	
Access	A	

When lead-containing equipment/materials within the Subject Site are to be disturbed and/or removed, including in instances where paint chip debris is removed and/or paint debris is created (e.g., preparing surfaces for re-painting), ensure compliance with the following:

- Exposure protection requirements of the COHSR and BC Reg. 296/97, including the provisions of the Lead Guideline.
- Transportation and disposal requirements of BC Reg. 63/88.
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation.

Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding).

Airborne lead dust or fumes should not exceed the COHSR and BC Reg. 296/97 eight-hour occupational exposure limit (OEL) of 0.05 mg/m^3 during the removal of paints and products containing any concentration of lead. The use of personal protective equipment is recommended to reduce the potential for over-exposure to lead dust. This can be achieved by:

- Providing workers with protective clothing and personal protective equipment or devices as necessary to protect them against the hazards to which the worker may be exposed.
- Providing workers with adequate and training in the care and use of clothing, equipment or device before wearing or using such items.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with washing facilities with clean water, soap and individual towels to properly wash prior to exiting the work area.

To avoid the inhalation of lead, it is essential to have the following control methods in place:

- Engineering controls.
- Work practices and hygiene practices.
- Respirators and personal protective equipment.
- Training.

Using an arc welder or oxyacetylene torch on steel that is coated with lead-containing paint can create hazardous lead fumes and is prohibited by section 12.115 of BC Reg. 296/97. In addition, the following information is provided in the BC Lead Guide:

- Welding or torch cutting of paints or coatings on metal can create very high concentrations of airborne lead fumes. Torch cutting structural steel, coated with paint containing as little as 130 mg/kg (equivalent to ppm) lead, can release airborne levels of lead as high as 0.8 mg/m^3 (16 times the exposure limit).

Given this information and that the analytical detection limit for lead paint analysis is in the order of 90 ppm (not significantly different than 130 ppm, which, per above, may release airborne lead levels 16 times the exposure limit), any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person.

Ultimately, the Contractor is responsible to review the work tasks required and the ways in which materials (including those coated with paints that may contain lead in varying concentrations) will be impacted, as well as the individuals that will be present in the immediate vicinity of the work

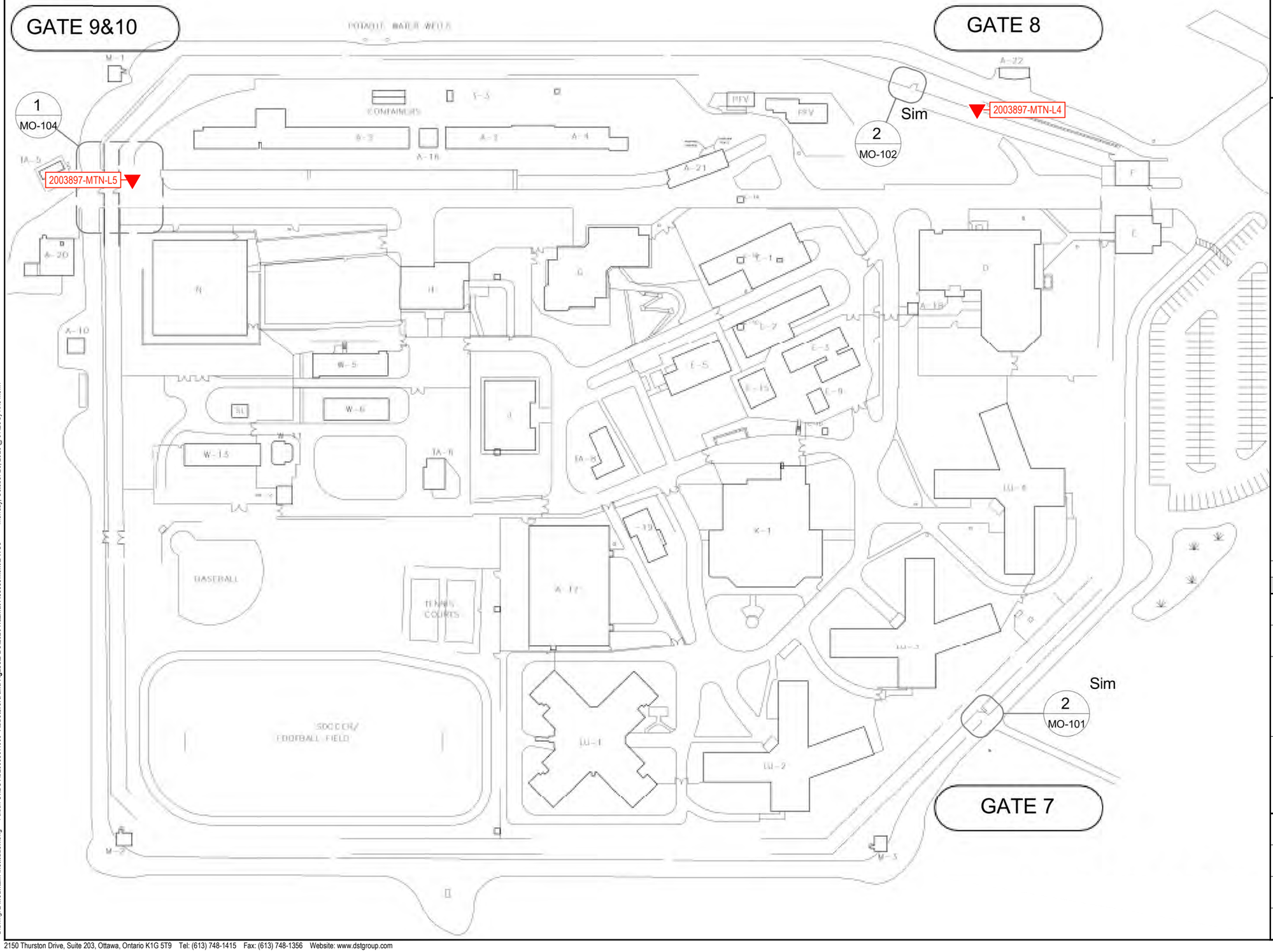
(i.e., potential for high-risk individuals) in order to determine the appropriate personal protective equipment (PPE—including respirators and protective clothing), containment and/or decontamination measures and work procedures that should be followed to protect workers from lead exposure.

Toxicity Characteristic Leachate Procedure (TCLP) must be performed on identified LCPs with a concentration of lead > 600 ppm to facilitate proper disposal of lead-containing wastes.

SILICA

Silica is expected to be present in the concrete bollard, concrete driveway below the orange painted swing gate, and fence post foundations present at the Subject Site. When silica-containing materials are to be removed or destructively altered, ensure a site-specific risk assessment and exposure control program are developed to ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97 (0.025 mg/m^3). This my include, but not be limited to, the following:

- Providing workers with respiratory protection.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with facilities to properly wash prior to exiting the work area.
- Providing dust control to mitigate the potential for demolition dust to escape from the work area into public and/or adjacent areas.



Note

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. Base plan provided by client.

Legend

- Approximate asbestos sample location
- Approximate lead sample location

0	10/26/2020	Original	
Revision	Date	Issue	Approval

Client
Public Services and Procurement Canada

Site
Mountain Institution, Agassiz, BC

Report Title
Hazardous Materials Assessment

Drawing Title
Mountain Institution
Sample Location Plan

Designed By	Scale
A.E.	NTS
Drawn By	**Date**
K.M.	October 2020
Approved By	**Project No.**
	02003897.000

Figure No. 2

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

APPENDIX 3 – MISSION MEDIUM INSTITUTION
FINDINGS, RECOMMENDATIONS AND SITE PLAN
GATES 12, 13, & 14

APPENDIX 3

FINDINGS AND RECOMMENDATIONS
MISSION MEDIUM INSTITUTION - MISSION, BC

The results of the assessment for each of the considered hazardous materials within the Subject Site are provided in the following sub-sections. A plan drawing of the Subject Site, which include locations of the samples collected during this assessment, is attached to this Appendix.

A copy of the certificate of analysis provided by EMSL Canada Inc. for the suspected ACM samples submitted as part of this assessment is attached in Appendix 6.

A copy of the certificate of analysis provided by Bureau Veritas Laboratories for the suspected Lead samples submitted as part of this assessment is attached in Appendix 6.

ASBESTOS-CONTAINING MATERIALS (ACMs)

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use), **ACMs were not identified at the Subject Site.**

Lead-Containing Materials (LCMs)

Based on our observations of building construction (estimated vintage of exterior finishes and uniformity of building material use) and on our interpretations of the results of suspected lead-containing paint samples analyzed through the current assessment, **paints containing > 600 ppm were identified at the Subject Site.**

At the time of the survey the LCPs were judged to be in **FAIR** condition, posing a **MODERATE RISK** of exposure to persons adjacent to the LCPs.

A summary of the materials sampled, sample point locations and analytical results are provided in Table A3-1, below.

Table A3-1 Suspected Lead-Containing Paint Sample Collection and Analysis Summary for Mission Medium Institution

Building Material	Sample Number	Sample Area	Sample Location within Area	Result Lead Parts Per Million (ppm)
Grey Paint	2003897-Miss-L6	Gate 12	Outer Fence Post	347
Light Grey Paint	2003897-Miss-L7	Gate 13	Gate Structure	1,500
Light Grey Paint	2003897-Miss-L8	Gate 13A	Gate Structure	2,660

Table A3-2 Summary of Identified LCPs Containing >600 ppm Lead – Mission Medium Institution

Identified Lead Paint Description		Photograph
Light Grey Paint on gate structure		
Paint Colour	Light Grey	
Substrate	Metal	
Location & Extent	Gate 13	
Lead Content (ppm)	1,500	
Condition	Fair	
Access	A	
Identified Lead Paint Description		**Photograph**
Light Grey Paint on gate structure		
Paint Colour	Light Grey	
Substrate	Metal	
Location & Extent	Gate 13A	
Lead Content (ppm)	2,660	
Condition	Fair	
Access	A	

RECOMMENDATIONS

When lead-containing equipment/materials within the Subject Site are to be disturbed and/or removed, including in instances where paint chip debris is removed and/or paint debris is created (e.g., preparing surfaces for re-painting), ensure compliance with the following:

- Exposure protection requirements of the COHSR and BC Reg. 296/97, including the provisions of the Lead Guideline.
- Transportation and disposal requirements of BC Reg. 63/88.
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation.

Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding).

Airborne lead dust or fumes should not exceed the COHSR and BC Reg. 296/97 eight-hour occupational exposure limit (OEL) of 0.05 mg/m^3 during the removal of paints and products containing any concentration of lead. The use of personal protective equipment is recommended to reduce the potential for over-exposure to lead dust. This can be achieved by:

- Providing workers with protective clothing and personal protective equipment or devices as necessary to protect them against the hazards to which the worker may be exposed.
- Providing workers with adequate and training in the care and use of clothing, equipment or device before wearing or using such items.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with washing facilities with clean water, soap and individual towels to properly wash prior to exiting the work area.

To avoid the inhalation of lead, it is essential to have the following control methods in place:

- Engineering controls.
- Work practices and hygiene practices.
- Respirators and personal protective equipment.
- Training.

Using an arc welder or oxyacetylene torch on steel that is coated with lead-containing paint can create hazardous lead fumes and is prohibited by section 12.115 of BC Reg. 296/97. In addition, the following information is provided in the BC Lead Guide:

- Welding or torch cutting of paints or coatings on metal can create very high concentrations of airborne lead fumes. Torch cutting structural steel, coated with paint containing as little as 130 mg/kg (equivalent to ppm) lead, can release airborne levels of lead as high as 0.8 mg/m^3 (16 times the exposure limit).

Given this information and that the analytical detection limit for lead paint analysis is in the order of 90 ppm (not significantly different than 130 ppm, which, per above, may release airborne lead levels 16 times the exposure limit), any paint coating on a metal surface to be welded, burned or

torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person.

Ultimately, the Contractor is responsible to review the work tasks required and the ways in which materials (including those coated with paints that may contain lead in varying concentrations) will be impacted, as well as the individuals that will be present in the immediate vicinity of the work (i.e., potential for high-risk individuals) in order to determine the appropriate personal protective equipment (PPE—including respirators and protective clothing), containment and/or decontamination measures and work procedures that should be followed to protect workers from lead exposure.

Toxicity Characteristic Leachate Procedure (TCLP) must be performed on identified LCPs with a concentration of lead > 600 ppm to facilitate proper disposal of lead-containing wastes.

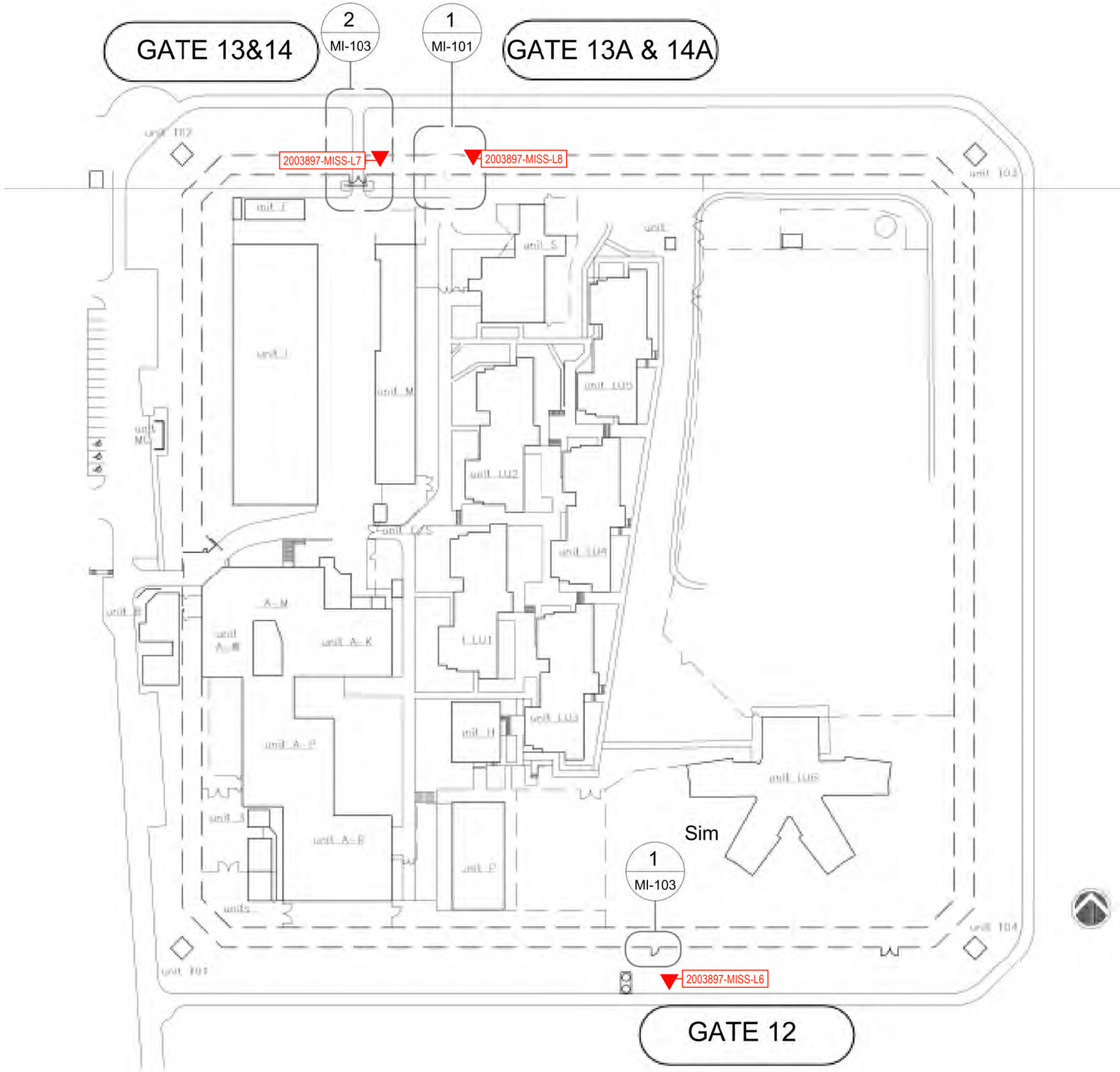
SILICA

Silica is expected to be present in the concrete driveway leading to the gate structure and the fence post foundations at the Subject Site.

RECOMMENDATIONS

When silica-containing materials are to be removed or destructively altered, ensure a site-specific risk assessment and exposure control program are developed to ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97 (0.025 mg/m^3). This my include, but not be limited to, the following:

- Providing workers with respiratory protection.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with facilities to properly wash prior to exiting the work area.
- Providing dust control to mitigate the potential for demolition dust to escape from the work area into public and/or adjacent areas.



Note

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. Base plan provided by client.

Legend

- Approximate asbestos sample location
- Approximate lead sample location

Revision	Date	Issue	Approval
0	10/26/2020	Original	

Client
Public Services and Procurement Canada

Site
Mission Medium Institution, Mission, BC

Report Title
Hazardous Materials Assessment

Drawing Title
Mission Medium Institution
Sample Location Plan

Designed By: A.E.	Scale: NTS
Drawn By: K.M.	Date: October 2020
Approved By:	Project No.: 02003897.000

Figure No. **3**

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

APPENDIX 4 – PACIFIC INSTITUTION
FINDINGS, RECOMMENDATIONS AND SITE PLAN
GATES 17 & 18

APPENDIX 4

FINDINGS AND RECOMMENDATIONS
PACIFIC INSTITUTION - ABBOTSFORD, BC

The results of the assessment for each of the considered hazardous materials within the Subject Site are provided in the following sub-sections. A plan drawing of the Subject Site, which include locations of the samples collected during this assessment, is attached to this Appendix.

A copy of the certificate of analysis provided by EMSL Canada Inc. for the suspected ACM samples submitted as part of this assessment is attached in Appendix 6.

A copy of the certificate of analysis provided by Bureau Veritas Laboratories for the suspected Lead samples submitted as part of this assessment is attached in Appendix 6.

ASBESTOS-CONTAINING MATERIALS (ACMs)

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use), **ACMs were not identified at the Subject Site.**

LEAD

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of the results of suspected lead-containing paint samples analyzed through the current assessment, **paints containing > 600 ppm were not identified at the Subject Site.**

A summary of the materials sampled, sample point locations and analytical results are provided in Table A4-1, below.

Table A4-1 Suspected Lead-Containing Paint Sample Collection and Analysis Summary for Pacific Institution

Building Material	Sample Number	Sample Area	Sample Location within Area	Result Lead Parts Per Million (ppm)
Dark Grey Paint	2003897-Pac-L9	Gate 17 & 18	Fence Post	208
Silver Paint	2003897-Pac-L10	Gate 17 & 18	Gate	168

RECOMMENDATIONS

When lead-containing equipment/materials within the Subject Site are to be disturbed and/or removed, including in instances where paint chip debris is removed and/or paint debris is created (e.g., preparing surfaces for re-painting), ensure compliance with the following:

- Exposure protection requirements of the COHSR and BC Reg. 296/97, including the provisions of the Lead Guideline.
- Transportation and disposal requirements of BC Reg. 63/88.
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation.

Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding).

Airborne lead dust or fumes should not exceed the COHSR and BC Reg. 296/97 eight-hour occupational exposure limit (OEL) of 0.05 mg/m^3 during the removal of paints and products containing any concentration of lead. The use of personal protective equipment is recommended to reduce the potential for over-exposure to lead dust. This can be achieved by:

- Providing workers with protective clothing and personal protective equipment or devices as necessary to protect them against the hazards to which the worker may be exposed.
- Providing workers with adequate and training in the care and use of clothing, equipment or device before wearing or using such items.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with washing facilities with clean water, soap and individual towels to properly wash prior to exiting the work area.

To avoid the inhalation of lead, it is essential to have the following control methods in place:

- Engineering controls.
- Work practices and hygiene practices.
- Respirators and personal protective equipment.
- Training.

Using an arc welder or oxyacetylene torch on steel that is coated with lead-containing paint can create hazardous lead fumes and is prohibited by section 12.115 of BC Reg. 296/97. In addition, the following information is provided in the BC Lead Guide:

- Welding or torch cutting of paints or coatings on metal can create very high concentrations of airborne lead fumes. Torch cutting structural steel, coated with paint containing as little

as 130 mg/kg (equivalent to ppm) lead, can release airborne levels of lead as high as 0.8 mg/m^3 (16 times the exposure limit).

Given this information and that the analytical detection limit for lead paint analysis is in the order of 90 ppm (not significantly different than 130 ppm, which, per above, may release airborne lead levels 16 times the exposure limit), any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person.

Ultimately, the Contractor is responsible to review the work tasks required and the ways in which materials (including those coated with paints that may contain lead in varying concentrations) will be impacted, as well as the individuals that will be present in the immediate vicinity of the work (i.e., potential for high-risk individuals) in order to determine the appropriate personal protective equipment (PPE—including respirators and protective clothing), containment and/or decontamination measures and work procedures that should be followed to protect workers from lead exposure.

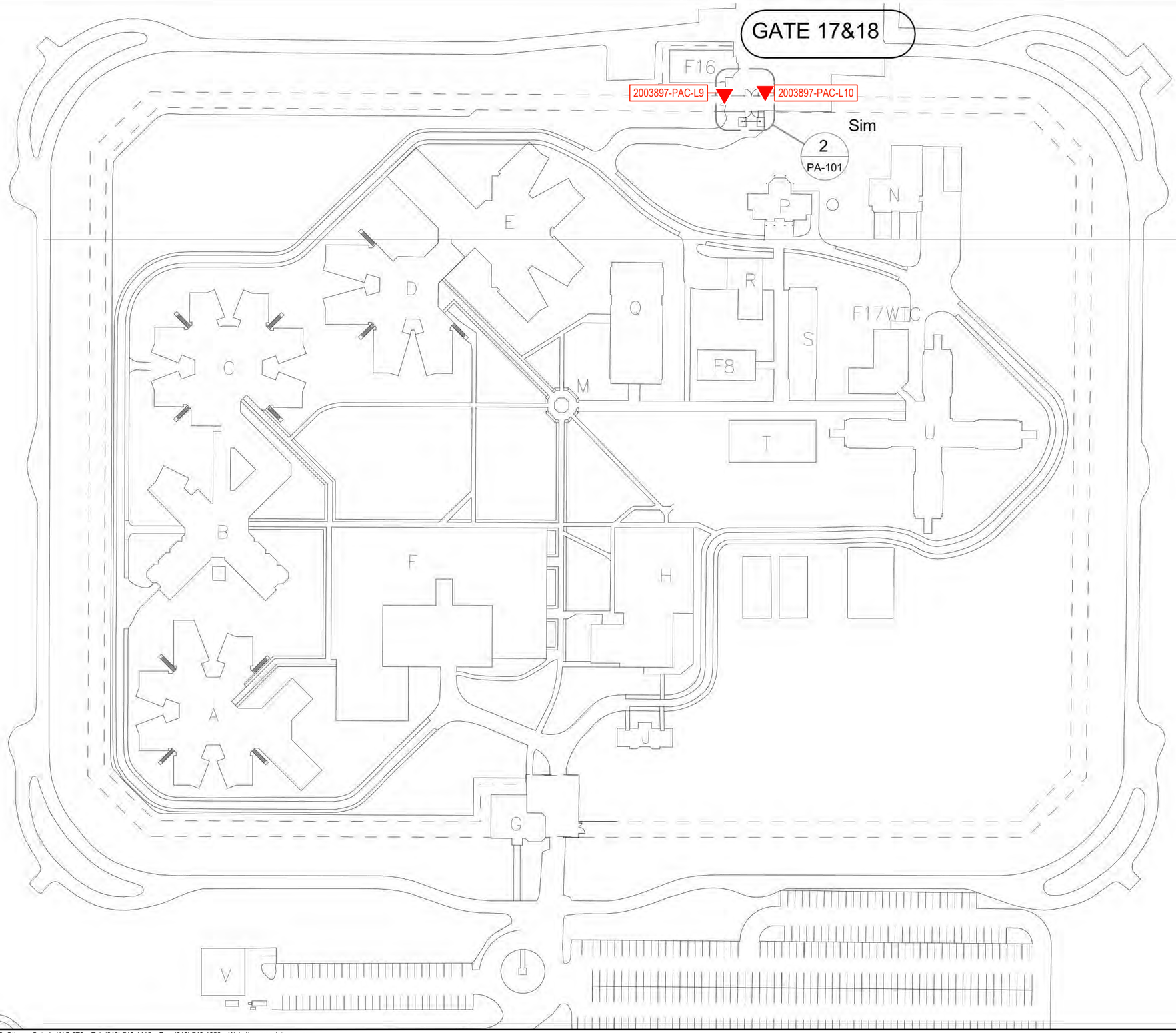
SILICA

Silica is expected to be present in the concrete driveway at the gate and the fence post foundations at the Subject Site.

RECOMMENDATIONS

When silica-containing materials are to be removed or destructively altered, ensure a site-specific risk assessment and exposure control program are developed to ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97 (0.025 mg/m^3). This my include, but not be limited to, the following:

- Providing workers with respiratory protection.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with facilities to properly wash prior to exiting the work area.
- Providing dust control to mitigate the potential for demolition dust to escape from the work area into public and/or adjacent areas.



consulting engineers
a division of Englobe

Note

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. Base plan provided by client.

Legend

- Approximate asbestos sample location
- Approximate lead sample location

Revision	Date	Issue	Approval
0	10/26/2020	Original	

Client
Public Services and Procurement Canada

Site
Pacific Institution, Abbotsford, BC

Report Title
Hazardous Materials Assessment

Drawing Title
Pacific Institution
Sample Location Plan

Designed By	Scale
A.E.	NTS
Drawn By	**Date**
K.M.	October 2020
Approved By	**Project No.**
	02003897.000

Figure No. 4

Drawing: 4 Pacific Institution.dwg Folder: C:\DST\02003897.000 Abbotsford and Agassiz BC\2020 Hazmat Assessment\DWGs Monday, October 26, 2020 @ 07:23 by Kris Morin

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

APPENDIX 5 – MATSQUI INSTITUTION
FINDINGS, RECOMMENDATIONS AND SITE PLAN
GATES 20, 23, & 24

APPENDIX 5

FINDINGS AND RECOMMENDATIONS
MATSQUI INSTITUTION - ABBOTSFORD, BC

The results of the assessment for each of the considered hazardous materials within the Subject Site are provided in the following sub-sections. A plan drawing of the Subject Site, which include locations of the samples collected during this assessment, is attached to this Appendix.

A copy of the certificate of analysis provided by EMSL Canada Inc. for the suspected ACM samples submitted as part of this assessment is attached in Appendix 6.

A copy of the certificate of analysis provided by Bureau Veritas Laboratories for the suspected Lead samples submitted as part of this assessment is attached in Appendix 6.

ASBESTOS-CONTAINING MATERIALS (ACMs)

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of the results of suspected ACM samples analyzed through the current assessment, **ACMs were not identified at the Subject Site.**

LEAD

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of the results of suspected lead-containing paint samples analyzed through the current assessment, **paints containing > 600 ppm were not identified at the Subject Site.**

A summary of the materials sampled, sample point locations and analytical results are provided in Table A5-1, below.

Table A5-1 Suspected Lead-Containing Paint Sample Collection and Analysis Summary for Matsqui Institution

Building Material	Sample Number	Sample Area	Sample Location within Area	Result Lead Parts Per Million (ppm)
Dark Grey Paint	2003897-Mats-L11	Gate 20	Fence Post	168
Silver Paint	2003897-Mats-L12	Gate 23 & 24	Gate	247

RECOMMENDATIONS

When lead-containing equipment/materials within the Subject Site are to be disturbed and/or removed, including in instances where paint chip debris is removed and/or paint debris is created (e.g., preparing surfaces for re-painting), ensure compliance with the following:

- Exposure protection requirements of the COHSR and BC Reg. 296/97, including the provisions of the Lead Guideline.
- Transportation and disposal requirements of BC Reg. 63/88.
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation.

Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding).

Airborne lead dust or fumes should not exceed the COHSR and BC Reg. 296/97 eight-hour occupational exposure limit (OEL) of 0.05 mg/m^3 during the removal of paints and products containing any concentration of lead. The use of personal protective equipment is recommended to reduce the potential for over-exposure to lead dust. This can be achieved by:

- Providing workers with protective clothing and personal protective equipment or devices as necessary to protect them against the hazards to which the worker may be exposed.
- Providing workers with adequate and training in the care and use of clothing, equipment or device before wearing or using such items.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with washing facilities with clean water, soap and individual towels to properly wash prior to exiting the work area.

To avoid the inhalation of lead, it is essential to have the following control methods in place:

- Engineering controls.
- Work practices and hygiene practices.
- Respirators and personal protective equipment.
- Training.

Using an arc welder or oxyacetylene torch on steel that is coated with lead-containing paint can create hazardous lead fumes and is prohibited by section 12.115 of BC Reg. 296/97. In addition, the following information is provided in the BC Lead Guide:

- Welding or torch cutting of paints or coatings on metal can create very high concentrations of airborne lead fumes. Torch cutting structural steel, coated with paint containing as little as 130 mg/kg (equivalent to ppm) lead, can release airborne levels of lead as high as 0.8 mg/m^3 (16 times the exposure limit).

Given this information and that the analytical detection limit for lead paint analysis is in the order of 90 ppm (not significantly different than 130 ppm, which, per above, may release airborne lead levels 16 times the exposure limit), any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person.

Ultimately, the Contractor is responsible to review the work tasks required and the ways in which materials (including those coated with paints that may contain lead in varying concentrations) will be impacted, as well as the individuals that will be present in the immediate vicinity of the work (i.e., potential for high-risk individuals) in order to determine the appropriate personal protective equipment (PPE—including respirators and protective clothing), containment and/or decontamination measures and work procedures that should be followed to protect workers from lead exposure.

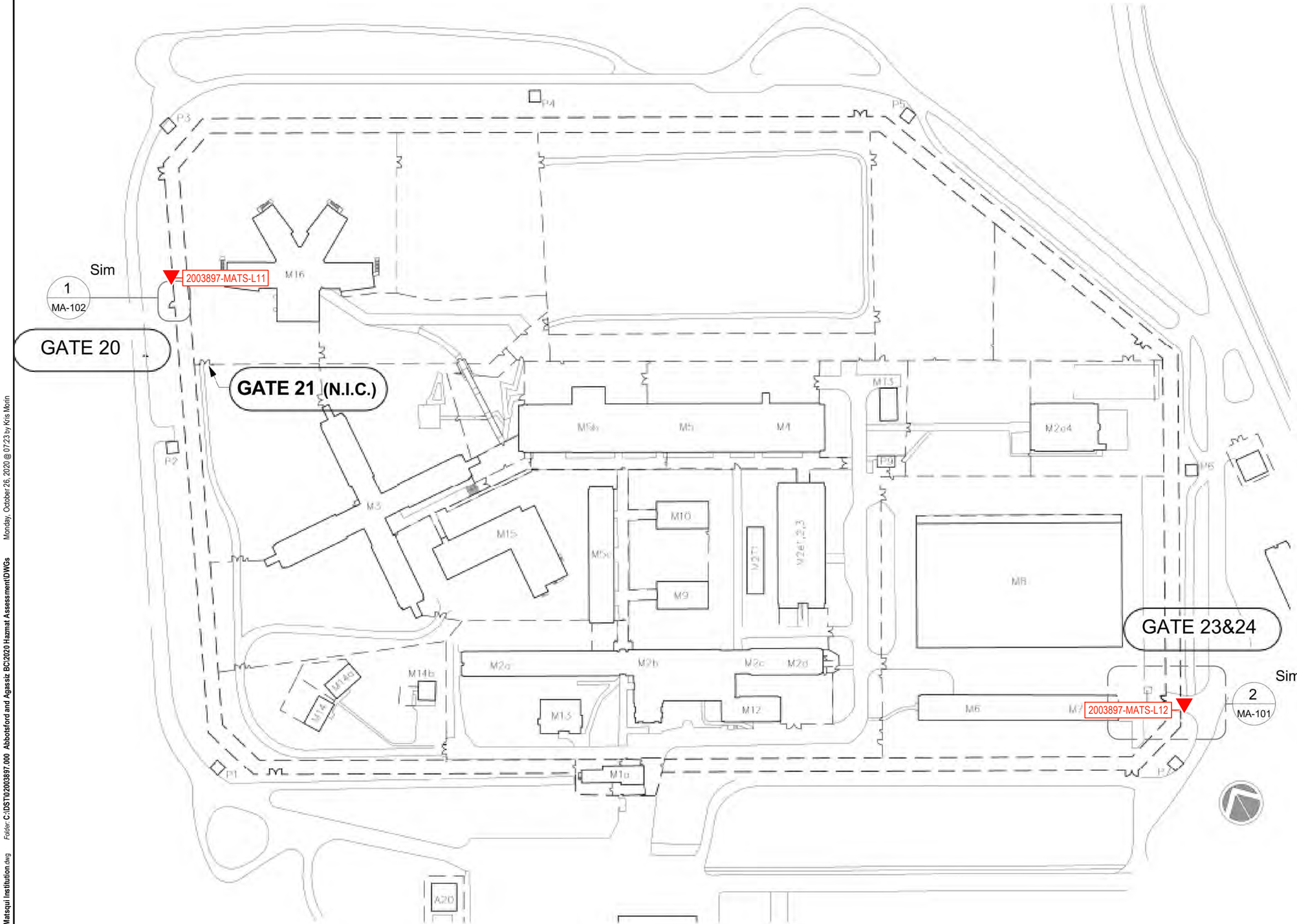
SILICA

Silica is expected to be present in the concrete driveway at the gate and the fence post foundations at the Subject Site.

RECOMMENDATIONS

When silica-containing materials are to be removed or destructively altered, ensure a site-specific risk assessment and exposure control program are developed to ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97 (0.025 mg/m^3). This my include, but not be limited to, the following:

- Providing workers with respiratory protection.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with facilities to properly wash prior to exiting the work area.
- Providing dust control to mitigate the potential for demolition dust to escape from the work area into public and/or adjacent areas.



Note

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. Base plan provided by client.

Legend

- Approximate asbestos sample location
- Approximate lead sample location

Revision	Date	Issue	Approval
0	10/26/2020	Original	

Client
Public Services and Procurement Canada

Site
Matsqui Institution, Abbotsford, BC

Report Title
Hazardous Materials Assessment

Drawing Title
Matsqui Institution
Sample Location Plan

Designed By	Scale
A.E.	NTS
Drawn By	**Date**
K.M.	October 2020
Approved By	**Project No.**
	02003897.000

Figure No. 5

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

APPENDIX 6

ANALYTICAL LABORATORY REPORTS

EMSL Canada Inc.

4506 Dawson Street Burnaby, BC V5C 4C1
Phone/Fax: (604) 757-3158 / (604) 757-4731
http://www.EMSL.com / vancouverlab@EMSL.com

EMSL Canada Order 692002285
Customer ID: 55DSTV42
Customer PO:
Project ID:

Attn: Aaron Enquist
DST Consulting Engineers
4125 McConnell Drive
Unit B
Vancouver, BC V5A 3J7

Phone: (604) 436-4588
Fax:
Collected:
Received: 9/24/2020
Analyzed: 9/24/2020

Proj: 2003897 - FRASER VALLEY CORRECTIONAL INSTITUTIONS, FENCE AND GATE UPGRADES

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: 2003897-KENT-1A ***Lab Sample ID:*** **692002285-0001**
Sample Description: BOLLARD/VINYL COVERING - BLACK

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	9/24/2020	Black	0.0%	100.0%	None Detected	

Client Sample ID: 2003897-KENT-1B ***Lab Sample ID:*** **692002285-0002**
Sample Description: BOLLARD/VINYL COVERING - BLACK

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	9/24/2020	Black	0.0%	100.0%	None Detected	

Client Sample ID: 2003897-KENT-1C ***Lab Sample ID:*** **692002285-0003**
Sample Description: BOLLARD/VINYL COVERING - BLACK

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	9/24/2020	Black	0.0%	100.0%	None Detected	

Analyst(s):

Margaret Lee PLM (3)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 09/24/202016:59:48

Your Project #: 2003897
Site Location: FENCE AND GATE UPGRADES FRASER VALLEY CORRECTIONAL INSTITUTIONS
Your C.O.C. #: 08485985

Attention: RESULTSVC

DST CONSULTING ENGINEERS
Unit B - 4125 McConnell Drive
Burnaby, BC
CANADA V5A 3J7

Report Date: 2020/09/25
Report #: R2933699
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C069312
Received: 2020/09/24, 12:40

Sample Matrix: Paint
Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Elements by ICP-AES (acid extr. solid)	12	2020/09/25	2020/09/25	BBY7SOP-00018	EPA 6010d m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Bureau Veritas Laboratories
25 Sep 2020 15:09:10

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Carmen McKay, Project Manager
Email: Carmen.MCKAY@bvlabs.com
Phone# (403)219-3683
==========
This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: C069312
Report Date: 2020/09/25

DST CONSULTING ENGINEERS
Client Project #: 2003897
Site Location: FENCE AND GATE UPGRADES FRASER VALLEY CORRECTIONAL INSTITUTIONS
Sampler Initials: AE

ELEMENTS BY ATOMIC SPECTROSCOPY (PAINT)

BV Labs ID		YM9203		YM9204	YM9205	YM9206		
Sampling Date		2020/09/21		2020/09/21	2020/09/21	2020/09/21		
COC Number		08485985		08485985	08485985	08485985		
	UNITS	2003897-KENT-L1 KENT-GATE 1 AND 2 YELLOW PAINT WATER HYDRANT PIPE	RDL	2003897-KENT-L2 KENT-GATE 1 AND 2 RED AND YELLOW PAINT BOLLARD FOR HYDRO LINE	2003897-KENT-L3 KENT-GATE 4 YELLOW PAINT CONCRETE BOLLARD	2003897-MTN-L4 MOUNTAIN-GATE 8 YELLOW PAINT CONCRETE BOLLARD	RDL	QC Batch
Total Metals by ICP								
Total Lead (Pb)	mg/kg	3970	8.0	112000	25000	27500	20	A016094
RDL = Reportable Detection Limit								

BV Labs ID		YM9207		YM9208		YM9209		
Sampling Date		2020/09/21		2020/09/21		2020/09/21		
COC Number		08485985		08485985		08485985		
	UNITS	2003897-MTN-L5 MOUNTAIN-GATE 9 AND 10 ORANGE PAINT METAL SWING GATE	RDL	2003897-MISS-L6 MISSION-GATE 12 GREY PAINT OUTER FENCE POST	RDL	2003897-MISS-L7 MISSION-GATE 13 LIGHT GREY PAINT GATE STRUCTURE	RDL	QC Batch
Total Metals by ICP								
Total Lead (Pb)	mg/kg	53600	20	347	2.0	1500	4.0	A016094
RDL = Reportable Detection Limit								

BV Labs ID		YM9210	YM9211	YM9212	YM9213		
Sampling Date		2020/09/21	2020/09/21	2020/09/21	2020/09/21		
COC Number		08485985	08485985	08485985	08485985		
	UNITS	2003897-MISS-L8 MISSION-GATE 13A LIGHT GREY PAINT GATE STRUCTURE	2003897-PAC-L9 PACIFIC-GATE 17 AND 18 DARK GREY PAINT FENCE POST	2003897-PAC-L10 PACIFIC-GATE 17 AND 18 SILVER PAINT GATE	2003897-MATS-L11 MATSQUI-GATE 20 DARK GREY PAINT FENCE POST	RDL	QC Batch
Total Metals by ICP							
Total Lead (Pb)	mg/kg	2660	208	168	168	2.0	A016094
RDL = Reportable Detection Limit							

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

BV Labs Job #: C069312
Report Date: 2020/09/25

DST CONSULTING ENGINEERS
Client Project #: 2003897
Site Location: FENCE AND GATE UPGRADES FRASER VALLEY CORRECTIONAL INSTITUTIONS
Sampler Initials: AE

ELEMENTS BY ATOMIC SPECTROSCOPY (PAINT)

BV Labs ID		YM9214		
Sampling Date		2020/09/21		
COC Number		08485985		
	UNITS	**2003897-MATS-L12 MASTQUI-GATE 20 SILVER PAINT GATE**	**RDL**	**QC Batch**
Total Metals by ICP				
Total Lead (Pb)	mg/kg	247	2.0	A016094
RDL = Reportable Detection Limit				

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

BV Labs Job #: C069312
Report Date: 2020/09/25

DST CONSULTING ENGINEERS
Client Project #: 2003897
Site Location: FENCE AND GATE UPGRADES FRASER VALLEY CORRECTIONAL INSTITUTIONS
Sampler Initials: AE

GENERAL COMMENTS

ELEMENTS BY ATOMIC SPECTROSCOPY (PAINT) Comments

Sample YM9203 [2003897-KENT-L1 KENT-GATE 1 AND 2 YELLOW PAINT WATER HYDRANT PIPE] Elements by ICP-AES (acid extr. solid): Detection limits raised due to insufficient sample volume.
Sample YM9204 [2003897-KENT-L2 KENT-GATE 1 AND 2 RED AND YELLOW PAINT BOLLARD FOR HYDRO LINE] Elements by ICP-AES (acid extr. solid): Detection limits raised due to dilution to bring analyte within the calibrated range.
Sample YM9205 [2003897-KENT-L3 KENT-GATE 4 YELLOW PAINT CONCRETE BOLLARD] Elements by ICP-AES (acid extr. solid): Detection limits raised due to dilution to bring analyte within the calibrated range.
Sample YM9206 [2003897-MTN-L4 MOUNTAIN-GATE 8 YELLOW PAINT CONCRETE BOLLARD] Elements by ICP-AES (acid extr. solid): Detection limits raised due to dilution to bring analyte within the calibrated range.
Sample YM9207 [2003897-MTN-L5 MOUNTAIN-GATE 9 AND 10 ORANGE PAINT METAL SWING GATE] Elements by ICP-AES (acid extr. solid): Detection limits raised due to dilution to bring analyte within the calibrated range.
Sample YM9209 [2003897-MISS-L7 MISSION-GATE 13 LIGHT GREY PAINT GATE STRUCTURE] Elements by ICP-AES (acid extr. solid): Detection limits raised due to insufficient sample volume.

Results relate only to the items tested.

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

BV Labs Job #: C069312
Report Date: 2020/09/25

QUALITY ASSURANCE REPORT

DST CONSULTING ENGINEERS
Client Project #: 2003897
FENCE AND GATE UPGRADES FRASER VALLEY
Site Location: CORRECTIONAL INSTITUTIONS
Sampler Initials: AE

			Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
A016094	Total Lead (Pb)	2020/09/25	102	75 - 125	<2.0	mg/kg	NC	40	97	70 - 130

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

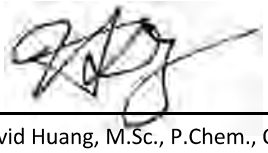
Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C069312
Report Date: 2020/09/25

DST CONSULTING ENGINEERS
Client Project #: 2003897
Site Location: FENCE AND GATE UPGRADES FRASER VALLEY CORRECTIONAL INSTITUTIONS
Sampler Initials: AE

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

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

DST
consulting engineers
a division of Englobe

C069312_COC

08485985

DST Consulting Engineers Inc.
Unit B – 4125 McConnell Drive
Burnaby, British Columbia
V5A 3J7

Chain of Custody

Date: September 23, 2020	**Project #:** 2003897	**Project Name:** Fence and Gate Upgrades
Project Address: Fraser Valley Correctional Institutions		**Approver Name / Project Manager Lance Pizzariello:**
Results Requested By: 24 Hours From Receipt		**Type of Analysis Requested:** EPA 6010D-M (Bureau Veritas)
Send Results To: Results Vancouver - resultsvc@dstgroup.com	**Additional Instructions: Report in PPM (mg/Kg)**	
Lab: Bureau Veritas Laboratories - 4606 Canada Way, Burnaby, BC V5G 1K5 403-219-3683	**Sampled By: Aaron Enquist**	**Date Sampled: September 21-23, 2020**
Relinquished By: Aaron Enquist - 604-417-4865 - aenquist@dstgroup.com	**Signature:**	
COC Accepted By:	**Signature:**	

Bulk Samples

Sample #	Area or Room	Building Material and Colour[1]	Sampling Location
2003897-Kent-L1	Kent - Gate 1 and 2	Yellow Paint	Water Hydrant Pipe
2003897-Kent-L2	Kent - Gate 1 and 2	Red and Yellow Paint	Bollard for Hydro Line
2003897-Kent-L3	Kent - Gate 4	Yellow Paint	Concrete Bollard
2003897-Mtn-L4	Mountain – Gate 8	Yellow Paint	Concrete Bollard
2003897-Mtn-L5	Mountain – Gate 9 and 10	Orange Paint	Metal Swing Gate
2003897-Miss-L6	Mission – Gate 12	Grey Paint	Outer Fence Post
2003897-Miss-L7	Mission – Gate 13	Light Grey Paint	Gate Structure
2003897-Miss-L8	Mission – Gate 13A	Light Grey Paint	Gate Structure
2003897-Pac-L9	Pacific – Gate 17 and 18	Dark Grey Paint	Fence Post
2003897-Pac-L10	Pacific – Gate 17 and 18	Silver Paint	Gate
2003897-Mats-L11	Matsqui – Gate 20	Dark Grey Paint	Fence Post
2003897-Mats-L12	Matsqui – Gate 20	Silver Paint	Gate

[1] DJC-Drywall Joint Compound, VSF-Vinyl Sheet Floor, VFT-Vinyl Floor Tile, FLC-Floor Leveling Compound, ADH-Adhesive, CT-Ceiling Tile

APPENDIX 7

APPLICABLE LEGISLATION, REGULATIONS AND GUIDELINES

APPENDIX 7

APPLICABLE LEGISLATION REGULATIONS AND GUIDELINES

Canada Labour Code

In federal jurisdictions, hazardous building materials are regulated under the Canada Labour Code, Part II, Part X, Hazardous Substances.

Asbestos-Containing Materials (ACMs)

ACMs are regulated under the Canada Occupational Health and Safety Regulations, (SOR/86-304).

Lead-Containing Paints (LCPs)

The Hazardous Products Act (HPA), Surface Coating Materials Regulation (SOR/2005-109) provides regulatory requirements for the sale and labeling of surface coatings.

In Canada, the Surface Coating Materials Regulations (SOR/2005-109) under the federal Hazardous Products Act provides a concentration of lead that must not be exceeded in surface coatings that are presently sold in this country (90 parts per million, or “ppm”). However, it is important to note that this regulation does not comment on the potential occupational exposure if the material is disturbed.

Under the COHSR, a regulatory limit has been established for occupational exposure to airborne lead that may be present in a workplace. The occupational exposure limit (OEL) for airborne lead dust or fumes per both regulatory instruments should not exceed the time-weighted average value of 0.05 milligram per cubic metre of air (mg/m^3).

BC Workers’ Compensation Act

In British Columbia, the management of hazardous building materials in the work place is regulated by WorkSafeBC under the Workers’ Compensation Act (effective April 15, 1998), as amended by the Workers’ Compensation (Occupational Health and Safety) Amendment Act (effective October 1, 1999). Specific requirements of the Occupational Health and Safety Amendment Act are prescribed in the British Columbia Occupational Health and Safety (BC OH&S) Regulation.

British Columbia Occupational Health and Safety (BC OH&S) Regulation

Asbestos-Containing Materials (ACMs)

ACMs are regulated under Part 6 (sections 6.1 to 6.32) of the BC OH&S Regulation. Under Part 6 Section 6.1, an asbestos containing material is defined as "a manufactured article or other material, other than vermiculite insulation, that would be determined to contain at least 0.5% asbestos if tested in accordance with one of the following methods:

(i) Asbestos, Chrysotile by XRD, Method 9000
(ii) Asbestos (bulk) by PLM, Method 9002
(iii) Test Method for the Determination of Asbestos in Bulk Building Materials (EPA/600/R-93/116)

WorkSafeBC Manual – "Safe Work Practices for Handling Asbestos"

This manual outlines basic information on asbestos and asbestos products, health hazard requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of ACMs. This document provides a guide to current practices that are to be followed in the Province of British Columbia.

Lead-Containing Paints (LCPs)

Lead is regulated under Part 6 (sections 6.59 to 6.69) of the BC OH&S Regulation. Under the BC OH&S Regulation, a regulatory limit has been established for occupational exposure to airborne lead that may be present in a workplace. The occupational exposure limit (OEL) for airborne lead dust or fumes should not exceed the time-weighted average value of 0.05 milligram per cubic metre of air (mg/m^3). The OEL represents the time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects.

WorkSafeBC has published the following document, which is intended to provide guidelines for managing lead exposures within applicable limits during renovation or demolition work, and which would meet the requirements of both the COHSR and BC Reg. 296/97:

- WorkSafeBC 2017 publication entitled Safe Work Practices for Handling Lead (BC Lead Guide).

With respect to potential lead exposures associated with disturbance to surfaces coated with lead-containing products, the 2011 WorkSafeBC manual titled Lead-Containing Paint and Coatings: Preventing Exposure in the Construction Industry, indicates the following:

- The improper removal of lead paint containing 600 mg/kg (equivalent to “parts per million” or “ppm”) lead results in airborne lead concentrations that exceed half of the exposure limit.
- This potential for exposure exceeding half of the occupational exposure limit would be the trigger for implementation of an exposure control plan.
- Lead concentrations as low as 90 mg/kg may present a risk to pregnant women and children.
- Any risk assessment should include for the presence of high-risk individuals within the workplace.

In addition to the above, the BC Lead Guide indicates the following:

- Unlike for asbestos-containing material, WorkSafeBC does not numerically define what would be considered a lead-containing paint or coating. All suspected paints or coatings should be tested for lead because, depending on the nature of the work, even a small amount could pose a risk to workers.
- In order to determine which controls and personal protective equipment would be required for a particular job, a qualified person must consider this information as part of the risk assessment.

Based on the above, and because both federally regulated workers and provincially regulated workers (e.g., contractors) are expected to carry out work activities within the Subject Building, and as the provincial regulations have a more stringent criteria, and generally include the requirements noted in the COHSR, this assessment was conducted to meet the requirements of BC Reg. 296/97. In other words, paints containing 600 mg/kg lead (equivalent to “parts per million” or “ppm”) or greater, are classified as paints that contain hazardous levels, i.e., LCPs.

Additionally, Toxicity Characteristic Leaching Procedure (TCLP) testing should be performed on identified LCPs, to facilitate the proper disposal of lead-containing wastes.

Crystalline Silica

Section 6.111(1) of the OHS Regulation describes specific requirements for workplace exposure to crystalline silica (rock dust).

There is no specific exposure limit for "rock dust". Rather, there are exposure limits for the constituents of rock dust that pose a hazard to a worker's health, for example, crystalline silica. Crystalline silica is a designated substance and, therefore, the requirements of section 5.57 of the Regulation apply.

Environmental Protection Act

In British Columbia, environmental matters pertaining to waste generally fall under the jurisdiction of the British Columbia Ministry of Environment (MoE), pursuant to the Environmental Management Act. The key waste regulation under the Environmental Management Act relating to hazardous building materials is the Hazardous Waste Regulation (HWR), as amended from time to time.

Hazardous Waste Regulation

The HWR provides the requirements for the proper handling, storage, transportation, treatment, recycling and disposal of hazardous wastes in the province. The regulation also outlines the materials and criteria to be used to characterize waste as hazardous.

APPENDIX J

ARCHAEOLOGICAL OVERVIEW ASSESSMENT

CORRECTIONAL SERVICE CANADA (CSC) –PACIFIC REGION
PERIMETER FENCE AND GATE UPGRADES

MILLENNIA RESEARCH LIMITED
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MR 2018

November 14, 2020

Amy Ferguson
Senior Environmental Specialist
Public Services and Procurement Canada

Dear Ms. Ferguson,

Re: Upgrading Perimeter Fences and Gates at Six Fraser Valley Institutions, Archaeological Overview Assessment.

Introduction

Millennia Research was requested by Public Services and Procurement Canada to undertake an Archaeological Overview Assessment (AOA) of perimeter fence upgrades at six Fraser Valley correctional institutions (Figure 1). These six institutions are at three address locations:

- Kent and Mountain Institutions, 4732 Cemetery Road in Agassiz, BC.
- Mission Medium Institution, 8751 Stave Lake Street in Mission, BC.
- Matsqui, Pacific and Fraser Valley Institutions, 33344 King Road in Abbotsford, BC;

The description of the upgrades relied upon are as described in Public Works and Government Services Canada (2020) and accompanying drawings for the project prepared by ISL Engineering and Land Services (2020). The proponent is Correctional Services Canada, and the project is to and build upgraded perimeter fences and gates. The general scope of this report was to undertake an archaeological overview to determine the risk level of the proposed works encountering archaeological remains, particularly in regard to construction tendering.

This report was written by Morley Eldridge, MA, RPCA. He has 52 years of archaeological experience in BC. He has undertaken considerable archaeological work in the Fraser Valley, beginning in 1976, and has published on the archaeology of the region (e.g., Eldridge 2017; Eldridge and Acheson 1992). He was assisted by Millennia staff Andrew Eckert, BA, Roger Eldridge, BA, RPCA, and Thea Sawin, MSc.

Figure 1. Study area overview.

A Task Authorization for this report was issued on October 20, 2020 and work was initiated shortly afterwards. The report due date was November 15, 2020. Due to the condensed timeline, a request to Sto:lo Resource and Research Management for information on archaeological data not retrievable through the provincial systems or traditional use site information did not have sufficient time to be responded to.

Project Description

The project is to replace gates and upgrade perimeter fencing at six correctional institutes. The work consists of (Public Works and Government Services Canada 2020: 7. Note that wording has been abbreviated from original):

1. Deconstruction of existing gates, adjoining fencing and inner perimeter anti-tunneling wall to accommodate the new gates and foundations;
2. Installation of lock hardware in new gates;
3. Installation of supplied crash barriers on new concrete foundations;
4. Modifications to existing security fences as indicated;
5. Remove/extend/modify perimeter security systems (FDS)(PIDS-PA), from existing inner perimeter fence line to inner temporary security fencing and reestablish systems to new inner perimeter gates and adjoining altered fencing;
6. Provide temporary security fencing with locking gates where new gates are indicated. Temporary security fencing will form a secure work area at new gates. At inner perimeter fence line extend FDS security systems to maintain integrity of Security systems during construction;
7. Provide temporary construction fencing at gates 15 & 16 and where indicated;
8. Civil work including new paving and landscaping.

Figures will show the location of specific components in the section on impact assessment below.

The project will be put to tender November 15 or shortly thereafter. The project is scheduled to commence immediately on official notification of acceptance of the contractor's bid, and to complete within 96 weeks of that notification. Details of phasing and scheduling are not considered pertinent for this review.

This project entails subsurface excavation work to facilitate the installation of new gate foundations, and adjacent paving and landscaping. Structural drawings have been provided for 13 gates at the Kent, Mountain, and Mission Institutions (gates 1 to 10, 12 to 14) (Public Works and Government Services Canada 2020), and civil works drawings have been provided for 15 gates at 11 locations at Kent, Mountain, Mission, Matsqui, and Pacific Institutions (1 & 2, 4, 7 to 10, 12 to 14, 17 & 18, 20, 23 & 24)(ISL Engineering and Land Services 2020).

Excavation for structural work is expected to approximately 1.5 m depth below surface (dbs) to accommodate new gate foundations, with additional excavation at the Mission Institution to approximately 2.5 m dbs to allow for construction of a structural fill granular pad for the foundations (Public Works and Government Services Canada 2020 Appendix D: Geotechnical Engineering

Review and Assessment (Mission Institution). Excavations for civil works including paving and landscaping are expected to reach approximately 0.5 m below surface (ISL Engineering and Land Services 2020).

Methodology

The basic research plan was to find and compile information regarding archaeological sites and archaeological potential and information about existing conditions from existing sources. A preliminary field reconnaissance was not considered necessary. These sources of information were used to estimate the general archaeological potential for the location. Considering existing development and land use during the historical period then allows an estimate for the net or residual potential for archaeological remains to occur in the specific location of the project where excavation is likely to be part of construction.

For existing archaeological resources, the BC Remote Access to Archaeological Data (RAAD) was checked November 5. Information about sites in the general vicinity of the three study areas was downloaded as pdf files (for attribute data) and shape files (for spatial data). A check of the Provincial Archaeological Resource Library (PARL) system was made November 11 using a series of keywords or phrases including “Mountain Institution” and “DhRk-2”. The main sources of geomorphological data are Google Earth Pro imagery and elevations, as well as plans of proposed work noting existing trenches etc. Geotechnical drilling results were available for three institutions. The plans and profiles also provided information on the depth of planned excavation.

Results

The study area is in the Fraser Valley, about mid way between Hope and the mouth of the river in Greater Vancouver. Mission Institution is about 60 km upstream of the mouth, and to the north of the Fraser River; Matsqui/Pacific/Fraser Valley institutions are also about 60 km upstream of the mouth, but south of the Fraser River, near the Canada/US border. Mountain/Kent institutions are about 100 km upstream of the mouth, and north of the Fraser River.

The following provides information of the First Nations of the area.

First Nations

Searches of the First Nations Consultation Areas Public Map Service reported the following First Nations and First Nation organizations had a stated interest in the areas as follows:

First Nation	Mountain/Kent	Mission	Matsqui/Pacific/Fraser Valley
Cheam First Nation	X		
Soowahlie First Nation	X	X	X
Shxw’ow’hamel First Nation	X	X	X
Stó:lō Nation	X	X	X
Stó:lō Tribal Council	X	X	X

First Nation	Mountain/Kent	Mission	Matsqui/Pacific/Fraser Valley
Skawahlook First Nation	X	X	X
Seabird Island Band	X	X	X
Sts'ailes First Nation	X		
Peters First Nation	X	X	X
Leq'a:mel First Nation	X	X	
Scowlitz First Nation	X		
Kwaw-Kwaw-Apilt First Nation	X		
Skwah First Nation	X		
People of the River Referrals Office	X		
Kwantlen First Nation		X	X
Matsqui First Nation		X	X
Popkum First Nation		X	
Sumas First Nation		X	
Stz'uminus First Nation		X	
Lyakson First Nation		X	
Lake Cowichan First Nation		X	
Halalt First Nation		X	
Penelakut Tribe		X	
Semiahmoo First Nation		X	X

Many of the First Nations resident in the Fraser Valley, but not all, conduct referrals through the People of the River Referrals Office. Being on this list does not reflect the strength of claim.

Study Area Geomorphology

All institutions are on large, level or gently sloping landforms in the upper and mid Fraser Valley. The Kent and Mountain Institutions are near Agassiz about 3 km north of the Fraser River but either within or bordering the pre-dyking floodplain (see Table 1). Mountain Institute gently slopes up from the floodplain on an apparent fan deposit at the base of Mount Agassiz (Figure 2). A slough (Mountain Slough) would have provided access to this location from the Fraser through much of the prehistoric past. The Harrison River once, in the early to mid Holocene, exited Harrison Lake east of Mt Aggasiz and flowed into the Fraser a short distance to the east of Kent/Mountain institutes (Lepofsky and Lenert 2005). The fan deposit on which Mountain Institute is build has a higher inherent archaeological potential than does Kent, as places safe from floodwaters, but convenient to the Fraser, would have been used more intensively than the floodplain itself, especially for residences. This is also reflected in their relative elevations (Table 1).

The Mission Institution is located about 2.5 km from the Fraser, and about 2 km from Hatzic L ake (Table 1). It lies on relatively subdued terrain that is likely a glacial outwash plain dating from the Pleistocene, with little further remodeling during the Holocene. Its elevation is too high to have ever been floodplain of the Fraser River (Table 1).

The Matsqui/Pacific/Fraser Valley Institutions are generally similar to the Mission Institute. There are several kettle lakes in the general region, suggesting that stagnant ice was present as the glaciers melted, but the .

Table 1. Attributes affecting archaeological potential for study sites.

Attribute	Mountain/Kent	Mission	Matsqui/Pacific/Fraser Valley
Geormorphology	flood plain (Kent & Mountain) & piedmont fan or apron (Mountain).	Periglacial outwash plain (?)	Glacial/glacio-fluvial kame terrace/outwash plain (?)
Water Bodies	Mountain Slough (precontact/early historic) 100 m?.Fraser River 3.5 km Harrison River/Fraser Rivers (in early/mid-Holocene) <50 m	Fraser River 2.5 km S; Hatzic Lake 2 km E No local waterbodies of note	Fraser River 9 km N. Sumas Lake (precontact/early historic) 2.7 km E No local waterbodies of note.
Elevation	15-30 m (Mountain) 15-16 m (Kent)	134-144 m	54-56 m (Pacific) 55-60 (Fraser) 57-58 (Matsqui)
Past Land Use	Agricultural (assumed)	Agricultural (assumed)	Agricultural (assumed)
Present Condition	Extensively levelled and filled, no original topographic features remain	Extensively levelled and filled, no original topographic features remain	Extensively levelled and filled, no original topographic features remain
Archaeological Sites – Sto:lo Historical Atlas: Plate 4D	Same as Province	None near	None near
Settlements - Sto:lo Historical Atlas: Pl 27A-B	c.1780 Town just east; hamlet west	None near	Sumas Lake to E
Stl'aleqem Sites Sto:lo Historical Atlas: Pl 2	'serpent' near mouth of slough about 3 km	None near	None near

Attribute	Mountain/Kent	Mission	Matsqui/Pacific/Fraser Valley
Trails: Communication and Transportation Routes, Sto:lo Historical Atlas: Pl 20	Trail parallel to Mountain Slough, further into flood plain	None near	None near

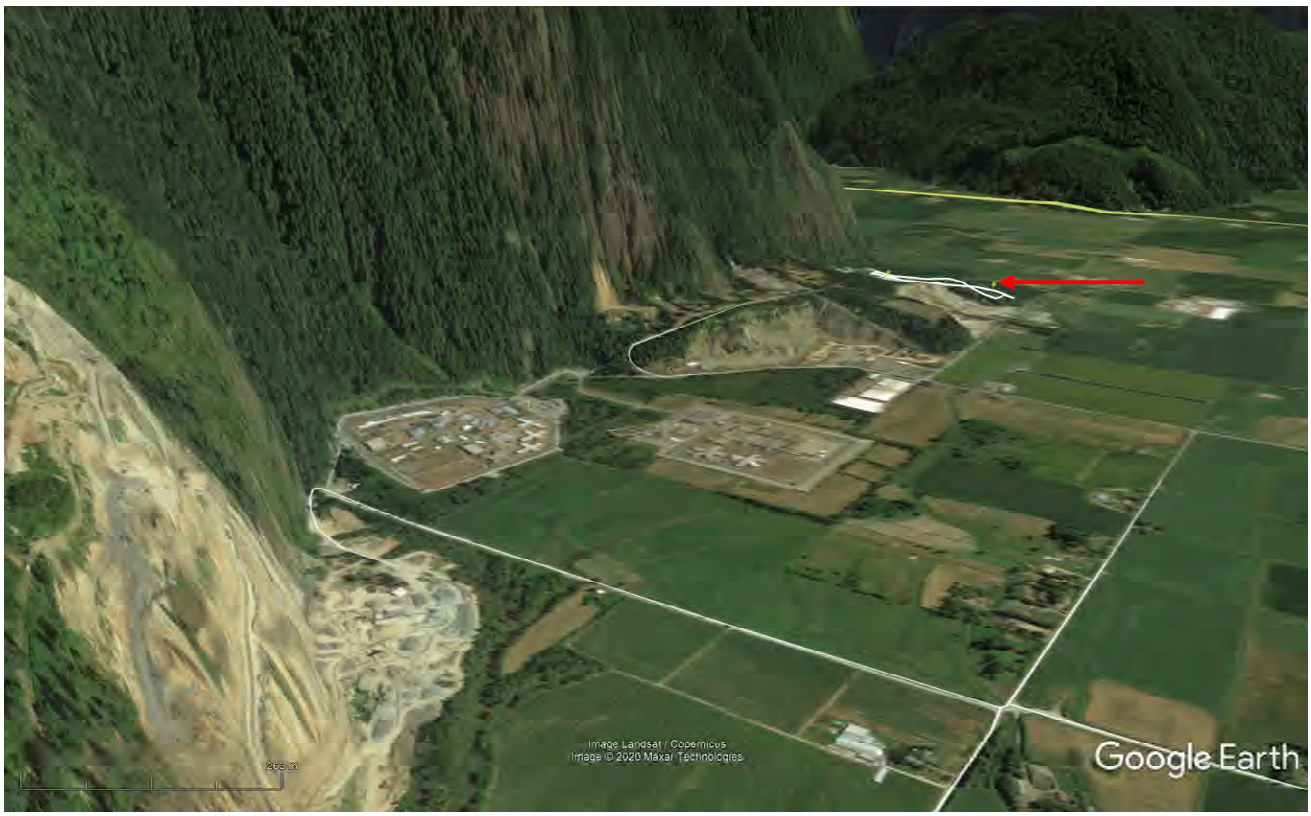

Figure 2. Image of Kent (right) and Mountain (left) institutes with elevation exaggerated X3 to show local rises. Imagery is 2017. DhRk-2 is located on 'terrace' indicated by arrow. Background flats are original outflow from Harrison Lake from the left, and the Fraser River from the right.

Known Villages and Archaeological Sites in Vicinity

The Matsqui/Pacific/Fraser Valley institutions have no archaeological sites recorded in the provincial inventory for a radius of several kilometres (Figure 3).

About 2.5 km from Mission Institution is Peckquaylis Indian Reserve on the shores of the Fraser (Figure 4). No sites are associated with this reserve and the Sto:lo Historical Atlas lists it as the small settlement of *Peqwx̲e:yles* with little associated information (McHalsie 2001). There are three archaeological sites, DgRn-26, 27 and 28 located just west of the reserve near D'Herbomez Creek. Two of these are associated with the Oblate Mission, while the third is also historic but also has a trace of precontact material. Hatzic Lake 2.5 km to the east has a large complex of archaeological sites including Hatzic Rock, *Xa:yem*, DgRn-23 a National Historic Site associated with a Transformer boulder and a 5,000 BP occupation with house features. This site near the Fraser River is just under 3 km from the Institution. Other sites with more recent occupation also occur in the vicinity. Isolated lithic sites are found up to 500 m west of Hatzic Lake, and about 3 km from the Institution.

Figure 3. Matsqui, Fraser Valley and Pacific Institutions and vicinity. There are no recorded archaeological sites in this area.

Figure 4. Mission Medium Security Institution overview. No archaeological sites are in this view but some are located a short distance away from the southern and eastern map boundaries.

The Mountain and Kent Institutions do have archaeological sites in the vicinity, although none are recorded within or very close to the Institutes. The Maccallum Site (DhRk 2) is just over 1 km to the east (Figure 5). This site has had considerable archaeological work over many decades, which has been summarized by Lepofsky and Lenert (2005). A.E. Pickford mapped and Marion Smith excavated several parts of the site in 1945. Depressions on the site were assumed to be early nineteenth century round pithouses and rectangular plank houses; the field map is highlighted in the *A Sto:lo Coast Salish Historical Atlas* (Carlson 2001Plate 12A). The site was assumed to be the physical location of a historic village known from oral history, with the name *Tsítsqem* (McHalsie 2001: Plate 45C Map E; 151) meaning fine slivers of fir bark or hazelnut pod. The village was associated with a 'tribe' referred to as the "Teiton" in an 1830 Hudson's Bay Company census (and assigned about 880 people in the Sto:lo Atlas) and "Steatons" in an HBC 1839 census (Carlson 2001 Plate 27B). The site is referenced as a large late precontact/early historic village with a population of 400-1200 in numerous places in the Sto:lo Atlas (e.g., Plates 27A, 27B). Other references noted by Lepofsky and Lenert suggest the village was abandoned after the 1792 smallpox epidemic.

The archaeological site is on a late glacial terrace, immediately beside the Fraser-Harrison floodplain (Lepofsky and Lenert 2005). Wilson Duff worked briefly at the site in 1949 concluding that the site might be considerably older. Robert Kidd then visited the site in 1968 and collected artifacts near the "housepit area". Development of the land as a gravel pit in 1999 resulted in the BC government purchasing the property. A Sto:lo/SFU/ UBC investigation of the site began in 2002 and conducted large-scale investigations in 2004. Lepofsky and Lenert conclude that the depressions mapped by Smith and Pickford and surfial ones they themselves excavated were glacial in origin and none were pithouses. The correspondence between the 1945 map and modern mapping was poor at the individual feature level. The artifacts found in low to moderate density all over the terrace almost all indicate an early-mid Holocene period. At one block excavation dense artifacts and a square depression feature (that had no surface expression) dated to 5740-5590 cal BP. An area of hearths and dumps nearby had a date of nearly 6,000 cal BP. One artifact found by Duff in 1949 on a depression rim indicated a considerably later, ca. 3,500 BP, age. No historic artifacts were found. Lepofsky and Lenert (2005:17) note that their examination of artifacts recovered during the 1940s work showed that most of the late period artifacts came from the slough (at lower elevation) and not the terrace. Lepofsky and Lenert do not speculate on where the late period village was located, but it is clear it is not on the large glacial terrace. One of the depressions excavated by Duff was possibly a pithouse and may date from about 3,000 BP, but is not representative of a large village. This begs the question, was the village somewhere in the nearby vicinity, and possibly not recorded as an archaeological site yet?

Minni (2000) recorded a single cobble core or chopper chopper at DhRk-60 just west of DhRk-2. This is very likely to date to the same time period as the nearby Maccallum Site. It is about 1 km east of the institutions.

About 3 km southwest of the Kent Institution near Mountain Slough about 500 m above the junction with the Fraser River are two sites, DhRl-66 and DhRl-69 (Figure 5). DhRl-66 or the McRae Site is a pithouse village first described by Wilson Duff in 1949 and 1952 but not included in the Provincial Registry until Golder Associates undertook an AIA for a road bridge (Brooke 2007). Duff

recorded the place name as *ɬi'ɬkʷəlks* meaning "a village site or a fishing-place at the end of the mountain where people lived year round" (Duff 1952). DhRl-69 is a pithouse, apparently originally part of a row of six, that is on a separate property.

Figure 5. Mountain Institution and Kent Institution and archaeological sites in locality.

Expected Site Types

Site types that could be expected to occur at any the institutions are lithic scatters including isolated finds. At Mountain and Kent Institutes, lithic scatters, pithouses (called *sqémél* in Halkomelem language), longhouse depressions, habitation remains such as hearths and roasting pits, wet sites (including wapato horticultural fields) and burials could have once been present.

Past Land Use and Effects on Archaeological Potential

It is probable that all the institutions were previously disturbed by logging and agriculture. The construction of the current facilities would have had major impacts on any archaeological remains once present. The entirety of each institution appears to have been mechanically levelled, erasing any surface topographic features and maximizing visibility for security. It is likely that all or most organic soils were removed. Available geotechnical reports support this, and the general geomorphological interpretations made.

At Kent Institution, soil log for Borehole AH/DCPT09-01, near the north of the Institution outside the perimeter fence (Figure 6), shows over 2 m of compacted fill with a trace of organics in a thin band at 2.3 to 2.7 m depth, with sands and gravels below that (Public Works and Government Services Canada 2020: Appendix C Appendix C 'Soil logs from Golder Associates'). A second test AH09-02 is about 60 m west, and third auger test AH09-03 near the northern edge of the parking lot both recovered mixed deposits with rootlets and reeds between 1.8 and 2.3 m depth, with clays, silts, sands and gravels deeper.

Mountain Institution Borehole BH16-01, near the southwest corner of the perimeter fence (Figure 6), showed fill to nearly 3 m depth, underlaid by peat over a metre deep, under which was silt, sand and gravel (Public Works and Government Services Canada 2020 Appendix D Appendix C 'Soil logs from AMEC Wheeler Forster [sic]'). BH16-02 a few metres away showed fill to 2.7 m (although this included a redeposited topsoil at about 1 m deep) with 70 cm of very soft peat underneath, in which the borehole terminated.

Mission Institution BH16-01, near the NW corner of the perimeter fence (Figure 7), showed only 50 cm of fill, under which was a buried topsoil to 70 cm, then silts and sands until glacial till was encountered at 4 m (Public Works and Government Services Canada 2020 Appendix D Appendix C, 'Soil logs from AMEC Wheeler Forster' [sic]). BH 16-02 close by had a similar profile, except glacial till was encountered at 5 m depth.

No geotechnical logs were available from the Matsqui/Pacific/Fraser Valley cluster of institutions (Figure 8).

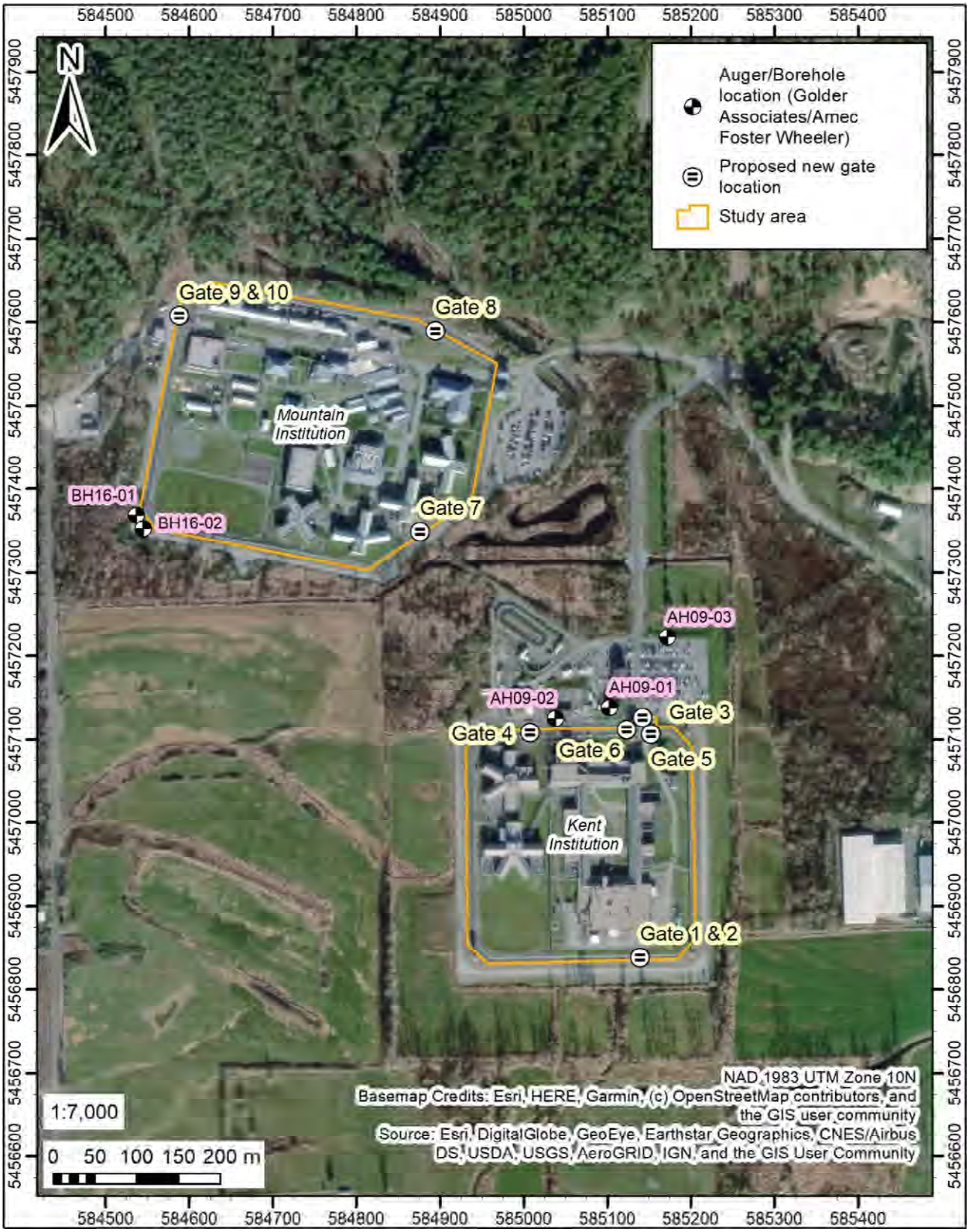

Figure 6. Detail, Mountain and Kent institutions.

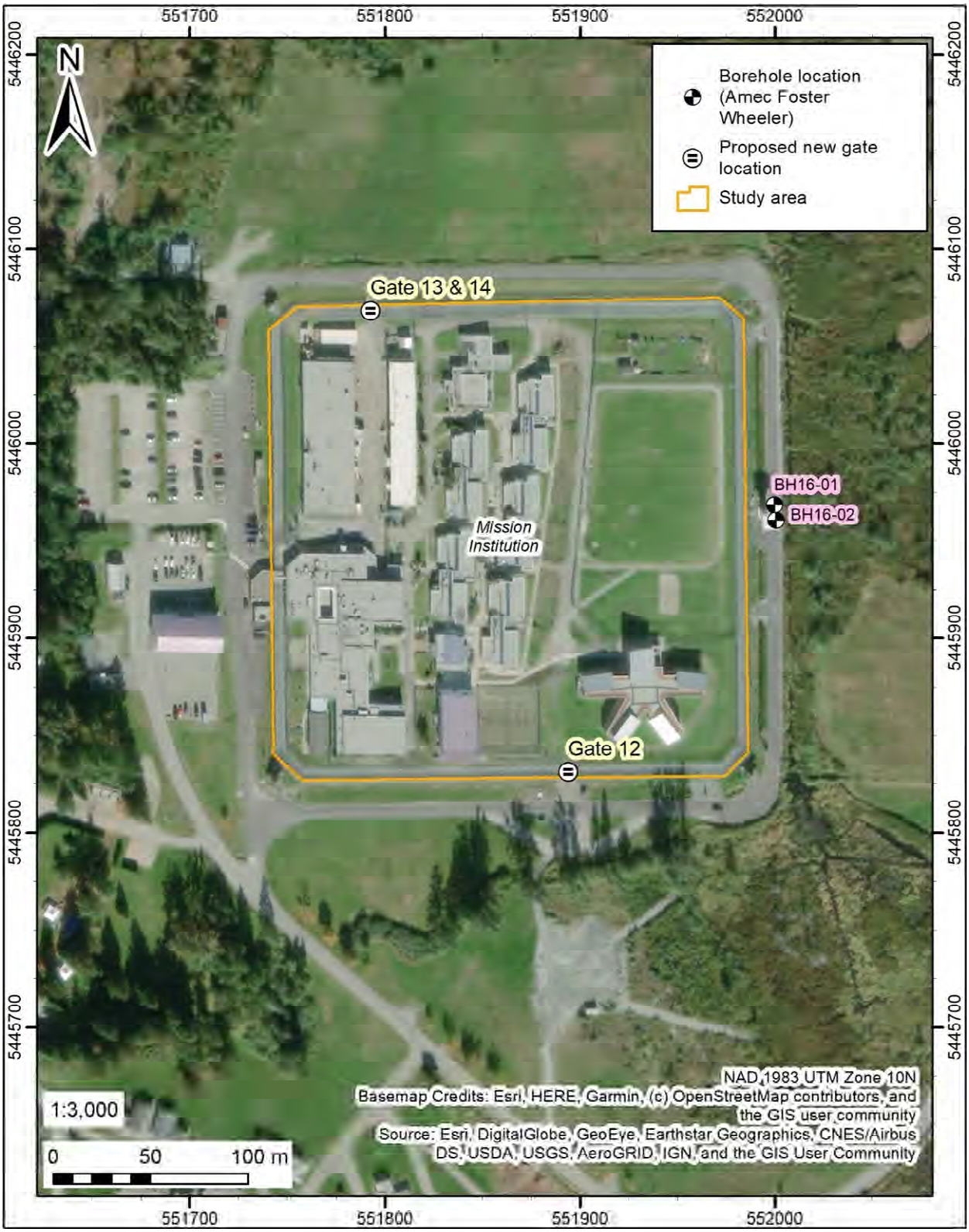

Figure 7. Detail, Mission Institution.

Figure 8. Detail, Matsqui/Pacific/Fraser Valley institutions.

Preliminary Impact Assessment

There will be no impact to known archaeological resources. Of the six institutes, Mountain has the highest archaeological potential, followed closely by Kent, although the original potential is not directly translatable to impact chance. Mountain Institution would have had high archaeological potential prior to the institution having been built, due to its location on a raised landform directly beside an early channel of the Fraser River and with later access provided by Mountain Slough. This would appear to have been a good location for a village at various periods of time. If the Maccallum Site is not the village of *Tsítsqem* (see above) this would be an alternative location for it – in an area with relatively few gentle raised landforms adjacent to the floodplain. The lower Kent Institute would have been subject to periodic flooding, but would also be expected to be used at least occasionally for habitation, hunting waterbirds and deer or elk, gathering wetland resources such as reeds, or tending wapato crops.

The possibility of encountering archaeological remains at all the remaining institutions would have been relatively low (although not nil) even prior to the construction of the Institutions, due primarily to their relatively remote locations in relationship to the major rivers and known trail corridors of the Fraser Valley. Table 1 attributes suggest that the localities would not have had obvious resources to draw people to these areas on a regular basis, although doubtless there was occasional use by hunting parties etc. The complete absence of any recorded archaeological sites in a huge area around the Pacific/Matsqui/Fraser Valley Institutions is particularly notable and supports this interpretation. At Mission, the density of known archaeological sites appears to fall to similarly low levels past about 500 m from the rivers or former river channels, although the Mission site is closer to known precontact hubs of activity than the trio south of the Fraser.

Construction has reduced the archaeological potential at all the study areas compared to the unaltered landscape. Bore holes, despite none being near the various gate features, do suggest the original soils have been largely removed and replaced by fill to make a featureless landform.

The depth of proposed excavations appears to be confined to within the fill. The scale of development (the relatively small footprint of excavated footings and other works) means that the risk of impact to relatively rare archaeological items – such as isolated finds – is low, even if some excavations are deeper than expected.

The general kinds of impacts the proposed project could have on any archaeological resources in the study area would be primarily during excavation work. Excavations will mostly be within existing imported fill materials (Public Works and Government Services Canada 2020 Appendices A through D), but may in some locations extend into underlying older sediments within which archaeological materials could be encountered. Impacts to archaeological resources could include loss or breakage of artifacts, features, anthropogenic faunal or floral remains, and loss or disturbance of human burials; most importantly for archaeology, the loss of context and association between these various items.

Recommendations

No further archaeological investigation or monitoring of construction excavation is recommended. However, to accommodate the very small residual risk, an Archaeological Chance Finds Procedure should be in place for all sites. At Mountain and Kent institutions the chances of an unexpected conflict are somewhat greater, particularly if some excavations require for any reason deeper than expected excavation below the fill and into original ground layers. At these two sites workers should receive Archaeological Awareness Training to be able to recognize potential archaeological remains and thereafter follow a Chance Find Procedure.

Chance Finds Procedure

If unanticipated archaeological remains are encountered during construction or land-altering activity the contractor is advised to halt work in the immediate area and contact designated CSC and Public Works and Government Services Canada representatives, who will contact a professional archaeologist for initial evaluation and further direction.

Limitations

The current study is concerned with the management of archaeological sites which may be affected by the proposed development. As with any archaeological investigation involving a sampling strategy or desktop review, unidentified cultural deposits may be present within the project area. On federal land, these deposits may be protected under the Treasury Board *Guide to the Management of Movable Heritage Assets* (Treasury Board of Canada Secretariat 2008) and *Policy on Management of Materiel* (Treasury Board of Canada Secretariat 2006). If unanticipated archaeological remains (including but not limited to those identified as potential site types in this document) are encountered during construction or land-altering activity the developer is advised to halt work in the immediate area and contact a professional archaeologist and the appropriate regulatory agency.

The information contained in this report has been compiled specifically for the project as defined by the proponent and discussed herein. Any subsequent changes to the proposed project may not be addressed by the current archaeological study and additional studies may be appropriate.

Professional Statement

The information compiled in this report has been prepared in accordance with the standards of the BC Association of Professional Archaeologists, the BC Archaeological Impact Assessment Guidelines (British Columbia Archaeology Branch 1998), and following the Treasury Board *Guide to the Management of Movable Heritage Assets* (Treasury Board of Canada Secretariat 2008) and *Policy on Management of Materiel* (Treasury Board of Canada Secretariat 2006). This report has been prepared by Millennia Research Limited staff and reviewed by a senior archaeologist (see signatories below).

Millennia Research Limited

Per:

Signature:

Morley Eldridge, MA, RPCA

President, Millennia Research Limited

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2000 *Archaeological impact assessments, Strong gravel pit, Bulgar gravel pit, Agassiz/McCallum gravel pit, Othellow gravel pit, Silter Lake gravel pit, Silver Skagit Ford gravel pit, Pierce Creek gravel pit. Permit 1999-383, Sto:lo Heritage Permit 1999-051.*

Public Works and Government Services Canada

2020 *Drawings and Specifications for SCS Pacific Region Perimeter Fence Upgrades. Project No. R.071529.001, June 2020.*