



CT & Associates Engineering Inc.

GEOTECHNICAL INVESTIGATION

UAPT 'WEST 240' LANDS

**5510 - 122 STREET NW
EDMONTON, ALBERTA**

Prepared for

UNIVERSITY OF ALBERTA PROPERTIES TRUST

FEBRUARY 2024

CTA File No. 02-3637



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Prepared by,

CT & ASSOCIATES ENGINEERING INC.



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1.0 INTRODUCTION

This report presents the results of a Geotechnical Investigation conducted by CT & Associates Engineering Inc. (CTA) for the proposed 'West 240' residential development to be located within the east upland portion of the property with the municipal address of 5510 - 122 Street NW, Edmonton, Alberta.

Authorization to proceed with the Investigation was provided by Keaton Seaby, P. Eng., PMP, Manager, Development and Construction with the University of Alberta Properties Trust (UAPT) on October 31, 2023.

This assessment and document has been prepared concurrently with a 'Slope Stability Evaluation and Determination of Set-Back Distances' of the lands that is prepared under separate cover on behalf of UAPT.

2.0 SITE DESCRIPTION AND DEVELOPMENT INTENT

2.1 GENERAL SITE DESCRIPTION

The subject property occupies the lands with the municipal address of 5510 - 122 Street NW, Edmonton, Alberta, located to the west of 122 Street NW and extending 1.2 km westerly to the Whitemud Creek Ravine, and to the south of 62 Avenue NW and extending approximately 800 m to the south.

The legal land descriptions of the property include Blocks A, B, and C, Plan 4971AJ, and Parcel B, Plan 3347EO.

The subject property is indicated on Drawing No. A-1, Appendix A, with representative site photos presented in Appendix B.



2.2 DEVELOPMENT DESCRIPTION

Based on the provided concept plan, it is understood that the future development within the site will include the following:

- 1) The majority of the site is to be developed with residential subdivision, with some Mixed-Use properties (including commercial, multi-family, and a school site) to be constructed at the east portion of the lands;
- 2) At the south central portion of the site a Storm-Water Management Facility (SWMF) is proposed, though the location may be modified as part of future planning;
- 3) Within the site are to be various open spaces and parks, with connecting roadways and municipal utilities.
- 4) Potential 'Low-Impact Development' (LID) may be included as part of the site development, that may include such features as bioretention basins/bioswales, soils cells, box planters, and absorbent landscaping.

2.3 PROJECT OBJECTIVES

The main objective of this project is to conduct a 'Subdivision Level' (NDR) Geotechnical Investigation, to:

- 1) Provide a comprehensive understanding of the subsurface soils and groundwater conditions;
- 2) Provide detailed geotechnical design criteria and construction requirements for the proposed land development, to be included and taken into consideration as part of planning of the development and for the future site construction;
- 3) Identify potential risks related to construction of 'Low-Impact Development' (LID) features from a geotechnical perspective, and to provide preliminary geotechnical design criteria and construction requirements for these facilities.



During future detailed design stages and based on CTA review of the proposed development plans, further site-specific geotechnical review and additional investigations (for the future specific structures and development/grading plans, such as SWMF, deep utilities, commercial/school/multi-family developments, or significant surface grading) may be required in order to confirm the criteria presented in this report.

3.0 SITE INVESTIGATION PROGRAM

3.1 SITE STUDY AND SITE RECONNAISSANCE

A review of historical air photos of the subject site was completed (representative historical air photos are presented in Appendix C), with an initial site review conducted on November 2, 2023.

Based on the proposed site development plan and subsequent field reconnaissance, the drilling investigation program was developed for the subject site.

3.2 DRILLING PROGRAM

The field drilling program to determine soils and groundwater conditions required for the Geotechnical Investigation of the uplands area and associated Slope Stability Analysis was completed between November 24, 2023 and December 21, 2023 consisting of twenty-six (26) boreholes, as follows:

- 1) Within the east upland areas, twenty (20) boreholes (Boreholes No. 7 through 26) to between 8.8 m to 11.9 m depth below the existing ground surface;
- 2) Along the Whitemud Creek ravine top-of-bank, six (6) boreholes (Boreholes No. 1 through 6) drilled to between 13.1 m to 24.1 m depth below the existing ground surface. The deep boreholes were intended to be drilled through the approximate full



- depth of the adjacent ravine though were ultimately terminated at an auger refusal depth, due to the very hard bedrock deposit encountered;
- 3) During drilling, a piezometer was installed at each borehole location for depth to groundwater monitoring purposes.

Drilling was conducted with a B-61 truck-mounted drill rig and was supervised at all times by a CT & Associates Engineering Inc. engineer. Disturbed samples were taken from auger cuttings typically at 0.8 m intervals. Standard Penetration Testing (SPT) was conducted at 1.5 m intervals, from which disturbed samples were also taken.

The borehole drilling program was submitted to the UAPT for approval of borehole locations to take into consideration ongoing agricultural research within the property. Based on the UAPT review, slight modifications of the borehole locations was completed to accommodate and not impact such research with the drilling rig and support trucks.

Drawing No. A-1, Appendix A, shows the borehole locations with logs of boreholes included in Appendix D.

Boreholes elevations were determined by CTA based on the City of Edmonton site contour data (3TM coordinates) relative to geodetic elevation.

3.3 LABORATORY TESTING PROGRAM

Laboratory testing was also conducted on soil samples for the determination of natural moisture content, Atterberg limits, soluble sulphate concentrations, and California Bearing Ratio (CBR).

Test results are presented on the individual borehole logs contained in Appendix D and E (California Bearing Ratio).



3.4 ASSESSMENT AND REPORT PREPARATION

Based on the findings of the site and historical reviews, field program, and in consideration of the proposed site development, geotechnical design parameters and construction requirements were developed, as presented herein.

4.0 SITE CONDITIONS

4.1 SITE LOCATION

The 'West 240' subject site is described as follows:

- 1) The subject site occupies the lands with the municipal address of 5510 - 122 Street NW, located to the west of 122 Street NW and extending 1.2 km westerly to the Whitemud Creek, and to the south of 62 Avenue NW and extending approximately 800 m to the south;
- 2) The legal land descriptions of the property include Blocks A, B, and C, Plan 4971AJ, and Parcel B, Plan 3347EO. The entirety of the site occupies approximately 93.5 ha (231 acres of land), with approximately 83.5 ha (198.5 acres) over the east upland portion of the site (east of the Whitemud Creek ravine slopes) which is considered developable.

The location of the subject property is presented on Drawing No. A-1, Appendix A.



4.2 SURFACE FEATURES

The subject site is generally described as follows:

1) East Upland Areas

The east, upland, developable portion of the subject site (east of the Whitemud Creek ravine slopes) includes approximately 83.5 ha (198.5 acres) of land, the majority of which is utilized as cultivated farmland (agricultural research purposes on behalf of the University of Alberta).

The majority of this area is relatively flat, though there is a local high area at the northeast portion of the site (with an approximate elevation of 678.5 m) with a gentle slope down to the east, south and west. Elevations over the east and south portions of the site vary from about 669.0 m to 670.0 m, while over the west portion of the site about 662.0 m to 668.0 m elevation along the ravine top-of-bank.

Local tree covered areas are present at the northeast and northwest corners of the site, with small localized low-lying areas at the southeast corner and south central portion of the site. Various local grass-covered pathways for vehicle traffic to research plots within the property are present throughout the site.

Underground utilities within the subject site include the following, as indicated on Drawing No. A-1, Appendix A:

- 1) Extending in a west to east direction through the south portion of the site is an underground EPCOR sanitary sewer. This sewer utility connects at a trestle located within the ravine to the west and then crosses 122 Street NW to the east;

- 2) At the southwest portion of the site is a high pressure TransMountain pipeline and Telus fibre, both extending in a southeast to northwest direction. The pipeline crosses under the adjacent Whitemud Creek Ravine, while the Telus fibre extends along the top-of-bank area and then crosses the ravine to the west via the EPCOR trestle.

2) Adjacent Ravine Slopes

Within the west portion of the subject site is a slope from the upland areas down to Whitemud Creek. This slope area is generally described as follows:

- 1) The slopes range in height from about 40 m to 43 m, and are generally covered with mature trees and vegetation;
- 2) Slope angles generally range from about 1 (v) : 4 (h) to 1 (v) : 6 (h), though there are locally steeper areas (at about 1(v) : 3 (h)) also present;
- 3) At the base of the ravine, the Whitemud Creek meanders significantly, and at three locations is present immediately at the toe of the slope coming down from the site.

4.3 LOCAL GEOLOGY AND COAL MINING

Based on our review of geological and coal mine maps, subsurface conditions at the subject site are summarized as follows:

- 1) According to the “Urban Geology of Edmonton - Alberta Research Council Bulletin 32” (Kathol & MacPherson, 1975), the subsurface geology over the subject site area is summarized as follows:
 - Local geology is expected to consist of approximately 18 m to 20 m of glaciolacustrine deposits of bedded sands, silts, and clay, over approximately

5 m of glacial till (composed of unsorted and stratified deposits of clay, silt, and sand, with pebbles and boulders);

- Within the clay till, localized, thin rafted bedrock and disturbed Saskatchewan Sand and Gravels deposits may be encountered;
- Below the clay till, a bedrock deposit consisting of interbedded shale and sandstone is expected.

2) With respect to coal mines in vicinity of the subject site:

- According to “Atlas: Coal Mine Workings of the Edmonton Area.” (Taylor, R., 1971), there are no coal mines identified within the subject site. Similarly, the Alberta Energy Regulator (AER) documentation does not identify any coal mines within the subject site.
- Former coal mines to south but do not extend to the subject site, as per Alberta Energy Regulator drawing presented in Appendix F;
- A small ‘prospecting’ shaft is identified to the west of the northwest portion of the subject site within the heavily treed area near the top-of-bank, (as approximately indicated on Drawing No. A-1, Appendix A), summarized as follows:
 - i) AER records indicate that in 1928, there had only been a ‘prospecting’ shaft or drill, with the location being uncertain. The records indicate that due the thickness of coal encountered ‘the prospect’ was dropped and the location abandoned as it was not commercially viable, though the nature of the work was not known;
 - ii) Review of this area did not observe any remains of this prospect shaft or drill;
 - iii) Based on the above, there are no records of coal mining occurred related to this prospecting location.



4.4 REVIEW OF SITE HISTORY

Review of historical air photos (1920 through 2023) was completed as part of the site study.

This review indicates the following:

- 1) The site has historically been utilized as farmland (since prior to 1920) with a few small low-lying areas within the east and south central portions of the site. Surrounding properties have historically also been agricultural land. In 1920, areas over about the east half of the subject site had been covered with trees and vegetation;
- 2) By 1952, the majority of the site was cultivated farmland, with small treed areas at the northeast and northwest corners of the site;
- 3) Through 1962, the site remained unchanged. By this time, commencement of the construction of the residential subdivision to the north had begun and the construction of a pipeline at the southwest corner of the property is apparent;
- 4) By 1967, the sewer trestle had been constructed within the adjacent Whitemud creek ravine, with various new walking trails apparent along the ravine slopes;
- 5) Through 1980, the subject site remained relatively unchanged. At this time, various research plots are apparent within the east portion of the subject site;
- 6) In 1987, a small area of disturbance is apparent at the northeast corner of the site related to the site farming/research;
- 7) The subject site remains relatively unchanged through 2023, the various research plots throughout continuing.

In summary, the subject site had been utilized as cultivated farmland since at least 1950, as it remains today. No historical evidence of fill placement or site grading was observed within the site.

Representative historical air photos presented in Appendix C.



4.5 SOIL CONDITIONS

Generally, the surface conditions at the subject site are summarized as follows:

- 1) At the borehole locations, a topsoil layer of between 100 mm to 450 mm thick was encountered, though typically in the order of 150 mm to 200 mm thickness;
- 2) Due to limitations for drill rig access related to the ongoing agricultural research projects and operations within the property, there may be sporadic areas with a thicker topsoil layer throughout the site;
- 3) Fill materials (of 0.5 m and 0.8 m thickness) were encountered at two isolated locations (Boreholes No. 22 and 25) potentially related to access pathway construction and research within the site.

Below the topsoil and isolated fill layer, a native clay deposit was encountered at between 0.1 m to 0.45 m below the existing ground surface and of between 2.9 m to 7.4 m thickness. The clay deposit was typically moist to wet, high plastic, and firm to stiff, though at some borehole locations was found to become low to medium plastic with depth.

Below the high plastic clay deposit:

- 1) Over the east and southwest portions of the site (Boreholes No. 8, 9, 12, 13, 15 through 17, 20, 22, and 23 through 26), a sand deposit was then encountered at between 3.0 m and 6.5 m depth and extending through the remaining borehole depths, 11.9 m below the existing ground surface. The sand deposit was typically encountered to be damp to moist, fine-grained, uniform, and compact to very dense;
- 2) Over the northwest and along the west boundary of the upland areas of the site (Boreholes No. 1, 2, 3, 4, 5, 7, and 11), varying thicknesses of silt and sand deposits were encountered from between 5.2 m and 7.3 m depth below the existing ground surface, and with a total thickness of between 1.8 m to 8.9 m.



At the locations of Boreholes No. 1, 2, 3, 5, 6, 10, and 14, a moist, low plastic, stiff to very stiff clay till deposit was then encountered at between 7.0 m to 11.4 m depth below the existing ground surface, and of between 0.7 m to 5.2 m thick. Such clay till was not encountered at the remaining borehole locations.

In the vicinity of the top-of-bank (locations of Boreholes No. 1 through 6, 10, and 14), bedrock (consisting of clay shale and sandstone) was then encountered at between 8.4 m to 15.2 m depth, and extending the remaining borehole depths. Boreholes were terminated at depths as indicated on the borehole logs due to auger refusal during drilling due to the very hard nature of the bedrock deposit.

A generalized soil stratigraphy for the site is summarized in Table 1.

Details of the soil stratigraphy can be found in the borehole logs in Appendix D.

**TABLE 1
GENERAL SOIL STRATIGRAPHY**

Material	Soil Description	Approximate Depth to Top of Stratum (m)	Range in Thickness of Stratum (m)
TOPSOIL ¹	Organic, silty, sandy, some clay, moist to wet, black	0.0	0.1 - 0.45
CLAY	Some silt to silt, trace sand, moist to wet, high plastic, firm to stiff, dark greyish brown - becomes low to medium plastic with depth	0.1 - 0.45	3.0 - 8.6
SAND ²	Silty, trace clay, fine-grained, uniform, damp to moist, compact to very dense, dark greyish brown to dark brown	3.0 - 6.5	> 6.9
SILT / SAND ³	<u>Silt</u> - Some sand, some clay, damp to wet, non plastic, stiff, dark greyish brown <u>Sand</u> - Silty, trace clay, fine-grained, uniform damp to moist, compact to very dense, dark greyish brown	5.2 - 7.3	1.8 - 8.9
CLAY TILL ⁴	Silty, sandy, trace coal and pebbles, moist to wet, low plastic, stiff to hard, dark greyish brown	7.0 - 11.4	0.7 - 5.2
BEDROCK	<u>Clay Shale</u> - Rafted to intact, silty, trace sand, damp to moist, high plastic, hard, grey <u>Sandstone</u> - Rafted to intact, clayey, silty, some sand, damp, medium to high plastic, hard, grey	8.4 - 15.2	> 12.2

- Note: ¹ At the locations of Boreholes No. 22 and 25, clay fill of 0.5 m and 0.9 m thickness was encountered
- ² Over the east and southwest portions of the site (Boreholes No. 8, 9, 12, 13, 15, 16, 17, 19, 20, 22, 23, 24, 25, and 26), a sand deposit was encountered below the clay deposit and extended through the remaining borehole depths, 11.9 m below the existing ground surface
- ³ Over the northwest portions and along the west boundary of the upland areas of the site (locations of Boreholes No. 1, 2, 3, 4, 5, 7, and 11), varying thicknesses of silt and sand deposits were encountered below the clay
- ⁴ Encountered only at the locations of Boreholes No. 1, 2, 3, 5, 6, 10, and 14



4.6 GROUNDWATER CONDITIONS

4.6.1 Completion of Drilling

At the completion of the drilling programs, no water was encountered at any of the borehole locations. There was also no sloughing conditions encountered at the majority of borehole locations, with the exception of minor sloughing only encountered at the location of Borehole No. 20 at 10.0 m depth and trace sloughing at the locations of Boreholes No. 21, 23, and 25.

4.6.2 Groundwater Monitoring

During drilling, twenty-six (26) piezometers were installed for groundwater monitoring purposes. Groundwater measurement readings were taken as follows:

- 1) On January 4, 2024, at between fifteen (15) and forty-one (41) days after piezometer installation, groundwater was only encountered at the locations of Boreholes No. 1 (20.0 m depth) and No. 3 (15.9 m depth) and with trace water encountered at the locations of Boreholes No. 17, 21, and 26. No water was measured at any of the other borehole piezometers;
- 2) On January 24, 2024, at between thirty-five (35) and sixty-one (61) days after piezometer installation, groundwater was only encountered at the locations of Boreholes No. 2 through 6 (deep boreholes along the top-of-bank area) at between 12.1 m to 18.3 m depth below the existing ground surface, while at the locations of Boreholes No. 10, 20, and 23 (within upland areas) at between 8.2 m to 9.5 m depth below the existing ground surface. Trace water was also encountered at the locations of Boreholes No. 17 and 23. No water was measured at any of the other borehole piezometers.

A summary of piezometer installation and groundwater level readings details are provided in Table 2.

TABLE 2
SUMMARY OF PIEZOMETER INSTALLATION AND GROUNDWATER TABLE READINGS

Piezometer No.	Piezo. Depth (m)	Intersected Lithology	Ground Elevation ¹ (m)	Depth to Water at Time of Installation ² (m)	Groundwater Level Readings			
					January 4, 2024 ³		January 25, 2024 ⁴	
					Depth to Water (m)	Elevation (m)	Depth to Water (m)	Elevation (m)
BH-1	23.6	Clay / Silt / Sand / Clay Till / Bedrock	666.4	Dry	20	646.4	Frozen ⁵	
BH-2	16	Clay / Silt / Clay Till / Bedrock	664.6	Dry	Dry	< 648.6	14.9	649.7
BH-3	22.1	Clay / Silt / Sand / Clay Till / Bedrock	664	Dry	15.9	648.1	16	648
BH-4	19.1	Clay / Silt / Sand / Bedrock	664.1	Dry	Dry	< 645.0	16.4	647.7
BH-5	19.7	Clay / Silt / Clay Till / Bedrock	665.6	Dry	Dry	< 645.9	18.3	647.3
BH-6	13.1	Clay / Sand / Clay Till / Bedrock	669.2	Dry	Dry	< 656.1	12.1	657.1
BH-7	8.4	Clay / Silt / Sand	668.9	Dry	Dry	< 660.5	Dry	< 660.5
BH-8	9.9	Clay / Sand	678.3	Dry	Dry	< 668.4	Dry	< 668.4
BH-9	8.4	Clay / Sand	670.4	Dry	Dry	< 662.0	Dry	< 662.0
BH-10	8.4	Clay / Bedrock	667.3	Dry	Dry	< 658.9	8.2	659.1
BH-11	8.4	Clay / Silt	668.4	Dry	Dry	< 660.0	Dry	< 660.0
BH-12	8.4	Clay / Sand	670.5	Dry	Dry	< 662.1	Dry	< 662.1
BH-13	8.4	Clay / Sand	674	Dry	Dry	< 665.6	Dry	< 665.6
BH-14	8.4	Clay / Clay Till / Bedrock	665.4	Dry	Dry	< 657.0	Dry	< 657.0
BH-15	8.4	Clay / Sand	668.6	Dry	Dry	< 660.2	Dry	< 660.2

TABLE 2 cont'd
SUMMARY OF PIEZOMETER INSTALLATION AND GROUNDWATER TABLE READINGS

Piezometer No.	Piezo. Depth (m)	Intersected Lithology	Ground Elevation ¹ (m)	Depth to Water at Time of Installation ² (m)	Groundwater Level Readings			
					January 4, 2024 ³		January 25, 2024 ⁴	
					Depth to Water (m)	Elevation (m)	Depth to Water (m)	Elevation (m)
BH-16	8.4	Clay / Sand	667.5	Dry	Dry	< 659.1	Dry	< 659.1
BH-17	8.4	Clay / Sand	667	Dry	Trace	658.2	Trace	658.2
BH-18	8.4	Clay	667.1	Dry	Dry	< 658.7	Dry	< 658.7
BH-19	8.4	Clay / Sand	665.8	Dry	Dry	< 657.4	Dry	< 657.4
BH-20	11.4	Clay / Sand	668.3	Dry	Dry	< 656.9	9.5	658.8
BH-21	11.4	Clay / Sand	669.5	Dry	Trace	658.1	Frozen ⁵	
BH-22	8.4	Clay / Sand	669.5	Dry	Dry	< 661.1	Dry	< 661.1
BH-23	8.4	Clay / Sand	668.7	Dry	Dry	< 660.3	8.2	660.5
BH-24	8.4	Clay / Sand	667.8	Dry	Dry	< 659.4	Dry	< 659.4
BH-25	8.4	Clay / Sand	668.7	Dry	Dry	< 660.3	Dry	< 660.3
BH-26	8.4	Clay/Sand	669	Dry	Trace	660.6	Trace	660.6

- Note: ¹ Boreholes elevations were determined by CTA based on the City of Edmonton site contour data (3TM coordinates) relative to geodetic elevation
- ² Piezometers installed on November 24, 2023, December 1, 4, 5, 8, 11, 13, 14, 19, 20, and 21, 2023
- ³ Groundwater measurements at between fifteen (15) and forty-one (41) days after piezometer installation
- ⁴ Groundwater measurements at between thirty-six (36) and sixty-two (62) days after piezometer installation
- ⁵ Piezometer frozen near ground surface due to recent significant cold weather

4.7 PLASTICITY AND MOISTURE CONDITION OF SHALLOW CLAYEY SOILS

With respect to the shallow clayey soils as encountered over the subject site:

- 1) Below the existing ground surface at between 0.15 m and 0.45 m, a high plastic clay deposit is present with a natural moisture content generally ranging from about 21% to 35%. At isolated borehole locations, moisture conditions ranged to as low 11% to 19% (Borehole No. 8) to as high as 38% (Borehole No. 24) though these are considered isolated within the site;
- 2) Atterberg limits (used to define the ‘plasticity’ of a cohesive soil, ie/ its ability to undergo deformation without cracking or fracturing, and also its swell potential, seventeen (17) tests completed) indicate:
 - Generally, the Liquid limit of the soils ranged from about 53% to 80%, with a Plastic limit ranging from about 21% to 28%. At three (3) isolated locations (Boreholes No. 8, 15, and 16), the Liquid limit ranged from 36% to 49% and the Plastic limit was between 18 and 22%;
 - Based on the Atterberg limits test results, the soils are practically defined as ranging from ‘medium to high plastic’ to ‘high plastic’, though should be considered as high plastic throughout the site;
- 3) Based on comparison of the natural moisture conditions of the clayey soils near the ground surface to the Plastic limit of the clay (which is used to compare to approximately the ‘Optimum Moisture Condition’ of the soil, ie/ how dry or wet the soil is in its existing state and used for assessment of the swelling potential of these soils), it is concluded that over the majority of the site, the existing soils moisture condition is at or above the expected optimum moisture content and thus considered to be on the wet of the optimum moisture content in its current state. However, over the isolated areas, the high plastic clay are also on the dry side of the optimum moisture content;

- 4) As a result, based on the existing moisture conditions of these shallow moist to wet, high plastic clayey soils, there is a potential for soil swelling, with any future water ingress resulting in an increase in moisture condition of the clayey soils, or with drying and future wetting of these soils.

5.0 GEOTECHNICAL ASSESSMENT FOR DEVELOPMENT

5.1 GENERAL

Generally, based on the soil and groundwater conditions encountered during the drilling program, the proposed residential, multi-family, and commercial development is feasible at the subject site.

The general summary of the site assessment is presented as follows:

- 1) Based on anticipated site grading that will be close to existing grades and the encountered subsurface conditions, standard design and construction practices are generally applicable for site grading, utilities installation, building foundation and roadway construction, provided that requirements and precautions with respect to the shallow, high plastic clayey soils are taken into consideration during design and construction, most notably with respect to building footing foundations;
- 2) A topsoil layer was encountered over the subject site, varying from between 100 mm to 450 mm thick. The topsoil layer will require removal as part of site preparation. Due to limitations for drill rig access related to the ongoing agricultural research projects and operations within the property, there may be sporadic areas with a thicker topsoil layer throughout the site, that should be further evaluated through additional site investigation at later design stages and once the entire site is available for study;

- 3) Over the majority of the site, groundwater levels were generally measured at greater than 8 depth below the existing ground surface, and are thus expected to have practically no detrimental effect on subdivision construction;
- 4) With respect to underground utility installation:
 - Generally, the moist wet, firm to stiff clayey soils (as encountered within upper portion of the clay deposit) can provide a stable trench for the short term utility installation in the order of between 3.0 and 5.0 m depth below the existing ground surface, provided that the trench slope is no greater than 1(h) : 1(v);
 - At depth, where the 'sugary' sand layer was encountered (at between 3.0 m and 8.5 m depth), a significantly less steep angle or a shield box for temporary shoring for trench support will be required. For trench backfill with these sand materials, mixing the sand with the upper clay will be required to improve compaction and achieve required backfill criteria;
 - Should wet and firm soils be encountered at the base of the utility installation, base improvement through sub-cutting of a minimum of a 0.3 m thick layer and replacement with washed rock wrapped in a woven geotextile (Layfield LP315, or equivalent) will be required to provide proper base support for utility construction;
- 5) With respect to a storm water management facility:
 - Due to the encountered silt and sand soils at depth, a clay liner will be required for the SWMF;
 - Consideration for appropriate equipment and construction techniques should also consider the presence of the dry to damp sand at depth;
- 6) With respect to commercial and multi-family developments and based on the encountered conditions, conventional design and construction practices are generally anticipated for the subject site area, provided that requirements and precautions with respect to the shallow, high plastic clayey soils are also taken into consideration during design and construction;



- 7) LID facilities are considered feasible for the subject site, provided considerations with respect to mitigating impacts to the local high plastic clays that may result in swelling potential are taken into consideration for their design and construction.

During future detailed design stages and based on CTA review of more detailed development plans, further site-specific geotechnical review and additional investigations (for future specific structures and development/grading plans, deep utilities, or significant surface grading) may also be required in order to confirm the criteria presented in this report.

5.2 SUBDIVISION DESIGN AND CONSTRUCTION CONSIDERATIONS FOR SHALLOW DAMP TO MOIST CLAYEY SOILS

As outlined in Sections 4.5 and 4.7, the subject site is generally underlain by high plastic clayey soils, extending from approximately 0.15 m to 7.4 m depth below the existing ground surface.

Based on the existing moisture conditions of these shallow moist to wet, high plastic clayey soils, there is a potential for significant soil swelling with any future water ingress resulting in an increase in moisture condition of the clayey soils, or with drying and future wetting of these soils.

In order to mitigate and minimize this potential, the following considerations and precautions are presented for the subdivision design and construction:

1) Residential Footings and Basements

It is anticipated that surface grading will generally maintain the existing ground elevation. As such, residential foundations and basement floor slabs will generally



be placed within the high plastic clayey soils that are prone to swelling if allowed to dry (and with future wetting).

Precautions should be in place during residential footing and basement construction to not allow the moisture condition changes (drying and/or wetting) of these clays, as this will present significant potential for swelling of the soils.

Provided such precautions and awareness are provided during construction, conventional footing and basement slab construction is anticipated.

2) Subdivision Underground Utilities

Conventional design and construction for underground utilities is expected (with uniform trench backfill), though moisture conditioning (drying) of the excavated wet clayey soils may be required for trench backfill placement to achieve required backfill criteria.

3) Surface Infrastructure

Depending on the final design elevations and grading, similar issues with respect to high plastic clayey soils and their future swelling potential could be encountered with surface infrastructure (roadways, curb and gutter, sidewalks, driveways, shallow basement slabs, and similar).

Potential impacts to surface infrastructure due to these soils conditions are to be taken as part of later grading design, and as part of construction planning and staging.



4) CTA Review of Later Detailed Design Stages

As part of on-going subdivision design, CTA is to be provided opportunity to review subdivision drawings to ensure they take into consideration geotechnical requirements for design and construction, most notably related to elevation and grading planning for residential basements (footings and basement floor slab).

5) Advisement to Designers and Contractors

It is strongly recommended that designers and contractors of construction work within the development site be advised of the presence of and potential swelling effects of these high plastic clayey soils, that indeed require appropriate planning as part of design and construction to overcome this potential.

5.3 SITE PREPARATION/GRADING AND COMPACTION STANDARDS

5.3.1 Site Preparation and Grading

Generally, the site is covered with a topsoil layer between 100 mm to 450 mm thick. The topsoil layer will require removal and replacement with engineered fill materials during site preparation and grading.

Due to limitations for drill rig access related to the ongoing agricultural research projects and operations within the property, there may be sporadic areas with a thicker topsoil layer throughout the site that should be further evaluated through additional site investigation at later design stages and once the entire site is available for study. In addition, at the isolated low-lying areas within the site, thicker topsoil and organic layers may be present.

The existing fill materials as encountered over isolated areas (Boreholes No. 22 and 25, of between 0.6 m to 0.8 m thickness) will require removal and replacement with engineered clay fill soils. As these fills potentially are related to access pathway modifications and research within the site, similar removals and replacement may be required at other pathway and access areas.

Generally, fair to good shallow sub-grade conditions are expected for site grading, however, should wetter or soft clays be encountered, additional sub-cutting and replacement of the underlying wet and soft soils may be required such to provide a 'bridge' effect during placement and compaction of engineered fill materials. Geotextile may also be required at these areas to achieve the required compaction of the engineered fill materials. The extent and thickness of any such sub-cut areas will be evaluated by CTA based on design grades and site reviews at time of site grading.

Groundwater conditions were generally measured over the majority of the site at greater than 8 m depth below the existing ground surface, and will have practically no detrimental effect on subdivision grading.

5.3.2 Compaction Standards

All imported clay fill to be used for placement on site as engineered fill is required to consist of low to medium plastic clay, and to the approval of CT & Associates Engineering Inc.

All engineered fill is required to be compacted to minimum of 98% of Standard Proctor Maximum Dry Density (ASTM D698) at between optimum to 2% above optimum water content, in maximum 150 mm compacted thickness lifts in order to provide proper sub-grade support for on-grade construction.

All engineered clay fill placement and compaction as part of site grading is also to be completed in accordance with the City of Edmonton Complete Streets Design Standards (CoE CSDS), Section 2.0 and 3.0 (2023).

Engineered fill construction requires full-time monitoring and testing by CTA during construction.

The existing native clay materials on site are considered suitable for reuse as part of site grading, though generally drying of the clayey soils near the existing ground surface will be required to meet the required compaction criteria.

5.4 UTILITY TRENCHING AND BACKFILL

5.4.1 Trench Excavation

It is expected that the utility trenches will be in the order of 3 m to 4 m deep. As such, over the majority of the site, the native clay soils can provide a stable trench for the short term utility installation, provided that the trench slope is no greater than 1(h) : 1(v), though the trench slope angle is to be modified in accordance with the construction experience gained through the site and lessened as required.

Should the dry 'sugary' sand layer was encountered at depth, a significantly less steep slope angle or a shield box for temporary shoring for trench support will be required.

All excavations are also required to be completed in accordance with pertinent OH & S regulations. Temporary surcharge loads such as excavated soils and stockpiles of materials should be kept back from the excavation crest by a minimum distance of equal to the excavation depth.

All open trench excavations are to be checked regularly for signs of cracking or sloughing, especially during and after periods of rainfall. It should be recognized that even small earth falls pose a significant danger to workers and must be guarded against at all times. Any sloughed or loosened materials on the trench walls should be promptly removed. If there is any evidence of bulging in the trench wall or cracking on the ground surface parallel to the trench, all work in the trench must be immediately terminated and the stability of the trench assessed by a CTA engineer. It may be necessary to shore that portion of the excavation, or to locally increase the cutback of the trench excavation slope.

Based on the encountered soils and groundwater conditions, groundwater seepage/inflow is expected to be nominal during construction and anticipated to be handled with conventional sump pump.

5.4.2 Utility Base Construction

Based on the encountered soils and groundwater conditions, over the majority of the site for the utility installation in the order of 3 m to 4 m deep, conventional bedding sand to City of Edmonton specification is expected to be suitable.

Should isolated areas of a wet, firm, clay deposit be encountered (such as at the locations of Boreholes No. 24 and 25), base improvement through sub-cutting of a minimum of a 0.3 m thick layer and replacement with washed rock wrapped in a woven geotextile (Layfield LP315, or equivalent) will be likely required to provide proper base support for utility construction.

The washed rock thickness should be further evaluated on site at the time of trench excavation. Trench de-watering via sump pump or draining water into downstream catch-basins may also be required.

5.4.3 Trench Backfill

Generally, underground utility installations are to be conducted following site grading and engineered clay fill placement.

The underground utility installation(s) will include a uniform trench backfill methodology in accordance with the CoE CSDS which includes excavation, placement and compaction of the clayey soils to a minimum of 98% Standard Proctor Maximum Dry Density (SPMDD - ASTM D698) within the uniform backfill zone (i.e. within 1.5 metres depth from the pavement sub-grade elevation, from property line to property line on both sides of the roadway right-of-way). This engineered fill construction will provide a suitable and uniform underlying clay sub-grade condition for the construction of subdivision surface infrastructure.

Beyond the 1.5 m depth of the clay sub-grade, all trench clay backfill is to be placed and compacted to 95% Standard Proctor Maximum Dry Density, or to the minimum standard required by the appropriate backfill zone.

It is required by the current City of Edmonton standards that all utility trench backfill (Type 1 Backfill) placement must meet the requirements of the current CoE CSDS, Section 3.1.3.7 - Density Requirements, which includes criteria related to compaction and moisture content of the backfill materials.

All backfill materials should be placed near the optimum moisture content and must be free of organics, contamination, deleterious debris, or stones greater than 75 mm in diameter.

Generally, due to the high moisture content of the clayey soils, drying of these soils will be required, or blending with dryer soils will be required, to ensure that the

trench backfill can be compacted to the required criteria. Alternatively, replacement of the materials with imported material approved by the site engineer is a viable option.

With utility installation within the 'sugary' sand at depth, mixing of the sand with the upper clay of the utility excavation will be required to improve backfill compaction to achieve the required compaction criteria.

In addition, due to the potentially high plastic nature of the bedrock soils at depth, should they be encountered during utility installation such materials should not be used as trench backfill, or alternatively be placed at the bottom of the utility trenches. Mixing with clay and sand soils from above will also reduce the plasticity of the bedrock materials and also aid in moisture conditioning.

5.4.4 Thrust Blocks

It is expected that underground water utilities will be placed between approximately 2.5 m to 3.5 m depth below the existing ground surface, with associated thrust blocks also placed at these depths. It is understood that as part of design and installation of the thrust block, a minimum soil bearing capacity of 72 kPa (1,500 psf) is required by EPCOR Water.

Generally, the allowable soil bearing capacity is estimated at 90 kPa and thus a standard thrust block installation is suitable. At later design stages, this thrust block design method should be reviewed, based on the design locations and depths of the water mains, including related to any grade changes of the site.

5.5 RESIDENTIAL BUILDING FOUNDATIONS AND BASEMENTS

It is anticipated that the majority of residential basements will be placed approximately 1.5 m to 2.5 m depth below finished grade.

Details of requirements for residential building construction are to be further evaluated at later detailed design stages, based on final grading plan, including finished grade elevations, existing subsurface conditions, and considerations for extent and thickness of any engineered fill to be placed over the existing native soils.

Based on the expected finished grade elevation as being similar to the existing ground surface elevation and encountered subsurface soils and groundwater conditions over the site, preliminary design criteria and construction requirements for footing and basement weeping tile are as follows:

5.5.1 Grading Considerations

Site grading for residential footings and basements is to take into consideration the requirements and precautions with respect to encountered the high plastic clayey soils over the site, as presented in Section 5.2, and removals of the surficial topsoil and fill materials as presented in Section 5.3.

As part of on-going subdivision design, CTA is to have opportunity to review subdivision design drawings to ensure that geotechnical requirements for design and construction are taken into account, most notably related to elevation and grading planning for residential basements (footings and basement floor slab).

5.5.2 Footing Foundation Design

Generally, strip and spread footings founded on native clay, or engineered clay fill base, are to be designed on an allowable bearing capacity of 90 kPa.

Over isolated areas (Boreholes No. 8, 13, 14, 16, and 20) where firm clay was encountered, footing foundation are to be designed based on a reduced allowable bearing capacity of 60 kPa and may require increased footing dimensions. The limits of these areas can be further evaluated at the time of grading planning preparation to determine footing depths relative to these soils conditions.

Footings should be cast on a clean, undisturbed surface. No loose or disturbed material should be allowed on the bearing surface of footing excavation prior to pouring of concrete. All footings for heated structures are to be completed to a minimum of 1.8 m depth below surrounding exterior grade to prevent movement due to frost penetration.

Footing excavations should be protected from rain, snow, wetting, drying and inflow of surface and groundwater at all times. Footings should not be cast directly onto or over frozen soil, nor should the soil beneath or adjacent to the footings be allowed to freeze subsequent to their installation. Should the soils below the footings experience such moisture changes, or freeze/thaw, significant footing movement (heave or settlement) could be experienced.

At the time of excavation and prior to footing and basement construction, the exposed base of excavation should be inspected by CTA to confirm suitability for the foundation to be constructed as such.



5.5.3 Weeping Tile and Backfill

Over the majority of the site, based on the encountered soils and groundwater conditions, provided the finished grade is maintained similar to the existing, no significant groundwater problems are expected for the residential building basements. Any groundwater flow can be handled effectively by normal weeping tile and sump operations, that are to be connected to the local municipal storm sewer system.

Backfill material around building perimeters should consist of nominally compacted clay fill, with positive drainage away from the building structures at all times.

5.6 CONSIDERATIONS FOR COMMERCIAL AND MULTI-FAMILY SITES

Design and construction of commercial and multi-family sites within the subject site is considered feasible, supported by cast-in-place concrete friction piles, with slab-on-grade, and associated infrastructure.

Site specific geotechnical studies will be required based on the nature and location of the respective developments.

Design and construction for commercial and multi-family site are to take into consideration the requirements with respect to the existing high plastic clayey soil conditions.

5.7 STORM WATER MANAGEMENT FACILITY

It is understood that future site development is to include construction of a storm water management facility (SWMF) within the south central portion of the site, expected to be in the vicinity of Boreholes No. 20 and 21. Should the intent of the SWMF structure and location be modified, additional site investigation and assessment will be required.

As encountered at the locations of Boreholes No. 20 and 21:

- 1) Soils conditions consist of about a 7 m thick clay layer, including moist to wet, firm to stiff, high plastic clay to about 4.6 m to 5.3 m depth, becoming very wet and low plastic below. Below the clay, a fine-grained sand is then present, extending to greater than 11.9 m depth;
- 2) Groundwater conditions at the area are at greater than 9.5 m depth.

The soil conditions as encountered are generally suitable for construction of the proposed SWMF, though liner requirements and SWMF slope angles are required to consider the soils conditions as encountered.

For preliminary design purposes:

- 1) Within the upper clay deposit, the SWMF side-slopes should be designed and constructed with a slope angle of no greater than 1(v) : 5 (h);
- 2) Based on the depth of the SMWF (ie/ does it extend into the sandy soils at depth, and if so, how deep? Will there be a 'silt trap' present within this sand deposit?) further stability analysis in order to determine the applicable design slope angles construction and operation feasibility will be required;
- 3) In view of the sand soils at depth, a 0.8 m thick clay liner (compacted to 95% SPMDD) is required at the base and the excavation walls to the HWL with surface

erosion protection (grass) along finished slopes. Existing shallow clayey soils can be utilized as the liner material.

Upon development of more detailed design of the proposed SWMF, CT & Associates Engineering Inc. is required to conduct a review of the proposed structure, to ensure suitability of the design, construction, and operation for the soils and groundwater conditions, including further site-specific field study.

5.8 PAVEMENT DESIGN AND STRUCTURES

It is anticipated that the major roadway systems in the proposed development are the 9.0 m local residential and 11.5 m local collectors.

It is expected that all roadway right-of-ways are to be prepared with 'uniform trench backfill' consisting of 1.5 m thick engineered clay fill (placed and compacted to 98% SPMDD) from below the sub-grade elevation, for the entire roadway right-of-way (from property line to property line).

California Bearing Ratio (CBR) testing of representative soil samples (two (2) soils samples) indicates the 'CBR' values to be in the range of 9, as presented in Appendix E.

Considering the in-situ softening processes within the pavement structure base materials during service life, freeze-thaw effects, the soil condition(s) within subject site, and the 'uniform' trench backfill preparation, a design roadbed resilient modulus of 30 MPa as per Table 1.2.1 from the City of Edmonton Complete Streets Design Standards (2023) (considered generally equivalent to a California Bearing Ratio (CBR) of 3.0) is thus considered conservative as part of pavement design, and is suitable for pavement design.

Designs for pavement structures (local residential, local collectors) are presented in Tables 3 and 4, respectively. The structures are considered to be in accordance with the revised City of Edmonton Pavement Structure designations and the design procedures as outlined within AASHTO Guide for Design of Pavement Structures (1993).

In accordance with City of Edmonton design and construction requirements, the sub-grade should be further confirmed at time of construction to ensure the sub-grade conditions are in accordance with the design values as outlined above. Sampling of the site sub-grade soils and their laboratory testing of the California Bearing Ratio (CBR) values will be required at time of detailed design and during construction to verify that the sub-grade soil conditions are in accordance with the design values as outlined in Section 5.8.1.

5.8.1 Pavement Structures

**TABLE 3
LOCAL RESIDENTIAL PAVEMENT STRUCTURE**

Material	Local Residential - ESAL Value $\approx 3.6 \times 10^4$	
	Reliability - 75%	
	Design Parameter	Design Input
Stage 2 Asphalt Concrete (LT ¹) - FAC	Thickness	35 mm
Stage 1 Asphalt Concrete (LT ¹)	Thickness	65 mm
Base Course/ Crushed Gravel (20 mm)	Thickness	200 mm
Prepared Roadbed/ Prepared Sub-grade ²	Thickness	150 mm ²
Roadbed (Uniform Trench Backfill) ³	Resilient Modulus	30 MPa ³

TABLE 4
LOCAL COLLECTOR PAVEMENT STRUCTURE

Material	Local Collector w/Bus - ESAL Value $\approx 3.6 \times 10^5$	
	Reliability - 85%	
	Design Parameter	Design Input
Stage 2 Asphalt Concrete (HT ¹) - FAC	Thickness	35 mm
Stage 1 Asphalt Concrete (HT ¹)	Thickness	75 mm
Base Course/ Crushed Gravel (20 mm)	Thickness	325 mm
Prepared Roadbed/ Prepared Sub-grade ²	Thickness	150 mm ²
Roadbed (Uniform Trench Backfill) ³	Resilient Modulus	30 MPa ³

Notes:

¹ Pre-approved asphalt supplied with 58-28 Performance Grade binder;

² Thickness and cement dosage to be confirmed at the time of proof-roll;

³ Table 1.2.1 from the City of Edmonton Complete Streets Design Standards (2023)

5.8.2 Sub-grade Preparation

In order to provide a non-deflective sub-grade condition, the clayey sub-grade soils should be properly prepared through scarifying, drying, and re-compaction, or cement stabilization.

Prior to sub-grade treatment, the sub-grade should be proof-rolled to determine the existing field conditions at that time and to determine the most effective method and depth required to be treated. The sub-grade should then be prepared according to one of the following methods:

1) Soil Drying or Material Replacement and Re-Compaction

The top of a minimum of 150 mm of the clay sub-grade should be scarified, dried, and re-compacted to 98% Standard Proctor Maximum Dry Density. The sub-grade preparation depth may have to be increased in areas of wet clayey soils at the surface or disturbance such as utility line trenches, to be determined on site.

2) Cement Stabilization

Should soil re-compaction not provide a non-deflective sub-grade condition, the sub-grade clayey soils may be cement treated by mixing a minimum of 10 kg of cement over 1 m² of surface area to a depth of 150 mm, and compacted to 100% of Standard Proctor Maximum Dry Density. The cement quantity and depth should be confirmed during site work based on field conditions at that time, and to the approval of CTA and the City of Edmonton.

Should the pavement structure be placed significantly after sub-grade preparation, the exposed base should again be proof-rolled under the supervision of CT & Associates Engineering Inc. to detect any soft areas that will require further treatment.

5.8.3 Maintenance of Roadway Areas

Precipitation and site maintenance during construction will have an effect on pavement sub-grade preparation requirements and should be taken into account during the planning of pavement construction, including the depth and quantity of cement required during the sub-grade stabilization process.



Proper on-going maintenance of the future pavement areas and mitigating of water effects during the construction period prior to the sub-grade treatment will reduce the depth and quantity of cement required during the sub-grade stabilization process that will ultimately be required.

5.9 CONSIDERATIONS FOR 'LOW-IMPACT DEVELOPMENT' FEATURES

It is understood that future site development may potentially include 'Low-Impact Development' (LID) within the development plan, including features as bioretention basins/bioswales, soils cells, box planters, and absorbent landscaping.

As part of initial evaluation of these features relative to the encountered high plastic shallow clay soils throughout the site, the following considerations are presented:

- 1) The subsurface conditions at the subject site generally consist of shallow high plastic clayey soils. With these soils types, changes of their moisture condition (whether through surface infiltration, change of groundwater condition, or the introduction of a new below-grade water source such as LID infrastructure) can result in swelling (including a soil volume increase and associated upward movements) of high plastic clay due to long-term moisture ingress into these soils, that are considered of a high degrees of swell potential.

These soil movement effects (whether upward swelling or downward settlement) can then result in impacts to the finished condition and performance of the infrastructure constructed at the ground surface, such as surface slab-on-grade, shallow infrastructure, and building foundations.

As such, at all stages of design and construction of LID facilities, mitigative measures to prevent the introduction of new water sources to these shallow soils

conditions, or a change of moisture condition during construction (ie/ drying and future wetting) resulting in a significant change to their moisture condition is of paramount concern. Alternatively, placement of the LID facilities only at locations within development areas where such movements can be tolerated (such as landscaping areas) should be considered.

Most notably, placement of the LID facilities in close proximity to building structures or sensitive concrete surface slabs should not be allowed;

- 2) The following initial LID design considerations are presented:
- Based on the high plastic, nearly impermeable native clay encountered, an underdrain system connected to the local storm sewer system, will be required beneath all LID facilities to prevent perched groundwater conditions above of the native clay layer. When absorbent landscaping LID facilities are provided with grading towards other LID facilities and water is not allowed to pond, underdrains would not be required for these areas;
 - Due to the high swelling potential of the high plastic clay, no LID facilities should be placed within 3 m of buildings foundation elements. The use of an impermeable membrane (Layfield Enviro Liner 1020, or equivalent) along the sides and bottom of the LID adjacent to the building, as outlined in the August 2023 EPCOR Design Standards - Volume 3-02 Stormwater Management and Design Manual, Section 5.2.5, is required for any LID facilities within 5 m of buildings, to be installed, sealed, and tested in accordance with manufacturer specifications. Care should be taken during installation and maintenance to avoid damage (tearing/puncturing) of the impermeable membrane;
 - For LID facilities in other development areas that are in close proximity to surface infrastructure that are sensitive to movement (such as roadways, curbs & gutters, and sidewalks), placement of an impermeable liner along the

- sides and bottom of these LID facilities should also be considered to mitigate swelling effects due to moisture changes of the adjacent high plastic clays;
- Based on the measured groundwater conditions (at greater than 8 m depth), separation of LID facilities to the groundwater condition as required by ECPOR should not be an issue;
- 3) Locations of such LID features must also take into considerations appropriate set-backs from the ravine top-of-bank, such to not introduce water ingress to the slope areas that could potentially impact the long-term stability of the ravine slopes.

5.10 SITE CLASSIFICATION FOR SEISMIC SITE RESPONSE

Based on the soil conditions as encountered during this drilling program, the subject site can be classified as Class D (Table 4.1.8.4.A. of NBCC 2020) as foundation of the buildings will be placed within stiff to very stiff clay deposit, compact to dense sand, or hard bedrock soils.

5.11 CEMENT TYPE

Initial testing for water soluble sulphate concentrations included eight (8) representative soil samples from across the site. All test results were less than 0.02% (by weight), indicating a negligible potential for sulphate attack on concrete.

As such, Cement Type GU is expected to be used for all concrete elements exposed to native soils. This requirement is also to be further evaluated and confirmed at later detailed design stages. Any imported clay fill materials should also be tested for water soluble sulphate concentrations.

Appropriate concrete design and strength parameters, in accordance with CSA requirements and in view of the above cement type and Class of Exposure, are also to be implemented as part of design. Air entrainment of 4% to 7% by volume is recommended for all concrete exposed to freezing temperatures and/or native soils.



6.0 REQUIREMENTS FOR FURTHER GEOTECHNICAL STUDY

At later design stages, additional geotechnical reviews, investigations, and studies may be required with respect to the following, though to be determined by CTA as project design and planning moves forward:

- 1) Adherence to subdivision lay-out and design with respect to findings and set-backs of the Slope Stability Evaluation and Set-Back Distance Determination report, as prepared by CTA under separate cover;
- 2) Additional confirmation of topsoil and fill thickness within the site, due to limitations for drill rig access related to the ongoing agricultural research projects and operations within the property and where there may be sporadic areas with a thicker topsoil layer throughout the site;
- 3) Upon confirmation of the SWMF details, including location, lay-out and elevations, inlet/outlet pipes, and facility function (wet pond, dry pond) further investigation will be required, including considerations of impacts due to the sand deposit at depth and inlet/outlet sewers;
- 4) Based on future site grading plans, assessment of areas with firm clayey soils at footing depth, and where reduced bearing capacities are present for footings, will be required;
- 5) With respect to multi-family and commercial development areas, site specific Geotechnical Investigations will be required based on the nature and location of the respective structures at detailed design stages;
- 6) Should there be areas of significant grade changes (greater than about 2.0 m thickness), analysis of fill settlement analysis (including both of the fill and underlying native clay soils) may be required;
- 7) Should deep utilities be constructed within the development that extend into the sand deposit at depth, additional study of excavation slope angles, backfill requirements, and impacts to adjacent developments may be necessary; and



- 8) Additional review and studies with respect to LID features may be necessary, in accordance with EPCOR requirements for geotechnical evaluation of such facilities, including potentially permeability testing.

7.0 CLOSURE

This report has been prepared in accordance with generally accepted geotechnical practices and procedures.

Classification of soil and groundwater conditions within the report have been based on generally accepted engineering practices in this area. Conditions identified during the field work, and thereby recommendations presented within this report are considered to be reasonably representative of the site. If however, conditions other than those presented are identified during any other work on the subject property, CT & Associates Engineering Inc. should be notified, and given an opportunity to review or modify our recommendations in light of new findings.

In order to ensure that the geotechnical design criteria and associated construction guidelines presented herein and any other geotechnical issues that may arise during construction are properly addressed, CT & Associates Engineering Inc., is required to be involved with on-site consulting, inspections and testing over the project duration. Without such involvement, CT & Associates Engineering Inc. will not take any responsibility for future design, construction or performance issues that may arise over time.



CT & Associates Engineering Inc.

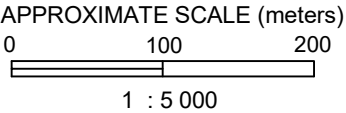
APPENDIX A

DRAWING



- LEGEND:
- SUBJECT SITE
 - BOREHOLE LOCATION
 - SANITARY SEWER LINE
 - TRANSMOUNTAIN PIPELINE
 - TELUS FIBRE AND TELEPHONE
 - COAL PROSPECTING LOCATION

NOTE: BASED ON GOOGLE EARTH AIR PHOTO (2021)



CT & ASSOCIATES ENGINEERING INC.

CLIENT
UNIVERSITY OF ALBERTA PROPERTIES TRUST

DATE
JAN. 19, 2024

DWN.
MLW

CHKD.
DSN

PROJECT
GEOTECHNICAL INVESTIGATION
'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE
SITE PLAN AND BOREHOLE LOCATIONS

FILE NO.
02-3637-A1

DWG. NO.
A-1



CT & Associates Engineering Inc.

APPENDIX B

SITE PHOTOGRAPHS



Photo 1: Northwest portion of subject lands.
Photo taken November 21, 2023, looking southwest from near 62 Avenue NW.



Photo 2: Southeast portion of subject lands.
Photo taken November 21, 2023, looking northwest from near 122 Street NW.



Photo 3: Southeast portion of subject lands.
Photo taken November 21, 2023, looking northeast from along south property boundary.



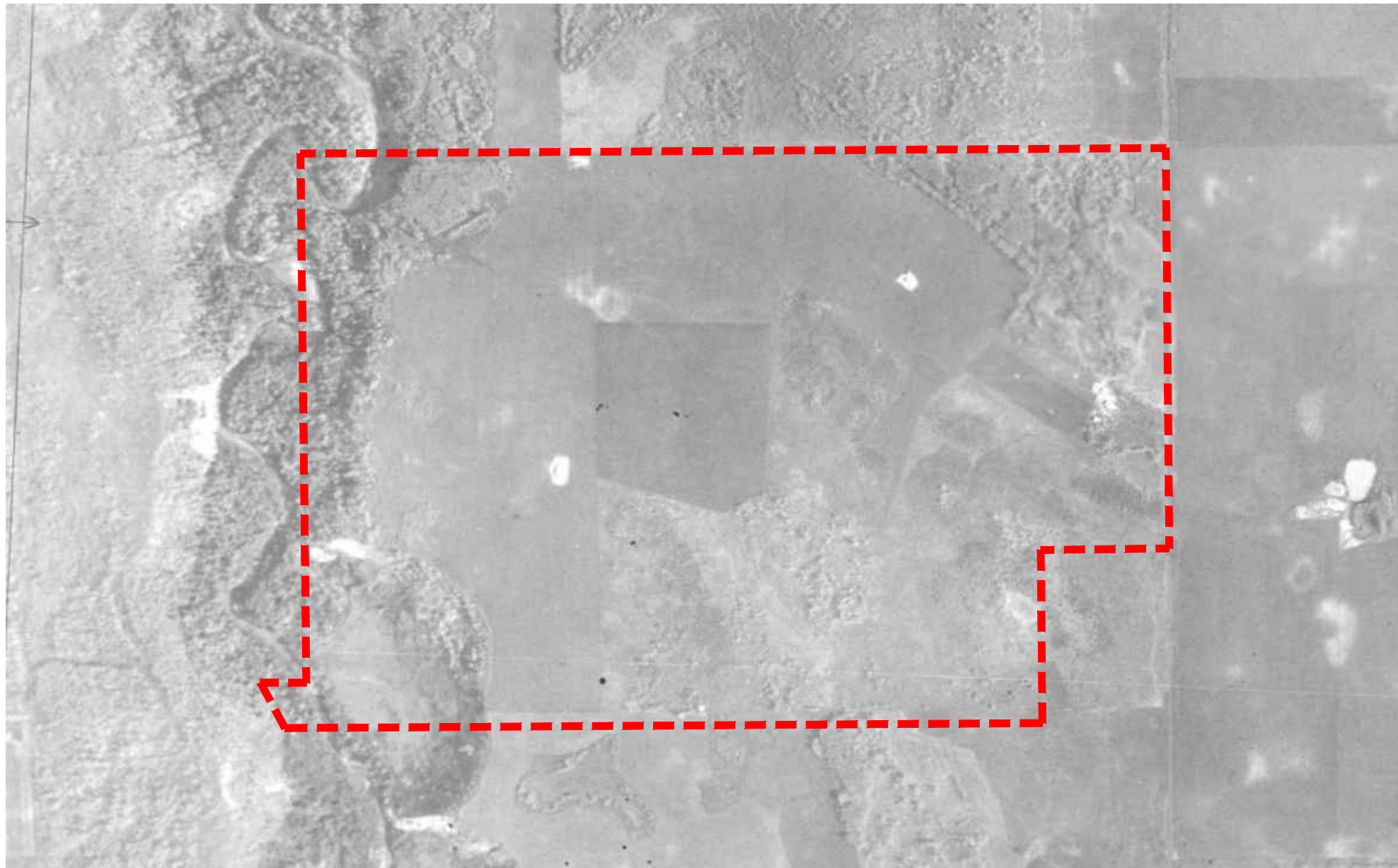
Photo 4: Southwest portion of subject lands.
Photo taken November 21, 2023, looking northwest from along south property boundary.



CT & Associates Engineering Inc.

APPENDIX C

HISTORICAL AIR PHOTOS

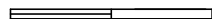


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1920)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



CT & ASSOCIATES ENGINEERING INC.

CLIENT

UNIVERSITY OF ALBERTA PROPERTIES TRUST (UAPT)

DATE

FEB. 5, 2024

DWN.

NL

CHKD.

DSN

PROJECT

GEOTECHNICAL INVESTIGATION
AND SLOPE STABILITY EVALUATION
'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

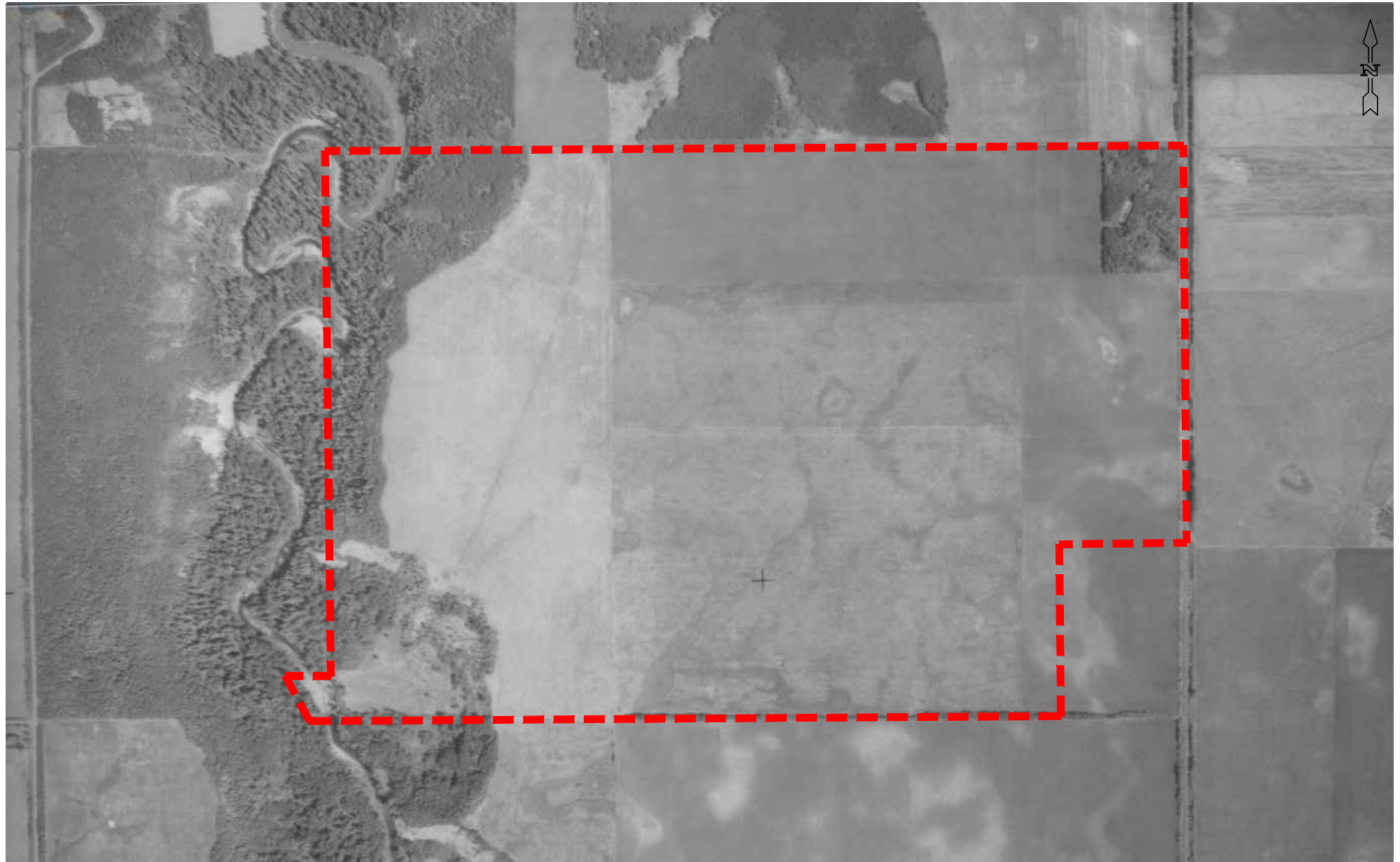
SITE AIR PHOTO - 1920

FILE NO.

02-3637

DWG. NO.

C-1

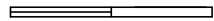


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1952)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1952

FILE NO.

02-3637

DWG. NO.

C-2

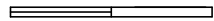


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1962)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

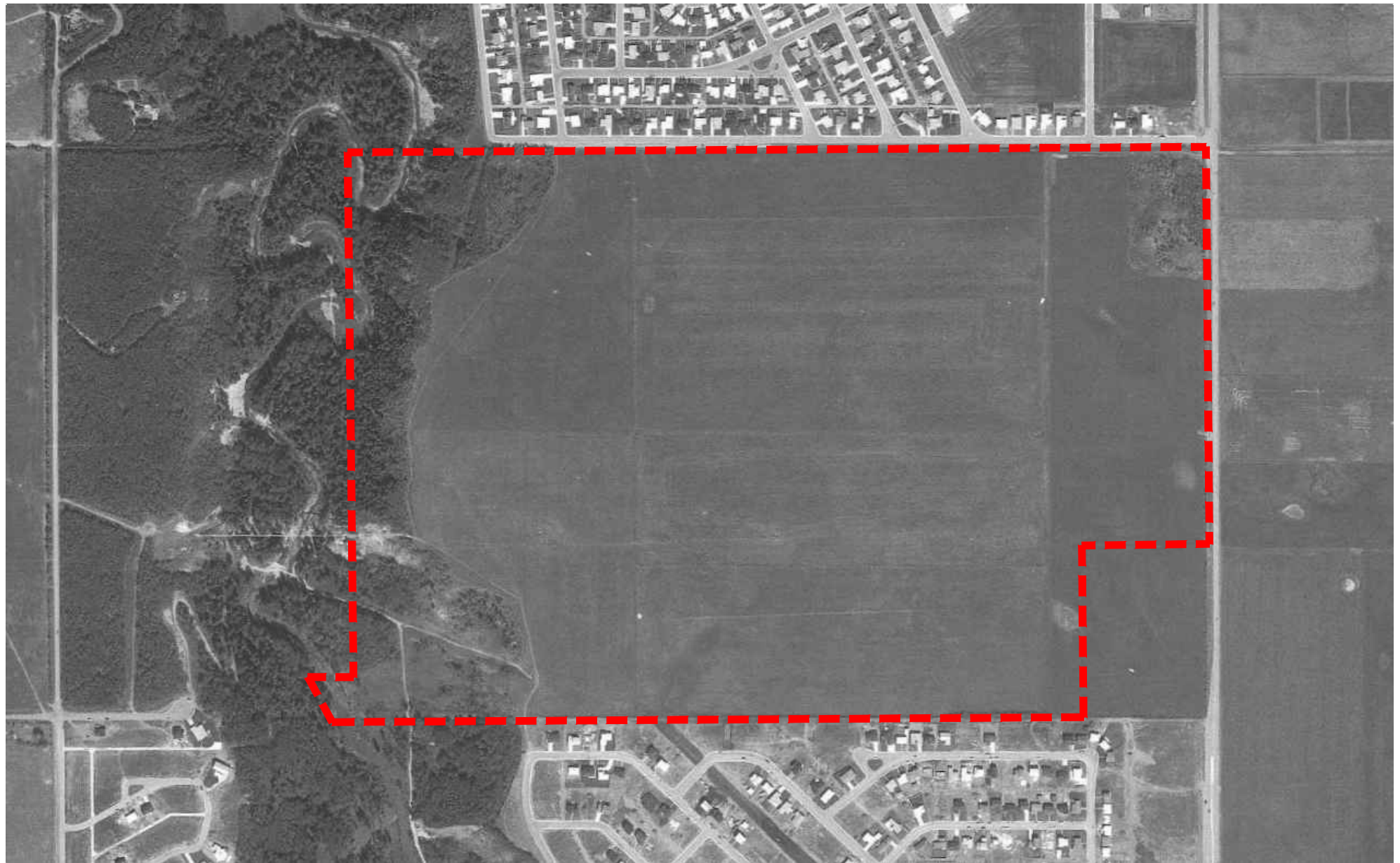
SITE AIR PHOTO - 1962

FILE NO.

02-3637

DWG. NO.

C-3

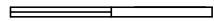


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1967)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1967

FILE NO.

02-3637

DWG. NO.

C-4

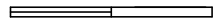


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1969)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1969

FILE NO.

02-3637

DWG. NO.

C-5

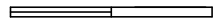


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1973)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
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TITLE

SITE AIR PHOTO - 1973

FILE NO.

02-3637

DWG. NO.

C-6

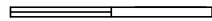


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1974)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



CT & ASSOCIATES ENGINEERING INC.

CLIENT

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AND SLOPE STABILITY EVALUATION
'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

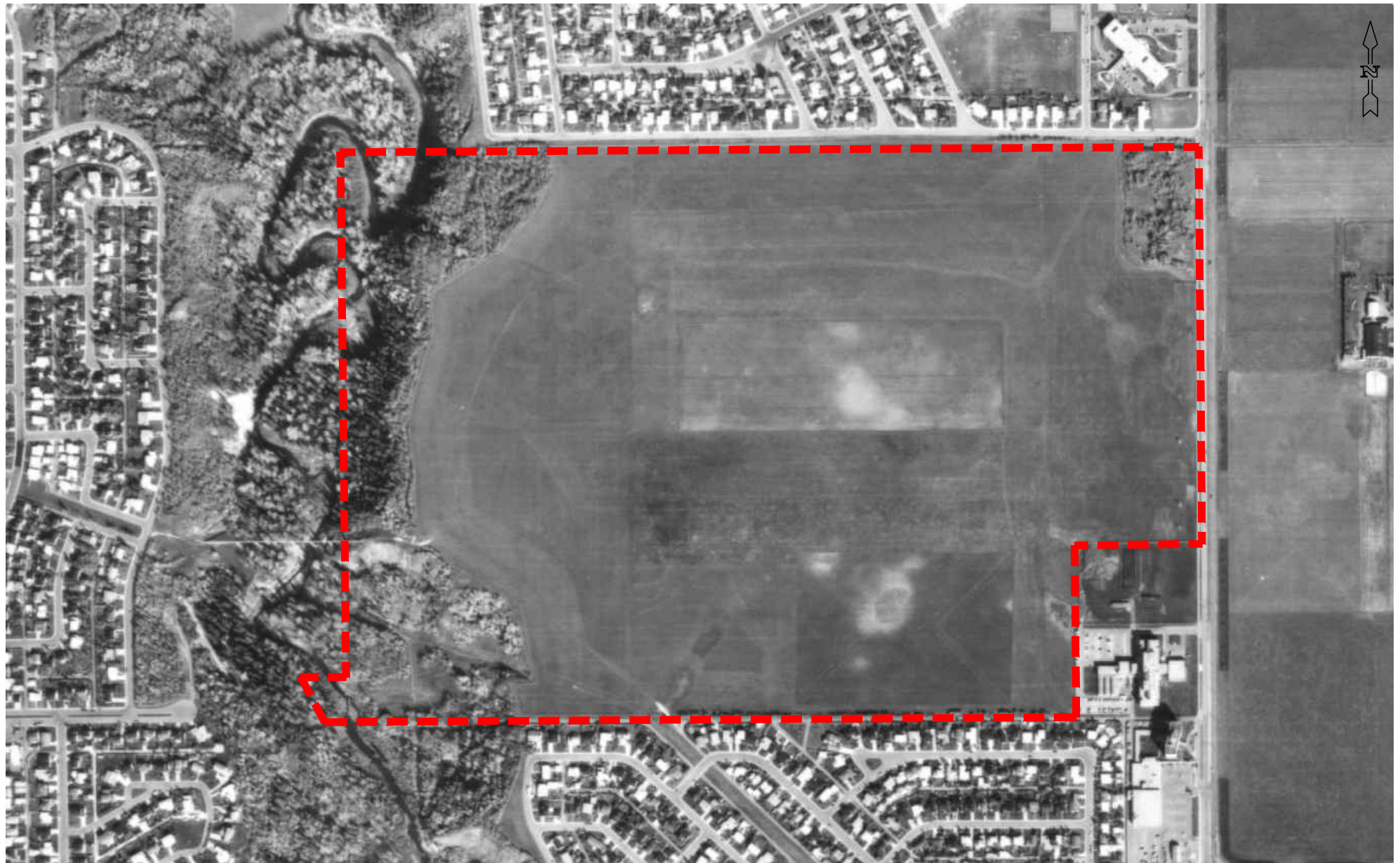
SITE AIR PHOTO - 1974

FILE NO.

02-3637

DWG. NO.

C-7

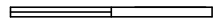


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1976)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



CT & ASSOCIATES ENGINEERING INC.

CLIENT

UNIVERSITY OF ALBERTA PROPERTIES TRUST (UAPT)

DATE

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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1976

FILE NO.

02-3637

DWG. NO.

C-8

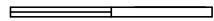


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1980)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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CLIENT

UNIVERSITY OF ALBERTA PROPERTIES TRUST (UAPT)

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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1980

FILE NO.

02-3637

DWG. NO.

C-9

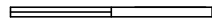


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1982)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1982

FILE NO.

02-3637

DWG. NO.

C-10



NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1986)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1986

FILE NO.

02-3637

DWG. NO.

C-11

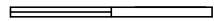


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1987)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1987

FILE NO.

02-3637

DWG. NO.

C-12

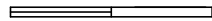


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1990)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1990

FILE NO.

02-3637

DWG. NO.

C-13

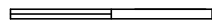


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (1993)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 1993

FILE NO.

02-3637

DWG. NO.

C-14

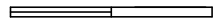


NOTE: BASED ON PROVINCE OF ALBERTA ARCHIVE
AIR PHOTO (2001)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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GEOTECHNICAL INVESTIGATION
AND SLOPE STABILITY EVALUATION
'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

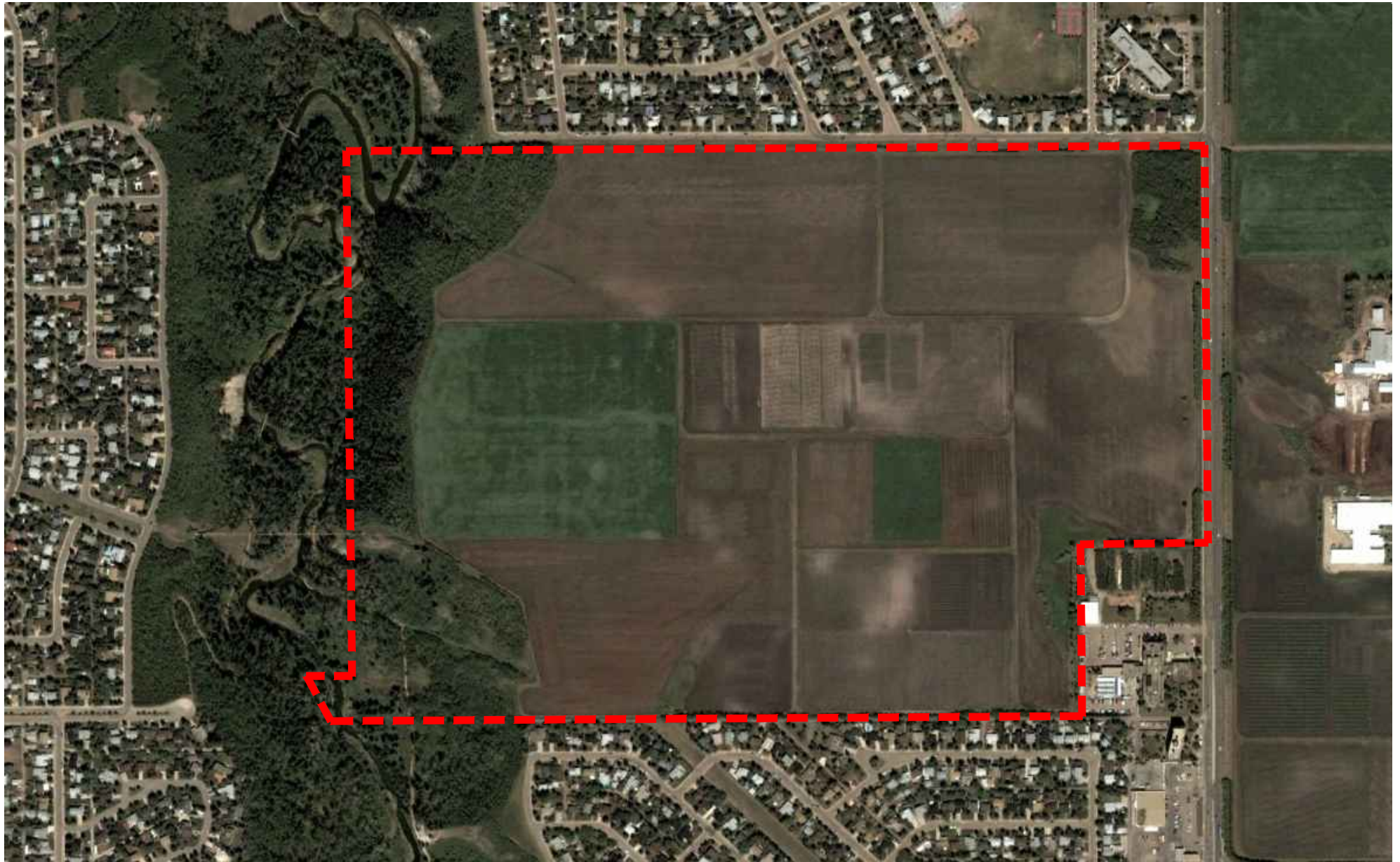
SITE AIR PHOTO - 2001

FILE NO.

02-3637

DWG. NO.

C-15

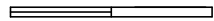


NOTE: BASED ON GOOGLE EARTH
AIR PHOTO (2004)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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CLIENT

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DATE

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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 2004

FILE NO.

02-3637

DWG. NO.

C-16

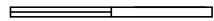


NOTE: BASED ON GOOGLE EARTH
AIR PHOTO (2008)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

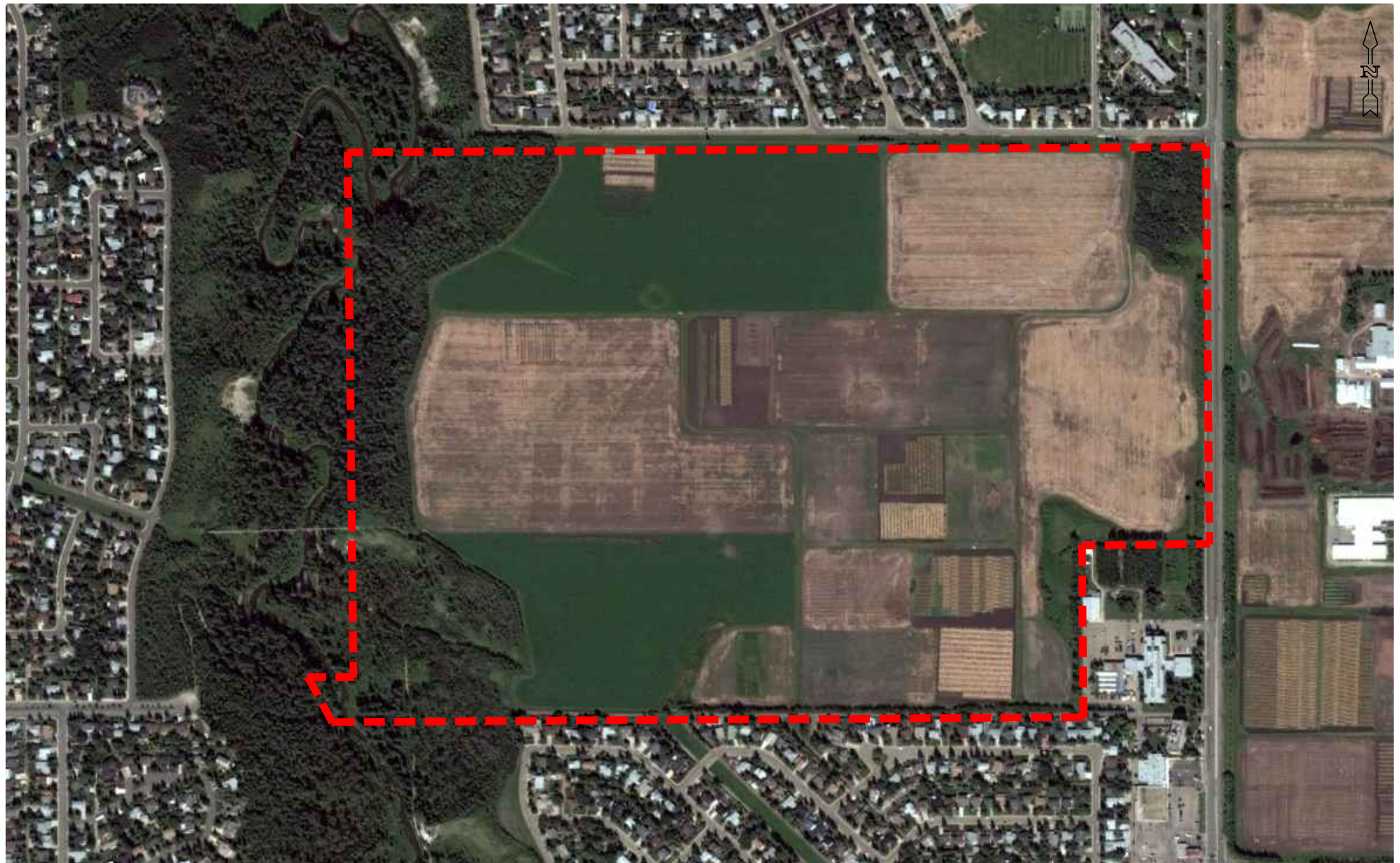
SITE AIR PHOTO - 2008

FILE NO.

02-3637

DWG. NO.

C-17

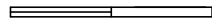


NOTE: BASED ON GOOGLE EARTH
AIR PHOTO (2012)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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CLIENT

UNIVERSITY OF ALBERTA PROPERTIES TRUST (UAPT)

DATE

FEB. 5, 2024

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PROJECT

GEOTECHNICAL INVESTIGATION
AND SLOPE STABILITY EVALUATION
'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

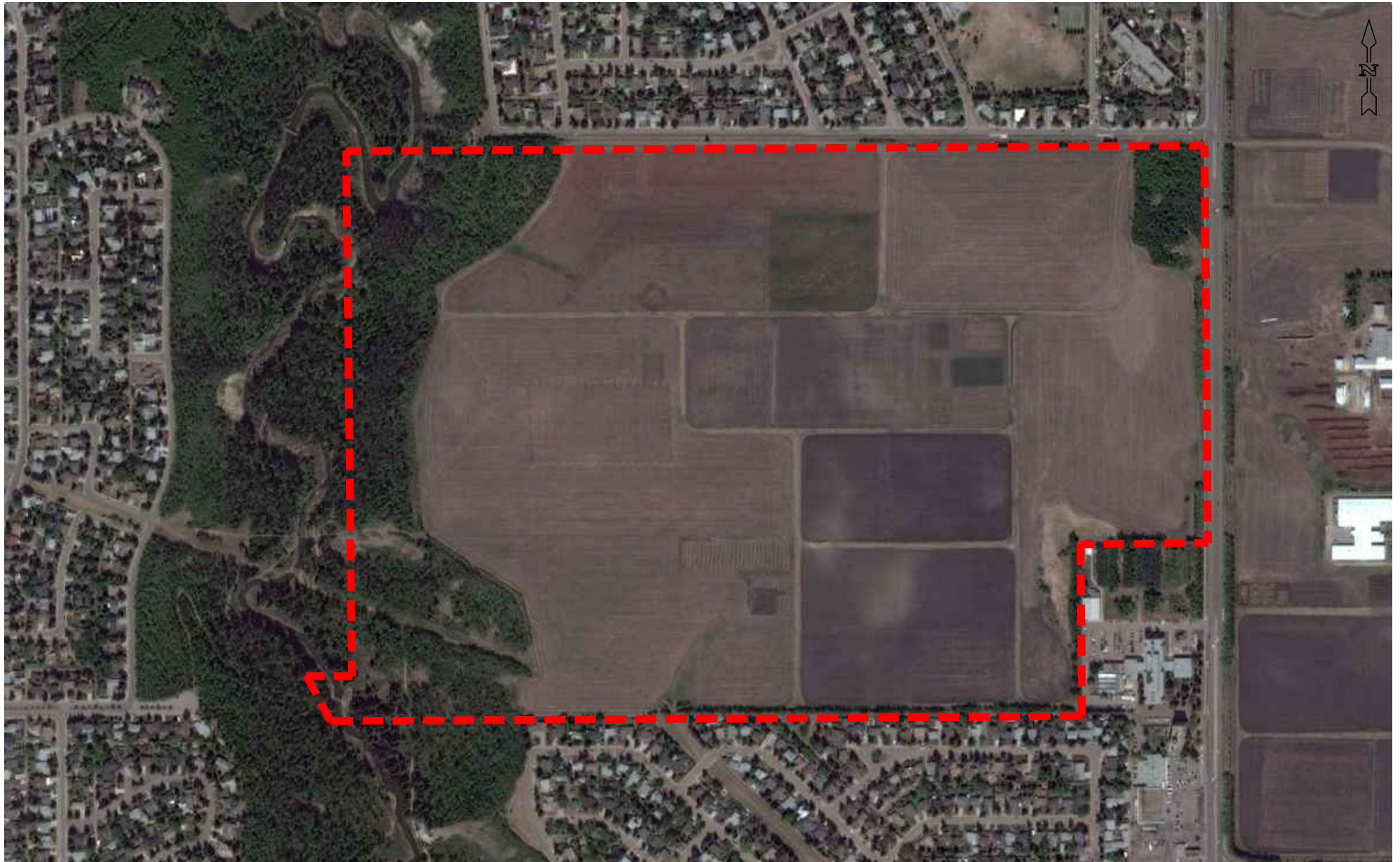
SITE AIR PHOTO - 2012

FILE NO.

02-3637

DWG. NO.

C-18

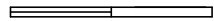


NOTE: BASED ON GOOGLE EARTH
AIR PHOTO (2016)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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GEOTECHNICAL INVESTIGATION
AND SLOPE STABILITY EVALUATION
'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

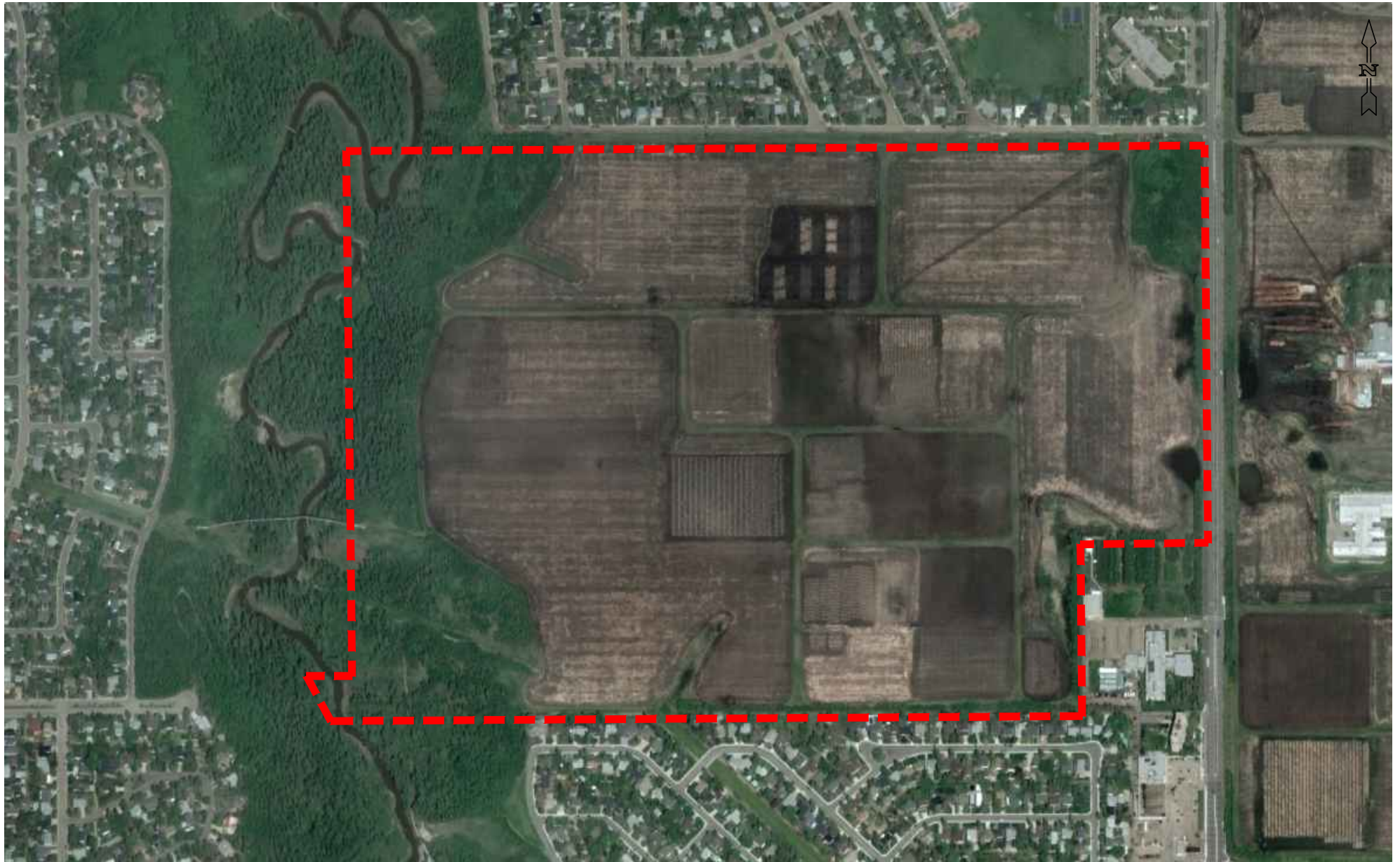
SITE AIR PHOTO - 2016

FILE NO.

02-3637

DWG. NO.

C-19

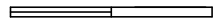


NOTE: BASED ON GOOGLE EARTH
AIR PHOTO (2020)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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GEOTECHNICAL INVESTIGATION
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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

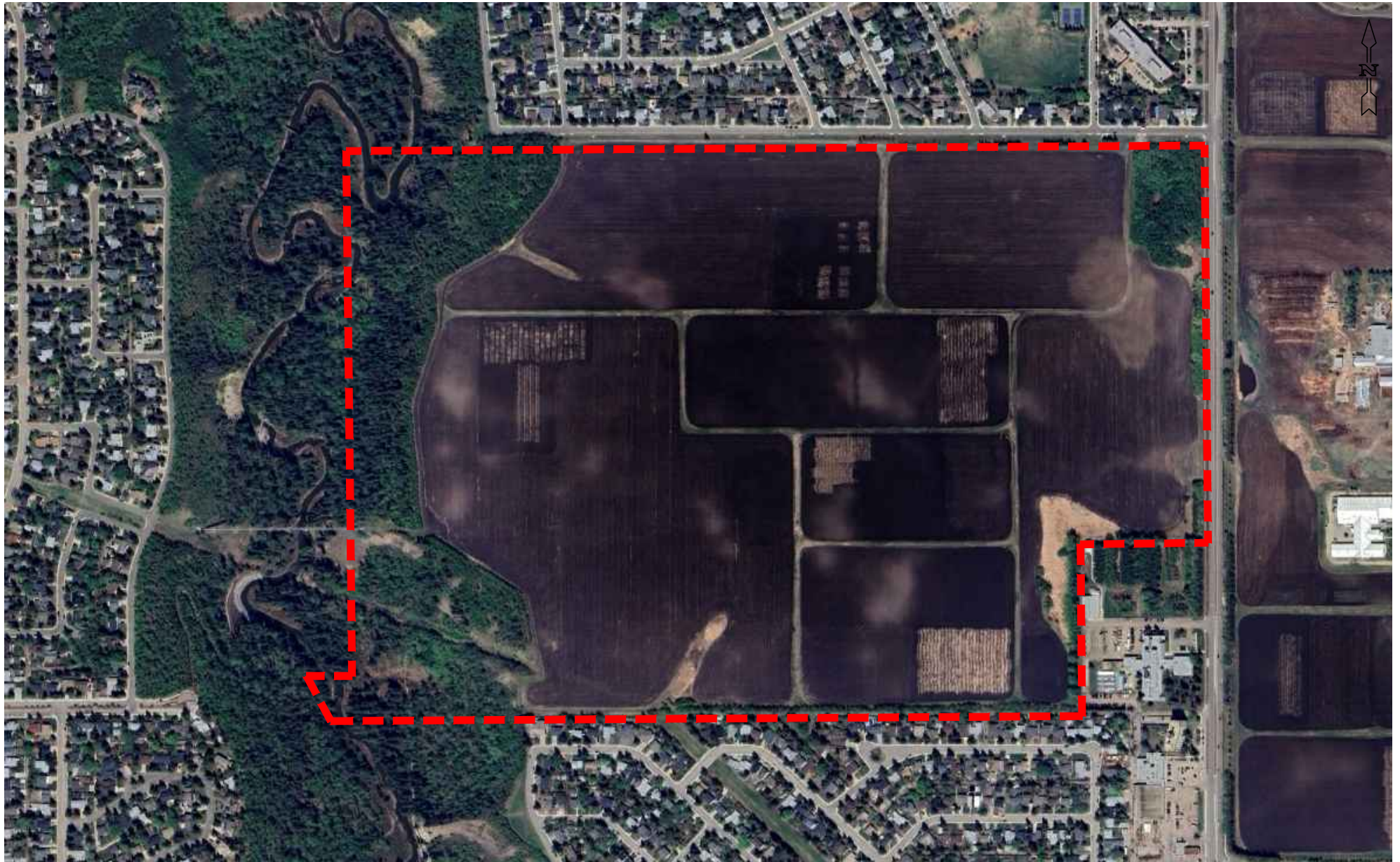
SITE AIR PHOTO - 2020

FILE NO.

02-3637

DWG. NO.

C-20

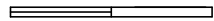


NOTE: BASED ON GOOGLE EARTH
AIR PHOTO (2023)

LEGEND: --- SUBJECT SITE

APPROXIMATE SCALE (meters)

0 100 200



1 : 7 500

SCALE ONLY VALID ON 8 1/2" x 11" PAPER



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'WEST 240' LANDS
EDMONTON, ALBERTA

TITLE

SITE AIR PHOTO - 2023

FILE NO.

02-3637

DWG. NO.

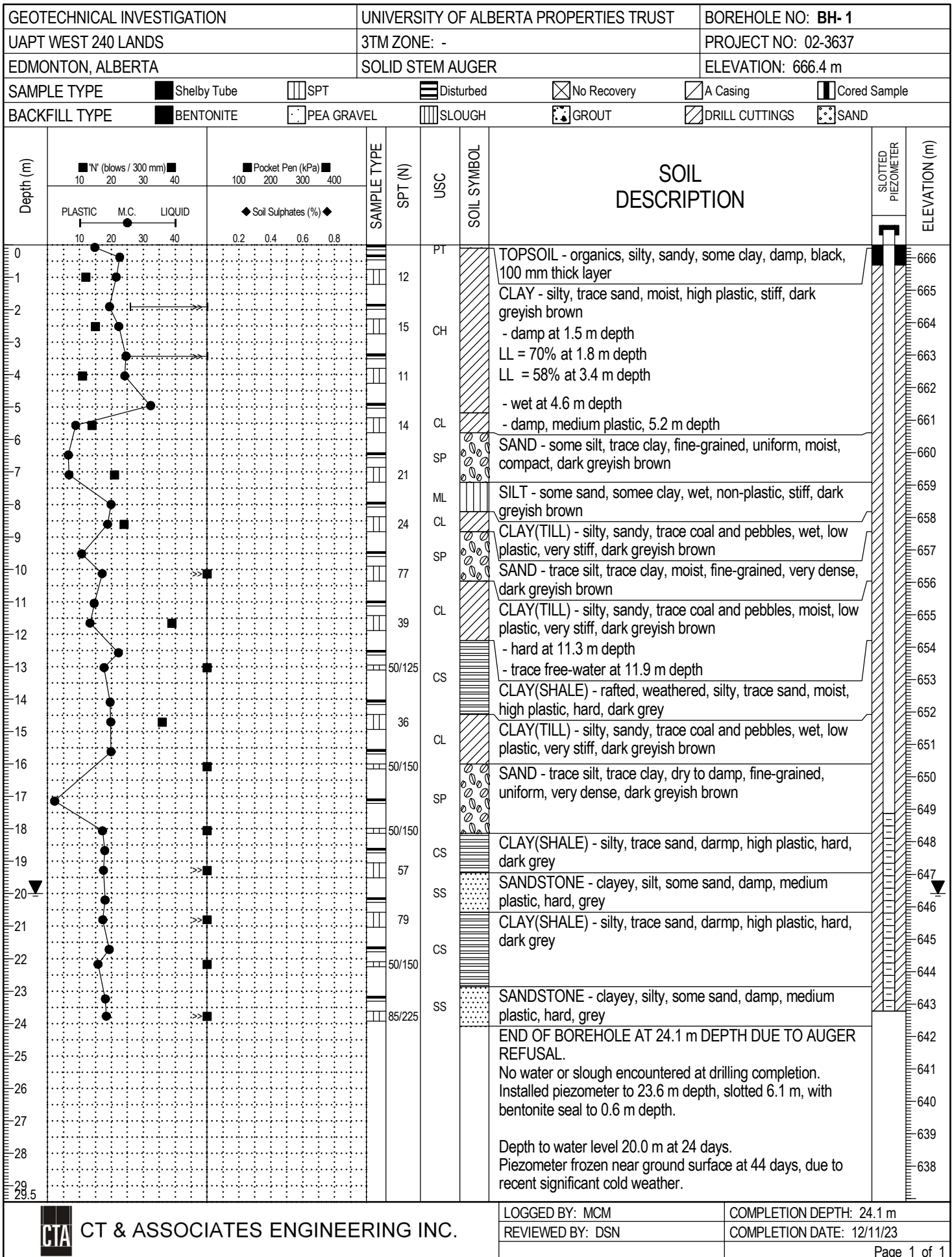
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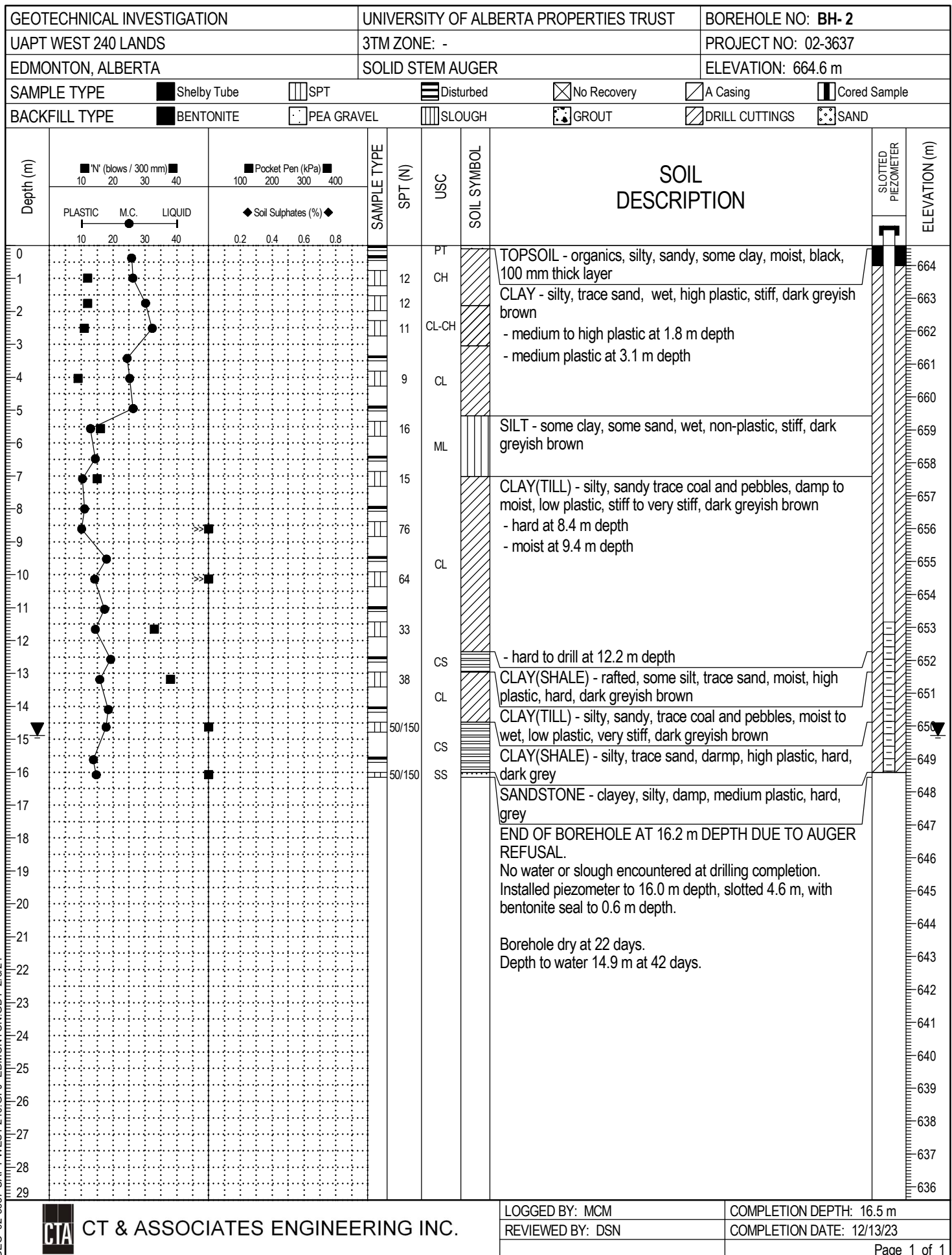


CT & Associates Engineering Inc.

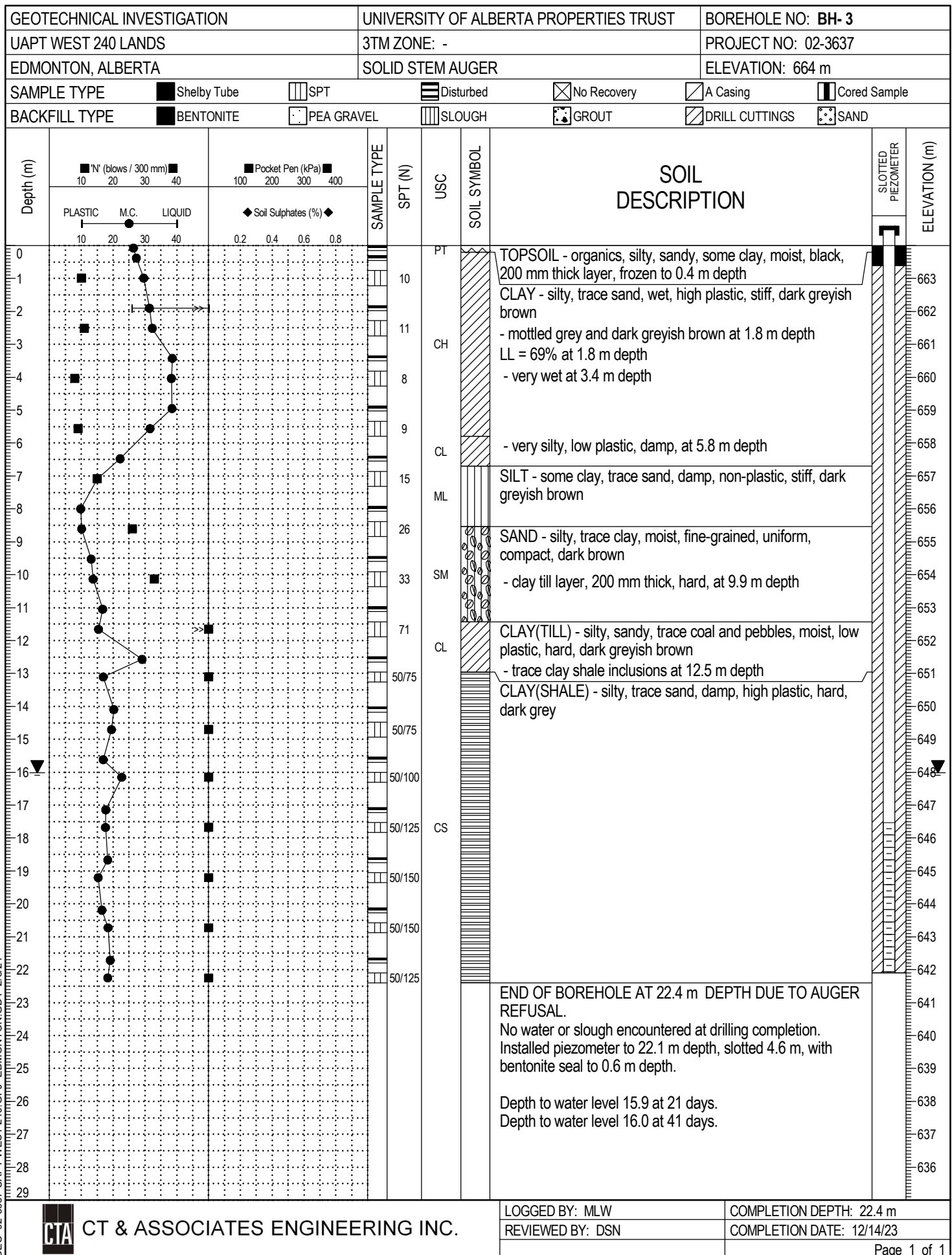
APPENDIX D

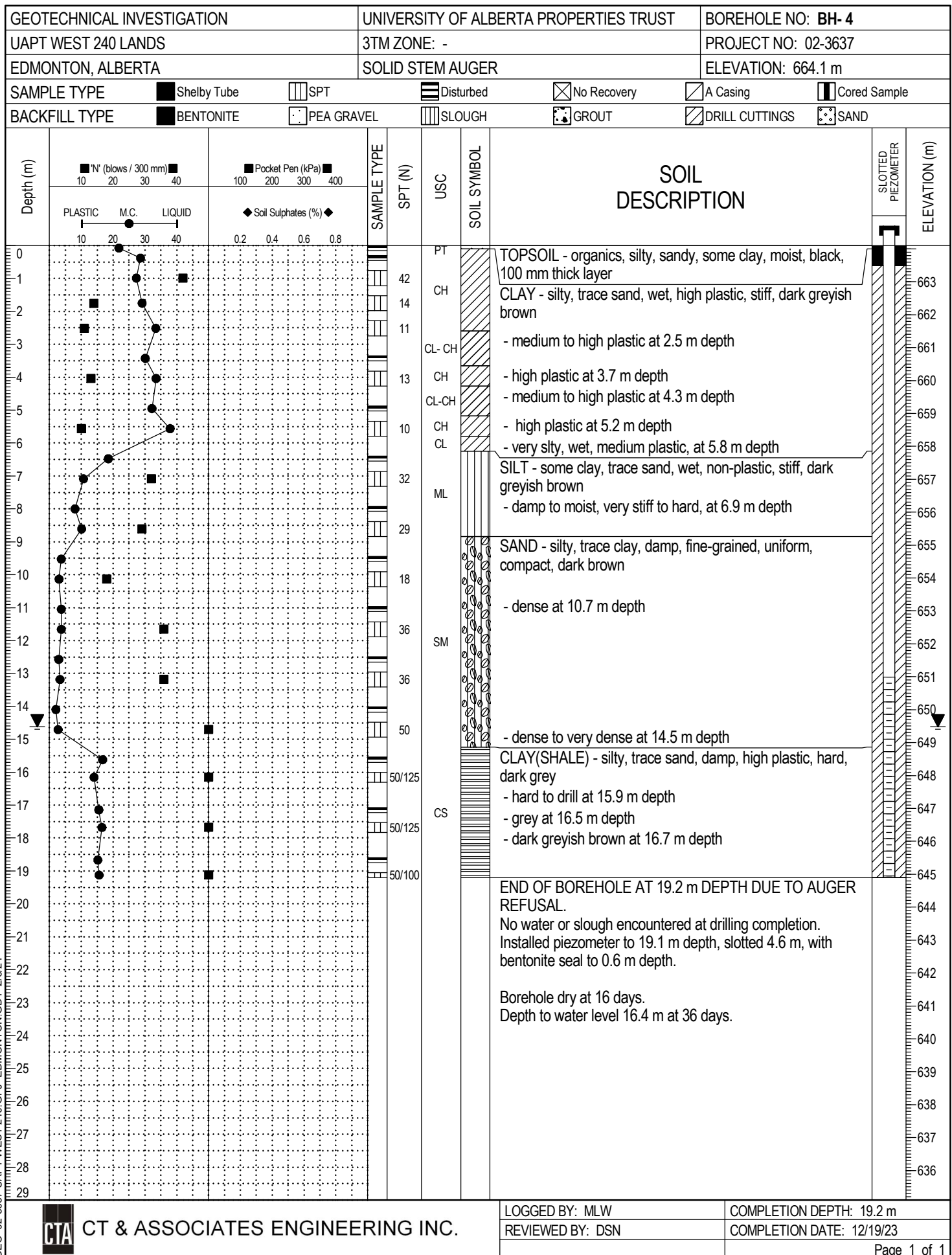
BOREHOLE LOGS

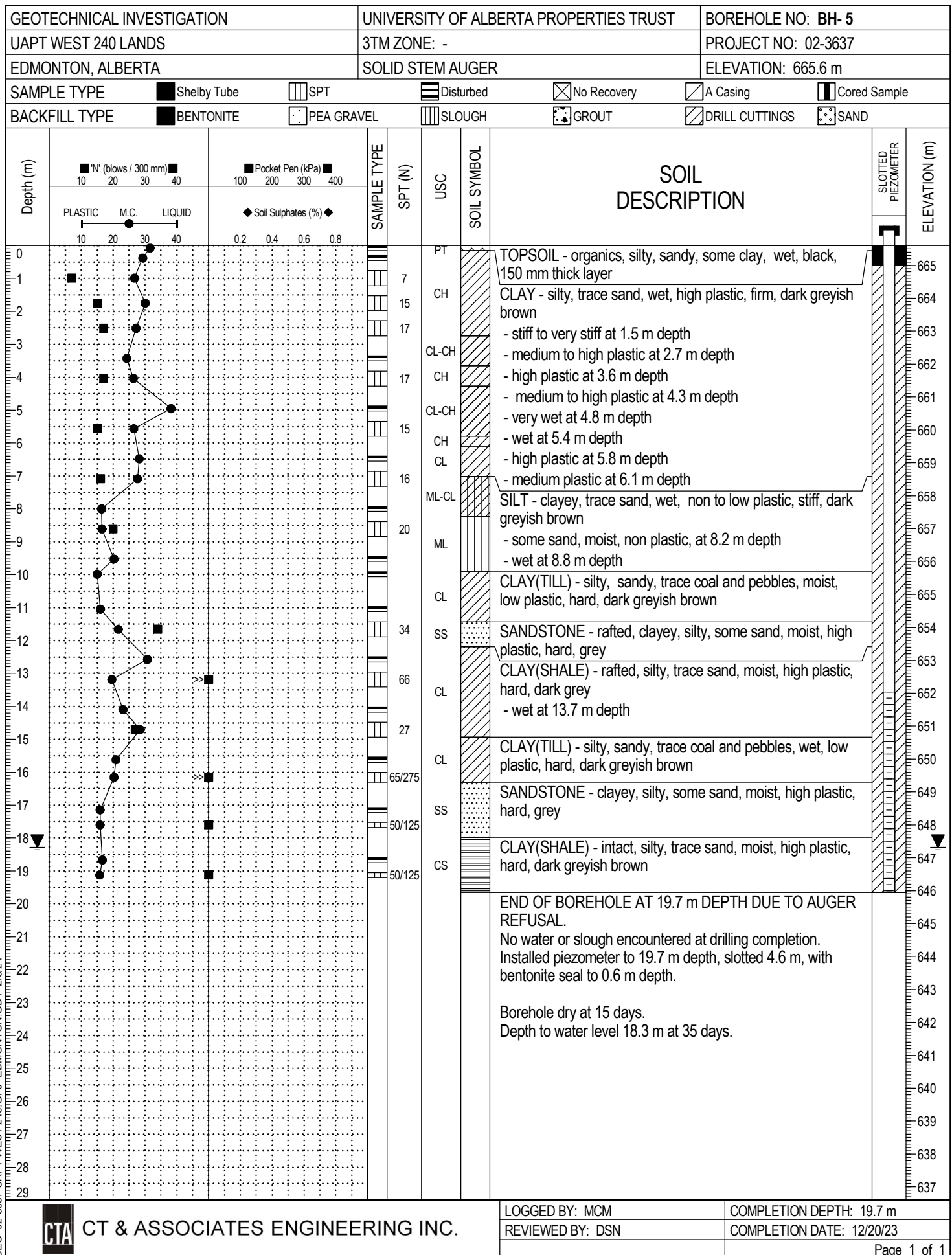


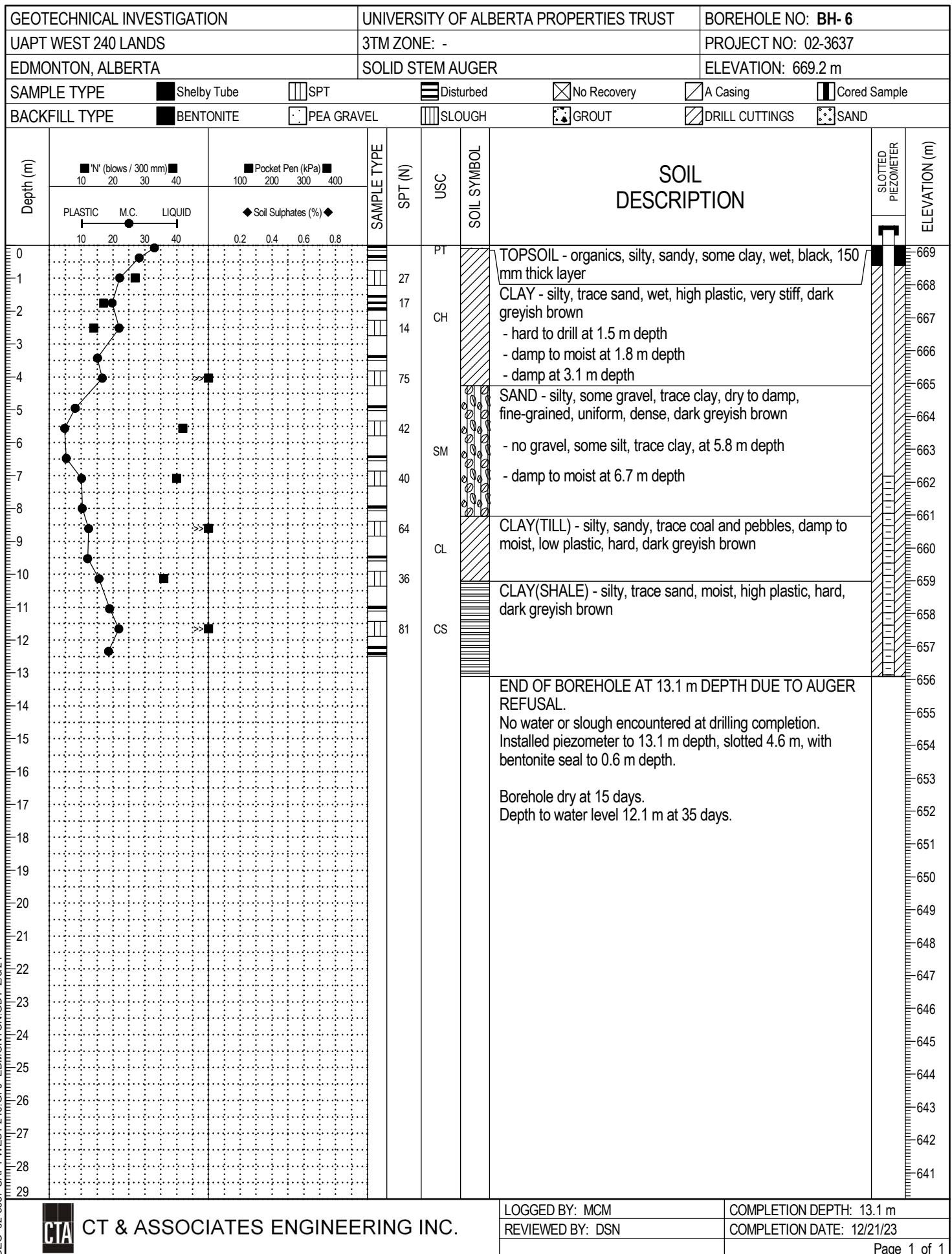


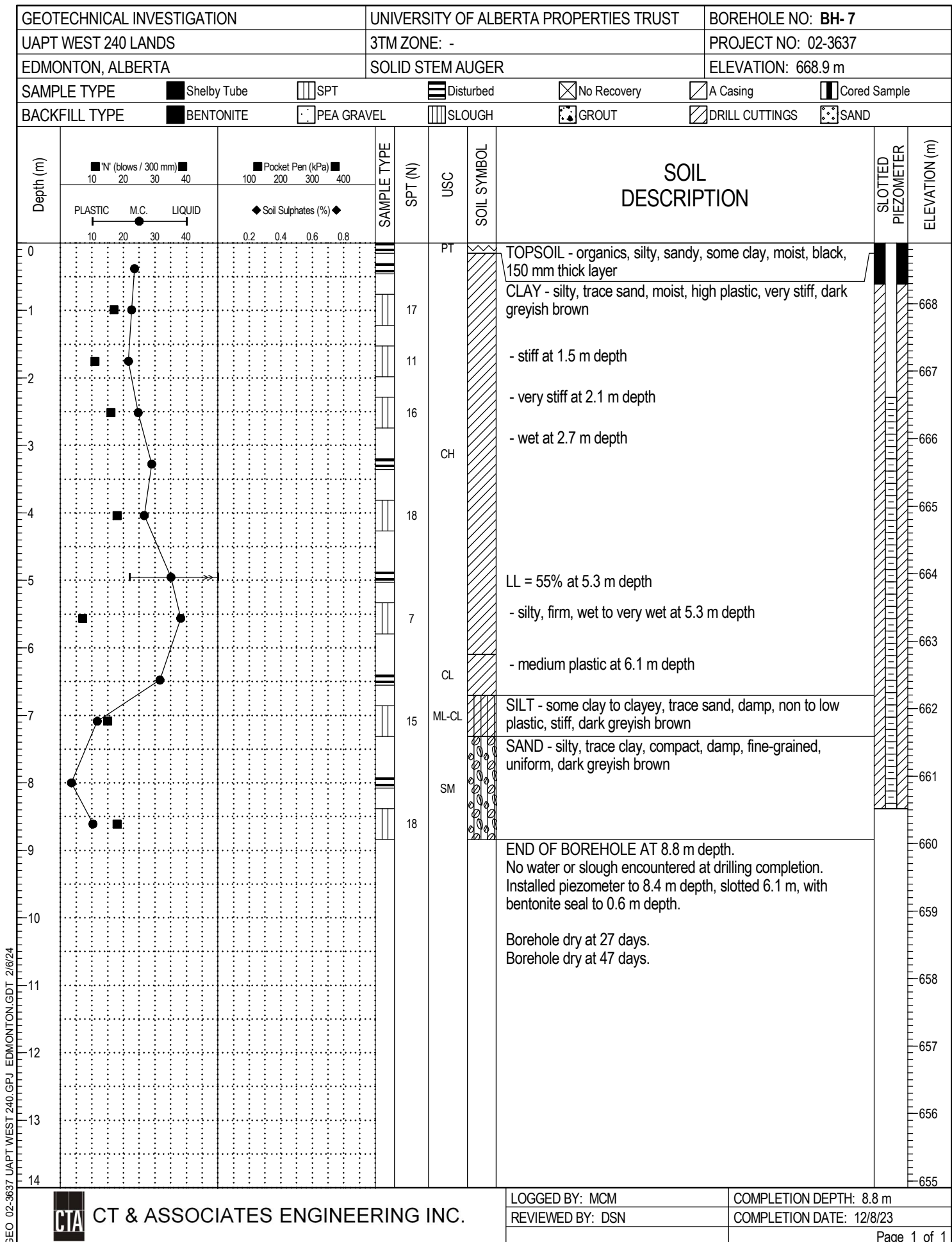
GEO 02-3637 UAPT WEST 240.GPJ EDMONTON.GDT 2/6/24

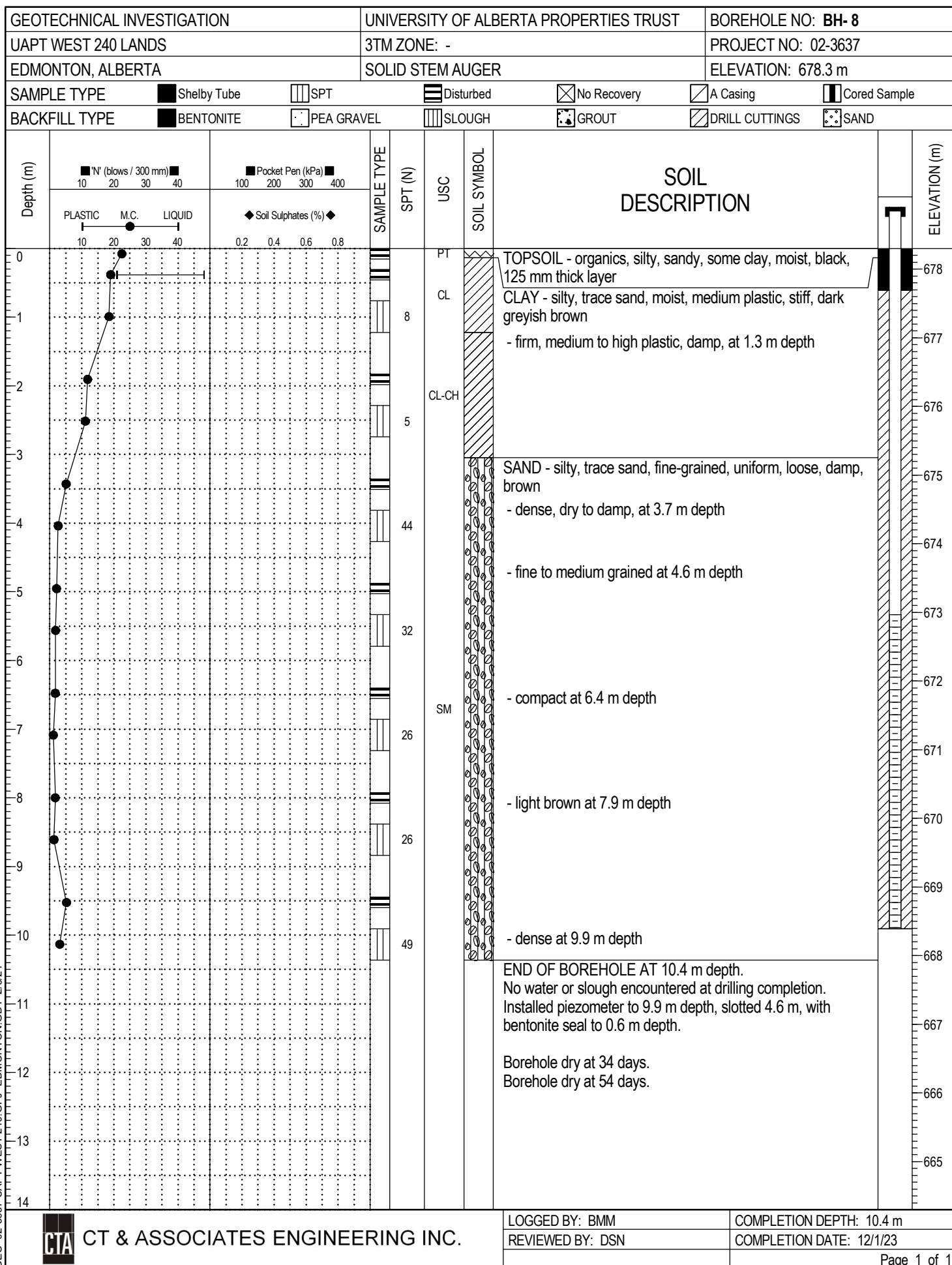












CT & ASSOCIATES ENGINEERING INC.

LOGGED BY: BMM

REVIEWED BY: DSN

COMPLETION DEPTH: 10.4 m

COMPLETION DATE: 12/1/23

GEOTECHNICAL INVESTIGATION		UNIVERSITY OF ALBERTA PROPERTIES TRUST		BOREHOLE NO: BH- 9	
UAPT WEST 240 LANDS		3TM ZONE: -		PROJECT NO: 02-3637	
EDMONTON, ALBERTA		SOLID STEM AUGER		ELEVATION: 670.4 m	
SAMPLE TYPE		☒ Shelby Tube ☐ SPT ☐ Disturbed ☐ No Recovery ☐ A Casing ☐ Cored Sample			
BACKFILL TYPE		☒ BENTONITE ☐ PEA GRAVEL ☐ SLOUGH ☐ GROUT ☐ DRILL CUTTINGS ☐ SAND			

Depth (m)	☒ N' (blows / 300 mm) ☒ 40 10 20 30 40		☒ Pocket Pen (kPa) ☒ 400 100 200 300 400		SAMPLE TYPE	SPT (N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION (m)
	PLASTIC M.C. LIQUID 10 20 30 40		☒ Soil Sulphates (%) ☒ 0.8 0.2 0.4 0.6 0.8							
0									TOPSOIL - organics, silty, sandy, some clay, moist, black, 125 mm thick layer	670
1						19			CLAY - silty, trace sand, moist to wet, high plastic, stiff, dark greyish brown	669
2						16			- medium to high plastic, very stiff, at 1.0 m depth	668
3						13			- trace gypsum inclusions, wet, at 1.2 m depth	667
4						14			- stiff at 3.2 m depth	666
5						13			- trace iron oxides inclusions at 4.0 m depth	665
6						13			- some sand, medium plastic, moist, at 4.9 m depth	664
7						24			- high plastic, wet, at 5.2 m depth	663
8						33			- some sand, medium plastic, moist to wet, at 6.1 m depth	662
9									SAND - silty, trace sand, damp, fine-grained, uniform, compact, brown	661
10									END OF BOREHOLE AT 8.8 m depth.	660
11									No water or slough encountered at drilling completion.	659
12									Installed piezometer to 8.4 m depth, slotted 4.6 m, with bentonite seal to 0.6 m depth.	658
13									Borehole dry at 34 days.	657
14									Borehole dry at 54 days.	

CTA

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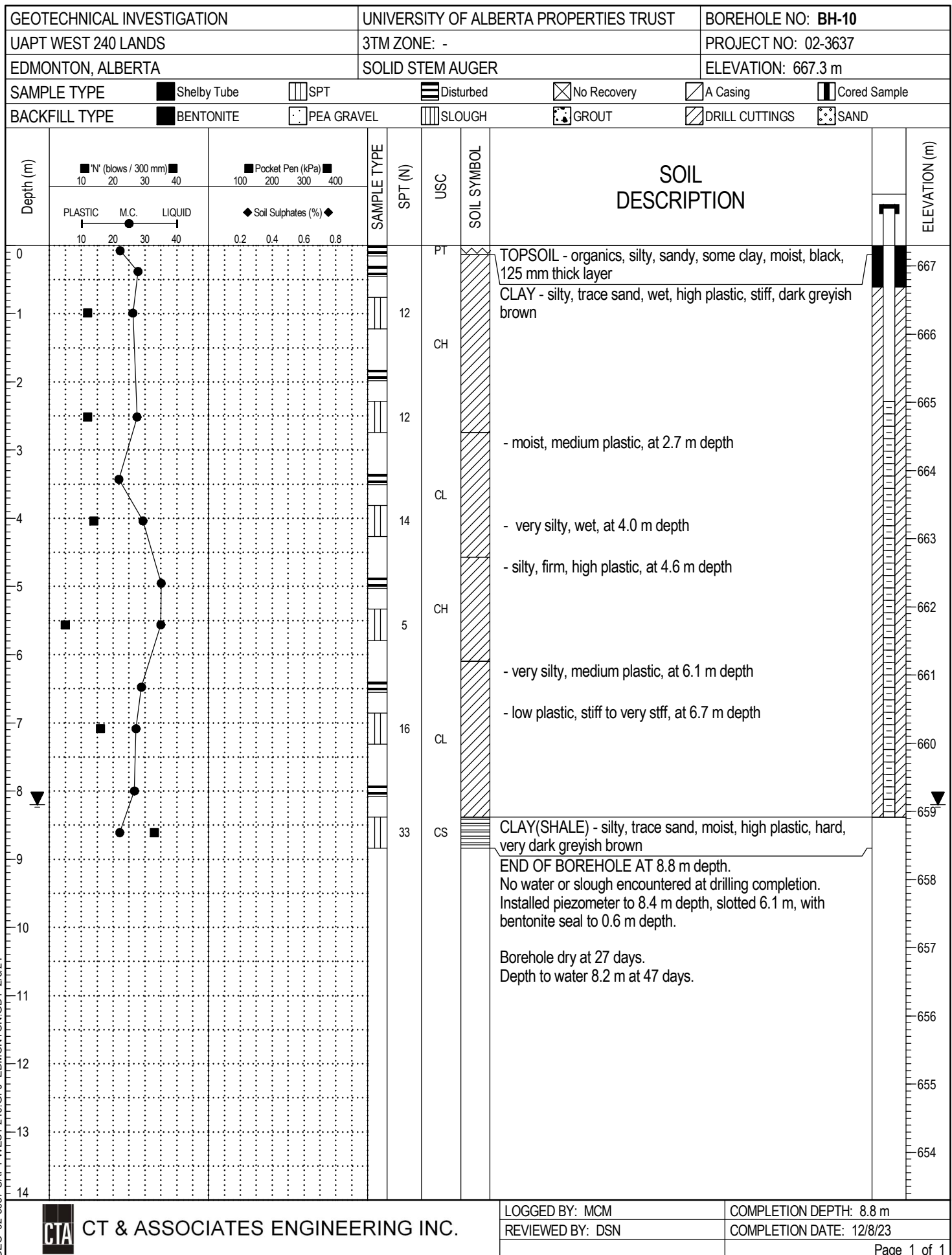
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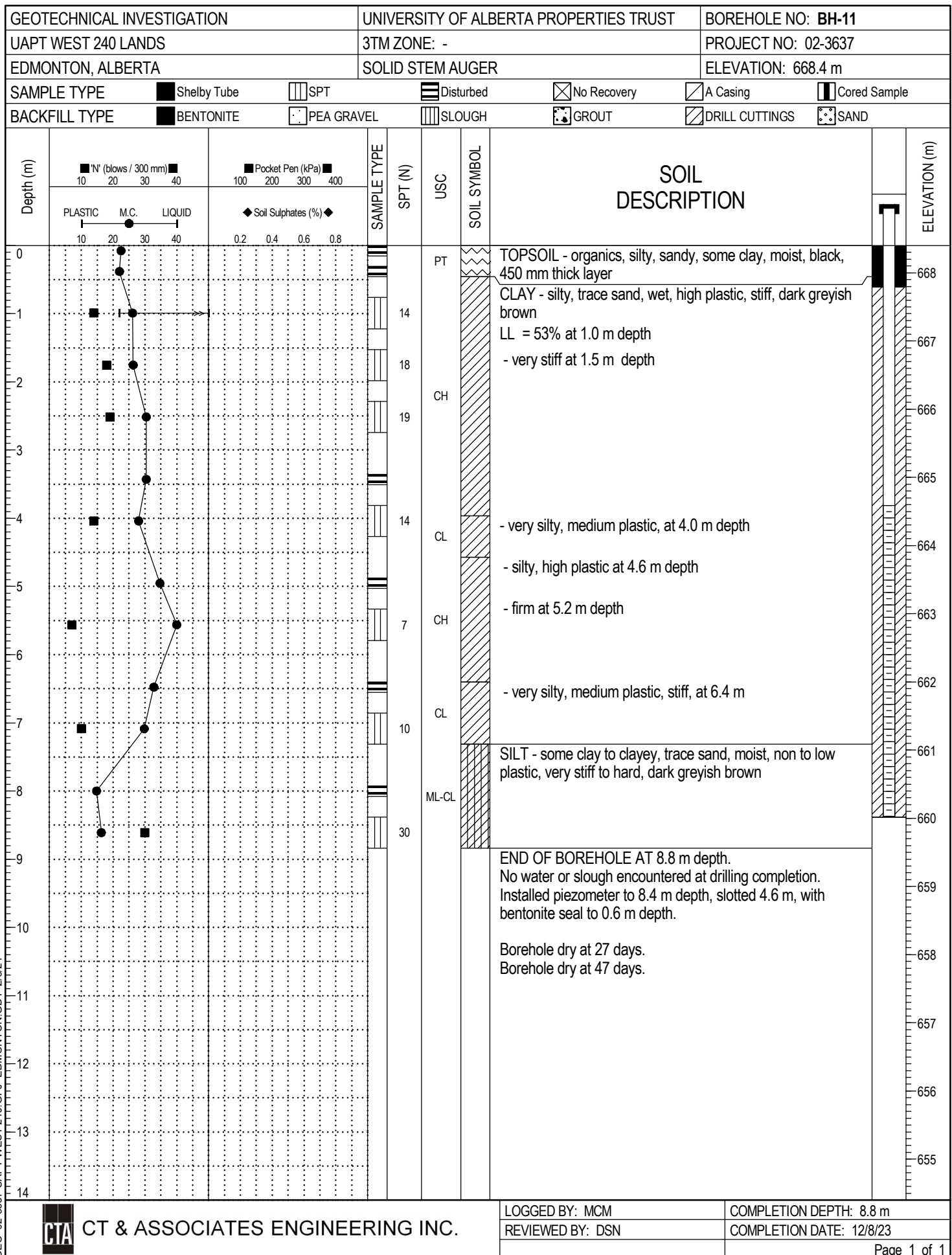
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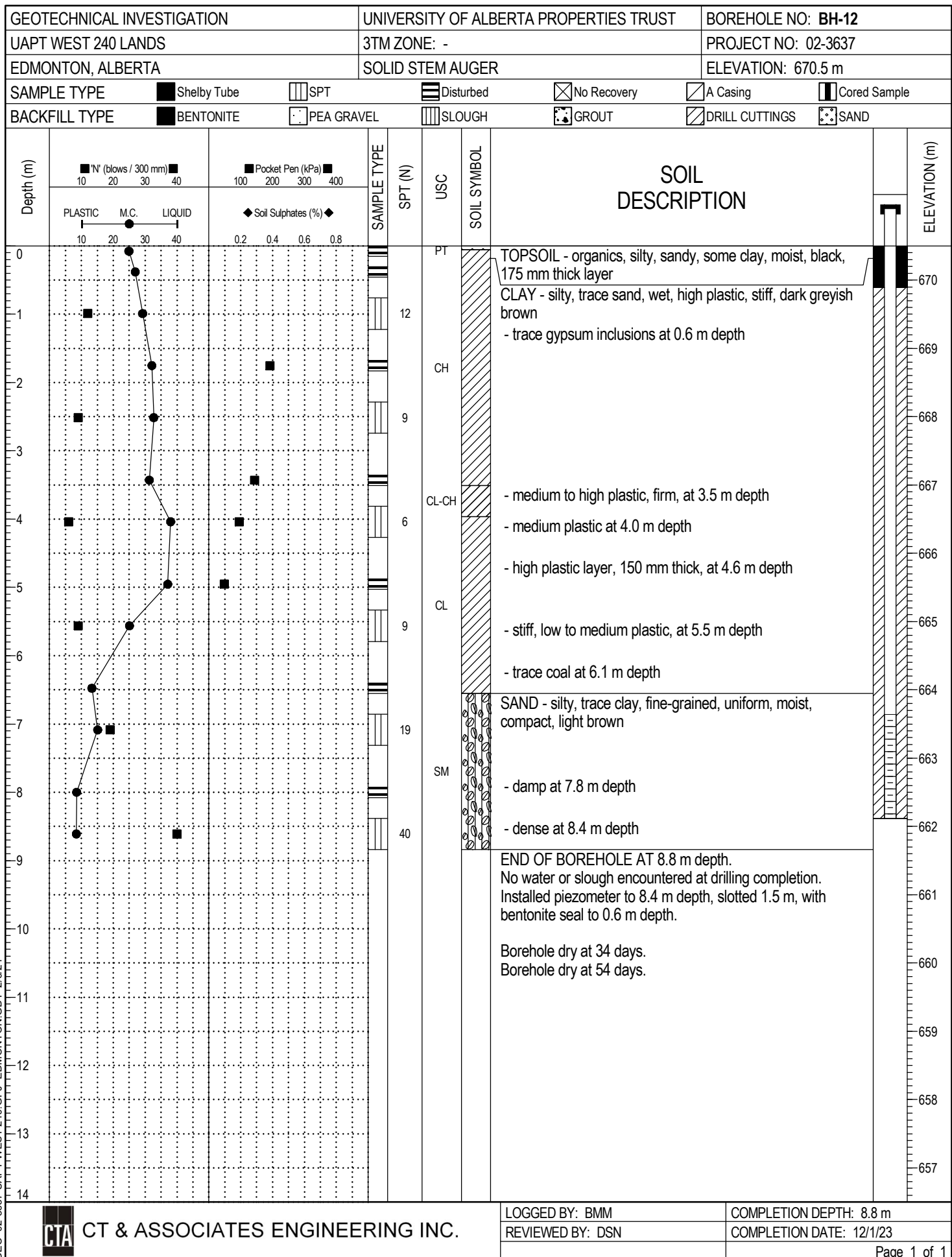
COMPLETION DEPTH: 8.8 m

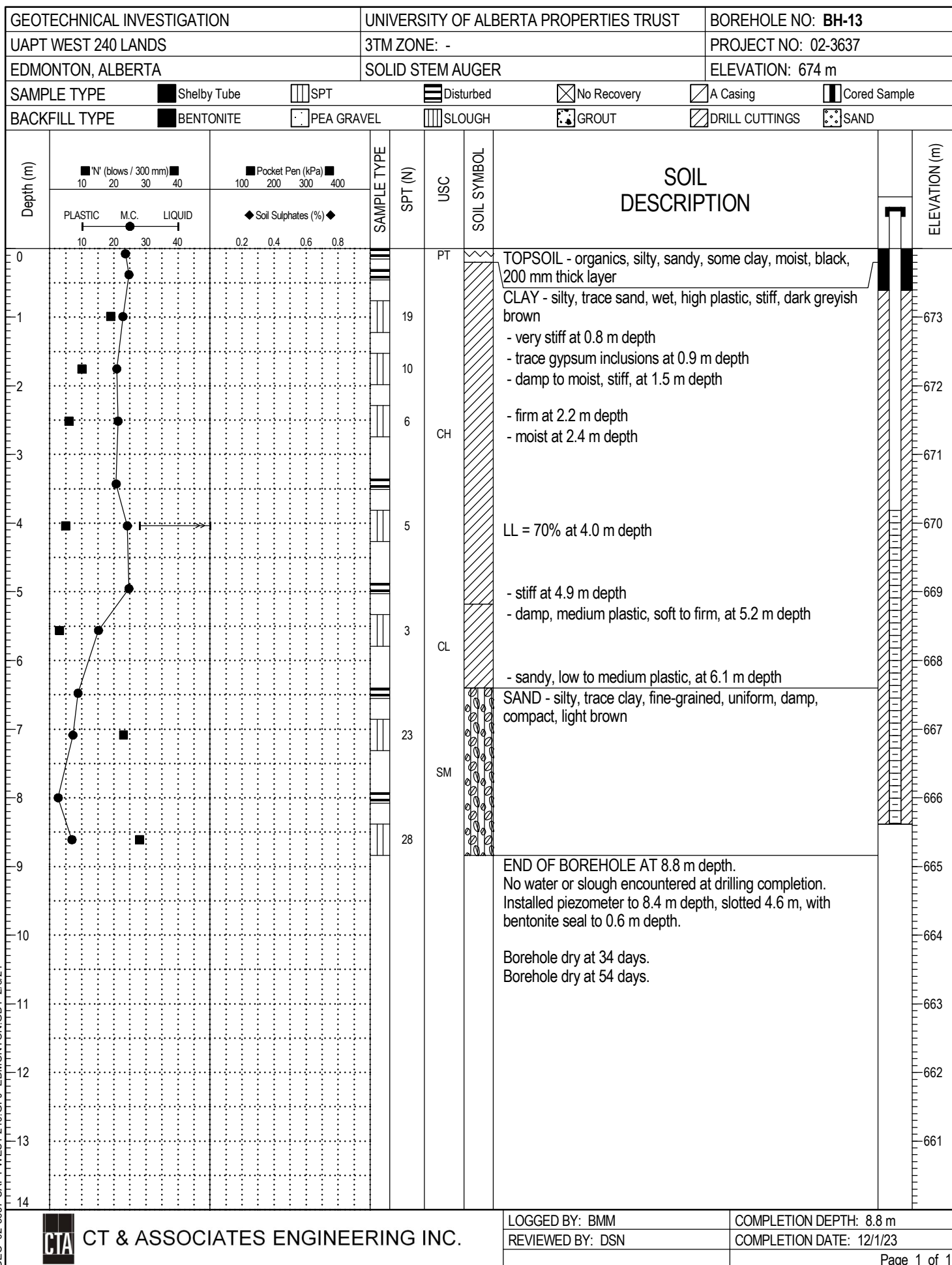
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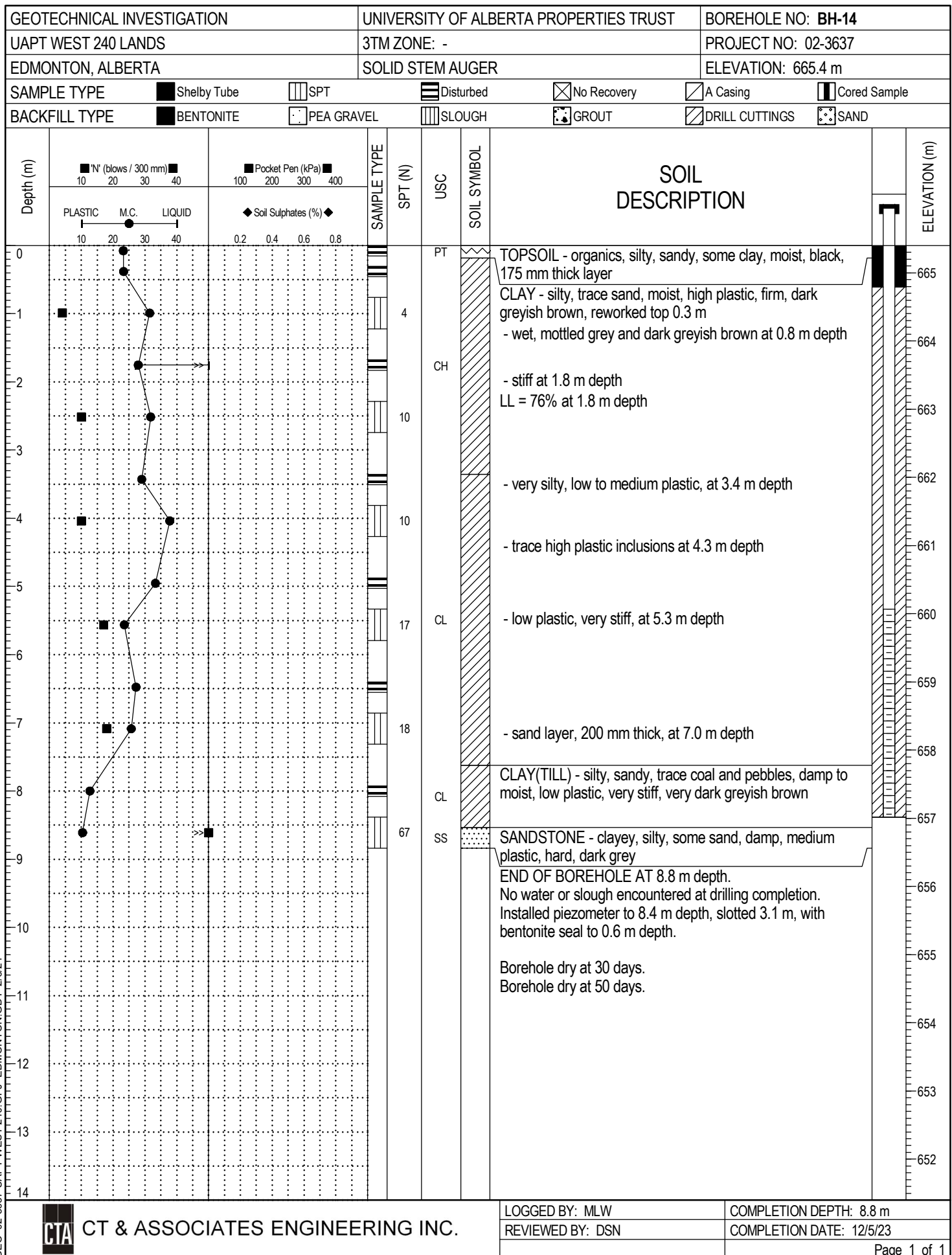
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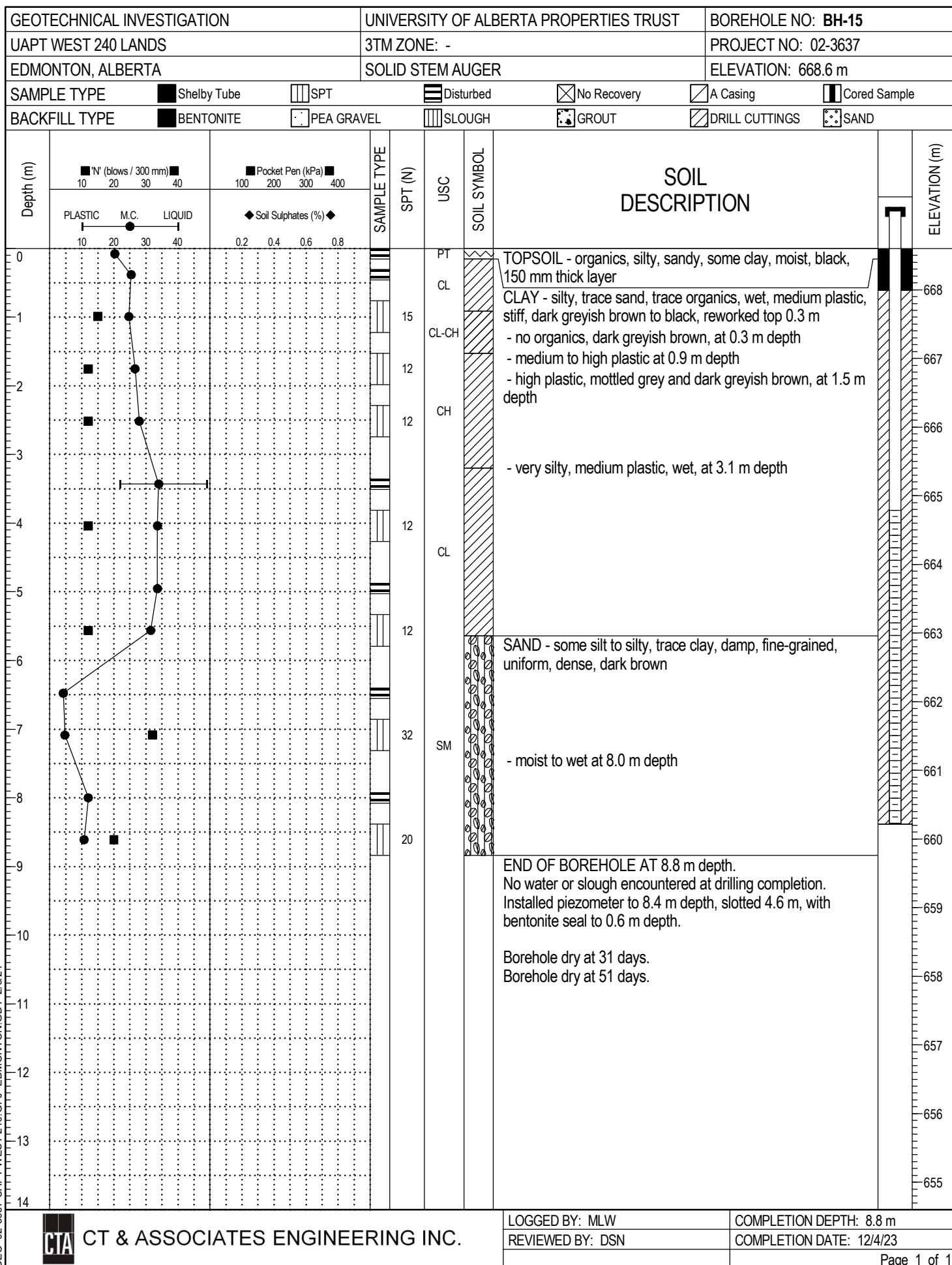












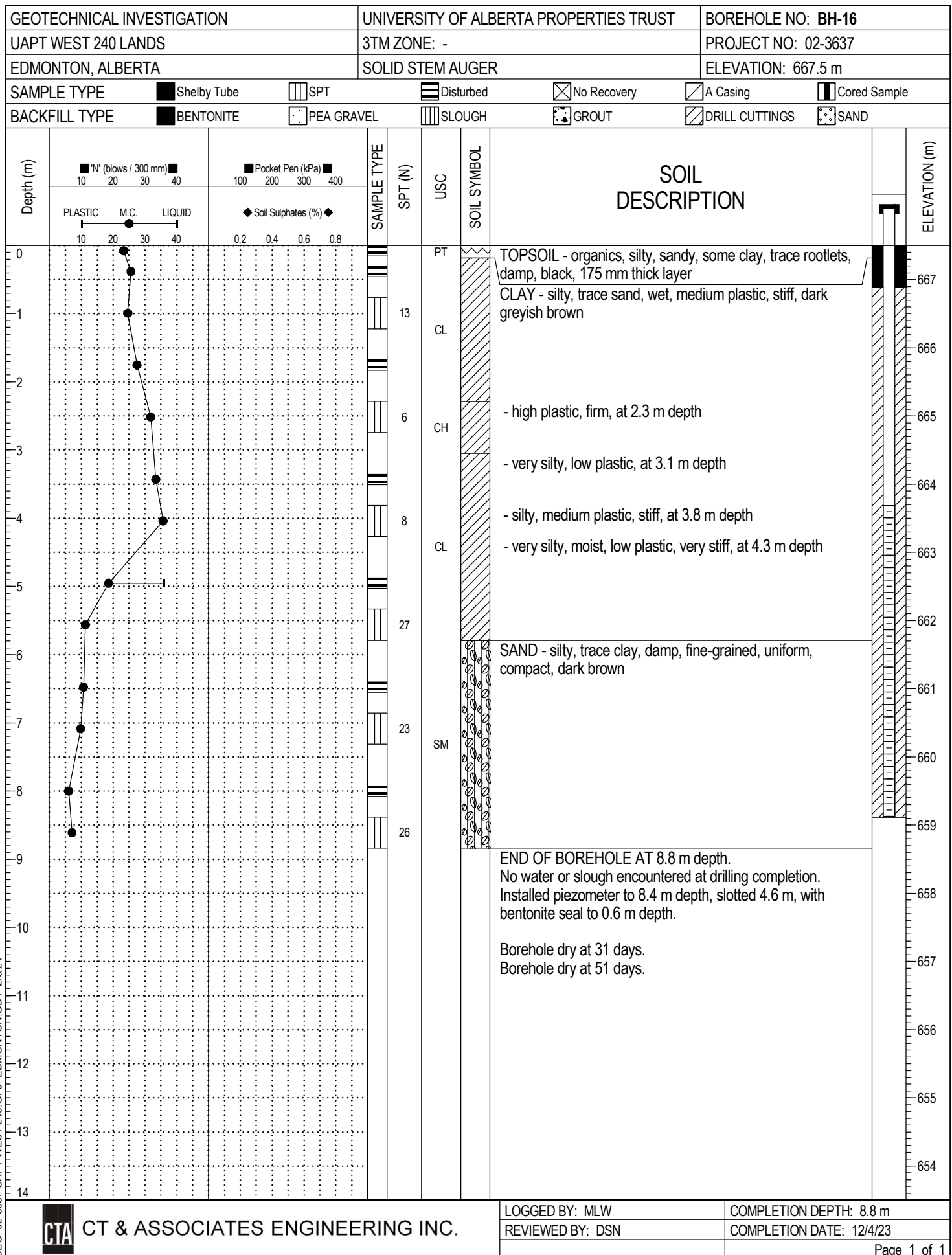
CT & ASSOCIATES ENGINEERING INC.

LOGGED BY: MLW

REVIEWED BY: DSN

COMPLETION DEPTH: 8.8 m

COMPLETION DATE: 12/4/23



GEOTECHNICAL INVESTIGATION		UNIVERSITY OF ALBERTA PROPERTIES TRUST		BOREHOLE NO: BH-17	
UAPT WEST 240 LANDS		3TM ZONE: -		PROJECT NO: 02-3637	
EDMONTON, ALBERTA		SOLID STEM AUGER		ELEVATION: 667 m	
SAMPLE TYPE	☒ Shelby Tube	☐ SPT	☐ Disturbed	☐ No Recovery	☐ A Casing
BACKFILL TYPE	☒ BENTONITE	☐ PEA GRAVEL	☐ SLOUGH	☐ GROUT	☐ DRILL CUTTINGS
	☐ Cored Sample				☐ SAND

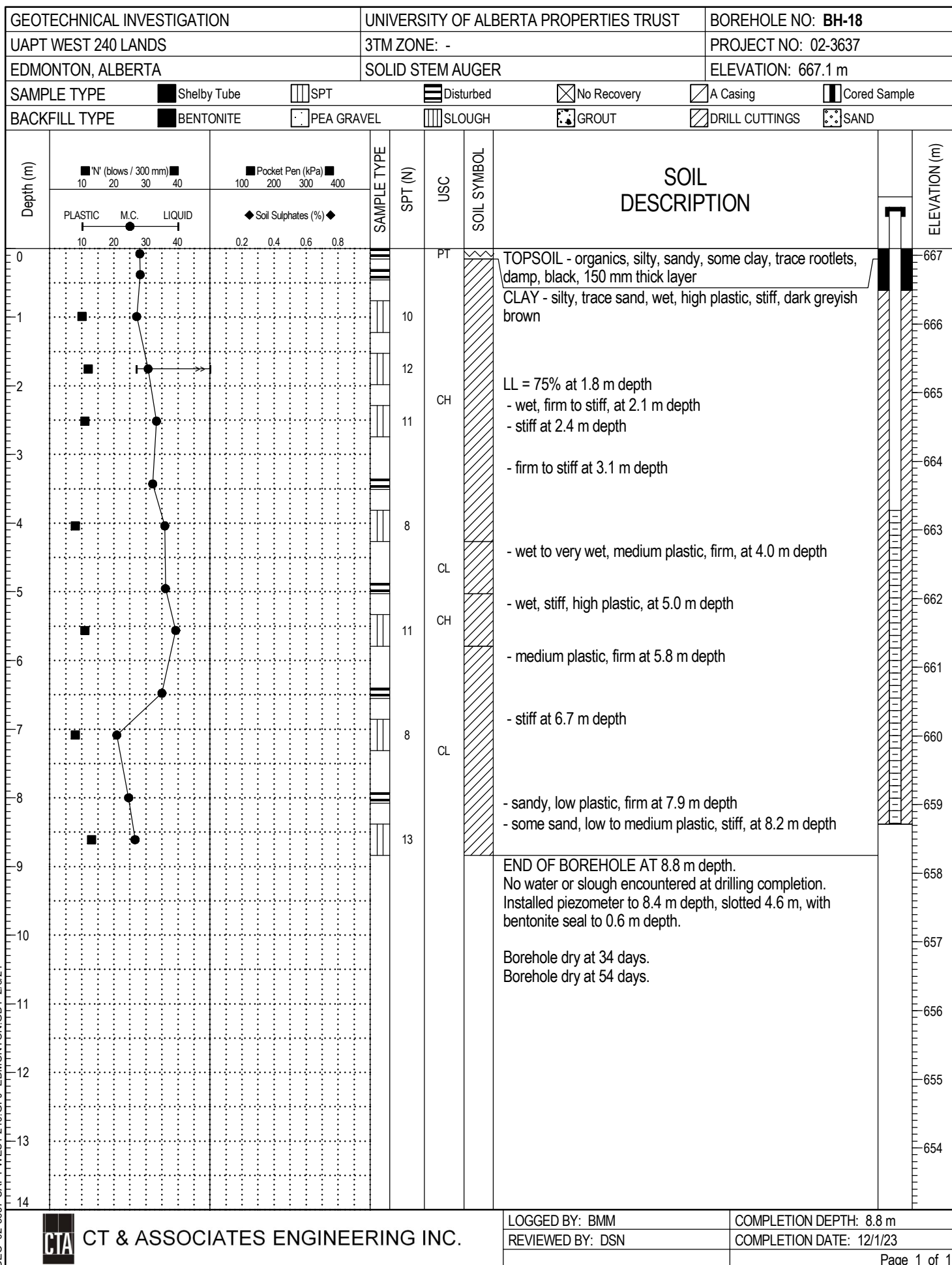
Depth (m)	N (blows / 300 mm) 10 20 30 40 PLASTIC M.C. LIQUID 10 20 30 40 Pocket Pen (kPa) 100 200 300 400 Soil Sulphates (%) 0.2 0.4 0.6 0.8	SAMPLE TYPE	SPT (N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION (m)
0				PT	TOPSOIL - organics, silty, sandy, some clay, trace rootlets, damp, black, 150 mm thick layer	666	
1			7		CLAY - silty, trace sand, moist, high plastic, firm, dark greyish brown	665	
2			11		LL = 80% at 0.4 m depth	664	
3			10	CH	- mottled grey and dark greyish brown, stiff, at 0.9 m depth	663	
4			10		- wet at 2.3 m depth	662	
5			10			661	
6			10		- very silty, low plastic, at 5.8 m depth	660	
7			31	CL		659	
8			46	SM	SAND - silty, trace clay, damp, fine-grained, uniform, dense, dark brown	658	
9					- very dense at 8.4 m depth	657	
10					END OF BOREHOLE AT 8.8 m depth.	656	
11					No water or slough encountered at drilling completion.	655	
12					Installed piezometer to 8.4 m depth, slotted 4.6 m, with bentonite seal to 0.6 m depth.	654	
13					Borehole dry at 31 days.		
14					Trace water at 51 days.		

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LOGGED BY: MLW
REVIEWED BY: DSN

COMPLETION DEPTH: 8.8 m
COMPLETION DATE: 12/4/23

Page 1 of 1



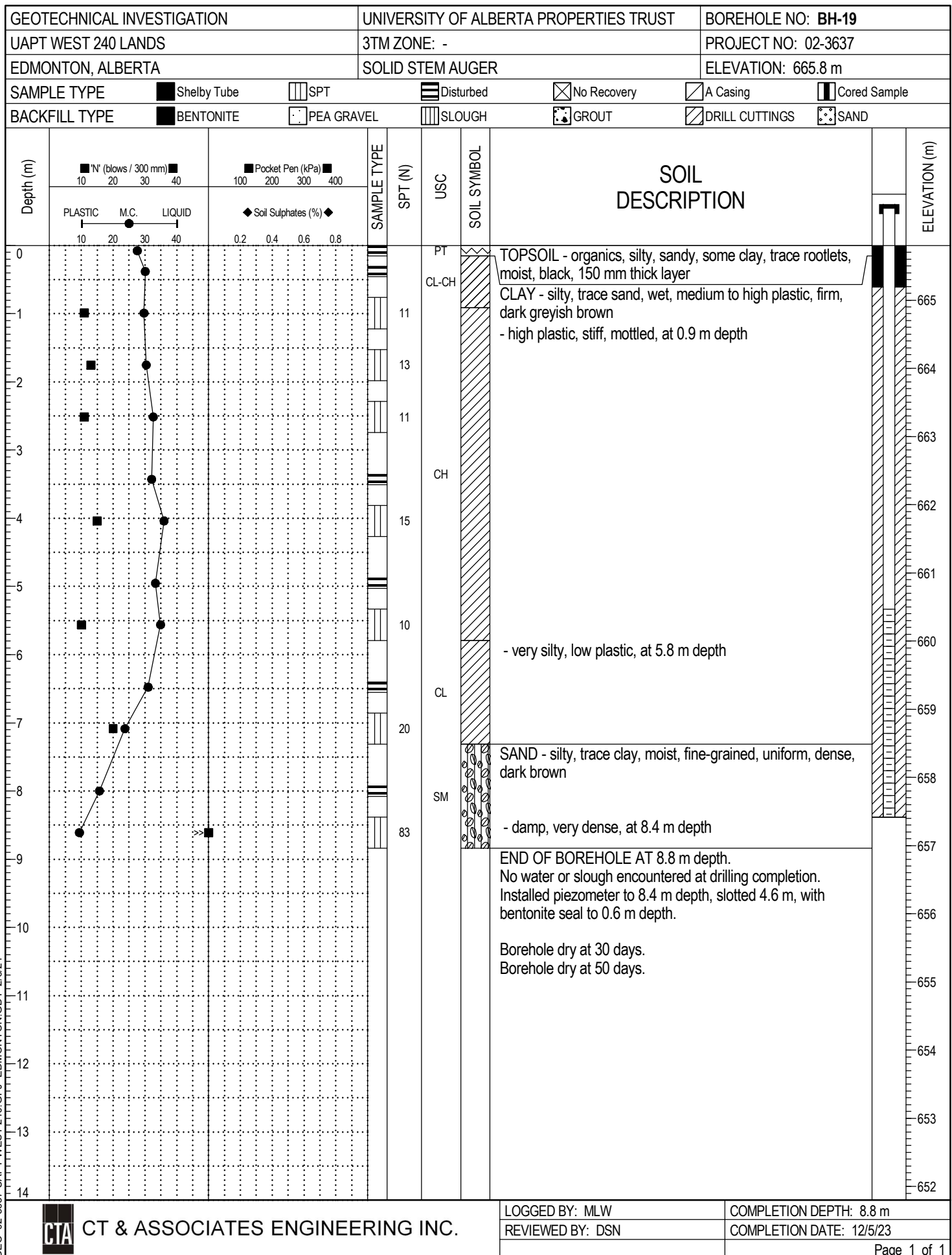
CT & ASSOCIATES ENGINEERING INC.

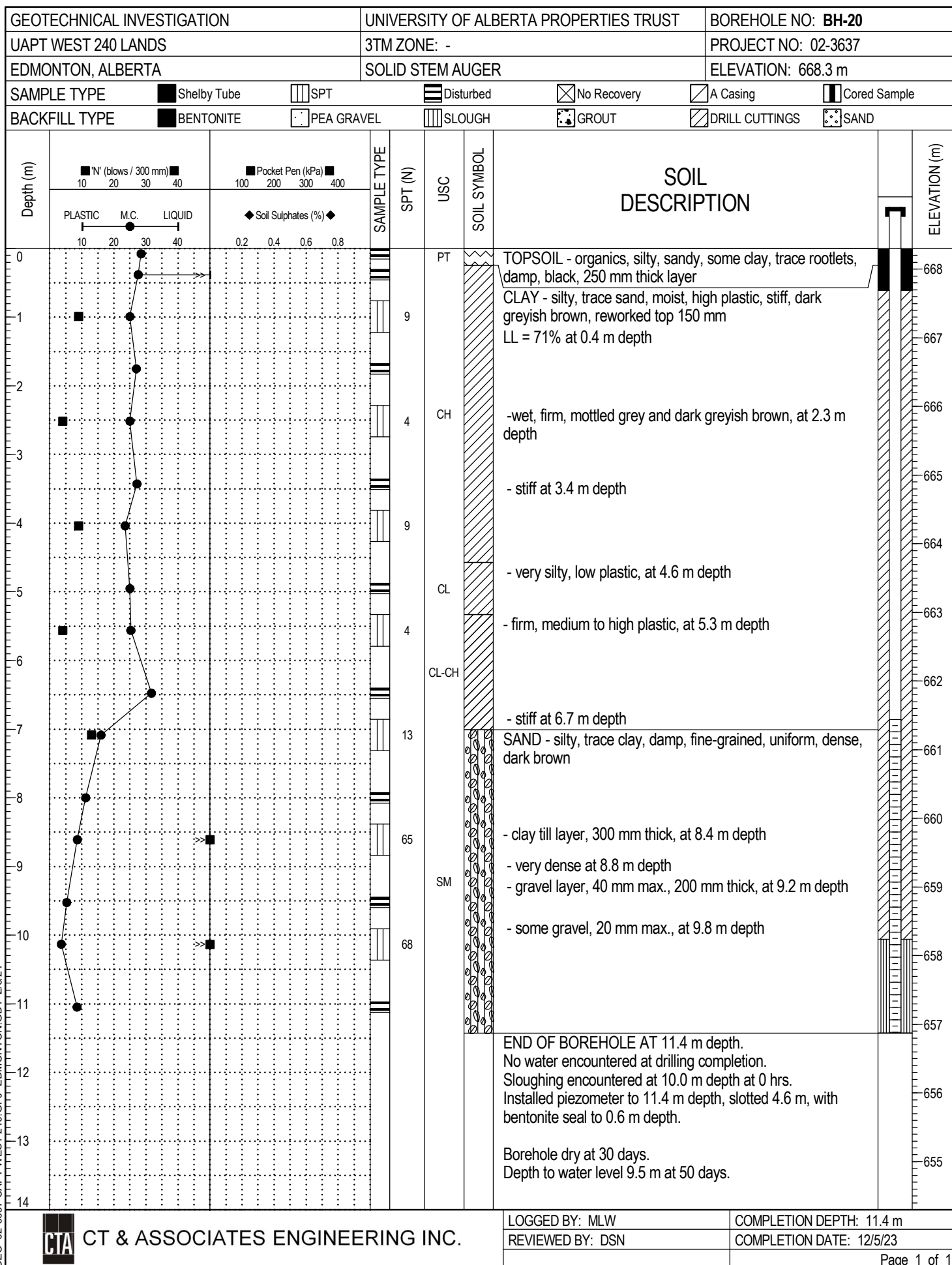
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REVIEWED BY: DSN

COMPLETION DEPTH: 8.8 m

COMPLETION DATE: 12/1/23





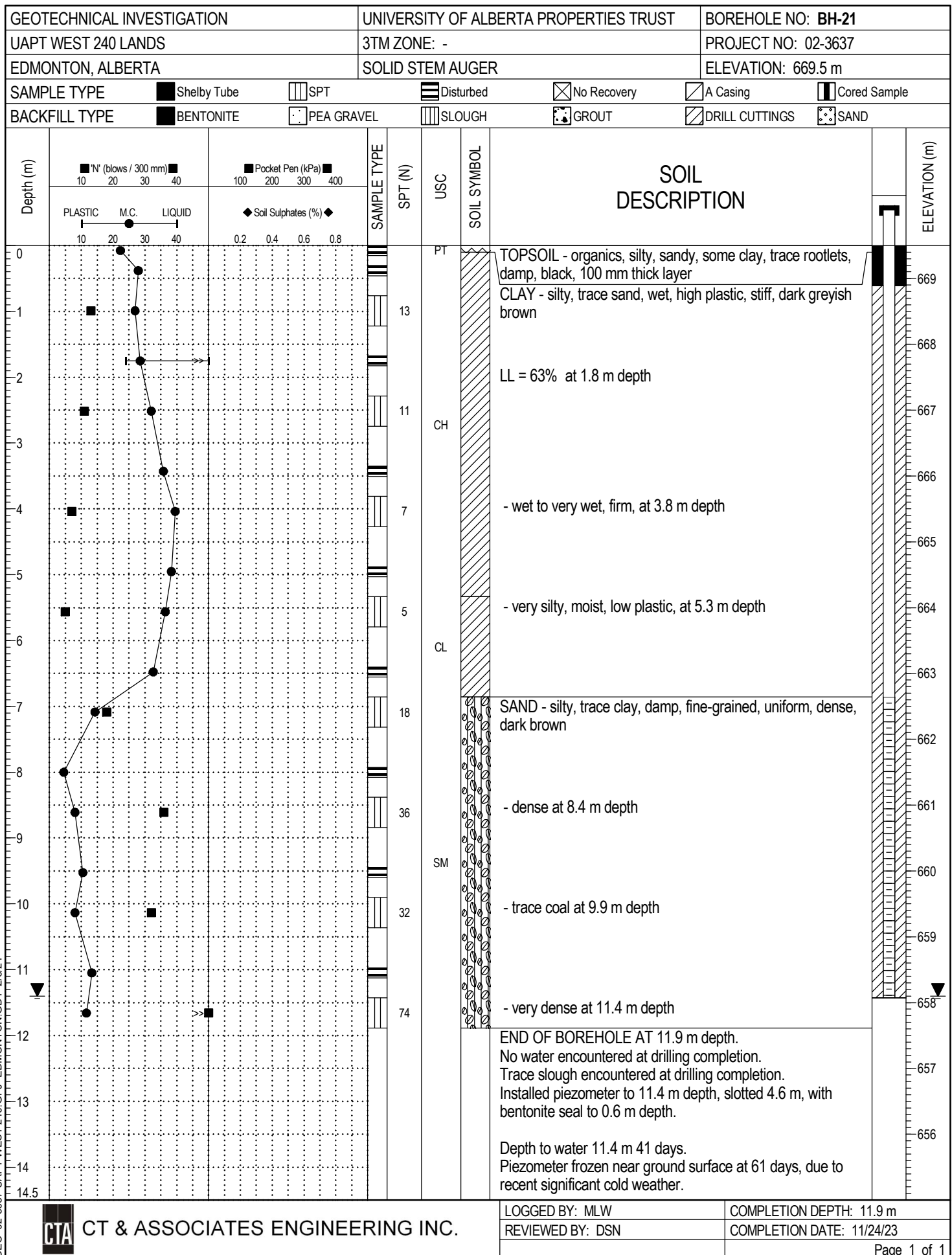
CT & ASSOCIATES ENGINEERING INC.

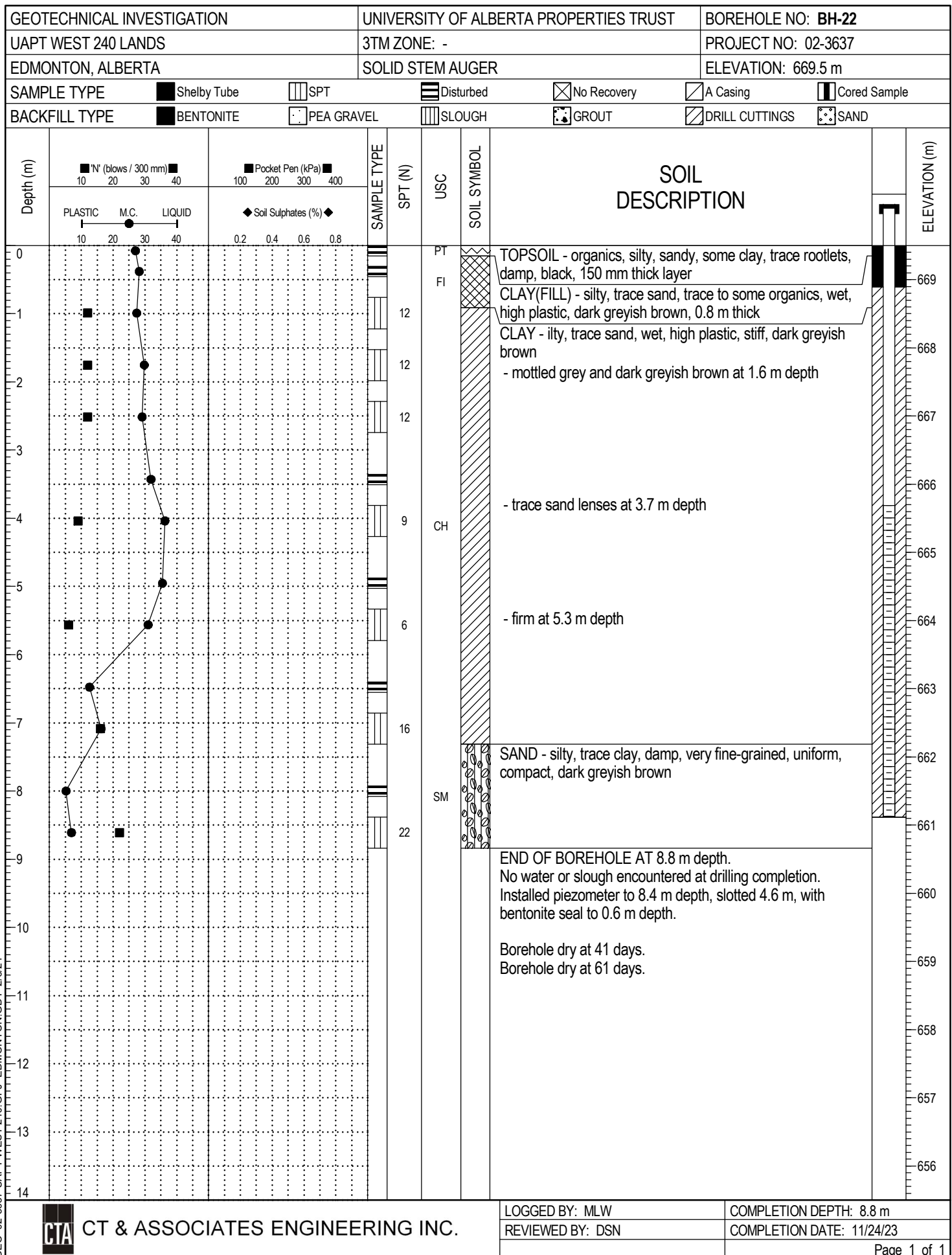
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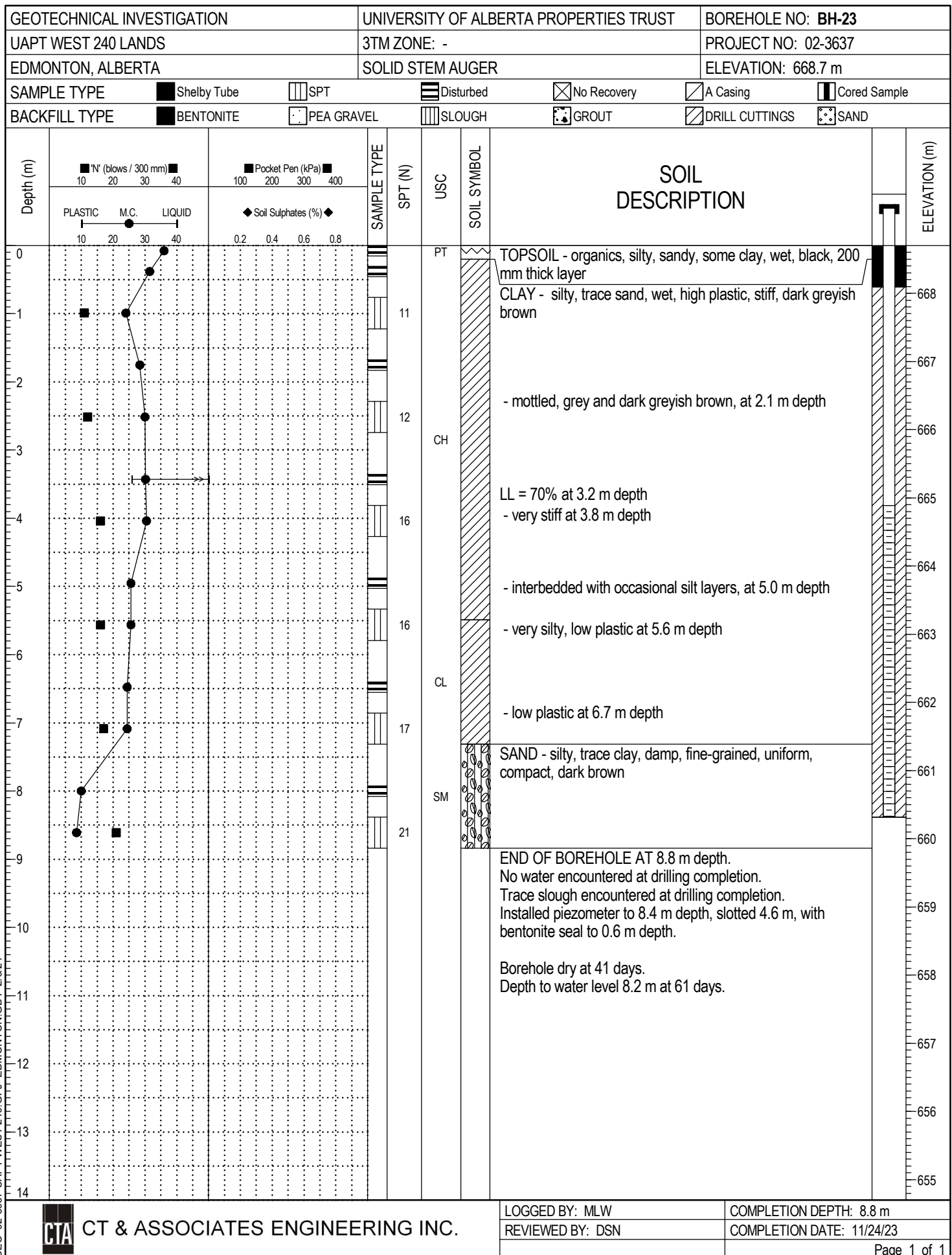
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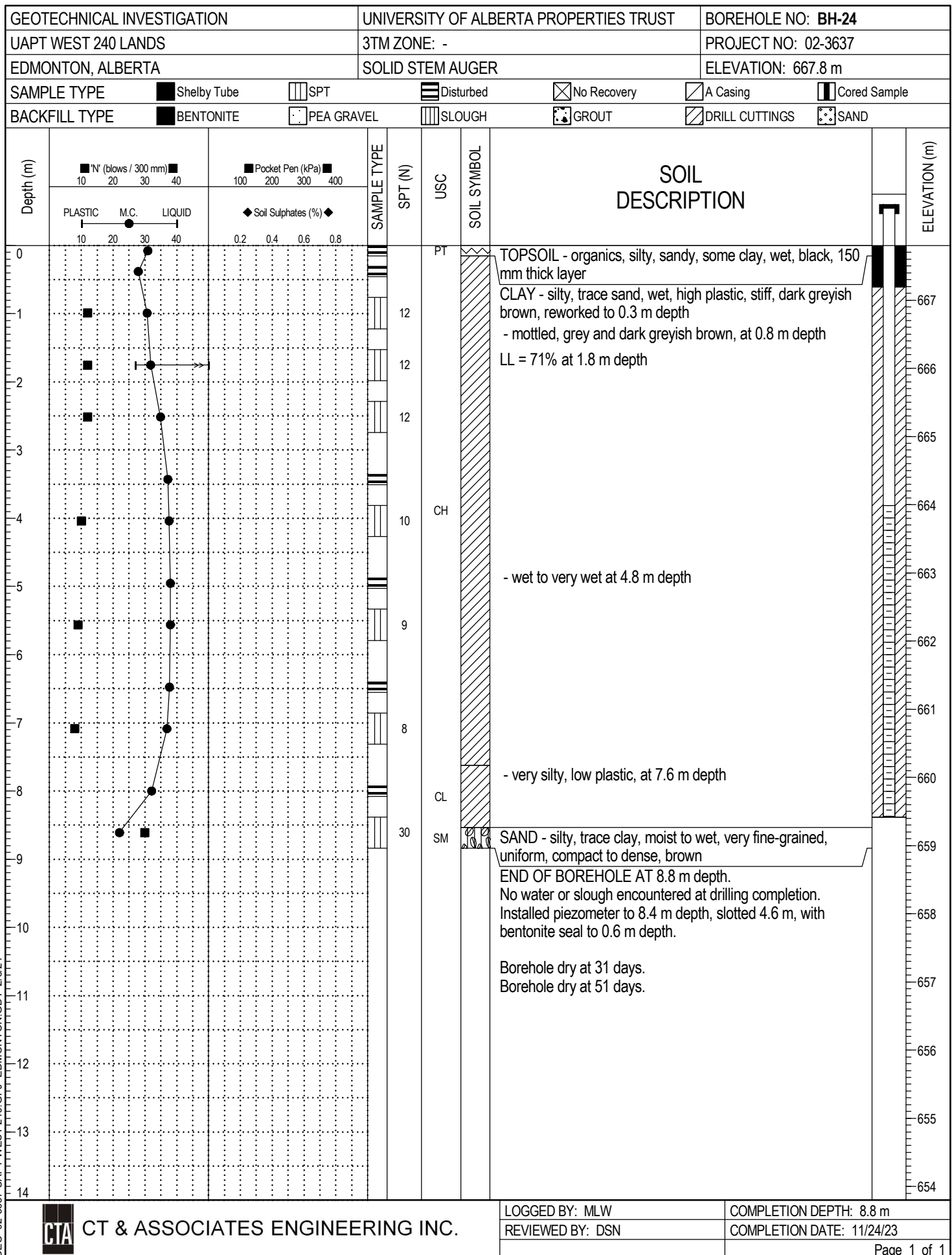
COMPLETION DEPTH: 11.4 m

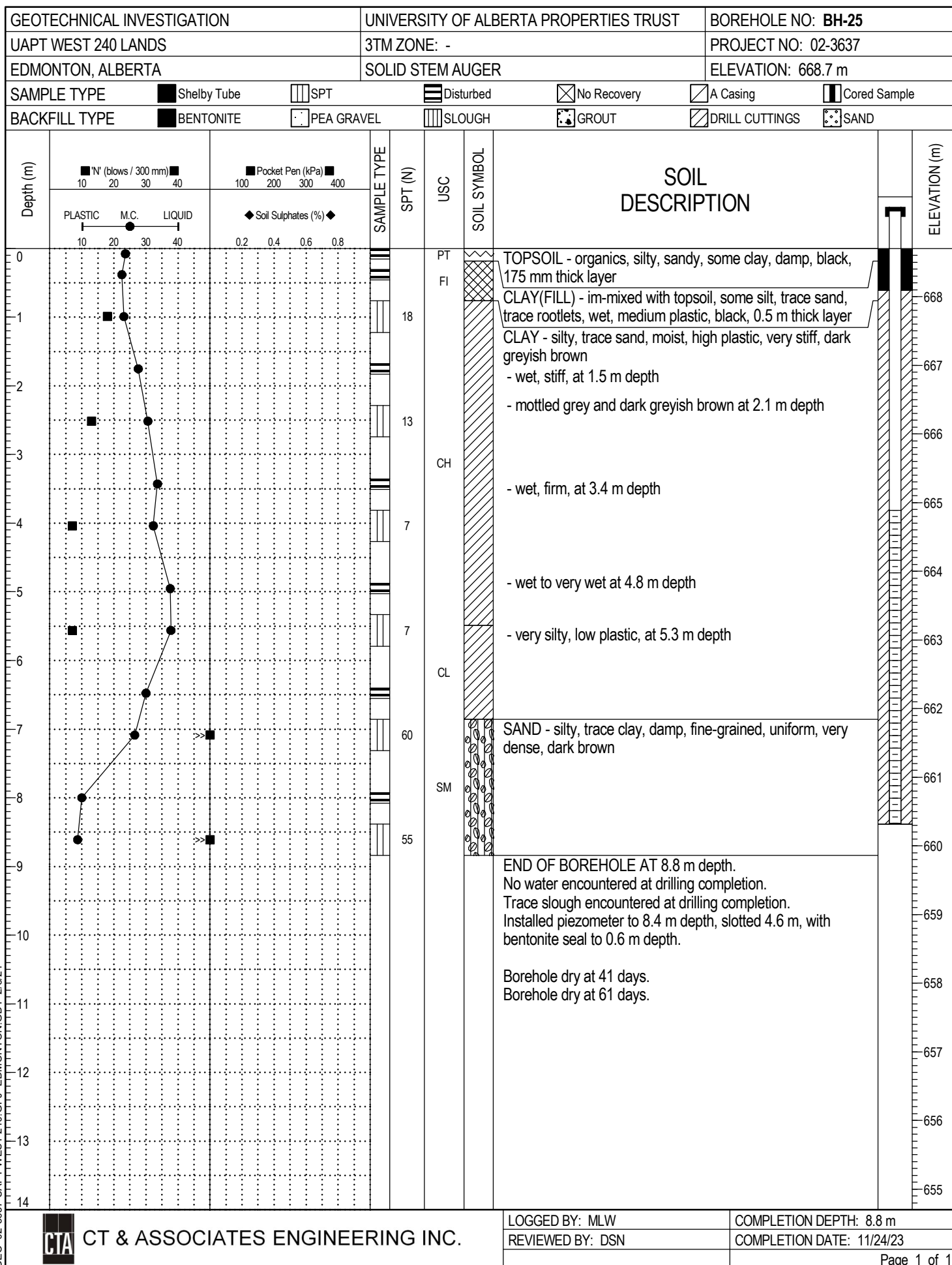
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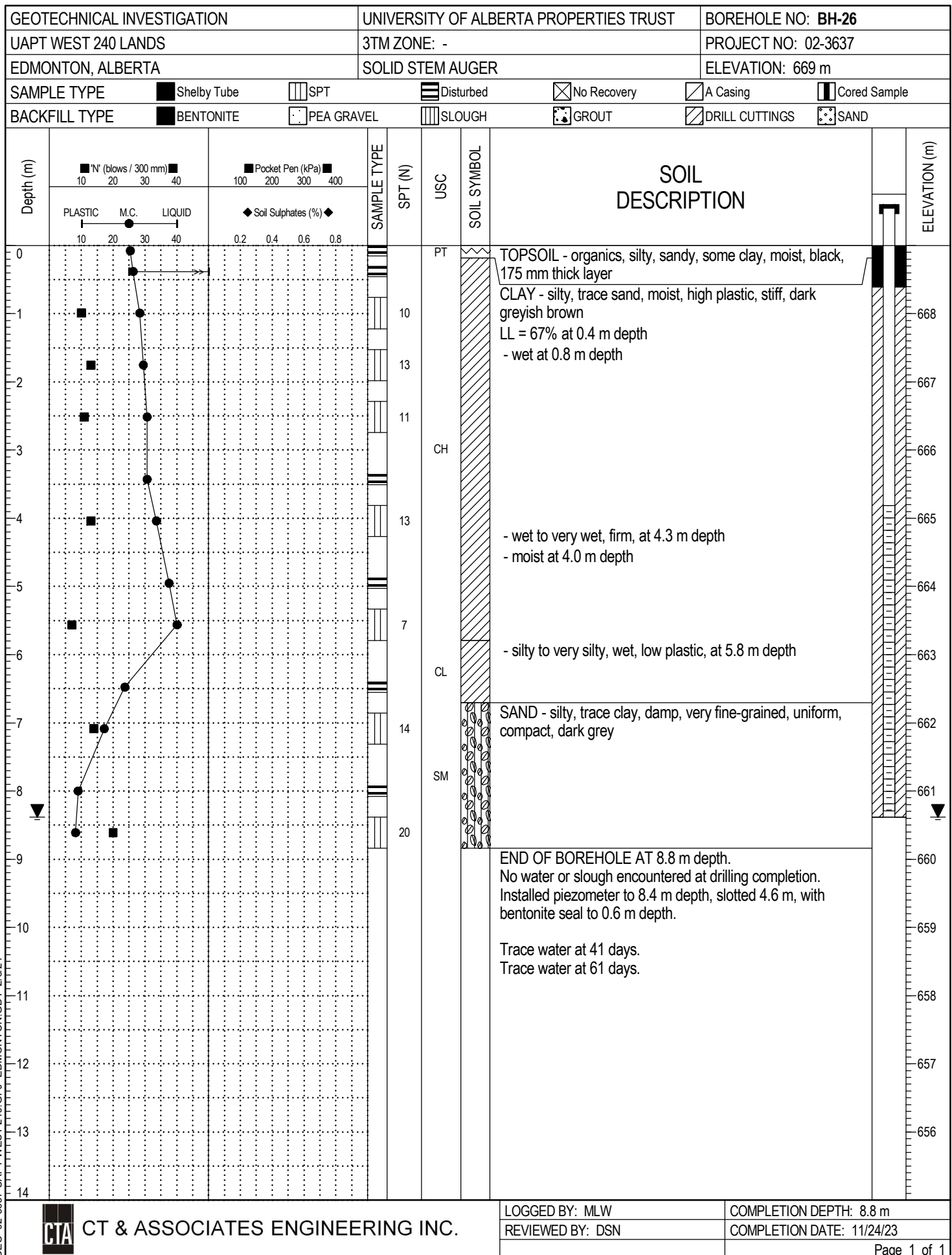














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APPENDIX E

CALIFORNIA BEARING RATIO TEST RESULTS

**CALIFORNIA BEARING RATIO TEST REPORT (ASTM D1883)**

Project:	Geo. Inv. West 240 for UAPT	Client:	University of Alberta Properties Trust
Location:	Edmonton, Alberta	Attention:	Keaton Seaby, Manager Dev't & Const'n
Project No.:	02-3637	Date Tested:	January 25, 2024
Sample No.:	BH-10 @ 1 - 5'	Tested By:	ZAB

Soil CharacteristicsSoil Description:

CLAY - some silt, high plastic

Natural Moisture Content:	29.7%	Reference Density:	1470 kg/m ³
Plasticity Index:		Optimum Moisture Content:	25.0 %
Liquid Limit:		ASTM Method:	Standard
Plastic Limit:		% Oversize (+20 mm Sieve):	N/A

California Bearing Ratio ParametersPrimary Specimen Compaction Data

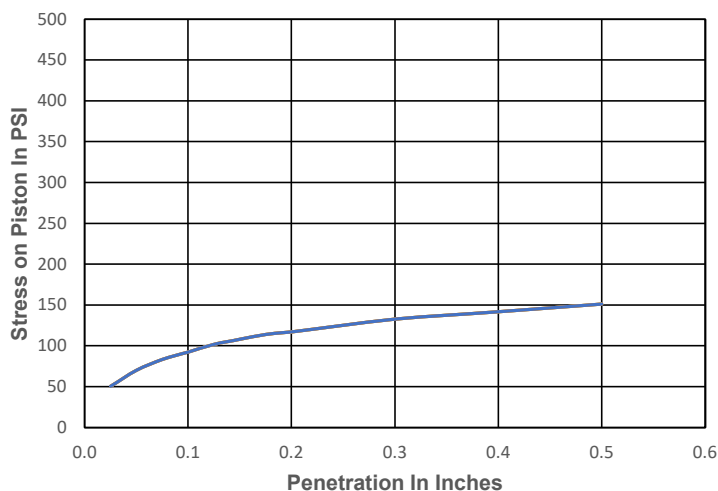
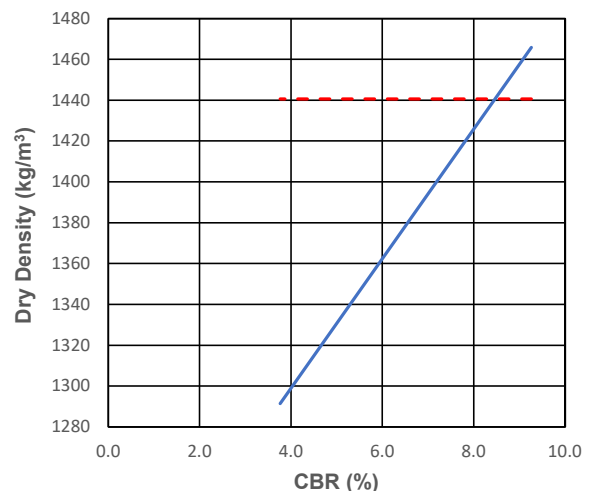
Specimen Preparation:	Unsoaked
Dry Density (kg/m ³):	1470 kg/m ³
Initial Moisture Content:	25.8%
Compaction %:	100.0%
CBR @ 0.100 in.:	9.26%

Soaked Sample Data (if applicable)

Top Inch. Moisture Content:	
Swell Percentage:	
Immersion Duration:	
CBR after Soak (%):	
CBR @ 0.100 in.:	

Other CBR Test Data

Surcharge Weight:	4.54 kg
Pavement Pressure:	2.5 kPa
10 blow Dry Density:	1300 kg/m ³
25 blow Dry Density:	
56 blow Dry Density:	1470 kg/m ³

Load Penetration Curve(s)**CBR vs Dry Density****Test Results:**
(for primary specimen)

CBR @ 0.1 Penetration: 9.3 @ 100% SPMDD
CBR @ 0.2 Penetration: 7.8 @ 100% SPMDD

** Indicates 98% SPD - - - -

Comments:

Reviewed By:

P. Eng.

**CALIFORNIA BEARING RATIO TEST REPORT (ASTM D1883)**

Project:	Geo. Inv. West 240 for UAPT	Client:	University of Alberta Properties Trust
Location:	Edmonton, Alberta	Attention:	Keaton Seaby, Manager Dev't & Const'n
Project No.:	02-3637	Date Tested:	January 23, 2024
Sample No.:	BH-25 @ 1 - 5'	Tested By:	ZAB

Soil CharacteristicsSoil Description:

CLAY - some silt, high plastic

Natural Moisture Content:	22.9%	Reference Density:	1500 kg/m ³
Plasticity Index:		Optimum Moisture Content:	25.0 %
Liquid Limit:		ASTM Method:	Standard
Plastic Limit:		% Oversize (+20 mm Sieve):	N/A

California Bearing Ratio ParametersPrimary Specimen Compaction Data

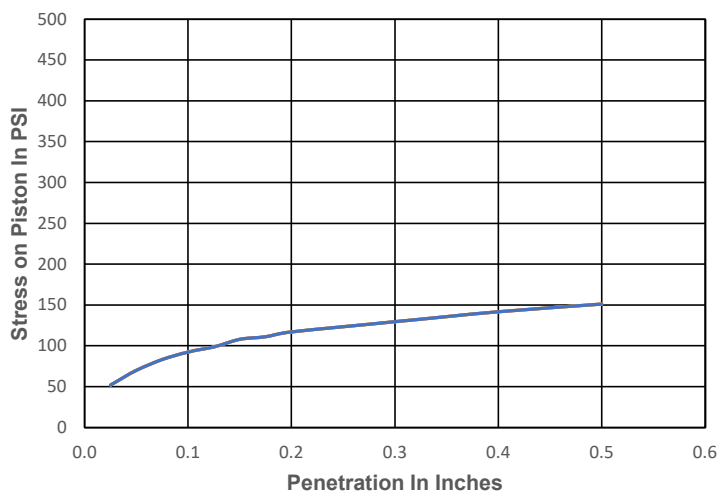
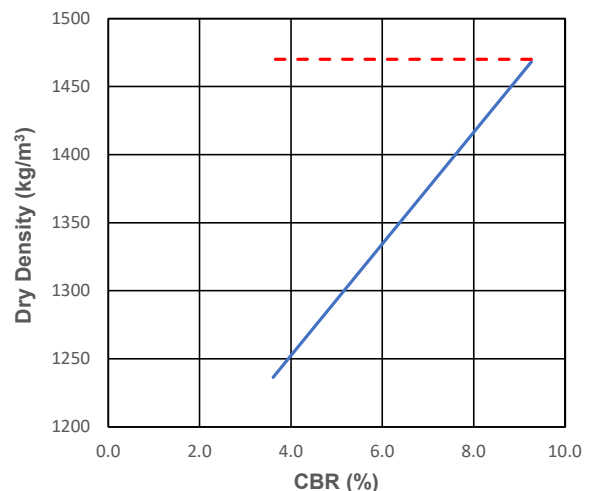
Specimen Preparation:	Unsoaked
Dry Density (kg/m ³):	1470 kg/m ³
Initial Moisture Content:	25.1%
Compaction %:	98.0%
CBR @ 0.100 in.:	9.26%

Soaked Sample Data (if applicable)

Top Inch. Moisture Content:	
Swell Percentage:	
Immersion Duration:	
CBR after Soak (%):	
CBR @ 0.100 in.:	

Other CBR Test Data

Surcharge Weight:	4.54 kg
Pavement Pressure:	2.5 kPa
10 blow Dry Density:	1240 kg/m ³
25 blow Dry Density:	
56 blow Dry Density:	1470 kg/m ³

Load Penetration Curve(s)**CBR vs Dry Density****Test Results:**
(for primary specimen)

CBR @ 0.1 Penetration: 9.3 @ 98% SPMDD
CBR @ 0.2 Penetration: 7.8 @ 98% SPMDD

** Indicates 98% SPD - - - - -

Comments:

Reviewed By:

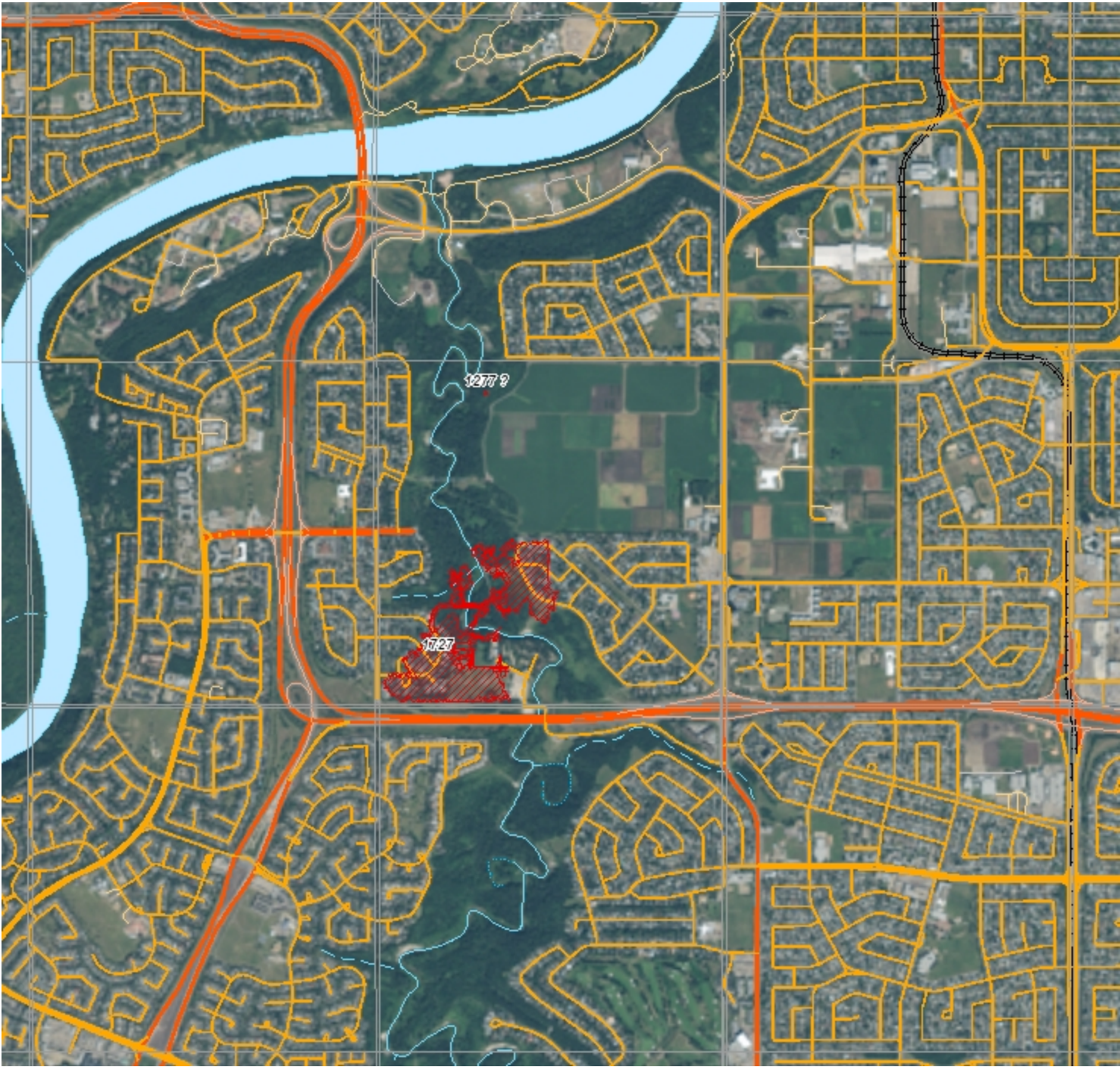
P. Eng.



CT & Associates Engineering Inc.

APPENDIX F

COAL MINE RECORDS DOCUMENTATION



Coal Mine Map	Base Data provided by: Government of Alberta		
	AuthorXXX	Printing Date:2/6/2024	
Legend ATS LSD label ATS LSD with Road Allowance ATS Quarter Section label ATS Quarter Section with Road Allowance ATS Section label (large scale) ATS Section with Road Allowance ATS Township (large scale) Provincial Boundary Coal Mine Permit Coal Mine Polygon Surface	Date Date (if applicable)		
	The Alberta Energy Regulator (AER) has not verified and makes no representation or warranty as to the accuracy, completeness, or reliability of any information or data in this document or that it will be suitable for any particular purpose or use. The AER is not responsible for any inaccuracies, errors or omissions in the information or data and is not liable for any direct or indirect losses arising out of any use of this information. For additional information about the limitations and restrictions applicable to this document, please refer to the AER Copyright & Disclaimer webpage: http://www.aer.ca/copyright-disclaimer.	Scale:45,139.89 0.69Kilometers0	
		Projection and Datum: WGS84 Web Mercator Auxiliary Sphere	
			