Geotechnical Data Report 2021
Highway 7 over Nicomen Slough Dewdney Bridge 00596 Replacement Project
Dewdney, BC

PRESENTED TO

British Columbia Ministry of Transportation and Infrastructure

APRIL 19, 2023
ISSUED FOR USE
FILE: 704-ENG.VGEO03551-02

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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of British Columbia Ministry of Transportation and Infrastructure and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than BC Ministry of Transportation and Infrastructure, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by the British Columbia Ministry of Transportation and Infrastructure (BC MoTI) to provide geotechnical engineering services for the Highway 7 over Nicomen Slough Dewdney Bridge No. 00596 Replacement Project. The site is located along Highway 7 in Dewdney, BC, approximately 12 km east of Mission, BC. The new Dewdney Bridge will replace the existing bridge that has a span of approximately 148 m and crosses the Nicomen Slough.

Tetra Tech has provided geotechnical engineering services to BC MoTI for the ground exploration and engineering design service to compete the conceptual design of the Dewdney Bridge Replacement Project. This report presents the findings of an additional ground exploration program conducted by Tetra Tech during December 2020 and January 2021, in support to the detailed design process for the replacement bridge and associated structures. Additional groundwater measurements performed in 2022 were also included in this data report.

The Limitations on the Use of this Document, attached in Appendix A, forms an integral part of this report.

2.0 PROJECT DESCRIPTION

This project involves the replacement of the existing Dewdney Bridge with a two-lane bridge. The three conceptual options include a five-span prestressed I-girder option, a long span truss, or a shorter span option which allows for top down construction (approximately 11 spans).

We understand that the existing bridge was constructed in the late 1950s comprising a 19.8 m main steel I-girder span and 15 “inverted bathtub” concrete spans approximately 8.5 m each, founded on timber piles. Available drawings for the bridge suggest that the timber piles extend to approximately 15 m below mudline, however pile installation or driving logs were not made available. We understand that the existing bridge has required numerous repairs in recent years and is in poor condition.

It is understood that the proposed bridge will be located at about 25 m upstream from the existing bridge and will consist of five-span prestressed concrete I-girder with an overall length of 183.5 m. This bridge will be supported on four 914 mm diameter steel pipe piles at each abutment, and on three steel pipe piles at each of the four in-slough piers. The proposed bridge will likely require additional fills to raise the road grade along Highway 7 as well as the approaches. The bridge approaches will tie into the existing dikes – the Dewdney Dike (#47) at the west abutment and the Nicomen Island Dike (#144) at the east abutment. Noted that the Nicomen Island Dike is a non-standard dike, which has a lower level of protection than a standard dike.

The objective of the current geotechnical subsurface exploration is to complement the existing information from the previous ground exploration program (File: 704-ENG.VGEO03551-01 dated March 25, 2019) with newly acquired geotechnical data to better characterize the existing conditions along the proposed alignment of the bridge abutments and approach fills, in order to aid the detailed design phase. The contents of this report therefore include the following:

- A description of the scope of work;
- A description of the methodology and equipment used;
- Results and factual data collected during the geotechnical site investigation; and
- A site plan figure showing the testhole locations.

3.0 GEOTECHNICAL SUBSURFACE EXPLORATION

3.1 General

The subsurface exploration was completed between December 21, 2020 and January 20, 2021 and consisted of the following:

- Six (6) Solid Stem Auger holes located along the proposed approach alignment and Hwy 7, one of them includes Dynamic Cone Penetration Test (DCPT);
- Two (2) Cone Penetration Test (CPT) soundings located along the approach alignments at each side of the bridge;
- Two (2) Seismic Cone Penetration Test (SCPT) soundings located at the proposed east and west bridge abutments; and
- Two (2) monitoring wells with standpipe piezometers at the proposed east and west bridge abutment locations.

The drilling and sounding locations were defined by Tetra Tech based on the proposed bridge alignment. A site plan and testing locations plan are shown on Figures 1 and 2, respectively. UTM coordinates were gathered for each location at site with a hand-held GPS. The coordinate and final depth of each testing location are provided in Table 3-1 for reference. Measurements on the existing ground elevation at the test hole locations were not performed.

Table 3-1: Summary Drilling and Testing locations Coordinates and Depths

Test ID	UTM Coordinates (1)		Depth (m) (2)
	Northing	Easting	
AH20-01	5446019	558621	15.2
AH20-02	5445963	558679	15.2
AH20-03	5445807	558940	15.2
AH20-04	5445762	559053	6.1
AH/DCPT20-05	5445760	559100	6.1
AH20-06	5445760	559152	6.1
CPT20-01	5445992	558652	15
CPT20-02	5445788	558997	17.2
SCPT21-01	5445961	558717	80
SCPT21-02	5445860	558888	91.6
MW21-01	5445961	558717	10.7
MW21-01	5445860	558888	10.7

(1) UTM Coordinates obtained in the field with hand-held GPS.
(2) Depth of sounding, or auger hole below existing ground.

A utility locate request (Ticket No. 20204906882 / 20204906915) was submitted to BC One Call by Tetra Tech. Quadra Utility Locating provided utility clearance at the selected drilling locations in support of this project. Electromagnetic scanning and GPR was used to locate all nearby utilities. Each drilling location was marked in the ground and cleared from underground utilities before commencing the drilling.

3.2 Solid Stem Auger and DCPT

The Solid Stem Auger testholes were carried out by Conetec Investigations Ltd (Conetec) using a track-mounted M5T rig and a Truck-mounted M7 rig for part of the scope of work. Two (2) holes were completed at the west side of the proposed bridge, at the approach fill locations and on Hwy 7, respectively. One (1) auger hole was completed at the eastern approach fill location and another three (3) were completed along the existing Hwy 7. At AH20-05 a DCPT sounding was included to gather additional information regarding the current state of the existing highway embankment fill. The auger holes were completed until reaching a target depth that ranged between 6 m and 15 m below ground surface. The auger holes were backfilled to surface with drilling cuttings and bentonite chips in accordance with the BC *Water Sustainability Act.* For auger holes performed along Hwy 7 the holes were topped with cold asphalt patch at the road surface.

3.3 Cone Penetration Testing and Seismic Cone Penetration Testing

The Cone Penetration Testing (CPT) / Seismic Cone Penetration Testing (SCPT) soundings were carried out by Conetec using a track-mounted M5T rig for depths up to 15 m and a truck-mounted C14 rig for the deep soundings. Two (2) CPT's were completed at each side of the proposed bridge along the alignment of the approach. Two (2) SCPT's were completed at the proposed east and west abutment locations. The CPT and SCPT soundings were completed using a 15 cm^2 seismic piezocone for detailed stratigraphic profiling and measurement of in situ soil properties. The testing was carried out in general accordance with ASTM D5778. Tip resistance (qc), sleeve friction (fs), and pore pressure (u2) were recorded at every 25 mm depth interval. Where cohesive soils were encountered, penetration was suspended at selected horizons to perform pore pressure dissipation tests (PPDT) to measure static groundwater levels and to estimate the permeability of the soil layers. Measurements of the shear wave velocity (V_s) of the soil were obtained in intervals of 1 m using a manual surface hammer shear wave source. Further details of the CPT / SCPT testing, including the cone dimensions, load cell specifications and data plots can be found in the attached report in Appendix B. For soundings deeper than 80 m the testing procedure required casing of the first 15 m to allow proper protection of the top rods. For this procedure after gathering the first 15 m reading, hollow stem augers were drilled into the ground to the target depth and used as a casing for the top rods. After gathering the totality of the readings, the remaining holes was grouted to surface in accordance with the *Dike Maintenance Act*.

3.4 Monitoring Well Installation with Standpipe Piezometer

Standpipe piezometers were installed at selected locations approximately where the proposed bridge abutments are to be located to monitor the ground water level in Nicomen Slough with time. The holes were drilled to a maximum depth of 10.7 m to install the standpipe to a target depth of 10 m below ground surface. A 1.5 m filter sand screen was placed for both standpipes and later grouted to surfaced as per the *Dike Maintenance Act*. The standpipes were sealed with a J-plug and covered with a flush mount cover.

3.5 Logging and Sampling

A Tetra Tech field engineer was on site during advancement of the testholes to log and sample the material encountered, as well as to direct the in situ testing, termination depths and backfilling. During the drilling, Tetra Tech's field engineer also monitored the drill advancement rates, soil recovery, bit wear, etc. and periodically sampled the soil cuttings to document the subsurface conditions. Soil samples recovered from the auger holes were retained for geotechnical index laboratory testing. Borehole logs including the details of the soil stratigraphy, samples collected and backfilling details for the monitoring wells are presented in Appendix C.

4.0 GROUNDWATER

Groundwater levels were measured in situ at two monitoring wells installed during the subsurface investigation at each proposed bridge abutment location. In addition, porewater pressure readings and dissipation data obtained at the CPT and SCPT locations were used to discern the groundwater level across the proposed alignment. Groundwater levels were measured at approximately 2.5 m and 7.2 m below existing surface grade. This information is summarized in the table below.

Table 4-1: Summary of Ground Water Depth Readings

Date	Testhole Location	Location on Alignment	Depth to Ground Water Level (m)
December 21, 2020	CPT20-01	West Approach	4.4
December 23, 2020	CPT20-02	East Approach	2.5
January 18, 2021	SCPT21-01	East Abutment	4.8
January 19, 2021	SCPT21-02	West Abutment	7.2
January 21, 2021	MW21-01	East Abutment	4.9
January 21, 2021	MW21-02	West Abutment	7.0
March 14, 2022	MW21-01	East Abutment	5.4
March 14, 2022	MW21-02	West Abutment	7.2
May 24, 2022	MW21-01	East Abutment	4.6
May 24, 2022	MW21-02	West Abutment	7.0

We anticipate that seasonal fluctuations in the Fraser River, seasonal runoff from Dewdney Peak and Nicomen Mountain, as well as periods of wet weather, will have an influence on groundwater levels and water levels within the slough.

5.0 LABORATORY TESTING

Laboratory tests were performed on disturbed soil samples recovered during the auger drilling. Laboratory testing was performed at the Tetra Tech geotechnical laboratory facility located in Richmond, BC. The following tests were conducted on selected samples:

- Water Content (ASTM D2216);
- Atterberg Limits (ASTM D4318);
- Particle Size Distribution (ASTM D6913); and
- Grain Size Analysis of material finer than 75 µm (ASTM D1140).

Laboratory tests were completed on January 12, 2021. The results are presented on the borehole logs and in Appendix D.

The tests completed as part of this subsurface exploration are briefly described in the following sections. The methodology used for each testing generally reflects the procedures outlined by the ASTM standards.

5.1 Soil Description (and Classification)

In the field, immediately upon recovery, the soil samples were classified visually and by texture in accordance with Tetra Tech internal geotechnical soil classification work method by Tetra Tech engineers. Tetra Tech geotechnical soil classification work method has been developed based on the general guidelines provided in the Canadian Foundation Engineering Manual 4th Edition and ASTM Standards. The detailed soil descriptions include the following information:

- Main soil type
- Secondary soil components
- Qualitative assessment of grading (granular soils)
- Structure, texture or other relevant descriptions
- Color

Soils have been classified as granular (coarse-grained) soils or fine-grained soils. Granular soils are described in terms of the relative proportions of the mineral constituents. Fine-grained soils are classified based on plasticity (Atterberg limits) as per ASTM D 4318.

On the final drilling logs presented in Appendix C, the field descriptions have been revised to include the results of the laboratory classification tests. The classification for each of the soil layers where specific laboratory test results are available is also included on the borehole logs.

5.2 Natural Water Content

Moisture content determinations were performed on a total of twenty-six (26) samples recovered from the auger holes. Water content in the samples selected varies in a range from 3% to 36%. The results of natural water content tests are plotted on the borehole logs (Appendix C) and are included in Appendix D.

Water (or moisture) contents were determined from the difference in measured total and dry weights before and after oven drying of specimens taken from soil samples recovered from the boreholes. Measurements were performed in accordance with the procedures described in ASTM D 2216.

5.3 Atterberg Limits

Atterberg limit tests were performed using the multipoint test on samples recovered from the boreholes. The liquid and plastic limits are determined for fine grained samples to assist soil classification using the test procedures described in ASTM D4318.

Two (2) samples were selected from the top cohesive layer, one at each side of the bridge. The results indicate that these materials are medium plasticity clays, with liquid limits ranging from 42% to 44%.

The results for the Atterberg Limits testing are plotted on the borehole logs in Appendix C and are presented in Appendix D.

5.4 Particle Size Determination

Full sieve analyses were performed for a total of twelve (12) soil samples. Sieve analyses were performed in accordance with the procedures described in ASTM D 6913. The proportion of fines (silt and clay) in a specimen was determined by washing the material through the #200 (75 µm) sieve and computing the percentage passing. Results for grain size distribution analyses are presented on a semi-logarithmic plot with grain size (log) versus percentage passing by weight finer than the grain size. Additionally, five (5) samples were selected to conduct fines content analyses. The fines portion is quantified after separating from the coarse portion by washing (ASTM D1140). The results of the grain size distributions are tabulated and presented graphically in Appendix D. The relative proportions of gravel, sand and fines are reported on the borehole logs (Appendix C) for reference.

6.0 CONCLUSIONS

This geotechnical data report presents the results of the additional site exploration program completed for the Dewdney Bridge Replacement project in Dewdney, BC from December 2020 to January 2021. The report is factual in nature and does not provide any interpretation of the results obtained. The information presented in this report will be used to update the geotechnical design report “Dewdney Bridge Replacement Project – Geotechnical Design Report”.

7.0 CLOSURE

We trust this data report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

PROFESSIONAL
PROVINCE OF
A. E. LUIS GONCALVES
19/APR/2023

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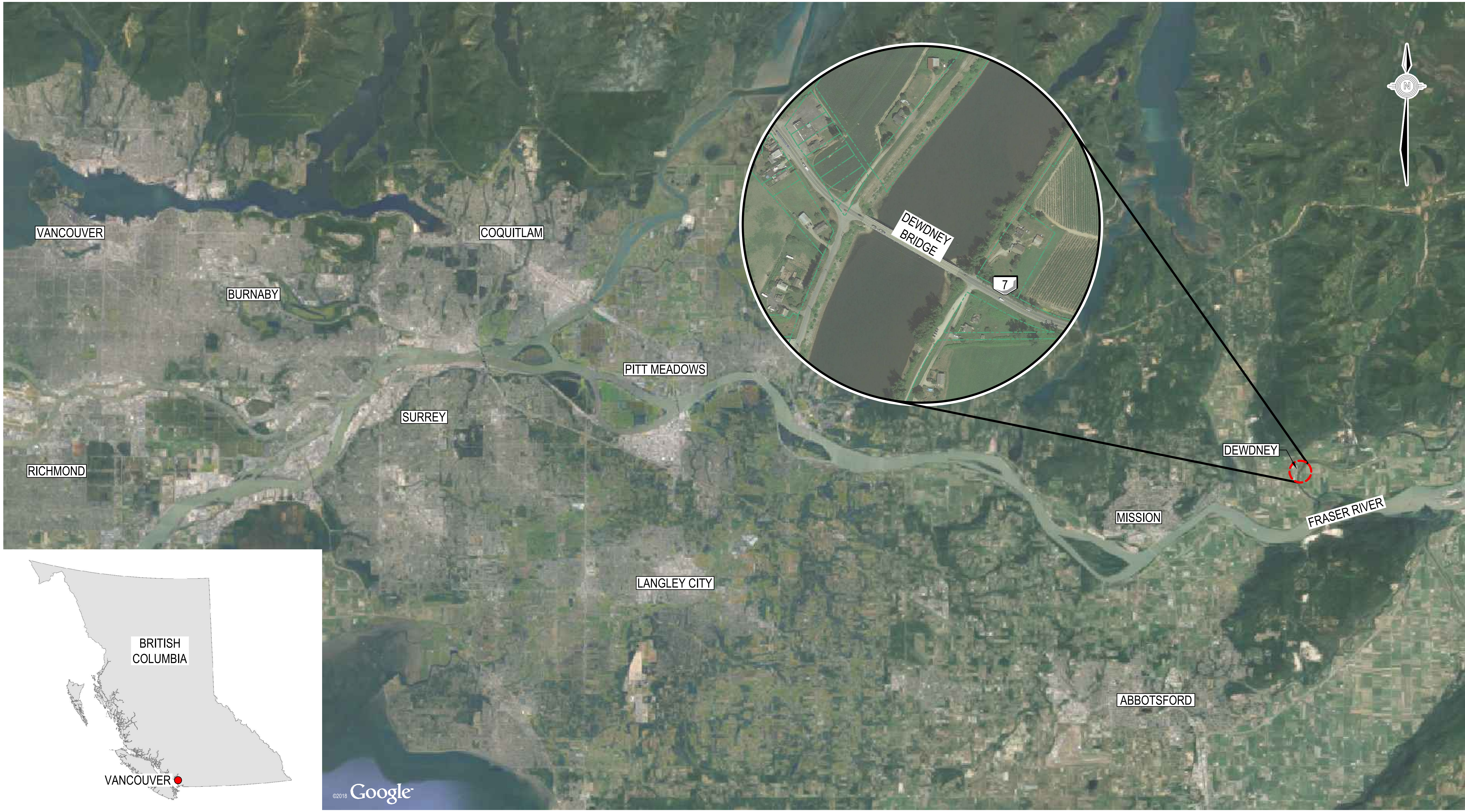
FIGURES



LEGEND
- - Site location

NOTES
1. Imagery from Google Earth Pro.

ISSUED FOR USE

0 10,000m
Scale: 1:200,000 @ 11"x17"

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

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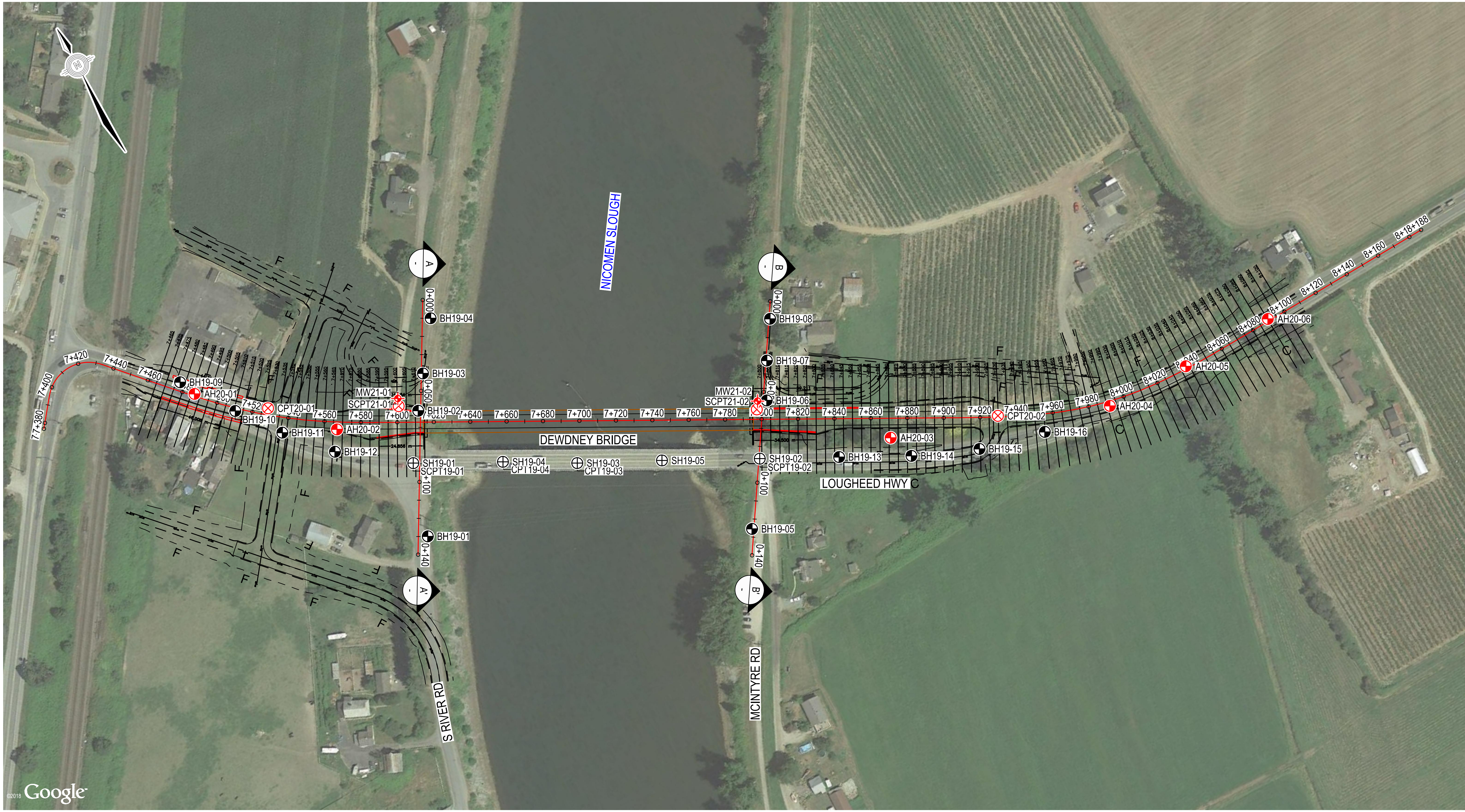
DEWDNEY BRIDGE REPLACEMENT PROJECT
DEWDNEY, BC

KEY PLAN

PROJECT NO.	DWN	CKD	REV
ENG.VGEO03551-01	RH	AL	3

OFFICE	DATE
VANC	April 17, 2023

Figure 1



Q:\Vancouver\Drafting\Engineering\VGEO\ENG.VGEO03551-01\ENG.VGEO03551-01 Section R3a.dwg [FIGURE 2] April 17, 2023 - 9:16:46 am (BY: HALL, ROBERT J)

LEGEND
- 2020-2021 Auger testholes
- 2020-2021 CPT/SCPT testholes
- 2020-2021 Monitoring wells
- 2019 Auger testholes
- 2019 Sonic testholes
- 2019 CPT/SCPT testholes
- Proposed wall locations

NOTES
1. Imagery from Google Earth pro.
2. Layout based on DWG. "TYPICAL WALL SECTIONS" received October 23, 2020.

ISSUED FOR USE

0 — 100m
Scale: 1:2,000 @ 11"x17"

CLIENT
British Columbia — Ministry of Transportation and Infrastructure

TETRA TECH

DEWDNEY BRIDGE REPLACEMENT PROJECT
DEWDNEY, BC

TESTHOLE LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
ENG.VGEO03551-01	RH	AL	3
OFFICE	DATE		
VANC	April 17, 2023		

Figure 2

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

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Both electronic file and/or hard copy versions of TETRA TECH’s Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH’s Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function. Where temporary or permanent drainage systems are installed within or around a structure, these systems must protect the structure from loss of ground due to mechanisms such as internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design details regarding the geotechnical aspects of such systems (e.g. bedding material, surrounding soil, soil cover, geotextile type) should be reviewed by the geotechnical engineer to confirm the performance of the system is consistent with the conditions used in the geotechnical design.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

APPENDIX B

CONETEC REPORT (CONE PENETRATION TEST DATA)

PRESENTATION OF SITE INVESTIGATION RESULTS

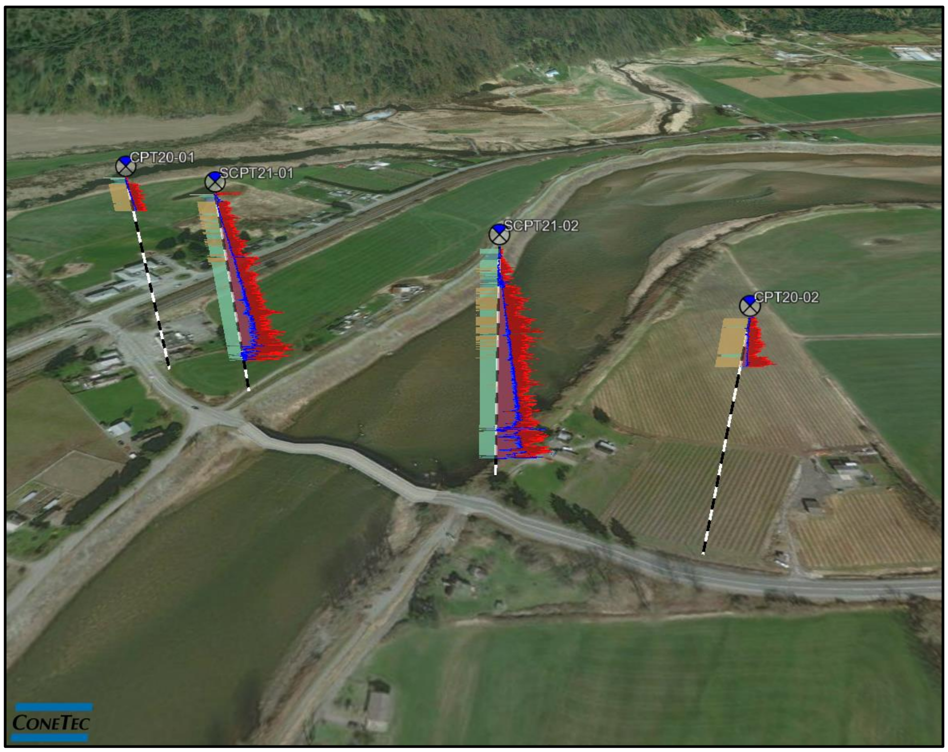
Tetra Tech Dewdney Bridge

Prepared for:

Tetra Tech Canada Inc.

ConeTec Job No: 20-02-21738

Project Start Date: 21-Dec-2020
Project End Date: 19-Jan-2021
Report Date: 29-Jan-2021



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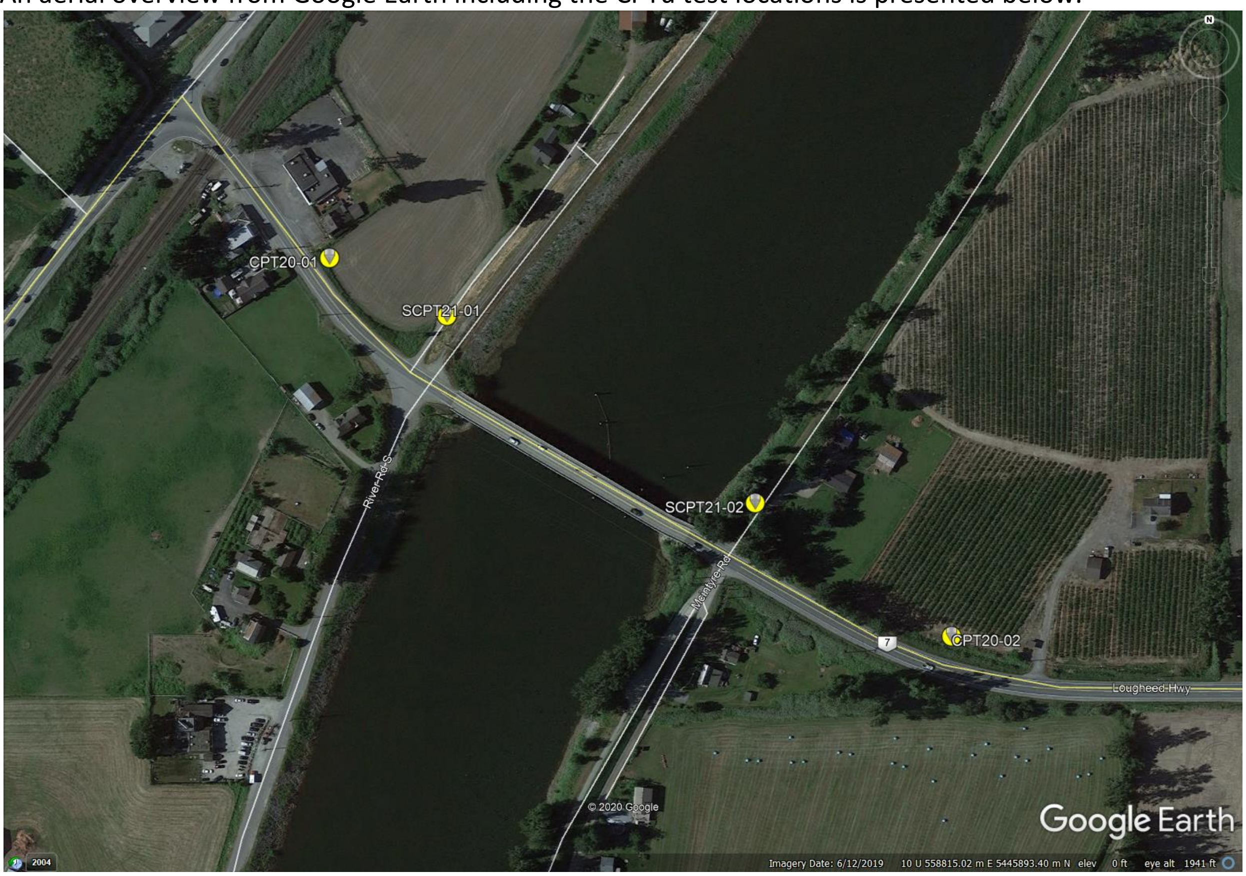
Introduction

The enclosed report presents the results of the site investigation program conducted by ConeTec Investigations Ltd. for Tetra Tech Canada Inc. along British Columbia Highway 7 near Nicomen Slough Bridge in Dewdney, BC. The program consisted of two cone penetration tests (CPTu) and two seismic cone penetration tests (SCPTu). Please note that this report, which also includes all accompanying data, are subject to the 3rd Party Disclaimer and Client Disclaimer that follow in the 'Limitations' section of this report.

Project Information

Project	
Client	Tetra Tech Canada Inc.
Project	Tetra Tech Dewdney Bridge
ConeTec project number	20-02-21738

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



Rig Description	Deployment System	Test Type
CPT track rig (M5T)	14 ton rig cylinder	CPTu
CPT truck rig (M7)	14 ton rig cylinder	SCPTu
CPT truck rig (C14)	30 ton rig cylinder	SCPTu

Coordinates		
Test Type	Collection Method	EPSG Number
CPTu, SCPTu	Consumer grade GPS	32610

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (psi)
672:T1500F15U500	AD672	15	225	1500	15	500
742:T1500F15U35	EC742	15	225	1500	15	35 bar
The CPTu summary indicates which cone was used for each sounding.						

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

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

Closure

Thank you for the opportunity to work on this project. The equipment used and the field procedures followed complied with current accepted practice standards. This report has been prepared under my supervision and I have reviewed and approved the content.

ConeTec Investigations Ltd.

PROFESSIONAL
PROVINCE OF
I. A. WEEMEES
BRITISH COLUMBIA
ENGINEER

29-Jan-2021

Ilmar Weemees, P.Eng.

Limitations

3rd Party Disclaimer

This report titled "Tetra Tech Dewdney Bridge", referred to as the ("Report"), was prepared by ConeTec for Tetra Tech Canada Inc.. The Report is confidential and may not be distributed to or relied upon by any third parties without the express written consent of ConeTec. Any third parties gaining access to the Report do not acquire any rights as a result of such access. Any use which a third party makes of the Report, or any reliance on or decisions made based on it, are the responsibility of such third parties. ConeTec accepts no responsibility for loss, damage and/or expense, if any, suffered by any third parties as a result of decisions made, or actions taken or not taken, which are in any way based on, or related to, the Report or any portion(s) thereof.

Client Disclaimer

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

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

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

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in 5 cm^2, 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross-sectional area (typically forty-four millimeter diameter over a length of thirty-two millimeter with tapered leading and trailing edges) located at a distance of 585 millimeters above the cone tip.

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

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

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

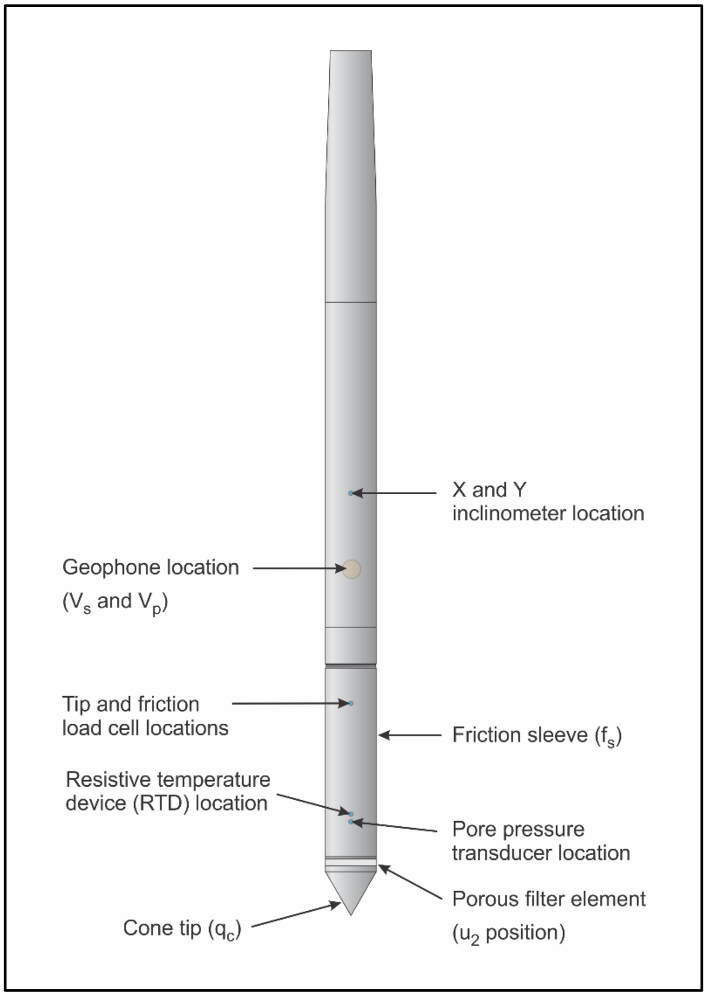


Figure CPTu. Piezocone Penetrometer (15 cm^2)

The ConeTec data acquisition systems consist of a Windows based computer and a signal conditioner and power supply interface box with a sixteen bit (or greater) analog to digital (A/D) converter. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording interval is 2.5 centimeters; custom recording intervals are possible. The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

References

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

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

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Mayne, P.W. and Peuchen, J., 2012, "Unit weight trends with cone resistance in soft to firm clays", Geotechnical and Geophysical Site Characterization *4,* Vol. 1 (Proc. ISC-4, Pernambuco), CRC Press, London: 903-910.

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

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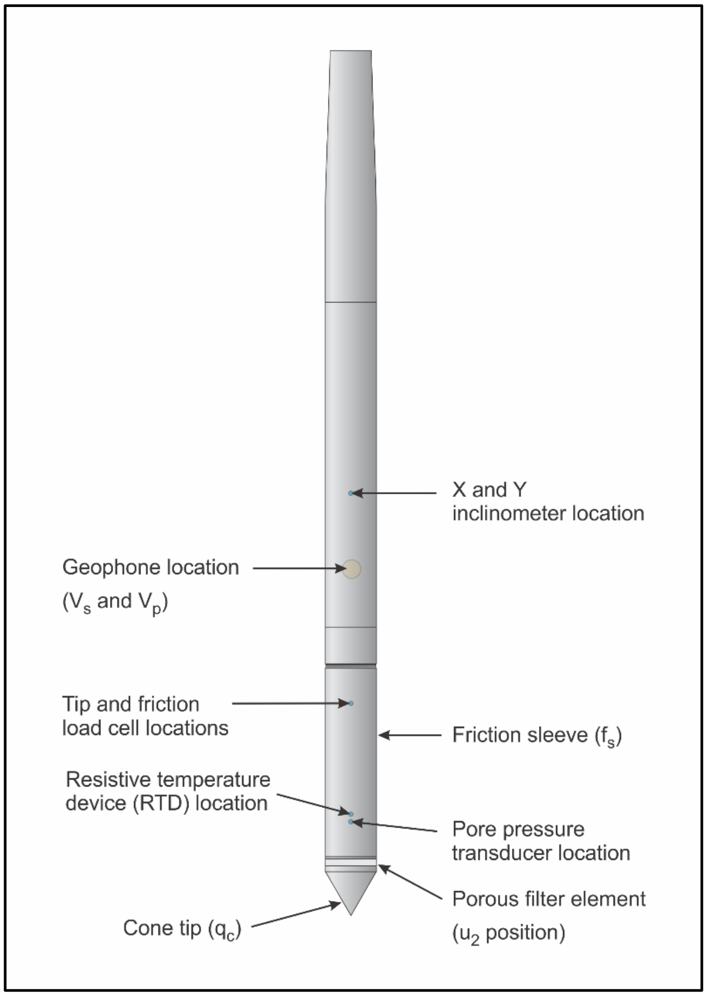

Figure CPTu. Piezocone Penetrometer (15 cm^2)

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

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- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

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

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

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

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

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

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

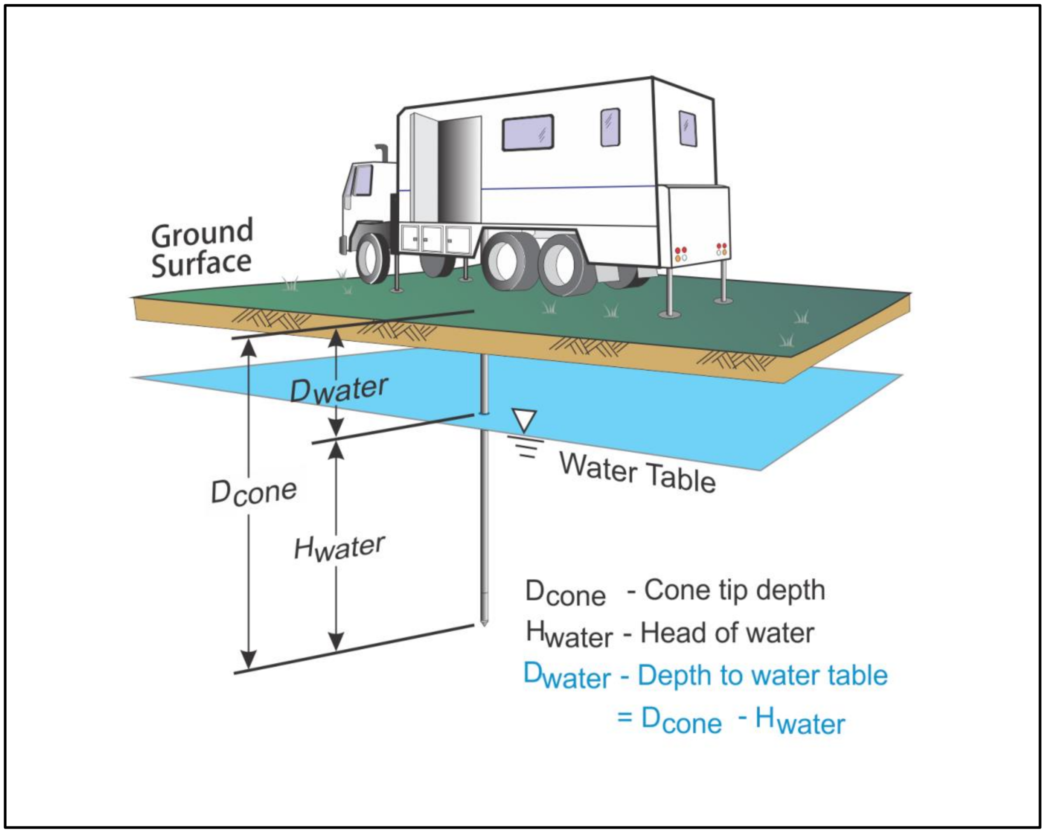

Figure PPD-1. Pore pressure dissipation test setup

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

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

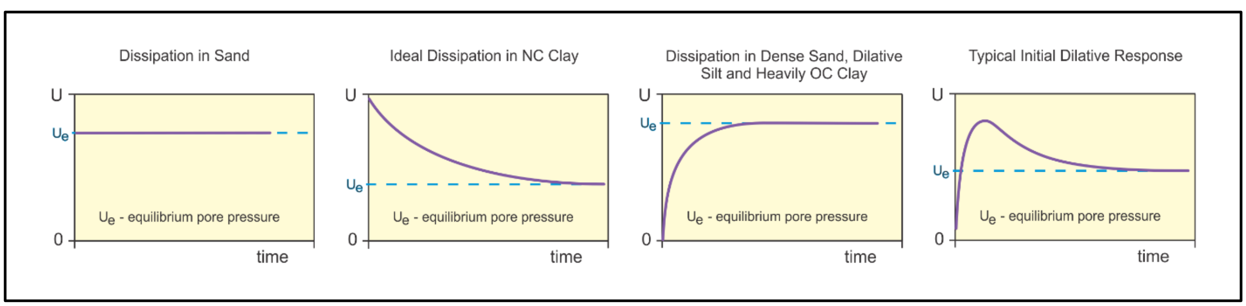

Figure PPD-2. Pore pressure dissipation curve examples

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

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

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

Where:

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

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

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

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

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

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

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

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

References

Burns, S.E. and Mayne, P.W., 1998, "Monotonic and dilatory pore pressure decay during piezocone tests", Canadian Geotechnical Journal 26 (4): 1063-1073. DOI: 1063-1073/T98-062.

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Jones, G.A. and Van Zyl, D.J.A., 1981, "The piezometer probe: a useful investigation tool", Proceedings, 10th International Conference on Soil Mechanics and Foundation Engineering, Vol. 3, Stockholm: 489-495.

Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G., 1992, "Estimating coefficient of consolidation from piezocone tests", Canadian Geotechnical Journal, 29(4): 539-550. DOI: 10.1139/T92-061.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils", Canadian Geotechnical Journal, 36(2): 369-381. DOI: 10.1139/T98-105.

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

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

ConeTec's piezocone penetrometers are manufactured with one horizontally active geophone (28 hertz) and one vertically active geophone (28 hertz). Both geophones are rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip. The vertically mounted geophone is more sensitive to compression waves.

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

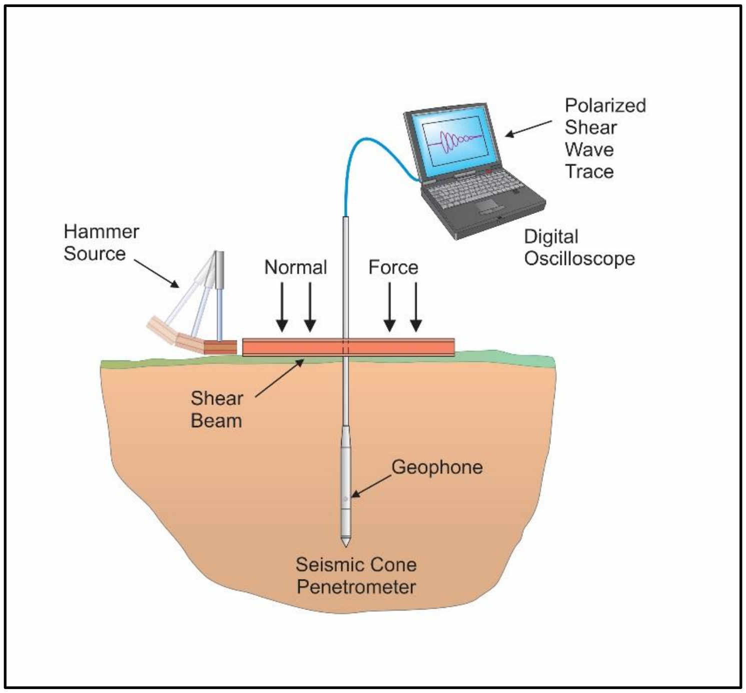


Figure SCPTu-1. Illustration of the SCPTu system

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

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

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

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

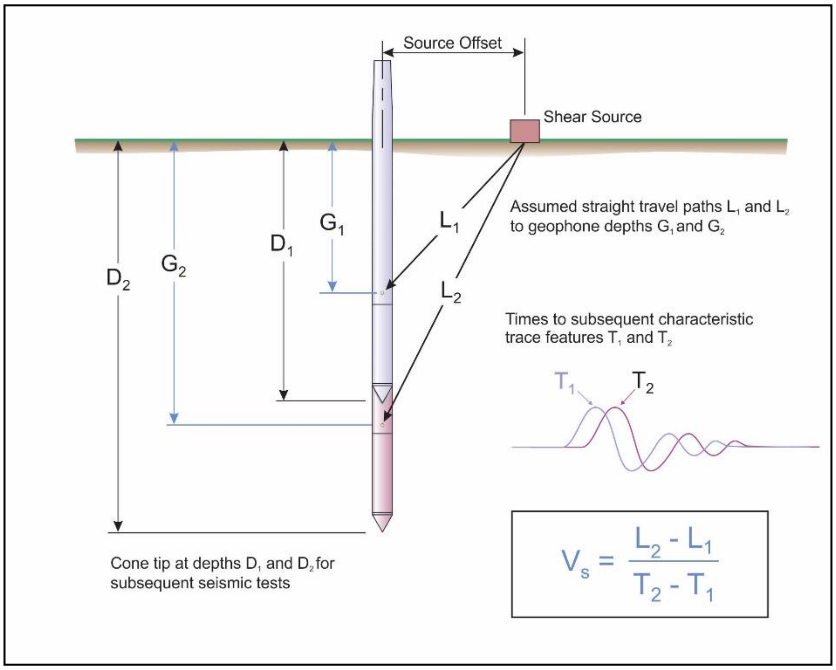


Figure SCPTu-2. Illustration of a seismic cone penetration test

Calculation of the interval velocities are performed by visually picking a common feature (e.g. the first characteristic peak, trough, or crossover) on all of the recorded wave sets and taking the difference in ray path divided by the time difference between subsequent features. Ray path is defined as the straight line distance from the seismic source to the geophone, accounting for beam offset, source depth and geophone offset from the cone tip.

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

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

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

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

References

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

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

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

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

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Advanced Cone Penetration Test Plots with Ic, Su(Nkt), Phi and N1(60)Ic
- Seismic Cone Penetration Test Plots
- Seismic Cone Penetration Test Shear Wave (Vs) Tabular Results
- Seismic Cone Penetration Test Shear Wave (Vs) Traces
- Soil Behaviour Type (SBT) Scatter Plots
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots
- Description of Methods for Calculated CPT Geotechnical Parameters

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

Job No: 20-02-21738
Client: Tetra Tech Canada Inc.
Project: Tetra Tech Dewdney Bridge
Start Date: 21-Dec-2020
End Date: 19-Jan-2021

CONE PENETRATION TEST SUMMARY

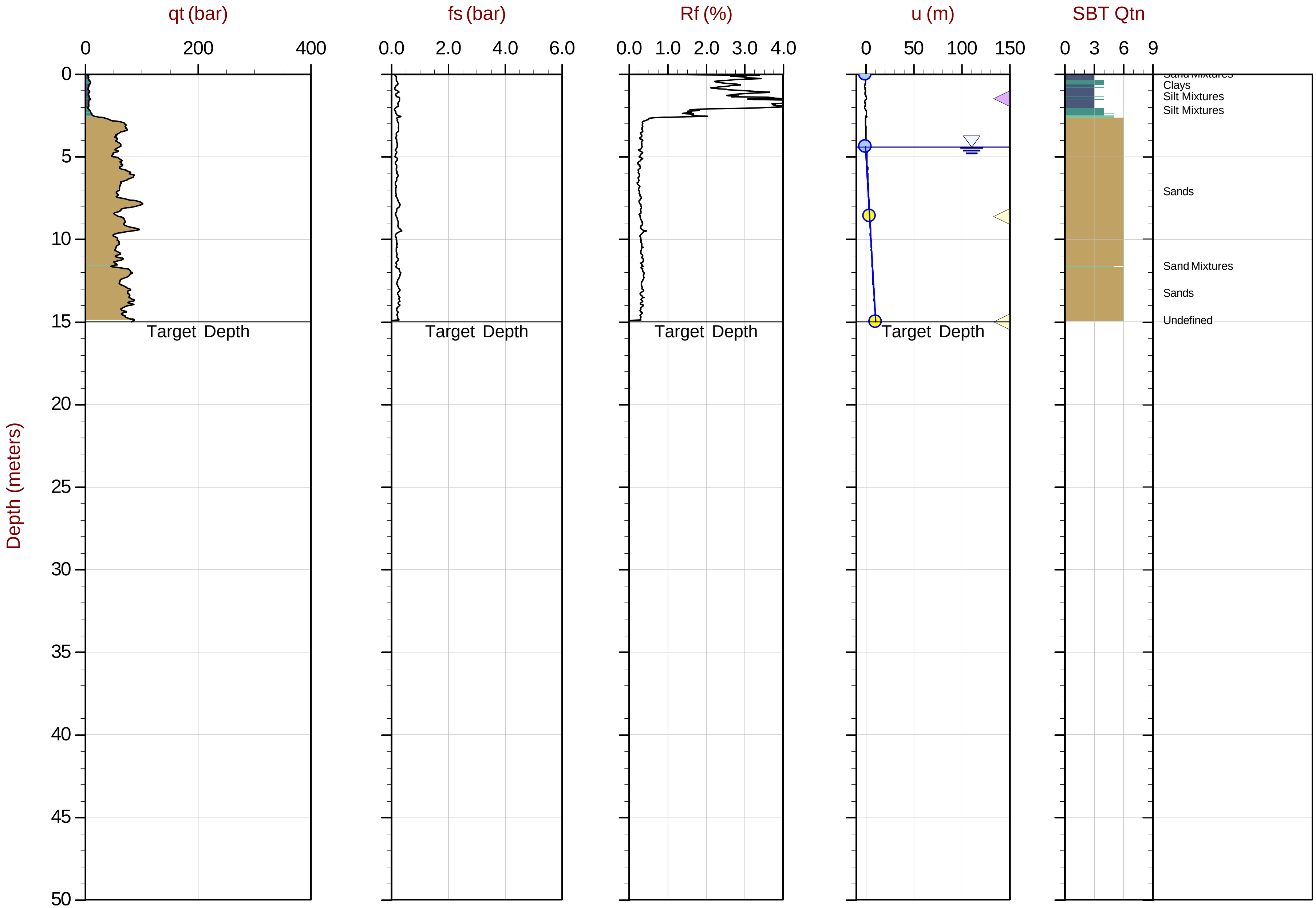
Sounding ID	File Name	Date	Cone	Cone Area (cm^2)	Assumed Phreatic Surface[1] (m)	Final Depth (m)	Northing[2] (m)	Easting[2] (m)	Refer to Notation Number
CPT20-01	20-02-21738_CP01	21-Dec-2020	672:T1500F15U500	15	4.4	15.000	5445992	558652	
CPT20-02	20-02-21738_CP02	23-Dec-2020	672:T1500F15U500	15	2.5	17.200	5445788	558997	
SCPT21-01	20-02-21738_SP01	18-Jan-2021	742:T1500F15U35	15	4.8	80.025	5445961	558717	
SCPT21-02	20-02-21738_SP02	19-Jan-2021	742:T1500F15U35	15	7.2	91.600	5445860	558888	

1. The assumed phreatic surface was based on pore pressure dissipation tests, unless otherwise noted. Hydrostatic conditions were assumed for the calculated parameters.
2. Coordinates were collected with a consumer grade GPS device, datum: WGS84 / UTM Zone 10N.

Tetra Tech Canada

Job No: 20-02-21738
Date: 2020-12-21 09:14
Site: Dewdney, BC

Sounding: CPT20-01
Cone: 672:T1500F15U500



Max Depth: 15.000 m / 49.21 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_CP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445992m E: 558652m
Sheet No: 1 of 1

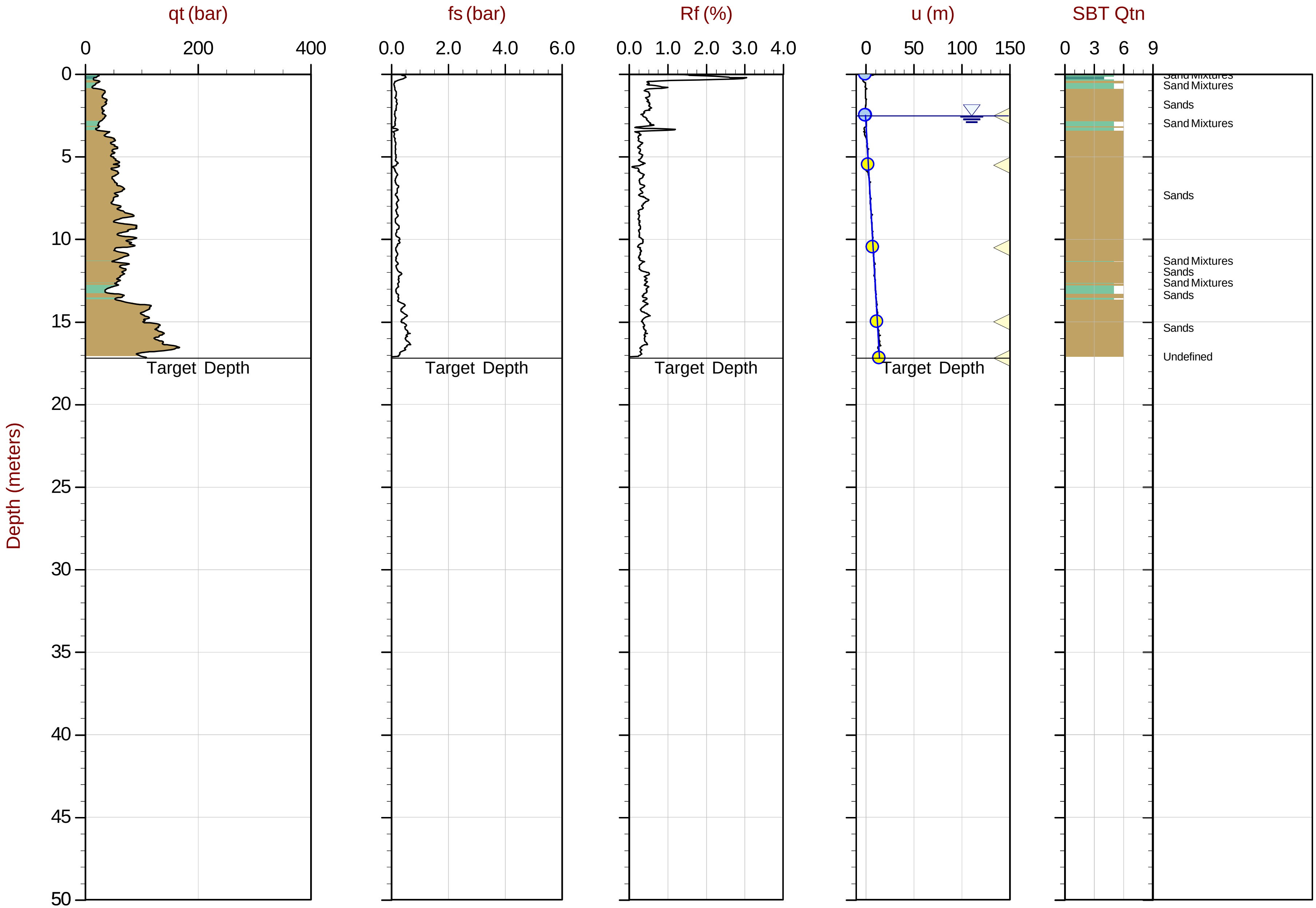
Overplot Item: Ueq; Assumed Ueq; Dissipation, Ueq achieved; Dissipation, Ueq not achieved; Dissipation, Ueq assumed; Hydrostatic Line

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

Tetra Tech Canada

Job No: 20-02-21738
Date: 2020-12-23 11:39
Site: Dewdney, BC

Sounding: CPT20-02
Cone: 672:T1500F15U500



Max Depth: 17.200 m / 56.43 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445788m E: 558997m
Sheet No: 1 of 1

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

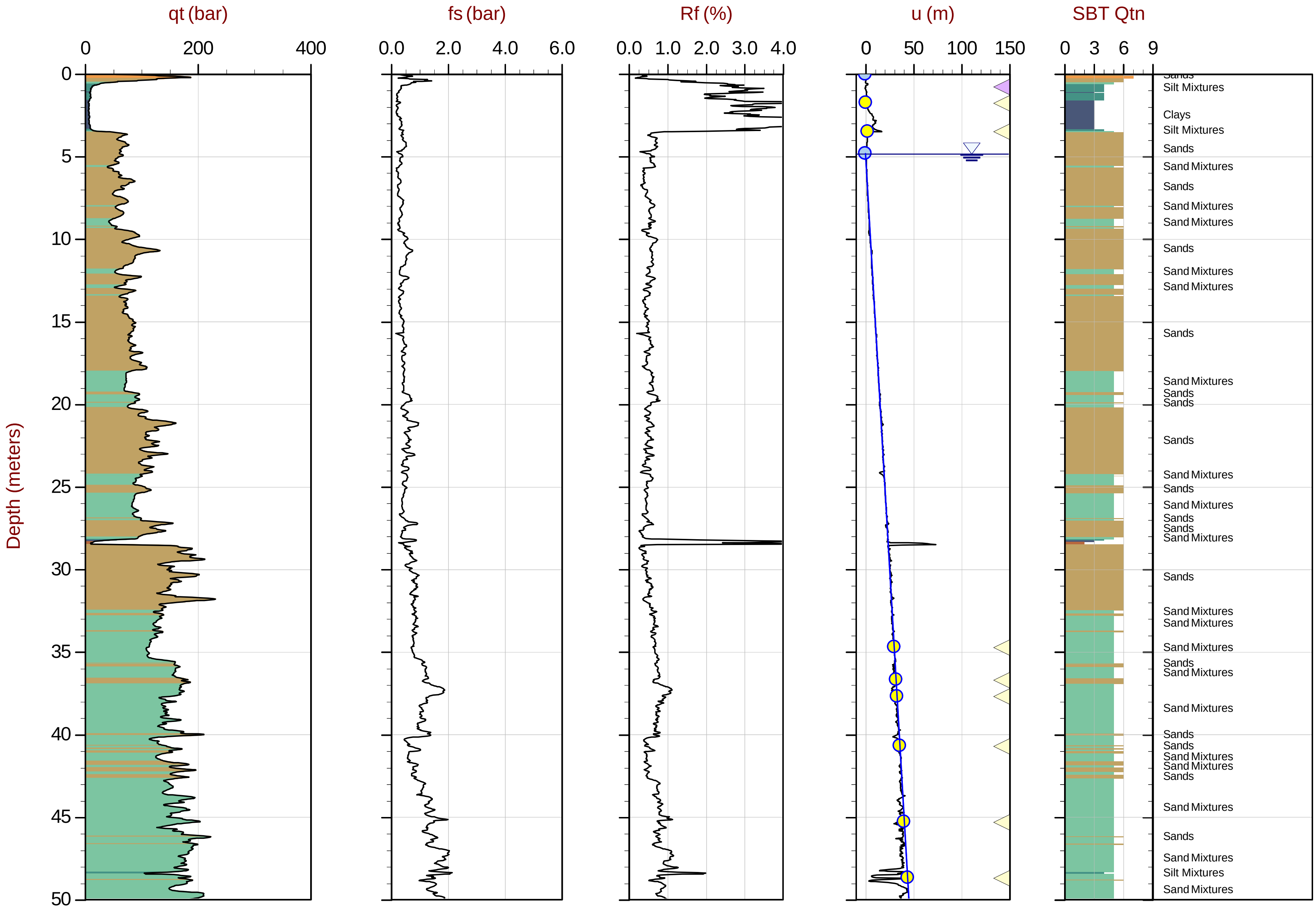
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-18 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742



Max Depth: 80.025 m / 262.55 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445961m E: 558717m
Sheet No: 1 of 2

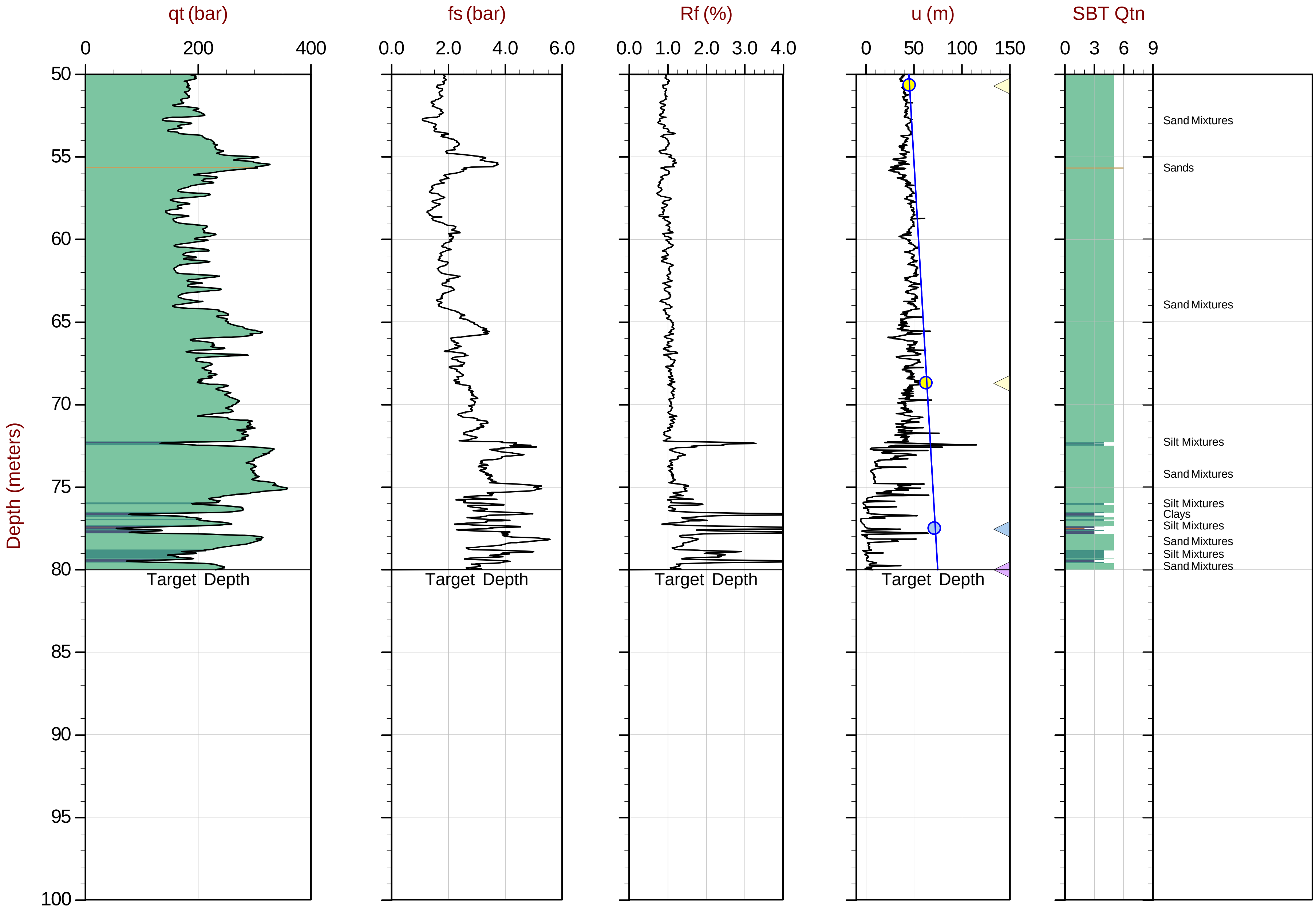
Overplot Item: Ueq   Assumed Ueq   Dissipation, Ueq achieved   Dissipation, Ueq not achieved   Dissipation, Ueq assumed   Hydrostatic Line

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

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-18 08:54
Site: Dewdney, BC
Sounding: SCPT21-01
Cone: EC742



Max Depth: 80.025 m / 262.55 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP01.COR
Unit Wt: SBTQtn (PKR2009)

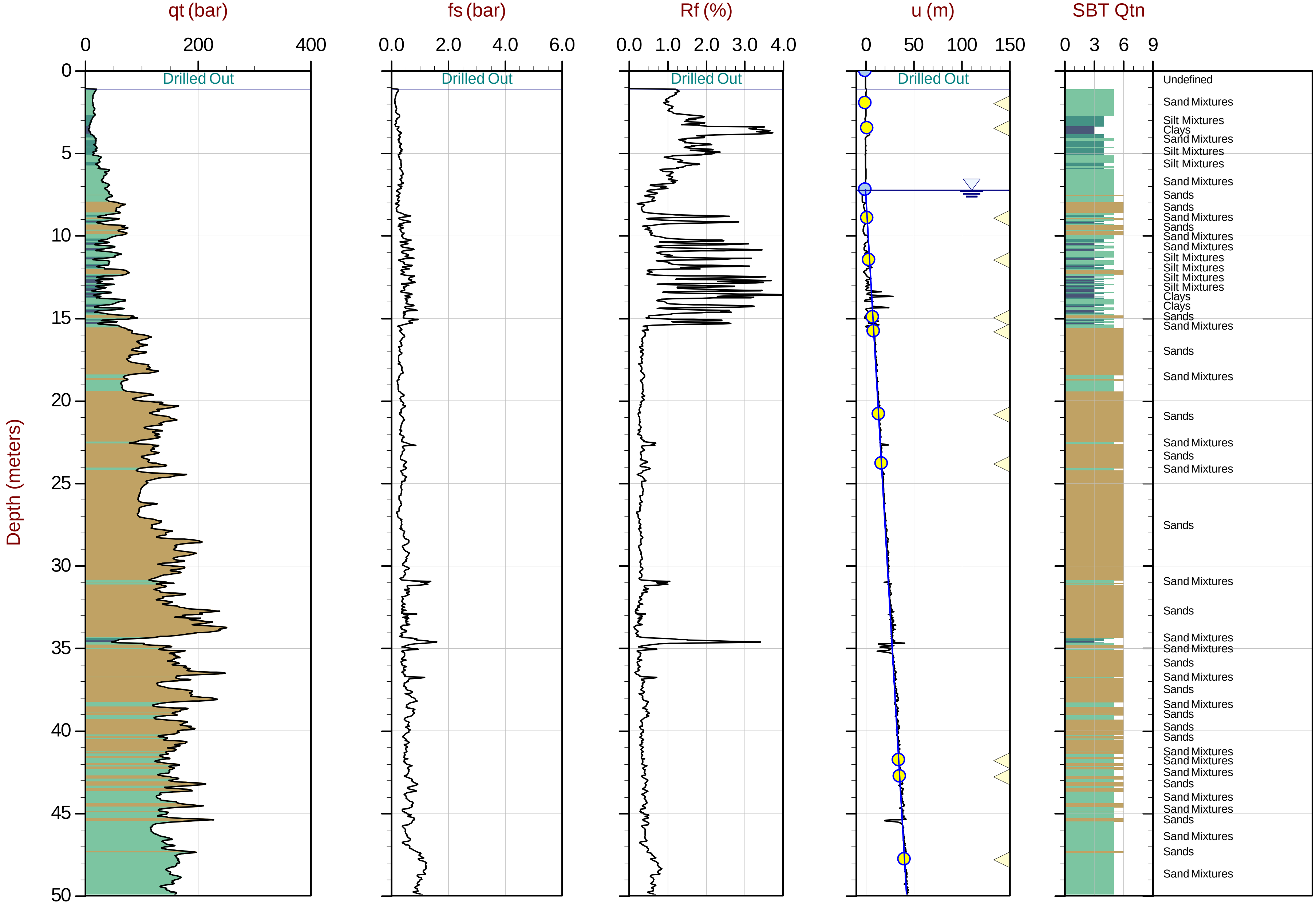
SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445961m E: 558717m
Sheet No: 2 of 2

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

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

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-19 07:43
Site: Dewdney, BC
Sounding: SCPT21-02
Cone: EC742



Max Depth: 91.600 m / 300.52 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445860m E: 558888m
Sheet No: 1 of 2

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

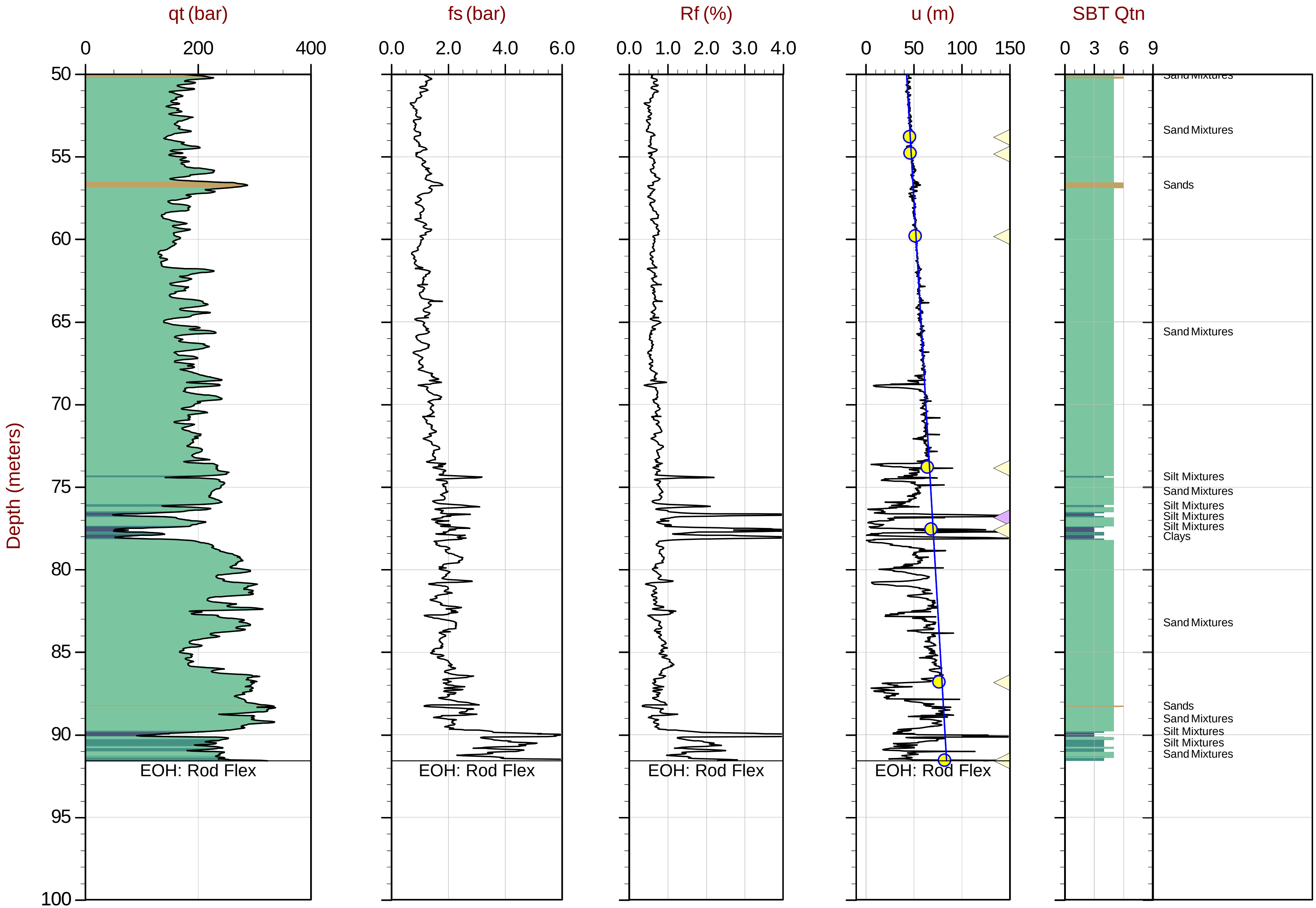
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-19 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742



Max Depth: 91.600 m / 300.52 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445860m E: 558888m
Sheet No: 2 of 2

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

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

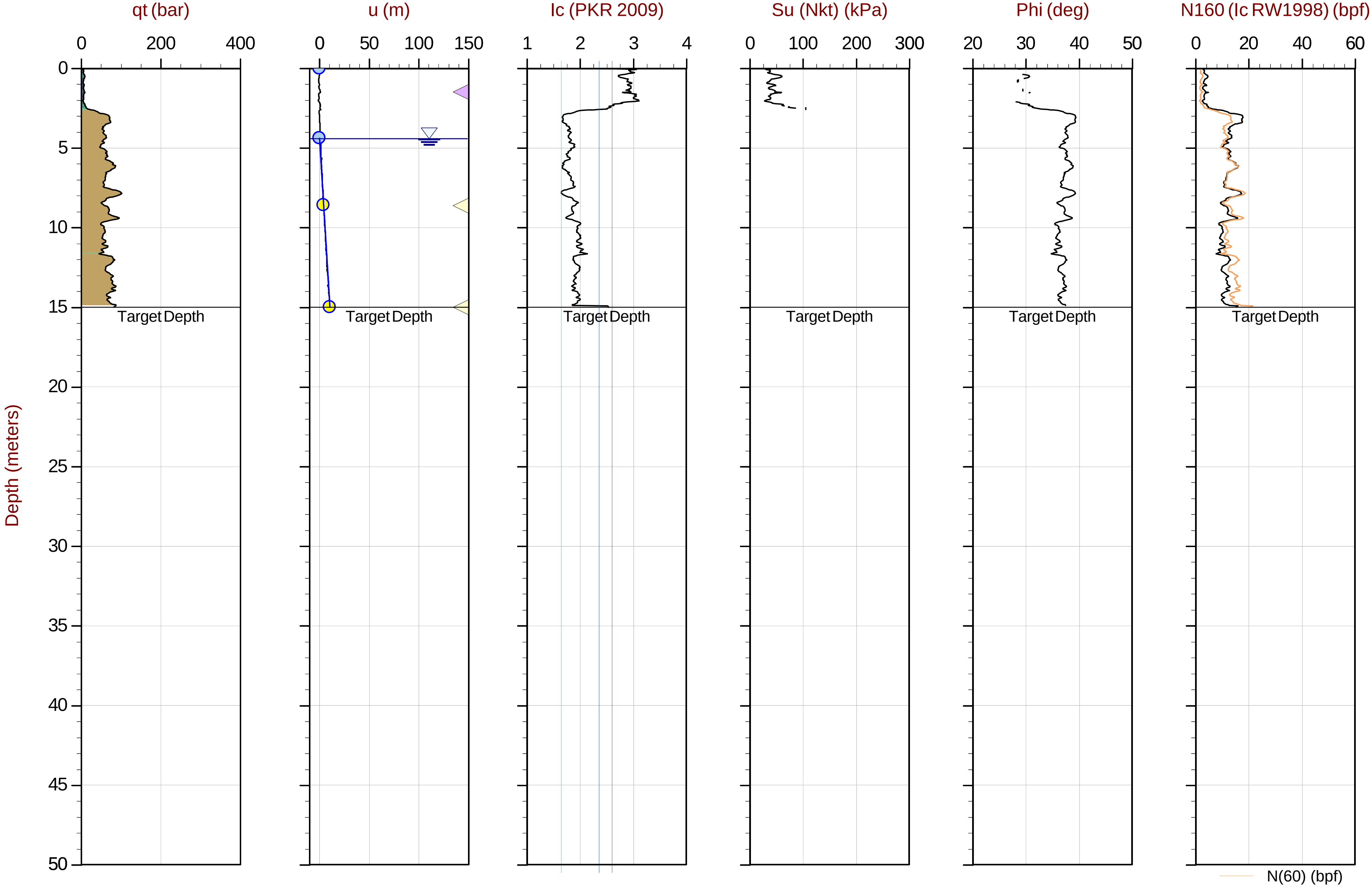
Advanced Cone Penetration Plots with Ic, Su(Nkt), Phi and N1(60)Ic

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2020-12-21 09:14
Site: Dewdney, BC

Sounding: CPT20-01
Cone: 672:T1500F15U500



Max Depth: 15.000 m / 49.21 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_CP01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445992m E: 558652m
Sheet No: 1 of 1

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

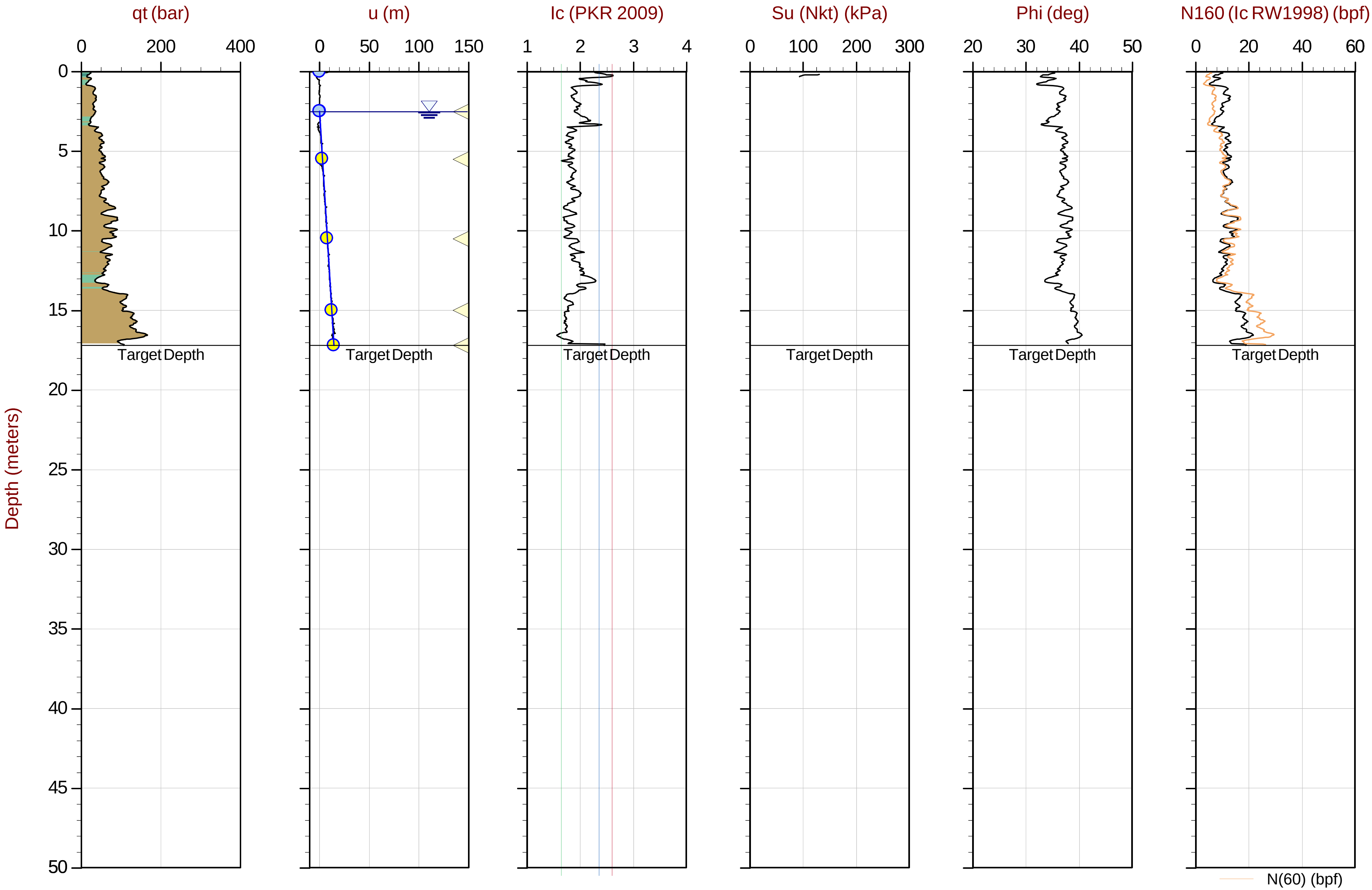
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2020-12-23 11:39
Site: Dewdney, BC

Sounding: CPT20-02
Cone: 672:T1500F15U500



Max Depth: 17.200 m / 56.43 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_CP02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445788m E: 558997m
Sheet No: 1 of 1

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

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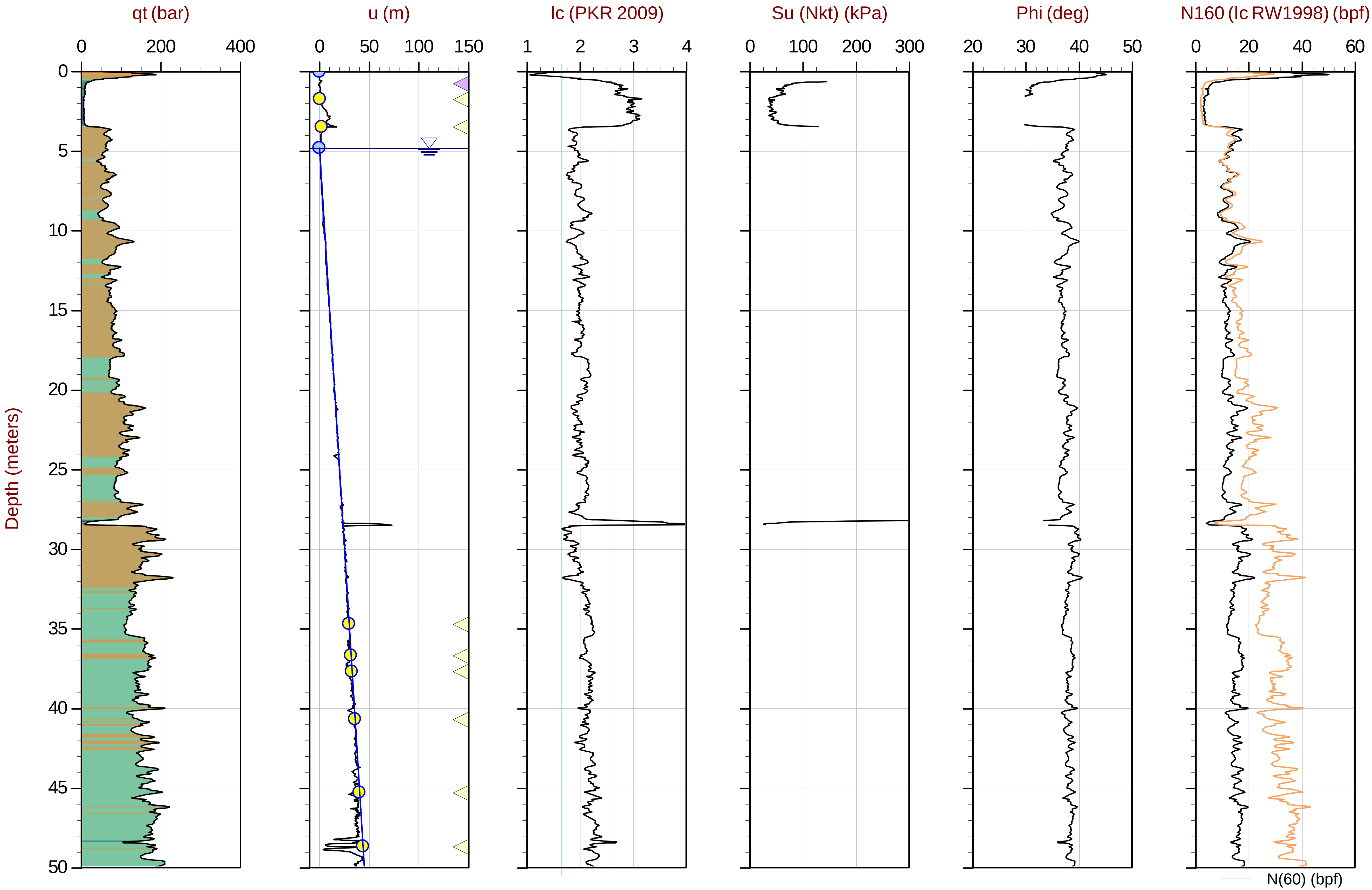
CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-18 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742



Max Depth: 80.025 m / 262.55 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445961m E: 558717m
Sheet No: 1 of 2

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

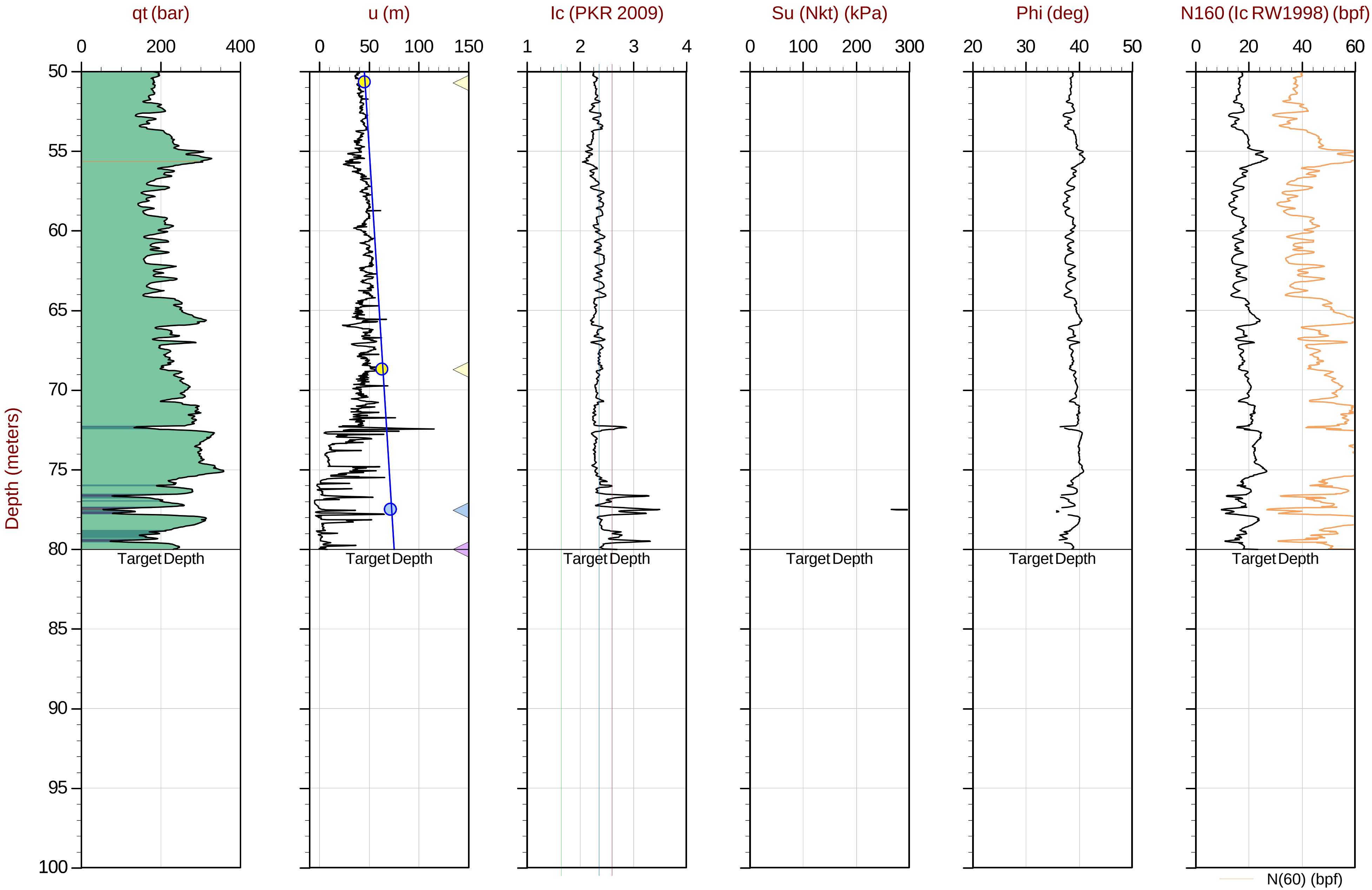
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-18 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742



Max Depth: 80.025 m / 262.55 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445961m E: 558717m
Sheet No: 2 of 2

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

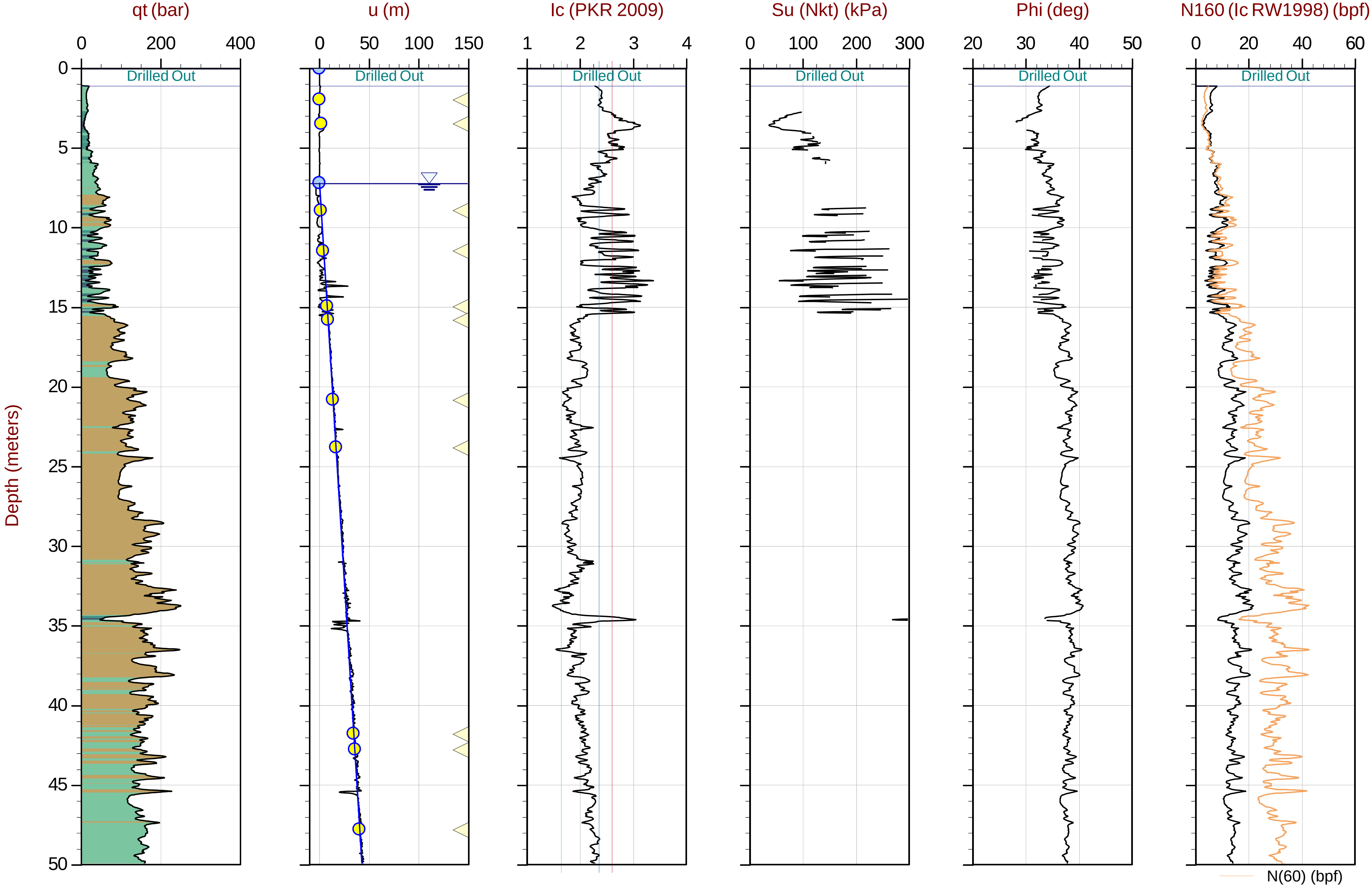
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-19 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742



Max Depth: 91.600 m / 300.52 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445860m E: 558888m
Sheet No: 1 of 2

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

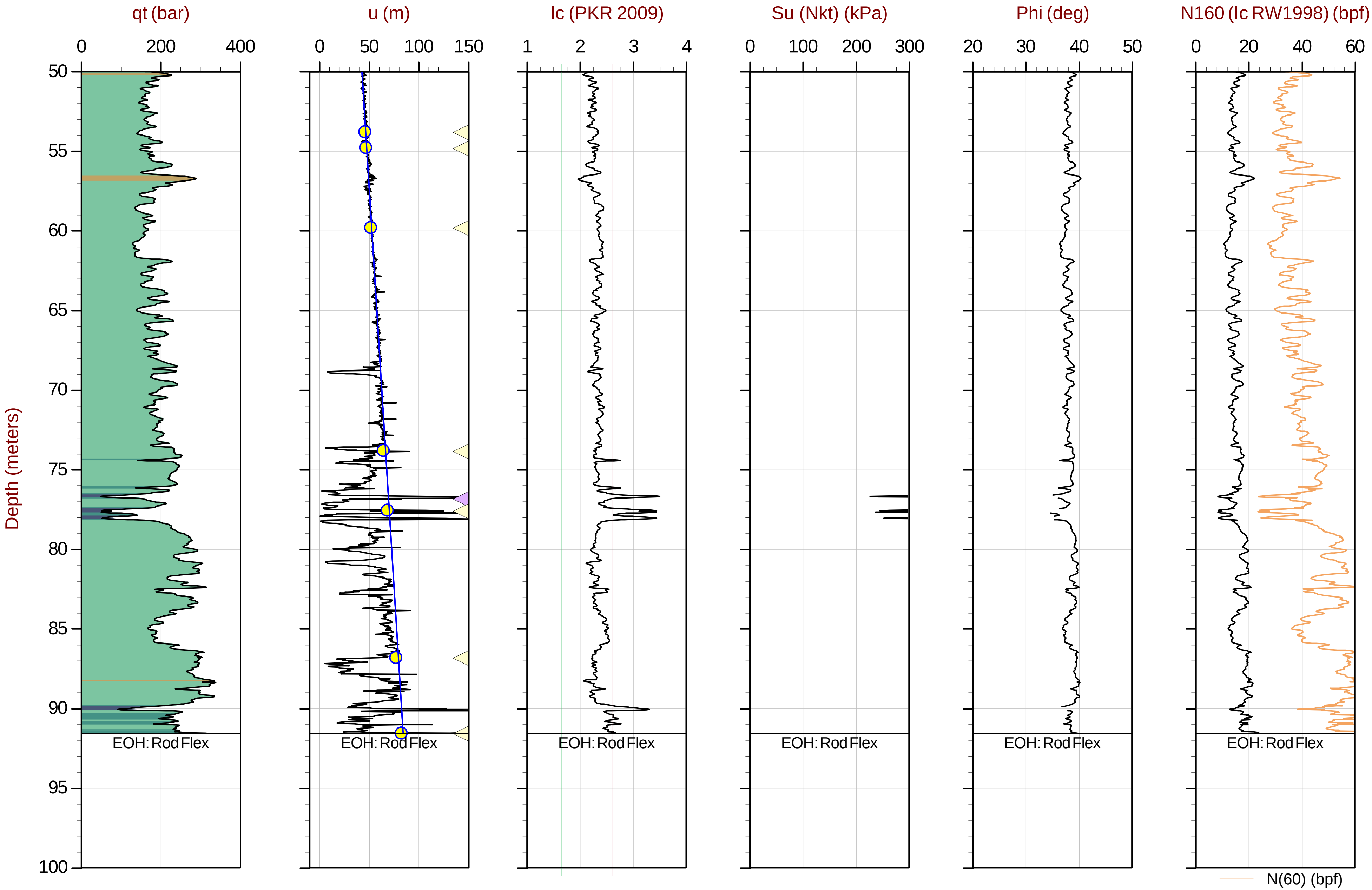
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-19 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742



Max Depth: 91.600 m / 300.52 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445860m E: 558888m
Sheet No: 2 of 2

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

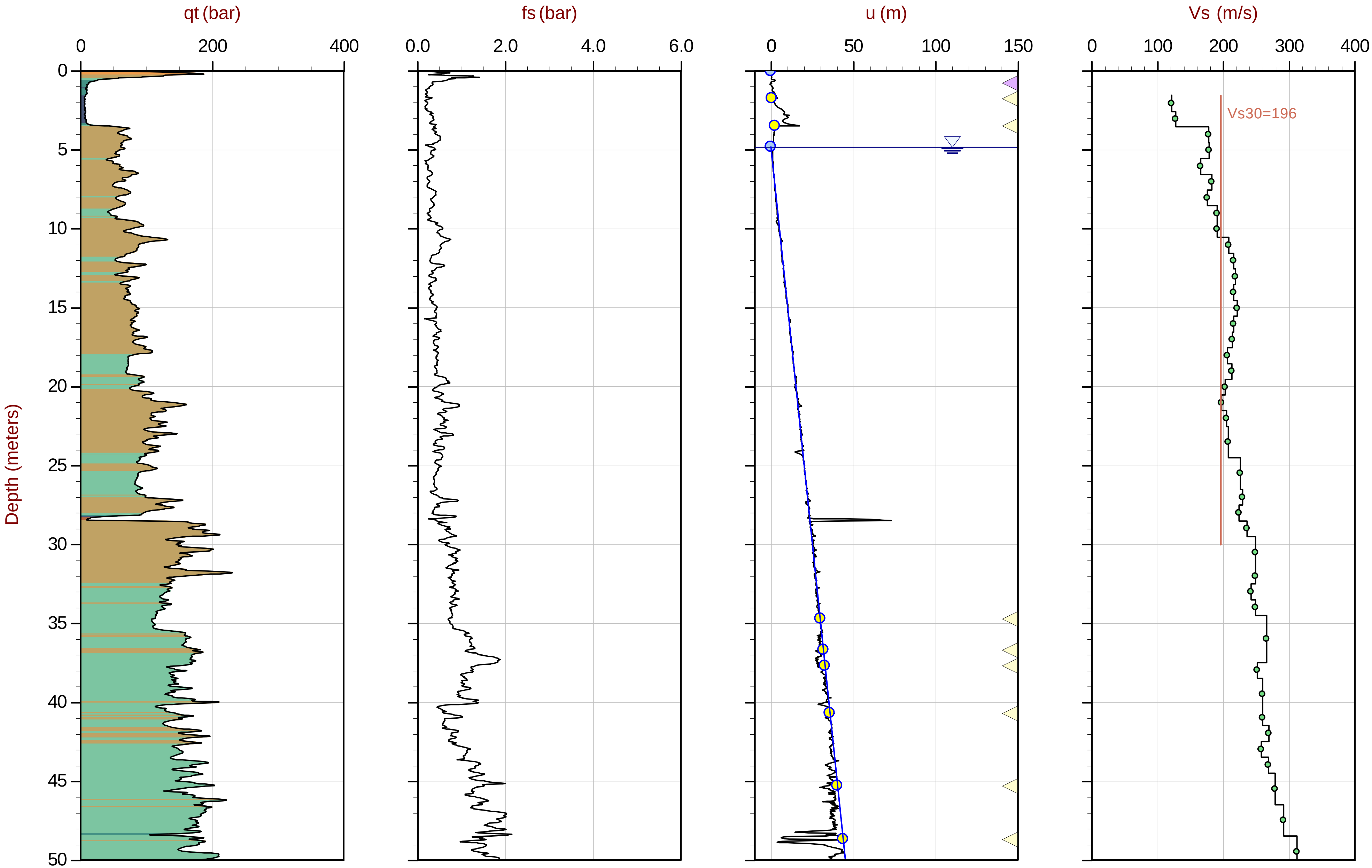
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Plots

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-18 08:54
Site: Dewdney, BC
Sounding: SCPT21-01
Cone: EC742



Max Depth: 80.025 m / 262.55 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445961m E: 558717m
Sheet No: 1 of 2

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

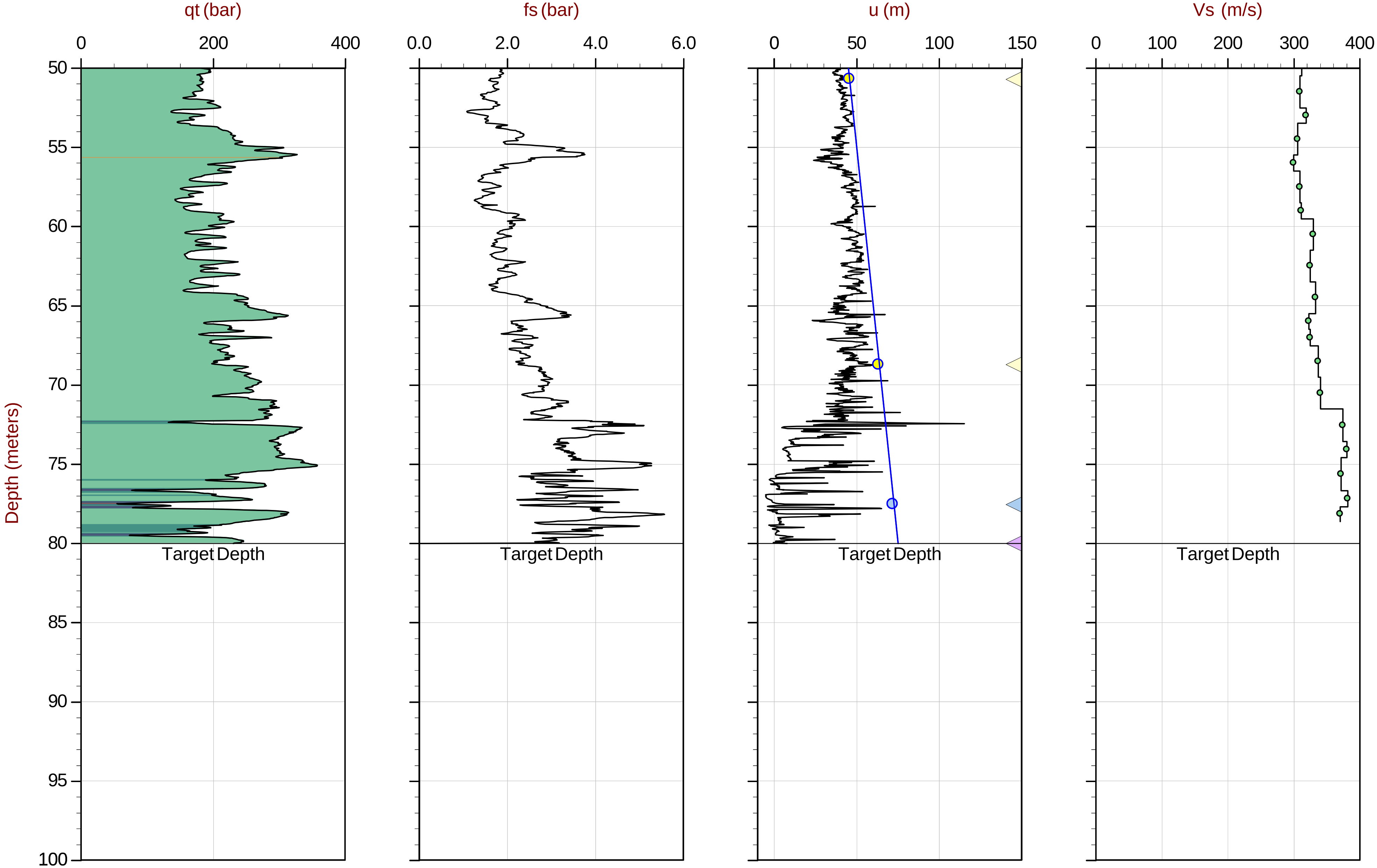
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-18 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742



Max Depth: 80.025 m / 262.55 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445961m E: 558717m
Sheet No: 2 of 2

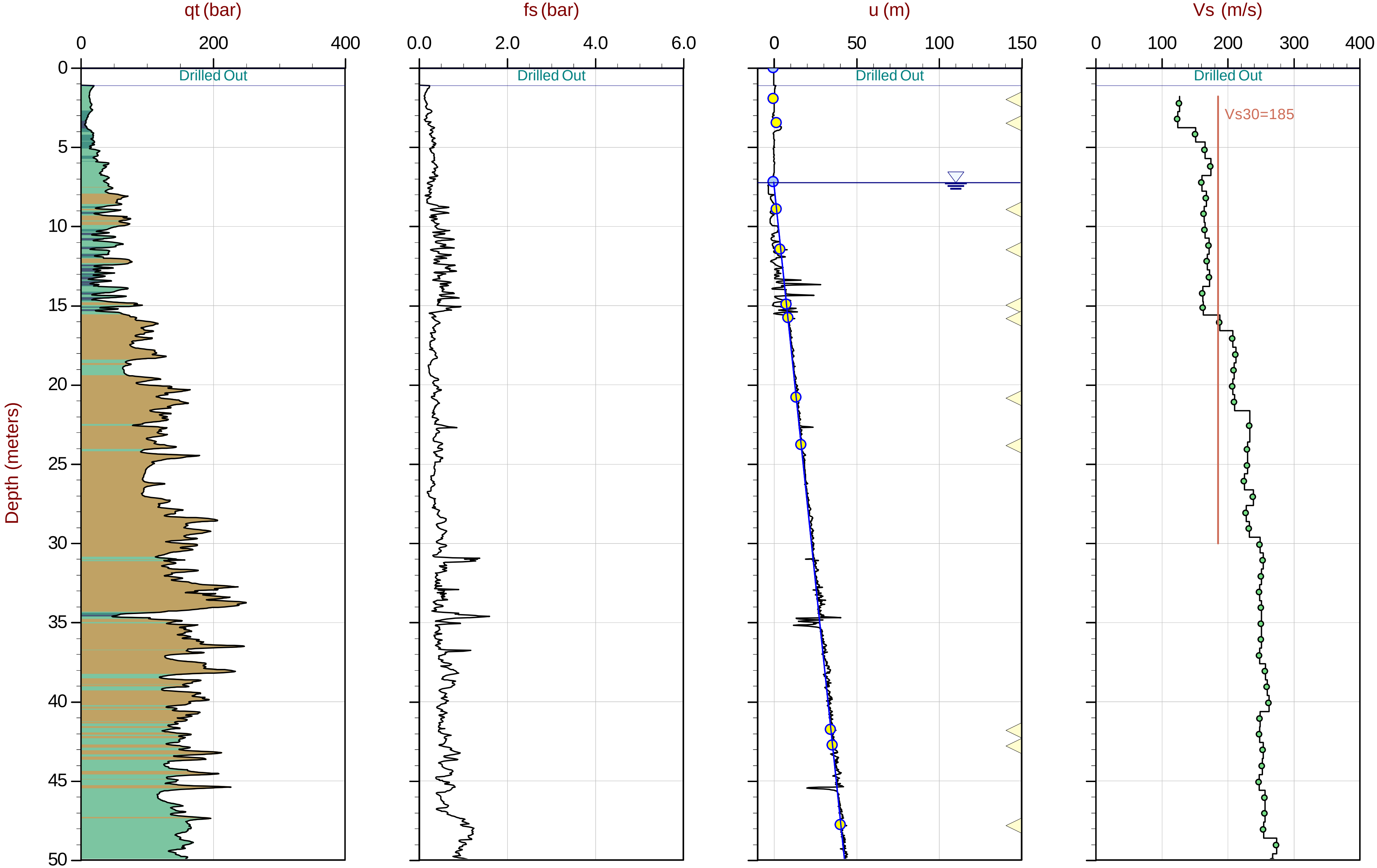
Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Hydrostatic Line

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

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-19 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742



Max Depth: 91.600 m / 300.52 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445860m E: 558888m
Sheet No: 1 of 2

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

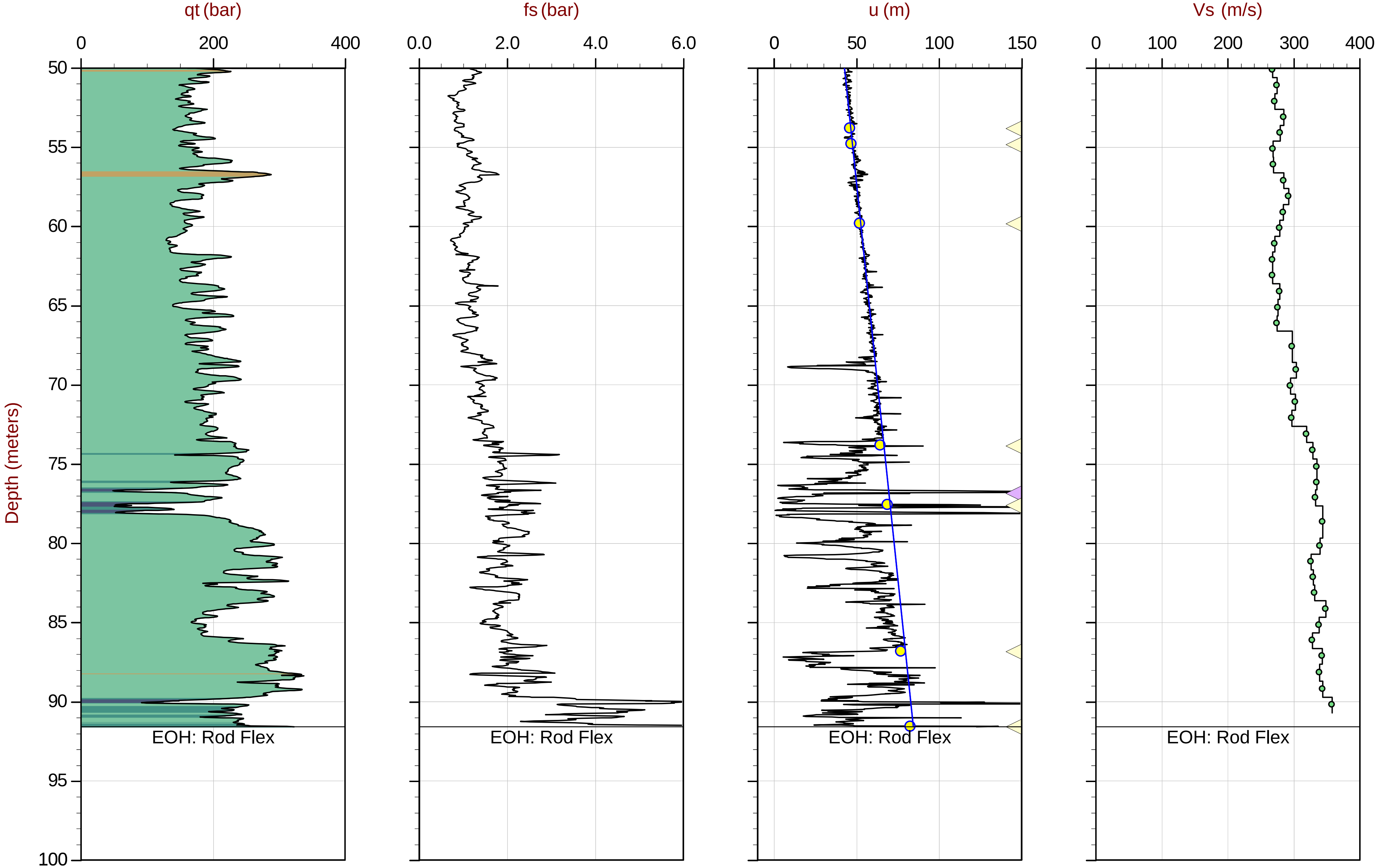
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-19 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742



Max Depth: 91.600 m / 300.52 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 20-02-21738_SP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 5445860m E: 558888m
Sheet No: 2 of 2

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

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

Seismic Cone Penetration Test Shear Wave (Vs) Tabular Results

	Job No:	20-02-21738
	Client:	Tetra Tech Canada
	Project:	Tetra Tech Dewdney Bridge
	Sounding ID:	SCPT21-01
	Date:	18-Jan-2021

Seismic Source:	Beam
Seismic Offset (m):	0.60
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
1.75	1.55	1.66			
2.78	2.58	2.65	0.99	8.13	121
3.75	3.55	3.60	0.95	7.45	128
4.75	4.55	4.59	0.99	5.57	178
5.75	5.55	5.58	0.99	5.57	178
6.75	6.55	6.58	1.00	6.01	166
7.75	7.55	7.57	1.00	5.46	183
8.75	8.55	8.57	1.00	5.68	176
9.75	9.55	9.57	1.00	5.23	191
10.75	10.55	10.57	1.00	5.23	191
11.75	11.55	11.57	1.00	4.80	208
12.75	12.55	12.56	1.00	4.62	216
13.75	13.55	13.56	1.00	4.57	219
14.75	14.55	14.56	1.00	4.62	216
15.75	15.55	15.56	1.00	4.52	221
16.75	16.55	16.56	1.00	4.62	216
17.75	17.55	17.56	1.00	4.66	214
18.75	18.55	18.56	1.00	4.84	207
19.75	19.55	19.56	1.00	4.68	213
20.75	20.55	20.56	1.00	4.92	203
21.72	21.52	21.53	0.97	4.91	198
22.75	22.55	22.56	1.03	5.02	205
24.72	24.52	24.53	1.97	9.47	208
26.72	26.52	26.53	2.00	8.85	226
27.72	27.52	27.53	1.00	4.36	230
28.72	28.52	28.53	1.00	4.45	224
29.72	29.52	29.53	1.00	4.23	236
31.72	31.52	31.53	2.00	8.04	249
32.72	32.52	32.53	1.00	4.02	249
33.72	33.52	33.53	1.00	4.12	243
34.72	34.52	34.53	1.00	4.02	249

Job No:	20-02-21738
Client:	Tetra Tech Canada
Project:	Tetra Tech Dewdney Bridge
Sounding ID:	SCPT21-01
Date:	18-Jan-2021

Seismic Source:	Beam
Seismic Offset (m):	0.60
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
37.70	37.50	37.51	2.98	11.21	266
38.70	38.50	38.51	1.00	3.97	252
40.70	40.50	40.50	2.00	7.68	260
41.70	41.50	41.50	1.00	3.84	260
42.70	42.50	42.50	1.00	3.72	269
43.70	43.50	43.50	1.00	3.87	258
44.72	44.52	44.52	1.02	3.79	269
46.72	46.52	46.52	2.00	7.17	279
48.70	48.50	48.50	1.98	6.79	292
50.70	50.50	50.50	2.00	6.40	312
52.72	52.52	52.52	2.02	6.53	309
53.70	53.50	53.50	0.98	3.07	319
55.70	55.50	55.50	2.00	6.53	306
56.70	56.50	56.50	1.00	3.33	300
58.72	58.52	58.52	2.02	6.53	309
59.72	59.52	59.52	1.00	3.21	312
61.70	61.50	61.50	1.98	6.00	330
63.70	63.50	63.50	2.00	6.15	325
65.70	65.50	65.50	2.00	6.00	334
66.70	66.50	66.50	1.00	3.10	323
67.75	67.55	67.55	1.05	3.23	325
69.73	69.53	69.53	1.98	5.87	338
71.73	71.53	71.53	2.00	5.87	341
73.80	73.60	73.60	2.07	5.53	374
74.80	74.60	74.60	1.00	2.63	381
76.88	76.68	76.68	2.08	5.59	372
77.90	77.70	77.70	1.02	2.67	382
78.85	78.65	78.65	0.95	2.56	371

Job No: 20-02-21738
Client: Tetra Tech Canada
Project: Tetra Tech Dewdney Bridge
Sounding ID: SCPT21-02
Date: 19-Jan-2021

Seismic Source: Beam
Seismic Offset (m): 0.90
Source Depth (m): 0.00
Geophone Offset (m): 0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
1.98	1.78	1.99			
2.95	2.75	2.89	0.90	7.08	127
3.98	3.78	3.89	0.99	7.99	124
4.88	4.68	4.77	0.88	5.80	152
5.93	5.73	5.80	1.03	6.23	166
6.98	6.78	6.84	1.04	5.96	174
7.98	7.78	7.83	0.99	6.18	161
8.93	8.73	8.78	0.94	5.63	168
9.95	9.75	9.79	1.02	6.17	164
10.95	10.75	10.79	1.00	6.02	166
11.95	11.75	11.78	1.00	5.79	172
12.95	12.75	12.78	1.00	5.91	169
13.98	13.78	13.81	1.03	5.95	173
14.95	14.75	14.78	0.97	5.96	163
15.80	15.60	15.63	0.85	5.22	163
16.80	16.60	16.62	1.00	5.30	188
17.83	17.63	17.65	1.03	4.95	208
18.83	18.63	18.65	1.00	4.70	212
19.83	19.63	19.65	1.00	4.76	210
20.83	20.63	20.65	1.00	4.81	208
21.83	21.63	21.65	1.00	4.75	210
23.83	23.63	23.65	2.00	8.56	233
24.83	24.63	24.65	1.00	4.33	231
25.83	25.63	25.65	1.00	4.34	231
26.83	26.63	26.65	1.00	4.44	225
27.83	27.63	27.65	1.00	4.18	239
28.83	28.63	28.64	1.00	4.39	228
29.83	29.63	29.64	1.00	4.29	233
30.83	30.63	30.64	1.00	4.01	249
31.83	31.63	31.64	1.00	3.94	254
32.83	32.63	32.64	1.00	3.98	251

Job No:	20-02-21738
Client:	Tetra Tech Canada
Project:	Tetra Tech Dewdney Bridge
Sounding ID:	SCPT21-02
Date:	19-Jan-2021
Seismic Source:	Beam
Seismic Offset (m):	0.90
Source Depth (m):	0.00
Geophone Offset (m):	0.20

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
33.83	33.63	33.64	1.00	4.02	249
34.83	34.63	34.64	1.00	3.98	251
35.83	35.63	35.64	1.00	3.98	251
36.83	36.63	36.64	1.00	3.98	251
37.83	37.63	37.64	1.00	4.02	249
38.83	38.63	38.64	1.00	3.89	257
39.83	39.63	39.64	1.00	3.85	260
40.83	40.63	40.64	1.00	3.80	263
41.80	41.60	41.61	0.97	3.89	249
42.80	42.60	42.61	1.00	4.02	249
43.80	43.60	43.61	1.00	3.93	254
44.82	44.62	44.63	1.02	4.04	252
45.82	45.62	45.63	1.00	4.04	248
46.82	46.62	46.63	1.00	3.90	256
47.82	47.62	47.63	1.00	3.90	256
48.82	48.62	48.63	1.00	3.93	254
49.82	49.62	49.63	1.00	3.65	274
50.82	50.62	50.63	1.00	3.73	268
51.82	51.62	51.63	1.00	3.64	275
52.82	52.62	52.63	1.00	3.68	272
53.82	53.62	53.63	1.00	3.51	285
54.82	54.62	54.63	1.00	3.57	280
55.82	55.62	55.63	1.00	3.72	269
56.82	56.62	56.63	1.00	3.71	270
57.82	57.62	57.63	1.00	3.51	285
58.82	58.62	58.63	1.00	3.42	293
59.82	59.62	59.63	1.00	3.52	284
60.82	60.62	60.63	1.00	3.59	279
61.82	61.62	61.63	1.00	3.68	272
62.82	62.62	62.63	1.00	3.72	268

Job No: 20-02-21738
Client: Tetra Tech Canada
Project: Tetra Tech Dewdney Bridge
Sounding ID: SCPT21-02
Date: 19-Jan-2021

Seismic Source: Beam
Seismic Offset (m): 0.90
Source Depth (m): 0.00
Geophone Offset (m): 0.20

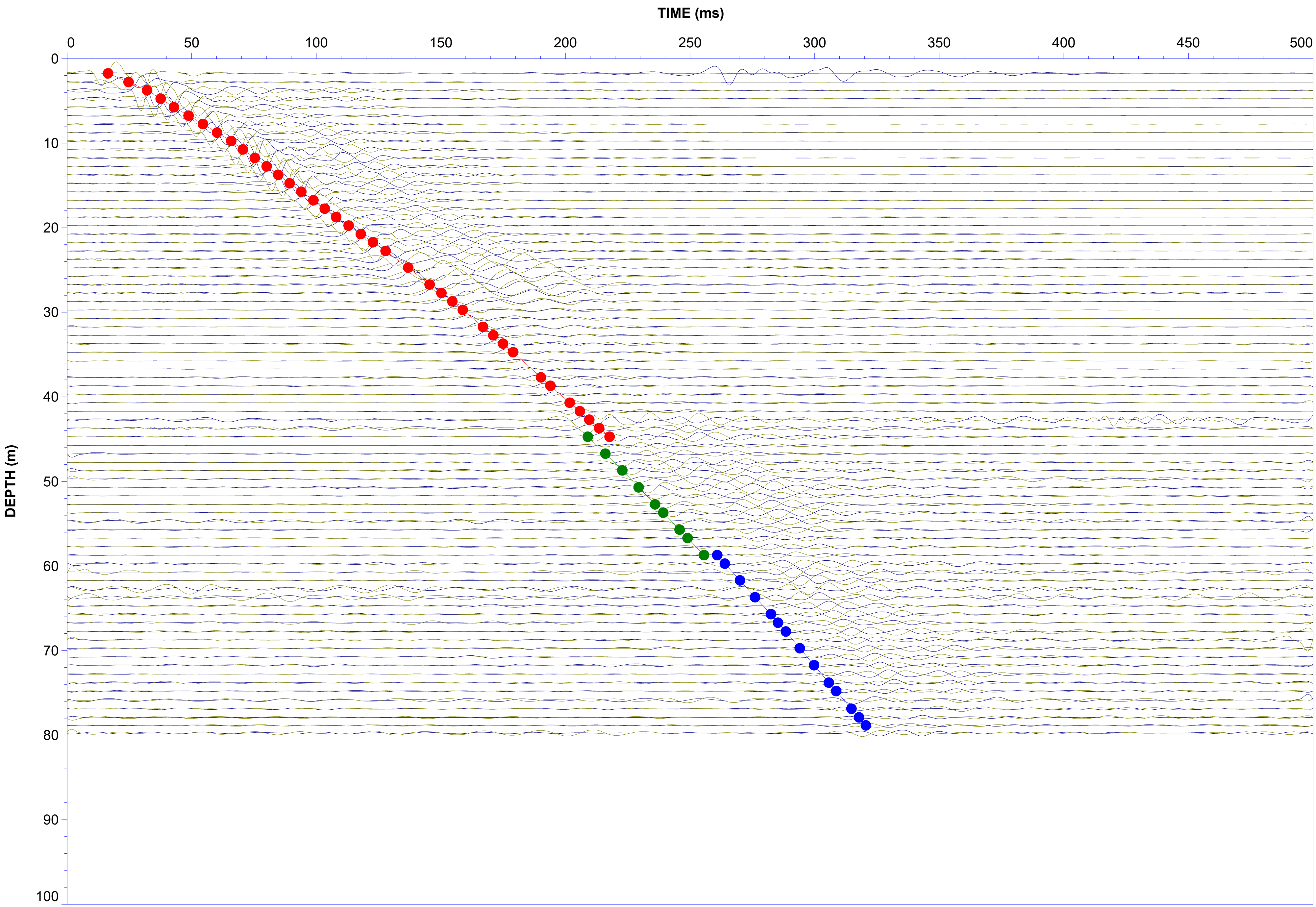
SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference (m)	Travel Time Interval (ms)	Interval Velocity (m/s)
63.82	63.62	63.63	1.00	3.73	268
64.82	64.62	64.63	1.00	3.59	279
65.85	65.65	65.66	1.03	3.73	276
66.82	66.62	66.63	0.97	3.53	275
68.78	68.58	68.59	1.96	6.57	298
69.78	69.58	69.59	1.00	3.29	304
70.80	70.60	70.61	1.02	3.45	295
71.80	71.60	71.61	1.00	3.30	303
72.82	72.62	72.63	1.02	3.43	297
73.85	73.65	73.66	1.03	3.22	320
74.88	74.68	74.69	1.03	3.13	329
75.90	75.70	75.71	1.02	3.04	336
76.85	76.65	76.66	0.95	2.83	335
77.85	77.65	77.66	1.00	3.00	334
79.88	79.68	79.69	2.03	5.91	344
80.90	80.70	80.71	1.02	3.00	340
81.88	81.68	81.69	0.98	3.00	327
82.85	82.65	82.66	0.97	2.94	330
83.85	83.65	83.66	1.00	3.01	332
84.88	84.68	84.69	1.03	2.95	349
85.88	85.68	85.69	1.00	2.95	339
86.85	86.65	86.66	0.97	2.95	329
87.85	87.65	87.66	1.00	2.91	343
88.93	88.73	88.74	1.08	3.18	339
89.93	89.73	89.74	1.00	2.90	344
90.93	90.73	90.73	1.00	2.79	358

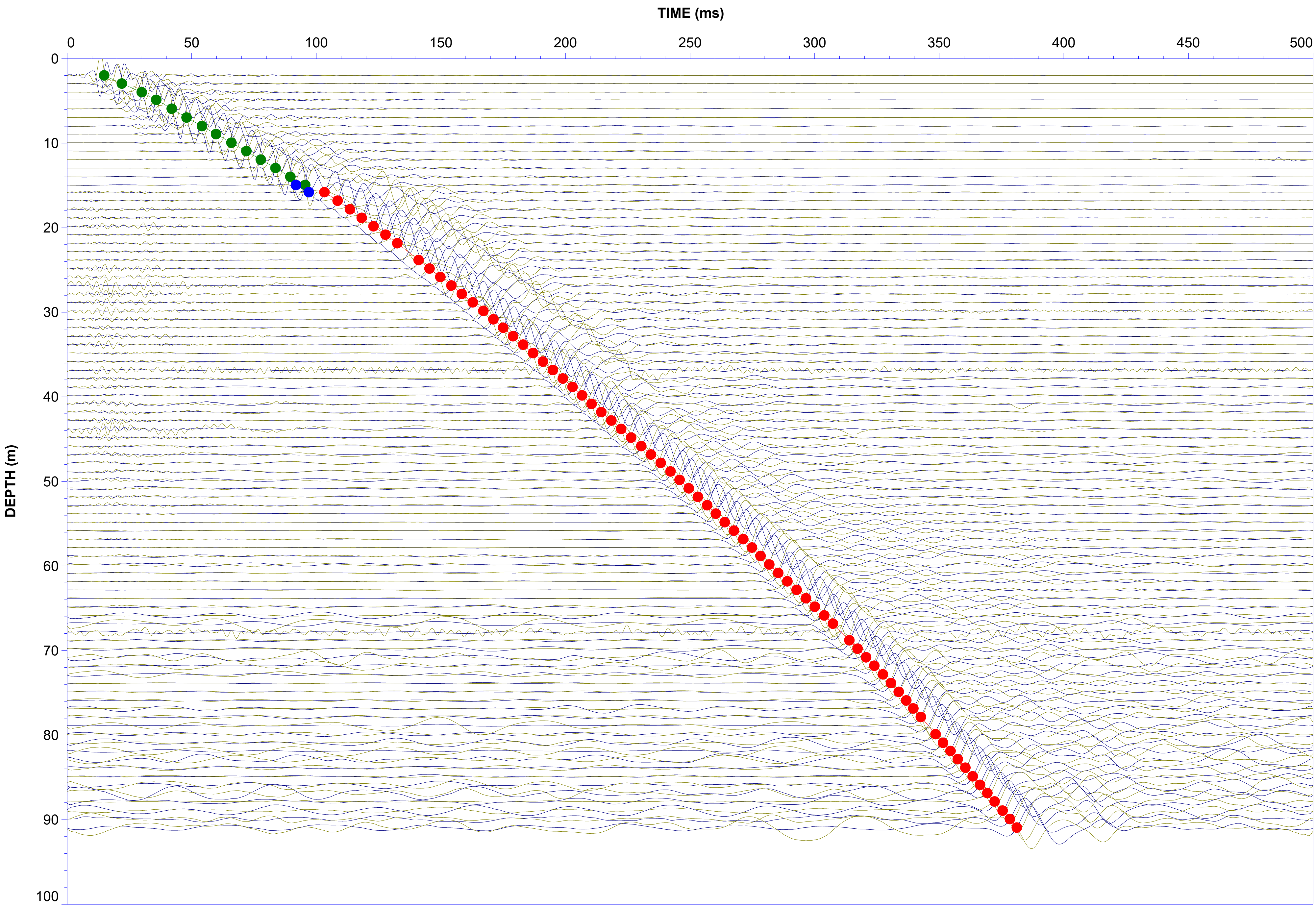
Seismic Cone Penetration Test Shear Wave (Vs) Traces

ConeTec

Job No: 20-02-21738 | Client: Tetra Tech Canada | Project: Tetra Tech Dewdney Bridge | Filter: 40 - 200Hz | Sounding: SCPT21-01 | Date: 18-Jan-2021



Job No: 20-02-21738 Client: Tetra Tech Canada Project: Tetra Tech Dewdney Bridge Filter: 0 - 300Hz Sounding: SCPT21-02 Date: 19-Jan-2021



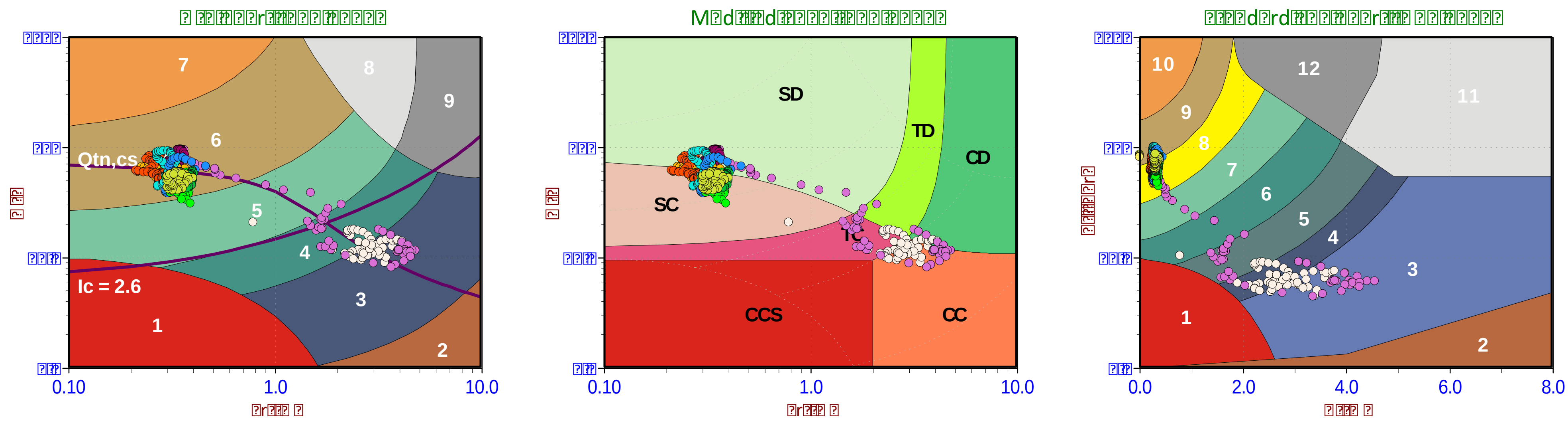
Soil Behaviour Type (SBT) Scatter Plots

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2020-12-21 09:14
Site: Dewdney, BC

Sounding: CPT20-01
Cone: 672:T1500F15U500



Depth Ranges
- >0.0 to 1.5 m
- >1.5 to 3.0 m
- >3.0 to 4.5 m
- >4.5 to 6.0 m
- >6.0 to 7.5 m
- >7.5 to 9.0 m
- >9.0 to 10.5 m
- >10.5 to 12.0 m
- >12.0 to 13.5 m
- >13.5 to 15.0 m
- >15.0 m

Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

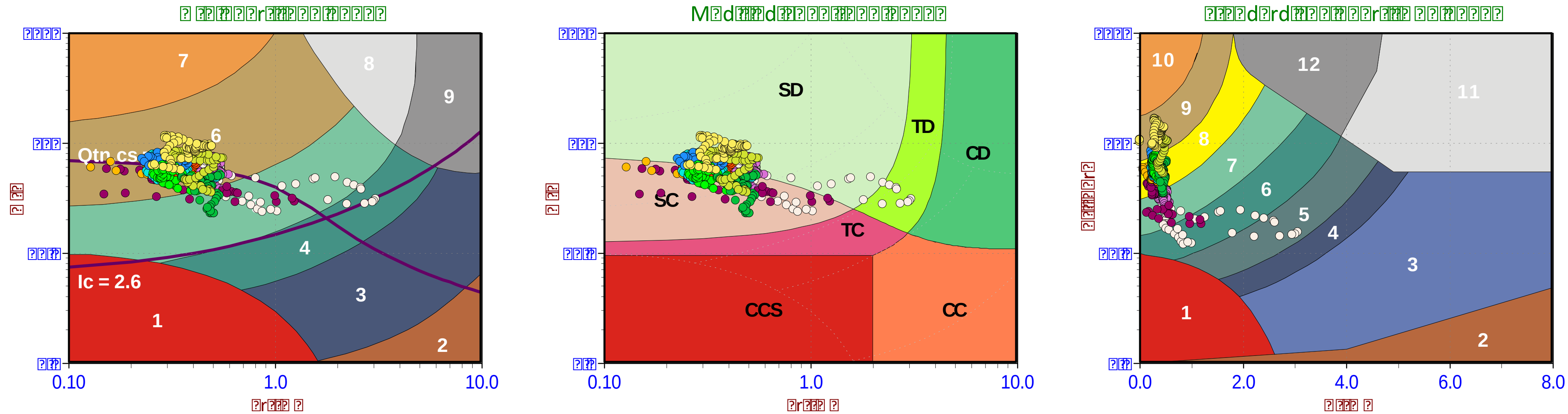
Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

CONETEC

Tetra Tech Canada

Job No: 20-02-21738
Date: 2020-12-23 11:39
Site: Dewdney, BC

Sounding: CPT20-02
Cone: 672:T1500F15U500



Depth Ranges
- >0.0 to 1.5 m
- >1.5 to 3.0 m
- >3.0 to 4.5 m
- >4.5 to 6.0 m
- >6.0 to 7.5 m
- >7.5 to 9.0 m
- >9.0 to 10.5 m
- >10.5 to 12.0 m
- >12.0 to 13.5 m
- >13.5 to 15.0 m
- >15.0 m

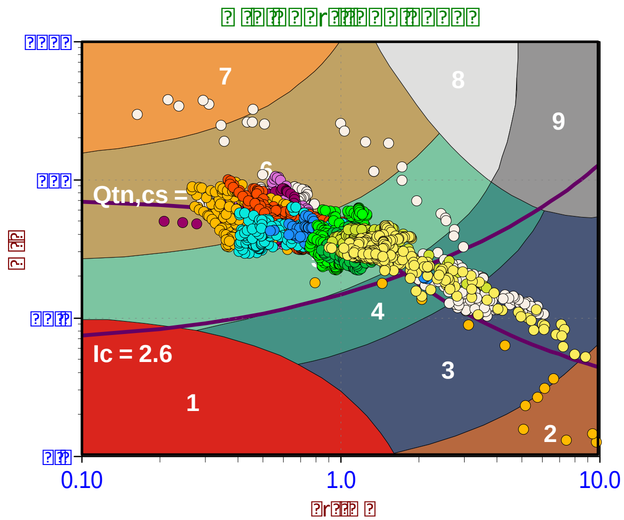
Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

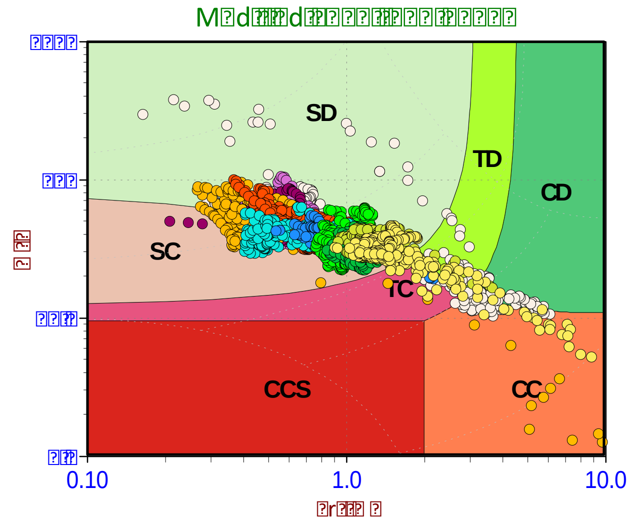
Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

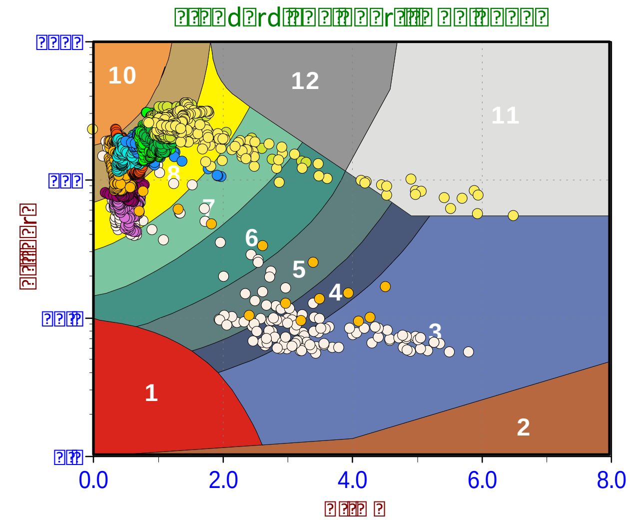
Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Tetra Tech Canada

Job No: 20-02-21738	Sounding: SCPT21-01
Date: 2021-01-18 08:54	Cone: EC742
Site: Dewdney, BC	







Depth Ranges

- >0.0 to 7.5 m
- >7.5 to 15.0 m
- >15.0 to 22.5 m
- >22.5 to 30.0 m
- >30.0 to 37.5 m
- >37.5 to 45.0 m
- >45.0 to 52.5 m
- >52.5 to 60.0 m
- >60.0 to 67.5 m
- >67.5 to 75.0 m
- >75.0 m

Legend

- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend

- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Legend

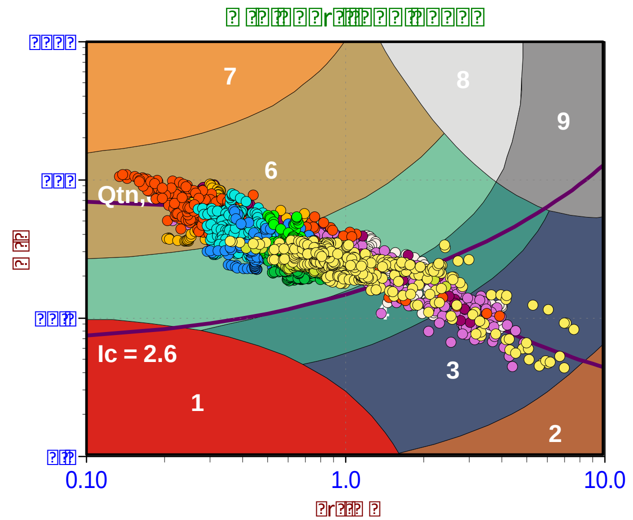
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

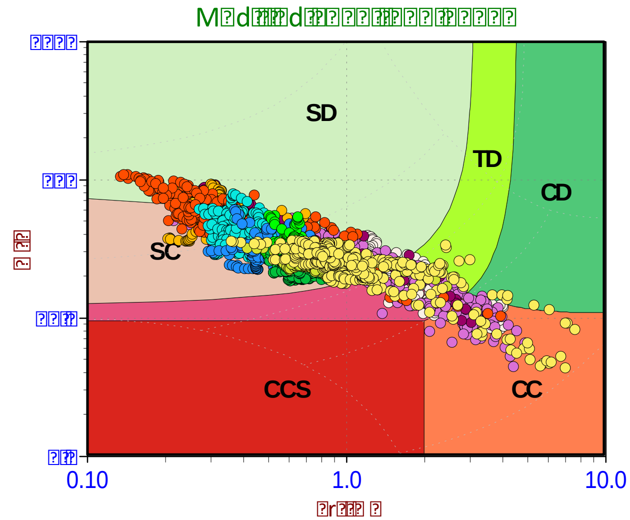
CONETEC

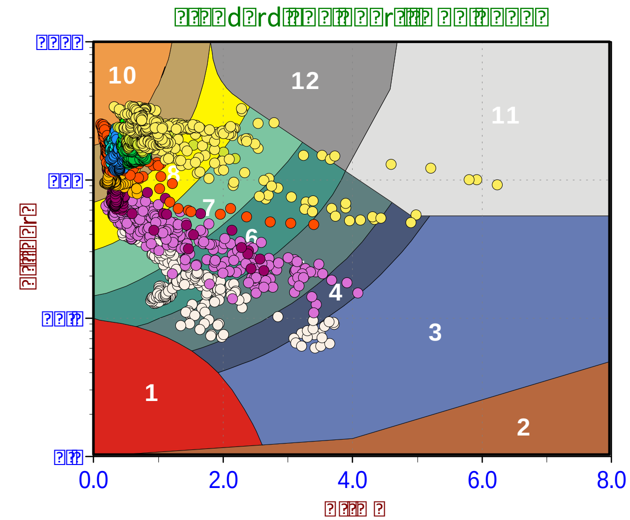
Tetra Tech Canada

Job No: 20-02-21738
Date: 2021-01-19 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742







Depth Ranges

- >0.0 to 7.5 m
- >7.5 to 15.0 m
- >15.0 to 22.5 m
- >22.5 to 30.0 m
- >30.0 to 37.5 m
- >37.5 to 45.0 m
- >45.0 to 52.5 m
- >52.5 to 60.0 m
- >60.0 to 67.5 m
- >67.5 to 75.0 m
- >75.0 m

Legend

- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend

- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Legend

- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Job No: 20-02-21738
Client: Tetra Tech Canada Inc.
Project: Tetra Tech Dewdney Bridge
Start Date: 21-Dec-2020
End Date: 19-Jan-2021

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (m)	Estimated Equilibrium Pore Pressure U_{eq} (m)	Calculated Phreatic Surface (m)	Estimated Phreatic Surface (m)	$t_{50}{}^{a}$ (s)	Assumed Rigidity Index (I_r)	$c_h{}^{b}$ (cm^2/min)
CPT20-01	20-02-21738_CP01	15	600	1.475	Not Achieved					
CPT20-01	20-02-21738_CP01	15	300	8.600	4.2	4.4				
CPT20-01	20-02-21738_CP01	15	300	15.000	10.6	4.4				
CPT20-02	20-02-21738_CP02	15	350	2.500	0.4	2.1				
CPT20-02	20-02-21738_CP02	15	200	5.500	3.0	2.5				
CPT20-02	20-02-21738_CP02	15	200	10.500	7.8	2.7				
CPT20-02	20-02-21738_CP02	15	200	15.000	12.3	2.7				
CPT20-02	20-02-21738_CP02	15	150	17.200	14.5	2.7				
SCPT21-01	20-02-21738_SP01	15	405	0.750	Not Achieved					
SCPT21-01	20-02-21738_SP01	15	5180	1.750	0.5	1.3		82	100	8.5
SCPT21-01	20-02-21738_SP01	15	515	3.475	2.4	1.1		14	100	51.8
SCPT21-01	20-02-21738_SP01	15	435	34.725	29.9	4.8				
SCPT21-01	20-02-21738_SP01	15	285	36.700	31.8	4.9				
SCPT21-01	20-02-21738_SP01	15	245	37.700	32.7	5.0				
SCPT21-01	20-02-21738_SP01	15	300	40.700	35.8	4.9				
SCPT21-01	20-02-21738_SP01	15	420	45.300	40.4	4.9				
SCPT21-01	20-02-21738_SP01	15	3140	48.700	43.9	4.8				
SCPT21-01	20-02-21738_SP01	15	185	50.700	45.8	4.9				
SCPT21-01	20-02-21738_SP01	15	255	68.725	63.4	5.4				

Job No:	20-02-21738
Client:	Tetra Tech Canada Inc.
Project:	Tetra Tech Dewdney Bridge
Start Date:	21-Dec-2020
End Date:	19-Jan-2021

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (m)	Estimated Equilibrium Pore Pressure U_{eq} (m)	Calculated Phreatic Surface (m)	Estimated Phreatic Surface (m)	t_{50}[a] (s)	Assumed Rigidity Index (I_r)	c_h[b] (cm^2/min)
SCPT21-01	20-02-21738_SP01	15	310	77.550	Not Achieved		5.4	43	100	16.4
SCPT21-01	20-02-21738_SP01	15	560	80.025	Not Achieved					
SCPT21-02	20-02-21738_SP02	15	115	1.975	0.0	2.0				
SCPT21-02	20-02-21738_SP02	15	385	3.475	1.8	1.7		55	100	12.8
SCPT21-02	20-02-21738_SP02	15	375	8.925	1.7	7.2				
SCPT21-02	20-02-21738_SP02	15	315	11.475	3.9	7.6		19	100	36.1
SCPT21-02	20-02-21738_SP02	15	410	14.950	7.7	7.3				
SCPT21-02	20-02-21738_SP02	15	595	15.800	8.9	6.9				
SCPT21-02	20-02-21738_SP02	15	110	20.825	13.8	7.0				
SCPT21-02	20-02-21738_SP02	15	405	23.825	16.8	7.0				
SCPT21-02	20-02-21738_SP02	15	125	41.800	34.6	7.2				
SCPT21-02	20-02-21738_SP02	15	530	42.800	35.7	7.1				
SCPT21-02	20-02-21738_SP02	15	245	47.825	40.5	7.3				
SCPT21-02	20-02-21738_SP02	15	115	53.825	46.3	7.5				
SCPT21-02	20-02-21738_SP02	15	120	54.825	47.2	7.7				
SCPT21-02	20-02-21738_SP02	15	175	59.825	52.1	7.7				
SCPT21-02	20-02-21738_SP02	15	115	73.850	64.8	9.0				
SCPT21-02	20-02-21738_SP02	15	145	76.850	Not Achieved					
SCPT21-02	20-02-21738_SP02	15	395	77.600	69.0	8.6		26	100	27.2

Job No:	20-02-21738
Client:	Tetra Tech Canada Inc.
Project:	Tetra Tech Dewdney Bridge
Start Date:	21-Dec-2020
End Date:	19-Jan-2021

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (m)	Estimated Equilibrium Pore Pressure U_{eq} (m)	Calculated Phreatic Surface (m)	Estimated Phreatic Surface (m)	t_{50} [a] (s)	Assumed Rigidity Index (I_r)	c_h [b] (cm^2/min)
SCPT21-02	20-02-21738_SP02	15	180	86.850	77.3	9.6				
SCPT21-02	20-02-21738_SP02	15	960	91.600	82.9	8.7				

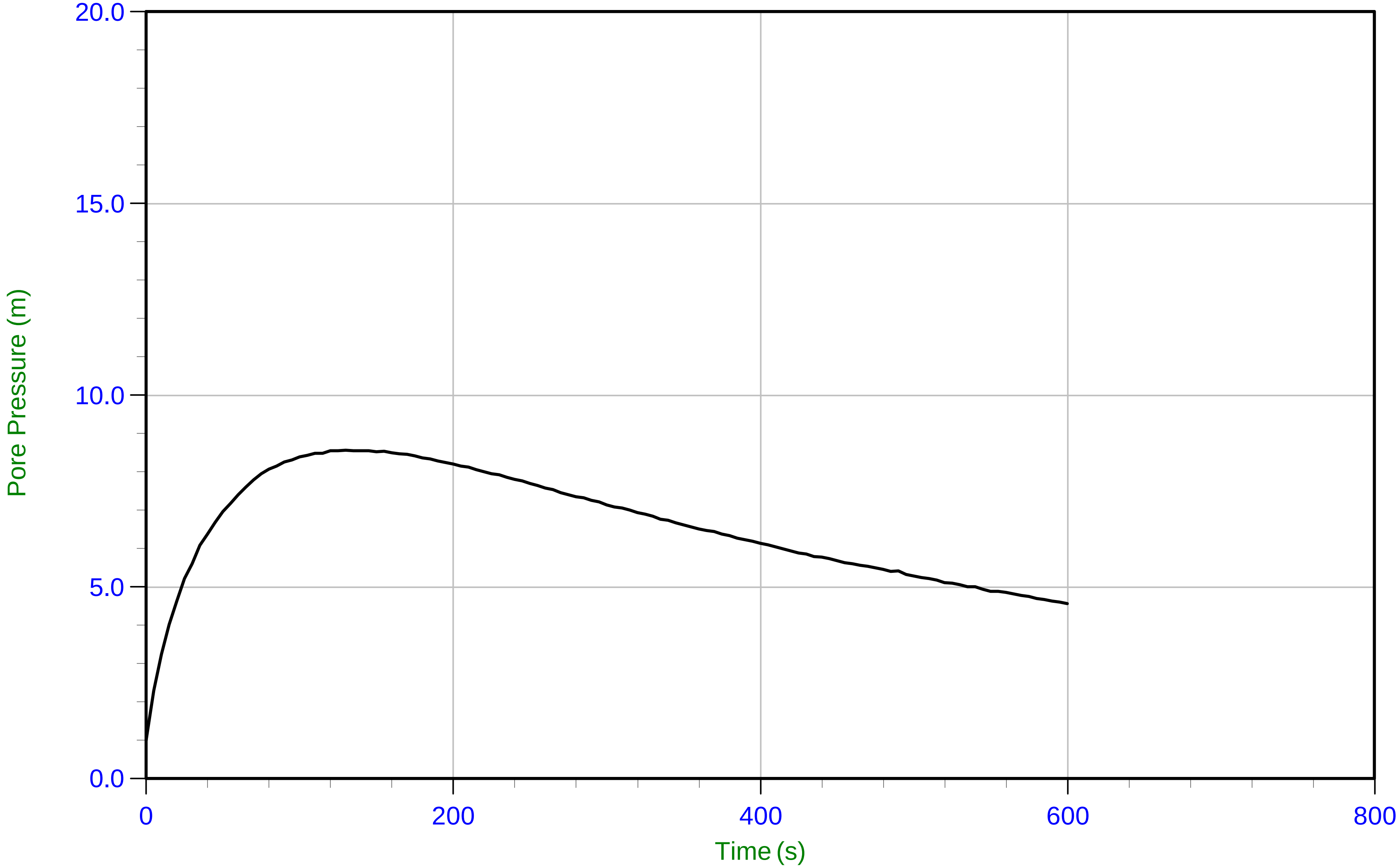
a. Time is relative to where umax occurred.

b. Houlsby and Teh, 1991.

Tetra Tech

Job No: 20-02-21738
Date: 12/21/2020 09:14
Site: Dewdney, BC

Sounding: CPT20-01
Cone: 672:T1500F15U500 Area=15 cm²



Trace Summary:

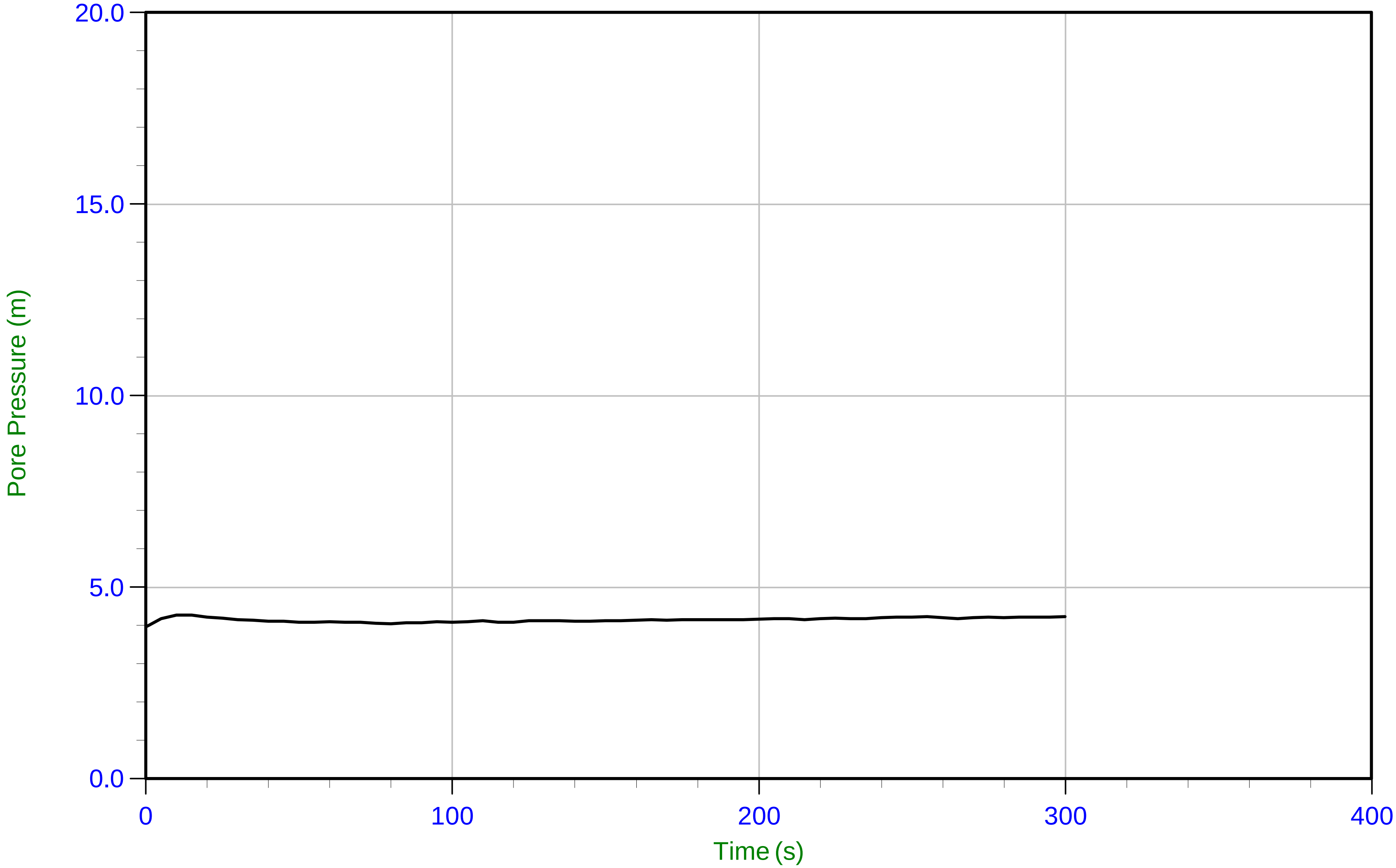
Filename: 20-02-21738_CP01.PPF
Depth: 1.475 m / 4.839 ft
Duration: 600.0 s

u Min: 1.0 m
u Max: 8.6 m
u Final: 4.6 m

Tetra Tech

Job No: 20-02-21738
Date: 12/21/2020 09:14
Site: Dewdney, BC

Sounding: CPT20-01
Cone: 672:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_CP01.PPF
Depth: 8.600 m / 28.215 ft
Duration: 300.0 s

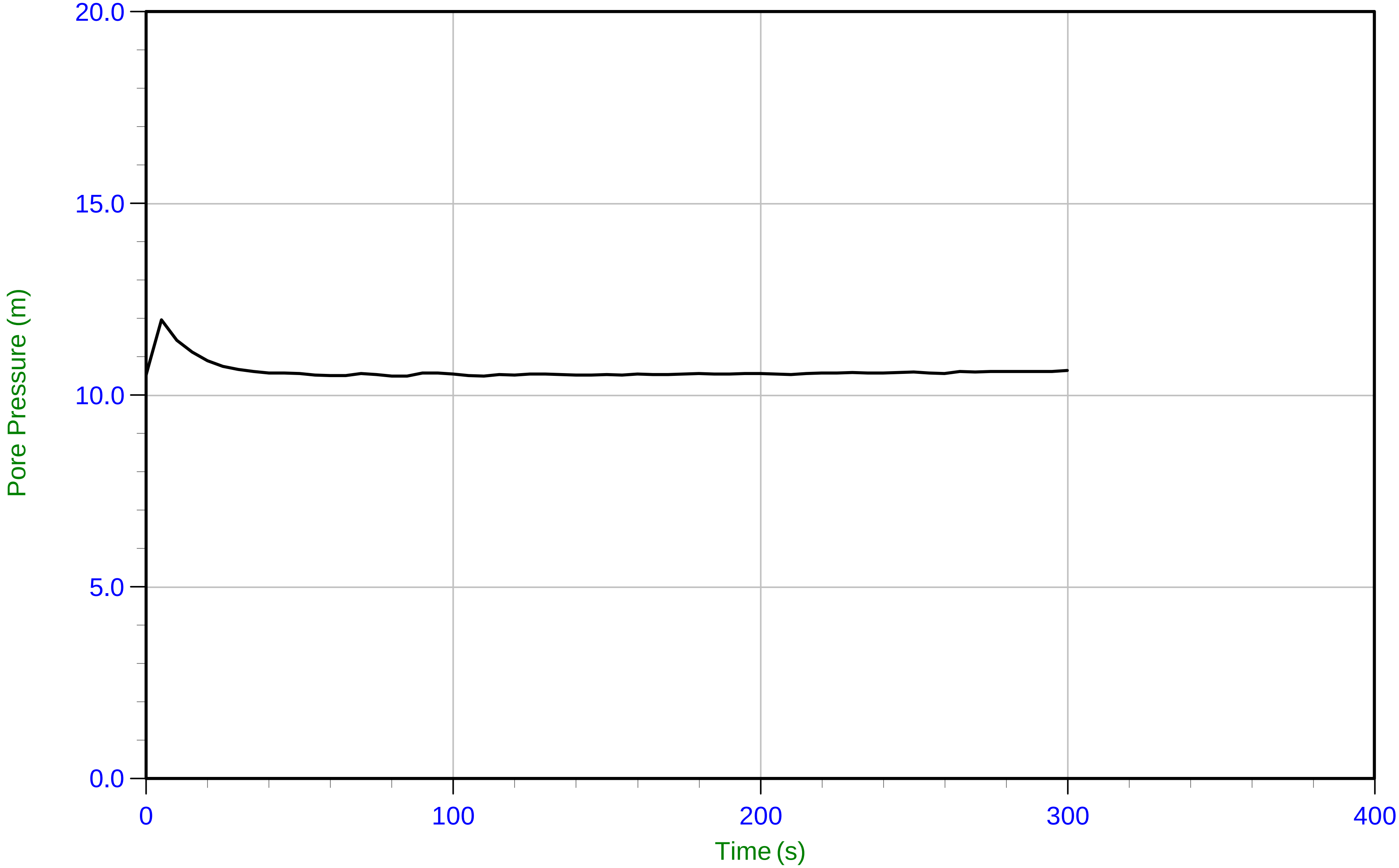
u Min: 4.0 m
u Max: 4.3 m
u Final: 4.2 m

WT: 4.400 m / 14.436 ft
Ueq: 4.2 m

Tetra Tech

Job No: 20-02-21738
Date: 12/21/2020 09:14
Site: Dewdney, BC

Sounding: CPT20-01
Cone: 672:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_CP01.PPF
Depth: 15.000 m / 49.212 ft
Duration: 300.0 s

u Min: 10.5 m
u Max: 12.0 m
u Final: 10.6 m

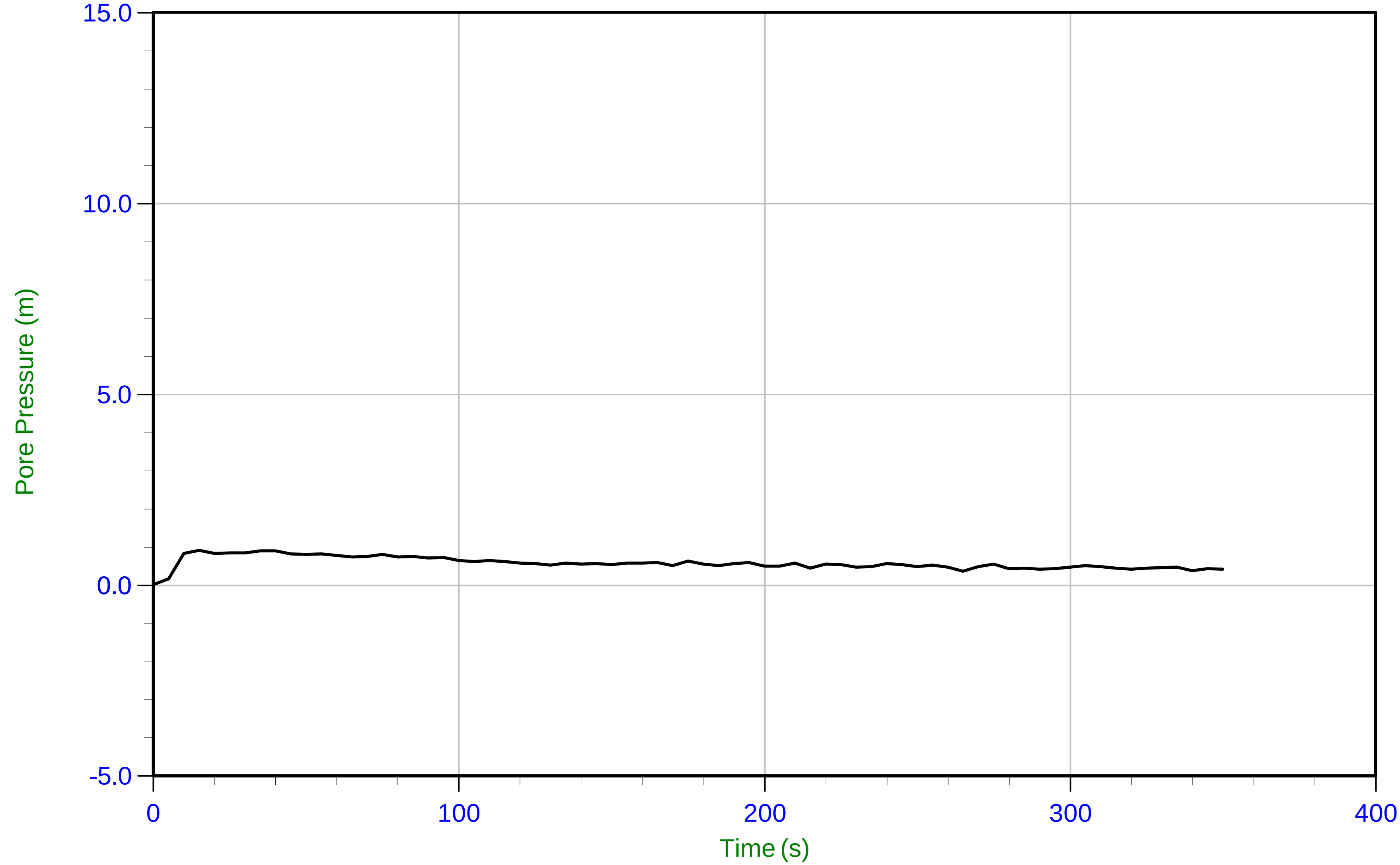
WT: 4.400 m / 14.436 ft
Ueq: 10.6 m

CONETEC

Tetra Tech

Job No: 20-02-21738
Date: 12/23/2020 11:39
Site: Dewdney, BC

Sounding: CPT20-02
Cone: 672:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_CP02.PPF
Depth: 2.500 m / 8.202 ft
Duration: 350.0 s

u Min: 0.0 m
u Max: 0.9 m
u Final: 0.4 m

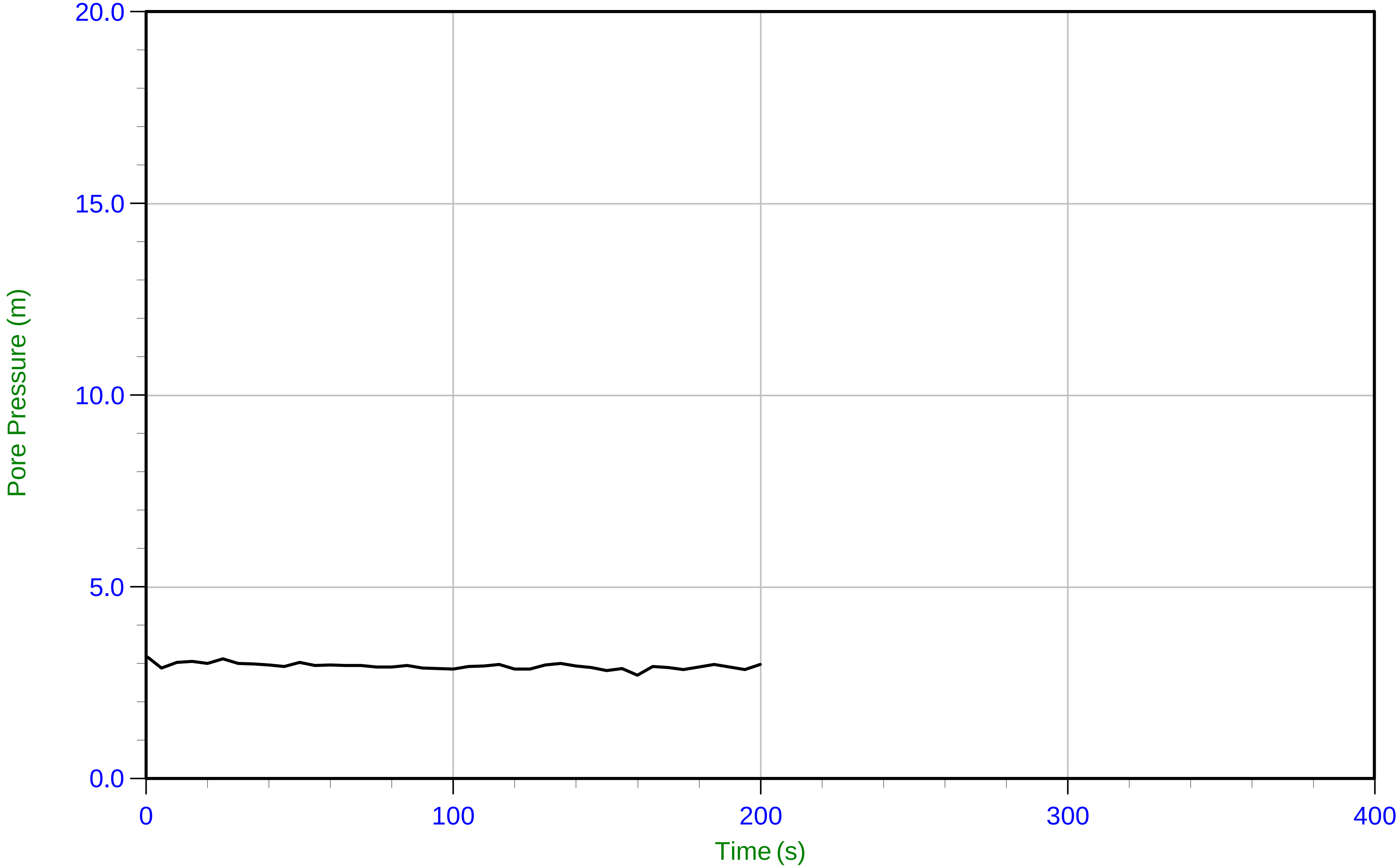
WT: 2.100 m / 6.890 ft
Ueq: 0.4 m

CONETEC

Tetra Tech

Job No: 20-02-21738
Date: 12/23/2020 11:39
Site: Dewdney, BC

Sounding: CPT20-02
Cone: 672:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_CP02.PPF
Depth: 5.500 m / 18.044 ft
Duration: 200.0 s

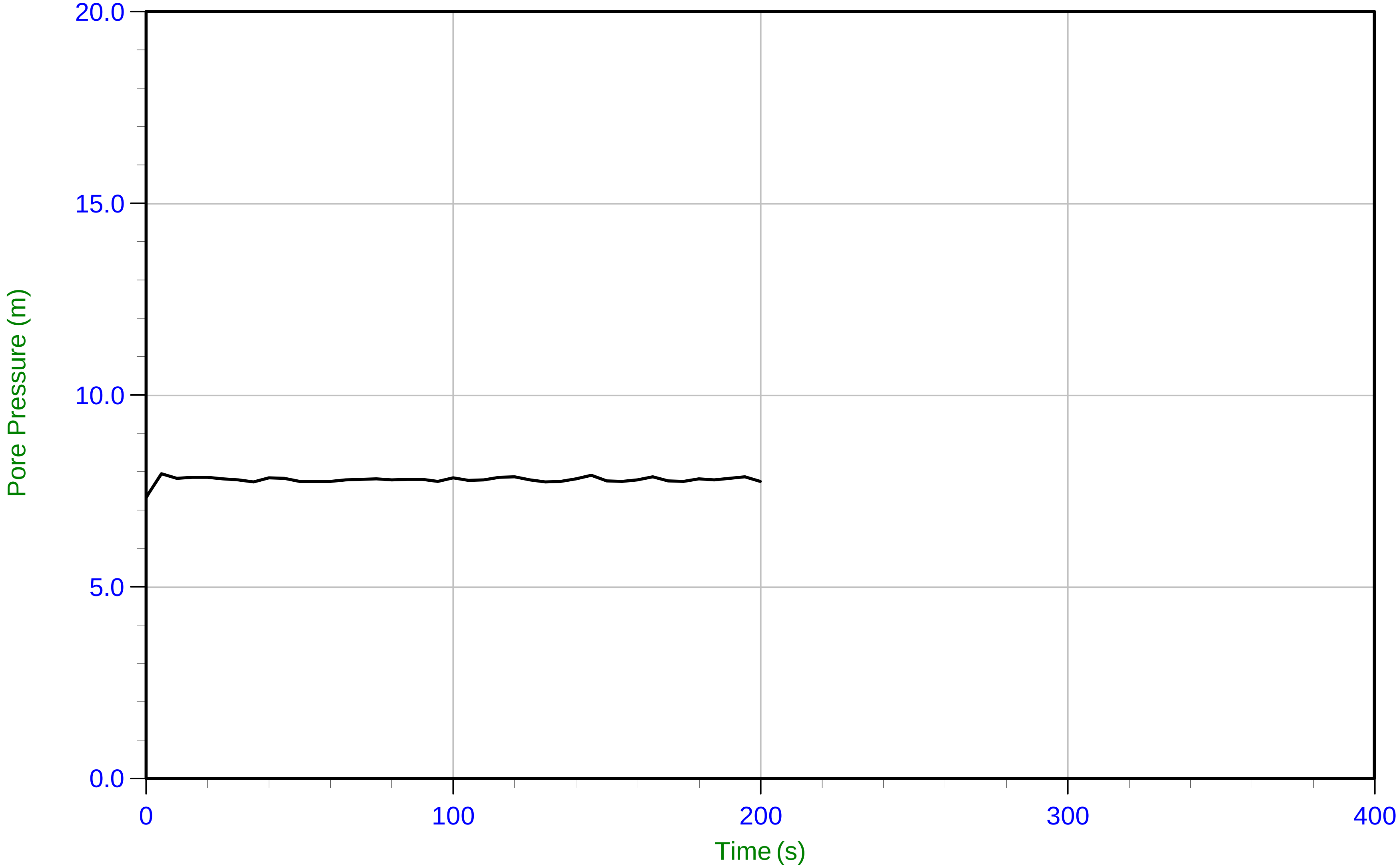
u Min: 2.7 m
u Max: 3.2 m
u Final: 3.0 m

WT: 2.500 m / 8.202 ft
Ueq: 3.0 m

Tetra Tech

Job No: 20-02-21738
Date: 12/23/2020 11:39
Site: Dewdney, BC

Sounding: CPT20-02
Cone: 672:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_CP02.PPF
Depth: 10.500 m / 34.448 ft
Duration: 200.0 s

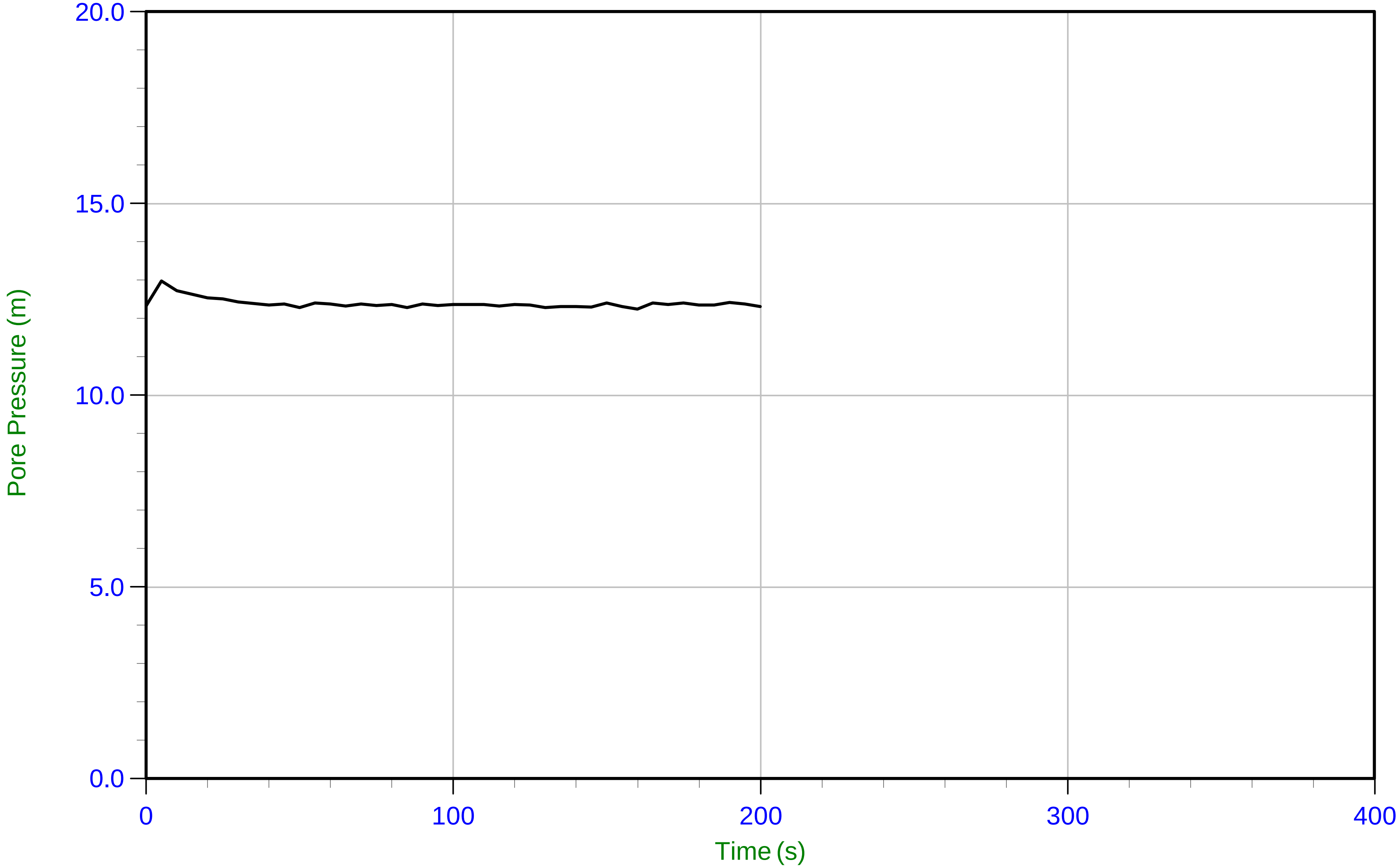
u Min: 7.3 m
u Max: 8.0 m
u Final: 7.8 m

WT: 2.700 m / 8.858 ft
Ueq: 7.8 m

Tetra Tech

Job No: 20-02-21738
Date: 12/23/2020 11:39
Site: Dewdney, BC

Sounding: CPT20-02
Cone: 672:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_CP02.PPF
Depth: 15.000 m / 49.212 ft
Duration: 200.0 s

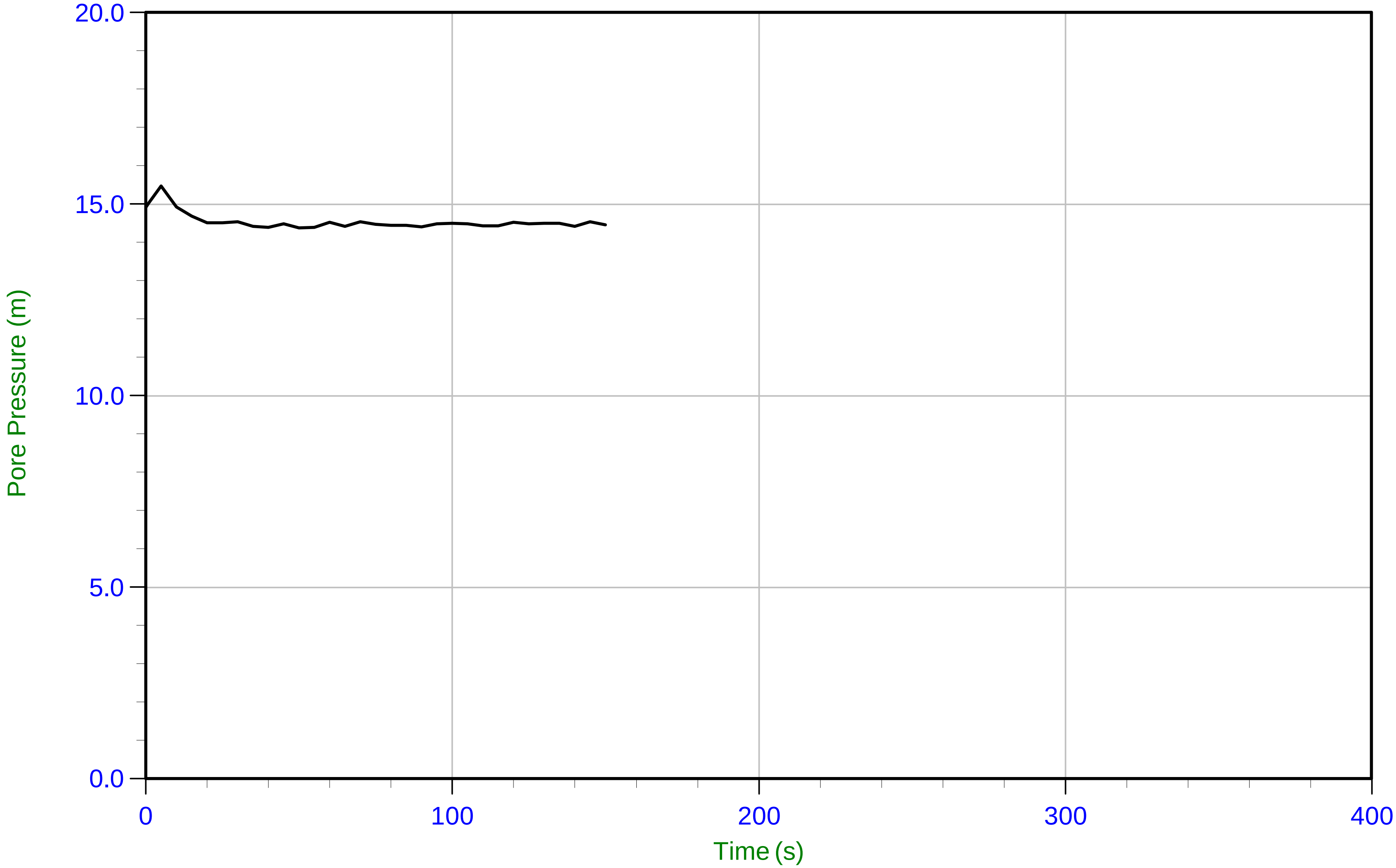
u Min: 12.2 m
u Max: 13.0 m
u Final: 12.3 m

WT: 2.700 m / 8.858 ft
Ueq: 12.3 m

Tetra Tech

Job No: 20-02-21738
Date: 12/23/2020 11:39
Site: Dewdney, BC

Sounding: CPT20-02
Cone: 672:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_CP02.PPF
Depth: 17.200 m / 56.430 ft
Duration: 150.0 s

u Min: 14.4 m
u Max: 15.5 m
u Final: 14.5 m

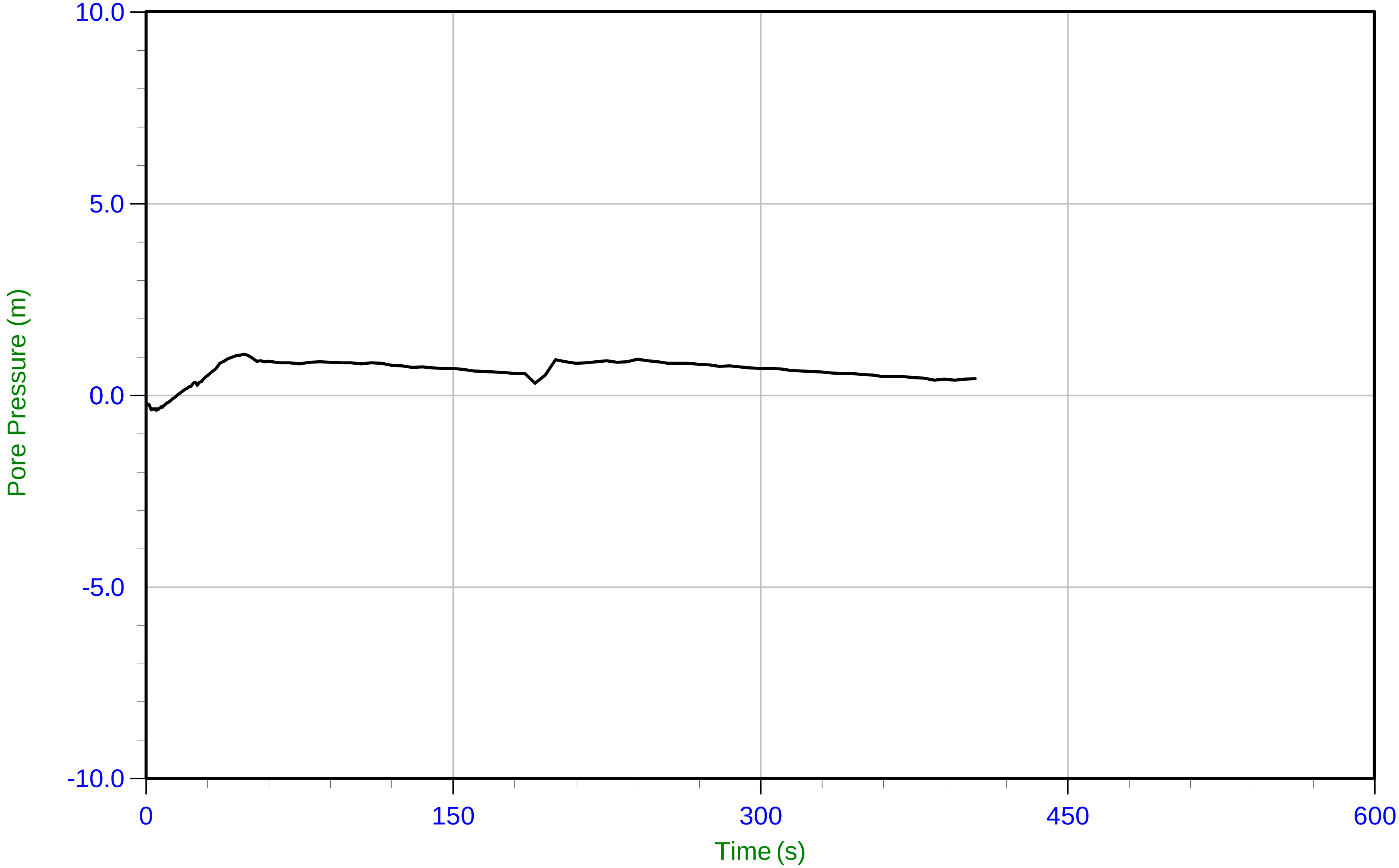
WT: 2.700 m / 8.858 ft
Ueq: 14.5 m

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



Trace Summary:

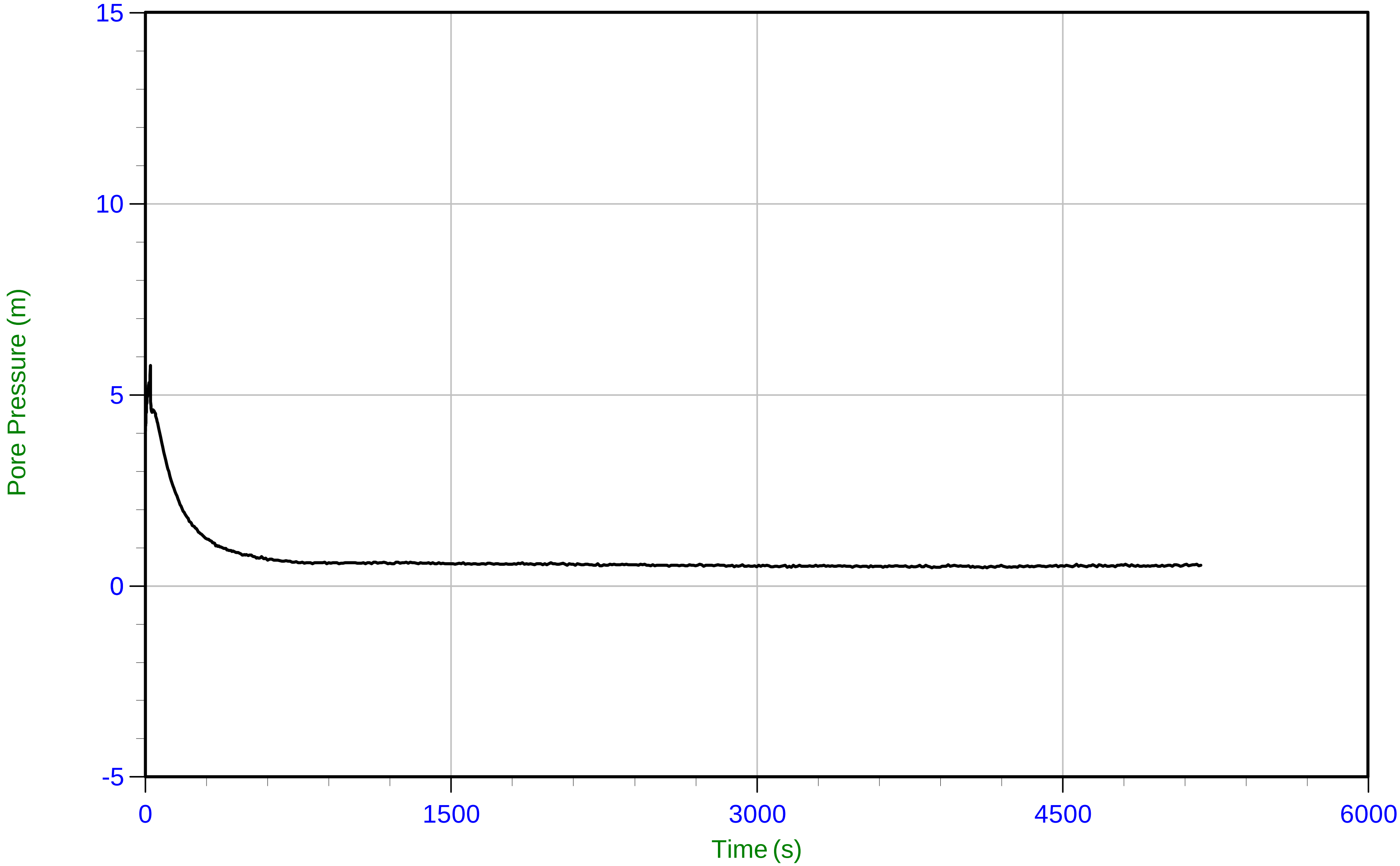
Filename: 20-02-21738_SP01.PPF
Depth: 0.750 m / 2.461 ft
Duration: 405.0 s

u Min: -0.4 m
u Max: 1.1 m
u Final: 0.4 m

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 1.750 m / 5.741 ft
Duration: 5180.0 s

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

WT: 1.276 m / 4.186 ft
Ueq: 0.5 m
U(50): 3.12 m

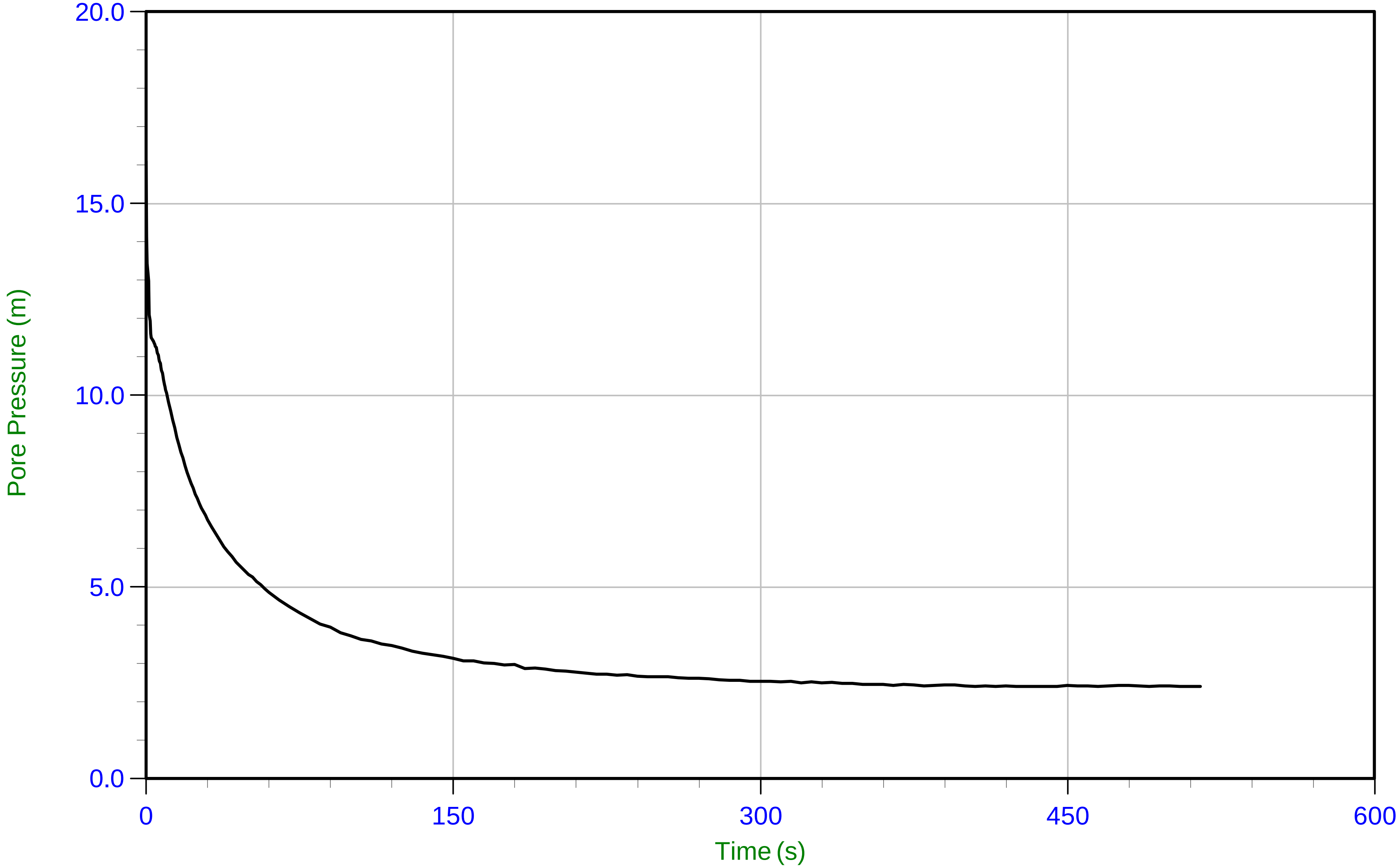
T(50): 82.2 s
Ir: 100
Ch: 8.5 cm²/min

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



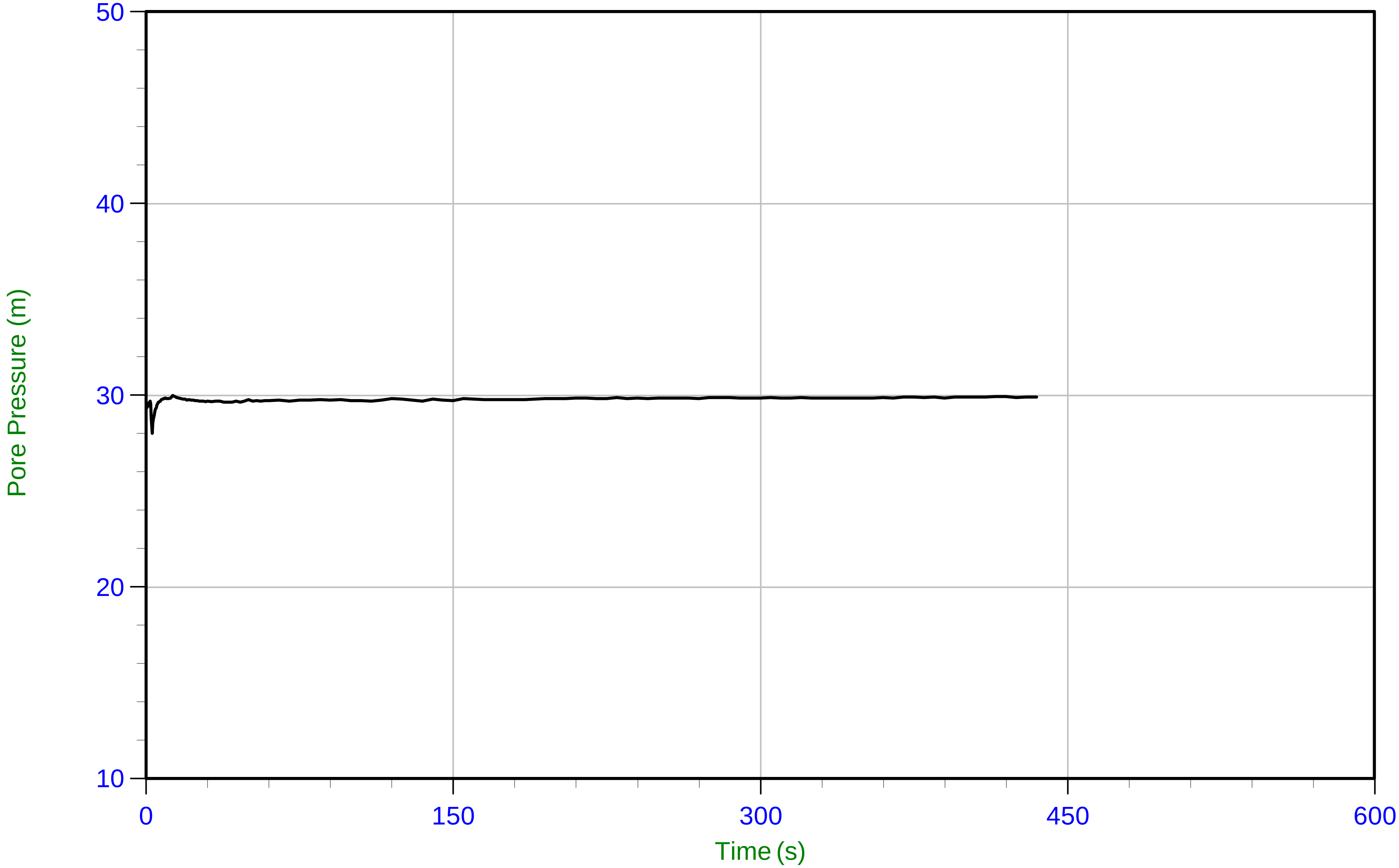
Trace Summary:

Filename: 20-02-21738_SP01.PPF	u Min: 2.4 m	WT: 1.107 m / 3.632 ft	T(50): 13.6 s
Depth: 3.475 m / 11.401 ft	u Max: 16.1 m	Ueq: 2.4 m	Ir: 100
Duration: 515.0 s	u Final: 2.4 m	U(50): 9.24 m	Ch: 51.8 cm²/min

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



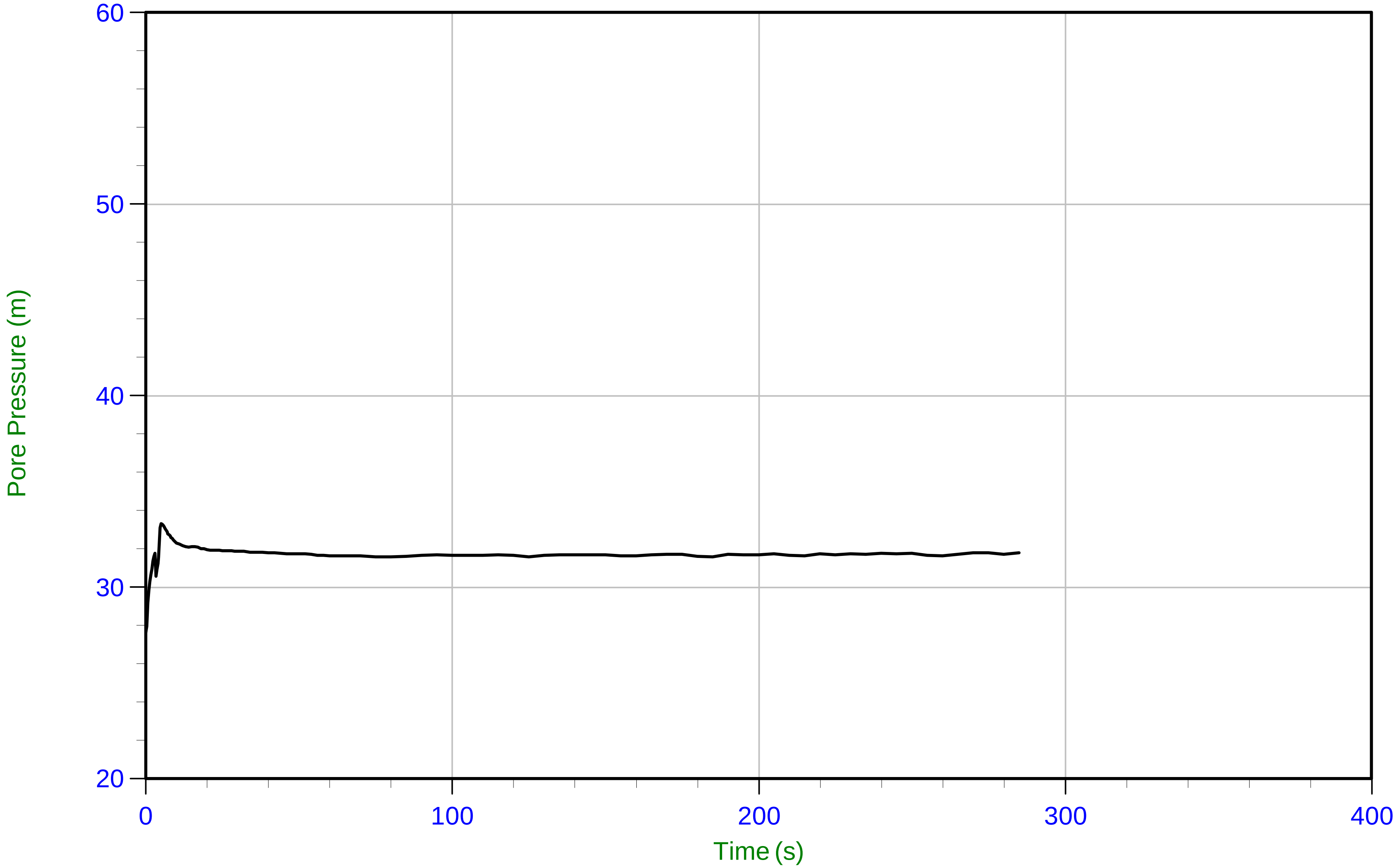
Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 34.725 m / 113.926 ft
Duration: 435.0 s

u Min: 28.0 m
u Max: 30.0 m
u Final: 29.9 m

WT: 4.830 m / 15.846 ft
Ueq: 29.9 m

Tetra Tech	Job No: 20-02-21738 Date: 01/18/2021 08:54 Site: Dewdney, BC	Sounding: SCPT21-01 Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 36.700 m / 120.405 ft
Duration: 285.0 s

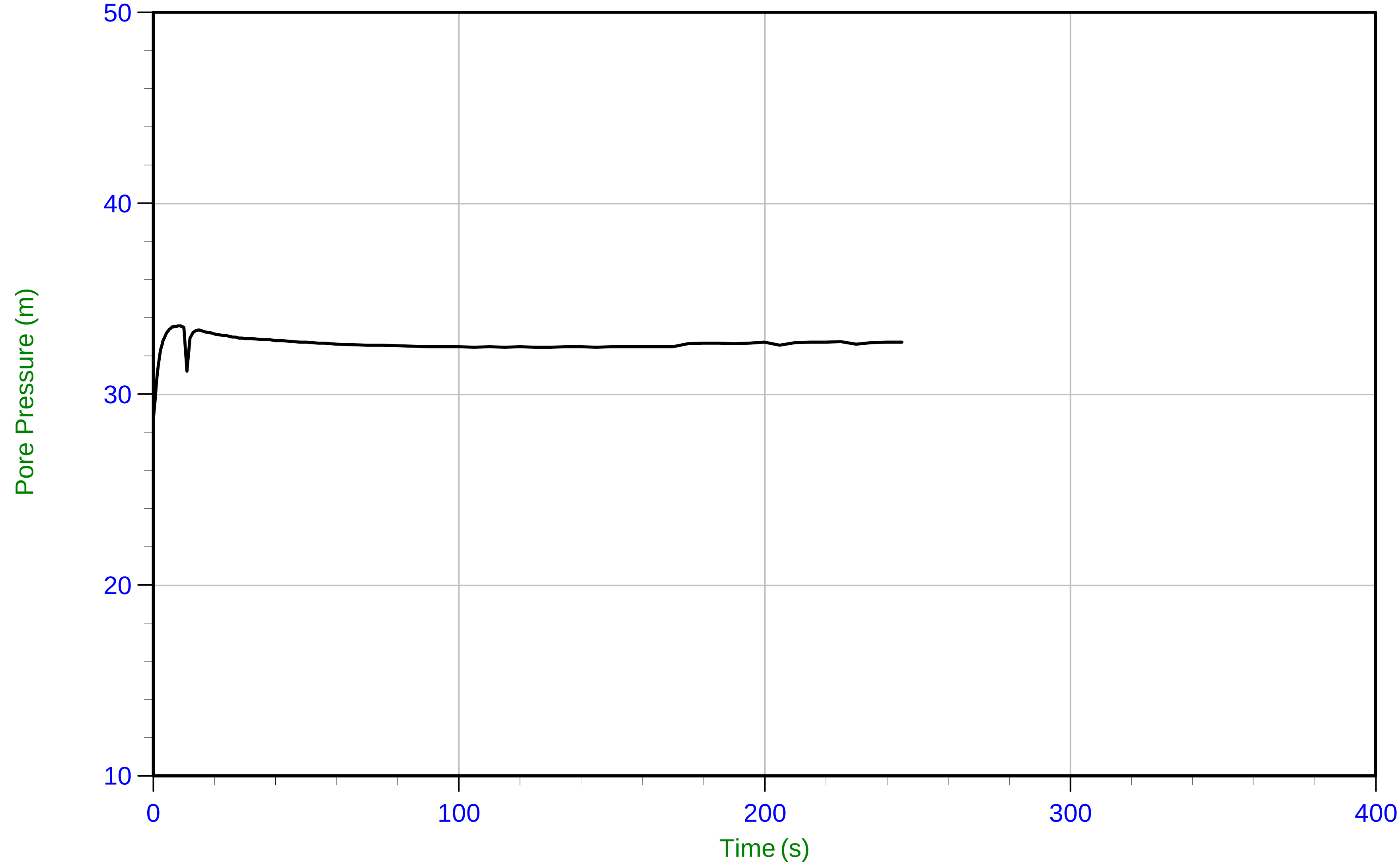
u Min: 27.6 m
u Max: 33.3 m
u Final: 31.8 m

WT: 4.911 m / 16.112 ft
Ueq: 31.8 m

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 37.700 m / 123.686 ft
Duration: 245.0 s

u Min: 28.7 m
u Max: 33.6 m
u Final: 32.7 m

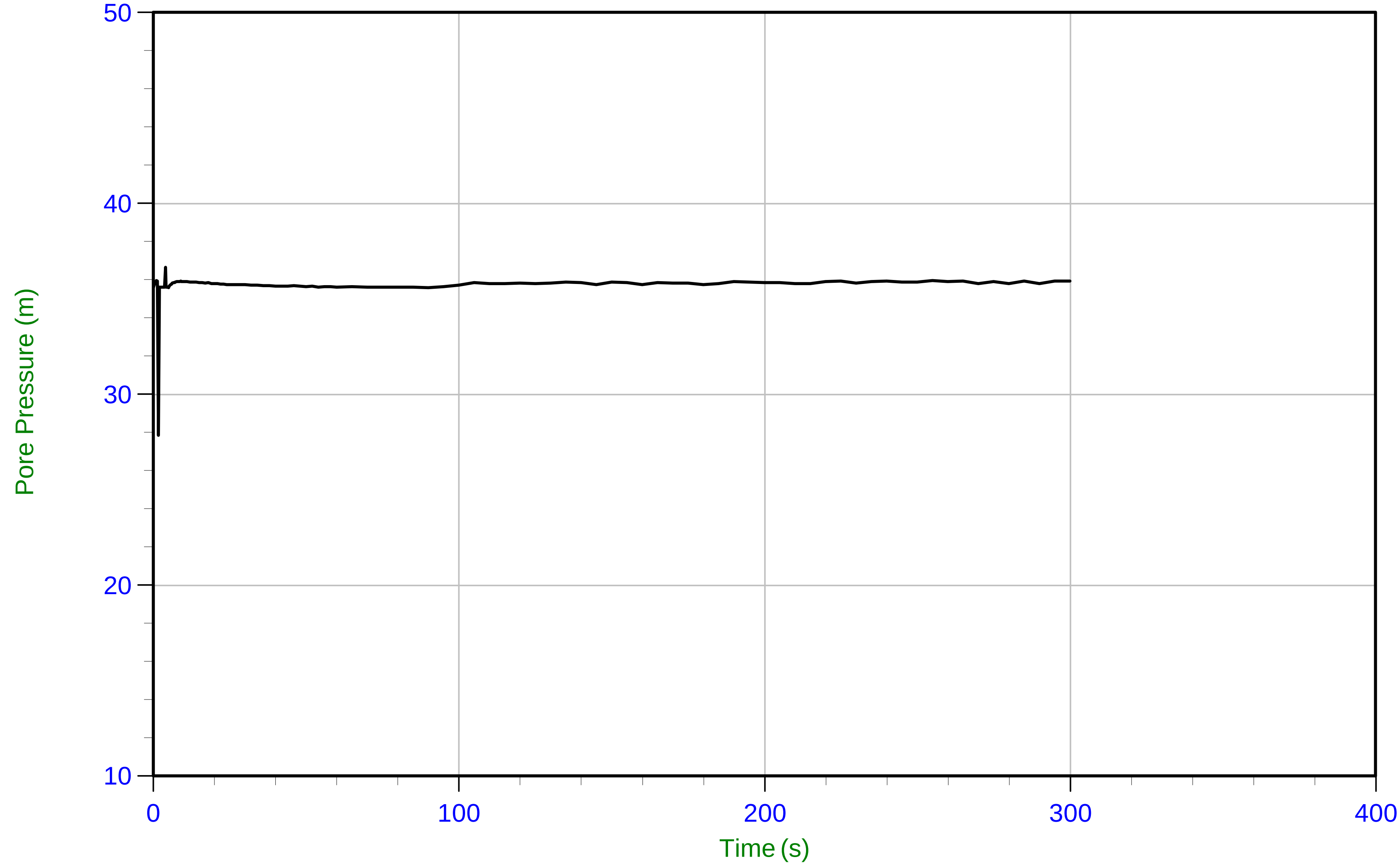
WT: 4.963 m / 16.283 ft
Ueq: 32.7 m

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 40.700 m / 133.529 ft
Duration: 300.0 s

u Min: 27.9 m
u Max: 36.6 m
u Final: 35.9 m

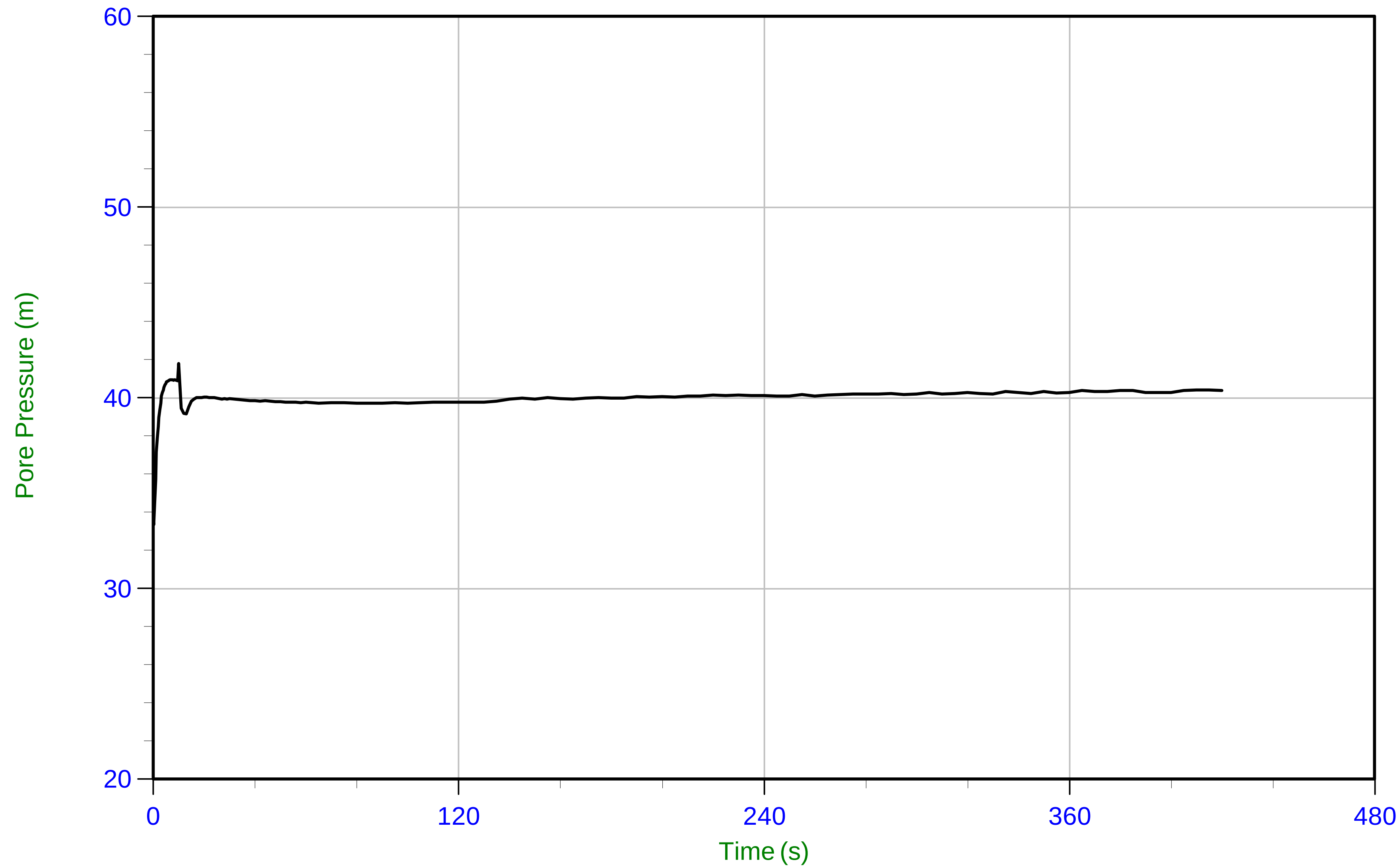
WT: 4.911 m / 16.112 ft
Ueq: 35.8 m

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 45.300 m / 148.620 ft
Duration: 420.0 s

u Min: 33.3 m
u Max: 41.8 m
u Final: 40.4 m

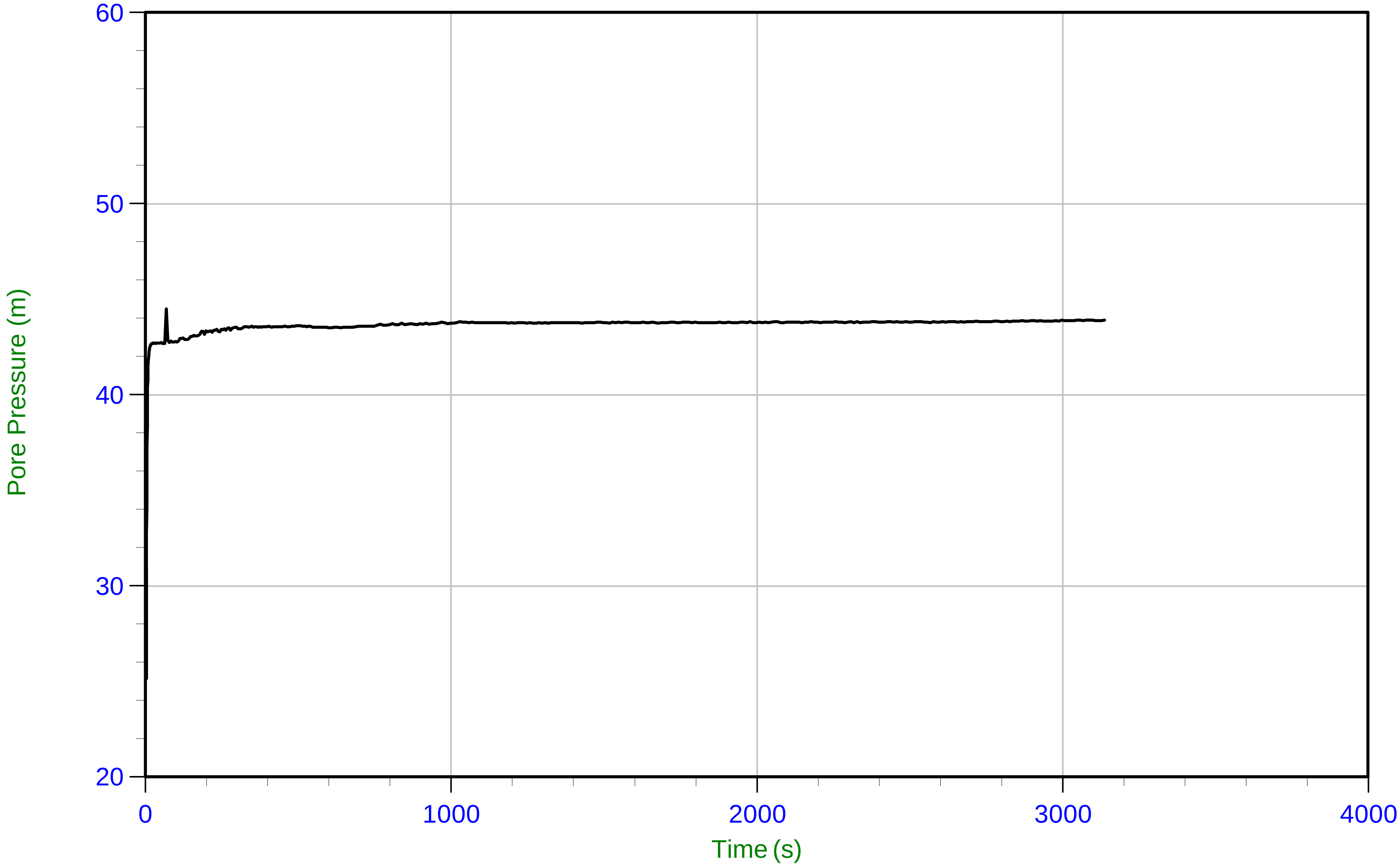
WT: 4.879 m / 16.007 ft
Ueq: 40.4 m

CONETEC

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 48.700 m / 159.775 ft
Duration: 3140.0 s

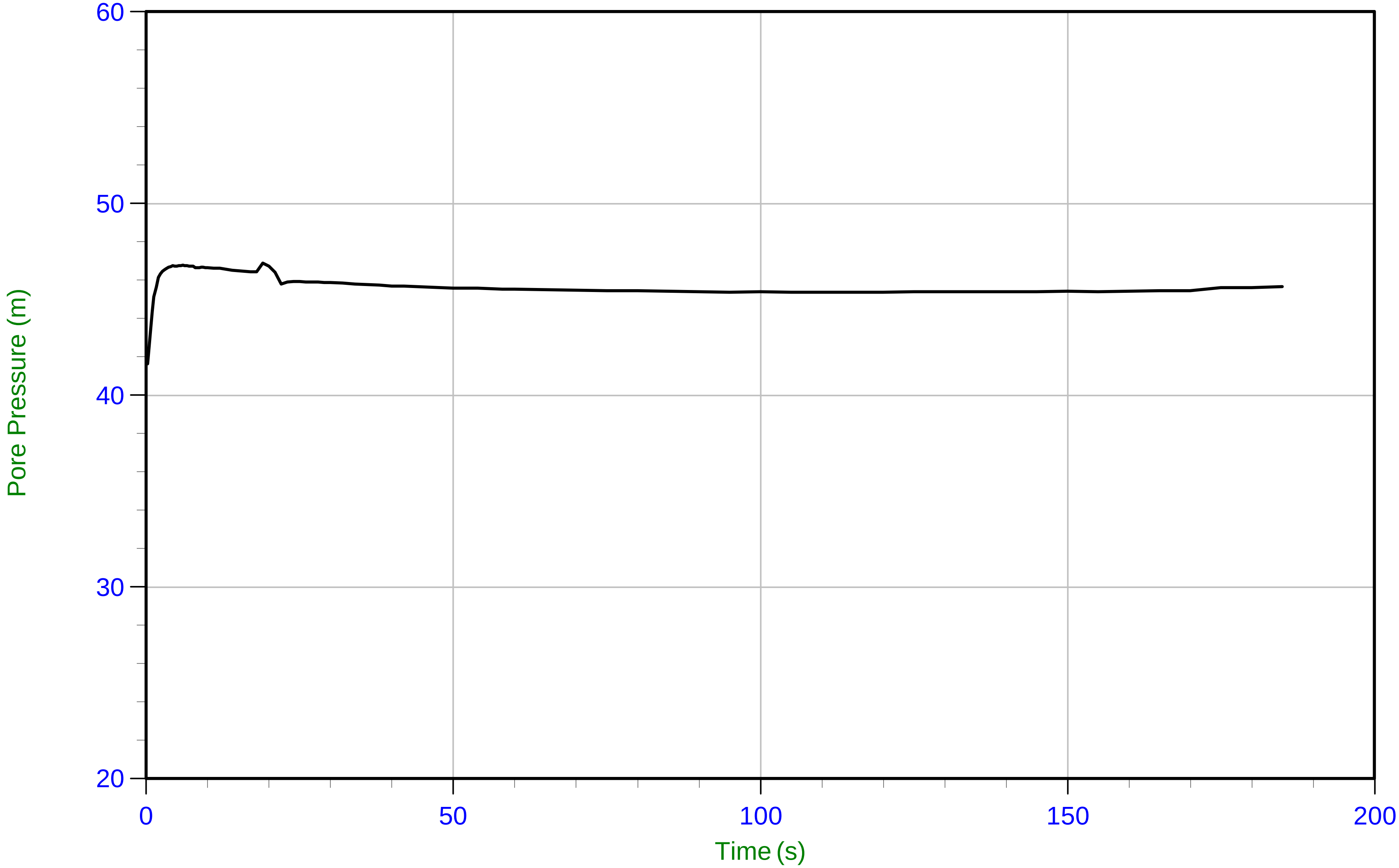
u Min: 25.2 m
u Max: 44.5 m
u Final: 43.9 m

WT: 4.805 m / 15.764 ft
Ueq: 43.9 m

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 50.700 m / 166.337 ft
Duration: 185.0 s

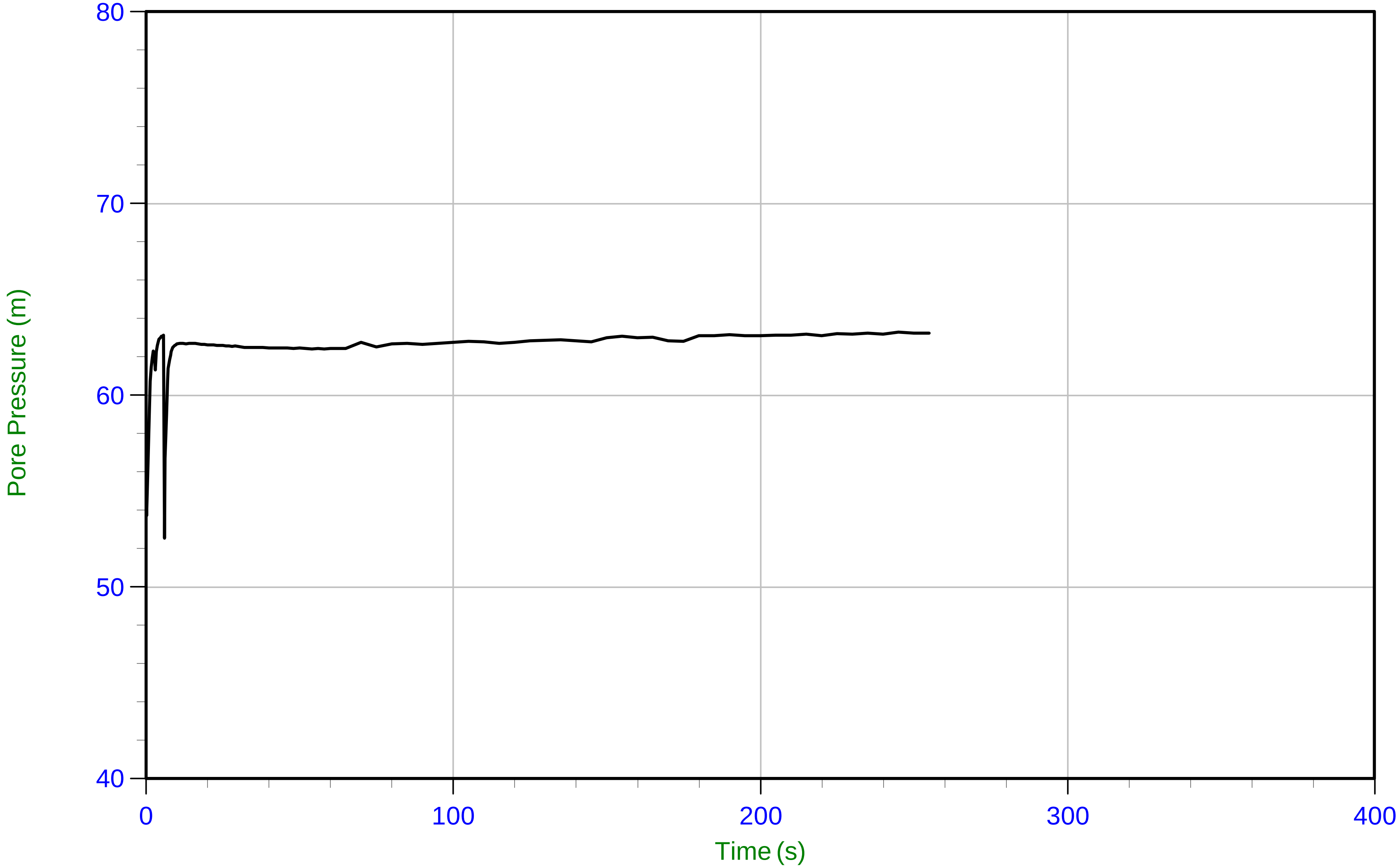
u Min: 41.7 m
u Max: 46.9 m
u Final: 45.7 m

WT: 4.911 m / 16.112 ft
Ueq: 45.8 m

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 68.725 m / 225.473 ft
Duration: 255.0 s

u Min: 52.5 m
u Max: 63.3 m
u Final: 63.2 m

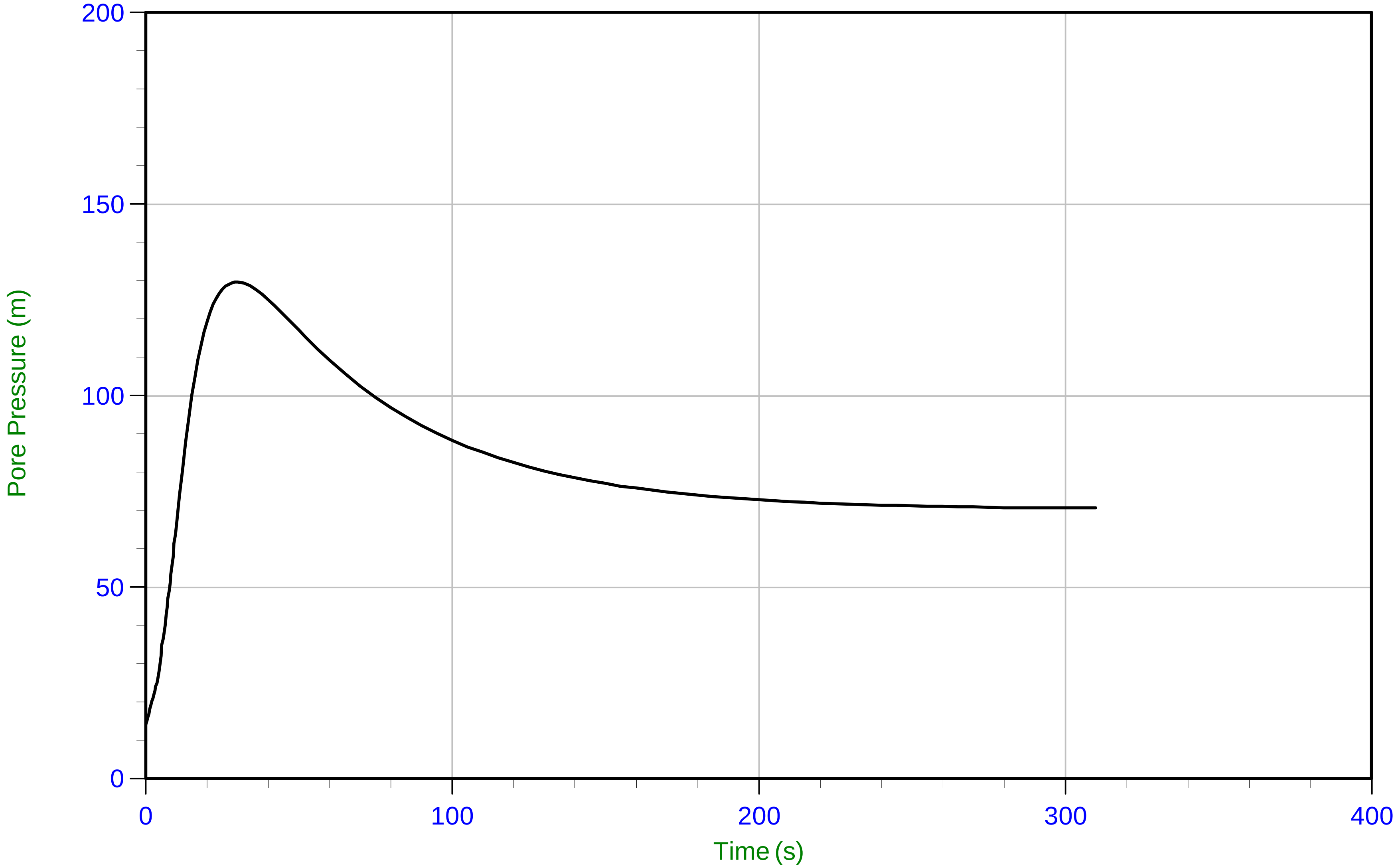
WT: 5.357 m / 17.575 ft
Ueq: 63.4 m

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/18/2021 08:54
Site: Dewdney, BC

Sounding: SCPT21-01
Cone: EC742 Area=15 cm²

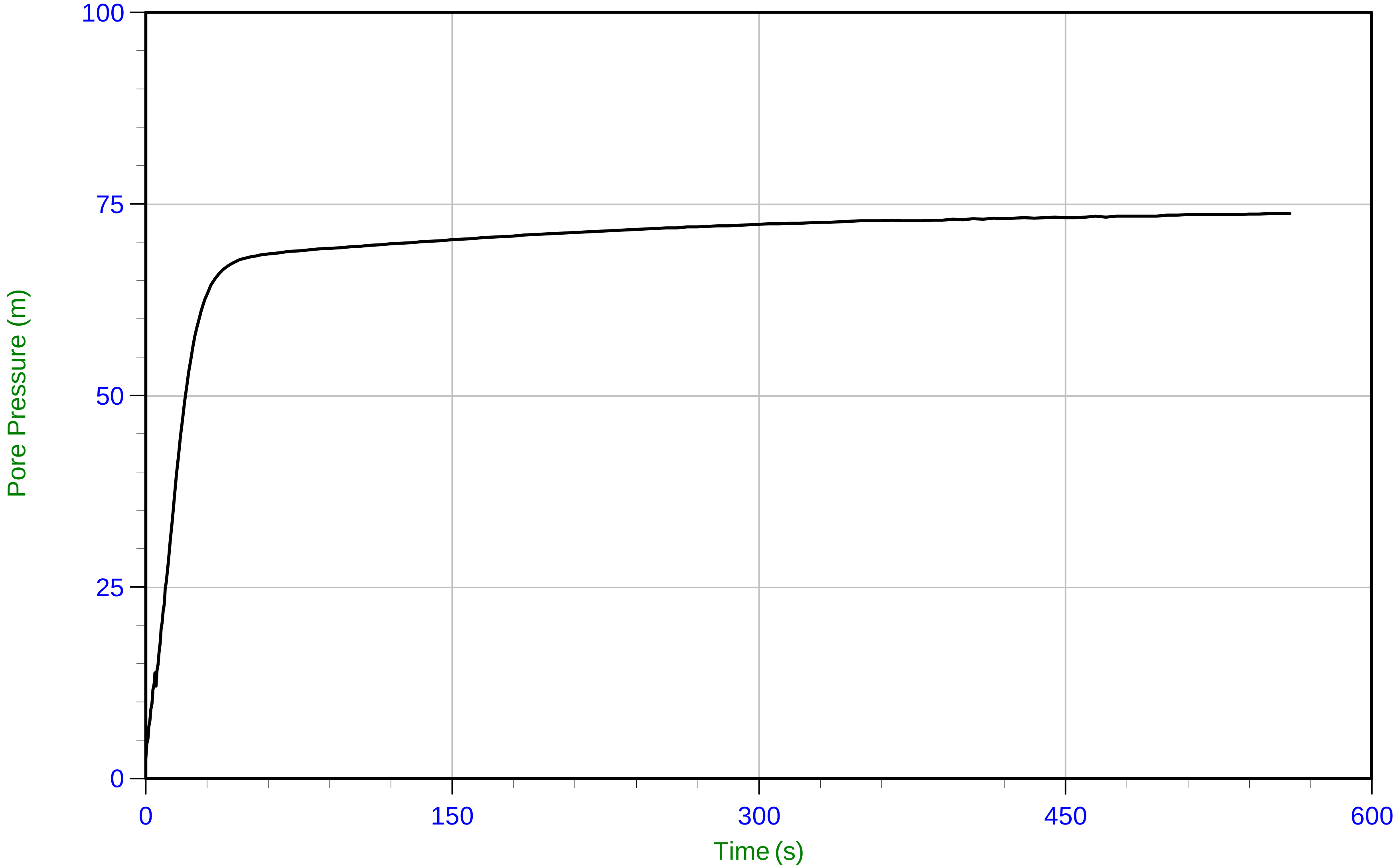


Trace Summary:

Filename: 20-02-21738_SP01.PPF	u Min: 14.2 m	WT: 5.400 m / 17.716 ft	T(50): 42.7 s
Depth: 77.550 m / 254.426 ft	u Max: 129.7 m	Ueq: 72.2 m	Ir: 100
Duration: 310.0 s	u Final: 70.7 m	U(50): 100.91 m	Ch: 16.4 cm²/min

CONETEC

Tetra Tech	Job No: 20-02-21738 Date: 01/18/2021 08:54 Site: Dewdney, BC	Sounding: SCPT21-01 Cone: EC742 Area=15 cm²

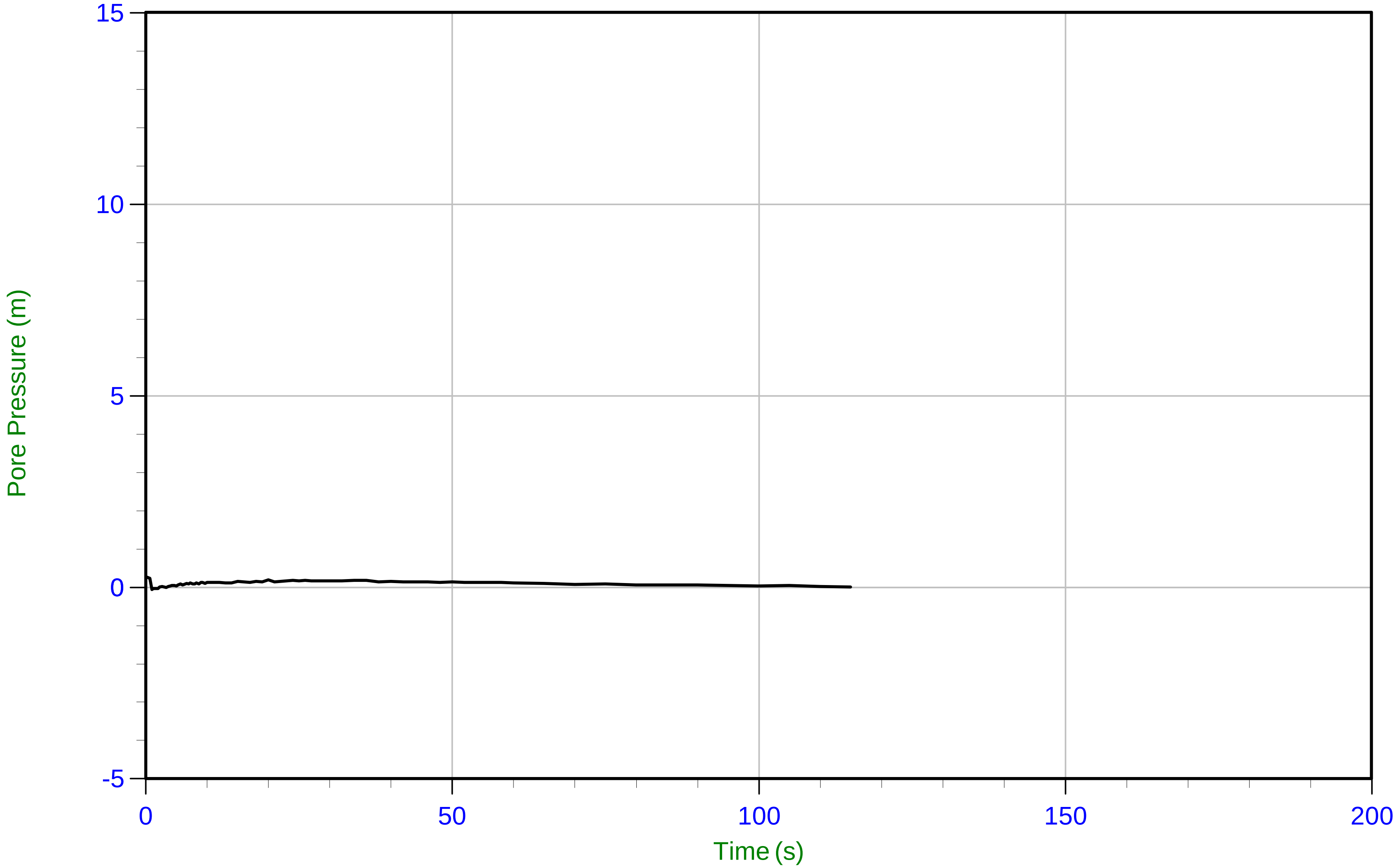


Trace Summary:

Filename: 20-02-21738_SP01.PPF
Depth: 80.025 m / 262.546 ft
Duration: 560.0 s

u Min: 2.7 m
u Max: 73.8 m
u Final: 73.8 m

Tetra Tech	Job No: 20-02-21738 Date: 01/19/2021 07:43 Site: Dewdney, BC	Sounding: SCPT21-02 Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 1.975 m / 6.480 ft
Duration: 115.0 s

u Min: -0.1 m
u Max: 0.3 m
u Final: 0.0 m

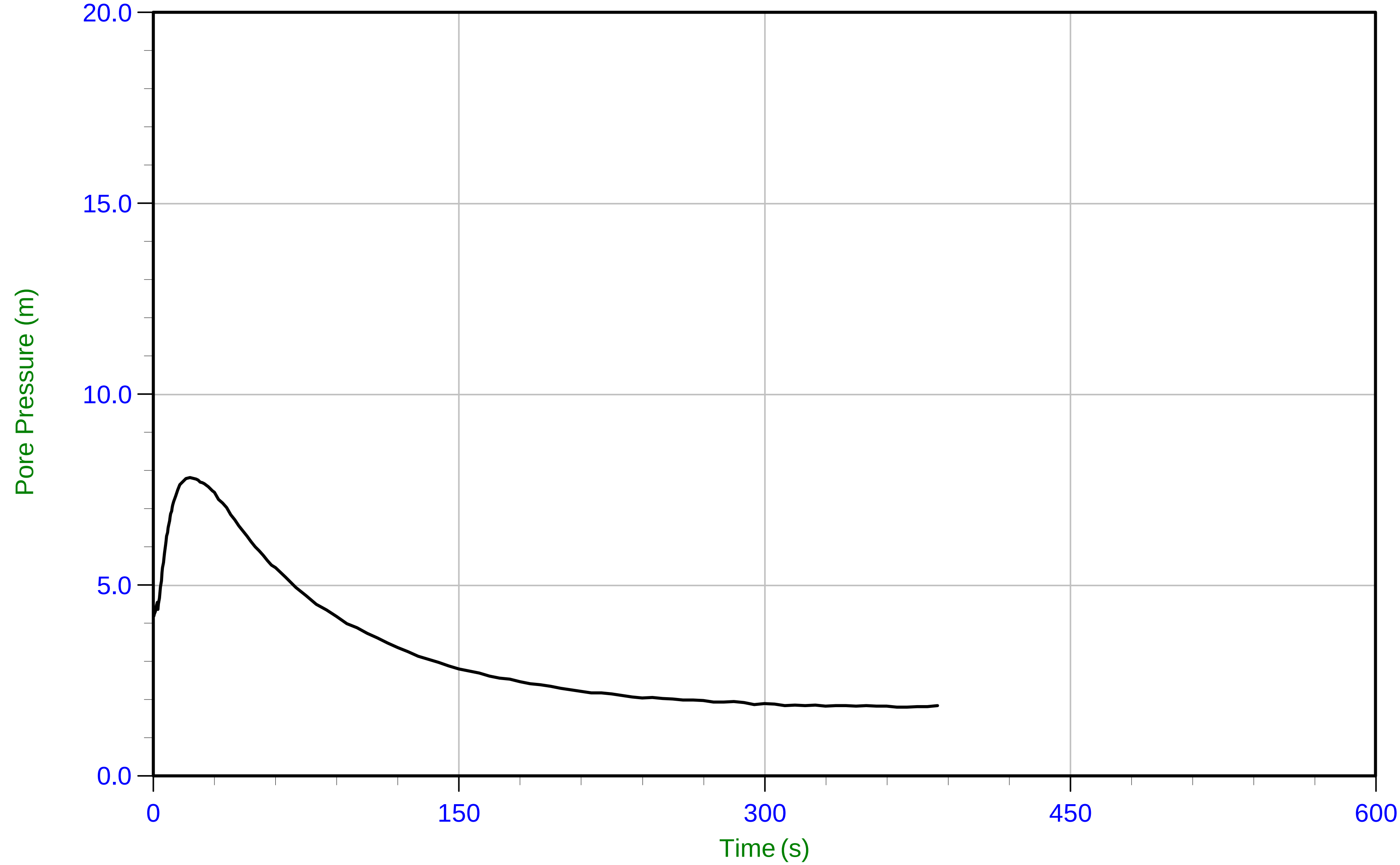
WT: 1.975 m / 6.480 ft
Ueq: 0.0 m

CONETEC

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 3.475 m / 11.401 ft
Duration: 385.0 s

u Min: 1.8 m
u Max: 7.8 m
u Final: 1.8 m

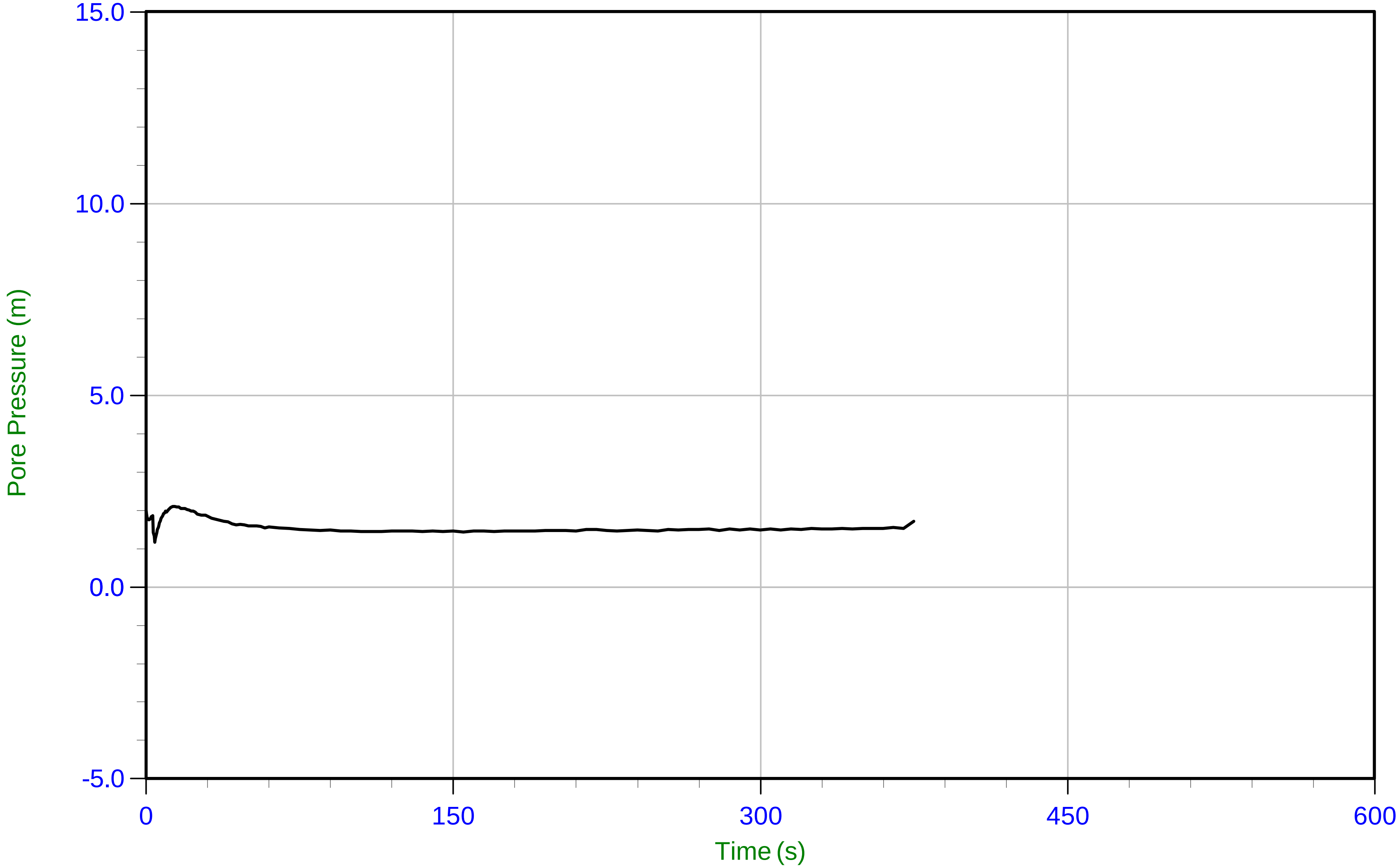
WT: 1.675 m / 5.495 ft
Ueq: 1.8 m
U(50): 4.81 m

T(50): 55.0 s
Ir: 100
Ch: 12.8 cm²/min

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 8.925 m / 29.281 ft
Duration: 375.0 s

u Min: 1.2 m
u Max: 2.1 m
u Final: 1.7 m

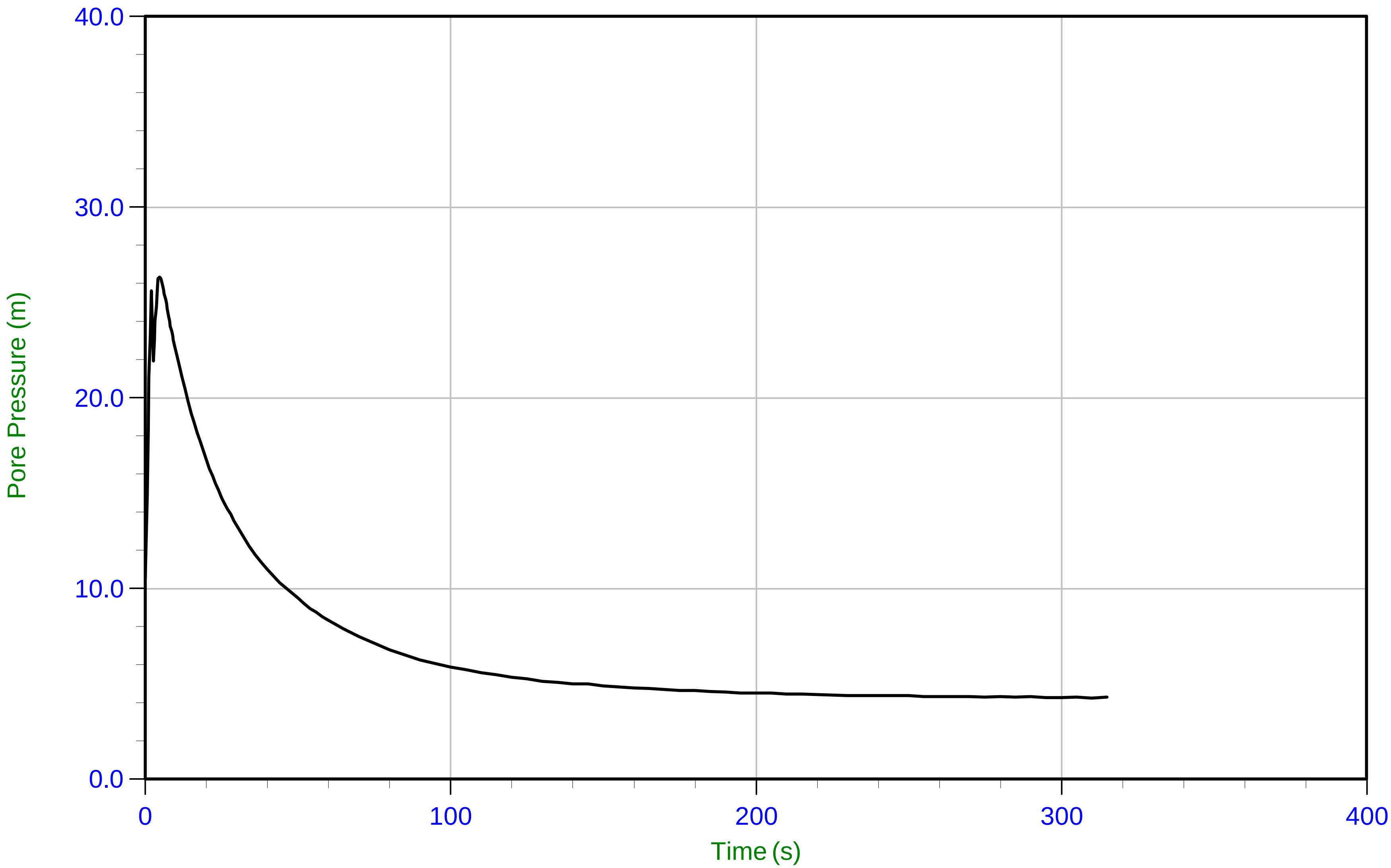
WT: 7.225 m / 23.704 ft
Ueq: 1.7 m

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 11.475 m / 37.647 ft
Duration: 315.0 s

u Min: 4.3 m
u Max: 26.3 m
u Final: 4.3 m

WT: 7.575 m / 24.852 ft
Ueq: 3.9 m
U(50): 15.11 m

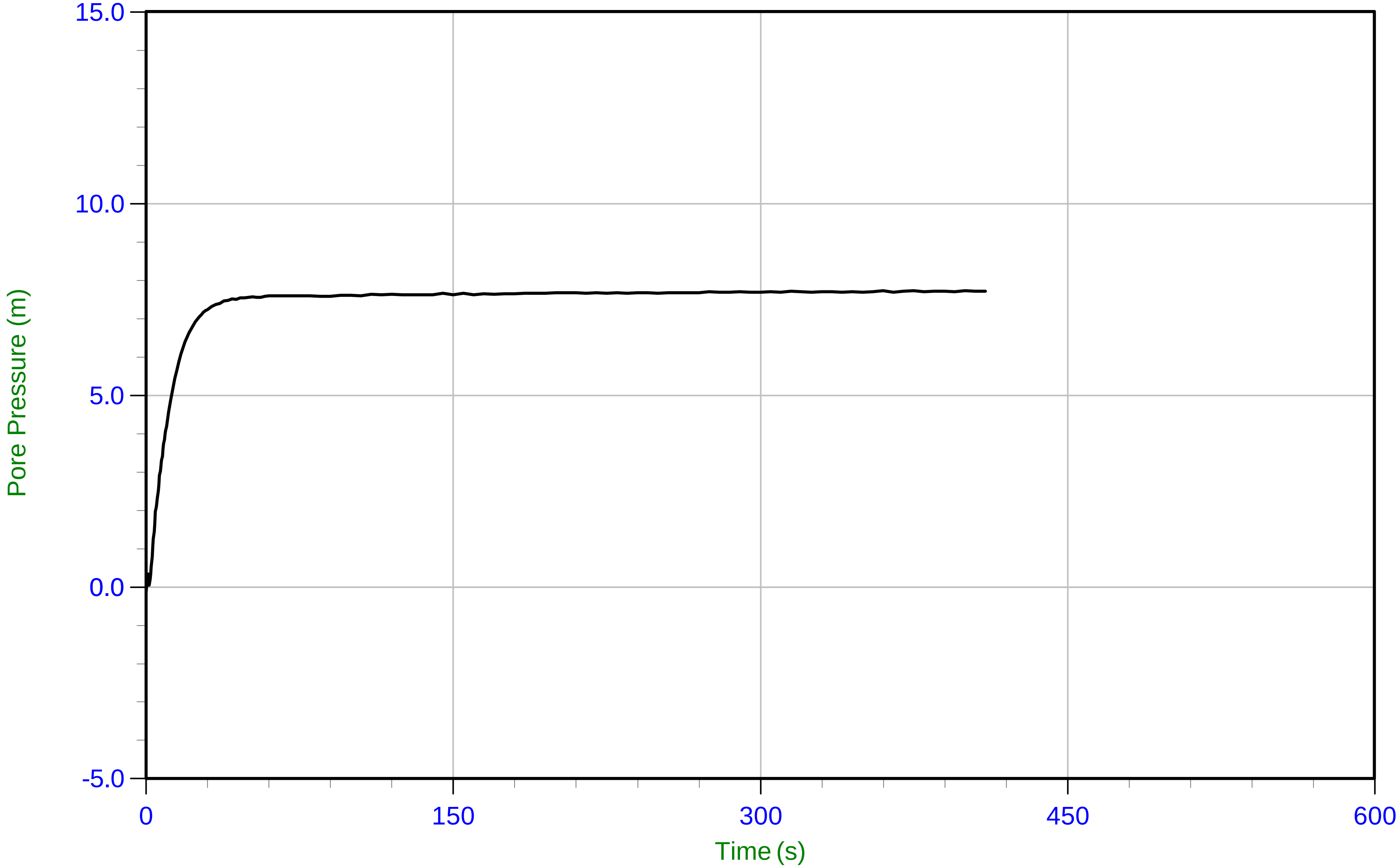
T(50): 19.4 s
Ir: 100
Ch: 36.1 cm²/min

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



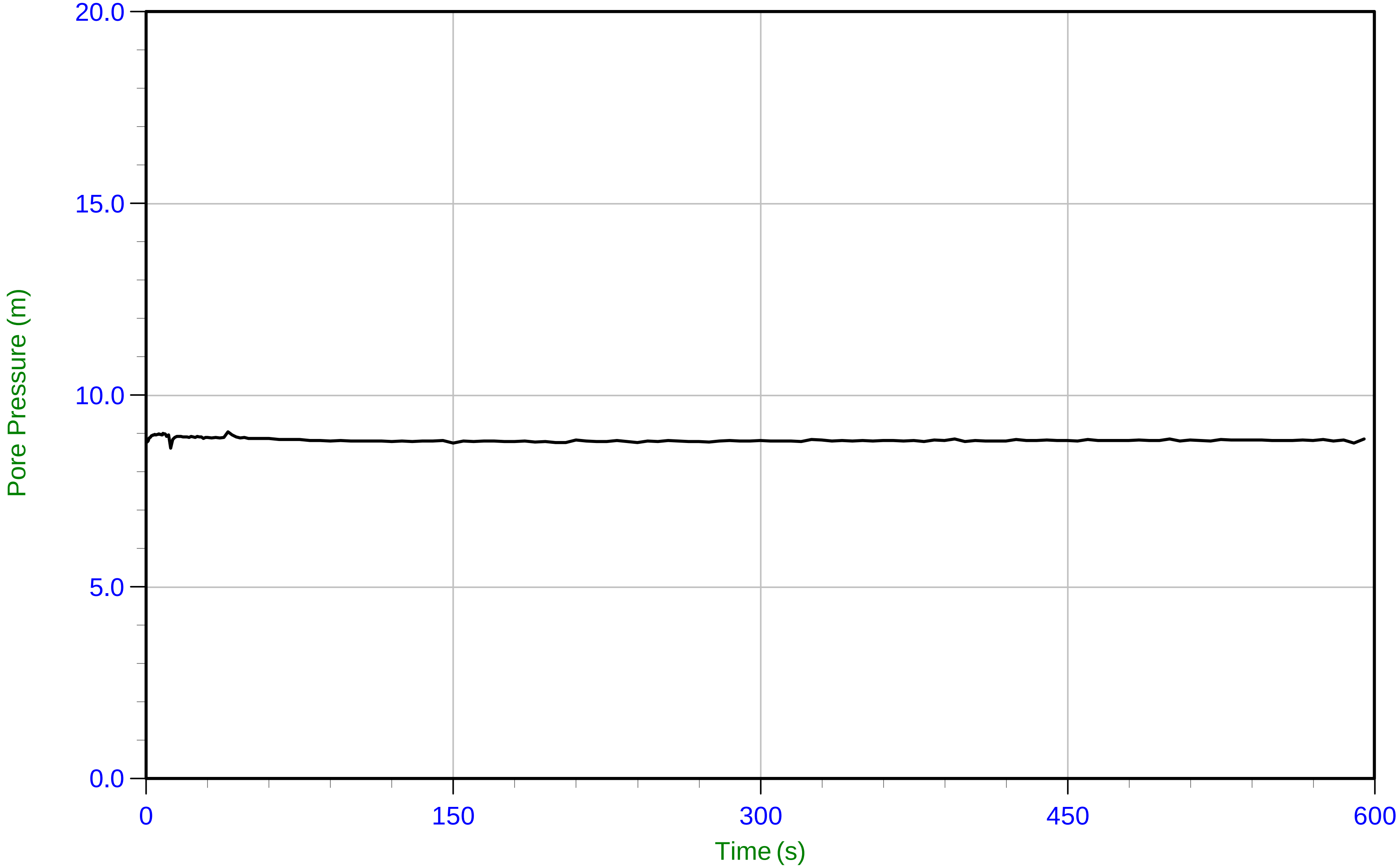
Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 14.950 m / 49.048 ft
Duration: 410.0 s

u Min: -0.1 m
u Max: 7.7 m
u Final: 7.7 m

WT: 7.250 m / 23.786 ft
Ueq: 7.7 m

Tetra Tech	Job No: 20-02-21738	Sounding: SCPT21-02
	Date: 01/19/2021 07:43	Cone: EC742 Area=15 cm²
	Site: Dewdney, BC	



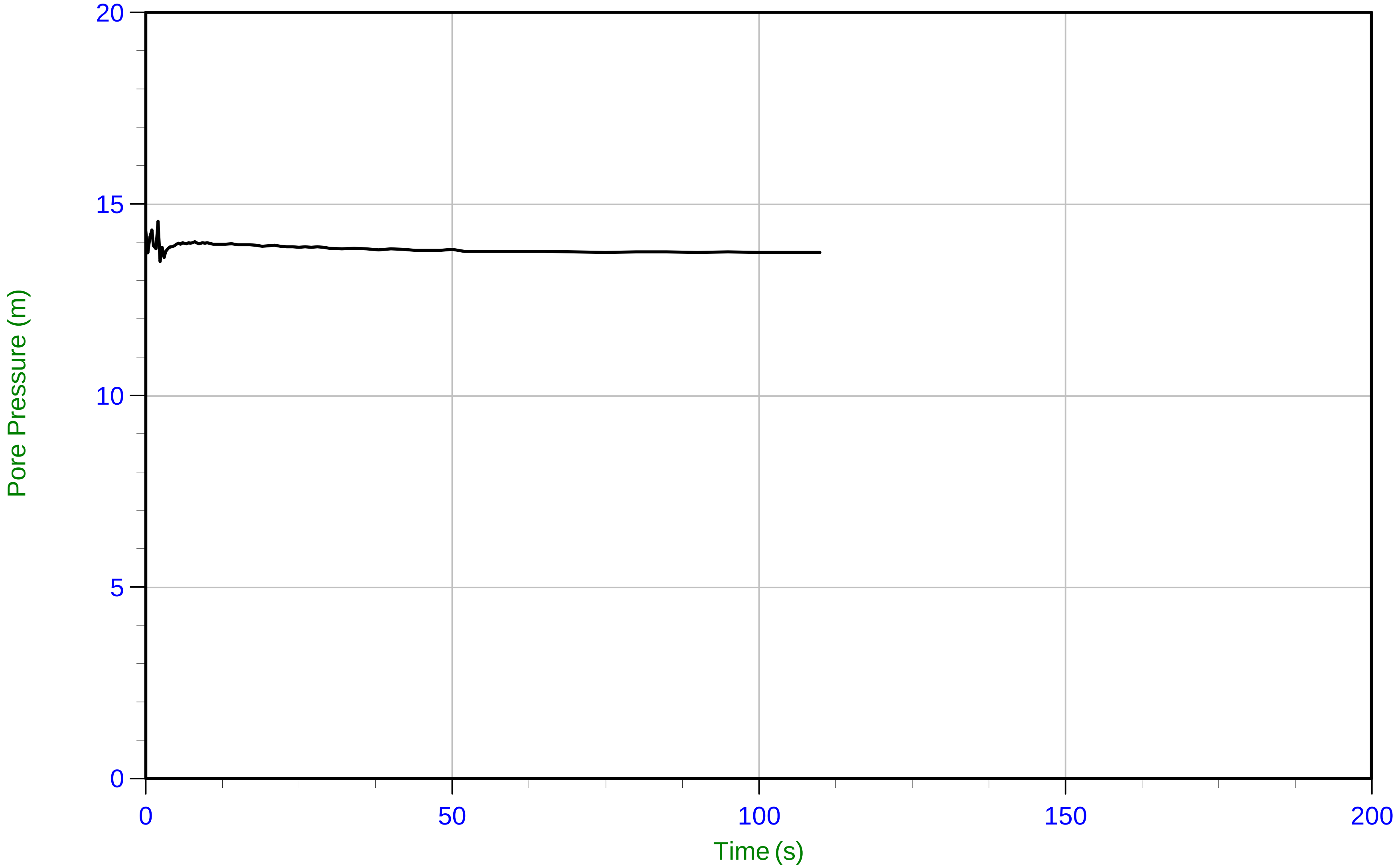
Trace Summary:

Filename: 20-02-21738_SP02.PPF	u Min: 8.6 m	WT: 6.900 m / 22.638 ft
Depth: 15.800 m / 51.837 ft	u Max: 9.0 m	Ueq: 8.9 m
Duration: 595.0 s	u Final: 8.9 m	

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 20.825 m / 68.323 ft
Duration: 110.0 s

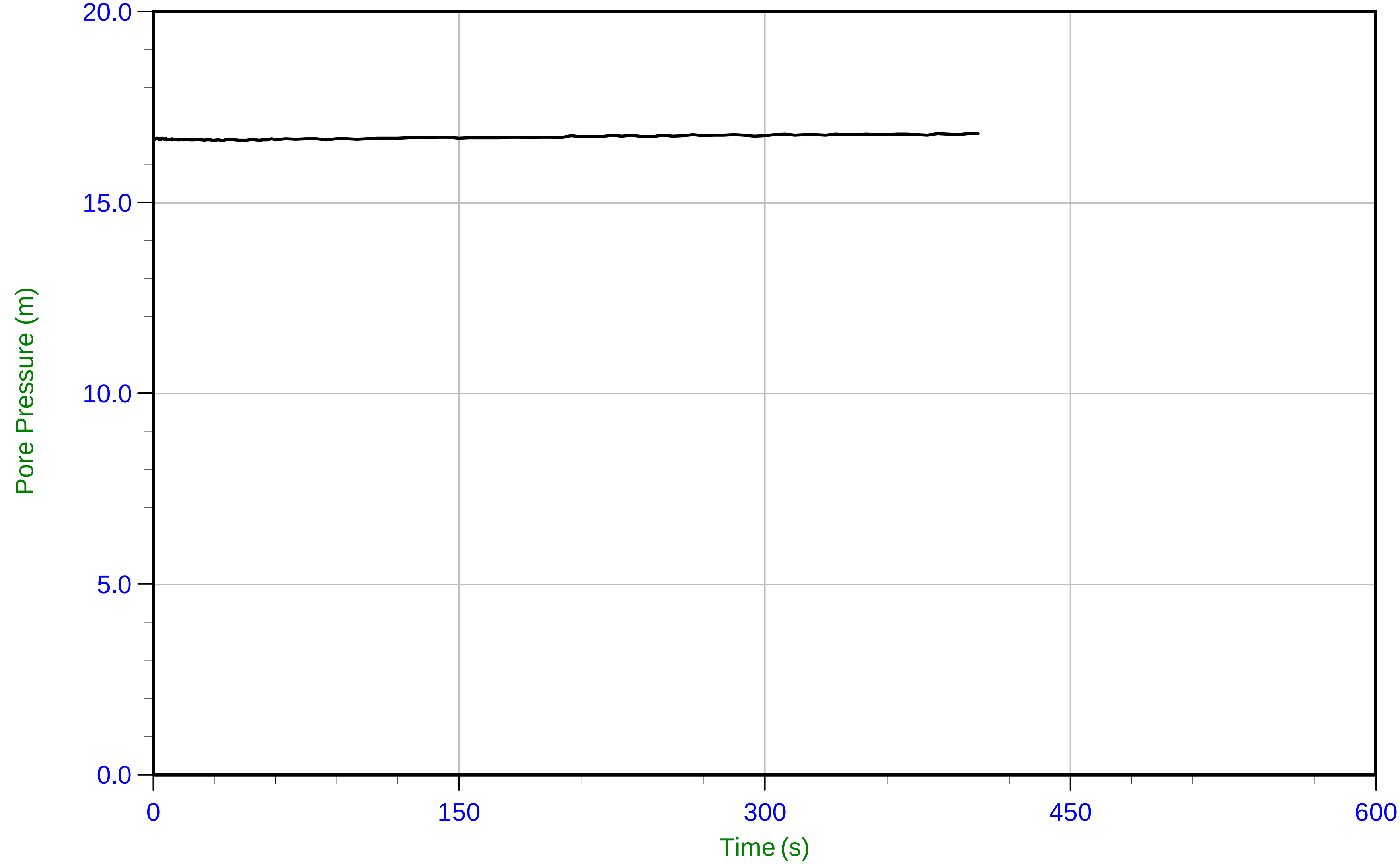
u Min: 13.5 m
u Max: 14.6 m
u Final: 13.7 m

WT: 7.036 m / 23.084 ft
Ueq: 13.8 m

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 23.825 m / 78.165 ft
Duration: 405.0 s

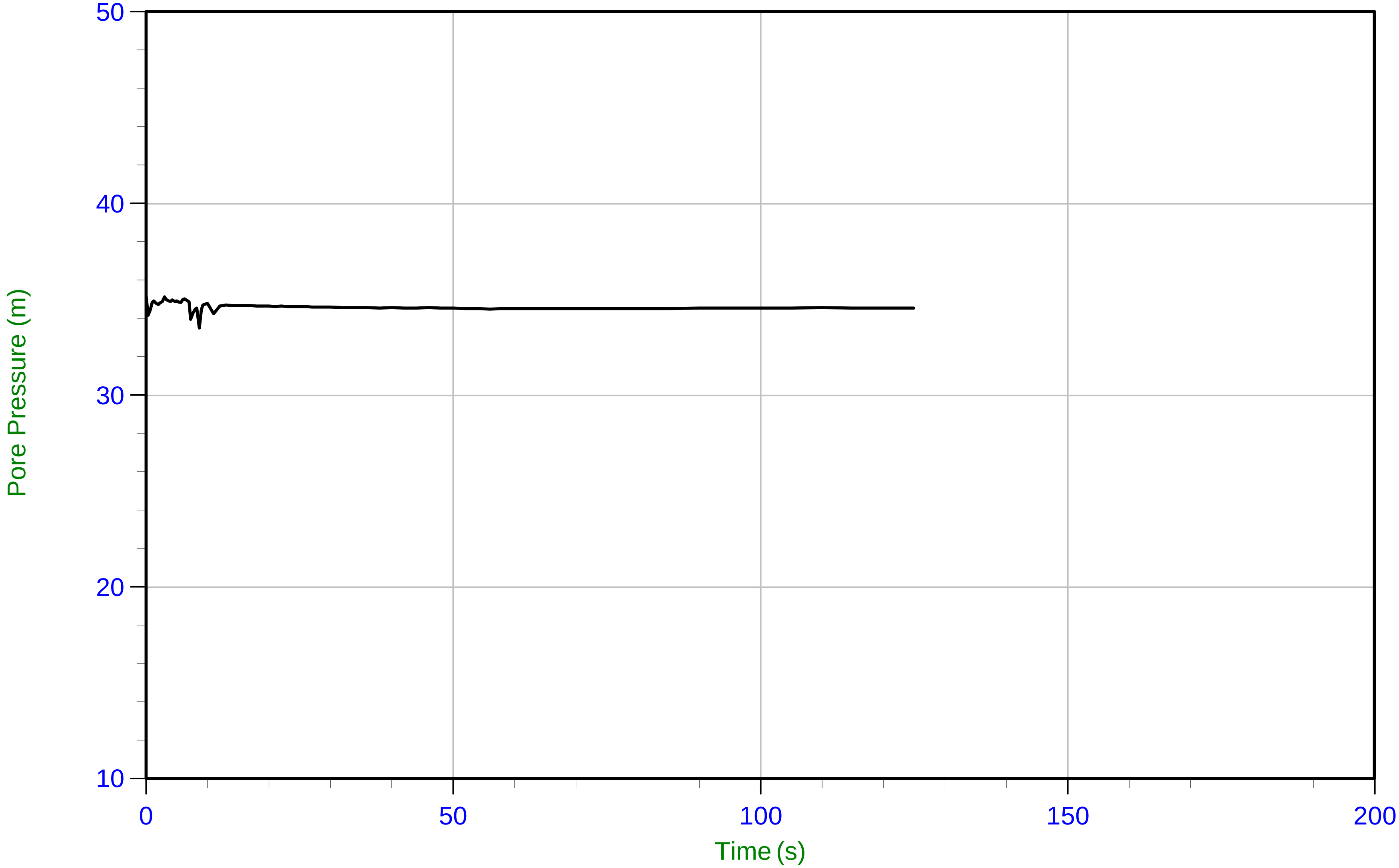
u Min: 16.6 m
u Max: 16.8 m
u Final: 16.8 m

WT: 7.025 m / 23.048 ft
Ueq: 16.8 m

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



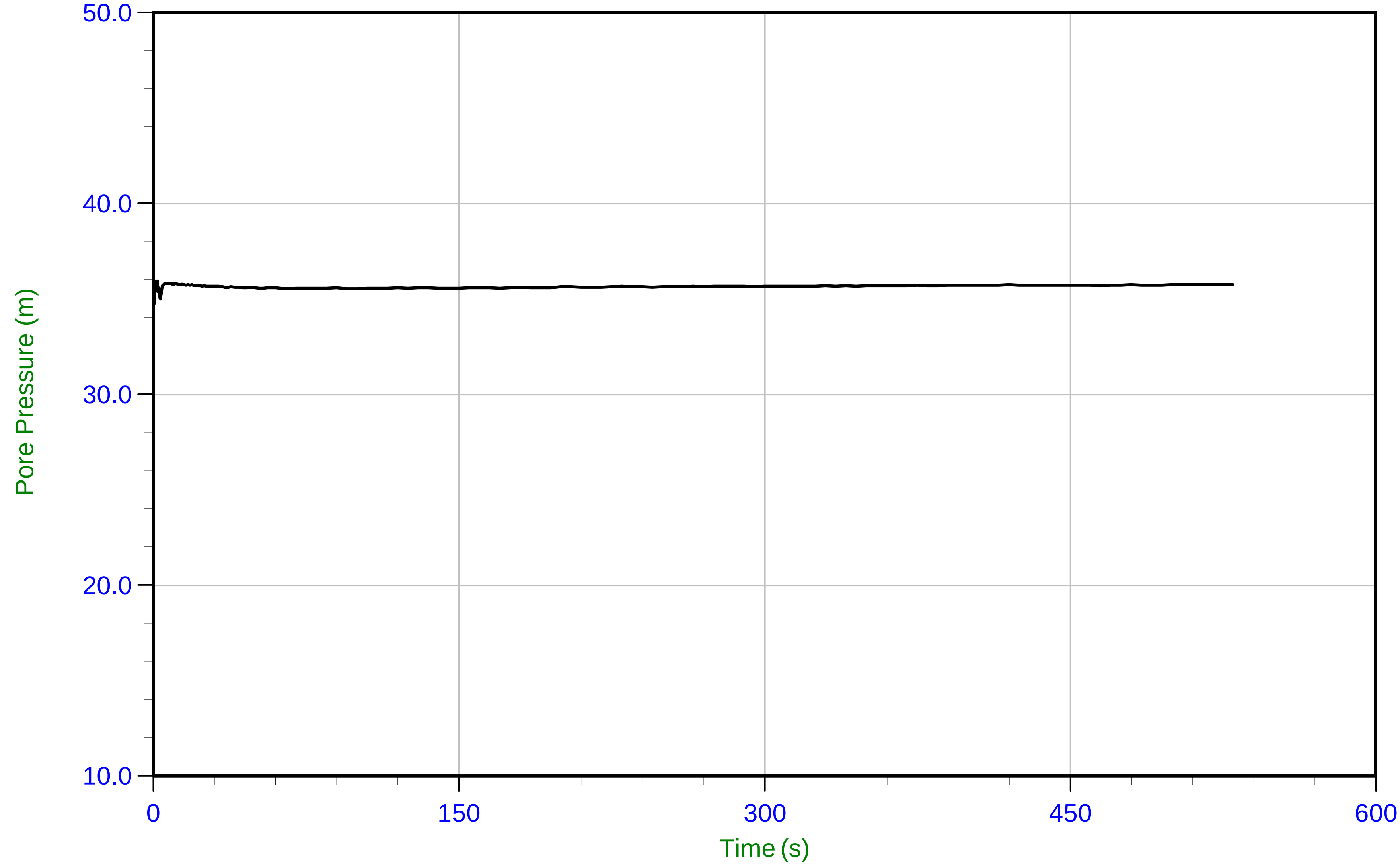
Trace Summary:

Filename: 20-02-21738_SP02.PPF	u Min: 33.5 m	WT: 7.168 m / 23.517 ft	
Depth: 41.800 m / 137.137 ft	u Max: 35.2 m	Ueq: 34.6 m	
Duration: 125.0 s	u Final: 34.5 m		

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 42.800 m / 140.418 ft
Duration: 530.0 s

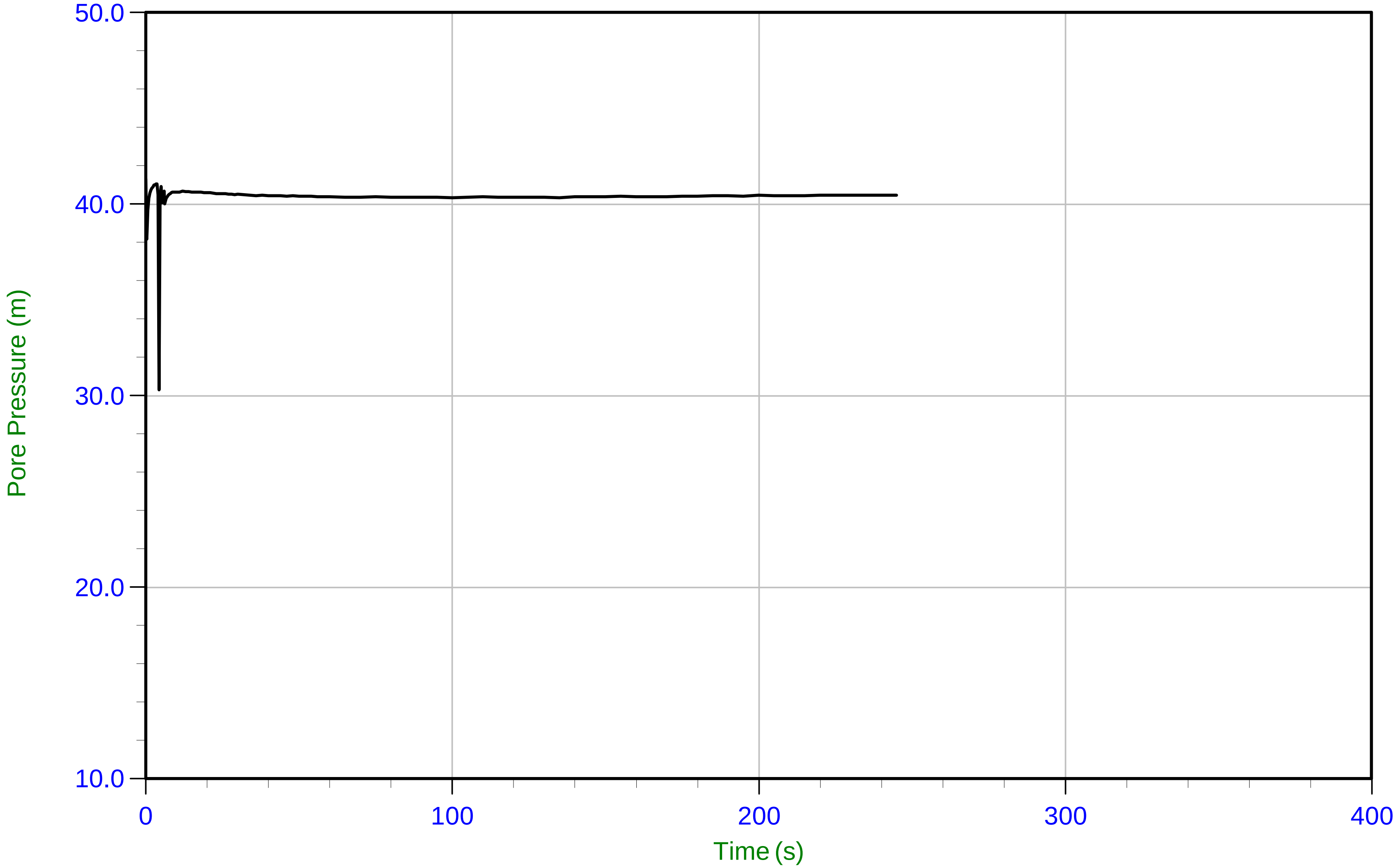
u Min: 34.7 m
u Max: 37.2 m
u Final: 35.7 m

WT: 7.100 m / 23.294 ft
Ueq: 35.7 m

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



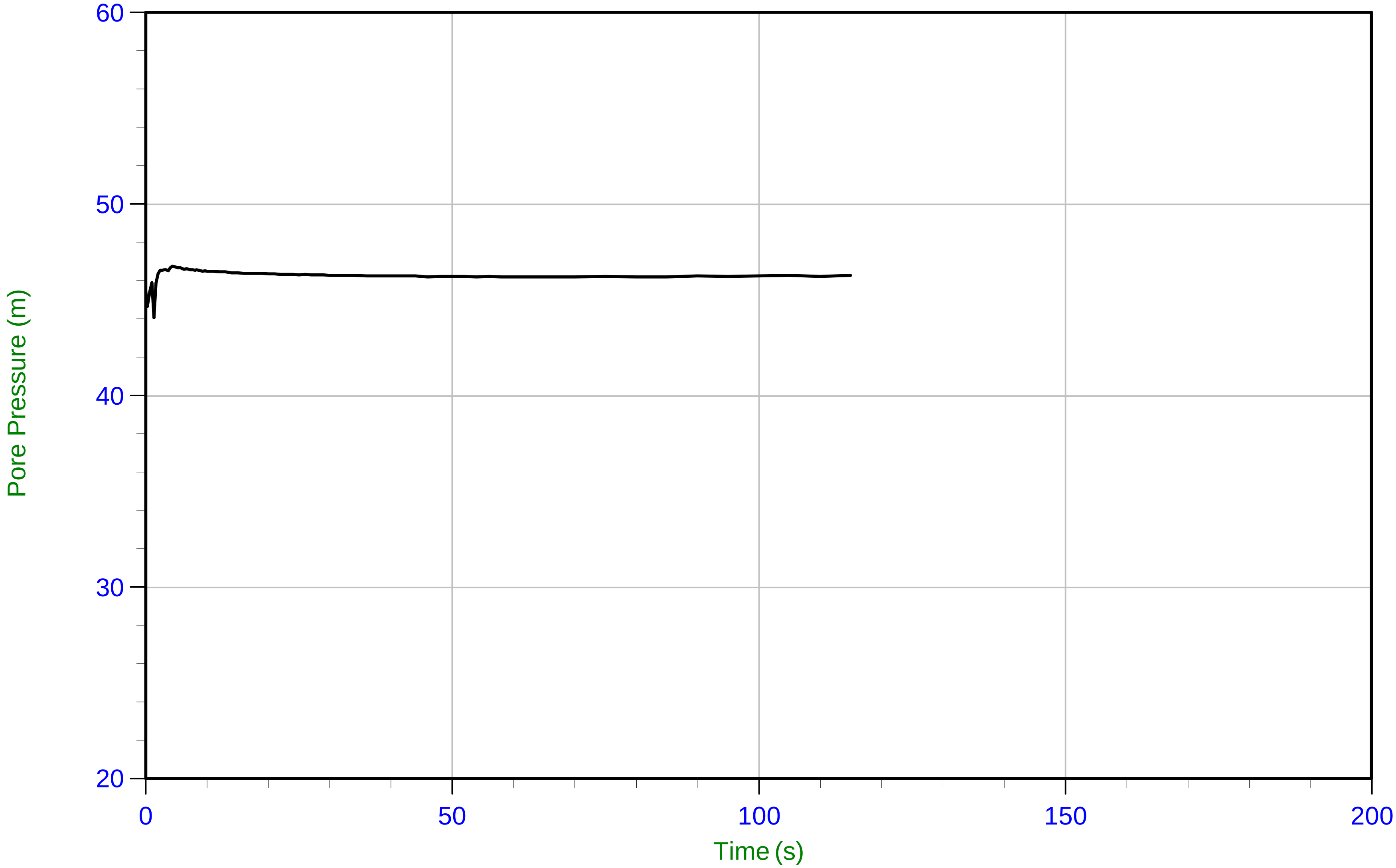
Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 47.825 m / 156.904 ft
Duration: 245.0 s

u Min: 30.3 m
u Max: 41.3 m
u Final: 40.5 m

WT: 7.325 m / 24.032 ft
Ueq: 40.5 m

Tetra Tech	Job No: 20-02-21738 Date: 01/19/2021 07:43 Site: Dewdney, BC	Sounding: SCPT21-02 Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 53.825 m / 176.589 ft
Duration: 115.0 s

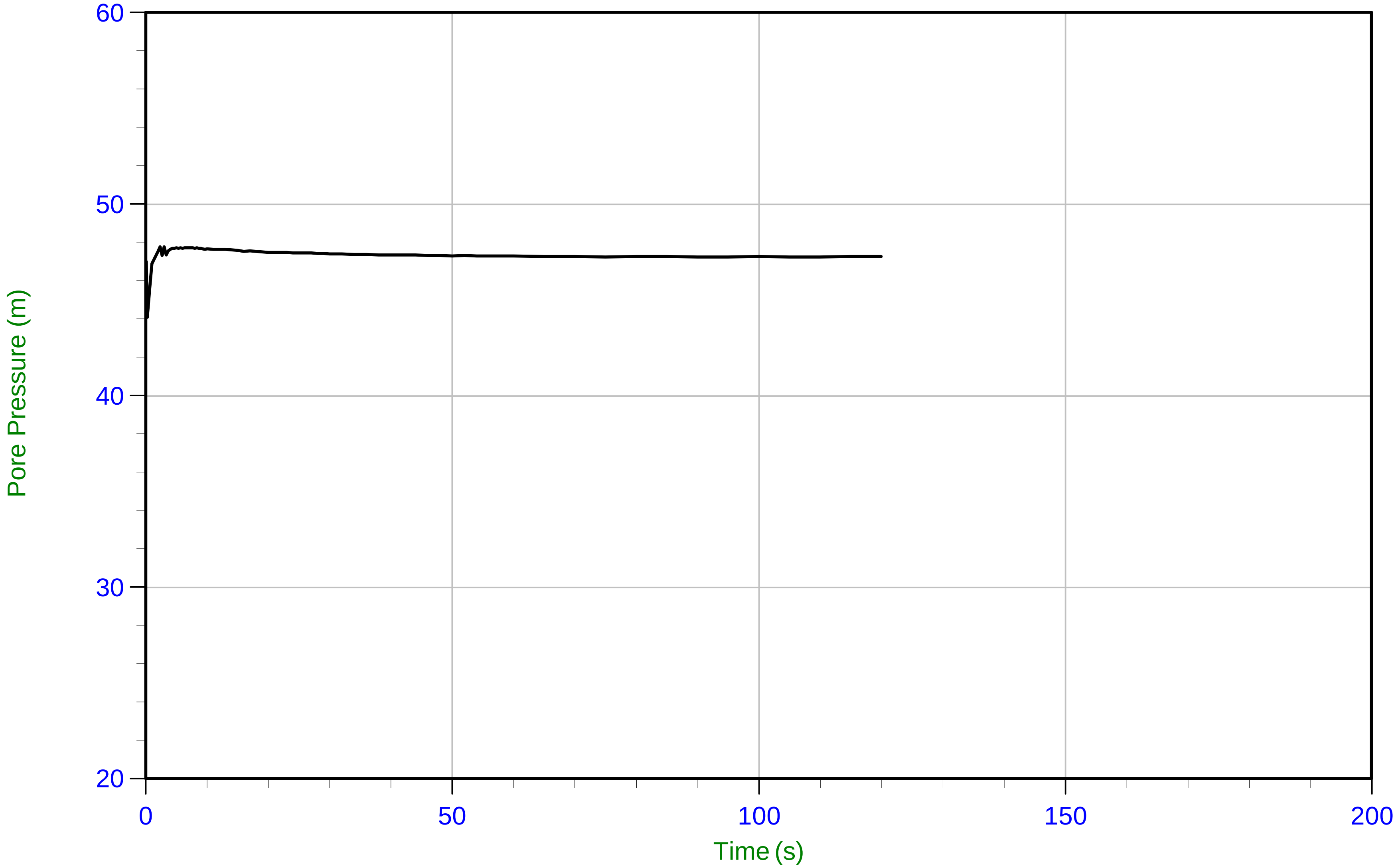
u Min: 44.1 m
u Max: 46.8 m
u Final: 46.3 m

WT: 7.509 m / 24.636 ft
Ueq: 46.3 m

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 54.825 m / 179.870 ft
Duration: 120.0 s

u Min: 44.1 m
u Max: 47.8 m
u Final: 47.3 m

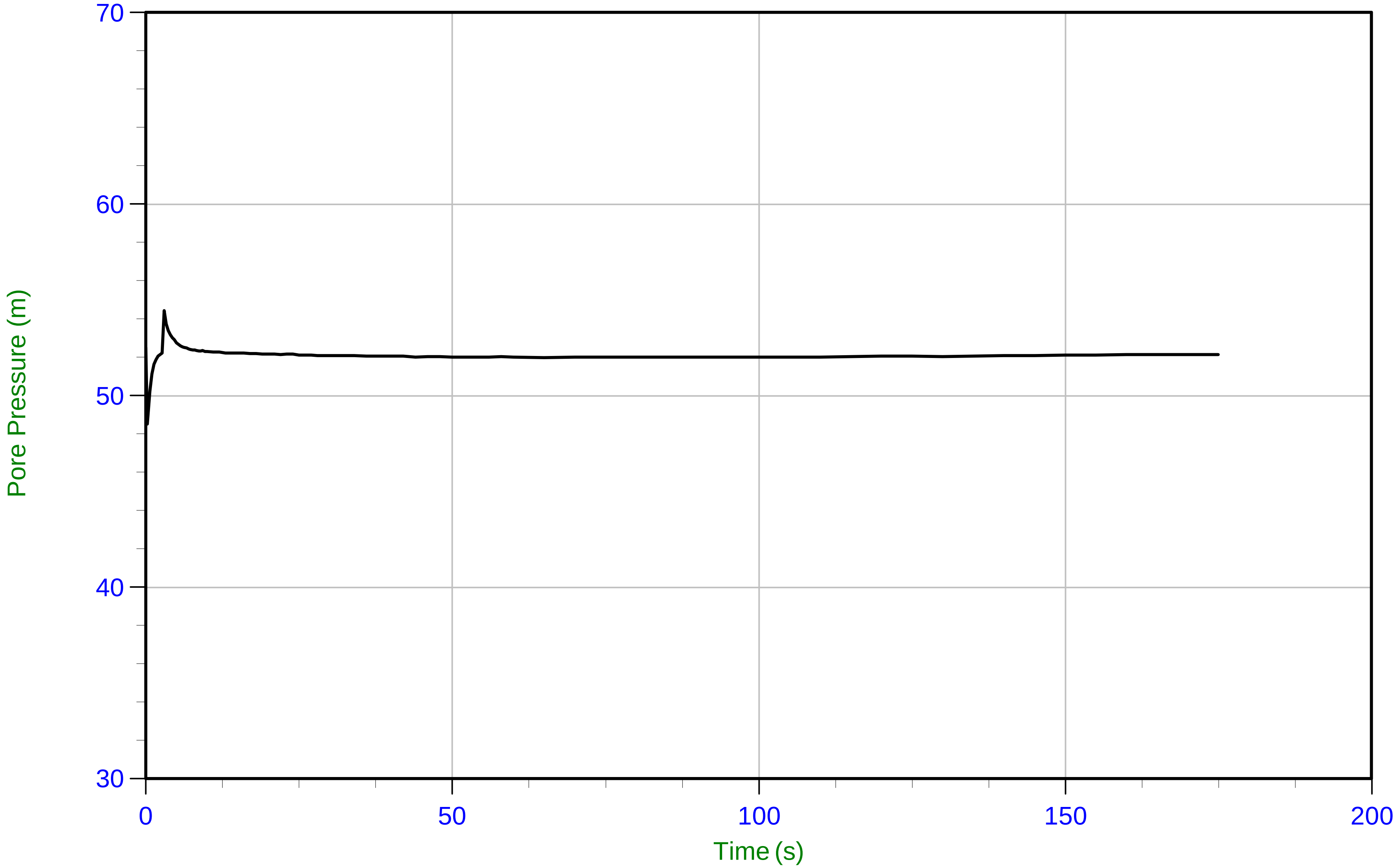
WT: 7.667 m / 25.154 ft
Ueq: 47.2 m

CONETEC

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



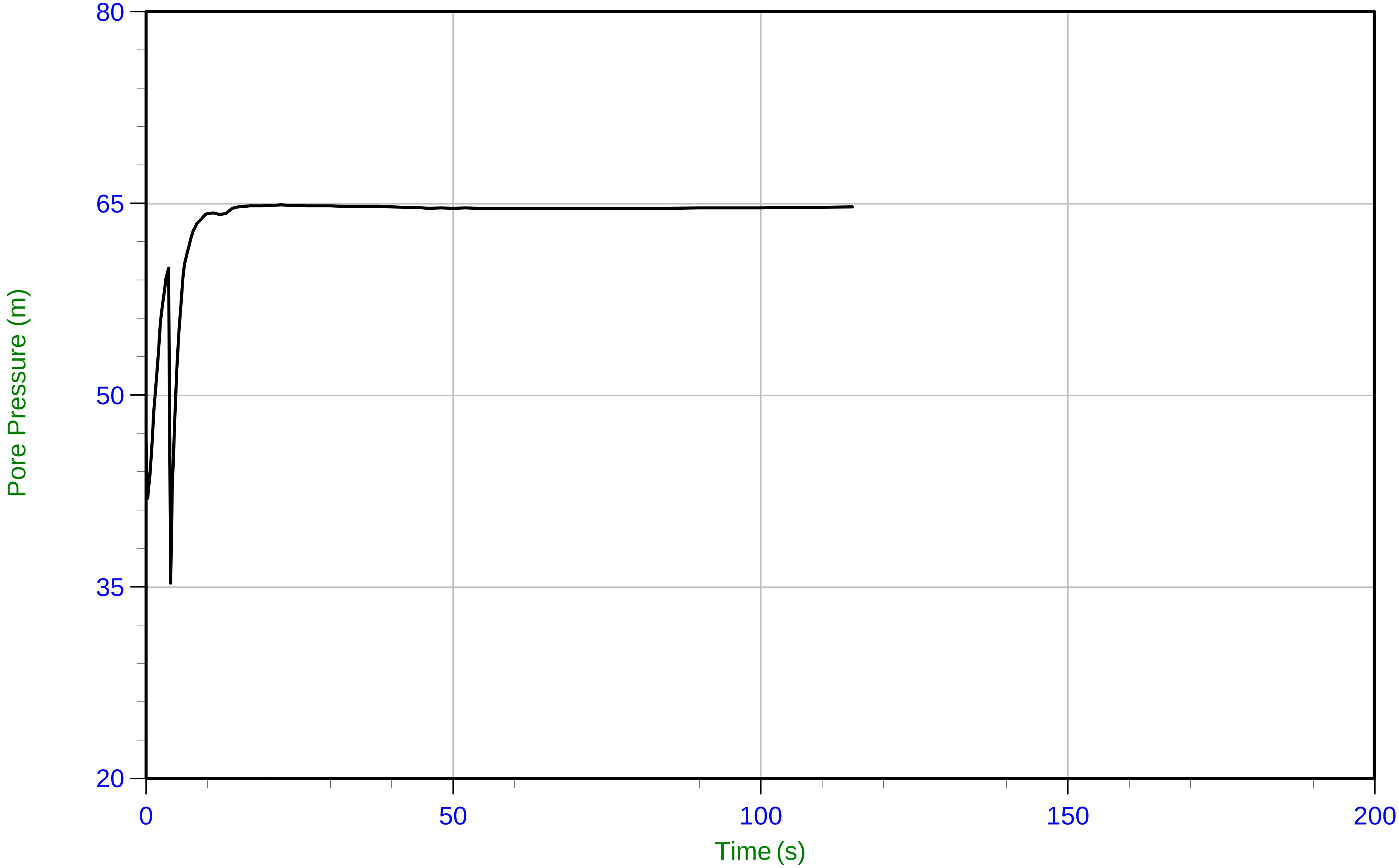
Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 59.825 m / 196.274 ft
Duration: 175.0 s

u Min: 48.5 m
u Max: 54.4 m
u Final: 52.1 m

WT: 7.720 m / 25.328 ft
Ueq: 52.1 m

Tetra Tech	Job No: 20-02-21738 Date: 01/19/2021 07:43 Site: Dewdney, BC	Sounding: SCPT21-02 Cone: EC742 Area=15 cm²



Trace Summary:

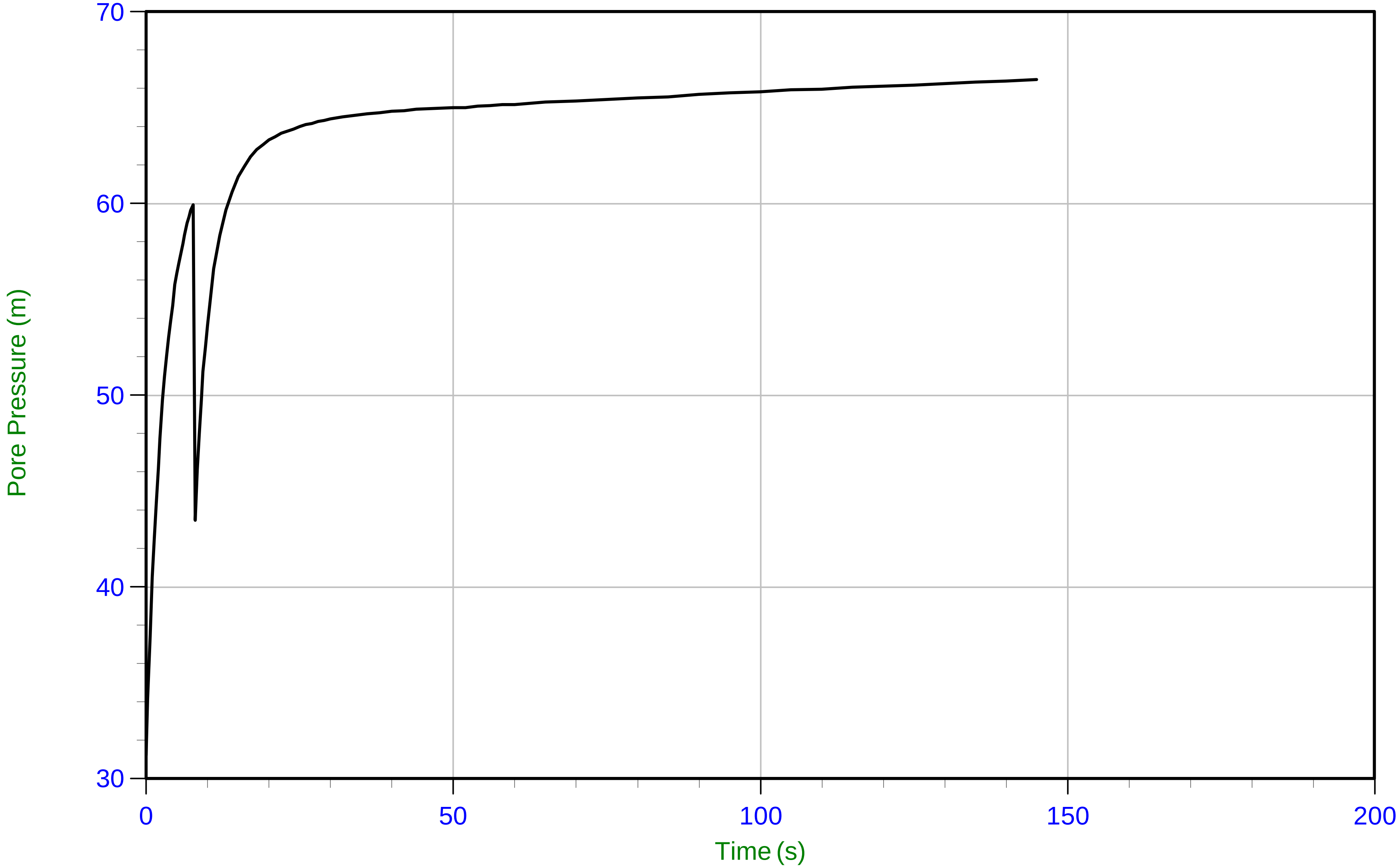
Filename: 20-02-21738_SP02.PPF	u Min: 35.3 m	WT: 9.008 m / 29.553 ft
Depth: 73.850 m / 242.287 ft	u Max: 64.9 m	Ueq: 64.8 m
Duration: 115.0 s	u Final: 64.7 m	

CONETEC

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 76.850 m / 252.129 ft
Duration: 145.0 s

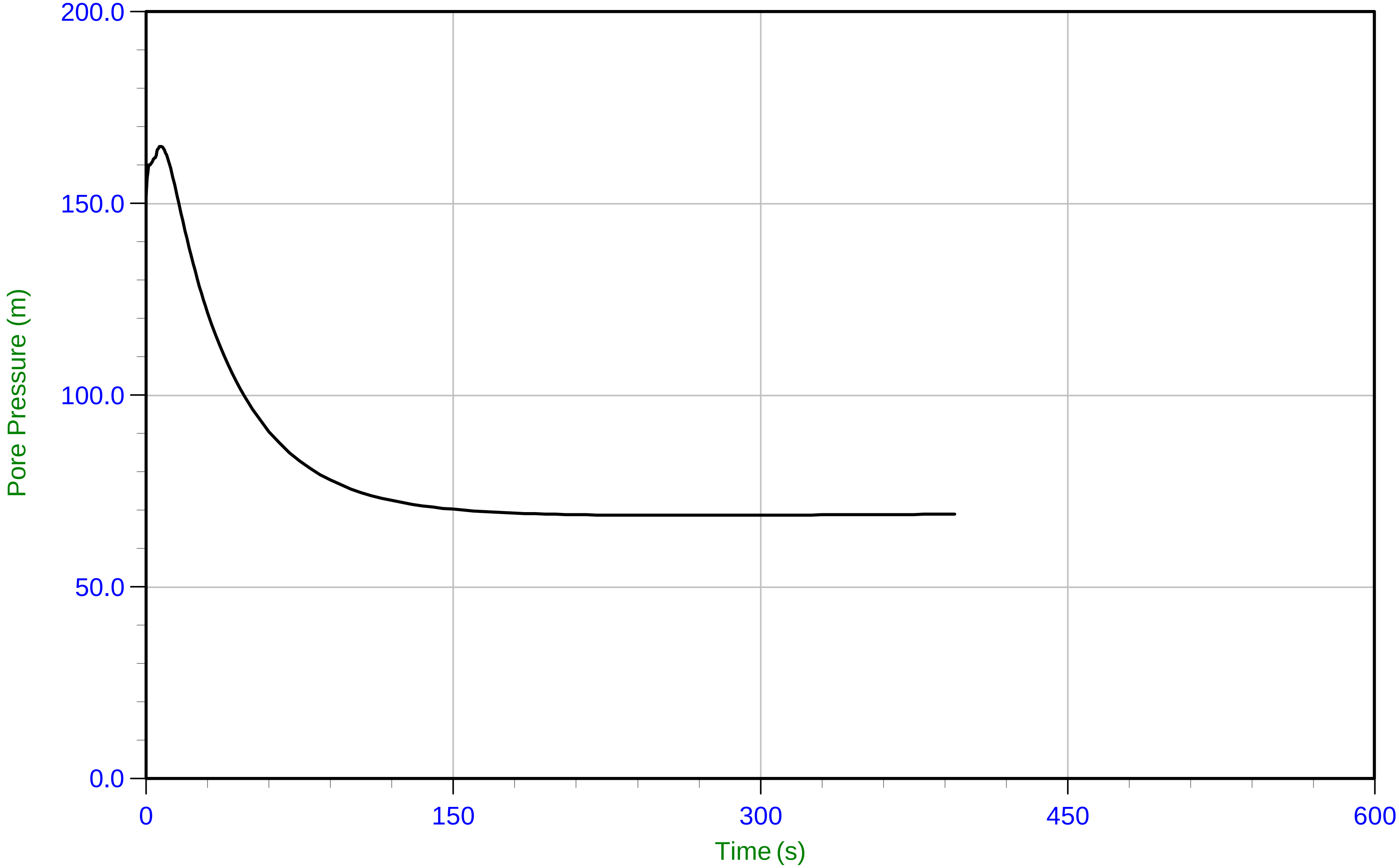
u Min: 31.2 m
u Max: 66.5 m
u Final: 66.5 m

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 77.600 m / 254.590 ft
Duration: 395.0 s

u Min: 68.7 m
u Max: 164.9 m
u Final: 69.0 m

WT: 8.600 m / 28.215 ft
Ueq: 69.0 m
U(50): 116.97 m

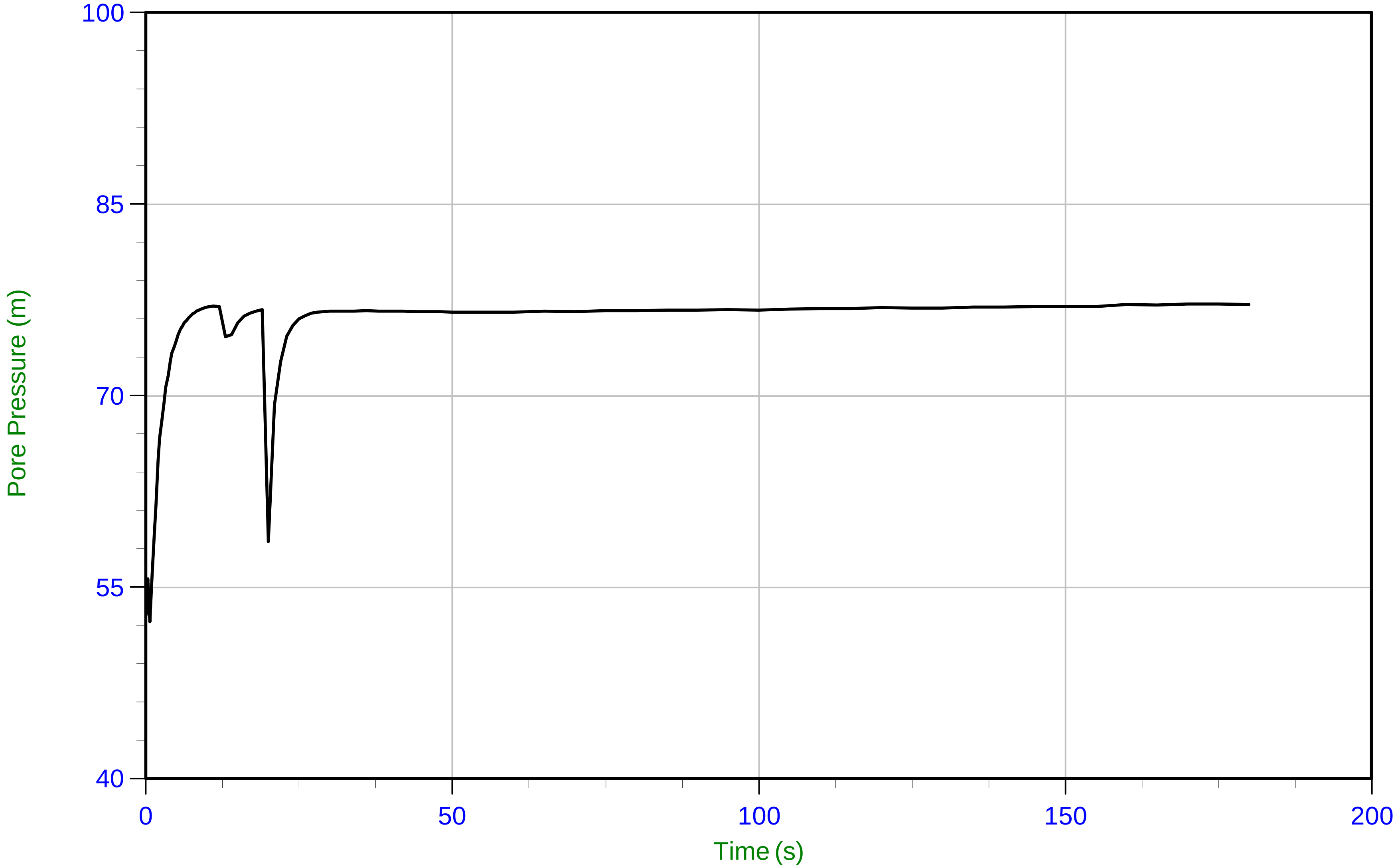
T(50): 25.8 s
Ir: 100
Ch: 27.2 cm²/min

ConeTec

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 86.850 m / 284.937 ft
Duration: 180.0 s

u Min: 52.3 m
u Max: 77.2 m
u Final: 77.1 m

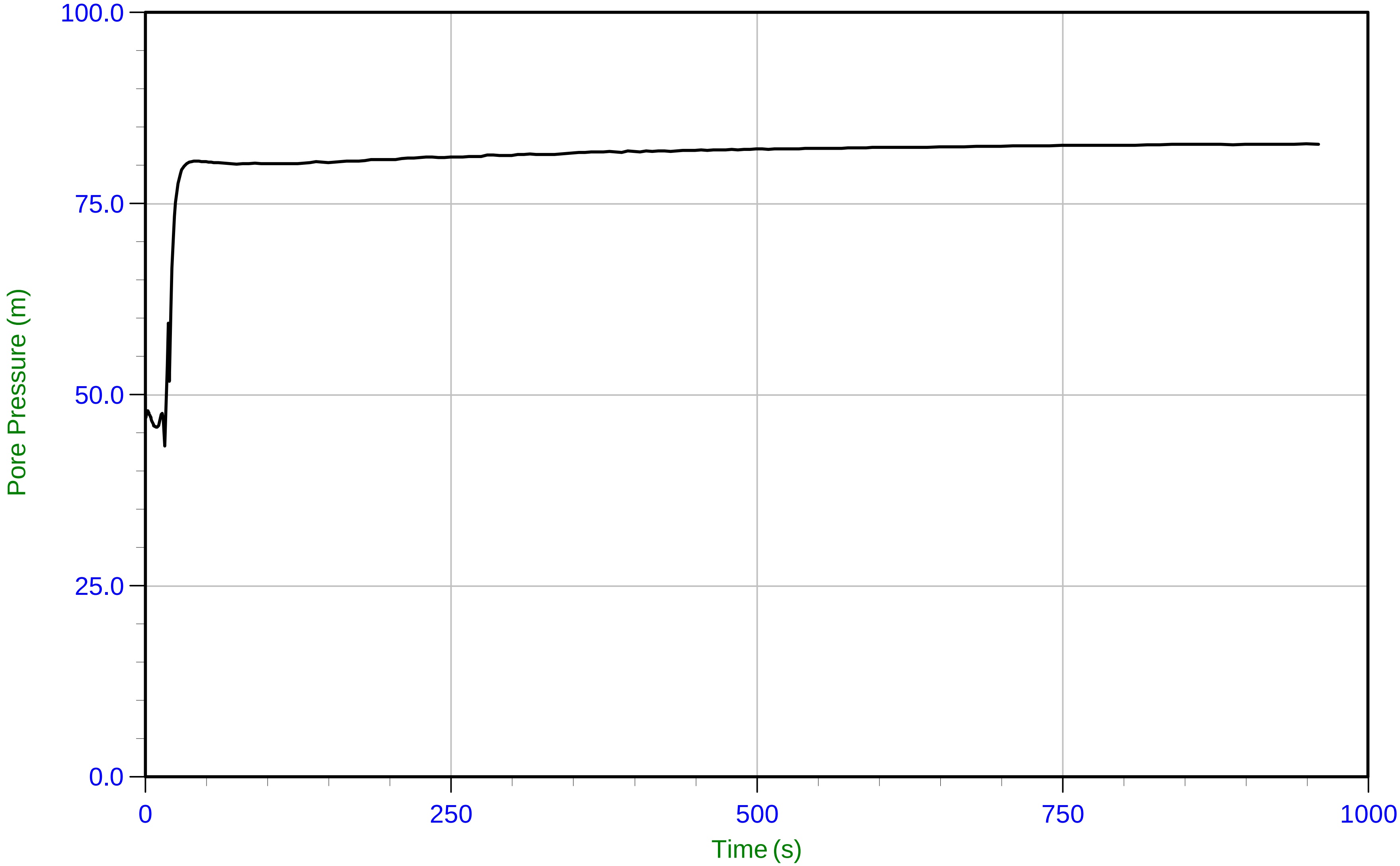
WT: 9.587 m / 31.453 ft
Ueq: 77.3 m

CONETEC

Tetra Tech

Job No: 20-02-21738
Date: 01/19/2021 07:43
Site: Dewdney, BC

Sounding: SCPT21-02
Cone: EC742 Area=15 cm²



Trace Summary:

Filename: 20-02-21738_SP02.PPF
Depth: 91.600 m / 300.521 ft
Duration: 960.0 s

u Min: 43.3 m
u Max: 82.8 m
u Final: 82.8 m

WT: 8.705 m / 28.560 ft
Ueq: 82.9 m

Description of Methods for Calculated CPT Geotechnical Parameters

CALCULATED CPT GEOTECHNICAL PARAMETERS

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

Revision SZW-Rev 14

Revised November 26, 2019
Prepared by Jim Greig, M.A.Sc, P.Eng (BC)

Limitations

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

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

ConeTec's Calculated CPT Geotechnical Parameters as of November 26, 2019

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

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

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

The tip correction is: $q_t = q_c + (1-a) \bullet u_2$ (consistent units are implied)

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

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

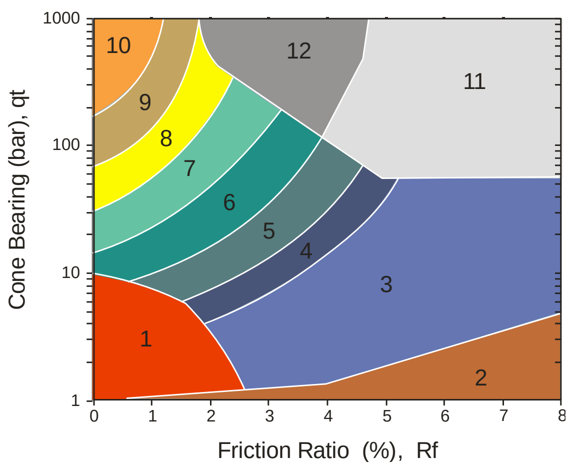
Effective vertical overburden stresses are calculated based on a hydrostatic distribution of equilibrium pore pressures below the water table or from a user defined equilibrium pore pressure profile (typically obtained from CPT dissipation tests) or a combination of the two. For over water projects the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

A majority of parameter calculations are derived or driven by results based on material types as determined by the various soil behavior type charts depicted in Figures 1 through 5. The parameter output files indicate the method(s) used.

The Soil Behavior Type classification chart shown in Figure 1 is the classic non-normalized SBT Chart developed at the University of British Columbia and reported in Robertson, Campanella, Gillespie and Greig (1986). Figure 2 shows the original normalized (linear method) SBT chart developed by Robertson (1990). The Bq classification charts shown in Figures 3a and 3b incorporate pore pressures into the SBT classification and are based on the methods described in Robertson (1990). Many of these charts have been summarized in Lunne, Robertson and Powell (1997). The

Jefferies and Davies SBT chart shown in Figure 3c is based on the techniques discussed in Jefferies and Davies (1993) which introduced the concept of the Soil Behavior Type Index parameter, I_c. Please note that the I_c parameter developed by Robertson and Fear (1995) and Robertson and Wride (1998) is similar in concept but uses a slightly different calculation method than that used by Jefferies and Davies (1993) as the latter incorporates pore pressure in their technique through the use of the Bq parameter. The normalized Qtn SBT chart shown in Figure 4 is based on the work by Robertson (2009) utilizing a variable stress ratio exponent, n, for normalization based on a slightly modified redefinition and iterative approach for I_c. The boundary curves drawn on the chart are based on the work described in Robertson (2010).

Figure 5 shows a revised behavior based chart by Robertson (2016) depicting contractive-dilative zones. As the zones represent material behavior rather than soil gradation ConeTec has chosen a set of zone colors that are less likely to be confused with material type colors from previous SBT charts. These colors differ from those used by Dr. Robertson.

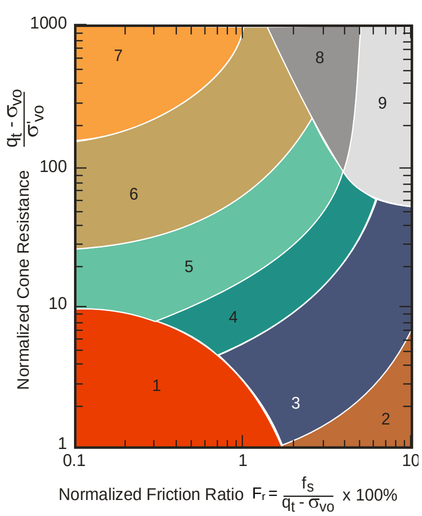


Zone	qt / N	Soil Behavior Type
1	2	sensitive fine grained
2	1	organic material
3	1	clay
4	1.5	silty clay to clay
5	2	clayey silt to silty clay
6	2.5	sandy silt to clayey silt
7	3	silty sand to sandy silt
8	4	sand to silty sand
9	5	sand
10	6	gravelly sand to sand
11	1	very stiff fine grained *
12	2	sand to clayey sand *

* overconsolidated or cemented

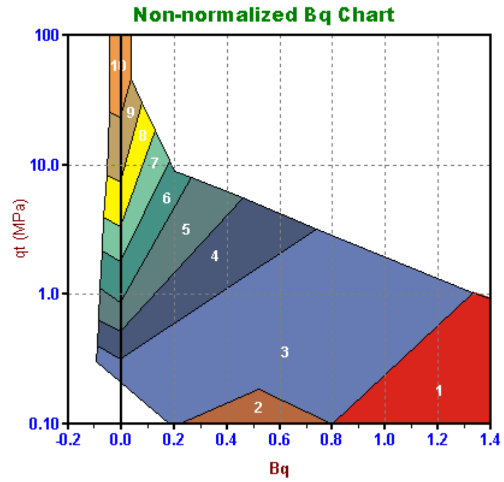
$$Rf = \left(\frac{fs}{qt}\right) \cdot 100\%$$

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

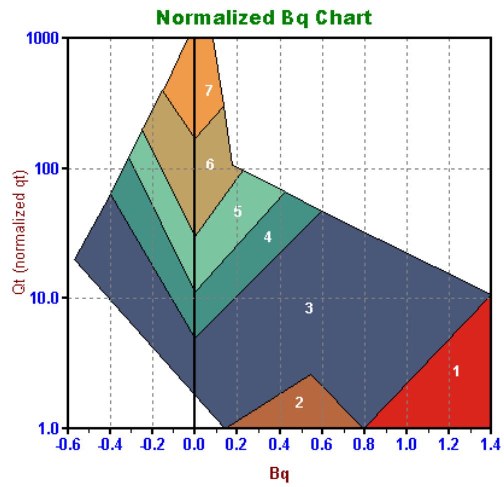


Zone	Normalized Soil Behavior Type
1	sensitive fine grained
2	organic material
3	clay to silty clay
4	clayey silt to silty clay
5	silty sand to sandy silt
6	clean sands to silty sands
7	gravelly sand to sand
8	very stiff sand to clayey sand
9	very stiff fine grained

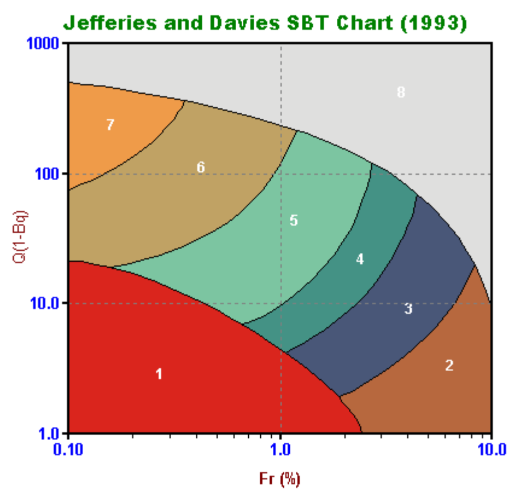
Figure 2. Normalized Soil Behavior Type Classification Chart (SBTn)



3a



3b



3c

Figure 3. Alternate Soil Behavior Type Charts

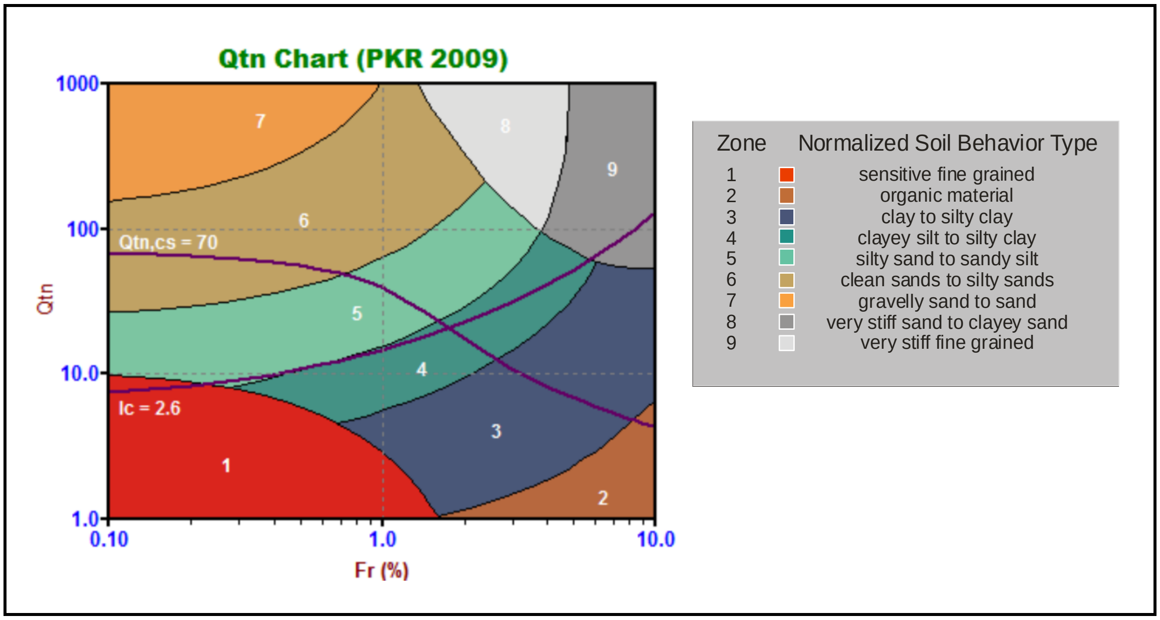


Figure 4. Normalized Soil Behavior Type Chart using Q_{tn} (SBT Qtn)

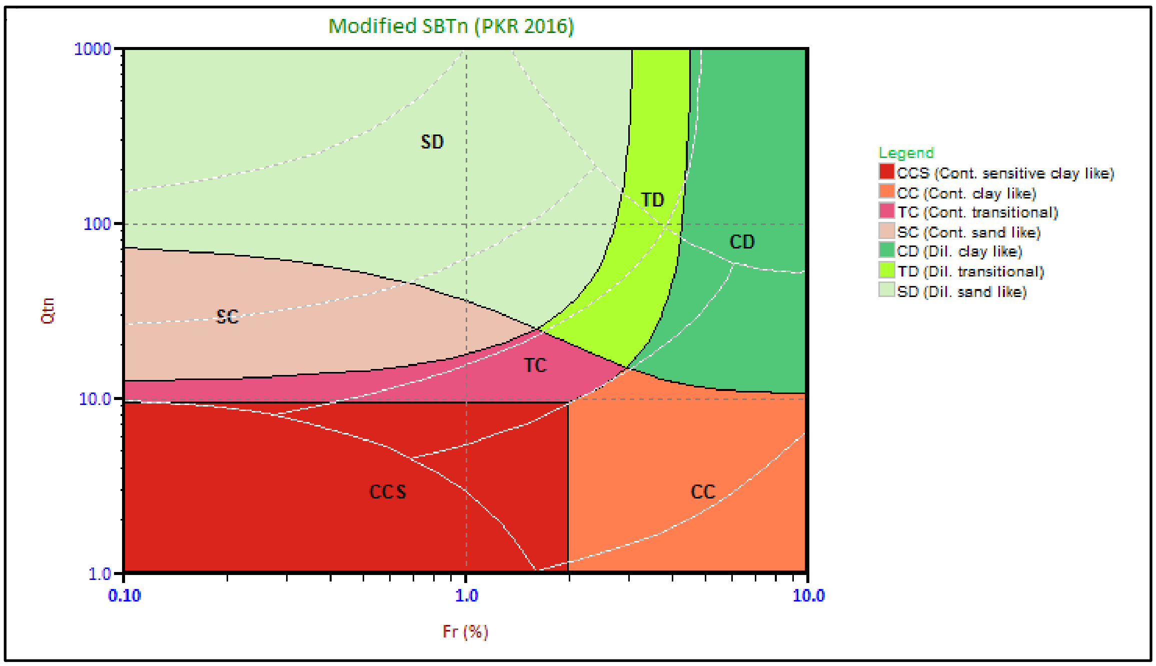


Figure 5. Modified SBTn Behavior Based Chart

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

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

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

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

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

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

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

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

The output files are typically provided in Microsoft Excel XLS or XLSX format. The ConeTec software has several options for output depending on the number or types of calculated parameters desired or requested by the client. Each output file is named using the original COR file base name followed by a three or four letter indicator of the output set selected (e.g. BSC, TBL, NLI, NL2, IFI, IFI2) and possibly followed by an operator selected suffix identifying the characteristics of the particular calculation run.

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

Calculated Parameter	Description	Equation	Ref
Depth	Mid Layer Depth *(where calculations are done at each point then Mid Layer Depth = Recorded Depth)*	*[Depth (Layer Top) + Depth (Layer Bottom)]/ 2.0*	CK*
Elevation	Elevation of Mid Layer based on sounding collar elevation supplied by client or through site survey	Elevation = Collar Elevation - Depth	CK*
Avg qc	Averaged recorded tip value (q_c)	$Avgqc = \frac{1}{n}\sum_{i=1}^{n} q_c$ *n=1 when calculations are done at each point*	CK*
Avg qt	Averaged corrected tip (q_t) where: $q_t = q_c + (1-a) \bullet u_2$	$Avgqt = \frac{1}{n}\sum_{i=1}^{n} q_t$ *n=1 when calculations are done at each point*	1
Avg fs	Averaged sleeve friction (f_s)	$Avgfs = \frac{1}{n}\sum_{i=1}^{n} fs$ *n=1 when calculations are done at each point*	CK*
Avg Rf	Averaged friction ratio (R_f) where friction ratio is defined as: $Rf = 100\% \bullet \frac{fs}{q_t}$	$AvgRf = 100\% \cdot \frac{Avgfs}{Avgqt}$ *n=1 when calculations are done at each point*	CK*
Avg u	Averaged dynamic pore pressure *(u)*	$Avgu = \frac{1}{n}\sum_{i=1}^{n} u_i$ *n=1 when calculations are done at each point*	CK*

Calculated Parameter	Description	Equation	Ref
Avg Res	Averaged Resistivity (this data is not always available since it is a specialized test requiring an additional module)	$AvgRes = \frac{1}{n}\sum_{i=1}^{n} Resistivity_i$ *n=1 when calculations are done at each point*	CK*
Avg UVIF	Averaged UVIF ultra-violet induced fluorescence (this data is not always available since it is a specialized test requiring an additional module)	$AvgUVIF = \frac{1}{n}\sum_{i=1}^{n} UVIF_i$ *n=1 when calculations are done at each point*	CK*
Avg Temp	Averaged Temperature (this data is not always available since it requires specialized calibrations)	$AvgTemp = \frac{1}{n}\sum_{i=1}^{n} Temperature_i$ *n=1 when calculations are done at each point*	CK*
Avg Gamma	Averaged Gamma Counts (this data is not always available since it is a specialized test requiring an additional module)	$AvgGamma = \frac{1}{n}\sum_{i=1}^{n} Gamma_i$ *n=1 when calculations are done at each point*	CK*
SBT	Soil Behavior Type as defined by Robertson et al 1986 (often referred to as Robertson and Campanella, 1986)	See Figure 1	1, 5
SBTn	Normalized Soil Behavior Type as defined by Robertson 1990 (linear normalization)	See Figure 2	2, 5
SBT-Bq	Non-normalized Soil Behavior type based on the Bq parameter	See Figure 3	1, 2, 5
SBT-Bqn	Normalized Soil Behavior based on the Bq parameter	See Figure 3	2, 5
SBT-JandD	Soil Behavior Type as defined by Jeffries and Davies	See Figure 3	7
SBT Qtn	Soil Behavior Type as defined by Robertson (2009) using a variable stress ratio exponent for normalization based on I_c	See Figure 4	15
Modified SBTn (contractive /dilative)	Modified SBTn chart as defined by Robertson (2016) indicating zones of contractive/dilative behavior.	See Figure 5	30
Unit Wt.	Unit Weight of soil determined from one of the following user selectable options: 1) uniform value 2) value assigned to each SBT zone 3) value assigned to each SBTn zone 4) value assigned to SBTn zone as determined from Robertson and Wride (1998) based on q_{c1n} 5) values assigned to SBT Qtn zones 6) Mayne fs (sleeve friction) method 7) Robertson 2010 method 8) user supplied unit weight profile The last option may co-exist with any of the other options	See references	3, 5, 15, 21, 24, 29

Calculated Parameter	Description	Equation	Ref
TStress σ_v	Total vertical overburden stress at Mid Layer Depth *A layer is defined as the averaging interval specified by the user where depths are reported at their respective mid-layer depth.* *For data calculated at each point layers are defined using the recorded depth as the mid-point of the layer. Thus, a layer starts half-way between the previous depth and the current depth unless this is the first point in which case the layer start is at zero depth. The layer bottom is half-way from the current depth to the next depth unless it is the last data point.* *Defining layers affects how stresses are calculated since the unit weight attributed to a data point is used throughout the entire layer. This means that to calculate the stresses the total stress at the top and bottom of a layer are required. The stress at mid layer is determined by adding the incremental stress from the layer top to the mid-layer depth. The stress at the layer bottom becomes the stress at the top of the subsequent layer. Stresses are NOT calculated from mid-point to mid-point.* *For over-water work the total stress due to the column of water above the mud line is taken into account where appropriate.*	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ *where* γ_i is layer unit weight h_i is layer thickness	CK*
EStress σ_v'	Effective vertical overburden stress at mid-layer depth	$\sigma_v' = \sigma_v - u_{eq}$	CK*
Equil u u_{eq} or u_0	Equilibrium pore pressure determined from one of the following user selectable options: 1) hydrostatic below water table 2) user supplied profile 3) combination of those above When a user supplied profile is used/provided a linear interpolation is performed between equilibrium pore pressures defined at specific depths. If the profile values start below the water table then a linear transition from zero pressure at the water table to the first defined pointed is used. Equilibrium pore pressures may come from dissipation tests, adjacent piezometers or other sources. Occasionally, an extra equilibrium point ("assumed value") will be provided in the profile that does not come from a recorded value to smooth out any abrupt changes or to deal with material interfaces. These "assumed" values will be indicated on our plots and in tabular summaries.	For hydrostatic option: $u_{eq} = \gamma_w \cdot (D - D_{wt})$ where u_{eq} is equilibrium pore pressure γ_w is unit weight of water D is the current depth D_{wt} is the depth to the water table	CK*
K_0	Coefficient of earth pressure at rest, K_0	$K_0 = (1 - \sin\Phi')\, OCR^{\sin\Phi'}$	17
C_n	Overburden stress correction factor used for $(N_1)_{60}$ and older CPT parameters	$C_n = (P_a/\sigma_v')^{0.5}$ where *0.0 < C_n < 2.0 (user adjustable, typically 1.7)* *P_a is atmospheric pressure (100 kPa)*	12
C_q	Overburden stress normalizing factor	$C_q = 1.8 / (0.8 + (\sigma_v'/P_a))$ where *0.0 < C_q < 2.0 (user adjustable)* *P_a is atmospheric pressure (100 kPa)*	3, 12

Calculated Parameter	Description	Equation	Ref
N_{60}	SPT N value at 60% energy calculated from q_t/N ratios assigned to each SBT zone. This method has abrupt N value changes at zone boundaries.	*See Figure 1*	5
(N1)60	SPT N_{60} value corrected for overburden pressure	$(N_1)_{60} = C_n \bullet N_{60}$	4
N60Ic	SPT N_{60} values based on the I_c parameter [as defined by Roberston and Wride 1998 (5), or by Robertson 2009 (15)].	$(q_t/P_a)/\ N_{60} = 8.5\ (1 - I_c/4.6)$ $(q_t/P_a)/\ N_{60} = 10^{\ (1.1268 - 0.2817Ic)}$ Pa being atmospheric pressure	5 15, 31
(N1)60Ic	SPT N_{60} value corrected for overburden pressure (using N_{60} I_c). User has 3 options.	1) $(N_1)_{60}Ic = C_n \bullet (N_{60}\, I_c)$ 2) $q_{c1n}/\ (N_1)_{60}I_c = 8.5\ (1 - I_c/4.6)$ 3) $(Q_{tn})/\ (N_1)_{60}I_c\ = 10^{\ (1.1268 - 0.2817Ic)}$	4 5 15, 31
Su or Su (Nkt)	Undrained shear strength based on q_t S_u factor N_{kt} is user selectable	$Su = \frac{qt - \sigma_v}{N_{kt}}$	1, 5
Su or Su (Ndu)	Undrained shear strength based on pore pressure S_u factor $N_{\Delta u}$ is user selectable	$Su = \frac{u_2 - u_{eq}}{N_{\Delta u}}$	1, 5
Dr	Relative Density determined from one of the following user selectable options: a) Ticino Sand b) Hokksund Sand c) Schmertmann (1978) d) Jamiolkowski (1985) - All Sands e) Jamiolkowski et al (2003) (various compressibilities, K_o)	See reference (methods a through d) Jamiolkowski et al (2003) reference	5 14
PHI ϕ	Friction Angle determined from one of the following user selectable options (methods a through d are for sands and method e is for silts and clays): a) Campanella and Robertson b) Durgunoglu and Mitchel c) Janbu d) Kulhawy and Mayne e) NTH method (clays and silts)	See appropriate reference	5 5 5 11 23
Delta U/qt	Differential pore pressure ratio (older parameter used before B_q was established)	$= \frac{\Delta u}{qt}$ *where:* $\Delta u = u - u_{eq}$ *and* *u = dynamic pore pressure* u_{eq} *= equilibrium pore pressure*	CK*
Bq	Pore pressure parameter	$Bq = \frac{\Delta u}{qt - \sigma_v}$ where : $\Delta u = u - u_{eq}$ *and* *u = dynamic pore pressure* u_{eq} *= equilibrium pore pressure*	1, 2, 5
Net qt or qtNet	Net tip resistance (used in many subsequent correlations)	$qt - \sigma_v$	CK*
qe	Effective tip resistance (using the dynamic pore pressure u_2 and not equilibrium pore pressure)	$qt - u_2$	CK*

Calculated Parameter	Description	Equation	Ref
qeNorm	Normalized effective tip resistance	$\frac{qt - u_2}{\sigma_v'}$	CK*
Q_t or Norm: Qt	Normalized q_t for Soil Behavior Type classification as defined by Robertson (1990) using a linear stress normalization. Note this is different from Q_{tn}.	$Qt = \frac{qt - \sigma_v}{\sigma_v'}$	2, 5
F_r or Norm: Fr	Normalized Friction Ratio for Soil Behavior Type classification as defined by Robertson (1990)	$Fr = 100\% \cdot \frac{fs}{qt - \sigma_v}$	2, 5
Q(1-Bq)	Q(1-Bq) grouping as suggested by Jefferies and Davies for their classification chart and the establishment of their I_c parameter	$Q \cdot (1 - Bq)$ *where Bq is defined as above and Q is the same as the normalized tip resistance, Q_t, defined above*	6, 7
qc1	Normalized tip resistance, q_{c1}, using a fixed stress ratio exponent, n (this method has stress units)	$q_{c1} = q_t \cdot (Pa/\sigma_v')^{0.5}$ where: Pa = atmospheric pressure	21
qc1 (0.5)	Normalized tip resistance, q_{c1}, using a fixed stress ratio exponent, n (this method is unit-less)	$q_{c1}\,(0.5) = (q_t/P_a) \cdot (Pa/\sigma_v')^{0.5}$ where: Pa = atmospheric pressure	5
qc1 (Cn)	Normalized tip resistance, q_{c1}, based on C_n (this method has stress units)	$q_{c1}(Cn) = C_n * q_t$	5, 12
qc1 (Cq)	Normalized tip resistance, q_{c1}, based on C_q (this method has stress units)	$q_{c1}\,(Cq) = C_q * q_t$ (some papers use q_c)	5, 12
qc1n	normalized tip resistance, q_{c1n}, using a variable stress ratio exponent, n (where n=0.0, 0.70, 1.0) (this method is unit-less)	$q_{c1n} = (q_t / P_a)(P_a/\sigma_v')^n$ where: P_a = atm. Pressure and n varies as described below	3, 5
I_c or Ic (RW1998)	Soil Behavior Type Index as defined by Robertson and Fear (1995) and Robertson and Wride (1998) for estimating grain size characteristics and providing smooth gradational changes across the SBTn chart	$I_c = [(3.47 - \log_{10}Q)^2 + (\log_{10} Fr + 1.22)^2]^{0.5}$ *Where:* $Q = \left(\frac{qt - \sigma_v}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *Or* $Q = q_{c1n} = \left(\frac{qt}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *depending on the iteration in determining I_c* *And Fr is in percent* *P_a = atmospheric pressure* *n varies between 0.5, 0.70 and 1.0 and is selected in an iterative manner based on the resulting I_c*	3, 5, 21
Ic (PKR 2009)	Soil Behavior Type Index, I_c (PKR 2009) based on a variable stress ratio exponent n, which itself is based on I_c (PKR 2009). An iterative calculation is required to determine Ic (PKR 2009) and its corresponding n (PKR 2009).	$I_c\,(PKR\ 2009) = [(3.47 - \log_{10}Q_{tn})^2 + (1.22 + \log_{10}F_r)^2]^{0.5}$	15

Calculated Parameter	Description	Equation	Ref
n (PKR 2009)	Stress ratio exponent n, based on I_c (PKR 2009). An iterative calculation is required to determine n (PKR 2009) and its corresponding Ic (PKR 2009).	*n (PKR 2009)* $= 0.381\,(I_c) + 0.05\,(\sigma_v'/P_a) - 0.15$	15
Qtn (PKR 2009)	Normalized tip resistance using a variable stress ratio exponent based on I_c (PKR 2009) and n (PKR 2009). An iterative calculation is required to determine Qtn (PKR 2009).	$Q_{tn} = [(qt - \sigma_v)/P_a](P_a/\sigma_v')^n$ where P_a = atmospheric pressure (100 kPa) n = stress ratio exponent described above	15
FC	Apparent fines content (%)	$FC=1.75(Ic^{3.25}) - 3.7$ $FC=100$ for $I_c > 3.5$ $FC=0$ for $I_c < 1.26$ $FC = 5\%$ if $1.64 < I_c < 2.6$ AND $F_r<0.5$	3
I_c Zone	This parameter is the Soil Behavior Type zone based on the I_c parameter (valid for zones 2 through 7 on SBTn or SBT Qtn charts)	$I_c < 1.31$ Zone = 7 $1.31 < I_c < 2.05$ Zone = 6 $2.05 < I_c < 2.60$ Zone = 5 $2.60 < I_c < 2.95$ Zone = 4 $2.95 < I_c < 3.60$ Zone = 3 $I_c > 3.60$ Zone = 2	3
State Param or State Parameter or ψ	The state parameter index, ψ, is defined as the difference between the current void ratio, e, and the critical void ratio, e_c. Positive ψ - contractive soil Negative ψ - dilative soil This is based on the work by Been and Jefferies (1985) and Plewes, Davies and Jefferies (1992) - vertical effective stress is used rather than a mean normal stress	See reference	6, 8
Yield Stress σ_p'	Yield stress is calculated using the following methods a) General method b) 1st order approximation using q_tNet (clays) c) 1st order approximation using Δu_2 (clays) d) 1st order approximation using q_e (clays)	All stresses in kPa a) $\sigma_p' = 0.33\cdot(q_t - \sigma_v)^{m'}(\sigma_{atm}/100)^{1-m'}$ where $m' = 1 - \dfrac{0.28}{1+(I_c/2.65)^{25}}$ b) $\sigma_p' = 0.33\cdot(q_t - \sigma_v)$ c) $\sigma_p' = 0.54\cdot(\Delta u_2)$ $\Delta u_2 = u_2 - u_0$ d) $\sigma_p' = 0.60\cdot(q_t - u_2)$	 19 20 20 20
OCR OCR(JS1978) OCR(Mayne2014) OCR (qtNet) OCR (deltaU) OCR (qe) OCR (Vs) OCR (PKR2015)	Over Consolidation Ratio based on a) Schmertmann (1978) method involving a plot plot of S_u/σ_v' /($S_u/\sigma_v')_{NC}$ and OCR b) based on Yield stresses described above c) approximate version based on qtNet d) approximate version based on Δu e) approximate version based on effective tip, q_e f) approximate version based on shear wave velocity, V_s g) based on Qt	a) requires a user defined value for NC S_u/P_c' ratio b through f) *based on yield stresses* g) $OCR = 0.25\cdot(Qt)^{1.25}$	9 19 20 20 20 18 32

Calculated Parameter	Description	Equation	Ref
Es/qt	Intermediate parameter for calculating Young's Modulus, E, in sands. It is the Y axis of the reference chart.	Based on Figure 5.59 in the reference	5
Es Young's Modulus E	Young's Modulus based on the work done in Italy. There are three types of sands considered in this technique. The user selects the appropriate type for the site from: a) OC Sands b) Aged NC Sands c) Recent NC Sands Each sand type has a family of curves that depend on mean normal stress. The program calculates mean normal stress and linearly interpolates between the two extremes provided in the E_s/q_t chart. Es is evaluated for an axial strain of 0.1%.	Mean normal stress is evaluated from: $\sigma'_m = \frac{1}{3}(\sigma'_v + \sigma'_h + \sigma'_h)^3$ where σ_v'= vertical effective stress σ_h'= horizontal effective stress *and* $\sigma_h = K_o \bullet \sigma_v'$ with K_o assumed to be 0.5	5
Delta U/TStress	Differential pore pressure ratio with respect to total stress	$= \frac{\Delta u}{\sigma_v}$ *where:* $\Delta u = u - u_{eq}$	CK*
Delta U/Estress, P Value, Excess Pore Pressure Ratio	Differential pore pressure ratio with respect to effective stress. Key parameter (P, Normalized Pore Pressure Parameter, Excess Pore Pressure Ratio) in the Winckler et. al. static liquefaction method.	$= \frac{\Delta u}{\sigma'_v}$ *where:* $\Delta u = u - u_{eq}$	25, 25a, CK*
Su/EStress	Undrained shear strength ratio with respect to vertical effective overburden stress using the S_u (N_{kt}) method	$= Su\ (N_{kt})\ /\ \sigma_v'$	CK*
Gmax	G_{max} determined from SCPT shear wave velocities (not estimated values)	$G_{max} = \rho V_s^2$ where ρ is the mass density of the soil determined from the estimated unit weights at each test depth	27
qtNet/Gmax	Net tip resistance ratio with respect to the small strain modulus G_{max} determined from SCPT shear wave velocities (not estimated values)	$= (qt - \sigma_v)\ /\ G_{max}$ where $G_{max} = \rho V_s^2$ and ρ is the mass density of the soil determined from the estimated unit weights at each test depth	15, 28, 30

*CK – common knowledge

CONETEC

Table 1b. CPT Parameter Calculation Methods – Liquefaction Parameters

Calculated Parameter	Description	Equation	Ref
K_{SPT}	Equivalent clean sand factor for $(N_1)60$	$K_{SPT} = 1 + ((0.75/30) \bullet (FC - 5))$	10
K_{CPT} or K_C (RW1998)	Equivalent clean sand correction for q_{c1N}	$K_{cpt} = 1.0$ for $I_c \leq 1.64$ $K_{cpt} = f(I_c)$ for $I_c > 1.64$ (see reference) $K_c = -0.403\, I_c^4 + 5.581\, I_c^3 - 21.63 I_c^2 + 33.75\, I_c - 17.88$	3, 10
Kc (PKR 2010)	Clean sand equivalent factor to be applied to Q_{tn}	$K_c = 1.0$ for $I_c \leq 1.64$ $K_c = -0.403\, I_c^4 + 5.581\, I_c^3 - 21.63 I_c^2 + 33.75\, I_c - 17.88$ for $I_c > 1.64$	16
$(N_1)_{60cs}Ic$	Clean sand equivalent SPT $(N_1)_{60}I_c$. User has 3 options.	1) $(N_1)_{60cs}Ic = \alpha + \beta((N_1)_{60}I_c)$ 2) $(N_1)_{60cs}Ic = K_{SPT} * ((N_1)_{60}I_c)$ 3) $(q_{c1ncs})/ (N_1)_{60cs}I_c = 8.5\,(1 - I_c/4.6)$ FC ≤ 5%: $\alpha = 0$, $\beta=1.0$ FC ≥ 35% $\alpha = 5.0$, $\beta=1.2$ 5% < FC < 35% $\alpha = \exp[1.76 - (190/FC^2)]$ $\beta = [0.99 + (FC^{1.5}/1000)]$	10 10 5
q_{c1ncs}	Clean sand equivalent q_{c1n}	$q_{c1ncs} = q_{c1n} \bullet K_{cpt}$	3
Qtn,cs (PKR 2010)	Clean sand equivalent for Q_{tn} described above - Q_{tn} being the normalized tip resistance based on a variable stress exponent as defined by Robertson (2009)	$Q_{tn,cs} = Q_{tn} \cdot K_c$ (PKR 2016)	16
Su(Liq)/ESv	Liquefied shear strength ratio as defined by Olson and Stark	$\frac{Su(Liq)}{\sigma_v'} = 0.03 + 0.0143(q_{c1})$ Note: σ_v' and s_v' are synonymous	13
Su(Liq)/ESv (PKR 2010)	Liquefied shear strength ratio as defined by Robertson (2010)	$\frac{Su(Liq)}{\sigma_v'}$ Based on a function involving $Q_{tn,cs}$	16
Su (Liq) (PKR 2010)	Liquefied shear strength derived from the liquefied shear strength ratio and effective overburden stress		16
Cont/Dilat Tip	Contractive / Dilative qc1 Boundary based on $(N_1)_{60}$	$(\sigma_v')_{boundary} = 9.58 \times 10^{-4}\, [(N_1)_{60}]^{4.79}$ *qc1* is calculated from specified qt(MPa)/N ratio	13
CRR	Cyclic Resistance Ratio (for Magnitude 7.5)	$q_{c1ncs} < 50$: $CRR_{7.5} = 0.833\, [q_{c1ncs}/1000] + 0.05$ $50 \leq q_{c1ncs} < 160$: $CRR_{7.5} = 93\, [q_{c1ncs}/1000]^3 + 0.08$	10
Kg	Small strain Stiffness Ratio Factor, Kg	$[Gmax/qt]/[qc1n^{-m}]$ m = empirical exponent, typically 0.75	26

Calculated Parameter	Description	Equation	Ref
SP Distance	State Parameter Distance, Winckler static liquefaction method	Perpendicular distance on Qtn chart from plotted point to state parameter Ψ = -0.05 curve	25
URS NP Fr	Normalized friction ratio point on Ψ = -0.05 curve used in SP Distance calculation		25
URS NP Qtn	Normalized tip resistance (Qtn) point on Ψ = -0.05 curve used in SP Distance calculation		25

Table 2. References

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No.	Reference
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APPENDIX C

BOREHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 TO 20%	0 to 4
Loose	20 TO 40%	4 to 10
Compact	40 TO 75%	10 to 30
Dense	75 TO 90%	30 to 50
Very Dense	90 TO 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (KPA)
Very Soft	Less than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater than 400

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

GENERAL DESCRIPTIVE TERMS

Slickensided - having inclined planes of weakness that are slick and glossy in appearance.
Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated - composed of thin layers of varying colour and texture.
Interbedded - composed of alternate layers of different soil types.
Calcareous - containing appreciable quantities of calcium carbonate.;
Well graded - having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded - predominantly of one grain size, or having a range of sizes with some intermediate size missing.

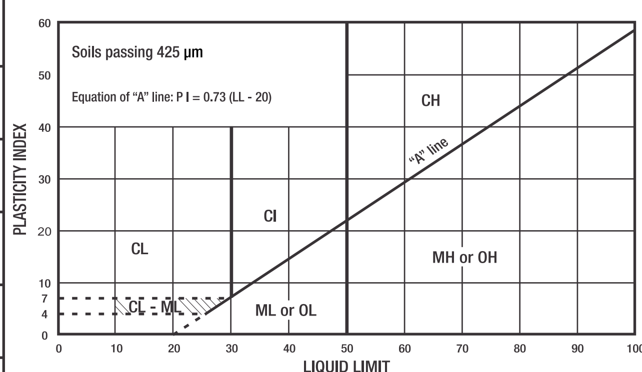
TETRA TECH

MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE-GRAINED SOILS More than 50% retained on 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on 4.75 mm sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines: Less than 5% Pass 75 µm sieve – GW, GP, SW, SP; More than 12% Pass 75 µm sieve – GM, GC, SM, SC; 5% to 12% Pass 75 µm sieve – Borderline Classification requiring use of dual symbols	$C_U = D_{60} / D_{10}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
	SANDS More than 50% of coarse fraction passes 4.75 mm sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines		$C_U = D_{60}/D_{10}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS	Liquid limit <50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity			
		Liquid limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
	CLAYS Above "A" line on plasticity chart negligible organic content	Liquid limit <30	CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays			
		Liquid limit 30-50	CI	Inorganic clays of medium plasticity, silty clays			
		Liquid limit >50	CH	Inorganic clays of high plasticity, fat clays			
	ORGANIC SILTS AND CLAYS	Liquid limit <50	OL	Organic silts and organic silty clays of low plasticity			
		Liquid limit >50	OH	Organic clays of medium to high plasticity			
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils			

For classification of fine-grained soils and fine fraction of coarse-grained soils.

PLASTICITY CHART



*Based on the material passing the 75 mm sieve
Reference: ASTM Designation D2487, for identification procedure see D2488. USC as modified by PFRA

SOIL COMPONENTS

FRACTION	SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY MASS OF MINOR COMPONENTS	
	PASSING	RETAINED	PERCENTAGE	DESCRIPTOR
GRAVEL				
coarse	75 mm	19 mm	>35 %	"and"
fine	19 mm	4.75 mm	21 to 35 %	"y-adjective"
SAND				
coarse	4.75 mm	2.00 mm	10 to 20 %	"some"
medium	2.00 mm	425 µm		
fine	425 µm	75 µm	>0 to 10 %	"trace"
SILT (non plastic) or CLAY (plastic)	75 µm		as above but by behavior	

OVERSIZE MATERIAL

Rounded or subrounded

COBBLES	75 mm to 300 mm
BOULDERS	> 300 mm

Not rounded

ROCK FRAGMENTS	>75 mm
ROCKS	> 0.76 cubic metre in volume

Tt_Modified Unified Soil Classification.cdr

TETRA TECH

SUMMARY LOG

Drill Hole #: AH20-01

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

Prepared by: 704-ENG.VGEO03551-01
Ministry of Transportation & Infrastructure
Logged by: AL Reviewed by: GF

Project: **Dewdney Bridge Replacement**
Location: Highway 7 - Dewdney, BC
Datum:
Northing/Easting: 5446019 , 558621
Elevation:
Alignment: L-100
Station/Offset: 1.2
Coordinates taken with GPS

Date(s) Drilled: December 21, 2020
Company: Conetec Investigations Ltd.
Driller: Alex
Drill Make/Model: M5T
Drilling Method: Auger

Column headings: DEPTH (m) | DRILLING DETAILS | Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% W% WL% 20 40 60 80 | SAMPLE TYPE | SAMPLE NO | RECOVERY (%) | SOIL SYMBOL | SOIL DESCRIPTION | CLASSIFICATION | COMMENTS TESTING | DEPTH (m)

Drilling details: Auger (0–10 m)

Depth (m)	Soil Description	Classification
0 – 0.18	ASPHALT	
0.18 – 1.52	SAND and GRAVEL (FILL), trace fines, well graded, dry to moist, brown; fine to coarse sand; fine gravel	FILL
1.52 – 2.13	SILT, sandy, moist, brown and grey	ML
2.13 – 3.05	SAND, silty, moist, brown; fine to medium sand, poorly graded	SM
3.05 –	SAND, some fines to trace fines, fine to medium, poorly graded, moist, brown	SP

Sample No	SPT "N"	Comments / Testing
S1	5.4	**Sieve** (Sa#S1) G:39% S:51% F:10%
S2		
S3	23.9	
S4		
S5	9.4	**Sieve** (Sa#S5) G:% S:82% F:18%
S6		
S7	24	**Sieve** (Sa#S7) G:% S:% F:20%
S8		
S9	27.3	**Sieve** (Sa#S9) G:% S:94% F:6%

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 15.0 m
Depth to Top of Rock: N/A

SUMMARY LOG

Drill Hole #: AH20-01

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

Project: Dewdney Bridge Replacement
Location: Highway 7 - Dewdney, BC

Date(s) Drilled: December 21, 2020
Company: Conetec Investigations Ltd.
Driller: Alex
Drill Make/Model: M5T
Drilling Method: Auger

Prepared by: 704-ENG.VGEO03551-01 Ministry of Transportation & Infrastructure
Logged by: AL Reviewed by: GF

Datum:
Northing/Easting: 5446019 , 558621
Elevation:
Alignment: L-100
Station/Offset: 1.2
Coordinates taken with GPS

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% W% WL% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING	DEPTH (m)
10	Auger			S10			SAND, some fines to trace fines, fine to medium, poorly graded, moist, brown *(continued)*			
11				S11						11
12				S12						12
13		28.2		S13						13
14				S14						14
				S15						
15							15.2m			15
							End of Auger Hole at 15.2 m - Upon completion of drilling, the auger hole was backfilled with drilling cuttings and bentonite pellets, and topped with cold asphalt patch. - UTM coordinates are approximate (+/- 5m) and were collected using a handheld GPS.			
16										16
17										17
18										18
19										19
20										

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 15.0 m
Depth to Top of Rock: N/A

SUMMARY LOG

Ministry of Transportation and Infrastructure — British Columbia

Drill Hole #: AH20-02

Project: **Dewdney Bridge Replacement**
Location: Highway 7 - Dewdney, BC

Prepared by: 704-ENG.VGEO03551-01 Ministry of Transportation & Infrastructure
Logged by: AL Reviewed by: GF

Datum:
Northing/Easting: 5445963 , 558679
Elevation:
Alignment: L-100
Station/Offset: 4.1
Coordinates taken with GPS

Date(s) Drilled: December 23, 2020
Company: Conetec Investigations Ltd.
Driller: Alex
Drill Make/Model: M5T
Drilling Method: Auger

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa); SPT "N" (BLOWS/300 mm); W_P%, W%, W_L%	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING
0	Auger						SILT, trace sand, non-plastic, moist, brown	ML	
		36.6		S1					**Sieve** (Sa#S1) G:% S:% F:99%
0.91m							CLAY, medium plastic, moist, firm, brown and grey	CL	
1		34.2		S2					**Atterberg** (Sa#S2): PL:24% LL:42%
1.68m							SAND, some fines to trace fines, fine to medium, poorly graded, moist to wet, brown - silty at S3		
2		25		S3					**Sieve** (Sa#S3) G:% S:73% F:27%
3				S4					
4				S5					
5		24.6		S6					**Sieve** (Sa#S6) G:% S:% F:14%
6							-sand becomes medium to coarse, grey below 6.1 m		
7				S7					
8		28.4		S8				SP	**Sieve** (Sa#S8) G:% S:92% F:8%
9									
10									

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 15.0 m
Depth to Top of Rock: N/A

SUMMARY LOG

Drill Hole #: AH20-02

Project: **Dewdney Bridge Replacement**
Location: Highway 7 - Dewdney, BC

Date(s) Drilled: December 23, 2020
Company: Conetec Investigations Ltd.
Driller: Alex
Drill Make/Model: M5T
Drilling Method: Auger

Prepared by: 704-ENG.VGEO03551-01
Ministry of Transportation & Infrastructure
Logged by: AL Reviewed by: GF

Datum:
Alignment: L-100
Northing/Easting: 5445963 , 558679
Station/Offset: 4.1
Elevation:
Coordinates taken with GPS

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% W% WL% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING	DEPTH (m)
10	Auger			S9			SAND, some fines to trace fines, fine to medium, poorly graded, moist to wet, brown *(continued)*			
11				S10						11
12		26.6		S11					**Sieve** (Sa#S11) G:% S:% F:20%	12
13										13
14				S12						14
15		26.1		S13			15.2m		**Sieve** (Sa#S13) G:% S:91% F:9%	15
16							End of Auger Hole at 15.2 m - Upon completion of drilling, the auger hole was backfilled with drilling cuttings and bentonite pellets. - UTM coordinates are approximate (+/- 5m) and were collected using a handheld GPS.			16
17										17
18										18
19										19
20										

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Final Depth of Hole: 15.0 m
Depth to Top of Rock: N/A

SUMMARY LOG

Ministry of Transportation and Infrastructure — British Columbia

Drill Hole #: AH20-03

Project: **Dewdney Bridge Replacement**		Date(s) Drilled: December 23, 2020
Location: Highway 7 - Dewdney, BC		Company: Conetec Investigations Ltd.
Datum:	Alignment: L-100	Driller: Alex
Northing/Easting: 5445807 , 558940	Station/Offset: 10.7	Drill Make/Model: M5T
Elevation:	*Coordinates taken with GPS*	Drilling Method: Auger

Prepared by: 704-ENG.VGEO03551-01 Ministry of Transportation & Infrastructure
Logged by: AL Reviewed by: GF

Pocket Penetrometer / Shear Strength (kPa): 100, 200, 300, 400
SPT "N" (BLOWS/300 mm)
W_P% — W% — W_L%: 20, 40, 60, 80

Drilling details: Auger (0 – 10 m)

DEPTH (m)	W%	SAMPLE TYPE	SAMPLE NO	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING
0 – 0.36m	35.1	G	S1	CLAY, medium plastic, moist, soft to firm, brown to grey	CL	**Atterberg** (Sa#S1): PL:26% LL:44%
0.36m – 4.0m		G	S2	SAND, some fines, fine to medium, poorly graded, moist to wet, brown	SP	
				-becomes wet below 2 m		
	26.5	G	S3			**Sieve** (Sa#S3) G:% S:80% F:20%
		G	S4			
4.0m – 9.0m	32.6	G	S5	SAND and SILT, wet, grey; fine to medium sand -grey sand below 4 m	SM	**Sieve** (Sa#S5) G:% S:60% F:40%
		G	S6			
		G	S7			
	30.7	G	S8			**Sieve** (Sa#S8) G:% S:% F:42%
9.0m –		G	S9	SAND, trace fines, fine to medium, poorly graded, wet, grey to brown		

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 15.0 m
Depth to Top of Rock: N/A

SUMMARY LOG

Drill Hole #: AH20-03

Ministry of Transportation and Infrastructure — British Columbia

Prepared by: 704-ENG.VGEO03551-01 Ministry of Transportation & Infrastructure	Project: **Dewdney Bridge Replacement**	Date(s) Drilled: December 23, 2020
Logged by: AL Reviewed by: GF	Location: Highway 7 - Dewdney, BC	Company: Conetec Investigations Ltd.
	Datum: / Alignment: L-100	Driller: Alex
	Northing/Easting: 5445807 , 558940 / Station/Offset: 10.7	Drill Make/Model: M5T
	Elevation: / *Coordinates taken with GPS*	Drilling Method: Auger

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% W% WL% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING	DEPTH (m)
10	Auger						SAND, trace fines, fine to medium, poorly graded, wet, grey to brown *(continued)*	SP		
				S10						
11				S11						11
12							-becomes brown below 12.3 m			12
13		24.9		S12					**Sieve** (Sa#S12) G:% S:92% F:8%	13
14										14
15				S13			15.2m			15
							End of Auger Hole at 15.2 m			
							- Upon completion of drilling, the auger hole was backfilled with drilling cuttings and bentonite pellets.			
16							- UTM coordinates are approximate (+/- 5m) and were collected using a handheld GPS.			16
17										17
18										18
19										19
20										

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 15.0 m
Depth to Top of Rock: N/A

SUMMARY LOG

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

Drill Hole #: AH20-04

Prepared by: 704-ENG.VGEO03551-01 Ministry of Transportation & Infrastructure	Project: **Dewdney Bridge Replacement**	Date(s) Drilled: December 22, 2020
Logged by: AL Reviewed by: GF	Location: Highway 7 - Dewdney, BC	Company: Conetec Investigations Ltd.
	Datum:	Alignment: L-100
	Northing/Easting: 5445762 , 559053	Station/Offset: 2.6
	Elevation:	*Coordinates taken with GPS*
		Driller: Alex
		Drill Make/Model: M7
		Drilling Method: Auger

Chart header: Pocket Penetrometer / Shear Strength (kPa) 100, 200, 300, 400; SPT "N" (BLOWS/300 mm); Wp% W% WL%: 20, 40, 60, 80

DEPTH (m)	DRILLING DETAILS	SPT "N"	SAMPLE TYPE	SAMPLE NO	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING
0 – 0.23m	Auger (0 – 6.1 m)				ASPHALT		
0.23m – 1.5m		9	Grab	S1	SAND and GRAVEL (FILL), well graded, dry, very dense, brown and grey; medium to coarse sand; angular to subangular gravel (poor recovery)	FILL	
1.5m – 2.0m			Grab	S2	SAND, silty, moist, brown; fine to medium sand	SM	
2.0m – 6.1m		24	Grab	S3, S4	SAND, trace fines, fine to medium, poorly graded, moist, brown and grey	SP	**Sieve** (Sa#S4) G:% S:92% F:8%
6.1m					End of Auger Hole at 6.1 m		

- Upon completion of drilling, the auger hole was backfilled with drilling cuttings and bentonite pellets, and topped with cold asphalt patch.

- UTM coordinates are approximate (+/- 5m) and were collected using a handheld GPS.

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 6.0 m
Depth to Top of Rock: N/A

SUMMARY LOG

Drill Hole #: AH20-05

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

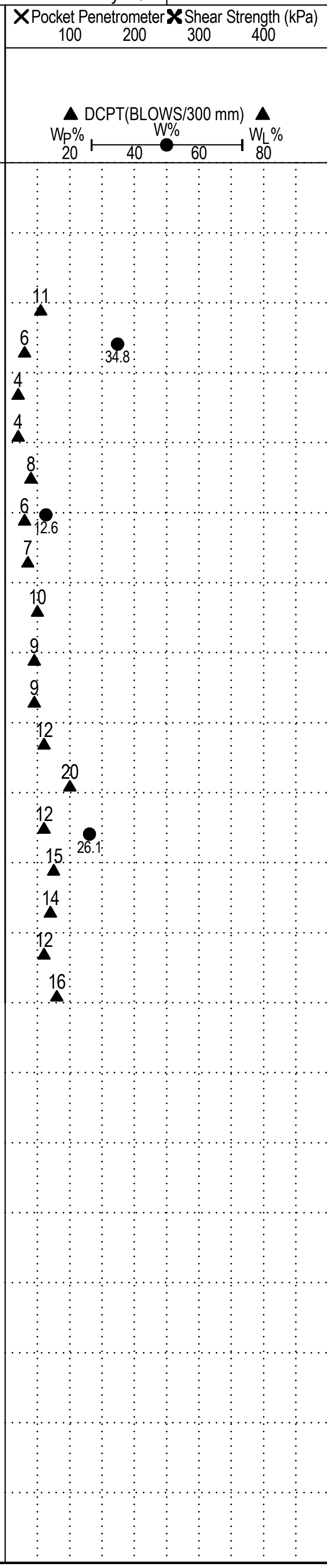
Project: **Dewdney Bridge Replacement**
Location: Highway 7 - Dewdney, BC

Prepared by: 704-ENG.VGEO03551-01 Ministry of Transportation & Infrastructure
Logged by: AL Reviewed by: GF

Datum:
Northing/Easting: 5445760 , 559100
Elevation:
Alignment: L-100
Station/Offset: 1.4
Coordinates taken with GPS

Date(s) Drilled: December 22, 2020
Company: Conetec Investigations Ltd.
Driller: Alex
Drill Make/Model: M7
Drilling Method: Auger / DCPT

DEPTH (m)	DRILLING DETAILS	SAMPLE TYPE	SAMPLE NO	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING
0–0.23m	Auger / DCPT			ASPHALT		
0.23m–1.07m			S1	SAND and GRAVEL (FILL), dry to moist, dense, brown and grey; fine to medium sand; angular to subangular gravel (poor recovery)	FILL	
1.07m–2.13m			S2	SILT, trace sand, trace gravel, moist, soft to firm, brown; fine to medium sand	ML	**Sieve** (Sa#S2) G:3% S:9% F:88%
2.13m–3.35m			S3	SAND, trace fines, fine to medium, poorly graded, moist, loose, brown	SP	
3.35m–6.1m			S4, S5	SAND, trace fines, medium to coarse, poorly graded, wet, loose to compact, brown and grey	SP	



End of Auger Hole at 6.1 m

- Upon completion of drilling, the auger hole was backfilled with drilling cuttings and bentonite pellets, and topped with cold asphalt patch.

- UTM coordinates are approximate (+/- 5m) and were collected using a handheld GPS.

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Final Depth of Hole: 6.0 m
Depth to Top of Rock: N/A

SUMMARY LOG

Drill Hole #: **AH20-06**

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

Project: **Dewdney Bridge Replacement**
Location: Highway 7 - Dewdney, BC

Date(s) Drilled: December 22, 2020
Company: Conetec Investigations Ltd.
Driller: Alex
Drill Make/Model: M7
Drilling Method: Auger

Prepared by: 704-ENG.VGEO03551-01
Ministry of Transportation & Infrastructure
Logged by: AL Reviewed by: GF

Datum:
Northing/Easting: 5445760 , 559152
Elevation:
Alignment: L-100
Station/Offset: 1.2
Coordinates taken with GPS

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% W% WL% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION		CLASSIFICATION	COMMENTS TESTING	DEPTH (m)
0	Auger (0–6.1 m)						ASPHALT	0.23m			
		3.3		S1			SAND and GRAVEL (ROAD FILL), dry, dense, brown and grey; fine to medium sand; angular to subangular gravel (poor recovery)	0.53m	FILL		
1				S2			SAND, trace gravel to some gravel, trace fines, moist, brown; fine to medium sand, poorly graded; subrounded gravel (Maximum size 38 mm)	2.13m	SP		1
2		16.1		S3			SAND and SILT, fine to medium, poorly graded, moist, brown	3.2m	SP-ML	**Sieve** (Sa#S3) G:% S:50% F:50%	2
3–6		31.5		S4, S5			SAND, trace fines, medium to coarse, poorly graded, wet, brown and grey	6.1m	SP		3, 4, 5, 6
6–10							End of Auger Hole at 6.1 m - Upon completion of drilling, the auger hole was backfilled with drilling cuttings and bentonite pellets, and topped with cold asphalt patch. - UTM coordinates are approximate (+/- 5m) and were collected using a handheld GPS.				7, 8, 9

Legend Sample Type: A-Auger; B-Becker; C-Core; G-Grab; V-Vane; L#-Lab Sample; S-Split Spoon; O-Odex (air rotary); W-Wash (mud return); T-Shelby Tube

Final Depth of Hole: 6.0 m
Depth to Top of Rock: N/A

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

SUMMARY LOG

Drill Hole #: **MW21-01**

Prepared by: 704-ENG.VGEO03551-01 Ministry of Transportation & Infrastructure	Project: **Dewdney Bridge Replacement**	Date(s) Drilled: January 20, 2021
Logged by: AL Reviewed by: GF	Location: Highway 7 - Dewdney, BC	Company: Conetec
	Datum:	Alignment: L-100
	Northing/Easting: 5445961 , 558717	Station/Offset: 13.4
	Elevation:	*Coordinates taken with GPS*
		Driller: Alex / Matt
		Drill Make/Model: M7
		Drilling Method: Auger

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% W% WL% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING	SLOTTED PIEZOMETER	DEPTH (m)
0–10.7	Hollow Stem Auger; 4.8m (water level)										
10.7							10.7m End of Auger Hole at 10.7 m - Upon completion of drilling, the auger holes was backfilled with bentonite pellets and cement grout. - A standpipe piezometer was installed at this locations to a depth of 10 m and finished at the surface with a flush mount cover. - UTM coordinates are approximate (+/- 5m) and were collected using a handheld GPS.				

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 10.7 m
Depth to Top of Rock:

SUMMARY LOG

Drill Hole #: MW21-02

BRITISH COLUMBIA — Ministry of Transportation and Infrastructure

Prepared by: 704-ENG.VGEO03551-01 Ministry of Transportation & Infrastructure	Project: **Dewdney Bridge Replacement**	Date(s) Drilled: January 20, 2021
Logged by: AL Reviewed by: GF	Location: Highway 7 - Dewdney, BC	Company: Conetec
	Datum:	Alignment: L-100
	Northing/Easting: 5445860 , 558888	Station/Offset: 9.8
	Elevation:	*Coordinates taken with GPS*
		Driller: Alex / Matt
		Drill Make/Model: M7
		Drilling Method: Auger

DEPTH (m)	DRILLING DETAILS	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; SPT "N" (BLOWS/300 mm); Wp% W% WL% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING	SLOTTED PIEZOMETER	DEPTH (m)
0 – 10.7	Hollow Stem Auger; 7.0m (water level)										
10.7m							End of Auger Hole at 10.7 m - Upon completion of drilling, the auger holes was backfilled with bentonite pellets and cement grout. - A standpipe piezometer was installed at this locations to a depth of 10 m and finished at the surface with a flush mount cover. - UTM coordinates are approximate (+/- 5m) and were collected using a handheld GPS.				

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

Legend Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 10.7 m
Depth to Top of Rock:

APPENDIX D

LABORATORY TEST RESULTS

TETRA TECH CANADA INC.

Form Nº TT103

Project:	Dewdney Bridge Replacement	Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC	Date:	January 12, 2021
Borehole:	Various	Page:	1 of 2

Water Content and Unit Weight (ASTM D2216)

Sample Nº	Depth (m)	Tin Nº	Wt. of tare (TW) (g)	TW+ Wet weight (g)	TW+ Dry weight (g)	Water Content (%)	Sample Diameter (mm)	Sample Height (mm)	Sample Weight (g)	Volume (cm^3)	Total Unit Weight (kN/m^3)	Dry Unit Weight (kN/m^3)
AH20-01												
S1	1.15	C01	149.48	1274.25	1216.28	5.4						
S3	2.52	78	22.87	81.70	70.35	23.9						
S5	4.35	67A	24.04	116.46	108.55	9.4						
S7	6.94	48	23.37	130.06	109.44	24.0						
S9	8.92	14A	24.87	239.15	193.25	27.3						
S13	13.49	24A	34.69	122.09	102.89	28.2						
AH20-02												
S1	0.69	53	25.30	90.48	73.00	36.6						
S2	1.15	26	23.91	64.58	54.21	34.2						
S3	2.21	95	22.05	152.58	126.51	25.0						
S6	5.41	34	35.31	168.22	142.02	24.6						
S8	8.16	35	35.16	230.58	187.38	28.4						
S11	12.42	B35	112.24	199.89	181.46	26.6						
S13	14.86	40	33.44	234.08	192.58	26.1						
AH20-03												
S1	0.23	91	33.46	73.48	63.09	35.1						
S3	2.37	88	22.28	181.98	148.51	26.5						
S5	4.19	55	24.24	198.67	155.79	32.6						
S8	8.16	81	24.06	117.17	95.29	30.7						
S12	13.49	27	23.55	200.46	165.21	24.9						

Performed By:	PC	Checked By:	PS	Approved By:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

TETRA TECH CANADA INC.

TETRA TECH

Form Nº TT103

Project:	Dewdney Bridge Replacement	Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC	Date:	January 12, 2021
Borehole:	Various	Page:	2 of 2

Water Content and Unit Weight (ASTM D2216)

Sample Nº	Depth (m)	Tin Nº	Wt. of tare (TW) (g)	TW+ Wet weight (g)	TW+ Dry weight (g)	Water Content (%)	Sample Diameter (mm)	Sample Height (mm)	Sample Weight (g)	Volume (cm^3)	Total Unit Weight (kN/m^3)	Dry Unit Weight (kN/m^3)
AH20-04												
S1	0.84	43	24.07	158.98	147.89	9.0						
S4	4.35	93	23.67	178.64	148.60	24.0						
AH20-05												
S2	1.30	4	33.97	89.56	75.22	34.8						
S3	2.52	13	24.83	110.59	101.02	12.6						
S5	4.80	85	33.31	183.85	152.70	26.1						
AH20-06												
S1	0.38	H2	196.95	1204.42	1172.41	3.3						
S3	2.37	111	33.11	143.94	128.56	16.1						
S5	5.11	17	24.91	194.94	154.19	31.5						

Performed By:	PC	Checked By:	PS	Approved By:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA

OQM CERTIFIED

TETRA TECH

TETRA TECH CANADA INC.

Form Nº TT104

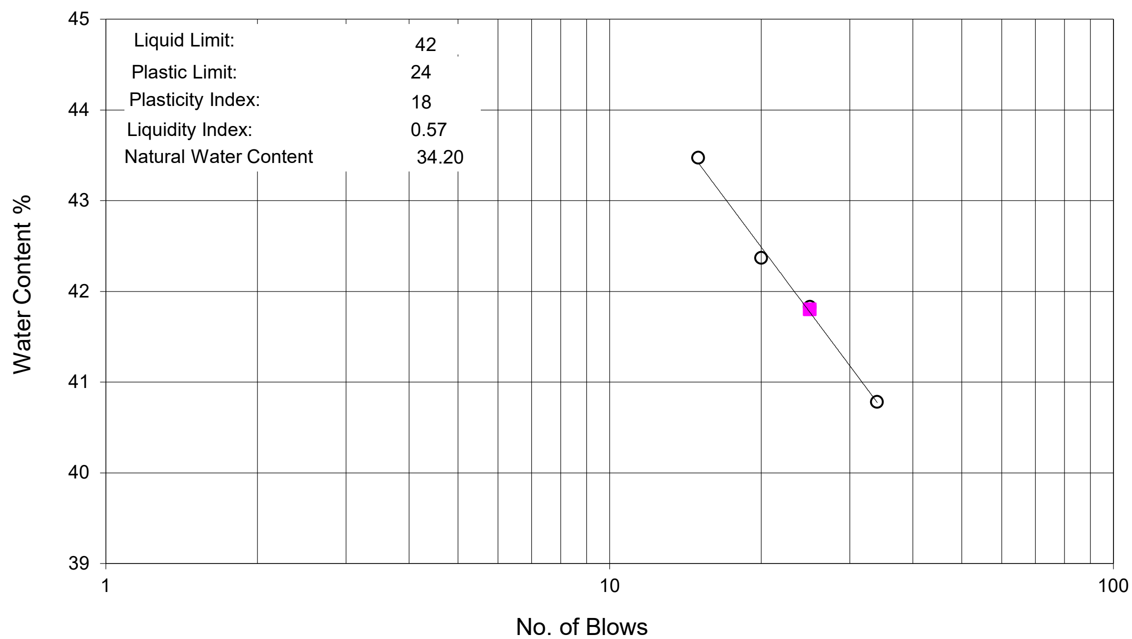
Project: Dewdney Bridge Replacement		Project No.:	704-ENG.VGEO03551-01
Location: Dewdney, BC		Date:	January 12, 2021
Borehole: AH20-02	Sample No.: S2	Depth (m):	1.15

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

LIQUID LIMIT								PLASTIC LIMIT						
TIN No.	Tare + Weight of Wet Soil (g)	Tare + Weight of Dry Soil (g)	Weight of Tin (g)	Weight of Water (g)	Weight of Dry Soil (g)	Water Content (%)	No. of Blows	TIN No.	Tare + Weight of Wet Soil (g)	Tare + Weight of Dry Soil (g)	Weight of Tin (g)	Weight of Water (g)	Weight of Dry Soil (g)	Water Content (%)
64	28.33	25.92	20.01	2.41	5.91	40.8	34	70	39.17	37.94	32.88	1.23	5.06	24.3
135	30.13	27.11	19.89	3.02	7.22	41.8	25	98	40.11	38.88	33.86	1.23	5.02	24.5
72	27.32	25.10	19.86	2.22	5.24	42.4	20							
142	29.44	26.51	19.77	2.93	6.74	43.5	15							

Classification of the material : CL

100 % with respect to the total of the material smaller than sieve No. 40



Observations:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

OQM CERTIFIED

TETRA TECH

TETRA TECH CANADA INC.

Form Nº TT104

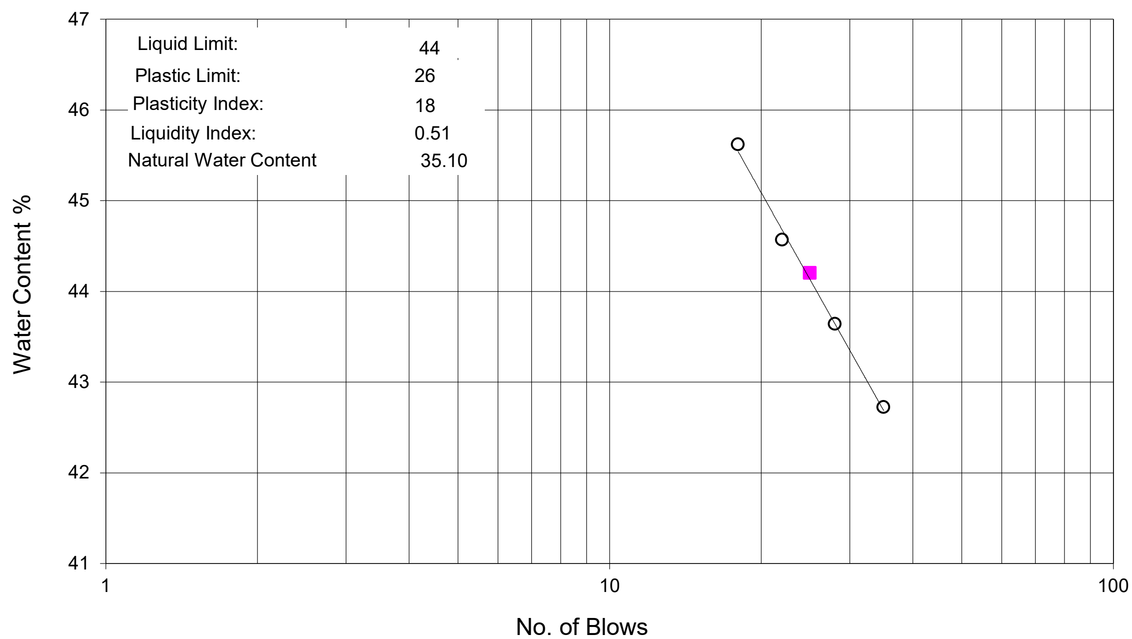
Project: Dewdney Bridge Replacement		Project No.:	704-ENG.VGEO03551-01
Location: Dewdney, BC		Date:	January 12, 2021
Borehole: AH20-03	Sample No.: S1	Depth (m):	0.23

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

LIQUID LIMIT								PLASTIC LIMIT						
TIN No.	Tare + Weight of Wet Soil (g)	Tare + Weight of Dry Soil (g)	Weight of Tin (g)	Weight of Water (g)	Weight of Dry Soil (g)	Water Content (%)	No. of Blows	TIN No.	Tare + Weight of Wet Soil (g)	Tare + Weight of Dry Soil (g)	Weight of Tin (g)	Weight of Water (g)	Weight of Dry Soil (g)	Water Content (%)
49	32.43	30.17	24.88	2.26	5.29	42.7	35	52A	30.64	29.12	23.30	1.52	5.82	26.1
18	42.31	39.84	34.18	2.47	5.66	43.6	28	77	40.70	39.28	33.83	1.42	5.45	26.1
36A	33.83	31.04	24.78	2.79	6.26	44.6	22							
19	41.26	38.71	33.12	2.55	5.59	45.6	18							

Classification of the material : CL

100 % with respect to the total of the material smaller than sieve No. 40



Observations:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

OQM CERTIFIED

TETRA TECH CANADA INC.

Form Nº TT108

Project:	Dewdney Bridge Replacement	Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC	Date:	January 12, 2021
Borehole:	Various	Page:	1 of 1

Fines Content, % < No. 200 Sieve (ASTM D1140-00)

Sample Nº	Depth (m)	Container + Sample Weight (g)	Weight of Container (g)	Sieve + Soil Weight (g)	Sieve Weight (g)	Retained Weight (g)	% Retained	% Passing
AH20-01								
S7	6.94	280.48	106.31	245.66	106.31	139.35	80.0%	20.0%
AH20-02								
S1	0.69	295.75	206.39	207.58	206.39	1.19	1.3%	98.7%
S6	5.41	347.63	149.44	319.33	149.44	169.89	85.7%	14.3%
S11	12.42	320.81	116.77	279.91	116.77	163.14	80.0%	20.0%
AH20-03								
S8	8.16	390.73	143.59	286.50	143.59	142.91	57.8%	42.2%

Performed By:	PC	Checked By:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

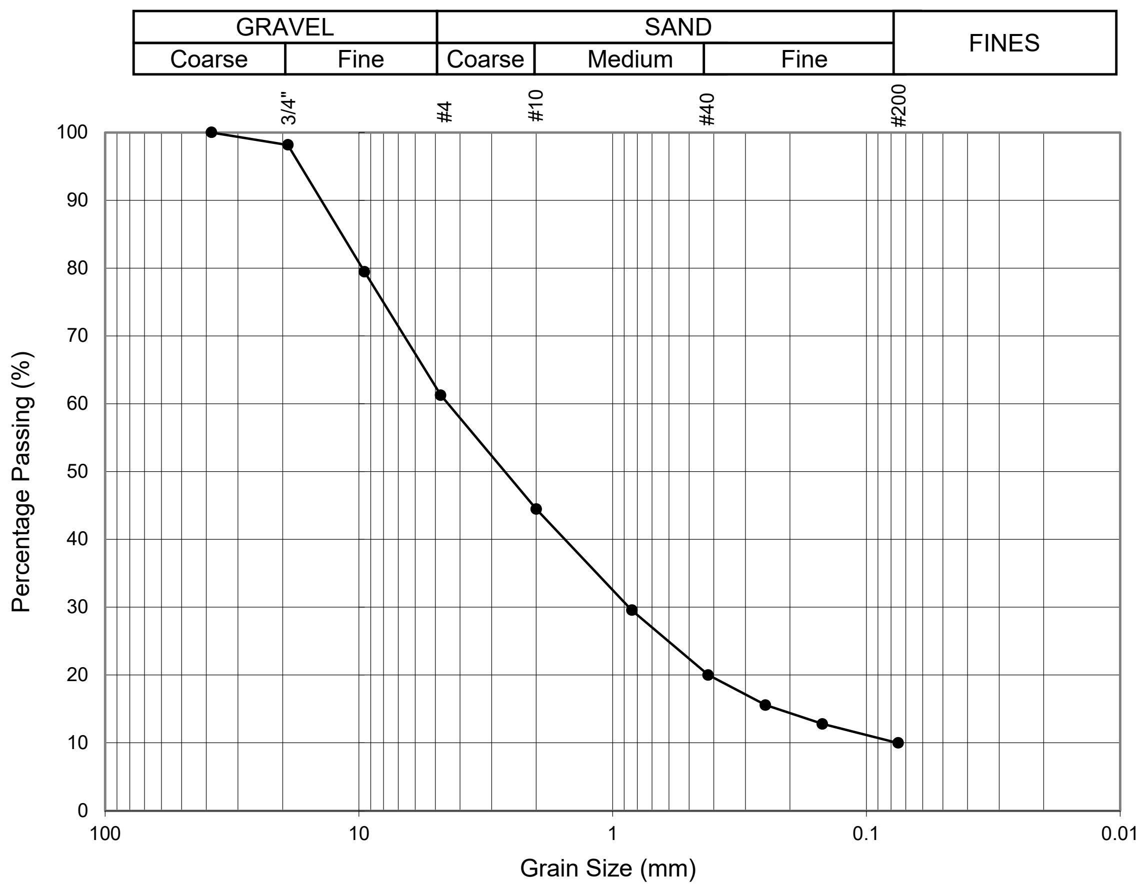
TETRA TECH CANADA INC.

TETRA TECH

Form Nº TT106a

Project:	Dewdney Bridge Replacement			Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC			Date:	January 12, 2021
Borehole:	AH20-01	Sample No.:	S1	Depth (m):	1.15

Particle Size Distribution (ASTM D6913)



Sample No.	Depth (m)	Percentage of Material by Weight (%)					
		Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	
S1	1.15	2	37	17	24	10	10

Comments:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

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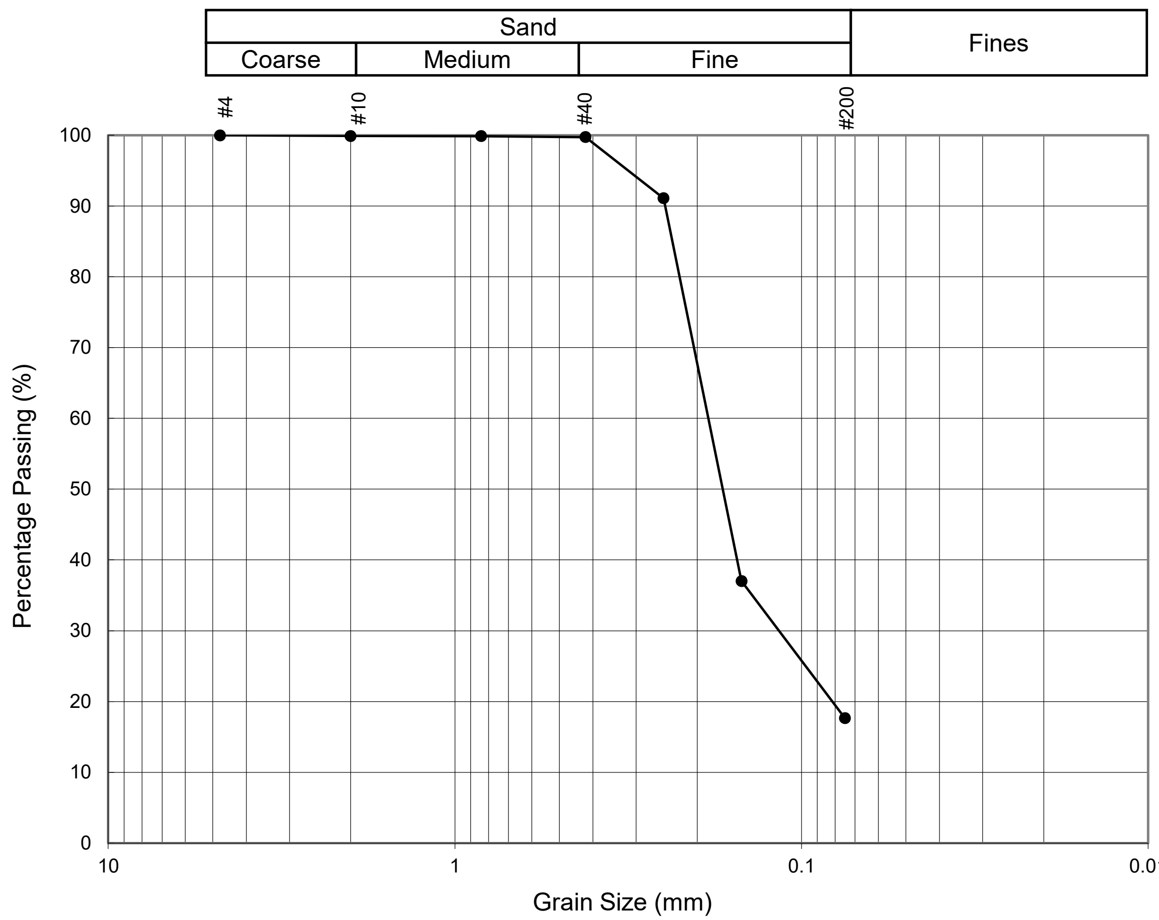
TETRA TECH CANADA INC.

TETRA TECH

Form Nº TT106

Project:	Dewdney Bridge Replacement	Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC	Date:	January 12, 2021
Borehole:	AH20-01 Sample No.: S5	Depth (m):	4.35

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S5	4.35	0	0	0	82	18

Comments:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

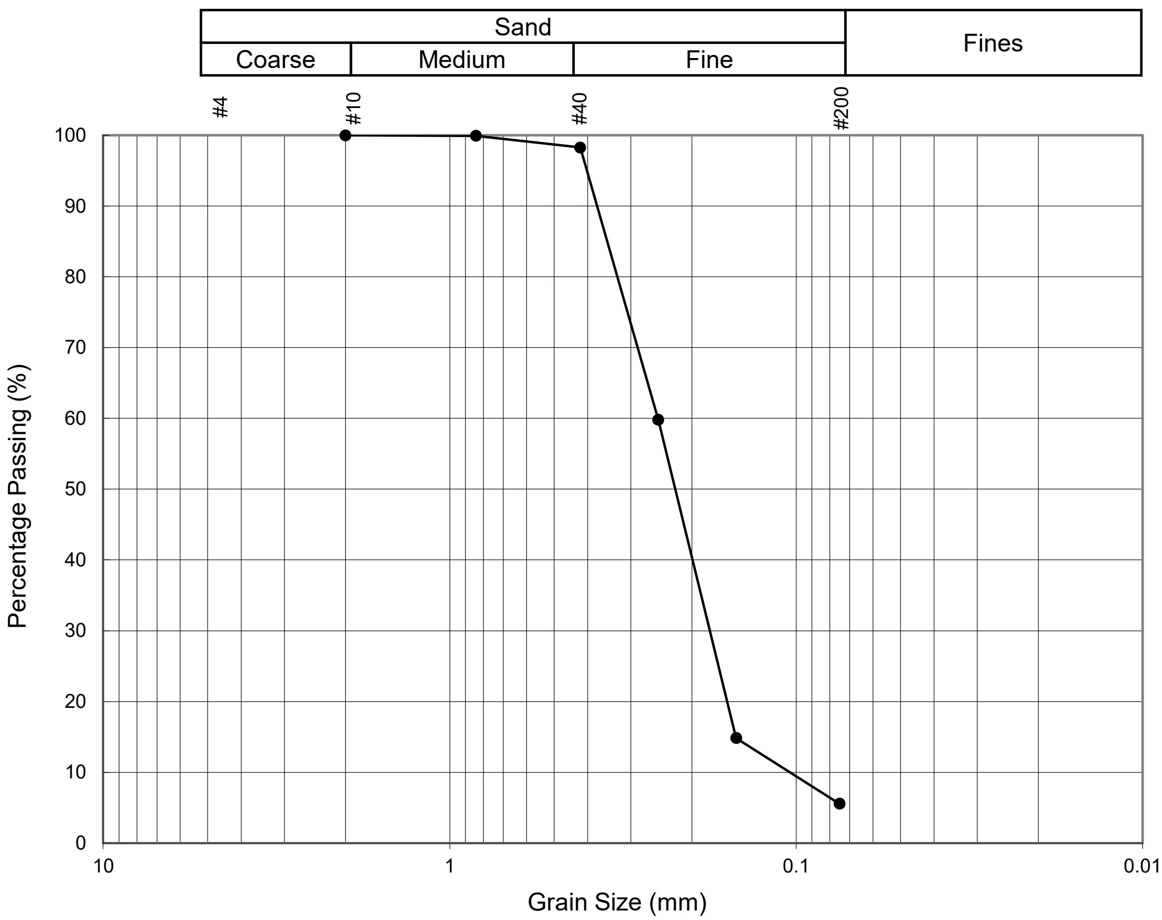
ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA OQM CERTIFIED

TETRA TECH CANADA INC.

Form Nº TT106

Project:	Dewdney Bridge Replacement			Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC			Date:	January 12, 2021
Borehole:	AH20-01	Sample No.:	S9	Depth (m):	8.92

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S9	8.92	0	0	1	93	6

Comments:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

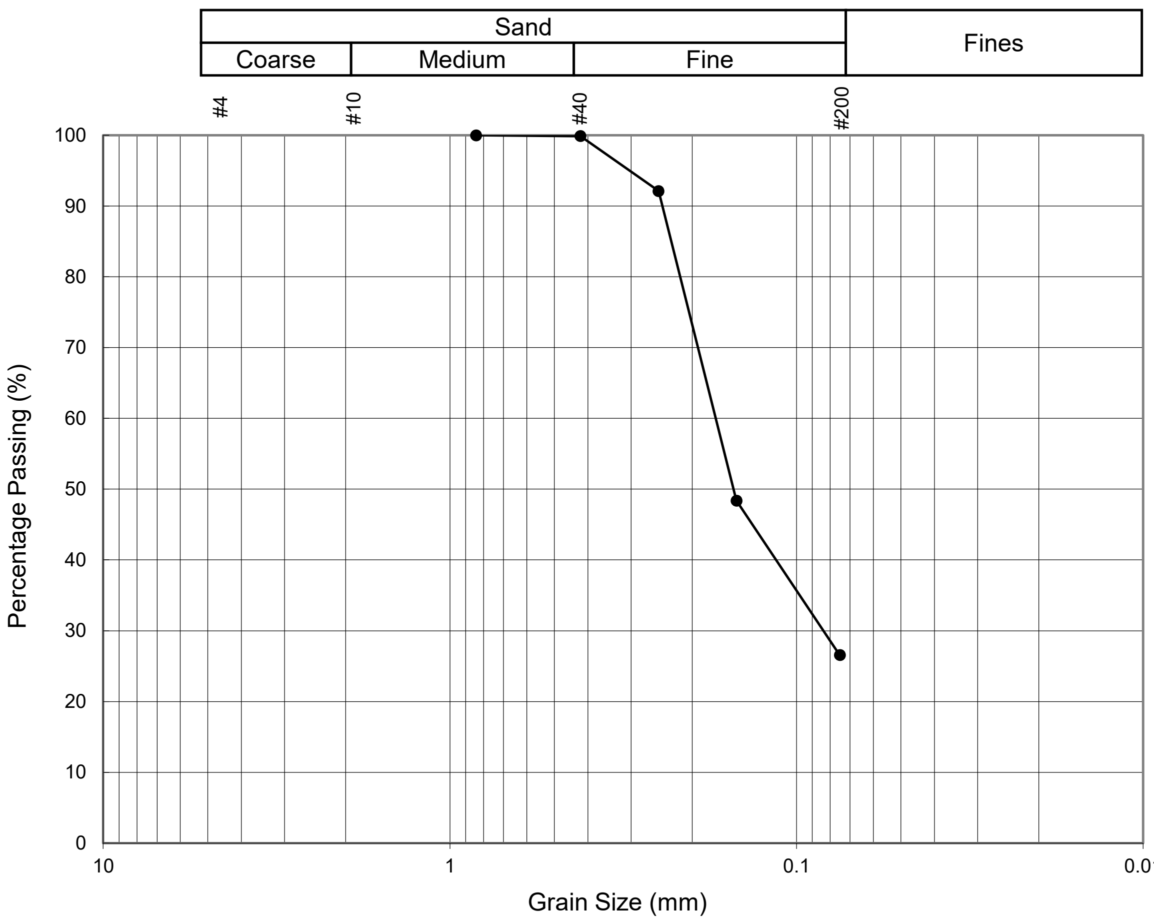
TETRA TECH CANADA INC.

TETRA TECH

Form Nº TT106

Project: Dewdney Bridge Replacement		Project No.:	704-ENG.VGEO03551-01
Location: Dewdney, BC		Date:	January 12, 2021
Borehole: AH20-02	Sample No.: S3	Depth (m):	2.21

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S3	2.21	0	0	0	73	27

Comments:

Prepared by: PC	Checked by: PS	Approved by: PS
Date: January 12, 2021	Date: January 12, 2021	Date: January 12, 2021

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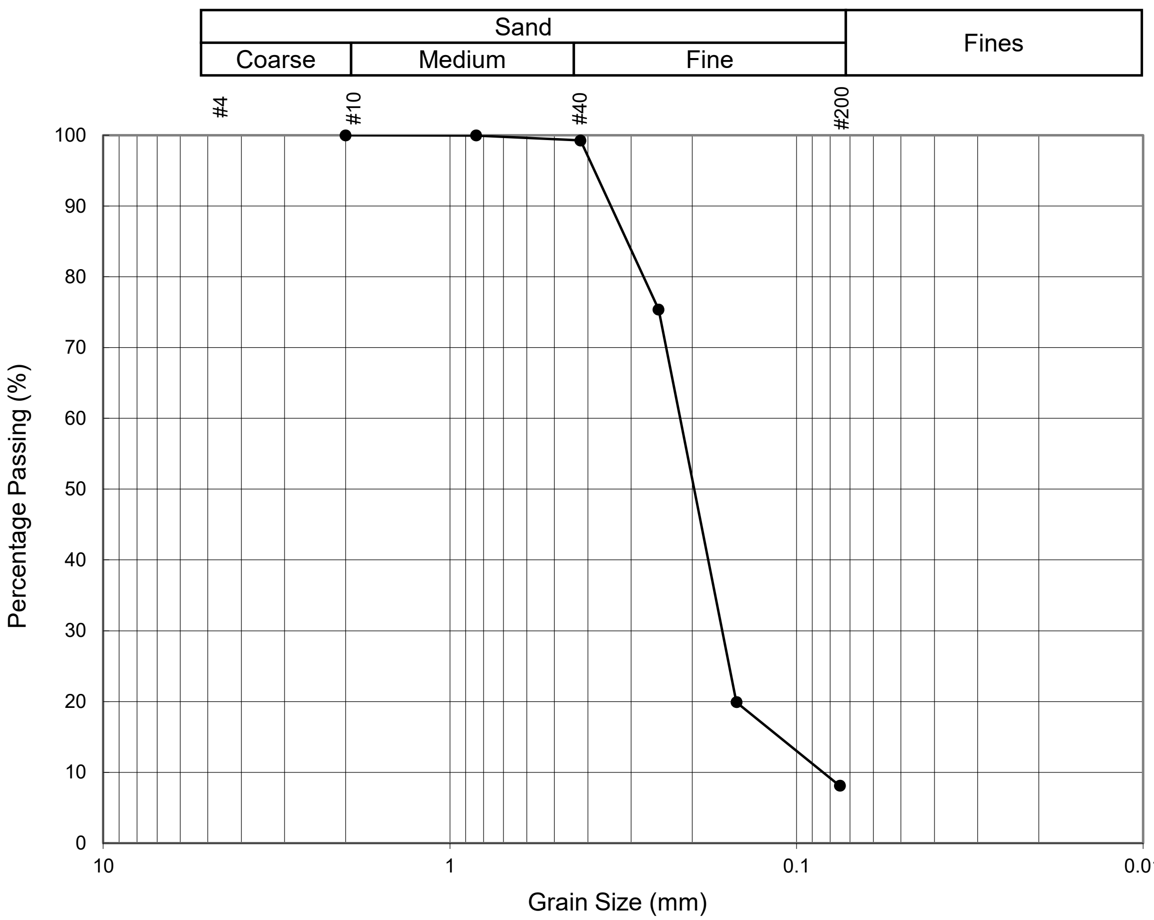
TETRA TECH CANADA INC.

TETRA TECH

Form Nº TT106

Project:	Dewdney Bridge Replacement			Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC			Date:	January 12, 2021
Borehole:	AH20-02	Sample No.:	S8	Depth (m):	8.16

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S8	8.16	0	0	1	91	8

Comments:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

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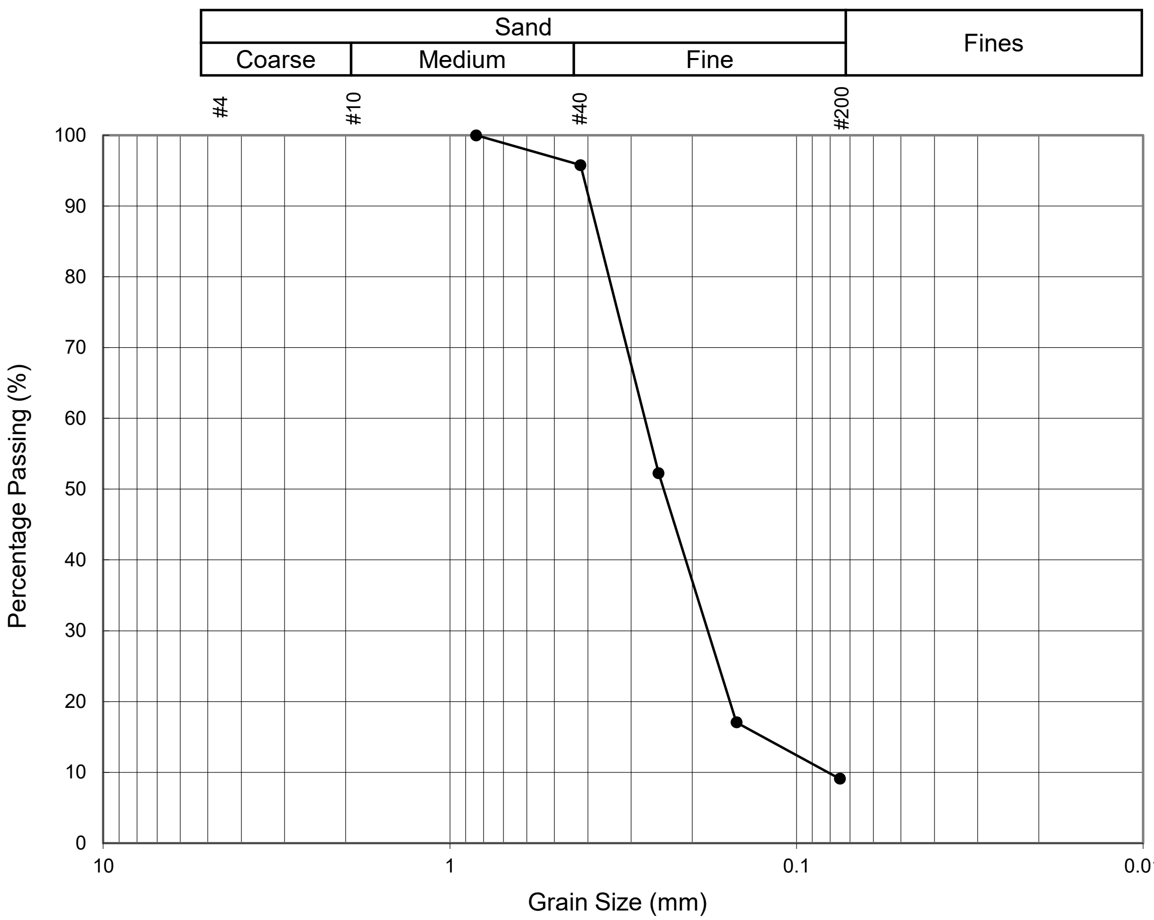
TETRA TECH CANADA INC.

Form Nº TT106

Project: Dewdney Bridge Replacement		Project No.:	704-ENG.VGEO03551-01
Location: Dewdney, BC		Date:	January 12, 2021
Borehole: AH20-02	Sample No.: S13	Depth (m):	14.86

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S13	14.86	0	0	4	87	9

Comments:

Prepared by: PC	Checked by: PS	Approved by: PS
Date: January 12, 2021	Date: January 12, 2021	Date: January 12, 2021

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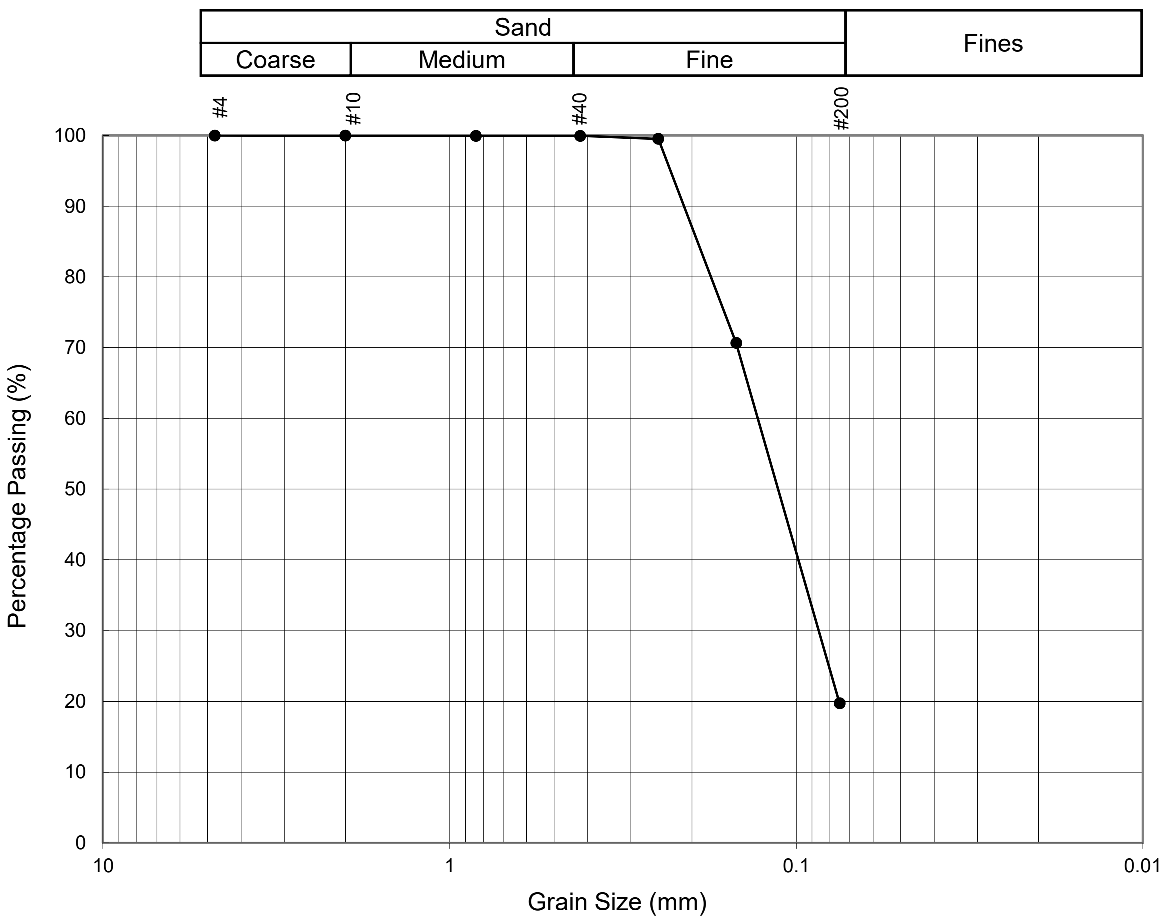
TETRA TECH CANADA INC.

TETRA TECH

Form Nº TT106

Project:	Dewdney Bridge Replacement	Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC	Date:	January 12, 2021
Borehole: AH20-03	Sample No.: S3	Depth (m):	2.37

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S3	2.37	0	0	0	80	20

Comments:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

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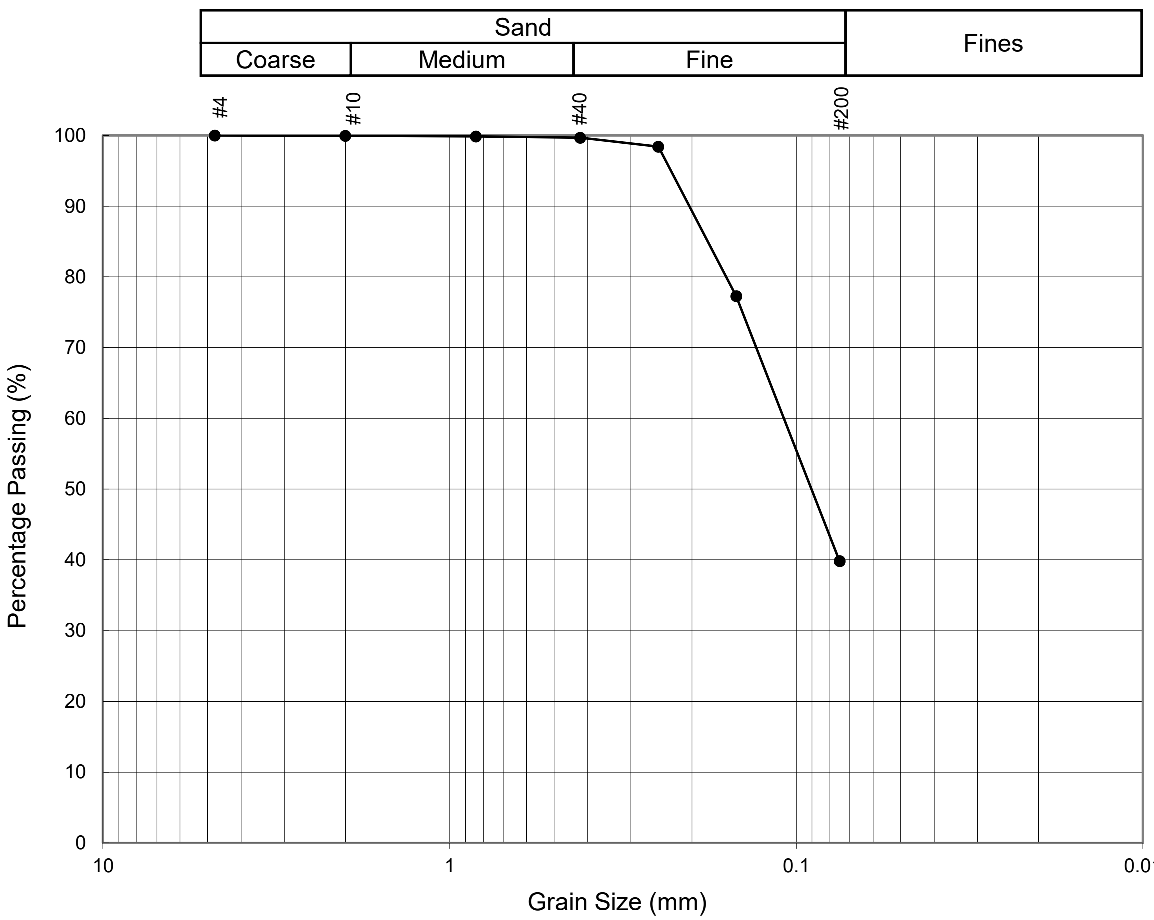
TETRA TECH

Form Nº TT106

Project:	Dewdney Bridge Replacement	Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC	Date:	January 12, 2021
Borehole:	AH20-03 Sample No.: S5	Depth (m):	4.19

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S5	4.19	0	0	0	60	40

Comments:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

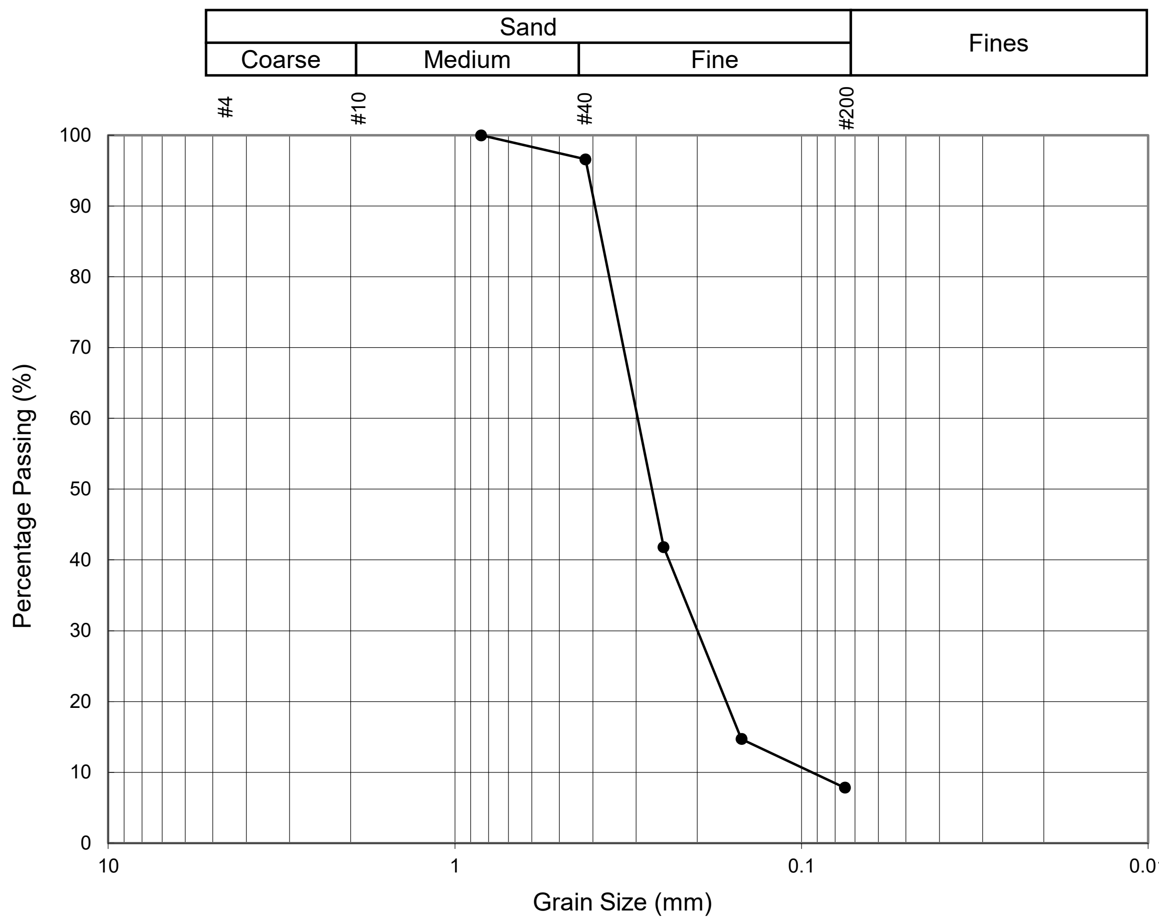
TETRA TECH CANADA INC.

TETRA TECH

Form Nº TT106

Project: Dewdney Bridge Replacement		Project No.: 704-ENG.VGEO03551-01	
Location: Dewdney, BC		Date: January 12, 2021	
Borehole: AH20-03	Sample No.: S12	Depth (m): 13.49	

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S12	13.49	0	0	3	89	8

Comments:

Prepared by: PC	Checked by: PS	Approved by: PS
Date: January 12, 2021	Date: January 12, 2021	Date: January 12, 2021

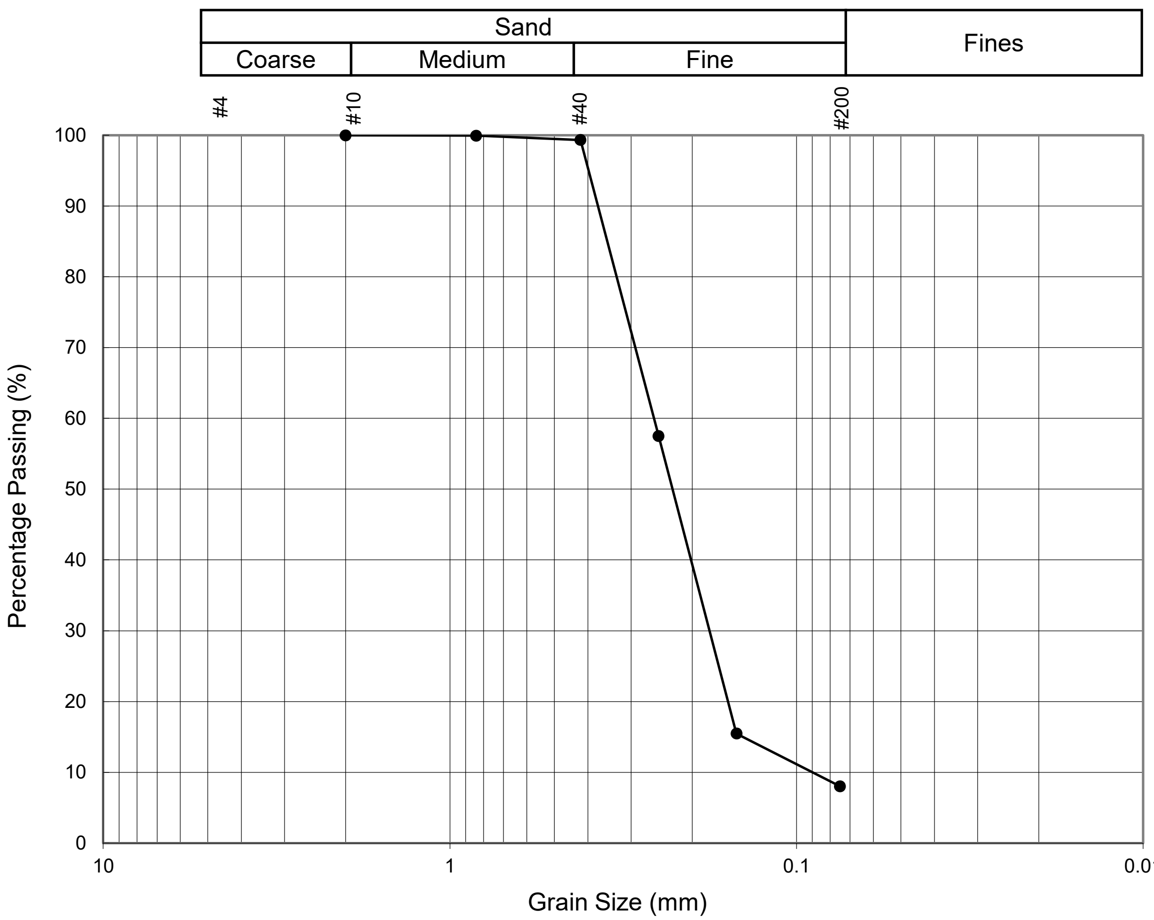
TETRA TECH

TETRA TECH CANADA INC.

Form Nº TT106

Project: Dewdney Bridge Replacement		Project No.:	704-ENG.VGEO03551-01
Location: Dewdney, BC		Date:	January 12, 2021
Borehole: AH20-04	Sample No.: S4	Depth (m):	4.35

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S4	4.35	0	0	1	91	8

Comments:

Prepared by: PC	Checked by: PS	Approved by: PS
Date: January 12, 2021	Date: January 12, 2021	Date: January 12, 2021

TETRA TECH CANADA INC.

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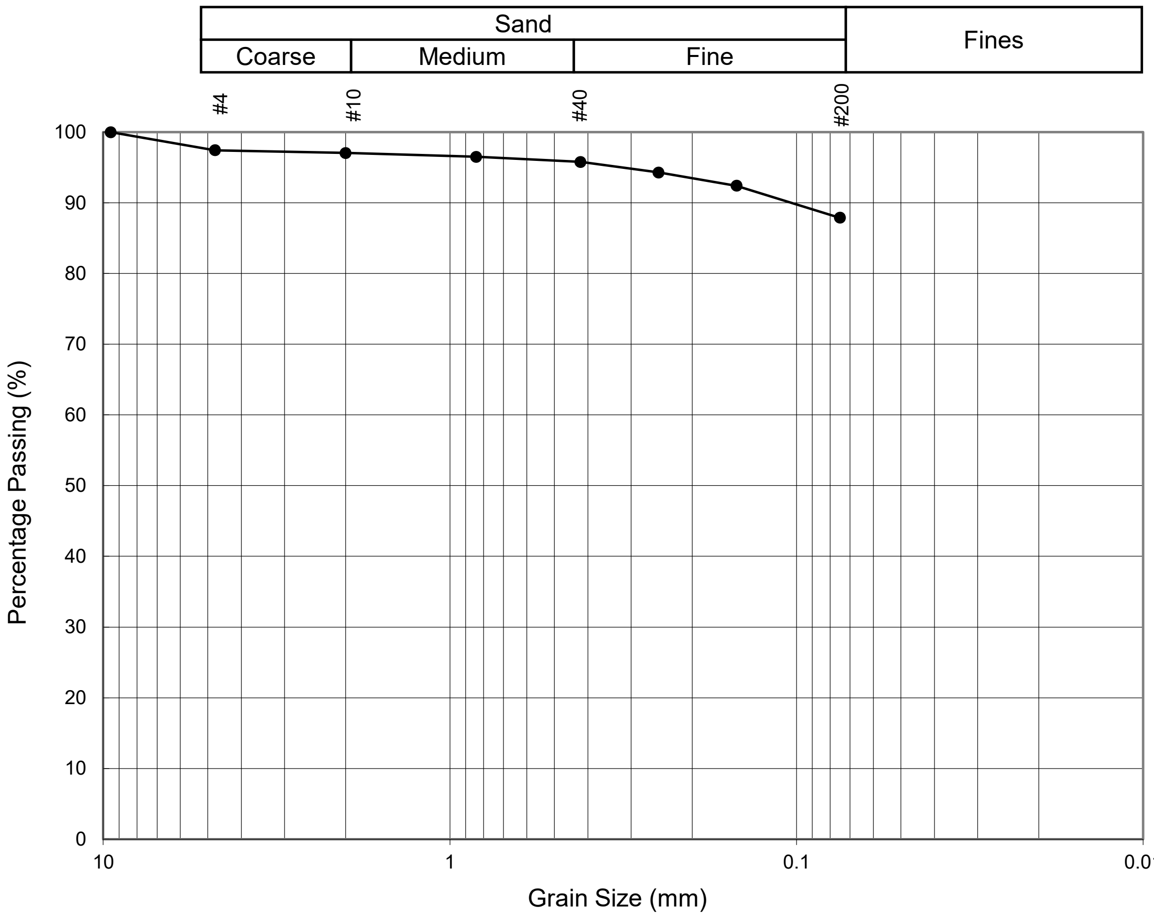
Form Nº TT106

Project:	Dewdney Bridge Replacement	Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC	Date:	January 12, 2021
Borehole:	AH20-05	Sample No.: S2	Depth (m): 1.30

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S2	1.30	3	0	1	8	88

Comments:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

TETRA TECH CANADA INC.

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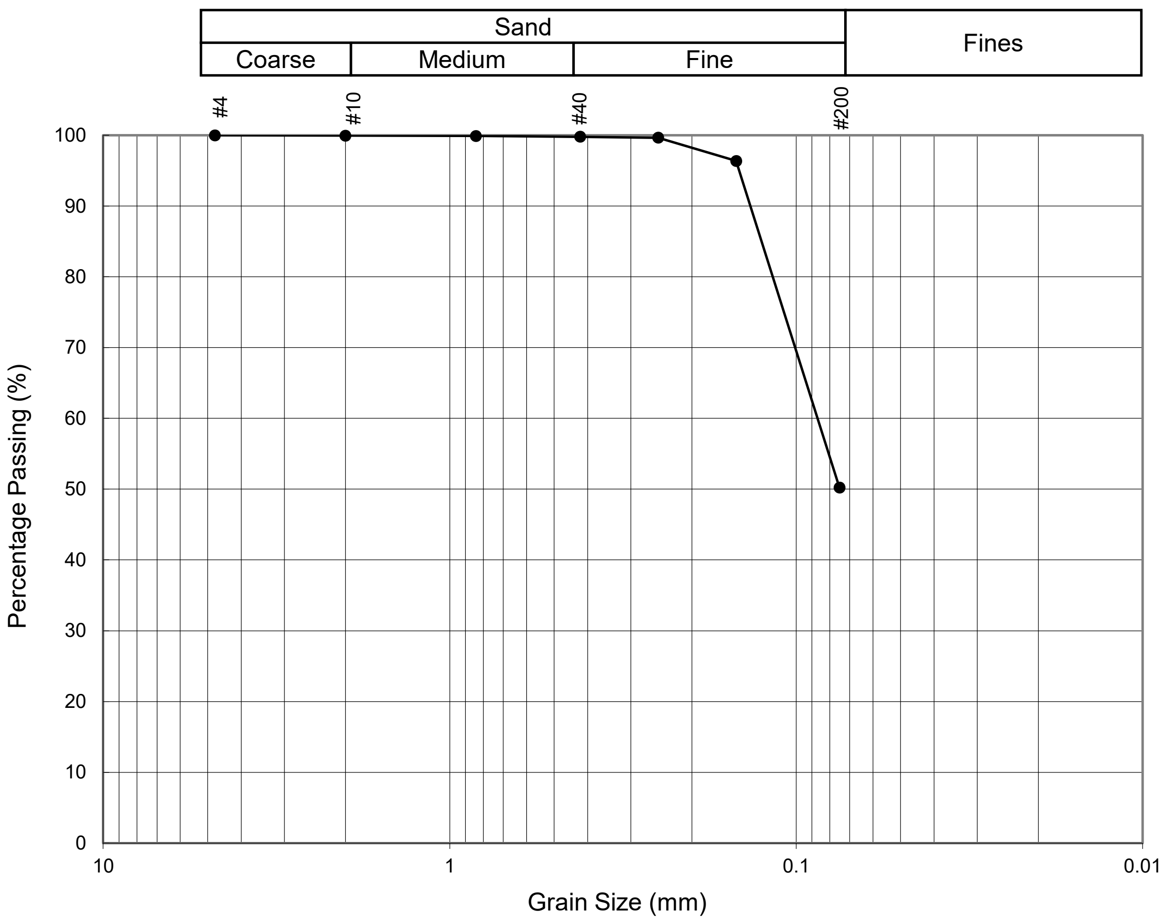
Form Nº TT106

Project:	Dewdney Bridge Replacement			Project No.:	704-ENG.VGEO03551-01
Location:	Dewdney, BC			Date:	January 12, 2021
Borehole:	AH20-06	Sample No.:	S3	Depth (m):	2.37

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
S3	2.37	0	0	0	50	50

Comments:

Prepared by:	PC	Checked by:	PS	Approved by:	PS
Date:	January 12, 2021	Date:	January 12, 2021	Date:	January 12, 2021

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