



A & L Sargeant Ltd

GEOTECHNICAL INVESTIGATION REPORT

147 to 153 Edgewater Drive, Pakuranga

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A	Issued for Consent	 Che Cheng Associate Geotechnical Engineer CMEngNZ, CPEng	 Shane Lander Principal Geotechnical Engineer CMEngNZ, CPEng

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1 PROJECT BRIEF AND SCOPE

This report has been prepared for A & L Sargeant Ltd in support of an application to Auckland Council for Resource Consent in accordance with the requirements of the Resource Management Act 1991.

Where appropriate, it is in accordance with the recommendations of NZS 4404, Land Development and Subdivision Engineering; Auckland Council Code of Practice for Land development and Subdivision, Section 2 Earthworks and Geotechnical Requirements (version 2.0); and related documents.

The principal objectives of this report were to determine:

- Ground model of the subject site.
- Groundwater condition of the subject site.
- Seismic consideration including liquefaction potential.
- Foundation options.
- Excavation and retention design recommendation for the basement,
- Potential effects on nearby structures due to groundwater drawdown and/or excavation.
- Subgrade strength for slabs on grade and pavements.

2 DESKTOP APPRAISAL

2.1 Related Reports

The following related reports have been reviewed in preparation of this report:

- Geotechnical report prepared by Moss Engineering Ltd (ref. 4116G) dated 27 November 2017 which was subsequently revised (REV 1) on 3 March 2018 (Moss).
- Geotechnical design report prepared by Lander Geotechnical Consultants Ltd (ref. J00983) dated 20 December 2018 (Lander). This was for a previous proposal within the same study area that has now been revised.
- Geotechnical Investigation Report prepared by LDE Ltd (Ref J00983), Dated 3/02/2023. This was for a previous proposal within the same study area that has now been revised.

2.2 Site Description

The site comprises 147 to 153 Edgewater Drive and covers an area of approximately 2,990 m². It is bounded by the Ambridge Rose Manor rest home to the north, a residential property to the south, Edgewater drive to the west and an esplanade reserve to the east. The overall site is relatively flat although dips gently to the southeast towards the reserve.

The lots are currently occupied by single level residential dwellings and garages/carports. A wastewater line runs approximately north/south through the central portions of the subject site.

2.3 Development Proposals

The development proposal is shown in the supplied drawings presented in Appendix A. The proposed development comprises two standalone, seven storey buildings (Blocks A and B) with ground floor level at RL5.1m. Block A has a basement level with Finished floor level of RL2.1m.

Block A occupies 151 and 153 Edgewater Drive while Block B occupies 147 and 149 Edgewater Drive.

Minor fill and cut will be required to level out the building platforms to RL approximately 5m.

2.4 Natural Hazard Risk Assessment

In accordance with Section 106 of the Resource Management Act (1991 and subsequent amendments), we have undertaken a qualitative site-specific natural hazards risk assessment for the proposed development which is presented in Table 1.

In summary, with appropriate design, the proposed development is unlikely to be affected by site-specific natural hazards and therefore fulfils Section 106 of the Act. Although touched on below, some regional hazards are beyond the scope of this report.

The risk rating scores (pre and post construction) outlined below have been assessed by LDE in accordance with Section 2.4.3 of ACCoP (inset right).

		Consequence				
		Insignificant 1	Minor 2	Moderate 3	Major 4	Extreme 5
Likelihood	Almost Certain 5	Medium 5	High 10	Very high 15	Extremely high 20	Extremely high 25
	Likely 4	Low 4	Medium 8	High 12	Very high 16	Extremely high 20
	Moderate 3	Low 3	Medium 6	Medium 9	High 12	Very high 15
	Unlikely 2	Very low 2	Low 4	Medium 6	Medium 8	High 10
	Rare 1	Very low 1	Very low 2	Low 3	Low 4	Medium 5

Table 1: Natural hazard and risk assessment

Seismic Hazards	Untreated Risk	Residual Risk	Risk Owner
	2 (Very Low)	1 (Very Low)	Building Designer
Potential Susceptibility	The site is more than 20km from the nearest active fault (the Waikopua Fault).		
Mitigation Measures	All future structures should be designed in accordance with the relevant Standards and guidelines.		
Groundwater Drawdown	Untreated Risk	Residual Risk	Risk Owner
	5 (Medium)	2 (Low)	N/A
Potential Susceptibility	Four piezometers have been monitored (refer Section Error! Reference source not found.) and determined highest groundwater levels approximately 1m below existing surface level. Cut depths are up to 3.5m from the ground floor level (allowing for 500mm over excavation and basement tanking) and will intercept the water table. An AUP E7 assessment has been undertaken (Section 6.11) and an assessment of effects provided (Section 7).		
Mitigation Measures	Nil		
Liquefaction	Untreated Risk	Residual Risk	Risk Owner
	6 (Medium)	3 (Low)	N/A
Potential Susceptibility	Auckland council GEOMAP show that the site is classified as 'Liquefaction Category is Undetermined' based on LEVEL B assessment. This site therefore requires a specific assessment. The liquefaction potential is determined to be moderate with no surface manifestation.		
Mitigation Measures	Foundation to be founded on piles and account for drag down effect.		
Settlement and Compressible Soils	Untreated Risk	Residual Risk	Risk Owner
	6 (Medium)	4 (Low)	Foundation Designer
Potential Susceptibility	The alluvial soils generally consist of stiff to very stiff clay and slit, and are not prone to major consolidation settlement the fill platform surcharge loads. However under the scale of building proposed, consolidation settlement can be a concern. Given the settlement concern, foundations for the structure should be piled to found within competent East Coast Bays Formation bedrock to mitigate these risks. Any lightly loaded structural elements (e.g. vehicle ramps, etc.) will not unacceptably settle if recommended bearing capacities for shallow foundations are not exceeded.		
Mitigation Measures	Building to be embedded within competent bedrock.		
Expansive Soils	Untreated Risk	Residual Risk	Risk Owner
	6 (Medium)	4 (Low)	Foundation Designer
Potential Susceptibility	Soils encountered at the basement level within the site generally comprised of silt and clay, which are typically expansive. This is typically mitigated via specific foundation design.		
Mitigation Measures	The buildings are to be founded on piles.		

Sensitive Soils	Untreated Risk	Residual Risk	Risk Owner
	4 (Low)	3 (Low)	Contractor
Potential Susceptibility	Soil sensitivities are shown in the borehole records (Appendix B) and were generally moderately sensitive to sensitive.		
Mitigation Measures	If sensitive soils are encountered, careful earthworks trafficking, and programme can be employed to limit risk in this regard. Any sensitive materials which have undergone pumping or weaving can be undercut and reinstated with engineered fills.		
Collapsible Soils	Untreated Risk	Residual Risk	Risk Owner
	1 (Very Low)	1 (Very Low)	N/A
Potential Susceptibility	No evidence of collapsible soils was encountered on this site.		
Mitigation Measures	Nil		
Landslide Susceptible Ground	Untreated Risk	Residual Risk	Risk Owner
	2 (Very Low)	2 (Very Low)	N/A
Potential Susceptibility	The site is generally flat with downslope steeper than 1v to 4h to the east, with no obvious evidence of slope instability.		
Mitigation Measures	Nil		
Stream Instability and Erosion	Untreated Risk	Residual Risk	Risk Owner
	1 (Very Low)	1 (Very Low)	N/A
Potential Susceptibility	There are no streams present on the site and therefore stream instability is not considered a risk to the proposed development.		
Mitigation Measures	Nil		
Coastal Instability and Erosion	Untreated Risk	Residual Risk	Risk Owner
	6 (Medium)	1 (Very Low)	N/A
Potential Susceptibility	Auckland Council Geomaps viewer shows that the site is within the zone for coastal inundation and instability areas. While the coast erosion extent is outside our area of scope of work and is addressed by others, we have provided recommendation for the eastern boundary wall preliminary design to account for the potential erosion risk.		
Mitigation Measures	Retaining wall to mitigate long term erosion risk to property.		
Geothermal Issues	Untreated Risk	Residual Risk	Risk Owner
	1 (Very Low)	1 (Very Low)	N/A
Potential Susceptibility	There is no evidence of geothermal activity on this site.		
Mitigation Measures	Nil		

Soil Erosion	Untreated Risk	Residual Risk	Risk Owner
	6 (Medium)	1 (Very Low)	Contractor
Potential Susceptibility & Mitigation Measures	Refer to our response to Coastal Instability and Erosion.		
Rockfall or Falling Debris	Untreated Risk	Residual Risk	Risk Owner
	1 (Very Low)	1 (Very Low)	N/A
Potential Susceptibility	There is no ground elevated steeply above the site.		
Mitigation Measures	Nil		
Uncontrolled Fill	Untreated Risk	Residual Risk	Risk Owner
	4 (Low)	2 (Very Low)	Contractor and Geotechnical Engineer
Potential Susceptibility	Uncontrolled fill was encountered in MH02 location to 500mm below existing ground level.		
Mitigation Measures	Any pre-existing fill will be removed as a during the basement excavation.		
Flood Hazard	Untreated Risk	Residual Risk	Risk Owner
	1 (Low)	1 (Low)	-
Potential Susceptibility	Auckland Council GeoMaps view shows the site is not within a mapped flood plain.		
Mitigation Measures	Nil		

3 GEOLOGY / GEOMORPHOLOGY

Based on GNS 1:250000 geology web map, the site is underlain by Puketoka Formation late Pliocene to middle Pleistocene age pumiceous river deposits of the Tauranga group.

4 SITE INVESTIGATIONS

Site investigations have been undertaken at the subject site by Moss in 2017 and by Lander in 2018, and by LDE in 2024. The previous investigations consist of the following:

- Moss Engineering Ltd previous investigation:
 - Eight hand auger boreholes (BH) to a depth of up to 5m below ground level (bgl).
 - Three CPT tests to between 11m and 15m bgl.
 - Two standpipe piezometers installed at BH3 and BH6 location.
- Lander geotechnical previous investigation:

- Three machine boreholes (MH01-MH03) extend to 16.5m bgl.
- Three standpipe piezometers installed in each machine borehole.
- LDE recent geotechnical investigation:
 - Three CPTs with standpipe installation to up to 15.3m bgl
 - One hand auger to 5m depth.

The site investigation records are presented in Appendix B.

5 SUMMARY OF GROUND CONDITIONS

5.1 Geological model

A geological model of the site has been developed based on the previous site investigations, and is summarised in Table 2 below:

Table 2: Ground model

Layer No	Geological Unit	Depth to top of layer (m)	Thickness range (m)	CPT qc range (MPa)
1	Topsoil/uncontrolled fill	0	0 – 0.4	-
2	Ash	0-0.4	0 - 1.8	1-2
3	Puketoka formation Alluvium	0.4 -2.0	5.9- 9.5	0.5-14
4	Transitional Waitemata group	7.4-11.5	1.5 - 3.1	1-10
5	Waitemata Group Bedrock	10.5-13	-	5-20+

Site investigation location plan and three cross sections are presented in Appendix C. Details are as follows:

5.1.1 Topsoil

Up to 400mm of topsoil has been identified across the site.

5.1.2 Uncontrolled fill

Uncontrolled fill that consists of clayey SILT with fine gravels was encounter at MH02 locations. Given that the uncontrolled fill was not encountered in any of the other investigation locations, we consider this layer is likely to be localised.

5.1.3 Ash and alluvium

Ash and alluvium were encountered from near surface in all machine boreholes, however Ash was not encountered at the recent LDE HA01 location. These materials generally comprised inorganic, stiff to hard, orange/brown/grey, silts and clays. Vane shear strengths measured in the drilling barrel and Hand auger location ranged between 32kPa and 200kPa and SPT N values ranged were typically between 4 and 8, although results of 17 and 27 were noted at the base of this layer in MH01.

5.1.4 Transitional Waitemata Group

Waitemata Group transitional materials were encountered between 7.4m and 9.5m below existing ground level in all boreholes. These materials comprised very stiff to hard, inorganic, dark grey, silty clays and sands. SPT N values within this layer ranged between 6 and 8 at the top of the layer to 50 at the base of the layer. The recent CPTs indicates that this layer is encountered at similar depth as the Machine boreholes.

5.1.5 Transitional Waitemata Bedrock

Waitemata Group bedrock materials were encountered beyond 10.5m to 12.5m below existing level across the site in all three boreholes. While CPT 06 infers rock level at the southeastern corner of 147 Edgewater Drive is at about 13m depth. These comprised very weak to weak, interbedded sandstone and siltstone with SPT N values all in excess of 50.

5.1.6 Groundwater

Historically, groundwater levels were measured at the completion of the hand auger boreholes on 11/11/2017, and in the standpipe piezometers on 22/11/2017 by Moss Engineering Ltd at BH3 and BH6 location. The groundwater was also measured in the standpipe piezometer at MH01 location by LDE on 28/03/2022, 9/12/2022, and 12/12/2022. Standpipe installed at BH3, BH6, MH02 and MH03 locations were not measured as they were destroyed by the time the readings were taken in 2022.

At the recent CPT standpipe locations, the groundwater levels were measured by LDE at 1/11/2024, 6/11/2024, 8/11/2024.

The groundwater monitoring record are summarised in Table 3 below:

Table 3: Groundwater levels

Standpipe location	Ground elevation (RL.m)	Measurement date	Groundwater depth (m.bgl)	groundwater depth (RL.m)
BH3	5.5	11/11/2017	4.2*	1.3*
		22/11/2017	2.9	2.6
BH6	5.6	11/11/2017	3.6*	2.0
		22/11/2017	2.4	3.2
MH01	5.8	28/03/2022	2.0	3.8
		9/12/2022 (high tide)	1.7	4.1
		9/12/2022 (low tide)	1.7	4.1
		12/12/2022 (high tide)	1.5	4.3
		12/12/2022 (low tide)	1.5	4.3
CPT04	5.8	1/11/2024	1.7	4.3
		6/11/2024	1.9	4.1
		8/11/2024	1.9	4.1
CPT05	5.8	1/11/2024	1.8	4.0
		6/11/2024	2.0	3.9
		8/11/2024	2.0	3.8
CPT06	5.9	1/11/2024	0.9	5.0
		6/11/2024	1.2	4.7
		8/11/2024	1.2	4.7

*Groundwater level measured on the day of the hand auger borehole, equilibrium may not have been reached, not used as basis of geotechnical assessments.

Mean high water spring tidal level and mean low water spring tidal level within the Tamaki River estuary are at RL 1.44m and RL -1.42m respectively based on LINZ information (<https://www.linz.govt.nz/guidance/marine-information/tide-prediction-guidance/standard-port-tidal-levels>). The relevant modelling shows no obvious tidal influences on GWL's.

5.2 Expansive Soils

A phenomenon common to the plastic soils found throughout this region is their expansive nature and tendency to shrink and swell, particularly with seasonal fluctuations of near surface water contents.

Technically, expansive soils are defined in NZS 3604 as those soils having a Liquid Limit of more than 50% and a Linear Shrinkage of more than 15%. Where soils are quite silty or sandy, expansion is less of a problem, due to lower clay contents.

Based on plasticity and our experience of the surficial ash and alluvium material, we assess that the near-surface soils are Highly Expansive (Class H1 in term of AS2870.2011). This should be subject to verification via laboratory Shrink-Swell testing during the detailed design phase, as outlined in by the guidance in MBIE (Acceptable Solution B1/AS1, amendment 20), if indeed expansive soils are even a consideration for the foundation and/ or floor slab design for a large building of this type.

6 GEOTECHNICAL ASSESSMENTS

6.1 Seismic Consideration

6.1.1 Seismic Site Subsoil Class

Based on the ground investigations at the site, and our experience in the area, we consider the seismic sub soil class for the site to be Class C – shallow rock sites in accordance with NZS 1170.5:2004 Section 3.1.3.

6.1.2 Ground acceleration

In accordance with the updated MBIE Guideline Module 1, the design PGA and effective magnitude is:

- ULS case – PGA of 0.19g, effective magnitude of 6.5 with return period of 500 years.
- SLS case – PGA of 0.04g, effective magnitude of 5.9 with return period of 25 years.

6.2 Quantitative Liquefaction Assessment

6.2.1 Approach

A seismic liquefaction assessment has been completed using GeoLogismiki Cliq v.3.5.2.5 software based on CPT04, CPT05 and CPT06 data.

The earthquake peak ground acceleration (PGA) and magnitude (Mw) for the Auckland region is provided in Table A1 of Module 1¹. Therefore, a ULS PGA of 0.19g and Mw of 6.5 have been used for this assessment assuming Importance Level 2 with a design working life of 50 years, Table 3.1, NZS1170.0².

The analysis has been completed by applying the Boulanger and Idriss (2014) CPT-based method in accordance with MBIE Module 3. CPT-based method which evaluates a soil's potential to liquefy based on the soil behaviour type index (I_c) and liquefaction triggering factor (i.e., the factor of safety). The soils behaviour index (I_c) has been estimated based on the Robertson and Wride methods. Soils have been assumed to be non-liquefiable when the I_c value is greater than 2.6.

The following assumptions have been made in our analysis:

- The material encounter at site does not trigger SLS level liquefaction concern.
- The soils at this site are assumed to be Class C, shallow soil site (NZS1170.5:2004 Table 3.2),
- The proposed building is assumed to be Importance Level 2 as defined in NZS1170.0:2002,

¹ New Zealand Geotechnical Society (NZGS) and Ministry of Business Innovation & Employment (MBIE) guidelines for Earthquake Geotechnical Practice in New Zealand. (2021) "Module 1: Overview of the guidelines" Rev. 1

² AS/NZS1170.0 (2002). Structural Design Actions, General Principles.

- Lateral spreading has not been considered in our analyses, given the silty nature of the alluvium material on site, liquefaction is only expected to occur in isolated pockets of soils and will not trigger lateral spreading concern.
- A conservative groundwater level of 1.0m has been used for all analysed scenarios CPTs across the site based on groundwater levels measured within the piezometers to date.
- We have limited the analysis depth to 10m in accordance with Canterbury Technical Guidance Part C.

6.2.2 Results

Liquefaction Potential Index (LPI) is used to assess the general performance level of liquefied deposits. The table below summarises the results from the liquefaction analysis. Based on the Module 3 guidelines for performance level categorisation as outlined in Table 5.1 of that document, this assessment found that the liquefaction risk was found to be L2 moderate (small differential settlements) for an Importance Level 2 ULS case. This is summarised in table 4 below:

Table 4: Liquefaction Analysis Results Summary

Test	LPI	Vertical Free field Settlement	Performance Level Categorisation (Module 3, Table 5.1)
CPT04	0.91	12mm	L2, Moderate (small differential settlements)
CPT05	1.82	27mm	L2, Moderate (small differential settlements)
CPT06	3.63	42mm	L2, Moderate (small differential settlements)

Given that the superstructure will be suspended on piles embedded within bedrock, liquefaction induced settlements will not affect the superstructure. Down-drag caused by post-liquefaction settlement will need to be considered for negative skin friction pile design.

The liquefaction analysis outputs are presented in Appendix D.

6.3 Foundation Assessments

6.3.1 Shallow foundation

Shallow foundations are not recommended for primary structures. For ancillary structures (e.g., sheds), 300 kPa bearing capacity may be used for strip and pad footings up to 0.6m wide and 1.0m square respectively. Where these are used, to account for expansive soils, we recommend they are embedded a minimum depth below final external ground level of 900mm or alternatively are designed in accordance with AS2870 for site class H1 (high) and/ or a specific design that accommodates this expansive site class.

6.4 Bored pile foundations

For bored cast-in-situ pile foundations founded on the Waitemata group bedrock at 10.5 to 13m below ground level, the design parameters presented in Table 5 are recommended for design. These capacities are unfactored and a strength reduction factor of 0.5 should be applied when calculating the factored (ULS) geotechnical resistance.

Table 5: Pile design geotechnical parameters

Material	Ultimate shaft friction (kPa)	Ultimate end bearing capacity (kPa)
Alluvium/ash	-	-
Transitional Waitemata Group	60	-
Waitemata Group bedrock	500	5000

Notes:

1. A minimum embedment of three times the pile diameter into the rock layer is required in order to use the bearing capacity given in the table for that layer.
2. A reduction factor of 0.8 should be applied to the ultimate shaft friction for uplift tension loading.
3. The upper 1m of soil should be discounted in the pile design due to the presence of topsoil, fill and expansive soils.
4. Depth to top of rock should be confirmed by site observations during construction for all piles relying on the bedrock capacities.
5. Piles should be spaced at least 3 pile diameter apart to avoid vertical pile ground effect.

For seismic case design of pile compression loading only, a down drag shaft friction of 40kPa should be accounted for over the top 8.5m length of the pile, to account for liquefaction induced negative skin friction effect.

It should be noted that given that shallow groundwater was encountered at the site, although the alluvial soils were generally noted to be stiff silts and clays, there were alluvial sands encountered in MH01. Therefore, we recommend the contractor allow a contingency for casings or a bentonite slurry if these materials do prove to collapse in.

For piling over existing public services, please refer to requirements in Watercare Pipe Bridging guidelines.

6.5 Strength reduction factor

As required by Section B1/VM4 of the New Zealand Building Code Handbook, a strength reduction factor of 0.50 must be applied to all recommended geotechnical ultimate soil capacities in conjunction with their use in factored design load cases for static and earthquake overstrength conditions respectively.

6.6 Other deep foundation options

Driven piles foundation is not recommended for the subject site due to the noise and proximity to residential neighbourhood / existing aged care facility, plus the potential for vibrations to be felt associated with such method.

Depending on structural loads screw piles could also be an alternative piling option for this project. These piles comprise steel tubes with flighted auger tips screwed into the bearing strata to design loads measured by torque meter. Some piles are then test-loaded with kentledge. Subject to economics, their use should be appropriate on this site. Anticipated load carrying capacities need to be assessed in conjunction with the specialist contractors who promote this product.

6.7 Pavement and Floor slab subgrade

Based on the site investigation we consider that a ground bearing slab constructed on grade is appropriate on this site. A CBR of 3% may be assumed for slabs and pavement bearing over subgrade with a minimum undrained shear strength of 70kPa. We recommend that shear vane testing be carried out at the time of construction to confirm the final subgrade construction details. Subgrade in areas which fall below the design CBR value may require undercutting and replacement with hardfill. It should be noted that CBR values can be highly affected by moisture content (i.e., exposure to the elements), and trafficking and we therefore recommend that the subgrade is only trimmed to final level immediately prior to placing basecourse.

6.8 Earthwork

No earthworks plans have been provided to us at the time of preparing this report, however based on the supplied drawings, we anticipate that at the edge of the proposed Block A developments, cut up to 3.5m will be necessary to construct the building basement and cut and fills of up to 800mm, for the proposed development.

Within areas of the subdivision affected by earthworks, all topsoil, vegetation, pre-existing fill, and any near surface organic, soft or otherwise unsuitable materials should be cleared under our direction. All stripping operations should be inspected by us to confirm competent soils have been exposed.

Any batters that are required to be formed higher than 3.5m, or not having the crest at the current ground level should be subject to specific design.

All engineered fills should be placed and compacted in lifts of no greater than 200mm to 300mm and fill compaction testing should be undertaken to ensure that fills meet minimum compaction requirements. Fill compaction requirements should be set by the certifying geotechnical professional prior to fill placement and once proposed fill materials are known.

Where imported fills are to be used, the certifying geo-professional should be given the opportunity to inspect the proposed fill to be used to confirm its suitability.

Redundant services will need to be removed and backfilled where they are shallow. Any deep obsolete services can be infilled with grout and left in place.

Given the low compressibility of the ground at the site, settlement due to earthwork fill is expected to be minor.

6.9 Retaining wall design

The design of any soldier pile wall to support the temporary basement excavation should include interaction between the geotechnical and the structural engineer during detailed design to ensure the design adequately captures all loads and deflections are within acceptable ranges.

For the design of the retaining wall on site, retaining wall geotechnical design parameters are summarised in table 6 below:

Table 6: Retaining wall design parameters

Depth (m)	Material	Unit Weight (kN/m ³)	Drained cohesion (kPa)	Effective friction angle	Undrained shear strength (kPa)	Effective young's modulus (MPa)
0-2	Ash	17.5	7	30	70	25
2-2.5	Firm Alluvium	17.5	3	26	35	10.5
2.5+	Stiff Alluvium	17.5	5	30	50	15

Due allowance should be made in the design for effects of building loads, traffic loads, and water loading etc. The retaining wall designer should decide whether K_a or K_o is more appropriate for design.

The proposed buildings are situated above an estuary. An in-ground palisade wall may be required at the eastern site boundary to mitigate long term coastal regression effect. This is a matter for detailed design, and we understand that coastal regression will be determined by a coastal engineer / scientist in a separate report.

6.10 Slope stability

6.10.1 Basement temporary batter

We understand that there may be scope to carry out temporary batters down to basement level. To assess appropriate batter angles for the basement excavations, a cut batter stability assessment was carried out using software SLIDE 2.0, using the Morgenstern-Price method for circular slips.

Based on the groundwater level monitoring data to date, a groundwater level of 1m below ground level was assumed.

A surcharge of 5kPa is modelled between the crest of the cut to 1m from the crest to represent pedestrian surcharge. 12kPa is modelled at 1m from the crest of the wall representing construction vehicles and surcharge outside of the property boundaries.

A factor of safety of 1.25 was targeted for construction case.

Based on the site investigation, we have adopted a ground model with parameters as presented in Table 7.

Table 7: Soil properties

Material	Unit Weight (kN/m ³)	Drained cohesion (kPa)	Effective friction angle
Alluvium/ash very stiff	17.5	5	30
Alluvium firm	17.5	3	28
Alluvium stiff	17.5	5	30

Full details of stability analysis are presented in Appendix E and are summarised in Table 8.

Table 8: Temporary batter stability summary

Conditions of Analysis	Maximum batter	Factor of safety
3.5m high temporary batter	1V:1.5H	1.29
3m high temporary batter	1V:1.3H	1.31
2.5m high temporary batter	1V:1.2H	1.32

Further if cut batters are left open for any period of time, especially during periods of rain, they should be covered with polythene sheeting and appropriate measures should be put in place upslope of the batters to appropriately redirect overland flow to avoid concentrated flows on the batters. The Contractor shall be responsible for such measures as deemed necessary.

6.10.2 Slope at eastern boundary

While the site is generally flat, preliminary slope stability analysis of the estuary along the eastern boundary has been assessed based on cross section CS2.

This cross section was then analyzed using computer modelling software Slide 2 (2018) using the Morgenstern/Price method for circular modes of failure using worst case scenario techniques.

The degree of stability of a slope is expressed as the factor of safety, which is the ratio of the resisting and driving forces causing instability. Theoretical failure of a slope is possible when the factor is 1.0, while increasing values above 1.0 indicate improving stability.

Acceptable factors of safety (FoS) for are prescribed in Auckland Council Code of Practice (ACCoP) Section 2.6.8 for residential developments as outlined in below.

- Normal conditions (long term conditions), minimum FoS 1.5
- Extreme (0.5m below ground level) groundwater conditions (short term transient conditions), minimum FoS 1.3
- Seismic condition with a 1 in 500-year event with a ULS seismic load of 0.19g and earthquake magnitude (Mw) of 6.5 is specified by in the NZGS Earthquake Geotechnical Engineering Practice Module 1, 2022, minimum FoS 1.0

A summary of analysis is presented in Table 9 below, indicating risk of slope instability encroaching the building platform is low even with conservative retaining wall embedment assumed:

Table 9: Estuary stability summary

Conditions of Analysis	Minimum FOS required	Factor of safety achieved
Existing groundwater	1.5	1.8
Elevated groundwater	1.3	1.6
Seismic	1.0	1.1

6.11 Groundwater Consent Requirements

Due to an expected requirement for a permanent groundwater take at the site the development will require a consent as a Restricted Discretionary Activity under the Auckland Unitary Plan (AUP) requirements as it falls outside of the "Permitted Activities" requirements. Based on the architectural drawings, we understand that the basement floor level is at RL 2.1m, by assuming a 0.5m over excavation, a final excavation level at RL 1.6m is assumed.

The summer/spring groundwater levels monitoring from the standpipes are presented in Section 8.1.6 based on standpipe readings, the lowest recorded water reading was at BH3 location at RL 2.6m. and the highest recorded water reading was at CPT06 location at RL 5.0m. Tidal influences appeared to be negligible. For resource consent purpose, a conservative groundwater of RL5.0m has been adopted in the E.7 assessments .

Table 10 assesses the compliance of the proposed lower floor excavations, as well as the installation of the proposed stormwater and wastewater infrastructure, to Auckland Council's Unitary Plan E7 groundwater guidelines, E7.6.1.6 and E7.6.1.10.

Table 10: E7 6.1.6 and E7.6.1.10 Assessment

Rule	Activity	Applicability to Site
E7.6.1.6 (1)	The water take must not be geothermal water.	Complies: There is no evidence of geothermal activity at the site in question.
E7.6.1.6 (2)	The water take must not be for a period of more than 10 days where it occurs in peat soils, or 30 days in other types of soil or rock.	Does Not Comply: The basement walls of the buildings will likely be permanently drained.
E7.6.1.6 (3)	The water take must only occur during construction.	Does Not Comply: The basement walls will likely be permanently drained. The water take due to construction of the stormwater and wastewater infrastructures are likely only temporary (i.e. during their construction).
E7.6.1.10 (2)	Any excavation that extends below natural groundwater level must not exceed: 1ha in total area; and 6m depth below the natural ground level	Complies: For the basement excavation, excavations proposed to extend below natural groundwater levels are less than 1ha in total and are less than 6m below ground depth.
E7.6.1.10 (3)	The natural groundwater level must not be reduced by more than 2m on the boundary of any adjoining site.	Does not Comply: There is a risk that the drawdown at the boundary is more than 2m.
E7.6.1.10 (4)	Any structure, excluding sheet piling that remains in place no more than 30 days, that physically impedes the flow	Does Not Comply: Length of the basement exceeded 20m and may extend more than 2m below the natural groundwater level.

Rule	Activity	Applicability to Site
	of groundwater through the site must not: Impeded the flow of groundwater over a length of more than 20m; and Extend more than 2m below the natural groundwater level	
E7.6.1.10 (5a)	The distance to any existing building or structure (excluding timber fences and small structures on the boundary) on an adjoining site from the edge of any trench or open excavation that extends below natural groundwater level must be at least equal to the depth of the excavation	Does Not Comply: the basement excavations are expected to have excavation depths greater than the offset at the northern and western sides.

As presented in table 10, the site does not comply with rules E7.6.1.6 (2), E7.6.1.6 (3), E7.6.1.10 (3), E7.6.1.10 (4) and E7.6.1.10 (5a) and a consent to take groundwater will be required.

7 EFFECTS ON NEIGHBOURING ASSETS

Based on the information retrieved from Auckland Council Geomaps, referring to Inset 2 below, settlement consideration due to the basement excavation and the boundary earthwork cut is given to the following assets.



Inset 2: Services and properties in the vicinity of the site

- Close edge of the Edgewater Drive footpath, approximately 1.5m from the site boundary.
- 50 diameter PVC water pipe runs along the far edge footpath of Edgewater Drive. Assumed to be buried 1m below current ground level. 6m horizontal offset to the proposed Block A basement excavation, and 3m offset from the boundary.

The neighbouring property Ambridge rose rest home at 159 Edgewater Drive has a drained basement level at RL3.1m, and is owned by our client A&L Sargent Ltd. Settlement effect on this building due to the proposed development is to be assessed in the detailed design stage.

A wastewater pipe running southwest to northeast through the Block A basement would likely require rerouting within the development extent subject to the opinion of the project civil engineer.

The effects on adjacent assets consist of two primary components:

1. Mechanical deformation of land behind temporary basement retaining walls, where space constraints prevent cutting a stable temporary batter.
2. Settlement of land due to basement dewatering.

The magnitude of these components is estimated in the following sections.

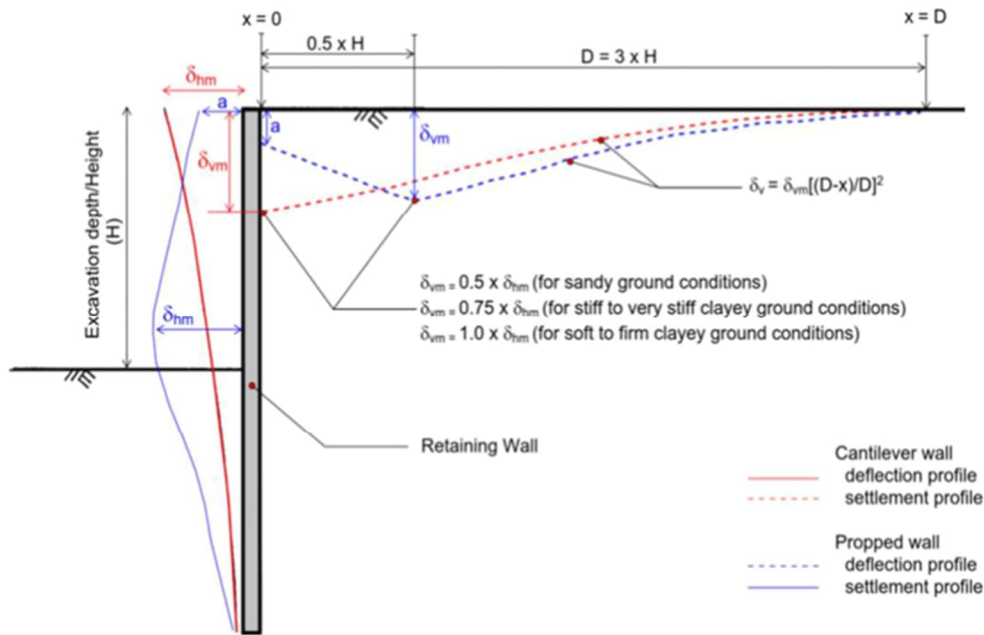
Adopting a temporary batter instead of a soldier pile wall prior to construction minimizes mechanical deformation. The basement's long-term structural integrity is ensured by the ground-level floor slab, which provides propping before backfilling behind the basement wall.

In areas with insufficient space for a full batter, a temporary retaining wall can be constructed below an excavated safe batter. This approach controls the required retaining wall size, height, and embedment.

For resource consent purposes, the analysis assumes a conservative approach, assuming the soldier pile walls at the building edges, extending to current ground level.

7.1.1 Mechanical deformation calculation

The WALLAP analysis included a staged approach to construction of installing the piles first and then excavating down to the target depths prior to installing permanent basement retaining wall in front of piles. Following the WALLAP analysis, a mechanical settlement profile has been prepared using the Ou, C., Hsieh, P., & Chiou, D. Y. (1993) method as outlined in a recent Engineering NZ course (Embedded Retaining Walls, by Martin Larish).



Inset 3: Ou, C., Hsieh, P., & Chiou, D. Y. (1993) mechanical settlement estimation

Basement excavation:

- 3.5m design height; (top of wall RL5.1m, base of wall RL1.6m, including over excavation)
- Reinforced concrete pile 600 diameter at 1.8m spacing;
- $E = 30\text{GPa}$ (Assume 30MPa concrete), $I_{\text{temp}} = 0.002651 \text{ m}^4/\text{m run}$; (75% I_{gross})
- Assume ground water at base of excavation level due to dewatering.
- Construction stage surcharge of 12kPa , 1m from the edge of the excavation.
- 4m embedment.
- Calculated deflection 11mm corresponding to 8mm of settlement at top of the wall.

WALLAP analysis results are presented in Appendix F.

7.1.2 Groundwater drawdown induced settlement

We have undertaken groundwater drawdown analysis using computer software SLIDE2.0, along a typical basement north/east section to estimate drawdown profile based on the lowest groundwater level at MH012m below ground level for drawdown settlement calculation. The analysis were carried out based on MH01 readings given its proximity to the western site boundary, and the data was monitored by LDE directly.

The soil permeability value was estimated based on the 3 recent CPTs. The minimum characteristic value was estimated to be $5 \times 10^{-7} \text{ m}^2$, based on soil between 2m to 5m depth which will experience the drawdown.

Normalised Friction Ratio, r_f (%)

Tabular results for cone resistance values ::

CPT Name	Start depth (m)	End depth (m)	Average q_t (MPa)	No points	StdDev	Min. charact. q_t value (MPa)	Min. q_t value (MPa)
CPT04	1.00	5.00	2.04	401	2.58	1.82	0.34
CPT05	1.00	5.00	2.13	401	2.39	1.94	0.31
CPT06	1.00	5.00	0.85	401	0.43	0.81	0.39
All CPT's			1.67	1203	2.12	1.57	0.31

Minimum characteristic values for estimated results ::

CPT Name	K_{sbt} (m/s)	N_{60} (blows/30cm)	E_s (MPa)	D_r (%)	ϕ (°)	M (MPa)	G_o (MPa)	S_u (kPa)	S_u ratio	OCR
CPT04	5.97E-007	6	0.00	0.00	0.00	14.20	32.34	52.82	1.54	7.10
CPT05	5.30E-007	7	0.00	0.00	0.00	15.08	36.16	75.95	1.85	8.52
CPT06	6.68E-008	4	0.00	0.00	0.00	6.09	20.13	48.92	1.58	7.29

Characteristic values are calculated based on 95% reliability and with the assumption that coefficient of variation is not known *a priori*

Inset 4: CPT estimated permeability K_{sbt}

A radius of influence from the excavation face of 20m has been estimated based on long term steady state analysis using SLIDE.

The drawdown profile in comparison to the lowest groundwater recording due to the Building A excavation was undertaken using computer software SLIDE.

The consolidated settlement at the edge of the Ambridge Manor rest home building is calculated using 1D consolidation formula of $s=(mv)(H)(\Delta\sigma)$

Table 11: Typical values of the coefficient of volume compressibility m_v .

Typical Values of the Coefficient of Volume Compressibility, m_v (after Carter 1983)

Type of clay	Description	m_v ($\times 10^{-3} \text{ m}^2/\text{kN}$)		
		Lower Limit	Upper Limit	Average
Heavy over-consolidated boulder clays, stiff weathered rocks and hard clays	Very low compressibility		0.05	
Boulder clays, marls, very stiff tropical red clays	Low compressibility	0.05	0.1	0.075
Firm clays, glacial outwash clays, lake deposits, weathered marls, firm boulder clays, normally consolidated clays at depth and firm tropical red clays	Medium compressibility	0.1	0.3	0.2

Where m_v is the compressibility of the soil assumed to be 0.0001 m^2/kN for stiff to very stiff clay by referring to table 11 above. (lower limit of firm clays).

$\Delta\sigma$ is change in stress due to groundwater drawdown.

'H' is the thickness of the compressible alluvium layer below the drawdown groundwater profile, to the base of the alluvium layer at RL-4. Stress reduction over depth due to drawdown is conservatively ignored.

The calculated settlement is therefore considered to project to 0mm at 20m distance, as per drawdown envelop curve developed by our SLIDE drawdown analysis.

Within 20m of the proposed development, to the west of the Block A excavation, the water pipe along Edgewater Drive and the footpath may be affected by the groundwater drawdown.

Drawdown settlement calculation has therefore been undertaken for these services and structures, the calculation results were annotated to our SLIDE drawdown analysis output and is presented in Appendix G.

7.2 Assessment of effect on buried services and neighbouring building

The PVC water pipe and footpath along Edgewater Drive are assumed to be relatively ductile and is able to tolerate up to 20mm of settlement,

Combining the findings presented in section 7.11 and 7.12, the combined settlement effect on the water pipe and footpath are summarised in table 12 below.

Note that in table 12, the differential settlement gradient is for between the close and the far edge of the affected structures. Settlement profile estimation are presented in Appendix H.

Table 12: Combined settlement effect

Asset	Mechanical deformation settlement (mm)	Groundwater drawdown settlement (mm)	Total settlement at close edge of asset (mm)	Differential settlement gradient	Damage category
Close edge of the Edgewater Drive footpath	5	7	12	N/A	Likely acceptable
50mm diameter PVC water pipe/far edge of the Edgewater Drive footpath	3	5	8	N/A	Likely acceptable

8 BASEMENT DRAINAGE DESIGN

Following discussions with the client, a drained basement is the preferred approach for the proposed development. The design may incorporate:

- A regular grid of subsoil drains with redundant flow paths
- A hardfill blanket covering the entire basement area

The drainage collector system will slope to a sump below basement level or be pumped out.

Approximate inflows to the excavation have been calculated, based on the estimation of steady state inflow rate to an open pit. This equation was derived from Thiem-Dupuit equation. Groundwater inflow was calculated by the following analytical equation presented by Krussenman and De Ridder (1976) and Singh et al.(1985).

$$Q = \frac{\pi K (H^2 - h^2)}{\ln\left(\frac{R}{r_p}\right)}$$

Where K is the permeability of the soil based on a baseline permeability of 5×10^{-7} m/s

H is the thickness of measured existing groundwater level to top of the transitional ECBF material

h is the thickness of excavation level to top of the transitional ECBF material

R is the radius of influence from the centre of the excavation

r_p is the equivalent well radius, calculated based on Singh and Reed (1988) method (for mines) as:

$$r = (2/\pi)(Y.W)^{1/2};$$

where: Y = length of mine (m)

W = width of mine (m)

The estimated baseline inflow is 9m³/day for Block A, an inflow range of 5m³/day to 15m³/day is recommended for preliminary design.

9 GROUNDWATER AND SETTLEMENT MONITORING CONTINGENCY PLAN

The proposed works will follow a prescribed construction sequence and monitoring is recommended to allow early review of ground response trends enabling early initiation of mitigation measures if these are required.

A draft construction monitoring and contingency plan (refer Appendix I) has been prepared and includes survey controls installed to monitor retaining wall deformation and potential building settlement due to ground excavation works. The Plan also indicates response procedures for reporting and potential mitigation measures should the alert or trigger levels be exceeded. The draft plan may required updating during the detailed design process.

10 FURTHER WORK

We understand at this stage that the proposed development will comprise Buildings founded on piles with single level basement. If significant changes (such as changes in retaining wall type or a foundation system not mentioned in this report) are proposed, we must be given an opportunity to review the updated drawings and reserve the right to revisit our evaluations and recommendations when they come to hand.

Borehole information has been extrapolated due to constraints from existing structures and property access. Further investigations are recommended during detailed design / building consent to confirm the ground model where conditions have been inferred by extrapolation, in order to reduce unforeseen ground condition risks during construction. Further investigations are recommended as part of a detailed design process.

Further, we should be given every opportunity to observe the construction works including (but not limited to) site stripping, earthworks operations, subgrade formation and all retaining wall and foundation/pile excavations to ensure the design parameters given in this report are valid. At the successful completion of these inspections we would then be in a position to provide a Producer Statement (PS4), if this is a requirement of a future building consent.

11 LIMITATIONS

This report has been prepared exclusively for A & L Sargeant Ltd in accordance with the brief given to us or the agreed scope and they will be deemed the exclusive owner on full and final payment of the invoice. Information, opinions, and recommendations contained within this report can only be used for the purposes with which it was intended. LDE accepts no liability or responsibility whatsoever for any use or reliance on the report by any party other than the owner or parties working for or on behalf of the owner, such as local authorities, and for purposes beyond those for which it was intended.

This report was prepared in general accordance with current standards, codes and best practice at the time of this report. These may be subject to change.

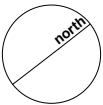
Opinions given in this report are based on visual methods and subsurface investigations at discrete locations designed to the constraints of the project scope to provide the best assessment of the environment. It must be appreciated that the nature and continuity of the subsurface materials between these locations are inferred and that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from those described in this report.

APPENDIX A

SUPPLIED DRAWINGS

2114 - Ambridge Rose



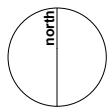


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RC-0-100	Cover Page		Author	Checker	Landscape	A1	0-000 GENERAL
RC-0-101	Sheet List		CB	Checker	Landscape	A1	0-000 GENERAL
RC-001	DRAWING LIST		Author	Checker	Landscape	A1	0-000 GENERAL
RC-099	EXISTING BASEMENT FLOOR PLAN		Author	Checker	Landscape	A1	1-000 EXISTING CONDITIONS & SITE
RC-100	EXISTING GROUND FLOOR PLAN		Author	Checker	Landscape	A1	1-000 EXISTING CONDITIONS & SITE
RC-101	EXISTING LEVEL 1 FLOOR PLAN		Author	Checker	Landscape	A1	1-000 EXISTING CONDITIONS & SITE
RC-102	EXISTING LEVEL 2 FLOOR PLAN		Author	Checker	Landscape	A1	1-000 EXISTING CONDITIONS & SITE
RC-103	EXISTING LEVEL 3 FLOOR PLAN		Author	Checker	Landscape	A1	1-000 EXISTING CONDITIONS & SITE
RC-2-000	Location Plan		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-001	Proposed Site Plan - Roof Plan		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-002	Proposed Site Plan - Ground Floor		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-004	Controls Plan		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-010	SOLAR STUDY		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-011	SOLAR STUDY		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-012	Hour by hour - Spring Equinox		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-013	Hour by hour - Winter Solstice		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-014	Site Coverage		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-015	Height Control		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-2-016	HIRB Views		CB	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
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RC-004	REGULATORY CONTROLS		Author	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-030	SITE ELEVATIONS (OVERALL)		Author	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
RC-040	SITE SECTIONS (OVERALL)		Author	Checker	Landscape	A1	2-000 GA PLANS/SECTIONS & ELEVATIONS
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RC-2-101	Block A - Ground Floor Plan		CB	Checker	Landscape	A1	2-100 FLOOR PLANS
RC-2-102	Block A - Typical Floor Plan		CB	Checker	Landscape	A1	2-100 FLOOR PLANS
RC-2-103	Block A - Level 5 Floor Plan		CB	Checker	Landscape	A1	2-100 FLOOR PLANS
RC-2-105	Block B - Ground Floor Plan		CB	Checker	Landscape	A1	2-100 FLOOR PLANS
RC-2-106	Block B - Typical Floor plan		CB	Checker	Landscape	A1	2-100 FLOOR PLANS
RC-2-107	Block B - Level 4 Floor Plan		CB	Checker	Landscape	A1	2-100 FLOOR PLANS
RC-2-108	Block B - Level 5 Floor Plan		CB	Checker	Landscape	A1	2-100 FLOOR PLANS
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RC-3-110	Block A - Elevations		CB	Checker	Landscape	A1	3-100 ELEVATIONS - GA
RC-3-111	Block A - Elevations		CB	Checker	Landscape	A1	3-100 ELEVATIONS - GA
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RC-3-116	Block B - Elevations		CB	Checker	Landscape	A1	3-100 ELEVATIONS - GA
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RC-301	PROPOSED ELEVATION 2 (inc. MATERIALITY)		Author	Checker	Landscape	A1	3-100 ELEVATIONS - GA
RC-310	MATERIAL PALLETTE		Author	Checker	Landscape	A1	3-100 ELEVATIONS - GA
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RC-3-210	Block A - Sections		CB	Checker	Landscape	A1	3-200 SECTIONS - GA
RC-3-211	Block B - Sections		CB	Checker	Landscape	A1	3-200 SECTIONS - GA
RC-400	PROPOSED SECTION (if required)		Author	Checker	Landscape	A1	3-200 SECTIONS - GA
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RC-602	SOLAR STUDY 3		Author	Checker	Landscape	A1	9-000 3D VIEWS
60							



Location Plan
SCALE 1 : 500



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Location Plan
2114 - Ambridge Rose
147-153 Edgewater Drive
DRAFT

CB Checker

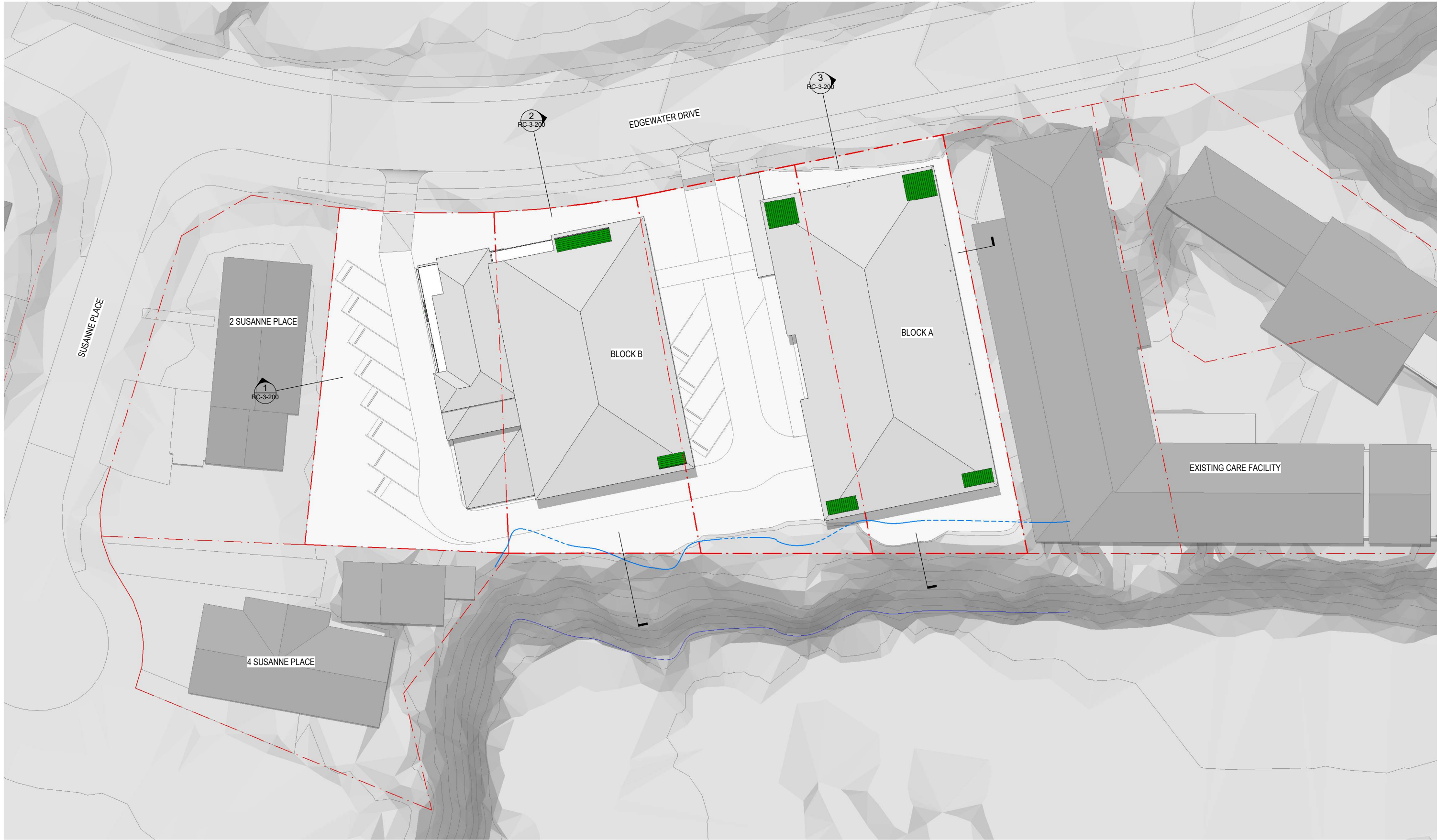
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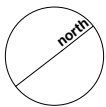
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1 Proposed Site Plan
SCALE 1 : 200



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Proposed Site Plan - Roof Plan
2114 - Ambridge Rose
147-153 Edgewater Drive

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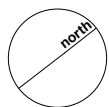
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1

Proposed Site Plan - Ground Floor
SCALE 1 : 200



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Proposed Site Plan - Ground Floor
2114 - Ambridge Rose
147-153 Edgewater Drive

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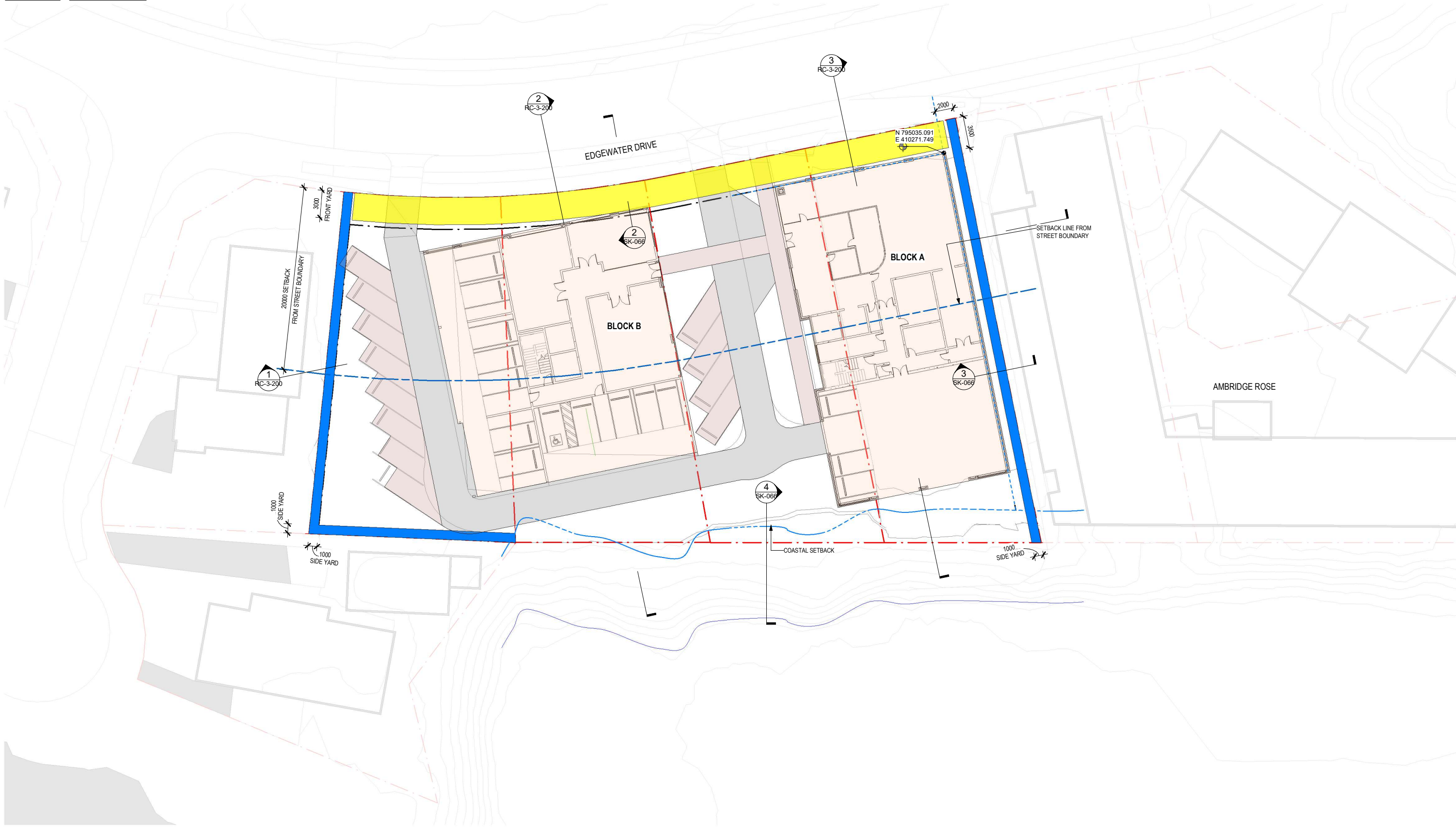
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LEGEND	
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	SIDE YARD - 1m. MIN.
	PROPERTY BOUNDARY
	BOUNDARY SETBACK LINE

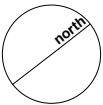


1

Controls Site Plan

RC-3-100

SCALE 1 : 200



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Controls Plan
2114 - Ambridge Rose
147-153 Edgewater Drive

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SHEET NUMBER:

2114 - RC-2-004

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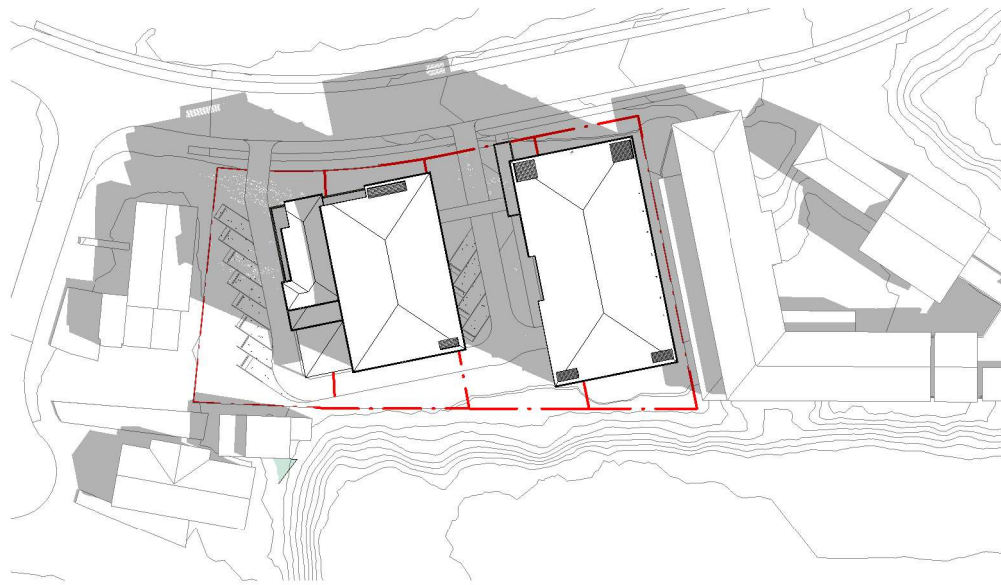
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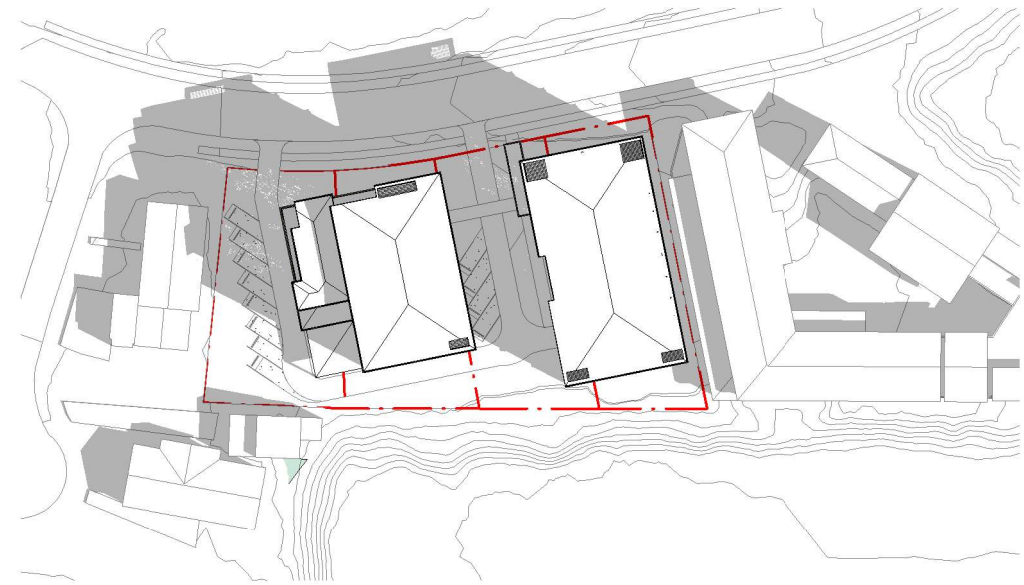
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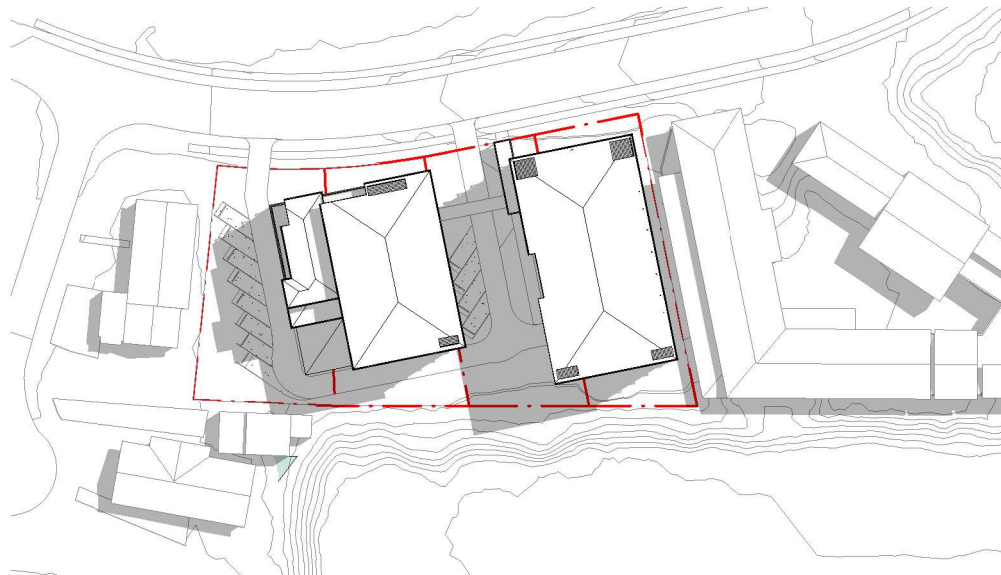
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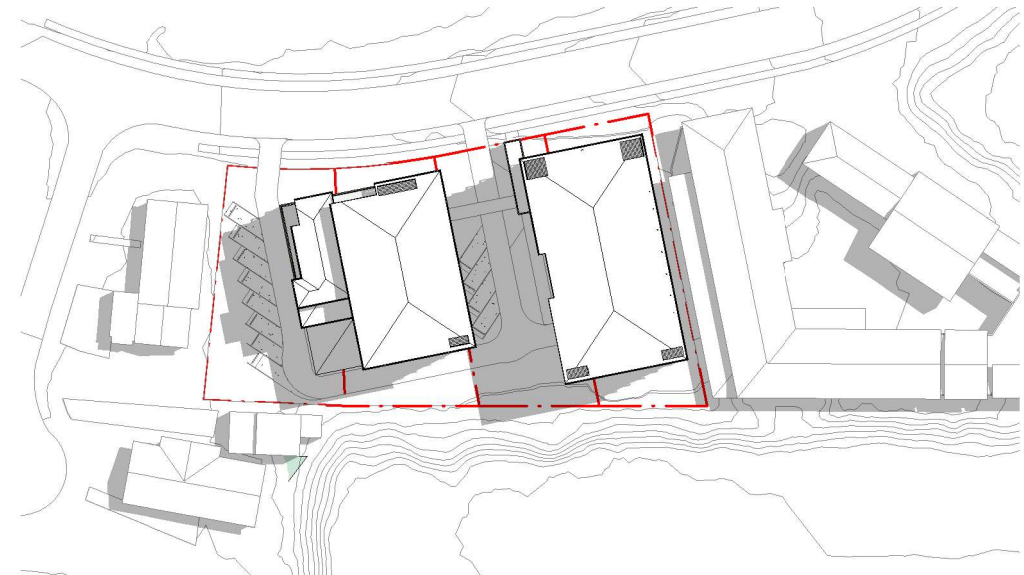
RC - SOLAR STUDY - 20 SEPTEMBER 9am - SPRING EQUINOX



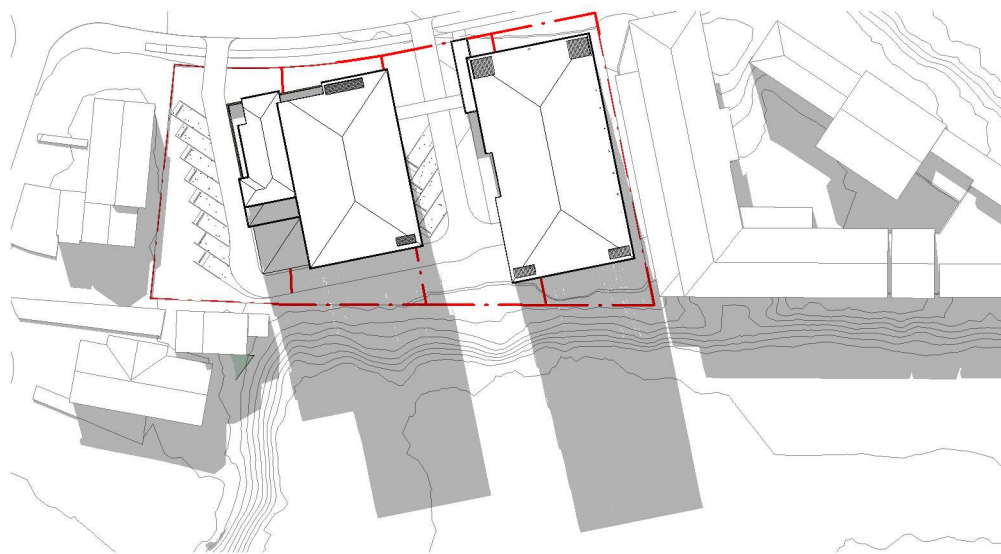
RC - SOLAR STUDY - 20 MARCH 9am - AUTUMN EQUINOX



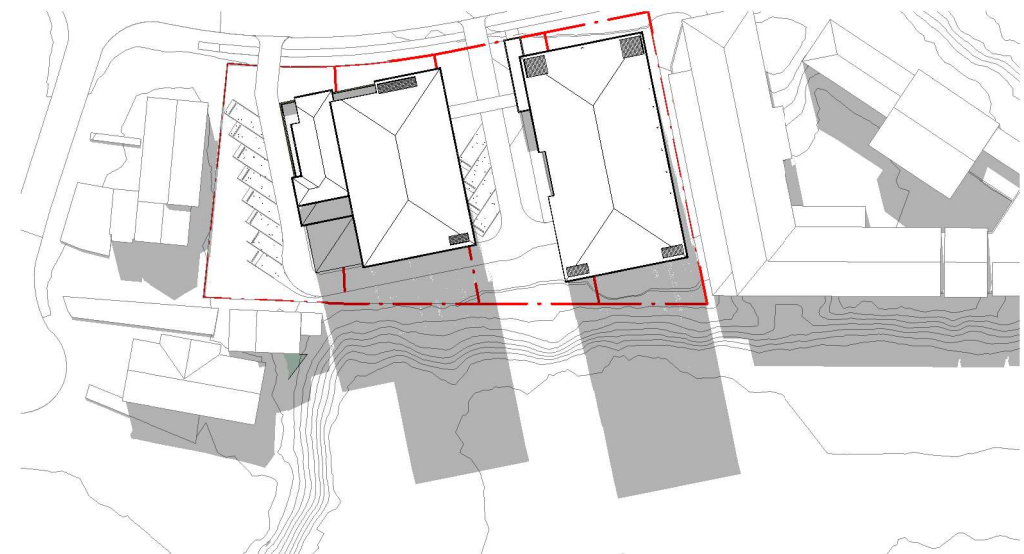
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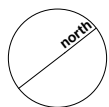
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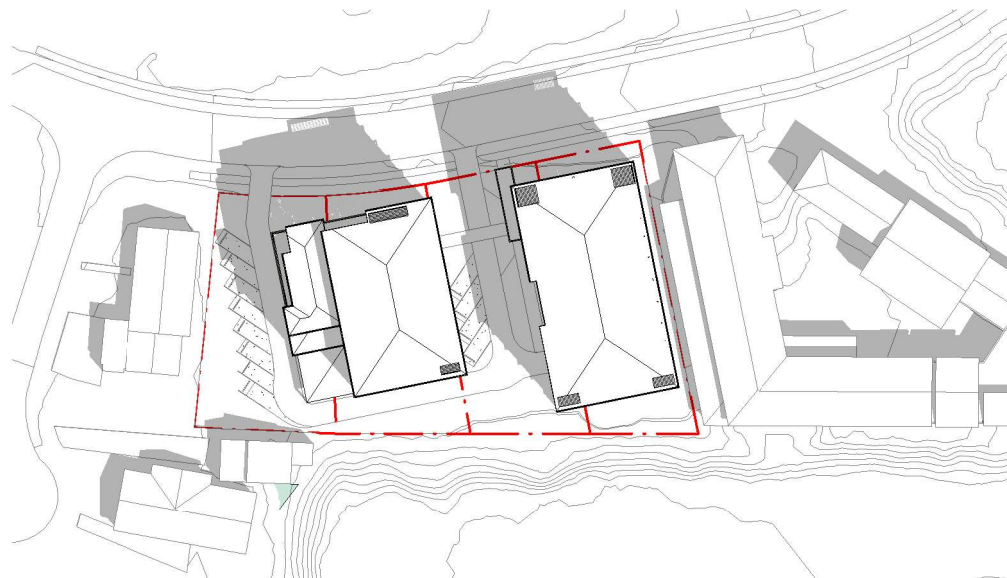
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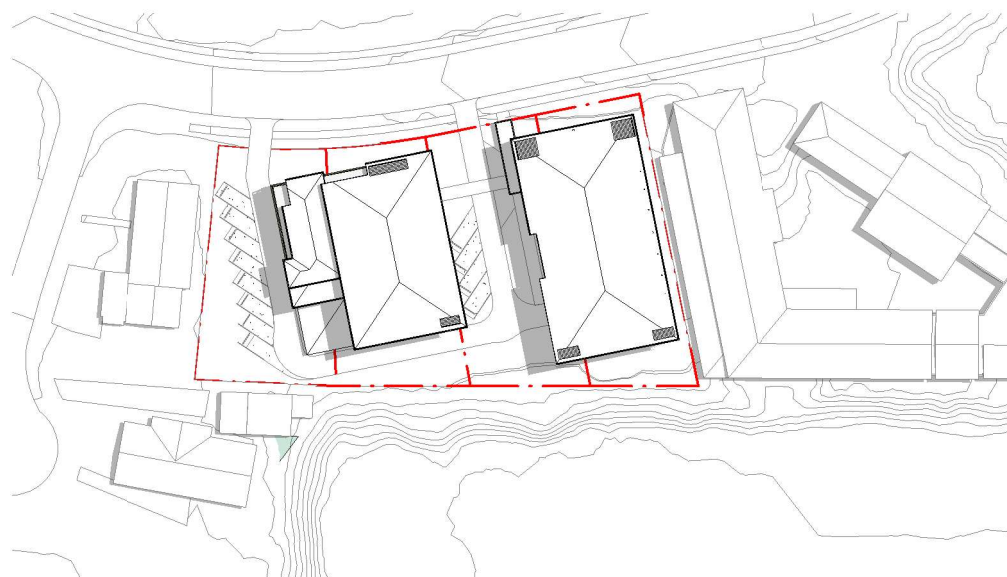
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PLEASE REFER PT DESIGN REPORT
FOR COMPARATIVE SHADING
STUDIES OF A COMPLIANT BUILDING



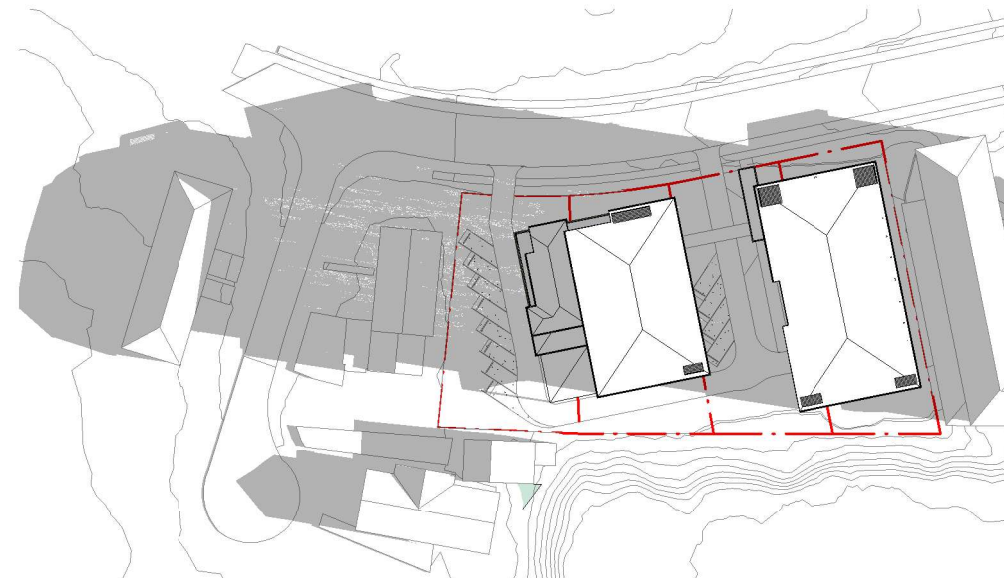
RC - SOLAR STUDY - 20 DECEMBER 9am - SUMMER SOLSTICE



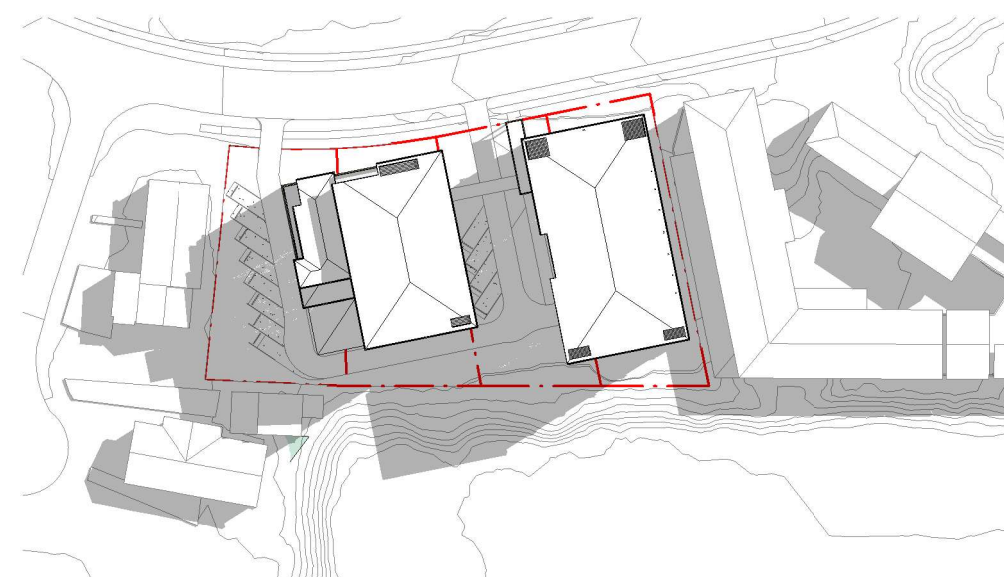
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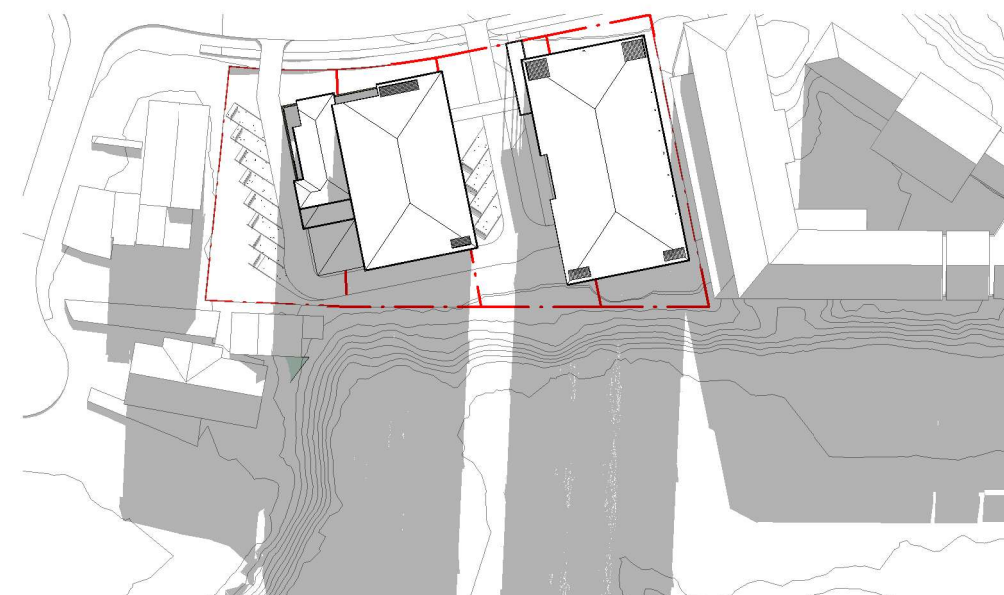
RC - SOLAR STUDY - 20 DECEMBER 4pm - SUMMER SOLSTICE



RC - SOLAR STUDY - 20 JUNE 9am - WINTER SOLSTICE

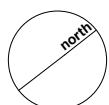


RC - SOLAR STUDY - 20 JUNE 12pm - WINTER SOLSTICE



RC - SOLAR STUDY - 20 JUNE 4pm - WINTER SOLSTICE

CB Checker



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SOLAR STUDY
2114 - Ambridge Rose
147-153 Edgewater Drive

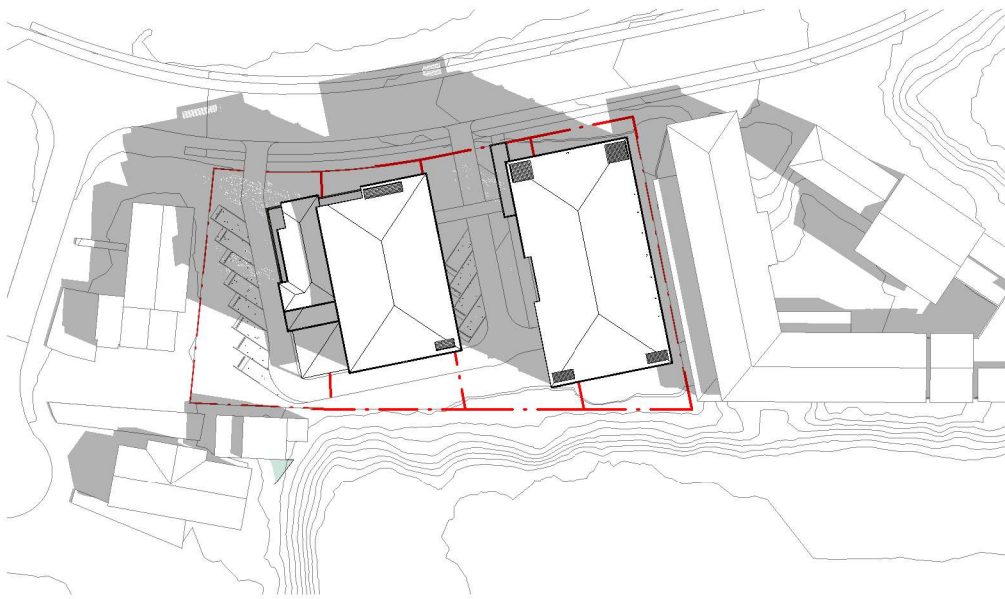
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2114 - RC-2-011

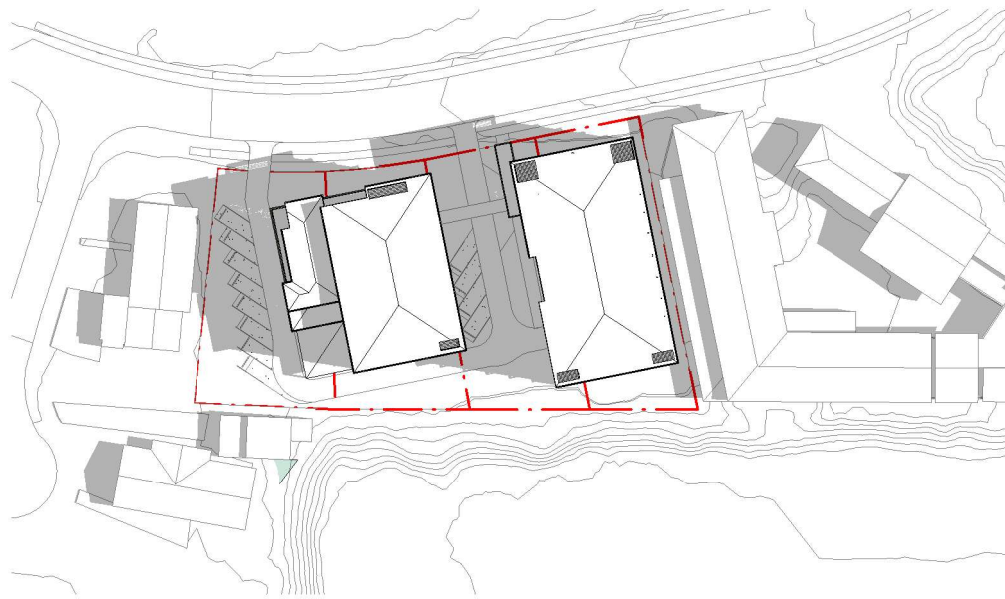
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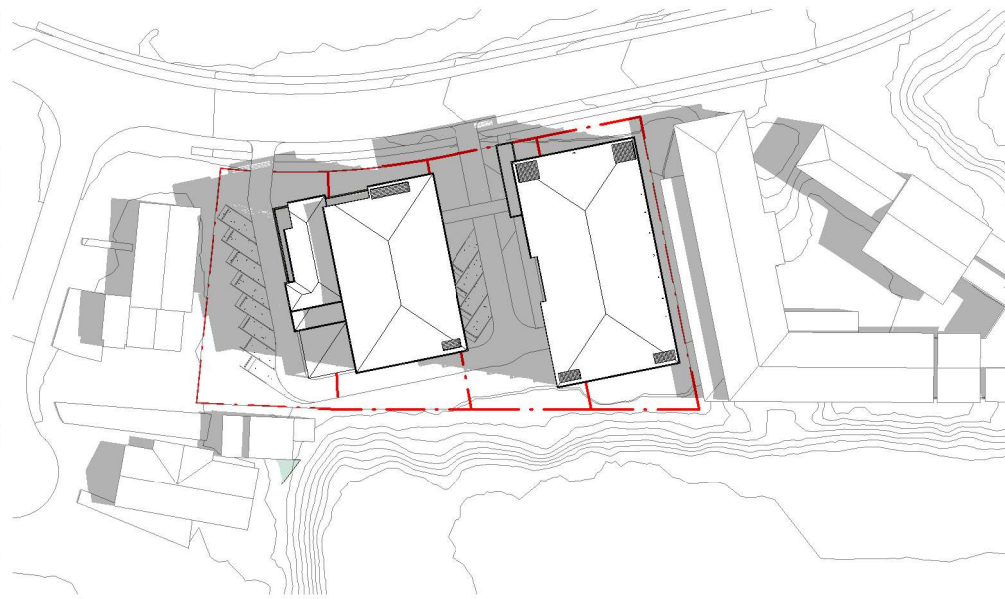
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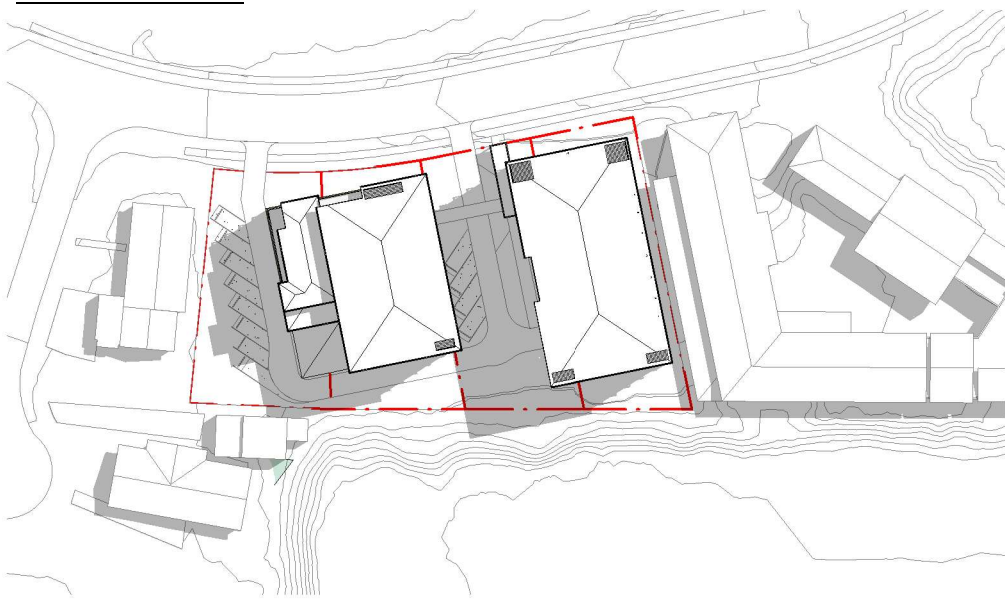
RC - hbh - SE 9am



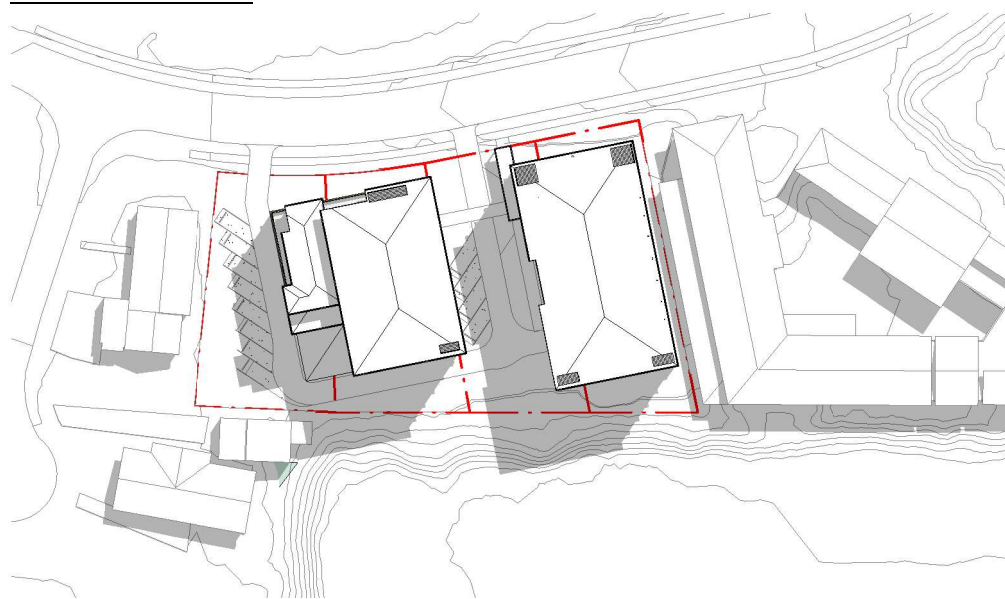
RC - hbh - SE 10am



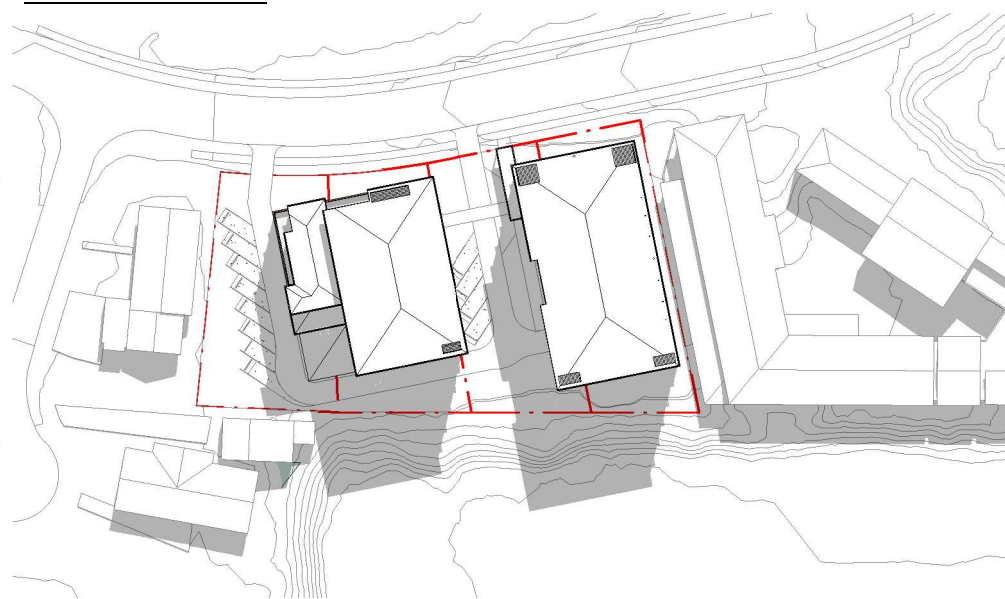
RC - hbh - SE 11am



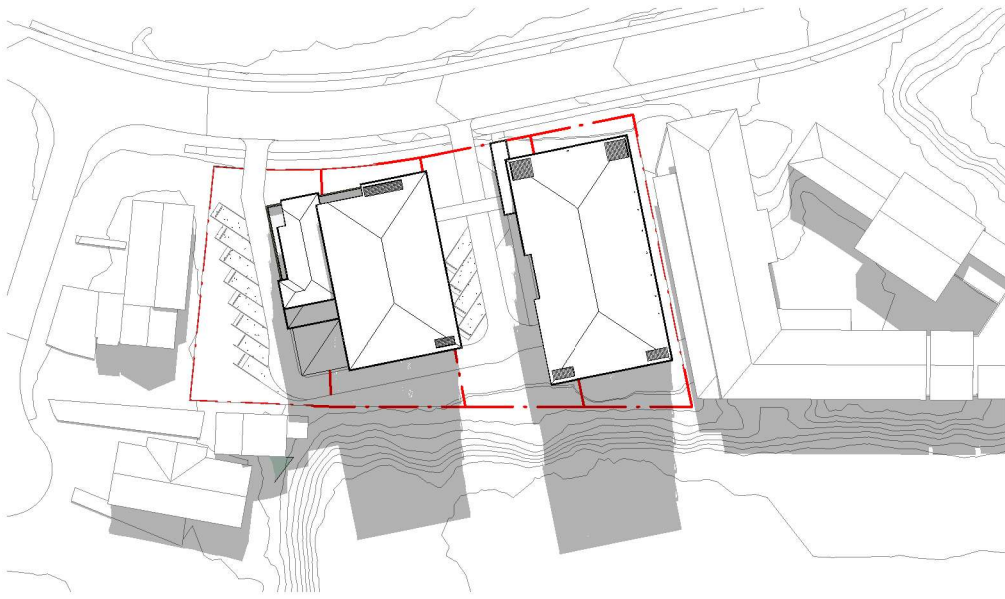
RC - hbh - SE 12pm



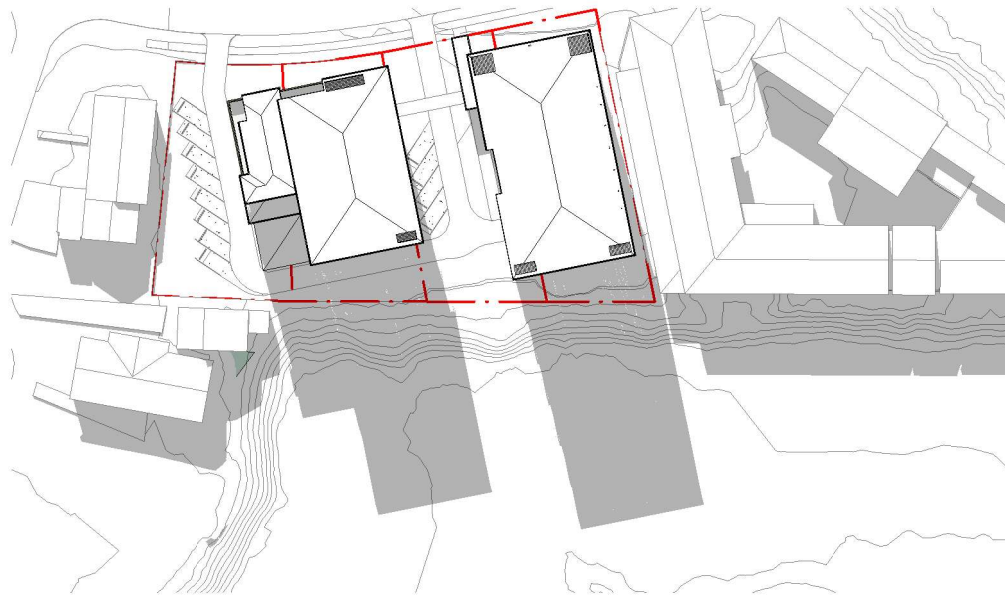
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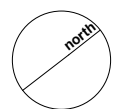
RC - hbh - SE 2pm



RC - hbh - SE 3pm



RC - hbh - SE 4pm



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Hour by hour - Spring Equinox
2114 - Ambridge Rose
147-153 Edgewater Drive

CB Checker

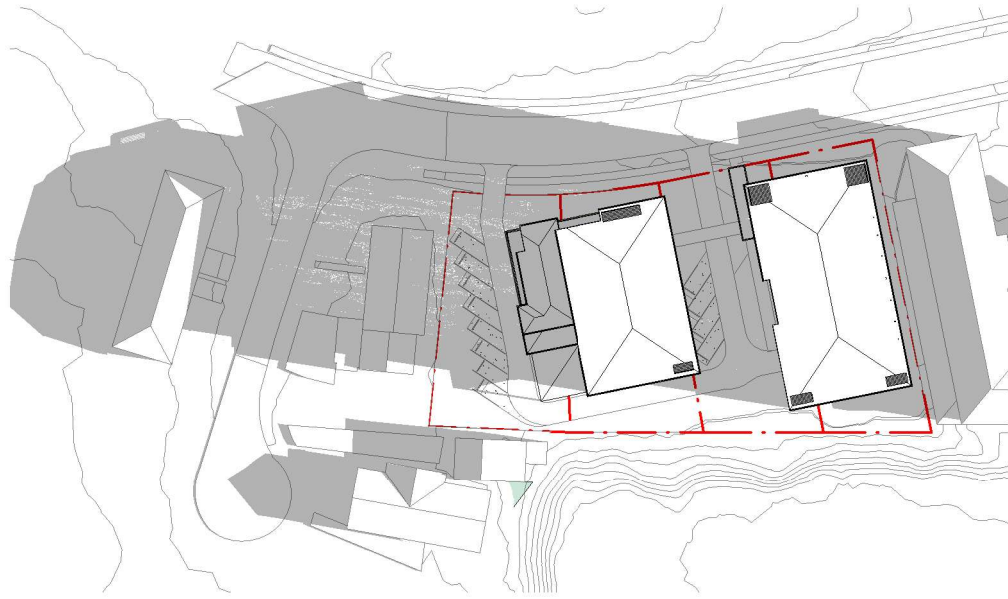
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2114 - RC-2-012

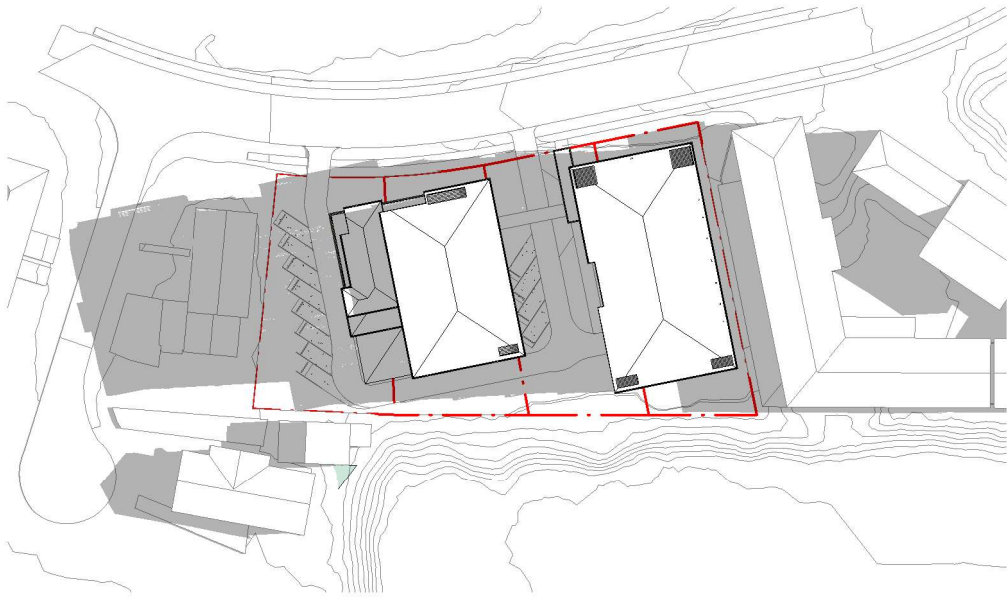
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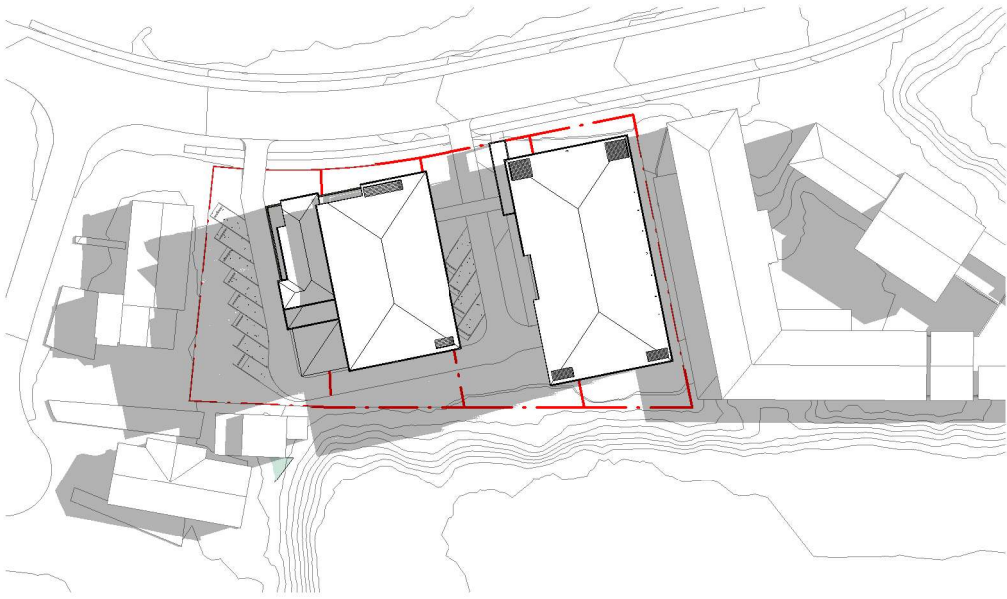
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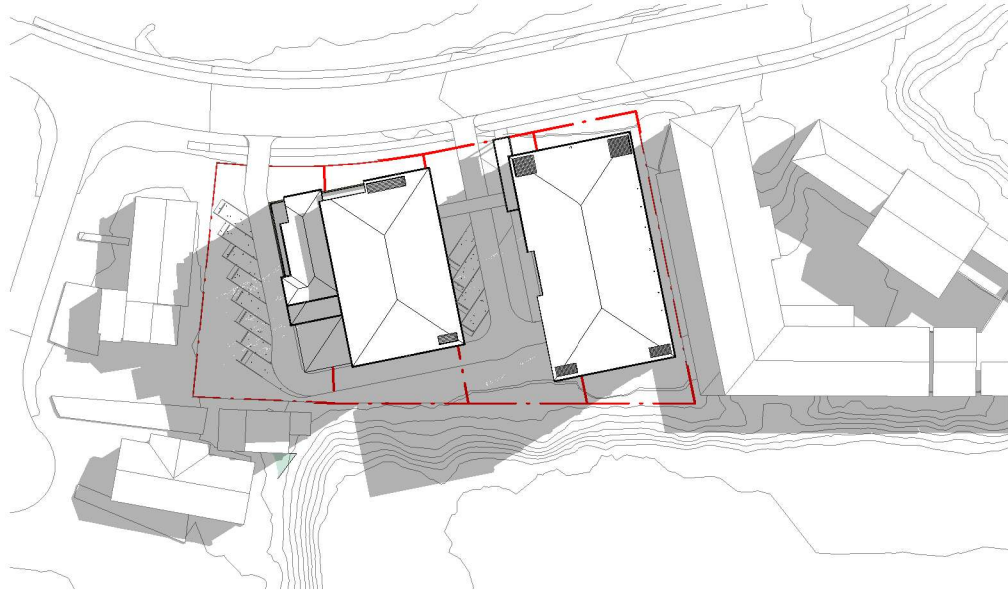
RC - hbh - WS 9am



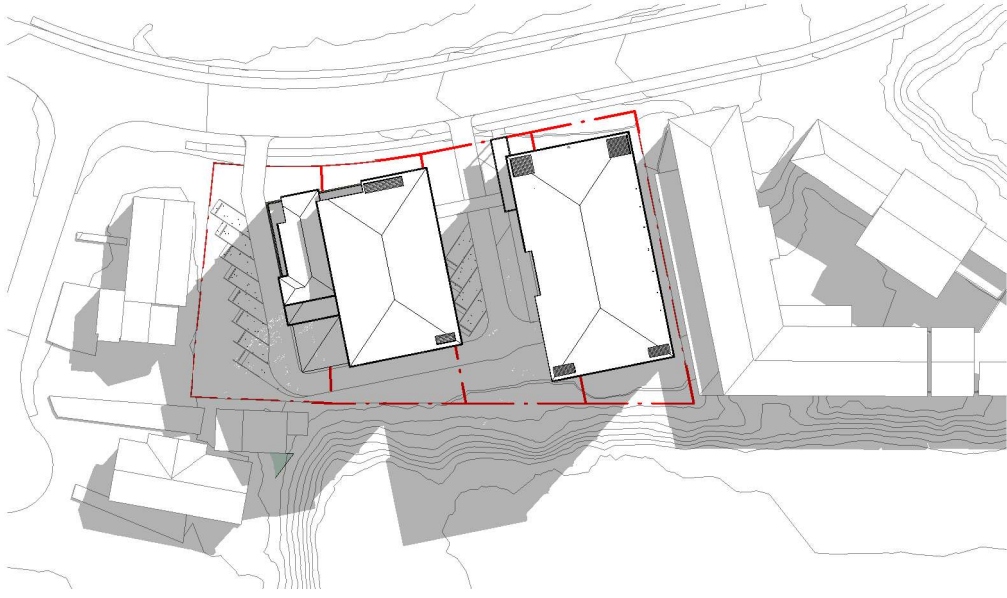
RC - hbh - WS 10am



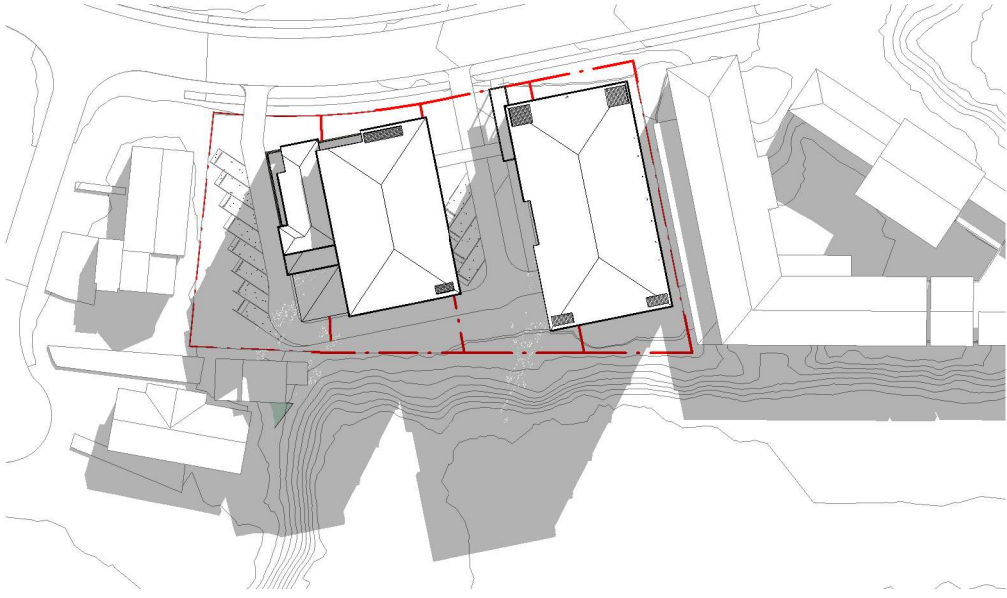
RC - hbh - WS 11am



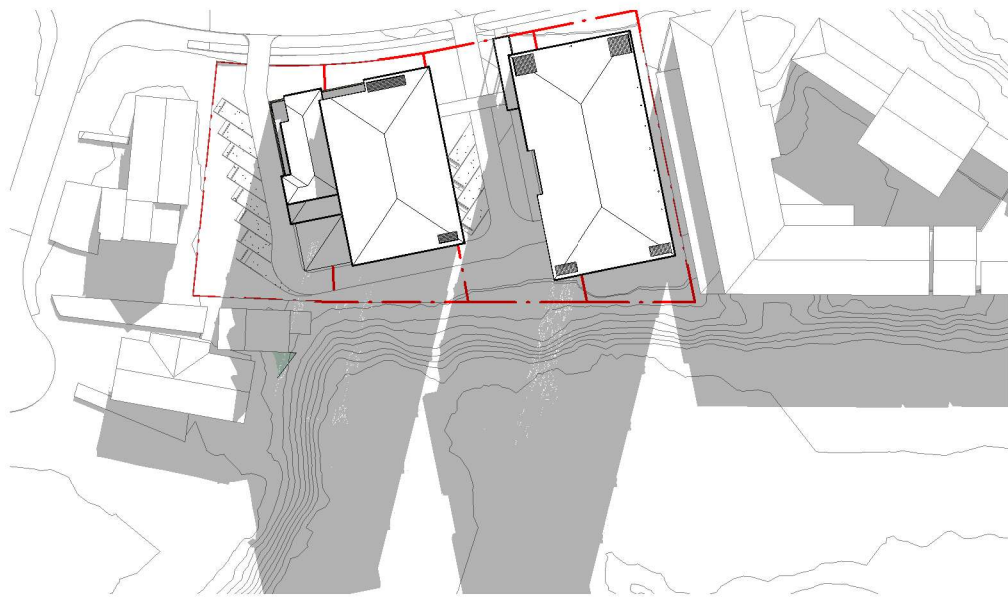
RC - hbh - WS 12pm



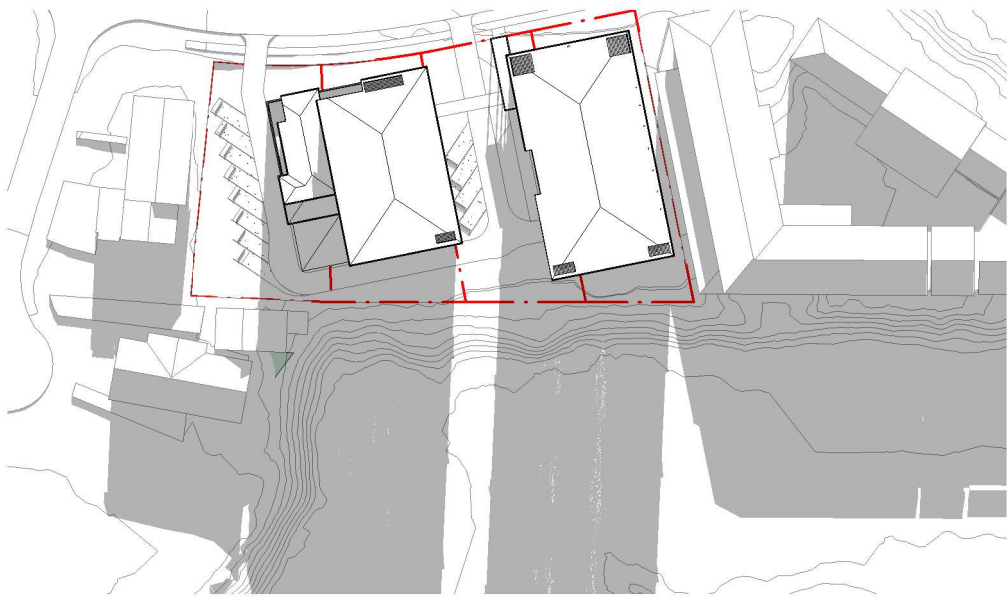
RC - hbh - WS 1pm



RC - hbh - WS 2pm



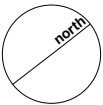
RC - hbh - WS 3pm



RC - hbh - WS 4pm

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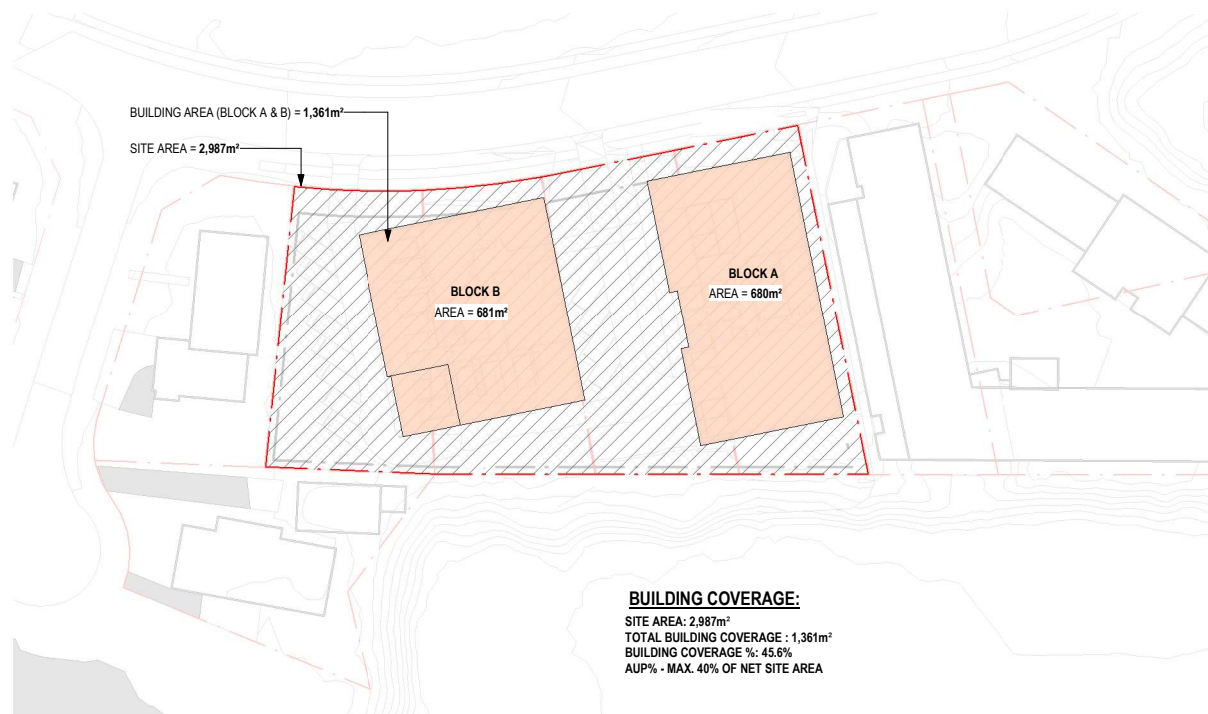
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Hour by hour - Winter Solstice
2114 - Ambridge Rose
147-153 Edgewater Drive

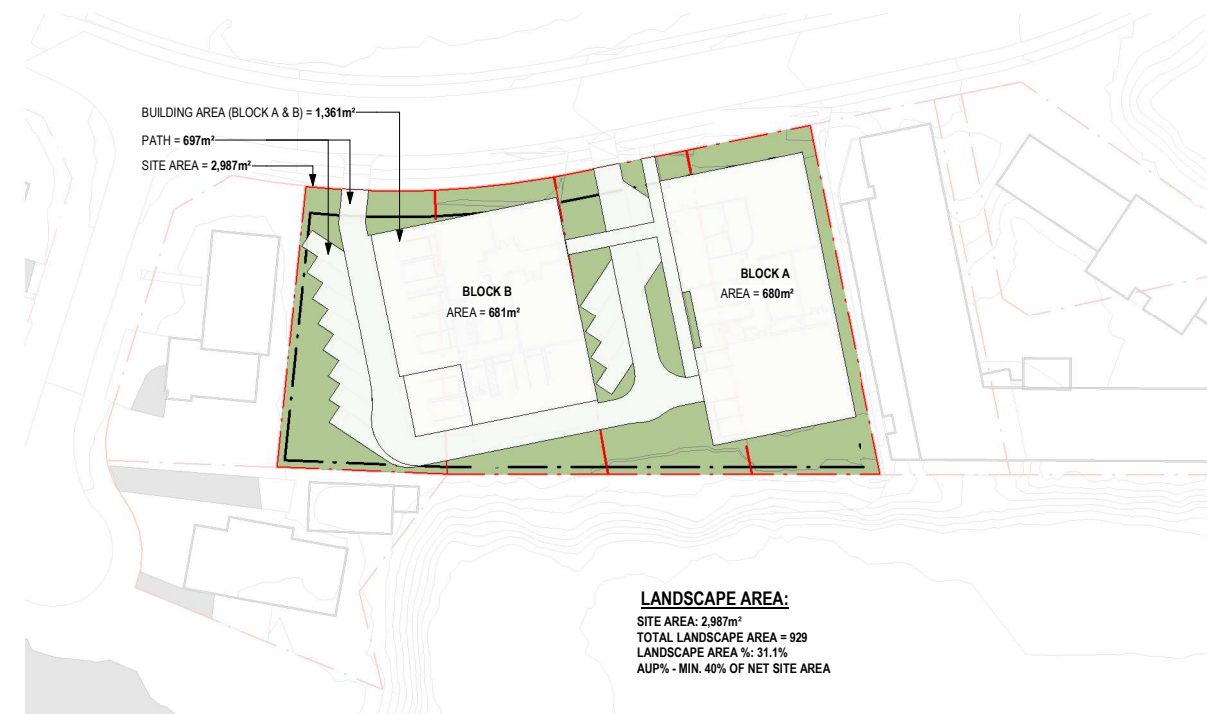
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2114 - RC-2-013

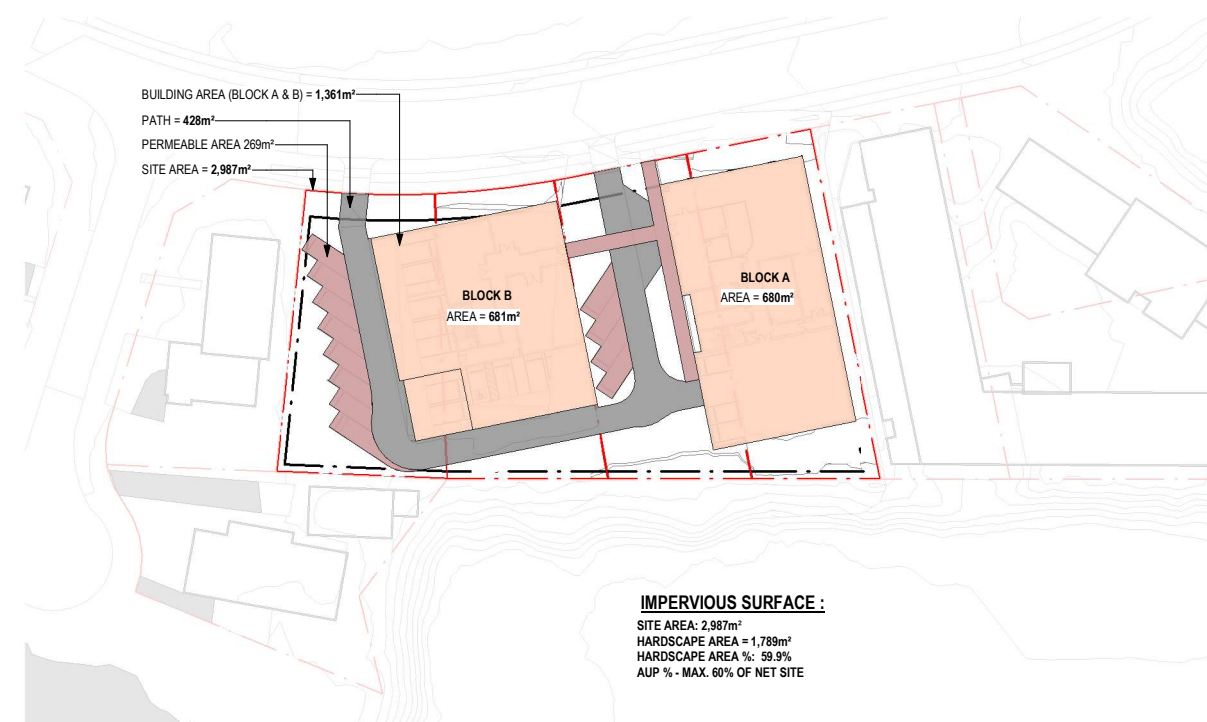
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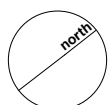
1 PROPOSED PLAN - BUILDING COVERAGE AREA
 RC-3-100 SCALE 1 : 500



2 PROPOSED PLAN - LANDSCAPE AREA
 RC-3-100 SCALE 1 : 500

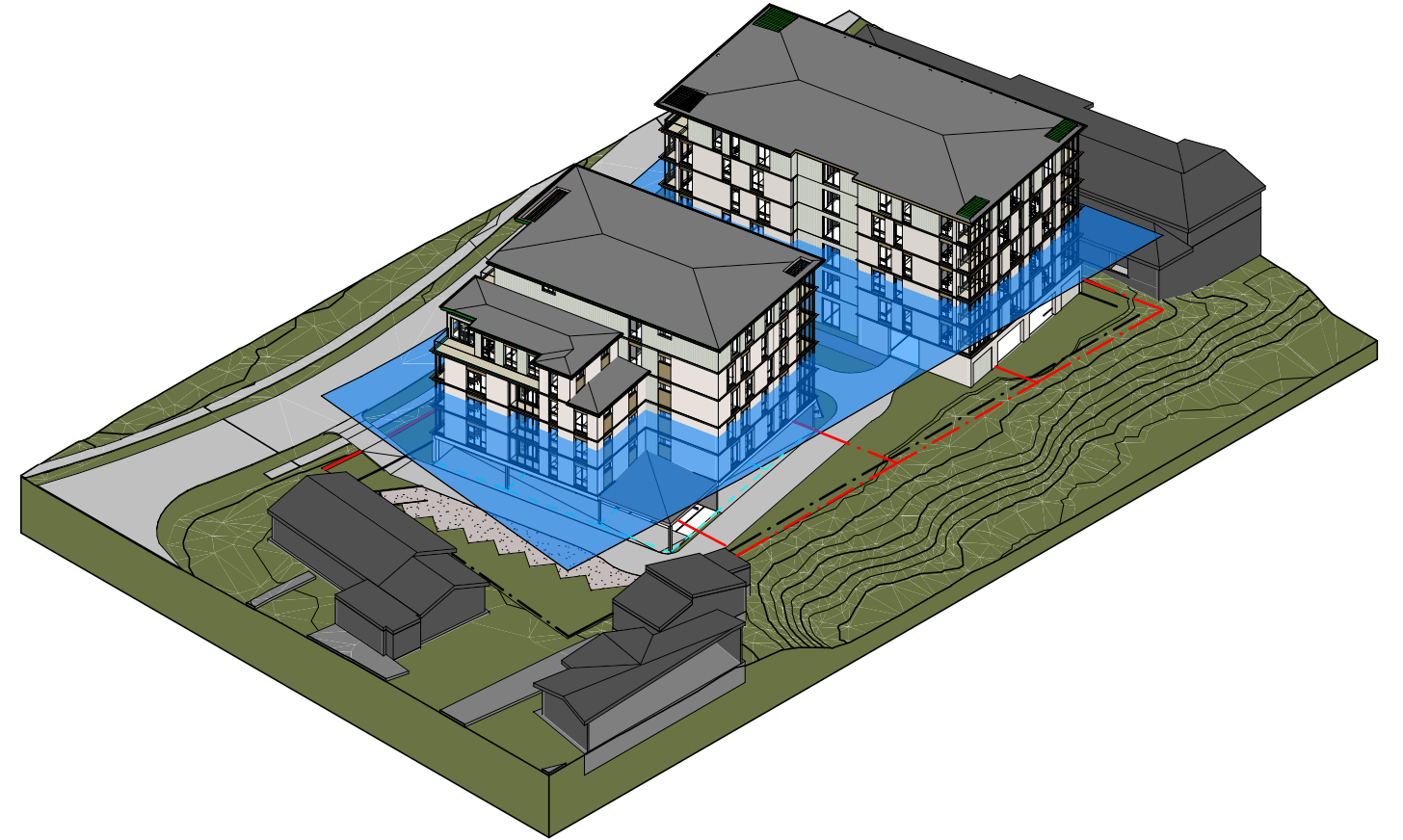


3 PROPOSED PLAN - IMPERVIOUS SURFACES
 RC-3-100 SCALE 1 : 500

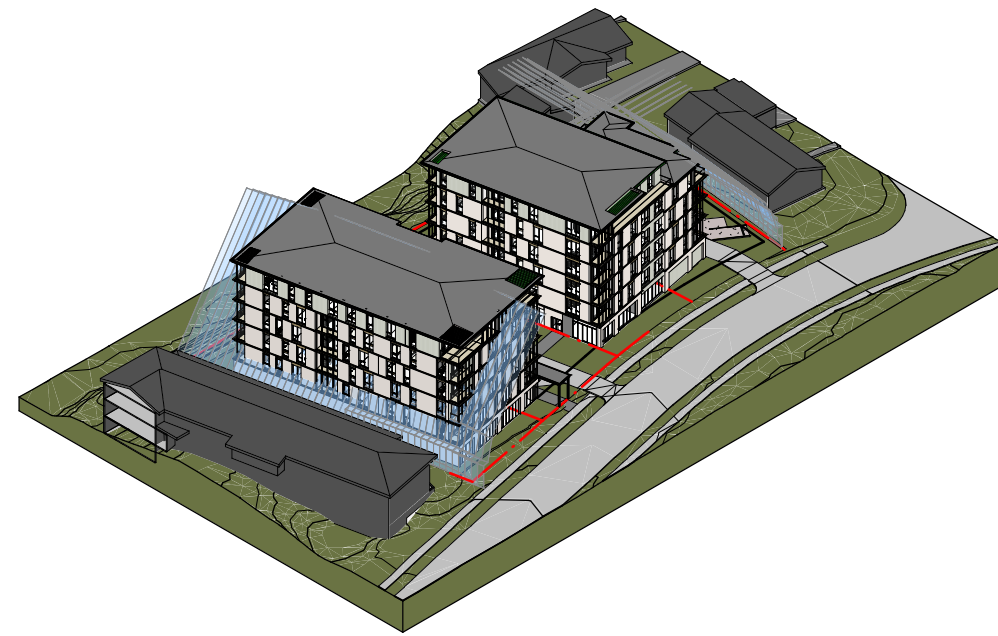




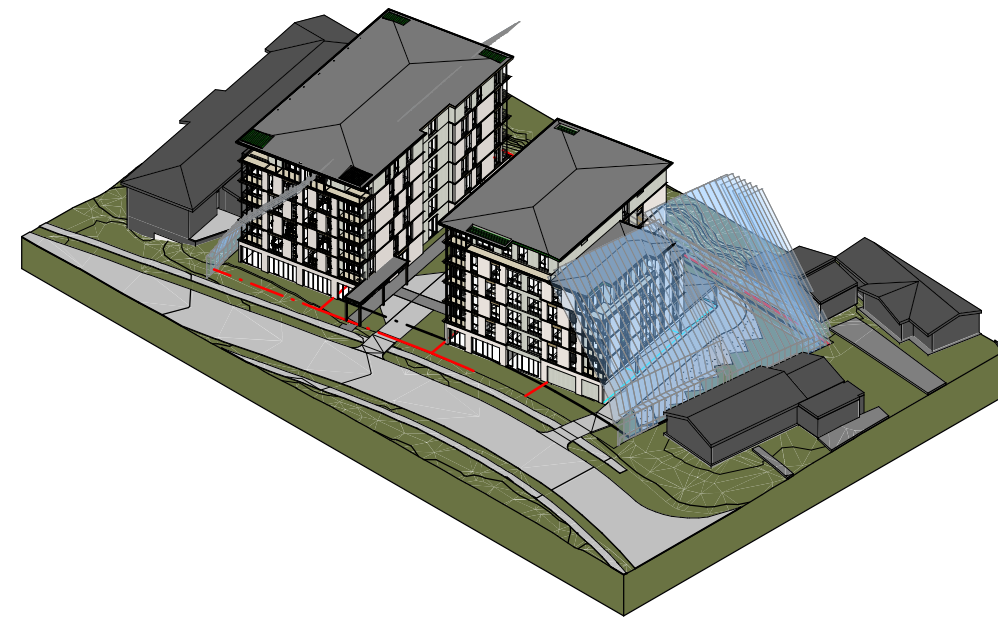
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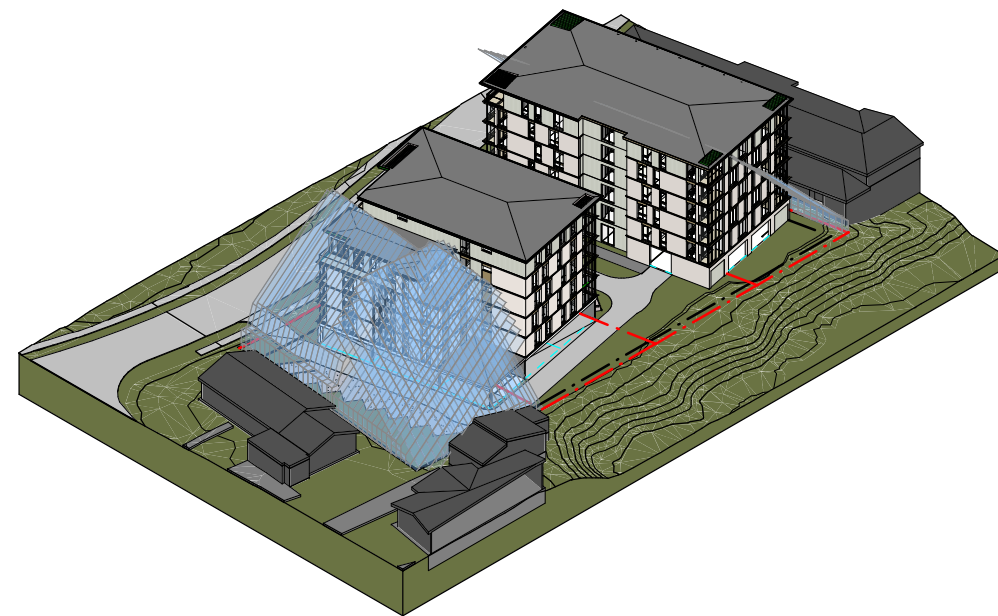
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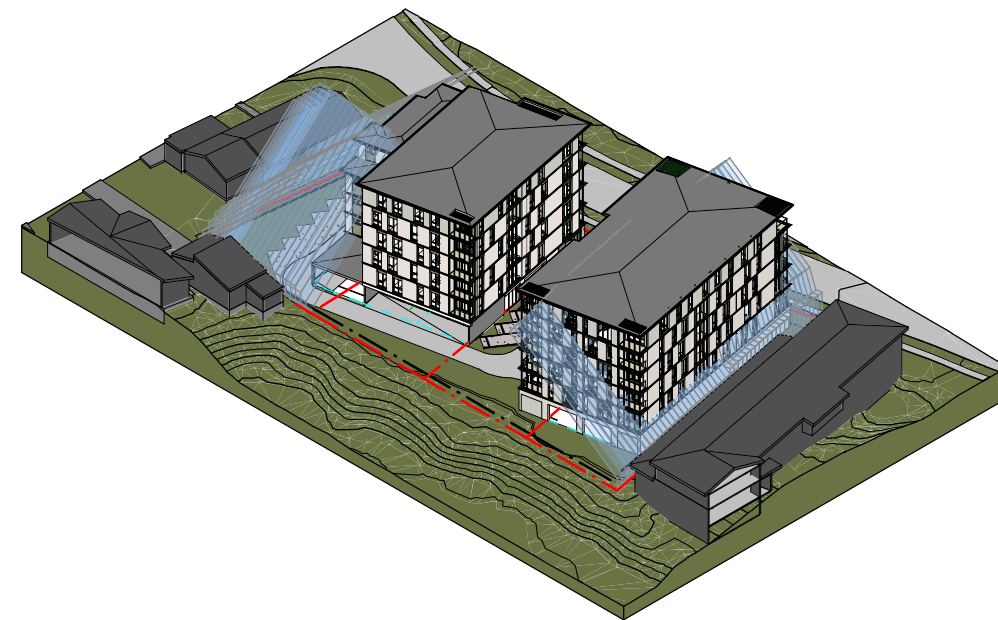
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HIRB 3D - 02

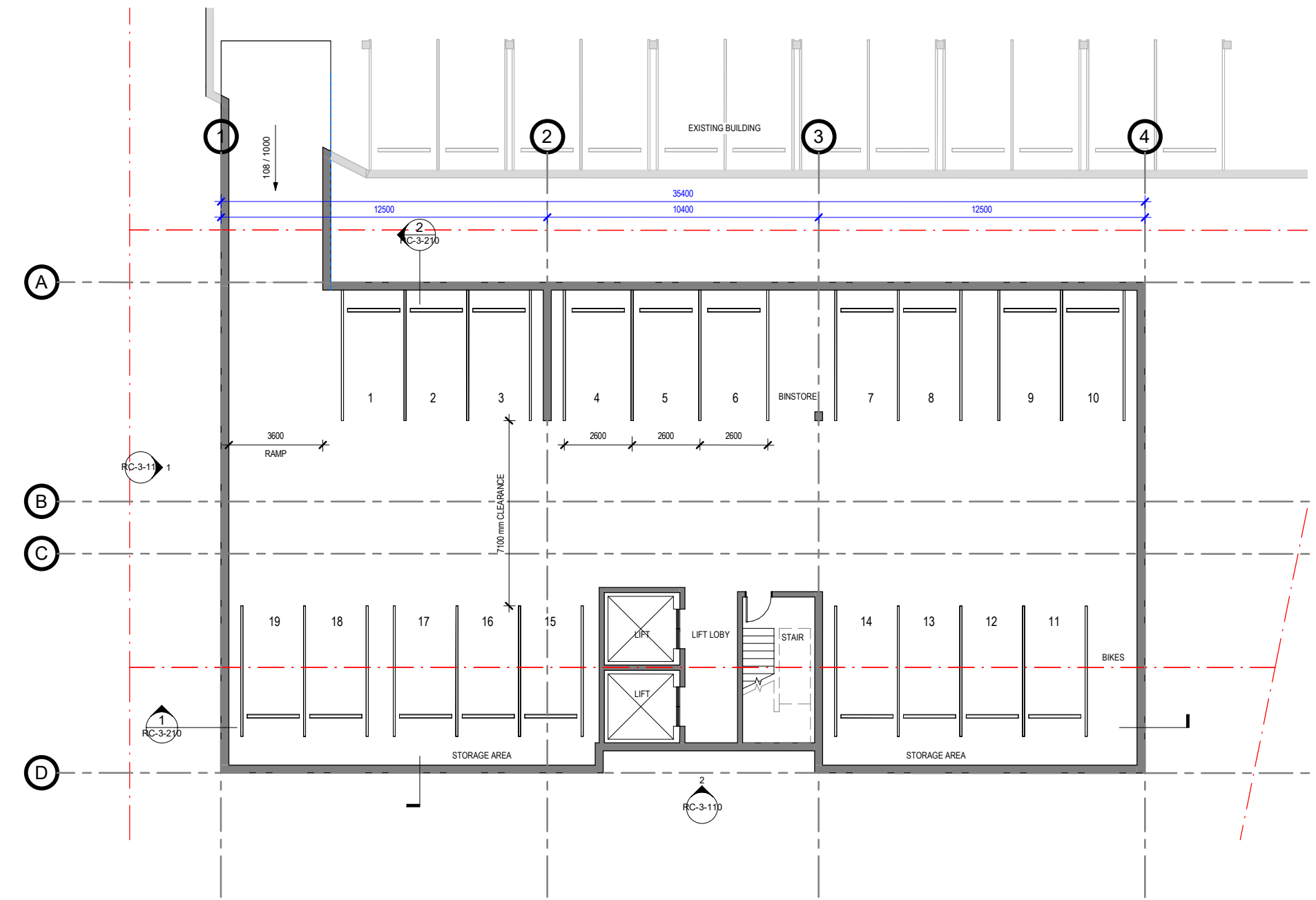


HIRB 3D - 03



HIRB 3D - 04

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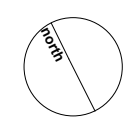


TOTAL GFA - BLOCK A		
Level	Name	Area
BASEMENT	BLOCK A - COMMON AREAS	659 m²
	BLOCK A - APARTMENTS	659 m²
GROUND FLOOR	BLOCK A - COMMON AREAS	677 m²
	BLOCK A - APARTMENTS	677 m²
LEVEL 1	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 2	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 3	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 4	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 5	BLOCK A - COMMON AREAS	113 m²
	BLOCK A - APARTMENTS	561 m²
TOTAL		4715 m²

*COMMON AREAS INCLUDE SERVICES/CIRCULATION/CARPARKS.

1 Block A - Basement Plan
SCALE 1 : 100

CB Checker

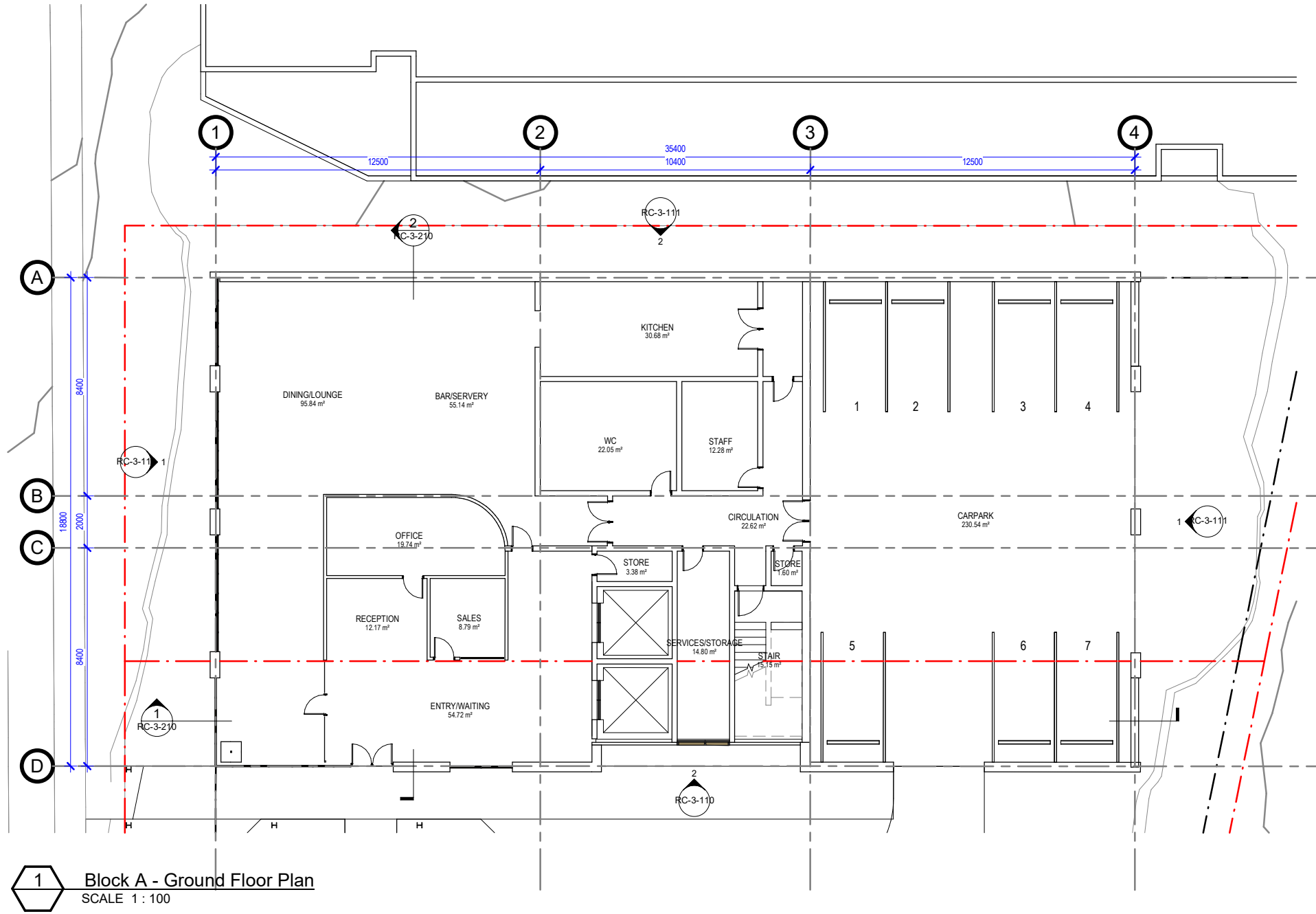


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Block A - Basement Plan
2114 - Ambridge Rose
147-153 Edgewater Drive

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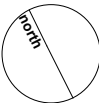
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TOTAL GFA - BLOCK A		
Level	Name	Area
BASEMENT	BLOCK A - COMMON AREAS	659 m²
		659 m²
GROUND FLOOR	BLOCK A - COMMON AREAS	677 m²
		677 m²
LEVEL 1	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 2	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 3	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 4	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 5	BLOCK A - COMMON AREAS	113 m²
	BLOCK A - APARTMENTS	561 m²
TOTAL		4715 m²

*COMMON AREAS INCLUDE SERVICES/CIRCULATION/CARPARKS.

CB Checker

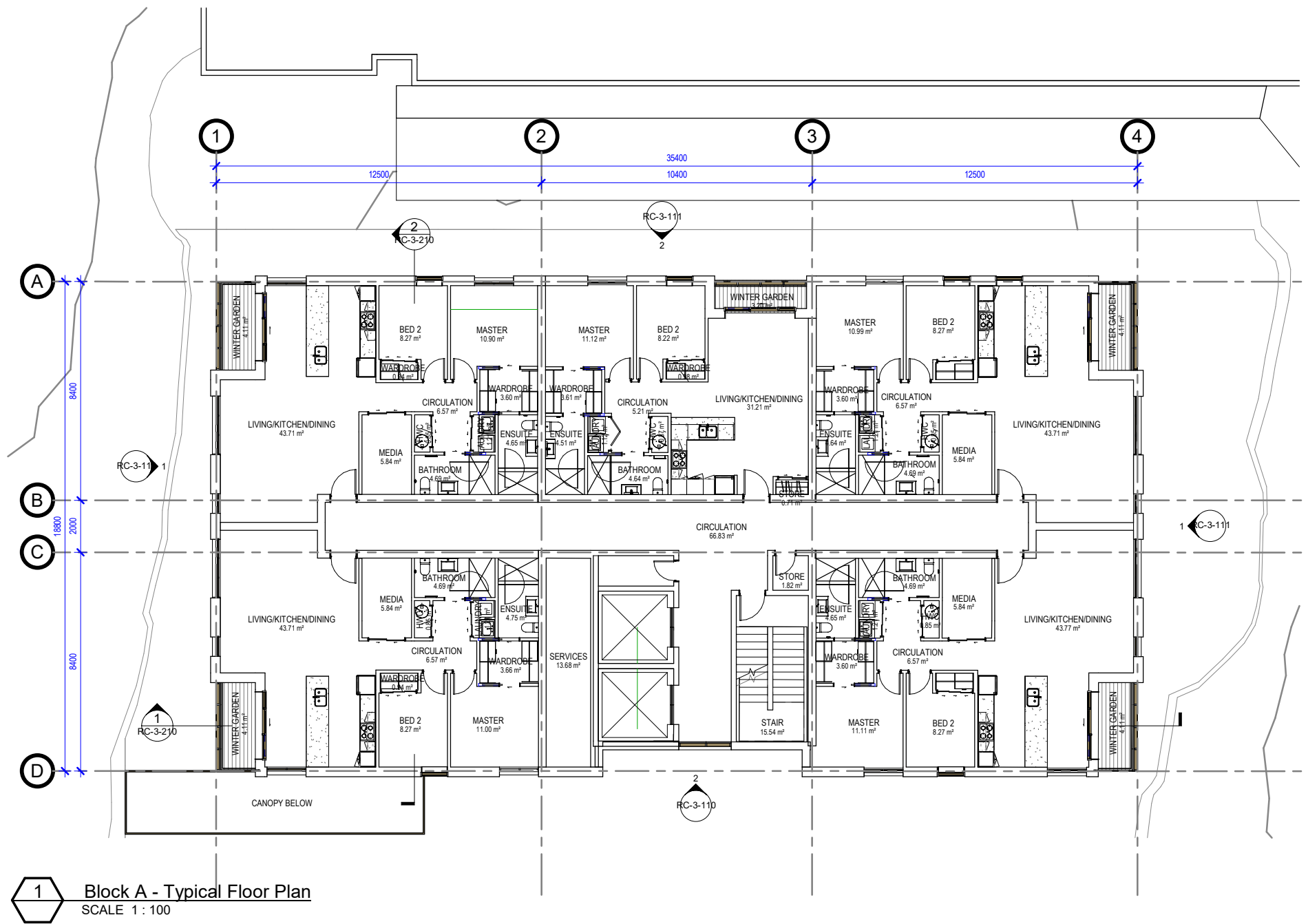


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Block A - Ground Floor Plan
2114 - Ambridge Rose
147-153 Edgewater Drive

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TOTAL GFA - BLOCK A		
Level	Name	Area
BASEMENT	BLOCK A - COMMON AREAS	659 m²
GROUND FLOOR	BLOCK A - COMMON AREAS	659 m²
		677 m²
LEVEL 1	BLOCK A - COMMON AREAS	139 m²
LEVEL 1	BLOCK A - APARTMENTS	537 m²
		676 m²
LEVEL 2	BLOCK A - COMMON AREAS	139 m²
LEVEL 2	BLOCK A - APARTMENTS	537 m²
		676 m²
LEVEL 3	BLOCK A - COMMON AREAS	139 m²
LEVEL 3	BLOCK A - APARTMENTS	537 m²
		676 m²
LEVEL 4	BLOCK A - COMMON AREAS	139 m²
LEVEL 4	BLOCK A - APARTMENTS	537 m²
		676 m²
LEVEL 5	BLOCK A - COMMON AREAS	113 m²
LEVEL 5	BLOCK A - APARTMENTS	561 m²
		674 m²
TOTAL		4715 m²

*COMMON AREAS INCLUDE SERVICES/CIRCULATION/CARPARKS.

APARTMENT SCHEDULE - BLOCK A		
Level	Name	Area
LEVEL 1	BLOCK A - 2 BED - TYPE A	88 m²
LEVEL 1	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 1	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 1	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 1	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 2	BLOCK A - 2 BED - TYPE A	88 m²
LEVEL 2	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 2	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 2	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 2	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 3	BLOCK A - 2 BED - TYPE A	88 m²
LEVEL 3	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 3	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 3	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 3	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 4	BLOCK A - 2 BED - TYPE A	88 m²
LEVEL 4	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 4	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 4	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 4	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 5	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 5	BLOCK A - 3 BED - TYPE B	156 m²
LEVEL 5	BLOCK A - 2 BED PLUS - TYPE C	157 m²
LEVEL 5	BLOCK A - 3 BED - TYPE A	160 m²
TOTAL APARTMENTS: 24		

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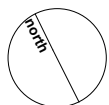
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2114 - - RC-2-102

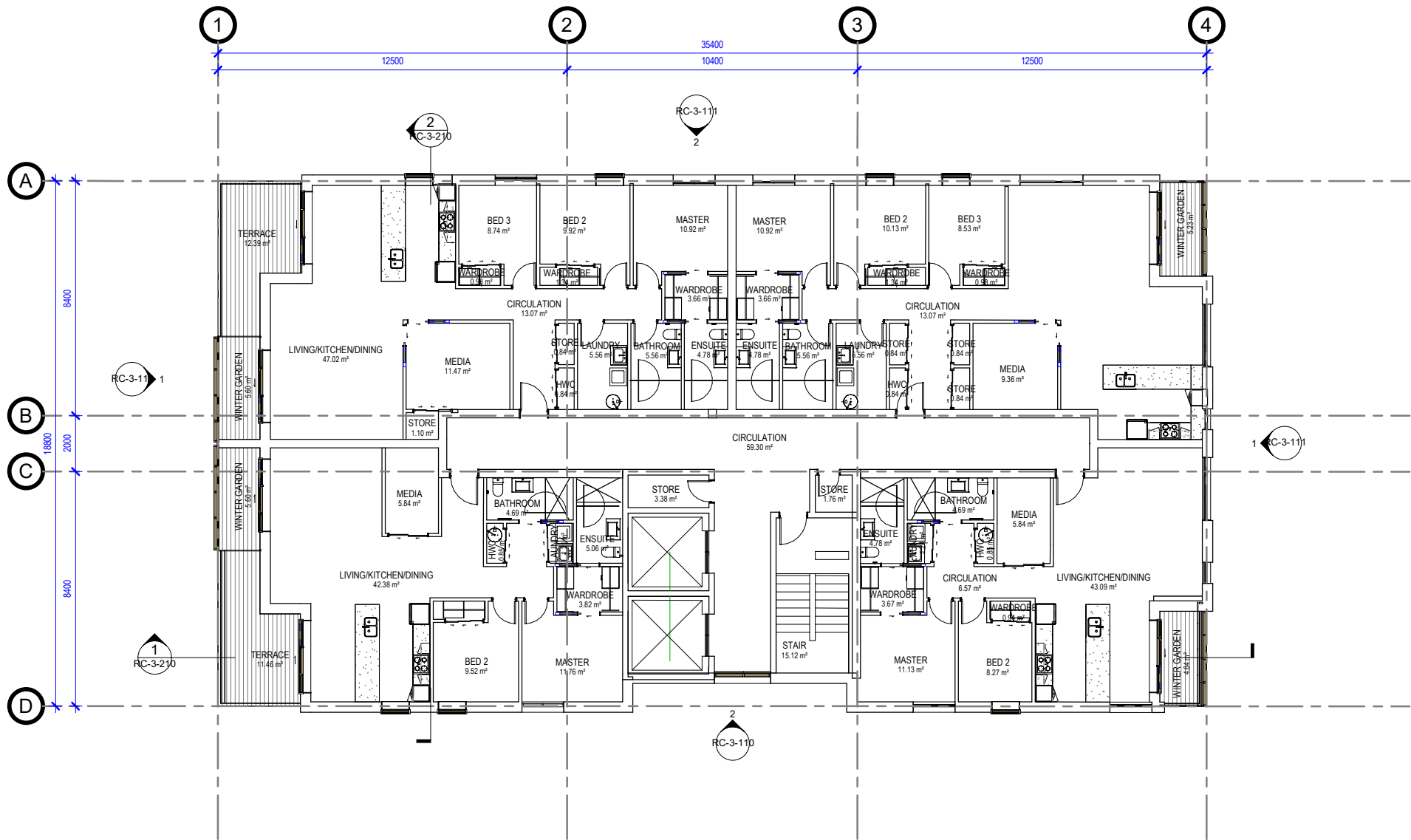
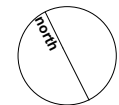
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Block A - Typical Floor Plan
2114 - Ambridge Rose
147-153 Edgewater Drive

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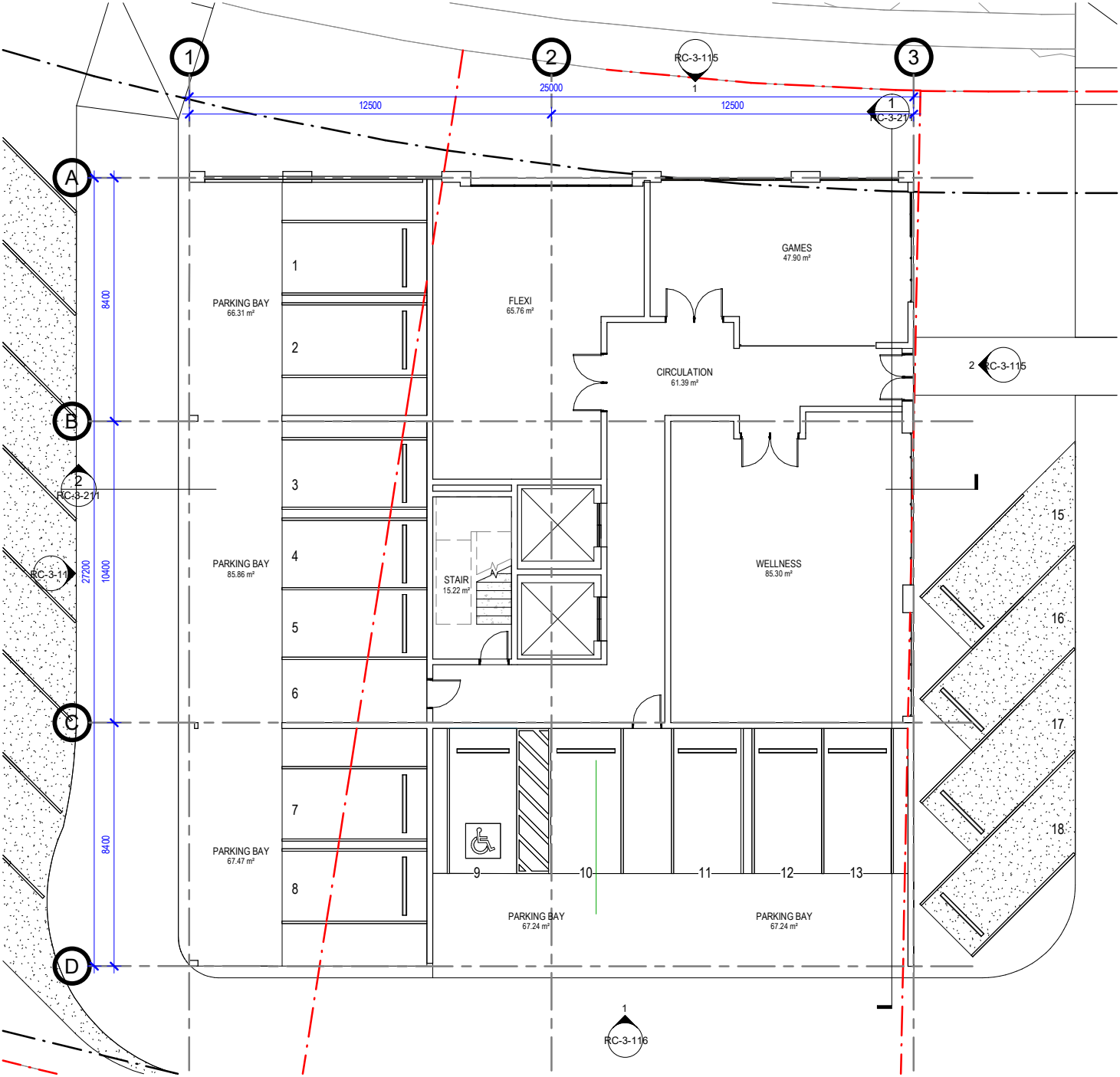
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TOTAL GFA - BLOCK A		
Level	Name	Area
BASEMENT	BLOCK A - COMMON AREAS	659 m²
	BLOCK A - APARTMENTS	677 m²
GROUND FLOOR	BLOCK A - COMMON AREAS	677 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 1	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 2	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 3	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 4	BLOCK A - COMMON AREAS	139 m²
	BLOCK A - APARTMENTS	537 m²
LEVEL 5	BLOCK A - COMMON AREAS	113 m²
	BLOCK A - APARTMENTS	561 m²
TOTAL		4715 m²

*COMMON AREAS INCLUDE SERVICES/CIRCULATION/CARPARKS.

APARTMENT SCHEDULE - BLOCK A		
Level	Name	Area
LEVEL 1	BLOCK A - 2 BED - TYPE A	88 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 2	BLOCK A - 2 BED - TYPE A	88 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 3	BLOCK A - 2 BED - TYPE A	88 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 4	BLOCK A - 2 BED - TYPE A	88 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 2 BED PLUS - TYPE B	112 m²
LEVEL 5	BLOCK A - 2 BED PLUS - TYPE B	112 m²
	BLOCK A - 3 BED - TYPE B	156 m²
	BLOCK A - 3 BED - TYPE C	160 m²
TOTAL APARTMENTS: 24		



1 Block B - Ground Floor Plan
RC-3-100 SCALE 1 : 100

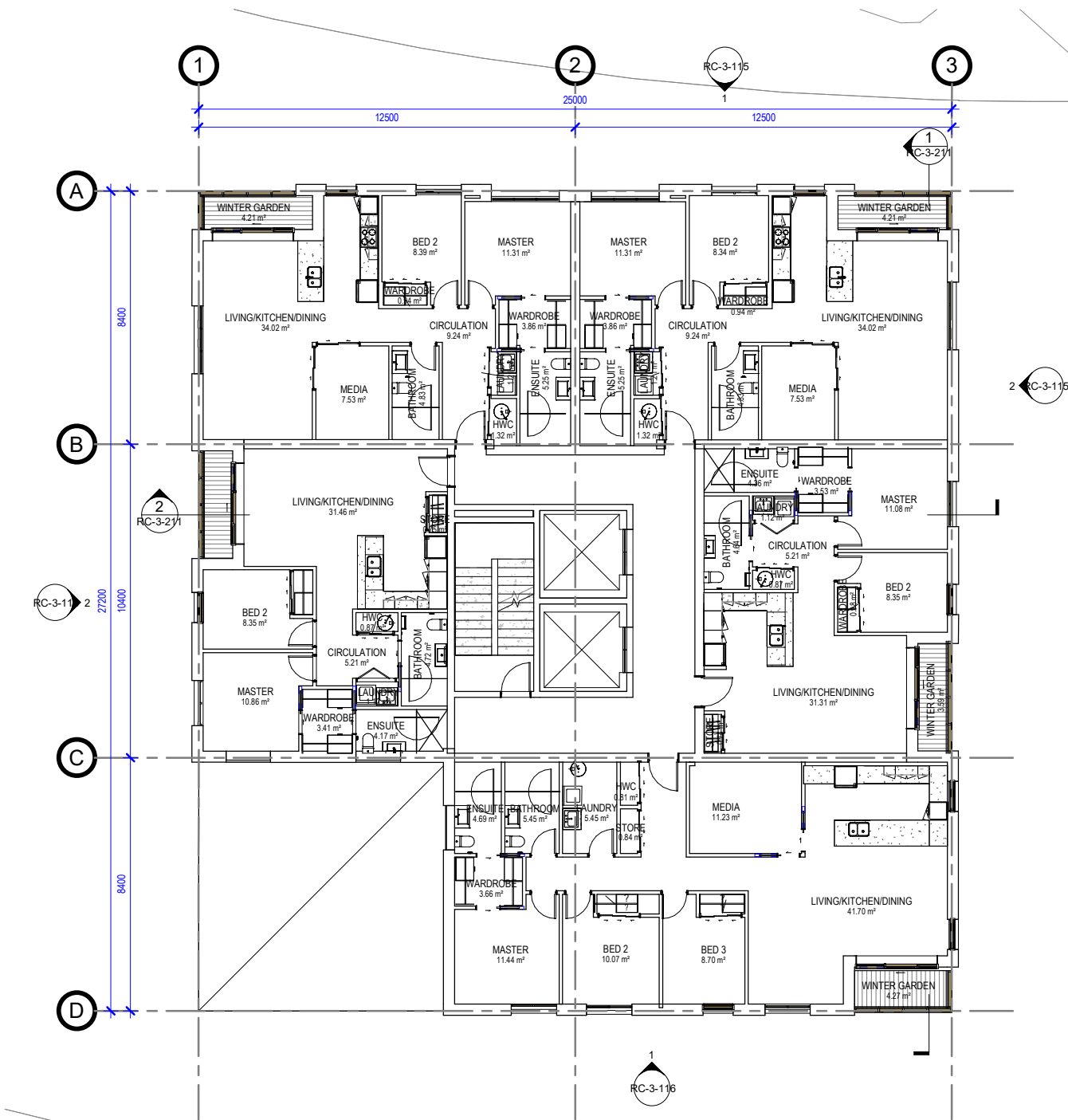
TOTAL GFA - BLOCK B		
Level	Name	Area
GROUND FLOOR	BLOCK B - COMMON AREAS	681 m²
		681 m²
LEVEL 1	BLOCK B - COMMON AREAS	85 m²
LEVEL 1	BLOCK B - APARTMENTS	541 m²
		626 m²
LEVEL 2	BLOCK B - COMMON AREAS	85 m²
LEVEL 2	BLOCK B - APARTMENTS	541 m²
		626 m²
LEVEL 3	BLOCK B - COMMON AREAS	85 m²
LEVEL 3	BLOCK B - APARTMENTS	541 m²
		626 m²
LEVEL 4	BLOCK B - COMMON AREAS	85 m²
LEVEL 4	BLOCK B - APARTMENTS	513 m²
		598 m²
LEVEL 5	BLOCK B - COMMON AREAS	71 m²
LEVEL 5	BLOCK B - APARTMENTS	398 m²
		469 m²
TOTAL		3625 m²

*COMMON AREAS INCLUDE SERVICES/CIRCULATION/CARPARKS.

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Block B - Ground Floor Plan
2114 - Ambridge Rose
147-153 Edgewater Drive

SHEET NUMBER: 2114 - - RC-2-105
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1 Block B - Typical Floor Plan
SCALE 1 : 100

TOTAL GFA - BLOCK B		
Level	Name	Area
GROUND FLOOR	BLOCK B - COMMON AREAS	681 m²
LEVEL 1	BLOCK B - COMMON AREAS	681 m²
LEVEL 1	BLOCK B - APARTMENTS	541 m²
LEVEL 2	BLOCK B - COMMON AREAS	626 m²
LEVEL 2	BLOCK B - APARTMENTS	541 m²
LEVEL 3	BLOCK B - COMMON AREAS	626 m²
LEVEL 3	BLOCK B - APARTMENTS	541 m²
LEVEL 4	BLOCK B - COMMON AREAS	626 m²
LEVEL 4	BLOCK B - APARTMENTS	513 m²
LEVEL 5	BLOCK B - COMMON AREAS	598 m²
LEVEL 5	BLOCK B - APARTMENTS	71 m²
LEVEL 5	BLOCK B - APARTMENTS	398 m²
TOTAL		469 m²
TOTAL		3625 m²

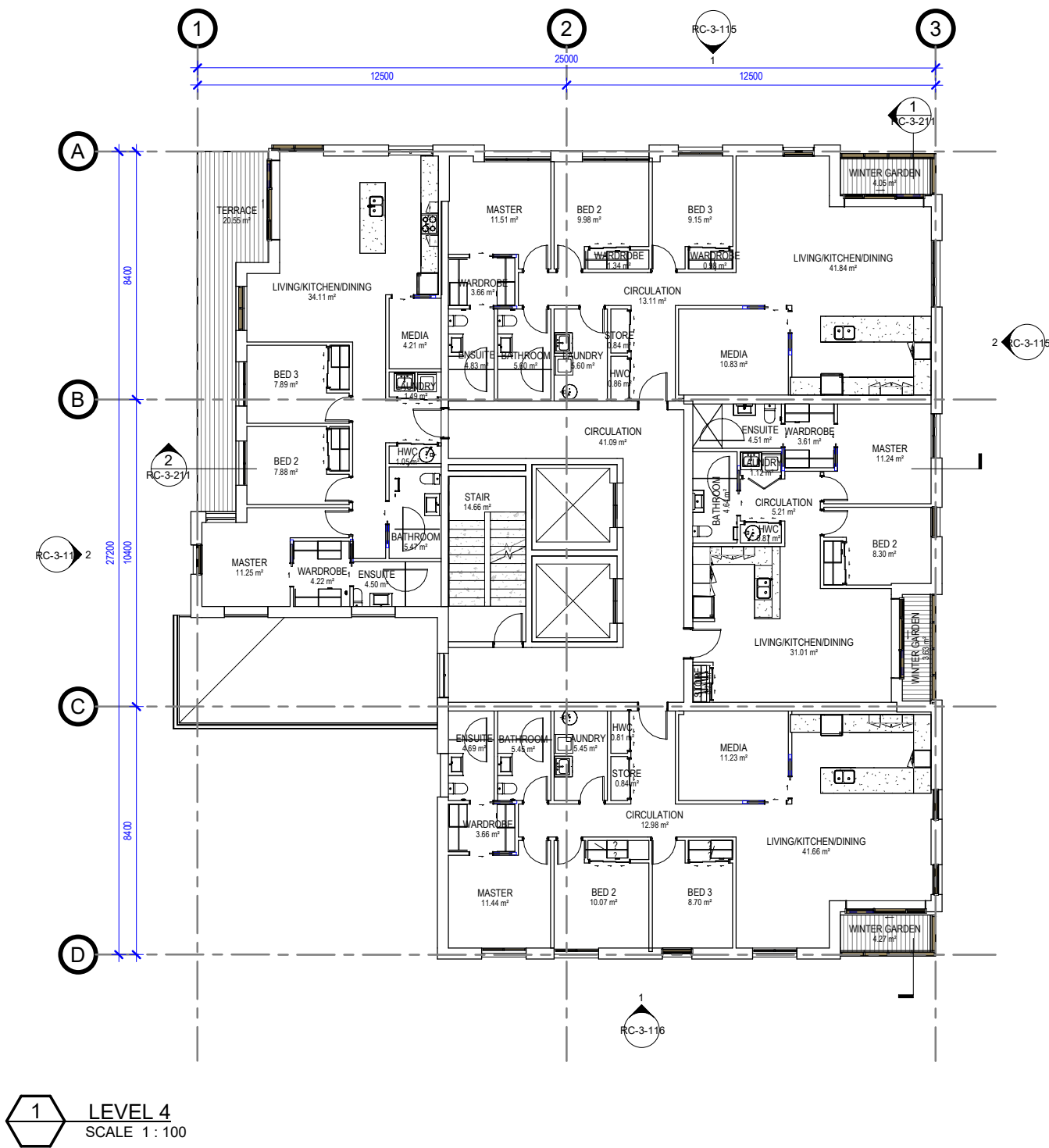
*COMMON AREAS INCLUDE SERVICES/CIRCULATION/CARPARKS.

APARTMENT SCHEDULE - BLOCK B		
Level	Name	Area
LEVEL 1	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 1	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 1	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 1	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 1	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 2	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 2	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 2	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 2	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 2	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 3	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 3	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 3	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 3	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 3	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 4	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 4	BLOCK B - 3 BED - TYPE B	135 m²
LEVEL 4	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 4	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 5	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 5	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 5	BLOCK B - 3 BED - TYPE C	164 m²
TOTAL APARTMENTS: 22		

CB Checker

Block B - Typical Floor plan
2114 - Ambridge Rose
147-153 Edgewater Drive

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TOTAL GFA - BLOCK B		
Level	Name	Area
GROUND FLOOR	BLOCK B - COMMON AREAS	681 m²
LEVEL 1	BLOCK B - COMMON AREAS	681 m²
LEVEL 1	BLOCK B - APARTMENTS	541 m²
LEVEL 2	BLOCK B - COMMON AREAS	626 m²
LEVEL 2	BLOCK B - APARTMENTS	541 m²
LEVEL 3	BLOCK B - COMMON AREAS	626 m²
LEVEL 3	BLOCK B - APARTMENTS	541 m²
LEVEL 4	BLOCK B - COMMON AREAS	626 m²
LEVEL 4	BLOCK B - APARTMENTS	513 m²
LEVEL 5	BLOCK B - COMMON AREAS	71 m²
LEVEL 5	BLOCK B - APARTMENTS	398 m²
TOTAL		469 m²
TOTAL		3625 m²

*COMMON AREAS INCLUDE SERVICES/CIRCULATION/CARPARKS.

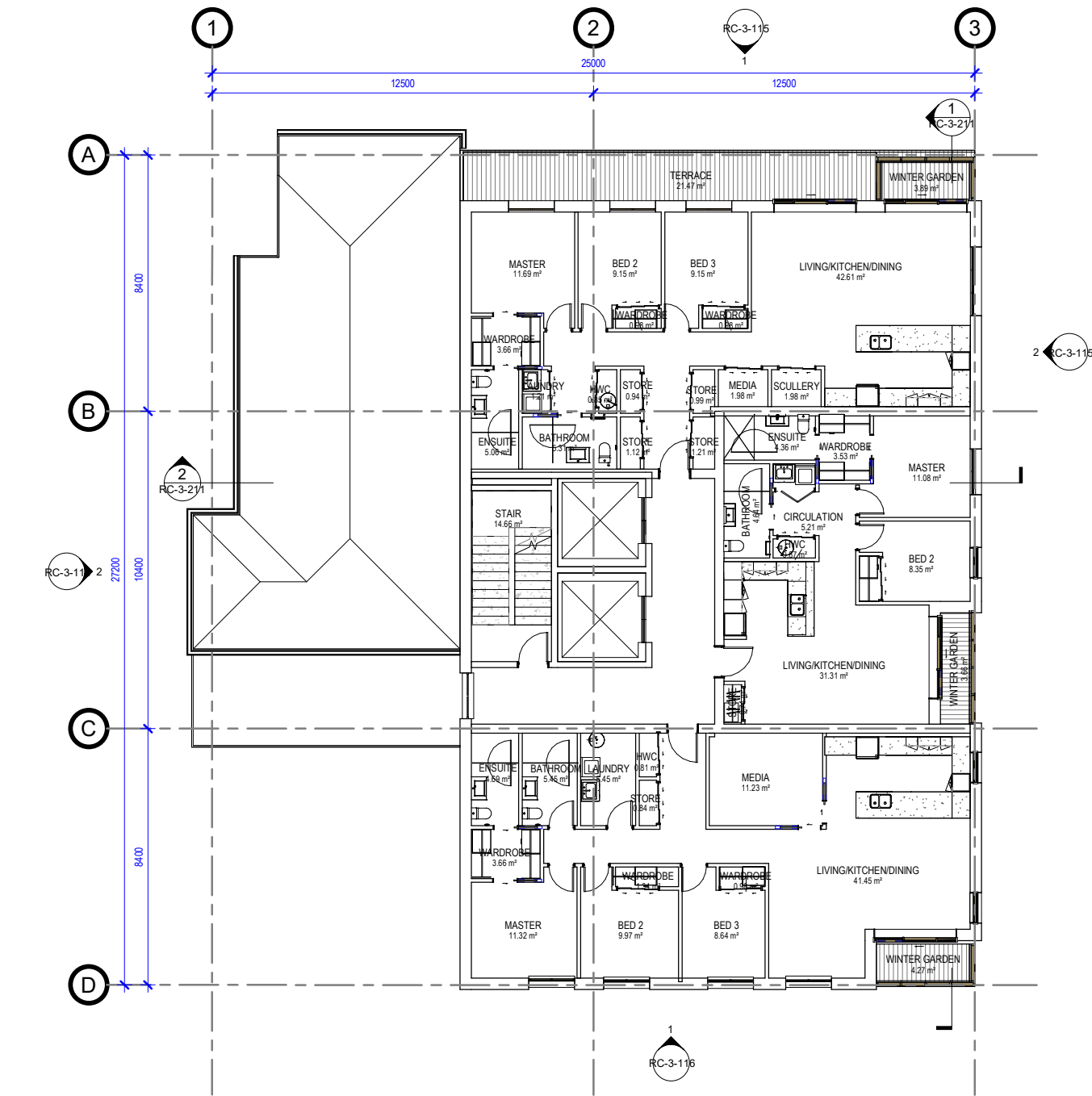
APARTMENT SCHEDULE - BLOCK B		
Level	Name	Area
LEVEL 1	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 1	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 1	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 1	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 1	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 2	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 2	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 2	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 2	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 2	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 3	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 3	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 3	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 3	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 3	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 4	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 4	BLOCK B - 3 BED - TYPE B	135 m²
LEVEL 4	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 4	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 5	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 5	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 5	BLOCK B - 3 BED - TYPE C	164 m²
TOTAL APARTMENTS: 22		

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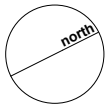
1 Block B - Level 5 Floor Plan
SCALE 1 : 100

TOTAL GFA - BLOCK B		
Level	Name	Area
GROUND FLOOR	BLOCK B - COMMON AREAS	681 m²
LEVEL 1	BLOCK B - COMMON AREAS	681 m²
LEVEL 1	BLOCK B - APARTMENTS	541 m²
LEVEL 2	BLOCK B - COMMON AREAS	626 m²
LEVEL 2	BLOCK B - APARTMENTS	541 m²
LEVEL 3	BLOCK B - COMMON AREAS	626 m²
LEVEL 3	BLOCK B - APARTMENTS	541 m²
LEVEL 4	BLOCK B - COMMON AREAS	626 m²
LEVEL 4	BLOCK B - APARTMENTS	513 m²
LEVEL 5	BLOCK B - COMMON AREAS	598 m²
LEVEL 5	BLOCK B - APARTMENTS	71 m²
LEVEL 5	BLOCK B - APARTMENTS	398 m²
TOTAL		469 m²
TOTAL		3625 m²

*COMMON AREAS INCLUDE SERVICES/CIRCULATION/CARPARKS.

APARTMENT SCHEDULE - BLOCK B		
Level	Name	Area
LEVEL 1	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 1	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 1	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 1	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 1	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 2	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 2	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 2	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 2	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 2	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 3	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 3	BLOCK B - 2 BED - TYPE B	90 m²
LEVEL 3	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 3	BLOCK B - 2 BED PLUS - TYPE B	109 m²
LEVEL 3	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 4	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 4	BLOCK B - 3 BED - TYPE B	135 m²
LEVEL 4	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 4	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 5	BLOCK B - 2 BED - TYPE A	89 m²
LEVEL 5	BLOCK B - 3 BED - TYPE A	145 m²
LEVEL 5	BLOCK B - 3 BED - TYPE C	164 m²
TOTAL APARTMENTS: 22		

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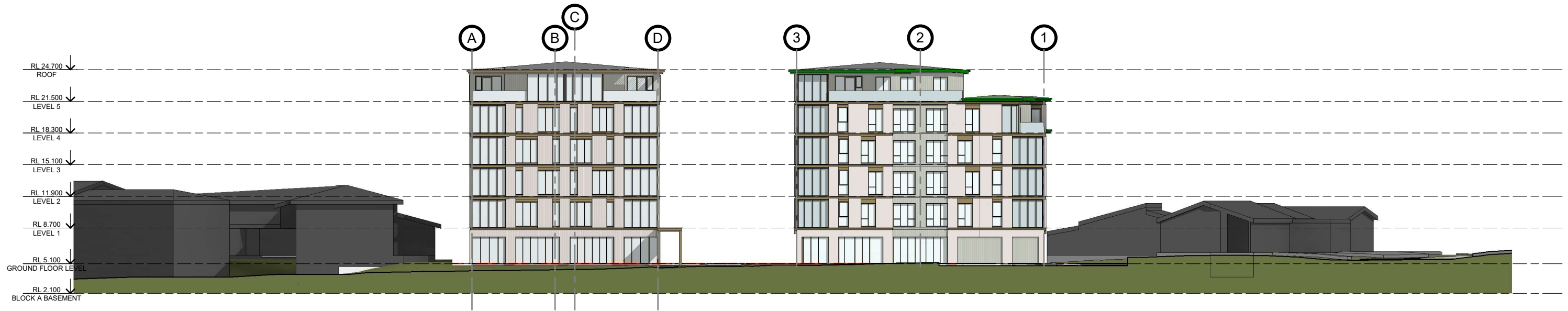


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Block B - Level 5 Floor Plan
2114 - Ambridge Rose
147-153 Edgewater Drive

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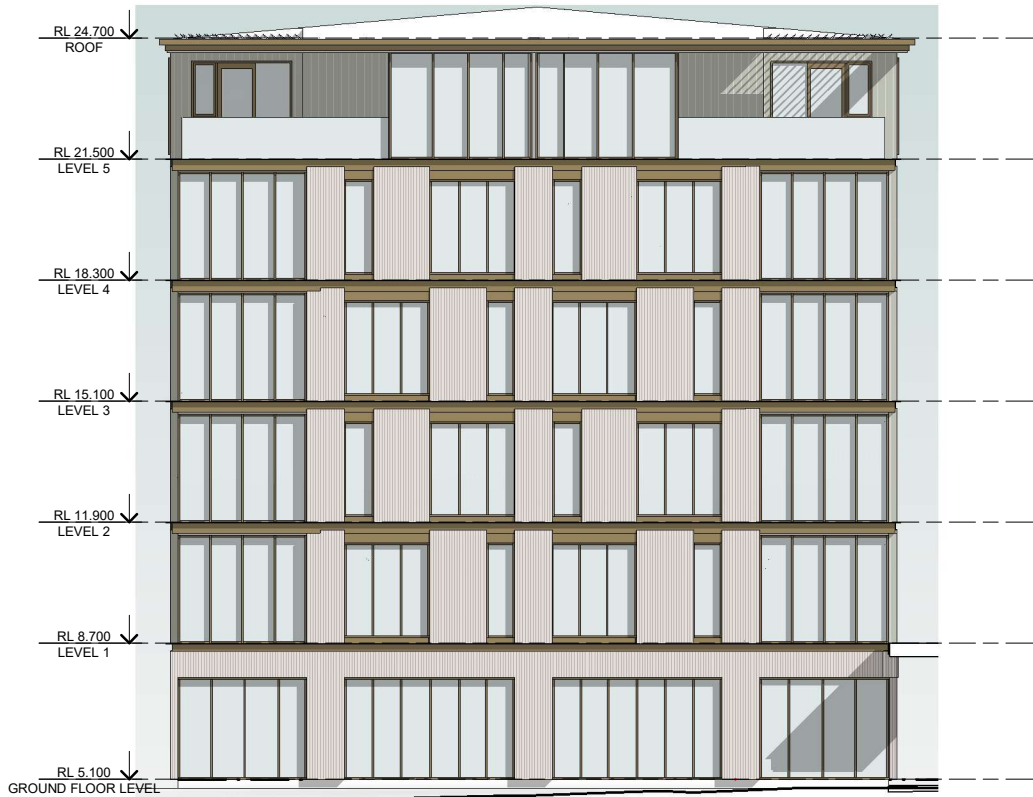


1 Street Elevation
SCALE 1 : 200



2 Coastal Elevation
SCALE 1 : 200

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1 Block A - Elevation 01
RC-2-100 SCALE 1 : 100



2 Block A - Elevation 02
RC-2-100 SCALE 1 : 100

CB Checker



1 Block A - Elevation 03
RC-2-101 SCALE 1 : 100



2 Block A - Elevation 04
RC-2-101 SCALE 1 : 100

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1 Block B - Elevation 01
RC-2-105 SCALE 1 : 100



2 Block B - Elevation 02
RC-2-105 SCALE 1 : 100

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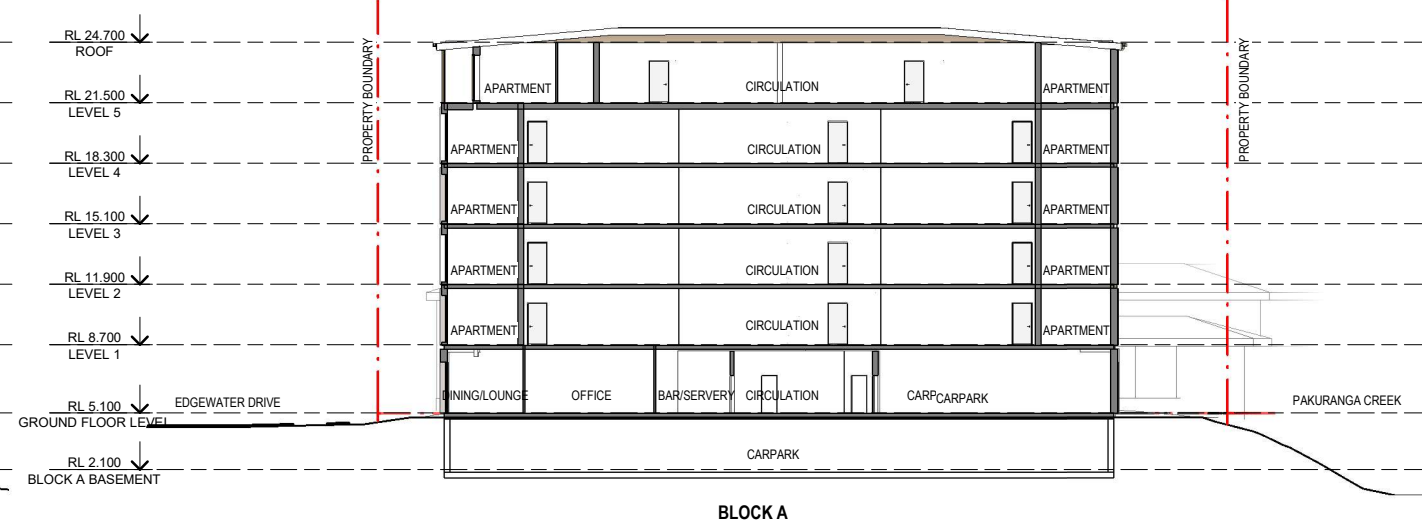
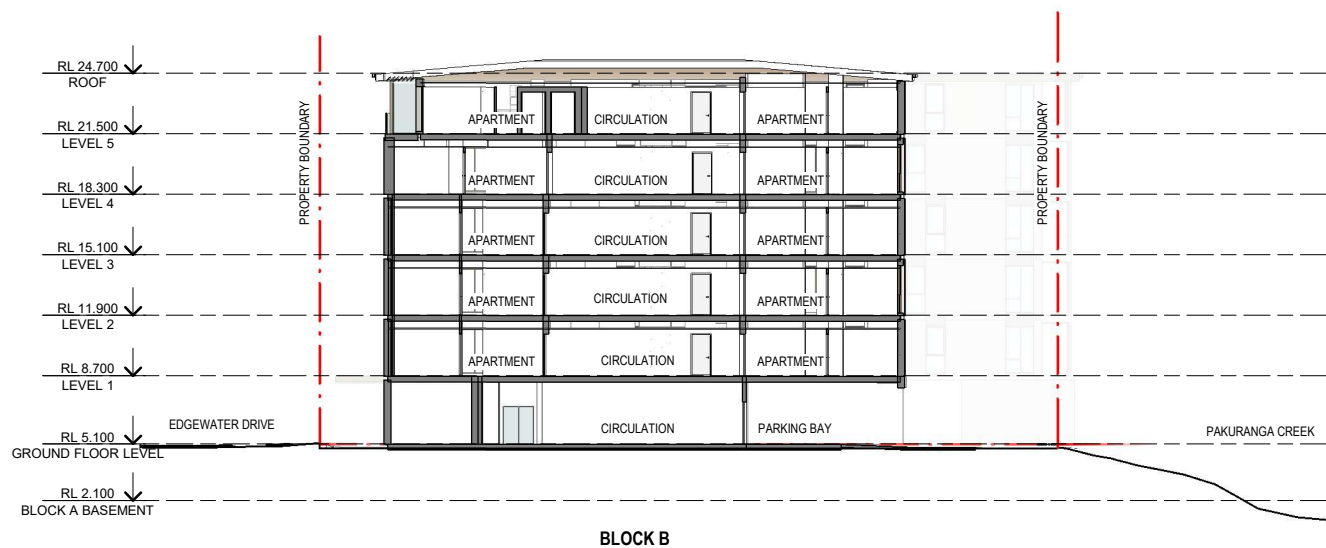
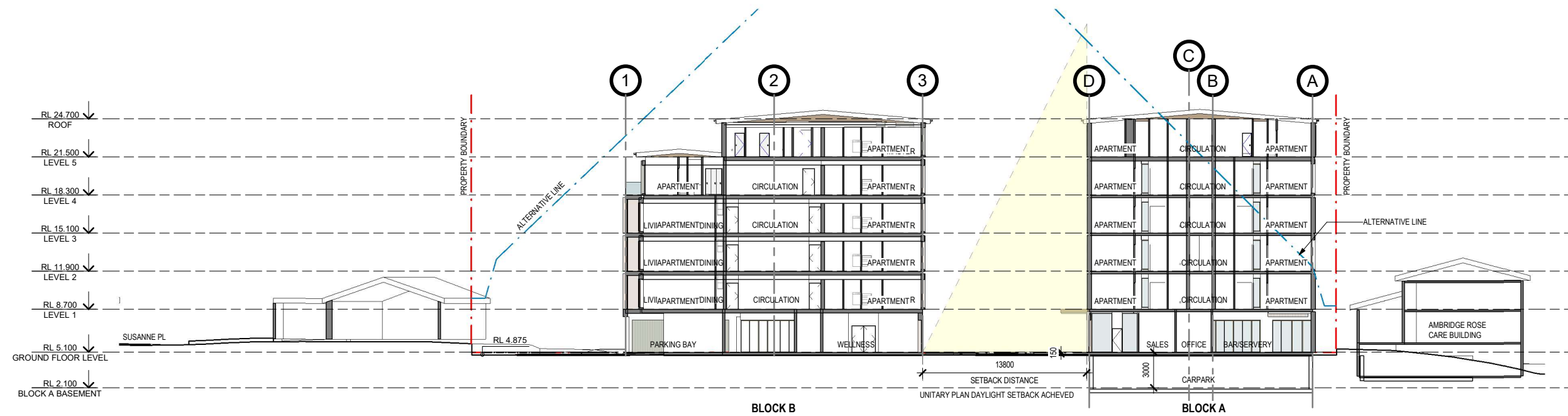


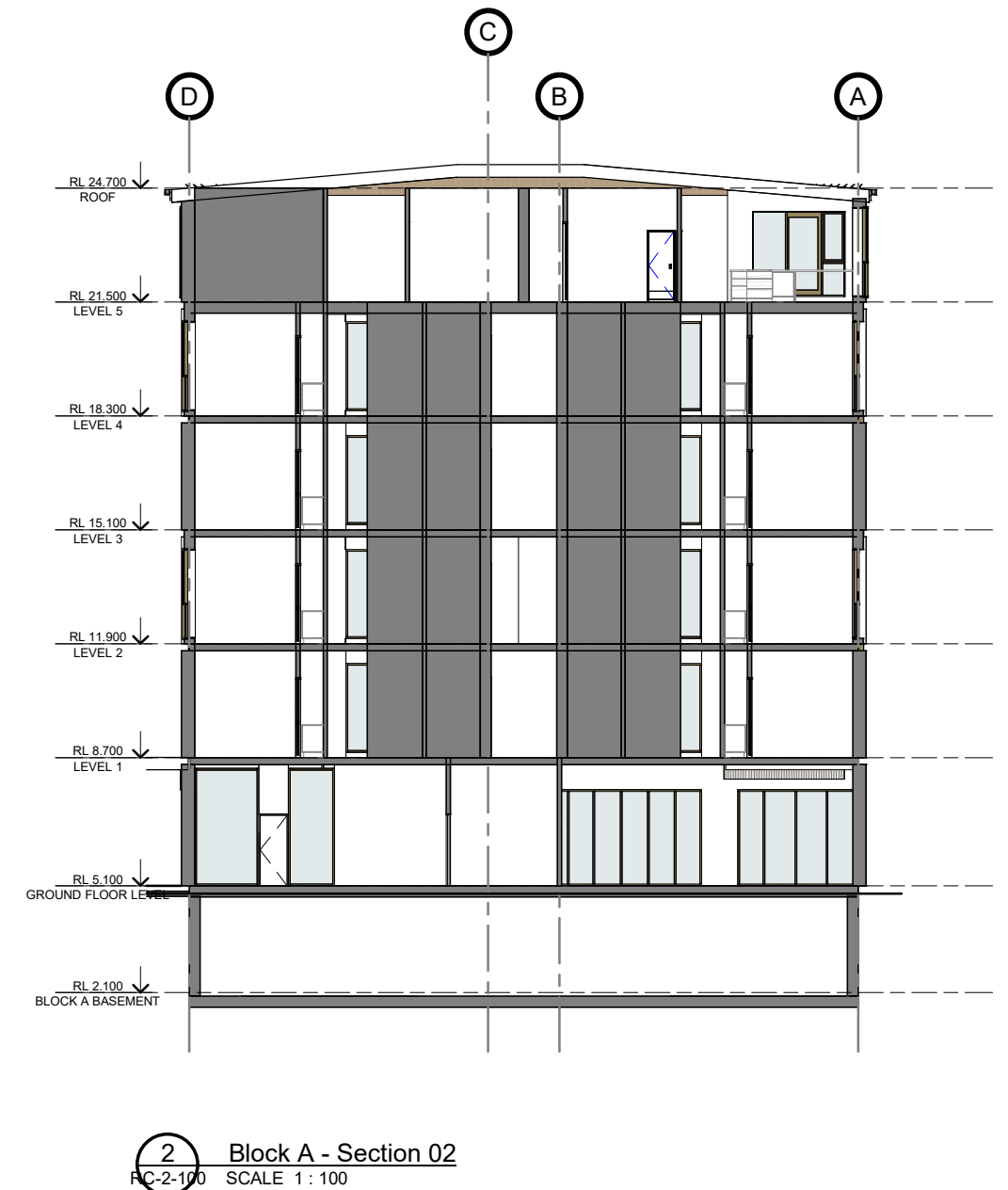
1 Block B - Elevation 03
RC-2-105 SCALE 1 : 100



2 Block B - Elevation 04
RC-2-105 SCALE 1 : 100

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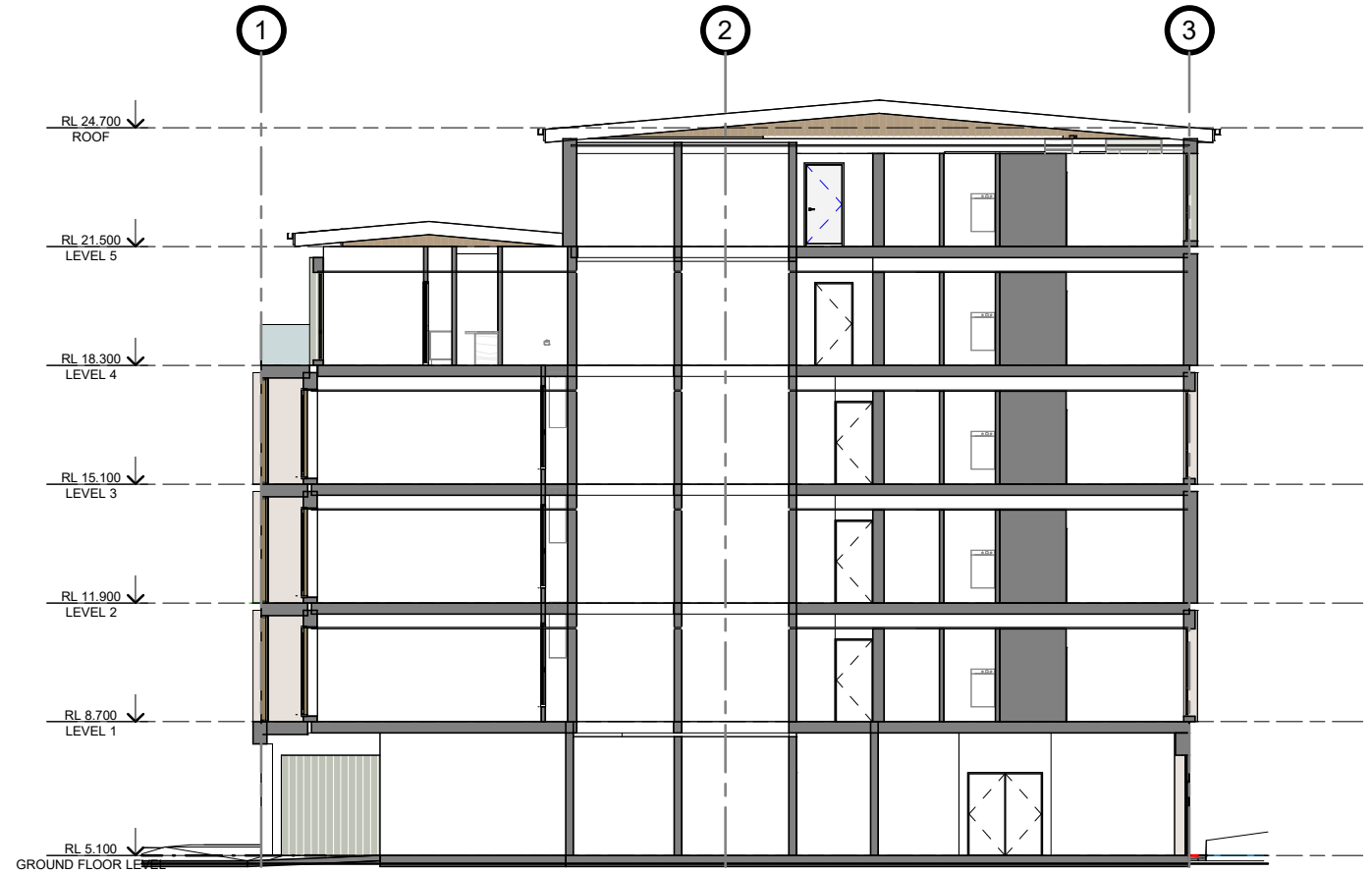


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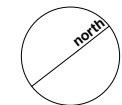


1 Block B - Section 01
RC-2-105 SCALE 1 : 100



2 Block B - Section 02
RC-2-105 SCALE 1 : 100

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Renders
2114 - Ambridge Rose
147-153 Edgewater Drive

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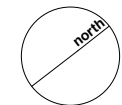
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Renders
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147-153 Edgewater Drive

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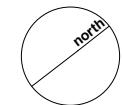
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Renders
2114 - Ambridge Rose
147-153 Edgewater Drive

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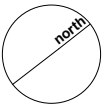
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Renders
2114 - Ambridge Rose
147-153 Edgewater Drive

CB Checker

APPENDIX B

SITE INVESTIGATION RECORDS

Client : A & L SARGEANT LTD						Machine Borehole No. MH01						
Project Location : 149 - 153 EDGEWATER DRIVE, PAKURANGA						Sheet 1 of 3						
Job Number: J00983						Vane Head: 2153	Logged By: AB	Processor : AB	Start Date: 15.10.18 Finish Date: 15.10.18			
Stratigraphy	Borehole Location:	mN	mE	Ground R.L.		Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT	
	Description:	Refer to site plan		Orientation: vertical								
	CORE DESCRIPTION	Legend	Depth (m)	DEFECTS								
Ash	TOPSOIL		[Pattern]			OPEN BARREL WITH CASING TO 1.5m		40		205+ 139/ 65 155/ 46		
	silty CLAY, orange mottled orange/ brown. Very stiff, moist, medium to high plasticity, with some orange limonite silt inclusions and staining		[Pattern]	0.5				100				
	with occasional coarse sand to fine gravel sized limonite clast inclusions at 0.8m, becoming orange and orange/ brown mottled brown/ grey		[Pattern]	1.0				100				
			[Pattern]	1.5								
			[Pattern]	2.0								
			[Pattern]	2.5								
			[Pattern]	3.0				SPT				
			[Pattern]	3.5								
			[Pattern]	4.0				81				
			[Pattern]	4.5								
Alluvium	silty CLAY, dark brown/ grey speckled blue/ grey. Very stiff, moist, medium to high plasticity, with trace organic staining		[Pattern]	2.0		TRIPLE TUBE		79		53/ 21 SPT at 3.0-3.45m 2/2/3 N=5 UTP UTP UTP SPT at 6.0-6.45m 10/13/14 N=27		
	becoming slightly silty CLAY, light blue/ grey, without organic staining		[Pattern]	2.5								
	becoming silty CLAY, green/ grey, with some medium to coarse sand sized clay clast inclusions		[Pattern]	3.0								
	clayey SILT, green/ grey. Hard, moist, low plasticity, with some medium to coarse sand sized clay clast inclusions		[Pattern]	3.5								
			[Pattern]	4.0								
			[Pattern]	4.5								
			[Pattern]	5.0				100				
			[Pattern]	5.5								
			[Pattern]	6.0				100				
			[Pattern]	6.5				SPT				
	pumiceous SILT, cream/ white. Loose, moist to wet, no plasticity		[Pattern]	7.0								
	becoming silt, grey		[Pattern]	7.5								
			[Pattern]	8.0								
		Comments:	Drilling Fluid:	Topsoil	[Pattern]	Sand	[Pattern]	Sandstone	[Pattern]	Plutonic	+++	
				Fill	[Pattern]	Gravel	[Pattern]	Siltstone	[Pattern]	No Core		
			Checked:	Clay	[Pattern]	Organic	[Pattern]	Limestone	[Pattern]			
				Silt	[Pattern]	Pumice	[Pattern]	Volcanic	[Pattern]			
Driller: Pro-Drill		Rig: Tractor										

Client : A & L SARGEANT LTD					Machine Borehole No. MH01								
Project Location : 149 - 153 EDGEWATER DRIVE, PAKURANGA					Sheet 2 of 3								
Job Number: J00983					Vane Head: 2153	Logged By: AB	Processor : AB	Start Date: 15.10.18	Finish Date: 15.10.18				
Stratigraphy	Borehole Location:	mN	mE	Ground R.L.		Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT		
	Description: Refer to site plan			Orientation: vertical									
	CORE DESCRIPTION		Legend	Depth (m)	DEFECTS								
Alluvium	fine sandy SILT with clay, grey. Very stiff, moist, no to low plasticity			8.5			TRIPLE TUBE	SPT					
	clayey fine SAND, grey. Stiff, moist, no to low plasticity							76					
Transitional Waitemata Group	with moderately thin bed of decayed wood			9.0									
	slightly silty CLAY, blue/ grey. Very stiff, moist, high plasticity			9.5	SPT					SPT at 8.0-8.45m 8/8/9 N=17			
				10.0									
				10.5	95								
Waitemata Group Bedrock	slightly clayey SILT, dark grey. Hard, moist, low plasticity			11.0				SPT				SPT at 9.5-9.95m 2/3/3 N=6	
	fine sandy SILT, dark grey. Dense, moist, no plasticity			11.5							SPT at 11.0-11.45m 12/24/26 N=50		
	highly weathered, dark grey, SILTSTONE; weak			12.0	12.0-12.5m, 5JT, PL, 90°, R3			100	60				
				12.5				SPT	SPT		SPT at 12.5-12.9m 16/24/26 for 95mm N>50		
	extremely weathered, dark grey, MUDSTONE; very weak			13.0	1JT, PL, 90°, R3 1DI, PL, 75-90°, R3			82	78				
	becoming highly weathered, weak			13.5									
	highly weathered, dark grey, SILTSTONE; weak			14.0	2JT, CU, 90°, R3-R2			100	74				
	with occasional black carbonaceous striking			14.5	14.8-15.0m, 4JT, PL-CU, 75-90°, R3			SPT	SPT		SPT at 15.0-15.1m 50 for 85mm N>50		
	moderately weathered, dark grey, fine grained SANDSTONE; weak			15.0	2JT, IR, 75-90°, R4								
				15.5	15.4-15.5m, 2JT, PL, 45-90°, R4								
			16.0				82	96					
		Comments:	Drilling Fluid:		Topsoil		Sand		Sandstone		Plutonic	+++	
					water	Fill		Gravel		Siltstone		No Core	
			Checked:		Clay		Organic		Limestone				
					Silt		Pumice		Volcanic				
Driller: Pro-Drill		Rig: Tractor											

[illegible]

Client : A & L SARGEANT LTD					Machine Borehole No. MH02							
Project Location : 149 - 153 EDGEWATER DRIVE, PAKURANGA					Sheet 1 of 2							
Job Number: J00983					Vane Head: 2153	Logged By: AB	Processor : AB	Start Date: 17.10.18	Finish Date: 17.10.18			
Stratigraphy	Borehole Location:	mN	mE	Ground R.L.		Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT	
	Description: Refer to site plan			Orientation: vertical								
	CORE DESCRIPTION		Legend	Depth (m)	DEFECTS							
Fill	TOPSOIL											
	clayey SILT with fine gravel, dark grey mottled orange/ brown. Very stiff, moist, low plasticity			0.5								
Ash	silty CLAY, light brown/ grey. Very stiff, moist, high plasticity							90			185/ 102	
				1.0				100				
Alluvium	with moderately thin layer of fine gravel			1.5			OPEN BARREL WITH CASING TO 1.5M					
	silty CLAY, streaked orange/ brown and grey. Very stiff, moist, high plasticity, with occasional limonite staining			2.0					57			81/ 21
				2.5								
				3.0								
				3.5					SPT			88/ 46 SPT at 3.0-3.45m 1/2/2 N=4
				4.0					100			
	SILT, green/ grey. Loose, moist, no plasticity			4.5								UTP
				5.0								
				5.5					80			
	becoming medium dense			6.0								UTP
			6.5					76				
			7.0									
silty CLAY, green/ grey. Very stiff, moist, medium plasticity			7.5				93					
			8.0									
Comments: Driller: Pro-DrillRig: Tractor				Drilling Fluid:	Topsoil		Sand		Sandstone		Plutonic	
					Fill		Gravel		Siltstone		No Core	
				Checked:	Clay		Organic		Limestone			
					Silt		Pumice		Volcanic			

Client : A & L SARGEANT LTD					Machine Borehole No. MH02							
Project Location : 149 - 153 EDGEWATER DRIVE, PAKURANGA					Sheet 2 of 2							
Job Number: J00983					Vane Head: 2153	Logged By: AB	Processor : AB	Start Date: 17.10.18	Finish Date: 17.10.18			
Stratigraphy	Borehole Location:	mN	mE	Ground R.L.		Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT	
	Description: Refer to site plan			Orientation: vertical								
	CORE DESCRIPTION			Legend	Depth (m)	DEFECTS						
Transitional Waitemata Group					8.5		TRIPLE TUBE	SPT			SPT at 8.0-8.45m 2/4/4 N=8	
					9.0			59				
					9.5							
					10.0			100				
					10.5							
Waitemata Group Bedrock	highly weathered, dark grey, SILTSTONE; weak				10.5	10.5-11.0m, 2JT, IR, 75° - 90°, R3					SPT at 11.0-11.3m 32/50 for 60mm N>50	
					11.0	1JT, IR, 90°, R3		SPT	SPT			
	highly weathered, dark grey, fine grained SANDSTONE; weak				11.5	11.4-11.6m, 3JT, PL, 90°, R3					SPT at 12.5-12.7m 38/50 for 15mm N>50	
					12.0		100	75				
					12.5	2DI, CU, 90°, R4		SPT	SPT			
					13.0	13.0-13.8m, 4JT, PL-CU, 90°, R4		50	66			
	slightly weathered, dark grey, fine to medium grained SANDSTONE; strong				13.5						SPT at 12.5-12.7m 50 for 50mm N>50	
					14.0	13.8-14.0m, chaotically fractured		SPT	SPT			
	EOB at 14.0m. Target Depth.				14.5							
					15.0							
				15.5								
				16.0								
		Comments:		Drilling Fluid:	Topsoil		Sand		Sandstone		Plutonic	
				water	Fill		Gravel		Siltstone		No Core	
				Checked:	Clay		Organic		Limestone			
					Silt		Pumice		Volcanic			
Driller: Pro-Drill		Rig: Tractor										

Client : Project Location : Job Number:					A & L SARGEANT LTD 149 - 153 EDGEWATER DRIVE, PAKURANGA J00983					Machine Borehole No. MH03 Sheet 1 of 2 Vane Head: 2153 Logged By: AB Processor : AB Start Date: 16.10.18 Finish Date: 16.10.18					
Stratigraphy	Borehole Location:	mN	mE	Ground R.L.		Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT				
	Description: Refer to site plan			Orientation: vertical											
	CORE DESCRIPTION		Legend	Depth (m)	DEFECTS										
Ash	TOPSOIL						OPEN BARREL WITH CASING TO 1.5m	50			205+				
	clayey SILT, orange/ brown. Very stiff, moist, low plasticity, with some clast inclusions														
	silty CLAY, brown mottled brown/ grey. Very stiff, moist, medium plasticity, with occasional orange limonite silt inclusions and staining at 1.0m, becoming streaked grey, brown, orange/ brown and green/ grey														
	becoming mottled green/ grey, brown and dark brown, with some organic staining, with some orange limonite gravel inclusions														
Alluvium	slightly silty CLAY, orange/ brown streaked grey. Very stiff, moist, high plasticity, with occasional limonite silt inclusions and staining							87							
	becoming streaked orange/ brown and grey														
	organic silty CLAY, green/ grey mottled dark brown/ black. Stiff, moist, medium to high plasticity, with occasional decayed wood inclusions							76			120/ 57				
	slightly silty CLAY, green/ grey. Stiff, moist to wet, high plasticity														
	organic clayey SILT, dark brown/ black. Very stiff, moist, low plasticity, with major decayed organic fibre inclusions							100			49/ 18 SPT at 6.0-6.45m 2/2/2 N=4				
	Comments:														
											Checked:	Topsoil	Sand	Sandstone	Plutonic
	Driller: Pro-Drill	Rig: Tractor										Fill	Gravel	Siltstone	No Core
											Clay	Organic	Limestone		
			Silt	Pumice	Volcanic										

Client : A & L SARGEANT LTD					Machine Borehole No. MH03						
Project Location : 149 - 153 EDGEWATER DRIVE, PAKURANGA					Sheet 2 of 2						
Job Number: J00983					Vane Head: 2153	Logged By: AB	Processor : AB	Start Date: 16.10.18	Finish Date: 16.10.18		
Stratigraphy	Borehole Location:	mN	mE	Ground R.L.		Groundwater/ Piezometer	Drilling Method & Casing	Recovery (%)	RQD (%)	Sample and Laboratory Test Details	Vane Dial / Sensitivity & SPT
	Description: Refer to site plan			Orientation: vertical							
	CORE DESCRIPTION		Legend	Depth (m)	DEFECTS						
Alluvium	becoming green/ grey		[Symbol]	8.5			OPEN BARREL	100			
				9.0				SPT			
Transitional Waitemata Group	silty CLAY, dark grey. Very stiff, moist, medium plasticity		[Symbol]	9.5				81			
				10.0							
	slightly clayey fine SAND, dark grey. Very stiff, moist, low to no plasticity			10.5				100			
	silty CLAY, dark grey. Hard, moist, medium to high plasticity			11.0							
Waitemata Group Bedrock	highly weathered, dark grey, MUDSTONE; extremely weak		[Symbol]	11.5	Chaotically Fractured		TRIPLE TUBE	33			
	becoming moderately weathered, weak			12.0				100			
				12.5				SPT			
	slightly weathered, dark grey, SILTSTONE; weak			13.0				SPT			
				13.5				88			
				14.0				SPT			
				14.5				91			
				15.0				SPT			
highly weathered, dark grey, fine grained SANDSTONE; very weak		[Symbol]	14.5	2DI, IR, 90°, R3 14.0-14.1m, 3JT, PL, 90°, R3-R4 1JT, IR, 90°, R4 1JT, CU, 90°, R4 2JT, CU, 75°, R4							
EOB at 15.5m. Target Depth.			15.5								SPT
			16.0								
 Comments:		Drilling Fluid:		Topsoil	[Symbol]	Sand	[Symbol]	Sandstone	[Symbol]	Plutonic	+++
		water		Fill	[Symbol]	Gravel	[Symbol]	Siltstone	[Symbol]	No Core	
		Checked:		Clay	[Symbol]	Organic	[Symbol]	Limestone	[Symbol]		
				Silt	[Symbol]	Pumice	[Symbol]	Volcanic	[Symbol]		
Driller: Pro-Drill		Rig: Tractor									

BOREHOLE NO: BH1					
ADDRESS:	149 – 153 Edgewater Drive	LOCATION:	Pakuranga		
CLIENT:	A & L Sargeant Ltd	PROJECT No:	4116G		
METHOD OF BORING: Hand Auger		ELEVATION (m):	DATUM:		

		Samples and Tests			Ground
Depth (m)	Soil Description	Depth (m)	Sample	Test	Water
	Topsoil.				
0.5	Silty CLAY; grey mottled orange and blue. Stiff, moist, moderately plastic. [Alluvium] Becoming very stiff.	0.5		C=144 C _r =17	
1.0		1.0		C=150 C _r =37	
1.5	SAND; dark brown. Very dense (Inferred), wet, fine sand.	1.5		C=156 C _r =34	1.4 ▼
	EOB @ 1.5 m Too Hard to Auger Further				
2.0		2.0			
2.5		2.5			
3.0		3.0			
3.5		3.5			
4.0		4.0			
4.5		4.5			
5.0		5.0			

Date Started 11/11/17 Date Finished 11/11/17 Driller GS Logged by GS Checked by MK	Samples	In-Situ Tests C = Undrained Shear Strength (kPa) C _r = Residual Shear Strength (kPa) S = Scala Reading, Blows / 150 mm UTP = Unable to Penetrate
MOSS ENGINEERING GEOTECHNICAL CONSULTANTS PO Box 151 326 New Lynn Ph: (09) 623 2071 Mobile: 021 387 779		

BOREHOLE NO: BH2					
ADDRESS:	149 – 153 Edgewater Drive			LOCATION:	Pakuranga
CLIENT:	A & L Sargeant Ltd			PROJECT No:	4116G
METHOD OF BORING: Hand Auger			ELEVATION (m):		DATUM:

		Samples and Tests			Ground
Depth (m)	Soil Description	Depth (m)	Sample	Test	Water
	Topsoil.				
	Silty CLAY; grey mottled orange. Stiff, moist, moderately plastic. [Alluvium]				
0.5	Becoming very stiff.	0.5		C=103 C _r =28	
1.0		1.0		C=121 C _r =31	
1.5	SAND; dark brown. Very dense (Inferred), wet, fine sand.	1.5		C=114 C _r =23	1.4 m 
2.0	EOB @ 1.7 m Too Hard to Auger Further	2.0			
2.5		2.5			
3.0		3.0			
3.5		3.5			
4.0		4.0			
4.5		4.5			
5.0		5.0			

Date Started	11/11/17	Samples	In-Situ Tests
Date Finished	11/11/17		
Driller	GS		
Logged by	GS		
Checked by	MK		
MOSS ENGINEERING GEOTECHNICAL CONSULTANTS			
PO Box 151 326 New Lynn Ph: (09) 623 2071 Mobile: 021 387 779			C = Undrained Shear Strength (kPa) C _r = Residual Shear Strength (kPa) S = Scala Reading, Blows / 150 mm UTP = Unable to Penetrate

BOREHOLE NO: BH3					
ADDRESS:	149 – 153 Edgewater Drive			LOCATION:	Pakuranga
CLIENT:	A & L Sargeant Ltd			PROJECT No:	4116G
METHOD OF BORING: Hand Auger			ELEVATION (m):		DATUM:

		Samples and Tests			Ground
Depth (m)	Soil Description	Depth (m)	Sample	Test	Water
	Topsoil.				
0.5	Silty CLAY; grey mottled orange and blue. Stiff, moist, moderately plastic. [Alluvium] Becoming very stiff.	0.5		C=101 C _r =43	
1.0		1.0		C=103 C _r =37	
1.5	Thin layer of fine sand. (Approx. 30 mm thick)	1.5		C=103 C _r =20	
2.0	Becoming stiff.	2.0		C=72 C _r =28	
2.5	SILT with some fine sand; orange mottled grey. Stiff, moist, slightly plastic.	2.5		C=46 C _r =23	
3.0	Silty CLAY; grey mottled orange. Stiff, moist, moderately plastic. Becoming firm.	3.0		C=117 C _r =31	
3.5	Becoming very stiff.	3.5		C=131 C _r =46	
4.0	Becoming blue mottled orange and red.	4.0		C=179 C _r =48	4.2 m 
4.5	Sandy SILT with some clay; blue mottled grey. Very stiff, moist, slightly plastic.	4.5		C=200+	
5.0	Becoming wet.	5.0		C=200+	
	SAND with some silt; blue. Dense (inferred), wet, fine sand.				
	EOB @ 5.0 m				

Date Started	11/11/17	Samples	In-Situ Tests
Date Finished	11/11/17		
Driller	GS		
Logged by	GS		
Checked by	MK		
MOSS ENGINEERING GEOTECHNICAL CONSULTANTS PO Box 151 326 New Lynn Ph: (09) 623 2071 Mobile: 021 387 779			C = Undrained Shear Strength (kPa) C _r = Residual Shear Strength (kPa) S = Scala Reading, Blows / 150 mm UTP = Unable to Penetrate

BOREHOLE NO: BH4					
ADDRESS:	149 – 153 Edgewater Drive	LOCATION:	Pakuranga		
CLIENT:	A & L Sargeant Ltd	PROJECT No:	4116G		
METHOD OF BORING:	Hand Auger	ELEVATION (m):	DATUM:		

		Samples and Tests			Ground
Depth (m)	Soil Description	Depth (m)	Sample	Test	Water
	Topsoil.				
	Silty CLAY; grey mottled brown. Stiff, moist, moderately plastic. [Alluvium]				
0.5		0.5		C=78 C _r =34	
1.0	Becoming very stiff.	1.0		C=111 C _r =43	
1.5		1.5		C=131 C _r =28	1.6 m 
	Becoming wet.				
	SAND; dark brown. Very dense (Inferred), wet, fine sand.				
2.0	EOB @ 1.8 m Too Hard to Auger Further	2.0			
2.5		2.5			
3.0		3.0			
3.5		3.5			
4.0		4.0			
4.5		4.5			
5.0		5.0			

Date Started	11/11/17	Samples	In-Situ Tests
Date Finished	11/11/17		
Driller	GS		
Logged by	GS		
Checked by	MK		
MOSS ENGINEERING GEOTECHNICAL CONSULTANTS PO Box 151 326 New Lynn Ph: (09) 623 2071 Mobile: 021 387 779			C = Undrained Shear Strength (kPa) C _r = Residual Shear Strength (kPa) S = Scala Reading, Blows / 150 mm UTP = Unable to Penetrate

BOREHOLE NO: BH5					
ADDRESS:	149 – 153 Edgewater Drive	LOCATION:	Pakuranga		
CLIENT:	A & L Sargeant Ltd	PROJECT No:	4116G		
METHOD OF BORING:	Hand Auger	ELEVATION (m):	DATUM:		

		Samples and Tests			Ground
Depth (m)	Soil Description	Depth (m)	Sample	Test	Water
0.5	Silty CLAY; grey mottled orange and blue. Stiff, moist, moderately plastic. [Alluvium] Becoming very stiff.	0.5		C=101 C _r =51	1.8 m 
1.0	Becoming stiff. Becoming blue mottled grey.	1.0		C=98 C _r =54	
1.5	Becoming very stiff.	1.5		C=114 C _r =43	
2.0	SAND; dark brown. Very dense (Inferred), wet, fine sand. EOB @ 1.9 m Too Hard to Auger Further	2.0			
2.5		2.5			
3.0		3.0			
3.5		3.5			
4.0		4.0			
4.5		4.5			
5.0		5.0			

Date Started 11/11/17 Date Finished 11/11/17 Driller GS Logged by GS Checked by MK	Samples	In-Situ Tests C = Undrained Shear Strength (kPa) C _r = Residual Shear Strength (kPa) S = Scala Reading, Blows / 150 mm UTP = Unable to Penetrate
MOSS ENGINEERING GEOTECHNICAL CONSULTANTS PO Box 151 326 New Lynn Ph: (09) 623 2071 Mobile: 021 387 779		

BOREHOLE NO: BH6					
ADDRESS:	149 – 153 Edgewater Drive	LOCATION:	Pakuranga		
CLIENT:	A & L Sargeant Ltd	PROJECT No:	4116G		
METHOD OF BORING: Hand Auger		ELEVATION (m):	DATUM:		

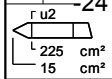
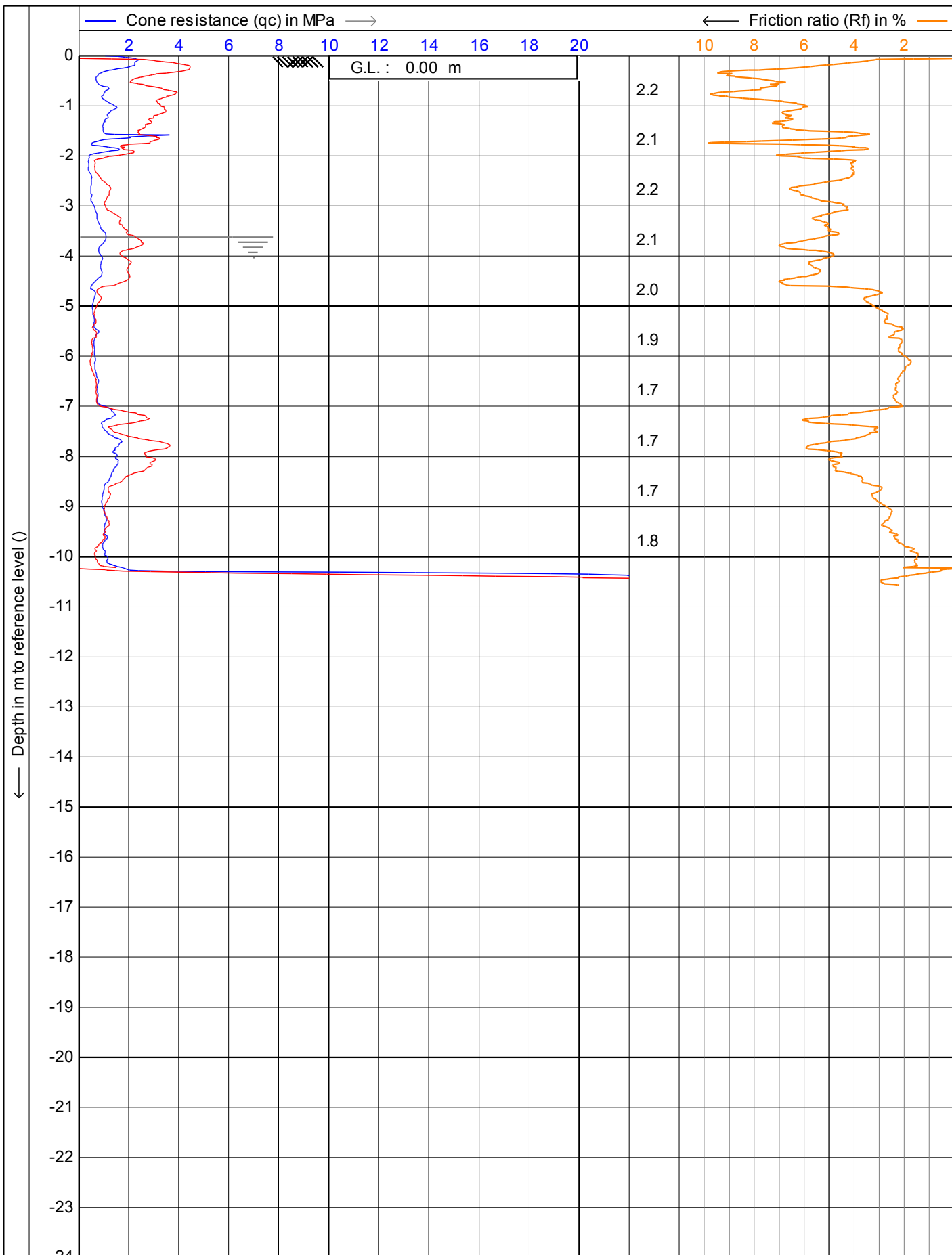
		Samples and Tests			Ground
Depth (m)	Soil Description	Depth (m)	Sample	Test	Water
	Topsoil.				
0.5	Silty CLAY; brown mottled orange. Stiff, moist, moderately plastic. [Alluvium]	0.5		C=98 C _r =31	
1.0	Becoming very stiff. Thin layer of fine sand. (Approx. 30 mm thick)	1.0		C=111 C _r =43	
1.5	CLAY with some silt; brown mottled yellow and orange. Very stiff, moist, highly plastic.	1.5		C=111 C _r =20	
2.0	Becoming firm.	2.0		C=40 C _r =17	
2.5	Becoming stiff.	2.5		C=60 C _r =34	
3.0	Becoming very stiff.	3.0		C=109 C _r =34	
3.5	Becoming stiff. Becoming wet.	3.5		C=78 C _r =40	3.6 m ▼
4.0	SAND with some silt; blue. Medium dense (Inferred), wet, fine sand.	4.0		C=111 C _r =43	
4.5	becoming dense.	4.5		C=200+	
5.0		5.0		C=200+	
EOB @ 5.0 m					

Date Started	11/11/17	Samples	In-Situ Tests
Date Finished	11/11/17		
Driller	GS		
Logged by	GS		
Checked by	MK		
MOSS ENGINEERING GEOTECHNICAL CONSULTANTS PO Box 151 326 New Lynn Ph: (09) 623 2071 Mobile: 021 387 779			C = Undrained Shear Strength (kPa) C _r = Residual Shear Strength (kPa) S = Scala Reading, Blows / 150 mm UTP = Unable to Penetrate

BOREHOLE NO: BH7					
ADDRESS:	149 – 153 Edgewater Drive	LOCATION:	Pakuranga		
CLIENT:	A & L Sargeant Ltd	PROJECT No:	4116G		
METHOD OF BORING: Hand Auger		ELEVATION (m):	DATUM:		

		Samples and Tests			Ground
Depth (m)	Soil Description	Depth (m)	Sample	Test	Water
	Topsoil.				
0.5	Silty CLAY; orange mottled grey. Stiff, moist, moderately plastic. [Alluvium] Becoming very stiff.	0.5		C=141 C _r =40	
1.0		1.0		C=162 C _r =37	
1.5	Becoming blue mottled grey, wet.	1.5		C=139 C _r =34	1.4 m 
	SAND; dark brown. Very dense (Inferred), wet, fine sand.				
2.0	EOB @ 1.8 m Too Hard to Auger Further	2.0			
2.5		2.5			
3.0		3.0			
3.5		3.5			
4.0		4.0			
4.5		4.5			
5.0		5.0			

Date Started	11/11/17	Samples	In-Situ Tests
Date Finished	11/11/17		
Driller	GS		
Logged by	GS		
Checked by	MK		
MOSS ENGINEERING GEOTECHNICAL CONSULTANTS			
PO Box 151 326 New Lynn Ph: (09) 623 2071 Mobile: 021 387 779			C = Undrained Shear Strength (kPa) Cr= Residual Shear Strength (kPa) S = Scala Reading, Blows / 150 mm UTP = Unable to Penetrate

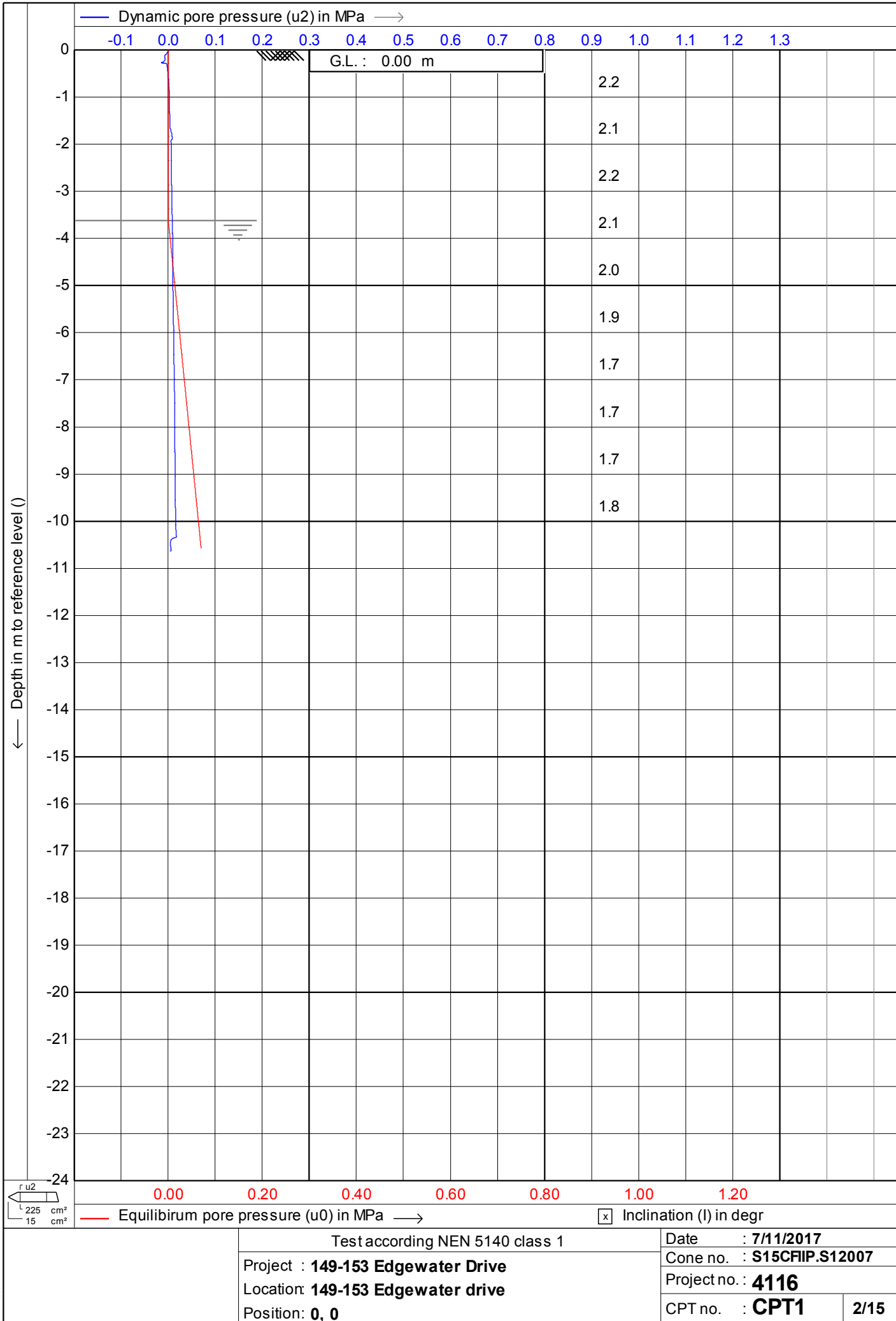


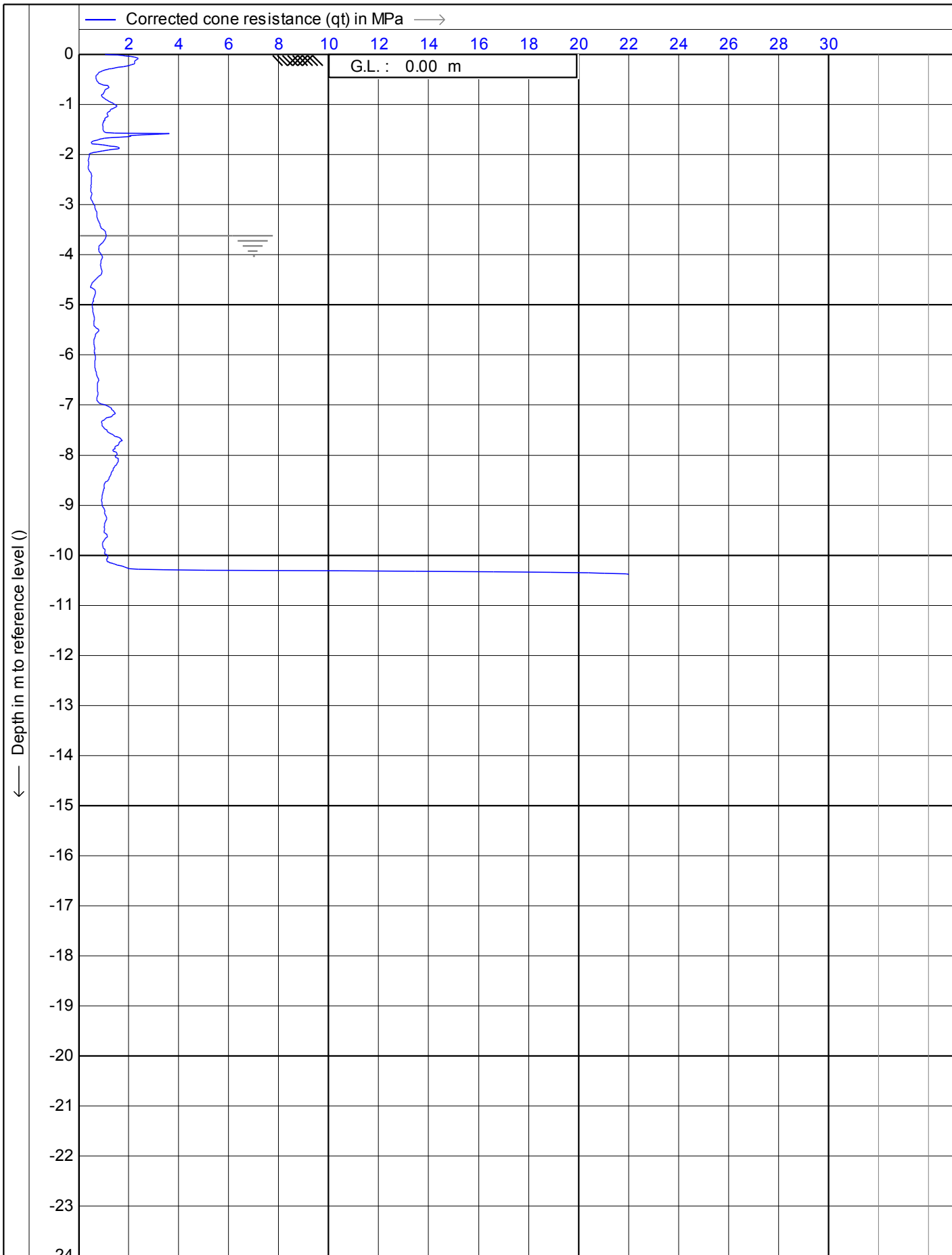
0.10 0.20 0.30 0.40 0.50

— Sleeve friction (fs) in MPa —→

☒ Inclination (I) in degr

Test according NEN 5140 class 1		Date : 7/11/2017	
Project : 149-153 Edgewater Drive		Cone no. : S15CFIP.S12007	
Location: 149-153 Edgewater drive		Project no. : 4116	
Position: 0, 0		CPT no. : CPT1	1/15





225 cm²

 15 cm²

Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

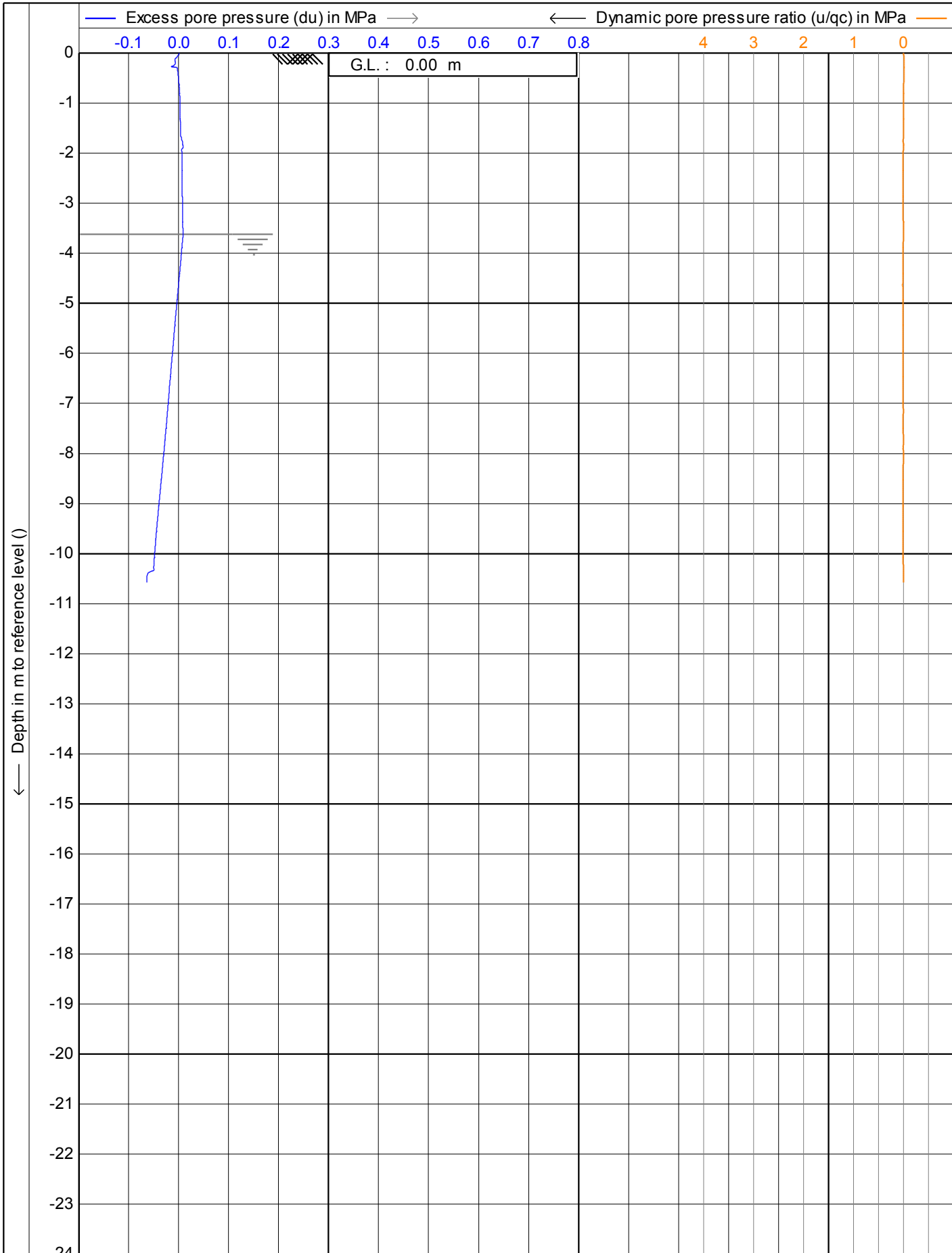
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT1**

3/15



225 cm²
15 cm²

Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

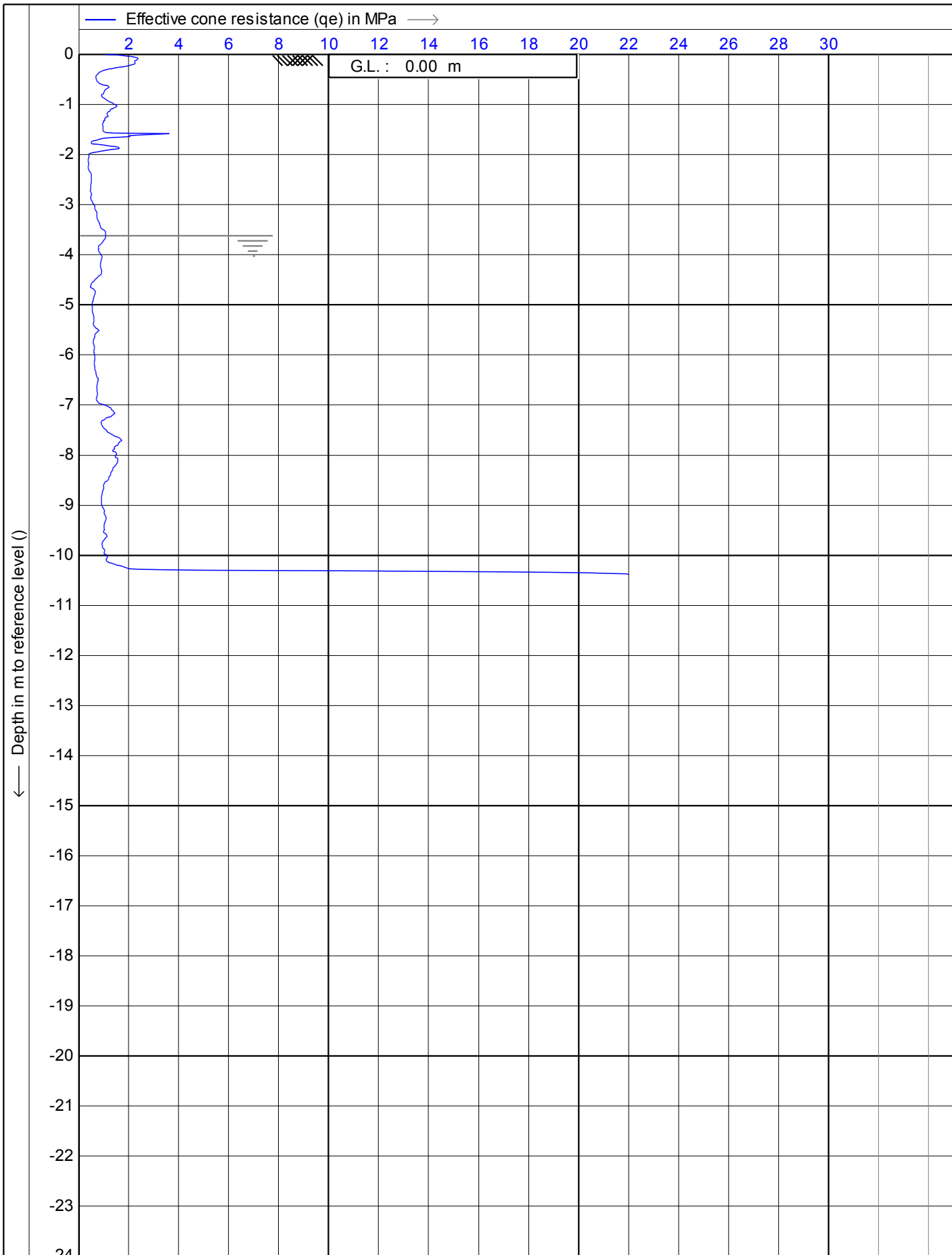
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT1**

4/15



$\frac{r}{u^2}$
 225 cm²
 15 cm²

Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

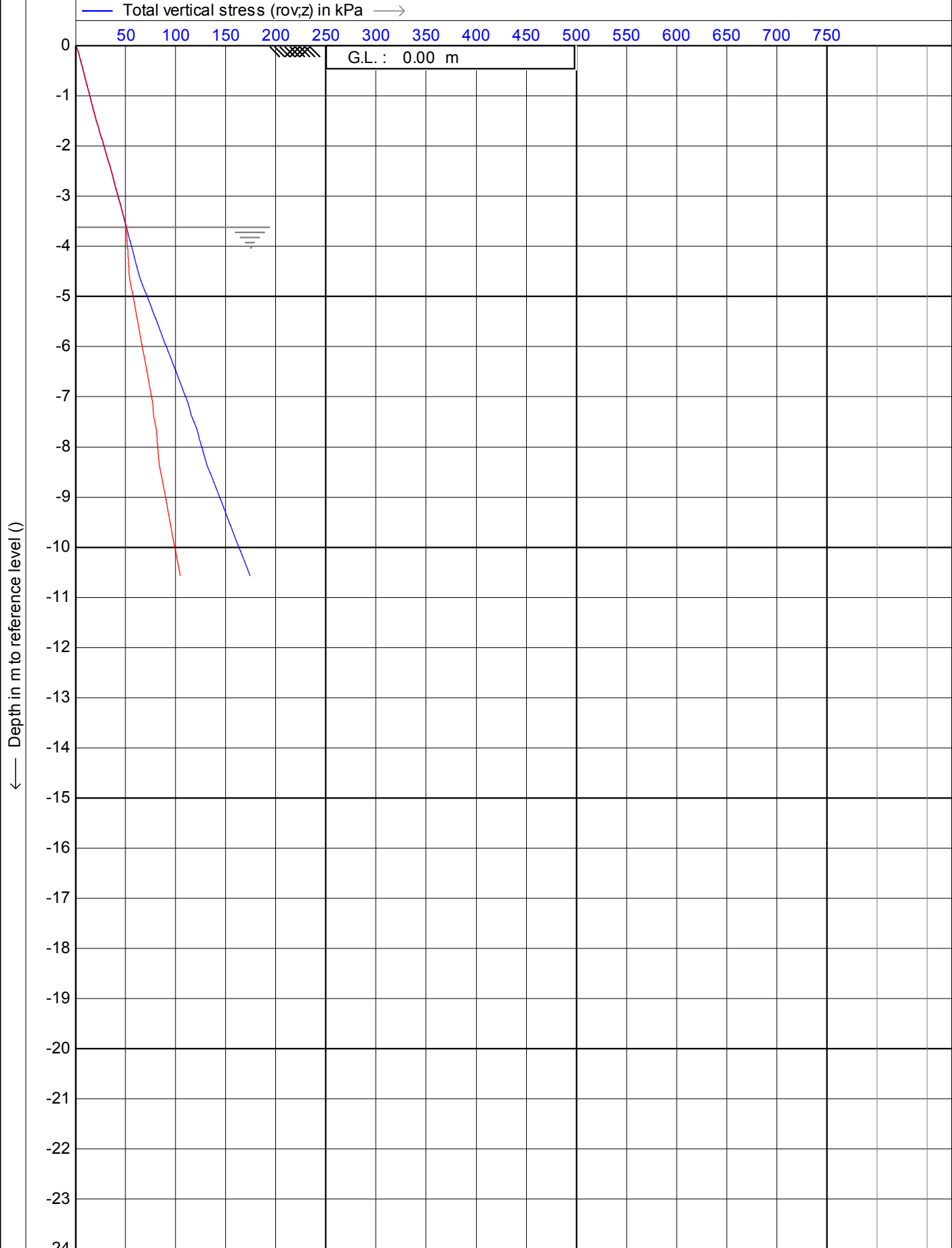
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

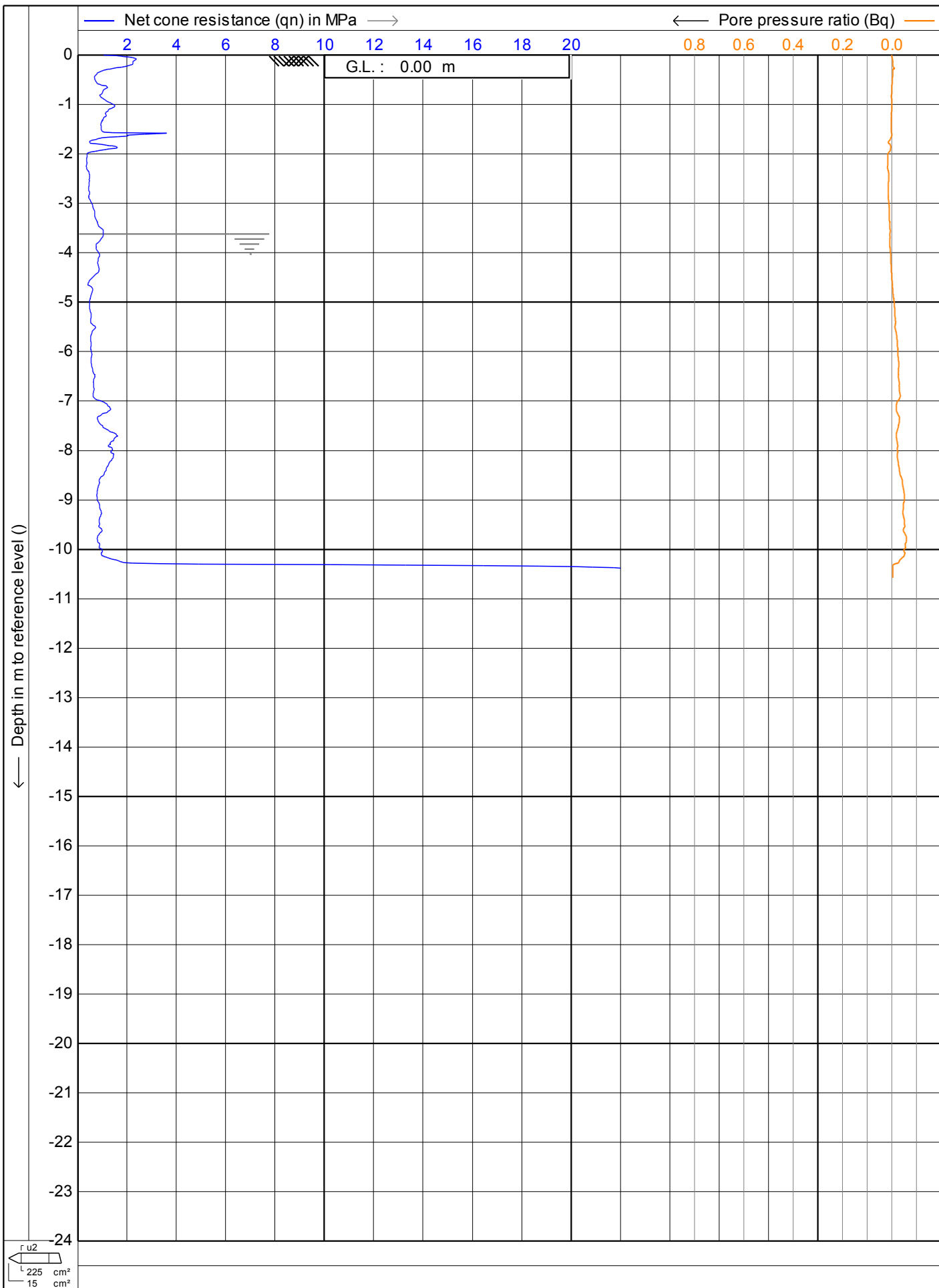
CPT no. : **CPT1**

5/15



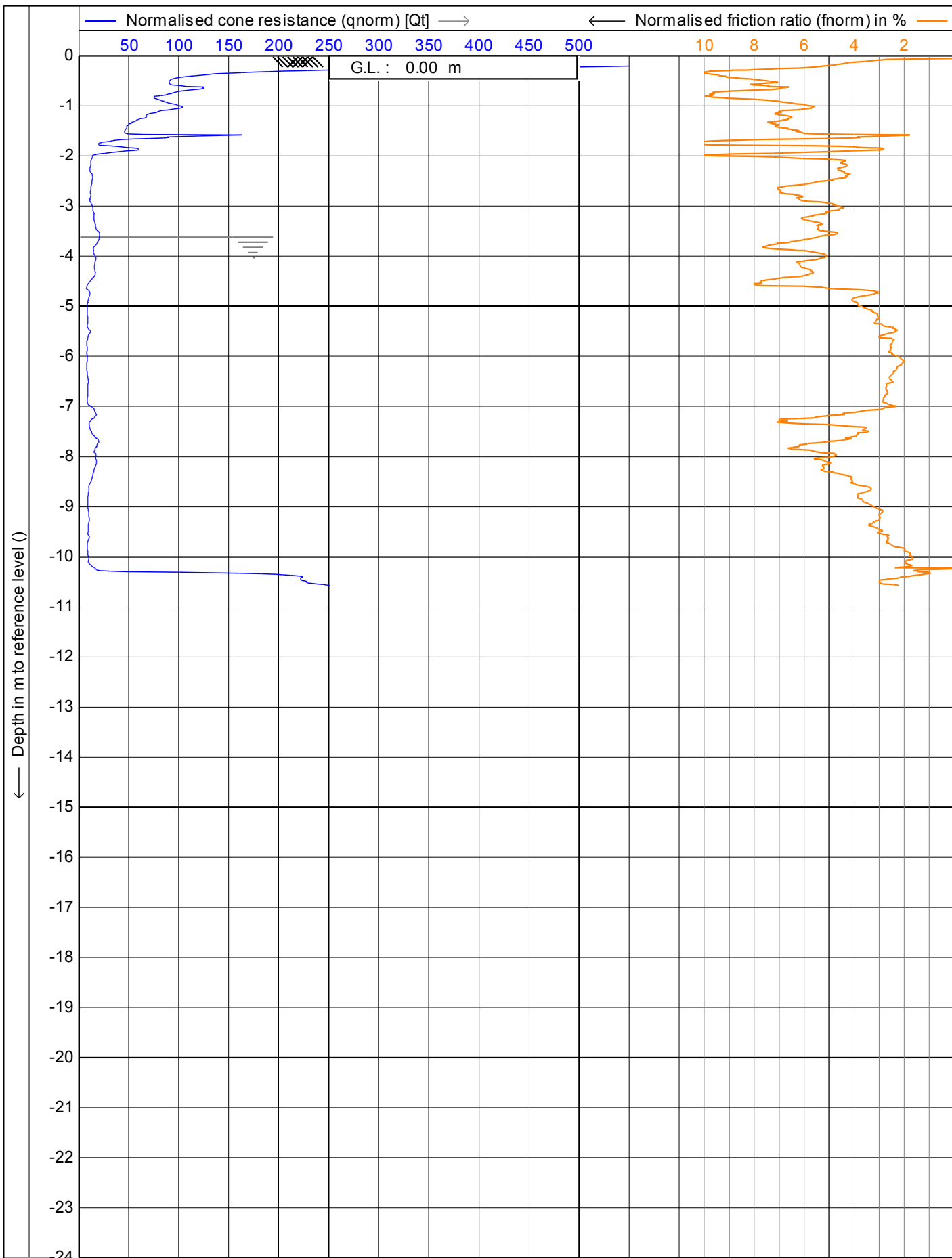
225 cm²
15 cm²

Test according NEN 5140 class 1		Date : 7/11/2017	
Project : 149-153 Edgewater Drive		Cone no. : S15CFIIP.S12007	
Location: 149-153 Edgewater drive		Project no. : 4116	
Position: 0, 0		CPT no. : CPT1	6/15



225 cm²
15 cm²

Test according NEN 5140 class 1	Date : 7/11/2017	
	Cone no. : S15CFIP.S12007	
	Project no. : 4116	
	CPT no. : CPT1	7/15
Project : 149-153 Edgewater Drive		
Location: 149-153 Edgewater drive		
Position: 0, 0		



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT1**

8/15

← Depth in m to reference level ()

— Soil behaviour type index (Ic) —→

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

(2) Organic soils
(3) Clay
(4) Silt mixtures
(5) Sand mixtures
(6) Sand clean to silty
(7) Gravelly sand

225 cm²
15 cm²

7

6

5

4

3

2

Test according NEN 5140 class 1

Date : 7/11/2017

Cone no. : S15CFIP.S12007

Project : 149-153 Edgewater Drive

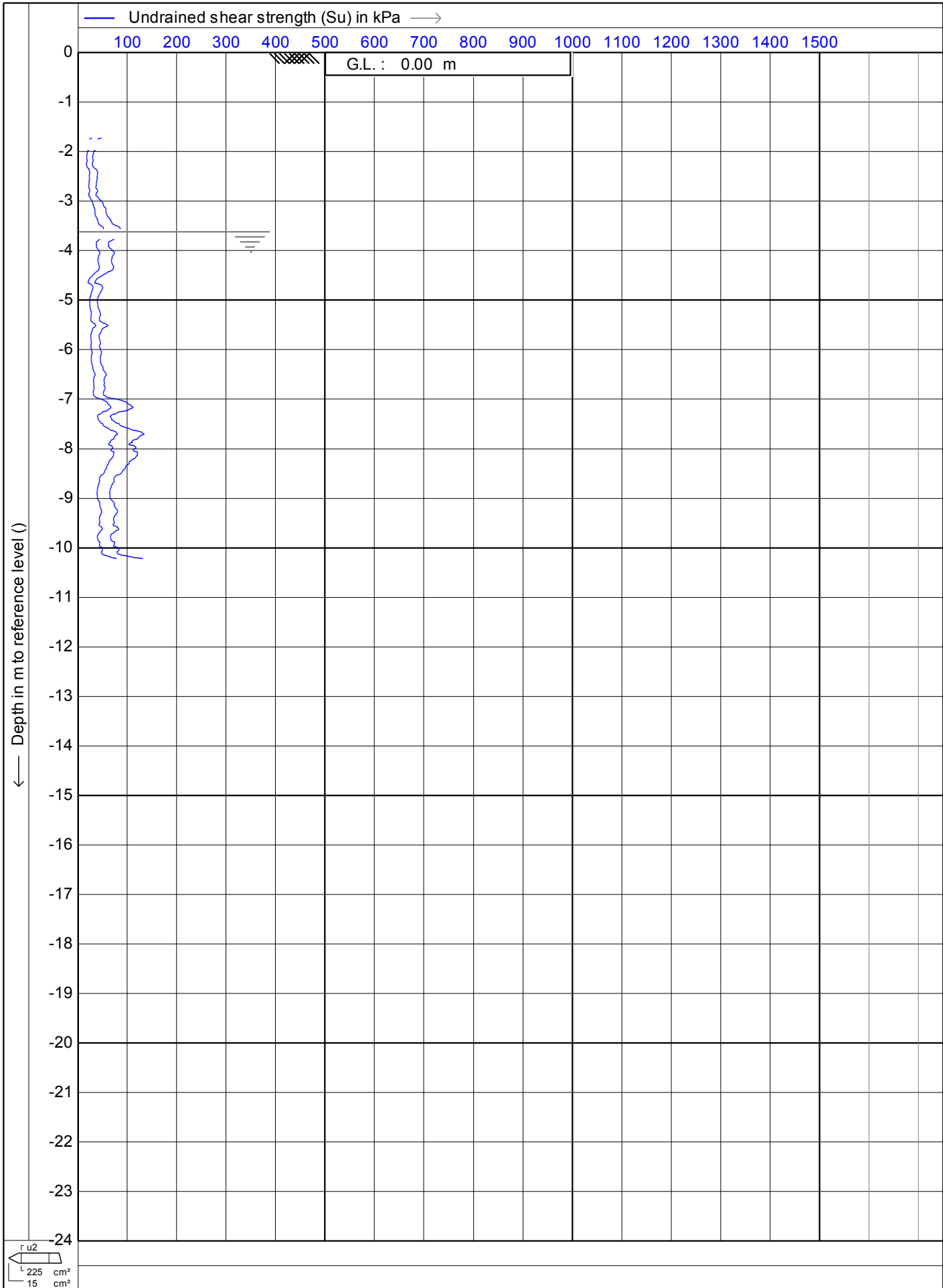
Project no. : 4116

Location: 149-153 Edgewater drive

Position: 0, 0

CPT no. : CPT1

9/15



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

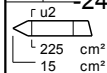
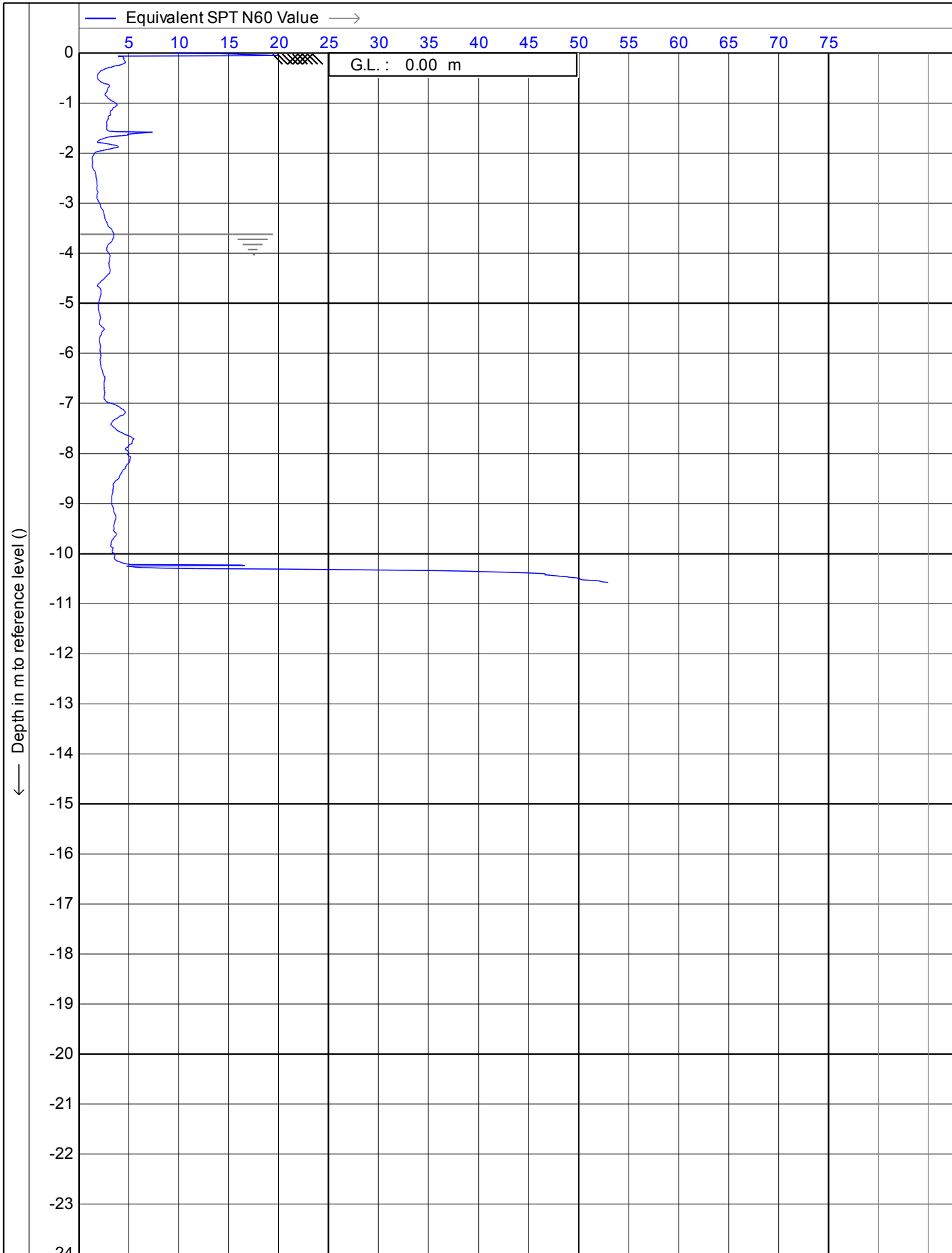
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Cone no. : **S15CFIP.S12007**

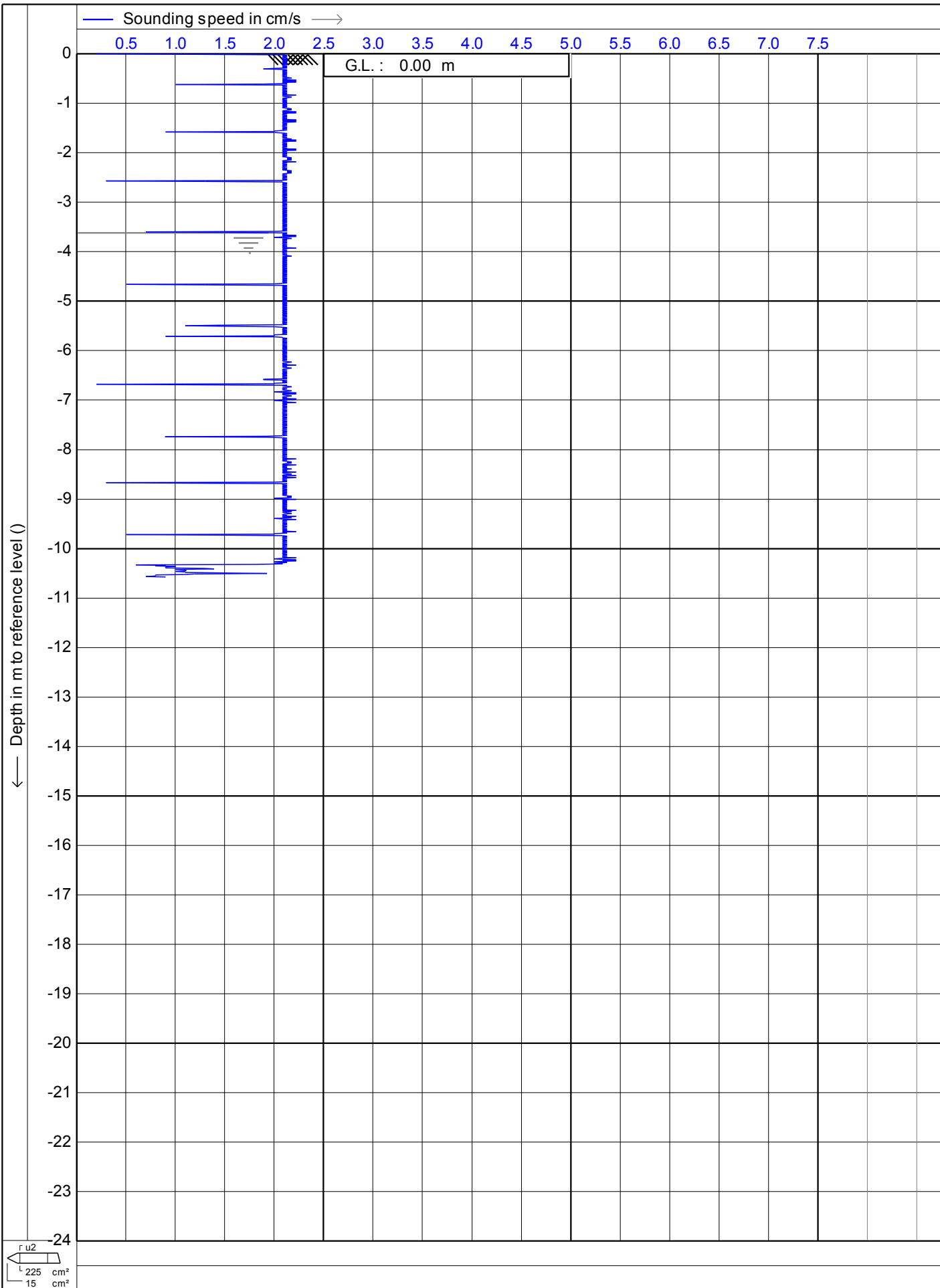
Project no. : **4116**

CPT no. : **CPT1**

10/15



Test according NEN 5140 class 1		Date : 7/11/2017
Project : 149-153 Edgewater Drive		Cone no. : S15CFIP.S12007
Location: 149-153 Edgewater drive		Project no. : 4116
Position: 0, 0		CPT no. : CPT1
		12/15



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

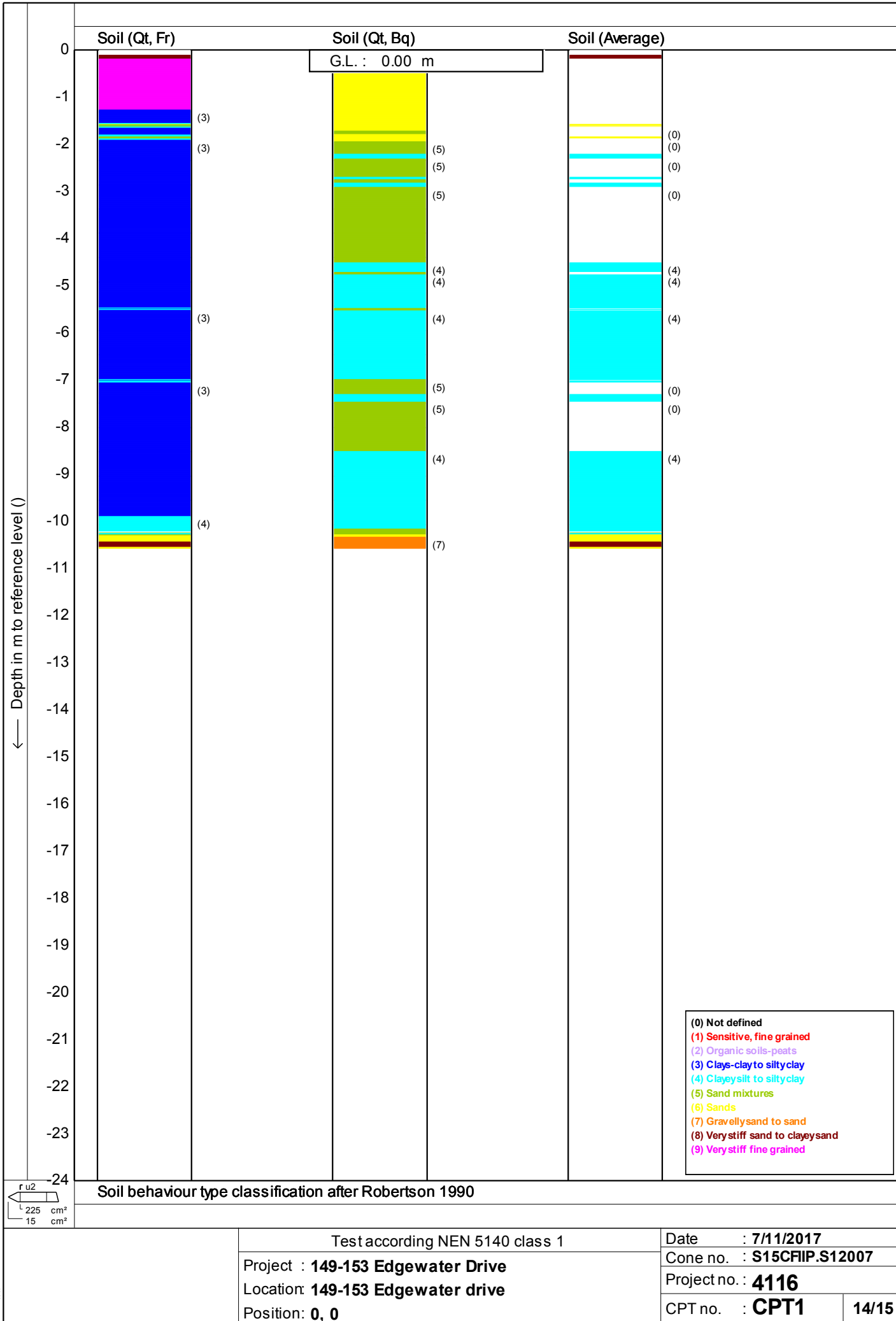
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT1**

13/15



← Depth in m to reference level ()

— Internal friction angle in degrees —→

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

G.L. : 0.00 m

γ u2
225 cm²
15 cm²

Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

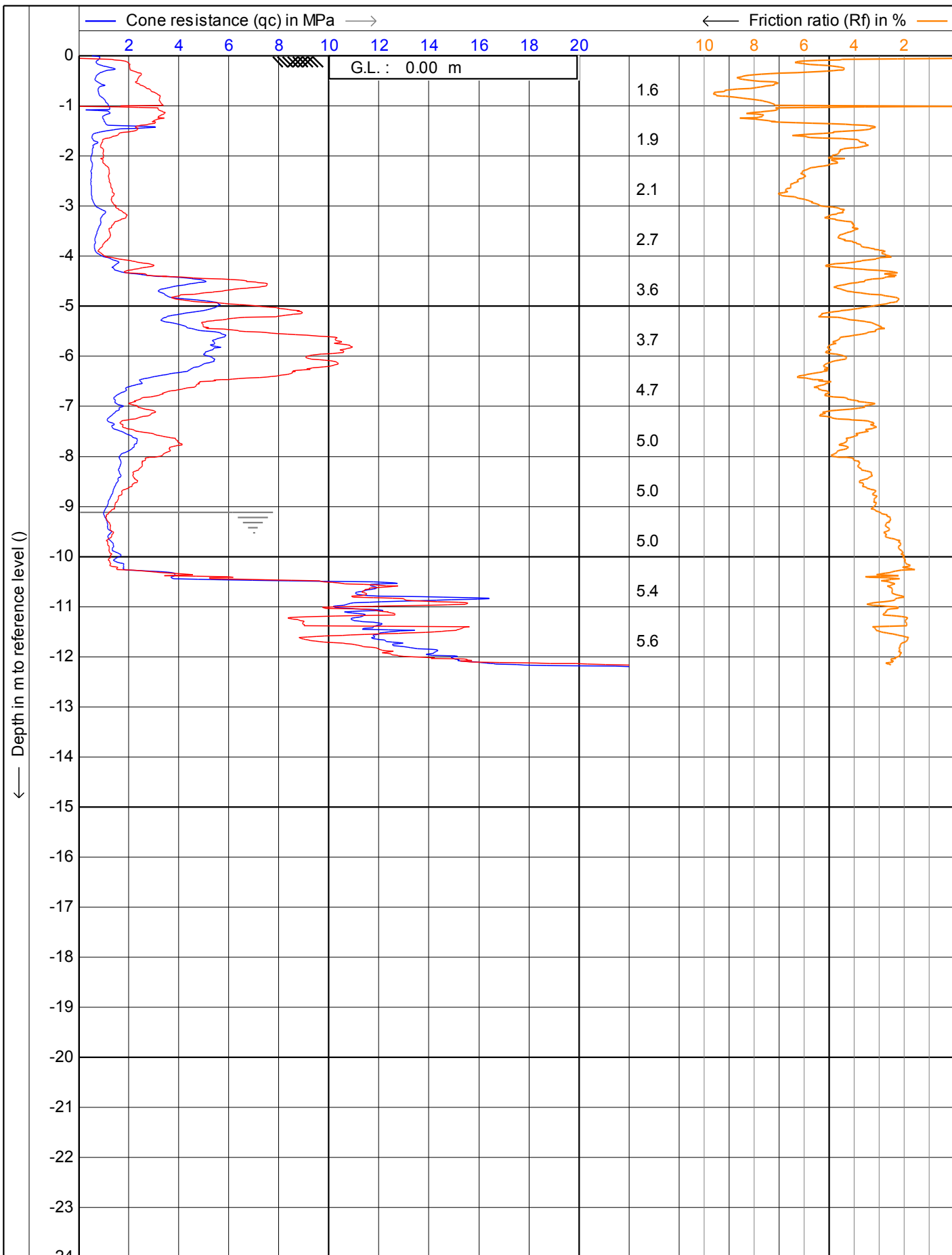
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

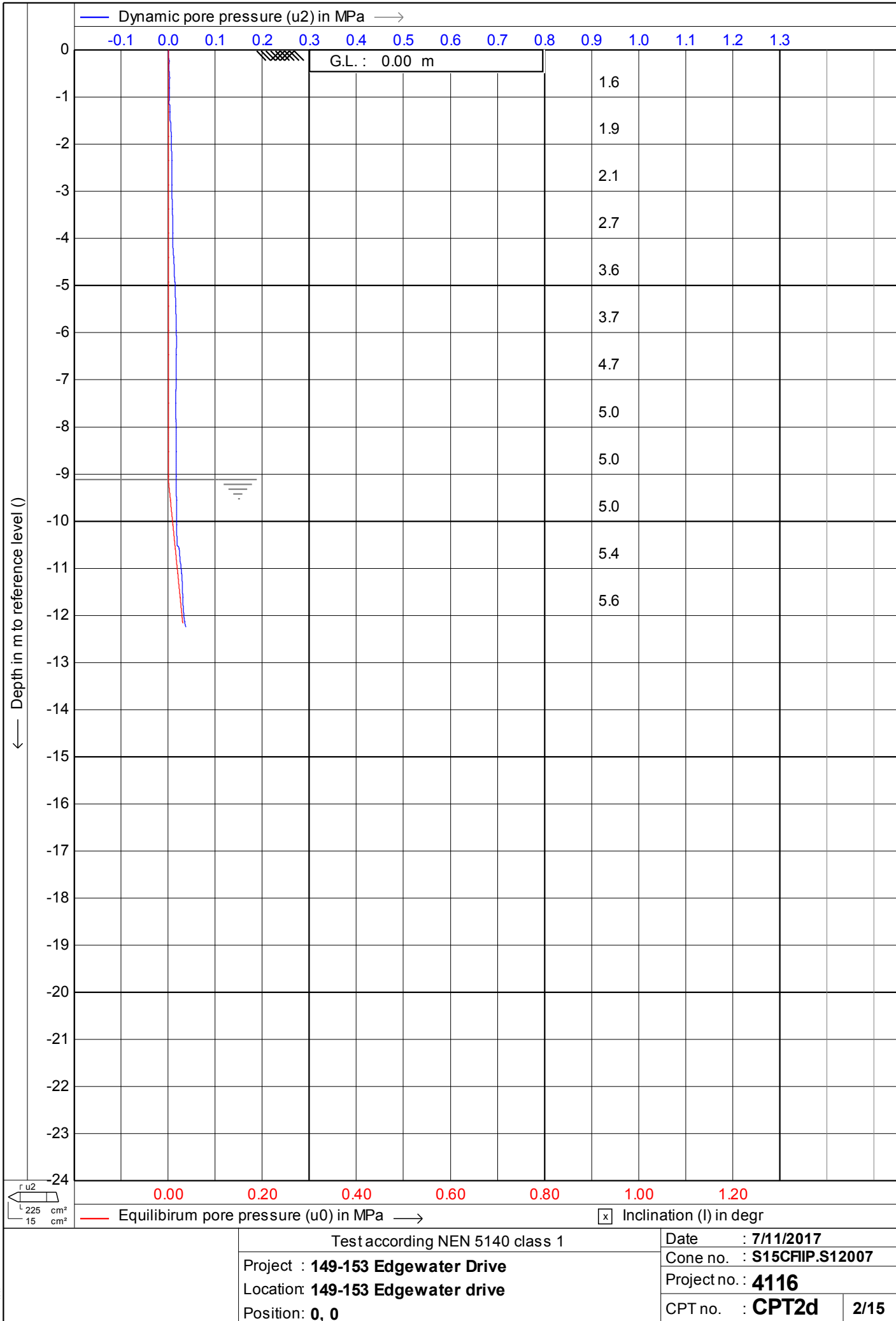
Project no. : **4116**

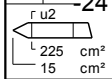
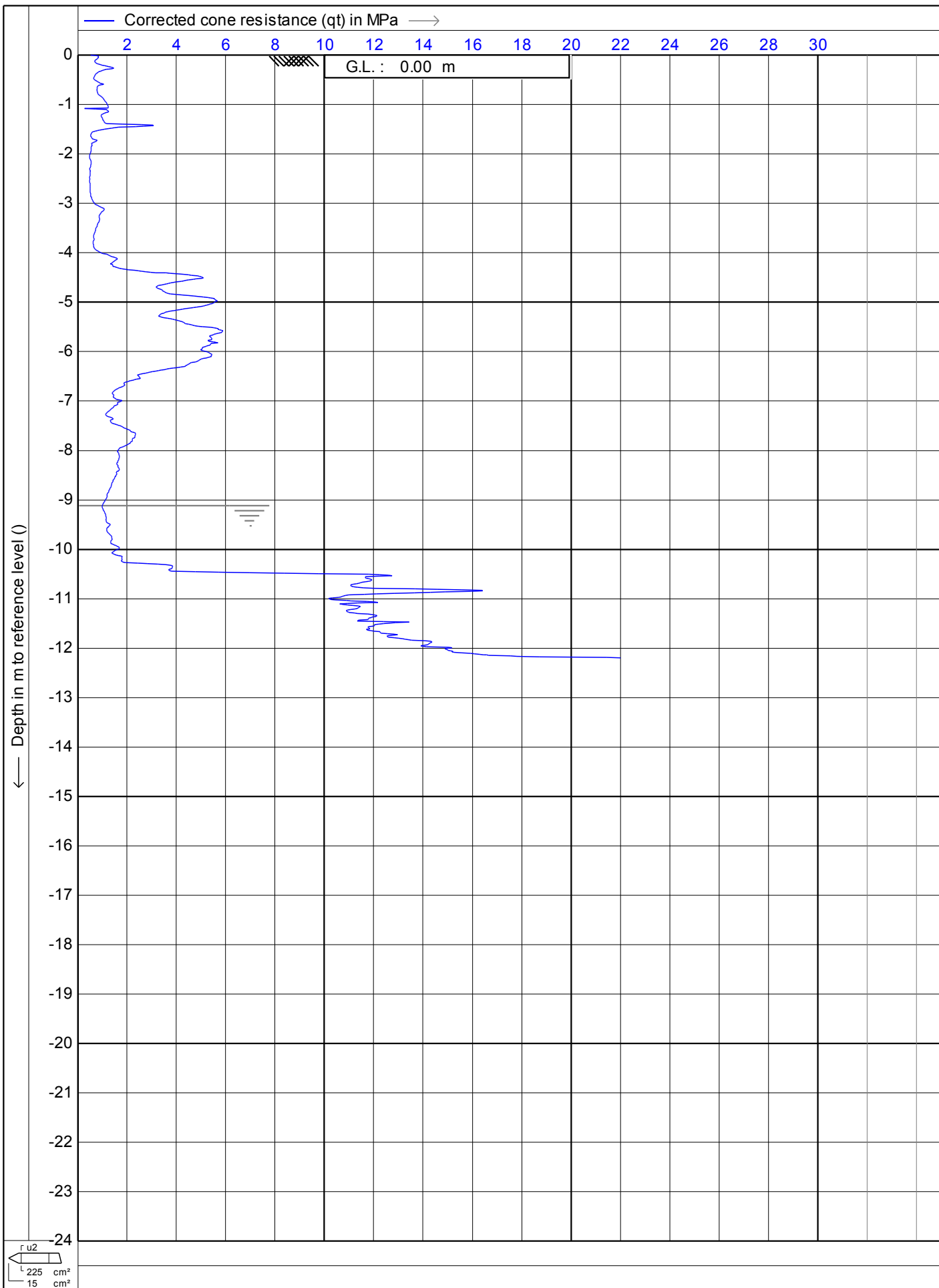
CPT no. : **CPT1**

15/15



1.47	Test according NEN 5140 class 1		Date : 7/11/2017	
	Project : 149-153 Edgewater Drive		Cone no. : S15CFIP.S12007	
	Location: 149-153 Edgewater drive		Project no. : 4116	
	Position: 0, 0		CPT no. : CPT2d	1/15





Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

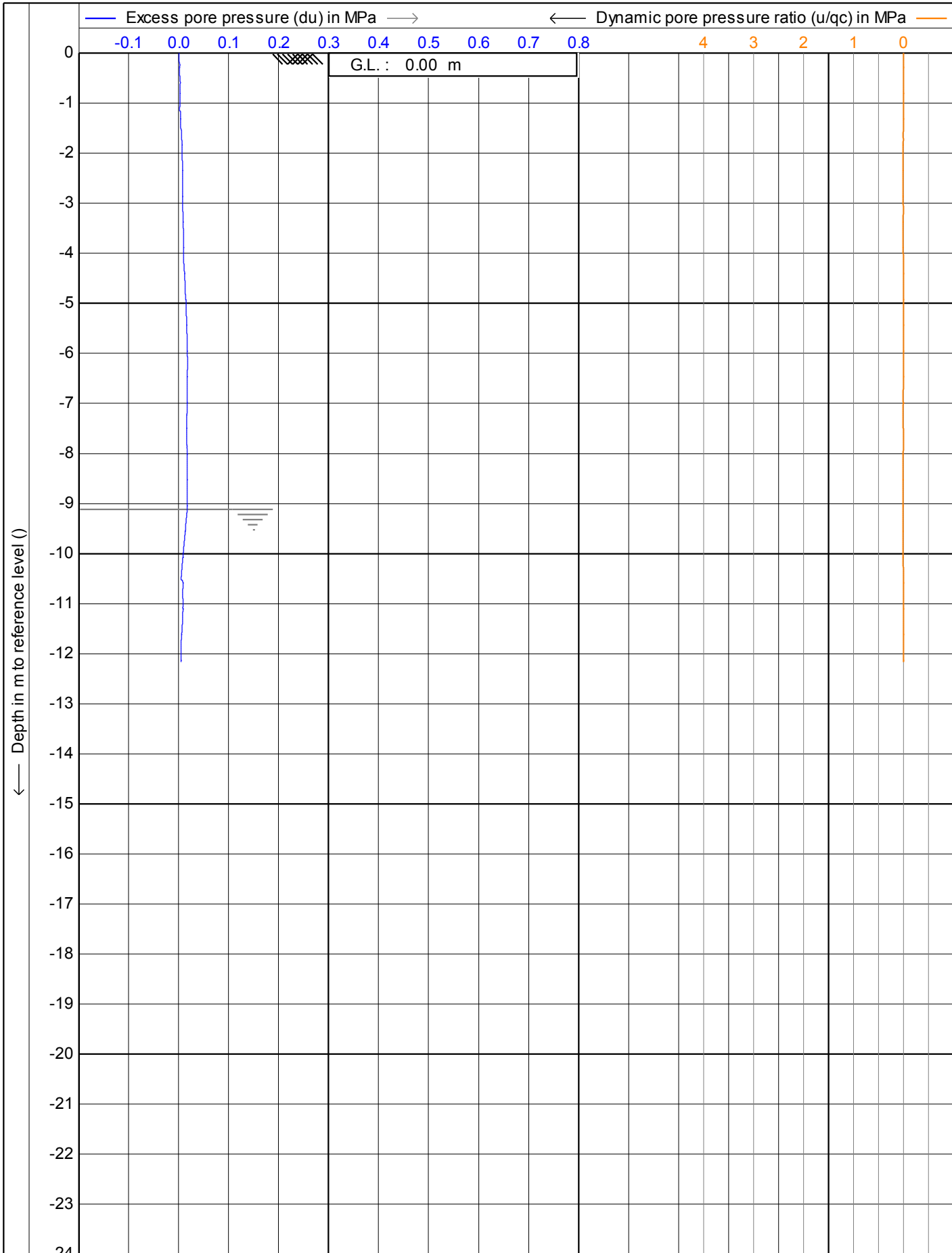
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT2d**

3/15



$\frac{r}{u^2}$
 225 cm^2
 15 cm^2

Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

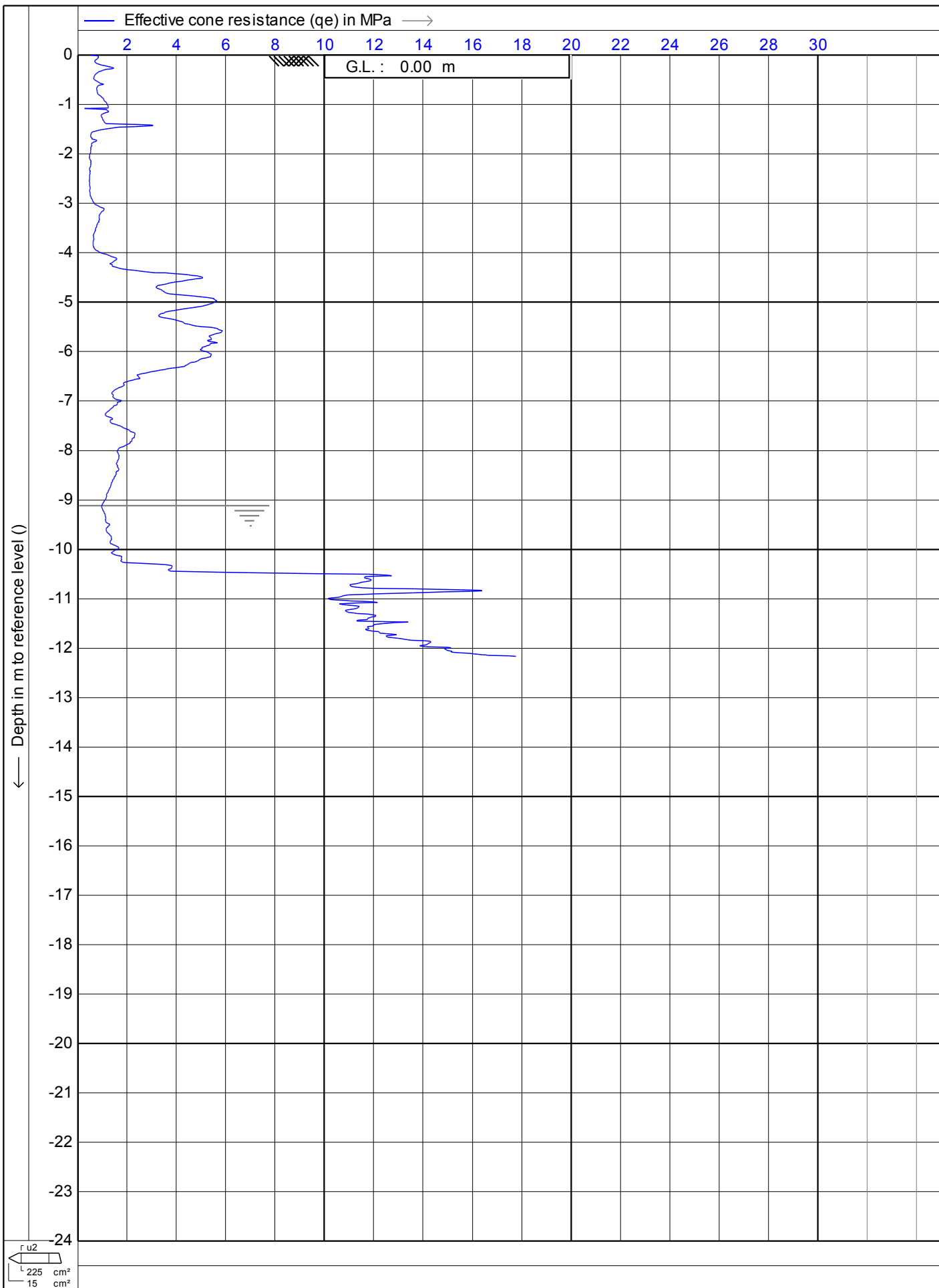
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT2d**

4/15



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

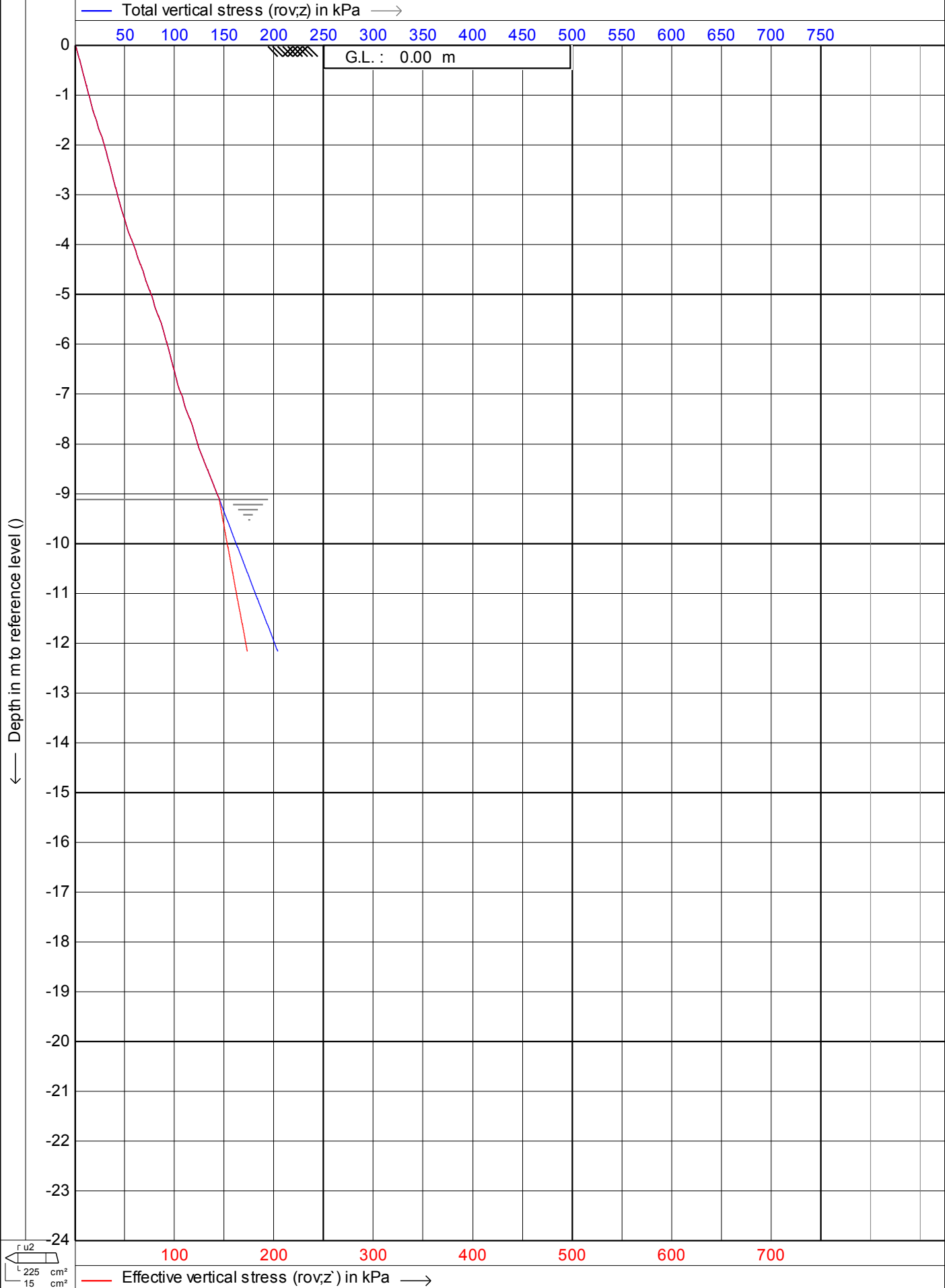
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT2d**

5/15



225 cm²
15 cm²

Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

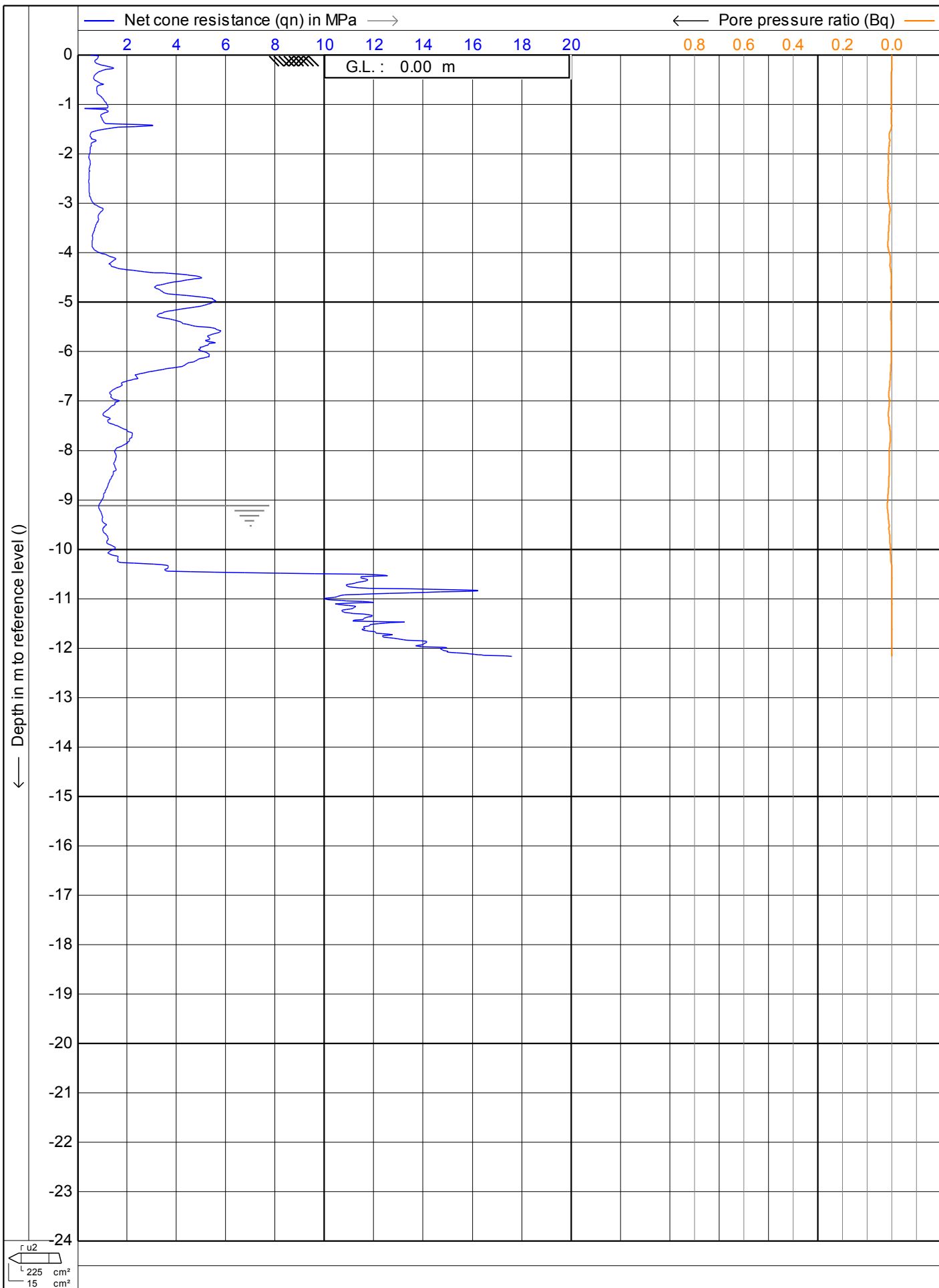
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT2d**

6/15



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

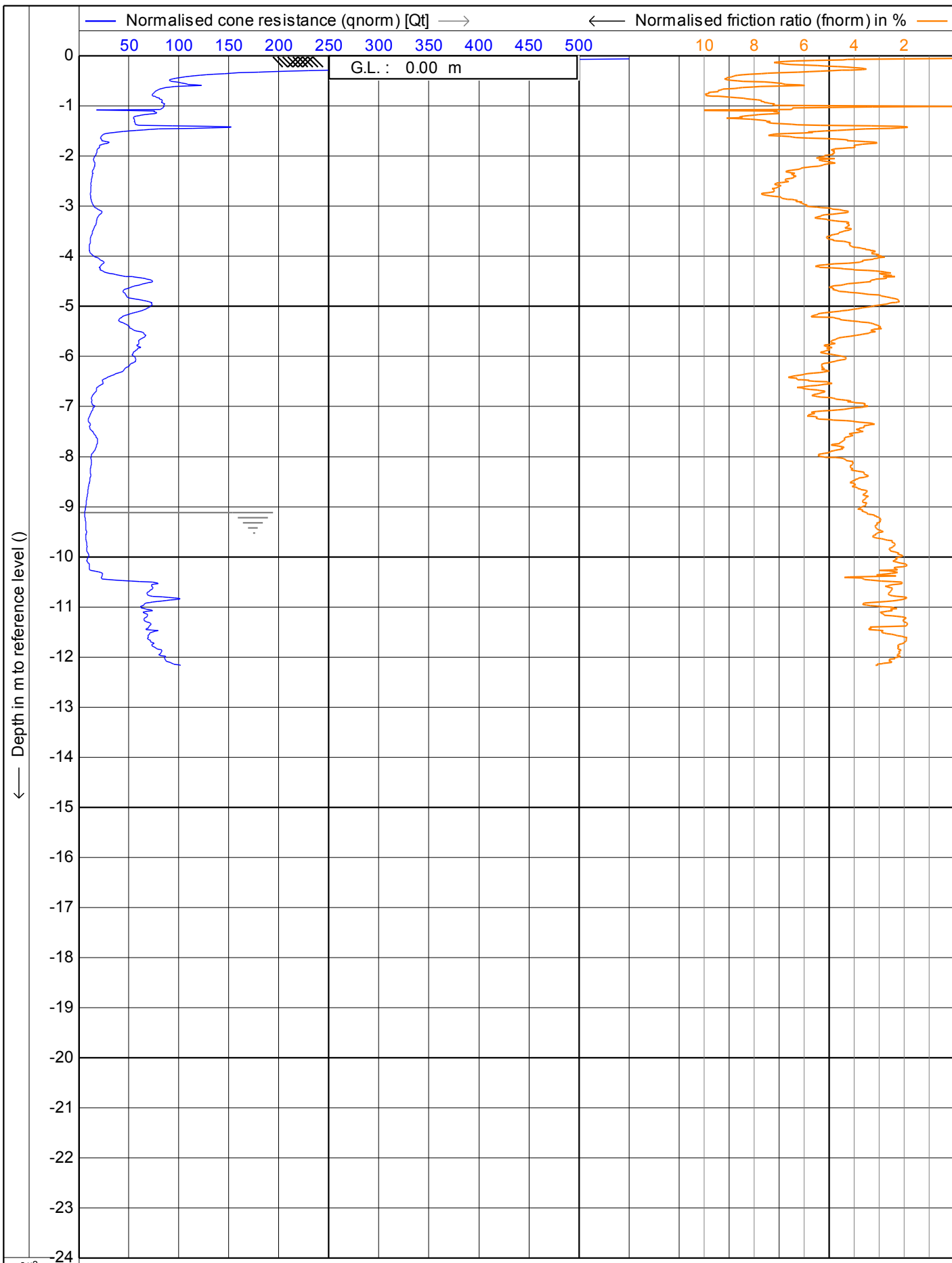
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

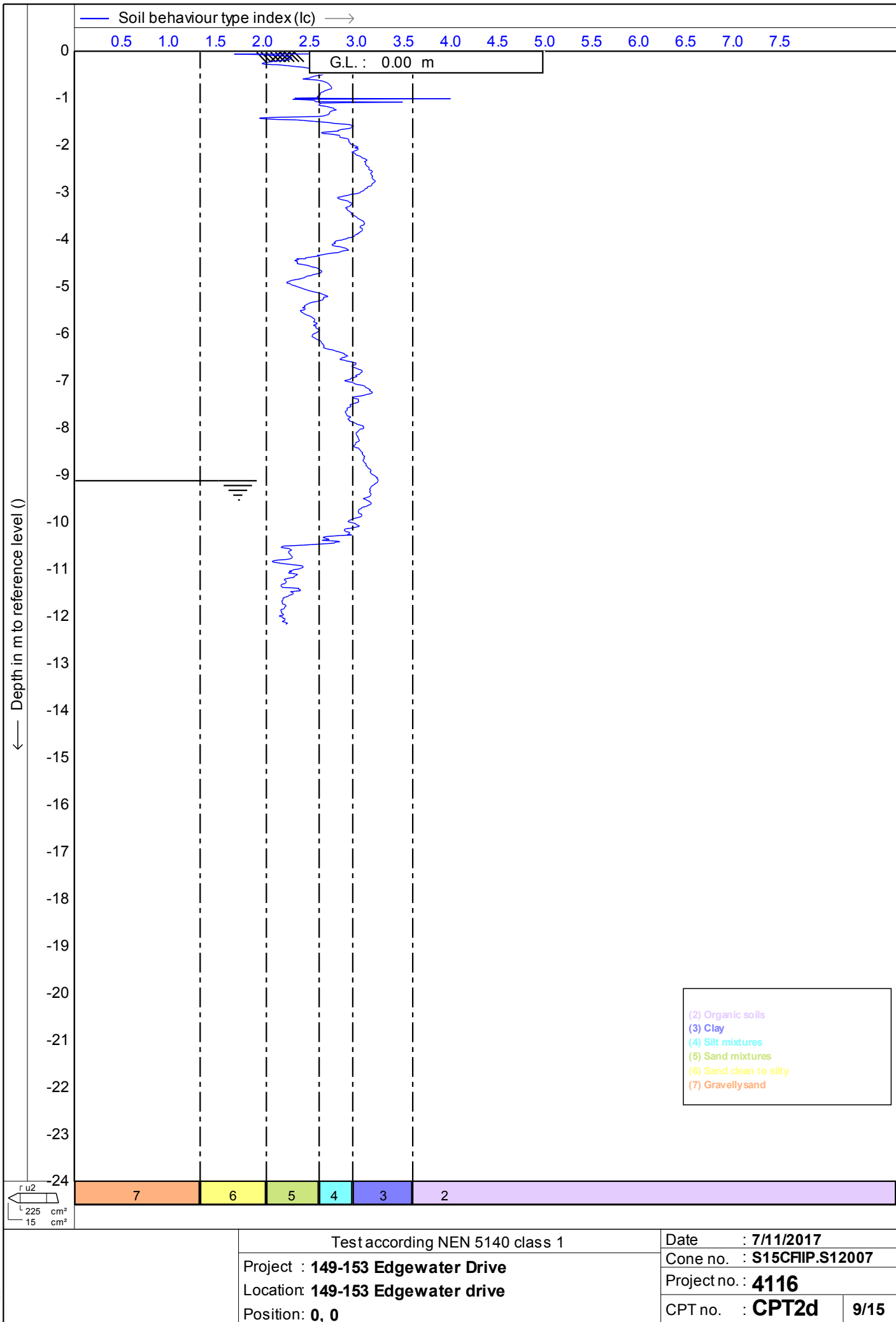
Project no. : **4116**

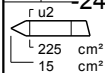
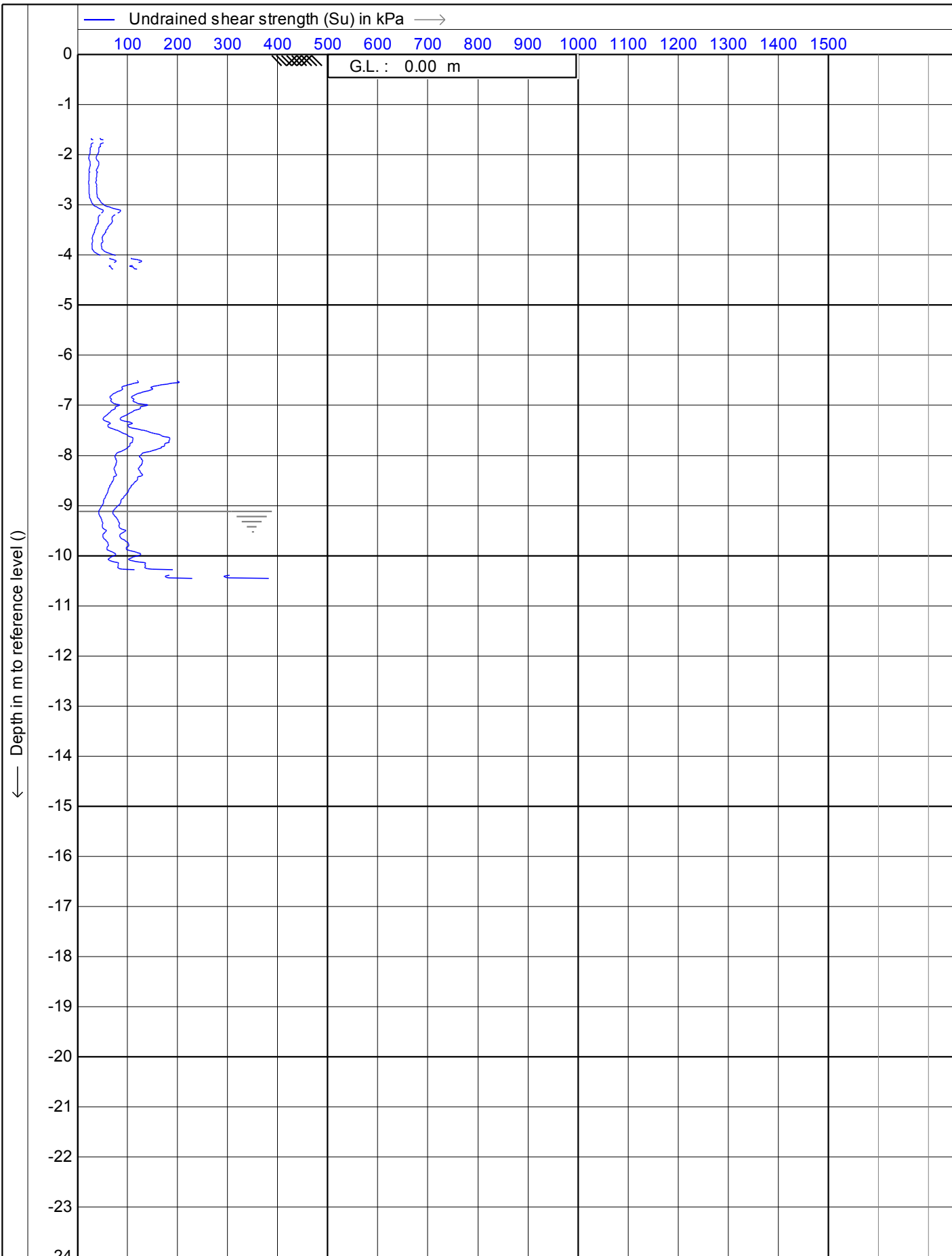
CPT no. : **CPT2d**

7/15



	Test according NEN 5140 class 1		Date : 7/11/2017	
	Project : 149-153 Edgewater Drive		Cone no. : S15CFIP.S12007	
	Location: 149-153 Edgewater drive		Project no. : 4116	
	Position: 0, 0		CPT no. : CPT2d	8/15





Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

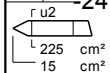
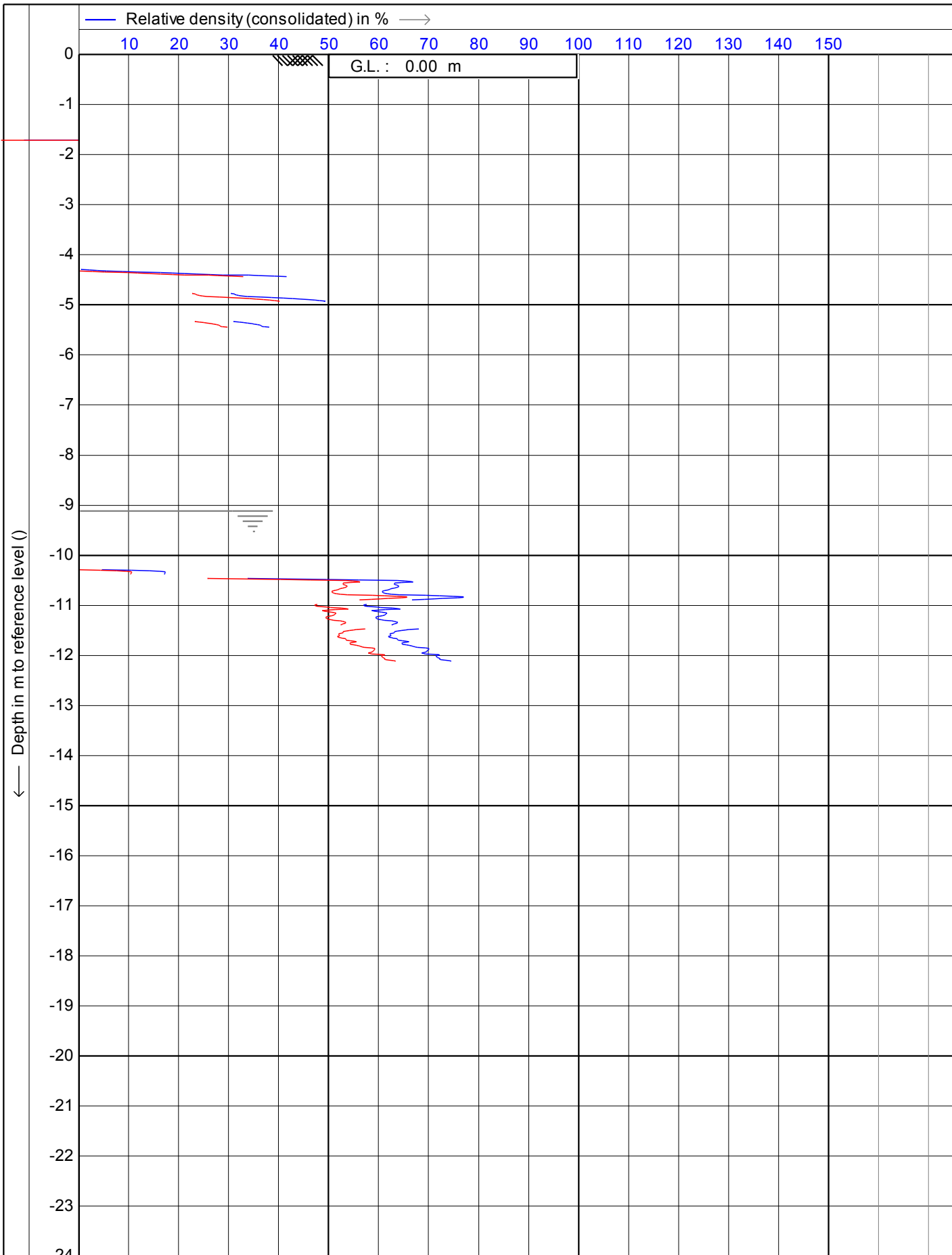
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

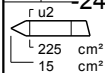
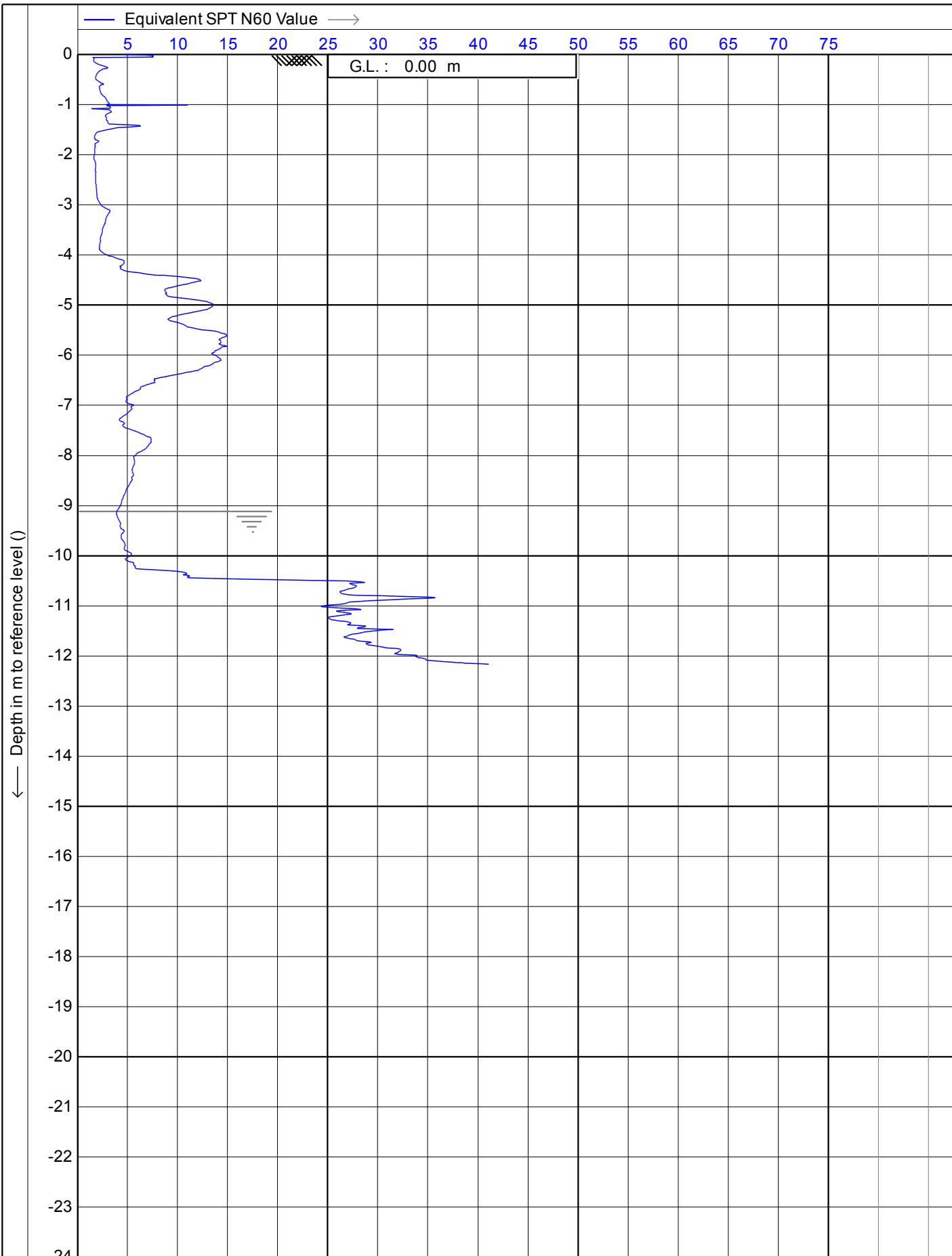
Project no. : **4116**

CPT no. : **CPT2d**

10/15



Test according NEN 5140 class 1		Date : 7/11/2017	
Project : 149-153 Edgewater Drive		Cone no. : S15CFIP.S12007	
Location: 149-153 Edgewater drive		Project no. : 4116	
Position: 0, 0		CPT no. : CPT2d	11/15



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

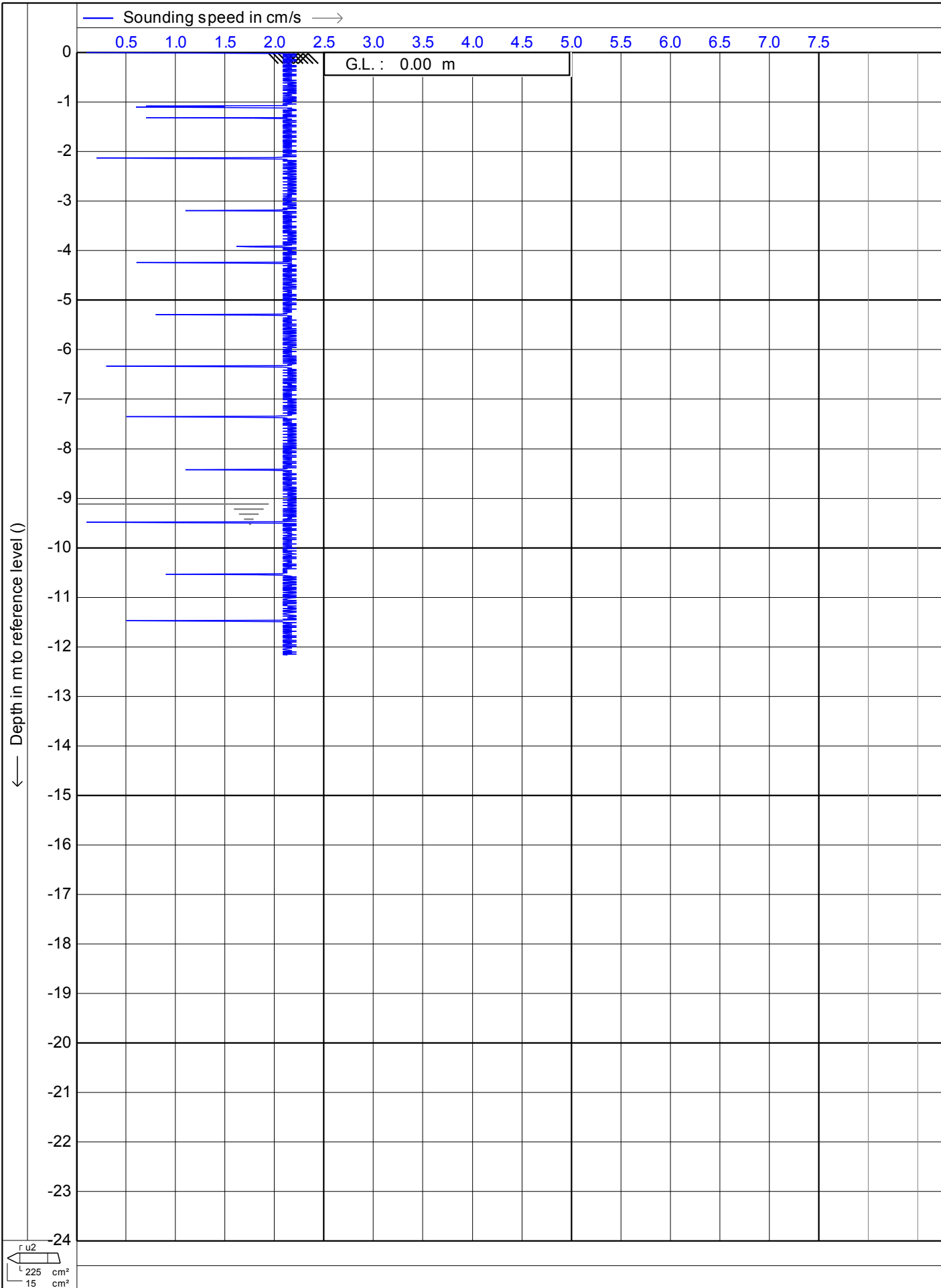
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT2d**

12/15



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

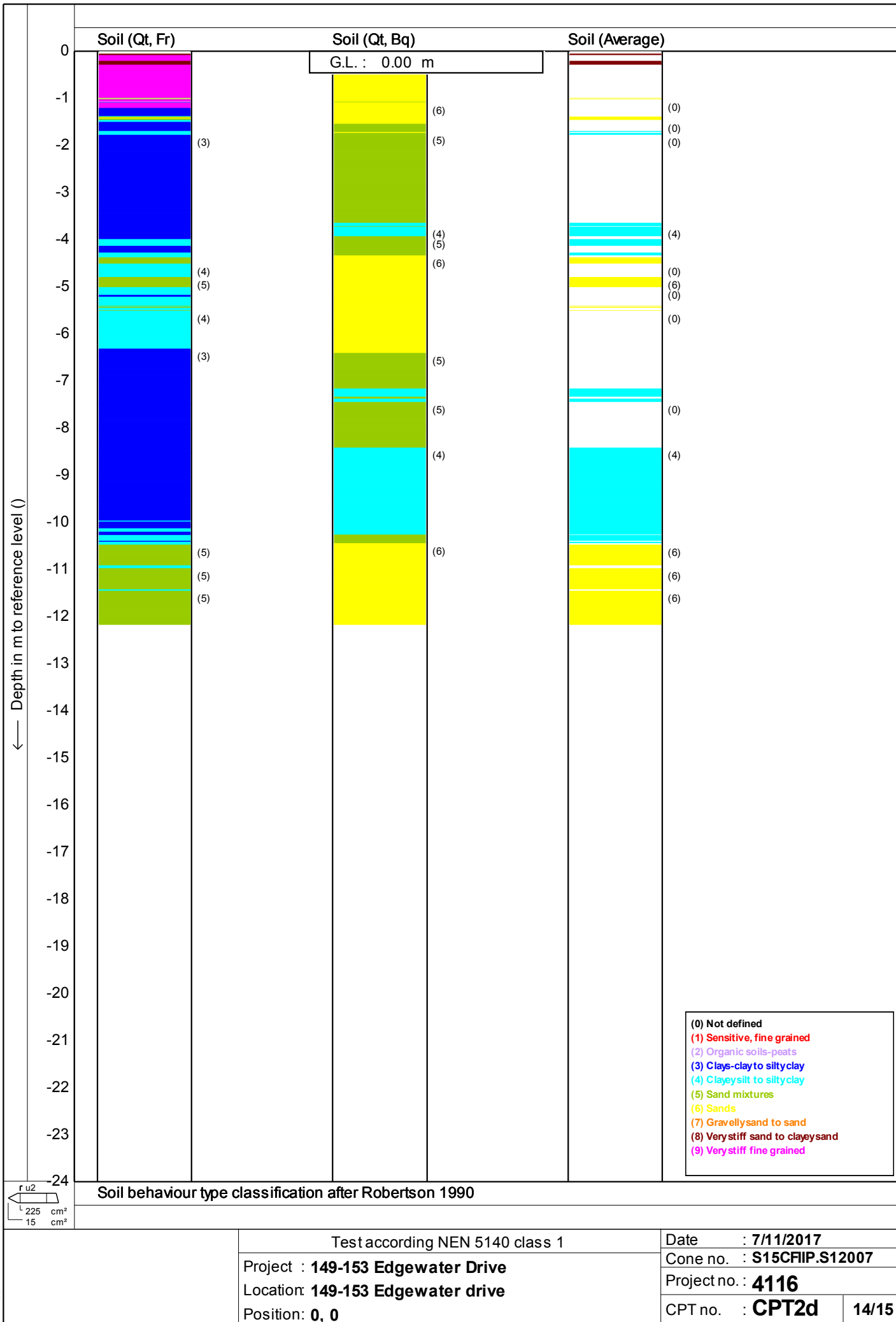
Date : **7/11/2017**

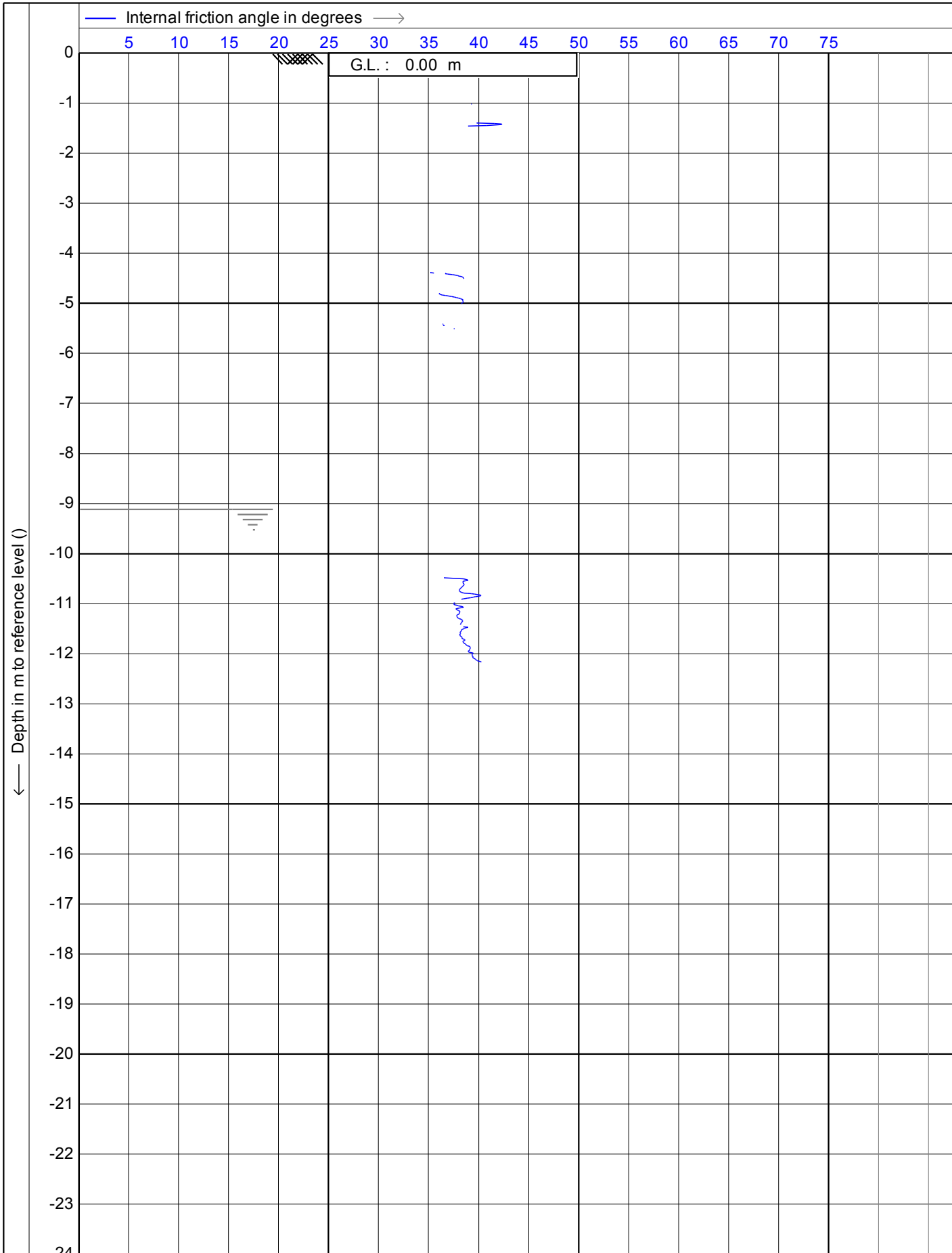
Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT2d**

13/15





σ_{u2}
 225 cm²
 15 cm²

Test according NEN 5140 class 1

Date : 7/11/2017

Project : 149-153 Edgewater Drive

Cone no. : S15CFIP.S12007

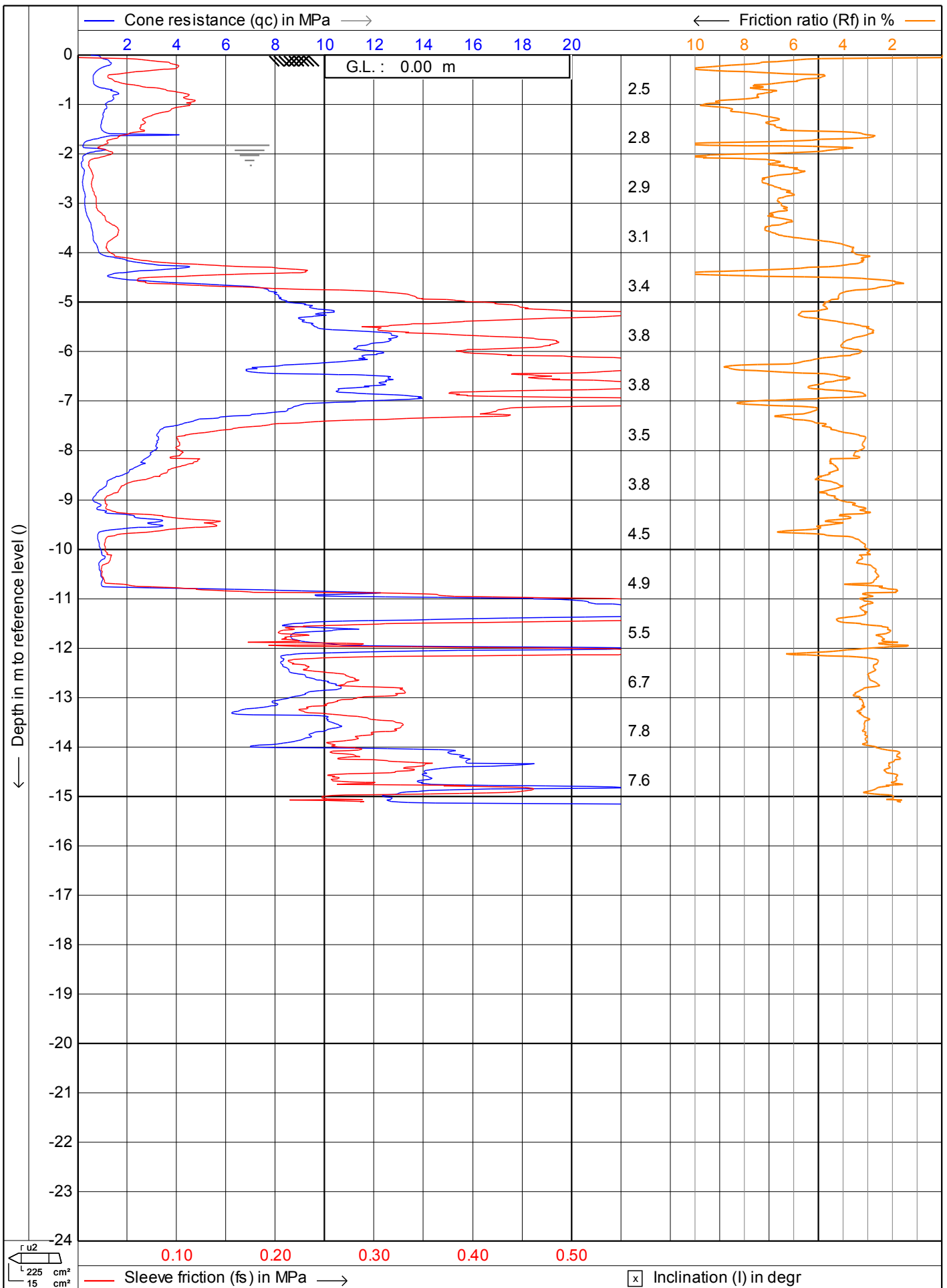
Location: 149-153 Edgewater drive

Project no. : 4116

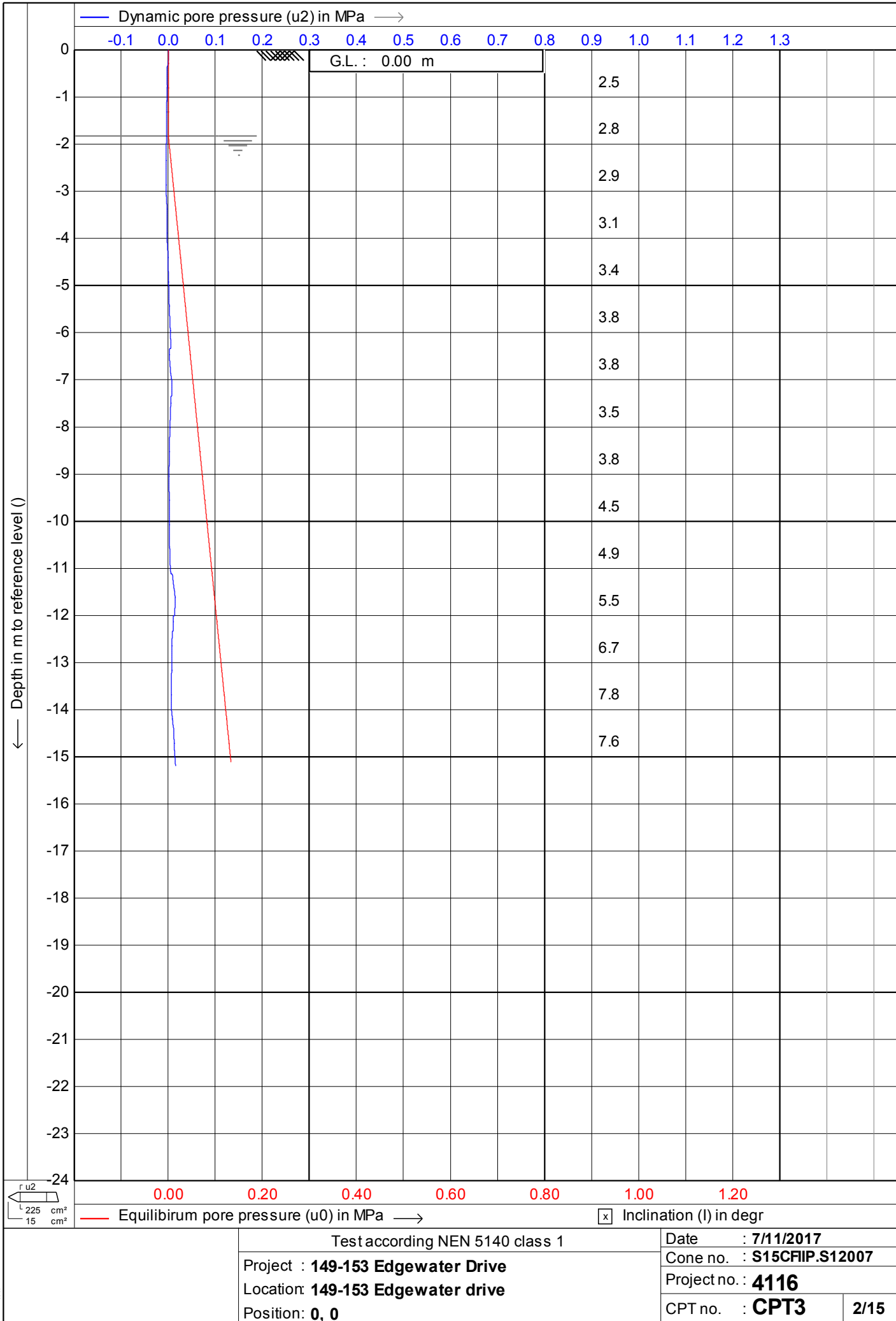
Position: 0, 0

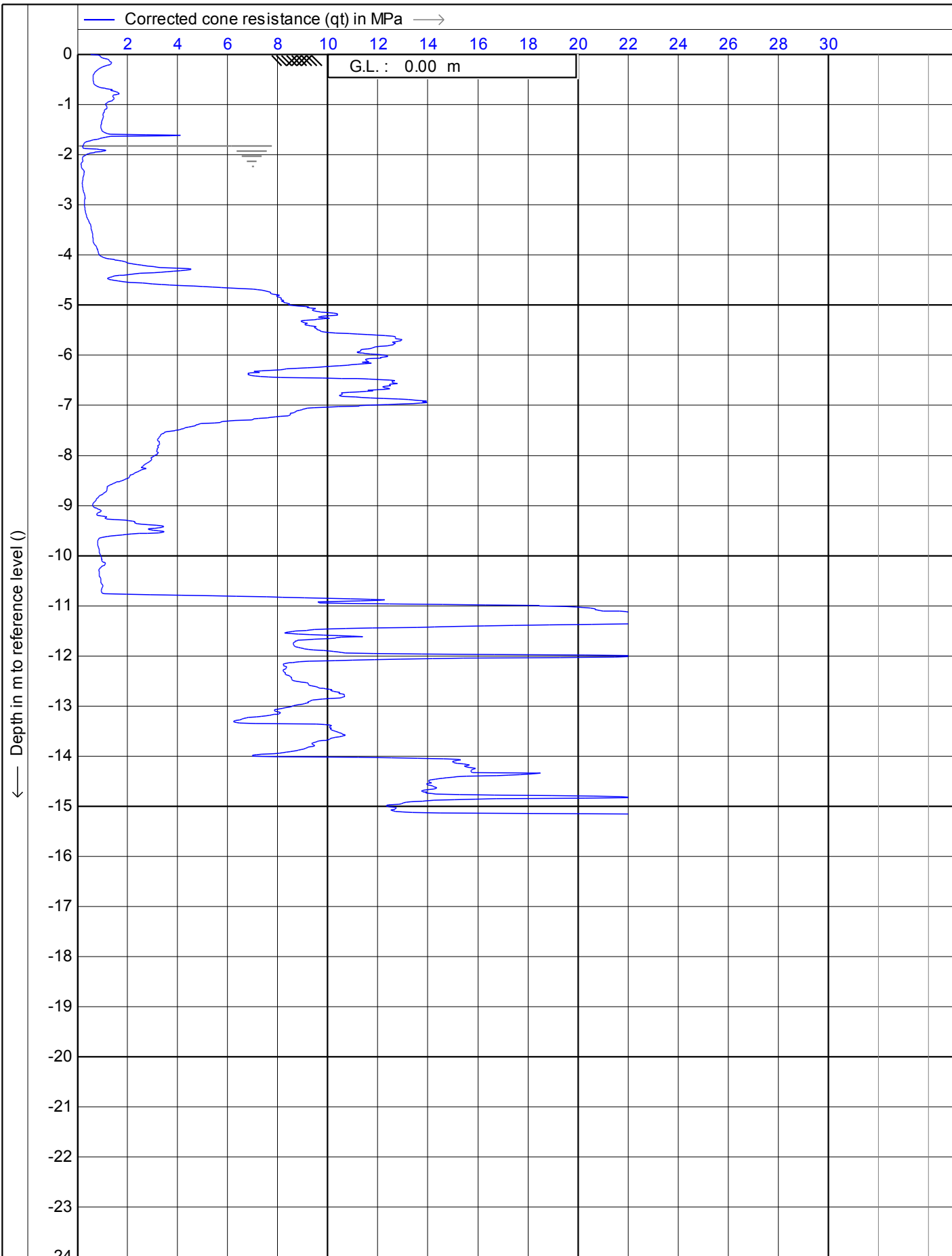
CPT no. : CPT2d

15/15



Test according NEN 5140 class 1		Date : 7/11/2017
Project : 149-153 Edgewater Drive		Cone no. : S15CFIP.S12007
Location: 149-153 Edgewater drive		Project no. : 4116
Position: 0, 0		CPT no. : CPT3
		1/15





Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

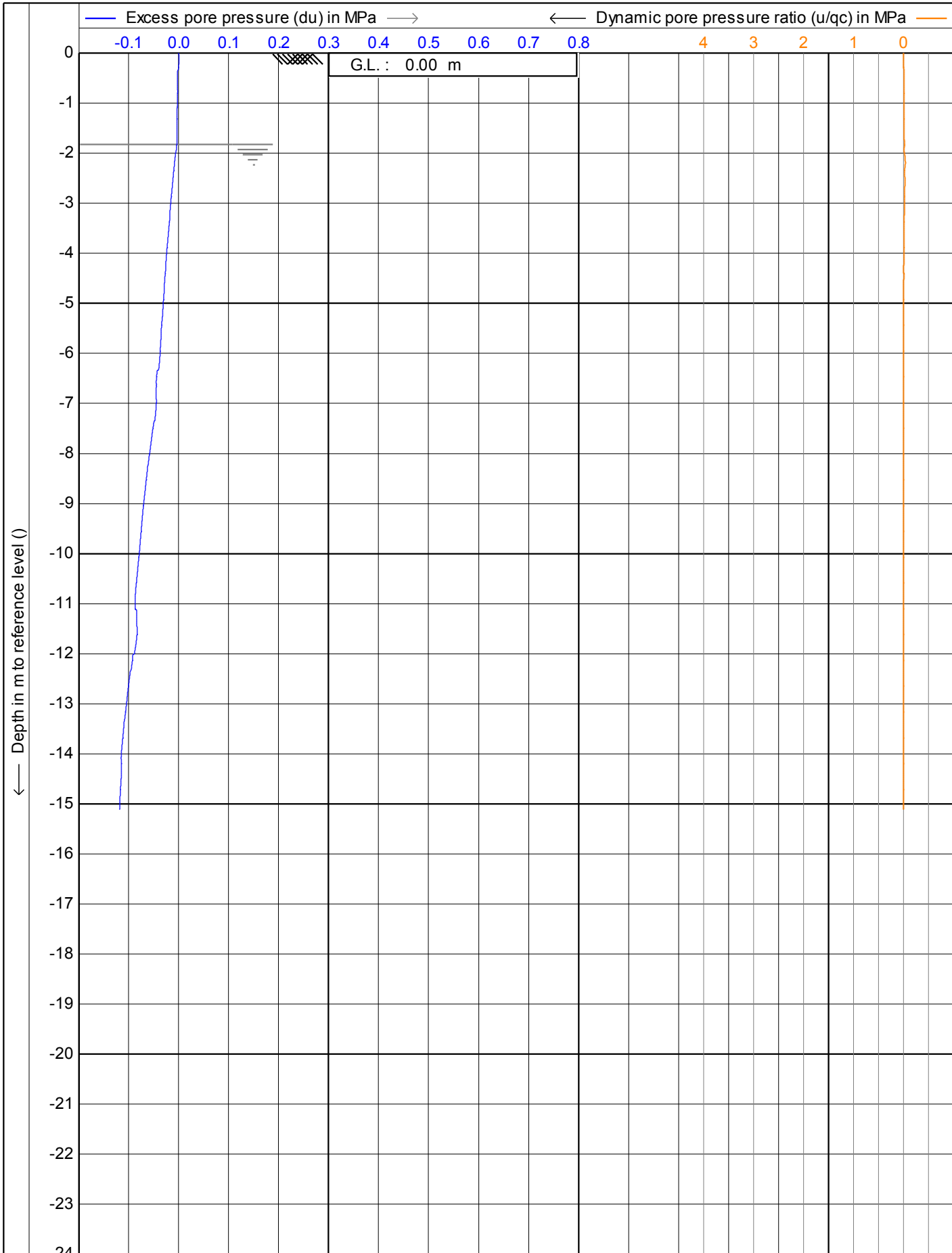
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT3**

3/15



225 cm²
 15 cm²

Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

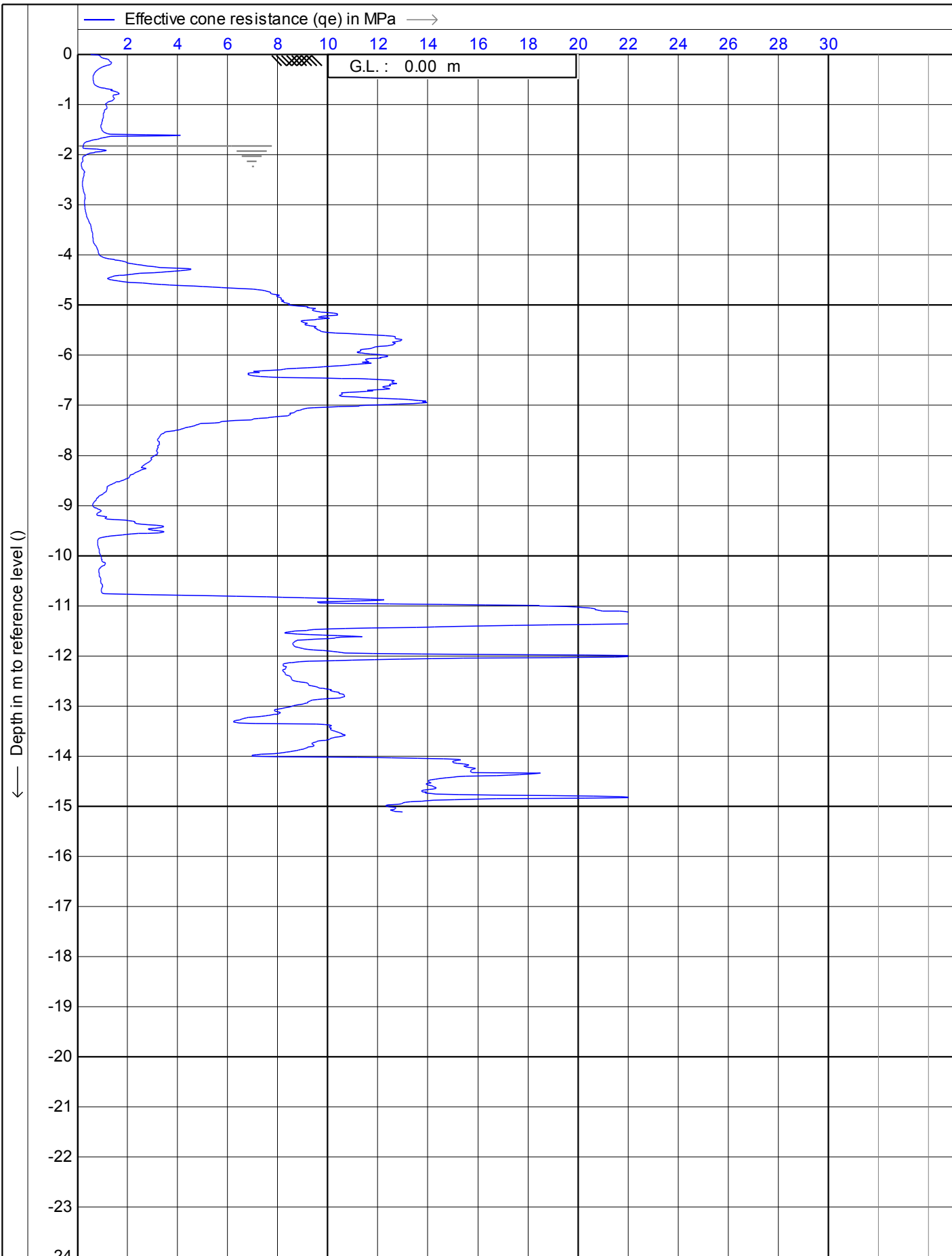
Date : **7/11/2017**

Cone no. : **S15CFIIP.S12007**

Project no. : **4116**

CPT no. : **CPT3**

4/15



$\frac{r}{u^2}$
 225 cm^2
 15 cm^2

Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

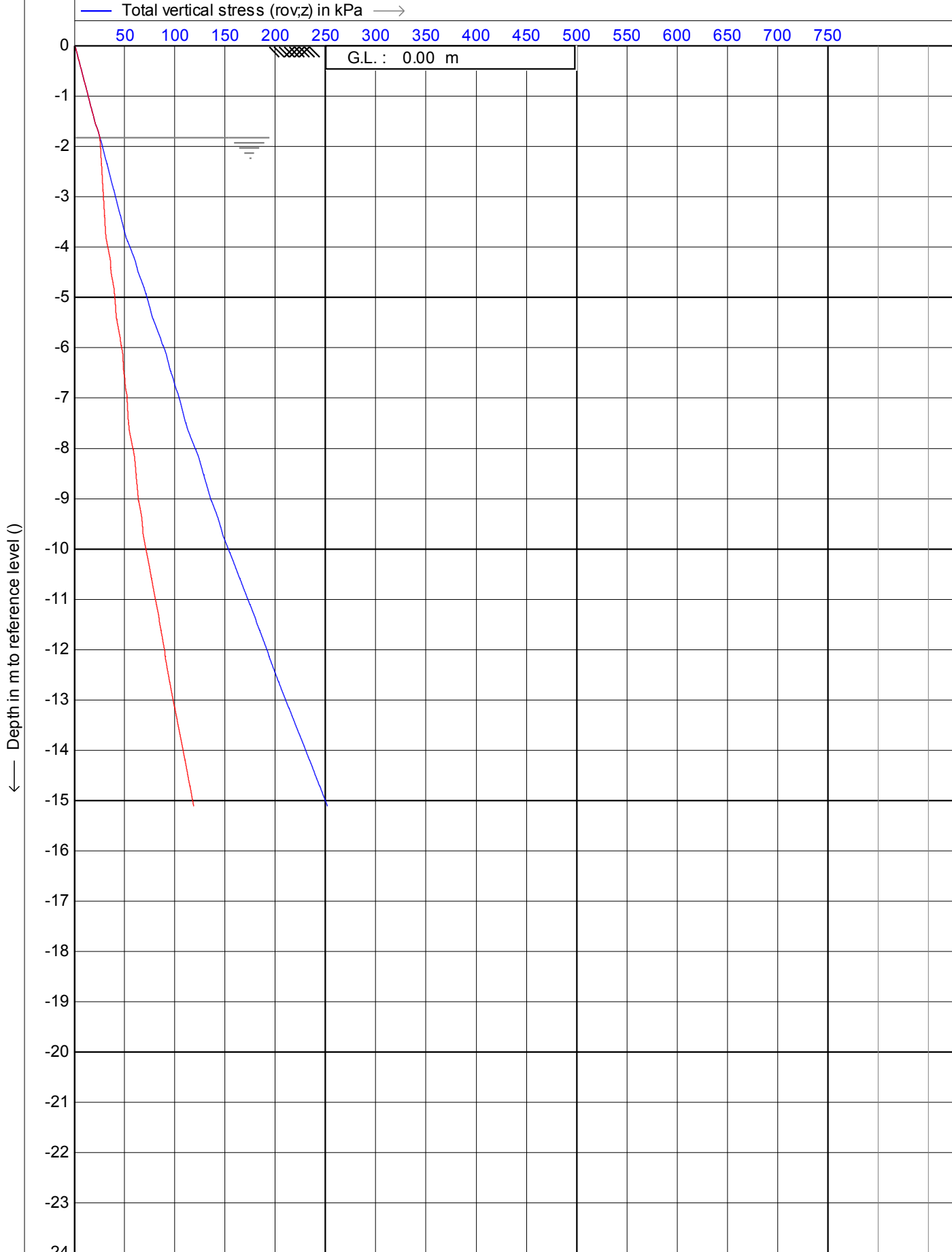
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

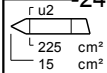
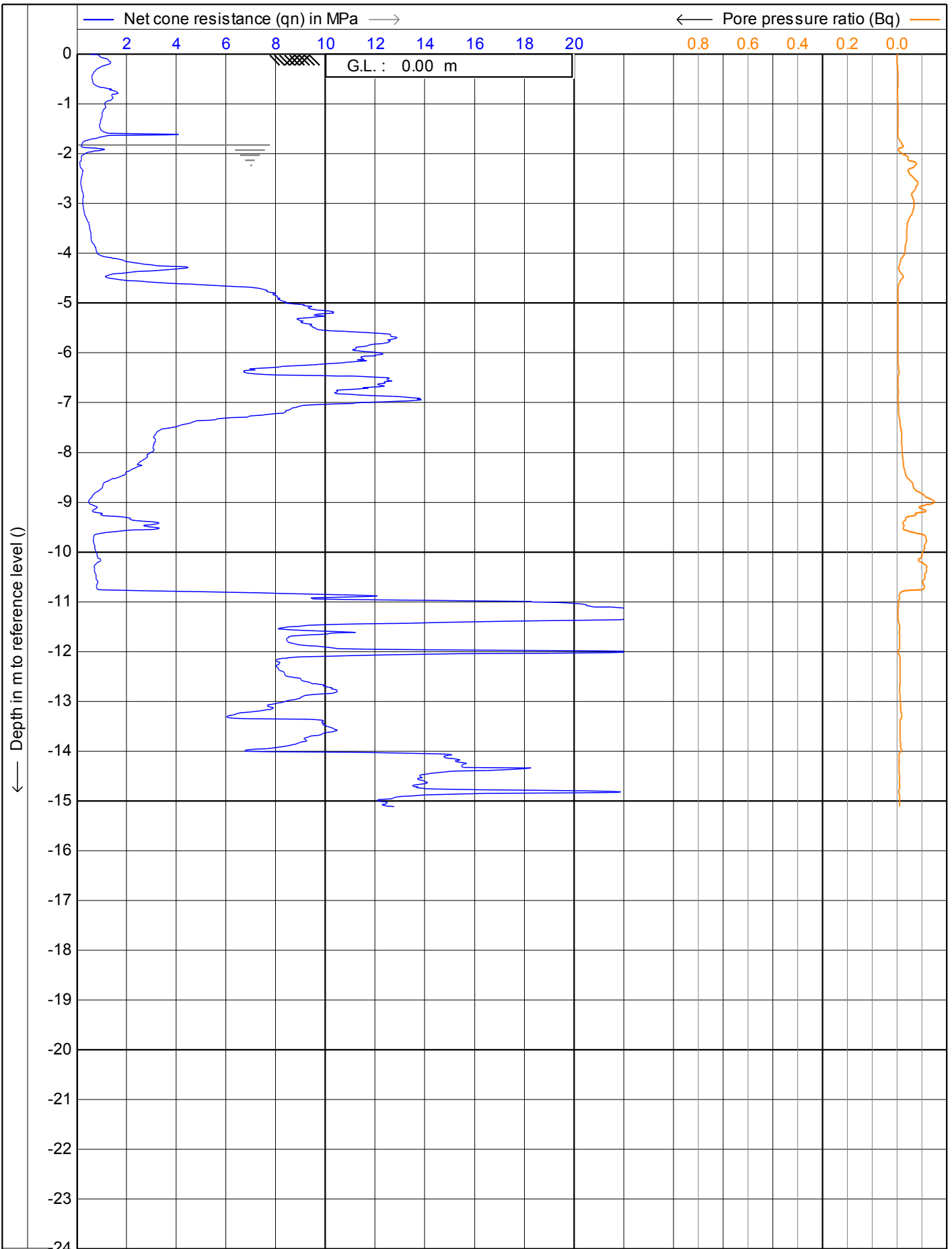
CPT no. : **CPT3**

5/15

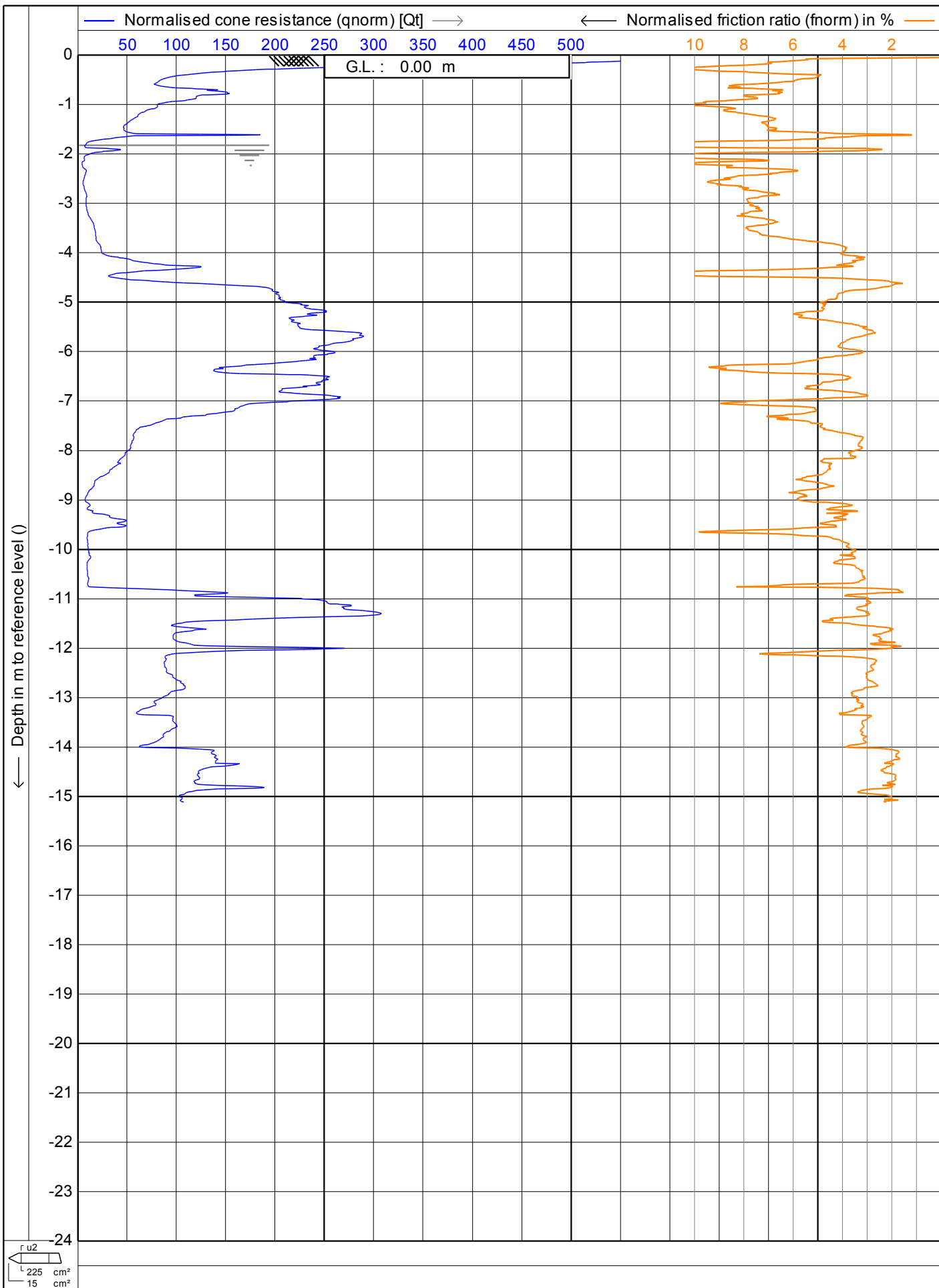


225 cm²
15 cm²

Test according NEN 5140 class 1		Date : 7/11/2017	
Project : 149-153 Edgewater Drive		Cone no. : S15CFIIP.S12007	
Location: 149-153 Edgewater drive		Project no. : 4116	
Position: 0, 0		CPT no. : CPT3	6/15



Test according NEN 5140 class 1	Date : 7/11/2017	
	Cone no. : S15CFIIP.S12007	
	Project no. : 4116	
	CPT no. : CPT3	7/15
Project : 149-153 Edgewater Drive		
Location: 149-153 Edgewater drive		
Position: 0, 0		



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

CPT no. : **CPT3**

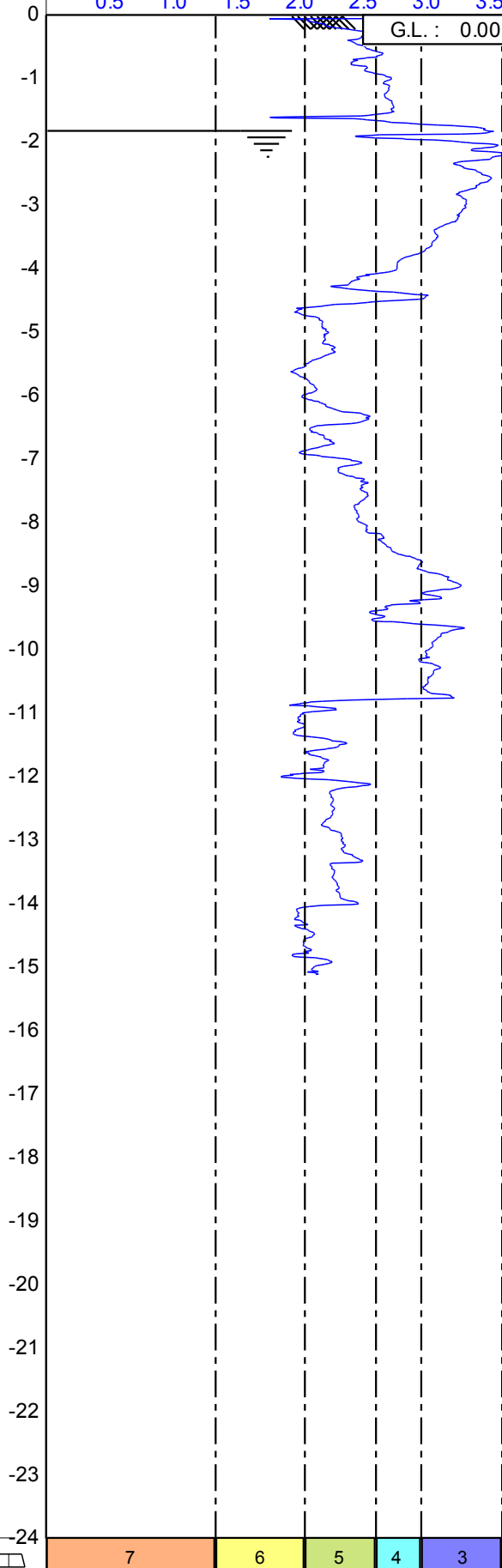
8/15

← Depth in m to reference level ()

— Soil behaviour type index (Ic) —→

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5

G.L. : 0.00 m



(2) Organic soils
(3) Clay
(4) Silt mixtures
(5) Sand mixtures
(6) Sand clean to silty
(7) Gravelly sand

225 cm²
15 cm²

Test according NEN 5140 class 1

Date : 7/11/2017

Cone no. : S15CFIIP.S12007

Project : 149-153 Edgewater Drive

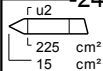
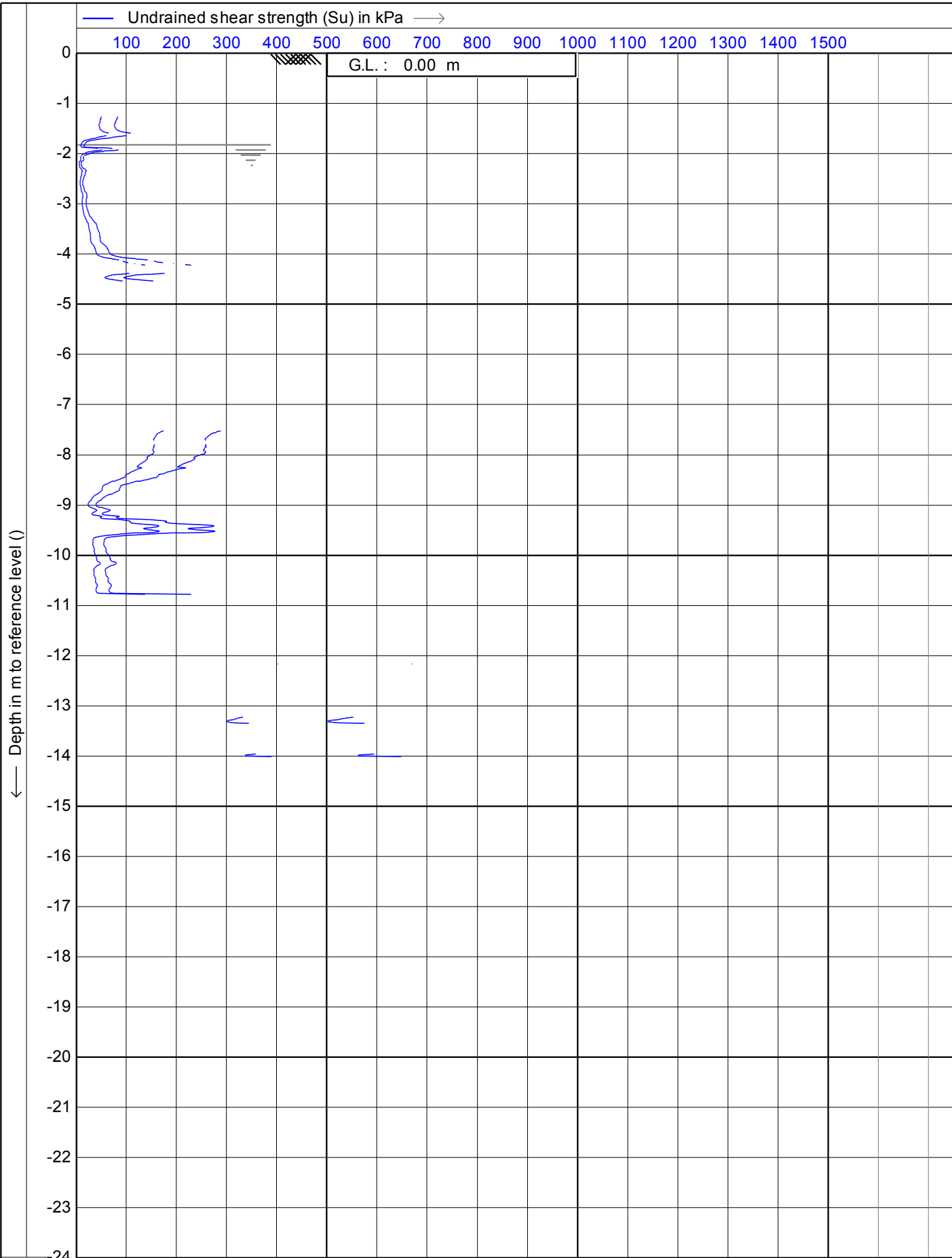
Project no. : 4116

Location: 149-153 Edgewater drive

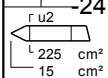
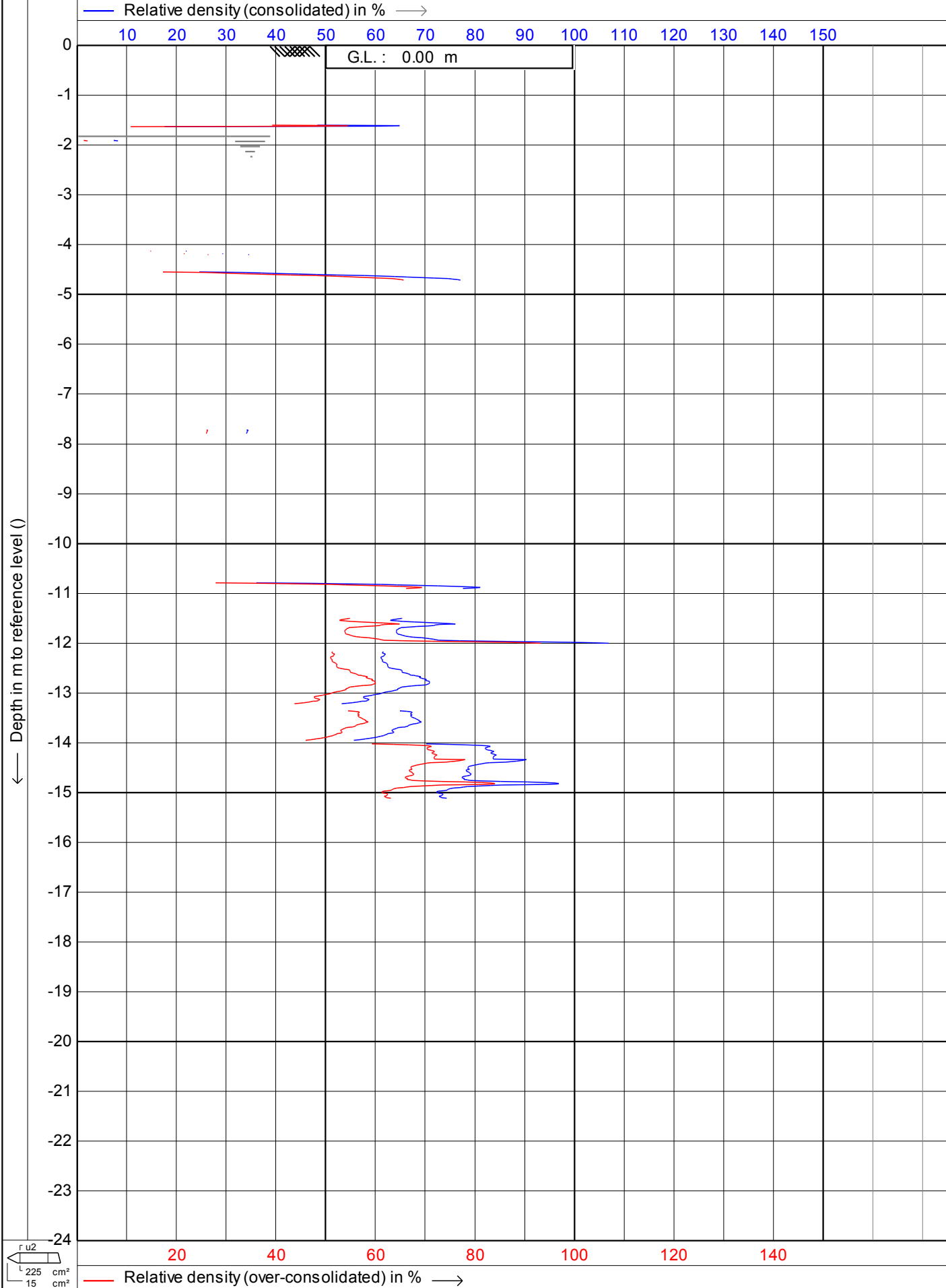
Position: 0, 0

CPT no. : CPT3

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Test according NEN 5140 class 1	Date : 7/11/2017	
	Cone no. : S15CFIP.S12007	
	Project no. : 4116	
	CPT no. : CPT3	10/15
Project : 149-153 Edgewater Drive		
Location: 149-153 Edgewater drive		
Position: 0, 0		



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

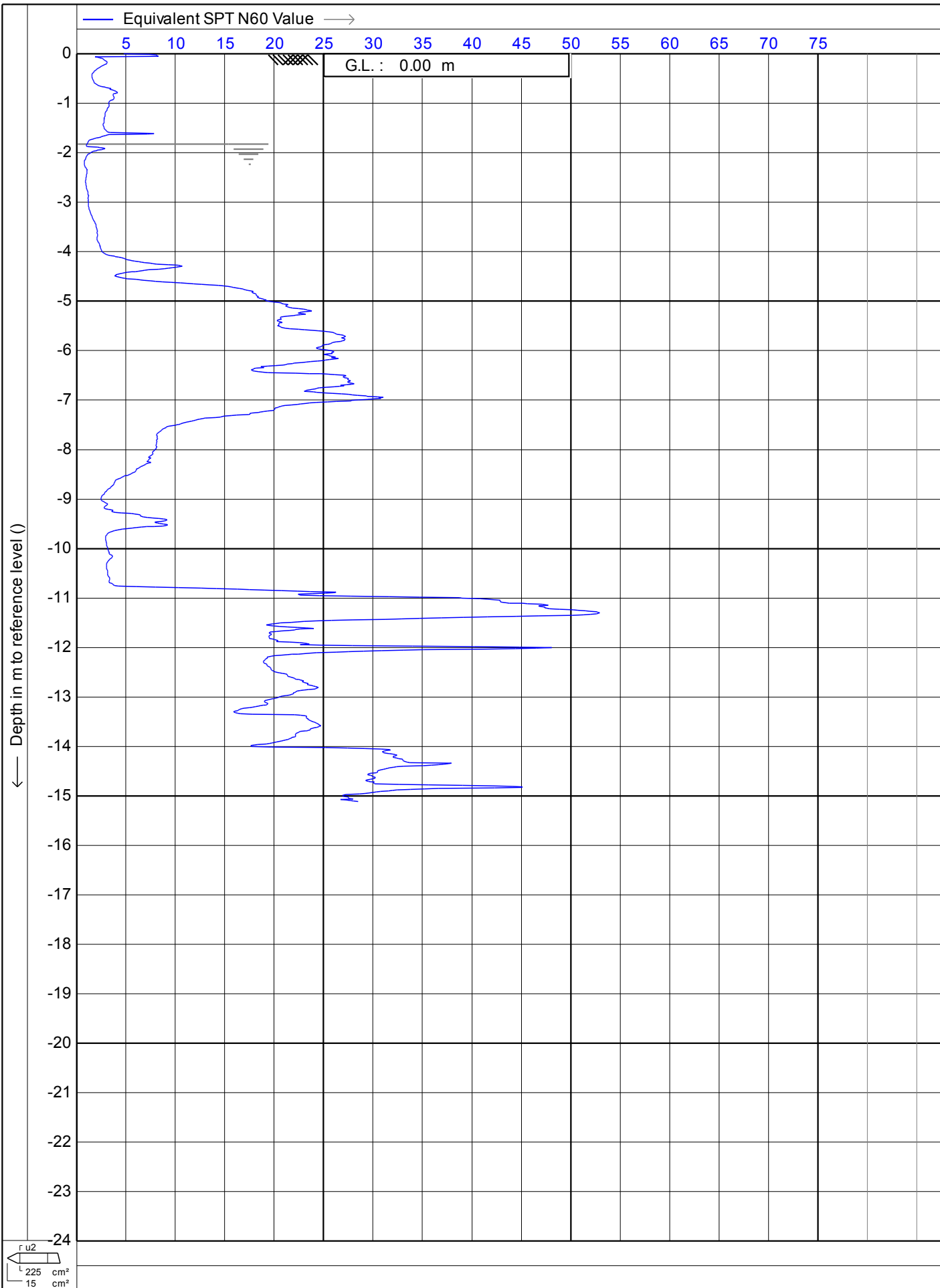
Date : **7/11/2017**

Cone no. : **S15CFIP.S12007**

Project no. : **4116**

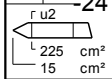
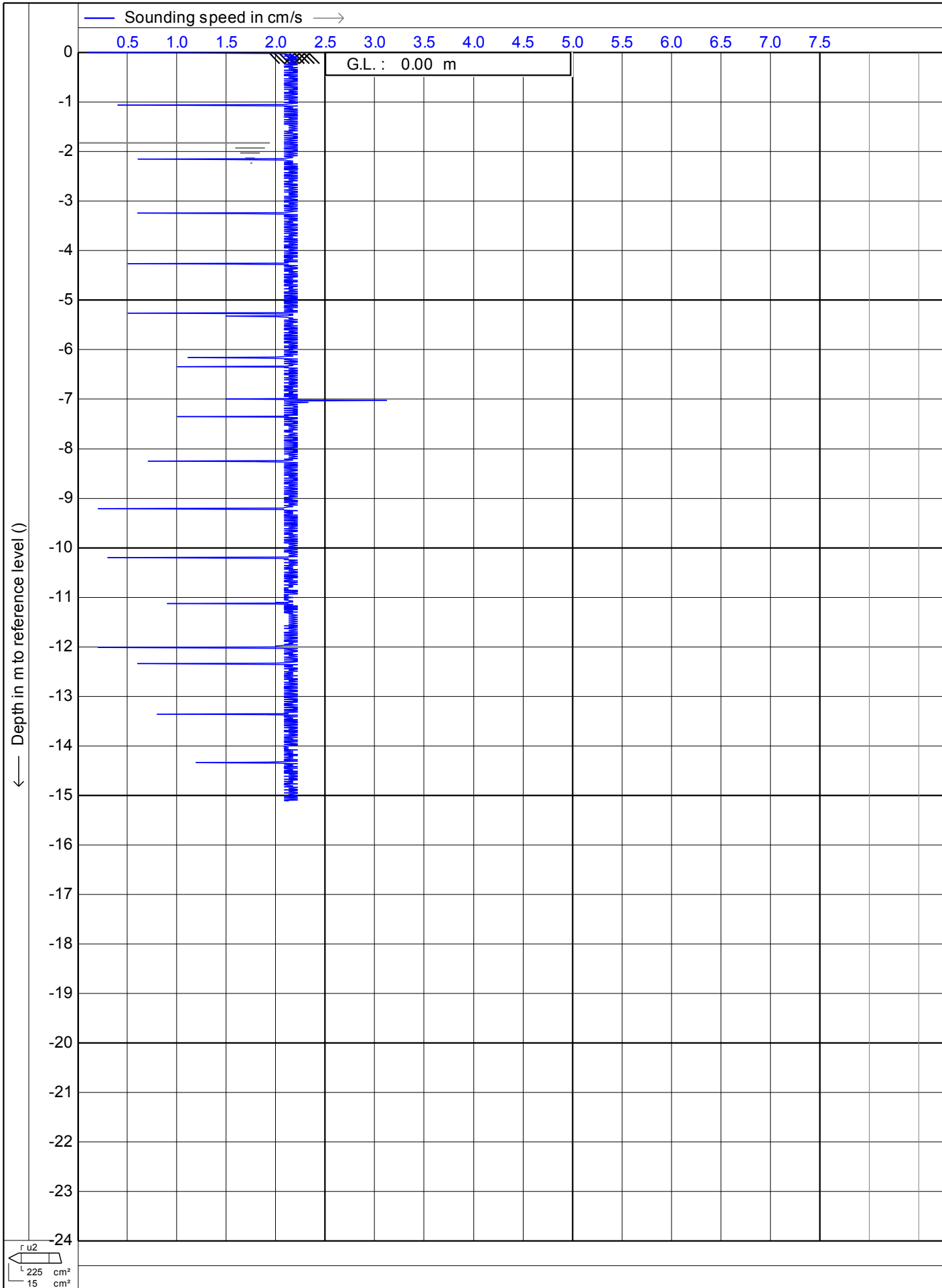
CPT no. : **CPT3**

11/15



225 cm²
 15 cm²

Test according NEN 5140 class 1		Date : 7/11/2017	
Project : 149-153 Edgewater Drive		Cone no. : S15CFIP.S12007	
Location: 149-153 Edgewater drive		Project no. : 4116	
Position: 0, 0		CPT no. : CPT3	12/15



Test according NEN 5140 class 1

Project : **149-153 Edgewater Drive**

Location: **149-153 Edgewater drive**

Position: **0, 0**

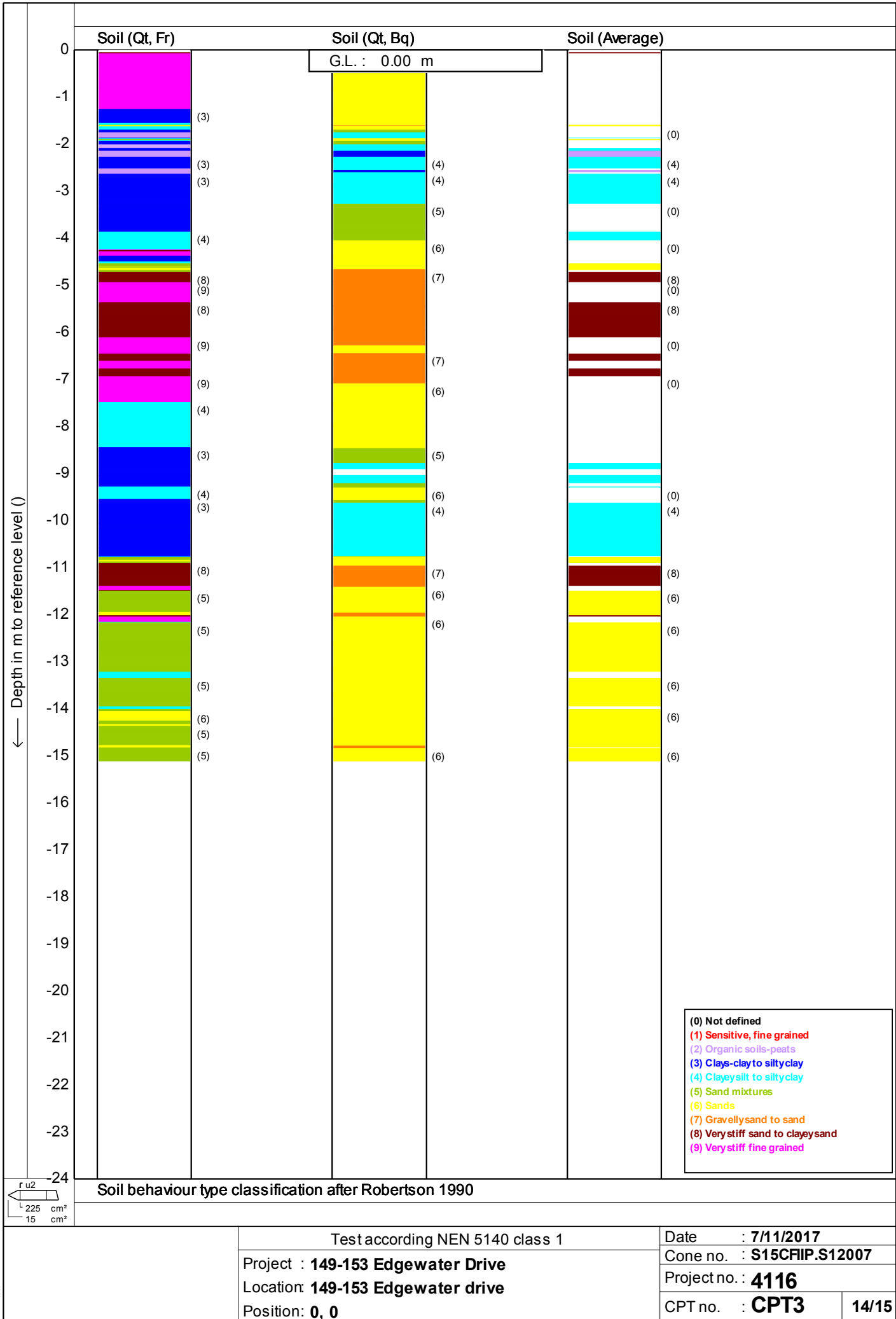
Date : **7/11/2017**

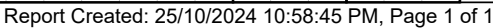
Cone no. : **S15CFIP.S12007**

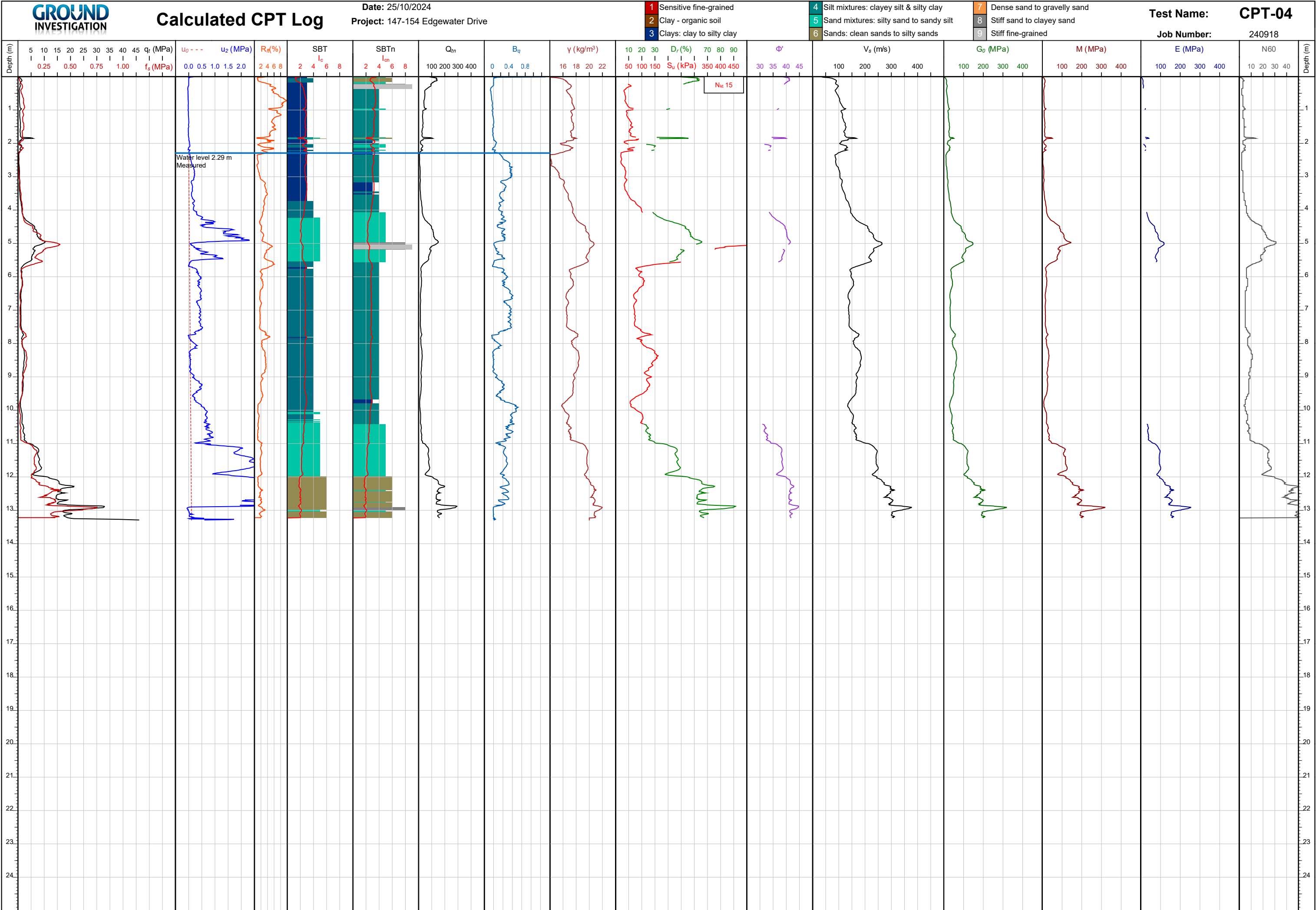
Project no. : **4116**

CPT no. : **CPT3**

13/15









CPT Formulas

Test Name: CPT-04

Job Number: 240918

General Information

Project:	147-154 Edgewater Drive	Location:	154 Edgewater Drive, Pakuranga, Auckland 2010, New Zealand
Contractor:	Ground Investigation		
WGS84 (deg):	-36.924567, 174.879638	Rig details:	Pagani 03
Elevation (m):	Unknown	Location method:	Handheld GPS
Date:	25/10/2024 11:48:08 AM	Elevation datum:	

Test Setup

Standard:	ISO 22476-1:2012
Test type:	
Pre-Drill (m):	0.00
Start length (m):	0
Cone ID:	001188
Cone type:	10cm2 Compression
Cone class:	
Manufacturer:	
Calibration date:	
Cone area ratio:	0.79
Sleeve area ratio:	0
Sleeve offset:	0.07
Filter type:	U2 Porous - Stainless Steel
Saturation method:	Silicone oil
Rig setup variation:	

Test Result

Termination reason:	Limit of reaction force
Termination depth:	13.46
Ground water level:	2.29
Water level origin:	Measured
Backfill:	None

Observations and materials encountered:

Deviations and interruptions:

Corrections applied:

Test catagory:

Operator name: Marcelo Martinez

Manager name:

Corrected cone resistance:	$q_t = q_c + u_z \cdot (1 - a)$
Friction ratio:	$R_f = \frac{f_s}{q_c} \cdot 100$
Non-normalised soil behaviour type (SBT):	Calculated using q_{net} and R_f for the Robertson's 2010 non-normalised CPT soil behaviour chart using zone equations defined by P.W. Mayne in "Evaluating effective stress parameters and undrained shear strength of soft-firm clays from CPT and DMT" 2016

Soil behaviour type index, (used for non-normalised SBT) :

Friction ratio: $F_r = \frac{f_s}{q_t - \sigma_{v0}} \cdot 100$

Refined normalised cone resistance: $Q_{tn} = \frac{(q_t - \sigma_{v0}) / \sigma_{atm}}{(\sigma'_{v0} / \sigma_{atm})^n}$ where $n = 0.381 \cdot I_c + 0.05 \cdot (\sigma'_{v0} / \sigma_{atm}) - 0.05 \leq 1.0$

Normalised soil behaviour type index: $I_c = \left((3.47 - \log(Q_{tn}))^2 + (\log(F_r) + 1.22)^2 \right)^{0.5}$

Normalised pore pressure: $B_q = \frac{\Delta u}{q_t - \sigma_{v0}}$

Normalised soil behaviour type (SBTn): Calculated using Q_m and F_r for the Robertson's 2010 normalised CPT soil behaviour chart using zone equations defined by P.W. Mayne in "Evaluating effective stress parameters and undrained shear strength of soft-firm clays from CPT and DMT" 2016

Undrained shear strength (s_u):
$$s_u = \frac{q_t - \sigma_{v0}}{N_{kt}}$$

Relative density (D_r): $D_r = 100 \cdot \sqrt{\frac{Q_{tn}}{350}}$

Friction angle (Φ'): $\Phi' = 17.60 + 11 \cdot \log(Q_{tn})$

Small strain shear modulus (G_0): $G_0 = (qt - \sigma_{y0}) \cdot (0.0188 \cdot 10^{(0.55 \cdot I_c + 1.68)})$

Estimated shear wave velocity (V_s): $V_s = \sqrt{\frac{G_0}{\rho}}$ where $\rho = \frac{\gamma}{\gamma_w}$

Constrained modulus (M):

$$M = \alpha_M (q_t - \sigma_{v0})$$

when $I_c > 2.2$

$$\alpha_M = Q_t \quad \text{when} \quad Q_t < 14$$

$$\alpha_M = 14 \quad \text{when} \quad Q_t > 14$$

when $I_c < 2.2$

$$\alpha_M = 0.0188 \cdot 10^{(0.55 \cdot I_c + 1.68)}$$

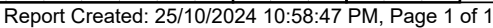
Youngs modulus (E_s): $E_s = (qt - \sigma_{i0}) \cdot (0.015 \cdot 10^{(0.55 \cdot I_c + 1.68)})$

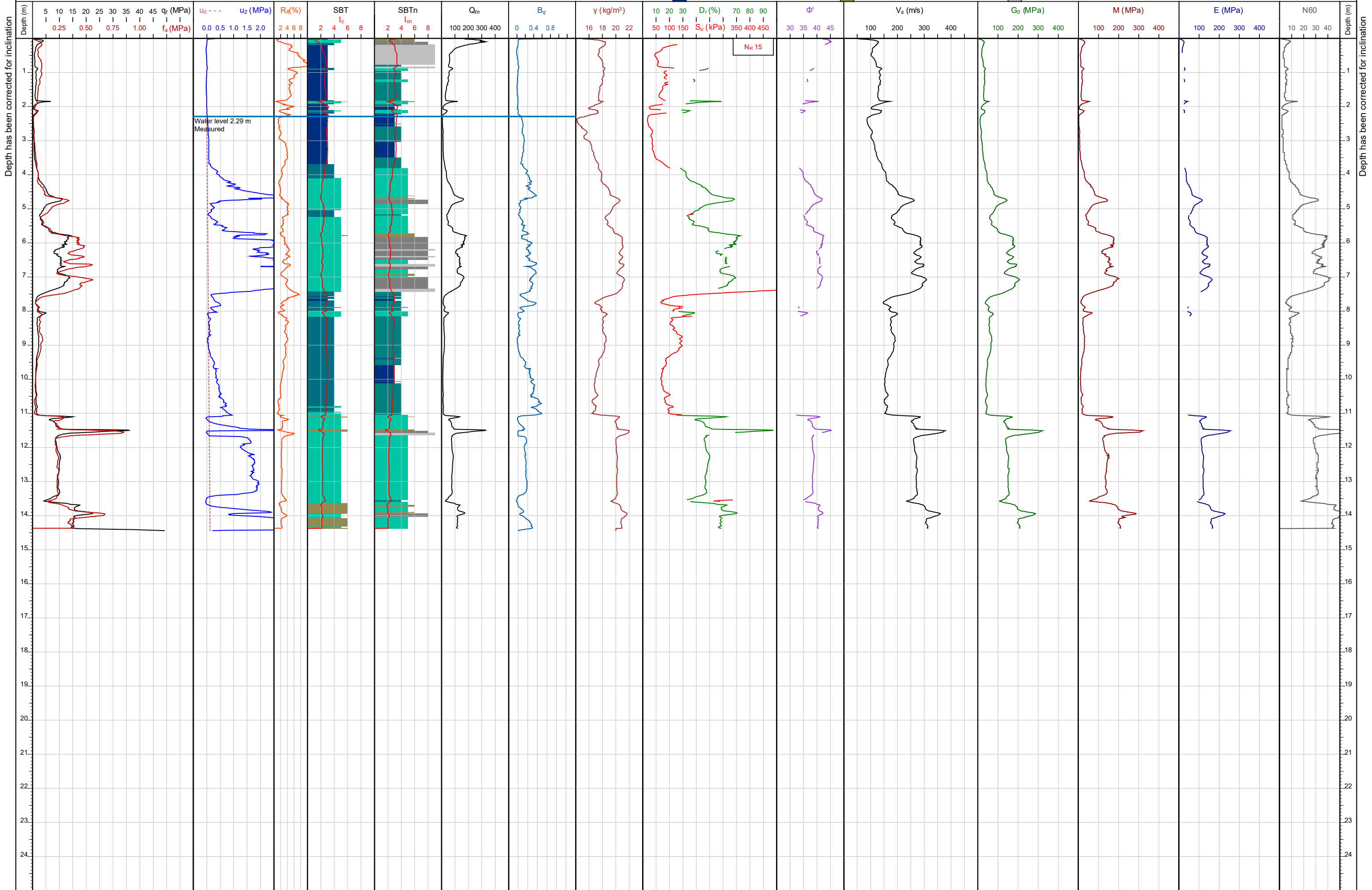
Estimated SPT N_{60} :

$$N_{60} = \frac{q_t / p_a}{8.5 \cdot \left(1 - \frac{I_c}{4.6}\right)}$$

Zero Readings

kPa	Initial zeros	Final zeros	Final difference	Clean zeros	Clean difference
Cone resistance	22,763.80	22,769.50	5.64	-	-
Sleeve friction	258.60	258.30	-0.26	-	-
Pore pressure	2,849.80	2,849.30	-0.55	-	-







CPT Details

CPT Formulas

Test Name: CPT-05

Job Number: 240918

General Information

Project:	147-154 Edgewater Drive	Location:	154 Edgewater Drive, Pakuranga, Auckland 2010, New Zealand
Contractor:	Ground Investigation		
WGS84 (deg):	-36.924670, 174.879425	Rig details:	Pagani 03
Elevation (m):	Unknown	Location method:	Handheld GPS
Date:	25/10/2024 1:12:52 PM	Elevation datum:	

Test Setup

Standard:	ISO 22476-1:2012
Test type:	
Pre-Drill (m):	0.00
Start length (m):	0
Cone ID:	000335
Cone type:	10cm2 Compression
Cone class:	
Manufacturer:	
Calibration date:	
Cone area ratio:	0.8
Sleeve area ratio:	0
Sleeve offset:	0.07
Filter type:	U2 Porous - Stainless Steel
Saturation method:	Silicone oil
Rig setup variation:	

Test Result

Termination reason:	Limit of reaction force
Termination depth:	14.59
Ground water level:	2.29
Water level origin:	Measured
Backfill:	None

Observations and materials encountered:

Deviations and interruptions:

Corrections applied:

Test category:

Operator name: Marcelo Martinez

Manager name:

Corrected cone resistance:	$q_t = q_c + u_z \cdot (1 - a)$
Friction ratio:	$R_f = \frac{f_s}{q_c} \cdot 100$
Non-normalised soil behaviour type (SBT):	Calculated using q_{net} and R_f for the Robertson's 2010 non-normalised CPT soil behaviour chart using zone equations defined by P.W. Mayne in "Evaluating effective stress parameters and undrained shear strength of soft-firm clays from CPT and DMT" 2016

Soil behaviour type index, (used for non-normalised SBT) :

$$I_c = \left((3.47 - \log(q_t))^2 + (\log(R_f) + 1.22)^2 \right)^{0.5}$$

Friction ratio: $F_r = \frac{f_s}{q_t - \sigma_{v0}} \cdot 100$

Refined normalised cone resistance: $Q_{tn} = \frac{(q_t - \sigma_{v0}) / \sigma_{atm}}{(\sigma'_{v0} / \sigma_{atm})^n}$ where $n = 0.381 \cdot I_c + 0.05 \cdot (\sigma'_{v0} / \sigma_{atm}) - 0.05 \leq 1.0$

Normalised soil behaviour type index: $I_c = ((3.47 - \log(Q_{tn}))^2 + (\log(F_r) + 1.22)^2)^{0.5}$

Normalised pore pressure: $B_q = \frac{\Delta u}{q_t - \sigma_{v0}}$

Normalised soil behaviour type (SBTn): Calculated using Q_{in} and F_r for the Robertson's 2010 normalised CPT soil behaviour chart using zone equations defined by P.W. Mayne in "Evaluating effective stress parameters and undrained shear strength of soft-firm clays from CPT and DMT" 2016

Undrained shear strength (s_u):
$$s_u = \frac{q_t - \sigma_{v0}}{N_{kt}}$$

Relative density (D_r):

$$D_r = 100 \cdot \sqrt{\frac{Q_{tn}}{350}}$$

Friction angle (Φ'): $\Phi' = 17.60 + 11 \cdot \log(Q_{tn})$

Small strain shear modulus (G_0): $G_0 = (qt - \sigma_{i0}) \cdot (0.0188 \cdot 10^{(0.55 \cdot I_c + 1.68)})$

Estimated shear wave velocity (V_s): $V_s = \sqrt{\frac{G_0}{\rho}}$ where $\rho = \frac{\gamma}{\gamma_w}$

Constrained modulus (M):

$$M = \alpha_M (q_t - \sigma_{v0})$$

when $I_c > 2.2$

$$\alpha_M = Q_t \quad \text{when} \quad Q_t < 14$$

$$\alpha_M = 14 \quad \text{when} \quad Q_t > 14$$

when $I_c < 2.2$

$$\alpha_M = 0.0188 \cdot 10^{(0.55 \cdot I_c + 1.68)}$$

Youngs modulus (E_s): $E_s = (qt - \sigma_{i0}) \cdot (0.015 \cdot 10^{(0.55 \cdot I_c + 1.68)})$

Estimated SPT N_{60} :

$$N_{60} = \frac{q_t / p_a}{8.5 \cdot \left(1 - \frac{I_c}{4.6}\right)}$$

Zero Readings

kPa	Initial zeros	Final zeros	Final difference	Clean zeros	Clean difference
Cone resistance	21,960.20	21,928.00	-32.24	-	-
Sleeve friction	263.60	264.60	0.93	-	-
Pore pressure	3,020.60	3,021.80	1.15	-	-



Measured CPT Log

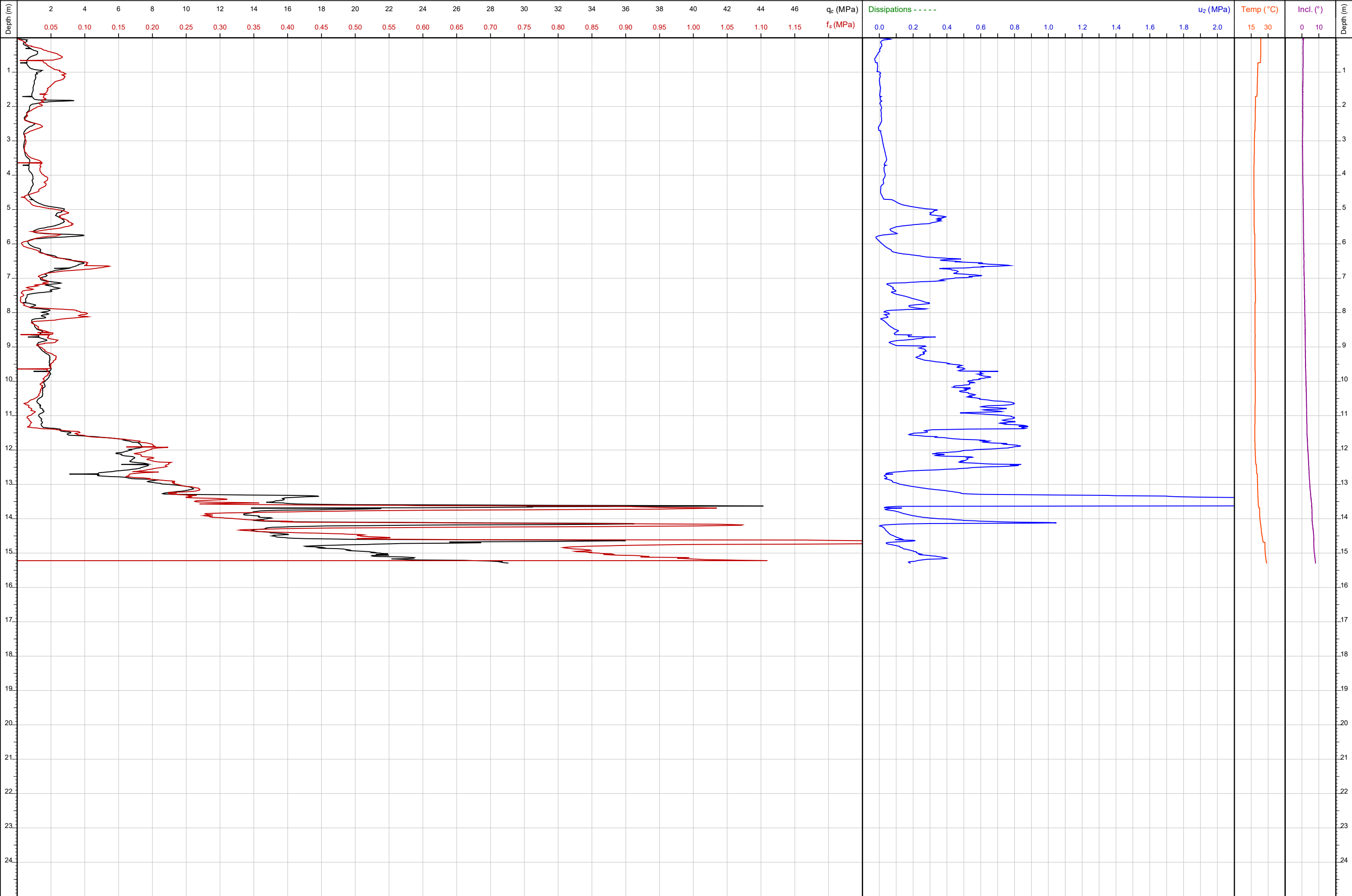
Client: LDE Ltd
Project: 147-154 Edgewater Drive
Remarks:

Depth (m): 15.29
Termination: Limit of reaction force

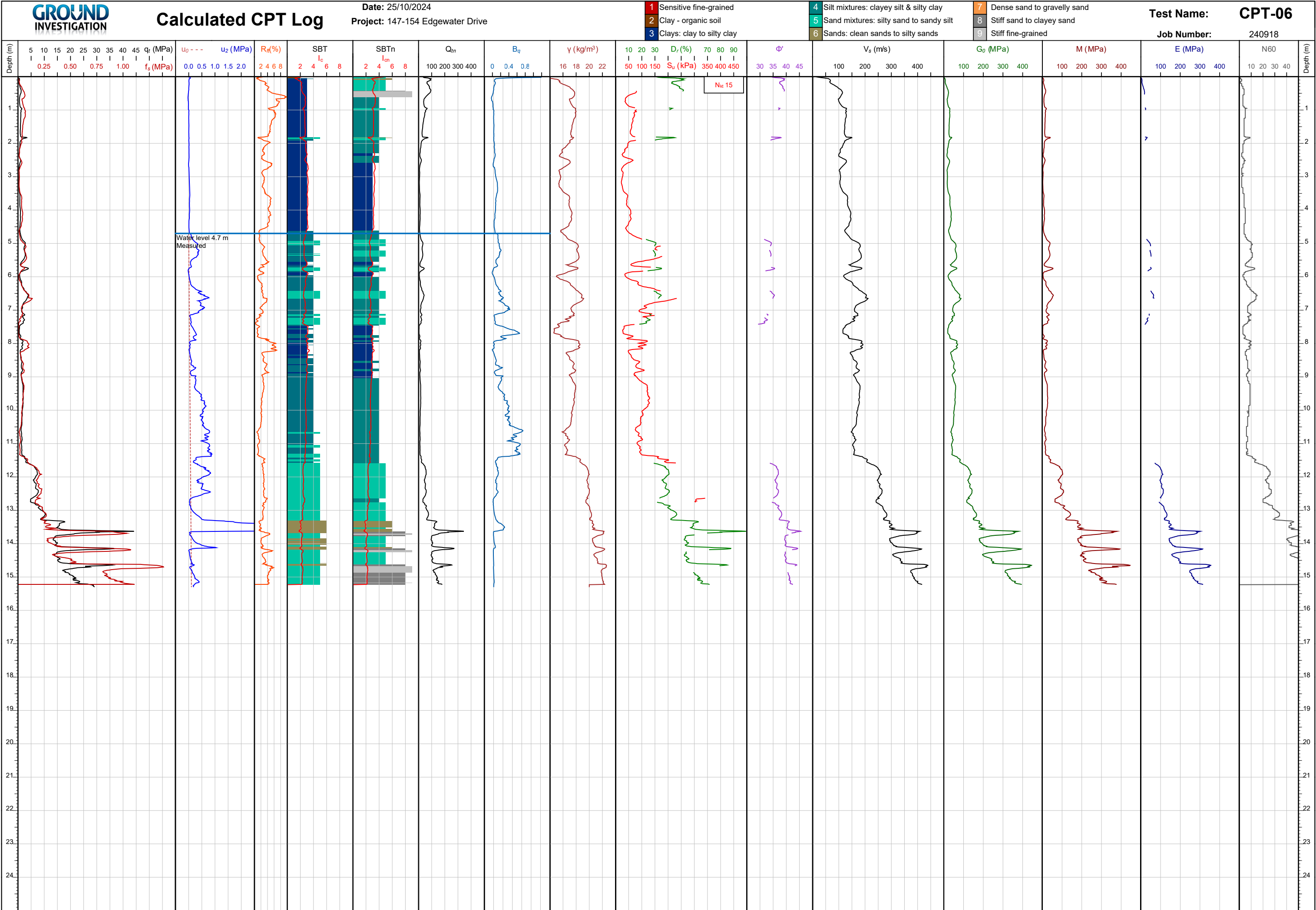
Standard: ISO 22476-1:2012 CETANZ TG6
Date: 25/10/2024
Cone Ref: 000335

Test Name: CPT-06
Job Number: 240918

Depth has been corrected for inclination



Depth has been corrected for inclination



APPENDIX C

SITE PLAN AND CROSS SECTIONS

Legend

CPT 01

BH1

MH01

50

Cone penetrometer test location

Handauger borehole test location

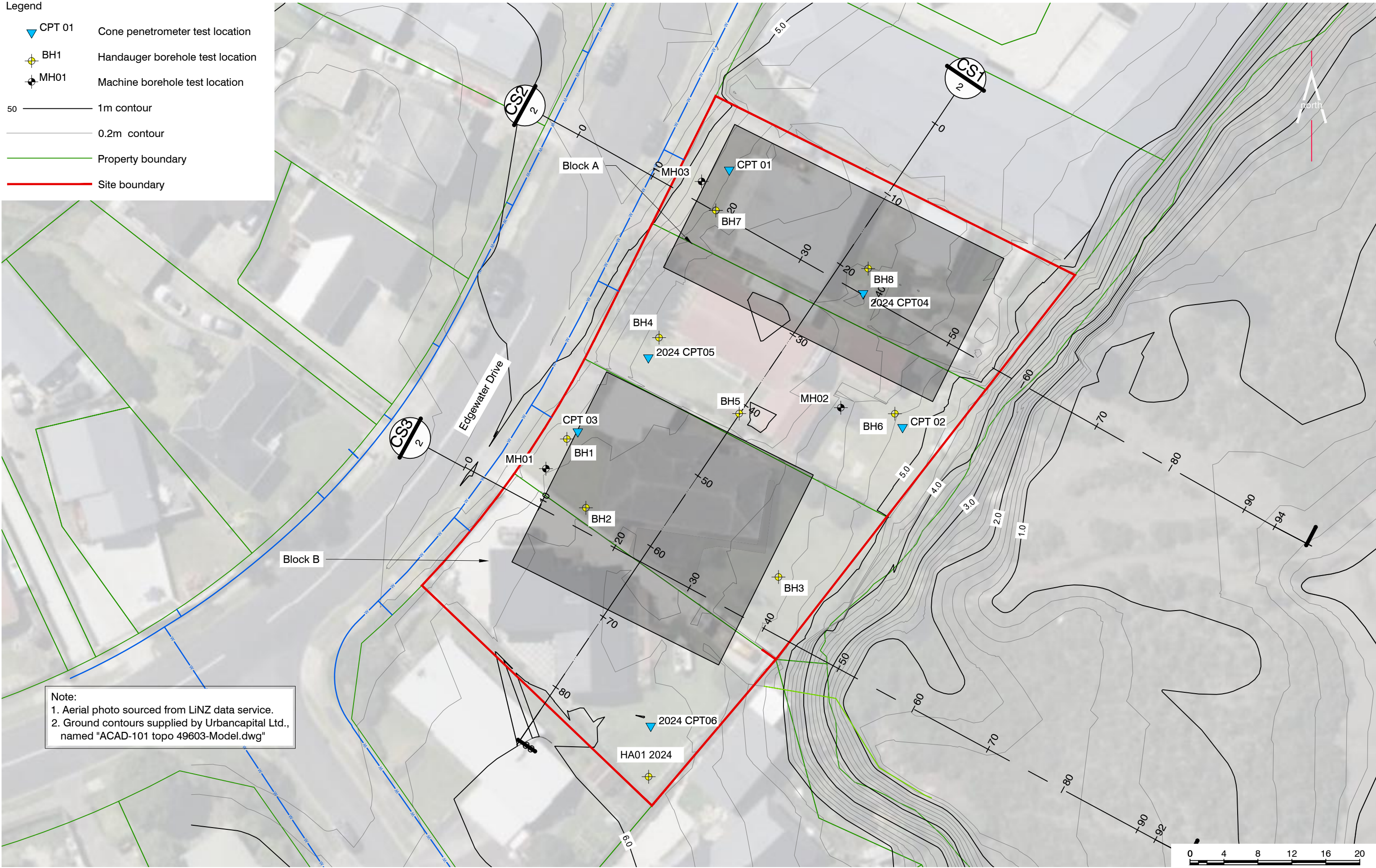
Machine borehole test location

1m contour

0.2m contour

Property boundary

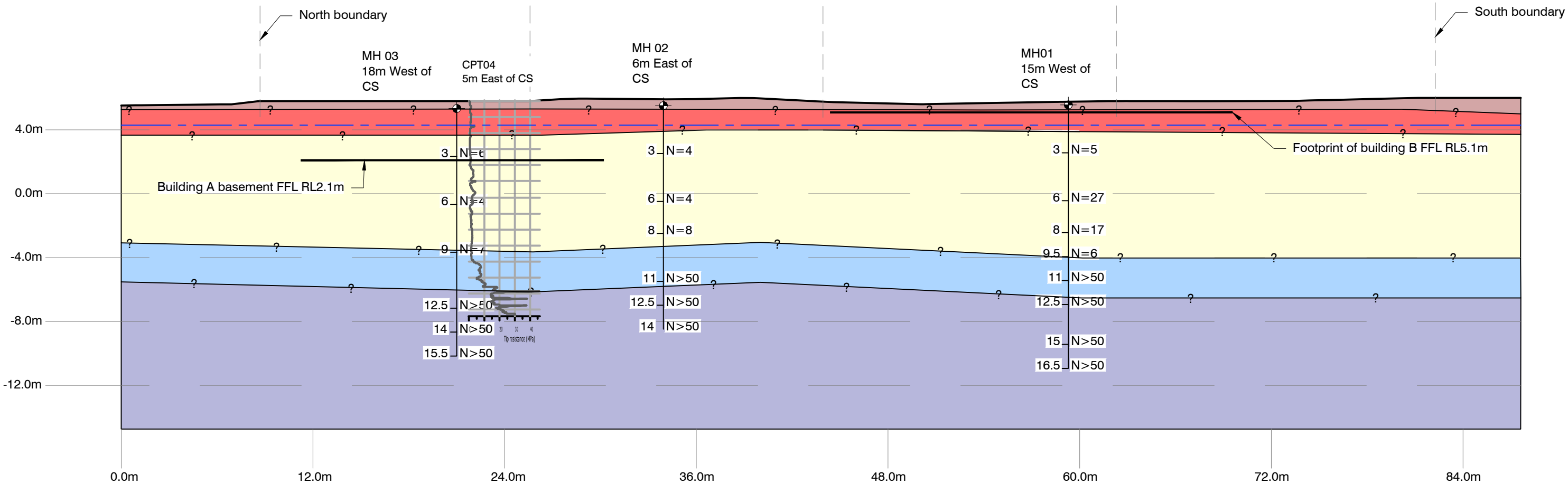
Site boundary



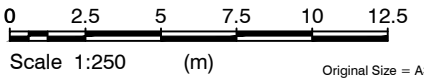
Note:
1. Aerial photo sourced from LiNZ data service.
2. Ground contours supplied by Urbancapital Ltd., named "ACAD-101 topo 49603-Model.dwg"

- Legend
- Existing surface profile
 - Property boundary
 - Summer groundwater
 - Topsoil/Fill
 - Ash
 - Alluvium
 - Transitional Waitemata
 - Waitemata Bedrock

Note:
1. Ground profile based on contours supplied by
Urbancapital Ltd, named "ACAD-101 topo 49603-Model.dwg"



Geotechnical Cross Section CS1
1:250



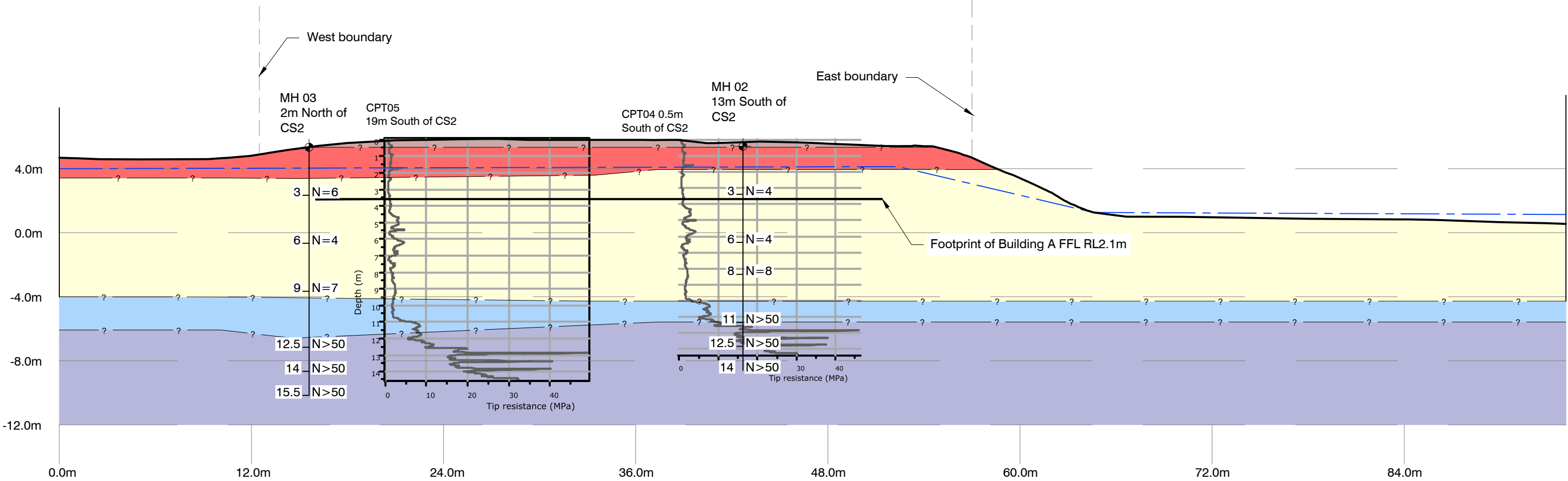
Copyright: LDE Ltd. All rights reserved / Do not scale off drawings / Confirm all dimensions on site prior to work

CLIENT A & L Sargeant Limited 78 Compass Point Way, Half Moon Bay, Auckland	PROJECT 147 - 153 Edgewater Drive, Pakuranga	DRAWING TITLE Geotechnical Cross Section CS1					DESIGN:	--	PROJECT STATUS: For Consent	
							DRAWN:	SJ	PROJECT: J00983	
							DATE:	14.04.2025	SHEET: 2 of 4	
							CHECKED:	CC	DRAWING No: J00983-2	
										REV: 1
1	Issued for Consent		SJ	14.04.2025	SCALE A3:	1:250				
0	Issued for Consent		SJ	22.11.2024						
No.		REVISION	BY	DATE						

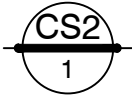
Legend

- Existing surface profile
- Property boundary
- Summer groundwater
- Topsoil/Fill
- Ash
- Alluvium
- Transitional Waitemata
- Waitemata Bedrock

Note:
1. Ground profile based on contours supplied by
Urbancapital Ltd, named "ACAD-101 topo 49603-Model.dwg"



Geotechnical Cross Section
1:250



Scale 1:250 (m) Original Size = A3

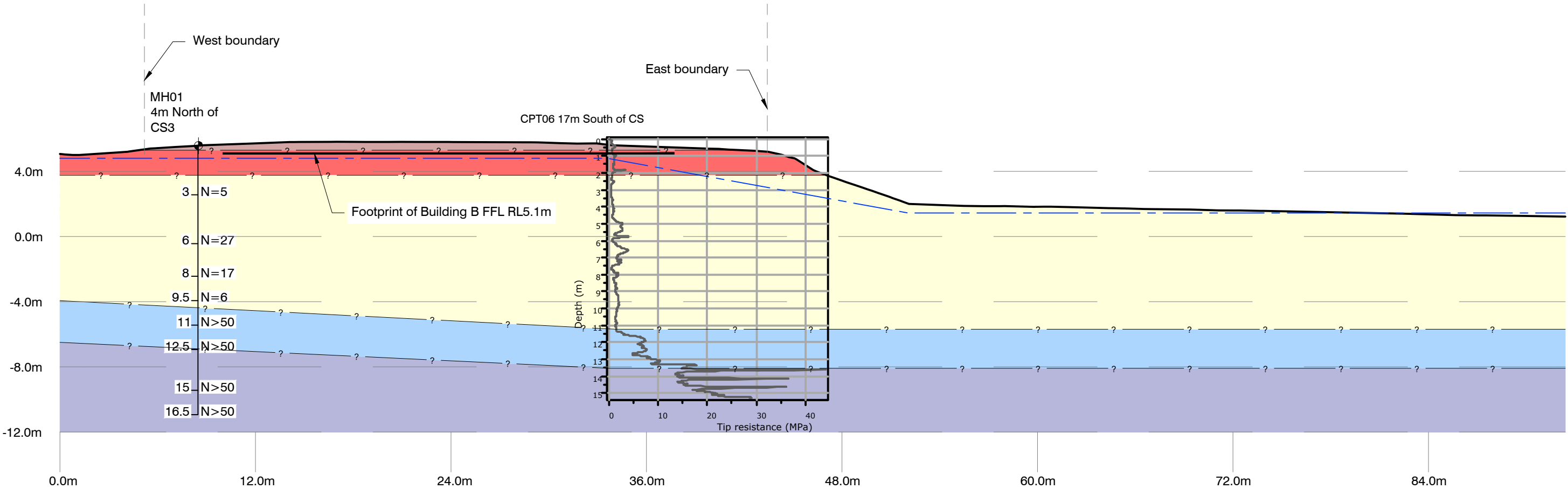
Copyright: LDE Ltd. All rights reserved / Do not scale off drawings / Confirm all dimensions on site prior to work

CLIENT A & L Sargeant Limited 78 Compass Point Way, Half Moon Bay, Auckland	PROJECT 147 - 153 Edgewater Drive, Pakuranga	DRAWING TITLE Geotechnical Cross Section CS2					DESIGN:	--	PROJECT STATUS: For Consent		
							DRAWN:	SJ	PROJECT: J00983		
							DATE:	14.04.2025	SHEET: 3 of 4		
							CHECKED:	CC	DRAWING No: J00983-3		
							SCALE A3: 1:250			REV: 1	
				1	Issued for Consent	SJ	14.04.2025				
				0	Issued for Consent	SJ	22.11.2024				
				No.	REVISION	BY	DATE				

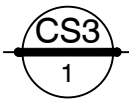
Legend

- Existing surface profile
- Property boundary
- Summer groundwater
- Topsoil/Fill
- Ash
- Alluvium
- Transitional Waitemata
- Waitemata Bedrock

Note:
1. Ground profile based on contours supplied by
Urbancapital Ltd, named "ACAD-101 topo 49603-Model.dwg"



Geotechnical Cross Section
1:250



Scale 1:250 (m) Original Size = A3

Copyright: LDE Ltd. All rights reserved / Do not scale off drawings / Confirm all dimensions on site prior to work

CLIENT

A & L Sargeant Limited
78 Compass Point Way, Half Moon Bay,
Auckland

PROJECT

147 - 153 Edgewater Drive, Pakuranga

DRAWING TITLE

Geotechnical Cross Section CS3

LDE

engineers • scientists

1	Issued for Consent	SJ	14.04.2025	
0	Issued for Consent	SJ	22.11.2024	
No.	REVISION	BY	DATE	

DESIGN:	--
DRAWN:	SJ
DATE:	14.04.2025
CHECKED:	CC
SCALE A3:	1:250

PROJECT STATUS:

For Consent

PROJECT:

J00983

SHEET:

4 of 4

DRAWING No:

J00983-4

REV:

1

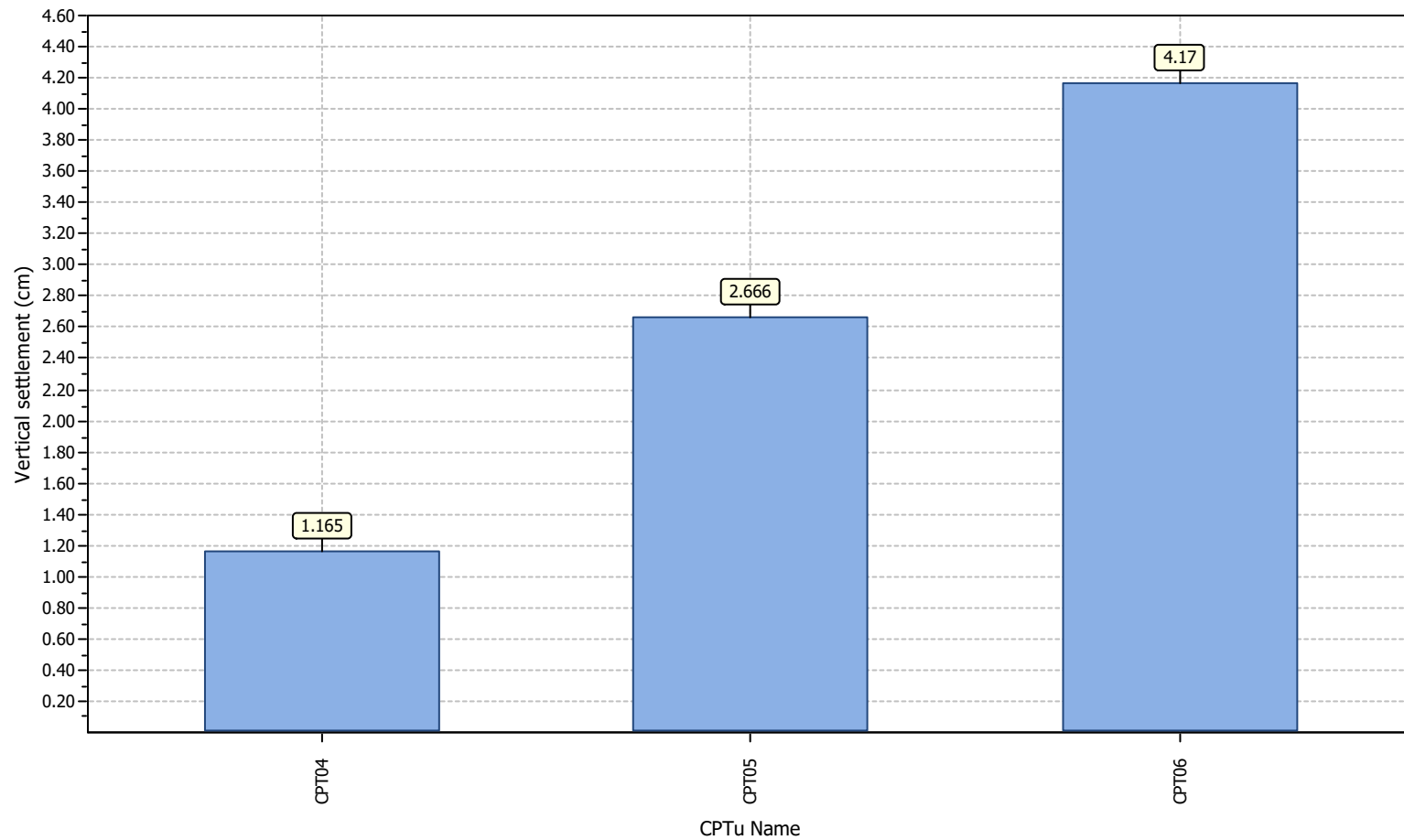
APPENDIX D

LIQUEFACTION ANALYSIS

Project title : 145-153 Edgewater drive

Location : 145-153 Edgewater drive

Overall vertical settlements report



LIQUEFACTION ANALYSIS REPORT

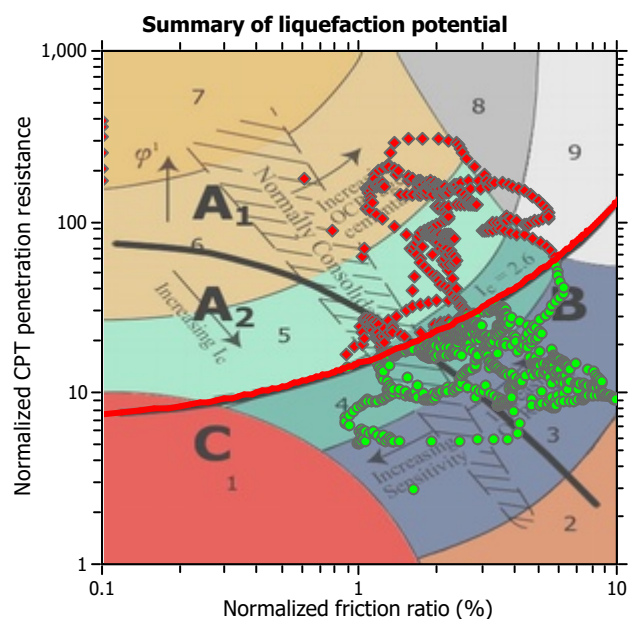
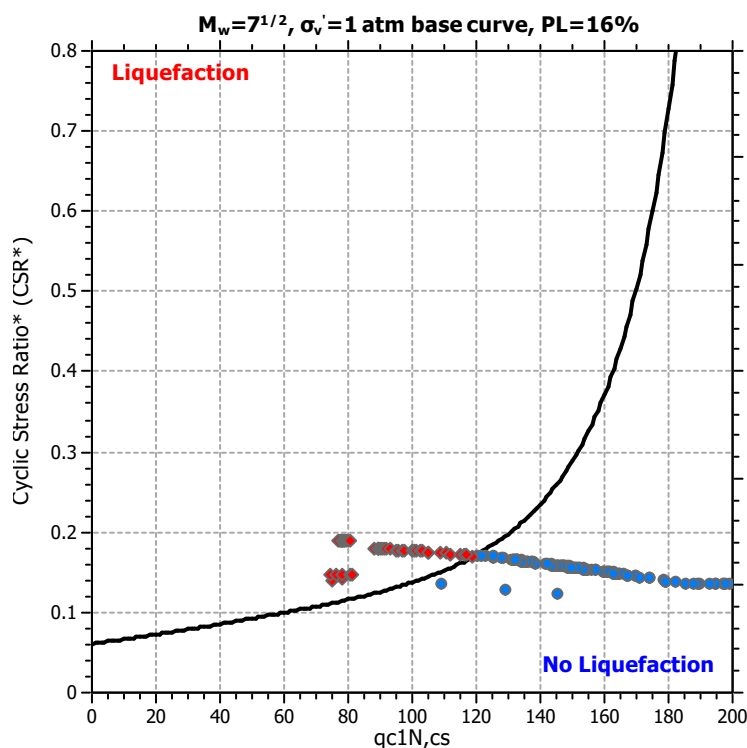
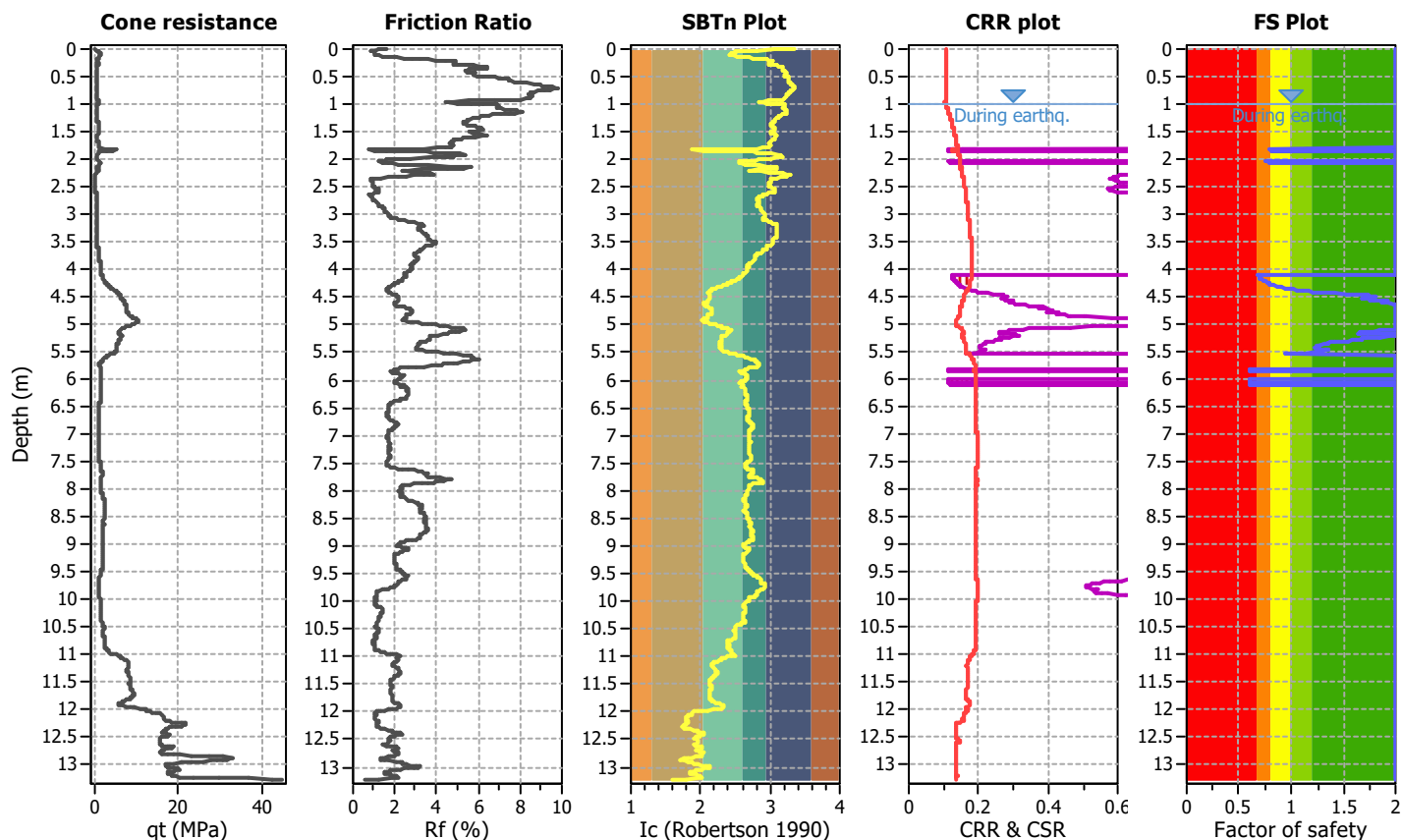
Project title : 145-153 Edgewater drive

Location : 145-153 Edgewater drive

CPT file : CPT04

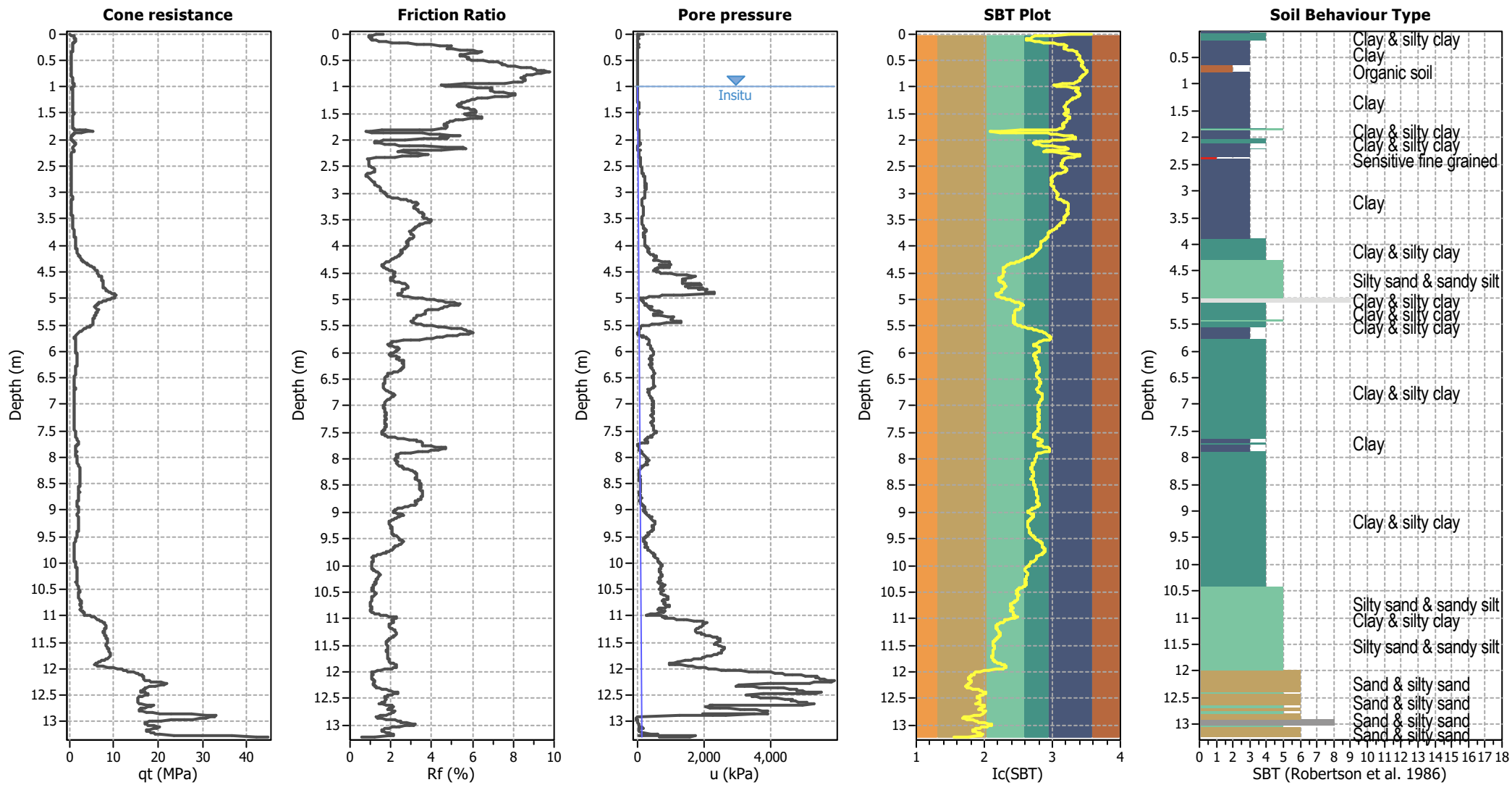
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sand & Clay
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



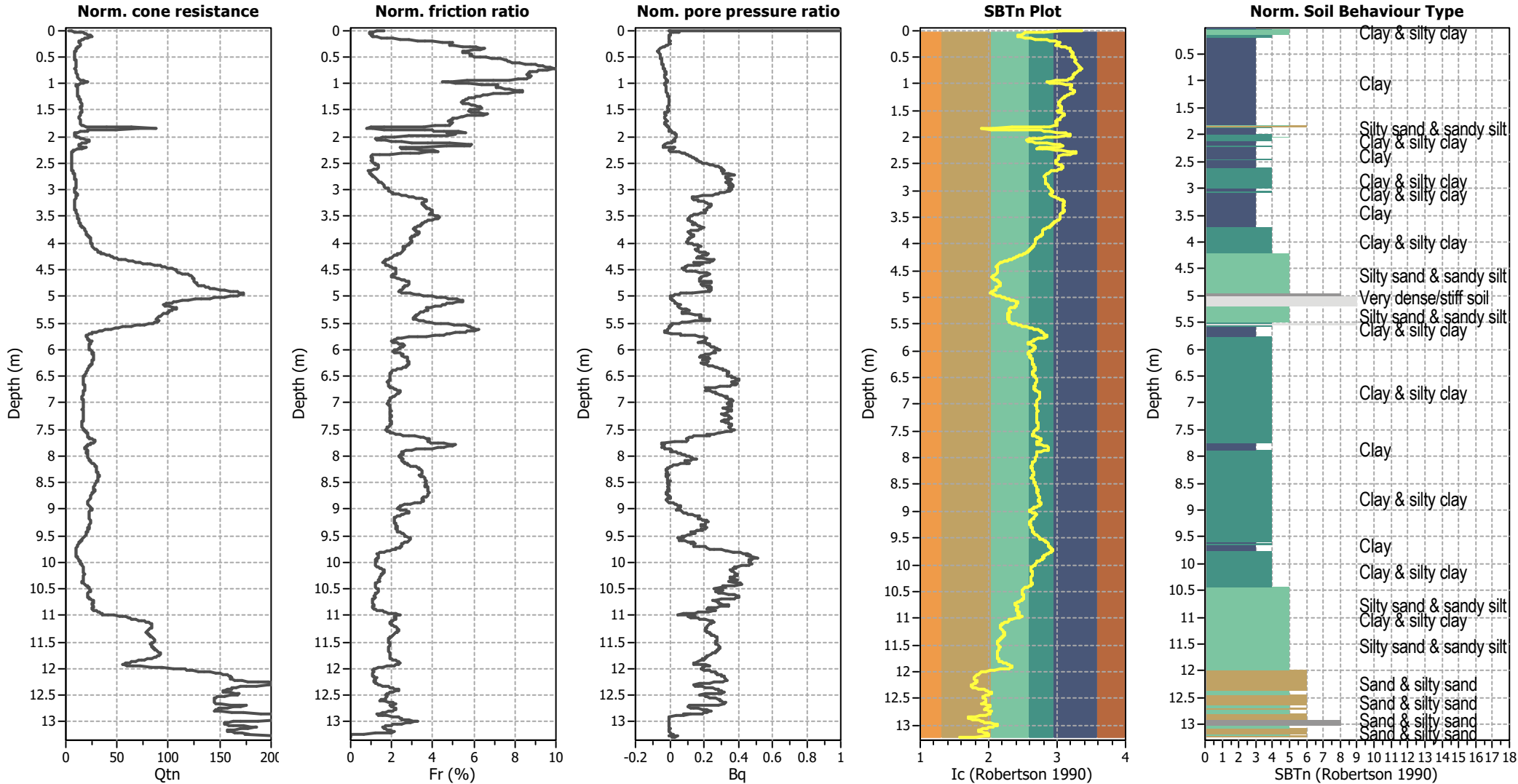
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

CPT basic interpretation plots (normalized)



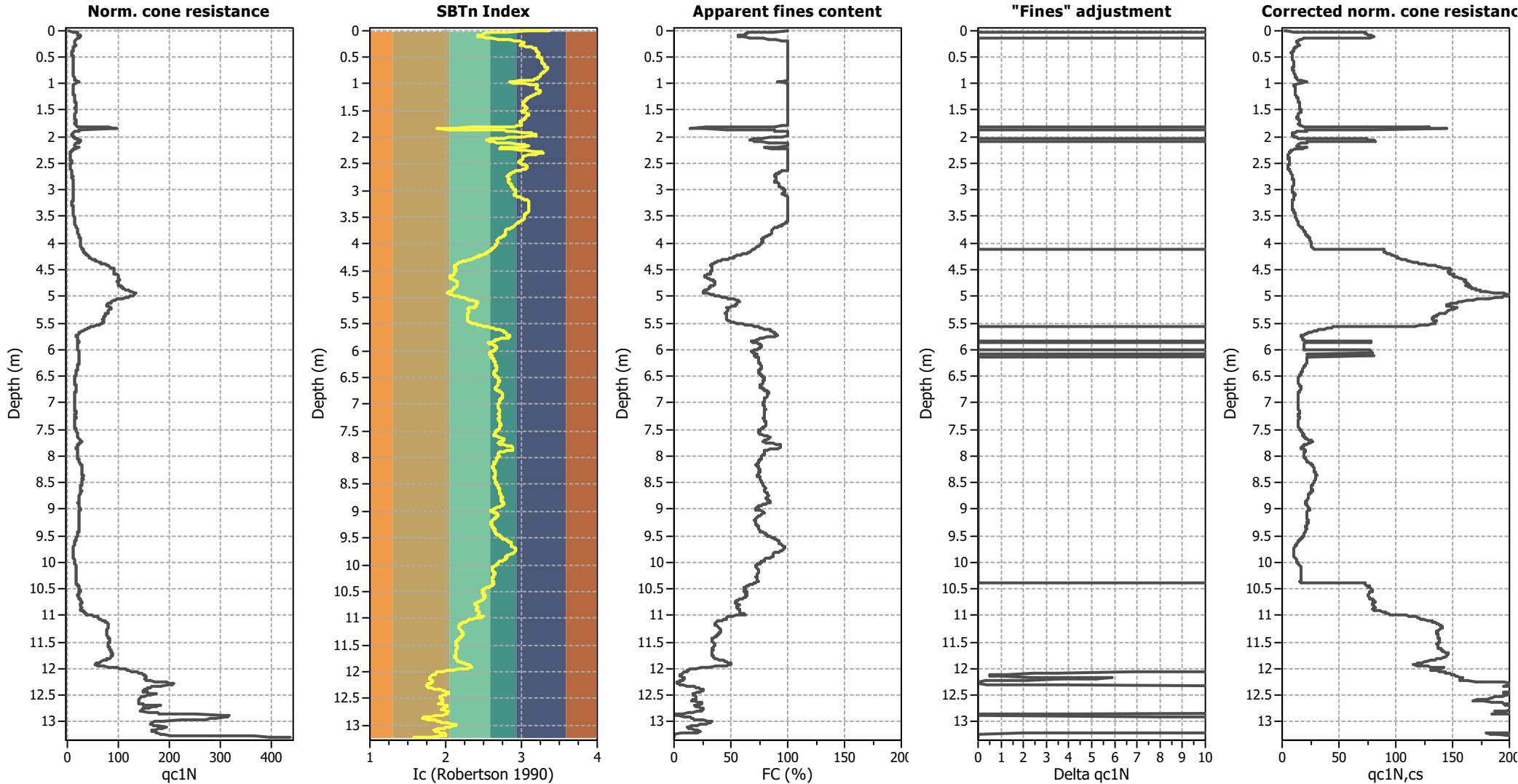
Input parameters and analysis data

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Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

SBTn legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

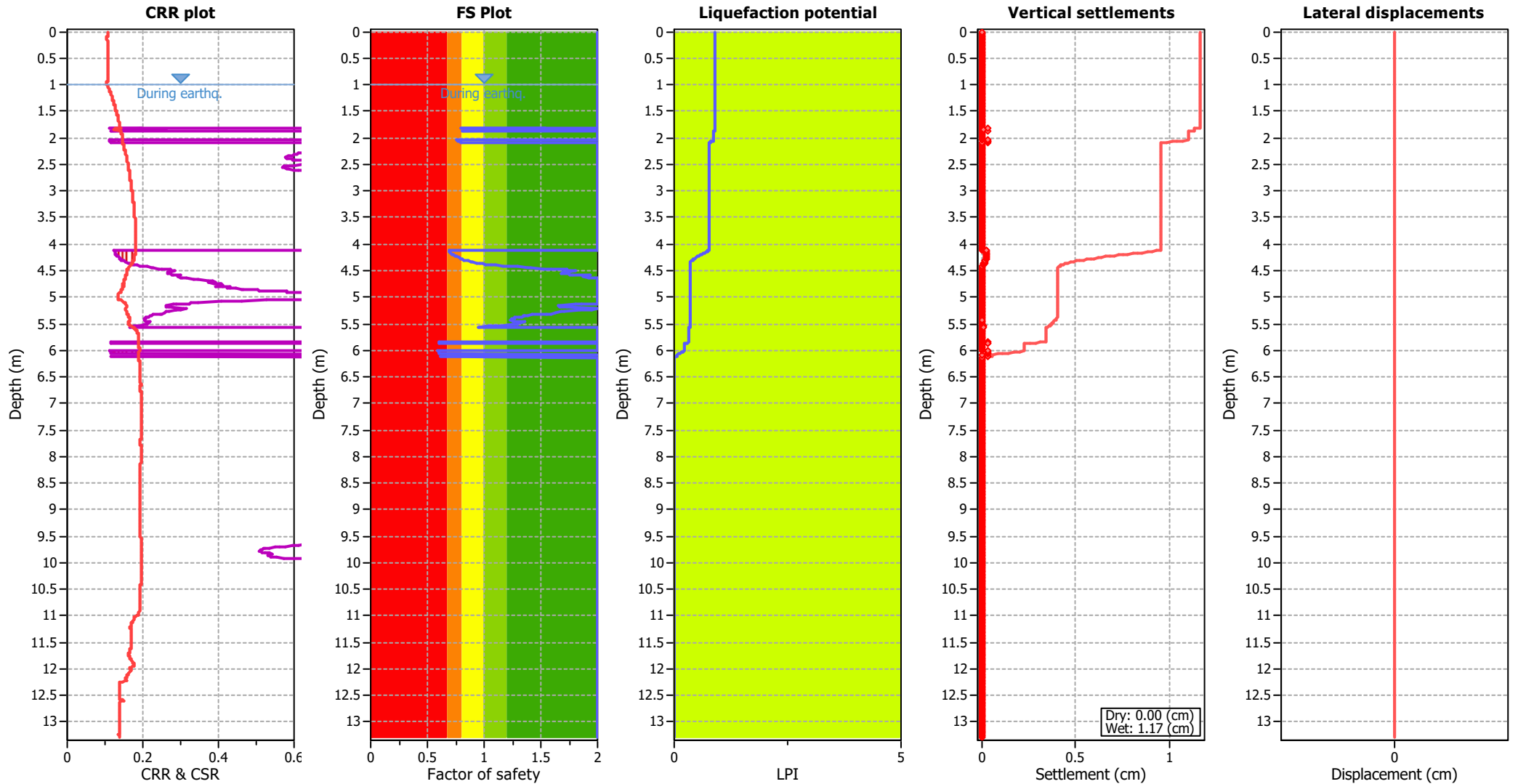
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

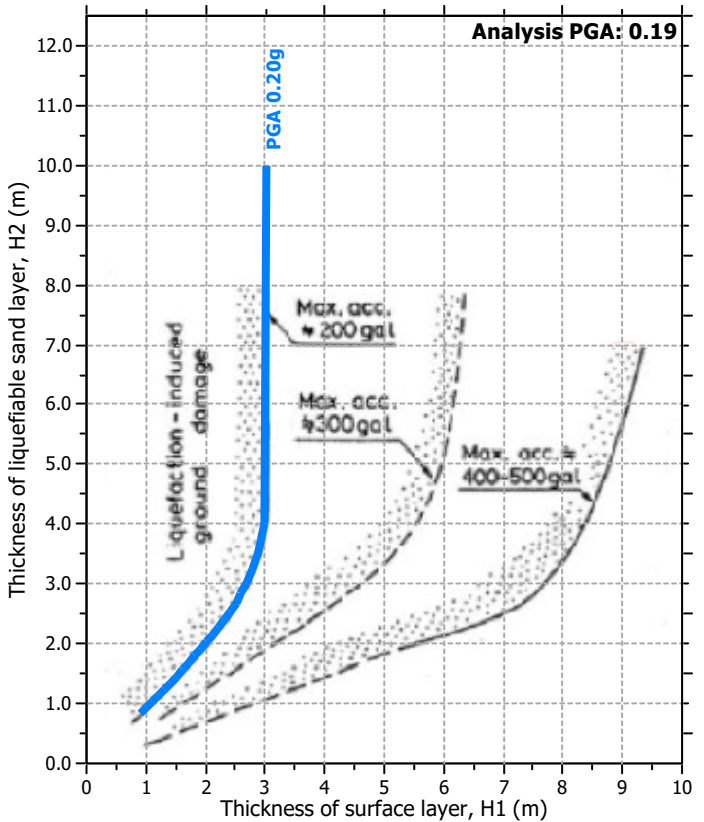
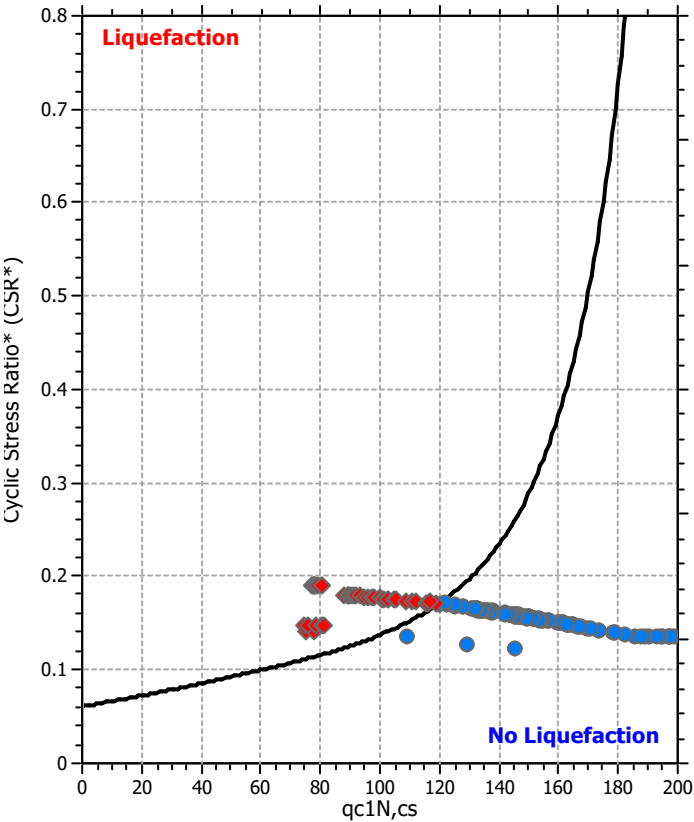
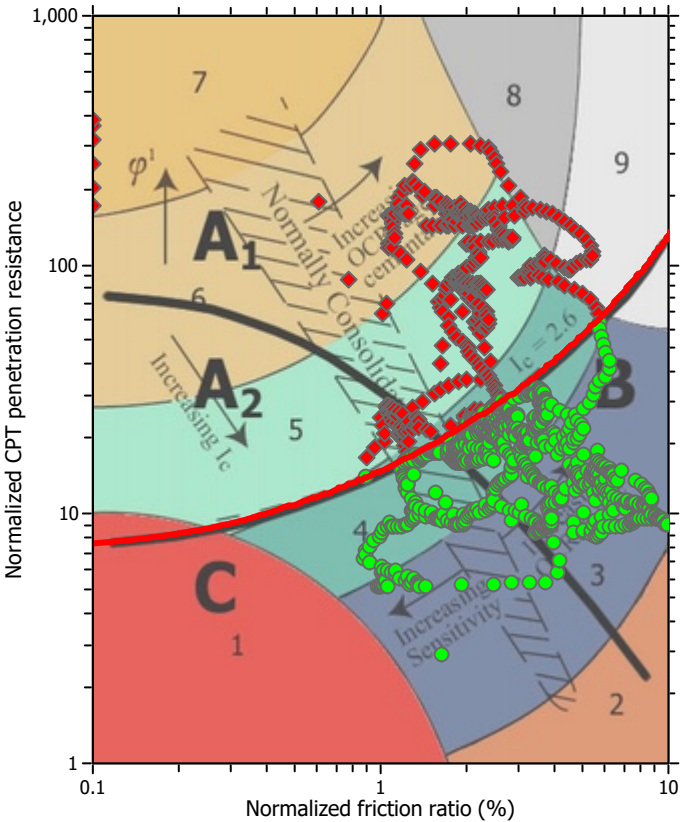
F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Light Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

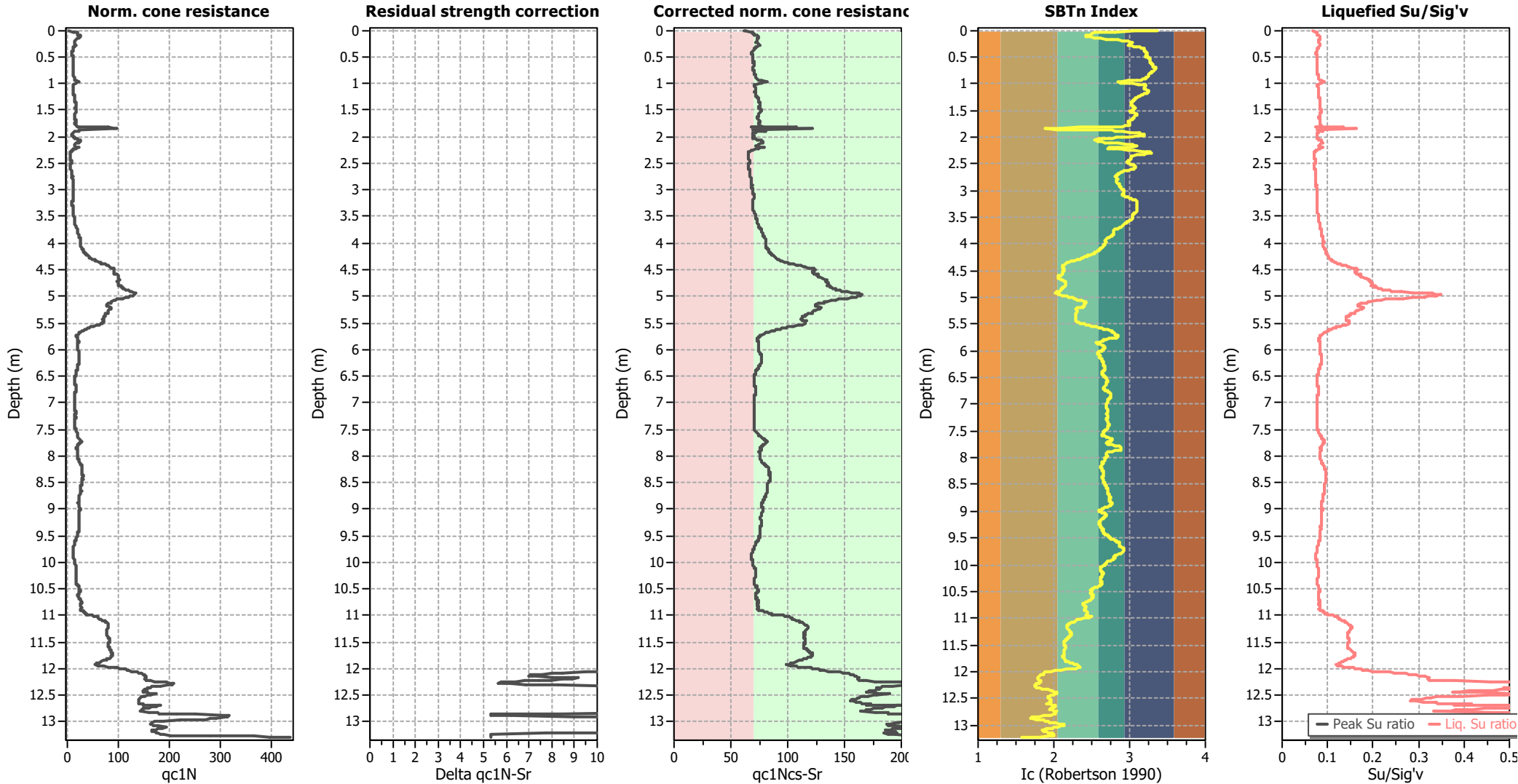
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{ϕ} applied:	Yes
Earthquake magnitude M_w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _g applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

LIQUEFACTION ANALYSIS REPORT

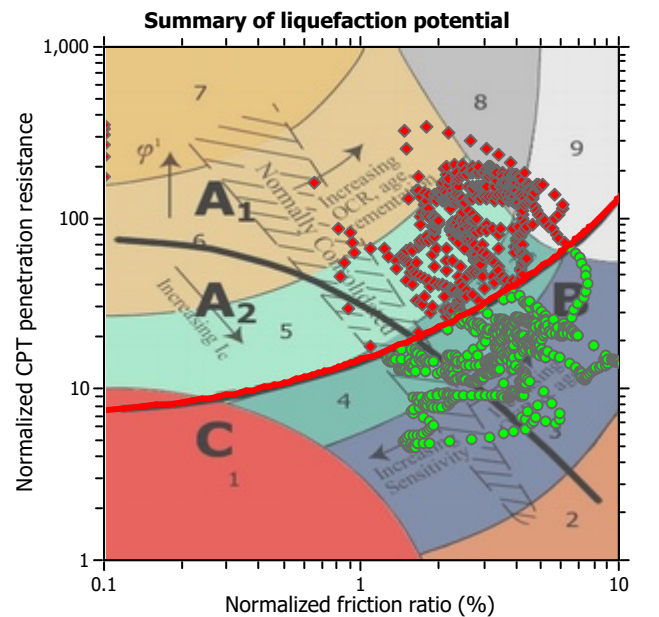
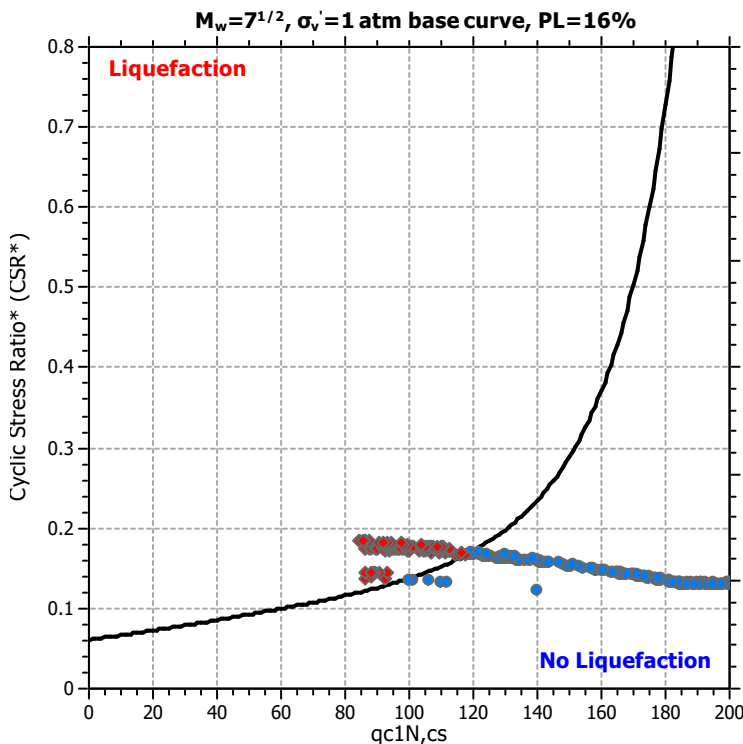
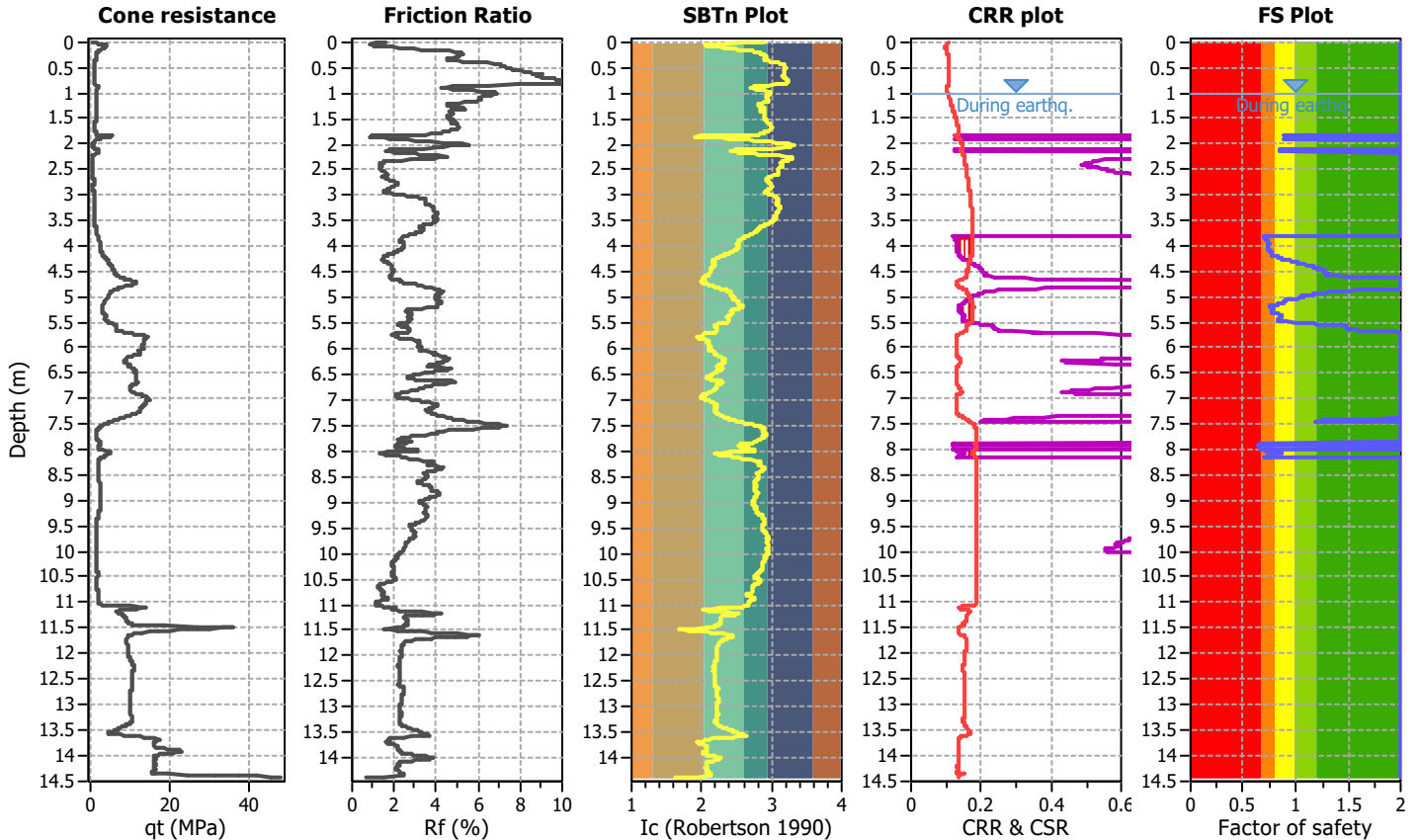
Project title : 145-153 Edgewater drive

Location : 145-153 Edgewater drive

CPT file : CPT05

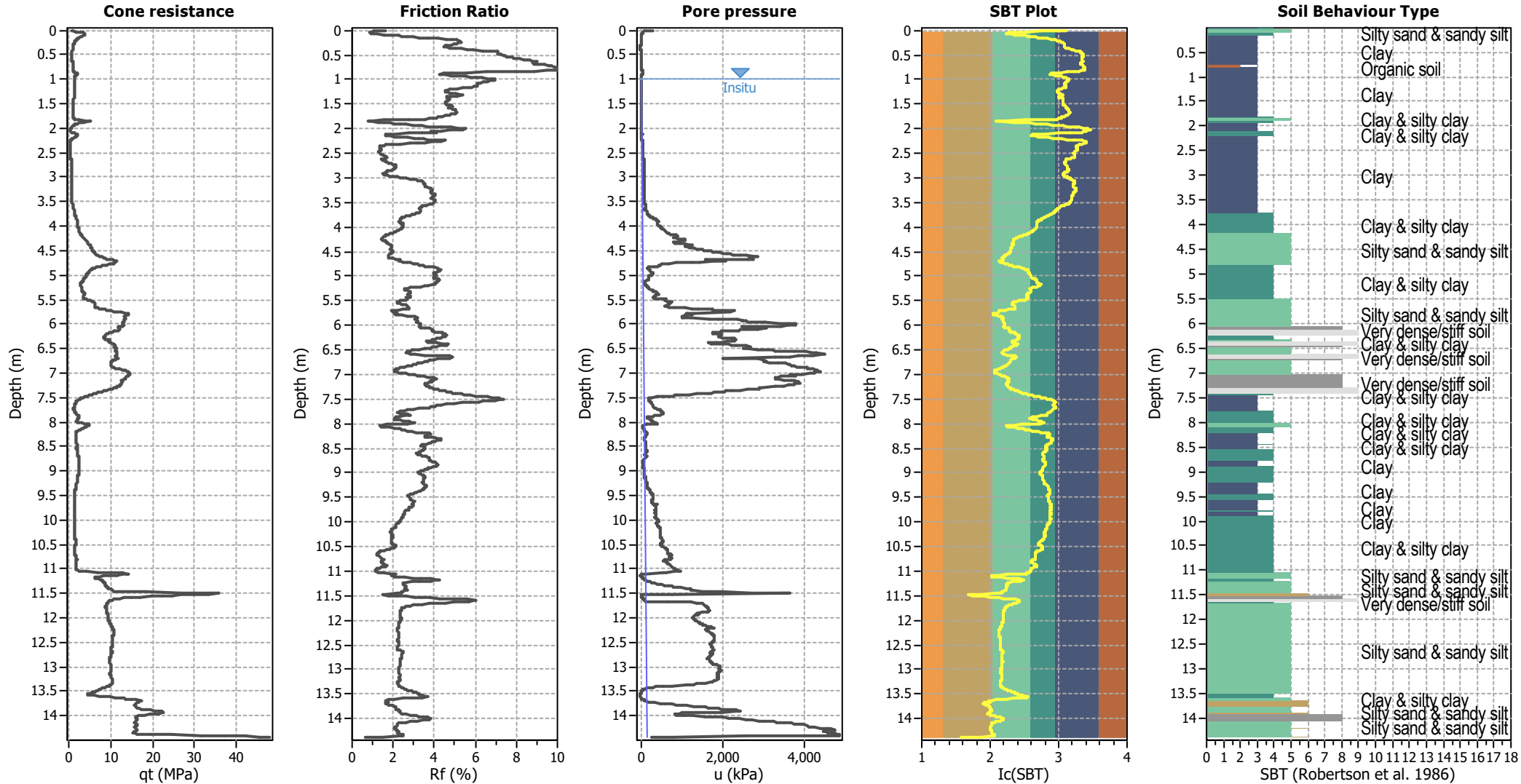
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sand & Clay
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained

2. Organic material

3. Clay to silty clay

4. Clayey silt to silty

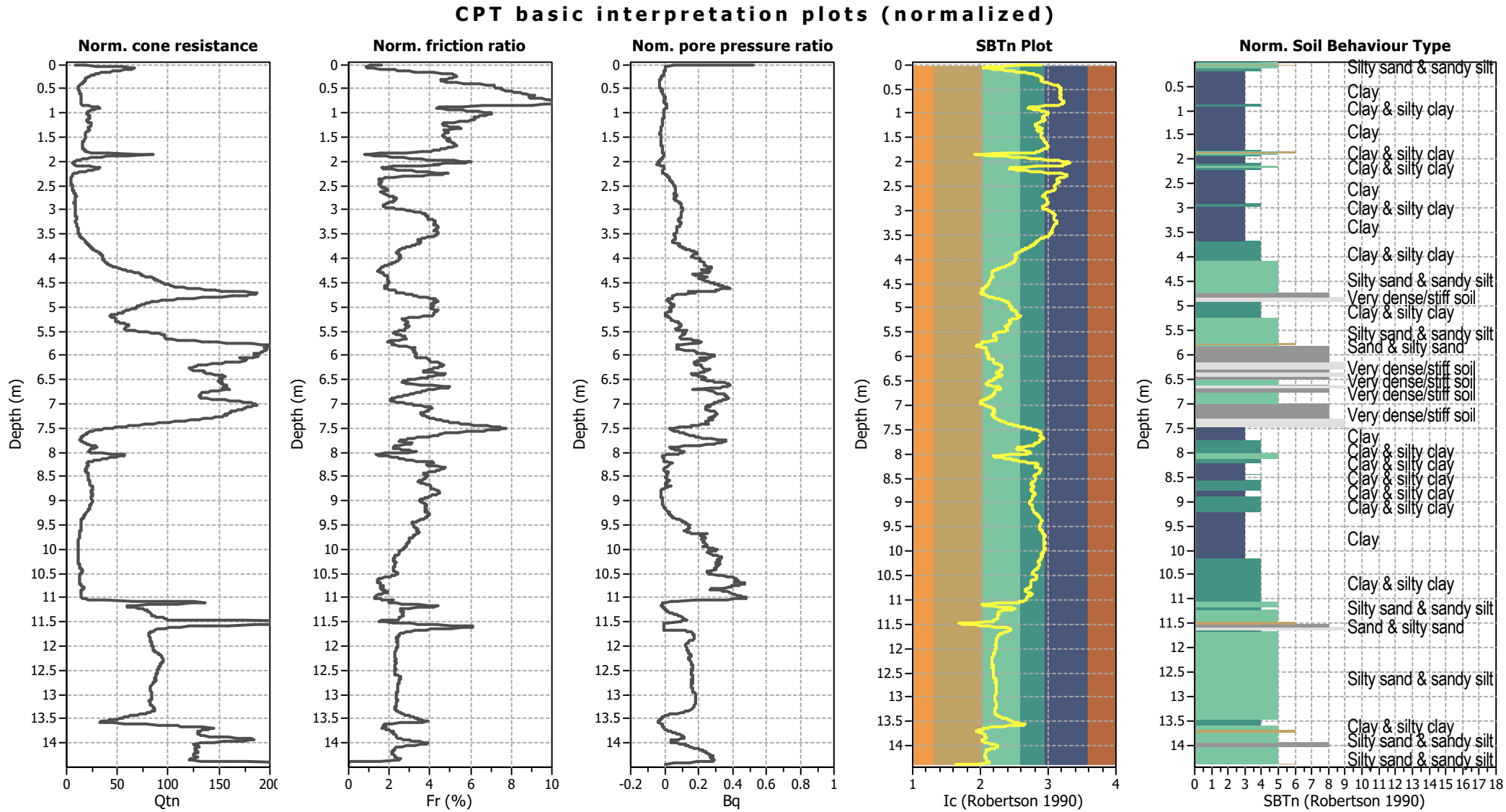
5. Silty sand to sandy silt

6. Clean sand to silty sand

7. Gravely sand to sand

8. Very stiff sand to

9. Very stiff fine grained

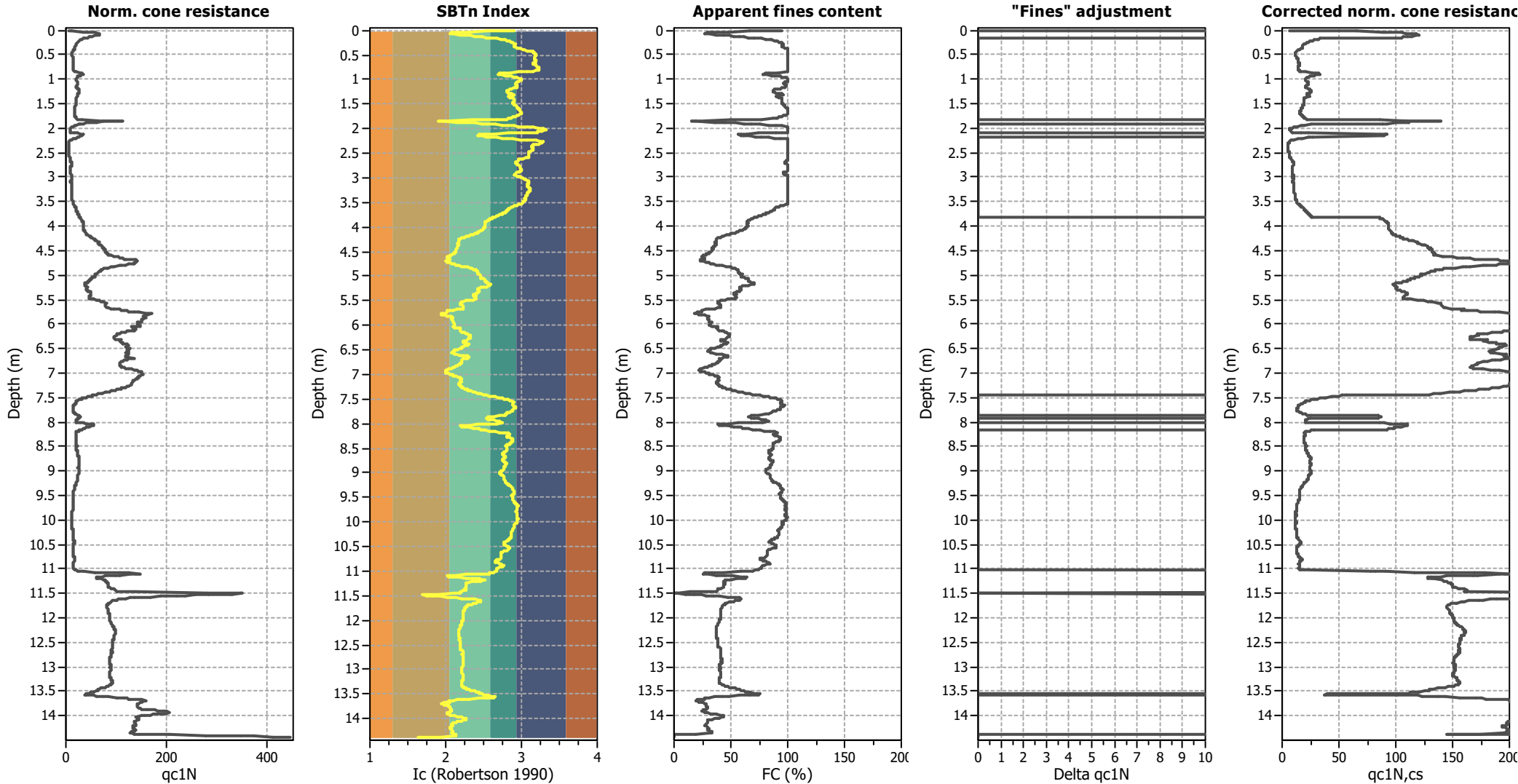


Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

SBTn legend		
1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

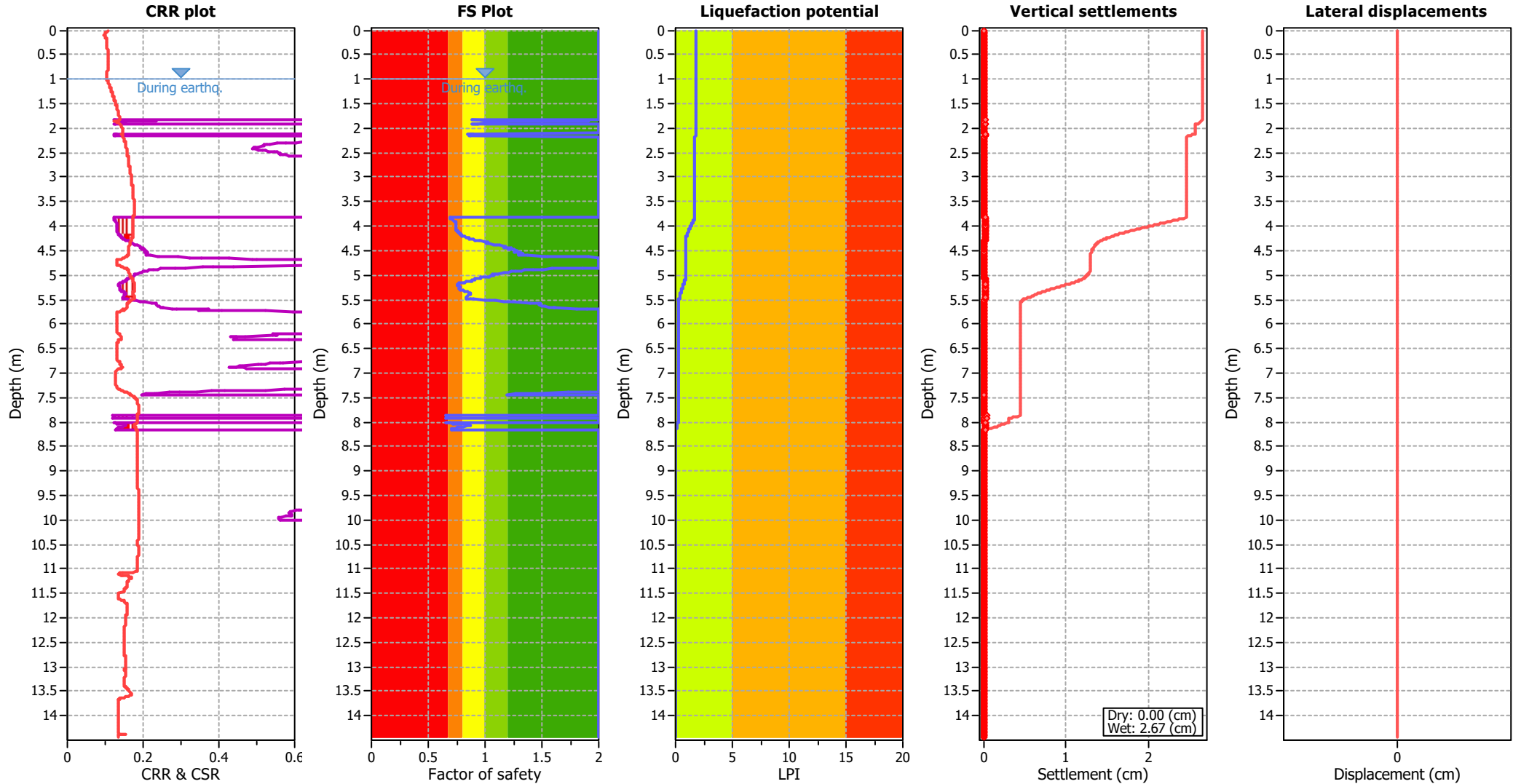
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

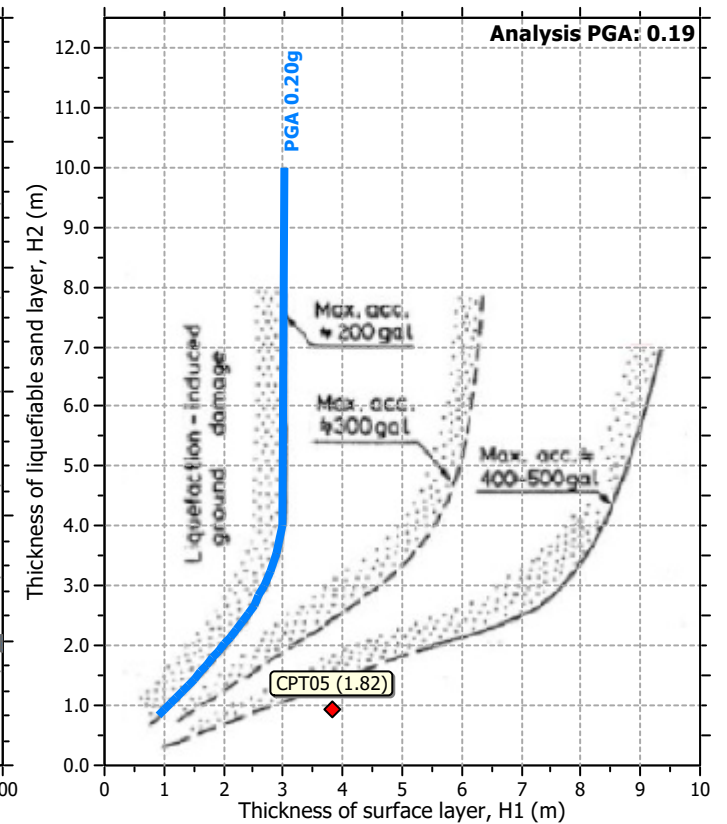
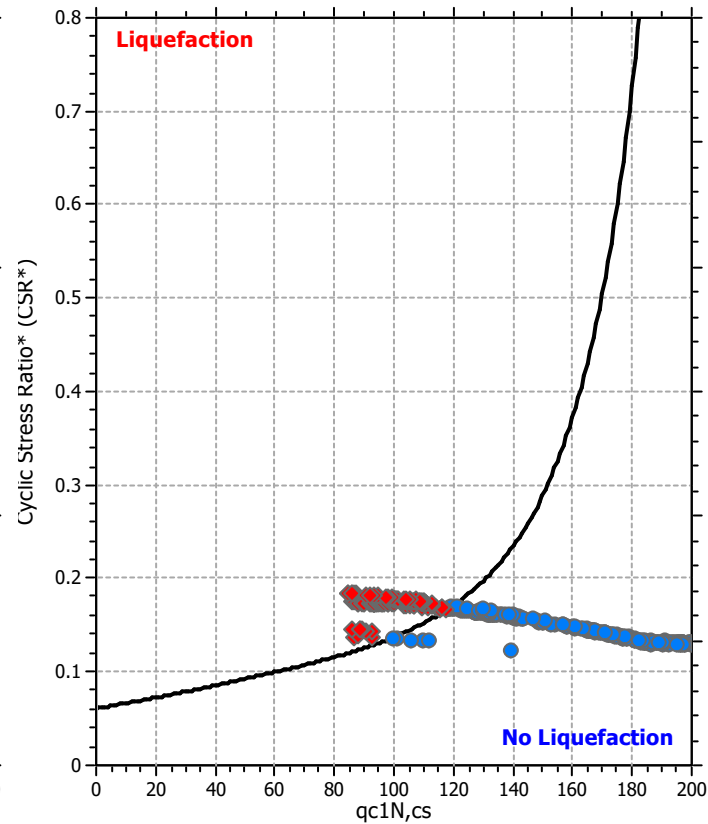
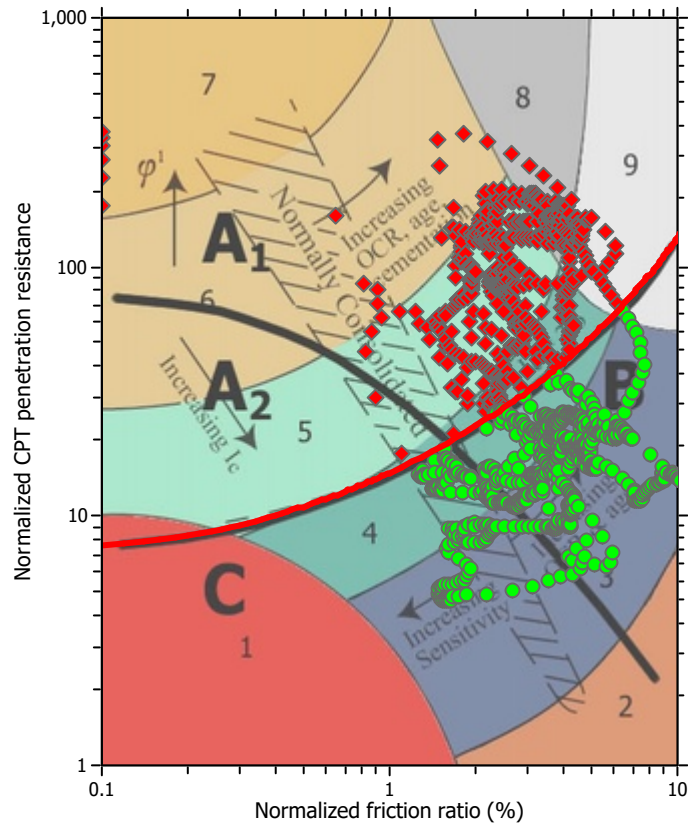
F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Light Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

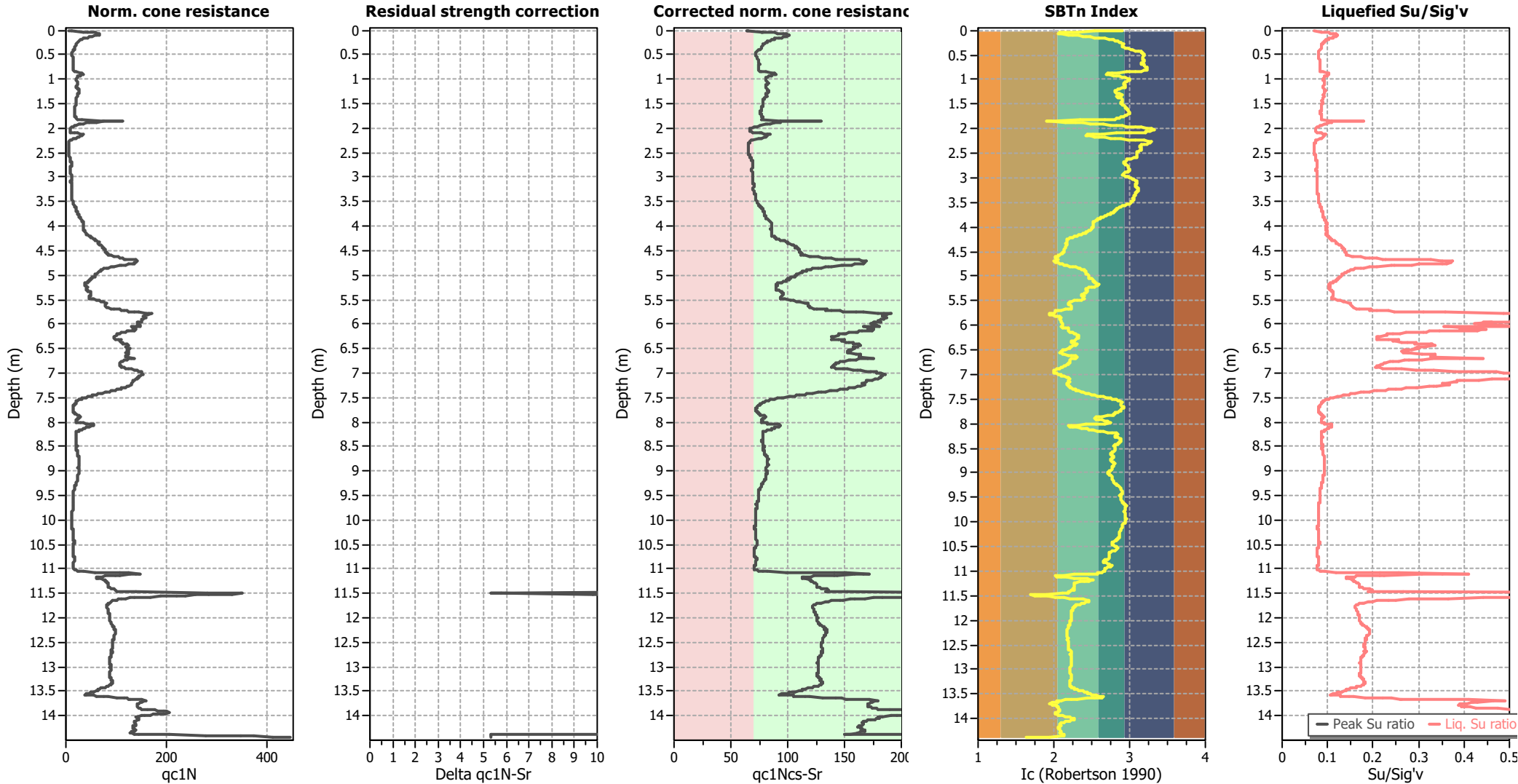
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I _c value	I _c cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _g applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

LIQUEFACTION ANALYSIS REPORT

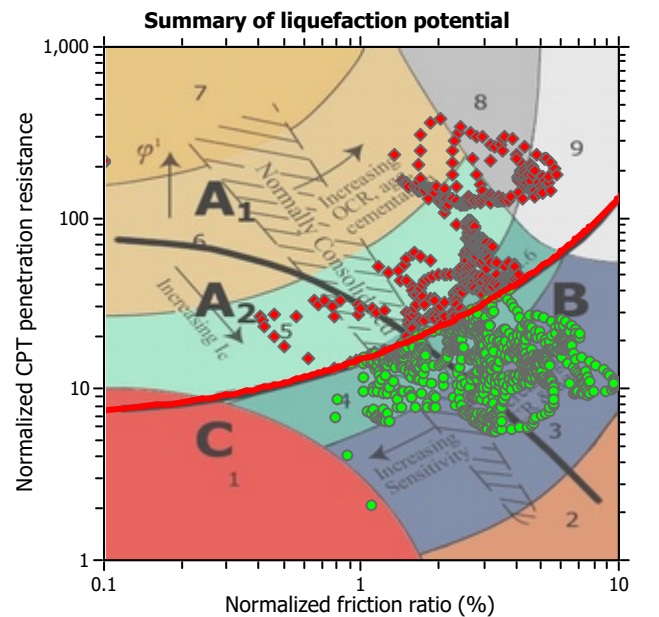
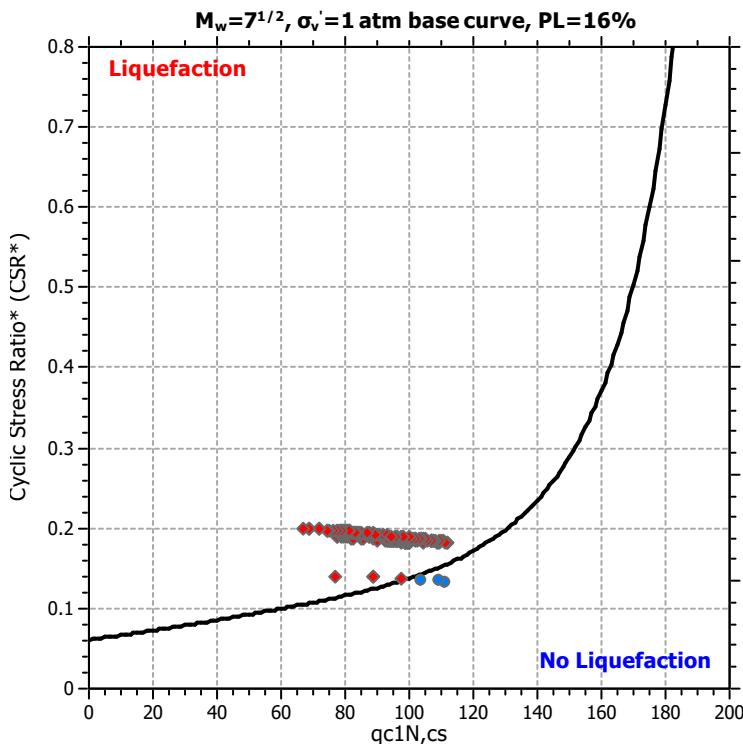
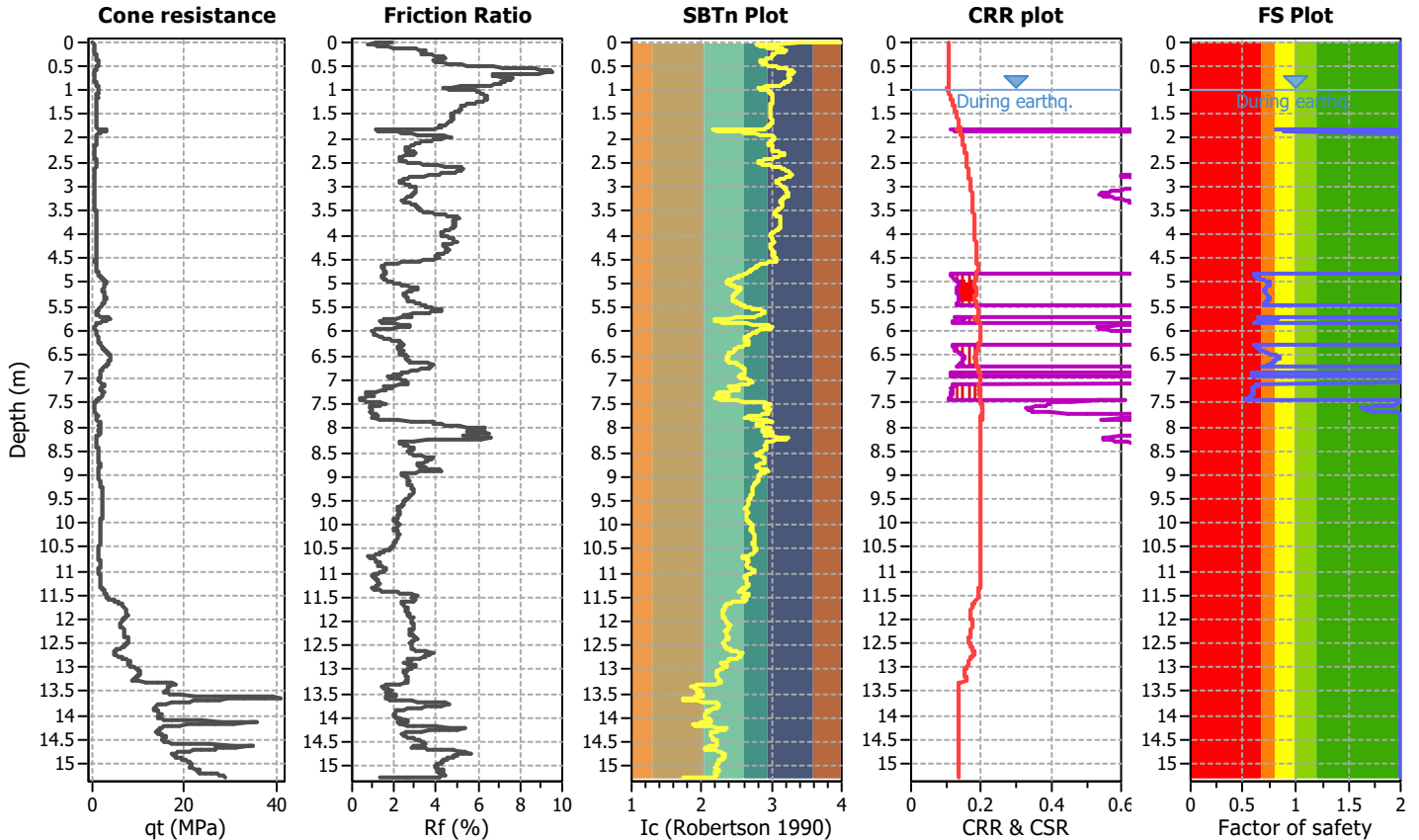
Project title : 145-153 Edgewater drive

Location : 145-153 Edgewater drive

CPT file : CPT06

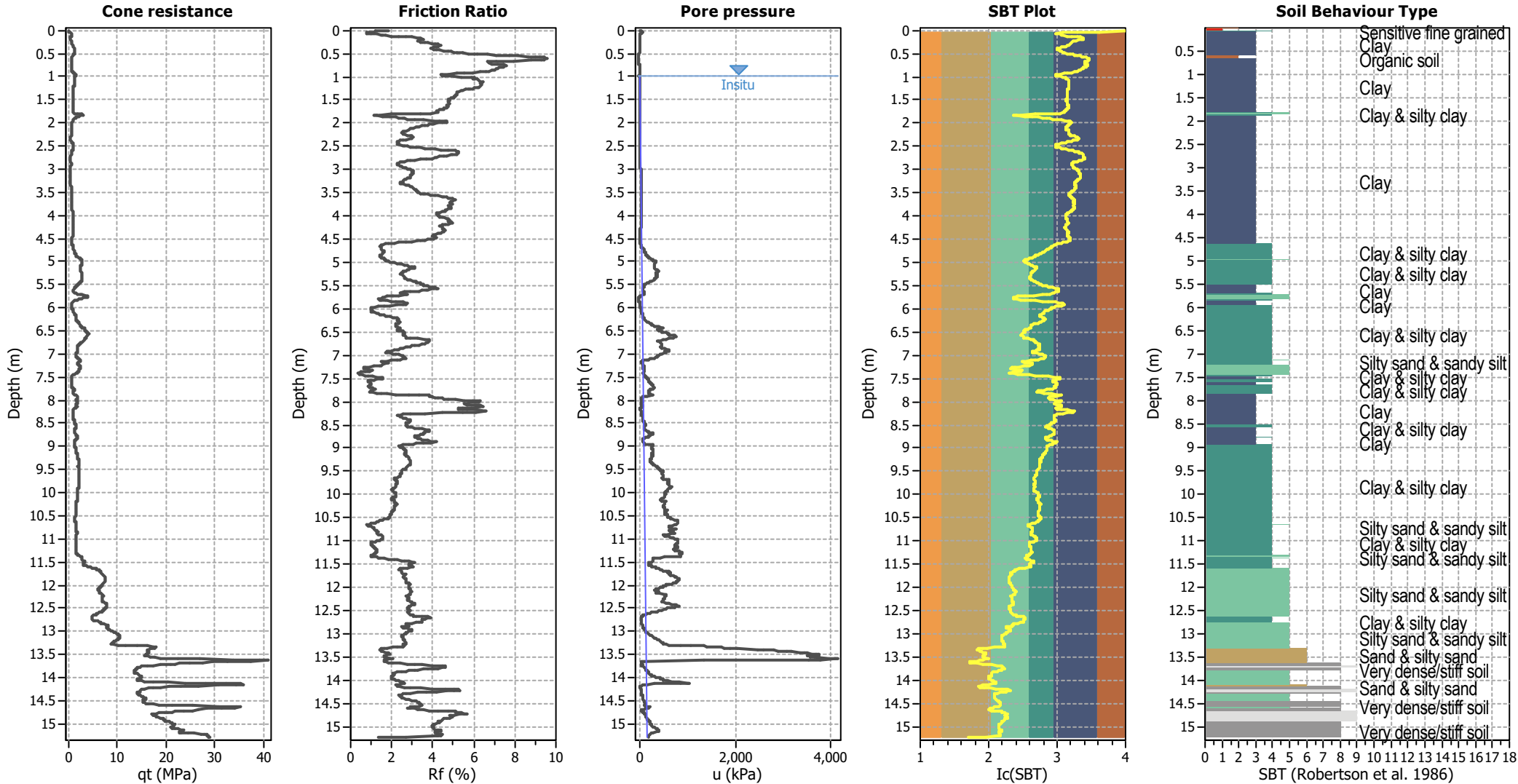
Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	applied:	Sand & Clay
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



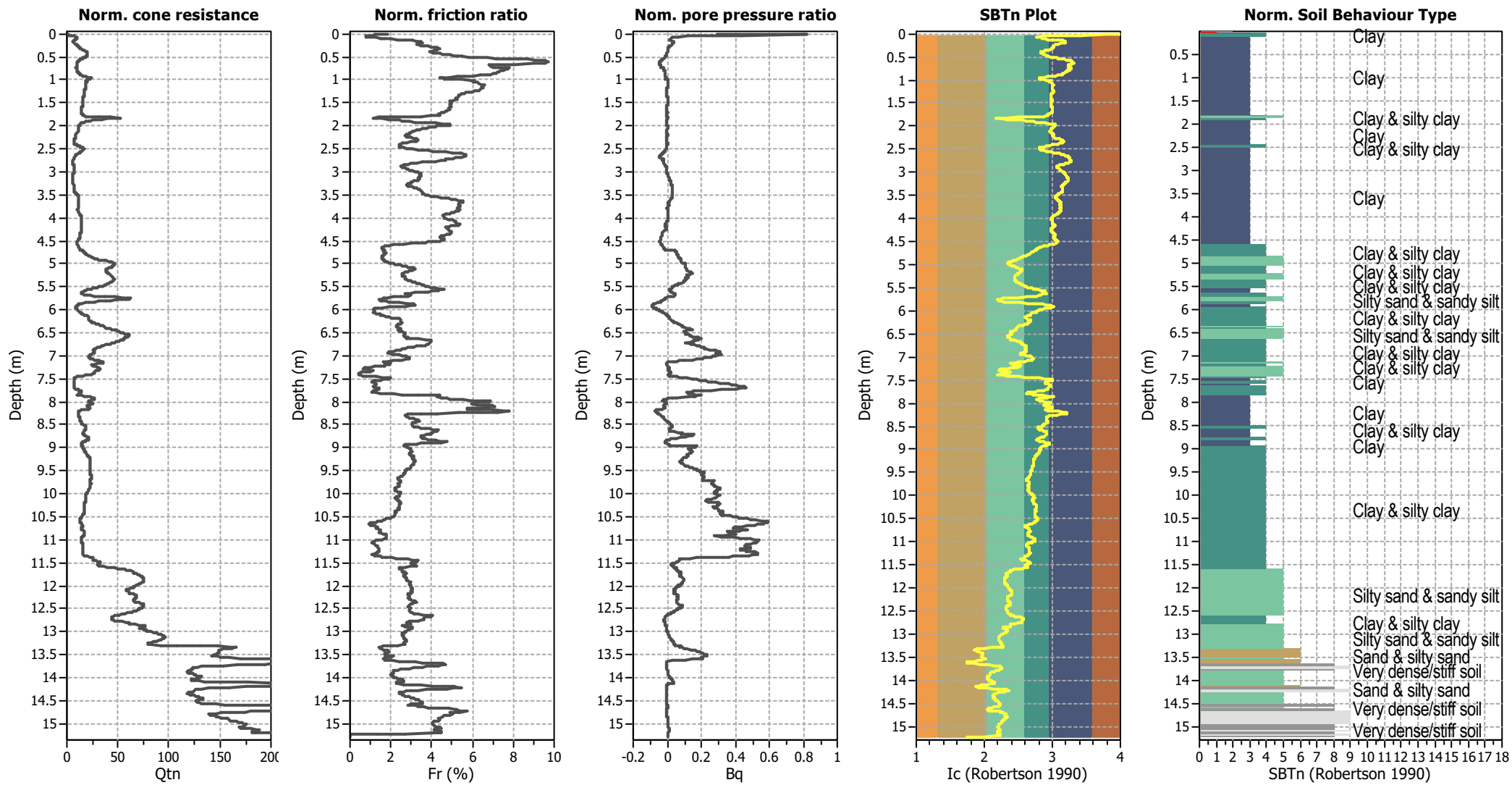
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

CPT basic interpretation plots (normalized)



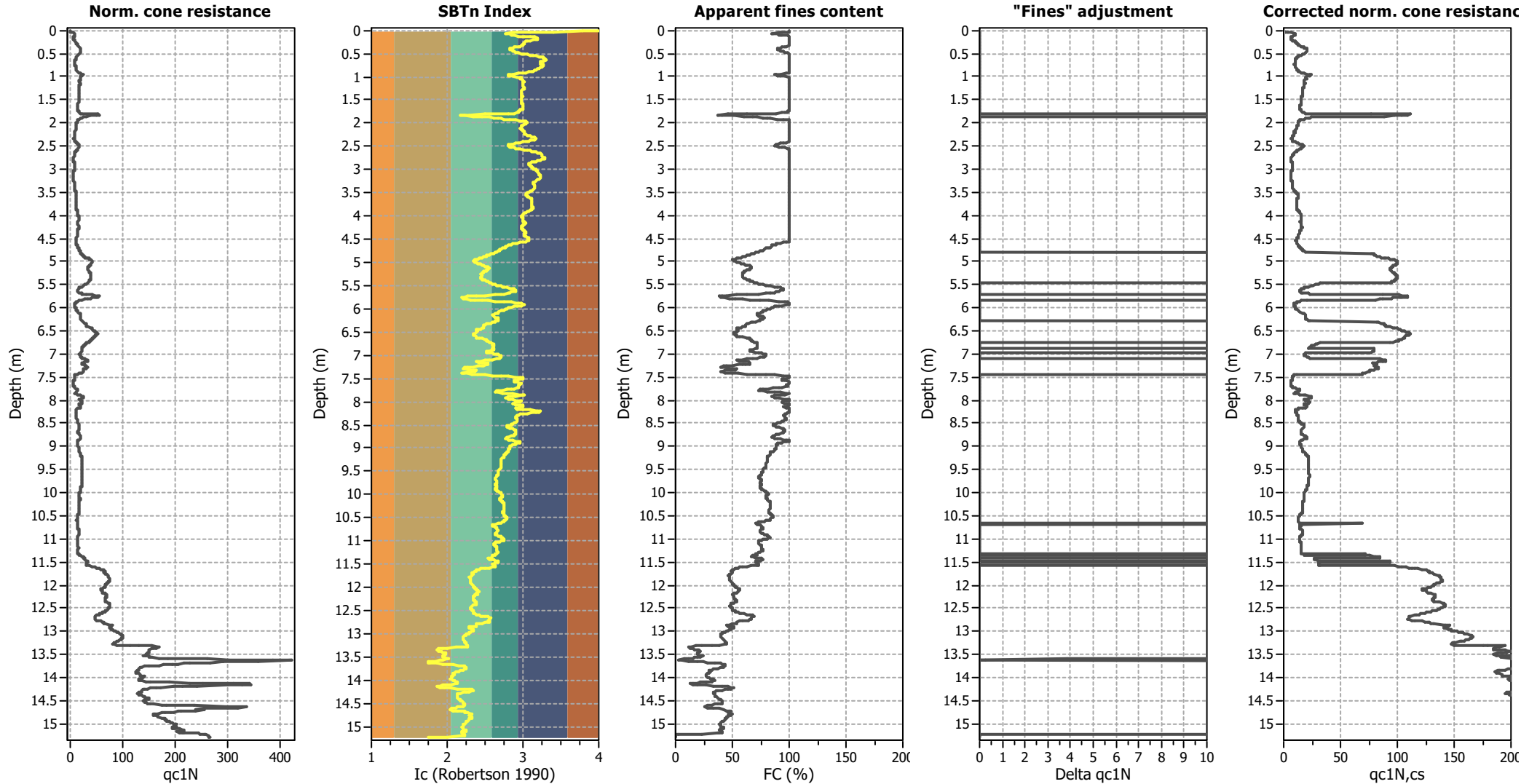
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

SBTn legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

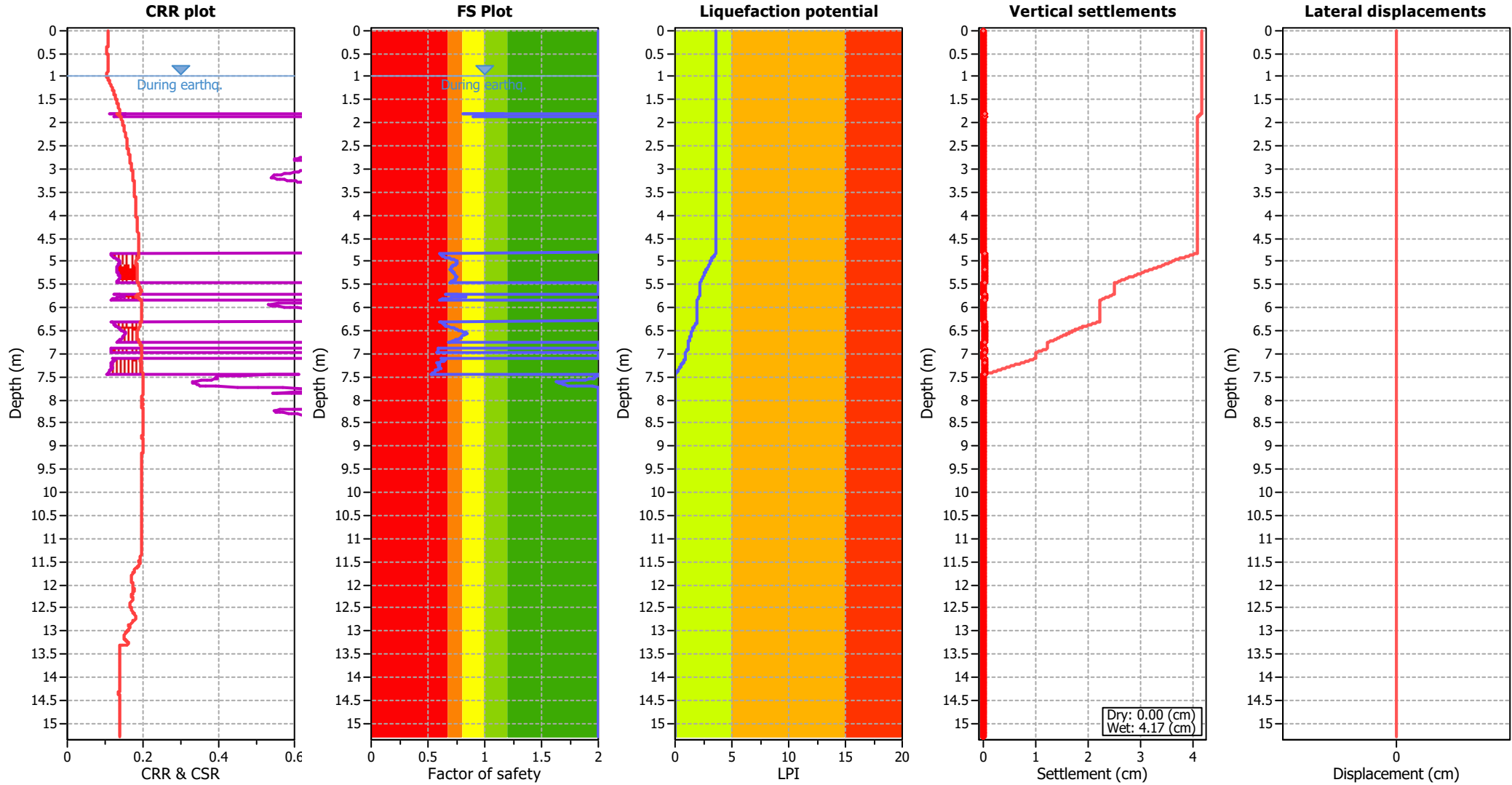
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (earthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

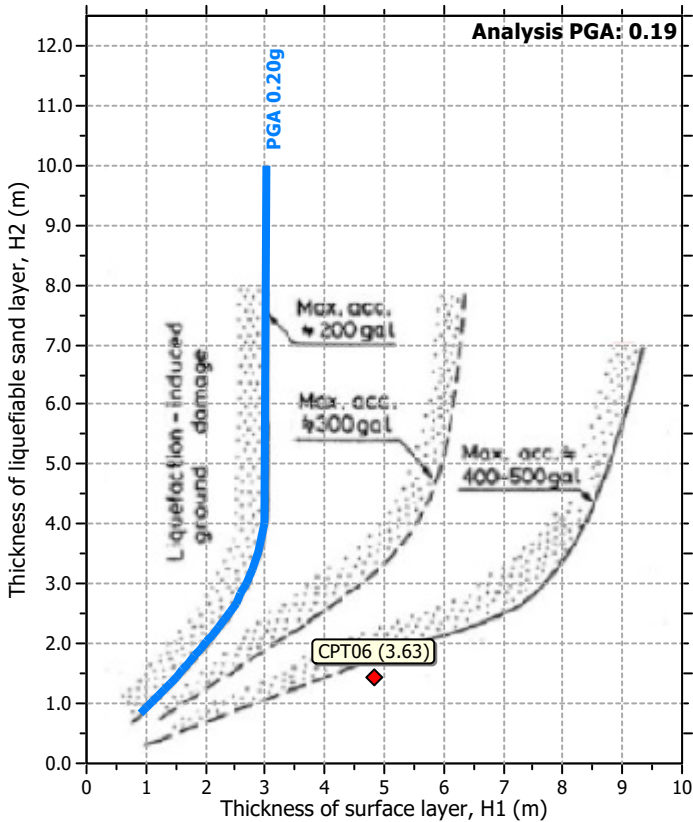
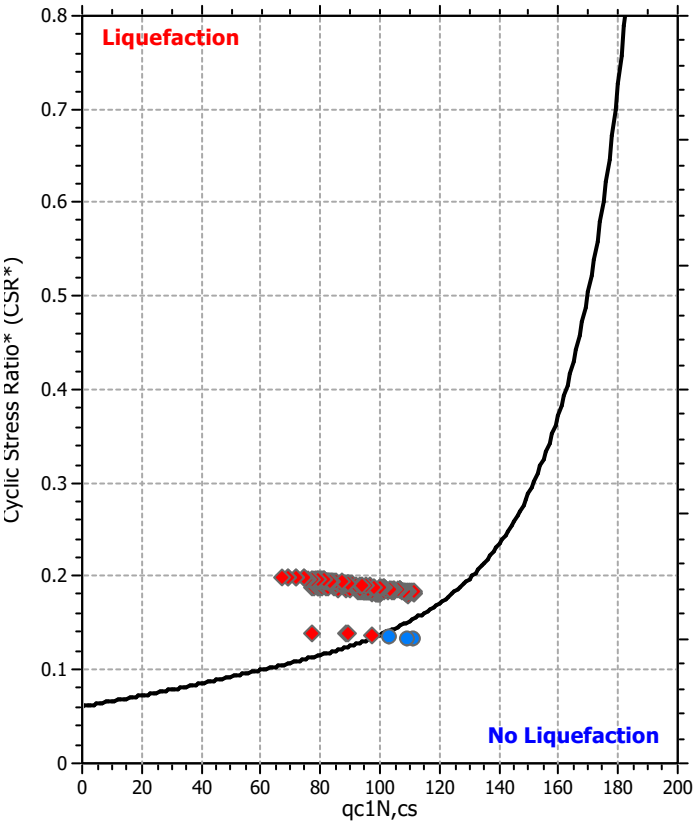
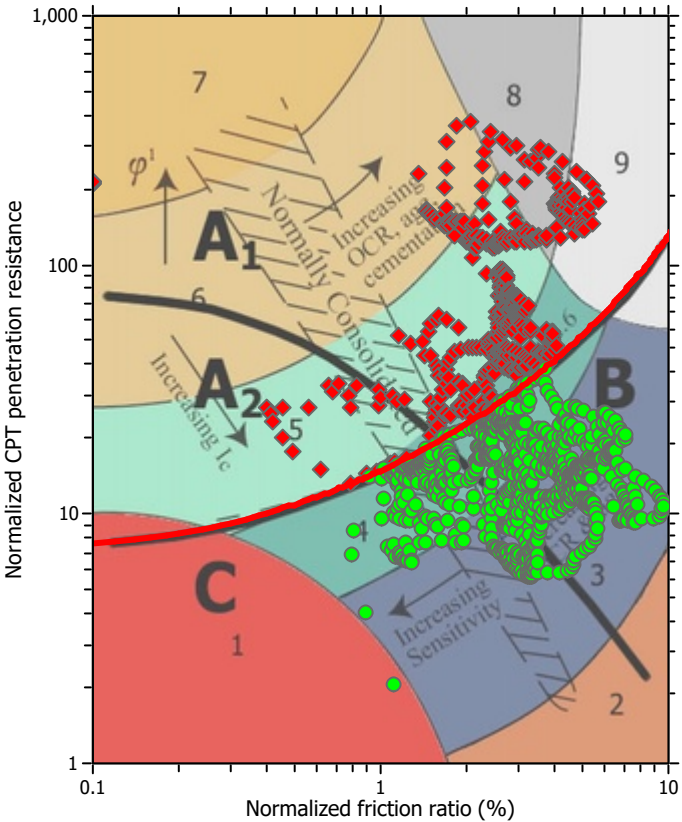
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

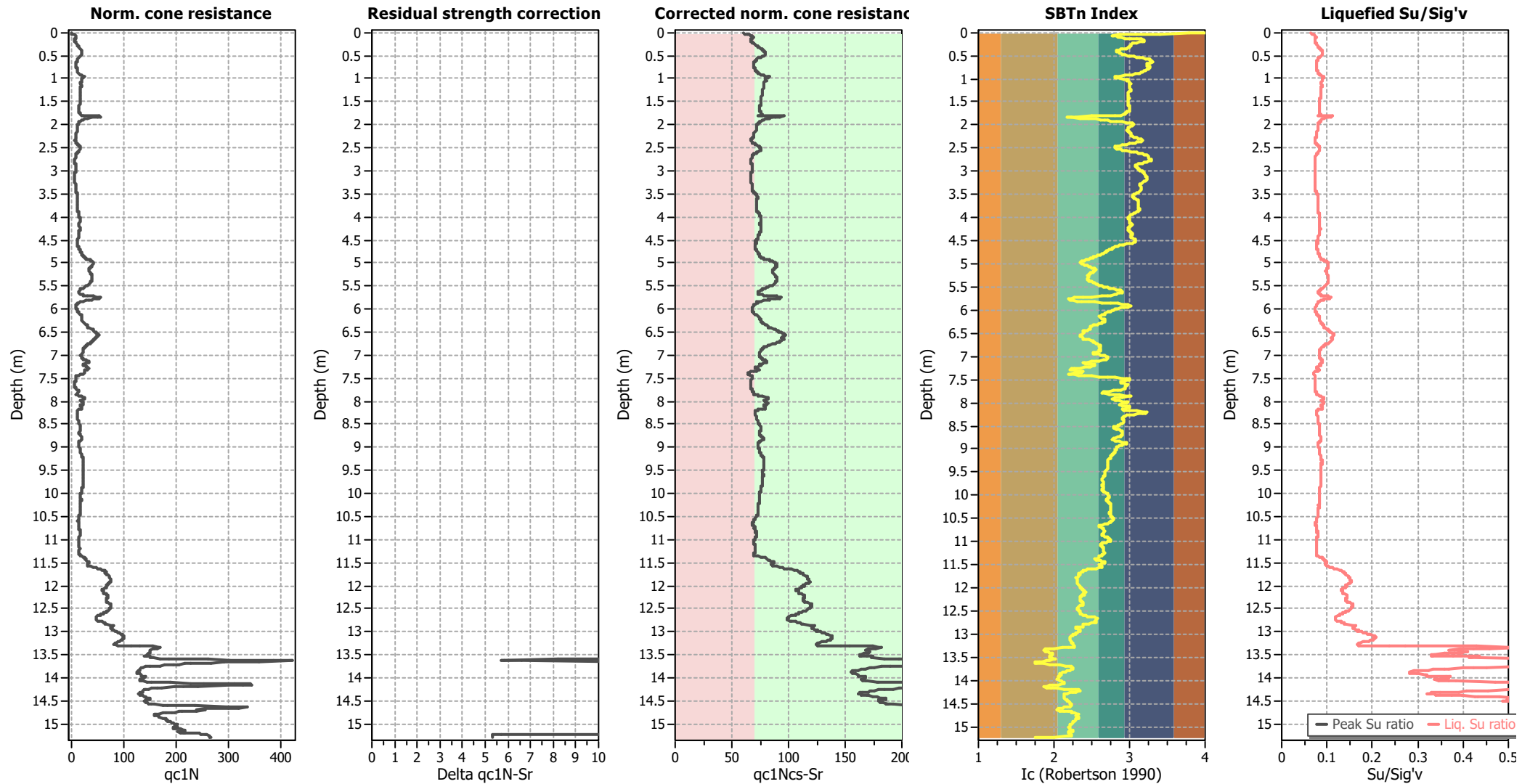
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_{ϕ} applied:	Yes
Earthquake magnitude M_w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

Check for strength loss plots (Idriss & Boulanger (2008))

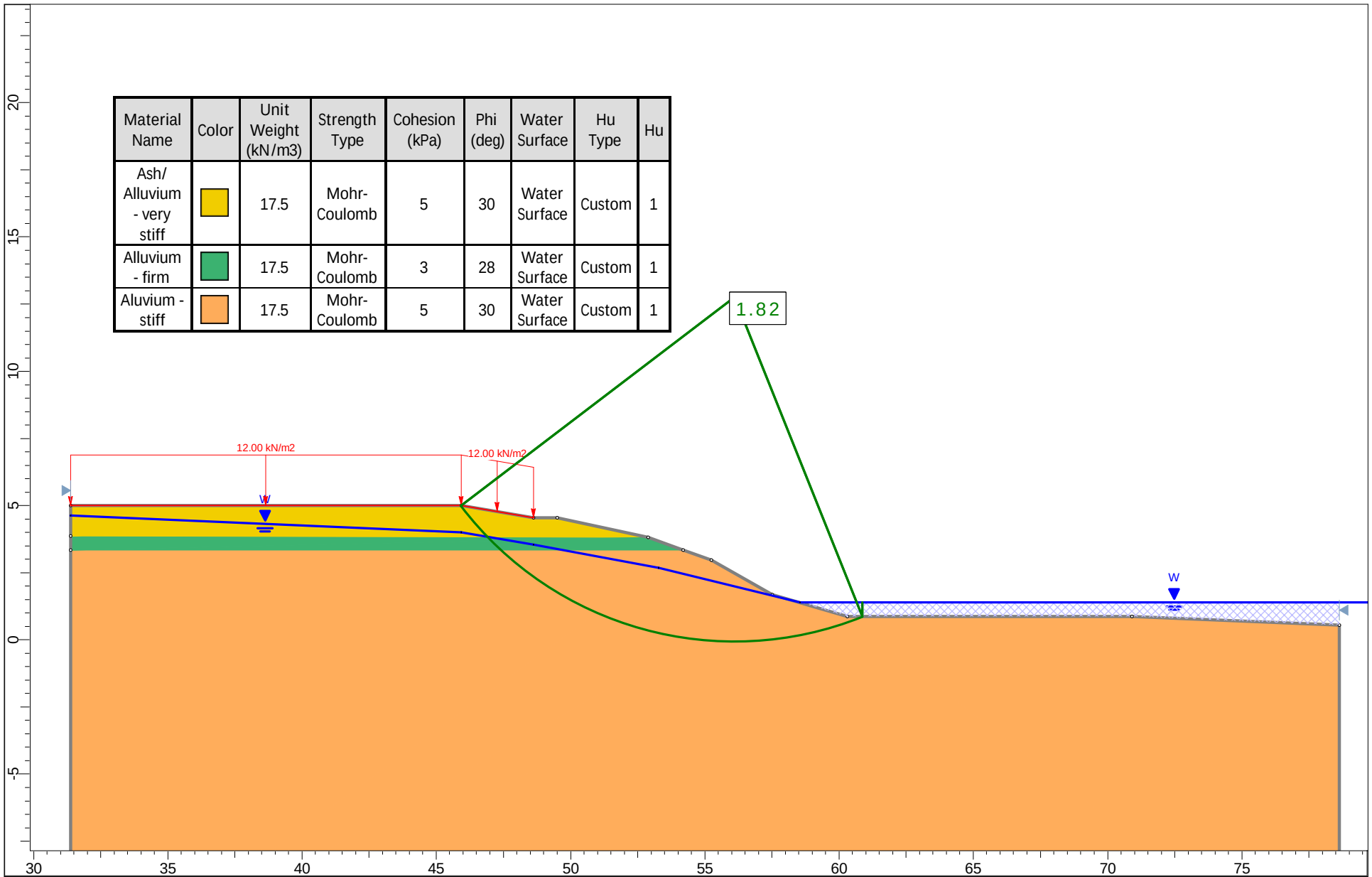


Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	10.00 m

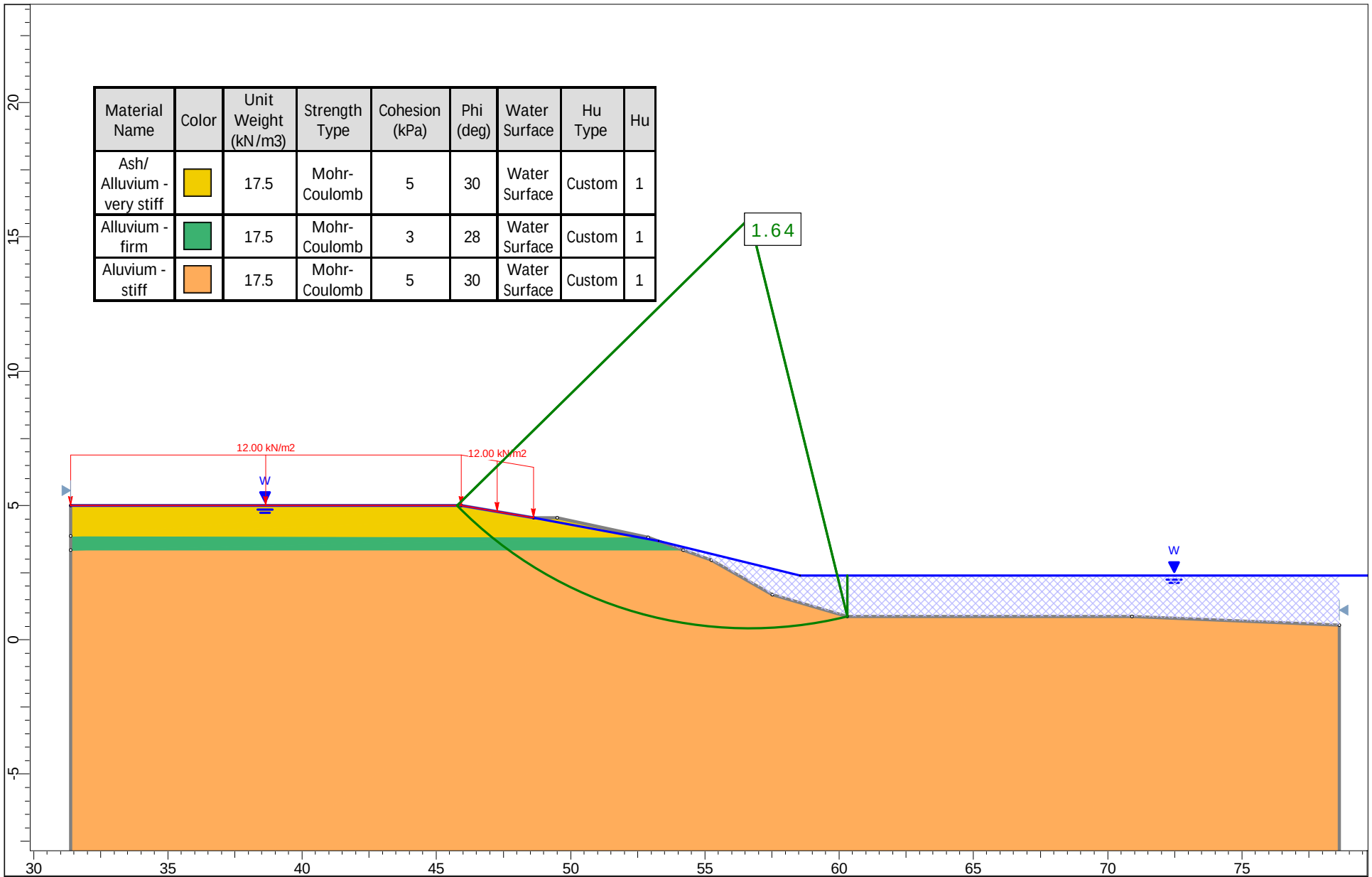
APPENDIX E

SLOPE STABILITY ANALYSIS



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Ash/ Alluvium - very stiff		17.5	Mohr-Coulomb	5	30	Water Surface	Custom	1
Alluvium - firm		17.5	Mohr-Coulomb	3	28	Water Surface	Custom	1
Aluvium - stiff		17.5	Mohr-Coulomb	5	30	Water Surface	Custom	1

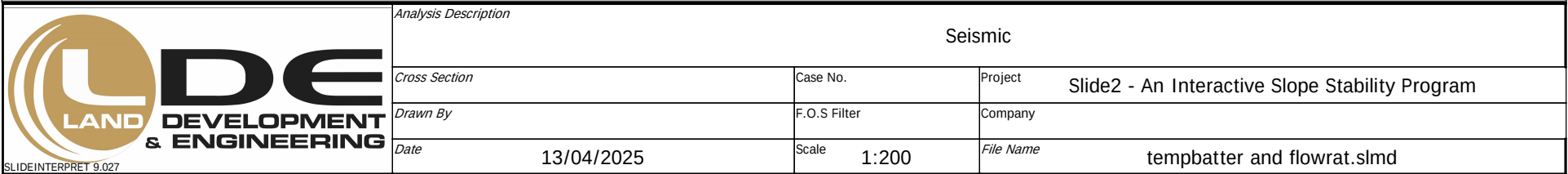
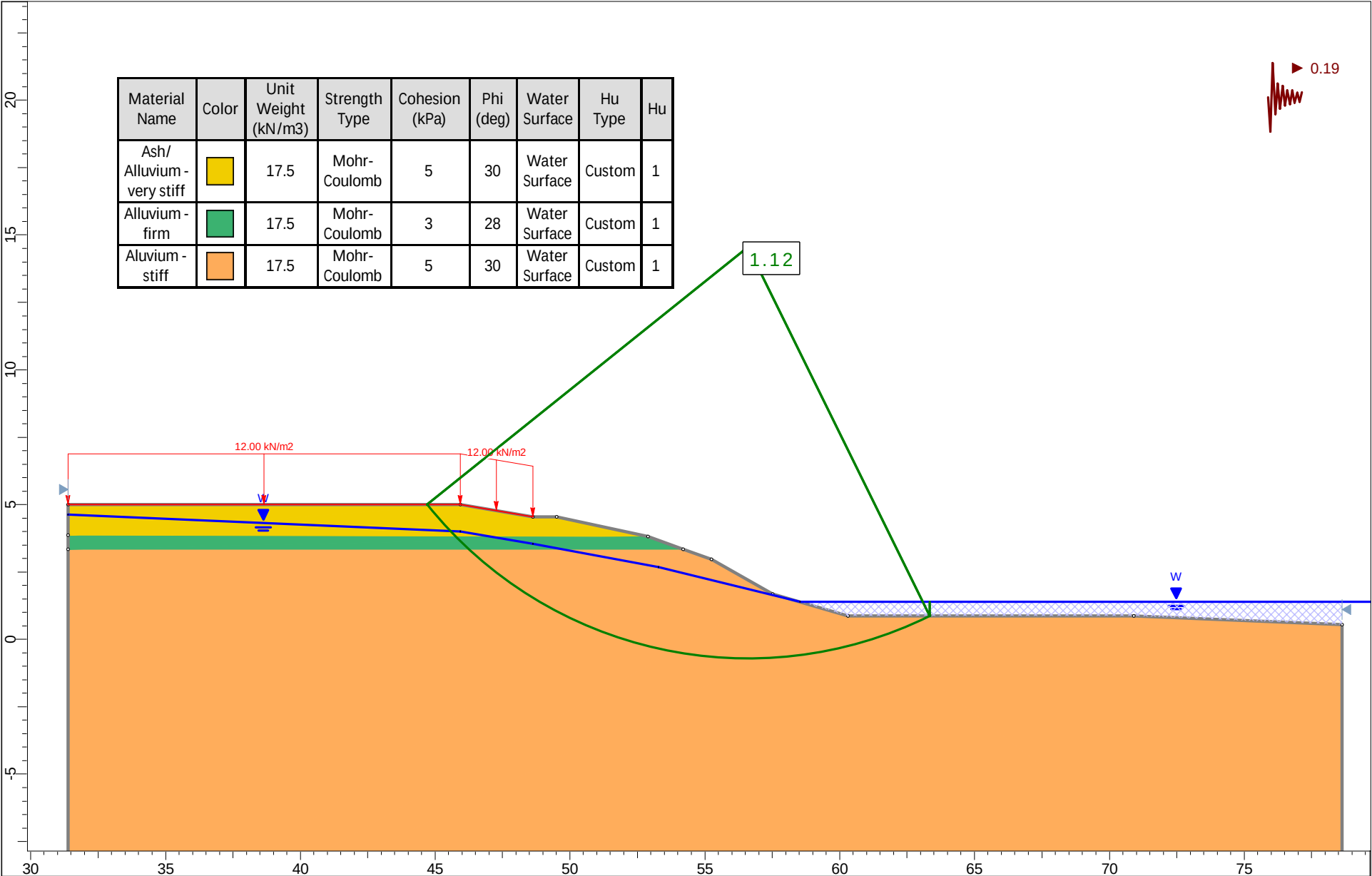
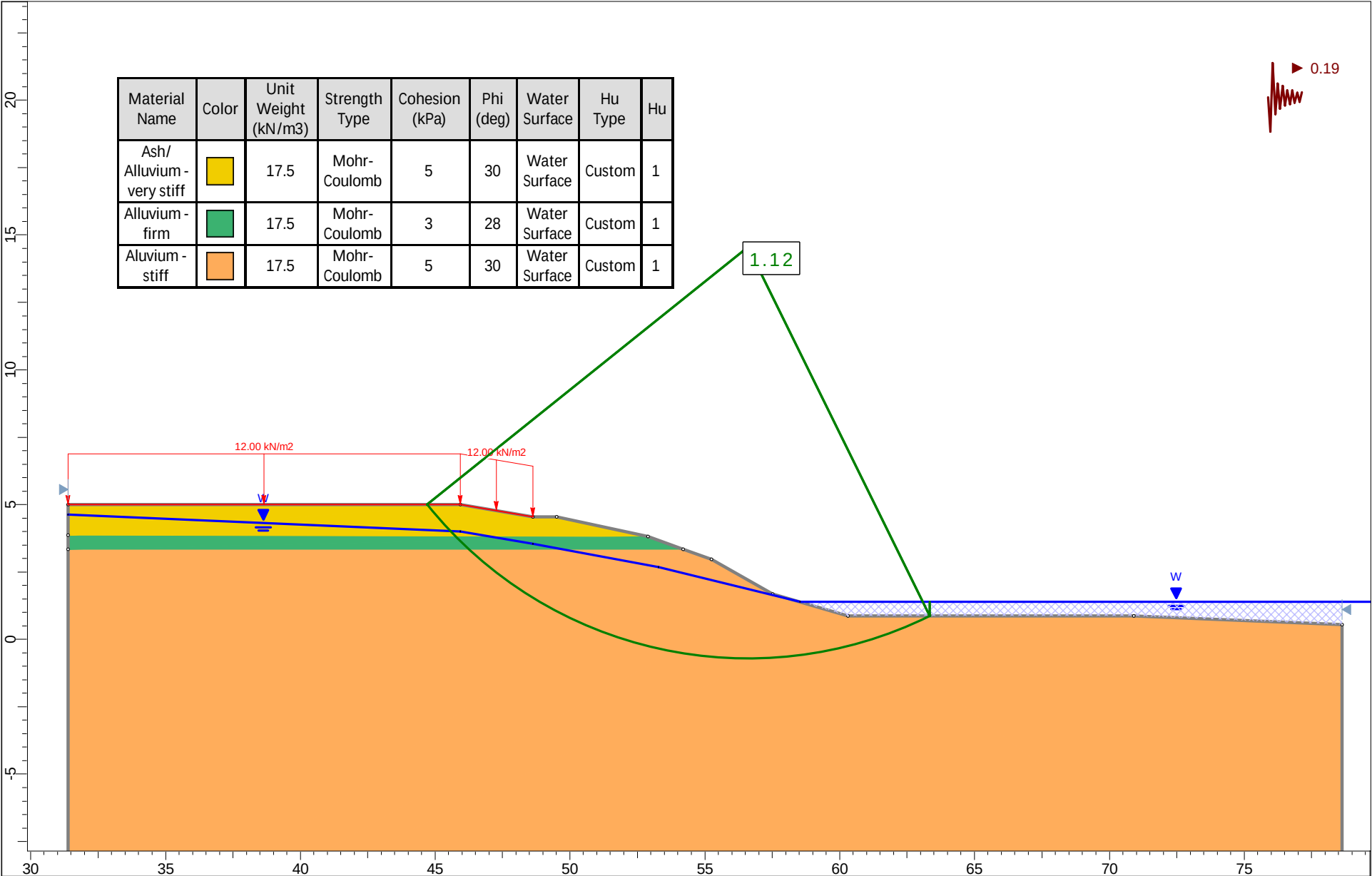
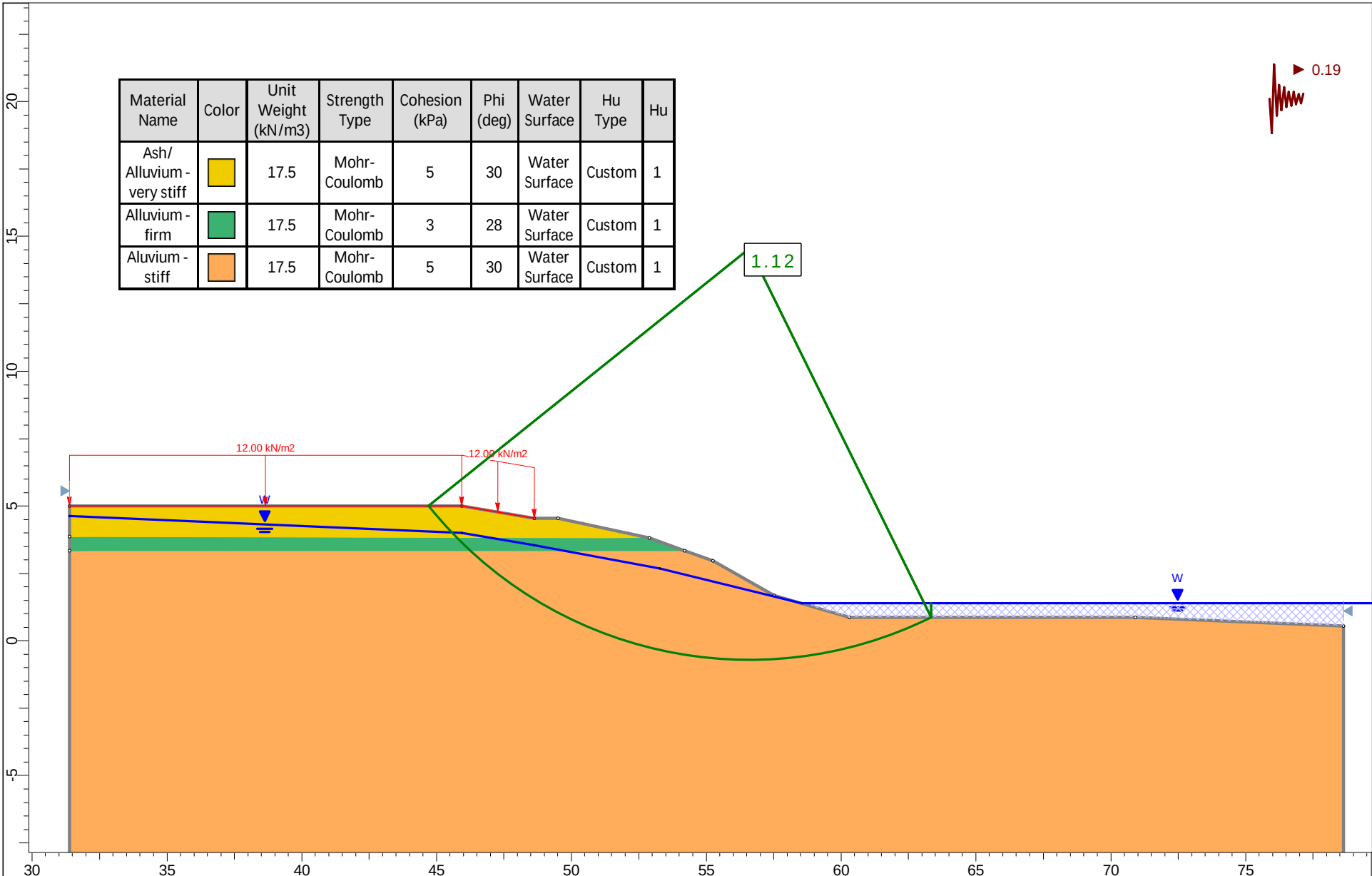
	Analysis Description		
	Normal groundwater		
	Cross Section	Case No.	Project Slide2 - An Interactive Slope Stability Program
	Drawn By	F.O.S Filter	Company
Date 13/04/2025		Scale 1:200	File Name tempbatter and flowrat.slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Ash/ Alluvium - very stiff		17.5	Mohr-Coulomb	5	30	Water Surface	Custom	1
Alluvium - firm		17.5	Mohr-Coulomb	3	28	Water Surface	Custom	1
Alluvium - stiff		17.5	Mohr-Coulomb	5	30	Water Surface	Custom	1

	Analysis Description		Elevated groundwater	
	Cross Section	Case No.	Project Slide2 - An Interactive Slope Stability Program	
	Drawn By	F.O.S Filter	Company	
	Date	Scale	File Name	
	13/04/2025	1:200	tempbatter and flowrat.slmd	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Ash/ Alluvium - very stiff		17.5	Mohr-Coulomb	5	30	Water Surface	Custom	1
Alluvium - firm		17.5	Mohr-Coulomb	3	28	Water Surface	Custom	1
Aluvium - stiff		17.5	Mohr-Coulomb	5	30	Water Surface	Custom	1



APPENDIX F

WALLAP ANALYSIS

LDE LTD	Sheet No.
Program: WALLAP Version 6.07 Revision A55.B74.R58	Job No. J00983
Licensed from GEOSOLVE	Made by : CCHE
Data filename/Run ID: Basement_wall	
Boundary wall wallap	Date:13-04-2025
Please modify / add	Checked :

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types	
		Left side	Right side
1	5.10	1 Ash	1 Ash
2	4.10	2 Firm Alluvium	2 Firm Alluvium
3	3.60	3 Stiff Alluvium	3 Stiff Alluvium

SOIL PROPERTIES

-- Soil type --	Bulk density	Young's Modulus	At rest coeff.	Consol state.	Active limit	Passive limit	Cohesion
No. Description (Datum elev.)	kN/m3	Eh, kN/m2 (dEh/dy)	Ko (dKo/dy)	NC/OC (Nu)	Ka (Kac)	Kp (Kpc)	kN/m2 (dc/dy)
1 Ash	17.50	25000	0.500	OC (0.300)	0.294 (1.222)	4.288 (5.694)	7.000d
2 Firm Alluvium	17.50	10500	0.560	OC (0.300)	0.348 (1.337)	3.404 (4.929)	3.000d
3 Stiff Alluvium	17.50	15000	0.500	OC (0.300)	0.294 (1.222)	4.288 (5.694)	5.000d

Additional soil parameters associated with Ka and Kp

		--- parameters for Ka ---			--- parameters for Kp ---		
		Soil friction	Wall adhesion	Back-fill	Soil friction	Wall adhesion	Back-fill
----- Soil type -----	No. Description	angle	coeff.	angle	angle	coeff.	angle
	1 Ash	30.00	0.464	0.00	30.00	0.464	0.00
	2 Firm Alluvium	26.00	0.473	0.00	26.00	0.473	0.00
	3 Stiff Alluvium	30.00	0.464	0.00	30.00	0.464	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	1.60	1.60

Automatic water pressure balancing at toe of wall : No

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -2.40
Maximum finite element length = 0.40 m
Youngs modulus of wall E = 3.0000E+07 kN/m2
Moment of inertia of wall I = 2.6510E-03 m4/m run
E.I = 79530 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Prop no.	Prop Elev.	Prop spacing	Cross-section area	Youngs modulus	Free length	Inclin -ation	Pre-stress	Strut or Anchor	Allow tension	L/R
		m	sq.m	kN/m2	m	(degs)	/prop kN		?	
1	0.70	1.00	0.300000	2.500E+07	10.00	0.00	0	Strut	No	R
2	4.30	1.00	0.300000	2.500E+07	10.00	0.00	0	Strut	No	R

SURCHARGE LOADS

Surch- arge no.	Distance from Elev. wall	Length parallel to wall	Width perpend. to wall	Surcharge ----- kN/m2 ----- Near edge Far edge		Equiv. Partial soil factor/ type Category
1	5.10	1.00 (L)	100.00	20.00	12.00 =	N/A N/A

Note: L = Left side, R = Right side

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.1 at elevation 5.10
2	Excavate to elevation 1.60 on RIGHT side

FACTORS OF SAFETY and ANALYSIS OPTIONS

Stability analysis:

Method of analysis - Strength Factor method

Factor on soil strength for calculating wall depth = 1.00

Parameters for undrained strata:

Minimum equivalent fluid density = 5.00 kN/m3

Maximum depth of water filled tension crack = 0.00 m

Bending moment and displacement calculation:

Method - Subgrade reaction model using Influence Coefficients

Open Tension Crack analysis? - No

Non-linear Modulus Parameter (L) = 5.000 m

Boundary conditions:

Length of wall (normal to plane of analysis) = 1000.00 m

Width of excavation on Left side of wall = 20.00 m

Width of excavation on Right side of wall = 20.00 m

Distance to rigid boundary on Left side = 20.00 m

Distance to rigid boundary on Right side = 20.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options		
		Displacement	Active, Passive pressures	Graph. output
1	Apply surcharge no.1 at elev. 5.10	No	No	No
2	Excav. to elev. 1.60 on RIGHT side	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

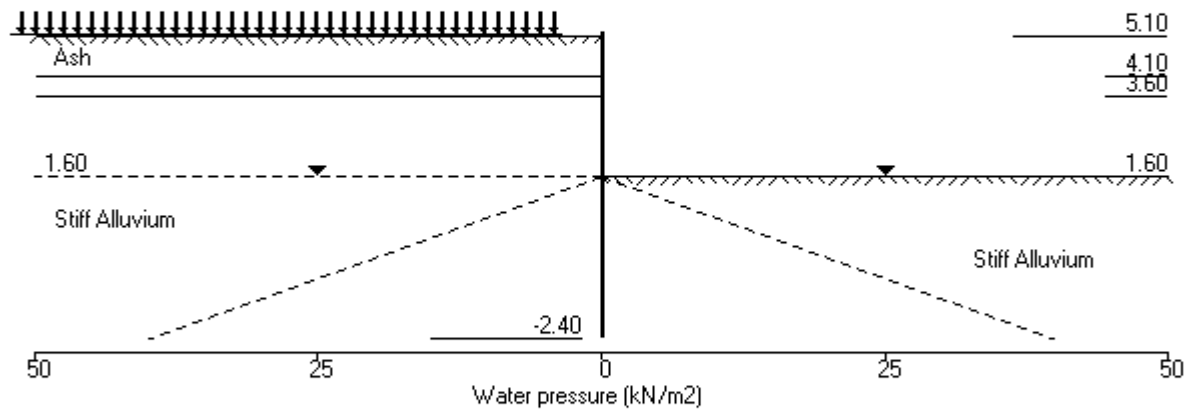
Program WALLAP - Copyright (C) 2020 by DL Borin, distributed by GEOSOLVE
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LDE LTD
Program: WALLAP Version 6.07 Revision A55.B74.R58
Licensed from GEOSOLVE
Data filename/Run ID: Basement_wall
Boundary wall wallap
Please modify / add

| Sheet No.
| Job No. J00983
| Made by : CCHE
| Date:13-04-2025
Checked :

Units: kN,m

Stage No.2 Excav. to elev. 1.60 on RIGHT side



LDE LTD	Sheet No.
Program: WALLAP Version 6.07 Revision A55.B74.R58	Job No. J00983
Licensed from GEOSOLVE	Made by : CCHE
Data filename/Run ID: Basement_wall	
Boundary wall wallap	Date:13-04-2025
Please modify / add	Checked :

Units: kN,m

Stage No. 2 Excavate to elevation 1.60 on RIGHT side

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

<u>Stage</u> <u>No.</u>	<u>Ground level</u>		<u>Prop</u> <u>Elev.</u>	<u>FoS for toe</u> <u>elev. = -2.40</u>		<u>Toe elev. for</u> <u>FoS = 1.000</u>		<u>Direction</u> <u>of</u> <u>failure</u>
	<u>Act.</u>	<u>Pass.</u>		<u>Factor</u> <u>of</u> <u>Safety</u>	<u>Moment</u> <u>equilib.</u> <u>at elev.</u>	<u>Toe</u> <u>elev.</u>	<u>Wall</u> <u>Penetr</u> <u>-ation</u>	
2	5.10	1.60	Cant.	1.300	-2.11	-0.35	1.95	L to R

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 1000.00m

Subgrade reaction model - Boussinesq Influence coefficients

Soil deformations are elastic until the active or passive limit is reached

Open Tension Crack analysis - No

Rigid boundaries: Left side 20.00 from wall

Right side 20.00 from wall

<u>Node</u> <u>no.</u>	<u>Y</u> <u>coord</u>	<u>Nett</u> <u>pressure</u> kN/m ²	<u>Wall</u> <u>disp.</u> m	<u>Wall</u> <u>rotation</u> rad.	<u>Shear</u> <u>force</u> kN/m	<u>Bending</u> <u>moment</u> kN.m/m	<u>Prop</u> <u>forces</u> kN/m
1	5.10	0.00	0.011	1.73E-03	0.0	0.0	
2	4.85	0.00	0.011	1.73E-03	0.0	0.0	
3	4.60	0.00	0.010	1.73E-03	0.0	0.0	
4	4.35	0.00	0.010	1.73E-03	0.0	0.0	
5	4.10	0.00	0.009	1.73E-03	0.0	0.0	
		2.84	0.009	1.73E-03	0.0	0.0	
6	3.85	4.69	0.009	1.73E-03	0.9	0.1	
7	3.60	6.51	0.008	1.72E-03	2.3	0.5	
		2.79	0.008	1.72E-03	2.3	0.5	
8	3.20	5.19	0.008	1.72E-03	3.9	1.8	
9	2.80	7.53	0.007	1.70E-03	6.5	3.8	
10	2.40	9.80	0.006	1.68E-03	9.9	7.1	
11	2.00	12.03	0.006	1.63E-03	14.3	11.9	
12	1.60	14.23	0.005	1.55E-03	19.6	18.7	
		-14.24	0.005	1.55E-03	19.6	18.7	
13	1.20	-24.64	0.005	1.44E-03	11.8	25.9	
14	0.80	-20.85	0.004	1.30E-03	2.7	28.7	
15	0.40	-16.28	0.003	1.16E-03	-4.7	28.6	
16	0.00	-10.12	0.003	1.02E-03	-10.0	25.4	
17	-0.40	-4.67	0.003	9.12E-04	-13.0	20.6	
18	-0.80	0.20	0.002	8.22E-04	-13.9	15.0	
19	-1.20	4.63	0.002	7.60E-04	-12.9	9.5	
20	-1.60	8.78	0.002	7.24E-04	-10.2	4.7	
21	-2.00	12.79	0.001	7.09E-04	-5.9	1.3	
22	-2.40	16.73	0.001	7.06E-04	0.0	-0.0	

(continued)

Stage No.2 Excavate to elevation 1.60 on RIGHT side

LEFT side								
Node no.	Y coord	Water press. kN/m2	Effective stresses				Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
			Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	5.10	0.00	0.00	0.00	39.86	0.00	0.00a	10013
2	4.85	0.00	4.45	0.00	58.94	0.00	0.00a	10013
3	4.60	0.00	9.24	0.00	79.46	0.00	0.00a	10013
4	4.35	0.00	14.37	0.00	101.49	0.00	0.00a	10013
5	4.10	0.00	19.68	0.00	124.24	0.00	0.00a	10013
		0.00	19.68	2.84	81.78	2.84	2.84a	4205
6	3.85	0.00	24.99	4.69	99.87	4.69	4.69a	4205
7	3.60	0.00	30.23	6.51	117.70	6.51	6.51a	4205
		0.00	30.23	2.79	158.09	2.79	2.79a	6008
8	3.20	0.00	38.40	5.19	193.10	5.19	5.19a	6008
9	2.80	0.00	46.32	7.53	227.06	7.53	7.53a	6008
10	2.40	0.00	54.04	9.80	260.18	9.80	9.80a	6008
11	2.00	0.00	61.62	12.03	292.66	12.03	12.03a	6008
12	1.60	0.00	69.08	14.23	324.67	14.23	14.23a	6008
13	1.20	4.00	72.46	15.22	339.16	15.22	19.22a	6008
14	0.80	8.00	75.78	16.20	353.37	16.20	24.20a	6008
15	0.40	12.00	79.04	17.16	367.36	18.40	30.40	6008
16	0.00	16.00	82.26	18.11	381.16	22.65	38.65	6008
17	-0.40	20.00	85.44	19.05	394.82	26.57	46.57	6008
18	-0.80	24.00	88.60	19.98	408.37	30.23	54.23	6008
19	-1.20	28.00	91.74	20.90	421.80	33.70	61.70	6008
20	-1.60	32.00	94.85	21.82	435.16	37.04	69.04	6008
21	-2.00	36.00	97.95	22.73	448.43	40.32	76.32	6008
22	-2.40	40.00	101.03	23.63	461.65	43.57	83.57	6008

RIGHT side								
Node no.	Y coord	Water press. kN/m2	Effective stresses				Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
			Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	5.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	4.85	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	4.35	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	3.85	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	3.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
10	2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	28.47	28.47	28.47p	7719
13	1.20	4.00	3.00	0.00	41.33	39.86	43.86	7719
14	0.80	8.00	6.00	0.00	54.20	37.05	45.05	7719
15	0.40	12.00	9.01	0.00	67.08	34.68	46.68	7719
16	0.00	16.00	12.01	0.00	79.98	32.76	48.76	7719
17	-0.40	20.00	15.03	0.00	92.89	31.23	51.23	7719
18	-0.80	24.00	18.04	0.00	105.84	30.03	54.03	7719
19	-1.20	28.00	21.07	0.09	118.81	29.07	57.07	7719
20	-1.60	32.00	24.10	0.99	131.82	28.26	60.26	7719
21	-2.00	36.00	27.15	1.88	144.86	27.53	63.53	7719
22	-2.40	40.00	30.20	2.78	157.95	26.83	66.83	7719

Run ID. Basement_wall
Boundary wall wallap
Please modify / add

| Sheet No.
| Date:13-04-2025
| Checked :

(continued)

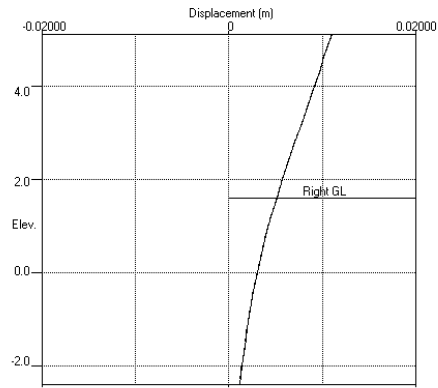
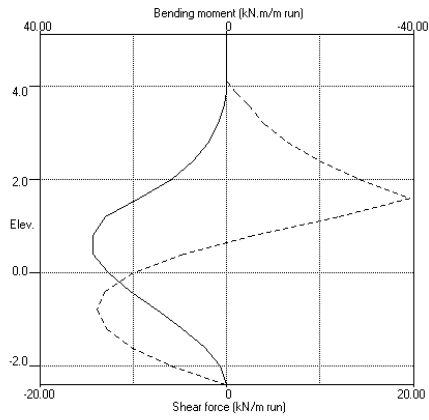
Stage No.2 Excavate to elevation 1.60 on RIGHT side
Note: 24.20 a Soil pressure at active limit
 28.47 p Soil pressure at passive limit

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 Program: WALLAP Version 6.07 Revision A55.B74.R58
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 Data filename/Run ID: Basement_wall
 Boundary wall wallap
 Please modify / add

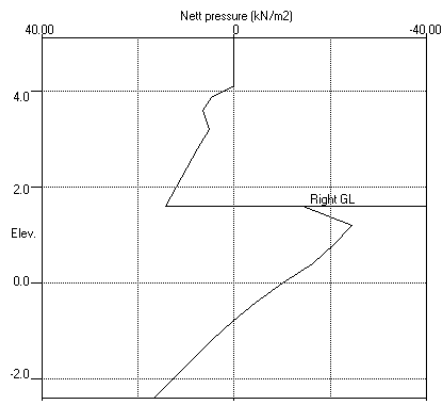
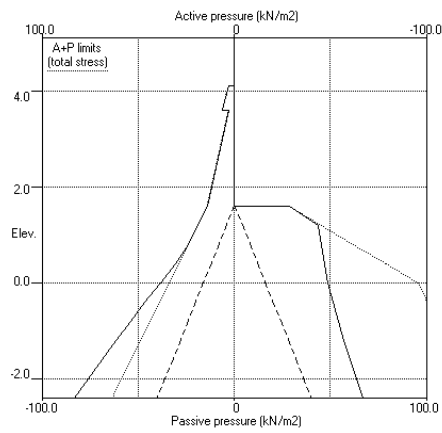
| Sheet No.
 | Job No. J00983
 | Made by : CCHE
 |
 | Date:13-04-2025
 | Checked :

Units: kN,m

Stage No.2 Excav. to elev. 1.60 on RIGHT side



Stage No.2 Excav. to elev. 1.60 on RIGHT side



LDE LTD	Sheet No.
Program: WALLAP Version 6.07 Revision A55.B74.R58	Job No. J00983
Licensed from GEOSOLVE	Made by : CCHE
Data filename/Run ID: Basement_wall	
Boundary wall wallap	Date:13-04-2025
Please modify / add	Checked :

Units: kN,m

Summary of results

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

<u>Stage</u> <u>No.</u>	<u>Ground level</u>		<u>Prop</u> <u>Elev.</u>	<u>FoS for toe</u> <u>elev. = -2.40</u>		<u>Toe elev. for</u> <u>FoS = 1.000</u>		<u>Direction</u> <u>of</u> <u>failure</u>
	<u>Act.</u>	<u>Pass.</u>		<u>Factor</u> <u>of</u> <u>Safety</u>	<u>Moment</u> <u>at elev.</u>	<u>Toe</u> <u>elev.</u>	<u>Wall</u> <u>Penetr</u> <u>-ation</u>	
1	5.10	5.10	Cant.	<u>Conditions not suitable for FoS calc.</u>				
2	5.10	1.60	Cant.	1.300	-2.11	-0.35	1.95	L to R

LDE LTD	Sheet No.
Program: WALLAP Version 6.07 Revision A55.B74.R58	Job No. J00983
Licensed from GEOSOLVE	Made by : CCHE
Data filename/Run ID: Basement_wall	
Boundary wall wallap	Date:13-04-2025
Please modify / add	Checked :

Units: kN,m

Summary of results

BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

Analysis options

Length of wall perpendicular to section = 1000.00m
 Subgrade reaction model - Boussinesq Influence coefficients
 Soil deformations are elastic until the active or passive limit is reached
 Open Tension Crack analysis - No

Rigid boundaries: Left side 20.00 from wall
 Right side 20.00 from wall

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment		Shear force	
		maximum	minimum	maximum	minimum	maximum	minimum
		m	m	kN.m/m	kN.m/m	kN/m	kN/m
1	5.10	0.011	0.000	0.0	0.0	0.0	0.0
2	4.85	0.011	0.000	0.0	-0.0	0.0	-0.1
3	4.60	0.010	0.000	0.0	-0.1	0.0	-0.3
4	4.35	0.010	0.000	0.0	-0.2	0.0	-0.6
5	4.10	0.009	0.000	0.0	-0.3	0.0	-0.8
6	3.85	0.009	0.000	0.1	-0.5	0.9	-0.7
7	3.60	0.008	0.000	0.5	-0.7	2.3	-0.6
8	3.20	0.008	0.000	1.8	-0.9	3.9	-0.5
9	2.80	0.007	0.000	3.8	-1.1	6.5	-0.4
10	2.40	0.006	0.000	7.1	-1.2	9.9	-0.2
11	2.00	0.006	0.000	11.9	-1.2	14.3	-0.1
12	1.60	0.005	0.000	18.7	-1.2	19.6	0.0
13	1.20	0.005	0.000	25.9	-1.1	11.8	0.0
14	0.80	0.004	0.000	28.7	-1.0	2.7	0.0
15	0.40	0.003	0.000	28.6	-0.9	0.4	-4.7
16	0.00	0.003	0.000	25.4	-0.7	0.4	-10.0
17	-0.40	0.003	0.000	20.6	-0.6	0.4	-13.0
18	-0.80	0.002	0.000	15.0	-0.4	0.4	-13.9
19	-1.20	0.002	0.000	9.5	-0.2	0.3	-12.9
20	-1.60	0.002	0.000	4.7	-0.1	0.3	-10.2
21	-2.00	0.001	0.000	1.3	-0.0	0.1	-5.9
22	-2.40	0.001	0.000	0.0	-0.0	0.0	0.0

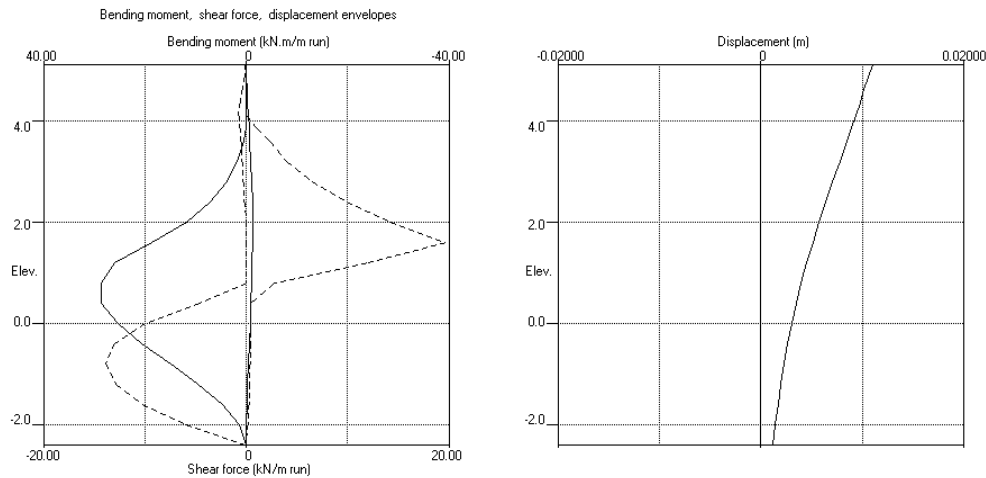
Maximum and minimum bending moment and shear force at each stage

Stage no.	Bending moment				Shear force			
	maximum	elev.	minimum	elev.	maximum	elev.	minimum	elev.
	kN.m/m		kN.m/m		kN/m		kN/m	
1	0.0	5.10	-1.2	2.00	0.4	-0.40	-0.8	4.10
2	28.7	0.80	-0.0	-2.40	19.6	1.60	-13.9	-0.80

Maximum and minimum displacement at each stage

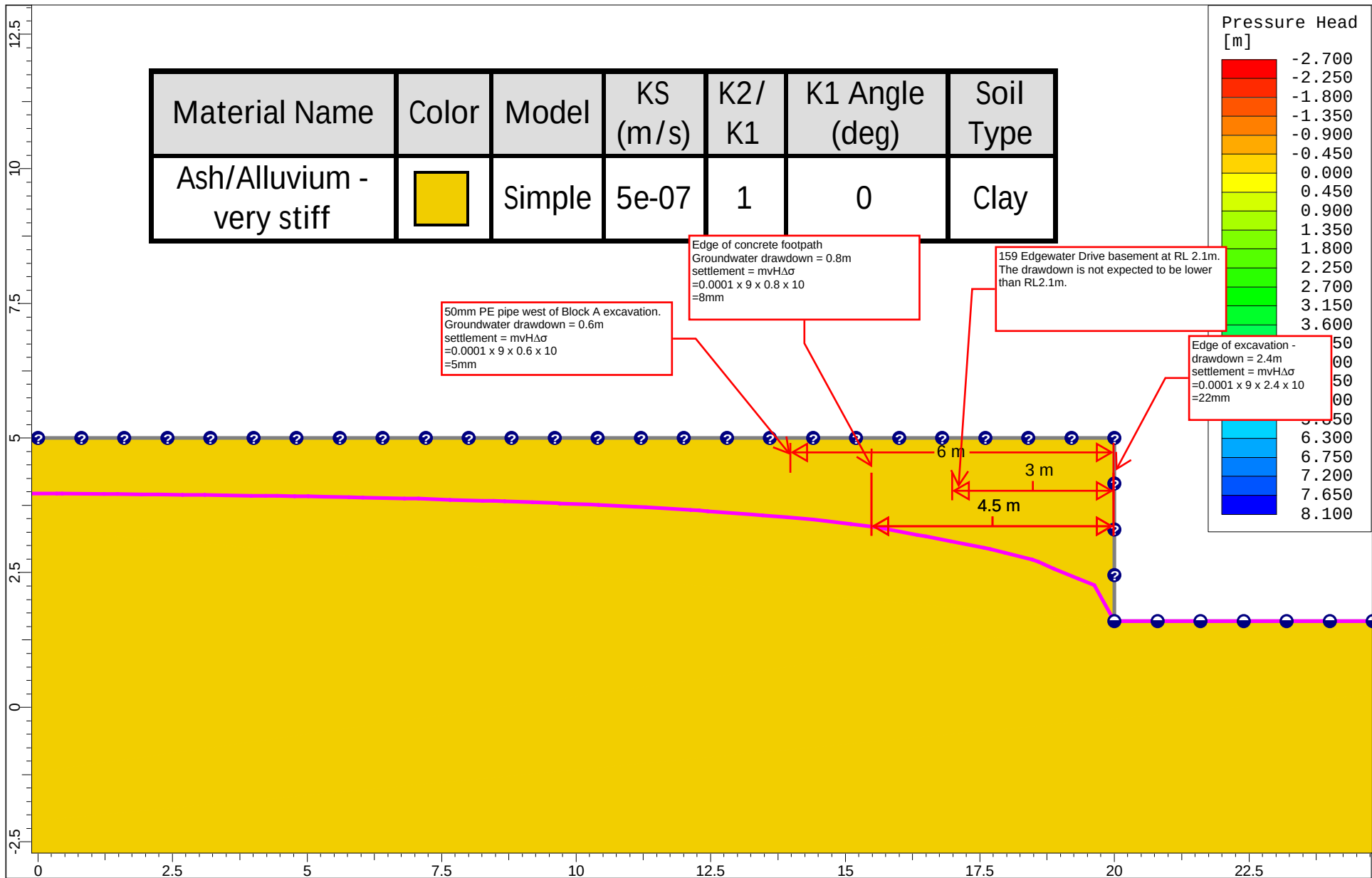
Stage no.	Displacement				Stage description
	maximum	elev.	minimum	elev.	
	m		m		
1	0.000	-2.40	0.000	5.10	Apply surcharge no.1 at elev. 5.10
2	0.011	5.10	0.000	5.10	Excav. to elev. 1.60 on RIGHT side

Units: kN,m



APPENDIX G

DRAWDOWN ANALYSIS OUTPUT



	Analysis Description		
	Drawdown and flowrate		
	Cross Section	Case No.	Project
	Drawn By	F.O.S Filter	Company
Date		Scale	File Name
13/04/2025		1:100	tempbatter and flowrat.slmd
CCHE		147 - 153 Edgewater Drive	
		LDE	

$$Q = \frac{\pi K (H^2 - h^2)}{\ln\left(\frac{R}{r_p}\right)}$$

$$r = (2/n)(Y.W)^{1/2} ;$$

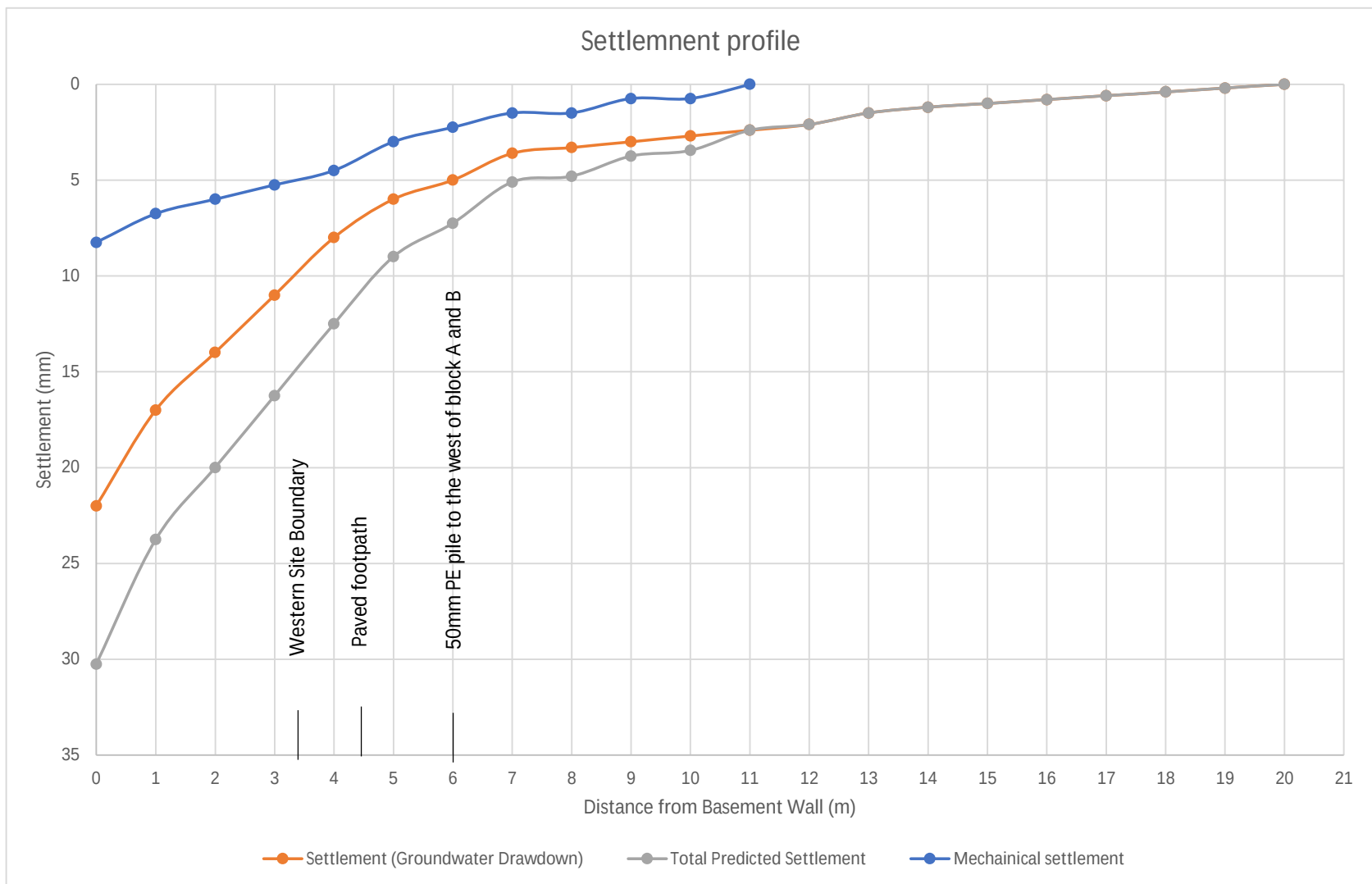
where: Y = length of mine (m)

W = width of mine (m)

		Baseline	Sensitivity	
Pi		3.14	3.14	
K	permeability	5.00E-07	8.00E-07 m/s	
		4.32E-02	6.91E-02 m/day	
H	Depth of water level	9	9 mRL	This is water level to RL-4 - to account for groundwater flow
h		5.6	5.6 mRL	This is water level to RL-4 - to account for groundwater flow
R		37.05951	37.05950944 m	
L	length of building	19.2	19.2 m	
w	width of building	37.4	37.4 m	
rp	equivlent building radius	17.05951	17.05950944 m	
Q	inflow	8.68	13.89	

APPENDIX H

SETTLEMENT PROFILE



APPENDIX I

DRAFT GROUNDWATER AND SETTLEMENT MONITORING

CONTINGENCY PLAN



A & L Sargeant Ltd

**DRAFT GROUNDWATER MONITORING AND SETTLEMENT
CONTINGENCY PLAN**

147 – 153 Edgewater Drive, Pakuranga

CONTENTS

1	INTRODUCTION	1
2	CONCEPT CONSTRUCTION METHODOLOGY	1
3	CONDITION SURVEYS	1
4	DISPLACEMENT MARKERS	2
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5	PIEZOMETERS	2
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8	MITIGATION AND CONTINGENCY MEASURES.....	4
9	FURTHER WORK	4
10	LIMITATIONS	4

APPENDIX 1: FIGURE 1: MONITORING LOCATION PLAN

1 INTRODUCTION

The scope of this plan is to provide an indication of likely methods for monitoring displacements, indicate preliminary trigger levels and provide potential mitigation measures which could be utilised in the event that trigger levels were exceeded. The types of monitoring, locations, frequencies, trigger levels and appropriate mitigation measures are subject to change based on the outcome of detailed design and confirmation of construction methodologies.

The purpose of instrumentation and monitoring is to proactively verify compliance with performance criteria, assess impacts on neighbouring properties/services, and enable timely implementation of contingency measures. All parties must adhere to agreed communication protocols for trigger escalations.

The requirement for this plan arises as the basement retaining walls of Building A which may potentially affect the neighbouring properties and nearby buried services.

2 CONCEPT CONSTRUCTION METHODOLOGY

A construction methodology has not been confirmed for the above site yet as detailed design has not been completed and a contractor is yet to be involved. A concept staging sequence for the site is summarised below:

1. Excavate the site to finish level, leaving a safe batter at the boundary.
2. Where there is not enough space for safe batter, construction soldier pile wall for temporary retention purposes.
3. Form a capping beam at the top of the piles
4. Excavate to basement level.
5. Construct basement floor slab and wall, and then construct first floor slab to prop the wall long term, and backfill the space between the batter/solider pile wall and the building.

The assumed cantilever soldier pile wall methodology is preliminary. A revised risk assessment and monitoring plan update will be required once the contractor's methodology is finalized.

3 CONDITION SURVEYS

The proposed works will be designed to mitigate effects from the basement excavation and construction activities on the neighbouring pavements and structures. However, as a minimum a precautionary survey of the existing condition of the following is recommended (subject to private property owner approval where relevant) prior to and following construction to verify no visible damage has occurred as a result of the proposed works:

1. Edgewater Drive (along the sites full north-western boundary and 20m beyond in each direction) – The footpath, berm and road pavement to observe existing condition;
2. Stormwater/wastewater lines to be rerouted.

The initial condition survey should involve general photos of the paved areas and building as well as noting any existing damage (aesthetic, serviceability and structural damage). Further the survey should identify foundation type where possible and note susceptibility of the structure to further movement.

A subsequent condition survey should be carried out at the completion of works to compare the condition of the pavements and structures to the initial condition survey and confirm that no further damage has occurred or to confirm the extent of any new damage that may have manifested as a result of the works.

4 DISPLACEMENT MARKERS

4.1 Purposes and installation

Retaining wall deflection markers should be attached to the top of basement retaining wall. These markers will monitor displacements and confirm they are within the design values and the performance criteria.

Locations in Figure 1 are provisional and require site verification during pre-start meetings. All displacement markers should be monitored in x, y and z directions and should be accurate to $\pm 2\text{mm}$.

4.2 Monitoring Frequency

Both foot path settlement and retaining wall deflection markers should be monitored as follows:

Table 1: Displacement Marker Minimum Monitoring Frequency

Construction Stage	Minimum Monitoring frequency
Prior to excavation	2 Baseline readings
During Excavation Works (i.e until basement and ground floor slabs have been completed)	Immediately prior to and following each stage of excavation and no less frequently than weekly
At the completion of basement works	Monthly for 3 months

The above frequencies may be increased by the Geotechnical Engineer should trigger levels be reached (as presented in Section 7) or if there is any other uncertainty in the data. They should also be reviewed if there is a change to the proposed concept methodology presented in Section 2.

5 PIEZOMETERS

Groundwater drawdown-induced settlements were considered in the design; thus, piezometers are not proposed at this stage.

6 HOLD POINTS

The following Hold Points should be adhered to during construction:

- A pre-start meeting should be held between the Constructor, Client, Geotechnical Engineer and Project Manager / Engineer to the Contract to discuss the proposed construction methodology, monitoring requirements and mitigation measures following site set out but prior to any works commencing on site, together with communication protocols;
- Basement construction should not commence until the minimum number of baseline readings outlined in Table 1 above have been obtained for all appropriate monitoring points and written approval of this is provided by the Geotechnical Engineer;
- A round of monitoring readings should be carried out and reviewed by the Geotechnical Engineer immediately prior to removal of the props. Written approval should be given by the Geotechnical Engineer prior to their removal.

7 TRIGGER LEVELS

The monitoring points and frequencies in the preceding sections are specified to ensure that retaining wall deflections stay within the required performance criteria and are in line with the assumptions made in the design. The alert and alarm levels presented in Table 2 are set to identify where the monitoring data is approaching (alert level) and exceeding (alarm level) the design levels.

Table 2: Alert and Alarm level for Monitoring Points

Monitoring station type	Alert level*	Alarm level*
Building excavation retaining wall horizontal displacement	15mm	20mm
Edgewater drive pavement settlement	15mm	20mm

* Final trigger levels require validation during detailed design. Unapproved deviations from concept assumptions invalidate these thresholds.

If monitoring results exceed the above limits, as a minimum, the following actions should be undertaken:

Alert Level: The Site Engineer and Geotechnical Engineer should be notified as soon as possible and within 24 hours of exceedance. All monitoring points within 30m of the affected point should be remeasured to check if other marks have reached trigger levels and a site walkover carried out by the Geotechnical Engineer. A review of all monitoring data and works being undertaken on site should be carried out. Where appropriate modifications to monitoring frequencies and/or site works may be recommended, and design checks may be carried out.

Alarm Level: The Site Engineer and Geotechnical Engineer should be notified immediately of any exceedance. All works which may contribute to wall movement should be ceased until written approval from Geotechnical Engineer is given. All monitoring points within 30m of the affect point should be remeasured to check if other marks have reached trigger levels. Where appropriate contingency measures as described in Section 8 will be recommended by the Geotechnical Engineer.

8 MITIGATION AND CONTINGENCY MEASURES

In the event that wall/ground movements are greater than allowed for in the design possible contingency options are presented below. The Contractor should have appropriate equipment on site (or readily available) during the basement construction period to immediately carry out these works if required.

- Add props to the affected portion of wall where practical to do so. – The number and location of the additional props would be dependent on the stage of construction alarm levels are reached at and would be determined during site works, and would require specific design.
- Toe Buttress / Hardfill Berms – This could involve placing a buttressing hardfill material back in front of the wall to prevent further movement following excavation. Excavation of the berm would then occur in a hit and miss or staged fashion once permanent retaining supports are in place, such that movements are controlled. This is also a specific design issue during construction.

9 FURTHER WORK

A wastewater pipe running southwest to northeast through the Block A basement would likely require rerouting subject to the confirmation of the project civil engineer. These rerouting would likely be required ahead of the basement excavation; Apart from the conditioning survey, settlement effect to the existing and rerouted portions of these pipes may need to be assessed once the location and depth of these rerouted drains are determined. Settlement criteria for rerouted drains must be incorporated into the final monitoring plan prior to excavation.

10 LIMITATIONS

This report has been prepared solely for the use of our client, A & L Sargeant Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity. All future owners of this property should seek professional geotechnical advice to satisfy themselves as to its ongoing suitability for their intended use.

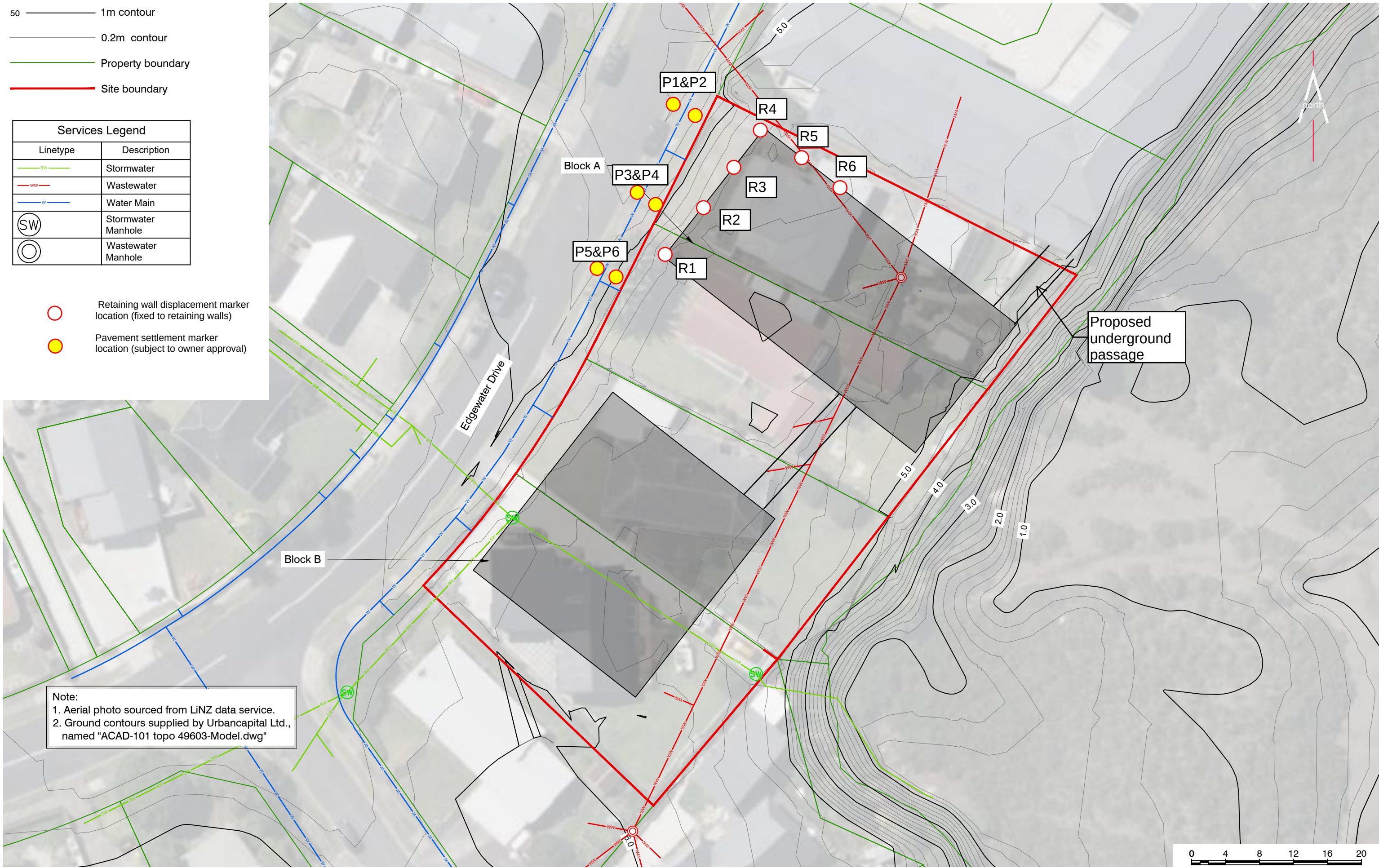
APPENDIX 1

MONITORING LOCATIONS PLAN

50 ——— 1m contour
——— 0.2m contour
——— Property boundary
——— Site boundary

Services Legend	
Linetype	Description
SW	Stormwater
WW	Wastewater
W	Water Main
SW	Stormwater Manhole
WW	Wastewater Manhole

○ Retaining wall displacement marker location (fixed to retaining walls)
● Pavement settlement marker location (subject to owner approval)



Note:
1. Aerial photo sourced from LINZ data service.
2. Ground contours supplied by Urbancapital Ltd., named "ACAD-101 topo 49603-Model.dwg"

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CLIENT
A & L Sargeant Limited
78 Compass Point Way, Half Moon Bay,
Auckland

PROJECT
147 - 153 Edgewater Drive, Pakuranga

Annotated draft monitoring and
contingency plan
Drawn: CCHE
Date: 22/11/2024



DESIGN:	---
DRAWN:	SJ
DATE:	22.11.24
CHECKED:	CC
SCALE A3:	1:400

PROJECT STATUS:	
For Consent	
PROJECT:	J00983
SHEET:	1 of 1
DRAWING No:	J00983-1
REV:	0