21 March 2025

PROPOSED SUBDIVISON AND DEVELOPMENT

Flanagan Road, Drury

DRURY CENTRE STAGE 2 ADDENDUM GEOTECHNICAL INVESTIGATION REPORT

Kiwi Property Group Holdings 2 Ltd C/O Woods

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Review and Update History

Version	Date	Comments
A	28 November 2024	Initial 50% draft for internal review
B	6 November 2024	90% draft for Project team review
0	31 January 2025	Final
1	27 February 205	Final following legal review and final plans
2	14 March 2025	Final
3	21 March 2025	Revised Report

STATEMENTS OF QUALIFICATIONS AND EXPERIENCE

Chris Ritchie

I am a Principal Engineering Geologist at CMW Geotechnical NZ Limited, trading as CMW Geosciences. CMW Geosciences is a specialist geotechnical engineering and geological sciences services consultancy with offices in New Zealand and Australia. I have been employed at CMW Geosciences since July 2019.
I hold the qualifications of MSc (Engineering Geology) from The University of Auckland, which I completed in 2010.
I am a Chartered Professional Engineering Geologist and Chartered Member of Engineering New Zealand.
I have 15 years of professional experience in engineering geology and geotechnical engineering in the Auckland region. My experience has been primarily in land and building development and linear infrastructure, the last 12 years has been focussed in the North Auckland area. Large portions of my work in this time have been focussed on development of land and the investigation and assessment of roading corridors in the wider Auckland region.
I confirm that, in my capacity as CMW's author of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

Sam Gibb

I am a Principal Geotechnical Engineer at CMW Geotechnical NZ Limited, trading as CMW Geosciences. CMW Geosciences is a specialist geotechnical engineering and geological sciences services consultancy with offices in New Zealand and Australia. I have been employed at CMW Geosciences since March 2014.
I hold the qualification of Bachelor of Science in Civil Engineering from The University of Plymouth (UK), which I completed in 2008. I am a Chartered Professional Engineer and Chartered Member of Engineering New Zealand.
I have 15 years experience working as a Geotechnical Engineer in New Zealand, predominantly in the Auckland region. My main area of expertise is land development of various scales in Auckland. I have been involved in numerous site investigations, hazard analyses, remedial design, review, and construction monitoring of land development projects.
I confirm that, in my capacity as CMW's internal reviewer of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

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EXECUTIVE SUMMARY

Kiwi Property is proposing the subdivision and development of Stage 2 of the Drury Metropolitan Centre comprising a combination of commercial, community and accommodation activities with associated buildings and ancillary car parking, bulk earthworks, the construction and installation of reticulation networks, open spaces and ecological enhancements, stormwater management areas and roading infrastructure.

Earthworks proposals indicate cuts of up to 8.5m in depth and fills of up to 7m above existing ground level are proposed to raise the eastern valley area. Total bulk earthworks volumes are shown as being approximately 212,225m3 of cut and 195,873m3 of fill across a total area of 20.85Ha.

Previous site investigations have been undertaken across the site comprising test pits, CPT's, machine boreholes and hand augers. More recently further test pit investigations were also undertaken by CMW.

Ground conditions encountered during the investigation comprise South Auckland Volcanic Field (SAVF) basalts and air fall deposits, overlying Tauranga Group alluvium at depth across central portions of the site. Within the low areas of the site including the central stream area, northern and eastern portions Tauranga Group alluvium is present.

Specific assessments were made against the key geotechnical hazards for the site with outcomes as follows:

- The liquefaction potential of the site is negligible;
- Proposed slopes along the central stream area have been assessed as meeting requisite factors of safety;
- Settlement assessments for both the proposed fill placement and future building development identified varying magnitudes of induced settlement. Ground improvement is recommended for building areas consisting of either pre-loading, or deep foundations for future buildings.
- Earthworks should be able to be carried out with conventional plant and methodologies however the presence of allophanic soils requires consideration by the contractor due to the potential for rapid strength loss during earthworks operations.

Development design recommendations are provided in the adjacent table.

Based on our assessment of the development proposals, the site is considered suitable for the proposed development and the geotechnical hazards can be appropriately mitigated subject to following the geotechnical recommendations within this report.

Engineering Design Recommendations

Item	Methodology	Value	Comment
Earthworks Operations	NZS4431		Earthworks to be carried out in accordance with NZS4431, Auckland Council Code of Practice for Land Development and Subdivision and the Geotechnical Works Specification
Subgrade CBR		5% to 6% 2% to 4%	in Fill in cut natural ground Subject to confirmation testing during construction.
Building foundations	B1/VM4	Geotechnical Ultimate Bearing Capacity 300kPa	Preliminary capacity available within natural cut / engineered fill areas. Requires confirmation at GCR stage and buildings subject the Specific Investigation and Design
Expansive Soil Site Class	AS2870	M (moderate)	Anticipated characteristic surface movement of up to 40mm. Requires confirmation at GCR stage
Strength reduction factors	B1/VM4[1]	0.8 0.5	Load combinations involving earthquake overstrength All other load combinations
Seismic Site Class(es)	NZS1170	C / D	Site class across the development varies between C and D with geology

[1] Ministry of Business, Innovation and Employment (2019) *Acceptable Solutions and Verification Methods for NZ Building Code Clause B1 Structure,* B1/VM4, Amendment 19

1.0 INTRODUCTION

CMW Geosciences (CMW) was engaged by Kiwi Property Group Holdings 2 Ltd C/O Woods to carry out a geotechnical review of a site located at Flanagan Road, Drury, which is being considered for the subdivision and development of Stage 2 of the Drury Metropolitan Centre comprising a combination of commercial, community and accommodation activities with associated buildings and ancillary car parking, bulk earthworks, the construction and installation of reticulation networks, open spaces and ecological enhancements, stormwater management areas and roading infrastructure. This Stage 2 subdivision and development is an extension of the wider Drury Metropolitan Centre approved in Stage 1 directly to the south of the project area, of which bulk earthworks has been carried out for Stage 1.

This report is to support a resource consent application to the Environmental Protection Agency (EPA) as part of a fast track consenting process.

This report is an addendum to the Aurecon Geotechnical Investigation Report prepared for the wider Drury Centre Subdivision, referenced 510611, Rev 5 dated 4 October 2022 ("Aurecon Geotechnical Report") and as such relies on the ground information collected and geotechnical interpretation undertaken as part of this report. The report is included in Appendix J.

The scope of work and associated terms and conditions of our engagement were detailed in our services proposal referenced P23-315 dated 10 November 2023.

This report does not include an assessment of Road 2 North proposed along the western boundary.

Additional activities included as part of this consent include:

- A proposal to subdivide superlots 10 -22 formed as part of Drury Centre Stage 1 into 292 new residential lots. The geotechnical assessment of this proposal is included in Appendix I, referenced AKS2023-0072AT Rev 1 dated 27 February 2025.
- Stormwater management in the form of a new Wetland labelled 2-2 and a shared path from Flanagan Road into the development. A preliminary geotechnical assessment of this activity is included in Appendix H, referenced AKS2023-0072AQ Rev 1, dated 26 February 2025.

2.0 SITE DETAILS

The site comprises an area of approximately 53Ha made up of several contiguous lots and is located near Flanagan Road, Drury as shown on Figure 3.2. Details of the site are as follows:

- The site is currently largely farm land, with several paddocks and existing buildings. Trees planted as sheltered belts are present along fence lines.
- The general topography is that of low hill country, with the highest point situated near the southern boundary at RL30m, the site falls from the high point to the west, and north towards the Hingaia Stream at approximately RL5m and to the east into a broad valley with a meandering creek at approximately RL10m.
- The Hingaia stream meanders to the west of the development site.

3.0 DEVELOPMENT PROPOSAL

Brief details for the proposal are as follows:

- The general arrangement of the proposed finished levels is to create near – level platforms which gently fall across the wider project area to the north to meet the existing Flanagan Road.
- In order to create these platforms, the cut and Fill plans prepared by Woods [2]show cuts of up to 8.5m in depth below ground level to lower the high point down to approximately RL21m in order to meet the existing Stage 1 earthworks platform. Fills of up to 6m above existing ground level are proposed to raise the eastern valley area. Total bulk earthworks volumes are shown as being approximately 212,225m3 of cut and 195,873m3 of fill across a total area of 20.85Ha.
- The earthworks plans also show modifications to existing earthworked areas including removal of stockpiles and the filling of sediment ponds.
- A stormwater pond is proposed near the existing head of the creek within the eastern valley. Minor realignments are proposed to twos sections of the existing stream and a road crossing is also shown.
- Roads and services are proposed across the site servicing multiple commercial, retail and community facilities along with residential buildings as depicted in Figure 3.2.

[2] Woods Fast Track Plans P24-447-01-1200-EW

Figure 3.1: Site Location and Contour Plan (From Auckland Council GIS)

Figure 3.2: Proposed Development Master Plan by Ignite Architects

FACTUAL

4.0 INVESTIGATIONS

4.1 Previous Investigations

4.1.1 Aurecon Investigation

The bulk of the geotechnical investigations for the Stage 2 project area has been completed in the Aurecon Geotechnical Report (Appendix J). The broader investigation scope for the wider Drury Metropolitan Centre on land owned and controlled by Kiwi Property included:

- 15 geotechnical boreholes (seven within Stage 2)
- 55 Cone Penetration Tests (CPTs) (30 within Stage 2)
- Five Seismic Dilatometer Tests (sDMT)
- 32 Test Pits (13 within Stage 2)
- 10 Hand Auger Boreholes (4 within Stage 2)
- MASW Geophysical Surveys
- A suite of laboratory testing.

4.1.2 CMW Investigation

CMW has undertaken limited investigation within the property to identify depth and extent of existing uncertified fills where there were no historic investigations (i.e. none undertaken by Aurecon). The scope of fieldwork completed is shown below:

Table 4.1: Investigation Summary

Test ID	Test Type	Ground Surface Elevation (RL m)	Depth (m)
TP01-24	Test Pit	6.75	0.5
TP02-24	Test Pit	6.25	0.5
TP03-24	Test Pit	6.00	0.7
TP04-24	Test Pit	7.75	1.0
TP05-24	Test Pit	8.75	1.8
TP06-24	Test Pit	9.00	1.8

Engineering logs of the relevant investigations are presented in Appendix B.

The approximate locations of the respective investigation sites referred to above are shown on the Geotechnical Investigation Plan as Drawing 01 and Figure 4.2 below.

Figure 4.1: Investigation Plan by Aurecon, orange line represents approximate Stage 2 extent assessed in this report

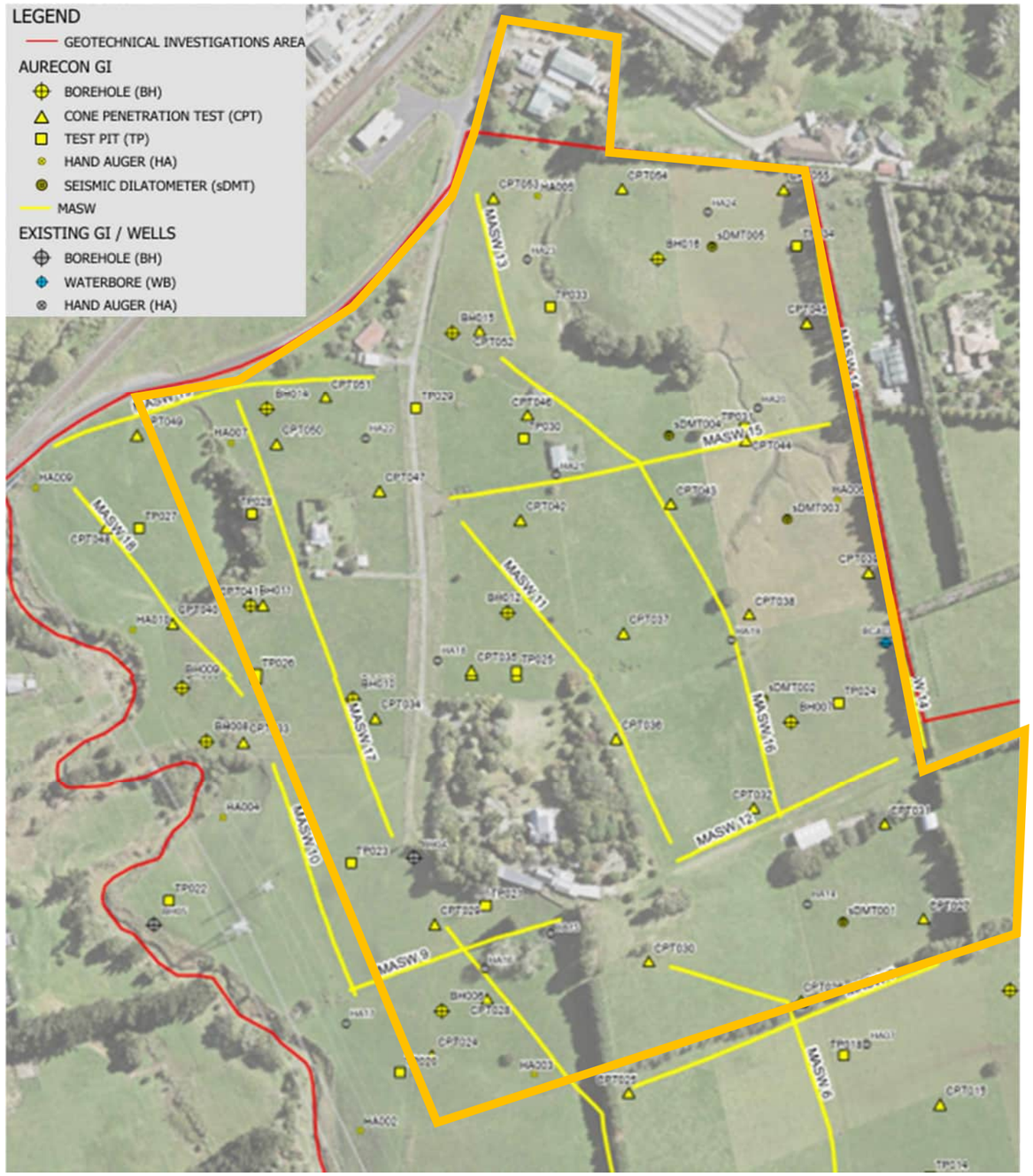


Figure 4.2: CMW Investigation Plan for 64 Flanagan Road

4.2 Groundwater

Standpipe piezometers were installed in six of the machine boreholes drilled within this stage. These were measured between February and May 2021. The results are shown in the Table 4.2 below.

Table 4.2: Aurecon Groundwater Monitoring Results

Borehole ID	Date Drilled	Collar (m RL)	Screened Depth (mbgl)	Measured Groundwater Depth (mbgl) (Values in RL)			
				3 February 2021	18 March 2021	13 April 2021	26 May 2021
BH005	30/11/20	24	9.0 to 12.0	8.13 (13.87)	8.56 (13.44)	8.71 (13.29)	8.61 (13.39)
BH007	03/12/20	15	9.0 to 11.0	4.25 (10.75)	4.61 (10.38)	4.81 (10.19)	4.42 (10.58)
BH009	18/12/20	8	6.0 to 9.0	4.33 (3.67)	4.41 (3.59)	4.47 (3.53)	4.35 (3.65)
BH011	15/1/21	18	12.0 to 15.0	8.35 (9.65)	9.53 (8.47)	9.52 (8.48)	9.55 (8.45)
BH015	09/12/20	18	3.0 to 6.0	5.23 (12.77)	5.67 (12.33)	5.66 (12.34)	5.77 (12.23)
BH016	8/12/20	12.5	7.0 to 10.0	4.65 (7.85)	4.92 (7.58)	5.12 (7.48)	4.55 (7.95)

5.0 GEOLOGY

5.1 Published Geology

Published 1:50,000 scale geological maps for Pukekohe from GNS (Bland et al, 2023) for the general project area depict the regional geology as comprising undifferentiated tephra of the Kerikeri Volcanic Group (Qut) and Takanini Formation. The Kerikeri Volcanic Group materials comprise of weathered airfall tephra and tuff deposits from eruptions in the local area, whilst the Takanini Formation (PQt) comprise poorly to moderately consolidated shallow marine deposits of sand and mud.

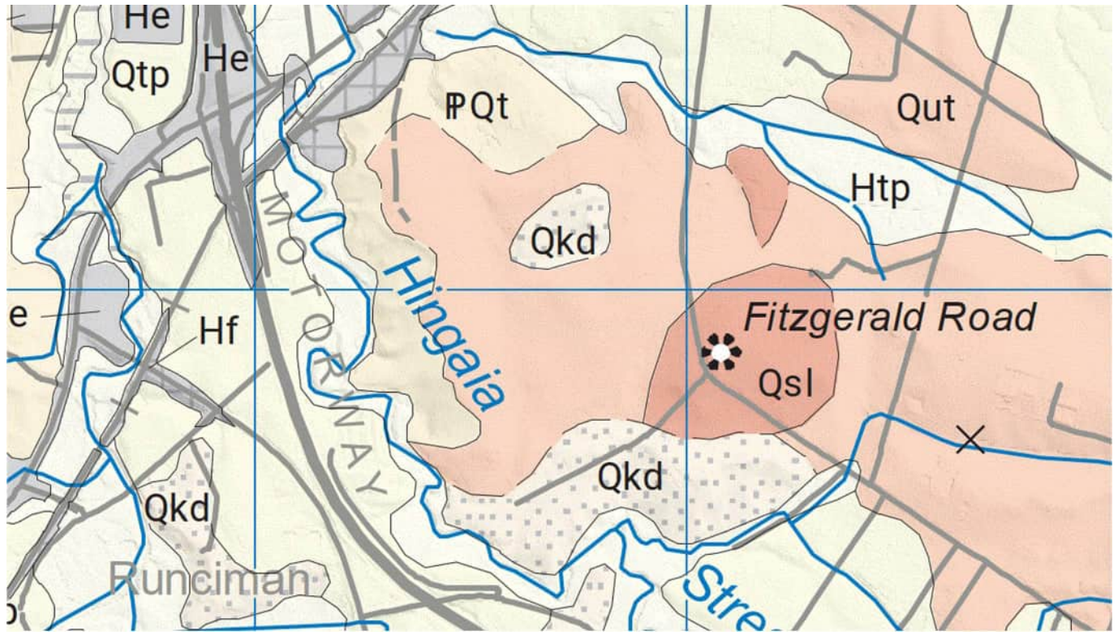
The main geohazards associated with these geological units are presented below:

Table 5.1: Published Geology Summary

Geological Unit	Location	Behaviour	Principal Potential Geohazards
Kerikeri Volcanic Group	Entire Site	Stiff to very stiff residual ash soils, moderately strong basalt	Expansive soils, difficult to excavate the basalt, potentially sensitive for earthworks due to allophanes. Corestones consisting of blocks of basalt are common in this geology.
Takanini Formation	North, East and West boundaries	Firm to Stiff, potentially compressible soils.	Load induced settlement

Further details on the ground model and geomorphology are presented within the Aurecon Geotechnical Report.

Figure 5.1: Regional Geology (GNS Science Web Geology Map[3])



INTERPRETIVE

[3] https://maps.gns.cri.nz/

6.0 GROUND MODEL

The following ground model has been adopted from the Aurecon Geotechnical Report.

6.1 Stratigraphic Units

Aurecon's assessment of the distribution of the stratigraphic layers is illustrated on the appended Geological Sections A-A', B-B' and C-C', these have been modified by CMW to show the proposed finished levels from the Woods design.

Table 6.1: Ground Model (from Aurecon GIR)

Geological Unit	Description	Indicative Thickness (m)
Topsoil	Sandy silt to organic silt with trace rootlets.	0.25-0.35
Completely Weathered Volcanics to Residual Soil (SAVF)	Clay and silt, sometimes with minor basalt gravel	1 -10
Moderately Weathered to Highly Weathered Volcanics (SAVF)	Sand and gravel. Gravels in highly weathered intervals weathered to clay	9 -13
Unweathered to Slightly Weathered Volcanics [SAVF]	Massive to vesicular basalt	>15
Tauranga Group (Younger Deposits, overlying and interbedded with SAVF)	Alluvial and colluvial deposits (clay, organic silt, silt, peat, sand) and reworked tephra (pumecious sand or silt)	<<9
Tauranga Group (Older deposits, generally underlying SAVF)	Alluvial deposits (clay, organic silt, silt, peat, sand), occasionally cemented.	>25

6.2 Groundwater

Groundwater measurements across the stage 2 area are shown in Table 4.2.

The piezometers installed on elevated ground in the central and southern portions of the site recorded groundwater levels ranging from approximately 8 m to 11 m below ground level.

Piezometers in lower-lying areas, including the topographic depression through the centre of the site and near the northern boundary, indicated groundwater depths of approximately 4 m to 7 m below ground level.

It should be noted that groundwater levels may fluctuate seasonally, and perched groundwater conditions may be encountered during earthworks.

6.3 Aurecon Geotechnical Parameters

Table 6.2: Geotechnical Design Parameters

Unit Description	γ (kN/m3)	c´ (kPa)	ϕ´ (deg)	Su (kPa)
Completely Weathered Volcanics to Residual Soil (SAVF)	17	2	26	75
Moderately Weathered to Highly Weathered Volcanics (SAVF)	21-23	10	33	-
Unweathered to Slightly Weathered Volcanics (SAV)	24	10	35	-
Tauranga Group (Younger Deposits)	17	2	26	40
Engineered Fill (Site-won Silts/Clays)	18.5	5	32	100

Figure 6.1: Cross Section A-A' Adopted from Aurecon (Pink line indicates Proposed surface)

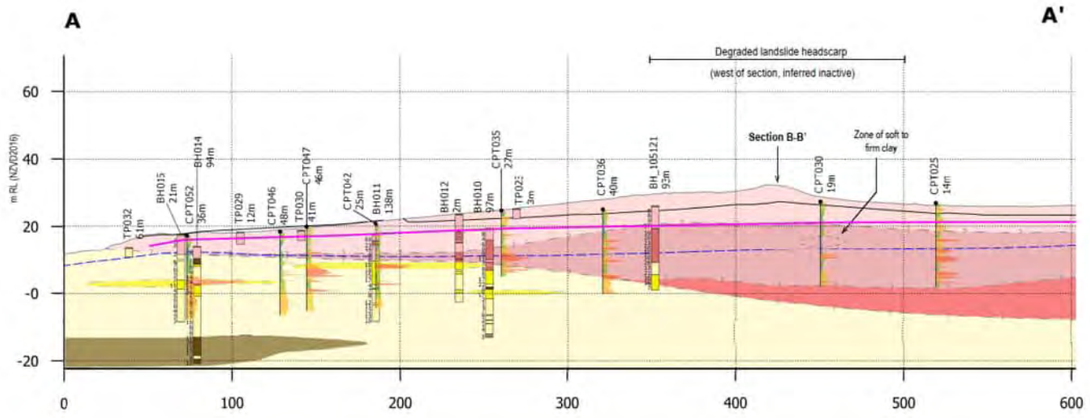


Figure 6.2: Cross Section B-B Adopted from Aurecon (Pink line indicates Proposed surface)

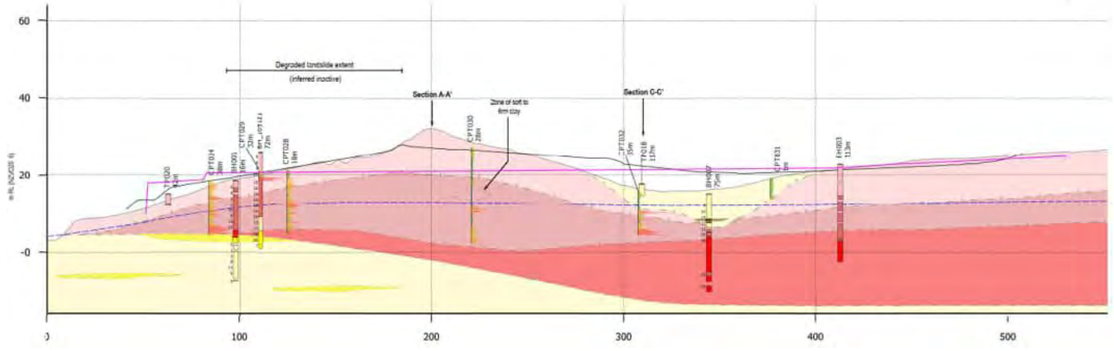
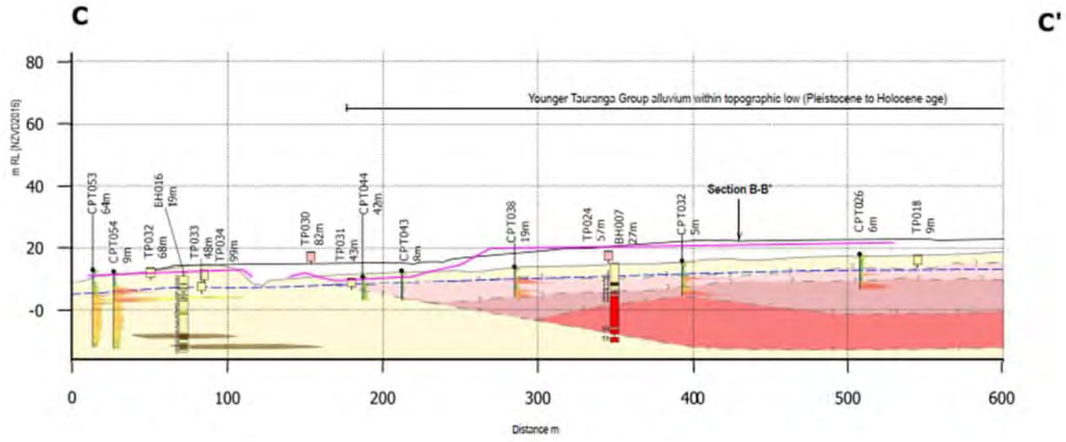


Figure 6.3: Cross Section C-C Adopted from Aurecon (Pink line indicates Proposed surface)



LEGEND

GEOLOGY

- Topsoil
- Fill
- South Auckland Volcanic Field - Residual Soil to Completely Weathered (VRb / VRr / VRt)
- South Auckland Volcanic Field - Highly Weathered to Moderately Weathered (VWb / VWt)
- South Auckland Volcanic Field - Slightly Weathered to Unweathered (VUb)
- Tauranga Group - Silt / Clay (TAz / TAc)
- Tauranga Group - Sand (TAs)
- Tauranga Group - Organic Clay / Peat (TAo / TAp)

- Proposed Earthworks Surface (15-02-2021)
- Inferred Groundwater Profile (Summer 2020/21)

INTERPRETIVE

7.0 GEOHAZARDS ASSESSMENT

The Aurecon GIR undertakes a full assessment of geohazards relevant to the wider development site, this should be read in conjunction with the summary below. The sections below discuss the most relevant hazards to the development, and an assessment of the proposed Stage 2 Development based on the finished surface information provided by Woods.

7.1 Seismicity

Reference to MBIE/ NZGS guidance[4] was made to determine peak horizontal ground acceleration or PGA (a_{max}) values based on a 50-year design life in accordance with the NZ Building Code[5] and importance level (IL) 2 structure for the proposed development. The PGA values for the serviceability limit states (SLS) and ultimate limit state (ULS) earthquake scenarios are presented in Table 7.1.

Table 7.1: Design Peak Ground Acceleration (PGA) for Various Limit States

Limit State	Return Period	PGA (g)	$Magnitude_{eff}$
SLS1	1/25	0.05	5.8
ULS	1/500	0.19	6.5
Note: SLS = serviceability limit state; ULS = ultimate limit state;			

7.2 Liquefaction

7.2.1 Design Criteria

General performance levels for liquefied deposits are presented below (as obtained from MBIE Module 3).

Figure 7.1: MBIE Module 3 Liquefaction Performance Levels

PERFORMANCE LEVEL	EFFECTS FROM EXCESS PORE WATER PRESSURE AND LIQUEFACTION	CHARACTERISTICS OF LIQUEFACTION AND ITS CONSEQUENCES	CHARACTERISTIC F_L, LPI
L0	**Insignificant**	No significant excess pore water pressures (no liquefaction).	$F_L > 1.4$ LPI=0 LSN <10
L1	**Mild**	Limited excess pore water pressures; negligible deformation of the ground and small settlements.	$F_L > 1.2$ LPI = 0 LSN = 5 – 15
L2	**Moderate**	Liquefaction occurs in layers of limited thickness (small proportion of the deposit, say 10 percent or less) and lateral extent; ground deformation results relatively small in differential settlements.	$F_L \approx 1.0$ LPI < 5 LSN 10 – 25
L3	**High**	Liquefaction occurs in significant portion of the deposit (say 30 percent to 50 percent) resulting in transient lateral displacements, moderate differential movements, and settlement of the ground in the order of 100mm to 200mm.	$F_L < 1.0$ LPI = 5 – 15 LSN = 15 – 35
L4	**Severe**	Complete liquefaction develops in most of the deposit resulting in large lateral displacements of the ground, excessive differential settlements and total settlement of over 200mm.	$F_L << 1.0$ LPI > 15 LSN > 30
L5	**Very severe**	Liquefaction resulting in lateral spreading (flow), large permanent lateral ground displacements and/or significant ground distortion (lateral strains/stretch, vertical offsets and angular distortion).	

7.2.2 Liquefaction Assessment

Liquefaction was assessed in the Aurecon Geotechnical Report in accordance with MBIE/NZGS Module 1: Overview of the guidelines dated November 2021 for Importance Level (IL) 2 buildings.

All 55 CPTs were analysed for liquefaction susceptibility in the software programme CLIQ. Generally, the soils were found to be non-liquifiable, with maximum SLS settlements of 0mm and ULS of <10mm.

As such it is concluded that the site is equivalent to Technical Category TC1 or Very Low Liquefaction Vulnerability.

Based on the updated development proposal for Stage 2 we consider this assessment appropriate and that the risk of liquefaction for the development to be very low.

INTERPRETIVE

[4] NZ Geotechnical Society publication "Earthquake geotechnical engineering practice, Module 1: Overview of the standards", (March 2016).
[5] Ministry of Business, Innovation and Employment (1992) NZ Building Code Handbook, Third Edition, Amendment 13 (effective from 14 February 2014).

7.3 Static Settlement / Compressible Soils

7.3.1 Aurecon Assessment

Static settlements were assessed in the Aurecon Geotechnical Report with a combination of elastic, primary and secondary consolidation settlements. The SAVF completely weathered volcanics and Tauranga Group Alluvium were considered compressible whilst the lower moderately weathered volcanics were considered incompressible.

Building platforms within Stage 1 were assessed, however given the unknown layout of Stage 2 at the time general areas were assessed. The results of this northern area assessments are summarised below.

Table 7.2: Aurecon Settlement Assessment

Area	Fill Load	Compressible Soil Depth	Groundwater Table	Immediate Settlement	Consolidation Settlement	U = 90% Time
North west	<4.5m	>20	~5m	65-85mm	60-110mm	2.5 years
North East	<8m	>20	>5m	75-95mm	75-130mm	2.5 years
Centre	<6m	~9m	~9m	60-95mm	30-55mm	9 months
South	<5.5m	~8m	~8m	50-65mm	20-30mm	6 months

7.3.2 Stage 2 Specific Settlement Assessment

7.3.2.1 Design Criteria

We consider that 50 year post-construction settlement values, which include the remainder of primary settlement plus the contribution of future widespread development deadload and secondary (creep) settlement, should not exceed 50mm for building developments. These are averaged, gradual, total settlements occurring at a similar rate across widespread areas. Associated angular distortions should also be kept within NZ3604 code limits (1 in 240, or 25mm over 6) so that they do not pose significant hazard to the anticipated future development.

7.3.2.2 Methodology

Proposed fill embankments and potential future building loads will induce settlements within the underlying subsoils.

Preliminary load induced settlement analysis was undertaken using the software CPeT-IT, with primary settlements calculated according to the following formula:

$$S_p = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

Where: $\Delta\sigma_v$ = change in effective stress
M_{CPT} = constrained modulus from CPT
Δz = change in depth

Secondary creep settlements were calculated according to the following equation:

$$S_c = C_\alpha \cdot \Delta z \cdot \log\left(\frac{t}{t_p}\right)$$

Where: C_α = coefficient of secondary compression
t_p = duration of primary consolidation (6 months assumed)
t = duration of design life (50 years)

7.3.2.3 Initial Results

Estimated static settlements are summarised for the main fill areas as follows:

Table 7.3: Stage 2 Settlement Assessment Results

CPT No. (Lot)	Compressible Soil Thickness (m)	Fill Height (m)	Construction Settlement (t90 mm)	Post Construction Settlement (mm)
CPT31 (Lot 38)	5	1	<10	<15
CPT32 (Lot 34)	10	6 (including pond backfill)	80	40
CPT38 (Lot 38)	10	4	50	45
CPT45 (Lot 37)	11	4	110	100
CPT51 (Lot 35)	12	1	40	110
Notes: Post construction settlements made up of secondary creep + remaining 10% fill induced consolidation + widespread development deadload induced consolidation (assumed to be 40kPa wide spread load). Embankment construction using available borrow materials (unit weight = 18kN/m^3) assumed. Greater settlements will occur if using imported rockfill or sand.				

7.3.2.4 Time Rate of Settlement

- The ground model presents a maximum compressible silt / clay layer thickness of 12m).
- In most cases, the compressible layer is underlain by low permeability silt, clays that will present only 1-way drainage.
- Estimates to achieve T90 settlements are between 6 to 24 months.

7.3.2.5 Settlement Summary

The post-construction settlement estimates exceed 50mm at some locations. Ground improvement may be undertaken as part of the earthworks, or limits stated in the Geotechnical Completion Report for future building development design to manage the settlement hazard. Further discussion is given in section 8.2.

7.4 Slope Stability

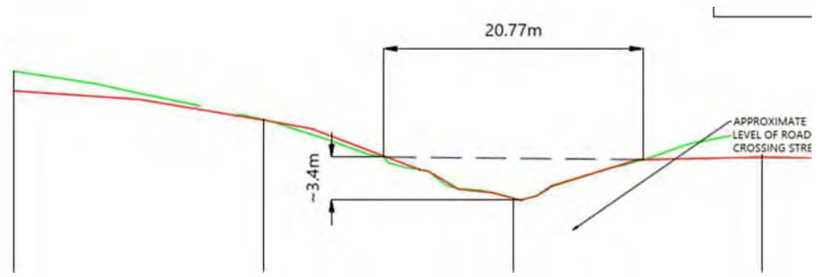
The earthworks proposals depict the formation of large broadly flat lots which present a low risk of global instability for the site as a whole and on neighbouring properties .

On the western extent of the development, existing natural slopes are present down the Hingaia Stream. This area is covered by development of the State Highway 1 Drury offramp project by NZTA and as such is excluded from this assessment.

On the north eastern extent of the site slopes are shown as being formed or modified, associated with works to create a stormwater pond and realignment of the stream.

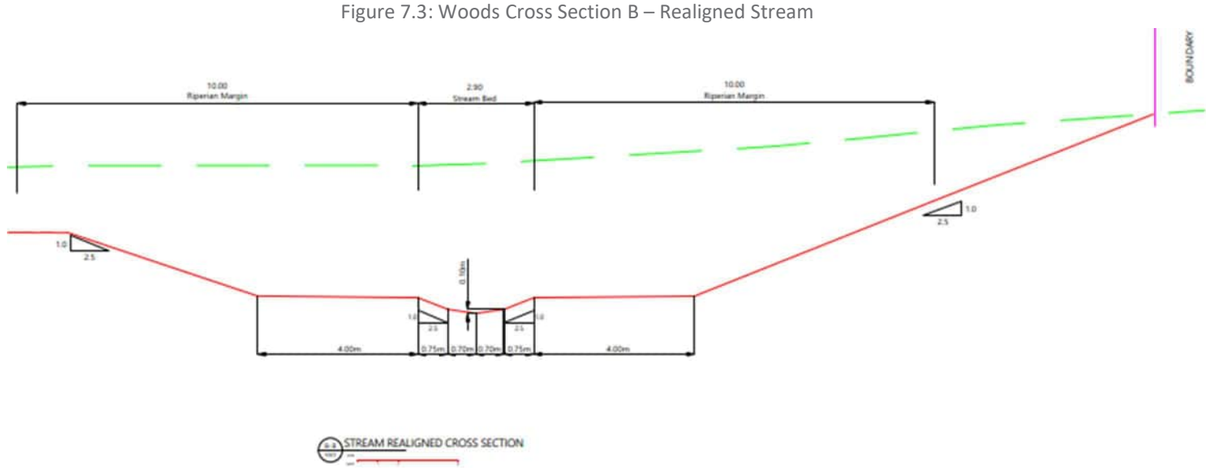
As shown in the below cross section, the natural stream slopes are typically at angles of 19 degrees (1v to 3v) which is generally considered stable in these geologies. No areas of instability in these areas have been identified as part of earlier reporting undertaken on the project.

Figure 7.2: Woods Cross Section C – Existing Stream



Where this stream is proposed to be diverted or re-aligned, cut slopes are shown at angles of up to 22 degrees (1v in 2.5h) as shown in woods cross section BB below.

Figure 7.3: Woods Cross Section B – Realigned Stream



CMW has completed slope stability analyses for the proposed cut slope at cross section B-B over a range of groundwater, static and seismic conditions as required by the current regulatory standards.

The stability of slopes under a range of design conditions is expressed in terms of a factor of safety, which is defined as the ratio of forces resisting failure to the forces causing failure. The following performance standards are recommended for slope stability assessment:

Table 7.4: Slope Stability Factor of Safety Requirements from Auckland Council Code of Practice for Land Development Chapter 2, V2 2023.

Condition	Required Minimum Factor of Safety
Normal Groundwater Condition	1.5
Extreme (worst credible) groundwater condition	1.3
Ultimate Limit State (ULS) seismic condition (calculated as 0.19g)	1.0

7.4.1 Stability Analyses

Slope stability analyses were undertaken using the Morgenstern-Price method of slices under both circular and translational failure mechanisms using the proprietary software SLIDE Version 6.

Design parameters were adopted from Table 6.2 and the ground models shown in Section 6.0.

Stability analyses outputs are attached in Appendix D and results are summarised below.

Table 7.5: Slope Stability Analysis Results for Proposed Landform

Section	Slope Stability Minimum Factor of Safety		
	Prevailing GW	Worst GW	ULS Seismic
B-B	1.6	1.3	1.4

The results demonstrate that appropriate factors of safety can be achieved for the proposed stream and pond profiles .

7.5 Expansive Soils

Seasonal soil moisture variations within most clay-rich soils typically result in the soil swelling during winter months and then shrinking during summer months. These seasonal movements can cause issues such as cracking of concrete floors, brittle cladding and masonry walls or distortion of building frames causing doors and windows to jam from differential settlement. The effects are further compounded by local influences that worsen differential movements. These may include growth of high demand trees and shrubs that cause localised soil drying or either leaking pipes or tree root removal, leading to localised wetting.

The potential effects need to be managed in a combination of appropriate:

- classification of the level of risk
- design of foundations
- management of soil moisture conditions by contractors during construction
- management of landscaping and plantings by homeowners throughout a building's lifetime

Thirteen soil samples were collected and tested for Atterberg limits and linear shrinkage within the Aurecon geotechnical Report. Using the laboratory test results and recommended climatic parameters, a surface movement of approximately 30mm was calculated using the approach presented in the BRANZ report correlating to a AS2870:2011 Class M site classification.

If AS2870 is used for the design solution, it must be noted that the characteristic surface movements in that code apply to a 300 year return period drought.

Prior to the introduction of the B1/AS1 design information in November 2019, minimum foundation depths recommended as appropriate by geotechnical consultants in Auckland for shallow footing design under AS2870 were typically of the order of 600mm for Class M.

For building types where neither B1/AS1 nor AS2870 design solutions are required to be applied, such as for IL1 buildings or commercial / industrial buildings, the structural designer should still consider the implications of the potential characteristic surface movement.

Due to the volume of earthworks proposed, further testing and confirmation of expansive class for each lot must be undertaken during preparation of the Geotechnical Completion Report.

7.5.1 Site Preparation During Construction

Foundation contractors need to be aware of the extreme damage potentially caused by expansive soils and the imperativeness of maintaining optimum moisture contents in all footing excavations and across building platform subgrades between the time of excavation and the pouring of concrete. Pouring foundations on dry, desiccated ground in summer months can lead to heaving and cracking, requiring extensive repairs or even complete house re-builds. Similarly, where perimeter foundations have been treated but floor slabs have been poured on dry ground, infiltration of moisture via pipe bedding can lead to localised heave, uplift and significant slab damage.

Remedial actions that may be appropriate include combinations of platform protection with a hard fill layer, pouring of a blinding layer of concrete in footing bases and soaking of the building platform with sprinklers for an extended period.

7.5.2 Site Maintenance and Landscaping

Landowners must be mindful of the potential impacts of planting or removal of high water demand plants. Where their roots may extend close to footings (i.e. within a lateral distance of 1.5 times the mature tree height), these actions can lead to significant settlement or heave damage.

Table 7.6: Framework Of Classification Methods for Expansive Soils

Reference	Identification Method(s)	Potential Assessment Outcomes
NZS3604-2011 Timber Framed Buildings	*(Refer to "Definitions – Good Ground")* Liquid Limit (LL) and Linear Shrinkage (LS) (NZS4402-1986 Test 2.2 and 2.6)	"Good Ground" **OR** Not "Good Ground" = LL>50 and LS>15
AS2870-2011 Residential Slabs and Footings	*(Refer to Clause2.3.2)* Shrink-Swell Indices (AS1289 Tests 7.1.1 to 7.1.3), **OR** Correlation with other clay index tests, OR Visual-tactile ID by a qualified person	*(Refer to Table 2.3 and Section 3)* Classes S, M, H1, H2, E with associated characteristic ground movements and design solutions for 300 year return period drought.
BRANZ Report SR120A (2008) Soil Expansivity in the Auckland Region	Shrink-Swell Indices (AS1289 Tests 7.1.1 to 7.1.3) Recommended soil suction profile given	Use of AS2870 Classes
NZBC Acceptable Solution B1/AS1 (from Nov 2019) **Applied amendments to the wording of NZS3604** to cover a method for a simple building form.	*(Clause7.5.13)* Specific requirements for the Acceptable Solution for Simple Buildings: Enquiry at local TA, **and/ or** A Cert. of Suitability per NZS4431, **and/ or** Soil tests by a qualified Engineer *(Clause7.5.13.1.2)* Soil tests are: Shrink-Swell Indices (AS1289 Tests 7.1.1 to 7.1.3)	Provides an Acceptable Solution for only a limited range of NZS3604 building sizes, shapes and materials on expansive soils. The provided acceptable design solution is only for a concrete slab with perimeter foundation. Classes S, M, H and E. and Characteristic ground movement limits based on a 500 year return period
Auckland Council Code of Practice for Land development and Subdivision (Chapter 2, version 2, May 2023) (ACCoPs)	*(Clause2.5.2)* Moisture Content (MC), Liquid Limit (LL), Plastic Limit (PL) (NZS4402-1986 Tests 2.1 to 2.4) plotted on plasticity chart (Plasticity Index, PI=LL-PL vs LL)	Use of NZBC B1/AS1 for foundation design. Any other specific design method to require Auckland Council or external review

Notes:

Liquid Limit test can be replicated by Cone Penetration Limit (CPL) Test, NZS4402-1986 Test 2.5.

Assessments using shrink-swell indices have been found to be unreliable in the Auckland context and are therefore not favoured in ACCoPs

B1/AS1 converted characteristic surface movements from 300 years in AS2870 to 500 years by multiplying values by 1.11.

B1/AS1 did not alter the NSZ 3604 "Good Ground" definition and did not repeal NZS3604 Informative Section 17 on expansive soils.

7.6 Groundwater Effects

An assessment has been made of the impact of the proposed works on groundwater in accordance with the standards in Chapter E7 of the Auckland Unitary Plan (AuP). The assessment has considered the impact of the proposed earthwork activities in relation to groundwater in particular.

Based on the measured groundwater levels presented in Table 4.2 above, our assessment has indicated that the bulk earthworks are unlikely to encounter groundwater and the development proposals are compliant with permitted standards E7.6.1.6 and E7.6.1.10. An assessment against these standards is provided in Appendix F.

7.6.1 Boundary Effects

The assessment of boundary effects at any location is considered to be the sum of:

- Groundwater-induced settlement due to draw-down from the lowest historic level (i.e. where the ground experiences new stress changes).
- Deflection-induced settlement due to lateral movement behind a retaining structure.
- Consideration is also given to temporary works that may impact stability or groundwater flow volumes.

In general no significant cuts are proposed along site boundaries, however excavations of up to 3 meters are shown in the South Eastern Boundary. These cuts are currently shown as being battered and as such no deflection-based settlement is anticipated on adjacent lots. Groundwater in this area was measured at depths greater than 4 meters therefore no groundwater drawdown is anticipated on the site boundaries.

8.0 RECOMMENDATIONS

Based on our assessment of the development proposals, the site is considered suitable for the proposed development. Specific engineering recommendations for the development are provided below.

8.1 Seismic Site Subsoil Category

The geological units encountered beneath the site comprise:

- SAVF of variable weathering overlying Tauranga Group over elevated portions of the site
- Tauranga Group soil present in the lower lying areas overlying Waitemata group bedrock at depth

With respect to the seismic site subsoil category defined in Section 3.1.3 of NZS1170.5, the two geologies are likely to respond differently and as such both Class C (shallow Soil) and Class D (Deep or Soft Soil) will apply to different areas of the site.

For future design of buildings and structures, specific investigation at building consent stage will need to be undertaken and assessed at the proposed location to determine which of the site classes should be applied .

8.2 Ground Improvement for Static Settlement

8.2.1 Ground Improvement Options

To minimise post construction static ground settlements, a range of options may be considered, including the following:

- Construction of a temporary surcharge or pre-load fill embankment above design finished design level, with or without wick drains, to over-consolidate the compressible soils and minimise post construction settlements;
- Use of lightweight geofoam, such as EPS-block materials for embankment construction to keep embankment pressures below pre-consolidation pressures within the compressible soil unit thereby reducing consolidation settlements;
- Undertake ground improvement beneath the fill or building footprints, such as stone columns, soil mixed columns, CFA piles, Rammed Aggregate Piers (RAP's) or similar rigid inclusions to transfer loads to more competent underlying soils at depth.

It is expected that pre-loading or surcharging is likely to be the preferred ground improvement technique for this project to reduce post construction static settlements to acceptable magnitudes. Extents, size and timeframes of preloads will need to be determined on a lot by lot basis depending on the final building development proposals.

8.2.2 Settlement Monitoring

The calculated settlement magnitude and time rate estimates are preliminary only and based on a limited amount of test data. As there will inevitably be some variation in soil composition and resulting settlement profiles from one location to the next, it is imperative that settlement monitoring is undertaken during construction.

Settlement markers shall be installed by the Contractor and monitored by a Surveyor that is able to provide the accuracy stated.

Should any of the settlement markers be damaged and become in-operable, a new marker may be required to be installed at a nearby location as agreed in consultation with the Geotechnical Engineer.

The locations of the proposed settlement markers can be found on Figure 8.1 and the attached ***Drawing 07*** a typical detail of the settlement makers is also appended ***Drawing 08.***

8.2.3 Monitoring Frequency

Settlement monitoring shall be undertaken in accordance with the following frequencies:

Table 8.1: Monitoring Frequency

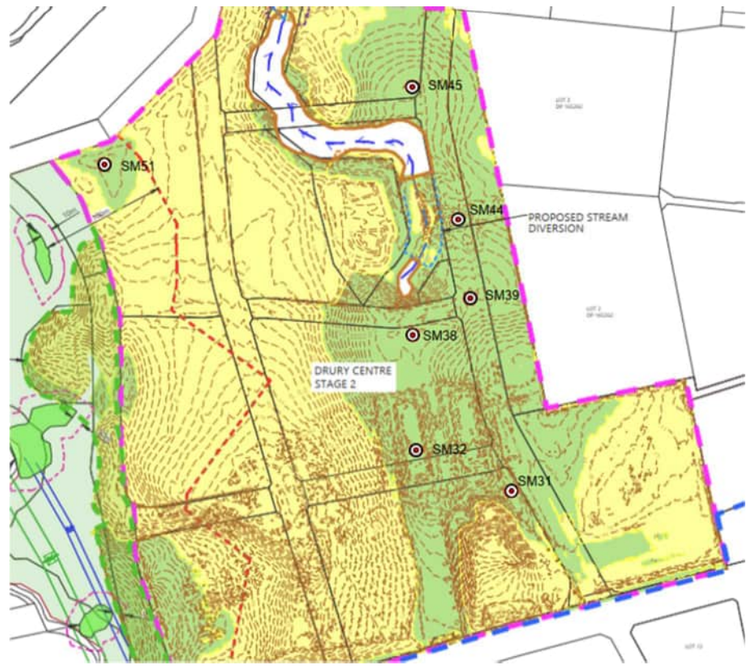
Monitoring Frequency	
Construction Stage	**Minimum Monitoring Frequency of Ground settlement markers**
Prior to construction	At least 2 baseline readings (minimum of 24 hours shall apply between reading sets)
During filling	Weekly during construction or every 1m lift (whichever is more frequent)
Completion of construction	Monthly for six months
Responsibility	Surveyor/Contractor

The frequencies above may be decreased or increased by the Geotechnical Engineer depending on the results of the monitoring.

Settlement markers shall be levelled by precise survey to an accuracy of ± 2mm at the frequencies outlined above. All survey data must be provided to the Geotechnical Engineer as soon as possible following completion.

The results of the settlement monitoring must be provided to the Geotechnical Engineer to verify settlement trends with respect to current predictions. Within 48 hours of full surcharge height being achieved, the RL must be recorded by precise levelling and the full extent of the surcharge must be surveyed and provided to the Geotechnical Engineer as soon as possible.

Figure 8.1: Settlement Marker Locations



8.3 Earthworks

8.3.1 General

All earthwork activities must be carried out in general accordance with the requirements of NZS 4431[6] and the requirements of the Auckland Council Infrastructure Development Code under the guidance of a Chartered Professional Geotechnical Engineer.

A Geotechnical Works Specification is provided as Appendix E. This document provides the requirements for site preparation, fill placement, subsoil drainage, compaction requirements, quality assurance testing and as-built requirements.

Those requirements are summarised below.

8.3.2 Excavatability

Given the completely weathered nature of the soil units that will be encountered within the proposed earthworks cuts, it is expected that excavation of these materials will be readily achieved with normal earthworks plant, such as scrapers and bulldozers with scoops. There is the potential for encountering gravels or corestones within the deeper cuts which may require block cutting or removal with an excavator.

Within the deeper cuts, soils typically contain much higher moisture contents, sometimes approaching the soil liquid limit and are highly sensitive, which can make them particularly challenging to earthwork. These materials can be used within engineered fills although will require drying, blending and compaction effort to place.

8.3.3 Subgrade Preparation

Preparation of the subgrade beneath the proposed fill areas should comprise stripping of all vegetation, topsoil, any pre-existing fill materials or weak alluvium followed by benching of the exposed subgrade where natural slopes beneath the fill exceed gradients of nominally 1:5 (vertical to horizontal). The subgrade should then be scarified and moisture conditioned where necessary and then proof rolled to verify the subgrade stiffness and consistency.

Where any particularly weak materials are encountered that weave excessively during the proof rolling process, they should be undercut and removed prior to placing engineered fill.

For all existing streams or pond areas which are to be filled, allowance should be made to drain them, provide temporary dewatering measures to manage any groundwater seepage and facilitate cleaning out of all accumulated sediment and soft alluvium, placement of drainage layers and bulk engineered fill above.

8.3.4 Stockpiles

Careful consideration must be given to the location of temporary topsoil / unsuitables stockpiles to ensure that they are not located immediately above steep or unstable slopes or immediately above proposed stormwater pond or temporary sediment retention ponds excavations.

The location of all temporary stockpiles must be approved by the Geotechnical Engineer prior to placement. Where stockpiles cannot be avoided above sloping ground they should be placed over a wide area with the height restricted under the direction of the Geotechnical Engineer.

8.3.5 Underfill Drainage

Underfill drains will need to be installed beneath new fills within low lying tributaries and gully or stream inverts.

We have provided approximate positions of the underfill drainage network required for the subdivision works based on existing contour data. Details are in the Geotechnical Works Specification (***Appendix E***), Underfill Drainage Plan (***Drawings 05***) and in the Underfill Drain Typical Detail (***Drawing 06***).

The function of subsoil drains and their outlets will be protected using restrictions applied in the Geotechnical Completion Report. These may also include foundation piling requirements to prevent settlement of foundations from poorly compacted filling, depending on the type, location and depths of the drains.

8.3.6 Compaction

Earthfill must be placed, spread and compacted in controlled 250mm to 300mm thick (loose) lifts under the direction of a geotechnical engineer. The fill may comprise either granular or cohesive material subject to being free of any organic material and having no particles greater than 150mm diameter.

Most of the proposed cut material, including the natural and existing fill materials should be suitable for reuse as Engineer Certified Fill. Soil textures and moisture contents will however vary widely and careful management, conditioning and compaction control will be required.

All earthfill must be placed to ensure adequate knitting of successive fill lifts by ripping any natural subgrade or fill surfaces that have become dry prior to placing the following fill lift.

Allophanes were identified as present within the natural soils. These can require careful handling as may experience rapid strength loss during earthworks operations and under machinery tracking. I

8.3.7 Temporary Sediment Retention Ponds

Six Temporary sediment retention ponds are shown as being required to store stormwater for significant periods (several months) and therefore their construction should be subject to design and observation input from the geotechnical engineer. As a minimum, the following input is recommended from the project geotechnical engineer:

- Advise on pond locations with respect to land stability and seepage potential;
- Structural design of pond fill embankments including key and compaction specification;
- Observe embankment subgrade conditions and advise on undercut requirements;
- Earthfill QA / QC testing of all embankment materials to ensure compliance with specification.

When decommissioning temporary sediment ponds, all water softened material in the bases and sides of the ponds shall be removed and undercut to the satisfaction of the Geotechnical Engineer. Backfilling of temporary ponds shall be to the compaction standard for general filling unless otherwise specified.

8.3.8 Stormwater Ponds

The proposed stormwater pond is shown in an area of both cut and fill. Subgrade materials will need to consist of a low permeability clay to prevent excessive seepage and as such allowance should be made for lining the pond with a minimum of a meter of engineered clay fill.

8.3.9 Quality Control

The stripping of existing topsoil, cutting of pre-existing fill materials and undercutting of soft surficial soils, where required from across the site as well as the gully areas must be subject to observation by the project geotechnical engineer to ensure that all unsuitable materials have been removed.

[6] NZS 4431:2022 Engineered fill construction for lightweight structures, New Zealand Standard.

The source and / or type of material used for engineered fill will dictate the type of quality control testing undertaken.

For granular (sand and gravel) fill materials, testing following compaction should be principally in terms of the maximum dry density within the appropriate water content range. Where the source or quality of fill changes, re-calibration will be required.

Where silts and clays are used as filling, alternative test criteria using vane shear strength and air voids should be used. The recommended specification for the proposed development is presented in Geotechnical Works Specification in Appendix E.

8.4 Civil Works

8.4.1 Subgrade CBR

The subdivision roading is shown as being constructed in a combination of both cut and fill areas. Based on testing undertaken by Aurecon, typical CBR values of between 5% and 6% should be available in fills. In areas of cut natural ground, CBR values as low as 2% to 4% are likely.

We recommend subgrade CBR testing is undertaken following formation of pavement subgrades to confirm actual CBR values. Subgrades should be protected from runoff or surface water to prevent deterioration during the construction period.

8.4.2 Service Trenches

Most of the materials to be exposed during the excavation of service trenches should be readily removed using an excavator.

At the completion of the development, Specific Design Zones for services will be applied in the Geotechnical Completion Report to protect future foundations from settlement from poorly compacted trench backfill and to prevent new loads crushing service pipes. This is a restriction on building foundations within the 45 degree zone of influence from pipe inverts as depicted in Auckland Council's drawing SW22 from their Code of Practice for Land Development and Subdivision.

8.4.3 Retaining Walls

Design parameters for permanent and temporary retaining walls are summarised in Table 6.2.

Should any fill be placed against the permanent retaining wall after construction, it is expected that the compaction induced pressures will be much greater than the above active earth pressures. The compaction equipment used to compact backfill behind the wall must be carefully selected and preferably light-weight compaction equipment should be used.

It is noted that some ground movement will occur behind temporary or permanent retaining walls. By definition, movement of the wall must occur to fully mobilise the active and passive earth pressure coefficients. The extent of this movement is dependent on the height of retaining, type of wall selected and construction methodology. This must be considered during the design and construction of the retaining walls to ensure adjacent facilities are not adversely affected.

At the completion of the development, Specific Design Zones (retaining) are expected to be applied in the Geotechnical Completion Report to protect retaining walls from future overloading at the crest or undermining at the toe that could lead to instability. These zones typically extend the same distance as the wall height and where they are present above a wall, require deepening of foundations unless the wall has been designed for future foundation loads. Where they are present below a wall, careful consideration needs to be given to location, depth and timing of any future excavations.

8.5 Foundations

At the completion of the works, a Geotechnical Completion Report (GCR) will be prepared. The GCR will advise on anticipated foundation design parameters and any restrictions that require further engineering investigation and/ or design on individual lots to address any remaining natural hazards as described in Section 71(3) of the Building Act, i.e. erosion, falling debris, subsidence, slippage, and inundation.

Restrictions that are expected to be applied in the GCR to protect the future buildings from natural hazards associated with steep slopes, retaining walls and drainage are outlined in the respective sections in this report.

The development proposal include a range of buildings for commercial, community and residential activities. The buildings will be subject to specific foundation investigation and design however our provisional expectation is that provided earthworks are completed in accordance with the standards and recommendations described herein, the following will apply:

- A preliminary geotechnical ultimate bearing pressure of 300kPa should be available for shallow strip and pad foundations constructed within both the natural cut ground and engineered fill areas, subject to the short axis of those footings measuring no greater than 2.5m in plan.
- There may be areas where localised variations in shear strength within the natural cut ground occur, particularly where the depth of cut varies across the building platforms. Further confirmation of available bearing pressures will be addressed at the time of post earthworks soil testing.
- The preliminary assessed the AS2870 Site Class for all lots on these stages of the development to be M (moderate) with an anticipated characteristic surface movement up to 40mm However lot specific testing will be required on completion of the earthworks to confirm the expansive class.

9.0 SAFETY IN DESIGN

The design landform requires site excavations that may include geotechnical works such as undercuts, temporary excavations, steep fill batters, subsoil drains as specified in the Geotechnical report(s) and on the drawings. Exposure to these works forms a significant safety risk for contractors and inspectors/ testers.

In conducting our scope of work, we have considered and addressed Safety in Design (SiD) aspects relevant to our understanding of the proposed design and construction work. SiD must consider the construction, operation, maintenance, and ultimate demolition phases of the relevant works.

It is noted that CMW are focussed on design aspects, and whilst we have attempted to be comprehensive in our assessment, it is the Contractors responsibility to cover construction related risks in a more comprehensive manner (being the competent party in that respect). The CMW designs/ specifications for undercuts and drainage elements have been made so that no personnel are ever expected to enter unbattered or unprotected excavations to complete the construction. If at any stage a contractor does not consider that a design for excavations can be safely constructed, then CMW must be contacted immediately to discuss alternative design and/ or methods and avoid risk to personnel.

Our SiD risk is a live process and as such this risk assessment must be communicated with all affected parties involved with the project and dealt with through specific on-site risk assessment plans and updated as the project progresses.

10.0 FURTHER WORK

- Further work and detail design of any ground improvement or preload design will be required based on future building proposals.
- Design of any structures such as retaining walls
- Construction monitoring Services to confirm the assumptions and recommendations made in this report have been interpreted as intended

11.0 CLOSURE

Additional important information regarding the use of your CMW report is provided in the '*Using your CMW Report*' document attached to this report.

This report has been prepared for use by Woods and Kiwi Property in relation to the Drury Centre Stage 2 project in accordance with the scope, proposed uses and limitations described in the report. Should you have further questions relating to the use of your report please do not hesitate to contact us.

Where a party other than Woods and Kiwi Property seeks to rely upon or otherwise use this report, the consent of CMW should be sought prior to any such use. CMW can then advise whether the report and its contents are suitable for the intended use by the other party.

USING YOUR CMW GEOTECHNICAL REPORT

Geotechnical reporting relies on interpretation of facts and collected information using experience, professional judgement, and opinion. As such it generally has a level of uncertainty attached to it, which is often far less exact than other engineering design disciplines. The notes below provide general advice on what can be reasonably expected from your report and the inherent limitations of a geotechnical report.

Preparation of your report

Your geotechnical report has been written for your use on your project. The contents of your report may not meet the needs of others who may have different objectives or requirements. The report has been prepared using generally accepted Geotechnical Engineering and Engineering Geology practices and procedures. The opinions and conclusions reached in your report are made in accordance with these accepted principles. Specific items of geotechnical or geological importance are highlighted in the report.

In producing your report, we have relied on the information which is referenced or summarised in the report. If further information becomes available or the nature of your project changes, then the findings in this report may no longer be appropriate. In such cases the report must be reviewed, and any necessary changes must be made by us.

Your geotechnical report is based on your project's requirements

Your geotechnical report has been developed based on your specific project requirements and only applies to the site in this report. Project requirements could include the type of works being undertaken; project locality, size and configuration; the location of any structures on or around the site; the presence of underground utilities; proposed design methodology; the duration or design life of the works; and construction method and/or sequencing.

The information or advice in your geotechnical report should not be applied to any other project given the intrinsic differences between different projects and site locations. Similarly geotechnical information, data and conclusions from other sites and projects may not be relevant or appropriate for your project.

Interpretation of geotechnical data

Site investigations identify subsurface conditions at discrete locations. Additional geotechnical information (e.g. literature and external data source review, laboratory testing etc) are interpreted by Geologists or Engineers to provide an opinion about a site specific ground models, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist due to the variability of geological environments. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. Interpretation of factual data can be influenced by design and/or construction methods. Where these methods change review of the interpretation in the report may be required.

Subsurface conditions can change

Subsurface conditions are created by natural processes and then can be altered anthropically or over time. For example, groundwater levels can vary with time or activities adjacent to your site, fill may be placed on a site, or the consistency of near surface conditions might be susceptible to seasonal changes. The report is based on conditions which existed at the time of investigation. It is important to confirm whether conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

Interpretation and use by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. To help avoid misinterpretations, it is important to retain the assistance of CMW to work with other project design professionals who are affected by the contents of your report. CMW staff can explain the report implications to design professionals and then review design plans and specifications to see that they have correctly incorporated the findings of this report.

Your report's recommendations require confirmation during construction

Your report is based on site conditions as revealed through selective point sampling. Engineering judgement is then applied to assess how indicative of actual conditions throughout an area the point sampling might be. Any assumptions made cannot be substantiated until construction is complete. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances from previous assumption, conduct additional tests if required and recommend solutions to problems encountered on site.

A Geotechnical Engineer, who is fully familiar with the site and the background information, can assess whether the report's recommendations remain valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

Environmental Matters Are Not Covered

Unless specifically discussed in your report environmental matters are not covered by a CMW Geotechnical Report. Environmental matters might include the level of contaminants present of the site covered by this report, potential uses or treatment of contaminated materials or the disposal of contaminated materials. These matters can be complex and are often governed by specific legislation.

The personnel, equipment, and techniques used to perform an environmental study can differ significantly from those used in this report. For that reason, our report does not provide environmental recommendations. Unanticipated subsurface environmental problems can have large consequences for your site. If you have not obtained your own environmental information about the project site, ask your CMW contact about how to find environmental risk-management guidance

APPENDIX A
Drawings

NOTES:

1. TEST LOCATIONS AND BOUNDARY SHOWN INDICATIVELY ONLY.

LEGEND:

TPXX TEST PIT (TP) LOCATION

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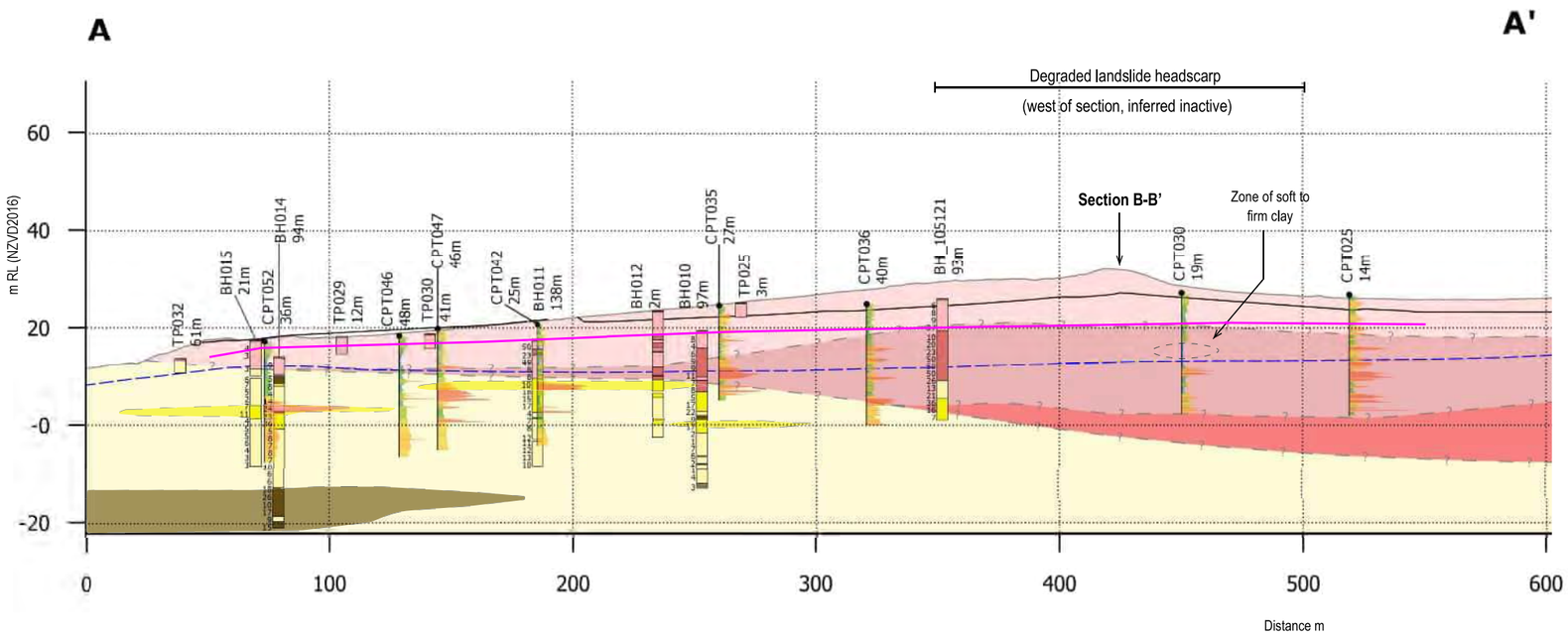
CLIENT:	Kiwi Property c/- Woods	DRAWN:	EM	PROJECT:	AKS2023-0072AO
PROJECT:	Drury Central	CHECKED:	CR	DRAWING:	01
		REVISION:	0	SCALE:	NTS
TITLE:	Test Pit Locations	DATE:	2/12/2024	SHEET:	A3



LEGEND

GEOLOGY

- Topsoil
- Fill
- South Auckland Volcanic Field - Residual Soil to Completely Weathered (VRb / VRr / VRt)
- South Auckland Volcanic Field - Highly Weathered to Moderately Weathered (VWb / VWt)
- South Auckland Volcanic Field - Slightly Weathered to Unweathered (VUb)
- Tauranga Group - Silt / Clay (TAz / TAc)
- Tauranga Group - Sand (TAs)
- Tauranga Group - Organic Clay / Peat (TAo / TAp)

CPT qc (MPa)

0 10 20 30 40

qc displayed on section as a coloured bar chart

SURFACES

—— Proposed Earthworks Surface (15-02-2021)

– – – Inferred Groundwater Profile (Summer 2020/21)

NOTES:
1. Refer to GIS (510611-002-06-REP-GG-001) for geological unit descriptions.
2. Groundwater surface based on Summer 2020/21 readings.
3. Depth to Tauranga Group below unweathered SAVF is based on historical well information (not shown).

NOTES:

1. GROUND MODEL ADOPTED FROM AURECON GIR
2. PROPOSED EARTHWORKS LEVELS FROM WOODS (PINK LINE)

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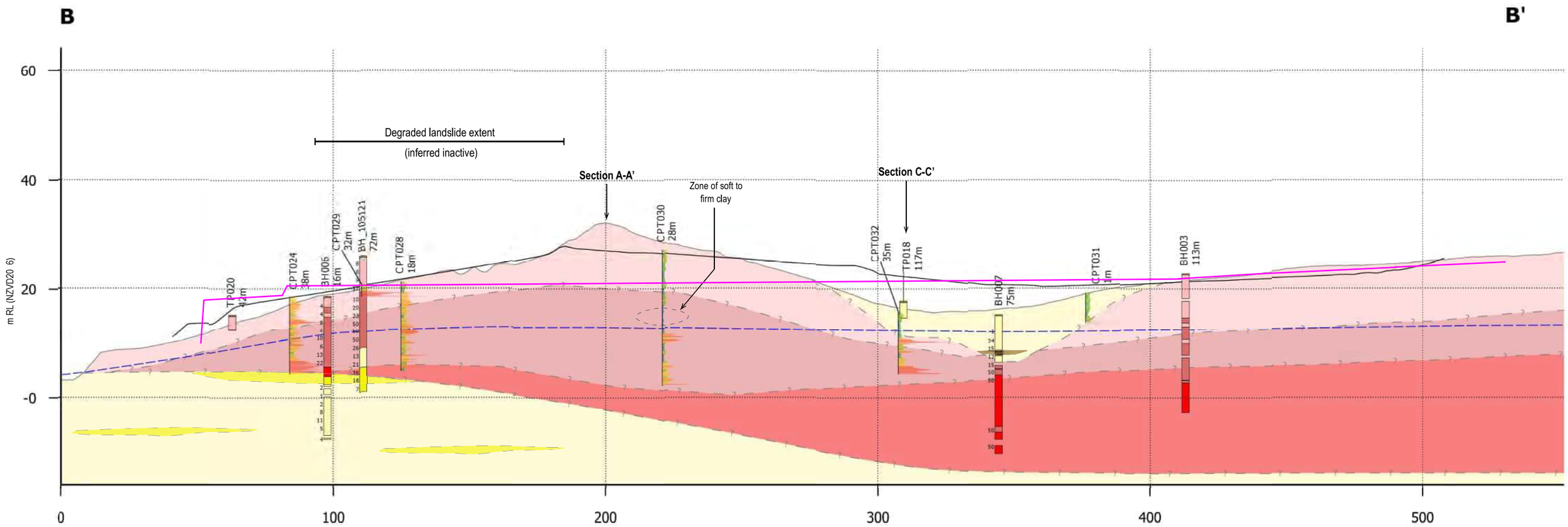
CLIENT: Woods		DRAWN: EM	PROJECT: AKS2023-0072
PROJECT: Drury Central Stage 2		CHECKED: CR	DRAWING: 02
		REVISION: 0	SCALE: NTS
TITLE: Cross Section A-A'		DATE: 28/11/24	SHEET: A3



LEGEND

GEOLOGY

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CPT qc (MPa)

0 10 20 30 40

qc displayed on section as a coloured bar chart

SURFACES

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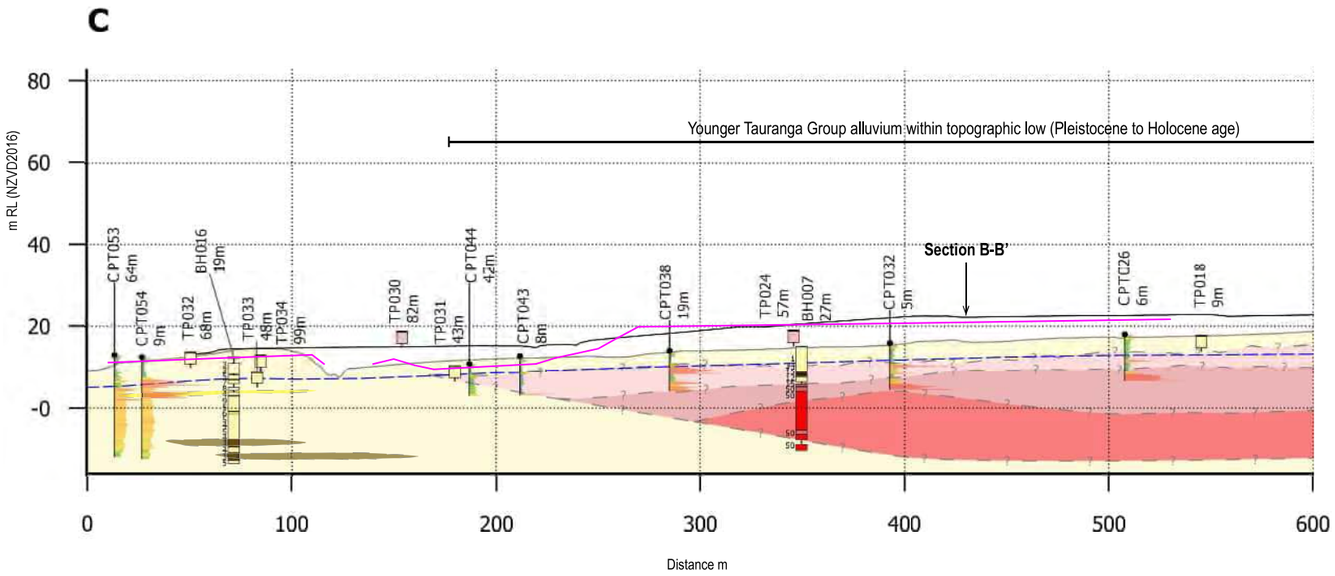
Great People | Practical Solutions

CLIENT: Woods		DRAWN: EM	PROJECT: AKS2023-0072
PROJECT: Drury Central Stage 2		CHECKED: CR	DRAWING: 03
		REVISION: A	SCALE: NTS
TITLE: Cross Section B-B'		DATE: 29/11/24	SHEET: A3



LEGEND

GEOLOGY

- Topsoil
- Fill
- South Auckland Volcanic Field - Residual Soil to Completely Weathered (VRb / VRr / VRt)
- South Auckland Volcanic Field - Highly Weathered to Moderately Weathered (VWb / VWt)
- South Auckland Volcanic Field - Slightly Weathered to Unweathered (VUb)
- Tauranga Group - Silt / Clay (TAz / TAc)
- Tauranga Group - Sand (TAs)
- Tauranga Group - Organic Clay / Peat (TAo / TAp)

CPT qc (MPa)

0 10 20 30 40

qc displayed on section as a coloured bar chart

SURFACES

—— Proposed Earthworks Surface (15-02-2021)

– – – Inferred Groundwater Profile (Summer 2020/21)

NOTES:
1. Refer to GIS (510611-002-06-REP-GG-001) for geological unit descriptions.
2. Groundwater surface based on Summer 2020/21 readings.
3. Depth to Tauranga Group below unweathered SAVF is based on historical well information (not shown).

NOTES:

1. GROUND MODEL ADOPTED FROM AURECON GIR
2. PROPOSED EARTHWORKS LEVELS FROM WOODS (PINK LINE)

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CLIENT: Woods		DRAWN: EM	PROJECT: AKS2023-0072
PROJECT: Drury Central Stage 2		CHECKED: CR	DRAWING: 04
		REVISION: 0	SCALE: NTS
TITLE: Cross Section C-C'		DATE: 29/11/24	SHEET: A3

NOTES:

1. BASE PLAN COURTESY OF WOODS
2. BOUNDARY SHOWN INDICATIVELY ONLY.

LEGEND:

PROPOSED SUBSOIL DRAIN ALIGNMENT

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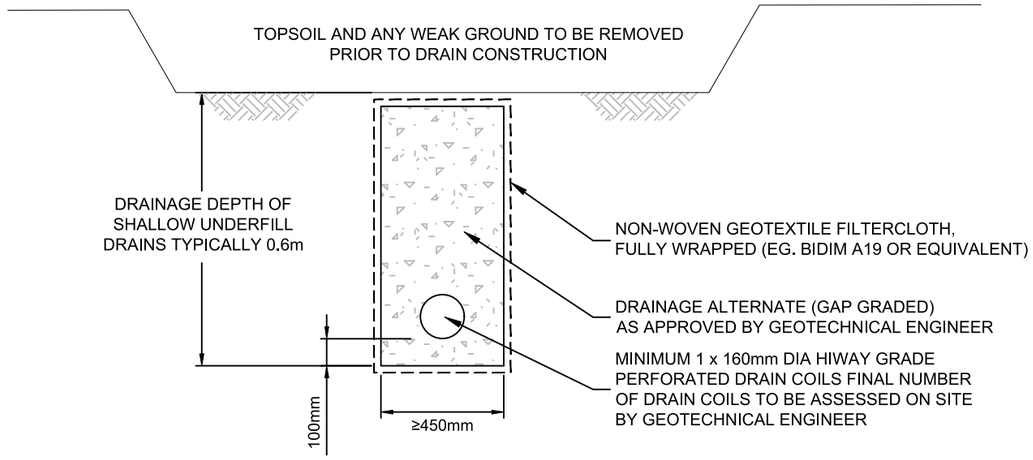
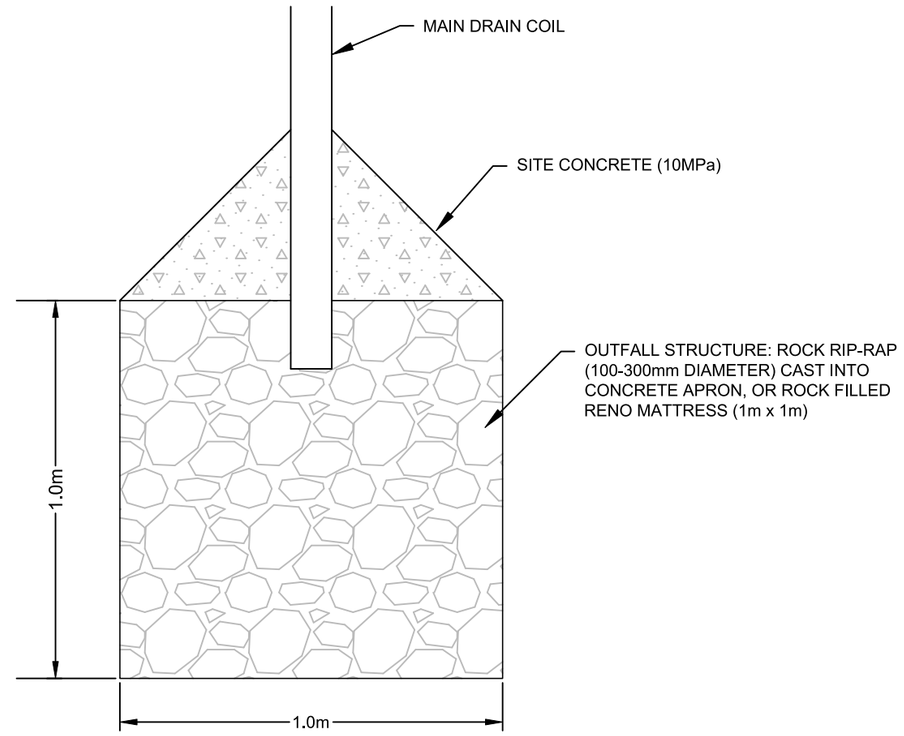
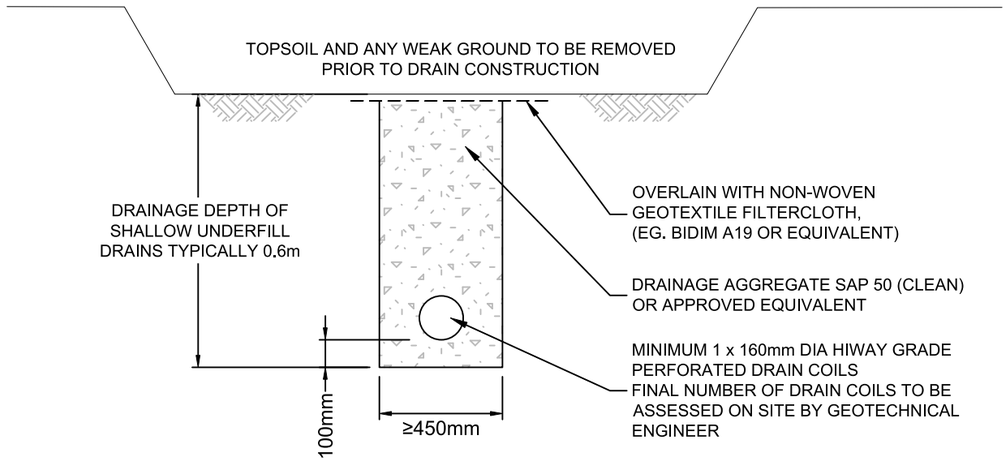
CLIENT: WOODS		DRAWN: SG	PROJECT: AKS2023-0072
PROJECT: DRURY CENTRE STAGE 2 DRURY		CHECKED: CR	DRAWING: 05
		REVISION: 0	SCALE: NTS
TITLE: SUBSOIL DRAINAGE LOCATION PLAN		DATE: 28/11/24	SHEET: A3



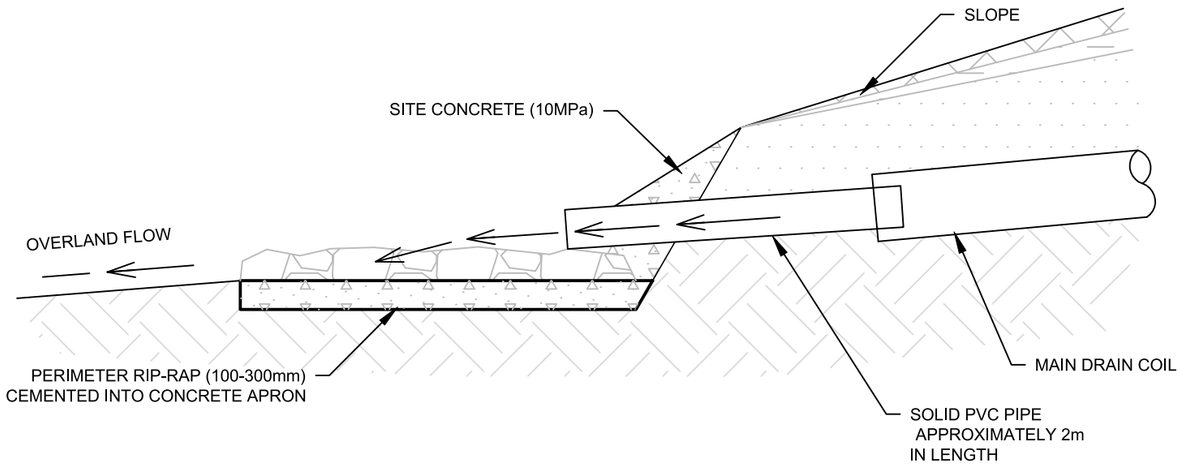
ALTERNATE SHALLOW UNDERFILL DRAIN DETAIL
NTS



DETAIL: PLAN OF OUTFALL STRUCTURE
NTS



TYPICAL UNDERFILL DRAIN DETAIL
NTS



TYPICAL OUTLET DRAIN DETAIL
NTS

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CLIENT: **WOODS**		DRAWN: JS	PROJECT No: AKS2023-0072
PROJECT: **DRURY CENTRE STAGE 2**		CHECKED:	DRAWING: 06
		REVISION:	SCALE: NTS
TITLE: **UNDERFILL DRAIN TYPICAL DETAIL**		DATE: 28/11/2024	SHEET: A3

\\CMWGEOSCIENCES.SHAREPOINT.COM@SSL\DAVWWWROOT\SITES\TICHSTEAM\SHARED DOCUMENTS\SOUTH AUCKLAND PROJECT DOCUMENTS\2023\AKS2023-0071 DRURY EAST STAGE 1 PRECINCT\DRAWINGS\CAD\AKS2023-0071 UNDERFILL DRAINS.DWG

NOTES:

1. BASE PLAN COURTESY OF WOODS AND AURECON.
3. TEST LOCATIONS AND BOUNDARY SHOWN INDICATIVELY ONLY.

LEGEND:

SMXX SETTLMENT MONITORING LOCATION

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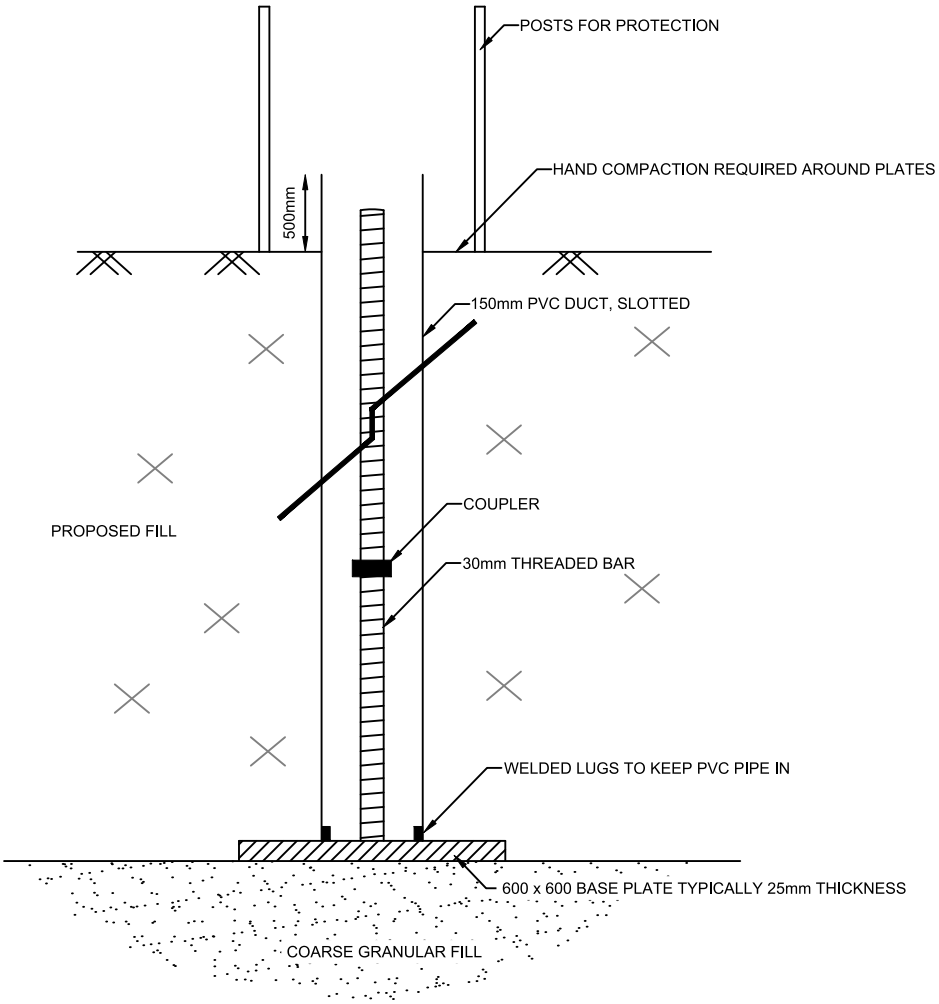
CLIENT: WOODS		DRAWN: CR	PROJECT: AKS2023-0072
PROJECT: DRURY CENTRE STAGE 2 DRURY		CHECKED: SG	DRAWING: 07
		REVISION: A	SCALE: NTS
TITLE: SETTLEMENT MONITORING PLAN		DATE: 28/11/24	SHEET: A3



CMW Geosciences Great People | Practical Solutions	CLIENT: **WOODS**	DRAWN: JS	PROJECT No: AKS2023-0072
	PROJECT: **DRURY CENTRE STAGE 2**	CHECKED: CR	DRAWING: 08
		REVISION: 0	SCALE: NTS
	TITLE: **SETTLEMENT PLATE DETAIL**	DATE: 28/11/2024	SHEET: A4P

APPENDIX B

Test Pit Logs

TEST PIT LOG - TP01-24

Client: Woods Group
Project: 133 Fitzgerald Road
Site Location: Drury
Project No.: AKS2023-0072
Date: 27/11/2024
Test Pit Location: Refer to Site Plan Logged by: OP/LG Checked by: SG Scale: 1:25 Sheet 1 of 1
Position: 1773384.9mE; 5891578.2mN Projection: NZTM Datum: NZVD2016
Pit Dimensions: m by m
Survey Source: Handheld GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
	0.2	Peak = UTP		0		GP: COBBLES: grey. Well graded. (Uncontrolled Fill)	M	H	5 10 15 20	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	0.3	Peak = 158kPa Residual = 52kPa				CL: Silty CLAY: with some fine to coarse gravel, with minor cobbles, with minor organic silt, with trace fine to coarse sand; greyish brown. Low plasticity. (Uncontrolled Fill)		VSt		
	0.5	Peak = 140kPa Residual = 35kPa				CL: Silty CLAY: with trace fine sand, with trace limonite gravel; light blueish grey mottled orange. High plasticity, moderately sensitive to sensitive. (Tauranga Group)				
						Test pit terminated at 0.50 m				
				1						
				2						
				3						
				4						
				5						

Termination Reason: Target Depth Reached.
Shear Vane No: 1911 DCP No:
Remarks: Natural ground encountered at 0.3m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP02-24

Client: Woods Group
Project: 133 Fitzgerald Road
Site Location: Drury
Project No.: AKS2023-0072
Date: 27/11/2024
Test Pit Location: Refer to Site Plan Logged by: OP/LG Checked by: SG Scale: 1:25 Sheet 1 of 1
Position: 1773406.3mE; 5891579.9mN Projection: NZTM Datum: NZVD2016
Pit Dimensions: m by m
Survey Source: Handheld GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
	0.2	Peak = UTP		0		GP: Fine to coarse GRAVEL: with some cobbles, with some fine to coarse sand; greyish brown. Low plasticity. (Uncontrolled Fill)	M	H	5 10 15 20	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
						ML: SILT: with minor clay, with trace fine sand; ; light grey streaked orange. Low plasticity. (Tauranga Group)				
	0.5	Peak = >200kPa				Test pit terminated at 0.50 m				
				1						
				2						
				3						
				4						
				5						

Termination Reason: Target Depth Reached.
Shear Vane No: 1911 DCP No:
Remarks: Natural ground encountered at 0.1m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP03-24

Client: Woods Group
Project: 133 Fitzgerald Road
Site Location: Drury
Project No.: AKS2023-0072
Date: 27/11/2024
Test Pit Location: Refer to Site Plan Logged by: OP/LG Checked by: SG Scale: 1:25 Sheet 1 of 1
Position: 1773431.9mE; 5891568.3mN Projection: NZTM Datum: NZVD2016
Pit Dimensions: m by m
Survey Source: Handheld GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
				0		GP: GRAVEL: with some cobbles, fine to coarse gravel, minor fine to coarse sand, some silt; greyish brown. Poorly graded. (Uncontrolled Fill)	M			
	0.5	Peak = 104kPa Residual = 35kPa				CH: Silty CLAY: with minor fine sand; light brownish orange mottled blueish grey. High plasticity. (Tauranga Group)		St to VSt		
	0.7	Peak = 69kPa Residual = 17kPa				Test pit terminated at 0.70 m				
				1						
				2						
				3						
				4						
				5						

Dynamic Cone Penetrometer (Blows/100mm): 5 10 15 20

Structure & Other Observations: Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks

Termination Reason: Target Depth Reached.
Shear Vane No: 1911 DCP No:
Remarks: Natural ground encountered at 0.5m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP04-24

Client: Woods Group
Project: 133 Fitzgerald Road
Site Location: Drury
Project No.: AKS2023-0072
Date: 27/11/2024
Test Pit Location: Refer to Site Plan Logged by: OP/LG Checked by: SG Scale: 1:25 Sheet 1 of 1
Position: 1773382.6mE; 5891549.3mN Projection: NZTM Datum: NZVD2016
Pit Dimensions: m by m
Survey Source: Handheld GPS

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Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
						OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	VSt to H	5 10 15 20	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	0.3	Peak = 170kPa				CH: Silty CLAY: with some fine to coarse gravel, with minor cobbles, with trace fine to coarse sand; light grey mottled orange, brown and grey. High plasticity. (Uncontrolled Fill)				
	0.4	Peak = UTP								
						ML: Clayey SILT: with some fine sand; light yellowish grey mottled orange and light grey. Low plasticity, moderately sensitive to sensitive. (Tauranga Group)				
	0.8	Peak = >200kPa Residual = 76kPa								
	1.0	Peak = 128kPa Residual = 21kPa		1		Test pit terminated at 1.00 m				
				2						
				3						
				4						
				5						

Termination Reason: Target Depth Reached.
Shear Vane No: 1911 DCP No:
Remarks: Natural ground encountered at 0.5m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP05-24

Client: Woods Group
Project: 133 Fitzgerald Road
Site Location: Drury
Project No.: AKS2023-0072
Date: 27/11/2024
Test Pit Location: Refer to Site Plan Logged by: OP/LG Checked by: SG Scale: 1:25 Sheet 1 of 1
Position: 1773405.6mE; 5891543.3mN Projection: NZTM Datum: NZVD2016
Pit Dimensions: m by m
Survey Source: Handheld GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
	0.3	Peak = 109kPa Residual = 24kPa				OL: Organic SILT: dark brown. Low plasticity. (Topsoil)				
	0.5	Peak = UTP				CL: Clayey SILT: with some fine to coarse basaltic gravel, with some fine to coarse sand; greyish brown mottled orange. Low plasticity. (Uncontrolled Fill)	M	VSt to H		
	1.3	Peak = UTP		1		CL: Silty CLAY: light yellowish grey mottled orange and light grey. Low plasticity. Sensitive. (Tauranga Group) *... from 1.30m to 1.40m, light blueish grey.*				
	1.5	Peak = 156kPa Residual = 48kPa				Test pit terminated at 1.80 m				
				2						
				3						
				4						
				5						

Dynamic Cone Penetrometer (Blows/100mm): 5 10 15 20

Structure & Other Observations: Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks

Termination Reason: Target Depth Reached.
Shear Vane No: 1911 DCP No:
Remarks: Natural ground encountered at 1.3m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP06-24

Client: Woods Group
Project: 133 Fitzgerald Road
Site Location: Drury
Project No.: AKS2023-0072
Date: 27/11/2024
Test Pit Location: Refer to Site Plan Logged by: OP/LG Checked by: SG Scale: 1:25 Sheet 1 of 1
Position: 1773427.8mE; 5891542.9mN Projection: NZTM Datum: NZVD2016
Pit Dimensions: m by m
Survey Source: Handheld GPS

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
						OL: Organic SILT: dark brown. Low plasticity. (Topsoil)				
	0.4	Peak = UTP				ML: Clayey SILT: with some fine to coarse gravel, with some fine to coarse sand; greyish brown. Low plasticity. (Uncontrolled Fill)	M	VSt to H		
	0.6	Peak = 159kPa								
						ML: SILT: with some clay and trace sand; light grey mottled orange. Low plasticity. (Tauranga Group)				
	1.0	Peak = 76kPa Residual = 14kPa		1						
						ML: SILT: with minor sand and trace clay; brownish grey. Low plasticity. (Tauranga Group)	W	St to VSt		
	1.4	Peak = 97kPa Residual = 35kPa								
	1.7	Peak = 100kPa Residual = 31kPa								
						Test pit terminated at 1.80 m				
				2						
				3						
				4						
				5						

Dynamic Cone Penetrometer (Blows/100mm): 5 10 15 20

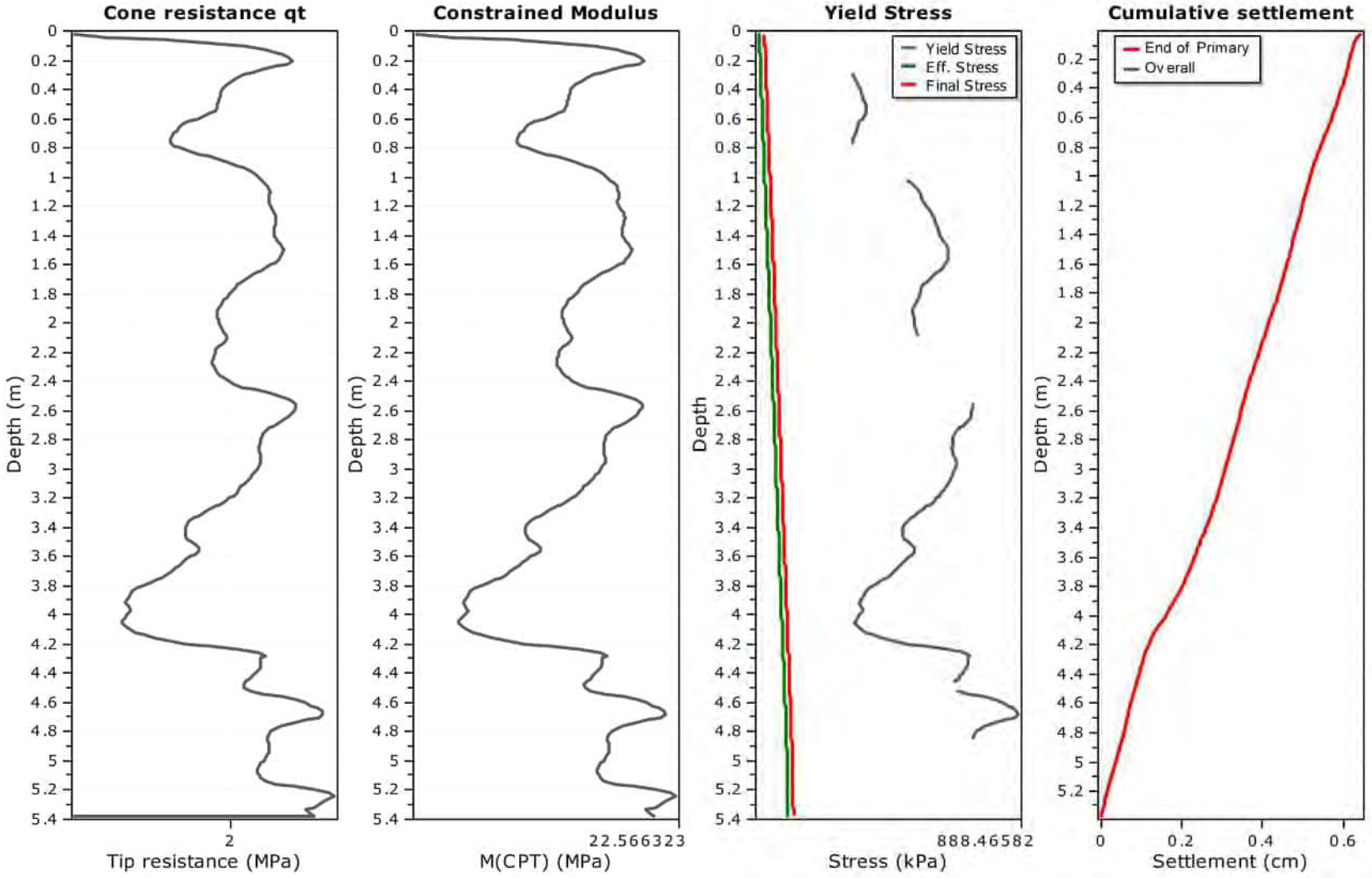
Structure & Other Observations: Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks

Termination Reason: Target Depth Reached.
Shear Vane No: 1911 DCP No:
Remarks: Natural ground encountered at 0.7m.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

APPENDIX C
Settlement Analyses

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 18.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

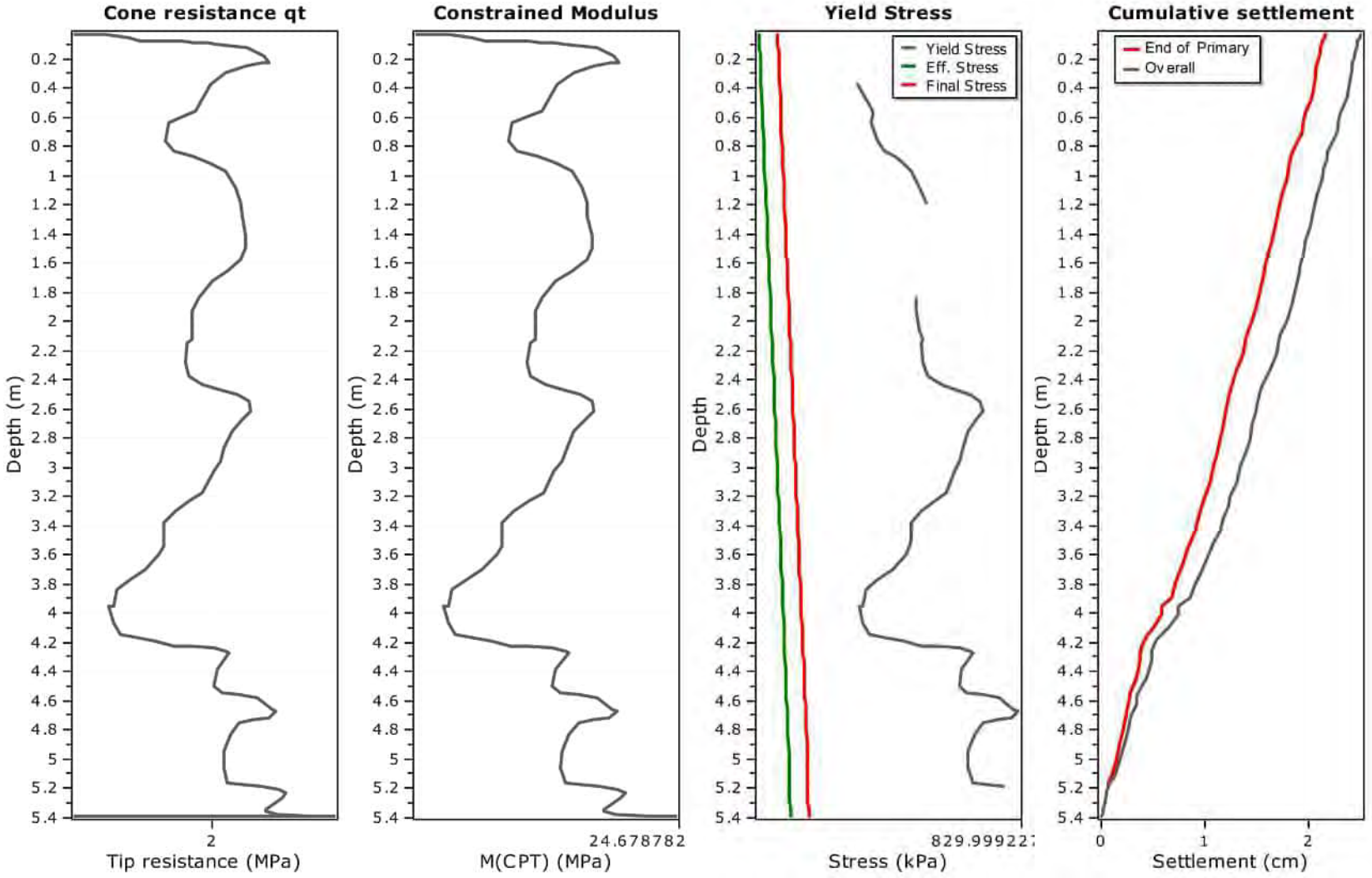
* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 58.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 594 months

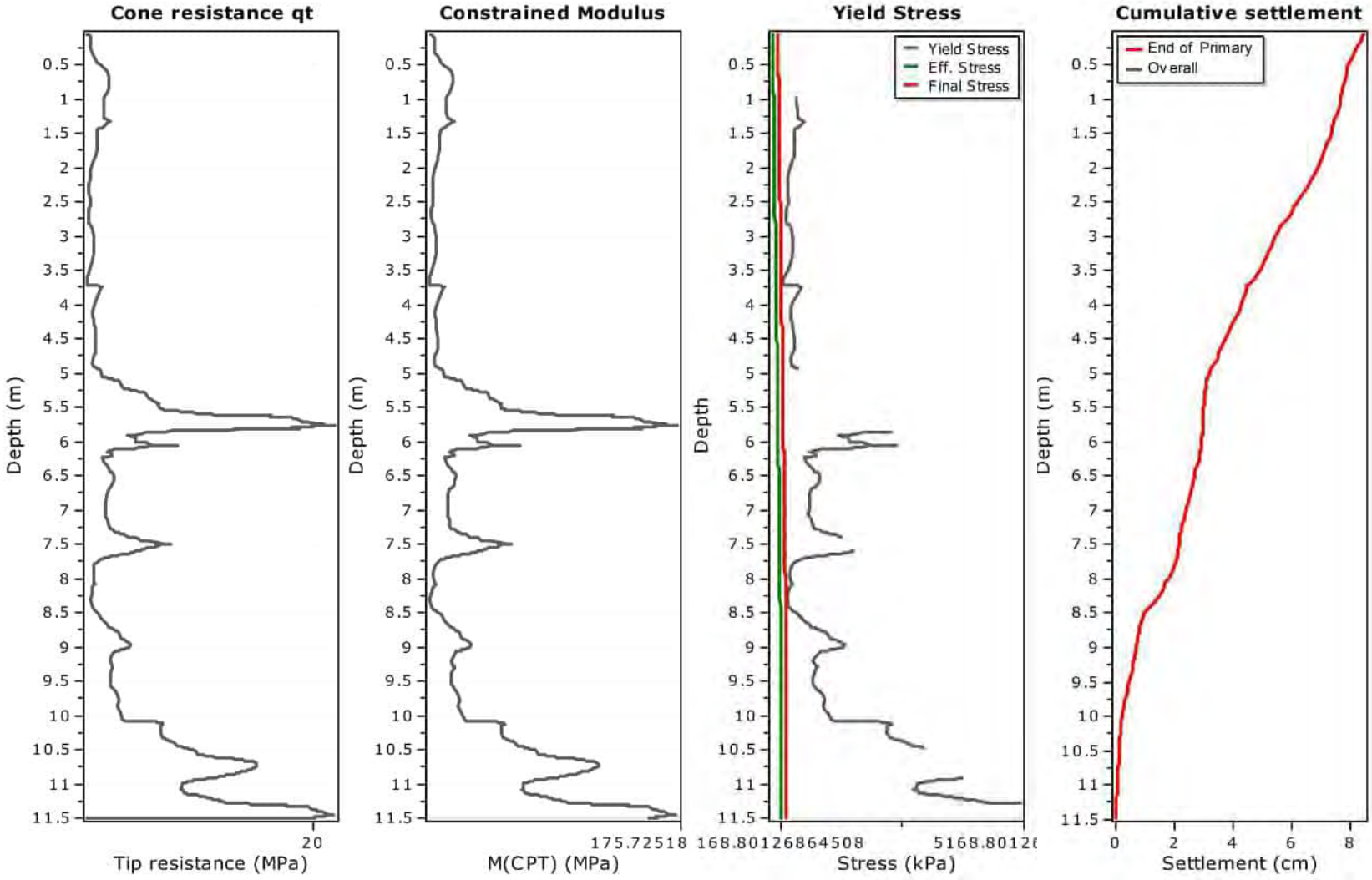
* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 108.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

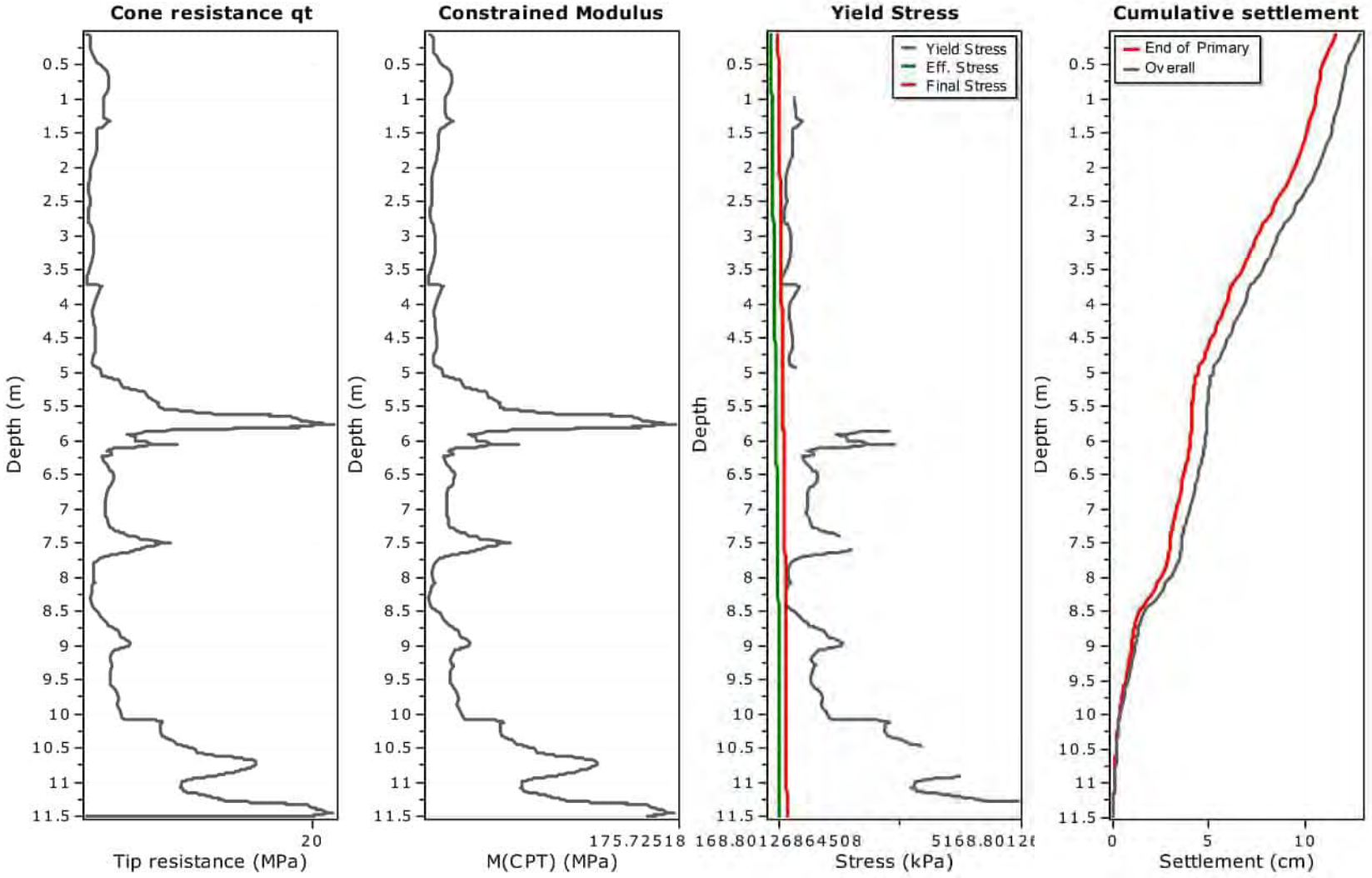
* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 148.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 594 months

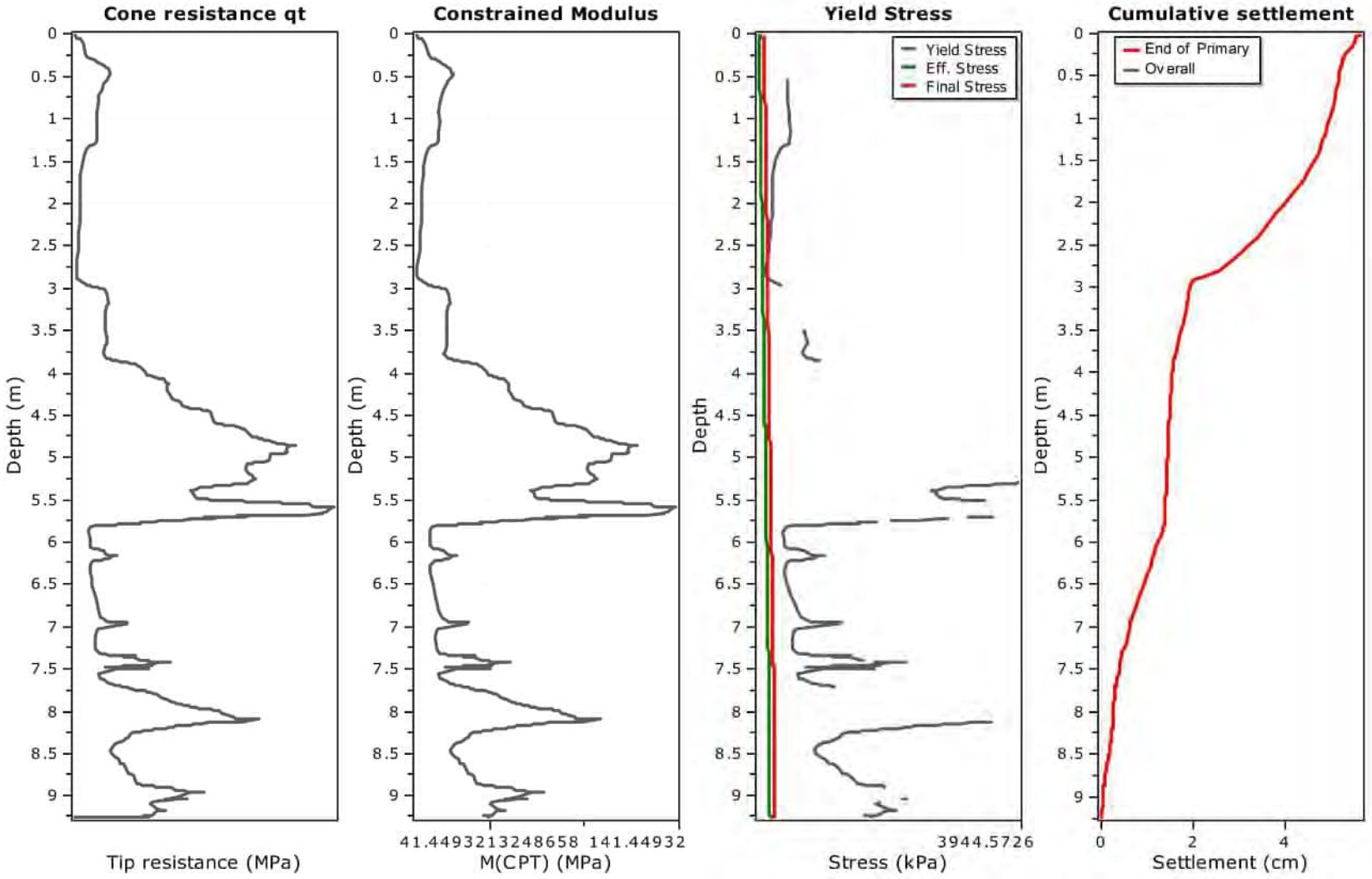
* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 72.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

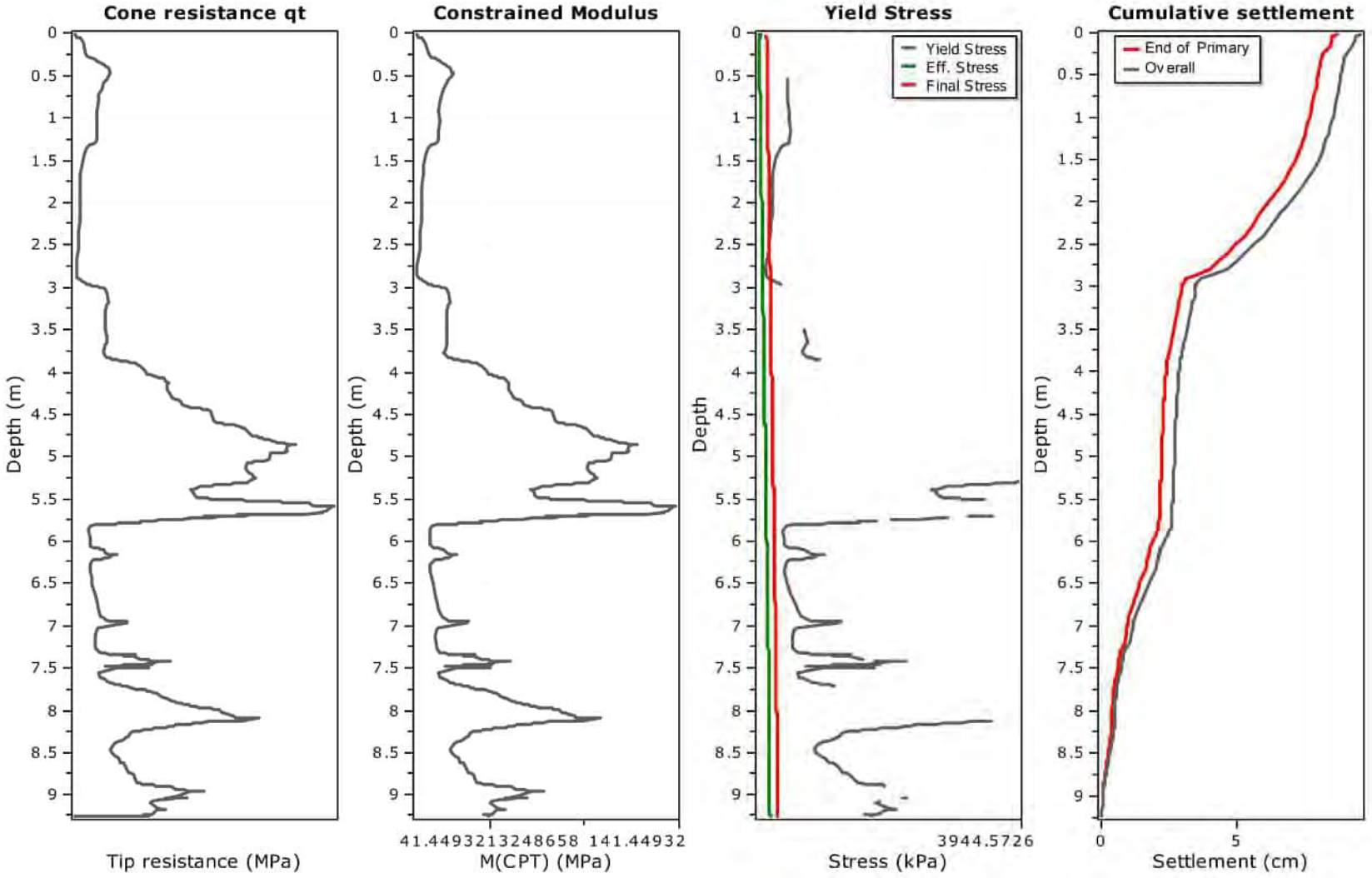
* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 112.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 594 months

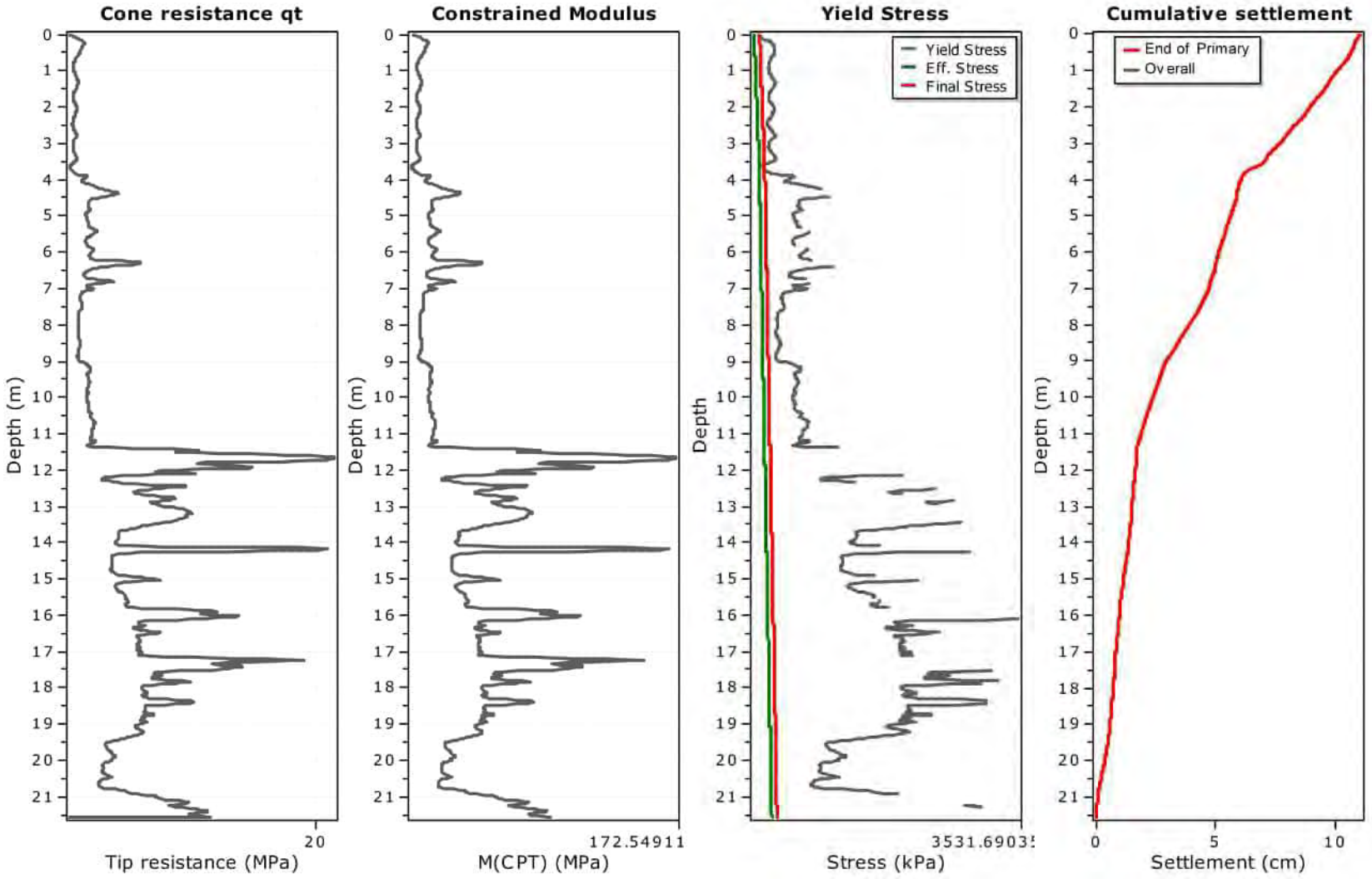
* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 72.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

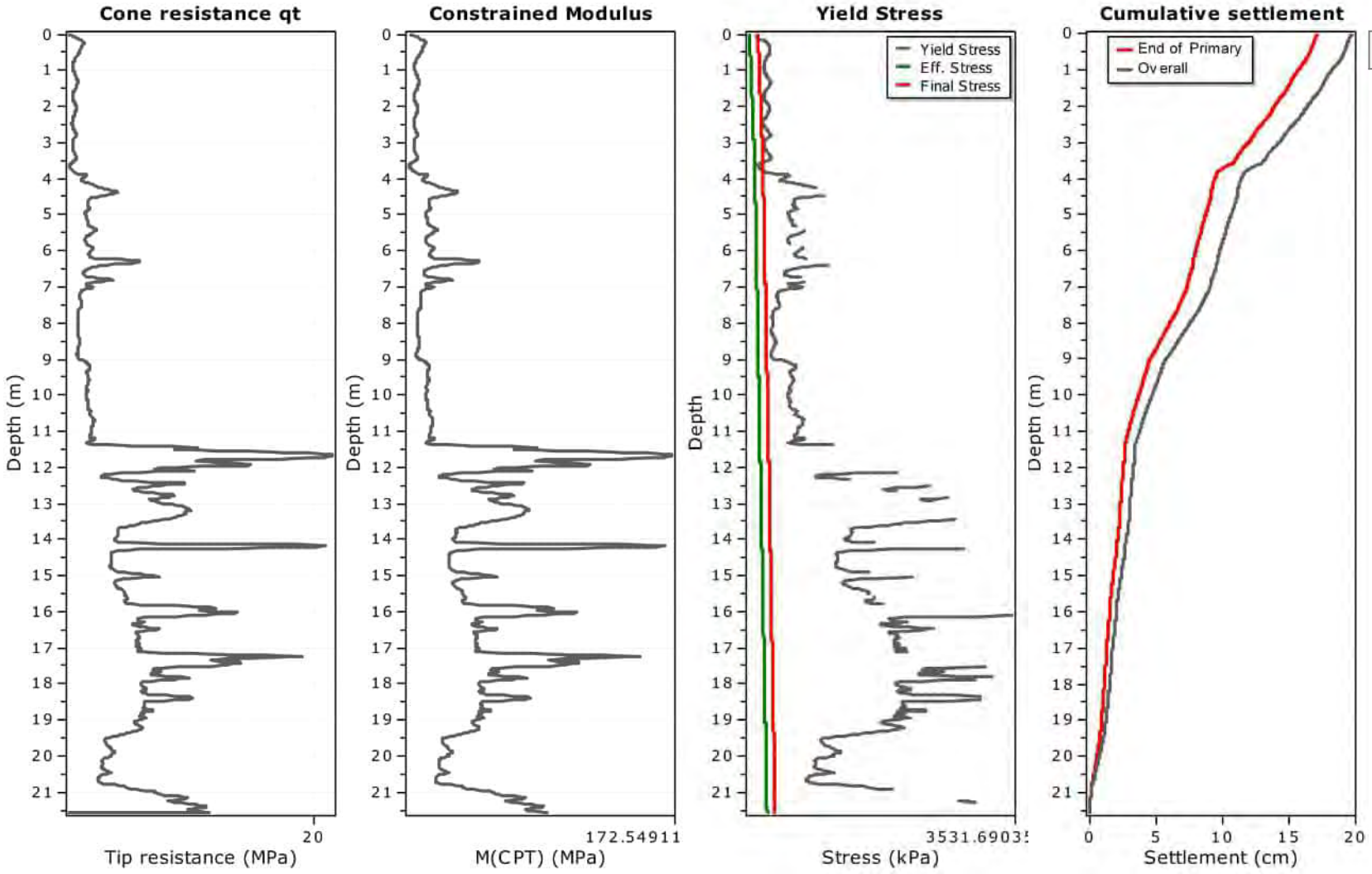
* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 112.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 594 months

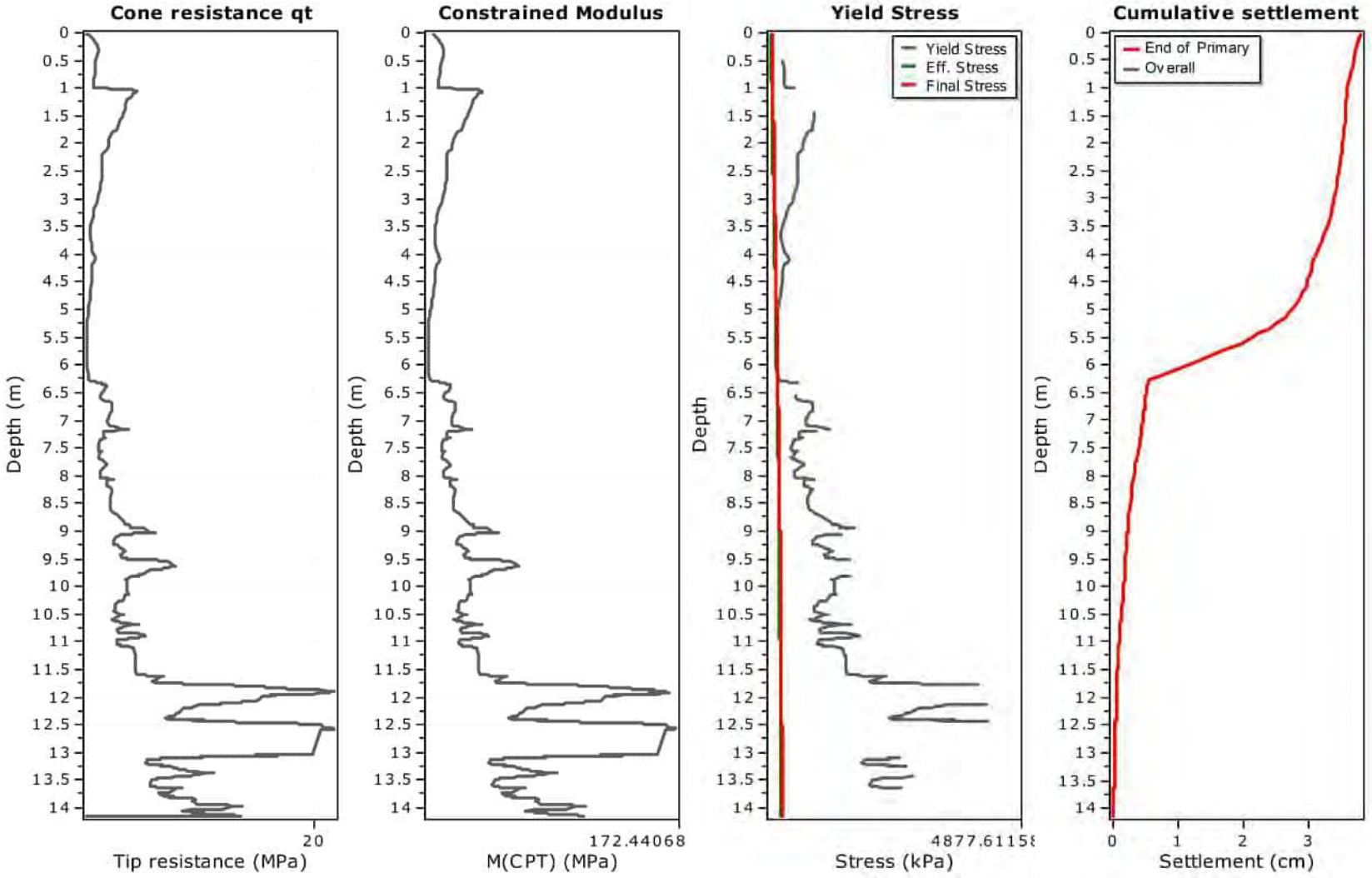
* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 18.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

* Primary settlement calculation is performed according to the following formula:

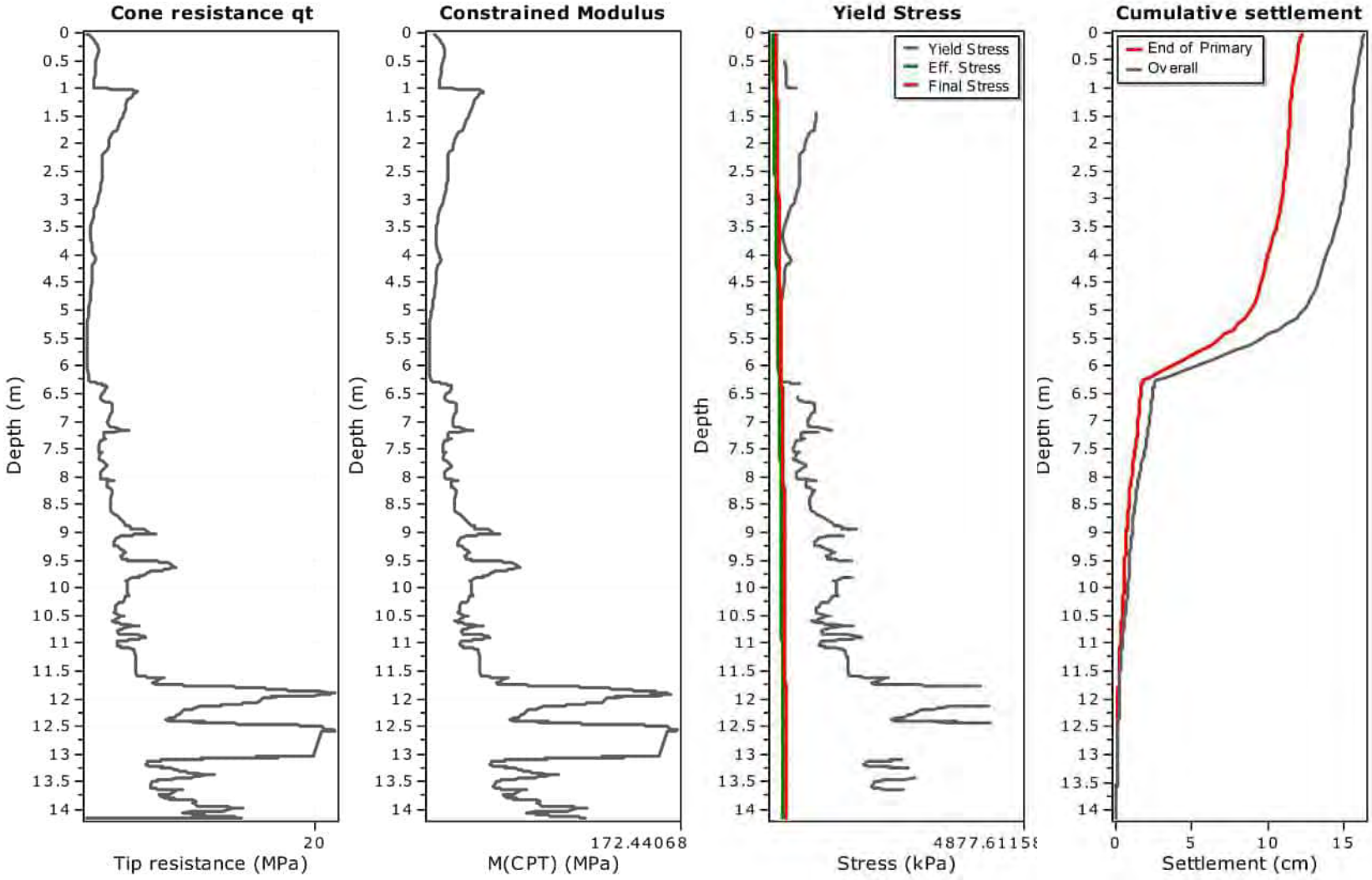
$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

[illegible]

where t_p is the duration of primary consolidation

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 58.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 594 months

* Primary settlement calculation is performed according to the following formula:

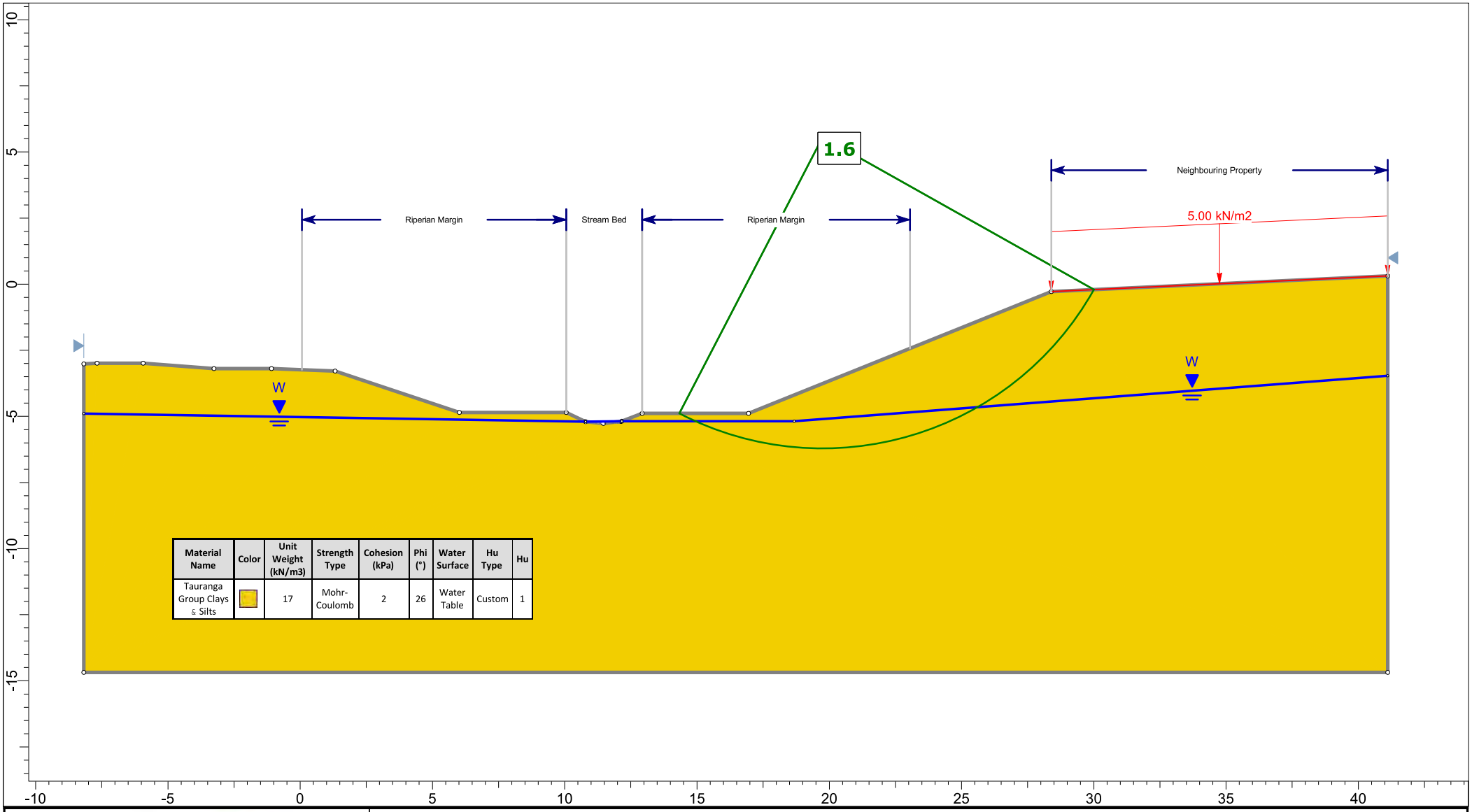
$$S = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

[illegible]

where t_p is the duration of primary consolidation

APPENDIX D
Stability Analyses

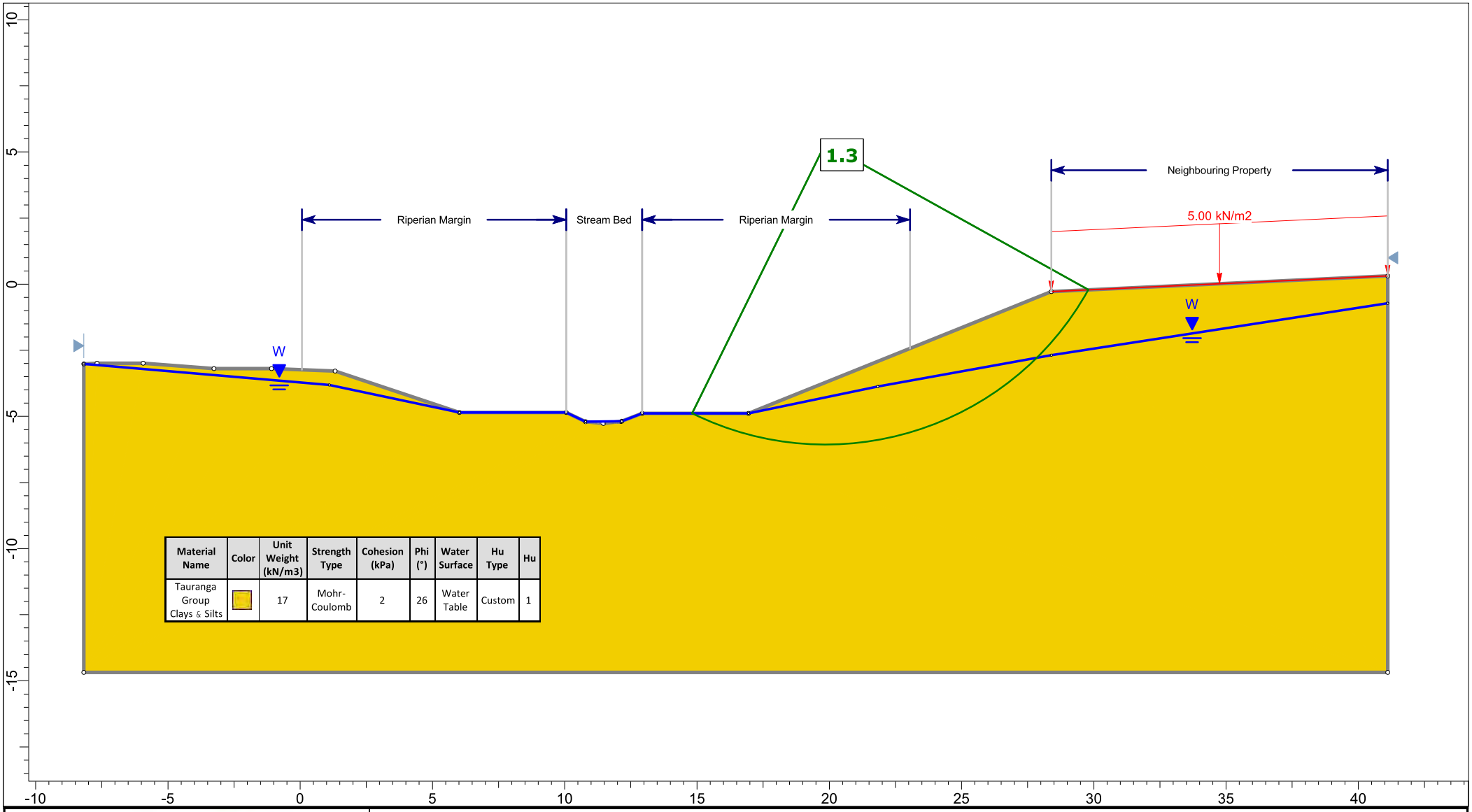


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Tauranga Group Clays & Silts		17	Mohr-Coulomb	2	26	Water Table	Custom	1

CMW Geosciences

SLIDEINTERPRET 9.036

Project	Drury Centre Stage 2		
Group	PROPOSED	*Scenario*	Proposed - Normal GW
Drawn By	SG	*Company*	Kiwi Property
Date	29/11/24	*File Name*	AKS2023-0072_BB_PR_SG_051224.slmd

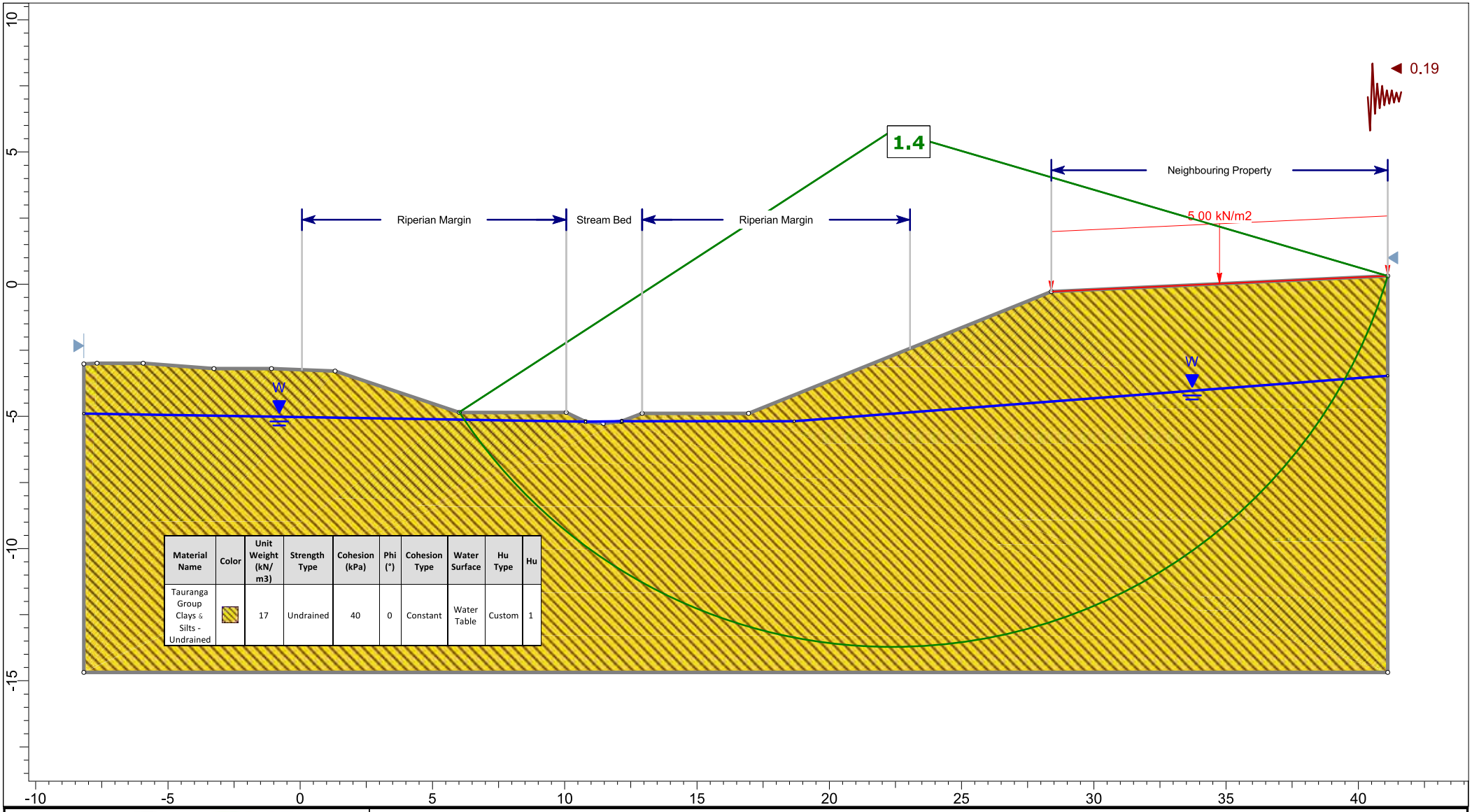


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Tauranga Group Clays & Silts		17	Mohr-Coulomb	2	26	Water Table	Custom	1

CMW Geosciences

SLIDEINTERPRET 9.036

Project	Drury Centre Stage 2		
Group	PROPOSED	*Scenario*	Proposed - High GW
Drawn By	SG	*Company*	Kiwi Property
Date	29/11/24	*File Name*	AKS2023-0072_BB_PR_SG_051224.slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu
Tauranga Group Clays & Silts - Undrained		17	Undrained	40	0	Constant	Water Table	Custom	1

CMW Geosciences

SLIDEINTERPRET 9.036

Project	Drury Centre Stage 2		
Group	PROPOSED	*Scenario*	Proposed Siesmic UD
Drawn By	SG	*Company*	Kiwi Property
Date	29/11/24	*File Name*	AKS2023-0072_BB_PR_SG_051224.slmd

APPENDIX E

Geotechnical Works Specification

06 December 2024

Drury Centre Stage 2

GEOTECHNICAL WORKS SPECIFICATION

Woods

Job No. AKS2023-0072AQ | Version 0

Auckland

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Version control

Document version information	
Jon number	AKS2023-0072AQ
Prepared by	Sam Gibb, Principal Geotechnical Engineer CMEngNZ, CPEng 
Reviewed by	Chris Ritchie, Principal Engineering Geologist CMEngNZ, PEngGeol 

Review and update history

Version	Date	Comments
A	29 November 2024	Initial draft for internal review
0	06 December 2024	Final draft for client review
[00]	[Choose date]	[Enter text]
[00]	[Choose date]	[Enter text]

CONTENTS

1.0 INTRODUCTION

CMW Geosciences (CMW) was engaged by Woods to prepare a Geotechnical Works Specification for a site located at Drury, which is being considered for the construction of the stage 2 Drury Centre.

This specification covers the geotechnical remediation works and associated earthworks outlined in the CMW Investigation Report (GIR), referenced AKS2023-0072AP It supplements the information provided on the design drawings and GIR. It provides detail on the required specification for:

- Site clearance and preparation including topsoil stripping and stockpiling.
- Geotechnical stabilisation works such as shear keys, geotextile reinforced earth slopes (with 30-degree face angle or less) and stability undercuts.
- Subsoil drainage installation.
- Cut to fill earthworks operations.
- Fill materials and testing requirements.
- Earthworks finishing and respread of topsoil; and,
- As-built records.

Excluded from the scope are geotextile reinforced slopes with a face and steeper than 30 degrees or retaining structures covered by a building consent. Such works will be carried out in accordance with an independent structure specific specification.

Unless varied onsite by the Geotechnical Engineer, the following specification requirements must be met in order for CMW to provide a Geotechnical Completion Report (GCR) for the works.

2.0 RELEVANT DOCUMENTS

2.1 Standards, Guidelines and Consents

The works shall comply with the relevant sections of the following standards, guidelines, and consents:

- Health and Safety at Work Act 2015 and Regulations 2016.
- All Project Resource Consent Conditions and Engineering Works Approvals.
- Auckland Council Infrastructure Design Standard
- NZS 4431:2022 Engineered Fill Construction for Lightweight Structures.
- NZS 4402: 1986 Methods of Testing Soils for Civil Engineering Purposes; and,
- NZS 4404: 2010 Code of Practice for Urban Land Subdivision.
- WorkSafe NZ – Excavation Safety Good Practice Guidelines, July 2016.

2.2 Geotechnical Investigation Report

Details of the geotechnical investigation, soil and rock conditions encountered, and the design of the geotechnical remedial works are contained in the CMW report AKS2023-0072AP The contractor should be aware of the contents and comply with the recommendations contained in that report.

2.3 Construction Drawings

The works shall comply with the following geotechnical design drawings and standard details:

- Woods Earthworks Methodology Report, Drury Centre Stage 2, Referenced P24-447-00 and dated 29 November 2024

2.4 Conflicting Information

Where there is any conflict or discrepancy in the requirements of this specification and the documents listed above the matter shall be referred to the Geotechnical Engineer (CMW) for clarification.

3.0 GEOTECHNICAL OBSERVATIONS

The following items form hold points in the construction works that require observation, testing and approval by the Geotechnical Engineer (CMW):

- Foundations for filling once topsoil and unsuitable materials have been stripped prior to fill placement.
- Undercuts to confirm depth and extents prior to backfilling.
- Subsoil drain excavations prior to placement of aggregate;
- Any imported soil fill materials prior to placement on site.
- Drainage aggregate quality prior to placement.
- Geotextile layers once in place and prior to backfilling.
- Filling placed at regular intervals to comply with the fill test frequency requirements below.
- Compaction of backfilling in critical service trenches.
- Flushing of the subsoil drainage system at the completion of earthworks.
- Any unforeseen ground conditions that may impact on the construction works or future land use; and,
- Installation of any settlement monitoring plates or points, application of pre-load and approval prior to its removal.

It is the contractor's responsibility to ensure that the Geotechnical Engineer is given reasonable notice and opportunity to observe the above works and that the works do not proceed until approval has been gained from the Geotechnical Engineer.

24 hours is considered reasonable notice.

4.0 CONSTRUCTION SPECIFICATION

4.1 Site Preparation

The Contractor shall remove all vegetation from the site of the earthworks except for trees indicated for preservation either by marking on the site or noted on the drawings and clear the remainder of the site.

Clearing shall mean the felling of all trees, except those indicated, removal of all growth other than grass and weeds, extraction of tree stumps, demolition of fences and other minor items remaining in the way of site stripping, and the complete disposal of all items. Stumping shall mean the removal of all roots greater than 25mm in diameter.

Cleared areas shall be stripped to remove all turf and organic topsoil to depths designated by the Engineer ahead of or during the stripping operations. Stripping shall also cover picking up any old topsoil stockpiles and any buried topsoil detected during the course of the works. The depth shall be sufficient to remove all materials considered unsuitable as fill or unsuitable to remain beneath fill but will not necessarily extend to the full limit of organic penetration.

4.2 Erosion and Sediment Control

The works shall be carried out in accordance with the project Erosion and Sediment Control Management Plan and associated drawings.

The contractor shall ensure good control of surface water runoff at all times by shaping of the surface in cut and fill areas to prevent ponding during rainfall events.

The location of temporary Sediment Retention Ponds (SRP) on sloping ground shall be decided upon with input from the Geotechnical Engineer. Where comment of SRP stability is sought by Council then all fill materials used to form batters, must be placed as engineered fill and tested accordingly unless advised otherwise by the Geotechnical Engineer.

When decommissioning temporary sediment ponds, all water softened material in the bases and sides of the ponds shall be removed and undercut to the satisfaction of the Geotechnical Engineer. Backfilling of temporary ponds shall be to the compaction standard for general filling unless otherwise specified.

4.3 Stockpiles

Topsoil stockpiles can add significant driving force for slope instability when placed at or near the crest of a slope. The location of all temporary stockpiles must be approved by the Geotechnical Engineer prior to placement. Where stockpiles cannot be avoided above sloping ground, they should be placed over a wide area with the height restricted under the direction of the Geotechnical Engineer.

4.4 Fill Foundations and Benching Slopes

The foundation on which filling is to be placed must be observed by the Geotechnical Engineer following clearing and prior to the placement of any filling to confirm the strength of the underlying soils is sufficient.

Where it is found, after clearing and stripping operations as specified, that the foundation on which filling is to be placed is unstable, or in cuttings if it is found after the excavation has been cut down to the levels shown in the drawings that unstable ground is encountered, then the Engineer may direct that the soft, yielding, or unstable materials causing such instability shall be removed to such depth as directed.

Benching of slopes prior to the placement and compaction of filling should be carried out in accordance with the normal requirements of NZS 4431 and related documents as mentioned above, especially on the steeper areas of the site, to ensure that the filling placed is keyed into the underlying natural ground. This would involve the cutting of benches approximately the width of a bulldozer, with a slight reverse gradient back into the slope. The optimum depth of each bench is best confirmed by careful Engineering inspections during construction.

4.5 Shear Key, Fill Drainage Key and Buttress Fill Excavations

All shear keys, fill drainage keys and buttress fills required to improve long term stability conditions are to be constructed in accordance with the design drawings and standard details. The key/buttress base width, lateral extent and benching requirements need to be confirmed on site by the Geotechnical Engineer during construction. In most cases this requires detailed logging of the excavation faces by a geo-professional and may require trial pits to be dug in the base of the excavation. The contractor should make allowance for the time and plant required for these inspections in their work programme.

4.6 Fill Materials and Conditioning

4.6.1 Material Types

Table 1: Material Types

Material Type	Description	Comments
T	Topsoil	Natural material at surface
F	Fine-grained	Based on more than 35% material passing the 63µm sieve
I	Intermediate-grained	Based on material that has between 15% to 35% passing the 63µm sieve
C	Coarse Grained or aggregate	Based on no more than 15% material passing the 63µm sieve
R	Rock	Material described as rock as per NZGS Field Description of Soil and Rock
M	Manufactured	Any manufactured material created or modified for the purpose of earthworks (such as crushed concrete, recycled asphalt, etc)

The soils at this site are predominantly classified as material type F

4.6.2 Blending of Unsuitables

The blending of ‘unsuitables’ into structural fills may be undertaken only at the discretion of the Geotechnical Engineer following a request by the contractor and with sufficient time for appropriate consideration. Approval for any such blending must be sought from and provided by the Geotechnical Engineer in writing prior to the commencement of any blending.

In consideration of any such requests, the Geotechnical Engineer will need to be able to assess, et. al., the composition of the materials requested to be blended, the location on the site for the proposed fills, the fill depths and the elevation of the blended materials within the fills and any environmental constraints.

As a minimum, it is expected that any blended fills will be directed to comply with the following conditions:

All significant, solid inorganics (such as roots and stumps) to be removed prior to blending; and,

All inclusions of suitable man-made materials (e.g. concrete) and any excavated rock must comply with the normal compaction requirements specified herein in terms of size and ability for appropriate compaction to be achieved in close vicinity to the inclusions.

All blended materials must be appropriately mixed/ blended normal fill materials to the specified ratio. Un-mixed interlayering of normal engineered filling with unsuitables will not be accepted.

As a preliminary indication, it is expected that the ratio of unsuitables to suitable fill will not exceed 1 in 10 by volume.

It is expected that the Geotechnical Engineer will also need to apply limits to the location/ depth of blended fills within any specified fill area.

4.6.3 Hardfill

Hardfill used as structural filling shall be a graded, unweathered, durable, crushed rock product approved by the Geotechnical Engineer, with a grading suitable for compaction.

4.6.4 Material Conditioning

The cut materials on site may require some drying prior to compaction to achieve the required specification. This may be done by harrowing (such as with discs) and air drying when conditions permit or by the addition of hydrated lime.

The addition of lime and/or cement to engineered filling in concentrations greater than 3% requires the approval of the Geotechnical Engineer.

All additives such as lime or cement proposed for use in backfill materials for Reinforced Earth Slopes or other materials in contact with geosynthetics must be approved and monitored by the Geotechnical Engineer.

4.7 Fill Placement, Compaction and Testing Requirements

4.7.1 Soil Fill

Soil placed in fills shall be conditioned and compacted until the following conditions are satisfied.

It should be noted that the surface of the fill area prior to placement of subsequent fill lifts should be in a state so as not to create a break in the consistency of the fill material between lifts. For example, if surfaces are left to dry out, or rolled to seal them from rainfall infiltration then the surface must be broken up and scarified with rippers or by other means to ensure a good bond between fill lifts.

The maximum lift of filling placed before compaction is dependent on the size and nature of the compaction equipment. Typically, 250mm to 300mm loose depth is considered the maximum for a Cat 815/820 type compactor. In any event the contractor must ensure that the fill is placed and compacted to achieve even and adequate compaction throughout each layer/lift.

The test criteria and frequency are set out below.Testing Requirements

Material Type	Test and Method	Acceptance Requirement	Minimum Frequency
F (Fine-grained)	Particle size distribution (NZS4407 test 3.8 or NZS4402.2.8.1)	100% passing 19mm sieve and min. 35% passing 0.075mm sieve	1 per source and 1 per change in material
	Dry density / water content relationship (NZS4402.4.1.1, NZS4402.4.1.2)	OMC and MDD determined	
	Water content (NZS4402.2.1)	Between OMC -2% and OMC +4%	
	Solid density (NZS4402.2.7.1 or 2.7.2)	Solid density determined	
	Liquid and plastic limits (NZS4402.2.2, NZS4402.2.3 and NZS4402.2.4)	PI < 25% and LL <50%	1 per source, 1 per change in material and 1 per 4,000m^3
	Field water content and density (NDM) (NZS4402.2.1 and NZS4407 test 4	>90% MDD and minimum <10% air voids over 10 tests. Maximum single value 12%	2 per 1,000m^3 (minimum 2 per lift)
	Shear strength (NZGS guideline for hand held shear vane)	Minimum average 140kPa over 10 tests. Minimum single value 120kPa	
I (Intermediate-grained)	Particle size distribution (NZS4407 test 3.8 or NZS4402.2.8.1)	100% passing 150mm sieve and max 15% passing 0.075mm sieve	1 per source and 1 per change in material
	Dry density / water content relationship (NZS4402.4.1.1, NZS4402.4.1.2)	OMC and MDD determined	
	Water content (NZS4402.2.1)	Between OMC -2% and OMC +4%	
	Solid density (NZS4402.2.7.1 or 2.7.2)	Solid density determined	
	Liquid and plastic limits (NZS4402.2.2, NZS4402.2.3 and NZS4402.2.4)	PI < 25% and LL <50%	1 per source, 1 per change in material and 1 per 4,000m^3
	Field water content and density (NDM) (NZS4402.2.1 and NZS4407 test 4	>90% MDD and minimum <10% air voids over 10 tests. Maximum single value 12%	2 per 1,000m^3 (minimum 2 per lift)
	Shear strength (NZGS guideline for hand held shear vane)	Minimum average 140kPa over 10 tests. Minimum single value 120kPa	
	Dynamic Cone Penetrometer	>5 blows per 100mm	
C (Coarse-grained)	Particle size distribution (NZS4407 test 3.8 or NZS4402.2.8.1)	100% passing 75mm sieve and min 15% and max 35% passing 0.075mm sieve	1 per source and 1 per change in material
	Dry density / water content relationship (NZS4402.4.1.1, NZS4402.4.1.2)	OMC and MDD determined	
	Water content (NZS4402.2.1)	Between OMC -2% and OMC +4%	
	Solid density (NZS4402.2.7.1 or 2.7.2)	Solid density determined	
	Field water content and density (NDM) (NZS4402.2.1 AND NZS4407 test 4)	>90% MDD and minimum <15% air voids over 10 tests. Maximum single value 12%	1 per 1,000m^3 (min 2 per lift)
	Dynamic Cone Penetrometer	>5 blows per 100mm	2 per 1,000m^3 (min 2 per lift)
	Impact test – 4.5kg hammer (ASTM D 5874)	CIV > 25	1 per 50m^3 on each compacted layer (min 2 per lift)

The test criteria and/or frequency may be relaxed at the discretion of the Geotechnical Engineer (CMW) for the project or in a discrete fill area subject to the consistency of the results achieved being acceptable over a specified period of time

4.7.2 Site Won Rock Fill

A compaction specification is to be determined by the Geotechnical Engineer based on site trials.

4.7.3 Hardfill

The test criteria and frequency are set out below for hardfill.

Testing Requirements			
Material Type	**Test and Method**	**Acceptance Requirement**	**Min Frequency**
GAP65	Particle size distribution (NZS4407 test 3.8 or NZS4402.2.8.1)	Refer GAP65 particle size criteria in NZS4431	1 per source and 1 per change in material
	Dry density / water content relationship (NZS4402.4.1.1, NZS4402.4.1.2)	OMC and MDD determined	
	Solid density (NZS4402.2.7.1 or 2.7.2)	Solid density determined	
	Weathering quality index	AA, AB, AC, BA, BB or CA	
	Field water content and density (NDM) (NZS4402.2.1 AND NZS4407 test 4)	>95% MDD and minimum <15% air voids over 10 tests. Maximum single value 12%	1 per 1,000m^3 (min 2 per lift)
	Dynamic Cone Penetrometer	>5 blows per 100mm	1 per 500m^3 (min 2 per lift)
	Impact test – 4.5kg hammer (ASTM D 5874)	CIV > 25	1 per 50m^3 on each compacted layer (min 2 per lift)
GAP40	Particle size distribution (NZS4407 test 3.8 or NZS4402.2.8.1)	Refer GAP40 particle size criteria in NZS4431	1 per source and 1 per change in material
	Dry density / water content relationship (NZS4402.4.1.1, NZS4402.4.1.2)	OMC and MDD determined	
	Solid density (NZS4402.2.7.1 or 2.7.2)	Solid density determined	
	Weathering quality index	AA, AB, AC, BA, BB or CA	
	Field water content and density (NDM) (NZS4402.2.1 AND NZS4407 test 4)	>95% MDD and minimum <15% air voids over 10 tests. Maximum single value 12%	1 per 1,000m^3 (min 2 per lift)
	Dynamic Cone Penetrometer	>5 blows per 100mm	1 per 500m^3 (min 2 per lift)
	Impact test – 4.5kg hammer (ASTM D 5874)	CIV > 25	1 per 50m^3 on each compacted layer (min 2 per lift)

4.7.4 Compaction Testing Reporting Requirements

All test location coordinates to be recorded by handheld GPS with reference to the NZTM projection. Test location coordinates, with date and test number reference are to be provided to the Geotechnical Engineer in electronic (excel) format on a weekly basis. Alternatively, the Geotechnical Engineer may approve the use of site plans to mark the location of tests in lieu of GPS location.

The volume of filling placed for each progress claim month (typically ending 20th of the month) including all filling placed (undercut and cut to fill) to be provided to the Geotechnical Engineer monthly by the contractor or Engineer to the Contract to allow assessment of test frequency adequacy.

Interim fill test summaries are to be provided to the Geotechnical Engineer for review on a regular basis.

4.8 Subsurface Drainage

4.8.1 General

Drainage for shear keys, fill drainage keys, buttress fills, underfill gully drains and counterfort drains shall be constructed in accordance with the design drawings and standard details.

4.8.2 Materials

4.8.2.1 Pipes

Drainage pipes used in subsoil drainage shall be 160mm diameter highway grade drain coil. Drain coil walls shall be perforated or solid as detailed in the design drawings or directed by the Geotechnical Engineer on site. Drain coils shall not have a geofabric filter sock unless requested by the Geotechnical Engineer on site.

4.8.2.2 Aggregate

Auckland Council now generally require that subsoil drainage has a 100-year design life and is essentially maintenance free, unless there is an entity such as body corporate or resident's association that maintenance responsibility can be transferred to. Maintenance by individual owners is not practical as the subsoil drainage systems usually cross over, and generally benefit, multiple lots.

This requires a high-quality drainage aggregate with the following properties:

- Self-filters against the soils present on site preventing loss of permeability over time; or, able to be practically wrapped in a suitable geofabric filter.
- High permeability, which translates to a low fines content; and
- Stable and not subject to crushing, weathering, internal erosion or piping, or significant loss of volume (settlement) over time.

Ideally the drainage aggregate should be a well graded self-filtering material such as a clean (free of significant cohesive fines) scoria SAP50 product or Transit F/2 specification filter media.

Alternatively, for shear key drainage, blanket drains, underfill drainage and all applications where full encapsulation with a geofabric filter cloth can be relatively simply and safely achieved, an open graded product, preferably 27/7 Scoria may be used. Care will need to be taken to ensure that the cloth fully encapsulates the aggregate. Observation of the cloth wrap should form an inspection hold point prior to backfilling over the drain. Drain coils in this instance do not require a filter sock.

For counterfort trench drains and applications where a full filter cloth wrap is not practical to construct, and the performance of the drain is not critical to maintaining slope stability then a SAP20 or SAP50 may be used without a filter cloth wrap. Drains which fall into this category must be defined and confirmed as such by the Geotechnical Engineer. Additionally, where such materials are used, regular visual inspections and approval of the aggregate quality and laboratory grading curves is required. This is to comprise visual inspection of each site stockpile prior to material being placed in the trench. One wet sieve grading curve from each site stockpile per week is required while material is being imported to site to monitor the fines content. Drain coils in this instance do not require a filter sock.

For counterfort trench drains and applications where a full filter cloth wrap is not practical to construct, and the performance of the drain is critical to maintaining slope stability then a TNZ/F2 or (approved) modified F2 aggregate must be used. In conjunction with this an approved high specification drainage pipe with filter cloth surround such as the Megaflo products may be specified.

Light compaction (i.e. tamping with back of excavator bucket) only is to be applied to drainage aggregates.

4.8.2.3 Filter Cloth

Any filter cloth surround specified on the drawings shall meet the requirements of Transit Specification TNZ/F7, Filtration Class 2 and Strength Class B unless otherwise specified on the drawings.

4.8.2.4 Trench Backfill in Service Trenches

It is important on all sloping land that service trenches running parallel to contours are avoided where possible as they can permit the ingress of surface water and/or lateral movement of trench sides that could lead to progressive land slippage, help develop tension cracks and possibly lead to slope and building instability.

Backfilling of all trenches should be to the general fill standard above unless specifically varied in writing by the Geotechnical Engineer and where possible the pipe bedding in all trenches on steep ground should contain a 50mm diameter perforated drain coil that is connected into each manhole on the line. This is to help prevent instability arising from the ingress of surface water and/or lateral movement of trench sides that could lead to progressive land slippage and is especially important where the lines are in close proximity to buildings.

The subdivision drain laying contractor must be made aware of these requirements and of the need to contact us when trench backfilling is to take place.

4.8.3 Depth and Extent

The location, extent and depth of the drainage shown on the design drawings may be varied on site by the Geotechnical Engineer in response to the ground conditions encountered.

4.8.4 Drainage Outlets and Inspection Points

Outlets for subsurface drainage shall be provided at regular intervals shown on the drawings or as determined on site by the Geotechnical Engineer. Pipe outlets shall be specifically formed structures with adequate protection such as a headwall and/or rock rip rap. The position of all outlets shall be recorded on the asbuilt drawings.

Where possible it is good practice to include additional inspection and/or flushing points in the subsoil drainage system in the event that their performance needs to be confirmed in the future.

In any event, at least one temporary flush point is required for each subsoil drainage system to enable flushing of the system once the earthworks are substantially complete.

The flushing of the subsoil drainage system must be witnessed by the Geotechnical Engineer.

4.9 Finishing Works and Topsoil Spread

4.9.1 Overcut

All areas cut to below finished level should be reinstated with engineered filling to the satisfaction of the Geotechnical Engineer.

4.9.2 Topsoil Depth

Topsoil respread depth should be between 100mm and 300mm, or as directed by the Engineer to the contract. On ground steeper than 1V:3H the surface should be roughened under the supervision of the Geotechnical Engineer prior to topsoil placement.

4.9.3 Unsuitable Materials

At the conclusion of earthworks all surplus unsuitable materials should be removed from site or placed in designated permanent stockpiles. The size and location of such stockpiles must be approved by the Geotechnical Engineer and recorded on the asbuilt drawings.

4.9.4 Road Subgrades

Testing and formation of road subgrades will be carried out as part of the subdivision civil works package.

5.0 ASBUILT INFORMATION REQUIREMENTS

In order to provide a Geotechnical Completion Report (GCR) certain as-built information must be provided to CMW. It is the contractor's responsibility to ensure that all of the following items are surveyed prior to placing filling. The survey of these items should therefore form a hold point in the construction sequence.

- The location and invert of all sub surface drainage; and,
- The depth of filling placed including all benching, undercuts, shear or fill drainage keys and temporary ponds which have been backfilled.
- CMW require the following as-built information to be provided for the GCR:
- Cut and fill depth plan (including undercuts and shear keys).
- Final contour plan.
- Drainage locations and inverts (surface and subsurface).
- Drainage outlet locations (surface and subsurface).
- Details of any defined overland flow paths.
- Location and heights of any retaining walls and Mechanically Stabilised Earth (MSE) structures.
- Position and extent of any geogrid layers (in plan view).
- Material data for imported products used such as draincoils, aggregates and geofabrics as well as confirmation that products installed comply with the requirements of the project drawings and this specification; and,
- Any settlement Monitoring Data.

APPENDIX F
Groundwater Assessment

GROUNDWATER ASSESSMENT

Project Number	Project Name
AKS2023-0072	Drury Central

Assessment of geotechnical aspects of proposed development with respect to the Auckland Unitary Plan Operative in Part

Chapter E: Auckland-wide rules, Natural resources»E7 Taking, using, damming and diversion of water and drilling»E7.6. Standards Permitted activities»E7.6.1. Permitted activities »E7.6.1.6. Dewatering or groundwater level control associated with a groundwater diversion permitted under Standard E7.6.1.10

Condition		Geotechnical Integration of Compliance
	Compliant	
1. The water take must not be geothermal water		1. Not in a geothermal zone
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		2. Lowest measured groundwater below the cut level, therefore groundwater unlikely to be encountered
3. The water take must only occur during construction		3. As above

Chapter E: Auckland-wide rules, Natural resources»E7 Taking, using, damming and diversion of water and drilling»E7.6. Standards Permitted activities»E7.6.1. Permitted activities »E7.6.1.10. Diversion of groundwater caused by any excavation, (including trench) or tunnel

Condition		Geotechnical Integration of Compliance
1.All of the following activities are exempt from the Standards E7.6.1.10(2) – (6) *a. pipes cables or tunnels including associated structures which are drilled or thrust and are less than 1.2m in external diameter* *b. pipes including associated structures up to 1.5m in external diameter where a closed faced or earth pressure balanced machine is used* *c. piles up to 1.5m in external diameter are exempt from these standards* *d. diversions for no longer than 10 days; or* *e. diversions for network utilities and road network linear trenching activities that are progressively opened, closed and stabilised where the part of the trench that is open at any given time is no longer than 10 days*	Compliant	a. There are not expected to be any pipes cables or tunnels≥1.2 m. b. N/A due to compliance with 1(a) above. c. No piles planned at this stage d. Groundwater unlikely to be encountered (below lowest maximum cut depth) e. These aren't planned at this stage
2.Any excavation that extends below natural groundwater level, must not exceed: *a. 1ha in total area; and* *b. 6m depth below the natural ground level*	Compliant	a. Groundwater is below the maximum cut depth b. Groundwater is below the maximum cut depth
3.The natural groundwater level must not be reduced by more than 2m on the boundary of any adjoining site.	Compliant	3. No groundwater drawdown anticipated as the groundwater is below the maximum cut depth
4.any structure, excluding sheet piling that remains in place for no more than 30 days, that physically impedes the flow of groundwater through the site must not: *a. impede the flow of groundwater over a length of more than 20m; and* *extend more than 2m below the natural groundwater level.*	Compliant	a. no structures of this natural planned at this stage b. no structures of this natural planned at this stage
5.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: *a.trench or open excavation that extends below natural groundwater level must be at least equal to the depth of the excavation* *b.tunnel or pipe with an external diameter of 0.2 - 1.5m that extends below natural groundwater level must be 2m or greater; or* *c.a tunnel or pipe with an external diameter of up to 0.2m that extends below natural groundwater level has no separation requirement.*	Compliant	a. All adjacent structures are anticipated to be outside of this extent. b. All adjacent structures are anticipated to be outside of this extent. c. Not required
6.The distance from the edge of any excavation that extends below natural groundwater level, must not be less than:	Compliant	

a.50m from the Wetland Management Areas Overlay *b.10m from a scheduled Historic Heritage Overlay; or* *c.10m from a lawful groundwater take.*		a. The edge of any excavation will not be within 50m of any Wetland Management Areas Overlay. b. The edge of any excavation will not be within 10m of a scheduled Historic Heritage Overlay c. The edge of any excavation is not expected to be within 10m of a lawful groundwater take

APPENDIX G

Wetland 2-2 and Shared Path Review

26 February 2025 Document Ref: AKS2023-0072AQ Rev 1

Kiwi Property Holdings No.2 Limited c/o Woods
6 Nugent Street
Newmarket, Auckland

Dear Colin

RE: WETLAND 2-2 AND SHARED PATH, ROAD 2 NORTH
DRURY CENTRAL

1.0 INTRODUCTION

CMW Geosciences were engaged by Kiwi Property Holdings No.2 Limited to carry out a geotechnical assessment of a proposed wetland development and preliminary shared path alignment to be constructed as part of the Drury Centre Stage 2 Development which forms part of the greater Drury Centre Precinct.

The scope of work and associated terms and conditions of our engagement were detailed in our services proposal referenced AKS2023-0072AR REV 0 VO6 dated 17th February 2025.

The purpose of this report is to review the global slope stability of the wetland and provide a preliminary review of the proposed shared path alignment.

2.0 PROPOSED DEVELOPMENT

With reference to the Drury Centre Proposed Wetland and shared path drawings prepared by Woods, (ref. P23-315-04-20 & P24-447-01-36) presented in Appendix B, the development proposal includes:

- Wetland 2-2 is located south of Road 2 North and has an approximate area of 3000m2. This will be formed from cuts up to 5m deep and fills up to 0.9m high.
- The proposed shared path and maintenance accessway consists of a 165m long, 3.5-4m wide asphalt surfaced track that extend from west of wetland 2-2 towards Flanagan Road.
- A timber boardwalk and shared path extends towards the south-east of wetland 2-2 (not assessed as part of this report).

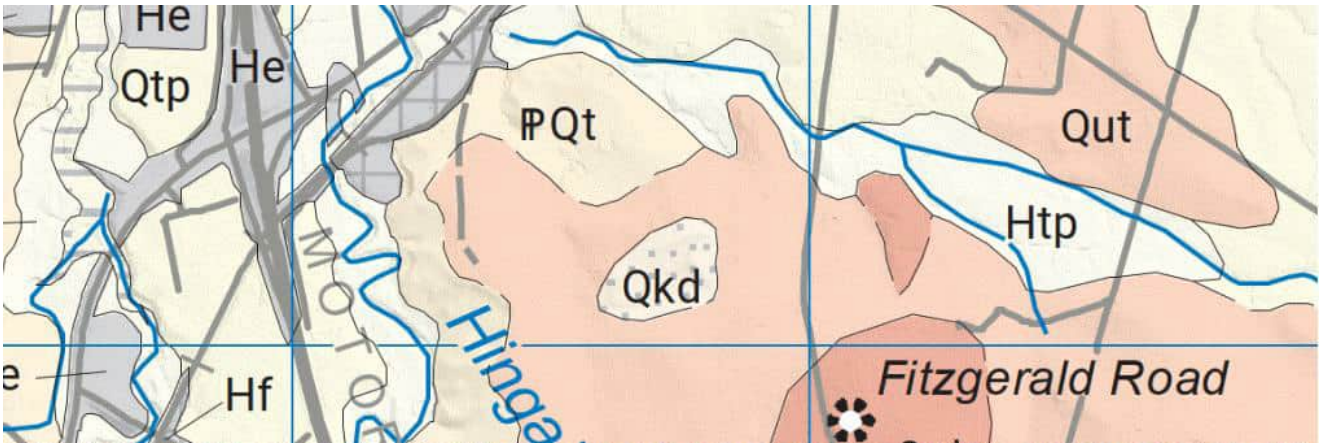
3.0 DESKTOP STUDY

3.1 Published Geology

Published 1:50,000 scale geological maps for Pukekohe from GNS (Bland et al, 2023) for the general project area depict the regional geology as comprising undifferentiated tephra of the Kerikeri Volcanic Group (Qut)

Takanini Formation (PQt) and Anthropogenic fill deposits related to construction/quarry fill or landfill (HF). The Kerikeri Volcanic Group materials comprise of weathered airfall tephra and tuff deposits from eruptions in the local area, whilst the Takanini Formation (PQt) comprise poorly to moderately consolidated shallow marine deposits of sand and mud.

Figure 1: Regional Geology (GNS Science Web Geology Map)



3.2 Existing Geotechnical Information

A desktop study review of the existing geotechnical investigations carried out by Aurecon New Zealand Limited for Drury Centre referenced 510611 REV 5 and dated 04/10/2022 was undertaken.

Relevant investigation locations are shown on Drawing 01 (AC) in Appendix A, the investigation logs extracted from the Aurecon GIR can be found in Appendix C. These comprised the following:

Test Pits: TP026, TP027, TP028

Hand Augers: HA007, HA09, HA10

Machine Boreholes: BH008, BH009, BH011

Cone Penetration Testing: CPT033, CPT040, CPT041, CPT048, CPT049.

4.0 WETLAND 2-2

The key geohazard for the proposed Wetland 2-2 is slope instability. The following sections describe analysis carried out to assess this geohazard.

4.1 Ground Model

The Aurecon investigations were used to generate a representative ground model. Representative cross sections are shown on the stability models in Appendix D, with the locations shown on Drawing 01 (AC) and Figure 2.

4.1.1 Recommended Geotechnical Parameters

Table 1 summarises the geotechnical parameters adopted for the Road 2 Project by CMW Geosciences and used in wetland slope stability analysis.

Table 1: Geotechnical Parameters

Geological Unit		Description	Unit Weight γ (kN/m3)	Effective Cohesion c´ (kPa)	Effective Friction Angle ϕ´ (deg)	Undrained shear strength Su (kPa)
Engineered Fill (Site won)		Clay/Silt with minor gravel.	18	5	30	--
South Auckland Volcanic Field [SAVF]	Completely Weathered Volcanics to Residual Soil [SAVF] (CW to RS)	Clay and Silt, with minor gravel (basalt rock fragments).Potential for basalt boulders.	17	5	28	175
Tauranga group (Older deposits)	Tauranga group (Older deposits), overlying and interbedded with SAVF (TA-Young)	Alluvial and colluvial deposits (clay, organic silt, silt, peat, sand) and reworked tephra (pumiceous sand or silt)	17	5	26	150
Unit weight, g = typical published values for similar soil types Effective cohesion, c' and Effective friction angle, f' = based on the published literatures for effective cohesive parameters, correlated to CPT and laboratory testing on the wider Drury Centre Development area Undrained shear strength = lower bound value determined from vane shear testing						

4.1.2 Groundwater

Groundwater was not encountered in the Aurecon investigations within this area.

4.2 Slope Stability

4.2.1 Design Criteria

We have been informed that the wetland earthworks design will need to meet the NZTA Bridge Manual, Version 3.3 (BM3.3) design criteria below:

- The geotechnical seismic design of the wetland embankments will be based on an IL3+ importance level (Tables 2.1 to 2.3), this considers the road to be classified as National (High Volume).
- Seismic design loads are to be adopted form the Site Specific Seismic Hazard Assessment, SSHA (Bradley 2024) for SH1 Drury Off Ramp and Bridge Project (Table 2 below).

4.2.2 Seismicity

The following peak ground accelerations have been adopted from the SSHA in respect to the proposed wetland, AEP values are based on the BM3.3 Table 2.2 (IL3+).

Table 2: Seismic Design Loads

Limit State	AEP	R	PGA(g)	$Magnitude_{eff}$
SLS1 (No damage)	1:25	0.25	0.02	6.2
SLS2 (Operation continuity)	1:100	0.5	0.06	6.2
DCLS	1:1500	1.50	0.26	6.3
Note: SLS = serviceability limit state; DCLS = damage control limit state; AEP = annual exceedance probability				

4.2.3 Slope Stability Analysis

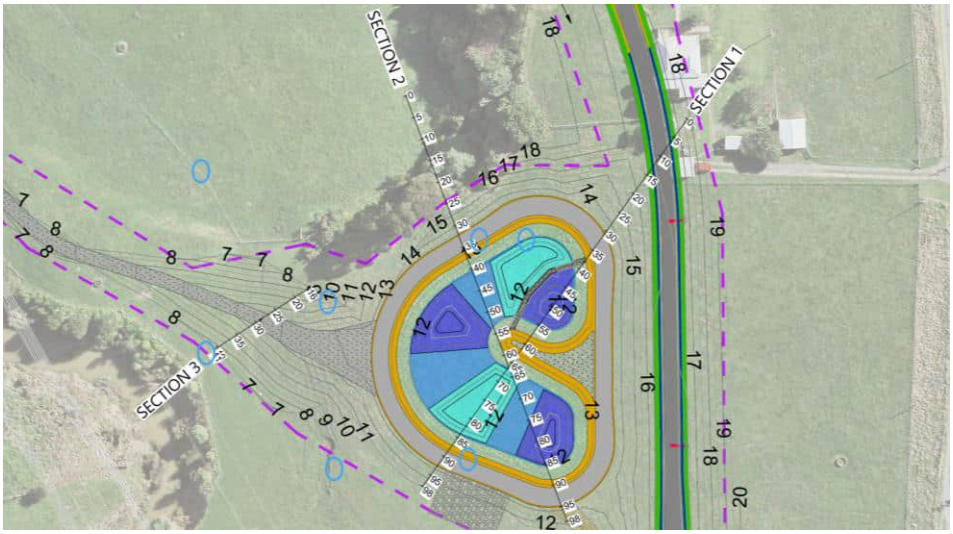
A global slope stability check was carried out using Slide2 for critical cross sections labelled 1 and 2 as shown on Figure 2 below and on Drawing 01(AQ), in accordance with BM3.3. The results of this stability modelling can be found in Table 3 below, with selected print outs in Appendix D.

The slope stability sections analysed were found to achieve the required factors of safety.

Table 3: Slope Stability Factor of Safety Criteria

Condition	Required Factor of Safety (BM3.3)
Static long-term conditions (effective stress soil shear strengths, normal groundwater, normal traffic loading)	1.5
Transient short-term conditions (elevated groundwater conditions, overload traffic loading)	1.2
DCLS seismic condition[1]	1.0
Note: 1. Factor of safety < 1.0 acceptable where displacement-based approach is adopted	

Figure 2: Wetland 2-2 Critical Stability Sections



4.3 Recommendations

The assessment of slope instability indicates that the proposed wetland achieves the slope stability factor of safety criteria outlined in BM3.3. The following recommendations must be considered during construction:

- All earthwork activities must be carried out in general accordance with the requirements of NZS 4431 and the requirements of the Auckland Council Infrastructure Development Code under the guidance of a Chartered Professional Geotechnical Engineer.
- Preparation of the subgrade beneath the proposed bund fill areas should comprise stripping of all vegetation, topsoil, any pre-existing fill materials or weak soils followed by benching of the exposed subgrade where natural slopes beneath the fill exceed gradients of nominally 1:5 (vertical to horizontal). The subgrade should then be scarified and moisture conditioned where necessary and then proof rolled to verify the subgrade stiffness and consistency.
- Bund fills must comprise structural engineered fill constructed to the Geotechnical Works Specification for the wider subdivision referenced AKS2023-0072AQ Rev 0 dated 6 December 2024. Earthfill must be placed, spread and compacted in controlled 250mm to 300mm thick (loose) lifts under the direction of a geotechnical engineer. The fill may comprise either granular or cohesive material subject to being free of any organic material and having no particles greater than 150mm diameter.
- Subgrade materials will need to consist of a low permeability clay to prevent excessive seepage and as such allowance should be made for lining the pond with a minimum of a metre of engineered clay fill.

5.0 PRELIMINARY SHARED PATH CONSIDERATIONS

It is understood that at this stage the alignment of the shared path is considered preliminary and may be subject to change following discussions with wider stakeholders. As such we have not undertaken detailed investigations at this stage.

5.1 Preliminary Ground Model

A preliminary ground model is described below is based on limited site investigations carried out in this area.

- It is understood that soft contaminated ground is present along the shared path alignment, in particular between chainage 80 and 165. Existing information within this area included TP27 was abandoned due the presence of contaminants. HA009 refused on fill at 0.4m depth.
- From chainage 80 to 0, the existing ground information suggests that the ground conditions comprise Tauranga Group Alluvium and South Auckland Volcanic Group materials, as described in Table 4.0 for Wetland 2-2.

5.2 Preliminary Geohazards Assessment

A review of the ground model presented above, and the proposed shared path alignment suggest the following:

<u>Chainage 0 to 80 – Fill Embankment</u>

- Global stability of this embankment will need to be checked once further ground investigation is carried out. It is understood that this fill embankment has proposed slopes of 1V:2H which are likely to undergo soil creep without further treatment such as geogrid reinforcement.
- The proposed fill embankment is up to 5m high, this is likely to cause load induced settlement of the underlying alluvium. Given the very stiff nature of the alluvium these settlements are likely to be largely ‘built out’ during construction and present a low risk of ongoing creep settlements that may cause ongoing damage to the proposed asphalt surface. This will need to be checked once further investigations are carried out and the shared path alignment is finalised.

<u>Chainage 80 to 165 – Potentially Soft Contaminated Fill Area</u>

- Fills in this area are limited to less than 1.0m in height so the risk of load induced consolidation settlements are low. However, this should reviewed following further investigation to check that secondary creep settlements are not excessive.
- If secondary creep settlements are considered excessive, treatments may include undercut and replacement of the soft materials, preloading/surcharge or the use of imported light weight fills (such as pumice sand).
- Where fills are not present, subgrade conditions are expected to be poor with low natural %CBR values. Subgrade improvement in the form of undercutting and replacement with engineered fills and/or lime stabilisation may be required.
- For particularly soft contaminated areas, the use of timber boardwalks with driven timber piles may be a more suitable solution.
- Areas in close proximity to the Hingaia Stream may be subject to global instability risk and/or ongoing soil creep. Set backs may be required once the ground model is further understood.

6.0 FURTHER WORK

As described in Section 5, further geotechnical investigation is required for the shared path alignment. This should comprise a series of hand auger boreholes evenly scaped along the alignment once this is finalised.

7.0 CLOSURE

Additional important information regarding the use of your CMW letter is provided in the '*Using your CMW Report*' document attached to this report.

This report has been prepared for use by Kiwi Property Holdings No.2 Limited in relation to the Drury Central Stage 2 project in accordance with the scope, proposed uses and limitations described in the report. Should you have further questions relating to the use of your report please do not hesitate to contact us.

Where a party other than Kiwi Property Holdings No.2 Limited seeks to rely upon or otherwise use this report, the consent of CMW should be sought prior to any such use. CMW can then advise whether the report and its contents are suitable for the intended use by the other party.

For and on behalf of CMW Geosciences

Prepared by:

Tasneem Khan
Geotechnical Engineer

Reviewed and authorised by:

Chris Ritchie
Principal Engineering Geologist

Distribution: 1 electronic copy to Colin Dryland via email
Original held at CMW Geosciences

Appendix A: CMW Drawings
Appendix B: Development Plans
Appendix C: Existing Investigation / Logs
Appendix D: Slope Stability Analysis.

USING YOUR CMW GEOTECHNICAL REPORT

Geotechnical reporting relies on interpretation of facts and collected information using experience, professional judgement, and opinion. As such it generally has a level of uncertainty attached to it, which is often far less exact than other engineering design disciplines. The notes below provide general advice on what can be reasonably expected from your report and the inherent limitations of a geotechnical report.

Preparation of your report

Your geotechnical report has been written for your use on your project. The contents of your report may not meet the needs of others who may have different objectives or requirements. The report has been prepared using generally accepted Geotechnical Engineering and Engineering Geology practices and procedures. The opinions and conclusions reached in your report are made in accordance with these accepted principles. Specific items of geotechnical or geological importance are highlighted in the report.

In producing your report, we have relied on the information which is referenced or summarised in the report. If further information becomes available or the nature of your project changes, then the findings in this report may no longer be appropriate. In such cases the report must be reviewed, and any necessary changes must be made by us.

Your geotechnical report is based on your project's requirements

Your geotechnical report has been developed based on your specific project requirements and only applies to the site in this report. Project requirements could include the type of works being undertaken; project locality, size and configuration; the location of any structures on or around the site; the presence of underground utilities; proposed design methodology; the duration or design life of the works; and construction method and/or sequencing.

The information or advice in your geotechnical report should not be applied to any other project given the intrinsic differences between different projects and site locations. Similarly geotechnical information, data and conclusions from other sites and projects may not be relevant or appropriate for your project.

Interpretation of geotechnical data

Site investigations identify subsurface conditions at discrete locations. Additional geotechnical information (e.g. literature and external data source review, laboratory testing etc) are interpreted by Geologists or Engineers to provide an opinion about a site specific ground models, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist due to the variability of geological environments. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. Interpretation of factual data can be influenced by design and/or construction methods. Where these methods change review of the interpretation in the report may be required.

Subsurface conditions can change

Subsurface conditions are created by natural processes and then can be altered anthropically or over time. For example, groundwater levels can vary with time or activities adjacent to your site, fill may be placed on a site, or the consistency of near surface conditions might be susceptible to seasonal changes. The report is based on conditions which existed at the time of investigation. It is important to confirm whether conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

Interpretation and use by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. To help avoid misinterpretations, it is important to retain the assistance of CMW to work with other project design professionals who are affected by the contents of your report. CMW staff can explain the report implications to design professionals and then review design plans and specifications to see that they have correctly incorporated the findings of this report.

Your report's recommendations require confirmation during construction

Your report is based on site conditions as revealed through selective point sampling. Engineering judgement is then applied to assess how indicative of actual conditions throughout an area the point sampling might be. Any assumptions made cannot be substantiated until construction is complete. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances from previous assumption, conduct additional tests if required and recommend solutions to problems encountered on site.

A Geotechnical Engineer, who is fully familiar with the site and the background information, can assess whether the report's recommendations remain valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

Environmental matters are not covered

Unless specifically discussed in your report environmental matters are not covered by a CMW Geotechnical Report. Environmental matters might include the level of contaminants present of the site covered by this report, potential uses or treatment of contaminated materials or the disposal of contaminated materials. These matters can be complex and are often governed by specific legislation.

The personnel, equipment, and techniques used to perform an environmental study can differ significantly from those used in this report. For that reason, our report does not provide environmental recommendations. Unanticipated subsurface environmental problems can have large consequences for your site. If you have not obtained your own environmental information about the project site, ask your CMW contact about how to find environmental risk-management guidance.

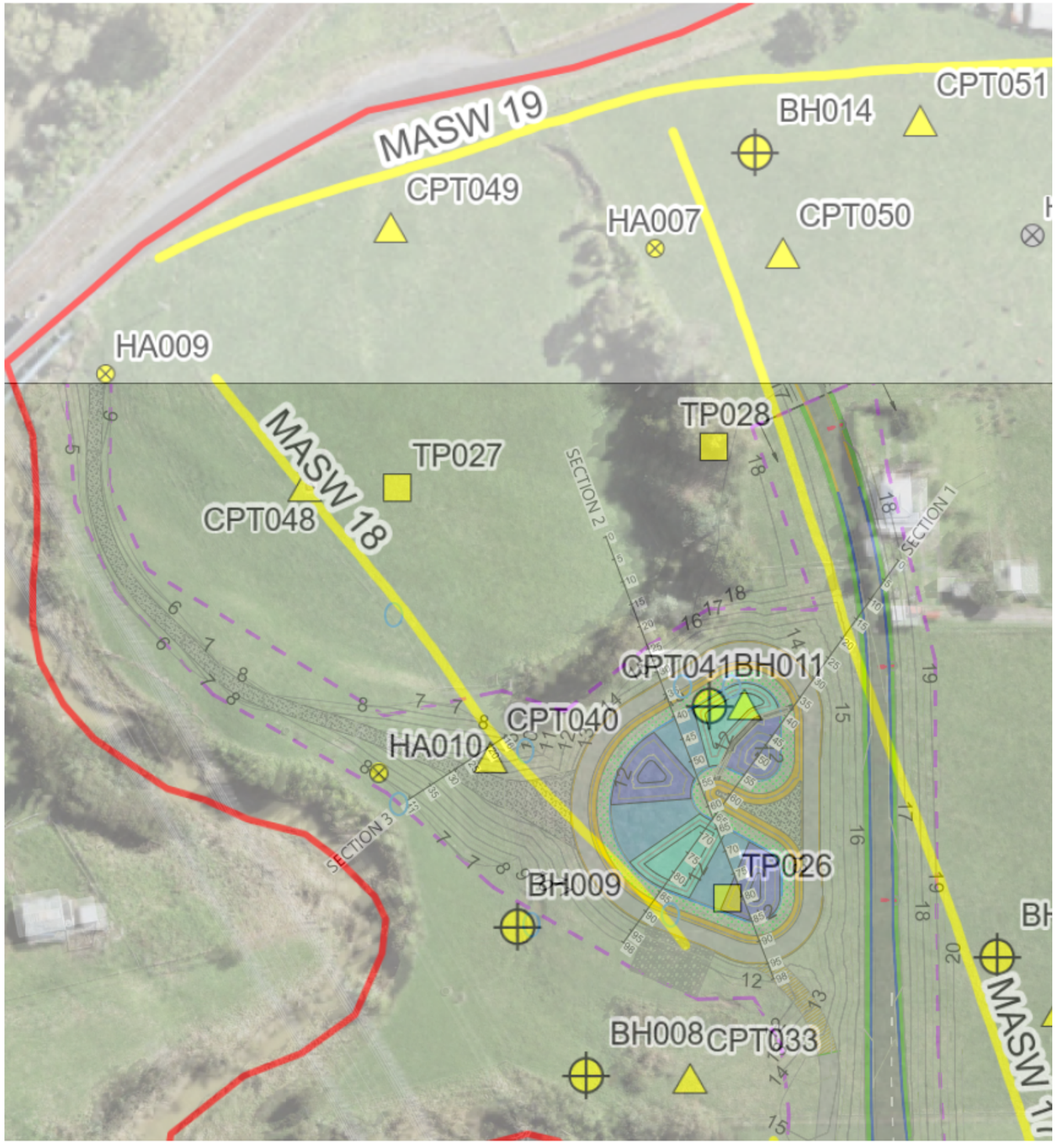
APPENDIX A
CMW Drawings

NOTES:

1. STORMWATER POND LOCATION FROM WOODS PLANS
2. TEST LOCATIONS FROM AURECON GIR

LEGEND:

⊗	HAXX	HAND AUGER (HA) LOCATION (AURECON)
△	CPTXXX	CONE PENETROMETER (CPT) LOCATION (AURECON)
⊕	BHXXX	BOREHOLE (BH) LOCATION (AURECON)
□	TPXXX	TEST PIT (TP) LOCATION (AURECON)



CMW Geosciences Great People | Practical Solutions	CLIENT: KIWI PROPERTY HOLDINGS NO2. LTD	DRAWN: EM	PROJECT: AKS2023-0072
	PROJECT: DRURY CENTRAL ROAD 2 NORTH	CHECKED: TK	DRAWING: 01
		REVISION: 0	SCALE: NTS
	TITLE: EXISTING GEOTECHNICAL INFORMATION	DATE: 19/02/2025	SHEET: A3

CMW Geosciences
Great People | Practical Solutions

APPENDIX B
Development Plans

NOTES

1. ALL WORKS & MATERIALS TO COMPLY WITH AUCKLAND TRANSPORT STANDARDS. ANY AMBIGUITY BETWEEN THESE DRAWINGS & THE STANDARDS IS TO BE REFERRED TO THE ENGINEER FOR CLARIFICATION.
2. ALL CATCHPITS TO BE SEMI-RECESSED 800X500 WITH 1.2M LINTEL UNLESS SPECIFIED OTHERWISE.
3. FOOTPATHS AND KERBS ARE TO BE CONSTRUCTED AS PER THE TYPICAL CROSS SECTIONS.
4. PRAM CROSSINGS TO BE CONSTRUCTED AS PER AUCKLAND TRANSPORT STANDARDS.
5. VEHICLE CROSSINGS SHOWN ON THIS PLAN ARE FOR PLANNING PURPOSES ONLY & WILL NOT BE CONSTRUCTED UNLESS OTHERWISE NOTED.
6. ALL LINE MARKING & ROAD SIGNAGE IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE NZTA TRAFFIC CONTROL AND DEVICES MANUAL WHERE IT REPLACES LEGACY MOTSAM.
7. REFER TO BARRIER DESIGN PLANS IN THIS SET FOR MORE DETAILS
8. REFER TO ROAD MARKING AND SIGNAGE PLANS IN THIS SET FOR MORE DETAILS

LEGEND

- CENTRELINE CHAINAGES
- PROPOSED CARRIAGEWAY
- PROPOSED FOOTPATH
- CATCHPITS
- RD 2 NTH WORK EXTENTS
- EXISTING BOUNDARIES
- PROPOSED STAGE 2 BOUNDARIES
- STREETLIGHTS
- PROPOSED RETAINING WALL
- PROPOSED SAFETY FENCE
- PROPOSED SEMI-RIGID BARRIER

EXTENT OF ROAD 2 NORTH WORKS AT CHAINAGE 625

BATTER INTERFACE (GHD 250125)

FUTURE CONNECTION

NZTA DESIGNATION BOUNDARY

ROAD 13

ROAD 1

ROAD 2 NORTH

WALL BY OTHERS

DRURY INTERCHANGE BY OTHERS

SHEET 2001

SHEET 2002

SHEET 2003

WALL 1

WAKA KOTAHI JURISDICTION LINE

EXISTING WALL

SHARED PATH/WETLAND ACCESS MAINTENANCE TRACK

FLANAGAN ROAD

NIMT RAILWAY

HINGAIA STREAM

GREAT SOUTH ROAD

REVISION DETAILS		INT	DATE	SURVEYED	
1	FOR 50% DETAILED DESIGN	AC	29/08/2024	DESIGNED	AC
2	FOR 85% DETAILED DESIGN	AC	09/12/2024	DRAWN	JLC
3	FOR 85% DETAILED DESIGN	EW	10/02/2025	CHECKED	JLC
4	JURISDICTION LINE MOVED	JLC	13/02/25	APPROVED	CD

BUILDING B, LEVEL 1
8 NUGENT ST, GRAFTON,
AUCKLAND 1023
+64 9 308 9229

WOODS.CO.NZ

Kiwi Property

DRURY CENTRE

ROAD 2 NORTH
OVERALL ROADING LAYOUT PLAN

STATUS	85% DESIGN	REV
SCALE	1:2000 @ A3	4
COUNCIL	AUCKLAND COUNCIL	
DWG NO	P23-315-04-2000-RD	

Plot Date: 10:01:43 am,14 February 2025, JOANNEC

File: C:\12DSYNERGY\DATA\WP-PEN-APP-01\P23-315_1 - CREEK ROAD_21792\02 DRAWINGS\01 ENG\P23-315-04-2000-RD_ROADING PLAN=ROAD 2 NORTH.DWG

BATTER INTERFACE (GHD 250125)

EXTENT OF ROAD 2 NORTH WORKS AT CHAINAGE 625

KERB AND CHANNEL COMMENCES

W BEAM GUARDRAIL

FUTURE CONNECTION

W BEAM GUARDRAIL TO END HERE. REFER TO THE BARRIER PLANS IN THIS SET FOR END TREATMENT DETAILS

1.00m

580

600

2.00m

3.50m

620

4.5%

640

3.50m

660

4.5%

680

2%

3%

700

2%

2.00m

2.00m

3.50m

720

740

2%

3%

1%

760

780

A THRIE BEAM END TREATMENT IS TO BE CONNECTED ONTO THE LAST CONCRETE TRANSITION BARRIER. REFER TO THE BARRIER PLANS IN THIS SET FOR CONNECTION DETAILS

CONCRETE BARRIER DESIGN BY GHD

WALL DESIGN BY GHD

W BEAM GUARDRAIL

WETLAND 2-2

3.5m WIDE SHARED PATH/WETLAND MAINTENANCE ACCESS TRACK. TO BE DG10 ASPHALT SURFACE

3m WIDE TIMBER BOARDWALK, REFER TO WETLAND DETAILS IN THIS PLAN SET

NOTES

1. REFER TO PLAN 2000.

LEGEND

- CENTRELINE CHAINAGES (100, 120)
- PROPOSED CARRIAGEWAY
- PROPOSED FOOTPATH
- CATCHPITS
- RD 2 NTH WORK EXTENTS
- EXISTING BOUNDARIES
- PROPOSED STAGE 2 BOUNDARIES
- STREETLIGHTS
- PROPOSED RETAINING WALL
- PROPOSED SAFETY FENCE
- PROPOSED SEMI-RIGID BARRIER

REVISION DETAILS		INT	DATE	SURVEYED	
1	FOR 50% DETAILED DESIGN	AC	29/08/2024	DESIGNED	AC
2	FOR 85% DETAILED DESIGN	AC	09/12/2024	DRAWN	AC
3	FOR 85% DETAILED DESIGN	EW	10/02/2025	CHECKED	JLC
				APPROVED	CD

BUILDING B, LEVEL 1
8 NUGENT ST, GRAFTON,
AUCKLAND 1023
+64 9 308 9229
WOODS.CO.NZ

Kiwi Property

DRURY CENTRE

ROAD 2 NORTH
ROADING PLAN

STATUS	85% DESIGN
SCALE	1:500 @ A3
COUNCIL	AUCKLAND COUNCIL
DWG NO	P23-315-04-2001-RD
REV	3

Plot Date: 10:02:15 am,14 February 2025, JOANNEC

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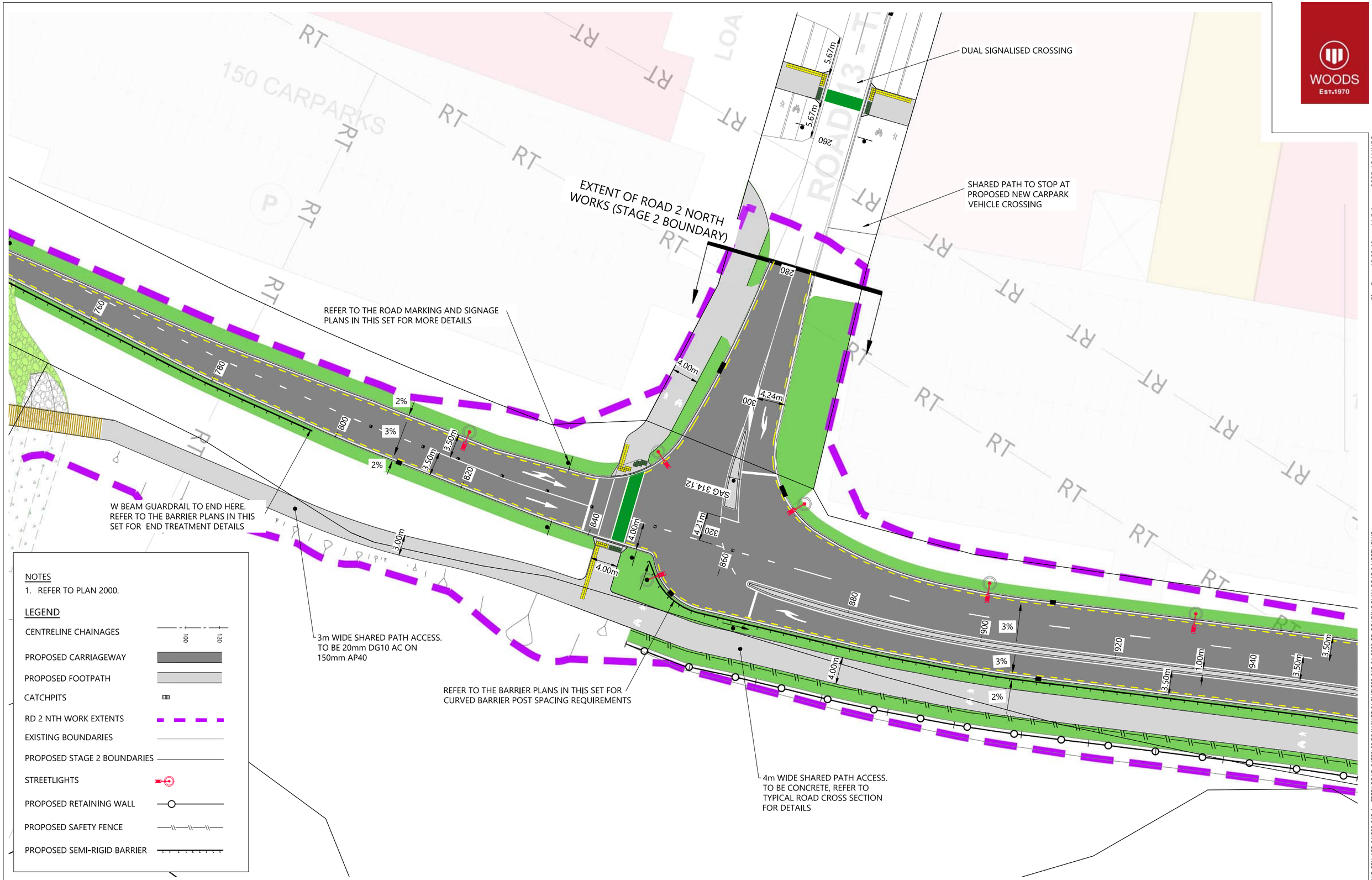

NOTES

1. REFER TO PLAN 2000.

LEGEND

- CENTRELINE CHAINAGES (100, 120)
- PROPOSED CARRIAGEWAY
- PROPOSED FOOTPATH
- CATCHPITS
- RD 2 NTH WORK EXTENTS
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- PROPOSED STAGE 2 BOUNDARIES
- STREETLIGHTS
- PROPOSED RETAINING WALL
- PROPOSED SAFETY FENCE
- PROPOSED SEMI-RIGID BARRIER

REVISION DETAILS		INT	DATE	SURVEYED	
1	FOR 50% DETAILED DESIGN	AC	29/08/2024	DESIGNED	AC
2	FOR 85% DETAILED DESIGN	AC	09/12/2024	DRAWN	AC
3	FOR 85% DETAILED DESIGN	EW	10/02/2025	CHECKED	JLC
				APPROVED	CD

BUILDING B, LEVEL 1
8 NUGENT ST, GRAFTON,
AUCKLAND 1023
+64 9 308 9229
WOODS.CO.NZ

Kiwi Property

DRURY CENTRE

ROAD 2 NORTH ROADING PLAN

STATUS	85% DESIGN
SCALE	1:500 @ A3
COUNCIL	AUCKLAND COUNCIL
DWG NO	P23-315-04-2002-RD
REV	3

Plot Date: 10:02:40 am,14 February 2025, JOANNEC

File: C:\12DSYNERGY\DATA\WP-PEN-APP-01\P23-315_1 - CREEK ROAD_21792\02 DRAWINGS\01 ENG\P23-315-04-2000-RD_ROADING PLAN-ROAD 2 NORTH.DWG

REVISION DETAILS		INT	DATE	SURVEYED	
1	FOR 50% DETAILED DESIGN	AC	29/08/2024	DESIGNED	AC
2	FOR 85% DETAILED DESIGN	AC	09/12/2024	DRAWN	AC
3	FOR 85% DETAILED DESIGN	EW	10/02/2025	CHECKED	JLC
				APPROVED	CD

BUILDING B, LEVEL 1
8 NUGENT ST, GRAFTON,
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+64 9 308 9229
WOODS.CO.NZ

Kiwi Property

DRURY CENTRE

ROAD 2 NORTH ROADING PLAN

STATUS	85% DESIGN	REV
SCALE	1:500 @ A3	3
COUNCIL	AUCKLAND COUNCIL	
DWG NO	P23-315-04-2003-RD	

Plot Date: 1:50:48 pm,13 February 2025, JOANNEC

File: C:\12DSYNERGY\DATA\WP-PEN-APP-01\P23-315_1 - CREEK ROAD_21792\02 DRAWINGS\01 ENG\P23-315-04-2000-RD_ROADING PLAN-ROAD 2 NORTH.DWG

INTERCHANGE CARRIAGEWAY MARKING

FLANAGAN ROAD

SEE SHEET 3602

WETLAND 2-1

WETLAND 2-2

STATE HIGHWAY 1

HINGAIA STREAM

ROAD 2 NORTH

ROAD 13

ROAD 1

LEGEND

- ROAD 2 NORTH WORKS EXTENT
- STAGE 1 BOUNDARY
- STAGE 2 BOUNDARY
- PROPOSED STORMWATER
- SINGLE CATCHPITS — CP DCP
- OUTLET ROCK RIPRAP
- PROPOSED CONTOURS
- 100-YEAR FLOOD EXTENTS
- EXISTING STREAM
- WETLAND DEEP MARSH
- WETLAND SHALLOW MARSH
- WETLAND MAINTENANCE TRACK
- EXISTING NATURAL WETLAND

SCALEBAR (m) 0 25 50 125

SCALE | 1:2500 @A3 | 1:1250 @A1

REVISION	DETAILS	INT	DATE	SURVEYED
1	FOR 50% DESIGN	AC	2[illegible]24	DESIGNED AC
2	FOR 6[illegible]% DESIGN	AC	19/[illegible]2024	DRAWN AC
3	FOR 85% DESIGN	JLW	10/02/2025	CHECKED JLC
				CD

DRAFT

BUILDING B, LEVEL 1
8 NUGENT ST, GRAFTON,
AUCKLAND 1023
+64 9 308 9229
WOODS.CO.NZ

Kiwi Property

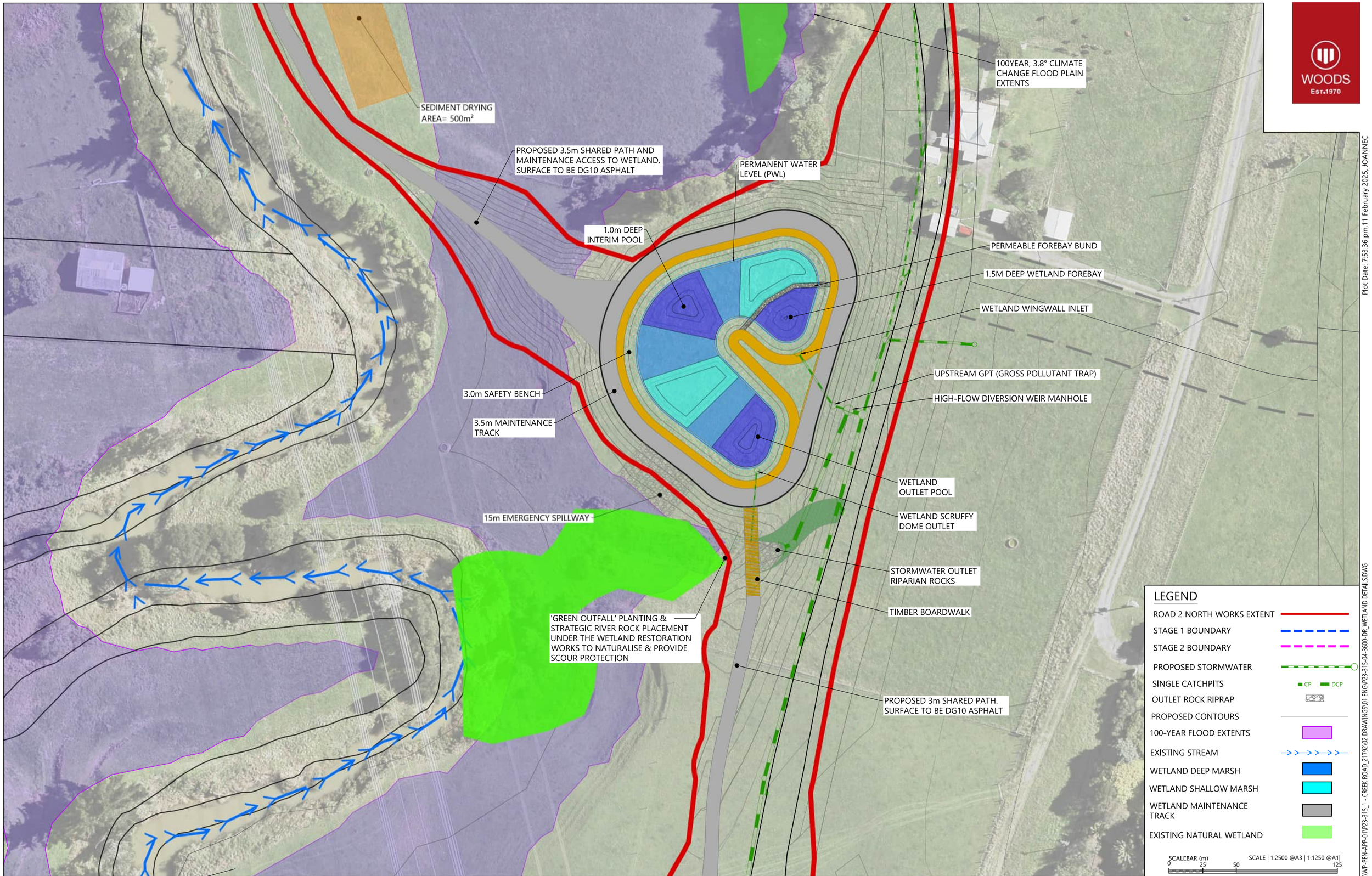
DRURY CENTRE - ROAD 2 NORTH

OVERALL WETLANDS LAYOUT PLAN

STATUS	FOR 85% DESIGN
SCALE	1:2500 @ A3
COUNCIL	AUCKLAND COUNCIL
DWG NO	P24-447-01-3600-DR
REV	3

Plot Date: 7:51:22 pm,11 February 2025, JOANNEC

File: C:\12DSYNERGY\DATA\WP-PEN-APP-01\P23-315_1 - CREEK ROAD_21792\02 DRAWINGS\01 ENG\P23-315-04-3600-DR_WETLAND DETAILS.DWG



WOODS
Est.1970

Plot Date: 7:53:36 pm,11 February 2025, JOANNEC

File: C:\12DSYNERGY\DATA\WP-PEN-APP-01\P23-315_1 - CREEK ROAD_21792\02 DRAWING\GS01 ENG\P23-315-04-3600-DR_WETLAND DETAILS.DWG

REVISION DETAILS					
1	FOR [illegible]% DESIGN	AC	20/11/2024	DESIGNED	AC
2	FOR [illegible]5% DESIGN	A[illegible]	10[illegible]/2025	DRAWN	AC
				CHECKED	JLC
				APPROVED	CD

DRAFT

BUILDING B, LEVEL 1
8 NUGENT ST, GRAFTON,
AUCKLAND 1023
+64 9 308 9229
WOODS.CO.NZ

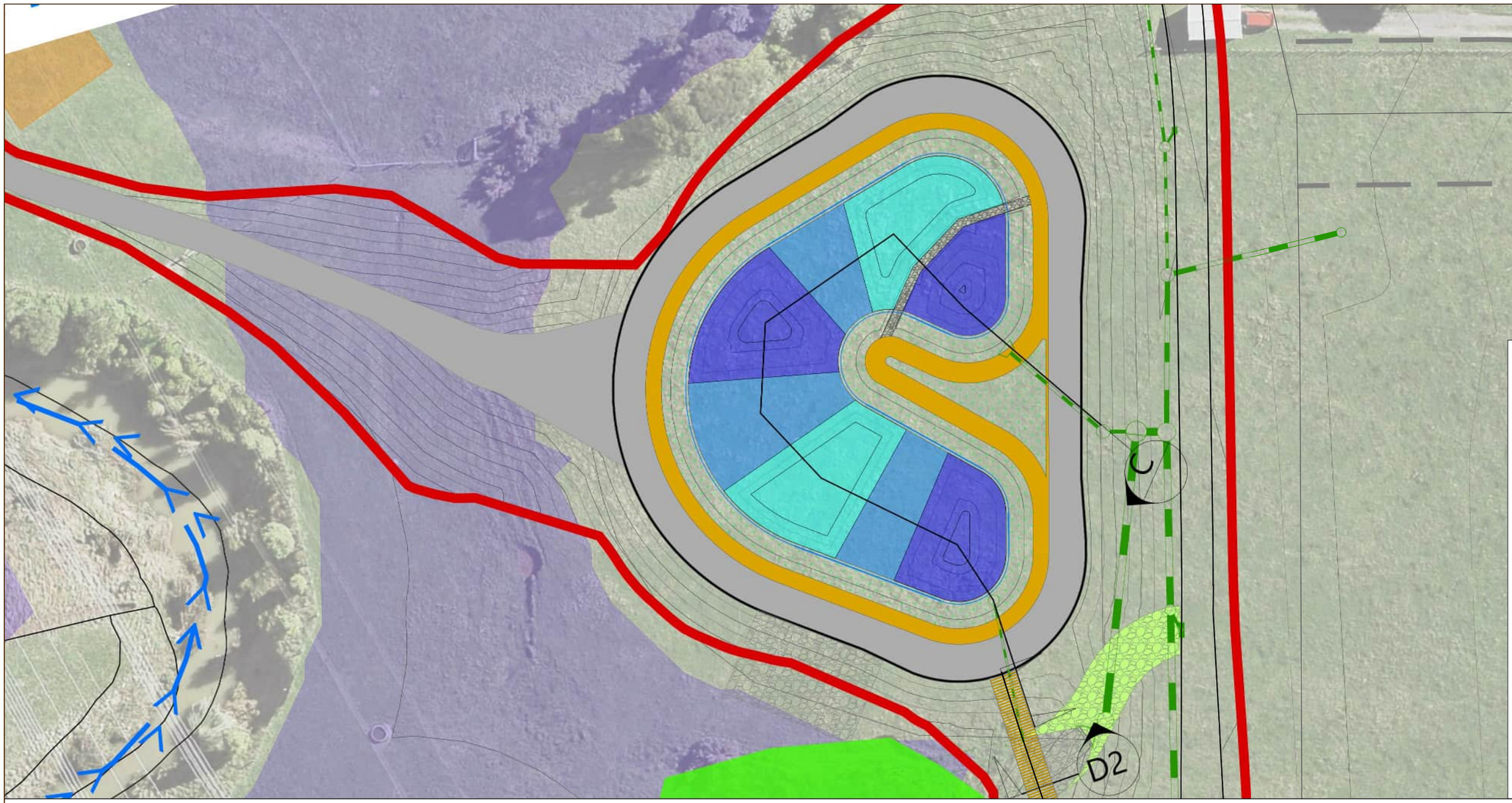
Kiwi Property

DRURY CENTRE - ROAD 2 NORTH

WETLAND 2-2 LAYOUT PLAN

N

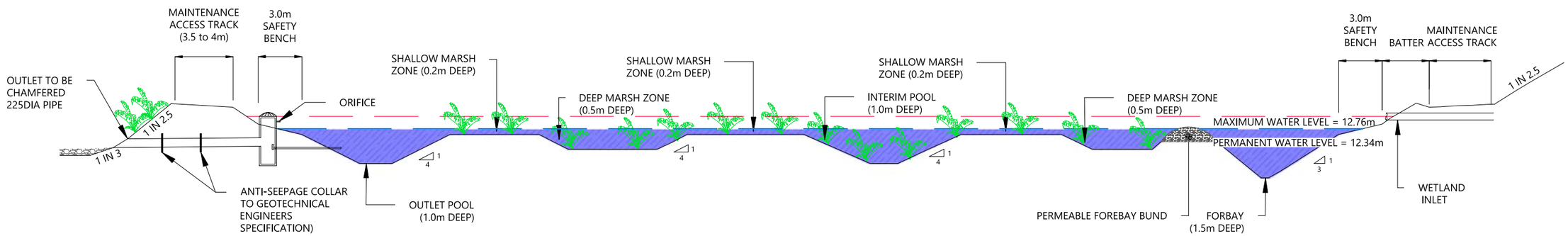
STATUS	FOR 85% DESIGN	REV
SCALE	1:750 @ A3	2
COUNCIL	AUCKLAND COUNCIL	
DWG NO	P23-315-04-3602-DR	



LEGEND

- ROAD 2 NORTH WORKS EXTENT
- STAGE 1 BOUNDARY
- STAGE 2 BOUNDARY
- PROPOSED STORMWATER — CP — DCP
- SINGLE CATCHPITS
- OUTLET ROCK RIPRAP
- PROPOSED CONTOURS
- 100-YEAR FLOOD EXTENTS
- EXISTING STREAM
- WETLAND DEEP MARSH
- WETLAND SHALLOW MARSH
- WETLAND MAINTENANCE TRACK
- EXISTING NATURAL WETLAND

SCALEBAR (m) 0 5 10 25 — SCALE | 1:500 @A3 | 1:250 @A1



WETLAND 2-2 CROSS-SECTION -C

SCALEBAR (m) 0 3 6 15 — SCALE | 1:300 @A3 | 1:150 @A1

REVISION DETAILS		INT	DATE	SURVEYED	
1	FOR 50% DESIGN	AC	29/11/2024	DESIGNED	AC
2	FOR 85% DETAILED DESIGN	EW	10/02/2025	DRAWN	AC
				CHECKED	JLC
				APPROVED	CD

BUILDING B, LEVEL 1
8 NUGENT ST, GRAFTON,
AUCKLAND 1023
+64 9 308 9229
WOODS.CO.NZ

Kiwi Property

DRURY CENTRE - ROAD 2 NORTH

WETLAND 2-2 CROSS-SECTION-C PLAN

N

STATUS	FOR 85% DESIGN	REV	
SCALE	AS SHOWN	2	
COUNCIL	AUCKLAND COUNCIL		
DWG NO	P24-447-01-3604-DR		

Plot Date: 1:59:48 pm,13 February 2025, ANUJC

File: C:\12DS\DATA\WP-AKL-APP-02\P23-315_1 - CREEK ROAD_21792\00 DRAWINGS\01 ENG\P23-315-04-3600-DR_WETLAND DETAILS.DWG