

Submission on Proposed District Plan of Hutt City Council.

In the matter of Proposed District Plan review incorporating the Intensification Streamlined Planning Process (ISPP), and the first schedule of the Resource Management Act.

Expert Evidence of Cameron Peter de Leijer on behalf of Kelson Heights Limited – Hearing 5 – ‘Natural Hazards’

Date: 03/08/2025

Next Event Date: 18-21 & 26-27 August 2026
Hearing Chair: Lindsay Daysh
Hearing Pannel: Liz Burge, David McMahon, Jason Jones

Introduction

- 1 My full name is Cameron Peter de Leijer. I am a Senior Surveyor and Planner at Spencer Holmes Ltd. I specialise in Cadastral Surveying, Resource Management, and Land development.
- 2 I am providing planning evidence on behalf of Kelson Heights Limited.

QUALIFICATIONS

- 3 My qualifications and experience are as follows:
 - 3.1 I have a Bachelor of Surveying from the University of Otago and Bachelor of Science from the University of Canterbury.
 - 3.2 I have 8 years post graduate experience as a surveyor in private practice at Spencer Holmes Limited. During that time, I have worked on a variety of survey projects. I now work closely in the land planning field which includes the preparation of resource consent applications, as well as developing land use strategies for clients.
 - 3.3 In October 2021 I achieved the requirements to be a Licensed Cadastral Surveyor under the Cadastral Survey Act 2002, which is a rigorous set of exams that require knowledge in the law surrounding Cadastral Surveying. Upon obtaining my license to undertake cadastral surveys, I became full member of the surveying professional body, Survey and Spatial New Zealand. I am also an associate member of the planning professional body, New Zealand Planning Institute.
- 4 My involvement in these proceedings (via Spencer Holmes Ltd) has been to prepare the submission for Kelson Heights Limited, as well as provide this evidence to support the submission and hearing.
- 5 I have been involved in the project as a cadastral surveyor and planner for 5 years and am very familiar with the development.

CODE OF CONDUCT

- 6 I have read the Code of Conduct for Expert Witnesses set out in the Environment Court's Practice Note 2023. Whilst this is a Council hearing, I have complied with the Code of Conduct in preparing my evidence and will continue to comply with it while giving oral evidence before the commissioners. My qualifications as an expert are set out above. Except where I state I rely on the evidence of another person, I confirm that the issues addressed in this statement of evidence are within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from my expressed opinions.

THE SUBMISSION

- 7 The original submission was to amend the portion of the site from Natural Open Space to Medium Density Residential Zone and to remove the Slope Assessment Overlay from the MDRS Zone at 64 Waipounamu Drive. However, this evidence is specifically in relation to the removal of the Slope Assessment Overlay.

BACKGROUND

- 8 The site at 64 Waipounamu Drive, Kelson is a large site which is approximately 10.4201 ha and is the subject to further development which is being undertaken in 6 stages. The below figure gives quick references to these stages.

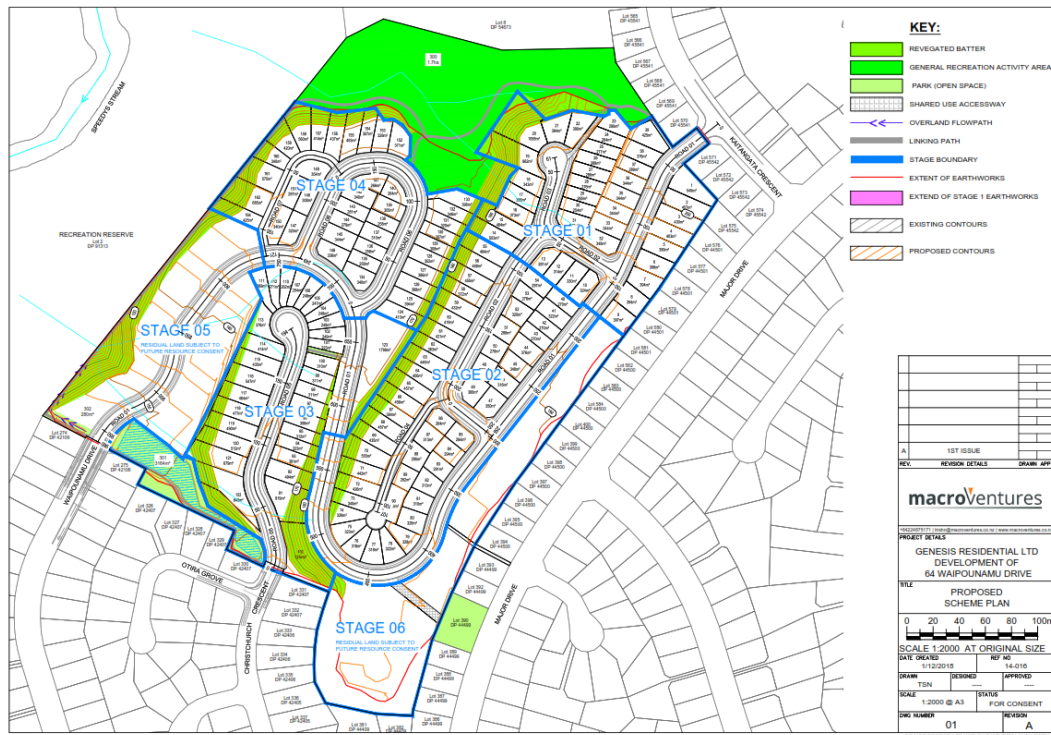


Figure 1: Staging for Subdivision at 64 Waipounamu Dr

- 9 A resource consent, RM180513, was granted to undertake the earthworks for the whole site, except stage 6, as well as facilitate the subdivision of Stage 1 and 2. The consent was provided with this original submission, as well as the approved application plans.
- 10 The first stage of the development was completed in November 2022, with Stage 2A and Stage 2B following in May 2023 and August 2024 respectively. Stage 2C has been completed in August 2025.
- 11 Due to the complexity of the site, the size and progression of the works involved, conditions relating to the subdivision were required to be changed. There have been two changes of conditions. One approved under RM 200328 which altered earthworks conditions and one that was granted under RM 240100, which allows for the change in earthworks and other conditions to finalise Stage 2C.
- 12 RM180513 has expired, and two separate consents were applied to replace this consent. RM250229 defines Stage 2D which was granted on 18 June 2026. RM260025 addresses the earthworks for the remainder of

the site, which seeks to essentially reconsult the earthworks for RM180513.

Original Submission and Slope Assessment Overlay (OSZ).

- 13 The original submission sought to remove the Slope Assessment Overlay from the site. This is due to the fact that the modelling prepared by WSP has not considered the completed earthworks on site, nor the earthworks consent that was live during the calls for submissions, which is currently being replaced.

Councils S42A Report.

- 14 The Council S42A Report recommends that this submission is rejected. Section 6.2.8 relates to Slope Assessment Overlay, but then in paragraph 908 and 909 of section 6.2.8, the report indicates reports on issues in relation to coastal inundation modelling.
- 15 Paragraph 911 refers us to section 3 as to the reasoning why no changes to site specific or broad changes to the modelling is supported.
- 16 Section 3.2.3, paragraph 108 states that single largest issue was site specific concerns with the quality of the monitoring and has been discussed in section 6. However as noted above, section 6.2.8 for Slope Assessment Overlay, does not discuss the modelling inaccuracies, but rather refers to the coastal inundation modelling.
- 17 This makes it difficult to ascertain why the submission was rejected. As such the discussion below will focus on the submission points raised, and the WSP report that was utilised to create the slope hazard overlay.

WSP Reports

- 18 The WSP memo provided with the S32A report states that the slope hazard overlay was created from a number of factors which were based on a study completed between 2021 and 2024. This includes slope

angle, slope aspect, lithology, land cover, distance to active fault distance to stream, soil drainage, soil hardness, slope curvature.

- 19 Identified in the report there is a number of limitations within the report, specifically in relation to Engineered or Modified Slopes. The specific wording is outlined below. “There are engineered and treated slopes in Hutt City, including cuttings, fills, and retaining structures built during residential, road and rail developments. The terrain information used to develop the overlay, and its inputs does not differentiate engineered slopes from unsupported slopes. Slope modification within individual properties is not captured beyond that which is captured in the LiDAR and aerial imagery. This is limited by the quality and age of the datasets. Any modifications following the acquisition of the LiDAR and aerial imagery will not have been captured. The slope hazard within individual properties may differ from what is captured in the overlay and confirmation of slope hazard would require more detailed, site-specific information on the subsurface conditions and efficacy of any existing mitigation measures.¹” These limitations are particularly relevant to the overlay in relation to the development site.

Works at Kelson Heights

- 20 The development at Kelson Heights has been ongoing from 2019 and the landform will continue to change until the earthworks are completed to the final design.
- 21 The proposed Slope Assessment Overlay largely does not cover the parts of the development that have been completed.
- 22 As highlighted in the S42A report, Policy 5 of the NPS-NH 2025 states “Natural hazard risk assessment and decisions must be based on the best available information and must be made even when that information is uncertain or incomplete”.

¹ WSP Memorandum – HCC Landslide Study – Development of Slope Hazard GIS Layer – Page 6

- 23 Whilst the reports were generally accurate for the time, ie used the most up to date information at the time, these reports are at minimum 2 years old. On a large-scale development, such as Kelson, this would mean that the data from 2021 and 2024 does not accurately depict the changes that are occurring on site.
- 24 We have provided the change in landform from 2021 to how it currently stands via depiction of contours between from the latest from the most recent survey data from 2024-2026, and the contours produced from the 2021 dated DEM boundary. These can be seen on the attached plans S19-0774-H5-T1 and S19-0774-H5-T2. This clearly indicates the changes from the data that WSP has used to create the subdivision.
- 25 LINZ has released a new DEM specifically within the Hutt City from 23 Jan 2025 – 3 February 2025. This publicly available data would encapsulate some of the development changes up to 2025.
- 26 Furthermore, Hutt City Council requires specific geotechnical sign off for the works being undertaken at Kelson Heights as part of the consents. These consents require detailed site-specific information on the subsurface conditions and the earthworks, which include the soil type, drainage considerations, and the change to the topography, which is as required by the WSP report to alter the Slope Assessment Overlay. We have provided examples of geotechnical completion reports that are required with the ongoing earthworks and stages.
- 27 The development has, and will continue to, alter the ground conditions such that the reports from WSP are no longer relevant to the site.
- 28 We recognise that this a limitation of the district plan process, however since there was a significant delay between the PDP being notified and the hearing process, Council should potentially revisit the mapping of areas where known developments are occurring.

Relief Sought

- 29 As such, the original proposed relief is to remove the Slope Assessment Overlay from the site. However, as there will be areas that will remain undeveloped on the site, we would propose to only remove the Slope Assessment Overlay from the proposed earthwork and development area.
- 30 We have provided on S19-0774-H5-O1 which shows where the Slope Hazard Assessment Overlay should apply based on the final earthworks design as proposed in RM260015 which is the current earthworks consent being processed by HCC.

Conclusion

- 31 The Slope Assessment Overlay was originally defined by two reports prepared by WSP. These reports were prepared between 2021 and 2024. The development has progressed to the point where the reports prepared by WSP are no longer relevant to the site.
- 32 The relief sought is to reduce the Slope Assessment Overlay to the areas that have not had, or will, have specific geotechnical oversight or development.
- 33 It is noted that this overlay will not likely affect the development of the site, as it is expected that the earthworks consent will issue prior to the rules of the PDP becoming operative.

Date: 04/08/2026

Review and Agreed by: Ian Leary

Signed: Cameron de Leijer



Appendices:

1. Reduction of Slope Assessment Overlay based on proposed earthworks S19-0774-H5-O1

2. Change to Contours from LINZ data vs current. S19-0774-H5-T1 and T2
3. Geotechnical Completion Reports for Stage 2C.



NO	REVISION	BY	DATE
A	FIRST ISSUE		
B	CHANGES TO EWKS EXTENT STAGE 4	JFC	05/02/2026
C	CHANGES TO EW DESIGN	CPD	25/03/2026
D	ADDED EXISTING CONTOURS	CPD	13/05/2026

NOTES:

GREY CONTOURS REPRESENT THE CURRENT DESIGN FORMATION. NOTE THIS MODEL IS SUBSTANTIALLY THE SAME AS CONSENTED BY HCC RM180513 & s127 RM 240100. KEY CHANGES RELATE TO AREAS AROUND STAGE 5 SWMS POND & ADJUSTMENT TO STAGE 4 EWKS EXTENT:

COORDINATE DATUM - NZGD 2000 (WELLINGTON)

HEIGHT ARE IN TERMS OF
- WELLINGTON DATUM 1953

ORIGIN OF LEVELS
- MARK NAME ORM V DP 42106
- REDUCED LEVEL 148,06
- SOURCE CONVERTED FROM NZVD 2016



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PO Box 588 Wellington New Zealand
(04) 472-2261 www.spencerholmes.co.nz

CLIENT
**GENESIS RESIDENTIAL
KELSON LIMITED**

PROJECT
KELSON HEIGHTS

DRAWING TITLE
**PROPOSED SLOPE
ASSESSMENT OVERLAY
BASED ON DESIGN**

DESIGN CONSULTANT

Copyright of this drawing is vested in Spencer Holmes Ltd.
The Contractor shall verify all dimensions on site.

CAUTION - The information shown on this plan has been prepared under specific instruction from the client and is intended solely for the clients use. The information is valid as at the date of survey. Spencer Holmes Limited will accept no liability for any consequence arising out of the use of this plan, or the information thereon whether in hard copy or electronic format by any other party for any purpose whatsoever.

☐ S19-0774-EWKS2026-H5 - H5-01
☐ DRAWN CPD
☐ CHECKED ITL
☐ FB
☐ DATE 24-11-2025

SCALE
1 : 1000
AT
A1

DRAWING NUMBER
S19-0774-H5-O1
REV
A

PROPOSED SLOPE ASSESSMENT OVERLAY

PROPOSED SLOPE
ASSESSMENT OVERLAY

PROPOSED SLOPE
ASSESSMENT OVERLAY

KAITANGATA CRES

WAIPOUNAMU DRIVE

MAJOR DRIVE

TAKAPO GR

KAIKUMATI CRESCENT

WAIPOUNAMU DRIVE

WAIPOUNAMU DRIVE

CHRISTCHURCH
CRESCENT

RESOURCE MANAGEMENT - LAND PLANNING - SURVEYING - STRUCTURAL - CIVIL - FIRE



NO	REVISION	BY	DATE
A	FIRST ISSUE		

NOTES:

GREY CONTOURS REPRESENT THE CURRENT LATEST TOPOGRAPHICAL DATA GATHERED BY SPENCER HOLMES. THIS CONSISTS OF A MIX OF GROUND BASED SURVEY AND DRONE SURVEY:

- MAJOR 5m INTERVALS
MINOR 1m INTERVALS

COORDINATE DATUM - NZGD 2000 (WELLINGTON)

HEIGHT ARE IN TERMS OF
- NZVD 2016

AERIAL IMAGRY FROM DRONE FLIGHT
DATED AUGUST 2025



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KELSON LIMITED**

PROJECT
KELSON HEIGHTS

DRAWING TITLE
**SITE CONTOURS
FROM SURVEY DATA
DATED 2024-2026**

DESIGN CONSULTANT

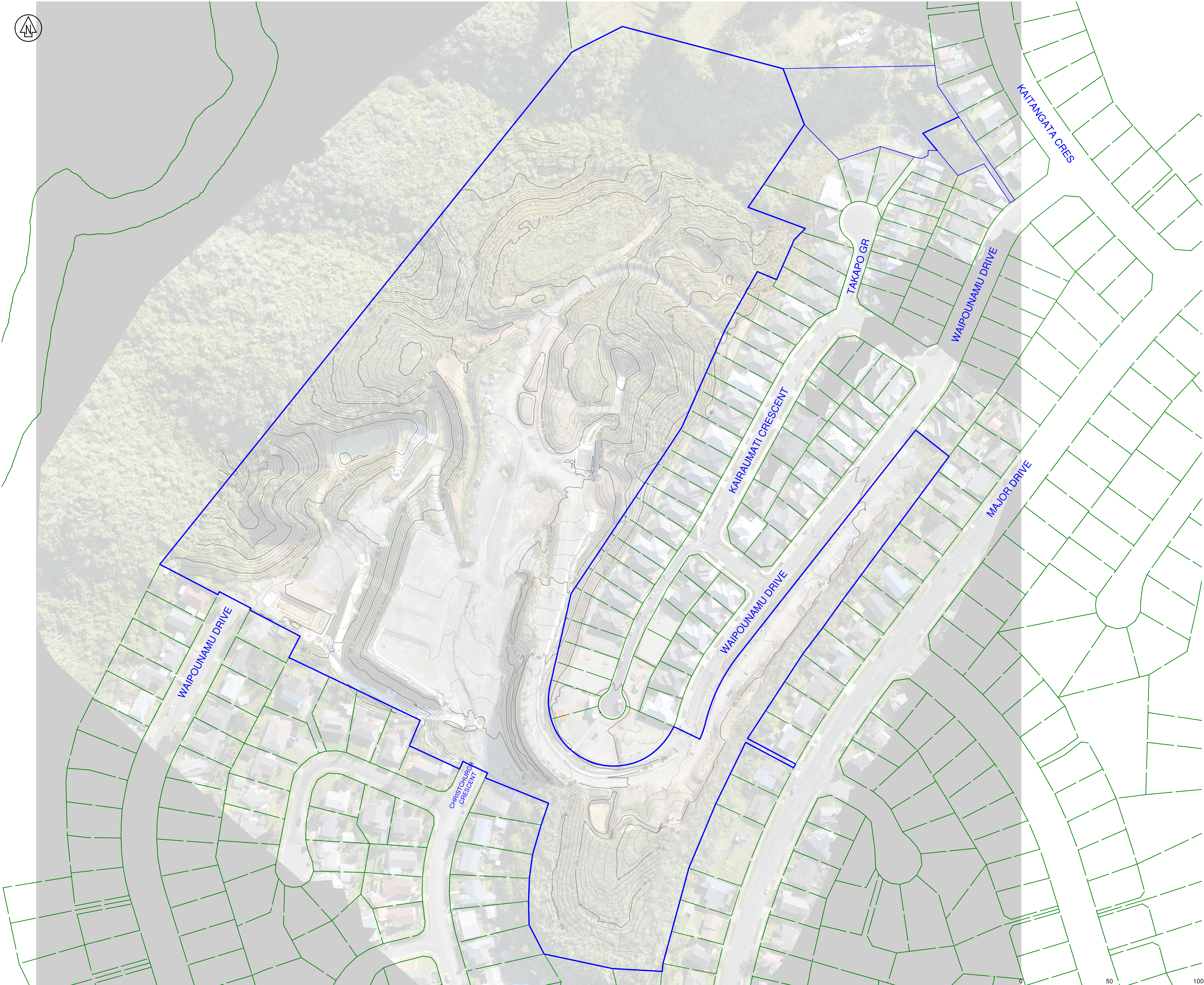
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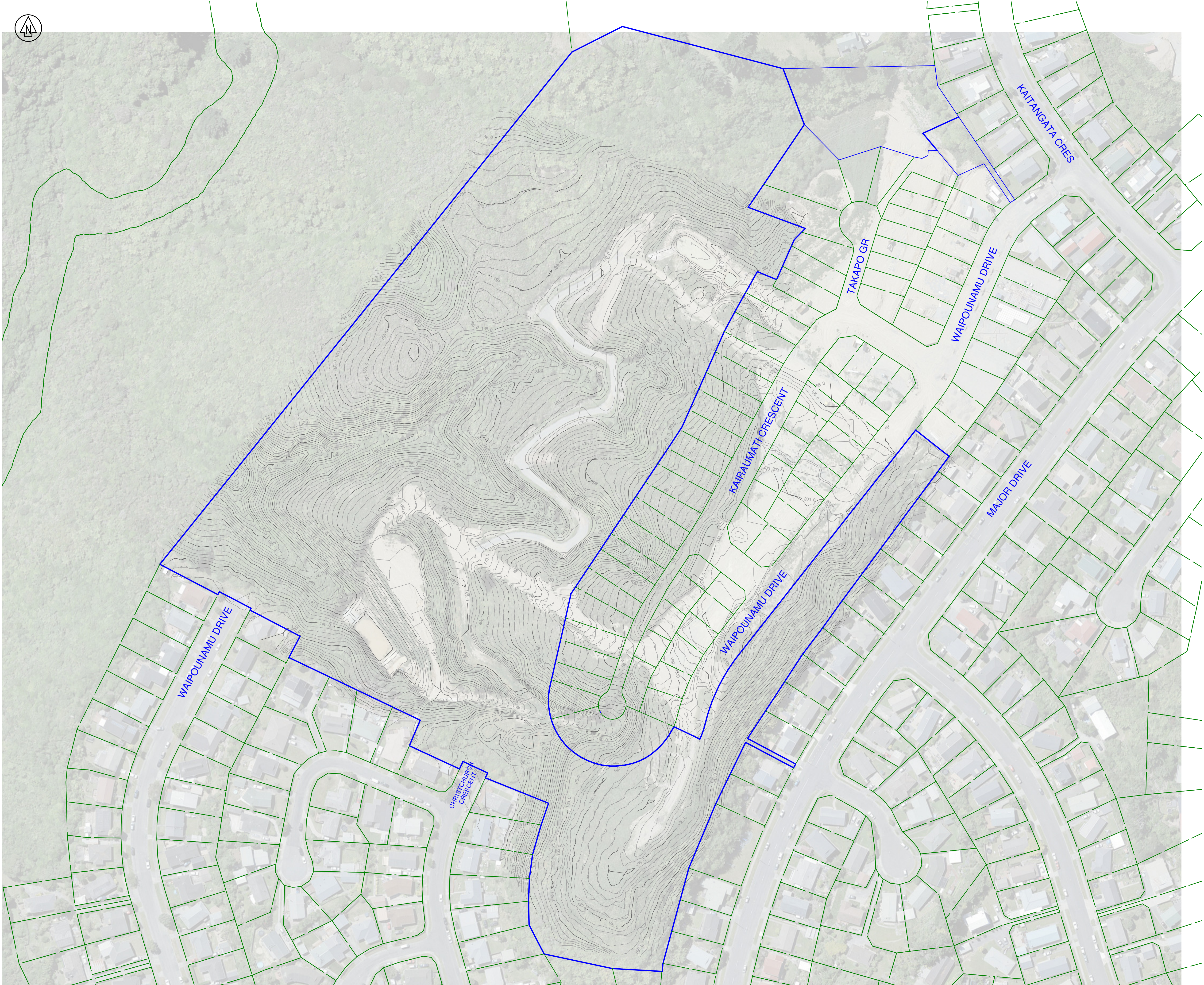
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☒ S19-0774-EWKS2026-H5 Topo - Drawing001
☐ DRAWN CPD ☐ FB
☐ CHECKED ITL ☐ DATE 24-11-2025

SCALE
1 : 1000 AT **A1**

DRAWING NUMBER
S19-0774-H5-T1 REV **A**





NO	REVISION	BY	DATE
A	FIRST ISSUE		

NOTES:

GREY CONTOURS REPRESENT THE CURRENT
CONTOURS EXTRACTED FROM THE LINZ 2021
DEM PUBLISHED ON LINZ DATA SERVICE:

MAJOR 5m INTERVALS
MINOR 1m INTERVALS

COORDINATE DATUM - NZGD 2000 (WELLINGTON)

HEIGHT ARE IN TERMS OF
- NZVD 2016

AERIAL IMAGRY SOURCED
FROM LINZ DATA SERVICE
2021 DATASET

SpencerHolmes
engineers - surveyors - planners

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CLIENT
**GENESIS RESIDENTIAL
KELSON LIMITED**

PROJECT
KELSON HEIGHTS

DRAWING TITLE
**SITE CONTOURS
FROM LINZ 2021
DEM**

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☐ S19-0774-EWKS2026-H5 Topo - Drawing001
☐ DRAWN CPD
☐ CHECKED ITL

☐ FB
☐ DATE 05-08-2026

SCALE
1 : 1000

DRAWING NUMBER
S19-0774-H5-T2

AT
A1

REV
A

Memorandum

Project Name:	Kelson Heights Development	Date:	27 May 2024
Project No:	T0093/03, Rev 01	Attention:	HCC Earthworks Compliance
Prepared By:	J Spinks	Client:	Genesis Residential Kelson Ltd
Reviewed By:	N Schumacher	Copies to:	Spencer Holmes Ltd
Subject:	Stage 2B, Geotechnical Completion Report and Schedule 2A (NZS4404:2010)		

1. INTRODUCTION

This memorandum presents all supporting geotechnical data and our Schedule 2A, 'Statement of Professional Opinion on Suitability of Land for Building Construction'. This memorandum has been prepared in accordance the Resource Consent Conditions RM180513, Clause 26 'Final Geotechnical Completion Report', which states:

'Final Geotechnical Completion Report - That, on completion of earthworks (or during earthworks if Council considers it necessary), the consent holder provides a geotechnical completion report from a qualified geotechnical engineer in accordance with Clause 2.6.1 of NZS 4404:2010. This report shall include details of the specific site investigations, design work, testing and construction monitoring undertaken and shall include a statement of professional opinion as set out in Schedule 2A of NZS 4404:2010. Where the report identifies development limitations, such as specific design for stability or foundation design or building setback distances, Council will register a consent notice regarding this on the certificates of title of any affected lots, as allowed for under section 221 of the Resource Management Act 1991. A completion report is required for each stage of the subdivision and is to be provided no later than at the time of application for the 224c certificate.'

The development is being constructed in several stages (Stage 1 to 6). The Stage 1 and Stage 2A completion reports were supplied by Vecta Ltd. This completion report addresses Stage 2B, which includes Lots 45 to 50, Lots 60 to 65 and Lots 82 to 86. Refer to the Spencer Holmes Ltd (SHL) Approved Engineering Plans in Appendix A. Refer to 'Important Note' below.

The earthworks generally comprise the following:

- A large bulk cutting creating a level building platform. The cutting extended into the highly weathered Greywacke.
- A large MSE Wall (EW 02) designed by Torlesse and SHL.

The Contractor responsible for the earthworks was RMS Contracting (Wellington) Ltd. The works commenced in 2022 and were nearing completion at the time of preparing this report.

2. CURRENT STATUS OF THE WORKS ON SITE

Important note to reader – an approximately 70m section of the cutting adjacent to Stage 2B was being constructed at the time of preparing this report. The associated lots are Lot 60 to Lot 64.

- Torlesse has completed site specific Scala testing and inspections and prepared PS1 sign off's for each individual lot.
- Torlesse's monitoring of these works will continue to confirm that they meet the requirements of the earthworks design and specification.

This report will be updated and reissued following completion of the cut batters, including coverage with hydroseed and bio coir matting.



Figure 1 – Current status of the bulk cutting to the north of EW 02.

3. INVESTIGATION AND DESIGN REPORTS

The earthworks followed the recommendations outlined in the following design reports and drawings:

Geotechnical Assessment Report

- Cook Costello 'Geotechnical Report for Earthworks Suitability of Lot 1 DP 91313, 64 Waipounamu Drive', dated 19 December 2017.

Civil Design Reports

- Vecta Ltd (previously known as Macro Ventures), 'Earthworks Volume', dated 16 August 2019.
- SHL, Stage 2B Overall Layout (HCC Approved Engineering Plans), dated 29 February 2024.

Geotechnical Design Reports

- Torlesse, 'T0093/02 – Geotechnical Design Report', dated 31 January 2024.
- Engeo, 'Manapouri Grove Design Report, Reinforced Soil Structures' 12 November 2019.
- Engeo, 'Manapouri Grove RSS Specification', 12 November 2019.
- Engeo, 'Bulk Earthworks Specification', 12 November 2019.

SHL are in the process of developing the Certificate 1C ('Certification Upon Completion of Land Development/Subdivision) to which this Geotechnical Completion Report will be appended. SHL's certification report will include asbuilts covering the following:

- Cut/fill plan (with quantities) that shows the difference between the project baseline 'natural surface' and the final as built levels.
- Contour plans showing the natural baseline contours against the final as built contours.
- Location of any geotechnical structures –EW 02.

4. QUALITY ASSURANCE AND CONTROLS

Site observations are provided in Appendix B. Our inspections focused on the elements summarised in Section 4.1 to 4.3 below.

With reference to Condition 19, an operation and maintenance manual will be developed in coordination between Torlesse and SHL. The Client (Genesis Residential Kelson Ltd) will be responsible for complying with the manual for the 5 year maintenance period.

With reference to Condition 9, our scope of service has included assisting SHL in monitoring compliance with the Cook Costello 'Earthworks Management Plan' dated 2 February 2018. Refer to our Monthly Earthworks Reports for further detail.

4.1.BULK CUTTING

Following our construction monitoring, we can confirm the bulk earthworks were performed in accordance with the following:

- Engeo, 'Bulk Earthworks Specification', dated 12 November 2019.

The subgrade at the finished level of the cutting comprised highly weathered and moderately weathered Greywacke. See Figure 2 below.



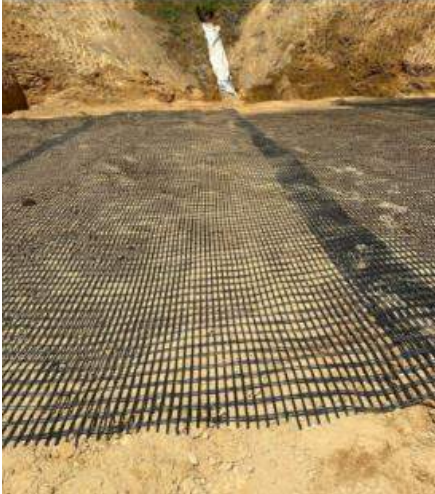
Figure 2: Bulk cutting showing insitu Greywacke across the level platform

4.2. EARTH WALL EW 02

With reference to the Torlesse EW 02 design report (T0093/02 dated 31 January 2024), the wall comprises six main elements, observations for each element are summarised in the table below. A summary of the compaction test results is provided in Appendix C.

Table 1: Inspection of key elements of the wall

Element	Sample Photo	Associated SOR
Foundation undercut		SOR08.02.24
Drainage		SOR22.02.24
Engineered Fill		SOR29.02.24

Benching		SOR29.02.24
Geogrids		SOR15.02.24
Slope treatment	Pending, at the time of completing this report	

4.3.EARTH WALL SETTLEMENT MONITORING

SHL were undertaking the settlement monitoring at the time of preparing this report, and will continue for a minimum of 3 months. The monitoring scheme included pins installed at the top of the EW 02. The monitoring was performed in accordance with Condition 13 and 14, and the Engeo Earthwall Specification, as referenced below.

- Section 6.9 – Settlement Monitoring Programme for Embankments.

5. SCHEDULE 2A CERTIFICATE

We are satisfied that the works have been constructed in accordance with the design, specification and consent conditions. The Schedule 2A Certificate is provided in Appendix D. Note – the Schedule 2A Certificate will be updated and reissued following completion of the bulk cutting north of EW 02.

6. APPLICABILITY

This report has been prepared on behalf of, and for the exclusive use of, the Client, and is subject to, and issued in accordance with, the provisions of the contract between Torlesse and the Client. Torlesse accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party. In preparing this report, Torlesse has relied upon information provided by or on behalf of our Client. Torlesse accept no responsibility for the reliability or accuracy of this information.

This report is not to be reproduced either wholly or in part without Torlesse's prior written approval. Interpretation of the ground conditions presented have been based on geotechnical data from point locations, between which ground conditions may differ. The actual underlying ground conditions may differ from those presented in this report.

Yours sincerely,

Signed by:



Jerry Spinks
Director, Geotechnical Engineer
CMEngNZ (CPEng)

Reviewed by:



Nathan Schumacher
Director, Geotechnical Engineer
CMEngNZ (CPEng)

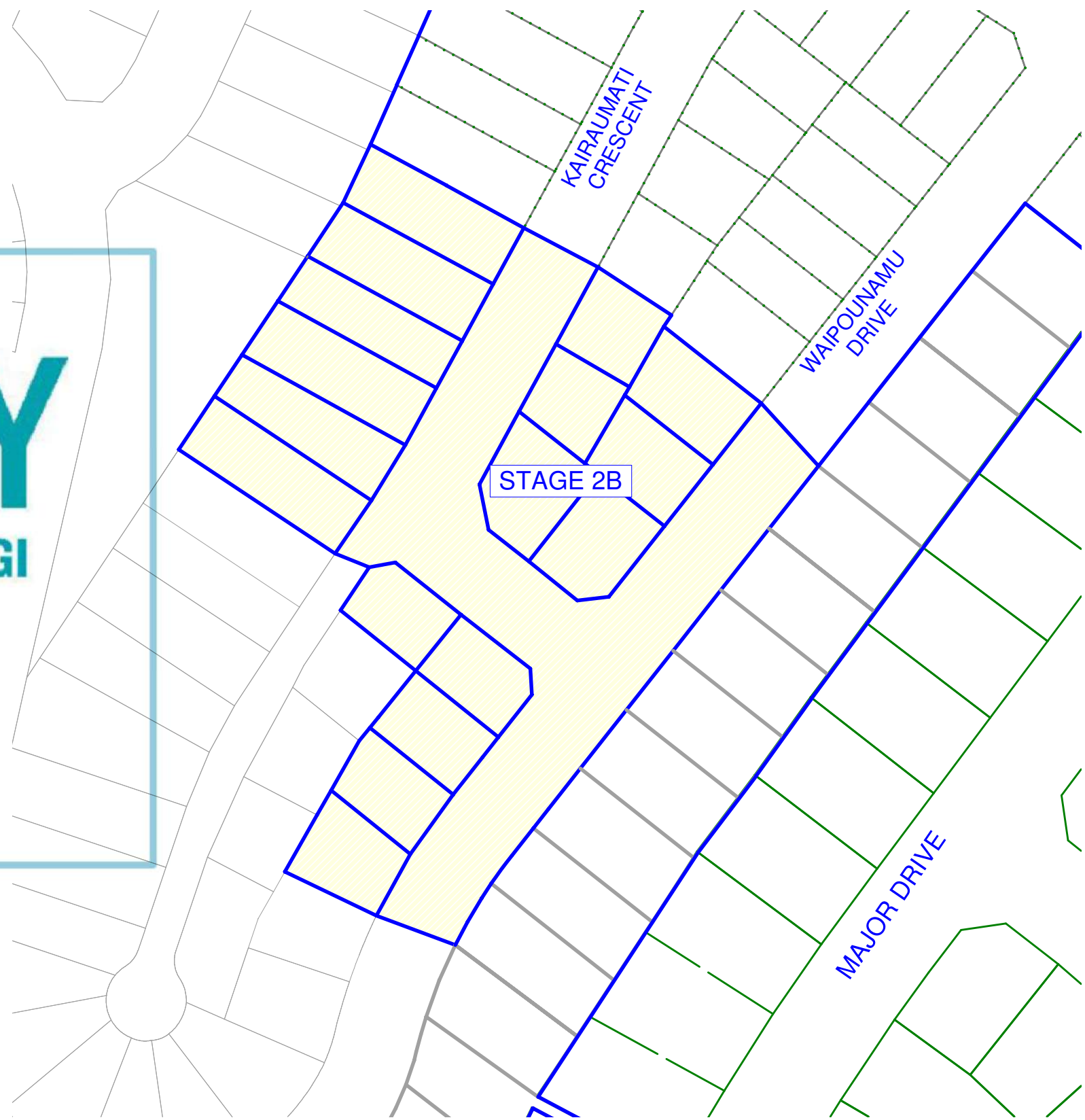
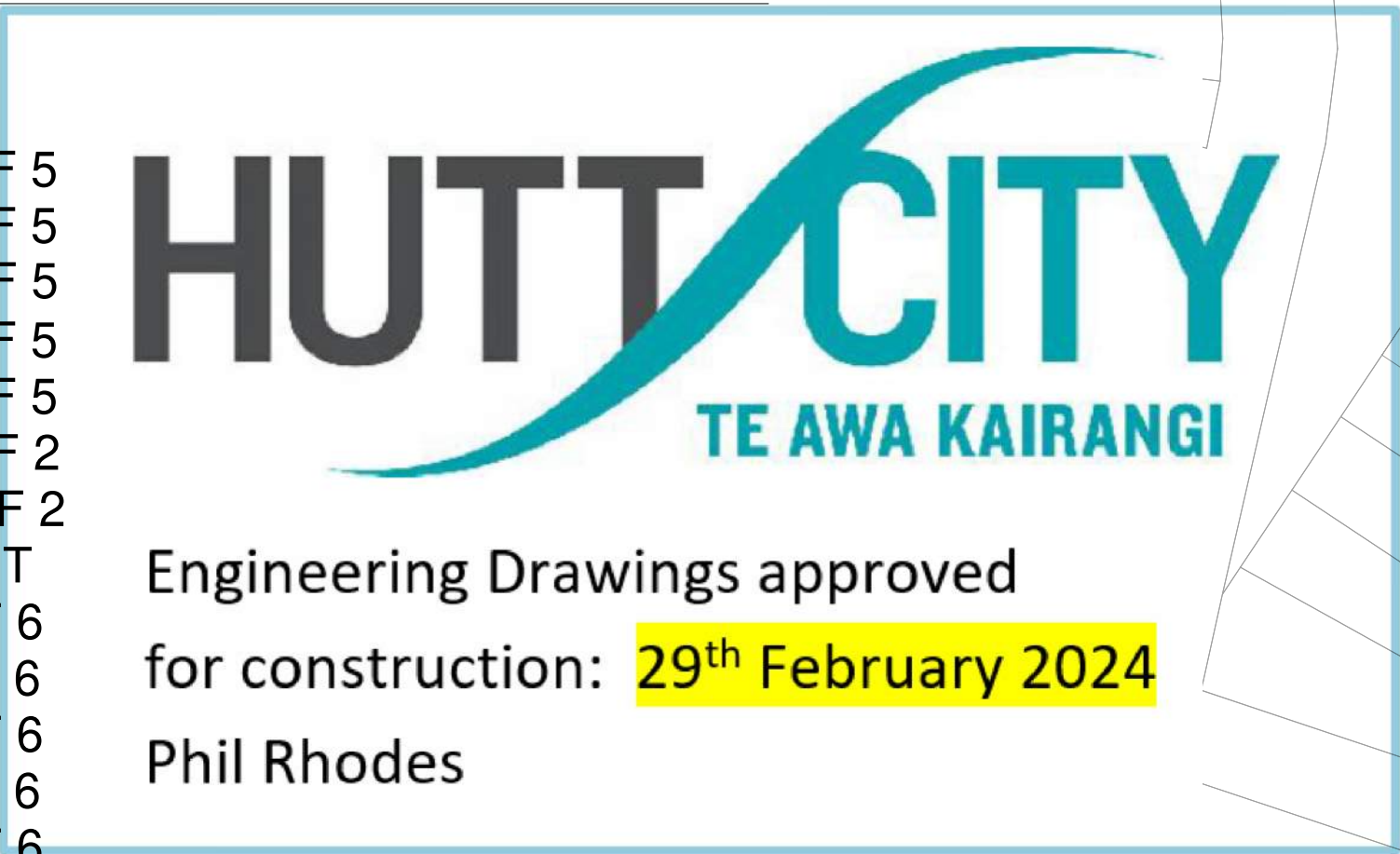
APPENDIX A – EARTHWORKS PLANS AND DESIGN REPORT

CIVIL ENGINEERING DESIGN

WAIPOUNAMU DRIVE SUBDIVISION STAGE 2B

64 WAIPOUNAMU DRIVE, KELSON, WELLINGTON

DWG No.	REV	DRAWING TITLE
S19-0774-2B-D0	G	DRAWING REGISTER
S19-0774-2B-D1	E	OVERALL LAYOUT
S19-0774-2B-D2	C	DRIVEWAY LAYOUT 1 OF 5
S19-0774-2B-D3	C	DRIVEWAY LAYOUT 2 OF 5
S19-0774-2B-D4	C	DRIVEWAY LAYOUT 3 OF 5
S19-0774-2B-D5	C	DRIVEWAY LAYOUT 4 OF 5
S19-0774-2B-D6	C	DRIVEWAY LAYOUT 5 OF 5
S19-0774-2B-D7	F	DRIVEWAY DETAILS 1 OF 2
S19-0774-2B-D8	C	DRIVEWAY DETAILS 2 OF 2
S19-0774-2B-D9	C	UTILITY TRENCH LAYOUT
S19-0774-2B-D10	C	SERVICES LAYOUT 1 OF 6
S19-0774-2B-D11	E	SERVICES LAYOUT 2 OF 6
S19-0774-2B-D12	D	SERVICES LAYOUT 3 OF 6
S19-0774-2B-D13	E	SERVICES LAYOUT 4 OF 6
S19-0774-2B-D14	D	SERVICES LAYOUT 5 OF 6
S19-0774-2B-D15	D	SERVICES LAYOUT 6 OF 6
S19-0774-2B-D16	D	SEWER LONGSECTIONS
S19-0774-2B-D17	B	STORMWATER LONGSECTIONS
S19-0774-2B-D18	B	SERVICES DETAILS 1 OF 3
S19-0774-2B-D19	B	SERVICES DETAILS 2 OF 3
S19-0774-2B-D20	A	SERVICES DETAILS 3 OF 3
S19-0774-2B-D21	A	STREET PLANTING & ROAD MARKING
S19-0774-2B-D22	A	ROADING LONGSECTIONS



NOT TO SCALE

SAFETY IN DESIGN

THE SERVICES DESIGN AS SHOWN IN THE SUBMITTED DESIGN PLANS HAVE BEEN PREPARED WITH REFERENCE TO THE COUNCIL STANDARDS, THE REGIONAL STANDARD FOR WATER SERVICES (2021), THE REGIONAL SPECIFICATION FOR WATER SERVICES (2021) AND NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE. IT IS OUR BELIEF THAT NO ASPECT OF THE SERVICES DESIGN INCLUDED HEREWITH HAS INTRODUCED ANY HEIGHTED RISK TO PERSONS EITHER LIVING AROUND OR WORKING WITH THE SERVICES INFRASTRUCTURE BEYOND A LEVEL WHICH IS CURRENTLY ACCEPTED BY SOCIETY TODAY, PERTAINING TO CONSTRUCTION, OPERATION, MAINTENANCE AND DEMOLITION PHASES OF THE ASSET THE RELEVANT CONTRACTOR SHALL:

- SUPPLY AND OPERATE UNDER A SITE SPECIFIC HEALTH AND SAFETY PLAN.
- CONSTRUCT SAFETY BARRIERS AND FALL PROTECTION PRIOR TO EXCAVATION AT EDGES OF OPENINGS AND ELEVATED AREAS.
- REVIEW ADEQUACY OF WORKING AND MOVEMENT SPACE AVAILABLE FOR CONSTRUCTION ACTIVITIES AND ENSURE SEPARATION OF PLANT AND PERSONNEL ON SITE.
- LOCATE LIFTING SLEW AND LAY DOWN AREAS AWAY FROM REGULAR CONSTRUCTION TRAFFIC.
- BE ADVISED THAT WRITTEN RISK ASSESSMENTS FOR ACCESS TO OPEN EXCAVATIONS ARE RECOMMENDED.
- PROVIDE ACCESS AND EGRESS TO EXCAVATIONS APPROPRIATE IN CASE OF INUNDATION, COLLAPSE OR ENGULFMENT.
- SEEK ADVICE FROM SUITABLY QUALIFIED GEOTECHNICAL OR STRUCTURAL ENGINEER PRIOR TO OPERATION OF HEAVY SURFACE PLANT AND EQUIPMENT OR STOCKPILING MATERIAL NEAR OPEN EXCAVATIONS OR EXISTING RETAINING STRUCTURES.
- DO NOT STOCKPILE MATERIALS BEHIND OR EXCAVATE IN FRONT OF EXISTING RETAINING WALLS UNTIL WALL STABILITY HAS BEEN REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER.
- SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER BEFORE CORING, CHASING, CUTTING OR REMOVAL OF EXISTING CONCRETE AND REINFORCEMENT.
- SEEK ADVICE FROM SUITABLY QUALIFIED ENGINEER IF PLANNING CRANE LIFTS OR HOIST INSTALLATION ON PARTIALLY ERECTED OR SUSPENDED STRUCTURES.
- INSTRUCT SERVICES CONTRACTORS UNDER NO CIRCUMSTANCES CAN STRUCTURAL MEMBERS BE CUT, NOTCHED OR DRILLED TO ACCOMMODATE NEW SERVICES.
- MINIMISE SITE BASED TREATMENTS (eg WELDING, CUTTING, SPRAY PAINTING, GRIT BLASTING, etc). PROVIDE ADEQUATE PROTECTION, SCREENING AND VENTILATION TO MINIMISE HAZARDS TO PERSONNEL IF SITE BASED TREATMENT IS UNAVOIDABLE.
- TRY TO AVOID WORKING IN CONFINED SPACES. IF CONFINED SPACES WORK CAN'T BE AVOIDED, PROVIDE SAFE WORK METHOD STATEMENT ADDRESSING MITIGATION OF RISKS. PROVIDE ADEQUATE SIGNAGE TO TEMPORARY AND PERMANENT CONFINED SPACES TO AS2865.
- AN ASSESSMENT PROTOCOL TO CEASE WORK IN BAD WEATHER CONDITIONS.

GENERAL NOTES

- PIPES, CABLES AND OTHER UTILITIES, FOUNDATIONS, LEVELS, REFERENCE MARKS AND OTHER OBSTRUCTIONS INDICATED ON THIS DRAWING ARE BASED ONLY ON READILY AVAILABLE RECORD PLANS AND OTHER INFORMATION. THIS INFORMATION MAY NOT BE COMPLETE, ACCURATE OR UP TO DATE PRIOR TO CARRYING OUT ANY EXCAVATION OR OTHER PHYSICAL WORK. CONTRACTORS SHALL OBTAIN THE LATEST INFORMATION FROM UTILITY PROVIDERS AND CARRY OUT DETAILED EXPLORATORY WORK, TRACING, LOCATING, PROTECTION, ISOLATION AND ALTERATIONS AS REQUIRED UNDER NZS 3910 CLAUSE 5.13 CONTRACTOR MUST FOLLOW OSH GUIDELINES FOR SAFE LOCATION OF UNDERGROUND SERVICES.
- RESIDENTS SHALL BE ADEQUATELY NOTIFIED PRIOR TO WORKS COMMENCING, AND 24 HOURS PRIOR TO DISRUPTION OF SERVICE.
- ALL CARE MUST BE TAKEN BY THE CONTRACTOR NOT TO DAMAGE PRIVATE PROPERTY, OR ANY GARDENED AREA OTHER THAN THOSE NECESSARY AS PART OF THE WORKS.
- ALL WORKS ARE TO BE CONSTRUCTED USING BEST TRADE PRACTICES.
- APPROVAL MUST BE SOUGHT FROM THE ENGINEER PRIOR TO THE REMOVAL OF ANY FIXTURE (IE FENCE, TREE) IN PRIVATE PROPERTY.
- ALL WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH NATIONAL CODE OF PRACTICE FOR UTILITIES ACCESS TO TRANSPORT CORRIDORS HUTT VALLEY LOCAL CONDITIONS. APRIL 2011, NATIONAL CODE OF PRACTICE FOR UTILITIES ACCESS TO THE TRANSPORT CORRIDOR NOVEMBER 2011, REGIONAL STANDARD FOR WATER SERVICES 2021, REGIONAL SPECIFICATION FOR WATER SERVICES 2021, WELLINGTON WATER APPROVED MATERIALS REGISTER 2021 AND MANUFACTURER'S SPECIFICATIONS.
- THE EXISTING SERVICES SHOWN SHOULD BE CONSIDERED INDICATIVE ONLY AND ARE BASED ON RECORDS SUPPLIED BY THE UTILITY COMPANIES OR WELLINGTON CITY COUNCIL FROM THEIR GIS DATABASE. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL SERVICES ARE LOCATED/MARKED BY THE APPROPRIATE SERVICE AUTHORITY, OR THEIR OWN STAFF, PRIOR TO ANY SITE WORKS, AND FOR PROTECTING THESE SERVICES FOR THE DURATION OF THE SITE CONTRACT.
- THE CONTRACTOR SHALL GIVE A MINIMUM OF 48 HOURS NOTICE TO WELLINGTON WATER SITE INSPECTOR PRIOR TO THE COMMENCEMENT OF WORK.
- THE CONTRACTOR SHALL PROVIDE WELLINGTON WATER SITE INSPECTOR WITH A LIST OF SITE HAZARDS AND A SITE SAFETY INDUCTION A MINIMUM OF 48 HOURS PRIOR TO THE COMMENCEMENT OF WORK.
- REFER TO THE ENGINEER'S SPECIFICATION FOR FURTHER TERMS.
- SERVICES DESIGN SHOWN IS TO UNITS ONLY, SEE ARCHITECTURAL DRAWINGS FOR DRAINAGE IN AND AROUND UNITS

WATER

- THE CONTRACTOR IS TO CHECK INVERT LEVELS OF EXISTING AND PROPOSED SYSTEM AND ADVISE ENGINEER OF ANY ANOMALIES PRIOR TO COMMENCING PIPE LAYING.
- WATER MAIN IS TO BE SOURCED TO REMOVE ALL DEBRIS BEFORE COMMISSIONING TESTING AND SERVICES ARE CONNECTED TO HOUSES.
- MINIMUM COVER OF 750mm AT ALL PLACES MEASURED FROM THE GROUND SURFACE MAXIMUM COVER TO BE 1350mm.
- CONCRETE THRUST BLOCKS TO BE CONSTRUCTED ON ALL BENDS, TAPERS, TEES AND DEAD ENDS. CONCRETE TO BE 20 MPa. THRUST BLOCKS TO BE CONSTRUCTED TO MAINTAIN ACCESS TO THE BOLTS ADJACENT JOINTS/FLANGES AND FITTINGS CONCRETE THRUST BLOCKS TO BE SIZED AS PER REGIONAL STANDARD (2019).
- ALL BACKFILL MATERIAL SHOULD BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING 200mm IN LOOSE DEPTH.
- THE CONTRACTOR SHALL CARRY OUT SCLA PENETROMETER TESTING AND NOT MORE THAN 5m DISTANCES ALONG TRENCH, THE RESULTS MUST BE RECORDED AND MADE AVAILABLE TO THE ENGINEER A COMPACTION OF NOT LESS THAN 7 BLOWS / 50mm, 4 BLOWS / 50mm AND 2 BLOWS / 50mm IN CARRIAGEWAYS, FOOTPATHS AND BERMS RESPECTIVELY MUST BE ACHIEVED.
- DETECTOR TAPE MUST BE LAID ABOVE ALL WATER PIPES IN ACCORDANCE WITH REGIONAL STANDARDS FOR WATER SERVICES.
- CONTRACTOR TO REMOVE ABANDONED VALVES AND HYDRANTS. NOTE ALL REINSTATEMENT IS TO COMPLY WITH NATIONAL CODE OF PRACTICE FOR UTILITY OPERATORS ACCESS TO TRANSPORT CORRIDORS.
- LOCATION AND REQUIREMENTS FOR BENDS SHOWN ARE INDICATIVE, CONTRACTOR TO CONFIRM SPECIFIC LOCATIONS AND REQUIREMENTS WITH ENGINEER ON SITE.
- SERVICE CONNECTION LOCATIONS ARE INDICATIVE ONLY; SERVICE PIPES SHALL BE LAID PERPENDICULAR TO THE MAIN. ALL SERVICE PIPES SHALL BE EXTENDED TO THE NEW MAIN.
- AN ENGRAVED PLASTIC TAG READING "WATER SUPPLY MANIFOLD FOR (STREET NUMBER)" IS TO BE SECURED TO THE MANIFOLD CLEARLY SHOWING WHICH PROPERTY IS SERVED BY THE MANIFOLD.

SEWER / STORMWATER

- ALL PIPE SIZES SHOWN ARE NOMINAL DIAMETER UNLESS OTHERWISE STATED.
- THE CONTRACTOR IS TO ENSURE ALL WASTEWATER IS CONTAINED WITHIN THE SEWER SYSTEM. ANY OVERPUMPING IS TO BE ALLOWED FOR IN THE CONTRACT RATES. THERE ARE TO BE NO SEWAGE SPILLS IN PRIVATE PROPERTY.
- THE CONTRACTOR IS TO ALLOW FOR ALL SHORING REQUIRED FOR TRENCHING IN ANY UNSTABLE GROUND WHICH MAY BE ENCOUNTERED.
- THE LATERAL STUB POSITIONS TO BE CONFIRMED FROM CCTV BY THE CONTRACTOR. PRIOR TO RECONNECTION TO THE NEW PIPELINE, TESTS SHALL BE CARRIED OUT TO DETERMINE LIVE LATERALS SHALL BE CONNECTED.
- EXISTING LAWN SHALL BE REMOVED AS TURF SLABS AND REINSTATED ON COMPLETION.
- CONTRACTOR TO DEWATER AS NECESSARY TO COMPLETE THE WORKS.
- CONTRACTOR TO REINSTATE ALL ROAD SURFACE MARKINGS AND RPPMS.
- PROVIDE WATER STOPS ON STEEP SECTIONS IN ACCORDANCE TO WITH REGIONAL WATER SPECIFICATIONS.
- EXISTING SEWER PIPES TO BE ABANDONED SHALL BE CAPPED OFF AT BOTH ENDS WITH A CONCRETE PLUG.
- WHERE EXISTING MANHOLES ARE BEING REPLACED WITH NEW, THE CONTRACTOR SHALL RECONNECT ALL EXISTING PIPELINES TO THE NEW MANHOLE.
- THE CONTRACTOR IS TO NOTIFY THE ENGINEER WHERE INVERT LEVELS FOR NEW MANHOLES DONT WORK WITH THE DESIGN GRADES OR WITH THE TOPOGRAPHY ONSITE.
- THE CONTRACTOR SHALL CHECK AND CONFIRM ALL EXISTING SEWER LOCATIONS AND LEVELS ON SITE AS AN INITIAL ACTIVITY. ADVISE THE ENGINEER FOR FURTHER INSTRUCTION SHOULD THESE DIFFER FROM THE INFORMATION SHOWN ON THE DRAWINGS.
- ALL MANHOLES AFFECTED BY THE WORK SHALL HAVE THEIR CONDITION REVIEWED BY THE CONTRACTOR AS AN INITIAL ACTIVITY INCLUDING A RECOMMENDATION AS TO WHETHER UPGRADE OR REPLACEMENT IS REQUIRED. THE ENGINEER SHALL INSTRUCT ON THE REQUIRED APPROACH THEN.
- ALL GRAVITY DRAINS TO BE CCTV INSPECTED AND SENT TO ENGINEER

UNDERGROUND POWER

AT LEAST 2 WORKING DAYS' NOTICE REQUIRED PRIOR TO EXCAVATION, HAND DIGGING IS REQUIRED WHEN EXCAVATING WITHIN 1m OF CABLE. REPLACEMENT TRENCH BACKFILL MATERIAL MUST BE THE SAME AS THE REMOVED AND MUST BE REPLACED TO THE SAME LEVEL OF COMPACTION.

UNDERGROUND TELECOM

ONSITE CABLE LOCATE OR STANDOVER IS REQUIRED IF WORKING WITHIN 1m OF THESE CABLES. AT LEAST 2 WORKING DAYS' NOTICE REQUIRED TO EXCAVATION. FOR LOCATE AND STANDOVER CONTACT 0800 248 344.

UNDERGROUND GAS

- EXCAVATION AROUND STRATEGIC INTERMEDIATE PRESSURE (FEEDER MAIN OPERATING AT PRESSURES GREATER THAN 700 KPa (100 PSI) AND MEDIUM GAS PIPES:
- MACHINE DIGGING IS NOT PERMITTED CLOSER THAN 1.0m FROM ANY STRATEGIC INTERMEDIATE PRESSURE AND MEDIUM PRESSURE GAS MAINS OR SERVICES ANT EXCAVATION WORK WITHIN THE DISTANCE MUST BE PERFORMED BY HAND DIGGING AND UNDER THE OBSERVATION OF A POWERCO APPROVED WORKS PROTECTION OBSERVER INCLUDING THE BACKFILLING OPERATION.
 - PLEASE REFER TO THE POWERCO STANDARD "EXCAVATION WORKS IN THE VICINITY OF STRATEGIC CABLES AND PIPES" BEFORE COMMENCING EXCAVATION WORK IN THE VICINITY OF STRATEGIC GAS PIPES.

- EXCAVATION AROUND MEDIUM AND LOW PRESSURE GAS PIPES:
- MACHINE DIGGING IS NOT PERMITTED CLOSER THAN 500mm FROM ANY MEDIUM OR LOW PRESSURE GAS MAIN OR SERVICE UNLESS THE POSITION OF THE PIPES HAS BEEN VERIFIED BY HAND DIGGING AND EXPOSING THEM FIRST.

- NOTIFICATION OF WORK NEAR STRATEGIC INTERMEDIATE PRESSURE AND MEDIUM PRESSURE GAS PIPES:
- AT LEAST 2 WORKING DAYS NOTICE MUST BE GIVEN TO POWERCO PRIOR TO ANY EXCAVATION WORK TAKING PLACE.
 - IT IS THE EXCAVATION CONTRACTORS RESPONSIBILITY TO CONTACT THE POWERCO HELP DESK ON 0800769372 FOR THE ABOVE INFORMATION.
 - THE EXCAVATION CONTRACTOR WILL BE ISSUED WITH A WORKS AGREEMENT WHICH MUST BE COMPLETED AND SIGNED PRIOR TO ANY EXCAVATION WORK TAKING PLACE ANY STRATEGIC PRESSURE OR MEDIUM PRESSURE GAS PIPES.

- LOCATION OF OTHERS SERVICES:
- NO SERVICES SHALL BE LAID CLOSER THAN 300mm FROM ANY INTERMEDIATE PRESSURE GAS PIPE FOR INTERMEDIATE PRESSURE GAS PIPES.
 - NO SERVICES SHALL BE LAID CLOSER THAN 150mm FROM ANY LOW OR MEDIUM PRESSURE GAS PIPE FOR LOW OR MEDIUM PRESSURE GAS PIPES.

HEIGHT DATUM

COORDINATE DATUM - NZGD 2000 (WELLINGTON)

HEIGHT ARE IN TERMS OF
- WELLINGTON DATUM 1953

- ORIGIN OF LEVELS
- MARK NAME ORM V DP 42106
 - REDUCED LEVEL 148.06
 - SOURCE CONVERTED FROM NZVD 2016

NO	REVISION	BY	DATE
A	FIRST ISSUE		
B	MINOR AMENDMENTS FOR HCC ENG APP	JFC	18-09-2023
C	UPDATED SEWER LEVELS	JDS	12-10-2023
D	UPDATED TRENCH DETAILS	JDS	13-11-2023
E	UPDATED STORMWATER DETAILS	JDS	27-11-2023
F	UPDATED DESIGN	JDS	01-02-2024
G	UPDATED DROP CROSSING	JDS	26-02-2024

SpencerHolmes
engineers - surveyors - planners

Level 10 - 57 Willis Street
PO Box 588 Wellington New Zealand
(04) 472-2261 www.spencerholmes.co.nz

CLIENT
**GENESIS RESIDENTIAL
KELSON LTD**

PROJECT
KELSON HEIGHTS

DRAWING TITLE
DRAWING REGISTER

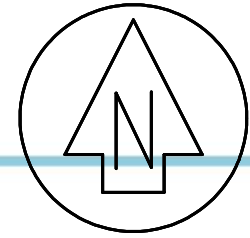
DESIGN CONSULTANT

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The Contractor shall verify all dimensions on site.

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☐ S19-0774-Des0b_Register - D0	
☐ DRAWN JDS	
☐ CHECKED JFC	
SCALE	AT
NOT TO SCALE	A1
DRAWING NUMBER	REV
S19-0774-2B-D0	G

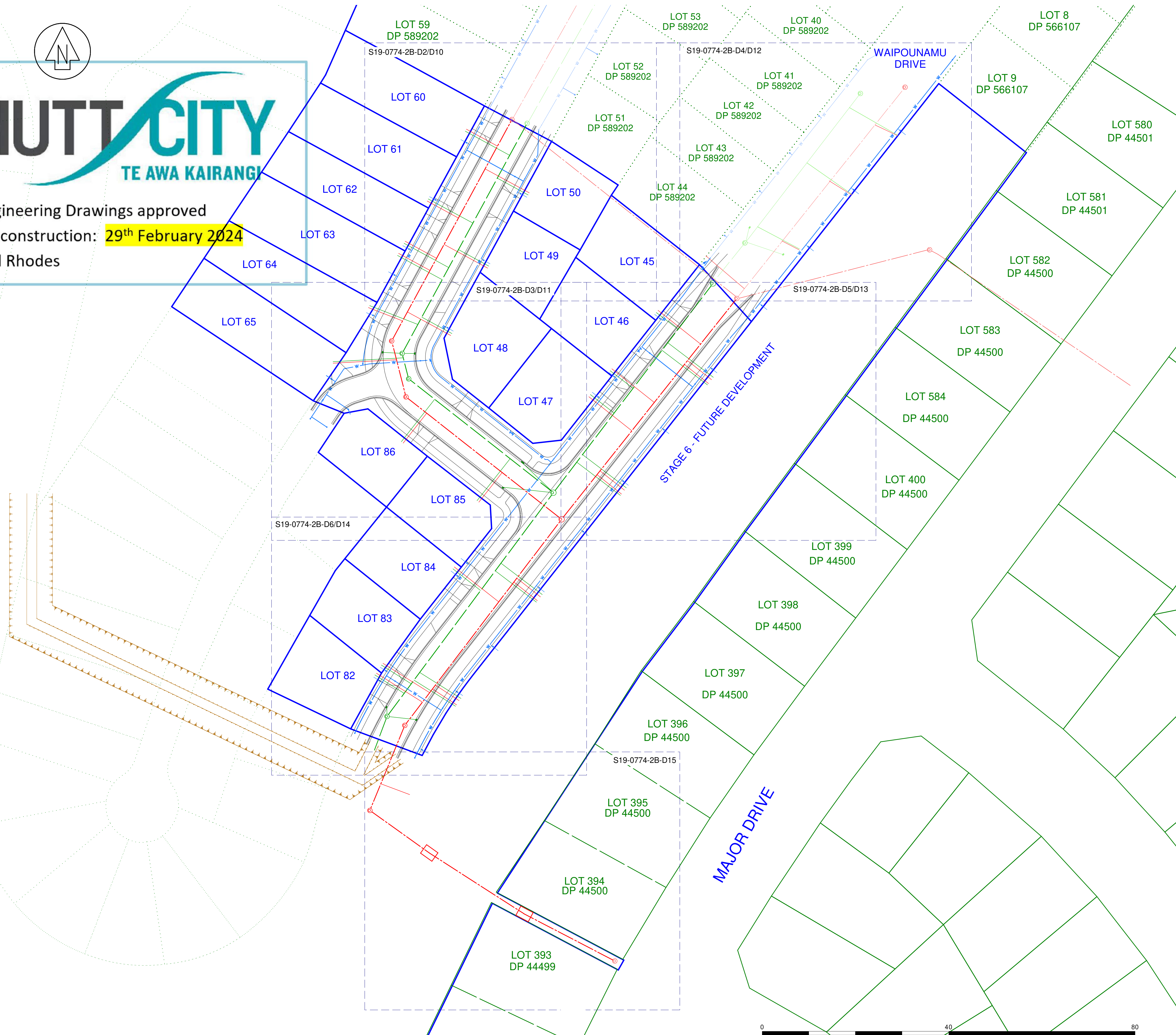
RESOURCE MANAGEMENT - LAND PLANNING - SURVEYING - STRUCTURAL - CIVIL - FIRE



HUTT CITY
TE AWA KAIRANGI

Engineering Drawings approved
for construction: 29th February 2024
Phil Rhodes

NO	REVISION	BY	DATE
A	FIRST ISSUE	JFC	18-09-2023
B	MINOR UPDATE - ENG APP	JDS	13-11-2023
C	UPDATED TRENCH DETAIL	JDS	27-11-2023
D	UPDATED STORMWATER LAYOUT	JDS	26-02-2024
E	UPDATED DROP CROSSING	JDS	



SpencerHolmes
engineers - surveyors - planners

Level 10 - 57 Willis Street
PO Box 588 Wellington New Zealand
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CLIENT
**GENESIS RESIDENTIAL
KELSON LTD**

PROJECT
KELSON HEIGHTS

DRAWING TITLE
**STAGE 2B:
OVERALL LAYOUT**

DESIGN CONSULTANT

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☐ S19-0774-DES1d_Overall 20230907 - D1
☐ DRAWN JDS
☐ CHECKED JFC

DATE 25/08/2023

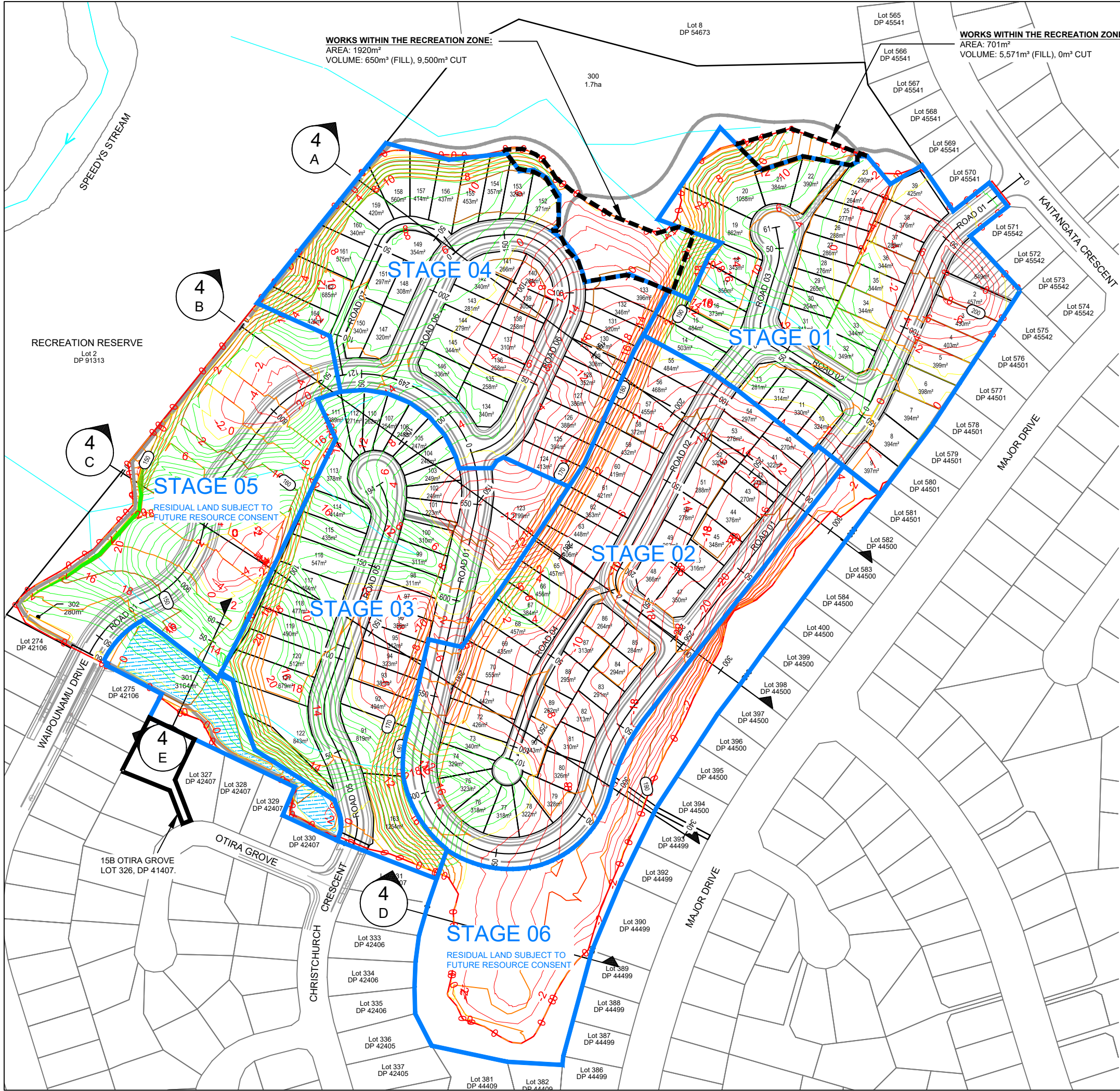
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DRAWING NUMBER
S19-0774-2B-D1

AT
A1

REV
E

RESOURCE MANAGEMENT - LAND PLANNING - SURVEYING - STRUCTURAL - CIVIL - FIRE



KEY:

6

CUT CONTOUR

6

FILL CONTOUR

0

0 CONTOUR LINE
(NO CUT/FILL)

LOT
301

PROPOSED WETLAND

QUANTITIES:
TOTAL BULK EARTHWORKS CUT TO FILL = 412,000m³
TOTAL SITE AREA TO BE DISTURBED AND VEGETATION REMOVED = 11.98 HA
STAGE 1 APPROVED AS PART OF STAGE 1 CONSENT IS = 7.19 HA
STAGE 2 TOTAL AREA AND VEGETATION REMOVABLE REQUIRED = 4.79 HA

B	REV B.	21 JULY 19
A	1ST ISSUE	BY TN
REV.	REVISION DETAILS	DRAWN APP.
macroVentures		
+64224875171 trishn@macroventures.co.nz www.macroventures.co.nz		
PROJECT DETAILS		
GENESIS RESIDENTIAL LTD DEVELOPMENT OF 64 WAIPOUNAMU DRIVE		
TITLE		
EARTHWORKS VOLUME		
020406080100m		
SCALE 1:2000 AT ORIGINAL SIZE		
DATE CREATED 16/8/2019		REF NO P1
DRAWN TSN	DESIGNED ----	APPROVED ----
SCALE 1:2000 @ A3		STATUS FOR CONSENT
DWG NUMBER 03		REVISION B

Report Layout

- Report Sheet No. 1 of 1 – Overview, Discussion and Recommendations
- Appendix A – Sketch 01 and 02, Geological Sections
- Appendix B – SHL , NTE 07–Wall Layout Drawings
- Appendix C – Test Locations and Logs
- Appendix D – Slope Stability Outputs
- Appendix E – Internal Stability Analyses
- Appendix F – ENGEO Earthwall Specification

Introduction

Genesis Residential Kelson Ltd (GRKL) have engaged Torlesse Ltd (Torlesse) to provide geotechnical engineering services for the residential land development project ‘Kelson Heights’ (the Project) located at Waipounamu Drive, Kelson, Lower Hutt. The development includes a six reinforced soil structures (RSS) of varying sizes. The preliminary design of all six RSS’s was undertaken by Engeo Ltd (Engeo). This report presents a summary of the detailed design for Earth Wall 05 (EW 05).

The following report presents the geotechnical findings and recommendations set out in Variation Order 07 of the Project. The terms and conditions for the Variation are set out in the Short Form Agreement dated 03 November. Our scope of work for Variation Order 07 comprises the following:

- Review and confirm the plan and geological sections prepared by Engeo.
- Undertake global slope stability analyses with the use of Rocscience Slide2 software, adopting a design life of 100 years and an Importance Level of 2.
- Complete internal stability checks via suppliers proprietary software.
- Confirm the subsoil drainage measures as part of the standard Engeo design are adequate for the wall.
- Provide a construction detail for controlling groundwater from the ephemeral stream.
- Mark up the wall and general arrangements on SHL drawings.
- Prepare a geotechnical report summarising the findings and recommendations from the detailed design.

Relevant Information

The following information has been received:

- Geotechnical Report for earth works suitability of Lot 1 DP 91313 64 Waipounamu Drive Kelson, Cook Costello, 19 September 2017.
- Design Report for Reinforced Soil Structures Manapouri Grove Kelson Lower Hutt, Engeo, 12 November 2019.
- Kelson Heights – Stage 3 Kelson (9124-5095), Cirtex, 26 January 2024
- Stage 2B, Kelson Heights, Kelson; Contract number P0246 , SHL, 24 January 2024

Preliminary Design

Engeo undertook the preliminary design of six RSS ‘embankments’ at 25 Waipounamu Drive in Kelson, Wellington. The embankments were designed to a 100 year design life and importance level 2. The general design for ‘Embankment 2’ is detailed below. Geogrids are separated vertically by 1.0m.

Ground Investigation

Limited ground investigation data is available at site. Twelve test pits were undertaken by Cook Costello in 2016, to a maximum depth of 3.2m below ground level (bgl). Bedrock was generally encountered between 1.0–3.0m bgl. Groundwater was only encountered in two of the test pits (TP05 and TPA). The depth to groundwater was around 1.5m bgl for both test pits. Test location and logs are presented in Appendix C.

Torlesse undertook site walkovers during de-vegetation and stripping of the subgrade to EW 02. The subgrade generally comprised a thin mantle of colluvium and completely weathered Greywacke, underlain by Highly Weathered Greywacke, refer to Figure 1.

Ground Model

Two geological sections were produced, one at CH40 and another at CH55. Refer to Appendix A for the geological cross sections. Soil parameters adopted for the design are set out in the table below.

Global Stability Analyses

Unit	γ (kN/m³)	φ’ (°)	c’ (kPa)
Engineered Fill	18	34	0
Colluvium/CW Greywacke	20	36	4
HW Greywacke	24	42	10

A set of slope stability analyses were undertaken with the use of RocScience Slide™ software. The model was set up to run the GLE / Morgenstern-Price stability method with non-circular slip surfaces. Outputs from the analyses are provided in Appendix D.

The ground motion parameters for the geotechnical analyses are estimated in line with NZGS Guidelines 2016-2017 and NZS 1170.5. These guidelines have been selected as they were the recommended guidelines at the time the preliminary design was completed. The peak ground accelerations (PGAs) were factored by 0.5 to account for wall deflection (W_d), and summarised as follows:

- SLS Seismic – 0.065g
- ULS Seismic – 0.27g

The retaining wall was designed with Cirtex SGU 80 geogrid, extending 12m and spaced at 1.0m vertically. Geological section CH40 and CH55 were used to evaluate the design. The vertical height of the wall at CH40 was 9m and at CH55 was 14m. The table below outlines the design criteria required for each design case for the wall. As demonstrated in the table, all cases for both geological sections met the FoS criteria.

Internal Stability

Case	Target FoS	CH40 FoS	CH55 FoS
Static	1.5	1.6	1.5
Static, high groundwater	1.3	1.5	1.3
Seismic - SLS	1.3	1.5	1.4
Seismic - ULS	1.0	1.0	1.0

The internal stability check was undertaken by Cirtex Industries Ltd (Cirtex) using ReSSA+ software. Cirtex evaluated seven cross sections along the RSS; chainages CH35–HC65 at 5m intervals. Design checks were undertaken for both static and seismic conditions. The outputs are presented in Appendix E.

Based on the analyses, the minimum design which meets internal stability requirements is 12.0m long SGU 80 grids, vertically spaced at 1.0m.

Detailed Design Summary

The design is summarised as follows:

- Maximum retained height: 14m
- Embedment: 2m
- Geogrid: Stratagrid SGU 80 at 1.0 vertical spacing, 12m length.
- Backfill: site won material approved by Torlesse. Blending of site won material with imported GAP65 may be required to achieve a suitable well graded fill. Compaction requirements to be advised following laboratory testing.
- Fall protection fence is required behind the wall facing to F4 of NZ Building Code. Install using Strata Sleeve-IT® post anchor. Fence to be designed by others.

Chainage (m)	Max Height (m)	Grid Length (m)	Grid
0 to 37 and 58 to 92	10	12	SGU 80
37 to 58	14	12	

Drainage

The retaining wall is to be constructed across an ephemeral stream. Soil drains should be installed along the ephemeral stream to ensure the stream is able to drain. The drains are to be overlaid by gravel material before constructing the RSS.

Global stability modelling showed the RSS is sensitive to groundwater and therefore adequate drainage will be crucial to the long term stability of the wall. The internal drainage of the embankments is to be constructed by placing a drainage geofabric along the rear cuts. These will lead to filter wrapped Novocoil drains at the base of the gully, refer to the notes within the SHL Wall Layout Drawings (Appendix B).

Construction Phase Monitoring

We will complete construction monitoring of the anchored wall to Engineering NZ Level CM4. Inspection hold points are presented on page 10 of Appendix F (Engeo Earthwall Specification). Inspection of non-specific design elements may generally be undertaken by a Building Inspector of Hutt City Council.



Figure 1: RSS Location.

Client:
Genesis Residential Ltd

Project Name:
Kelson Heights Development

Site Location:
Waipounamu Drive, Kelson, Lower Hutt

Sheet Title:
EW 02—Overview, Discussion and Recommendations

Project/Report No:
T0093/02

Sheet No:
1 of 1

Prepared By:
O Ross

Initials:
OR

Reviewed By:
N Schumacher

Initials:
NS

Rev.	Date:	Description	Initials
A	30/01/24	DRAFT	OR

Notes:

Applicability Statement:

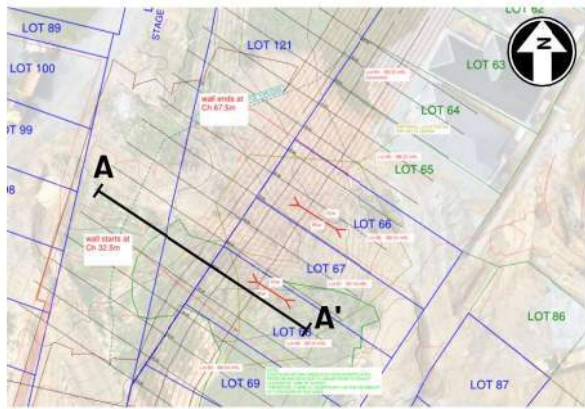
This report has been prepared on behalf of, and for the exclusive use of, the Client, and is subject to, and issued in accordance with, the provisions of the contract between Torlesse and the Client. Torlesse accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party. In preparing this report, Torlesse has relied upon information provided by or on behalf of our Client. Torlesse accept no responsibility for the reliability or accuracy of this information. This report is not to be reproduced either wholly or in part without Torlesse’s prior written approval. Interpretation of the ground conditions presented have been based on geotechnical data from point locations, between which ground conditions may differ. The actual underlying ground conditions may differ from those presented in this report.

Torlesse™

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MEMBER

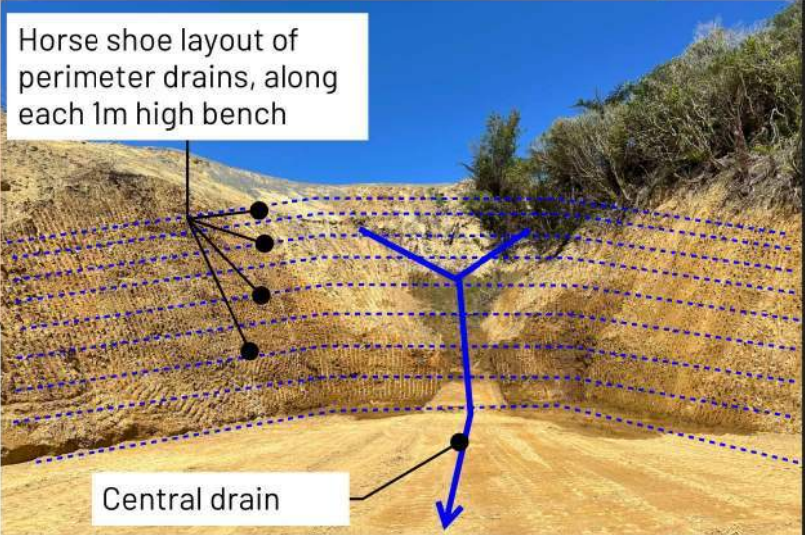
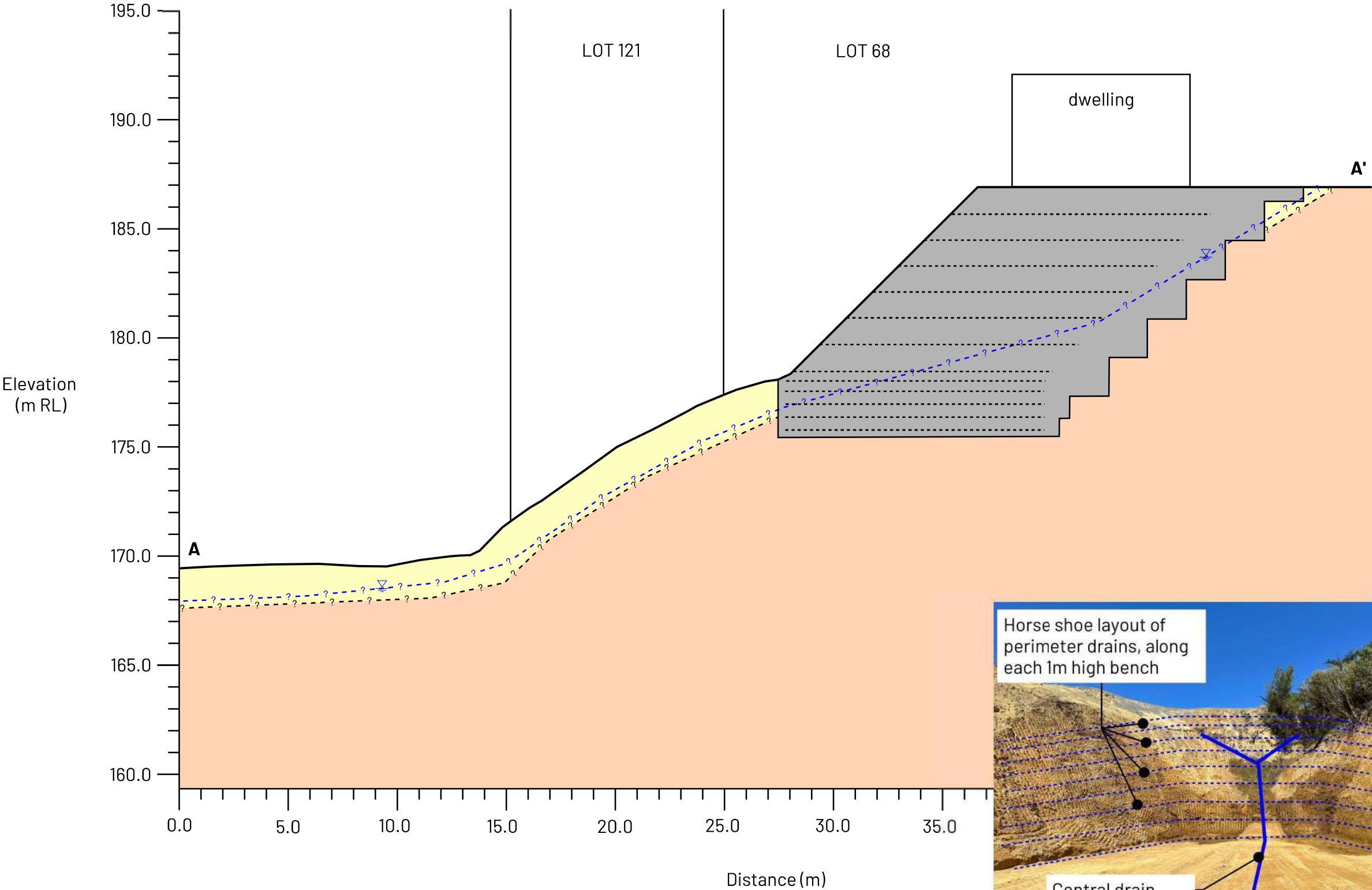
ENGINEERING
NEW ZEALAND
OFFICIAL
MEMBER

APPENDIX A: SKETCH 01 AND 02, GEOLOGICAL SECTIONS

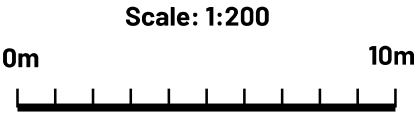


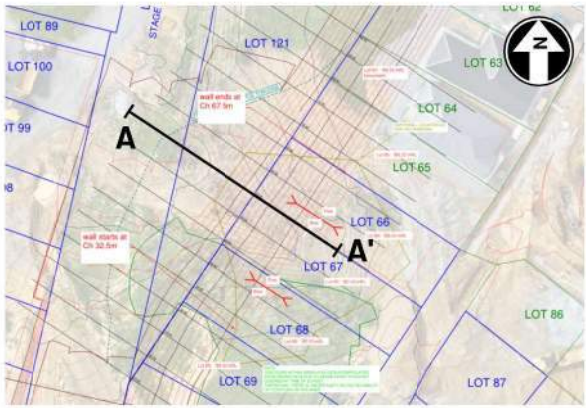
LEGEND

- Engineered Fill
- Colluvium/CW Greywacke
- HW Greywacke
- Groundwater table
- SG500 Geogrid



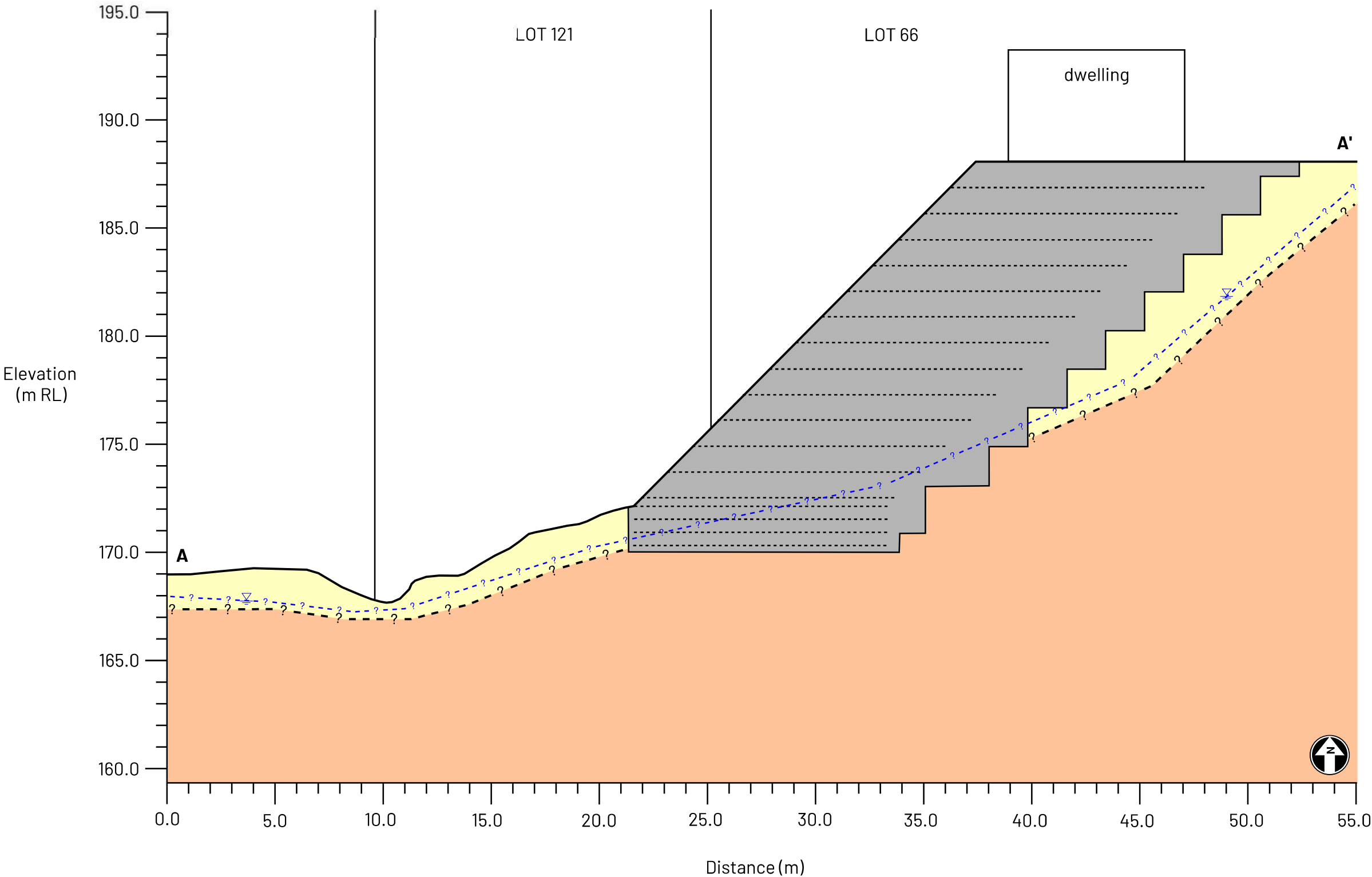
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Project Name: Kelson Heights			
Site Location: Waipounamu Drive, Kelson, Lower Hutt			
Sketch Title: Geological Section CH40			
Project/Report No.: T0093/02			
Sketch ID: 2 of 2			
Author: O Ross			Initials: OR
Checked By: J Spinks			Initials: JS
Rev.	Date	Description	Initials
-	30/01/24	Draft	OR
Notes: 1. No existing dwelling at Lot 68. Distance and loading has been assumed.			





LEGEND

- Engineered Fill
- Colluvium/CW Greywacke
- HW Greywacke
- Groundwater table
- SG500 Geogrid



Client:
Genesis Residential
Kelson Ltd

Project Name:
Kelson Heights

Site Location:
Waipounamu Drive, Kelson, Lower Hutt

Sketch Title:
EW 05, Geological Section CH55

Project/Report No.:
T0093/02

Sketch ID:
1 of 2

Author:
O Ross

Initials:
OR

Checked By:
J Spinks

Initials:
JS

Rev.	Date	Description	Initials
-	30/01/24	Draft	OR

Notes:
1. No existing dwelling at Lot 66.
Distance and loading has been assumed.

Torlesse™



APPENDIX B: SHL, NTE 07 – WALL LAYOUT DRAWINGS

Site Instruction



Instruction No. 7

Date 24/01/2024

Job Ref **SHL S19-0774**

Client Genesis Residential Ltd

Project **Stage 2B, Kelson Heights, Kelson**
Contract number P0246

PO Box 588
Level 10, 57 Willis Street
Wellington New Zealand
Ph: 04 472 2261
email admin@spencerholmes.co.nz

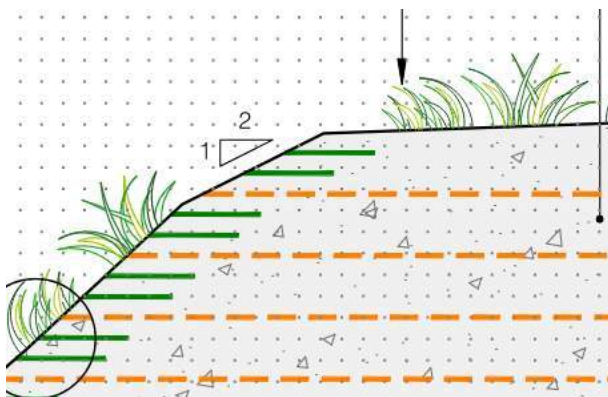
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	RMS Contracting	Ross Troughton	ross@rmscontracting.co.nz
	Genesis Residential Ltd	Chris Mason	chris.mason@bvh.co.nz
	Spencer Holmes Ltd	Mark Cooney	mwc@spencerholmes.co.nz
	Spencer Holmes Ltd	Rowan Tailby	rmt@spencerholmes.co.nz
	Spencer Holmes Ltd	Jo Cushen	jfc@spencerholmes.co.nz
	Torlesse	Jerry Spinks	jerry@torlesse.co

Details

EW02 Design Documentation from Torlesse

Please find attached the 7p document 'S19-0774 EW 02, geotech mark ups, 15.12.23 v1' that details the design parameters from Torlesse for EW02. Key points to note:

- Page 1: The latest design information is shown in red (both line work & text). Please ignore the dark cyan dashed line labelled 'Draft 20231212 EW02 Toe Torlesse' text and the mustard line labelled 'Earthwall Location as per Vecta Design'
- Pages 2-6: Detail the cross sections through EW02. The green line represents the 29/11/2023 topographical surface, the red line the Vecta design mesh. The thick black line is the Torlesse mark up of the estimated EW02 extent.
- Page 7: Details the typical geogrid details. Please note the Torlesse amendment to the toe details, being '2m deep, 4 rows of Grid'.
- The Vecta Design Tin for the project, already issued to RMS, remains current.
- RMS need to allow for a profiled batter at the top of the wall as per the sketch below:



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Wellington New Zealand
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email admin@spencerholmes.co.nz

- If too much material has been excavated from the slope while clearing vegetation, there may be a need for a 2H:1V engineered fill slope extending from the toe of the wall / or continue the wall down so that it ties in with the current ground level. Torlesse can advise on this on site.
- Any design queries about EW02 need to be raised early and will be addressed by Torlesse.

Let us know if there are any questions.

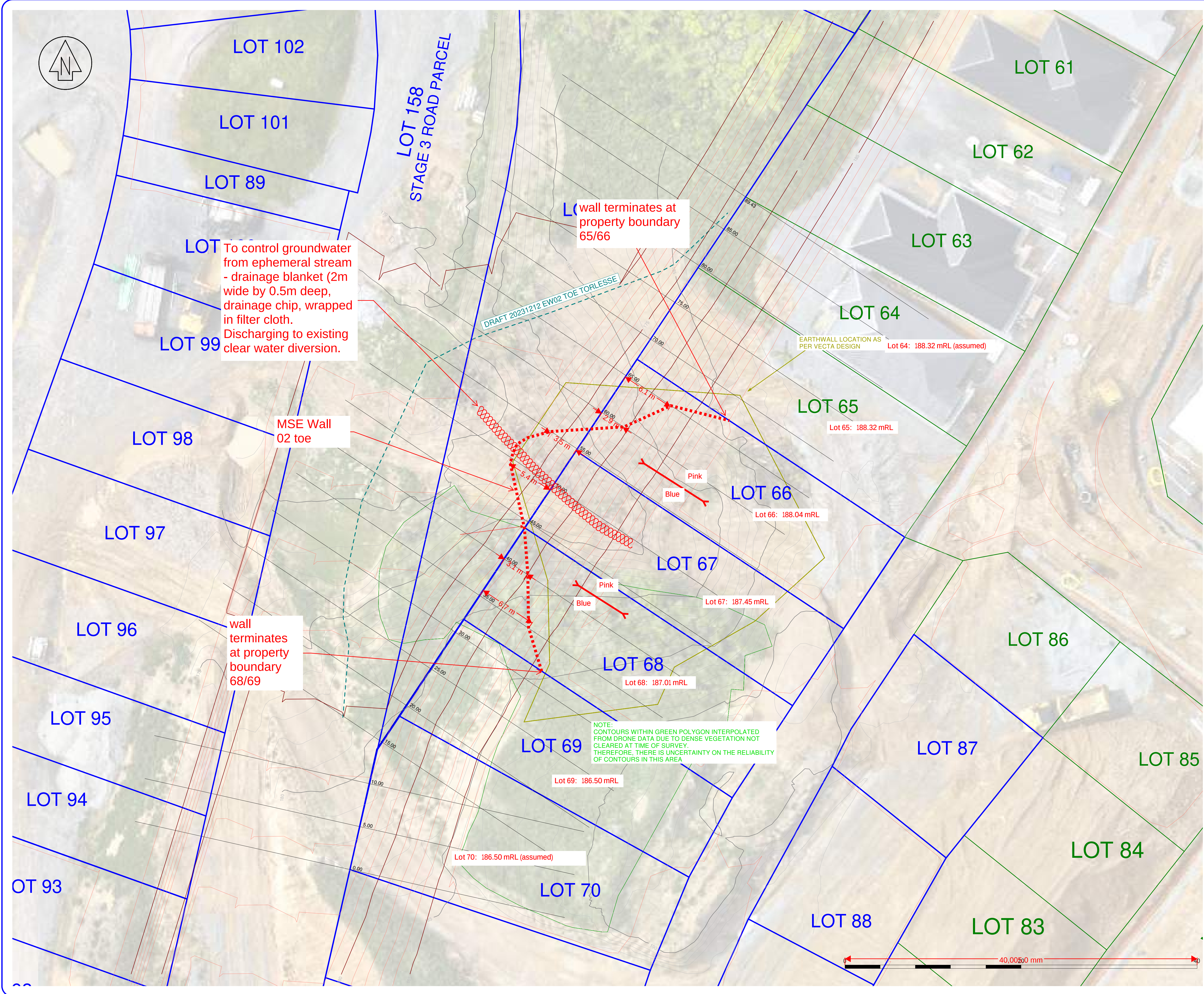
Jo Cushen

Associate - Licensed Cadastral Surveyor

SpencerHolmes Limited

jfc@spencerholmes.co.nz

M 021 952 998



NO	REVISION	BY	DATE
A	FIRST ISSUE		

CONTOUR KEY:

SHL TOPOGRAPHIC SURVEY CONTOURS:

MAJOR: —

MINOR: —

VECTA DESIGN CONTOURS:

MAJOR: —

MINOR: —

Topographical Survey Work
Contours have been interpolated from surveyed spot heights. Accuracy will vary depending on proximity to the spot heights used to derive the contour.

Retaining walls either on or very close to a boundary can affect the assessment of ground level at the boundary. Care must be taken when assessing ground level at the boundary for the determination of building recession planes.

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If the specific position or height of any wall, building or structure is critical to the design then its accuracy must be confirmed by SHL before it can be relied upon.

Topographic details measured through combined Drone & Total Station survey.
Imagery from Drone flight conducted 29/11/2023.

For cross sections, refer to adjoining plan "S19-0774-T39"

COORDINATE DATUM - NZGD 2000 (WELLINGTON)
- WELLINGTON 1953

HEIGHT ARE IN TERMS OF
- REDUCED LEVEL 148.06
- SOURCE CONVERTED FROM NZVD 2016

ORIGIN OF LEVELS
- MARK NAME ORM V DP 42106
- REDUCED LEVEL 148.06
- SOURCE CONVERTED FROM NZVD 2016

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PROJECT
WAIPOUNAMU DR, KELSON

DRAWING TITLE
EW02: TOPOGRAPHICAL SURVEY WITH DESIGN ANALYSIS

DESIGN CONSULTANT

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☐ s190774 EW02 TOPO FOR DES

☐ DRAWN MDM

☐ CHECKED JFC

☐ FB

☐ DATE

13/12/2023

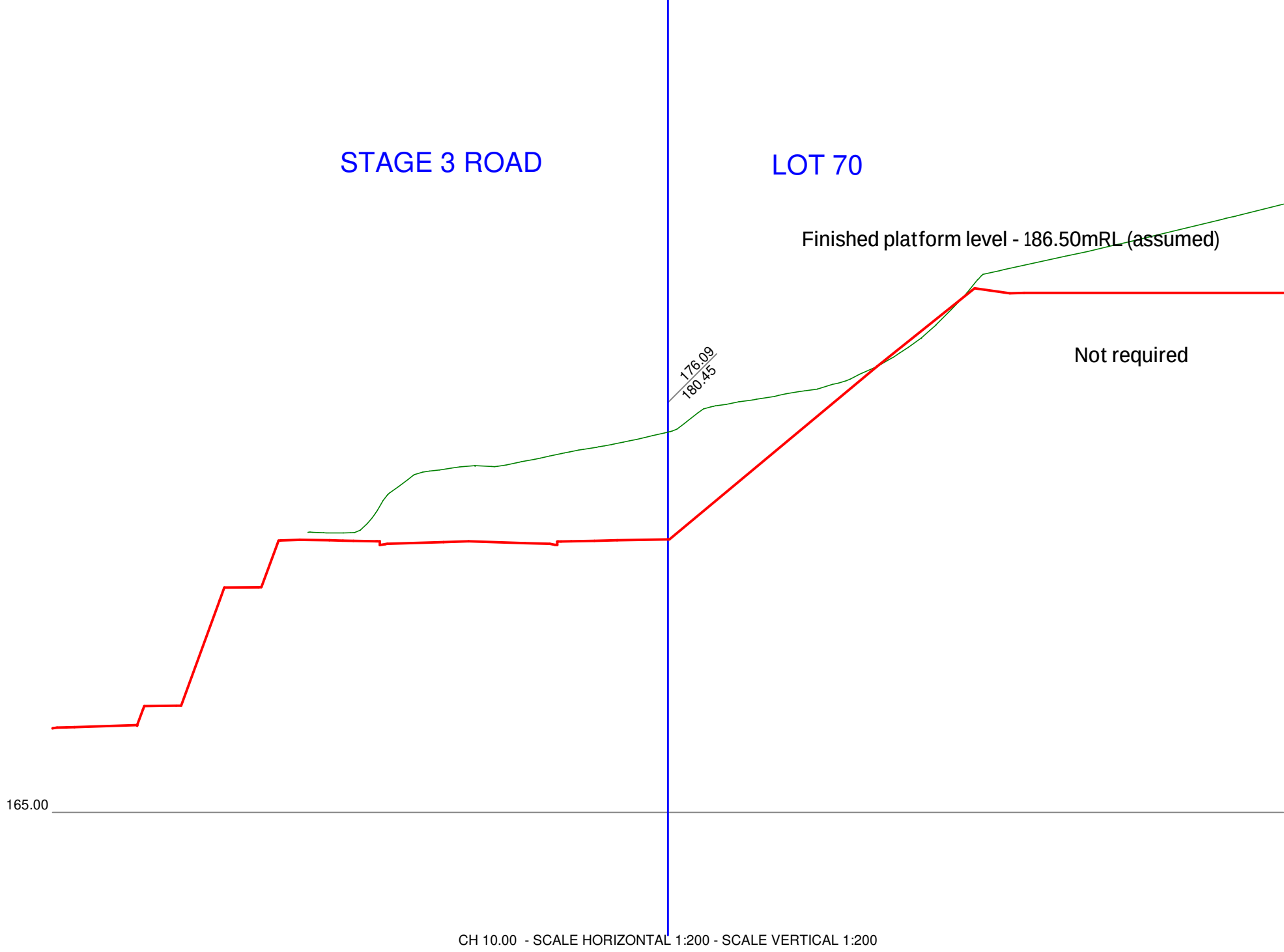
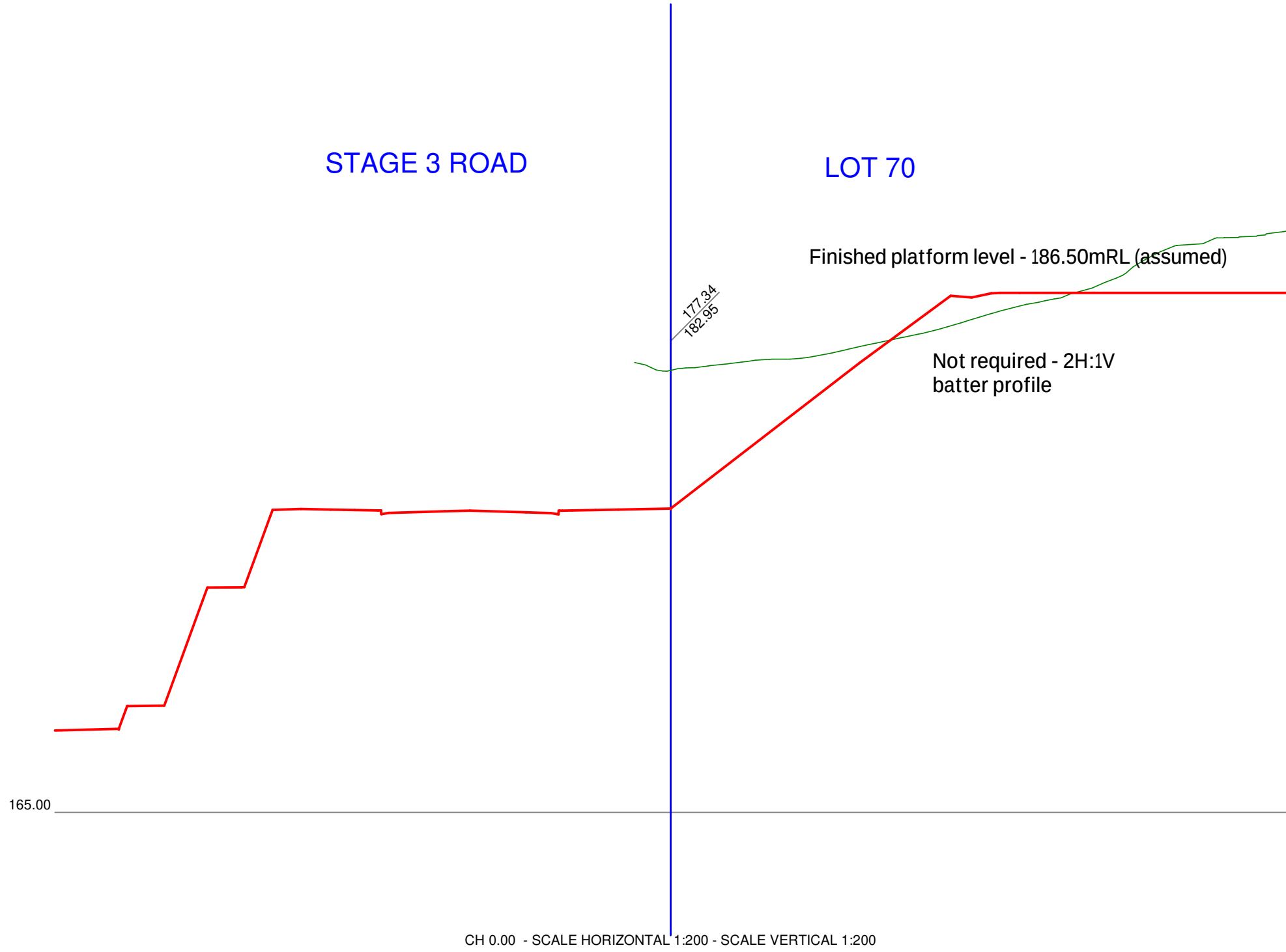
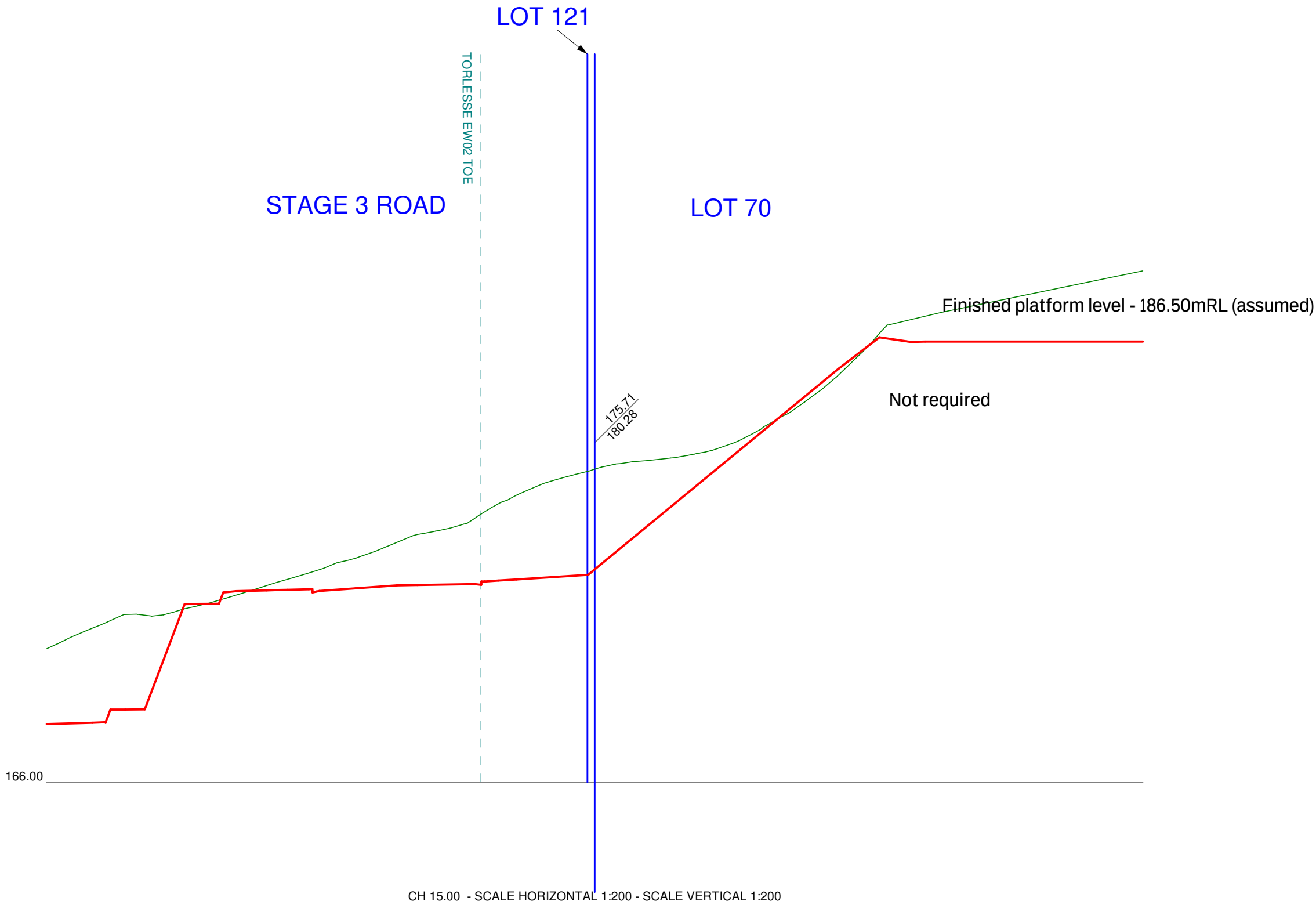
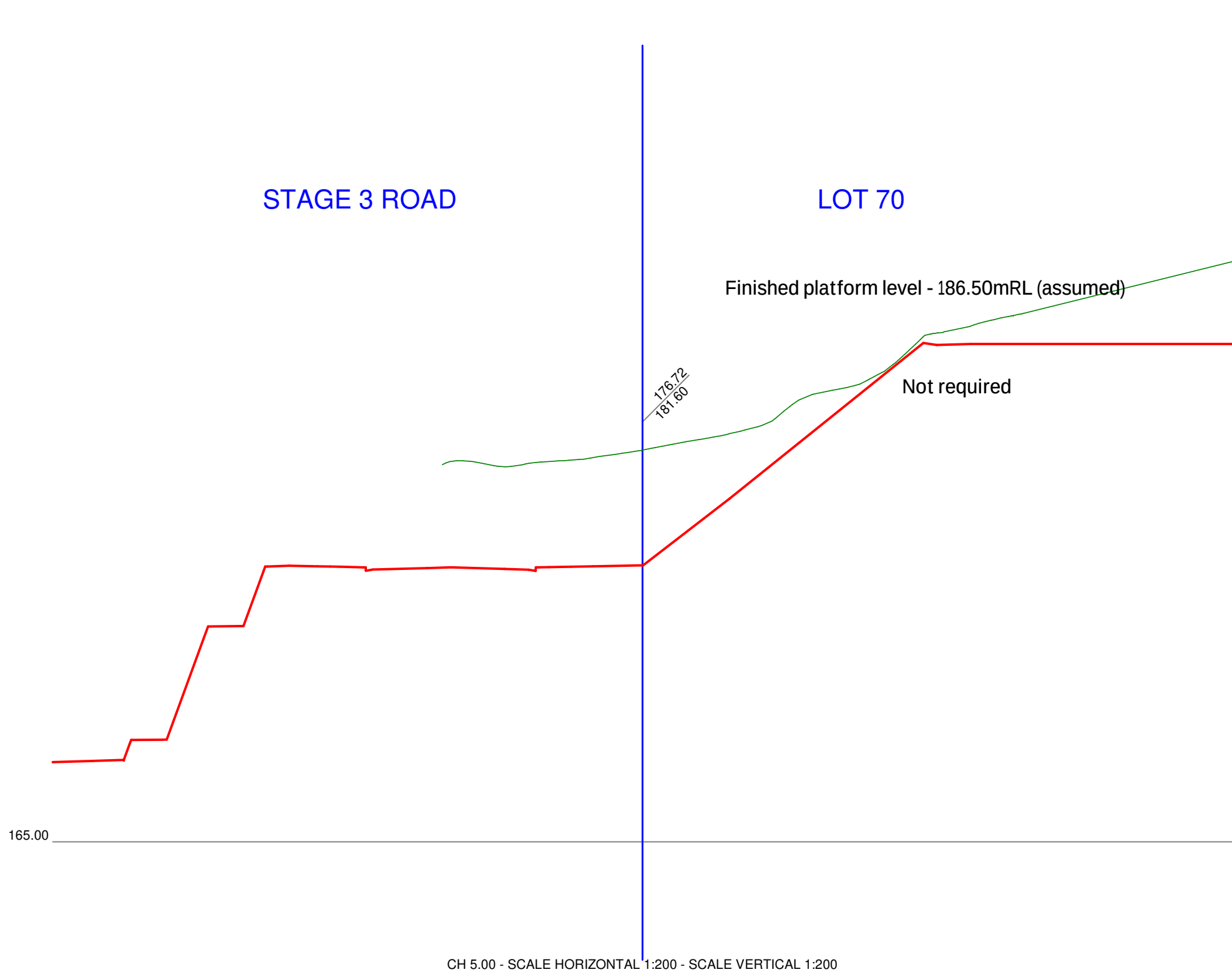
SCALE
1 : 200

DRAWING NUMBER
S19-0774-T38

AT
A1

REV
A

NO	REVISION	BY	DATE
A	FIRST ISSUE		



Topographical Survey Work
Contours have been interpolated from surveyed spot heights. Accuracy will vary depending on proximity to the spot heights used to derive the contour.

Retaining walls either on or very close to a boundary can affect the assessment of ground level at the boundary. Care must be taken when assessing ground level at the boundary for the determination of building recession planes.

Any interpolation of the surveyed data is made entirely at the risk of the person making that interpolation.

If the specific position or height of any wall, building or structure is critical to the design then its accuracy must be confirmed by SHL before it can be relied upon.

Topographic details measured through Total Station survey. Imagery from Drone flight conducted 29/11/2023.

For cross-sections locations, refer to adjoining plan "S19-0774-T38"

TOPOGRAPHIC SURVEY MESH:

VECTA LTD DESIGN MESH:

COORDINATE DATUM - NZGD 2000 (WELLINGTON)

HEIGHT ARE IN TERMS OF
- WELLINGTON 1953

ORIGIN OF LEVELS
- MARK NAME ORM V DP 42106
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PROJECT
**WAIPOUNAMU DR,
KELSON**

DRAWING TITLE
**EW02 ADDITIONAL
CROSS SECTIONS
SHEET 1/5**

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☐ S19-0774-T38 XSECTIONS v3b - T39-1
☐ DRAWN MDM ☐ FB
☐ CHECKED JFC ☐ DATE 13/12/2023

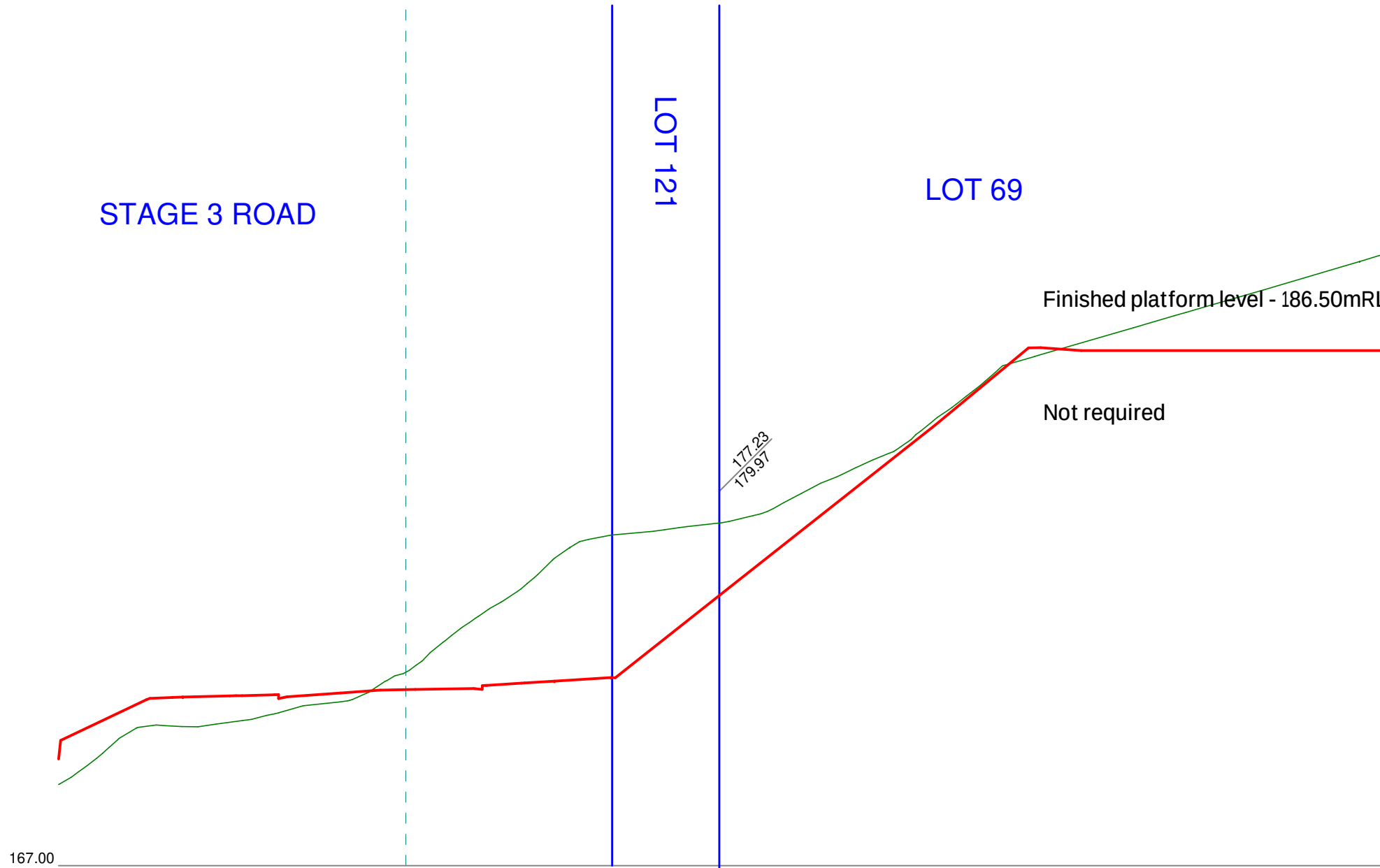
SCALE
1 : 200

DRAWING NUMBER
S19-0774-T39-1

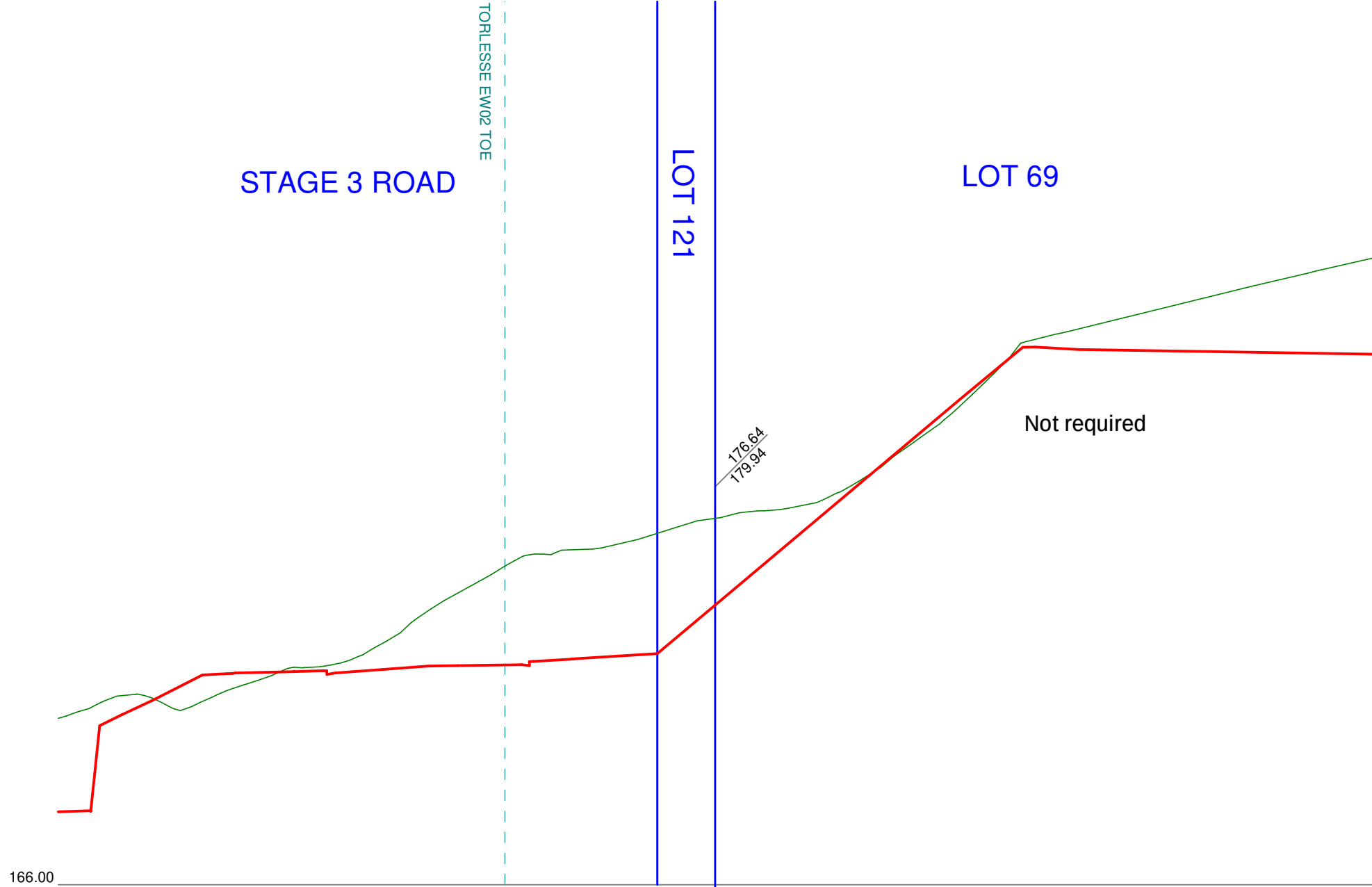
AT
A1

REV
A

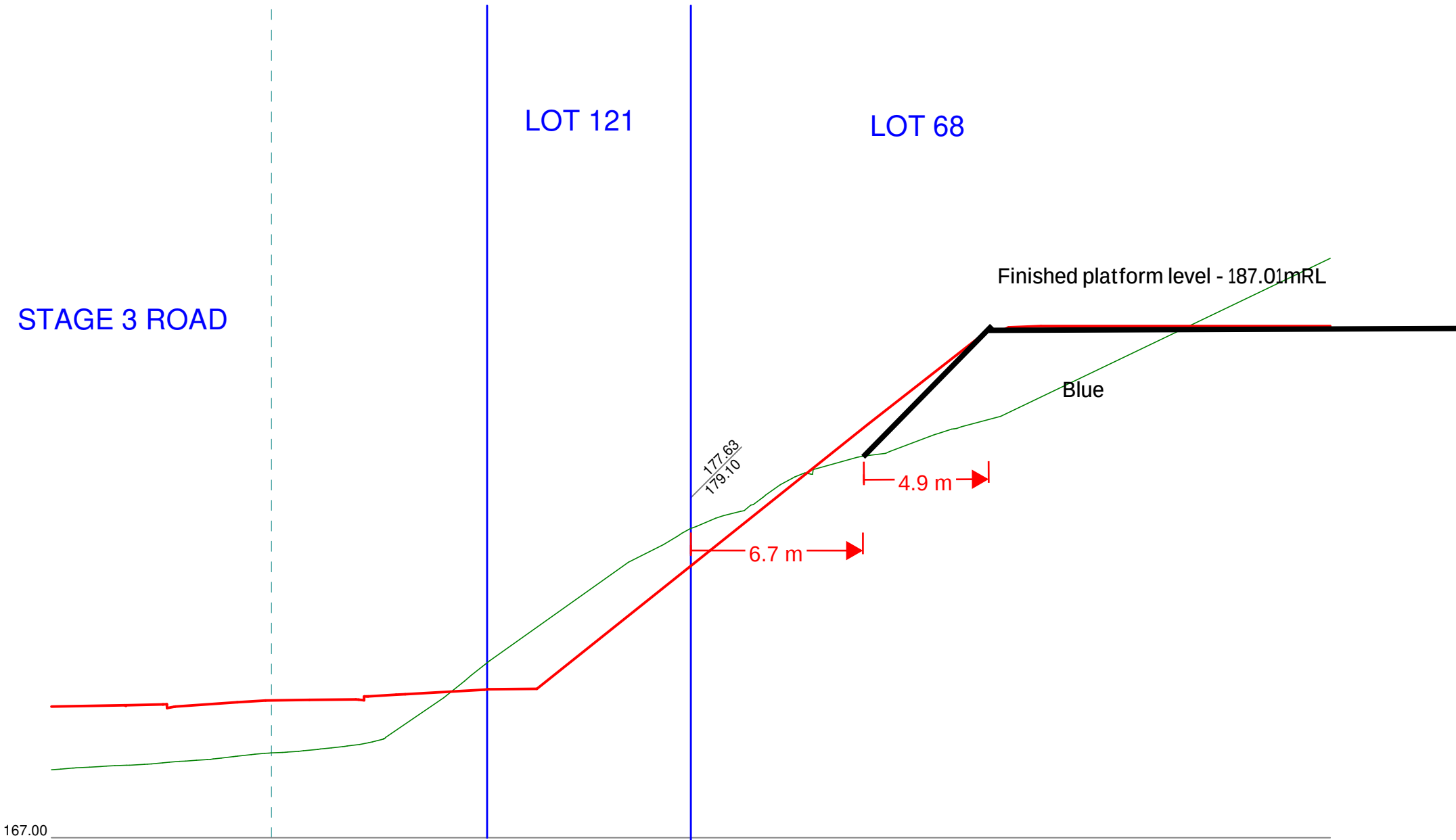
NO	REVISION	BY	DATE
A	FIRST ISSUE		



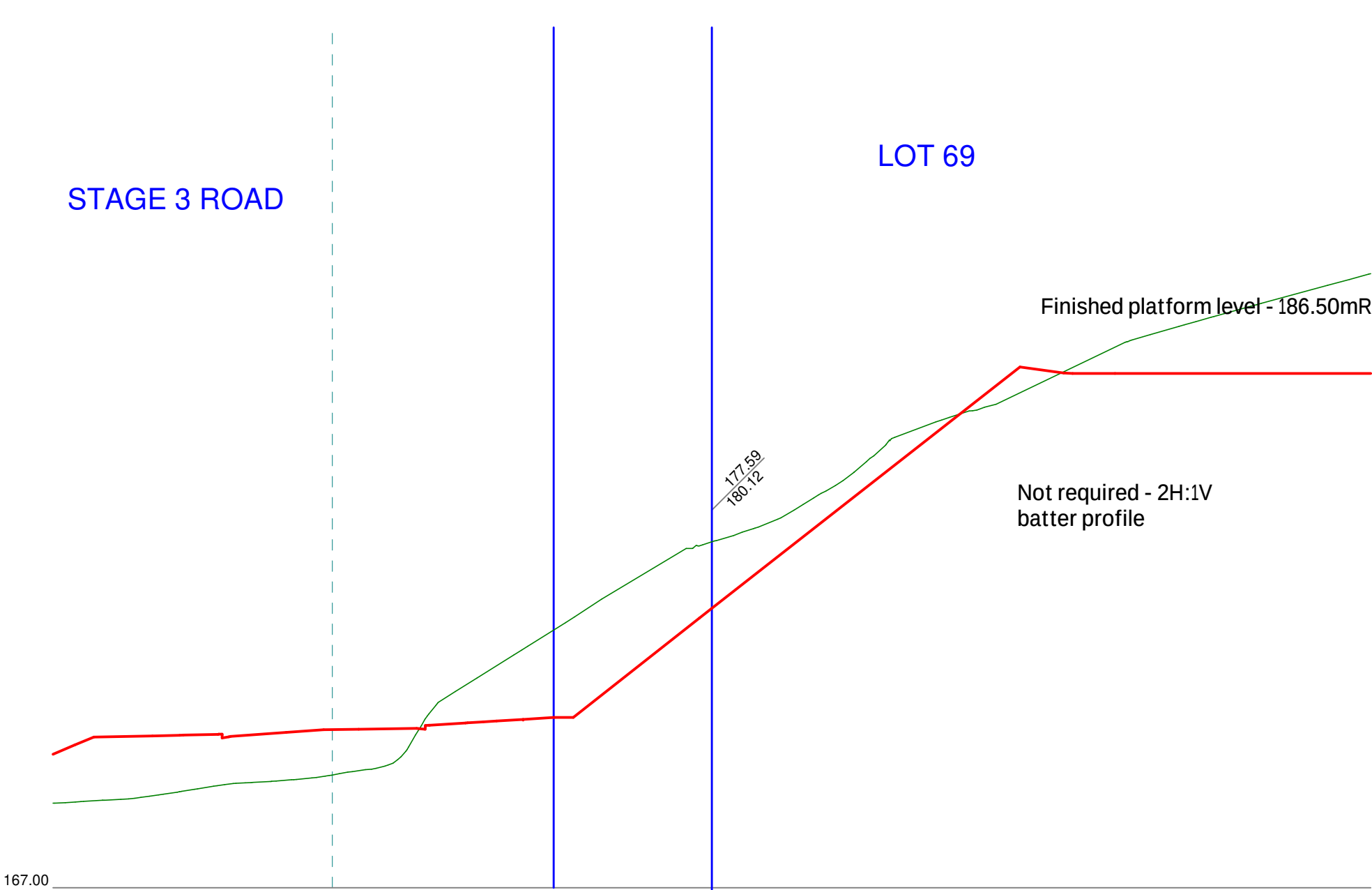
CH 25.00 - SCALE HORIZONTAL 1:200 - SCALE VERTICAL 1:200



CH 20.00 - SCALE HORIZONTAL 1:200 - SCALE VERTICAL 1:200



CH 35.00 - SCALE HORIZONTAL 1:200 - SCALE VERTICAL 1:200



CH 30.00 - SCALE HORIZONTAL 1:200 - SCALE VERTICAL 1:200

Topographical Survey Work
Contours have been interpolated from surveyed spot heights. Accuracy will vary depending on proximity to the spot heights used to derive the contour.

Retaining walls either on or very close to a boundary can affect the assessment of ground level at the boundary. Care must be taken when assessing ground level at the boundary for the determination of building recession planes.

Any interpolation of the surveyed data is made entirely at the risk of the person making that interpolation.

If the specific position or height of any wall, building or structure is critical to the design then its accuracy must be confirmed by SHL before it can be relied upon.

Topographic details measured through Total Station survey. Imagery from Drone flight conducted 29/11/2023.

For cross-sections locations, refer to adjoining plan "S19-0774-T38"

TOPOGRAPHIC SURVEY MESH:

VECTA LTD DESIGN MESH:

COORDINATE DATUM - NZGD 2000 (WELLINGTON)
HEIGHT ARE IN TERMS OF
- WELLINGTON 1953

ORIGIN OF LEVELS
- MARK NAME ORM V DP 42106
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DRAWING TITLE
EW02 ADDITIONAL CROSS SECTIONS SHEET 2/5

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☐ S19-0774-T38 XSECTIONS v3b - T39-2
☐ DRAWN MDM ☐ FB
☐ CHECKED JFC ☐ DATE 13/12/2023

SCALE
1 : 200

DRAWING NUMBER
S19-0774-T39-2

AT
A1

REV
A

NO	REVISION	BY	DATE
A	FIRST ISSUE		

Topographical Survey Work
Contours have been interpolated from surveyed spot heights. Accuracy will vary depending on proximity to the spot heights used to derive the contour.

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Topographic details measured through Total Station survey. Imagery from Drone flight conducted 29/11/2023.

For cross-sections locations, refer to adjoining plan "S19-0774-T38"

TOPOGRAPHIC SURVEY MESH:

VECTA LTD DESIGN MESH:

COORDINATE DATUM - NZGD 2000 (WELLINGTON)
HEIGHT ARE IN TERMS OF
- WELLINGTON 1953

ORIGIN OF LEVELS
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DRAWING TITLE
EW02 ADDITIONAL CROSS SECTIONS SHEET 3/5

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☐ DRAWN MDM

☐ CHECKED JFC

DATE

13/12/2023

SCALE

1 : 200

DRAWING NUMBER

S19-0774-T39-3

REV

A

AT

A1

REV

A

STAGE 3 ROAD

LOT 121

LOT 67

Finished platform level - 188.04mRL

Pink

11.4 m

CH 45.00 - SCALE HORIZONTAL 1:200 - SCALE VERTICAL 1:200

STAGE 3 ROAD

LOT 121

LOT 66

Finished platform level - 188.04mRL

Pink

3.5 m

15.6 m

CH 55.00 - SCALE HORIZONTAL 1:200 - SCALE VERTICAL 1:200

STAGE 3 ROAD

LOT 121

LOT 68

Finished platform level - 187.01mRL

Blue

3.1 m

8.4 m

CH 40.00 - SCALE HORIZONTAL 1:200 - SCALE VERTICAL 1:200

STAGE 3 ROAD

LOT 121

LOT 67

Finished platform level - 187.45mRL

Pink

5.4 m

16.7 m

CH 50.00 - SCALE HORIZONTAL 1:200 - SCALE VERTICAL 1:200

Scale Horizontal 1:200 Vertical 1:200

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A	FIRST ISSUE		

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Topographic details measured through Total Station survey. Imagery from Drone flight conducted 29/11/2023.

For cross-sections locations, refer to adjoining plan "S19-0774-T38"

TOPOGRAPHIC SURVEY MESH:

VECTA LTD DESIGN MESH:

COORDINATE DATUM - NZGD 2000 (WELLINGTON)
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ORIGIN OF LEVELS
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DRAWING TITLE
EW02 ADDITIONAL CROSS SECTIONS SHEET 4/5

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☐ S19-0774-T38 XSECTIONS v3b - T39-4

☐ DRAWN MDM ☐ FB

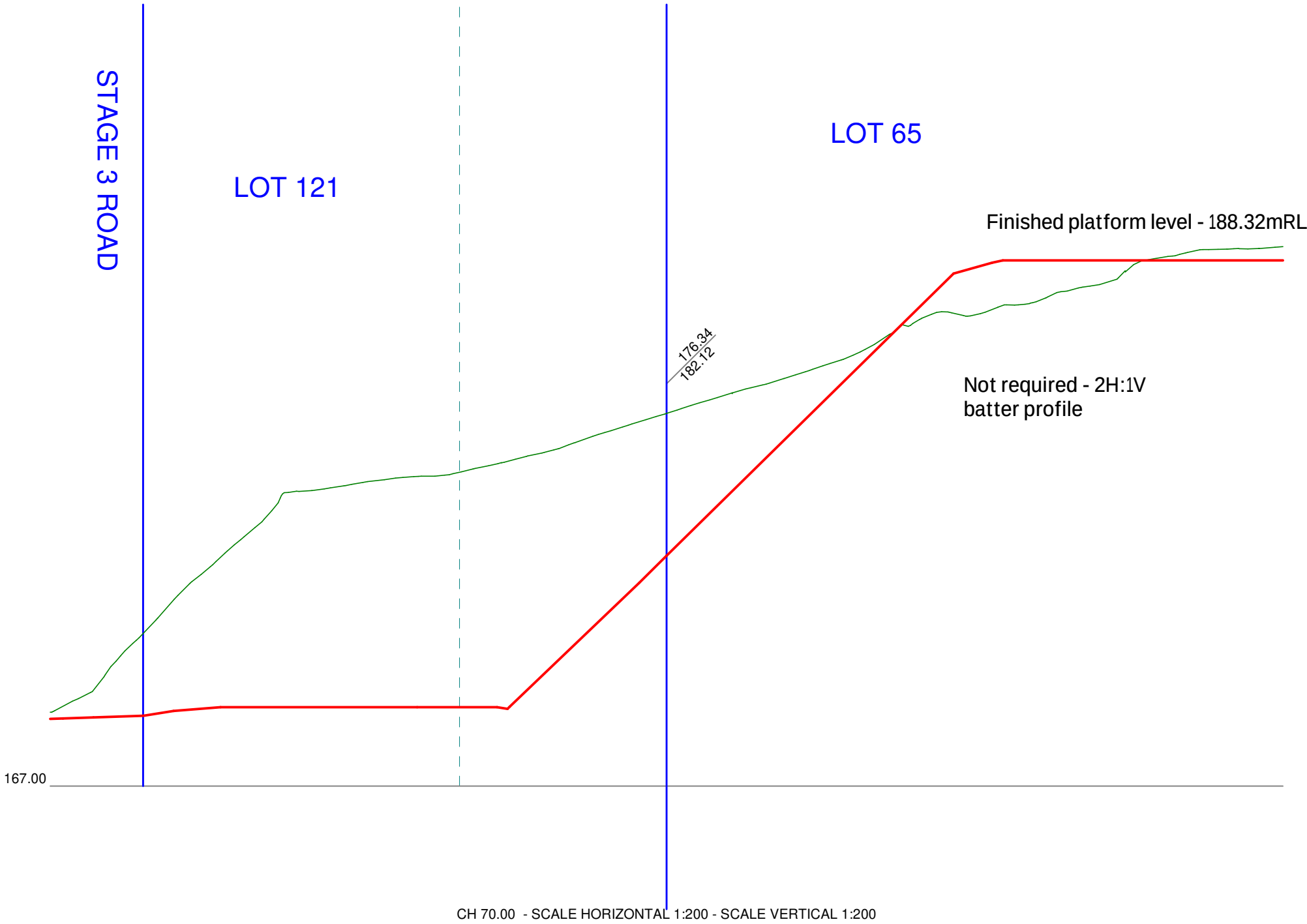
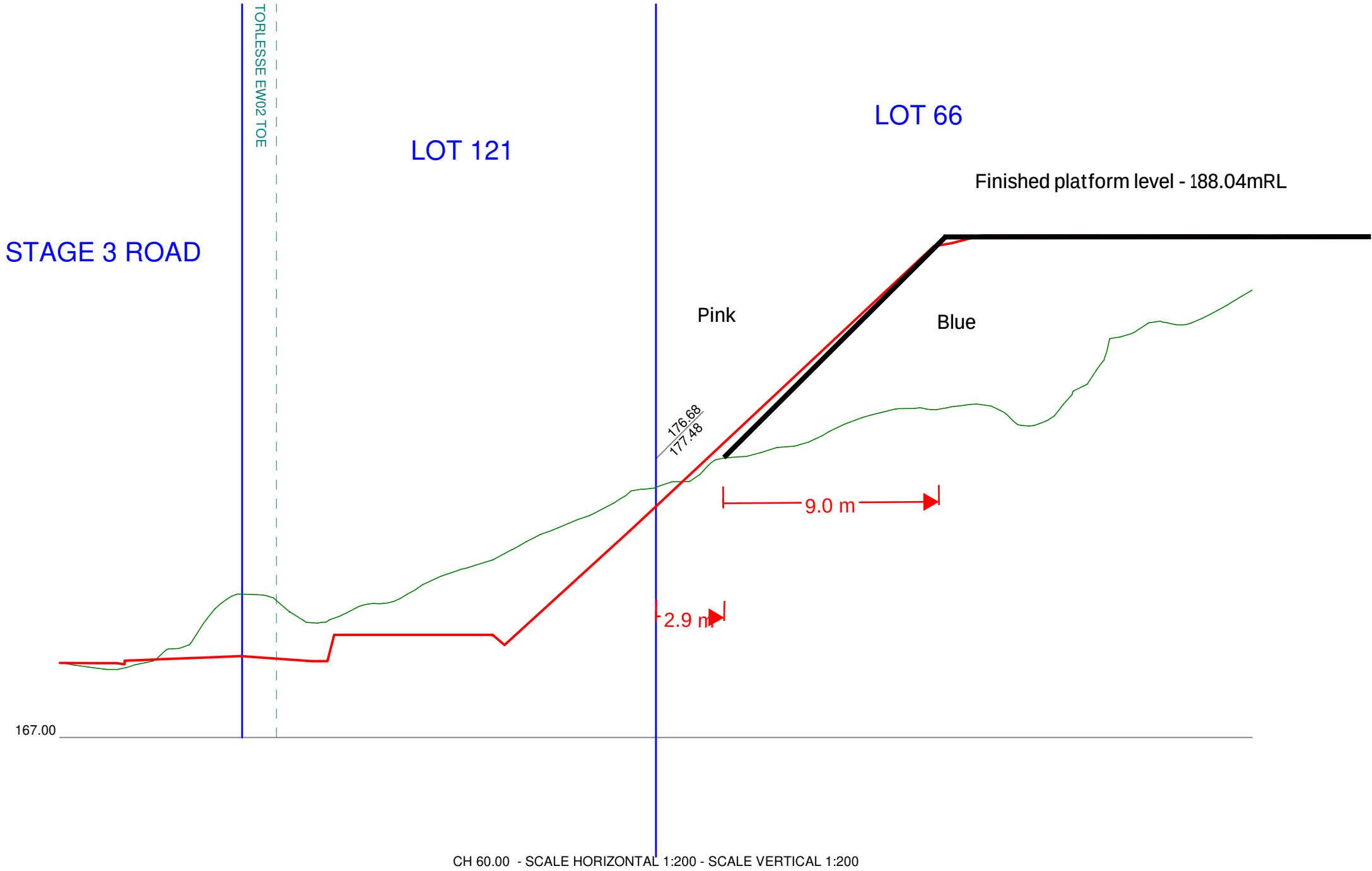
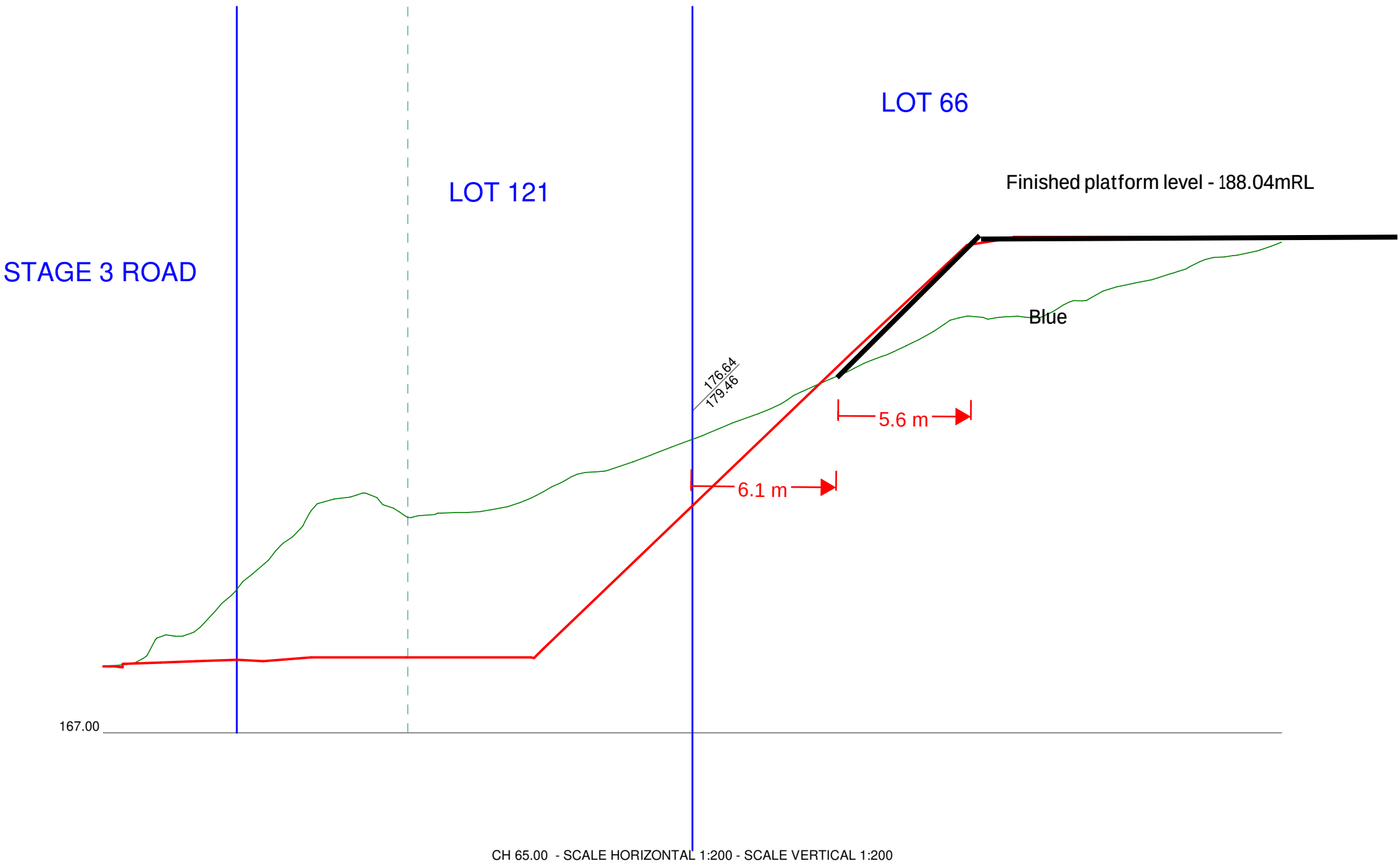
☐ CHECKED JFC ☐ DATE 13/12/2023

SCALE
1 : 200

DRAWING NUMBER
S19-0774-T39-4

AT
A1

REV
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A	FIRST ISSUE		

Topographical Survey Work
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For cross-sections locations, refer to adjoining plan "S19-0774-T38"

TOPOGRAPHIC SURVEY MESH:

VECTA LTD DESIGN MESH:

COORDINATE DATUM - NZGD 2000 (WELLINGTON)

HEIGHT ARE IN TERMS OF
- WELLINGTON 1953

ORIGIN OF LEVELS
- MARK NAME ORM V DP 42106
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DRAWING TITLE
EW02 ADDITIONAL CROSS SECTIONS SHEET 5/5

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☒ DRAWN MDM ☐ FB

☒ CHECKED JFC ☐ DATE 13/12/2023

SCALE
1 : 200

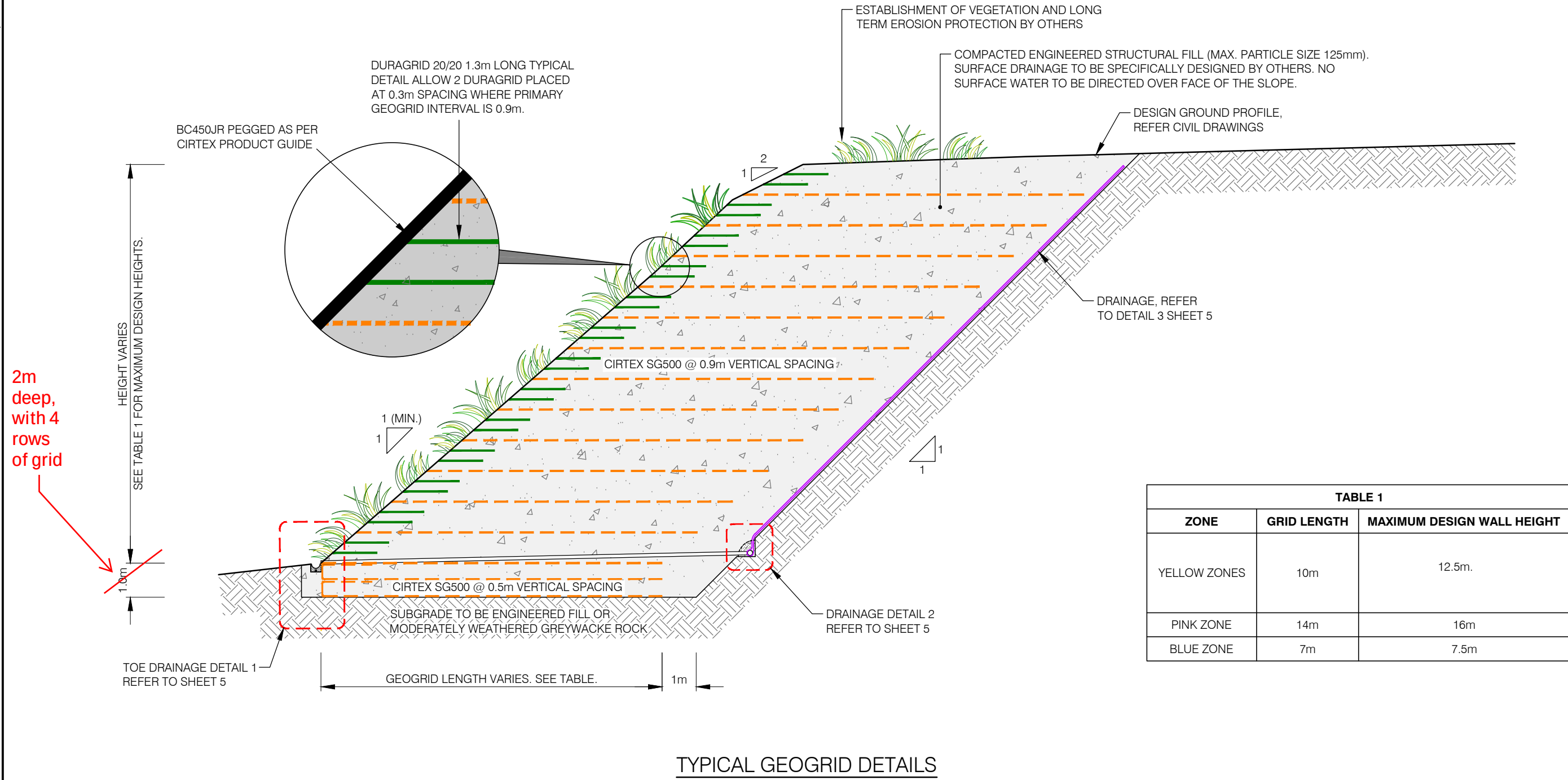
DRAWING NUMBER
S19-0774-T39-5

AT
A1

REV
A

Scale Horizontal 1:200 Vertical 1:200

DATE PLOTTED: 24 February 2021 11:58 PM BY: CAROLINE DUEPDJERAN



A	15.2.21	For Consent	DF	OVR	
Rev	Date	Description	Drwn	Chkd	



Wellington Office
Level 18, Grand Plimmer
Tower, 2 - 6 Gilmer Tce
Wellington 6011
Tel: 04 472 0820,
www.engeo.co.nz

Title:

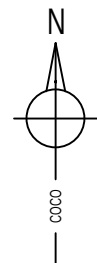
EMBANKMENT 05 - TYPICAL GEOGRID DETAILS

Client: GENESIS RESIDENTIAL LIMITED		Sheet No: 3 Size: A3
Project: MANAPOURI GROVE 64 WAIPOUNAMU DRIVE KELSON, LOWER HUTT	Designed: GC	
	Drawn: DF	
	Checked: OVR	
Proj No: 15777.000.000		Scale: 1:125
		Rev: A

APPENDIX C: TEST LOCATIONS AND LOGS

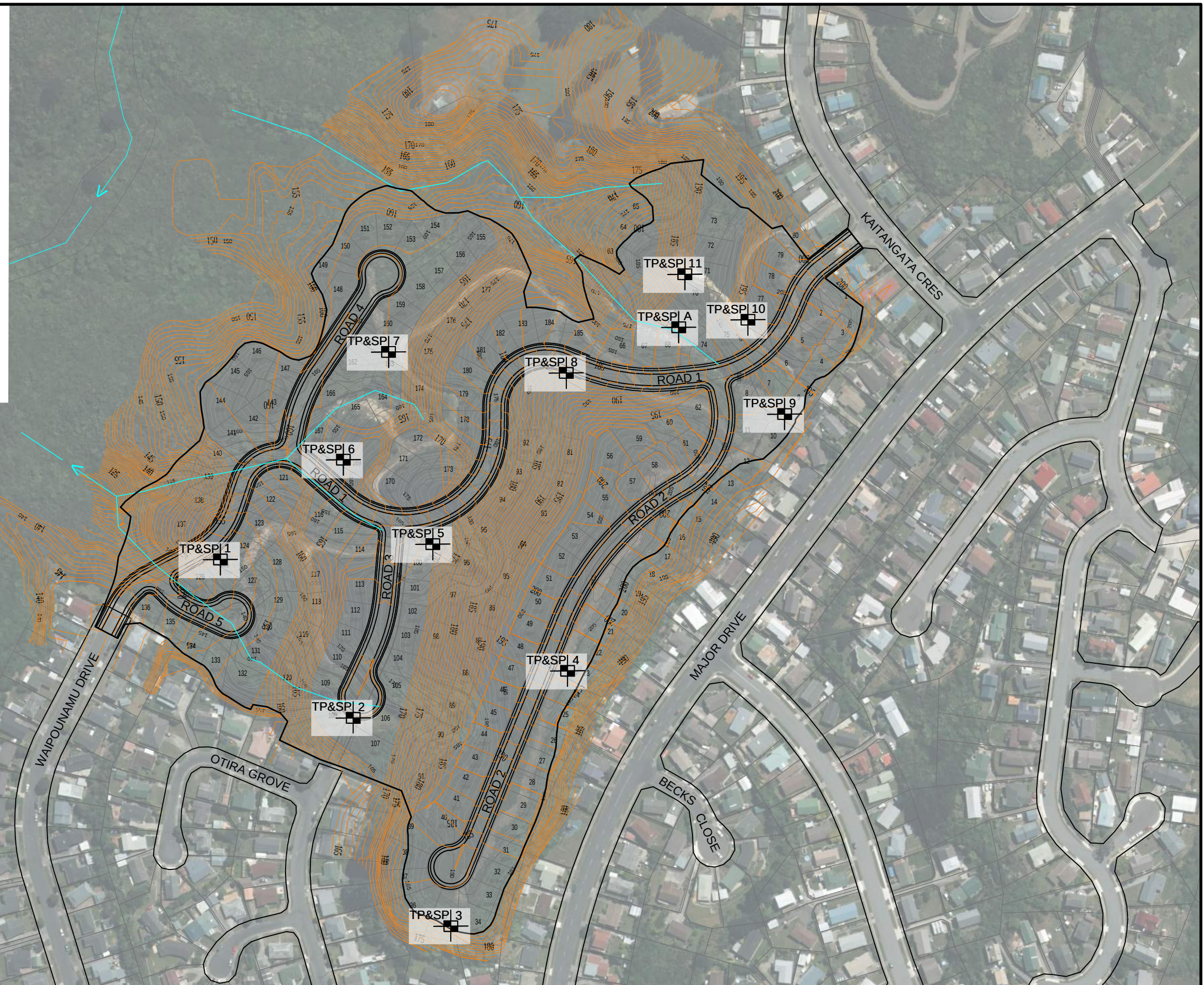
LEGEND

- TEST PIT
- EXISTING WATERCOURSE
- PROPOSED CONTOUR
- EXISTING CONTOUR



TEST PITS:
TEST PIT LOCATIONS HAS BEEN PLOTTED
USING A HANDHELD GPS UNIT. THE
LOCATIONS SHOWN ON THE PLAN IS
CONSIDERED TO BE WITHIN ± 2.0m.

GENERAL NOTES:
PROPOSED AND EXISTING CONTOURS HAS
BEEN PROVIDED BY CUTTRISS
CONSULTANTS ON 10 JUNE 2016



100
50
0
SCALE 1:2500

0 50 100 SCALE 1:2500

C			
B			
A			
-	FOR REVIEW	JM	09-03-17
REV.	REVISION DETAILS	DRAWN	DATE



Whangarei | 09 4389 529
Auckland | 09 373 5357
Wellington | 04 472 7282
Christchurch | 03 365 5960

ccl@coco.co.nz
www.coco.co.nz



KELSON HEIGHTS LIMITED

PROPOSED SUBDIVISION

64 WAIPOUNAMU DRIVE, KELSON

TITLE TEST PIT LOCATION PLAN		
DESIGNED JM	CCL REF. No. 12652-002	DWG NAME & REV. G01-RA
APPROVED TSN	SCALE 1:2500 @ A3	SHEET No. 01 OF 02
STATUS FOR REVIEW		

DO NOT REPRODUCE WITHOUT WRITTEN AUTHORITY

DATE PLOTTED: 25/09/2017 FILE PATH: Z:\12500-12999\12652\12652-002\CAD\Consent Drawings Working Folder\12652-002 Geotech Site plan 160620.dwg

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 1
Location: TP1
Drilling Method: Excavator

Page: 1
Tested by: JAM
Logger: JAM
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			100mm TOPSOIL; dark brown, moist,					
-0.1								
-0.3		ML	Clayey SILT with traces of coarse sand, traces of sand; light brown, very stiff, slightly moist, slightly plastic; traces of cobbles		172/7			
-0.5								
-1			Bedrock @ 1mbgl. EOB @ 1.2mbgl.					
-1.5								
-2								
-2.5								
-3								
Remarks: Groundwater was not encountered. Could not embed SV.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 2
Location: TP2
Drilling Method: Excavator

Page: 1
Tested by: TSN
Logger: TSN
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			200mm TOPSOIL; dark brown, slightly moist, friable					
-0.2								
-0.3			300mm Weathered Rock					
-0.5								
-1			EOB @ 1mbgl. Too hard to auger					
-1.5								
-2								
-2.5								
-3								
Remarks: Groundwater was not encountered.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 3
Location: TP3
Drilling Method: Excavator

Page: 1
Tested by: JAM
Logger: JAM
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			300mm TOPSOIL; dark brown, slightly moist, friable					
-0.3								
-0.5		ML	Clayey SILT with traces of coarse sand; light brown; stiff, slightly moist, slightly plastic. traces of cobbles		139/40			
-0.7								
-1			Clayey SILT; light brown; stiff, slightly moist, slightly plastic, traces of cobbles		159/15			
-1.5								
-2			Bedrock encountered @ 2mbgl. EOB @ 2mbgl.					
-2.5								
-3								
Remarks: Groundwater was not encountered.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 4
Location: TP4
Drilling Method: Excavator

Page: 1
Tested by: JAM
Logger: JAM
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			200mm TOPSOIL; dark brown, slightly moist, friable					
-0.2								
-0.5		ML	Clayey SILT with traces of coarse sand; orange brown; slightly moist, slightly plastic; traces of cobbles		172/24			
-1			Clayey SILT with traces of coarse sand; dark orange brown; slightly moist; increasing traces of cobbles cobbles					
-1.5			Bedrock encountered @ 1.8mbgl.					
-2								
-2.5								
-3								
Remarks: Groundwater was not encountered.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 5
Location: TP5
Drilling Method: Excavator

Page: 1
Tested by: TSN
Logger: TSN
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			100 mm TOPSOIL; dark brown, moist, friable					
-0.5		ML	Clayey SILT with traces of medium to coarse sand; orange brown, stiff, slightly moist					
-1			Clayey SILT; orange mottled with blue alluvial material about 1mbgl 500mm deep.					
-1.5			Water table @ 1.2-1.5mbgl					
-2								
-2.5								
-3			Bedrock @ 2.8mbgl.					
Remarks: Groundwater was encountered at 1.2-1.5mbgl.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 6
Location: TP6
Drilling Method: Excavator

Page: 1
Tested by: JAM
Logger: JAM
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			200mm TOPSOIL; dark brown, slightly moist, friable					
-0.2								
-0.3		ML	Clayey SILT with traces of medium to coarse sand; orange brown, stiff, slightly moist, slightly plastic, traces of cobbles		175/9			
-0.5					176/37			
-1			EOB 1mbgl. Terminated due to excavator slipping					
-1.5								
-2								
-2.5								
-3								
Remarks: Groundwater was not encountered. Could not embed SV into soil.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 7
Location: TP7
Drilling Method: Excavator

Page: 1
Tested by: TSN
Logger: TSN
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			100mm TOPSOIL; dark brown, slightly moist, friable					
-0.2		CL	Silty CLAY, orange brown, very stiff, slightly moist, friable		139/7			
-0.4								
-0.5								
-0.7								
-1								
-1.5								
-2								
-2.5								
-3			EOB @ 3mbgl.					
Remarks: Groundwater was not encountered. Could not embed SV into soil					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 8
Location: TP8
Drilling Method: Excavator

Page: 1
Tested by: JAM
Logger: JAM
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			TOPSOIL; medium brown, dry, friable					
-0.2								
-0.4		ML	Clayey SILT with traces of medium to coarse sand, light brown, stiff, moist, plastic		159/16			
-0.5								
-0.7								
-1			Clayey SILT with traces of medium to coarse sand, light brown, firm, moist, plastic		95/16			
-1.5								
-2			Clayey SILT with traces of medium to coarse sand, light brown, firm, moist, plastic					
-2.5								
-3			EOB @ 3mbgl.					
Remarks: Groundwater was not encountered.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 9
Location: TP9
Drilling Method: Excavator

Page: 1
Tested by: TSN
Logger: TSN
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			Pushover fill to a depth of 500mm					
-0.5		CL	Silty Clay with traces of medium to coarse sand, orange brown, slightly moist, traces of cobbles and weathered rock		185 at 1mbgl			
-1								
-1.5								
-2			EOB at 2mbgl.					
-2.5								
-3								
Remarks: Groundwater was not encountered.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 10
Location: TP10
Drilling Method: Excavator

Page: 1
Tested by: TSN
Logger: TSN
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			100 mm TOPSOIL; dark brown, moist, friable					
-0.2		ML	Clayey SILT; mottled orange and blue alluvial material, stiff, physically uniform at depth					
-0.4								
-0.5								
-0.7								
-1								
-1.5								
-2			Change in colour, very stiff, traces of weathered/inferred rock, slightly plastic					
-2.5								
-3			EOB @ 3.2mbgl					
Remarks: Groundwater was not encountered.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 11
Location: TP11
Drilling Method: Excavator

Page: 1
Tested by: TSN
Logger: TSN
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			TOPSOIL; medium brown, dry, friable					
-0.2		CL	Silty CLAY with traces of coarse sand; orange uniform constant colour		86/13			
-0.4								
-0.5								
-0.7								
-1					126/15			
-1.5					185kPa			
-2								
-2.5								
-3			EOB @ 3mbgl.					
Remarks: Groundwater was not encountered.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

BOREHOLE LOG AND TEST SHEET

NZGS November 1988

Ref.: 12652-002
Client: Chris Mason
Date: 14/06/2016
Borehole No.: 12
Location: TPA
Drilling Method: Excavator

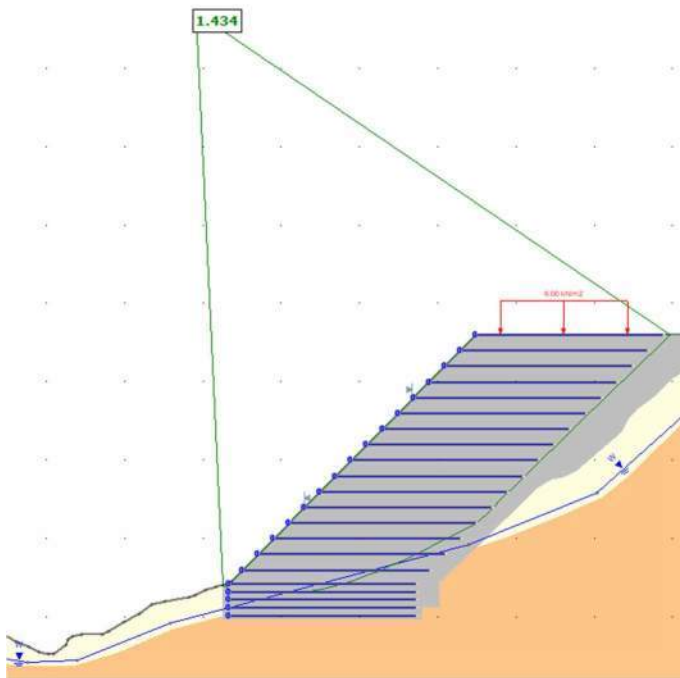
Page: 1
Tested by: TSN
Logger: TSN
Checked:
Date Checked:

Depth (m)	Legend	Soil Symbol	Soil Description	Water Level	Vane Shear Strength maximum/residual corrected kPa	Soil Sensitivity	Sample Number	Other Tests
0			TOPSOIL; medium brown, slightly moist, friable					
-0.5		ML	Clayey SILT with traces of medium to coarse sand; orange, stiff, slightly moist, friable		159			
-1.5			Watertable @ 1.5mbgl.		106/13			
-2			EOB @ 2mbgl.					
-2.5								
-3								
Remarks: Groundwater was encountered at 1.5mbgl.					Topsoil		Sand	
					Fill		Gravel	
					Clay		Peat	
					Silt		Rock	

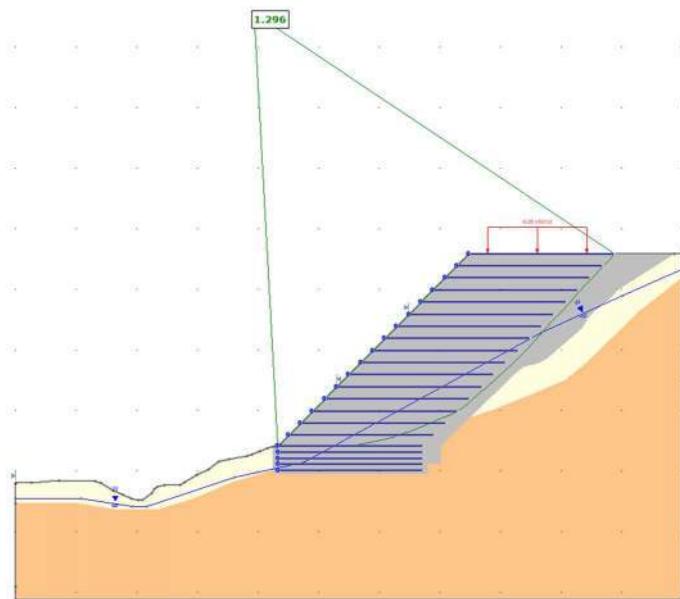
APPENDIX D: SLOPE STABILITY OUTPUTS

CH55 – Pink

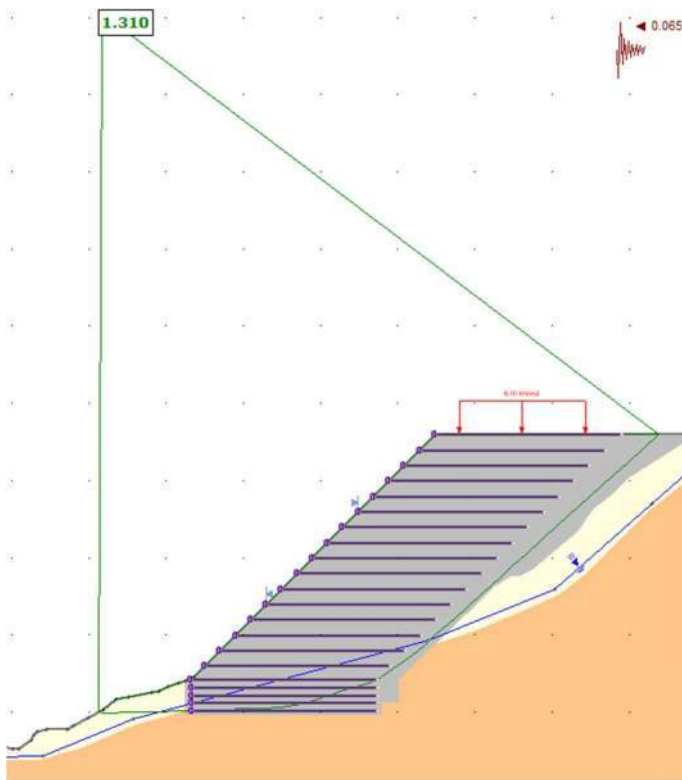
1. Static



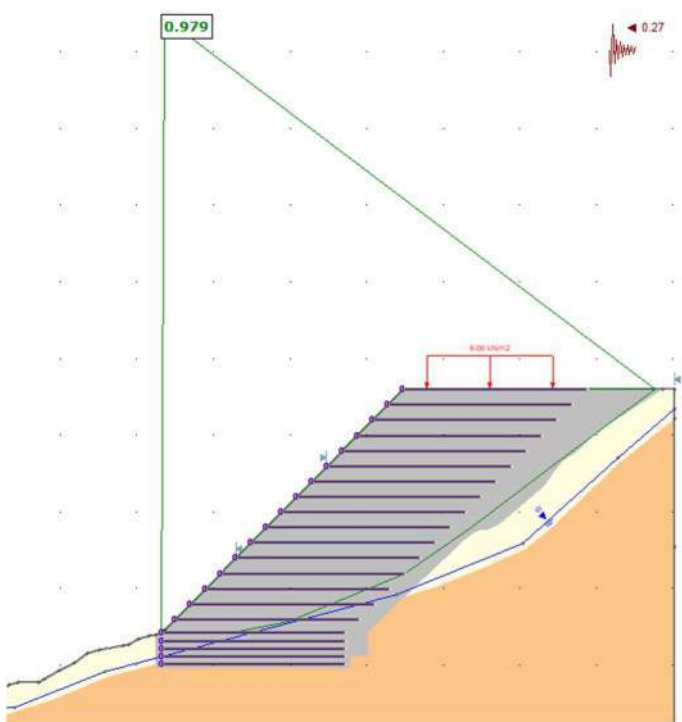
2. Static – high groundwater



3. Seismic SLS



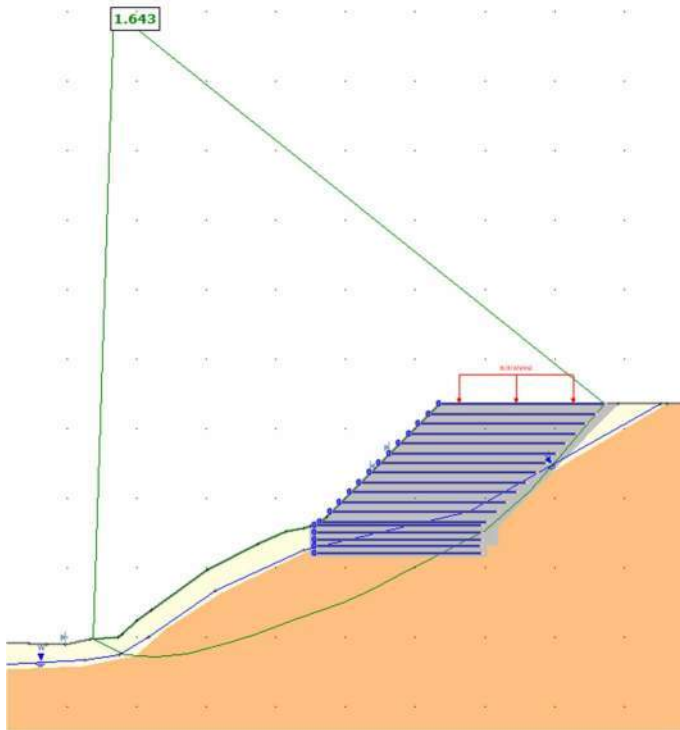
4. Seismic ULS



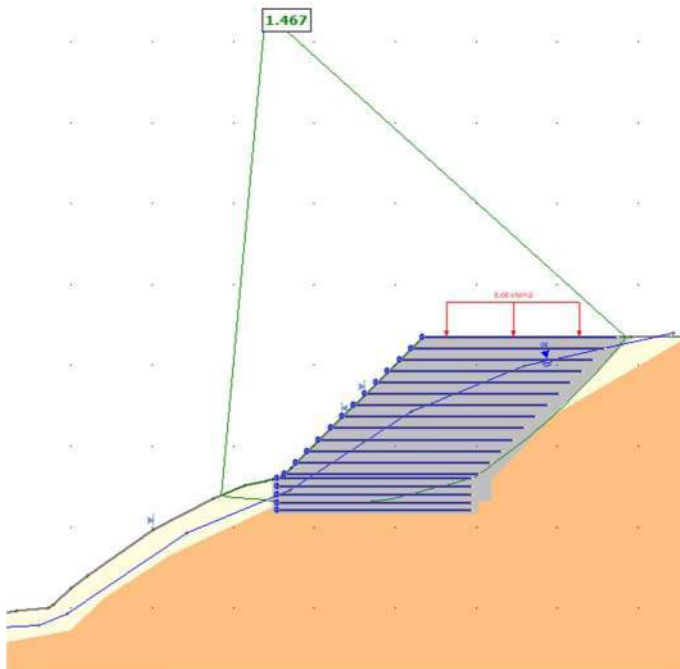
CH40 – Blue

All non-circular slip surfaces

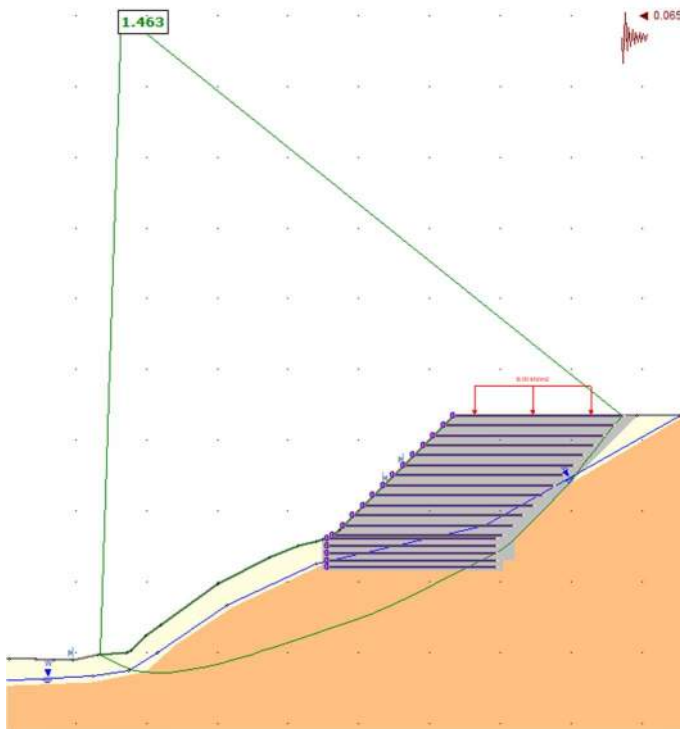
1. Static



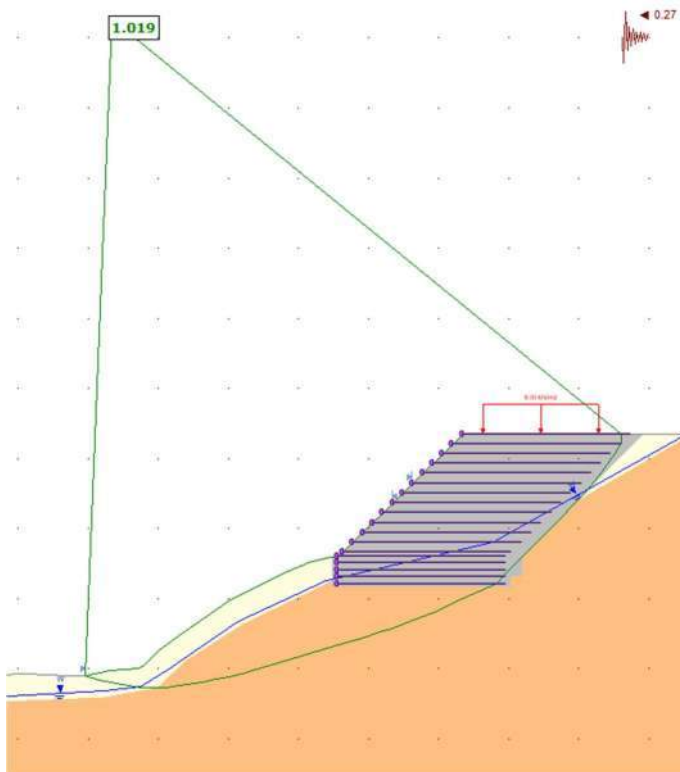
2. Static – high groundwater



3. Seismic SLS



4. Seismic ULS



APPENDIX E: INTERNAL STABILITY ANALYSES

KELSON HEIGHTS, EW 02, Stage 2B Kelson

PROJECT OVERVIEW

Cirtex Industries Ltd is a specialist supplier of geosynthetics and advanced geosynthetic solutions. Cirtex has been in contact with Torlesse Ltd (hereafter called the consultant) to propose a value engineered geosynthetic reinforced slope solution for a site in Kelson.

CIRTEX TECHNICAL SUPPORT OPTIONS

Cirtex offers Technical Support in 3 levels as set out in the Cirtex Design Toolbox Series, available on the Cirtex website or on request. This proposal is described as a "Project Concept" as set out in the [Project Design Options Document](#).

SOURCE OF INFORMATION

The concept described herein is based on the following information, provided by the consultant:

- Email dated 29 Jan 2024, from Jerry Spinks, Torlesse Ltd
- Email dated 24 Jan 2024, from Olivia Ross, Torlesse Ltd
- Email dated 18 Jan 2024, from Olivia Ross, Torlesse Ltd
- Email dated 11 Jan 2024, from Jerry Spinks, Torlesse Ltd
- Email dated 14 Dec 2023, from Jerry Spinks, Torlesse Ltd
- Cross-sectional and site plan drawings attached to the above-mentioned email, dated 14 Dec 2023.

INPUT PARAMETERS

This project concept has been prepared based on the following input parameters. The consultant must review the inputs used and satisfy themselves that these are correct and relevant. Cirtex can amend these parameters and re-submit the concept if required.

GEOMETRY

	CH 35	CH 40	CH 45	CH 50	CH 55	CH 60	CH 65
Slope height	4.9 m	8.4 m	11.4 m	16.7 m	15.6 m	9.0 m	5.6 m
Face angle	45 °	45 °	45 °	45 °	45 °	45 °	45 °
Crest slope	level	level	level	level	level	level	level
Toe slope	20 °	25 °	25 °	15 °	20 °	25 °	10 °

SOIL DATA

	Unit Weight, γ (kN/m ³)	Friction Angle, ϕ (degrees)	Cohesion, c' (kPa)
Reinforced Fill	18	36	0
Retained Soil	18	36	0
Foundation Soil	24	42	10

GEOGRID REINFORCEMENT

StrataGrid reinforcement geogrids have been used in this proposal. The relevant reduction factors and interaction parameters have been selected from the linked documentation, which forms the basis of the NZTA approval for the use of StrataGrid in reinforced soil applications in New Zealand.

The reinforced fill material in contact with the geogrid is assumed to be a well graded, granular fill, made up of aggregates with a maximum particle size of less than 75mm. Any change to this fill material will require re-assessment of the structure.

To facilitate compaction of the reinforced fill and prevent surface erosion and sloughing, DuraGrid X 20/20 secondary/intermediate reinforcement geogrids should be installed at approximately 0.33 m spacing from the primary geogrid.

SURCHARGE LOADS

This project concept is based on a surcharge load of 15 kPa, positioned 1m from the DuraSlope crest.

SEISMIC LOADS

A horizontal PGA of 0.44 g together with a W_d factor of 0.5, as supplied by the consultant, have been employed within the design. The assessed ground water conditions and surcharge loadings are the same for both the seismic and static cases.

DESIGN LIFE

StrataGrid is approved by NZTA for use in State Highway projects and has a design life of 100+ years.

PRESENCE OF GROUND WATER

Ground water levels are assumed to be well below the walls and have not been considered.

METHOD AND SCOPE OF PROJECT CONCEPT

The analysis for this concept was produced with ReSSA+. The rotational failure mode is analysed with the Bishop method and translational failure with the Spencer two-part wedge method.

GLOBAL STABILITY

While we have carried out slope stability calculations to estimate the approximate length of geogrid reinforcement required, verification of the overall, deeper slope stability of the site remains the responsibility of the consultant. The potential for settlement of the structure has not been assessed.

ANALYSIS RESULTS

The analysis was conducted using the commercially available software program, ReSSA+. The following minimum factors of safety (FoS) were identified:

Case	Targeted		Rotational		Translational/Sliding	
	Static	Seismic	Static	Seismic	Static	Seismic
Ch 35	≥ 1.5	≥ 1.0	1.6	1.1	1.6	1.1
Ch 40	≥ 1.5	≥ 1.0	1.6	1.1	1.6	1.0
Ch 45	≥ 1.5	≥ 1.0	1.6	1.1	1.5	1.0
Ch 50	≥ 1.5	≥ 1.0	1.6	1.1	1.5	1.0
Ch 55	≥ 1.5	≥ 1.0	1.6	1.1	1.5	1.0
Ch 60	≥ 1.5	≥ 1.0	1.7	1.1	1.5	1.0
Ch 65	≥ 1.5	≥ 1.0	1.5	1.1	1.6	1.1

**Note that only internal stability has been assessed.*

GEOGRID LAYOUT

The table below outlines the geogrid layout derived as acceptable for this project.

	CH 35	CH 40	CH 45	CH 50	CH 55	CH 60	CH 65
Primary geogrids							
Geogrid type	SGU 80	SGU 80	SGU 80	SGU 80	SGU 80	SGU 80	SGU 80
Geogrid length	4.0 m	6.0 m	8.5 m	12.0 m	11.5 m	6.5 m	4.5 m
Vertical spacing	1.0 m	1.0 m	1.0 m	1.0 m	1.0 m	1.0 m	1.0 m
Secondary geogrids							
Geogrid type	X 20/20	X 20/20	X 20/20	X 20/20	X 20/20	X 20/20	X 20/20
Geogrid length	1.5 m	1.5 m	1.5 m	1.5 m	1.5 m	1.5 m	1.5 m
Vertical spacing	0.33 m	0.33 m	0.33 m	0.33 m	0.33 m	0.33 m	0.33 m
Facing system	Vegetated DuraSlope facing system assumed						

Further details relating to the proposed DuraSlope concept may be obtained at this link:
[DuraSlope Reinforced Soil System - Cirtex \(cirtexcivil.co.nz\)](https://www.cirtexcivil.co.nz/DuraSlope-Reinforced-Soil-System)

DETAILING

GEOGRID CONFIGURATION

We recommend that the primary geogrids should be consistently installed at 1.0 m high lifts, as this methodology simplifies the construction process and significantly reduces the risk of any confusion on site. 1.5m lengths of DuraGrid X 20/20 secondary/intermediate reinforcement geogrids should be installed at approximately 0.33 m vertical spacing between the primary geogrid layers.

DRAINAGE

Drainage is of utmost importance in the design and construction of reinforced earth structures. The consultant must ensure that all drainage detailing is sufficient. This project concept is based on but not limited to the following two fundamental drainage details:

Surface Drainage - The surface must be detailed to direct surface water away from the reinforced zone. At no time should water pond on or be allowed to discharge into the reinforced earth zone.

Internal Drainage - Water from the retained zone and the area adjacent to the reinforced zone must not be allowed to saturate the reinforced fill. Cirtex DuraFlow Drainage Composite is to be laid against the back of the cut excavation up to at least 80% of the retained height discharging into an appropriately sized round perforated drainage pipe with Filter Sleeve. In cohesive soils the drainage pipe must be laid in a bed of washed sand or similar drainage aggregate.

FACING

We have assumed the use of a vegetated DuraSlope facing finish for this project. Vegetation of the slope face is critical to the long-term performance of reinforced slopes, as such the slope face should consist of a suitable, stable growing media. The contractor must ensure the slope is vegetated by either hydro seeding or placing a seeded soil mix directly under the ECC3 erosion control matting. The seed mix must be suitable to the local environment and the contractor must ensure it is sufficiently watered until established. Note that trees or large shrubs are not recommended due to their invasive root system that may lead to instability of the reinforced slope over time.

The erosion control mat serves to protect the bare soil face against erosion until the vegetation is established, assist in reducing runoff velocity for increased water absorption by the soil, thus promoting long-term survival of the vegetative cover and reinforce the surficial root system of the vegetative cover.

Local Council requirements associated with topsoil thickness should be considered prior to construction, as these requirements potentially necessitate further design and may influence construction costs and sequence.

PROJECT SPECIFICATION

The following Polymeric Reinforcement and Facing was assumed in the analysis:

- StrataGrid SGU 80
- DuraSlope Facing System

Primary reinforcement shall therefore be StrataGrid as listed in the Geogrid Layout table above. Primary reinforcement shall have the following minimum values and characteristics:

- Long Term Design Strength as per Cirtex Analysis printouts
- Creep Reduction Factor no more than 1.39
- Manufactured from High Tenacity Polyester Yarn
- Manufactured to ISO 9001 QA Program
- Must be NZTA Approved

Best practice regarding all features of MSEW construction must be adhered to in addition to the installation guide for the Cirtex reinforcement product used.

FURTHER REFERENCES

[StrataGrid Technical Data Sheet](#)

[StrataGrid Product Summary – 2019.11](#)

[DuraSlope Installation Guide](#)

[DuraSlope Typical Section](#)

[DuraGrid X 20/20 Technical Data Sheet](#)

Note the above links are for the current version of each of these documents, at time of download.

APPENDICIES

Appendix A - **Analysis Results - Ch 35**

Appendix B - **Analysis Results - Ch 40**

Appendix C - **Analysis Results - Ch 45**

Appendix D - **Analysis Results - Ch 50**

Appendix E - **Analysis Results - Ch 55**

Appendix F - **Analysis Results - Ch 60**

Appendix G - **Analysis Results - Ch 65**

KELSON HEIGHTS, EW 02, Stage 2B
Torlesse Ltd

29 January 2024
9124-5095

CIRTEX INDUSTRIES LTD

Prepared by:

Sharon Hunter-Smith
Engineering Technician

Reviewed by:

Michael Sorensen
Technical Manager

DISCLAIMER

This Project Concept has been prepared based on information supplied by others, and some assumed input parameters. The input data and project parameters have not been independently verified. It is the responsibility of the consultant or the client to make themselves familiar with the methods and data used and make their own judgement as to its suitability. Cirtex Industries Ltd has not visited the site or undertaken any testing of the in-situ or fill materials proposed. This proposal in its entirety must be checked and approved by a suitably qualified engineer before being included in any project submission. The information in this proposal and any attached files is confidential and/or legally privileged. It is intended for the addressee only.

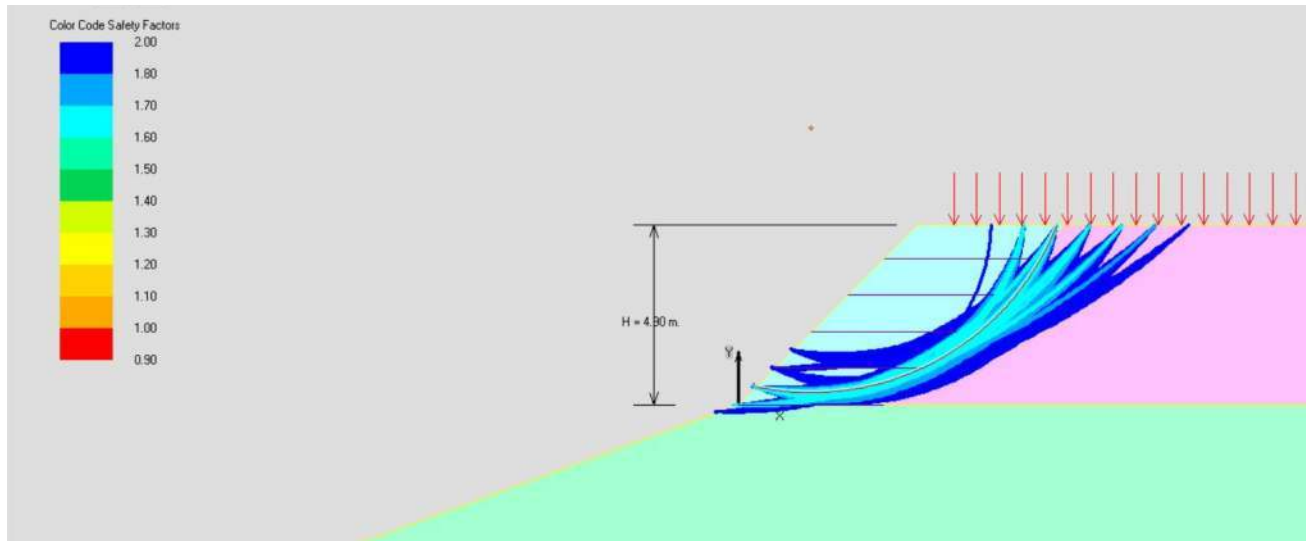
CALL US ON
0800 CIRTEX (247 839)

FOR FURTHER INFORMATION VISIT
WWW.CIRTEX.CO.NZ

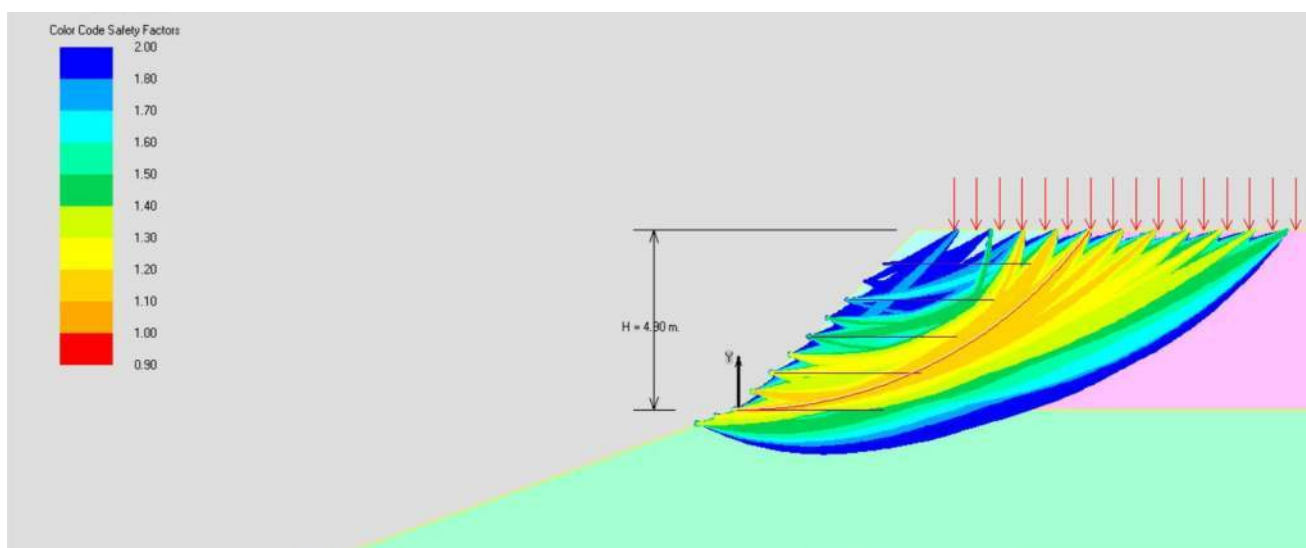


APPENDIX A

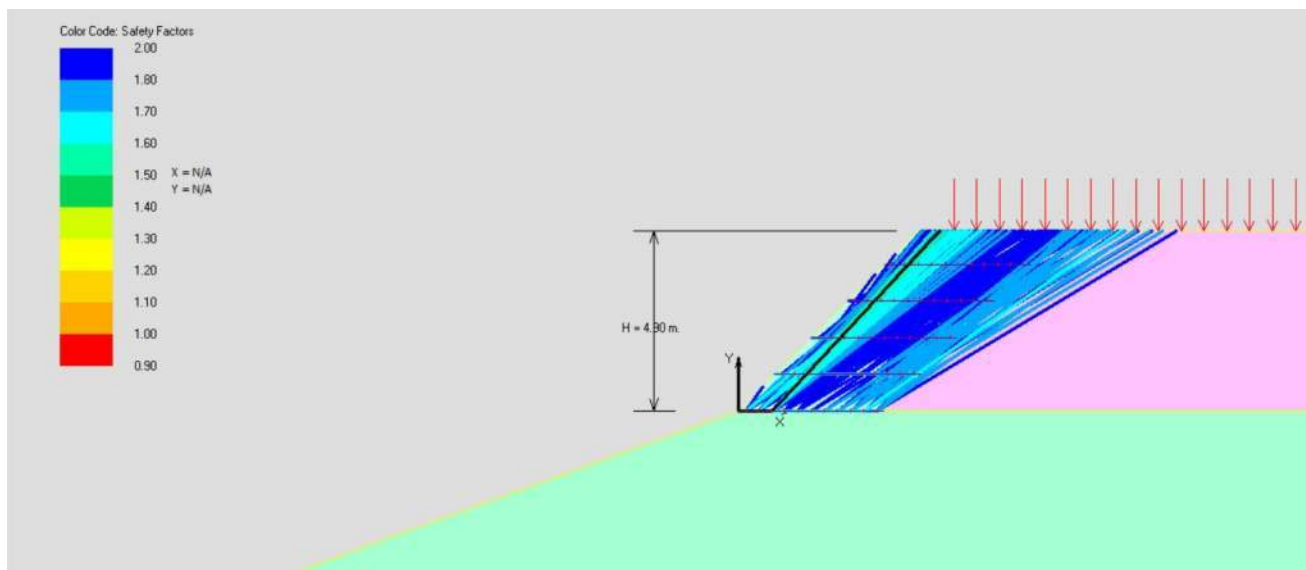
ANALYSIS RESULTS - CH 35



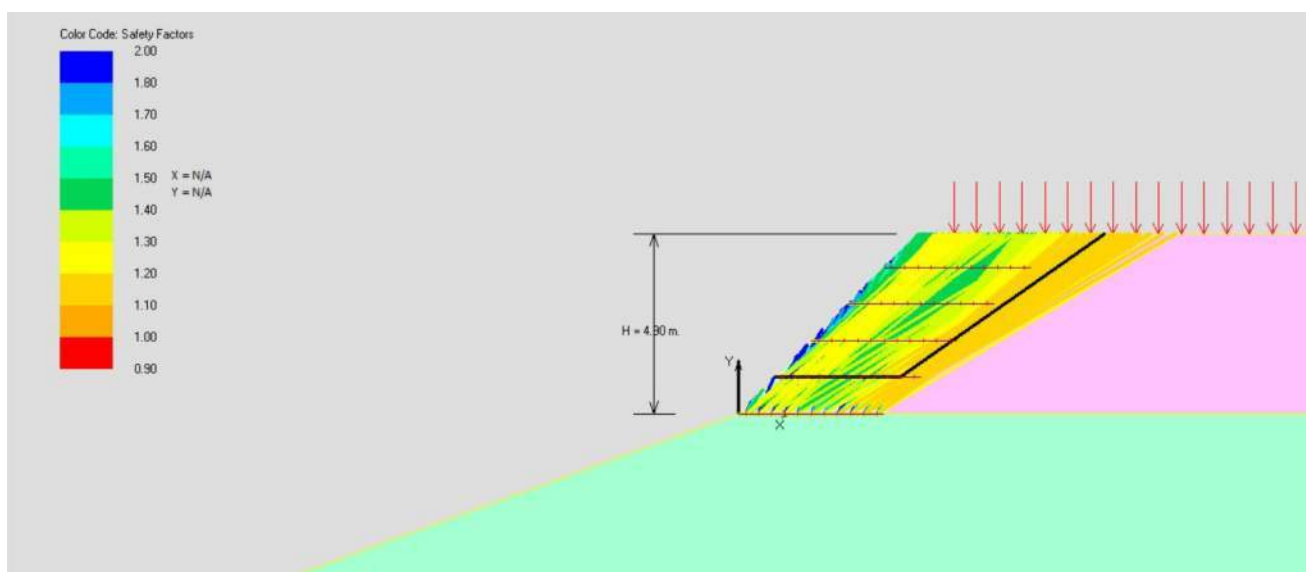
Static Rotational



Seismic Rotational



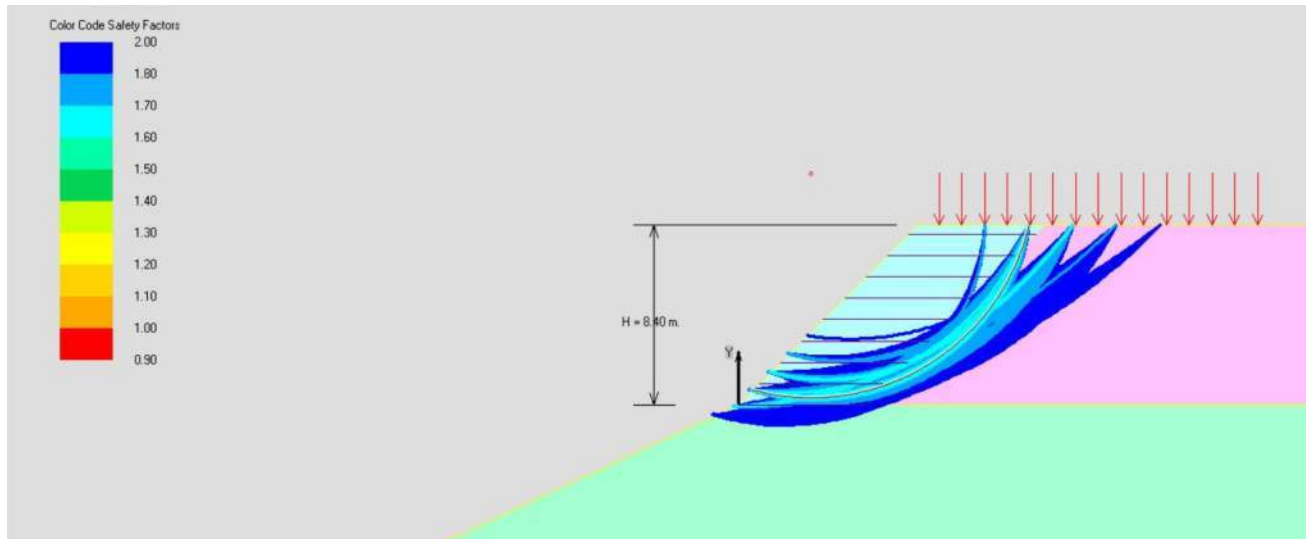
Static Translational



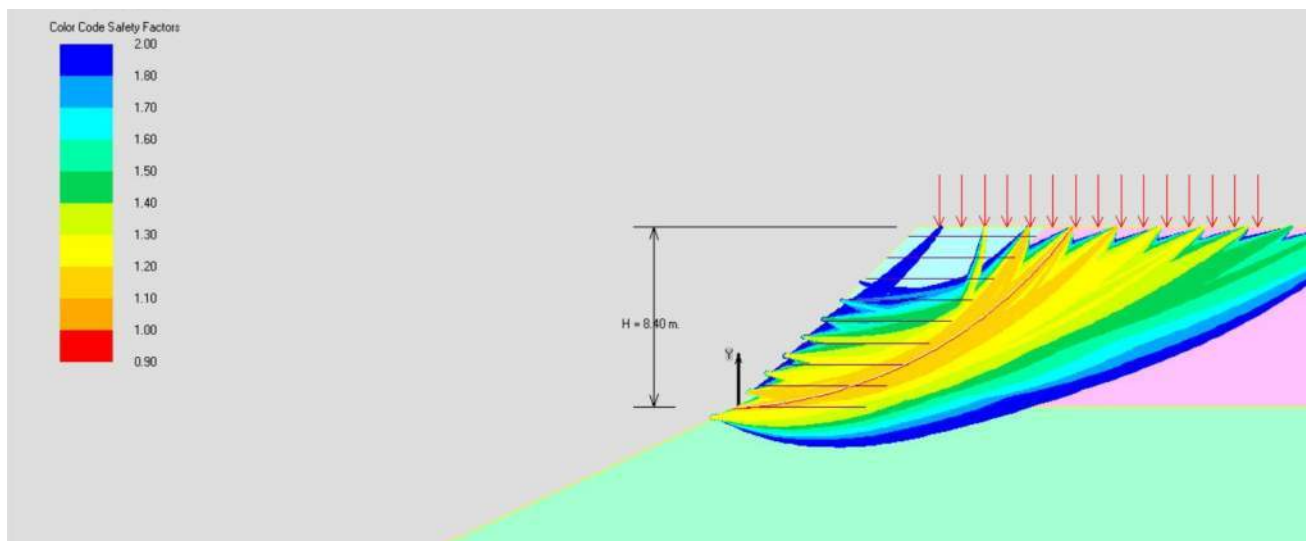
Seismic Translational

APPENDIX B

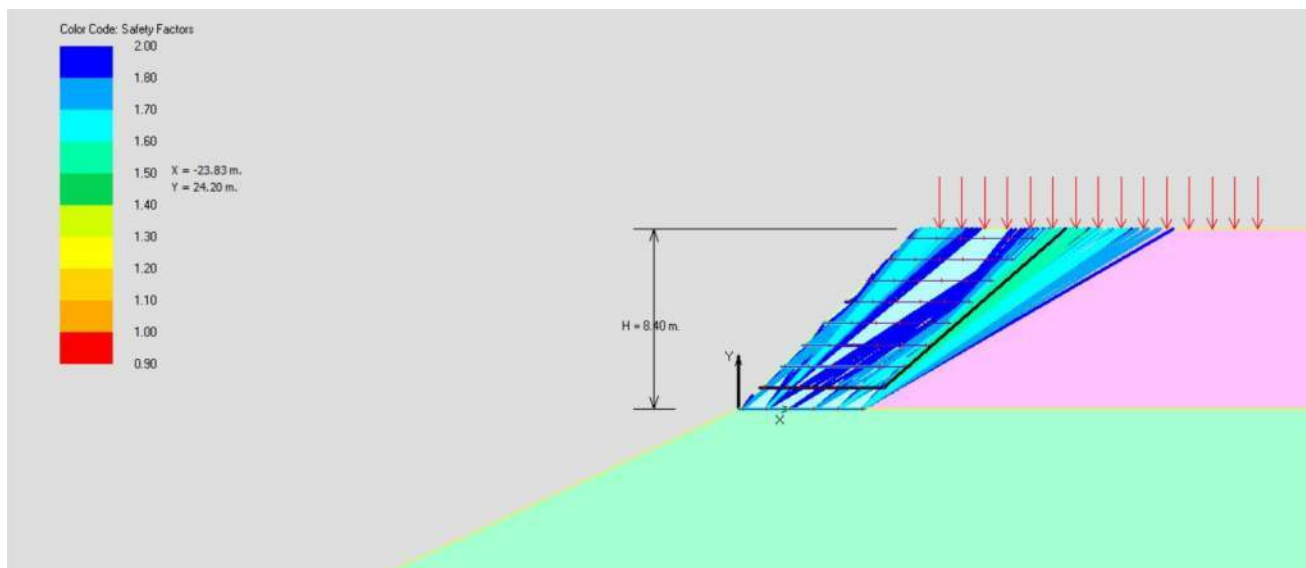
ANALYSIS RESULTS - CH 40



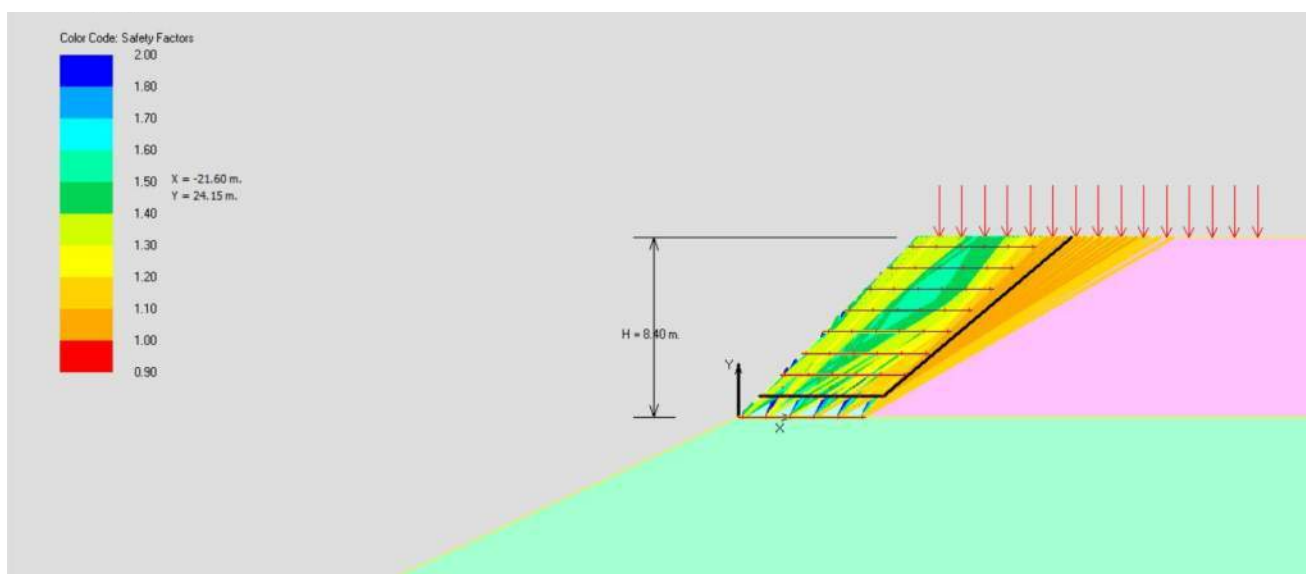
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Seismic Rotational



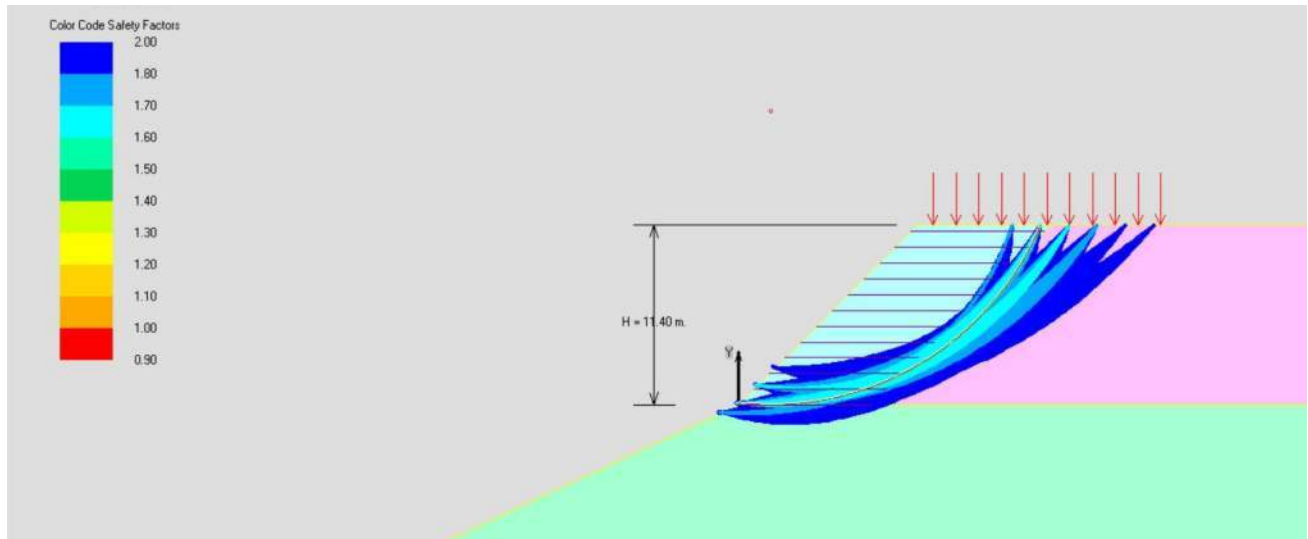
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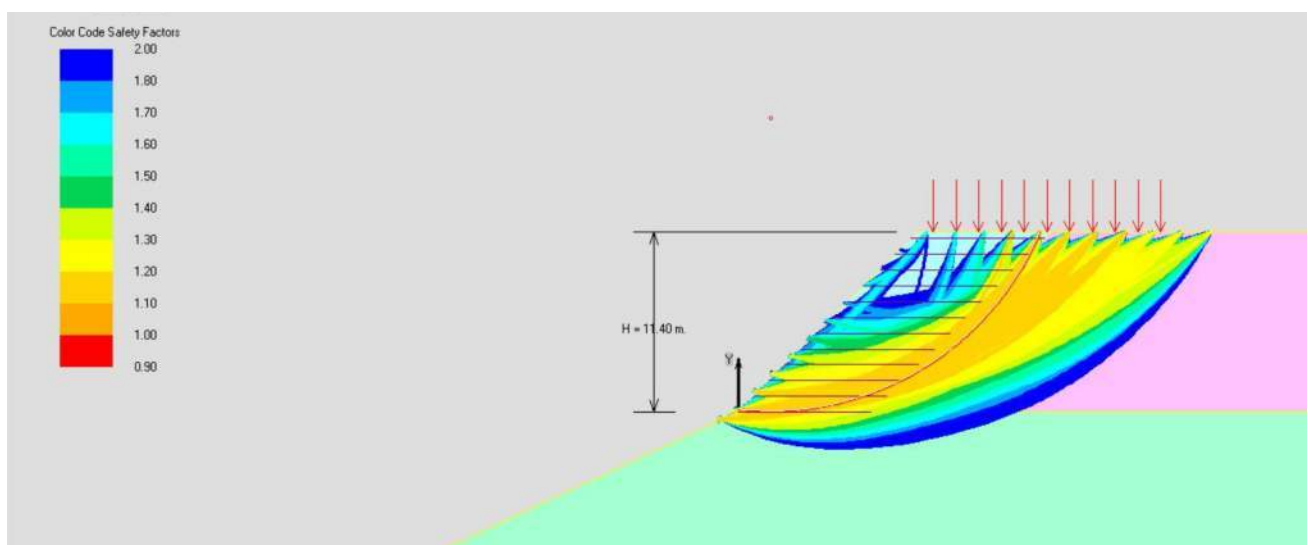
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APPENDIX C

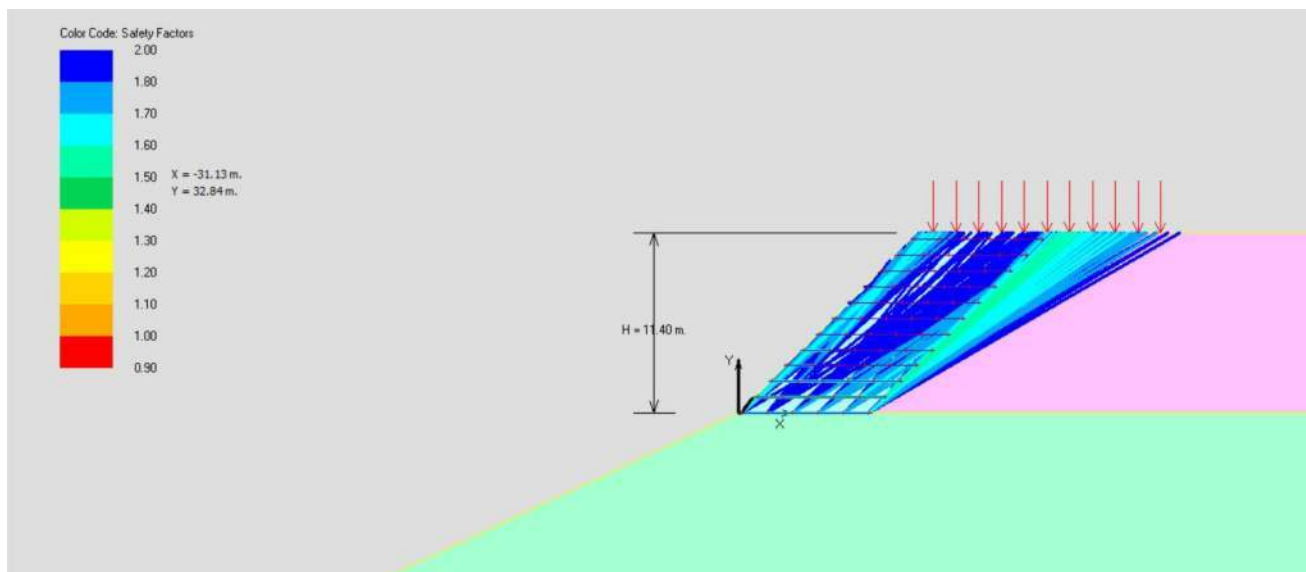
ANALYSIS RESULTS - CH 45



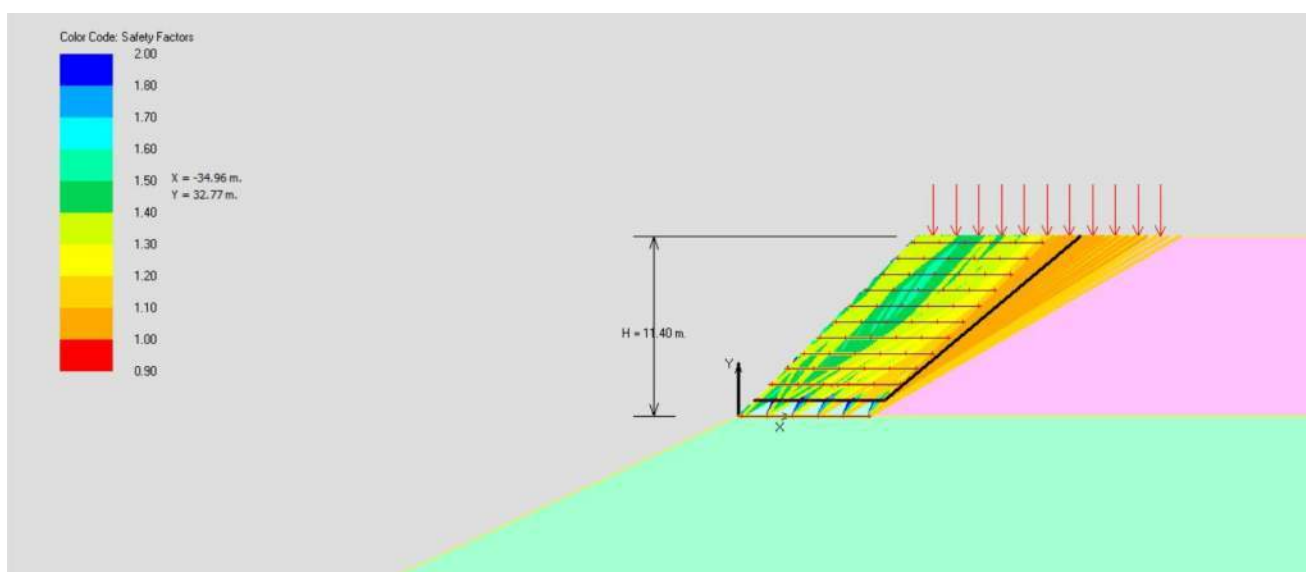
Static Rotational



Seismic Rotational



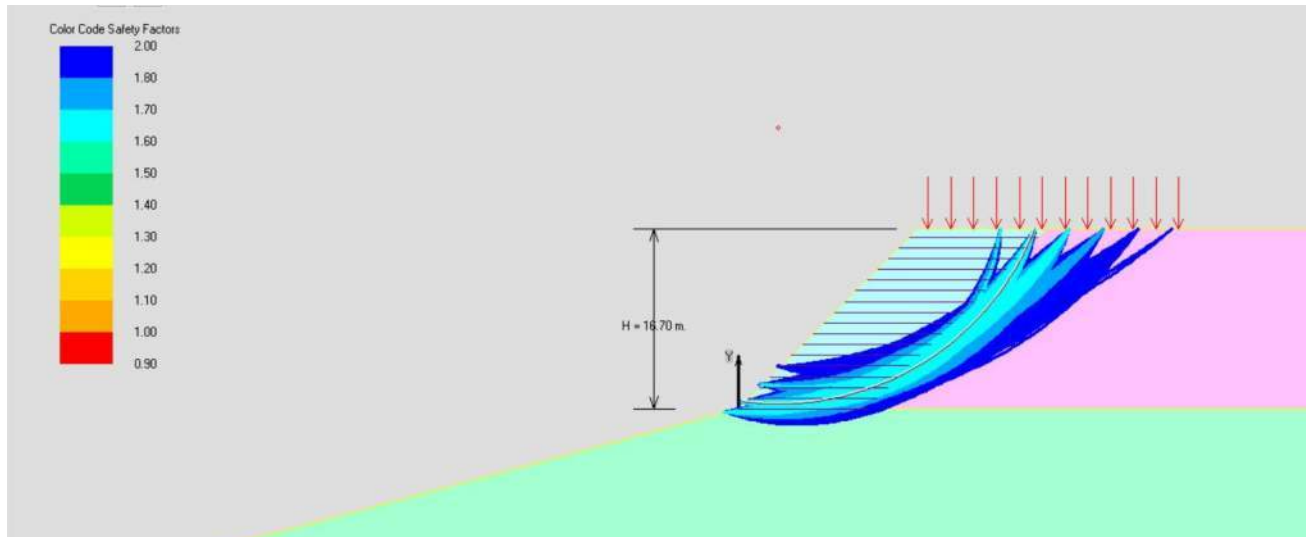
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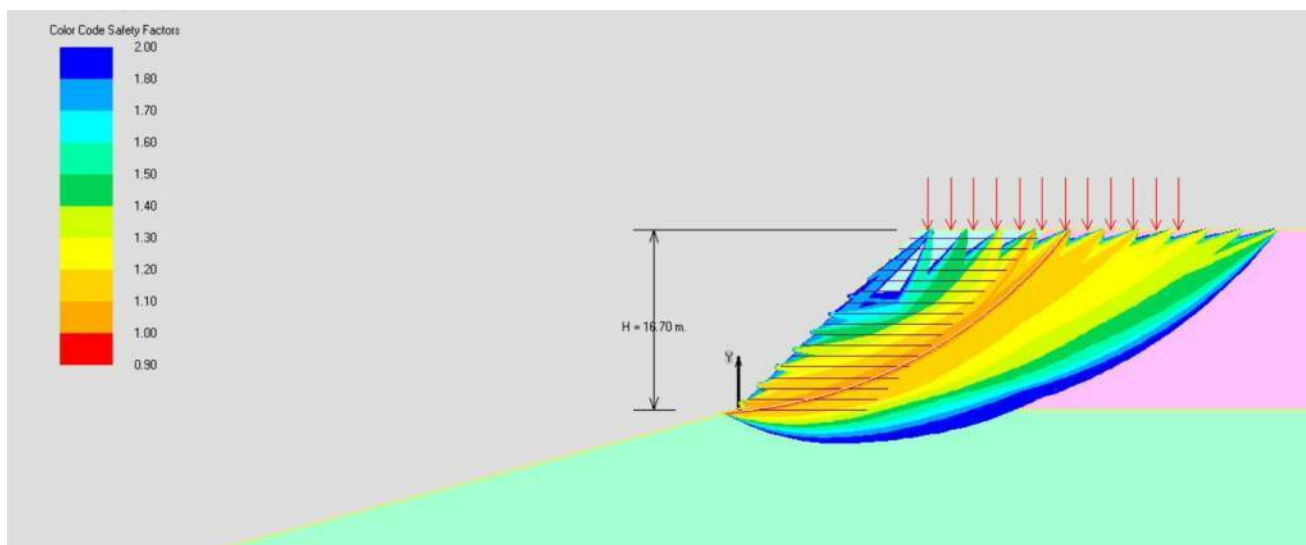
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APPENDIX D

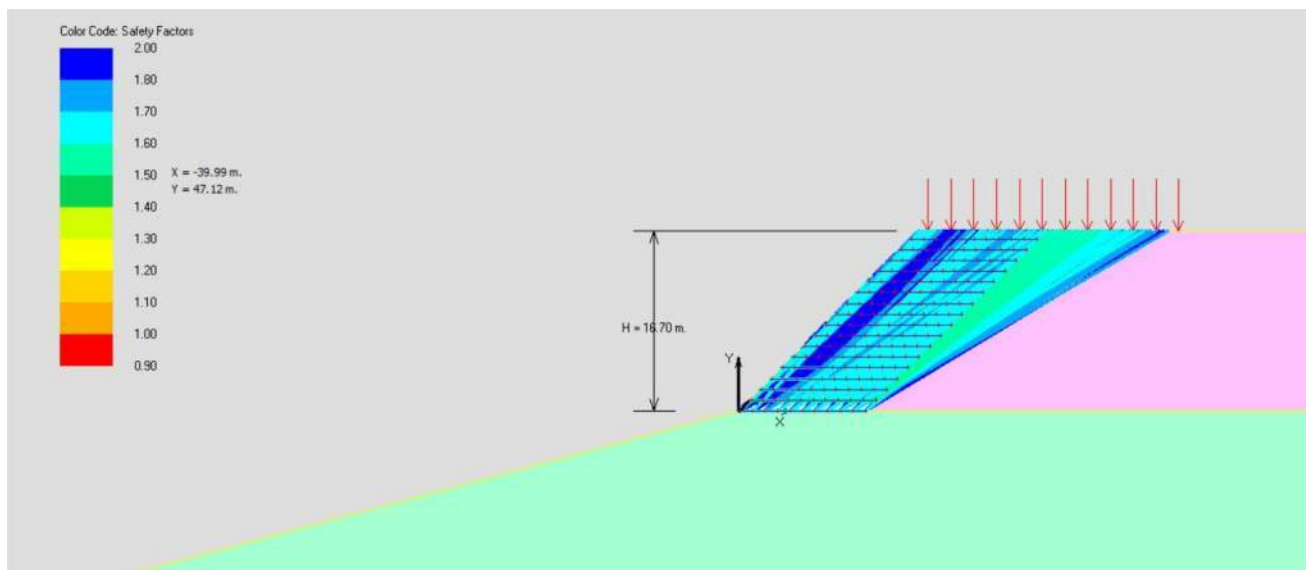
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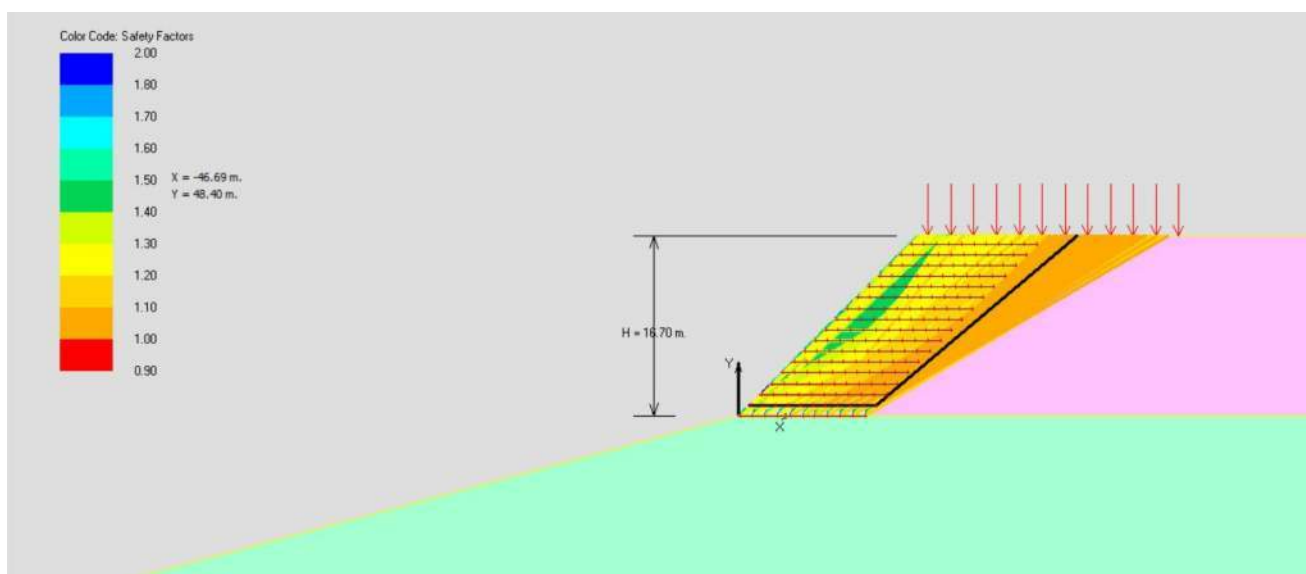
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Seismic Rotational



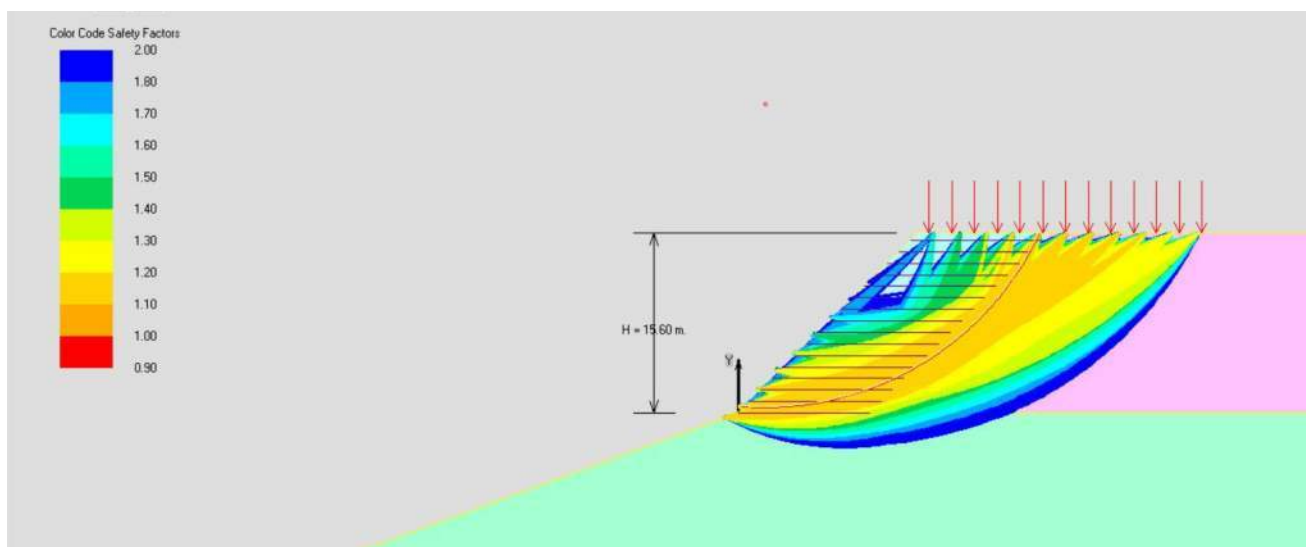
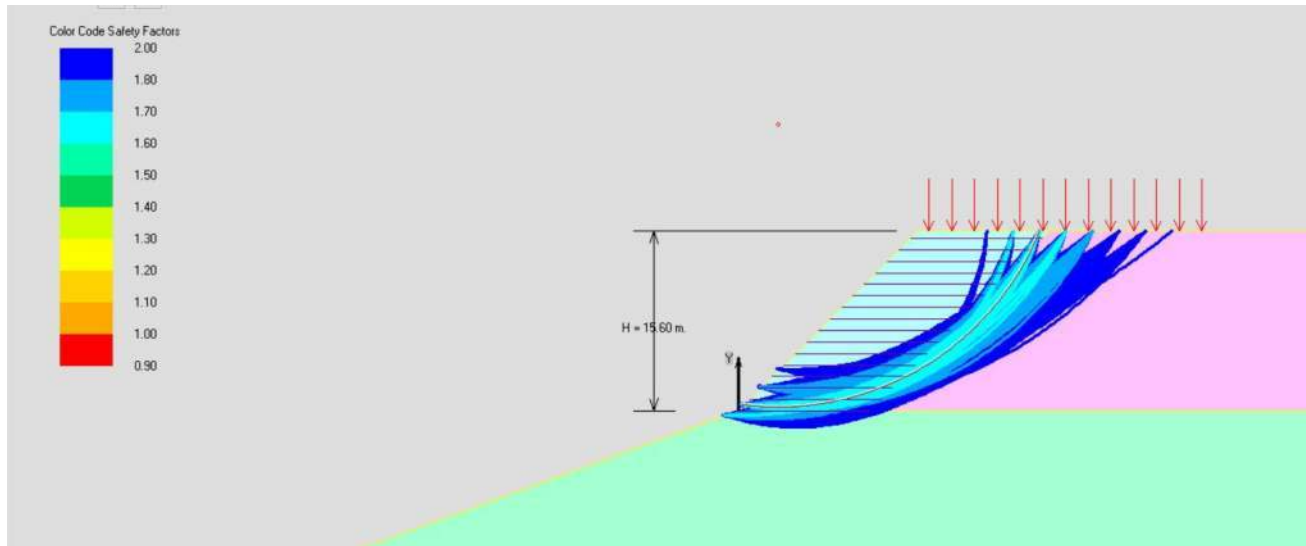
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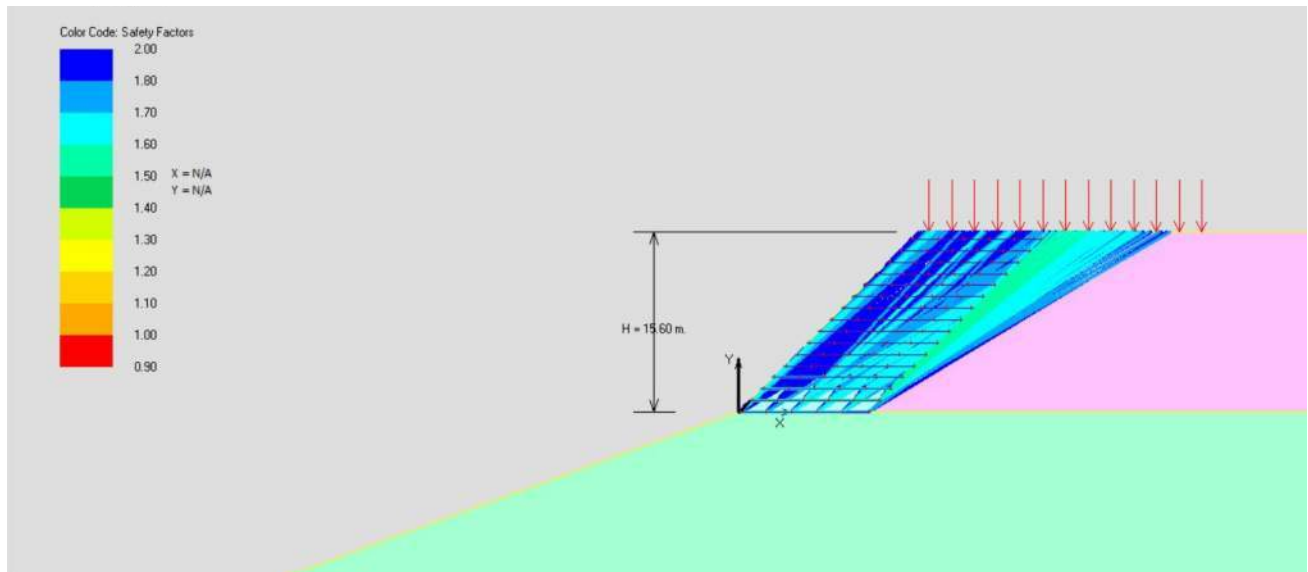


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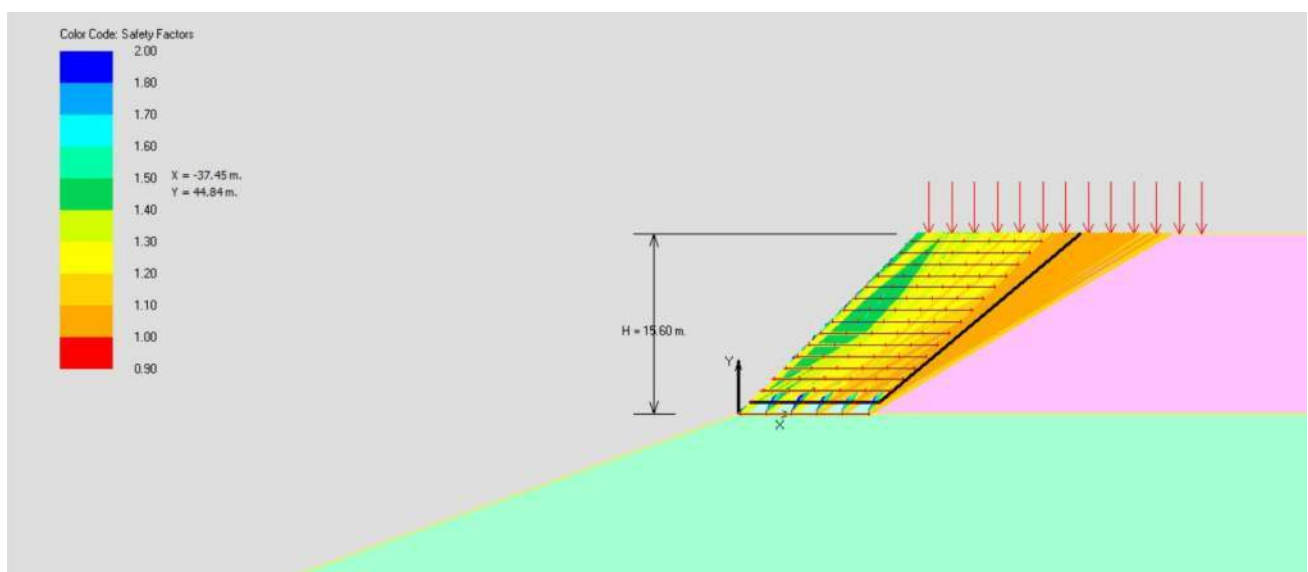
APPENDIX E

ANALYSIS RESULTS - CH 55





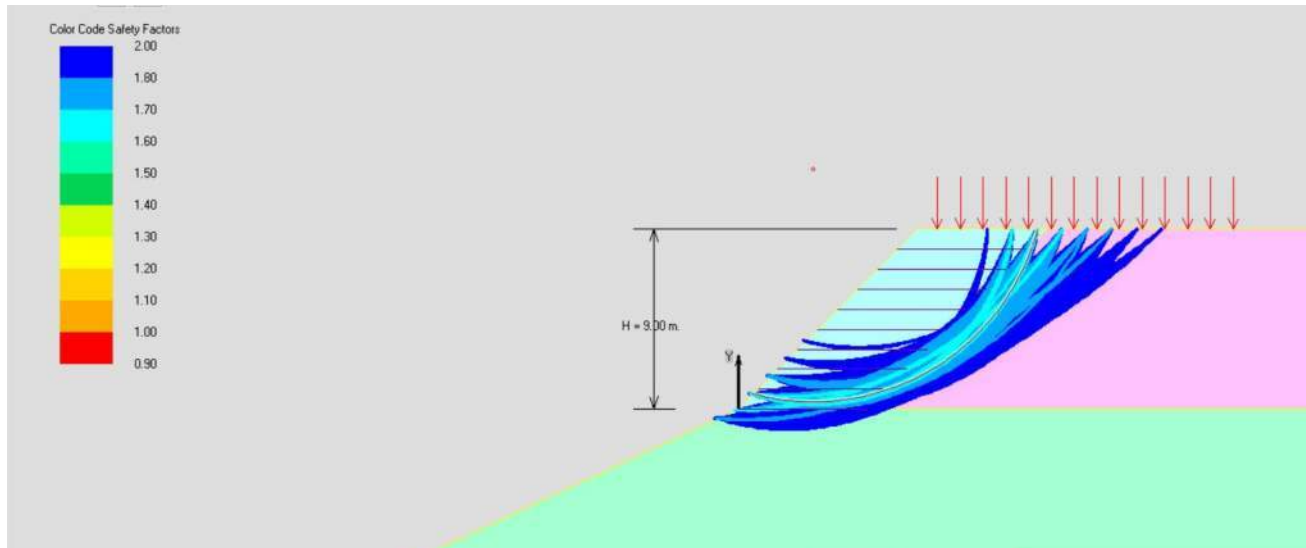
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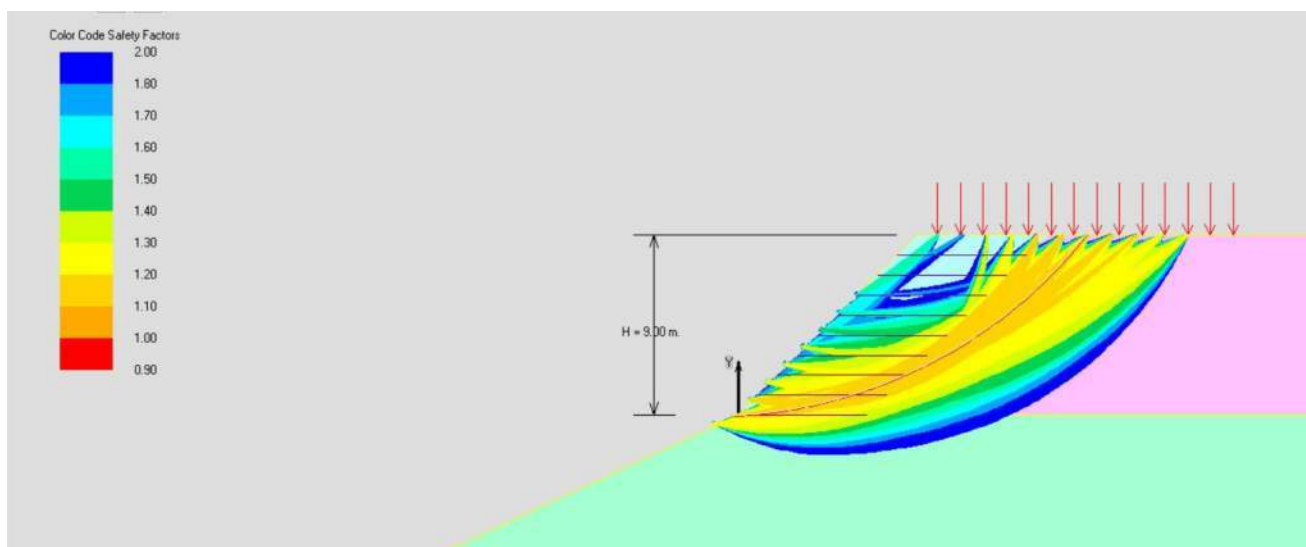
Seismic Translational

APPENDIX F

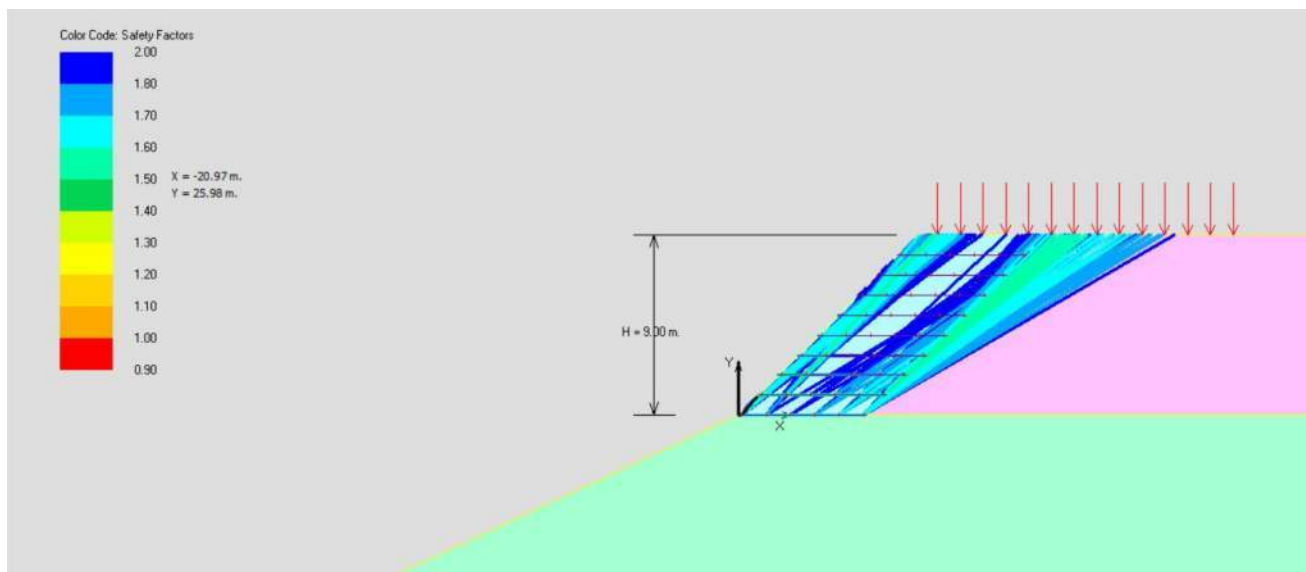
ANALYSIS RESULTS - CH 60



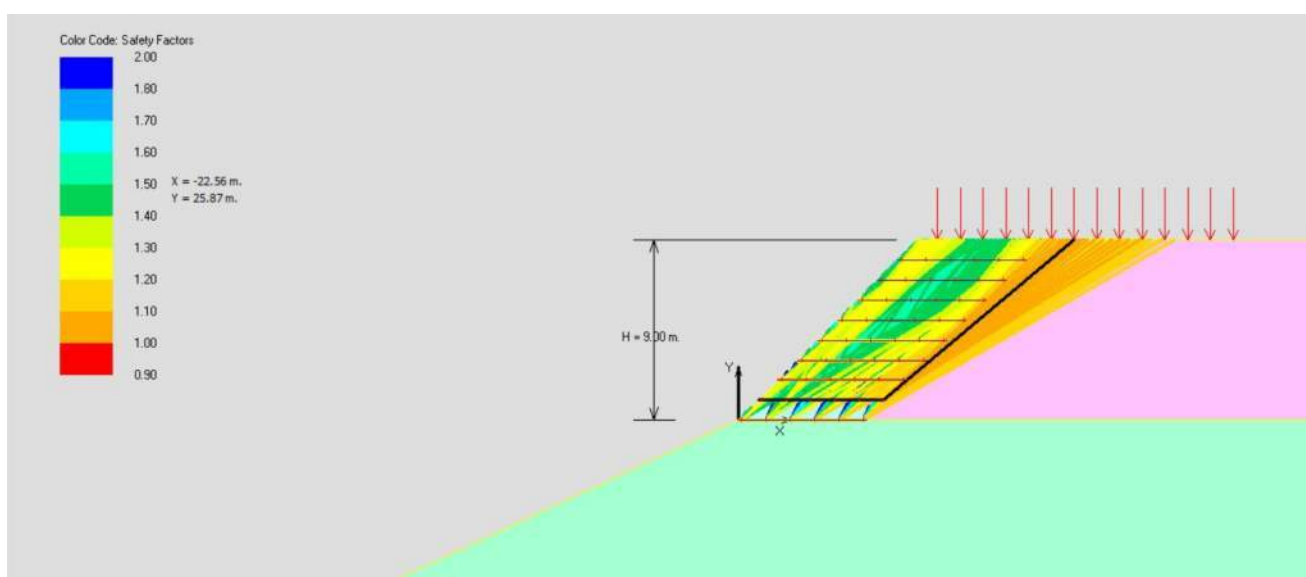
Static Rotational



Seismic Rotational



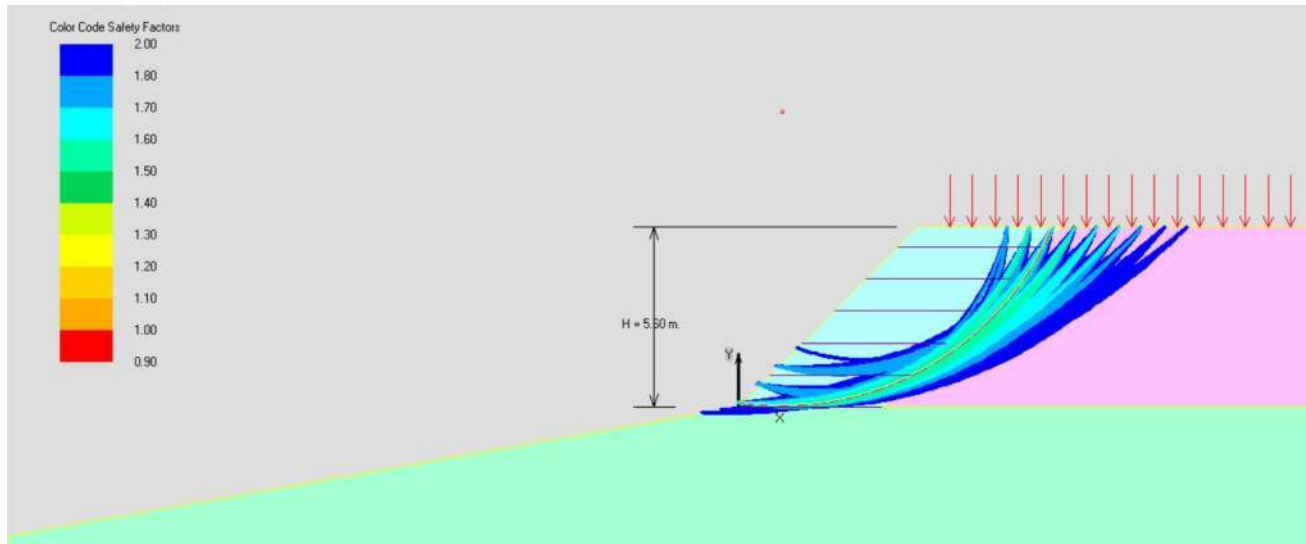
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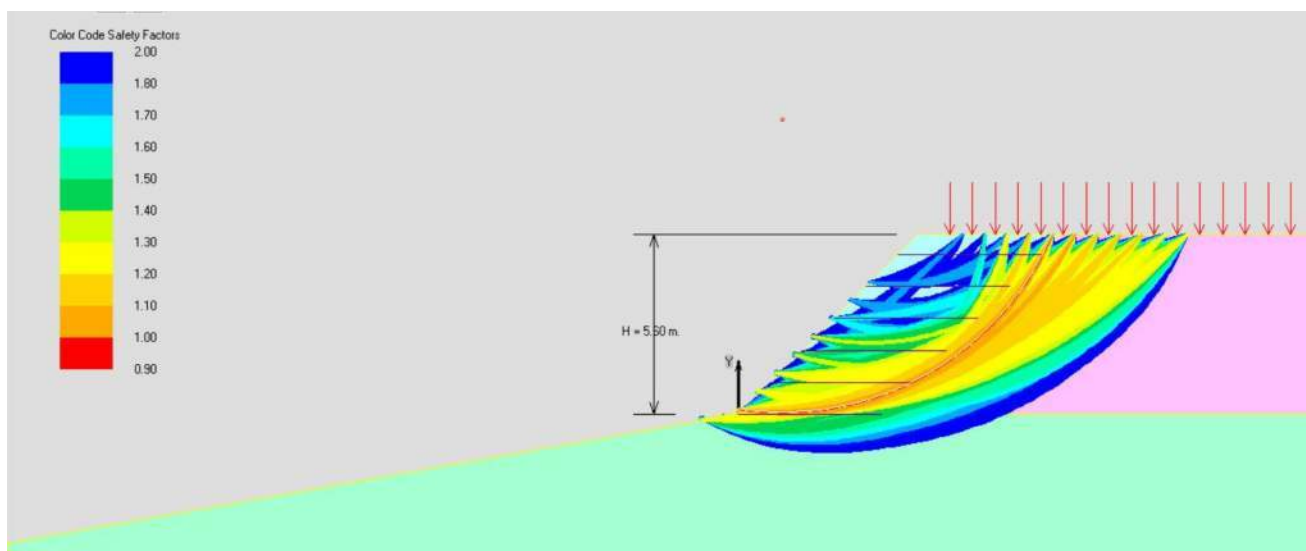
Seismic Translational

APPENDIX G

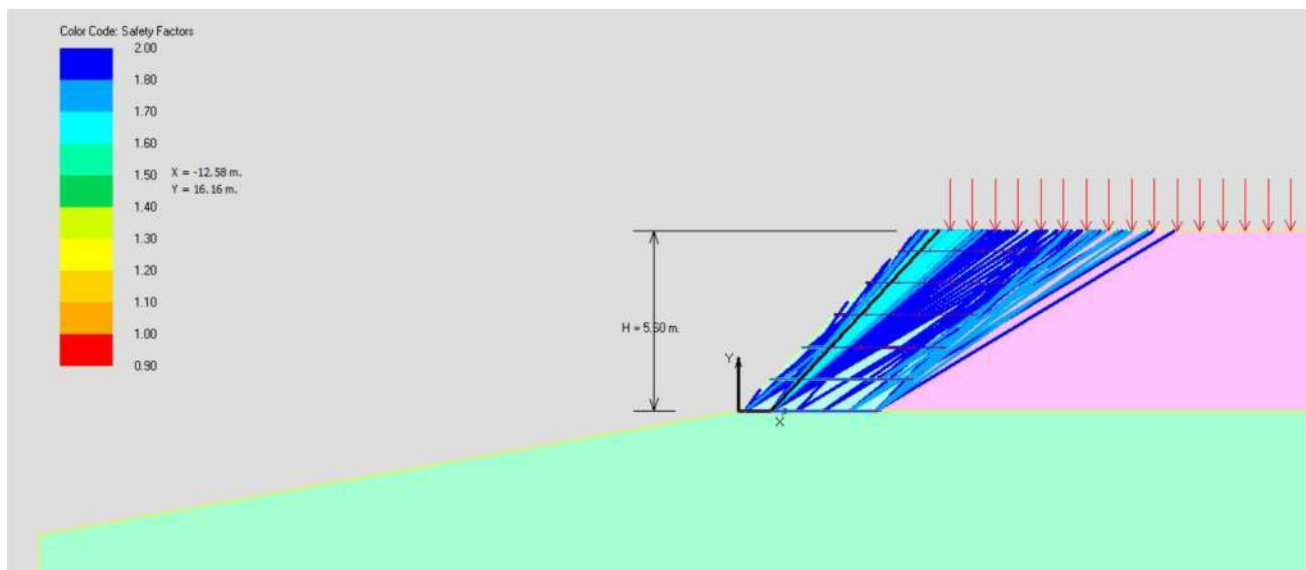
ANALYSIS RESULTS - CH 65



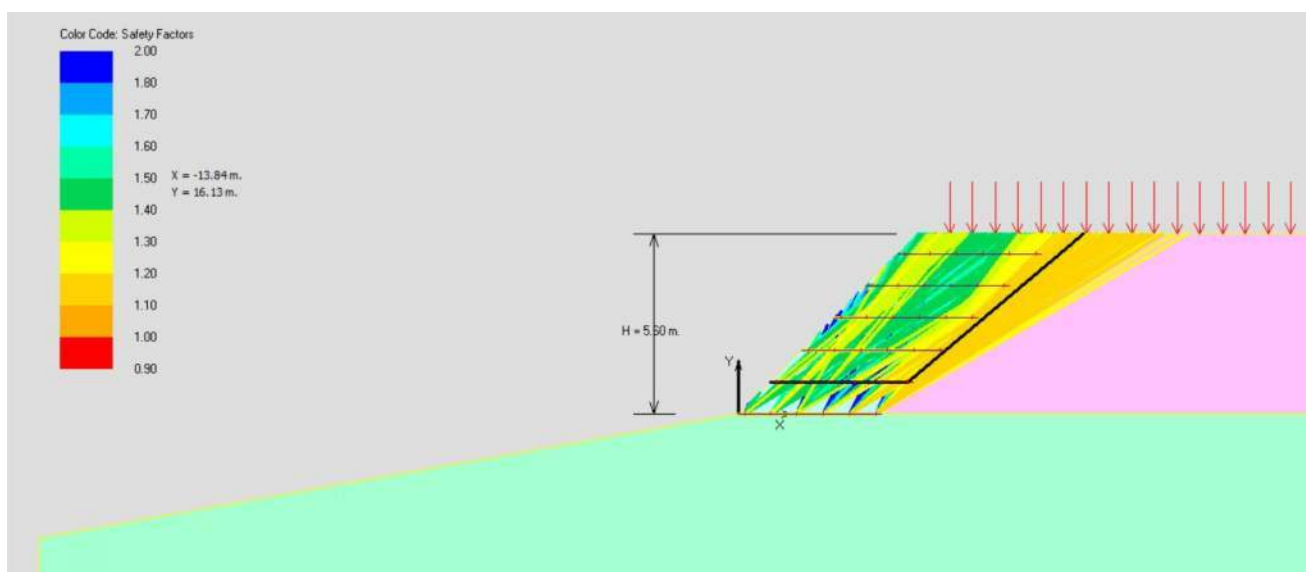
Static Rotational



Seismic Rotational



Static Translational



Seismic Translational

APPENDIX F: ENGEO EARTH WALL SPECIFICATION



Construction Specifications for Reinforced Soil Structure

Manapouri Grove
Kelson
Lower Hutt

Submitted to:

Genesis Residential Ltd
C/- Trishn Nand
Wellington

ENGEO Limited

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12.11.2019
15777.000.000_29



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ENGEO Document Control:

Report Title	Construction Specifications for Reinforced Soil Structure			
Project Address	Manapouri Grove, Waipounamu Drive, Lower Hutt			
Project No.	15777.000.000	Doc ID	29	
Client	Genesis Residential Ltd	Client Contact	Trishn Nand	
Distribution (PDF)	Trishn Nand			
Date	Revision Details/Status	WP	Author	Reviewer
12/11/2019	Issue for Information	BK	AS	AW

1 Safety

The contractor shall conform fully both on and off site with the provisions of the New Zealand Building Code in all matters related to construction safety, in particular with approved documents F1 (Hazardous Agents on Site), F2 (Hazardous Building Materials), F4 (Safety from Falling) and F5 (Construction and Demolition Hazards). The contractor shall at all times comply with the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016.

1.1 Standards and Specifications

All works shall comply with the specifications set out within this document and with the relevant requirements of the following standard specifications:

- NZS 4402 (1986) - Methods of Testing Soils for Civil Engineering Purposes
- NZS 4404 (2010) - Land Development and Subdivision Infrastructure
- NZS 4431 (1989) - Code of Practice for Earth Fill for Residential Development
- NZTA Specification TNZ F/1 (1997) - Specification for Earthworks Construction
- NZTA Specification TNZ F/2 (2000) - Specification for Pipe Subsoil Drain Construction
- NZTA Specification TNZ F/6 (2000) - Specification for Geotextile Wrapped Aggregate Subsoil
- NZTA Specification TNZ F/7 (2000) - Specification for Geotextiles

The following reports also include information and recommendations relevant to this specification and should be read in conjunction with this specification:

- Manapouri Grove Design Report
- Manapouri Grove Bulk Earthworks Specification
- Manapouri Grove Design Drawings

2 Site Survey

Boundary, building and embankment locations are indicative only and are not to be used for setting out of any works. A detailed site survey and boundary location will be required to ensure that construction is within legal boundaries.

On successful completion of construction, an as-built contour plan should be compiled as per NZS 4431-1989 and should be submitted to the local authority. Further to this, due to the benched construction nature of the embankment construction, we require every bench level to be surveyed.

3 Reinforced Soil Slope Design Plans

The Reinforced Soil Slopes (RSS) shall be constructed in accordance with the specification, design plans and the design report produced by ENGEO.

A copy of the design documents shall be kept on site at all times during the course of the RSS construction.

4 Earthworks

4.1 Scope

The work specified in this section covers preparation and maintenance of the site for construction of the RSS embankments, specifically:

Structural fill - the material placed from the face of the RSS embankment, to the rear of the geogrid length.

Bulk fill - any fill placed behind the geogrid.

All earthworks shall comply with NZS 4431-1989.

4.2 Foundation Subgrade

All topsoil, organic soils, vegetation and *in situ* soils not constituting moderately weathered rock, as per the NZGS guidelines, shall be removed from the footprint / construction platform. The subgrade for the reinforced soil structure shall be graded level for the entire area of the base as shown in the plans. The soil reinforcement components are to be **positioned on native moderately weathered Greywacke rock only**. The rock subgrade shall be visually approved by a qualified Professional Engineering Geologist or Geotechnical Engineer.

As discontinuity in rock is important, each new cut face **MUST be inspected and mapped / logged by an experienced Engineer or Engineering Geologist before filling can commence.**

4.2.1 Plate Load Testing

Where directed by the Geotechnical Engineer, plate load testing shall be carried out on the exposed foundation subgrade. The contractor shall allow for two plate load tests to be carried out per RSS structure.

4.2.2 Site Maintenance

Exposed native soil should be provided with adequate surface protection while exposed to minimise erosion from local climatic conditions, in particular from rainfall and wind. The contractor shall not allow surface water runoff from adjacent areas to enter the wall construction area at any time during the construction operation. In addition, at the end of each day's operation, the contractor shall slope the last lift of backfill away from the RSS facing so that runoff is directed away from RSS face to limit face erosion during the construction phase.

A sediment control plan should be designed for the site and implemented. The sediment control measures should be monitored throughout the project to ensure they remain adequate, particularly following heavy rainfall events.

4.3 Excavation

The contractor shall ensure that temporary slopes are safe during the period of RSS construction. The back slope of the excavation shall be benched, in approximately 1.5 m bench heights.

If rock conditions change, or a soil material is encountered during excavation, a suitably qualified and experienced Geotechnical Engineer / Engineering Geologist must be contacted.

5 Drainage

During the construction of the RSS embankments, the contractor shall divert all surface runoff away from the RSS facing and structural fill zone.

The surface of earthworks areas shall be kept adequately drained at all times to avoid ponding of surface water. Surface water shall be directed to approved discharge locations (appointed by the site Civil Engineer) and in a manner to minimise erosion of the ground surface. Drains shall be maintained with silt traps or erosion protection measures as required by the resource consents.

All the drainage should be discharged to an approved storm outlet. A record should be kept of the position, type and size of all subsoil drain and their outlets.

Internal drainage of the embankments is to be constructed by placing a drainage geofabric along all rear vertical cuts; these shall lead to filter wrapped novocoil drains at the base of all benches, which are connected to multiple vertical chimney drains at 20 m centres. See design drawings for details.

5.1 Drainage Composite Materials

The geofabric drain shall be a composite construction consisting of a supporting structure or drainage core material surrounded by a geotextile. The geotextile shall encapsulate the drainage core and prevent random soil intrusion into the drainage structure. The drainage core material shall consist of a material that permits flow along the core laterally and vertically.

The core structure shall also be constructed to permit flow regardless of the water inlet surface. The drainage core shall provide support to the geotextile to reduce pinching or crushing during the fill process.

A geotextile flap shall be provided along all drainage core edges. This flap shall be of sufficient width for sealing the geotextile to the adjacent drainage structure edge to prevent soil intrusion into the structure during and after installation. The geotextile shall cover the full length of the core.

The geofabric core shall be furnished with an approved method of constructing and connecting with outlet pipes or weepholes as shown on the plans. Any fittings shall allow entry of water from the core, but prevent intrusion of backfill material into the core material.

6 Engineered Structural Fill Material

6.1 Scope

This section consists of the supply, placement and compaction of all engineered fill material for the RSS embankments required for the satisfactory completion of the work. All fill shall comply with NZS 4431-1989, unless otherwise specified.

6.2 Fill Type

The fill material shall be free of shale, organic matter, mica, gypsum, smectite, montmorillonite or other poor durability particles. No salvaged material, such as asphaltic, concrete millings or Portland Cement Concrete rubble etc, will be allowed.

We understand that site won, Wellington Greywacke is to be used as structural fill. The below parameters must be met during the use of this material.

6.3 Gradation and Plasticity Index

Gradation shall be determined in accordance with Table 1, unless otherwise specified. The reinforced backfill shall be well graded.

Plasticity index (PI) shall not exceed 20.

Table 1: Backfill Gradation Requirements

Sieve Size	Percent Passing
3 inch (75 mm)	100
No. 40 (0.42 mm)	0 - 60
No 200 (0.075 mm)	0 - 20

6.4 Retained Backfill Material

Backfill behind the limits of the reinforced backfill shall be considered as BULK backfill. The retained backfill shall be free of shale, mica, gypsum, smectite, montmorillonite or other soft particles of poor durability.

The percentage of fines (the fraction passing No. 200 sieve) shall be less than 15% as determined with particle distribution test.

The liquid limit (LL) shall be less than 40.

The plasticity Index (PI) shall be less than 20.

Material that is composed primarily of rock fragments (material that has less than 25 percent passing a 19 mm sieve), shall be considered a rock backfill.

6.5 Structural Fill Placement

Structural fill shall be placed in such a manner to avoid damage or disturbance of the soil reinforcement or facing members. The contractor shall place backfill to the level of the connection and in such a manner as to ensure that no voids exist directly beneath reinforcing elements.

Fill shall be placed and compacted to a maximum lift thickness of 300 mm where heavy compaction equipment is to be used, and a 150 mm maximum lift thickness where hand operated equipment is used (within 1.5 m of the RSS face). Any layer of fill material that has deteriorated after an interruption in the earthmoving operation should be re-compacted prior to any further layer being placed over it.

A minimum of 150 mm of fill should be maintained between the reinforcement and the wheels or tracks of the construction equipment. Care should be taken to avoid any deformation or movement of the reinforcement.

Structural fill must be placed from the face of the RSS embankment, moving towards the rear of the embankment; this ensures the geogrid material has no slack near the face.

6.6 Moisture Control

The moisture content of the backfill material prior to and during compaction shall be uniformly dispersed throughout each layer. Backfill materials shall have a placement moisture content within 5 percentage points of the optimum moisture content.

6.7 Fill Compaction

All fill layers should be compacted to a minimum 98% of the maximum dry density and each layer should be tested to confirm adequate compaction. Compaction should be carried out parallel to the slope face.

The specified compaction quality control testing for structural fill areas and building sites include:

- Scala Penetrometer testing (NZS 4402: 1988, Test 6.5.2) performed on the completed fill platform with a minimum of one test per 300 m².
- *In situ* density and moisture content testing by nuclear densometer direct measurement method (in accordance with NZS 4407) at a minimum of one test per 1000 m² per lift. The interval of testing shall also meet a minimum of one test for every 500 m³ of fill placement, or as specified by the Earthworks Engineer. Testing shall be undertaken every 0.6 m vertically over the first 5 m due to the force exerted through the toe of the embankments; this may be relaxed after this point if the Design Engineer is satisfied.

Lighter compaction equipment should be used towards the face of the RSS embankment. The backfill density requirement within 1 m of the facing shall be 92% of maximum dry density.

6.8 Compaction Testing and Reporting Requirements

If the earthworks contractor is undertaking the compaction control testing, in order for the Engineer to effectively review the test data, the following information shall be provided as a minimum:

- The test results should be copied to the Engineer's office as soon as is practical upon completion of testing. All tests, including retests, shall be identified by an individual numbering system and indicate the date of the test.

- Test results shall include locations, typically as coordinates (such as northing and easting with reference to the datum used) or as chainage. Results must include elevation of the tested surface.
- Failed tests and re-tests shall be identified, as well as the type of material tested and thickness of the fill layer relevant to each test. This information should also be included on the final test result reports.
- In the event of a test failing, the earthworks contractor should also be notified so that the appropriate remedial actions can be implemented. In general, the fill should be either further compacted to exceed the minimum compaction specifications or removed and re-compacted (with adjustments to the water content as necessary). If failing results cannot be readily corrected, the Design Engineer should be notified by telephone as soon as possible, preferably while the technician is still on site.

6.9 Settlement Monitoring Programme for Embankments

As part of the proposed on site QA/QC for the earthworks construction process a settlement monitoring programme is required for all embankments. This process must be accurately monitored and documented in a settlement monitoring programme.

We have summarised our settlement monitoring programme below:

- Place settlement markers on the face of the RSS structure, within the bottom 2 m of the RSS structure, at approximately 20 m horizontal intervals. These should be surveyed every two weeks during construction.
- Once the fill platform is at design level, place pin settlement markers every 20 m length of the wall in a zig-zag pattern on top of the fill. All points should be monitored weekly to fortnightly to an accuracy of ± 2 mm.
- When settlement is complete, or when the Geotechnical Engineer agrees (settlement has zeroed out over a 3-month period), building construction may commence.

No services or permanent infrastructure shall be placed within the fill on site until the recorded settlement, over a three month period, indicates the fill settlement is within tolerable limits and this must be confirmed in writing by the Geotechnical Engineer.

7 Geosynthetic Reinforcing Materials

7.1 Scope

This section consists of the supply and installation of all reinforcing for the RSS required for the satisfactory completion of the work.

7.2 Quality Assurance

It is the contractor's responsibility to ensure that the reinforcement placed complies in all respects with the Drawings and the Specification. ENGEO will observe placement of the reinforcing material where practicable.

7.3 Materials and Workmanship

All materials and workmanship shall conform to the requirements of the product specifications, the New Zealand Building Code and conditions of the Building Consent, and are to be installed in conformance with the RSS design plans.

7.4 Storage

All geosynthetic materials must be stored under cover in clean, dry conditions. The materials must be protected from any form of chemical or mechanical damage, which may impair their performance, and from exposure to extreme temperatures.

7.5 Geogrid Reinforcing

As specified in the design drawings, Stratagrid SG550 and SG500 or approved similar geogrid are to be used.

The geosynthetic reinforcement shall be installed in accordance with the manufacturer's recommendations, unless otherwise modified by these specifications. The geosynthetic reinforcement shall be placed within the layers of the compacted soil as shown on the plans or as directed.

The geosynthetic reinforcement shall be placed in continuous longitudinal strips in the direction of main reinforcement. Joints in the design strength direction (perpendicular to the slope) shall not be permitted with geotextile or geogrid, except as indicated on the drawings.

Horizontal coverage of less than 100 percent shall not be allowed; lengths of geogrid material must have an overlap of 50 mm between every sheet.

After a layer of geosynthetic reinforcement has been placed, the next succeeding layer of soil shall be placed and compacted as appropriate. After the specified soil layer has been placed, tested and approved, the next geosynthetic reinforcement layer shall be installed. The process shall be repeated for each subsequent layer of geosynthetic reinforcement and soil.

Geosynthetic reinforcement shall be placed to lay flat and pulled tight prior to backfilling (filling from the face backwards to tension the grid). After a layer of geosynthetic reinforcement has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geosynthetic reinforcement in position until the subsequent soil layer can be placed. Under no circumstances shall a track-type vehicle be allowed on the geosynthetic reinforcement before at least 150 mm of soil has been placed. Sudden braking and sharp turning – sufficient to displace fill – shall be avoided.

During construction, the surface of the fill should be kept horizontal.

8 Slope Facing Finishing (Vegetation)

Ultraviolet light exposure can degrade geosynthetics over time. Vegetation shall be established and maintained on the face of the slope. In the unlikely event that suitable vegetation cover cannot be established, a permanent facing may be applied to provide long term ultraviolet protection. If this is required, ENGEO should be contacted for guidance.

It is understood that the vegetation / erosion protection of the face is to be undertaken by others, however, we require an erosion blanket and vegetation over 100% of the embankment face, and this to be maintained over a 50 year period.

8.1 Hydroseeding

Hydroseeding should be carried out by a qualified professional specialising in hydroseed application. Seed mix and fertiliser type and quantity should be selected in consultation with a qualified professional familiar with local site conditions and the local climatic conditions. In addition to hydroseeding, it is possible to plant native shrub and willow cuttings in a minimum quantity of 1 plant every 1 m to 3 m, in order to enhance the consolidation of the external facing, due to the rotting of the plant.

The services of a Botanist familiar with local conditions should be involved for plantation.

The slope should be watered in accordance with the recommendations of the qualified professional involved in selecting the seed mix, and equipment should not damage the slope, plants or any other materials on site.

9 Engineer's Inspections (HOLD POINT SUMMARY)

Inspections by the Engineer are required at several points within the construction as set out below. The contractor shall provide the Engineer with 48 hours' notice prior to the inspection.

- The Engineer shall observe all cut slopes and foundation subgrades prior to placement of geogrid and fill material.
- All cut slopes, both above and below subgrade level, must be mapped by a suitably qualified and experienced Geotechnical Engineer or Engineering Geologist for adverse fracture and shear zone conditions.
- The Engineer shall observe the placement of subsurface drainage system within every lift.
- The Engineer shall observe primary reinforcing geogrids.
- The Engineer shall observe the quality of fill material and placement of fill material (random ongoing lab testing of the fill material will be undertaken to ensure this meets the specification).
- The Engineer shall be provided with fill compaction test results (if testing is not undertaken by ENGEO Ltd) within 24 hours of the tests having been completed.
- The Engineer shall observe the completed embankment prior to hydroseeding.

In addition to Engineer's inspections as part of the construction quality assurance process, we recommend that a limited monitoring programme be undertaken by the contractor. The monitoring programme shall monitor the horizontal and vertical movement of the reinforced soil structure by surveying method, using suitable measurement points on the facing element or on the surface of the retained soil. The monitoring data shall be provided to the Engineer on a weekly basis.

APPENDIX B – SITE OBSERVATION REPORTS

.Site Observation Report

Project Name: Kelson Heights Development

Project No: T0093

**Date of the
Inspection:** 28.04.23

Prepared By: Jerry Spinks

Attention: Chris Mason – Genesis
Residential Ltd

Reviewed By: Nathan Schumacher

Reference: T0093 / SOR 09

Contractor Sam Bone – RMS Contractors

Subject: Walkover across entire site

OBSERVATIONS

Completed a walkover of the entire site.

1. MSE Wall 05 – geogrids and blading out of engineered fill.
2. Inspection of sediment retention devices.
3. Bulk cutting at Stage 6 region, including formation of temporary cut slopes.

ACTIONS REQUIRED

4. None.

NEXT INSPECTION

5. Monthly throughout winter period, current scheduled for mid-May.

Table 1: Photographs taken during site visit



Photo 1 - Bulk Filling - MSE Wall 05



Photo 2 - Sediment containment/treatment devices



Photo 3 – Temporary cut slopes at Stage 6

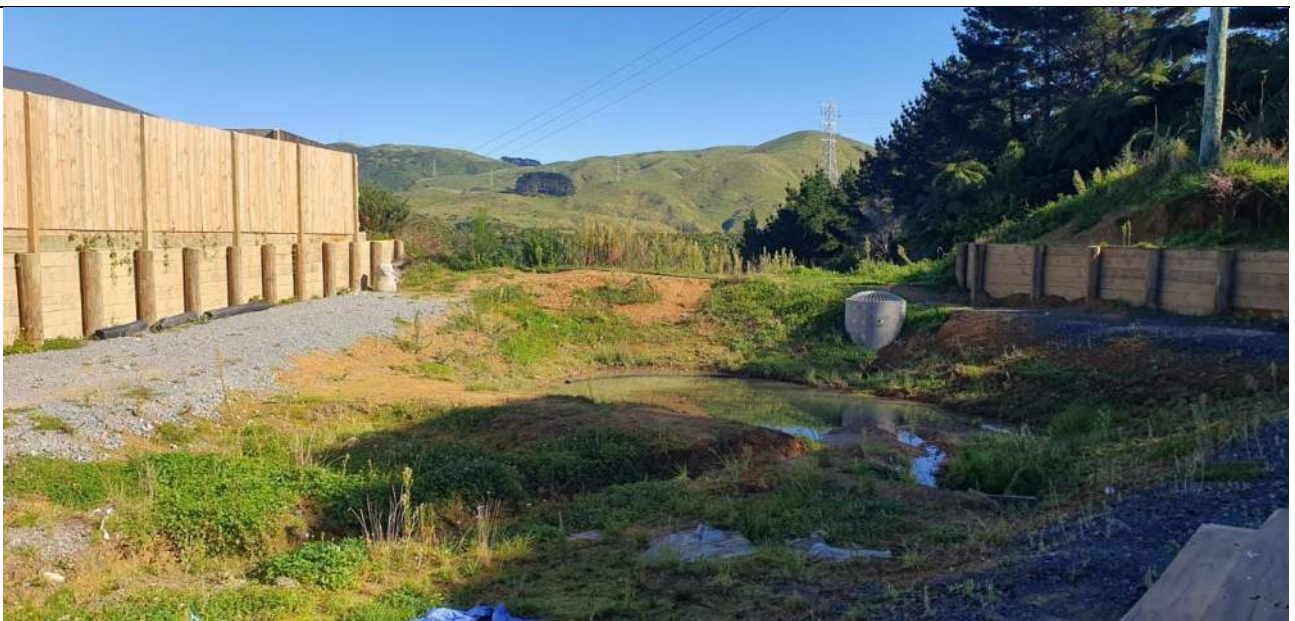


Photo 4 – Stormwater detention pond, temporary install

.Site Observation Report

Project Name: Kelson Heights Development

Project No: T0093

**Date of the
Inspection:** 18.05.23

Prepared By: Jerry Spinks

Attention: Chris Mason – Genesis
Residential Ltd

Reviewed By: Nathan Schumacher

Reference: T0093 / SOR 10

Contractor Sam Bone – RMS Contractors

Subject: Preparation for winter operation

OBSERVATIONS

1. Minor works only, mainly to secure MSE Wall 05 as lead into winter period, including capping off the fill surfaces.
2. Placement and compaction of engineered fill, as part of MSE Wall 05, refer to Photo 1.
3. Capping off Stage 6 area in preparation for winter works, doubling also as the finishing surface for the residential lots.

ACTIONS REQUIRED

4. RMS Contractors to supply earthworks compaction testing results.

NEXT INSPECTION

5. Monthly throughout winter period, current scheduled for Thursday 22 June.

Table 1: Photographs taken during site visit



Photo 1 – Bulk Filling – MSE Wall 05



Photo 2 – Stockpile of GAP40, placed as capping for winter, Stage 6. In the background, bulk cutting for placement of fill at MSE Wall 05

.Site Observation Report

Project Name:	Kelson Heights Development		
Project No:	T0093	Date of the Inspection:	15 December 2023
Prepared By:	Jerry Spinks	Attention:	Chris Mason – Genesis Residential Kelson Ltd
Reviewed By:	Nick Clendon		
Reference:	T0093 / SOR 14	Contractor	Fred Whitton – RMS Contractors
Subject:	EW 05 – Bulk Filling		

OBSERVATIONS

1. MSE Wall 05 – placement and compaction of fill sourced from Stage 3 cut
2. Maintenance of erosion and sediment control measures refer to Photo 3.

ACTIONS REQUIRED

3. None

NEXT INSPECTION

4. Weekly inspections throughout the summer period.



Photo 1 –EW 02, on hold pending receipt of final designs



Photo 2 – Blading out bulk fill for EW 05



Photo 3 – Sediment detention basin, for pumped surface water



Photo 4 – Stockpile source material carting to EW 05

Site Observation Report

TorlesseTM

Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 04.04.24
Author:	Olivia Ross	Attention:	Fred Whitton (RMS) Jo Cushen (SHL) Chris Mason (Client)
Reviewed By:	Jerry Spinks		
Reference:	SOR04.04.24	Contractor:	RMS Contractors
Subject:	EW 05 trial placement of bio-cor matting, and cutting to the South		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

EW02 - limited progress from week prior.



EW02 and 45 degree cut slope extending to the south



Stormwater control, possible blocked culvert

OBSERVATIONS

EW05 - limited progress from prior weeks. Assumed to be due to the issue of wind creating dust at neighbouring properties.



EW05.



EW05 - adjacent to properties.

ACTIONS REQUIRED

n/a

NEXT INSPECTION

Weekly - next thursday

Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 07.03.24
Author:	Olivia Ross	Attention:	Jo Cushen (SHL)
Reviewed By:	Jerry Spinks		
Reference:	SOR07.03.24	Contractor:	RMS Contractors
Subject:	EW 02		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

EW02 was approximately 2m below target height and is expected to be completed by the end of next week.

NDM testing was being undertaken at the time of the site visit.

One of RMS' machines broke down on the earth wall. The lock function meant the roller could not be dragged off the slope and a mechanic would need to fix it on the EW. A mechanic was scheduled to visit site later in the afternoon. Progress on EW02 would be limited until the machine is fixed.



Broken down roller.



Rolling the edge of the EW.



NDM test.

ACTIONS REQUIRED

n/a

NEXT INSPECTION

Weekly - next thursday

Site Observation Report



Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 08.02.24
Author:	Olivia Ross	Attention:	Fred Whitton (RMS) Jo Cushen (SHL) Chris Mason (Client)
Reviewed By:	Jerry Spinks		
Reference:	SOR08.02.24	Contractor:	RMS Contractors
Subject:	EW 02 and EW 05		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

The 2m toe at the base of the wall had been excavated and RMS had begun placing grids and backfilling. Approximately 0.5m of the toe area remained to be fill, with one more layer of grid to be placed. RMS stated that to-date all NDM tests had passed at the first attempt.

An 1.0m by 2.0m (approximate) area had been excavated towards the back of the toe, in front of the ephemeral stream drain. RMS was unsure about the purpose of the excavation.



EW02 - looking east



EW02 - looking west



Excavated area at the back of the toe

OBSERVATIONS

Organic fill, including roots and trees, still present in the engineered fill to EW05. RMS have recently moved to a new location for the fill material. It is expected the organic material is the topsoil/surface layers from this new location. RMS to remove and replace with suitable material.



Roots within fill



Earth Wall 05

ACTIONS REQUIRED

RMS to send through earthworks testing certificates for Nov/Dec 2023 and Jan 2024, all outstanding.

NEXT INSPECTION

Weekly - next thursday

Site Observation Report



Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 12.04.24
Author:	Olivia Ross	Attention:	Fred Whitton (RMS) Jo Cushen (SHL) Chris Mason (Client)
Reviewed By:	Jerry Spinks		
Reference:	SOR12.04.24	Contractor:	RMS Contractors
Subject:	EW 02 and EW 05		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

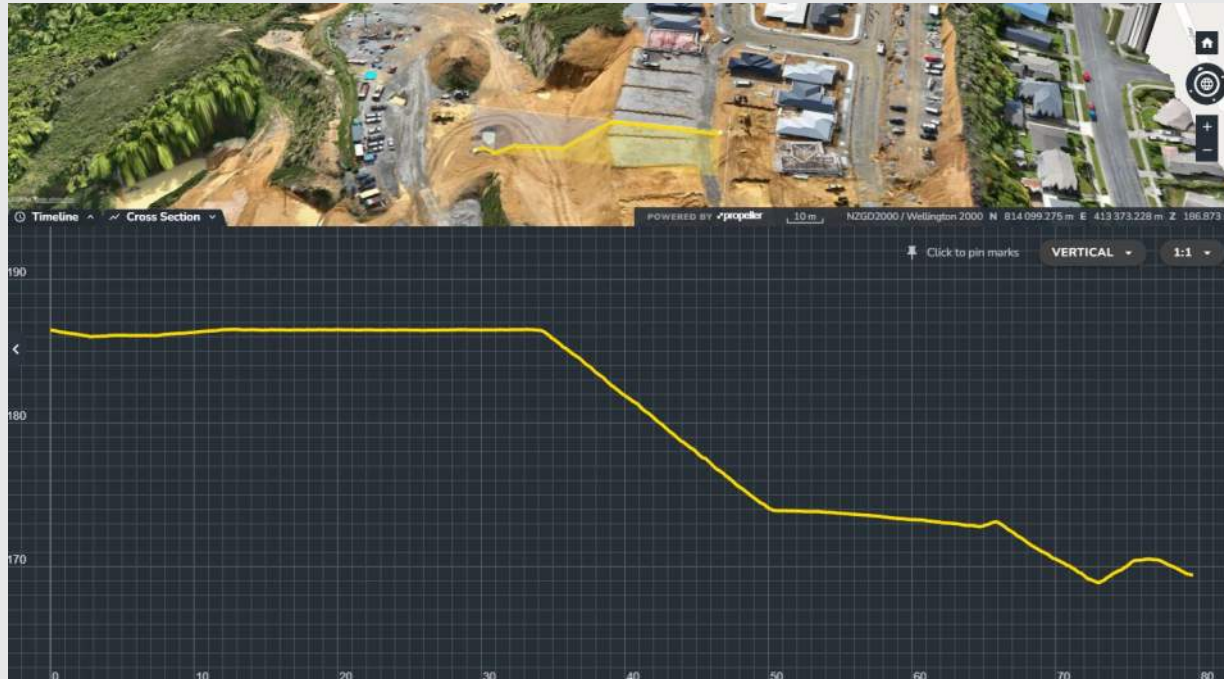
EW02 - similar to prior weeks.

The slope to the south of the the earth wall has been graded. The graded angle is approximately 45 deg. Majority of the slope is in-situ rock, however towards the top of the slope colluvium is present. The current angle is acceptable for rock, however it must be graded back to a shallower angle where colluvium is present. RMS are aware of this and plan to grade it back in the following week. Refer to the Figure on the following page for the existing graded slope angle.



Area of visible colluvium south of EW02.

OBSERVATIONS



Graded angle of slope to the south of EW02 (screenshot from Propeller march survey).

OBSERVATIONS

EW05 - little progress. RMS are still having issues with the dust affecting neighbouring properties. Is difficult to mitigate effects, so have been undertaking limited work in this area.



EW05 - looking south.



EW05 - looking west.

OBSERVATIONS

Runoff and drainage controls look appropriate on site. See Figures below.



Erosion shown in drainage channel.



Intermediate pit for silt sedimentation.

ACTIONS REQUIRED

RMS to profile the top of the cut batter south of EW 02 so that consistent with the bulk earthworks specification (Colluvium - 2H:1V)

NEXT INSPECTION

Weekly - next thursday

Site Observation Report



Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 14.03.24
Author:	Olivia Ross	Attention:	Jo Cushen (SHL)
Reviewed By:	Jerry Spinks		
Reference:	SOR14.03.24	Contractor:	RMS Contractors
Subject:	EW 02 and EW 05		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

EW02 had reached target height. RMS were scraping the additional material off the face from the top of the slope. This makes sure all material is well compacted, including the material at the face.

RMS queried whether the slope face needed to be matted and seeded, or just seeded.



EW02 - view from the bottom



EW02 - view from the top

OBSERVATIONS

Figure of EW05 below. Northerly winds have limited progress at this EW, so efforts have been focused more on completing EW02.



EW05

ACTIONS REQUIRED

n/a

NEXT INSPECTION

Weekly - next thursday

Site Observation Report



Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 15.02.24
Author:	Olivia Ross	Attention:	Fred Whitton (RMS) Jo Cushen (SHL) Chris Mason (Client)
Reviewed By:	Jerry Spinks		
Reference:	SOR15.02.24	Contractor:	RMS Contractors
Subject:	EW 02		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

RMS had begun placing fill and geogrids to construct the earth wall, and have completed approximately just under half.

NDM tests have been completed every 600mm. To date, every test has passed. The tests are required every 600mm and the geogrids are placed every 1.00m. This means some tests must be undertaken between the grid placements, in the middle of the fill. To complete this testing, RMS place the 1.0m lift of fill, then excavate a small area back to the test location (i.e. excavate 400mm into the fill) and then undertake the test before backfilling.

Trees and organic material was noticed at the earthwall location. It was noted that this material was being cleared and removed.



Geogrid placement



EW02, approximately half completed



Trees and organics being cleared

OBSERVATIONS

Organics (roots and trees) no longer visible in the fill at EW 05.



EW 05 with organics no longer visible.

ACTIONS REQUIRED

RMS to organise time for Torlesse to observe NDM testing onsite.

NEXT INSPECTION

Weekly - next thursday

Site Observation Report

TorlesseTM

Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 21.03.24
Author:	Jerry Spinks	Attention:	Fred Whitton (RMS) Jo Cushen (SHL) Chris Mason (Client)
Reviewed By:	Nathan Schumacher		
Reference:	SOR21.03.24	Contractor:	RMS Contractors
Subject:	EW 02 and 05		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

EW05 - Looking south, with drainage blanket draped between the RE fill on the right and the much higher engineered fill on the left.



EW05 - Looking along the north facing batter, the BioCoir Coconut Matting has been placed across all slopes to EW 05



OBSERVATIONS

EW05 - Sediment detention pond to the west of the wall toe, appears well maintained, with flocculant ready to be discharged if needed



Sediment detention pond, near the north-western boundary of the site. Again, appeared well maintained.



OBSERVATIONS

EW05 - Sediment retention basin adjacent to the property boundary



OBSERVATIONS

Stage 2 - continuing the excavation for engineered fill for placement at EW 05



Stage 2 - temporary fill stockpile



OBSERVATIONS

EW02- Looking south, crest of the finished wall. Water cart spraying in the background to suppress dust.



EW02- Looking north, showing the tie in of the crest of the wall and the spur of the hill. Lot 64 can be seen in the background



OBSERVATIONS

Discussions with the contractor (RMS):

- EW02, contractor to supply photos of the 20/20 grid 1.5m wide at 0.3m intervals along the face of the wall
- Permanent treatment of the facing to EW02 not confirmed. Contractor recommended hydroseed with a polymer binder, and the mulch as per the landscape design drawings/spec. To be discuss with SHL and the client
- Contractor requested un updated design for EW 04 extension. Jerry to follow up with SHL to confirm design.

ACTIONS REQUIRED

EW02, contractor to supply photos of the 20/20 grid 1.5m wide at 0.3m intervals along the face of the wall

NEXT INSPECTION

Weekly - next thursday

Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 22.02.24
Author:	Jerry Spinks	Attention:	Fred Whitton (RMS) Jo Cushen (SHL) Chris Mason (Client)
Reviewed By:	Nathan Schumacher		
Reference:	SOR22.02.24	Contractor:	RMS Contractors
Subject:	EW 02 and 05		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

EW02 - Elevation view of the all looking east



EW02 - Looking south-east, showing the tie in of the shoulder of the MSE wall into the existing ground level.



OBSERVATIONS

EW02 - Perimeter strip drains, connecting to the central subsoil drain



EW02 - Central subsoil drain, collecting groundwater from the ephemeral local stream



OBSERVATIONS

EW05 - Sediment retention basin adjacent to the property boundary



OBSERVATIONS

EW05 - Subsoil drain extending below the engineered fill.



EW05 - Top soil placed along the southern slopes, in prep for placement of the bio-cor matting



OBSERVATIONS

EW05 - Operator had dumped and spread a lift of highly organic soils, with various tree stumps etc. Torlesse instructed to remove entirely, and replace with material compliant with the Specification



OBSERVATIONS

EW05 - RMS removed the lift of organic material, that same day and took photo and forwarded to Torlesse. Refer below.



ACTIONS REQUIRED

None

NEXT INSPECTION

Weekly - next thursday

Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 28.03.24
Author:	Olivia Ross	Attention:	Fred Whitton (RMS) Jo Cushen (SHL) Chris Mason (Client)
Reviewed By:	Jerry Spinks		
Reference:	SOR28.03.24	Contractor:	RMS Contractors
Subject:	EW 02		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

Placement of geogrids is complete at EW02. There is a minor, shallow slip at the top of the retaining wall. RMS have graded the slope at the northern extent of the retaining wall.



EW02 - minor slip visible at the top.



Grading of the slope at the northern extent of EW02.

OBSERVATIONS

EW05 - limited progress:



ACTIONS REQUIRED

n/a

NEXT INSPECTION

Weekly - next thursday

Site Observation Report



Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Thursday 29.02.24
Author:	Olivia Ross	Attention:	Fred Whitton (RMS) Jo Cushen (SHL) Chris Mason (Client)
Reviewed By:	Jerry Spinks		
Reference:	SOR29.02.24	Contractor:	RMS Contractors
Subject:	EW 02		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

EW02 was approximately 4m below target height and is expected to be completed by the end of next week.

RMS had begun accessing the wall from the top of the slope rather than the bottom. The bench which was constructed at the base of the slope for access was being removed and the soil was being transported to EW05.

The slope of the northern boundary of the wall had been graded down towards the wall.



Extending subsoil drains.



Graded slope.



EW02.

OBSERVATIONS

Progress at EW05 shown in photo below. Coconut matting had been placed along the southern edge for dust minimisation.



EW 05.

ACTIONS REQUIRED

RMS to organise time for Torlesse to observe NDM testing onsite.

NEXT INSPECTION

Weekly - next thursday

Project Name:	Kelson Heights Development		
Project No:	T0093	Date of Inspection:	Wednesday 31.01.24
Author:	Olivia Ross / Jerry Spinks	Attention:	
Reviewed By:	Jerry Spinks		
Reference:	SOR31.01.24	Contractor:	RMS Contractors
Subject:	EW 02 and EW 05		
Purpose of Visit:	Weekly Inspection		

OBSERVATIONS

The earthwall cut had been backfilled to the base of toe (target height), and the next step is to excavate 2m for the toe of the earthwall.

Construction of both drainage and benching was discussed with the contractor.

Drainage: agreed to use novacoils, drape over benches and at base (in horseshoe shape), direct to the drain at the ephemeral stream.

Benching: construct benches at 1m height intervals, the horizontal bench distance is up to the contractor (i.e. whatever distance is practicable).



Drain for ephemeral stream.



Excavation backfilled to target height. Saturated areas from ephemeral stream visible.

Construction of EW05 observed. Organic material noticed in the recent lifts of the engineered material. Contractors advised to ensure there is no organics in the remaining engineered material.

OBSERVATIONS

A thin but widespread layer of organic fill, including roots, identified in the engineered fill to EW05. It appears this material was sourced from the landscape fill stockpile, and inadvertently placed by the RMS as engineered fill. RMS to remove and replace with suitable material.



Roots within fill



Blading out the structural fill to EW 05



Sediment detention pond at base of EW 05

ACTIONS REQUIRED

Produce NTC to describe agreed drainage design and methodology.

RMS to send through earthworks testing certificates for Nov/Dec 2023 and Jan 2024, all outstanding.

NEXT INSPECTION

Weekly - next thursday

APPENDIX C – COMPACTION TEST RESULTS

Contract	Earthwall	Sample Number	Test Date	Elevation (m RL)	Field MC (%)	OMC (%)	Field DD (t/m3)	MDD (t/m3)	Rel Compaction (%)
SHL	2	1232/S/113139	31/01/2024	171.00	10.4	15.5	1.88	1.80	105
SHL	2	1232/S/113140	31/01/2024	171.00	15.2	18.0	1.75	1.70	103
SHL	2	1232/S/113141	31/01/2024	171.00	12.1	15.5	1.83	1.80	102
SHL	2	1232/S/113244	9/02/2024	173.40	16.8	18.0	1.78	1.70	105
SHL	2	1232/S/113245	9/02/2024	173.40	16.8	18.0	1.71	1.70	100
SHL	2	1232/S/113242	9/02/2024	173.10	15.1	18.0	1.75	1.70	103
SHL	2	1232/S/113243	9/02/2024	173.10	16.9	18.0	1.70	1.70	100
SHL	2	1232/S/113240	9/02/2024	172.80	18.8	18.0	1.71	1.70	100
SHL	2	1232/S/113241	9/02/2024	172.80	17.5	18.0	1.70	1.70	100
SHL	2	1232/S/113235	9/02/2024	161.90	18.4	18.0	1.71	1.70	100
SHL	2	1232/S/113236	9/02/2024	161.90	18.4	18.0	1.70	1.70	100
SHL	2	1232/S/113237	9/02/2024	161.90	18.4	18.0	1.70	1.70	100
SHL	2	1232/S/113238	9/02/2024	161.90	18.4	18.0	1.71	1.70	101
SHL	2	1232/S/113239	9/02/2024	161.90	18.1	18.0	1.71	1.70	100
SHL	2	1232/S/113230	9/02/2024	161.60	19.7	18.0	1.70	1.70	100
SHL	2	1232/S/113231	9/02/2024	161.60	19.1	18.0	1.72	1.70	102
SHL	2	1232/S/113232	9/02/2024	161.60	18.4	18.0	1.71	1.70	101
SHL	2	1232/S/113233	9/02/2024	161.60	18.4	18.0	1.76	1.70	104
SHL	2	1232/S/113234	9/02/2024	161.60	18.1	18.0	1.74	1.70	103
SHL	2	1232/S/113225	9/02/2024	161.30	16.2	18.0	1.68	1.70	98
SHL	2	1232/S/113226	9/02/2024	161.30	16.1	18.0	1.71	1.70	101
SHL	2	1232/S/113227	9/02/2024	161.30	15.6	18.0	1.71	1.70	100
SHL	2	1232/S/113228	9/02/2024	161.30	15.7	18.0	1.71	1.70	101
SHL	2	1232/S/113229	9/02/2024	161.30	16.4	18.0	1.69	1.70	100
SHL	2	1232/S/113203	9/02/2024	171.50	10.8	15.5	1.87	1.70	104
SHL	2	1232/S/113204	9/02/2024	171.50	10.9	15.5	1.82	1.70	102
SHL	2	1232/S/113205	9/02/2024	171.50	10.9	15.5	1.85	1.70	103
SHL	2	1232/S/113209	9/02/2024	172.00	12.2	15.5	1.82	1.80	102
SHL	2	1232/S/113210	9/02/2024	172.00	12.1	15.5	1.87	1.80	104
SHL	2	1232/S/113211	9/02/2024	172.00	12.5	15.5	1.88	1.80	105
SHL	2	1232/S/113085	9/02/2024	169.18	8.5	15.5	1.86	1.80	103
SHL	2	1232/S/113086	9/02/2024	169.29	10.6	15.5	1.82	1.80	101
SHL	2	1232/S/1132313	9/02/2024	172.50	13.3	18.0	1.74	1.70	102
SHL	2	1232/S/1132314	9/02/2024	172.50	13.3	18.0	1.82	1.70	107
SHL	2	1232/S/1132315	9/02/2024	172.50	13.5	18.0	1.81	1.70	106
SHL	2	1232/S/113264	12/02/2024	174.90	16.3	18.0	1.78	1.70	105
SHL	2	1232/S/113265	12/02/2024	174.90	16.1	18.0	1.77	1.70	104
SHL	2	1232/S/113266	12/02/2024	175.40	16.7	18.0	1.72	1.70	101
SHL	2	1232/S/113267	12/02/2024	175.40	16.3	18.0	1.72	1.70	101
SHL	2	1232/S/113262	12/02/2024	174.40	16.8	18.0	1.70	1.70	100
SHL	2	1232/S/113263	12/02/2024	174.40	16.6	18.0	1.71	1.70	101
SHL	2	1232/S/113260	12/02/2024	173.90	15.7	18.0	1.77	1.70	104
SHL	2	1232/S/113261	12/02/2024	173.90	16.2	18.0	1.76	1.70	104
SHL	2	1232/S/113330	14/02/2024	176.50	18.4	18.0	1.70	1.70	100
SHL	2	1232/S/113331	14/02/2024	176.50	18.4	18.0	1.75	1.70	103
SHL	2	1232/S/113328	14/02/2024	176.00	18.4	18.0	1.70	1.70	100
SHL	2	1232/S/113329	14/02/2024	176.00	18.4	18.0	1.70	1.70	100
SHL	2	1232/S/113332	14/02/2024	177.00	18.1	18.0	1.74	1.70	102
SHL	2	1232/S/113333	14/02/2024	177.00	18.8	18.0	1.73	1.70	102
SHL	2	1232/S/113334	14/02/2024	177.50	17.4	18.0	1.70	1.70	100
SHL	2	1232/S/113335	14/02/2024	177.50	15.1	18.0	1.76	1.70	103
SHL	2	1232/S/113405	19/02/2024	179.00	13.4	18.0	1.78	1.70	105
SHL	2	1232/S/113406	19/02/2024	179.00	13.4	18.0	1.78	1.70	105
SHL	2	1232/S/113403	16/02/2024	178.50	13.1	18.0	1.78	1.70	105
SHL	2	1232/S/113404	16/02/2024	178.50	13.1	18.0	1.78	1.70	105
SHL	2	1232/S/113401	16/02/2024	178.00	13.4	18.0	1.76	1.70	104
SHL	2	1232/S/113402	16/02/2024	178.00	13.4	18.0	1.78	1.70	105
SHL	2	1232/S/113407	19/02/2024	179.50	13.3	18.0	1.76	1.70	104
SHL	2	1232/S/113408	19/02/2024	179.50	13.3	18.0	1.77	1.70	104
SHL	2	1232/S/113499	22/02/2024	180.00	16.6	18.0	1.73	1.70	102
SHL	2	1232/S/113500	22/02/2024	180.00	16.5	18.0	1.70	1.70	100
SHL	2	1232/S/113501	22/02/2024	180.50	14.8	18.0	1.79	1.70	105
SHL	2	1232/S/113502	22/02/2024	180.50	14.0	18.0	1.71	1.70	101
SHL	2	1232/S/113609	27/02/2024	181.00	14.4	18.0	1.74	1.70	102
SHL	2	1232/S/113610	27/02/2024	181.00	14.4	18.0	1.70	1.70	100
SHL	2	1232/S/113611	27/02/2024	181.50	13.9	18.0	1.72	1.70	101
SHL	2	1232/S/113612	27/02/2024	181.50	13.9	18.0	1.70	1.70	100
SHL	2	1232/S/113613	27/02/2024	182.00	15.5	18.0	1.73	1.70	102
SHL	2	1232/S/113614	27/02/2024	182.00	15.5	18.0	1.73	1.70	102
SHL	2	1232/S/113615	27/02/2024	182.50	12.3	18.0	1.70	1.70	99
SHL	2	1232/S/113616	27/02/2024	182.50	12.3	18.0	1.70	1.70	99

SHL	2	1232/S/113677	4/03/2024	183.00	14.9	18.0	1.75	1.70	103
SHL	2	1232/S/113678	4/03/2024	183.00	14.9	18.0	1.76	1.70	104
SHL	2	1232/S/113679	4/03/2024	183.50	13.1	18.0	1.77	1.70	104
SHL	2	1232/S/113680	4/03/2024	183.50	13.1	18.0	1.78	1.70	105
SHL	2	1232/S/113681	4/03/2024	184.00	12.5	18.0	1.82	1.70	107
SHL	2	1232/S/113682	4/03/2024	184.00	12.5	18.0	1.83	1.70	108
SHL	2	1232/S/113683	4/03/2024	184.50	12.0	18.0	1.82	1.70	107
SHL	2	1232/S/113684	4/03/2024	184.50	12.0	18.0	1.80	1.70	106
SHL	2	1232/S/113719	7/03/2024	185.00	12.7	18.0	1.78	1.70	104
SHL	2	1232/S/113720	7/03/2024	185.00	12.7	18.0	1.72	1.70	101
SHL	2	1232/S/113721	7/03/2024	185.50	13.3	18.0	1.67	1.70	98
SHL	2	1232/S/113722	7/03/2024	185.50	13.4	18.0	1.69	1.70	99
SHL	2	1232/S/113723	7/03/2024	186.00	13.3	18.0	1.70	1.70	104
SHL	2	1232/S/113724	7/03/2024	186.00	13.5	18.0	1.70	1.70	101
SHL	2	1232/S/113725	7/03/2024	186.50	14.1	18.0	1.70	1.70	104
SHL	2	1232/S/113726	7/03/2024	186.50	14.0	18.0	1.70	1.70	103
SHL	2	1232/S/113920	18/03/2024	187.00	12.8	18.0	1.78	1.70	105
SHL	2	1232/S/113921	18/03/2024	187.00	8.1	18.0	1.92	1.70	113
SHL	2	1232/S/113924	18/03/2024	188.00	13.3	18.0	1.81	1.70	107
SHL	2	1232/S/113925	18/03/2024	188.00	14.0	18.0	1.70	1.70	100
SHL	2	1232/S/113922	18/03/2024	187.40	12.4	18.0	1.77	1.70	104
SHL	2	1232/S/113923	18/03/2024	187.40	11.5	18.0	1.88	1.70	111

APPENDIX D – SCHEDULE 2A CERTIFICATE

SCHEDULE 2A

STATEMENT OF PROFESSIONAL OPINION ON SUITABILITY OF LAND FOR BUILDING CONSTRUCTION

Development Kelson Heights Development
Developer Genesis Residential (Kelson) Ltd
Location Waipounamu Drive, Kelson, Lower Hutt Torlesse Ltd (Custom House, Ground Floor South, 88 Waterloo Quay, Pipitea, Wellington)
I Jeremy Spinks of
(Full name) (Name and address of firm)

Hereby confirm that:

1. I am a geo-professional as defined in clause 1.2.2 of NZS 4404:2010 and was retained by the developer as the geo-professional on the above development. (not relevant)
2. The extent of my preliminary investigations are described in my Report(s) number, dated (not relevant), and the conclusions and recommendations of that/those document(s) have been re-evaluated in the preparation of this report. The extent of my inspections during construction, and the results of all tests and/or re-evaluations carried out are as described in my geotechnical completion report dated 14 March 2023
3. In my professional opinion, not to be construed as a guarantee, I consider that (delete as appropriate):
S19-0774-2B-D0
(a) The earth fills shown on the attached Plan No..... have been placed in compliance with the requirements of the Hutt City Council and my specification.
(b) The completed works take into account land slope and foundation stability considerations, subject to the appended foundation recommendations and earthworks restrictions, (which should be read in conjunction with the appended final site contour plan).
(c) Subject to 3(a) and 3(b) of this Schedule, the original ground not affected by filling is suitable for the erection of buildings designed according to NZS 3604 provided that:
(i)..... Each individual Lot is inspected and tested by an appropriately qualified geotechnical engineer
(ii).....
(d) Subject to 3(a) and 3(b) of this Schedule, the filled ground is suitable for the erection of buildings designed according to NZS 3604 provided that:
(i)..... Each individual Lot is inspected and tested by an appropriately qualified geotechnical engineer
(ii).....
(e) The original ground not affected by filling and the filled ground are not subject to erosion, falling debris (including soil, rock, snow and ice), subsidence (including liquefaction induced subsidence), inundation (including flooding, overland flow, storm surge, tidal effects and ponding) or slippage in accordance with the provisions of section 106 of the Resource Management Act 1991 provided that:
(i)
(ii).....

NOTE – These subclauses may be deleted or added to as appropriate, to include such considerations as expansive soils where excluded from NZS 3604, and site seismic characteristics as covered in clause 3.1.3 of NZS 1170.5.

QLDC LDSC 2020

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4. This professional opinion is furnished to the TA and the developer for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.
5. This certificate shall be read in conjunction with my geotechnical report referred to in clause 2 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

Signed..........

Date.....23 May 2024.....

(Name, title, and professional qualifications)

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