Te Kaunihera o Te Hiku o te Ika
Far North District Council

Office Use Only
Application Number:

Application for resource consent or fast-track resource consent

(Or Associated Consent Pursuant to the Resource Management Act 1991 (RMA)) (If applying for a Resource Consent pursuant to Section 87AAC or 88 of the RMA, this form can be used to satisfy the requirements of Form 9). Prior to, and during, completion of this application form, please refer to Resource Consent Guidance Notes and Schedule of Fees and Charges — both available on the Council's web page.

1. Pre-Lodgement Meeting

Have you met with a council Resource Covnsent representative to discuss this application prior to lodgement?

◯ **Yes** ✔ **No**

2. Type of consent being applied for

(more than one circle can be ticked):

✔ **Land Use**
◯ **Fast Track Land Use***
◯ **Subdivision**
◯ **Consent under National Environmental Standard**
(e.g. Assessing and Managing Contaminants in Soil)
◯ **Discharge**
◯ **Change of Consent Notice (s.221(3))**
◯ **Extension of time (s.125)**
◯ **Other (please specify)** _____

**The fast track is for simple land use consents and is restricted to consents with a controlled activity status.*

3. Would you like to opt out of the fast track process?

◯ **Yes** ✔ **No**

4. Consultation

Have you consulted with Iwi/Hapū? ◯ **Yes** ✔ **No**

If yes, which groups have you consulted with?

Who else have you consulted with?

*For any questions or information regarding iwi/hapū consultation, please contact Te Hono at Far North District Council, **tehonosupport@fndc.govt.nz***

5. Applicant details

Name/s: Quail Ridge Country Club c/o Pete Lawrence

Email: [redacted]

Phone number: Work [redacted] Home

Postal address:
(or alternative method of service under section 352 of the act)

82 Rainbow Falls Road, Kerikeri

Postcode 247

Have you been the subject of abatement notices, enforcement orders, infringement notices and/or convictions under the Resource Management Act 1991? ◯ **Yes** ✔ **No**

If yes, please provide details.

6. Address for correspondence

Name and address for service and correspondence (if using an Agent write their details here)

Name/s: Steven Sanson - Bay of Islands Planning

Email: [redacted]

Phone number: Work [redacted] Home

Postal address:
(or alternative method of service under section 352 of the act)

PO Box 318, Paihia

0247

Postcode 247

All correspondence will be sent by email in the first instance. Please advise us if you would prefer an alternative means of communication.

7. Details of property owner/s and occupier/s

Name and Address of the owner/occupiers of the land to which this application relates (where there are multiple owners or occupiers please list on a separate sheet if required)

Name/s: Refer to Record of Titles attached

Property address/
location:

Postcode

8. Application site details

Location and/or property street address of the proposed activity:

Name/s: Quail Ridge Country Club LImited

Site address/ location: 82 Rainbow Falls Road, Kerikeri
0230
Postcode

Legal description: Lot 1 DP 311575 **Val Number:**

Certificate of title: 45724

Please remember to attach a copy of your Certificate of Title to the application, along with relevant consent notices and/or easements and encumbrances (search copy must be less than 6 months old)

Site visit requirements:

Is there a locked gate or security system restricting access by Council staff? ◯ **Yes** ✔ **No**

Is there a dog on the property? ◯ **Yes** ✔ **No**

Please provide details of any other entry restrictions that Council staff should be aware of, e.g. health and safety, caretaker's details. This is important to avoid a wasted trip and having to re-arrange a second visit.

Please call applicant or agent prior to undertaking site visit

9. Description of the proposal

Please enter a brief description of the proposal here. Please refer to Chapter 4 of the *District Plan, and Guidance Notes*, for further details of information requirements.

New clubhouse, carehouse, dementia unit and villlas.

If this is an application for a Change or Cancellation of Consent Notice conditions (s.221(3)), please quote relevant existing Resource Consents and Consent Notice identifiers and provide details of the change(s), with reasons for requesting them.

10. Would you like to request public notification?

◯ **Yes** ✔ **No**

11. Other consent required/being applied for under different legislation

(more than one circle can be ticked):

◯ **Building Consent** Enter BC ref # here (if known)

◯ **Regional Council Consent (ref # if known)** Ref # here (if known)

◯ **National Environmental Standard Consent** Consent here (if known)

◯ **Other (please specify)** Specify 'other' here

12. National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health:

The site and proposal may be subject to the above NES. In order to determine whether regard needs to be had to the NES please answer the following:

Is the piece of land currently being used or has it historically ever been used for an activity or industry on the Hazardous Industries and Activities List (HAIL)? ☑ **Yes** ○ **No** ○ **Don't know**

Is the proposed activity an activity covered by the NES? Please tick if any of the following apply to your proposal, as the NESCS may apply as a result? ○ **Yes** ☑ **No** ○ **Don't know**

○ **Subdividing land**
○ **Changing the use of a piece of land**
○ **Disturbing, removing or sampling soil**
○ **Removing or replacing a fuel storage system**

13. Assessment of environmental effects:

Every application for resource consent must be accompanied by an Assessment of Environmental Effects (AEE). This is a requirement of Schedule 4 of the Resource Management Act 1991 and an application can be rejected if an adequate AEE is not provided. The information in an AEE must be specified in sufficient detail to satisfy the purpose for which it is required. Your AEE may include additional information such as written approvals from adjoining property owners, or affected parties.

Your AEE is attached to this application ☑ **Yes**

14. Draft conditions:

Do you wish to see the draft conditions prior to the release of the resource consent decision? ☑ **Yes** ○ **No**

If yes, please be advised that the timeframe will be suspended for 5 working days as per s107G of the RMA to enable consideration for the draft conditions.

15. Billing Details:

This identifies the person or entity that will be responsible for paying any invoices or receiving any refunds associated with processing this resource consent. Please also refer to Council's Fees and Charges Schedule.

Name/s: (please write in full) refer billing details attached

Email: [redacted]

Phone number: Work [redacted] Home

Postal address:
(or alternative method of service under section 352 of the act)

82 Rainbow Falls Road, Kerikeri
Bay of Islands

Postcode 0230

Fees Information
An instalment fee for processing this application is payable at the time of lodgement and must accompany your application in order for it to be lodged. Please note that if the instalment fee is insufficient to cover the actual and reasonable costs of work undertaken to process the application you will be required to pay any additional costs. Invoiced amounts are payable by the 20th of the month following invoice date. You may also be required to make additional payments if your application requires notification.

15. Billing details continued...

Declaration concerning Payment of Fees

I/we understand that the Council may charge me/us for all costs actually and reasonably incurred in processing this application. Subject to my/our rights under Sections 357B and 358 of the RMA, to object to any costs, I/we undertake to pay all and future processing costs incurred by the Council. Without limiting the Far North District Council's legal rights if any steps (including the use of debt collection agencies) are necessary to recover unpaid processing costs I/we agree to pay all costs of recovering those processing costs. If this application is made on behalf of a trust (private or family), a society (incorporated or unincorporated) or a company in signing this application I/we are binding the trust, society or company to pay all the above costs and guaranteeing to pay all the above costs in my/our personal capacity.

Name: (please write in full) Peter Lawrence - for and on behalf of Quail Ridge Country Club (Project Manager)

Signature: (signature of bill payer) [redacted] Date 11-Nov-2025

MANDATORY

16. Important Information:

Note to applicant

You must include all information required by this form. The information must be specified in sufficient detail to satisfy the purpose for which it is required.

You may apply for 2 or more resource consents that are needed for the same activity on the same form.

You must pay the charge payable to the consent authority for the resource consent application under the Resource Management Act 1991.

Fast-track application

Under the fast-track resource consent process, notice of the decision must be given within 10 working days after the date the application was first lodged with the authority, unless the applicant opts out of that process at the time of lodgement.

A fast-track application may cease to be a fast-track application under section 87AAC(2) of the RMA.

Privacy Information:

Once this application is lodged with the Council it becomes public information. Please advise Council if there is sensitive information in the proposal. The information you have provided on this form is required so that your application for consent pursuant to the Resource Management Act 1991 can be processed under that Act. The information will be stored on a public register and held by the Far North District Council. The details of your application may also be made available to the public on the Council's website, www.fndc.govt.nz. These details are collected to inform the general public and community groups about all consents which have been issued through the Far North District Council.

17. Declaration

The information I have supplied with this application is true and complete to the best of my knowledge.

Name (please write in full) steven sanson

Signature [redacted] Date 13-Nov-2025

A signature is not required if the application is made by electronic means

See overleaf for a checklist of your information...

15. Billing details continued...

Declaration concerning Payment of Fees

I/we understand that the Council may charge me/us for all costs actually and reasonably incurred in processing this application. Subject to my/our rights under Sections 357B and 358 of the RMA, to object to any costs, I/we undertake to pay all and future processing costs incurred by the Council. Without limiting the Far North District Council's legal rights if any steps (including the use of debt collection agencies) are necessary to recover unpaid processing costs I/we agree to pay all costs of recovering those processing costs. If this application is made on behalf of a trust (private or family), a society (incorporated or unincorporated) or a company in signing this application I/we are binding the trust, society or company to pay all the above costs and guaranteeing to pay all the above costs in my/our personal capacity.

Name: (please write in full) Peter Lawrence - for and on behalf of Quail Ridge Country Club (Project Manager)

Signature:
(signature of bill payer)

Date 11-Nov-2025

MANDATORY

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The information I have supplied with this application is true and complete to the best of my knowledge.

Name (please write in full)

Signature

Date

A signature is not required if the application is made by electronic means

See overleaf for a checklist of your information...

Checklist

Please tick if information is provided

- ◯ Payment (cheques payable to Far North District Council)
- ◯ A current Certificate of Title (Search Copy not more than 6 months old)
- ◯ Details of your consultation with Iwi and hapū
- ◯ Copies of any listed encumbrances, easements and/or consent notices relevant to the application
- ◯ Applicant / Agent / Property Owner / Bill Payer details provided
- ◯ Location of property and description of proposal
- ◯ Assessment of Environmental Effects
- ◯ Written Approvals / correspondence from consulted parties
- ◯ Reports from technical experts (if required)
- ◯ Copies of other relevant consents associated with this application
- ◯ Location and Site plans (land use) AND/OR
- ◯ Location and Scheme Plan (subdivision)
- ◯ Elevations / Floor plans
- ◯ Topographical / contour plans

Please refer to Chapter 4 of the District Plan for details of the information that must be provided with an application. Please also refer to the RC Checklist available on the Council's website. This contains more helpful hints as to what information needs to be shown on plans.

BAY OF ISLANDS PLANNING (2022) LIMITED

Kerikeri House
Suite 3, 88 Kerikeri Road
Kerikeri
Email – office@bayplan.co.nz Website - www.bayplan.co.nz

14 November 2025

Dear Team Leaders

Re: Quail Ridge Country Club Development

Our client, Quail Ridge Country Club Limited [**QRCC**], seeks resource consent for the for the next phase of its development at 82 Rainbow Falls Road, Kerikeri. This application specifically covers the construction of:

- 23 x Campervan Parks.
- Sports Pavillion.
- A Club House and Care House with 22 Car Parks.
- 4 x Villas in Zone A [Mission 02, Stonebrook A 02 x 2, Stonebrook A01]. With one being a Dementia Care House.
- 4 x Villas in Zone B [Grange, Point A, Parisian 02, Stonebrook 01]
- 4 x Villas in Zone C [Stonebrook A 03 x 2, Stonebrook B, Glade]
- 6 x Villas in Zone D [Mission Roberts x 2, Parisian 02 x 3, Mission 01]

The 16.9 hectare site is located within the Quail Ridge Country Club zone within the operative Far North District Plan [**ODP**].

The site is zoned Quail Ridge zone under the Proposed Far North District Plan [**PDP**].

A **Discretionary Activity** consent is required under the ODP.

The application is supported by the following information:

- **Planning Report and Assessment of Environmental Effects**
- **Appendix A – Records of Title & Instruments;**
- **Appendix B – Development Plans [Foley Group];**
- **Appendix C – Approved Discharge Consent [NRC]**
- **Appendix D – Approved DSI Report [Hawthorn Geddes]**
- **Appendix E – Site Suitability Report [Hawthorn Geddes]**

Please do not hesitate to contact me should you require any further information.

Steve Sanson
Consultant Planner

APPLICANT & PROPERTY DETAILS

Applicant	Quail Ridge Country Club LImited
Address for Service	Bay of Islands Planning [2022] Limited PO Box 318 PAIHIA 0247 C/O – Steve Sanson steve@bayplan.co.nz 021-1606035
Legal Description	Lot 4 DP 78387 & Lot 1 DP 311575
Certificate Of Title	NA54A/357 & 45724
Physical Address	82 Rainbow Falls Road, Kerikeri
Site Area	16.9ha
Owner of the Site	Quail Ridge Country Club Limited
Operative District Plan [ODP]	Quail Ridge Country Club Zone
Proposed District Plan [PDP]	Quail Ridge Special Purpose Zone
Archaeology	Nil
NRC Overlays	Nil
Soils	2c1 , 4e8
Protected Natural Area	Nil
HAIL	Consented under previous approvals

Schedule 1

SUMMARY OF PROPOSAL

Proposal	Construction of a new Clubhouse, an attached Care House, and 18 new retirement units, one being a Dementia Care House at 82 Rainbow Falls Road, Kerikeri.
Reason for Application	The proposal is considered to breach the following rules: • Rule 18.9.6.2.2 Buildings and/or Activities • Rule 18.9.6.2.4 Setback from Boundaries • Rule 18.9.6.2.7 Impermeable Surfaces • Rule 18.9.6.2.10 On Site Access, Parking & Loading • Rule 12.4.6.1.2 Fire Risk to Residential Units Overall, the proposal is a **Discretionary Activity**
Appendices	Appendix A – Record of Title; Appendix B – Development Plans Appendix C – Approved Discharge Consent NRC Appendix D – Approved DSI Report Appendix E – Site Suitability Report Appendix F – Landscape Plan
Consultation	Not applicable.
Pre-Application Consultation	Not applicable.

1.0 INTRODUCTION

This report has been prepared for QRCC supporting the construction of the following activities:

- 23 x Campervan Parks.
- A Sports Pavillion.
- A Club House and Care House with 16 Car Parks.
- 4 x Villas in Zone A [Mission 02, Stonebrook A 02 x 2, Stonebrook A01
- 4 x Villas in Zone B [Grange, Point A, Parisian 02, Stonebrook 01]
- 4 x Villas in Zone C [Stonebrook A 03 x 2, Stonebrook B, Glade]
- 6 x Villas in Zone D [Mission Roberts x 2, Parisian 02 x 3, Mission 01]

A copy of the Records of Title is attached at **Appendix A**.

The application is supported by Development Plans produced by Foley Group, attached at **Appendix B**.

The application is also supported by the following reports which are typically required for a development at the Country Club:

- Appendix C – Approved Discharge Consent NRC.
- Appendix D – Approved DSI Report
- Appendix E – Site Suitability Report
- Appendix F – Landscape Plan
- Appendix G – FENZ Approval

2.0 SITE AND LOCALITY DESCRIPTION

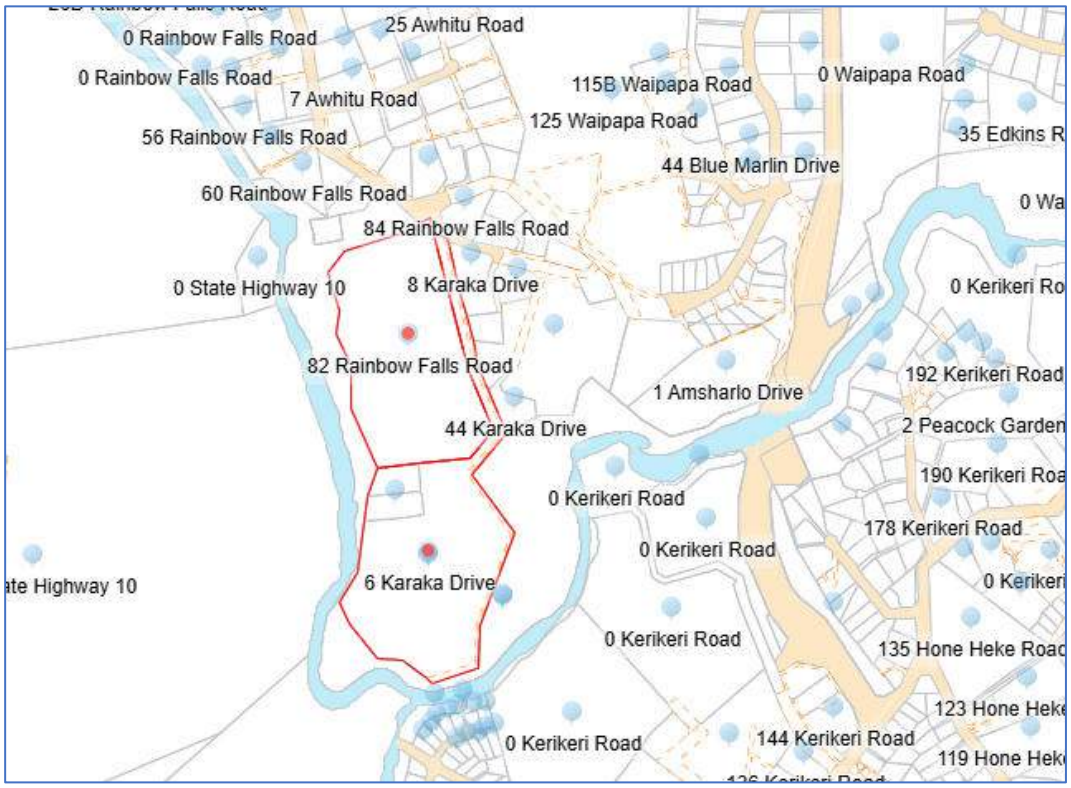


Figure 1: Site [Source: Prover]

Figure 2: Site Aerial [Source: PDP Maps]

The subject site is located at the end of Rainbow Falls Road ~850m form the intersection of Waipapa Road. The Kerikeri urban centre is located south of the Quail Ridge Country Club zone and is less than 100m in distance as a crow flies.

The immediate and surrounding environment is a mix of Rural Production land to the west, Rural Living to the north and east and Residential to the south. Approximately three quarters of the site is surrounded by the Kerikeri River and there is a recreation reserve directly abutting the site in these areas which are managed by the Department of Conservation.

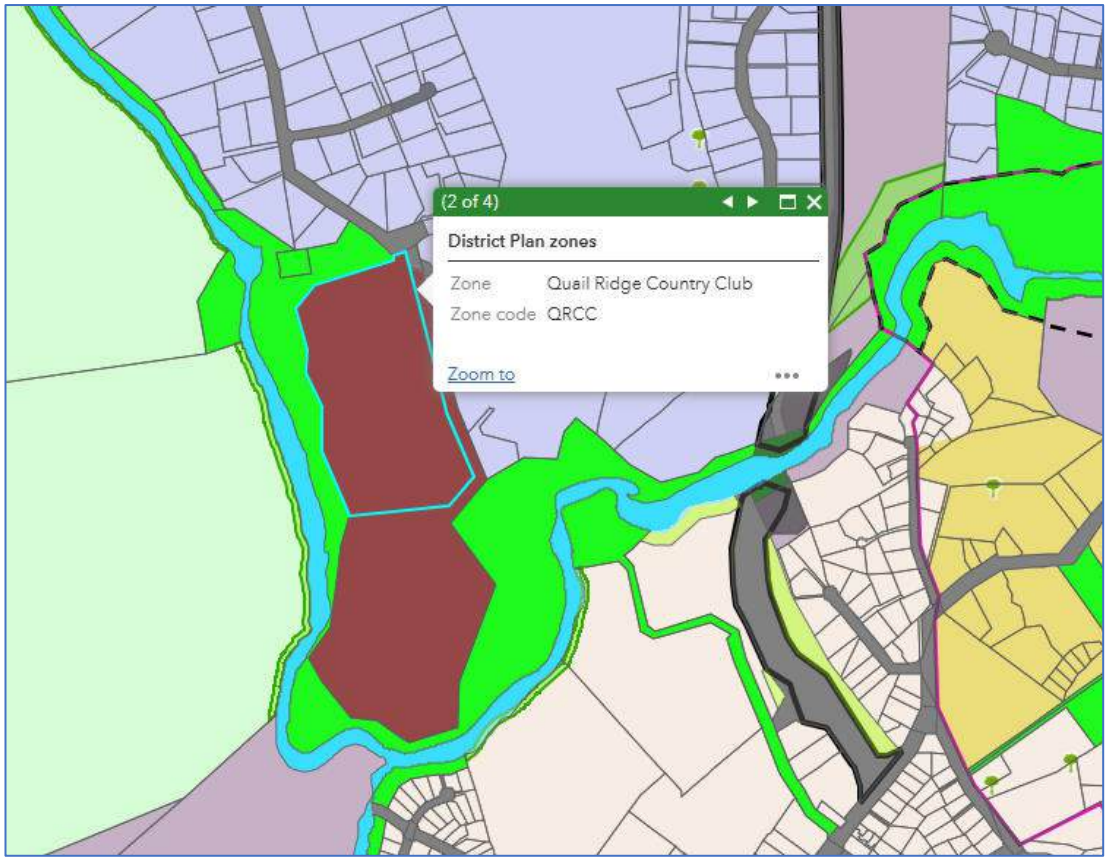


Figure 3: Zoning Map – Quail Ridge Country Club zone [Source: Far North Maps]

Access to the site is via a dedicated entrance to the Country Club off Rainbow Falls Road.

Figure 4: Entrance to the site on the right hand sire off the shared crossing [Source: Google]

Much of the northern portion of the site is flat, and the site falls away to the river on all sides and to the south of the site.

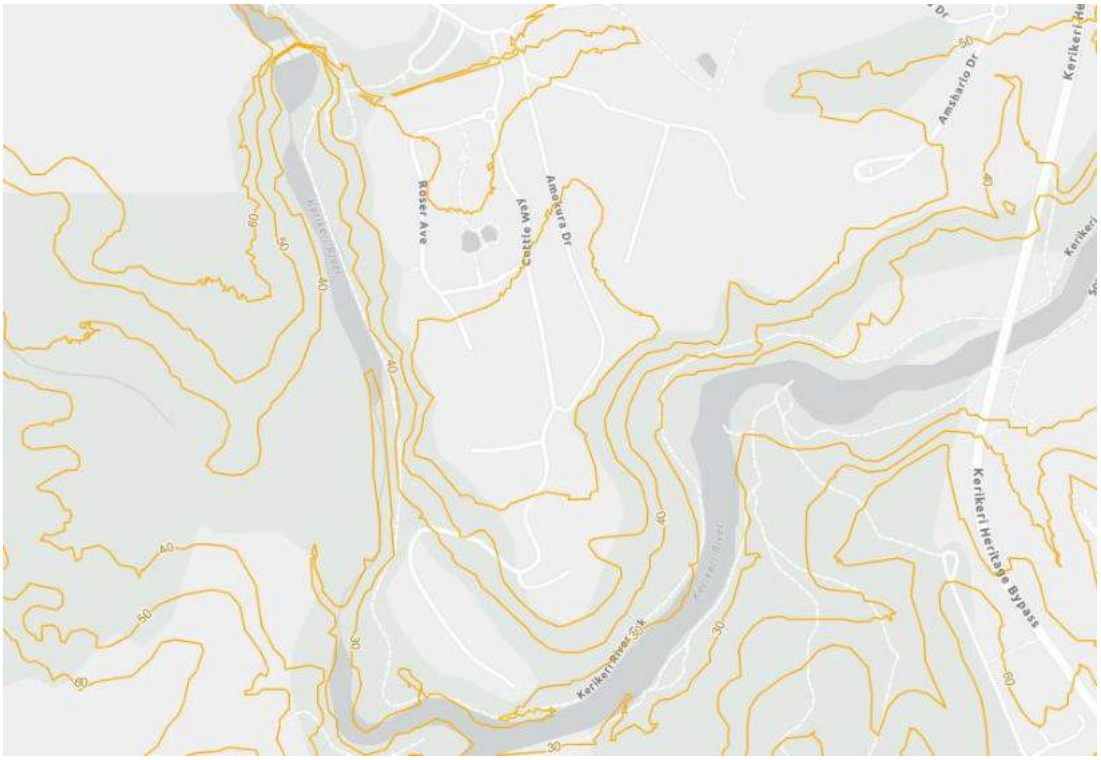


Figure 5: Topography [Source: Far North Maps]

The site has been development in general accordance with the Quail Ridge Master Plan since 2011. The site currently accommodates a total of 126 approved retirement villas.

The existing development is serviced by Council reticulated water supply via a branch line extension that connects to the Council's Waipapa Road water main. Within the development, an internal reticulated water supply network provides a connection to each individual unit.

The development operates an on-site wastewater treatment and disposal system under an approved discharge permit from the Northland Regional Council [**NRC**]. This is located in **Appendix C**.

Stormwater from all roofed and paved areas is managed through an internal reticulated system, also authorised by an NRC consent.

The site is not subject to any known hazards.

The site has previously been identified as a potential HAIL site. A Detailed Site Investigation has previously been conducted before development was undertaken. Reports concluded that the site can be considered remediated, with no further investigation required.

The on-site disposal and capping of contaminated soil was accepted as an appropriate method to address any risk to human health. This report is provided in **Appendix D.**

3.0 RECORD OF TITLE, CONSENT NOTICES AND LAND COVENANTS

The Record of Title is attached at **Appendix A**. There are no consent notices that apply to the site or other items of relevance.

4.0 DESCRIPTION OF THE PROPOSAL

The applicant seeks resource consent for the construction of a new central Clubhouse with an attached Care House, 18 new retirement units, and associated outdoor recreational facilities and site works at the Quail Ridge Country Club. The proposal will be in accordance with the development plans provided in **Appendix B**.

Clubhouse and Care House

The development features a new, large, single-level building that integrates the main community facilities with a dedicated care wing.

- The Clubhouse [968.3 m^2] - The Clubhouse is designed as the primary social hub for the village. Its key features include:
  - A large central dining and function area, a servery, a 34.5 m^2 bar, and a commercial kitchen.
  - Multiple recreational and hobby rooms, such as a 73.9 m^2 Snooker room, a 28.3 m^2 Craft Room, and a Darts room.
  - Lounge and relaxation spaces, including a 23.9 m^2 Library and an 18-seat Media Room.
  - Wellness facilities, including a dedicated Wellness room and a 20.2 m^2 Beauty Room.
  - Administrative spaces, including a reception area, sales office, and a meeting room.
  - An extensive 203.8 m^2 outdoor verandah for resident use.
- The Care House [316.4 m^2] – This is physically attached to the Clubhouse, this wing provides a higher level of care for residents. It includes:
  - Six resident bedrooms, each with a floor area of 18.1 m^2.
  - A centrally located nurse's station.
  - Support facilities, including a linen room, sluice room, and laundry.

New Retirement Units

A total of 18 new retirement villas are proposed in a new residential area to the south of the central Clubhouse building. The layout of the units is arranged in four distinct zones:

- 4 x Villas in Zone A [Mission 02, Stonebrook A 02 x 2, Stonebrook A01]. One of the Stonebrook A 02 units will comprise a Dementia Care House].
- 4 x Villas in Zone B [Grange, Point A, Parisian 02, Stonebrook 01]
- 4 x Villas in Zone C [Stonebrook A 03 x 2, Stonebrook B, Glade]
- 6 x Villas in Zone D [Mission Roberts x 2, Parisian 02 x 3, Mission 01]

The unit types are expected to be a mix of the village's established "modified" designs, such as the Grange, Stonebrook, Parisian, and Artisan models .

The estimated size of each dwelling is up to:

- Grange = 234.30m^2
- Mission 01 = 223.44m^2
- Mission 02 = 223.44m^2
- Parisian = 188.27m^2
- Stonebrook A = 188.60m^2
- Stonebrook B = 216.28m^2
- Point A = 215.47m^2
- Glade = 172.56m^2

Roading
Zone D requires a new road extension from Cottle Way which provides access to these Villas as well as a service area with 3 buildings.

Parking
Each residential unit is to contain 2 x car parks. The Club House and Care House have 16 car parks allocated.

Stormwater, Water Supply and Wastewater
The total site coverage to date and inclusive of the proposal is 46.5%. Based on the Site Suitability Report, the approach is to manage all stormwater from the new development [Zones A-D] using a new reticulated system.

This system is designed to capture the runoff and direct it to granular storage zones [located under the new driveways]. These zones will hold the water, which is then released at a controlled rate through small outlets.

This method ensures that the peak water flow *after* development is attenuated (slowed down) to match the pre-development rates for both 2-year and 10-year storm events, keeping it compliant with the existing site-wide consent.

Water is reticulated to the site via Council supply.

The wastewater system is authorized by NRC discharge and is detailed in the documentation provided in **Appendix C.** The design [approx. 13,210 L/day total] is confirmed to be suitable and will be treated by new Eloy C-90 CB systems before connecting to the existing consented on-site network.

Earthworks & NES-SC
Based on the Cut/Fill Summary tables in the Site Suitability Report [Figures 04-07, pages 54-57], the required earthworks for each zone are as follows:

- Zone A [Clubhouse]: 6,394 m^3 of cut and 5 m^3 of fill, resulting in a net cut of 6,389 m^3.

- Zone B [Villas]: 1,102m^3 of cut and 22m^3 of fill, resulting in a net cut of 1,080m^3.
- Zone C [Villas]: 422m^3 of cut and 63m^3 of fill, resulting in a net cut of 358m^3.
- Zone D [Villas]: 502m^3 of cut and 650m^3 of fill, resulting in a net fill of 148m^3.

Overall, this phase of development will involve a total of 8,420m^3 of cut and 740m^3 of fill, resulting in a total net cut of 7,680m^3 across the project. A consent is required from the Northland Regional Council and FNDC can also submit consent conditions to manage this aspect.

Landscaping
The overall landscape approach is to fully integrate the new Clubhouse, Care House, and 18 villas [Zones A-D] into the existing village, creating a high-amenity, private, and cohesive environment. The design focuses on three key functions:

1. Amenity and Integration at the Central Clubhouse
The landscaping around the new Clubhouse and Care House is designed to create a central, high-amenity hub that connects to new and existing recreational facilities.

- Feature Entrance: A formal, high-impact entrance to the Clubhouse will be established, featuring specimen palms, formal amenity gardens, and Pōhutukawa trees.
- Recreational Hub: The Clubhouse's main terrace, which includes a pergola, is designed to provide seamless access to the new Sports Pavilion, Pickleball court, and Petanque courts, integrating them with the existing bowling green.
- Lush, Formal Planting: The areas around the central buildings will be defined by lawns, formal gardens, and feature trees, creating a resort-like feel.

2. Privacy and Screening
A primary function of the landscape design is to use planting for deliberate screening and to create separation between different functional areas and buildings.

- Building Separation: Mixed amenity planting will be used to provide a visual buffer and separation between the Clubhouse deck and the Care House deck.
- Care House Privacy: The Care House's communal deck will be screened by a 1.6-metre high evergreen hedge on its west side. Additional mixed amenity planting will screen the new Care House from the existing Villa 214, and create private patio spaces for the care rooms.

3. Residential Privacy in Villa Zones [A, B, C, D]
For the new residential villas in Zones A, B, C, and D, the landscaping is critical for establishing privacy and a high-quality living environment. The plans show generous green spaces wrapping each villa, ensuring they are well-separated from internal roads and neighbouring units.

4. Plant Palette and Character
The proposed plant palette [LS.04] is designed to create a lush, subtropical, and established feel.

- Specimen Trees & Palms: Feature trees like Pōhutukawa, ornamental pears, and crabapples, along with palms [Pītt Island Nikau, Queen Palm, Kentia Palm], will be used for scale and character.
- Screening: Hedges like Griselinia ['Broadway Mint'] and Ficus Tuffy will be used to create the screening and privacy described above.
- Community Feel: The palette also includes fruit trees [citrus]) and allows for seasonal vegetable planters, enhancing the residential community atmosphere.

Number of Dwellings

The current number of villas on the site is 126. The proposed 18 units takes the total number to 144. This is well within the 273 units envisaged for the site [when connected to urban wastewater] and 238 if wastewater is managed on site .

Proposal Relationship to Master Plan

Figure 6 below shows the general arrangement / location of buildings as approved under the District Plan. Areas where development proposed are highlighted in the figure by red circles.

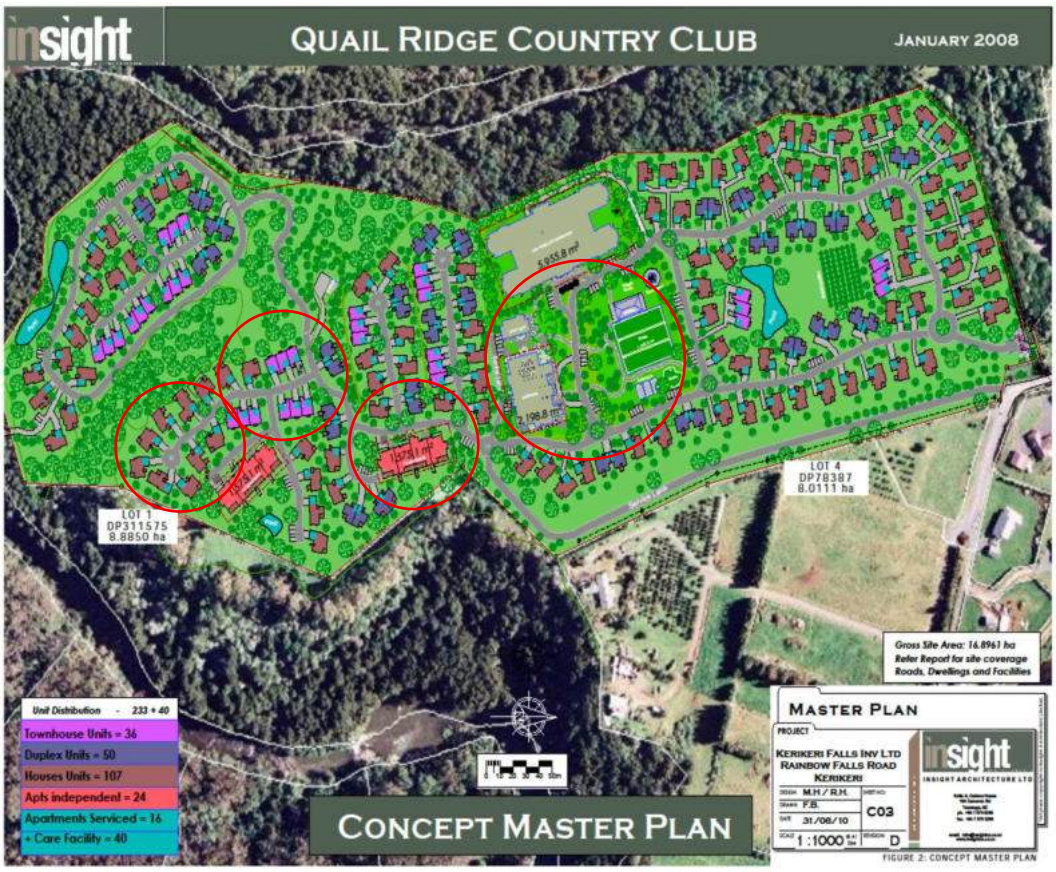


Figure 6: Concept Master Plan [Source: Far North District Plan]

The areas generally contain the area for the proposed care centre, villas and apartments and villas.

As is outlined below, the location of the Club House, Care House and Zone A villas are generally located in accordance with the Master Plan. Villas in Zone B are largely located in an area where apartments were proposed. Villas in Zone C and Zone D are also generally located where townhouse and house units were envisaged.

Notwithstanding the above, consent is required for minor discrepancies from the Concept Master Plan.

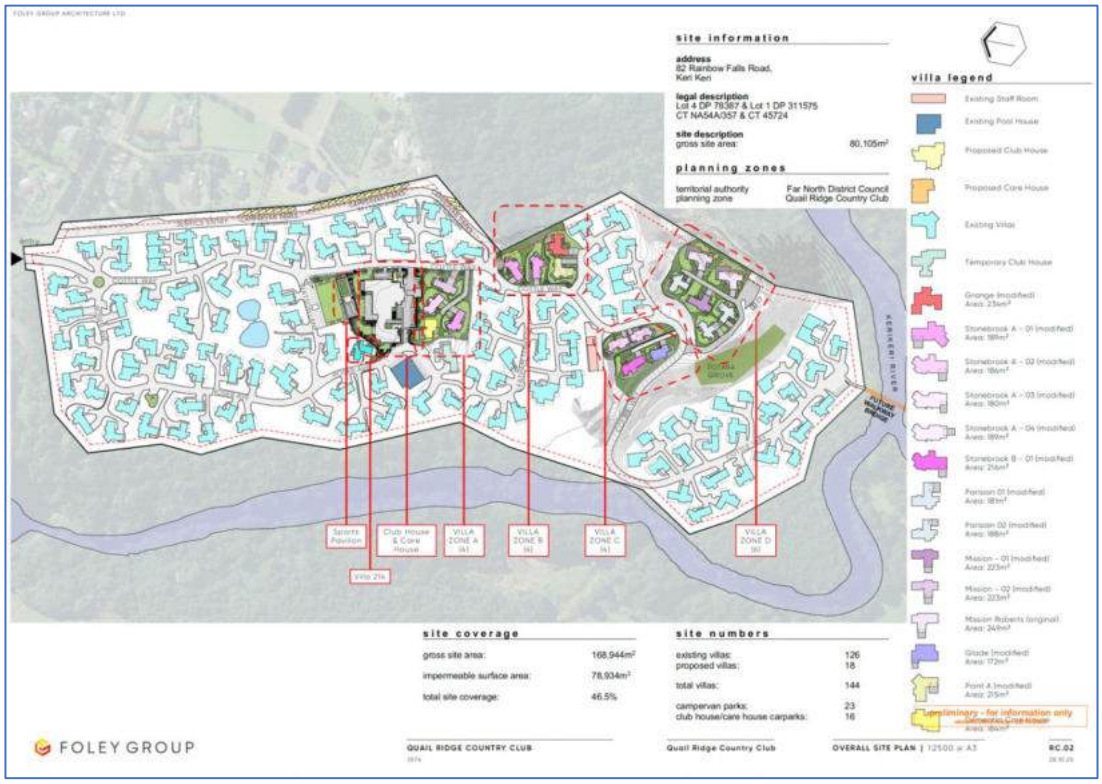


Figure 7: Proposed Site Plan [Source: Foley Group]

5.0 REASONS FOR CONSENT

Table 1 below provides an assessment against the applicable ODP performance standards [rules] and identifies the reasons for resource consent.

Table 1 – Quail Ridge Country Club

Permitted Activities	Assessment
Rule 18.9.6.1.1 Use of Land for Retirement Village Purposes The use, maintenance and repair of the land, buildings and ancillary facilities and structures within the Quail Ridge Country Club zone for a retirement village.	The proposal activities are associated with the retirement village. **COMPLIES**

Rule 18.9.6.1.2 Noise This rule sets the following limits on noise emissions as measured at the boundaries of the site: • Daytime (0700-2200hours) of 55 dBA L_{10} • Nighttime (2200-0700hours) of 45 dBA L_{10} and 70dBA $_{Lmax}$	The activities proposed are not expected to breach this rule. **COMPLIES**
Rule 18.9.6.1.3 Signs Signs are to be located either: (a) immediately adjacent to the Rainbow Falls Road frontage of the site and shall comply with the permitted activity standards for signs in the Residential zone in Part 3 of the Plan - District Wide Provisions; or be (b) located elsewhere on the site and not be visible from adjacent properties, including the adjoining scenic reserve.	The activities proposed are not expected to breach this rule. **COMPLIES**
Rule 18.9.6.1.4 Keeping of Animals The site shall not be used for a boarding or breeding kennel or cattery or for factory farming or for the keeping of mustelids. Domestic pets may only be kept in accordance with the specified pet policy.	This activity is not proposed. **COMPLIES**
Controlled Activities	**Assessment**
Rule 18.9.6.2.1 Residential Intensity The number of residential units, including the care facility, shall not exceed 273, except that if a connection is not available to the Kerikeri township wastewater scheme the total number of residential units, including the care facility, shall not exceed 238.	The total number of residential units is 144 [inclusive of the proposal]. **COMPLIES**
Rule 18.9.6.2.2 Buildings and/or Activities Buildings and/or activities shall be sited in accordance with the Concept Master Plan Except that in the case of any house, duplex or townhouse shown on the Concept Master	Zone A is considered to be in accordance with the Master Plan. The rule appropriately provides for houses to be replaced and relocated which is proposed for Zones B, C and D.

Plan, the relocation elsewhere within the site and an increase in footprint area by up to 10% is also a controlled activity, provided that: - the relocated building footprint complies with all other controlled activity standards; and - the total number of houses, duplexes and townhouses on the site does not exceed 193, being the total number of these unit types shown on the Concept Master Plan; - the relocated building footprint is within the area identified for houses, duplexes and townhouses on the Concept Master Plan except that in the case of ponds, recreational facilities and roads, including service lanes, shown on the Concept Master Plan, the relocation and any increase in footprint area is also a controlled activity provided that: i. the activities are relocated to a position that is no closer to any site boundary, and ii. the impermeable surface standard and all other controlled activity standards; are met, and iii. the resultant location of such facilities and services are still in general accordance with the Concept Master Plan and the Landscape Enhancement Plan.	However, the rule does not allow for villas to replace apartment areas which is proposed for Zone B and D. At Zone D, two dwellings also breach the setback rule which is not provided for. **RESTRICTED DISCRETIONARY**
Rule 18.9.6.2.3 Building Height (a) The maximum height of any dwelling, duplex, townhouse or accessory building shall be 8m. (b) The maximum height of the clubhouse and the care facility/serviced apartment building, shall be 9m.	All Villas are below the 8m height threshold as shown in **Appendix B.** The Clubhouse and Care Facility are less than 9m in height. The Sports Pavillion [accessory building] is less than 8m in height. **COMPLIES**

(c) The maximum height of the two independent living apartment buildings shall be 11.5m.	
Rule 18.9.6.2.4 Setback from Boundaries No building shall be erected within 7.5m of any site boundary.	Two Mission Villas within Zone D are within the 7.5m setback. **RESTRICTED DISCRETIONARY**
Rule 18.9.6.2.5 Sunlight No part of any building shall project beyond a 45-degree recession plane as measured inwards from any point 2m vertically above ground level on any site boundary except where a site boundary adjoins a legally established entrance strip, private way, access lot, or access way serving a rear site, the measurement shall be taken from the farthest boundary of the entrance strip, private way, access lot, or access way.	No building breaches this rule as shown on in **Appendix B.** **COMPLIES**
Rule 18.9.6.2.6 Building Design & Appearance (a) All buildings are to be of a New Zealand residential vernacular nature. Exotic or unusual forms such as 'A' frames, domes and towers are not permitted. Kitset, prefabricated and relocated buildings are also not permitted. (b) The roof forms of all dwellings, duplexes and townhouses are to be simple and have gable or hip variations with either soft barges or parapet roof ends. (c) All exterior walls and roofs are to be finished in neutral or dark colours suited to the landscape setting. They shall have a reflectivity value of less than 40% as illustrated on the Resene BS5282 colour range. This restriction does not apply to doors or window joinery.	All buildings will meet these requirements. **COMPLIES**
Rule 18.9.6.2.7 Impermeable Surfaces	The total site coverage is 46.5%

The maximum site area covered by buildings and other impermeable surfaces on the site shall be 42%.	**RESTRICTED DISCRETIONARY**
Rule 18.9.6.2.8 Earthworks Earthworks shall only be undertaken in association with any buildings, roading and activities identified on the Concept Master Plan and in accordance with the conditions of any resource consent granted by the Regional Council or by the Far North District Council.	Earthworks are proposed for the purposes outlined in the rule. **COMPLIES**
Rule 18.9.6.2.9 Fencing & Landscaping A fence and visual screen of native plants and other shrubs is to be provided and maintained along the site boundaries...	This will be provided where applicable. **COMPLIES**
Rule 18.9.6.2.10 On Site Access, Parking & Loading The access, internal roading, parking and loading provisions in Part 3 and Appendix 3 of the Plan – District-wide provisions apply to the site except as specified in relation to: (a) Internal roads (b) Services lanes (c) Parking (care facilities, clubhouse and serviced apartments only)	Internal roads and service lanes will be designed to meet the required standard within the Zone. In terms of parking, the care facility is required to provide 1 car park per every 2 beds provided = 3 car parks. The Clubhouse is to provide 1 car park for every 2 staff. Number of new staff is considered to be 8. 4 car parks are provided overall. The proposal includes 16 car parks. The proposal includes an activity ancillary to the retirement village which is the proposed campervan car parking. The parks will meet the relevant standards required. **COMPLIES**
Rule 18.9.6.2.11 Off Site Road Improvements	These improvements are complete. **COMPLIES**
Rule 18.9.6.2.12 Bush Protection, Weed and Pest Control	These matters have been completed. **COMPLIES**
Rule 18.9.6.2.13 Control of Domestic Pets	This mechanism is already in place.

	COMPLIES
Rule 18.9.6.2.14 Stormwater, Water Supply & Wastewater Facilities	Please refer to the Site Suitability Report in **Appendix E.** **COMPLIES**
Rule 18.9.6.2.15 Controls	Not relevant. **COMPLIES**
Restricted Discretionary Activities	**Assessment**
18.9.6.3.1 Buildings and/or Activities A. The relocation and enlargement/extension of the clubhouse, any building used for recreational purposes, or accessory building shown on the Concept Master Plan is a restricted discretionary activity, provided that the relocated building footprint adjoins the approved building footprint shown on the Concept Master Plan and the enlargement/extension is no more than 10% over and above the building footprint shown on the Concept Master Plan, and the controlled activity standards are met. B. The relocation and enlargement/extension of any apartment and/or care building shown on the Concept Master Plan is a restricted discretionary activity provided that the relocated building footprint adjoins the approved building footprint shown on the Concept Master Plan and the enlargement/extension is no more than 10% over and above the building footprint shown on the Concept Master Plan and the controlled activity standards are met	No activities under A or B are proposed. **COMPLIES**
18.9.6.3.2 Setback from Boundaries	Refer above. **COMPLIES**
18.9.6.3.3 Sunlight	Refer above. **COMPLIES**
18.9.6.3.4 Building Design & Appearance	Refer above. **COMPLIES**

18.9.6.3.5 Impermeable Surfaces	Refer above. **COMPLIES**
18.9.6.3.6 Earthworks	Refer above. **COMPLIES**
18.9.6.3.7 Fencing & Landscaping	Refer above. **COMPLIES**
18.9.6.3.8 Noise	Refer above. **COMPLIES**

Table 2 - Natural and Physical Resources - Performance Standards

Chapter 12 – Natural and Physical Resources	
12.1 Landscapes and Natural Features	Not applicable **COMPLIES**
12.2 Indigenous Flora and Fauna	No vegetation clearance is required. **COMPLIES**
12.3 Soils and Minerals	These rules are not considered relevant as there is a specific earthworks rules [18.9.6.2.8] in the Zone. There is no specific rule for the Zone of relevance. **COMPLIES**
12.4 Natural Hazards	A number of villas are located less than 20m from existing vegetation that surrounds the site. Consent is required under Rule 12.4.6.1.2 Fire Risk to Residential Units. **DISCRETIONARY**
12.5 Heritage	Not applicable **COMPLIES**
12.6 Air	Not applicable **COMPLIES**
12.7 Lakes, Rivers Wetlands and the Coastline	Not applicable **COMPLIES**
12.8 Hazardous Substances	Not applicable **COMPLIES**

12.9 Renewable Energy and Energy Efficiency	Not applicable **COMPLIES**

Table 3 - Transportation Performance Standards

Chapter 15 - Transportation	
15.1.6A.2 Traffic Intensity	There is no TIF for the Quail Ridge Country Club Zone. **COMPLIES**
15.1.6B.1 Parking	Parking standards are provided within the zone for the activities proposed. **COMPLIES**
15.1.6C Access	Access standards are provided within the zone for the activities proposed. **COMPLIES**

In terms of the PDP, the following rules are assessed in Table 4 below.

Table 4 –Relevant Rules in the PDP

Matter	Rule/Std Ref	Relevance	Compliance	Evidence
Hazardous Substances Majority of rules relates to development within a site that has heritage or cultural items scheduled and mapped however Rule HS-R6 applies to any development within an SNA – which is not mapped	Rule HS-R2 has immediate legal effect but only for a new significant hazardous facility located within a scheduled site and area of significance to Māori, significant natural area or a scheduled heritage resource HS-R5, HS-R6, HS-R9	N/A	Yes	Not proposed.
Heritage Area Overlays (Property specific) This chapter applies only to properties within identified heritage area overlays (e.g. in	All rules have immediate legal effect (HA-R1 to HA-R14) All standards have immediate legal effect (HA-S1 to HA-S3)	N/A	Yes	Not indicated on Far North Proposed District Plan

the operative plan they are called precincts for example)				
Historic Heritage (Property specific and applies to adjoining sites (if the boundary is within 20m of an identified heritage item)). Rule HH-R5 Earthworks within 20m of a scheduled heritage resource. Heritage resources are shown as a historic item on the maps) This chapter applies to scheduled heritage resources – which are called heritage items in the map legend	All rules have immediate legal effect (HH-R1 to HH-R10) Schedule 2 has immediate legal effect	N/A	Yes	Not indicated on Far North Proposed District Plan
Notable Trees (Property specific) Applied when a property is showing a scheduled notable tree in the map	All rules have immediate legal effect (NT-R1 to NT-R9) All standards have legal effect (NT-S1 to NT-S2) Schedule 1 has immediate legal effect	N/A	Yes	Not indicated on Far North Proposed District Plan
Sites and Areas of Significance to Māori (Property specific) Applied when a property is showing a site / area of significance to Maori in the map	All rules have immediate legal effect (SASM-R1 to SASM-R7) Schedule 3 has immediate legal effect	N/A	Yes	Not indicated on Far North Proposed District Plan

or within the Te Oneroa-a Tohe Beach Management Area (in the operative plan they are called site of cultural significance to Maori)				
Ecosystems and Indigenous Biodiversity SNA are not mapped – will need to determine if indigenous vegetation on the site for example	All rules have immediate legal effect (IB-R1 to IB-R5)	N/A	Yes	Not indicated on Far North Proposed District Plan. No vegetation clearance proposed.
Activities on the Surface of Water	All rules have immediate legal effect (ASW-R1 to ASW-R4)	N/A	Yes	Not indicated on Far North Proposed District Plan
Earthworks all earthworks (refer to new definition) need to comply with this	The following rules have immediate legal effect: EW-R12, EW-R13 The following standards have immediate legal effect: EW-S3, EW-S5	Yes	Yes	Earthworks associated with the development will be in accordance with the relevant standards including GD-05 and will have an ADP applied.
Signs (Property specific) as rules only relate to situations where a sign is on a scheduled heritage resource (heritage item), or within the Kororareka Russell or Kerikeri Heritage Areas	The following rules have immediate legal effect: SIGN-R9, SIGN-R10 All standards have immediate legal effect but only for signs on or attached to a scheduled heritage resource or heritage area	N/A	Yes	Not indicated on Far North Proposed District Plan
Orongo Bay Zone (Property specific as rule relates to a zone only)	Rule OBZ-R14 has partial immediate legal effect because RD-1(5) relates to water	N/A	Yes	Not indicated on Far North Proposed District Plan

No consents are required under the PDP.

Having considered the proposal against the Proposed Regional Plan, no regional council consents are required in addition to those which already exist.

Overall, consent is required as a **Discretionary Activity**.

6.0 STATUTORY CONSIDERATIONS

Section 104B governs the determination of applications for Discretionary Activities.

104B Determination of applications for discretionary or non-complying activities

After considering an application for a resource consent for a discretionary activity or non-complying activity, a consent authority—

(a) may grant or refuse the application; and

(b) if it grants the application, may impose conditions under section 108.

With respect to Discretionary activities, a consent authority may grant or refuse the application and may impose conditions under section 108 of the RMA.

Section 104 of the RMA sets out matters to be considered when assessing an application for a resource consent,

104 Consideration of applications

(1) When considering an application for a resource consent and any submissions received, the consent authority must, subject to Part 2 and section 77M, have regard to–

(a) any actual and potential effects on the environment of allowing the activity; and

(ab) any measure proposed or agreed to by the applicant for the purpose of ensuring positive effects on the environment to offset or compensate for any adverse effects on the environment that will or may result from allowing the activity; and

(b) any relevant provisions of—

(i) a national environmental standard:

(ii) other regulations:

(iii) a national policy statement:

(iv) a New Zealand coastal policy statement:

(v) a regional policy statement or proposed regional policy statement:

(vi) a plan or proposed plan; and

(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.

All regional planning matters are considered under existing consents. A copy of the relevant consents is provided in **Appendix C**.

Those relevant s104 considerations are addressed and followed by an assessment of Part II matters as they apply to the application.

Section 104 (1)(a) Assessment of Effects on the Environment / Persons

This assessment focuses on the actual and potential environmental effects of the proposal.

Table 5 – Assessment of Effects / Persons

Effect	Assessment
Positive Effects	The development is an efficient use of special zoned land in Kerikeri, which anticipates the activities proposed for retirement village sector. The proposal will bring economic growth and employment to the construction sector. The proposal has already benefitted consultants as part of the feasibility assessments and reporting for resource and building consent processes. The proposal brings additional housing choice in Kerikeri for those looking to retire. This is proposed to be matched with additional on site services such as campervan car parking and the Clubhouse to increase amenity and the Carehouse will increase health services on site.
Buildings and Activities (a) the extent to which the proposal is in keeping with the character and form of development on the site and adjacent sites, in particular with the external scale and proportion of buildings or activities on the site and on adjacent sites; (b) the extent to which the buildings(s) or activities may reduce outlook and privacy of adjacent properties; (c) the extent to which the activity may adversely affect use of adjacent reserve areas; (d) the ability to mitigate any adverse effects on the surrounding environment for example by way of building design, external appearance and landscaping; (e) the extent to which any associated access, manoeuvring space, loading bays	All additional villas proposed largely match consented and already developed villas on the site. They are of a form, character, and scale that are well known, architecturally designed and finished which ensures effects to neighbours are minimal. The Clubhouse and Carehouse are located internal to the site and are of no immediate concern to adjacent persons. There is a minor setback from boundary breach for two villas, but otherwise the boundaries of the site are usually landscaped / fenced to ensure appropriate privacy. The immediately adjacent property to these two dwellings is the wider reserve managed by DoC with no persons having easy access to this area as the walkway is located along the waterway. The proposed building design as noted above for the Villas is no different to that already promoted on the site. The indicative building

and parking spaces comply with the Plan rules; and (f) the extent to which the proposal impacts on the Landscape Enhancement Plan.	design and external appearance for the Clubhouse and Carehouse are provided in **Appendix B.** The design is considered in keeping with the overall Retirement Village character. The proposal has no known impacts to the Landscape Enhancement Plan.
Setback from Boundaries (a) the extent to which the building(s) reduces outlook and privacy of adjacent properties, particularly reserves; (b) the extent to which the building(s) restrict visibility for access and egress of vehicles; and (c) the ability to mitigate any adverse effects on the environment, for example by way of building design, appearance or planting.	The impact to the adjacent reserve has been considered above. The breach of the rule are to small areas [corners] of each dwelling. They are not expected to impact privacy. The location of the breach does not impact access / egress to the site. The setback breach is to the rear of the site and landscaping is proposed in this area as outlined on the Landscape Plan which provides sufficient mitigation.
Impermeable Surfaces (a) the extent to which impermeable surfaces contribute to total catchment impermeability; (b) the extent to which low impact design principles have been used; (c) the visual and amenity related effects of the additional impermeable surfaces; and (d) the degree to which mitigation measures are proposed and their likely effectiveness.	While the 42% standard is breached, the potential adverse effects of this breach (i.e., increased stormwater runoff) are fully mitigated. As detailed in the Site Suitability Report [**Appendix E**], a comprehensive stormwater attenuation system is proposed using granular storage zones. This design ensures that post-development peak flows are attenuated to match pre-development rates for both 2-year and 10-year storm events. Therefore, the breach is technical in nature, the environmental outcomes are managed, and there will be no adverse downstream stormwater effects
Fire Risk To Residential Units	The overall site has its own provision for fire-fighting water and this has been a condition of previous developments to provide appropriate fire-fighting water to support the development. This is not unusual for the proposal which contains dwellings within

	20m of various stands of trees. A consent conditions is offered as follows: *"The consent holder shall provide an internal reticulated water supply with a connection to each unit prior to occupation. At the time of lodging building consents for the buildings approved under this consent, the consent holder shall provide to Council details of the firefighting water supply system conforming to NZS4509:2008 or alternate design to the approval of Fire and Emergency New Zealand for firefighting purposes that is to be accessible to any fire appliance and that is positioned so as to reach all developments on the site. The consent holder shall provide confirmation from Fire and Emergency NZ that they are satisfied with the arrangements made for the provision of firefighting water. Confirmation is to be supplied to Council's Resource Consent Monitoring Officer or designate prior to the occupation of any building"*
Geotech & Earthworks	The Site Suitability Report [**Appendix E**] confirms the site is geotechnically stable and suitable for the proposed development, provided the report's recommendations are followed. Potential slope stability effects are fully mitigated through engineered setbacks. • Villas in Zones B and D will be set back at least 8.0 metres from the crest of the slopes. • Villas in Zone C will be set back at least 1.0 metre from the existing engineered timber crib retaining wall. • The current development plans comply with these setbacks. Unsuitable Soil Mitigation (Zone B): The report identifies uncontrolled fill in Zone B. This will be mitigated by either: 1. Removing and re-compacting the soil as certified engineered fill; or

	2. Using driven timber piles to found the villas in the competent natural ground below the fill. The soils are classified as Class M (moderately expansive). All foundations will require specific engineering design (SED) to mitigate this, such as a stiffened waffle raft foundation designed to AS2870:2011 . All earthworks will be managed in accordance with NZS4431:2022. Any new excavation batters will be no steeper than 1V:2.5H and will be planted to ensure long-term stability. Provided these aspects are conditioned, there are less than minor effects resulting.
Servicing	The proposal will generate approximately 13,210 L/day. This is well within the 32,500 L/day (32.5 m^3) limit of the existing Northland Regional Council discharge consent (AUT.019289.01.05). Effects are fully managed as the new villas and clubhouse will be connected to new, appropriately-sized Eloy C-90 CB treatment systems, which then connect to the existing consented on-site network. Potential adverse effects from the impermeable surface breach (46.5%) are fully mitigated. As detailed in the Site Suitability Report (Appendix E), a low-impact attenuation design will be used. All runoff from new impervious areas will be captured in granular storage zones (e.g., rock-filled trenches) under the driveways. This system is designed to slow the release of water, ensuring that post-development peak flows match pre-development rates for both 2-year and 10-year storm events, resulting in no adverse downstream stormwater effects. The development will be serviced by connecting to the Council's reticulated water

	supply via the existing internal network on site.
Deviation From Concept Master Plan	The proposed villas are a less intensive built form than the apartments envisaged by the CMP. This results in less building mass, more open space, and a superior outcome for visual amenity and the "open space character" sought by Policy 18.9.4.4. The villas are consistent with the existing, established character of the Quail Ridge development, which is valued by residents. Multi-storey apartment buildings, although accepted, would introduce a new, more dominant typology. The proposal better "recognises the predominantly retirement village nature" of the zone [Policy 18.9.4.3]. While built form is changing, the overall intensity is not. The proposal for 144 total units is well within the 238-unit cap, demonstrating the proposal is well within the overall capacity anticipated by the District Plan.

In conclusion, the proposal is considered to result in less than minor effects on the environment.

The assessment also considered relevant adjacent persons which are limited to DoC.

The effect to this party is considered to be less than minor for the reasons outlined in the table above and result from a marginal setback breach from two dwellings. These effects can be isolated and mitigated by way of landscaping and are not considered to result in effects that would warrant limited notification.

Section 104 (1)(ab) Any measures to achieve positive effects

As outlined in Table 5 above.

Section 104 (b)(i) and (ii) National Environmental Standards & Other Regulations

The overall site has been considered in terms of the NES-CS. No other National Environmental Standard or Other Regulations are relevant.

Section 104 (b)(iii) National Policy Statement(s)

The site has Class 2 and Class 4 soils and the National Policy Statement for Highly Productive Land is applicable. The definition of 'urban' as a description of a zone includes 'any special purpose zone, other than a Māori Purpose zone'. Therefore, the NPS-HPL does not apply to the application.

The National Policy Statement for Urban Development has some relevance, albeit limited. The proposal seeks to promote intensive retirement village living on the outskirts of the urban areas of Kerikeri. The zone anticipates increased density should the potential to connect to urban wastewater facilities are enables. This is within the intent of the NPS-UD. Car parking is provided in accordance with the zone.

There are no other relevant National Policy Statements.

Section 104 (b)(iv) New Zealand Coastal Policy Statement (NZCPS)

The site is not located in the Coastal Environment.

Section 104 (b)(v) Regional Policy Statement or Proposed Regional Policy Statement

The Northland Regional Policy Statement is the applicable regional statutory document that applies to the Northland region. Jurisdiction for subdivision is governed by the FNDC and the policy framework for establishing an appropriate land use pattern across the district is set out in the ODP. This Plan is subject to the governing regional policy framework set out in the Northland Regional Policy Statement.

Table 6 – NRC Regional Policy Statement Review Assessment

Objective / Policy	Assessment
Integrated Catchment Management	Not relevant
Region Wide Water Quality	Not relevant
Ecological Flows and Water Quality	Not relevant
Enabling Economic Wellbeing	The proposal includes a range of construction activities that will enable economic wellbeing in Kerikeri and the wider Northland region. Job growth and creation will occur as a result.
Economic Activities – Reverse Sensitivity and Sterilisation.	No reverse sensitivity effects or sterilisation occurs in this instance with the activities being consistent with what is expected in the Special Zone.
Regionally Significant Infrastructure	The proposal relies on limited regionally significant infrastructure and otherwise relies on site infrastructure to provide for the activities.
Efficient and Effective Infrastructure	As above, the proposal relies on existing infrastructure on the site to service activities.
Security of Energy Supply	Power is provided to the site.
Use and Allocation of Common Resources	No use of common resources is proposed.

Regional Form	The proposal is within the density arrangement expected for the Quail Ridge Country Club Zone.
Tangata Whenua Role in Decision Making	Council can provide this application to Tangata Whenua.
Natural Hazard Risk	The fire risk for the development has been considered and appropriately mitigated.
Natural Character, Outstanding Natural Features, Outstanding Natural Landscapes and Historic Heritage	These features do not apply to the site.

Section 104 (b)(vi) Plans or Proposed Plans

This application is subject to the provisions of the ODP and is subject to consideration (limited weight) of the PDP objectives and policies.

Table 7 – ODP Quail Ridge Objective and Policy Assessment

Objectives	**Assessment**
18.9.3.1 To provide for the staged development of a residential village in accordance with a Concept Master Plan and provision of pedestrian bridge/walkways, roads and utility services linked to future development of the surrounding area.	This proposal provides an additional stage of development as expected within the Concept Master Plan.
18.9.3.2 To ensure that residential and other development of the site is carried out in a manner that protects and enhances the ecological, heritage, landscape and amenity values of the site and surrounding area.	It is considered that the additional residential villas proposed are of a character that are similar to that already existing and have less than minor effects on ecological, heritage, landscape and amenity values of the site.
Policies	**Assessment**
18.9.4.1 That the Concept Master Plan form the basis of the village development and the provision of recreational facilities and utility services be linked to it.	This is noted.
18.9.4.2 That multi storey buildings be generally confined to the environmentally suitable locations shown in Stage 2 shown on the Concept Master Plan.	No multi storey buildings are proposed.
18.9.4.3 That buildings, roads and other facilities be sited and designed in a manner that recognises the predominantly retirement village nature of the village and	The activities proposed are extensions to the predominant retirement residential use on the site and the Clubhouse, Carehouse and

the sensitivity of adjacent reserve and rural lifestyle areas.	parking all support the overarching retirement village activity.
18.9.4.4 That significant areas of the site be retained as landscaped open space and for recreational activities.	A majority of the site [more than 50%] is retained as open space. The Clubhouse although within a building provides for a form of recreation.
18.9.4.5 That provision is made for the relocation of buildings, roads and other activities within the site subject to appropriate environmental quality standards being maintained.	This is noted and applied to some of the Zones.

Table 8 - PDP Quail Ridge Objective and Policy Assessment

Objectives	**Assessment**
QR-O1 The Quail Ridge zone is a staged development in general accordance with the Quail Ridge Concept Master Plan, including the provision of a pedestrian bridge/walkways, roads/footpaths and utility services linked to future development of the surrounding area.	Refer above in the ODP.
QR-O2 Development in the Quail Ridge zone is carried out in a manner that protects and enhances the ecological, heritage, landscape and amenity values on the site and surrounding area.	Refer above in the ODP.
Policies	**Assessment**
QR-P1 Enable development that is in accordance with the Quail Ridge Concept Master Plan where it can be can be served by on-site infrastructure, or reticulated infrastructure where available.	Appropriate infrastructure is / will be provided to service the proposed development.
QR P2 Ensure that multi-storey buildings are generally confined to the locations shown in Stage 2 shown on the Quail Ridge Concept Master Plan.	Refer above in the ODP.
QR-P3 Ensure that buildings, roads and other facilities are constructed and designed in a manner that recognises the zone purpose as a retirement village located in a rural residential area adjacent to a	Refer above in the ODP.

public reserve with high ecological, heritage, landscape and amenity values.	
QR-P4 Ensure that significant areas of the site are retained as landscaped open space and for recreational activities in accordance with the Quail Ridge Concept Master Plan.	Refer above in the ODP.
QR-P5 Enable for the relocation of buildings, roads and other activities within the Quail Ridge zone provided: a. the total number of buildings does not increase; b. the same environmental outcomes are achieved as anticipated by the Quail Ridge zone and the Quail Ridge Concept Master Plan; and c. the timing of the pedestrian bridge/walkway and the upgrading of Rainbow Falls Road does not alter.	Refer above in the ODP. The total number of buildings proposed is not more than the maximum limit established.
QR-P6 Protect the ecological integrity of the surrounding public reserve by limiting the number of domestic pets and their access to the reserve by: a. prohibiting the keeping of mustelids or operating a boarding or breeding kennel, a cattery or intensive farming; b. creating a pets policy that is incorporated into the license to occupy for any residential activity; and c. erecting signage at the entry and exit points of the Department of Conservation managed reserves prohibiting dog entry.	These matters are unchanged through the proposal.
QR-P7 Provide for boundary adjustments within the Quail Ridge zone to avoid fragmentation of the site.	Not proposed.

Overall, it is considered that the proposal is consistent with both the ODP and PDP frameworks.

Section 104 (c) Other Matters

There are no other matters that are considered relevant.

7.0 NOTIFICATION

S95A of the RMA determines circumstances when public or limited notification of an application may be appropriate. Section 95A sets out a series of steps for determining public notification. These include:

- Step 1 – Mandatory public notification in certain circumstances. In respect of this application, the applicant is not seeking public notification, nor is it subject to a mandatory notification requirement.

- Step 2 – Public notification precluded in certain circumstances. Overall the application is for a discretionary activity. None of the circumstances in this step apply.

- Step 3 – Public notification required in certain circumstances. In respect of clause 8(a) the application is not subject to a rule or national environmental standard that requires public notification. In respect of clause 8(b), this assessment of effects on the environment concludes that any adverse effects would be less than minor. For these reasons, it is considered that the application can be processed without public notification.

- Step 4 – Public notification in special circumstances. 'Special circumstances' are those that are unusual or exceptional, but they may be less than extraordinary or unique. (Peninsula Watchdog Group Inc v Minister of Energy [1996] 2NZLR 5290). It is considered that there are no unusual or exceptional circumstances that would warrant notification of this application.

Section 95B sets out a series of steps for determining limited notification. These include:

- Step 1 – certain affected groups and affected persons must be notified. These include affected customary rights groups or marine title groups (of which there are none relating to this application). Affected groups and persons may also include owners of adjacent land subject to statutory acknowledgement if that person is affected in accordance with s95E. There are no groups or affected persons that must be notified with this application.

- Step 2 – limited notification precluded in certain circumstances. These include any rule or national environmental standard that precludes limited notification, or the activity is solely for a controlled activity or a prescribed activity. These circumstances do not apply to this application.

- Step 3 – certain other persons must be notified. An affected person is determined in accordance with s95E. A person is affected if the consent authority decides that the activity's adverse effects on the person are minor or more than minor (but are not less than minor). Adverse effects on a person may be disregarded if a rule or a national environmental standard permits an activity with that effect or is a controlled or RDA with an adverse effect that does not relate to a matter over which a rule or standard reserves control or discretion. Those circumstances do not apply to this application. S95E(3) states that a person is not affected if the person has given, and not withdrawn their written approval for a proposed activity or a consent authority is satisfied that it is unreasonable in the circumstances for an applicant to seek a person's written approval.

- Step 4 – Public notification in special circumstances. As above no special circumstances exist.

The assessment of effects above has concluded that the effects on the environment will be less then minor. The proposed density of development and location of activities support an overall retirement village in a manner which is expected by the ODP and PDP.

The effects are insular to the development and are a continuation of activities that already exist on site. There are no known off-site effects that are generated by the proposal.

It is therefore reasonable to conclude that the effects of the proposal would incur less than minor effects on the adjacent landowners.

Section 95C relates to the public notification after a request for further information which does not apply to this application. Section 95D provides the basis for determining notification under Section 95A(8)(b) if adverse effects are likely to be more than minor.

This assessment concludes that potential adverse effects arising from the proposal would be less than minor, as such it can proceed on a non-notified basis.

8.0 PART II – RMA

Purpose of the RMA

Section 5 in Part 2 of the Act identifies the purpose as being the sustainable management of natural and physical resources. This means managing the use of natural and physical resources in a way that enables people and communities to provide for their social, cultural and economic well-being which sustain those resources for future generations, protecting the life supporting capacity of ecosystems, and avoiding remedying or mitigating adverse effects on the environment.

It is considered that proposal represents a sustainable use of existing resources that allow people and the community to provide for its social and economic wellbeing in a manner that mitigates adverse effects on the environment.

Matters of National Importance

In achieving the purpose of the Act, a range of matters are required to be recognised and provided for. This includes:

a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:

b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:

c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:

d) the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:

e) the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:

f) the protection of historic heritage from inappropriate subdivision, use, and development:

g) the protection of protected customary rights:

h) the management of significant risks from natural hazards.

In context, the relevant items to the proposal and have been recognised and provided for in the design of the overall development and this proposal.

Other Matters

In achieving the purpose of the Act, a range of matters are to be given particular regard. This includes:

(a) kaitiakitanga:

(aa) the ethic of stewardship:

(b) the efficient use and development of natural and physical resources:

(ba) the efficiency of the end use of energy:

(c) the maintenance and enhancement of amenity values:

(d) intrinsic values of ecosystems:

(e) [Repealed]

(f) maintenance and enhancement of the quality of the environment:

(g) any finite characteristics of natural and physical resources:

(h) the protection of the habitat of trout and salmon:

(i) the effects of climate change:

(j) the benefits to be derived from the use and development of renewable energy.

These matters have been given particular regard through the design of the proposal.

9.0 CONCLUSION

Resource consent is sought as a Discretionary Activity for a range of activities in the Quail Ridge Country Club Zone.

The assessment of environmental effects has concluded that any potential adverse effects will be less than minor. The scale of the development is appropriate for the site and its surrounding context, and the effects of the proposal can all be appropriately mitigated.

The proposal is consistent with the relevant objectives and policies of the RPS, ODP and PDP, and it aligns with the purpose of sustainable management under Part 2 of the RMA.

Given the assessment carried out in this report, it is considered that this proposal can be determined non-notified under the RMA.

We would appreciate the review of draft conditions when available.

Kind regards

Steven Sanson
Consultant Planner

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Guaranteed Search Copy issued under Section 60 of the Land Transfer Act 2017

R.W. Muir
Registrar-General of Land

Identifier	**45724**
Land Registration District	**North Auckland**
Date Issued	27 March 2003

Prior References
NA55B/129

Estate	Fee Simple
Area	8.8850 hectares more or less
Legal Description	Lot 1 Deposited Plan 311575
Registered Owners	

Quail Ridge Country Club Limited

Interests

Subject to a right (in gross) to convey electricity, telecommunications and computer media over part marked A on DP 482156 in favour of Top Energy Limited created by Easement Instrument 9988730.1 - 13.3.2015 at 10:10 am

10594333.2 Encumbrance to Covenant Trustee Services Limited - 24.1.2017 at 4:02 pm

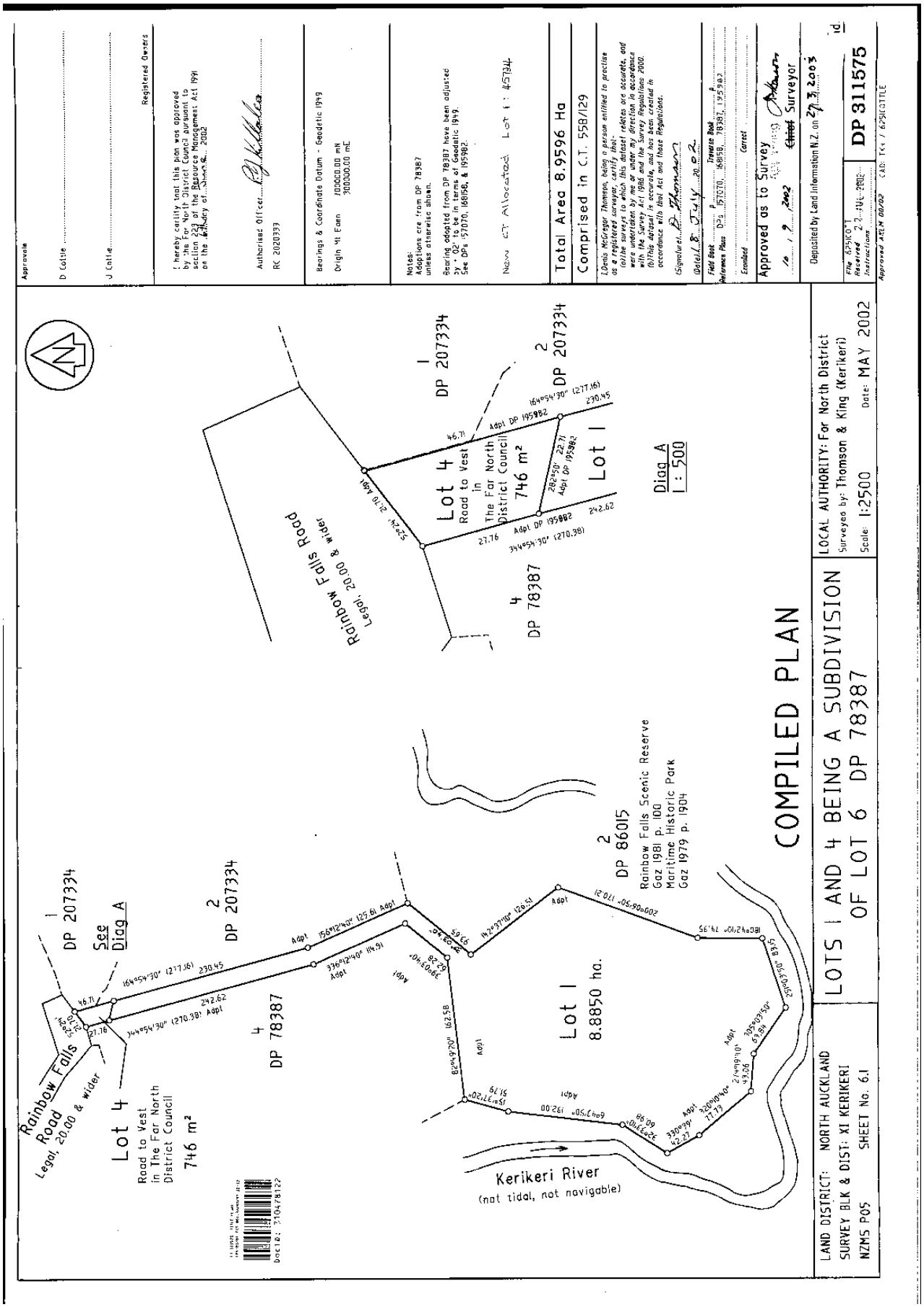
10778791.1 Notice of the registration of Quail Ridge Country Club as a Retirement Village. Subject to Section 22 Retirement Villages Act 2003 (which provides priority for the rights of the residents ahead of the rights of holders of security interests) - 4.5.2017 at 7:00 am

11779769.1 CAVEAT BY TOP ENERGY LIMITED - 22.6.2020 at 11:37 am

11987067.3 Mortgage to Senior Trust Retirement Village Income Generator Limited - 26.1.2021 at 3:42 pm

12212847.1 CERTIFICATE PURSUANT TO SECTION 77 BUILDING ACT 2004 THAT THIS RECORD OF TITLE IS SUBJECT TO THE CONDITION IMPOSED UNDER SECTION 75(2) (ALSO AFFECTS NA54A/357) - 10.8.2021 at 7:00 am

12212847.1 Subject to Section 81(2) and 81(3) Building Act 2004 (affects NA54A/357) - 10.8.2021 at 7:00 am


COMPILED PLAN
LOTS 1 AND 4 BEING A SUBDIVISION OF LOT 6 DP 78387
DP 311575
LOCAL AUTHORITY: Far North District
Surveyed by: Thomson & King (Kerikeri)
Scale: 1:2500
Date: MAY 2002
LAND DISTRICT: NORTH AUCKLAND
SURVEY BLK & DIST: XI KERIKERI
NZMS P05 SHEET No. 6.1
Approvals
D Cattle
J Cattle
Registered Owners
Authorised Officer
RC 2020393
Bearings & Coordinate Datum - Geodetic 1949
Origin 41 Eden 1100000.00 mN 300000.00 mE
Notes:
Adoptions are from DP 78387 unless otherwise shown.
Bearing adopted from DP 78387 have been adjusted by -0° 02' to be in terms of Geodetic 1949.
See DPs 157070, 168958, & 195982.
New CT Allocated Lot 1 : 457344
Total Area 8.9596 Ha
Comprised in C.T. 558/129
Deposited by Land Information N.Z. on 27.3.2003
Approved as to Survey
Surveyor
Rainbow Falls Road
Legal 20.00 & wider
Lot 4
Road to Vest in The Far North District Council
746 m²
Lot 1
8.8850 ha.
Lot 4
Road to Vest in The Far North District Council
746 m²
Rainbow Falls Road
Legal 20.00 & wider
Kerikeri River
(not tidal, not navigable)
Rainbow Falls Scenic Reserve
Gaz 1981 p. 100
Maritime Historic Park
Gaz 1979 p. 1904
Diag A
1 : 500
See Diag A
1 DP 207334
2 DP 207334
4 DP 78387
2 DP 86015
Adopt DP 195982
Adopt DP 157070
Adopt DP 168958
Adopt DP 78387
Adopt

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Guaranteed Search Copy issued under Section 60 of the Land Transfer Act 2017

R.W. Muir
Registrar-General of Land

Identifier	**NA54A/357**
Land Registration District	**North Auckland**
Date Issued	12 September 1983

Prior References
NA34C/141

Estate	Fee Simple
Area	8.0111 hectares more or less
Legal Description	Lot 4 Deposited Plan 78387
Registered Owners	

Quail Ridge Country Club Limited

Interests

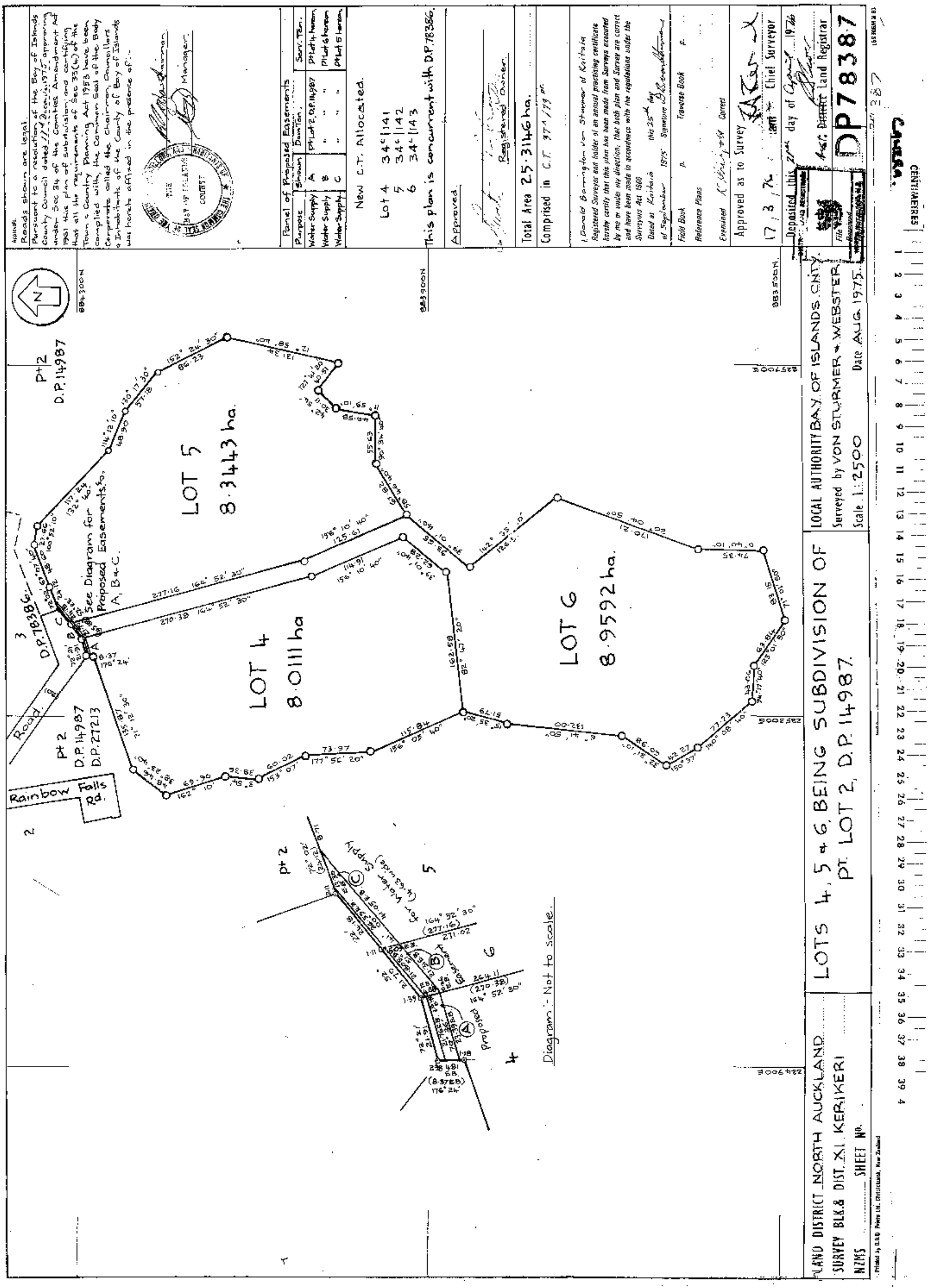
9166384.1 Encumbrance to Covenant Trustee Services Limited - 27.8.2012 at 3:03 pm

9171834.1 Notice of the registration of Quail Ridge Country Club Limited as a Retirement Village. Subject to section 22 of the Retirement Villages Act 2003 (which provides priority for the rights of the residents ahead of the rights of holders of security interests) - 4.9.2012 at 7:00 am

11987067.3 Mortgage to Senior Trust Retirement Village Income Generator Limited - 26.1.2021 at 3:42 pm

12212847.1 CERTIFICATE PURSUANT TO SECTION 77 BUILDING ACT 2004 THAT THIS RECORD OF TITLE IS SUBJECT TO THE CONDITION IMPOSED UNDER SECTION 75(2) (ALSO AFFECTS 45724) - 10.8.2021 at 7:00 am

12212847.1 Subject to Section 81(2) and 81(3) Building Act 2004 (affects 45724) - 10.8.2021 at 7:00 am


LOTS 4, 5 & 6 BEING SUBDIVISION OF
PT. LOT 2, D.P. 14987
LOT 5
8.3443 ha.
LOT 4
8.0111 ha
LOT 6
8.9592 ha.
See Diagram for Proposed Easements A, B & C.
Rainbow Falls Rd.
Road
P+2 D.P. 14987
3 D.P. 78386
P+2 D.P. 14987 D.P. 27213
Diagram: Not to scale.
New C.T. Allocated.
Lot 4 34C/141
5 34C/142
6 34C/143
This plan is concurrent with D.P. 78386.
Approved.
Registered Owner
Total Area 25.3146 ha.
Comprised in C.T. 37A/79
Approved as to Survey
Chief Surveyor
Deposited this
Land Registrar
DP 78387
LOCAL AUTHORITY BAY OF ISLANDS CNTY.
Surveyed by VON STURMER & WEBSTER
Scale 1:2500
Date AUG. 1975.
LAND DISTRICT NORTH AUCKLAND
SURVEY BLK.& DIST. XI. KERIKERI
NZMS SHEET No.
CENTIMETRES

QUAIL RIDGE
COUNTRY CLUB

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB

LAND USE CONSENT SET

by FOLEY GROUP ARCHITECTURE LTD

FOLEY GROUP

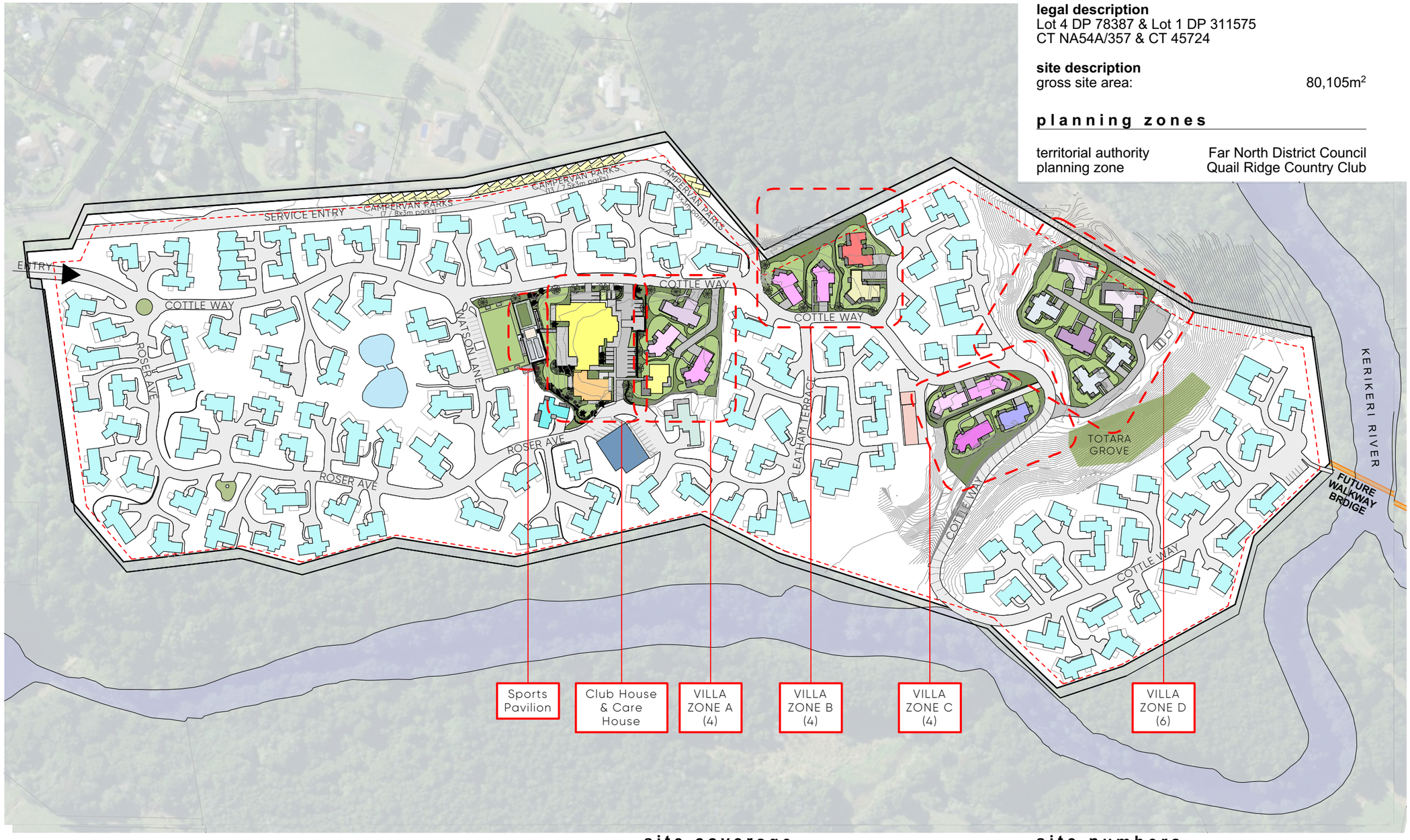
QUAIL RIDGE COUNTRY CLUB

82 Rainbow Falls Road Keri Keri

LAND USE CONSENT SET

Dwg No.	Title	Dwg Rev.	Date
. RC.01	TITLE	A	12/11/2025
. RC.02	OVERALL SITE PLAN	A	12/11/2025
. RC.03	CLUB & CARE HOUSE / ZONE A SITE PLAN	A	12/11/2025
. RC.04	SECTIONS: CLUB & CARE HOUSE	A	12/11/2025
. RC.05	SECTIONS: ZONE A	A	12/11/2025
. RC.06	ZONE B SITE PLAN	A	12/11/2025
. RC.07	SECTIONS: ZONE B	A	12/11/2025
. RC.08	ZONE C SITE PLAN	A	12/11/2025
. RC.09	SECTIONS: ZONE C	A	12/11/2025
. RC.10	ZONE D SITE PLAN	A	12/11/2025
. RC.11	SECTIONS: ZONE D	A	12/11/2025
. RC.12	GRANGE VILLA	A	12/11/2025
. RC.13	STONEBROOK A - 01	A	12/11/2025
. RC.14	STONEBROOK A - 02	A	12/11/2025
. RC.15	STONEBROOK A - 03	A	12/11/2025
. RC.16	STONEBROOK A - 04	A	12/11/2025
. RC.17	STONEBROOK A - 05	A	12/11/2025
. RC.18	STONEBROOK B - 01	A	12/11/2025
. RC.19	PARISIAN - 01	A	12/11/2025
. RC.20	PARISIAN - 02	A	12/11/2025
. RC.21	PARISIAN - 03	A	12/11/2025
. RC.22	MISSION - 01	A	12/11/2025
. RC.23	MISSION - 02	A	12/11/2025
. RC.24	MISSION ROBERTS	A	12/11/2025
. RC.25	GLADE	A	12/11/2025
. RC.26	POINT A	A	12/11/2025
. RC.27	DEMENTIA CARE HOUSE	A	12/11/2025
. RC.28	CLUB & CARE HOUSE PLAN	A	12/11/2025
. RC.29	CLUB & CARE HOUSE ELEVATIONS	A	12/11/2025

Foley Group Architecture Ltd.
T. 03 3775 666 | W. www.foleygroup.co.nz
PO Box 22166, Christchurch 8140 | 30 Southwark St, Christchurch 8011



site information

address
82 Rainbow Falls Road,
Keri Keri

legal description
Lot 4 DP 78387 & Lot 1 DP 311575
CT NA54A/357 & CT 45724

site description
gross site area: 80,105m²

planning zones

territorial authority: Far North District Council
planning zone: Quail Ridge Country Club

site coverage

gross site area:	168,944m²
impermeable surface area:	78,934m²
total site coverage:	46.5%

site numbers

existing villas:	126
proposed villas:	18
total villas:	144
campervan parks:	23
club house/care house carparks:	16

villa legend

- Existing Staff Room
- Existing Pool House
- Proposed Club House
- Proposed Care House
- Existing Villas
- Temporary Club House
- Grange (modified) Area: 234m²
- Stonebrook A - 01 (modified) Area: 189m²
- Stonebrook A - 02 (modified) Area: 186m²
- Stonebrook A - 03 (modified) Area: 180m²
- Stonebrook A - 04 (modified) Area: 189m²
- Stonebrook A - 05 (modified) Area: 193m²
- Stonebrook B - 01 (modified) Area: 216m²
- Parisian 01 (modified) Area: 181m²
- Parisian 02 (modified) Area: 188m²
- Parisian 03 (modified) Area: 188m²
- Mission - 01 (modified) Area: 223m²
- Mission - 02 (modified) Area: 223m²
- Mission Roberts (original) Area: 249m²
- Glade (modified) Area: 172m²
- Point A (modified) Area: 215m²
- Dementia Care House Area: 184m²

villa legend

- Existing Staff Room
- Existing Pool House
- Proposed Club House
- Proposed Care House
- Existing Villas
- Temporary Club House
- Dementia Care House
  Area: 184m²
- Stonebrook A - 01 (modified)
  Area: 189m²
- Stonebrook A - 02 (modified)
  Area: 186m²
- Mission - 01 (modified)
  Area: 223m²

FOLEY GROUP

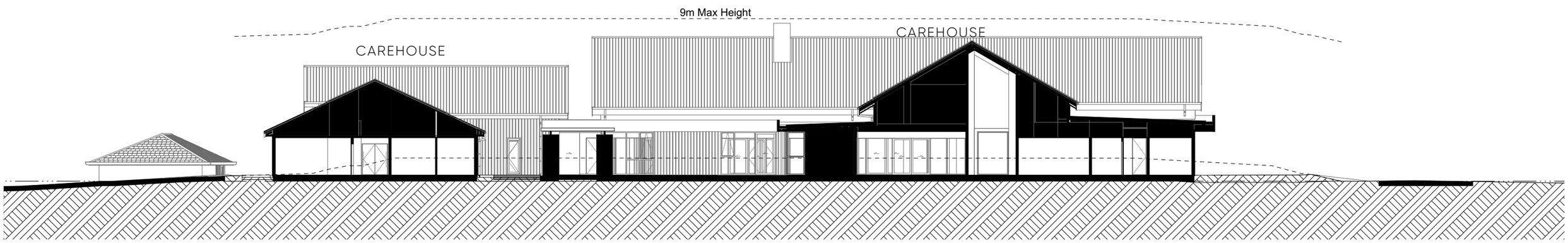
QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

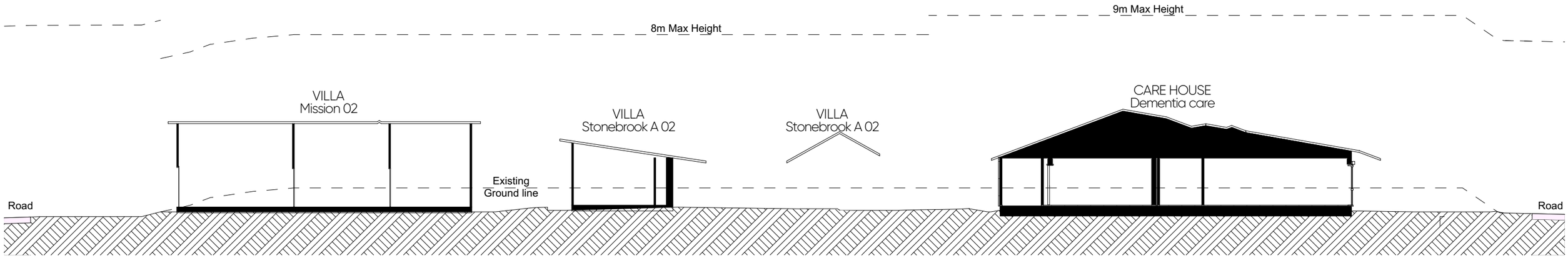
CLUB & CARE HOUSE / ZONE A SITE PLAN | 1:500 @ A3
REVISION A

RC.03
12/11/2025

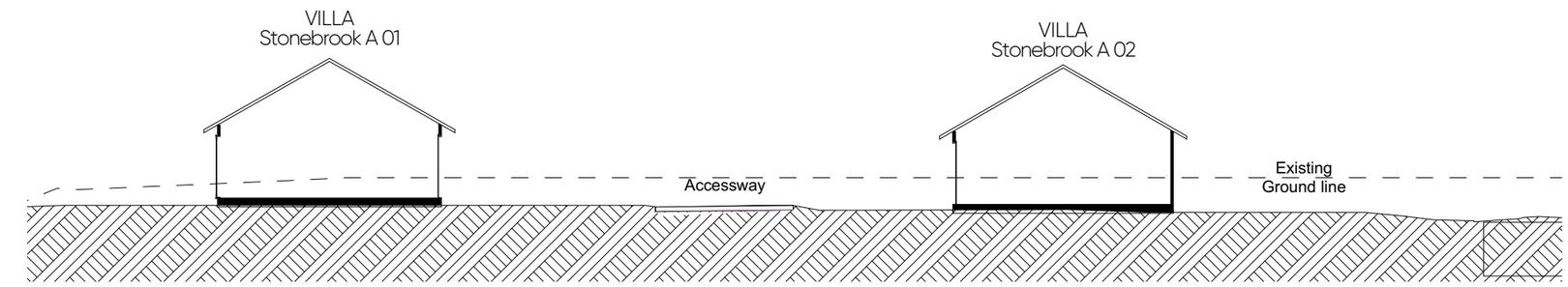
01 club house section: 01 — Scale 1:250 @ A3 — RC.03



02 club & care house section: 02 — Scale 1:250 @ A3 — RC.03



01 Zone A section 01
Scale 1:200 @ A3
-
RC.03



02 Zone A section 02
Scale 1:200 @ A3
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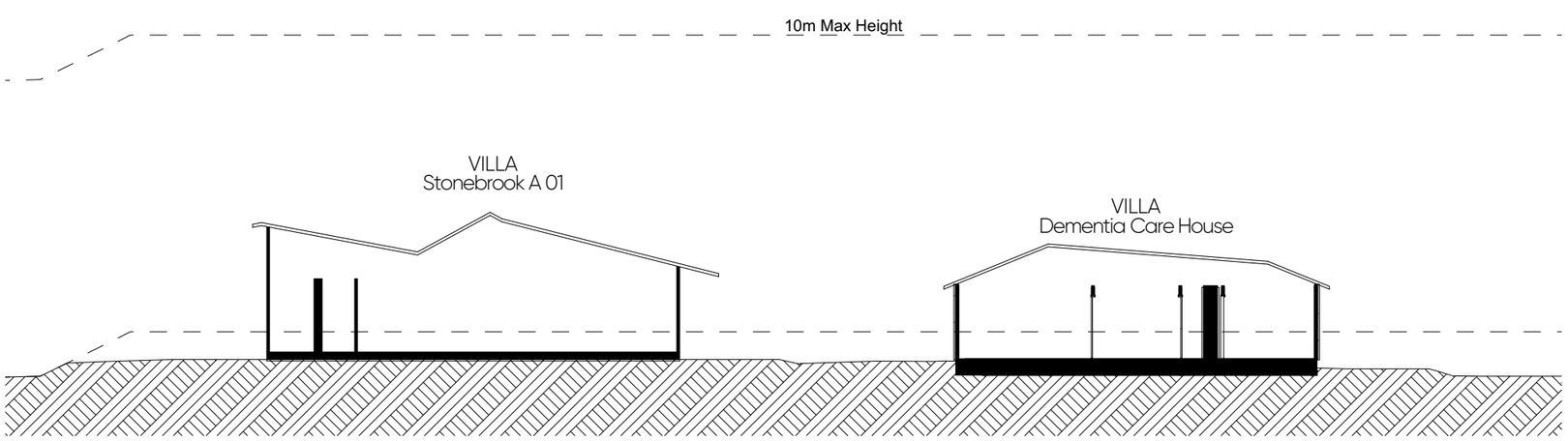
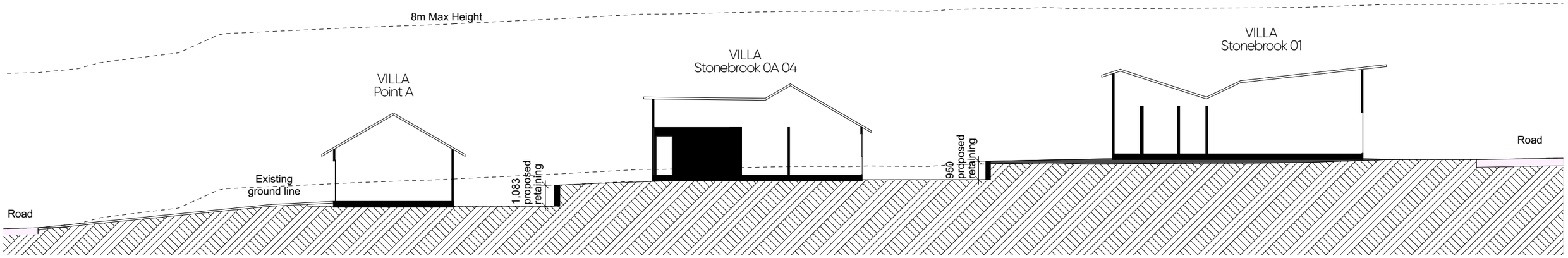
RC.03



03 Zone A section 03
Scale 1:200 @ A3
-
RC.03

villa legend

- Existing Villas
- Grange (modified)
  Area: 234m²
- Stonebrook A - 01 (modified)
  Area: 189m²
- Stonebrook A - 04 (modified)
  Area: 189m²
- Point A (modified)
  Area: 215m²



01 Zone B section 01
Scale 1:200 @ A3
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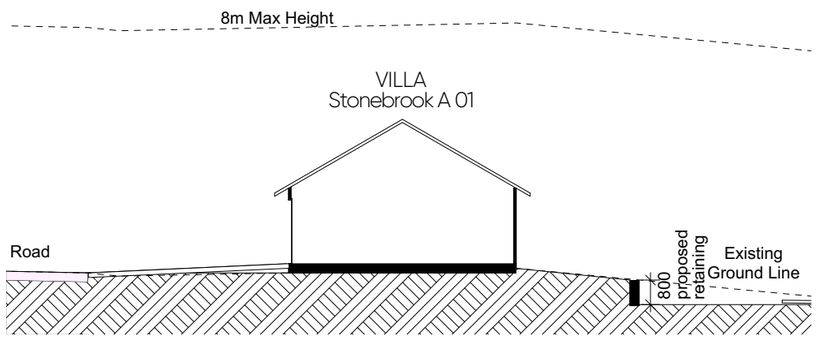
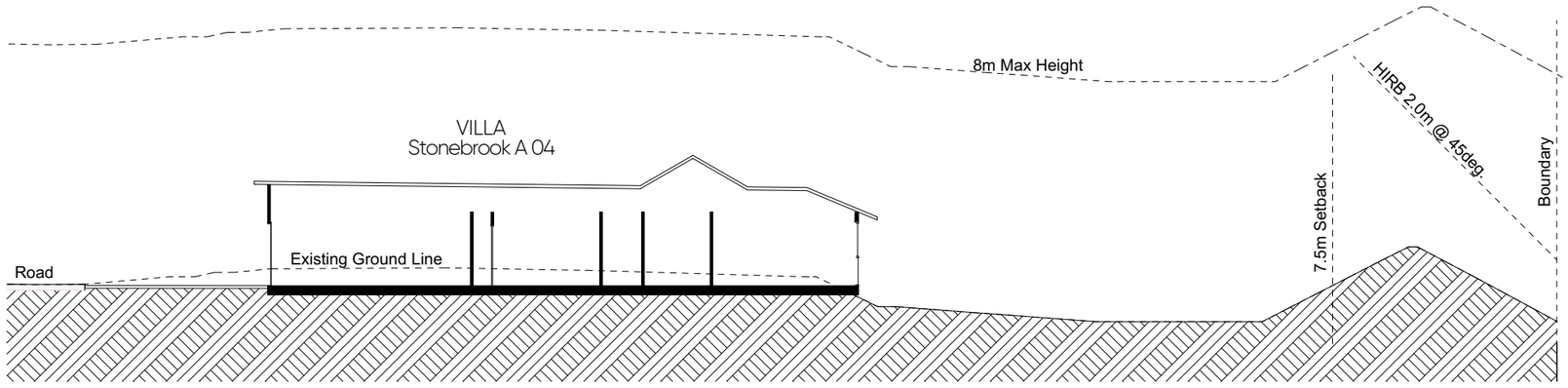
RC.06



02 Zone B section 02
Scale 1:200 @ A3
-
RC.06



03 Zone B section 03
Scale 1:200 @ A3
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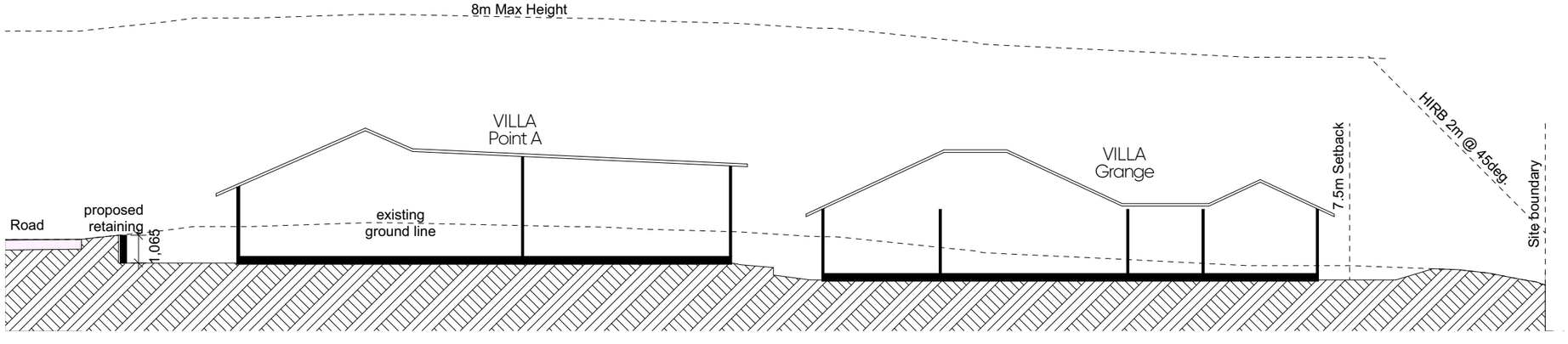
RC.06



04 Zone B section 04
Scale 1:200 @ A3
-
RC.06

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

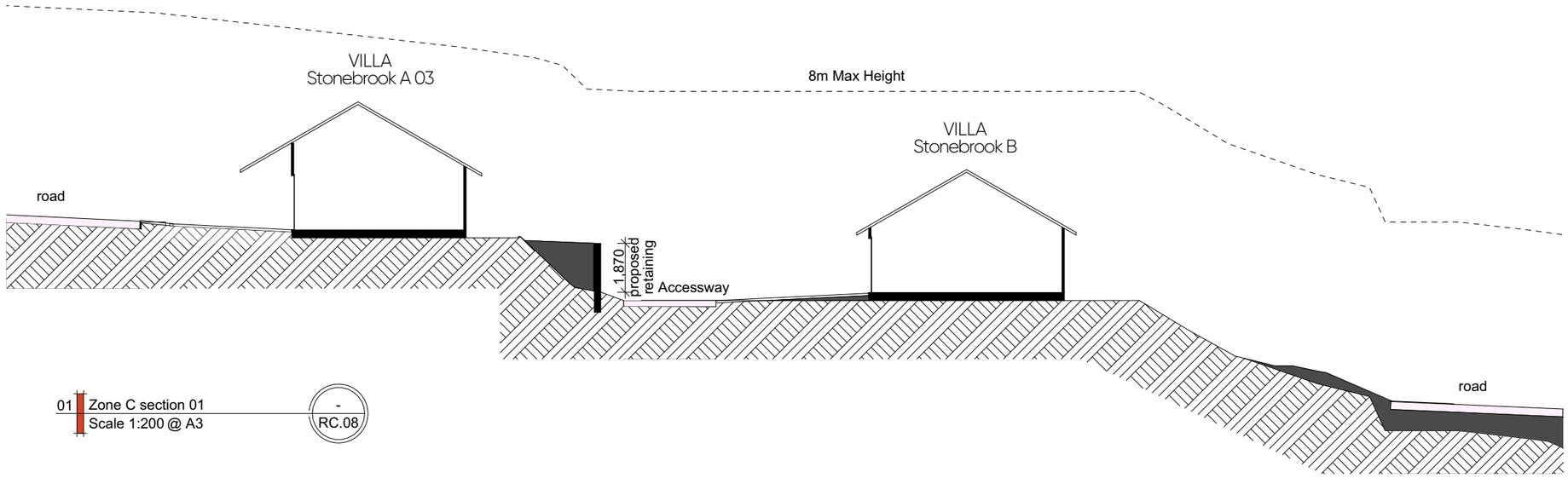
Quail Ridge Country Club

SECTIONS: ZONE B | 1:200 @ A3
REVISION A

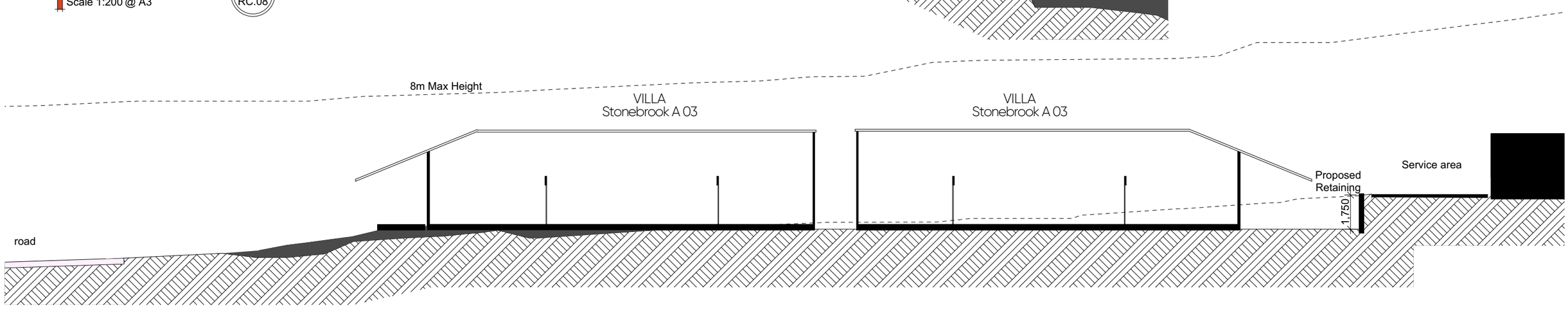
RC.07
12/11/2025

villa legend

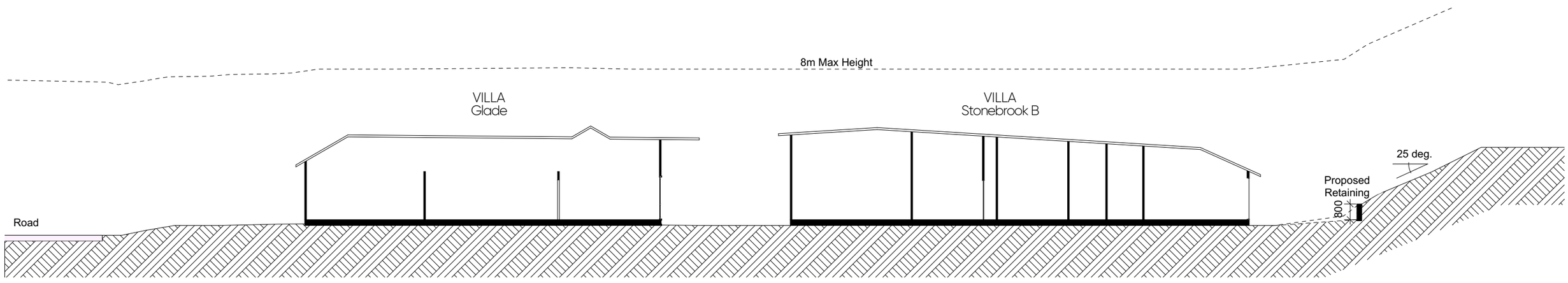
- Existing Villas
- Stonebrook A - 03 (modified)
  Area: 180m²
- Stonebrook A - 05 (modified)
  Area: 193m²
- Stonebrook B - 01 (modified)
  Area: 216m²
- Glade (modified)
  Area: 172m²
- Parisian 02 (modified)
  Area: 188m²
- Mission - 01 (modified)
  Area: 223m²



01 Zone C section 01
Scale 1:200 @ A3
- RC.08



02 Zone C section 02
Scale 1:200 @ A3
- RC.08



03 Zone C section 03
Scale 1:200 @ A3
- RC.08

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

SECTIONS: ZONE C | 1:200 @ A3
REVISION A

RC.09
12/11/2025

villa legend

- Existing Villas
- Parisian 01 (modified) Area: 181m²
- Parisian 02 (modified) Area: 188m²
- Parisian 03 (modified) Area: 188m²
- Mission - 01 (modified) Area: 223m²
- Mission Roberts (original) Area: 249m²
- Stonebrook A - 05 (modified) Area: 193m²
- Glade (modified) Area: 172m²

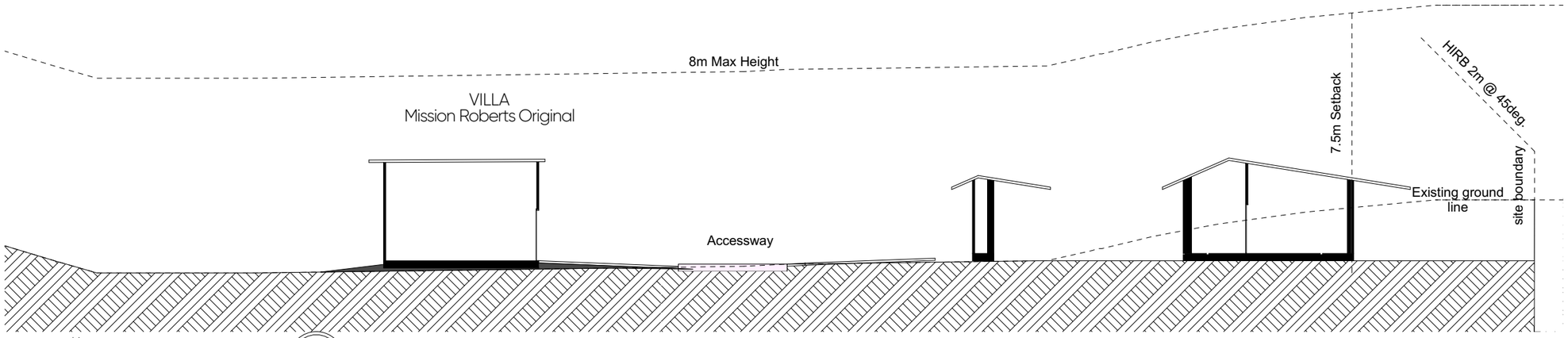
FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

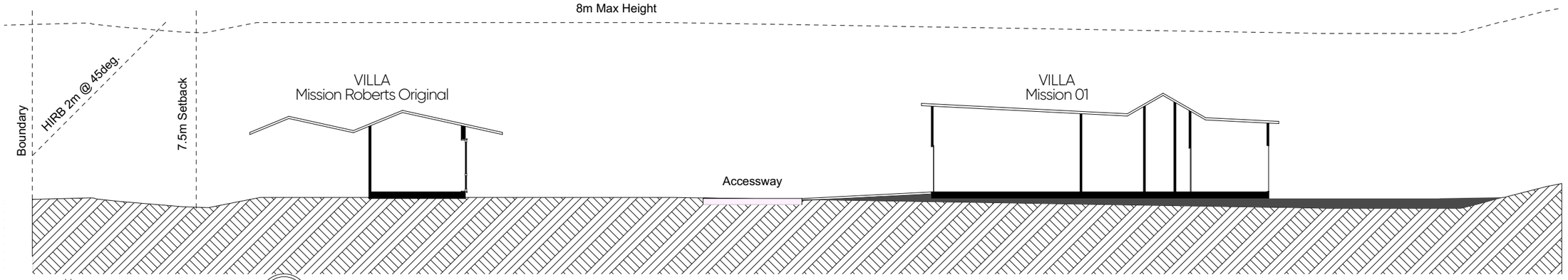
Quail Ridge Country Club

ZONE D SITE PLAN | 1:500 @ A3
REVISION A

RC.10
12/11/2025



01 Zone D section 01
Scale 1:200 @ A3
-
RC.10



02 Zone D section 02
Scale 1:200 @ A3
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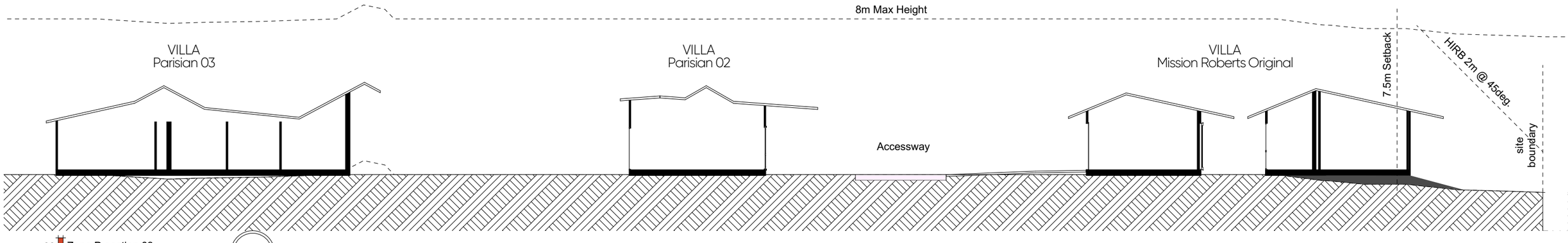
RC.10



03 Zone D section 03
Scale 1:200 @ A3
-
RC.10

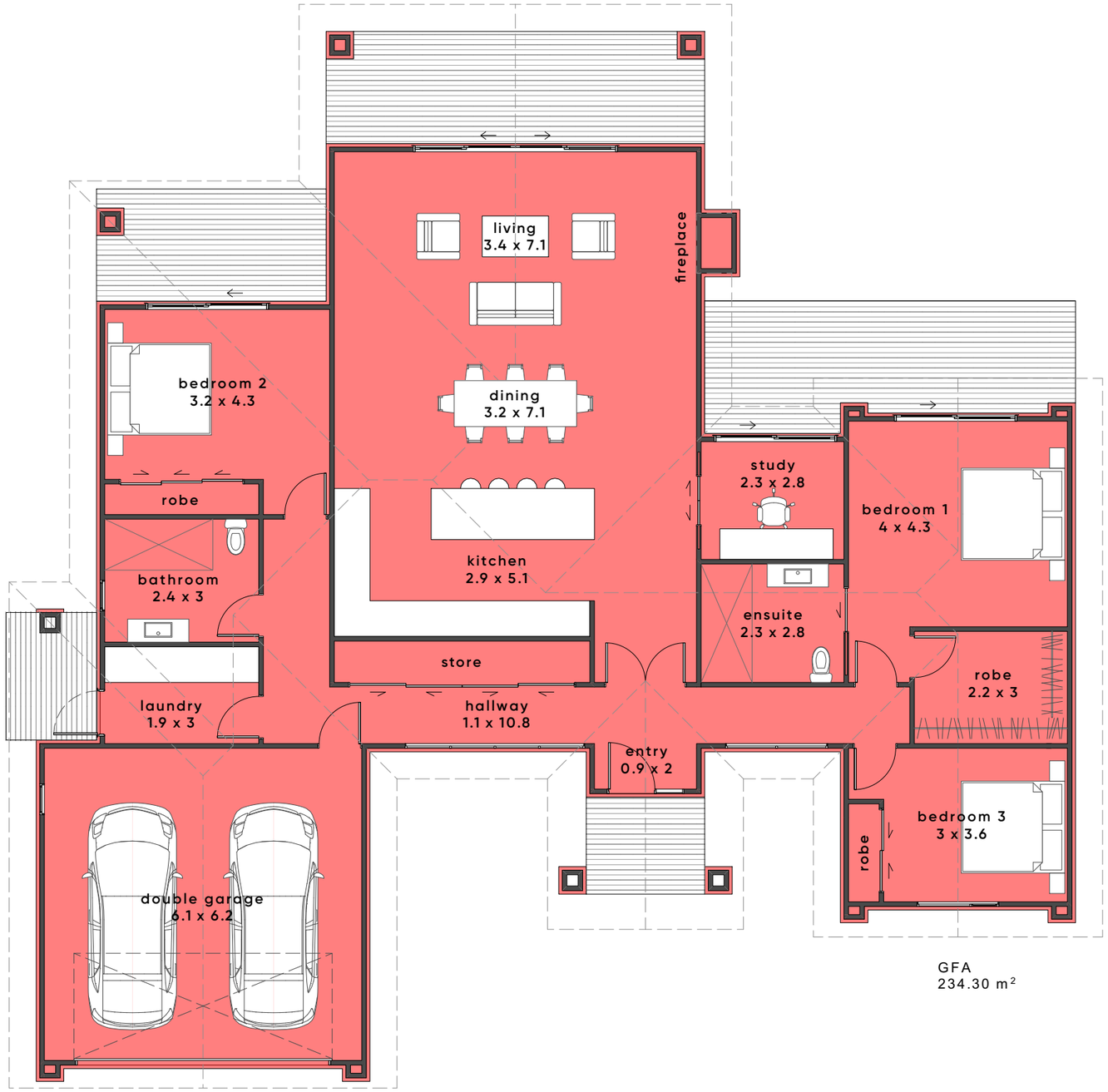
FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

SECTIONS: ZONE D | 1:200 @ A3
REVISION A

RC.11
12/11/2025



GFA
234.30 m²

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

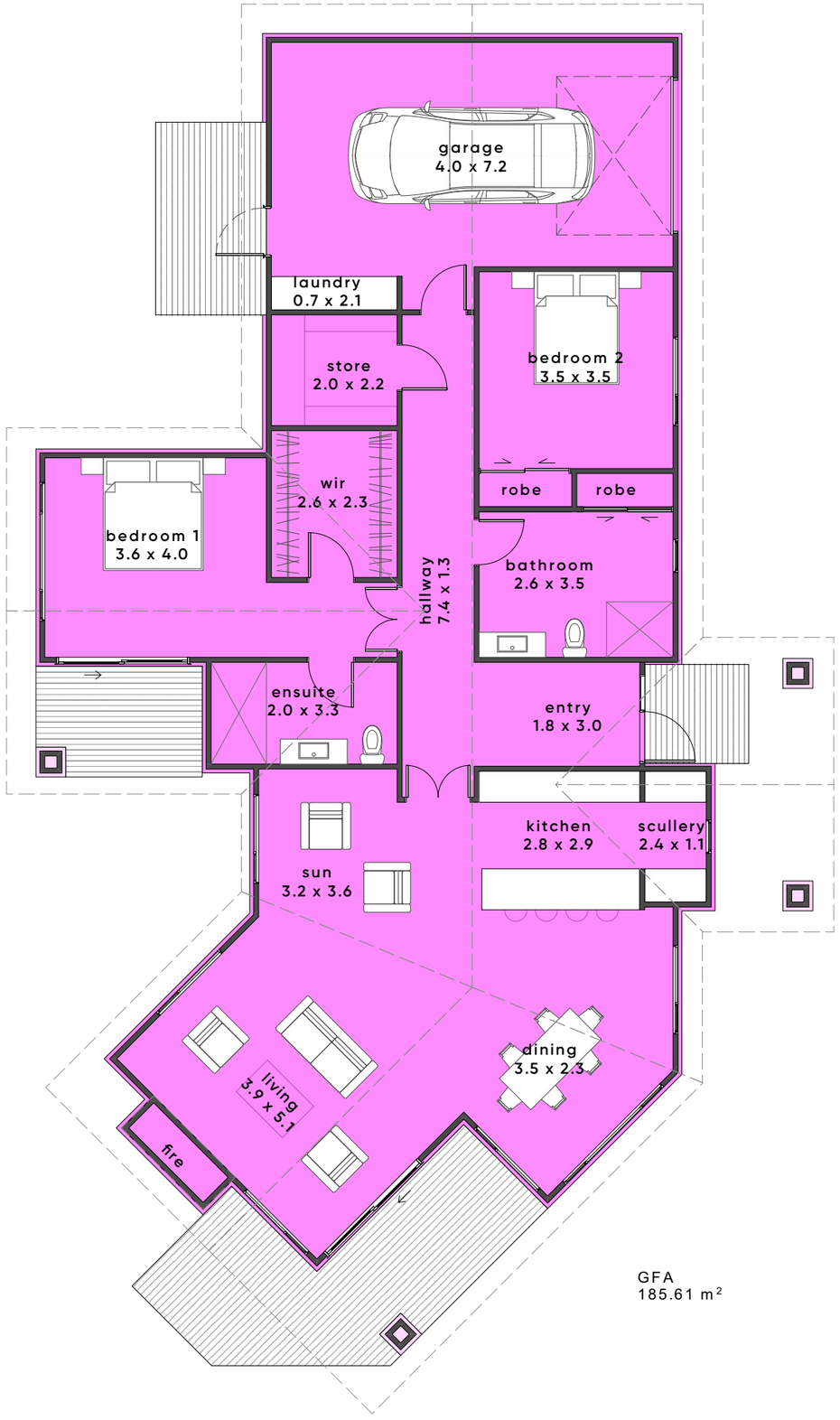
Quail Ridge Country Club

GRANGE VILLA | 1:100 @ A3
REVISION A

RC.12
12/11/2025


fire
living
3.9 x 5.1
sun
3.2 x 3.6
kitchen
2.5 x 2.9
scullery
2.4 x 1.1
ensuite
2.4 x 2.7
dining
3.5 x 2.3
wir
2.2 x 2.9
bedroom 1
3.6 x 3.9
entry
1.8 x 2.1
bathroom
2.8 x 2.3
hallway
7.4 x 1.3
bedroom 2
3.5 x 3.5
store
2.2 x 2.3
st.
robe
store
laundry
0.7 x 1.9
garage
6.0 x 7.2

GFA
188.60 m²



GFA
185.61 m²

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

STONEBROOK A - 02 | 1:100 @ A3
REVISION A

RC.14
12/11/2025

GFA
179.81 m²

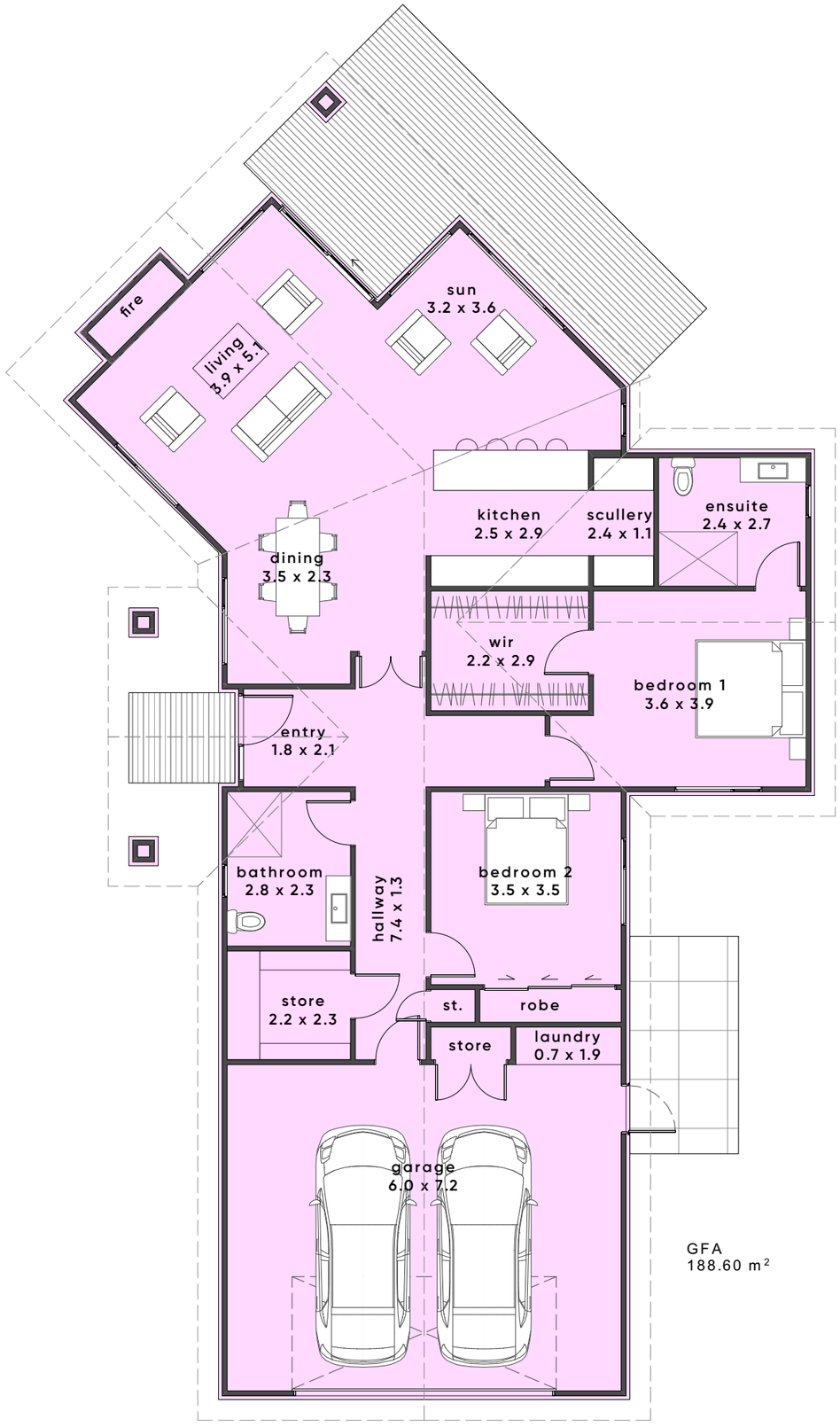
FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

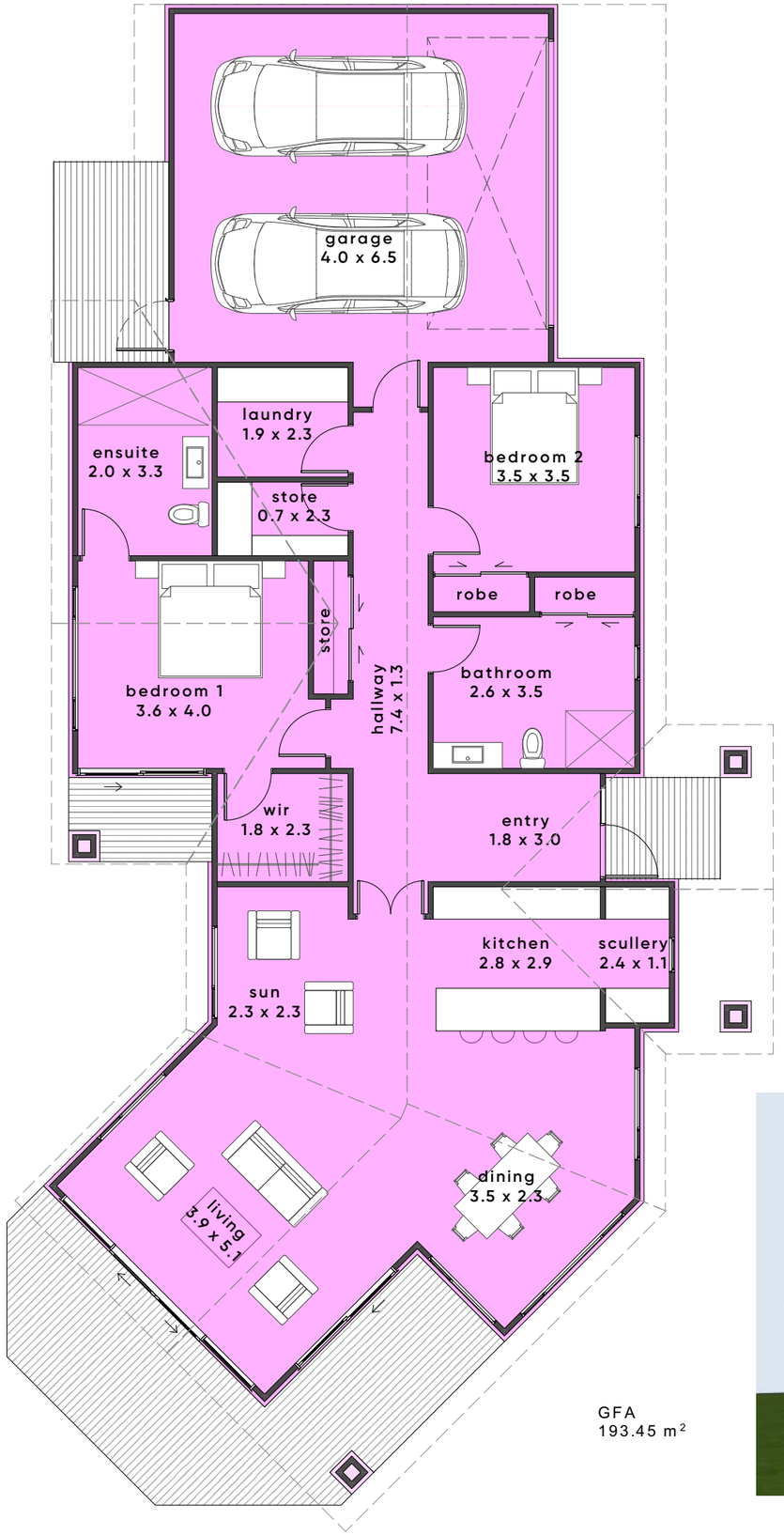
Quail Ridge Country Club

STONEBROOK A - 03 | 1:100 @ A3
REVISION A

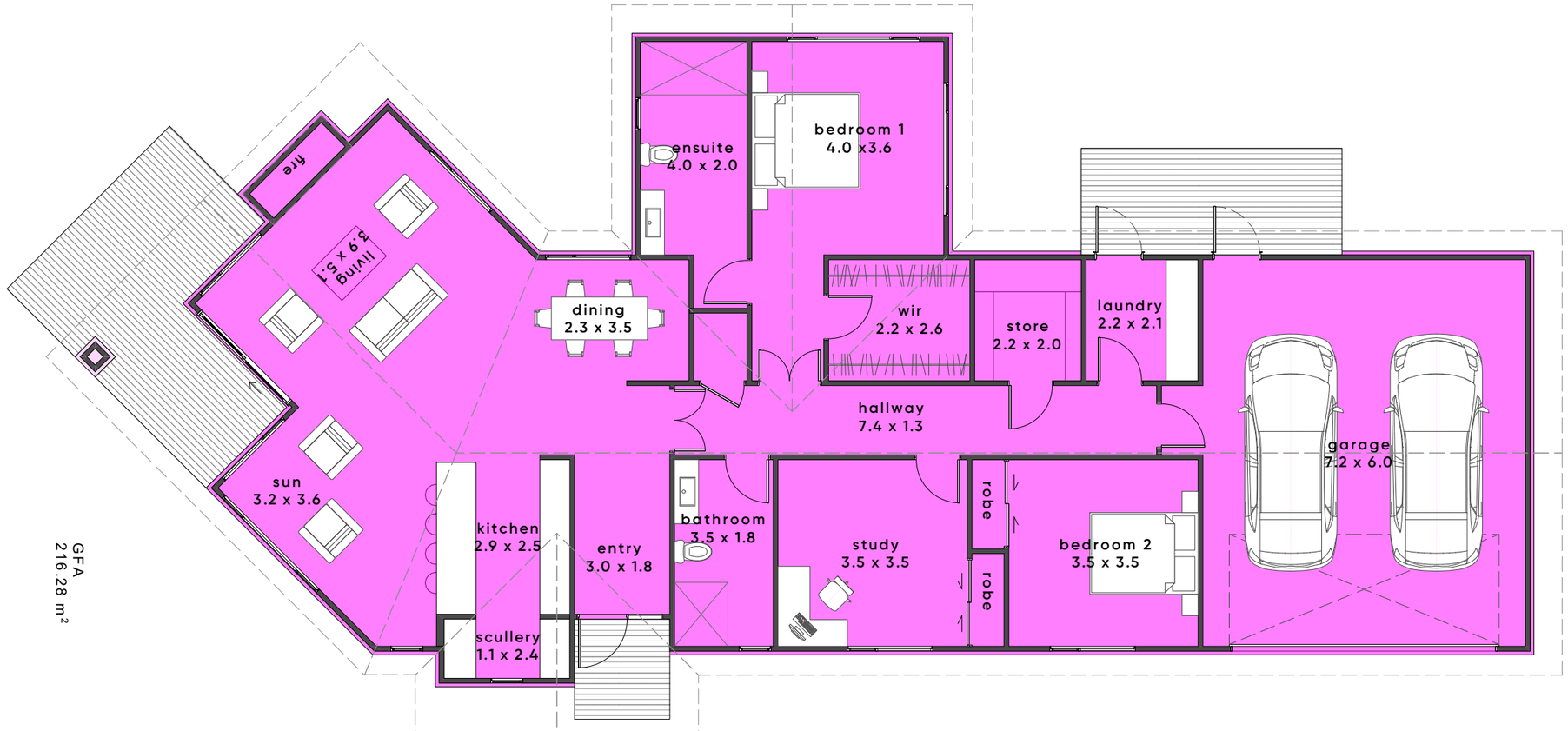
RC.15
12/11/2025


fire
living
3.9 x 5.1
sun
3.2 x 3.6
kitchen
2.5 x 2.9
scullery
2.4 x 1.1
ensuite
2.4 x 2.7
dining
3.5 x 2.3
wir
2.2 x 2.9
bedroom 1
3.6 x 3.9
entry
1.8 x 2.1
bathroom
2.8 x 2.3
hallway
7.4 x 1.3
bedroom 2
3.5 x 3.5
store
2.2 x 2.3
st.
robe
store
laundry
0.7 x 1.9
garage
6.0 x 7.2

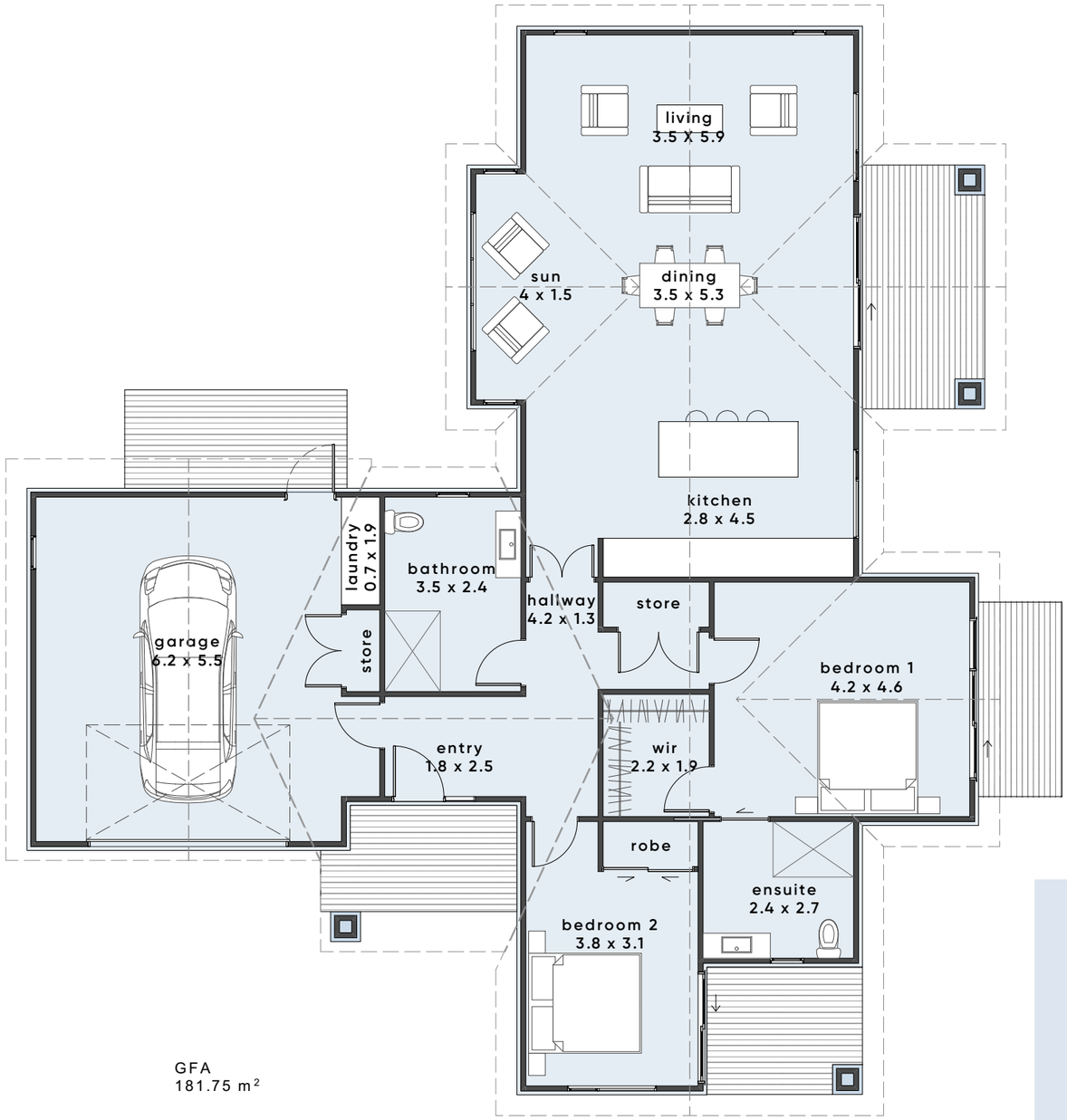
GFA
188.60 m²


garage
4.0 x 6.5
laundry
1.9 x 2.3
ensuite
2.0 x 3.3
store
0.7 x 2.3
bedroom 2
3.5 x 3.5
robe
robe
store
hallway
7.4 x 1.3
bedroom 1
3.6 x 4.0
bathroom
2.6 x 3.5
wir
1.8 x 2.3
entry
1.8 x 3.0
kitchen
2.8 x 2.9
scullery
2.4 x 1.1
sun
2.3 x 2.3
dining
3.5 x 2.3
living
3.9 x 5.1

GFA
193.45 m²


fire
living
3.9 x 5.1
dining
2.3 x 3.5
ensuite
4.0 x 2.0
bedroom 1
4.0 x3.6
wir
2.2 x 2.6
store
2.2 x 2.0
laundry
2.2 x 2.1
hallway
7.4 x 1.3
garage
7.2 x 6.0
sun
3.2 x 3.6
kitchen
2.9 x 2.5
entry
3.0 x 1.8
bathroom
3.5 x 1.8
study
3.5 x 3.5
robe
robe
bedroom 2
3.5 x 3.5
scullery
1.1 x 2.4

GFA
216.28 m²



GFA
181.75 m²

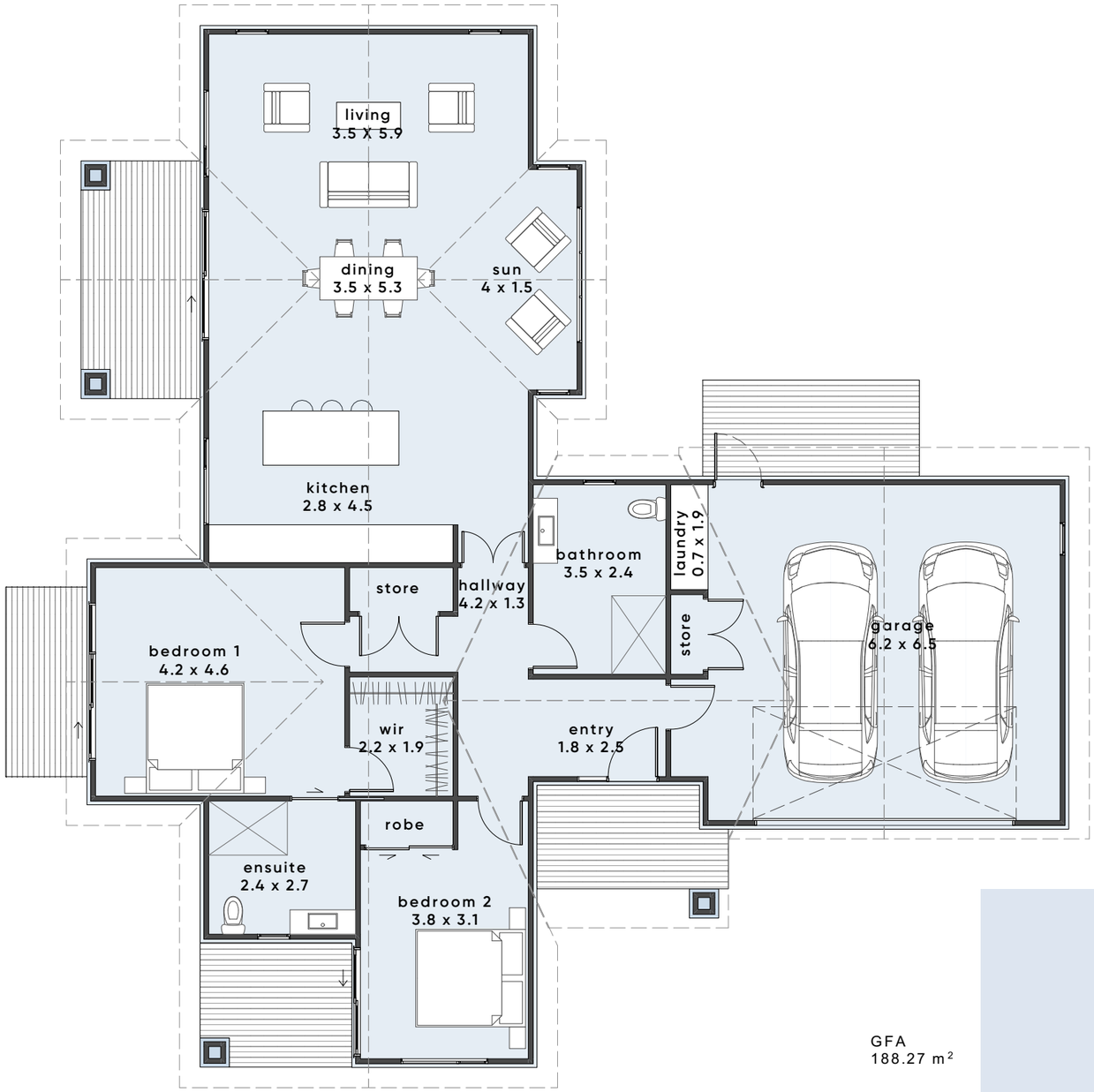
FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

PARISIAN - 01 | 1:100 @ A3
REVISION A

RC.19
12/11/2025



GFA
188.27 m²

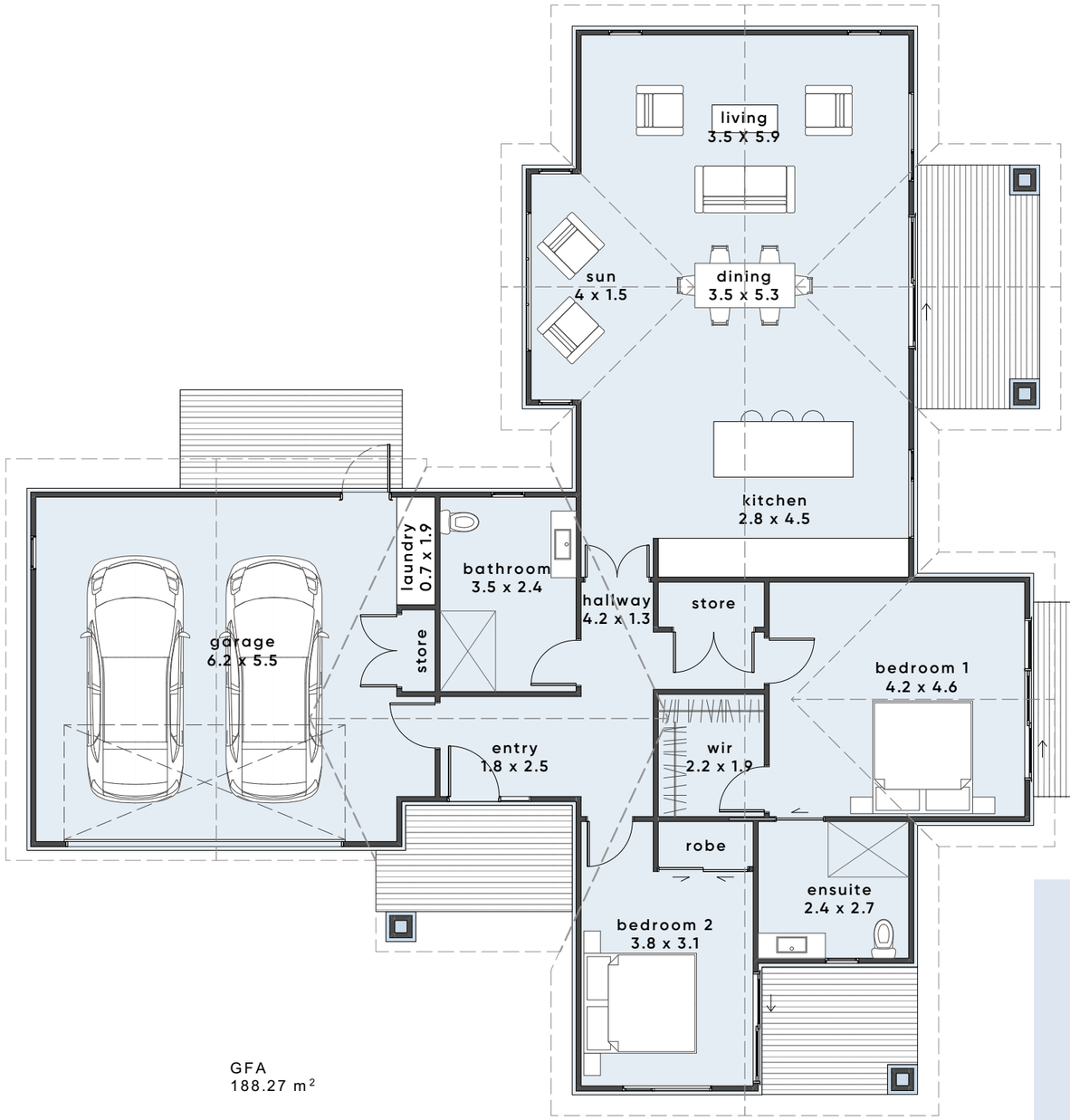
FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

PARISIAN - 02 | 1:100 @ A3
REVISION A

RC.20
12/11/2025



GFA
188.27 m²

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

PARISIAN - 03 | 1:100 @ A3
REVISION A

RC.21
12/11/2025

GFA
223.44 m²

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

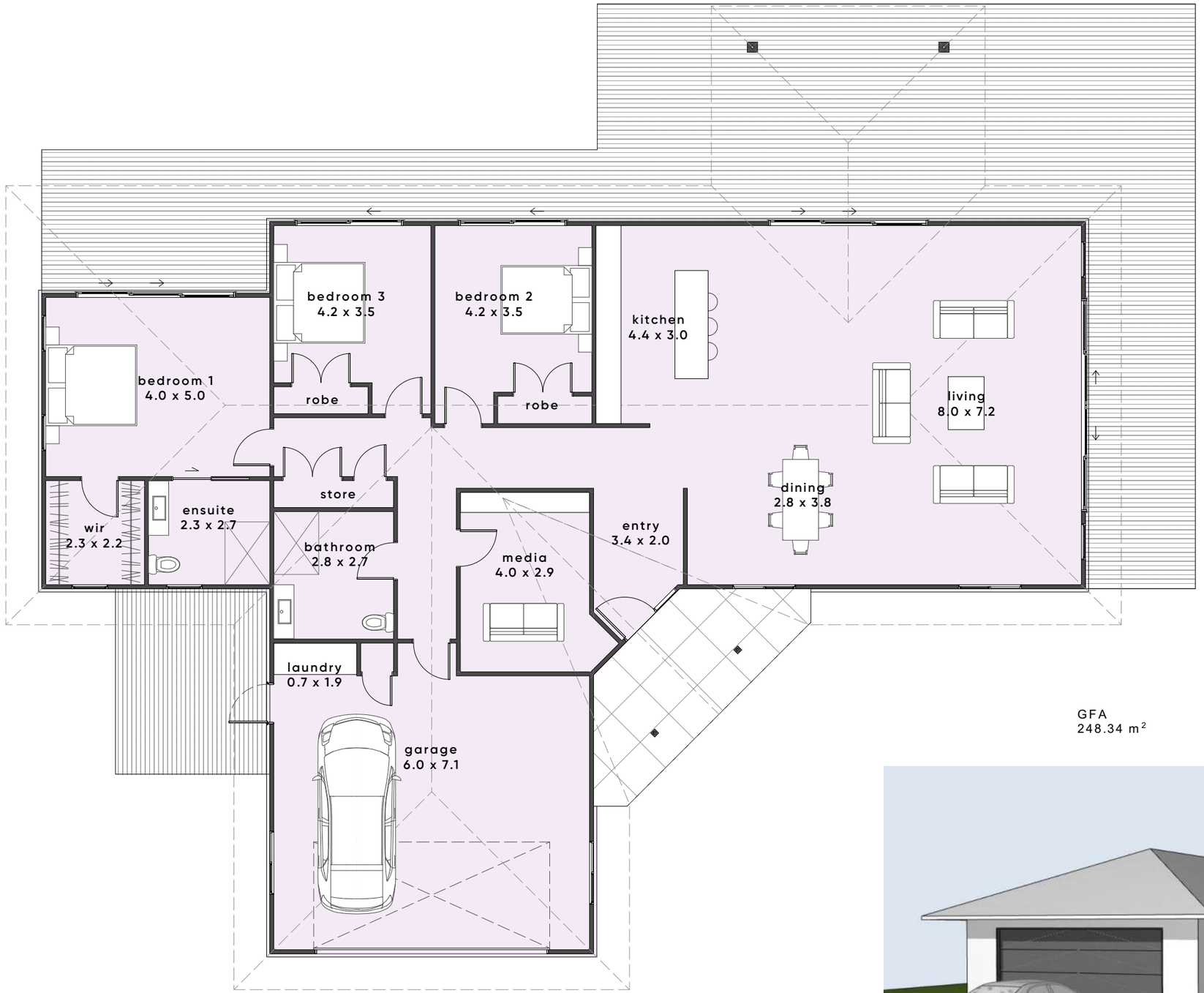
Quail Ridge Country Club

MISSION - 01 | 1:100 @ A3
REVISION A

RC.22
12/11/2025


living
3.4 x 6.2
dining
3.8 x 2.8
bedroom 2
3.4 x 3.5
bedroom 3
3.4 x 3.5
bedroom 1
4.1 x 4.9
robe
robe
store
sun
3.2 x 4.3
entry
1.2 x 2.5
kitchen
2.5 x 3.8
study
2.8 x 2.2
store
store
ensuite
2.4 x 2.6
wir
2.4 x 2.2
bathroom
2.8 x 2.7
laundry
0.7 x 1.9
st.
garage
5.9 x 7.1

GFA
223.44 m²



GFA
248.34 m²

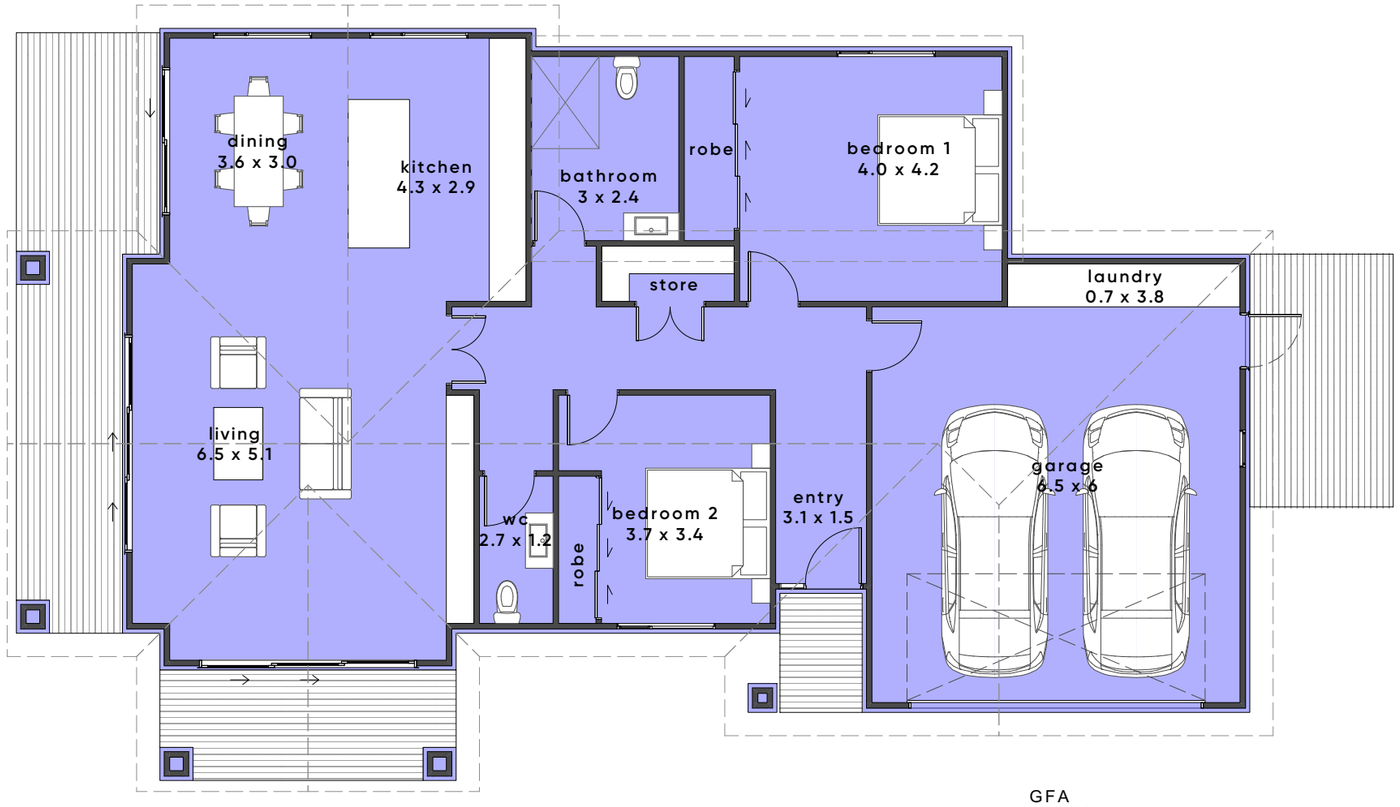
FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

MISSION ROBERTS | 1:100 @ A3
REVISION A

RC.24
12/11/2025



GFA
172.56 m²

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

GLADE | 1:100 @ A3
REVISION A

RC.25
12/11/2025

GFA
215.47 m²

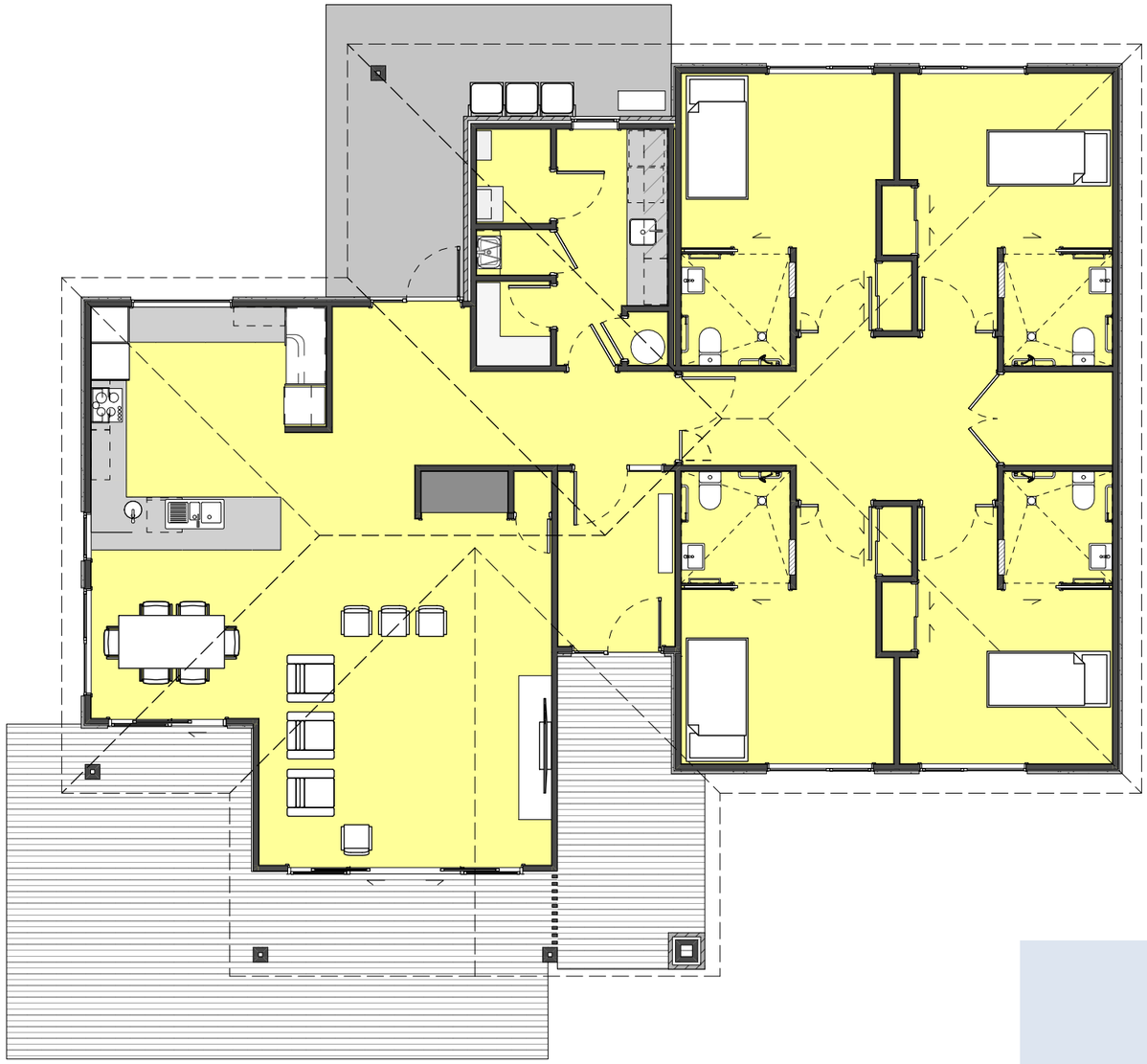
FOLEY GROUP

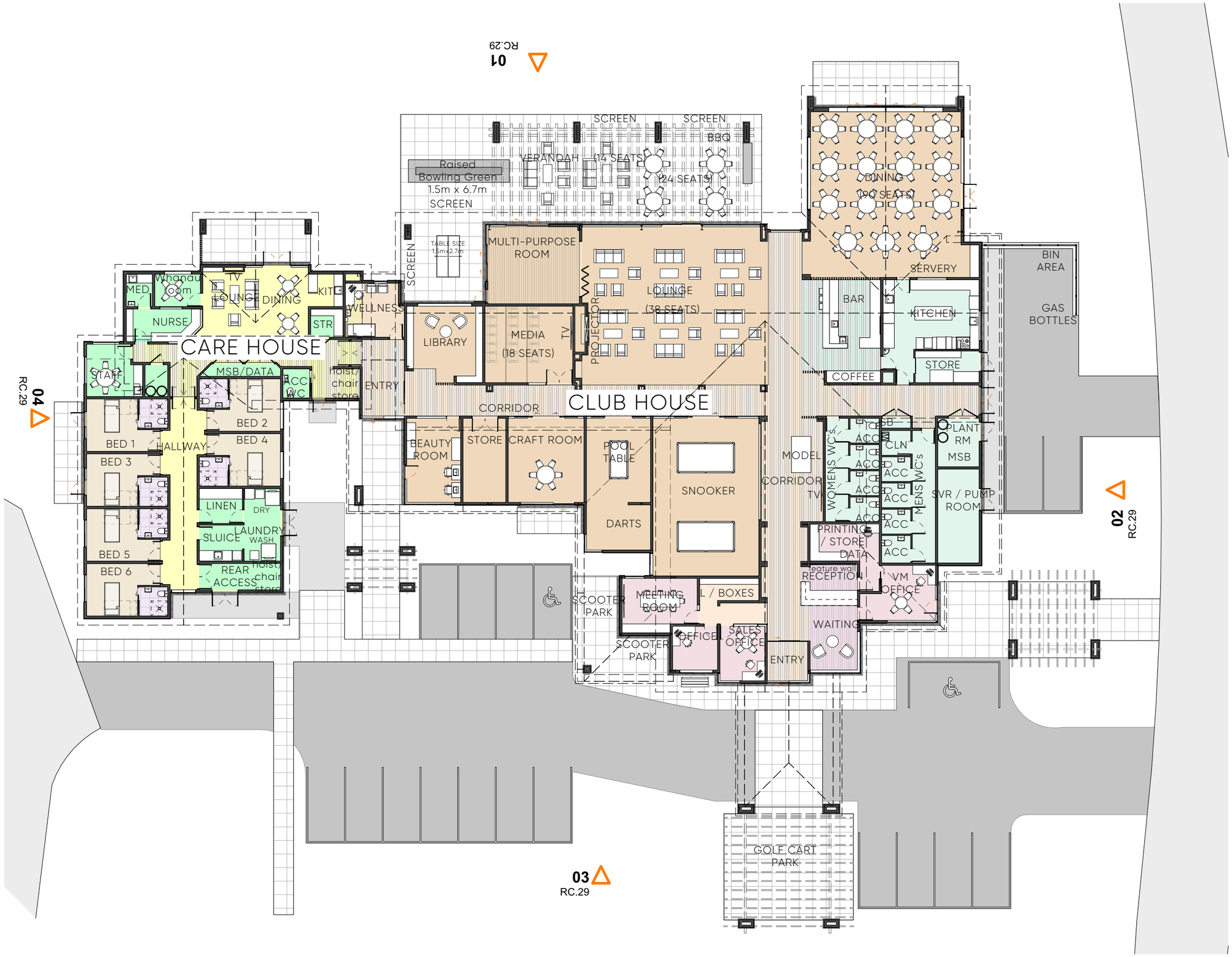
QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

POINT A | 1:100 @ A3
REVISION A

RC.26
12/11/2025





FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

CLUB & CARE HOUSE PLAN | 1:250 @ A3
REVISION A

RC.28
12/11/2025

01 elevation 01 - Scale 1:200 @ A3 -

02 elevation 02 - Scale 1:200 @ A3 -

04 elevation 04 - Scale 1:200 @ A3 -

03 elevation 03 - Scale 1:200 @ A3 -

LEGEND

- Dark profiled metal roofing flaxpod (tbc)
- Light profiled metal roofing titania (tbc)
- Dark plaster cladding (tbc)
- Light plaster cladding
- Vertical cedar cladding
- Feature stone cladding
- Dark window and door frames

Note: All exterior walls and roofs to have a reflectivity value of less than 40%

FOLEY GROUP

QUAIL RIDGE COUNTRY CLUB
3574

Quail Ridge Country Club

CLUB & CARE HOUSE ELEVATIONS | 1:200 @ A3
REVISION A

RC.29
12/11/2025

Resource Consent

FILE: 19289
(01 and 02)
Change

Document Date: 12.02.2025

Pursuant to the Resource Management Act 1991, the Northland Regional Council (hereinafter called "the council") does hereby grant a Resource Consent to:

QUAIL RIDGE COUNTRY CLUB LIMITED

To undertake the following activities associated with a retirement village on Lot 1 DP 311575 and Lot 4 DP 78387 (82 Rainbow Falls Road, Kerikeri), at or about location co-ordinates 1686081E 6102120N:

Note: All location co-ordinates in this document refer to Geodetic Datum 2000, New Zealand Transverse Mercator Projection.

AUT.019289.01.05 **Discharge tertiary treated wastewater to land.**

AUT.019289.02.04 **Discharge contaminants (odour) to air.**

Subject to the following conditions:

AUT.019289.01 – Discharge to Land

1 The volume of wastewater discharged per day shall not exceed 32.5 cubic metres.

2 The volume of wastewater discharged per day to the overflow irrigation area shall not exceed 10.5 cubic metres per day.

3 The treatment and disposal system shall be constructed generally in accordance with the **attached** drawings referenced as Northland Regional Plan Numbers **5010/A**, **5010/B** and **5010/C, 5010/D, 5010/E** and **5010/F**. However, if there are any differences or apparent conflict between these documents and any conditions of this consent, then the conditions of consent shall prevail.

4 The concentration of total suspended solids and five-day biochemical oxygen demand in the secondary treated wastewater, as measured in any wastewater sample collected from the final outlet of the wastewater treatment system prior to it being discharged to land, shall be less than 45 grams per cubic metre and 30 grams per cubic metre respectively.

5 An audible and visual high wastewater level alarm system shall be installed and maintained within each wastewater treatment system that has a pump installed and all pump stations, which is activated when high wastewater levels and/or wastewater pump failures occur. In addition, there shall be at least 24 hours emergency wastewater storage capacity within each treatment system above the level at which the high wastewater level alarm is activated.

6 The treated wastewater shall be UV treated prior to discharge.

7 The treated wastewater shall be discharged to land via a disposal bed system with a minimum basal area of 3000 square metres.

Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

8 Treated wastewater shall, at all times, be evenly loaded to the disposal bed system via a distribution system that is operating effectively.

9 The treated wastewater shall not be applied to the disposal bed system at an areal loading rate greater than 20 litres per square metre per day.

10 The treated wastewater shall not be discharged to the overflow irrigation area at an areal loading rate greater than 3 litres per square metre per day.

11 The irrigation lines within the overflow irrigation area shall, at all times, be located at least 50 millimetres beneath the surface of the disposal area or firmly affixed to the surface of the disposal area and covered by a mulch, or an appropriate alternative, to a minimum depth of 100 millimetres.

12 A meter that has a measurement error of $\pm$5% or less shall be installed and maintained on the final outlet of the wastewater treatment system to the disposal bed system and on the final outlet from the underdrain tank to the overflow irrigation area. These meters shall be used to measure the quantity of treated wastewater discharged to land.

13 To enable collection of wastewater samples, easy and safe access shall be provided at all times to a point immediately after the outlet from the wastewater treatment system to the disposal area.

14 Stormwater from all roofed and paved areas shall be diverted away from the wastewater treatment and disposal areas. In addition, stormwater from surrounding areas and groundwater shall be prevented from entering the treatment system, and stormwater from surrounding areas shall, as far as is practicable, be prevented from entering the disposal area.

15 Wastewater shall be prevented from entering stormwater including any stormwater interceptor drains.

16 The Consent Holder shall, at least two weeks prior to the installation of a new wastewater treatment system, the installation of the disposal system, and any new connection to an existing wastewater treatment system notify the council's assigned monitoring officer in writing of the proposed date that the wastewater treatment and/or disposal system is to be installed and the name of the proposed installer.

17 The installation of each treatment system and the installation of the disposal system shall be supervised by a suitably qualified and experienced person. The Consent Holder shall, within two weeks after a wastewater treatment system and/or the disposal system has been installed, submit to the council's assigned monitoring officer:

(a) A certificate of compliance or a written statement from the suitably qualified and experienced person. The certificate or statement shall provide sufficient details and information to enable the council's assigned monitoring officer to verify compliance with Conditions 3 to 15; and

(b) Final "as built" plans that show the siting of all components of the wastewater treatment and/or disposal system. For the purpose of this Condition, the Consent Holder shall ensure that the "as built" plans are drawn to scale and provide sufficient detail for a council monitoring officer to locate all features identified on the plans.

18 The Consent Holder shall keep written records of the following:

(a) The quantity of treated wastewater discharged to the disposal area each month using the meter required by Condition 12;

(b) The calculated average daily discharge volume for each calendar month;

(c) The volume of wastewater discharged to the overflow irrigation area each month using the meter required by Condition 12; and

(d) A record of all maintenance undertaken on the wastewater treatment and disposal system.

19 A copy of the records required by Condition 18 for the previous year (1 July to 31 June) shall be forwarded to the council's assigned monitoring officer by the following 31 July or immediately on written request by the council.

20 The wastewater disposal area shall, at all times, be planted with appropriate plant species and shall be adequately maintained so that plant coverage of the area is maximised.

21 Vehicles and stock shall, at all times be prevented from accessing the disposal areas.

22 A reserve disposal area that is equal to at least 28 percent of the design disposal area shall remain undeveloped for future use if required. For this condition, "undeveloped" is defined as not being covered by an impermeable surface or permanent structure.

23 There shall be no ponding of wastewater within, or surface runoff of any contaminants from, the wastewater treatment and disposal areas as a result of the exercise of this consent.

24 The Consent Holder shall have a contract with a suitably qualified and experienced person to maintain the wastewater treatment and disposal system so that it works effectively at all times.

Advice Note: *For compliance purposes, a "suitably qualified and experienced person" is a person employed or trained by the manufacturer of the wastewater treatment system, or someone who can provide evidence of satisfactory qualifications and/or experience in maintaining the type of wastewater treatment and disposal system installed.*

AUT.019289.02 – Discharge to Air

25 The operation of the wastewater treatment and disposal system shall not give rise to any discharge of contaminants to air at or beyond the legal boundary of the Consent Holder's property that are deemed by a council monitoring officer to be noxious, dangerous, offensive, or objectionable.

General Conditions

26 These consents do not commence until 1 April 2025, being the day after the expiry of resource consents AUT.019289.01.03 and AUT.019289.02.02 unless these consents have been surrendered in writing beforehand.

27 The Consent Holder shall notify the council in writing if the property is sold, within four weeks of the sale. This is to allow the council, if required, to initiate the transfer of these consents to the new owners.

28 The Consent Holder shall, on becoming aware of any discharge associated with the Consent Holder's operations that is not authorised by these consents:

(a) Immediately take such action, or execute such work as may be necessary, to stop and/or contain the discharge; and

(b) Immediately notify the council by telephone of the discharge; and

(c) Take all reasonable steps to remedy or mitigate any adverse effects on the environment resulting from the discharge; and

(d) Report to the council's assigned monitoring officer in writing within one week on the cause of the discharge and the steps taken, or being taken, to effectively control or prevent the discharge.

For telephone notification during the council's opening hours, the council's assigned monitoring officer for these consents shall be contacted. If that person cannot be spoken to directly, or it is outside of the council's opening hours, then the Environmental Hotline shall be contacted.

Advice Note: *The Environmental Hotline is a 24 hour, seven day a week, service that is free to call on 0800 504 639.*

29 These consents shall not lapse until their expiry.

30 The council may, in accordance with Section 128 of the Resource Management Act 1991 (The Act) serve notice on the Consent Holder of its intention to review the conditions of this consent annually during the month of March. The review may be initiated for any one or more of the following purposes:

(a) To deal with any adverse effects on the environment that may arise from the exercise of these consents and which it is appropriate to deal with at a later stage; or

(b) To require the adoption of the best practicable option to remove or reduce any adverse effect on the environment.

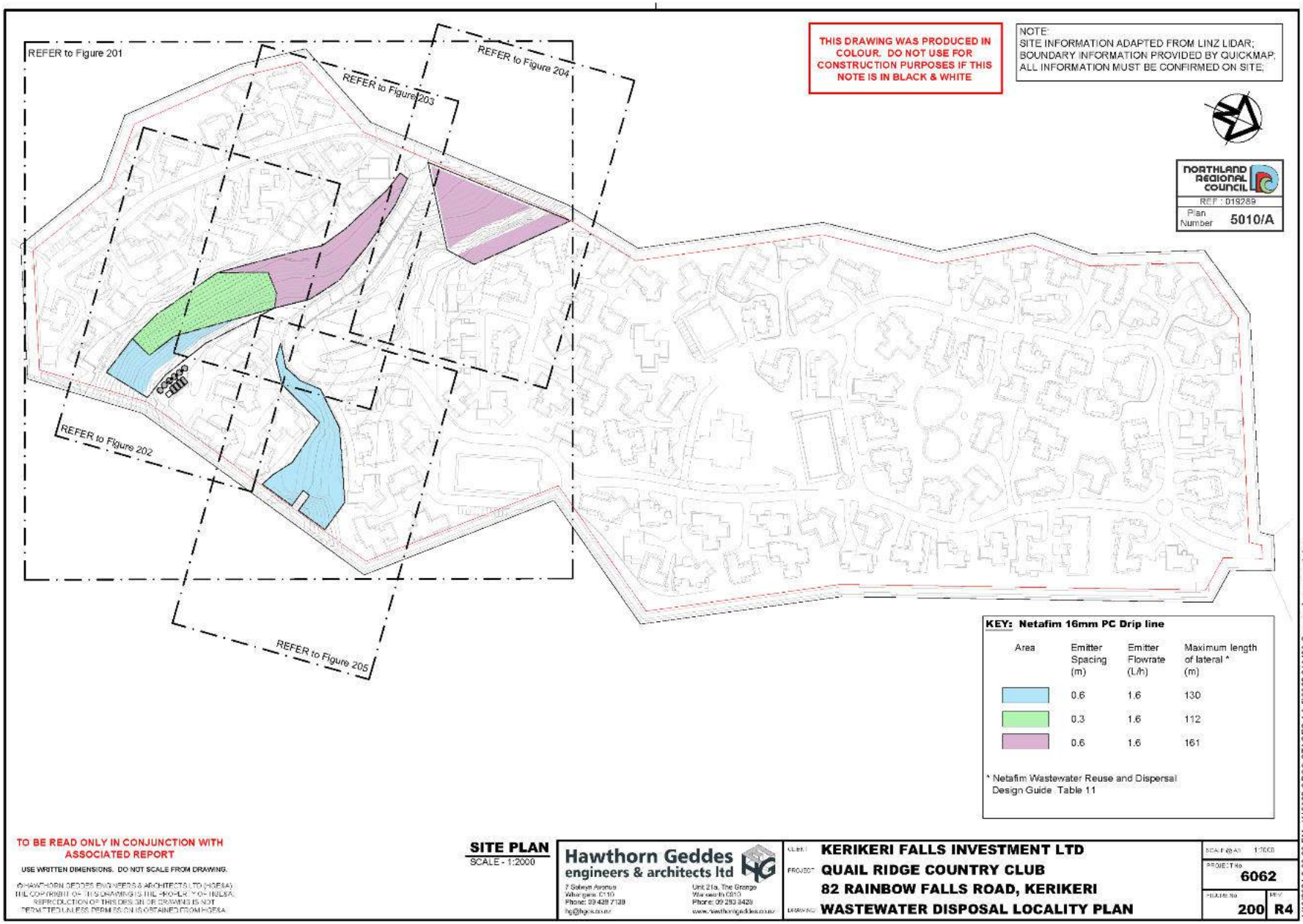
The Consent Holder shall meet all reasonable costs of any such review.

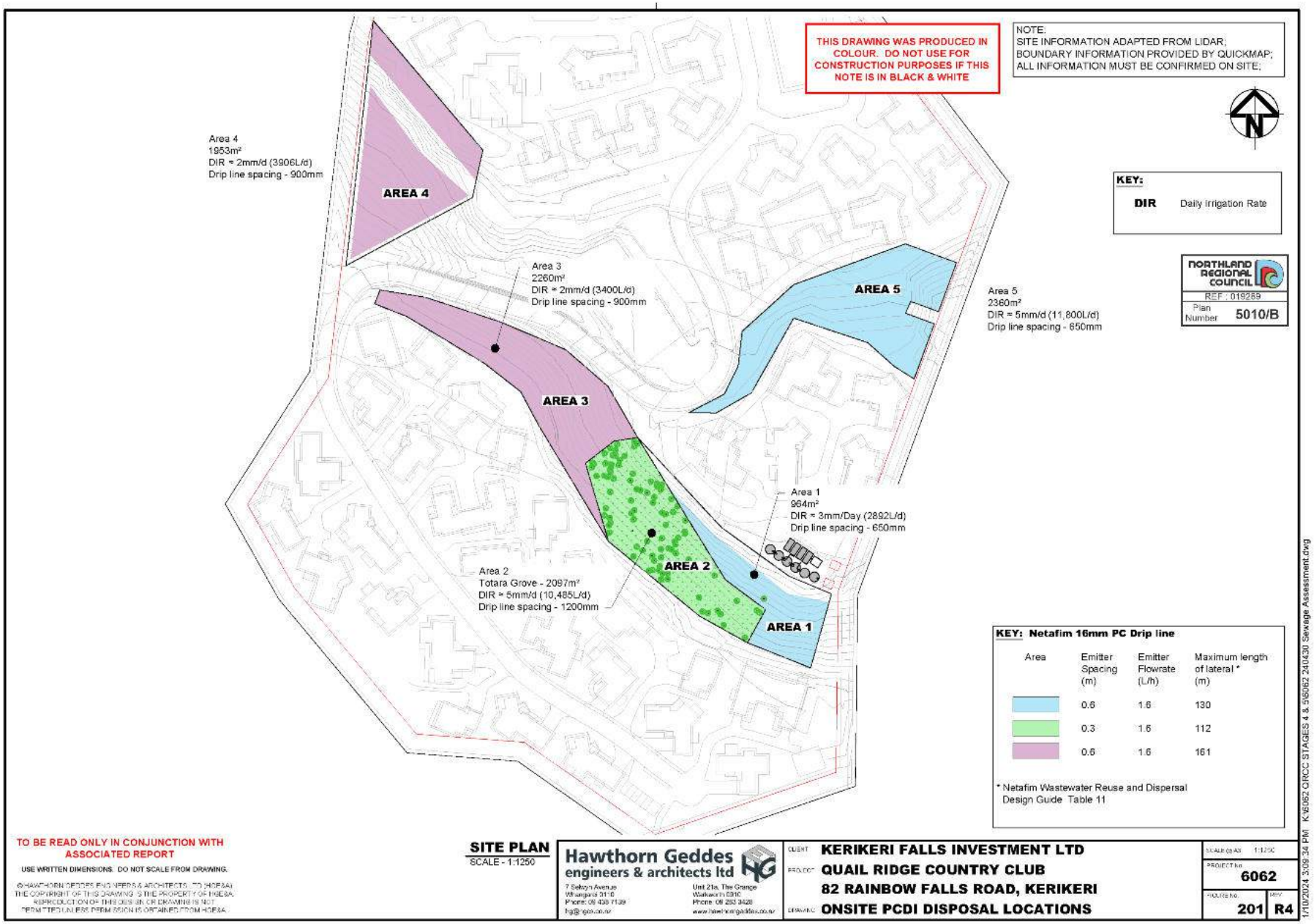
EXPIRY DATE: 30 APRIL 2031

These changes to consent Conditions 1 and 3 and replacement plans are granted this Twelfth day of February 2025 under delegated authority from the council by:

Paul Maxwell
Coastal and Works Consents Manager

Note: *The plans attached to this consent are reduced copies and therefore may not be to scale and may be difficult to read. In the event that compliance and/or enforcement action is to be based on compliance with the attached plans, it is important that the original plans, are sighted and used. Originals of the plans referred to are available for viewing at the council's Whangārei office.*


REFER to Figure 201
REFER to Figure 202
REFER to Figure 203
REFER to Figure 204
REFER to Figure 205
THIS DRAWING WAS PRODUCED IN COLOUR. DO NOT USE FOR CONSTRUCTION PURPOSES IF THIS NOTE IS IN BLACK & WHITE
NOTE:
SITE INFORMATION ADAPTED FROM LINZ LIDAR;
BOUNDARY INFORMATION PROVIDED BY QUICKMAP;
ALL INFORMATION MUST BE CONFIRMED ON SITE;
NORTHLAND REGIONAL COUNCIL
REF : 019289
Plan Number 5010/A
KEY: Netafim 16mm PC Drip line
Area | Emitter Spacing (m) | Emitter Flowrate (L/h) | Maximum length of lateral * (m)
0.6 | 1.6 | 130
0.3 | 1.6 | 112
0.6 | 1.6 | 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:2000
Hawthorn Geddes engineers & architects ltd
7 Selwyn Avenue, Whangarei 0110, Phone: 09 438 7138, hg@hgea.co.nz
Unit 2 Ila, The Grange, Warkworth 0910, Phone: 09 253 8428, www.hawthorngeddes.co.nz
CLIENT: KERIKERI FALLS INVESTMENT LTD
PROJECT: QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
DRAWING: WASTEWATER DISPOSAL LOCALITY PLAN
SCALE @ A1: 1:2000
PROJECT No: 6062
DRAWING No: 200
REV: R4
1/10/2024 3:08:28 PM K:\6062 QRCC STAGES 4 & 5\6062 240430 Sewage Assessment.dwg


THIS DRAWING WAS PRODUCED IN COLOUR. DO NOT USE FOR CONSTRUCTION PURPOSES IF THIS NOTE IS IN BLACK & WHITE
NOTE:
SITE INFORMATION ADAPTED FROM LIDAR;
BOUNDARY INFORMATION PROVIDED BY QUICKMAP;
ALL INFORMATION MUST BE CONFIRMED ON SITE;
N
KEY:
DIR Daily Irrigation Rate
NORTHLAND REGIONAL COUNCIL
REF : 019289
Plan Number 5010/B
Area 4
1953m²
DIR = 2mm/d (3906L/d)
Drip line spacing - 900mm
AREA 4
Area 3
2260m²
DIR = 2mm/d (3400L/d)
Drip line spacing - 900mm
AREA 3
AREA 5
Area 5
2360m²
DIR = 5mm/d (11,800L/d)
Drip line spacing - 650mm
Area 1
964m²
DIR = 3mm/Day (2892L/d)
Drip line spacing - 650mm
AREA 2
Area 2
Totara Grove - 2097m²
DIR = 5mm/d (10,485L/d)
Drip line spacing - 1200mm
AREA 1
KEY: Netafim 16mm PC Drip line
Area
Emitter Spacing (m)
Emitter Flowrate (L/h)
Maximum length of lateral * (m)
0.6 1.6 130
0.3 1.6 112
0.6 1.6 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
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SITE PLAN
SCALE - 1:1250
Hawthorn Geddes
engineers & architects ltd
7 Selwyn Avenue
Whangarei 0110
Phone: 09 438 1139
hg@hgea.co.nz
Unit 21a, The Grange
Warkworth 0910
Phone: 09 250 3428
www.hawthorngeddes.co.nz
CLIENT KERIKERI FALLS INVESTMENT LTD
PROJECT QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
DRAWING ONSITE PCDI DISPOSAL LOCATIONS
SCALE @ A3 1:1250
PROJECT No 6062
FIGURE No. 201
REV R4
1/10/2024 3:09:34 PM K:\6062 QRCC STAGES 4 & 5\6062 240430 Sewage Assessment.dwg


AREA 3
AREA 2
AREA 1
Zone 3
Zone 2
Zone 1
Zone 2
Zone 1
Shed
THIS DRAWING WAS PRODUCED IN COLOUR. DO NOT USE FOR CONSTRUCTION PURPOSES IF THIS NOTE IS IN BLACK & WHITE
NOTE:
SITE INFORMATION ADAPTED FROM LINZ LIDAR;
BOUNDARY INFORMATION PROVIDED BY QUICKMAP;
ALL INFORMATION MUST BE CONFIRMED ON SITE;
KEY:
Check Valve
Air Valve
Feeder Line (50mm ID PE)
Lateral Line (50mm)
Zone boundary
NOTE:
Check Valve to be installed every 5m
Flush Valve to be installed at the end of each lateral line
PCDI lines laid along contours at Emitter Spacings in Key
Air Valve to be installed at high point of zone feeds
KEY: Netafim 16mm PC Drip line
Area | Emitter Spacing (m) | Emitter Flowrate (L/h) | Maximum length of lateral * (m)
0.6 | 1.6 | 130
0.3 | 1.6 | 112
0.6 | 1.6 | 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
NORTHLAND REGIONAL COUNCIL
REF: 019269
Plan Number 5010/C
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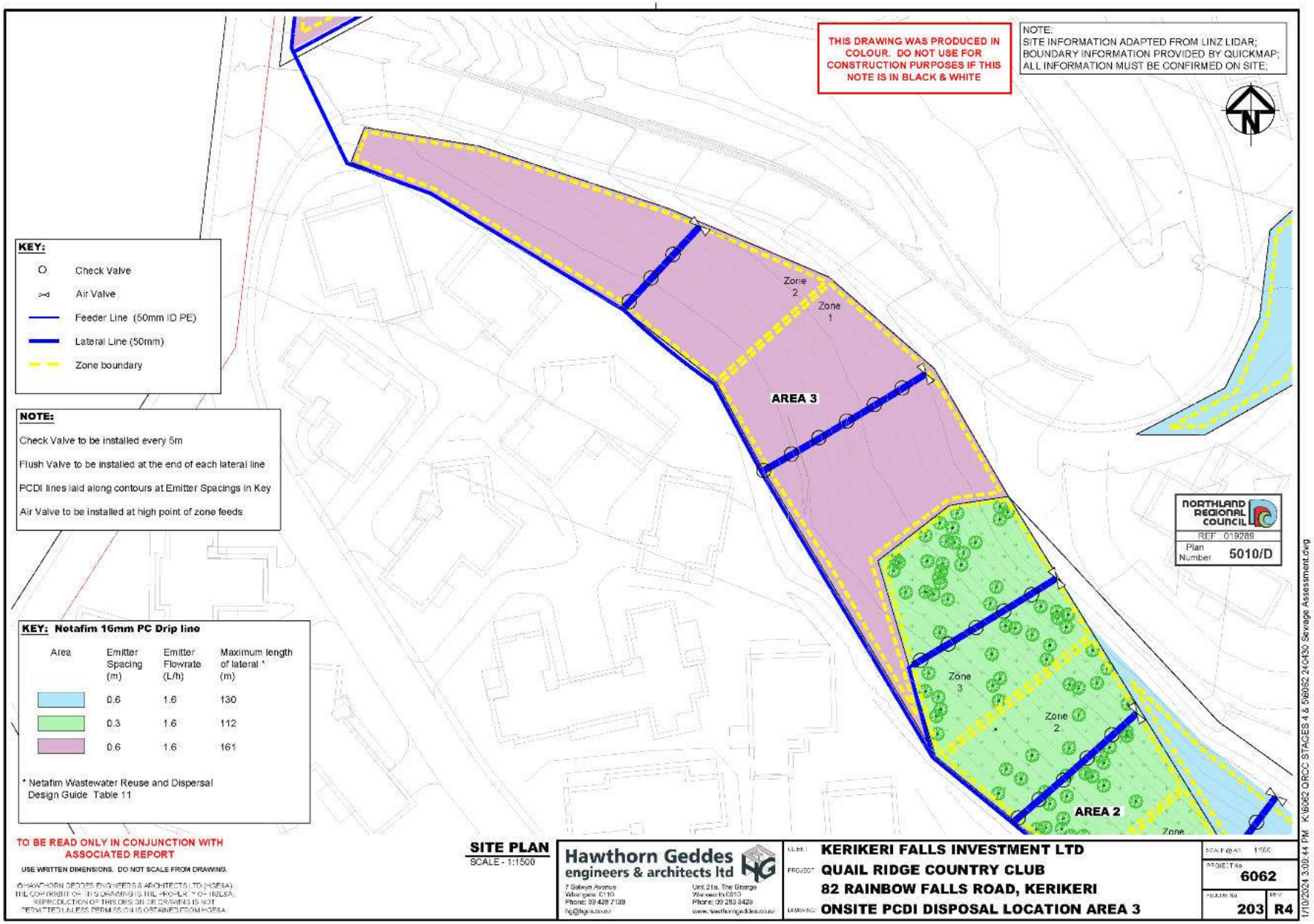
SITE PLAN
SCALE - 1:500
Hawthorn Geddes engineers & architects ltd
7 Selwyn Avenue, Whangarei 0110, Phone: 09 438 7139, hge@hges.co.nz
Unit 21a, The Grange, Warkworth 0910, Phone: 09 425 3428, www.hawthorngeddes.co.nz
CLIENT KERIKERI FALLS INVESTMENT LTD
PROJECT QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
DRAWING ONSITE PCDI DISPOSAL LOCATION AREAS 1 & 2
SCALE @ A3 1:500
PROJECT No. 6062
FIGURE No. 202
REV R4
1:10.2024 3:09:39 PM K:\6062 QRCC STAGES 4 & 5\6062 240430 Sewage Assessment.dwg


THIS DRAWING WAS PRODUCED IN COLOUR. DO NOT USE FOR CONSTRUCTION PURPOSES IF THIS NOTE IS IN BLACK & WHITE
NOTE:
SITE INFORMATION ADAPTED FROM LINZ LIDAR;
BOUNDARY INFORMATION PROVIDED BY QUICKMAP;
ALL INFORMATION MUST BE CONFIRMED ON SITE;
KEY:
Check Valve
Air Valve
Feeder Line (50mm ID PE)
Lateral Line (50mm)
Zone boundary
NOTE:
Check Valve to be installed every 5m
Flush Valve to be installed at the end of each lateral line
PCDI lines laid along contours at Emitter Spacings in Key
Air Valve to be installed at high point of zone feeds
KEY: Netafim 16mm PC Drip line
Area
Emitter Spacing (m)
Emitter Flowrate (L/h)
Maximum length of lateral * (m)
0.6 1.6 130
0.3 1.6 112
0.6 1.6 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
Zone 1
Zone 2
AREA 3
Zone 3
Zone 2
AREA 2
Zone
NORTHLAND REGIONAL COUNCIL
REF 019289
Plan Number 5010/D
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:1500
Hawthorn Geddes
engineers & architects ltd
7 Selwyn Avenue
Whangarei 0110
Phone: 09 438 7188
hg@hgea.co.nz
Unit 21a, The Grange
Warkworth 0910
Phone: 09 253 8428
www.hawthorngeddes.co.nz
CLIENT KERIKERI FALLS INVESTMENT LTD
PROJECT QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
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PROJECT No 6062
DRAWING No 203
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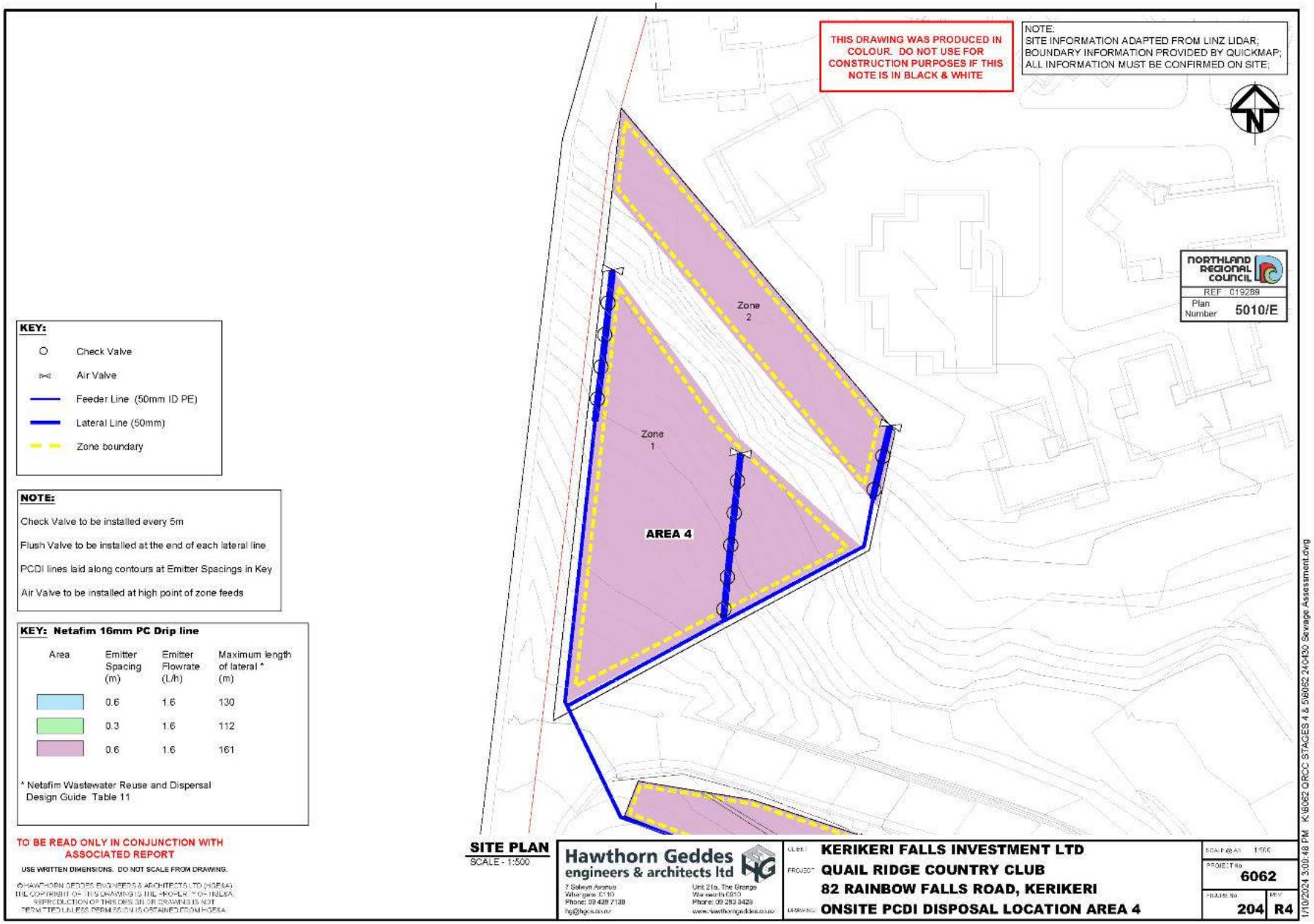
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NOTE:
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BOUNDARY INFORMATION PROVIDED BY QUICKMAP;
ALL INFORMATION MUST BE CONFIRMED ON SITE;
N
NORTHLAND REGIONAL COUNCIL
REF CI19289
Plan Number 5010/E
KEY:
Check Valve
Air Valve
Feeder Line (50mm ID PE)
Lateral Line (50mm)
Zone boundary
NOTE:
Check Valve to be installed every 5m
Flush Valve to be installed at the end of each lateral line
PCDI lines laid along contours at Emitter Spacings in Key
Air Valve to be installed at high point of zone feeds
KEY: Netafim 16mm PC Drip line
Area
Emitter Spacing (m)
Emitter Flowrate (L/h)
Maximum length of lateral * (m)
0.6 1.6 130
0.3 1.6 112
0.6 1.6 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
Zone 2
Zone 1
AREA 4
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:500
Hawthorn Geddes engineers & architects ltd
7 Selwyn Avenue Whangarei 0110 Phone: 09 438 7188 hg@hges.co.nz
Unit 21a, The Grange Warkworth 0910 Phone: 09 253 8428 www.hawthorngeddes.co.nz
CLIENT KERIKERI FALLS INVESTMENT LTD
PROJECT QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
DRAWING ONSITE PCDI DISPOSAL LOCATION AREA 4
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PROJECT No 6062
DRAWING No 204
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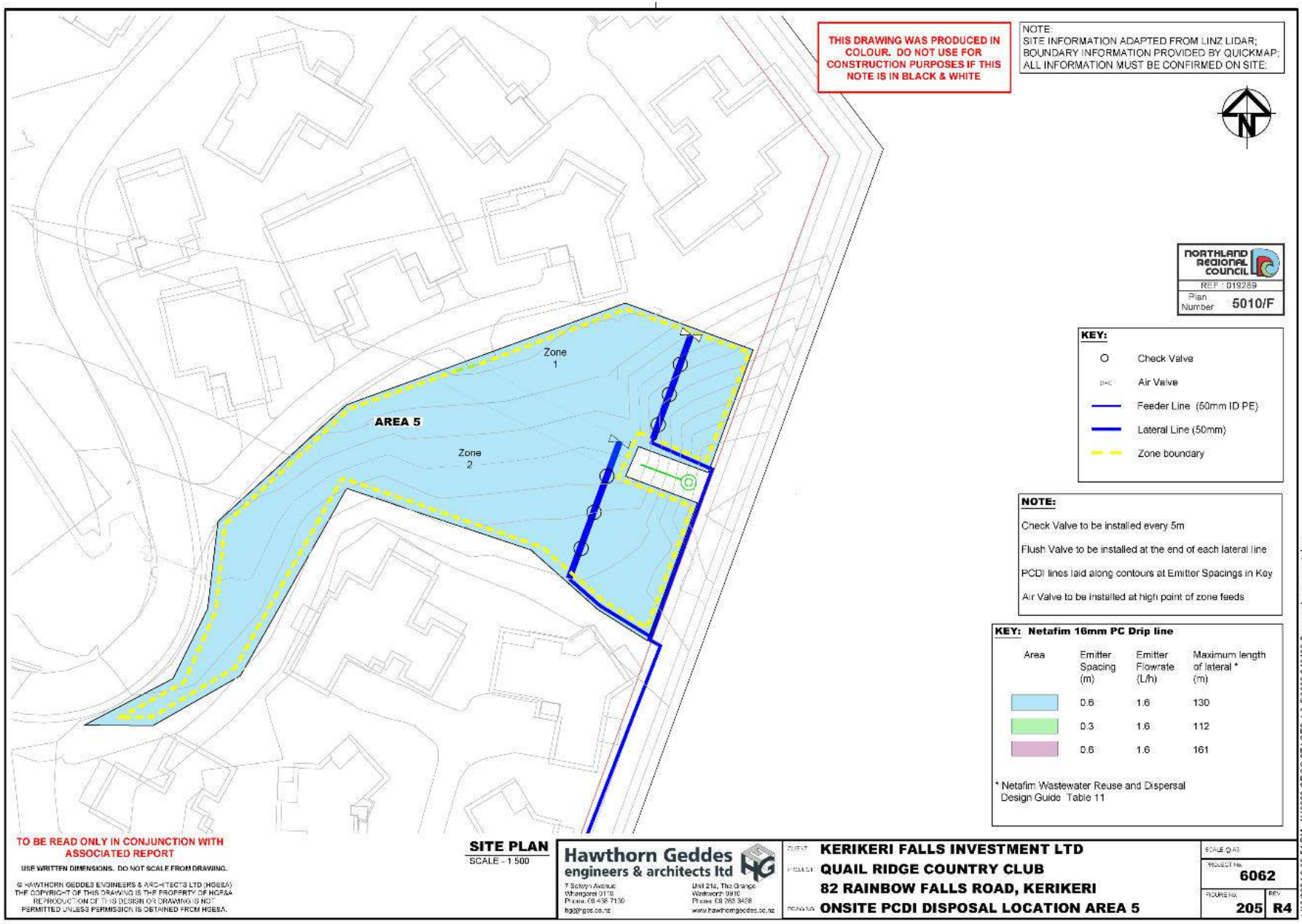
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N
NORTHLAND REGIONAL COUNCIL
REF : 019289
Plan Number 5010/F
KEY:
Check Valve
Air Valve
Feeder Line (50mm ID PE)
Lateral Line (50mm)
Zone boundary
NOTE:
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PCDI lines laid along contours at Emitter Spacings in Key
Air Valve to be installed at high point of zone feeds
KEY: Netafim 16mm PC Drip line
Area
Emitter Spacing (m)
Emitter Flowrate (L/h)
Maximum length of lateral * (m)
0.6 1.6 130
0.3 1.6 112
0.6 1.6 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
Zone 1
AREA 5
Zone 2
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hga@hges.co.nz
Unit 21a, The Grange
Warkworth 0910
Phone: 09 263 3428
www.hawthorngeddes.co.nz
CLIENT KERIKERI FALLS INVESTMENT LTD
PROJECT QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
DRAWING ONSITE PCDI DISPOSAL LOCATION AREA 5
SCALE @ A3
PROJECT No. 6062
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REV. R4
I:\6062 QRCC STAGES 4 & 5\6062 240430 Sewage Assessment.dwg 7/10/2024 3:06:54 PM K

Application Number: **APP.019289.01.05**

Application Type: **Non-notified Change**

Applicant Name: **Quail Ridge Country Club Limited**

Changes are shown as ~~strike-through~~, **underscored and bolded** text.

QUAIL RIDGE COUNTRY CLUB LIMITED

To undertake the following activities associated with a retirement village on Lot 1 DP 311575 and Lot 4 DP 78387 (82 Rainbow Falls Road, Kerikeri), at or about location co-ordinates 1686081E 6102120N:

Note: All location co-ordinates in this document refer to Geodetic Datum 2000, New Zealand Transverse Mercator Projection.

AUT.019289.01.~~0~~405 **Discharge tertiary treated wastewater to land.**

AUT.019289.02.~~03~~04 **Discharge contaminants (odour) to air.**

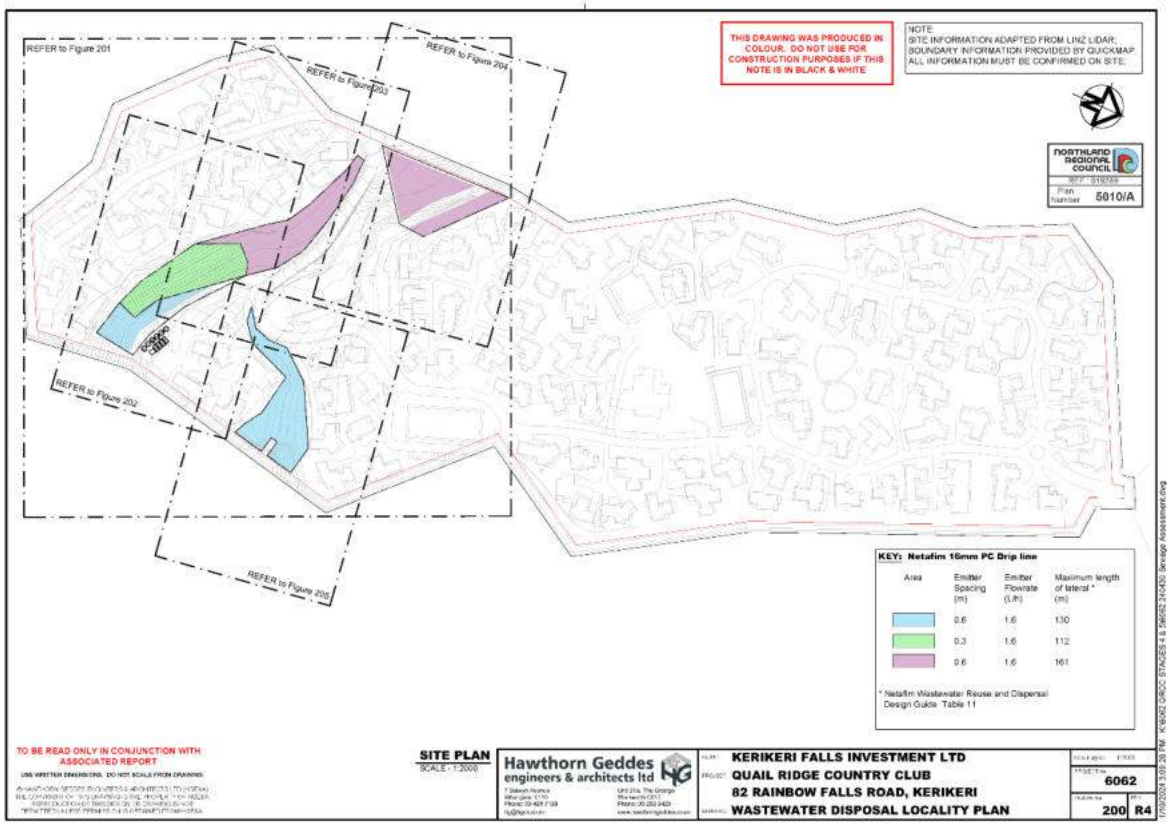
…..

1 The volume of wastewater discharged per day shall not exceed ~~60~~ **32.5** cubic metres.

…..

3 The treatment and disposal system shall be constructed generally in accordance with the **attached** drawings referenced as Northland Regional Plan Numbers **5010/A, 5010/B, 5010/C, 5010/D, 5010/E and 5010/F**. However, if there are any differences or apparent conflict between these documents and any conditions of this consent, then the conditions of consent shall prevail.

…..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REFER to Figure 204
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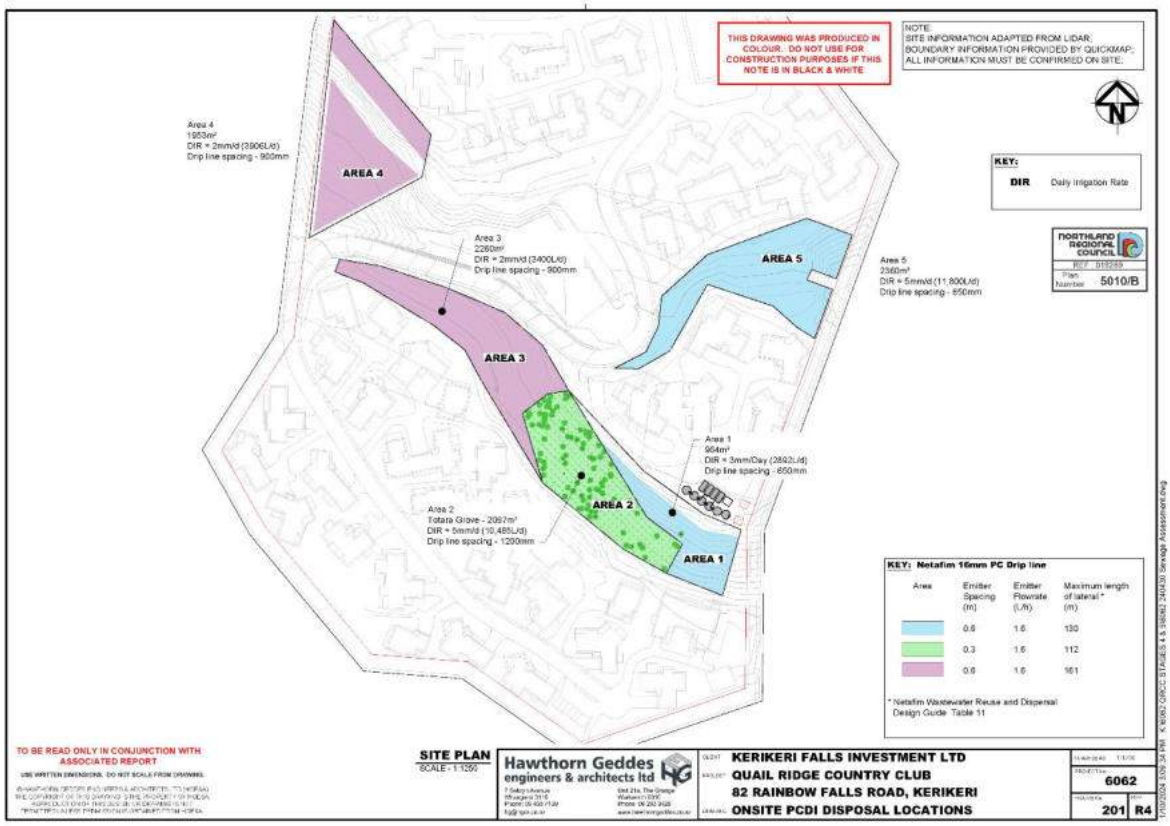
NORTHLAND REGIONAL COUNCIL
Plan Number 5010/A
KEY: Netafim 16mm PC Drip line
Area | Emitter Spacing (m) | Emitter Flowrate (L/h) | Maximum length of lateral * (m)
0.6 | 1.6 | 130
0.3 | 1.6 | 112
0.6 | 1.6 | 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:2000
Hawthorn Geddes engineers & architects ltd
KERIKERI FALLS INVESTMENT LTD
QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
WASTEWATER DISPOSAL LOCALITY PLAN
6062
200 R4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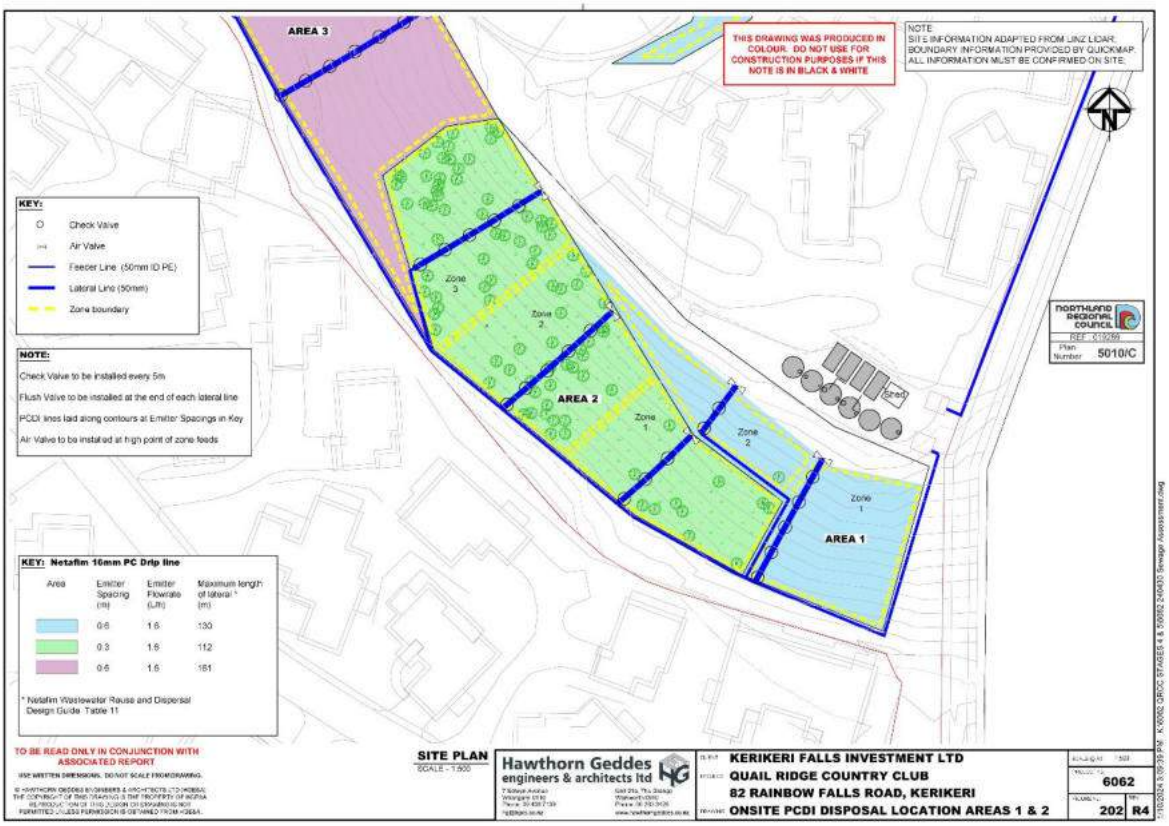
NOTE:
SITE INFORMATION ADAPTED FROM LIDAR;
BOUNDARY INFORMATION PROVIDED BY QUICKMAP;
ALL INFORMATION MUST BE CONFIRMED ON SITE.
Area 4
1953m²
DIR = 2mm/d (3906L/d)
Drip line spacing - 900mm
AREA 4
Area 3
2260m²
DIR = 2mm/d (3400L/d)
Drip line spacing - 900mm
AREA 3
AREA 5
Area 5
2360m²
DIR = 5mm/d (11,800L/d)
Drip line spacing - 650mm
Area 1
964m²
DIR = 3mm/Day (2892L/d)
Drip line spacing - 650mm
AREA 2
AREA 1
Area 2
Totara Grove - 2097m²
DIR = 5mm/d (10,485L/d)
Drip line spacing - 1200mm
KEY:
DIR Daily Irrigation Rate
NORTHLAND REGIONAL COUNCIL
Plan Number 5010/B
KEY: Netafim 16mm PC Drip line
Area | Emitter Spacing (m) | Emitter Flowrate (L/h) | Maximum length of lateral * (m)
0.6 | 1.6 | 130
0.3 | 1.6 | 112
0.6 | 1.6 | 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:1250
Hawthorn Geddes engineers & architects ltd
KERIKERI FALLS INVESTMENT LTD
QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
ONSITE PCDI DISPOSAL LOCATIONS
6062
201 R4


AREA 3
AREA 2
AREA 1
Zone 1
Zone 2
Zone 3
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NOTE:
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KEY:
Check Valve
Air Valve
Feeder Line (50mm ID PE)
Lateral Line (50mm)
Zone boundary
NOTE:
Check Valve to be installed every 5m
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Area
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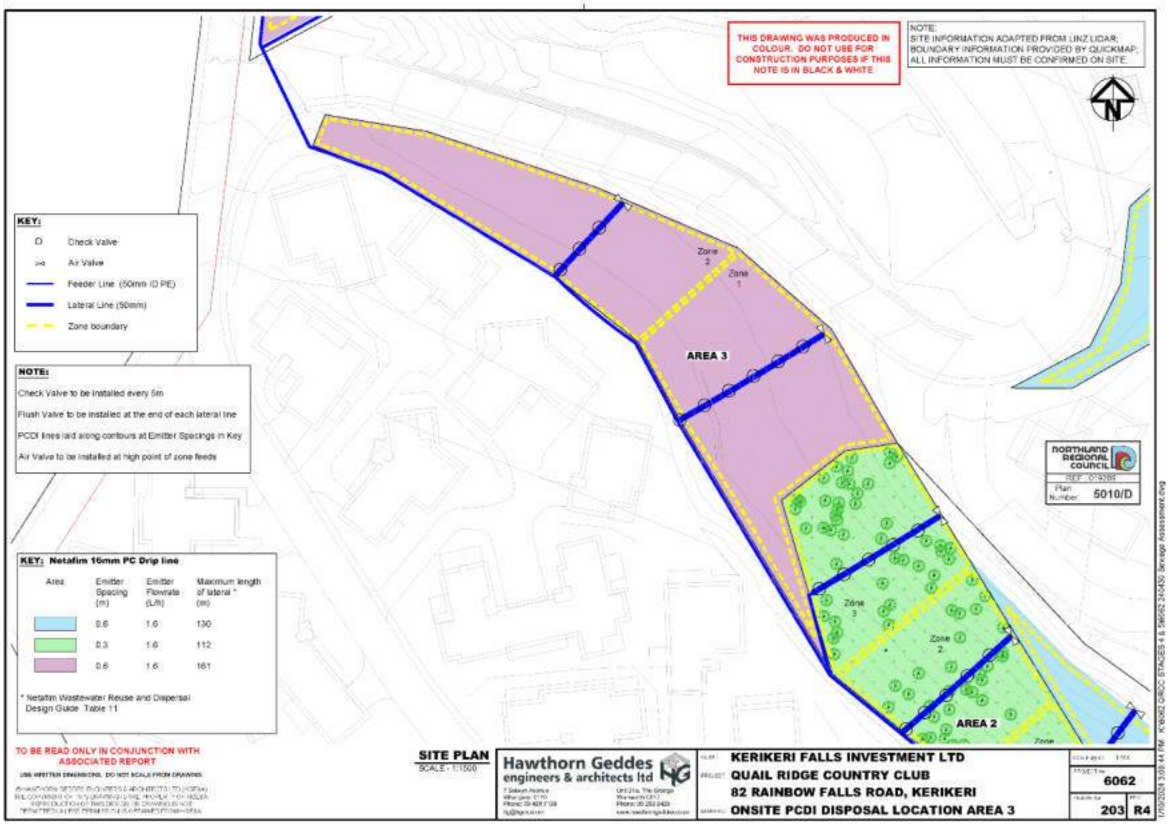
Emitter Flowrate (L/h)
Maximum length of lateral * (m)
0.6 1.6 130
0.3 1.6 112
0.6 1.6 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
Shed
NORTHLAND REGIONAL COUNCIL
Plan Number 5010/C
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:500
Hawthorn Geddes engineers & architects ltd
KERIKERI FALLS INVESTMENT LTD
QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
ONSITE PCDI DISPOSAL LOCATION AREAS 1 & 2
6062
202 R4


AREA 3
AREA 2
Zone 1
Zone 2
Zone 3
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Emitter Flowrate (L/h)
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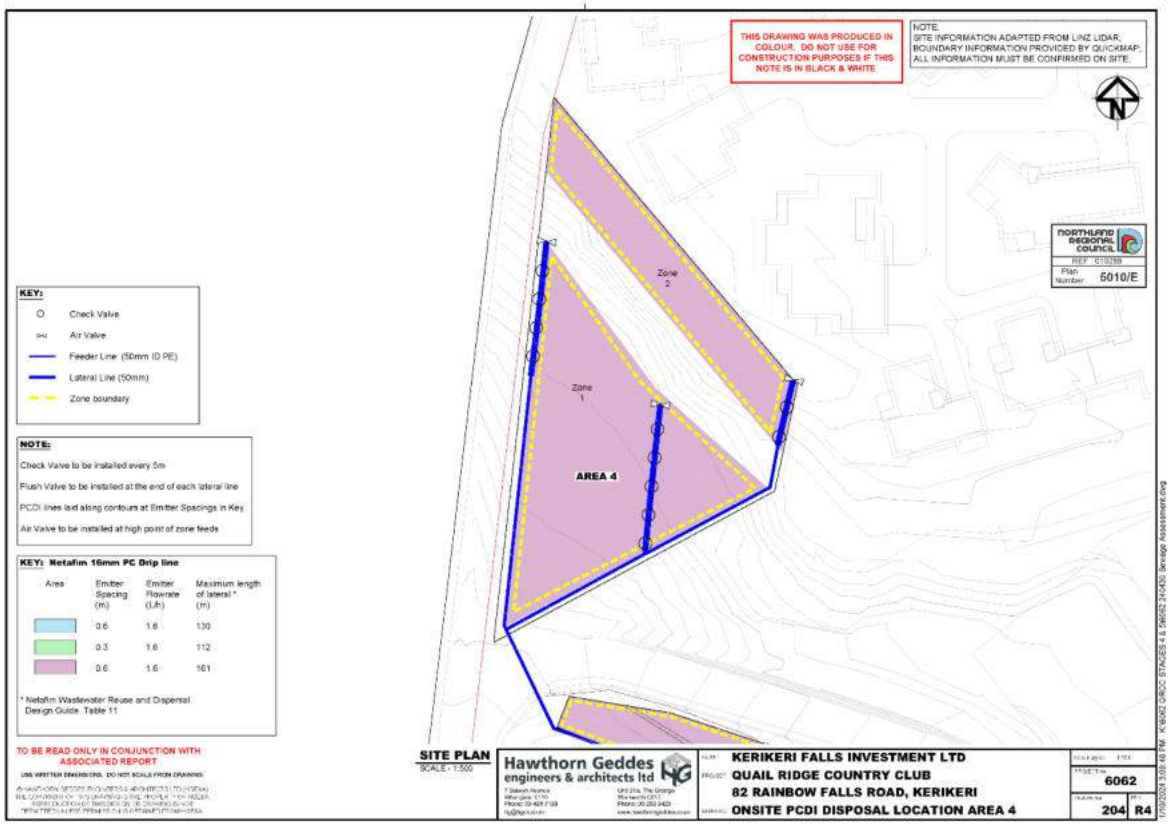
0.6 1.6 130
0.3 1.6 112
0.6 1.6 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
NORTHLAND REGIONAL COUNCIL
Plan Number 5010/D
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:1500
Hawthorn Geddes engineers & architects ltd
KERIKERI FALLS INVESTMENT LTD
QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
ONSITE PCDI DISPOSAL LOCATION AREA 3
6062
203 R4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NORTHLAND REGIONAL COUNCIL
REF: C10289
Plan Number 5010/E
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Air Valve
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Lateral Line (50mm)
Zone boundary
NOTE:
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PCDI lines laid along contours at Emitter Spacings in Key
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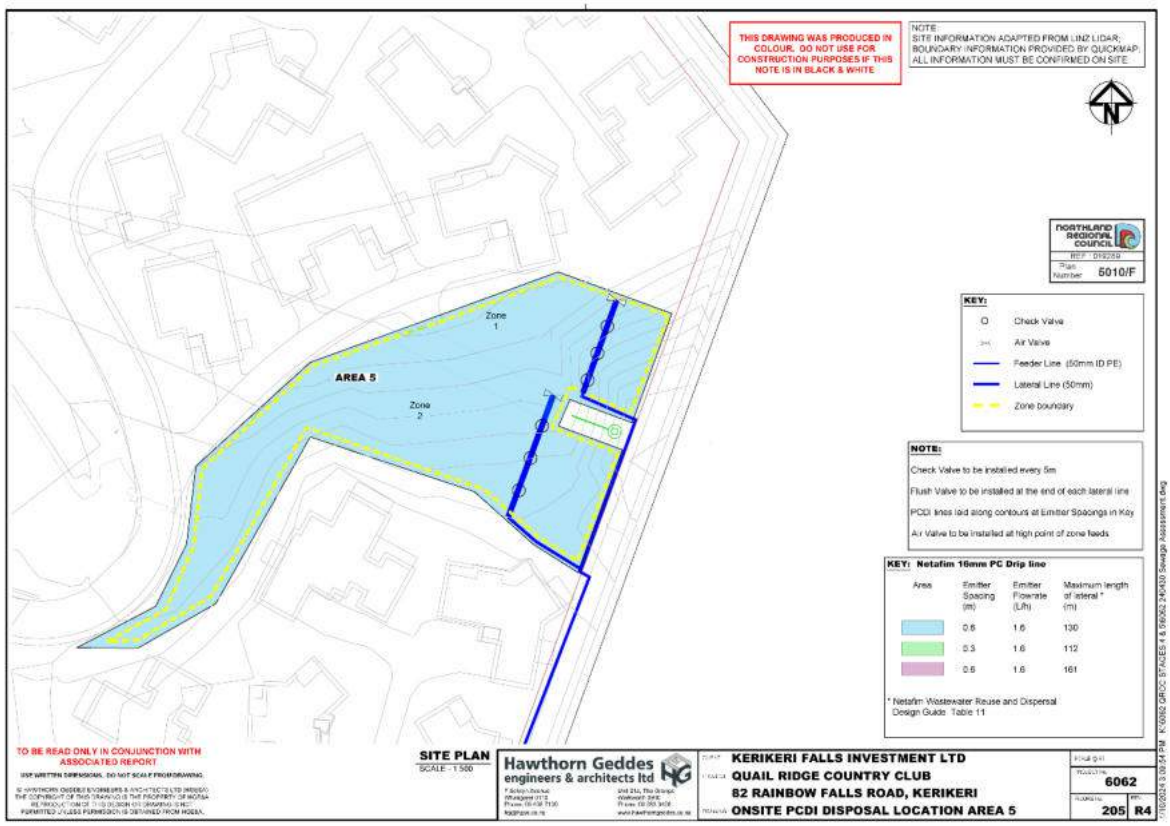
Area
Emitter Spacing (m)
Emitter Flowrate (L/h)
Maximum length of lateral * (m)
0.6 1.6 130
0.3 1.6 112
0.6 1.6 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
Zone 2
Zone 1
AREA 4
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:500
Hawthorn Geddes
engineers & architects ltd
KERIKERI FALLS INVESTMENT LTD
QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
ONSITE PCDI DISPOSAL LOCATION AREA 4
PROJECT No 6062
DRG No 204 R4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N
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REF: D10289
Plan Number 5010/F
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Air Valve
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Lateral Line (50mm)
Zone boundary
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PCDI lines laid along contours at Emitter Spacings in Key
Air Valve to be installed at high point of zone feeds
KEY: Netafim 16mm PC Drip line
Area
Emitter Spacing (m)
Emitter Flowrate (L/h)
Maximum length of lateral * (m)
0.6 1.6 130
0.3 1.6 112
0.6 1.6 161
* Netafim Wastewater Reuse and Dispersal Design Guide Table 11
Zone 1
Zone 2
AREA 5
TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT
USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.
SITE PLAN
SCALE - 1:500
Hawthorn Geddes
engineers & architects ltd
KERIKERI FALLS INVESTMENT LTD
QUAIL RIDGE COUNTRY CLUB
82 RAINBOW FALLS ROAD, KERIKERI
ONSITE PCDI DISPOSAL LOCATION AREA 5
PROJECT No 6062
DRG No 205 R4

REASONS FOR THE DECISION

This change to a condition of consent is granted pursuant to Section 104B of the Resource Management Act 1991 (the Act). In reaching this decision, the council has considered the matters outlined in Part 2 and Section 104 of the Act. It has been determined that:

(1) The adverse effects of the proposed change to condition on the environment will be no more than minor.

(2) The proposed change to condition is consistent with the relevant statutory planning documents and regulations.

(3) The granting of this change to condition achieves the purposes of the Act.

Summary of Change

The application is to change Conditions 1 and 3 in Resource Consents AUT.019289.01.04 and AUT.019289.02.03 which authorises the discharge of wastewater to land and associated odour to air on properties ((Lot 1 DP 311575 and Lot 4 DP 78387) that has been developed as a retirement village at 82 Rainbow Falls Road, Kerikeri.

The Applicant proposes to change the volume of wastewater discharged from up to 60 cubic metres per day to 32.5 cubic metres per day (Condition 1), to change the referenced drawings (Condition 3) showing the disposal areas and system design.

Five separate disposal areas are proposed to optimise the disposal of wastewater generated at the development, this is in contrast to the single large disposal area authorised by the existing consent.

The site is currently consented to discharge up to 39 cubic metres of wastewater per 24 hours with a uniform areal loading rate of 4 millimetres per square metre per day. Following rearrangements of the site layout, specific areas have been reassessed as having design irrigation rates of between 2 and 5 millimetres per square metre per day. Wastewater volumes have also been reassessed in light of robust disposal volume records for the last three years and incorporating the anticipated flow generation from the fully developed site.

Section 127 of the Act

Under Section 127 of the Act, an application for a change to a consent condition is deemed to be a discretionary activity.

Actual and Potential Effects (Section 104(1)(a) of the Act)

The adverse effects on the environment of the change have been determined to be no more than minor for the following reasons:

Site investigations encountered Category 4 soils (silt loam – moderate drainage) and category 5 soils (silty clay, loam – moderate to slow drainage). The design loading rate used for the disposal areas between 2 and 5 litres per square metre per day. This rate is appropriate for the soil categories of the site and is in accordance with the AS/NZS 1547:2012 standard for wastewater system design.

The daily maximum discharge volume has been calculated on an estimated number of staff, residents and visitors that may be on site. To confirm that the discharge volume is compliant with the design discharge volume for the disposal area, a meter will continue to be required as part of the system. The daily discharge volume is also required to be recorded and a copy of this record provided to the council's assigned monitoring officer on request.

The closest watercourse is the Kerikeri River, approximately 20 metres to the west of the disposal area. The sub-surface discharge and heavily vegetated river edge should minimise any surface run-off of contaminants from the disposal area.

The groundwater level was estimated to be greater than 20 metres below the surface. The nearest known groundwater bore is approximately 400 meters to the north of the disposal area. Given the separation distance, the discharge should not affect the bore.

Given the high level of treatment provided by the proposed treatment system and the renovation of the wastewater within the underlying unsaturated soil layers, there is unlikely to be any measurable adverse effect on surface or ground water quality as a result of this discharge.

The risk of odour from the high volume of wastewater discharge should be minimal if the wastewater system is well maintained.

No significant issues have been identified during monitoring of the site with no ponding or odours around the disposal area and recent compliance with resource consent conditions.

Regular maintenance of the system is necessary for the ongoing effective treatment and discharge of wastewater. The consent will continue to require that the system is maintained by a suitably qualified and experienced person, and that the record of maintenance undertaken is kept and supplied to the council on request.

Cultural Effects

The application has been circulated to tāngata whenua who have registered with council as having an interest in resource consent applications within the area of the activity. A response has been received by council from Te Rūnanga o Ngāti Rēhia requesting a site visit. The Applicant has undertaken to facilitate this request with Te Rūnanga o Ngāti Rēhia, however at the time that this decision is required to be made a site visit had not yet been able to be undertaken.

Relevant Statutory Provisions (Section 104(1)(b) of the Act)

The council has determined that the granting of this change to the resource consent is consistent with the objectives and policies contained in Chapters D.1, D.2, D.3, D.4 and F of the Proposed Regional Plan for Northland (PRP).

The objectives and policies of the PRP now have considerable weight. Council therefore considers that it does not need to undertake an additional assessment of the respective objectives and policies in the Regional Coastal Plan for Northland.

Te Rūnanga o Ngāti Rēhia has an iwi/hapū environmental management plan relevant to the location of this activity. A wastewater discharge to land which does not adversely affect ground water or surface water quality is not contrary to the objectives and policies contained within this plan and there are no identified customary activities which would be put at risk by the implementation of the

proposal. The objectives and policies contained within the iwi/hapū environmental management plans have been considered along with the objectives and policies of the relevant planning documents.

Name and Signature of Authorised Person:

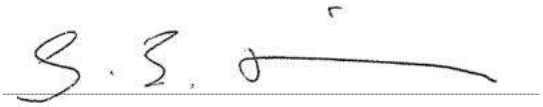
Paul Maxwell
Coastal and Works Consents Manager

12 February 2025

ADMINISTRATION MATTERS

APP.019289.01.05

Consents Processing Officer (preparation of conditions and reasons):

Signed: 

Garth Richards
Consents Officer - Generalist

Date: 12 December 2023

AUTHORISATION IRIS ID NUMBER	ACTIVITY TYPE	ACTIVITY SUB-TYPE	ACTIVITY CLASS	MONITORING OFFICER
AUT.019289.01.05	Discharge to Land	Sewage	DISCRETIONARY	EMO North
AUT.019289.02.04	Discharge to Air	Sewage	DISCRETIONARY	EMO North

REMINDER ACTIONS REQUIRED TO BE COMPLETED PRIOR TO REPORT GOING TO ADMINISTRATOR:

- **PLANS FOR DECISION CLEARLY IDENTIFIED AND/OR ELECTRONIC COPIES ON IRIS**
- **IRIS LOCATION RECORD CREATED FOR EACH ACTIVITY IF REQUIRED**
- **MONITORING PROGRAMME COMPLETED (not required for FDE)**
- **SECTION 37 EXTENSIONS ON IRIS THAT PROVIDES AT LEAST THREE WORKING DAYS TO DECISION DUE DATE**

DECISION CHECKLIST – ***(please check the box that is relevant to this consent)***

Decision to be Sent to Iwi Group(s) – ***Officers please provide names and addresses***

☑ **Te Whare Taiao o Ngati Rehia**
taiao@ngatirehia.co.nz

☐ **Enclose copy of HNZ Accidental Discovery Protocol? – where archaeological site(s) known/likely near site**

☐ **Decision to be sent to MPI – UAE for Marine Farms only**

☐ **Transfer of Functions Decision – copy of consent and report to TLA**

☐ **Coastal Sign**

- **Number Required ..... – *Officer to seek approval for this disbursement from the applicant***

OFFICERS – ***have you ticked the relevant boxes above?***

Hawthorn Geddes
engineers & architects ltd

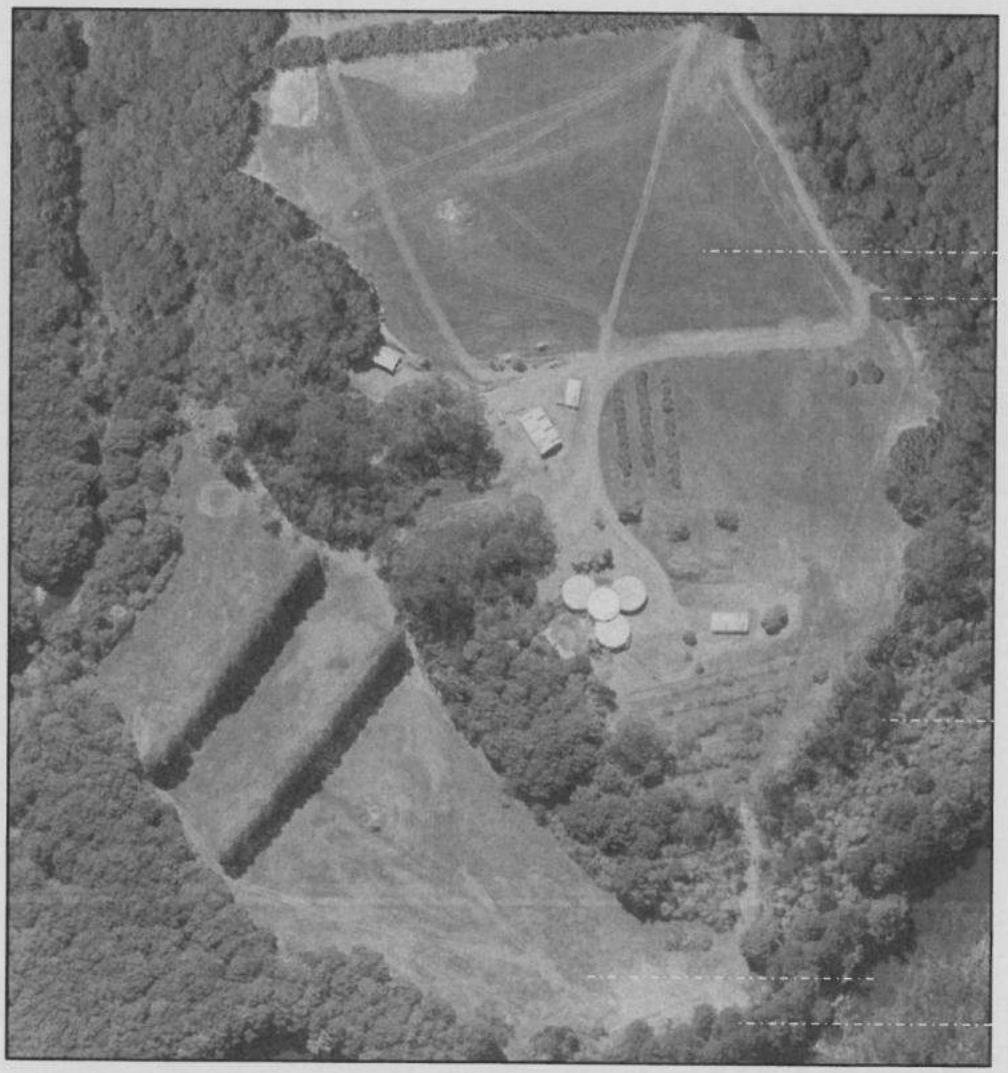
COMBINED NES SITE INVESTIGATION REPORT

STAGES 4 & 5 AT 6 KARAKA DRIVE, KERIKERI

Lot 1 DP 317665

Prepared for

QUAIL RIDGE COUNTRY CLUB



7 Selwyn Avenue
Whangarei 0110
09 438 7139

hg@hgcs.co.nz

21A The Grange
Warkworth 0910
09 283 3428

hawthorngeddes.co.nz

Civil, Structural, Environmental and Geotechnical Engineers
Registered Architects and Project Managers

Also at Warkworth

COMBINED NES SITE INVESTIGATION REPORT – 6 KARAKA DRIVE, KERIKERI

Table of Contents

Report Prepared by: Conal Summers

Report Reviewed by: Dean Botica

DOCUMENT TRANSMITTAL			
Prepared for: Quail Ridge Country Club			Job No.: 6062
Revision	**Issued To**	**Copies Issued**	**Date**
1	Quail Ridge Country Club	1	05.03.19

1. Executive Summary

The purpose of this report is to provide a combined NES report incorporating a Detailed Site Investigation (DSI), Remedial Action Plan (RAP) and Site management Plan (SMP) for the above property in accordance with the Ministry for the Environment (MfE) Guidelines to satisfy the National Environmental Standard (NES) for Assessing Contaminants in Soil to Protect Human Health.

This report is suitable for resource consent application. Information was drawn from local councils, aerial photographs and interviews with the current owner.

Quail Ridge Country Club is a retirement lifestyle village located of Rainbow Falls Road and Karaka Drive in Kerikeri. Stages 1 to 3 have already been developed. Stages 4 & 5 of include provision of numerous residential sites, an assisted care facility, and associated accessways and infrastructure. Earthworks will be required to establish final contours, access ways, and prepare building platforms.

For the purposes of this combined report, the piece of land is defined as an area of approximately 5.9 Ha being Stage 4 and 5 of the proposed development, but excluding the bush covered escarpment and accessway. The contaminant source in the conceptual model arises from historical application of pesticides to the crops and use of treated timber on site.

Stages 4 and 5 were initially sampled on a grid basis and analysed for heavy metals and organochlorine pesticides. Composites comprising 4 samples for the grid sampled sites were prepared in the laboratory for the pesticide analysis while metals were individually analysed.

Following detection of elevated arsenic concentrations in two locations in Stage 5 an iterative targeted approach was undertaken to determine the extent of vertical and horizontal contamination. It is likely the elevated arsenic levels arose due to storage of freshly treated timber whilst the kiwifruit orchard was being established. The highest result was 960 mg/kg, significantly in excess of the Soils Contaminant Standards of 20 mg/kg for residential/10% produce and 70 mgkg for outdoor work exposure.

The proposed remediation involves removal of 108m^3 of the contaminated material and deposition in a thin layer on site, in an area where over 2m of fill will be placed on top of the material, removing any pathway in the conceptual site model. Much of the Stage 5 site is to be filled by 2-3 m with cut material from Stage 4. It is proposed that the contaminated topsoil at sites 48 and 54 initially have vegetation sprayed off, then be removed to a depth of 500mm.

In terms of Rule 10 (2) of the NES the activity of subdivision and change of land use is a restricted discretionary activity and requires resource consent. The recommended remedial action involves excavation of contaminated material to be spread as a layer nominally 50mm deep, (but no greater than 100mm deep) at the base of a previously excavated fill area where fill levels will be greater than 2m, prior to capping and filling with the site-won clay fill.

Under Rule 10 (3) of the NES, the matters over which discretion is restricted are as follows:

(a) the adequacy of the detailed site investigation, including—
    (i) site sampling:

(ii) laboratory analysis:
(iii) risk assessment:

(b) the suitability of the piece of land for the proposed activity, given the amount and kind of soil contamination:

(c) the approach to the remediation or ongoing management of the piece of land, including—

(i) the remediation or management methods to address the risk posed by the contaminants to human health:
(ii) the timing of the remediation:
(iii) the standard of the remediation on completion:
(iv) the mitigation methods to address the risk posed by the contaminants to human health:
(v) the mitigation measures for the piece of land, including the frequency and location of monitoring of specified contaminants:

(d) the adequacy of the site management plan or the site validation report or both, as applicable:

(e) the transport, disposal, and tracking of soil and other materials taken away in the course of the activity:

(f) the requirement for and conditions of a financial bond:

(g) the timing and nature of the review of the conditions in the resource consent:

(h) the duration of the resource consent.

We have included a Remedial Action Plan and Site Management Plan within this report.

It is recommended that the consent include a condition requiring the Remedial Action Plan (RAP) and Site Management Plan (SMP) be implemented. Following site remediation a Site Validation Report must be prepared to evaluate the outcomes of the remedial actions.

It is noted that an underground diesel tank in Stage 4 was removed in January 2019 and is the subject of a separate site investigation, undertaken by Pattle Delamore, and excluded from further consideration in this report. At the time of writing this report was not yet completed.

2. Scope of Work

Stages 4 & 5 of Quail Ridge Country Club (QRCC) include provision of numerous residential sites, an assisted care facility, and associated accessways and infrastructure. Earthworks will be required to establish final contours, access ways, and prepare building platforms.

Soil disturbance activities will exceed the NES permitted activity rules 8(3)(d) and 8(3)(d) (ii) of 25m^3 soil disturbance activity per 500m^2.

The purpose of this report is to present the results of a Detailed Site Investigation in accordance with the *'Resource management Regulations 2011 - National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil to Protect Human Health'*.

This report is suitable as supporting information for land use consent application.

The objectives of this Detailed Site Investigation are to identify and locate potential contaminant sources and their pathways for migration and risks for human health and environmental receptors.

As per NES Regulations 2011 a Detailed Site Investigation is required where the land use history indicates that hazardous substances are likely to be associated with the land as per Hazardous Activities and Industries List (HAIL).

This report compiles readily available information and relevant site history. Information was drawn from local councils, aerial photographs and interviews with the current owners.

3. Site Identification

The site consists of one lot (Lot 1 DP 311575) located at the end of Rainbow Falls Road in Kerikeri. The piece of land is defined as the area of the parcel excluding the accessway and bush clad escarpments areas, an area of approximately 5.9 Ha. Refer to Figure 1 for further details.

It is noted that an underground diesel tank in Stage 4 was removed in January 2019 and is the subject of a separate site investigation, undertaken by Pattle Delamore, and excluded from further consideration in this report. At the time of writing this report was not yet completed.

The land is bordered on 3 sides by scenic reserve and the Kerikeri River, Stages 1-3 of Quail Ridge County Club are to the north. Copies of the Computer Freehold Register are also attached to this report.

SITE:	6 Karaka Drive Kerikeri
LEGAL DESCRIPTION:	Lot 1 DP 311575
AREA:	8.8973 Ha more or less
OWNER:	Quail Ridge Country Club Limited
MAP REFERENCE:	NZTM
EAST:	1686062.40
NORTH:	6102257.30
CERTIFICATE OF TITLE:	Computer Freehold Register identifier NA-55B/129

4. Site History

Historical information was derived from review of historical titles, interviews with Don Cottle (who has owned the land since 1982 and is a partner in the current owners, Quail Ridge Country Club) and aerial photographs from Retrolens, Google Maps, NRC and FNDC GIS. The land is zoned Quail Ridge Country Club in the Far North District Plan.

4.1 Land Ownership

A copy of the latest computer freehold register is attached. Historical owners are shown in Table 1.

Title	Date	Action	Owned	Appellation
NA693/152	1/09/1937	Issued	Beresford Harry Huey Edkins	Lot 2 DP 14987
	15/04/1965	Transfer	Kenneth Pemberton Procter & Jeffray Frances Proctor	
NA37A/73	3/03/1976	Issued	Kenneth Pemberton Procter & Jeffray Frances Proctor	Pt Lot 2 DP 14987

NA34C/143	2/04/1976	Issued	Kenneth Pemberton Procter & Jeffray Frances Proctor	Lot 6 DP 78387
	15/06/1976	Transfer	Errol Calvin Hammond & Elena Vera Hammond	
	1/09/1982	Transfer	Donald James Cottle & Jill Noeline Cottle & Gerald Peter Haddon	
NA55B/129	2/11/1983	Issued	Donald James Cottle & Jill Noeline Cottle & Gerald Peter Haddon	Lot 6 DP 78387
45724	27/03/2003	Issued	Donald James Cottle & Jill Noeline Cottle & Gerald Peter Haddon	Lot 1 DP 311575
Current	21/06/2011	Transfer	Quail Ridge Country Club Ltd	

Table 1: Historic Owners

4.2 Land Use

We have reviewed aerial photographs and discussed the past land use with the property owners.

The aerial photographs from 1953 shows the land in pasture with some bush adjoining to the south and west along the Kerikeri River. The 1977 photo, although not clear, appears to show rows of crops, particularly in the Stage 5 area. 1977 shows horticultural plantings over both Stages 4 and 5. The dwelling and sheds, which still exist today, were observed on the aerial photos from 1979. The accessway was cleared of plantings sometime between 2009 and 2012.

The previous owner of the property, DJ Cottle, (currently a partner in Quail Ridge) confirms that the site had been a kiwifruit orchard since at least 1982 and was then converted to a mandarin orchard in the late 1980s and early 1990s. The majority of the Mandarin trees had been removed in 2005. The fruit trees and vines were irrigated via drip feed using water from the nearby Kerikeri River.

We were advised that pesticides were applied on the crops using airblasting equipment. Generally, insecticide/ pesticide products and water were filled in holding tanks of the airblasting equipment. The spray was then mixed within the machinery and applied onto the crops using the airblasting fan, which was towed through the plantation rows.

Filling of the spraying equipment took place at a shed outside the piece of land, which has been discussed in detail in an earlier Detailed Site Investigation related to Stages 1-3 of the development.

The table below lists hazardous substances/contaminants as per HAIL, which are likely to be associated with the historical land use and processes. Kiwifruit are grown on wires supported by Copper-Chrome-Arsenic treated timber trusses so this has been included as a potential HAIL activity.

HAIL-Code	Activity or industry	Hazardous substances likely to be associated with that activity or industry
A10	Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds	Arsenic, lead, copper, mercury; wide range of organic compounds including acidic herbicides, organophosphates and organochlorines (e.g. endosulfan on golf and bowling greens)
A18	Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or **bulk storage of treated timber outside**	Pentachlorophenol (PCP), copper, arsenic, chromium, boron, PAHs, phenolics (creosote), antisapstain, organochlorine pesticides, fungicides, and tributyltin (TBT)

Table 2: HAIL Classification

5. Geology and Groundwater

The geotechnical investigation for this development included the excavation of 13 test pits on Stages 4 and 5. Stage 4 soils were 100-200mm of topsoil underlain by 2.5 to 3 m of clayey silt. Stage 5 soils were 100-200mm of topsoil underlain by 1.5 to 2.5 m of clayey silt progressing to silty gravel to the 3m extent of the testpits.

The NRC GIS map identifies a groundwater borehole on the neighbouring property to the north. The bore is 52 m deep and used for domestic purposes. There is no data available about groundwater flows in this area.

Hydrology

The ground contours of the existing land indicate that surface water from Stage 4 flows to the southeast and southwest. Stage 5 is relatively flat with gradual surface water flows to the south. Both stages ultimately discharge into the adjacent Kerikeri River.

6. Site Condition and Surrounding Environment

A site visit was undertaken on 5 December 2017.

The following features were noted on site:

- Fill piles were present to the west of Stage 4, adjacent to the boundary with Stage 3, up to 15 m height. This precluded the area from being sampled.
- Stage 4 slopes in a west/southwest direction to an escarpment, at the base of which Stage 5 commences.
- Both stage 4 and 5 were in pasture, with approximately 1000 m^2 of mandarins in 3 rows present in Stage 4 and a further orchard of approximately 1800 m^2 in the Southwestern corner of Stage 4.
- A fuel bowser and underground tank were observed adjacent to the sheds on Stage 4 (Grid area 20 on the attached sampling plan). These have been subject to a separate site investigation undertaken by PDP Limited.

6.1 Council GIS Maps

Northland Regional Council (NRC) GIS maps define the following zones for the site:

NRC Map	Item	Site	Neighbouring sites
Environment	Water	Main Northland Aquifer- Kerikeri	Main Northland Aquifer - Kerikeri
Hazards	Land Hazards: Selected Land use	Recorded (no details)	N/A

Table 3: NRC GIS map classifications

NRC has no record of land hazard incidents on the site and there are also no records on the Selected Land Use Register. The NRC response (attached) indicates that following review, they now consider the site as HAIL A10.

7. Sampling, Analysis Plan and Sampling Methodology

For the purposes of this DSI, the piece of land is defined as an area of approximately 5.9 Ha being Stage 4 and 5 of the proposed development, but excluding the bush covered escarpment and accessway. Refer to Figure 1 for further details. The contaminant source in the conceptual model arises from historical application of pesticides to the crops and use of treated timber on site.

A grid sampling approach was deemed the most appropriate to quantify the risk across the areas of historical plantings. Stages 4 and 5 were treated separately for the purposes of establishing an appropriate grid. Refer to the attached sampling plans for sample locations. Sample locations 1-8 on Stage 4 were not accessible at the time of sampling through to the current time as they are being used to stockpile fill material excavated form Stages 1-3.

For Stage 4 an initial grid size of 28m was used based on the site size and ability to detect a circular hotspot of approximately 25m with a 95% confidence interval as per Table A1, Appendix B, CLMG5. A 25m grid was overlaid on the site and a single sample taken per grid. Sample depths for all locations were 0-150mm as the most likely exposure pathway is soil ingestion or dermal exposure.

For Stage 5 an initial grid size of 26m was used based on the site size and ability to detect a circular hotspot of approximately 22m with a 95% confidence interval as per Table A1, Appendix B, CLMG5. A 22m grid was overlaid on the site and a single sample taken per grid. Sample depths for all locations were 0-150mm as the most likely exposure pathway is soil ingestion or dermal exposure.

Refer to the attached site plans for sample locations

Following detection of elevated arsenic concentrations in two locations in Stage 5 an iterative targeted approach was undertaken to determine the extent of vertical and horizontal contamination. This will be discussed in greater detail in subsequent sections of this report.

Initial samples (including replicates) were analysed for heavy metals and organochlorine pesticides. Composites comprising 4 samples for the grid sampled sites were prepared in the laboratory for the pesticide analysis while metals were individually analysed.

8. Field Quality Assurance (QA) and Quality Control (QC)

The soil samples were collected with a stainless steel trowel from holes dug with a stainless steel spade. The spade and sampling tools were cleaned/decontaminated using deionised

water and Decon 90 and rinsed prior to taking each individual sample. The soil was filled in glass jars or plastic containers with lids, provided by the laboratory, with samples kept in a chillybin for transport to and from the site and to the laboratories. Samples were sent to Hill Laboratories in Hamilton for analysis.

The investigation was undertaken in accordance with MfE Contaminated Land Management Guidelines (CLMG) No.5 – Site investigation and Analysis of Soils and No.1 – Reporting on Contaminated Sites in New Zealand.

Environmental Engineers from Hawthorn Geddes engineers & architects took soil samples on the following dates. A duplicate sample was taken for approximately each 10 samples.

Sampling undertaken on or after 30/10/2018 was targeted around sites 48 and 54 which returned elevated Arsenic levels, in order to determine the extent of contamination, and on areas that were in the vicinity of sites 48 and 54 that are going to be cut during earthworks.

Sampling Date	Locations
10/10/2018	Stage 4, 9-23
11/10/2018	Stage 4, 24-28
15/10/2018	Stage 4, 29-44 Stage 5, 45-77
30/10/2018	Stage 5, Sites 48 and 54, cardinal points 1m radius
20/11/2018	Stage 5, Sites 48 and 54, cardinal points 3m and 5m radius
10/12/2018	Stage 5, Sites 48 and 54, intercardinal points and cardinal 7.5,10,12.5,15 m
11/01/2019	Cut areas in vicinity of 48 and 54

9. QA/QC Data Evaluation

Blind replicate (duplicates) samples were taken and analysed for heavy metals approximately every 10 samples. Relative difference results (%RD) are given in Table 4 below:

Sample Date	Sample	As	Cd	Cr	Cu	Pb	Ni	Zn
10/10/2018	**20**	6	0.49	145	36	8.6	22	48
	20a	7	0.53	157	37	9.2	20	46
	% RD	**-15%**	**-8%**	**-8%**	**-3%**	**-7%**	**10%**	**4%**
11/10/2018	**30**	6	0.29	128	39	13	31	56
	30a	5	0.28	114	36	12.2	29	51
	% RD	**18%**	**4%**	**12%**	**8%**	**6%**	**7%**	**9%**
	40	3	0.38	32	27	6.4	15	51
	40a	3	0.21	31	29	6.2	16	55
	% RD	**0%**	**58%**	**3%**	**-7%**	**3%**	**-6%**	**-8%**
	50	4	0.16	88	20	5.8	21	25
	50a	4	0.15	78	19	5.7	20	24
	% RD	**0%**	**6%**	**12%**	**5%**	**2%**	**5%**	**4%**
	60	4	0.17	142	26	6.6	24	28

	60a	4	0.16	132	24	6.2	22	27
	% RD	**0%**	**6%**	**7%**	**8%**	**6%**	**9%**	**4%**
	70	17	0.34	73	47	15.5	20	98
	70a	17	0.32	71	47	19.4	17	106
	% RD	**0%**	**6%**	**3%**	**0%**	**-22%**	**16%**	**-8%**
	77	4	0.18	97	26	9.9	31	36
	77a	3	0.18	95	24	8.5	30	31
	% RD	**29%**	**0%**	**2%**	**8%**	**15%**	**3%**	**15%**

30/10/2018	48 East (150-300)	72
	48 East Dup(150-300)	84
	% RD	**-15%**
	54 South (0-150)	1060
	54 South Dup (0-150)	800
	% RD	**28%**
20/11/2018	54 W5 (150-300)	3
	54 W5 (D)(150-300)	3
	% RD	**0%**
	54 E5 (0-150)	4
	54 E5 (D) (0-150)	4
	% RD	**0%**
	48 N3 (0-150)	55
	48 N3 (D) (0-150)	66
	% RD	**-18%**
	48 W5 (150-300)	3
	48 W5 (D) (150-300)	3
	% RD	**0%**
10/12/2018	48 N10 (0-150)	4
	48 N10 (D) (0-150)	4
	% RD	**0%**
	48 NE5 (0-150)	6
	48 NE5 (D) (0-150)	6
	% RD	**0%**
	48 NW5 (0-150)	10
	48 NW5 (D) (0-150)	12
	% RD	**-18%**
	54 N15 (0-150)	5
	54 N15 (D) (0-150)	5
	% RD	**0%**
	54 NE7.5 (0-150)	4
	54 NE7.5 (D) (0-150)	4
	% RD	**0%**
	54 NW5 (0-150)	5
	54 NW5 (D) (0-150)	7
	% RD	**-33%**

11/01/2019	13	5
	13a	4
	% RD	**22%**
	51A2	5
	51A2a	5
	% RD	**0%**
	51A4	4
	51A4a	4
	% RD	**0%**
21/01/2019	60A4	3
	60A4(a)	4
	% RD	**-29%**

Table 4: Duplicate Differences

With the exception of one cadmium analysis at 58%, duplicate sample results were in good agreement and within or below the 30-50% stated as a typical data quality objective in CLMG 5. The exception is considered acceptable given the large number of replicates undertaken, and in view of the relatively low cadmium levels.

10. Basis for Guideline Values

The NES contains soil contaminant standards (SCS) for a variety of contaminants considering different pathways/exposure scenarios and land uses.

For the piece of land covering the proposed residential dwellings, the applicable scenario is residential/10% produce as detailed in Section 7 of the *Methodology for deriving standards for contaminants in soil to protect human health* (Ministry for the Environment, 2011)

For site preparation including earthworks, the applicable scenario is Commercial/industrial outdoor worker (unpaved) as detailed in Section 7 of the *Methodology for deriving standards for contaminants in soil to protect human health* (Ministry for the Environment, 2011).

Table 5 gives details of the limits defined in the SCS for relevant contaminants.

Contaminant	**SCS (mg/kg) Residential/ 10% Produce**	**SCS (mg/kg) Commercial/industrial outdoor worker (unpaved)**
As	20	70
Cd	3	1300
Cr (VI)	460	6300
Cu	>10,000	>10,000
Pb	210	3,300
DDT	70	1,000
Dieldrin	2.6	160

Table 5: Soil Contaminant Standards

11. Results

Full lab results can be found in the Appendix.

All organochlorine pesticide results were below the detection limit and the relevant SCS.
All Stage 4 samples were below the relevant SCS for heavy metals.
Stage 5 samples with the exception of sites 48 and 54 were below the relevant SCS for heavy metals. Sites 48 and 54 are discussed in greater detail below.

Sites 48 and 54

Initial samples from sites 48 and 54 returned arsenic levels of 188 and 270 mg/kg respectively at the 0-150mm depth. This is 9 and 13 times greater respectively than the residential/10% produce SCS. A further 4 rounds of testing were undertaken based around these sites to further delineate the vertical and horizontal extent of the contamination, and to evaluate levels on a reduced grid size on the adjoining area where cut formations are required during site preparation. Table 6 shows the results with those exceeding the SCS in **bold**.

Site 48				Site 54			
Direction	**Radius**	**Depth (mm)**	**As (mg/kg)**	**Direction**	**Radius**	**Depth (mm)**	**As (mg/kg)**
Initial	0	0-150	**188**	Initial	0	150	**270**
Initial	0	150-300	**260**	Initial	0	150-300	13
Initial	0	300-500	3	Initial	0	300-500	3
Initial	0	500-750	3	Initial	0	500-1000	2
Initial	0	750-1000	2	Initial	0	750-1000	3
N	1	0-150	**108**	N	1	0-150	**117**
N	1	150-300	**55**	N	1	150-300	7
S	1	0-150	**98**	S	1	0-150	**930**
S	1	150-300	**124**	S	1	150-300	**60**
E	1	0-150	**72**	E	1	0-150	**410**
E	1	150-300	**85**	E	1	150-300	**450**
W	1	0-150	**124**	W	1	0-150	**510**
W	1	150-300	**126**	W	1	150-300	**136**
N	3	0-150	**60**	N	3	0-150	**148**
NE	3	0-150	17	NE	3	0-150	**410**
E	3	0-150	**50**	SE	3	0-150	**154**
SE	3	0-150	**24**	S	3	0-150	17
S	3	0-150	**22**	SW	3	0-150	**32**
NW	3	0-150	**28**	NW	3	0-150	**47**
W	3	0-150	10	N	5	0-150	**220**
N	5	0-150	**37**	NE	5	0-150	5
NE	5	0-150	6	E	5	0-150	4
E	5	0-150	5	SE	5	0-150	7
SE	5	0-150	7	S	5	0-150	15
S	5	0-150	15	SW	5	0-150	4
NW	5	0-150	11	W	5	0-150	4

N	7.5	0-150	7	NW	5	0-150	6
NE	7.5	0-150	5	N	7.5	0-150	**161**
NW	7.5	0-150	6	NE	7.5	0-150	4
N	10	0-150	4	NW	7.5	0-150	9
NE	10	0-150	4	N	10	0-150	**58**
NW	10	0-150	6	NE	10	0-150	3
N	12.5	0-150	4	NW	10	0-150	9
N	15	0-150	4	N	12.5	0-150	4
				N	15	0-150	5

Table 6: Site 48 & Site 54 Arsenic Results

Sampling locations and spatial variability of the 2 sites for the 0-150mm samples is shown in the figures below. The dashed line indicates extents of contamination for remediation purposes

Figure 1: Site 48 Arsenic results 0-150mm (mg/kg)

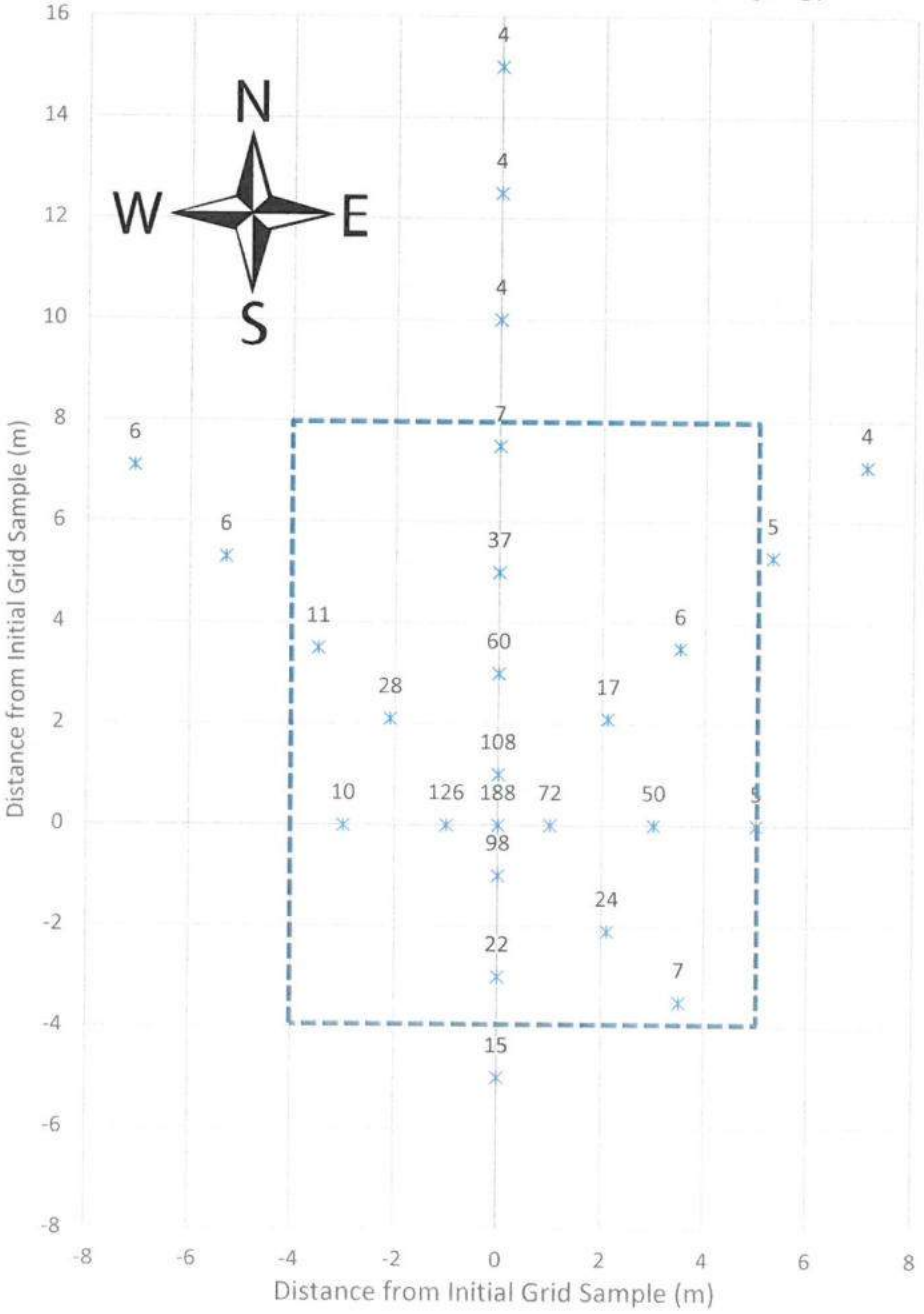
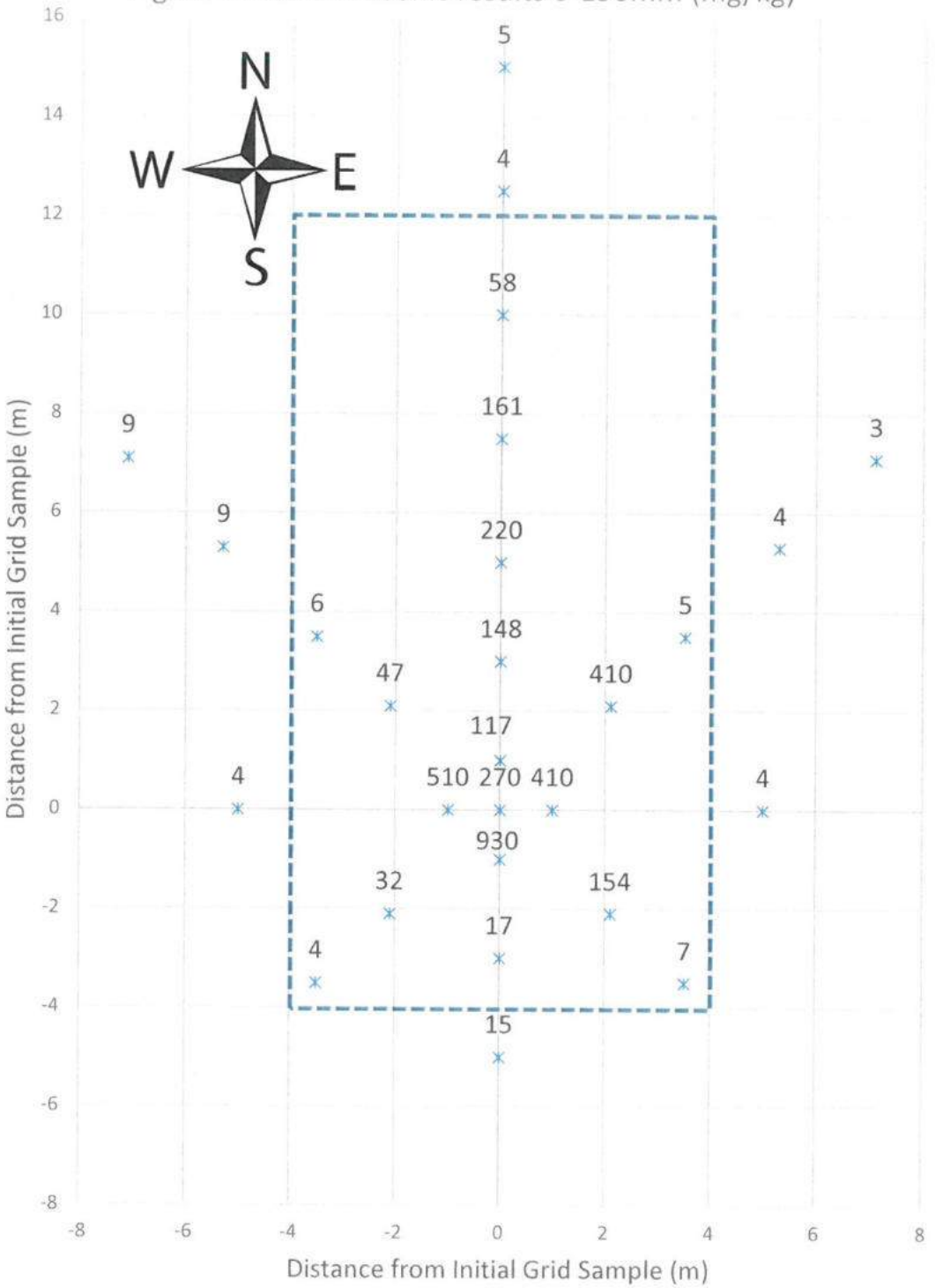


Figure 2: Site 54 Arsenic results 0-150mm (mg/kg)



Following analysis of sites 48 and 52, the hotspot size for site 48 (the smallest hotspot) was estimated as 8m diameter, and a revised grid size of 6.5m calculated using Appendix B of CLMG5 for the subsequent sampling. Subsequent sampling (0-150mm depth) on the reduced grid size was undertaken in the areas of site where it was considered likely that treated timber would be unloaded (at the base of the access track from Stage 4 to Stage 5, and contiguous with Site 48), using a sampling grid size of recommended in CLMG 5 Appendix B. Refer to Sample plan 2 (attached) for sampling locations. Results from these samples are given in Table 7, all are below the relevant SCS.

Sample ID	**As (mg/kg)**	Sample ID	**As (mg/kg)**
QRCC 1	4	QRCC 56B1	4
QRCC 2	4	QRCC 56B2	4
QRCC 3	4	QRCC 56B3	15
QRCC 4	4	QRCC 56C1	7
QRCC 5	4	QRCC 56C2	4
QRCC 6	3	QRCC 56C3	4
QRCC 7	3	QRCC 56C4	5
QRCC 8	3	QRCC 52A1	3
QRCC 9	6	QRCC 52A2	6
QRCC 10	6	QRCC 52A3	4
QRCC 11	4	QRCC 52A4	4
QRCC 11a	5	QRCC 52B1	4
QRCC 12	4	QRCC 52B2	4
QRCC 13	5	QRCC 52B3	3
QRCC 13a	4	QRCC 52B4	4
QRCC 14	6	QRCC 52C1	5
QRCC 15	4	QRCC 52C2	3
QRCC 16	4	QRCC 52C3	4
QRCC 51A1	4	QRCC 52C4	4
QRCC 51A2	5	QRCC 60A1	3
QRCC 51A2a	5	QRCC 60A2	4
QRCC 51A3	4	QRCC 60A3	3
QRCC 51A4	4	QRCC 60A4	3
QRCC 51A4a	4	QRCC 60A4 (a)	4
QRCC 56A1	5	QRCC 60B1	3
QRCC 56A2	4	QRCC 60B2	6
QRCC 56A3	4	QRCC 60B3	6
QRCC 56A4	4	QRCC 60B4	4

Table 7: "Cut" area As results

12. Site Characterisation

The conceptual site model for the site is shown in Table 8. The most relevant contaminant pathways for the proposed residential site use are through direct contact with soil (dermal), ingestion of soil (e.g. by children) and through ingestion of food grown in the soil. During site preparation there is also potential for dermal contact by excavation workers and ingestion of soil particles

Source	Pathway	Receptor.
Pesticide Use on Orchards • Organochlorines • Organophosphates • Heavy metals	• Ingestion both direct and via produce uptake • Dermal contact during site development and post development	• Residents • Earthworks/maintenance contractors
Treated Timber storage and use	• Ingestion both direct and via produce uptake • Dermal contact during site development and post development • Dust generation during site development	• Residents • Earthworks/maintenance contractors

As all samples returned results for pesticides less than detection limits, there is no source in relation to pesticides.

A contaminant source for the highly elevated Arsenic levels on sites 48 and 54 could not initially be established with any certainty. However, in discussions with Don Cottle, previous site owner and current partner in QRCC, it was mentioned that while converting the land to kiwifruit cultivation, treated timber was in short supply and was being delivered very shortly after treatment, and unloaded in bulk on Stage 5. This is the most likely source of the arsenic contamination and would explain the highly localised nature and extreme levels encountered on site.

A pathway currently exists as the arsenic contamination is in the top 150mm of soil. QRCC were notified of the elevations as soon as results were received and are not undertaking any activities likely to generate soil disturbance in the vicinity of Sites 48 and 54.

Receptors are not currently present as no work is being undertaken in the vicinity and no one resides within the affected area. However, during and following construction (once residents are on site), a pathway would exist should the contaminant source remain. Levels are significantly elevated above the limits for residential and outdoor worker exposure, and appropriate remedial measures are detailed in the Remedial Action Plan following.

13. Remedial Action Plan

13.1. Remediation Goal

The remediation goal is to reduce arsenic levels to no more than the SCS (Residential 10% Produce) for arsenic (20mg/kg) in the 2 sites that returned results greater than the relevant SCS (Locations 48 and 54).

Overall volumes for remediation are 118m^3 based on a conservative depth of 500mm and calculated areas of 108m^2 for Site 48 (9m x 12 m) and 128 m^2 for Site 54 (8m x 16m). Refer to Figures 1 and 2 in Section 11 for graphical outlines. There are a number of options for undertaking remediation, these are discussed in greater detail below. Compliance with this Remedial Action Plan may be included as an appropriate resource consent condition.

13.2. Options Assessment

13.2.1. Option 1: Do Nothing (Status Quo)

Leaving the site as is (the "do nothing scenario") does not mitigate the risk as the site will be developed for residential purposes and will be unable to comply with the relevant standards. This option is not appropriate

13.2.2. Option 2: Removal and offsite disposal

This option involves removal of the contaminated soil to a depth of 400mm, with disposal to an approved facility (Puwera landfill). Based on previous Puwera disposal rates of $145/T, estimated disposal costs (including excavation and transport) are in the order of $30,000. This is unlikely to be commercially viable.

13.2.3. Option 3: On site disposal and capping

This is the preferred option due considering both economic and risk factors. Much of the Stage 5 site is to be filled by 2-3 m with cut material from Stage 4. It is proposed that the contaminated topsoil at site 48 and 54 initially have vegetation sprayed off, then be removed to a depth of 300mm (500mm for a 3m x 3m grid centred on Site 48).

The excavated contaminated material will then be spread as a layer nominally 50mm deep, (but no greater than 75mm deep) at the base of a previously excavated fill area where fill levels will be greater than 2m, prior to capping and filling with the site-won clay fill. This will effectively close the pathway in the conceptual site model. This is preferred to Option 2 as there is no transport component on public roads and time of exposure of contaminated material can be limited through effective site management. Refer to the Figure 2 in Appendix 1.

Prior to any spraying or earthworks commencing Hawthorn Geddes will undertake the delineation on site of the extents to be remediated. Following removal of the topsoil validation sampling shall be undertaken on a 3m grid and analysed for Arsenic.

13.3. Preremediation Site Plan

Prior to remediation commencing the contaminated site extents should be delineated through use of visual marking such as temporary fencing or high visibility paint. Signage should be erected detailing the nature of the works and identifying hazards present.

13.4. Site Contact Details

Contact details for personnel involved in the remedial process are as follows:

Project Manager: Alwin Roessler
Quail Ridge Country Club
Mobile 021 0271 3408
Phone 09 401 6578
Email alwin@quailridgecc.co.nz

Technical Advice: Conal Summers/Dean Botica
Hawthorn Geddes engineers & architects Ltd
Phone 09 4387139
Email cs@hgcs.co.nz / db@hgcs.co.nz

Contractor: TBC

13.5. Contingency Plan

Should the remedial strategy defined above fail to achieve the remediation goal, further excavations will be undertaken with repeated sampling until results indicate the remediation goals have been met.

14. Site Management Plan

The following items need to be implemented during the operational phase.

Contractor and Site Management Awareness

Contractors should be formally made aware of the risk involved on site and acknowledge in writing that the Remedial Action Plan and Site Management Plan have been read and understood. It is strongly recommend that site management regularly monitor the procedures being used on site to ensure compliance with the recommendations below.

Stormwater and soil management

- Excavation of the site should be undertaken in such a way that avoids tracking of soil from the elevated areas into areas meeting the SCS, through washing/brushing of wheels and removal of any loose soil from the earthmoving equipment. This also applies for machinery placing the contaminated soil within

the area where it is to be capped (i.e. place material at one end and work back off clean material).

- Once contaminated soil has been placed in the receiving area, cover material should be placed as soon as is practicable to minimise the amount of contaminated material exposed.
- No specific stormwater control measures are required given the flat nature of the sites.

Noise/Odour & Dust control

If conditions are such that dust is generated during excavation, contractors should use appropriate dust filters and minimise dust generation through use of water.

Contingency Plans

In the event of any accidental discharge of contaminated material either on or off site, Hawthorn Geddes should be contacted in the first instance so appropriate remedial measures can be determined.

Occupational Health & Safety

Standard protective measures should be employed by staff on site. These should include (but not be limited to):

- Long sleeved clothing & enclosed safety footwear
- Gloves if contacting exposed earth
- Dust masks if conditions are dry and there is potential for dust generation
- All PPE to be thoroughly cleaned following use, or use of disposable PPE.

Provided the above measures are followed there is limited potential for site staff to contact the contaminated soil. Should staff come into contact with the soil it is recommend that the affected areas be washed thoroughly as soon as is practicable. It is noted that the arsenic levels in the soil are significantly higher than the SCS for outdoor workers, with analysed levels of up to 960 mg/kg (averaged from duplicates) compared to the outdoor worker exposure limit of 70 mg/kg).

15. Conclusions and Recommendations

The site has been used for horticultural purposes for at least 20 years. Crops grown on site were primarily kiwifruit & mandarins.

Sampling and analysis for heavy metals, multiresidue and organochlorine pesticides was undertaken across the site, a former orchard. Levels of arsenic elevated above the relevant SCS (Residential/10% produce and Outdoor worker) were found in 2 locations, with a maximum value (averaged from duplicates) of 960 mg/kg.

In terms of Rule 10 (2) of the NES the activity of subdivision and change of land use is a restricted discretionary activity and requires resource consent. In accordance with the approved RAP and SMP, the recommended remedial action involves excavation of contaminated material to be spread as a layer nominally 50mm deep, (but no greater than 75mm deep) at the base of a previously excavated fill area where fill levels will be greater than 2m, prior to capping and filling with the site-won clay fill

Under Rule 10 (3) of the NES, the matters over which discretion is restricted are as follows:

(a) the adequacy of the detailed site investigation, including—
  (i) site sampling:
  (ii) laboratory analysis:
  (iii) risk assessment:
(b) the suitability of the piece of land for the proposed activity, given the amount and kind of soil contamination:
(c) the approach to the remediation or ongoing management of the piece of land, including—
  (i) the remediation or management methods to address the risk posed by the contaminants to human health:
  (ii) the timing of the remediation:
  (iii) the standard of the remediation on completion:
  (iv) the mitigation methods to address the risk posed by the contaminants to human health:
  (v) the mitigation measures for the piece of land, including the frequency and location of monitoring of specified contaminants:
(d) the adequacy of the site management plan or the site validation report or both, as applicable:
(e) the transport, disposal, and tracking of soil and other materials taken away in the course of the activity:
(f) the requirement for and conditions of a financial bond:
(g) the timing and nature of the review of the conditions in the resource consent:
(h) the duration of the resource consent.

We have included a Remedial Action Plan within this report.

It is recommended that the consent include a condition requiring the Remedial Action Plan (RAP) and Site Management Plan be implemented. Following site remediation a Site Validation Report must be prepared to evaluate the outcomes of the remedial actions.

16. Suitably Qualified & Experienced Person Statement

Conal Summers

Qualifications and Memberships:

- Bachelor of Technology (Environmental Engineering, 1st Class Hons)
- New Zealand Certificate of Science (Chemistry)
- Certificate in Quality Assurance from the New Zealand Organisation for Quality
- Chartered Member Engineering NZ
- Chartered Professional Engineer
- Member of Waste Management Institute of NZ

Conal has more than ten years of chemical and microbiological laboratory experience in New Zealand and the UK including sampling, analysis and quality assurance on water, soil, process and product samples.

As a Pollution Prevention Officer in the Waste Department for Northland Regional Council, he undertook site contamination assessments and HSNO compliance duties.

As Stormwater Asset Engineer for Whangarei District Council he was responsible for obtaining and monitoring consents related to the discharge of contaminants from the stormwater networks including water and sediment loadings.

Conal is currently providing assistance to Kaipara District Council to review contaminated land assessments and investigations for resource consent applications.

Dean Botica

Qualifications and Memberships:

- Bachelor of Engineering
- Chartered Member Engineering NZ
- Chartered Professional Engineer.
- Member of Waste Management Institute of NZ

Dean is a Director at Hawthorn Geddes, responsible for contaminated land management.

He has more than ten years performing investigations and soil sampling for a wide range of sites. This includes investigations of contaminated industrial land in Auckland and undertaking environmental baseline investigations for service stations across the Northern Territory, Australia.

Since 2012 he has been responsible for Preliminary and Detailed Site Investigations for a range of HAIL sites, particularly orchard conversions across Northland, including the Far North District.

Dean has been approved by Whangarei District Council as a SQEP for assessing agricultural/horticultural sites and fuel storage facilities.

17. Limitation

Recommendations and opinions in this report are based on data from the investigation described herein. The nature and continuity of subsoil conditions away from the test locations is inferred and it is possible that actual conditions could vary from those assumed. Should subsoil conditions vary from those described in this report, it is essential that Hawthorn Geddes engineers and architects ltd be contacted to confirm the applicability of the recommendations.

This report has been prepared solely for the benefit of our clients Quail Ridge Country Club and the Far North District Council in relation to the resource consent application for which this report has been prepared. The comments in it are limited to the purpose stated in this report. No liability is accepted by Hawthorn Geddes engineers & architects ltd in respect of its use by any other person, and any other person who relies upon any matter contained in this report does so entirely at their own risk.

Appendix 1 – Site & Sampling Plan
Remedial Action Site Plan

Date: 05.03.19
Job No.:6062

NOTE:
BOUNDARY INFORMATION PROVIDED BY QUICKMAP;
AERIAL PHOTO PROVIDED BY LINZ AND MAY SHOW DISTORTION;
ALL INFORMATION MUST BE CONFIRMED ON SITE;
TO BE READ IN CONJUNCTION WITH HAWTHORN GEDDES ENGINEERS & ARCHITECTS LTD REPORT REFERENCE 6062

SITE PLAN
SCALE - 1:1250

Hawthorn Geddes
engineers & architects ltd

7 Selwyn Avenue
Whangarei 0110
Phone: 09 438 7139
hg@hgcs.co.nz

Unit 21a, The Grange
Warkworth 0910
Phone: 09 283 3428
www.hawthorngeddes.co.nz

CLIENT **KERIKERI FALLS INVESTMENT LTD**
PROJECT **QRCC - NES SITE INVESTIGATION**
RAINBOW FALLS ROAD, KERIKERI
DRAWING **SAMPLING PLAN**

PROJECT No. **6062**
SHEET **Figure 1**

19/02/2019 8:38:27 a.m. K:\6062 QRCC STAGES 4 & 5\site sampling stg 4 and 5.dwg

NOTE:
BOUNDARY INFORMATION PROVIDED BY QUICKMAP;
AERIAL PHOTO PROVIDED BY LINZ AND MAY SHOW DISTORTION;
ALL INFORMATION MUST BE CONFIRMED ON SITE;
TO BE READ IN CONJUNCTION WITH HAWTHORN GEDDES ENGINEERS & ARCHITECTS LTD REPORT REFERENCE 6062

Key

- Contaminated soil areas
- Indicative area for contaminated soil deposition (2360m²)
- Approximate extent of area with fill greater than 2m
- Proposed stage 5 road paving and access

16.00
12.00
9.00
54
48
Townhouse Block

SITE PLAN
SCALE - 1:1250

Hawthorn Geddes
engineers & architects ltd
7 Selwyn Avenue
Whangarei 0110
Phone: 09 438 7139
hg@hgcs.co.nz
Unit 21a, The Grange
Warkworth 0910
Phone: 09 283 3428
www.hawthorngeddes.co.nz

CLIENT **KERIKERI FALLS INVESTMENT LTD**
PROJECT **QRCC - NES SITE INVESTIGATION**
RAINBOW FALLS ROAD, KERIKERI
DRAWING **STAGE 5 - NES REMEDIATION PLAN**

PROJECT No. **6062**
SHEET **Figure 2**

5/03/2019 12:02:59 p.m. K:\6062 QRCC STAGES 4 & 5\site sampling stg 4 and 5.dwg

Appendix 2 – Laboratory Results

Date: 05.03.19
Job No.:6062

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2063805 SPv1
Contact:	Conal Summers	**Date Received:**	12-Oct-2018
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	17-Oct-2018
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

Sample Name:		QRCC 9 0-150 10-Oct-2018 11:30 am	QRCC 14 0-150 10-Oct-2018 12:00 pm	QRCC 15 0-150 10-Oct-2018 12:15 pm	QRCC 16 0-150 10-Oct-2018 12:30 pm	QRCC 17 0-150 10-Oct-2018 12:45 pm
Lab Number:		2063805.1	2063805.2	2063805.3	2063805.4	2063805.5
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	13	8	11	7	11
Total Recoverable Cadmium	mg/kg dry wt	0.41	0.45	0.44	0.33	0.58
Total Recoverable Chromium	mg/kg dry wt	138	149	149	141	151
Total Recoverable Copper	mg/kg dry wt	43	47	38	28	50
Total Recoverable Lead	mg/kg dry wt	8.2	7.4	9.4	10.6	15.8
Total Recoverable Nickel	mg/kg dry wt	21	26	21	13	19
Total Recoverable Zinc	mg/kg dry wt	43	37	41	35	52

Sample Name:		QRCC 18 0-150 10-Oct-2018 1:01 pm	QRCC 19 0-150 10-Oct-2018 3:16 pm	QRCC 20 0-150 10-Oct-2018 3:00 pm	QRCC 20a 0-150 10-Oct-2018 3:02 pm	QRCC 21 0-150 10-Oct-2018 2:25 pm
Lab Number:		2063805.6	2063805.7	2063805.8	2063805.9	2063805.10
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	8	7	6	7	8
Total Recoverable Cadmium	mg/kg dry wt	0.47	0.13	0.49	0.53	0.48
Total Recoverable Chromium	mg/kg dry wt	158	133	145	157	147
Total Recoverable Copper	mg/kg dry wt	49	47	36	37	52
Total Recoverable Lead	mg/kg dry wt	12.4	19.0	8.6	9.2	13.2
Total Recoverable Nickel	mg/kg dry wt	19	38	22	20	24
Total Recoverable Zinc	mg/kg dry wt	45	64	48	46	62

Sample Name:		QRCC 22 0-150 10-Oct-2018 2:36 pm	QRCC 23 0-150 10-Oct-2018 2:50 pm	QRCC 24 0-150 11-Oct-2018 10:13 am	QRCC 25 0-150 11-Oct-2018 10:30 am	QRCC 26 0-150 11-Oct-2018 10:20 am
Lab Number:		2063805.11	2063805.12	2063805.13	2063805.14	2063805.15
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	8	14	7	6
Total Recoverable Cadmium	mg/kg dry wt	0.40	0.40	0.63	0.13	0.41
Total Recoverable Chromium	mg/kg dry wt	163	169	178	150	145
Total Recoverable Copper	mg/kg dry wt	42	48	71	37	49
Total Recoverable Lead	mg/kg dry wt	7.3	6.9	47	14.0	14.0
Total Recoverable Nickel	mg/kg dry wt	28	24	45	21	24
Total Recoverable Zinc	mg/kg dry wt	40	41	310	49	46

Sample Name:	QRCC 27 0-150 11-Oct-2018 10:35 am	QRCC 28 0-150 11-Oct-2018 10:40 am	Composite Of QRCC 9 0-150, QRCC 14 0-150, QRCC 15 0-150 & QRCC 16 0-150	Composite Of QRCC 17 0-150, QRCC 18 0-150, QRCC 19 0-150 & QRCC 20 0-150	Composite Of QRCC 21 0-150, QRCC 22 0-150, QRCC 23 0-150 & QRCC 24 0-150
Lab Number:	2063805.16	2063805.17	2063805.18	2063805.19	2063805.20

Sample Type: Soil						
Sample Name:		QRCC 27 0-150 11-Oct-2018 10:35 am	QRCC 28 0-150 11-Oct-2018 10:40 am	Composite Of QRCC 9 0-150, QRCC 14 0-150, QRCC 15 0-150 & QRCC 16 0-150	Composite Of QRCC 17 0-150, QRCC 18 0-150, QRCC 19 0-150 & QRCC 20 0-150	Composite Of QRCC 21 0-150, QRCC 22 0-150, QRCC 23 0-150 & QRCC 24 0-150
Lab Number:		2063805.16	2063805.17	2063805.18	2063805.19	2063805.20
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	67	69	72
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	10	11	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.36	0.37	-	-	-
Total Recoverable Chromium	mg/kg dry wt	145	194	-	-	-
Total Recoverable Copper	mg/kg dry wt	45	46	-	-	-
Total Recoverable Lead	mg/kg dry wt	6.6	5.6	-	-	-
Total Recoverable Nickel	mg/kg dry wt	34	33	-	-	-
Total Recoverable Zinc	mg/kg dry wt	58	44	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
alpha-BHC	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
beta-BHC	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
delta-BHC	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
gamma-BHC (Lindane)	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
cis-Chlordane	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
trans-Chlordane	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
4,4'-DDD	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
2,4'-DDE	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
4,4'-DDE	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
2,4'-DDT	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
4,4'-DDT	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Total DDT Isomers	mg/kg dry wt	-	-	< 0.09	< 0.09	< 0.09
Dieldrin	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endosulfan I	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endosulfan II	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endosulfan sulphate	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endrin	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endrin aldehyde	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endrin ketone	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Heptachlor	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Heptachlor epoxide	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Hexachlorobenzene	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Methoxychlor	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014

Sample Name:		Composite Of QRCC 25 0-150, QRCC 26 0-150, QRCC 27 0-150 & QRCC 28 0-150				
Lab Number:		2063805.21				
Individual Tests						
Dry Matter	g/100g as rcvd	69	-	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.014	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.014	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.014	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.014	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.014	-	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.014	-	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.014	-	-	-	-

Sample Type: Soil						
Sample Name:		Composite Of QRCC 25 0-150, QRCC 26 0-150, QRCC 27 0-150 & QRCC 28 0-150				
Lab Number:		2063805.21				
Organochlorine Pesticides Screening in Soil						
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	-	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.014	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.014	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.014	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.014	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.014	-	-	-	-
4,4'-DDT	mg/kg dry wt	< 0.014	-	-	-	-
Total DDT Isomers	mg/kg dry wt	< 0.09	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.014	-	-	-	-
Endosulfan I	mg/kg dry wt	< 0.014	-	-	-	-
Endosulfan II	mg/kg dry wt	< 0.014	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.014	-	-	-	-
Endrin	mg/kg dry wt	< 0.014	-	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.014	-	-	-	-
Endrin ketone	mg/kg dry wt	< 0.014	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.014	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.014	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.014	-	-	-	-
Methoxychlor	mg/kg dry wt	< 0.014	-	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-17
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-17
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082). Tested on as recieved sample	0.010 - 0.06 mg/kg dry wt	18-21
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	18-21
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-8, 10-17

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2066087 SPv1
Contact:	Conal Summers	**Date Received:**	17-Oct-2018
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	23-Oct-2018
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

Sample Name:		QRCC 29 0-150 15-Oct-2018 11:25 am	QRCC 30 0-150 15-Oct-2018 11:20 am	QRCC 30a 0-150 15-Oct-2018 11:22 am	QRCC 31 0-150 15-Oct-2018 11:10 am	QRCC 32 0-150 15-Oct-2018 10:52 am
Lab Number:		2066087.1	2066087.2	2066087.3	2066087.4	2066087.5
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	6	5	4	5
Total Recoverable Cadmium	mg/kg dry wt	0.19	0.29	0.28	0.55	0.33
Total Recoverable Chromium	mg/kg dry wt	187	128	114	115	153
Total Recoverable Copper	mg/kg dry wt	34	39	36	50	45
Total Recoverable Lead	mg/kg dry wt	5.8	13.0	12.2	7.0	5.6
Total Recoverable Nickel	mg/kg dry wt	49	31	29	28	33
Total Recoverable Zinc	mg/kg dry wt	29	56	51	45	36

Sample Name:		QRCC 33 0-150 15-Oct-2018 10:46 am	QRCC 34 0-150 15-Oct-2018 11:33 am	QRCC 35 0-150 15-Oct-2018 11:35 am	QRCC 36 0-150 15-Oct-2018 11:40 am	QRCC 37 0-150 15-Oct-2018 11:45 am
Lab Number:		2066087.6	2066087.7	2066087.8	2066087.9	2066087.10
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	13	5	4	3
Total Recoverable Cadmium	mg/kg dry wt	0.14	0.19	0.27	0.41	0.43
Total Recoverable Chromium	mg/kg dry wt	230	169	58	42	104
Total Recoverable Copper	mg/kg dry wt	69	32	28	35	38
Total Recoverable Lead	mg/kg dry wt	3.3	8.9	7.7	5.7	5.2
Total Recoverable Nickel	mg/kg dry wt	104	32	18	16	21
Total Recoverable Zinc	mg/kg dry wt	23	68	56	59	46

Sample Name:		QRCC 38 0-150 15-Oct-2018 11:50 am	QRCC 39 0-150 15-Oct-2018 12:07 pm	QRCC 40 0-150 15-Oct-2018 12:26 pm	QRCC 40a 0-150 15-Oct-2018 12:29 pm	QRCC 41 0-150 15-Oct-2018 12:00 pm
Lab Number:		2066087.11	2066087.12	2066087.13	2066087.14	2066087.15
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	11	3	3	4
Total Recoverable Cadmium	mg/kg dry wt	0.14	0.40	0.38	0.21	0.30
Total Recoverable Chromium	mg/kg dry wt	106	63	32	31	37
Total Recoverable Copper	mg/kg dry wt	25	45	27	29	30
Total Recoverable Lead	mg/kg dry wt	7.0	8.5	6.4	6.2	4.5
Total Recoverable Nickel	mg/kg dry wt	21	17	15	16	15
Total Recoverable Zinc	mg/kg dry wt	39	30	51	55	70

Sample Name:		QRCC 42 0-150 15-Oct-2018 12:55 pm	QRCC 43 0-150 15-Oct-2018 12:12 pm	QRCC 44 0-150 15-Oct-2018 12:16 pm	QRCC 45 0-150 15-Oct-2018 4:42 pm	QRCC 46 0-150 15-Oct-2018 4:20 pm
Lab Number:		2066087.16	2066087.17	2066087.18	2066087.19	2066087.20

Sample Type: Soil						
	Sample Name:	QRCC 42 0-150 15-Oct-2018 12:55 pm	QRCC 43 0-150 15-Oct-2018 12:12 pm	QRCC 44 0-150 15-Oct-2018 12:16 pm	QRCC 45 0-150 15-Oct-2018 4:42 pm	QRCC 46 0-150 15-Oct-2018 4:20 pm
	Lab Number:	2066087.16	2066087.17	2066087.18	2066087.19	2066087.20
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	< 2	5	3
Total Recoverable Cadmium	mg/kg dry wt	0.50	0.38	0.17	0.12	< 0.10
Total Recoverable Chromium	mg/kg dry wt	46	39	31	135	69
Total Recoverable Copper	mg/kg dry wt	35	104	53	52	19
Total Recoverable Lead	mg/kg dry wt	5.1	6.3	4.4	6.7	4.8
Total Recoverable Nickel	mg/kg dry wt	18	14	18	36	24
Total Recoverable Zinc	mg/kg dry wt	67	54	60	48	23

	Sample Name:	QRCC 47 0-150 15-Oct-2018 4:24 pm	QRCC 48 0-150 15-Oct-2018 4:38 pm	QRCC 49 0-150 15-Oct-2018 4:13 pm	QRCC 50 0-150 15-Oct-2018 4:05 pm	QRCC 50a 0-150 15-Oct-2018 4:07 pm
	Lab Number:	2066087.21	2066087.22	2066087.23	2066087.24	2066087.25
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	188	4	4	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.13	< 0.10	0.16	0.15
Total Recoverable Chromium	mg/kg dry wt	100	127	66	88	78
Total Recoverable Copper	mg/kg dry wt	18	59	22	20	19
Total Recoverable Lead	mg/kg dry wt	6.6	6.4	4.2	5.8	5.7
Total Recoverable Nickel	mg/kg dry wt	19	26	33	21	20
Total Recoverable Zinc	mg/kg dry wt	19	43	39	25	24

	Sample Name:	QRCC 51 0-150 15-Oct-2018 4:30 pm	QRCC 52 0-150 15-Oct-2018 4:34 pm	QRCC 53 0-150 15-Oct-2018 3:50 pm	QRCC 54 0-150 15-Oct-2018 4:00 pm	QRCC 55 0-150 15-Oct-2018 1:00 pm
	Lab Number:	2066087.26	2066087.27	2066087.28	2066087.29	2066087.30
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	4	3	270	3
Total Recoverable Cadmium	mg/kg dry wt	0.27	0.27	< 0.10	0.18	0.10
Total Recoverable Chromium	mg/kg dry wt	106	131	66	114	109
Total Recoverable Copper	mg/kg dry wt	29	34	23	60	18
Total Recoverable Lead	mg/kg dry wt	8.8	7.0	5.0	13.1	14.7
Total Recoverable Nickel	mg/kg dry wt	22	22	33	21	20
Total Recoverable Zinc	mg/kg dry wt	32	43	32	34	25

	Sample Name:	QRCC 56 0-150 15-Oct-2018 12:56 pm	QRCC 57 0-150 15-Oct-2018 3:30 pm	QRCC 58 0-150 15-Oct-2018 3:45 pm	QRCC 59 0-150 15-Oct-2018 1:05 pm	QRCC 60 0-150 15-Oct-2018 1:15 pm
	Lab Number:	2066087.31	2066087.32	2066087.33	2066087.34	2066087.35
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	3	4	4	4
Total Recoverable Cadmium	mg/kg dry wt	0.10	< 0.10	0.15	0.13	0.17
Total Recoverable Chromium	mg/kg dry wt	129	69	89	119	142
Total Recoverable Copper	mg/kg dry wt	30	20	21	25	26
Total Recoverable Lead	mg/kg dry wt	6.8	6.6	5.5	7.0	6.6
Total Recoverable Nickel	mg/kg dry wt	26	23	21	22	24
Total Recoverable Zinc	mg/kg dry wt	31	31	26	28	28

	Sample Name:	QRCC 60a 0-150 15-Oct-2018 1:17 pm	QRCC 61 0-150 15-Oct-2018 3:17 pm	QRCC 62 0-150 15-Oct-2018 3:21 pm	QRCC 63 0-150 15-Oct-2018 1:27 pm	QRCC 64 0-150 15-Oct-2018 1:23 pm
	Lab Number:	2066087.36	2066087.37	2066087.38	2066087.39	2066087.40
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	4	10	3	3
Total Recoverable Cadmium	mg/kg dry wt	0.16	0.16	0.12	0.18	< 0.10
Total Recoverable Chromium	mg/kg dry wt	132	76	84	132	156
Total Recoverable Copper	mg/kg dry wt	24	21	26	28	24
Total Recoverable Lead	mg/kg dry wt	6.2	7.5	5.8	7.7	7.5
Total Recoverable Nickel	mg/kg dry wt	22	22	17	39	19
Total Recoverable Zinc	mg/kg dry wt	27	30	22	21	27

Sample Type: Soil						
	Sample Name:	QRCC 65 0-150 15-Oct-2018 3:06 pm	QRCC 66 0-150 15-Oct-2018 3:00 pm	QRCC 67 0-150 15-Oct-2018 1:34 pm	QRCC 68 0-150 15-Oct-2018 1:38 pm	QRCC 69 0-150 15-Oct-2018 2:56 pm
	Lab Number:	2066087.41	2066087.42	2066087.43	2066087.44	2066087.45
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	7	7	3	11
Total Recoverable Cadmium	mg/kg dry wt	0.17	0.18	0.12	0.12	0.26
Total Recoverable Chromium	mg/kg dry wt	74	91	105	95	71
Total Recoverable Copper	mg/kg dry wt	23	32	22	22	33
Total Recoverable Lead	mg/kg dry wt	5.7	10.2	8.5	7.0	11.6
Total Recoverable Nickel	mg/kg dry wt	22	22	20	17	18
Total Recoverable Zinc	mg/kg dry wt	28	43	28	37	42

	Sample Name:	QRCC 70 0-150 15-Oct-2018 1:51 pm	QRCC 70a 0-150 15-Oct-2018 1:53 pm	QRCC 71 0-150 15-Oct-2018 1:46 pm	QRCC 72 0-150 15-Oct-2018 2:50 pm	QRCC 73 0-150 15-Oct-2018 2:20 pm
	Lab Number:	2066087.46	2066087.47	2066087.48	2066087.49	2066087.50
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	17	17	4	5	10
Total Recoverable Cadmium	mg/kg dry wt	0.34	0.32	0.25	0.16	0.14
Total Recoverable Chromium	mg/kg dry wt	73	71	58	72	86
Total Recoverable Copper	mg/kg dry wt	47	47	31	22	31
Total Recoverable Lead	mg/kg dry wt	15.5	19.4	6.8	10.5	10.8
Total Recoverable Nickel	mg/kg dry wt	20	17	15	17	19
Total Recoverable Zinc	mg/kg dry wt	98	106	46	33	40

	Sample Name:	QRCC 74 0-150 15-Oct-2018 2:25 pm	QRCC 75 0-150 15-Oct-2018 2:35 pm	QRCC 76 0-150 15-Oct-2018 2:30 pm	QRCC 77 0-150 15-Oct-2018 2:40 pm	QRCC 77a 0-150 15-Oct-2018 2:42 pm
	Lab Number:	2066087.51	2066087.52	2066087.53	2066087.54	2066087.55
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	2	4	3
Total Recoverable Cadmium	mg/kg dry wt	0.11	0.12	< 0.10	0.18	0.18
Total Recoverable Chromium	mg/kg dry wt	62	77	65	97	95
Total Recoverable Copper	mg/kg dry wt	17	20	28	26	24
Total Recoverable Lead	mg/kg dry wt	13.2	6.4	7.2	9.9	8.5
Total Recoverable Nickel	mg/kg dry wt	23	19	24	31	30
Total Recoverable Zinc	mg/kg dry wt	31	25	38	36	31

	Sample Name:	Composite of QRCC 29 0-150, QRCC 30 0-150, QRCC 31 0-150 and QRCC 32 0-150 15-Oct-2018	Composite of QRCC 33 0-150, QRCC 34 0-150, QRCC 35 0-150 and QRCC 36 0-150 15-Oct-2018	Composite of QRCC 37 0-150, QRCC 38 0-150, QRCC 39 0-150 and QRCC 40 0-150 15-Oct-2018	Composite of QRCC 41 0-150, QRCC 42 0-150, QRCC 43 0-150 and QRCC 44 0-150 15-Oct-2018	Composite of QRCC 45 0-150, QRCC 46 0-150, QRCC 47 0-150 and QRCC 48 0-150 15-Oct-2018
	Lab Number:	2066087.56	2066087.57	2066087.58	2066087.59	2066087.60
Individual Tests						
Dry Matter	g/100g as rcvd	62	63	66	66	72
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
	Sample Name:	Composite of QRCC 29 0-150, QRCC 30 0-150, QRCC 31 0-150 and QRCC 32 0-150 15-Oct-2018	Composite of QRCC 33 0-150, QRCC 34 0-150, QRCC 35 0-150 and QRCC 36 0-150 15-Oct-2018	Composite of QRCC 37 0-150, QRCC 38 0-150, QRCC 39 0-150 and QRCC 40 0-150 15-Oct-2018	Composite of QRCC 41 0-150, QRCC 42 0-150, QRCC 43 0-150 and QRCC 44 0-150 15-Oct-2018	Composite of QRCC 45 0-150, QRCC 46 0-150, QRCC 47 0-150 and QRCC 48 0-150 15-Oct-2018
	Lab Number:	2066087.56	2066087.57	2066087.58	2066087.59	2066087.60
Organochlorine Pesticides Screening in Soil						
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

	Sample Name:	Composite of QRCC 49 0-150, QRCC 50 0-150, QRCC 51 0-150 and QRCC 52 0-150 15-Oct-2018	Composite of QRCC 53 0-150, QRCC 54 0-150, QRCC 55 0-150 and QRCC 56 0-150 15-Oct-2018	Composite of QRCC 57 0-150, QRCC 58 0-150, QRCC 59 0-150 and QRCC 60 0-150 15-Oct-2018	Composite of QRCC 61 0-150, QRCC 62 0-150, QRCC 63 0-150 and QRCC 64 0-150 15-Oct-2018	Composite of QRCC 65 0-150, QRCC 66 0-150, QRCC 67 0-150 and QRCC 68 0-150 15-Oct-2018
	Lab Number:	2066087.61	2066087.62	2066087.63	2066087.64	2066087.65
Individual Tests						
Dry Matter	g/100g as rcvd	66	71	67	74	66
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		Composite of QRCC 69 0-150, QRCC 70 0-150, QRCC 71 0-150 and QRCC 72 0-150 15-Oct-2018	Composite of QRCC 73 0-150, QRCC 74 0-150, QRCC 75 0-150 and QRCC 76 0-150 15-Oct-2018			
Lab Number:		2066087.66	2066087.67			
Individual Tests						
Dry Matter	g/100g as rcvd	67	69	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Total DDT Isomers	mg/kg dry wt	< 0.06	< 0.06	-	-	-
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-55
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-55
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082). Tested on as recieved sample	0.010 - 0.06 mg/kg dry wt	56-67
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	56-67
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-2, 4-13, 15-24, 26-35, 37-46, 48-53

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental

Hill Laboratories
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Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2069596 SPv1
Contact:	Conal Summers	**Date Received:**	25-Oct-2018
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	30-Oct-2018
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

		Sample Name:	QRCC 48 150-300 [16:40-16:41] 15-Oct-2018	QRCC 54 150-300 [16:02-16:04] 15-Oct-2018			
		Lab Number:	2069596.1	2069596.2			
Total Recoverable Arsenic	mg/kg dry wt		260	13	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-2
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2073314 SPv1
Contact:	Conal Summers	**Date Received:**	01-Nov-2018
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	05-Nov-2018
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

	Sample Name:	48 North 0-150 30-Oct-2018 1:21 pm	48 North 150-300 30-Oct-2018 1:25 pm	48 South 0-150 30-Oct-2018 1:29 pm	48 South 150-300 30-Oct-2018 1:34 pm	48 East 0-150 30-Oct-2018 1:50 pm
	Lab Number:	2073314.1	2073314.2	2073314.3	2073314.4	2073314.5
Total Recoverable Arsenic	mg/kg dry wt	108	55	98	124	72

	Sample Name:	48 East 150-300 30-Oct-2018 1:55 pm	48 West 0-150 30-Oct-2018 1:39 pm	48 West 150-300 30-Oct-2018 1:42 pm	48 East Dup 150-300 30-Oct-2018 1:55 pm	54 North 0-150 30-Oct-2018 2:25 pm
	Lab Number:	2073314.6	2073314.7	2073314.8	2073314.9	2073314.10
Total Recoverable Arsenic	mg/kg dry wt	85	124	126	84	117

	Sample Name:	54 North 150-300 30-Oct-2018 2:30 pm	54 South 0-150 30-Oct-2018 2:10 pm	54 South 150-300 30-Oct-2018 2:12 pm	54 East 0-150 30-Oct-2018 2:15 pm	54 East 150-300 30-Oct-2018 2:20 pm
	Lab Number:	2073314.11	2073314.12	2073314.13	2073314.14	2073314.15
Total Recoverable Arsenic	mg/kg dry wt	7	1,060	60	410	450

	Sample Name:	54 West 0-150 30-Oct-2018 2:39 pm	54 West 150-300 30-Oct-2018 2:47 pm	54 South Dup 0-150 30-Oct-2018 2:10 pm		
	Lab Number:	2073314.16	2073314.17	2073314.18		
Total Recoverable Arsenic	mg/kg dry wt	510	136	800	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-18
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-18
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-18
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-18

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Kim Harrison MSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2085189 SDSPv1
Contact:	Conal Summers	**Date Received:**	23-Nov-2018
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	28-Nov-2018
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Analysis Results

Sample Name:	Lab Number	Total Recoverable Arsenic mg/kg dry wt
QRCC 54 C 300-500 20-Nov-2018 1:25 pm	2085189.1	3
QRCC 54 C 500-750 20-Nov-2018 1:26 pm	2085189.2	3
QRCC 54 C 750-1000 20-Nov-2018 1:27 pm	2085189.3	2
QRCC 54 S3 0-150 20-Nov-2018 1:30 pm	2085189.4	17
QRCC 54 S3 150-300 20-Nov-2018 1:31 pm	2085189.5	5
QRCC 54 N3 0-150 20-Nov-2018 1:44 pm	2085189.6	148
QRCC 54 N3 150-300 20-Nov-2018 1:45 pm	2085189.7	7
QRCC 54 W3 0-150 20-Nov-2018 1:39 pm	2085189.8	5
QRCC 54 W3 150-300 20-Nov-2018 1:40 pm	2085189.9	3
QRCC 54 S5 0-150 20-Nov-2018 1:37 pm	2085189.10	15
QRCC 54 S5 150-300 20-Nov-2018 1:38 pm	2085189.11	3
QRCC 54 N5 0-150 20-Nov-2018 1:46 pm	2085189.12	220
QRCC 54 N5 150-300 20-Nov-2018 1:47 pm	2085189.13	11
QRCC 54 W5 0-150 20-Nov-2018 1:41 pm	2085189.14	4
QRCC 54 W5 150-300 20-Nov-2018 1:42 pm	2085189.15	3
QRCC 54 W5(D) 150-300 20-Nov-2018 1:43 pm	2085189.16	3
QRCC 54 E5 0-150 20-Nov-2018 1:48 pm	2085189.17	4
QRCC 54 E5(D) 0-150 20-Nov-2018 1:49 pm	2085189.18	4
QRCC 54 E5 150-300 20-Nov-2018 1:50 pm	2085189.19	3
QRCC 48 C 300-500 20-Nov-2018 11:25 am	2085189.20	3
QRCC 48 C 500-750 20-Nov-2018 11:27 am	2085189.21	2
QRCC 48 C 750-1000 20-Nov-2018 11:30 am	2085189.22	3
QRCC 48 S3 0-150 20-Nov-2018 11:43 am	2085189.23	22
QRCC 48 S3 150-300 20-Nov-2018 11:45 am	2085189.24	4

Analysis Results

Sample Name:	Lab Number	Total Recoverable Arsenic mg/kg dry wt
QRCC 48 N3 0-150 20-Nov-2018 12:10 pm	2085189.25	55
QRCC 48 N3(D) 0-150 20-Nov-2018 12:08 pm	2085189.26	66
QRCC 48 N3 150-300 20-Nov-2018 12:09 pm	2085189.27	4
QRCC 48 W3 0-150 20-Nov-2018 12:00 pm	2085189.28	10
QRCC 48 W3 150-300 20-Nov-2018 12:02 pm	2085189.29	3
QRCC 48 E3 0-150 20-Nov-2018 12:15 pm	2085189.30	50
QRCC 48 E3 150-300 20-Nov-2018 12:16 pm	2085189.31	4
QRCC 48 S5 0-150 20-Nov-2018 11:50 am	2085189.32	15
QRCC 48 S5 150-300 20-Nov-2018 11:53 am	2085189.33	3
QRCC 48 N5 0-150 20-Nov-2018 12:10 pm	2085189.34	37
QRCC 48 N5 150-300 20-Nov-2018 12:11 pm	2085189.35	4
QRCC 48 W5 0-150 20-Nov-2018 12:05 pm	2085189.36	5
QRCC 48 W5 150-300 20-Nov-2018 12:06 pm	2085189.37	3
QRCC 48 W5(D) 150-300 20-Nov-2018 12:07 pm	2085189.38	3
QRCC 48 E5 0-150 20-Nov-2018 12:17 pm	2085189.39	5
QRCC 48 E5 150-300 20-Nov-2018 12:18 pm	2085189.40	5

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-40
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-40
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-40
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-40

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Kim Harrison MSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2094964 SPv1
Contact:	Conal Summers	**Date Received:**	11-Dec-2018
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	13-Dec-2018
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

	Sample Name:	QRCC 48N7.5 0-150 10-Dec-2018 12:32 pm	QRCC 48N10 0-150 10-Dec-2018 12:35 pm	QRCC 48N10(D) 0-150 10-Dec-2018 12:36 pm	QRCC 48N12.5 0-150 10-Dec-2018 12:37 pm	QRCC 48N15 0-150 10-Dec-2018 12:40 pm
	Lab Number:	2094964.1	2094964.2	2094964.3	2094964.4	2094964.5
Total Recoverable Arsenic	mg/kg dry wt	7	4	4	4	4

	Sample Name:	QRCC 48NE3 0-150 10-Dec-2018 12:50 pm	QRCC 48NE5 0-150 10-Dec-2018 12:51 pm	QRCC 48NE5(D) 0-150 10-Dec-2018 12:52 pm	QRCC 48NE7.5 0-150 10-Dec-2018 12:55 pm	QRCC 48NE10 0-150 10-Dec-2018 12:58 pm
	Lab Number:	2094964.6	2094964.7	2094964.8	2094964.9	2094964.10
Total Recoverable Arsenic	mg/kg dry wt	17	6	6	5	4

	Sample Name:	QRCC 48NW3 0-150 10-Dec-2018 12:45 pm	QRCC 48NW5 0-150 10-Dec-2018 12:46 pm	QRCC 48NW5(D) 0-150 10-Dec-2018 12:47 pm	QRCC 48NW7.5 0-150 10-Dec-2018 12:48 pm	QRCC 48NW10 0-150 10-Dec-2018 12:50 pm
	Lab Number:	2094964.11	2094964.12	2094964.13	2094964.14	2094964.15
Total Recoverable Arsenic	mg/kg dry wt	28	10	12	6	6

	Sample Name:	QRCC 48SE3 0-150 10-Dec-2018 1:00 pm	QRCC 48SE5 0-150 10-Dec-2018 1:01 pm	QRCC 54N7.5 0-150 10-Dec-2018 11:25 am	QRCC 54N10 0-150 10-Dec-2018 11:27 am	QRCC 54N12.5 0-150 10-Dec-2018 11:30 am
	Lab Number:	2094964.16	2094964.17	2094964.18	2094964.19	2094964.20
Total Recoverable Arsenic	mg/kg dry wt	24	7	161	58	4

	Sample Name:	QRCC 54N15 0-150 10-Dec-2018 11:32 am	QRCC 54N15(D) 0-150 10-Dec-2018 11:34 am	QRCC 54NE3 0-150 10-Dec-2018 11:43 am	QRCC 54NE5 0-150 10-Dec-2018 11:46 am	QRCC 54NE7.5 0-150 10-Dec-2018 11:50 am
	Lab Number:	2094964.21	2094964.22	2094964.23	2094964.24	2094964.25
Total Recoverable Arsenic	mg/kg dry wt	5	5	410	5	4

	Sample Name:	QRCC 54NE7.5(D) 0-150 10-Dec-2018 11:51 am	QRCC 54NE10 0-150 10-Dec-2018 11:53 am	QRCC 54NW3 0-150 10-Dec-2018 11:58 am	QRCC 54NW5 0-150 10-Dec-2018 12:01 pm	QRCC 54NW5(D) 0-150 10-Dec-2018 12:00 pm
	Lab Number:	2094964.26	2094964.27	2094964.28	2094964.29	2094964.30
Total Recoverable Arsenic	mg/kg dry wt	4	3	47	5	7

	Sample Name:	QRCC 54NW7.5 0-150 10-Dec-2018 12:05 pm	QRCC 54NW10 0-150 10-Dec-2018 12:06 pm			
	Lab Number:	2094964.31	2094964.32			
Total Recoverable Arsenic	mg/kg dry wt	9	9	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-32
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-32
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-32
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-32

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2063805 SPv1
Contact:	Conal Summers	**Date Received:**	12-Oct-2018
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	17-Oct-2018
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

Sample Name:		QRCC 9 0-150 10-Oct-2018 11:30 am	QRCC 14 0-150 10-Oct-2018 12:00 pm	QRCC 15 0-150 10-Oct-2018 12:15 pm	QRCC 16 0-150 10-Oct-2018 12:30 pm	QRCC 17 0-150 10-Oct-2018 12:45 pm
Lab Number:		2063805.1	2063805.2	2063805.3	2063805.4	2063805.5
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	13	8	11	7	11
Total Recoverable Cadmium	mg/kg dry wt	0.41	0.45	0.44	0.33	0.58
Total Recoverable Chromium	mg/kg dry wt	138	149	149	141	151
Total Recoverable Copper	mg/kg dry wt	43	47	38	28	50
Total Recoverable Lead	mg/kg dry wt	8.2	7.4	9.4	10.6	15.8
Total Recoverable Nickel	mg/kg dry wt	21	26	21	13	19
Total Recoverable Zinc	mg/kg dry wt	43	37	41	35	52

Sample Name:		QRCC 18 0-150 10-Oct-2018 1:01 pm	QRCC 19 0-150 10-Oct-2018 3:16 pm	QRCC 20 0-150 10-Oct-2018 3:00 pm	QRCC 20a 0-150 10-Oct-2018 3:02 pm	QRCC 21 0-150 10-Oct-2018 2:25 pm
Lab Number:		2063805.6	2063805.7	2063805.8	2063805.9	2063805.10
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	8	7	6	7	8
Total Recoverable Cadmium	mg/kg dry wt	0.47	0.13	0.49	0.53	0.48
Total Recoverable Chromium	mg/kg dry wt	158	133	145	157	147
Total Recoverable Copper	mg/kg dry wt	49	47	36	37	52
Total Recoverable Lead	mg/kg dry wt	12.4	19.0	8.6	9.2	13.2
Total Recoverable Nickel	mg/kg dry wt	19	38	22	20	24
Total Recoverable Zinc	mg/kg dry wt	45	64	48	46	62

Sample Name:		QRCC 22 0-150 10-Oct-2018 2:36 pm	QRCC 23 0-150 10-Oct-2018 2:50 pm	QRCC 24 0-150 11-Oct-2018 10:13 am	QRCC 25 0-150 11-Oct-2018 10:30 am	QRCC 26 0-150 11-Oct-2018 10:20 am
Lab Number:		2063805.11	2063805.12	2063805.13	2063805.14	2063805.15
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	8	14	7	6
Total Recoverable Cadmium	mg/kg dry wt	0.40	0.40	0.63	0.13	0.41
Total Recoverable Chromium	mg/kg dry wt	163	169	178	150	145
Total Recoverable Copper	mg/kg dry wt	42	48	71	37	49
Total Recoverable Lead	mg/kg dry wt	7.3	6.9	47	14.0	14.0
Total Recoverable Nickel	mg/kg dry wt	28	24	45	21	24
Total Recoverable Zinc	mg/kg dry wt	40	41	310	49	46

Sample Name:	QRCC 27 0-150 11-Oct-2018 10:35 am	QRCC 28 0-150 11-Oct-2018 10:40 am	Composite Of QRCC 9 0-150, QRCC 14 0-150, QRCC 15 0-150 & QRCC 16 0-150	Composite Of QRCC 17 0-150, QRCC 18 0-150, QRCC 19 0-150 & QRCC 20 0-150	Composite Of QRCC 21 0-150, QRCC 22 0-150, QRCC 23 0-150 & QRCC 24 0-150
Lab Number:	2063805.16	2063805.17	2063805.18	2063805.19	2063805.20

Sample Type: Soil						
	Sample Name:	QRCC 27 0-150 11-Oct-2018 10:35 am	QRCC 28 0-150 11-Oct-2018 10:40 am	Composite Of QRCC 9 0-150, QRCC 14 0-150, QRCC 15 0-150 & QRCC 16 0-150	Composite Of QRCC 17 0-150, QRCC 18 0-150, QRCC 19 0-150 & QRCC 20 0-150	Composite Of QRCC 21 0-150, QRCC 22 0-150, QRCC 23 0-150 & QRCC 24 0-150
	Lab Number:	2063805.16	2063805.17	2063805.18	2063805.19	2063805.20
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	67	69	72
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	10	11	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.36	0.37	-	-	-
Total Recoverable Chromium	mg/kg dry wt	145	194	-	-	-
Total Recoverable Copper	mg/kg dry wt	45	46	-	-	-
Total Recoverable Lead	mg/kg dry wt	6.6	5.6	-	-	-
Total Recoverable Nickel	mg/kg dry wt	34	33	-	-	-
Total Recoverable Zinc	mg/kg dry wt	58	44	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
alpha-BHC	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
beta-BHC	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
delta-BHC	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
gamma-BHC (Lindane)	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
cis-Chlordane	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
trans-Chlordane	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
4,4'-DDD	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
2,4'-DDE	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
4,4'-DDE	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
2,4'-DDT	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
4,4'-DDT	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Total DDT Isomers	mg/kg dry wt	-	-	< 0.09	< 0.09	< 0.09
Dieldrin	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endosulfan I	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endosulfan II	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endosulfan sulphate	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endrin	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endrin aldehyde	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Endrin ketone	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Heptachlor	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Heptachlor epoxide	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Hexachlorobenzene	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014
Methoxychlor	mg/kg dry wt	-	-	< 0.015	< 0.014	< 0.014

	Sample Name:	Composite Of QRCC 25 0-150, QRCC 26 0-150, QRCC 27 0-150 & QRCC 28 0-150				
	Lab Number:	2063805.21				
Individual Tests						
Dry Matter	g/100g as rcvd	69	-	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.014	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.014	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.014	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.014	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.014	-	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.014	-	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.014	-	-	-	-

Sample Type: Soil						
Sample Name:		Composite Of QRCC 25 0-150, QRCC 26 0-150, QRCC 27 0-150 & QRCC 28 0-150				
Lab Number:		2063805.21				
Organochlorine Pesticides Screening in Soil						
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	-	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.014	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.014	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.014	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.014	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.014	-	-	-	-
4,4'-DDT	mg/kg dry wt	< 0.014	-	-	-	-
Total DDT Isomers	mg/kg dry wt	< 0.09	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.014	-	-	-	-
Endosulfan I	mg/kg dry wt	< 0.014	-	-	-	-
Endosulfan II	mg/kg dry wt	< 0.014	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.014	-	-	-	-
Endrin	mg/kg dry wt	< 0.014	-	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.014	-	-	-	-
Endrin ketone	mg/kg dry wt	< 0.014	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.014	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.014	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.014	-	-	-	-
Methoxychlor	mg/kg dry wt	< 0.014	-	-	-	-

Summary of Methods

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Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-17
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-17
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082). Tested on as recieved sample	0.010 - 0.06 mg/kg dry wt	18-21
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	18-21
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-8, 10-17

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2108370	SDSPv1
Contact:	Conal Summers	**Date Received:**	15-Jan-2019	
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	17-Jan-2019	
	PO Box 575	**Quote No:**	88342	
	Whangarei 0140	**Order No:**		
		Client Reference:		
		Submitted By:	Conal Summers	

Analysis Results

Sample Name:	Lab Number	Total Recoverable Arsenic mg/kg dry wt
QRCC 1 11-Jan-2019 10:35 am	2108370.1	4
QRCC 2 11-Jan-2019 10:45 am	2108370.2	4
QRCC 3 11-Jan-2019 10:47 am	2108370.3	4
QRCC 4 11-Jan-2019 10:50 am	2108370.4	4
QRCC 5 11-Jan-2019 11:00 am	2108370.5	4
QRCC 6 11-Jan-2019 11:10 am	2108370.6	3
QRCC 7 11-Jan-2019 11:15 am	2108370.7	3
QRCC 8 11-Jan-2019 11:17 am	2108370.8	3
QRCC 9 11-Jan-2019 11:30 am	2108370.9	6
QRCC 10 11-Jan-2019 11:32 am	2108370.10	6
QRCC 11 11-Jan-2019 11:34 am	2108370.11	4
QRCC 11a 11-Jan-2019 11:35 am	2108370.12	5
QRCC 12 11-Jan-2019 11:36 am	2108370.13	4
QRCC 13 11-Jan-2019 11:51 am	2108370.14	5
QRCC 13a 11-Jan-2019 11:52 am	2108370.15	4
QRCC 14 11-Jan-2019 11:50 am	2108370.16	6
QRCC 15 11-Jan-2019 11:47 am	2108370.17	4
QRCC 16 11-Jan-2019 11:45 am	2108370.18	4
QRCC 51A1 11-Jan-2019 3:25 pm	2108370.19	4
QRCC 51A2 11-Jan-2019 3:26 pm	2108370.20	5
QRCC 51A2a 11-Jan-2019 3:27 pm	2108370.21	5
QRCC 51A3 11-Jan-2019 3:30 pm	2108370.22	4
QRCC 51A4 11-Jan-2019 3:31 pm	2108370.23	4
QRCC 51A4a 11-Jan-2019 3:32 pm	2108370.24	4
QRCC 56A1 11-Jan-2019 2:38 pm	2108370.25	5
QRCC 56A2 11-Jan-2019 2:39 pm	2108370.26	4
QRCC 56A3 11-Jan-2019 2:36 pm	2108370.27	4
QRCC 56A4 11-Jan-2019 2:35 pm	2108370.28	4
QRCC 56B1 11-Jan-2019 2:50 pm	2108370.29	4
QRCC 56B2 11-Jan-2019 2:53 pm	2108370.30	4
QRCC 56B3 11-Jan-2019 2:52 pm	2108370.31	15
QRCC 56C1 11-Jan-2019 3:00 pm	2108370.32	7
QRCC 56C2 11-Jan-2019 3:02 pm	2108370.33	4
QRCC 56C3 11-Jan-2019 3:01 pm	2108370.34	4
QRCC 56C4 11-Jan-2019 3:05 pm	2108370.35	5 #1
QRCC 52A1 11-Jan-2019 1:30 pm	2108370.36	3
QRCC 52A2 11-Jan-2019 1:32 pm	2108370.37	6
QRCC 52A3 11-Jan-2019 1:33 pm	2108370.38	4
QRCC 52A4 11-Jan-2019 1:35 pm	2108370.39	4

Analysis Results

Sample Name:	Lab Number	Total Recoverable Arsenic mg/kg dry wt
QRCC 52B1 11-Jan-2019 1:45 pm	2108370.40	4
QRCC 52B2 11-Jan-2019 1:47 pm	2108370.41	4
QRCC 52B3 11-Jan-2019 1:50 pm	2108370.42	3
QRCC 52B4 11-Jan-2019 1:52 pm	2108370.43	4
QRCC 52C1 11-Jan-2019 2:06 pm	2108370.44	5
QRCC 52C2 11-Jan-2019 2:05 pm	2108370.45	3
QRCC 52C3 11-Jan-2019 2:08 pm	2108370.46	4
QRCC 52C4 11-Jan-2019 2:10 pm	2108370.47	4

Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-47
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-47
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-47
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-47

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Hill Laboratories
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R J Hill Laboratories Limited
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Hamilton 3240 New Zealand

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2112466 SPv1
Contact:	Conal Summers	**Date Received:**	22-Jan-2019
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	25-Jan-2019
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

	Sample Name:	QRCC 60A1 21-Jan-2019 12:06 pm	QRCC 60A2 21-Jan-2019 12:07 pm	QRCC 60A3 21-Jan-2019 12:02 pm	QRCC 60A4 21-Jan-2019 12:04 pm	QRCC 60A4 (a) 21-Jan-2019 12:05 pm
	Lab Number:	2112466.1	2112466.2	2112466.3	2112466.4	2112466.5
Total Recoverable Arsenic	mg/kg dry wt	3	4	3	3	4

	Sample Name:	QRCC 60B1 21-Jan-2019 12:17 pm	QRCC 60B2 21-Jan-2019 12:20 pm	QRCC 60B3 21-Jan-2019 12:16 pm	QRCC 60B4 21-Jan-2019 12:15 pm	QRCC 54 SE 3 21-Jan-2019 11:28 am
	Lab Number:	2112466.6	2112466.7	2112466.8	2112466.9	2112466.10
Total Recoverable Arsenic	mg/kg dry wt	3	6	6	4	154

	Sample Name:	QRCC 54 SE 5 21-Jan-2019 11:31 am	QRCC 54 SW 3 21-Jan-2019 11:30 am	QRCC 54 SW 5 21-Jan-2019 11:32 am		
	Lab Number:	2112466.11	2112466.12	2112466.13		
Total Recoverable Arsenic	mg/kg dry wt	7	32	4	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-13
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-13
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-13
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-13

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Appendix 3– Computer Freehold Register

Date: 05.03.19
Job No.:6062

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**45724**
Land Registration District	**North Auckland**
Date Issued	27 March 2003

Prior References
NA55B/129

Estate	Fee Simple
Area	8.8850 hectares more or less
Legal Description	Lot 1 Deposited Plan 311575

Registered Owners
Quail Ridge Country Club Limited

Interests

Subject to a right (in gross) to convey electricity, telecommunications and computer media over part marked A on DP 482156 in favour of Top Energy Limited created by Easement Instrument 9988730.1 - 13.3.2015 at 10:10 am

10594333.2 Encumbrance to Covenant Trustee Services Limited - 24.1.2017 at 4:02 pm

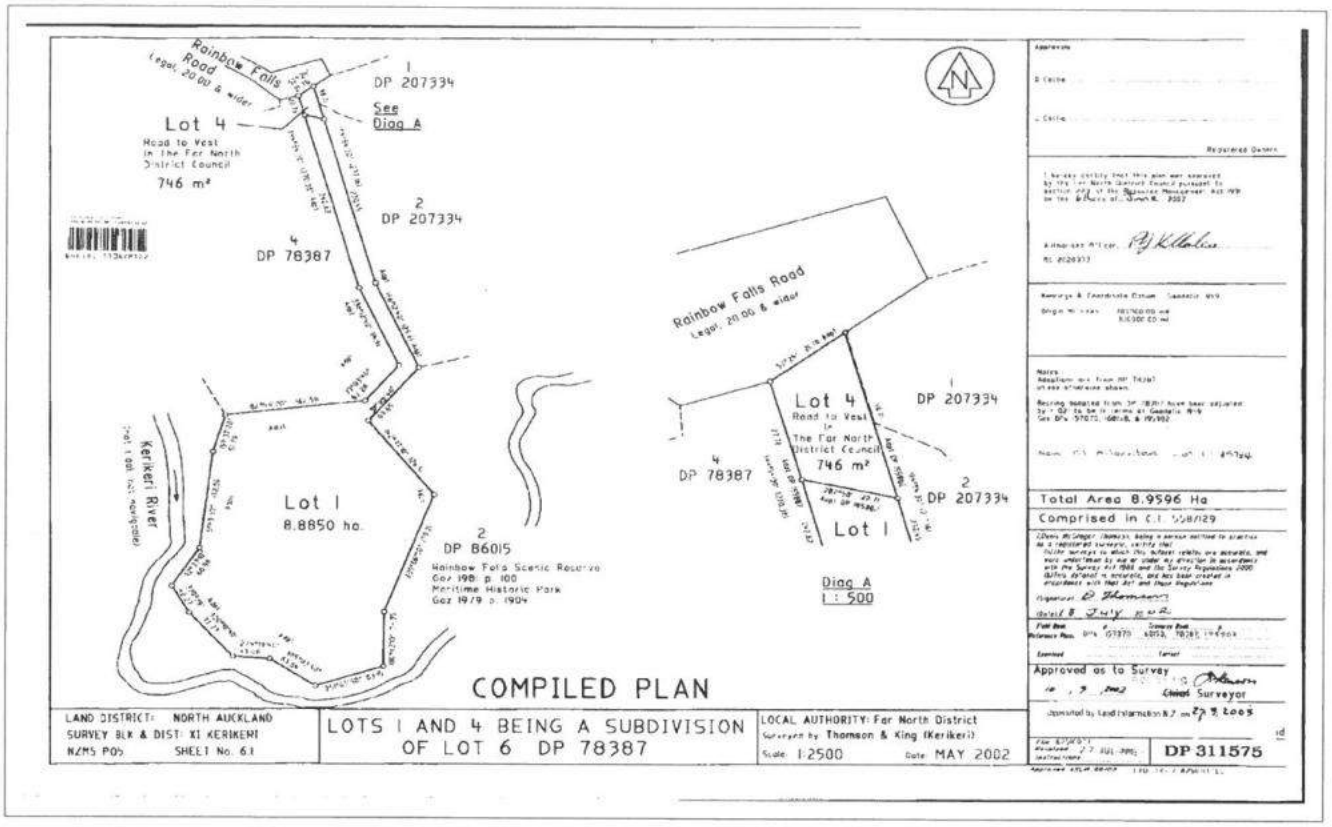
10594333.3 Mortgage to The New Zealand Guardian Trust Company Limited - 24.1.2017 at 4:02 pm

10764417.1 Variation of Mortgage 10594333.3 - 20.4.2017 at 9:29 am

10778791.1 Notice of the registration of Quail Ridge Country Club as a Retirement Village. Subject to Section 22 of the Retirement Village Act 2003 (which provides priority for the rights of the residents ahead of the rights of holders of security interests) - 4.5.2017 at 7:00 am

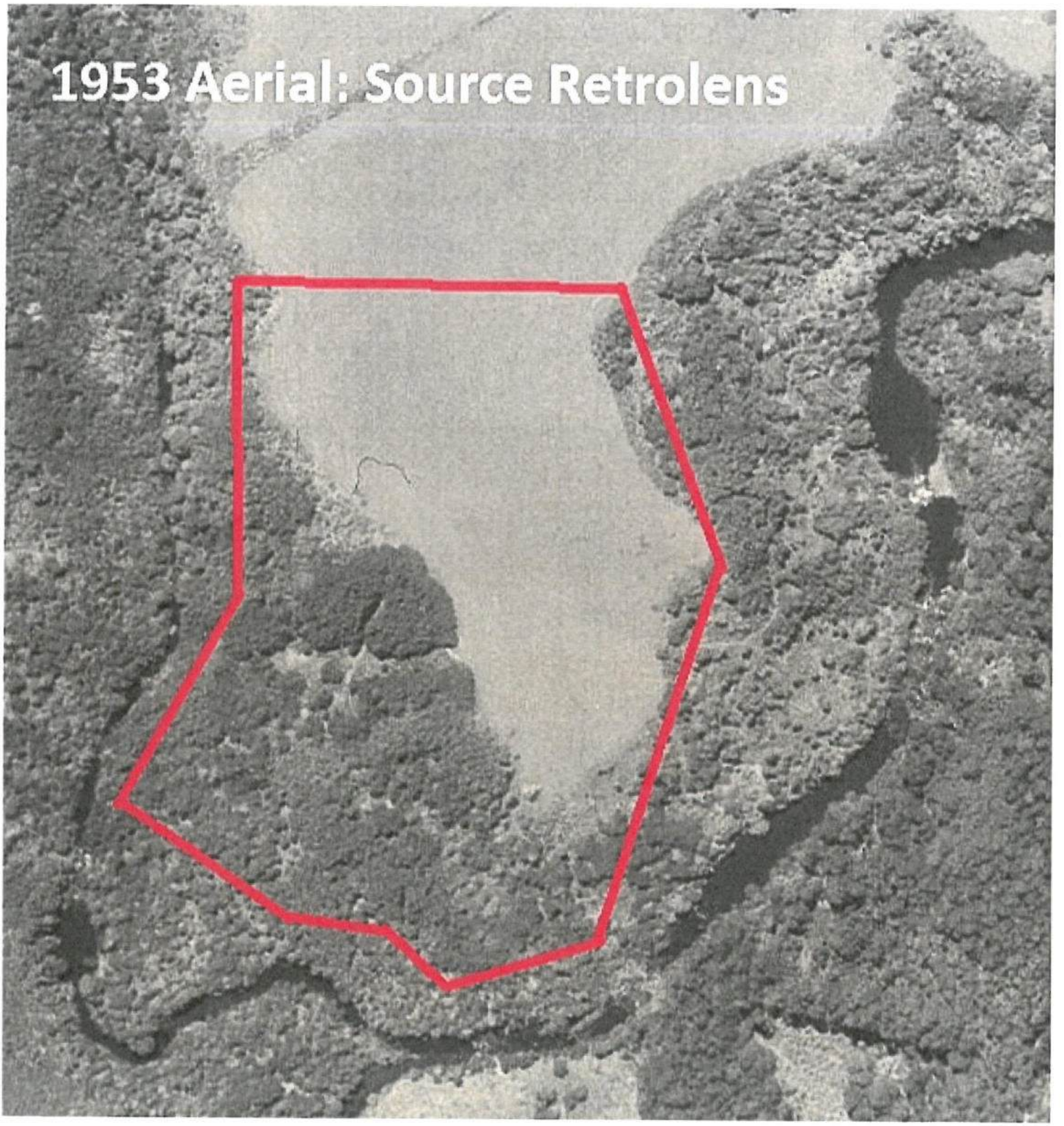
10938317.1 Mortgage to Senior Trust Capital Limited - 30.11.2017 at 12:47 pm

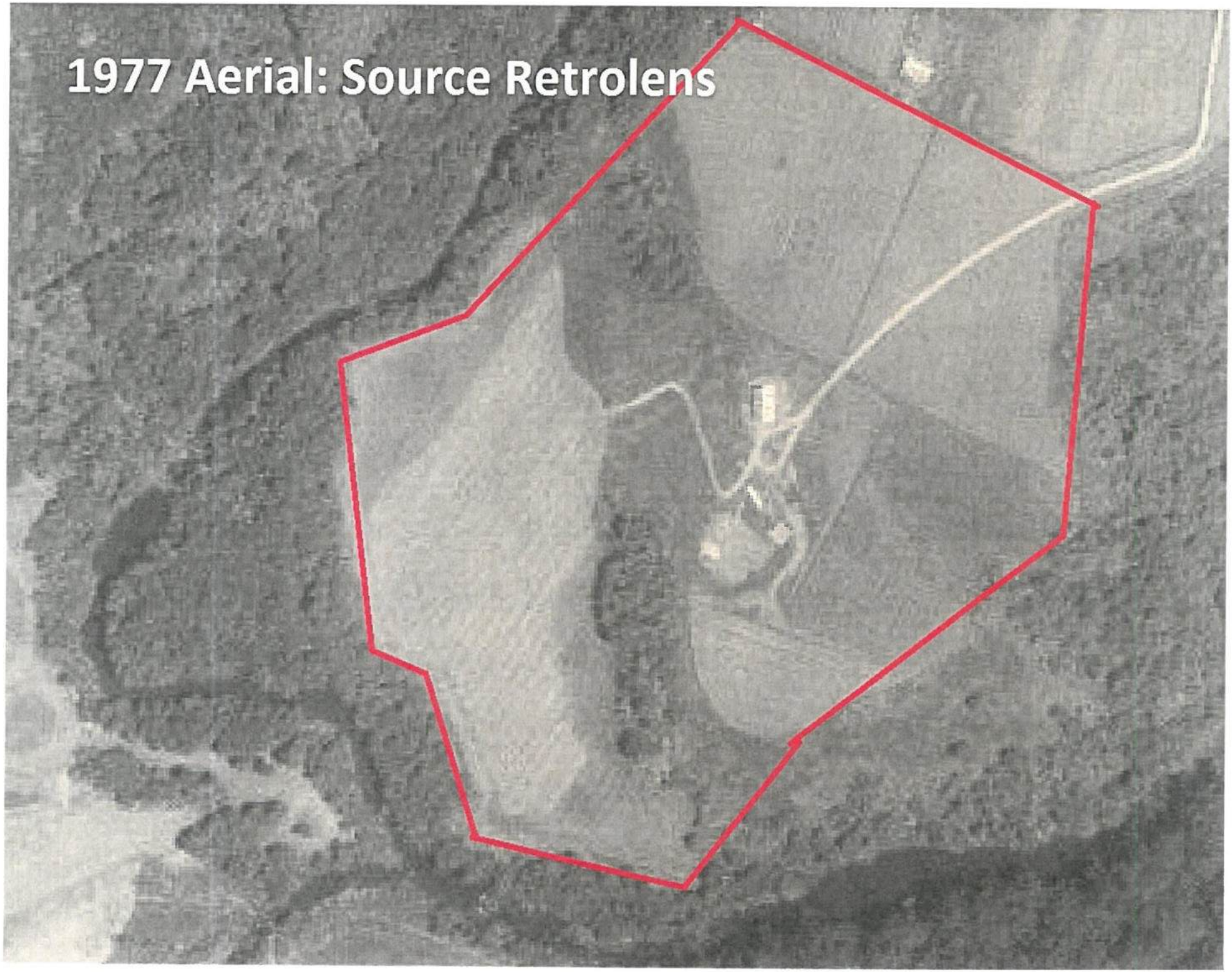
11119436.1 CERTIFICATE PURSUANT TO SECTION 77 BUILDING ACT 2004 THAT THIS COMPUTER REGISTER IS SUBJECT TO THE CONDITION IMPOSED UNDER SECTION 75(2) (ALSO AFFECTS NA54A/357) - 18.5.2018 at 7:00 am

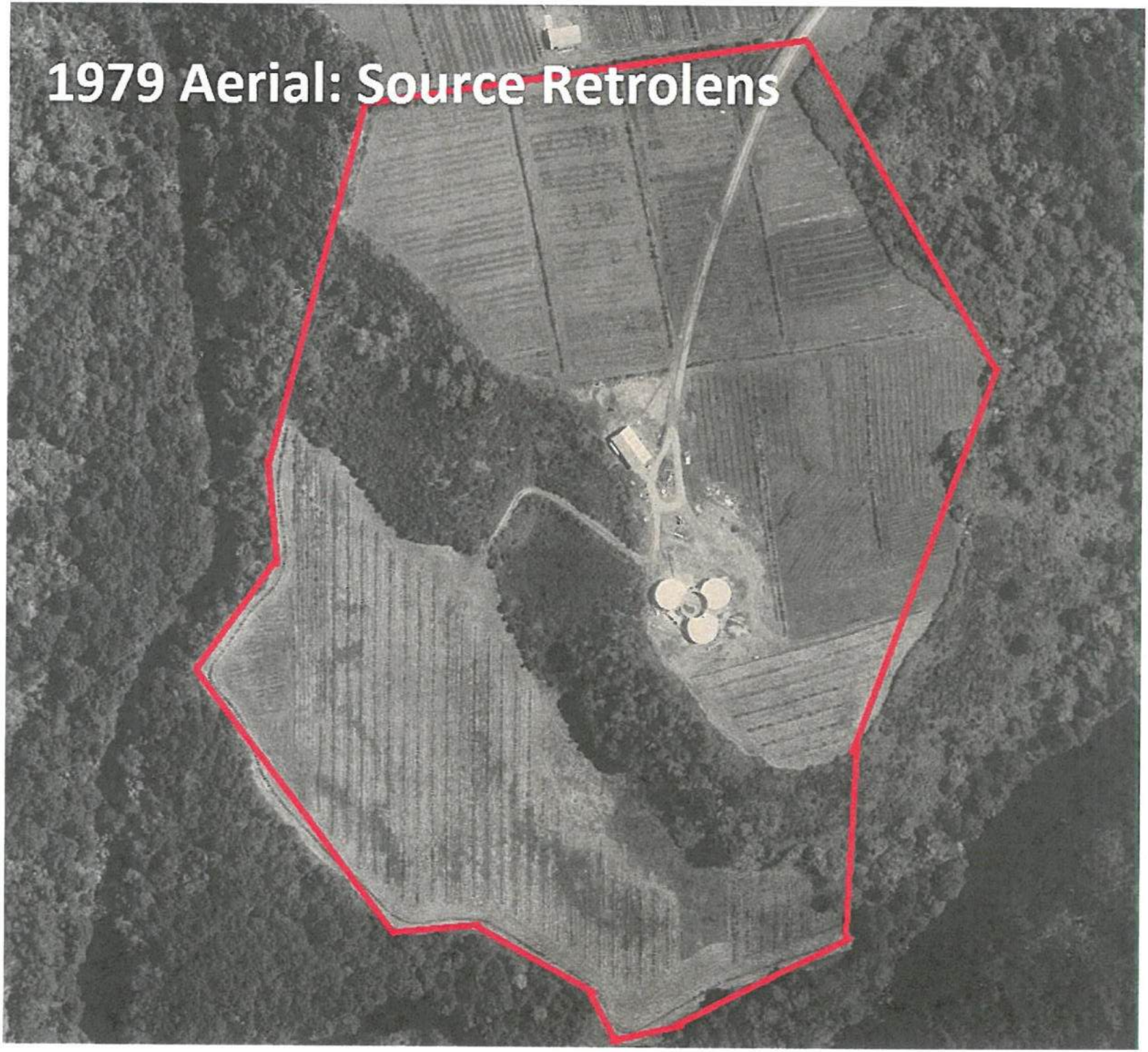

Rainbow Falls Road
Legal 20.00 & wider
Lot 4
Road to Vest in The Far North District Council
746 m²
1
DP 207334
See Diag A
2
DP 207334
4
DP 78387
Lot 1
8.8850 ha.
Kerikeri River
2
DP 86015
Rainbow Falls Scenic Reserve
Gaz 1985 p. 100
Maritime Historic Park
Gaz 1979 p. 1904
COMPILED PLAN
LAND DISTRICT: NORTH AUCKLAND
SURVEY BLK & DIST: XI KERIKERI
NZMS PO's SHEET No. 61
LOTS 1 AND 4 BEING A SUBDIVISION OF LOT 6 DP 78387
LOCAL AUTHORITY: Far North District
Surveyed by Thomson & King (Kerikeri)
Scale: 1:2500 Date: MAY 2002
Diag A
1 : 500
Total Area 8.9596 Ha
Comprised in C.T. 558/129
Approved as to Survey
Chief Surveyor
DP 311575

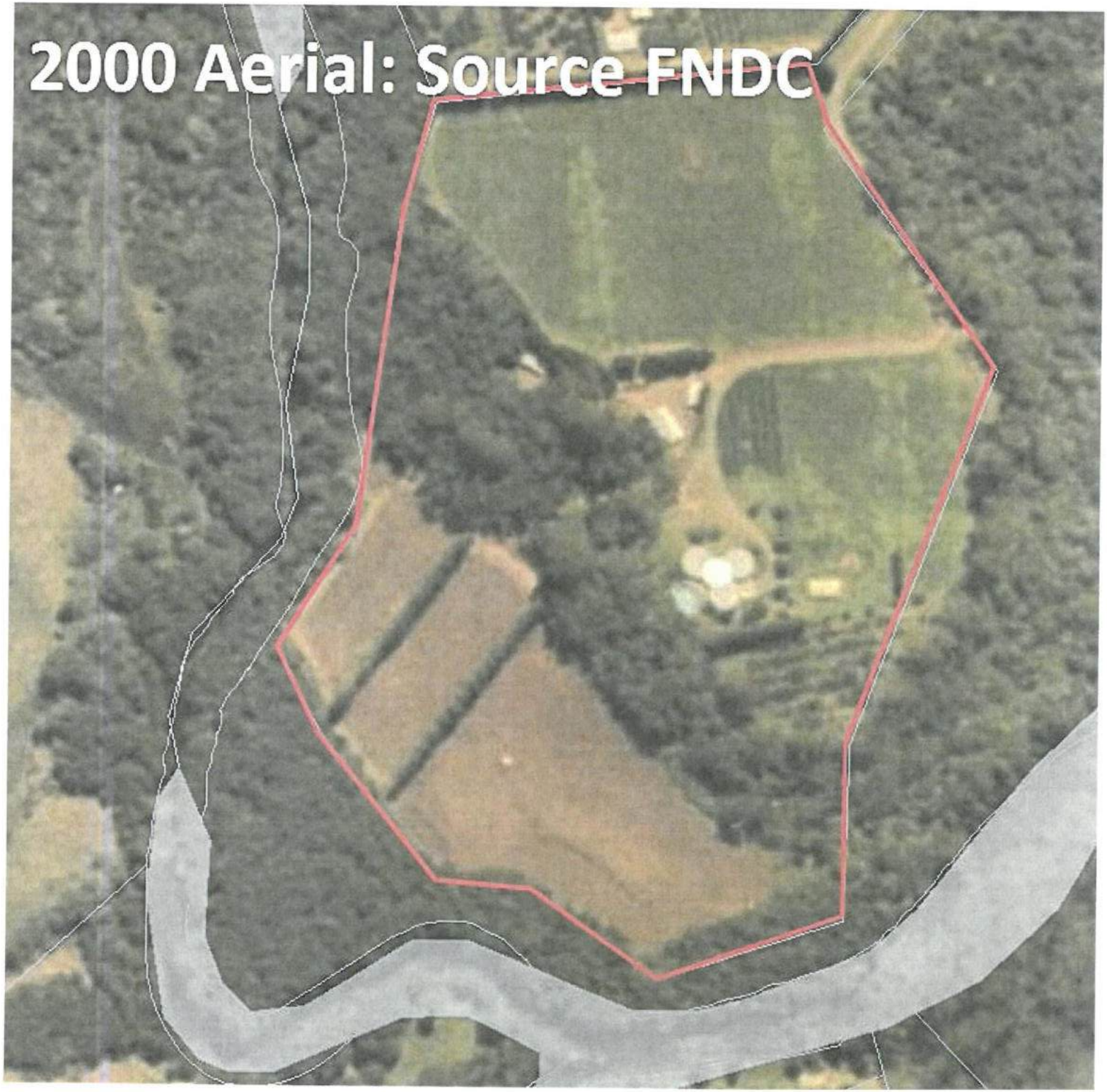
Appendix 4 – Historic Aerial Photos (1953-2015)

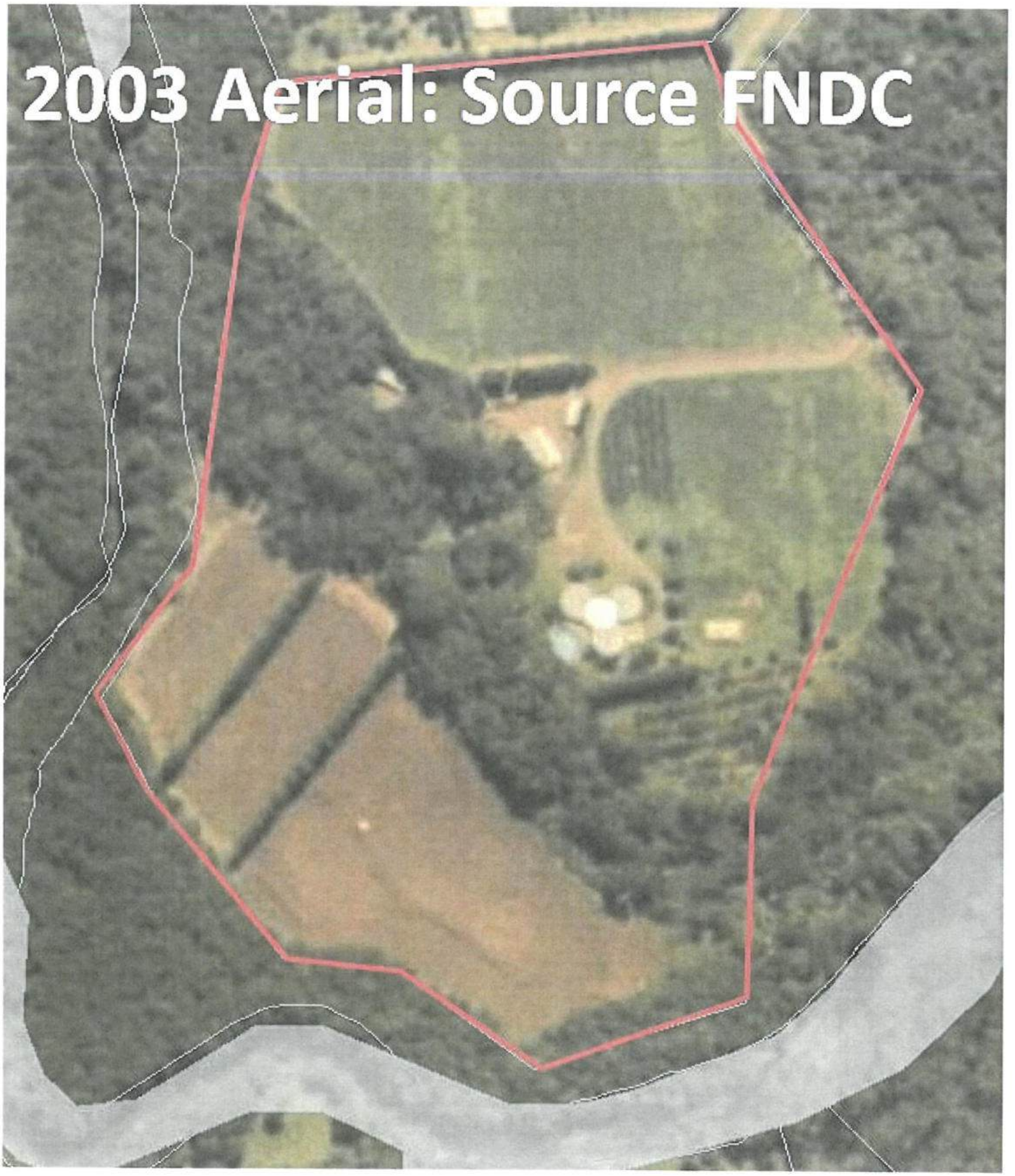
Date: 05.03.19
Job No.:6062


1953 Aerial: Source Retrolens


1977 Aerial: Source Retrolens


1979 Aerial: Source Retrolens


2000 Aerial: Source FNDC


2003 Aerial: Source FNDC


2009 Aerial: Source FNDC

2015 Aerial:Source FNDC

Date Printed: 19-February-2019

SCALE 1: 2,500

0 125

Meters

Projection: NZGD_2000_New_Zealand_Transverse_Mercator

FAR NORTH MAPS

Appendix 5 – NRC Response

Date: 05.03.19
Job No.:6062

Conal Summers

From: Heather Giles <heatherg@nrc.govt.nz>
Sent: Wednesday, 20 February 2019 10:45 a.m.
To: Conal Summers
Subject: RE: Site Contamination Query- Lot 1 DP 317665 - NRC Reference REQ.593605
Attachments: Retrolens image Lot 1 DP 311575 1980.jpg

Hi Conal,

The property that you have enquired about is not currently listed on the NRC Selected Land-use Register (SLR) for any current or historical Hazardous Activities and Industries List (HAIL) activities.

I have reviewed historic imagery sourced from Retrolens which show rows of crops across the property. The property will therefore be added to the SLR as HAIL A10.

There are no environmental incidents recorded on the property.

Kind regards,
Heather

Ngā mihi

Heather Giles
Environmental Monitoring Officer – Waste Management
Northland Regional Council » Te Kaunihera ā rohe o Te Taitokerau

P 09 470 1210 ext 9212
M 027 615 3952

Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

P 0800 002 004 » W www.nrc.govt.nz

From: Conal Summers [mailto:cs@hgcs.co.nz]
Sent: Tuesday, 19 February 2019 12:53 PM
To: Heather Giles <heatherg@nrc.govt.nz>
Subject: RE: Site Contamination Query- Lot 1 DP 317665

Hawthorn Geddes
engineers & architects ltd

SITE VALIDATION REPORT

STAGES 4 & 5 AT 6 KARAKA DRIVE, KERIKERI

Lot 1 DP 317665

Prepared for

QUAIL RIDGE COUNTRY CLUB

7 Selwyn Avenue
Whangarei 0110
09 438 7139

hg@hgcs.co.nz

21A The Grange
Warkworth 0910
09 283 3428

hawthorngeddes.co.nz

SITE VALIDATION REPORT QUAIL RIDGE COUNTRY CLUB STAGES 4 & 5

Table of Contents

Report Prepared & Reviewed by:

Conal Summers

DOCUMENT TRANSMITTAL			
Prepared for: Quail Ridge Country Club			Job No.:6062
Revision	**Issued To**	**Copies Issued**	**Date**
0	Quail Ridge Country Club	1	03.02.20

1. Executive Summary

The purpose of this report is to provide a Site Validation Report for the above property in accordance with the Ministry for the Environment (MfE) Guidelines to satisfy the National Environmental Standard (NES) for Assessing Contaminants in Soil to Protect Human Health.

This report summarises the outcomes of remediation undertaken in accordance with the Hawthorn Geddes Engineers & Architects Combined Site Report (dated 5/03/2019), which included a Detailed Site Investigation, Remedial Action Plan, and Site Management Plan, as required to meet conditions in the Far North District Council Consent RM2200008-RMACOM.

- Quail Ridge Country Club is a retirement lifestyle village located of Rainbow Falls Road and Karaka Drive in Kerikeri. Stages 1 to 3 have already been developed. Stages 4 & 5 include provision of numerous residential sites, an assisted care facility, and associated accessways and infrastructure. Earthworks will be required to establish final contours, access ways, and prepare building platforms.

- Stages 4 and 5 were initially sampled on a grid basis and analysed for heavy metals and organochlorine pesticides. Composites comprising 4 samples for the grid sampled sites were prepared in the laboratory for the pesticide analysis while metals were individually analysed.

- Following detection of elevated arsenic concentrations in two locations in Stage 5 an iterative targeted approach was undertaken to determine the extent of vertical and horizontal contamination. It is likely the elevated arsenic levels arose due to storage of freshly treated timber whilst the kiwifruit orchard was being established. The highest result was 960 mg/kg, significantly in excess of the Soils Contaminant Standards of 20 mg/kg for residential/10% produce and 70 mg/kg for outdoor work exposure.

- The remediation involved removal of 108m^3 of the contaminated material and deposition on site. The contaminated material was deposited in a thin layer (50mm) on site, in areas of Stage 5 to be covered with a minimum of 2m fill, impervious surfaces (roads and buildings), and below any proposed piped infrastructure. The material was then covered with a minimum of 2m of fill from the tested areas in Stage 4 (all below SCS) placed on top of the material, removing any pathway in the conceptual site model

- Validation sampling was undertaken and results indicate that locations 48 and 54 are now below the SCS specified in the Remedial Action Plan. In terms of Far North District Council Consent RM2200008-RMACOM for Stage 4, Decision B: Condition 1 is considered met.

- For any Stage 5 consent. the site can be considered remediated, with no further investigation required, provided final levels, layouts and infrastructure provision is undertaken in general accordance with the areas indicated on the attached site remediation plan. It is recommended that a copy of this report and the Combined Site Report (dated 25/03/2019) be kept on the property file for future reference.

2. Scope of Work & Background

Stages 4 & 5 of Quail Ridge Country Club (QRCC) include provision of numerous residential sites, an assisted care facility, and associated accessways and infrastructure. Earthworks are underway to establish final contours, access ways, and prepare building platforms.

The purpose of this report is to present the results of a Site Validation Investigation in general accordance with the *'Resource management Regulations 2011 - National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil to Protect Human Health'* and *"Contaminated Land Management Guideline No. 1"*.

3. Site Identification

The site consists of one lot (Lot 1 DP 311575) located at the end of Rainbow Falls Road in Kerikeri. The piece of land is defined as the area of the parcel excluding the accessway and bush clad escarpments areas, an area of approximately 5.9 Ha. Refer to Figure 1 for further details.

The land is bordered on 3 sides by scenic reserve and the Kerikeri River, Stages 1-3 of Quail Ridge County Club are to the north. Copies of the Computer Freehold Register are also attached to this report.

SITE:	6 Karaka Drive Kerikeri
LEGAL DESCRIPTION:	Lot 1 DP 311575
AREA:	8.8973 Ha more or less
OWNER:	Quail Ridge Country Club Limited
MAP REFERENCE:	NZTM
EAST:	1686062.40
NORTH:	6102257.30
CERTIFICATE OF TITLE:	Computer Freehold Register identifier NA-55B/129

4. Site History

Full site history and historic aerial photo reviews were given in the Hawthorn Geddes Engineers & Architects Combined Site Report (dated 5/03/2019). Site history indicates use as a kiwifruit and citrus orchard from the early 1980's. The table below lists hazardous substances/contaminants as per HAIL, which are likely to be associated with the historical land use and processes. Kiwifruit are grown on wires supported by Copper-Chrome-Arsenic treated timber trusses so this was included as a potential HAIL activity.

As stated in the Combined Site Report dated 5/03/2019, the contaminant source for the highly elevated Arsenic levels on sites 48 and 54 could not initially be established with any certainty. However, in discussions with Don Cottle, previous site owner and current partner in QRCC, it was mentioned that while converting the land to kiwifruit cultivation, treated timber was in short supply and was being delivered very shortly after treatment, and unloaded in bulk on Stage 5. This is the most likely source of the arsenic contamination and would explain the highly localised nature and extreme levels encountered on site.

HAIL-Code	Activity or industry	Hazardous substances likely to be associated with that activity or industry
A10	Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds	Arsenic, lead, copper, mercury; wide range of organic compounds including acidic herbicides, organophosphates and organochlorines (e.g. endosulfan on golf and bowling greens)
A18	Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or **bulk storage of treated timber outside**	Pentachlorophenol (PCP), copper, arsenic, chromium, boron, PAHs, phenolics (creosote), antisapstain, organochlorine pesticides, fungicides, and tributyltin (TBT)

Table 1: Potential HAIL categories from Combined Site Investigation

5. Site Condition and Surrounding Environment

A site visit was undertaken on 5 December 2017 (prior to any Stage 4 and 5 earthworks commencing).

The following features were noted on site:

- Fill piles were present to the west of Stage 4, adjacent to the boundary with Stage 3, up to 15 m height. This precluded the area from being sampled.
- Stage 4 slopes in a west/southwest direction to an escarpment, at the base of which Stage 5 commences.
- Both stage 4 and 5 were in pasture, with approximately 1000 m^2 of mandarins in 3 rows present in Stage 4 and a further orchard of approximately 1800 m^2 in the Southwestern corner of Stage 4.
- A fuel bowser and underground tank were observed adjacent to the sheds on Stage 4. These have been subject to a separate site investigation undertaken by PDP Limited.

On 14 January 2020 the site other than the remediation extents and deposition area were in the process of being filled with up to 2m of material from Stage 4.

6. Geology and Hydrology

The geotechnical investigation for this development included the excavation of 13 test pits on Stages 4 and 5. Stage 4 soils were 100-200mm of topsoil underlain by 2.5 to 3 m of clayey silt. Stage 5 soils were 100-200mm of topsoil underlain by 1.5 to 2.5 m of clayey silt progressing to silty gravel to the 3m extent of the testpits.

The NRC GIS map identifies a groundwater borehole on the neighbouring property to the north. The bore is 52 m deep and used for domestic purposes. There is no data available about groundwater flows in this area.

Hydrology

The ground contours of the existing land indicate that surface water from Stage 4 flows to the southeast and southwest. Stage 5 is relatively flat with gradual surface water flows to the south. Both stages ultimately discharge into the adjacent Kerikeri River.

7.Sampling, Analysis Plan and Sampling Methodology

Sampling was undertaken in general accordance with Figures 1 and 2 in the Remedial Action Plan, at 3m grid spacings. Refer to the field mark ups in the appendix for Sample ID's. A total of 30 Samples were taken, including 3 duplicates.

Validation samples were tested for arsenic only, as the sampling undertaken in the combined site report had not indicated any other heavy metals or pesticides of concern.

8. Field Quality Assurance (QA) and Quality Control (QC)

The soil samples were collected from holes dug with a stainless steel trowel to a depth of 150 mm. The sampling tools were cleaned and decontaminated using Decon 90 and deionised water prior to taking each individual sample. The soil was filled in glass jars or plastic containers with lids, provided by the laboratory, with samples kept in a chillybin for transport to and from the site and to the laboratories. Samples were sent to Hill Laboratories in Hamilton for analysis in accordance with the site-specific risk profile.

The investigation was undertaken by a suitably qualified and experienced practitioner in accordance with MfE Contaminated Land Management Guidelines (CLMG) No.5 – Site investigation and Analysis of Soils and No.1 – Reporting on Contaminated Sites in New Zealand.

An Environmental Engineer from Hawthorn Geddes Engineers & Architects took soil samples for the purposes of remediation and validation on 14 January 2020. A duplicate sample was taken for approximately each 10 samples. Refer to the attached analysis report for details regarding the laboratory QA/QC.

9. QA/QC Data Evaluation

Blind replicate (duplicates) samples were taken and analysed for Arsenic.
Comparative results are given in Table 3 below:

Sample	As (mg/kg)	Relative % Diff.
QRCC 48/6	2	NA
QRCC 48/6A	<2	
QRCC 54/2	<2	NA
QRCC 54/2A	<2	
QRCC 54/10	2	40%
QRCC 54/10A	3	

Table 2: Duplicate Differences

Two duplicates had results at or below the detection limit. The third sample result was also close to the detection limit of 2 mg/kg, and was between the 30% - 50% relative difference stated as a typical data quality objective in the Contaminated Land Management Guidelines No. 5.

10. Basis for Guideline Values

The NES contains soil contaminant standards (SCS) for a variety of contaminants considering different pathways/exposure scenarios and land uses.

For the piece of land covering the proposed residential dwellings, the applicable scenario is residential/10% produce as detailed in Section 7 of the Methodology for deriving standards for contaminants in soil to protect human health (Ministry for the Environment, 2011)

For site preparation including earthworks, the applicable scenario is Commercial/industrial outdoor worker (unpaved) as detailed in Section 7 of the Methodology for deriving standards for contaminants in soil to protect human health (Ministry for the Environment, 2011).

In terms of the validation testing post remediation, the relevant SCS is **20 mg/kg** for Arsenic.

11. Results

Results are reproduced in the tables below and the full lab results and uncertainties can be found in the Appendix. Individual analysis was undertaken for arsenic.

Sample	Arsenic (mg/kg)	Sample	Arsenic (mg/kg)	Sample	Arsenic (mg/kg)	Sample	Arsenic (mg/kg)
QRCC 48/1	2	QRCC 48/7	3	QRCC 54/2	< 2	QRCC 54/9	< 2
QRCC 48/2	2	QRCC 48/8	2	QRCC 54/2A	< 2	QRCC 54/10	2
QRCC 48/3	< 2	QRCC 48/9	< 2	QRCC 54/3	< 2	QRCC 54/10A	3
QRCC 48/4	2	QRCC 48/10	2	QRCC 54/4	3	QRCC 54/11	3
QRCC 48/5	2	QRCC 48/11	2	QRCC 54/5	< 2	QRCC 54/12	2
QRCC 48/6	2	QRCC 48/12	< 2	QRCC 54/6	< 2	QRCC 54/13	2
QRCC 48/6A	< 2	QRCC 54/1	< 2	QRCC 54/7	3	QRCC 54/14	3
				QRCC 54/8	< 2	QRCC 54/15	2

Table 3: Results

12. Site Characterisation

The source in the conceptual site model arises from historical treated timber storage. The most relevant contaminant pathways for the proposed residential site use are through direct contact with soil (dermal), ingestion of soil (e.g. by children) and through ingestion of food grown in the soil. During site preparation there is also potential for dermal contact by excavation workers and ingestion of soil particles.

Source	Pathway	Receptor.
Treated Timber storage and use	• Ingestion both direct and via produce uptake • Dermal contact during site development and post development • Dust generation during site development	• Residents • Earthworks/maintenance contractors

Table 4: Conceptual Site Model

The results indicate that all initial locations are now below the SCS specified in the DSI and RAP, thus the source in the conceptual site model is no longer present (through removal from the initial locations, and disposal to an area to be capped with impervious surfaces.

13. Remedial Actions

Remedial Actions were undertaken as per the Remedial Action Plan in the Hawthorn Geddes Engineers & Architects Combined Site Report (dated 5/03/2019)

Contaminated topsoil ($108m^3$) at sites 48 and 54 initially had vegetation sprayed off, then was removed to a maximum depth of 500mm. The contaminated material was deposited in a thin layer (50mm) on site, in areas of Stage 5 to be covered with impervious surfaces (roads and buildings), and below any proposed piped infrastructure.

The material was then covered with a minimum of 2m of fill from the tested areas in Stage 4 (all below SCS) placed on top of the material, removing any pathway in the conceptual site model. A copy of the remediation plan is included in the appendix.

14. Validation

As detailed in the results section, remediation goals of arsenic levels below 20 mg/kg were met in Locations 48 and 54, with the contaminated material being deposited in an area capped with 2m of fill and to be covered in impervious surfaces during Stage 5.

15. Site Management Plan

A Site Management Plan was provided in the Hawthorn Geddes Engineers & Architects Combined Site Report (dated 5/03/2019). During the validation sampling, earthworks on Location 54 and spreading of the contaminated material was still in progress.

Discussion with the machinery operators on site indicated that they had not been made fully aware of the nature of the material and the precautionary measures as specified in the Site Management Plan, although their standard work practices addressed some of the recommendations (long sleeved clothing, work boots, minimal contact with material). This was formally raised with the Site manager.

The remainder of the Plan with regards to soil management, dust minimisation and procedural aspects was complied with.

16. Conclusions and Recommendations

Hawthorn Geddes Engineers & Architects prepared a Combined Site Report (dated 25/03/2019) which included a Detailed Site Investigation, Remedial Action Plan, and Site Management Plan. Compliance with this plan formed a consent condition under Far North District Council Consent RM2200008-RMACOM.

Remedial works and Site Management were undertaken in general accordance with those detailed in the Combined Site Report, with validation sampling indicating that remediation goals of arsenic levels below 20 mg/kg were met in Locations 48 and 54.

The contaminated material was deposited in a thin layer (50mm) on site, in areas of Stage 5 to be covered with impervious surfaces (roads and buildings), and below any proposed piped infrastructure.

In terms of Far North District Council Consent RM2200008-RMACOM for Stage 4, Decision B: Condition 1 is considered met.

For any Stage 5 consent. the site can be considered remediated, with no further investigation required, provided final levels, layouts and infrastructure provision is undertaken in general accordance with the areas indicated on the attached site remediation plan.

It is recommended that a copy of this report and the Combined Site Report (dated 25/03/2019) be kept on the property file for future reference.

17. SQEP Statement

Conal Summers

Qualifications and Memberships:

- Bachelor of Technology (Environmental Engineering, 1st Class Hons)
- New Zealand Certificate of Science (Chemistry)
- Certificate in Quality Assurance from the New Zealand Organisation for Quality
- Chartered Member Engineering NZ
- Chartered Professional Engineer
- Member of Waste Management Institute of NZ

Conal has more than ten years of chemical and microbiological laboratory experience in New Zealand and the UK including sampling, analysis and quality assurance on water, soil, process and product samples.

As a Pollution Prevention Officer in the Waste Department for Northland Regional Council, he undertook site contamination assessments and HSNO compliance duties.

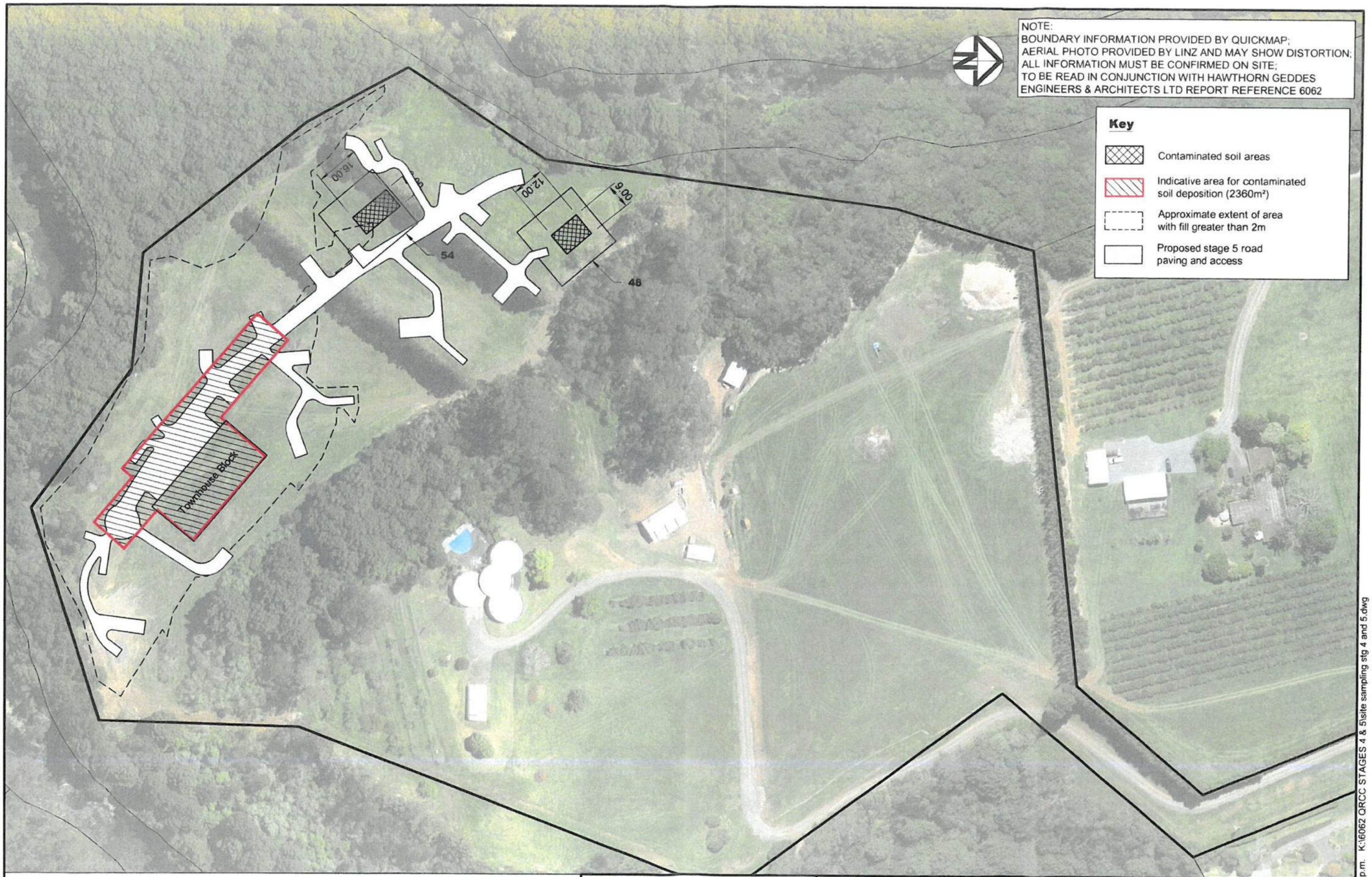
As Stormwater Asset Engineer for Whangarei District Council he was responsible for obtaining and monitoring consents related to the discharge of contaminants from the stormwater networks including water and sediment loadings.

Conal is currently providing assistance to Kaipara District Council to review contaminated land assessments and investigations for resource consent applications.

18. Limitation

This report has been prepared solely for the benefit of our client Bob Kennedy and the Whangarei District Council in relation to the resource consent application for which this report has been prepared. The comments in it are limited to the purpose stated in this report. No liability is accepted by Hawthorn Geddes engineers & architects ltd in respect of its use by any other person, and any other person who relies upon any matter contained in this report does so entirely at their own risk.

Appendix A –Remediation Plan



USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.

SITE PLAN
SCALE - 1:1250

Hawthorn Geddes
engineers & architects ltd
7 Selwyn Avenue
Whangarei 0110
Phone: 09 438 7139
hg@hgcs.co.nz
Unit 21a, The Grange
Warkworth 0910
Phone: 09 283 3428
www.hawthorngeddes.co.nz

CLIENT **KERIKERI FALLS INVESTMENT LTD**
PROJECT **QRCC - NES SITE INVESTIGATION**
RAINBOW FALLS ROAD, KERIKERI
DRAWING **STAGE 5 - NES REMEDIATION PLAN**

PROJECT No **6062**
SHEET **Figure 2**

5/03/2019 12:02:59 p.m. K:\6062 QRCC STAGES 4 & 5\site sampling stg 4 and 5.dwg

Appendix B - Lab Results

Hill Laboratories
TRIED, TESTED AND TRUSTED
R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand
T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2305567 SPv1
Contact:	Conal Summers	**Date Received:**	16-Jan-2020
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	20-Jan-2020
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

	Sample Name:	QRCC 54/15 14-Jan-2020 1:56 pm				
	Lab Number:	2305567.1				
Total Recoverable Arsenic	mg/kg dry wt	2	-	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Dates of testing are available on request. Please contact the laboratory for more information.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
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Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Hawthorn Geddes Engineers & Architects Limited	**Lab No:**	2305529 SPv1
Contact:	Conal Summers	**Date Received:**	15-Jan-2020
	C/- Hawthorn Geddes Engineers & Architects Limited	**Date Reported:**	20-Jan-2020
	PO Box 575	**Quote No:**	88342
	Whangarei 0140	**Order No:**	
		Client Reference:	
		Submitted By:	Conal Summers

Sample Type: Soil

	Sample Name:	QRCC 48/1 14-Jan-2020 12:15 pm	QRCC 48/2 14-Jan-2020 12:18 pm	QRCC 48/3 14-Jan-2020 12:20 pm	QRCC 48/4 14-Jan-2020 12:22 pm	QRCC 48/5 14-Jan-2020 12:24 pm
	Lab Number:	2305529.1	2305529.2	2305529.3	2305529.4	2305529.5
Total Recoverable Arsenic	mg/kg dry wt	2	2	< 2	2	2

	Sample Name:	QRCC 48/6 14-Jan-2020 12:30 pm	QRCC 48/6A 14-Jan-2020 12:35 pm	QRCC 48/7 14-Jan-2020 12:38 pm	QRCC 48/8 14-Jan-2020 12:40 pm	QRCC 48/9 14-Jan-2020 12:42 pm
	Lab Number:	2305529.6	2305529.7	2305529.8	2305529.9	2305529.10
Total Recoverable Arsenic	mg/kg dry wt	2	< 2	3	2	< 2

	Sample Name:	QRCC 48/10 14-Jan-2020 12:43 pm	QRCC 48/11 14-Jan-2020 12:46 pm	QRCC 48/12 14-Jan-2020 12:48 pm	QRCC 54/1 14-Jan-2020 1:20 pm	QRCC 54/2 14-Jan-2020 1:21 pm
	Lab Number:	2305529.11	2305529.12	2305529.13	2305529.14	2305529.15
Total Recoverable Arsenic	mg/kg dry wt	2	2	< 2	< 2	< 2

	Sample Name:	QRCC 54/2A 14-Jan-2020 1:22 pm	QRCC 54/3 14-Jan-2020 1:24 pm	QRCC 54/4 14-Jan-2020 1:26 pm	QRCC 54/5 14-Jan-2020 1:29 pm	QRCC 54/6 14-Jan-2020 1:32 pm
	Lab Number:	2305529.16	2305529.17	2305529.18	2305529.19	2305529.20
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	3	< 2	< 2

	Sample Name:	QRCC 54/7 14-Jan-2020 1:35 pm	QRCC 54/8 14-Jan-2020 1:38 pm	QRCC 54/9 14-Jan-2020 1:41 pm	QRCC 54/10 14-Jan-2020 1:43 pm	QRCC 54/10A 14-Jan-2020 1:45 pm
	Lab Number:	2305529.21	2305529.22	2305529.23	2305529.24	2305529.25
Total Recoverable Arsenic	mg/kg dry wt	3	< 2	< 2	2	3

	Sample Name:	QRCC 54/11 14-Jan-2020 1:47 pm	QRCC 54/12 14-Jan-2020 1:50 pm	QRCC 54/13 14-Jan-2020 1:52 pm	QRCC 54/14 14-Jan-2020 1:54 pm	
	Lab Number:	2305529.26	2305529.27	2305529.28	2305529.29	
Total Recoverable Arsenic	mg/kg dry wt	3	2	2	3	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-29
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-29
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-29

ilac-MRA IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-29

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Dates of testing are available on request. Please contact the laboratory for more information.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental

Hawthorn Geddes
engineers & architects ltd

SITE SUITABILITY REPORT FOR PROPOSED CLUBHOUSE & VILLA ZONES A-D

FOR QUAIL RIDGE COUNTRY CLUB LTD

82 RAINBOW FALLS ROAD, KERIKERI

SITE SUITABILITY REPORT FOR PROPOSED QUILRIDGE COUNTRY CLUB

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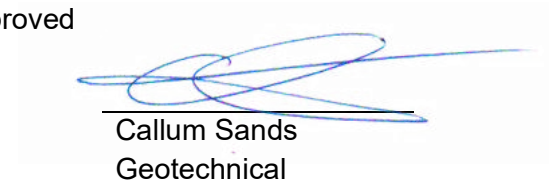

Callum Sands
Geotechnical Engineer
BE(Hons),CMEngNZ, CPEngNZ

DOCUMENT TRANSMITTAL			
Prepared for: Quail Ridge Country Club Limited			Job No.: 6062
Revision	**Issued To**	**Copies Issued**	**Date**
1	Client: Quail Ridge Country Club Limited Attention: Peter Lawerance Via email: pete@serve.nz CC: Foley Group Attention: Greg Holmes Via Email: greg@foleygroup.co.nz	EMAIL	10.11.2025

1. Purpose

The purpose of this report is to evaluate the engineering suitability of the Quail Ridge Country Club (QRCC) development site for the proposed new development zones.

This report provides advice on stormwater management, wastewater treatment, earthworks, slope stability, and soil conditions for foundations.

This report is suitable to support both a resource consent (land use) and building application(s) to the Far North District Council (FNDC).

2. Proposal

It is understood that QRCC propose to develop a new clubhouse, along with four new residential villa Zones in the footprint of the wider QRCC development. The new villa zones have been designated as Zone A, Zone B, Zone C and Zone D.

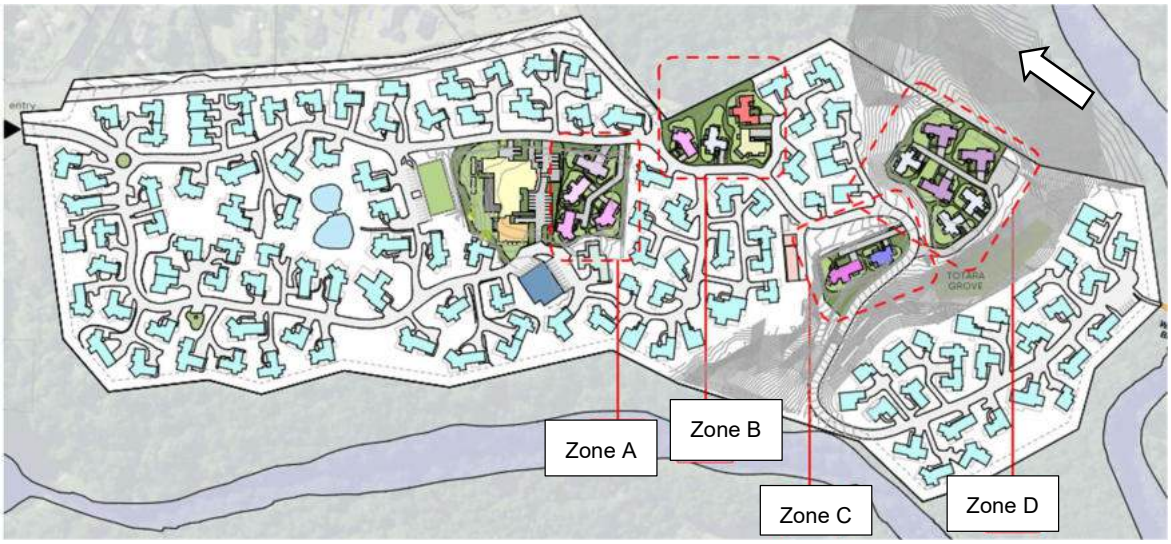

Figure A: Proposed Developments with zones A, B, C, D (Source: Foley Group:2025)

It is proposed to construct a new clubhouse at the QRCC. This clubhouse will be positioned just south of the existing bowling green, within Stage 3 of the overall QRCC development. The clubhouse is proposed to be a single-storey building, some 1285m2, constructed of timber framing, with lightweight steel roofing, and either, or a combination of centre, brick veneer and timber cladding, all supported over a conventional shallow concrete floor slab.

The clubhouse is proposed to be constructed over the old site office/car parking area. This site office was formed over natural ground, and surfaced with some 100mm of GAP 40 gravels/fill. Earthworks to form the proposed building platform will likely comprise minor excavation and filing not more than 2m.

Figure B: Proposed clubhouse layout (Source: Foley Group:2025)

The new unit within each of the villa zones is proposed to comprise single-story residential-style dwellings, ranging from 189m2 to 249m2, comprising two to three bedroom units, with built-in double garages, and large living spaces. These units will likely be constructed of lightweight timber framing, with a combination of brick veneer, weatherboard cladding, tile, or steel roofing, all supported over waffle-raft concrete foundations.

All units will be connected to the QRCC reticulated wastewater and stormwater system, further comments on which are provided later in this report.

Zone A is proposed to include a dementia care facility, the structure of which is considered to be a residential dwelling.

It is understood that earthworks to form the proposed building platforms will not likely be greater than 2.0m of excavation, and or fill. Retaining walls up to 1.75m are proposed in Zones B and C; these walls will retain excavations, and may be surcharged by traffic, or slopes up to 25º (1V:2.5H).

3. Site Description

The QRCC has been developed over five stages (Stage 1 through 5), comprising extensive earthworks to form the development site that exists today (2025). The proposed clubhouse is to be constructed towards the northern boundary of Stage 4a, within the southern portion of Stage 3. The new Villa Zones will be staggered through the QRCC development area, with Zones B, C and D within Stages 4 and 5.

The northern portion of the site (Stages 1 through 4a) is entirely gently sloping, and the southern portion of the site (Stages 4b,4c, and 5) is gently to steeply sloping, generally trending south, and have been subject to significant modification (earthworks). There is an existing driveway off Cottle Way providing access to the proposed clubhouse and retirement units.

Figure C: Extent of QRCC (Google Earth Images; January 2022).

4. Geological Setting

The 1:250,000 scale published geology of the area, viewed online from the GNS Science website indicates that the site is underlain by Kerikeri Volcanic Group Late Miocene basalt of Kaikohe - Bay of Islands Volcanic Field, see Figure D below. The site is closely bordered by an outcrop of the older Ruatangata Sandstone of Waro Subgroup (Te Kuiti Group), likely the basement unit beneath the basalt overlay.

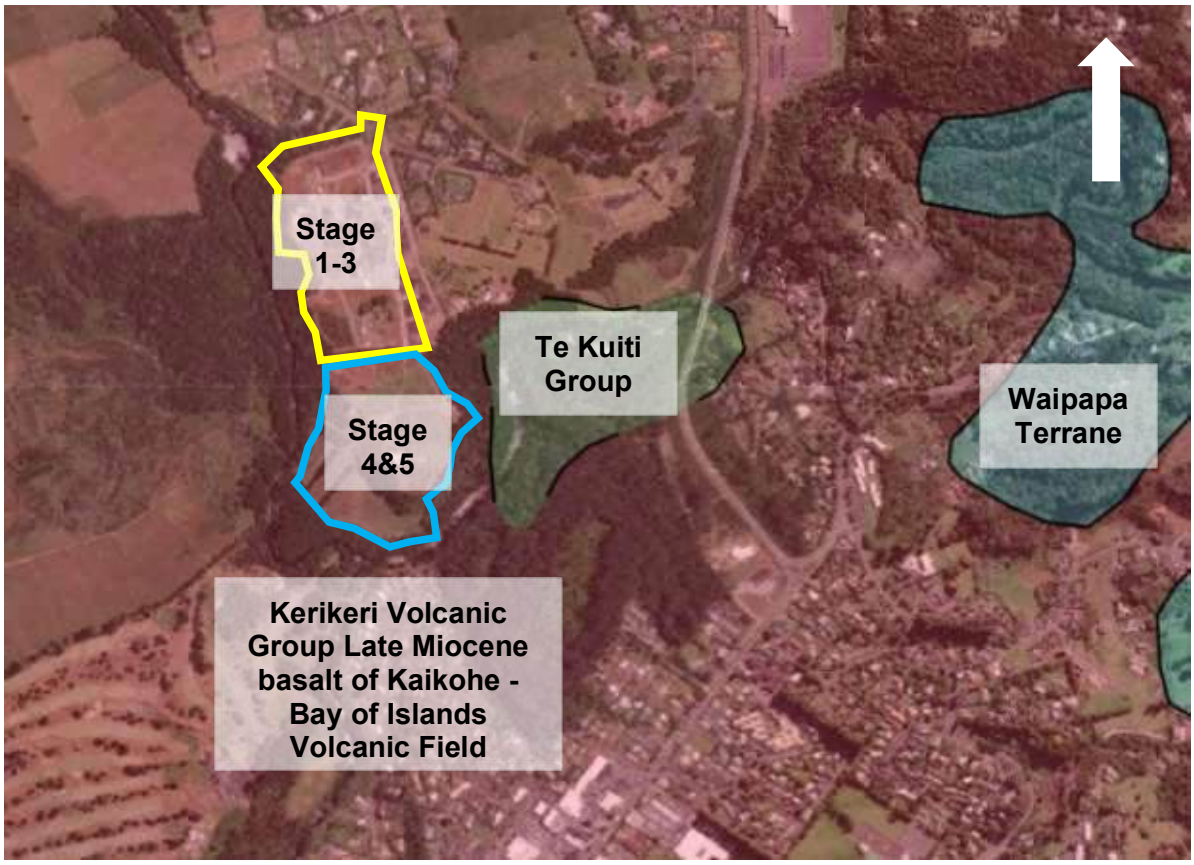

Figure D: Aerial imagery of the property and its surrounds with the published geology overlay

The Kerikeri Volcanic Group comprises Late Miocene basaltic lava flows, volcanic plugs, and minor tuff deposits, associated with the Kaikohe–Bay of Islands Volcanic Field. This field includes over 30 eruptive centres, primarily consisting of monogenetic basaltic cones and lava flows, with occasional rhyolitic domes. The basalt is typically fine-grained, dense, and dark-coloured, and may include vesicular textures and phenocrysts of plagioclase or pyroxene. These volcanic rocks are generally competent and durable, but may exhibit fracturing or weathering near the surface, particularly around older plugs or flow margins. Geotechnically, the basalt provides a stable foundation material, though excavation may be challenging due to its hardness.

To the east, the site is bordered by an outcrop of Ruatangata Sandstone, part of the Waro Subgroup within the Te Kuiti Group, which is of Late Eocene to Early Oligocene age. This unit is typically described as a slightly calcareous, glauconitic, muddy fine-grained sandstone, deposited in a shallow marine environment during a period of transgression. The

presence of glauconite suggests slow sedimentation and low-energy conditions, while the calcareous content indicates some biogenic input. The sandstone is generally moderately consolidated, with variable cementation and occasional fossil content. Geotechnically, it may be less competent than the overlying basalt, and could exhibit moderate weathering or erosion on exposed slopes.

Although the site is mapped as being underlain by the Kerikeri basalt, the proximity to the Ruatangata Sandstone suggests potential lithological transitions or faulted contacts, particularly near the southern boundary.

5. Subsoil Conditions

HGEA have been engaged by QRCC to undertake subsoil investigation and engineering oversight to earthworks over the wider development since 2017, for Stages 2 through 5. During this time, extensive subsoil investigation, comprising a combination of hand augered boreholes (HA), machine augered boreholes (MBH), test pit excavations (TP), and rotary augered boreholes (BH), have been undertaken, supervised and logged by HGEA. The extent of this investigation is outlined by Figure E below, and in more detail on the attached Figures 01 through 03.

Figure E: HGEA subsoil investigation plan with Foley Group Master Plan overlay

Extensive earthworks have been undertaken across the QRCC development, comprising a large-scale cut-and-fill operation, with the subject developed positioned over the earthworks completed in the last 5 years for Stages 4 and 5.

The extent of the earthworks undertaken across Stages 4 – 5 is depicted below, Figure F. Villa zones B and D are within areas of mostly excavation, and Villa Zone C is within an area of both excavation and fill, supported by a timber crib retaining wall.

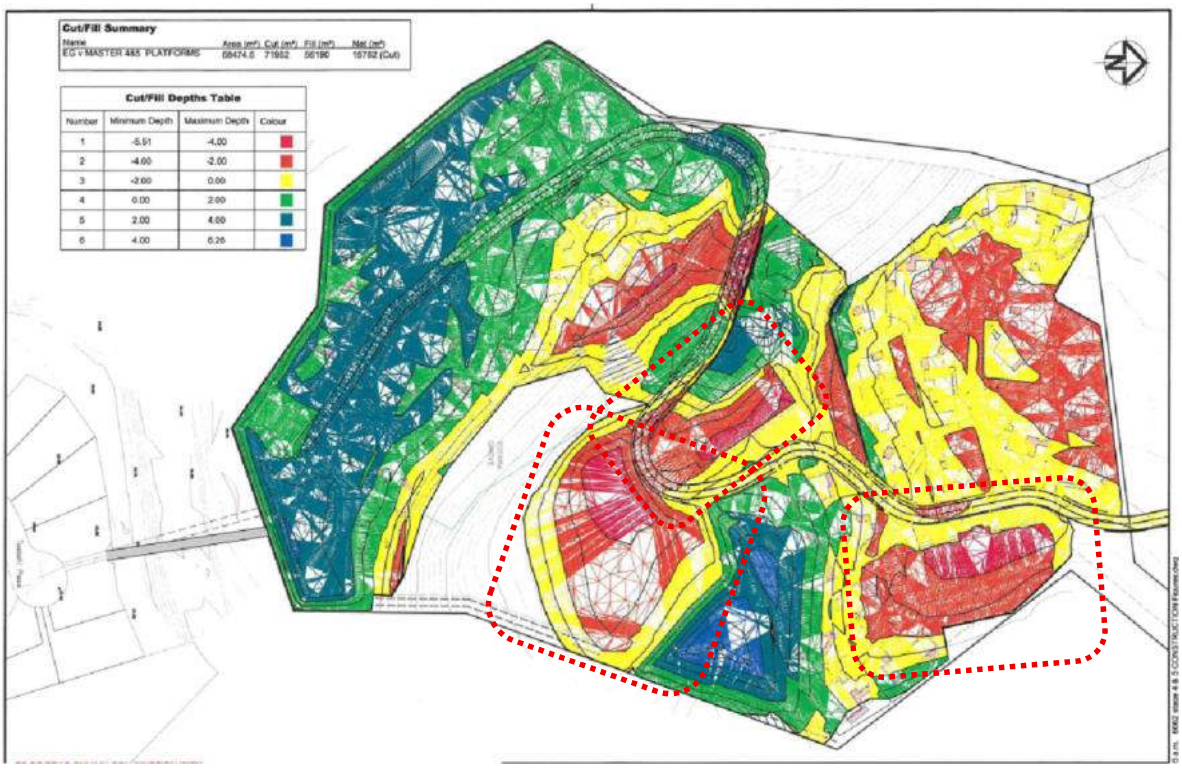

Figure F: as-built cut-fill extents for Stages 4 and 5 (Source: HGEA drawing, Figure 06, Revision R1). Villa zone(s) shown by dashed red lines, shown left to right as Villa Zones D, C and B

Outlined herein are the key observations made during this earthworks monitoring, and a summary of the subsoil conditions from the various investigations, where relevant to each of the Villa Zones.

A copy of all subsoil investigation logs, and site plans, Figure 01 through 03 are attached this this report for further reference.

5.1 Earthworks Observations – General

HGEA have been involved in geotechnical works, including subsoil investigation and oversight of all earthworks over the wider development since March 2017.

From this oversight, we can confirm the site is underlain by up to 25.0m of soil and rock (weathered basalt) of the Kerikeri Volcanic Group, with the underlying unit comprising Ruatangata Sandstone. The Kerikeri residual soils comprise of a weathered tuff layer; dark grey/brown/red, low plastic, very stiff to hard silts with minor clay and sand content. The sandstone is a highly fractured and faulted, very weak to weak sandstone.

Excavation through Stage 5 resulted in the uncovering of the underlying weathered basalt rock, where fracturing, bedding, and faulting in the rock were observed, see below, Figure G. The same was observed in the MBHs (MBH1 through MBH3) drilled up to 22.5 bgl. The extent of this excavation comprised cuts up to 5.5m bgl, as shown in Figure F.

Figure G – View north over excavation above Stage 5 access (photo taken during earthworks 2021). Weathering, Fracturing and faulting are evident in the underlying Basalt Rock

All earthfilling with Stage 5 was verified by HGEA through NDM and shear vane testing in accordance with NZS4431:2022. Further information on the fill type, compaction specification, and compliance are outlined in detail in the HGEA earthwork completion report titled "EARTHWORKS COMPLETION STAGES 4 & 5 REVISION 2 PREPARED FOR KERIKERI FALLS INVESTMENTS LTD AT 82 RAINBOW FALLS ROAD, KERIKERI" and dated 18.01.2023. All fill material was site won, comprising weathered tuff of the Kerikeri Volcanic group, a low to moderately plastic, very stiff to hard, silt with variable clay content. All fill was verified as subtitle for development.

Notably this report includes the inspection, verification and sign off of fill placed in Stage 4c, over which a portion of the Villa Zone B is proposed.

5.2 Earthworks Observations (Stage 4a, and 4b)

During stage 4a and 4b earthworks, an engineering geologist from HGEA attended site on the 09/08/2019 to the extent of the excavation, which included logging of exposure, assessing all unsuitable soils were removed, and the completion of hand augered boreholes. A subsequent geotechnical report titled "Geotechnical investigation report for proposed development at Quail Ridge Country Club at 90 Rainbow Falls Road," dated 13/08/2019 was produced to support BC applications for the retirement units within stages 4a and 4b. The report provided a summary of the geotechnical investigation and provided soil conditions for foundations of Stage 4 of the QRCC development. Key findings of this report are summarised below:

Hand augered boreholes were drilled over the excavated platform to establish subsoil and founding conditions. Soils were typically very stiff to hard, moderately plastic silty clays with undrained shear strengths in the order of 110kPa to 240kPa.

Inspection of an exposed excavation face indicates the site is underlain by the weather tuff of the Kerikeri volcanics.

Figure H – View north towards future units 223 to 227 (photo taken during earthworks 2019)

5.3 Soil Investigation – Zone A (Clubhouse + Villas)

A review of the historic HGEA subsoil investigation data indicates a combination of hand augers, test pits, and rotary augered boreholes have been completed within the Zone A perimeter. These are outlined in detail in Table 1 below:

The proposed location of the clubhouse is generally underlain by compacted hardfill to a depth of 0.4m bgl. This hardfill has served as site parking to date. The localised fill and hardfill will be excavated to form the building platform to the proposed level.

Groundwater was not encountered in any hand augured borehole drilled over this zone. Based on the observed soil conditions during wide earthworks, site locality, and geomorphology of the site, we do not expect groundwater to be within 8m of the existing ground level.

Soils encountered in all the boreholes were consistent with the GNS published map geology of Kerikeri Volcanic Group Late Miocene basalt of Kaikohe - Bay of Islands Volcanic Field.

Table 1: Summary of subsoil investigation data within Zone A

Investigation key and date	Termination Depth	Scala Penetrometer Termination Depth	Topsoil Depth	Groundwater Depth	Shear Vane Soil Strengths	Scala Penetrometer Raw Data in Natural Ground	Generalised Description
All depths measured in (m) below current ground level					min - max		
					kPa	Blows/ 100mm	
HA1 (2019)	3.0	NM	NE	NE	147-UTP	NM	**Residual soils / Weathered Tuff**: Silts and silty clays with minor sands, non-plastic to moderate plastic very stiff to hard, moist. **Fill**: clayey silt trace gravel, moist, low plasticity. **Rock**: highly weathered volcanic Basalt, fractured
HA1 (2022)	3.5	NM	NE	NE	199-UTP	NM	
HA2 (2022)	3.0	NM	NE	NE	100-UTP	NM	
HA3 (2022)	4.5	NM	NE	NE	83-UTP	NM	
HA4 (2025)	0.9	NM	NE	NE	190- UTP	NM	
MA3 (BH3 - 2019)	7.5	NM	NE	NE	NM	NM	
TP2 (2017)	3.2	NM	NE	NE	NM	NM	

Table 1 Notes:

(1) NM = not measured
(2) NE = not encountered
(3) UTP = unable to penetrate

5.4 Soil Investigation – Zone B

The historic subsoil investigations undertaken within, and in proximity to this zone have comprised two hand augered, two rotary machine augered boreholes, as well as two test pit. These are outlined in detail in Table 2 below:

Notably, the test pits and rotary boreholes predate any filling or excavation undertaken in this area, with the more recent 2025 hand augers (HA10 and HA11) drilled through areas designated as in excavation; results of these augers, however, indicate the presence of some 2.0m of dark, minor organic silts. It is understood this was the previous topsoil stock pile area, and the fill has likely NOT been verified by HGEA, nor included in part of any of the historic earthworks completion reporting.

Groundwater was not encountered in any hand-augured borehole drilled over this zone. Based on the observed soil conditions during wide earthworks, site locality, and geomorphology of the site, we do not expect groundwater to be within 8m of the existing ground level.

Soils encountered in all the test locations were consistent with the GNS published map geology of Kerikeri Volcanic Group Late Miocene basalt of Kaikohe - Bay of Islands Volcanic Field. The 2025 investigation has identified non-engineered fills up to 2.0m.

Table 2: Summary of subsoil investigation data within Zone B

Investigation key and date	Termination Depth	Scala Penetrometer Termination Depth	Topsoil Depth	Groundwater Depth	Shear Vane Soil Strengths	Scala Penetrometer Raw Data in Natural Ground	Generalised Description
All depths measured in (m) below current ground level					min - max		
					kPa	Blows/ 100mm	
HA10 (2025)	3.0	NM	NE	NE	190	NM	**Residual soils / Weathered Tuff**: Silts and silty clays with minor sands, non-plastic to moderate plastic, very stiff to hard, moist. **Fill**: clayey silt trace gravel, moist, low plasticity. Some organics, soft to firm
HA11 (2025)	3.0	6.0	NE	NE	190	3-10	
TP1 (2017)	3.0	NM	0.2	NE	86-UTP	NM	
TP5 (2017)	3.0	NM	0.2	NE	111	NM	

Investigation key and date	Termination Depth	Scala Penetrometer Termination Depth	Topsoil Depth	Groundwater Depth	Shear Vane Soil Strengths	Scala Penetrometer Raw Data in Natural Ground	Generalised Description
All depths measured in (m) below current ground level					min - max kPa	min - max Blows/ 100mm	
MA6 (BH6 - 2019	7.8	NM	NE	NE	NM	NM	**Rock**: highly weathered volcanic Basalt, fractured
MA8 (BH8 - 2019	11.0	NM	NE	NE	NM	NM	

Table 2 Notes:

(4) NM = not measured
(5) NE = not encountered
(6) UTP = unable to penetrate

5.5 Soil Investigation – Zone C

This zone is within an area of filling, supported by an existing timber crib retaining wall, designed, and inspected (signed off – PS4) by HGEA.

A single machine augered borehole (MBH3) was completed behind the timber crib wall by Prodrill Ltd in 2021, with the recovered cores logged by HGEA. This MBH found not more than 1.0m of overlying soil (weathered tuff), with a 8.0m thick layer of saprolitic, weathered basalt from 1.0 to 9.0m bgl, before encountering the underlying poorly cemented sandstone.

Groundwater was not encountered within the MBH throughout its entire depth. From this normal groundwater transmissions are expected to be at least 1.0m down, with elevated not greater than 4.0m.

The overlying saprolitic basalt is characterised by completely weathered columnar basalt formations. The original columnar structure remains visually identifiable, though the rock has undergone extensive chemical weathering, resulting in a soft, clay-rich matrix. Within this matrix, numerous basalt boulders were observed, preserved as core stones amidst the saprolitic material. These boulders vary in size and are embedded within a fine-grained soil matrix, which appears to have infilled the spaces between columns and fractures. This can be observed in Figure F below, taken during bulk earthworks, prior to the construction of the timber crib retaining wall.

Figure I – View north-east towards the proposed Zone C, taken during earthworks 25th February 2021

Within Zone C, the western third is within an area of filling up to 4.0m. This fill has been subject to compaction verification by HGEA, and is retained by the timber Cribb retaining wall.

5.6 Soil Investigation – Zone D

The historic subsoil investigations undertaken within, and in proximity to this zone have comprised three hand augered, two rotary machine augered boreholes, as well as two test pit. These are outlined in detail in Table 3 below:

Notable, the test pits and rotary boreholes predate any filling or excavation undertaken in this area, with the more recent 2025 hand augers (HA5, HA6 and HA7) drilled through areas of excavation, which found very minor to no fill, and were drilled through natural ground.

Groundwater was not encountered in any hand-augured borehole drilled over this zone. Based on the observed soil conditions during wide earthworks, site locality, and geomorphology of the site, we do not expect groundwater to be within 8m of the existing ground level.

Soils encountered in all the test locations were consistent with the GNS published map geology of Kerikeri Volcanic Group Late Miocene basalt of Kaikohe - Bay of Islands Volcanic Field.

Table 3: Summary of subsoil investigation data within Zone A

Investigation key and date	Termination Depth	Scala Penetrometer Termination Depth	Topsoil Depth	Groundwater Depth	Shear Vane Soil Strengths	Scala Penetrometer Raw Data in Natural Ground	Generalised Description
All depths measured in (m) below current ground level					min - max kPa	min - max Blows/ 100mm	
HA5(2025)	3.0	NM	NE	NE	68-190	NM	**Residual soils / Weathered Tuff**: Silts and silty clays with minor sands, non-plastic to moderately plastic, very stiff to hard, moist. **Fill**: clayey silt, trace gravel, moist, low plasticity. **Rock**: highly weathered volcanic Basalt, fractured
HA6 (2025)	1.0	NM	NE	NE	190	NM	
HA7 (2025)	2.5	NM	NE	NE	41-163	NM	
TP6 (2017)	3.0	NM	0.2	NE	95	NM	
TP7 (2017)	3.0	NM	0.2	NE	NM	NM	
MA7 (BH7 2019)	8.0	NM	NE	NE	NM	NM	
MA9 (BH9 2019)	5.3	NM	NE	NE	NM	NM	

Table 3 Notes:

(7) NM = not measured
(8) NE = not encountered
(9) UTP = unable to penetrate

5.7 Seismic Soil Class

The results of the investigation indicate the site is Seismic Subsoil Class C; in accordance with AS/NZS 1170.5:2004. This was assessed based on the geological properties measured during our investigation in correlation with AS/NZS 1170.5:2004;

(method (d) of the hierarchy for site classification methods, AS/NZS 1170.5:2004, Amd 2014, Section 3.1.3.1).

5.8 Expansive Soils

Soil expansivity is the result of soil column changes in volume as a response to variation in the soil's moisture content. This process occurs in clay-rich soils, where increased moisture content causes swelling of the clay particles and decreased moisture content results in shrinking of the soil particles. Soil expansivity typically occurs in the upper 1.0m of the subsurface soil column but is also significantly dependent on clay content, moisture variations, soil compaction, and environmental factors.

Expansive soils can impact structures and infrastructures found within these soils. Management of expansive soils is required to mitigate against foundation movement, cracking, differential settlement, and/or infrastructure damage.

Several soil samples have been taken from across the QRCC site, including annual ground and engineered fill. Atterberg Limit testing was undertaken in-house at Hawthorn Geddes Engineers & Architects Ltd in accordance with standard testing methods outlined in NZS4402:1986:

- Test 2.2 – Determination of Liquid Limit (Casagrande method)
- Test 2.3 – Determination of Plastic Limit and Plasticity Index

These test procedures align with the verification methods set out in the New Zealand Building Code (NZBC) Clause B1 – Structure, specifically Verification Method B1/VM3, as amended by Amendment 3 (effective from 28 November 2019).

The results of the HGEA soil testing are presented in Table 4 below:

Table 4: Atterberg Limit Test Results

Sample Description	Sample Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index	AS 2870:2011 Soil Class
Weathered Tuff – Silt	0.5 to 0.8	96	39	57	E
Weathered Tuff – Silt Clays	1.6 – 1.9	116	68	45	E
Clay/Silty CLAY	0.6 to 1.0	83	35	46	H
Engineered Fill – Silt, moderately plastic	Not applicable	58	43	15	M

The liquid limit and plasticity index presented above were used to assign the expansive soil class, as described in AS 2870:2011 Clause 2.1.2, based on guidance set out in AASHTO T 258-81 Table 1. Soils are considered extremely expansive, Class E, which DEOS NOT align with observations made during the site walkover.

The liquid limit and plasticity index are used to assign the expansivity soil class as described in AS 2870:2011 Clause 2.1.2, based on guidance set out in AASHTO T 258-81 Table 1. Atterberg Limit testing completed on KVG soils returns an extremely expansive result (typically >100%), which is not the case when observed in-situ. Atterberg testing has been designed for clay-rich sedimentary residual soils, KVG derived soils are volcanic in origin and react differently to the test.

When observed in-situ, KVG basalt derived soils behave low to non-plastic in nature as a result of mineralogical characteristics similar to low activity clay types (i.e., halloysite and kaolinite). Low activity clay types refer to soils with clays that are not typically reactive to moisture changes therefore do not noticeably shrink / swell. When in-situ, the presence of larger grain sizes (i.e., gravels or greater) are frequently present in the soil column, these grain sizes typically decrease any observable shrink/swell movements.

Based on the reviewed literature(1) and our experience with KVG soils, we have not undertaken Atterberg Limit testing and conservatively determine the encountered soils beneath the proposed development to be marginally expansive, Class M in terms of AS 2870:2011.

(1) – Soil Expansivity Characteristics in Residual Soils of the Kerikeri Volcanic Group by Keavy E. Mitchell, 2023.

6. Slope Stability Assessment

A visual stability assessment has been undertaken by a chartered professional geotechnical engineer from HGEA. This comprised a detailed site walkover, a review of historical aerial photographs (source: Google Earth and Retro Lens), a review of available LiDAR data, the historic HGEA earthworks modelling, and current topographical survey data. A numerical slope stability analysis has been undertaken to determine the Factor of Safety (FoS) against sliding of various slopes over the site using several computer packages, PLAXIS 2D, Geostudio SlopeW, and RocScience Slide 2. The cross-sections used for the analysis have been adopted from topographical survey and available LiDAR data (for slopes beyond the boundary).

The subject property, forming part of the wider QRCC development, is located on a south-facing basalt plateau (or basalt flow), with the Kerikeri River bordering the eastern and southern boundaries as it flows southward. Refer to Figure F below, noting that the LiDAR-derived topographical contours represent conditions prior to bulk earthworks in Stage 5, while the aerial imagery is from 2024.

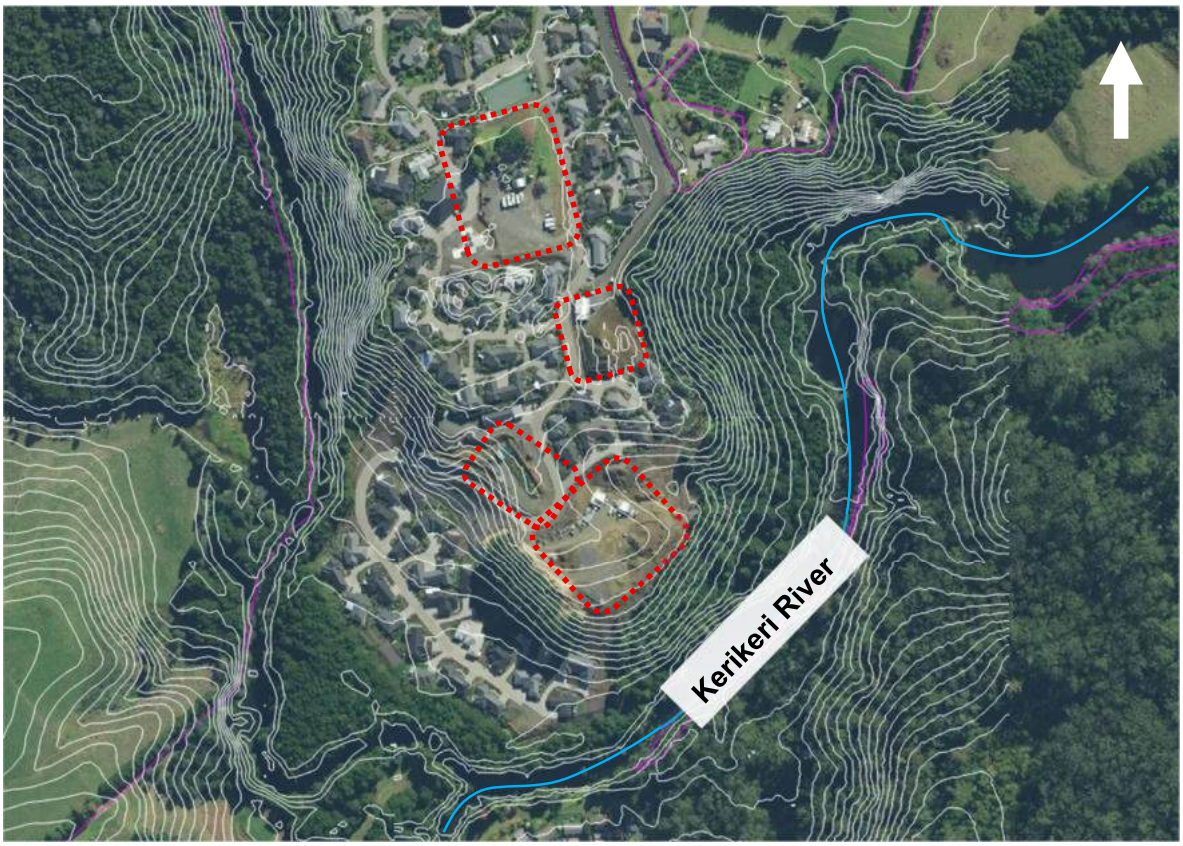

Figure J: Aerial of subject QRCC development area and the surrounding slopes (Source: 2024 LINZ Basemaps Imagery, Northland LiDAR - pre-development 2.0m, contours, using QGIS). Zones depicted A, B, C and D, read down the page, in red dashed lines

Slopes to the west and east of the QRCC site range between 16° and 20° and are densely vegetated with mature native species, including tōtara, kānuka, mānuka, and occasional kauri trees. Based on site walkovers and historical observations, these mature trees have remained stable and exhibit vertical growth, indicating no evidence of active global slope movement. Within these vegetated slopes, minor surface erosion is evident, particularly where surface water runoff is concentrated; however, no signs of slope regression toward the subject site have been identified.

The visual slope stability assessments have been undertaken for each of the proposed zones, with numerical analysis undertaken where considered necessary for proposed developments near to steeper slopes to the east of the development, where not previously assessed by HGEA.

6.1 Stage 5 Escapement (South of Zones C & D)

It is noted that the Totara Grove area, including the southern escarpment leading to Stage Five and the slopes beneath the proposed Zones C and D, has already been assessed by HGEA. This assessment, which included numerical analysis, is detailed in the HGEA Earthworks Completed Report dated 18 January 2025.

In summary, the assessment determined that an appropriate batter for the slopes between Cottle Way and the unit below is 1V:2H, with a factor of safety (FoS) against sliding of 1.57, as calculated using GeoStudio Slope/W limit equilibrium analysis.

The FoS against global slippage, including the as-built timber crib and soil nail wall, was assessed using PLAXIS 2D for the Ultimate Limit State (ULS) design case defined as high groundwater conditions, resulting in an estimated FoS of 1.32. Additional assessments of Serviceability Limit State (SLS) and ULS for both local and global stability were undertaken using Slope/W, which determined FoS values of not less than 1.54 under normal groundwater conditions, 1.35 under elevated groundwater, and 1.05 under seismic loading.

The slopes between Cottle Way and Stage Five were treated with heavy-duty coconut matting and sparsely planted with low-lying shrubs in July 2023. Two cutoff drains were constructed parallel to the slopes to control and divert runoff from the limited catchment above. Results of a walkover assessment conducted approximately two years later, in October 2025, indicate that the vegetation has not successfully established. No slumping or erosion was observed; however, the matting has significantly degraded. See Figures G and H below for comparison.

Figure K: View north towards Zones C and D, taken July 2023

Figure L: View north towards Zones C and F taken October 2025

6.2 Zone A

The proposed clubhouse, dementia care facility and two new residential units are situated over fully engineered slopes, comprising almost entirely excavations, and only localised filling.

All excavations within the zone are either retained or have been formed under HGEA supervision to suitable gradients, not steeper than 1V:2.5H.

No numerical slope stability analysis has been undertaken for Zone A, as there are no unretained slopes within 50m of this zone.

6.3 Zone B

The proposed Zone B is positioned some 5m above a eastern facing gulley, with slopes typically 22 degrees, leading 140m east towards the Kerikeri River. Results of our subsoil investigation, and site observation indicate that these slopes are underlain by weathered tuff, underlain by a thick layer of weathered saprolitic basalt.

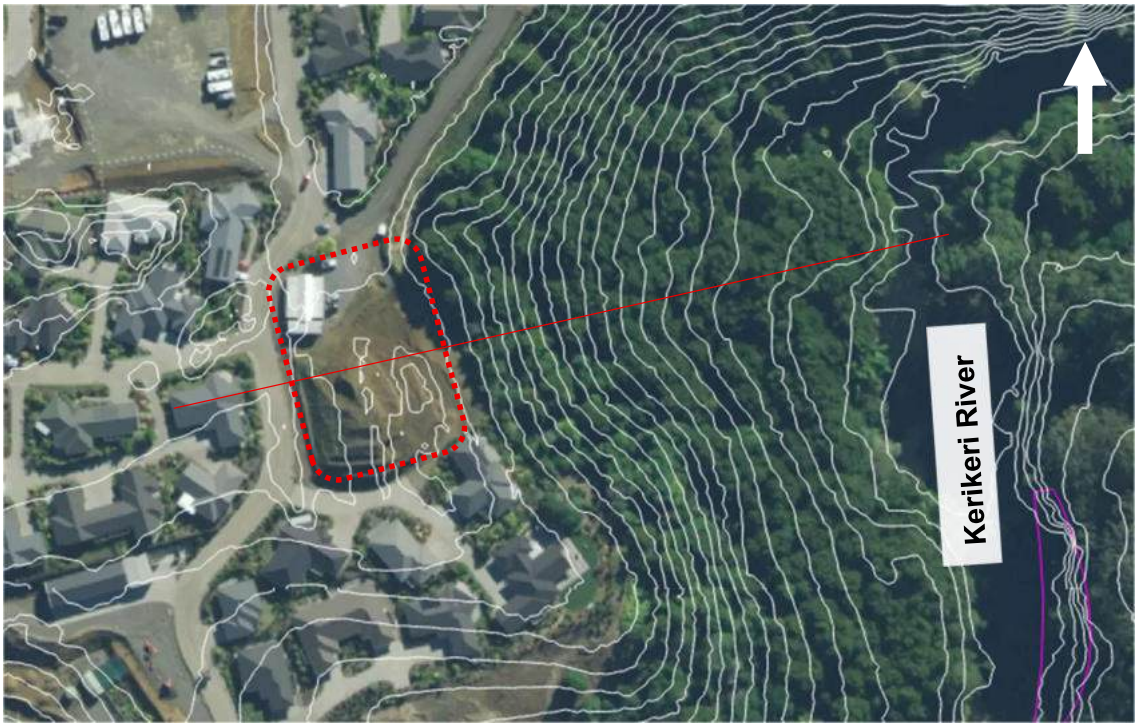

Figure M: Aerial of subject Zone B development site and the surrounding slopes (Source: 2024 LINZ Basemaps Imagery, Northland LiDAR - pre-development 2.0m, contours, using QGIS). Development area in red dashed lines

Given the gradient, and proximity of the eastern slopes to the Zone B development A numerical slope stability analysis has been undertaken to determine the Factor of Safety (FoS) against sliding for the proposed building platform has been completed using RocScience Slide 2. The cross section used for the analysis has been adopted from available LiDAR data, and the HGEA design surface, see Figure I above for section locality.

Global stability is defined as the large-scale instability of the site where the critical failure plane intercepts the proposed building platforms. Local stability relates to smaller slippage of localised steep slopes and earthworks (cute/fill) batters.

The numerical analysis presented in this report was completed using Slide2 and the Morgenstern-Price slope model, to assess the global and local stability of the proposed development through the critical nominated building platform.

An analysis has been undertaken for the critical cross-section through the proposed building platforms. To ensure the parameters and methods used are critical representations, a sensitivity analysis was conducted.

Three load cases / slope conditions have been assessed; these are:

1. Normal groundwater conditions (NGWT),
2. Elevated groundwater conditions (EGWT), and
3. Seismic with normal groundwater conditions (DCLS).

Soil lithology and depth for the forward analysis has been inferred based on site topography and profiles encountered in the hand auger and DCPTs, inferring (post earthworks) slope conditions. The calibrated MC soil parameters used for this analysis are summarised in Table 4 below:

Table 5: Calibrated Mohr-Coulomb Soil Parameters

Soil Description	***Soil Unit Weight (ɣ)***	***Effective Cohesion (c')***	***Effective Friction Angle (ϕ')***
	kN/m^3	***kPa***	***Degrees***
Weathered Tuff – *Clays / Silts*	*18*	*2*	*28*
Saprolitic Basalt – *weathered basalt*	*20*	*3*	*30*
Highly Weathered Sandstone	*20*	*5*	*32*
Moderately Weathered Sandstone	*22*	*10*	*36*

For an IL2 structure, DCLS level seismic event may be adopted to model a minimum seismicity event in areas with a perceived low seismic potential such as the property as is recommended within the NZ Bridge Manual (SP/M/022) which has been adopted for use within residential properties as standard engineering practice.

The analysis criteria adopted herein is based on the current industry best practice. This requires a minimum FoS against sliding of 1.5 to be achieved for normal groundwater conditions, 1.3 for extreme groundwater conditions (undrained) and 1.0 for a DCLS level seismic event.

Peak ground acceleration (PGA) and magnitude for this analysis have been adopted from Table A1, Appendix A of the MBIE/NZGS Earthquake Geotechnical Engineering Practice Module 1, 2021. Input parameters have been taken as a earthquake magnitude of 6.5, and acceleration of 0.19g.

The proposed building platform(s) have been modelled with a 12.5kPa surcharge load to represent the proposed structures.

Groundwater has conservatively been modelled at 5.0m bgl for elevated conditions and at 10.0m bgl for normal conditions, from the crest of the spur existing ground level. Actual groundwater transmissions (elevated and normal) are to be deeper based on absence of wet soils and the site's geomorphology.

Results of our numerical slope stability analysis identify the lowest FoS in relation to the proposed building platform and are presented in Table 5 below:

Table 6: Assessed Critical FoS 5 – Eastern Slopes

Cross-Section	**Condition**	**FoS (critical FoS beyond 8.0m setback)**
Cross-Section A **(*location – Figure I above*)**	Normal Groundwater Transmissions	1.76
	Elevated Groundwater Transmissions	1.38
	Seismic - DCLS	1.10

Table 4 Notes:

- The FoS presented above have been rounded to the nearest two decimal places.

Results of our numerical stability analyses indicate that the FoS against *rotational* failure for slopes near and/or beneath the proposed building platform(s) is adequate, subject to a minimum setback from the crest of slopes of 8.0m.

A copy of the slide2 outputs are attached to this report

6.4 Zone C

The proposed Zone C is positioned above the Stage 5 escapement and has been historically formed by a combination of excavation and filling, up to 3.0m for both. The southern boundary of these earthworks is supported by an existing timber crib retaining wall that was designed by HGEA in September 2020. This crib wall was designed to support both engineered fill and excavated soils up to 3.0m. The wall was consented and constructed in May 2021.

To the north of Zone C, there is an existing unretained excavation face, some 2.5m high, sloping at up to 1V:1H (45º). This slope shows signs of erosion and slumping, with no vegetation cover.

Figure N: view west across the existing timber crib retaining wall, and proposed Zone C. Photograph taken October 2025

The slopes over the proposed Zone C have been fully engineered, and are supported by existing retaining, to the south, with future retaining walls proposed to support the existing steep excavation batter. Therefore, no numerical analysis is considered necessary and has been undertaken.

A design review of the existing timber crib retaining wall has been undertaken, and concludes that the wall has adequate margins of safety in design to accommodate the proposed new unit, subject to a setback of 1.0m from the back of the wall, and no filling within 5.0m of the wall.

6.5 Zone D

The proposed development Zone D is positioned on the southern end of the Basalt Platea, with south-west through east trending slopes, sloping at some 22 degrees, towards the Kerikeri River, some 85 m away.

The south-western portion of the slopes is covered with mature Totara trees (Totara Grove). These trees appear to be growing true (straight), with minor bowing in the younger trees where growing at the crest / transition of the slopes. Slopes to the south-east are covered with low to medium shrubs, and native trees such as Kanuka and Manuka

Figure O: Aerial of subject Zone D development site and the surrounding slopes (Source: 2024 LINZ Basemaps Imagery, Northland LiDAR - pre-development 2.0m, contours, using QGIS). Development area in red dashed lines

The slopes to the east of the Totara Grove have historically had uncontrolled fill placed over them. Inspection by HGEA in September 2021, instructed the fill ton be removed, and the slopes graded to not steeper than 1V:2H. Inspection again in November 2022 saw this work completed. See Figures L and M below.

The QRCC wastewater treatment plant is positioned immediately above the crest of the Totara Grove. Inspection of the placement of the Innoflow treatment units saw these placed over the weathered basalt unit some 2.0m below ground level, indicating a shallow horizon of Weathered Tuff over these slopes.

Figure P: View north towards Zone D, showing fill over slopes east of the Totara Grove. Taken 22.11.2021

Figure Q: View north-west towards Zone D, showing re-contoured over slopes east of the Totara Grove. Taken 15.11.2022

Given the gradient and proximity of the steep slopes to the south through east, a numerical slope stability analysis has been undertaken for the slopes east through south of the Zone D, including the Totara Grove, using Rocscience Slide2, adopting the parameters outlined in Section 6.3 above. This analysis is undertaken to determine suitable setbacks of future development in Zone D from the crest of these slopes.

The proposed building platform(s) have been modelled with a 12.5kPa surcharge load to represent the proposed structures.

Groundwater has conservatively been modelled at 2.0m bgl for elevated conditions and at 5.0m bgl for normal conditions, from the escarpment elevation. Actual groundwater transmissions (elevated and normal) are to be deeper based on absence of wet soils and the site's geomorphology.

Results of our numerical slope stability analysis identify the lowest FoS in relation to the proposed building platform and are presented in Table 6 below:

Table 7: Assessed Critical FoS 5 – Eastern Slopes

Cross-Section	Condition	FoS (critical FoS beyond 8.0m setback)
Cross-Section A (***location – Figure K above***)	Normal Groundwater Transmissions	1.75
	Elevated Groundwater Transmissions	1.35
	Seismic - DCLS	1.0

Table 6 Notes:

- The FoS presented above have been rounded to the nearest two decimal places.

Results of our numerical stability analyses indicate that the FoS against *rotational* failure for slopes near and/or beneath the proposed building platform(s) is adequate, subject to a minimum setback from the crest of slopes of 8m.

A copy of the slide2 outputs are attached to this report

7. Liquefaction

Liquefaction is a phenomenon whereby saturated low plasticity soils temporarily lose strength due to high pore pressure development during earthquake or similar shaking. It generally occurs in loose to medium dense, cohesionless soils such as sands and river deposited non-plastic silts, most common in low-lying and coastal areas with associated high groundwater tables. Liquefaction of near-surface soils typically results in surface cracking, dislocations, ground distortion/deformation, and lateral spreading. Sand boils (surface eruptions of water and sandy materials) are also common during a seismic event where there is insufficient confining pressure on the liquefiable soil layers.

7.1 Liquefaction-Induced Vertical Settlement

Results of the subsoil investigation show the property is typically underlain by Kerikeri Volcanic Group basalt silts.

Hand augered boreholes, shear vane tests, and SPTs were undertaken in conjunction with a 'Level B' calibrated desktop assessment of liquefaction risk, as per the Planning and Engineering Guidance released by EQC, MBIE, and MfE in 2017 (PEG 2017). The assessment was completed to provide a significant reduction in the uncertainty level of liquefaction related risks.

We have considered the future residential development over the subject property to be an Importance Level 2 (IL2) building. Following the guidance set out in the MBIE Module 4 and NZS 1170.5:2004, IL2 structures are required to be designed to resist seismic shaking with an annual probability exceedance of 1/25-year (25-year return period), known as Serviceability Limit State (SLS) design load.

An Ultimate Limit State (ULS) is also defined for an annual probability of exceedance 1/500-year event, whereby the structure must remain sound enough to allow evacuation and preserve life (though possibly irreparable damage to the structure may occur).

Based on the site's underlying geology, we consider the property to be unlikely to undergo liquefaction damage during a 500-year shaking event, or any other intermediate level seismic event. The prospect for liquefaction induced ground damage is unlikely for a 500-year shaking event with a probability of damage occurring at a rate of less than 15% for the site. Where hand augered boreholes were completed, a rate of less than 1% can confidently be applied.

7.2 Lateral Spreading

Lateral spreading normally occurs along an open slope face such as a riverbank or steep coastal slope, where loose, saturated sandy soils are commonly encountered at shallow depths. The effect of lateral spreading generally decreases with increased distance from the slope face. T

Although there are significant level changes throughout the development, including up to 7.0m retaining walls, lateral spreading is not considered likely and has not been assessed. As he underlying soils are non-liquefiable, due to being cohesive in nature, and well above the groundwater table.

8. Wastewater Management

The estimated and potential wastewater generation for the Quail Ridge Country Club development has been assessed. The assessment covers four zones within the development- Zone A (Clubhouse, Care Home, Dementia Care Unit, and three residential dwellings) and residential Zones B, C, and D (all residential units).

A base generation rate of 200 L/person/day has been adopted assuming 2 people in one household, equating to 400 L/day per household (equivalent to 1 household unit equivalent HUE with 1 HUE in the context of QRCC being a single household with 2 occupants). This is aligned with the basis of design (BoD) for the original consent from NRC. For the clubhouse and care facilities, allowances have been derived from typical commercial flow rates and as per NZS 1547:2000.

- Clubhouse: 3,880 L/day (≈10 HUE)
- Care Home: 1,640 L/day (≈4 HUE)
- Dementia Care Unit: 890 L/day (≈2.2 HUE)
- Three dwellings in Zone A: 1,200 L/day (3 HUE)

This results in a total wastewater generation for Zone A of approximately 7,610 L/day (≈19 HUE). Refer to the table below for the details of the Wastewater generation for Zone A:

Table 8: Waste generation calculation for Zone A

USE	Number	Wastewater Flow Allowance in L/Person/Day as per NZS 1547:2000	Total Wastewater generated in L per Day	Notes
Clubhouse waste generation				
Office Staff	4	40	160	
Café Staff	2	40	80	
	6	40	240	
Kitchen Staff	1	40	40	2 Person - Part Day is assumed as 1 Person Full day
Restaurant Manager	1	40	40	
Waiting Staff in Restaurant	2	40	80	
Restaurant Users	80	30	2400	40 persons twice daily is assumed as 80 persons daily
Lounge Area Users	2.5	30	75	10 person- 2-3hrs/day is

USE	Number	Wastewater Flow Allowance in L/Person/Day as per NZS 1547:2000	Total Wastewater generated in L per Day	Notes
				assumed as 2.5person/day
Sales Clients	1.5	30	45	6 Persons- 2 hrs/day is assumed as 1.5person/day
Cleaner	1	40	40	
Maintenance Staff	1	40	40	
Club Members	16	40	640	30-40 members twice per week is assumed as 16 members/day
Total Wastewater Volume in L/DAY =			**3880**	
Care home waste generation				
	Number	Wastewater Flow Allowance in L/Person/Day as per NZS 1547:2000	Total Wastewater generated in L per Day	
Care beds	6	250	1500	
Nurse	1.5	40	60	2 nurses overlap shifts or partial double shift is taken as 1.5 person
Kitchen staff	2	40	80	
Total Wastewater Volume in L/DAY =			**1640**	
Dementia care waste generation				
	Number	Wastewater Flow Allowance in L/Person/Day as per NZS 1547:2000	Total Wastewater generated in L per Day	
Care beds	3	250	750	
Nurse	1.5	40	60	2 nurses overlap shifts or partial double shift is

USE	Number	Wastewater Flow Allowance in L/Person/Day as per NZS 1547:2000	Total Wastewater generated in L per Day	Notes
				taken as 1.5 person
Kitchen staff	2	40	80	
Total Wastewater Volume in L/DAY =			**890**	

The remaining residential zones are calculated as follows:

- Zone B: 1,600 L/day (4 HUE)
- Zone C: 1,600 L/day (4 HUE)
- Zone D: 2,400 L/day (6 HUE)

The total development discharge is therefore approximately 13,210 L/day, equating to 33.2 HUE.

Wastewater generated from the Quail Ridge Country Club development is collected and treated within small clusters in the site using a series of Eloy wastewater treatment systems, selected and sized to suit each development zone. The site's wastewater disposal is consented on this basis and these four zones follow the same principle. All household and facility discharges will connect to the internal reticulated network, which conveys flows to a combined on-site pump station for final discharge in accordance with the existing consented arrangement for the wider Quail Ridge development.

For the secondary treatment system sizing, Eloy's hydraulic design rate of 150 L/person/day has been applied to determine the required treatment capacity in Person Equivalent (PE) units. The calculated design flows and corresponding treatment requirements for each zone are summarised below.

Table 9: Recommended Eloy system

Zone	Household Unit Equivalent (HUE)	Wastewater generation(l/d)	Required Eloy capacity (Person Equivalent- PE)	Recommended Eloy system
Clubhouse+ Care Home (Zone A)	14	5520	37	C-90 CB 38 PE
Dementia care+ 3 houses (Zone A)	5	2090	14	C90 CB 20 PE
Zone B	4	1600	11	C90 CB 20 PE
Zone C	4	1600	11	C90 CB 20 PE
Zone D	6	2400	16	C90 CB 20 PE

9. Stormwater Management

The stormwater management for the proposed development has been designed based on attenuation of the post-development peak flow to pre-development rates with discharges to the primary stormwater network on the site. The storage element has been designed to address the runoff generated by a 50% AEP (2-year ARI) and a 10% AEP (10-year ARI) storm event. The proposed stormwater design has met all the requirements of the underlying plan change consent and maintains the discharge from the site below the consented limits.

The remaining development of the site were modelled in HydroCAD,.The hydraulic behaviour of the site was modelled in HydroCAD using SCS Type 1A nested rainfall hyetograph methodology and site-specific rainfall data obtained from NIWA HIRDS V4.

9.1 Zone A (Clubhouse + Stone Brook Villas)

The stormwater catchment of zone A is divided into 3 sub catchments. Catchment 1 includes half the clubhouse building, half the clubhouse carpark and the care house building. The catchment 2 includes the other half of the clubhouse and the adjacent car park, and catchment 3 includes the Dementia care building,3 Stonebrook villas and the driveway of the villa and private access to these villas.

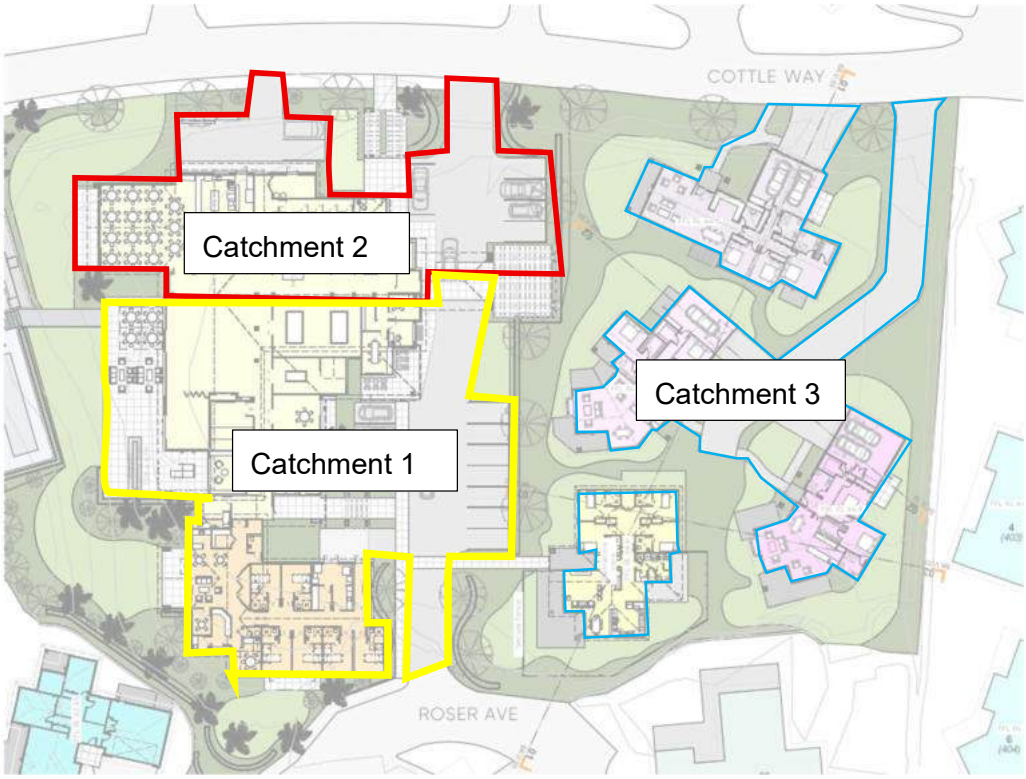

Figure R: Stormwater catchment divisions for zone A

Pre-Development

For all three catchments, the pre-development soil is classified as Hydrologic Soil Group B, and a Curve Number (CN) of 69 has been applied. The pre-development impervious areas have been represented as pasture, with 1563 m² for Catchment 1 (including half the clubhouse roof, clubhouse parking, and the care house), 834 m² for Catchment 2 (including the remaining half of the clubhouse roof and staff parking), and 1087 m² for Catchment 3 (including the villas and driveways). Refer to the attached HydroCAD report summary sheets for details.

The pre-development runoff rates were defined by applying a 50% AEP and a 10% AEP storm event established from HIRDS v3 with 60 min duration.

The resulting pre-development peak flows are given in Table 9 below:

Table 10: Pre-Development Flows

Site	Area (m²)	50% AEP Peak flow (L/s)	10% AEP Peak flow (L/s)
Catchment 1	1563	2.5	8.0
Catchment 2	834	1.3	4.3
Catchment 3	1087	1.7	5.6

These are used as the upper limits for controlled runoff post-development peak flows.

Post-Development

Residual pervious areas are excluded as the runoff characteristics remain unchanged pre- to post-development. The site has been modelled with the proposed areas shown in Table x. A 100mm diameter pipe (minimum) will be required to convey the attenuated flows from the granular storage zone to the existing stormwater network within the development, which is ultimately routed to an existing piped outlet 1 (525mmdia). Refer to the attached HydroCAD report summary sheets and see the table below for granular storage volumes with orifice control details.

Table 11: Granular storage

Storage	Area (m²) x Depth	50% AEP size and orifice height	10% AEP orifice size and height
Granular storage 1	144m²x0.8m	35mm at -0.1m	65mm at 0.8m
Granular storage 2	64m²x1m	25mm at -0.1m	50mm at 0.73m
Granular storage 3	80m²x1.3m	25mm at -0.1m	60mm at 0.92m

Results

The results are summarised below:

Table 12: Post-Development Flows

	Catchment 1	Catchment 2	Catchment 3
Impervious Area (m^2)	1563	834	1024
50% AEP Peak Flow (L/s)	2.3	1.2	3.6
10% AEP Peak Flow (L/s)	7.5	4.0	5.4

The proposed attenuation design meets the requirements of the FNDC ES (2009) and plan change discharge consent.

9.2 Zone B

The stormwater catchments of Zone B consist of four proposed villas and their adjoining driveways.

Figure 8: Zone B with four villas

Pre-Development

In the pre-development condition, the soil has been assessed as a hydrologic soil group B, and as a result, the CN of 69 has been used. The pre-development form for the impervious footprint has been defined as 1095m² of pasture for the total catchment. For

this catchment, the calculated peak flow rate during a 50% AEP storm event is 1.8 l/sec, and during a 10% AEP storm event, the peak flow rate is 5.6 l /sec.

These are used as the upper limits for controlled runoff post-development peak flows.

Post-Development

The site has been modelled with the proposed impervious area of 1095m². All runoff from the impervious areas is to be captured via site reticulation to a granular storage zone of dimensions 90m² x 1.2m in depth to be located under the driveway, with overflows discharging to the existing stormwater network. Discharge will be via 2 staged orifices, with the 20% AEP event controlled through a 30mm orifice at 100mm below the base level of storage and the 1% AEP event controlled by a 55mm orifice at 717mm above the invert of the first orifice.

A 100mm diameter pipe (minimum) will be required to convey the attenuated flows from the granular storage zone to the existing stormwater network within the property, which is ultimately routed to an existing piped outlet 2 (450mmdia). Refer to the attached HydroCAD report summary sheets.

Results

The results are summarised below:

Table 13: Post-Development Flows

Item	Details
Impervious Area (m2)	1095
50% AEP Peak Flow (L/s)	1.6
10% AEP Peak Flow (L/s)	5.3

The proposed attenuation design meets the requirements of the FNDC ES (2009).

9.3 Zone C

Figure T: Proposed zone C with 4 villas

The stormwater catchments of zone C consist of four proposed villas, their adjoining driveways and the access road from Cottle Way

Pre-Development

The soil for pre devilment condition is identified as hydrologic soil group B, and as a result, the CN of has been used. The pre-development form for the impervious footprint has been defined as 1055m² of pasture for the total catchment. For this catchment, the calculated peak flow rate during a 50% AEP storm event is 1.7 l/sec, and during a 10% AEP storm event, the peak flow rate is 5.4 l /sec.

These are used as the upper limits for controlled runoff post-development peak flows.

Post-Development

The site has been modelled with the proposed impervious area of 1055m². All runoff from the impervious areas is to be captured via site reticulation to a granular storage zone of dimensions 90m² x 1m in depth to be located under the driveway, with overflows discharging to the existing stormwater network. Discharge will be via 2 staged orifices, with the 20% AEP event controlled through a 30mm orifice at 100mm below the base level of storage and the 1% AEP event controlled by a 55mm orifice at 680mm above the invert of the first orifice.

A 100mm diameter pipe (minimum) will be required to convey the attenuated flows from the granular storage zone to the existing stormwater network, which is ultimately routed to an existing piped outlet 2 (450mmdia). Refer to the attached HydroCAD report summary sheets.

Results

The results are summarised below:

Table 14: Post-Development Flows

Item	Details
Impervious Area (m2)	1095
50% AEP Peak Flow (L/s)	1.6
10% AEP Peak Flow (L/s)	5.2

The proposed attenuation design meets the requirements of the FNDC ES (2009) and plan change discharge consent.

9.4 Zone D

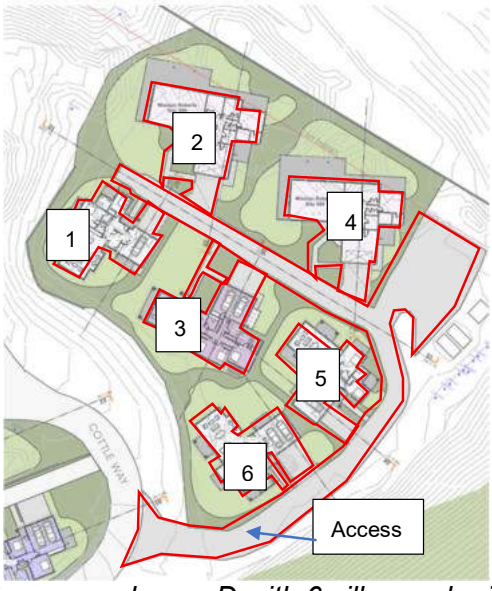

Figure U: proposed zone D with 6 villas and private access

The stormwater catchments of zone D consist of 6 proposed villas, their adjoining driveways and the access road from Cottle Way.

Pre-Development

In the pre-development condition, the soil has been classified as Hydrologic Soil Group B, and the corresponding Curve Number (CN) of 69 has been applied. The total impervious footprint is 1970 m² and has been represented as pasture for the entire catchment. The estimated peak flow rates are 3.2 L/s for a 50% AEP storm event and 10 L/s for a 10% AEP storm event.

These are used as the upper limits for controlled runoff post-development peak flows.

Post-Development

The site has been modelled with the proposed impervious area of 1970m². A granular storage zone is proposed to discharge to the proposed stormwater network. All runoff from the impervious areas is to be captured via site reticulation to a granular storage zone of dimensions 144m² x 1.2m in depth to be located under the driveway, with overflows discharging to the existing stormwater network. Discharge will be via 2 staged orifices, with the 20% AEP event controlled through a 40mm orifice at 100mm below the base level of storage and the 1% AEP event controlled by a 70mm orifice at 800mm above the invert of the first orifice.

A 100mm diameter pipe (minimum) will be required to convey the attenuated flows from the granular storage zone to the existing stormwater network within the property, which is ultimately routed to an existing piped outlet 3 (450mmdia). Refer to the attached HydroCAD report summary sheets.

Results

The results are summarised below:

Table 15: Post-Development Flows

Items	Details
Impervious Area (m2)	1970
50% AEP Peak Flow (L/s)	3.2
10% AEP Peak Flow (L/s)	9.5

The proposed attenuation design meets the requirements of the FNDC ES (2009) and plan change discharge consent.

10. Earthworks

Excavations, not likely to exceed 2.0m, and limited filling, will be required for the formation of the various proposed building platforms, refer to HGEA drawing sheets Figures 04 through 07, Revision 0, reference 6062.

All earthworks over the site shall be undertaken in general accordance with NZS4431:2022 and shall be subject to the following engineering specification and supervision:

10.1 Earthwork Specification

The underlying volcanic soils across the wider site are considered to be suitable for use as engineering fill. Prior to application on-site, a bulk sample of the source material, not less than 25kg, shall be provided for dry density/water content relationship (compaction curve) testing to determine the site-won soil's optimum moisture content (OMC), and maximum dry density (MDD). This shall be undertaken by an accredited soil laboratory in accordance with the relevant New Zealand soil testing standards as below:

- Water content: NZS4402:1986: Test 2.1
- NZ Standard compaction: NZS4402:1986L Test 4.1.1
- Particle size distribution: NZS4402 Test 2.8.1

Nuclear Densometer (NDM) testing shall be undertaken in general accordance with NZS4407:2015, Test 4.3. This testing shall be undertaken at a frequency not less than two tests per 1000m3, and/or two every 0.5m lifts, whichever comes first. Strip all topsoil and vegetation from beneath the area to be filled, extending a minimum of 2.0m from the edge of the proposed filling perimeter (where achievable).

- Average undrained shear strengths as measured with a handheld shear vane shall be an average of 140kPa with no single value less than 120kPa, and
- Air voids measured by NDM testing and following water content correction testing, the results shall average no greater than 8%, with no single value greater than 10%.

Appropriate compaction equipment and methodology shall be adopted to achieve the desired level of compaction for any material used. All areas to be filled must be stripped of topsoil, and where fill is to be greater than 1.0m deep, it shall be benched as required, prior to filling.

11. Recommendations and Conclusions

11.1. Stability

The WRCC development is positioned over a Basalt Platea (shelf) that trends southward and is bordered east through south by the Kerikeri River. Slopes over the crest of the shelf are generally sloping at 16 to 26 degrees, and are mostly heavily vegetated with native fauna. Minor erosion and slumping are observed in these slopes where no vegetation cover is established, although these are generally stable, with no signs of global slope movement.

Results of numerical slope stability analysis completed by HGEA indicate that the FoS against sliding for the encompassing slopes is greater than 1.5 and 1.3 for normal and elevated groundwater conditions, where developments are generally at least 8.0m from the slope crests.

The Stage 5 escarpment remains sparsely vegetated, with minimal growth observed since initial planting and establishment in October 2022. The coconut matting originally installed has now significantly deteriorated. Although there is currently no visible evidence of erosion across these slopes, it is recommended that additional planting be undertaken.

To enhance slope stability and prevent future erosion, the use of deeper-rooted and ground-covering plant species shall be planted over the Stage Five escapement, and is recommended on the slopes north of Zone D, and west of Zone C. These species will provide better soil anchorage and surface coverage, contributing to long-term erosion control and ecological resilience. Some recommended species that a deep rooting and have low to medium height include:

- Tauhinu (Ozothamnus leptophyllus)
- Carmichaelia spp. (Native Broom)
- Coprosma acerosa (Sand Coprosma)
- Leptinella squalida (Brass Buttons)
- Acaena inermis ‘Purpurea’ (Purple Bidibid)

More information on planting is available from:
https://www.hbrc.govt.nz/assets/Document-Library/Information-Sheets/Land/LMNT1.pdf

Zone-specific recommendations on slope stability are presented below:

11.1.1 Zone A

The proposed clubhouse, new villa units, and dementia ward are proposed to be founded over shallow foundations within areas of previously verified engineered fill and natural ground. These structures are considered to be adequately set back from all steep slopes, with engineered retaining walls supporting any excavations where battering is not feasible.

Development within Zone A is assessed as having a negligible effect on slope stability and is considered to be located on stable ground.

11.1.2 Zone B

Results of our slope stability assessment indicate that the proposed Zone B is of adequate slope stability (compliant with engineering best practice FoS against sliding), subject to all development being setback at least 8.0m from the crest of the setback slopes to the east.

The proposed Zone B retaining wall(s) shall be subject to specific engineering design in accordance with the recommendations outlined in Section 11.5 of this report.

Subject to the above recommendations, and those for earthworks and retaining wall design set out in Sections 11.2 and 11.5, the proposed Zone B is considered stable, suitable for the intended development, and not subject to slope instability.

A review of the current Foley Group Master Plan confirms that the proposed units within Zone B comply with the required setbacks from the eastern slopes.

11.1.3 Zone C

The proposed Zone C developments will be supported on shallow foundations within areas of engineered fill and excavated ground. Previous excavation within this zone removed a portion of the weathered tuff, exposing the underlying saprolitic basalt. Excavation works for Cottle Way involved cuts of approximately 3.0 m directly beneath Zone C, which are currently supported by an engineered timber crib retaining wall.

A review of the HGEA engineering design calculations for the existing timber crib wall confirms that the factors of safety (FoS) for both Serviceability Limit State (SLS) and Ultimate Limit State (ULS) design cases meet or exceed the requirements of NZ Building Code Clause B1 – Structure, which requires that siteworks and retaining structures withstand all loads likely to be experienced during their life cycle. The analysis indicates that an additional surcharge load of up to 12.5 kPa, provided it is set back at least 1.0 m from the rear of the retaining wall, will not reduce the FoS below acceptable limits. These limits align with industry practice and Building Code performance requirements for structural stability under combined load conditions.

The proposed Zone C retaining wall(s) shall be subject to specific engineering design in accordance with the recommendations outlined in Section 11.5 of this report.

Subject to the above design requirements and compliance with the Building Code, the proposed Zone C development is considered suitable for the site conditions and is not subject to slope instability.

11.1.4 Zone D

Results of our slope stability assessment indicate that the proposed Zone B is of adequate slope stability (compliant with engineering best practice FoS against sliding), subject to all development being setback at least 8.0m from the crest of the setback slopes to the east.

A review of the current Foley Group Master Plan confirms that the proposed units within Zone B comply with the required setbacks from the eastern slopes.

It is recommended that the portion of the slopes south of Sone D that are not covered with vegetation be heavily planted, as outlined in Section 11.1 above, to improve erosion protection and long-term stability of the slopes.

There shall be no stormwater runoff/overland flow over the southern or eastern slopes. Bunds, or cut-off drains, shall be implemented to ensure long-term slope stability.

11.2. Earthworks

All earthworks undertaken across the property shall be undertaken in general accordance with NZS44310:2022 and satisfy the engineering specification above.

All excavation batters shall be formed at no steeper than 1V:2.5H(22º) where cut into natural ground, and shall be planted with deep-rooting vegetation cover. Prior to planting, a thick coconut matting shall be pinned to the surface to protect slopes against erosion and aid in the establishment of vegetation. Where excavation batters are within engineered fill, and not less than 1.5m tall, batters may be increased to not more than 1V:2H (26º)

Where battering to the above is not possible, retaining will be required. Retaining wall shall be subject to specific engineering design where greater than 1.5m in retained height, or surcharged (traffic, or building loading within 2x the effective wall height). All retaining wall designs shall adhere to the recommendations in section 11.4 below.

Uncontrolled fill has been identified with Zone B, where the historic large stockpile of topsoil was. This fill comprises silts with varied organic content, and is not considered suitable for founding the proposed new villa unit. These soils shall be stripped down to natural ground, and the void backfilled with engineered fill, compacted to the specification outline in Section 8.3.1 above. Alternatively, foundations within Zone B may be supported over driven timber piles, some 3.0m long, with a full suspended raft concrete slab on top. If this is adopted, it is expected that the uncontrolled fill will settle over time.

11.3 Liquefaction

The results of our geotechnical assessment found that the property is underlain by non-liquefiable cohesive soils.

A 'Level B' liquefaction assessment was completed to reduce the uncertainty of liquefaction-related risks. Ground damage induced by an earthquake or similar shaking has a >85% likelihood of not occurring at this site. Winter groundwater levels are approximated to be no shallower than 8m deep based on an absence of soil evidence.

This site is considered to have very low liquefaction vulnerability in areas that underwent a subsoil investigation and is unlikely to occur in all other areas, as established from PEG 2017.

11.4 Foundations

Near-surface soils over the property (upper 3.0m) generally comprise stiff to hard silty soils, either in insitu or reworked (engineered fill) of the same. Measured undrained shear strengths of the soils were typically in the range of 80kPa to 230kPa. The ultimate geotechnical bearing capacity of the site soils averages not less than 300kPa.

We have classified the soils as extremely expansive, Class M, in accordance with Clause 2.2.3 of AS2870:2011, based on our site observations and experience with similar soils.

Based on our subsoil investigation, we consider the site suitable for the proposed clubhouse supported on a conventional slab designed in accordance with the New Zealand Building Code, AS1 B1 VM2 Amendment 21 (B1 VM2), or waffle raft style foundations designed in accordance with AS2870:2011. In both cases, specific engineering design will be required, and shall consider the site soils as moderately expansive, or Class M (as defined in both standards).

Where design is adopted in accordance with B1 VM2, the permitter footings of foundations shall be at least 600mm deep beneath cleared ground level to ensure the footings bear beneath the zone of influence. Design shall adopt the following soil parameters:

- Internal friction angle (ϕ'): 24°
- Unit weight (γ): 18kN/m^3
- Undrained shear strength (Su): 120kPa
- Cohesion (C'): 3kPa
- Ultimate geotechnical bearing capacity: 300kPa
- Characteristic surface movement (Ys): 20mm
- Soil suction depth (Hs): 1.5m

Ultimate limit state design shall adopt a soil strength reduction factor of 0.5.

11.5 Retaining Wall Design

The engineering design of any retaining walls shall be carried out in accordance with B1/VM2. For walls with an effective retained height of 3.0 metres or less, simplified methods such as Broms' method may be adopted. However, where the effective height exceeds 3.0 metres, more advanced numerical modelling—such as WALLAP or equivalent software—shall be used to appropriately assess soil-structure interaction.

Design calculations using advanced methods shall incorporate the soil parameters outlined in Section 11.4, along with the following additional parameters:

- Poisson's Ratio (v): 0.35
- Over-consolidation Ratio (OCR): 1.0
- Young's Modulus (E): 80 MPa

Ultimate limit state design shall adopt a soil strength reduction factor of 0.5.

All retaining wall designs must comply with:

- NZ Building Code Clause B1 – Structure, which requires that siteworks and retaining structures withstand all loads likely to be experienced during their life cycle.
- NZS 3604:2011 for timber structures and relevant retaining wall provisions.
- Clause F4 – Safety from Falling, where applicable.

This includes consideration of surcharge loads, drainage, and long-term stability under normal, elevated groundwater, and seismic conditions.

11.6 Wastewater

The wastewater design for the Quail Ridge development is based on a generation rate of 200 L/person/day assuming 2 people in one household, equating to 400 L/day per household (equivalent to 1 household unit equivalent HUE with 1 HUE in the context of QRCC being a single household with 2 occupants). The total design flow across all zones is approximately 13,210 L/day (33.2 HUE), allocated as follows:

- Zone A (clubhouse, care home, dementia unit, and 3 houses): 7,610 L/day (≈19 HUE)
- Zone B (4 lots): 1,600 L/day (4 HUE)
- Zone C (4 lots): 1,600 L/day (4 HUE)
- Zone D (6 lots): 2,400 L/day (6 HUE)
  - Two Eloy C-90 CB secondary treatment systems are proposed to treat the flows:
- C-90 CB 38 PE for Zone A (clubhouse, care home, dementia unit, and 3 houses)
- C-90 CB 24 PE- one each for the remaining residential zones (B–D)

Wastewater from the Quail Ridge Country Club development is collected in small clusters and treated using appropriately sized Eloy systems for each zone. All flows will connect to the internal reticulated network and be pumped to the central on-site pump station for discharge, consistent with the site's existing consented wastewater arrangement.

11.7 Stormwater

The increase in impervious areas proposed for Zones A, B, C, and D has been managed to ensure that stormwater discharges from the overall development remain compliant with the conditions of the underlying planning zone consent.

12. Limitation

Recommendations and opinions in this report are based on data from the investigation described herein. The nature and continuity of subsoil conditions away from the boreholes are inferred, and it is possible that actual conditions could vary from those assumed. Should subsoil conditions vary from those described in this report, it is essential that Hawthorn Geddes engineers and architects ltd be contacted to confirm the applicability of the recommendations.

This report has been prepared solely for the benefit of our client, Quail Ridge Country Club Limited, and the Far North District Council in relation to the Resource Consent application for which this report has been prepared.

The comments in it are limited to the purpose stated in this report. No liability is accepted by Hawthorn Geddes engineers & architects ltd in respect of its use by any other person, and any other person who relies upon any matter contained in this report does so entirely at their own risk.

Appendix A – Figures

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LEGEND

- Villa Zone C
- Villa ZoneD
- Villa Zone A
- Villa Zone B
- 2025 Hand Augers
- Hand Augured Boreholes (2020)
- Hand Augured Boreholes (2019)
- Hand Augured Boreholes (2022)
- Machine Augured Boreholes (rotary)
- Test Pits (2017)
- Site Boundary
- Site Boundary
- Site Boundary

HA1 HA2 HA3 HA4 HA1 HA2 TP3 MA2 HA3 MA1 TP2 MA3 TP1 HA11 HA10 TP4 MA5 MA6 HA1 HA2 MA4 MA8 TP5 MA7 TP6 MA9 HA6 TP7 TP8 TP9 HA5 TP10 HA7 TP11 TP12 TP13

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USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.

SITE PLAN

SCALE - 1:2500

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www.hawthorngeddes.co.nz

CLIENT	QRCC
PROJECT	QRCC
DRAWING	GEOTECHNICAL INVESIGATION PLAN
SCALE @ A3	1:2500
Project No.	6062
FIGURE No.	01
REV	FINAL

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SITE PLAN

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CLIENT	**QRCC**
PROJECT	**QRCC**
DRAWING	**GEOTECHNICAL INVESIGATION PLAN**
SCALE @ A3	1:1000
Project No.	**6062**
FIGURE No.	**02**
REV	**FINAL**

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SITE PLAN

SCALE - 1:1000

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CLIENT	**QRCC**
PROJECT	**QRCC**
DRAWING	**GEOTECHNICAL INVESIGATION PLAN**

SCALE @ A3	1:1000
Project No.	**6062**
FIGURE No.	**03**
REV	**FINAL**

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NOTE:

SITE INFORMATION ADAPTED FROM SITE PLAN PROVIDED BY FOLEY GROUP REFERENCE QUAIL RIDGE COUNTRY CLUB.
EXISTING GROUND LEVELS DERIVED FROM SURVEY DRAWING PROVIDED BY THOMSON SURVEY REF: 10676.
EARTHWORK LEVELS ARE 450mm BELOW FINISHED FLOOR LEVELS AND 400mm BELOW PAVEMENT DESIGN LEVEL.
ALL INFORMATION MUST BE CONFIRMED ON SITE.

Cut/Fill Depths Table

Number	Minimum Depth	Maximum Depth	Colour	Range Volume [m³]	Area [m²]
1	-2.50	-2.00		2	45.4
2	-2.00	-1.50		454	2278.6
3	-1.50	-1.00		1494	1460.7
4	-1.00	-0.50		2029	960.6
5	-0.50	0.00		2415	860.9
6	0.00	0.50		5	58.3

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
EW_S1	1.000	1.000	5240.1sq.m	6394 Cu. M.	5 Cu. M.	6389 Cu. M.<Cut>
Totals			5240.1sq.m	6394 Cu. M.	5 Cu. M.	6389 Cu. M.<Cut>

THIS FIGURE IS TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT

USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.

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7 Selwyn Avenue, Whangarei 0110, Phone: 09 438 7139, hg@hges.co.nz
Unit 21a, The Grange, Warkworth 0910, Phone: 09 283 3428, www.hawthorngeddes.co.nz

CLIENT: KERIKERI FALLS INVESTMENT LTD
PROJECT: QUAIL RIDGE COUNTRY CLUB
RAINBOW FALLS ROAD, KERIKERI
DRAWING: EARTHWORK - ZONE A

SCALE @ A3: 1:500
PROJECT No.: 6062
FIGURE No.: 04
REV.: 0

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Cut/Fill Depths Table

Number	Minimum Depth	Maximum Depth	Colour	Range Volume [m³]	Area [m²]
1	-2.50	-2.00		1	14.9
2	-2.00	-1.50		44	224.5
3	-1.50	-1.00		194	330.7
4	-1.00	-0.50		335	273.5
5	-0.50	0.00		528	656.0
6	0.00	0.50		19	132.2
7	0.50	1.00		3	10.5
8	1.00	1.50		0	0.5

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
EW_S2	1.000	1.000	1538.2sq.m	1102 Cu. M.	22 Cu. M.	1080 Cu. M.<Cut>
Totals			1538.2sq.m	1102 Cu. M.	22 Cu. M.	1080 Cu. M.<Cut>

THIS FIGURE IS TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT

USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.

Hawthorn Geddes engineers & architects ltd
7 Selwyn Avenue, Whangarei 0110, Phone: 09 438 7139, hg@hgcs.co.nz
Unit 21a, The Grange, Warkworth 0910, Phone: 09 283 3428, www.hawthorngeddes.co.nz

CLIENT: KERIKERI FALLS INVESTMENT LTD
PROJECT: QUAIL RIDGE COUNTRY CLUB
RAINBOW FALLS ROAD, KERIKERI
DRAWING: EARTHWORK - ZONE B

SCALE @ A3: 1:500
PROJECT No.: 6062
FIGURE No.: 05
REV.: 0

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THIS DRAWING WAS PRODUCED IN COLOUR. DO NOT USE FOR CONSTRUCTION PURPOSES IF THIS NOTE IS IN BLACK & WHITE

NOTE:

SITE INFORMATION ADAPTED FROM SITE PLAN PROVIDED BY FOLEY GROUP REFERENCE QUAIL RIDGE COUNTRY CLUB.
EXISTING GROUND LEVELS DERIVED FROM SURVEY DRAWING PROVIDED BY THOMSON SURVEY REF: 10676.
EARTHWORK LEVELS ARE 450mm BELOW FINISHED FLOOR LEVELS AND 400mm BELOW PAVEMENT DESIGN LEVEL.
ALL INFORMATION MUST BE CONFIRMED ON SITE.

Cut/Fill Depths Table

Number	Minimum Depth	Maximum Depth	Colour	Range Volume [m³]	Area [m²]
1	-1.50	-1.00		1	7.7
2	-1.00	-0.50		53	311.4
3	-0.50	0.00		368	1074.1
4	0.00	0.50		57	224.9
5	0.50	1.00		6	34.9
6	1.00	1.50		0	1.7

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
EW_S3	1.000	1.000	1605.5sq.m	422 Cu. M.	63 Cu. M.	358 Cu. M.<Cut>
Totals			1605.5sq.m	422 Cu. M.	63 Cu. M.	358 Cu. M.<Cut>

THIS FIGURE IS TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT

USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.

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Unit 21a, The Grange, Warkworth 0910, Phone: 09 283 3428, www.hawthorngeddes.co.nz

CLIENT: KERIKERI FALLS INVESTMENT LTD
PROJECT: QUAIL RIDGE COUNTRY CLUB
RAINBOW FALLS ROAD, KERIKERI
DRAWING: EARTHWORK - ZONE C

SCALE @ A3: 1:500
PROJECT No.: 6062
FIGURE No.: 06
REV.: 0

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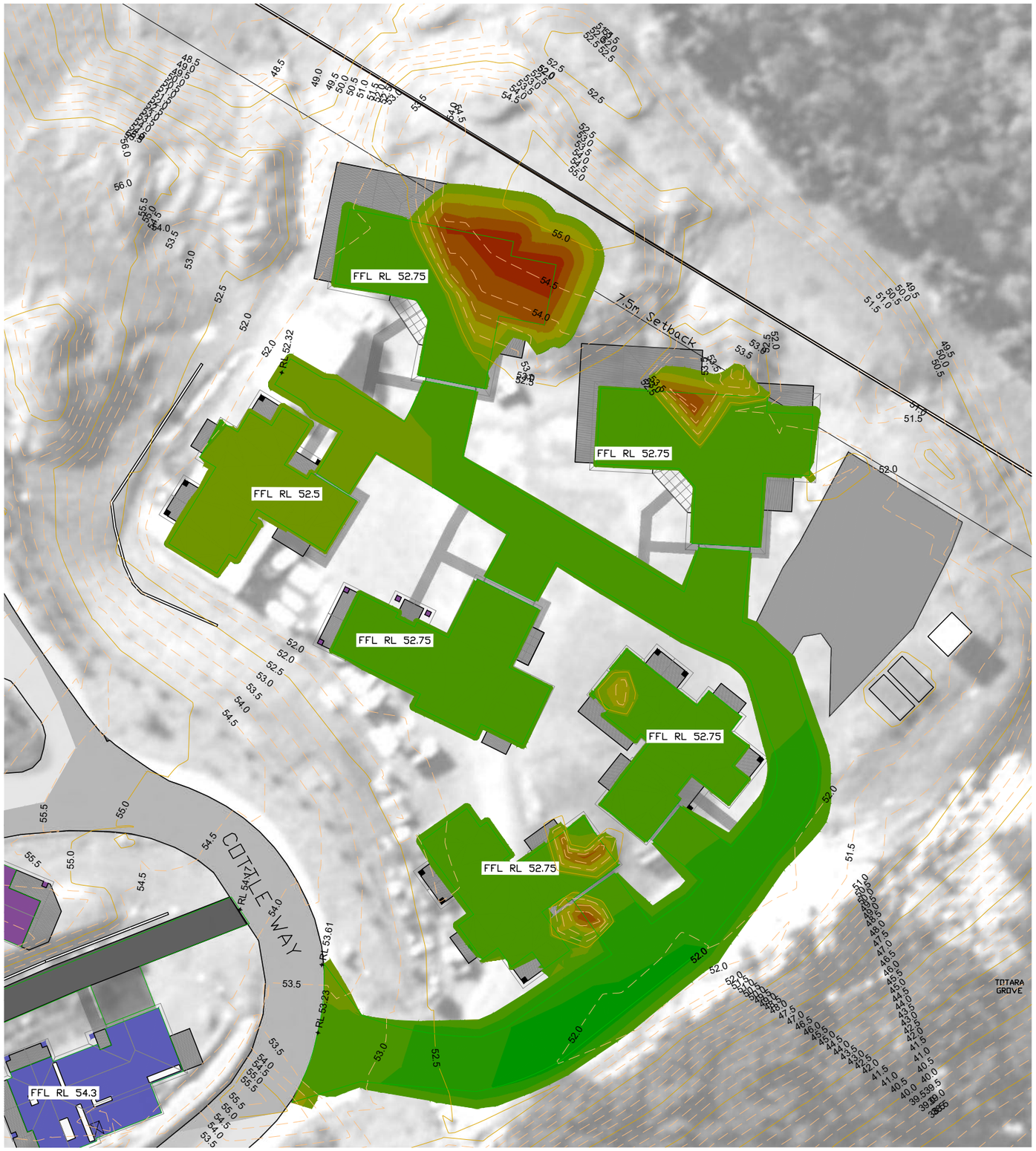

THIS DRAWING WAS PRODUCED IN COLOUR. DO NOT USE FOR CONSTRUCTION PURPOSES IF THIS NOTE IS IN BLACK & WHITE

NOTE:

SITE INFORMATION ADAPTED FROM SITE PLAN PROVIDED BY FOLEY GROUP REFERENCE QUAIL RIDGE COUNTRY CLUB.
EXISTING GROUND LEVELS DERIVED FROM SURVEY DRAWING PROVIDED BY THOMSON SURVEY REF: 10676.
EARTHWORK LEVELS ARE 450mm BELOW FINISHED FLOOR LEVELS AND 400mm BELOW PAVEMENT DESIGN LEVEL.
ALL INFORMATION MUST BE CONFIRMED ON SITE.

Cut/Fill Depths Table

Number	Minimum Depth	Maximum Depth	Colour	Range Volume [m³]	Area [m²]
1	-2.50	-2.00		8	46.6
2	-2.00	-1.50		42	84.1
3	-1.50	-1.00		81	88.7
4	-1.00	-0.50		126	125.5
5	-0.50	0.00		245	504.8
6	0.00	0.50		508	1650.7
7	0.50	1.00		135	351.7
8	1.00	1.50		8	103.9

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
EW_S4	**1.000**	**1.000**	2836.7sq.m	502 Cu. M.	650 Cu. M.	148 Cu. M.<Fill>
Totals			2836.7sq.m	502 Cu. M.	650 Cu. M.	148 Cu. M.<Fill>

THIS FIGURE IS TO BE READ ONLY IN CONJUNCTION WITH ASSOCIATED REPORT

USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.

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Unit 21a, The Grange, Warkworth 0910, Phone: 09 283 3428, www.hawthorngeddes.co.nz

CLIENT: KERIKERI FALLS INVESTMENT LTD
PROJECT: QUAIL RIDGE COUNTRY CLUB
RAINBOW FALLS ROAD, KERIKERI
DRAWING: EARTHWORK - ZONE D

SCALE @ A3: 1:500
PROJECT No.: 6062
FIGURE No.: 07
REV.: 0

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Appendix B – Subsoil Investigation Logs

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH1

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
						Topsoil		
						0.200		
						Clayey SILT, with some gravel; brown. Hard; high plasticity; moist; gravel, medium; (Kerikeri Volcanic Weathered Tuff).		
1								
	SPT (C)		2, 3 / 2, 3, 3, 4 (12)					
2								
3							Groundwater Not Encountered	
4								
	SPT (C)		0, 1 / 1, 7, 1, 2 (11)					

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH1

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
						[CONT] Clayey SILT, with some gravel; brown. Hard; high plasticity; moist; gravel, medium; (Kerikeri Volcanic Weathered Tuff).		
6	SPT (C)		1, 1 / 1, 1, 1, 2 (6)			6.000 Gravelly SILT, with minor clay; brown. Low plasticity; gravel, fine to medium; (Kerikeri Volcanics - Saprolitic BASALT).	Groundwater Not Encountered	
7								
8								
9								

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH1

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
11	SPT (C)		1, 1 / 2, 2, 1 (6)			10.100 [CONT] Gravelly SILT, with minor clay; brown. Low plasticity; gravel, fine to medium; (Kerikeri Volcanics - Saprolitic BASALT). SILT, with some gravel; brown. Low plasticity; moist; gravel, medium, BASALT; Friable, (Kerikeri Volcanic - Saprolitic BASALT). 11.000 Completely weathered; extremely weak; BASALT some silt, brown with black staining, brownish orange mottling.	Groundwater Not Encountered	
12	SPT (C)		1, 1 / 1, 1, 2 (5)					
13	SPT (C)		1, 1 / 1, 1, 3, 2 (8)					
14								

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH1

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
	SPT (C)		2, 2 / 2, 2, 2, 3 (9)			[CONT] Completely weathered; extremely weak; BASALT some silt, brown with black staining, brownish orange mottling.	Groundwater Not Encountered	
16						16.000		
	SPT (C)		3, 2 / 3, 2, 2, 3 (10)			Highly weathered; weak; BASALT.		
17								
18	SPT (C)		5, 6 / 6, 6, 8, 9 (29)					
19						19.000		
	SPT (C)		7, 15 / 11, 16, 23 (50)			Moderately weathered; weak; BASALT.		

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH1

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
21	SPT (C)		50 (50)			[CONT] Moderately weathered; weak; BASALT.	Groundwater Not Encountered	
22								
						22.500 EOH: 22.50m		
	SPT (C)		50 (50)					
23								
24								

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH2

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
1						Highly weathered; fine fabric; weak; BASALT, rough, planar jointing with silt infill, (Kerikeri Volcanic - Saprolitic BASALT).	Groundwater Not Encountered	
2	SPT (C)		3, 1 / 3, 2, 2, 2 (9)					
3	SPT (C)		3, 5 / 6, 6, 6, 6 (24)					
4	SPT (C)		2, 2 / 3, 2, 3, 2 (10)					

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH2

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
6	SPT (C)		2, 2 / 2, 3, 4, 5 (14)			[CONT] Highly weathered; fine fabric; weak; BASALT, rough, planar jointing with silt infill, (Kerikeri Volcanic - Saprolitic BASALT).	Groundwater Not Encountered	
7	SPT (C)		2, 2 / 3, 3, 4, 4 (14)			7.200 CLAY, with some sand; orange. High plasticity; sand, fine; (Residual Soils - Ruatangata Sandstone).		
8						8.5m: Sandy		
9	SPT (C)		2, 2 / 2, 3, 3, 3 (11)			9.100 Silty SAND, with some clay; greyish black with light grey speckling.. Low plasticity; sand, fine to medium; (Ruatangata Sandstone).		

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH2

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
						[CONT] Silty SAND, with some clay; greyish black with light grey speckling.. Low plasticity; sand, fine to medium; (Ruatangata Sandstone).		
11	SPT (C)		2, 2 / 3, 3, 6, 6 (18)			11.000		
						Gravelly SAND, with minor clay; orange. Low plasticity; sand, fine; gravel, fine to medium, subangular.		
						11.200 Completely weathered; SANDSTONE; extremely weak; coarse sand, (Ruatangata Sandstone) .		
12	SPT (C)		1, 3 / 3, 3, 4, 3 (13)					
						12.5m: Horizontal (90 degree) thick joints (<30mm), stained black		
13								
	SPT (C)		10, 9 / 4, 3, 3, 12 (15)			13.500 EOH: 13.50m		
14								

Groundwater Not Encountered

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH3

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
1						Silty CLAY; brownish orange. High plasticity; (Kerikeri Volcanics Weathered Tuff).	Groundwater Not Encountered	
						1.000 Unweathered; BASALT (boulder); very strong.		
2	SPT (C)		8, 10 / 6, 10, 7, 8 (31)					
						2.800 Gravelly SILT, with minor clay and sand; reddish brown, . Low plasticity; gravel, fine to medium; boulders, large, (Saprolitic BASALT).		
3	SPT (C)		7, 7 / 6, 8, 6, 6 (26)			3.500		
4								
	SPT (C)		1, 3 / 6, 8, 7, 6 (27)					

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH3

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
6	SPT (C)		50 (50)			Unweathered; BASALT (boulder); black, strong.	Groundwater Not Encountered	
7								
	SPT (C)		50 (50)			7.600 Unweathered; BASALT (boulder); very strong.		
8								
9	SPT (C)		1, 1 / 1, 0, 1, 0 (2)					

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF BOREHOLE

MBH3

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Pro-Drill Auckland
DRILLING METHOD
LOGGED BY
HOLE LOCATION

DEPTH (m)	SAMPLE TYPE	RECOVERY (%)	BLOW COUNTS (N-VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	INSTALLATION
						[CONT] Unweathered; BASALT (boulder); very strong.	Groundwater Not Encountered	
11	SPT (C)		1, 2 / 2, 2, 2, 2 (8)			11.000 EOH: 11.00m		
12								
13								
14								

REMARKS

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA1

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE 09/08/19 **COMPLETED DATE** 09/08/19 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY DG
HOLE LOCATION NE side

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				silty CLAY; brownish orange, moist, moderately plastic, very stiff		
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
				0.5m: dark brown		
		SV = 150 / 94 kPa (DR4604)				
		SV = UTP (DR4604)				
1		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
				1.2m: brownish orange	Groundwater Not Encountered	
		SV = 147 / 109 kPa (DR4604)				
		SV = 153 / 119 kPa (DR4604)		1.8m: some red mottling		
2						
		SV = 109 / 78 kPa (DR4604)		2.2m: wet		
		SV = 188 / 106 kPa (DR4604)				
		SV = 150 / 97 kPa (DR4604)		2.8m: dark brown		
3				3.000 EOH: 3.00m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA2

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE 09/08/19 **COMPLETED DATE** 09/08/19 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY DG
HOLE LOCATION Mid North

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = UTP (DR4604)		silty CLAY; brownish orange, moist, moderately plastic, hard	Groundwater Not Encountered	
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
1		SV = UTP (DR4604)		1.0m: some red mottling		
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
		SV = UTP (DR4604)		1.6m: dark brown		
		SV = UTP (DR4604)				
2		SV = UTP (DR4604)				
		SV = UTP (DR4604)		2.200 EOH: 2.20m		
3						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA3

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRC Geotechnical Investigation for Stage 4 QRC Development
PROJECT NUMBER 6062:Stage4
PROJECT LOCATION 90 Rainbow Falls Rd, Kerkeri
START DATE 09/08/19 **COMPLETED DATE** 09/08/19 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY DG
HOLE LOCATION NW side

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				silty CLAY; brown, moist, moderately plastic, hard	Groundwater Not Encountered	
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
1		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
		SV = UTP (DR4604)				
2		SV = UTP (DR4604)		2.000 EOH: 2.00m		
3						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA1

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 23/08/20 **COMPLETED DATE** 23/08/20 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR HGEA
DRILLING METHOD Hand Auger
LOGGED BY CBS
HOLE LOCATION over slopes below pool site

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				TOPSOIL		
				0.20		
		SV = 196 / - kPa (GEO952)		SILT (MH), with some clay; dark brown. Very stiff; high plasticity.		
				0.60		
		SV = 196 / - kPa (GEO952)		Clayey SILT (MH); brown. Hard; high plasticity; moist.		
		SV = 196 / - kPa (GEO952)		1.00		
1				SILT (ML), with some gravel, with trace clay. Gravel, fine, basalt, MPS < 5mm; moderately plastic; fraible.		
		SV = UTP (GEO952)				
		SV = UTP (GEO952)				
		SV = 196+ kPa (GEO952)				
2				2.0m: Becoming wet		
		SV = 196+ kPa (GEO952)				
		SV = 196+ kPa (GEO952)				
		SV = 196+ kPa (GEO952)		2.8m: Becoming hard to auger with poor recovery		
3		SV = UTP (GEO952)				
				3.20 EOH: 3.20m		

Groundwater Not Encountered

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA10

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 08/10/25 **COMPLETED DATE** 08/10/25 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY CBS
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0		SV = 190+ kPa (Geo 3928)		Silty CLAY, with minor gravel; brown. Very stiff; high plasticity; moist; gravel, fine; Fill.	Groundwater Not Encountered	
		SV = 190+ kPa (Geo 3928)		0.5m: With trace rootlets.		
		SV = 190+ kPa (Geo 3928)				
1		SV = 190+ kPa (Geo 3928)				
		SV = 190+ kPa (Geo 3928)				
		SV = 190+ kPa (Geo 3928)				
		SV = 190+ kPa (Geo 3928)				
2		SV = 190+ kPa (Geo 3928)		2.30		
		SV = 190+ kPa (Geo 3928)		Clayey SILT; reddish brown. Very stiff; non-plastic; moist; Kerikeri Volcanic Group Late Miocene basalt of Kaikohe-Bay of Islands Volcanic Field.		
		SV = 190+ kPa (Geo 3928)		3.00 EOH: 3.00m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA10

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 08/10/25 **COMPLETED DATE** 08/10/25 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY CBS
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = 190+ kPa (Geo 3928)				

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA11

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	08/10/25	**COMPLETED DATE**	08/10/25
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	50mm Hand Auger		
LOGGED BY	CBS		
HOLE LOCATION			

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = 190 / - kPa (Geo 3928)		Clayey SILT; brown. Very stiff; non-plastic; moist; Fill.	Groundwater Not Encountered	
		SV = 190 / - kPa (Geo 3928)				
1		SV = 190 / - kPa (Geo 3928)				
		SV = 190 / - kPa (Geo 3928)				
		SV = 190 / - kPa (Geo 3928)				
		SV = 190 / - kPa (Geo 3928)				
2		SV = 190 / - kPa (Geo 3928)				
		SV = 190 / - kPa (Geo 3928)		2.40		
		SV = 190 / - kPa (Geo 3928)		Clayey SILT; reddish brown. Very stiff; non-plastic; moist.		
		SV = 190 / - kPa (Geo 3928)		3.00 EOH: 3.00m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA11

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 08/10/25 **COMPLETED DATE** 08/10/25 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY CBS
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
	3	SV = 190 / - kPa (Geo 3928)				
	3					
	4					
	4					
	4					
	5					
	5					
	5					
	7					
	9					
	7					
	7					
	9					
	7					
	6					
	7					
	7					
	6					
	7					
	7					
	6					
	7					
	7					
	8					
	8					
	7					
	8					
	8					
	8					
	10					

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA2

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 23/08/20 **COMPLETED DATE** 23/08/20 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR HGEA
DRILLING METHOD Hand Auger
LOGGED BY CBS
HOLE LOCATION over slopes below pool site

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0		SV = 196+ kPa (GEO952)		Clayey SILT (MH); brown . Hard; high plasticity; moist.	Groundwater Not Encountered	
		SV = 196+ kPa (GEO952)				
1		SV = 196+ kPa (GEO952)				
				1.20 SILT (ML), with some clay and gravel; orange brown. Gravel, fine, basalt, MPS < 5mm; friable, hard to auger.		
		SV = UTP (GEO952)				
				1.80 EOH: 1.80m		
2		SV = UTP (GEO952)				
3						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA4

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = 190+ kPa (Geo 3928)		Clayey SILT, with trace gravel; brown. Very stiff; low plasticity; moist; gravel, fine; Fill.	Groundwater Not Encountered	
		SV = 190+ kPa (Geo 3928)				
		SV = UTP (Geo 3928)		0.90 EOH: 0.90m 0.9m: EOH: Well Compacted Fill.		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF HAND AUGER

HA5

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = 68 / 27 kPa (Geo 3928)		Clayey SILT; brown and red. Very stiff; non-plastic; moist; Fill.	Groundwater Not Encountered	
		SV = 68 / 27 kPa (Geo 3928)				
		SV = 81 / 27 kPa (Geo 3928)				
1		SV = 136 / 27 kPa (Geo 3928)				
		SV = 136 / 27 kPa (Geo 3928)		1.4m: Grey and brown mottled orange.		
		SV = 190 / 27 kPa (Geo 3928)				
2		SV = 190+ kPa (Geo 3928)				
		SV = 190+ kPa (Geo 3928)		2.50		
		SV = 190+ kPa (Geo 3928)		CLAY, with some silt, with trace gravel; brown. Very stiff; high plasticity; moist; gravel, fine.		
				3.00 EOH: 3.00m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA5

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
	3	SV = 190+ kPa (Geo 3928)		3.0m: EOH: Unable to Penetrate.		
	4					
	3					
	6					
	6					
	5					
	6					
	5					
	5					
	5					
	4					
	5					
	14					
	10					
	20					

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF HAND AUGER

HA6

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE		**COMPLETED DATE**	
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	50mm Hand Auger		
LOGGED BY			
HOLE LOCATION			

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = 190+ kPa (Geo 3928)		Clayey SILT, with trace gravel; brown and orange. Very stiff; non-plastic; moist; gravel, fine; Fill.	Groundwater Not Encountered	
				0.2m: Grey, brown and orange.		
		SV = 190+ kPa (Geo 3928)				
		SV = 190+ kPa (Geo 3928)				
				1.00 EOH: 1.00m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF HAND AUGER

HA6

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE **COMPLETED DATE** **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				1.0m: EOH: well compacted fill.		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF HAND AUGER

HA7

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE		**COMPLETED DATE**	
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	50mm Hand Auger		
LOGGED BY			
HOLE LOCATION			

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = 41 / 14 kPa (Geo 3928)		Clayey SILT, with trace gravel; brown. Very stiff; non-plastic; moist; gravel, fine; Fill.	Groundwater Not Encountered	
		SV = 41 / 14 kPa (Geo 3928)				
1		SV = 47 / 14 kPa (Geo 3928)				
		SV = 163 / 27 kPa (Geo 3928)		1.2m: Stiff.		
		SV = 149 / 14 kPa (Geo 3928)				
		SV = 156 / 14 kPa (Geo 3928)				
2		SV = 163 / 14 kPa (Geo 3928)				
				2.50 EOH: 2.50m 2.5m: EOH: Unable to Penetrate.		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF TEST PIT

TP1

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On near flat ground		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.		
				0.20 Clayey SILT (MH) brown, dry, highly plastic, very stiff, floury.		
		SV = 86 / 22 kPa (GEO287)				
1		SV = 184 / 22 kPa (GEO287)				
		SV = UTP (GEO287)		1.4m: - beginning to see moderately weathered scoria and andesitic boulders MPS 200mm.		
2		SV = 222+ kPa (GEO287)				
		SV = 159 / 63 kPa (GEO287)		2.5m: - becoming wet		
3		SV = 111 / 63 kPa (GEO287)		3.00 EOH: 3.00m		

Groundwater Not Encountered

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF TEST PIT

TP10

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On Near flat ground		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = 127 / 35 kPa (GEO287)		0.10 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets. Clayey SILT (MH) reddish brown, moist, very stiff, floury.	Groundwater Not Encountered	
1		SV = 155 / 43 kPa (GEO287)		1.0m: - becoming wet		
				1.50 Well graded sandy clayey GRAVEL, whitish grey speckled orange matrix with dark grey rounded boulders and gravels, MPS 700mm, excavator struggling.		
2				2.50 EOH: 2.50m		
3						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF TEST PIT

TP11

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On Near flat ground		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				0.10 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.		
				Clayey SILT (MH), reddish brown, moist, highly plastic, very stiff, floury.		
		SV = UTP (GEO287)				
1		SV = 127 / 22 kPa (GEO287)		1.0m: - becoming wet		
		SV = 108 / 38 kPa (GEO287)				
2		SV = 92 / 48 kPa (GEO287)				
				2.50 Well graded sandy clayey GRAVEL, whitish grey speckled orange matrix with dark grey rounded boulders and gravels, MPS 700mm, excavator struggling.		
3				3.00 EOH: 3.00m		

Groundwater Not Encountered

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF TEST PIT

TP12

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 14/03/17 **COMPLETED DATE** 14/03/17 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Norm Ruddell
DRILLING METHOD 12T Excavator
LOGGED BY CP
HOLE LOCATION On Near flat ground

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
			TS	0.10 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.		
				Clayey SILT (MH) reddish brown, moist, highly plastic, very stiff, floury.		
		SV = UTP (GEO287)				
1		SV = UTP (GEO287)				
		SV = 146 / 44 kPa (GEO287)				
2		SV = 79 / 22 kPa (GEO287)		2.0m: - becoming wet	Groundwater Not Encountered	
				2.90		
3				Well graded sandy clayey GRAVEL, whitish grey speckled orange matrix with dark grey rounded boulders and gravels, MPS 700mm, excavator struggling.		
				3.50 EOH: 3.50m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF TEST PIT

TP13

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On Near flat ground		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				0.10 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.		
				Clayey SILT (MH), reddish brown, moist, highly plastic, very stiff, floury.		
		SV = 159 / 22 kPa (GEO287)				
1		SV = UTP (GEO287)		1.0m: -becoming more greyish brown speckled orange and wet		
		SV = 82 / 38 kPa (GEO287)				
				2.00		
2				Well graded sandy clayey GRAVEL, whitish grey speckled orange matrix with dark grey rounded boulders and gravels, MPS 700mm, excavator struggling.		
				2.50 EOH: 3.00m		
3						

Groundwater Not Encountered

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF TEST PIT

TP2

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On Near flat ground		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.		
				0.20		
				Clayey SILT (MH) brown, moist, highly plastic, very stiff, floury.		
		SV = 111 / 32 kPa (GEO287)				
1		SV = UTP (GEO287)				
		SV = 127 / 32 kPa (GEO287)				
				2.00		
2		SV = UTP (GEO287)		Silty CLAY (CH) with gravels, brownish grey, moist, highly plastic, MPS 40mm (completely weathered Andesite).		
		SV = 143 / 70 kPa (GEO287)				
				3.00 EOH: 3.20m		
3		SV = 159 / 51 kPa (GEO287)				

Groundwater Not Encountered

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF TEST PIT

TP3

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On Near flat ground		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				0.10 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.		
		SV = 111 / 32 kPa (GEO287)		Clayey SILT (MH) brown, moist, highly plastic, minor gravels MPS 80mm (completely weathered Andesite), floury.		
				0.70 Clayey SILT (MH) with gravels, brownish grey, moist, highly plastic, MPS 80mm (completely weathered Andesite).		
1		SV = UTP (GEO287)				
		SV = UTP (GEO287)				
2		SV = 159 / 51 kPa (GEO287)				
		SV = 159 / 48 kPa (GEO287)		2.70 EOH: 2.70m		
3						

Groundwater Not Encountered

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF TEST PIT

TP4

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On 10H:1V slope		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				0.20 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.	Groundwater Not Encountered	
		SV = 174 / 25 kPa (GEO287)		Clayey SILT with gravels, dark brown, moist, highly plastic, MPS 180mm (completely weathered Andesite), floury.		
1		SV = 206 / 82 kPa (GEO287)				
		SV = 162 / 48 kPa (GEO287)				
2		SV = 127 / 63 kPa (GEO287)				
		SV = 159 / 79 kPa (GEO287)		2.5m: - becoming dark greyish brown		
3				3.00 EOH: 3.00m		
4						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF TEST PIT

TP5

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 14/03/17 **COMPLETED DATE** 14/03/17 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Norm Ruddell
DRILLING METHOD 12T Excavator
LOGGED BY CP
HOLE LOCATION On 10H:1V slope

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				0.15 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.	Groundwater Not Encountered	
				CLayey SILT (MH), brown, moist, highly plastic, very stiff, floury.		
		SV = 111 / 32 kPa (GEO287)				
1				1.0m: - beginning to encounter trace boulders MPS 650mm, lots of smaller andesite boulders 50-100mm.		
2						
3				3.00 EOH: 3.00m		
4						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF TEST PIT

TP6

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 14/03/17 **COMPLETED DATE** 14/03/17 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR Norm Ruddell
DRILLING METHOD 12T Excavator
LOGGED BY CP
HOLE LOCATION On 10H:1V slope

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				0.20 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.	Groundwater Not Encountered	
		SV = 95 / 38 kPa (GEO287)		Clayey SILT (MH), brown, moist, highly plastic, very stiff, floury.		
1				1.0m: -beginning to encounter gravels and few boulders, MPS 500mm.		
2						
3				3.00 EOH: 3.00m		
4						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF TEST PIT

TP7

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On 10H:1V slope		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				0.20 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.	Groundwater Not Encountered	
				Clayey SILT (MH) brown, moist, highly plastic, very stiff, floury.		
		SV = 111 / 32 kPa (GEO287)		0.5m: - beginning to encounter gravels and few boulders, MPS 500mm.		
1						
2						
3				3.00 EOH: 3.00m		
4						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF TEST PIT

TP8

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On 4H:1V slope		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				Clayey SILT FILL with gravel and coarse organics (roots and branches) 50-80mm, MPS 40mm.	Groundwater Not Encountered	
0.30						
0.40			TS	Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.		
				Clayey SILT (MH) brown, moist, highly plastic, very stiff, floury.		
0.9m: beginning to encounter gravels and few boulders, MPS 400mm.						
1						
2						
2.50						
				Clayey SILT with gravels and few boulders, dark greyish brown, moist, highly plastic, very stiff.		
3						
3.00				EOH: 3.00m		
4						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF TEST PIT

TP9

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	14/03/17	**COMPLETED DATE**	14/03/17
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR	Norm Ruddell		
DRILLING METHOD	12T Excavator		
LOGGED BY	CP		
HOLE LOCATION	On 5H:1V slope		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0			TS	0.10 Clayey SILT TOPSOIL, dark brown, moist, highly plastic, rootlets.	Groundwater Not Encountered	
				0.1m Clayey SILT (MH) brown, moist, highly plastic, very stiff, floury		
		SV = UTP (GEO287)		0.5m: - beginning to encounter boulders and completely weathered gravels MPS 300mm.		
1		SV = UTP (GEO287)				
		SV = UTP (GEO287)				
2		SV = UTP (GEO287)				
				3.00 EOH: 3.00m		
3						
4						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

OG OF [SELECT HOLE TYP

BH1

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 17/10/19 **COMPLETED DATE** 17/10/19 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 12T - 20T Excavator
LOGGED BY CBS
HOLE LOCATION Stage 4 & 5

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				silty CLAY; brown, moist, highly plasticity	Groundwater Not Encountered	
2.00				clayey SILT; some cemented silt, brown, moist		
4.50				weathered rock, volcanic (basalt) fractured, greyish purple mottled black and yellow		
8.00				EOH: 8.00m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

)G OF [SELECT HOLE TYP

BH2

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 17/10/19 **COMPLETED DATE** 17/10/19 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 12T - 20T Excavator
LOGGED BY AA
HOLE LOCATION Stage 4 & 5

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				silty CLAY; brown, moist, highly plastic	Groundwater Not Encountered	
3.00				clayey SILT; purple brown, moist, moderately plastic		
4.50				SILT;cemented, brown, moist, low plasticity		
				5.0m: weathered volcanic rocks (MPS=<50mm)		
				6.5m: cemented SILT, weathered rock (MPS= < 80mm)		
7.50				EOH: 7.50m		
				7.5m: bedrock, hard to auger		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF [SELECT HOLE TYP

BH3

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	17/10/19	**COMPLETED DATE**	17/10/19
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	12T - 20T Excavator		
LOGGED BY	CBS		
HOLE LOCATION	Stage 4 & 5		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				silty CLAY; dark brown, moist, high plasticity	Groundwater Not Encountered	0
2.00				clayey SILT; purplish grey, moist, high plasticity		2.00
3.0m: becoming compacted silt, some gravels						
3.60				highly weathered rock, volcanic (basalt) fractured, brownish grey, silty		3.60
5.8m: becoming wet						
6.4m: weathered rock size increase, some silt, purple mottled black						
7.50				EOH: 7.50m		7.50

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

OG OF [SELECT HOLE TYP

BH4

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	17/10/19	**COMPLETED DATE**	17/10/19
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	12T - 20T Excavator		
LOGGED BY	AA		
HOLE LOCATION	Stage 4 & 5		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				silty CLAY; organics, brown, highly plastic	Groundwater Not Encountered	
1						
2						
3						
4				4.00 SILT; brown, moist, low plasticity, cemented		
5				5.5m: weathered rock (MPS = <50mm)		
6				6.3m: increasing the size of weathered rock		
7				7.00 EOH: 7.00m 7.0m: wet		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF [SELECT HOLE TYP

BH5

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	17/10/19	**COMPLETED DATE**	17/10/19
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	12T - 20T Excavator		
LOGGED BY	AA		
HOLE LOCATION	Stage 4 & 5		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				clayey SILT; brown, moist, highly plastic	Groundwater Not Encountered	
4.00				SILT; dark purplish grey, moist, low plasticity		
5.0				5.0m: some weathered volcanic rocks (MPS=<50mm)		
6.00				highly weathered rock, volcanic (basalt) fractured, brownish grey, silty		
8.00				EOH: 8.00m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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)G OF [SELECT HOLE TYP

BH6

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	17/10/19	**COMPLETED DATE**	17/10/19
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	12T - 20T Excavator		
LOGGED BY	AA		
HOLE LOCATION	Stage 4 & 5		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				silty CLAY; brown, moist, highly plastic	Groundwater Not Encountered	
1						
2				2.0m: some grey cemented silt		
3				3.00 clayey SILT; compacted silt, low plasticity		
4				3.6m: grey cemented silt, white yellow mottling 4.50		
5				weathered rock (MPS= <50mm), volcanic ash (black), purple grey yellow		
6				6.00 highly weatherd rock, volcanic (basalt) fractured, yellow grey, silty		
7						
8				8.00 EOH: 7.80m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF [SELECT HOLE TYP

BH7

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	17/10/19	**COMPLETED DATE**	17/10/19
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	12T - 20T Excavator		
LOGGED BY	AA		
HOLE LOCATION	Stage 4 & 5		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				silty CLAY, brown, moist, highly plastic	Groundwater Not Encountered	
1						
2						
3				3.2m: some cemented silt, purple brown, moist, highly plastic		
4				4.20		
				Cemented SILT; brown, moist, low plasticity		
5						
6				6.00		
				cemented SILT; yellow grey mottling, moist		
7				6.8m: increasing cemented silt, grey, moist		
8				8.00 EOH: 8.00m		
				8.0m: dark brown, moist, low plasticity		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF [SELECT HOLE TYP

BH8

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	17/10/19	**COMPLETED DATE**	17/10/19
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	12T - 20T Excavator		
LOGGED BY	AA		
HOLE LOCATION	Stage 4 & 5		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				clayey SILT; brown, moist, highly plastic	Groundwater Not Encountered	0
1						1
2						2
3						3
4				4.20		4
5				SILT; dark purplish grey, moist, low plasticity, cemented		5
6				6.50		6
7				highly weathered rock, volcanic (basalt) fractured, brownish grey, silty		7
8				7.50 EOH: 7.50m		8

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF [SELECT HOLE TYP

BH9

CLIENT QRCC c/o: Alwin Roessler
PROJECT Quail Ridge Soakage tests
PROJECT NUMBER 6062
PROJECT LOCATION Rainbow Falls Road, Kerikeri
START DATE 17/10/19 **COMPLETED DATE** 17/10/19 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 12T - 20T Excavator
LOGGED BY AA
HOLE LOCATION Stage 4 & 5

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0				cemented clayey SILt; brown, highly plastic	Groundwater Not Encountered	
1						
2						
3				3.00 clayey SILT; grey brown, moist, highly plastic		
4				4.50 highly weathered rock, volcanic (basalt) fractured, brownish grey, silty; hard to auger, MPS (>50mm)		
5				5.30 EOH: 5.30m 5.3m: Refusal: Hard to Auger		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF [SELECT HOLE TYP

BH10

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Quail Ridge Soakage tests
PROJECT NUMBER	6062	**PROJECT LOCATION**	Rainbow Falls Road, Kerikeri
START DATE	17/10/19	**COMPLETED DATE**	17/10/19
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	12T - 20T Excavator		
LOGGED BY	CBS		
HOLE LOCATION	Stage 4 & 5		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
1				clayey SILT; brown, moist, highly plastic	Groundwater Not Encountered	
2				2.10 SILT; dark purplish grey, moist, low plasticity		
3				2.3m: some volcanic angular gravels		
4				3.5m: SILT; more gravels (MPS = < 50mm), brown mottled yellow		
5				4.20 highly weathered rock, volcanic (basalt) fractured, brownish grey, silty		
6				5.5m: less silt, more rocks (MPS = 80 - 200mm)		
7				7.40 weathered rock, volcanic ash (black), purple grey yellow		
8				8.00 EOH: 8.00m		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF HAND AUGER

HA1

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRCC Stages 4 & 5
PROJECT NUMBER 6062 (Club house)
PROJECT LOCATION RD2
START DATE 25/03/22 **COMPLETED DATE** 25/03/22 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY GS
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = UTP (GEO287)		SILT, with minor clay and sand; dark orange brown. Hard; non-plastic; dry; sand, fine to medium; (Weathered Tuff) (logged observing the cut face).	Groundwater Not Encountered	
		SV = UTP (0)				
		SV = UTP (0)		0.8m: reddish orange		
1		SV = UTP (0)		1.2m: started drilling borehole		
		SV = UTP (0)		1.20 SILT, with minor clay and sand; reddish orange. Hard; non-plastic; moist; sand, fine to medium;		
		SV = 233+ kPa (0)				
		SV = 233+ kPa (0)				
2		SV = 199 / 116 kPa (0)				
		SV = 233 / 130 kPa (0)		2.5m: dark grey brown		
		SV = 213 / 133 kPa (0)		2.7m: purple grey		
3		SV = 203 / 125 kPa (0)				
		SV = 183 / 110 kPa (0)		3.50 EOH: 3.50m		
4						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA2

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRCC Stages 4 & 5
PROJECT NUMBER 6062 (Club house)
PROJECT LOCATION RD2
START DATE 25/03/22 **COMPLETED DATE** 25/03/22 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY GS
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
0		SV = 33 / 13 kPa (0)		SILT, with minor clay and sand; dark orange. Firm; non-plastic; moist; sand, fine to medium; (Fill).	Groundwater Not Encountered	
		SV = 100 / 40 kPa (0)		0.80		
1		SV = 233+ kPa (0)		SILT, with minor clay and sand; dark orange. Hard; non-plastic; moist; (Weathered Tuff).		
		SV = UTP (0)				
		SV = 216 / 106 kPa (0)		1.5m: Very stiff.		
		SV = 169 / 133 kPa (0)				
2		SV = 183 / 125 kPa (0)		2.0m: Grey orange.		
		SV = 166 / 120 kPa (0)		2.5m: Purple grey, lack streaks.		
		SV = 179 / 123 kPa (0)				
3		SV = 133 / 66 kPa (0)		3.00 EOH: 3.00m		
4						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA3

CLIENT QRCC c/o: Alwin Roessler
PROJECT QRCC Stages 4 & 5
PROJECT NUMBER 6062 (Club house)
PROJECT LOCATION RD2
START DATE 25/03/22 **COMPLETED DATE** 25/03/22 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY GS
HOLE LOCATION

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
				Hardfill		
		SV = UTP (0)		SILT, with minor clay and sand; dark orange. Hard; non-plastic; moist; sand, fine to medium; (Weathered Tuff) (logged observing the cut face).		
				0.4m: reddish orange		
		SV = UTP (0)				
		SV = UTP (0)				
1				1.2m: started drilling borehole		
				1.20		
		SV = 233+ kPa (0)		SILT, with minor clay and sand; dark orange. Hard; non-plastic; moist; sand, fine to medium;.		
		SV = 199 / 95 kPa (0)				
		SV = 213 / 130 kPa (0)				
2						
		SV = 173 / 103 kPa (0)				
		SV = 169 / 113 kPa (0)		2.5m: grey, orange streaks		
		SV = 83 / 23 kPa (0)		2.7m: orange		
3						
		SV = UTP (0)				
		SV = 83 / 33 kPa (0)		3.2m: Purple grey, orange mottles. Stiff; wet.		
		SV = 116 / 33 kPa (0)				
		SV = 120 / 30 kPa (0)		3.9m: dark grey, orange streaks		
4						
		SV = 116 / 30 kPa (0)				
				4.50 EOH: 4.50m		
		SV = 83 / 40 kPa (0)				

Groundwater Not Encountered

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

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LOG OF HAND AUGER

HA1

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Kerikeri retirement lifestyle village
PROJECT NUMBER	6062(11828structure)	**PROJECT LOCATION**	Rainbow Falls Rd,Kerikeri
START DATE	19/02/20	**COMPLETED DATE**	19/02/20
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	50mm Hand Auger		
LOGGED BY	AA		
HOLE LOCATION	southern corner of building site		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = UTP (GEO952)		FILL: silty CLAY; gravel mix (MPS=40mm, sub-angular), brown, dry	Groundwater Not Encountered	
		SV = UTP (GEO952)				
		SV = UTP (GEO952)				
		SV = UTP (GEO952)				
		SV = UTP (GEO952)		0.90 EOH: 0.90m 0.9m: unable to penetrate		
1						

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA2

CLIENT	QRCC c/o: Alwin Roessler	**PROJECT**	Kerikeri retirement lifestyle village
PROJECT NUMBER	6062(11828structure)	**PROJECT LOCATION**	Rainbow Falls Rd,Kerikeri
START DATE	19/02/20	**COMPLETED DATE**	19/02/20
COORDINATES		**LEVEL**	0.00
DRILLING CONTRACTOR			
DRILLING METHOD	50mm Hand Auger		
LOGGED BY	DG		
HOLE LOCATION	mid-slope SW corner		

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = UTP (GEO287)		FILL: silty CLAY; gravel mix (MPS= 40mm, well graded), brown, dry	Groundwater Not Encountered	
		SV = UTP (GEO287)				
				0.50		
		SV = UTP (GEO287)		silty CLAY; reddish brown, dry, moderately plastic		
		SV = UTP (GEO287)				
1		SV = UTP (GEO287)		1.0m: some moisture		
		SV = UTP (GEO287)				
				1.40 EOH: 1.40m		
		SV = UTP (GEO287)		1.4m: unable to penetrate		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Hawthorn Geddes engineers & architects ltd

LOG OF HAND AUGER

HA3

CLIENT QRCC c/o: Alwin Roessler
PROJECT Kerikeri retirement lifestyle village
PROJECT NUMBER 6062(11828structure)
PROJECT LOCATION Rainbow Falls Rd,Kerikeri
START DATE 19/02/20 **COMPLETED DATE** 19/02/20 **COORDINATES** **LEVEL** 0.00
DRILLING CONTRACTOR
DRILLING METHOD 50mm Hand Auger
LOGGED BY AA
HOLE LOCATION centre of building site

DEPTH (m)	SCALA (Blows / 100mm)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER	DEPTH (m)
		SV = UTP (GEO952)		silty CLAY; some brown sub-angular gravel (MPS=40mm), reddish brown, dry, moderately plastic	Groundwater Not Encountered	
				0.2m: no gravel		
		SV = UTP (GEO952)				
		SV = UTP (GEO952)				
		SV = UTP (GEO952)				
1		SV = UTP (GEO952)		1.00 EOH: 1.00m 1.0m: unable to penetrate		

PHOTO / SKETCH

WATER OBSERVATIONS

Date / Time	Water Level (m)	Type	Remarks

REMARKS

SYMBOLS

- Standing Water Level
- Water Out flow
- Water In flow

Appendix C – HGEA Stage 4 & 5 Earthworks Completion Reporting

Date: 11.11.2025
HG ref.:6062

Hawthorn Geddes
engineers & architects ltd

EARTHWORKS COMPLETION STAGES 4 & 5

REVISION 2

PREPARED FOR

KERIKERI FALLS INVESTMENTS LTD

AT 82 RAINBOW FALLS ROAD, KERIKERI

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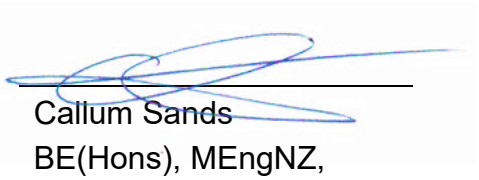
EARTHWORKS COMPLETION REPORT FOR KERIKERI FALLS INVESTMENTS LTD

Table of Contents

Report
Prepared by:



Callum Sands
BE(Hons), MEngNZ,
CPEng

DOCUMENT TRANSMITTAL				
Prepared for: Kerikeri Falls Investment Ltd				Job No.: 6062
Revision	**Issued To**		**Copies Issued**	**Date**
0	Client: Attn: Via email: Cc: Via email:	Kerikeri Falls Investment Ltd Alwin Roessler alwin@quailridgecc.co.nz Tony Smitheram tony@quailridgecc.co.nz	email	27.07.2021
1	Client: Attn: Via email: Cc: Via email:	Kerikeri Falls Investment Ltd Alwin Roessler alwin@quailridgecc.co.nz Tony Smitheram tony@quailridgecc.co.nz	email	25.03.2022
2	Client: Attn: Via email: Cc: Via email:	Kerikeri Falls Investment Ltd Alwin Roessler alwin@quailridgecc.co.nz Tony Smitheram tony@quailridgecc.co.nz	email	18.01.23

1. Purpose

The purpose of this report is to summarise the results of observations and soil testing undertaken at Quail Ridge Country Club for Stages 4 and 5. This report provides advice on soil conditions for foundations and stability for retirements units 416 through 423, and 501 through 525. Advice will be given on stability only for units 401 through 415.

Foundation conditions for the serviced apartment are not included as part of this report. This will be subject to specific engineering assessment and design at a later stage. Earthworks and stability are assessed and included within the recommendation of this report.

A copy of the Hawthorn Geddes engineers and architects Ltd (HGEA) earthworks drawings for Stages 4 and 5 is attached to this report, Figures 05 through 21.

This report is suitable to support a resource consent completion and building consent applications to the Far North District Council for retirement units on the relevant building platforms.

This report supersedes the previous version dated 25.03.2022. Earthworks to form building platforms for those units 508 through 515, 521, 523 through 526, and 510 and 511 (previously excluded) have since been completed. Updates to the extent of earthworks compliance testing and conclusions and recommendations sections of the previous report have been made.

2. Background

2.1. Site Description

Stages 4 and 5 are located over the southern portion of the Quail Ridge Country Club, shown in Figure A below. The development is closely bordered by Waipekakoura River to the west through south and Rainbow Falls to the north. Stage 5 is proposed within the lower river plateau below Stages 1 through 4.

Figure A – Extent of QRCC (Google Earth Images).

2.2. Geological Background

The 1:250,000 scale published geology of the area, viewed online from the GNS Science website, indicates that the site is underlain by Kerikeri volcanic basaltic lava flow, with the underlying geological unit of Ruatangata Sandstone.

Soils over the existing Stages 1 through 3, the under-construction Stage 4, and the source material for all fill used over Stages 4 and 5, were all consistent with the Kerikeri Volcanic soils. The underlying cut materials and retained soils over Stage 5 and the access road are Ruatangata Sandstone.

Subsoil investigation over Stages 4 and 5 comprised 13 test pits (TP1 to TP13) that were excavated in March 2017. Hand augered boreholes were also drilled across Stages 4a and 4b, and through the escarpment below to depths between 2m and 3m. Further testing was completed in March 2021, comprising three machine boreholes (MBH1 to MBH3), drilled to depths of 22.5m, 13.5m, and 11m, respectively.

The subsoil conditions encountered in the TPs and MBHs typically comprised a stiff to very stiff, moderately plastic, clayey silty, residual soil overlying completely weathered sandstone. Undrained shear strength testing in the residual soils yielded results typically 100kPa to 150kPa, with SPT 'n' testing performed in the sandstone typically 8 to 12 blows per 300mm penetration and increasing with depth, to 50 blows in the moderately to slightly weathered sandstone.

Groundwater was not encountered in the TPs or the MBHs. Piezometers installed during the MBH drilling were monitored for several weeks, over a period of fine to wet weather and did not indicate any static water level.

Logs of the TPs and MBHs are attached to this report.

2.3. Development

Stage 4 comprises three substages, 4a, 4b, and 4c, as well as two serviced apartment buildings and a manshed area. Stage 5 will entirely contain standalone retirement units. There are a total of 48 units proposed between the two stages. These retirement units are proposed to be single-story, timber-framed with timber and brick cladding, supported over stiffened waffle raft foundations, with units of various sizes and generally three bedrooms.

Stage 4a and 4b are both essentially flat platforms formed entirely within excavations, containing 15 standalone retirement units, (units 401 to 415). Stage 4b is retained along its southern boundary by a timber crib retaining wall. PS1 and PS4 documents have been issued by HGEA, dated 15th April 2020 and 20th August 2020 respectively, for the design and construction of this retaining wall, FNDC building consent EBC 2020-11368. At the time of writing, all units within Stage 4a were completed, and units within stage 4b were under construction.

Stage 4c will contain 8 various retirement units (units 416 to 423), all units in Stage 4C will be partially founded over engineered fill, with units 421 to 423 entirely over fill.

Stage 5 is proposed to comprise 25 standalone retirement units (units 501 to 526). This stage comprises excavations up to 3.5m along the northern edge, at the base of the escarpment, forming building platforms for units 521 to 525. Filling is required to form all other building platforms with a maximum depth of 4.3m in the eastern corner, but generally less than 3.0m elsewhere.

Access to Stage 5 will comprise a shared driveway, extending from the lower plateau up the escarpment towards Stage 4, see Figure 2 below. The driveway will be retained by a large timber-crib/soil nail composite wall to the north, up to 7m tall, with the escarpment below battered such that is does not exceed 1V:2H (26°) along the southern edge. Stability of the wall and escarpment are assessed later in this report, see section 6.0 Stability Assessment. The nail wall and timber crib wall have been subject to specific engineering design by HGEA.

See Figure B below for stage and retirement unit layout:

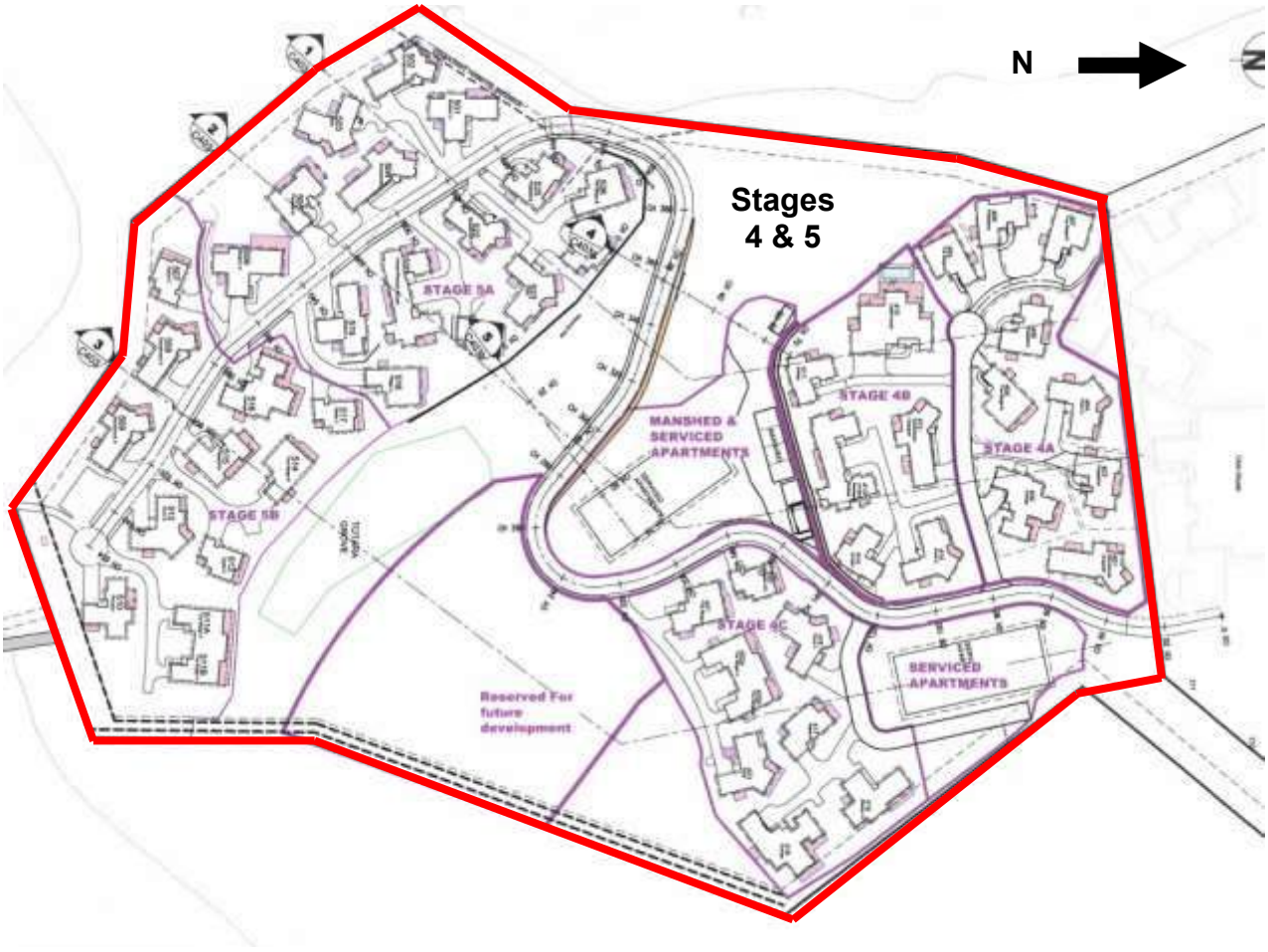


Figure B – Stage 4 & 5 Quail Ridge Country Club, units 401 to 526 (HGEA drawing C401 B5).

3. Fill Material

All soils excavated during earthworks Stages 1 through 3 were stock piled on site for use as fill over the development as a whole. A geotechnical engineer from Hawthorn Geddes (HGEA) identified the soil as appropriate for use as fill, with solid density and compaction testing performed by WSP Opus.

The fill material is described as clayey silt to silty clay, reddish-brown, moderately plastic.

Lab testing completed by WSP Opus determined the soil to have a solid density of 2.82t/m³.

A copy of the lab results is attached to this report.

3.1. Fill Specification

All fill was placed in loose layers not exceeding 200mm and compacted with a sheep-foot roller. Soil stockpiles were watered to ensure soils were as close as possible to optimum moisture content at the time of filling. During the drought of 2019/2020 summer, water was sprayed over the soils during the placement of fill in layers not more than 200mm to prevent moisture change.

Typically, Nuclear Densometer Testing (NDM) and shear vane testing were performed at 500mm fill depth intervals as the site was developed, with a minimum of 2 tests per 1,000m².

Fill specifications, as provided to the contractor by HGEA, were:

- Shear Vane Undrained Shear Strengths of an average not less than 140kPa and no individual value off less than 110kPa.
- Air voids average value of 8%, with no individual value of more than 10%.

4. Earthworks Compliance Testing

Earthworks during Stage 4a and 4b comprised mostly cut to form suitable building platforms. However, stage 4c comprised excavation to the north and filling to the south of the stage, with filling to depths typically 2m and up to 4.9m.

Stage 5 earthworks comprised almost entirely fill, with a small area of cut to the north where excavations were limited to 2m. Fill depths varied across the site, with fill depths of up to 4.9m to the east and shallowing to some 2m to the west.

A copy of the cut and fill plans, as prepared by Hawthorn Geddes (HGEA), is attached to this report.

4.1. Stage 4

4.1.1 Stage 4a & 4b

During stage 4a and 4b earthworks, an engineering geologist from HGEA attended site on the 09/08/2019 to assess and monitor excavations and complete a subsoil investigation. A subsequent geotechnical report titled “Geotechnical investigation report for proposed development at Quail Ridge Country Club at 90 Rainbow Falls Road,” dated 13/08/2019 was produced to support BC applications for the retirement units within stages 4a and 4b. The report provided a summary of the geotechnical investigation and provided soil conditions for foundations of Stage 4 of the QRCC development. Key findings of this report are summarised below:

Hand augered boreholes were drilled over the excavated platform to establish subsoil and founding conditions. Soils were typically very stiff to hard, moderately plastic silty clays with undrained shear strengths in the order of 110kPa to 240kPa.

Soils were considered suitable for the proposed retirements units on waffle raft foundations designed in accordance with AS 2870 for Class M soils.

A copy of this report is attached.

4.1.2 Stage 4c

Fill testing over Stage 4c was completed between 16/04/2019 and 22/10/2020. A total of 31 Nuclear Densometer tests (NDM) were completed over the fill area. Testing was generally completed at 500mm lift intervals, with a minimum of 2 tests per 100m².

NDM tests performed over Stage 4c showed that compaction achieved the minimum engineering specification. The field worksheets and laboratory corrections for each NDM is attached to this report, see Appendix C.

A summary of test results is shown in Table 1 below:

Table 1 - NDM Result Summary Stage 4C

Test Number	Date	Air Voids (%)	Pass/Fail	Retest (test number)	Retest Pass/Fail
189	16/04/2019	8.7	Pass		
190	16/04/2019	10.2	Fail	**193/194**	**Pass**
191	16/04/2019	7.6	Pass		
192	16/04/2019	7.5	Pass		
193	10/05/2019	7.4	Pass		
194	10/05/2019	6.9	Pass		
195	10/05/2019	<1.0	Pass		
196	10/05/2019	3.3	Pass		
197	21/05/2019	8.5	Pass		
198	21/05/2019	6.2	Pass		
199	21/05/2019	6.8	Pass		
200	21/05/2019	3.5	Pass		
201	21/05/2019	5.8	Pass		
202	21/05/2019	5.6	Pass		
203	22/05/2019	7.3	Pass		
204	22/05/2019	7.7	Pass		
205	22/05/2019	6.2	Pass		
206	24/05/2019	12	Fail	**209/210**	**Pass**
207	24/05/2019	8.8	Pass		
208	24/05/2019	1.7	Pass		
209	19/06/2019	<1.0	Pass		
210	19/06/2019	1.1	Pass		
211	11/07/2009	3.1	Pass		
212	11/07/2009	<1.0	Pass		
213	11/07/2009	1.1	Pass		
214	11/07/2009	1.6	Pass		
215	11/07/2009	<1.0	Pass		
216	08/09/2020	3.05	Pass		
217	08/09/2020	5.0	Pass		
218	08/09/2020	4.23	Pass		
219	22/10/2020	6.86	Pass		
220	22/10/2020	8.75	Pass		

Note: Test numbering does not reflect number of tests performed on site

4.2. Stage 5

Earthworks for Stage 5 began in November 2019. An engineer from HGEA attended site to ensure all topsoil and unsuitable soils had been adequately stripped prior to filling. NDM testing begun on 11/11/2019 and was completed on 07.02.2022. A total of 65 NDM tests were performed over the extent of Stage 5.

Excavation of units 518 to 525, at the base of the escarpment, and were inspected by a geotechnical engineer from HGEA to confirm founding soil conditions. Soils were consistent with those encountered during our subsoil investigation.

All NDM tests performed over Stage 5, achieved the minimum engineering specification, with retesting completed as required.

Test results are shown in Table 2 below:

Table 2 – NDM Results Summary Stage 5

Test Number	Date	Air Voids (%)	Pass/Fail	Retest (test number)	Retest Pass/Fail
221	06/11/2019	**8.5**	**Fail**	**223**	**Pass**
222	06/11/2019	**8.2**	**Fail**	**224**	**Pass**
223	06/12/2019	2.58	Pass		
224	06/12/2019	5.97	Pass		
225	12/12/2019	6	Pass		
226	12/12/2019	**13**	**Fail**	**227**	**Pass**
227	09/01/2020	6.72	Pass		
228	09/01/2020	**13.82**	**Fail**	**229**	**Pass**
229	14/01/2020	7.93	Pass		
230	14/01/2020	**10.44**	**Fail**	**231**	**Pass**
231	21/01/2020	3.4	Pass		
232	21/01/2020	**9.48**	**Fail**	**235**	**Pass**
233	21/01/2020	4.1	Pass		
234	28/01/2020	**10.93**	Pass	**236**	**Pass**
235	28/01/2020	5.27	Pass		
236	12/02/2020	**9.42**	**Fail**	**249**	**Pass**
237	12/02/2020	**15.32**	**Fail**	**249**	**Pass**
238	12/02/2020	**9.98**	**Fail**	**239**	**Pass**
239	25/02/2020	**11.36**	**Fail**	**242**	**Pass**
240	25/02/2020	6.56	Pass		
241	25/02/2020	6.36	Pass		

Test Number	Date	Air Voids (%)	Pass/Fail	Retest (test number)	Retest Pass/Fail
242	04/06/2020	5.34	Pass		
243	04/03/2020	2	Pass		
244	04/03/2020	6	Pass		
245	22/10/2020	3.42	Pass		
246	22/10/2020	3.45	Pass		
247	22/10/2020	<1.0	Pass		
248	22/10/2020	**12.88**	**Fail**	**253**	**Pass**
249	22/10/2020	**17.87**	**Fail**	**254**	**Pass**
250	22/10/2020	1.31	Pass		
251	04/11/2020	1.96	Pass		
252	04/11/2020	4.28	Pass		
253	04/11/2020	1.44	Pass		
254	04/11/2020	4.2	Pass		
255	02/12/2020	8.82	Pass		
256	02/12/2020	9.4	Pass		
257	02/12/2020	6.42	Pass		
258	02/12/2020	2.11	Pass		
259	02/12/2020	9.45	Pass		
260	07/12/2020	2.52	Pass		
261	07/12/2020	<1	Pass		
262	07/12/2020	3.76	Pass		
263	11/12/2020	2.1	Pass		
264	11/12/2020	5.72	Pass		
265	11/12/2020	5.81	Pass		
266	17/12/2020	5.19	Pass		
267	17/12/2020	4.02	Pass		
268	12/01/2021	0.1	Pass		
269	12/01/2021	7.21	Pass		
270	12/01/2021	1.41	Pass		
271	12/01/2021	4.14	Pass		
272	12/01/2021	1.34	Pass		
273	21/01/2021	q	Pass		
274	21/01/2021	3.58	Pass		
275	21/01/2021	**12.34**	**Fail**	**276**	**Pass**
276	12/11/2021	7.57	Pass		

Test Number	Date	Air Voids (%)	Pass/Fail	Retest (test number)	Retest Pass/Fail
277	12/11/2021	**9.53**	**Fail**	**281**	**Pass**
278	12/11/2021	**13.14**	**Fail**	**281**	**Pass**
279	20/12/2021	8.1	Pass		
280	20/12/2021	**11.13**	**Fail**	**286**	**Fail**
281	20/12/2021	5.58	Pass		
282	07/02/2022	3.51	Pass		
283	07/02/2022	2.9	Pass		
284	07/02/2022	3.54	Pass		
285	07/02/2022	2.65	Pass		
286	07/02/2022	**12.35**	**Fail**	**287**	**Pass**
287	20/10/2022	<1.0	Pass		
288	20/10/2022	<1.0	Pass		
289	20/10/2022	1.09	Pass		
290	26/10/2022	<1.0	Pass		
291	26/10/2022	0.75	Pass		
292	26/10/2022	<1.0	Pass		
293	03/11/2022	<1.0	Pass		
294	03/11/2022	1.90	Pass		
295	03/11/2022	<1.0	Pass		
296	15/11/2022	<1.0	Pass		
297	15/11/2022	<1.0	Pass		
298	15/11/2022	<1.0	Pass		
299	05/12/2022	8.01	Pass		
300	05/12/2022	11.32	Pass		
301	05/12/2022	8.04	Pass		
302	20/12/2022	7.15	Pass		
303	20/12/2022	6.64	Pass		

Note: Test numbering does not reflect the number of tests performed on site. All air void results indicated in bold font either exceeded the 10% max single value or testing did not achieve the average value not more than 8%.

5. Soil Expansivity

Two soil samples have been tested to ascertain the shrink/swell characteristics of each soil type. These soils consisted of a highly plastic clay soil (Ruatangata Sandstone derived), as encountered below Stage 5 cut sites, and the moderately plastic silty soils used as engineering fill over Stage 5 (Kerikeri Volcanic - Basalt). Atterberg Limit testing was performed in house and the results are presented below:

Clay Soil (Ruatangata Sandstone derived)

- Liquid Limit (LL) = 83
- Plasticity Limit (PL) = 35
- Plasticity Index (PI) = 46

The soil class has been assessed based on the liquid limit and plasticity index and following the guidance set out in AASHTO T 258-81 Table 1. The Ruatangata derived soils have been classified as class H, highly expansive, as described in AS2870:2011 clause 2.1.2.

Silty Fill (Kerikeri Volcanic, basalt derived)

- Liquid Limit (LL) = 58
- Plasticity Limit (PL) = 43
- Plasticity Index (PI) = 15

The volcanic derived soils have been classified as class M, moderately expansive, as described in AS2870:2011 clause 2.1.2.

These results are as expected for the site soils and are considered representative of the site.

6. Stability Analysis

A slope stability analysis has been undertaken for Stage 4 and Stage 5 where retirement units are near steep slopes, as well as a numerical assessment for the Stage 5 shared accessway. This analysis has comprised an assessment of sliding depths over localised steeper slopes and a numerical analysis of the global instability of the Stage 5 access.

6.1. Stage 4

Units 407 through 410 within Stage 4a have been constructed some 5m to 8.5m away from slopes typically some 1V:2H (26°), and as steep as 0.83V:1H (40°). Hand augered boreholes drilled though these slopes indicate some 1.5m to 2m of residual soil overlying the completely weathered soil.

Slope stability analysis of the escarpment, detailed later in Section 6.3, indicates that the site soils achieve a Factor of Safety (FoS) against sliding of greater than 1.5, where sloping at no greater than 1V:2H(26°), this angle is therefore considered suitable for the site soils.

6.1.2 Unit 407

Unit 407 foundations are setback 8m from the top of the steep bank to the south-west. These slopes are assessed to be up to 40° and are not considered stable. Assessment of the likely sliding depth based on hand augered boreholes (1.5m to 2m), and the suitable slope angle of 26° as mentioned above, indicate a zone of soil subject to instability, as detailed on attached Figure 01. The house foundations are setback 5m from the edge of this zone; this is considered appropriate.

Attached Figure 01, details the critical cross-section through the above-mentioned unit, detailing the foundation setbacks and slope angles for each.

6.1.3 Units 408 & 409

Unit 408 and 409 are found over essentially flat building platforms. With the ground immediately south-west of the platforms sloping at approximately 1V:3H (11°) and steepening to 1V:2H (26°) some 8m from the foundations. The units are sufficiently set back such that the foundation loading will not mobilise the steeper slopes below.

Attached Figure 01, details the critical cross-section through the above-mentioned unit, detailing the foundation setbacks and slope angles for each.

6.1.4 Unit 410

Unit 410 foundations are setback approximately 8.5m from the top of the escarpment bank, with a swimming pool perched just above the escarpment. Specific engineering design of an in-ground palisade timber pole retaining wall was completed by HGEA in September 2020, to prevent the additional loading from the pool resulting in slope instability and loss of support to dwelling foundations.

Attached Figure 01 details the critical cross-section through this unit, with foundation setbacks and slope angles for each.

6.1.5 Units 401 through 406, 411 through 423

These units are over essentially flat ground, either isolated from all steeper slopes or are retained.

6.2. Stage 5

6.2.1 Units 502, 503 & 507 through 509

Units 502, 503, and 507 through 509 sit just above the fill batter on the southern side of Stage 5. This fill batter is formed entirely of engineered fill, generally at than 1V:2H (26°). Some isolated areas of fill were unable to be trimmed to 1V:2H (26°) due to the proximity of foundations, therefore fill batters were excavated to 1V:1.5H (33°).

These units are typically setback some 1.5m to 3m from the top of the fill batter. The foundation loading on the fill batters is not considered critical where the fill is trimmed to no steeper than 1V:2H (26°); all batters steeper than this are not considered sufficiently stable to support foundations.

Where foundations are supported by fill batters exceeding 1V:2H (26°), the foundation load shall be transferred such that the load is spread over a wider soil platform, therefore, not relying on the steeper slopes for support. This can be achieved by deepening the edge beam of the waffle rafts to at least 300mm below the zone of influence.

The zone of influence is the area of fill above the line drawn at 1H:2V (26°) from the base of the fill batter; see attached Figure 02, Appendix A. All foundations within this zone shall adhere to the recommendation above.

6.3. Stage 5 Access/Global Stability

The numerical analysis to determine the Factor of Safety (FoS) against sliding of the proposed development was completed using the computer programmes GeoStudio 2012 Slope/W and PLAXIS 2D Geotechnical Finite Element Software. Model cross-sections used for analysis were based on site survey and design earthworks contours as prepared by HGEA. Engineering soil parameters for the residual soils and underlying rock have been calibrated based on SPT ‘n’ values and back analysis of existing ground and slope conditions.

The back analysis was performed based on the slope profile through the Stage 5 access, prior to any earthworks, based a conservative, assumed, factor of safety (FoS) against sliding of 1.3. This FoS was used based on evidence of some minor shallow instability observed within the totara grove (area relatively undisturbed by earthworks). The instability observed was indicative by leaning and fallen totara tree and soil slumping/terracettes. The calibrated Mohr-Coulomb soil parameter used for this analysis is summarised in Table 3 below.

Table 3 – Mohr Coulomb Soil Design Parameters

Soil Type	Soil Unit Weight (γ) kN/m^3	Effective Cohesion (c') kPa	Effective Friction Angle (ϕ') degrees
Clayey Silt	18	2	28
CW Sandstone	19	3	30
HW Sandstone	20	5	32
MW Sandstone	24	10	35

The numerical slope stability analysis of the proposed accessway has been completed for a critical cross-section through the tallest point of the development, for details, refer Figure C403a Rev C2, Appendix A. The modelling was completed for global stability and the slopes below the accessway, using finite element analysis and the Morgenstern-Price model.

Both Serviceability Limit State (SLS); normal groundwater conditions, and Ultimate Limit State (ULS); extreme groundwater conditions, have been assessed as part of this analysis. Groundwater conditions, based on site geomorphology, are considered conservative, with the likely groundwater table (GWT) to be much deeper than modelled.

The cases modelled to find the FoS of the proposed development are as follows:

1. Excavations with no retaining (global stability),
2. Excavations with full retaining (global stability),
3. Stability of slopes below access: both ULS and SLS, and extreme GWT (surface saturation),
4. Seismic.

Peak ground acceleration and magnitude events for both Serviceability Limit State (SLS) and Ultimate Limit State (ULS) seismic events have been calculated from 1170.5:2004. Input parameters for the seismic assessment are summarised in Table 4 below:

The analysis was completed for an importance level 2 building (ordinary building) and for a site soil seismic class C, interpreted from machine boreholes.

Table 4: Seismic Input Parameters for Seismic Assessment

Importance Level	Limit State	Probability of Exceedance (per annum)	F	$C_{0.1000}$	Return period, Ru	PGA	Earthquake Magnitude
2	SLS	1/25	1.33	0.13	0.25	0.033	5.75
	ULS	1/500			1	0.13	

Results of the stability assessment are as follows:

Case One:

The critical slip FoS against sliding for the proposed earthworks, if left un-retained, is 1.2 and 1.35 for ULS and SLS cases, respectively.

Case Two:

The global FoS against sliding for Stage 5 access is assessed to be in the order of 1.35 and 1.5 for ULS and SLS cases, respectively.

Case Three:

The FoS for the escarpment slopes formed at no steeper than 1V:2H is assessed to be 1.55 for both ULS and SLS cases and 1.3 for an extreme groundwater depth (surface saturation).

Case Four:

The global FoS during a ULS and SLS seismic event will drop to 1.0 and 1.4, respectively.

The above factors of safety against sliding for each design case are considered appropriate for the proposed development and comply with standard industry practice.

A copy of both Slope/W and PLAXIS outputs are attached to this report, see Appendix D.

7. Conclusions and Recommendations

7.1. Earthworks

Earthworks over the units covered in this report were monitored by HGEA over the period February 2019 through June 2021.

All fill placed during this period was placed in accordance with NZS4431:1989 and complied with the engineering specification as set by HGEA. The fill is therefore considered suitable for the proposed development.

A copy the “Schedule 2a, NZS4404:2010, statement of professional option on land suitability” is attached to this report.

7.2. Stage 5 Access - Stability

Results of the numerical analysis indicate that the excavations to form the shared accessway to Stage 5 will not have adequate stability without some form of retaining.

The timber crib and soil nail retaining wall has been designed by HGEA to improve the localised instability of the excavation such that it achieves adequate stability.

Based on adequate retaining, the result of the analysis indicates that the global stability, independent of retaining, has a FoS greater than 1.35 for ULS and 1.5 for SLS for the modelled GWT depths. These levels of safety are considered adequate and are within the industry standard minimum requirements. Furthermore, the assessed FoS for the seismic design is also within the industry-standard requirements.

The analysis shows that the escarpment has a FoS greater than 1.5 for both ULS and SLS groundwater cases, and a FoS in the order 1.3 for an extreme groundwater saturation case. These levels of safety are considered appropriate for the formed slopes.

7.3. Stage 4 units 407 through 410

7.3.1 Stability

Dwellings over these units have all been constructed such that they are sufficiently set back and are isolated from the steeper slopes to the south, we therefore conclude that these building platforms are stable and not subject to any stability hazards.

7.3.2 Soil Conditions for Foundation

Subsoil investigation and monitoring found the underlying site soils comprised in situ Kerikeri volcanic derived soils and site won (Kerikeri volcanic) engineered fill.

These soils are considered suitable for the proposed stiffened waffle raft foundations, designed to account for moderately expansive soils, class M, as described in AS 2870:2011.

7.4. Stage 4 Units 401 through 406 & 411 through 423

7.4.1 Stability

The building sites are all formed essentially flat. The sites are formed over entirely cut platforms into the natural ground, over engineered fill, or a combination of the two. We therefore conclude that these building sites are stable and not subject to instability.

7.4.2 Soil Conditions for Foundations

These units are underlain by both in situ and engineering fill, both comprising Kerikeri volcanic derived soils. These soils are considered suitable for the proposed stiffened waffle raft foundations, designed to account for moderately expansive soils, class M, as described in AS 2870:2011.

7.5. Stage 5 Units 502, 503 & 507 through 509

7.5.1 Stability

Fill batters within stage 5 have been cut to no steeper than 1V:2H (26°) below the building platforms where applicable. The engineered fill is considered stable and not subject to movement at this slope angle.

Where building foundations are supported by fill batters steeper than 1V:2H (26°), the perimeter beam of the foundations shall be extended below-cleared ground level into the fill, such that the base of the foundation is 300mm below the zone of influence.

Subject to these recommendations, we conclude that the unit sites are stable and suitable for development.

7.5.2 Soil conditions for Foundations

These units are entirely underlain by engineered fill, comprising site won, Kerikeri volcanic derived soils. These soils are considered suitable for the proposed stiffened waffle raft foundations, designed to account for moderately expansive soils, class M, as described in AS 2870:2011.

7.6. Stage 5 Units 501, 504, 505, 506, 508, and 512 through 525

7.6.1 Stability

Development over these building sites are over essentially flat platforms formed from engineered fill and/or fully retained excavations in natural ground. The building platforms are isolated from and not subject to instability. We therefore conclude that these are stable and suitable for development.

7.6.2 Soil Conditions for Foundations

These units are underlain by both in situ and engineering fill, both comprising Kerikeri volcanic derived soils. These soils are considered suitable for the proposed stiffened waffle raft foundations, designed to account for moderately expansive soils, class M, as described in AS 2870:2011.

8. Section 106 Resource Management Act

We consider that in terms of Section 106 (1), of the Resource Management Act 1991:

a) the land in respect of which a consent is sought, or any structure on the land, is not and is not likely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; and

b) (Repealed)

c) sufficient provision has been made for physical access to each allotment to be created by the subdivision.

9. Section 71 Building Act 2004

Based on the above recommendations and conclusions we consider that the risk of future instability affecting the property is low, and in terms of Section 71 of the Building Act 2004 that:

a) The land is not subject to, or is not likely to be subject to, instability, subsidence, or falling debris; and

b) The building work to which this application for a building consent relates will not accelerate, worsen, or result in instability or subsidence on the land on which the building work is to be carried out or any other property.

A section 72 shall therfroe not apply to this title.

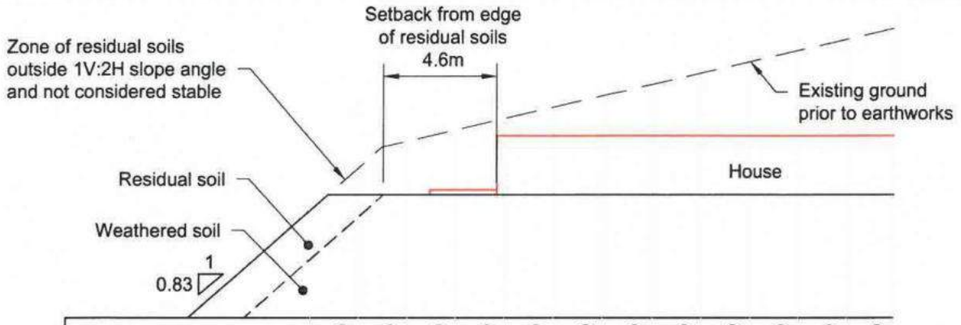
10. Limitation

Recommendations and opinions in this report are based on data from the investigation described herein. The nature and continuity of subsoil conditions away from the boreholes is inferred and it is possible that actual conditions could vary from those assumed. Should subsoil conditions vary from those described in this report, it is essential that Hawthorn Geddes engineers and architects ltd be contacted to confirm the applicability of the recommendations.

This report has been prepared solely for the benefit of our client Kerikeri Falls Investments Ltd and the Far North District Council in relation to the resource consent completion and a building consent applications for which this report has been prepared.

The comments in it are limited to the purpose stated in this report. No liability is accepted by Hawthorn Geddes engineers & architects ltd in respect of its use by any other person, and any other person who relies upon any matter contained in this report does so entirely at their own risk.

Appendix A – Figures



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EXISTING LEVELS	64.22	64.43	64.53	64.62	64.71	64.80	64.90	64.99	65.08	65.17	65.26	65.35	
DESIGN LEVELS	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00

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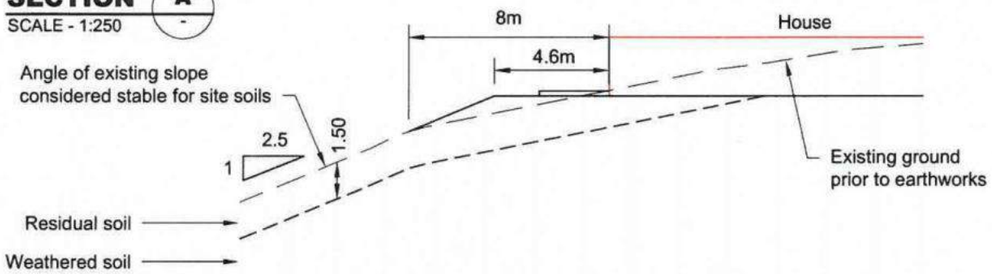
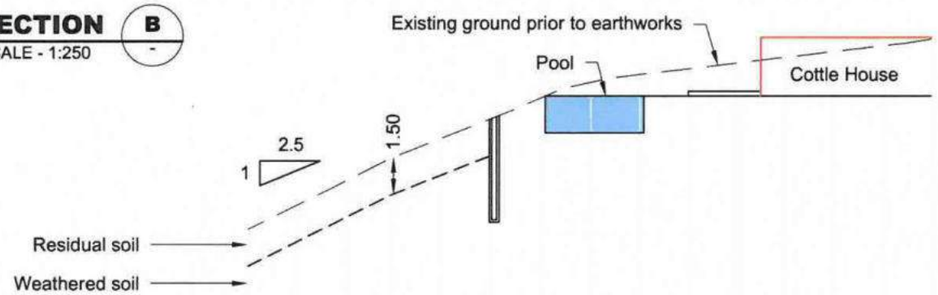


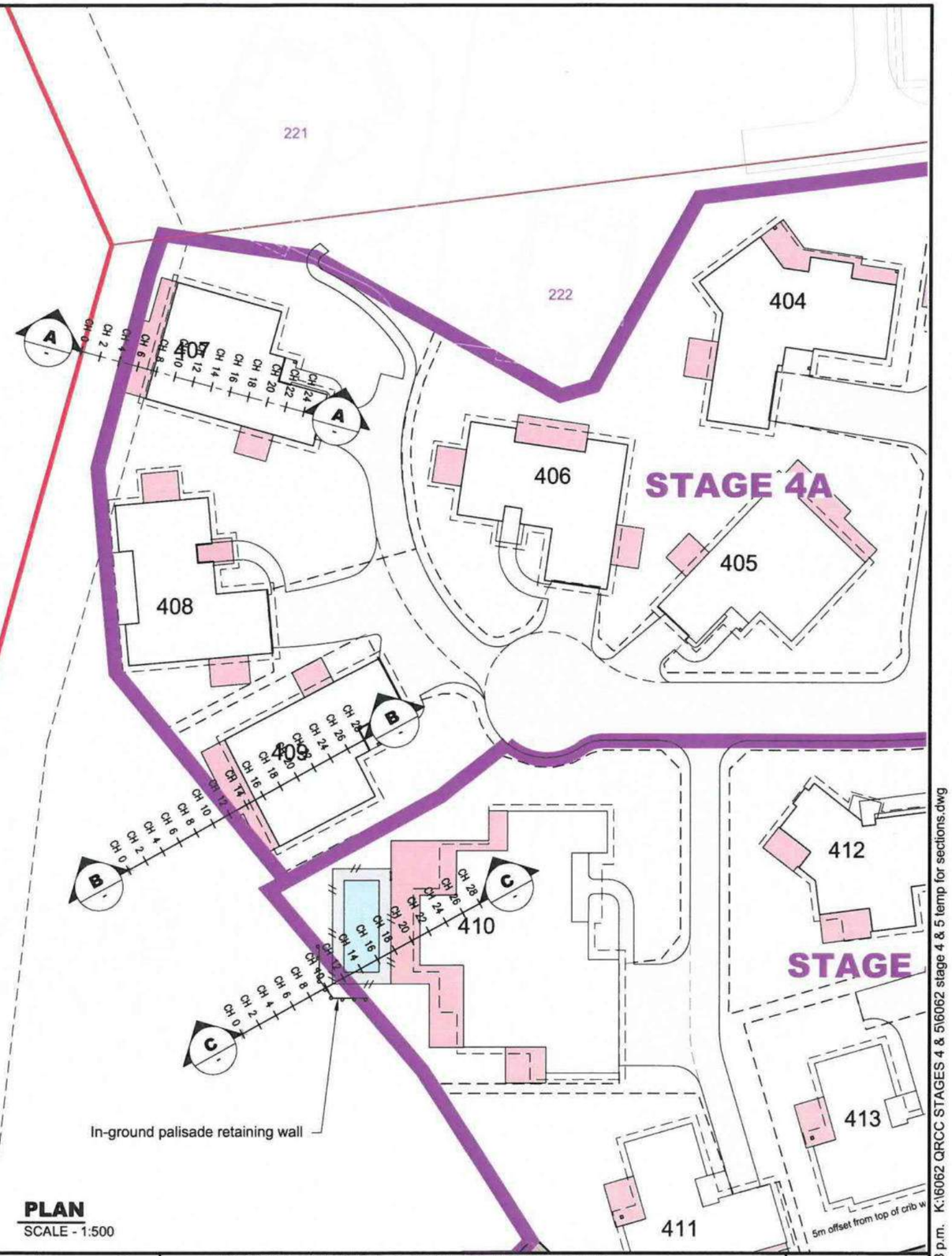
CHAINAGE	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28
EXISTING LEVELS	59.39	60.20	61.01	61.87	62.51	62.91	63.31	63.71	64.10	64.50	64.85	65.11	65.43	65.67	65.83
DESIGN LEVELS	62.69	63.51	63.70	63.70	63.70	63.70	63.70	63.70	63.70	63.70	63.70	63.70	63.70	63.70	63.70

SECTION B
SCALE - 1:250



CHAINAGE	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28
EXISTING LEVELS	57.78	58.74	59.72	60.71	61.50	62.29	63.12	63.77	64.08	64.31	64.55	64.78	65.01	65.25	65.52
DESIGN LEVELS								63.20	63.20	63.20	63.20	63.20	63.20	63.20	63.20

SECTION C
SCALE - 1:250



PLAN
SCALE - 1:500

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CLIENT **KERIKERI FALLS INVESTMENT LTD**
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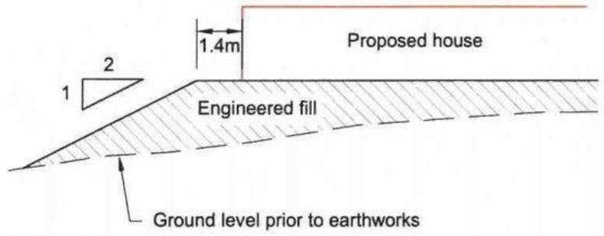
RAINBOW FALLS ROAD, KERIKERI
DRAWING **STAGE 4A - PROXIMITY TO ESCARPMENT**

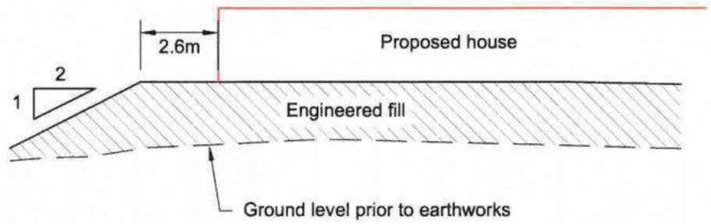
SCALE @ A3 AS SHOWN
PROJECT No. **6062**
FIGURE No. **01**
REV. **R1**

27/07/2021 4:04:18 p.m. K:\6062 QRCC STAGES 4 & 5\6062 stage 4 & 5 temp for sections.dwg



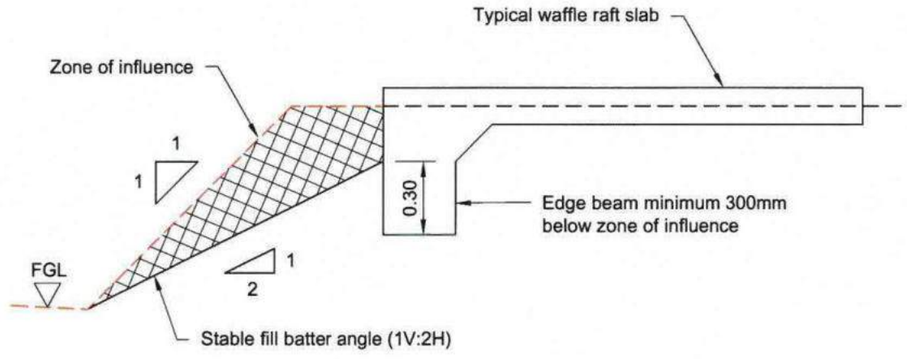
DESIGN LEVELS			32.14	33.14	34.13	34.55	34.55	34.55	34.55	34.55	34.55	34.55
EXISTING LEVELS			31.82	32.12	32.24	32.48	32.77	33.09	33.24	33.38	33.52	33.53
CHAINAGE	0	2	4	6	8	10	12	14	16	18	20	22

SECTION D
SCALE - 1:200

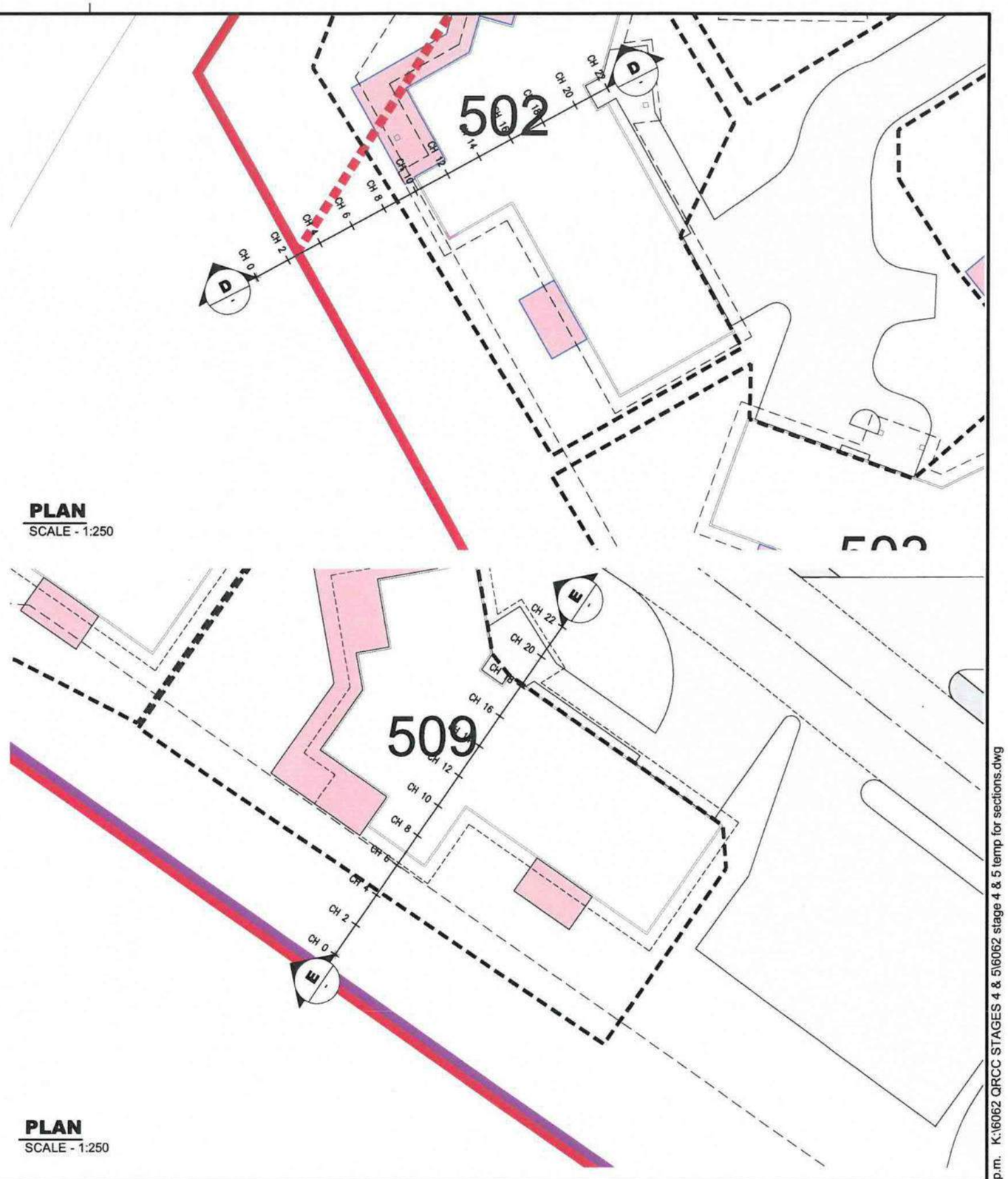


DESIGN LEVELS	31.54	32.55	33.58	33.70	33.70	33.70	33.70	33.70	33.70	33.70	33.66	33.62
EXISTING LEVELS	31.13	31.24	31.48	31.62	31.72	31.81	31.79	31.74	31.69	31.63	31.58	31.53
CHAINAGE	0	2	4	6	8	10	12	14	16	18	20	22

SECTION E
SCALE - 1:200



EDGE BEAM DETAIL FOR BATTERS EXCEEDING 1V:2H
SCALE - 1:250



PLAN
SCALE - 1:250

PLAN
SCALE - 1:250

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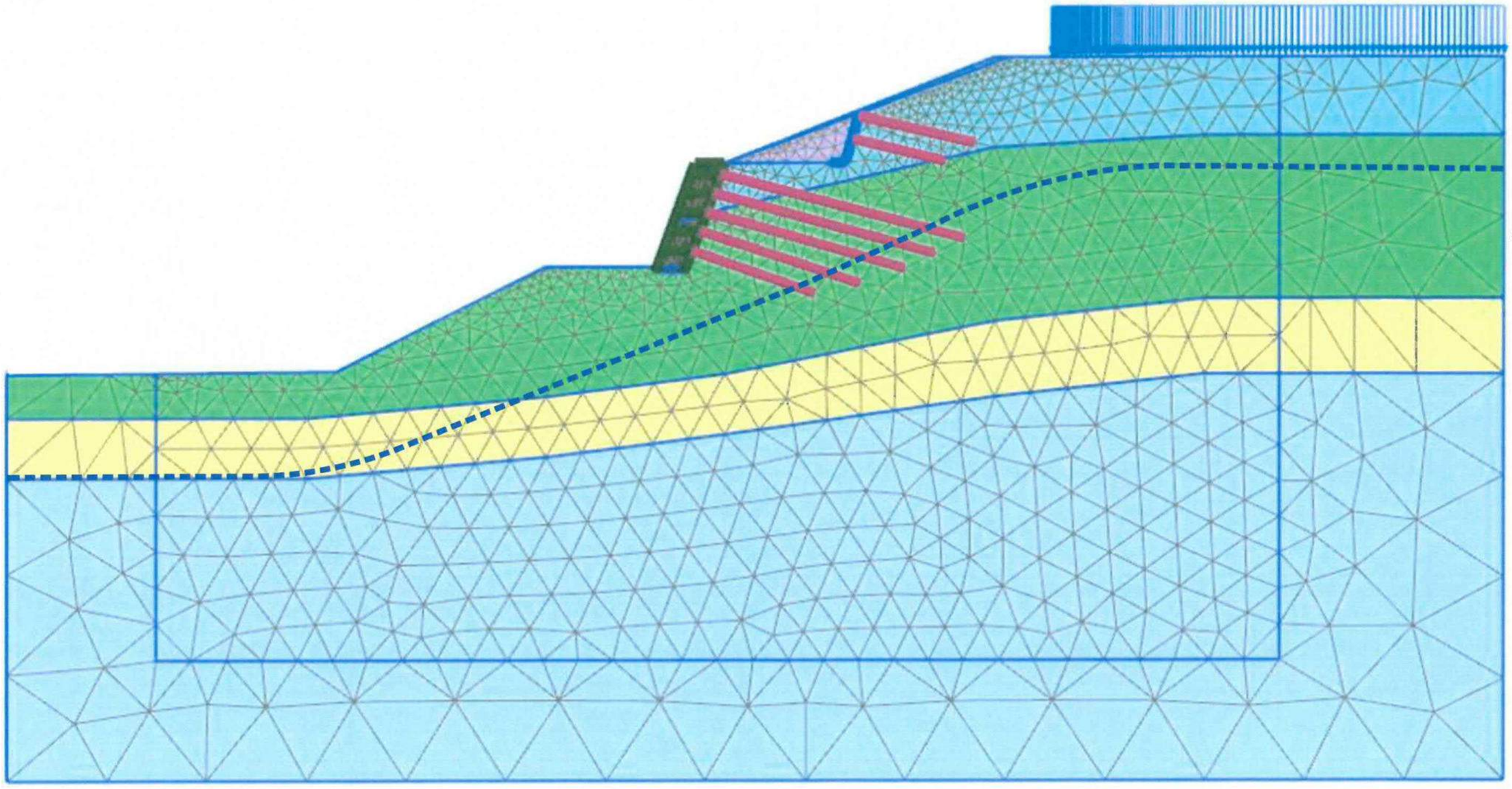
DRAWING **STAGE 5 - PROXIMITY TO ESCARPMENT**

SCALE @ A3 AS SHOWN
PROJECT No. 6062
FIGURE No. 02
REV. R1

27/07/2021 4:10:55 p.m. K:\6062 QRCC STAGES 4 & 5\6062 stage 4 & 5 temp for sections.dwg



PLAXIS 2D MODEL - GLOBAL STABILITY INPUT FOR NAIL/CRIB COMPOSITE WALL ANALYSIS

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DRAWING **PLAXIS 2D MODEL - GLOBAL STABILITY INPUT**

SCALE @ A3

PROJECT No. **6062**

FIGURE No. **03**

REV. **R1**

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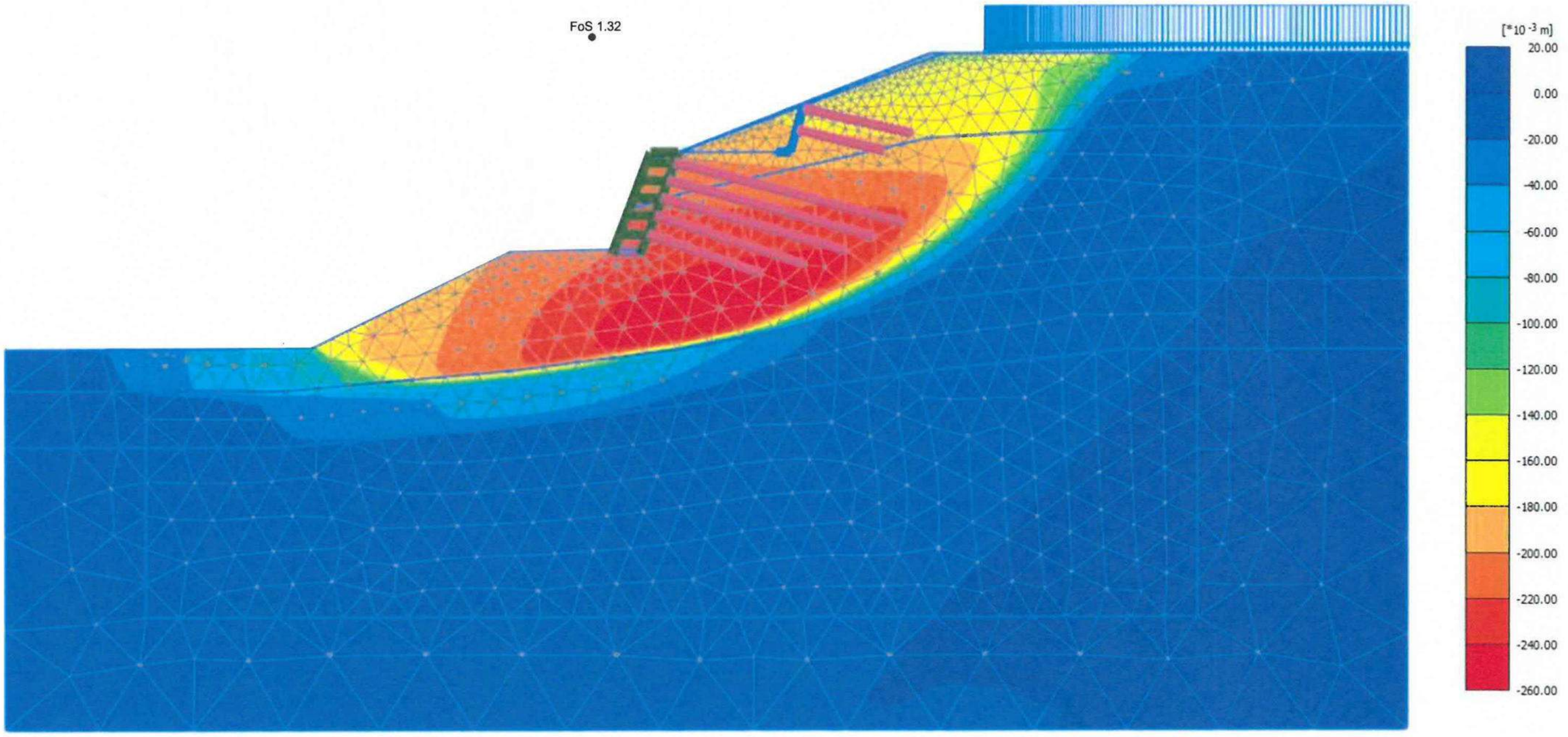

PLAXIS 2D MODEL - GLOBAL STABILITY OUTPUT FOR NAIL/CRIB COMPOSITE WALL ANALYSIS

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DRAWING PLAXIS 2D MODEL - GLOBAL STABILITY OUTPUT

SCALE @ A3

PROJECT No. 6062

FIGURE No. 04

REV. R1

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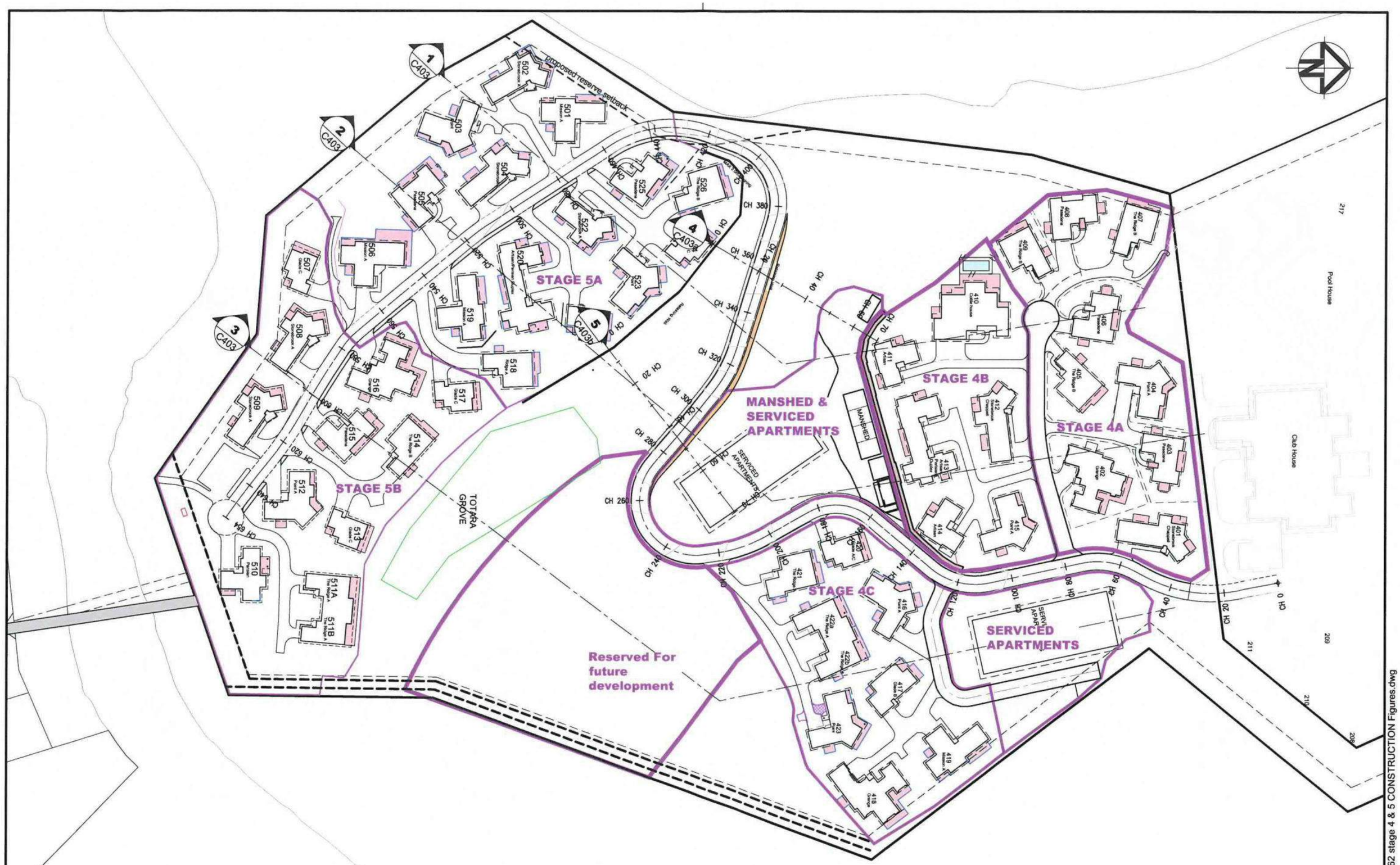

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DRAWING STAGES 4 & 5 - GENERAL ARRANGEMENT

SCALE @ A3 1:1250
PROJECT No. 6062
FIGURE No. 05
REV. R1

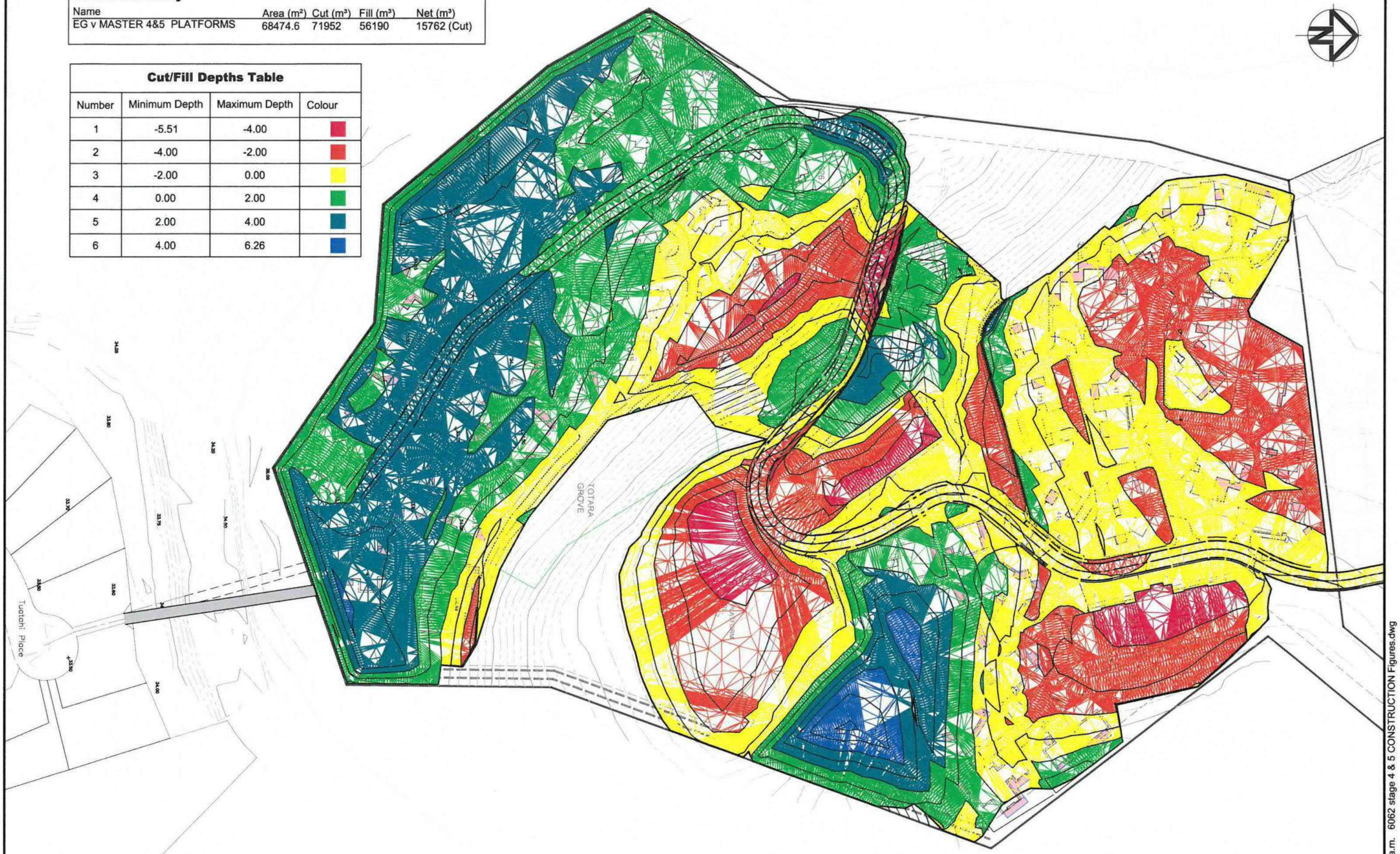
5/07/2021 1:46:45 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg

Cut/Fill Summary

Name	Area (m²)	Cut (m³)	Fill (m³)	Net (m³)
EG v MASTER 4&5 PLATFORMS	68474.6	71952	56190	15762 (Cut)

Cut/Fill Depths Table

Number	Minimum Depth	Maximum Depth	Colour
1	-5.51	-4.00	
2	-4.00	-2.00	
3	-2.00	0.00	
4	0.00	2.00	
5	2.00	4.00	
6	4.00	6.26	



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DRAWING STAGES 4 & 5 - CUT AND FILL PLAN

SCALE @ A3 1:1250

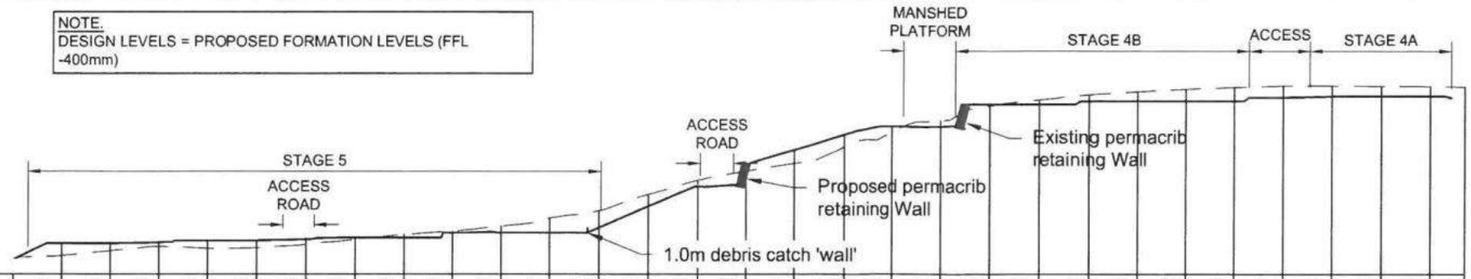
PROJECT No. 6062

FIGURE No. 06

REV. R1

26/07/2021 10:11:05 a.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg

NOTE.
DESIGN LEVELS = PROPOSED FORMATION LEVELS (FFL -400mm)



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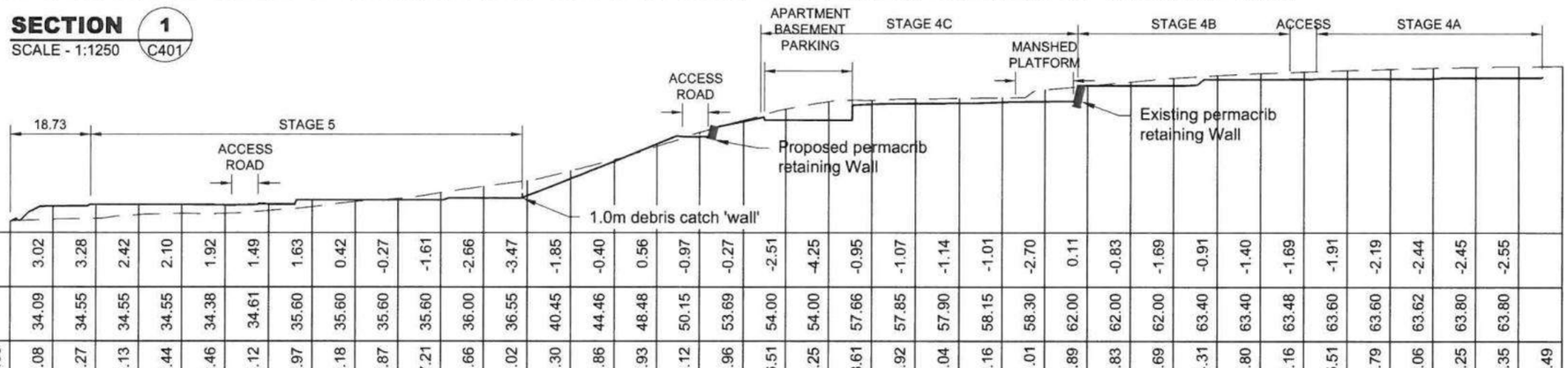
EXISTING LEVELS		31.76	32.76	33.63	33.27	33.37	34.06	35.09	36.07	36.72	37.76	39.42	40.95	44.22	47.09	48.96	50.52	53.93	56.96	59.23	62.21	63.43	64.48	65.12	65.62	65.99	66.27	66.31	66.22	66.19	66.14
DESIGN LEVELS		34.25	34.25	34.46	34.85	34.86	35.09	35.45	35.45	36.43	36.45	36.45	37.47	41.82	45.86	47.55	53.28	56.39	58.00	58.06	62.50	62.50	63.18	63.20	63.20	63.20	63.97	64.17	64.20	64.20	
CUT/FILL DEPTHS		2.49	1.49	0.83	1.58	1.50	1.03	0.36	-0.62	-0.29	-1.31	-2.97	-3.48	-2.40	-1.23	-1.41	2.76	2.46	1.04	-1.17	0.29	-0.93	-1.30	-1.92	-2.42	-2.79	-2.29	-2.14	-2.02	-1.99	

SECTION 1
SCALE - 1:1250 C401



2
DATUM: 28.00

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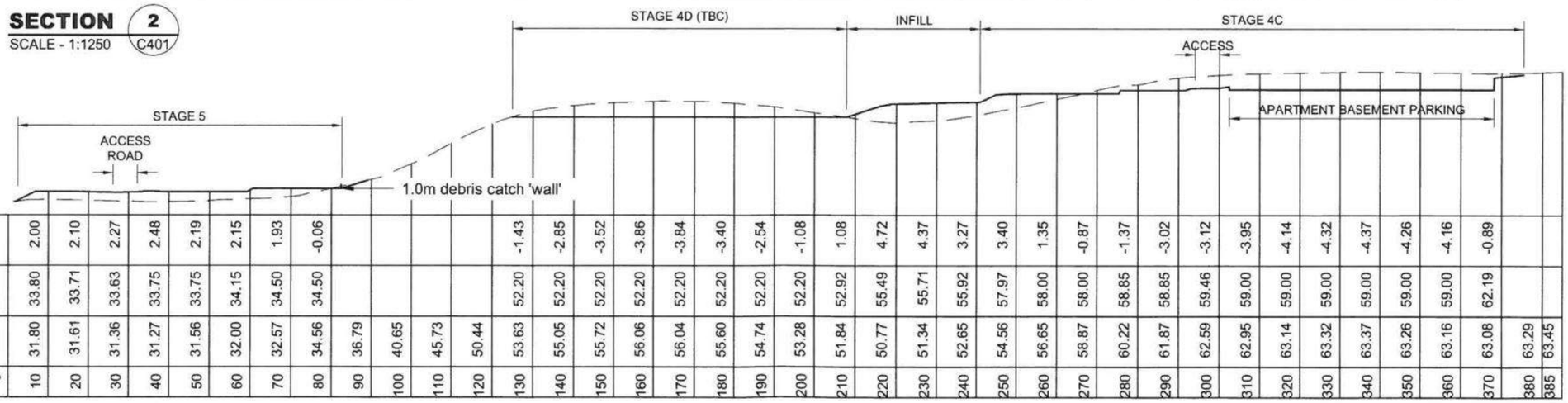
EXISTING LEVELS	30.66	31.08	31.27	32.13	32.44	32.46	33.12	33.97	35.18	35.87	37.21	38.66	40.02	42.30	44.86	47.93	51.12	53.96	56.51	58.25	58.61	58.92	59.04	59.16	61.01	61.89	62.83	63.69	64.31	64.80	65.16	65.51	65.79	66.06	66.25	66.35	66.49
DESIGN LEVELS		34.09	34.55	34.55	34.55	34.38	34.61	35.60	35.60	35.60	35.60	36.00	36.55	40.45	44.46	48.48	50.15	53.69	54.00	54.00	57.66	57.85	57.90	58.15	58.30	62.00	62.00	62.00	63.40	63.40	63.48	63.60	63.60	63.62	63.80	63.80	
CUT/FILL DEPTHS		3.02	3.28	2.42	2.10	1.92	1.49	1.63	0.42	-0.27	-1.61	-2.66	-3.47	-1.85	-0.40	0.56	-0.97	-0.27	-2.51	-4.25	-0.95	-1.07	-1.14	-1.01	-2.70	0.11	-0.83	-1.69	-0.91	-1.40	-1.69	-1.91	-2.19	-2.44	-2.45	-2.55	

SECTION 2
SCALE - 1:1250 C401



3
DATUM: 28.00

CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	385
EXISTING LEVELS		31.80	31.61	31.36	31.27	31.56	32.00	32.57	34.56	36.79	40.65	45.73	50.44	53.63	55.05	55.72	56.06	56.04	55.60	54.74	53.28	51.84	50.77	51.34	52.65	54.56	56.65	58.87	60.22	61.87	62.59	62.95	63.14	63.32	63.37	63.26	63.16	63.08	63.29	63.45
DESIGN LEVELS		33.80	33.71	33.63	33.75	33.75	34.15	34.50	34.50					52.20	52.20	52.20	52.20	52.20	52.20	52.20	52.20	52.92	55.49	55.71	55.92	57.97	58.00	58.00	58.85	58.85	59.46	59.00	59.00	59.00	59.00	59.00	59.00	62.19		
CUT/FILL DEPTHS		2.00	2.10	2.27	2.48	2.19	2.15	1.93	-0.06					-1.43	-2.85	-3.52	-3.86	-3.84	-3.40	-2.54	-1.08	1.08	4.72	4.37	3.27	3.40	1.35	-0.87	-1.37	-3.02	-3.12	-3.95	-4.14	-4.32	-4.37	-4.26	-4.16	-0.89		

SECTION 3
SCALE - 1:1250 C401

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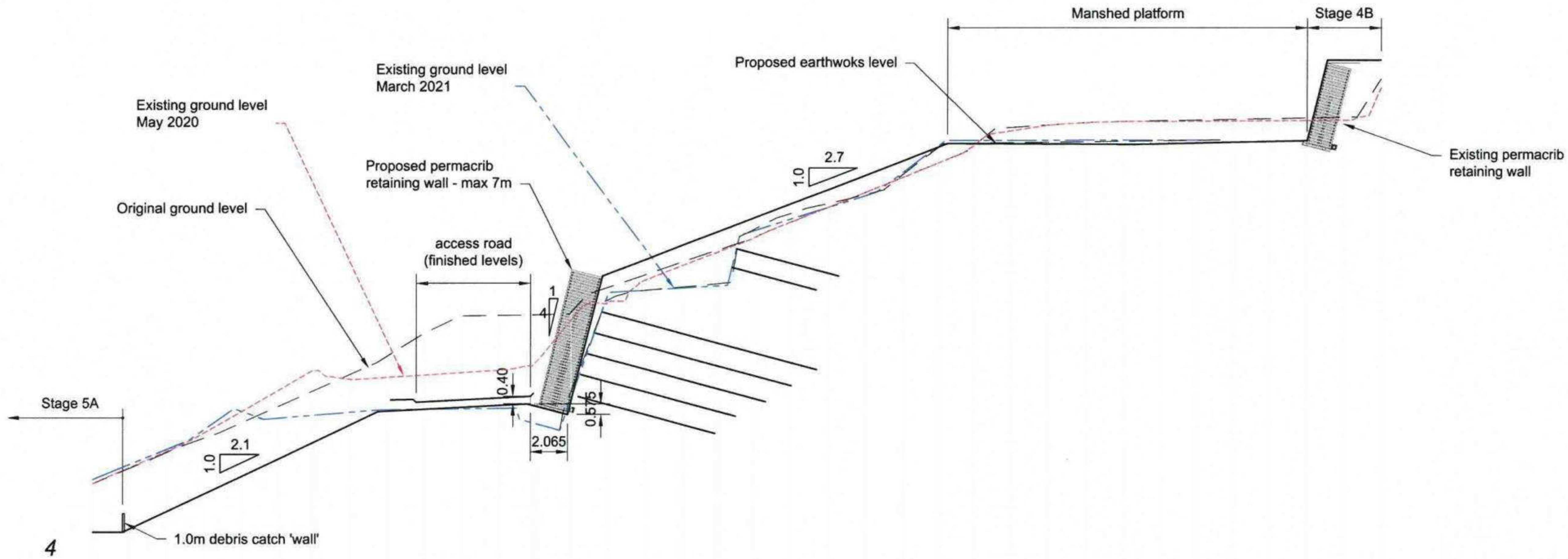
DRAWING STAGES 4 & 5 - SITE SECTIONS

SCALE @ A3 1:1250
PROJECT No. 6062
FIGURE No. 07
REV. R1

5/07/2021 1:47:03 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg



4

DATUM: 34.00

CUT/FILL DEPTHS	-2.63	-3.28	-3.20	-3.03	-2.90	-2.85	-2.79	-2.73	-2.97	-4.10	-4.94	-4.87
DESIGN LEVELS	37.00	37.18	38.11	39.05	39.99	40.93	41.87	42.81	43.54	43.64	43.75	43.85
EXISTING LEVELS FROM STRING – MAR '21	39.85	40.67	41.48	42.53	43.55	43.17	43.33	43.49	43.63	43.65	43.67	43.70
EXISTING LEVELS FROM MAY '20 SURVEY	39.64	40.51	41.37	42.37	43.51	44.65	45.73	45.25	45.37	45.50	45.64	45.76
EXISTING LEVELS FROM ORIGINAL SURVEY	39.63	40.45	41.31	42.08	42.90	43.78	44.66	45.54	46.51	47.75	48.69	48.72
CHAINAGE	0	2	4	6	8	10	12	14	16	18	20	22

CUT/FILL DEPTHS	-4.93	-4.77	0.72	0.81	0.90	0.98	1.05	0.98	0.95	0.91	0.88	0.85
DESIGN LEVELS	43.82	44.12	50.96	51.72	52.48	53.24	54.00	54.76	55.53	56.29	57.05	57.81
EXISTING LEVELS FROM STRING – MAR '21	42.88	44.24	49.82	50.08	50.20	50.32	53.31	53.94	54.57	55.20	56.42	57.88
EXISTING LEVELS FROM MAY '20 SURVEY	46.17	48.49	49.50	50.63	51.39	52.15	52.94	53.79	54.58	55.38	56.17	56.97
EXISTING LEVELS FROM ORIGINAL SURVEY	48.75	48.90	50.23	50.91	51.58	52.26	52.95	53.79	54.58	55.38	56.17	56.96
CHAINAGE	24	26	28	30	32	34	36	38	40	42	44	46

CUT/FILL DEPTHS	0.04	-0.88	-1.03	-1.16	-1.24	-1.25	-1.24	-1.23	-1.23	-1.23	3.08	
DESIGN LEVELS	57.99	57.98	57.98	57.97	57.96	57.98	58.02	58.07	58.11	58.15	62.50	
EXISTING LEVELS FROM STRING – MAR '21	58.17	58.17	58.18	58.18	58.18	58.18	58.19					
EXISTING LEVELS FROM MAY '20 SURVEY	57.95	58.70	59.00	59.13	59.19	59.19	59.20	59.22	59.23	59.24	59.26	61.00
EXISTING LEVELS FROM ORIGINAL SURVEY	57.95	58.87	59.00	59.13	59.19	59.23	59.26	59.30	59.34	59.38	59.42	61.48
CHAINAGE	48	50	52	54	56	58	60	62	64	66	68	70

SECTION 4 / C401
SCALE - 1:1250

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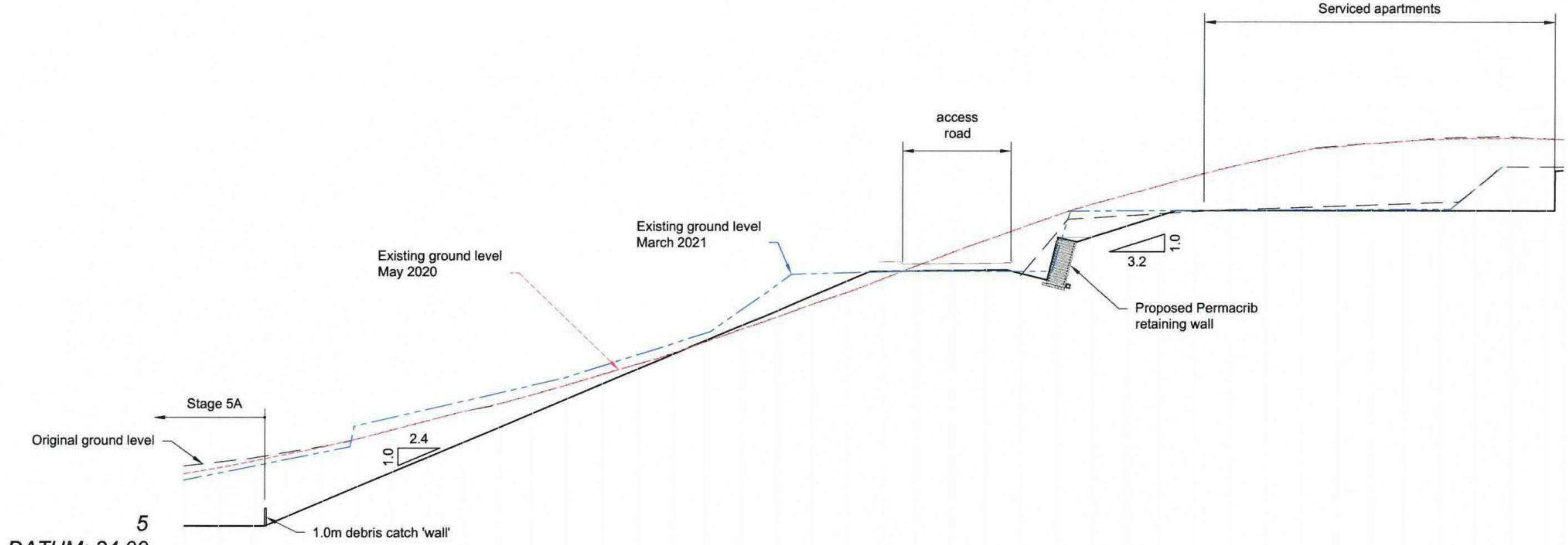
DRAWING **STAGES 4 & 5 - SITE SECTIONS**

SCALE @ A3 1:250
PROJECT No. **6062**
FIGURE No. **08**
REV. **R1**

26/07/2021 10:16:03 a.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg



DATUM: 34.00

CHAINAGE	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
CUT/FILL DEPTHS	-3.42	-3.64	-3.88	-3.64	-3.13	-2.73	-2.41	-2.09	-1.77	-1.36	-1.07	-0.79	-0.54	-0.29	-0.07	0.07	0.21	0.34	0.47	0.65
DESIGN LEVELS	36.00	36.00	36.00	36.57	37.41	38.25	39.08	39.92	40.76	41.59	42.43	43.27	44.11	44.94	45.78	46.62	47.45	48.29	49.13	49.96
EXISTING LEVELS FROM STRING – MAR '21	38.63	39.02	39.42	39.81	40.21	41.74	42.20	42.66	43.12	43.58	44.04	44.51	45.14	45.77	46.40	47.03	48.38	49.81	50.40	50.45
EXISTING LEVELS FROM MAY '20 SURVEY	38.97	39.33	39.72	40.12	40.51	40.98	41.49	42.01	42.53	42.96	43.50	44.06	44.65	45.24	45.85	46.54	47.25	47.95	48.66	49.34
EXISTING LEVELS FROM ORIGINAL SURVEY	39.42	39.64	39.88	40.21	40.54	40.97	41.49	42.01	42.52	42.95	43.50	44.06	44.65	45.24	45.85	46.54	47.25	47.95	48.66	49.31

CHAINAGE	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	79
CUT/FILL DEPTHS																					
DESIGN LEVELS																					
EXISTING LEVELS FROM STRING – MAR '21	50.51	50.54	50.54	50.54	50.54	51.49	53.98	53.99	54.00	54.01	54.02	54.03	54.05	54.06	54.07	54.08	54.09	55.28			
EXISTING LEVELS FROM MAY '20 SURVEY	50.08	50.85	51.61	52.32	53.04	53.74	54.36	54.90	55.45	55.99	56.50	56.95	57.39	57.63	57.83	57.96	58.06	58.12	58.14	58.09	58.07
EXISTING LEVELS FROM ORIGINAL SURVEY	50.08	50.85	51.61	52.32	53.04	53.74	54.36	54.90	55.43	55.99	56.50	56.95	57.39	57.67	57.84	57.96	58.13	58.18	58.19	58.11	58.08

SECTION 5 / C401
SCALE - 1:1250

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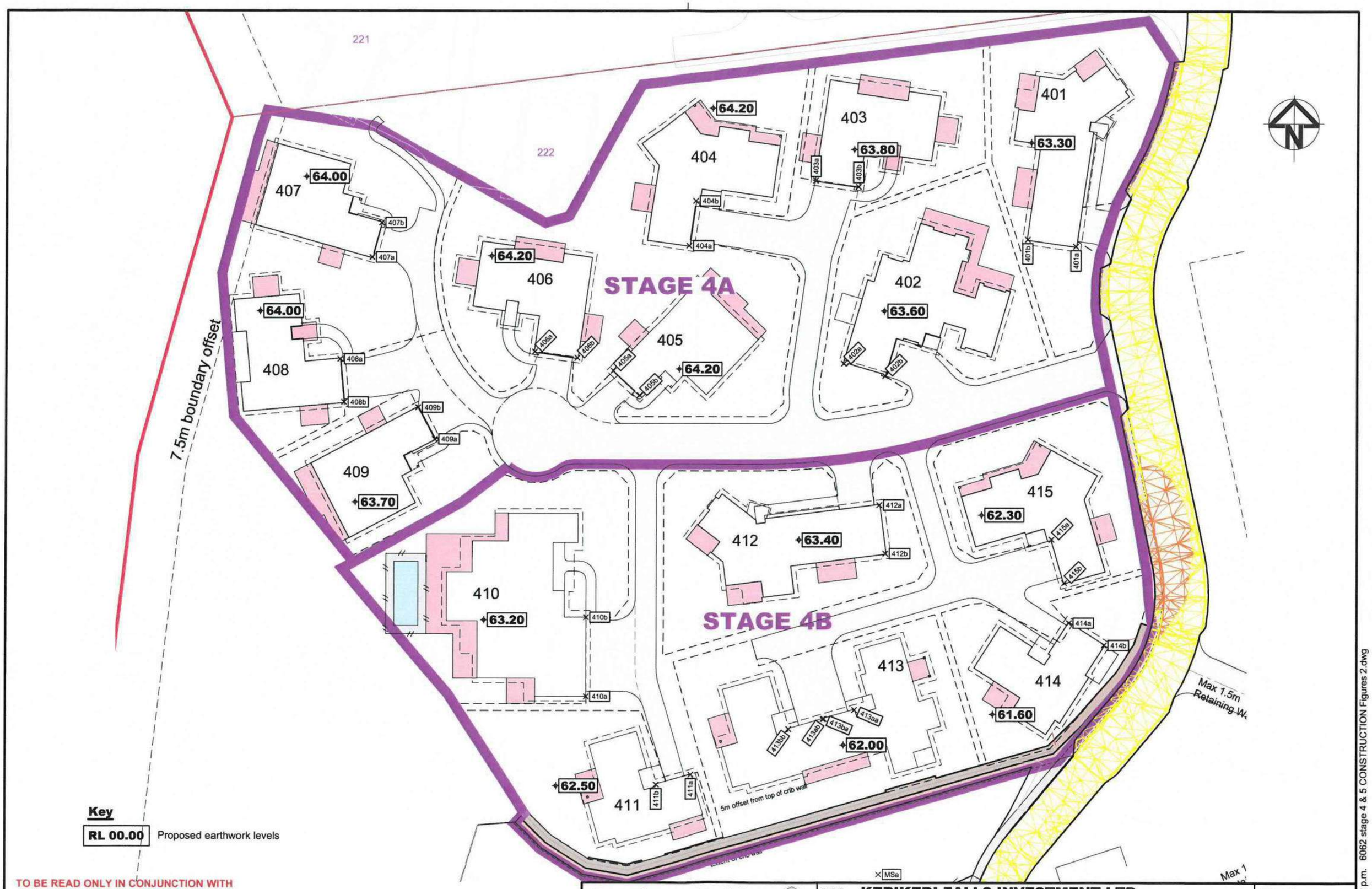
SCALE @ A3 1:250
PROJECT No. **6062**
FIGURE No. **09** REV. **R1**

5/07/2021 1:47:53 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg



Key

RL 00.00 Proposed earthwork levels

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DRAWING **STAGE 4A & 4B BUILDING PLATFORMS**

SCALE @ A3 2:1 XREF

PROJECT No. **6062**

FIGURE No. **10** REV. **R1**

5/07/2021 1:51:42 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures 2.dwg

THIS DRAWING WAS PRODUCED IN COLOUR. DO NOT USE FOR CONSTRUCTION PURPOSES IF THIS NOTE IS IN BLACK & WHITE

Key

00.00 Proposed earthwork levels

58.00 58.10 58.00 58.10 58.00 58.10 58.00 58.00 58.35 59.41 58.00 58.00 58.30 58.00

Extent of Crib Wall

MANSHED

MSb MSa

APART2b

MANSHED & SERVICED APARTMENTS

SERVICED APARTMENTS

54.00

APART2a

SERVICED APARTMENTS

59.00

APART1a APART1b

Max 1.5m Retaining Wall

58.00

420 420a 420b

416 59.00 416a 416b

Max 1.0m Retaining Wall

STAGE 4C

417 58.85 417a 417b

419 59.00 419a 419b

421 57.30 421a 421b

422a 58.00 422aa 422ab 422b 422ba 422bb

58.00 423 423a 423b

58.00 418 418a 418b

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DRAWING STAGE 4C BUILDING PLATFORMS

SCALE @ A3 1:500

PROJECT No. 6062

FIGURE No. 11

REV. R1

5/07/2021 1:51:53 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures 2.dwg

Retaining Wall

Retaining Wall

MAX 3.0m Retaining

TOTARA GROVE

proposed reserve setback

7.5m boundary offset

524 524b 524a 37.00
526 526b 526a 37.00
523 36.45
525 525a 525b 35.70
523a 523b 35.45
522 522a 522b
521 36.00 521a 521b
520 520ab 520aa 520bb 520ba 35.60
518 518a 518b 35.50
519 519a 519b 34.60
517 517a 517b 35.00
514 514a 514b 34.50
516 34.20
515 515a 515b 33.75
513 513a 513b 34.00
511A 511Aa 511Ab 511B 511Ba 511Bb 34.00
512 512a 512b 33.60
510 510a 510b 33.50
501 501a 501b 35.15
504 504a 504b 34.85
502 502a 502b 34.11
503 503a 503b 34.25
505 505a 505b 34.55
506 506a 506b 34.30
508 508a 508b 33.80
509 509a 509b 33.70
507 507a 507b 34.05

KEY

RL 00.00	Proposed earthwork levels
×507b	Building setout points

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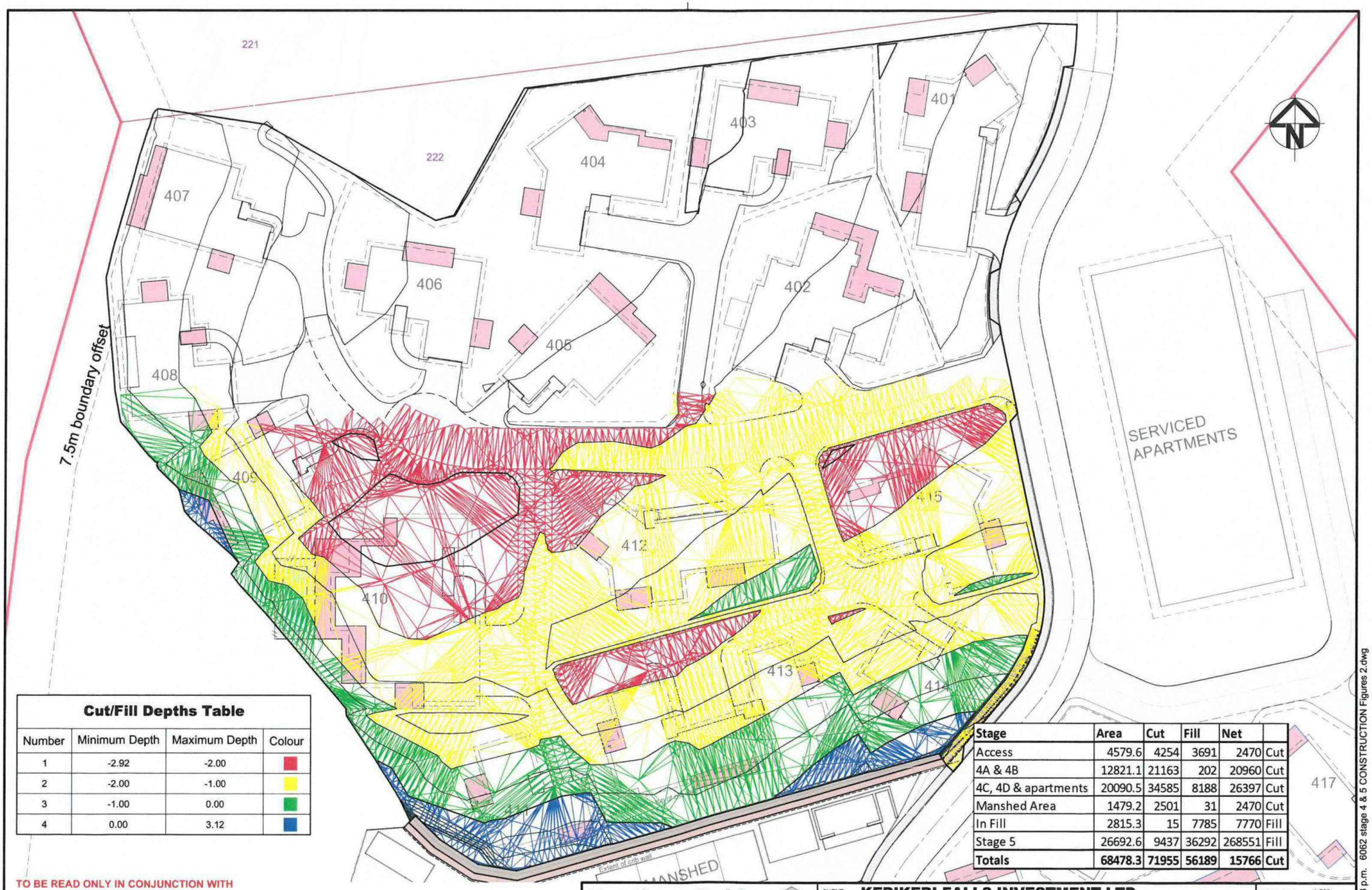
SCALE @ A3 1:750
PROJECT No. 6062
FIGURE No. 12
REV. R1

5/07/2021 1:52:03 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures 2.dwg



Cut/Fill Depths Table

Number	Minimum Depth	Maximum Depth	Colour
1	-2.92	-2.00	
2	-2.00	-1.00	
3	-1.00	0.00	
4	0.00	3.12	

Stage	Area	Cut	Fill	Net	
Access	4579.6	4254	3691	2470	Cut
4A & 4B	12821.1	21163	202	20960	Cut
4C, 4D & apartments	20090.5	34585	8188	26397	Cut
Manshed Area	1479.2	2501	31	2470	Cut
In Fill	2815.3	15	7785	7770	Fill
Stage 5	26692.6	9437	36292	268551	Fill
Totals	**68478.3**	**71955**	**56189**	**15766**	**Cut**

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DRAWING **STAGE 4A & 4B CUT AND FILL**

SCALE @ A3 1:500

PROJECT No. **6062**

FIGURE No. **13**

REV. **R1**

5/07/2021 1:52:13 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures 2.dwg

INFILL AREA

Cut/Fill Depths Table			
Number	Minimum Depth	Maximum Depth	Colour
1	-0.80	2.00	
2	2.00	4.00	
3	4.00	6.27	

STAGE 4C & 4D

CUT / FILL

Cut/Fill Depths Table			
Number	Minimum Depth	Maximum Depth	Colour
1	-6.09	-4.00	
2	-4.00	-2.00	
3	-2.00	0.00	
4	0.00	2.00	
5	2.00	6.27	

Refer to sheet C417 for Cut & Fill volumes

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DRAWING STAGE 4C & 4D CUT AND FILL

SCALE @ A3 1:1000
PROJECT No. 6062
FIGURE No. 14
REV. R1

5/07/2021 1:52:23 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures 2.dwg

STAGE 5

Cut/Fill Depths Table

	Number	Minimum Depth	Maximum Depth	Colour
CUT	1	-5.99	-4.00	
	2	-4.00	-2.00	
	3	-2.00	0.00	
FILL	4	0.00	2.00	
	5	2.00	3.00	
	6	3.00	4.20	

Refer to sheet C417 for Cut & Fill volumes

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DRAWING **STAGE 5 CUT AND FILL**

SCALE @ A3 1:750

PROJECT No. **6062**

FIGURE No. **15**

REV. **R1**

26/07/2021 10:20:11 a.m. 6062 stage 4 & 5 CONSTRUCTION Figures 2.dwg

MANSHED AREA

Cut/Fill Depths Table

Number	Minimum Depth	Maximum Depth	Colour
1	-4.01	-3.00	
2	-3.00	-2.00	
3	-2.00	-1.00	
4	-1.00	0.00	
5	0.00	2.00	
6	2.00	3.11	

Refer to sheet C417 for Cut & Fill volumes

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DRAWING **MANSHED AREA CUT AND FILL**

SCALE @ A3 1:250

PROJECT No. **6062**

FIGURE No. **16**

REV. **R1**

5/07/2021 1:52:43 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures 2.dwg

STAGE 5A

STAGE 5B

STAGE 4A

STAGE 4B

STAGE 4C

MANSHED & SERVICED APARTMENTS

MANSHED

SERVICED APARTMENTS

Reserved For future development

TOTARA GROVE

Stage 4 & 5 access road
Refer to sheet C422

Alignment 4A
Refer to Sheet C423

Alignment 4B
Refer to Sheet C423

Reserve setback

Retaining wall

501 502 503 504 505 506 507 508 509 510 511A 511B 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526

401 402 403 404 405 406 407 408 409 410 411 412 413 414 415

CH 0 CH 20 CH 40 CH 60 CH 80 CH 100 CH 120 CH 133 CH 140 CH 160 CH 180 CH 200 CH 220 CH 240 CH 260 CH 280 CH 300 CH 320 CH 340 CH 360 CH 380 CH 400 CH 420 CH 440 CH 460 CH 480 CH 500 CH 520 CH 540 CH 560 CH 580 CH 600 CH 620 CH 640 CH 654

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DRAWING STAGE 4 & 5 - ROAD LAYOUT

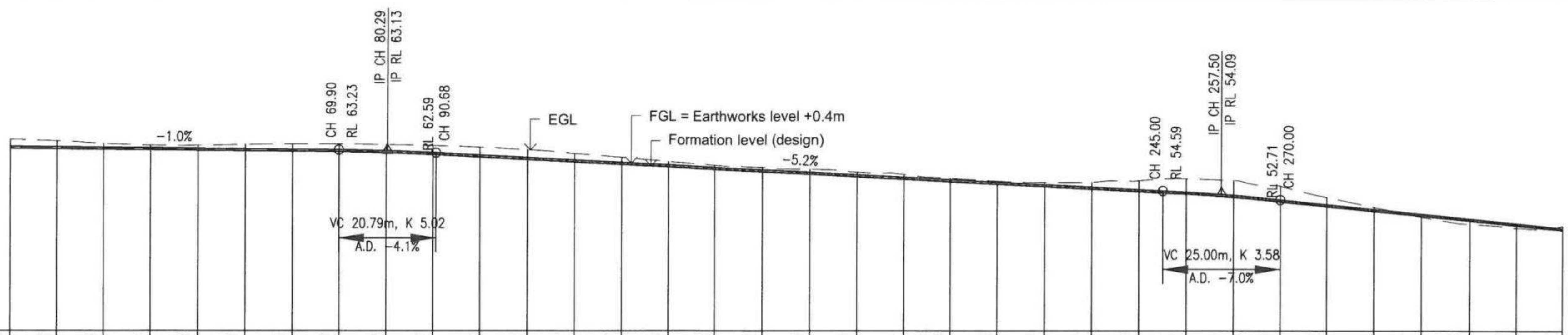
SCALE @ A3 1:1250

PROJECT No. 6062

FIGURE No. 17

REV. R1

5/07/2021 1:48:03 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg

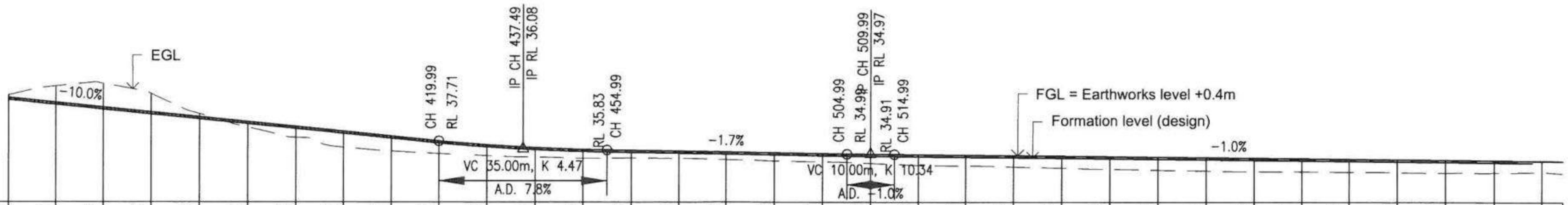


ACCESS 210211
DATUM: 25.00

CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
DESIGN LEVELS FINISHED SURFACE	63.93	63.83	63.73	63.63	63.53	63.43	63.33	63.23	63.03	62.63	62.11	61.59	61.07	60.55	60.04	59.52	59.00
CUT/FILL DEPTHS EARTHWORKS	-1.89	-1.66	-1.24	-0.95	-1.02	-1.30	-1.54	-1.64	-1.69	-1.88	-2.07	-2.06	-1.81	-1.50	-1.10	-0.86	-0.96
DESIGN LEVELS EARTHWORKS	63.53	63.43	63.33	63.23	63.13	63.03	62.93	62.83	62.63	62.23	61.71	61.19	60.67	60.15	59.64	59.12	58.60
EXISTING LEVELS	63.53	63.43	63.33	63.23	63.13	63.03	62.93	62.83	62.63	62.23	61.71	61.19	60.67	60.15	59.64	59.12	58.60

CHAINAGE	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330
DESIGN LEVELS FINISHED SURFACE	58.48	57.96	57.44	56.93	56.41	55.89	55.37	54.85	54.36	53.67	52.71	51.71	50.71	49.71	48.71	47.71	46.71
CUT/FILL DEPTHS EARTHWORKS	-1.01	-0.98	-1.00	-0.74	-0.64	-0.88	-1.42	-2.32	-3.24	-3.56	-3.32	-1.93	-0.87	0.25	0.69	0.53	-0.91
DESIGN LEVELS EARTHWORKS	58.08	57.56	57.04	56.53	56.01	55.49	54.97	54.45	53.96	53.27	52.31	51.31	50.31	49.31	48.31	47.31	46.31
EXISTING LEVELS	58.08	57.56	57.04	56.53	56.01	55.49	54.97	54.45	53.96	53.27	52.31	51.31	50.31	49.31	48.31	47.31	46.31

NOTE.
DESIGN LEVELS = PROPOSED FORMATION LEVELS
(FINISHED SURFACE -400mm)



ACCESS 2 210211
DATUM: 25.00

CHAINAGE	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490
DESIGN LEVELS FINISHED SURFACE	46.71	45.71	44.71	43.71	42.71	41.71	40.71	39.71	38.71	37.71	36.89	36.30	35.93	35.75	35.58	35.41	35.24
CUT/FILL DEPTHS EARTHWORKS	-0.91	-3.79	-5.33	-4.24	-1.06	0.76	1.88	2.92	2.73	2.24	1.85	1.56	1.41	1.16	1.06	1.18	1.29
DESIGN LEVELS EARTHWORKS	46.31	45.31	44.31	43.31	42.31	41.31	40.31	39.31	38.31	37.31	36.49	35.90	35.53	35.35	35.18	35.01	34.84
EXISTING LEVELS	46.31	45.31	44.31	43.31	42.31	41.31	40.31	39.31	38.31	37.31	36.49	35.90	35.53	35.35	35.18	35.01	34.84

CHAINAGE	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	654
DESIGN LEVELS FINISHED SURFACE	35.07	34.96	34.86	34.75	34.65	34.55	34.45	34.35	34.25	34.15	34.05	33.95	33.84	33.74	33.64		
CUT/FILL DEPTHS EARTHWORKS	1.29	1.48	1.79	1.83	1.93	2.05	2.20	2.29	2.35	2.37	2.28	2.28	2.26	2.25	2.11		
DESIGN LEVELS EARTHWORKS	34.67	34.56	34.46	34.35	34.25	34.15	34.05	33.95	33.85	33.75	33.65	33.55	33.44	33.34	33.24		
EXISTING LEVELS	34.67	34.56	34.46	34.35	34.25	34.15	34.05	33.95	33.85	33.75	33.65	33.55	33.44	33.34	33.24	33.14	

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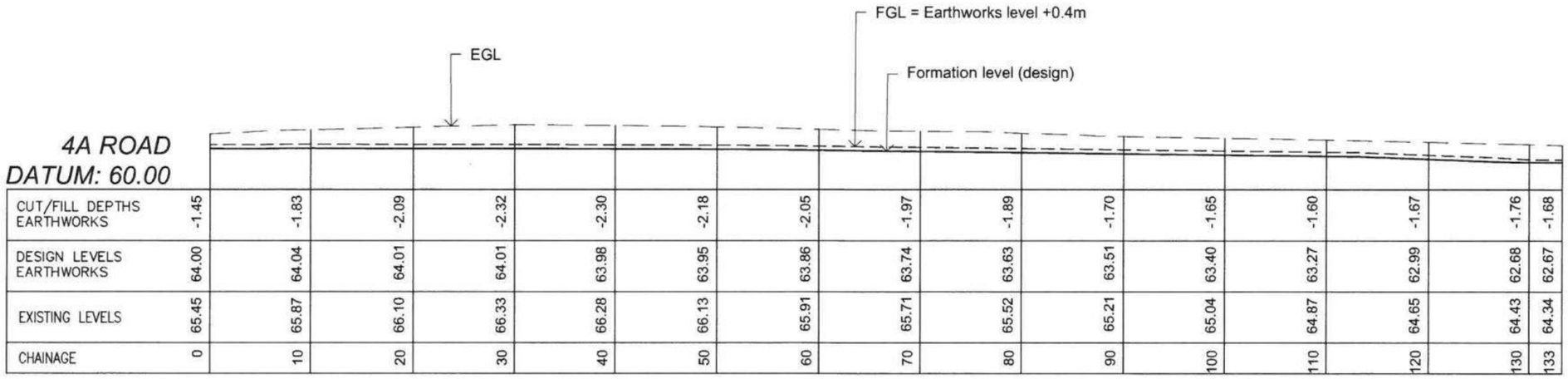
PROJECT **QUAIL RIDGE COUNTRY CLUB**
RAINBOW FALLS ROAD, KERIKERI
DRAWING **STAGES 4 & 5 - ACCESS ROAD LONG-SECTION**

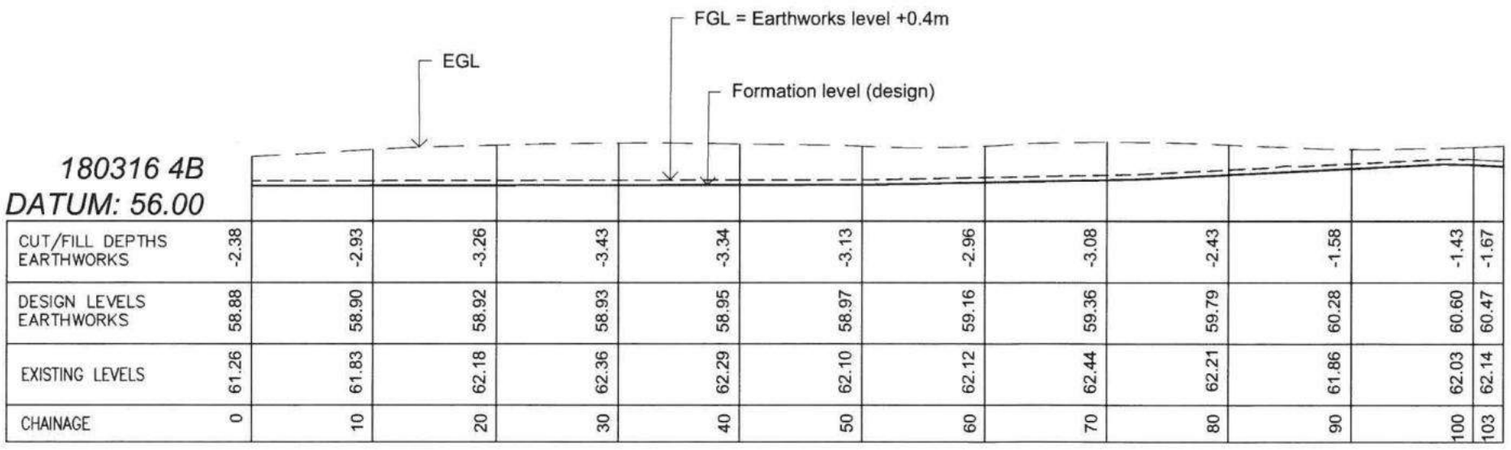
SCALE @ A3 1:1000
PROJECT No. **6062**
FIGURE No. **18**
REV. **R1**

5/07/2021 1:48:13 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg



4A ROAD
DATUM: 60.00

CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	110	120	130	133
EXISTING LEVELS	65.45	65.87	66.10	66.33	66.28	66.13	65.91	65.71	65.52	65.21	65.04	64.87	64.65	64.43	64.34
DESIGN LEVELS EARTHWORKS	64.00	64.04	64.01	64.01	63.98	63.95	63.86	63.74	63.63	63.51	63.40	63.27	62.99	62.68	62.67
CUT/FILL DEPTHS EARTHWORKS	-1.45	-1.83	-2.09	-2.32	-2.30	-2.18	-2.05	-1.97	-1.89	-1.70	-1.65	-1.60	-1.67	-1.76	-1.68



180316 4B
DATUM: 56.00

CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	103
EXISTING LEVELS	61.26	61.83	62.18	62.36	62.29	62.10	62.12	62.44	62.21	61.86	62.03	62.14
DESIGN LEVELS EARTHWORKS	58.88	58.90	58.92	58.93	58.95	58.97	59.16	59.36	59.79	60.28	60.60	60.47
CUT/FILL DEPTHS EARTHWORKS	-2.38	-2.93	-3.26	-3.43	-3.34	-3.13	-2.96	-3.08	-2.43	-1.58	-1.43	-1.67

NOTE.
DESIGN LEVELS = PROPOSED FORMATION LEVELS
(FINISHED SURFACE -400mm)

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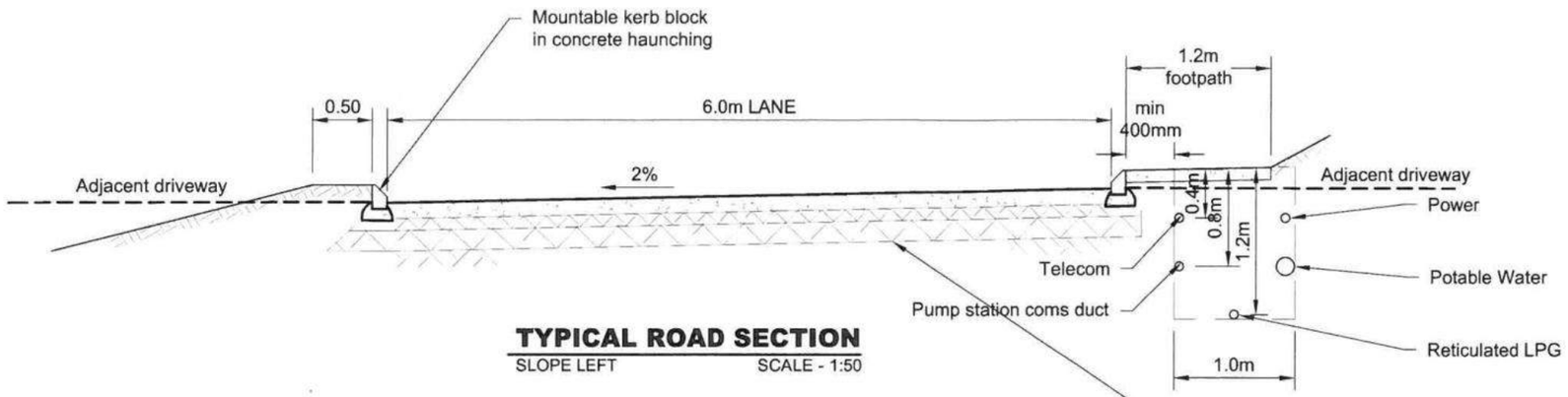
RAINBOW FALLS ROAD, KERIKERI
DRAWING STAGE 4 - MINOR ROAD LONG-SECTIONS

SCALE @ A3 1:500
PROJECT No. 6062
FIGURE No. 19
REV. R1

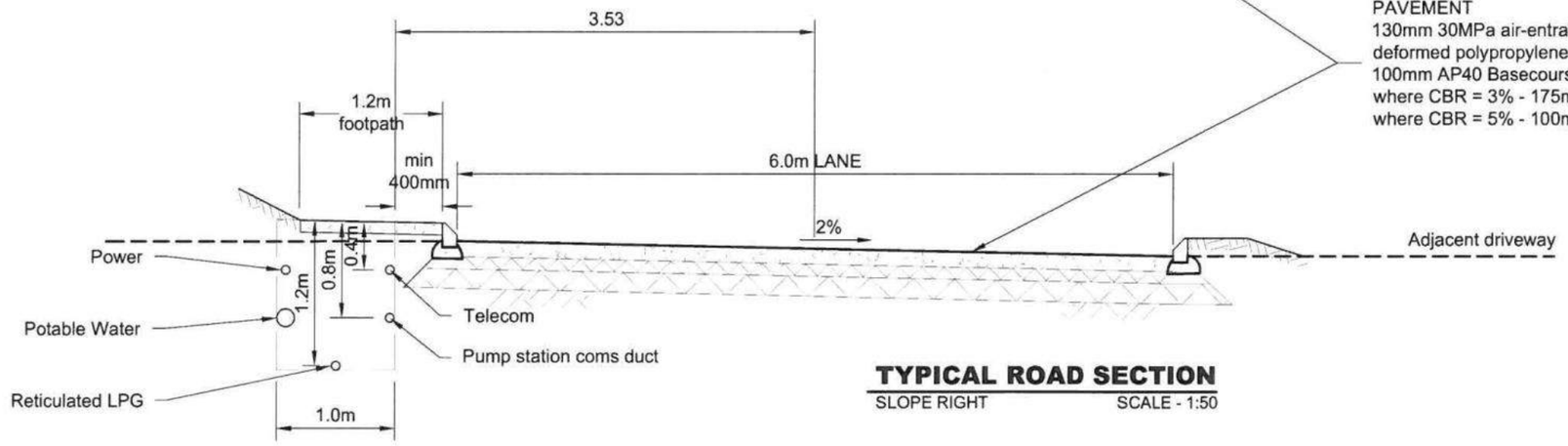
5/07/2021 1:48:53 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg



TYPICAL ROAD SECTION

SLOPE LEFT SCALE - 1:50

PAVEMENT
130mm 30MPa air-entrained concrete with 3.5kg/m² deformed polypropylene fibre reinforcing over
100mm AP40 Basecourse over
where CBR = 3% - 175mm GAP65 Sub-Base
where CBR = 5% - 100mm GAP65 Sub-Base



TYPICAL ROAD SECTION

SLOPE RIGHT SCALE - 1:50

NOTES:
1. ALL SUBSURFACE CONCRETE SHALL BE ORDINARY GRADE 20 MPa IF CAST INSITU & 25 MPa IF SLIP FORMED AT 28 DAYS.
PAVEMENT CONCRETE TO BE 130MM 30MPa AIR-ENTRAINED WITH 3.5KG/M² DEFORMED POLYPROPYLENE FIBRE REINFORCING

2. CRACK CONTROL JOINTS TO BE FORMED AT MINIMUM OF 3 METER INTERVALS.

3. ALL KERBS AND CHANNELS SHALL BE UNDERLAIN BY A MINIMUM 75 MM OF COMPACTED AP40 PAVEMENT AGGREGATE..

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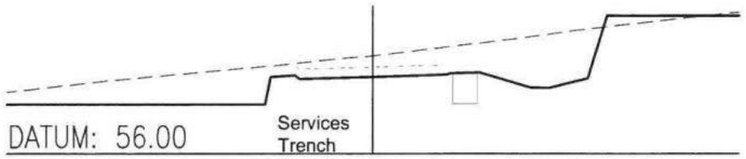
RAINBOW FALLS ROAD, KERIKERI
DRAWING STAGES 4 & 5 - ACCESS ROAD CROSS-SECTIONS

SCALE @ A3 1:50
PROJECT No. 6062
FIGURE No. 20
REV. R1

5/07/2021 1:49:33 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg

NOTE.
DESIGN LEVELS = PROPOSED FORMATION LEVELS
(FINISHED SURFACE -400mm)



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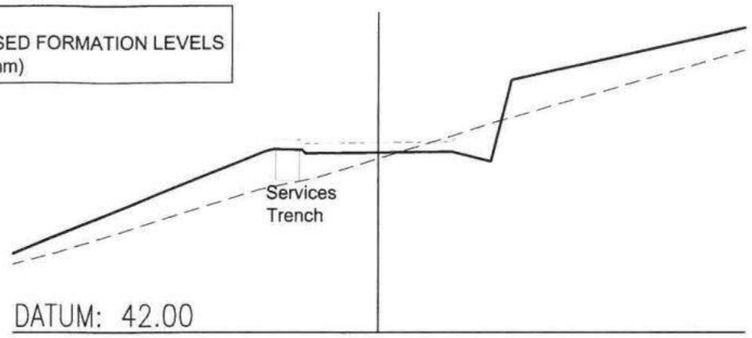

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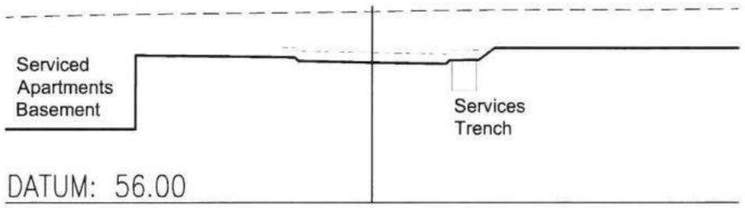

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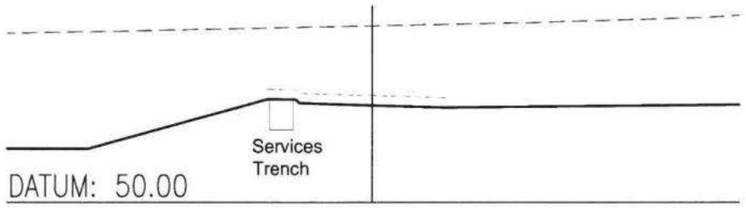

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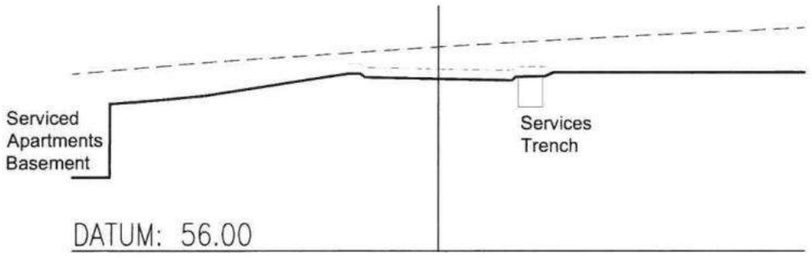

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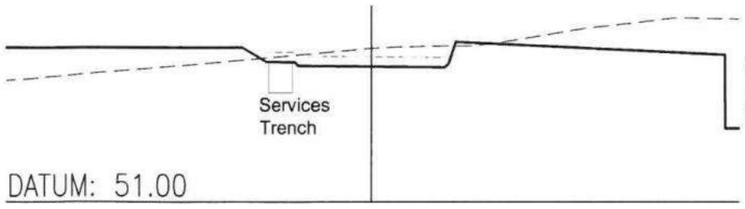

CH: 200.00

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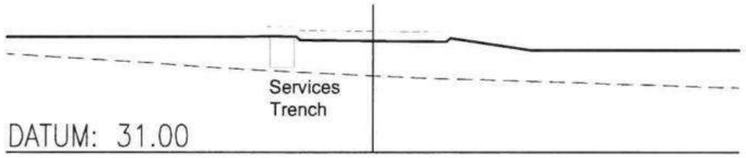
DRAWING STAGES 4 & 5 - ACCESS ROAD CROSS-SECTIONS

SCALE @ A3 1:250
PROJECT No. 6062
FIGURE No. 21
REV. R1

5/07/2021 1:50:13 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg

NOTE.
DESIGN LEVELS = PROPOSED FORMATION LEVELS
(FINISHED SURFACE -400mm)



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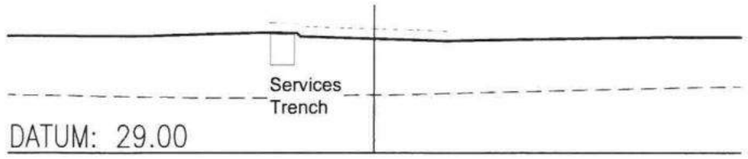

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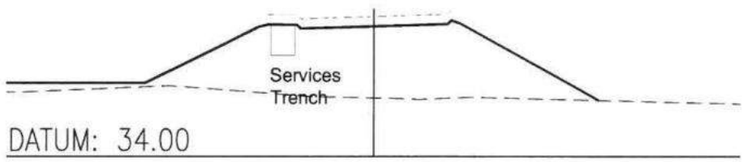

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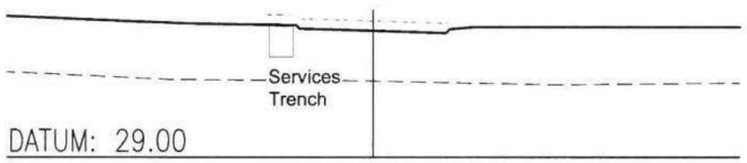

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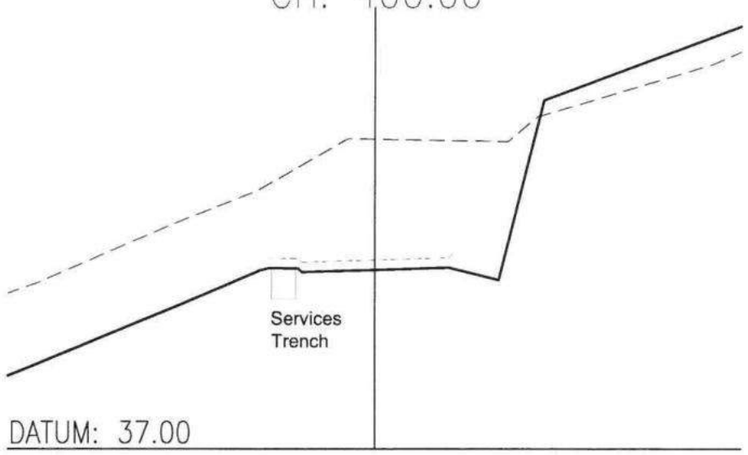

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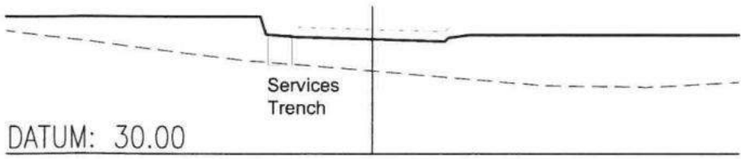

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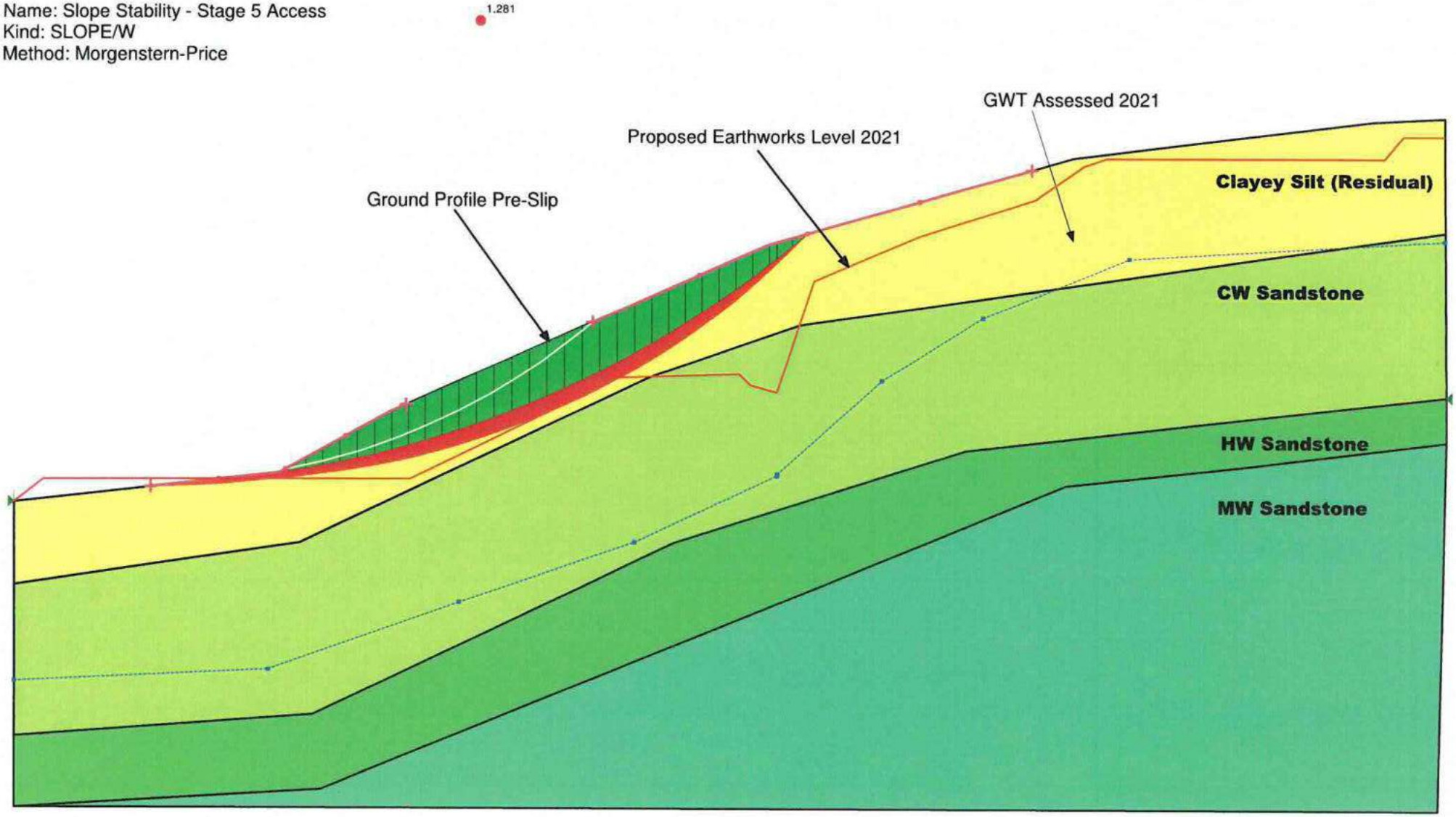
DRAWING STAGES 4 & 5 - ACCESS ROAD CROSS-SECTIONS

SCALE @ A3 1:250
PROJECT No. 6062
FIGURE No. 22
REV. R1

5/07/2021 1:50:53 p.m. 6062 stage 4 & 5 CONSTRUCTION Figures.dwg

Appendix B – Slope Stability Figures/Outputs

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price



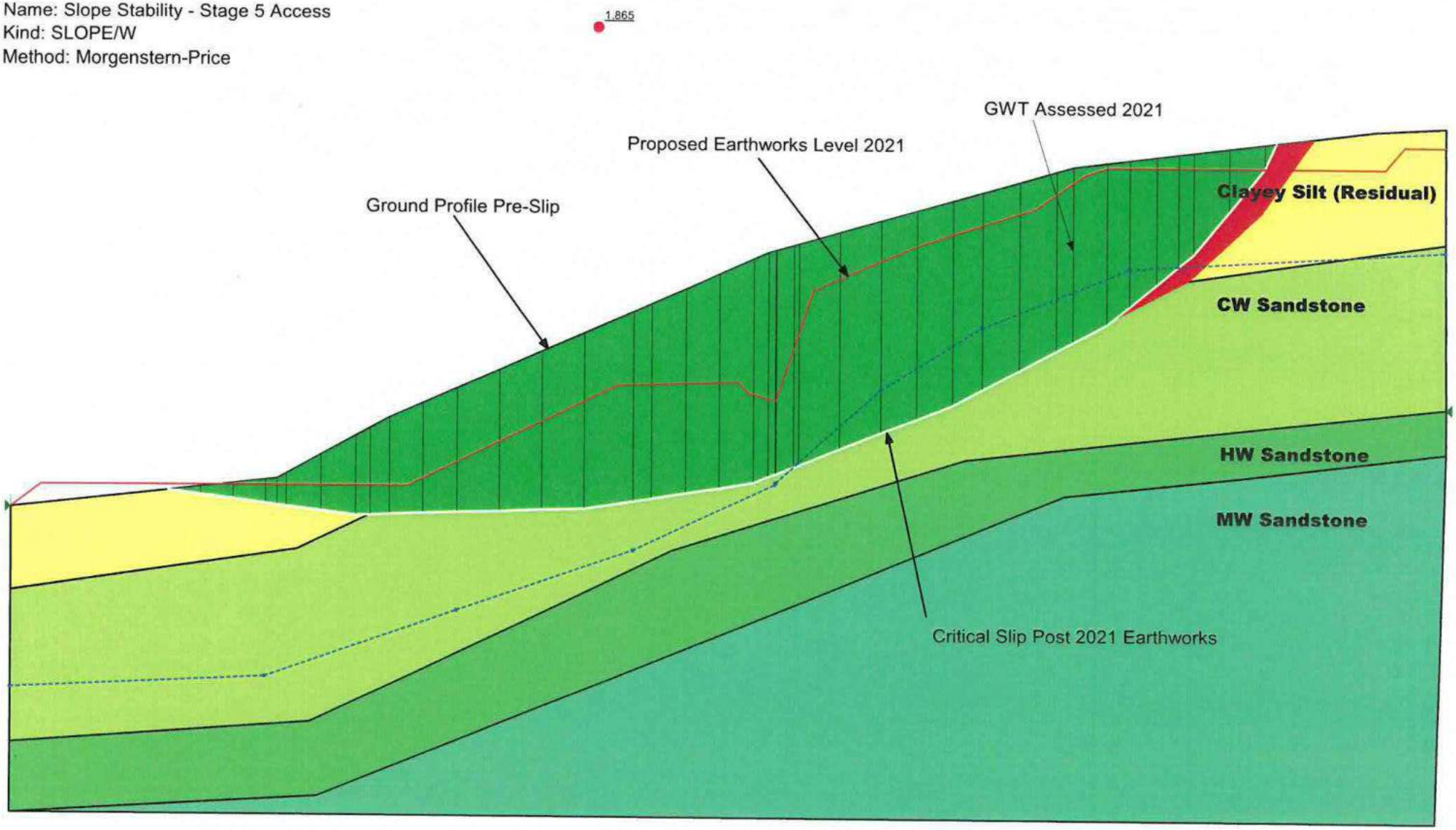
Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210622 pre earthworks slope satbility.gsz

Slope/W Analysis - Stage 5 Access Global Stability Analysis

Analysis: Historic Slope Profile "2018 Lidar"

Job Number: 6062
Engineer: CBS
Date: 22.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price



Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210622 pre earthworks slope satbility.gsz

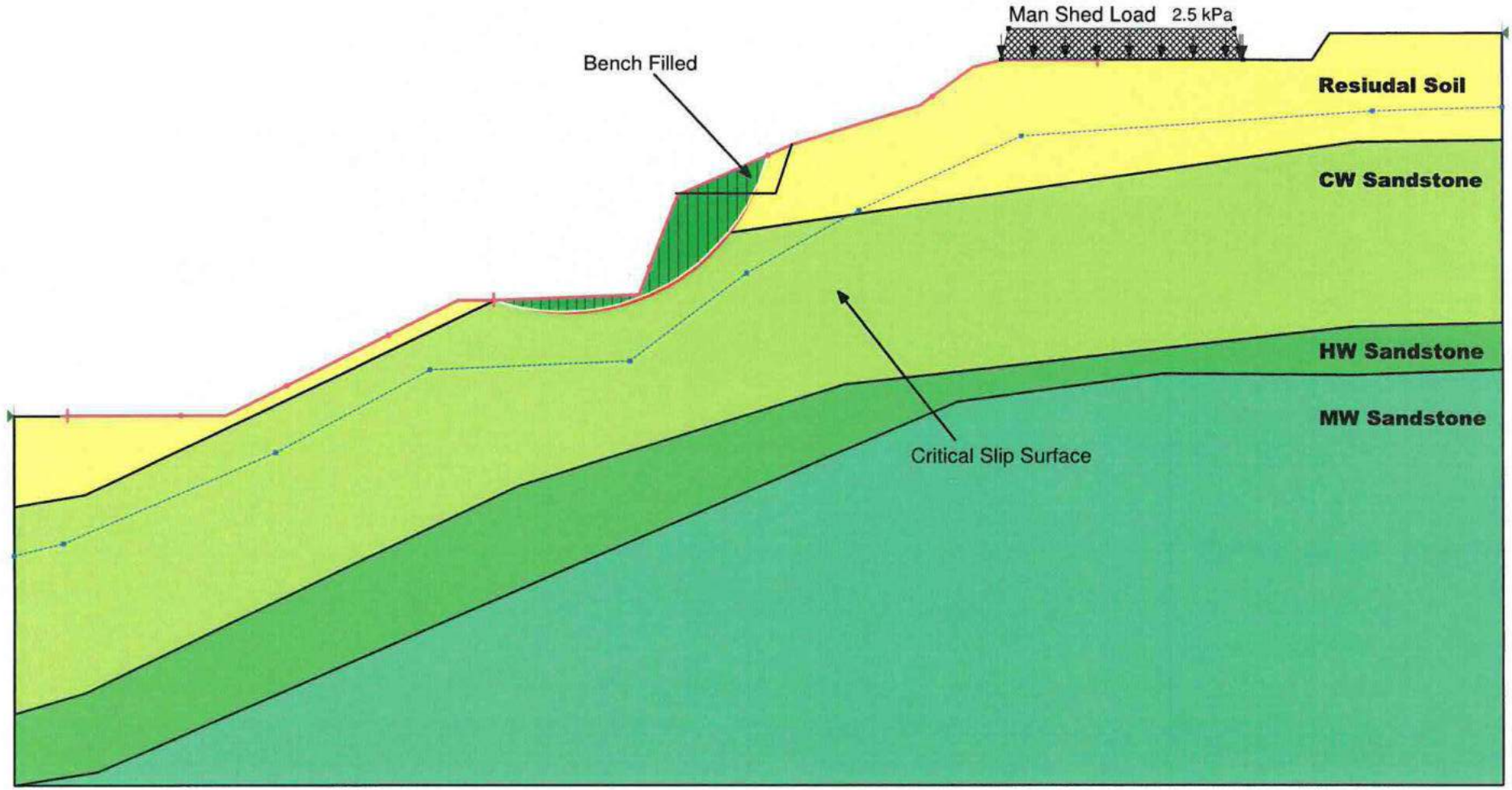
Slope/W Analysis - Stage 5 Access Global Stability Analysis

Analysis: Historic Slope Profile "2018 Lidar"

Job Number: 6062
Engineer: CBS
Date: 22.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price

1.177



Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210413 - ULS DL no retaining.gsz

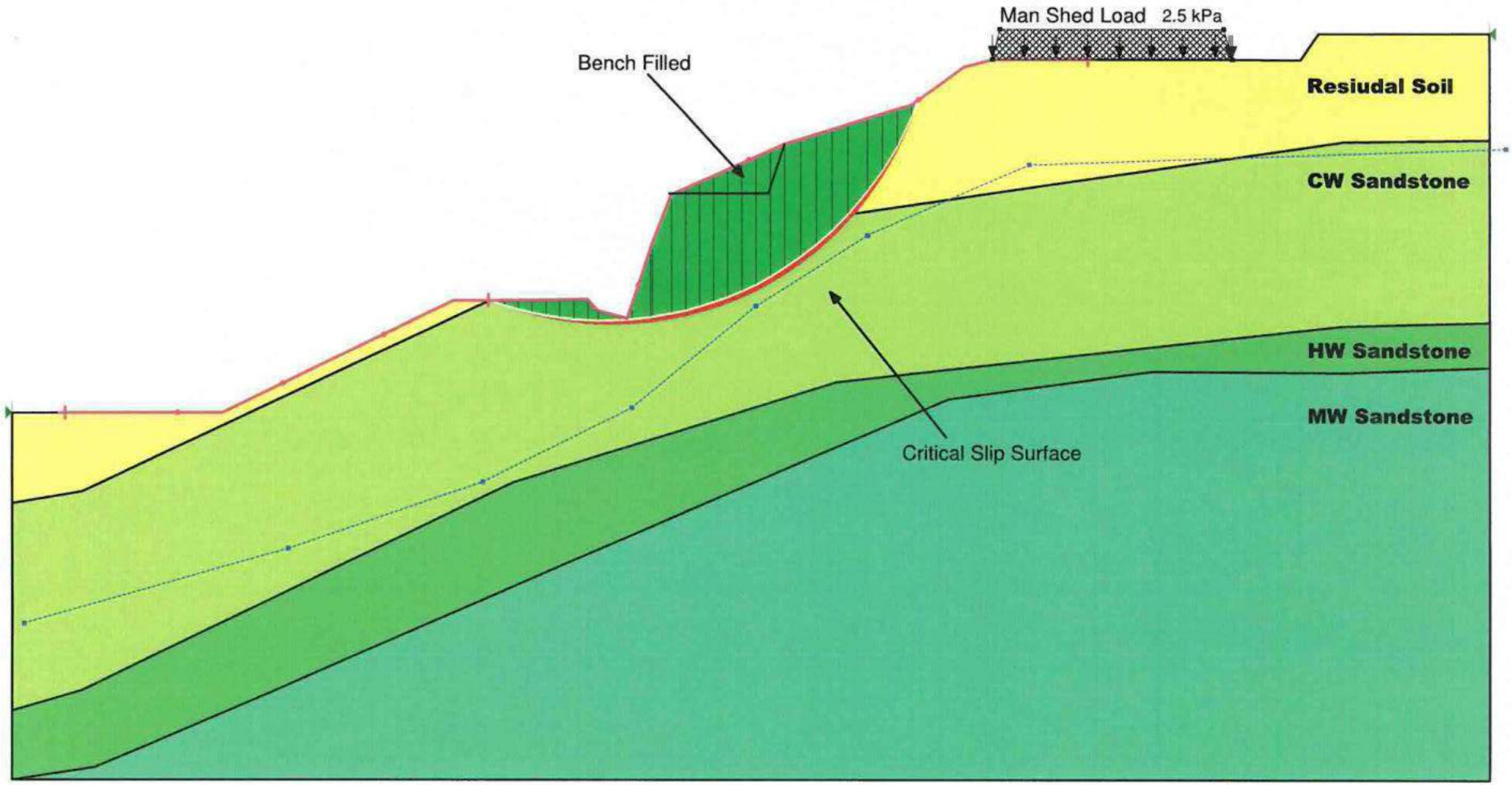
Slope/W Analysis - Stage 5 Access Global Stability Analysis

ULS Analysis: Design levels with no retaining

Job Number: 6062
Engineer: CBS
Date: 22.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price

1.355



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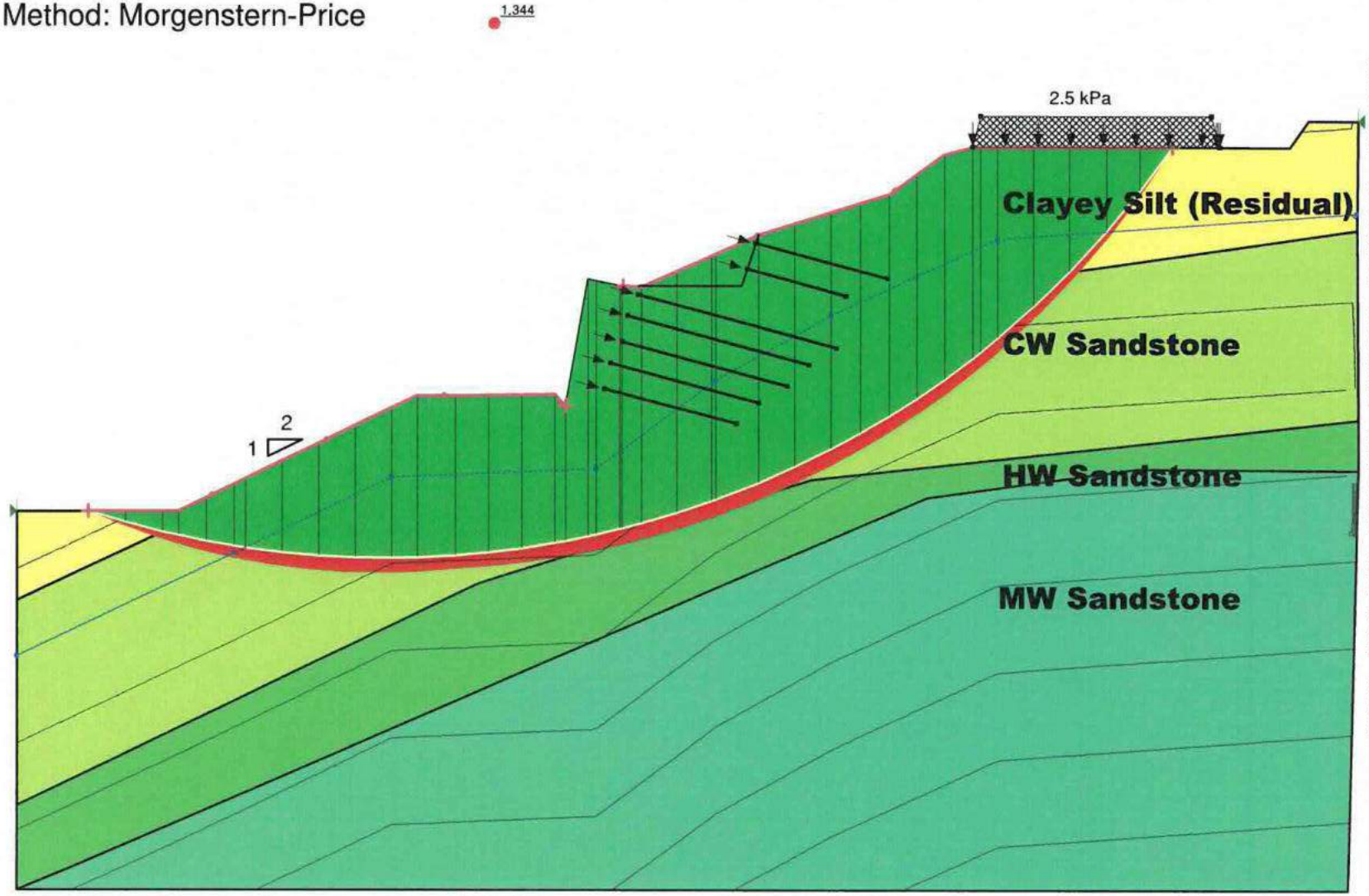
Slope/W Analysis - Stage 5 Access Global Stability Analysis

SLS Analysis: Design levels with no retaining

Job Number: 6062
Engineer: CBS
Date: 22.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price



Name: Clayey Silt (Residual)
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion': 2 kPa
Phi': 28 °

Name: Completely Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion': 3 kPa
Phi': 30 °

Name: Highly Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 32 °

Name: Moderately Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 24 kN/m³
Cohesion': 10 kPa
Phi': 35 °

Name: 60/40 Fill
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 35 °

Name: Cribb Wall
Model: High Strength
Unit Weight: 17 kN/m³

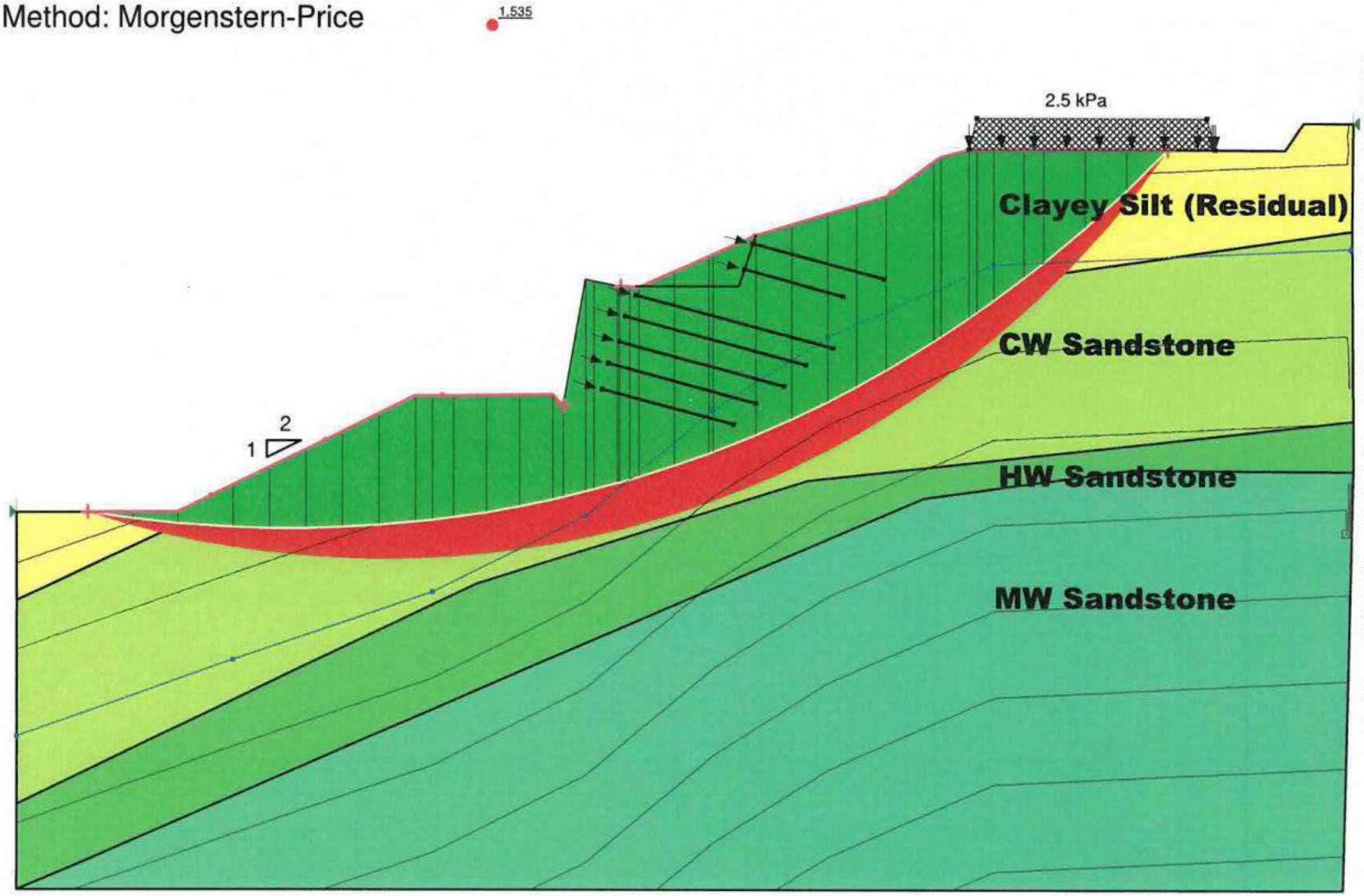
Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210616 ULS Global Stability Fully Retained.gsz

Slope/W Analysis - Stage 5 Access Global Stability Analysis

HGW
~~ULS~~ Analysis: Design ground levels Global Stability, Fully Retained

Job Number: 6062
Engineer: CBS
Date: 26.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price



Name: Clayey Silt (Residual)
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion': 2 kPa
Phi': 28 °

Name: Completely Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion': 3 kPa
Phi': 30 °

Name: Highly Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 32 °

Name: Moderately Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 24 kN/m³
Cohesion': 10 kPa
Phi': 35 °

Name: 60/40 Fill
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 35 °

Name: Cribb Wall
Model: High Strength
Unit Weight: 17 kN/m³

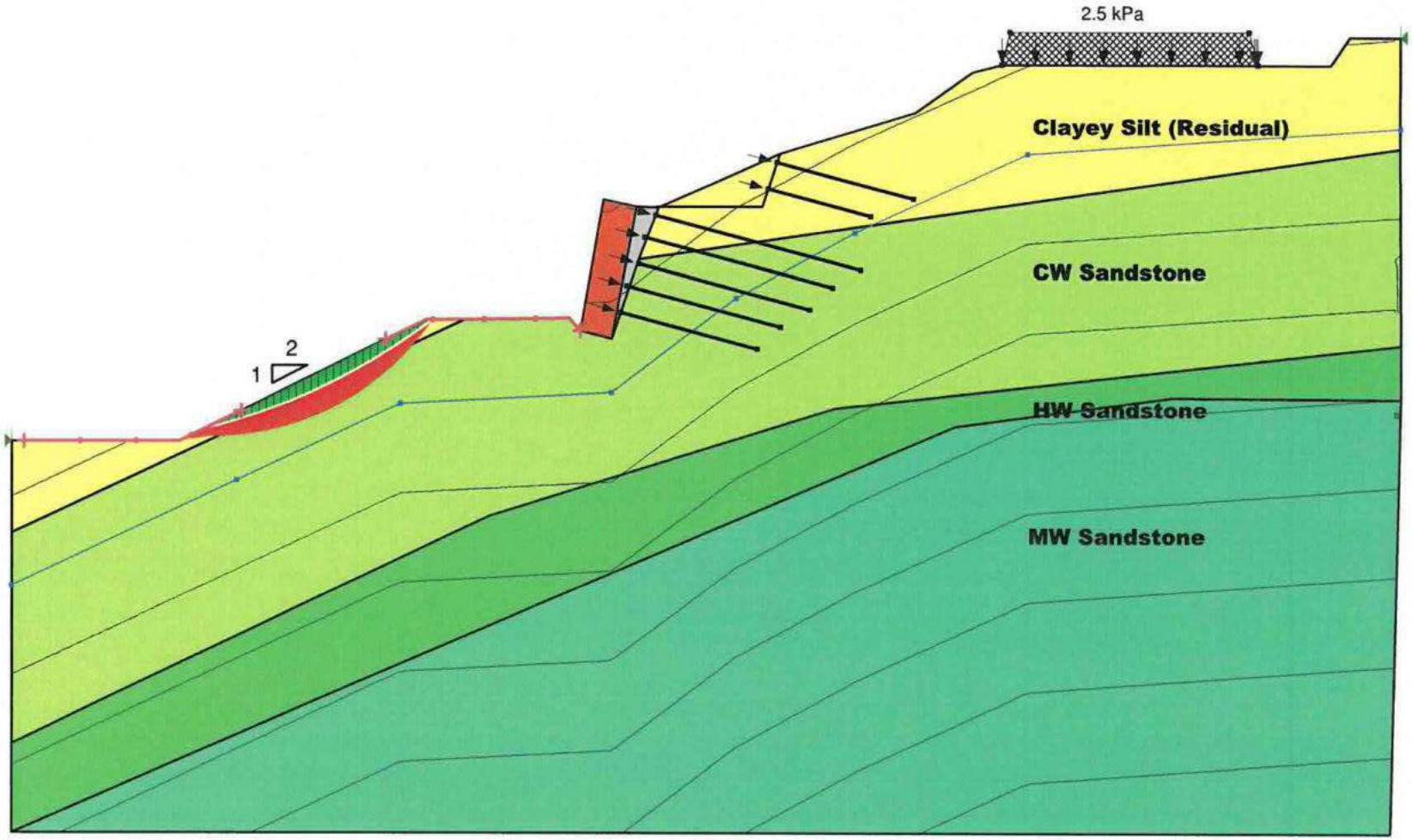
Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210616 SLS Global Stability Fully Retained.gsz

Slope/W Analysis - Stage 5 Access Global Stability Analysis

SLS Analysis: Design ground levels Global Stability, Fully Retained

Job Number: 6062
Engineer: CBS
Date: 26.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price



Name: Clayey Silt (Residual)
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion': 2 kPa
Phi': 28 °

Name: Completely Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion': 3 kPa
Phi': 30 °

Name: Highly Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 32 °

Name: Moderately Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 24 kN/m³
Cohesion': 10 kPa
Phi': 35 °

Name: 60/40 Fill
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 35 °

Name: Cribb Wall
Model: High Strength
Unit Weight: 17 kN/m³

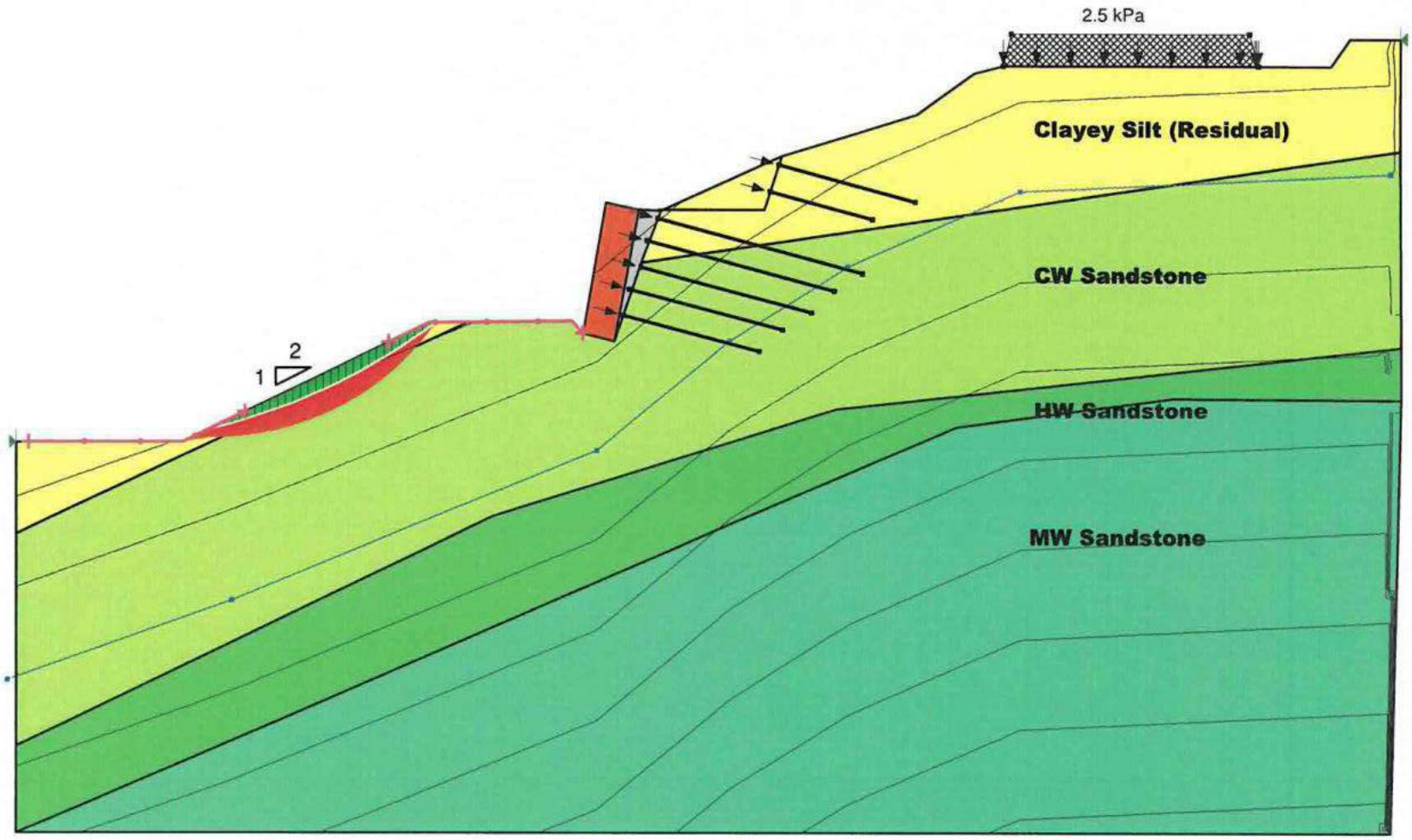
Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210622 ULS Escarpment Stability.gsz

Slope/W Analysis - Stage 5 Access Global Stability Analysis

ULS Analysis: Design levels, lower slopes stability at 1V:2H (26*)

Job Number: 6062
Engineer: CBS
Date: 22.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price



Name: Clayey Silt (Residual)
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion': 2 kPa
Phi': 28 °

Name: Completely Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion': 3 kPa
Phi': 30 °

Name: Highly Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 32 °

Name: Moderately Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 24 kN/m³
Cohesion': 10 kPa
Phi': 35 °

Name: 60/40 Fill
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 35 °

Name: Cribb Wall
Model: High Strength
Unit Weight: 17 kN/m³

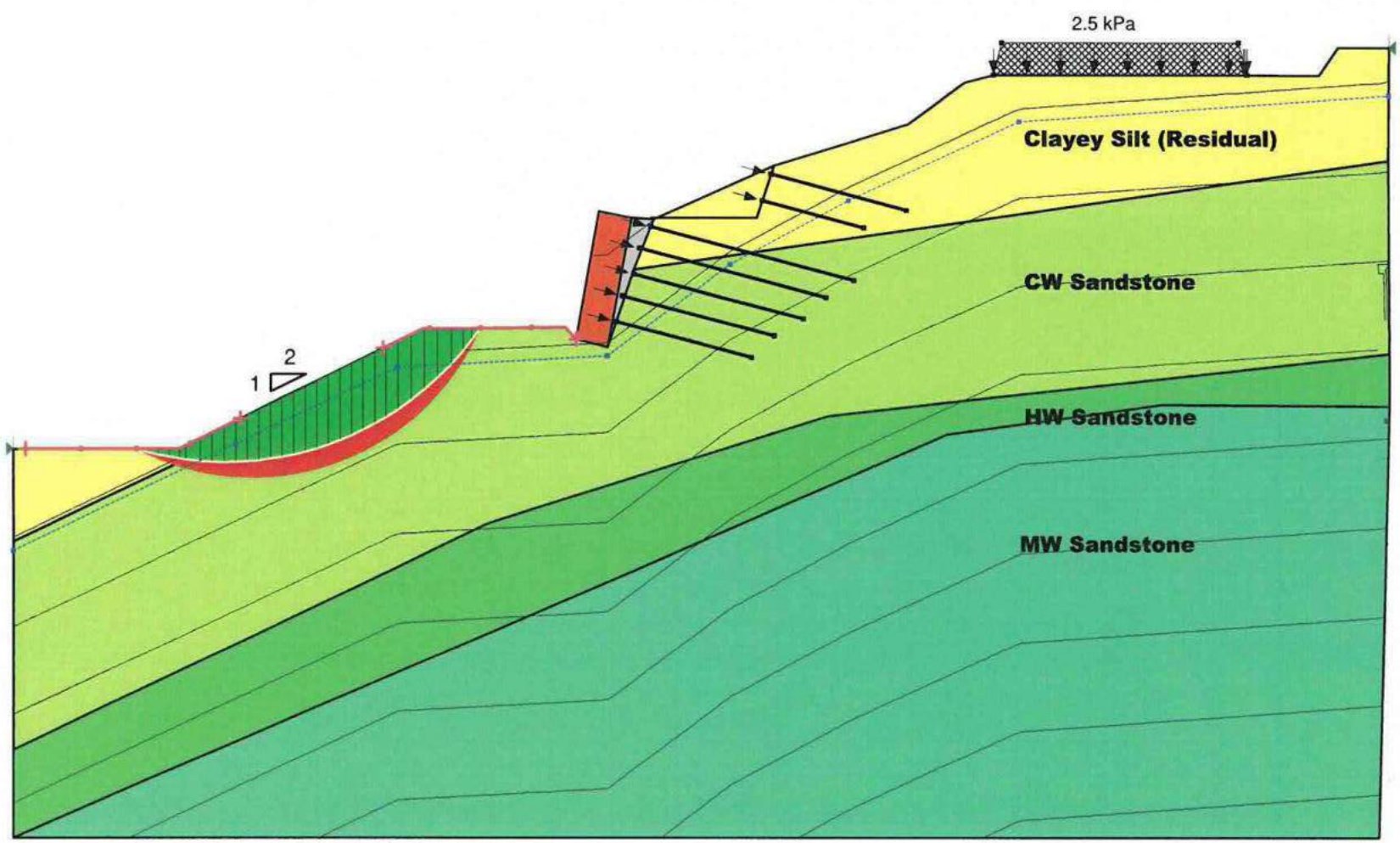
Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210622 SLS Escarpment Stability.gsz

Slope/W Analysis - Stage 5 Access Global Stability Analysis

SLS Analysis: Design levels, lower slopes stability at 1V:2H (26*)

Job Number: 6062
Engineer: CBS
Date: 22.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price



Name: Clayey Silt (Residual)
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion': 2 kPa
Phi': 28 °

Name: Completely Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion': 3 kPa
Phi': 30 °

Name: Highly Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 32 °

Name: Moderately Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 24 kN/m³
Cohesion': 10 kPa
Phi': 35 °

Name: 60/40 Fill
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 35 °

Name: Cribb Wall
Model: High Strength
Unit Weight: 17 kN/m³

Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210622 Escarpment Stability Extreme GWT.gsz

Slope/W Analysis - Stage 5 Access Global Stability Analysis

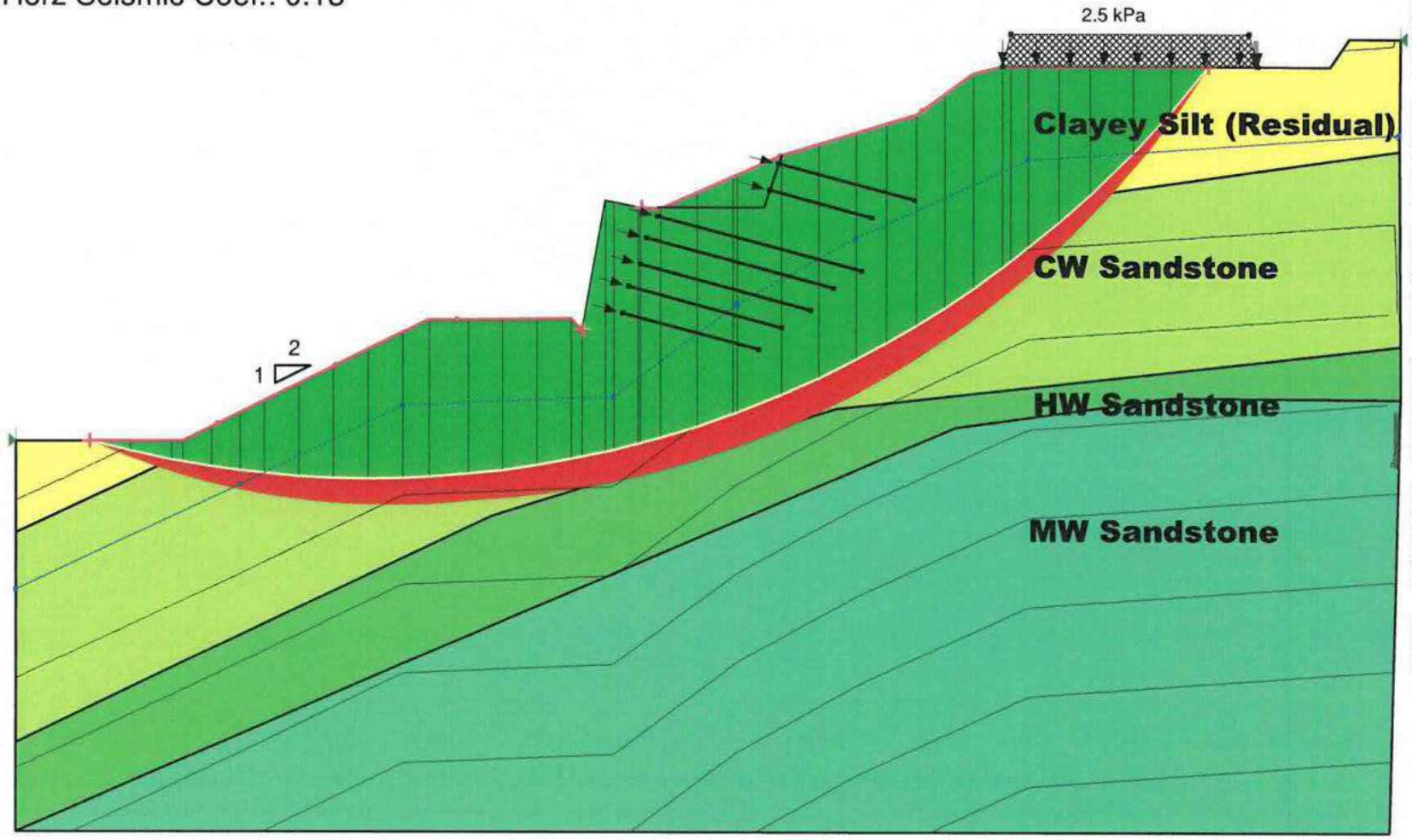
EXTREME GWT Analysis: Design levels, lower slopes stability at 1V:2H (26*)

Job Number: 6062
Engineer: CBS
Date: 22.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price

1.030

Horz Seismic Coef.: 0.13



Name: Clayey Silt (Residual)
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion': 2 kPa
Phi': 28 °

Name: Completely Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion': 3 kPa
Phi': 30 °

Name: Highly Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 32 °

Name: Moderately Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 24 kN/m³
Cohesion': 10 kPa
Phi': 35 °

Name: 60/40 Fill
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 35 °

Name: Cribb Wall
Model: High Strength
Unit Weight: 17 kN/m³

Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210616 ULS Seismic Global Stability Fully Retained.gsz

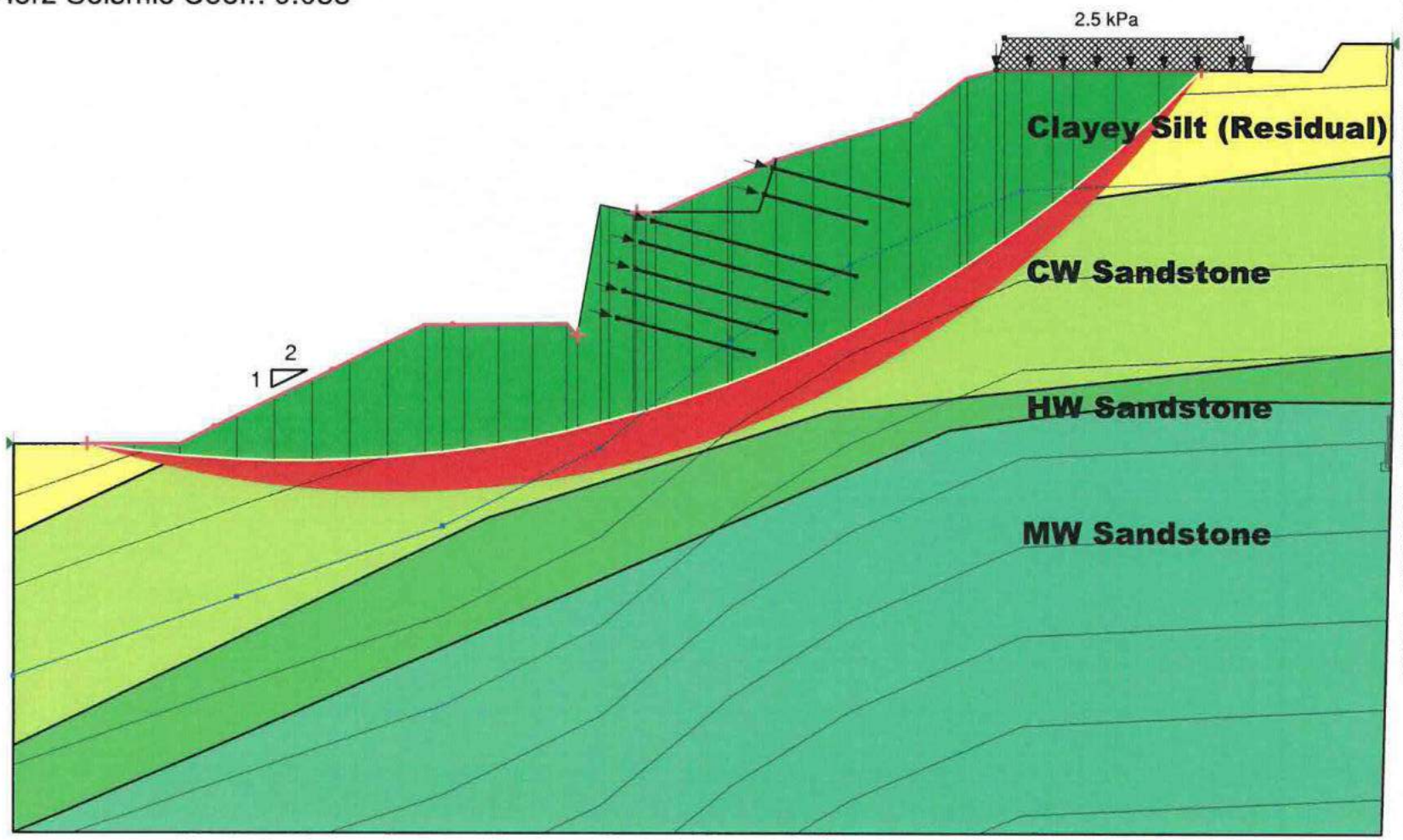
Slope/W Analysis - Stage 5 Access Global Stability Analysis

ULS Seismic Analysis: Design ground levels Global Stability, Fully Retained

Job Number: 6062
Engineer: CBS
Date: 26.06.2021

Name: Slope Stability - Stage 5 Access
Kind: SLOPE/W
Method: Morgenstern-Price

Horz Seismic Coef.: 0.033



Name: Clayey Silt (Residual)
Model: Mohr-Coulomb
Unit Weight: 18 kN/m³
Cohesion': 2 kPa
Phi': 28 °

Name: Completely Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 19 kN/m³
Cohesion': 3 kPa
Phi': 30 °

Name: Highly Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 32 °

Name: Moderately Weathered Sandstone
Model: Mohr-Coulomb
Unit Weight: 24 kN/m³
Cohesion': 10 kPa
Phi': 35 °

Name: 60/40 Fill
Model: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion': 5 kPa
Phi': 35 °

Name: Cribb Wall
Model: High Strength
Unit Weight: 17 kN/m³

Directory: J:\6062 QRCC STAGES 4 & 5\SlopeW files\06-2021\SlopeW 210616 SLS Seismic Global Stability Fully Retained.gsz

Slope/W Analysis - Stage 5 Access Global Stability Analysis

SLS Seismic Analysis: Design ground levels Global Stability, Fully Retained

Job Number: 6062
Engineer: CBS
Date: 26.06.2021

Appendix C – SCHEDULE 2A NZS4404:2010 *Statement of Professional Opinion on Suitability of Land for Building Construction*

SCHEDULE 2A
STATEMENT OF PROFESSIONAL OPINION ON SUITABILITY OF LAND FOR BUILDING CONSTRUCTION

Development	**Quail Ridge Country Club Stage 4 & Stage 5**
Developer	**Kerikeri Falls Investment LTD**
Location	**82 RAINBOW FALLS ROAD, KERIKERI**

I, **Callum Sands** of **Hawthorn Geddes engineers and architects ltd**

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.

2. The extent of my inspections during construction, and the results of all tests and/or evaluations carried out are as described in the earthworks completion report titled **"Earthworks Completion Stage 4 & 5 REVISION 1" numbered 6062 and dated 18th January 2023 .**

3. In my professional opinion, not to be construed as a guarantee, I consider that:

   (a) The earth fills shown on the attached Plans No **Figure 05 through Figure 21** have been placed in compliance with the requirements of the **Far North District 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) **Refer to Completion Report numbered 6062 and dated 18th January 2023 .**
   (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) **Refer to Completion Report numbered 6062 and dated 18th January 2023 .**
   (ii) .....

   (e) The original ground not affected by filling and the filled ground are not subject to erosion, subsidence, or slippage in accordance with the provisions of section 106 of the Resource Management Act 1991 provided that:
   (i) **Refer to Completion Report numbered 6062 and dated 18th January 2023 .**
   (ii) .....

4. This professional opinion is furnished to the TA and the developer for their purposes along 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 any 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 18.07.2025

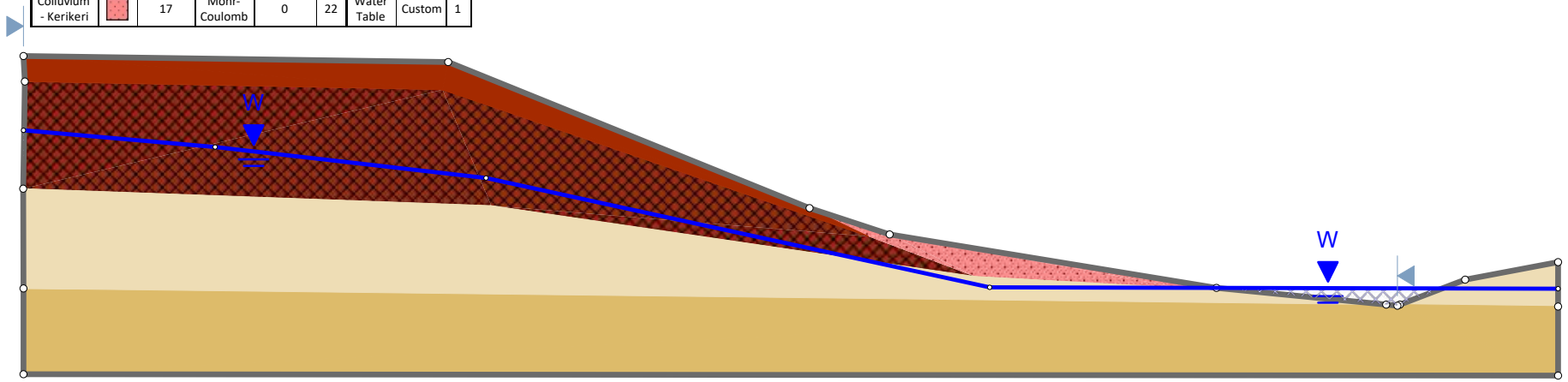
Callum Sands

(Director, Geotechnical Engineer)

BE(Hons), CPEng, MEngNZ

Appendix D – Slide2 Analysis

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Weathred Tuff - Silty Soils		18	Mohr-Coulomb	2	28	Water Table	Custom	1
Saprolitic Basalt		20	Mohr-Coulomb	3	30	Water Table	Custom	1
HW Sandstone		20	Mohr-Coulomb	5	32	Water Table	Custom	1
MW Sandstone		22	Mohr-Coulomb	1	36	Water Table	Custom	1
Colluvium - Kerikeri		17	Mohr-Coulomb	0	22	Water Table	Custom	1

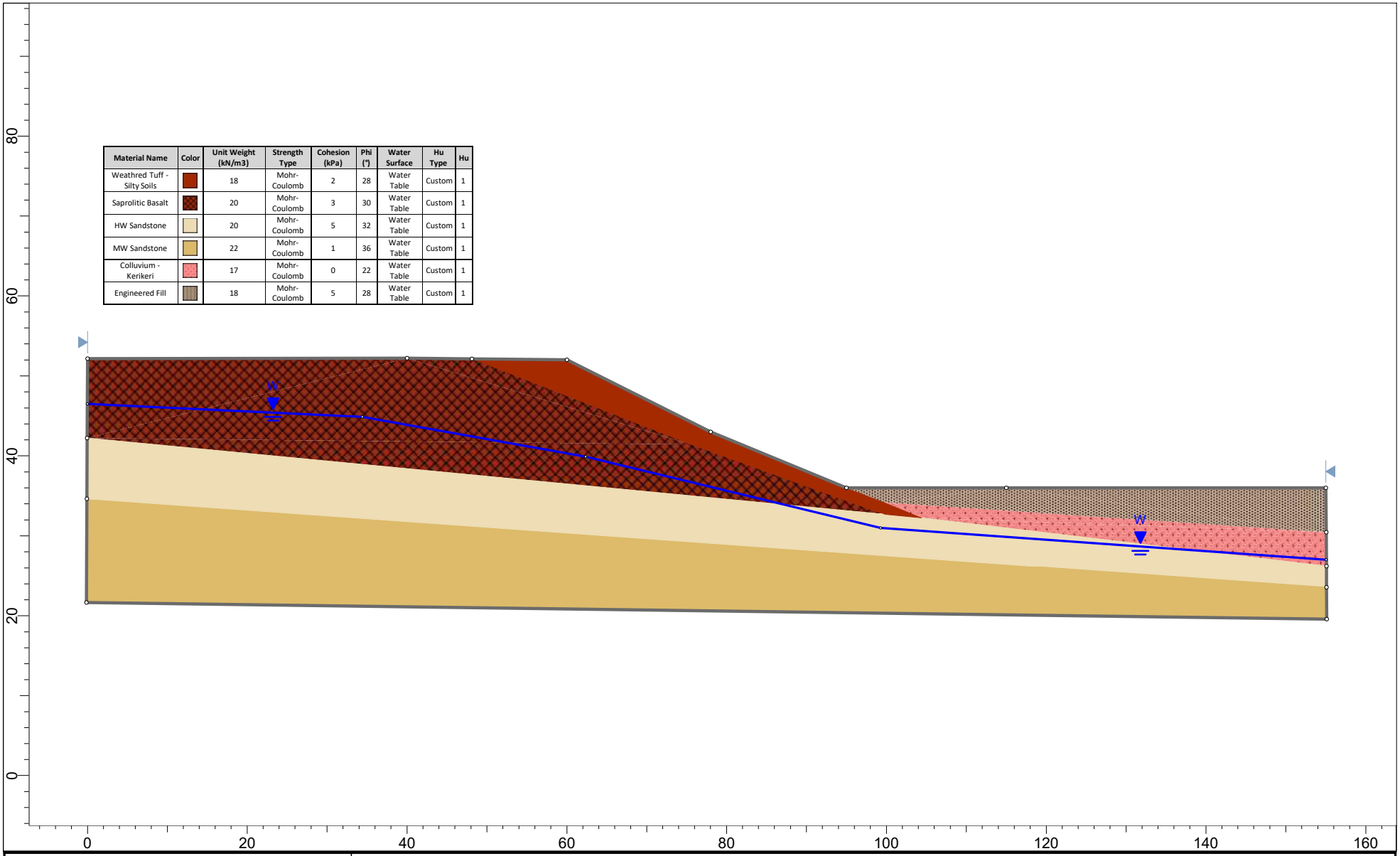


Hawthorn Geddes engineers & architects ltd

SLIDEINTERPRET 9.040

Project	Slide2 - An Interactive Slope Stability Program		
Group	Zone B - Critical Slope Section	*Scenario*	Master Scenario
Drawn By		*Company*	
Date	10/11/2025, 10:59:16 AM	*File Name*	calc 251110 slide analysis.slmd

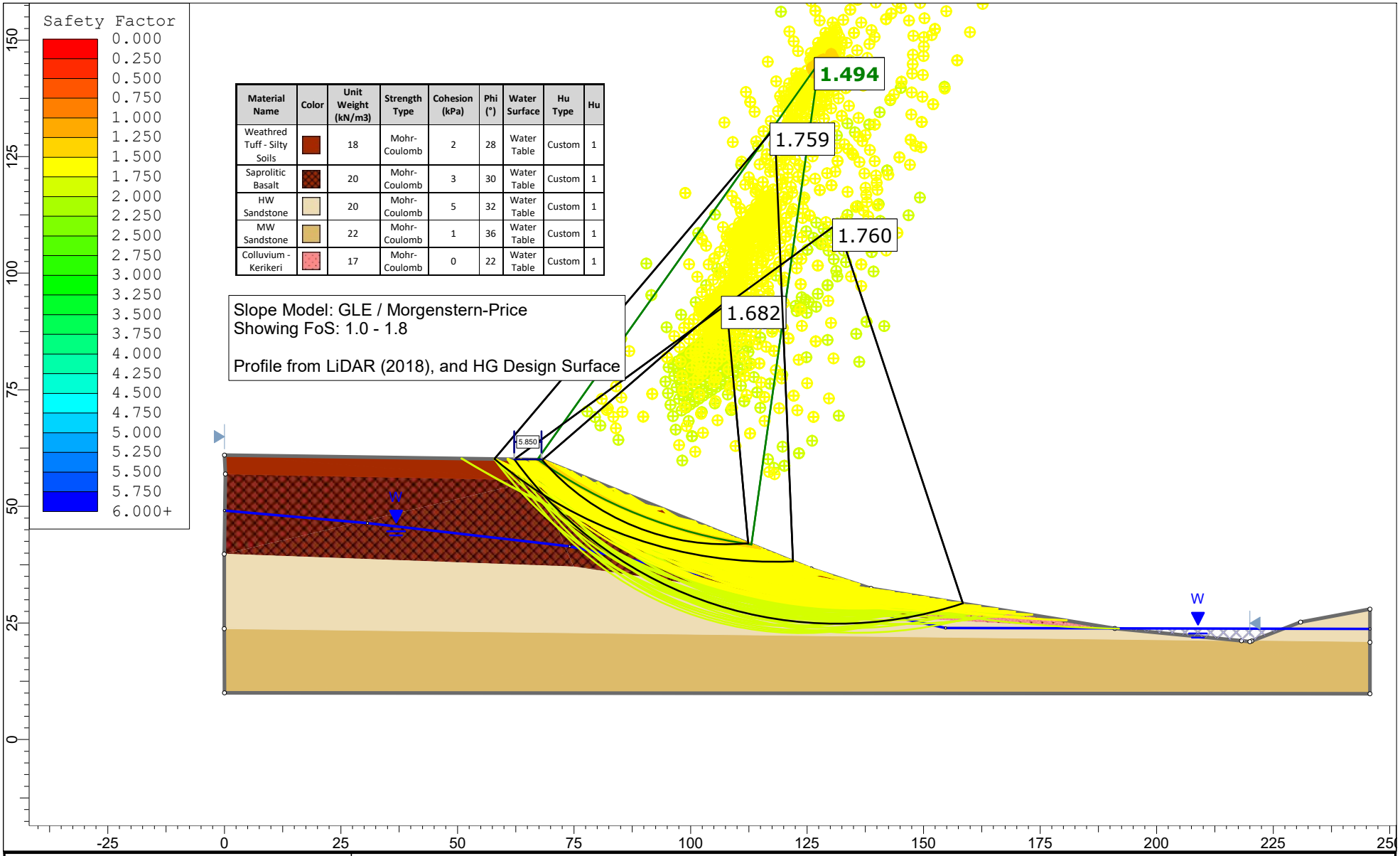
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Weathred Tuff - Silty Soils		18	Mohr-Coulomb	2	28	Water Table	Custom	1
Saprolitic Basalt		20	Mohr-Coulomb	3	30	Water Table	Custom	1
HW Sandstone		20	Mohr-Coulomb	5	32	Water Table	Custom	1
MW Sandstone		22	Mohr-Coulomb	1	36	Water Table	Custom	1
Colluvium - Kerikeri		17	Mohr-Coulomb	0	22	Water Table	Custom	1
Engineered Fill		18	Mohr-Coulomb	5	28	Water Table	Custom	1



Hawthorn Geddes engineers & architects ltd

SLIDEINTERPRET 9.040

Project	Slide2 - An Interactive Slope Stability Program		
Group	Zone D - Critical Slope Section	*Scenario*	Master Scenario
Drawn By		*Company*	
Date	10/11/2025, 10:59:16 AM	*File Name*	calc 251110 slide analysis.slmd



Hawthorn Geddes engineers & architects ltd

SLIDEINTERPRET 9.040

Project	Slide2 - An Interactive Slope Stability Program		
Group	Zone B - Critical Slope Section	*Scenario*	normal groundwater
Drawn By		*Company*	
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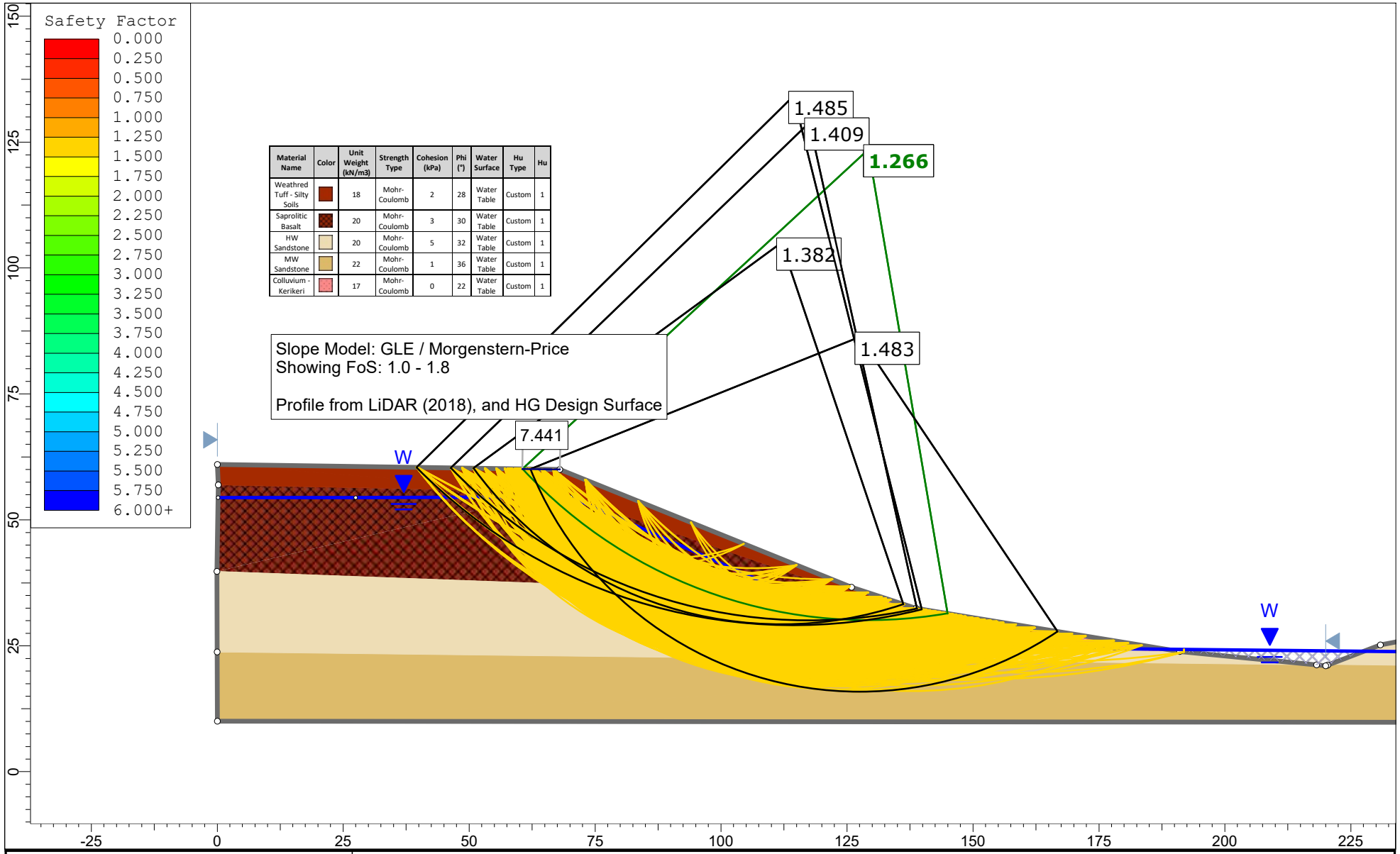

Hawthorn Geddes engineers & architects ltd

SLIDEINTERPRET 9.040

Project	Slide2 - An Interactive Slope Stability Program		
Group	Zone B - Critical Slope Section	*Scenario*	elevated groundwater
Drawn By		*Company*	
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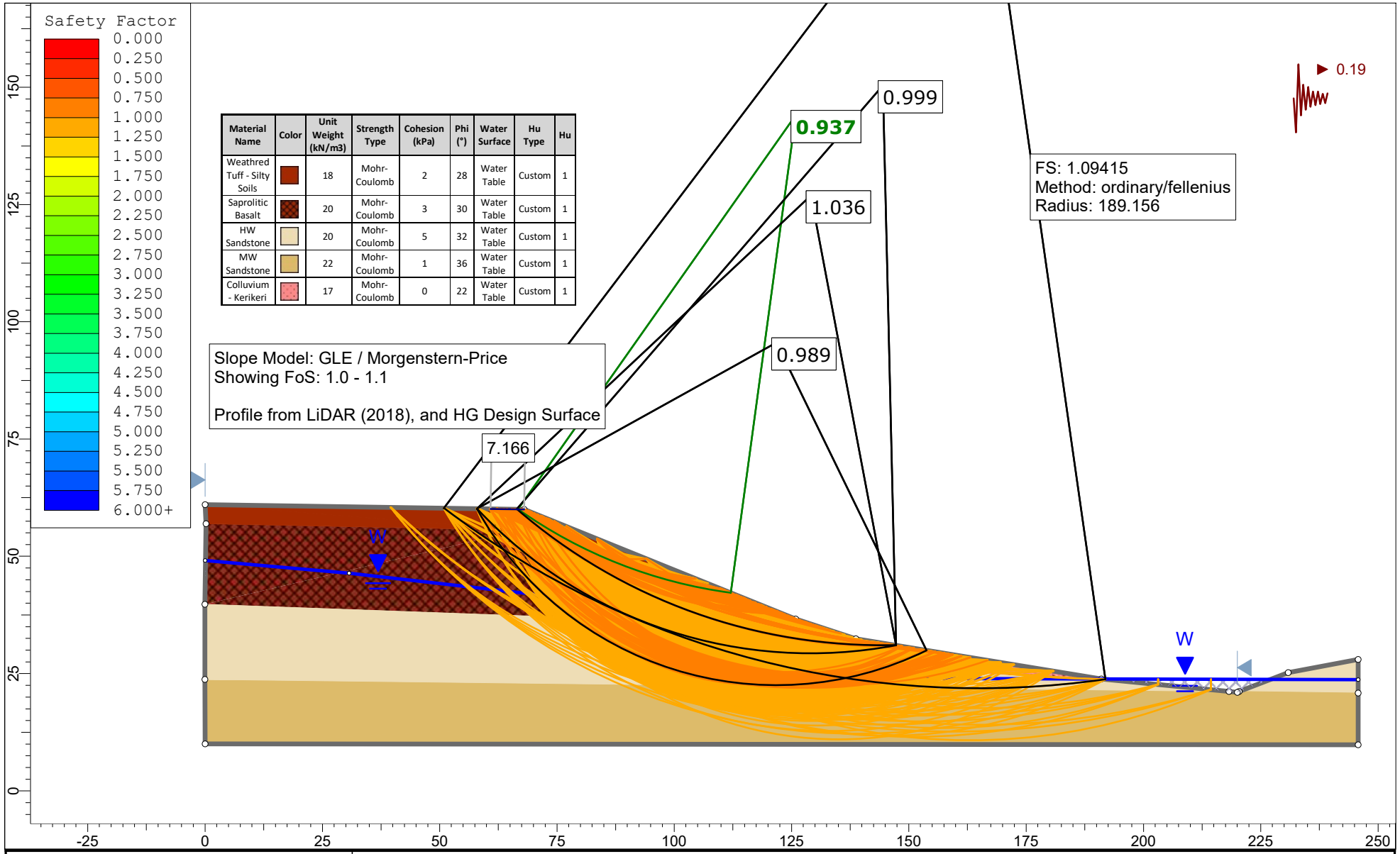

Hawthorn Geddes engineers & architects ltd

SLIDEINTERPRET 9.040

Project	Slide2 - An Interactive Slope Stability Program		
Group	Zone B - Critical Slope Section	Scenario	seismic
Drawn By		Company	
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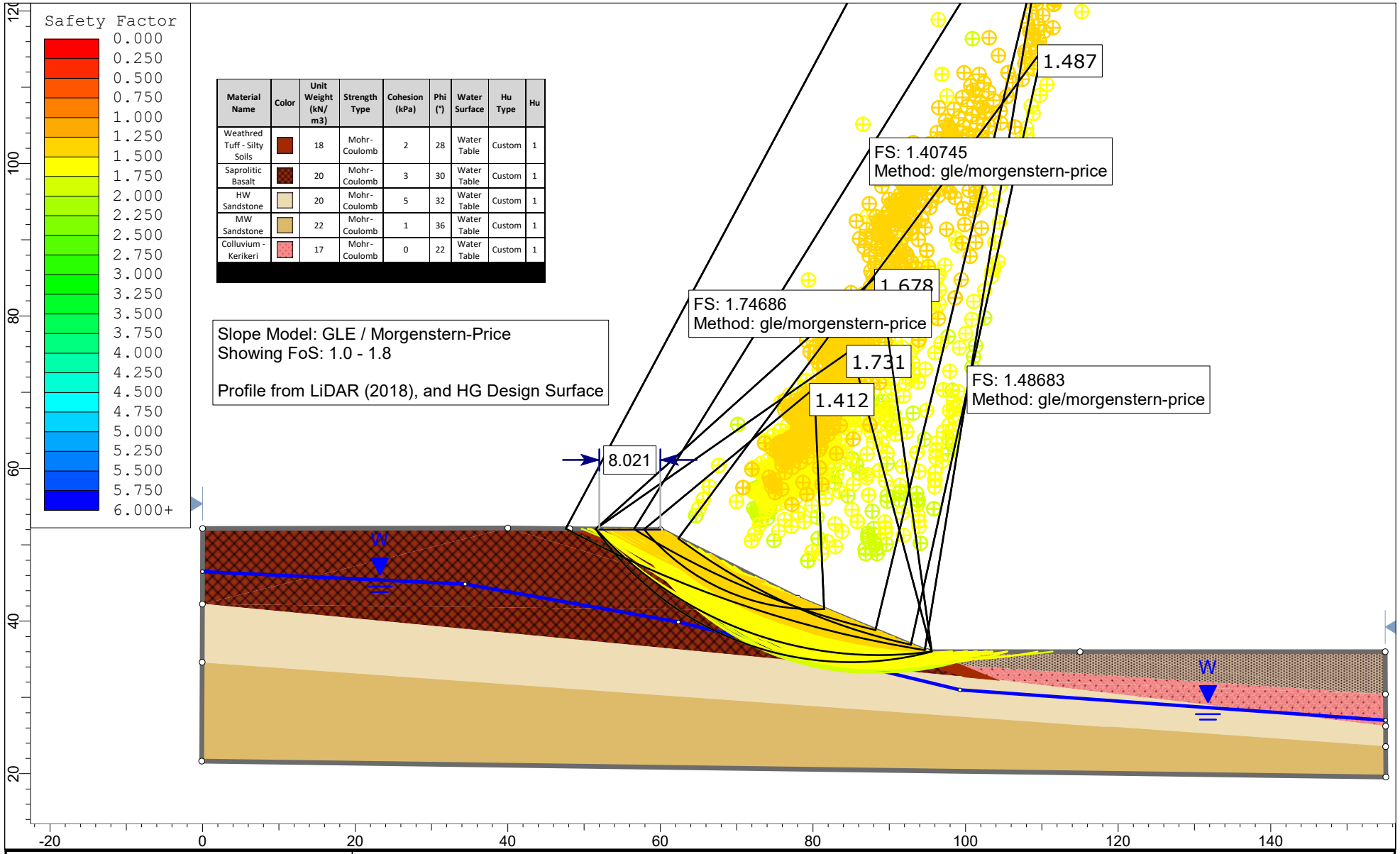

Hawthorn Geddes engineers & architects ltd

SLIDEINTERPRET 9.040

Project	Slide2 - An Interactive Slope Stability Program		
Group	Zone D - Critical Slope Section	*Scenario*	normal groundwater
Drawn By		*Company*	
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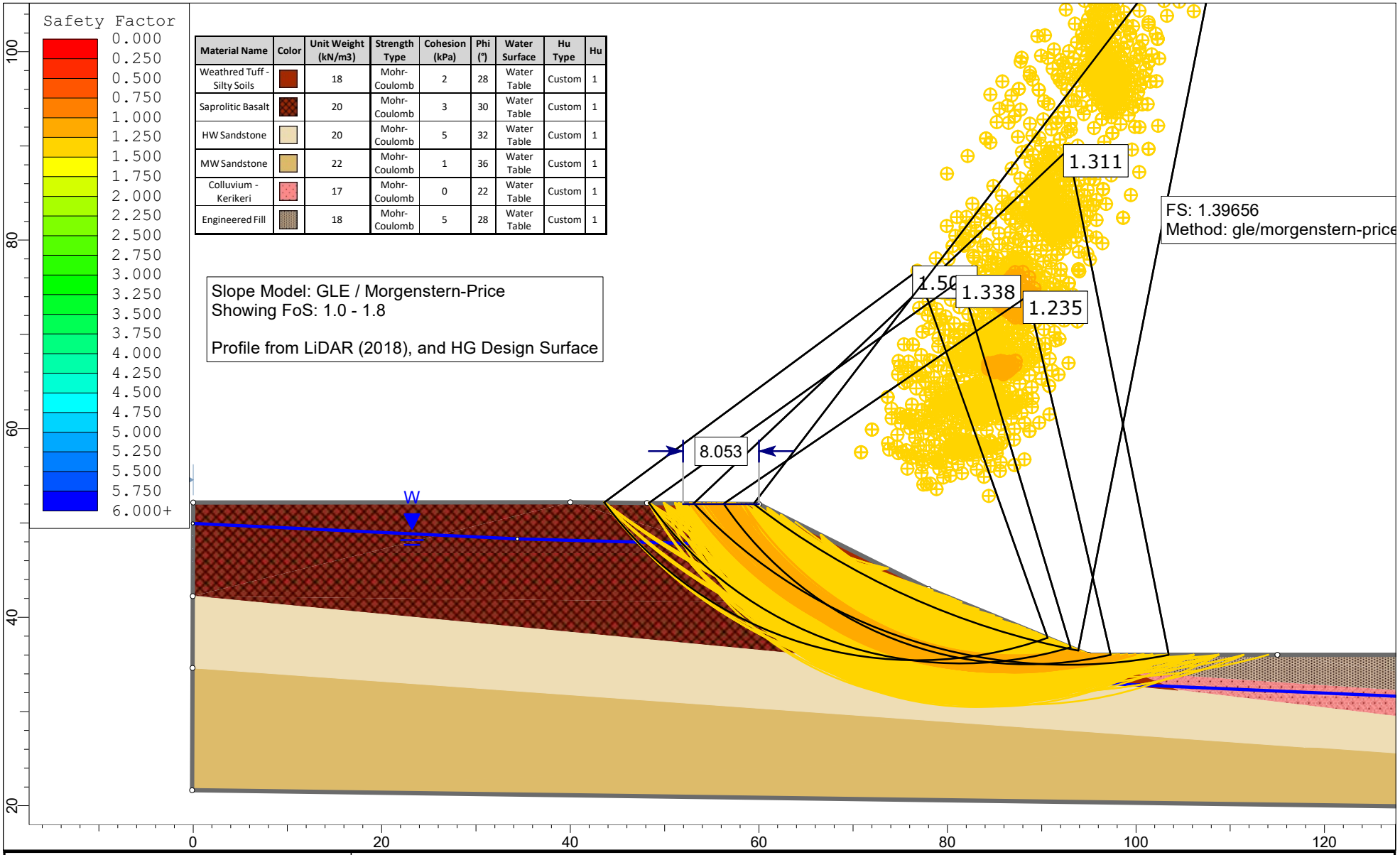
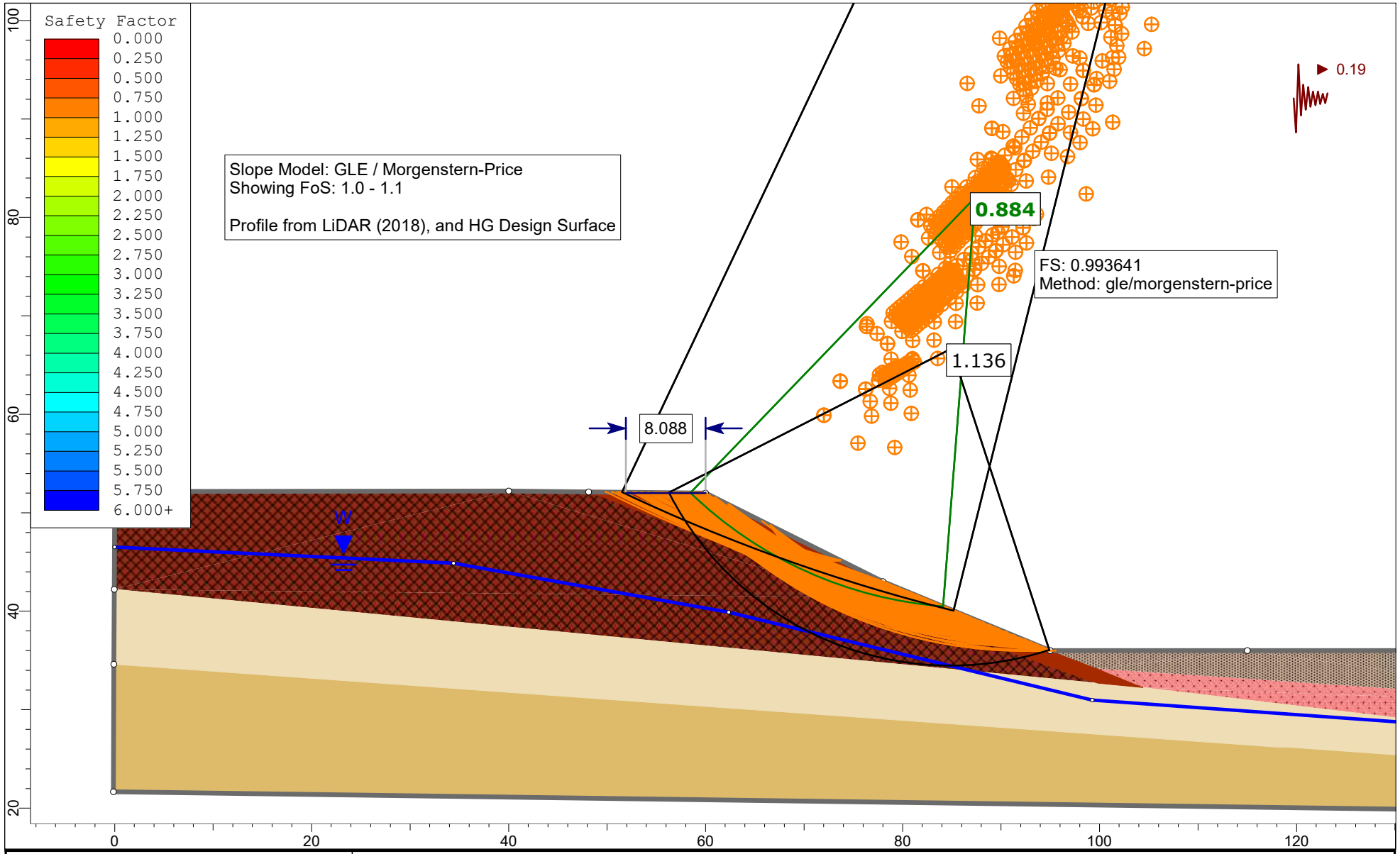


Hawthorn Geddes engineers & architects ltd

SLIDEINTERPRET 9.040

Project	Slide2 - An Interactive Slope Stability Program		
Group	Zone D - Critical Slope Section	*Scenario*	elevated groundwater
Drawn By		*Company*	
Date	10/11/2025, 10:59:16 AM	*File Name*	calc 251110 slide analysis.slmd



Hawthorn Geddes engineers & architects ltd	*Project*	Slide2 - An Interactive Slope Stability Program	
	Group	Zone D - Critical Slope Section	*Scenario* seismic
	Drawn By		*Company*
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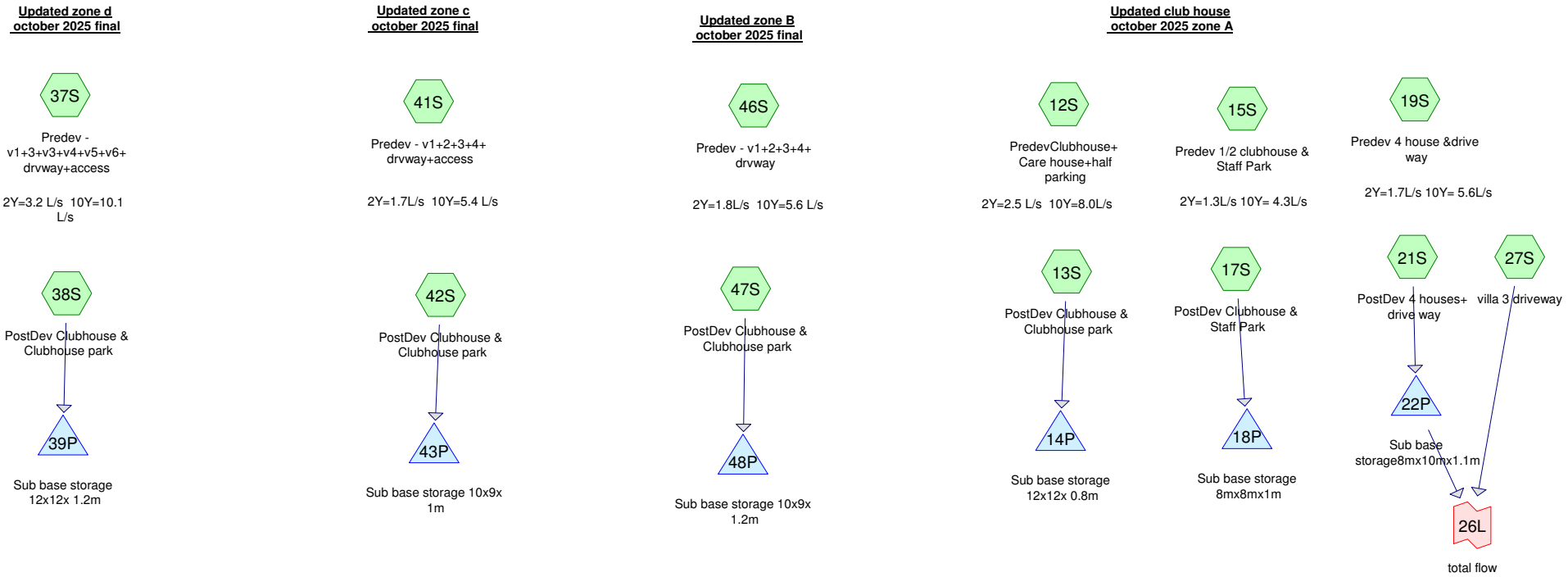
Appendix E – Hydrocad Outputs



Routing Diagram for Clubhouse SW Rev Linta 24 Nov 2017 - Aj

Prepared by Hawthorn Geddes Eng & Arch Ltd, Printed 7/11/2025

Summary for Pond 14P: Sub base storage 12x12x 0.8m

Inflow Area = 0.1563 ha,100.00% Impervious, Inflow Depth > 76 mm for 2 years event
Inflow = 0.01049 m³/s @ 7.86 hrs, Volume= 0.119 Ml
Outflow = 0.00237 m³/s @ 9.84 hrs, Volume= 0.104 Ml, Atten= 77%, Lag= 119.2 min
Primary = 0.00237 m³/s @ 9.84 hrs, Volume= 0.104 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.774 m @ 9.84 hrs Surf.Area= 121.0 m² Storage= 35.6 m³

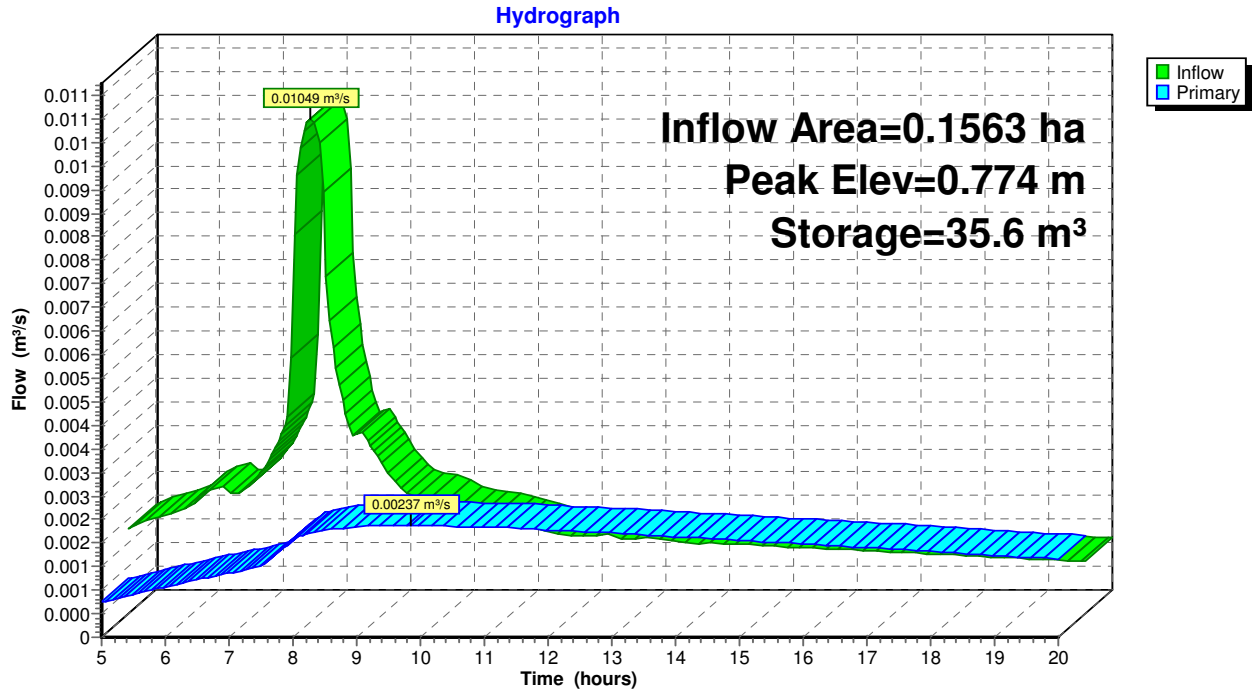
Plug-Flow detention time= 187.6 min calculated for 0.104 Ml (87% of inflow)
Center-of-Mass det. time= 120.5 min (765.4 - 644.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	55.2 m³	**11.00 mW x 11.00 mL x 1.20 mH Prismatoid** 145.2 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**35 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.800 m	**65 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00237 m³/s @ 9.84 hrs HW=0.774 m (Free Discharge)
└─**1=Culvert** (Passes 0.00237 m³/s of 0.01591 m³/s potential flow)
└─**2=Orifice/Grate** (Orifice Controls 0.00237 m³/s @ 2.46 m/s)
└─**3=Orifice/Grate** (Controls 0.00000 m³/s)

Pond 14P: Sub base storage 12x12x 0.8m



Summary for Pond 18P: Sub base storage 8mx8mx1m

Inflow Area = 0.0838 ha,100.00% Impervious, Inflow Depth > 76 mm for 2 years event
Inflow = 0.00563 m³/s @ 7.86 hrs, Volume= 0.064 Ml
Outflow = 0.00120 m³/s @ 10.07 hrs, Volume= 0.054 Ml, Atten= 79%, Lag= 132.6 min
Primary = 0.00120 m³/s @ 10.07 hrs, Volume= 0.054 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.735 m @ 10.07 hrs Surf.Area= 72.0 m² Storage= 20.1 m³

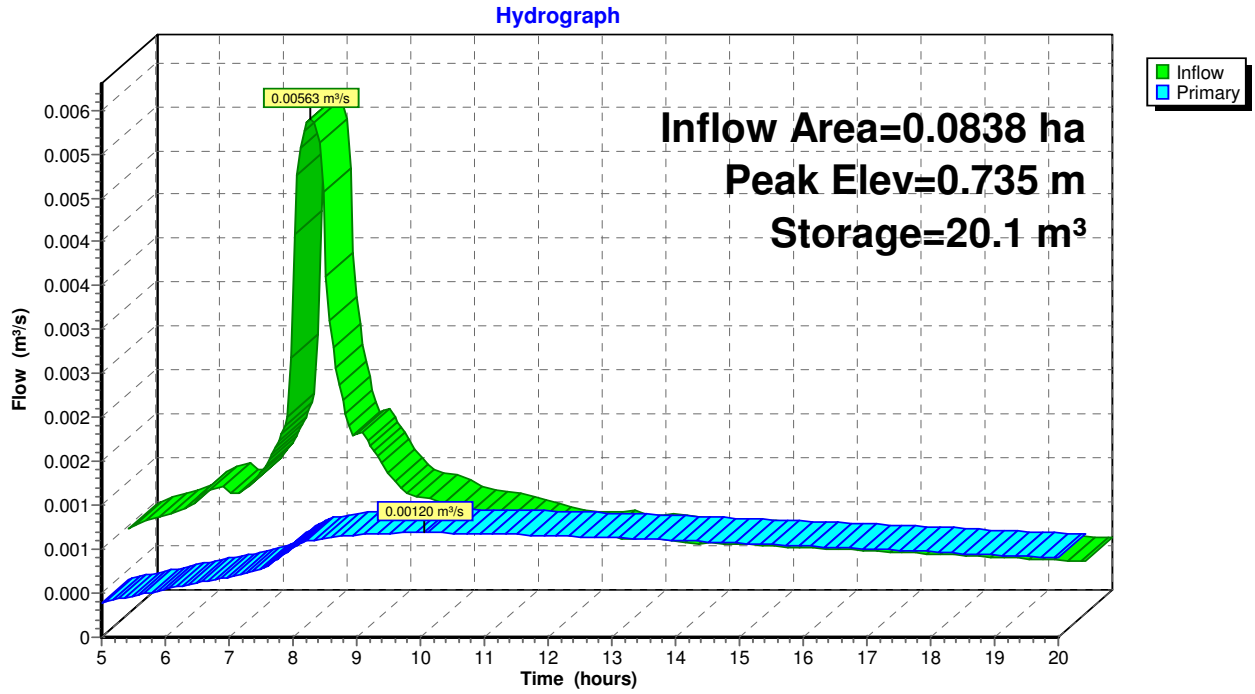
Plug-Flow detention time= 209.4 min calculated for 0.053 Ml (83% of inflow)
Center-of-Mass det. time= 126.1 min (770.9 - 644.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	30.1 m³	**8.00 mW x 9.00 mL x 1.10 mH Prismatoid** 79.2 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**25 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.730 m	**50 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00120 m³/s @ 10.07 hrs HW=0.735 m (Free Discharge)
└─**1=Culvert** (Passes 0.00120 m³/s of 0.01555 m³/s potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.00118 m³/s @ 2.41 m/s)
  └─**3=Orifice/Grate** (Orifice Controls 0.00002 m³/s @ 0.14 m/s)

Pond 18P: Sub base storage 8mx8mx1m



Summary for Pond 22P: Sub base storage8mx10mx1.1m

Inflow Area = 0.1024 ha,100.00% Impervious, Inflow Depth > 76 mm for 2 years event
Inflow = 0.00687 m³/s @ 7.86 hrs, Volume= 0.078 Ml
Outflow = 0.00127 m³/s @ 11.09 hrs, Volume= 0.058 Ml, Atten= 82%, Lag= 194.1 min
Primary = 0.00127 m³/s @ 11.09 hrs, Volume= 0.058 Ml
Routed to Link 26L : total flow

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.942 m @ 11.09 hrs Surf.Area= 80.0 m² Storage= 28.6 m³

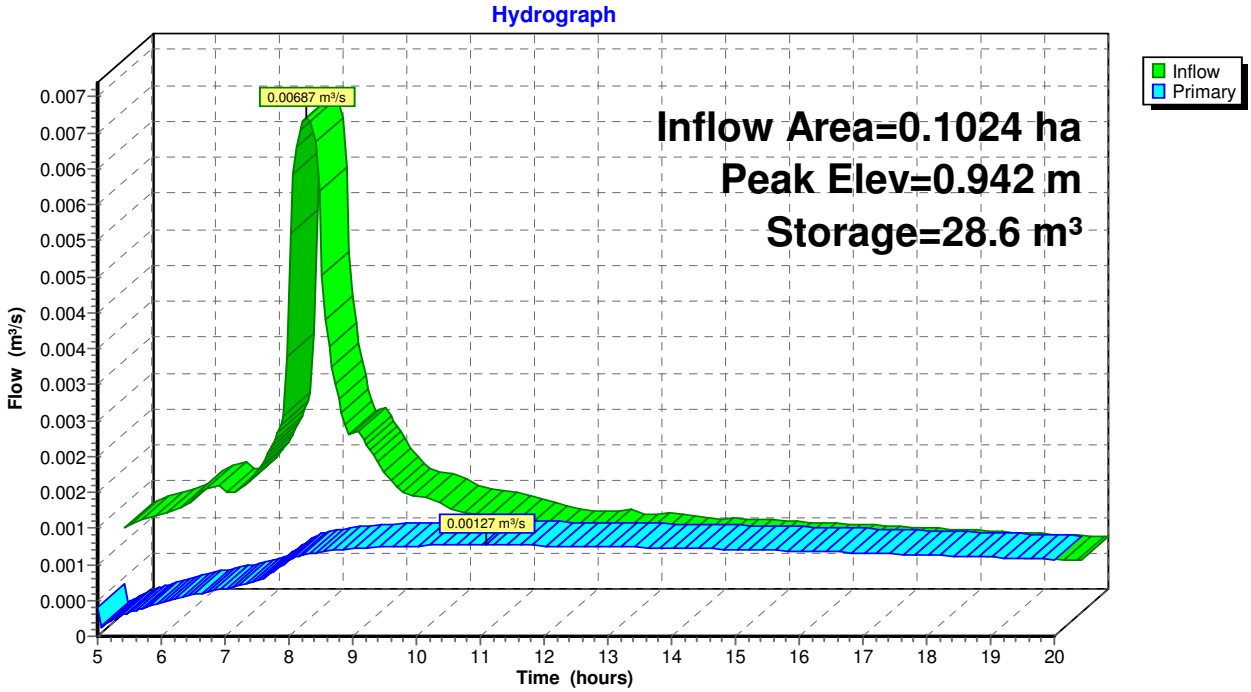
Plug-Flow detention time= 266.9 min calculated for 0.058 Ml (74% of inflow)
Center-of-Mass det. time= 143.4 min (788.3 - 644.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	39.5 m³	**8.00 mW x 10.00 mL x 1.30 mH Prismatoid** 104.0 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**25 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.942 m	**60 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00127 m³/s @ 11.09 hrs HW=0.942 m TW=0.000 m (Dynamic Tailwater)
↑└─**1=Culvert** (Passes 0.00127 m³/s of 0.01651 m³/s potential flow)
↑ ├─**2=Orifice/Grate** (Orifice Controls 0.00127 m³/s @ 2.58 m/s)
└─**3=Orifice/Grate** (Orifice Controls 0.00000 m³/s @ 0.02 m/s)

Pond 22P: Sub base storage8mx10mx1.1m



Summary for Pond 39P: Sub base storage 12x12x 1.2m

Inflow Area = 0.1970 ha,100.00% Impervious, Inflow Depth > 76 mm for 2 years event
Inflow = 0.01322 m³/s @ 7.86 hrs, Volume= 0.151 Ml
Outflow = 0.00312 m³/s @ 9.47 hrs, Volume= 0.134 Ml, Atten= 76%, Lag= 97.1 min
Primary = 0.00312 m³/s @ 9.47 hrs, Volume= 0.134 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.791 m @ 9.47 hrs Surf.Area= 144.0 m² Storage= 43.3 m³

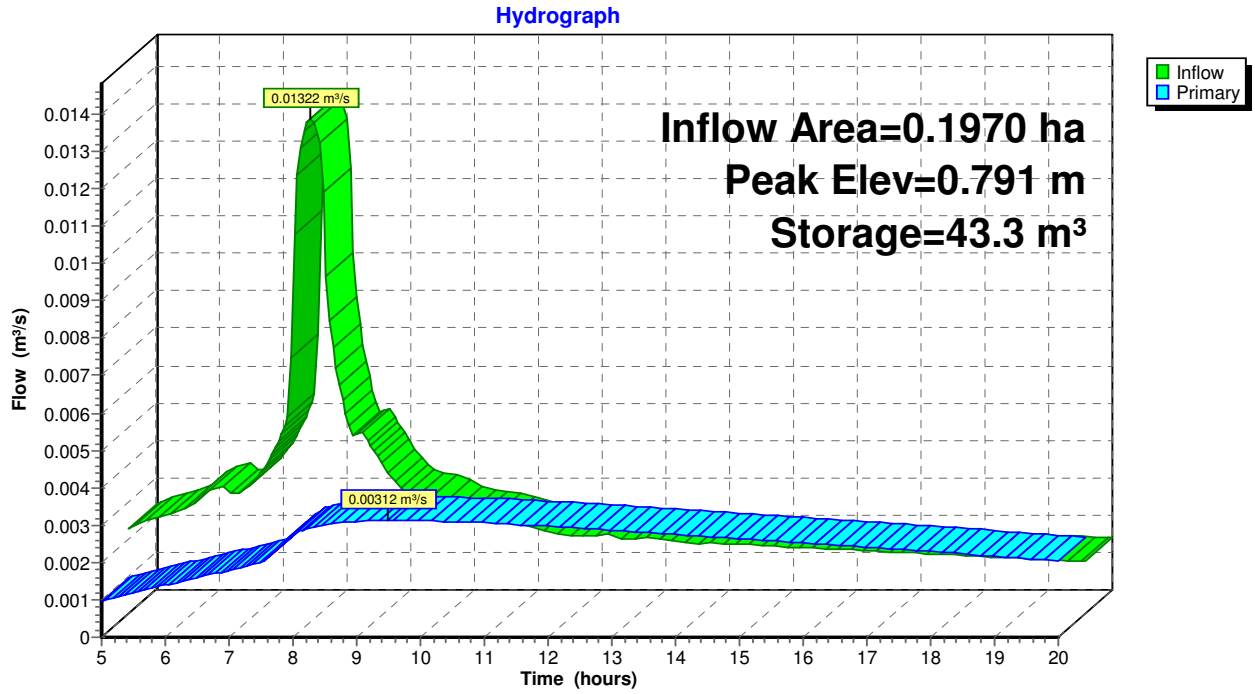
Plug-Flow detention time= 173.2 min calculated for 0.134 Ml (89% of inflow)
Center-of-Mass det. time= 116.2 min (761.1 - 644.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	65.7 m³	**12.00 mW x 12.00 mL x 1.20 mH Prismatoid** 172.8 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**40 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.800 m	**70 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00312 m³/s @ 9.47 hrs HW=0.791 m (Free Discharge)
└**1=Culvert** (Passes 0.00312 m³/s of 0.01606 m³/s potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.00312 m³/s @ 2.48 m/s)
└**3=Orifice/Grate** (Controls 0.00000 m³/s)

Pond 39P: Sub base storage 12x12x 1.2m



Summary for Pond 43P: Sub base storage 10x9x 1m

Inflow Area = 0.1055 ha,100.00% Impervious, Inflow Depth > 76 mm for 2 years event
Inflow = 0.00708 m³/s @ 7.86 hrs, Volume= 0.081 Ml
Outflow = 0.00164 m³/s @ 9.71 hrs, Volume= 0.072 Ml, Atten= 77%, Lag= 111.2 min
Primary = 0.00164 m³/s @ 9.71 hrs, Volume= 0.072 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.680 m @ 9.71 hrs Surf.Area= 90.0 m² Storage= 23.3 m³

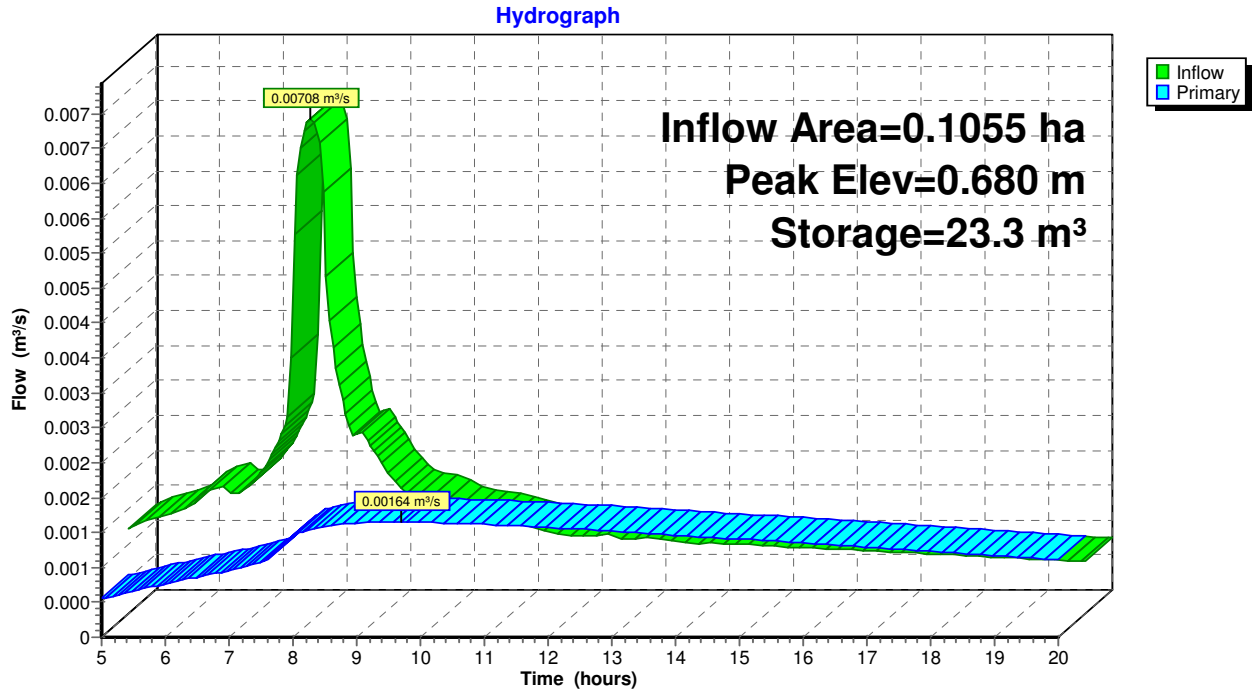
Plug-Flow detention time= 175.6 min calculated for 0.071 Ml (88% of inflow)
Center-of-Mass det. time= 116.9 min (761.8 - 644.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	34.2 m³	**10.00 mW x 9.00 mL x 1.00 mH Prismatoid** 90.0 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**30 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.680 m	**55 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00164 m³/s @ 9.71 hrs HW=0.680 m (Free Discharge)
└**1=Culvert** (Passes 0.00164 m³/s of 0.01503 m³/s potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.00164 m³/s @ 2.32 m/s)
└**3=Orifice/Grate** (Orifice Controls 0.00000 m³/s @ 0.03 m/s)

Pond 43P: Sub base storage 10x9x 1m



Summary for Pond 48P: Sub base storage 10x9x 1.2m

Inflow Area = 0.1095 ha,100.00% Impervious, Inflow Depth > 76 mm for 2 years event
Inflow = 0.00735 m³/s @ 7.86 hrs, Volume= 0.084 Ml
Outflow = 0.00168 m³/s @ 9.78 hrs, Volume= 0.074 Ml, Atten= 77%, Lag= 115.3 min
Primary = 0.00168 m³/s @ 9.78 hrs, Volume= 0.074 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.717 m @ 9.78 hrs Surf.Area= 90.0 m² Storage= 24.5 m³

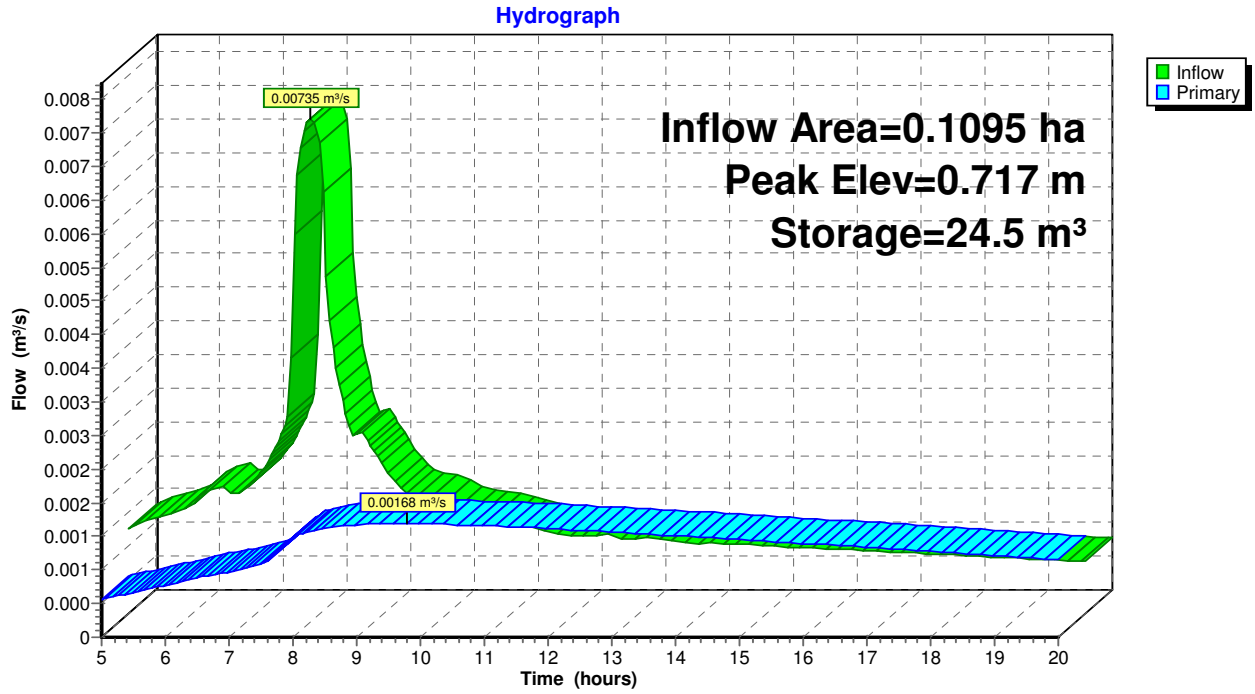
Plug-Flow detention time= 181.2 min calculated for 0.074 Ml (88% of inflow)
Center-of-Mass det. time= 118.6 min (763.4 - 644.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	41.0 m³	**10.00 mW x 9.00 mL x 1.20 mH Prismatoid** 108.0 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**30 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.717 m	**55 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00168 m³/s @ 9.78 hrs HW=0.717 m (Free Discharge)
└**1=Culvert** (Passes 0.00168 m³/s of 0.01538 m³/s potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.00168 m³/s @ 2.38 m/s)
└**3=Orifice/Grate** (Controls 0.00000 m³/s)

Pond 48P: Sub base storage 10x9x 1.2m

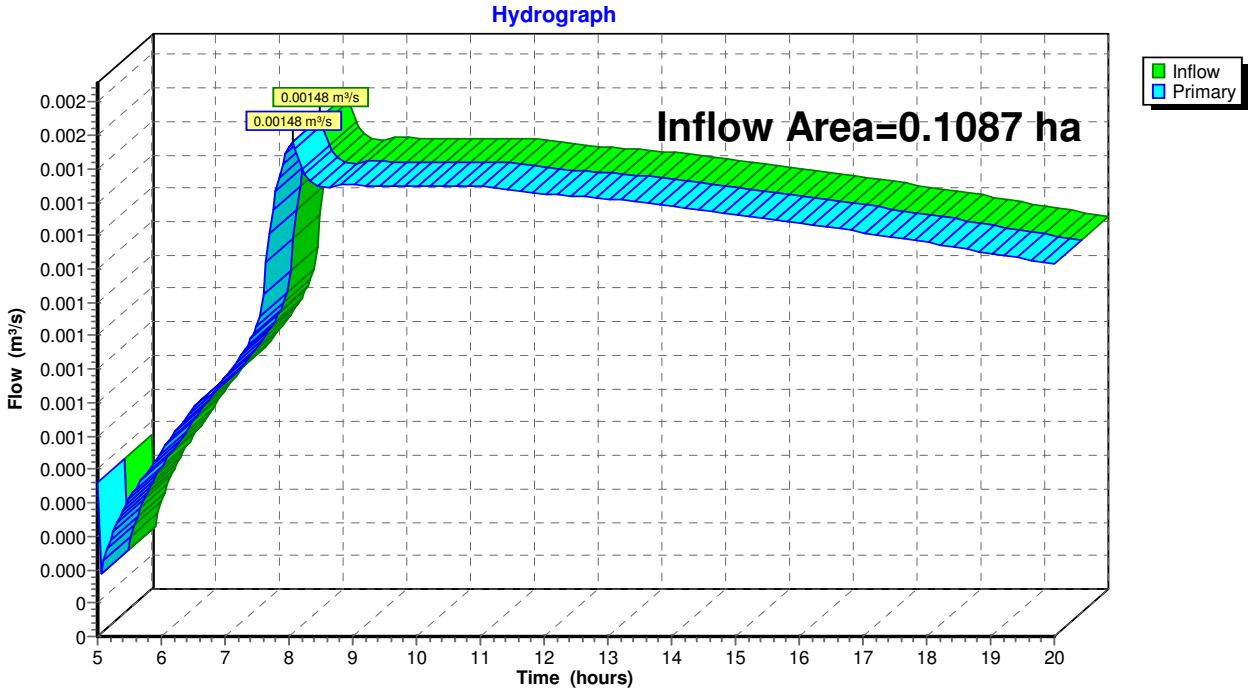


Summary for Link 26L: total flow

Inflow Area = 0.1087 ha,100.00% Impervious, Inflow Depth > 58 mm for 2 years event
Inflow = 0.00148 m³/s @ 8.05 hrs, Volume= 0.063 Ml
Primary = 0.00148 m³/s @ 8.05 hrs, Volume= 0.063 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 26L: total flow



Summary for Pond 14P: Sub base storage 12x12x 0.8m

Inflow Area = 0.1563 ha,100.00% Impervious, Inflow Depth > 127 mm for 10 years event
Inflow = 0.01744 m³/s @ 7.85 hrs, Volume= 0.198 Ml
Outflow = 0.00752 m³/s @ 8.35 hrs, Volume= 0.166 Ml, Atten= 57%, Lag= 29.8 min
Primary = 0.00752 m³/s @ 8.35 hrs, Volume= 0.166 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.119 m @ 8.35 hrs Surf.Area= 121.0 m² Storage= 51.4 m³

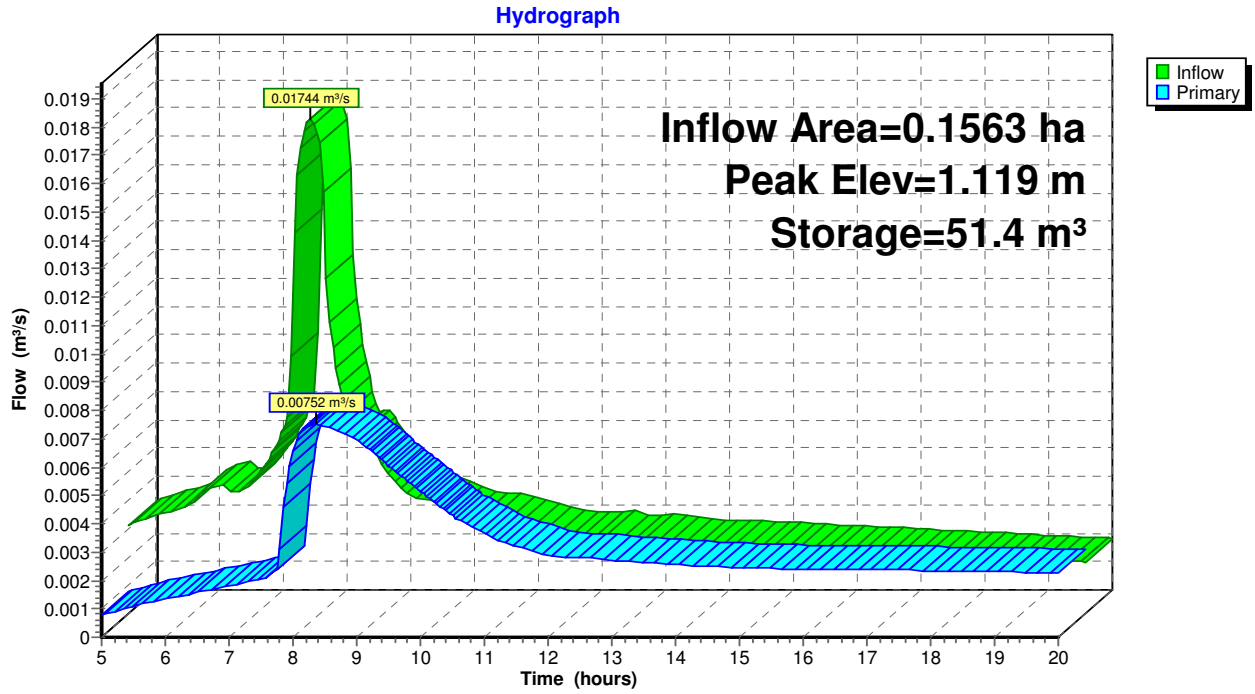
Plug-Flow detention time= 159.5 min calculated for 0.165 Ml (83% of inflow)
Center-of-Mass det. time= 76.6 min (720.0 - 643.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	55.2 m³	**11.00 mW x 11.00 mL x 1.20 mH Prismatoid** 145.2 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**35 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.800 m	**65 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00752 m³/s @ 8.35 hrs HW=1.119 m (Free Discharge)
└─**1=Culvert** (Passes 0.00752 m³/s of 0.01878 m³/s potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.00280 m³/s @ 2.91 m/s)
  └─**3=Orifice/Grate** (Orifice Controls 0.00472 m³/s @ 1.42 m/s)

Pond 14P: Sub base storage 12x12x 0.8m



Summary for Pond 18P: Sub base storage 8mx8mx1m

Inflow Area = 0.0838 ha,100.00% Impervious, Inflow Depth > 127 mm for 10 years event
Inflow = 0.00935 m³/s @ 7.85 hrs, Volume= 0.106 Ml
Outflow = 0.00408 m³/s @ 8.34 hrs, Volume= 0.087 Ml, Atten= 56%, Lag= 29.3 min
Primary = 0.00408 m³/s @ 8.34 hrs, Volume= 0.087 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.023 m @ 8.34 hrs Surf.Area= 72.0 m² Storage= 28.0 m³

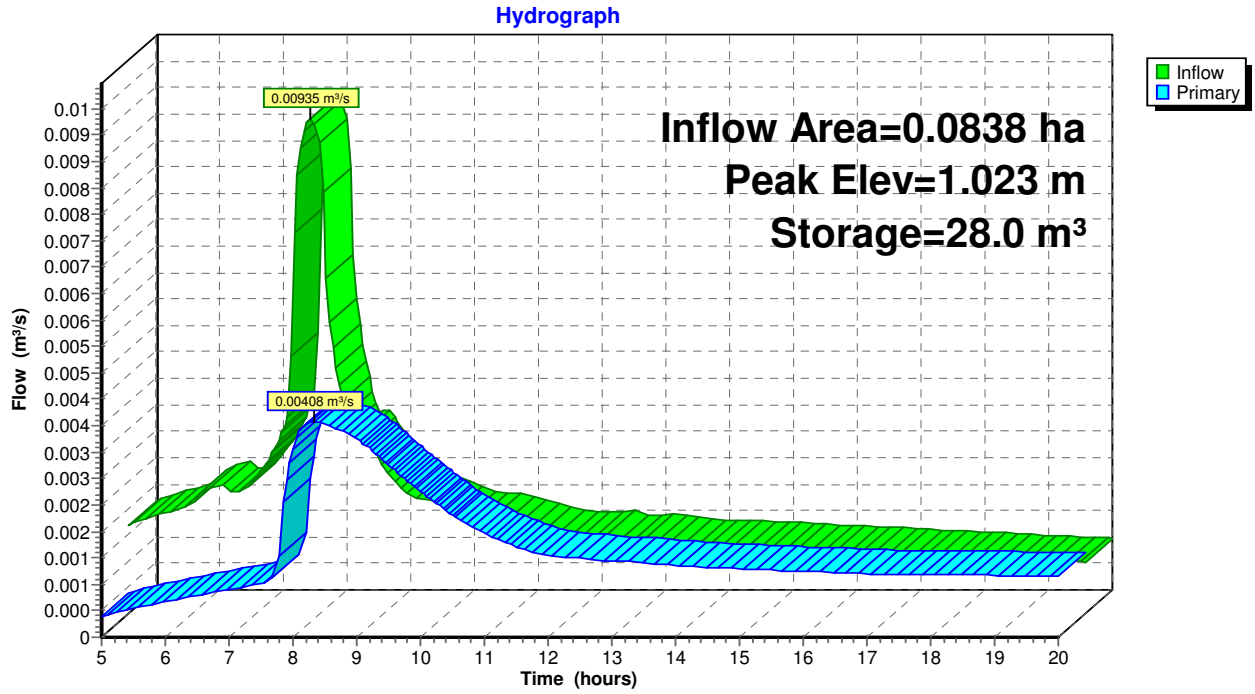
Plug-Flow detention time= 163.1 min calculated for 0.087 Ml (82% of inflow)
Center-of-Mass det. time= 73.1 min (716.5 - 643.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	30.1 m³	**8.00 mW x 9.00 mL x 1.10 mH Prismatoid** 79.2 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**25 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.730 m	**50 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00408 m³/s @ 8.34 hrs HW=1.023 m (Free Discharge)
└**1=Culvert** (Passes 0.00408 m³/s of 0.01803 m³/s potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.00137 m³/s @ 2.80 m/s)
└**3=Orifice/Grate** (Orifice Controls 0.00270 m³/s @ 1.38 m/s)

Pond 18P: Sub base storage 8mx8mx1m



Summary for Pond 22P: Sub base storage8mx10mx1.1m

Inflow Area = 0.1024 ha,100.00% Impervious, Inflow Depth > 127 mm for 10 years event
Inflow = 0.01143 m³/s @ 7.85 hrs, Volume= 0.130 Ml
Outflow = 0.00510 m³/s @ 8.32 hrs, Volume= 0.101 Ml, Atten= 55%, Lag= 28.3 min
Primary = 0.00510 m³/s @ 8.32 hrs, Volume= 0.101 Ml
Routed to Link 26L : total flow

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.210 m @ 8.32 hrs Surf.Area= 80.0 m² Storage= 36.8 m³

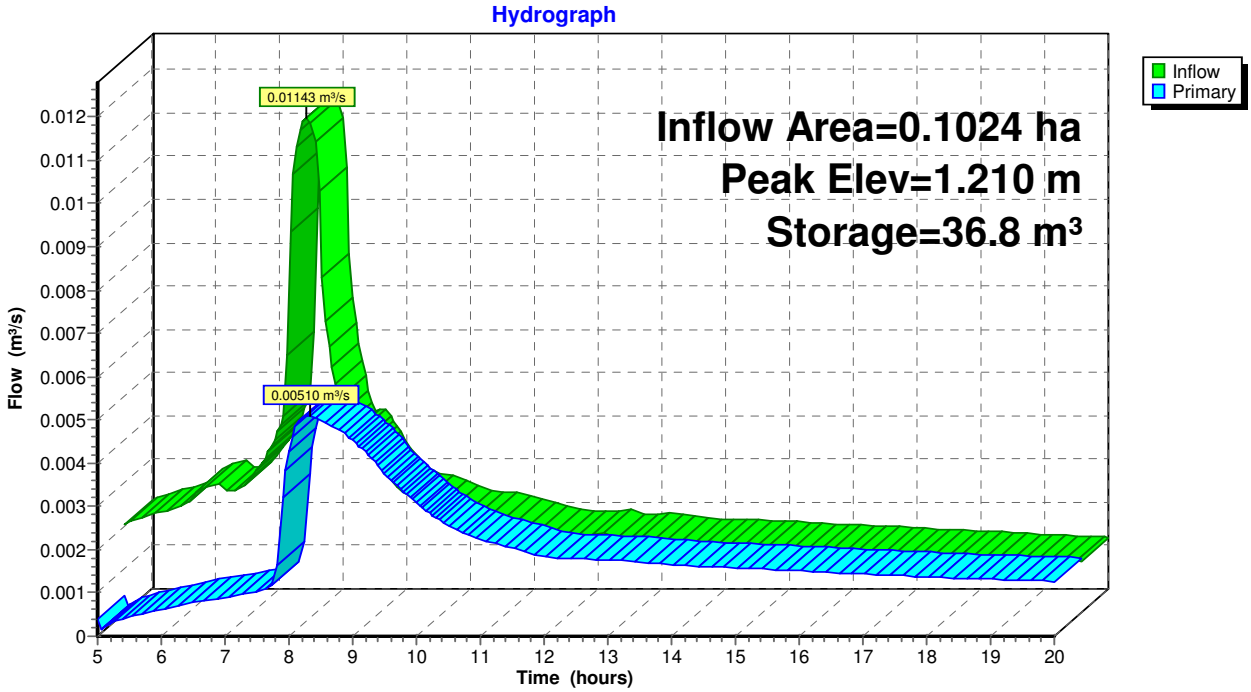
Plug-Flow detention time= 186.4 min calculated for 0.101 Ml (78% of inflow)
Center-of-Mass det. time= 78.7 min (722.1 - 643.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	39.5 m³	**8.00 mW x 10.00 mL x 1.30 mH Prismatoid** 104.0 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**25 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.942 m	**60 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00510 m³/s @ 8.32 hrs HW=1.209 m TW=0.000 m (Dynamic Tailwater)
↑└─**1=Culvert** (Passes 0.00510 m³/s of 0.01871 m³/s potential flow)
↑ ├─**2=Orifice/Grate** (Orifice Controls 0.00143 m³/s @ 2.92 m/s)
└─**3=Orifice/Grate** (Orifice Controls 0.00366 m³/s @ 1.29 m/s)

Pond 22P: Sub base storage8mx10mx1.1m



Summary for Pond 39P: Sub base storage 12x12x 1.2m

Inflow Area = 0.1970 ha,100.00% Impervious, Inflow Depth > 127 mm for 10 years event
Inflow = 0.02198 m³/s @ 7.85 hrs, Volume= 0.250 Ml
Outflow = 0.00954 m³/s @ 8.35 hrs, Volume= 0.213 Ml, Atten= 57%, Lag= 29.5 min
Primary = 0.00954 m³/s @ 8.35 hrs, Volume= 0.213 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.159 m @ 8.35 hrs Surf.Area= 144.0 m² Storage= 63.4 m³

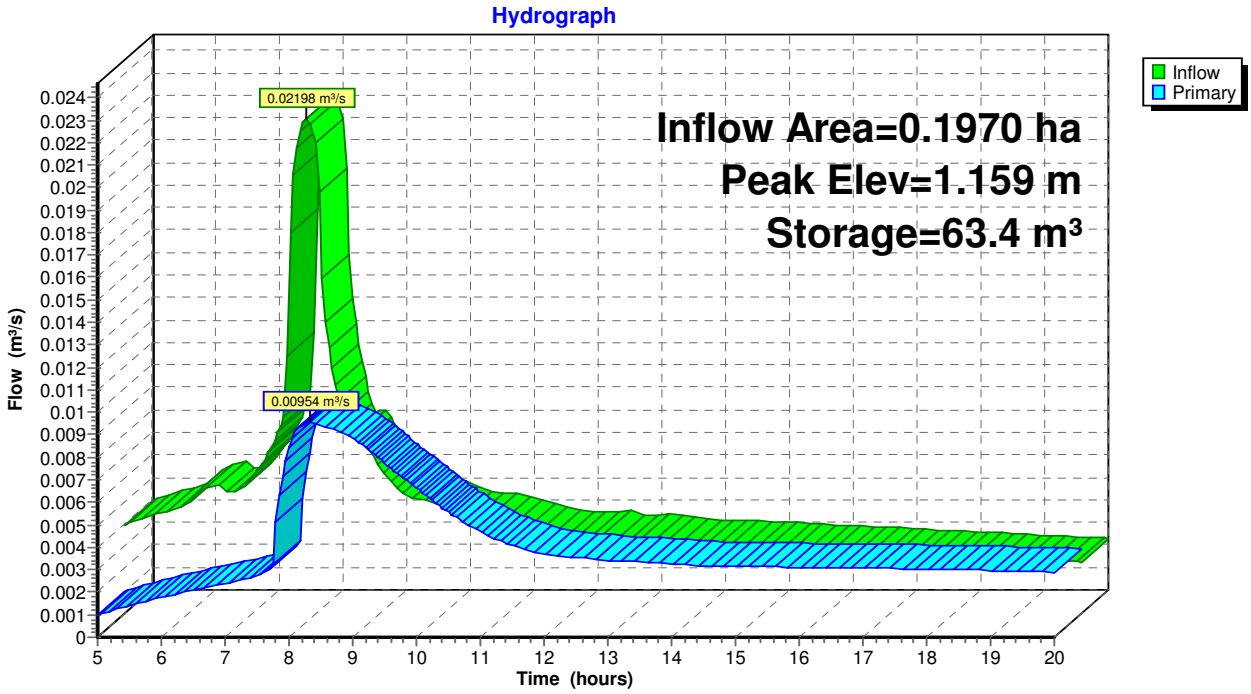
Plug-Flow detention time= 151.4 min calculated for 0.212 Ml (85% of inflow)
Center-of-Mass det. time= 75.8 min (719.2 - 643.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	65.7 m³	**12.00 mW x 12.00 mL x 1.20 mH Prismatoid** 172.8 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**40 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.800 m	**70 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00954 m³/s @ 8.35 hrs HW=1.159 m (Free Discharge)
└─**1=Culvert** (Passes 0.00954 m³/s of 0.01909 m³/s potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.00372 m³/s @ 2.96 m/s)
  └─**3=Orifice/Grate** (Orifice Controls 0.00582 m³/s @ 1.51 m/s)

Pond 39P: Sub base storage 12x12x 1.2m



Summary for Pond 43P: Sub base storage 10x9x 1m

Inflow Area = 0.1055 ha,100.00% Impervious, Inflow Depth > 127 mm for 10 years event
Inflow = 0.01177 m³/s @ 7.85 hrs, Volume= 0.134 Ml
Outflow = 0.00526 m³/s @ 8.32 hrs, Volume= 0.114 Ml, Atten= 55%, Lag= 28.2 min
Primary = 0.00526 m³/s @ 8.32 hrs, Volume= 0.114 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.984 m @ 8.32 hrs Surf.Area= 90.0 m² Storage= 33.6 m³

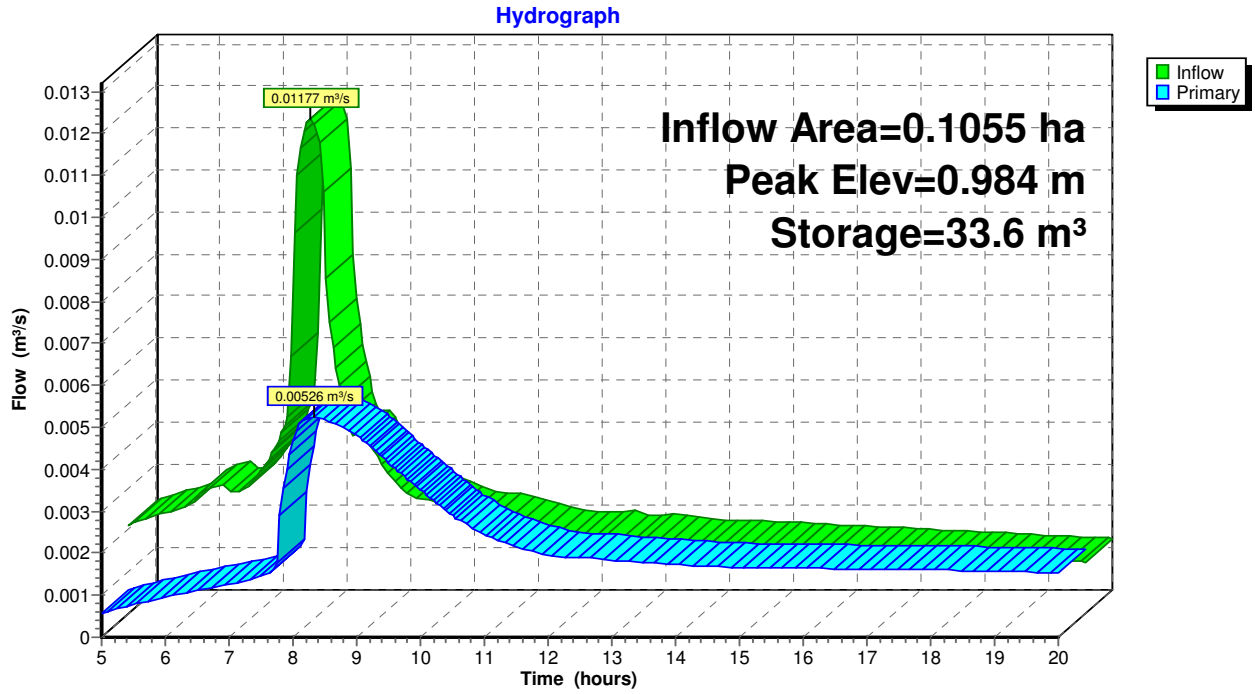
Plug-Flow detention time= 150.1 min calculated for 0.113 Ml (85% of inflow)
Center-of-Mass det. time= 73.5 min (717.0 - 643.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	34.2 m³	**10.00 mW x 9.00 mL x 1.00 mH Prismatoid** 90.0 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**30 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.680 m	**55 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00526 m³/s @ 8.32 hrs HW=0.983 m (Free Discharge)
└**1=Culvert** (Passes 0.00526 m³/s of 0.01771 m³/s potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.00194 m³/s @ 2.75 m/s)
└**3=Orifice/Grate** (Orifice Controls 0.00332 m³/s @ 1.40 m/s)

Pond 43P: Sub base storage 10x9x 1m



Summary for Pond 48P: Sub base storage 10x9x 1.2m

Inflow Area = 0.1095 ha,100.00% Impervious, Inflow Depth > 127 mm for 10 years event
Inflow = 0.01222 m³/s @ 7.85 hrs, Volume= 0.139 Ml
Outflow = 0.00538 m³/s @ 8.33 hrs, Volume= 0.118 Ml, Atten= 56%, Lag= 28.9 min
Primary = 0.00538 m³/s @ 8.33 hrs, Volume= 0.118 Ml

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.033 m @ 8.33 hrs Surf.Area= 90.0 m² Storage= 35.3 m³

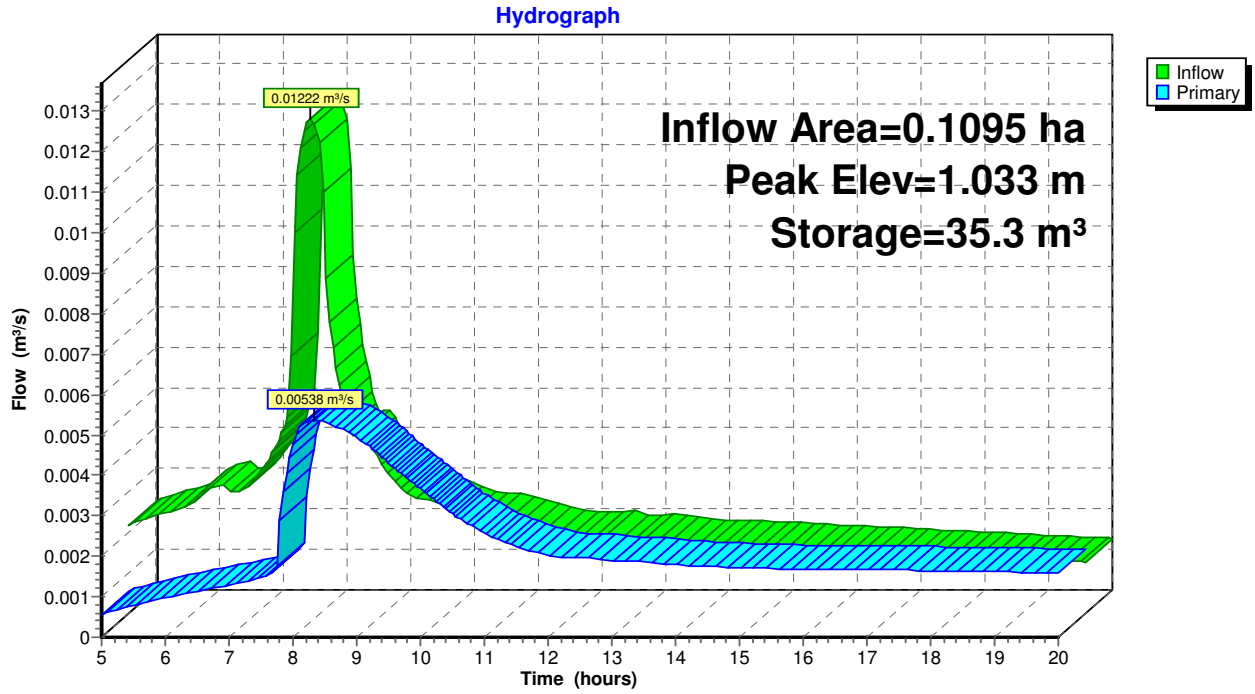
Plug-Flow detention time= 152.8 min calculated for 0.117 Ml (84% of inflow)
Center-of-Mass det. time= 73.9 min (717.4 - 643.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	41.0 m³	**10.00 mW x 9.00 mL x 1.20 mH Prismatoid** 108.0 m³ Overall x 38.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	-0.100 m	**100 mm Round Culvert** L= 10.00 m CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= -0.100 m / -0.200 m S= 0.0100 m/m Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.008 m²
#2	Device 1	-0.100 m	**30 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	0.717 m	**55 mm Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00538 m³/s @ 8.33 hrs HW=1.033 m (Free Discharge)
└─**1=Culvert** (Passes 0.00538 m³/s of 0.01811 m³/s potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.00199 m³/s @ 2.81 m/s)
  └─**3=Orifice/Grate** (Orifice Controls 0.00339 m³/s @ 1.43 m/s)

Pond 48P: Sub base storage 10x9x 1.2m



Summary for Link 26L: total flow

Inflow Area = 0.1087 ha,100.00% Impervious, Inflow Depth > 101 mm for 10 years event
Inflow = 0.00549 m³/s @ 8.19 hrs, Volume= 0.109 Ml
Primary = 0.00549 m³/s @ 8.19 hrs, Volume= 0.109 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 26L: total flow