THE SANCTUARY PROJECT
RESOURCE CONSENT

494 Wanaka-Mount Aspiring Rd
Wanaka
FOR
Nature Preservation Trustee Limited

Layout ID	Revision	Layout Name	Issued	Comment
		TITLE SHEET	☒	
RC.A1-101	01	SITE PLAN EXISTING-GROUND LEVEL	☒	Issued for Resource Consent
RC.A1-102	01	SITE PLAN PROPOSED-GROUND LEVEL	☒	Structural columns added
RC.A1-103	01	SITE PLAN PROPOSED-BASEMENT LEVEL	☒	Structural columns added
RC.A1-104	02	BASEMENT LEVEL FLOOR PLAN	☒	Structural columns added
RC.A1-105	02	GROUND LEVEL FLOOR PLAN	☒	Structural columns added
RC.A1-106	02	UPPER LEVEL FLOOR PLAN	☒	Structural columns added
RC.A1-201	02	SECTIONS	☒	Structural columns added
RC.A1-301	02	EAST ELEVATIONS	☒	Structural columns added
RC.A1-302	02	ELEVATIONS	☒	Structural columns added
RC.A1-303	02	ELEVATIONS	☒	Structural columns added
RC.A1-304	01	GREEN WALL-HANGING GARDEN	☒	Issued for Resource Consent

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PO Box 339 Wanaka 9192 NZ | P:03 443 1661 M:02744474147

SITE PLAN EXISTING-GROUND LEVEL

Scale 1:1000 @ A1

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Published Date: Friday, 17 September 2021

RC.A1-101

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SITE PLAN PROPOSED-GROUND LEVEL

Scale 1:1000 @ A1

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Published Date: Friday, 17 September 2021 RC.A1-102

SITE PLAN PROPOSED-BASEMENT LEVEL

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Published Date: Friday, 17 September 2021

RC.A1-103

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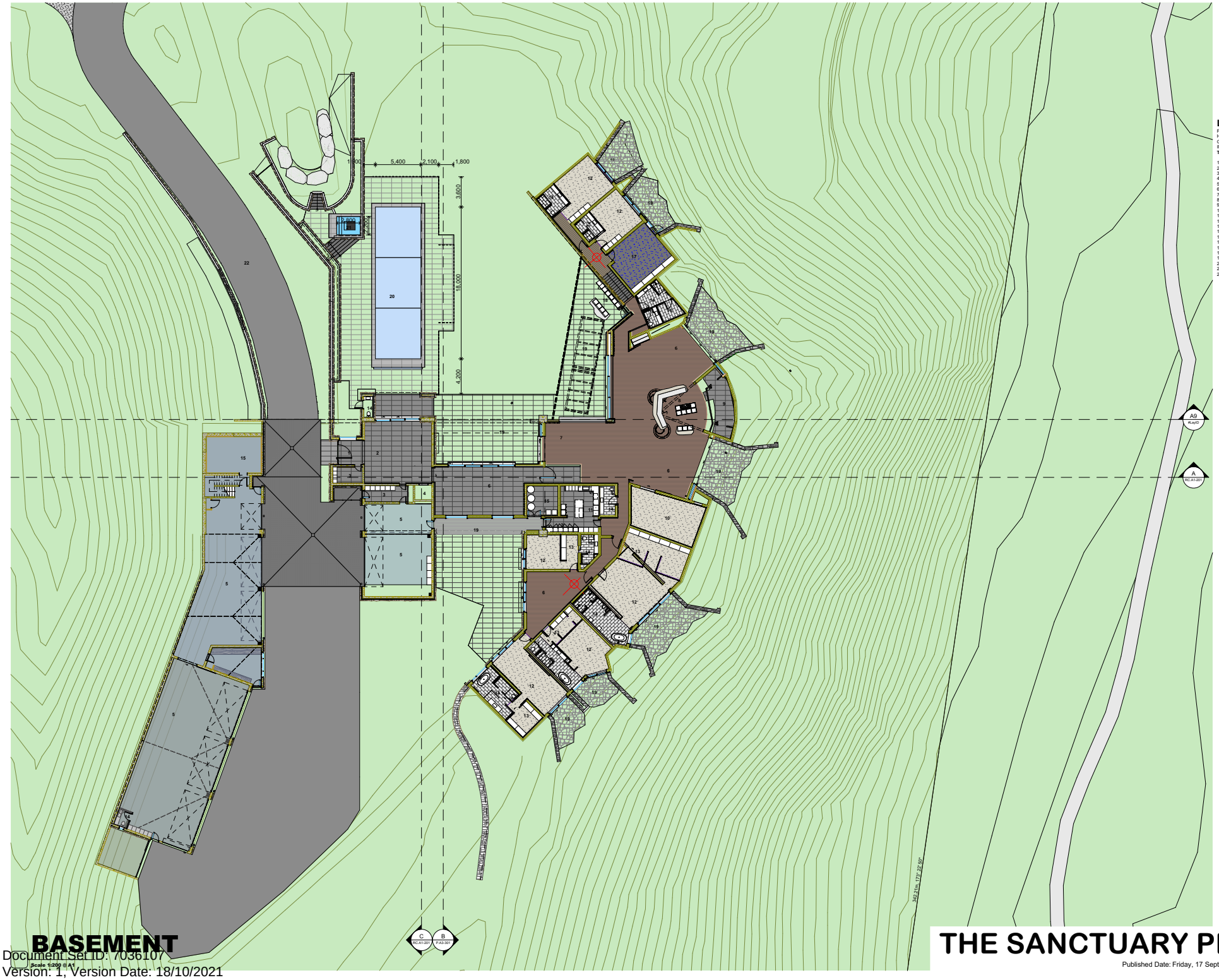

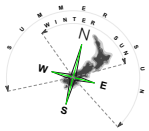

LEVEL 1

FFL 331.400

HOUSE =	1094.42m²
GARAGE =	82.32m²
IMPLEMENT SHED =	449.95m²
TOTAL AREA =	**1626.69m²**

1. Entrance
2. Foyer
3. Store/Mudroom
4. Lift
5. Garage/Implement Shed
6. Lounge
7. Dining
8. Kitchen
9. Scullery
10. Media
11. Laundry
12. Bedroom
13. Wardrobe
14. Bathroom/WC
15. Utility/Plantroom
16. Sauna
17. Gym
18. BBQ
19. Terrace
20. Pool
21. Hot tub
22. Driveway

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BASEMENT

Scale 1:200 @ A1

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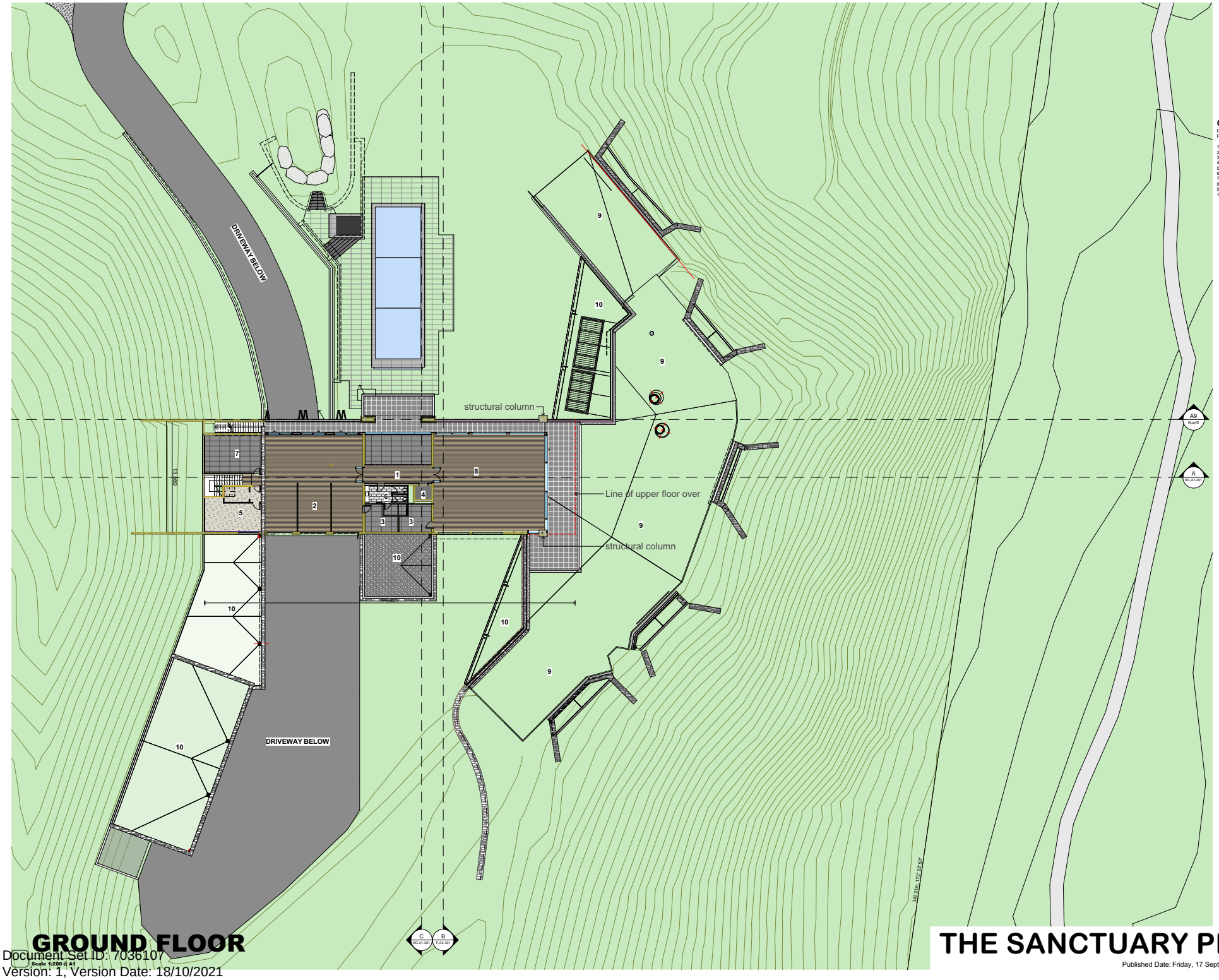
RC.A1-104



GROUND LEVEL

FFL 335.200
FLOOR AREA = 486.80m²

1. Landing
2. Study
3. Closet
4. Lift
5. Studio
6. Bathroom
7. Storage
8. Library / Games
9. Green Roof
10. Ballast Roof

GROUND FLOOR

Scale 1:200 @ A1

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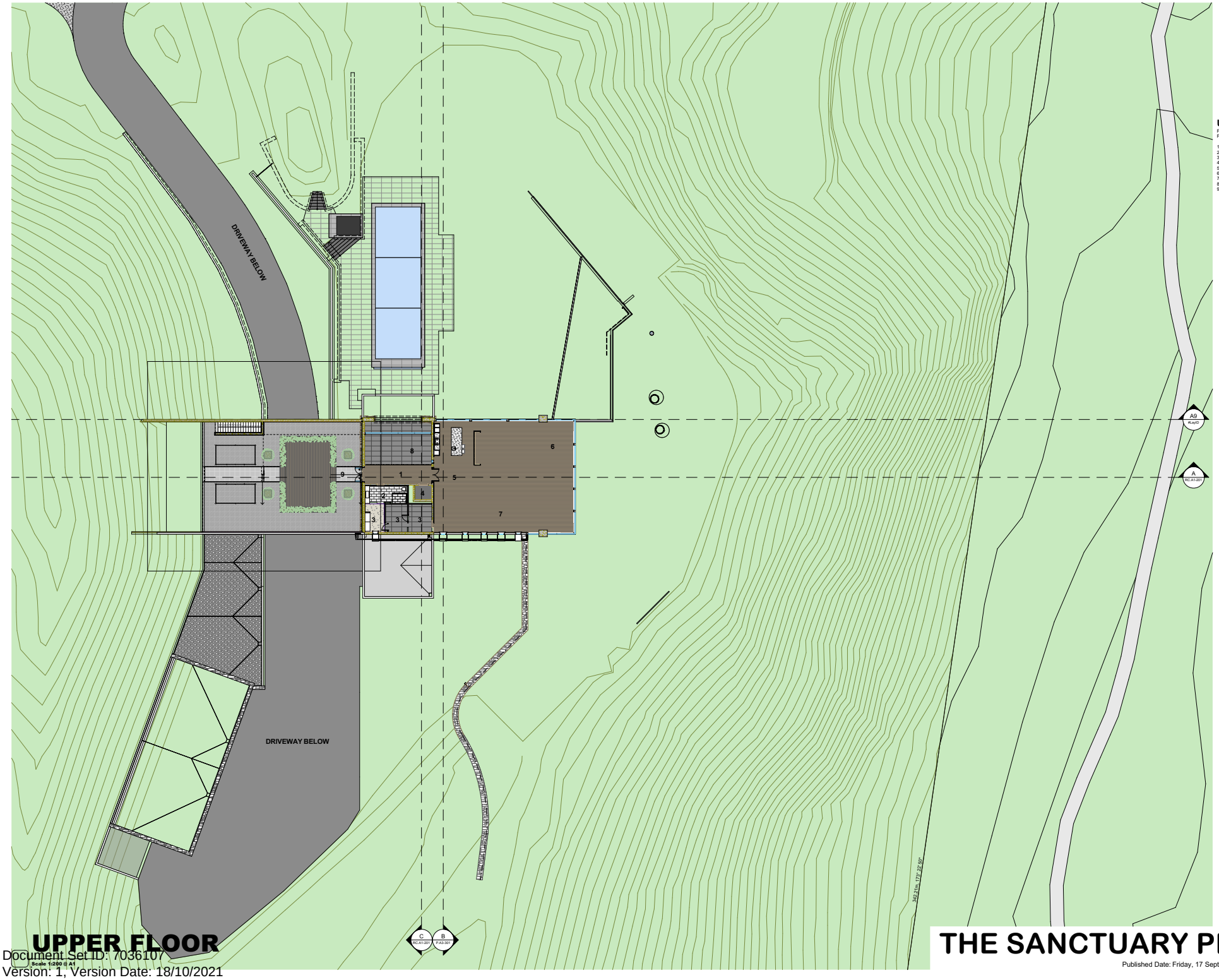

UPPER LEVEL

FFL 338.480
FLOOR AREA = 344.46m²

1. Landing
2. Bathroom
3. Closet
4. Lift
5. Hobbies
6. Lounge
7. Study
8. Void
9. Deck

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SORTED ARCHITECTURE

UPPER FLOOR

Scale 1:200 @ A1

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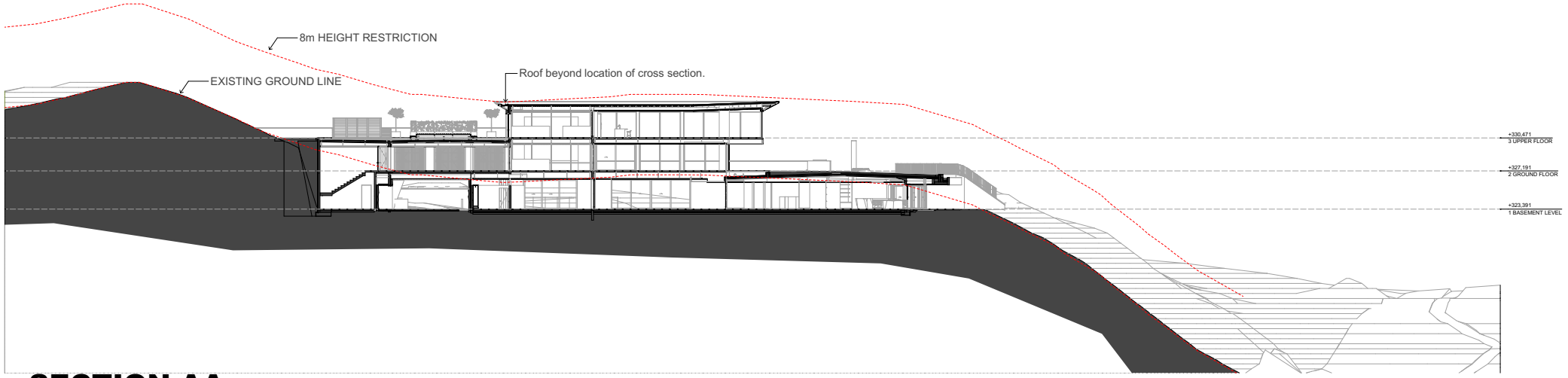
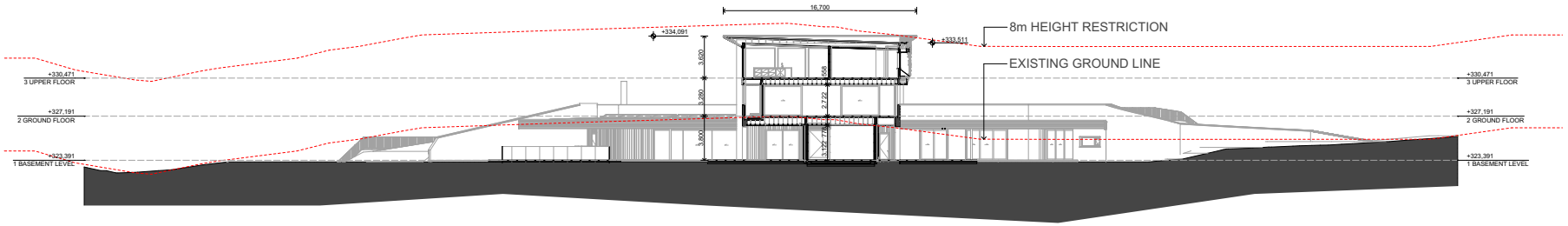
Published Date: Friday, 17 September 2021

RC.A1-106



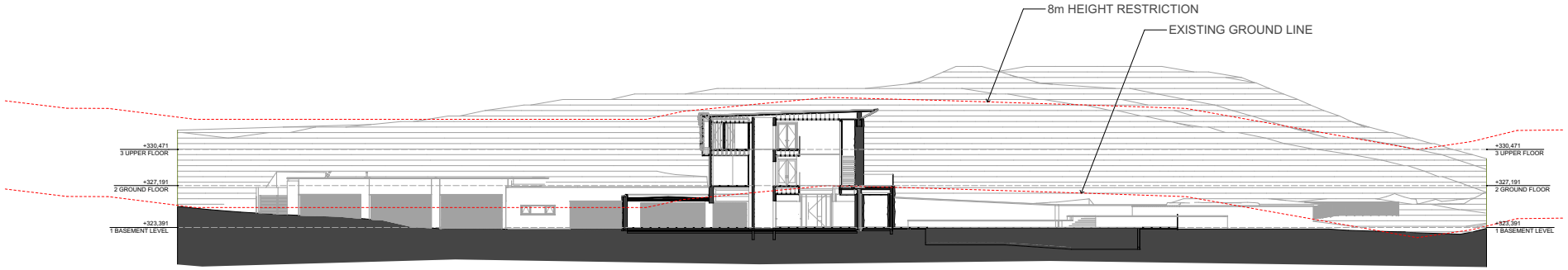
SECTION AA

Scale 1:200 @ A1



SECTION BB

Scale 1:200 @ A1



SECTION CC

Scale 1:200 @ A1

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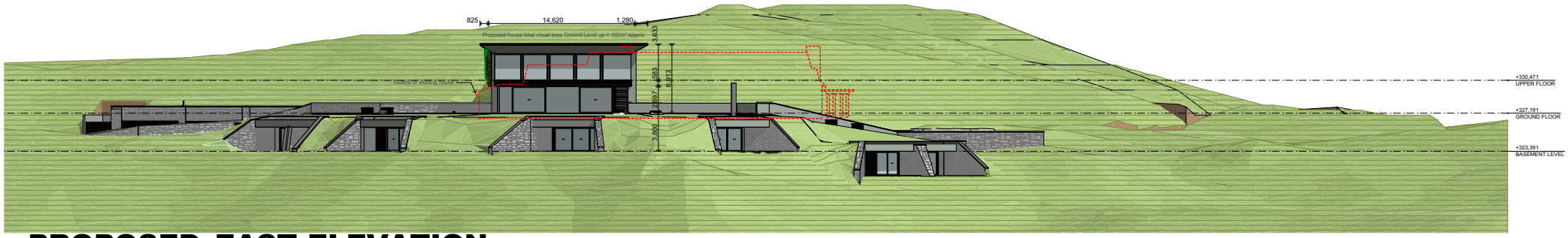
Published Date: Friday, 17 September 2021 RC.A1-201

EXISTING_EAST ELEVATION

Scale 1:200 @ A1



PROPOSED_EAST ELEVATION

Scale 1:200 @ A1

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Published Date: Friday, 17 September 2021 RC.A1-301

TIMBER CLADDING

Soffit and horizontal timber wall cladding to be Thermory Ash with natural stain finish or stained Accoya

Dulux 9159145M Flaxpod LRV 6

Dulux Metropolis Coal Dust LRV 8

Dulux 95081156 Gunmetal Metallic LRV 10

SOFFIT LINING

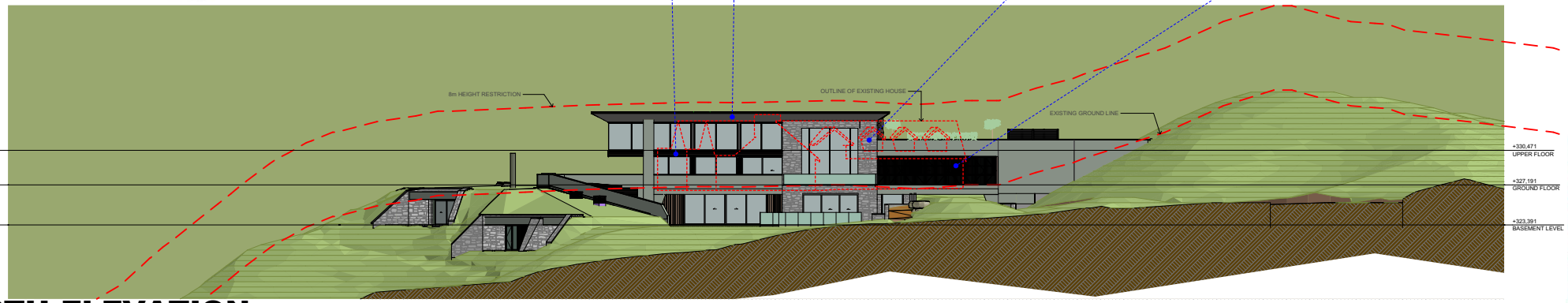
Aluminium powder coated panel soffit lining similar to above image and finished with with one of the selected colours above.

SCHIST STONE VENEER

Similar stone sizing and colour to current house. Stone to be Cluden blend style as per top image, with 10mm flush mortar finish similar to bottom image

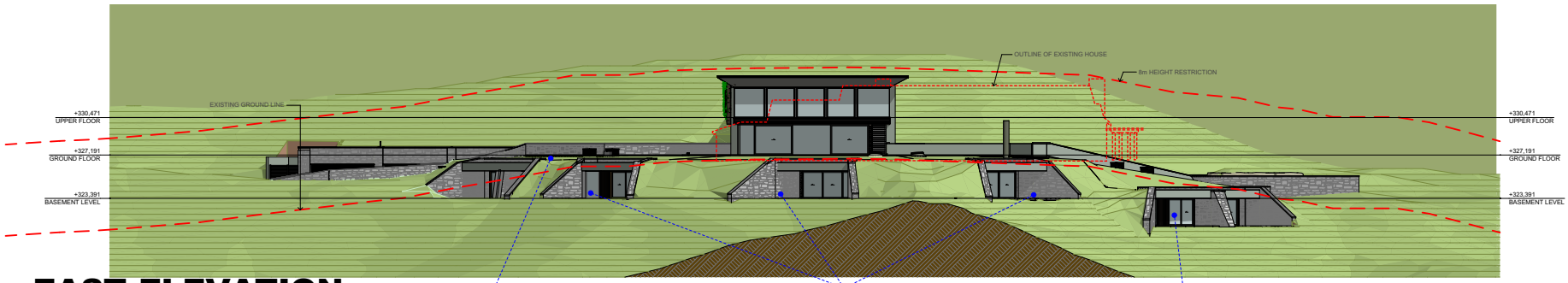
EXTERIOR TIMBER SHUTTERS

Style as per image above. Timber to be Thermory Ash or stained Accoya to match timber cladding



NORTH ELEVATION

Scale 1:200 @ A1



EAST ELEVATION

Scale 1:200 @ A1

GREEN ROOF

Green Roof planted with grasses, shrubs and ground covers

SCHIST CLAD NATURALLY LANDSCAPED OPENINGS

Landscaped openings planted with selected grasses, ground covers and lichen over schist clad walls intergrating the openings seamlessly into the landscape of the existing escarpment .

EXTERIOR JOINERY

Powder Coated Aluminium windows and doors finished with one of the selected colours below.

Dulux 9159145M Flaxpod LRV 6

Dulux Metropolis Coal Dust LRV 8

Dulux 95081156 Gunmetal Metallic LRV 10

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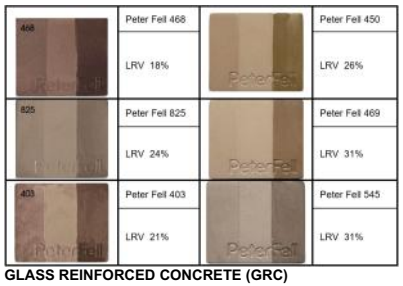
STONE BALLAST ROOF

CORTEN

Corten steel window shrouds with built-in planters above

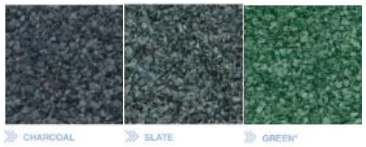
WIRE TRELLIS

Planting trained onto wire trellis



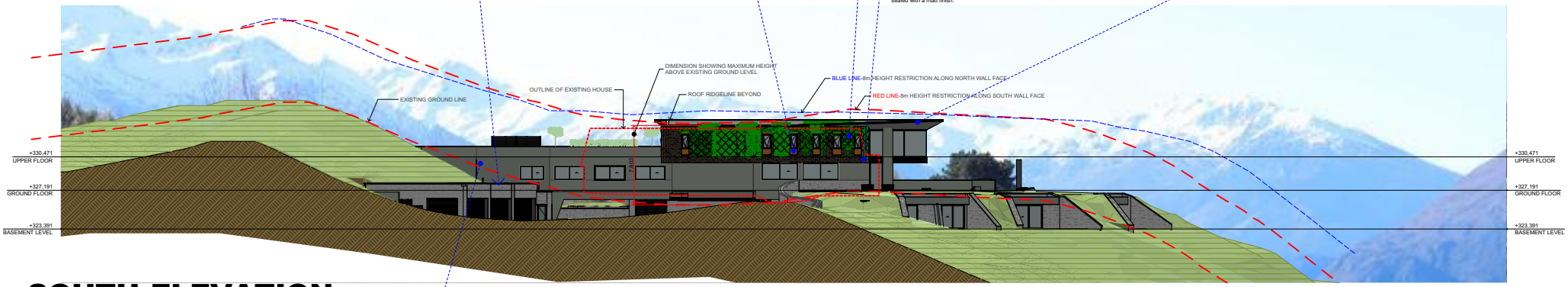
GLASS REINFORCED CONCRETE (GRC) FACADE PANELS

GRC facade panels with a three dimensional pattern manufactured with a rough sawn board form texture creating a subtle shadowing which will defuse the appearance of a monolithic colour and further reduce the overall LRV of the wall. The concrete used to form the GRC panels will be coloured in a selected colour from the Peter Fell range of specialists colours, sealed with a matt finish.



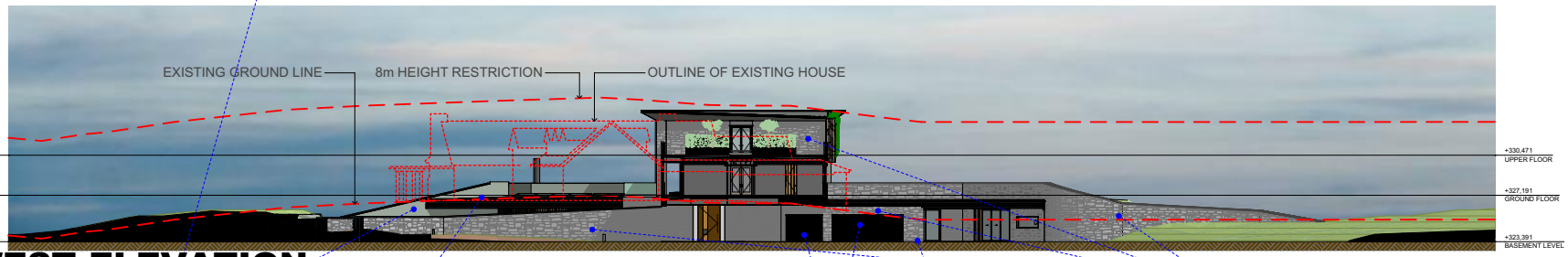
NURAPLY 3PM ROOFING MEMBRANE

Nuraply 3PM roofing membrane finished with a selected slate chip



SOUTH ELEVATION

Scale 1:200 @ A1



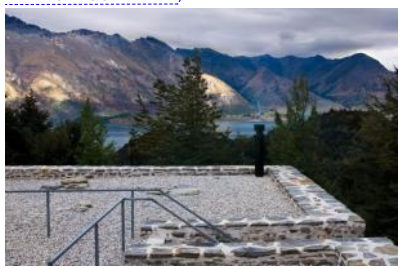
WEST ELEVATION

Scale 1:200 @ A1

CONCRETE WALLS

Board form precast concrete panels. Coloured as per Peter Fell images below

BALLAST ROOF



TIMBER GARAGE DOORS

Garage door style as per top image. Timber to be Thermory Ash or stained Accoya as per bottom image

SCHIST FLAG STONE PAVING

To selected outdoor paved areas

SCHIST STONE VENEER

Similar stone sizing and colour to current house. Stone to be Cluden blend style as per top image, with 10mm flush mortar finish similar to bottom image

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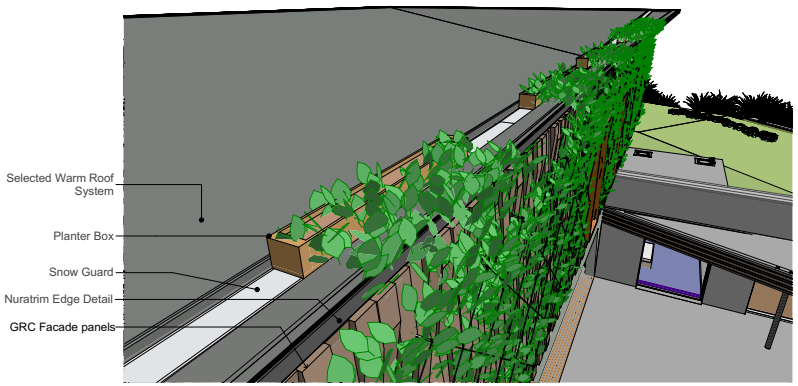
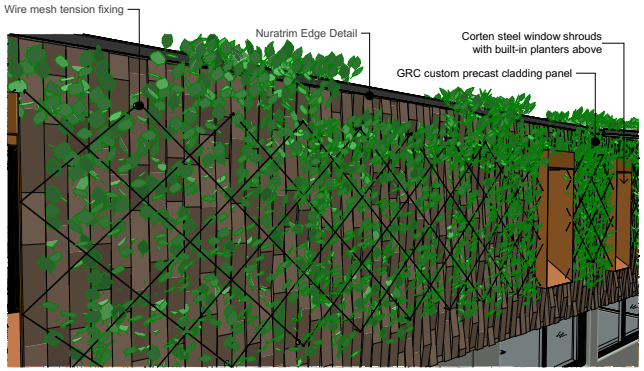


EAVE PLANTER

NTS



WINDOW PLANTER

NTS

Clematis panicula 'Purity' – Clematis

Metrosideros perforata – Climbing Rata

Coprosma kirkii or Coprosma depressa – Coprosma

Muehlenbeckia axillaris/complexa – Creeping Wire Vine

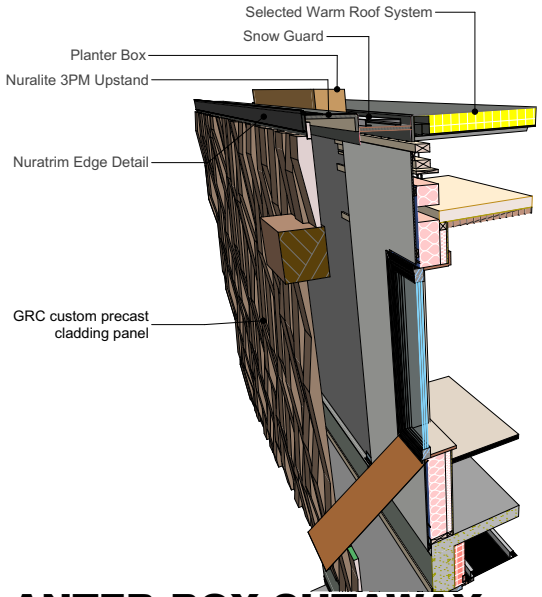
Rosmarinus officinalis 'Prostratus' – Creeping Rosemary

Trachelospermum jasminoides – Star Jasmine

Parsonsia heterophylla - Kaihua/NZ Jasmine

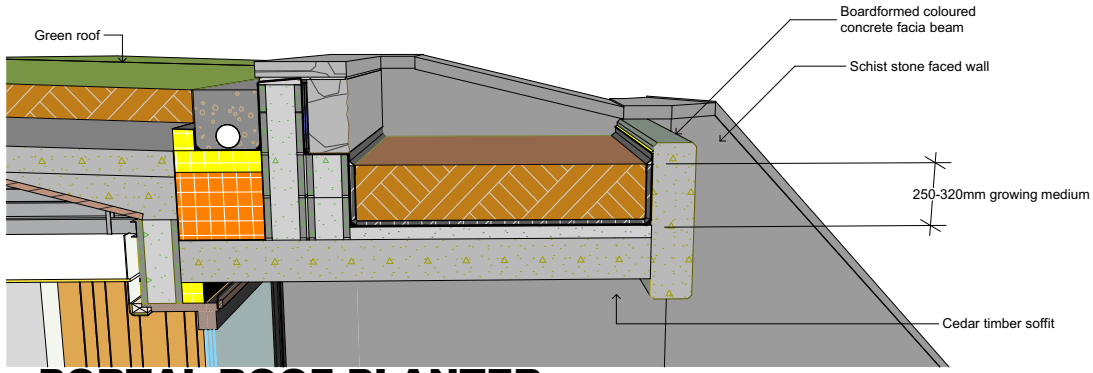
PLANT SPECIES

Proposed plants to be selected from the above list.



PLANTER BOX CUTAWAY

NTS



PORTAL ROOF PLANTER

NTS

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THE SANCTUARY PROJECT

Published Date: Friday, 17 September 2021 RC.A1-304

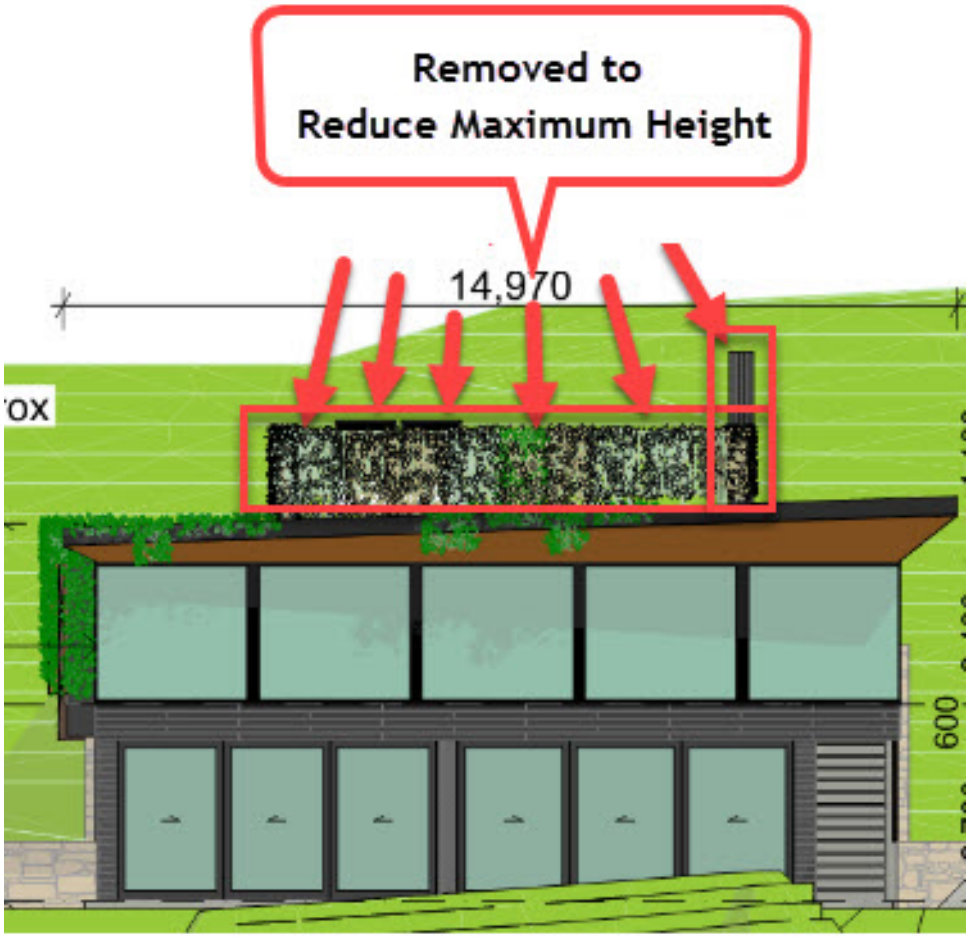
The Sanctuary Project

"At one with the environment."

By New Zealand Citizens who are long term, local Wanaka residents.

Background: To replace an existing house

Overall Height Reduction



Replacement House

Additional Improvements over the Previous Application

Overall reduction of the maximum height by ≈ .784 metres.

1. Removal of the roof top fence.
2. Removal of the roof top services equipment.
3. Removal of the exterior stairs going to the roof.
4. Removal of the 2.5 meter high chimney that was extending from the roof top.
5. Roof-line tapered slightly more for increased shadowing and to give it an even lighter and more delicate visual appearance.
6. in addition, there has been a large reduction in earthworks over the previous application.

By: Nature Preservation Trust & Sorted Architecture

Date: 20, May, 2021

The Sanctuary Project

"At one with the environment."

By New Zealand Citizens who are long term Wanaka resident locals.
For private residence- not a lodge business

Overall improvement of amenity values ✓

Overall reduction of the visible impact of the current house ✓

Background: To replace an existing house

Additional Highlights and Improvements

Upper level, lake facing reflective surface areas:

Before: Multi-angled, reflective surface areas with a large metal roof.

After: ≈ 25% reduction of the reflective surface area.

- **Estimated > 90% reduction in available times of day for possible reflections due to removal of the large metal roof with highly reflective material and highly reflective low angles to the sun.**
- **One less metal roof in Wanaka's ONL.**

Before: Standard glass windows facing lake with an estimated normal LRV of 7%.

After: Specialized low reflective 2% LVR glass ≈ 71% reduction in the light reflectance value.

Driveway:

Before: Driveway is at a higher level and is closer to the lake.

After: Driveway is at a lower level and further from lake making it less visible.

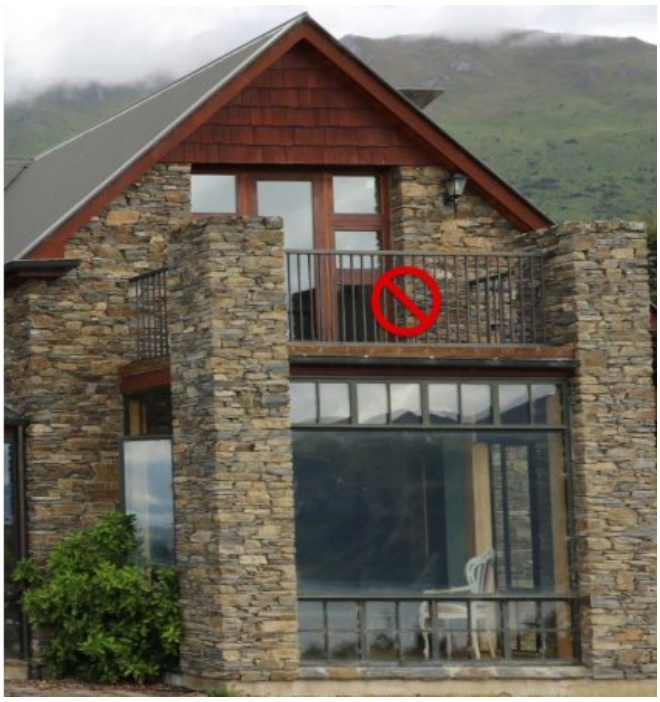
Upper level, lake facing, exterior lighting:

Before: External, lake facing lights on upper level.

After: None.

Balcony 1 (To be removed)

Balcony 2 (To be removed)



Additional highlights of the replacement house:

Ecological - Green Roof

Green Roof Benefits:
Purifies the air; minimizes heat loss; regulates the indoor temperature; increased energy efficiency means a reduced carbon footprint; reduction in ambient noise outside and inside; doubles or triples the lifespan of the roof; sustainable drainage system with reduction in storm water runoff; increased amenity values.

Green Walls

Integrated into the natural environment

Renewable Heating/Cooling Solution

The main heating/cooling system will be a ground or water sourced heat pump which has a low environmental impact and reduces one's carbon footprint.

Hanging plants

On the south side upper level from irrigated planter boxes above the thin windows on top of the corten steel coloured shrouds. They will be trained to grow as designed with vertical wires.

Ecologically sourced native plantings from locally sourced seeds

Grown locally by the specialist native nursery, Matukituki Natives.

Thousands of eco-native plants is far beyond those needed for screening and is intended to improve the area's amenity values and attract more birds and wildlife to the lake. (Please also see landscaping plan and native planting progress report.

The site of the current & re-placement house is the farthest removed site from neighbors in the area

Document Set ID: 6913484
Version: 1, Version Date: 22/06/2021

The Sanctuary Project

"At one with the environment."

By New Zealand Citizens who are long time Wanaka resident locals.
For private residence- not a lodge business

Background: To replace an existing house.

Overall improvement of amenity values ✓

Overall reduction of the visible impact of the current house ✓

2021 Application - To Further Reduce the Visibility of the proposed replacement dwelling

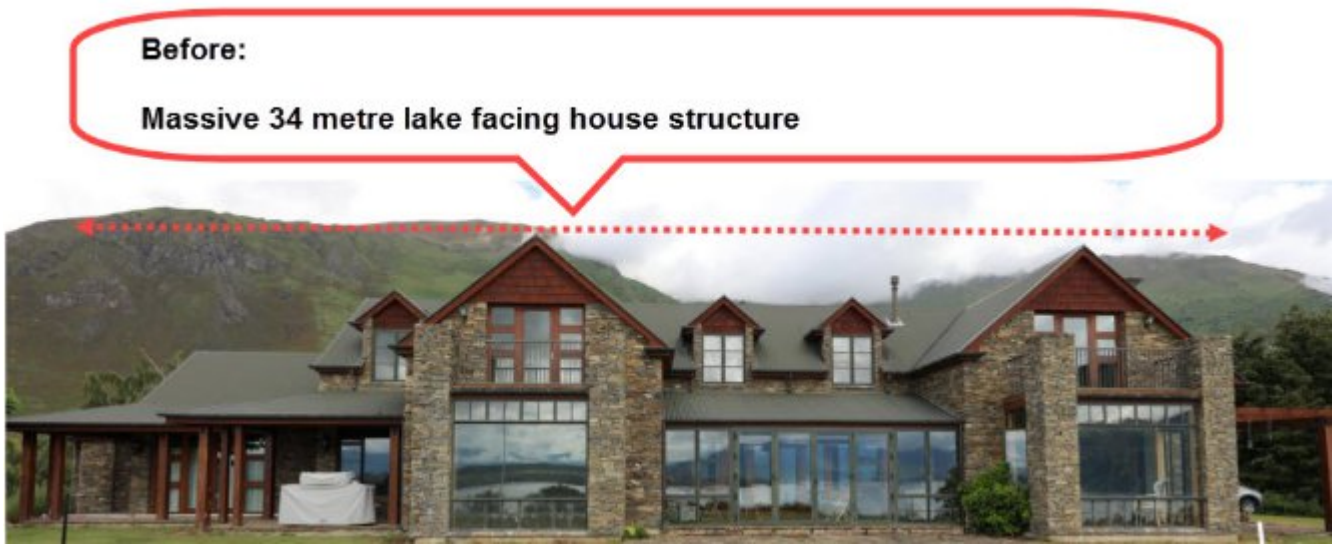
Authors: Nature Preservation Trust
Sorted Architecture

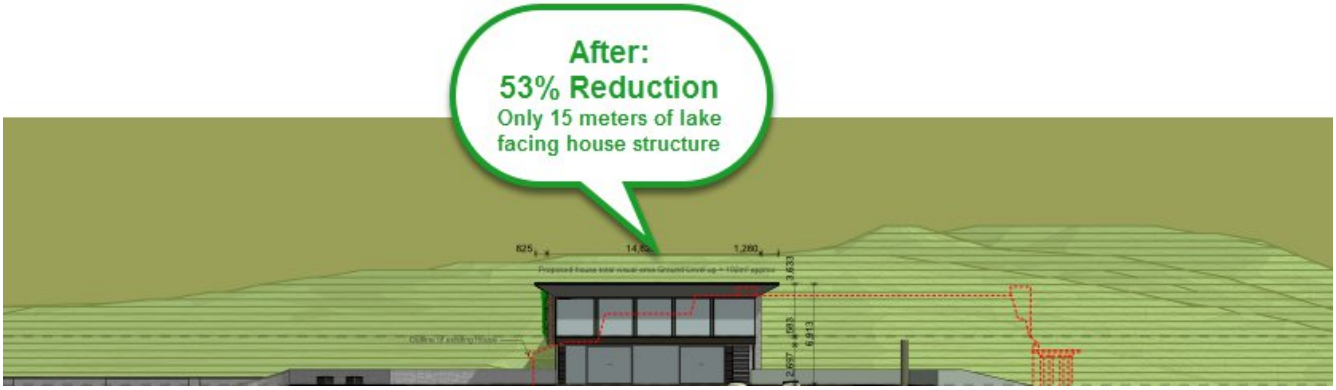
Date: 27, May 2021

Summary of the Positive Visual Improvements of the replacement house.

Before and After key points regarding the Current house and the Replacement

53% Reduction: Above Ground, Lake Facing, Visible House Structure Length:





Number of Lake Facing Rooms:

Before: 10 above ground lake facing rooms.
After: 2 above ground lake facing rooms **= 80% reduction.**

Upper Level Lake Facing Rooms:

Before: 5 lake facing rooms.
After: 1 lake facing room **= 80% reduction.**

Before: 2 lake facing, external, protruding upper level balconies.
After: No upper level lake facing balconies **= 100% reduction.**

Driveway:

The current driveway is to be relocated to a lower level and further away from the lake to reduce its viability and improve amenity values.

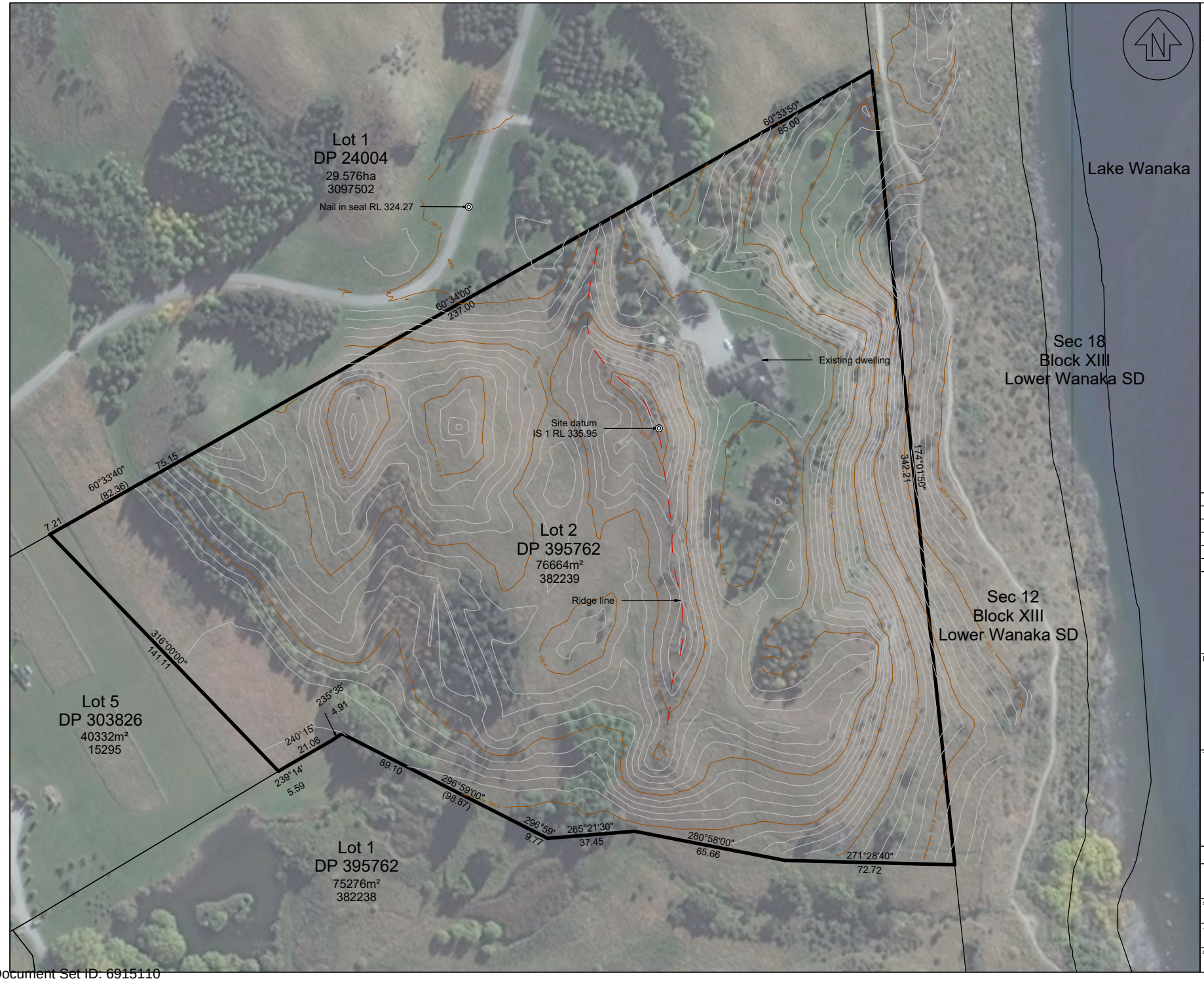
Entire House Profile In Relation to Environment:

Before: All above ground.
After: ≈ 68% below current ground level.

Before: The ground, lake facing floor is not recessed and it extends out in places.
After: The ground, lake facing floor is recessed in shadows underneath the upper level **making it less visible.**

Before: Above ground portion of house is on average closer to the lake.
After: Above ground portion of house is on average further from the lake.

Before: Above ground portion of the house is bigger.
After: Above ground portion of the house is smaller.



NOTES:

1) Origin of Levels IS 1 RL = 335.95m.
2) Aerial Photo is for indicative purposes only.

LEGEND

- Site Boundary
- Contour Minors (1.0m)
- Contours Major (5.0m)
- Existing Ridge Line

Revision	Amendments	Date
B	Moved text, add legend	17/03/2021
C	Changed datum to NZVD2016	29/01/2021

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CROMWELL
17A MURRAY TERRACE
P.O. BOX 51
03 445 0376

WANAKA
LEVEL 3, 80 ARDMORE ST
P.O. BOX 599
03 443 5052

www.chasurveyors.co.nz

Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

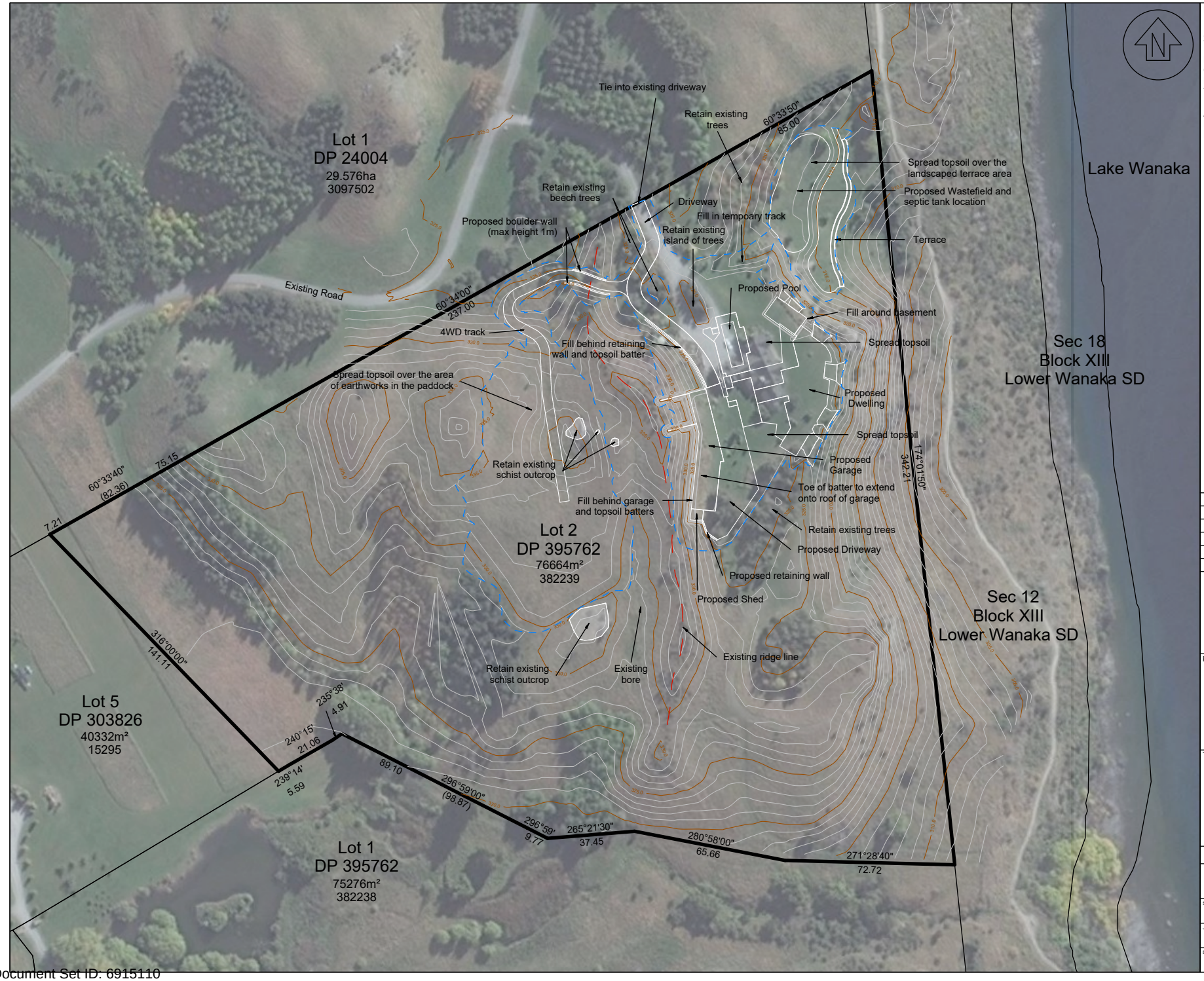
Title:

EXISTING GROUND

CONTOURS

PRELIMINARY

Scale:			
1:1500 (A3)			
Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	1	C	23/11/2020



NOTES:

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2) Aerial Photo is for indicative purposes only.

Earthworks Quantities

Cut	20,800m³
Fill	20,800m³
Total Volume	41,600m³
Area	17,500m²
Max Cut	7.2m
Max Fill	5.3m

LEGEND

- Site Boundary
- Contours Minor (1.0m)
- Contours Major (5.0m)
- Existing Ridge Line
- Extent of Earthworks

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Earthworks over site and quantities	26/04/2021
F	Earthwork quantities note	05/05/2021

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

Title:

PROPOSED CONSTRUCTION EARTHWORKS DESIGN CONTOURS

PRELIMINARY

Scale: 1:1500 (A3)

Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	2	F	23/11/2020

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.
2) Aerial Photo is for indicative purposes only.

Earthworks Quantities

Cut	20,800m³
Fill	20,800m³
Total Volume	41,600m³
Area	17,500m²
Max Cut	7.2m
Max Fill	5.3m

LEGEND

- Site Boundary
- Depth Contours (at 0.5m interval)
- Extent of Earthworks Sections

CUT/FILL

CUT
- 5.0m +
- 4.0 - 5.0m
- 3.0 - 4.0m
- 2.0 - 3.0m
- 1.0 - 2.0m
- 0.5 - 1.0m
- 0 - 0.5m

FILL
- 0 - 0.5m
- 0.5 - 1.0m
- 1.0 - 2.0m
- 2.0 - 3.0m
- 3.0 - 4.0m
- 4.0 - 5.0m
- 5.0m +

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Earthworks over site and quantities	26/04/2021
F	Earthwork quantities note	05/05/2021

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

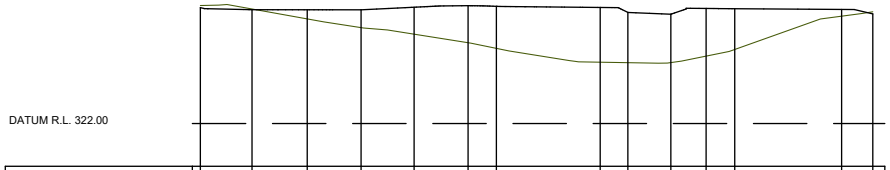
Title:

PROPOSED CONSTRUCTION EARTHWORKS DEPTH POLYGONS

PRELIMINARY

Scale: 1:1500 (A3)

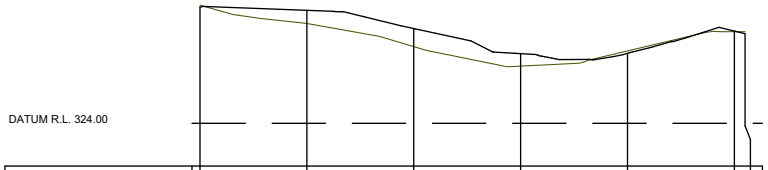
Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	3	F	23/11/2020



FINISHED SURFACE LEVELS	332.85	332.65	332.65	332.64	332.88	333.03	332.97	332.86	332.40	332.23	332.77	332.74	332.68	332.26
EXISTING SURFACE LEVELS	333.04	332.72	331.79	330.97	330.36	329.56	329.03	327.74	327.69	327.70	328.31	328.93	332.05	332.46
EARTHWORKS CUT(-) / FILL(+)	-0.20	-0.07	0.86	1.67	2.52	3.47	3.93	5.12	4.71	4.53	4.46	3.81	0.63	-0.20
CHAINAGE	0.00	4.83	10.00	15.04	20.00	25.05	27.70	37.41	40.00	44.02	47.32	50.00	60.00	62.92

CROSS SECTION - B-B'

SCALE HORIZ=1:500 VERT=1:500



FINISHED SURFACE LEVELS	334.866	334.571	332.867	330.519	330.551	332.629	332.386
EXISTING SURFACE LEVELS	335.054	333.341	331.177	329.350	330.773	332.571	332.570
EARTHWORKS CUT(-) / FILL(+)	-0.188	1.230	1.691	1.169	-0.223	0.058	-0.184
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	51.000

CROSS SECTION - A-A'

SCALE HORIZ=1:500 VERT=1:500

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Changed scale.	12/04/2021
F	Earthworks and changed scale.	26/04/2021

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

Title:

PROPOSED CONSTRUCTION

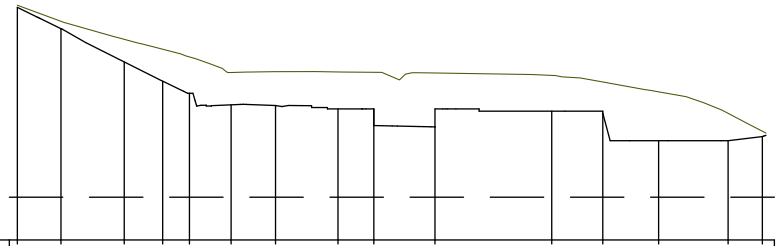
EARTHWORKS CROSS SECTIONS

A-A' & B-B'

PRELIMINARY

Scale: AS SHOWN (A3)

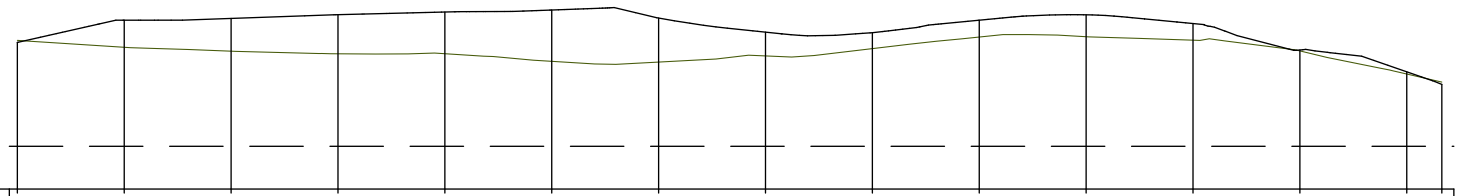
Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	4	F	23/11/2020



FINISHED SURFACE LEVELS	332.76	330.77	327.66	325.85	324.72	323.64	323.58	323.26	323.26	321.58	323.05	322.86	320.29	320.29	320.67
EXISTING SURFACE LEVELS	332.96	331.46	329.77	328.85	328.13	326.67	326.75	326.72	326.69	326.62	326.40	325.78	324.86	322.85	321.18
EARTHWORKS CUT(-) / FILL(+)	-0.20	-0.69	-2.11	-3.00	-3.40	-3.02	-3.17	-3.46	-3.43	-5.04	-3.35	-2.92	-4.57	-2.56	-0.50
CHAINAGE	0.00	4.08	10.00	13.60	16.10	20.00	24.16	30.00	33.35	39.07	50.00	54.78	60.00	66.50	69.71

CROSS SECTION - D-D'

SCALE HORIZ=1:500 VERT=1:500



FINISHED SURFACE LEVELS	329.72	331.80	331.96	332.32	332.56	332.75	332.00	330.68	330.63	331.80	332.30	331.49	329.01	326.97	325.79
EXISTING SURFACE LEVELS	329.91	329.27	328.90	328.66	328.66	327.95	327.88	328.46	329.14	330.22	330.25	329.93	328.93	326.76	326.01
EARTHWORKS CUT(-) / FILL(+)	-0.20	2.53	3.06	3.66	3.90	4.80	4.12	2.22	1.49	1.58	2.05	1.56	0.08	0.21	-0.22
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	133.28

CROSS SECTION - C-C'

SCALE HORIZ=1:500 VERT=1:500

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Changed scale.	12/04/2021
F	Earthworks and changed scale.	26/04/2021

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

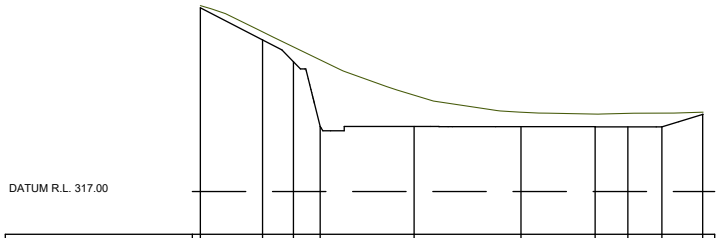
Title:

PROPOSED CONSTRUCTION EARTHWORKS CROSS SECTIONS C-C' & D-D'

PRELIMINARY

Scale: AS SHOWN (A3)

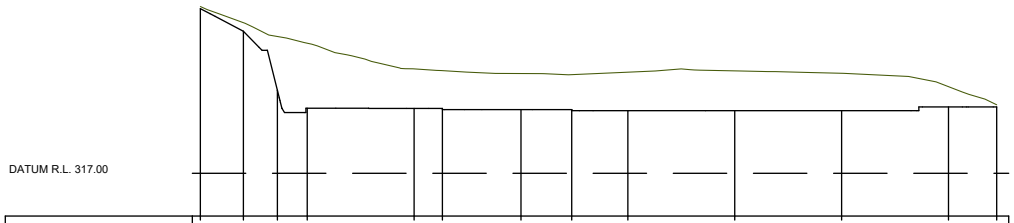
Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	5	F	23/11/2020



FINISHED SURFACE LEVELS	334.19	331.19	329.14	323.09	323.09	323.07	323.05	323.05	323.05	324.22	
EXISTING SURFACE LEVELS	334.40	331.94	330.53	329.32	326.01	324.42	324.25	324.31	324.34	324.42	
EARTHWORKS CUT(-) / FILL(+)	-0.20	-0.76	-1.39	-6.23	-2.93	-1.35	-1.20	-1.26	-1.29	-0.21	
CHAINAGE	0.00	5.82	8.71	11.21	20.00	30.00	36.94	40.00	43.18	47.00	

CROSS SECTION - F-F'

SCALE HORIZ=1:500 VERT=1:500



FINISHED SURFACE LEVELS	332.40	330.29	324.77	323.09	323.07	322.96	322.96	322.96	322.86	322.86	322.86	323.21	323.21
EXISTING SURFACE LEVELS	332.60	331.09	329.80	329.17	326.77	326.61	326.34	326.23	326.46	326.58	326.36	325.11	323.41
EARTHWORKS CUT(-) / FILL(+)	-0.20	-0.80	-5.03	-6.08	-3.70	-3.65	-3.38	-3.27	-3.60	-3.72	-3.50	-1.90	-0.20
CHAINAGE	0.00	4.03	7.21	10.00	20.00	22.65	30.00	34.75	40.00	50.00	60.00	70.00	74.51

CROSS SECTION - E-E'

SCALE HORIZ=1:500 VERT=1:500

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Changed scale.	12/04/2021
F	Earthworks and changed scale.	26/04/2021

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Project:

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EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

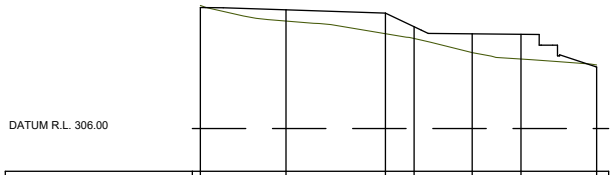
Title:

PROPOSED CONSTRUCTION EARTHWORKS CROSS SECTIONS E-E' & F-F'

PRELIMINARY

Scale: AS SHOWN (A3)

Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	6	F	23/11/2020



FINISHED SURFACE LEVELS	317.32	317.11	316.80	315.53	314.86	314.82	311.75
EXISTING SURFACE LEVELS	317.52	316.06	314.87	314.43	313.10	312.50	311.95
EARTHWORKS CUT(-) / FILL(+)	-0.20	1.05	1.93	1.10	1.76	2.31	-0.19
CHAINAGE	0.00	8.01	17.32	20.00	25.44	30.00	37.08

CROSS SECTION - H-H'

SCALE HORIZ=1:500 VERT=1:500

FINISHED SURFACE LEVELS	323.08	322.13	321.91	323.05	323.05	323.26	321.31	321.41	321.69	321.81	322.96	322.96	322.96	322.96	323.05	323.05	323.05	323.73	
EXISTING SURFACE LEVELS	323.29	322.92	322.75	323.51	325.34	326.43	326.51	326.50	326.29	326.30	326.51	326.48	325.47	324.77	324.57	324.41	324.31	324.29	
EARTHWORKS CUT(-) / FILL(+)	-0.21	-0.79	-0.84	-0.46	-2.29	-3.16	-5.20	-5.09	-4.60	-4.48	-3.55	-3.52	-2.51	-1.81	-1.52	-1.36	-1.26	-0.55	
CHAINAGE	0.00	2.69	5.72	9.82	20.00	29.77	32.77	35.77	40.00	48.77	53.97	60.00	70.00	75.77	80.00	90.00	97.68	100.66	

CROSS SECTION - G-G'

SCALE HORIZ=1:500 VERT=1:500

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.

Revision	Amendments	Date

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

Title:

PROPOSED CONSTRUCTION EARTHWORKS CROSS SECTIONS G-G' & H-H'

PRELIMINARY

Scale: AS SHOWN (A3)

Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	7	A	23/04/2021

Geotechnical Report for Resource Consent

492 Wanaka-Mount Aspiring Road,
Wanaka

Report prepared for:

Batchelar McDougall Consulting Ltd

Report prepared by:

GeoSolve Limited

Distribution:

Batchelar McDougall Consulting Ltd

GeoSolve Limited (File)

May 2021

GeoSolve Ref: 170051.01

Revision	Issue Date	Purpose	Author	Reviewed
0	**04/05/2017**	Client Issue	GSH	FAW
1	**03/03/2021**	Client issue	MDP	FAW
2	**28/05/2021**	Client issue	MDP	FAW

GEOTECHNICAL WATER RESOURCES PAVEMENTS

Table of Contents

1 Introduction

1.1 General

This report presents the results of a geotechnical investigation carried out by GeoSolve Ltd at 492 Wanaka-Mt Aspiring Rd, Wanaka.

It provides geotechnical inputs for a dwelling, garage, and swimming pool to be built following demolition of the existing house (Photo 1). Earthworks plans have been provided by C Hughes and Associates.

Geotechnical issues associated with other proposed earthworks on the property, and an infiltration site for wastewater and stormwater/pool water dispersal are also addressed.

The scope of work comprises:

- Site investigation for the house and garage to determine soil types and bedrock profile;
- Foundation bearing capacity design parameters;
- Retaining wall parameters including backfill parameters between the structure and bedrock;
- Temporary batter slopes in cut areas;
- Identification of possible groundwater issues;
- Identification of geotechnical issues associated with formation of the pool excavation (potential for “floatation”, suitability of foundation soils);
- Issues associated with an expanded wastewater treatment system and discharge of stormwater and pool water;
- Investigation of various cuts and fills proposed around the property;
- Preliminary slope stability review.

The investigations were carried out for Batchelar McDougall Consulting Ltd in accordance with GeoSolve Ltd’s proposal dated 2 February 2017.

Photo 1. Site photo showing existing house which is to be demolished and a new building constructed in front.

1.2 Development

The proposed development is a three-storey dwelling (replacing the existing house), a garage and swimming pool (see Figure 1, Appendix A).

2 Site Description

2.1 General

The property (Lot 2 DP 395762) is located approximately 4.2 km northwest of the Wanaka town centre, (see Figure 1) and is accessed from Wanaka-Mt Aspiring Road to the west. It has an existing dwelling, grassed areas and a cover of native trees and shrubs.

The site is bounded by the Whare Kea Lodge & Chalet to the north, 450A Wanaka-Mount Aspiring Rd to the south and 450B Wanaka-Mount Aspiring Road, lies to the west. A walking track runs along the eastern boundary.

Figure 1. Site location (blue symbol) in relation to Wanaka township (Source: http://maps.qldc.govt.nz/qldcviewer/).

2.2 Topography and Surface Drainage

The existing site topographic contours are shown in Figure 1a, Appendix A.

The site of the proposed building is flat to gently sloping. The land drops steeply towards Lake Wanaka to the east of the proposed building.

Photo 2. View of site from south with excavator at proposed building location, note steep slope to lake.

Photo 3. View downslope from front of building site showing steep schist slope.

There are no streams or springs on the property. A valley 100 m to the south contains a stream draining into Lake Wanaka.

3 Geotechnical Investigations

An engineering geological site assessment has been undertaken with confirmatory subsurface investigations. GeoSolve Ltd visited the subject property on the 2nd February 2017, undertaking geotechnical investigations comprising:

- 11 test pits which were advanced to a maximum depth of 3.8 m below ground level (bgl);
- Dynamic cone (Scala) penetrometer tests were undertaken at TPs 2, 4 and 6;

Test pit and Scala penetrometer locations and logs are contained in Appendices A and B respectively.

4 Subsurface Conditions

4.1 Geological Setting

The site is located in the Wanaka Basin, a valley feature formed predominately by glacial advances. Published references indicate last glacial advance occurred in the region about 18,000 years ago.

The glaciations have left glacial deposits comprising glacial till, and outwash gravel over ice-scoured schist bedrock. Post-glacial times have been dominated by erosion of the bedrock by local watercourses and deposition of alluvial fan deposits. Rockslides and rock-falls have also occurred on steep slopes. Lacustrine sediments were deposited in Lake Wanaka and beach gravel around the shoreline as post-glacial lake levels fell.

The Alpine Fault, located approximately 70 km away, runs along the western foothills of the Southern Alps, and is likely to present a significant seismic risk. There is a high probability that an earthquake of Magnitude 8 or more will occur along the Alpine Fault within the next 50 years and such a rupture is likely to result in strong ground shaking in the vicinity of Wanaka.

4.2 Stratigraphy

Test pit investigations were constrained by the existing buildings. They focused on profiling the contact between bedrock schist and the overlying glacial till where excavations for a basement level are proposed.

The garage site is located on a glacial till ridge to the west of the house, requiring a cut into the ridge. TP 10 located at the back of the cut (see Figure 1), found glacial till to 1.5 m depth, where progress was prevented by either bedrock or a large schist boulder. Foundations and excavations are likely to be in glacial till and schist bedrock, but the detailed geology is unknown and will require further investigations following removal of existing buildings.

The underlying geology in the area typically consists of the following:

- 0.2 to 0.3 m of **topsoil**, overlying;
- 0.2 to 0.5 m of **loess**, overlying;
- 0.1 to 1.3 m of **colluvium**, overlying;
- 0.5 to 3.5 m of **glacial till**, overlying;
- **Schist bedrock.**

Topsoil comprising organic SILT was observed at the surface of every test pit.

Underlying the topsoil lies thin **loess**, which comprises stiff, sandy SILT with rootlets.

Colluvium was observed to underlie the topsoil and loess and comprises brown, loose to medium dense, sandy GRAVEL with some silt and rootlets to silty sandy GRAVEL and stiff, sandy SILT with minor gravel and rootlets.

Glacial till was observed to underlie the loess and colluvium in all test pits and comprises grey, very stiff, sandy SILT, SILT and gravelly sandy SILT and medium dense, silty SAND.

Schist bedrock was observed to underlie the glacial till in TPs 4, 5 and 10 and comprises grey, strong, slightly weathered, SCHIST with contorted foliation and moderate to widely spaced joints. Schist was also observed to outcrop at the surface across the site.

Full descriptions of the observed subsurface stratigraphy at the site is provided in the test pit logs in Appendix B.

4.3 Groundwater

No groundwater seepage was observed in any of the test pits during site investigations. The soils observed were predominantly moist in condition and the groundwater table is inferred to lie at considerable depth below the site.

5 Engineering Considerations

5.1 General

The recommendations and opinions contained in this report are based upon ground investigation data obtained at discrete locations on site and historical information held on the GeoSolve database. The nature and continuity of subsoil conditions away from the investigation locations is inferred and cannot be guaranteed.

5.2 Geotechnical Parameters

Table 1 provides a summary of the recommended geotechnical design parameters for the soils expected to be encountered during construction of the proposed dwelling, garage and retaining walls.

Table 1 – Recommended geotechnical design parameters

Unit	Thickness (m)	Bulk Density γ (kN/m^3)	Effective Cohesion c´ (kPa)	Effective Friction ϕ´ (deg)	Elastic Modulus E (kPa)	Poissons Ratio ν
Topsoil (organic SILT)	0.2-0.3	16	To be removed from building footprint and engineered fill areas			
Loess (stiff, sandy SILT)	0.2-0.5	18	0	31	5,000	0.3
Colluvium (loose to medium dense, sandy GRAVEL to silty sandy GRAVEL and stiff, sandy SILT)	0.1-1.3	18	0	31-33	5,000-10,000	0.3
Glacial Till (very stiff, sandy SILT, SILT and gravelly sandy SILT and medium dense, silty SAND)	0.5-3.5	18	2	34	20,000-30,000	0.3

5.3 Site Preparation

During the earthworks operations all topsoil, organic matter, uncertified fill, loess, colluvium and other unsuitable materials should be removed from the construction areas in accordance with the recommendations of NZS 4431:1989.

Robust, shallow graded sediment control measures should be instigated during construction where rainwater and drainage run-off across exposed soils is anticipated.

Exposure to the elements should be limited for all soils and covering the soils with polythene sheeting or site concrete will reduce degradation due to wind, rain and surface run-off.

Water should not be allowed to pond or collect near or under a foundation slab. Positive grading of the subgrade should be undertaken to prevent water ingress or ponding.

All fill that is utilised as bearing for foundations should be placed and compacted in accordance with the recommendations of NZS 4431:1989 and certification provided to that effect. The colluvium and glacial till can be used as engineered fill on site (during good weather and in accordance with an earthfill specification). The topsoil and loess are not suitable as a fill source. As the natural fill sources comprise silt and fine sand, any fill earthworks should only proceed in drier, warmer months (during earthworks season). Due to the changeable grain size of the natural soil materials on site, a range of compaction reference tests will be required. Maximum density and optimum moisture content will vary. There should be a contingency in the earthworks programme and budget to strip wet and weaving layers and allow drying time following rainfall. Compaction of the fill sources at lab tested optimum moisture content is critical for these soil types. In all cases, rounded gravel clasts as well as boulders and cobbles over 100 mm in size will need to be screened from engineered fill sources. Alternatively, granular fill can be imported from a local quarry. An earthfill specification can be provided by GeoSolve on request.

We recommend topsoil stripping and subsequent earthworks be undertaken only when a suitable interval of fair weather is expected, or during the earthworks construction season.

5.4 Excavations

Recommendations for temporary and permanent batter slope angles are described below in Table 2. Slopes that are required to be steeper than those described below should be structurally retained or subject to specific geotechnical design.

All slopes should be periodically monitored during construction for signs of instability and excessive erosion, and, where necessary, corrective measures should be implemented to the satisfaction of a Geotechnical Engineer or Engineering Geologist.

No seepage was encountered during test pitting and hence groundwater is unlikely to be encountered during excavations. However, a geotechnical practitioner should inspect any seepage, spring flow or under-runners that may be encountered during construction.

The subsurface soils are anticipated to be excavated by conventional methods.

5.4.1 Cut and Fill Slopes in Soils

Table 2 summarises the recommended batter angles for temporary and permanent slopes up to 8 m high formed in the soils identified at the site.

Table 2 – Recommended batters for temporary and permanent cuts up to 8 m in height in dry soils

Soil Material Type	Recommended Maximum Batter for Temporary Cuts Less than 8 m High (horizontal to vertical)	Recommended Maximum Batter for Permanent Cuts Less than 8 m High (horizontal to vertical)
Topsoil, Loess and Colluvium	2 : 1	3 : 1
Glacial Till	1 : 1	2 : 1

5.4.2 Excavations in Schist Bedrock

Depending on the depth of the excavation, the cut may be partially formed within schist bedrock. The stability of cut slopes in schist rock is governed by the strength and orientation

of the defects present within the rock mass (joints, fractures, crush zones, foliation shear zones etc.).

The primary defect present within the schist rock is the foliation. The foliation is a persistent plane of weakness, which has the potential to result in stability issues. In addition, secondary defect sets are present in the rock mass, which can interact with the foliation to form unstable blocks and effect the stability of the proposed cut slopes. The presence, location, condition and impact of the secondary defects is difficult to assess prior to construction.

Measures to support unstable rock cuts commonly include the installation of rock anchors, rock bolts and/or shotcrete facing, trimming back the cut face to a shallower angle, and the construction of a retaining structure and/or propping.

Due to the variability of schist terrain, and the random occurrence of secondary defects, it is recommended that a staged approach be adopted for the proposed excavation construction to enable any additional support requirements to be confirmed on a case-by-case basis.

The following recommendations are provided with respect to the proposed excavation in rock materials:

- Pilot cuts should be made in advance of the bulk excavation. Such pilot cuts should be supervised; controlled and logged by a geotechnical specialist and comprise small “slots” which due to their size, location, and depth will not pose a significant instability risk to adjacent sites. Observations made in the pilot cuts should be used to confirm any rock support requirements and the excavation construction sequence prior to proceeding with the bulk excavation.
- The bulk excavation should be completed in a staged manner and advanced in several small steps and bays. The depth and size of the excavation should increase with each stage of excavation. Based on previous local experience, GeoSolve recommends that all batters in schist are initially formed at 0.25H: 1.0V or flatter.
- Each new section of exposed cut face should be inspected by an engineering geologist or geotechnical engineer to confirm the ground conditions and verify any requirement for additional support measures or modification to the excavation sequence.
- The construction programme and budget should make appropriate allowance for the completion of a staged excavation sequence and the installation of additional stabilisation measures.

5.5 Engineered Fill Slopes

All fill underlying the dwelling foundations should be placed and compacted in accordance with the recommendations of NZS 4431: 1989 and Queenstown Lakes District Council Standards. All cut and fill earthworks should be inspected and tested as appropriate during construction and certified by a Chartered Professional Engineer.

All un-retained fill slopes which are less than 6 m high should be constructed with a batter slope angle of 2.0H: 1.0V (horizontal to vertical) or flatter and be benched into sloping ground.

Reinforced earth slopes can be considered if batters need to be steeper than 2.0H: 1.0V.

5.6 Ground Retention

Retaining walls should be designed by a Chartered Professional Engineer using the geotechnical parameters recommended in Table 1 of this report. Due allowance should be made during the detailed design of all retaining walls for forces such as surcharge due to the sloping ground surface behind the retaining walls, groundwater, seismic and traffic loads, swimming pools and buildings.

All temporary slopes for retaining wall construction should be battered in accordance with the recommendations outlined in Table 2 of this report. Where these batter slopes cannot be achieved, temporary retaining will be required.

Groundwater was not identified in the test pits but has the potential to develop following completion of the earthworks, in particular as a result of heavy or prolonged rainfall. To ensure potential groundwater seeps and flows are properly controlled behind the retaining walls, the following recommendations are provided:

- A minimum 0.3 m width of durable free draining granular material should be placed behind all retaining structures;
- A heavy duty non-woven geotextile cloth, such as Bidim A14, should be installed between the natural ground surface and the free draining granular material to prevent siltation and blockage of the drainage media;
- A heavy-duty (TNZ F/2 Class 500) perforated pipe should be installed within the drainage material at the base of all retaining structures to minimise the risk of excessive groundwater pressures developing. This drainage pipe should be connected to the permanent piped storm water system;
- Comprehensive waterproofing measures should be provided to the back face of all retaining walls forming changes in floor level within the dwelling to minimise groundwater seepage into the finished buildings.

It is recommended that the retaining wall excavation batters are inspected by a suitably qualified and experienced Geotechnical Engineer or Engineering Geologist.

5.7 Groundwater Issues

The water table is expected to lie at considerable depth below the site. Dewatering or other groundwater-related construction issues are therefore unlikely to be required. It is important that GeoSolve be contacted should there be any seepage, spring flow or under-runners encountered during construction.

5.8 Slope Stability at House Site

The proposed building is located near the crest of a slope extending down to the shoreline of Lake Wanaka (see Photos 2 & 3). Slopes below the site range up to 45°.

The proposed dwelling is to be excavated down by approximately 3-4 m depth at the slope crest.

A surface layer of glacial till a few metres thick is underlain by schist bedrock. The schist is typically strong, with contorted, highly folded structure making foliation difficult to define. Jointing is moderately to widely spaced, and weathering slight.

No evidence of significant existing slope instability was observed on the slopes below the proposed building, apart from several loose schist blocks.

The building structure is setback less than 3 m from the crest of the slope. No slope stability assessment has been completed at this stage and it is recommended that a detailed slope stability analysis is completed at the detailed design stage, supplemented with additional geotechnical investigations. As the building is positioned close to the slope crest it is critical that geotechnical investigations confirm the glacial till to schist bedrock contact and foliation and defect measurements within the schist rock mass. This can be completed by field mapping of the slope face, trenched test pit/pilot cuts and rock core drilling. Cross sections of the geotechnical model will be completed to assist the slope stability analysis.

If required safety factors are not met suitable remedial options are available comprising benched or piled foundations, rock anchors or soil anchors.

The property boundary is offset 30 m to the east of the proposed dwelling footprint, therefore there is sufficient room to complete remedial measures within the boundary if needed.

All earthworks construction cuts should be subject to inspection during construction, and if higher or steeper than outlined in Table 2 should be subject to specific design.

5.9 Settlement and Foundations

5.9.1 Shallow Foundations

It is expected the building foundations will comprise a concrete slab on grade or engineered fill for the extent of the building platform.

The foundation will bear on either glacial till or possibly schist, following removal of the topsoil, loess & colluvium. Two Scala penetrometer tests were carried out (SC2 & 3) adjacent to TP 4 & 6 (see Appendix B). The test results indicate ‘good bearing’ in the glacial till below the surficial soils.

All unsuitable soil materials identified in foundation excavations, particularly those softened by exposure to water, should be undercut and replaced with engineered fill during construction. Any fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect.

It is recommended the foundation excavations be inspected and tested by a suitably qualified and experienced geotechnical specialist to confirm the conditions are in accordance with the assumptions and recommendations provided in this report.

To minimise the effects of freeze-thaw cycles in footings founded on soil, all shallow foundations should be founded a minimum of 0.4 m below the adjacent finished ground surface.

Figure 2 summarises the recommended working stresses for shallow footings, which bear upon glacial till or engineered fill (overlying glacial till or schist rock). It should be noted the foundation working stresses presented on Figure 2 are governed by bearing capacity in the case of narrow footings and settlement in the case of wide footings.

Figure 2 summarises the recommended working stresses for shallow footings, which bear upon glacial till or engineered fill (overlying glacial till or schist rock). It should be noted the foundation working stresses presented on Figure 2 are governed by bearing capacity in the case of narrow footings and settlement in the case of wide footings.

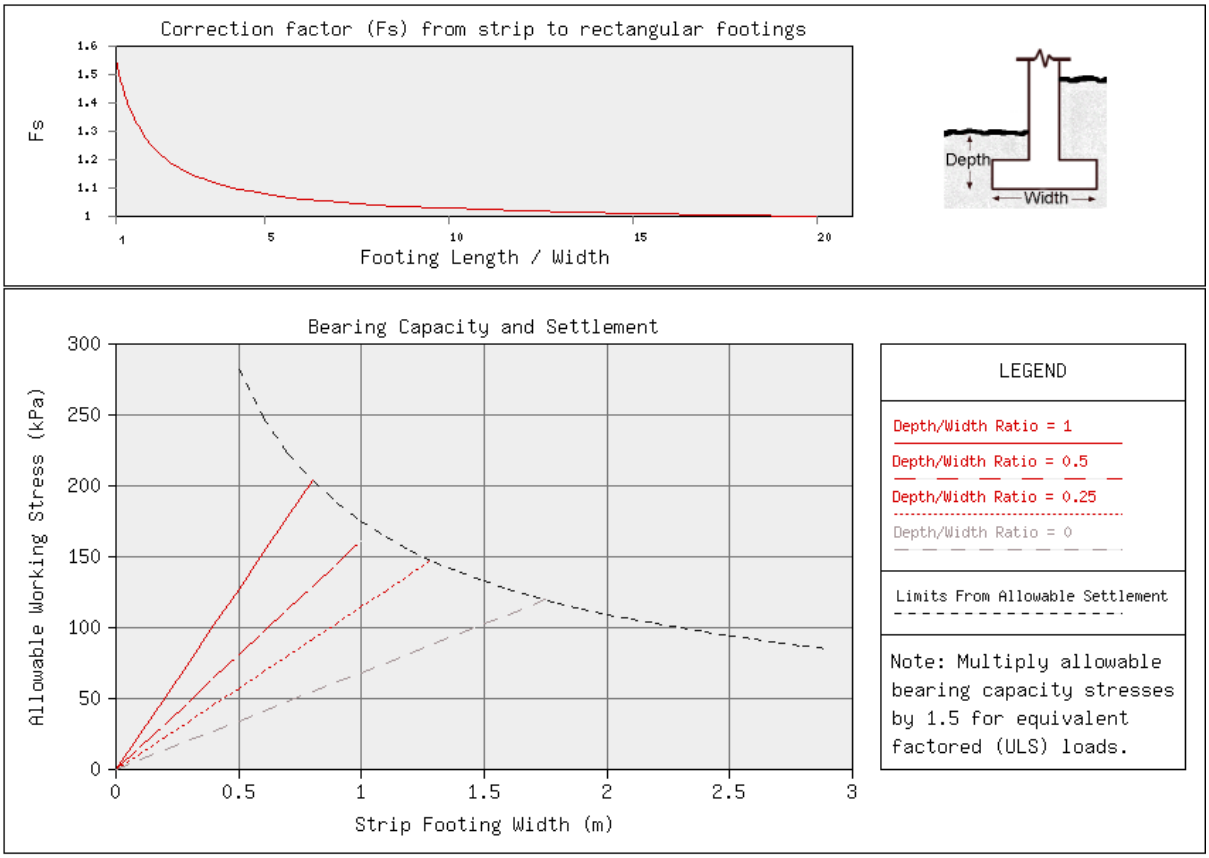


Figure 2. Recommended Bearing for Shallow Footings on glacial till or engineered fill overlying the same.

From Figure 2 it can be seen an allowable working stress of approximately 100 kPa is recommended for a 400 mm wide by 400 mm deep strip footing founded within glacial till or engineered fill. This corresponds to a factored (ULS) bearing capacity of approximately 150 kPa and an ultimate geotechnical bearing capacity of 300 kPa.

Inspection and testing (Scala penetrometers) should be completed along the footing alignments during construction to confirm the above values are applicable and that the soil has not been softened by weather or excavation.

5.9.2 Foundations on Schist Bedrock

For foundations bearing on competent schist bedrock an allowable working stress of 300 kPa is recommended for a 0.4 m wide by 0.4 m deep footing. This corresponds to a factored (ULS) geotechnical bearing capacity of approximately 450 kPa and an ultimate geotechnical bearing capacity of 900 kPa.

5.9.3 Settlement

Settlement and differential settlement of shallow foundations are expected to be within structurally acceptable limits provided the recommendations of Section 5.9 are followed and

all unsuitable soil materials, particularly those softened by water, are undercut and replaced with engineered fill during construction.

5.10 Site Subsoil Category

For detailed design purposes it is recommended the magnitude of seismic acceleration be estimated in accordance with the recommendations provided in NZS 1170.5:2004.

Following the proposed excavations, the building footprint is likely Class B (less than 3 m of soil overlying competent rock) and Class C (shallow soil site) in accordance with NZS 1170.5:2004 seismic provisions. As the development is expected to partially bear upon schist bedrock or less than 3 m of soil overlying schist it is recommended that Class C is adopted for design purposes.

5.11 Topographic Amplification Factor

The proposed development is situated close to the edge of a ~50 m high, moderately inclined (up to approximately 45°) slope. During earthquake shaking seismic waves radiate out from the source and converge along steep topography at the Earth's surface such as cliff edges or ridge tops. Evaluation of damage in the Port Hills following the Christchurch earthquakes observed well demarked areas of increased damage near the crest of steep slopes which indicated clear zones of seismic amplification.

Based on the recommendations of Eurocode 8[1], a topographic amplification factor of 1.2 is recommended to be adopted for the design of the building.

5.12 Other Earthworks

Investigations were carried out for a series cuts and fills in other parts of the property (see Figure 1c, Appendix A for the proposed cut and fill plan).

- A new access road to the house requires a cut through a 3 m high moraine ridge to the northwest. TP11 was located on the ridge and found glacial till to 3.1 m depth indicating the excavations would be entirely in glacial till.
- Landscaping fill is proposed on gently sloping ground downslope of the house at the northern end of the property. TPs 1-3 and a Scala penetrometer test were located in this area to check soil relative density. The test pits found thin loess/colluvium underlain by glacial till and no evidence of groundwater. The areas appear to be appropriate for suitably designed landscape fill benches. Further commentary around the wastewater field proposed for this area is given below.
- Fills of up to 5.5 m (however generally less than 2.0 m) are proposed to the west of the dwelling to dispose of the required dwelling excavation excess fill material. This area is expected to be underlain by glacial till and schist bedrock. Instability would appear unlikely assuming fills are well compacted and constructed in accordance with the recommendations provided within Section 5.4 and 5.5.

5.13 Pool Foundations

A swimming pool is proposed on a gently sloping site at the northern end of the proposed building complex (see Figure 1, Appendix A).

[1] Eurocode 8: Design Provisions for Earthquake Resistant Structures

To provide a preliminary assessment of likely ground conditions, a test pit (TP9) was undertaken adjacent to the proposed pool location. TP9 observed topsoil and colluvium to 0.6 m depth, underlain by glacial till to 2.8 m. No groundwater was present in the pit.

The data suggests that 'floatation' conditions due to a high watertable are unlikely to be an issue. Further work would be necessary to determine if schist bedrock could be encountered in other parts of the pool excavation.

5.14 Wastewater Disposal Area

The wastewater disposal field is proposed in the northeast of the site as shown on Figures 1a-c, Appendix A. TPs 1-3 were undertaken within this area which observed shallow loess and colluvium overlying glacial till comprising sandy SILT, SILT and silty SAND with minor gravel. Fill earthworks of up to 2.5 m thickness is proposed for the wastewater disposal area. It is recommended that wastewater disposal is targeted within the natural soils below the proposed landscaping fill. It is not recommended to dispose of wastewater into engineered fills onsite.

Glacial till comprising the above is considered likely to be a Soil Category 4 soil (CLAY LOAM). Glacial till was observed to extend to a depth of up to 2.6 m bgl in the proposed wastewater disposal area. The depth to rock is unknown at this stage.

Site specific testing can be completed at detailed design to confirm the soil category (a loading rate higher than that of Soil Category 4 may be able to be achieved with further testing) if required by the designer.

6 Neighbouring Structures/Hazards

Natural Hazards: Known seismic hazards affecting the development are detailed in Section 4.1 and appropriate allowance should be made for seismic loading during detailed design of the proposed building and foundations. The development is not located within any mapped slope instability features, liquefaction susceptibility areas or any other hazard features on the QLDC or GeoSolve databases. Due to the nature of the soils, shallow bedrock, and depth to water table there is no liquefaction risk on this site.

Distances to adjoining structures: The site is situated on a large section and it is 300 m to the nearest dwelling. No adverse geotechnical implications apply for neighbouring properties during construction of the dwelling as long as dust mitigation measures are undertaken.

Aquifers: No aquifer resource will be adversely affected by the development.

Erosion and Sediment Control: The site presents some potential to generate silt runoff during heavy rainfall events and this would naturally drain downslope. Effective systems for erosion control are runoff diversion drains and contour drains, while for sediment control, options are earth bunds, silt fences, vegetation buffer strips and sediment ponds. Only the least amount of subsoil should be exposed at any stage and surfacing established as soon as practical. Details for implementation are given within the following link: http://esccanterbury.co.nz/.

Noise: It is expected that conventional earthmoving equipment, such as excavators, trucks and rollers will be required during construction. No neighbouring dwellings are located near the proposed earthworks areas.

Dust: Regular dampening of soil materials with sprinklers to QLDC standards should be effective if required.

Vibration: No vibration induced settlement is expected in these soil types. No buildings will be in close proximity to the proposed engineered fill works.

7 Conclusions and Recommendations

- The site is in glacial terrain elevated high above the lake shore, with glacial till overlying schist bedrock, and surficial loess & colluvium;
- No groundwater seepage was observed in the test pits during site investigations and the water table is inferred to lie at considerable depth;
- Geotechnical investigations show the foundations of the proposed building are likely to be on glacial till overlying schist bedrock or directly upon schist bedrock;
- Additional investigations for the building foundations should be carried out at detailed design when the existing dwelling is removed;
- The proposed building is located within 3 m of the crest of a high, steep (up to 45°) schist slope. A detailed slope stability assessment is recommended at detailed design stage, supplemented with further geotechnical investigations;
- For detailed design purposes it is recommended the magnitude of seismic acceleration be estimated in accordance with the recommendations of NZS 1170.5:2004 using “Class C” subsoil conditions;
- Due to the ridge-top location of the building, a seismic amplification factor should be applied during detailed design. This is detailed within Section 5.11;
- Recommendations for temporary and permanent batter slope angles are described in Table 2. Slopes that are required to be steeper than those described should be structurally retained or subject to specific geotechnical design;
- All retaining walls should be designed by a Chartered Professional Engineer using the geotechnical parameters recommended in Table 1 of this report;
- All unsuitable materials identified in foundation excavations, particularly those softened by exposure to water, should be undercut and replaced with engineered fill during construction.
- Any fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect;
- A geotechnical practitioner should inspect all excavation batters and foundation soils and additionally any seepage, spring flow or under-runners that may be encountered during construction;
- Limited investigations adjacent to the proposed pool show no groundwater issues, with excavations likely to be in glacial till but with the possibility of some schist bedrock.

8 Applicability

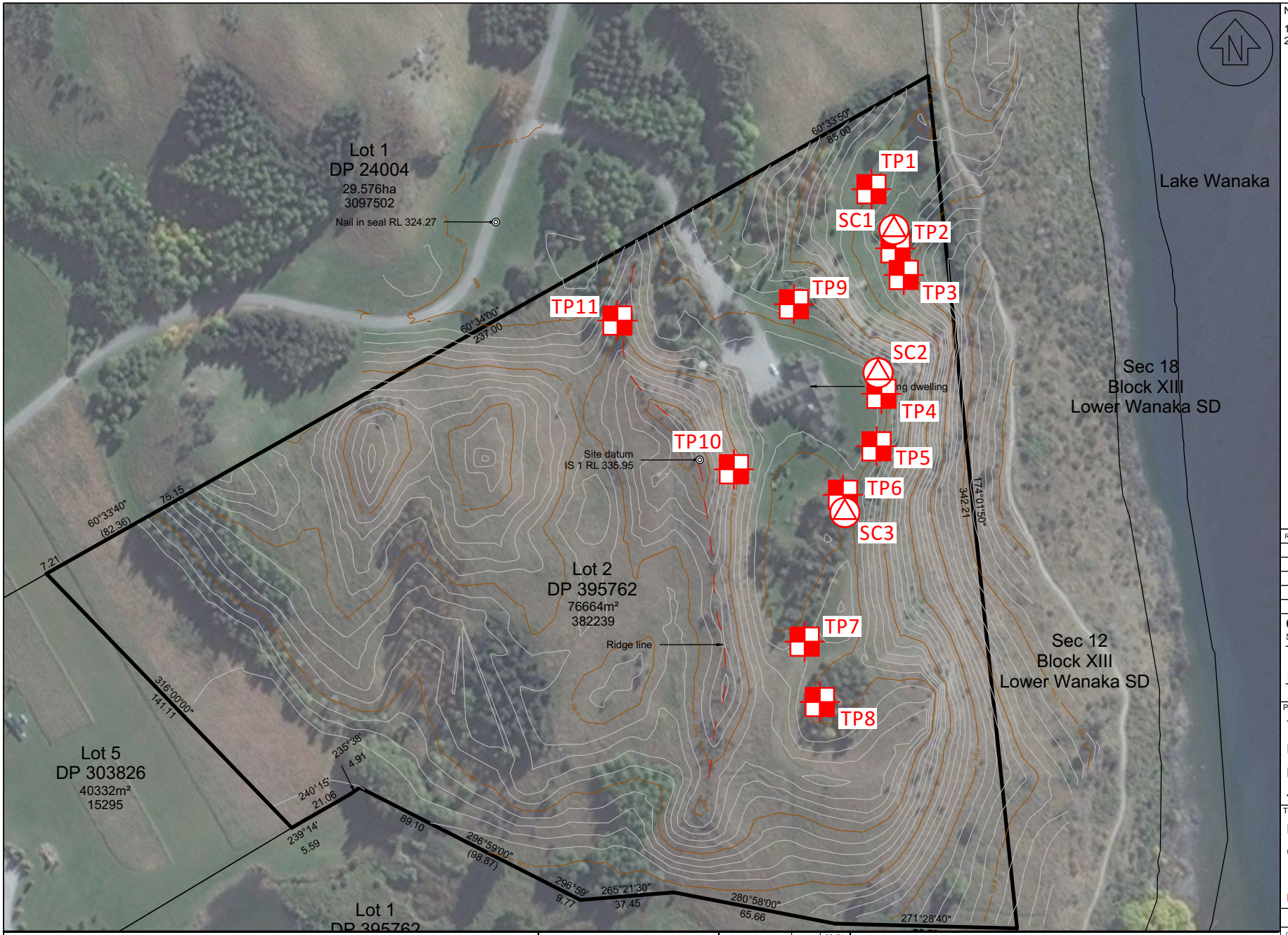
This report has been prepared for the benefit of Batchelar McDougall Consulting Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Additional investigations for the building foundations should be carried out when the existing dwelling is demolished.

Please don't hesitate to contact the undersigned if we can provide any further assistance with this project.

Report prepared by:	Reviewed for GeoSolve Ltd by:
	
.....	.....
Mike Plunket	Fraser Wilson
Geotechnical Engineer	Senior Engineering Geologist

Appendix A: Site Plan & Cross-sections



NOTES:

1) Origin of Levels IS 1 RL = 335.95m.
2) Aerial Photo is for indicative purposes only.

LEGEND

- Site Boundary
- Contour Minors (1.0m)
- Contours Major (5.0m)
- Existing Ridge Line

Revision	Amendments	Date
B	Moved text, add legend	17/03/2021
C	Changed datum to NZVD2016	29/01/2021

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

Title:

EXISTING GROUND

CONTOURS

PRELIMINARY

Key

TP1 = Test Pit location

SC1 = Scala Penetrometer test location

GEOSOLVE
ENGINEERING CONSULTANTS

DRAWN	MDP	03/21
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APPROVED	FAW	03/21
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SCALE: (AT A3 SIZE) As Shown		
PROJECT No. 200864		

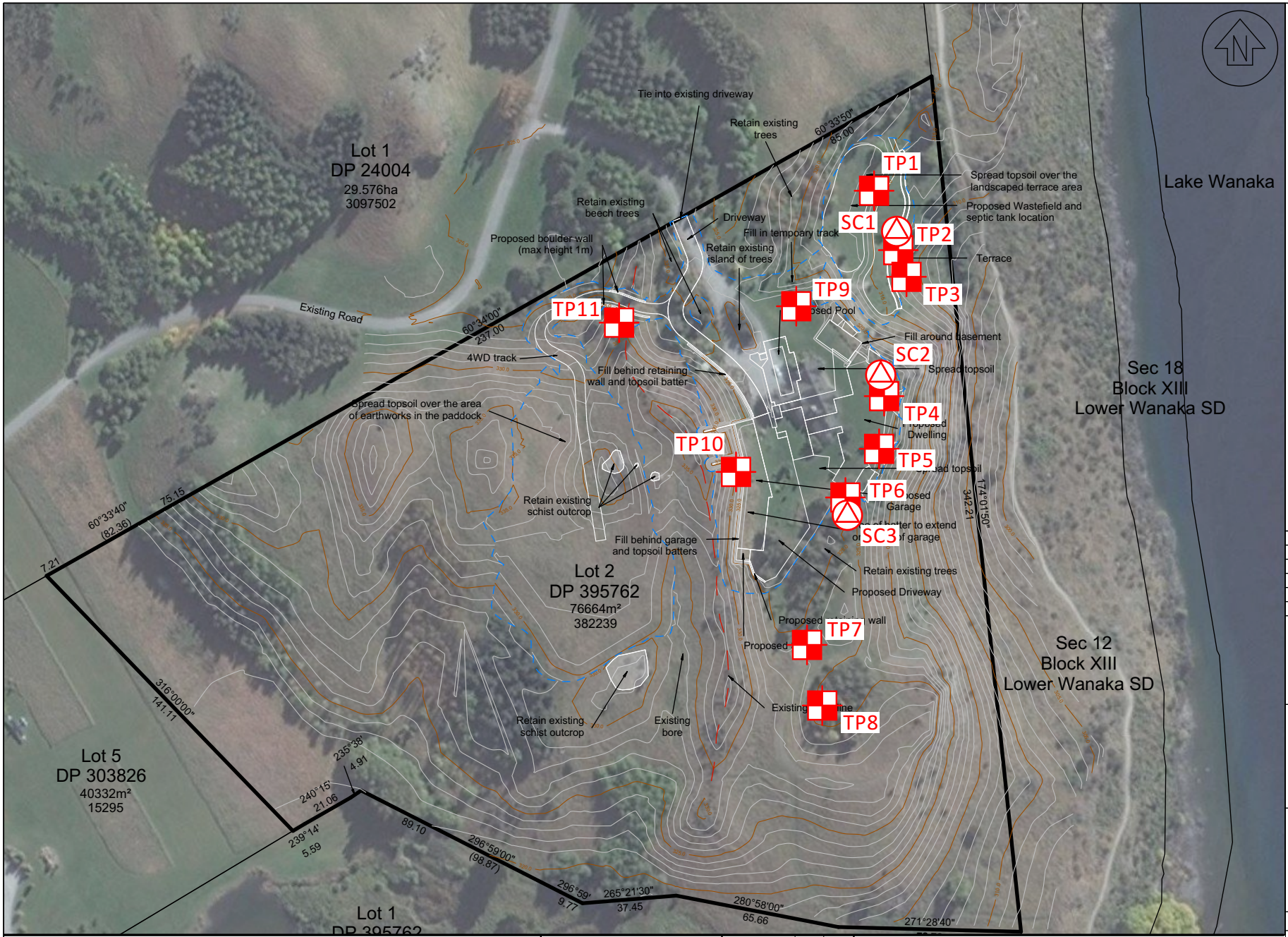
Batchelar McDougall Consulting
492 Wanaka-Mt Aspiring Road, Wanaka
Geotechnical Investigation
Investigation Site Plan

FIG No. Appendix A - Figure 1a REV. 0

Scale: 1:1500 (A3)

Job No:	Drawn By:	Datum:
5450	SR	NZVD2016

Drawing No:	Sheet No:	Revision:	Date Created:
C1538	1	C	23/11/2020



NOTES:

1) Origin of Levels IS 1 RL = 335.95m.
2) Aerial Photo is for indicative purposes only.

Earthworks Quantities

Cut	20,800m³
Fill	20,800m³
Total Volume	41,600m³
Area	17,500m²
Max Cut	7.2m
Max Fill	5.3m

LEGEND

- Site Boundary
- Contours Minor (1.0m)
- Contours Major (5.0m)
- Existing Ridge Line
- Extent of Earthworks

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Earthworks over site and quantities	26/04/2021
F	Earthwork quantities note	05/05/2021

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THE SANCTUARY PROJECT
EARTHWORKS DESIGN
LOT 2 DP 395762
494 WANAKA-MT ASPIRING ROAD

Title:
PROPOSED CONSTRUCTION EARTHWORKS DESIGN CONTOURS
PRELIMINARY

Key

TP1 = Test Pit location

SC1 = Scala Penetrometer test location

GEOSOLVE ENGINEERING CONSULTANTS

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SCALE: (AT A3 SIZE) As Shown		
PROJECT No. 200864		

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Geotechnical Investigation
Investigation Site Plan

FIG No. Appendix A - Figure 1b REV. 0

Scale: 1:1500 (A3)

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5450	SR	NZVD2016

Drawing No:	Sheet No:	Revision:	Date Created:
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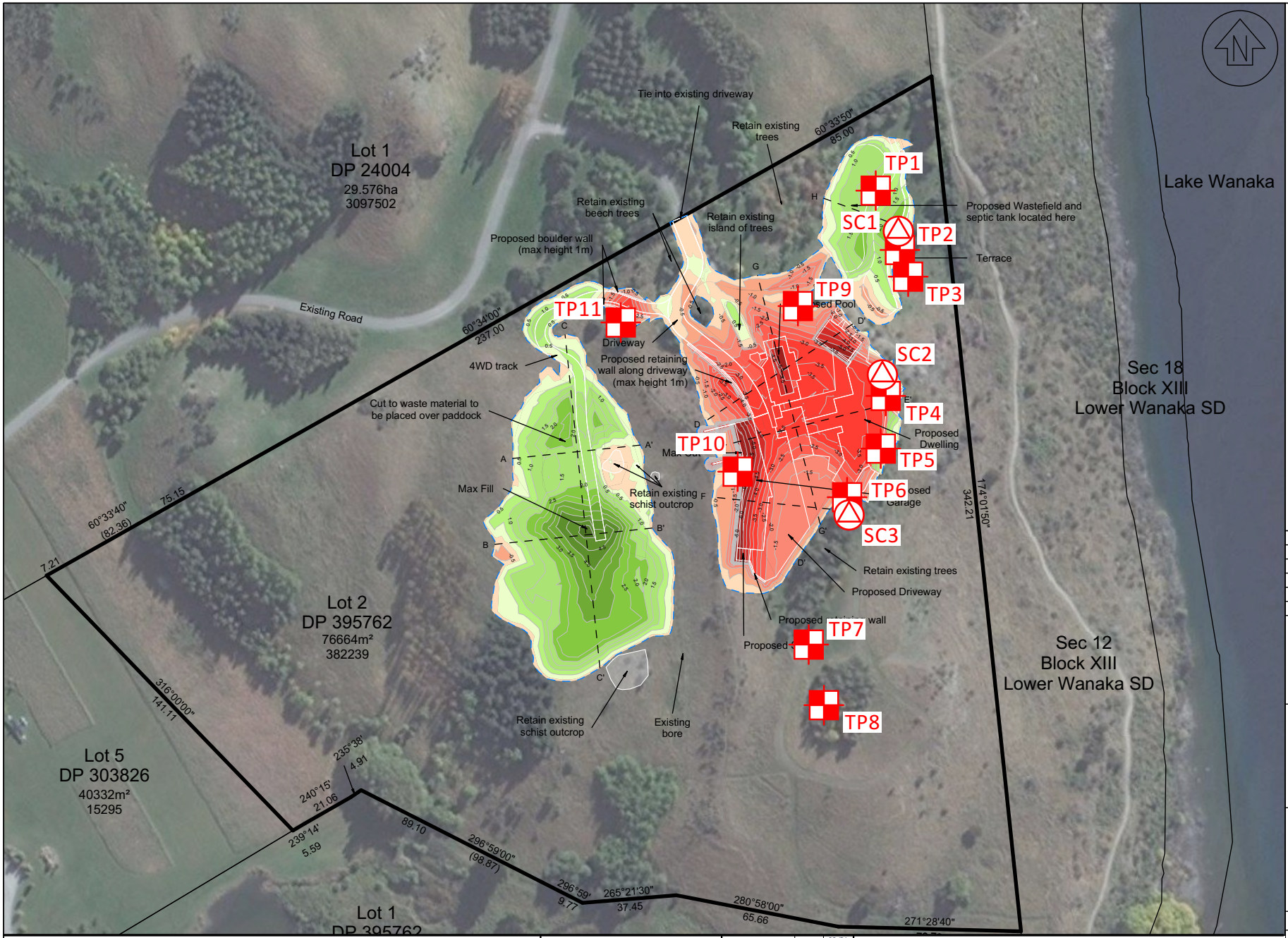

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.
2) Aerial Photo is for indicative purposes only.

Earthworks Quantities

Cut	20,800m³
Fill	20,800m³
Total Volume	41,600m³
Area	17,500m²
Max Cut	7.2m
Max Fill	5.3m

LEGEND

Site Boundary
Depth Contours (at 0.5m interval)
Extent of Earthworks
Sections

CUT/FILL

CUT: 5.0m +; 4.0 - 5.0m; 3.0 - 4.0m; 2.0 - 3.0m; 1.0 - 2.0m; 0.5 - 1.0m; 0 - 0.5m

FILL: 0 - 0.5m; 0.5 - 1.0m; 1.0 - 2.0m; 2.0 - 3.0m; 3.0 - 4.0m; 4.0 - 5.0m; 5.0m +

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Earthworks over site and quantities	26/04/2021
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Project:
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EARTHWORKS DESIGN
LOT 2 DP 395762
494 WANAKA-MT ASPIRING ROAD

Title:
PROPOSED CONSTRUCTION EARTHWORKS DEPTH POLYGONS
PRELIMINARY

Key

TP1 = Test Pit location

SC1 = Scala Penetrometer test location

GEOSOLVE ENGINEERING CONSULTANTS

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APPROVED	FAW	03/21
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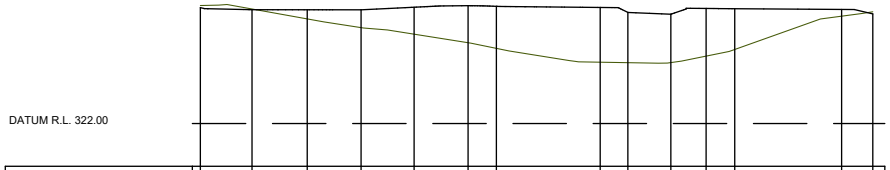
Geotechnical Investigation
Investigation Site Plan

FIG No. Appendix A - Figure 1c REV. 0

Scale: 1:1500 (A3)

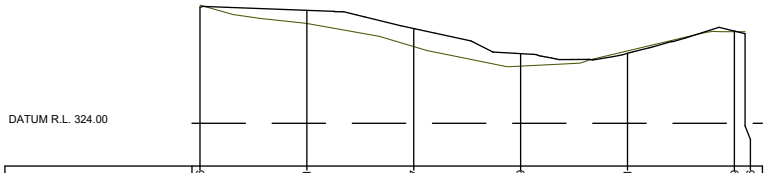
Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	3	F	23/11/2020



FINISHED SURFACE LEVELS	332.85	332.65	332.65	332.64	332.88	333.03	332.97	332.86	332.40	332.23	332.77	332.74	332.68	332.26
EXISTING SURFACE LEVELS	333.04	332.72	331.79	330.97	330.36	329.56	329.03	327.74	327.69	327.70	328.31	328.93	332.05	332.46
EARTHWORKS CUT(-) / FILL(+)	-0.20	-0.07	0.86	1.67	2.52	3.47	3.93	5.12	4.71	4.53	4.46	3.81	0.63	-0.20
CHAINAGE	0.00	4.83	10.00	15.04	20.00	25.05	27.70	37.41	40.00	44.02	47.32	50.00	60.00	62.92

CROSS SECTION - B-B'

SCALE HORIZ=1:500 VERT=1:500



FINISHED SURFACE LEVELS	334.866	334.571	332.867	330.519	330.551	332.629	332.386
EXISTING SURFACE LEVELS	335.054	333.341	331.177	329.350	330.773	332.571	332.570
EARTHWORKS CUT(-) / FILL(+)	-0.188	1.230	1.691	1.169	-0.223	0.058	-0.184
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	51.000

CROSS SECTION - A-A'

SCALE HORIZ=1:500 VERT=1:500

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Changed scale.	12/04/2021
F	Earthworks and changed scale.	26/04/2021

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

Title:

PROPOSED CONSTRUCTION

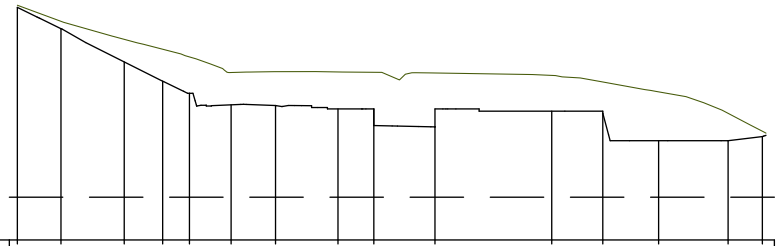
EARTHWORKS CROSS SECTIONS

A-A' & B-B'

PRELIMINARY

Scale: AS SHOWN (A3)

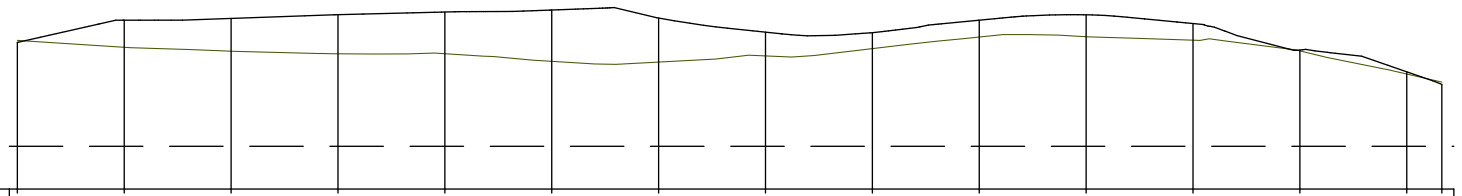
Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	4	F	23/11/2020



FINISHED SURFACE LEVELS	332.76	330.77	327.66	325.85	324.72	323.64	323.58	323.26	323.26	321.58	323.05	322.86	320.29	320.29	320.67
EXISTING SURFACE LEVELS	332.96	331.46	329.77	328.85	328.13	326.67	326.75	326.72	326.69	326.62	326.40	325.78	324.86	322.85	321.18
EARTHWORKS CUT(-) / FILL(+)	-0.20	-0.69	-2.11	-3.00	-3.40	-3.02	-3.17	-3.46	-3.43	-5.04	-3.35	-2.92	-4.57	-2.56	-0.50
CHAINAGE	0.00	4.08	10.00	13.60	16.10	20.00	24.16	30.00	33.35	39.07	50.00	54.78	60.00	66.50	69.71

CROSS SECTION - D-D'

SCALE HORIZ=1:500 VERT=1:500



FINISHED SURFACE LEVELS	329.72	331.80	331.96	332.32	332.56	332.75	332.00	330.68	330.63	331.80	332.30	331.49	329.01	326.97	325.79
EXISTING SURFACE LEVELS	329.91	329.27	328.90	328.66	328.66	327.95	327.88	328.46	329.14	330.22	330.25	329.93	328.93	326.76	326.01
EARTHWORKS CUT(-) / FILL(+)	-0.20	2.53	3.06	3.66	3.90	4.80	4.12	2.22	1.49	1.58	2.05	1.56	0.08	0.21	-0.22
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	133.28

CROSS SECTION - C-C'

SCALE HORIZ=1:500 VERT=1:500

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Changed scale.	12/04/2021
F	Earthworks and changed scale.	26/04/2021

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

Title:

PROPOSED CONSTRUCTION

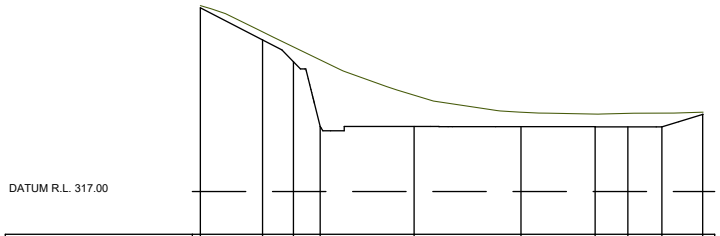
EARTHWORKS CROSS SECTIONS

C-C' & D-D'

PRELIMINARY

Scale: AS SHOWN (A3)

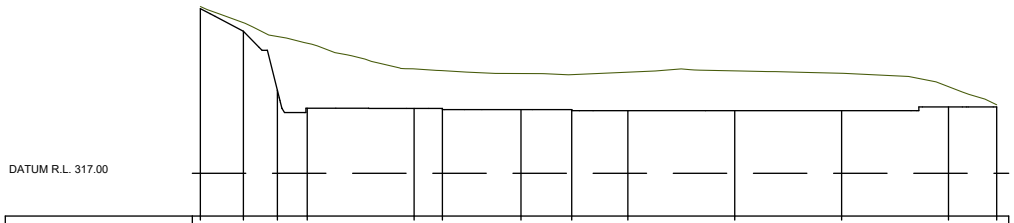
Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	5	F	23/11/2020



FINISHED SURFACE LEVELS	334.19	331.19	329.14	323.09	323.09	323.07	323.05	323.05	323.05	324.22	
EXISTING SURFACE LEVELS	334.40	331.94	330.53	329.32	326.01	324.42	324.25	324.31	324.34	324.42	
EARTHWORKS CUT(-) / FILL(+)	-0.20	-0.76	-1.39	-6.23	-2.93	-1.35	-1.20	-1.26	-1.29	-0.21	
CHAINAGE	0.00	5.82	8.71	11.21	20.00	30.00	36.94	40.00	43.18	47.00	

CROSS SECTION - F-F'

SCALE HORIZ=1:500 VERT=1:500



FINISHED SURFACE LEVELS	332.40	330.29	324.77	323.09	323.07	322.96	322.96	322.96	322.86	322.86	322.86	323.21	323.21
EXISTING SURFACE LEVELS	332.60	331.09	329.80	329.17	326.77	326.61	326.34	326.23	326.46	326.58	326.36	325.11	323.41
EARTHWORKS CUT(-) / FILL(+)	-0.20	-0.80	-5.03	-6.08	-3.70	-3.65	-3.38	-3.27	-3.60	-3.72	-3.50	-1.90	-0.20
CHAINAGE	0.00	4.03	7.21	10.00	20.00	22.65	30.00	34.75	40.00	50.00	60.00	70.00	74.51

CROSS SECTION - E-E'

SCALE HORIZ=1:500 VERT=1:500

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.

Revision	Amendments	Date
B	Earthworks terrace, tracks removed and quantities	28/01/2021
C	Earthworks over site and quantities	17/01/2021
D	Changed datum to NZVD2016	29/01/2021
E	Changed scale.	12/04/2021
F	Earthworks and changed scale.	26/04/2021

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

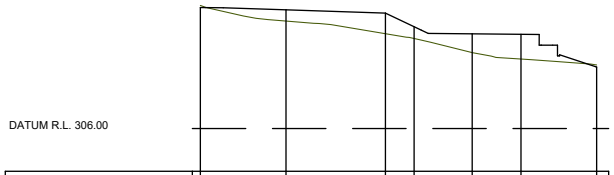
Title:

PROPOSED CONSTRUCTION EARTHWORKS CROSS SECTIONS E-E' & F-F'

PRELIMINARY

Scale: AS SHOWN (A3)

Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	6	F	23/11/2020



FINISHED SURFACE LEVELS	317.32	317.11	316.80	315.53	314.86	314.82	311.75
EXISTING SURFACE LEVELS	317.52	316.06	314.87	314.43	313.10	312.50	311.95
EARTHWORKS CUT(-) / FILL(+)	-0.20	1.05	1.93	1.10	1.76	2.31	-0.19
CHAINAGE	0.00	8.01	17.32	20.00	25.44	30.00	37.08

CROSS SECTION - H-H'

SCALE HORIZ=1:500 VERT=1:500

FINISHED SURFACE LEVELS	323.08	322.13	321.91	323.05	323.05	323.26	321.31	321.41	321.69	321.81	322.96	322.96	322.96	322.96	323.05	323.05	323.05	323.73	
EXISTING SURFACE LEVELS	323.29	322.92	322.75	323.51	325.34	326.43	326.51	326.50	326.29	326.30	326.51	326.48	325.47	324.77	324.57	324.41	324.31	324.29	
EARTHWORKS CUT(-) / FILL(+)	-0.21	-0.79	-0.84	-0.46	-2.29	-3.16	-5.20	-5.09	-4.60	-4.48	-3.55	-3.52	-2.51	-1.81	-1.52	-1.36	-1.26	-0.55	
CHAINAGE	0.00	2.69	5.72	9.82	20.00	29.77	32.77	35.77	40.00	48.77	53.97	60.00	70.00	75.77	80.00	90.00	97.68	100.66	

CROSS SECTION - G-G'

SCALE HORIZ=1:500 VERT=1:500

NOTES:

1) Origin of Levels IS 1 RL = 335.95m.

Revision	Amendments	Date

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Project:

THE SANCTUARY PROJECT

EARTHWORKS DESIGN

LOT 2 DP 395762

494 WANAKA-MT ASPIRING ROAD

Title:

PROPOSED CONSTRUCTION EARTHWORKS CROSS SECTIONS G-G' & H-H'

PRELIMINARY

Scale: AS SHOWN (A3)

Job No:	Drawn By:	Datum:	
5450	SR	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
C1538	7	A	23/04/2021

Appendix B: Investigation Data

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 1**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger		OPERATOR: Ethan	
NORTHING:	mN	INFOMAP NO.		COMPANY: Diverse Works	
ELEVATION:	m	DIMENSIONS:		HOLE STARTED: 7-Feb-17	
METHOD:		EXCAV. DATUM:		HOLE FINISHED: 7-Feb-17	

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.2		Black, organic SILT.	Moist	TOPSOIL
		0.5		Light brown, sandy SILT with rootlets. Sand is fine. Silt is non-plastic. Stiff. Massive.	Moist	LOESS
		0.9		Brown, silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse. Medium dense. Massive.	Moist	COLLUVIUM
	NO SEEPAGE	2.4		Grey, interbedded sandy SILT, SILT & silty SAND with minor gravel. Gravel is fine to coarse. Sand is fine. Silt is non-plastic. Very stiff/Medium dense. Massive to weakly bedded.	Moist	TILL

Total Depth = 2.4 m

COMMENT:	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 2**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger		OPERATOR: Ethan	
NORTHING:	mN	INFOMAP NO.		COMPANY: Diverse Works	
ELEVATION:	m	DIMENSIONS:		HOLE STARTED: 7-Feb-17	
METHOD:		EXCAV. DATUM:		HOLE FINISHED: 7-Feb-17	

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.3		Black, organic SILT.	Moist	TOPSOIL
		1.6		Chocolate brown, sandy GRAVEL with some silt & rootlets. Sand is fine. Gravel is fine to coarse. Loose. Massive.	Moist	COLLUVIUM
	NO SEEPAGE	2.1		Grey, interbedded sandy SILT, SILT & silty SAND with minor gravel. Gravel is fine to coarse. Sand is fine. Silt is non-plastic. Very stiff/Medium dense. Massive to weakly bedded.	Moist	TILL

Total Depth = 2.1 m

COMMENT:	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 3**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger	OPERATOR: Ethan
NORTHING:	mN	INFOMAP NO.	COMPANY: Diverse Works
ELEVATION:	m	DIMENSIONS:	HOLE STARTED: 7-Feb-17
METHOD:		EXCAV. DATUM:	HOLE FINISHED: 7-Feb-17

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.3		Black, organic SILT.	Moist	TOPSOIL
		0.6		Light brown, sandy SILT with rootlets. Sand is fine. Silt is non-plastic. Stiff. Massive.	Moist	LOESS
		1.2		Brown, silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse. Medium dense. Massive.	Moist	COLLUVIUM
	NO SEEPAGE	2.6		Grey, interbedded sandy SILT, SILT & silty SAND with minor gravel. Gravel is fine to coarse. Sand is fine. Silt is non-plastic. Very stiff/Medium dense. Massive to weakly bedded.	Moist	TILL

Total Depth = 2.6 m

COMMENT:	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 4**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger		OPERATOR: Ethan	
NORTHING:	mN	INFOMAP NO.		COMPANY: Diverse Works	
ELEVATION:	m	DIMENSIONS:		HOLE STARTED: 7-Feb-17	
METHOD:		EXCAV. DATUM:		HOLE FINISHED: 7-Feb-17	

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.3		Dark brown, organic SILT.	Moist	TOPSOIL
		0.6		Brown, sandy SILT with minor gravel & rootlets. Sand is fine. Gravel is fine to medium. Silt is non-plastic. Stiff. Massive.	Moist	COLLUVIUM
		1.9		Grey, gravelly sandy SILT with minor lenses of fine sand. Sand is fine to coarse. Gravel is fine to coarse. Silt is non-plastic. Very stiff. Massive.	Moist	TILL
	NO SEEPAGE	2.0		Grey, SCHIST. Slightly weathered. Strong. Foliation contorted, joints widely spaced.	Moist	SCHIST

Total Depth = 2 m

COMMENT: B4 Pole 7- Cut 2.29 m below top of poll (top of poll 0.89 m above ground level).	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 5**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger	OPERATOR: Ethan
NORTHING:	mN	INFOMAP NO.	COMPANY: Diverse Works
ELEVATION:	m	DIMENSIONS:	HOLE STARTED: 7-Feb-17
METHOD:		EXCAV. DATUM:	HOLE FINISHED: 7-Feb-17

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.2		Dark brown, organic SILT.	Moist	TOPSOIL
		0.7		Brown, sandy SILT with minor gravel & rootlets. Sand is fine. Gravel is fine to medium. Silt is non-plastic. Stiff. Massive.	Moist	COLLUVIUM
	NO SEEPAGE	2.7		Grey, sandy SILT with some gravel & boulders. Sand is fine to coarse. Boulders max. diameter 500mm. Silt is non-plastic. Very stiff. Massive.	Moist	TILL
		2.8		Grey, SCHIST. Slightly weathered. Strong. Foliation contorted, joints widely spaced.	Moist	SCHIST

Total Depth = 2.8 m

COMMENT: Near B5 Pole 9 -Cut 2.07 m below top of hole (top of hole 0.86 m above ground level).	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 6**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger		OPERATOR: Ethan	
NORTHING:	mN	INFOMAP NO.		COMPANY: Diverse Works	
ELEVATION:	m	DIMENSIONS:		HOLE STARTED: 7-Feb-17	
METHOD:		EXCAV. DATUM:		HOLE FINISHED: 7-Feb-17	

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.2		Dark brown, organic SILT.	Moist	TOPSOIL
		0.4		Light brown, sandy SILT with rootlets. Sand is fine. Silt is non-plastic. Stiff. Massive.	Moist	LOESS
		0.6		Brown, silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse. Medium dense. Massive.	Moist	COLLUVIUM
	NO SEEPAGE	2.0		Grey, sandy SILT. Sand is fine. Silt is non-plastic. Very stiff. Poorly developed laminations.	Moist	TILL

Total Depth = 2 m

COMMENT: B6 Pole 16- Cut 2.79 m below top of poll (top of poll 0.87 m above ground level).	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 7**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger	OPERATOR: Ethan
NORTHING:	mN	INFOMAP NO.	COMPANY: Diverse Works
ELEVATION:	m	DIMENSIONS:	HOLE STARTED: 7-Feb-17
METHOD:		EXCAV. DATUM:	HOLE FINISHED: 7-Feb-17

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.2		Black, organic SILT.	Moist	TOPSOIL
		0.3		Brown, silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse. Medium dense. Massive.	Moist	COLLUVIUM
		1.9		Grey, sandy SILT. Sand is fine. Silt is non-plastic. Very stiff. Poorly developed laminations.	Moist	TILL
	NO SEEPAGE	3.8		Grey, gravelly sandy SILT with minor lenses of fine sand. Sand is fine to coarse. Gravel is fine to coarse. Silt is non-plastic. Very stiff. Massive.	Moist	TILL

Total Depth = 3.8 m

COMMENT:	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 8**

PROJECT: 492 Mt Aspiring-Wanaka Rd			Job Number: 170051
LOCATION: See Site Plan	Inclination:	VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger		OPERATOR: Ethan	
NORTHING:	mN	INFOMAP NO.		COMPANY: Diverse Works	
ELEVATION:	m	DIMENSIONS:		HOLE STARTED: 7-Feb-17	
METHOD:		EXCAV. DATUM:		HOLE FINISHED: 7-Feb-17	

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.3		Chocolate brown, organic SILT loam with rootlet voids & tree roots.	Moist	TOPSOIL
		0.6		Light brown, sandy SILT with rootlets. Sand is fine. Silt is non-plastic. Stiff. Massive.	Moist	LOESS
	NO SEEPAGE	2.2		Grey, sandy SILT with minor to some gravel. Sand is fine. Gravel is fine to medium. Silt is non-plastic. Very stiff. Massive.	Moist	TILL

Total Depth = 2.2 m

COMMENT:	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 9**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger	OPERATOR: Ethan
NORTHING:	mN	INFOMAP NO.	COMPANY: Diverse Works
ELEVATION:	m	DIMENSIONS:	HOLE STARTED: 7-Feb-17
METHOD:		EXCAV. DATUM:	HOLE FINISHED: 7-Feb-17

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.3		Black, organic SILT with rootlets.	Moist	TOPSOIL
		0.6		Brown, silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse. Medium dense. Massive.	Moist	COLLUVIUM
	NO SEEPAGE	2.8		Grey, silty SAND & sandy SILT with minor gravel. Sand is fine. Gravel is fine to coarse. Medium dense/ Very stiff. Massive.	Moist	TILL

Total Depth = 2.8 m

COMMENT: P3- 2.81 m cut to pool BL (peg 0.85 m above ground level).	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 10**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger		OPERATOR: Ethan	
NORTHING:	mN	INFOMAP NO.		COMPANY: Diverse Works	
ELEVATION:	m	DIMENSIONS:		HOLE STARTED: 7-Feb-17	
METHOD:		EXCAV. DATUM:		HOLE FINISHED: 7-Feb-17	

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
	NO SEEPAGE	0.3		Black, organic SILT.	Moist	TOPSOIL
		0.8		Light brown, sandy SILT with rootlets. Sand is fine. Silt is non-plastic. Stiff. Massive.	Moist	LOESS
		1.5		Grey, silty SAND with minor to some gravel & boulders. Sand is fine. Gravel is fine to coarse. Max. boulder diameter 500mm. Medium dense. Massive.	Moist	TILL
		1.6		Grey, SCHIST. Slightly weathered. Strong. Foliation contorted, joints widely spaced.	Moist	SCHIST

Total Depth = 1.6 m

COMMENT: G6- Cut 6.69 m to garage FFL (peg 0.85 m above ground level).	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd
EXCAVATION LOG

EXCAVATION NUMBER: **TP 11**

PROJECT: 492 Mt Aspiring-Wanaka Rd		Job Number: 170051
LOCATION: See Site Plan	Inclination: VERTICAL	Direction:

EASTING:	mE	EQUIPMENT: 8Tonne digger	OPERATOR: Ethan
NORTHING:	mN	INFOMAP NO.	COMPANY: Diverse Works
ELEVATION:	m	DIMENSIONS:	HOLE STARTED: 7-Feb-17
METHOD:		EXCAV. DATUM:	HOLE FINISHED: 7-Feb-17

SCALA PENETRATION	GROUNDWATER / SEEPAGE	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	WATER CONTENT	GEOLOGICAL: SOIL / ROCK TYPE, ORIGIN, MINERAL COMPOSITION, DEFECTS, STRUCTURE, FORMATION
		0.3		Grey, organic SILT with roots.	Moist	TOPSOIL
		0.5		Light brown, sandy SILT. Sand is fine. Silt is non-plastic. Stiff. Massive.	Moist	LOESS
	NO SEEPAGE	3.1		Grey, sandy SILT with minor to some gravel & cobbles. Sand is fine. Gravel is fine to coarse. Cobbles max. size 200mm. Silt is non-plastic. Very stiff. Massive.	Moist	TILL

Total Depth = 3.1 m

COMMENT: D3 -Cut 2.8 m (peg 0.75 m above ground level).	Logged By: GSH/JH
	Checked Date:
	Sheet: 1 of 1

GeoSolve Ltd

SCALA PENETROMETER LOG

Job No: 170051
Project: 492 Mt Aspiring-Wanaka Rd

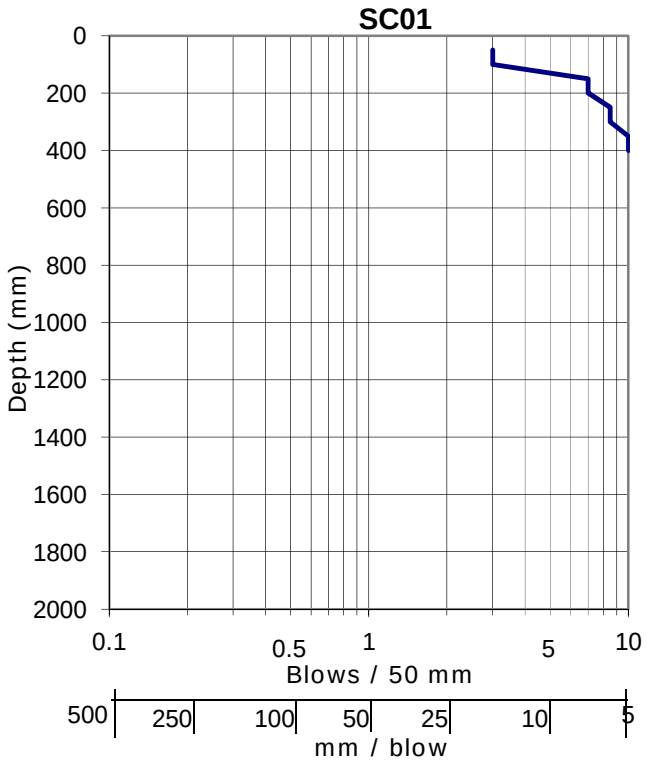
Date: 7/02/2017
Operated: JXH
Logged: GSH

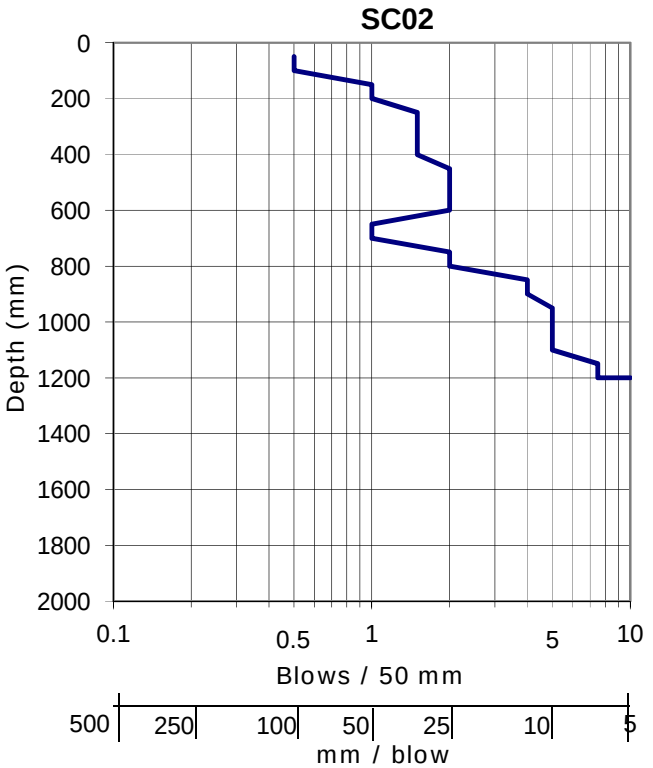
Test Number SC01 & SC02

Sheet 1 of 2

SC01 Location: See Plan RL: -1.4m	
mm Driven	No. of Blows
50	3
100	3
150	7
200	7
250	8.5
300	8.5
350	10
400	10
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1000	
1050	
1100	
1150	
1200	
1250	
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
Inferred Soil Type	
Watertable Depth	

SC02 Location: TP4 RL: GL	
mm Driven	No. of Blows
50	0.5
100	0.5
150	1
200	1
250	1.5
300	1.5
350	1.5
400	1.5
450	2
500	2
550	2
600	2
650	1
700	1
750	2
800	2
850	4
900	4
950	5
1000	5
1050	5
1100	5
1150	7.5
1200	7.5
1250	Refusal
1300	
1350	
1400	
1450	
1500	
1550	
1600	
1650	
1700	
1750	
1800	
1850	
1900	
1950	
2000	
Inferred Soil Type	
Watertable Depth	





GeoSolve Ltd

SCALA PENETROMETER LOG

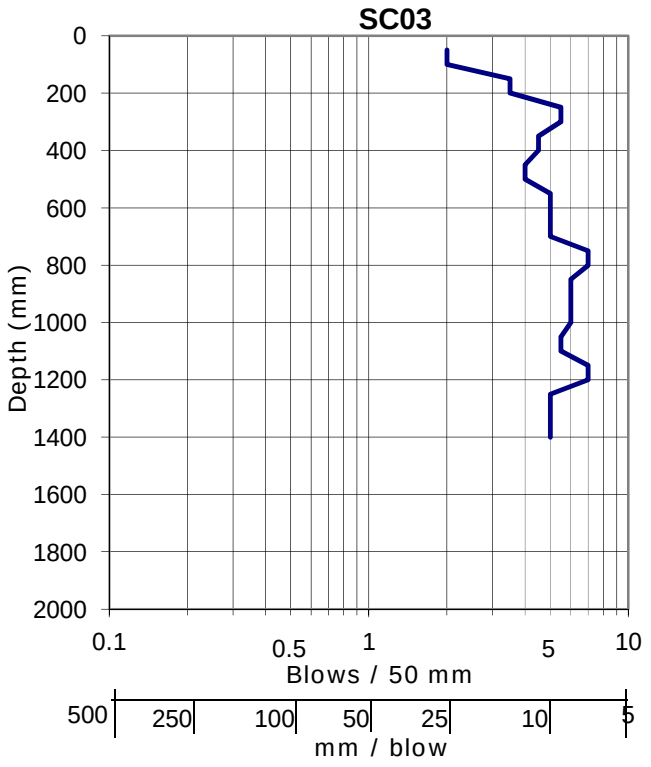
Job No: 170051
Project: 492 Mt Aspiring-Wanaka Rd

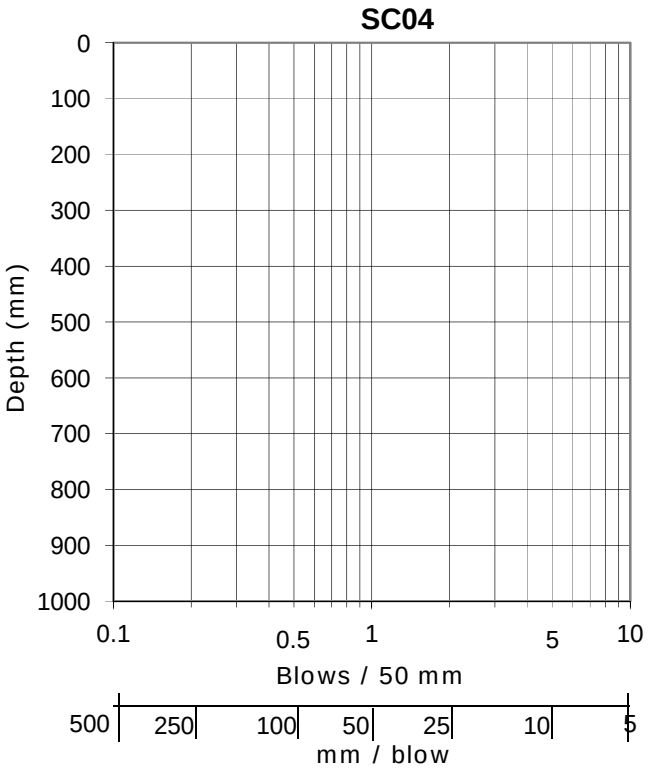
Date: 7/02/2017
Operated: JXH
Logged: GSH

Test Number SC03 & SC04

Sheet 2
of 2

SC03 Location: TP6 RL: GL		SC04 Location: See Plan RL: n/a	
mm Driven	No. of Blows	mm Driven	No. of Blows
50	2	50	
100	2	100	
150	3.5	150	
200	3.5	200	
250	5.5	250	
300	5.5	300	
350	4.5	350	
400	4.5	400	
450	4	450	
500	4	500	
550	5	550	
600	5	600	
650	5	650	
700	5	700	
750	7	750	
800	7	800	
850	6	850	
900	6	900	
950	6	950	
1000	6	1000	
1050	5.5	1050	
1100	5.5	1100	
1150	7	1150	
1200	7	1200	
1250	5	1250	
1300	5	1300	
1350	5	1350	
1400	5	1400	
1450		1450	
1500		1500	
1550		1550	
1600		1600	
1650		1650	
1700		1700	
1750		1750	
1800		1800	
1850		1850	
1900		1900	
1950		1950	
2000		2000	
Inferred Soil Type		Inferred Soil Type	
Watertable Depth		Watertable Depth	





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Report Number: AC18238 – 02 – R3

Proposed residential development, 492 Wanaka Mt Aspiring Road, Wanaka: Assessment of Construction Noise Effects

Prepared for:

Nature Preservation Trustees Limited

C/- Southern Planning Group
PO Box 1081
QUEENSTOWN, 9348

27 May 2021

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AC18238 – 02 – D1	Draft	23 August 2018	Aaron Zhao
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AC18238 – 02 – R2	Revised dwelling design	5 March 2021	Aaron Zhao
AC18238 – 02 – R3	Revised dwelling design	27 May 2021	Aaron Zhao

Document Acceptance

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On behalf of Acoustic Engineering Services Limited
27 May 2021

Table of Contents

1.0 BACKGROUND

Acoustic Engineering Services (AES) have been engaged by Southern Planning Group on behalf of the Applicant to undertake an assessment of construction noise effects associated with the earthworks and construction of the proposed residential dwelling at 492 Wanaka Mt Aspiring Road, in Wanaka. The Applicant requires an assessment of the construction noise emitted by this activity, with regard to section 104 (1) of the Resource Management Act (RMA), which requires the actual and potential effects of the activity on the environment to be considered.

We have based our analysis on the following documentation:

- Earthwork Design drawings titled *The Sanctuary Project, Earthworks Design, Lot 2 DP 395762, 494 Wanaka-Mt Aspiring Road*, Revision F, as prepared by C. Hughes & Associates Ltd and dated the 5th of May 2021.
- Resource Consent drawings titled *The Sanctuary Project, Resource Consent, 494 Wanaka-Mt Aspiring Rd*, *Wanaka, for Nature Preservation Trustee Limited*, as prepared by Sorted Architecture, and dated the 15th of February 2021.
- E-mail correspondence with Steve Humpherson of Sorted Architecture titled *Construction Noise Acoustic Assessment*, dated the 2nd of August 2018.
- E-mail correspondence with Sean Dean of Southern Planning Group titled *Construction Noise Acoustic Assessment*, dated the 23rd of August 2018.
- E-mail correspondence with Sean Dean of Southern Planning Group titled *Nature Preservation Trustee Limited*, dated the 26th of February 2021.
- E-mail correspondence with Sean Dean of Southern Planning Group titled *Nature Preservation Trustee Limited*, dated the 26th of May 2021.

1.1 Site and surrounding area

The applicant site is located at 492 Wanaka – Mt Aspiring Road, in Wanaka, with a legal description of LOT 2 DP 395762. The site is located within the Rural General zone in the Operative Queenstown Lakes District Plan and the Rural zone in the Proposed Queenstown Lakes District Plan, as are all the surrounding sites.

The property is roughly a wedge shape, and has varied topography, including hills, modified level areas, steep slopes and rocky outcrops.

The site is accessed by a long, shared driveway which branches off Wanaka – Mt Aspiring Road and snakes in an eastern direction, past developed neighbouring properties to the western half of the subject site, where the existing dwelling is located.

All surrounding properties are also zoned Rural General. Based on correspondence, we understand that the noise-sensitive neighbouring properties are shown in figure 1.1 below:

- A: Dwelling located at 450B Wanaka – Mt Aspiring Road to the southwest (approximately 95 metres away)
- B: Dwelling located at 450 Wanaka – Mt Aspiring Road to the southwest (approximately 300 metres away)
- C: Visitor accommodation (Whare Kea Lodge & Chalet) located at 494 Wanaka – Mt Aspiring Road to the north (approximately 300 metres away)
- D: Dwelling located at 449 Wanaka – Mt Aspiring Road to the southwest across Wanaka – Mt Aspiring Road (approximately 380 metres away)

- E: Dwelling located at 450A Wanaka – Mt Aspiring Road to the south (approximately 170 metres away)

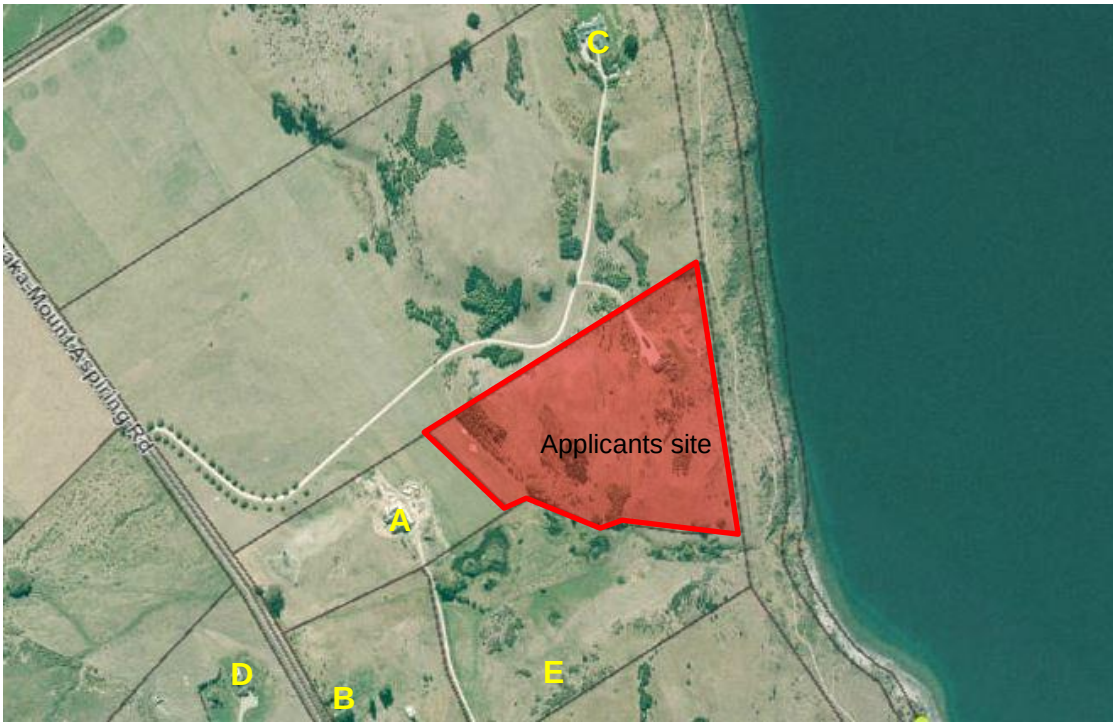


Figure 1.1 – Site and surrounding area (QLDC)

1.2 Proposal

The proposal is to replace the existing 650 m^2 dwelling with a new three storey dwelling in the same general proximity of the existing building foot print. Extensive earthworks will be required to construct the new dwelling, as parts of the structure will be buried beneath the existing ground surface to minimise its visibility. The ridge behind the house will be essentially shifted to the west and formed at a gradient that would be suitable for planting, as shown in figure 1.2 below.

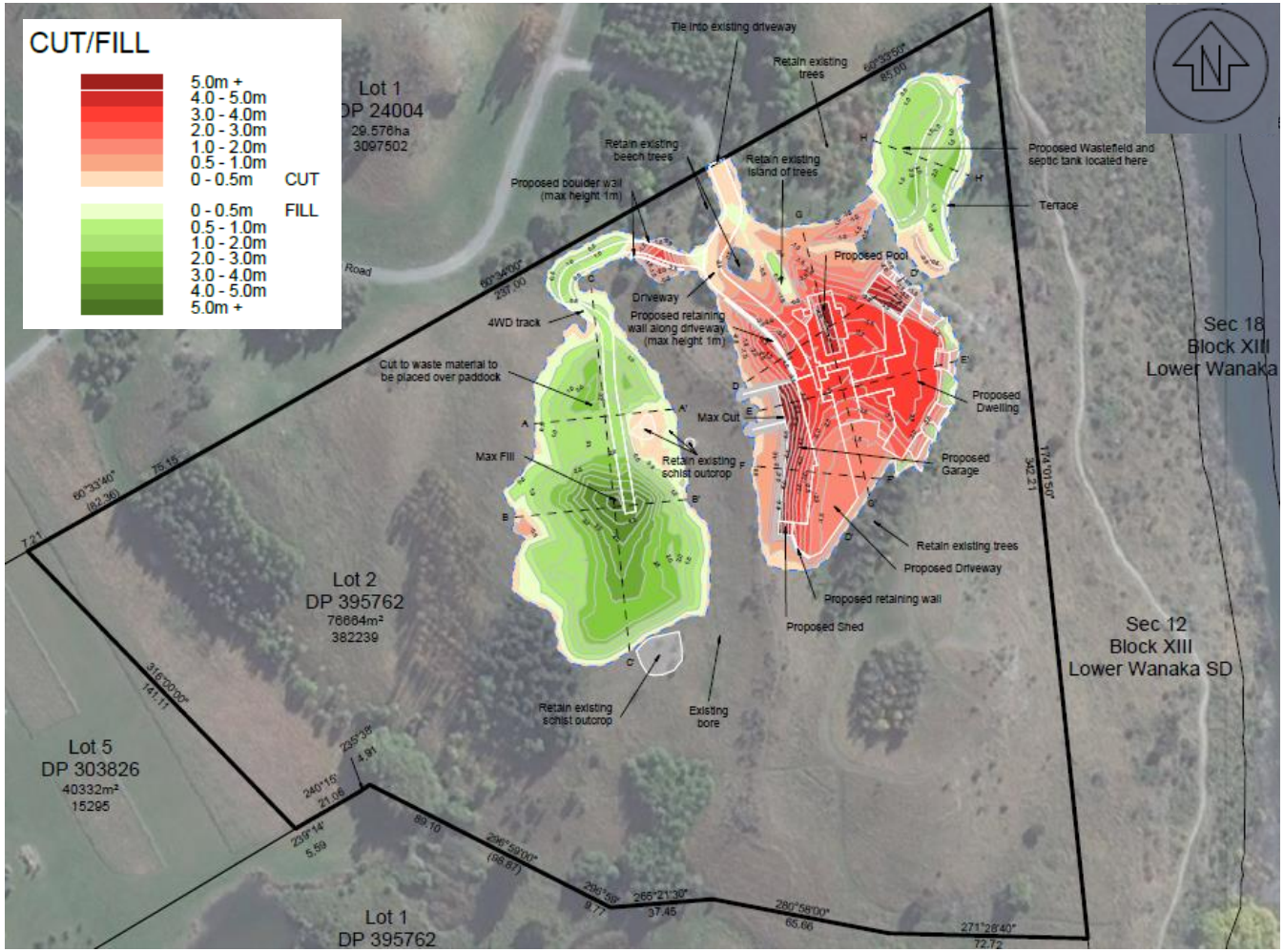


Figure 1.2 – Proposed earthworks

2.0 ACOUSTIC CRITERIA

The site is located within a Rural General zone and therefore the Operative Queenstown Lakes District Plan, *Volume 1, Section 5: Rural Areas (Rural General and Ski Area sub zone) and Gibbston Rural Character Zone, 5.3 Rural General and Ski Area Sub-Zone - Rules, 5.3.5 Standards*, rule applies, clause *v Noise (c)* of this rule states:

> *(c) The noise limits in (a) shall not apply to construction sound which shall be assessed in accordance and comply with NZS 6803:1999*.

The Proposed Queenstown Lakes District Plan (Decisions version), *Section 36 Noise, 36.5 Rules - Standards, 36.5.12 Construction Noise* states:

> *Construction sound must be measured and assessed in accordance with NZS 6803:1999 Acoustics – Construction Noise. Construction sound must comply with the recommended upper limits in Tables 2 and 3 of NZS 6803. Construction sound must be managed in accordance with NZS 6803.*

NZS 6803:1999 *Acoustics – Construction Noise* contains guidelines for the setting of construction noise limits, as these limits will depend on different situations, as explained in section C7.1.1: "*The acceptability of construction noise in any community is likely to depend on the potential for interfering with activities, the expected duration of the noise and the existing background sound level at the places affected…".*

NZS 6803:1999 *Acoustics – Construction Noise* provides noise limits for construction activities for three durations. This is because higher noise levels are tolerable for short term activities as opposed to those of a more permanent nature. The duration of work is for the total construction activity on the site as opposed to a specific activity, therefore for this activity we would expect the 'long-term duration' (more than 20 weeks) to apply. These noise limits apply at 1 metre from the noise-sensitive neighbouring dwellings.

Table 2.1 – Noise limits outlined in NZS6803:1999

Time of week	**Time period**	**Duration of work**					
		Typical duration (dBA)		**Short-term duration** (dBA)		**Long-term duration** (dBA)	
		L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Weekdays	0630-0730	60	75	65	75	55	75
	0730-1800	75	90	80	95	70	85
	1800-2000	70	85	75	90	65	80
	2000-0630	45	75	45	75	45	75
Saturdays	0630-0730	45	75	45	75	45	75
	0730-1800	75	90	80	95	70	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75
Sundays and public holidays	0630-0730	45	75	45	75	45	75
	0730-1800	55	85	55	85	55	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75

We note that NZS 6803:1999 states that best practicable options for noise avoidance or mitigation should be applied to construction activities on the site; however if the best practicable options are applied and the noise limits are still not met, discretion is able to be applied.

Nevertheless, we consider that compliance with the long-term construction noise limit would be in line with good practice and would result in reasonable and acceptable noise effects.

3.0 NOISE GENERATING ACTIVITIES

The main noise sources associated with the construction of the residential development are expected to be:

- Noise from rock breaking activities and resultant excavation
- Noise associated with the demolition of the existing dwelling
- Noise from drilling rock anchors to retain the excavated schist rock faces
- Noise from cranage activities
- Noise associated with the formation of the foundations and retaining walls (concrete pouring, concrete pumping etc.)
- Noise from vehicles associated with the excavation and construction (including heavy vehicles)

There are several additional noise sources which will likely be present on site; however due to the long distance between the construction area and the adjacent dwellings / visitor accommodation we would expect the noise levels from these to be less than the sources identified above and that this noise will be able to be controlled. These include:

- General construction equipment and plant including nail guns and the like
- Construction of the internal fit-out
- Noise from tradespeople talking on site

3.1 Noise from rock breaking activities

Rock breaking and excavation will need to be undertaken to level the site. The total volume of excavation is approximately 20,800 m^3, with the maximum cut depth of 7.2 metres. 20,000 m^3 of fill will be deposited across the site, with a maximum fill depth of 5.3 metres. It is expected that the cut and fill will occur as shown in figure 1.2 above.

We understand that the breaking of rock will be undertaken with a hydraulic breaker attached to an excavator. Where required, rock anchors will then be installed for the retaining walls.

The highest continuous noise generating activity on the site during this process would be the breaking of the rock, through the use of a hydraulic breaker attached to an excavator. Based on the range of values for activity of this kind provided in NZS 6803:1999 *Acoustics – Construction Noise* we have assumed a worst-case sound power level of 120 dB L_{wA}.

In order to illustrate the noise levels which are likely to occur, we have considered two worst-case scenarios:

1. Excavation near the northeast boundary, and;
2. Excavation near the south boundary.

Scenario 1 – Excavation near the northwest boundary

We have modelled a scenario where the excavator is breaking rock in close proximity to the northwest boundary. This scenario would generate worst-case noise levels for the visitor accommodation (Whare Kea Lodge & Chalet) located at 494 Wanaka – Mt Aspiring Road.

The resultant contour with the excavator breaking rock in close proximity to the northwest boundary is shown in figure 3.1 below.

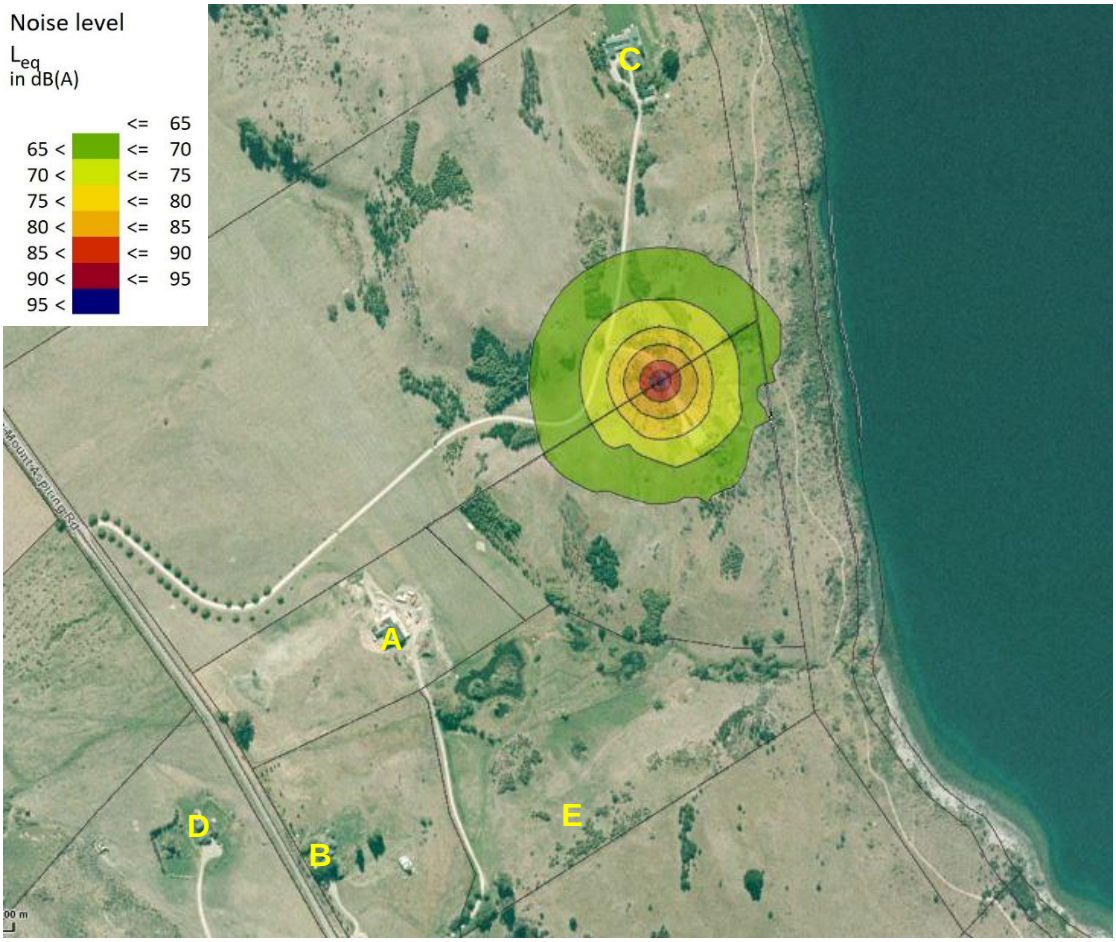


Figure 3.1 – Noise emissions from Scenario 1

Based on the modelling, the following noise levels received at the identified dwellings and visitor accommodation are expected to be associated with excavation near the northwest boundary:

- A: Dwelling at 450B Wanaka – Mt Aspiring Road
  56 dB L_{Aeq}
- B: Dwelling at 450 Wanaka – Mt Aspiring Road
  51 dB L_{Aeq}
- C: Visitor accommodation at 494 Wanaka – Mt Aspiring Road
  57 dB L_{Aeq}
- D: Dwelling at 449 Wanaka – Mt Aspiring Road
  50 dB L_{Aeq}
- E: Dwelling at 450A Wanaka – Mt Aspiring Road
  54 dB L_{Aeq}

Based on this analysis, full compliance is expected with the 70 dB L_{Aeq} noise limit between 0730 and 1800 hours (Monday to Saturday) and the 65 dB L_{Aeq} noise limit between 1800 and 2000 hours (Monday to Friday).

Scenario 2 – Excavation near the south boundary

We have modelled a scenario where the excavator is breaking rock in close proximity to the south boundary. This scenario would generate worst-case noise levels for the dwellings located at 450B Wanaka – Mt Aspiring Road and 450A Wanaka – Mt Aspiring Road.

The resultant contour with the excavator breaking rock in close proximity to the south boundary is shown in figure 3.2 below.

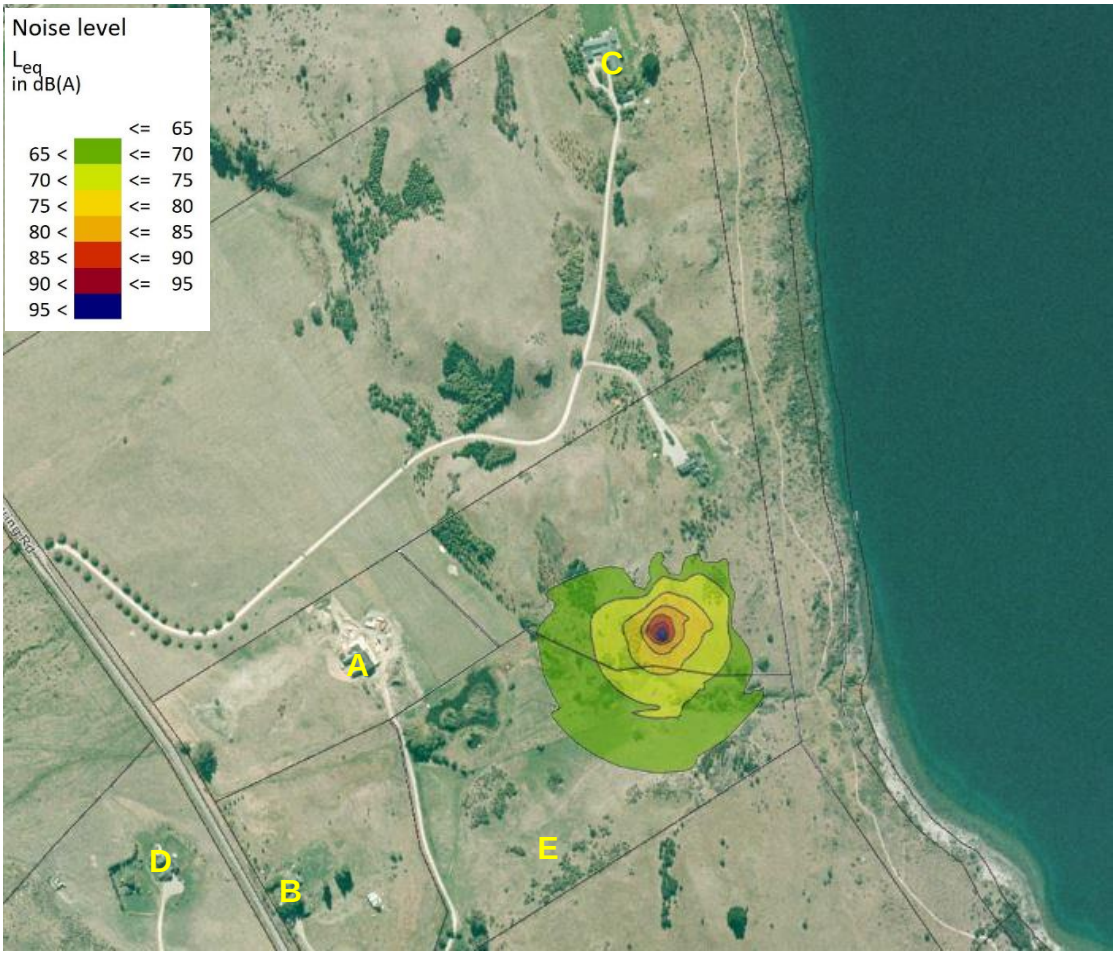


Figure 3.2 – Noise emissions from Scenario 2

Based on the modelling, the following noise levels received at the identified dwellings and visitor accommodation are expected to be associated with excavation near the south boundary:

- A: Dwelling at 450B Wanaka – Mt Aspiring Road
  58 dB L_{Aeq}
- B: Dwelling at 450 Wanaka – Mt Aspiring Road
  54 dB L_{Aeq}
- C: Visitor accommodation at 494 Wanaka – Mt Aspiring Road
  46 dB L_{Aeq}
- D: Dwelling at 449 Wanaka – Mt Aspiring Road
  52 dB L_{Aeq}
- E: Dwelling at 450A Wanaka – Mt Aspiring Road
  61 dB L_{Aeq}

Based on this analysis, full compliance is expected with the 70 dB L_{Aeq} noise limit between 0730 and 1800 hours (Monday to Saturday) and the 65 dB L_{Aeq} noise limit between 1800 and 2000 hours (Monday to Friday).

We therefore recommend that rock breaking is only undertaken between 0730 and 1800 hours (Monday to Saturday), and between 1800 and 2000 hours (Monday to Friday).

3.2 Demolition of existing dwelling

A dwelling currently occupies the subject site and will be removed. An excavator is expected to be used for the demolition.

Noise levels for this activity are not expected to be higher than those shown in figure 3.1 and 3.2 above. Therefore, full compliance is expected with the 70 dB L_{Aeq} noise limit between 0730 and 1800 hours (Monday to Saturday) and the 65 dB L_{Aeq} noise limit between 1800 and 2000 hours (Monday to Friday).

We therefore recommend that this activity is only undertaken between 0730 and 1800 hours (Monday to Saturday), and between 1800 and 2000 hours (Monday to Friday).

3.3 Noise from concrete, foundation, and retaining wall activities

We expect there will be two main noise emitting processes during the concrete, foundation, and retaining wall activities, as follows:

- Concrete trucks discharging the concrete into the concrete pump, and concrete pump pumping the concrete to the site.
- Concrete power floats being used on the slab.

Concrete pumping / pouring

We anticipate that the pump will be set up inside the site, adjacent to the building footprint. The noise levels emitted by the equipment will vary throughout the process as different tasks are undertaken. For example, we expect the concrete pump will steadily idle most of the time, with higher noise emissions when the engine increases in speed to move the nozzle over the site. Similarly, the concrete trucks will be idling most of the time, but will generate higher noise emissions when their engine speed is increased before transferring the concrete to the pump.

Based on our past experience, we have based our analysis on a sound power of 105 dB L_{wA}, which we expect would be equivalent to the concrete truck revving prior to the transfer, or the pump truck pumping the concrete.

Based on above, the resultant contour is shown in figure 3.3 below.

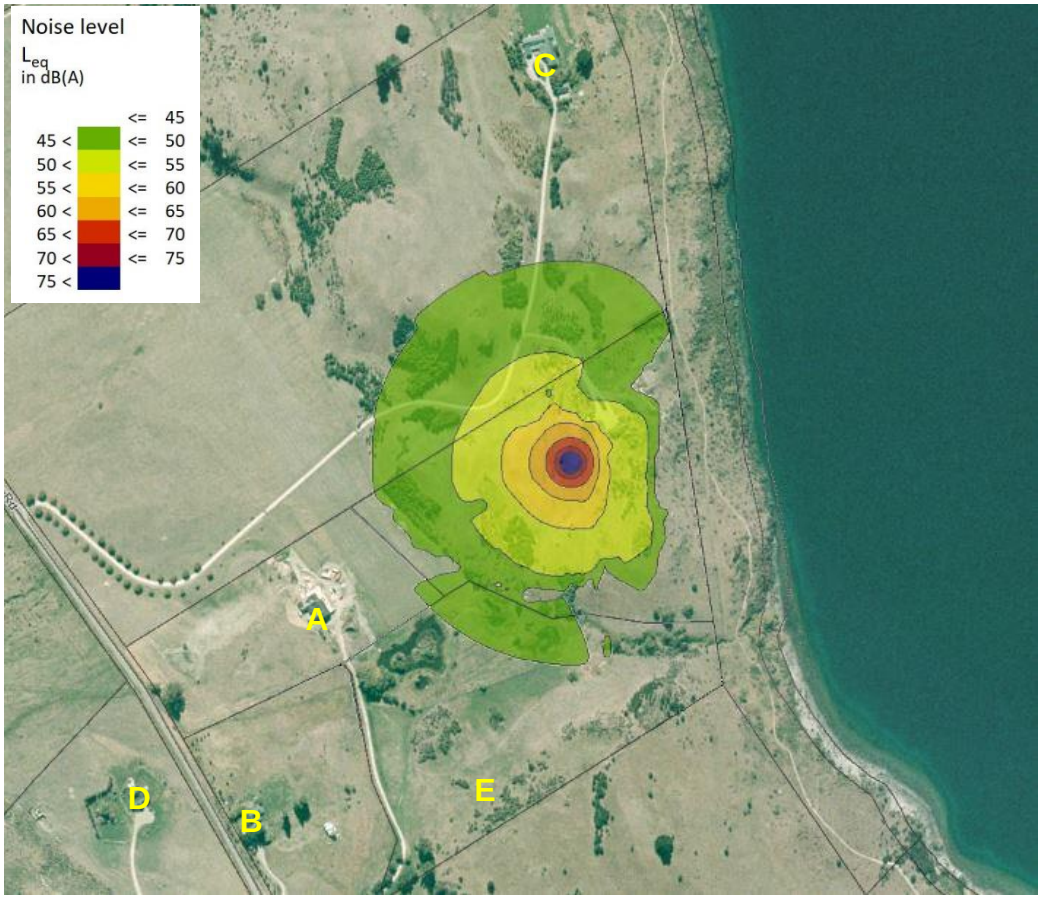


Figure 3.3 – Noise emissions from concrete pumping / pouring

Based on the modelling, the following noise levels are expected at the identified dwellings and visitor accommodation:

- A: Dwelling at 450B Wanaka – Mt Aspiring Road
  43 dB L_{Aeq}
- B: Dwelling at 450 Wanaka – Mt Aspiring Road
  40 dB L_{Aeq}
- C: Visitor accommodation at 494 Wanaka – Mt Aspiring Road
  39 dB L_{Aeq}
- D: Dwelling at 449 Wanaka – Mt Aspiring Road
  37 dB L_{Aeq}
- E: Dwelling at 450A Wanaka – Mt Aspiring Road
  42 dB L_{Aeq}

Based on this analysis, the noise levels received at the identified dwellings and visitor accommodation are expected to be lower than 45 dB L_{Aeq}, and therefore full compliance is expected with the noise limits at all times.

Concrete floating

Once the concrete has been poured we understand that a concrete float would likely be used on the setting slab. While the overall sound levels of the specific equipment on site will vary (due to the range of concrete floats available) we have based our preliminary analysis on a concrete float with a sound power of 100 dB L_{wA}, as outlined in NZS 6803:1999.

Based on this sound power level, the noise levels received at the neighbouring dwellings and visitor accommodation are expected to be lower than 45 dB L_{Aeq} when the concrete float is being used and therefore full compliance is expected at the neighbouring dwellings and visitor accommodation at all times.

The noise levels can vary significantly for different types of power floats; however full compliance with the 70 dB L_{Aeq} noise limit between 0730 and 1800 hours (Monday to Saturday) and the 65 dB L_{Aeq} noise limit between 1800 and 2000 hours (Monday to Friday) is expected with all models of float. If concrete floating occurs outside of the above time periods, we recommend that prior to use on site noise measurements are undertaken on the actual concrete float which will be used on site to verify that compliance will be achieved.

3.4 Noise from cranage

Based on correspondence, we understand that a crane will be required as part of the general site works during construction. Based on the values given in BS 5228-1:2009, for typical cranes which may be used on site (12-100 ton), a worst-case noise level of 67 dB L_{Aeq} at 10 metres has been used. We are unsure if a tower crane or mobile crane is to be used, and so our assessment is based on a worst-case scenario where a mobile crane is used on site.

We understand that cranage is anticipated to be carried out within the building footprint. Based on the above, the following noise levels are expected at the notional boundaries of the identified noise sensitive properties:

- A: Dwelling at 450B Wanaka – Mt Aspiring Road
  36 dB L_{Aeq}
- B: Dwelling at 450 Wanaka – Mt Aspiring Road
  32 dB L_{Aeq}
- C: Visitor accommodation at 494 Wanaka – Mt Aspiring Road
  37 dB L_{Aeq}
- D: Dwelling at 449 Wanaka – Mt Aspiring Road
  31 dB L_{Aeq}
- E: Dwelling at 450A Wanaka – Mt Aspiring Road
  37 dB L_{Aeq}

The noise levels generated by cranage activity are therefore expected to comply with the construction noise limits at any time at all adjacent properties.

The noise levels can vary significantly for different types of cranes depending on size and model; however full compliance with the 70 dB L_{Aeq} noise limit between 0730 and 1800 hours (Monday to Saturday) and the 65 dB L_{Aeq} noise limit between 1800 and 2000 hours (Monday to Friday) is expected with all models of crane. If cranage activities occur outside of the above time periods, we recommend that prior to use on site noise measurements are undertaken on the actual crane which will be used on site to verify that compliance will be achieved.

3.5 Noise from vehicle movements

We have assessed noise associated with construction vehicles.

We have assumed that during a worst-case 15-minute period, two truck movements would occur (one departing and one arriving on site). Calculations for the truck movements have been based on a single vehicle movement having a sound power of 110 dB L_{wA}.

Based on the above, the following noise levels are expected to be associated with heavy vehicles travelling around on the site:

- A: Dwelling at 450B Wanaka – Mt Aspiring Road
  28 dB L_{Aeq}
- B: Dwelling at 450 Wanaka – Mt Aspiring Road
  23 dB L_{Aeq}
- C: Visitor accommodation at 494 Wanaka – Mt Aspiring Road
  26 dB L_{Aeq}
- D: Dwelling at 449 Wanaka – Mt Aspiring Road
  22 dB L_{Aeq}
- E: Dwelling at 450A Wanaka – Mt Aspiring Road
  28 dB L_{Aeq}

The noise levels generated by heavy vehicles travelling around the site are therefore expected to comply with the construction noise limits at any time at all adjacent properties.

We have also considered construction vehicles travelling along the shared driveway and Wanaka – Mt Aspiring Road.

Assuming a worst-case scenario of two heavy vehicle movements along shared driveway and Wanaka – Mt Aspiring Road in a worst-case 15 minute period, and the SEL of a heavy vehicle movement given above, the following noise levels are expected to be associated with heavy vehicles:

- A: Dwelling at 450B Wanaka – Mt Aspiring Road
  36 dB L_{Aeq}
- B: Dwelling at 450 Wanaka – Mt Aspiring Road
  49 dB L_{Aeq}
- C: Visitor accommodation at 494 Wanaka – Mt Aspiring Road
  26 dB L_{Aeq}
- D: Dwelling at 449 Wanaka – Mt Aspiring Road
  42 dB L_{Aeq}
- E: Dwelling at 450A Wanaka – Mt Aspiring Road
  28 dB L_{Aeq}

Therefore, the noise levels from heavy vehicles travelling along the shared driveway and Wanaka – Mt Aspiring Road comply with the construction noise limits between 0630 and 2000 hours from Monday to Friday and between 0730 and 1800 on Saturday.

To ensure that noise from heavy vehicles associated with construction are in line with that stated above, we recommend implementing a Construction Noise and Vibration Management Plan which would cover the following:

- Limitations on the arrival and departure times of the heavy vehicles to between 0630 and 2000 hours from Monday to Friday, and 0730 to 1800 on Saturday.
- No engine brakes to be used in the vicinity of the site.
- Reversing beepers to be limited in terms of sound level and frequency of use.
- Discouragement of vehicles idling on site for extended periods of time. This could be included as part of the site foreman's responsibilities.
- No use of horns unnecessarily.

4.0 VIBRATION

The use of the hydraulic breaker attached to an excavator when breaking the schist rock on the site also has the potential to cause adverse vibration effects at the neighbouring properties. Vibration effects are typically considered in two ways – with regard to possible structural or cosmetic damage to buildings, and human response. We note that individuals can detect levels of building vibration that are well below those required to cause any risk of damage (the threshold of human perception of vibration is between 0.14 mm/s to 0.3 mm/s) to the building or its contents.

In terms of excavation, in this case the hydraulic breaker used for rock breaking is expected to generate continuous vibration for short periods of time. This vibration may potentially result in two main effects for occupants within the neighbouring buildings; perceptible (structure-borne) vibration, i.e. vibration of walls, floors etc. which is perceived by occupants through tactile sensation or audible motion such as rattling of windows; and low frequency noise, where sound waves radiated by the vibrating surfaces inside buildings are perceived by the human ear as noise - often referred to as ground-borne noise.

4.1 Vibration criteria

The proposed Queenstown Lakes District Plan (Decisions Version), *Section 36 Noise, 36.5 Rules - Standards, 36.5.9 Vibration* states:

> *Vibration from any activity shall not exceed the guideline values given in DIN 4150-3:1999 Effects of vibration on structures at any building on any other site.*

Vibration levels that outlined in table 1 of *DIN 4150-3 Structural Vibration – Part 3: Effects of vibration on structures*, and outlined in table 4.1 below. Compliance with these criteria will ensure that there will not be an adverse effect on the serviceability of a structure.

Table 4.1 – Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on structures (reproduced from DIN 4150-3:1999)

Line	Type of Structure	Guideline values for velocity, v_i, *in mm/s*			
		Vibration at the foundation at the frequency of			Vibration at horizontal plan of highest floor at all frequencies
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*)	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8
*At frequencies above 100 Hz, the values given in this column may be used as minimum values.					

4.2 Expected vibration levels

There are many factors which will influence the vibration level experienced in the foundation of any adjacent buildings. A review of literature states that the vibration generated by a 1500 kg hydraulic breaker is expected to be 4.5 mm/s measured at a distance of 5 metres on the ground adjacent to the hydraulic breaker when it is operating in hard sandstone.

We note that the soil or rock conditions are expected to effect the vibration levels measured in the foundation of the neighbouring dwellings. However given the closest dwelling is located 95 metres from the site, we expect that vibration levels from the hydraulic breaker will be significantly below 5 mm/s for this activity and will comply with criteria outlined in table 4.1 above. Therefore effects from vibration caused by rock breaking are expected to be acceptable.

5.0 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

As demonstrated above, a number of operational and management strategies need to be adopted by the Applicant to control and reduce noise emissions from the construction activity. Therefore we recommend that the Applicant establishes a Construction Noise and Vibration Management Plan outlining the measures which will be employed to ensure that noise impacts on neighbouring properties are minimised as far as practicable.

The Construction Noise and Vibration Management Plan would need to discuss the following:

- Rock breaking should only occur between 0730 hours and 2000 hours Monday to Friday, and between 0730 hours and 1800 hours Saturday (excluding Public Holiday).

- If the concrete floating and cranage occur between 2000 and 0700 hours from Monday to Friday, and between 1800 and 0700 hours on Saturday, the requirement for specific equipment to be tested prior to being used on site and the physical mitigation required to result in complying levels, including additional acoustic screening and the like.

- Limitations on the arrival and departure times of heavy vehicles, and operating recommendations.

- Details of complaints procedures and the need for and responsibilities of a Noise Liaison Officer for the community.

6.0 CONCLUSIONS

Noise from construction sources expected to be associated with the proposed residential development at 492 Wanaka – Mt Aspiring Road, in Wanaka, has been considered.

Based on a review of the District Plan and New Zealand Standard NZS6803:1999, given the construction duration and the noise-sensitivity of the neighbouring properties we consider that compliance with the long-term construction noise level is appropriate and would result in reasonable and acceptable noise effects. We also recommend a limitation on the rock breaking hours to between 0730 hours and 2000 hours Monday to Friday, and between 0730 hours and 1800 hours Saturday (excluding Public Holiday).

Based on our analysis we consider it reasonable to conclude that the noise limits outlined above can be complied with at all times, provided the mitigation measures recommended below are adopted.

7.0 RECOMMENDATIONS

To give confidence that noise emissions associated with the construction of the development are maintained at appropriate levels, we recommend the following mitigation measures be adopted during the construction process:

- All construction activities on the site shall comply with the long-term constructions noise limits outlined in Table 2 of NZS6803:1999.
- Rock breaking activities on site should be restricted further in terms of hours between 0730 hours and 2000 hours Monday to Friday, and between 0730 hours and 1800 hours Saturday (excluding Public Holiday).
- If the concrete floating and cranage occur between 2000 and 0700 hours from Monday to Friday, and between 1800 and 0700 hours on Saturday, prior to use on site that noise measurements are undertaken on actual concrete floating and cranage which will be used on site to determine if additional mitigation required to result in complying levels, including additional acoustic screening and the like.
- Limitations on the arrival and departure times of the heavy vehicles to within 0630 to 2000 hours from Monday to Friday, and 0730 to 1800 on Saturday.

Key Native Plant Species

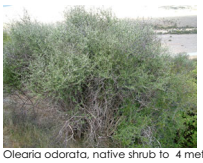

Sophora microphylla (Kowhai tree) to 5-7 metres


Pittosporum tennufolium, native shrub to 3-4metres


Fuscospora cliffortioides native tree to 10-15 metres


Coprosma propinqua, native shrub to 4-5 metres


Aristotelia fruticosa, native shrub to 3 metres


Olearia odorata, native shrub to 4 metres


Muehlenbeckia complexa, climbing ground cover


Coprosma kirkii, tough spreading evergreen groundcover


Coprosma tayloriae (Dumosa), native shrub to 7 metres


Coprosma virescens, native shrub to 3-4 metres


Kunzea ericoides (Kanuka) Native tree to 5-6 metres


Olearia lineata, native shrub to 3-4 metres


Coprosma virescens, native shrub to 4 metres

Planting Guidelines

Planting
All plants are ecosourced from the Wanaka area and supplied locally. Location of plants is indicative only. New plants to be grouped around existing native vegetation and planted at 1.0 - 1.5 metre centres. Groups of existing rocks where practical to remain exposed.

Mulching
Individual plants protected with a biodegradeable Nature guard and mulch mat.

Fertiliser
Each plant to be planted with Koch slow release fertiliser.

Rabbit proofing
The property is rabbit proofed with a wire mesh fence along boundary and an ongoing programme of trapping for rabbits and stoats.

On Going Maintenance
On going maintenance / weeding of the planting would be required until established.

Irrigation
Overhead irrigators to irrigate plants for first 2-3 years to get planting established.

Scale1:250@ A2

Key

Proposed Beech trees (where soil depth allows)

Indicative rock placement as informal retaining between portals

Existing native remnant vegetation

Grass mown

Grass unmown

Existing rocks

Stone paving at G.L in front of portals

NOTE
Large Fuscospora cliffortioides (Mountain Beech) trees to be planted after construction

For planting over portals refer to Architects details

Plant Schedule

ID	Quantity	Latin Name	Common Name	Scheduled Size	Notes
Ari fru	15	Aristotelia fruticosa	Wineberry	2.5 Litre	1.5 metre spacing
Cop kir	29	Coprosma Kirkii		Pb 5	1.2 metre centres
Cop pro LG	19	Coprosma propinqua LG	Mingimingi	2.5 Litre	1.5 metre centres
Cop prop	69	Coprosma propinqua	Mingimingi	35 F	1.5 metre centres
Cop prop LG	13	Coprosma propinqua LG	Mingimingi	2.5 Litre	1.5 metre centres
Cop tay	10	Coprosma tayloriare		2.5 Litre	1 metre centres
Cop vir	53	Coprosma virescens		35F	1.5 metre centres
Cop vir LG	6	Coprosma virescens LG		2.5 Litre	1.5 metre centres
Fus cli	18	Fuscospora cliffortioides	Mountain Beech	35 Litre	5 metre centres
Kun er	62	Kunzea ericoides	Kanuka	2 Litre	1.5 metre centres
Kun eri LG	61	Kunzea ericoides LG	Kanuka	Pb 8	1.5 metre centres
Mueh com	16	Muehlenbeckia complexa		1 Litre	1 metre
Ole lin	6	Olearia lineata		2.5 Litre	1 metre spacings
Ole odo	12	Olearia odorata		2.5 Litre	1 metre centres
Pitt 'LB'	7	Pittosporum 'Little Burger'		PB3	1.0 metre centres
Pitt ten	42	Pittosporum tenufolium	Pittosporum	1.5 Litre	1.5 metre centres
Sop mic	3	Sophora microphylla	Kowhai	25 Litre	As per plan

Vectorworks file; Sanctuary Proj - REV PLANS 14-06-2021

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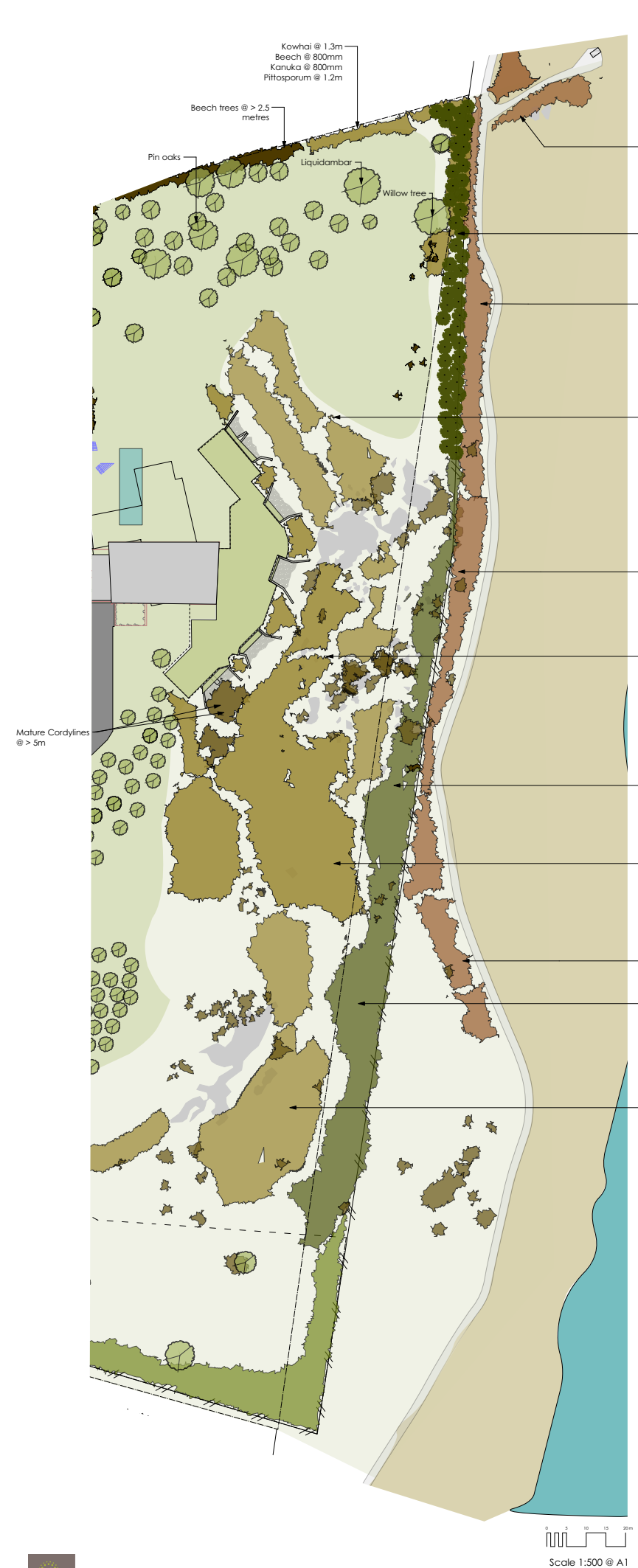
Screening Cave Portals - Planting Plan



Scale 1:500 @ A1

Key

- Proposed building underground
- Existing building to be removed
- Proposed building
- Driveway
- Pool
- Existing mix grass scrub
- Grass areas - mown grass/curtilage
- Grass areas - unmown
- Existing exotic vegetation
- Te Kakano - planting areas
- Plant mix - kanuka / shrubland mix
- Plant mix - tall / beech dominated
- Plant mix - native broadleaf plant
- Native groundcovers
- Rocks
- Stone paving at G.L in front of portals
- Existing amenity tree to be retained
- Existing Douglas fir tree
- Existing remnant native vegetation
- Fences
- Boundary

Plant heights as at Feb 2021 measured on site by N Smethan
Indicative locations only

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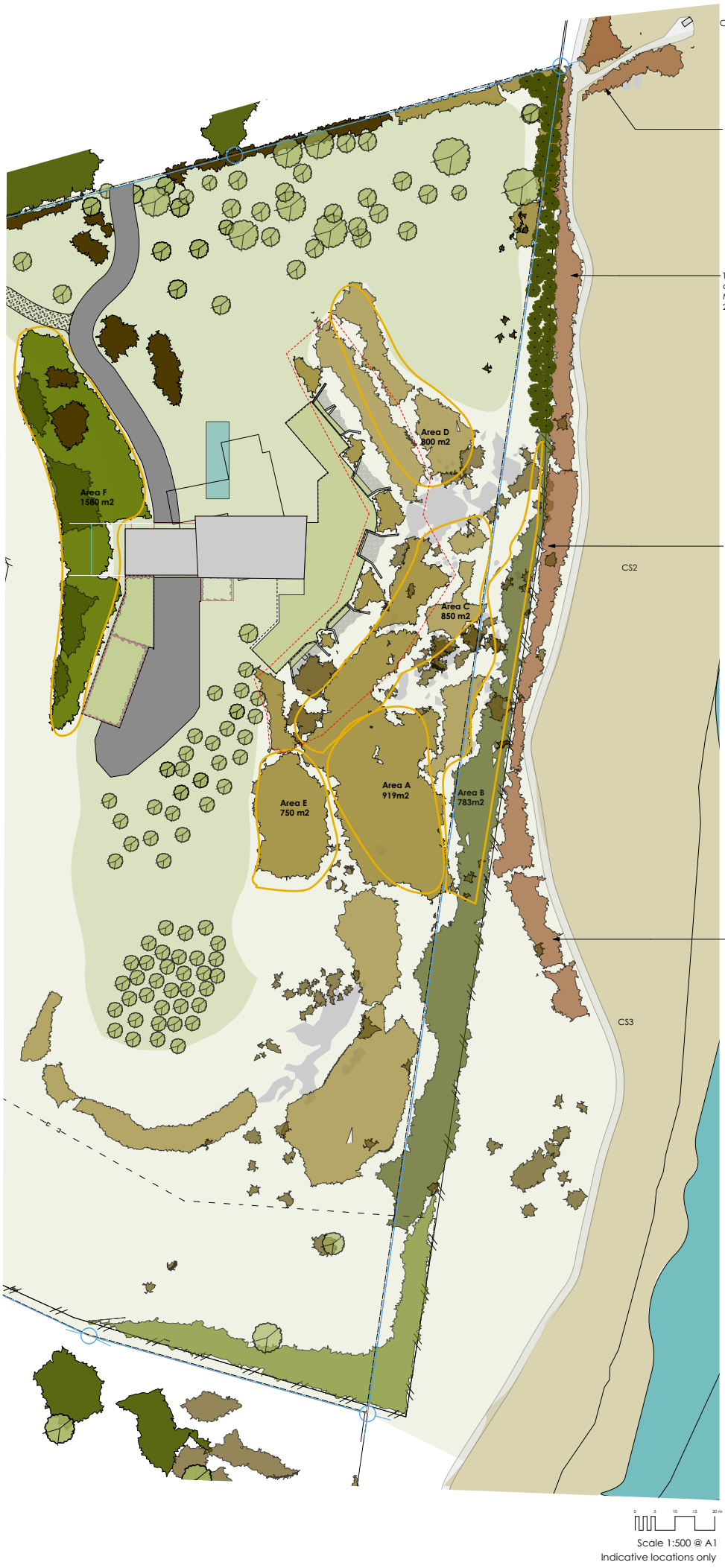
The Sanctuary / Weka Project

Existing Planting Areas - Heights



Scale 1:500 @ A1
Indicative locations only

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- Rocks
- Stone paving at GL in front of portals
- Existing amenity tree to be retained
- Existing Douglas fir tree
- Existing remnant native vegetation
- Fences
- Boundary
- Weka planting areas - stages
- Refer detail planting area - cave portals

WEKA PLANTING GUIDELINES

Plants
All plants are ecosourced plants from the Wanaka area.
Plants to be planted at 1.0 - 1.5 metre centres.
All plants to be planted with a mulch mat and bamboo stake.
Planting to be grouped around existing native vegetation to give shelter to new plants.
Groups of rocks where practical to be left in open areas to allow habitat for lizards and geckos.

Track
2 metre wide track to be marked, confirmed on site and then slashed.
Track to go around exposed rock areas.

Fertiliser
Each plant to be planted with Apex Field Grow Fertiliser.

Rabbit proofing
Property is rabbit proofed with a wire mesh fence along the boundary and a continuing programme of trapping.

On Going Maintenance
On going maintenance of the planting would be handed to Weka.

Irrigation
A new bore is being investigated.

Te Kakano Planting
All Te Kakano planting areas will be irrigated (where practical) using the Weka Project irrigation.

WEKA PLANTING

STAGE 1

AREA A & B, PLANTED IN AUTUMN 2017 Total 1967 M2 approx
Kanuka shrubland mix on exposed dry rocky sites
Kunzea ericoides (Kanuka) - 470 x 35 F
Coprosma propinqua - 300 x 35 F
Pittosporum tennufolium - 275 x Pb3,
Olearia odorata - 75 x 35 F
Olearia lineata - 75 x 35 F
Olearia avicenniaefolia - 75 x Pb5
Olearia hectorii - 45 x Pb 5
Coprosma rugosa - 30 x 35 F
Coprosma tayloriae - 155 x Pb 5

AREA B
Tall tree mix
Fuscospora cliffortioides (Mountain beech)- 125 x Pb5
Prumnopitys taxifolius - 25 x Pb5
Pittosporum tennufolium - 100 x 35 F
Kunzea ericoides (Kanuka) - 150 x 35 F
Hebe salicifolia - 15 x Pb 3
Cordyline australis - 90 x Pb 5

STAGE 2

AREA C & D, PLANTED IN MAY 2019 Total 1800 M2 approx
Kanuka shrubland mix
Kunzea ericoides (Kanuka) - 620 x 35F, 21 x Pb8,1 x Pb5,
Coprosma crassifolia - 50 x 35F, 2 x 2.5Litre
Coprosma propinqua - 150 x 35F
Coprosma virescens - 100 x 35F, 2 x 2.5 Litre
Pittosporum tennufolium - 187 x 35F, 10 x 2.5 Litre, 55 x 1.5 Litre, 133 x Pb3
Coprosma rugosa - 35F x 30, 10 x 2.5 Litre
Coprosma rotundifolia 2 x 2.5 Litre
Aristotelia fruticosa - 15 x 2.5 Litre
Fuscospora cliffortioides - 125 x 2.5 Litre
Hebe salicifolia - 50 x 2.5 Litre
Olearia avicennifolia - 37 x 2.5 Litre, 38 x Pb5,
Olearia hectorii - 45 x 2.5 Litre
Olearia lineata - 77 x 2.5 Litre
Olearia odorata - 85 x 2.5 Litre, 1 x Pb 12, 1 x Pb 18
Plaginathus regius - 25 x 2.5 Litre
Prunmnopitys taxifolia 25 x Pb 5
Sophora microphylla - 77 x 2.5 Litre, 1 x 25 Litre, 1 x Pb 18, 44 x 1.5 Litre
Coprosma tayloriae 30 x 35F, 155 x Pb 5, 10 x 2.5 Litre
Melicytus lanceolatus - 10 x Pb5

STAGE 3

AREA E - PLANTING TO BE UNDERTAKEN IN SPRING 2021
AREA F - POST EARTHWORKS
AREA G - POST CONSTRUCTION OF PORTALS

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Existing and Proposed Planting Areas - Staging Plan

KEY NATIVE PLANTS

Kanuka shrubland mix
Aristotelia fruiticosa
Coprosma crassifolia
Coprosma propinqua
Coprosma rugosa
Corosma taylioriae
Coprosma virescens
Kunzea ericoides (Kanuka)
Olearia avicenniaefolia
Olearia hectorii
Olearia lineata
Olearia odorata
Pittosporum tennufolium
Sophora microphylla

Tall plant mix
Cordyline australis
Fuscospora solandri var. cliffotioides (Mountain beech)
Kunzea ericoides (Kanuka)
Prumnopitys taxifolius
Pittosporum tennufolium

Broadleaf Plant Mix
Coprosma lucida
Cordyline australis (Cabbage tree)
Hebe salicifolia
Griselina littoralis
Melicytus lanceolatus (Large leaf mahoe)
Pittosporum tennufolium
Phormium cookianum (Mountain flax)

Groundcovers
Coprosma kirkii
Muehlenbeckia complexa

Key

- Proposed building underground
- Existing building to be removed
- Proposed building
- Driveway
- Pool
- Existing mixed grass scrub
- Grass areas - mown grass/ curtilage
- Grass areas - unmown
- Existing exotic vegetation
- Te Kakano planting
- Kanuka shrubland mix
- Tall / beech dominated plant mix
- Broadleaf plant mix
- Native groundcovers
- Existing rocks
- Stone paving at GL in front of portals
- Indicative rock placement as informal retaining between portals
- Existing amenity tree to be retained
- Douglas fir
- Existing native vegetation
- Exotic woodlot
- Fences
- Boundary
- Cross sections
- Refer detailed planting area - cave portals

0 5 10 15 20m
Scale 1:750 @ A1

Vectorworks file; Sanctuary Proj - REV PLANS 21-04-2021

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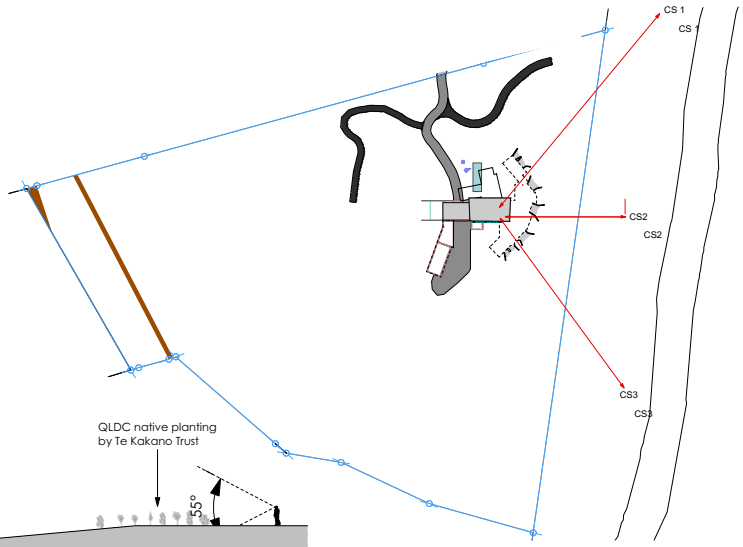
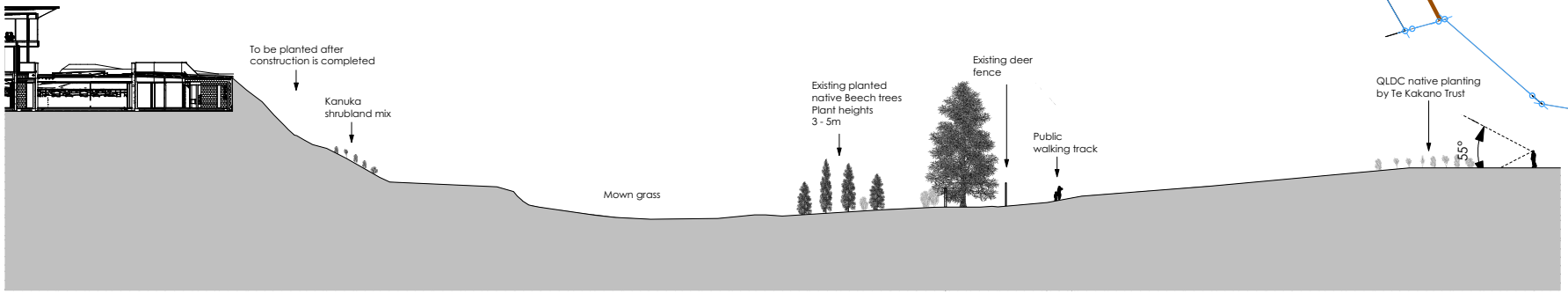
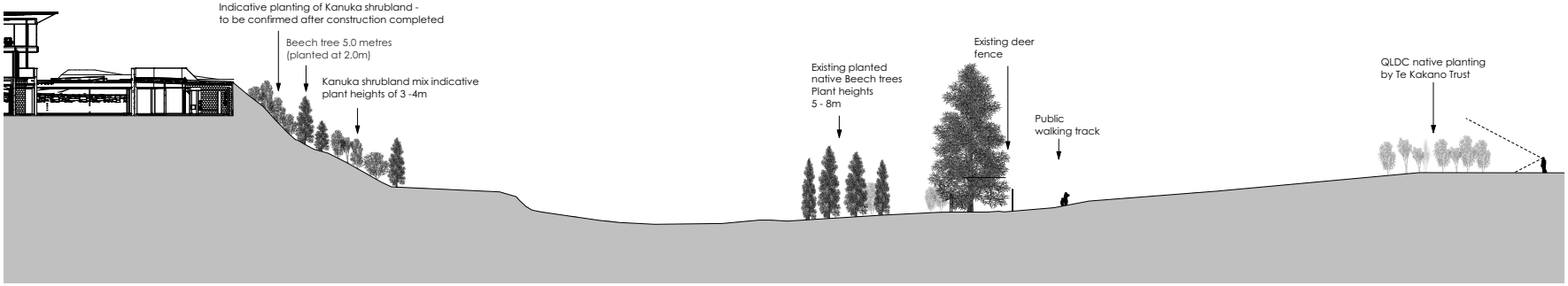
The Sanctuary Project
Resource Consent Planting Plan



Site Plan - Cross Sections
Scale1:1800

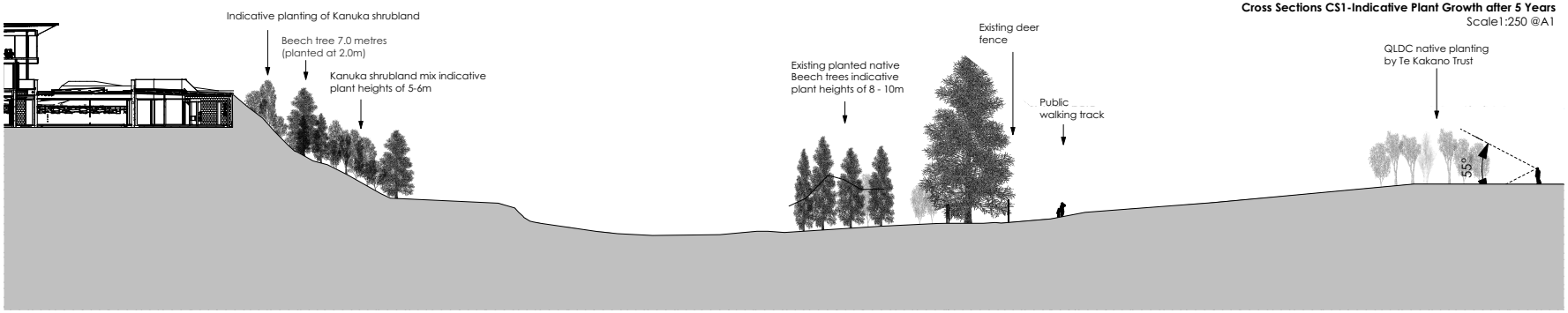


Cross Sections CS1 - Existing Indicative Plant Heights
Scale1:250 @A1



Plant growth based on existing heights plus 400-500mm growth per year when irrigated.

Cross Sections CS1-Indicative Plant Growth after 5 Years
Scale1:250 @A1



Plant growth based on current heights plus 400-500mm growth per year when irrigated.

Cross Sections CS1-Indicative Plant Growth after 10 Years
Scale1:250 @A1

Vectorworks file; Sanctuary Proj REV PLANS 15-04-2021

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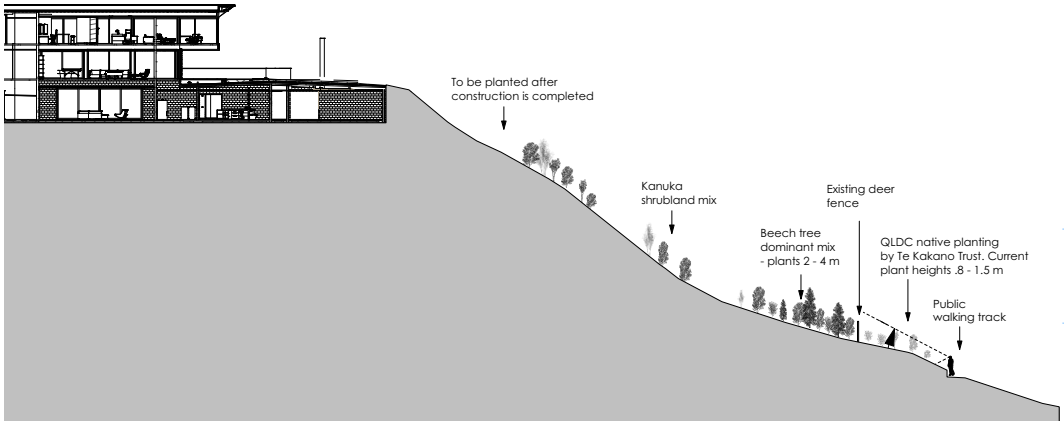
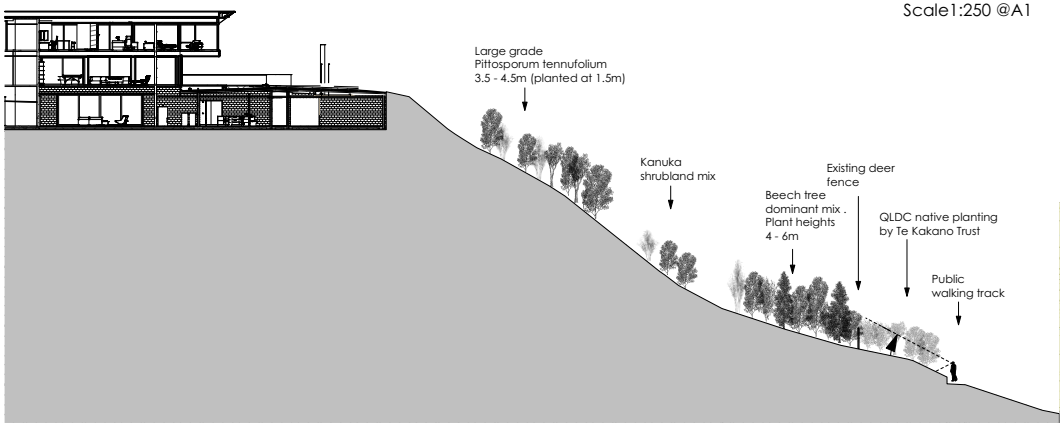
Cross Section 1 - Existing & Indicative Plant Growth 5 and 10 years

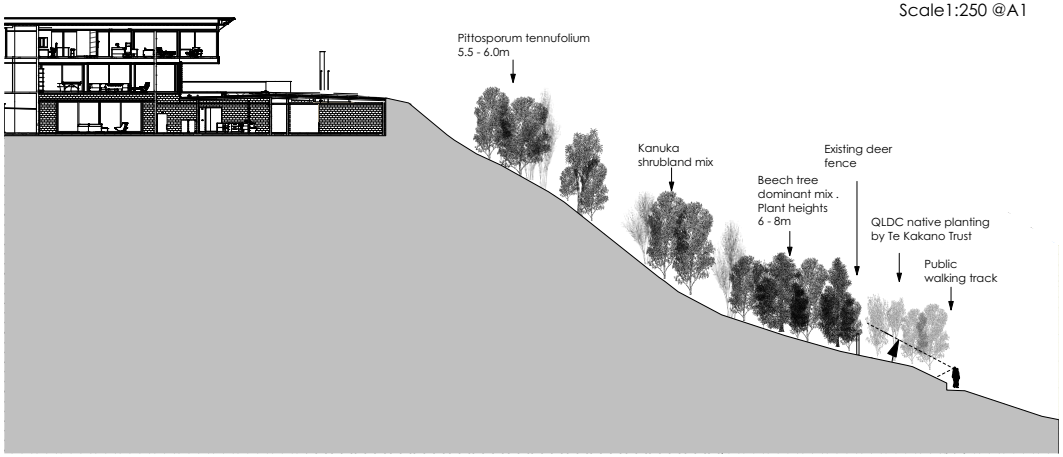


Cross Sections CS2 - Existing Indicative Plant Heights
Scale1:250 @A1



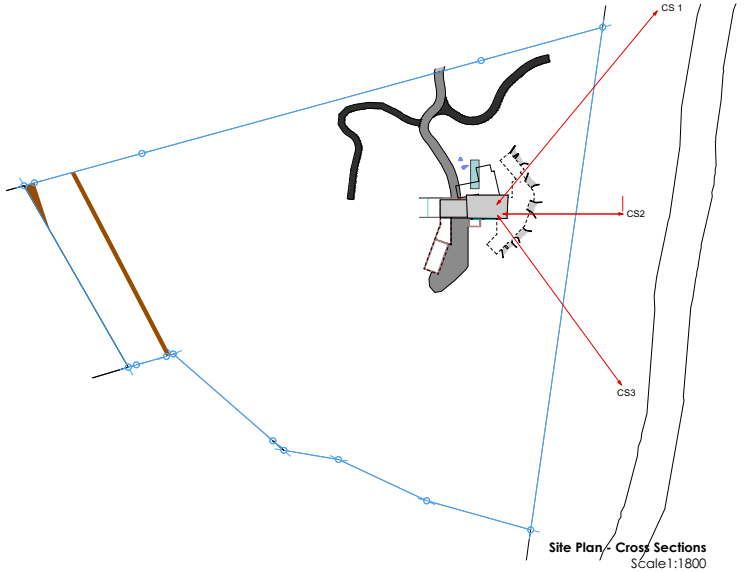
Plant growth based on existing heights plus 400-500mm growth per year when irrigated.

Cross Sections CS2-Indicative Plant Growth after 5 Years
Scale1:250 @A1



Plant growth based on current heights plus 400-500mm growth per year when irrigated.

Cross Sections CS2-Indicative Plant Growth after 10 Years
Scale1:250 @A1



Site Plan - Cross Sections
Scale1:1800

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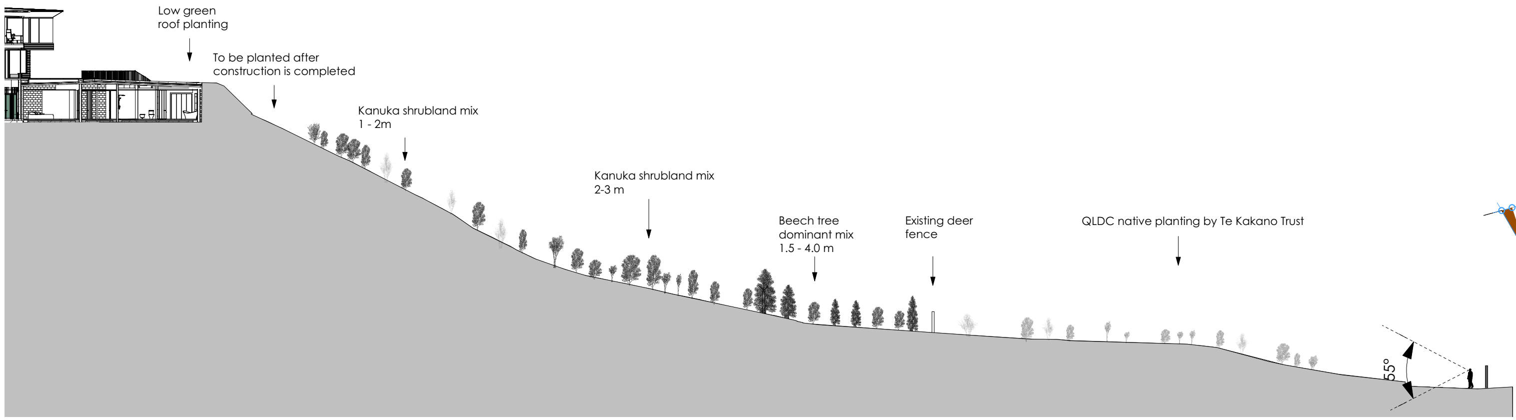
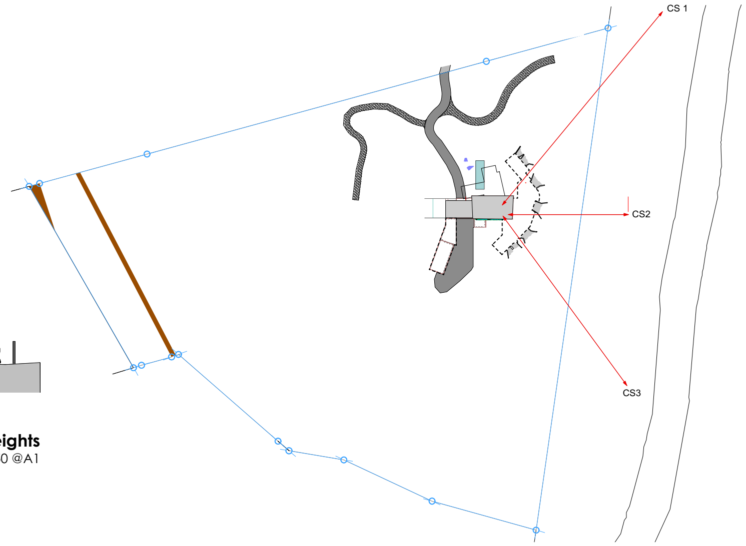
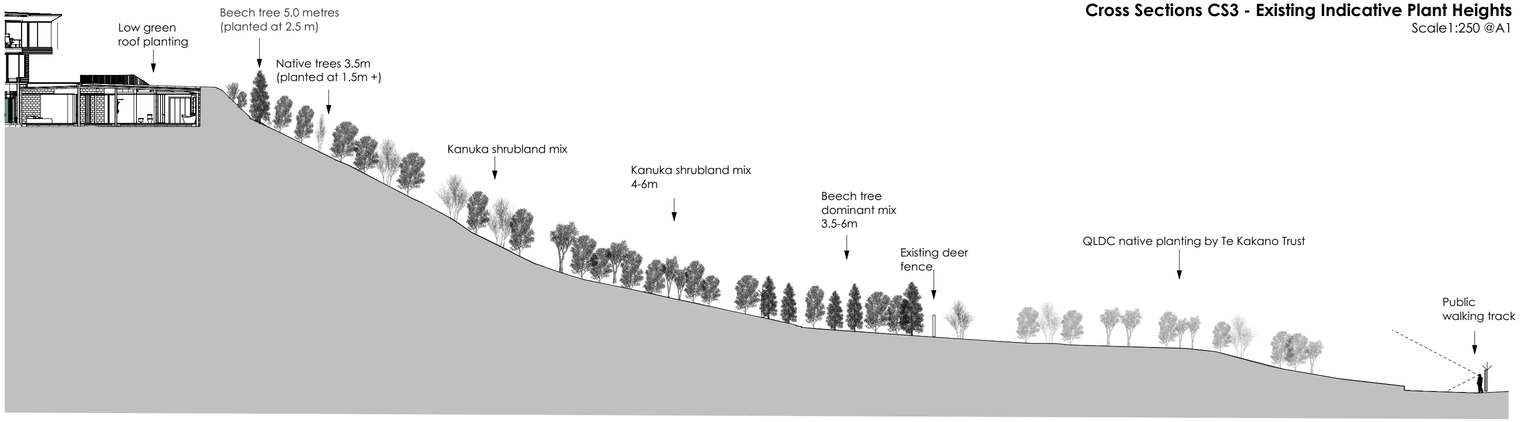
Cross Section 2 - Existing & Indicative Plant Growth 5 and 10 years



Cross Sections CS3 - Existing Indicative Plant Heights
Scale1:250 @A1

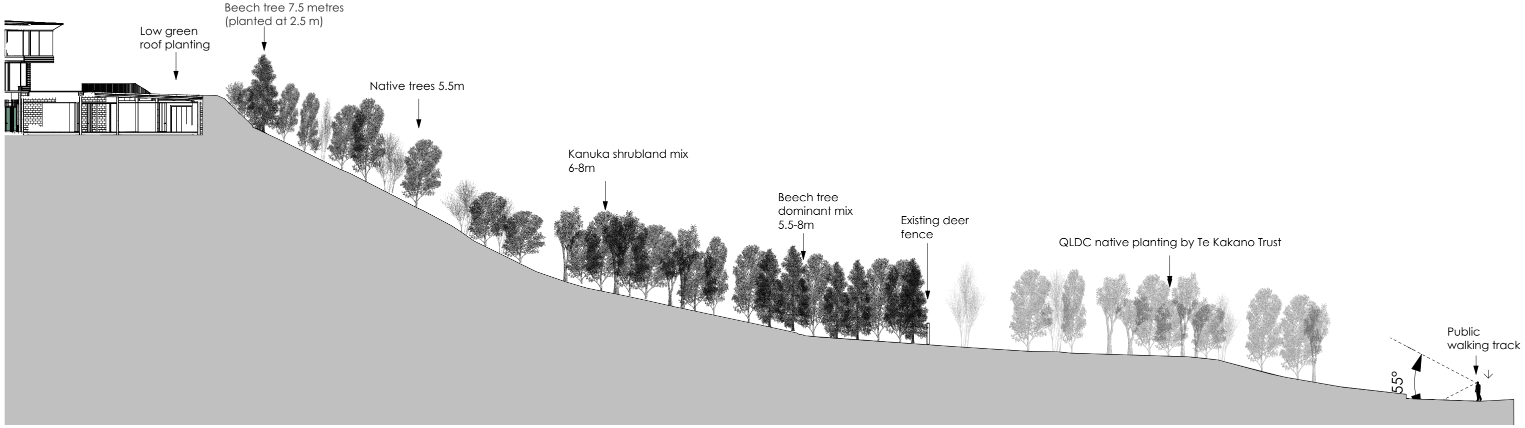


Site Plan - Cross Sections
Scale1:1800



Plant growth based on existing heights plus 400-500mm growth per year when irrigated.

Cross Sections CS3-Indicative Plant Growth after 5 Years
Scale1:250 @A1



Plant growth based on current heights plus 400-500mm growth per year when irrigated.

Cross Sections CS3-Indicative Plant Growth after 10 Years
Scale1:250 @A1

Vectorworks file; Sanctuary Proj REV PLANS 15-04-2021

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Cross Section 3 - Existing & Indicative Plant Growth 5 and 10 years