

BWN LTD – Engineering and Environmental Consultants

# GEOTECHNICAL INVESTIGATION REPORT

52 Kaurilands Road, Titirangi, Auckland

Prepared for 'MAQ Enterprises Ltd'

REF: 1935  
09/07/21

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## ABBREVIATIONS

AVF	Auckland Volcanic Field
A/C	Alluvium/Colluvium
CF	Cornwallis Formation
ECBF	East Coast Bays Formation
EOB	End of borehole
GCR	Geotechnical Completion Report
GIR	Geotechnical Investigation Report
NA	Northland Allochthon
NZGD	New Zealand Geotechnical Database
PF	Puketoka Formation
TG	Tauranga Group
UTP	Unable to penetrate
VD	Volcanic deposits
WG	Waitemata Group

## 1. INTRODUCTION

BWN has undertaken a geotechnical investigation for the proposed new development at 52 Kaurilands Road, Titirangi, Auckland. This report presents findings of the geotechnical site investigation and assessment. The scope of work includes:

- Site observation and evaluation
- Field investigation – five handauger boreholes (with shear vane testing)
- Interpretation of soil profiles and design parameters
- Foundation and retaining wall assessment
- Stability analysis
- Assessment of AUP E7.6.1.6 and E7.6.1.10

Engineering considerations are given in Section 7 of this report.

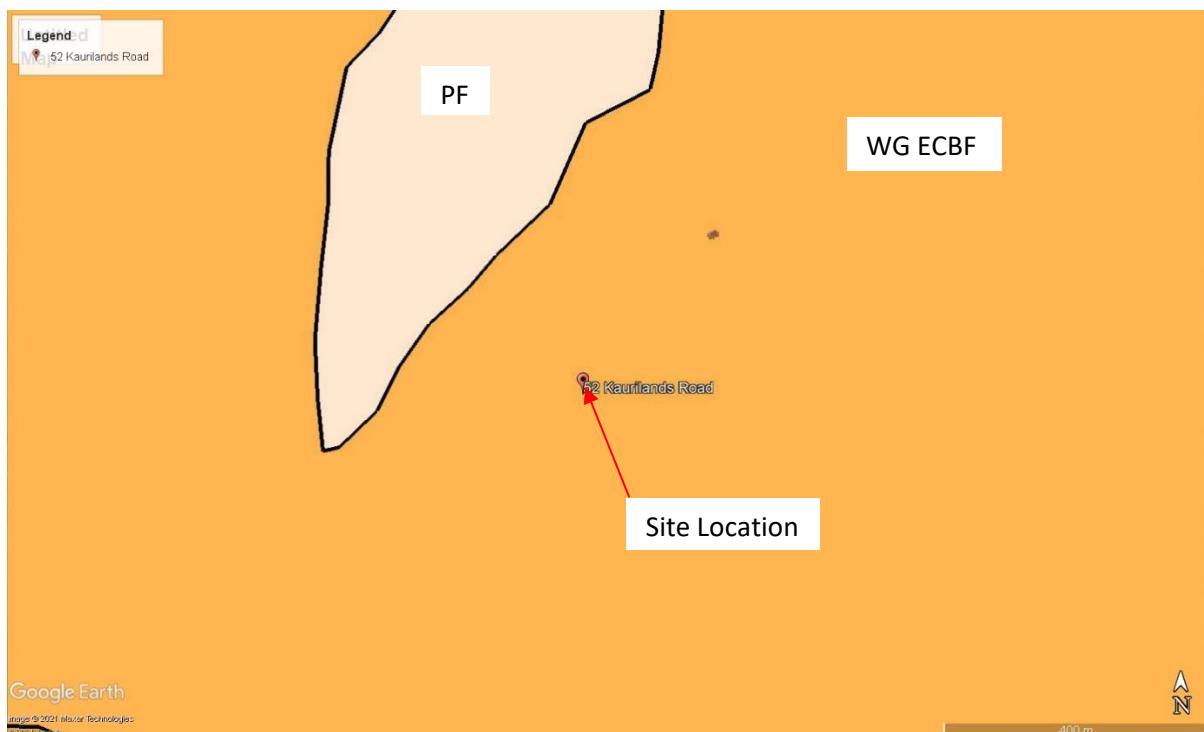
## 2. PROPOSED DEVELOPMENT

The proposed development is to demolish the existing house and build three triple-storey stand-alone new dwellings. Architectural design drawings (including retaining wall plan) are attached in Appendix A.

The new building platforms will involve excavation up to 3m deep approximately. Filling is expected to be up to 1m deep approximately. Near-boundary retaining walls will involve excavation up to 2m deep approximately.

## 3. GEOLOGY

According to GNS online published geological map, the site is underlain by the East Coast Bays Formation (ECBF) of the Waitemata Group.



**Figure 1: GNS online published geological map**

#### **4. SITE CONDITIONS**

The site slopes down from west to east. The slope gradient varies between 1v:2h and 1v:3.5h approximately on the northern side of the existing house. The southern side of the house is slightly flatter than the northern side. The driveway and ground around the garage are generally flat. There is an existing timber retaining wall near the west boundary.

Auckland Council GeoMAP indicates that no public pipeline runs across the site.



**Figure 2: Auckland Council GeoMap**



### Front /driveway /looking west



West side of house /existing timber retaining wall / looking north

### **Figure 3: Site Photographs**

## 5. FIELD INVESTIGATIONS

The field investigation was undertaken on the 5<sup>th</sup> of March 2021 which involved five handauger boreholes (HA1 to HA5). Shear vane testing was undertaken in each borehole at an interval of 0.5m to a maximum depth of 4m. Groundwater levels were re-checked on the 8<sup>th</sup> of March.

Borehole locations were chosen to take into account proposed building footprints and the current site conditions. The geotechnical site investigation plan is attached in Appendix B, which shows the investigation locations.

## 6. SUBSURFACE CONDITIONS

Fill and topsoil were encountered within the depth of 0.4m to 1.1m. Nature soil consisted of firm to very stiff Puketoka Formation (silty clay and peaty clay). The encountered fill is not engineered fill.

Factual investigation results are summarised in Table 1. Bore logs are given in Appendix B.

**Table 1: Summary of subsurface conditions**

Location	Hole Depth (m)	Topsoil/Fill Thickness (m)	Natural Ground	S <sub>u</sub> (kPa) <sup>[1]</sup>		Groundwater		
				min	max	Depth (m) <sup>[2]</sup>	RL (m)	Date
HA1	4	0.6	PF	43	144	3 2.18	49.4 50.22	05/03/21 08/03/21
HA2	4	1	PF	98	128	3.8 3.65	48.2 48.35	05/03/21 08/03/21
HA3	4	0.4	PF	38	161	3 2.68	48.3 48.62	05/03/21 08/03/21
HA4	4	-	PF	31	156	2.1 2.1	47.9 47.9	05/03/21 08/03/21
HA5	3	1.1	PF	34	UTP	1.6 1.85	48.1 47.2	05/03/21 08/03/21

Notes:

<sup>[1]</sup> S<sub>u</sub> is undrained shear strength measured using a shear vane. <sup>[2]</sup> below the existing ground level

## 7. ENGINEERING CONSIDERATIONS

### 7.1 General

The geotechnical assessment has been based on the borehole and testing results obtained at limited discrete locations. It should be noted that conditions of the ground away from the borehole and testing locations may differ from what are discussed in the report. Some assumptions have also been made for the analysis or assessment on the basis of our knowledge and experience. Considerations and recommendations given in the report are prepared for the proposed development as described in Section 2 of this report. Any significant variation to the proposed development may affect the recommendations.

### 7.2 Stability

#### 7.2.1 Long Term Stability

The post-development stability has been analysed using the software SLIDE. A critical section A-A is chosen for the analysis, which is shown on the site plan. The Morgenstern-Price method

has been used for the analysis. The analyses indicate that the factor of safety (FOS) against a global slope failure is greater than the minimum requirement (i.e. 1.5 for long term static case, 1.3 for high groundwater case and 1.2 for seismic case). Analysis outputs are given in Appendix C.

To meet the global stability, the following design inputs have been considered for the near-boundary retaining wall behind Lot 3 building:

- Retaining wall poles shall have a minimum shear resistance of 60 kN per metre wall length, i.e., if the pole central spacing is 1.2m, the minimum shear resistance is 72 kN each pole.
- Poles shall be at least 1m deeper than the ground floor

We have followed a commonly accepted practice that no lateral resistance to the cut is considered from the Lot 3 foundation wall and no building surcharge is considered for the platform.

The analysis results are summarised below:

**Table 2: Summary of stability analysis**

Analysis case	Minimum FOS	Minimum required FOS	Comment
Long-term static	1.60	1.5	Satisfactory
High groundwater	1.38	1.3	Satisfactory
Seismic (150 year return earthquake event as per Auckland Council COP for Land Development & Subdivision; PGA=0.056g assessed in accordance with NZTA Bridge Manual, for Class D site)	1.47	1.2	Satisfactory

### 7.2.2 Temporary Stability and Construction Methodology

The contractors shall carry out earthworks with due care of all existing property boundaries. A good construction practice shall always be considered. Any cut and fill areas shall be protected to ensure sufficient stability. Safe batters, props, barrier piles (soldier piles) and specific construction methodologies shall be considered wherever feasible and necessary. A safety fence or barrier shall be set back at a sufficient distance from the cut face. The neighbours shall be notified prior to excavation. Contingency measures shall be taken if necessary (e.g. temporarily close a driveway, fully backfill an excavated area, etc.).

The contractors shall carry out the construction in accordance with the **Health and Safety at Work Act 2015** for the safety of all workers and visitors.

A temporary safe batter should not exceed 45° at the site. If such a temporary safe batter is not feasible, suitable propping systems and/or specific construction methodologies shall be considered.

If temporary props are used, props should be installed without delay. The propping system should be maintained in place during the wall construction until the wall is backfilled. A prop may be relocated to a new location if it is in obstruction of construction but shall not be removed.

For timber retaining walls along the south-east or north-east boundary, the following ‘top-down’ methodology shall be considered:

*Retaining wall piles should be installed prior to bulk excavation. Concrete should be poured to the proposed excavation level. After the concrete reaches its strength, excavation should be undertaken using a small digger in section by section (each section not exceeding 2m long). Excavation of a section should not commence until the preceding section is backfilled or temporarily propped.*

If necessary, retaining wall laggings can be installed in front of piles. For this option, no excavation behind piles is required for drainage fill. There is no need of excavation in section by section because only minor cutting of soil between piles is required for installation of vertical drains.

If a block retaining wall is proposed along the south-east or north-east boundary, temporary propping should be considered and should be installed without delay:

*Excavation shall be undertaken in section by section (each section not exceeding 2m long). Props shall be installed immediately after excavation of each section. Excavation shall not continue until a preceding section is fully propped. The blockwall should be built in several stages (e.g. 0.6m, 1.2m and 1.8m height). The completed portion of a blockwall at a certain stage shall be fully concreted and backfilled prior to commencement of the next stage. The propping system should be maintained in place during the wall construction until the wall is fully backfilled. A prop may be relocated to a new location if it is in obstruction of construction but shall not be removed.*

Along the west boundary, the proposed new retaining wall height varies from approx. 0.7m at the southern end to approx. 1.9m at the northern end. Due to close proximity to the boundary and the existing retaining wall, a blockwall is not considered to be practical in terms of safe construction/boundary stability. Therefore, an embedded retaining wall shall be considered (e.g. timber pole wall). The above ‘top-down’ construction methodology shall be considered for excavation and construction of the retaining wall.

At Lot 3, the maximum excavation depth for the ground floor is 3m approximately. As the ground floor excavation will be close to the near-boundary retaining wall, the structural design of the retaining wall shall consider the adverse influence of the subsequent excavation of the ground floor.

Similarly at Lot 1, the maximum excavation depth for the ground floor is 2.4m approximately. The structural design of the retaining wall shall consider the adverse influence of the subsequent excavation of the ground floor.

The existing timber retaining wall at the west boundary shall be considered in the design of new retaining walls.

A pre-construction site meeting shall be held to discuss further details regarding to the temporary retention. The constructors, structural designer and the geotechnical engineer shall attend the meeting. Auckland Council shall also be notified in advance (as per resource consent conditions).

### 7.3 Groundwater Effects

The groundwater table measured on the 8<sup>th</sup> of March 2021 was 2.18m, 3.65m, 2.68m and 2.1m below the existing ground at HA1, HA2, HA3 and HA4 respectively. The groundwater is representatively of dry season groundwater regime. Based on our experience for similar site conditions, the historical lowest groundwater table should be at least 3m deep. This is consistent with the soil strength and colour profiles. The proposed near-boundary cut depth is up to 2m. The ground floor excavation at Lot 3 is up to 3m deep but is approximately 3m away from the west boundary. The ground floor excavation at Lot 1 is up to 2.4m deep but is at least 4m away from the boundary. Hence, the proposed cut levels are assessed to be above the historical lowest groundwater table and the adverse effect on the neighbouring site in terms of consolidation ground settlement is expected to be no more than minor.

However, the groundwater table fluctuates with the weather. For the site conditions, a high ground table of 1.5m deep is likely to occur in wet winter seasons. The assessment of AUP E7.6.1.6 and E7.6.1.10 is given in Appendix D. The assessment is based on assumed winter ground table of 1.5m deep.

Based on the assessment, the proposed earthworks do not comply with AUP E7.6.1.6 (2) & (3) due to retaining wall drainage taking water after the construction.

However, such non-compliance is considered to be minor (approx. up to 0.6m dewatering at the boundary, up to 1.5m dewatering at ground floor foundation blockwalls at Lot 3) and is unavoidable as the retaining drainage is required for the engineering design to prevent flooding on the neighbouring sites. Such water take mainly occurs in winter seasons when the groundwater is normally abundant in Auckland and is not expected to adversely affect the natural resource.

The adverse diversion effect is expected to be negligible as long as proper drainage materials and filtered drains are built behind the retaining walls and all drains are properly connected to the stormwater network.

### 7.4 Soil Category

#### 7.4.1 Expansivity

Class 'H2' is recommended for the foundation design to take into account soil expansivity effects.

Note: the above soil expansivity class is based on visual/hand tactile assessment. No laboratory test was undertaken. It is not guaranteed that the assessment would be the same as any laboratory tests or assessment made by other consultants. However, the above soil class is considered to be sufficient for the foundation design at the site.

#### 7.4.2 Seismicity

Based on NZGD published deep machine borehole information, the site is best categorised as class 'D' (deep or soft soil site) in accordance with NZS 1170.5:2004.



**Figure 4: NZGD published deep machine boreholes**

## 7.5 Foundation Design

### 7.5.1 Shallow Foundations

Shallow foundations (pad/strip footings or rafts) are considered suitable except piles as recommended in Section 7.5.2.

Strip/pad footings, raft beams and thickenings may be designed using an ultimate bearing capacity of 200 kPa. A strength reduction factor of 0.5 should be applied for the ULS design (to obtain the dependable capacity).

Strip and pad footings should have a minimum embedment of 900mm below the finished ground level.

Shallow foundations shall be founded in natural firm to stiff ground fill or new compacted hardfill.

New engineering fill shall not exceed 600mm thick (not including hardfill to replace unsuitable fill). Light-weight fill (e.g. polyrock) should be used for additional fill if required. Alternatively, subflooring should be considered.

A layer of minimum 100mm hardfill (GAP40 or GAP20) shall be placed under footings and slab to protect the subgrade from being weakened by rain or desiccated by sun. The hardfill layer shall be illustrated on the engineer's foundation details.

### 7.5.2 Pile Foundation

Piles should be considered under all external walls. Piles shall have a minimum embedment of 3.5m at the down-slope sides at Lot 2 and Lot 3, and minimum 2.5m elsewhere.

The down-slope pile zones at Lot 2 and Lot 3 are shown on the geotechnical site plan.

**Table 3: Pile vertical design parameters (already factored for ULS design – dependable capacities)**

Soil Layer	Design skin friction $f_s$ (kPa)	Design end bearing capacity $f_b$ (kPa) for piles up to $\phi 500\text{mm}$
Natural firm to stiff ground	0 (upper 1m) 10 (>1m deep)	180 ( $\geq 2.5\text{m}$ deep)

Piles at the down-slope sides (Lot 2 and Lot 3) should be designed for lateral loads due to soil creeping effects. These piles shall have a central spacing not exceeding 3D. Soil creeping design parameters are given below:

**Table 4: Pile design parameters for soil creeping effects**

$K_0$	Unit weight	Width	Depth (m)
0.55	18 kN/m <sup>3</sup>	3D (D is pile diameter)	1.5

## 7.6 Retention Design

A permanent retaining wall is required for any excavation or filling deeper than 0.3m unless a safe batter is constructed.

Vehicle loading, building surcharge, boundary/neighbouring site conditions and sloping ground (both in front and at back of a retaining wall) should be considered in the design where applicable. The design shall also consider any influence of the subsequent excavation of platforms. The existing retaining wall at the west boundary shall be considered in the design.

**Table 5: Retaining wall design parameters**

Soil Layer Parameters	Natural firm to stiff ground
Unit weight, $\gamma$ (kN/m <sup>3</sup> )	18
Friction angle	27°
Unfactored undrained shear strength, $S_u$ (kPa)	40

## 7.7 Earthworks

Earthworks should be undertaken under good weather conditions. When rain is expected, excavated surfaces (particularly the founding soil and temporary slope cut faces) should be protected from being eroded or softened.

To protect the subgrade from being disturbed by subsequent works, the best practice is to place a layer of compacted hardfill or site concrete over the subgrade immediately after the proposed cut level is reached (including a footing trench).

For expansive soils, if the construction is undertaken in a dry season, exposed soil (e.g. slab areas, footing bases, retaining wall cut faces) should be protected to avoid being dried out. If necessary, water should be evenly sprayed over the subgrade until the surface is properly protected. The subgrade shall not be either too dry or too wet.

Silt fences should be installed at boundaries for erosion and sediment control. Topsoil and unsuitable fill under shallow footings/slab and under driveways should be removed.

Granular hardfill or polyrock is recommended for new engineering fill. Cohesive fill (clay/silt) shall not be used within building platforms and under new driveway.

### **7.8 Stormwater and Erosion Control**

Stormwater due to the new development (e.g. from roof, paved areas and retaining walls if any) should be collected and be discharged via sealed pipes to the reticulated stormwater network or an approved outlet to avoid any adverse effects on neighbouring sites.

Any unpaved ground within the site should be grassed or vegetated.

### **7.9 Pavement**

A CBR of 2% may be used for the design of any new pavement founded in the natural ground or engineered fill.

### **7.10 Inspections**

A minimum 48-hour notice shall be given to us prior to any site inspections during the construction. If we are not available, another suitably qualified geotechnical practitioner should be engaged, who should be familiar with the assumptions and recommendations made in this report. The designers should be notified promptly if any significant variation in the ground conditions is found during an inspection.

## 8. CONCLUSIONS AND RECOMMENDATIONS

Based on the site investigation and experience, the site is considered suitable for the proposed development subject to the engineering considerations given in Section 7 of this report. The main findings and recommendations are given as follows:

- Topsoil and unsuitable fill shall be sub-excavated under building platforms and driveway.
- An ultimate bearing capacity of 200 kPa is recommended for strip/footings, raft beams and thickenings.
- Soil expansivity is categorised as class 'H2' as per AS2870-2011.
- New engineering fill shall not exceed 600mm thick. Light-weight fill shall be considered if additional fill is required. Alternatively, subflooring should be considered.
- Piles should be designed as per Section 7.5.2.
- Specific construction methodologies shall be considered for near-boundary excavation (see Section 7.2.2).
- Cohesive fill (clay or silt) shall not be placed within building platforms and new driveway.

## LIMITATIONS

This report has been prepared for the specific brief provided to BWN by the client and should not be used in other contexts for any other purpose without a prior agreement. Land contamination assessment (if required) is not covered by this report.

The engineering recommendations are based on findings obtained from a limited number of boreholes or field tests at discrete positions. It should be appreciated that ground conditions may vary from what was encountered at the borehole or testing locations. The assessment is made on the basis of our best understanding of the available information (including topographical plan and architectural plans). Re-assessment shall be undertaken if actual site/ground conditions and the design proposal are significantly different from what has been assumed. BWN also requests an opportunity to undertake re-assessment if there is any misunderstanding of the information provided by the client.

Due to complexity of geotechnical engineering, it is not guaranteed that our assessment would be the same as other assessment based on any laboratory tests, any other types of in-situ tests or any assessment made by other consultants.

Yours Faithfully,

**BWN Ltd** - Engineering and Environmental Consultants

Bing NI



Managing Director/Geotechnical Engineer

DipEng, ME (1<sup>st</sup> Hon.), PhD, CPEng, IntPE, CMEngNZ

## Appendix A: Architectural Drawings

LOT 2 DP 148094

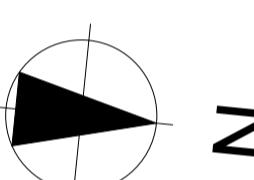
TOTAL SITE  
812m<sup>2</sup> AREA GROSS  
EXISTING BUILDING COVERAGE 137m<sup>2</sup> (17% GROSS & NET)  
EXISTING IMPERMEABLE COVERAGE 353m<sup>2</sup> (43% GROSS)  
EXISTING PERMEABLE GROUND 459m<sup>2</sup> (57% GROSS)  
EXISTING LANDSCAPE AREA 649m<sup>2</sup>(80% GROSS)

LOT 1 DP 148094

LOT 4 DP 40917

PT LOT 1 DP 34220

KAURILANDS RD



NOTES  
Contractor to check all dimensions and conditions on site before commencing work.

Work only from figured dimensions.

In the event of a discrepancy consult the designer.

If in doubt ASK.

All timber is to be MSG8 unless specified.

Construction shall comply with NZS 3604:2011 & NZS 4229:1999 unless noted otherwise.

All fastenings and fixtures 600 or less from finished ground level shall be Type 304 SS.

All exposed fastenings above 600mm from finished ground level shall be either:  
Type 304 SS; or  
Hot dipped galvanised with additional protection

Job Title  
**KAURILANDS**  
For  
**REFRESH**  
At 52 KAURILANDS RD  
AUCKLAND

PLANS 4 U

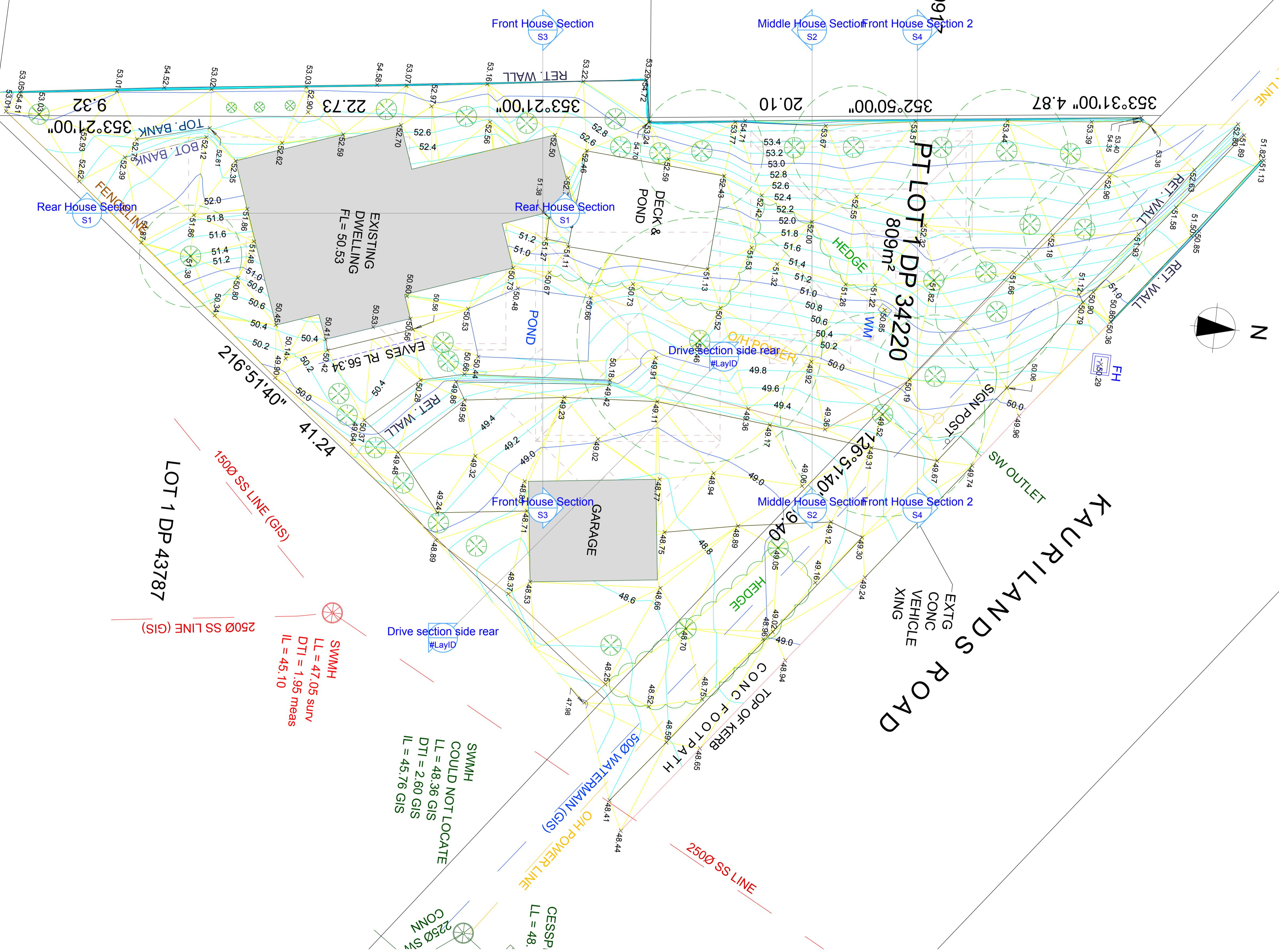
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Checked #Architect  
Creation Date 14/09/2009  
Plot Date 30/06/2021

Drawing Title

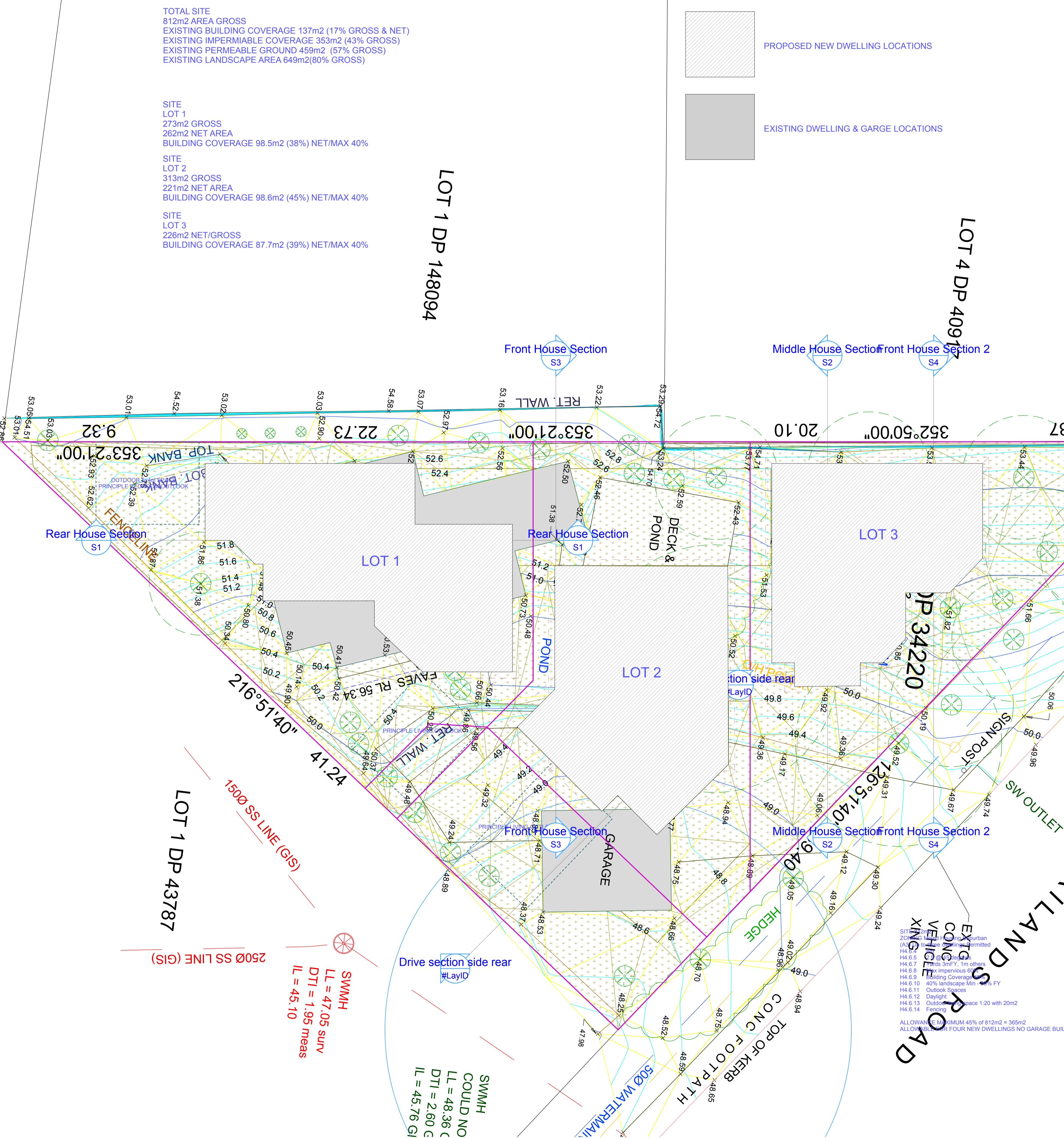
PRE SUBDIVISION PLAN

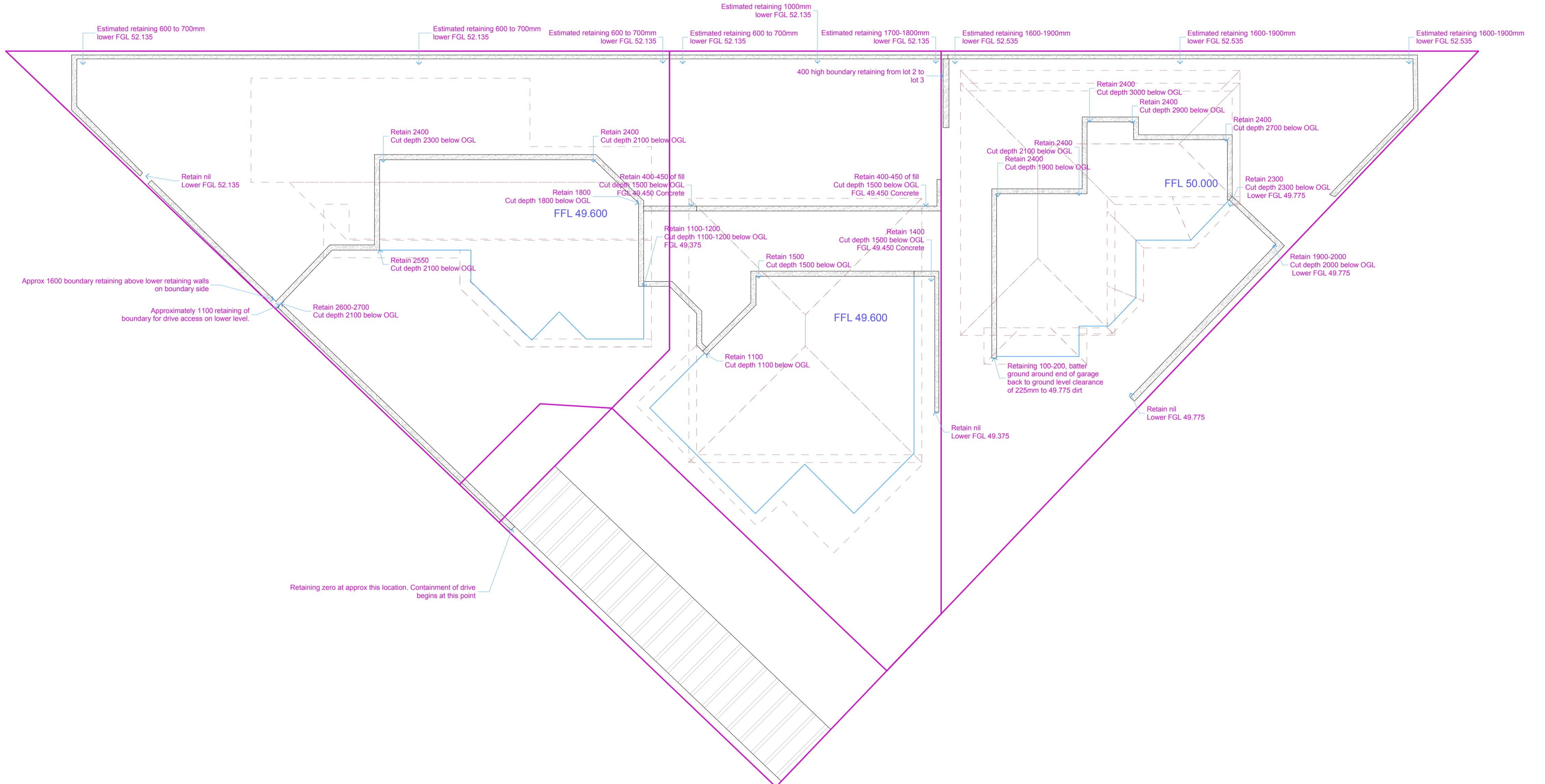
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ALL DIMENSIONS TO BE VERIFIED ON SITE



# LOT 2 DP 148094





Retaining Plan

Job Title	<b>KAURILANDS</b>
For	<b>REFRESH</b>
Ai	<b>52 KAURILANDS RD AUCKLAND</b>
PLANS 4 U	021 433462
Drawn	#CAD Technician
Checked	#Architect
Creation Date	14/09/2009
Pilot Date	7/07/2021
Drawing Title	<b>RETAINING WALLS</b>
Drawing Number	Scale
L108	1:100

ALL DIMENSIONS TO BE VERIFIED ON SITE

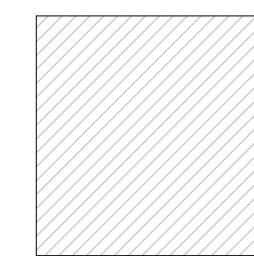
**PROPOSED SUBDIVISION  
52 KAURILANDS ROAD  
UNITARY PLAN ZONE - RESIDENTIAL MIXED HOUSING SUBURBAN**

**TOTAL SITE  
812m<sup>2</sup> AREA GROSS  
EXISTING BUILDING COVERAGE 137m<sup>2</sup> (17% GROSS & NET)  
EXISTING IMPERMEABLE COVERAGE 353m<sup>2</sup> (43% GROSS)  
EXISTING PERMEABLE GROUND 459m<sup>2</sup> (57% GROSS)  
EXISTING LANDSCAPE AREA 649m<sup>2</sup>(80% GROSS)**

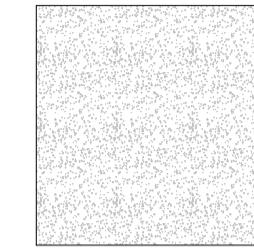
SITE  
LOT 1  
271m<sup>2</sup> GROSS  
260m<sup>2</sup> NET AREA  
BUILDING COVERAGE 98.5m<sup>2</sup> (38%) NET  
IMPERMIABLE COVERAGE 183m<sup>2</sup> (68% GROSS)  
PERMEABLE GROUND 90m<sup>2</sup> (32% GROSS)  
LANDSCAPE AREA 114m<sup>2</sup> (42% GROSS)  
%LANDSCAPE CONCRETE 18m<sup>2</sup> (16% LANDSCAPE)

SITE  
LOT 2  
313m<sup>2</sup> GROSS  
221m<sup>2</sup> NET AREA  
BUILDING COVERAGE 98.6m<sup>2</sup> (45%) NET/MAX 40%  
IMPERMIABLE COVERAGE 201m<sup>2</sup> (64% GROSS)  
PERMEABLE GROUND 112m<sup>2</sup> (36% GROSS)  
LANDSCAPE AREA 140m<sup>2</sup> (45% GROSS)  
%LANDSCAPE CONCRETE 19m<sup>2</sup> (14% LANDSCAPE)  
FRONT YARD AREA 33m<sup>2</sup>  
FRONT YARD LANDSCAPE 23m<sup>2</sup> (70% FY AREA)

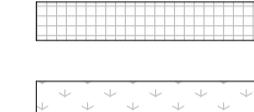
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LOT 3  
226m<sup>2</sup> NET/GROSS  
BUILDING COVERAGE 87.7m<sup>2</sup> (39%) NET/MAX 40%  
IMPERMIABLE COVERAGE 156m<sup>2</sup> (69% GROSS)  
PERMEABLE GROUND 70m<sup>2</sup> (31% GROSS)  
LANDSCAPE AREA 110m<sup>2</sup> (49% GROSS)  
%LANDSCAPE CONCRETE 33m<sup>2</sup> (30% LANDSCAPE)  
FRONT YARD AREA 81m<sup>2</sup>  
FRONT YARD LANDSCAPE 22m<sup>2</sup> (63% FY AREA)



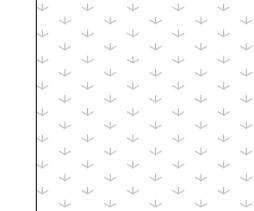
## PROPOSED NEW DWELLING LOCATION



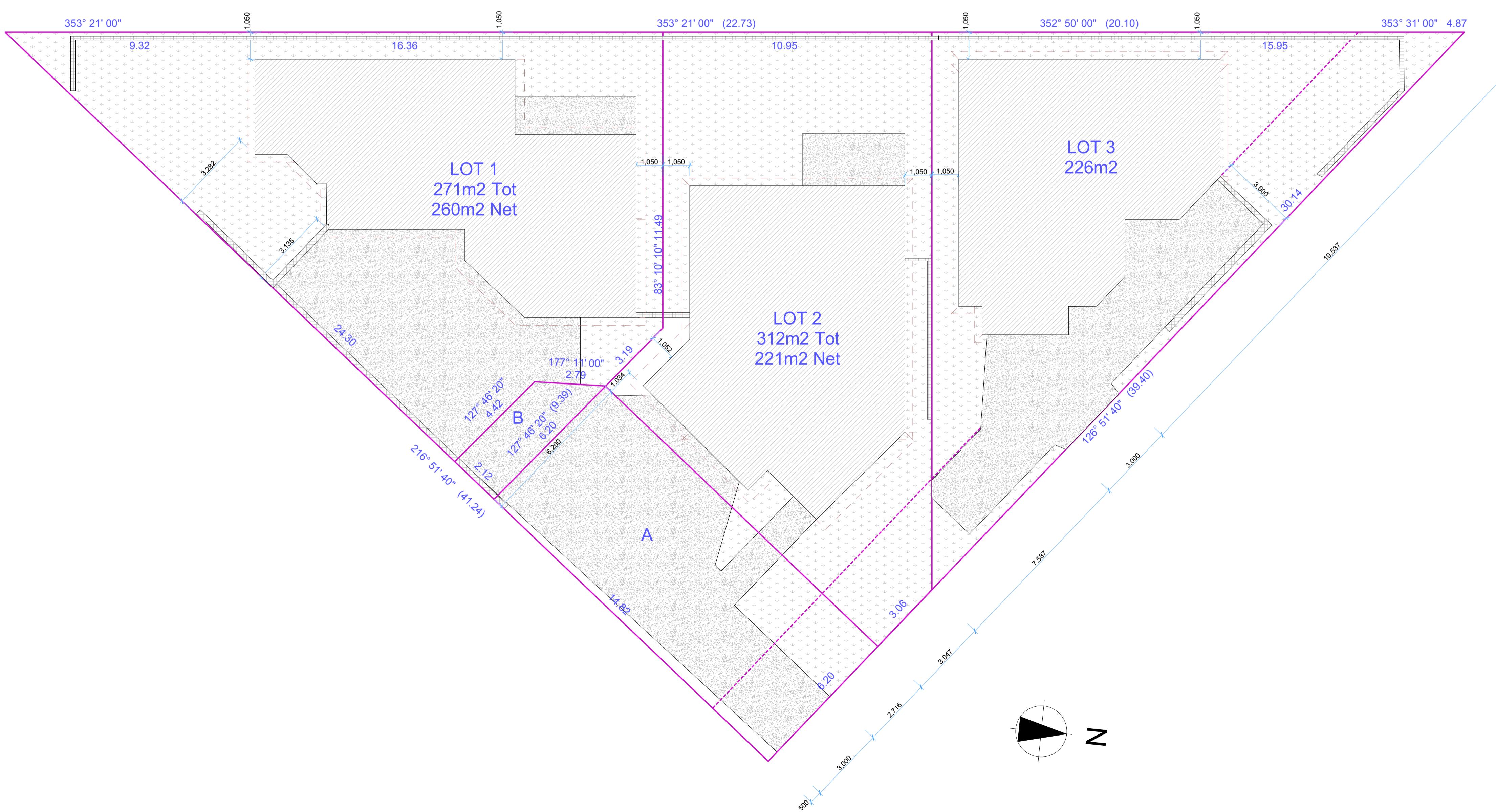
## CONCRETE COVER OUTSIDE OF BUILDING LINE



## INDICATIVE LOCATION OF RETAINING WALL



## GRASS & AREAS AVAILABLE FOR PLANTING



## NOTES

Contractor to check all dimensions and conditions on site before commencing work.

Work only from figured dimensions.

In the event of a discrepancy  
consult the designer.

All timber is to be MSG8 unless

Construction shall comply with  
NZS 3604:2011 & NZS  
4229:1999 unless noted  
otherwise.

All fastenings and fixtures 600 or less from finished ground level shall be Type 304 SS.

All exposed fastenings above  
600 from finished ground level  
shall be either  
Type 304 SS; or  
Hot dipped galvanised with  
additional protection

Job Title  
**KALUBIL LANDS**

For  
**REFRESH**  
At **52 KAURILANDS RD**

# AUCKLAND

**PLANS 4 U**  
021 433462

Drawn	#CAD Technic
	"A - Unit

Checked #Archives  
Creation Date 14/09/2023

Plot Date	30/06/20
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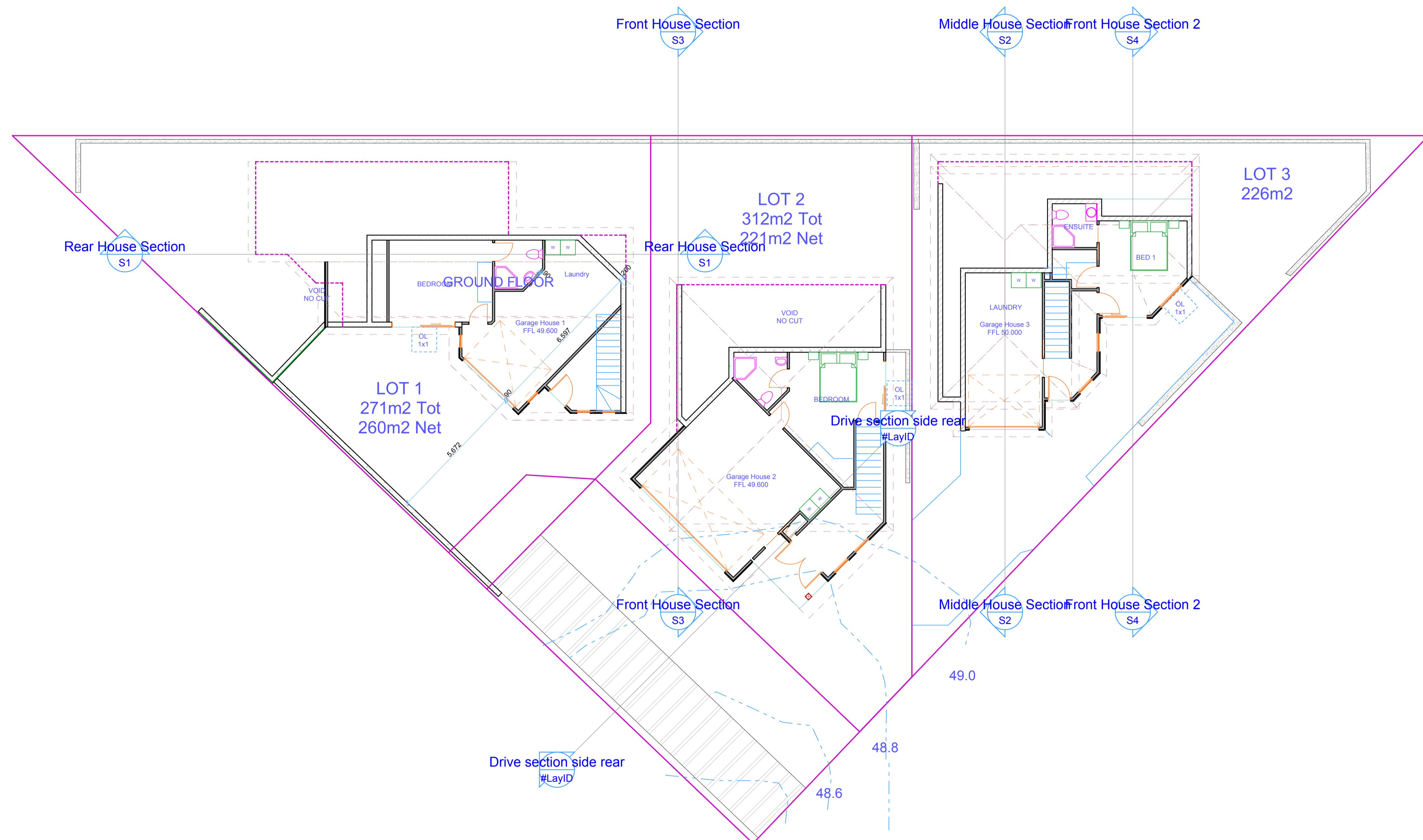
## Drawing Title

## SITE PLAN

Drawing Number	Scale
----------------	-------

L103 1:100

ALL DIMENSIONS TO BE VERIFIED ON S



**NOTES**  
Contractor to check all dimensions and conditions on site before commencing work.

Work only from figured dimensions.

In the event of a discrepancy  
consult the designer.

If in doubt ASK.

All timber is to be MSG8 unless specified.

NZS 3604:2011 & NZS  
4229:1999 unless noted  
otherwise.

All fastenings and fixtures 600

All exposed fastenings above

shall be either  
Type 304 SS; or  
Hot dipped galvanised with  
additional protection.

Job Title  
**KAURILANDS**

For  
**REFRESH**

At **52 KAURILANDS RD**

# AUCKLAND

**PLANS 4 U**  
021 433462

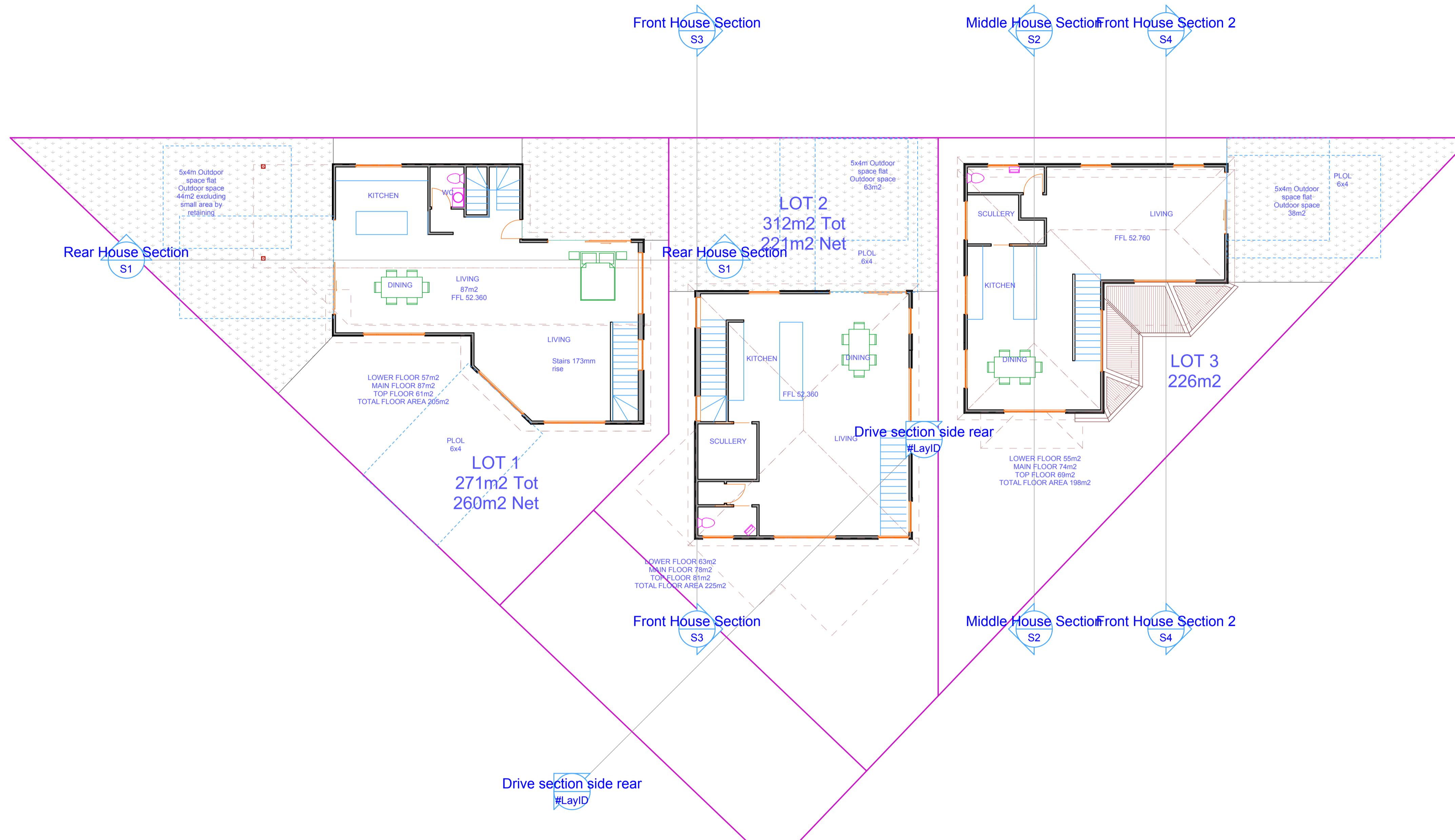
Checked	#Archite
Creation Date	14/09/20
	22/09/20

Plot Date	30/06/20
Drawing Title	<b>LOWER FLOOR PLAN</b>

**DRAWING NUMBER**

L104 1:100

ALL DIMENSIONS TO BE VERIFIED ON SITE



## NOTES

Work only from figured dimensions.

In the event of a discrepancy  
consult the designer.

If in doubt ASK.

All timber is to be MCSC unless specified.

Construction shall comply with NZS 3604:2011 & NZS 4229:1999 unless noted otherwise.

All fastenings and fixtures 600 or less from finished ground level shall be Type 304 SS.

All exposed fastenings above  
600 from finished ground level  
shall be either  
Type 304 SS: or  
Hot dipped galvanised with  
additional protection

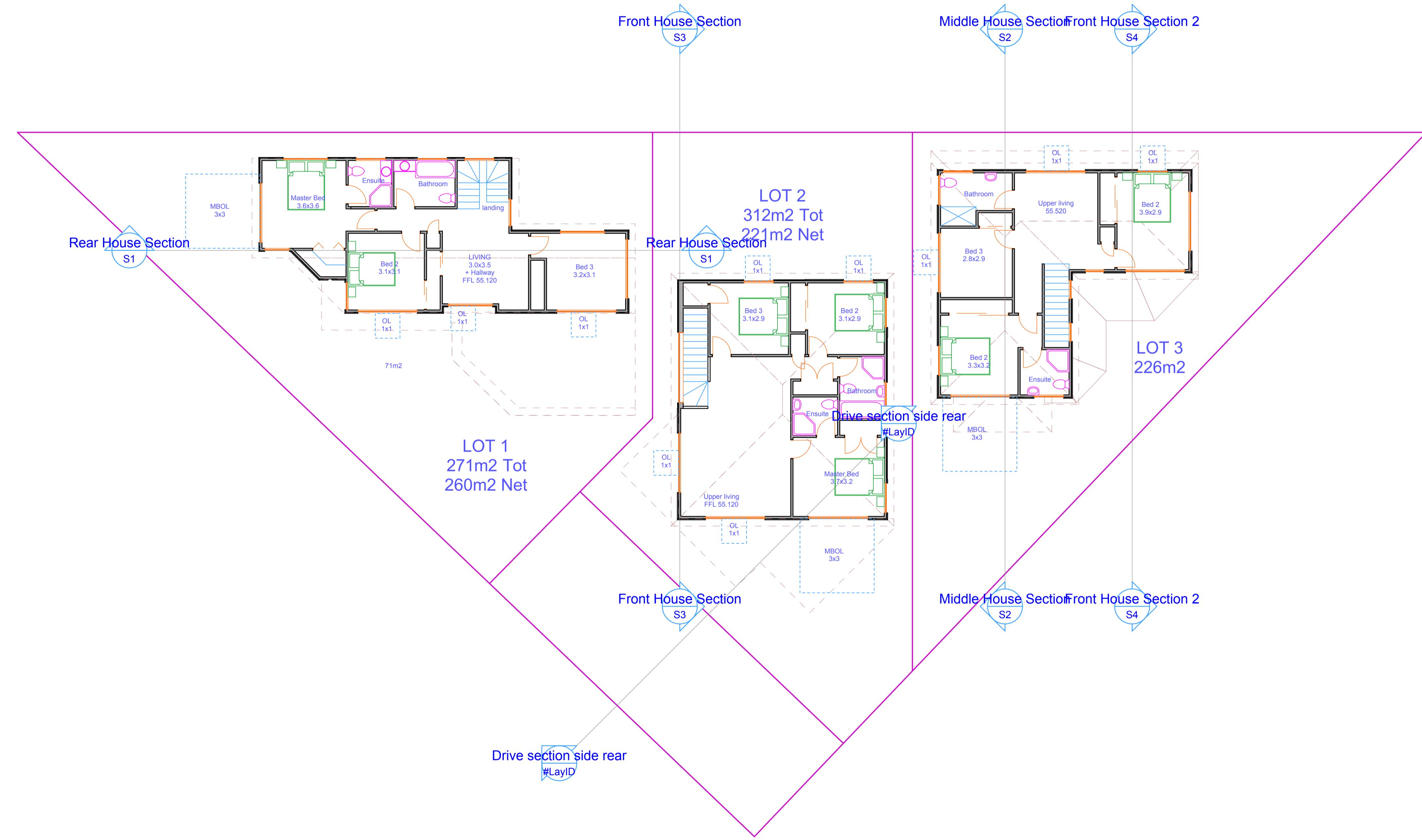
Job Title  
**KAURILANDS**

For  
**REFRESH**

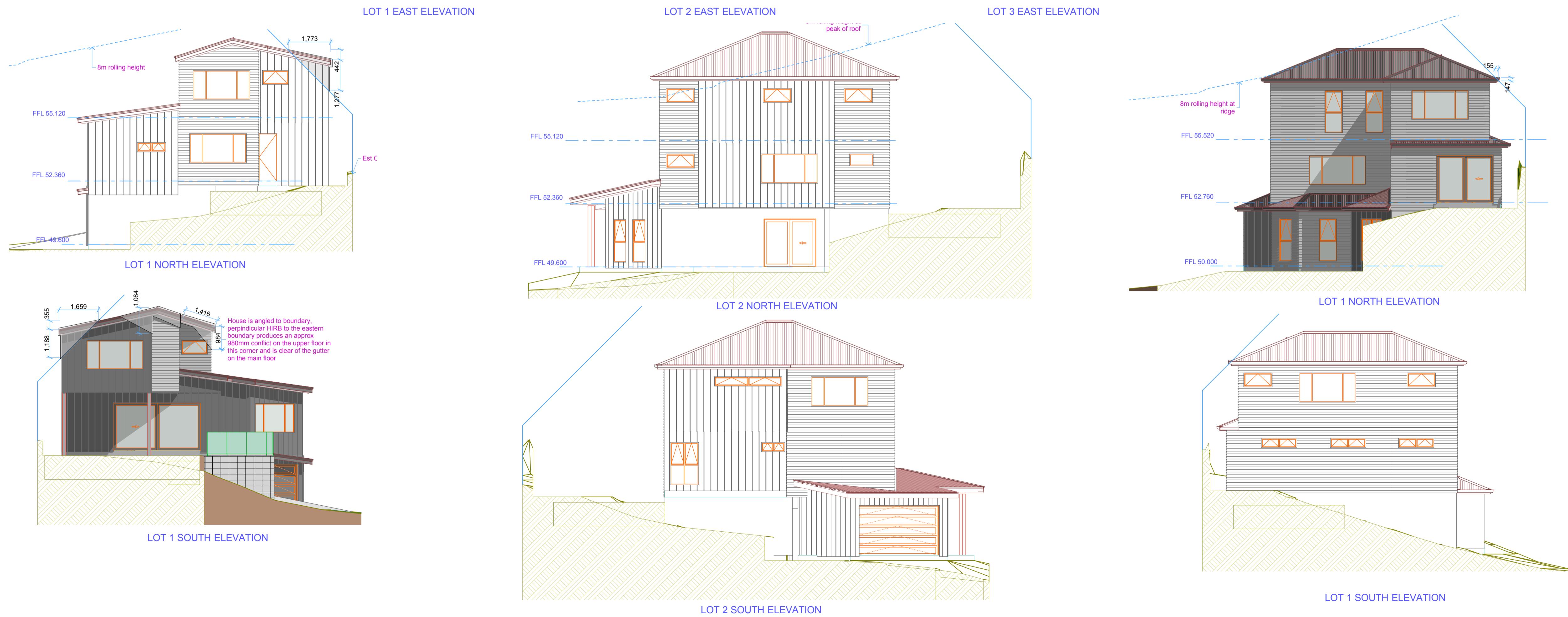
At **52 KAURILANDS RD**

<b>AUCKLAND</b>	
<b>PLANS 4 U</b>	
<b>021 433462</b>	
Drawn	#CAD Technic
Checked	#Archit
Creation Date	14/09/20

Plot Date	30/06/20
Drawing Title	
<b>MAIN FLOOR PLAN</b>	
Drawing Number	Scale
L105	1:100



Job Title	<b>KAURILANDS</b>	
For	<b>REFRESH</b>	
At	52 KAURILANDS RD AUCKLAND	
<b>PLANS 4 U</b>		
021 433462		
Drawn	#CAD Technician	
Checked	#Architect	
Creation Date	14/09/2009	
Plot Date	30/06/2021	
Drawing Title	UPPER FLOOR PLANS	
Drawing Number	Scale	
L106	1:100	
ALL DIMENSIONS TO BE VERIFIED ON SITE		



NOTES  
Contractor to check all dimensions and conditions on site before commencing work.

Work only from figured dimensions.

In the event of a discrepancy consult the designer.

If in doubt ASK.

All timber is to be MSG8 unless specified.

Construction shall comply with NZS 3604:2011 & NZS 4229:1999 unless noted otherwise.

All fastenings and fixtures 600 or less from finished ground level shall be Type 304 SS.

All exposed fastenings above 600 from finished ground level shall be either Type 304 SS or Hot dipped galvanised with additional protection.

Job Title **KAURILANDS**  
For **REFRESH**  
At **52 KAURILANDS RD AUCKLAND**

**PLANS 4 U**

021 433462

Drawn #CAD Technician

Checked #Architect

Creation Date 14/09/2009

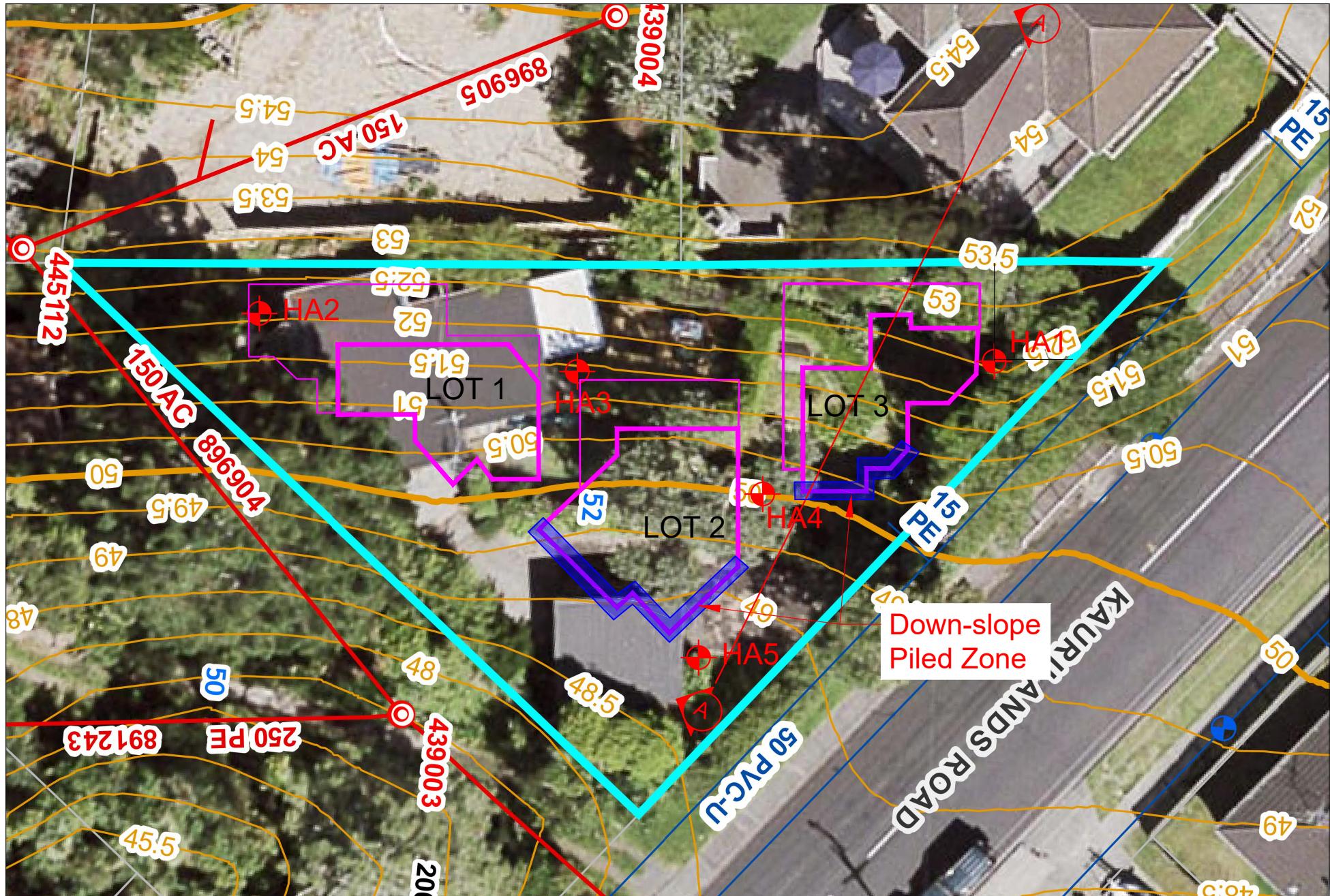
Plot Date 30/06/2021

Drawing Title **ELEVATIONS**

Drawing Number **L107** Scale **1:100**

ALL DIMENSIONS TO BE VERIFIED ON SITE

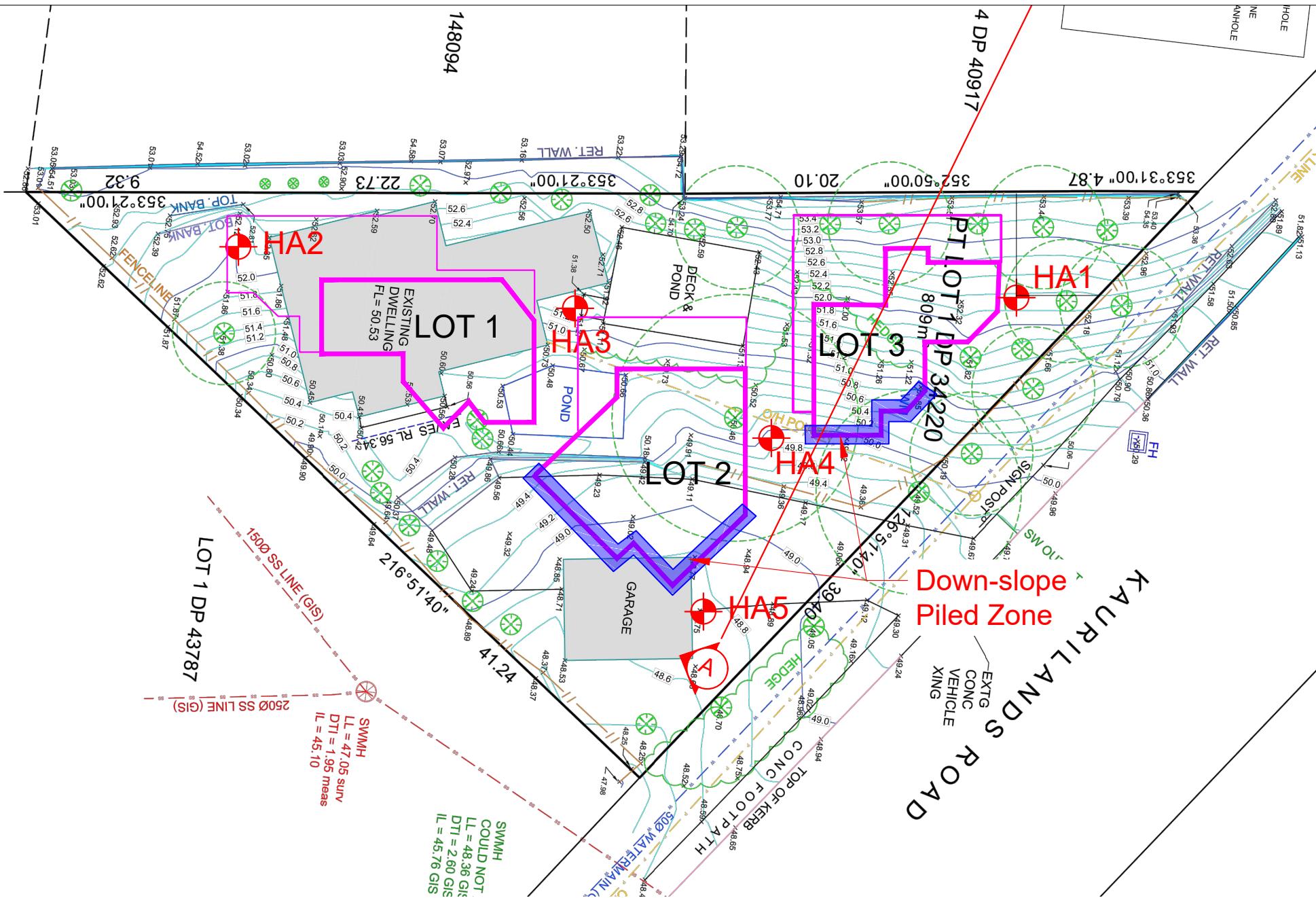
## Appendix B: Geotechnical Site Investigation Plan and Logs



BWN LIMITED ENGINEERING & ENVIRONMENTAL CONSULTANTS 18 HAZEL GLEN, BAYVIEW, AUCKLAND PHONE: (09) 441 7575 MOBILE: (021) 2375865 www.bnwn.co.nz		JOB TITLE LOT 4, TA MOKO DRIVE HOBBS BAY AUCKLAND DRAWING TITLE GEOTECHNICAL SITE INVESTIGATION PLAN		DRAWING NO. 1800	REVISION A	CLIENT THE OWNER
		SHEET NO. 100	DATE 09/07/21	ENGINEER B. NI		

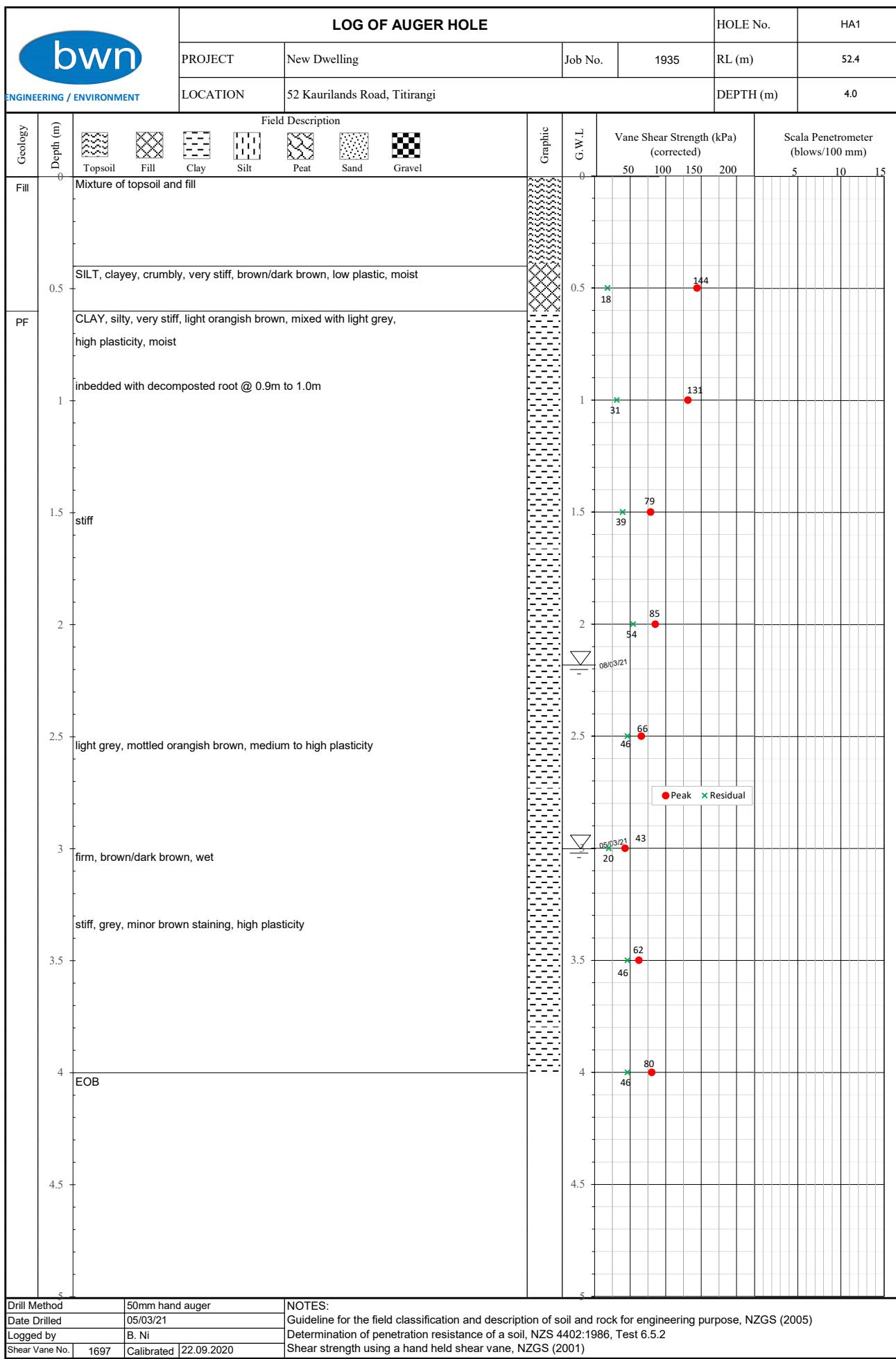
### LEGEND

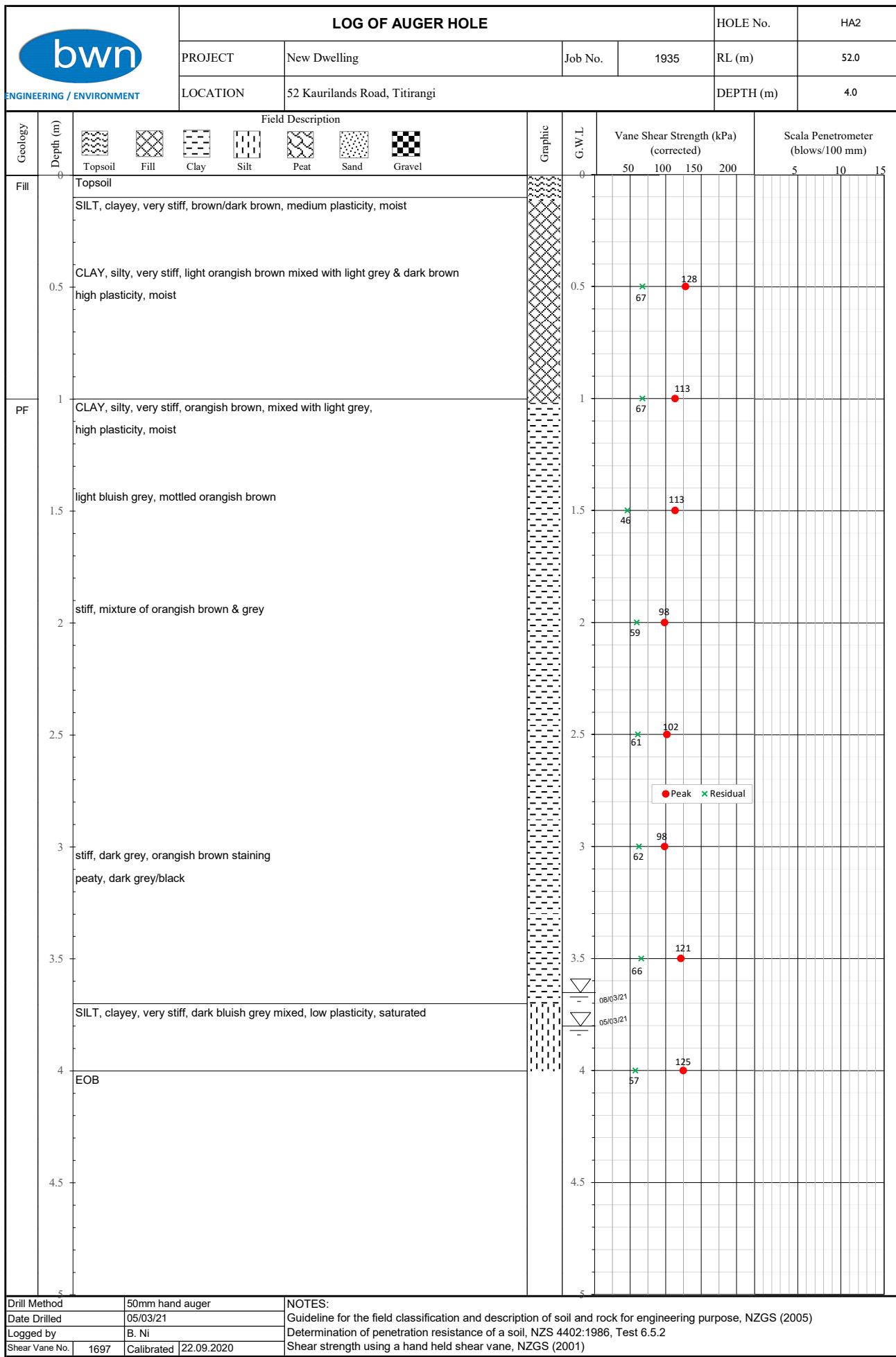
HA1 HANDAUGER BOREHOLE

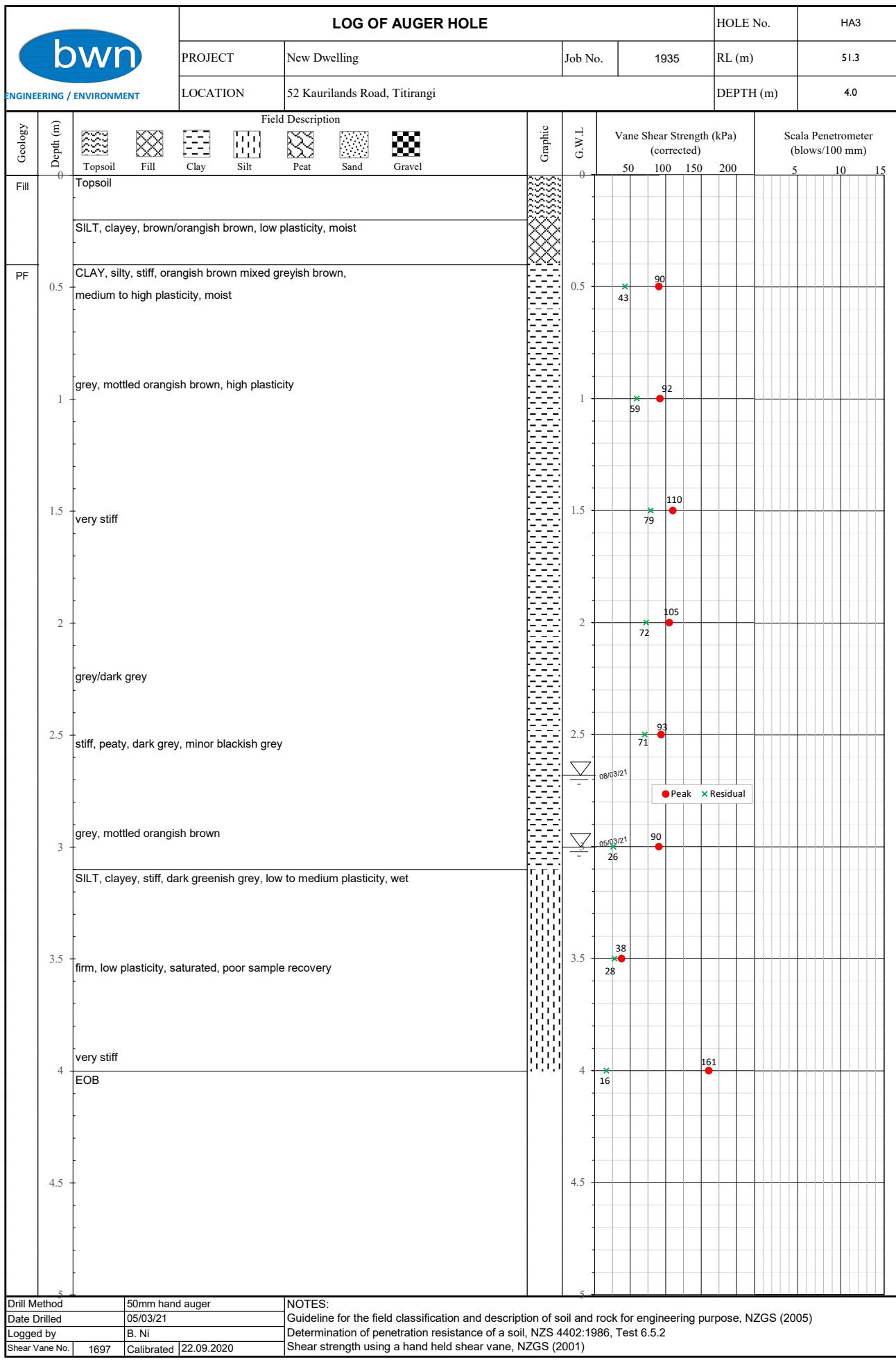


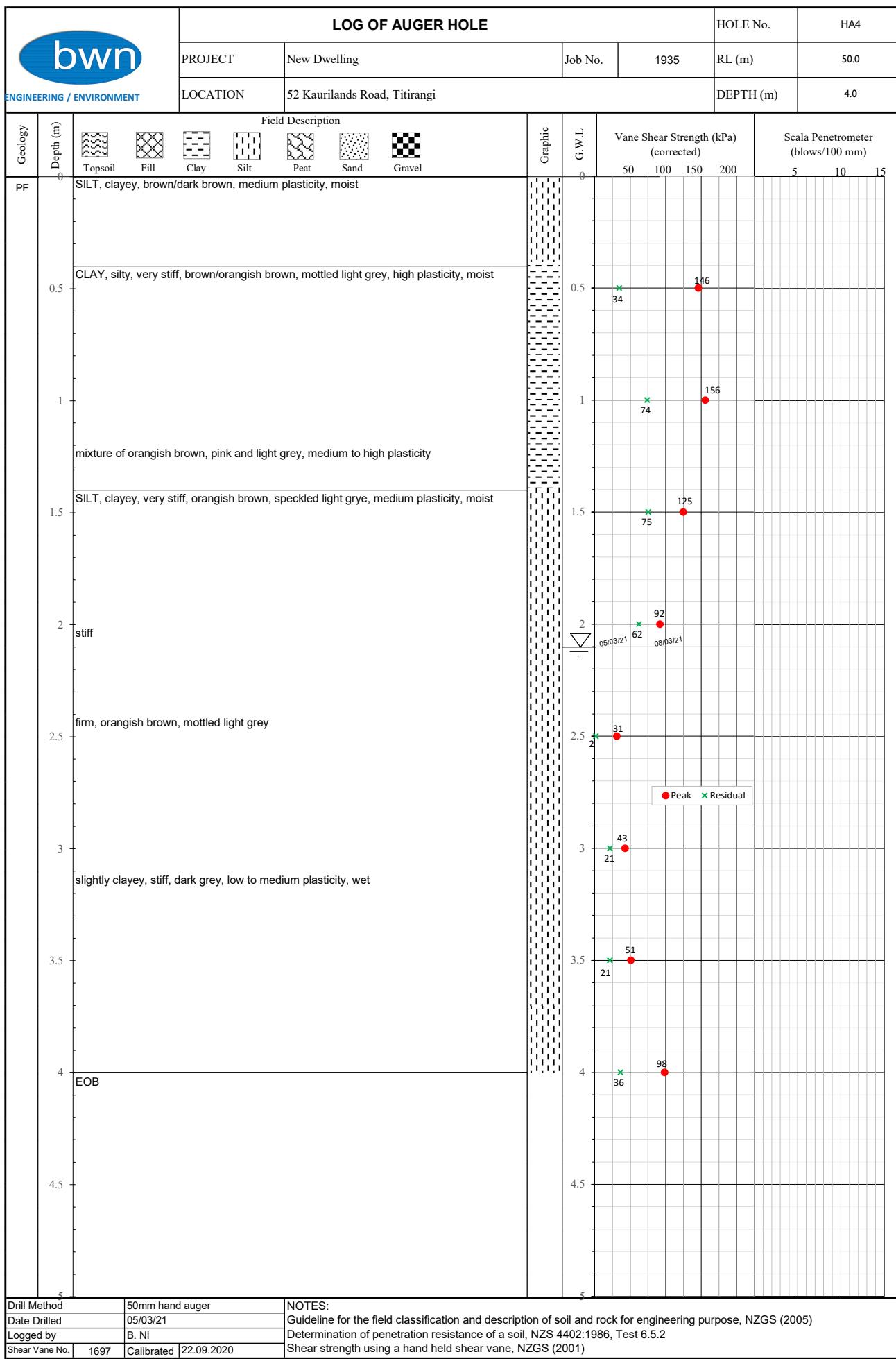
NOTE: BASE PLAN PROVIDED BY THE CLIENT

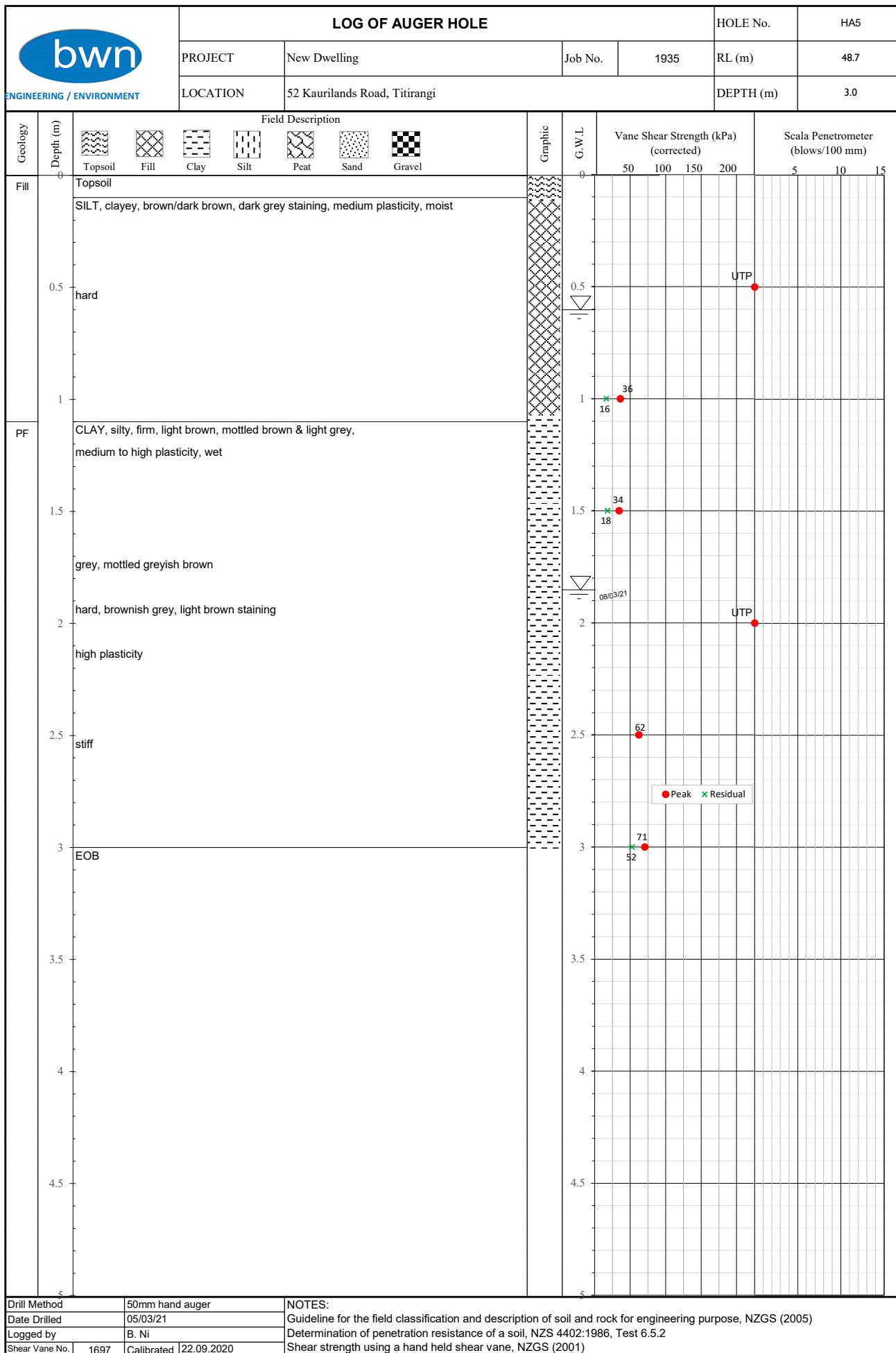
 <b>BWN LIMITED</b> ENGINEERING & ENVIRONMENTAL CONSULTANTS 18 HAZEL GLEN, BAYVIEW, AUCKLAND PHONE: (09) 441 7575 MOBILE: (021) 2375865 <a href="http://www.bwn.co.nz">www.bwn.co.nz</a>	JOB TITLE <b>LOT 4, TA MOKO DRIVE HOBBS BAY AUCKLAND</b>	DRAWING NO. <b>1800</b>	REVISION <b>A</b>	CLIENT <b>THE OWNER</b>
DRAWING TITLE <b>GEOTECHNICAL SITE INVESTIGATION PLAN</b>	SHEET NO. <b>100</b>	DATE <b>09/07/21</b>	ENGINEER <b>B. NI</b>	<b>HA1</b> HANDAUGER BOREHOLE













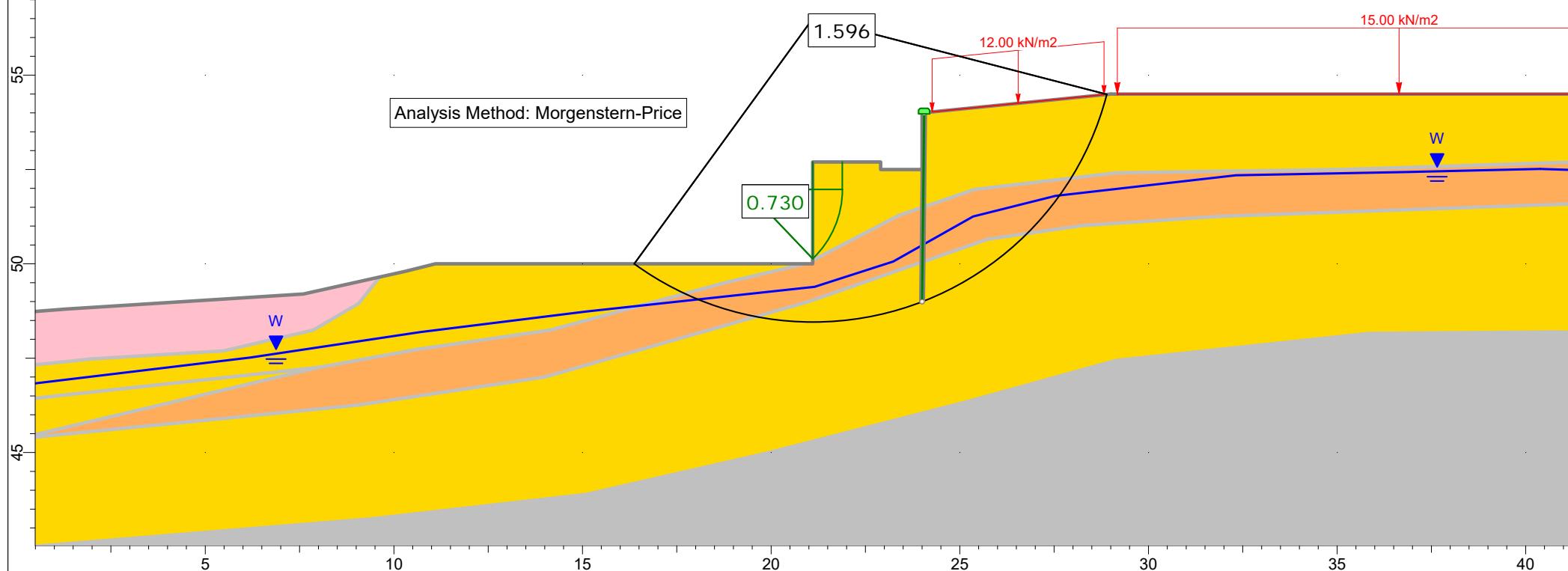




## Appendix C: Stability Analyses

Material Name	Color	Unit Weight (kN/m³)	Sat. Unit Weight (kN/m³)	Cohesion (kPa)	Phi (deg)	Hu Type	Hu
Fill	Light Red	18	18.5	1	26	Custom	1
firm to Stiff PF PF soils	Orange	18	18.5	3	27	Custom	1
stiff PF soils	Yellow	18	18.5	5	28	Custom	1
Very stiff PF or WG soils	Grey	18.5	19	5	30	Custom	1

Support Name	Color	Out-Of-Plane Spacing (m)	Pile Shear Strength (kN)
Retaining Wall	Dark Green	1	60



 bwn	Project	52 Kaurilands R Titirangi		
	Analysis Description	Long Term Static (Section A-A)		
	Drawn By	Bing Ni	Scale	1:150
	Date		Company	BWN Ltd - Engineering and Environmental Consultants
			File Name	LTS.slim

Material Name	Color	Unit Weight (kN/m³)	Sat. Unit Weight (kN/m³)	Cohesion (kPa)	Phi (deg)	Hu Type	Hu
Fill	Light Red	18	18.5	1	26	Custom	1
firm to Stiff PF PF soils	Orange	18	18.5	3	27	Custom	1
stiff PF soils	Yellow	18	18.5	5	28	Custom	1
Very stiff PF or WG soils	Grey	18.5	19	5	30	Custom	1

Support Name	Color	Out-Of-Plane Spacing (m)	Pile Shear Strength (kN)
Retaining Wall	Dark Green	1	60

60

55

50

45

5

10

15

20

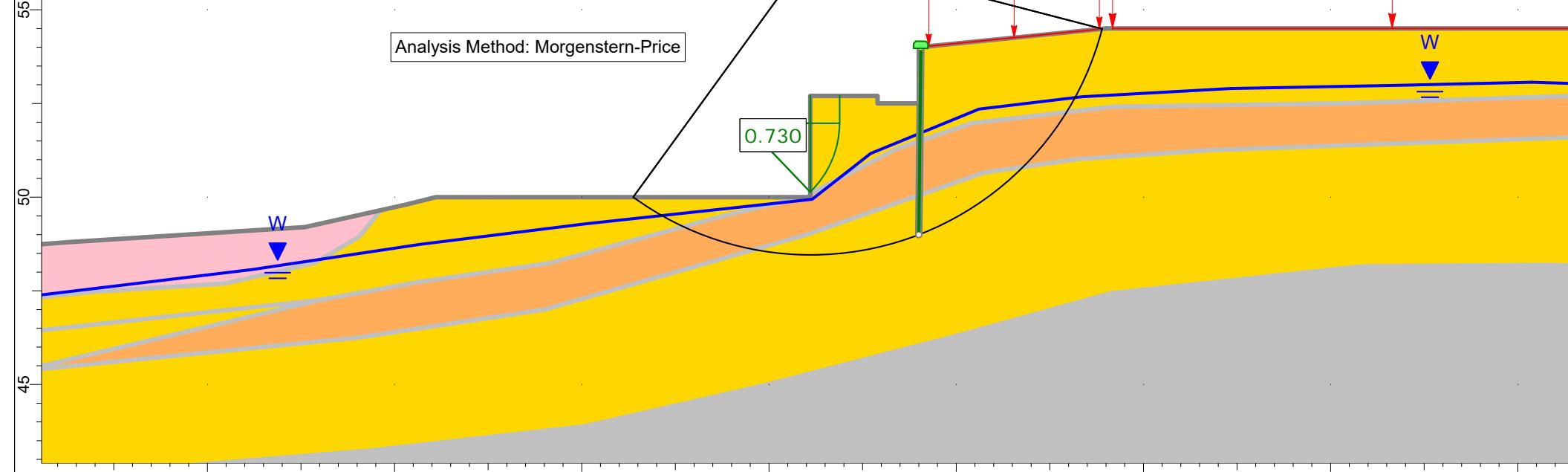
25

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Analysis Method: Morgenstern-Price



SLIDEINTERPRET 7.035

Project

52 Kaurilands R Titirangi

Analysis Description

High groundwater (Section A-A)

Drawn By

Bing Ni

Scale

1:150

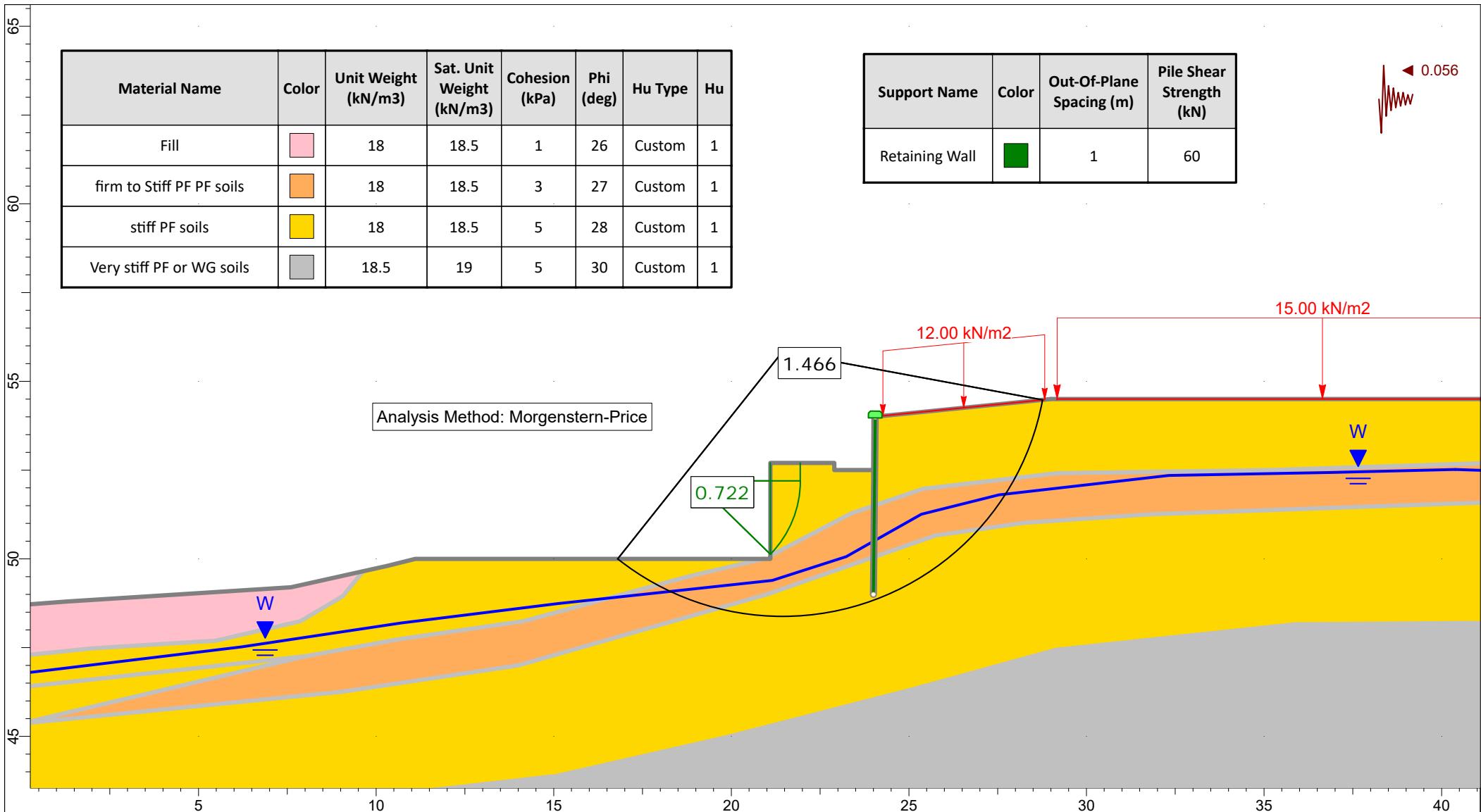
Company

BWN Ltd - Engineering and Environmental Consultants

Date

File Name

HGW.slim



 SLIDEINTERPRET 7.035	Project	52 Kaurilands R Titirangi		
	Analysis Description	Seismic (Section A-A)		
	Drawn By	Bing Ni	Scale	1:150
	Date			File Name
				Seismic.slim

#### Appendix D: Assessment of AUP E7.6.1.6 and E7.6.1.10

Clauses		Clause satisfied or not?	Comment
E7.6.1.6	(1) The water take must not be geothermal water	Yes	Based on personal knowledge, the site is not in a geothermal area
	(2) The water take must not be for a period of more than 10 days where it occurs in peat soils, or 30 days in other types of soil or rock	No	Retaining wall drains will take water more than 30 days.
	(3) The water take must only occur during construction	No	Retaining wall drains will take water after the construction.
E7.6.1.10	<p>(1) All of the following activities are exempt from the Standards E7.6.1.10 (2) – (6)</p> <p>(a) pipes, cables or tunnels including associated structures which are drilled or thrust and are less than 1.2m in external diameter</p> <p>(b) pipes including associated structures up to 1.5m in external diameter where a closed faced or earth pressure balanced machine is used.</p> <p>(c) pipes up to 1.5m in external diameter are exempt from these standards;</p> <p>(d) diversion for no longer than 10 days or</p> <p>(e) diversions for network utilities and road network linear trenching activities that are progressively opened, closed and closed and stabilised where the part of the trench that is open at any given time is no longer than 10 days.</p>	Yes	Such activities are not relevant to the proposed development.
	<p>(2) any excavation that extends natural groundwater level, must not</p> <p>(a) 1ha in total area; and</p> <p>(b) 6m depth below the natural ground level</p>	Yes	The total site area is 809 m <sup>2</sup> (i.e. <0.1ha); the maximum excavation will be approximately 3m.
	(3) The groundwater level must not be reduced by more than 2m on the boundary of any adjoining site	Yes	Groundwater drawdown is negligible in dry seasons; in wet seasons, the maximum drawdown at property boundaries is assessed to be 0 ~ 0.6m.
	<p>(4) Any structure, excluding sheet piling that remains in place no more than 30 days, that physically impedes the flow of ground water through the site must not:</p> <p>(a). impede the flow of groundwater over a length of more than 20m; and</p> <p>(b). extend more than 2m below the natural groundwater level</p>	Yes	Maximum impedance width is 18m approximately at Lot 3 (near-boundary retaining wall) in winter seasons. None to negligible impedance in dry seasons.
	(5) The distance to any existing building or structure (excluding timber fences and	Yes	(a). The nearest building at 56 Kauriland Rd is approximately 3.8m to the proposed retaining wall (1.9m high max).

Clauses	Clause satisfied or not?	Comment
<p>small structures on the boundary) on an adjoining site from the edges of any:</p> <p>(a). trench or open excavation that extends below natural groundwater level must be at least equal to the depth of the excavation.</p> <p>(b). tunnel or pipe with an external diameter of 0.2 – 1.5m that extends below natural groundwater level must be 2m or greater; or</p> <p>(c). a tunnel or pipe with an external diameter up to 0.2m that extends below the natural groundwater level has no separation requirement</p>		<p>(b). Not applicable. No such tunnel or pipe will be within 2m of any existing structures</p> <p>(c). Not applicable. No such tunnel or pipe</p>
<p>(6) The distance from the edge of any excavation that extends below natural groundwater level, must not be less than:</p> <p>(a). 50m from the Wetland Management Areas Overlay</p> <p>(b). 10m from a schedule Historical Heritage Overlay; or</p> <p>(c). 10m from a lawful groundwater take.</p>	Yes	Based on personal knowledge and assumptions, the site is not near a wetland management area, or a scheduled historical overlay or a lawful groundwater take.