Far North District Council
Te Kaunihera o Tai Tokerau ki te Raki

HE ARA TĀMATA
CREATING GREAT PLACES
Supporting our people

Private Bag 752, Kaikohe 0440, New Zealand
ask.us@fndc.govt.nz
0800 920 029
fndc.govt.nz

Request for approval of engineering plans and reports required by conditions of Resource Consent or Consent Notice

1. Applicant details (Consent Holder or Property Owner):

Name/s: (please write all names in full) Dandy Developments Ltd

Phone numbers: Work: [redacted] Home:

Email: [redacted]

☑ **Check this box if the you wish to be included in correspondence regarding this application.**

2. Designer/Engineer contact details (Contact Person):

Name/s: (please write all names in full) [redacted]

Contact phone number: [redacted]

Email: [redacted]

3. Primary Contact details:

(Please specify which person identified above is the primary point of contact):

Name/s: Sebastian Hicks

4. The document number for which these plan(s) or report(s) relate:

Please note the Resource Consent or Consent Notice reference below. Please ensure the correct suffix is used if there are any variations or objections associated with this application.

2230063-RMASUB

5. Conditions to be approved:

List the conditions to which this request relates and specify which documents relate to each.

If additional space is required, please attach a summary document.

Condition	Document reference	Drawing numbers
3(d)(i)	Geologix ENGINEERING REPORT FOR ENGINEERING DESIGN APPROVAL	300 & 390
3(d)(ii)		Section 5, Sheets 300, 250 & 380
3(d)(iii)		Section 4, Sheets 110, 380 & 390
3(d)(iv)		Section 6, 6.1, Sheet 130

6. Does this application include any of the following (tick where appropriate):

Infrastructure:	To be vested:	Upgrades:	New connection:
Roads			
Street lighting			
Wastewater	Note - Lot 7 to vest in	FNDC for sewerage -	but no wastewater assets
Stormwater			
Potable Water			

7. Please note any associated Building Consent reference (if applicable):

N/A

9. Billing details:

This identifies the person or entity that will be responsible for paying any invoices or receiving any refunds associated with processing this request for approval of engineering plans and reports. Staff time required to process this approval will be charged on completion of the work. Please also refer to the council's Fees and Charges document (available at www.fndc.govt.nz). A deposit is payable when you submit this request.

Name/s: (please write all names in full) Dandy Developments

Postal address: [redacted]

Post code: [redacted]

Phone numbers: Work: [redacted] Home: _____

Fax: _____ Email: [redacted]

Name of bill payer: Danielle Moa (please print)

Signature: [redacted] (signature of bill payer – mandatory) Date: [redacted]

Important information:

Privacy information: Once this application is lodged with the council it becomes public information. Please advise us if there is sensitive information included in this request. The information you have provided on this form is required so that your application for approval can be processed. The information will be stored on the council's property files and held by the Far North District Council and will be made available on request.

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

Name: Danielle Moa (please print)

Signature: [redacted] (signature) Date: [redacted]

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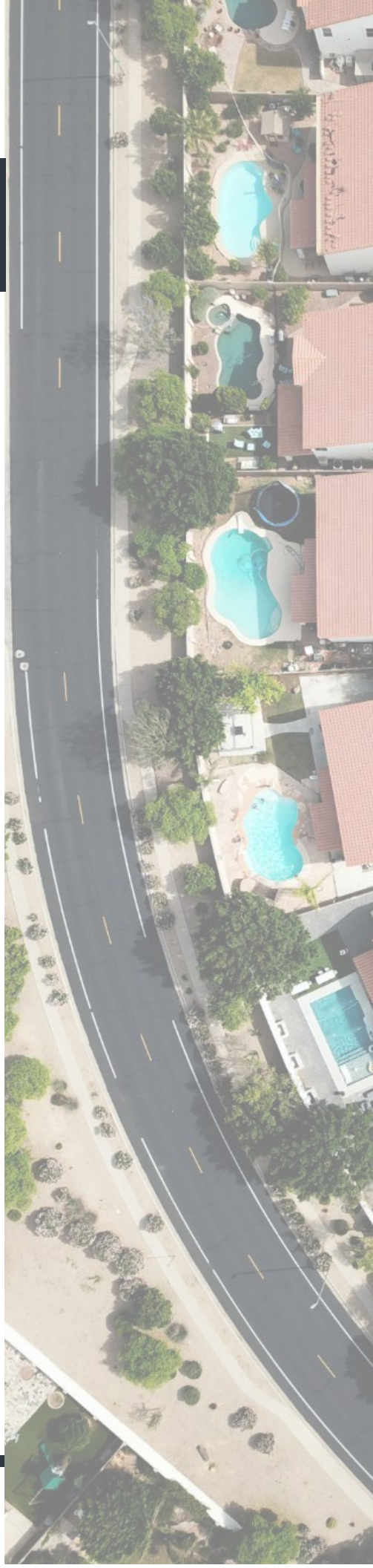
ENGINEERING REPORT

FOR ENGINEERING DESIGN APPROVAL (EDA)

458A HIHI ROAD, HIHI

MOA EQUITY LTD

C0651N-S02
AUGUST 2025
REVISION 1



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DOCUMENT MANAGEMENT

Document Title	Engineering Report – For Engineering Design Approval (EDA)
Site Reference	458A Hihi Road, Hihi
Client	Moa Equity Ltd
Geologix Reference	C0651N-S02
Issue Date	August 2025
Revision	01
Prepared by	Gerard McHardy Civil Engineer, BE Civil
Reviewed	Sebastian Hicks Principal Civil Engineer, BSc Eng (Hons), CPEng Reg. 1168062, IntPE(NZ) /APEC Engineer, CMEngNZ
Approved by	Edward Collings Managing Director, CEnvP Reg. 0861, CPEng Reg. 1033153, CMEngNZ

REVISION HISTORY

Date	Issue	Prepared	Reviewed	Approved
August 2025	For EDA Application	GM	SH	EC

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TABLE OF FIGURES

1 INTRODUCTION

This Engineering Report has been prepared by Geologix Consulting Engineers Ltd (Geologix) for Moa Equity Ltd as our Client in accordance with our standard short form agreement and general terms and conditions of engagement.

The scope of works has been undertaken to prepare an Engineering Design Approval (EDA) application in relation to the proposed subdivision of 458A Hihi Road, Hihi (the 'site') into 7 new Lots. Refer Figure 1 and 2 for images of the proposed site layout.

The proposed subdivision has been granted Resource Consent by Far North District Council (FNDC). The FNDC Resource Consent reference is 2230063-RMASUB. The consents are based on supporting information provided by others. This documentation is noted below for reference and included in the appendices of this report where indicated:

- Scheme Plan, Ref. No 23812, Proposed Subdivision of Lot 2 DP 195378, Dated May 2022, by Williams and King Ltd, stamped "Approved Plan" by FNDC 22/04/2024 – Refer Appendix A
- Site Suitability Report for Proposed Subdivision, Ref 22118, Revision Final, Dated May 2022, by Haigh Workman Ltd Civil and Structural Engineers[1]

The detailed design presented with this EDA application intends to only advance the necessary elements of the preliminary design to satisfy the related conditions of consent. This report serves to provide clarity to the adopted design and drawings included in Appendix B.

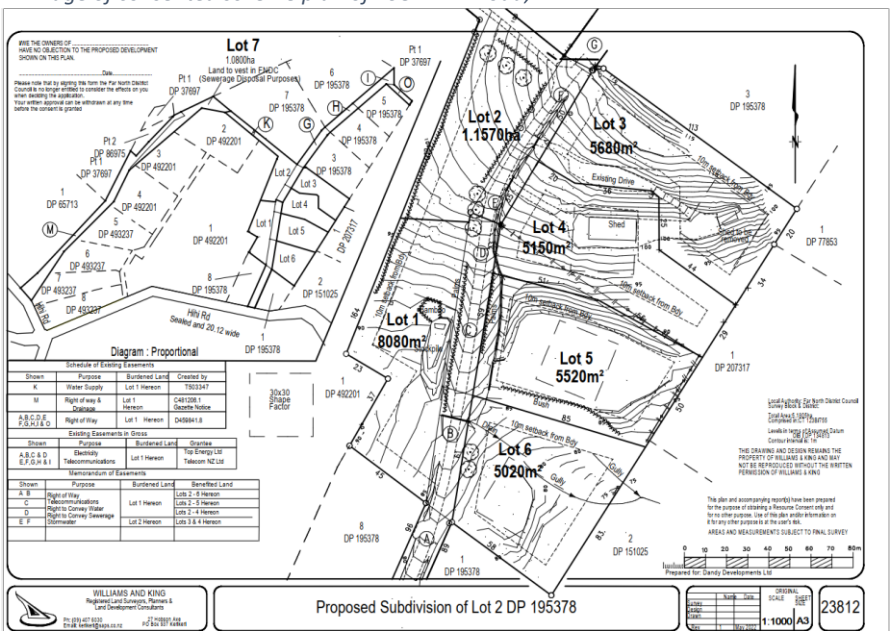
The focus of the detailed design is the accessway (Right of Way) and stormwater drainage to facilitate the subdivision to the satisfaction of the related conditions of consent. All other on-lot infrastructure (such as wastewater and water supply) is to be applied for under the individual on-lot development consents in accordance with the conditions of the above-referenced resource consent.

It is also noted that the vehicle crossings to each lot from the Right of Way are indicative within in this submission. These crossings are proposed to be finalised and formed at time of individual lot development, rather than at subdivision formation.

[1] *Site Suitability Report for Proposed Subdivision, Ref 22118, Revision Final, Dated May 2022, by Haigh Workman Ltd Civil and Structural Engineers*

Figure 1: Aerial Image of 458A Hihi Road, Hihi

Figure 2: Image of consented scheme plan of 458A Hihi Road, Hihi



2 SITE DESCRIPTION

The site is located on Hihi Road, Hihi, on the northern side of the road. The site encompasses 51,772 m^2, including access road corridors, with the gross area of approximately 35,000m^2 available for the subdivision. The majority of the site is grass with some areas of bush along the eastern side. There is an existing unconsented shed in the north-eastern quadrant of the

site which will be removed as part of the development. The topography of the site is generally gently rising to the north from Hihi Road with an unsealed access road following a ridge along the western side of the site. In the south-eastern corner of the site there is a gully trending southeast towards an estuary feeding the Mangonui Harbour.

As indicated on FNDC Maps and in Figure 3 below, there is no existing 3 water infrastructure or reticulated networks present within the site boundaries.

Figure 3: FNDC 3Waters Maps GIS Image of Existing Services

3 PROPOSED DEVELOPMENT

The approved scheme plan[2] received from Williams and King presents a subdivision comprising 6 residential Lots and an access road (Lot 7) to be vested in Council.

It is proposed to upgrade the existing vehicle crossing off Hihi Road which complies with the Councils Engineering Standard FNDC/S/6D and section 3.3.7.1 of the Engineering standards and NZS4404:2004 in accordance with the plans approved under Condition 3(b) of the Resource Consent. Vegetation is to be cleared in both directions along Hihi Road in accordance with the recommendations in Haigh Workman report[3], reference 22 118, Chapter 5.6.

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[2] Scheme Plan, Ref. No 23812, Proposed Subdivision of Lot 2 DP 195378, Dated May 2022, by Williams and King Ltd

[3] Site Suitability Report for Proposed Subdivision, Ref 22118, Revision Final, Dated May 2022, by Haigh Workman Ltd Civil and Structural Engineers

The existing access road will be upgraded to a sealed access ROW with a 5m wide carriageway in accordance with condition 4(b) of the Resource Consent, noting this is a departure from Table 3-16 of the FNDC Engineering Standards.

The formation is to consist of a minimum of 150mm of GAP 65 sub-base and 100mm GAP 40 basecourse with a sealed surface and is to include water table drains, culverts and culvert wingwalls as required to direct and control stormwater runoff.

Stormwater considerations are detailed further in Section 4.

The site has minimal earthworks proposed and is only required to implement the above roading and drainage.

4 STORMWATER

4.1 Existing (Pre-development) Considerations

Stormwater runoff on the eastern side of the existing accessway generally flows towards a gully within the proposed Lot 6, trending south-eastwards through a neighbouring property to the CMA.

Runoff from the accessway and proposed Lots 1 and 2 is generally directed to swale drains alongside the accessway and discharged towards the gully, with a 300mm culvert under the accessway directing runoff from the western side towards the gully.

To the south of this culvert, stormwater is directed to swale drains on either side of the accessway carry runoff to the Hihi Road water table. Two culverts carry the runoff across the road towards the estuary via a neighbouring property.

At the northern end of the accessway, there is a 250mm culvert that crosses the ROW and redirects the runoff to the west.

It is noted that sediment and vegetation has caused many of the intakes to be partially blocked.

4.2 Proposed Stormwater Management

The stormwater management elements directly addressed within this Engineering Approval application are:

- Catchment post-development flows for the proposed subdivision, determined by the rational method.
- Sizing of roadside swales.
- Routing of drainage, considering the new paved ROW and the effect on the existing drainage paths.
- Sizing of culverts under the right of way and proposed vehicle crossings.

Key design criteria for stormwater management elements are presented as follows:

- The stormwater discharge from the site is determined for a design storm of 10% AEP.
- Rainfall data has been obtained from NIWA HIRDS V4.0, for the 10yr ARI / 10% AEP, 10-minute storm duration, adjusted for a 20% increase due to climate change as per FNDC engineering standards.

The site has been divided into five catchments.

Catchment A encompasses approximately 5,380 m^2, incorporating most of Lots 1 and 2 and the western side of the proposed RoW. Stormwater is directed towards the western swale drain the passes through a culvert towards the gully within Lot 6, ultimately being directed to the CMA.

Catchment B encompasses approximately 1,705 m^2, incorporating the eastern side of the proposed RoW and a thin strip of adjacent land. Stormwater is directed towards the eastern swale drain then through the gully within Lot 6, ultimately being directed to the CMA.

Catchment C encompasses approximately 30,142 m^2, incorporating land on the eastern side of the proposed RoW. Stormwater is directed towards the gully within Lot 6, ultimately being directed to the CMA.

Catchment D encompasses approximately 5,724 m^2, incorporating the balance of Lot 1 and a portion of the neighbouring site and the western side of the proposed RoW. Stormwater is directed towards the Hihi Road water table then through a culvert under Hihi Road towards the CMA via a neighbouring property.

Catchment E encompasses approximately 942 m^2, incorporating the eastern side of the proposed RoW and a thin strip of adjacent land. Stormwater is directed towards the Hihi Road water table then through a culvert under Hihi Road towards the CMA via a neighbouring property.

The overall primary stormwater discharge for the proposed RoW will be managed through roadside water tables. These will be piped below road crossings and driveways where required.

The slope of the RoW generally exceeds 10%, as such all swales are to be rock lined.

All inlets are to have headwalls with screens to prevent blockage from vegetation.

There is no need to build wingwalls on the downstream side of the culverts as the swale is to be rock lined.

On lot development stormwater management will be provided as per the conditions of consent.

Engineering Calculations can be found in Appendix C.

4.3 Stormwater Attenuation

As there are no downstream properties below the site, and the receiving infrastructure/channels have sufficient capacity to convey the design storms to the coastal marine area, attenuation of accessway runoff for the formed subdivision is not required.

5 ROADING

5.1 Internal Roading

The internal roading layout and details have been prepared in accordance with the conditions of consent as supported by the RC Engineering Report.

For purposes of clarification:

The roading cross-section has been prepared in accordance with the FNDC engineering standards Sheet 9, Rural Privateway Details.

The existing driveway will be upgraded to a sealed access ROW with a 5m wide carriageway along its' full length in accordance with condition 4(b) of the Resource Consent, noting this is a departure from Table 3-16 of the FNDC Engineering Standards.

The RoW will have dual crossfall throughout the full length, with a standard crossfall of 3%. The formation is to consist of a minimum of 150mm of GAP 65 sub-base and 100mm GAP 40 basecourse with a sealed surface and is to include water table drains, culverts and culvert wingwalls as required to direct and control stormwater runoff.

Longitudinal grades exceed 5%, as such the table drains will be rock lined. This will occur along the full length of the RoW.

6 EARTHWORKS

Earthworks are required to form the proposed internal roading, drainage channels and the stormwater pond.

The proposed earthworks activities have been modelled with 3d design by Geologix. Proposed earthworks are summarised below within Table 2.The cut volumes presented in this volume assessment includes topsoil stripping volume and fill volumes include for the pavement layer works. Earthworks for vehicle crossings has not been modelled and is anticipated to involve topsoil strip only.

Table 2: Summary of Proposed Earthworks

Activity	Proposed Volume	Net Volume	Total Area	Max. Height
Cut	330m^3	40m^3		1.0m
Fill	290m^3			0.8m
Total	**m^3**	**40m^{3}cut**	**2,670m^2**	

6.1 Erosion and Sediment Control

Erosion and sediment control measures are required to control sediment runoff from areas of proposed earthworks. These include:

- Stabilised entrance formed at the proposed crossings to Hihi Road and Brunton Place.
- Silt fences along the downslope face of the proposed RoW.
- Temporary diversion of existing overland flow paths, i.e. drainage ditches around culvert

7 LIMITATIONS

This report has been prepared for Moa Equity Limited as our Client. It may be relied upon by our Client and their appointed Consultants, Contractors and for the purpose of Consent as outlined by the specific objectives in this report. This report and associated recommendations, conclusions or intellectual property is not to be relied upon by any other party for any purpose unless agreed in writing by Geologix Consulting Engineers Ltd and our Client. In any case the reliance by any other party for any other purpose shall be at such parties' sole risk and no reliability is provided by Geologix Consulting Engineers Ltd.

The opinions and recommendations of this report are based on plans, specifications and reports provided to us at the time of writing, as referenced. Any changes, additions or amendments to the project scope and referenced documents may require an amendment to this report and Geologix Consulting Engineers should be consulted. Geologix Consulting Engineers Ltd reserve the right to review this report and accompanying plans.

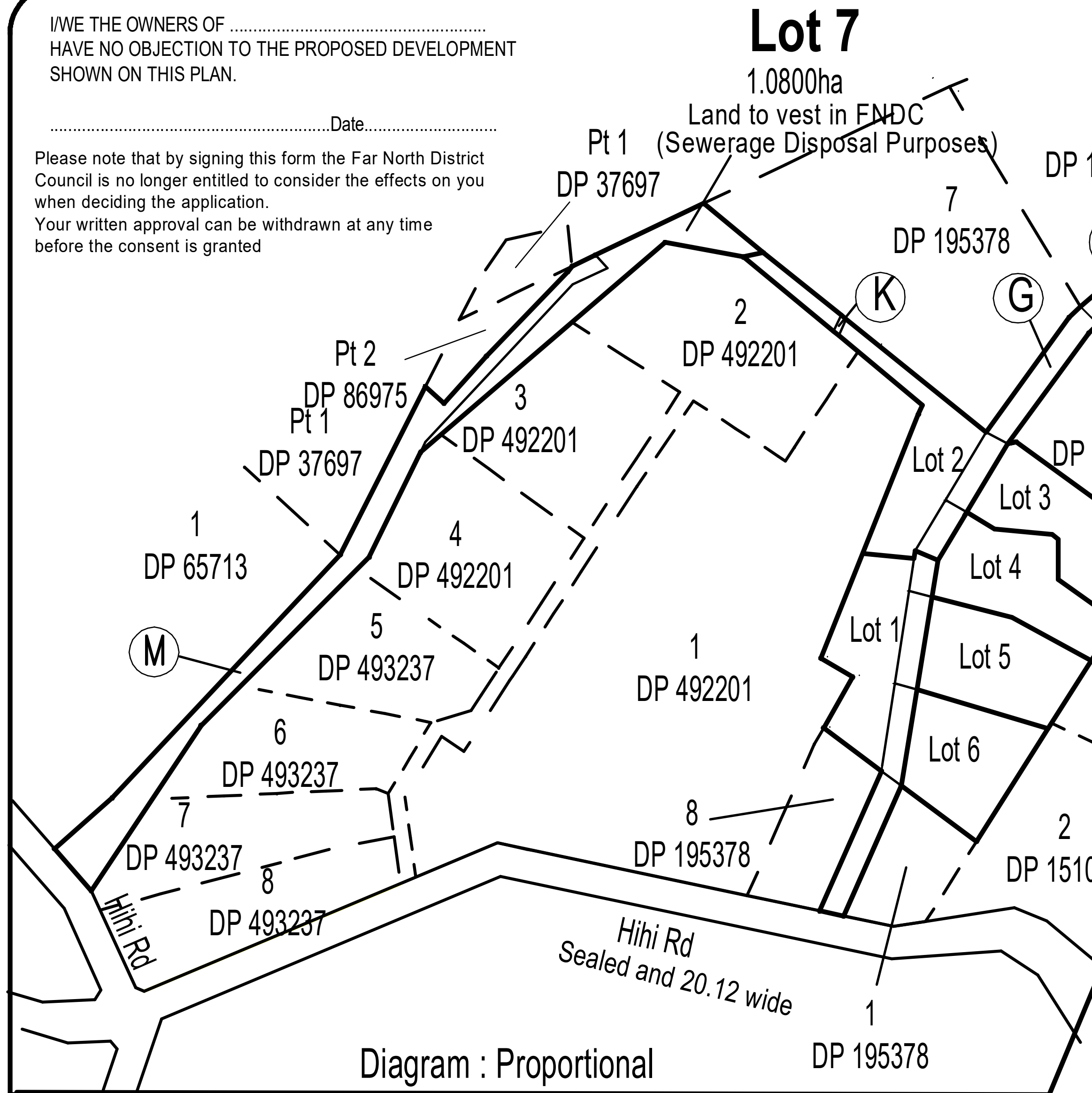
APPENDIX A

Scheme Plan

I/WE THE OWNERS OF ....
HAVE NO OBJECTION TO THE PROPOSED DEVELOPMENT
SHOWN ON THIS PLAN.

....Date..............................

Please note that by signing this form the Far North District Council is no longer entitled to consider the effects on you when deciding the application.
Your written approval can be withdrawn at any time before the consent is granted

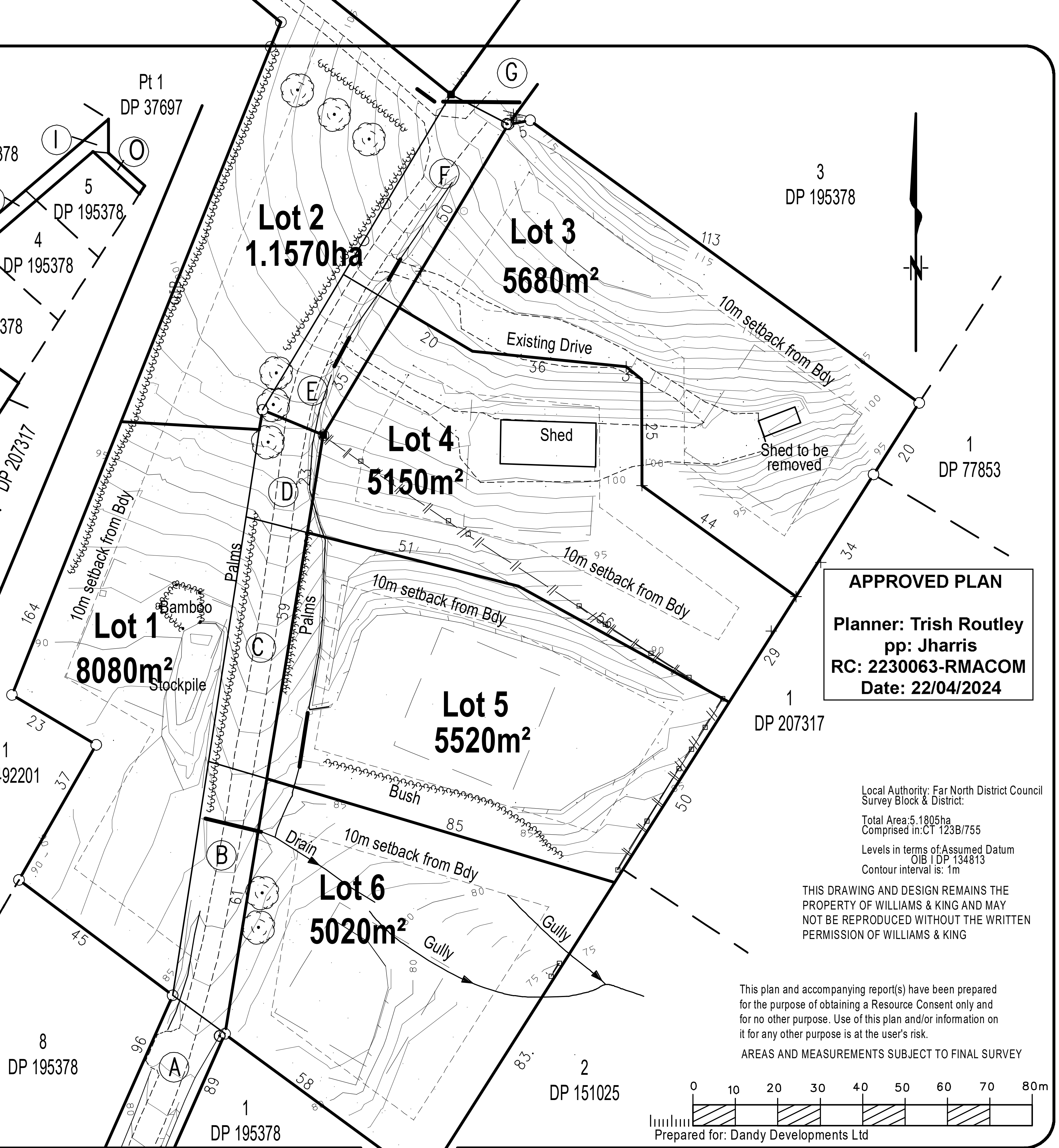


Schedule of Existing Easements			
Shown	Purpose	Burdened Land	Created by
K	Water Supply	Lot 1 Hereon	T503347
M	Right of way & Drainage	Lot 1 Hereon	C481206.1 Gazette Notice
A,B,C,D,E F,G,H,I & O	Right of Way	Lot 1 Hereon	D459841.8

Existing Easements in Gross			
Shown	Purpose	Burdened Land	Grantee
A,B,C & D E,F,G,H & I	Electricity Telecommunications	Lot 1 Hereon	Top Energy Ltd Telecom NZ Ltd

Memorandum of Easements			
Shown	Purpose	Burdened Land	Benefited Land
A B	Right of Way	Lot 1 Hereon	Lots 2 - 6 Hereon
C	Telecommunications		Lots 2 - 5 Hereon
D	Right to Convey Water Right to Convey Sewerage		Lots 2 - 4 Hereon
E F	Stormwater	Lot 2 Hereon	Lots 3 & 4 Hereon

30x30
Shape
Factor



APPROVED PLAN

Planner: Trish Routley
pp: Jharris
RC: 2230063-RMACOM
Date: 22/04/2024

Local Authority: Far North District Council
Survey Block & District:

Total Area:5.1805ha
Comprised in:CT 123B/755

Levels in terms of:Assumed Datum
OIB I DP 134813
Contour interval is: 1m

This plan and accompanying report(s) have been prepared for the purpose of obtaining a Resource Consent only and for no other purpose. Use of this plan and/or information on it for any other purpose is at the user's risk.

AREAS AND MEASUREMENTS SUBJECT TO FINAL SURVEY

0 10 20 30 40 50 60 70 80m

Prepared for: Dandy Developments Ltd

WILLIAMS AND KING
Registered Land Surveyors, Planners & Land Development Consultants
Ph: (09) 407 6030
Email: kerikeri@saps.co.nz
27 Hobson Ave
PO Box 937 Kerikeri

Proposed Subdivision of Lot 2 DP 195378

	Name	Date	ORIGINAL SCALE	SHEET SIZE	
Survey			1:1000	A3	23812
Design					
Drawn					
Rev	1	May 2022			

APPENDIX B

Drawings

GENERAL NOTES

1. DRAWING REPRODUCED FROM WILLIAMS AND KING PROPOSED SCHEME PLAN REF. 23812, DATED MAY 2022
2. CONTOURS AT 1.0 m INTERVALS.
3. TOPOGRAPHIC SURVEY DATA PROVIDED BY GEOLOGIX DRONE SURVEY
   -VERTICAL DATUM NZVD2016
   -CRS:NZTM2000.

15 0 Meters 15 30

1:1250

Revision	Issue	Date
2	DETAIL DESIGN	07/2025
1	CONSENT	11/05/2022

geologix consulting engineers

AUCKLAND | NORTHLAND

Project Name and Address

458A HIHI ROAD

HIHI, FAR NORTH

SUBDIVISION OF LOT 1 DP492201

Project	Drawn By
C0458A	TV

Client

MOA EQUITY LTD

Sheet Title

PROPOSED SCHEME PLAN

Sheet

100

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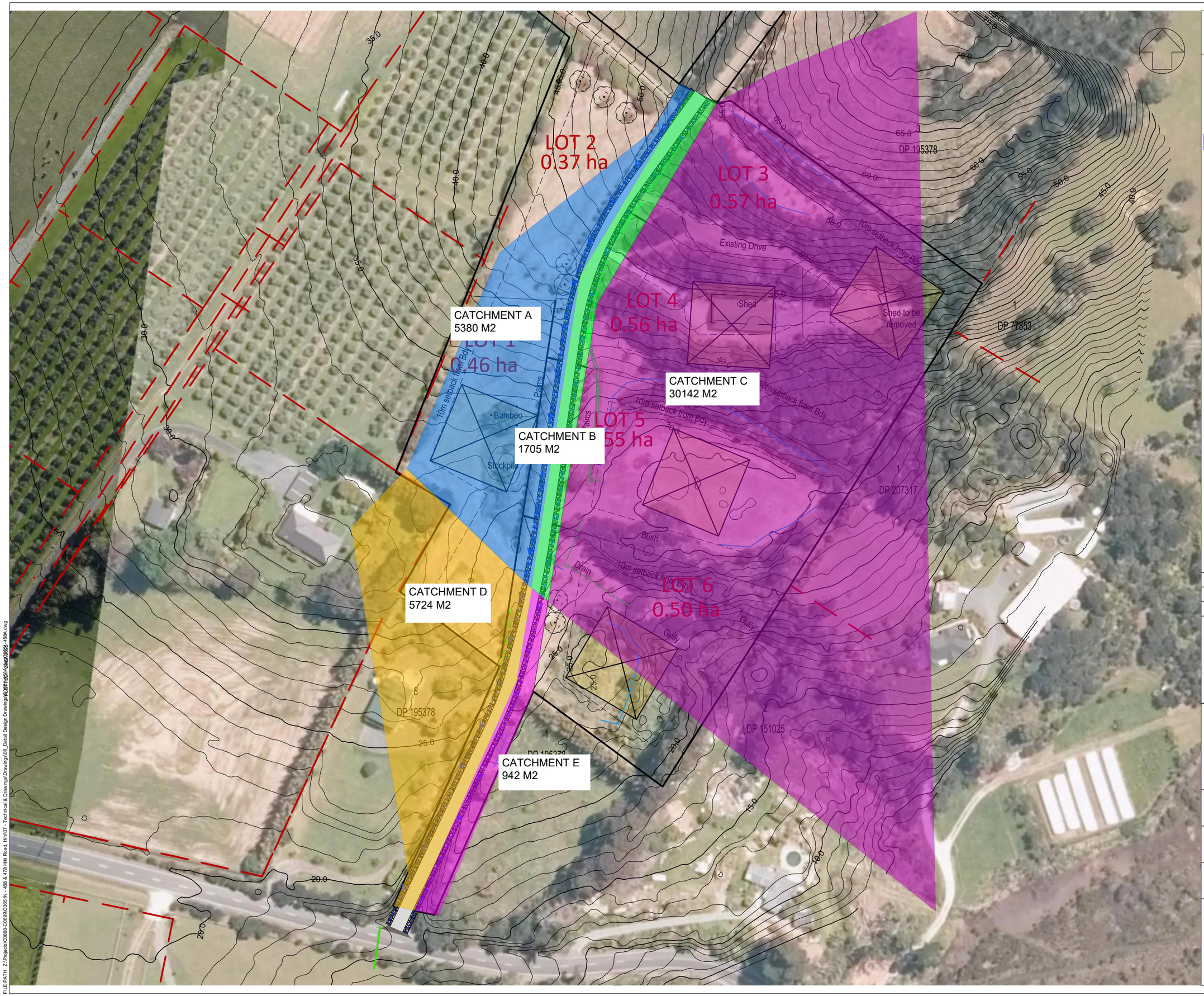
PLOTTED: 29/07/2025



GENERAL NOTES

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   -CRS:NZTM2000.

CATCHMENT A
CATCHMENT B
CATCHMENT C
CATCHMENT D
CATCHMENT E

WATERCOURSE
OVERLAND FLOWPATH
SW EXISTING DRAINAGE

Meters
15 0 15 30
1:1250

Revision	Issue	Date
2	DETAIL DESIGN	07/2025
1	CONSENT	11/05/2022

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AUCKLAND | NORTHLAND

Project Name and Address
458A HIHI ROAD
HIHI, FAR NORTH
SUBDIVISION OF LOT 1 DP492201

Project	Drawn By
C0458A	TV

Client
MOA EQUITY LTD

Sheet Title
CATCHMENT PLAN

Sheet
110

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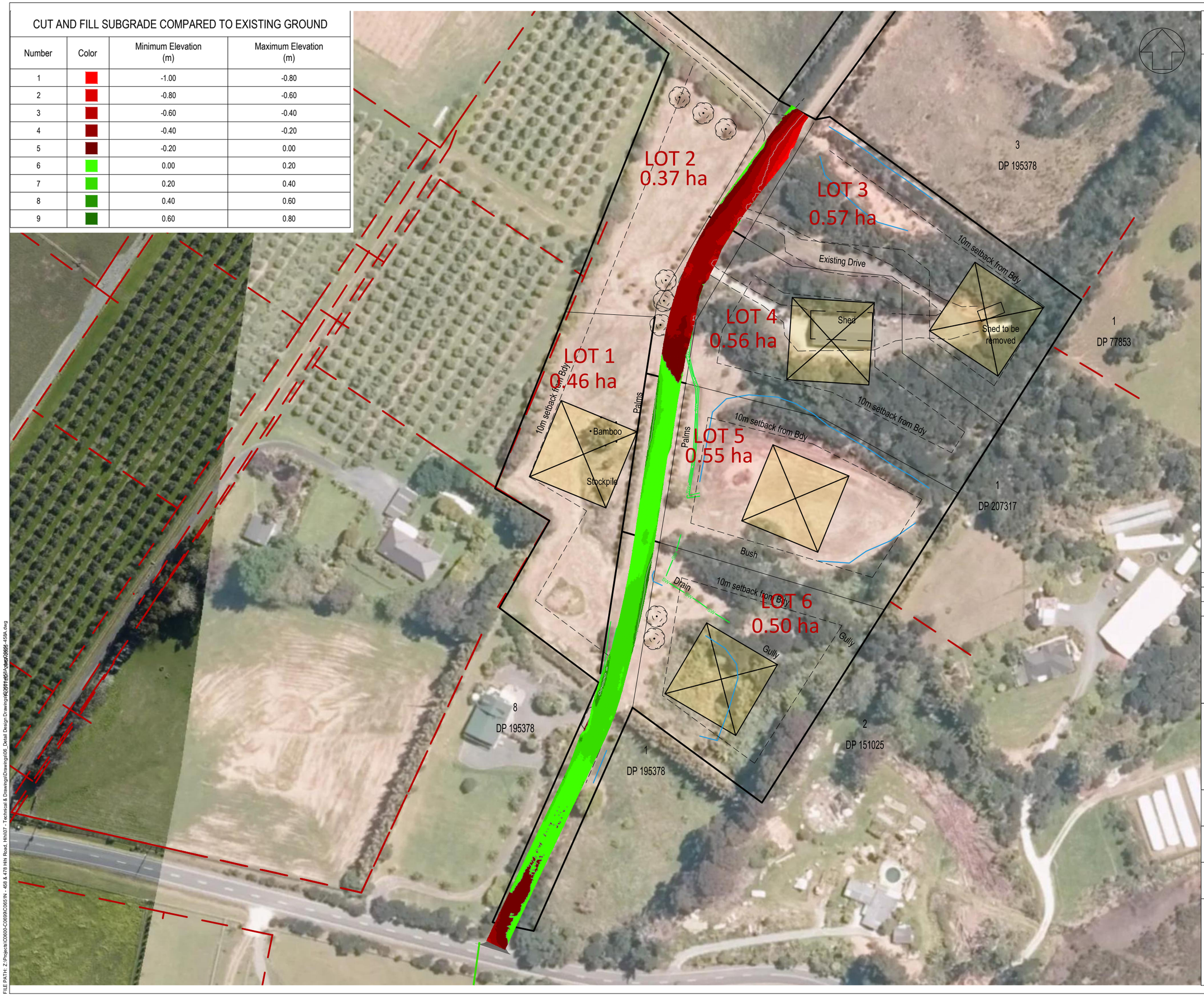
CUT AND FILL SUBGRADE COMPARED TO EXISTING GROUND

Number	Color	Minimum Elevation (m)	Maximum Elevation (m)
1		-1.00	-0.80
2		-0.80	-0.60
3		-0.60	-0.40
4		-0.40	-0.20
5		-0.20	0.00
6		0.00	0.20
7		0.20	0.40
8		0.40	0.60
9		0.60	0.80



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   -VERTICAL DATUM NZVD2016
   -CRS:NZTM2000.

EARTHWORK QUANTITIES

SUBGRADE SURFACE COMPARED TO EXISTING GROUND

STAGE & ACTIVITY	VOLUME	NET
STAGE 2 CUT	330m³	40m³ FILL
STAGE 2 FILL	290m³	

TOTAL EARTHWORKS AREA - 2670 m²

CUT INCLUDES TOPSOIL STRIP VOLUME
FILL INCLUDES PAVEMENT LAYER WORKS

Meters
15 0 15 30
1:1250

Revision	Issue	Date
2	DETAIL DESIGN	07/2025
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AUCKLAND | NORTHLAND

Project Name and Address
458A HIHI ROAD
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SUBDIVISION OF LOT 1 DP492201

Project	Drawn By
C0458A	TV

Client
MOA EQUITY LTD

Sheet Title
EARTHWORKS PLAN

Sheet
130

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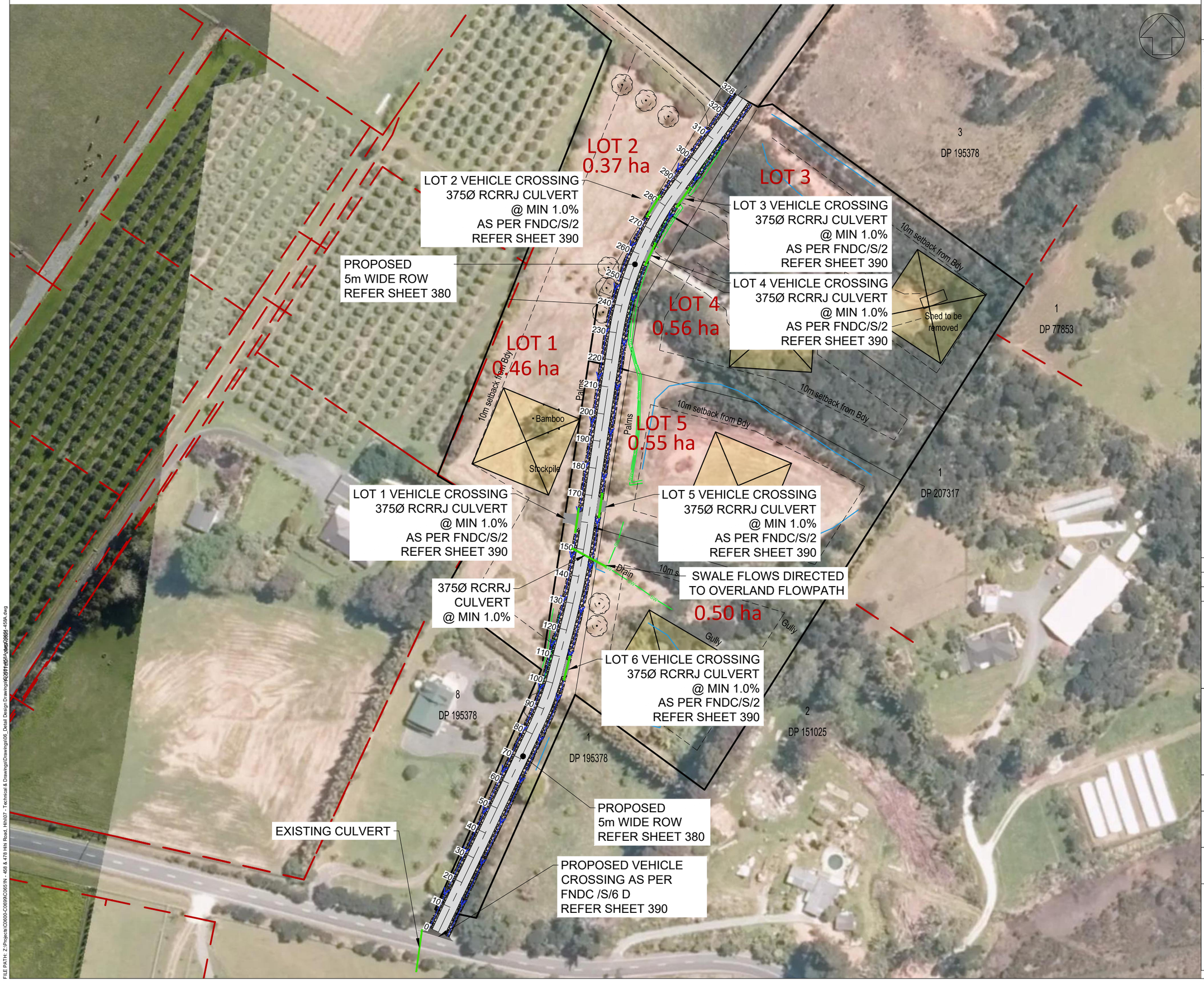

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   -VERTICAL DATUM NZVD2016
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CULVERT PIPE

OVERLAND FLOW PATH

Meters
15 0 15 30
1:1250

Revision	Issue	Date
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AUCKLAND | NORTHLAND

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Project	Drawn By
C0458A	TV

Client
MOA EQUITY LTD

Sheet Title
PROPOSED ROW PLAN

Sheet
300

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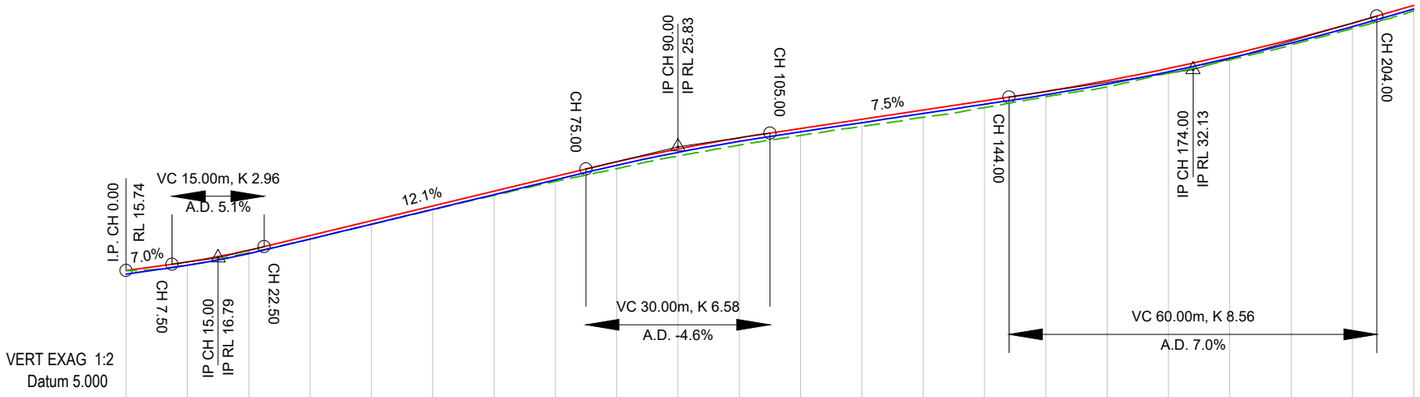
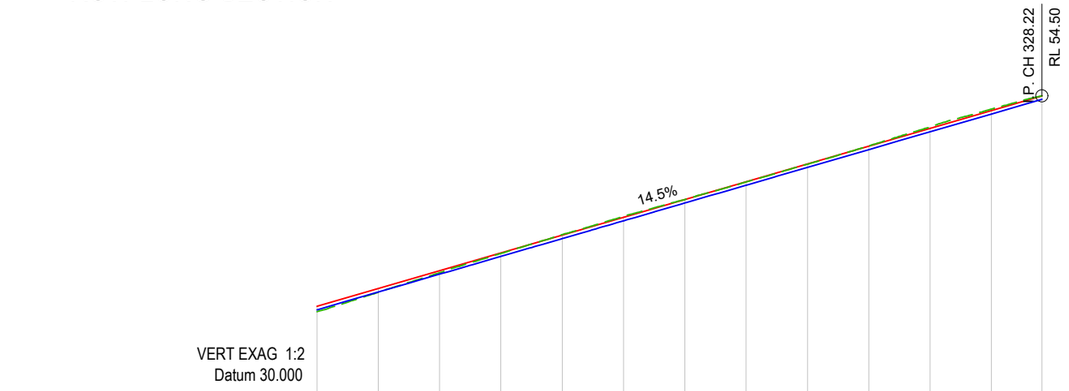


DESIGN LEVELS	15.739	16.449	17.402	18.597	19.802	21.008	22.213	23.419	24.605	25.659	26.560	27.329	28.079	28.829	29.579	30.350	31.228	32.223	33.335	34.564	35.910	37.351
EXISTING LEVELS	15.739	16.191	17.195	18.299	19.506	20.708	21.866	23.011	24.050	25.080	25.963	26.752	27.485	28.237	29.021	29.906	30.701	31.823	32.918	34.149	35.475	36.918
DEPTH	0.000	0.258	0.207	0.297	0.296	0.300	0.347	0.407	0.555	0.579	0.597	0.577	0.594	0.592	0.558	0.443	0.527	0.401	0.417	0.416	0.434	0.434
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000

ROW LONG SECTION



FINISH SURFACE LEVEL	37.351	38.802	40.253	41.704	43.155	44.606	46.057	47.507	48.958	50.409	51.860	53.311	54.503
EXISTING LEVELS	36.918	38.497	40.090	41.665	43.200	44.690	46.056	47.493	48.939	50.429	51.978	53.436	54.503
DEPTH	0.434	0.305	0.163	0.039	-0.045	-0.084	0.000	0.014	0.019	-0.020	-0.118	-0.125	0.000
SUBGRADE LEVEL	36.92	38.50	40.09	41.67	43.20	44.69	46.06	47.49	48.94	50.43	51.98	53.44	54.50
CHAINAGE	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	328.220

ROW LONG SECTION

GENERAL NOTES

Meters
15 0 15 30
1:1000

Revision	Issue	Date
2	DETAIL DESIGN	07/2025
1	CONSENT	11/05/2022

geologix consulting engineers
AUCKLAND | NORTHLAND

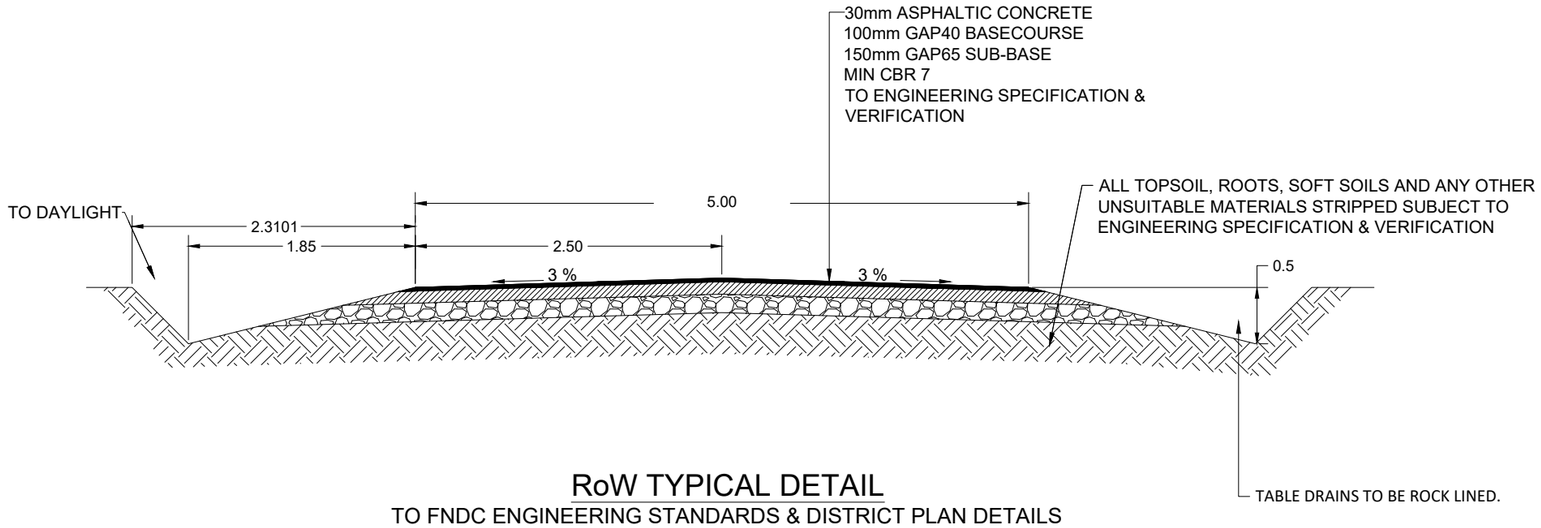
Project Name and Address
458A HIHI ROAD
HIHI, FAR NORTH
SUBDIVISION OF LOT 1 DP492201

Project	Drawn By
C0458A	TV

Client
MOA EQUITY LTD

Sheet Title
ROW LONG SECTION

Sheet
350

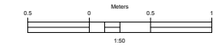


RoW TYPICAL DETAIL

TO FNDC ENGINEERING STANDARDS & DISTRICT PLAN DETAILS

1:50 @ A3

GENERAL NOTES



Revision	Issue	Date
2	DETAIL DESIGN	07/2025
1	CONSENT	11/05/2022

geologix consulting engineers

AUCKLAND | NORTHLAND

Project Name and Address

458A HIHI ROAD

HIHI, FAR NORTH

SUBDIVISION OF LOT 1 DP492201

Project	Drawn By
C0458A	TV

Client

MOA EQUITY LTD

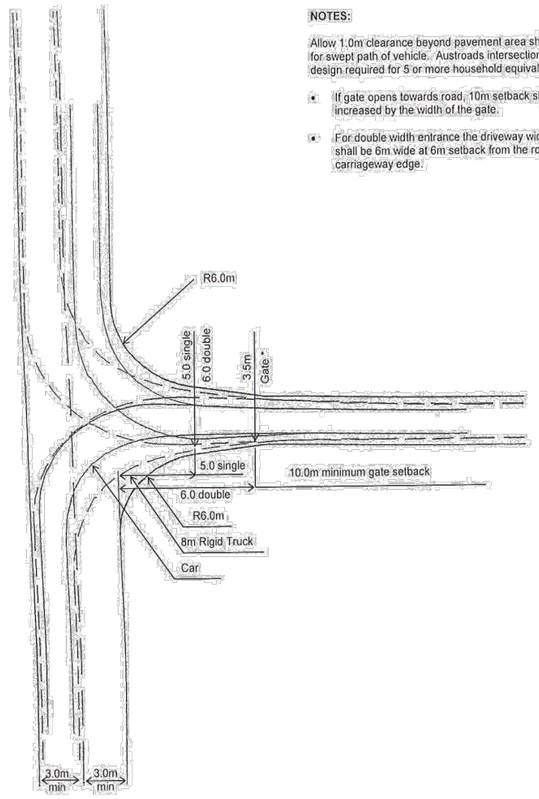
Sheet Title

TYPICAL CROSS SECTIONS

Sheet

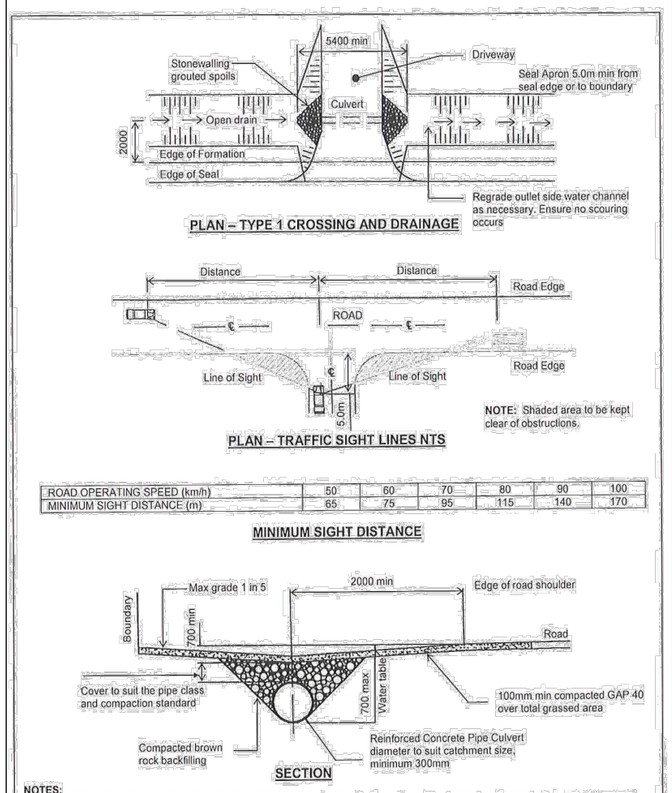
380

FILE PATH: Z:\Projects\C0600-C0699\C0651N - 458 & 476 Hihi Road, Hihi\07 - Technical & Drawings\Drawings\06_Detail Design Drawings\[C0651N-458A.dwg



FAR NORTH DISTRICT COUNCIL ENGINEERING STANDARDS

No	AMENDMENTS	DATE	DOMESTIC CROSSING LAYOUT (RURAL OR UNKERBED ROAD)	DATE JULY 2007
				FNDC / S / 6B



PLAN – TYPE 1 CROSSING AND DRAINAGE

PLAN – TRAFFIC SIGHT LINES NTS

ROAD OPERATING SPEED (km/h)	50	60	70	80	90	100
MINIMUM SIGHT DISTANCE (m)	65	75	95	115	140	170

MINIMUM SIGHT DISTANCE

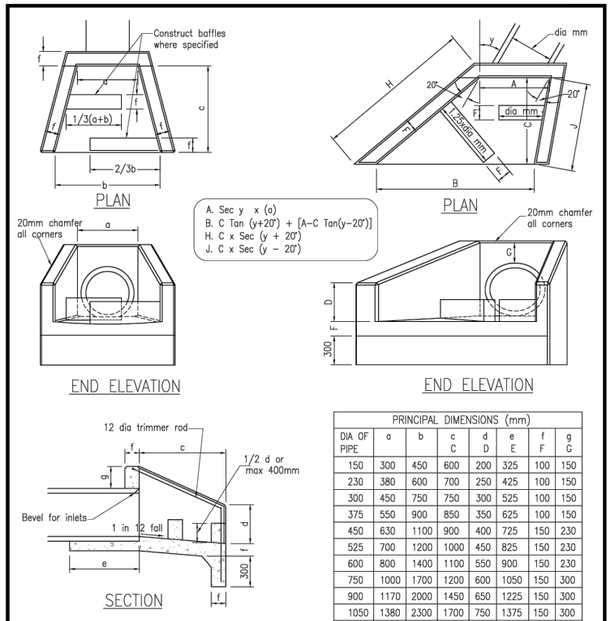
SECTION

NOTES:
1. Width sufficient to allow a vehicle to turn in from the left on an 8 metre inside radius without crossing the centerline. On commercial vehicle crossings (including farms), this radius shall be increased to 15 metres.
2. On arterial roads, vehicle access to properties which generate more than 60 vehicles per day shall be in accordance with Diagram D of the Transit NZ document "planning for a Safe and Efficient State Highway Network Under the Resource Management Act".

FAR NORTH DISTRICT COUNCIL ENGINEERING STANDARDS

No	AMENDMENTS	DATE	RESIDENTIAL VEHICLE CROSSINGS UNKERBED ROADS	DATE JULY 2007
				FNDC / S / 6

Sheet 35 Inlet and Outlet Structures



PRINCIPAL DIMENSIONS (mm)								
DIA OF PIPE	a	b	c C	d D	e E	f F	g G
150	300	450	600	200	325	100	150
230	380	600	700	250	425	100	150
300	450	750	750	300	525	100	150
375	550	900	850	350	625	100	150
450	630	1100	900	400	725	150	230
525	700	1200	1000	450	825	150	230
600	800	1400	1100	550	900	150	230
750	1000	1700	1200	600	1050	150	300
900	1170	2000	1450	650	1225	150	300
1050	1380	2300	1700	750	1375	150	300
1200	1520	2600	2100	750	1550	150	450
1350	1680	2800	2400	750	1725	150	450

NOTE:
1. Reinforce floors & walls with:
   150 – 375 665 mesh
   450 – 600 633 mesh or D10 rods at 250 crs.
   675 – 900 D12 rods at 250 crs.
   1050 – 1350 D12 rods at 150 crs.
2. All reinforcement shall be placed centrally in walls and floor, and shall be continuous between walls and floor.
3. Laps in structural grade bars to be 300 min.
4. There shall be at least 2 bars – whether mesh or M.S. over the top of the pipe.
5. Concrete is to be 20MPa at 28 days as per NZS 3104:2021.
6. Baffles are to be constructed as shown when outlet velocities and soil conditions dictate, in extreme cases specific design may be required by the Council.
7. Inlet structures shall have reverse apron fall and no baffles.

INLET AND OUTFALL STRUCTURES

FAR NORTH DISTRICT COUNCIL
ENGINEERING STANDARDS

Date:	FEB 2022
Revision:	0.2
Scale:	AS SHOWN
SHEET No.	35

GENERAL NOTES

Revision	Issue	Date
2	DETAIL DESIGN	07/2025
1	CONSENT	11/05/2022

geologix consulting engineers
AUCKLAND | NORTHLAND

Project Name and Address
458A HIHI ROAD
HIHI, FAR NORTH
SUBDIVISION OF LOT 1 DP492201

Project	Drawn By
C0651	TV

Client
MOA EQUITY LTD

Sheet Title
TYPICAL CROSS SECTIONS

Sheet
390

FILE PATH: Z:\Projects\C0600-C0699\C0651N - 458 & 478 Hihi Road, Hihi\07 - Technical & Drawings\Drawings\06_Detail Design Drawings\C0651 - 478.dwg

geologix
consulting engineers

APPENDIX C

Calculations

Project Ref:	C0651N		**PEAK RUNOFF ASSESSMENT**	geologix consulting engineers
Project Address:	458A HIHI ROAD, HIHI			
Prepared By:	GM		**CATCHMENT A - PROPOSED LOTS 1-2 & PART ROW**	
Date:	1 July 2025	REV 1		

ATTENUATION DESIGN PROVIDED IN ACCORDANCE WITH NEW ZEALAND BUILDING CODE E1 FOR THE RATIONALE METHOD ACCOUNTING FOR THE EFFECTS OF CLIMATE CHANGE (20% FACTOR AS PER 2023 FNDC ENGINEERING STANDARDS).

RUNOFF COEFFICIENTS DETERMINED FROM FNDC ENGINEERING STANDARDS 2023 TABLE 4-3.

PREDEVELOPMENT SCENARIO				**POST DEVELOPMENT SCENARIO**			
ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION	ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION
	4870	0.67	PASTURE/ GRASS		4230	0.67	PASTURE/ GRASS
	510	0.85	EXISTING ACCESSWAY		510	0.96	PROPOSED RIGHT OF WAY
					640	0.96	PROPOSED LOT ROOF/PAVING
TOTAL	**5380**	TYPE D	PR = PROPOSED	**TOTAL**	**5380**	TYPE D	

PRE TO POST DEVELOPMENT RUNOFF - 20 % AEP			
20 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	74.4	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
20 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	89.3	mm/hr	
20 % AEP PRE DEVELOPMENT PEAK FLOW	91.67	l/s	
20 % AEP POST DEVELOPMENT PEAK FLOW	97.66	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	5.99	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 50 % AEP			
50 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	57.3	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
50 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	68.8	mm/hr	
50 % AEP PRE DEVELOPMENT PEAK FLOW	70.60	l/s	
50 % AEP POST DEVELOPMENT PEAK FLOW	75.22	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	4.62	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 10 % AEP			
10 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	**87.1**	**mm/hr**	*** CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.**
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDAR	**20**	**%**	
10 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	**104.5**	**mm/hr**	
10 % AEP PRE DEVELOPMENT PEAK FLOW	**107.32**	**l/s**	
10 % AEP POST DEVELOPMENT PEAK FLOW	**114.34**	**l/s**	
PRE TO POST DEVELOPMENT DIFFERENCE	**7.02**	**l/s**	

PRE TO POST DEVELOPMENT RUNOFF - 1 % AEP			
1 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	132.0	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
1 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	158.4	mm/hr	
1 % AEP PRE DEVELOPMENT PEAK FLOW	154.32	l/s	
1 % AEP POST DEVELOPMENT PEAK FLOW	173.28	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	18.96	l/s	

Project Ref:	C0651N		**PEAK RUNOFF ASSESSMENT**	geologix consulting engineers
Project Address:	458A HIHI ROAD, HIHI			
Prepared By:	GM		**CATCHMENT B - PART ROW**	
Date:	1 July 2025	REV 1		

ATTENUATION DESIGN PROVIDED IN ACCORDANCE WITH NEW ZEALAND BUILDING CODE E1 FOR THE RATIONALE METHOD ACCOUNTING FOR THE EFFECTS OF CLIMATE CHANGE (20% FACTOR AS PER 2023 FNDC ENGINEERING STANDARDS).

RUNOFF COEFFICIENTS DETERMINED FROM FNDC ENGINEERING STANDARDS 2023 TABLE 4-3.

PREDEVELOPMENT SCENARIO				**POST DEVELOPMENT SCENARIO**			
ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION	ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION
	1195	0.67	PASTURE/ GRASS		1195	0.67	PASTURE/ GRASS
	510	0.85	EXISTING ACCESSWAY		510	0.96	PROPOSED RIGHT OF WAY
							PROPOSED LOT ROOF/PAVING
TOTAL	**1705**	TYPE D	PR = PROPOSED	**TOTAL**	**1705**	TYPE D	

PRE TO POST DEVELOPMENT RUNOFF - 20 % AEP			
20 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	74.4	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
20 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	89.3	mm/hr	
20 % AEP PRE DEVELOPMENT PEAK FLOW	30.61	l/s	
20 % AEP POST DEVELOPMENT PEAK FLOW	32.00	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	1.39	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 50 % AEP			
50 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	57.3	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
50 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	68.8	mm/hr	
50 % AEP PRE DEVELOPMENT PEAK FLOW	23.57	l/s	
50 % AEP POST DEVELOPMENT PEAK FLOW	24.64	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	1.07	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 10 % AEP			
10 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	**87.1**	**mm/hr**	*** CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.**
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	**20**	**%**	
10 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	**104.5**	**mm/hr**	
10 % AEP PRE DEVELOPMENT PEAK FLOW	**35.83**	**l/s**	
10 % AEP POST DEVELOPMENT PEAK FLOW	**37.46**	**l/s**	
PRE TO POST DEVELOPMENT DIFFERENCE	**1.63**	**l/s**	

PRE TO POST DEVELOPMENT RUNOFF - 1 % AEP			
1 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	132.0	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
1 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	158.4	mm/hr	
1 % AEP PRE DEVELOPMENT PEAK FLOW	54.30	l/s	
1 % AEP POST DEVELOPMENT PEAK FLOW	56.77	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	2.47	l/s	

Project Ref:	C0651N		**PEAK RUNOFF ASSESSMENT**	geologix consulting engineers
Project Address:	458A HIHI ROAD, HIHI			
Prepared By:	GM		**CATCHMENT C - LOTS 3-6**	
Date:	1 July 2025	REV 1		

ATTENUATION DESIGN PROVIDED IN ACCORDANCE WITH NEW ZEALAND BUILDING CODE E1 FOR THE RATIONALE METHOD ACCOUNTING FOR THE EFFECTS OF CLIMATE CHANGE (20% FACTOR AS PER 2023 FNDC ENGINEERING STANDARDS).

RUNOFF COEFFICIENTS DETERMINED FROM FNDC ENGINEERING STANDARDS 2023 TABLE 4-3.

PREDEVELOPMENT SCENARIO				**POST DEVELOPMENT SCENARIO**			
ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION	ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION
	30142	0.67	PASTURE/ GRASS		28662	0.67	PASTURE/ GRASS
	0	0.96	EXISTING ACCESSWAY		0	0.96	PROPOSED RIGHT OF WAY
					1480	0.96	PROPOSED LOT ROOF/PAVING
TOTAL	**30142**	TYPE D	PR = PROPOSED	**TOTAL**	**30142**	TYPE D	

PRE TO POST DEVELOPMENT RUNOFF - 20 % AEP			
20 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	74.4	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
20 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	89.3	mm/hr	
20 % AEP PRE DEVELOPMENT PEAK FLOW	500.84	l/s	
20 % AEP POST DEVELOPMENT PEAK FLOW	511.48	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	10.64	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 50 % AEP			
50 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	57.3	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	25.62	%	
50 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	72.0	mm/hr	
50 % AEP PRE DEVELOPMENT PEAK FLOW	403.79	l/s	
50 % AEP POST DEVELOPMENT PEAK FLOW	412.37	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	8.58	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 10 % AEP			
10 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	**87.1**	**mm/hr**	*** CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.**
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDAR	**27.51**	**%**	
10 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	**111.1**	**mm/hr**	
10 % AEP PRE DEVELOPMENT PEAK FLOW	**623.03**	**l/s**	
10 % AEP POST DEVELOPMENT PEAK FLOW	**636.27**	**l/s**	
PRE TO POST DEVELOPMENT DIFFERENCE	**13.24**	**l/s**	

PRE TO POST DEVELOPMENT RUNOFF - 1 % AEP			
1 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	132.0	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	28.56	%	
1 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	169.7	mm/hr	
1 % AEP PRE DEVELOPMENT PEAK FLOW	951.97	l/s	
1 % AEP POST DEVELOPMENT PEAK FLOW	972.20	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	20.23	l/s	

Project Ref:	C0651N		**PEAK RUNOFF ASSESSMENT**	geologix consulting engineers
Project Address:	458A HIHI ROAD, HIHI			
Prepared By:	GM		**CATCHMENT D - BALANCE OF LOT 1**	
Date:	1 July 2025	REV 1		

ATTENUATION DESIGN PROVIDED IN ACCORDANCE WITH NEW ZEALAND BUILDING CODE E1 FOR THE RATIONALE METHOD ACCOUNTING FOR THE EFFECTS OF CLIMATE CHANGE (20% FACTOR AS PER 2023 FNDC ENGINEERING STANDARDS).

RUNOFF COEFFICIENTS DETERMINED FROM FNDC ENGINEERING STANDARDS 2023 TABLE 4-3.

PREDEVELOPMENT SCENARIO				**POST DEVELOPMENT SCENARIO**			
ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION	ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION
	5179	0.67	PASTURE/ GRASS		4859	0.67	PASTURE/ GRASS
	545	0.85	EXISTING ACCESSWAY		545	0.96	PROPOSED RIGHT OF WAY
					320	0.96	PROPOSED LOT ROOF/PAVING
TOTAL	**5724**	TYPE D	PR = PROPOSED	**TOTAL**	**5724**	TYPE D	

PRE TO POST DEVELOPMENT RUNOFF - 20 % AEP			
20 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	74.4	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
20 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	89.3	mm/hr	
20 % AEP PRE DEVELOPMENT PEAK FLOW	97.54	l/s	
20 % AEP POST DEVELOPMENT PEAK FLOW	101.33	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	3.79	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 50 % AEP			
50 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	57.3	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	25.62	%	
50 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	72.0	mm/hr	
50 % AEP PRE DEVELOPMENT PEAK FLOW	78.64	l/s	
50 % AEP POST DEVELOPMENT PEAK FLOW	81.70	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	3.05	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 10 % AEP			
10 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	**87.1**	**mm/hr**	*** CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.**
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDAR	**27.51**	**%**	
10 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	**111.1**	**mm/hr**	
10 % AEP PRE DEVELOPMENT PEAK FLOW	**121.34**	**l/s**	
10 % AEP POST DEVELOPMENT PEAK FLOW	**126.05**	**l/s**	
PRE TO POST DEVELOPMENT DIFFERENCE	**4.71**	**l/s**	

PRE TO POST DEVELOPMENT RUNOFF - 1 % AEP			
1 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	132.0	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	28.56	%	
1 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	169.7	mm/hr	
1 % AEP PRE DEVELOPMENT PEAK FLOW	185.40	l/s	
1 % AEP POST DEVELOPMENT PEAK FLOW	192.61	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	7.20	l/s	

Project Ref:	C0651N		**PEAK RUNOFF ASSESSMENT**	geologix consulting engineers
Project Address:	458A HIHI ROAD, HIHI			
Prepared By:	GM		**CATCHMENT E - PART ROW**	
Date:	1 July 2025	REV 1		

ATTENUATION DESIGN PROVIDED IN ACCORDANCE WITH NEW ZEALAND BUILDING CODE E1 FOR THE RATIONALE METHOD ACCOUNTING FOR THE EFFECTS OF CLIMATE CHANGE (20% FACTOR AS PER 2023 FNDC ENGINEERING STANDARDS).

RUNOFF COEFFICIENTS DETERMINED FROM FNDC ENGINEERING STANDARDS 2023 TABLE 4-3.

PREDEVELOPMENT SCENARIO				**POST DEVELOPMENT SCENARIO**			
ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION	ITEM	AREA, A, m2	COEFFICIENT, C	DESCRIPTION
	397	0.67	PASTURE/ GRASS		397	0.67	PASTURE/ GRASS
	545	0.85	EXISTING ACCESSWAY		545	0.96	PROPOSED RIGHT OF WAY
							PROPOSED LOT ROOF/PAVING
TOTAL	**942**	TYPE D	PR = PROPOSED	**TOTAL**	**942**	TYPE D	

PRE TO POST DEVELOPMENT RUNOFF - 20 % AEP			
20 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	74.4	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	20	%	
20 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	89.3	mm/hr	
20 % AEP PRE DEVELOPMENT PEAK FLOW	18.09	l/s	
20 % AEP POST DEVELOPMENT PEAK FLOW	19.57	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	1.49	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 50 % AEP			
50 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	57.3	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	25.62	%	
50 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	72.0	mm/hr	
50 % AEP PRE DEVELOPMENT PEAK FLOW	14.58	l/s	
50 % AEP POST DEVELOPMENT PEAK FLOW	15.78	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	1.20	l/s	

PRE TO POST DEVELOPMENT RUNOFF - 10 % AEP			
10 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	**87.1**	**mm/hr**	*** CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.**
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDAR	**27.51**	**%**	
10 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	**111.1**	**mm/hr**	
10 % AEP PRE DEVELOPMENT PEAK FLOW	**22.50**	**l/s**	
10 % AEP POST DEVELOPMENT PEAK FLOW	**24.35**	**l/s**	
PRE TO POST DEVELOPMENT DIFFERENCE	**1.85**	**l/s**	

PRE TO POST DEVELOPMENT RUNOFF - 1 % AEP			
1 % AEP RAINFALL INTENSITY, 10 MIN, I, mm/hr	132.0	mm/hr	* CLIMATE CHANGE FACTOR OF 20% APPLIED IN ACCORDANCE WITH FNDC ENGINEERING STANDARDS 4.3.9.1. NIWA HISTORIC RAINFALL INTENSITY DATA, 10MIN, IS MULTIPLIED BY CLIMATE CHANGE FACTOR.
CLIMATE CHANGE FACTOR, 20% AS PER FNDC STANDARI	28.56	%	
1 % AEP RAINFALL INTENSITY, 10 MIN WITH CC	169.7	mm/hr	
1 % AEP PRE DEVELOPMENT PEAK FLOW	34.38	l/s	
1 % AEP POST DEVELOPMENT PEAK FLOW	37.20	l/s	
PRE TO POST DEVELOPMENT DIFFERENCE	2.83	l/s	

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: ≠ HIHI
Coordinate system: WGS84
Longitude: 173.5479
Latitude: -34.971

DDF Model Parameters:	c	d	e	f	g	h	i
Values:	0.001702	0.504677	-0.03943	0	0.25324	-0.01065	3.196961

Example:	Duration (h	ARI (yrs)	x	y	Rainfall Rate (mm/hr)
	24	100	3.178054	4.600149	8.92641

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	52.3	40.2	33.8	24.4	17	8.87	5.6	3.4	1.99	1.43	1.12	0.924
2	0.5	57.3	44	37.1	26.8	18.7	9.73	6.14	3.74	2.19	1.57	1.23	1.02
5	0.2	74.4	57.2	48.2	34.9	24.3	12.7	8.04	4.9	2.87	2.06	1.62	1.34
10	0.1	87.1	67	56.5	41	28.6	15	9.47	5.77	3.38	2.43	1.91	1.58
20	0.05	100	77.2	65.1	47.2	33	17.3	11	6.68	3.92	2.82	2.22	1.83
30	0.033	108	83.3	70.3	51	35.6	18.7	11.8	7.23	4.25	3.06	2.4	1.98
40	0.025	114	87.7	74	53.7	37.6	19.7	12.5	7.63	4.48	3.23	2.54	2.09
50	0.02	118	91.1	76.9	55.9	39.1	20.5	13	7.94	4.67	3.36	2.64	2.18
60	0.017	122	94	79.3	57.6	40.3	21.2	13.4	8.2	4.82	3.47	2.73	2.25
80	0.013	128	98.5	83.1	60.4	42.3	22.2	14.1	8.61	5.06	3.65	2.87	2.37
100	0.01	132	102	86.1	62.6	43.8	23	14.6	8.93	5.25	3.78	2.97	2.46
250	0.004	151	116	98.3	71.5	50.1	26.4	16.8	10.3	6.04	4.35	3.42	2.83

Intensity standard error (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	6.7	4.4	3.2	2.4	1.7	1	0.71	0.56	0.36	0.27	0.21	0.18
2	0.5	7.3	4.8	3.5	2.6	1.8	1.1	0.78	0.63	0.4	0.31	0.23	0.2
5	0.2	10	6.9	5.2	3.7	2.6	1.6	1.1	0.84	0.53	0.41	0.31	0.27
10	0.1	13	9.1	6.9	4.9	3.4	2	1.3	1	0.64	0.49	0.37	0.32
20	0.05	16	12	9.2	6.5	4.5	2.6	1.7	1.2	0.75	0.58	0.44	0.37
30	0.033	19	14	11	7.6	5.3	3	2	1.3	0.83	0.64	0.48	0.41
40	0.025	21	16	12	8.5	6	3.4	2.2	1.4	0.88	0.68	0.52	0.44
50	0.02	23	17	13	9.3	6.6	3.7	2.4	1.5	0.93	0.72	0.54	0.46
60	0.017	24	18	14	10	7.1	4	2.6	1.5	0.97	0.75	0.57	0.48
80	0.013	27	20	16	11	7.9	4.4	2.9	1.7	1	0.8	0.61	0.51
100	0.01	29	22	17	12	8.7	4.8	3.1	1.7	1.1	0.84	0.64	0.54
250	0.004	39	31	24	17	12	6.9	4.5	2.2	1.3	1	0.79	0.66

Rainfall intensities (mm/hr) :: RCP2.6 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	56	43	36.2	26.2	18.1	9.36	5.86	3.54	2.06	1.47	1.15	0.949
2	0.5	61.4	47.2	39.7	28.7	20	10.3	6.45	3.89	2.27	1.62	1.27	1.05
5	0.2	80	61.5	51.8	37.5	26.1	13.5	8.48	5.12	2.98	2.14	1.67	1.38
10	0.1	93.8	72.2	60.9	44.1	30.7	15.9	10	6.05	3.52	2.53	1.98	1.63
20	0.05	108	83.2	70.2	50.9	35.5	18.4	11.6	7	4.09	2.93	2.3	1.89
30	0.033	117	89.9	75.8	55	38.4	19.9	12.5	7.58	4.43	3.18	2.49	2.05
40	0.025	123	94.6	79.8	58	40.4	21	13.2	8	4.67	3.36	2.63	2.17
50	0.02	128	98.4	83	60.3	42.1	21.9	13.8	8.33	4.87	3.49	2.74	2.26
60	0.017	131	101	85.6	62.2	43.4	22.6	14.2	8.61	5.03	3.61	2.83	2.33
80	0.013	138	106	89.8	65.3	45.5	23.7	14.9	9.04	5.29	3.79	2.97	2.45
100	0.01	143	110	93	67.6	47.2	24.6	15.5	9.38	5.48	3.94	3.09	2.55
250	0.004	163	126	106	77.3	54	28.2	17.8	10.8	6.31	4.53	3.56	2.93

Rainfall intensities (mm/hr) :: RCP2.6 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	56	43	36.2	26.2	18.1	9.36	5.86	3.54	2.06	1.47	1.15	0.949
2	0.5	61.4	47.2	39.7	28.7	20	10.3	6.45	3.89	2.27	1.62	1.27	1.05
5	0.2	80	61.5	51.8	37.5	26.1	13.5	8.48	5.12	2.98	2.14	1.67	1.38
10	0.1	93.8	72.2	60.9	44.1	30.7	15.9	10	6.05	3.52	2.53	1.98	1.63
20	0.05	108	83.2	70.2	50.9	35.5	18.4	11.6	7	4.09	2.93	2.3	1.89
30	0.033	117	89.9	75.8	55	38.4	19.9	12.5	7.58	4.43	3.18	2.49	2.05
40	0.025	123	94.6	79.8	58	40.4	21	13.2	8	4.67	3.36	2.63	2.17
50	0.02	128	98.4	83	60.3	42.1	21.9	13.8	8.33	4.87	3.49	2.74	2.26
60	0.017	131	101	85.6	62.2	43.4	22.6	14.2	8.61	5.03	3.61	2.83	2.33
80	0.013	138	106	89.8	65.3	45.5	23.7	14.9	9.04	5.29	3.79	2.97	2.45
100	0.01	143	110	93	67.6	47.2	24.6	15.5	9.38	5.48	3.94	3.09	2.55
250	0.004	163	126	106	77.3	54	28.2	17.8	10.8	6.31	4.53	3.56	2.93

Rainfall intensities (mm/hr) :: RCP4.5 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	56.9	43.7	36.8	26.6	18.4	9.48	5.93	3.58	2.08	1.48	1.16	0.955
2	0.5	62.5	48	40.4	29.2	20.3	10.4	6.53	3.93	2.29	1.63	1.28	1.05
5	0.2	81.4	62.6	52.8	38.2	26.6	13.7	8.59	5.18	3.01	2.16	1.69	1.39
10	0.1	95.5	73.5	62	44.9	31.3	16.2	10.1	6.12	3.56	2.55	2	1.64
20	0.05	110	84.8	71.5	51.9	36.1	18.7	11.7	7.08	4.13	2.96	2.32	1.91
30	0.033	119	91.5	77.2	56.1	39.1	20.2	12.7	7.67	4.48	3.21	2.51	2.07
40	0.025	125	96.4	81.3	59.1	41.2	21.4	13.4	8.1	4.72	3.39	2.65	2.19
50	0.02	130	100	84.6	61.4	42.8	22.2	14	8.43	4.92	3.53	2.77	2.28
60	0.017	134	103	87.2	63.4	44.2	22.9	14.4	8.71	5.08	3.65	2.86	2.35
80	0.013	140	108	91.5	66.5	46.4	24.1	15.1	9.15	5.34	3.83	3	2.47
100	0.01	145	112	94.8	68.9	48	25	15.7	9.49	5.54	3.98	3.12	2.57
250	0.004	166	128	108	78.7	55	28.6	18	10.9	6.37	4.58	3.59	2.96

Rainfall intensities (mm/hr) :: RCP4.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	59.9	45.9	38.7	28	19.3	9.88	6.14	3.69	2.13	1.52	1.18	0.975
2	0.5	65.7	50.5	42.5	30.8	21.3	10.9	6.78	4.06	2.35	1.68	1.31	1.08
5	0.2	85.9	66.1	55.7	40.3	28	14.3	8.94	5.36	3.1	2.22	1.73	1.42
10	0.1	101	77.7	65.5	47.5	33	16.9	10.6	6.34	3.67	2.63	2.05	1.69
20	0.05	116	89.6	75.6	54.8	38.1	19.6	12.2	7.34	4.26	3.05	2.38	1.96
30	0.033	126	96.8	81.7	59.3	41.2	21.2	13.3	7.95	4.62	3.3	2.58	2.12
40	0.025	132	102	86	62.4	43.4	22.4	14	8.4	4.88	3.49	2.73	2.25
50	0.02	137	106	89.5	65	45.2	23.3	14.6	8.74	5.08	3.64	2.85	2.34
60	0.017	142	109	92.3	67	46.6	24.1	15	9.04	5.25	3.76	2.94	2.42
80	0.013	149	115	96.8	70.4	49	25.3	15.8	9.49	5.52	3.95	3.09	2.54
100	0.01	154	119	100	72.9	50.7	26.2	16.4	9.86	5.73	4.1	3.21	2.64
250	0.004	175	135	114	83.3	58.1	30.1	18.8	11.3	6.59	4.72	3.69	3.04

Rainfall intensities (mm/hr) :: RCP6.0 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	56.6	43.4	36.5	26.4	18.3	9.43	5.9	3.56	2.07	1.48	1.16	0.953
2	0.5	62	47.7	40.1	29	20.1	10.4	6.5	3.92	2.28	1.63	1.28	1.05
5	0.2	80.9	62.2	52.4	38	26.4	13.6	8.55	5.16	3	2.15	1.68	1.39
10	0.1	94.9	73	61.6	44.6	31	16.1	10.1	6.09	3.55	2.54	1.99	1.64
20	0.05	109	84.2	71	51.5	35.9	18.6	11.7	7.05	4.11	2.95	2.31	1.9
30	0.033	118	90.9	76.7	55.7	38.8	20.1	12.6	7.64	4.46	3.2	2.5	2.06
40	0.025	124	95.7	80.7	58.6	40.9	21.2	13.3	8.06	4.7	3.38	2.64	2.18
50	0.02	129	99.5	84	61	42.5	22.1	13.9	8.39	4.9	3.52	2.76	2.27
60	0.017	133	103	86.6	62.9	43.9	22.8	14.3	8.67	5.06	3.63	2.85	2.34
80	0.013	139	108	90.8	66	46	23.9	15	9.1	5.32	3.82	2.99	2.47
100	0.01	144	111	94.1	68.4	47.7	24.8	15.6	9.45	5.52	3.96	3.11	2.56
250	0.004	164	127	107	78.2	54.6	28.5	17.9	10.9	6.35	4.56	3.58	2.95

Rainfall intensities (mm/hr) :: RCP6.0 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	62.5	48	40.4	29.2	20.1	10.2	6.33	3.79	2.18	1.55	1.21	0.992
2	0.5	68.7	52.8	44.4	32.1	22.2	11.3	7	4.17	2.4	1.71	1.33	1.1
5	0.2	89.9	69.1	58.3	42.2	29.2	14.9	9.25	5.52	3.18	2.27	1.77	1.45
10	0.1	106	81.4	68.6	49.7	34.5	17.6	10.9	6.53	3.77	2.69	2.1	1.72
20	0.05	122	93.9	79.2	57.5	39.9	20.4	12.7	7.57	4.38	3.13	2.44	2
30	0.033	132	101	85.6	62.2	43.1	22.1	13.7	8.21	4.75	3.39	2.65	2.17
40	0.025	139	107	90.2	65.5	45.5	23.3	14.5	8.67	5.01	3.58	2.8	2.3
50	0.02	144	111	93.8	68.2	47.3	24.3	15.1	9.02	5.23	3.73	2.92	2.39
60	0.017	149	115	96.8	70.3	48.8	25.1	15.6	9.33	5.4	3.86	3.01	2.47
80	0.013	156	120	102	73.8	51.3	26.3	16.4	9.8	5.68	4.06	3.16	2.6
100	0.01	161	125	105	76.5	53.2	27.3	17	10.2	5.89	4.21	3.29	2.7
250	0.004	184	142	120	87.4	60.8	31.3	19.5	11.7	6.78	4.84	3.79	3.11

Rainfall intensities (mm/hr) :: RCP8.5 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	57.6	44.2	37.2	26.9	18.6	9.58	5.98	3.6	2.09	1.49	1.17	0.96
2	0.5	63.2	48.6	40.9	29.6	20.5	10.5	6.59	3.96	2.3	1.64	1.29	1.06
5	0.2	82.5	63.4	53.4	38.7	26.9	13.9	8.67	5.22	3.03	2.17	1.7	1.4
10	0.1	96.8	74.5	62.8	45.5	31.7	16.3	10.2	6.17	3.59	2.57	2.01	1.65
20	0.05	112	85.9	72.5	52.6	36.6	18.9	11.9	7.14	4.16	2.98	2.33	1.92
30	0.033	120	92.8	78.3	56.8	39.6	20.5	12.8	7.74	4.51	3.23	2.53	2.08
40	0.025	127	97.7	82.4	59.9	41.7	21.6	13.5	8.17	4.76	3.41	2.67	2.2
50	0.02	132	102	85.7	62.3	43.4	22.5	14.1	8.5	4.96	3.55	2.78	2.29
60	0.017	136	105	88.4	64.2	44.8	23.2	14.6	8.79	5.12	3.67	2.88	2.37
80	0.013	142	110	92.7	67.4	47	24.4	15.3	9.23	5.38	3.86	3.02	2.49
100	0.01	147	114	96.1	69.8	48.7	25.3	15.9	9.58	5.59	4	3.14	2.58
250	0.004	168	130	110	79.8	55.7	29	18.2	11	6.42	4.61	3.61	2.98

Rainfall intensities (mm/hr) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	68.4	52.5	44.2	31.9	21.9	11	6.75	4.01	2.29	1.62	1.26	1.03
2	0.5	75.3	57.9	48.7	35.2	24.3	12.2	7.49	4.43	2.53	1.79	1.39	1.14
5	0.2	98.9	76.1	64.1	46.4	32.1	16.2	9.95	5.88	3.37	2.39	1.86	1.52
10	0.1	117	89.7	75.6	54.8	37.9	19.1	11.8	6.98	4	2.84	2.21	1.81
20	0.05	135	104	87.5	63.4	43.9	22.2	13.7	8.09	4.65	3.3	2.57	2.1
30	0.033	145	112	94.6	68.6	47.5	24.1	14.8	8.78	5.05	3.58	2.79	2.28
40	0.025	153	118	99.6	72.3	50.1	25.5	15.7	9.28	5.32	3.79	2.95	2.42
50	0.02	159	123	104	75.3	52.2	26.5	16.3	9.66	5.56	3.95	3.08	2.52
60	0.017	164	127	107	77.7	53.8	27.4	16.9	9.99	5.74	4.09	3.18	2.6
80	0.013	172	133	112	81.6	56.6	28.7	17.7	10.5	6.04	4.29	3.34	2.74
100	0.01	178	138	116	84.5	58.6	29.9	18.4	10.9	6.27	4.46	3.47	2.84
250	0.004	203	157	133	96.6	67.1	34.2	21.1	12.5	7.21	5.13	4	3.27

Colebrook-White Calculation

Project:	458A HIHI ROAD, HIHI		**By:**
Calculation:	Stormwater Pipe Analysis		GM
	Colebrook-White Pipe Analysis		**Approved:**
Sheet Number:	1	**Date:** 18-Jul	SH

General Info		
Kinematic Viscosity *(v)*	1.139	mm²/s
Gravity *(g)*	9.80665	m/s²

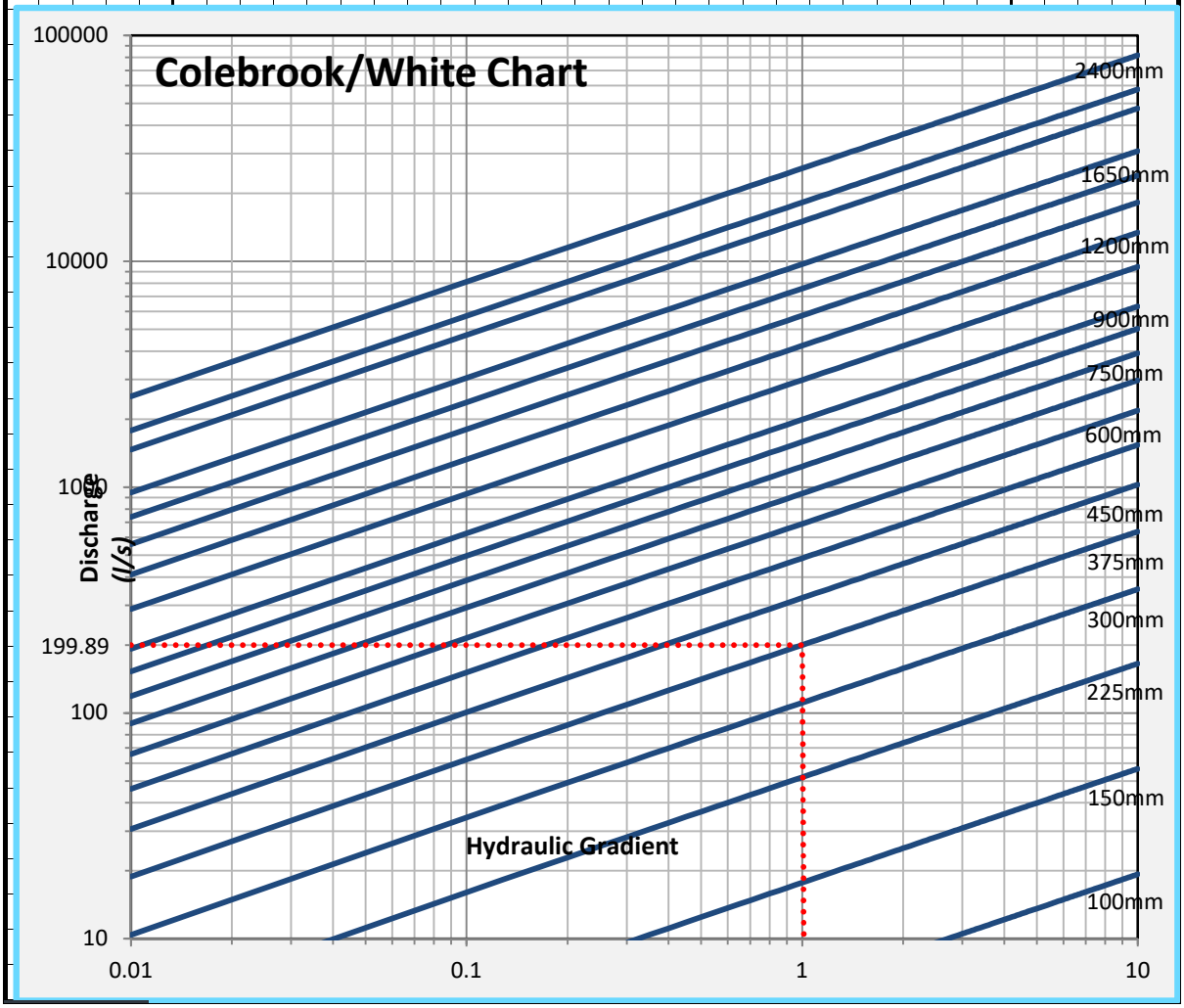
Pipe Info		
Roughness Coefficient *(k_s)*	0.6	mm
Hydraulic Gradient *(S)*	1	%
Internal Diameter *(D)*	375	mm

= 0.01 m/m
or 1 in 100

$$Q = -2\sqrt{2gDS} \times \log\left[\frac{ks}{3.7D} + \frac{2.51v}{D\sqrt{2gDS}}\right]A$$

Results When Flowing Full		
Velocity *(v)*	**1.81**	m/s
Flow *(Q)*	**199.89**	l/s

= 0.20 m³/s

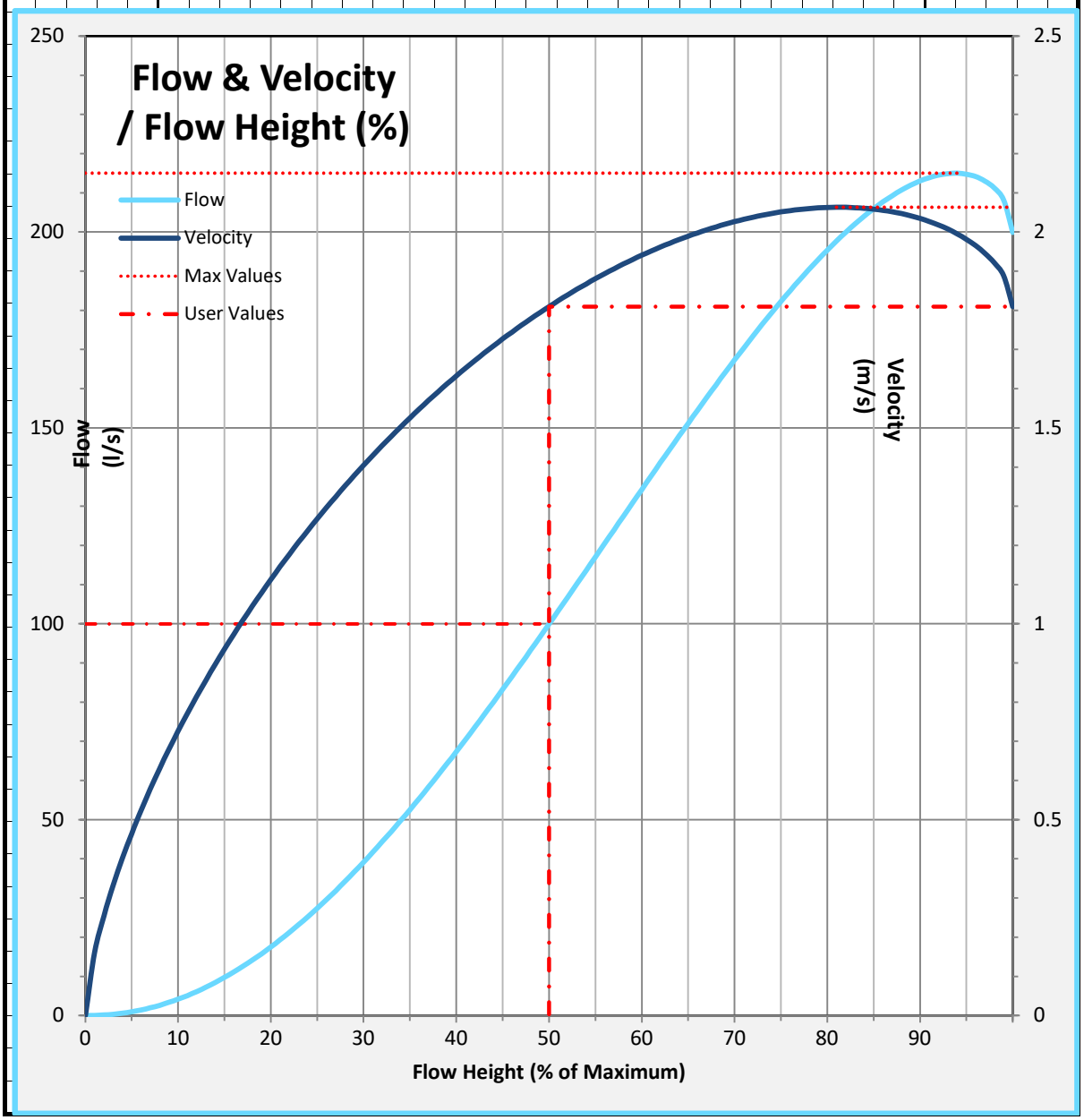


Colebrook-White Calculation

geologix consulting engineers	**Project:**	458A HIHI ROAD, HIHI		**By:**
	Calculation:	Stormwater Pipe Analysis		GM
				Approved:
	Sheet Number:	2	**Date:** 18-Jul	SH

Results When Flowing Partially Full

Max Velocity at 81.4% Height			
Vmax	**2.06**	m/s	
Max Flow at 93.8% Height			
Qmax	**215.0**	l/s	= 0.22 m³/s
User Defined Height	50	%	= 0.188 m
Velocity (v)	**1.81**	m/s	
Flow (Q)	**99.9**	l/s	= 0.10 m³/s



Colebrook-White Calculation

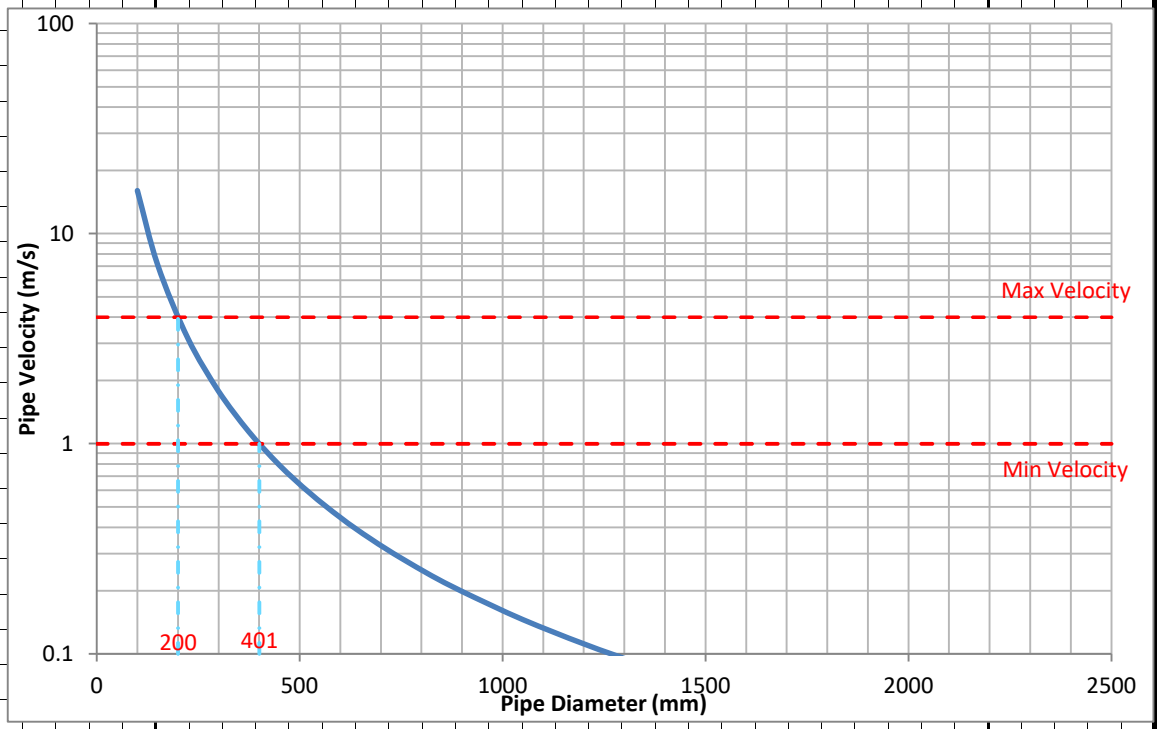
Project:	458A HIHI ROAD, HIHI		**By:**
Calculation:	SW Pipe RoW		GM
	Colebrook-White Pipe Design		**Approved:**
Sheet Number:	1	**Date:** 1-Jul	SH

General Info		
Kinematic Viscosity (v)	1.139	mm²/s
Gravity *(g)*	9.80665	m/s²

Pipe Info		
Roughness Coefficient (k_s)	0.6	mm

Required Flow	126.05	l/s
Min Velocity	1	m/s
Max Velocity	4	m/s

= 0.13 m³/s



Suggested Pipe Sizes and Gradients

	Pipe Diameter	Full Flow Velocity (m/s)	Required Gradient (%)	Required Gradient (1 in X)
1	225	3.17	5.84	17.11
2	300	1.78	1.29	77.30
3	375	1.14	0.40	247.64
4				
5				
6				
7				
8				
9				
10				

Colebrook-White Calculation

geologix	**Project:**	458A HIHI ROAD, HIHI		**By:**
	Calculation:	SW Pipe RoW		GM
				Approved:
	Sheet Number:	2	**Date:**	1-Jul SH

Chosen Pipe Analysis

Pipe Diameter	375	mm
Pipe Gradient	2.75	%

= 0.03 m/m
or 1 in 36.4

Max Pipe Capacity at Full Flow:	332.5	l/s	Acceptable	= 0.33 m³/s
Max Flow at 93.8% Height:	357.7	l/s	Acceptable	= 0.36 m³/s
Velocity at Full Flow:	3.01	m/s	Acceptable	
Actual Velocity at 126.05 l/s:	2.78	m/s	Acceptable	
Max Velocity at 81.4% Height	3.43	m/s	Acceptable