ENGINEERING AND INFRASTRUCTURE REPORT
TO SUPPORT A LANDUSE AND RESOURCE CONSENT APPLICATION
FOR AN 87 LOT DEVELOPMENT
FOR HND HMB LTD
AT 3 PIGEON MOUNTAIN ROAD, HALF MOON BAY

Job No: 220571/01

Issue Date: 20 September 2024

Document Control Record

Document Prepared By:
Airey Consultants Limited
Level 1, Fountain Lane North, Botany Town Centre
PO Box 259 339, Botany, Auckland 2163

T: +64 9 534 6523
E: samsonw@aireys.co.nz
W: **aireys.co.nz**

Client:
HND HMB Ltd
3 Pigeon Mountain Road, Half Moon Bay

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Revision	Description	Issue Date	Prepared by	Reviewed by
0	Infrastructure Report – Issue 1	15/05/2023	SW	RCHT
1	S92	24/10/2023	SW	RCHT
2	For Public Notification	20/09/2024	SW	RCHT

Contents

EXECUTIVE SUMMARY

This report addresses the civil engineering aspects and requirements for infrastructure for the proposed 87 lot subdivision at 3 Pigeon Mountain Road, Half Moon Bay. The existing buildings and structures will be removed and 87 new dwellings constructed. This report concludes that the development can be serviced by the existing and proposed infrastructure detailed within this report. The development will be provided with stormwater, wastewater and water supply service, and is able to be connected to the local power and telecommunications reticulation.

1 INTRODUCTION

This report covers the engineering aspects for the resource consent application for the proposed 87 Lot development at 3 Pigeon Mountain Road, Half Moon Bay.

This Infrastructure Report identifies the engineering issues related to the proposed development and highlights the civil works that will be necessary to ensure that the proposed lots can be adequately serviced.

2 SITE DESCRIPTION

2.1 Location

The subject site is pentagonal in shape with an area of 1.4073 Ha. The existing buildings and structures will be removed. The property is bounded by commercial building to the north and residential dwellings to the east, south and west.

Figure One: Aerial Photo of 3 Pigeon Mountain Road, Half Moon Bay

2.2 Titles/Zoning

The legal description of the site is Lot 1 DP 212125. The site is zoned Residential – Mixed Housing Suburban Zone under the Auckland Council Unitary Plan (AUP). The Site is zoned Residential – Mixed Housing Urban Zone under the Auckland Council - Plan Change 78.

2.3 Topography

The site topography slopes from the south-western boundary towards the north-eastern boundary of the site. The gradient of the slope ranges from 3.5% in the north-eastern half to the site to 12.8% for the south-western half of the site.

3 PROPOSED DEVELOPMENT

The proposed development is to undertake an 87-lot fee simple subdivision comprising 87 dwellings.

The existing building and structures will be removed.

3.1 Access

There are currently three formed concrete vehicle crossings for the site. One crossing is located at the eastern boundary off Pigeon Mountain Road while the other two crossings are located along the southern boundary off Compass Point Way. These will be removed and reinstated as part of the development. A new 6m wide vehicle crossing will be constructed at the southern boundary to serve the common access way, parking and manoeuvring area of the site. The vehicle crossing will be constructed to AT VX0203 standards. The common access will be constructed to Councils GD12 Standards as common accessway.

3.2 Flooding Considerations & Overland Flow Path

3.2.1 Flood plain and flood sensitive areas

The site is not identified to be located within a flood plain nor flood sensitive area.

3.2.2 Coastal Inundation

The site is not subject to coastal inundation.

3.2.3 Overland flowpaths

There is a minor overland flow (contributory catchment area less than 1Ha) identified originated from the site. The overland flow exits the eastern boundary of the site and joins an overland flow within Pigeon Mountain Road. It is proposed to divert the overland flow from the site to exit the site at multiple locations. Though the exit points of the overland flow will change; ultimately, the flow joins up with the main flow within Pigeon Mountain Road and has less than minor effect on the downstream properties.

Please refer to **Appendix F** and **Appendix H (s92 Responses)** enclosed.

3.3 Earthworks

3.3.1 Proposed Earthworks

The proposed development will have earthworks involved for constructing the common accessways, building platforms and the utility and services. A site-specific geotechnical report by others has been prepared for the proposed development.

3.3.2 Erosion & Sediment Control

During the development, sediment control in accordance with the requirements of Auckland Council's GD05 document (legacy ARC TP90 publication) will be carried out as required. The area of earthworks exposed to erosion at any given time is minimised through staging and progressive stabilisation. The existing vehicle crossings to 3 Pigeon Mountain Road will provide initial accesses to the site. The proposed Erosion and Sediment Control Measures has been detailed in Earthworks Management Plan by Airey Consultants Ltd, dated 20/11/2023.

Please refer to **Appendix G** enclosed for Earthworks Management Plan.

3.4 Stormwater

3.4.1 Existing Stormwater

There is a public 225mmØ concrete stormwater pipe along the eastern boundary of the site. The 225mmØ drains to a 300mmØ concrete line across Pigeon Mountain Road via a stormwater manhole (SAP ID 2000323535). There is also a 300mmØ concrete stormwater pipe along the western boundary of the site, which joins into a public 450mmØ concrete stormwater pipe via a stormwater manhole (SAP ID 20002345285). Property files records shows that the site currently discharges stormwater into stormwater manhole 20002345285.

3.4.2 Proposed Stormwater

It is proposed to abandon the existing stormwater connection to stormwater manhole 20002345285 and extend public stormwater drainage from the stormwater manholes 2000234285 and 2000323535 to service the development. The site runoff will be split into two catchments to reduce the impact on the existing stormwater infrastructure.

The new assets proposed to be vested with Council are:

- SW1 up to SW Filter 1 – 29.2m (6.5+22.7) of 300mmØ uPVC SN16 and 1 x SWMH
- SW4 up to SW Filters 2– 28.8m (3.8+25) of 300mmØ uPVC SN16 and 1 x SWMH
- SW5 and SW 6 up to SW Filter 3 – 76.6m (68.9+7.7) of 300mmØ uPVC SN16 and 1 x SWMH

Preliminary plans are enclosed in **Appendix A**.

All stormwater assets including and past the stormwater quality treatment devices within the development will be private and will be designed at building consent stage.

3.4.3 Stormwater Management

Auckland Unitary Plan (AUP)

3.4.3.1 Stormwater Management – Flow

The site is not classified as within the Stormwater Management Area Control – Flow (SMAF) area. The public stormwater infrastructure which serves this area operates under Auckland Council's Stormwater Network Discharge Consent.

Future Impervious Areas

There will be an increase in impervious area, from 40.02% to 68.2% imperviousness, as a result of the development. With the proposed development considered as a Large Brownfields development under NDC Schedule 4, a site-specific Stormwater Management Plan (SMP) has been prepared and is enclosed in **Appendix C**.

3.4.3.2 Public Stormwater Capacity

Capacity assessment of the downstream network indicates there is insufficient capacity to service the development. Calculations are enclosed in **Appendix B**. With the proposed development considered as a Large Brownfields development under NDC Schedule 4, a site-specific Stormwater Management Plan (SMP) has been prepared and is enclosed in **Appendix C**. We propose to reduce the site discharge to pre-development levels (existing condition) using detention so consider the capacity of the existing system suitable.

3.4.3.3 Stormwater Management - Quality

With the proposed development considered as a Large Brownfields development under NDC Schedule 4, a site-specific Stormwater Management Plan (SMP) has been prepared and is enclosed in **Appendix C**. At source, water sensitive stormwater management devices, namely the Stormwater 360 storm filters with peak flow diversions (or equivalent) are proposed downstream of the stormwater detention devices. The stormfilters are designed to remove greater than 75% TSS from stormwater runoffs. Stormwater 360 storm filters are approved by Auckland Council for use on all public and private developments.

3.5 Wastewater

3.5.1 Existing Wastewater

There are 150mmØ public wastewater pipes and wastewater manhole within the site Property files records shows that the site currently discharges wastewater into wastewater manhole 465006.

3.5.2 Proposed Wastewater

It is proposed to abandon the existing wastewater connection to manhole 465006 and extend public wastewater drainage from manholes 465006 and 483450 to service the development. The site runoff will be split into two catchments to reduce the impact on the existing wastewater infrastructure. New 150mmØ uPVC lines will be extended from the new manholes, ending at new manholes, to provide wastewater connections to the proposed development. See engineering plans enclosed in **Appendix A**.

Wastewater flow calculations are based on three-bedroom dwellings, of which each person produces a Peak Wet Weather Flow of 1,206 litres/Person/Day as specified within Watercare's Code of Practice. The existing wastewater flow calculations are based on day and overnight occupancies for the site. The site is currently occupied by STAND. STAND currently has a maximum occupancy of 60-day staff, 25 overnight children, 4 overnight staff and additional 10 people in emergency housing. Please find site peak design flow calculations enclosed in **Appendix B**.

With the proposed development being greater than 20 new dwellings and the calculated net change in Peak Design Flow form the site is greater than 1.0L/s, we have carried out a Level 1 desk top assessment of the downstream network with PWWF calculations in accordance with Watercare Code of Practice. Level 1 assessment indicates that the downstream pipes have the capacity to service the development. Level 1 assessment is enclosed in **Appendix D**.

3.6 Water Supply

3.6.1 Existing Water Supply

The existing site has a water supply connection and meter. This connection and meter will be retained to service one of the proposed dwellings.

3.6.2 Proposed Water Supply

There is a public 150mmØ AC water pipe and a sluice valve located in the berm at the front of the property. It is proposed to extend the water main in Pigeon Mountain Road and Compass Point Way. New connections will be made to the public water main to provide a meter for the new dwellings along the public road frontage. A bulk meter will be applied for to provide reticulated water to service the dwellings without direct public road frontage. The meters for the new dwellings shall be applied for at building consent stage.

3.6.3 Water Supply Fire Fighting

The New Zealand Fire Service Firefighting Water Supplies Code of Practice Table 1 states that the firefighting requirements for residential dwellings without sprinklers is classified FW2, which requires a flow rate of 12.5 L/s within 135m and a further 12.5 L/s within 270m of the property, using a maximum of two hydrants.

To service the development, fire engineer has been engaged to assess the firefighting requirements. A new fire hydrant will be installed at the new entrance of the development to comply with the requirement of the Fire Service Code of Practice. Please refer to Fire Engineer correspondence and markup enclosed in **Appendix E**.

Fire hydrant flow tests were undertaken by Nova Flowtech Services. Please refer to the flow test result enclosed in **Appendix E**.

3.7 Utilities

3.7.1 Power

Underground power is available in Pigeon Mountain Road and Compass Point Way. New underground connections to the existing power infrastructure located along Pigeon Mountain Road and Compass Point Way will be provided to serve the development. The power requirements will be assessed by Vector/Northpower and upgraded accordingly if required within the road reserve.

3.7.2 Gas

Underground gas is available in Pigeon Mountain Road and Compass Point Way. New underground connections to the existing gas infrastructure located along Pigeon Mountain Road and Compass Point Way will be provided to serve the development where necessary. The gas requirements will be assessed by Vector and upgraded accordingly if required within the road reserve.

3.7.3 Telecommunications

Underground telecommunications are available in Pigeon Mountain Road and Compass Point Way. New underground telecommunications connections to the existing infrastructure located along Pigeon Mountain Road and Compass Point Way will be able to be provided to serve the development. The telecommunications requirement will be assessed by Chorus/Ventia and upgraded accordingly if required within the road reserve.

4 CONCLUSION

The proposal to undertake a 87 lot subdivision at 3 Pigeon Mountain Road, Half Moon Bay, along with the removal of the existing dwelling and garage is considered feasible through the provision of stormwater, wastewater, utilities, water supply and access in accordance with relevant Unitary Plan requirements, Engineering Standards and Construction Good Practice.

Mitigation of effects of construction and subsequent use are able to be practicably undertaken.

Sediment controls can be erected to mitigate the potential adverse effects of sediment laden runoff from the installation of services which will be of a small scale with rapid stabilisation for the development.

Construction of infrastructure for the development is feasible to serve the proposed development, with minimal adverse effects.

Water and utility services will be provided by underground means by way of connection to the existing reticulation in Pigeon Mountain Road and Compass Point Way.

The parent site has overland flow path and may be subjected to inundation. Minimum floor levels for the building platforms have been provided. It is proposed that with the recommendations in the flood report be adopted and with the existing and proposed infrastructure, the site can be suitably serviced and that Resource Consent conditions may be set to allow development in accordance with Council Development Standards.

Report prepared by
AIREY CONSULTANTS LTD

Weng

Samson Weng
Civil Engineer
BE Hons (Civil)

Reviewed and approved by
AIREY CONSULTANTS LTD

Royden Tsui

Royden Tsui
Associate Director
CPEng(NZ), CMEngNZ, IntPE(NZ), MEPM (hons), BE (Civil)

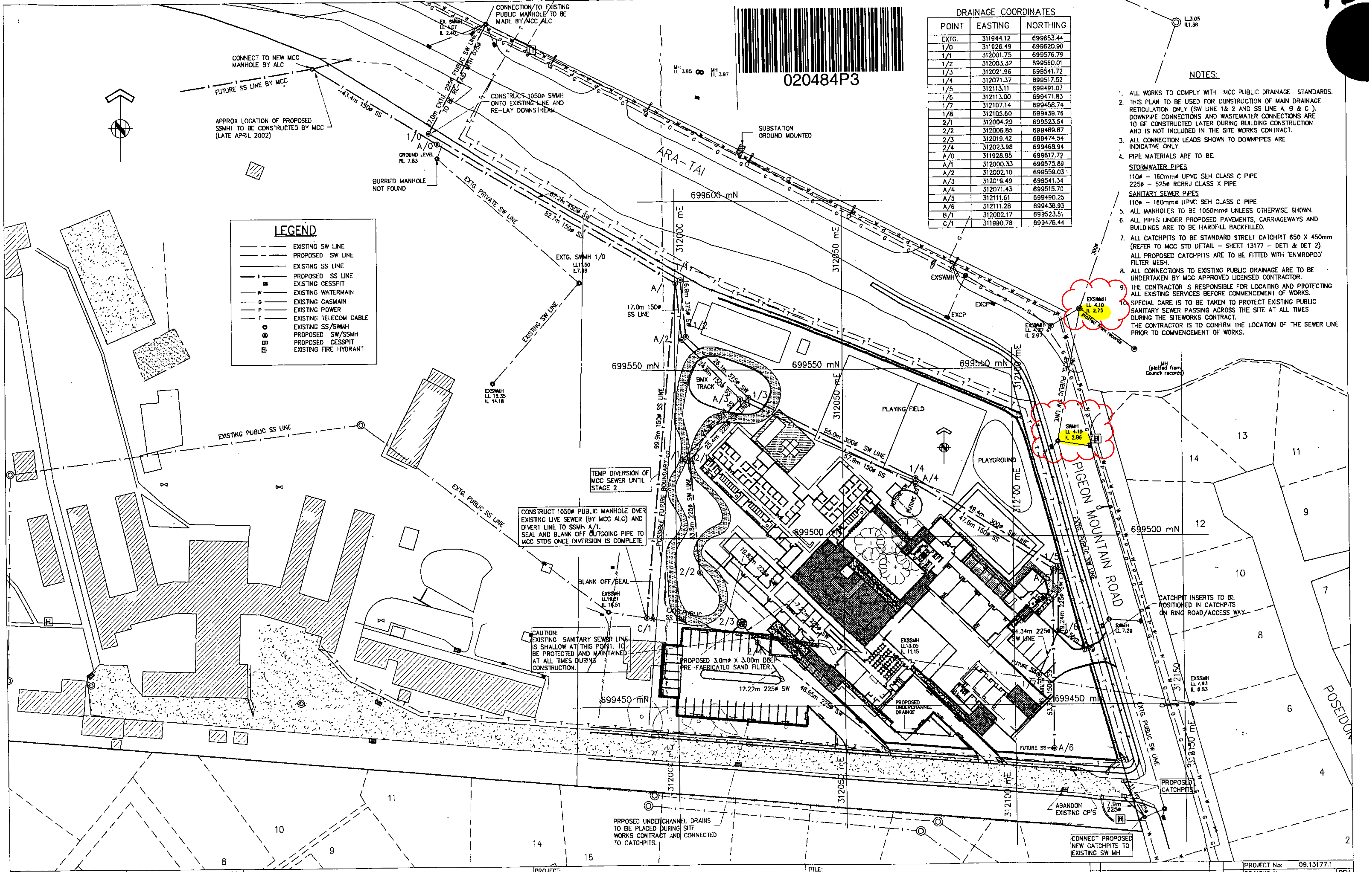
Appendix A

- Property Files As-built Plans

- Preliminary Engineering Plans

P3

020484P3



DRAINAGE COORDINATES

POINT	EASTING	NORTHING
EXTG.	311944.12	699653.44
1/0	311926.49	699620.90
1/1	312001.75	699576.79
1/2	312003.32	699560.01
1/3	312021.96	699541.72
1/4	312071.37	699517.52
1/5	312113.11	699491.07
1/6	312113.00	699471.83
1/7	312107.14	699458.74
1/8	312105.60	699439.76
2/1	312004.29	699523.54
2/2	312006.85	699489.87
2/3	312019.42	699474.54
2/4	312023.98	699468.94
A/0	311928.95	699617.72
A/1	312000.33	699575.89
A/2	312002.10	699559.03
A/3	312019.49	699541.34
A/4	312071.43	699515.70
A/5	312111.61	699490.25
A/6	312111.28	699436.93
B/1	312002.17	699523.51
C/1	311990.78	699476.44

NOTES:

1. ALL WORKS TO COMPLY WITH MCC PUBLIC DRAINAGE STANDARDS.
2. THIS PLAN TO BE USED FOR CONSTRUCTION OF MAIN DRAINAGE RETICULATION ONLY (SW LINE 1& 2 AND SS LINE A, B & C). DOWNPIPE CONNECTIONS AND WASTEWATER CONNECTIONS ARE TO BE CONSTRUCTED LATER DURING BUILDING CONSTRUCTION AND IS NOT INCLUDED IN THE SITE WORKS CONTRACT.
3. ALL CONNECTION LEADS SHOWN TO DOWNPIPES ARE INDICATIVE ONLY.
4. PIPE MATERIALS ARE TO BE:

   STORMWATER PIPES

   110ø – 160mmø UPVC SEH CLASS C PIPE
   225ø – 525ø RCRRJ CLASS X PIPE

   SANITARY SEWER PIPES

   110ø – 160mmø UPVC SEH CLASS C PIPE
5. ALL MANHOLES TO BE 1050mmø UNLESS OTHERWISE SHOWN.
6. ALL PIPES UNDER PROPOSED PAVEMENTS, CARRIAGEWAYS AND BUILDINGS ARE TO BE HARDFILL BACKFILLED.
7. ALL CATCHPITS TO BE STANDARD STREET CATCHPIT 650 X 450mm (REFER TO MCC STD DETAIL – SHEET 13177 – DET1 & DET 2). ALL PROPOSED CATCHPITS ARE TO BE FITTED WITH 'ENVIROPOD' FILTER MESH.
8. ALL CONNECTIONS TO EXISTING PUBLIC DRAINAGE ARE TO BE UNDERTAKEN BY MCC APPROVED LICENSED CONTRACTOR.
9. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL EXISTING SERVICES BEFORE COMMENCEMENT OF WORKS.
10. SPECIAL CARE IS TO BE TAKEN TO PROTECT EXISTING PUBLIC SANITARY SEWER PASSING ACROSS THE SITE AT ALL TIMES DURING THE SITEWORKS CONTRACT. THE CONTRACTOR IS TO CONFIRM THE LOCATION OF THE SEWER LINE PRIOR TO COMMENCEMENT OF WORKS.

LEGEND

——— – ———	EXISTING SW LINE
━━━ ━ ━━━	PROPOSED SW LINE
————————	EXISTING SS LINE
━━ I ━━━	PROPOSED SS LINE
■	EXISTING CESSPIT
—— W ——	EXISTING WATERMAIN
—— G ——	EXISTING GASMAIN
—— P ——	EXISTING POWER
—— T ——	EXISTING TELECOM CABLE
●	EXISTING SS/SWMH
◉	PROPOSED SW/SSMH
▥	PROPOSED CESSPIT
▣	EXISTING FIRE HYDRANT

SURVEYED BY:		DRAWN BY:	Adp
DATE SURVEYED:		DATE PLOTTED:	12.03.02
SDRMAP REF:		CAD REFERENCE:	CAD/LANDDEV/13177-DR1
		CAD XREFS:	BASE-XREF; CONT-XREF, XREF-NEW
DESIGNED:	Adp 10/01	APPROVED:	JCT
CHECKED:	amb		

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HG

CONSULTING ENGINEERS SURVEYORS PLANNERS

PROJECT:

CHILDRENS HEALTH CAMP
OF NEW ZEALAND
PAKURANGA

TITLE:

PROPOSED DRAINAGE
PLAN

REF	AMENDMENTS	BY	DATE
E	SAND FILTER MOVED/NEW MH 2/4	ARS	15.04.02
D	MANHOLE 1/0 MOVED	AMB	14.3.02
C	MINOR AMENDMENTS	ADP	8.02.002
B	SAND FILTER ADDED AT 2/3	AMB	21.12.01
A	DRAFT ISSUE	AMB	24.10.01

PROJECT No: 09.13177.1

DRAWING No: 13177–DR1

REV E

ORIGINAL SCALE: 1:500
REDUCED SCALE: 1:1000

A1

AS BUILT - JUNE 2003

PLUMBCO LTD.
P.O. BOX 101-198,
NSMC, AUCKLAND.
Ph. (09) 379-7545.
Fax: (09) 379-7544.

Rev No.	Revision	Date	Date	Issued

HARRISON GRIERSON
CONSULTANTS LTD
71 Gt Sth Rd
NEWMARKET

Client
THE NEW ZEALAND FOUNDATION
FOR CHILDREN AND
FAMILY HEALTH DEVELOPMENT

Project PAKURANGA CHILDREN'S
HEALTH CAMP

Drawing Title DRAINAGE SERVICES
INTERNAL BUILDING PRIVATE
DRAIN LAYOUT PLAN

Drawn	Checked	Date

Scale
A1 1:250, A3 1:500

Project No.	Drawing No.	Revision
13177	DR 2	AB

I, GLEN ALBERT CORNELIUS, REGISTERED ENGINEER, HEREBY CERTIFY THAT THE MANHOLE POSITIONS, SCHEDULE OF COORDINATES, INVERT AND LID LEVELS AND DISTANCES BETWEEN MANHOLES AND PIPE SIZES ARE CORRECT. CONNECTIONS TO THE LINES HAVE BEEN PLOTTED AND DIMENSIONED FROM INFORMATION SUPPLIED TO US BY THE CONTRACTOR FOR THE WORK.

GA Cornelius
REGISTERED ENGINEER

LEGEND:

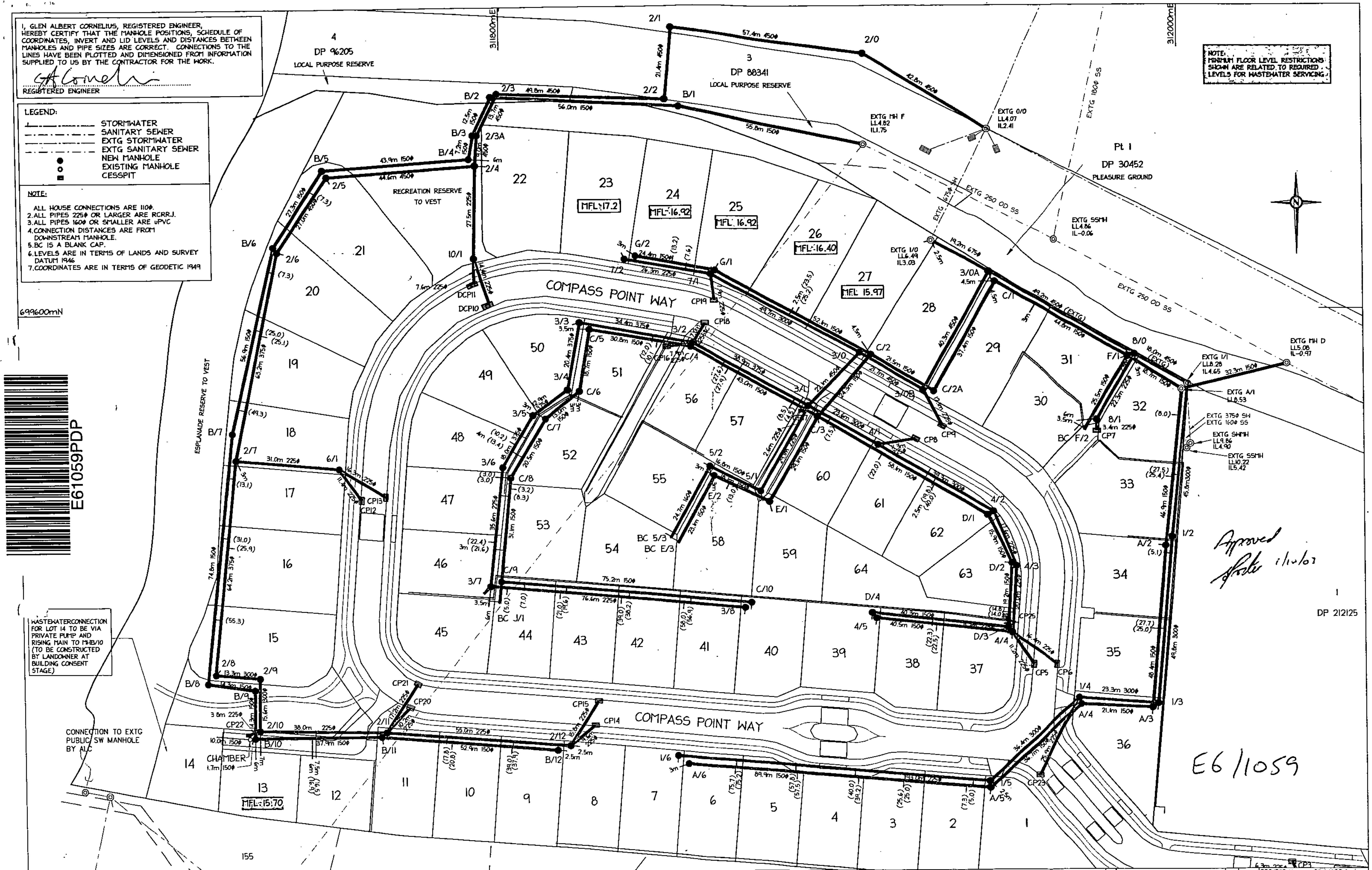
—·—·—·—	STORMWATER
—·—·—·—	SANITARY SEWER
—·—·—·—	EXTG STORMWATER
—·—·—·—	EXTG SANITARY SEWER
●	NEW MANHOLE
○	EXISTING MANHOLE
▬	CESSPIT

NOTE:

ALL HOUSE CONNECTIONS ARE 110ϕ.
2. ALL PIPES 225ϕ OR LARGER ARE RCRRJ.
3. ALL PIPES 160ϕ OR SMALLER ARE uPVC
4. CONNECTION DISTANCES ARE FROM DOWNSTREAM MANHOLE.
5. BC IS A BLANK CAP.
6. LEVELS ARE IN TERMS OF LANDS AND SURVEY DATUM 1946
7. COORDINATES ARE IN TERMS OF GEODETIC 1949

NOTE:
MINIMUM FLOOR LEVEL RESTRICTIONS SHOWN ARE RELATED TO REQUIRED LEVELS FOR WASTEWATER SERVICING.

WASTEWATERCONNECTION FOR LOT 14 TO BE VIA PRIVATE PUMP AND RISING MAIN TO MHB/10 (TO BE CONSTRUCTED BY LANDOWNER AT BUILDING CONSENT STAGE)



E61059PDP

Approved
[signature] 1/10/03

E6/1059

SURVEYED BY: M Stevens
DATE SURVEYED: SEP/2003
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DESIGNED:
CHECKED: DTJM SEP/2003
DRAWN BY: BB SEP/2003
DATE PLOTTED: 29.09.03
CAD REFERENCE: 14152-AB03.dwg
CAD XREF'S:
APPROVED:

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CONSULTING ENGINEERS SURVEYORS PLANNERS

PROJECT:
ST JUST ENTERPRISES LIMITED
COMPASS POINT SUBDIVISION
HALF MOON BAY

TITLE:
DRAINAGE AS-BUILT
SHEET 1 OF 2 SHEETS

REF	AMENDMENTS	BY	DATE

PROJECT No: 09.14152.1
DRAWING No: 14152-AB03
REV
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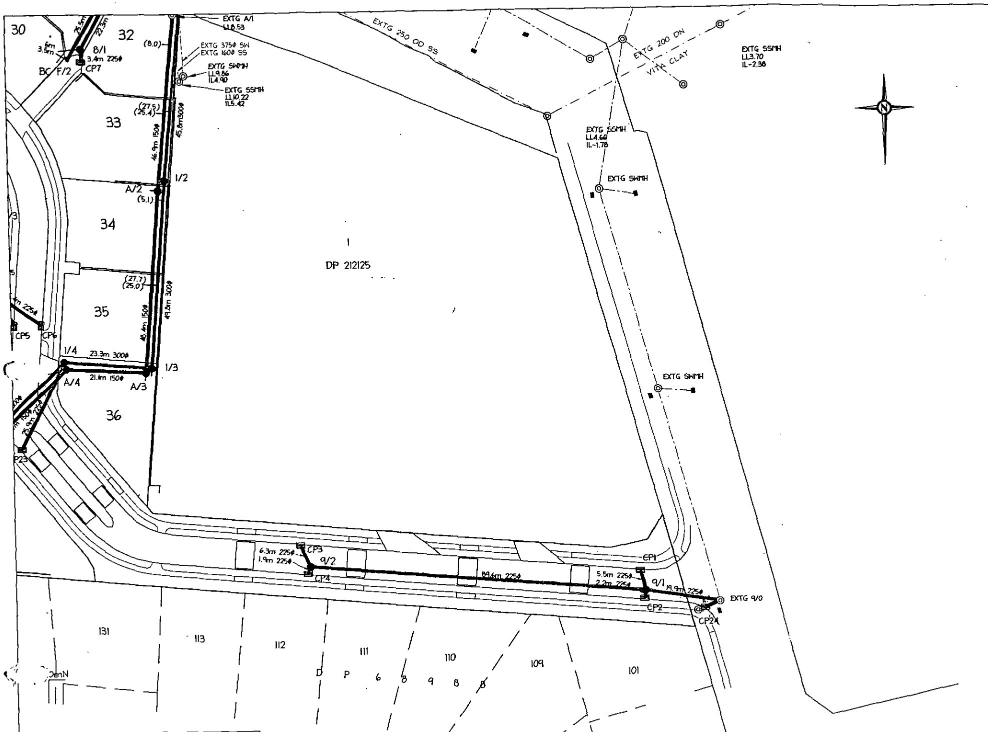

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2/4	699643.36	311792.47	15.37	11.60
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4/5	699508.01	311910.07	22.12	20.89
5/1	699545.97	311876.38	20.04	18.24
5/2	699553.48	311861.30	10.91	18.58
BC 5/3			N/A	N/A
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MH No	Northing	Easting	LL	IL
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B/4	699645.31	311790.67	14.74	11.32
B/5	699642.41	311746.83	15.39	12.07
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C/2	699586.55	311909.27	18.39	14.77
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C/7	699567.85	311812.34	19.66	17.63
C/8	699550.36	311801.74	19.70	17.90
C/9	699519.48	311798.34	20.74	18.24
C/10	699512.80	311873.29	21.88	20.55
D/1	699538.62	311943.33	19.18	18.15
D/2	699524.29	311950.16	19.35	18.36
D/3	699505.22	311948.93	20.94	18.67
D/4	699509.57	311908.86	21.96	18.18
E/1	699542.86	311878.98	20.12	18.72
E/2	699550.66	311862.66	19.95	18.72
BC E/3			N/A	N/A
F/1	699585.92	311984.91	8.71	6.02
BC F/2			N/A	N/A
G/1	699611.79	311863.66	17.89	15.72
G/2	699616.26	311839.68	17.94	16.01
BC J/1			N/A	N/A
Chamber	699473.53	311722.23	14.92	14.28

CP No	Northing	Easting
CP1	699426.91	312122.50
CP2	699419.47	312123.63
CP3	699434.83	312032.12
CP4	699427.33	312034.00
CP5	699493.99	311956.40
CP6	699493.96	311963.66
CP7	699563.55	311975.89
CP8	699561.37	311922.31
CP9	699565.24	311930.22
CP12	699544.28	311757.04
CP13	699545.16	311764.39
CP14	699476.47	311825.61
CP15	699483.72	311826.71
CP16	699589.23	311848.74
CP17	699569.85	311888.43
CP18	699596.20	311860.35
CP19	699602.87	311863.24
CP20	699482.47	311770.45
CP21	699489.42	311772.84
CP22	699474.77	311721.81
CP23	699461.04	311957.82
CP24	699416.93	312139.60
CP25	699508.25	311948.42
DCP10	699602.12	311796.11
DCP11	699608.25	311791.72

Approved
1/10/07

E6/1059

LEGEND:

————————	STORMWATER
—·—·—·—·	SANITARY SEWER
—— — ——	EXTG STORMWATER
— · — · — ·	EXTG SANITARY SEWER
●	NEW MANHOLE
○	EXISTING MANHOLE
▬	CESSPIT

NOTE:

1. ALL HOUSE CONNECTIONS ARE 110ϕ.
2. ALL PIPES 225ϕ OR LARGER ARE RCRRJ.
3. ALL PIPES 160ϕ OR SMALLER ARE uPVC
4. CONNECTION DISTANCES ARE FROM DOWNSTREAM MANHOLE.
5. BC IS A BLANK CAP.
6. LEVELS ARE IN TERMS OF LANDS AND SURVEY DATUM 1946
7. COORDINATES ARE IN TERMS OF GEODETIC 1949

I, GLEN ALBERT CORNELIUS, REGISTERED ENGINEER, HEREBY CERTIFY THAT THE MANHOLE POSITIONS, SCHEDULE OF COORDINATES, INVERT AND LID LEVELS AND DISTANCES BETWEEN MANHOLES AND PIPE SIZES ARE CORRECT. CONNECTIONS TO THE LINES HAVE BEEN PLOTTED AND DIMENSIONED FROM INFORMATION SUPPLIED TO US BY THE CONTRACTOR FOR THE WORK.

GA Cornelius
REGISTERED ENGINEER

312000mE

SURVEYED BY:	M Stevens	DRAWN BY:	BB SEP/2003
DATE SURVEYED:	SEP/2003	DATE PLOTTED:	29.09.03
SORMAP REF:		CAD REFERENCE:	14152-AB03.dwg
		CAD XREF'S:	
DESIGNED:		APPROVED:	
CHECKED: DTJM SEP/2003			

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HARRISON GRIERSON
HG
CONSULTING ENGINEERS SURVEYORS PLANNERS

PROJECT:
ST JUST ENTERPRISES LIMITED
COMPASS POINT SUBDIVISION
HALF MOON BAY

TITLE:
DRAINAGE AS-BUILT
SHEET 2 OF 2 SHEETS

REF	AMENDMENTS	BY	DATE

PROJECT No: 09.14152.1
DRAWING No: 14152-AB04
REV
ORIGINAL SCALE: 1:500
REDUCED SCALE: 1:1000(A3)
A1

Appendix B

- Engineering Calculations

ENGINEERING CALCULATIONS

FOR

Client: HND HMB Ltd

Address: 3 Pigeon Mountain Road, Half Moon Bay

Job No: 220571/01

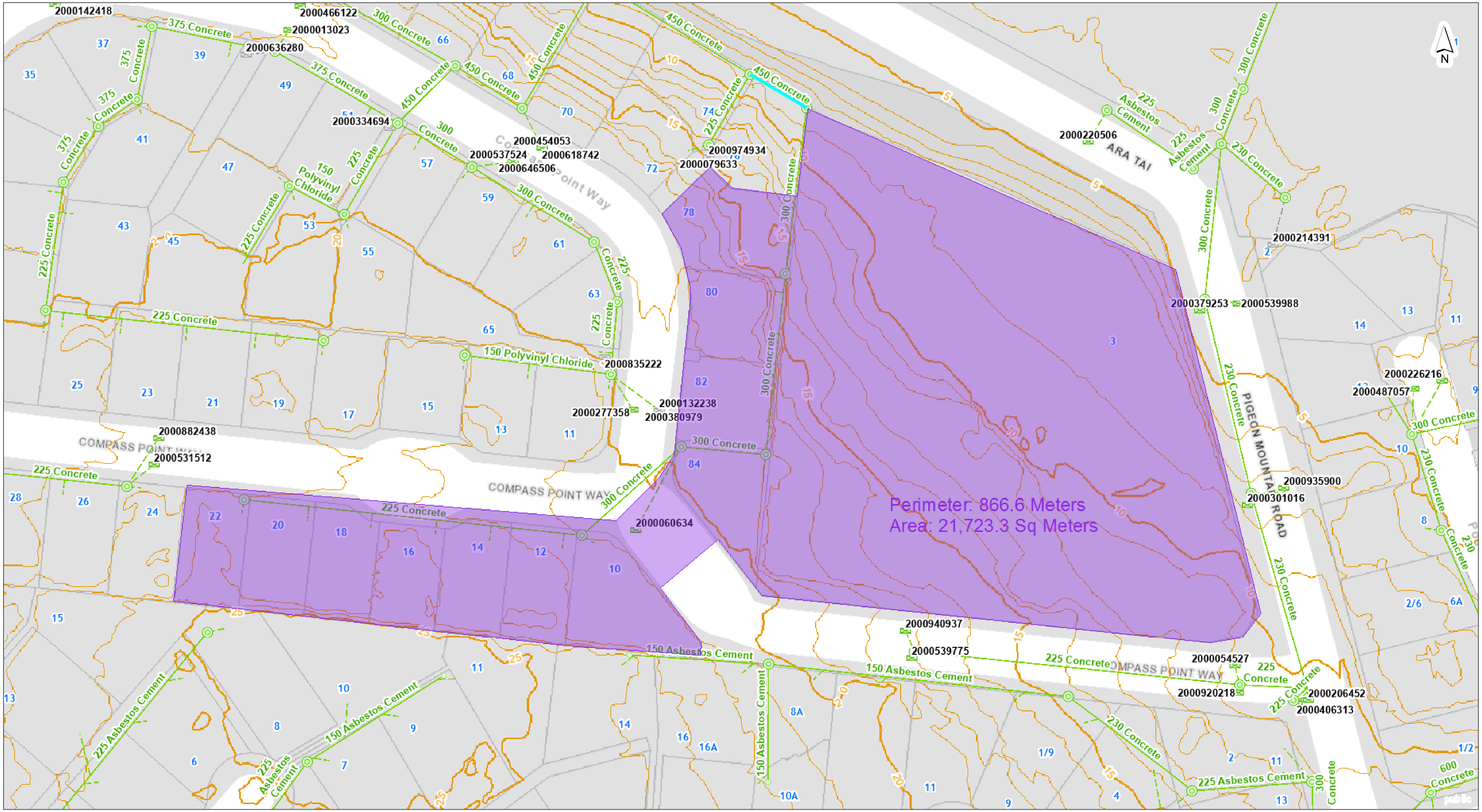
Date: 24 October 2023

Design Engineer: Samson Weng

Reviewed by: Royden Tsui

Contact Phone: (09) 534 6523

Email: samsonw@aireys.co.nz



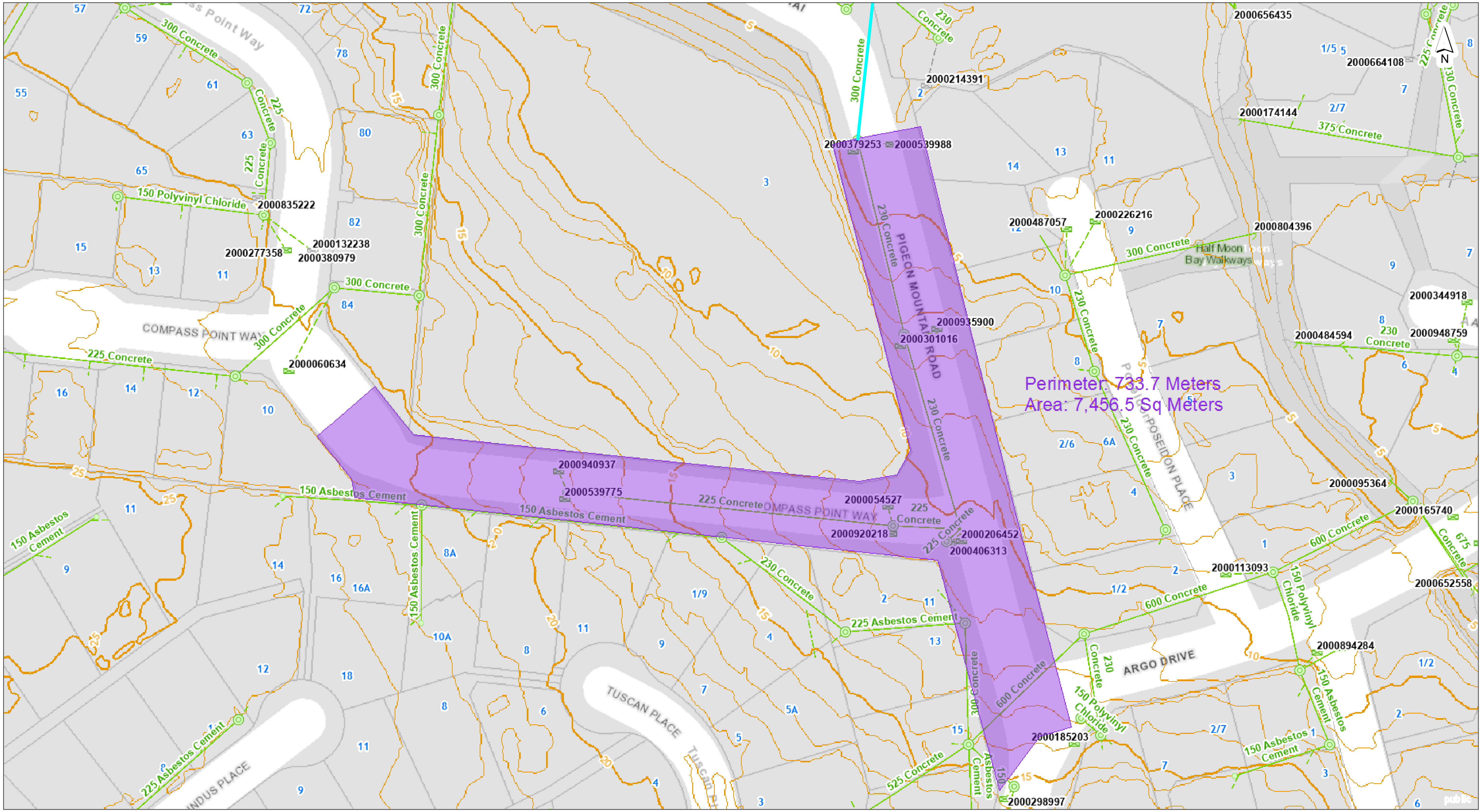
450mmØ 2000600476 SW Catchment

0 10 20 30
Meters

Scale @ A3
= 1:1,000

Date Printed:
21/02/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau



300mmØ 2000633032 SW Catchment

0 10 20 30
Meters

Scale @ A3
= 1:1,000

Date Printed:
15/05/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau

S92 - DRAFT

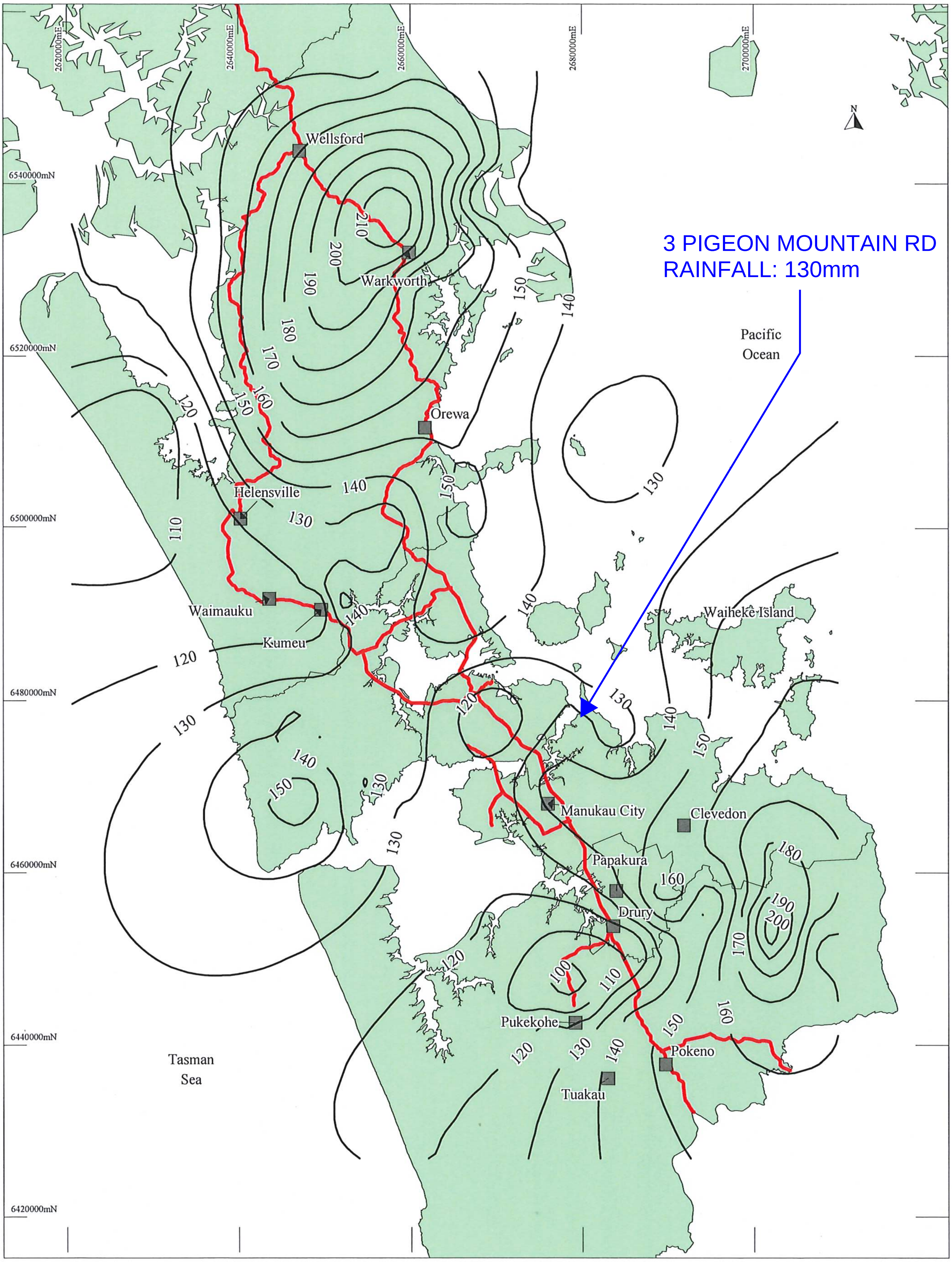
asc architects

3 PIGEON MOUNTAIN ROAD

COMPASS POINT ROAD
PROPOSED SITE PLAN

Project No. :	**JOB NO. 22924**
Scale:	1:250@ **A1**
Date:	25/09/2023
Revison:	B

RA0100



3 PIGEON MOUNTAIN RD
RAINFALL: 130mm

Auckland **Regional** Council

Legend: — 90 — Rainfall Contour (mm)

━━ State Highways

Figure A.3
10 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)

(Revised 25/08/1999)

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\10yrari.wor Date: 25/08/1999

TP108 Rainfall

Rainfall Depth	130	mm
ARI	10	years

Duration hr	**Duration** mins	**Depth** mm	**Intensity** mm/hr (Q_{10})
0.166	10.0	16.95	**102.13**
0.333	20.0	26.07	78.29
0.5	30	32.15	64.31
1	60	45.33	45.33
2	120	61.22	30.61
6	360	93.59	15.60
12	720	120.08	10.01
24	1440	147.16	6.18

ARI	Ratio
2	9.0%
5	11.3%
10	13.2%
20	15.1%
50	16.8%
100	16.8%

ARI:	10
Ratio:	13.2%

EXISTING 450mmØ PIPE CAPACITY (2000600476)

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 1
CALCS. BY: SW
DATE: 21/02/2023

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate

$Q = 2.78\ C\ i\ A$

Rational Formula

Storm Scenario		**10%**	AEP
Coefficent of Runoff	C	**0.65**	
Rainfall Intensity	i	**102.1**	mm/hr
Area of Runoff	A	**2.17**	ha
Overland Runoff Rate	**Q**	**400**	**l/s**

Design Capacity

$V_d = {}^1/n\ R^{2/3}\ S^{1/2}$

Manning's Formula

Pipe Material		**Concrete**		
Pipe Size		**450**	mm	
Pipe Slope	S	**1.50%**		
Number of Barrels		**1**		
Manning's n	n	0.012		
Pipe Design Flow	Q_d	**378.3**	**l/s**	**NG**

EXISTING 300mmØ PIPE CAPACITY (2000633032)
CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 2
CALCS. BY: SW
DATE: 21/02/2023

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate

$Q = 2.78\ C\ i\ A$

Rational Formula

Storm Scenario		**10%**	AEP
Coefficent of Runoff	C	**0.65**	
Rainfall Intensity	i	**102.1**	mm/hr
Area of Runoff	A	**0.75**	ha
Overland Runoff Rate	**Q**	**137**	**l/s**

Design Capacity

$V_d = {}^{1}/n\ R^{2/3}\ S^{1/2}$

Manning's Formula

Pipe Material		**Concrete**		
Pipe Size		**300**	mm	
Pipe Slope	S	**0.00%**		
Number of Barrels		**1**		
Manning's n	n	0.012		
Pipe Design Flow	Q_d	**7.3**	**l/s**	**NG**

PIPE FLOW CALCULATIONS					REFERENCE
Overland Flow Rate		**$Q = 2.78\ C\ i\ A$**			*Rational Formula*
Storm Scenario		**10%**	AEP		
Coefficent of Runoff	C	**0.65**			
Rainfall Intensity	i	**102.1**	mm/hr		
Area of Runoff	A	**0.26**	ha		
Overland Runoff Rate	**Q**	**62**	**l/s**		*From Tank 1 (Hec-HMS)*
Design Capacity		**$V_d = {}^{1}/n\ R^{2/3}\ S^{1/2}$**			*Manning's Formula*
Pipe Material		**uPVC**			
Pipe Size		**300**	mm		
Pipe Slope	S	**0.75%**			*minimum gradient*
Number of Barrels		**1**			
Manning's n	n	0.011			
Pipe Design Flow	**Q_d**	**99.0**	**l/s**	**OK**	
Pipe Flow Charateristics					
Flow Ratio	q/Q	0.63			
Approx Depth Ratio	d/D	0.59			
Approx Velocity Ratio	v/V	1.06			
Approx Pipe Flow Velocity	**V**	**1.48**	**m/s**		

SW 4 (From Existing to SWMH)

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 4
CALCS. BY: SW
DATE: 24/10/2023

PIPE FLOW CALCULATIONS					REFERENCE
Overland Flow Rate		**$Q = 2.78\ C\ i\ A$**			*Rational Formula*
Storm Scenario		**10%**	AEP		
Coefficent of Runoff	C	**0.65**			
Rainfall Intensity	i	**102.1**	mm/hr		*Flow from Tanks 4 and 6 combined (HEC-HMS)*
Area of Runoff	A	**0.68**	ha		
Overland Runoff Rate	**Q**	**148**	**l/s**		
Design Capacity		**$V_d = {}^{1}/n\ R^{2/3}\ S^{1/2}$**			*Manning's Formula*
Pipe Material		**uPVC**			
Pipe Size		**300**	mm		
Pipe Slope	S	**2.00%**			
Number of Barrels		**1**			
Manning's n	n	0.011			
Pipe Design Flow	**Q_d**	**161.6**	**l/s**	**OK**	
Pipe Flow Charateristics					
Flow Ratio	q/Q	0.92			
Approx Depth Ratio	d/D	0.80			
Approx Velocity Ratio	v/V	1.14			
Approx Pipe Flow Velocity	**V**	**2.61**	**m/s**		

SW4 (Detention 2)

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 5
CALCS. BY: SW
DATE: 24/10/2023

PIPE FLOW CALCULATIONS

REFERENCE

Overland Flow Rate

$Q = 2.78\ C\ i\ A$

Rational Formula

Storm Scenario		**10%**	AEP	
Coefficent of Runoff	C	**0.65**		
Rainfall Intensity	i	**102.1**	mm/hr	
Area of Runoff	A	**0.31**	ha	
Overland Runoff Rate	**Q**	**72**	**l/s**	*From HEC-HMS*

Design Capacity

$V_d = {}^{1}/n\ R^{2/3}\ S^{1/2}$

Manning's Formula

Pipe Material		**uPVC**			
Pipe Size		**300**	mm		
Pipe Slope	S	**0.75%**			*min grade*
Number of Barrels		**1**			
Manning's n	n	0.011			
Pipe Design Flow	Q_d	**99.0**	**l/s**	**OK**	

Pipe Flow Charateristics

Flow Ratio	q/Q	0.73	
Approx Depth Ratio	d/D	0.66	
Approx Velocity Ratio	v/V	1.10	
Approx Pipe Flow Velocity	**V**	**1.54**	**m/s**

SW4 to SW5 (Detention Tank 3 Discharge)

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 6
CALCS. BY: SW
DATE: 24/10/2023

PIPE FLOW CALCULATIONS					**REFERENCE**
Overland Flow Rate		**$Q = 2.78 C i A$**			*Rational Formula*
Storm Scenario		**10%**	AEP		
Coefficent of Runoff	C	**0.65**			
Rainfall Intensity	i	**102.1**	mm/hr		
Area of Runoff	A	**0.37**	ha		
Overland Runoff Rate	**Q**	**76**	**l/s**		*From HEC-HMS*
Design Capacity		**$V_d = {}^1/n\, R^{2/3}\, S^{1/2}$**			*Manning's Formula*
Pipe Material		**uPVC**			
Pipe Size		**300**	mm		
Pipe Slope	S	**0.75%**			*min grade*
Number of Barrels		**1**			
Manning's n	n	0.011			
Pipe Design Flow	**Q_d**	**99.0**	**l/s**	**OK**	
Pipe Flow Charateristics					
Flow Ratio	q/Q	0.77			
Approx Depth Ratio	d/D	0.68			
Approx Velocity Ratio	v/V	1.11			
Approx Pipe Flow Velocity	**V**	**1.55**	**m/s**		

Airey

Civil, Structural
and Fire Engineers

Takapuna **Botany** Queenstown

Client:			**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	15/05/2023

Watercare Code of Practice Wastewater Flow Calculations

🟨 ***Enter Values***
🟩 ***Result Cells***

1. Occupany Allowance

EXISTING SITE CONDITION - SIMILAR TO SCHOOL

Number of dwellings = 13
Watercare Design Occupancy (per dwelling) = 3
Total occupancy for design purposes = 39 maximum 39 people overnight

2. Residential Wastewater Flows

Peak Design Flow (PWWF) (Litres/Person/Day) = 1206
Self-Cleansing Design Flow (Litres/Person/Day) = 540
Residential Wastewater Design Flow (Litres/sec) = 0.54
Self-Cleansing Design Flow (Litres/sec) = 0.24

3. Commercial, Industrial or CBD Wastewater Design Flows

Design Flow (Litres/employee/day) = 45 Table 5.1.F Watercare CoP for School
Number of Employee = 60
Commercial Peak Design Flow (Litres/sec) = 0.21
Commercial Self-Cleansing Design Flow (Litres/sec) 0.06

Total Wastewater Design Flow (Litres/sec) = 0.75

PIPE CAPACITY FORMULA

Colebrook-White $V=-2\sqrt{(2gDS)}\log(ks/3.7D+2.51\upsilon/(D\sqrt{(2gDS)}))$

υ= 1.141 x10^6 kinematic viscosity of fluid
(water at 15 degrees)
k_s= 1.5 mm (effective roughness)
D= diameter
S= hydraulic gradient
R= d/4 (circ. pipes)
Q= VA

Pipe Grade S(%)	**Pipe Dia D (mm)**	**Pipe Vel'y (m/s)**	**PIPE CAP'Y (l/s)**	**DESIGN FLOW (l/s)**
0.73	150	0.75	**13.2**	**0.8**

Notes:

1) 150mm diameter critical pipe has sufficient capacity to cater for the proposed development

Airey	**Civil, Structural and Fire Engineers**	**Client:**		**Sheet No:** 1
		Job:	3 Pigeon Mountain Road Half Moon Bay	**Job No:** 220571/01
Takapuna **Botany** Queenstown		**Calc's By:** **Reviewed By:**	SW RCHT	**Phone:** 09 534 6523 — **Date:** 15/05/2023

Watercare Code of Practice Wastewater Flow Calculations

🟨 ***Enter Values***
🟩 ***Result Cells***

1. Occupany Allowance

PROPOSED DEVELOPMENT

Number of dwellings = 92
Watercare Design Occupancy (per dwelling) = 3
Total occupancy for design purposes = 276

2. Residential Wastewater Flows

Peak Design Flow (PWWF) (Litres/Person/Day) = 1206
Self-Cleansing Design Flow (Litres/Person/Day) = 540
Residential Wastewater Design Flow (Litres/sec) = 3.85
Self-Cleansing Design Flow (Litres/sec) = 1.73

3. Commercial, Industrial or CBD Wastewater Design Flows

Design Flow (Litres/employee/day) = 0 Table 5.1.F Watercare CoP for School
Number of Employee = 0
Commercial Peak Design Flow (Litres/sec) = 0.00
Commercial Self-Cleansing Design Flow (Litres/sec) 0.00

Total Wastewater Design Flow (Litres/sec) = 3.85

PIPE CAPACITY FORMULA

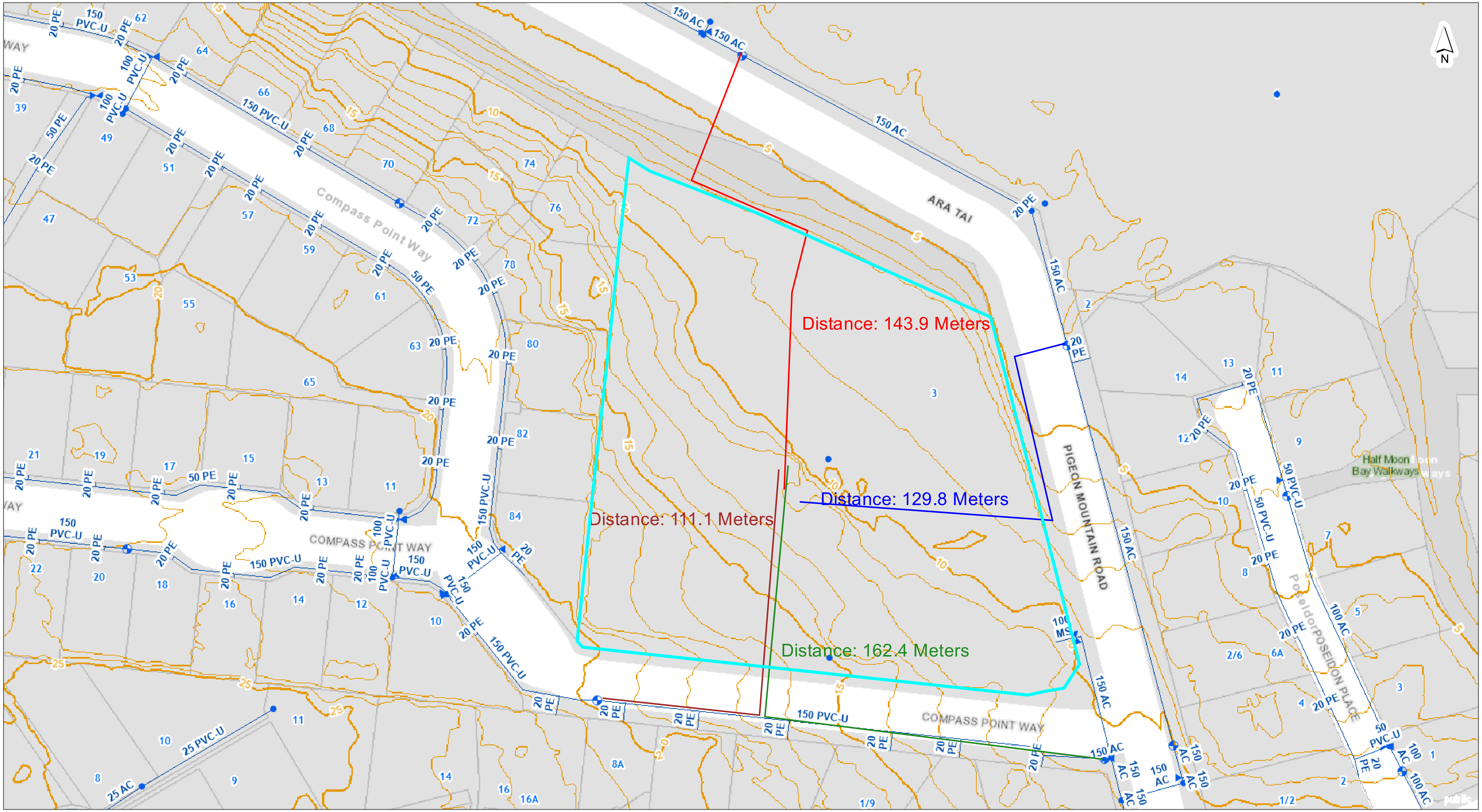
Colebrook-White $V=-2\sqrt{(2gDS)}\log(ks/3.7D+2.51\upsilon/(D\sqrt{(2gDS)}))$

υ= 1.141 $x10^6$ kinematic viscosity of fluid (water at 15 degrees)
k_s= 1.5 mm (effective roughness)
D= diameter
S= hydraulic gradient
R= d/4 (circ. pipes)
Q= VA

Pipe Grade S(%)	Pipe Dia D (mm)	Pipe Vel'y (m/s)	PIPE CAP'Y (l/s)	DESIGN FLOW (l/s)
0.75	150	0.76	**13.4**	**3.9**

Notes:

1) 150mm diameter critical pipe has sufficient capacity to cater for the proposed development



Fire Hydrant

0 10 20 30
Meters

Scale @ A3
= 1:1,000

Date Printed:
9/02/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Appendix C

- Stormwater Management Plan (SMP)

STORMWATER MANAGEMENT PLAN (SMP)

FOR HND HMB LTD

AT 3 PIGEON MOUNTAIN ROAD, HALF MOON BAY

Job No: 220571/01

Issue Date: 02 February 2024

Airey Consultants Ltd | Botany Office
PO Box 259 339, Botany, 2163 | Level 1, Fountain Lane North, Botany Town Centre
T: +64 9 534 6523 E: botany@aireys.co.nz

Engineering
Ingenuity

Document Control Record

Document Prepared By:	**Client:**
Airey Consultants Limited	HND HMB Ltd
Level 1, Fountain Lane North, Botany Town Centre	3 Pigeon Mountain Road, Half Moon Bay
PO Box 259 339, Botany, Auckland 2163	

T: +64 9 534 6523
E: samsonw@aireys.co.nz
W: **aireys.co.nz**

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Revision	Description	Issue Date	Prepared by	Reviewed by
0	SMP – Issue 1	15/05/2023	SW	RCHT
1	SMP – Issue 2	24/10/2023	SW	RCHT
2	Revised Layout	02/02/2024	SW	RCHT

Contents

Executive Summary

This Stormwater Management Plan addresses the stormwater management and treatment considerations for the proposed development at 3 Pigeon Mountain Road, Half Moon Bay. The proposed development will involve the development of 88 residential units. With the development classified as a large brownfields development, this Stormwater Management Plan has been prepared to accompany the Stormwater Network Discharge Consent application.

This plan is intended to provide a framework for the design of new stormwater reticulation and treatment associated with the development of the site. It is concluded that the development can be adequately serviced by the existing Stormwater network for storms up to the 10% AEP 10-minute storm events, which is what the existing infrastructure is designed to cater for. For storms above this, the existing overland flow paths will be able to service the development without causing further nuisance to the downstream properties.

1 INTRODUCTION

Airey Consultants Ltd have been engaged to prepare a stormwater management plan in support of a Resource Consent for the proposed development at 3 Pigeon Mountain Road, Half Moon Bay.

This Stormwater Management Plan describes the stormwater management approach to the proposed development. The Stormwater Assessment has been undertaken in accordance with the Auckland Council Unitary Plan requirements, along with the requirements of the Network Discharge Consent (NDC), Auckland Design Manual, and GD01.

2 EXISTING SITE APPRAISAL

2.1 Summary of Data sources and dates

Existing site appraisal item	*Source and date of data used*
Topography	• Third-party topographic survey, Envivo, 2022
Geotechnical/soil conditions	• Auckland Council Geology and Geotechnical Layer, accessed 2023 • Geotechnical Investigation Report, Total Ground Engineering, 2022
Existing stormwater network	• Auckland Council GeoMaps data, accessed 2023. • Third-party topographic survey, Envivo, 2022
Existing hydrological features	• Auckland Council GeoMaps Overland Flow Paths and Stream Layers, accessed 2023. • Auckland Land Surveys, 2019 Auckland Council Unitary Plan Viewer, significant ecological area layer, accessed 2023.
Flooding and flowpaths	• Auckland Council GeoMaps Overland Flow Paths Layer, accessed 2023. • Auckland Council GeoMaps Flood Plain Layer, accessed 2023.
Coastal Inundation	• Auckland Council GeoMaps Emergency Management Layer, accessed 2023.
Ecological/environmental areas	• Auckland Council GeoMaps Unitary Plan Viewer, Significant Ecological Area Layer, accessed 2023. • Auckland Council GeoMaps Unitary Plan Viewer, Significant Vegetation Layer, accessed 2023.
Cultural and heritage sites	• Auckland Council GeoMaps Cultural Heritage Site Layer, accessed 2023.

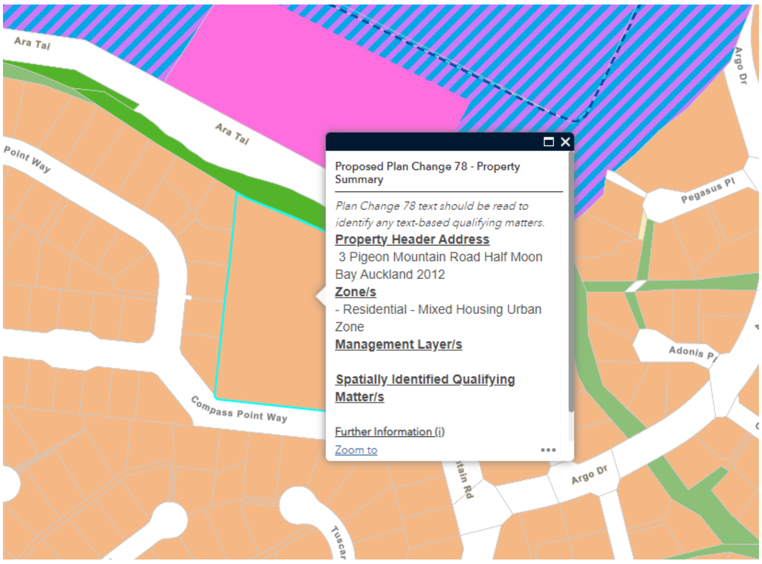
2.2 Location

The subject site comprises of the following parcels of land totalling 1.4073 Ha.

Site Elements	
Site address	• 3 Pigeon Mountain Road, Half Moon Bay
Legal description	• Lot 1 DP 212125
Current Zoning	• Residential – Mixed Housing Suburban Zone
Plan Change 78 Zoning	• Residential – Mixed Housing Urban Zone

Figure 1. Aerial view of Subject Site – Council Geomaps

Figure 2. Auckland Unitary Plan, Operative in Part: Zoning Map



Proposed Plan Change 78 - Property Summary

Plan Change 78 text should be read to identify any text-based qualifying matters.

Property Header Address

3 Pigeon Mountain Road Half Moon Bay Auckland 2012

Zone/s

- Residential - Mixed Housing Urban Zone

Management Layer/s

Spatially Identified Qualifying Matter/s

Further Information (i)

Zoom to

Figure 3. Pan Change 78 Proposed Zoning

2.3 Topography

The subject site slopes in a north easterly direction towards Pigeon Mountain Road and Ara Tai, with gradients ranging from 3.5% to 12.8%.

A 1% AEP minor overland flowpath originates from the site and exists the property at the eastern boundary.

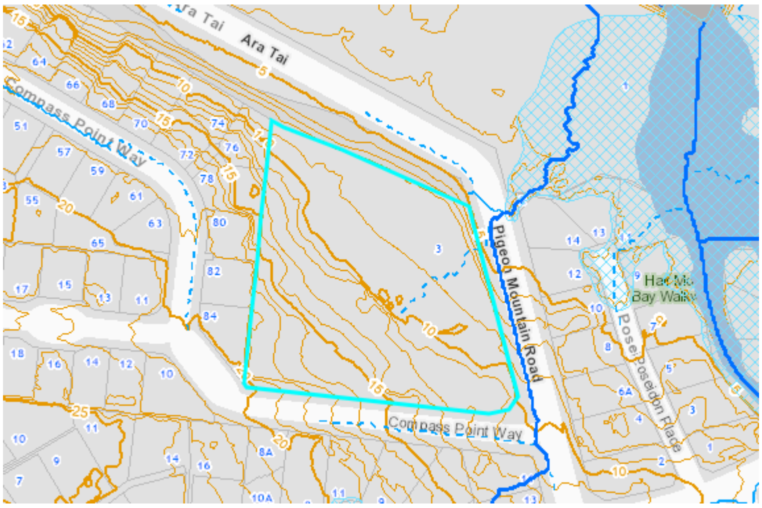


Figure 4. Aerial view of Subject Site – Council Geomap

2.4 Geotechnical

Below is an extract from the Geotechnical Report as prepared by Total Ground Engineering, dated 12 July 2022:

Reference has been made to the New Zealand Geology Web Map on the GNS website, http://data.gns.cri.nz/geology/, accessed on 10th June 2022 (refer Figure 7).

The maps indicate that the site is underlain by Tuff of the Auckland Volcanic Field (AVF, coloured purple in Figure 7). The AVF tuff comprises comminuted pre-volcanic materials with basaltic fragments, and unconsolidated ash and lapilli deposits. These volcanic materials can be spatially variable in terms of material types, often with abrupt end to ash deposits, with well sorted lapilli, tuff, ash and breccia at the margins.

The map indicates a geological boundary to the north of the site, mapped as East Coast Bays Formation (ECBF, coloured orange in Figure 7) of the Waitemata Group. The ECBF comprises alternating sandstone and mudstone with variable volcanic content and interbedded volcaniclastic grit beds.

The ECBF typically weathers at the surface forming stiff to very stiff silts and clays which can contain reactive clay mineralogy and be prone to shrinking and swelling due to varying moisture content conditions.

2.5 Existing Drainage Features and Stormwater Infrastructure

According to a topographical survey prepared by Envivo and Auckland Council Geomaps, there are 225mmØ stormwater pipes along the southern and north-eastern boundary. There is also an existing 300mmØ concrete public stormwater line running along the western boundary. The 225mmØ line runs along Pigeon Mountain Road and eventually connects into a 300mmØ stormwater drain crossing Pigeon Mountain Road and Ara Tai. The site currently discharges stormwater into SWMH 2000234285 which discharges into downstream 450mmØ stormwater drain.

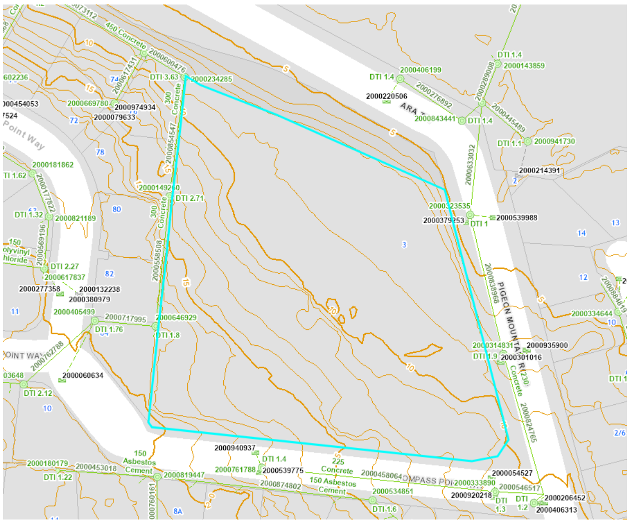


Figure 5. Existing Public Stormwater Network (Auckland Council Geomaps)

2.6 Receiving Environment

From the subject sites, the public stormwater network collects stormwater from a number of other upstream properties forming the Pakuranga – Tamaki River Catchment. The receiving catchment environment for this network is the Tamaki Catchment.

2.7 Existing Hydrological Features

There are no natural streams, wetlands or ponds in the development area.

2.8 Flooding and Flowpaths

2.8.1 Flood plain and Flood Sensitive Area

The site is not situated within the 100-year flood plain, nor flood sensitive area.

2.8.2 Overland Flow Paths

Council GIS Indicates that there is an overland flow path originating from the site. Please refer to **Overland Flowpath Assessment, Rev 2, dated 2 February 2024**, prepared by **Airey Consultants Ltd**.

2.9 Coastal Inundation

Auckland Council GeoMaps indicates that the site is not subject to coastal inundation.

2.10 Biodiversity

Auckland Council GeoMaps indicates that there is no Significant Ecological Area (SEA) located within the subject sites. The downstream discharge point of the public network is located within a SEA.

2.11 Cultural and Heritage Sites

The site is identified as a historic heritage and special character site.

3 STORMWATER MANAGEMENT

The stormwater management strategy for the development has been developed in accordance with the objectives of the Auckland Regionwide Stormwater Network Discharge Consent.

As per the Auckland Unitary Plan, the subject site is not situated within the areas of Stormwater Management Areas, SMAF 1 or SMAF 2. Additionally, the site is not discharging stormwater runoff directly into a classified stream. Consequently, stormwater retention and detention for stream hydrology is not required.

Discharge of Stormwater from the Proposed Development will not require resource consent as this is considered a permitted activity per the AUP: OP, Section E8.4.1 Item A1 – *Diversion of stormwater runoff from lawfully established impervious areas directed into an authorised stormwater network or a combined sewer network that complies with Standard E8.6.2.1.* The proposed future development of the site will increase the impervious area on site from its current situation and requires resource consent. *Per AUP: OP, Section H4.6.8 Item 1 – the maximum impervious area must not exceed 60 percent of the site area*.

4 IMPERVIOUS AND PERVIOUS AREAS

The catchment areas for the subject site pre-development are as follows, which is imperviousness of 40.02%:

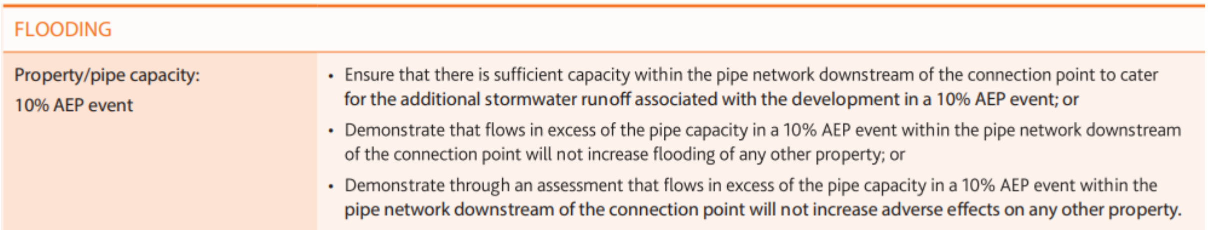
	3 Pigeon Mountain Road, Half Moon Bay
Roof/Balcony Areas (m^2)	2,980.1
Driveway/Paved Areas (m^2)	2,652.3
Total Impervious Area (m^2)	5,632.4
Total Pervious Area (m^2)	8,440.6
Total Gross Area (m^2)	**14,073**

The catchment areas for the subject site post-development are as follows, which is an imperviousness of 64.83%:

	3 Pigeon Mountain Road, Half Moon Bay
Roof/Balcony Areas (m^2)	5,500
Driveway/Paved Areas (m^2)	3,624
Total Impervious Area (m^2)	9,124
Total Pervious Area (m^2)	4,949
Total Gross Area (m^2)	**14,073**

5 10% AEP ATTENUATION

As per Auckland Unitary Plan E8 Stormwater – Discharge and Diversion, the diversion and discharge must not result in or increase the flooding of other properties in rainfall events up to the 10% AEP. Additionally, as per Auckland Council Regionwide Stormwater Network Discharge Consent Schedule 4: Connection requirements for Brownfields Large (20 lots and over), the pipe network downstream of the connection point shall have sufficient capacity to cater for the additional stormwater runoff associated with the development in a 10% AEP event. With an overland flowpath originating from the site and downstream stormwater pipes at capacity, 10% AEP storm detention is required by NDC to attenuate the stormwater discharge from the development.



FLOODING	
Property/pipe capacity: 10% AEP event	• Ensure that there is sufficient capacity within the pipe network downstream of the connection point to cater for the additional stormwater runoff associated with the development in a 10% AEP event; or • Demonstrate that flows in excess of the pipe capacity in a 10% AEP event within the pipe network downstream of the connection point will not increase flooding of any other property; or • Demonstrate through an assessment that flows in excess of the pipe capacity in a 10% AEP event within the pipe network downstream of the connection point will not increase adverse effects on any other property.

Based on the 10% AEP storm events, using rational method, we have calculated the pre-developed flow to be 211.88 L/s.

We propose all roof and access way runoff from the proposed development be detained in underground detention tanks. The sizing of the detention devices is based on the difference between the site runoff for the pre-development and post-development areas. The permissible tank discharge is equal to the pre-development site runoff (211.88 L/s) less the permeable runoff (42.12 L/s). We have calculated that the minimum storage required for the 10% AEP storm event (including 2.1°C climate change) to be 77,073 Litres for the entire site. The site has been split into 3 catchments.

To discharge the detention volume over time, we propose the below detention tank design for each catchment.

- Catchment SW1: Impervious runoff will be detained in a Rainsmart STIM-02-R Quad Module x 45 (1.8m Wide x 1.35m High x 9m Long) fitted with an 175mmØ orifice at the outlet.
- Catchment SW4: Impervious runoff will be detained in a Rainsmart STIM-02-R Quad Module x 45 (1.8m Wide x 1.35m High x 9m Long) fitted with an 175mmØ orifice at the outlet.
- Catchment SW6: Impervious runoff will be detained in a Rainsmart STIM-02-R Quad Module x 90 (3.6m Wide x 1.35m High x 9m Long) fitted with an 175mmØ orifice at the outlet.

3.1 HEC-HMS Basin Model

To validate the detention design, a HEC-HMS model was used to model the runoff from the catchments for both pre-development and post-development scenarios. The model included routing of the post-development flows through detention storage so the peak discharges could be controlled back to pre-development conditions.

Time of concentration was calculated using the time of concentration formula in the Auckland Council Stormwater guideline (TP108) with the minimum value of 10 minutes adopted.

GNS Geology maps indicates the site is located within clay soils belonging to the Waitemata group. This consists of interbedded, graded sandstone and siltstone or mudstone, massive mudstone and sandstone, local intercalated volcanic grit, breccia and conglomerate, and minor bioclastic limestone.

As per TP108, the runoff Curve Number (CN) for such geology shall be 74. The CN used for impervious areas shall be 98. Rainfall depth has been extracted from TP108 10 Year ARI rainfall map with climate change applied. The 10% AEP rainfall depth (incorporating 2.1^{o}C climate change), being 147.16mm, entered HEC-HMS has been 24 hours normalised as per required by TP108.

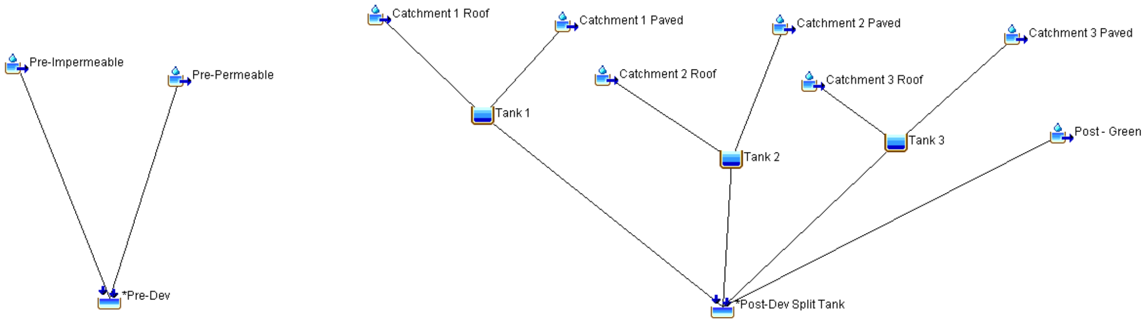
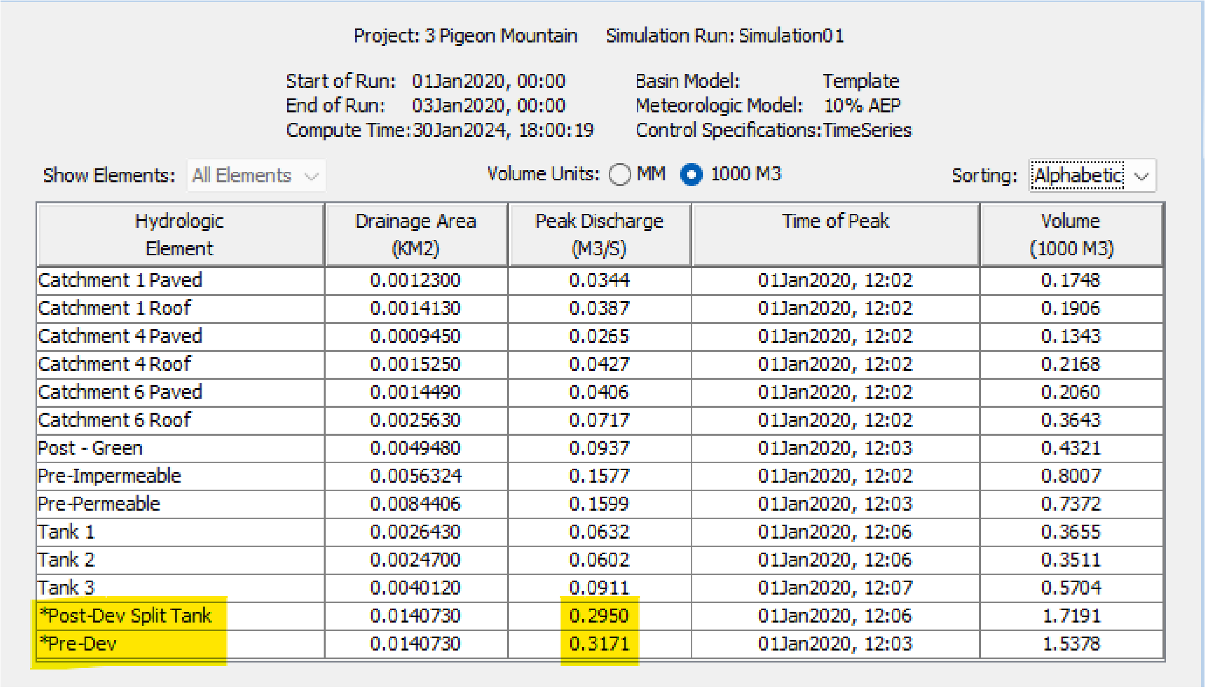


Figure 6. HEC-HMS Basin Model

With reference to the above HEC-HMS Basin Model, all roofs and common accessway runoffs will be detained by the proposed underground tanks. The pre-development peak discharge, over the TP108 24-hour normalised rainfall, is 317.1 L/s at 12 hours 03 minutes into the rainfall event. The post-development peak discharge, over the TP108 24-hour normalised rainfall, is 295.0 L/s at 12 hours 06 minutes into the rainfall event. The proposed detention systems delay the time at which the peak flows enter the public system and reduce the peak discharge rate form the site to less than the predevelopment runoff rate.



Project: 3 Pigeon Mountain   Simulation Run: Simulation01

Start of Run: 01Jan2020, 00:00   Basin Model: Template
End of Run: 03Jan2020, 00:00   Meteorologic Model: 10% AEP
Compute Time: 30Jan2024, 18:00:19   Control Specifications: TimeSeries

Show Elements: All Elements   Volume Units: ○ MM ● 1000 M3   Sorting: Alphabetic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Catchment 1 Paved	0.0012300	0.0344	01Jan2020, 12:02	0.1748
Catchment 1 Roof	0.0014130	0.0387	01Jan2020, 12:02	0.1906
Catchment 4 Paved	0.0009450	0.0265	01Jan2020, 12:02	0.1343
Catchment 4 Roof	0.0015250	0.0427	01Jan2020, 12:02	0.2168
Catchment 6 Paved	0.0014490	0.0406	01Jan2020, 12:02	0.2060
Catchment 6 Roof	0.0025630	0.0717	01Jan2020, 12:02	0.3643
Post - Green	0.0049480	0.0937	01Jan2020, 12:03	0.4321
Pre-Impermeable	0.0056324	0.1577	01Jan2020, 12:02	0.8007
Pre-Permeable	0.0084406	0.1599	01Jan2020, 12:03	0.7372
Tank 1	0.0026430	0.0632	01Jan2020, 12:06	0.3655
Tank 2	0.0024700	0.0602	01Jan2020, 12:06	0.3511
Tank 3	0.0040120	0.0911	01Jan2020, 12:07	0.5704
*Post-Dev Split Tank	0.0140730	0.2950	01Jan2020, 12:06	1.7191
*Pre-Dev	0.0140730	0.3171	01Jan2020, 12:03	1.5378

Figure 7. HEC-HMS Simulation Result

Please refer to Appendix A for detailed Engineering Calculations and HEC-HMS model entries.

6 WATER QUALITY

Due to the development being considered as a large brown field development, Auckland Unitary Plan E9 and Network Discharge Consent (NDC4) requires management of the quality of stormwater runoff from all impervious areas (including roof and paved areas) in accordance with Auckland Council Guideline Document GD01 2017/001 (GD01).

At source, water sensitive stormwater management devices, namely the Stormwater 360 storm filters with peak flow diversions (or equivalent) are proposed downstream of the stormwater detention devices. The stormfilters are designed to remove greater than 75% TSS from stormwater runoffs. Stormwater 360 storm filters are approved by Auckland Council for use on all public and private developments.

Please refer to Appendix A for detailed Engineering Calculations.

7 ASSETS

7.1 Ownership

All stormwater assets including and past the stormwater quality treatment devices within the development will be private. Pipe networks will service the units collecting roof runoff from downpipes and catchpits will collect driveway runoff and discharge into the communal attenuation tanks. All this collected stormwater will discharge to the public system via proprietary Auckland Council approved stormwater treatment devices, designed in accordance with the requirements of Auckland Council GD01/TP10. The private infrastructure will be constructed in accordance with the NZ Building Code and Stormwater Bylaw 2015. Unless otherwise approved, the private stormwater system connecting to the public system will be designed and built-in compliance with the design processes and standards per the Auckland Council Stormwater Code of Practice. This will be further designed under the Building Consent for the development.

The new assets proposed to be vested with Council are:

- SW1 up to SW Filter 1 – 33.7m (11.6+22.1) of 300mmØ uPVC SN16 and 1 x SWMH
- SW4 up to SW Filters 2– 28.8m (3.8+25) of 300mmØ uPVC SN16 and 1 x SWMH
- SW5 and SW 6 up to SW Filter 3 – 76.6m (68.9+7.7) of 300mmØ uPVC SN16 and 1 x SWMH

The public infrastructure will be constructed in accordance with the Auckland Council Stormwater Code of Practice and will be vested to the Auckland Council. The private infrastructure will be jointly owned by the residents of the development (by way of a residents; society or similar mechanism). Responsibility for maintenance of the system will, therefore, be held by the residents' society. An operations and maintenance manual for the private stormwater system will be prepared and will be provided at the Building Consent stage for the private drainage.

7.2 On-going Maintenance Requirements

There will be ongoing maintenance requirements for the Private Stormwater Mitigation and Treatment System which will fall on the Body Corporate/Residents Society. These will be detailed in the Building Consent documentation.

8 CONCLUSION

We consider that the stormwater management proposed for the development at 3 Pigeon Mountain Road, Half Moon Bay is in accordance with the objectives and policies of the Auckland Unitary Plan, the Regionwide Stormwater Network Discharge Consent, Auckland Design Manual and GD01. The proposed development will have minimal effects on the downstream receiving environment.

Report prepared by
AIREY CONSULTANTS LTD

Weng

Samson Weng
Civil Engineer
BE Hons (Civil)

Reviewed and approved by
AIREY CONSULTANTS LTD

Royden Tsui

Royden Tsui
Associate Director
CPEng(NZ), CMEngNZ, IntPE(NZ), MEPM (hons), BE (Civil)

Appendix A

- Engineering Calculations

ENGINEERING CALCULATIONS

FOR

Client: HND HMB Ltd

Address: 3 Pigeon Mountain Road, Half Moon Bay

Job No: 220571/01

Date: 2 February 2024

Design Engineer: Samson Weng

Reviewed by: Royden Tsui

Contact Phone: (09) 534 6523

Email: samsonw@aireys.co.nz

DATE: 28/06/2022 12:08:23 PM LOGIN NAME: SARAH CAMMICK
LOCATION: J:\33367 - 1-9 Pigeon Mountain Rd, Half Moon Bay\Surveying\12D CAD\33367-SUR-00-XX-DR-G-120-IF-A.dwg

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NOTES:
- HORIZONTAL DATUM IS NZGD 2000.
- MERIDIONAL CIRCUIT IS MOUNT EDEN 2000.
- HEIGHT DATUM IS AUCKLAND VERTICAL DATUM 1946 (MSL) FROM BP 7363 SO57793 RL=15.85.
- BOUNDARIES SHOWN ON THIS PLAN ARE FROM LANDONLINE. IF THE POSITION OF THE BOUNDARIES IS REQUIRED A REDEFINITION SURVEY SHOULD BE UNDERTAKEN.
- SOURCED FROM THE LINZ DATA SERVICE AND LICENSED FOR REUSE UNDER THE CC BY 4.0 LICENCE.
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- NOT ALL PUBLIC & PRIVATE DRAINAGE INFORMATION IS SHOWN ON THIS PLAN. SYMBOLS AND MODELS OF SERVICES ARE SHOWN DIAGRAMMATICALLY ONLY AND NOT TO SCALE.
- UNLESS OTHERWISE SHOWN THE POSITION AND ALIGNMENT OF SERVICES SHOWN ON THIS PLAN HAVE BEEN OBTAINED FROM COUNCIL RECORDS AND ARE SUBJECT TO THE ERRORS OR OMISSIONS OF THAT DATA, THEY SHOULD NOT BE USED FOR DESIGN PURPOSES. ALL SERVICES SHOULD BE LOCATED BEFORE ANY DESIGN OR CONSTRUCTION BEGINS.
- IF SHOWN, SPECIFIED UNDERGROUND UTILITIES AND DRAINAGE HAVE BEEN LOCATED USING INDUSTRY BEST PRACTICE METHODS AND FOLLOWING NZUAG CODE OF PRACTICE. DIFFERENCES IN LOCATION BETWEEN THE VARIOUS METHODS IS NORMAL.
- CRITICAL LEVELS SHOULD BE CHECKED ON SITE PRIOR TO DESIGN. THE LEVELS SHOWN ON THIS PLAN MAY NOT CORRESPOND TO THE COUNCIL'S DEFINITION OF GROUND LEVEL FOR DESIGN PURPOSES.
- CONTOURS SHOWN ON THIS PLAN HAVE BEEN ELECTRONICALLY COMPUTED, THEY MAY NOT REPRESENT THE TRUE GROUND LEVELS.
- THE SIZE AND POSITION OF TREES SHOWN ON THIS PLAN IS APPROXIMATE. THE TREE 'TYPE' IS A BEST GUESS. IF CRITICAL, TREES SHOULD BE IDENTIFIED BY A QUALIFIED ARBORIST.

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ENGINEERING SURVEYING PLANNING
envivo ltd po box 109 207 newmarket auckland 1149
+64 9 630 9512 admin@envivo.nz www.envivo.nz

REV	BY	DATE	APP'D	REVISION/ COMMENTS
.	.	.	.	.

TITLE
SITE PLAN

PROJECT/LOCATION
1-9 PIGEON MOUNTAIN ROAD, HALF MOON BAY

LEGAL DESCRIPTION
LOT 1 DP 212125

RECORD OF TITLE
NA140A/266, 1.407 ha

SURVEYED	DRAWN	DESIGNED	APPROVED
KP	MR	.	.
DATE	DATE	DATE	DATE
21/06/22	22/06/22	.	.

SCALE @A3: 1:750
ZONING: MIXED HOUSING SUBURBAN

PROJECT	ORIG	ZONE	LOC	TYPE	RL	DRG No	SUIT	REV
33367	SUR	00	XX	DR	G	120	IF	A

S92 RESPONSE

asc architects

3 PIGEON MOUNTAIN ROAD

COMPASS POINT ROAD
PROPOSED SITE PLAN

Project No. :	JOB NO. 22924
Scale:	1:250@ A1
Date:	18/01/2024
Revison:	G

RA0100

BUILDING COVERAGE BY...		
UNIT	AREA	TOTAL UNITS
BLOCK A		
A2	70 m^2	1
A2	70 m^2	1
A2	70 m^2	1
A2	70 m^2	1
A2	71 m^2	1
A2	71 m^2	1
A2	71 m^2	1
A2	72 m^2	1
	566 m^2	8
BLOCK B		
A2	70 m^2	1
A2	70 m^2	1
A2	71 m^2	1
A2	71 m^2	1
A2	72 m^2	1
A2	72 m^2	1
	426 m^2	6
BLOCK C		
E	80 m^2	1
E	80 m^2	1
	161 m^2	2
BLOCK D		
A1	73 m^2	1
A1	73 m^2	1
A1	73 m^2	1
A1	73 m^2	1
A1	73 m^2	1
A1	73 m^2	1
A1	73 m^2	1
	511 m^2	7
BLOCK E		
C	73 m^2	1
C	74 m^2	1
C	74 m^2	1
C	74 m^2	1
C	79 m^2	1
C	81 m^2	1
C3	73 m^2	1
C3	74 m^2	1
C3	91 m^2	1
C3	91 m^2	1
C-2	81 m^2	1
	866 m^2	11
BLOCK F		
C	91 m^2	1
C	91 m^2	1
C	91 m^2	1
C	91 m^2	1
C	91 m^2	1
C	91 m^2	1
	548 m^2	6
BLOCK G		
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
	447 m^2	7

BUILDING COVERAGE BY...		
UNIT	AREA	TOTAL UNITS
BLOCK H		
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
B	64 m^2	1
	702 m^2	11
BLOCK I		
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
	310 m^2	8
BLOCK J		
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
	117 m^2	3
BLOCK K		
D	38 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
	350 m^2	9
BLOCK L		
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	39 m^2	1
D	81 m^2	1
D	102 m^2	1
	497 m^2	10
TOTAL AREA:	5500 m^2	88

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

BUILDING COVERAGE:		**COMPLIANCE**
MIX HOUSING SUB-URBAN ZONE REQUIREMENT :	**40% MAX NET SITE AREA (5628㎡)**	
PROPOSED AREA:	39.1% (5500㎡)	YES
PREVIOUS BUILDING COVERAGE:	*40.5%(5702m^2)*	

S92 RESPONSE

asc architects

3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (BUILDING COVERAGE)

N

Project No. :	**JOB NO. 22924**
Scale:	**1 : 300@ A1**
Date:	**18/01/2024**
Revison:	**G**

RA0200

IMPERVIOUS SPACE	
NAME	AREA
BLOCK A	
TYPE A-2	558 m²
DRIVEWAYS / CAR PARK	102 m²
BLOCK B	
TYPE A-2	421 m²
DRIVEWAYS / CAR PARK	98 m²
BLOCK C	
TYPE E-1	151 m²
DRIVEWAYS / CAR PARK	1659 m²
BLOCK D	
TYPE A-1	469 m²
DRIVEWAYS / CAR PARK	53 m²
BLOCK E	
TYPE C-3	342 m²
TYPE C-2	81 m²
TYPE C-1	443 m²
BLOCK F	
TYPE C-1	548 m²
BLOCK G	
TYPE B-1	282 m²
BLOCK H	
TYPE B-1	1950 m²
DRIVEWAYS / CAR PARK	5 m²
BLOCK I	
TYPE D-1	265 m²
DRIVEWAYS / CAR PARK	120 m²
BLOCK J	
TYPE D-1	99 m²

IMPERVIOUS SPACE	
NAME	AREA
BLOCK K	
TYPE D-1	298 m²
DRIVEWAYS / CAR PARK	78 m²
BLOCK L	
TYPE D-1	497 m²
DRIVEWAYS / CAR PARK	10 m²
AREA TOTAL	8531 m²

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

IMPERVIOUS AREA:		**COMPLIANCE**
MIX HOUSING SUB-URBAN ZONE REQUIREMENT:	**60% MAX NET SITE AREA (8442㎡)**	
PROPOSED AREA:	60.6% (8531㎡)	NO
PREVIOUS AREA:	67.2% (9457㎡)	

S92 RESPONSE

asc architects

3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (IMPERVIOUS AREA)

N

Project No. :	JOB NO. 22924
Scale:	1 : 300@ A1
Date:	18/01/2024
Revison:	G

RA0201

LEGEND

🟩 LANDSCAPED AREA

🟧 PERMEABLE AREA

🟩 PUBLIC LANDSCAPED AREA

LANDSCAPED AREA	
BLOCK	AREA
BLOCK A	391 m²
BLOCK B	255 m²
BLOCK C	173 m²
BLOCK D	238 m²
BLOCK E	518 m²
BLOCK F	288 m²
BLOCK G	382 m²
BLOCK H	525 m²
BLOCK I	219 m²
BLOCK J	168 m²
BLOCK K	278 m²
BLOCK L	458 m²
PARK	211 m²
PUBLIC LANDSCAPE AREA	1222 m²
TOTAL AREA	5327 m²

PERMEABLE AREA	
BLOCK	AREA
BLOCK A	132 m²
BLOCK B	86 m²
BLOCK C	33 m²
BLOCK D	91 m²
BLOCK G	81 m²
BLOCK H	126 m²
BLOCK I	63 m²
BLOCK J	72 m²
BLOCK K	89 m²
BLOCK L	43 m²
PUBLIC LANDSCAPE AREA	451 m²
TOTAL AREA	1268 m²

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

LANDSCAPE AREA:		**COMPLIANCE**
MIX HOUSING SUBURBAN ZONE REQUIREMENT:	**40% MIN NET SITE AREA (5628㎡)**	
PROPOSED AREA:	38% (5327㎡)	
PREVIOUS AREA :	*32.7%(4606m²)*	NO
MIX HOUSING URBAN ZONE REQUIREMENT:	**35% MIN NET SITE AREA (4925㎡)**	
PROPOSED AREA:	38% (5367㎡)	
PREVIOUS AREA :	*32.7%(4606m²)*	YES
PERMEABLE AREA: 25% MAX.		
PROPOSED AREA:	24% (1268㎡)	YES
PREVIOUS AREA :	*28.2%(1299m²)*	

S92 RESPONSE

asc architects

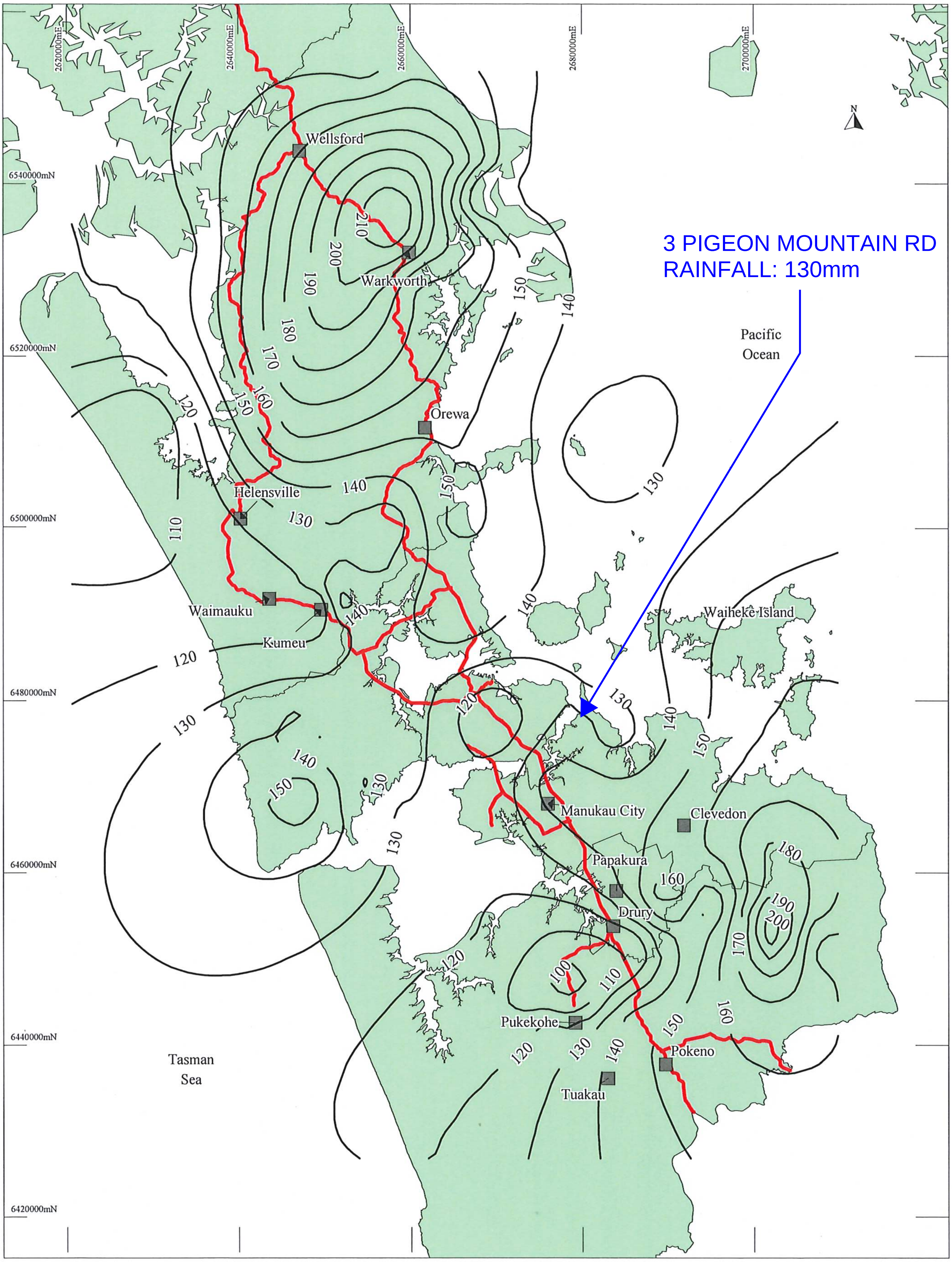
3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (LANDSCAPED AREA)

N

Project No. :	**JOB NO. 22924**
Scale:	**1 : 300@ A1**
Date:	**18/01/2024**
Revison:	**G**

RA0202



3 PIGEON MOUNTAIN RD
RAINFALL: 130mm

Legend: — 90 — Rainfall Contour (mm)

State Highways

Auckland **Regional** Council

Figure A.3
10 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)

(Revised 25/08/1999)

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\10yrari.wor Date: 25/08/1999

Civil, Structural
and Fire Engineers

Takapuna **Botany** Queenstown

Client: HND HMB Ltd

Sheet No: 1

Job: 3 Pigeon Mountain Rd
Half Moon Bay

Job No: 220571/01

Calc's By: SW
Reviewed By: RCHT

Phone: (09 534 6523)

Date: Feb-24

By Pass Flow Calculation

Enter Runoff Areas

	A(m^2)	C	AxC	
roof	0	0.90	0	m^2
paved	0	0.85	0	m^2
grass	4949.00	0.30	1484.7	m^2
	4949		1485	m^2
Q			42.12	L/s

Rainfall Depth 130 mm **ARI** 10 max discharge 211.88 L/s

Pre-Development Rate

	A(m^2)	C	AC	
Roof	2980.1	0.90	2682.09	m^2
Paved	2652.3	0.85	2254.46	m^2
Grass	8440.6	0.30	2532.18	m^2
	14073		7468.73	m^2
Q			211.88	L/s

Airey	**Civil, Structural and Fire Engineers**	**Client:**	HND HMB Ltd		**Sheet No:** 1
		Job:	3 Pigeon Mountain Rd Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown		**Calc's By:** **Reviewed By:**	SW RCHT	**Phone:** (09 534 6523)	**Date:** Feb-24

Detention Tank Size Calculation

Enter Runoff Areas

	A(m^2)	C	AxC	
roof	5500	0.90	4950	m^2
paved	3624	0.85	3080.4	m^2
grass	0.00	0.30	0	m^2
	9124		8030	m^2

Rainfall Depth 130 mm **ARI** 10 max discharge 169.76 L/s

^less permeable bypass

Pre-Development Rate

	A(m^2)	C	AC	
Roof	2980.1	0.90	2682.09	m^2
Paved	2652.3	0.85	2254.46	m^2
Grass	8440.6	0.30	2532.18	m^2
	14073		7468.73	m^2
Q			211.88	L/s

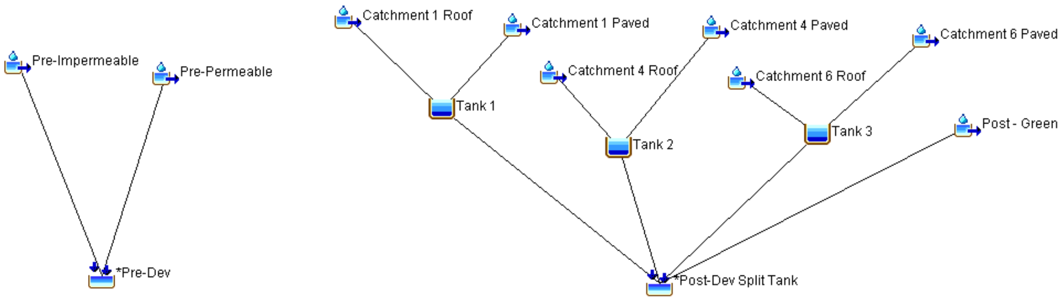
Duration hr	**Duration** mins	**Depth** mm	**Intensity** mm/hr (Q_{10})	**Q** l	**Total volume in** l	**tal volume c** l*0.65	**difference** (storage)
0.166	10.0	16.95	102.13	136142.7	136143	65942	70200
0.333	20.0	26.07	78.29	209354.8	209355	132282	77073
0.5	30	32.15	64.31	258213.2	258213	198621	59592
1	60	45.33	45.33	363980.1	363980	397243	-33263
2	120	61.22	30.61	491609.5	491610	794486	-302876
6	360	93.59	15.60	751595.3	751595	2383457	-1631861
12	720	120.08	10.01	964311.0	964311	4766913	-3802602
24	1440	147.16	6.18	1181753.7	1181754	9533827	-8352073

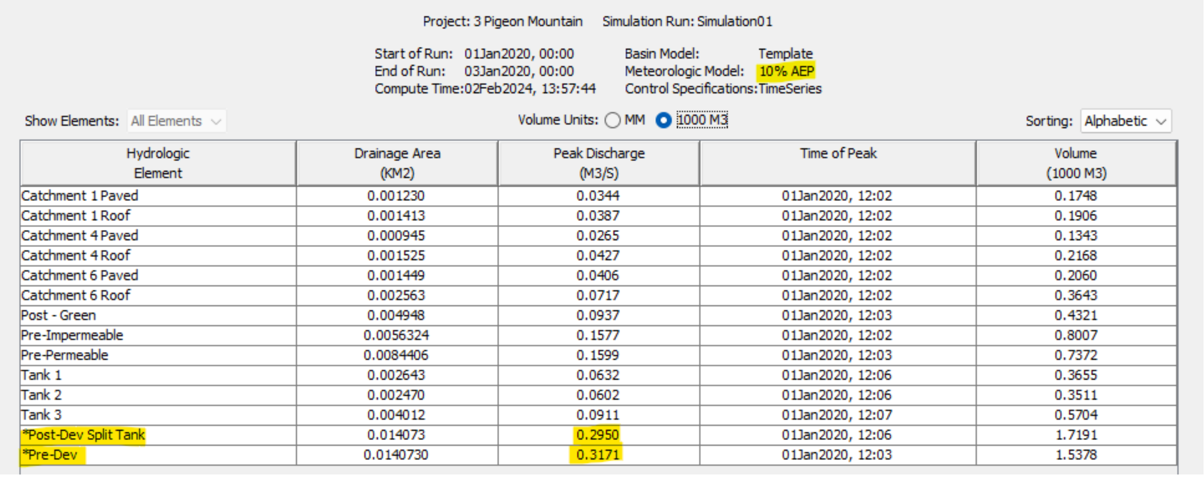
min storage reqd 77073 L

ARI	Ratio
2	9.0%
5	11.3%
10	13.2%
20	15.1%
50	16.8%
100	16.8%

ARI:	10
Ratio:	13.2%

3 Paddington Street HEC-Model Output




Project: 3 Pigeon Mountain   Simulation Run: Simulation01

Start of Run: 01Jan2020, 00:00   Basin Model: Template
End of Run: 03Jan2020, 00:00   Meteorologic Model: 10% AEP
Compute Time:02Feb2024, 13:57:44   Control Specifications:TimeSeries

Show Elements: All Elements   Volume Units: ○ MM ● 1000 M3   Sorting: Alphabetic

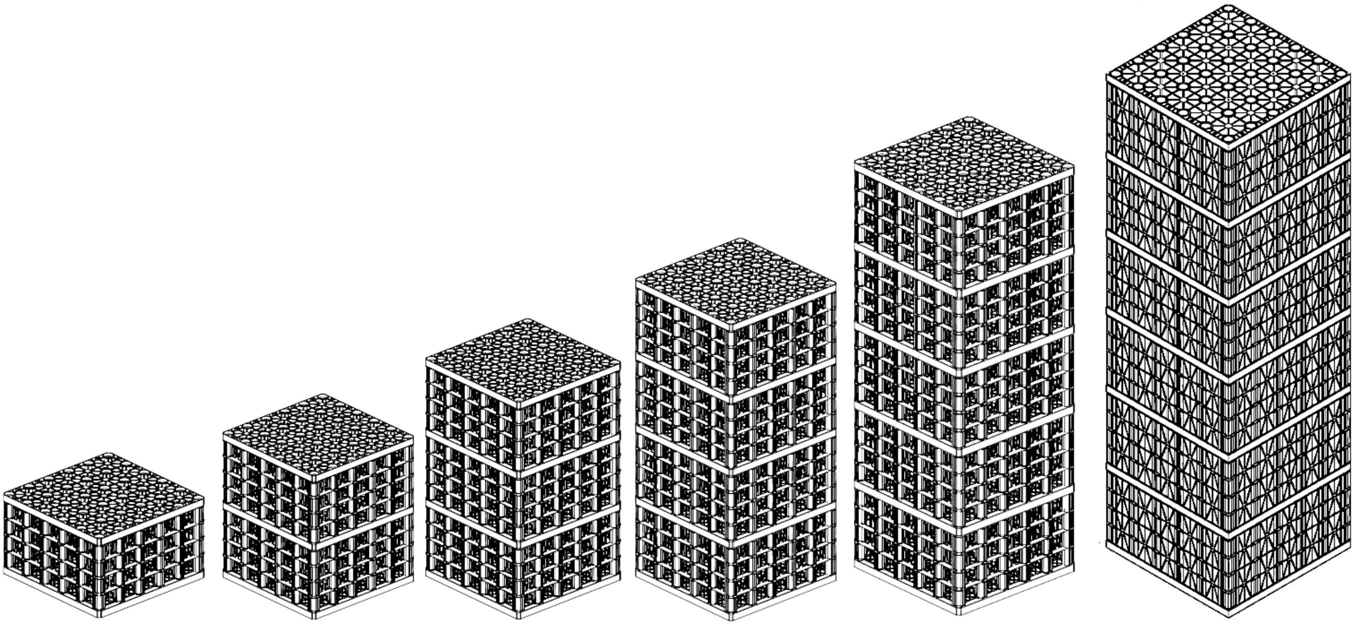
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Catchment 1 Paved	0.001230	0.0344	01Jan2020, 12:02	0.1748
Catchment 1 Roof	0.001413	0.0387	01Jan2020, 12:02	0.1906
Catchment 4 Paved	0.000945	0.0265	01Jan2020, 12:02	0.1343
Catchment 4 Roof	0.001525	0.0427	01Jan2020, 12:02	0.2168
Catchment 6 Paved	0.001449	0.0406	01Jan2020, 12:02	0.2060
Catchment 6 Roof	0.002563	0.0717	01Jan2020, 12:02	0.3643
Post - Green	0.004948	0.0937	01Jan2020, 12:03	0.4321
Pre-Impermeable	0.0056324	0.1577	01Jan2020, 12:02	0.8007
Pre-Permeable	0.0084406	0.1599	01Jan2020, 12:03	0.7372
Tank 1	0.002643	0.0632	01Jan2020, 12:06	0.3655
Tank 2	0.002470	0.0602	01Jan2020, 12:06	0.3511
Tank 3	0.004012	0.0911	01Jan2020, 12:07	0.5704
*Post-Dev Split Tank	0.014073	0.2950	01Jan2020, 12:06	1.7191
*Pre-Dev	0.0140730	0.3171	01Jan2020, 12:03	1.5378

HEC-HMS available upon request.

Technical Specification.

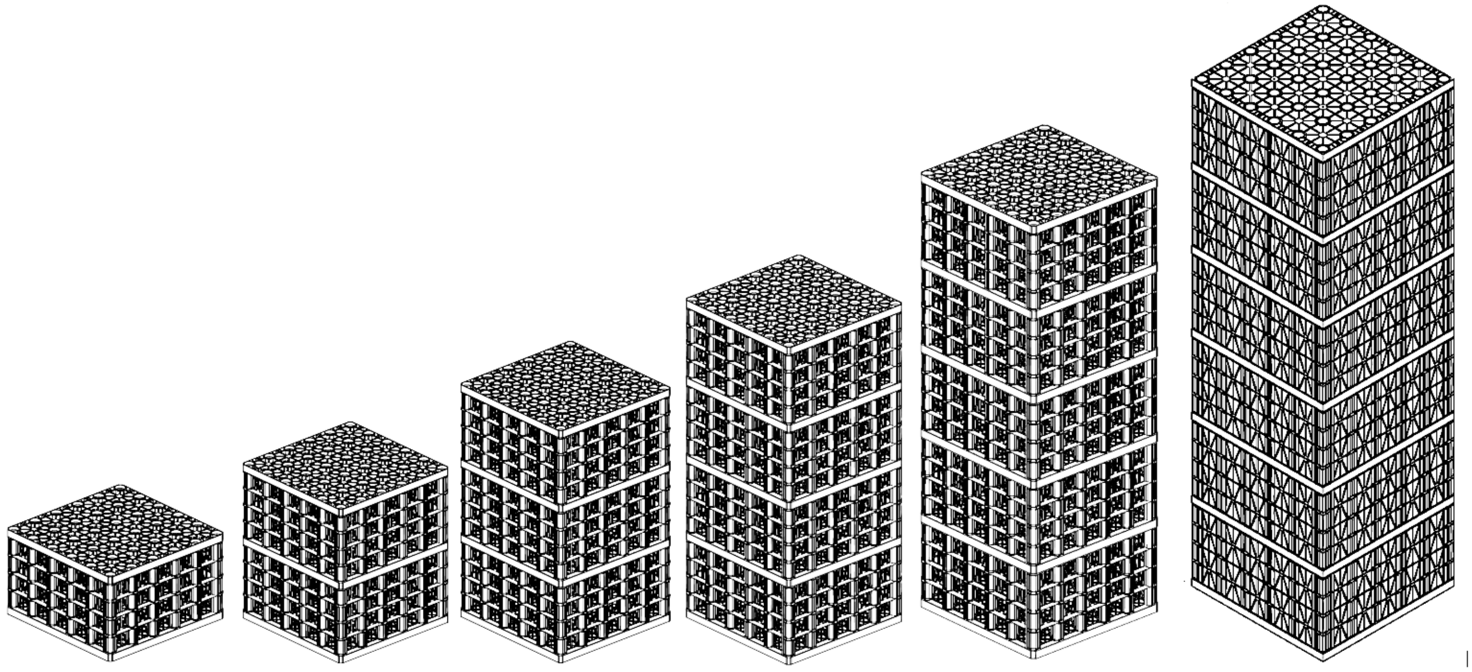
RAINSMART
SOLUTIONS
A Smarter Way to Manage Stormwater...

RAINSMART® STM-02- R MODULE SPECIFICATION SHEET.



Module Dimensions:						
Module (Unit)	Width (mm)	Width (inches)	Length (mm)	Length (inches)	Height (mm)	Height (inches)
Single (1)	600	23.62	600	23.62	360	14.17
Double (2)	600	23.62	600	23.62	690	27.16
Triple (3)	600	23.62	600	23.62	1020	40.15
Quad (4)	600	23.62	600	23.62	1350	53.15
Penta (5)	600	23.62	600	23.62	1680	66.14
Hexa (6)	600	23.62	600	23.62	2010	79.13

Module Storage:						
Module (Unit)	Tank Volume (L)	Tank Volume (cf)	Tank Volume (gal)	Water Storage Volume (l)	Water Storage Volume (cf)	Water Storage Volume (gal)
Single (1)	129.60	4.57	34.23	123.12	4.35	32.52
Double (2)	248.40	8.77	65.62	235.98	8.33	62.34
Triple (3)	367.20	12.97	97.00	348.84	12.32	92.15
Quad (4)	486.00	17.16	128.38	461.70	16.30	121.97
Penta (5)	604.80	21.36	159.77	574.56	20.29	151.78
Hexa (6)	723.60	25.55	191.15	687.42	24.27	181.60



Item	Description	Value	Unit
Void Area	Area available for water storage vs. that made up of plastic	**>95**	%
Surface Void Area	Open area where water may percolate in or out of the units	**>95**	%
Service Temperature	Operating temperature where the units can be expected to perform adequately	**07 to 60°C (-44 to 140°F)**	°C (°F)
Material Content	90% Post Industrial Selected Polypropylene + 10% proprietary mix Virgin in Nature	**100%**	%
Biological & Chemical Resistance	Unaffected by moulds, algae, Soil borne Chemical, bacteria and bitumen, polypropylene is very inert	**	**
Short Term Compressive Strength	Short Term Vertical Compressive Strength*	**85 (120.80)**	tons/sqm (PSI)
	Short Term Lateral Compressive Strength*	**9.5 (13.51)**	tons/sqm (PSI)
Short Term Deflection	Vertical Deflection	**54.80 kN/ m^2**	Per mm
	Lateral Deflection	**3.2 kN/m^2**	Per mm
Long Term Deflection	Estimated long term deflection (vertical **creep**) projected 50 yrs ** *applied test load of 135 kN / m^2*	**1.08% (3.88mm)**	*135 kN/m^2*
	Estimated long term deflection **(lateral creep**) projected 50 yrs ** *applied test load of 23kN/m^2*	**1.41% (8.46 mm)**	*23 kN/m^2*

***** All compressive strength at yield, maximum recommended safe design value, safety factors to be incorporated.***

****Derived from long term Extrapolated Creep testing data, 516 day minimum***

NOTE: ***All 'RAINSMART Products and Systems are DESIGN REGISTERED.***

Safety Factors: Engineers, designers and geotechnical engineers should design and calculate safety factors to a serviceable limited state to suit specific project. In case of doubt, consult your nearest distributor or representative.

Disclaimer: All information provided in this publication is correct to the best knowledge of the company and is given out in good faith. This information is intended only as a general guide, no responsibility can be accepted for any errors, omissions or incorrect assumption. As each project is unique, and as Rainsmart Solutions Pty. l td. and its distributors and agents worldwide have no direct control over the methods employed by the user in specifying, installing or supervising of its products hence no responsibility is accepted by RAINSMART Solutions Pty Ltd. and its distributors and agents worldwide. Users should satisfy themselves as to the suitability of the product for their purpose.

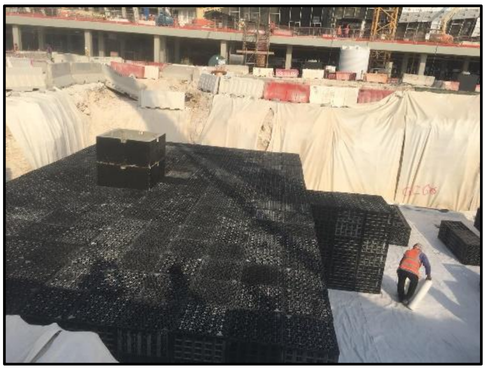
Underground Stormwater Management System.

STM MODULAR TANK

Installation Guide.

ASSEMBLING

INSTALLING



BACKFILLING

www.rainsmartsolutions.com

Pre-Construction Checklist.

A Tools You'll Need

- Laser or Transit
- Measuring Tape (long enough to mark Rainsmart Tank footprint)
- Razor Knife
- Screw Driver/Nut Driver Set
- String Line
- Marking Line
- Reciprocating Saw (to cut in Inspection & Maintenance Ports)

If you're assembling Rainsmart STM Tanks:

- Dead-Blow Rubber Mallets
- Work Tables (3/4" Plywood Placed on Assembled Tanks works Well)

Figure 1 Most contractors find installing a Rainsmart STM Tank system surprisingly easy.

B Materials You'll Need

- Rainsmart STM Tank Module Units
- Geotextile 200 - 300 gsm minimum
- Geogrid (Only for Load Bearing Application)
- Impermeable Liner (Only for Retention / Recycling Tank Application)
- Clean Base & Backfill Material (95% Compactable angular stone or sand ½" - 2", free of debris - NO CLAY)
- Pipe Boot Kits (If not using kits, you'll need duct tape and a stainless steel band clamp for each inlet and outlet pipe, and for each inspection or maintenance port.)
- Pipe for Inspection & Maintenance Ports (Typically 12" (3000mm) schedule 40 PVC, respectively)
- Ring, collar & cap (to fit all ports)
- Maintenance Port Kits (If not using kits, you will need non-corrosive rigid anti-scour pad [15" x 15"] [375mm x 375mm] to fit below Maintenance ports. Plexiglass works well. Fabric pipe boot, duct tape, stainless steel band clamp and H20 loaded ring and cover.)
- Metallic Tape

C Equipment You'll Need

- Forklift and other equipment/tools needed to unload box truck
- Pallet jack (to unload material from box truck)
- Walk-Behind Trench Roller (Plate compactor may work for smaller projects)
- Low Ground Pressure (LGP) tracked Skid Steer or Loader (<7.0 psi Gross Operating Pressure)
- For Larger Projects (>10,000cf / 250 Cbm):
    - LGP Dozer -10 ton Max gross weight and 4.52 psi (3.17 t/sqm) Max operating pressure.
    - Roller - 5 Ton Max Gross Vehicle Weight

Note: This list does not include equipment or tools needed to excavate or level the floor of the excavation

D General Notes:

Be sure to contact your local Representative at least two weeks prior to installation. We will provide you with on-site installation support AT NO CHARGE in order to facilitate your installation.

All pictures, illustrations and instructions have been included to guide you through a typical installation. The approved engineering drawings should ALWAYS take precedence over these instructions.

Coordinate the installation of Rainsmart-STM Tank System at the end of the construction activities to minimize the construction traffic over the system. If the installation is completed during construction activities then the system MUST be roped off and construction traffic routed around the system (including excavators, loaders, dump trucks, forklifts, concrete trucks, material delivery trucks and cranes). The installation contractor is responsible for all loads placed or driven over the STM Tank during the construction process: (including excavators, loaders, dump trucks, forklifts, concrete trucks, material delivery trucks and cranes). Rope off the area to prevent unauthorized traffic from driving over the STM Tank. If sequencing of the project makes this impossible, a construction road or pad may be constructed over the STM Tank System. Consult the project engineer and/or Rainsmart Solutions for assistance before allowing construction traffic on system. (**See Step #12: Secure the Installation** for additional information.)

After installation of the Rainsmart STM Tank system, stormwater should not be allowed to enter the Tank until the site is completely stabilized and all pre-treatment systems (designed to remove debris and heavy sediment) are active. Otherwise, the STM Tank may become prematurely contaminated with sediments from the project. For more information on Pre-Treatment systems, contact Rainsmart and request a copy of our Pre-Treatment Tech Note.

Throughout this document you will see three types of notes:

- **TIP:** Ideas to improve your profitability on the installation.
- **IMPORTANT:** Steps that require extra attention.
- **WARNING:** Critical issues that MUST be handled correctly to ensure a good installation.

Any questions or issues not covered by these instructions can be directed to its closest Agent or Distributor or to:

Rainsmart Solutions Pty Ltd.
25 Lidco Street,
Arndell Park, NSW-2148, Australia.
(T) +61 2 9678 9667 (F) +61 2 9678 9670
(e) info@rainsmartsolutions.com

1 Excavation

The excavation limits and the location of the STM Tank System should be staked out. The design drawings should be used to determine these locations. If the excavation limits are not shown on the plans, then add 2' (600mm) on each side of the STM Tank System to determine the limits.

Excavate the designated surveyed area according to plans following all relevant local, state and OHS guidelines. Typical excavations should include:

- Two-foot (600mm) perimeter around STM Tank to allow for proper compaction of backfill.
- Enough depth to accommodate a minimum 6" (150mm) base below the STM Tank.

Fig. 2 Excavate according to plans, following all Government & OHS Regulations

Fig. 3 Compacted and Levelled subbase to 95% proctor

Level the bottom of the excavation (Fig.2) as shown on plans. All excavations have a flat bottom NO falls or gradient.

Prepare the subgrade according to plans. Base of excavation shall be smooth, uniform level and free of debris and soft or yielding subgrade areas. Compact to at least 95% Standard Proctor Density (or as required by Engineer) (Fig. 3) unless infiltration of stormwater into sub grade is desired. A minimum bearing capacity of 2,000 psf (96Kpa) as per section 3.02D must be achieved or a CBR > 5 must be achieved prior to beginning installation of STM Tanks.

If the subgrade is pumping or appears excessively soft, the design engineer should be consulted for advice. In many cases a stabilization Geotextile and 6" (150mm) of compactable material that drains well will be sufficient to amend the bearing capacity of the soil, or as recommended and approved by site engineer.

2 Assemble Rainsmart STM-01 & STM-02 Tank Units.

If STM Tank units arrive on your project in flat panels they will need to be assembled on-site. Building the units should take 2-3 minutes per segment. This is a conservative estimate used to approximate the total man hours needed for assembly. The estimate includes the workers doing the assembly as well as material handling people to keep the assembly workers moving.

Units	Time
Single	2-3 Minutes
Double	4-6 Minutes
Triple	6-9 Minutes
Quad	8-12 Minutes

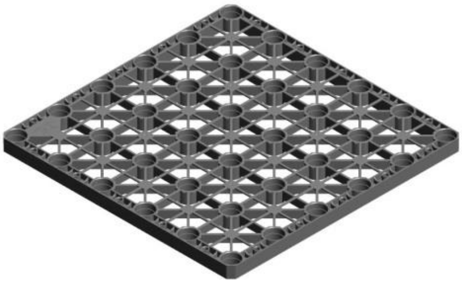


Fig. 4 Lay the bottom large STM-01 tank plate on the flat floor / ply table.

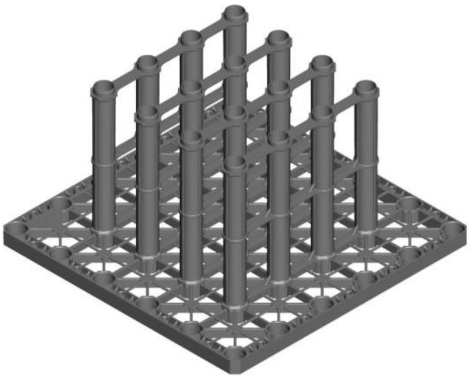


Fig. 4 Insert and click the 4 STM Inner panels into the large bottom plate in given locations using a dead blow hammer. To make STM-01 Units.

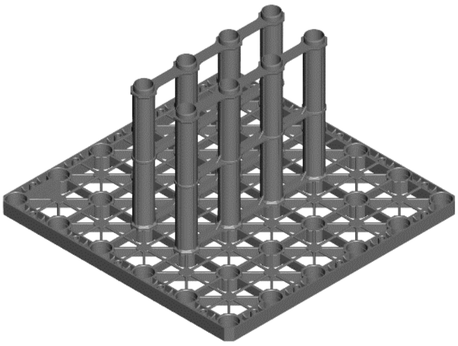


Fig. 5 Insert and click the 2 STM Inner panels into the large bottom plate in given centre locations using a dead blow hammer. To make and STM-02 Units.

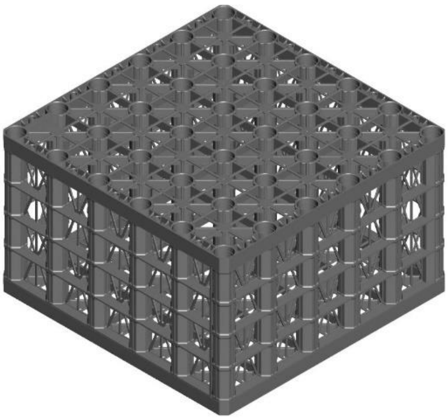


Fig. 6 Insert and click the 4 side frame panels into the large bottom plate align the top Large Plate in position and lock with rubber hammer in place. Starting from one end to other.

***** please refer to STM Tank Assembly guide for details illustrations and explanation to make the process faster.***

***** To build a Double tank unit repeat step 4/5 and 6 on top of the ready Single tank, such that the large plate in the middle will be a common plate.***

Completed STM tank Modules should be staged as close to the installation area as possible.

TIP: To increase the speed of the installation, many contractors choose to assemble the STM Tank unit's prior to or during excavation (Step 2) and base preparation (Step 3). Other contractors wait until these steps are completed and then perform the assembly IN THE EXCAVATION (Fig. 3) allowing completed units to be placed into their final location as they are assembled. Consider which option will work best for your project.

3

Prepare Base

Examine prepared excavation and conditions for smoothness, compaction and level. Do not start STM Tank installation until unsatisfactory conditions are corrected. Check for presence of high-water table, which must be kept at levels below the bottom of the STM Tank structure at all times. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Project Manager for resolution.

Standing water in the excavation will prevent proper base preparation and must be removed, if present.

In regions with sandy soils meeting the requirements noted and where the subgrade elevation is above the groundwater table, imported backfill materials may not be needed.

Grade and level base as shown on plans with more than 1/2” variance. Base must be free of debris and large rocks. Install base materials. Base materials must be as per spec section 2.03A:

Compaction	95% Compactable
Shape	Angular
Size	Not Larger than 1” in Diameter (10-20mm dia is ideal)
Consistency	Free of Lumps, debris and sharp objects that could puncture the Geotextile
Applicability	Stone or sand is acceptable if it meets these requirements.
	In **NO** case shall clays be used

Fig. 7 & 7A Base must be smooth to ensure units fit together without gaps.

TIP: Creating a smooth, level platform will allow for faster installation of STM Tank® modules, as they will fit together evenly, eliminating detail work that can delay your progress.

4 Place Geotextile

Geotextile will be required below the STM Tanks on most projects, but not all. Check your plans to ensure that geotextile is to be placed between the base and the STM Tank units.

Cut full-width strips of Geotextile to the proper length and place them over the base, covering the floor of the excavation and the side walls. The Geotextile should extend at least 2' (600mm) beyond the edge of the STM Tank footprint. This will enable the whole unit to be able to be wrapped to the dimensions required. All overlaps are then to be suitably secured, weighted down tapped or stapled in order to minimize the ingress of deleterious materials.

Geotextile are flammable. No smoking should be permitted on the Geotextile. Adjacent panels of material should be overlapped by 12" (300mm) or more, as shown on the plans (Fig.8 & 9).

Use pins, staples, sandbags or other ballast to hold the Geotextile in place, preventing it from blowing or sliding out of position.

Patch any holes made in the Geotextile by placing a small patch of fabric over the damaged area. The patch must be large enough to cover the damaged area with at least 12" (300mm) of overlap on undamaged material.

If a liner and/or additional Geotextile are required per plans, install these now as shown on the project plans.


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Fig 8: Overlap Geotextile by minimal 12" (300mm) or more. Pull Wrinkles out of Geotextile

Fig 9: Reduced overlaps don't create significant savings and can create delays.

TIP: Some contractors choose to cut the Geotextile strips long enough to wrap up the sides and over the top of the STM Tank in a single piece (Fig. 6). If space allows and the folded flaps of Geotextile will not slow our progress, you may want to consider doing this. If a liner is required on your project, this method should be used to protect the liner.

TIP: Many contractors find that it is both easier and less expensive to have specialty contractors install the liner (typically used when building a cistern). If you are installing a liner yourself, handle it VERY CAREFULLY to avoid damage.

5 Install STM-Tanks

Determine the starting location. It is often helpful to use an inlet or outlet pipe to guide you. Using a string line, establish two adjacent edges of the STM Tank footprint. Ensure that your corner is square. Mark these two edges with marking paint and remove the string line (Fig. 10 & 10A).

> **IMPORTANT:** If using a liner, be careful not to puncture it with stakes or pins while placing your string line.

Begin placing STM Tanks in the corner of the marked area. Do NOT place units on their sides, as this will void the warranty. Check your plans to ensure correct orientation of the STM Tanks (Fig. 9/9A/9B).

Check the plans to ensure the STM Tanks are running in the correct direction (North/South vs. East/West) to match the footprint shown. As the modules are 600mm x 600mm in footprint if any mistakes are made during laying, this can be squared off at the end, to get accurate dimensions as per plans.

- STM Tank Width = 600mm (23.62")
- STM Tank Length = 600mm (23.62")

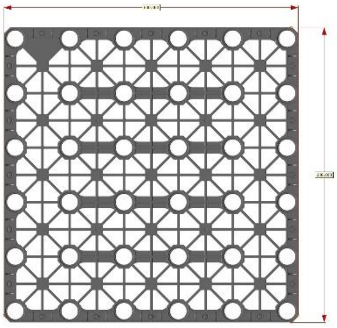

Fig 9: TOP VIEW (L x W)
600MM X 600MM

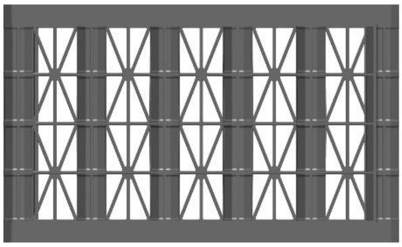

Fig 9A: SIDE VIEW (L x H)
600MM X 600MM

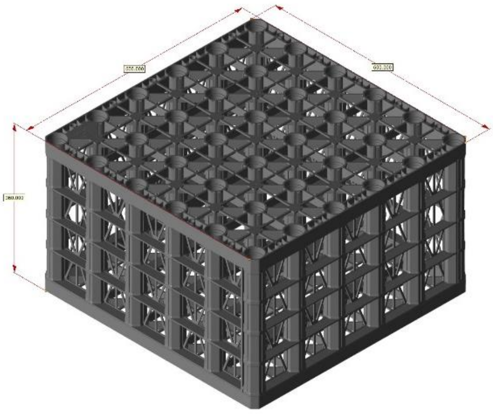

Fig 9B: ISOMETRIC VIEW (L X W x H)
600MM X 600MM X 360MM

Fig 10: Use a String line & marking paint to square the system footprint.

Fig 10A : Place the frame STM tank in Capital "L" format and start building the tank from the corner out to achieve perfect layout.

TIP: Creating a smooth, level flat compacted base, will allow for faster installation of STM Tanks, as they will fit together evenly, eliminating detail work that can delay your progress (Fig. 7 & 7A).

STM Tank units should fit together evenly. Minor gaps between units (< ½") or variations in the height of the units (< ½") are acceptable (Fig. 9A), but reasonable efforts should be made to minimize these variations. Minor gaps will be eliminated during compaction of side backfill material.

No lateral connections between adjacent STM Tanks are required, but frame Modules can be clipped together using the STM top clips as a house keeping measure.

Fig 10: Plan view showing the end row turned perpendicular, corners may not matchup, so 2 options shown.

TIP: Moving STM Tank units into the excavation quickly is essential to a profitable installation. Many contractors fabricate a platform that can be lifted by their forklift to quickly move as many units with each trip, or create an access ramp, with rollers.

Identify locations of inlet, outlet, Inspection Rows, and Inspection ports, and any other penetrations. Inspection rows will be wrapped in its own separate geotextile. All pipes should be positioned at 90 degree to the tank structure. Any inlets, outlets etc should be installed flush (butted up) to the tank and the geotextile fabric shall be cut to enable hydraulic continuity at the inlet and outlet and secured around the pipe using a suitable coupling or a stainless-steel clamp prior to backfilling.

After placement of Rainsmart® STM tanks, wrap with geotextile which is brought up around the sides and lapped over the top of the full structure. Should any gaps be evident additional fabric can be cut and placed over any of these areas. Fold excess fabric at corners to lay flat against sides of structure, securing folds and seams with staples or similar methods.

Tanks require ventilation for proper hydraulic performance, number of pipes and vents will depend on the size of the tank. Vents are often installed using a 90 degree elbows etc with PVC pipe into soft landscape area with 'U' bend or venting bollard to inhabit the ingress of debris, alternatively a ground level concrete steel cover can be fixed to suit.

Fig 10 A: Showing Inspection row being installed and being surrounded in its own geotextile casing to prevent debris from spreading into the entire tank Structure.

6 Install Inspection /Maintenance Ports

All ports should be made from pipe long enough to extend from the top of the STM Tank to finished grade. They are typically Schedule 40 PVC pipe, but can be formed from other types of pipe, as well.

Identify the location of all ports and remove the top geotextile from STM Tank from each location. STM Inspect shaft module will be installed in these locations.

Maintenance / Inspection Ports:

Typically made from 12” (300mm) Schedule 40 PVC pipe, cut the pipe to length, leaving enough excess to trim the top when final grade is reached. Install the pipe into the STM Tank unit, pore 150mm of concrete mix around the pipe to prevent it from moving during back fill (Fig: 11). Seal the opening on top of the pipe with a cap or temporary lid to prevent debris from entering the system.

TIP: If the location of Maintenance Ports is not shown on your plans, include a port within 10’ (3mts) of all inlet and outlet pipes (a single maintenance Port can cover multiple pipe connections), and include additional Maintenance Ports, as needed, to prevent the distance between ports from exceeding 65 feet (20mts).

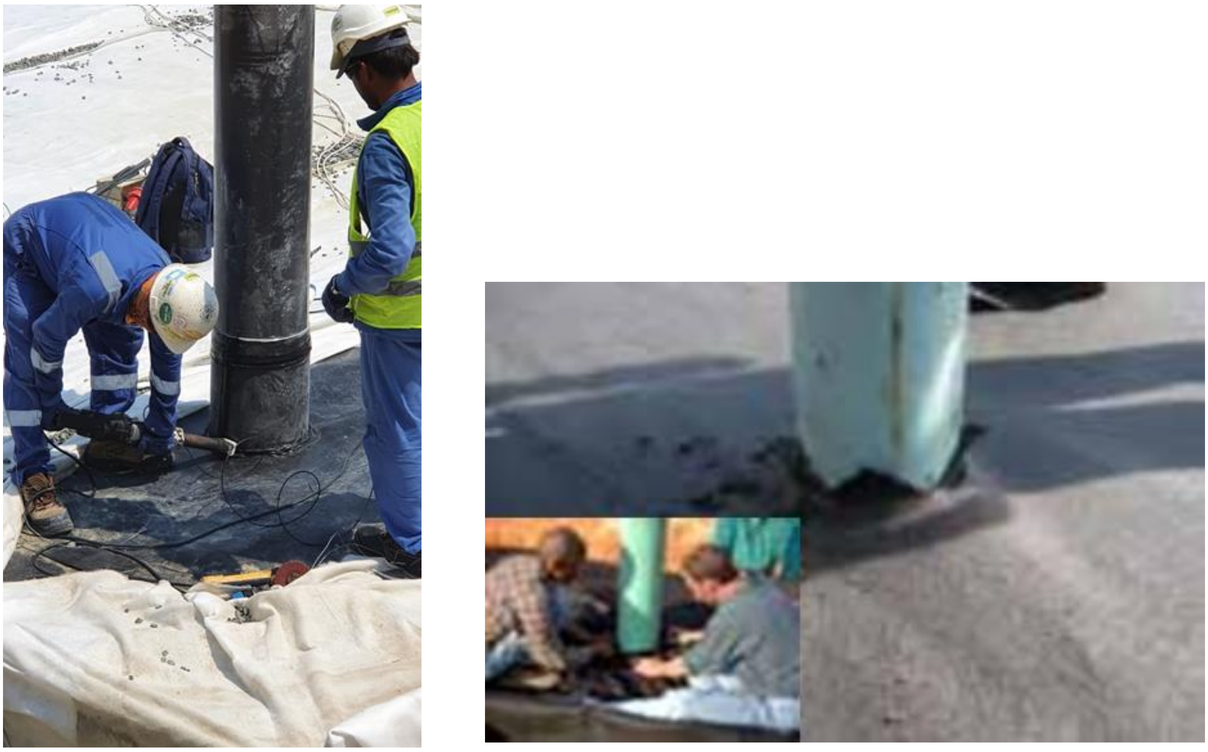

Fig. 11 Cut an “X” into textile to accommodate pipe penetration.

IMPORTANT: Take special care with Inside Corners on the footprint of the system. Cut geotextile as needed to ensure that it lays flat against the STM Tank.
Use additional pieces of geotextile to seal the corner and any cuts that are made (12” overlap).

7 Seal Tanks with Geotextile

Clean off any debris that may be lying on top of the exposed Geotextile around the perimeter of the STM Tank.

Cut strips of geotextile to fit over the top and down both sides of the STM Tank with at least 2’ (600mm) of excess material on each side of the system. This 2’ (600mm) flap should overlay the geotextile placed below the STM Tank units, creating a clean 24” overlap to seal the system.

Adjacent strips of geotextile should overlap at least 12” (300mm) or as shown on plans. Use duct tape, sand bags or other ballast to temporarily secure overlaps (Fig. 13).

Where the geotextile intersects an Inspection or Maintenance Port, cut an “**X**” into the geotextile and pull it over the pipe. The flaps of the “**X**” should point AWAY from the STM Tank (Fig. 11). Use stainless steel band clamp to seal the flaps to the pipe.

Fold geotextile for outside corners similar to sheets on a bed, and lay excess material flat against STM Tank. Leave corners loose to avoid creating weak spots in the material. Temporarily secure excess fabric with duct tape (Fig. 11).

Fig. 12 Encapsulate STM Tanks with geotextile

Fig. 13 Maintain 12" (300mm) overlap

Fig. 14 Seal the pipe boot with band clamps and duct tape.

Connect Inlet & Outlet Pipe

Where the inlet and outlet pipes connect to the STM Tank, cut an "**X**" into the geotextile so that the pipe makes DIRECT contact with the STM Tank. Pull the flaps of the "**X**" over the pipe so that the flaps of the "**X**" point AWAY from the STM Tank. Use a stainless-steel band clamp to seal the flaps to the pipe.

If used, adjust all pipe boots so that the fabric lays snug against the STM Tank. Tighten the band clamps with a screw/nut driver. Use duct tape to secure the boot flap to the outside of the geotextile envelope (Fig. 21). Walk bottom edge of geotextile to eliminate gaps between the fabric and the bottom corner of the STM Tank (Fig. 12).

TIP: If using Prefabricated Pipe Boot Kits, install them onto the Inlet and Outlet Pipes, leaving the band clamps loose so that final adjustments may be made.

WARNING: Inlet and Outlet pipes must make DIRECT contact with the STM Tank, allowing effluent to flow directly into or out of the STM Tank without filtering through the geotextile. Failing to correctly connect pipes to the STM Tank will void the warranty.

8 Backfill Sides

Place Backfill material (same as Base Materials in Step 3) around perimeter of the STM Tank, distributing the material evenly to prevent shoving of the STM Tank units. All backfill Material must meet the requirements listed in the specification,

Use a trench roller or plate compactor to compact backfill in 12" (300mm) lifts. Continue placing and compacting backfill in 12" (300mm) lifts until the material reaches the top of the STM Tank units. Ensure the Plate compacter doesn't hit the STM tank. Or tear off the Geotextile wrap.

Fig. 15 "Walk" the geotextile into the corner to eliminate folds & air gaps.

Fig. 16 Vibratory compaction of side backfill is always required , regardless of what backfill material is used.

IMPORTANT: Vibratory compaction of the side backfill (Fig.15 & 16) is a critical step that both compacts the backfill and eliminates the minor gaps between individual STM Tank units. While some backfill materials will yield a 95% proctor density without compaction, ***vibratory compaction of the material must be completed to ensure the stability of the system.*** Skipping this step will void the manufacturer's warranty.

9 Backfill Top.

Dump backfill material adjacent to the STM Tank and, using your LGP Skid Steer or Dozer, push the material over the STM Tank system (Fig. 17).

Largest Track Dozers that can be used with 12" (300mm) of cover over the STMTank.

MACHINE	Operating Weight *(imp)*	Operating Weight (metric)	Track Dimensions *(imp)*	Track Dimensions (metric)	Ground Pressure *(imp)*	Ground Pressure (metric)
Case 850K LGP	20,700 lbs	9.38 t	28" x 92.6"= 2593 si	0.7m x 2.35m = 1.67 sqm	4.0 psi	2.8 t/sqm
Caterpillar D5K LGP	21,347 lbs	9.68 t	26" x 91"= 2366 si	0.66m x 2.31m =1.52 sqm	4.52 psi	3.17 t/sqm
John Deere 550J LGP	18,252 lbs	8.27 t	24" x 86"= 2064 si	0.61m x 2.18m = 1.33 sqm	4.2 psi	2.95 t/sqm
Komatsu D39PX-21	19,620 lbs	8.90 t	25" x 93"= 2325 si	.635m x 2.36m = 1.49 sqm	4.27 psi	3.00 t/sqm
New Holland D95 LGP	20,700 lbs	9.38 t	28" x 93"= 2604 si	0.71m x 2.36m = 1.68 sqm	4.0 psi	2.81 t/sqm

** This list is not intended to be all inclusive, but representative.

If your machine is not listed, you'll need to find your vehicle's Operating Weight and measure the area where the tracks contact the ground. Take these dimensions and multiply them (Length x Width), then multiply by 2 (since the machine has two tracks), then divide the Operating Weight by the total square inches (sqm) of contact area to determine the contact pressure of the machine. If the contact pressure is less than 3.52 psi (3.17t/sqm) and the operating weight is less than 20,000 lbs(10.0t) the machine will work with 12" (300mm) of cover. Compact top backfill to 95% standard proctor density or as shown on plans using your walk-behind trench roller.

Lightly compact top backfill to 95% Standard Proctor density or as shown on the plans using a walk behind trench roller, Alternately, a roller (maximum gross vehicle weight of 5 tons) may be used. Roller must remain in Static mode until an minimum of 24'' (600mm) of cover has been placed on the modules. Sheep Foot Rollers should not be used.

TIP: When pushing backfill over STM Tank units, work in the direction of the geotextile overlap to avoid shoving material between the fabric layers.

WARNING: A minimum of 12" (350mm) of material must be maintained between the Dozer tracks and the top of the STM Tank. For best results, push at least 20" (660mm) or more if needed of backfill over the units so that as the material compacts beneath the dozer, a 12"(300mm) minimum lift is maintained. It is recommended that the dozer drive straight on and then back straight off of the system during backfill placement. Turning or manovering movements are likely to shove the backfill material, reducing the thickness of the lift and potentially damaging the units. Hence not recommended.

Fig. 17 Use an LGP dozer to push backfill over STM Tank units.

WARNING: Dump trucks should not drive over or dump material on top of the STM Tank.

WARNING: Some materials will compact significantly while others may shove excessively as you work. Never allow your lift thickness to compact to less than 12" without adding more material.

10 Place Geogrid.

Geogrid is required for all load-bearing applications (Fig. 18), such as systems placed beneath parking lots and roads. It is not required above systems used in open space where traffic is prohibited, such as sport fields or natural Landscaped areas.

Geogrid must be placed 12" (300mm) above the STM Tank. Overlap adjacent panels by 18"(450mm) minimum or as specified in plans. Roll out Geogrid over the top of the system, with the edges of the grid extending 5' (1.50m) from STM Tank footprint or 3' (900mm) from edge of excavation or more as show on plans (refer to CAD detail H20 loads).

Fig. 18 Overlap Geogrid 18" (300mm) or as required by plans.

If metallic tape used to locate the system has been specified, now is a good time to install it.

11 Place Additional Cover Material as Needed

If additional cover or pavement base is required by the plans, begin placing and compacting material in the same manner as discussed in Step 9. Push cover material parallel to the geogrid for best results (Fig. 19). All cover materials must meet requirements of sequence of works specification section 2.03

⚙ **TIP:** To achieve proper compaction requirements, it may be beneficial to begin placing material in 6" (150mm) lifts.

Please contact Rainsmart or closest distributor for load calculations and design details for Maximum and minimum allowable top fill, based on project requirements.

Fig. 19 Pushing backfill parallel to the Geogrid prevents the grid from shoving.

12 Secure the Installation.

The STM Tank System should be secured to prevent damage from construction equipment once it has been installed.

Construction loads are often the heaviest loads that ever drive over the STM Tank System, and there are many construction vehicles that exceed the HS20 standard that most detention systems are designed to meet. To prevent damage from these vehicles, the installation should be secured to prevent unauthorized traffic from driving over the system once it has been installed.
Projects nearing completion (within three months) should use warning tape or temporary fencing to secure the installation (Figure 20).
For larger projects with ongoing construction activities, consider a more durable method for preventing unauthorized traffic from accessing the system (Figure 21).

Regardless of what method is selected to secure the installation, it must remain in place until construction activity has concluded and no further access of vehicles exceeding the HS20 standard is necessary.

Fig. 20 Secure the installation with temporary fencing.

Fig. 21 Secured STM Tank installation using Jersey Barriers.

13 Install a Pre-treatment Devices.

Install pre-treatment devices prior to activating R- STM Tank System to keep any debris from entering the system.

Fig. 22 Trash Guard Plus prevents contamination

-

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Project Details

Project Name	3 PMR - Filter 1	Project Number	220571/1
Project Address	3 PMR	Local Council	Auckland
Location	Auckl	Author	Samson Weng

Catchment Details

Reference	Catchment Type	Runoff Coefficients (C)	Area, m2 (A)	Product, m2 (CxA)
	Roof	0.95	1235.45	1173.6775
	Hardstand/Road	0.9	1354	1218.6
	Pervious (Clay)	0.3	1081.25	324.375
Totals	-	0.74	3670.7	2716.6525

Rainfall Intensity (iwq): 10 mm/hr

*Note: The chosen rainfall intensity value is to treat 90% of annual rainfall (10mm/hr for Auckland region as per Auckland Council. 5mm/hr for Christchurch region as per Christchurch City Council, and 10mm/hr for other councils). If unsure, please contact Stormwater360

Output

Required treatable flow rate (Qwq)	7.55 L/s	Calculated using Rational method Qwq = C x iwq x A (L/s)
Cartridge size/height	69cm	Recommended hydraulic effect is 770mm, for lower hydraulic effect option please contact Stormwater360
Media	Perlite	Other media options are available, please contact Stormwater360
Design treatment flow rate per cartridge (Qcart)	1.42 L/s	
No. of cart required (nCart)	6	Calculated - Qwq/Qcart (Rounded up to whole number)
Design StormFilter treatment flow (QSF)	8.52 L/s	Calculated - Qcart x nCart
Is QSF > Qwq?	Yes	
StormFilter model required	SF-MH-69-1800-T-20	Please refer to drawing for footprint and size
Peak Diversion model required	SF-MHPD-69-2050-T-20	MHPD is an integrated Peak Diversion option for off-line configuration

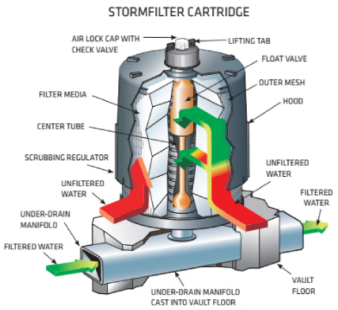


Figure 1: StormFilter Cartridge

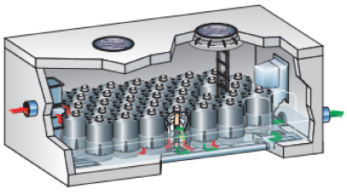
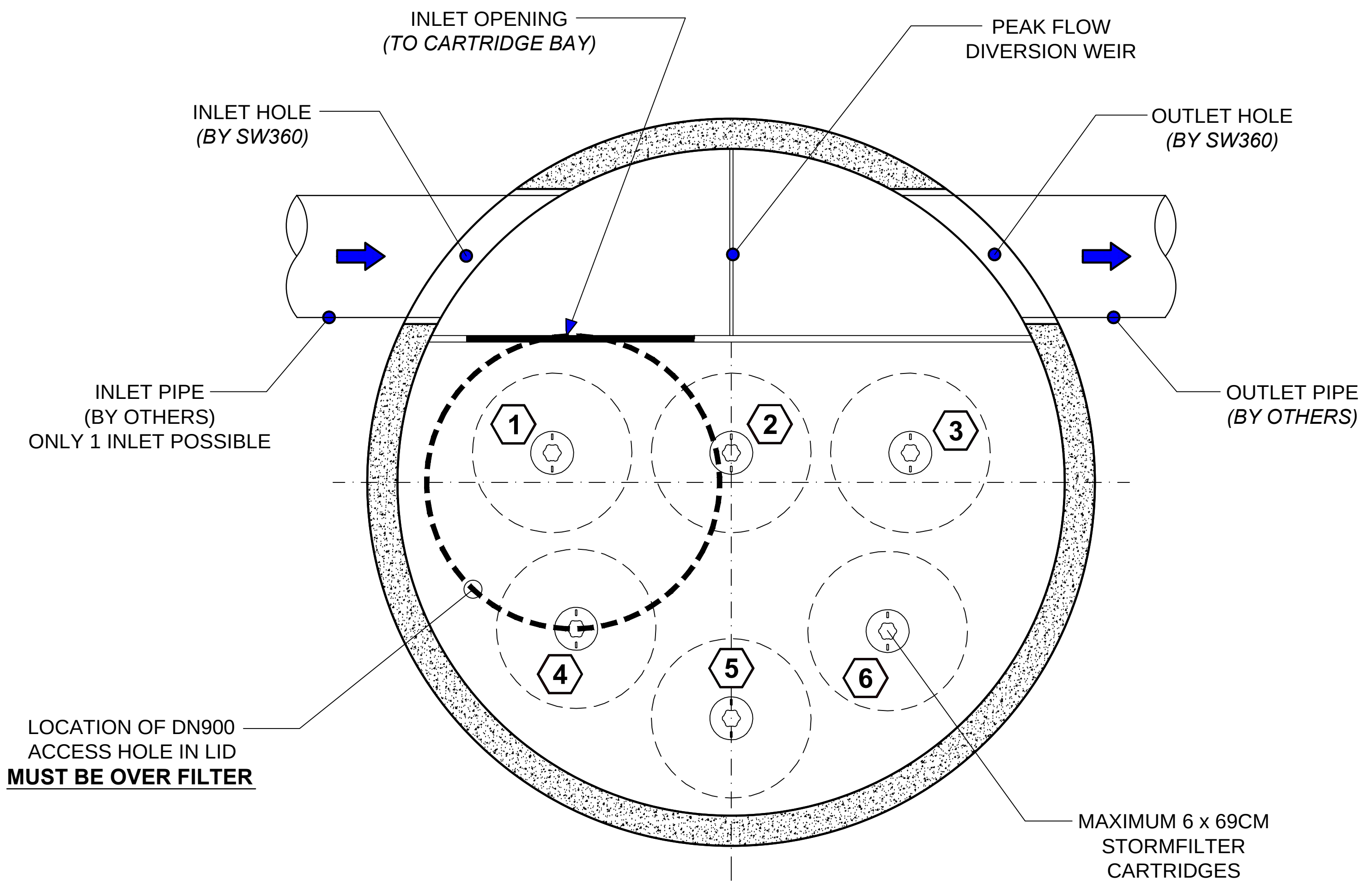
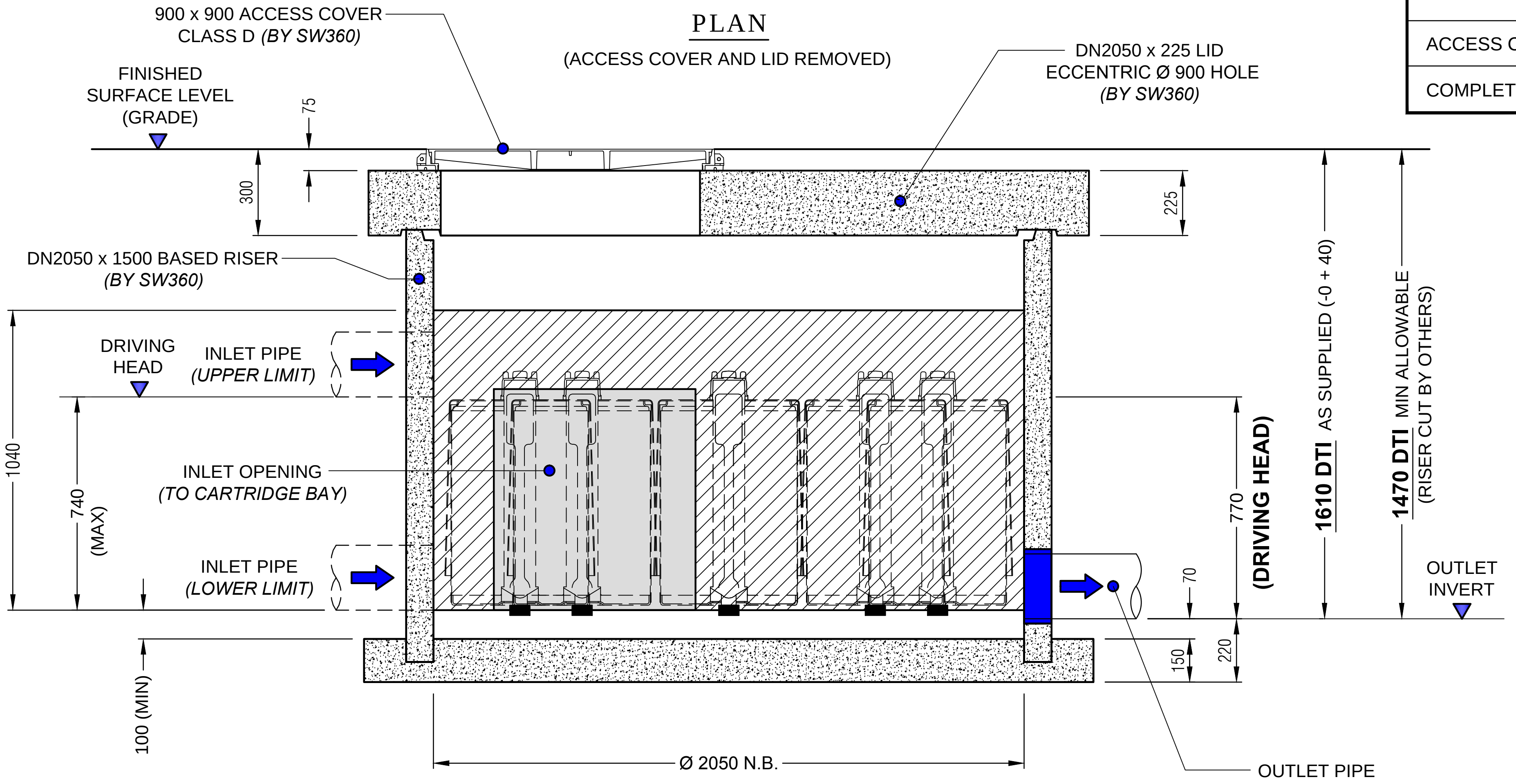


Figure 2: StormFilter Vault



PLAN

(ACCESS COVER AND LID REMOVED)



ELEVATION

TO BE COMPLETED BY CUSTOMER / CONTRACTOR

COMPANY :	P.O. NUMBER :

SITE ADDRESS :

SITE CONTACT & PHONE :

PREFERRED DELIVERY DATE (TBC SW360) :

STORMFILTER REFERENCE (IF APPLICABLE) :

INLET PIPE Ø : *DN375 RCRRJ - MAX* *DN375 PVC - MAX*	PIPE MATERIAL : *(PVC OR RCRRJ)*	CORE DRILL Ø :	INLET (IL) :
OUTLET PIPE Ø : *DN375 RCRRJ - MAX* *DN375 PVC - MAX*	PIPE MATERIAL : *(PVC OR RCRRJ)*	CORE DRILL Ø :	OUTLET (IL) :
LID LEVEL (RL) :	DTI :	ORIENTATION : 180° *(AS DRAWN)* / 90° / 135°	
COMPLETED BY :		SIGNED :	DATE :

TO BE COMPLETED BY SW360

SW360 PRODUCT CODE :

MEDIA TYPE (CIRCLE ONE) :	PERLITE	ZPG	OTHER :	
CARTRIDGE QTY (STATE) :			PRE-INSTALLATION (Y/N) :	
SP FLOW RATE (CIRCLE ONE) :	FULL (Ø 27.6 ID) BLACK/MUSTARD	3 QTR (Ø 24.0 ID) WHITE/OPAL	HALF (Ø 19.7 ID) GREEN	OTHER :
ACCESS COVER (CIRCLE ONE) :	900 x 900 WEB-FORGE / CLASS D		OTHER :	
COMPLETED BY :	SIGNED :		DATE :	

NOTES

1. MANHOLE UNIT FITTED WITH 2 SWIFTLIFT ANCHOR POINTS. DO NOT EXCEED 60 DEGREE LIFT ANGLE. CONCRETE LID FITTED WITH 4 SWIFTLIFT ANCHOR POINTS.
2. UNIT SUPPLIED WITH INLET & OUTLET CORE DRILLED.
3. SEALING / GROUTING OF MANHOLE COMPONENTS AND PIPES BY CONTRACTOR. ENSURING LOCAL CODES AND REGULATIONS ARE COMPLIED WITH.
4. ANY RISERS REQUIRED TO INCREASE THE DEPTH TO INVERT (DTI) FROM THAT AS DRAWN TO BE SUPPLIED BY THE CONTRACTOR.
5. FOR A DTI EXCEEDING 5m PLEASE CONTACT **0800STORMWATER**.
6. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION RELATED EROSION RUNOFF.
7. BACKFILL, BEDDING AND BUOYANCY DESIGN BY ENGINEER OF RECORD
8. QTY OF CARTRIDGES BY ENGINEER OF RECORD.
9. CONCRETE MANHOLE RISERS ARE DESIGNED AND MANUFACTURED IN ACCORDANCE WITH AS/NZS 4058 : 2007
10. CONCRETE MANHOLE BASES ARE DESIGNED AND MANUFACTURED IN ACCORDANCE WITH NZS 3101 : 2006 & NZS 3109 : 1997
11. CONCRETE LID DESIGNED AND MANUFACTURED TO HN-HO-72
12. FOR REQUIREMENTS OUTSIDE OF DRAWING SPECIFICATIONS PLEASE CONTACT **0800STORMWATER**.

APPROX WEIGHTS

MANHOLE SECTION INCLUDING CARTRIDGES : **4850 Kg**
(AS DELIVERED, BASED ON QTY 5 ZPG CARTS)
LID WEIGHT : **2460 Kg**

Stormwater360
BETWEEN SKY AND SEA

☎ 0800 STORMWATER
✉ sales@stormwater360.co.nz
www.stormwater360.co.nz

CONDITION OF USE

STORMFILTER® PEAK DIVERSION
OFF - LINE CARTRIDGE FILTRATION SYSTEM
69cm CART / DN2050 x 1500 MH - TRAFFICABLE
GENERAL ARRANGEMENT

SCALE : N.T.S. DRG No : SF-MHPD-69-2050-T-20 REV : 0 DATE : 22.05.19

JOB NO :			
PROJECT :			
DRN :	R.P.	22.05.19	
CKD :	G.S.	22.05.19	

REV	REVISION DETAIL	DATE
A	FOR APPROVAL	22.05.19
0	APPROVED	23.05.19

Project Details

Project Name	3 PMR - Filter 4	Project Number	220571/1
Project Address	3 PMR	Local Council	Auckland
Location	Auckland	Author	Samson Weng

Catchment Details

Reference	Catchment Type	Runoff Coefficients (C)	Area, m^2 (A)	Product, m^2 (CxA)
	Roof	0.95	1417.35	1346.4825
	Hardstand/Road	0.9	1647.6	1482.84
	Pervious (Clay)	0.3	1680.65	504.195
Totals	-	0.70	4745.6	3333.5175

Rainfall Intensity (iwq): 10 mm/hr

*Note: The chosen rainfall intensity value is to treat 90% of annual rainfall (10mm/hr for Auckland region as per Auckland Council. 5mm/hr for Christchurch region as per Christchurch City Council, and 10mm/hr for other councils). If unsure, please contact Stormwater360

Output

Required treatable flow rate (Qwq)	9.26 L/s	Calculated using Rational method Qwq = C x iwq x A (L/s)
Cartridge size/height	69cm	Recommended hydraulic effect is 770mm, for lower hydraulic effect option please contact Stormwater360
Media	Perlite	Other media options are available, please contact Stormwater360
Design treatment flow rate per cartridge (Qcart)	1.42 L/s	
No. of cart required (nCart)	7	Calculated - Qwq/Qcart (Rounded up to whole number)
Design StormFilter treatment flow (QSF)	9.94 L/s	Calculated - Qcart x nCart
Is QSF > Qwq?	Yes	
StormFilter model required	SF-MH-69-1800-T-20	Please refer to drawing for footprint and size
Peak Diversion model required	SF-MHPD-69-2300-T-20	MHPD is an integrated Peak Diversion option for off-line configuration

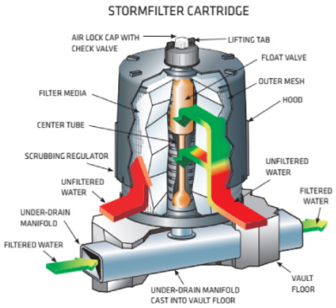


Figure 1: StormFilter Cartridge

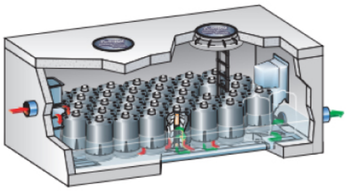


Figure 2: StormFilter Vault

Project Details

Project Name	3 PMR - Filter 6
Project Address	3 PMR
Location	Auckland

Project Number	220571/1
Local Council	Auckland
Author	Samson Weng

Catchment Details

Reference	Catchment Type	Runoff Coefficients (C)	Area, m2 (A)	Product, m2 (CxA)
	Roof	0.95	2243.1	2130.945
	Hardstand/Road	0.9	1457.75	1311.975
	Pervious (Clay)	0.3	1955.85	586.755
Totals	-	0.71	5656.7	4029.675

Rainfall Intensity (iwq): 10 mm/hr

*Note: The chosen rainfall intensity value is to treat 90% of annual rainfall (10mm/hr for Auckland region as per Auckland Council. 5mm/hr for Christchurch region as per Christchurch City Council, and 10mm/hr for other councils). If unsure, please contact Stormwater360

Output

Required treatable flow rate (Qwq)	11.19 L/s	Calculated using Rational method Qwq = C x iwq x A (L/s)
Cartridge size/height	69cm	Recommended hydraulic effect is 770mm, for lower hydraulic effect option please contact Stormwater360
Media	Perlite	Other media options are available, please contact Stormwater360
Design treatment flow rate per cartridge (Qcart)	1.42 L/s	
No. of cart required (nCart)	8	Calculated - Qwq/Qcart (Rounded up to whole number)
Design StormFilter treatment flow (QSF)	11.36 L/s	Calculated - Qcart x nCart
Is QSF > Qwq?	Yes	
StormFilter model required	SF-MH-69-2050-T-20	Please refer to drawing for footprint and size
Peak Diversion model required	SF-MHPD-69-2300-T-20	MHPD is an integrated Peak Diversion option for off-line configuration

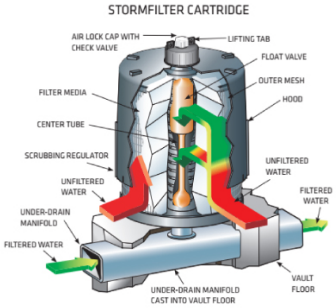


Figure 1: StormFilter Cartridge

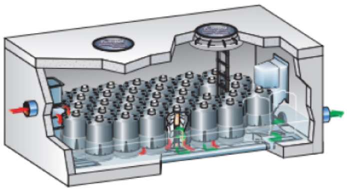
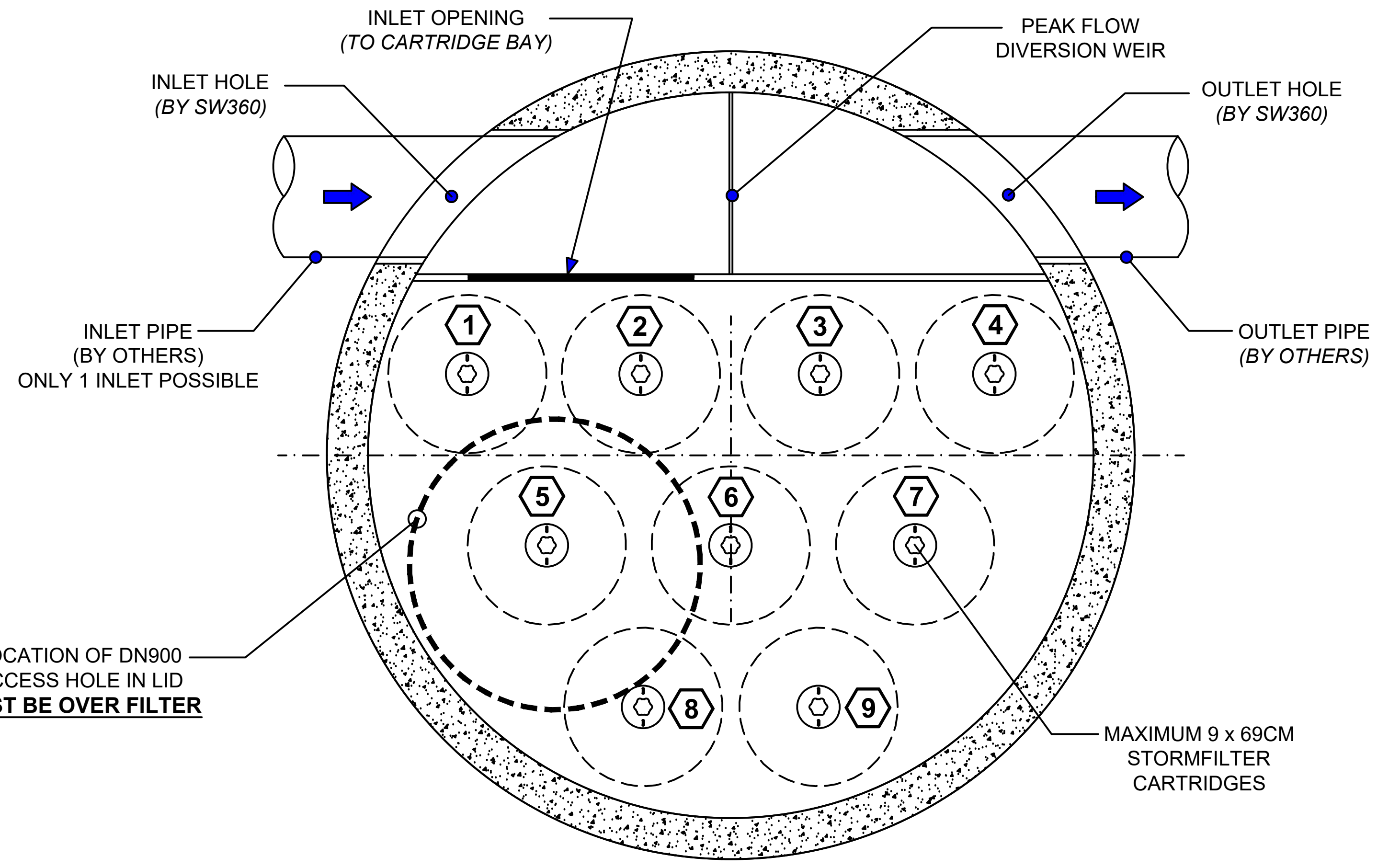
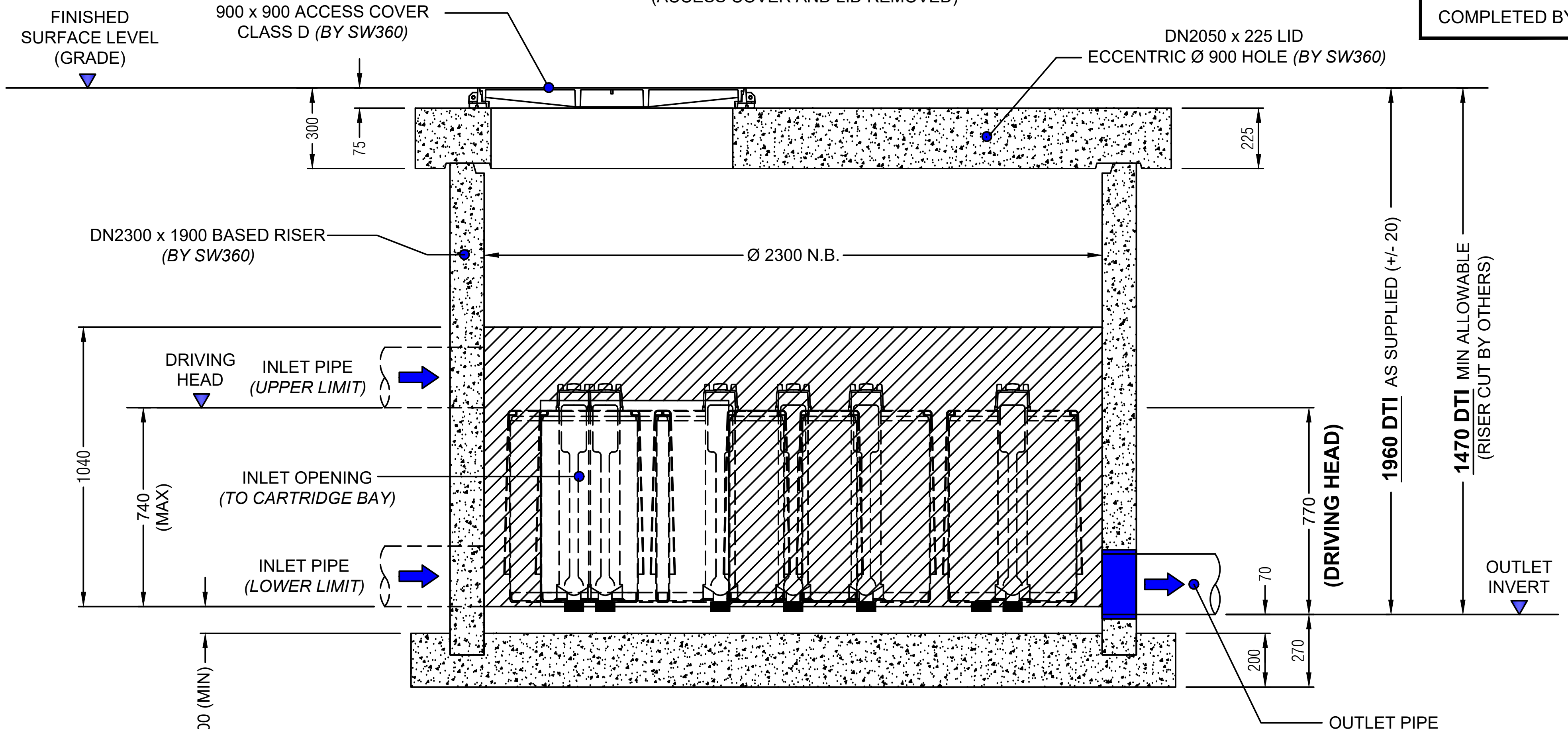


Figure 2: StormFilter Vault



PLAN

(ACCESS COVER AND LID REMOVED)



ELEVATION

TO BE COMPLETED BY CUSTOMER / CONTRACTOR

COMPANY :		P.O. NUMBER :	
SITE ADDRESS :			
SITE CONTACT & PHONE :			
PREFERRED DELIVERY DATE (TBC SW360) :			
STORMFILTER REFERENCE (IF APPLICABLE) :			
INLET PIPE Ø : *DN450 RCRRJ - MAX* *DN475 PVC - MAX*	PIPE MATERIAL : *(PVC OR RCRRJ)*	CORE DRILL Ø :	INLET (IL) :
OUTLET PIPE Ø : *DN450 RCRRJ - MAX* *DN475 PVC - MAX*	PIPE MATERIAL : *(PVC OR RCRRJ)*	CORE DRILL Ø :	OUTLET (IL) :
LID LEVEL (RL) :	DTI :	ORIENTATION : 180° *(AS DRAWN)* / 90° / 135°	
COMPLETED BY :		SIGNED :	DATE :

TO BE COMPLETED BY SW360

SW360 PRODUCT CODE :				
MEDIA TYPE (CIRCLE ONE) :	PERLITE	ZPG	OTHER :	
CARTRIDGE QTY (STATE) :			PRE-INSTALLATION (Y/N) :	
SP FLOW RATE (CIRCLE ONE) :	FULL (Ø 27.6 ID) BLACK/MUSTARD	3 QTR (Ø 24.0 ID) WHITE/OPAL	HALF (Ø 19.7 ID) GREEN	OTHER :
ACCESS COVER (CIRCLE ONE) :	900 x 900 WEB-FORGE / CLASS D		OTHER :	
COMPLETED BY :	SIGNED :		DATE :	

NOTES

1. MANHOLE AND LID FITTED WITH SWIFT-LIFT ANCHOR POINTS.
2. UNIT SUPPLIED WITH INLET & OUTLET CORE DRILLED.
3. SEALING / GROUTING OF MANHOLE COMPONENTS AND PIPES BY CONTRACTOR. ENSURING LOCAL CODES AND REGULATIONS ARE COMPLIED WITH.
4. ANY RISERS REQUIRED TO INCREASE THE DEPTH TO INVERT (DTI) FROM THAT AS DRAWN TO BE SUPPLIED BY THE CONTRACTOR.
5. FOR A DTI EXCEEDING 5m PLEASE CONTACT **0800STORMWATER**.
6. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION RELATED EROSION RUNOFF.
7. BACKFILL, BEDDING AND BUOYANCY DESIGN BY ENGINEER OF RECORD
8. QTY OF CARTRIDGES BY ENGINEER OF RECORD.
9. CONCRETE MANHOLE RISERS ARE DESIGNED AND MANUFACTURED IN ACCORDANCE WITH AS/NZS 4058 : 2007
10. CONCRETE MANHOLE BASES ARE DESIGNED AND MANUFACTURED IN ACCORDANCE WITH NZS 3101 : 2006 & NZS 3109 : 1997
11. CONCRETE LID DESIGNED AND MANUFACTURED TO HN-HO-72
12. FOR REQUIREMENTS OUTSIDE OF DRAWING SPECIFICATIONS PLEASE CONTACT **0800STORMWATER**.

APPROX WEIGHTS

MANHOLE SECTION INCLUDING CARTRIDGES : **9300 Kg**
(AS DELIVERED, BASED ON QTY 9 ZPG CARTS)
LID WEIGHT : **3480 Kg**

Stormwater360®
BETWEEN SKY AND SEA

0800 STORMWATER
sales@stormwater360.co.nz
www.stormwater360.co.nz

CONDITION OF USE

STORMFILTER® PEAK DIVERSION
OFF - LINE CARTRIDGE FILTRATION SYSTEM
69cm CART / DN2300 x 1900 MH - TRAFFICABLE
GENERAL ARRANGEMENT

SCALE : N.T.S. | DRG No : SF-MHPD-69-2300-T-20 | REV : 2 | DATE : 13.02.20

			REV	REVISION DETAIL	DATE
JOB NO :					
PROJECT :			2	RISER CHANGE	13.02.20
			1	CORRECTION	02.08.19
DRN :	R.P.	22.05.19	0	APPROVED	23.05.19
CKD :	G.S.	22.05.19			

STORMFILTER™

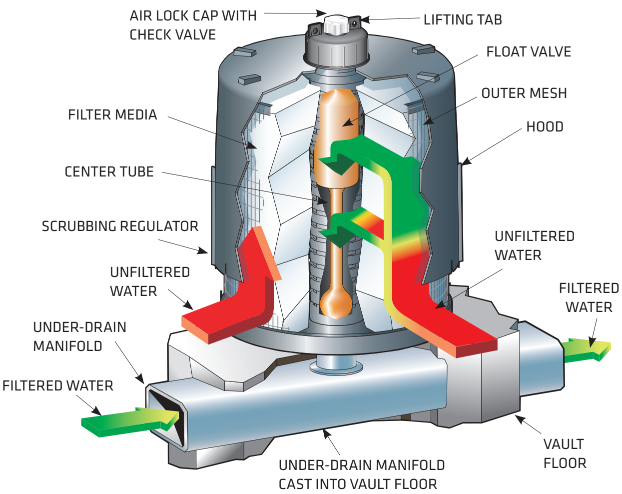
High efficiency / low maintenance stormwater filter.

SIPHON-ACTUATED FILTRATION The Stormwater Management StormFilter® cleans stormwater through a patented passive filtration system, effectively removing pollutants to meet the most stringent regulatory requirements. Highly reliable, easy to install and maintain, and proven performance over time, StormFilter products are recognised as a versatile BMP for removing a variety of pollutants, such as sediments, oil and grease, metals, organics, and nutrients. These systems come in variable configurations to match local conditions and come with prolonged maintenance periods to ensure long-term performance and reduce operating costs.

HOW DOES IT WORK?

During a storm, runoff passes through the filtration media and starts filling the cartridge center tube. Air below the hood is purged through a one-way check valve as the water rises. When water reaches the top of the float, buoyant forces pull the float free and allow filtered water to drain.
After the storm, the water level in the structure starts falling. A hanging water column remains under the cartridge hood until the water level reaches the scrubbing regulators. Air then rushes through the regulators releasing water and creating air bubbles that agitate the surface of the filter media, causing accumulated sediment to drop to the vault floor. This patented surface-cleaning mechanism helps restore the filter's permeability between storm events.

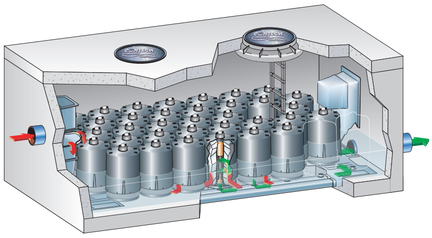
STORMFILTER CARTRIDGE



PROVEN PERFORMANCE

- New Zealand's only independently verified filter by Washington Department of Ecology, New Jersey Department of Environmental Protection and USEPA's Environmental Technology Verification program).
- Approved Auckland Council >75% TSS removal and approved on high trafficked roads (>20,000 V.P.D)
- Over 550 x StormFilter's installed throughout New Zealand-treating over 3.7 million m^2 of catchment area
- 8th generation of the product. Design refined and perfected over two decades of research and experience

STORMFILTER VAULT



STORMFILTER BENEFITS

UNDERGROUND SYSTEMS MAXIMISE PROFITABILITY

- Save land space allowing denser developments reducing sprawl
- Add parking spaces and increase building size, increasing profitability
- Compact design reduces construction and installation costs by limiting excavation

RELIABLE LONGEVITY & LOWER MAINTENANCE COSTS

- Self cleaning hood prevents surface blinding, ensures use of all media and prolongs cartridge life
- 1-3 year maintenance cycles
- 8 years maintenance experience – 1-5 year contracts with cost guarantees
- Minimal or no standing water. Lower disposal costs

CONTACT DETAILS

Stormwater360

FREEPHONE:
0800 STORMWATER
(0800 786769)

www.stormwater360.co.nz

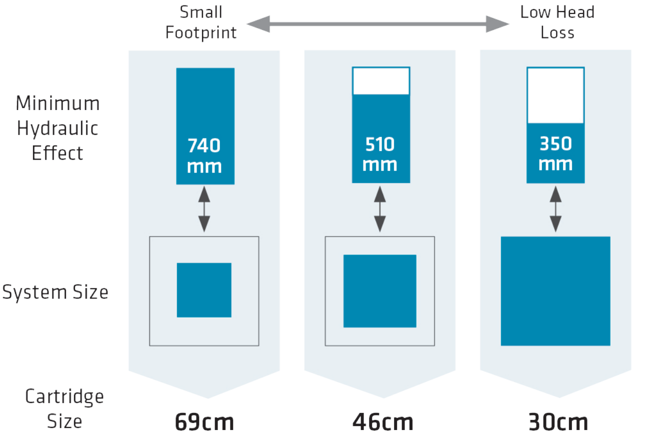
Stormwater360®
BETWEEN SKY AND SEA

www.stormwater360.co.nz

BETWEEN SKY AND SEA

SUPERIOR HYDRAULICS

Multiple cartridge heights gives design solutions for site restraints.



Other hydraulic benefits

- Low hydraulic effect as low as 350 mm head loss
- Zero surcharge of inlet pipe unlike upward flowing filters
- Can be operated with tail water e.g tidal conditions
- Online and offline configurations can limit hydraulic effects

MEDIA CHOICES

Our filtration products can be customised using different filter media to target site-specific pollutants. A combination of media is often recommended to maximise pollutant removal effectiveness.

Perlite is naturally occurring puffed volcanic ash. Effective for removing TSS, oil and grease.

ZPG™ is a multi-purpose media option approved for highly trafficked sites or sites with high metal loadings. ZPG is a mixture of Zeolite, Perlite and GAC (granular activated carbon). ZPG is ideal for removing soluble metals, TSS, oils and grease, organics and ammonium.

Zeolite is a naturally occurring mineral used to remove soluble metals, ammonium and some organics.

GAC (Granular Activated Carbon) has a micro-porous structure with an extensive surface area to provide high levels of adsorption. It is primarily used to remove oil and grease and organics such as PAHs and phthalates.

CONFIGURATION

Stormfilter's can be configured in any drainage structure. Please contact SW360 for a customised design.

PRECAST VAULT

- Treats medium sized sites
- Simple installation – arrives on-site fully assembled

PRECAST MANHOLE

- Provides a low drop, point-of-entry configuration
- Uses drop from the curb inlet to the conveyance pipe to drive the passive filtration cartridges
- No crane required (Hi-AB lifting for most sizes)
- 1050-2400mm diameter sizes available

HIGH FLOW

- Treats flows from large sites
- Consists of large, precast components designed for easy assembly on-site
- Several configurations available, including: Panel Vault, Box Culvert, or Cast-In-Place

Stormwater360®
BETWEEN SKY AND SEA

Appendix B

- SMP Checklist

Stormwater Management Plan
Healthy Waters review and adoption report

SMP Title	Stormwater Management Plan (SMP) for HND HMB Ltd at 3 Pigeon Mountain Road, Half Moon Bay
SMP Date	02/02/2024
SMP Version	2
SMP prepared by	Airey Consultants Ltd
SMP prepared for:	HND HMB Ltd
Location	3 Pigeon Mountain Road, Halfmoon Bay
Consolidated Receiving Environment	Half Moon Bay Marina
Stormwater Catchment	Tamaki River at Half Moon Bay Marina
Development type	Brownfield
SMP Purpose	Resource Consent
Unitary Plan Precinct	IN/A
Resource consent reference	BUN60419132

HW Reference	HW to complete
Date SMP received	HW to complete
HW Review team	HW to complete

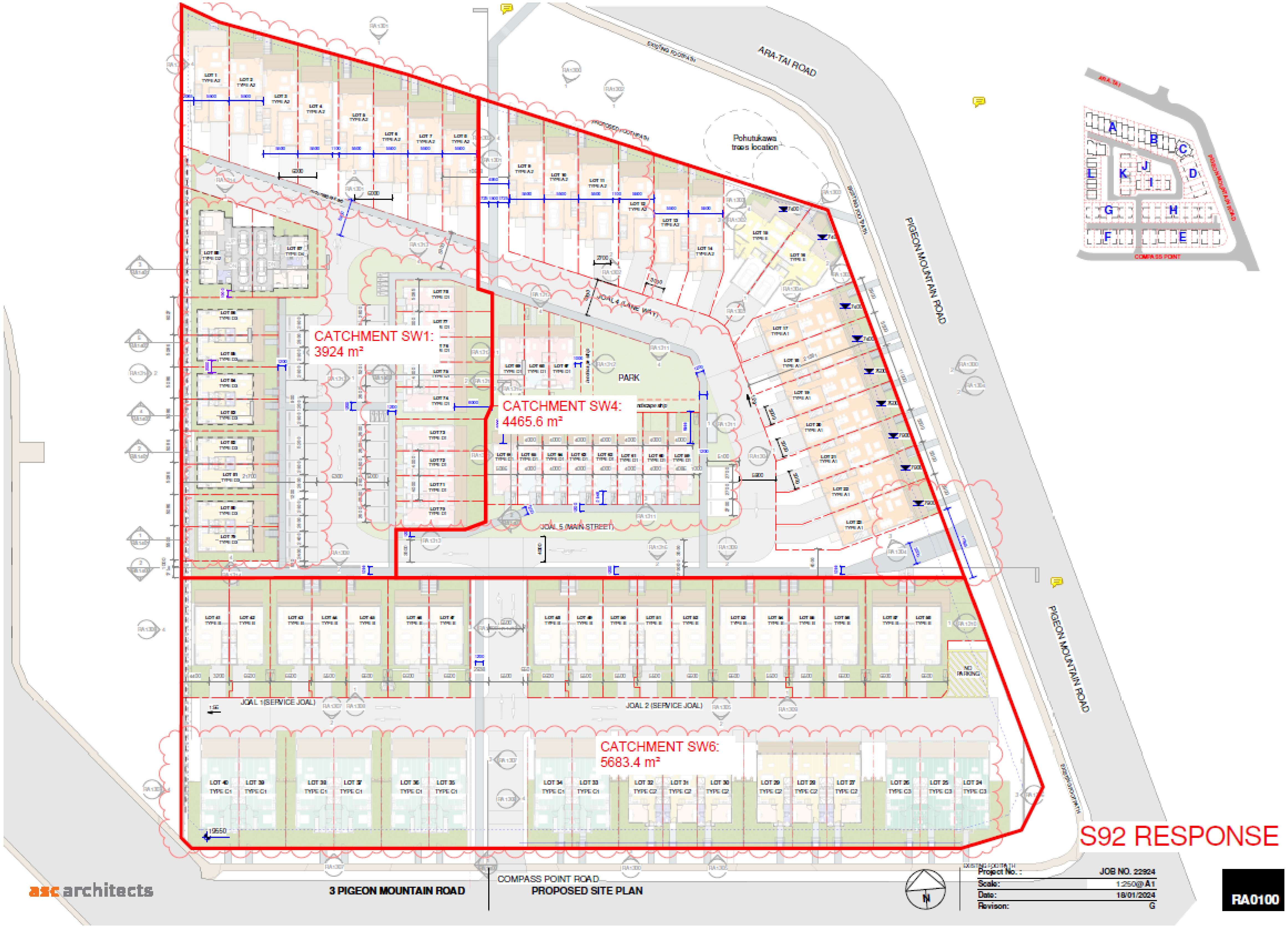
Proposed stormwater management

Stormwater management catchment	Proposed land use	Receiving environment (type & SEA)	Water quality management	Hydrology mitigation (retention)	Hydrology mitigation (detention)	Flood management	Outlet design	Assets to be vested with council	General comments
Tamaki River Catchment	88 residential units, 64.83% impervious	Tamaki River at Half Moon Bay Marina	First 10mm of runoff from all impervious surfaces as per to GD01 requirement, 75% TSS, SW360 filters	N/A	10% AEP detention tanks	All contained within common driveway, minimum freeboard provided where prone to inundation, DV Product less than 0.4 m²/s	Existing	Pipes up to storm filters: *SW1 up to SW Filter 1 – 33.7m (11.6+22.1) of 300mmØ uPVC SN16 and 1 x SWMH* *SW4 up to SW Filters 2– 28.8m (3.8+25) of 300mmØ uPVC SN16 and 1 x SWMH* *SW5 and SW 6 up to SW Filter 3 – 76.6m (68.9+7.7) of 300mmØ uPVC SN16 and 1 x SWMH*	

Notes:

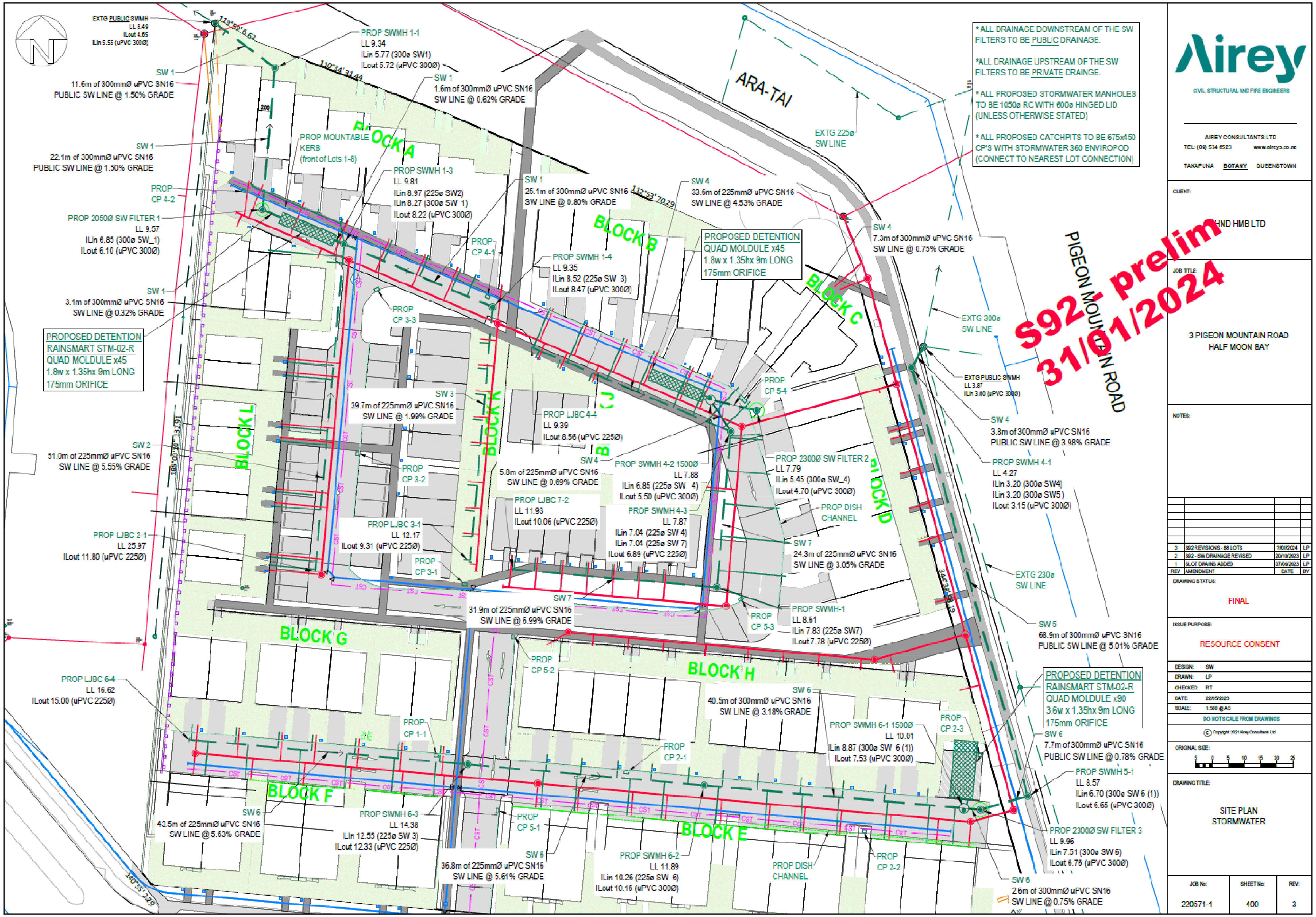
Sub-catchments within the site examined.

Site area


ARA-TAI ROAD
EXISTING FOOTPATH
PROPOSED FOOTPATH
Pohutukawa trees location
PIGEON MOUNTAIN ROAD
JOAL 4 (LANE WAY)
CATCHMENT SW1:
3924 m²
PARK
CATCHMENT SW4:
4465.6 m²
JOAL 5 (MAIN STREET)
JOAL 1 (SERVICE JOAL)
JOAL 2 (SERVICE JOAL)
NO PARKING
CATCHMENT SW6:
5683.4 m²
PIGEON MOUNTAIN ROAD
S92 RESPONSE
A
B
C
D
E
F
G
H
I
J
K
L
COMPASS POINT
asc architects
3 PIGEON MOUNTAIN ROAD
COMPASS POINT ROAD
PROPOSED SITE PLAN
N
Project No. : JOB NO. 22924
Scale: 1:250@ A1
Date: 18/01/2024
Revison: G
RA0100

Development plan

[Insert map/plan(s) showing development plan or indicative masterplan (as appropriate) with location of stormwater devices, including communal devices and drainage reserve (as appropriate to scale of SMP)]



* ALL DRAINAGE DOWNSTREAM OF THE SW FILTERS TO BE PUBLIC DRAINAGE.

*ALL DRAINAGE UPSTREAM OF THE SW FILTERS TO BE PRIVATE DRAINAGE.

* ALL PROPOSED STORMWATER MANHOLES TO BE 1050ø RC WITH 600ø HINGED LID (UNLESS OTHERWISE STATED)

* ALL PROPOSED CATCHPITS TO BE 675x450 CP'S WITH STORMWATER 360 ENVIROPOD (CONNECT TO NEAREST LOT CONNECTION)

Airey
CIVIL, STRUCTURAL AND FIRE ENGINEERS
AIREY CONSULTANTS LTD
TEL: (09) 534 6523 www.aireys.co.nz
TAKAPUNA BOTANY QUEENSTOWN

CLIENT: HND HMB LTD

JOB TITLE: 3 PIGEON MOUNTAIN ROAD HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY
3	S92 REVISIONS - 88 LOTS	1/01/2024	LP
2	S92 - SW DRAINAGE REVISED	20/10/2023	LP
1	SLOT DRAINS ADDED	07/06/2023	LP

DRAWING STATUS: FINAL

ISSUE PURPOSE: RESOURCE CONSENT

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 22/05/2023
SCALE: 1:500 @ A3
DO NOT SCALE FROM DRAWINGS
© Copyright 2021 Airey Consultants Ltd

ORIGINAL SIZE:

DRAWING TITLE: SITE PLAN STORMWATER

JOB No:	SHEET No:	REV:
220571-1	400	3

Review

Stormwater management and BPO

Comments	*[Any general comments or particular areas that are complicated/unusual/controversial/excellent/noteworthy]*
How does the SMP address the development requirements in Schedule 4? Refer to Appendix 1. **Explain how the SMP represent the BPO for the site.**	*Summarise very briefly here.* *If relying on BPO discuss why BPO is appropriate in this case.* *Example text for simple application:* *The stormwater mitigation proposed in the SMP meets the Schedule 4 requirements:* *Water quality – all impervious surfaces to be treated by stormwater 360 filters* *Stream hydrology – N/A as non-SMAF and not discharging directly to stream* *Flooding 10% - capacity issue for existing line. 10% AEP mitigation proposed to existing runoff rate by Rainsmart Modules (or similar).* *Flooding 1% - OLFP originates from site.* OLFP contained within common driveways, minimum freeboard provided where prone to inundation, DV Product less than 0.4 m²/s, considered safe for pedestrian and vehicles. Downstream OLFP depth increase negligible. *Assets – All assets including and past the stormfilters proposed to be in private ownership. Only 8 new length pipes and 2 new SWMHs proposed to be vested to Council.*
How will the BPO be implemented?	*All proposed public and private stormwater systems will be constructed by the application. Raintanks and stormfilters will remain in private ownership and be maintained by the body corporate/residents society. Conditions may be set in the subdivision consent for ongoing operation and maintenance.* *The proposed 8 lengths of SW pipes and 2 manholes to be vested to council will require maintenance by Council.*
Confirm the SMP is consistent with Schedule 2	*The proposed stormwater management will contribute to the objectives in Schedule 2.* - *Existing assets already at capacity, suitable mitigation methods proposed (10% AEP mitigation). Stormfilters also proposed to meet 75% TSS removal.* - *The proposed SMP supports the growth of community in providing 88 additional dwellings to Half Moon Bay. With stormwater detention and treatment devices, a water sensitive development is achieved.* - *OLFP and downstream OLFP effects has been examined. It is determined that the OLFP discharged from site are considered to be safe for pedestrians and vehicles and the increase in 1% AEP overland flow rate has negligible increase in flow depth for downstream.*

Commented [GC1]: *Include as many or as few comments as is proportional to the scale and complexity of the development.*

Example text has been added to be used for simple SMPs which are meeting the default Schedule 4 requirements.

Where an SMP is relying on a BPO approach instead of the schedule 4 defaults add more detailed comments on that aspect.

The more complex the application the more discussion is expected.

The purpose of this checklist is to document the reasoning for HW decisions. Keep that in mind when writing the comments.

Delete the example text that you are not using and format the bits you are keeping as normal black text

	- *Stream health is not applicable as the stormwater network discharges to Half Moon Bay Marina.* - *Coastal health is not impacted as 10% AEP detention is provided and stormwater treatment is provided.* - *Ground water aquifers is not impacted as determined by Geotech engineer.* - *Wastewater system is not impacted as there is public wastewater system available to site for extension.*

Appendix D

- Wastewater Level 1 Assessment

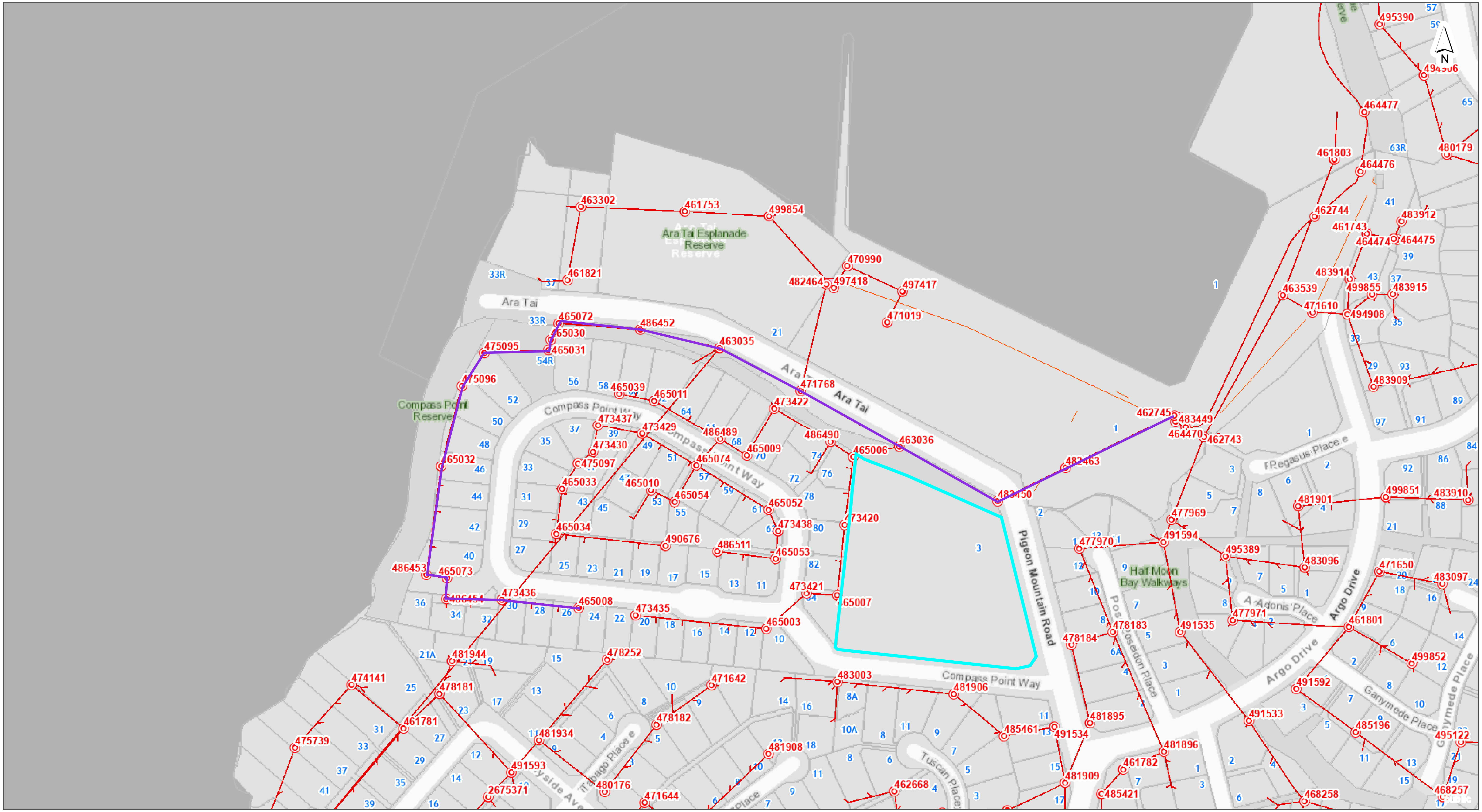
- Water Supply/Wastewater Planning Assessment

- Hydrant Test Results

WASTEWATER AND WATER ASSESSMENT

FOR

Client:	HND HMB Ltd
Address:	3 Pigeon Mountain Road, Half Moon Bay
Job No:	220571/01
Date:	15 May 2023
Design Engineer:	Samson Weng
Reviewed by:	Royden Tsui
Contact Phone:	(09) 534 6523
Email:	samsonw@aireys.co.nz



Height datum: Auckland 1946.

Level 1 WW Assessment

0 25 50 75
Meters

Scale @ A3
= 1:2,500

Date Printed:
15/05/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Sewer Pipe Network Capacity Check for 3 Pigeon Mountain Road, Half Moon Bay

Kinematic viscosity of fluid 1.141

Pipe and manhole information derived from Topographical Survey, Property files, CCTV, Watercare and Auckland Council GIS (length, invert, diameter, materials)

								Existing Capacity Assessment						Existing and Future Capacity Assessment						
Pipe ID	**DS IL**	**Grade (%)**	**Pipe Length (m)**	**Cumulative Pipe Length (m)**	**Pipe Diameter (mm)**	**Flow Velocity**	**Pipe Capacity**	**Existing Dwellings**	**Cumulative Existing Dwellings**	**No of Occupants (3)**	**Actual Flow Existing**	**Peak Flow Existing - 6.7**	**Demand Capacity (%)**	**Future and Existing Dwellings**	**Cumulative No. of Dwellings**	**No. of Occupants (3)**	**Actual Flow L/s**	**Peak Flow - 6.7 (l/s)**	**Demand/Capacity (%)**	**Comments**
	20.2							1	1					1	1					IL from drainage as-asbuilt from Property Files, lenth of pipe from drainage as-built from Property Files where possible. Other length of pipes measured on Geomaps/GIS.
730055	18.5	3.3	53	53	150	1.6	28.4	3	4	12	0.0	0.2	0.6	3	4	12	0.0	0.2	0.6	
756475	14.0	11.7	38	91	150	3.0	53.1	3	7	21	0.0	0.3	0.6	3	7	21	0.0	0.3	0.6	
732106	13.9	1.2	14	105	150	1.0	16.9	0	7	21	0.0	0.3	1.7	0	7	21	0.0	0.3	1.7	
732107	13.6	1.6	14	119	150	1.1	19.6	0	7	21	0.0	0.3	1.5	0	7	21	0.0	0.3	1.5	
2565840	12.9	0.9	75	194	150	0.8	14.7	3	10	30	0.1	0.4	2.8	3	10	30	0.1	0.4	2.8	
2565843	12.41	0.9	57	251	150	0.8	14.9	3	13	39	0.1	0.5	3.6	3	13	39	0.1	0.5	3.6	
729616	12.0	1.4	27	278	150	1.0	18.0	1	14	42	0.1	0.6	3.3	1	14	42	0.1	0.6	3.3	
2565844	11.3	1.6	44	322	150	1.1	19.8	1	15	45	0.1	0.6	3.2	1	15	45	0.1	0.6	3.2	
2565789	5.2	85.1	7	330	150	8.1	143.6	0	15	45	0.1	0.6	0.4	0	15	45	0.1	0.6	0.4	
2565794	3.7	12.3	13	342	150	3.1	54.5	0	15	45	0.1	0.6	1.2	0	15	45	0.1	0.6	1.2	
2565787	3.0	1.2	56	398	150	1.0	16.9	0	15	45	0.1	0.6	3.7	0	15	45	0.1	0.6	3.7	
729244	1.8	2.2	56	454	150	1.3	23.0	0	15	45	0.1	0.6	2.7	0	15	45	0.1	0.6	2.7	
738112	-0.1	2.9	63	517	225	2.0	77.7	0	15	45	0.1	0.6	0.8	0	15	45	0.1	0.6	0.8	
716883	-1.0	1.2	78	594	225	1.2	49.4	104	119	357	0.7	5.0	10.1	104	119	357	0.7	5.0	10.1	Where Shops, club house and ferry building discharges into drains, assumed 50% office buildings and 50% wet retail. Area approx 5800 m^2. Office flow = 2900/15 x 65 = 12567 L/day. Wet retail = 2900 x 15 = 43500L/day. Total flow = 56067L/day. 56067L/3 person/180L/day = 103.8 = 104 dwellings
716760	-1.8	1.1	77	671	205	1.1	36.5	67	186	558	1.2	7.8	21.3	141	260	780	1.6	10.9	29.8	Exisitng dwellings = 49. Health Camp max 39 people over night and maximum of 60 people thoughout the day. Flow of 60 staff at 45 L/person/day = 2700L. 2700L/3/180L/day = 5 dwellings. 39/3 = 13 dwellings. 13+5+49 = 67 Proposed dwellings = 92 units. 92+49 = 141
722020	-2.4	1.2	52	723	200	1.1	35.9	0	186	558	1.2	7.8	21.7	0	260	780	1.6	10.9	30.4	commercial loading included in loading for line 716883
716730	-3.3	1.1	83	806	200	1.1	35.0	0	186	558	1.2	7.8	22.3	0	260	780	1.6	10.9	31.1	

Development information form – Wastewater network planning summary assessment

Information to be completed by Developer/ Engineering Consultant

Development consideration	**Description**	**Comments**
Query status	RC	*Pre-purchase enquiry / Enquiry to support Plan Change application / Pre-application enquiry / Resource Consent application / Engineering Plan approval.*
Query submission date	15/05/2023	
Address	3 Pigeon Mountain Road, Half Moon Bay	*Include suburb*
Attach layout plan	Please refer to appendix	*Plan must clearly show proposed development site and include:* • *Aerial photograph with elevation contours (Note 1)* • *Road names* • *Boundary of development* • *Preferred point of connection to existing water supply and wastewater asset.*
Current land use	School/Health Camp	*Residential (single family dwellings) / Residential (multi-unit dwellings) / Residential (multi-storey apartment blocks) / Commercial / Industrial / Other (Please specify).*
Proposed land use	Residential – Terraced Housing	
Unitary plan zoning	*Residential – Mixed Housing Suburban Zone;* *Plan Change 78 – Mixed Housing Urban Zone*	*Refer Auckland Unitary Plan*
Total development site area (m²/ hectares) (i.e. Land area for residential developments)	1.4073 Ha	
Total development floor area (m²) (i.e. Include all levels of multi-storey apartments and commercial developments)	12,238 m²	
Number of proposed residential dwellings (Typically consent or include ultimate if development is to be staged and consented at a future date)	*92 new dwellings*	*Include type and number of bedrooms for residential dwellings:* *Type:* / *Quantity:* *1 bed* 0 *2 bed* 33 *3 bed* 40 *4bed* 19 *5+bed* 0
Note: (1) Watercare's GIS Viewer for Asset Data Query and Land Development/ Subdivision can be used to display aerial photography and land contour information.		

(This section should not be duplicated if both water and wastewater is applied. Refer to Chapter 6 of the CoP.)

Refer to the Auckland Code of Practice for Land Development and Subdivision chapter 5: Wastewater, when completing this form:

Wastewater development assessment			
Design consideration		**Description**	**Comments**
Existing site design flows - pre-development scenario (If site is currently undeveloped, write 0.00 L/s in the design flows for this section)	**Residential Design Flows (L/s)**	Self-Cleansing Design Flow = 39 x 180 x 3 / 24/60/60 = 0.24 L/s Peak Design Flow =39 x 180 x 6.7 / 24/60/60 =0.54 L/s	*Show calculations based on Watercare CoP.* *<u>Ultimate development:</u>* *Ultimate development is where further development may / can / will occur upstream / or within the development site currently under consideration.* *If relevant Ultimate Peak Design Flow is to be calculated and will include number of potential units/ lot.*
	Non-Residential Design Flows (L/s)	Self-Cleansing Design Flow = 60 x 45 x 2 / 24/60/60 =0.06 L/s Peak Design Flow = 60 x 45 x 6.7/ 24/60/60 = 0.21 L/s	
Proposed development site design flows - post-development scenario	**Residential Design Flows (L/s)**	Self-Cleansing Design Flow = 92x 3 x 180 x 3 / 24/60/60 = 1.73 L/s Peak Design Flow =92 x 3 x 180 x 6.7 / 24/60/60 = 3.85 L/s *And if relevant* Ultimate Peak Design Flow =	*For further guidance on whether this application needs to consider Ultimate development, refer CoP Sections:* • *5.3.2 Structure Plan* • *5.3.3 Future development* • *5.3.4 System Design*
	Non-Residential Design Flows (L/s)	Self-Cleansing Design Flow = N/A Peak Design Flow = N/A	
	Non-Residential Discharge profile / trend (i.e. Operations)	N/A	*E.g. 24 hr operation / 10 hr (9am – 5pm) / Other (Please specify).*
Change in site flows	**Net difference between post-development and pre-development site design flows (L/s)**	Net Change in Self-Cleansing Design Flow = 1.43 L/s Net Change in Peak Design Flow = 3.1 L/s	

Wastewater development assessment

Design consideration	**Description**	**Comments**
New assets required for development	New WW Drainage Pipes	*If applicable please provide supporting calculations and indicative design parameters (i.e. pump station and rising main or storage.*
Existing network infrastructure capacity assessment *A sewer capacity check is to be carried out if the 'Net Change in Peak Design Flow' calculated above shows a net increase of greater than 1.0 L/sec.* Notes: *1. At Watercare's discretion, a Sewer Capacity Check may be required even if the net increase in site flow is < 1.0 L/sec.* *2. The Level 1 Sewer Capacity Check as described in the CoP is to be undertaken in the first instance, unless specifically advised by Watercare. The Level 1 Capacity Check is intended to help identify applications that may require more accurate/detailed design calculations and/or identify whether data held on the existing network is sufficient to enable an accurate assessment of capacity.*	Type of Sewer Capacity Check undertaken: = (**Level 1** / ~~Level 2 / Level 3~~) *(circle / delete as appropriate)* Did the *Existing WW Capacity Assessment Design Flow* exceed the pipe-full capacity for *any* pipes within the *Existing Network Assessment Extents?* On pipes where asset data (i.e. gradient and diameter) is known: = (~~Yes~~ / **No**) On pipes where asset data was assumed: = (~~Yes~~ / **No**)	*See Watercare's GIS Viewer for Asset Data Query and Land Development/Subdivision to assist with obtaining data required for the capacity assessment.* *In addition to the assessment findings summary requested here, other required existing network capacity assessment key steps/ deliverables include:* *1. Network Assessment Extents to be identified as described in the CoP. A map is to be provided showing the network assessment extent.* *2. Catchment Boundaries for the assessment is to be determined. Catchment Boundary data (where available) can be viewed in the Watercare GIS Viewer. Where not available, the developer and their engineers will be required to produce catchment boundaries. A map is to be submitted depicting the catchment extents.* *3. Existing WW Capacity Assessment Design Flow is to be calculated as described in the CoP. The flows are to be tabulated for each pipe-reach within the Network Assessment Extent. A pipe-reach will typically be regarded as the section of network between points where significant tributaries enter the network.* *4. Pipe Capacity Vs. Design Flow Check is to be carried out; a table detailing the calculated full pipe*

Wastewater development assessment		
Design consideration	**Description**	**Comments**
		capacity compared to the 'Existing WW Capacity Assessment Design Flow' is to be provided. Pipes with missing asset data are to have the missing data assumed as described in the CoP. *5. Pipe Full Capacity Exceedance - Pipes where the 'Existing WW Capacity Assessment Design Flow' exceeds the pipe full capacity are to be identified both in the tabular data, and on a map of the Network Assessment Extent. Pipes with assumed data are to be identified separately to those with known data.*
Further wastewater comments:		

Development information form – Water network planning summary assessment

Development consideration	**Description**	**Comments**
Query status	RC	*Pre-purchase enquiry / Enquiry to support Plan Change application / Pre-application enquiry / Resource Consent application / Engineering Plan approval.*
Query submission date	15/05/2023	
Address	3 Pigeon Mountain Road, Half Moon Bay	*Include suburb*
Attach layout plan	Please refer to appendix	*Plan must clearly show proposed development site and include:* • *Aerial photograph with elevation contours (Note 1)* • *Road names* • *Boundary of development* • *Preferred point of connection to existing water supply and wastewater asset.*
Current land use	School/Health Camp	*Residential (single family dwellings) / Residential (multi-unit dwellings) / Residential (multi-storey apartment blocks) / Commercial / Industrial / Other (Please specify).*
Proposed land use	Residential – Terraced Housing	
Unitary plan zoning	*Residential – Mixed Housing Suburban Zone;* *Plan Change 78 – Mixed Housing Urban Zone*	*Refer Auckland Unitary Plan*
Total development site area (m^2/ hectares) (i.e. Land area for residential developments)	1.4073 Ha	
Total development floor area (m^2) (i.e. Include all levels of multi-storey apartments and commercial developments)	12,238 m^2	

Number of proposed residential dwellings (Typically consent or include ultimate if development is to be staged and consented at a future date)	*92 new dwellings*	*Include type and number of bedrooms for residential dwellings:* *Type:* *Quantity:* *1 bed* *0* *2 bed* *33* *3 bed* *40* *4bed* *19* *5+bed* *0*
Note: (1) Watercare's GIS Viewer for Asset Data Query and Land Development/ Subdivision can be used to display aerial photography and land contour information.		

Information to be completed by Developer/ Engineering Consultant
(This section should not be duplicated if both water and wastewater is applied. Refer to Chapter 5 of the CoP.)

Refer to the Auckland Code of Practice for Land Development and Subdivision chapter 6: Water, when completing this form:

Water supply development assessment		
Design consideration	**Description**	**Comments**
Average and Peak Residential Demand (L/s)	Average Demand Design Flow = 92 x 3 x 220 / 24 /60 / 60 = 0.70 L/s Peak Demand Design Flow = 92 x 3 x 220 x 2 / 24/60/60 = 1.41 L/s	*Show calculations based on Watercare CoP.*
Average and Peak Non-Residential Demand **(L/s)**	N/A	*Show calculations based on Watercare CoP.*
Non-Residential Demand typical daily consumption profile / trend	N/A	*E.g. 24 hr operation / 10 hr (9am – 5pm) / Filling on-site storage at certain frequency.*
Fire- fighting classification required by the proposed site		*Refer to New Zealand Standard SNZ PAS 4509:2008.*

Hydrant flow test results	☒ Yes ☐ No	*Attach hydrant flow test layout plan and results showing test date & time; location of hydrants tested and pressure logged; static pressure; flow; residual pressure.*
Sprinkler system in building?	☐ Yes ☒ No	*Sprinkler design should consider Watercare Level of Service: minimum pressure at 200kPa and minimum flow at 25 l/min. The building owner shall conduct periodic review of sprinkler design.*

Further water supply comments:

NOVA FLOWTEC SERVICES LTD
HYDRANT TESTING SPECIALISTS

E: info@novaflowtec.co.nz
T: 09 444 8375
PO Box 241, Albany Village, Auckland 0755
www.novaflowtec.co.nz

13th March 2023

HND HMB Ltd.

RE: Firefighting Water Supply at 3 Pigeon Mountain Road, Half Moon Bay

Attention: Allen Lu

Dear Allen

Nova Flowtec Services were engaged to conduct a FW2 hydrant flow test for the development at the above address.
The testing was conducted on Friday 10th March at 12.55pm.
The object of the testing was to prove that there is sufficient water for firefighting purposes.

Requirements:
In order to meet the FW2 minimum requirements of PAS 4509: 2008, 12.5Lps is required within 135m and an additional 12.5Lps is required within 270m of the development buildings.
This being a total of 25Lps at a minimum residual pressure of 100kPa.

Results:
Unfortunately, during testing the FW2 minimum requirement was unable to be achieved as insufficient hydrants were available within the allowable distances as described above.
However, the nearest two hydrants located on Compass Point Way and Pigeon Mountain Road were tested and a flow of 27.9Lps at 830kPa was recorded, proving the minimum FW2 requirement is available at the nearest street hydrants.
Additional hydrant(s) will need to be fitted so as every proposed dwelling has a hydrant within 135m of the front door.
Please find the results table and the hydrant map on the following page.

Should you have any questions please do not hesitate to contact me.

Kind Regards

MKeane

Melanie Keane
Testing Manager

FW2 Water Classification Test

	Hydrant One	Hydrant Two	Total Flow (Lps)	Pressure (kPa)
			0	930
Flow (Lps)	14.7		14.7	865
Flow (Lps)	14.7	13.2	27.9	830
Date & Time:	Friday 10th March 2023 at 12.55pm			
Site Address:	3 Pigeon Mountain Road, Half Moon Bay			
Full Flow Result:	27.9Lps at 830kPa			

Hydrant Map

Appendix E

- Firefighting Engineer Comments

Samson Weng

From:	Allen Lv <allen.l@rislandnz.co.nz>
Sent:	Wednesday, 1 March 2023 4:50 pm
To:	Samson Weng
Cc:	Royden Tsui
Subject:	FW: Request fire service proposal for 3 Pigeon Mountain
Attachments:	3 Pigeon Mountain Rd - FENZ Fire Hose and Hydrants.pdf

Hello Samson,

We get the confirmation from fire engineer that There is no requirement for a fire hydrant on the land.

Thanks

Allen Lu

029 127 6540

Allen.l@rislandnz.co.nz

From: Thomas Grace <tom@ferrierfire.com>
Sent: Wednesday, March 1, 2023 4:46 PM
To: Allen Lv <allen.l@rislandnz.co.nz>
Cc: Hung Tan <Hung.Tan@ascarchitects.co.nz>; Logan Hooi <Logan.Hooi@ascarchitects.co.nz>; Sarah Tan <Sarah.Tan@ascarchitects.co.nz>; Neeng Chia <Neeng.Chia@ascarchitects.co.nz>
Subject: Re: Request fire service proposal for 3 Pigeon Mountain

Hi Allen,

There is no requirement for a fire hydrant on the land for the following reasons (also see markup):

- The distance between hydrant and entrance to the furthest house will not exceed 135. This will require an additional hydrant at the entrance of the site - is this ok (see proposed location on attached markup).
- The fire hose coverage between the fire access route for FENZ vehicle and the furthest floor of the furthest terraced house will be <75m.
- The distance between hydrants will not exceed 135m.

Kind regards,
Tom

Thomas Grace ME (Fire), CPEng, CMEngNZ, MSFPE

Fire Engineer

E: tom@ferrierfire.com

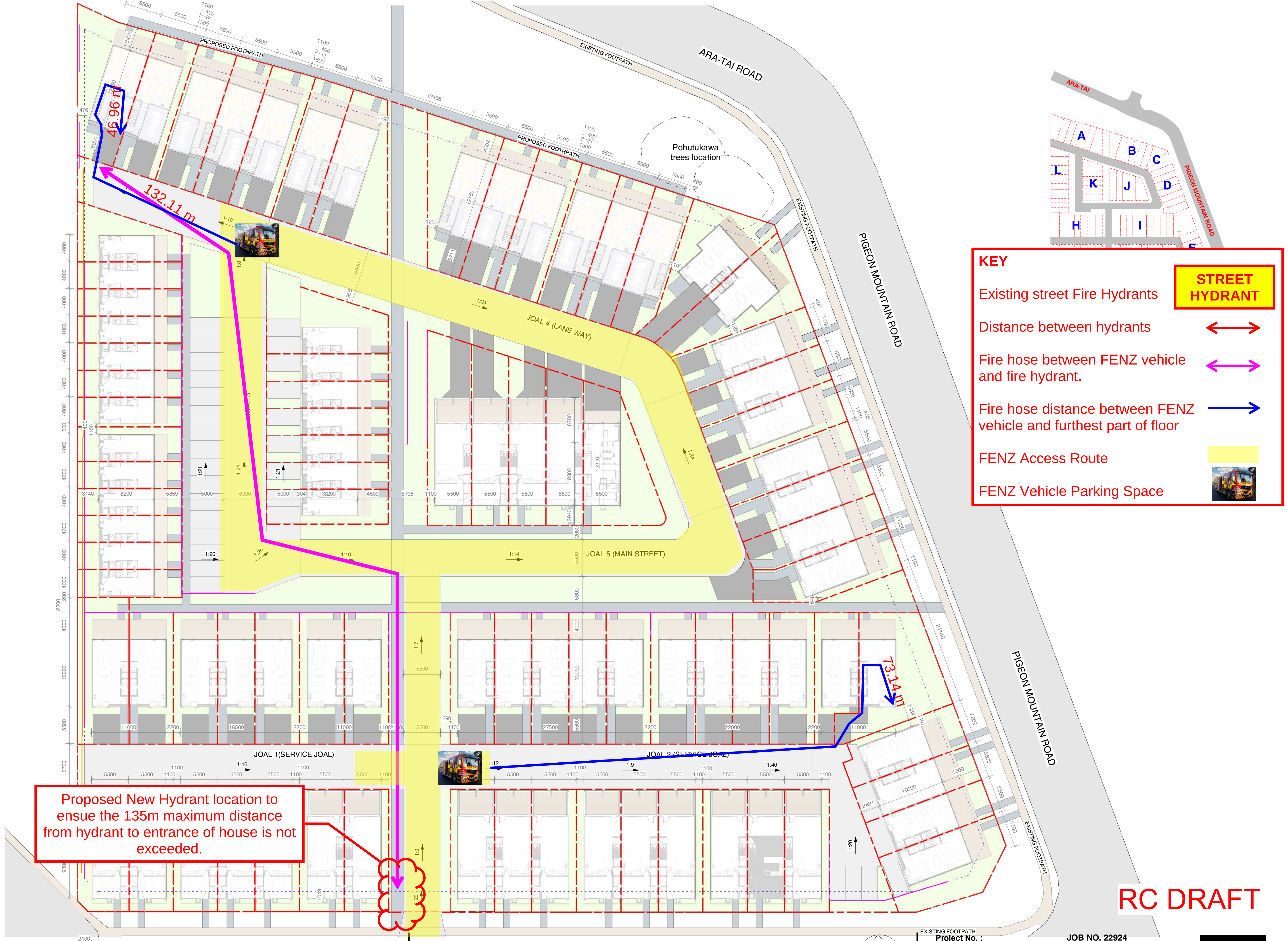
M: 021 08386860

W: www.ferrierfire.com

Ferrier Fire Limited

On Wed, Mar 1, 2023 at 2:17 PM Allen Lv <allen.l@rislandnz.co.nz> wrote:

> Hello Tom,
>
> Can you help us to confirm whether we need fire hydrant in the land? We need it to instruct hydrant test.
>
> Thanks
>
> Allen Lu
>
> 029 127 6540
>
> Allen.l@rislandnz.co.nz
>
> ---
>
> **From:** Hung Tan <Hung.Tan@ascarchitects.co.nz>
> **Sent:** Wednesday, March 1, 2023 2:08 PM
> **To:** Tom <tom@ferrierfire.com>
> **Cc:** Logan Hooi <Logan.Hooi@ascarchitects.co.nz>; Allen Lv <allen.l@rislandnz.co.nz>; Sarah Tan <Sarah.Tan@ascarchitects.co.nz>; Neeng Chia <Neeng.Chia@ascarchitects.co.nz>
> **Subject:** RE: Request fire service proposal for 3 Pigeon Mountain
>
> Hi Tom,



KEY

Existing street Fire Hydrants	STREET HYDRANT
Distance between hydrants	↔
Fire hose between FENZ vehicle and fire hydrant.	↔
Fire hose distance between FENZ vehicle and furthest part of floor	→
FENZ Access Route	🟨
FENZ Vehicle Parking Space	

Proposed New Hydrant location to ensue the 135m maximum distance from hydrant to entrance of house is not exceeded.

RC DRAFT

STREET HYDRANT ↔ 127.42 m ↔ **STREET HYDRANT**

asc architects

3 PIGEON MOUNTAIN ROAD

COMPASS POINT ROAD

PROPOSED SITE PLAN

N

EXISTING FOOTPATH

Project No. : JOB NO. 22924
Scale: As indicated@ A1
Date: 02/2023
Revison: E

RA0100

Appendix F

- Overland Flow Path Assessment

OVERLAND FLOWPATH ASSESSMENT FOR
FOR HND HMB LTD
AT 3 PIGEON MOUNTAIN ROAD, HALF MOON BAY

Job No: 220571/01

Issue Date: 02 February 2024

Airey Consultants Ltd | Botany Office
PO Box 259 339, Botany, 2163 | Level 1, Fountain Lane North, Botany Town Centre
T: +64 9 534 6523 E: botany@aireys.co.nz

Engineering
Ingenuity

Document Control Record

Document Prepared By:
Airey Consultants Limited
Level 1, Fountain Lane North, Botany Town Centre
Bay
PO Box 259 339, Botany, Auckland 2163

T: +64 9 534 6523
E: samsonw@aireys.co.nz
W: **aireys.co.nz**

Client:
HND HMB Ltd
3 Pigeon Mountain Road, Half Moon

This report has been prepared solely for the benefit of the HND HMB Ltd . No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval or to fulfil a legal requirement.

Revision	Description	Issue Date	Prepared by	Reviewed by
0	Overland Flowpath Assessment	15/05/2023	SW	RCHT
1	S92 Amendment	24/10/2023	SW	RCHT
2	Revised Layout	02/02/2024	SW	RCHT

Contents

1 INTRODUCTION

Airey Consultants Ltd have been engaged to undertake a flood assessment review for the proposed subdivision at 3 Pigeon Mountain Road, Half Moon Bay. The 1.4073 Ha site will be subdivided into 88lots. The existing buildings and structures will be removed and 88 dwellings constructed. The impervious areas are estimated to increase from 40% to around 64.8%.

2 AUCKLAND COUNCIL GIS DATA

We have reviewed Council records and GIS. The GIS indicates There is a public 225mmØ concrete stormwater pipe along the eastern boundary of the site. The 225mmØ drains to a 300mmØ concrete line across Pigeon Mountain Road via a stormwater manhole (SAP ID2000323535). There is also a 300mmØ concrete stormwater pipe along the western boundary of the site. The GIS shows a 1% AEP overland flow originating from the site. An overland flowpath is also identified to run parallel to the eastern boundary within Pigeon Mountain Road. The overland flow from 3 Pigeon Mountain Road is identified to merge with the overland flow along Pigeon Mountain Road, traverses across the road and flows toward Half Moon Bay Marina and ultimately into the ocean.

Figure 1 – OLFP and Flood Plain Identified on Geomaps

3 IMPERVIOUS AND PERVIOUS AREAS

The catchment areas for the subject site pre-development are as follows, which is imperviousness of 40.02%:

	3 Pigeon Mountain Road, Half Moon Bay
Roof/Balcony Areas (m^2)	2,980.1
Driveway/Paved Areas (m^2)	2,652.3
Total Impervious Area (m^2)	5,632.4
Total Pervious Area (m^2)	8,440.6
Total Gross Area (m^2)	**14,073**

The catchment areas for the subject site post-development are as follows, which is an imperviousness of 64.83%:

	3 Pigeon Mountain Road, Half Moon Bay
Roof/Balcony Areas (m^2)	5,500
Driveway/Paved Areas (m^2)	3,624
Total Impervious Area (m^2)	9,124
Total Pervious Area (m^2)	4,949
Total Gross Area (m^2)	**14,073**

4 DISCUSSION

From our site visit on 2 February 2023, we confirmed that the overland flows will likely follow the flow path as identified by Council Geomaps. In a heavy rainfall event, it is possible for the stormwater pipes serving the area surrounding 3 Pigeon Mountain Road to be blocked and flood plain formed. According to survey data and the GIS maps, an overland flow originates from the site and exits the eastern boundary. This overland flow then combines with the overland flow along Pigeon Mountain Road.

Figure 2a – Site photo taken from Western Boundary

Figure 2b – Site photo from Northern Boundary

Figure 2c – Site photo towards Marina

Figure 2d – Site photo from South-eastern corner

As per SW CoP (Version 3.0) 4.3.5.6, pipes less than 600mmØ are considered as fully blocked. Consequently, all pipes around the site are considered to be fully blocked.

The contributing catchments for the overland flow identified along Pigeon Mountain Road are made up of predominantly residential area to the south being approximately 11.72 Ha. We have adopted the SCS method to determine the flow rate so storage in soil and the time of concentration are accounted for. The stormwater flow generated from the 1% storm event has been calculated to be

3.897 m³/s. We have determined the 1% AEP flood levels at the south-eastern site boundary as 9.35 mRL. With the steep bank within the Pigeon Mountain Road road berm along the site boundary, the flood water is fully contained within the road reserve. This overland flow joins up with the overland flow from the subject site and the minor overland flow from Ara-Tai. The combined flow then traverses towards the north, across Pigeon Mountain Road, into the carpark of Halfmoon Bay Marina business complex.

The small overland flow from Ara-Tai is determined to have a catchment of approximately 4,850 m². Due to the short flow path, rational method was adopted to determine the 1% AEP runoff. The stormwater flow generated from the 1% storm event has been calculated to be **142 L/s**.

The contributing catchments for the existing main overland flow originating from 3 Pigeon Mountain Road is approximately 5,490 m². Two additional minor overland flows are identified with the catchments of approximately 3,438 m² and 2,802m². The existing 1% AEP site runoff flowrates were determined using the rational method (with weighted coefficient of runoff) with TP108 1% AEP rainfall depth with climate change ratio from Auckland Council's Stormwater Code of Practice. The existing site runoff rates, flow depth and velocity are as follows:

3 Pigeon Mountain Road, Half Moon Bay				
Existing Site Runoffs	**Runoff Rate (L/s)**	**Depth (mm)**	**Velocity (m/s)**	**DV (m²/s)**
Main OLFP	131	70	1.429	0.100
Minor OLFP - 1	82	40	1.084	0.043
Minor OLFP - 2	67	30	1.063	0.032
Existing Site Total (inc non-OLFP catchment)	**336**			

The existing overland flow traversing across Pigeon Mountain Road is determined to be **4.375m³/s** (3.897 + 0.336+0.142).

The existing overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai.

The post developed areas have been split into 12 smaller catchments to assess the overland flow paths within the subdivision. Please refer to Post Development Catchment Plan enclosed in **Appendix A**. is proposed to contain all overland flows originating from the site within the common accessways and discharge the overland flows from the site to the existing overland flow paths along Pigeon Mountain Road and Ara-Tai. The collected overland flows from the site will exit the site at 5 locations, being end of JOAL 2, pedestrian footpath onto Pigeon Mountain Road, gaps between Block B, C and D and gap between 76 Compass Point Way and Lot 1. Surface runoff from deck and outdoor areas (permeable runoffs) for Lots 1 to 23 are to discharge straight onto Pigeon Mountain Road and Ara-Tai.

Using rational formula with weighted coefficient of runoffs, the peak discharge flows from each catchment are as follows:

3 Pigeon Mountain Road, Half Moon Bay	
Catchment	**Runoff Rate (L/s)**
1 (JOAL 2, OLFP Section G-G) Incl half catchment 2 and catchment 11 runoff, discharges to PMR	132
2 (JOAL 1, OLFP Section J-J)	59
3 (Centre Ped Footpath, OLFP Section H-H) Discharges to PMR	7
4 (JOAL 5, OLFP Section L-L) Incl all runoff from catchment 12	82
5 (JOAL 5, OLFP Section R-R) Incl all runoff from catchment 4	123
6 (Part JOAL 3 and JOAL 4, OLFP Section P-P and OLFP Section N-N)	27
7 (JOAL 4, OLFP Section M-M) Incl all runoff from catchment 6 and catchment 8	132
8 (Part JOAL 3 and JOAL 4, OLFP Section P-P and OLFP Section N-N)	40
9 (JOAL 4, OLFP Section Q-Q) Discharges to Ara-tai	21
10 (Block C, OLFP Sections C-C, D-D, E-E and F-F) Incl all runoff from catchment 5 and catchment 7, discharges to PMR/Ara-Tai	265
11 (JOAL 1, OLFP Section I-I)	6
12 (JOAL 1, OLFP Section K-K) Incl half catchment 2 and half catchment 11	30
Post Development Site Total **inc Lots 1-23 permeable runoffs**	**431**

The increase in 1% AEP runoff from the site is **95L/s** (431 - 336). This equates to around **2.2% increase only (**0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow. Please refer to calculations enclosed in **Appendix A**.

The depths, velocity and Depth-Velocity Products of overland flows are determined as below:

3 Pigeon Mountain Road, Half Moon Bay			
Overland Flow	**Depth (mm)**	**Velocity (m/s)**	**DV (m^2/s)**
JOAL 2, OLFP Section G-G	50	1.479	0.07
JOAL 1, OLFP Section J-J	50	2.065	0.11
Centre Ped Footpath, OLFP Section H-H	10	0.769	0.01
JOAL 5, OLFP Section L-L	40	1.840	0.07
JOAL 3, OLFP Section P-P	40	1.378	0.06
JOAL 4, OLFP Section N-N)	30	0.772	0.02
JOAL 4, OLFP Section M-M)	50	1.550	0.08
JOAL 4, OLFP Section Q-Q	50	0.696	0.03
JOAL 5, OLFP Section R-R	60	1.159	0.07
JOAL 5, OLFP Section I-I	20	1.304	0.03
JOAL 5, OLFP Section K-K	40	1.666	0.07
Block C, OLFP Sections C-C	90	0.966	0.09
Block C, OLFP Sections D-D	50	0.677	0.03
Block C, OLFP Sections E-E	70	1.328	0.09
Block C, OLFP Sections F-F	50	1.085	0.05

Overland flow channel capacity analysis determined that catchment flows can be contained within the common accessways. As for Block C dwellings, that are prone to inundation, the flow depths are determined to be at most 90mm. Consequently, a freeboard of 150mm above the 1% AEP flood level is required as per Auckland Council's Stormwater Code of Practice for Lots 14, 15, 16 and 17.

Post Development overland flow depths are all less than 100mm and the Depth-Velocity products are all less than $0.4 m^2/s$. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai.

Please note that the above post development assessment is based on a previous revision of the site layout with **greater** impervious area. The latest layout has lesser impervious areas and the post-development flows and impact will be lesser than outlined above.

5 CONCLUSION

As per The Auckland Code of Practice for Land Development and Subdivision – Chapter 4: Stormwater Table 5, for development within flood-sensitive areas, finished floor levels for overland flow paths where flow is less than 2m³/s:

- 500 mm where surface water has a depth of 100 mm or more and extends from the building directly to a road or car park, other than a car park for a single dwelling.
- 150 mm for all other cases

For the proposed residential subdivision on 3 Pigeon Mountain Road, we propose the following minimum finished floor levels (MFFL):

Property	Minimum Freeboard (m)	Proposed MFFL (m)
Lot 13-16	0.15	8.00

The proposed finished floor level for Lot 13 is RL 8.20 m. The proposed finished floor levels for Lot 14-16 are RL 8.00m. We are satisfied that, at these levels, the dwellings are not at risk from inundation.

Post Development Depth-Velocity products for overland flows within and discharging from the subject site are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The increase in 1% AEP runoff from the site is **95L/s** (431 - 336). This equates to around **2.2% increase only (**0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow.

Where overland flow rate exceeds 100L/s, an overland flow easement in favour of Council is required.

We request that Council review the enclosed documentation and approve the proposal with the proposed minimum floor levels as discussed above. GIS plots, site plans and calculations are enclosed in Appendix.

Report prepared by
AIREY CONSULTANTS LTD

Wong

Samson Wong
Civil Engineer
BE Hons (Civil)

Reviewed and approved by
AIREY CONSULTANTS LTD

Royden Tsui

Royden Tsui
Associate Director
CPEng(NZ), CMEngNZ, IntPE(NZ), MEPM (hons), BE (Civil)

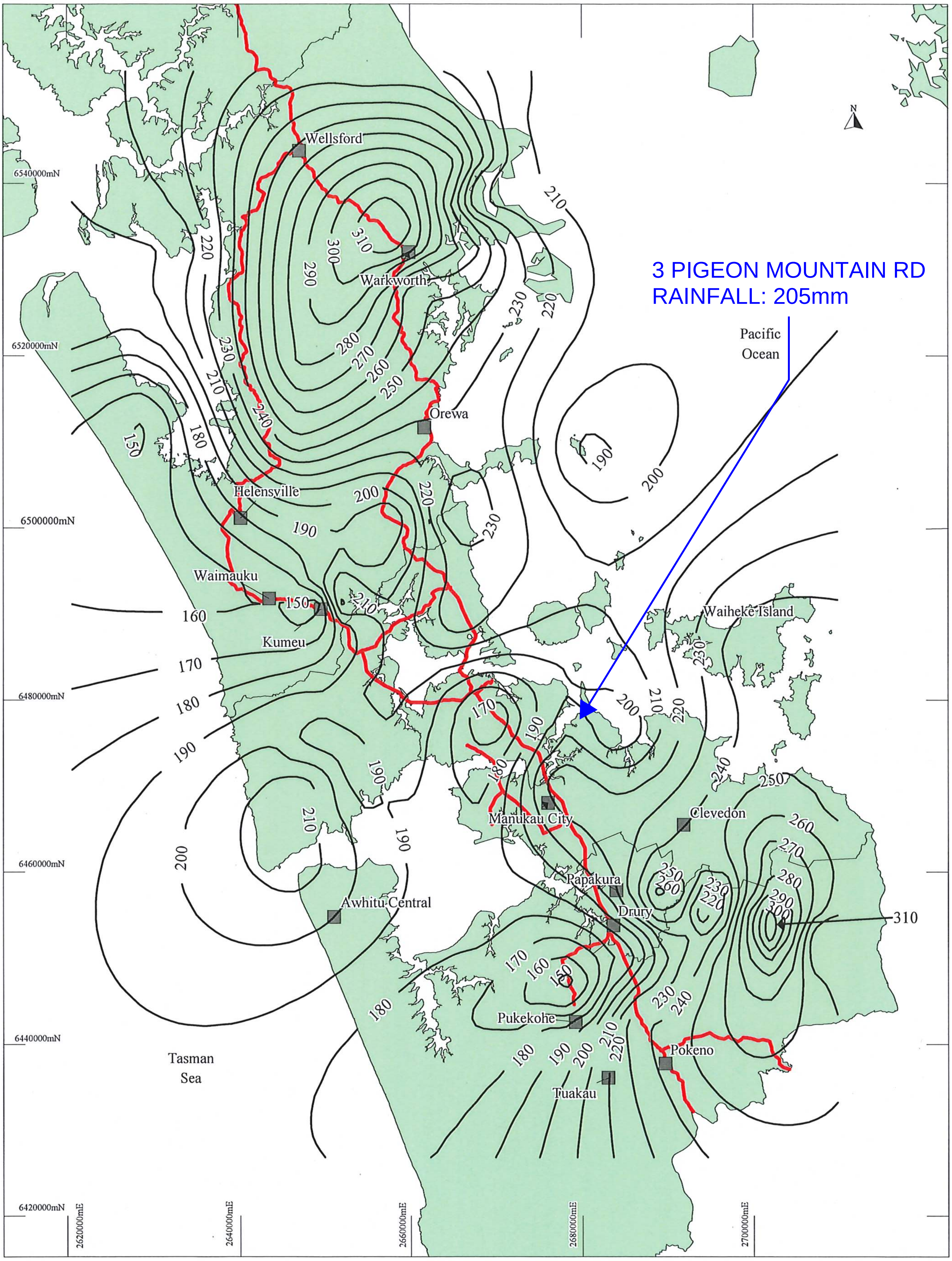
Appendix A

- Overland Flowpath Calculations

OVERLAND FLOW CALCULATIONS

FOR

Client:	HND HMB Ltd
Address:	3 Pigeon Mountain Road, Half Moon Bay
Job No:	220571/01
Date:	2 February 2024
Design Engineer:	Samson Weng
Reviewed by:	Royden Tsui
Contact Phone:	(09) 534 6523
Email:	samsonw@aireys.co.nz



3 PIGEON MOUNTAIN RD
RAINFALL: 205mm

Legend: — 90 — Rainfall Contour (mm)
State Highways

Auckland **Regional** Council

Figure A.6
100 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)

(Revised 25/08/1999)

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\100yrari.wor Date: 25/08/1999

Airey Civil, Structural and Fire Engineers Takapuna **Botany** Queenstown	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Rd Half Moon Bay		**Job No:** 220517/01
	Calc's By:	SW	**Phone:**	**Date:**
	Reviewed By:	RCHT	09 534 6523	17/01/2022

TP108 Rainfall

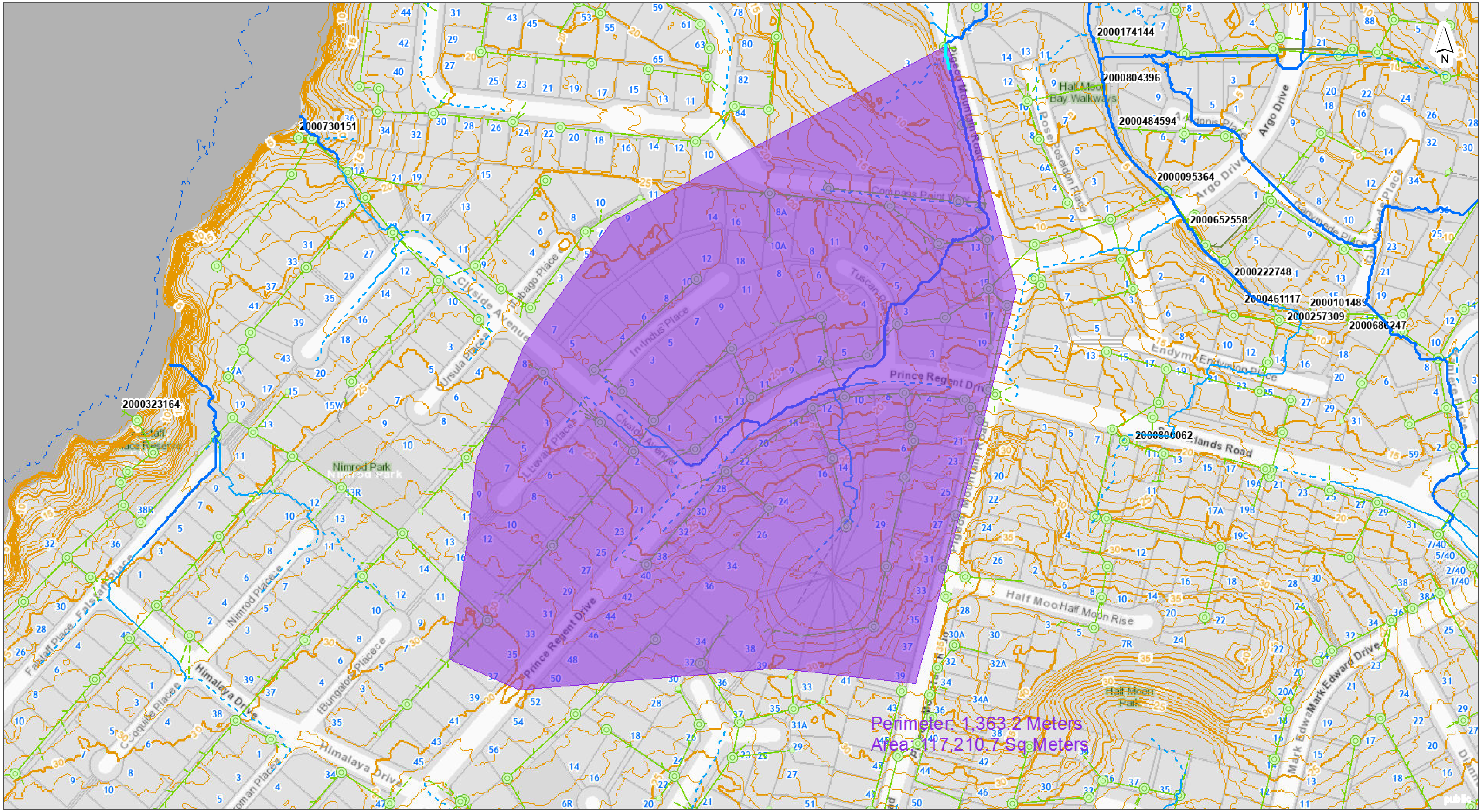
Rainfall Depth	205	mm
ARI	100	years

Duration hr	**Duration** mins	**Depth** mm	**Intensity** mm/hr (Q_{10})
0.166	10.0	27.58	**166.17**
0.333	20.0	42.42	127.38
0.5	30	52.32	104.64
1	60	73.75	73.75
2	120	99.61	49.80
6	360	152.28	25.38
12	720	195.38	16.28
24	1440	**239.44**	10.06

ARI	Ratio
2	9.0%
5	11.3%
10	13.2%
20	15.1%
50	16.8%
100	16.8%

ARI:	100
Ratio:	16.8%

Auckland Council **Map**



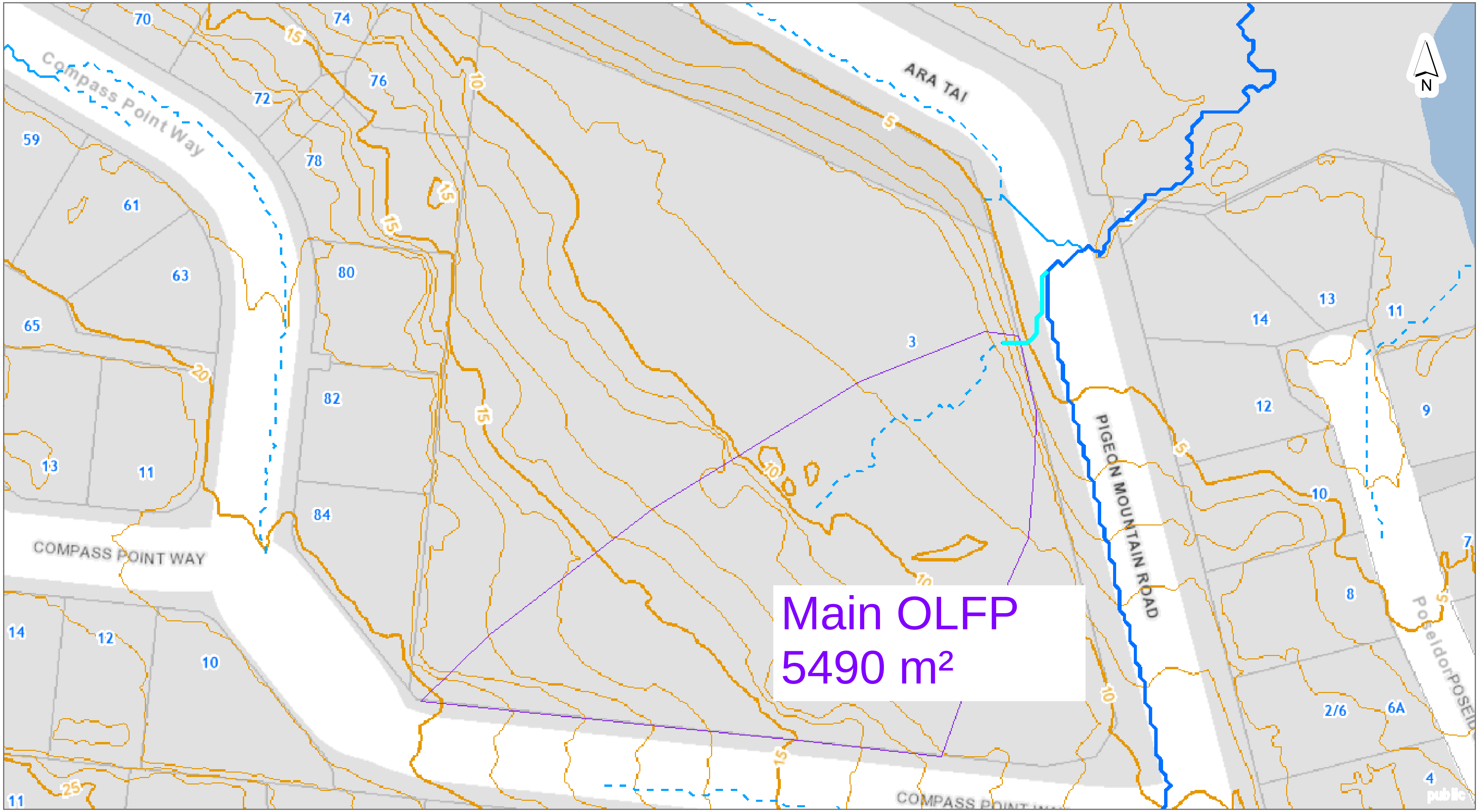
PMR OLFP CATCHMENT

0 25 50 75
Meters

Scale @ A3
= 1:2,500

Date Printed:
17/02/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau



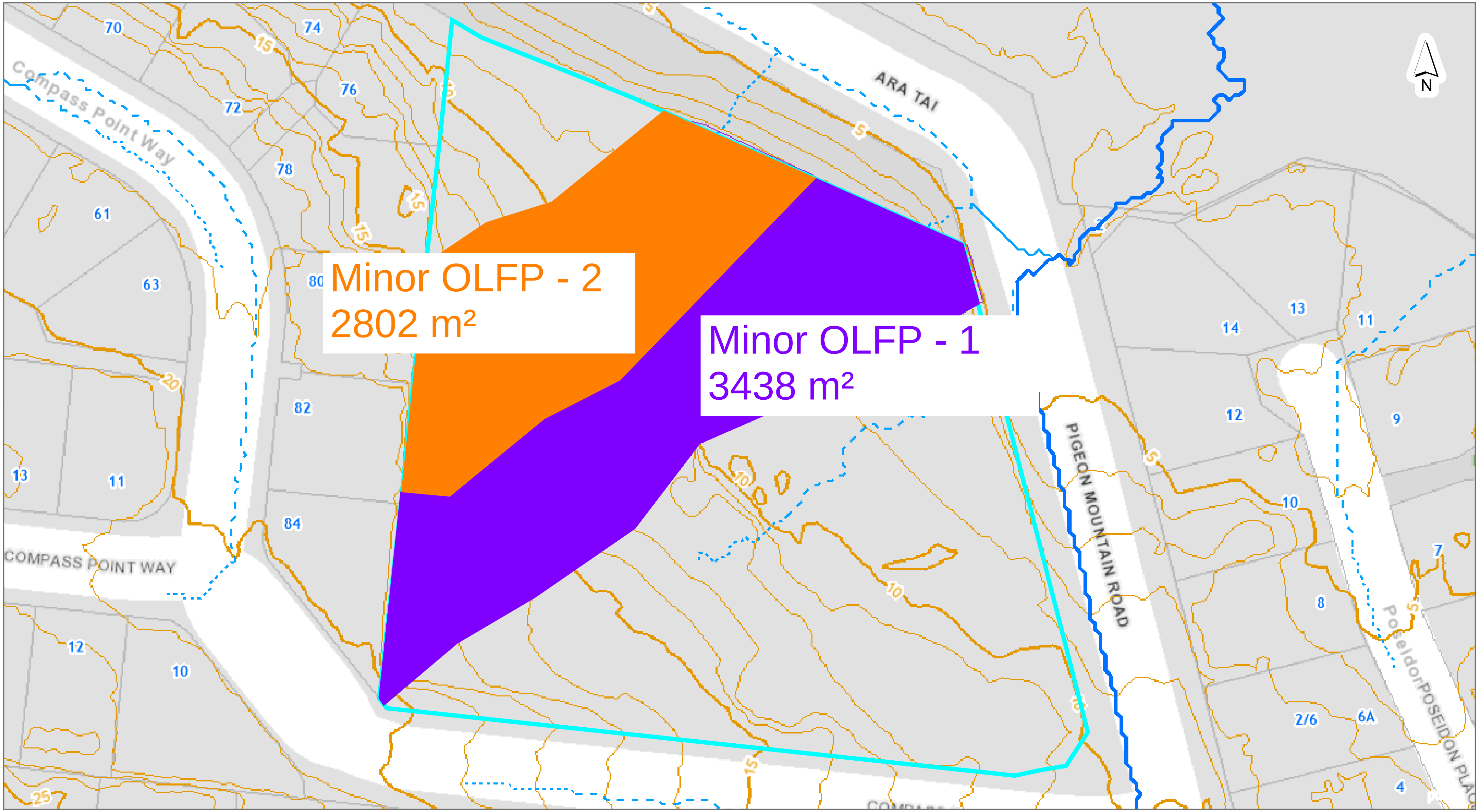
OLFP Catchment

0 6.5 13 19.5
Meters

Scale @ A4
= 1:1,000

Date Printed:
9/02/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau



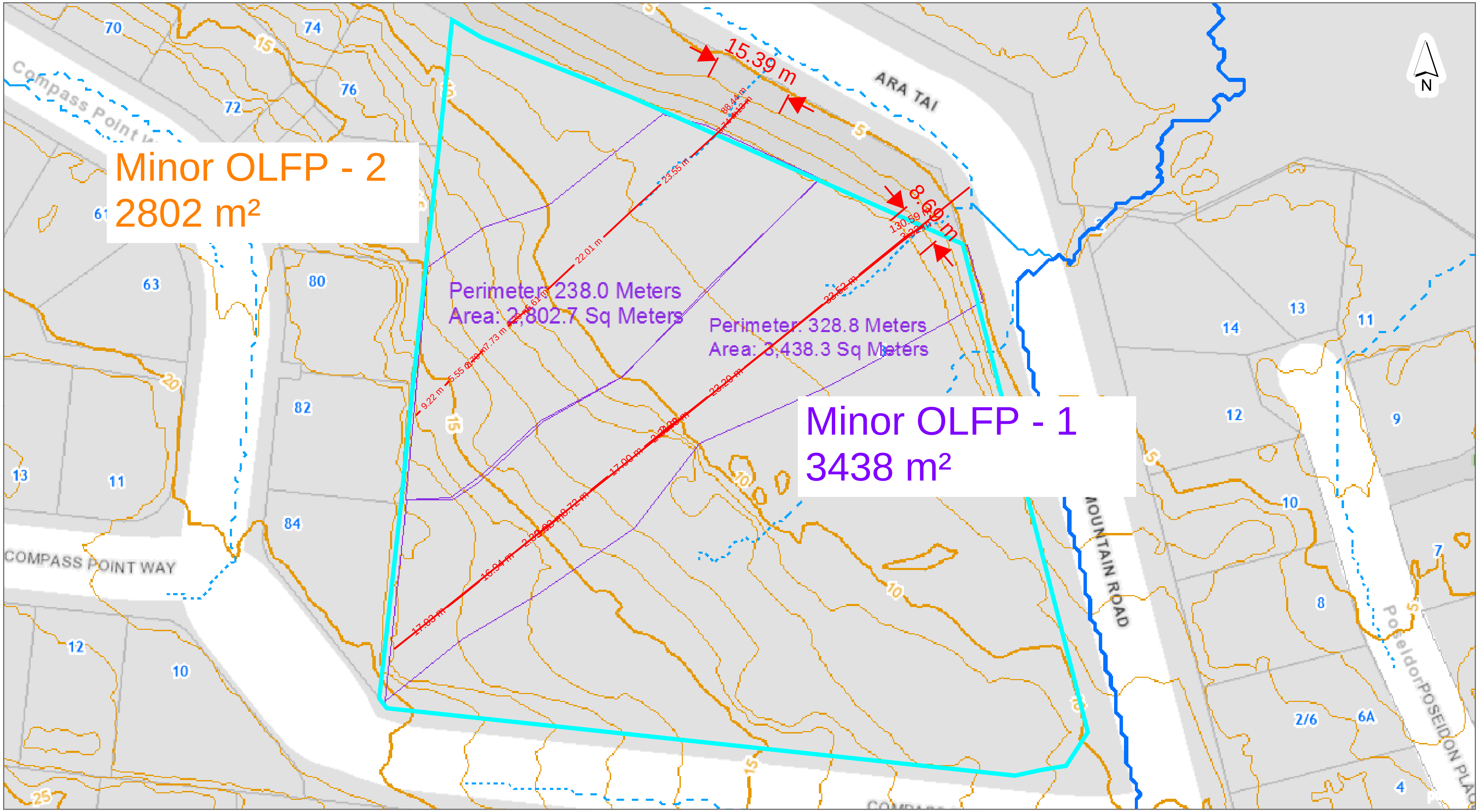
3 PGM Minor Flows

0 6.5 13 19.5
Meters

Scale @ A4
= 1:1,000

Date Printed:
8/09/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau



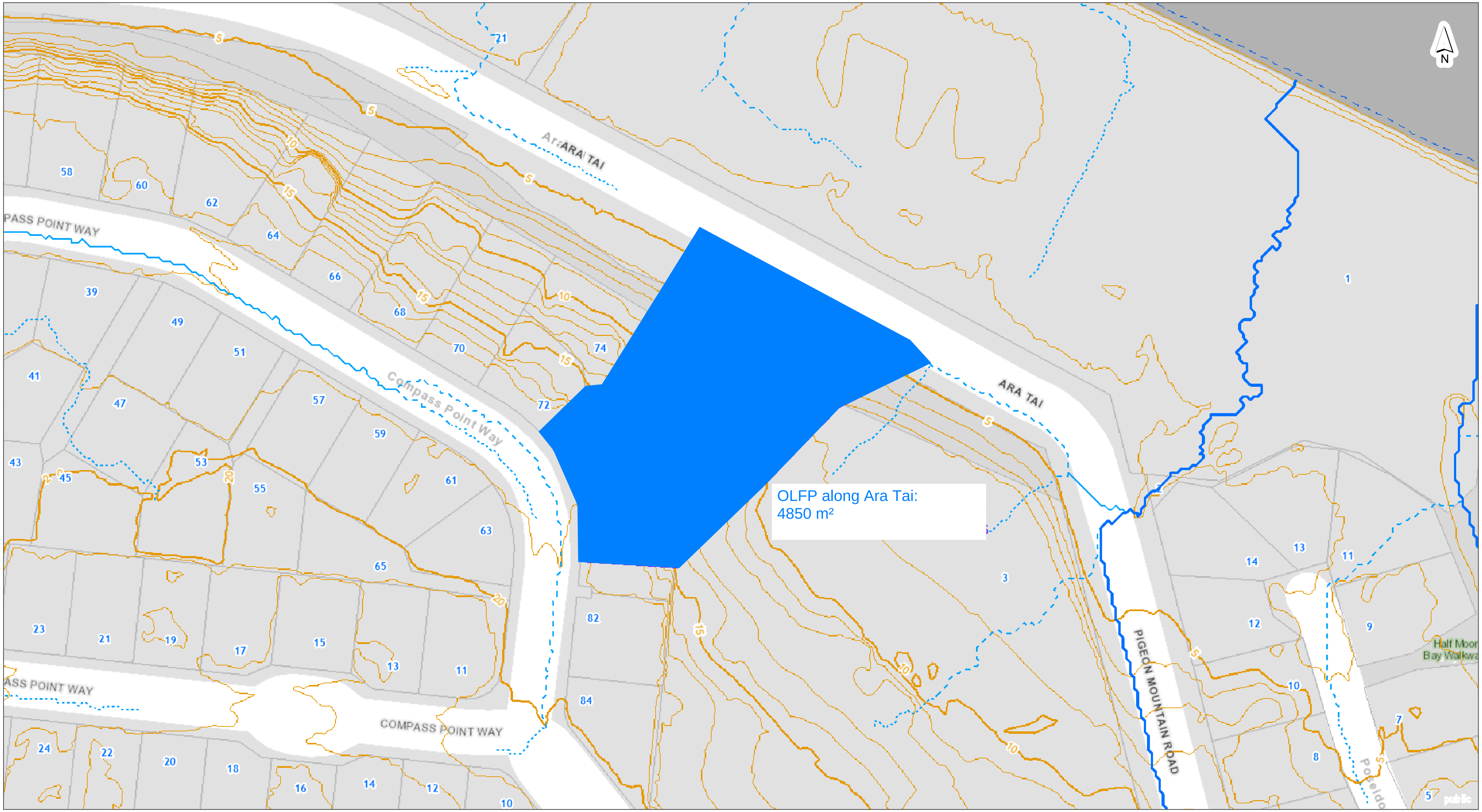
3 PGM Minor Flows

0 6.5 13 19.5
Meters

Scale @ A4
= 1:1,000

Date Printed:
8/09/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau



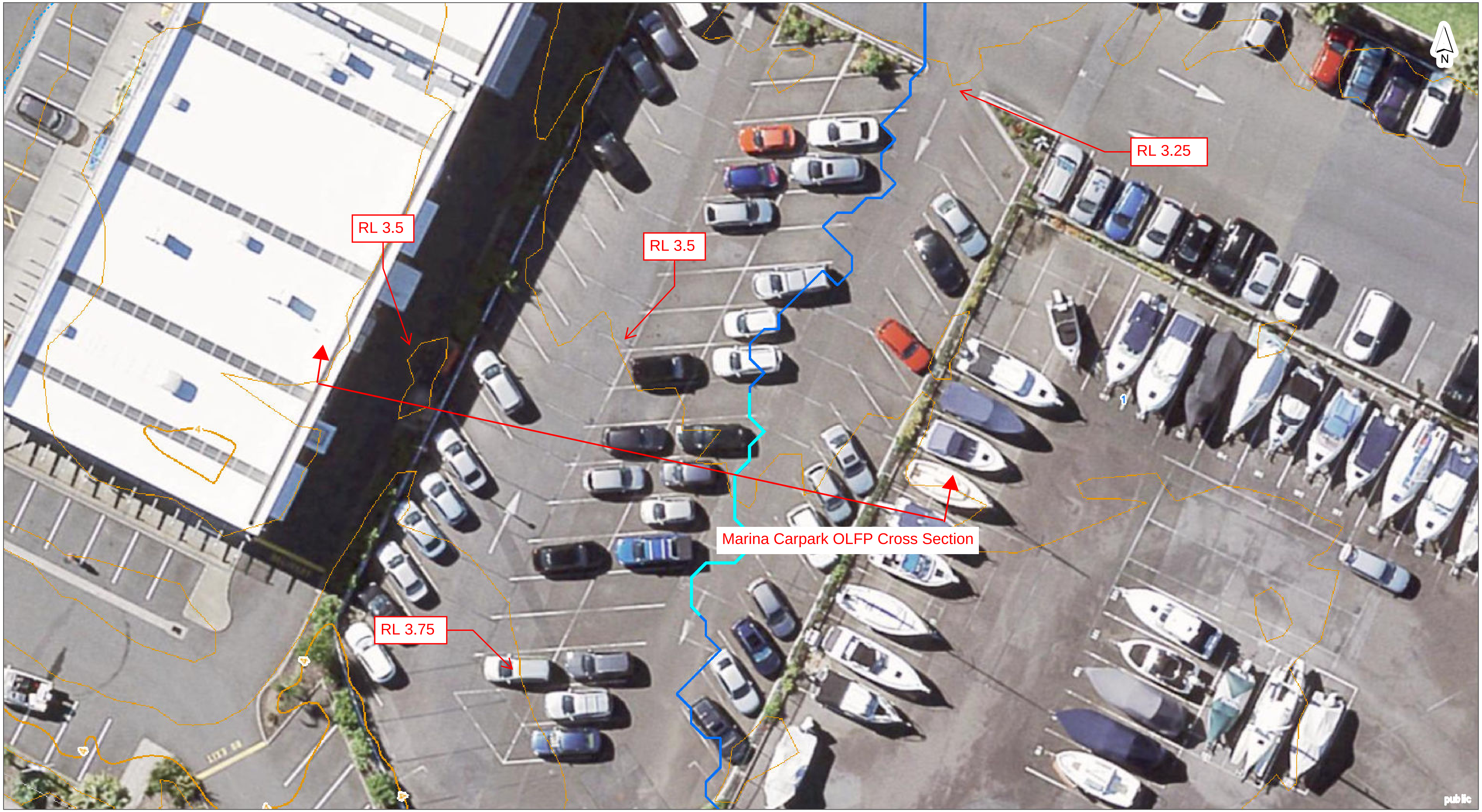
OLFP along Ara-Tai

0 10 20 30
Meters

Scale @ A3
= 1:1,000

Date Printed:
16/10/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau



Half Moon Bay Marina Carpark OLFP

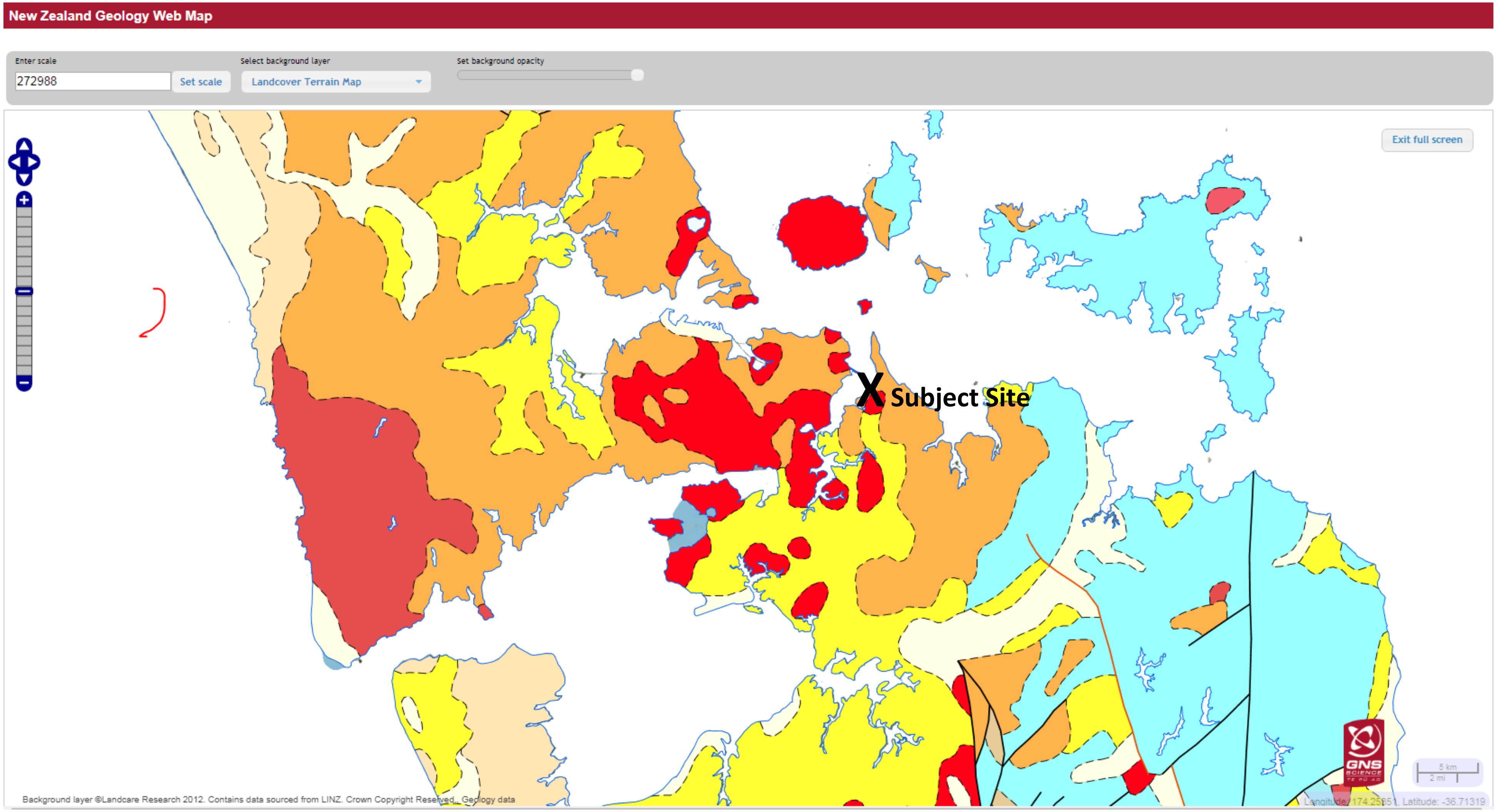
0 2.5 5 7.5
Meters

Scale @ A3
= 1:250

Date Printed:
16/10/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau

GNS - Auckland Geology Map: 3 Pigeon Mountain Road, Half Moon Bay, Auckland



Enter scale: 272988

Select background layer: Landcover Terrain Map

Background layer ©Landcare Research 2012. Contains data sourced from LINZ. Crown Copyright Reserved. Geology data

Longitude: 174.25851, Latitude: -36.71319

BROWN AREAS: TP108 Clay - Runoff Curve Number CN=74

Plot symbol	eM
Name	Waitemata Group
Description	Interbedded, graded sandstone and siltstone or mudstone, massive mudstone and sandstone; local intercalated volcanic grit, breccia and conglomerate, and minor bioclastic limestone.
Geologic history	Early Miocene
Simple name	Zealandia Megasequence Mainly Marine Sedimentary Rocks (Neogene)

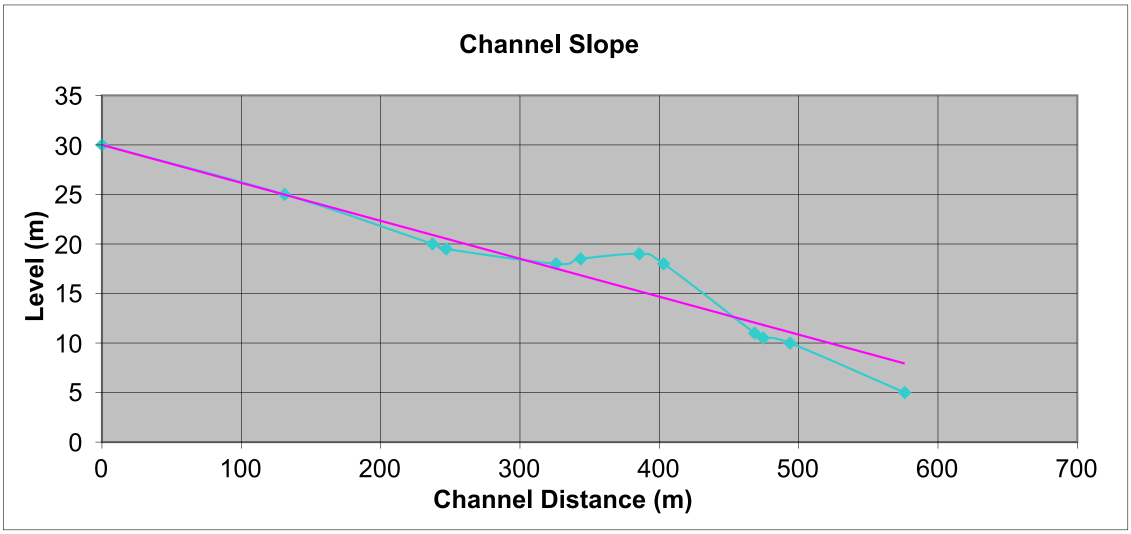
Civil, Structural
and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	8/09/2023

CATCHMENT SLOPE ANALYSIS
SLOPE CALCULATIONS - EQUAL AREA METHOD - TP10 FOR PMR OLFP

Description	**Level (m)**	**Incremental distance (m)**	**Running distance (m)**	**"Area" from TP108**	**Average Slope Level**
Inlet point	30	0	0		30
	25	131.1	131.1	3605.25	25
	20	106.1	237.2	2387.25	21
	19.5	9.8	247	193.55	21
	18	78.9	325.9	1479.375	18
	18.5	17.7	343.6	323.025	17
	19	42	385.6	787.5	15
	18	17.5	403.1	323.75	15
	11	65.3	468.4	946.85	12
	10.5	6.2	474.6	66.65	12
	10	19.2	493.8	196.8	11
	5	82.3	576.1	617.25	8
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
Channel length (m)			**576.1**	10927.25	
Average Channel Slope	**-0.03830**				



Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** **Reviewed By:**	SW RCHT	**Phone:** 09 534 6523	**Date:** 15/05/2023

Hydrographs- SCS Method:

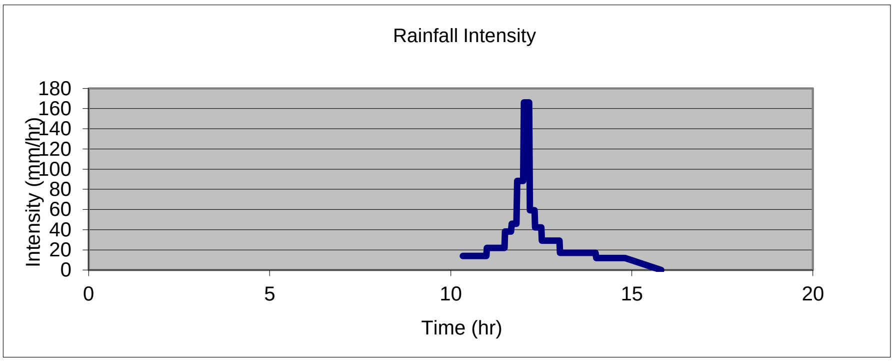
Rainfall Depth (mm)	239.44	100 YEAR ARI

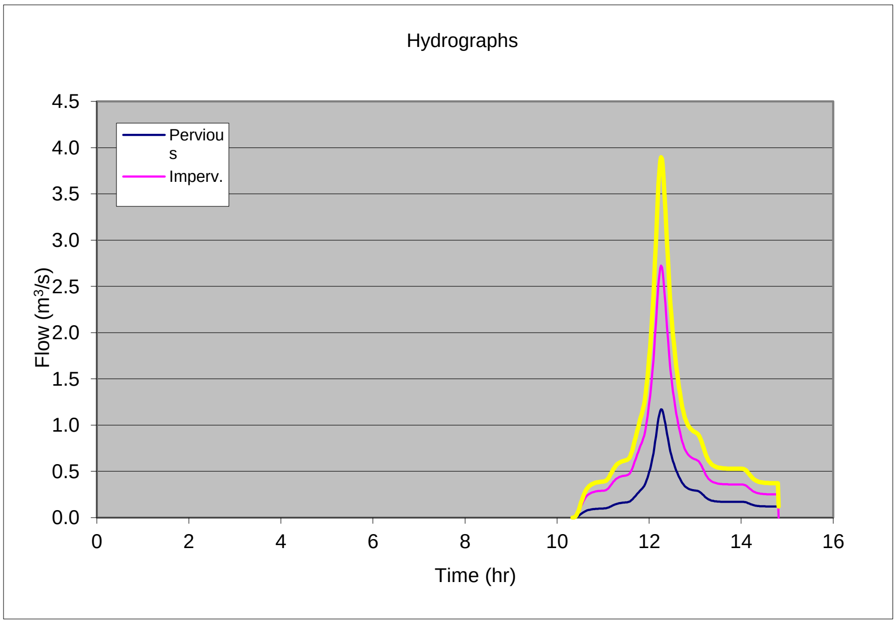
Catchment Data	**Pervious Ar**	**Impervious A**
Area (ha)	4.10	7.62
Runoff No (CN)	74	98
Initial Loss (Ia-mm)	5	0
Channel Length (L-m)	576.1	576.1
Channel Slope (Sc-m/m)	0.0383	0.0383
Channel Factor (CF-0.6 to 1.0)	0.8	0.6
Time of Concentration (tc-min)	16.7	16.7
Soil storage (S-mm)	89.2	5.2

Notes:

1. Inputs
2. Typical inputs for CN, Ia, CF are in 'Typical Inputs' Sheet.
3. Method based on ARC TP108.
4. Maximum Impervious area = 65% for Urban areas to AUP H2.

Outputs			**Total**
Runoff (mm)	169.8	234.4	211.8
Peak Flow (m^3/s)	1.172	2.726	**3.897**
Time (hr) at Peak Flow	12.26	12.26	12.26
Rainfall (mm/h) over tc	131.55	131.55	131.55
Runoff Coefficient - Peak	0.78	0.98	0.91
Runoff Coefficient - Volume	0.71	0.98	0.88





Airey Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client: HND HMB Ltd

Job: 3 Pigeon Mountain Road
Bombay

Calc's By: SW **Phone:**

Reviewed By: RCHT 09 534 6523

Sheet No: 1

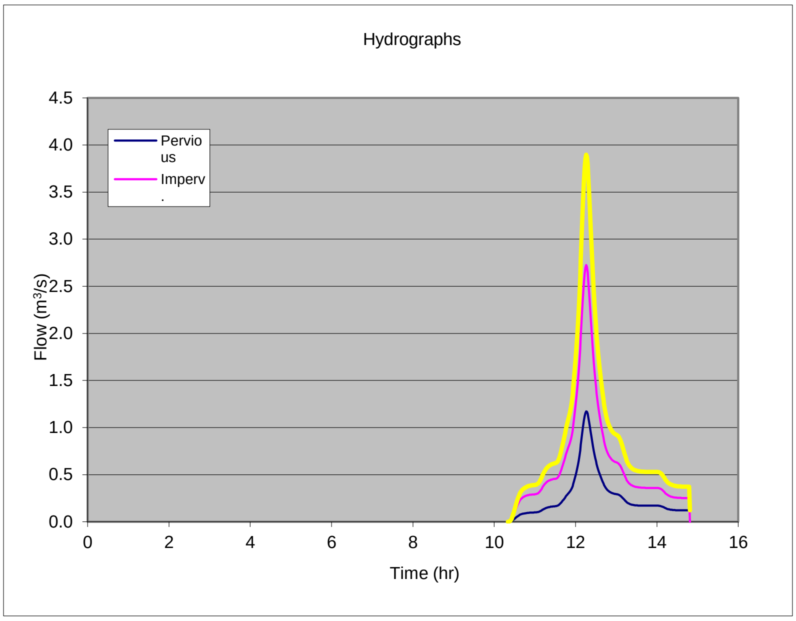
Job No: 220571/01

Date: 15/05/2023

Hydrographs- SCS Method:

Total Hydrograph in tabular form: (based on simualtion from above)

Volumetric error in scaling 1.84%



Time (hr)	Flow (m^3/s)
10.336	0.000
10.891	0.384
11.121	0.432
11.298	0.574
11.447	0.615
11.578	0.653
11.696	0.849
11.805	1.061
11.907	1.275
12.002	1.735
12.092	2.388
12.178	3.337
12.260	3.897
12.310	3.704
12.360	3.255
12.412	2.753
12.465	2.309
12.519	1.977
12.574	1.709
12.631	1.480
12.689	1.286
12.749	1.135
12.810	1.035
12.874	0.977
12.940	0.943
13.008	0.922
13.079	0.891
13.153	0.802
13.230	0.686
13.311	0.604
13.397	0.563
13.488	0.543
13.587	0.534
13.694	0.531
13.812	0.529
13.946	0.529
14.105	0.511
14.313	0.403
14.813	0.121
-1.000	0.000

Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 3
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** **Reviewed By:**	SW RCHT	**Phone:** 09 534 6523	**Date:** 15/05/2023

CHANNEL CAPACITY CALCULATIONS

EXISTING OLFP ALONG PIGEON MOUNTAIN ROAD

INPUTS

Case (A or B)	B

Case A

Flow (m^3/s)	3.897

Case B

Slope (S_o)	0.042	
Water level (m)	9.35	0.23
MFFL	9.85	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	9.6	0.02		Berm
3	9.3	0.013		Edge of FP
4.2	9.3	0.02		Edfe of FP
5.6	9.27	0.013		Top of Kerb
5.6	9.12	0.013		Kerb Channel
11	9.3	0.013		Carriageway
16.4	9.25	0.013		Carriageway
17.6	9.27	0.013		Kerb Channel
17.6	9.42	0.013		Top of Kerb
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	4.388	OK
Velocity (m/s)	3.063	
S_o or S_f	0.0420	
Energy (m)	9.828	
Froude No	3.175	
Bed Stress (Pa)	38.485	
Equivalent "n"	0.014	
Equivalent k_s(mm)	2.37	

Geometry for wetted conditions

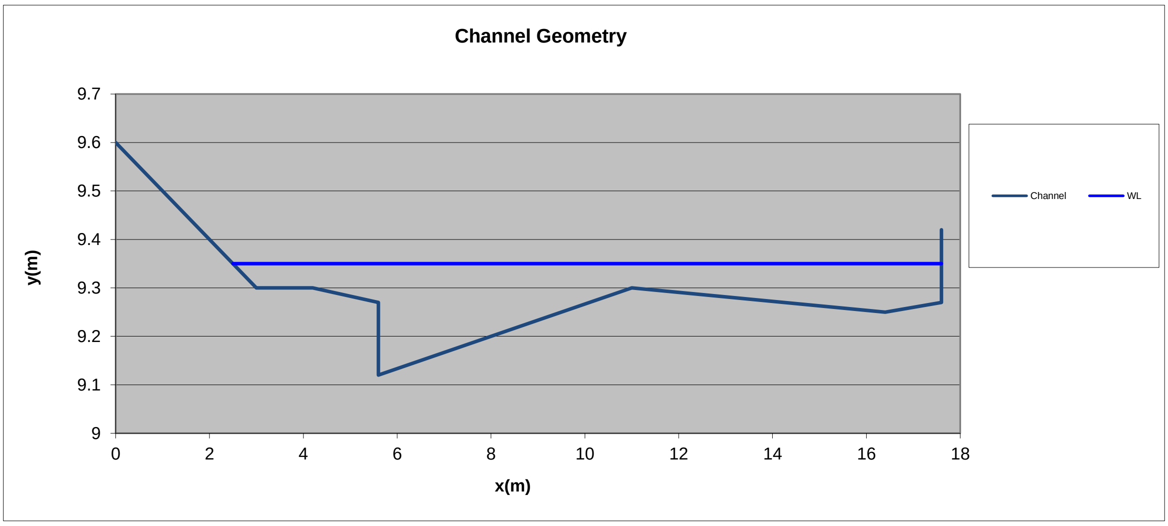
Depth (d-m)	9.350
Area (A-m^2)	1.432
Width (B-m)	15.100
Perimeter (P-m)	15.336

Critical Flow Conditions

Flow (m^3/s)	1.382	INCREASE CHANNEL
Velocity (m/s)	0.965	
Energy (m)	9.397	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



OLFP CONTAINED WITHIN CARRIAGEWAY

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate

$Q = 2.78\ C\ i\ A$

Rational Formula

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.53**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**0.55**	ha
Overland Runoff Rate	**Q**	**131**	**l/s**

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate Q = 2.78 C i A — *Rational Formula*

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.53**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**0.34**	ha
Overland Runoff Rate	**Q**	**82**	**l/s**

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate **Q = 2.78 C i A** *Rational Formula*

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.53**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**0.28**	ha
Overland Runoff Rate	**Q**	**67**	**l/s**

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate

Q = 2.78 C i A

Rational Formula

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.53**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**1.41**	ha
Overland Runoff Rate	**Q**	**336**	**l/s**

PIPE FLOW CALCULATIONS	REFERENCE
Overland Flow Rate **Q = 2.78 C i A**	*Rational Formula*

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.65**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**0.49**	ha
Overland Runoff Rate	**Q**	**142**	**l/s**

Airey Civil, Structural and Fire Engineers Takapuna **Botany** Queenstown	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
	Reviewed By:	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

EXISTING SITE OLFP

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.131	
Case B		
Slope (S_o)	0.073	
Water level (m)	5.33	0.07
MFFL	5.83	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	5.89	0.02	
2	5.75	0.02	
4	5.61	0.02	
6	5.39	0.02	
8	5.33	0.02	
10	5.26	0.02	
12	5.33	0.02	
14	5.36	0.02	
16.9	5.4	0.02	
-1			

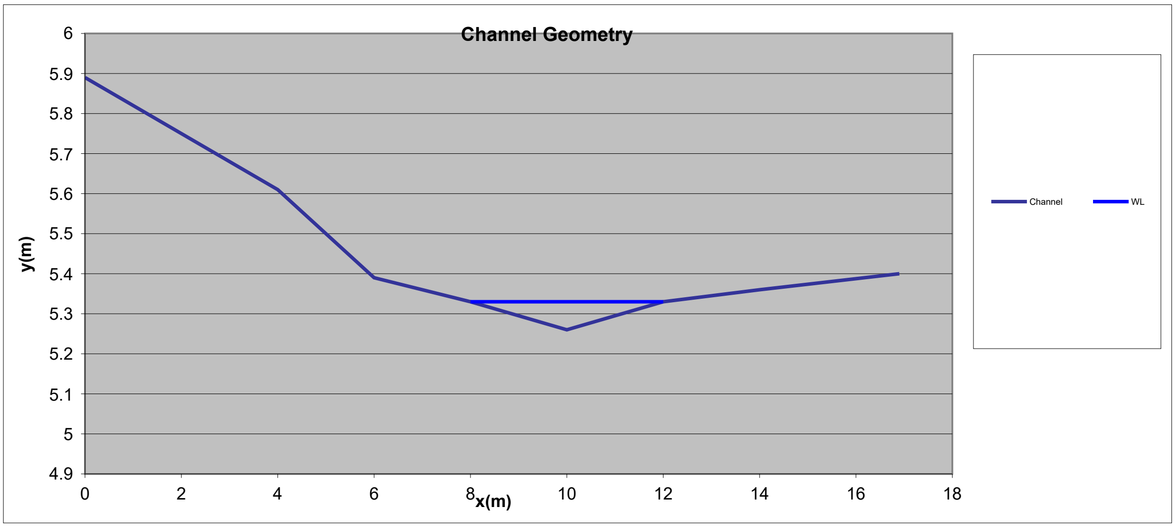
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1n_1^{1.5}+\ldots.)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	0.200	OK
Velocity (m/s)	1.429	
S_o or S_f	0.0730	
Energy (m)	5.434	
Froude No	2.438	
Bed Stress (Pa)	25.049	
Equivalent "n"	0.020	
Equivalent k_s(mm)	13.08	
Geometry for wetted conditions		
Depth (d-m)	5.330	
Area (A-m^2)	0.140	
Width (B-m)	4.000	
Perimeter (P-m)	4.002	
Critical Flow Conditions		
Flow (m^3/s)	0.082	INCREASE CHANNEL
Velocity (m/s)	0.586	
Energy (m)	5.348	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Civil, Structural
and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:**
			1
Job:	3 Pigeon Mountain Road		**Job No:**
	Half Moon Bay		220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

EXISTING SITE MINOR OLFP 1

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.082	
Case B		
Slope (S_o)	0.090	
Water level (m)	8.04	0.04
MFFL	8.54	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	8.5	0.02		imaginary wall
0	8	0.02		
2	8.04	0.02		
8.69	8	0.02		
8.69	8.5	0.02		imaginary wlal
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.

$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

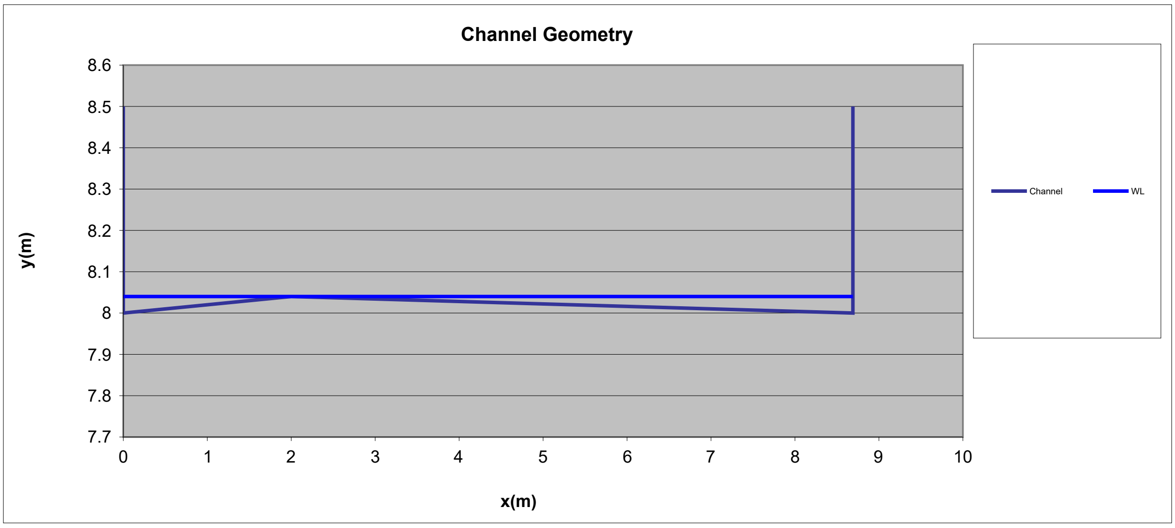
OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	0.188	OK
Velocity (m/s)	1.084	
S_o or S_f	0.0899	
Energy (m)	8.100	
Froude No	2.446	
Bed Stress (Pa)	17.476	
Equivalent "n"	0.020	
Equivalent k_s(mm)	10.38	

Geometry for wetted conditions	
Depth (d-m)	8.040
Area (A-m^2)	0.174
Width (B-m)	8.690
Perimeter (P-m)	8.771

Critical Flow Conditions		
Flow (m^3/s)	0.077	INCREASE CHANNEL
Velocity (m/s)	0.443	
Energy (m)	8.050	

Typical "n" values	
Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

EXISTING SITE MINOR OLFP 2

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.067	
Case B		
Slope (S_o)	0.126	
Water level (m)	5.93	0.03
MFFL	6.43	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	6	0.02	
2	5.9	0.02	
15.39	6	0.02	
-1			

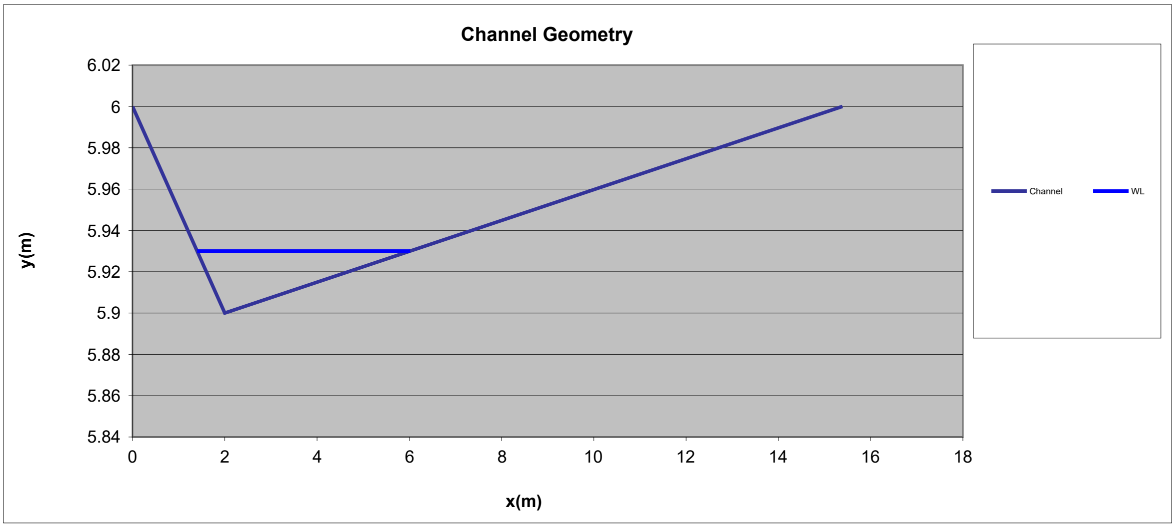
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	**0.074**	OK
Velocity (m/s)	1.063	
S_o or S_f	0.1258	
Energy (m)	5.988	
Froude No	2.772	
Bed Stress (Pa)	18.508	
Equivalent "n"	0.020	
Equivalent k_s(mm)	9.17	
Geometry for wetted conditions		
Depth (d-m)	5.930	
Area ($A-m^2$)	0.069	
Width (B-m)	4.617	
Perimeter (P-m)	4.618	
Critical Flow Conditions		
Flow (m^3/s)	**0.027**	INCREASE CHANNEL
Velocity (m/s)	0.384	
Energy (m)	5.938	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:**
				1
	Job:	3 Pigeon Mountain Road		**Job No:**
		Half Moon Bay		220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

EXISTING Marina Carpark

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	4.375	
Case B		
Slope (S_o)	0.031	
Water level (m)	3.59	0.12
MFFL	4.09	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	3.65	0.013		building, 150mm ground clearance
0	3.5	0.013		carpark
6.27	3.5	0.013		carpark
15.495	3.57	0.013		carpark
24.72	3.50	0.013		carpark
25.49	3.47	0.013		carpark
26.7	3.5	0.013		carpark
34.33	3.65	0.013		kerb
-1				

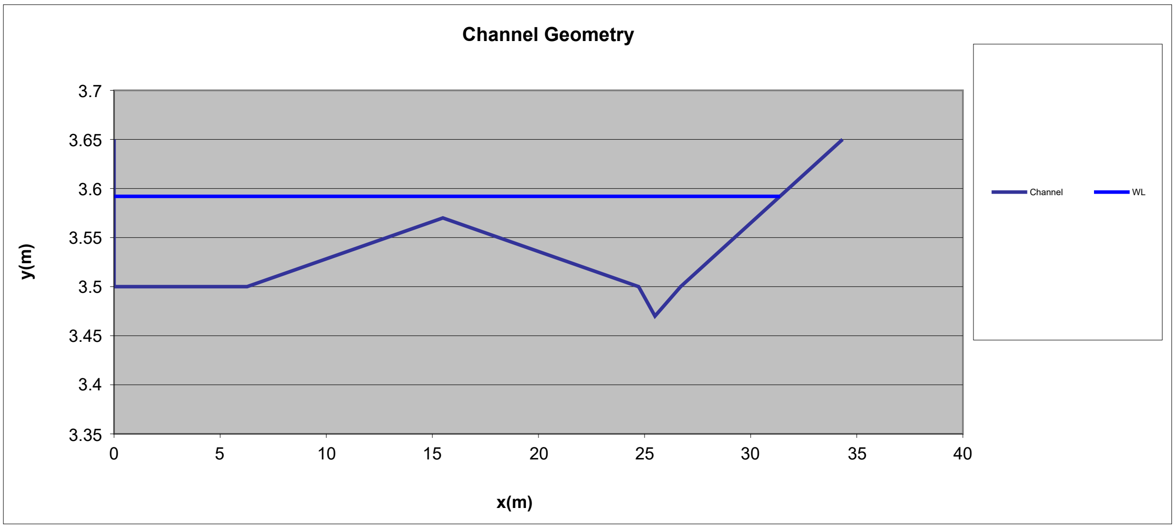
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	**4.481**	OK
Velocity (m/s)	2.180	
S_o or S_f	0.0311	
Energy (m)	3.834	
Froude No	2.720	
Bed Stress (Pa)	19.926	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.77	
Geometry for wetted conditions		
Depth (d-m)	3.592	
Area (A-m^2)	2.056	
Width (B-m)	31.380	
Perimeter (P-m)	31.474	
Critical Flow Conditions		
Flow (m^3/s)	**1.648**	INCREASE CHANNEL
Velocity (m/s)	0.802	
Energy (m)	3.625	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



S92 RESPONSE

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3 PIGEON MOUNTAIN ROAD

COMPASS POINT ROAD
PROPOSED SITE PLAN

Project No. :	JOB NO. 22924
Scale:	1:250@ A1
Date:	18/01/2024
Revison:	G

RA0100

BUILDING COVERAGE BY...

UNIT	AREA	TOTAL UNITS
BLOCK A		
A2	70 m²	1
A2	70 m²	1
A2	70 m²	1
A2	70 m²	1
A2	71 m²	1
A2	71 m²	1
A2	71 m²	1
A2	72 m²	1
	566 m²	8
BLOCK B		
A2	70 m²	1
A2	70 m²	1
A2	71 m²	1
A2	71 m²	1
A2	72 m²	1
A2	72 m²	1
	426 m²	6
BLOCK C		
E	80 m²	1
E	80 m²	1
	161 m²	2
BLOCK D		
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
	511 m²	7
BLOCK E		
C	73 m²	1
C	74 m²	1
C	74 m²	1
C	74 m²	1
C	79 m²	1
C	81 m²	1
C3	73 m²	1
C3	74 m²	1
C3	91 m²	1
C3	91 m²	1
C-2	81 m²	1
	866 m²	11
BLOCK F		
C	91 m²	1
C	91 m²	1
C	91 m²	1
C	91 m²	1
C	91 m²	1
C	91 m²	1
	548 m²	6
BLOCK G		
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
	447 m²	7

BUILDING COVERAGE BY...

UNIT	AREA	TOTAL UNITS
BLOCK H		
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
B	64 m²	1
	702 m²	11
BLOCK I		
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
	310 m²	8
BLOCK J		
D	39 m²	1
D	39 m²	1
D	39 m²	1
	117 m²	3
BLOCK K		
D	38 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
	350 m²	9
BLOCK L		
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	39 m²	1
D	81 m²	1
D	102 m²	1
	497 m²	10
TOTAL AREA:	5500 m²	88

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

BUILDING COVERAGE:		COMPLIANCE
MIX HOUSING SUB-URBAN ZONE REQUIREMENT :	**40% MAX NET SITE AREA (5628㎡)**	
PROPOSED AREA:	39.1% (5500㎡)	YES
PREVIOUS BUILDING COVERAGE:	*40.5%(5702m²)*	

S92 RESPONSE

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3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (BUILDING COVERAGE)

N

Project No. :	**JOB NO. 22924**
Scale:	**1 : 300@ A1**
Date:	**18/01/2024**
Revison:	**G**

RA0200

IMPERVIOUS SPACE

NAME	AREA
BLOCK A	
TYPE A-2	558 m²
DRIVEWAYS / CAR PARK	102 m²
BLOCK B	
TYPE A-2	421 m²
DRIVEWAYS / CAR PARK	98 m²
BLOCK C	
TYPE E-1	151 m²
DRIVEWAYS / CAR PARK	1659 m²
BLOCK D	
TYPE A-1	469 m²
DRIVEWAYS / CAR PARK	53 m²
BLOCK E	
TYPE C-3	342 m²
TYPE C-2	81 m²
TYPE C-1	443 m²
BLOCK F	
TYPE C-1	548 m²
BLOCK G	
TYPE B-1	282 m²
BLOCK H	
TYPE B-1	1950 m²
DRIVEWAYS / CAR PARK	5 m²
BLOCK I	
TYPE D-1	265 m²
DRIVEWAYS / CAR PARK	120 m²
BLOCK J	
TYPE D-1	99 m²

IMPERVIOUS SPACE

NAME	AREA
BLOCK K	
TYPE D-1	298 m²
DRIVEWAYS / CAR PARK	78 m²
BLOCK L	
TYPE D-1	497 m²
DRIVEWAYS / CAR PARK	10 m²
AREA TOTAL	8531 m²

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

IMPERVIOUS AREA:		**COMPLIANCE**
MIX HOUSING SUB-URBAN ZONE REQUIREMENT:	**60% MAX NET SITE AREA (8442㎡)**	
PROPOSED AREA:	60.6% (8531㎡)	NO
PREVIOUS AREA:	67.2% (9457㎡)	

S92 RESPONSE

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3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (IMPERVIOUS AREA)

N

Project No. :	JOB NO. 22924
Scale:	1 : 300@ A1
Date:	18/01/2024
Revison:	G

RA0201

LEGEND

🟩 LANDSCAPED AREA

🟫 PERMEABLE AREA

🟩 PUBLIC LANDSCAPED AREA

LANDSCAPED AREA	
BLOCK	AREA
BLOCK A	391 m²
BLOCK B	255 m²
BLOCK C	173 m²
BLOCK D	238 m²
BLOCK E	518 m²
BLOCK F	288 m²
BLOCK G	382 m²
BLOCK H	525 m²
BLOCK I	219 m²
BLOCK J	168 m²
BLOCK K	278 m²
BLOCK L	458 m²
PARK	211 m²
PUBLIC LANDSCAPE AREA	1222 m²
TOTAL AREA	5327 m²

PERMEABLE AREA	
BLOCK	AREA
BLOCK A	132 m²
BLOCK B	86 m²
BLOCK C	33 m²
BLOCK D	91 m²
BLOCK G	81 m²
BLOCK H	126 m²
BLOCK I	63 m²
BLOCK J	72 m²
BLOCK K	89 m²
BLOCK L	43 m²
PUBLIC LANDSCAPE AREA	451 m²
TOTAL AREA	1268 m²

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

LANDSCAPE AREA:		**COMPLIANCE**
MIX HOUSING SUBURBAN ZONE REQUIREMENT:	**40% MIN NET SITE AREA (5628㎡)**	
PROPOSED AREA:	38% (5327㎡)	
PREVIOUS AREA :	*32.7%(4606m²)*	NO
MIX HOUSING URBAN ZONE REQUIREMENT:	**35% MIN NET SITE AREA (4925㎡)**	
PROPOSED AREA:	38% (5367㎡)	
PREVIOUS AREA :	*32.7%(4606m²)*	YES
PERMEABLE AREA: 25% MAX.		
PROPOSED AREA:	24% (1268㎡)	YES
PREVIOUS AREA :	*28.2%(1299m²)*	

S92 RESPONSE

asc architects

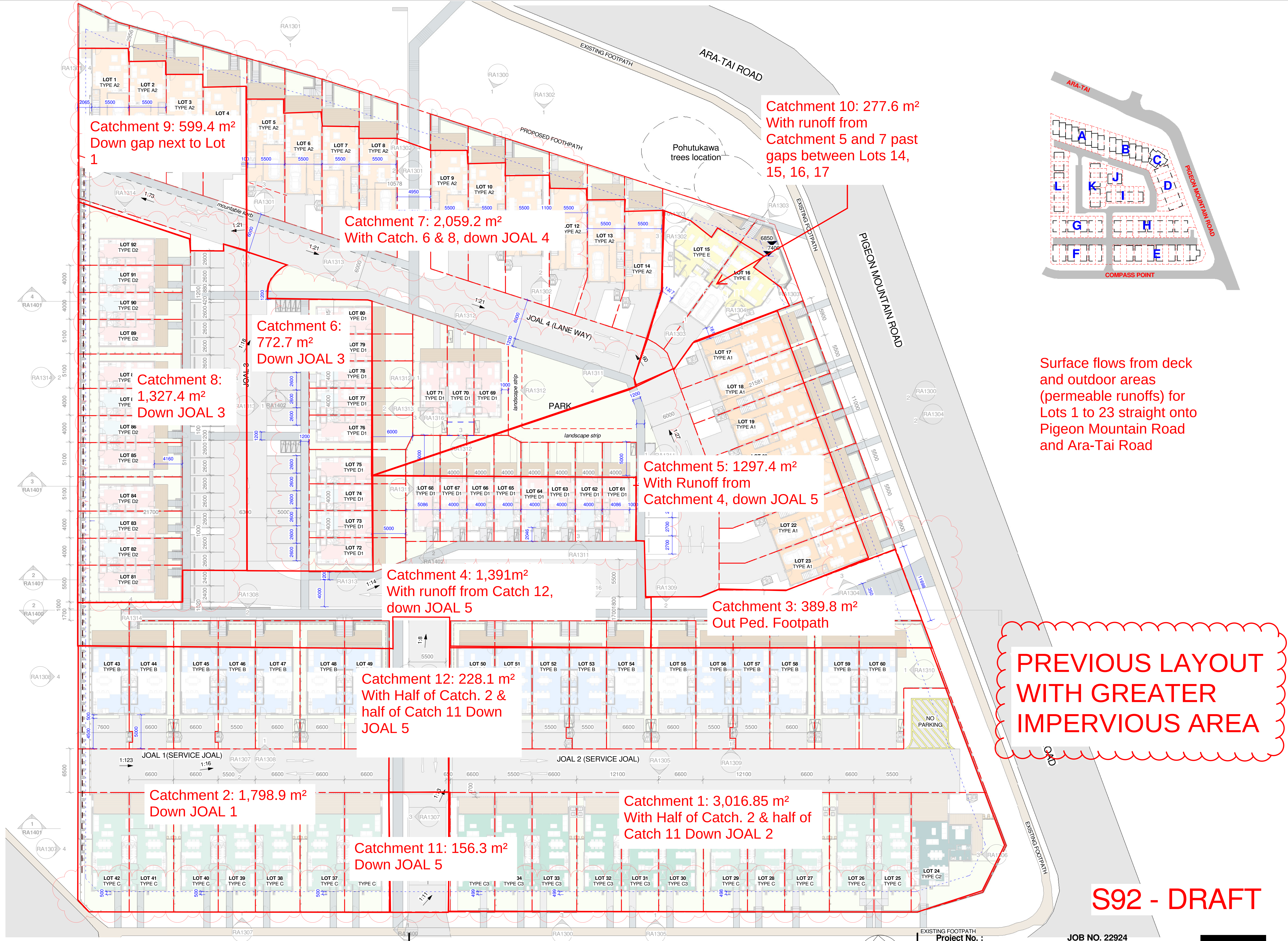
3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (LANDSCAPED AREA)

N

Project No. :	**JOB NO. 22924**
Scale:	**1 : 300@ A1**
Date:	**18/01/2024**
Revison:	**G**

RA0202



Catchment 9: 599.4 m² Down gap next to Lot 1

Catchment 7: 2,059.2 m² With Catch. 6 & 8, down JOAL 4

Catchment 10: 277.6 m² With runoff from Catchment 5 and 7 past gaps between Lots 14, 15, 16, 17

Catchment 6: 772.7 m² Down JOAL 3

Catchment 8: 1,327.4 m² Down JOAL 3

Catchment 5: 1297.4 m² With Runoff from Catchment 4, down JOAL 5

Surface flows from deck and outdoor areas (permeable runoffs) for Lots 1 to 23 straight onto Pigeon Mountain Road and Ara-Tai Road

Catchment 4: 1,391m² With runoff from Catch 12, down JOAL 5

Catchment 3: 389.8 m² Out Ped. Footpath

Catchment 12: 228.1 m² With Half of Catch. 2 & half of Catch 11 Down JOAL 5

PREVIOUS LAYOUT WITH GREATER IMPERVIOUS AREA

Catchment 2: 1,798.9 m² Down JOAL 1

Catchment 1: 3,016.85 m² With Half of Catch. 2 & half of Catch 11 Down JOAL 2

Catchment 11: 156.3 m² Down JOAL 5

S92 - DRAFT

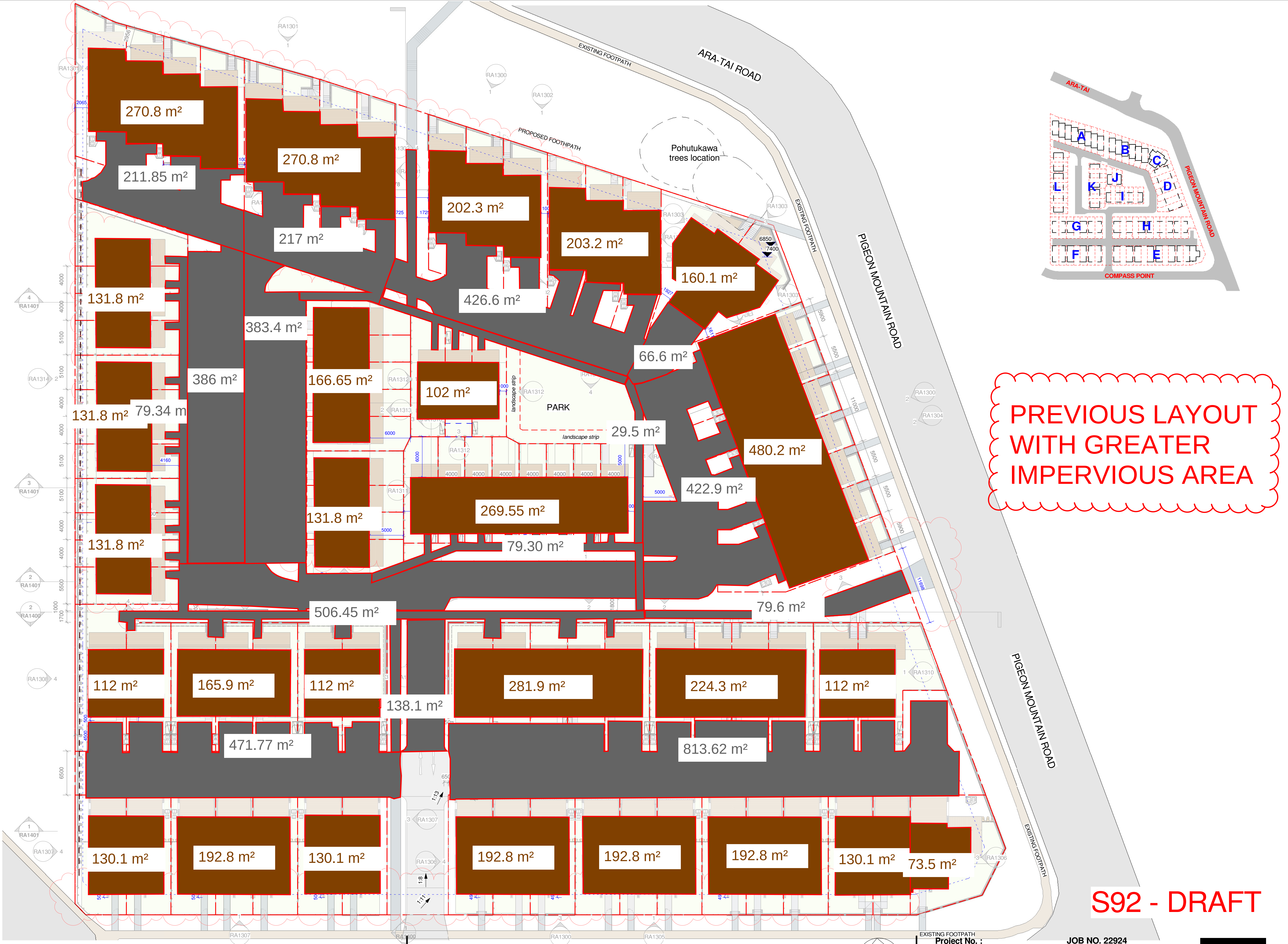
asc architects

3 PIGEON MOUNTAIN ROAD

COMPASS POINT ROAD
PROPOSED SITE PLAN

Project No. :	JOB NO. 22924
Scale:	1:250@ A1
Date:	25/09/2023
Revison:	B

RA0100



PREVIOUS LAYOUT WITH GREATER IMPERVIOUS AREA

S92 - DRAFT

asc architects

3 PIGEON MOUNTAIN ROAD

COMPASS POINT ROAD
PROPOSED SITE PLAN

Project No. :	JOB NO. 22924
Scale:	1:250@ A1
Date:	25/09/2023
Revison:	B

RA0100

PREVIOUS LAYOUT WITH GREATER IMPERVIOUS AREA

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TAKAPUNA **BOTANY** QUEENSTOWN

CLIENT:
HND HMB LTD

JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

REV	AMENDMENT	DATE	BY

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
OLFP CALCS

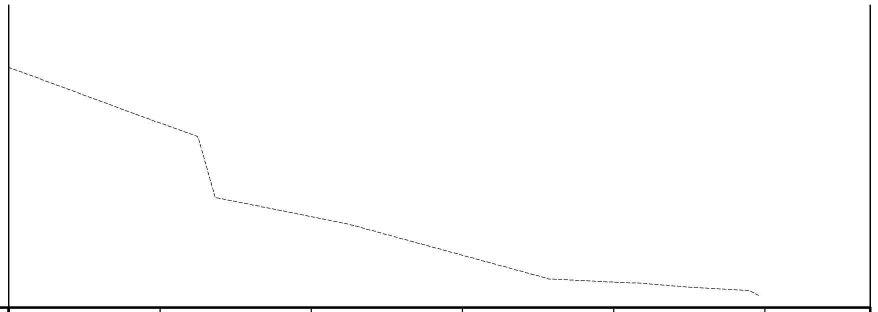
DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 24/10/2023
SCALE: 1:250 @ A3
DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
SITE PLAN
OVERLAND FLOWPATH
POST DEVELOPMENT

JOB No:	SHEET No:	REV:
220571-1	OLFP03	-

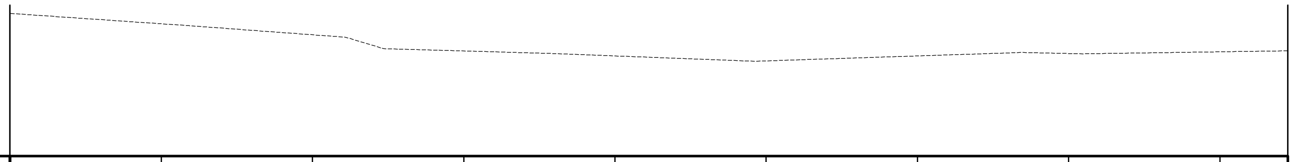
PREVIOUS LAYOUT WITH GREATER IMPERVIOUS AREA



DATUM 4.00

EXISTING LEVEL	7.18	6.44	5.20	4.69	4.33		
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	11.39

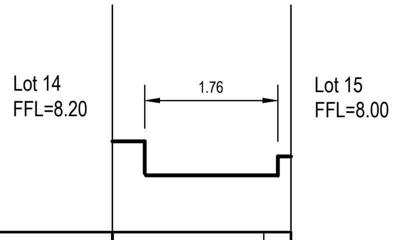
SECTION OLFP – EX 1–1



DATUM 4.00

EXISTING LEVEL	5.89	5.75	5.61	5.39	5.33	5.26	5.33	5.36	5.38	5.40
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	16.90

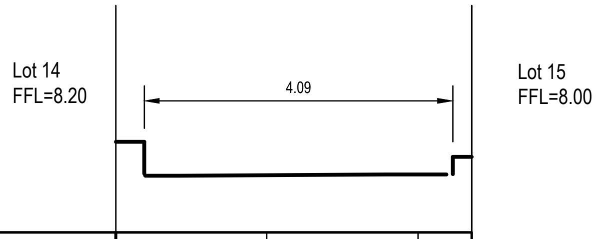
SECTION OLFP – EX 2–2



DATUM 7.00

EXISTING LEVEL	8.20	7.75	8.00
DISTANCE (m)	0.00	2.00	2.36

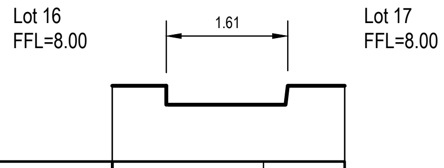
SECTION OLFP – PROP C–C



DATUM 7.00

EXISTING LEVEL	8.20	7.76	7.77	8.00
DISTANCE (m)	0.00	2.00	4.00	4.71

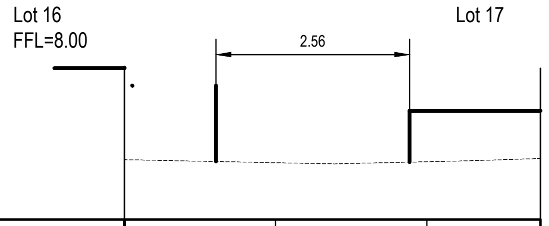
SECTION OLFP – PROP D–D



DATUM 7.00

EXISTING LEVEL	8.00	7.75	8.00
DISTANCE (m)	0.00	2.00	3.08

SECTION OLFP – PROP E–E



DATUM 6.00

EXISTING LEVEL	8.00		7.44	7.44
DISTANCE (m)	0.00	2.00	4.00	5.50

SECTION OLFP – PROP F–F

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CLIENT:
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JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
OLFP CALCS

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 24/10/2023
SCALE: 1:100 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
OLFP CROSS-SECTIONS

JOB No:	SHEET No:	REV:
220571-1	OLFP01	-

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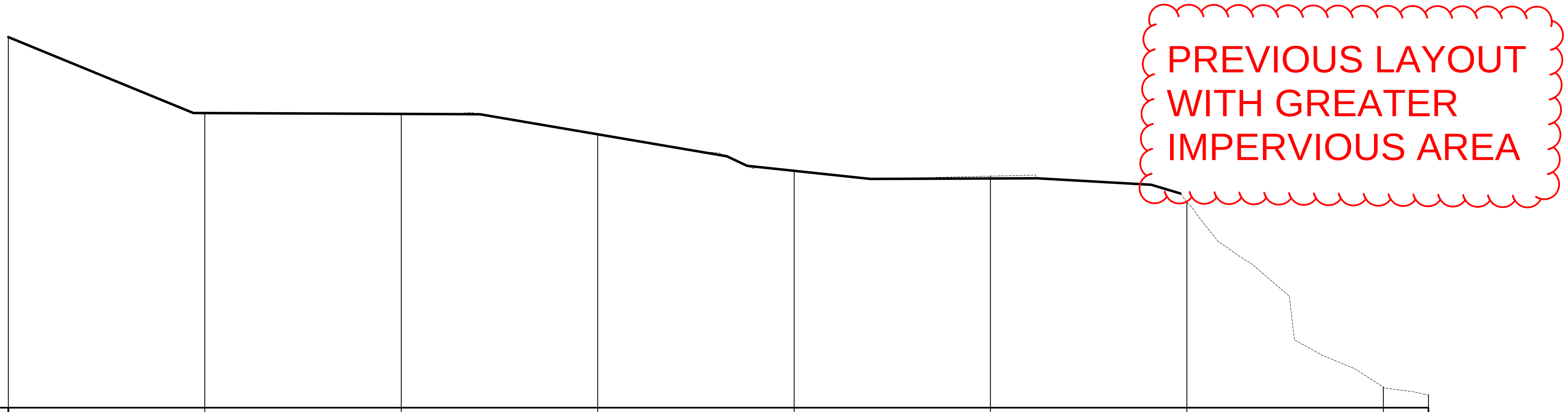
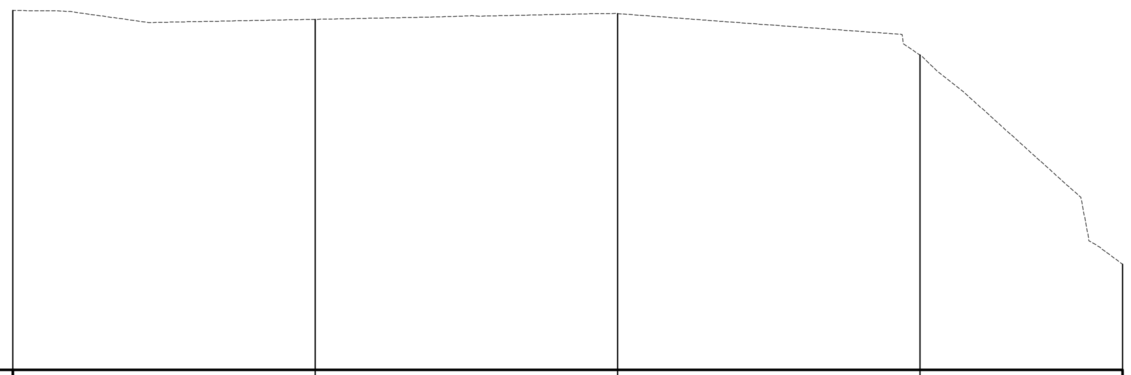

PREVIOUS LAYOUT WITH GREATER IMPERVIOUS AREA

DATUM 4.00

E GL	11.54	9.99	9.98	9.56	8.82	8.71	8.19	4.42	4.26
F GL	11.54	10.00	9.98	9.57	8.82	8.67			
CUT−/FILL+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIST	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	72.30

GRADE −16.42% −0.16% −6.83% −18.67% −4.23% 0.14% −2.25% −12.00%

VERT 1:100
HORIZ 1:250
OLFP – EX LS

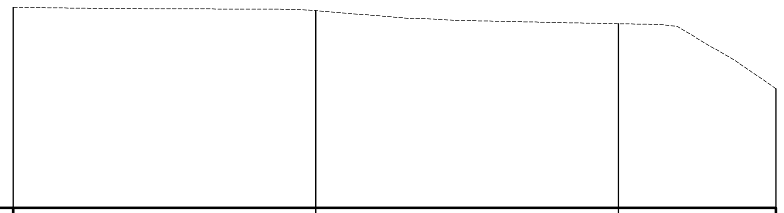


DATUM 4.00

E GL	8.75	8.64	8.71	8.17	5.40
F GL	8.75	8.64	8.71	8.17	5.40
CUT−/FILL+	0.00	0.00	0.00	0.00	0.00
DIST	0.00	10.00	20.00	30.00	36.70

GRADE −0.[illegible]5.61% 0.77% 1.4[illegible]0.86% 0.52% −2.98% −2.88% −3[illegible]36.01[illegible]%

VERT 1:100
HORIZ 1:250
OLFP – PROP A–A



DATUM 6.00

E GL	8.65	8.61	8.44	7.57
F GL	8.65	8.61	8.44	7.57
CUT−/FILL+	0.00	0.00	0.00	0.00
DIST	0.00	10.00	20.00	25.21

GRADE −0.3[illegible]61% −0.18% −2.46% 3.27% [illegible] 0.85% [illegible]22% 0.73% −4.[illegible]3%

VERT 1:100
HORIZ 1:250
OLFP – PROP B–B

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CLIENT:
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JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
OLFP CALCS

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 24/10/2023
SCALE: 1:250 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
OLFP LONGSECTION

JOB No:	SHEET No:	REV:
220571-1	OLFP02	-

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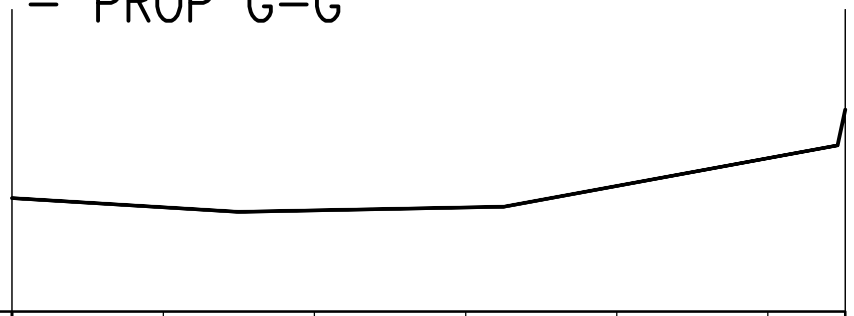
DATUM 8.00

EXISTING LEVEL	10.00	9.89	9.78	9.67	9.61	9.65	9.72	9.74	9.71
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	15.41

SECTION OLFP – PROP G–G

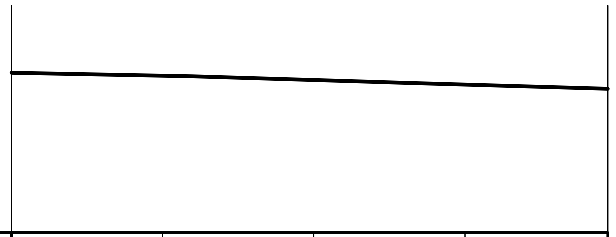


DATUM 6.00

EXISTING LEVEL	7.50	7.38	7.34	7.38	7.66	8.03	8.68
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	11.02

SECTION OLFP – PROP H–H

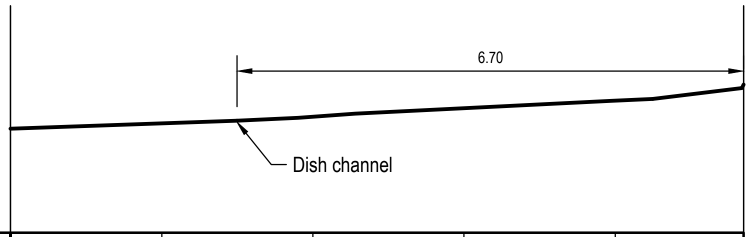
PREVIOUS LAYOUT
WITH GREATER
IMPERVIOUS AREA



DATUM 13.00

EXISTING LEVEL	15.11	15.07	15.01	14.95	14.90
DISTANCE (m)	0.00	2.00	4.00	6.00	7.89

SECTION OLFP – PROP I–I



DATUM 13.00

EXISTING LEVEL	14.37	14.44	14.53	14.64	14.74	14.96
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	9.70

SECTION OLFP – PROP J–J

DATUM 11.00

EXISTING LEVEL	12.60	12.56	12.50	12.44	12.38
DISTANCE (m)	0.00	2.00	4.00	6.00	7.89

SECTION OLFP – PROP K–K

DATUM 8.00

EXISTING LEVEL	9.34	9.30	9.36	9.42	9.48	9.50
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	8.69

SECTION OLFP – PROP L–L

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JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
OLFP CALCS

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 24/10/2023
SCALE: 1:100 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
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DRAWING TITLE:
OLFP CROSS-SECTIONS

JOB No:	SHEET No:	REV:
220571-1	OLFP04	-

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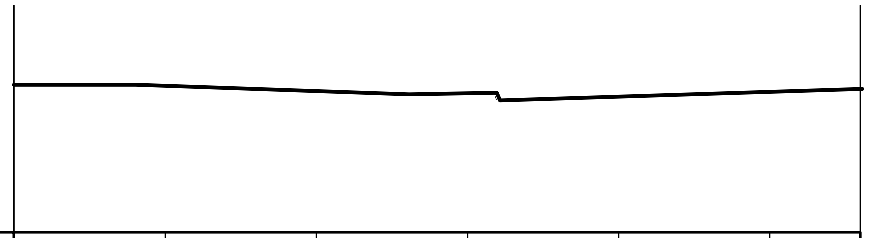
DATUM 7.00

EXISTING LEVEL	8.12	8.11	8.17	8.23	8.28	8.35
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	9.00

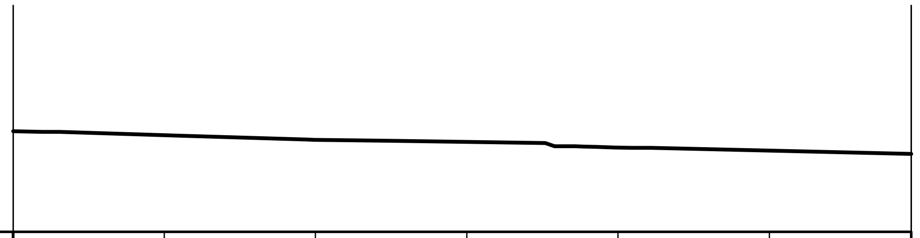
SECTION OLFP – PROP M–M



DATUM 8.00

EXISTING LEVEL	9.95	9.92	9.79	9.81	9.80	9.86	
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	11.20

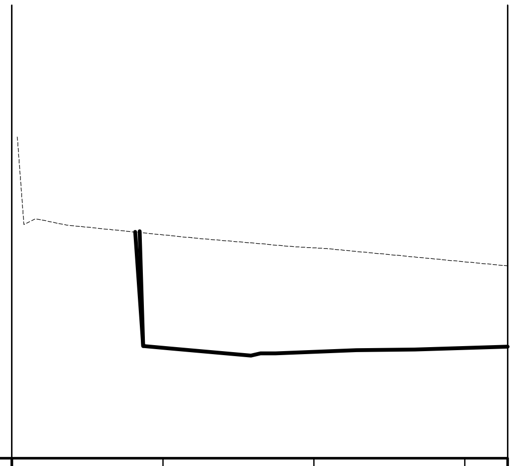
SECTION OLFP – PROP N–N



DATUM 9.00

EXISTING LEVEL	10.33	10.28	10.22	10.19	10.12	10.08	10.03
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	11.88

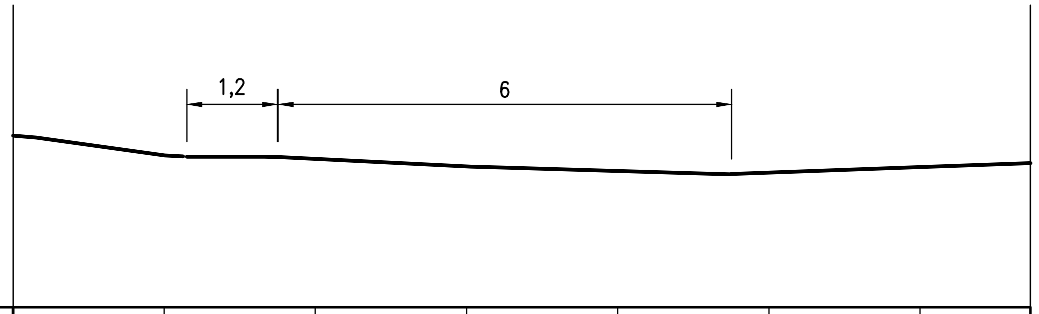
SECTION OLFP – PROP P–P



DATUM 8.00

EXISTING LEVEL		9.46	9.41	9.46	9.48
DISTANCE (m)	0.00	2.00	4.00	6.00	6.57

SECTION OLFP – PROP Q–Q



DATUM 6.00

EXISTING LEVEL	8.27	8.01	7.97	7.87	7.81	7.78	7.86	7.91
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	13.46

SECTION OLFP – PROP R–R

PREVIOUS LAYOUT
WITH GREATER
IMPERVIOUS AREA

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CLIENT:
HND HMB LTD

JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
OLFP CALCS

DESIGN:	SW
DRAWN:	LP
CHECKED:	RT
DATE:	24/10/2023
SCALE:	1:100 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
OLFP CROSS-SECTIONS

JOB No:	SHEET No:	REV:
220571-1	OLFP05	-

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Airey **Civil, Structural and Fire Engineers**	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Road		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** IG **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project	Whole Site	**By**	SW	**Date**	11/10/2023
Location	3 PMR	**Checked**	RCHT	**Date**	

Circle One [✓ **Present**] **Developed**

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.298	0.27
	Impervious areas - Pavement	0.85	0.265	0.23
	Pervious areas	0.3	0.844	0.25
				0.00
				0.00
			1.4073	0.75

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.75}{1.41} = 0.53$$

Airey **Civil, Structural and Fire Engineers**	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road		**Job No:** 220571/01
	Calc's By:	IG	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed**	RCHT	09 534 6523	11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project	Whole Site	**By**	SW	**Date**	11/10/2023
Location	3 PMR	**Checked**	RCHT	**Date**	

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.490	0.44
	Impervious areas - Pavement	0.85	0.446	0.38
	Pervious areas	0.3	0.472	0.14
				0.00
				0.00
			1.4073	0.96

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.96}{1.41} = \boxed{0.68}$$

Airey **Civil, Structural and Fire Engineers**	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** **Reviewed**	IG RCHT	**Phone:** 09 534 6523	**Date:** 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project Catchment 1 **By** SW **Date** 11/10/2023

Location 3 PMR **Checked** RCHT **Date**

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.140	0.13
	Impervious areas - Pavement	0.85	0.081	0.07
	Pervious areas	0.3	0.080	0.02
				0.00
				0.00
			0.3017	0.22

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.22}{0.30} = 0.73$$

Airey **Civil, Structural and Fire Engineers** Takapuna **Botany** Queenstown	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road		**Job No:** 220571/01
	Calc's By: **Reviewed**	IG RCHT	**Phone:** 09 534 6523	**Date:** 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project	Catchment 2	**By**	SW	**Date**	11/10/2023
Location	3 PMR	**Checked**	RCHT	**Date**	

Circle One Present [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.084	0.08
	Impervious areas - Pavement	0.85	0.047	0.04
	Pervious areas	0.3	0.048	0.01
				0.00
				0.00
			0.1799	0.13

$$C_{(\text{weighted})} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.13}{0.18} = 0.73$$

Airey Civil, Structural and Fire Engineers	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Road		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** IG **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project Catchment 3 **By** SW **Date** 11/10/2023

Location 3 PMR **Checked** RCHT **Date**

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.000	0.00
	Impervious areas - Pavement	0.85	0.008	0.01
	Pervious areas	0.3	0.031	0.01
				0.00
				0.00
			0.0390	0.02

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.02}{0.04} = 0.41$$

Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road		**Job No:** 220571/01
Calc's By:	IG	**Phone:**	**Date:**
Reviewed	RCHT	09 534 6523	11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project	Catchment 4	**By**	SW	**Date**	11/10/2023
Location	3 PMR	**Checked**	RCHT	**Date**	

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.027	0.02
	Impervious areas - Pavement	0.85	0.059	0.05
	Pervious areas	0.3	0.054	0.02
				0.00
				0.00
			0.1391	0.09

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.09}{0.14} = 0.65$$

Airey Civil, Structural and Fire Engineers Takapuna **Botany** Queenstown	**Client:** HND HMB Ltd **Job:** 3 Pigeon Mountain Road **Calc's By:** IG **Phone:** **Reviewed** RCHT 09 534 6523	**Sheet No:** 1 **Job No:** 220571/01 **Date:** 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project	Catchment 5	**By**	SW	**Date**	11/10/2023
Location	3 PMR	**Checked**	RCHT	**Date**	

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.048	0.04
	Impervious areas - Pavement	0.85	0.045	0.04
	Pervious areas	0.3	0.036	0.01
				0.00
				0.00
			0.1297	0.09

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.09}{0.13} = 0.71$$

Airey

Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client: HND HMB Ltd

Job: 3 Pigeon Mountain Road

Calc's By: IG

Reviewed RCHT

Phone: 09 534 6523

Sheet No: 1

Job No: 220571/01

Date: 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project Catchment 6 **By** SW **Date** 11/10/2023

Location 3 PMR **Checked** RCHT **Date**

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.027	0.02
	Impervious areas - Pavement	0.85	0.038	0.03
	Pervious areas	0.3	0.012	0.00
				0.00
				0.00
			0.0773	0.06

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.06}{0.08} = \boxed{0.78}$$

Airey **Civil, Structural and Fire Engineers**

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road		**Job No:** 220571/01
Calc's By:	IG	**Phone:**	**Date:**
Reviewed	RCHT	09 534 6523	11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project	Catchment 7	**By**	SW	**Date**	11/10/2023
Location	3 PMR	**Checked**	RCHT	**Date**	

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.078	0.07
	Impervious areas - Pavement	0.85	0.064	0.05
	Pervious areas	0.3	0.064	0.02
				0.00
				0.00
			0.2059	0.14

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.14}{0.21} = 0.70$$

Civil, Structural and Fire Engineers	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Road		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** IG **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project Catchment 8 **By** SW **Date** 11/10/2023

Location 3 PMR **Checked** RCHT **Date**

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.040	0.04
	Impervious areas - Pavement	0.85	0.047	0.04
	Pervious areas	0.3	0.047	0.01
				0.00
				0.00
			0.1327	0.09

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.09}{0.13} = 0.67$$

Airey **Civil, Structural and Fire Engineers** Takapuna **Botany** Queenstown	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Road		**Job No:** 220571/01
	Calc's By: IG **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project	Catchment 9	**By**	SW	**Date**	11/10/2023
Location	3 PMR	**Checked**	RCHT	**Date**	

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.027	0.02
	Impervious areas - Pavement	0.85	0.021	0.02
	Pervious areas	0.3	0.012	0.00
				0.00
				0.00
			0.0599	0.05

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.05}{0.06} = \boxed{0.77}$$

Airey **Civil, Structural and Fire Engineers**

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road		**Job No:** 220571/01
Calc's By:	IG	**Phone:**	**Date:**
Reviewed	RCHT	09 534 6523	11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project Catchment 10 **By** SW **Date** 11/10/2023

Location 3 PMR **Checked** RCHT **Date**

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.016	0.01
	Impervious areas - Pavement	0.85	0.007	0.01
	Pervious areas	0.3	0.005	0.00
				0.00
				0.00
			0.0278	0.02

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.02}{0.03} = 0.78$$

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate

Q = 2.78 C i A

Rational Formula

Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.85**		
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.02**	ha	*Catchment 1*
Overland Runoff Rate	**Q**	**6**	**l/s**	

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.73**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.18**	ha	*Catchment 2*
Overland Runoff Rate	**Q**	**59**	**l/s**	

Catchment 12 - OLFP K K

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 3
CALCS. BY: SW
DATE: 11/10/2023

PIPE FLOW CALCULATIONS					REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**			*Rational Formula*
Storm Scenario		**1%**	AEP		
Coefficent of Runoff	C	**0.73**			*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr		
Area of Runoff	A	**0.09**	ha		*Half Catchment 2*
Overland Runoff Rate	**Q**	**30**	**l/s**		
Overland Flow Rate		**Q = 2.78 C i A**			*Rational Formula*
Storm Scenario		**1%**	AEP		
Coefficent of Runoff	C	**0.85**			
Rainfall Intensity	i	**162.1**	mm/hr		*Catchment 12*
Area of Runoff	A	**0.02**	ha		
Overland Runoff Rate	**Q**	**9**	**l/s**		
Overland Flow Rate		**Q = 2.78 C i A**			*Rational Formula*
Storm Scenario		**1%**	AEP		
Coefficent of Runoff	C	**0.85**			
Rainfall Intensity	i	**162.1**	mm/hr		
Area of Runoff	A	**0.01**	ha		*Half Catchment 11*
Overland Runoff Rate	**Q**	**3**	**l/s**		
Total Overland Runoff Rate	**Q**	**41**	**l/s**		

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.73**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.30**	ha	*Catchment 1*
Overland Runoff Rate	**Q**	**99**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.73**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.09**	ha	*Half Catchment 2*
Overland Runoff Rate	**Q**	**30**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.85**		
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.01**	ha	*Half Catchment 11*
Overland Runoff Rate	**Q**	**3**	**l/s**	
Total Overland Runoff Rate	**Q**	**132**	**l/s**	

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.73**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.09**	ha	*Half Catchment 2*
Overland Runoff Rate	**Q**	**30**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.85**		
Rainfall Intensity	i	**162.1**	mm/hr	*Catchment 12*
Area of Runoff	A	**0.02**	ha	
Overland Runoff Rate	**Q**	**9**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.85**		
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.01**	ha	*Half Catchment 11*
Overland Runoff Rate	**Q**	**3**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.65**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.14**	ha	*Catchment 4*
Overland Runoff Rate	**Q**	**41**	**l/s**	
Total Overland Runoff Rate	**Q**	**82**	**l/s**	

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate **Q = 2.78 C i A** *Rational Formula*

Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.41**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.04**	ha	*Catchment 3*
Overland Runoff Rate	**Q**	**7**	**l/s**	

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.78**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.08**	ha	*Catchment 6*
Overland Runoff Rate	**Q**	**27**	**l/s**	

Catchment 8 - Part OLFP P P and Part OLFP N N

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.67**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.13**	ha	*Catchment 8*
Overland Runoff Rate	**Q**	**40**	**l/s**	

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 9
CALCS. BY: SW
DATE: 11/10/2023

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.77**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.06**	ha	*Catchment 9*
Overland Runoff Rate	**Q**	**21**	**l/s**	

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.78**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.08**	ha	*Catchment 6*
Overland Runoff Rate	**Q**	**27**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.70**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.21**	ha	*Catchment 7*
Overland Runoff Rate	**Q**	**65**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.67**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.13**	ha	*Catchment 8*
Overland Runoff Rate	**Q**	**40**	**l/s**	
Total Overland Runoff Rate	**Q**	**132**	**l/s**	

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.73**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.09**	ha	*Half Catchment 2*
Overland Runoff Rate	**Q**	**30**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.85**		
Rainfall Intensity	i	**162.1**	mm/hr	*Catchment 12*
Area of Runoff	A	**0.02**	ha	
Overland Runoff Rate	**Q**	**9**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.85**		
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.01**	ha	*Half Catchment 11*
Overland Runoff Rate	**Q**	**3**	**l/s**	
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.65**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.14**	ha	*Catchment 4*
Overland Runoff Rate	**Q**	**41**	**l/s**	

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.71**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.13**	ha	*Catchment 5*
Overland Runoff Rate	**Q**	**41**	**l/s**	
Total Overland Runoff Rate	**Q**	**123**	**l/s**	

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate

Q = 2.78 C i A

Rational Formula

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.68**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**1.41**	ha
Overland Runoff Rate	**Q**	**431**	**l/s**

Catchment 10 - OLFP CC, DD, EE

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 13
CALCS. BY: SW
DATE: 11/10/2023

PIPE FLOW CALCULATIONS				REFERENCE
Overland Flow Rate		**Q = 2.78 C i A**		*Rational Formula*
Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.78**		*Weighted C Value*
Rainfall Intensity	i	**162.1**	mm/hr	
Area of Runoff	A	**0.03**	ha	*Catchment 10*
Overland Runoff Rate	**Q**	**10**	**l/s**	
Catchment 5 Overland Flow Rate		**123**	**l/s**	
Catchment 7 Overland Flow Rate		**132**	**l/s**	
Total Overland Runoff Rate	**Q**	**265**	**l/s**	

Airey Civil, Structural and Fire Engineers Takapuna **Botany** Queenstown	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
	Reviewed By:	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 5
Section I I

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.006	
	Catchment 11	
Case B		
Slope (S_o)	0.143	
Water level (m)	14.92	0.02
MFFL	15.07	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	15.11	0.013	
4	15.01	0.013	
7.89	14.9	0.013	
7.89	15	0.013	
-1			

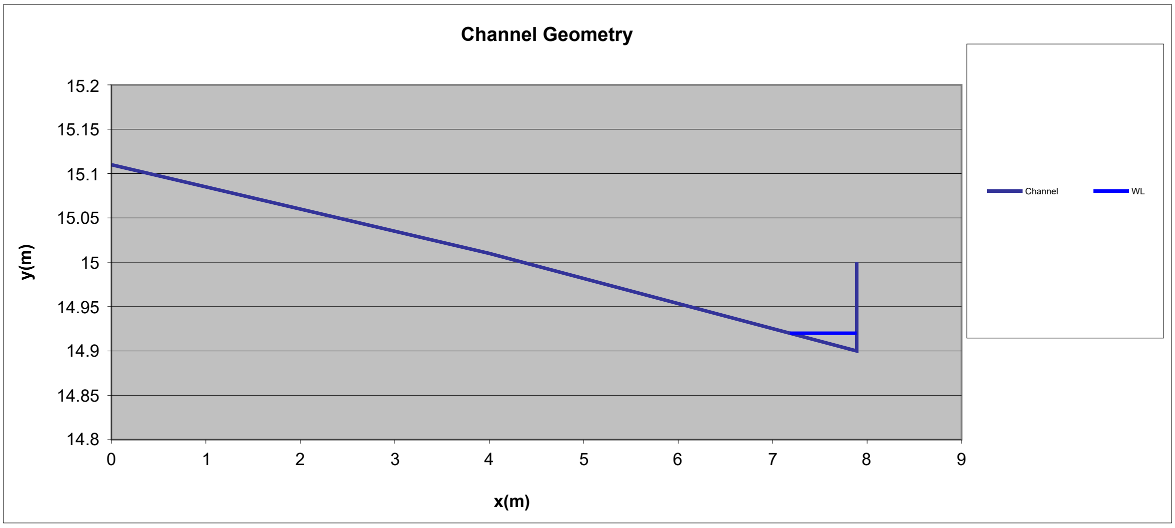
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	0.009	OK
Velocity (m/s)	1.304	
S_o or S_f	0.1428	
Energy (m)	15.007	
Froude No	4.163	
Bed Stress (Pa)	13.618	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.49	
Geometry for wetted conditions		
Depth (d-m)	14.920	
Area (A-m^2)	0.007	
Width (B-m)	0.707	
Perimeter (P-m)	0.728	
Critical Flow Conditions		
Flow (m^3/s)	0.002	INCREASE CHANNEL
Velocity (m/s)	0.313	
Energy (m)	14.925	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 2
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** **Reviewed By:**	SW RCHT	**Phone:** 09 534 6523	**Date:** 16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 5
Section K K

INPUTS

Case (A or B)	B

Case A

Flow (m^3/s)	0.041
	Catchment 12

Case B

Slope (S_o)	0.092	
Water level (m)	12.42	0.04
MFFL	12.57	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	12.6	0.013	
4	12.5	0.013	
7.89	12.38	0.013	
7.89	12.48	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	0.043	OK
Velocity (m/s)	1.666	
S_o or S_f	0.0924	
Energy (m)	12.561	
Froude No	3.761	
Bed Stress (Pa)	17.578	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.69	

Geometry for wetted conditions

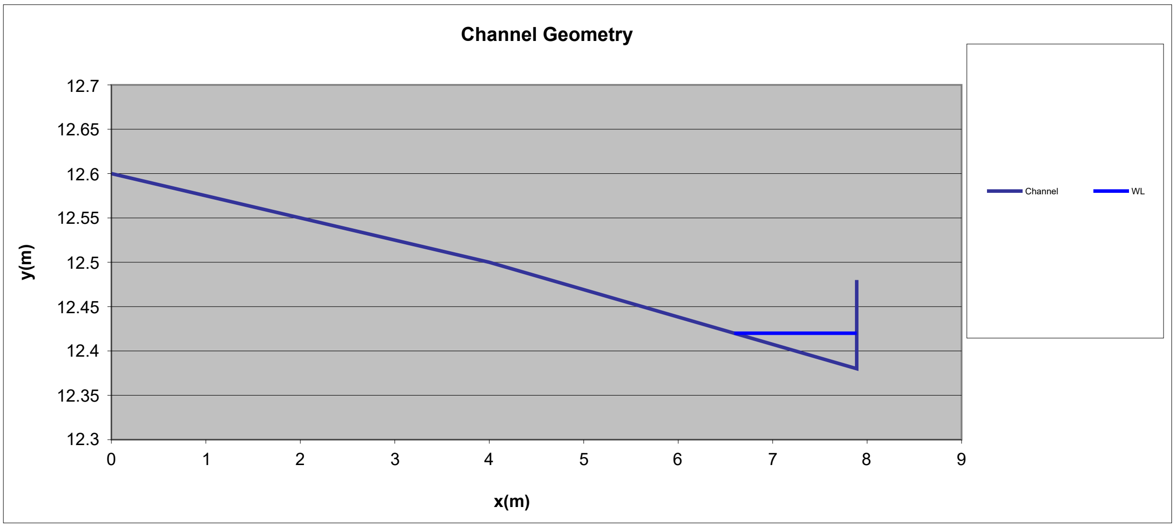
Depth (d-m)	12.420
Area (A-m^2)	0.026
Width (B-m)	1.297
Perimeter (P-m)	1.337

Critical Flow Conditions

Flow (m^3/s)	0.011	INCREASE CHANNEL
Velocity (m/s)	0.443	
Energy (m)	12.430	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 3
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 1
Section J J

INPUTS

Case (A or B)	B		
Case A			
Flow (m^3/s)	0.041		
	Catchment 2		
Case B			
Slope (S_o)	0.059		
Water level (m)	14.50	0.05	
MFFL	14.65		

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
2.75	14.5	0.013		Dish Channel
2.76	14.47	0.013		Dish Channel
2.8	14.455	0.013		Dish Channel
2.9	14.451	0.013		Dish Channel
3	14.45	0.013		Dish Channel
3.1	14.451	0.013		Dish Channel
3.2	14.455	0.013		Dish Channel
3.24	14.47	0.013		Dish Channel
3.25	14.5	0.013		Dish Channel
-1				

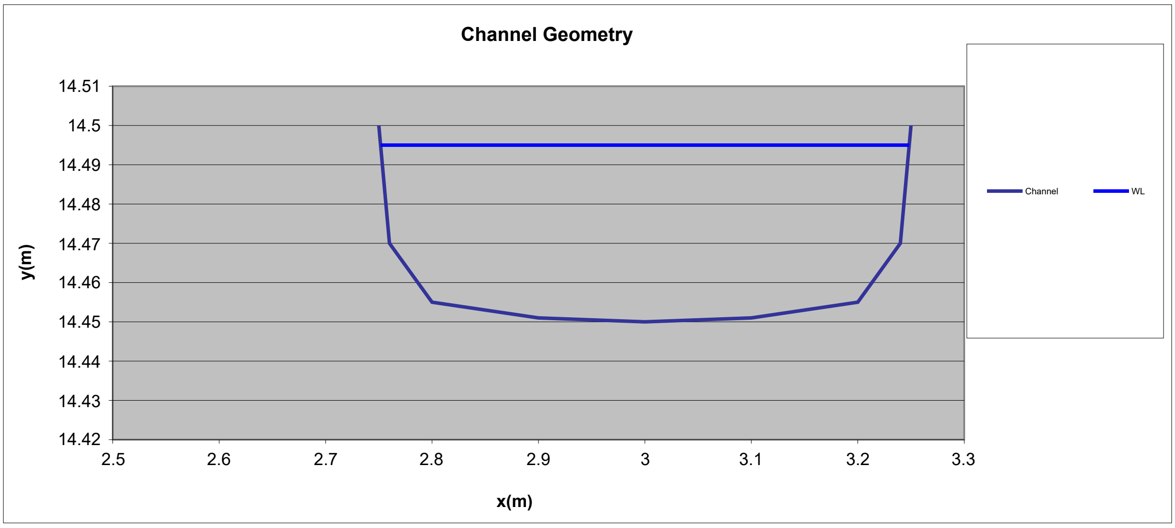
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	**0.042**	OK
Velocity (m/s)	2.065	
S_o or S_f	0.0590	
Energy (m)	14.712	
Froude No	3.277	
Bed Stress (Pa)	21.620	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.79	
Geometry for wetted conditions		
Depth (d-m)	14.495	
Area (A-m^2)	0.020	
Width (B-m)	0.497	
Perimeter (P-m)	0.538	
Critical Flow Conditions		
Flow (m^3/s)	**0.013**	INCREASE CHANNEL
Velocity (m/s)	0.630	
Energy (m)	14.515	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd	**Sheet No:** 4
	Job:	3 Pigeon Mountain Road Half Moon Bay	**Job No:** 220571/01
	Calc's By:	SW	**Phone:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523

Date: 16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 2
Section G G

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.132	
	Catchment 1	
Case B		
Slope (S$_o$)	0.049	
Water level (m)	9.66	0.05
MFFL	9.81	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	10	0.013	
4	9.78	0.013	
8	9.61	0.013	
10	9.65	0.013	
12	9.72	0.013	
14	9.74	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

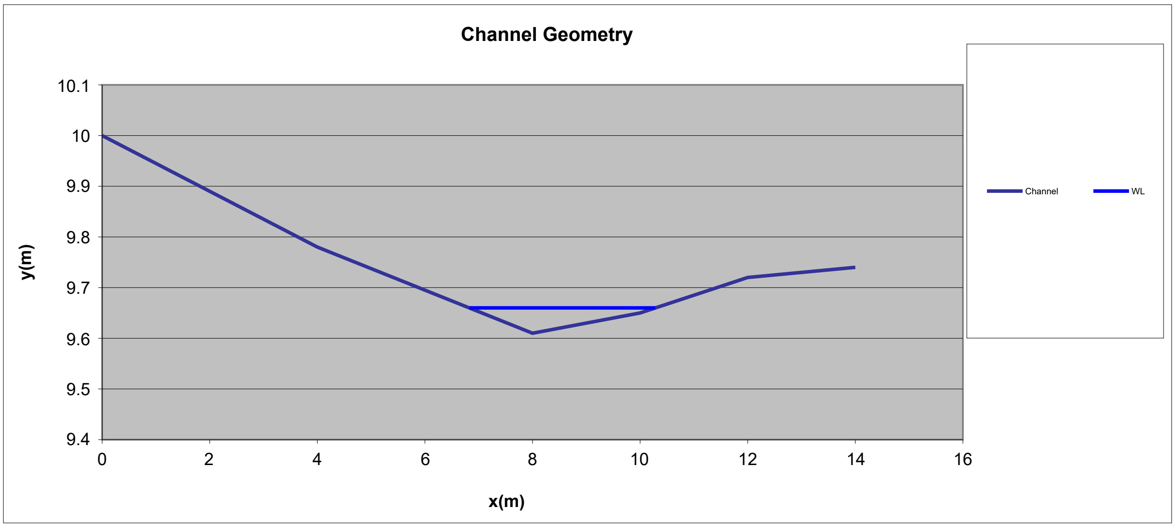
Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.

$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S$_o$.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	**0.134**	OK
Velocity (m/s)	1.479	
S$_o$ or S$_f$	0.0486	
Energy (m)	9.771	
Froude No	2.915	
Bed Stress (Pa)	12.503	
Equivalent "n"	0.013	
Equivalent k$_s$(mm)	1.74	
Geometry for wetted conditions		
Depth (d-m)	9.660	
Area (A-m^2)	0.091	
Width (B-m)	3.462	
Perimeter (P-m)	3.464	
Critical Flow Conditions		
Flow (m^3/s)	**0.046**	INCREASE CHANNEL
Velocity (m/s)	0.507	
Energy (m)	9.673	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Airey Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

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Job:	3 Pigeon Mountain Road Half Moon Bay			**Job No:** 220571/01
Calc's By:	SW	**Phone:**		**Date:**
Reviewed By:	RCHT	09 534 6523		16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP Ped Footpath
Section H H

INPUTS

Case (A or B)	B

Case A

Flow (m^3/s)	0.007
	Catchment 1

Case B

Slope (S_o)	0.100	
Water level (m)	7.51	0.01
MFFL	7.66	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	8.2	0.013	
2	7.58	0.013	
2.28	7.5	0.013	
4	7.51	0.013	
8	7.57	0.013	
10	7.86	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	0.008	OK
Velocity (m/s)	0.769	
S_o or S_f	0.0997	
Energy (m)	7.541	
Froude No	3.228	
Bed Stress (Pa)	5.657	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.28	

Geometry for wetted conditions

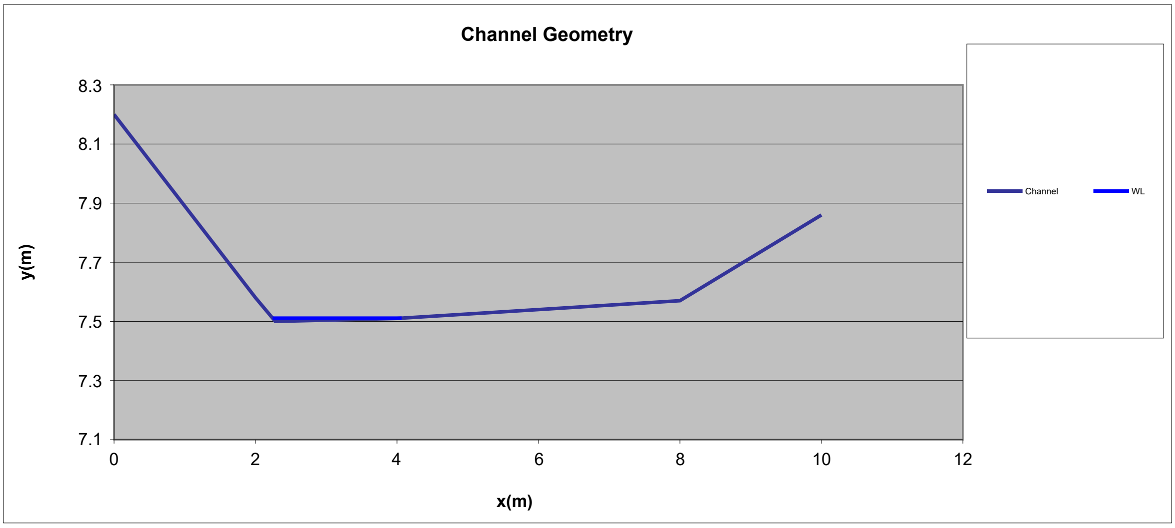
Depth (d-m)	7.511
Area (A-m^2)	0.011
Width (B-m)	1.825
Perimeter (P-m)	1.827

Critical Flow Conditions

Flow (m^3/s)	0.003	INCREASE CHANNEL
Velocity (m/s)	0.238	
Energy (m)	7.514	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 6
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 5
Section L L

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.082	
	Catchment 4	
Case B		
Slope (S_o)	0.100	
Water level (m)	9.31	0.04
MFFL	9.46	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	9.34	0.013	
0.47	9.27	0.013	
2	9.3	0.013	
4	9.36	0.013	
6	9.42	0.013	
8	9.48	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

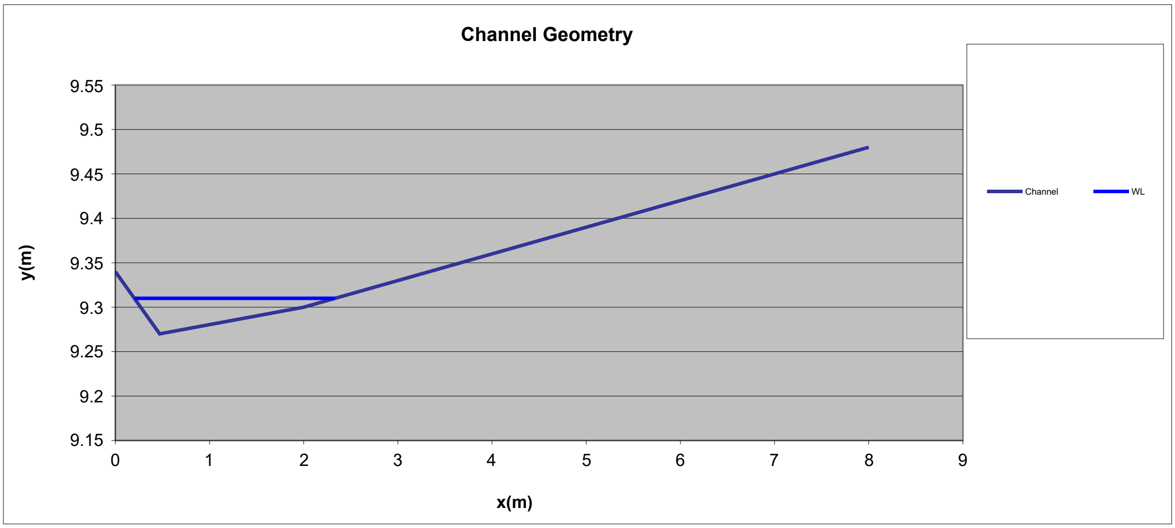
OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	0.083	OK
Velocity (m/s)	1.840	
S_o or S_f	0.1000	
Energy (m)	9.483	
Froude No	4.031	
Bed Stress (Pa)	20.806	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.71	

Geometry for wetted conditions	
Depth (d-m)	9.310
Area (A-m^2)	0.045
Width (B-m)	2.132
Perimeter (P-m)	2.135

Critical Flow Conditions		
Flow (m^3/s)	0.021	INCREASE CHANNEL
Velocity (m/s)	0.457	
Energy (m)	9.321	

Typical "n" values	
Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 7
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
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CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 5
Section R R

INPUTS

Case (A or B) B

Case A

Flow (m^3/s) 0.123

Catchment 5

Case B

Slope (S_o)	0.022	
Water level (m)	7.82	0.06
MFFL	7.97	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	8.27	0.02	
2.27	7.99	0.013	
3.48	7.99	0.013	
9.48	7.76	0.013	
10	7.78	0.013	
13.46	7.91	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.

$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o. Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	0.124	OK
Velocity (m/s)	1.159	
S_o or S_f	0.0220	
Energy (m)	7.893	
Froude No	2.072	
Bed Stress (Pa)	6.884	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.55	

Geometry for wetted conditions

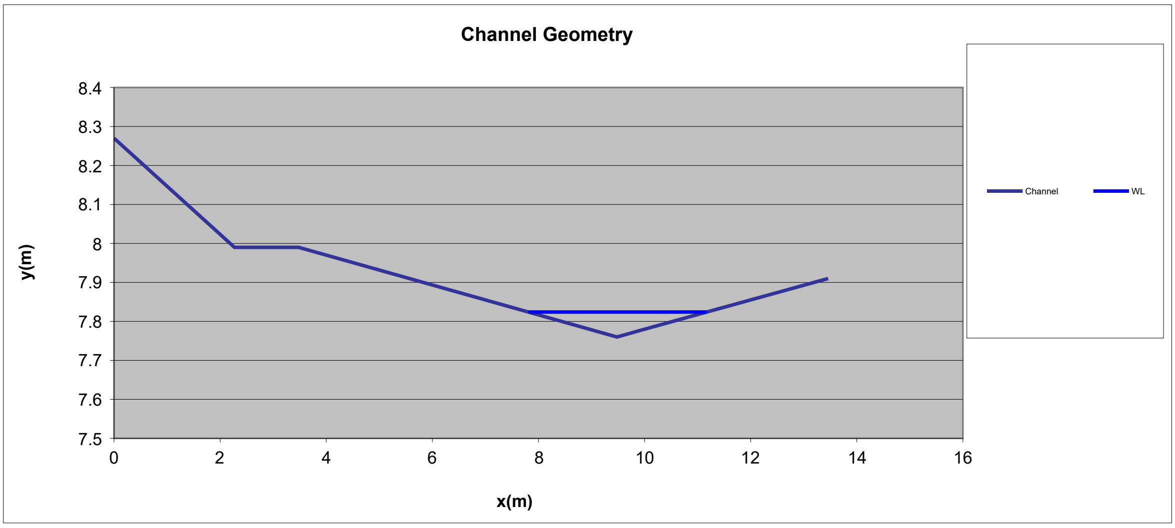
Depth (d-m)	7.824
Area (A-m^2)	0.107
Width (B-m)	3.361
Perimeter (P-m)	3.363

Critical Flow Conditions

Flow (m^3/s)	0.060	INCREASE CHANNEL
Velocity (m/s)	0.560	
Energy (m)	7.840	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 8
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 3
Section P P

INPUTS

Case (A or B)	B

Case A

Flow (m^3/s)	0.067
	Catchment 6 + Catchment 8

Case B

Slope (S_o)	0.055	
Water level (m)	10.22	0.04
MFFL	10.37	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	10.27	0.013	
2	10.25	0.013	
4	10.22	0.013	
6	10.19	0.013	
7.03	10.18	0.013	
7.03	10.28	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	0.091	OK
Velocity (m/s)	1.378	
S_o or S_f	0.0550	
Energy (m)	10.317	
Froude No	2.979	
Bed Stress (Pa)	11.607	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.71	

Geometry for wetted conditions

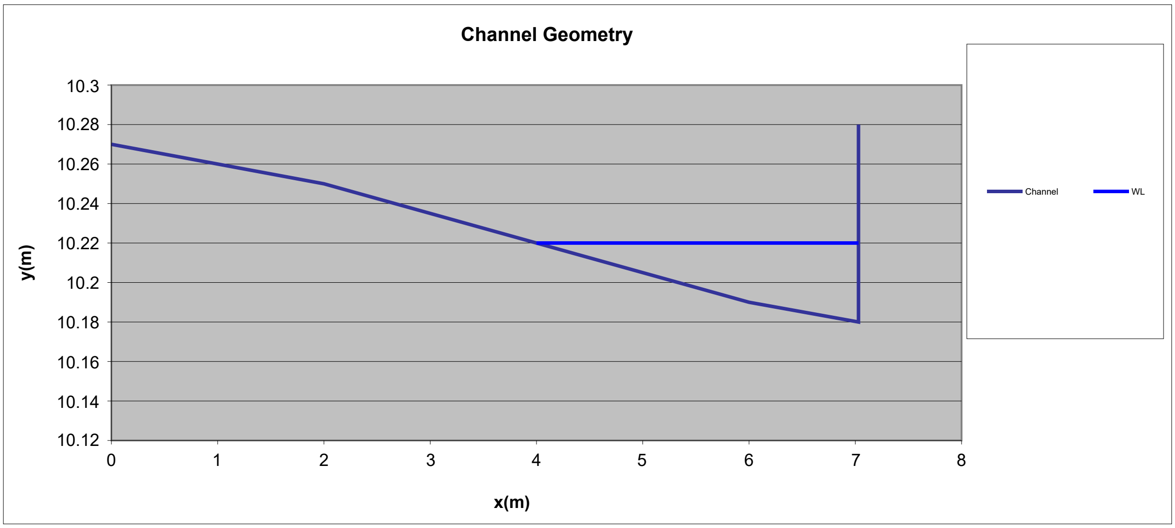
Depth (d-m)	10.220
Area (A-m^2)	0.066
Width (B-m)	3.030
Perimeter (P-m)	3.070

Critical Flow Conditions

Flow (m^3/s)	0.031	INCREASE CHANNEL
Velocity (m/s)	0.462	
Energy (m)	10.231	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 9
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 4
Section N N

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.067	
	Catchment 6 + Catchment 8	
Case B		
Slope (S_o)	0.022	
Water level (m)	9.82	0.03
MFFL	9.97	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	9.95	0.013	
2	9.92	0.013	
4	9.79	0.013	
6	9.81	0.013	
8	9.80	0.013	
10	9.86	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

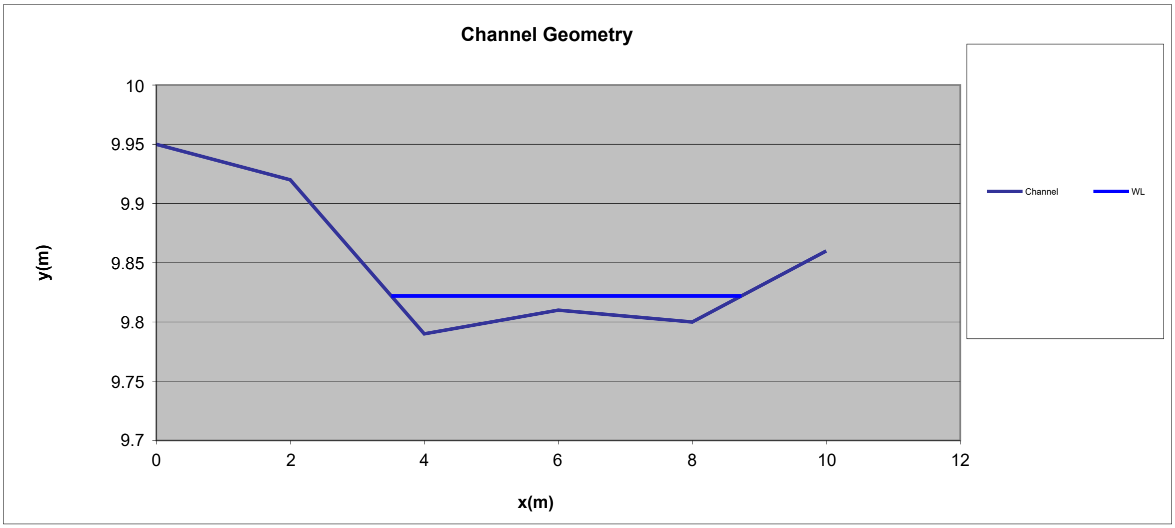
OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	0.073	OK
Velocity (m/s)	0.772	
S_o or S_f	0.0220	
Energy (m)	9.852	
Froude No	1.839	
Bed Stress (Pa)	3.879	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.64	

Geometry for wetted conditions	
Depth (d-m)	9.822
Area ($A-m^2$)	0.094
Width (B-m)	5.226
Perimeter (P-m)	5.227

Critical Flow Conditions		
Flow (m^3/s)	0.039	INCREASE CHANNEL
Velocity (m/s)	0.420	
Energy (m)	9.831	

Typical "n" values	
Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 10
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP JOAL 4
Section M M

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.132	
	Catchment 6 +7 +8	
Case B		
Slope (S_o)	0.054	
Water level (m)	8.13	0.05
MFFL	8.28	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
-5	8.35	0.02	
0	8.12	0.013	
0.86	8.08	0.013	
2	8.11	0.013	
4	8.17	0.013	
6	8.23	0.013	
-1			

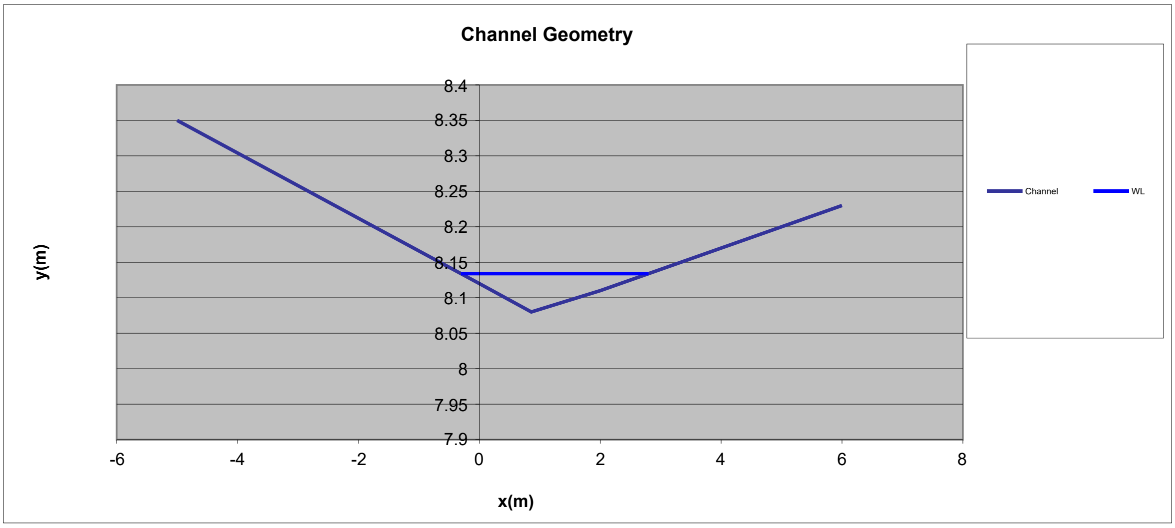
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	0.132	OK
Velocity (m/s)	1.550	
S_o or S_f	0.0538	
Energy (m)	8.257	
Froude No	2.984	
Bed Stress (Pa)	14.515	
Equivalent "n"	0.013	
Equivalent k_s(mm)	2.12	
Geometry for wetted conditions		
Depth (d-m)	8.134	
Area (A-m^2)	0.085	
Width (B-m)	3.104	
Perimeter (P-m)	3.106	
Critical Flow Conditions		
Flow (m^3/s)	0.044	INCREASE CHANNEL
Velocity (m/s)	0.520	
Energy (m)	8.148	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 11
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP Past Lot 1
Section Q Q

INPUTS

Case (A or B) B

Case A

Flow (m^3/s) 0.021

Catchment 9

Case B

Slope (S_o) 0.022

Water level (m) 9.41 0.05

MFFL 9.56

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	12.25	0.02	
1.63	10.99	0.02	
1.74	9.49	0.02	
3.13	9.36	0.013	
3.28	9.39	0.013	
4	9.41	0.013	
6	9.46	0.013	
-1			

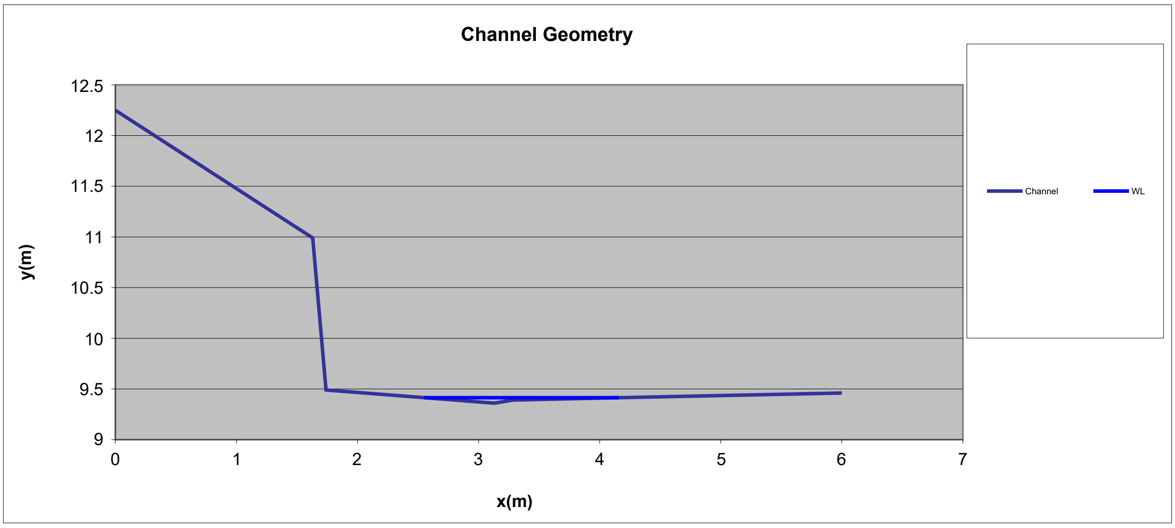
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	0.022	OK
Velocity (m/s)	0.696	
S_o or S_f	0.0220	
Energy (m)	9.439	
Froude No	1.578	
Bed Stress (Pa)	4.260	
Equivalent "n"	0.015	
Equivalent k_s(mm)	3.75	
Geometry for wetted conditions		
Depth (d-m)	9.414	
Area (A-m^2)	0.032	
Width (B-m)	1.607	
Perimeter (P-m)	1.613	
Critical Flow Conditions		
Flow (m^3/s)	0.014	INCREASE CHANNEL
Velocity (m/s)	0.441	
Energy (m)	9.424	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 12
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP in Front of Lot 15 - Lot 16

INPUTS

Case (A or B)	B

Case A

Flow (m^3/s)	0.265
	Catchment 10 Runoff Rate

Case B

Slope (S_o)	0.080	
Water level (m)	7.80	0.04
MFFL	7.95	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	8.06	0.013	
5	7.76	0.013	
10	7.76	0.013	
15	8.06	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	0.530	OK
Velocity (m/s)	2.336	
S_o or S_f	0.0800	
Energy (m)	8.078	
Froude No	3.943	
Bed Stress (Pa)	28.077	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.79	

Geometry for wetted conditions

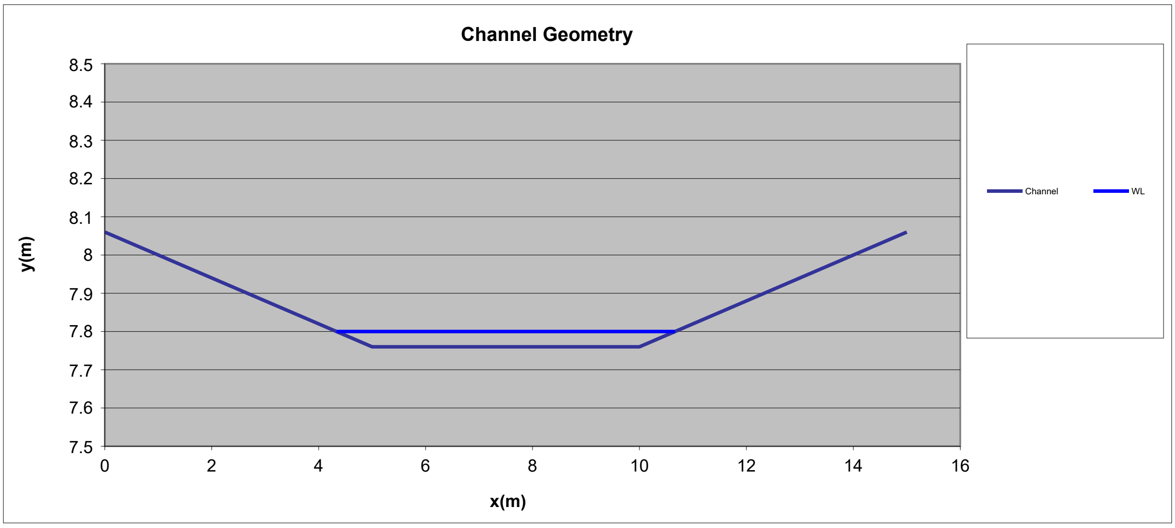
Depth (d-m)	7.800
Area ($A-m^2$)	0.227
Width (B-m)	6.333
Perimeter (P-m)	6.336

Critical Flow Conditions

Flow (m^3/s)	0.134	INCREASE CHANNEL
Velocity (m/s)	0.593	
Energy (m)	7.818	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 13
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP B-B
Section CC

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.1325	
	half of Catchment 10 flow (0.265/2 = 0.1325)	
Case B		
Slope (S_o)	0.010	
Water level (m)	7.84	0.09
MFFL	7.99	

Channel Geometry		Mannings	Sinuosity
x (m)	y (m)	"n" value	
0	8.2	0.013	
0	7.75	0.02	
1.76	7.75	0.02	
1.76	8	0.013	
-1			

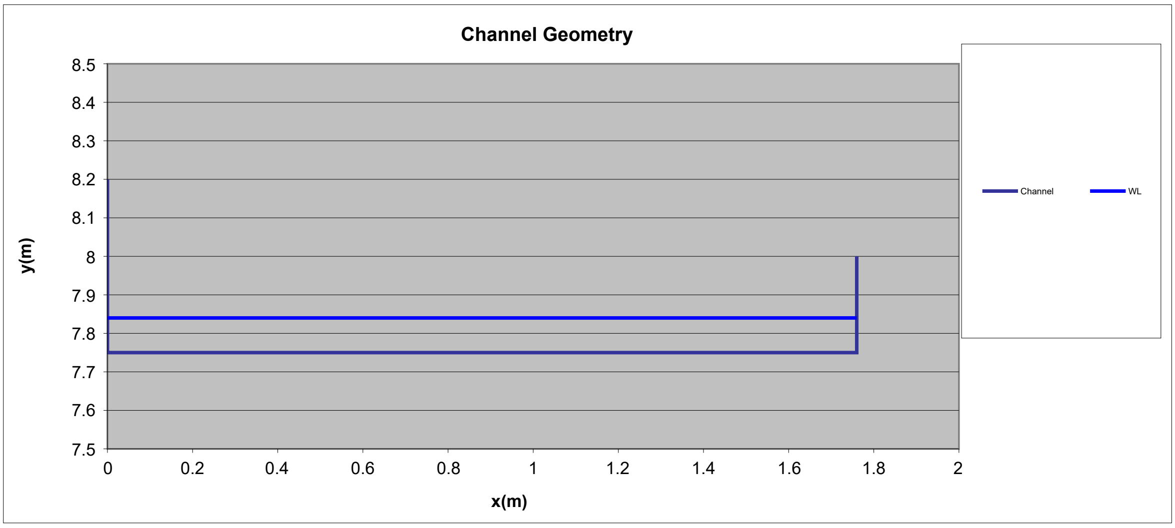
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	**0.153**	OK
Velocity (m/s)	0.966	
S_o or S_f	0.0100	
Energy (m)	7.888	
Froude No	1.028	
Bed Stress (Pa)	8.010	
Equivalent "n"	0.019	
Equivalent k_s(mm)	14.86	
Geometry for wetted conditions		
Depth (d-m)	7.840	
Area (A-m^2)	0.158	
Width (B-m)	1.760	
Perimeter (P-m)	1.940	
Critical Flow Conditions		
Flow (m^3/s)	**0.149**	INCREASE CHANNEL
Velocity (m/s)	0.940	
Energy (m)	7.885	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 14
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP B-B
Section DD

INPUTS

Case (A or B) B

Case A

Flow (m^3/s) 0.1325

half of Catchment 10 flow (0.265/2 = 0.1325)

Case B

Slope (S_o)	0.010	
Water level (m)	7.80	0.05
MFFL	7.95	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	8.2	0.013	
0	7.75	0.02	
4.09	7.75	0.02	
4.09	8	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	**0.138**	OK
Velocity (m/s)	0.677	
S_o or S_f	0.0100	
Energy (m)	7.823	
Froude No	0.966	
Bed Stress (Pa)	4.788	
Equivalent "n"	0.020	
Equivalent k_s(mm)	13.40	

Geometry for wetted conditions

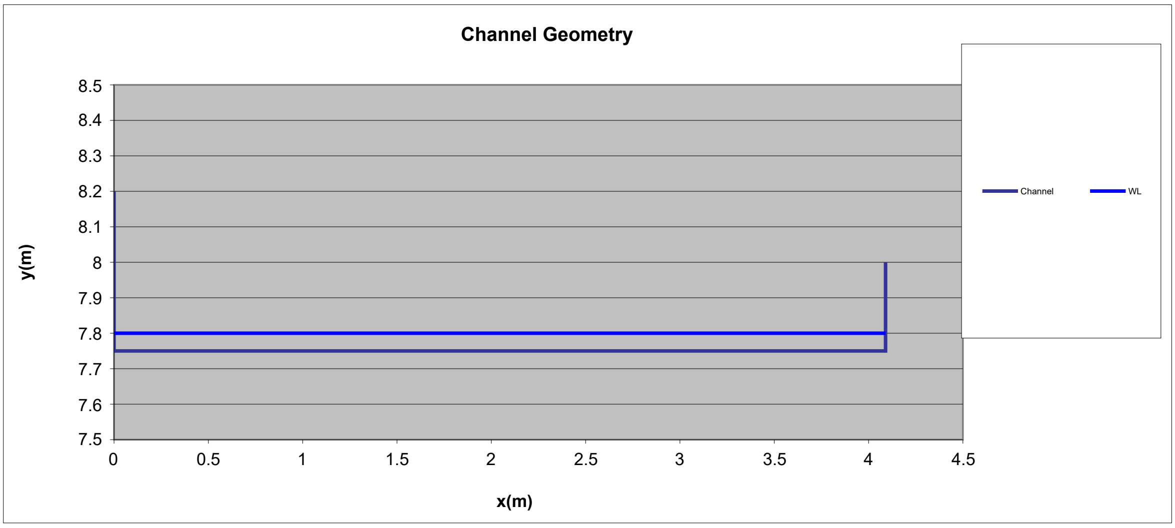
Depth (d-m)	7.800
Area ($A-m^2$)	0.204
Width (B-m)	4.090
Perimeter (P-m)	4.190

Critical Flow Conditions

Flow (m^3/s)	**0.143**	OK
Velocity (m/s)	0.700	
Energy (m)	7.825	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 15
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP A-A
Section EE

INPUTS

Case (A or B) B

Case A

Flow (m^3/s) 0.1325

half of Catchment 10 flow (0.265/2 = 0.1325)

Case B

Slope (S_o) 0.026

Water level (m) 7.82 0.07

MFFL 7.97

Channel Geometry		Mannings	Sinuosity
x (m)	y (m)	"n" value	
0	8	0.013	
0	7.75	0.02	
1.61	7.75	0.02	
1.61	8	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.

$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	0.150	OK
Velocity (m/s)	1.328	
S_o or S_f	0.0261	
Energy (m)	7.910	
Froude No	1.602	
Bed Stress (Pa)	16.476	
Equivalent "n"	0.019	
Equivalent k_s(mm)	14.08	

Geometry for wetted conditions

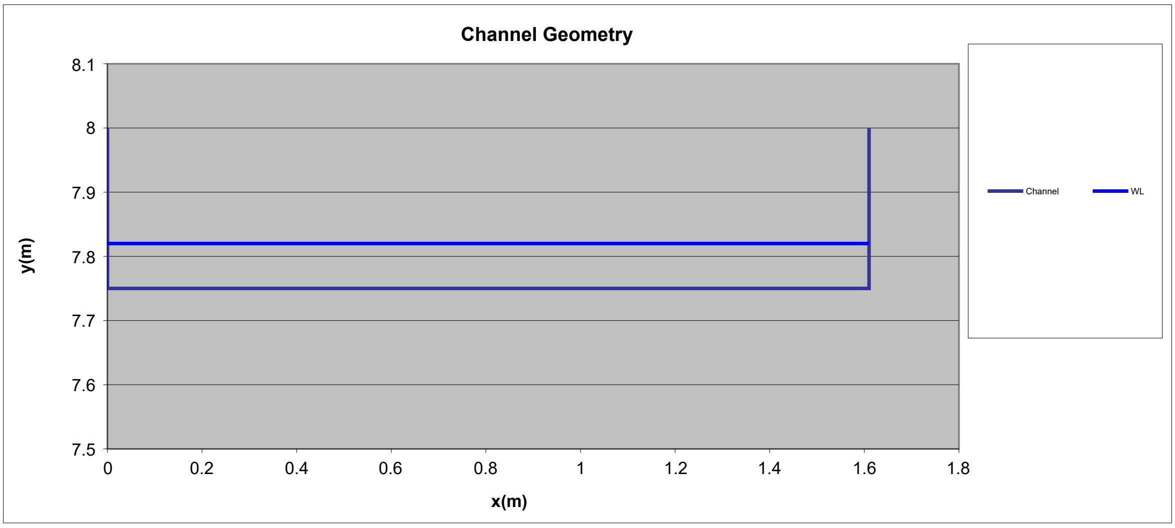
Depth (d-m)	7.820
Area (A-m^2)	0.113
Width (B-m)	1.610
Perimeter (P-m)	1.750

Critical Flow Conditions

Flow (m^3/s)	0.093	INCREASE CHANNEL
Velocity (m/s)	0.829	
Energy (m)	7.855	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 16
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev OLFP A-A
Section FF

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.1325	
	half of Catchment 10 flow (0.265/2 = 0.1325)	
Case B		
Slope (S_o)	0.026	
Water level (m)	7.80	0.05
MFFL	7.95	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	8	0.013	
0	7.75	0.02	
2.56	7.75	0.02	
2.56	8	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	0.139	OK
Velocity (m/s)	1.085	
S_o or S_f	0.0261	
Energy (m)	7.860	
Froude No	1.549	
Bed Stress (Pa)	12.311	
Equivalent "n"	0.019	
Equivalent k_s(mm)	13.25	

Geometry for wetted conditions

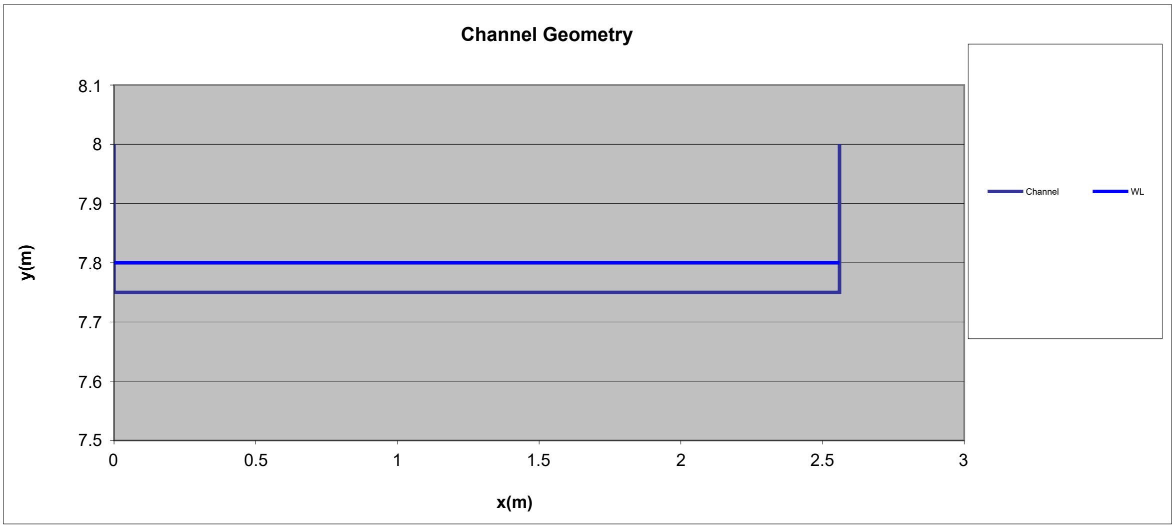
Depth (d-m)	7.800
Area ($A-m^2$)	0.128
Width (B-m)	2.560
Perimeter (P-m)	2.660

Critical Flow Conditions

Flow (m^3/s)	0.090	INCREASE CHANNEL
Velocity (m/s)	0.700	
Energy (m)	7.825	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:**
				17
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	16/10/2023

CHANNEL CAPACITY CALCULATIONS

Post Dev Marina Carpark

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	4.47	
Case B		
Slope (S_o)	0.031	
Water level (m)	3.59	0.12
MFFL	4.09	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	3.65	0.013		building, 150mm ground clearance
0	3.5	0.013		carpark
6.27	3.5	0.013		carpark
15.495	3.57	0.013		carpark
24.72	3.50	0.013		carpark
25.49	3.47	0.013		carpark
26.7	3.5	0.013		carpark
34.33	3.65	0.013		kerb
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

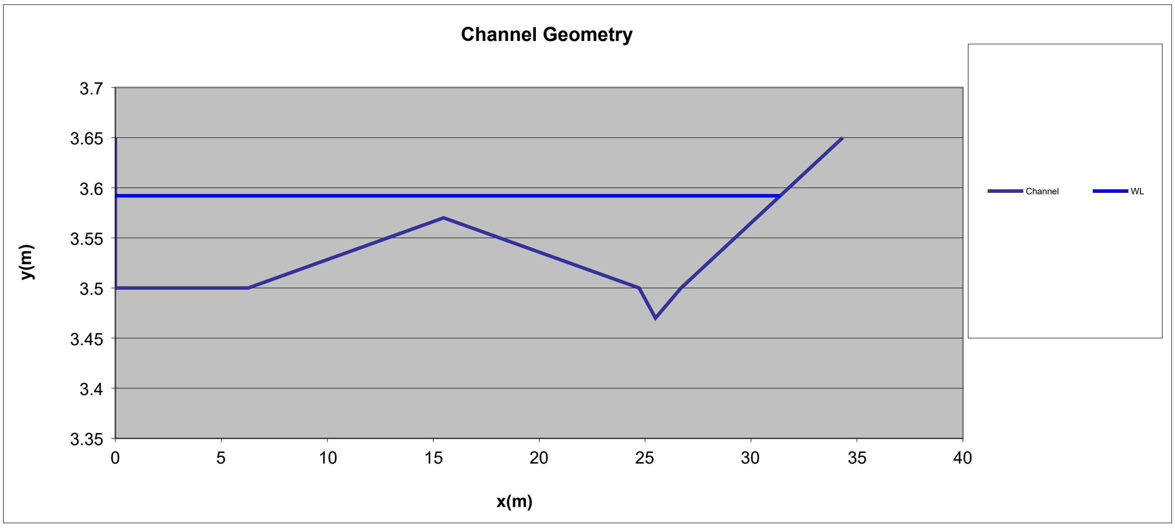
Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.

$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o. Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	**4.474**	OK
Velocity (m/s)	2.177	
S_o or S_f	0.0310	
Energy (m)	3.833	
Froude No	2.715	
Bed Stress (Pa)	19.862	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.77	
Geometry for wetted conditions		
Depth (d-m)	3.592	
Area (A-m^2)	2.056	
Width (B-m)	31.380	
Perimeter (P-m)	31.474	
Critical Flow Conditions		
Flow (m^3/s)	**1.648**	INCREASE CHANNEL
Velocity (m/s)	0.802	
Energy (m)	3.625	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Appendix B

- E36.9 Flood Hazard Risk Assessment

AUP Chapter E36.9 Flood Hazard Risk Assessment Report	Site Address: 3 Pigeon Mountain Road, Half Moon Bay	
Prepared by Airey Consultants Ltd	Application No.: BUN60419132	
(a) The frequency, duration and scale of the flooding hazard;		
State If the site being developed will be impacted by flooding in more frequent events than 1 % AEP If assessment is for overland flow, determine trigger event as well as 1% AEP scenario. *An assessment of the duration of the flooding hazard for the 1 % AEP event should be made supported with a study of the hydrology of the contributing sub catchments* that is appropriate for the scale of the risk.* *Describe extent of flooding on site along with discharge rates, depths and velocities at critical points on the developed site.*	Please refer attached calculation (Appendix A) for the flood depths and velocities of the pre and developed site. The existing overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The increase in 1% AEP runoff from the site is 95L/s (431 - 336). This equates to around 2.2% increase only (0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow. Overland flow channel capacity analysis determined that catchment flows can be contained within the common accessways. As for Block C dwellings, that are prone to inundation, the flow depths are determined to be at most 90mm. Consequently, a freeboard of 150mm above the 1% AEP flood level is required as per Auckland Council's Stormwater Code of Practice for Lots 14, 15, 16 and 17 Post Development overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai.	low
(b) the type of activity being undertaken and its vulnerability to flooding events;		
Identify the activity or activites incorporated in the proposed development as listed in table E36.4.1. Described the vulnerability (exposure) of the activity or activities to the flood events determined by the investigation into the flooding hazards impacting the site described in E36.9(a). This should include whether the building footprint , any vehicle parking area and means of egress are within the flooding extent	Residential attached dwellings are proposed. Overland flow channel capacity analysis determined that catchment flows can be contained within the common accessways. As for Block C dwellings, that are prone to inundation, the flow depths are determined to be at most 90mm. Consequently, a freeboard of 150mm above the 1% AEP flood level is required as per Auckland Council's Stormwater Code of Practice for Lots 14, 15, 16 and 17. Post Development overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. Any fences are recommended to have a minimum gap of 100mm to allow overland flows to enter the site per existing condition.	low
(c) the consequences of a flooding event in relation to the proposed activity and the people likely to be involved in that activity;		
Identify the impacts on the proposed activity during a flood event e.g. if the building footprint is fully or partially within the flooded area what level will the flooding reach in respect to the living areas and other components of the dwelling. If egress from the building will be flooded . . to what depth and for what period of time. Identify any potential for damage to, or deterioration of, the stuctural and functional integrity of the building resulting from the intensity and or frequency of flooding.	Overland flow channel capacity analysis determined that catchment flows can be contained within the common accessways. As for Block C dwellings, that are prone to inundation, the flow depths are determined to be at most 90mm. Consequently, a freeboard of 150mm above the 1% AEP flood level is required as per Auckland Council's Stormwater Code of Practice for Lots 14, 15, 16 and 17. Post Development overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai.	low
(d) the potential effects on public safety and on other property;		

Describe effects on public safety if the activity will include public use. Identify any potential flooding of upstream or downstream properties that may be affected by the proposed activity	Overland flow channel capacity analysis determined that catchment flows can be contained within the common accessways. As for Block C dwellings, that are prone to inundation, the flow depths are determined to be at most 90mm. Consequently, a freeboard of 150mm above the 1% AEP flood level is required as per Auckland Council's Stormwater Code of Practice for Lots 14, 15, 16 and 17. Post Development overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The increase in 1% AEP runoff from the site is 95L/s (431 - 336). This equates to around 2.2% increase only (0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow.	low
(e) Any exacerbation of an existing flooding hazard risks or creation of a new flooding hazard risk;		
Describe results of investigation into any potential effects on other property if the activity results in diversion of flood flow or overland flow. Identify any new activity that results in an increase to the number of people exposed to an existing flood risk.	There are existing OLFPs originating from site. While there will be an increase in 1% AEP runoff and the exit point of the OLFPs will be altered, post development overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The OLFPs will continue to join the existing OLFP along PMR and continue to travers across Marina businees complex carpark. The increase in 1% AEP runoff from the site is 95L/s (431 - 336). This equates to around 2.2% increase only (0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow.	low
(h) the design and construction of buildings and structures to mitigate the effects of flooding		
Decribe how the potential flooding effects identified above, determined by investigation and described in detail in a flooding report, will be mitigated by the design and materials of the building.	Overland flow channel capacity analysis determined that catchment flows can be contained within the common accessways. As for Block C dwellings, that are prone to inundation, the flow depths are determined to be at most 90mm. Consequently, a freeboard of 150mm above the 1% AEP flood level is required as per Auckland Council's Stormwater Code of Practice for Lots 14, 15, 16 and 17.	low
(j) site layout and management to avoid or mitigate the adverse effects of flooding hazard, including access and exit during a flooding event;		
Decribe how the potential flooding effects identified above, including any effects on upstream and downstream properties, determined by investigation and described in detail in a flooding report, will be mitigated by the design form of any structures and site works. Describe measures proposed to provide safe egress from property	No upstream or downstream properties will be affected by the proposed works. Overland flow channel capacity analysis determined that catchment flows can be contained within the common accessways. As for Block C dwellings, that are prone to inundation, the flow depths are determined to be at most 90mm. Consequently, a freeboard of 150mm above the 1% AEP flood level is required as per Auckland Council's Stormwater Code of Practice for Lots 14, 15, 16 and 17. Any fences are recommended to have a minimum gap of 100mm to allow overland flows to enter the site per existing condition. Flood waters will safely egress from the property. While the exit points will be altered, post development overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m²/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The OLFPs will continue to join the existing OLFP along PMR and continue to travers across Marina businees complex carpark. The increase in 1% AEP runoff from the site is 95L/s (431 - 336). This equates to around 2.2% increase only (0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow.	low
(l) any measures and/ or plans proposed to mitigate the flooding hazard or the effects of the flooding hazard.		
Describe any other measures to mitigate the flooding hazard which can include information about future works planned by Auckland Council in the wider catchment that will reduce the flooding risk. Include any other measures to mitigate effects that are not described above.	On-Site stormwater detention tanks will assist with reducing peak flows generated from the proposed development for the 10% AEP rainfall events. No upstream or downstream properties will be affected by the proposed works. Overland flow channel capacity analysis determined that catchment flows can be contained within the common accessways. As for Block C dwellings, that are prone to inundation, the flow depths are determined to be at most 90mm. Consequently, a freeboard of 150mm above the 1% AEP flood level is required as per Auckland Council's Stormwater Code of Practice for Lots 14, 15, 16 and 17.	low

Appendix G

- Earthworks Management Plan

EARTHWORKS MANAGEMENT PLAN (EMP)

FOR HND HMB LTD

AT 3 PIGEON MOUNTAIN ROAD, HALF MOON BAY

Job No: 220571/01 **Issue Date:** 26 March 2024

Airey Consultants Ltd | Botany Office
PO Box 259 339, Botany, 2163 | Level 1, Fountain Lane North, Botany Town Centre
T: +64 9 534 6523 E: botany@aireys.co.nz

Engineering
Ingenuity

Document Control Record

Document Prepared By:
Airey Consultants Limited
Level 1, Fountain Lane North, Botany Town Centre
PO Box 259 339, Botany, Auckland 2163

T: +64 9 534 6523
E: samsonw@aireys.co.nz
W: **aireys.co.nz**

Client:
HND HMB Ltd
3 Pigeon Mountain Road, Half Moon Bay

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This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval or to fulfil a legal requirement.

Revision	Description	Issue Date	Prepared by	Reviewed by
0	EMP – Rev 0	31/08/2023	SW	RCHT
1	S92 Response	20/11/2023	SW	RCHT
2	S92 Response – Areas and Volumes Updated	26/03/2024	SW	RCHT

Contents

1 INTRODUCTION

1.1 Objective and Scope

Airey Consultants Ltd has been engaged to prepare an Earthworks Management Plan (EMP) in support of a Resource Consent application for the proposed residential subdivision development at 3 Pigeon Mountain Road, Half Moon Bay.

This plan sets out management methods, controls and reporting standards to be implemented in order to meet the legislative requirements relating to the earthworks activities associated with the development. The document also provides an overview of the different aspects of the earthworks programme and the key environmental and social issues to be addressed.

The plan will be implemented in the course of the earthworks stage. It is written to inform the project management team of any environmental effects associated with the design and construction of the project and the measures that will need to be put in place to remediate the effects identified.

The overall objective of the EMP is to avoid, remedy or mitigate any adverse effects associated with the earthworks activity as far as reasonably practicable. The plan should be updated by the Contractor in the earthworks stage to suit the operation of the work. It should also be regularly updated in the course of the work to cope with the actual site conditions and construction constraints; and reviewed by management team annually as a minimum to ensure complying with the Council's environmental legislations and the EMP objectives.

Any changes to certified management plans will require recertification by the Council.

The consent holder shall provide a copy of this consent and any documents and plans referred to in this document to each Contractor undertaking works authorised by consents within this document, prior to the works commencing.

Any amendment proposed to this Environment Management Plan (EMP) for construction shall be submitted in writing to the Manager, Environmental Management and Regulation, Auckland Council. Implementation of any amendment shall only occur once the amendment has been authorised in writing by the Manager, Environmental Management and Regulation, Auckland Council.

1.2 Project Description

The site at 3 Pigeon Mountain Road, Half Moon Bay (Lot 1 DP 212125) is 1.4073 Ha in size and located within the Residential – Mixed Housing Suburban Zone under the Auckland Unitary Plan (AUP). The site topography slopes from the south-western boundary towards the north-eastern boundary of the site. The gradient of the slope ranges from 3.5% in the north-eastern half to the site to 12.8% for the south-western half of the site. There are currently three access points to the site. One crossing is located at the eastern boundary off Pigeon Mountain Road while the other two crossings are located along the southern boundary off Compass Point Way.

Figure One: Aerial Photo of 3 Pigeon Mountain Road, Half Moon Bay

2 ESTIMATION OF SEDIMENT LOSS

The Universal Soil Loss Equation (USLE) has been used to undertake an estimate of soil loss for the site. The primary function of the USLE is to identify erosion prone areas on a site so that specific control techniques can be selected. However, the USLE has not been calibrated for New Zealand conditions and values obtained may not necessarily reflect reality.

Notwithstanding the above, based on the calculations an estimated 170.8 tonnes/ha/year of sediment could potentially be generated from the whole project. With the appropriate erosion and sediment controls put in place, sediment loss would potentially be 17.53 tonnes over the construction period of 15 weeks, with 75% sediment control measure efficiency. This is based on the assumption of a bare site with no vegetation or topsoil and compacted smooth. Please note that the bulk earthworks will be carried out in several stages with the maximum disturbed area limited to around 6,400 m² at any given time. Please see Appendix B for design calculations.

In the short term aspect, the key objective is to minimise unnecessary earthworks disturbance as much as practicable by implementing effective and innovative solutions to earthworks and erosion and sediment control.

The earthworks activity will mainly involve the following:

- Installation of erosion & sediment control measures;
- Perform cut to fill operation to form the proposed dwelling platforms and common accessways;
- Removal of two large stockpiles;
- Install timber pole retaining walls along subdivision perimeter boundaries;
- Install the underground services;
- Decommission and remove the erosion & sediment control measures;
- Decommission and remove the sediment retention pond (SRP) to the proposed site levels; and
- Reinstate the disturbed area with topsoil, grass and mulch.

3 PRINCIPLES OF EROSION & SEDIMENT CONTROL

The principle of the ESCP is to provide guidelines to the Contractors to undertake land disturbing activities in a manner that reduces the potential for erosion of bare soils to occur (erosion control) and to employ treatment devices to treat all sediment laden water prior to discharging from the site (sediment control). The basic erosion and sediment control principles applicable to this project are as follows:

- Minimise disturbance - only work in areas required for construction.
- Stage construction - carefully plan works to minimise the area of disturbance.
- Protect steep slopes - steep slopes should be avoided where possible. Where disturbed, the slopes should rapidly stabilised.
- Stabilise exposed areas rapidly.
- Install perimeter controls - divert clean water away from the area of disturbance and divert sediment-laden runoff from areas disturbed into sediment control treatment devices. Sediment controls devices are to be installed before the start of earthworks and rainfall events.
- Experience and training – ensure experienced and trained personnel are responsible for installing and maintaining erosion & sediment control devices.
- Ensure the ESCP evolves as construction progresses and the nature of land disturbing activities changes, the ESCP needs to be modified to reflect the changing conditions on site.
- Assess and adjust - inspect, monitor and maintain control measures.

4 EROSION & SEDIMENT CONTROL MEASURES

All earthworks, erosion and sediment control measures will be carried out in accordance with the requirements of Auckland Council's Guideline Document 2016/005, *"Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region" (Amendment 1, October 2018).*

Key earthworks include:

- Remove existing buildings, structures and carparks;
- Cut (*3,300 m*^{3}) and cover, and fill (*6,600* m^3) for the formation of the site profile;
- Trimming and levelling areas for the building platform and driveway construction;
- Retaining wall construction; and
- Commission and decommission of the erosion & sediment control measures.

The following methodology will be employed:

Stabilised Construction Access

- A min. 10-metre long stabilised construction entrance will be installed according to GD05 over one of the existing vehicle access point off Compass Point Way prior to commencement of earthworks. A14 BIDIM (or similar approved) shall be laid over the stripped entrance, with GAP65 placed on top.
- The stabilised construction access point will help to minimise the tracking of mud and sediment out of the site and onto the road reserve, which could impact the downstream stormwater system.

Silt Fence

- Standard silt fences will be established along the northern and eastern boundaries where necessary, as shown.
- The silt fences shall be installed in accordance with the requirements of GD05 and be maintained throughout the duration of earthworks.

Clean Water Diversion

- Clean water diversion channels/bunds lined by geocloth are to be installed along the site and stage boundaries as necessary. This measure is to isolate the site and prevent clean runoff entering the site from neighbouring properties and between stages. The runoff will be directed and discharged into the new public stormwater drainage.
- Cess-pit Protection – Installation of filter insert/silt socks and frame onto nearby downstream catchpits.

- Silt socks – Installation of silt socks on top of existing retaining wall along the western boundary and southern boundary. This measure is to isolate the site and prevent clean runoff entering the site from neighbouring properties Compass Point Road Reserve.

Sediment Retention Pond

- Sediment Retention Pond is to be formed at the north-eastern corner of the site. A forebay and a main pond will be completed in accordance with the requirements of GD05 and be maintained throughout the duration of earthworks.
- The sediment laden runoff from the exposed areas will be directed towards the Sediment Retention Pond to allow the suspended solids to settle out, prior to discharging to the newly laid stormwater drain along Pigeon Mountain Road.
- The pond is sized to provide $2m^3$ of storage volume for every $100m^2$ of catchment area. The length to width ratio (at storage level or at the height of the primary spillway) of the device is 1W:3L. 30% of the total storage will be the dead storage volume, while the remaining will be the live storage volume as per Section F1.2 of GD05.
- The SRP has been sized for a maximum catchment of $6,400m^2$.

Dirty Runoff Diversion

- Runoff diversion channels will be built at the downhill side of the works, where the proposed cut & fill operations are to take place. The diversion earth bund will be lined with geocloth. The laden water flowing from the exposed area will be conveyed to the proposed Sediment Retention Pond via the diversion channels.

Commence Earthworks Operation

- A ‘cut to fill’ approach is to be adopted with progressive stabilisation of the site. Exposed areas will be stabilised progressively using clean topsoil and mulch. Any unsuitable material is to be disposed of to an approved tipping facility.

Minimise Dust Generation

- Construction activities such as earthworks and vehicle movement on site have the potential to generate dust, particularly during dry and windy conditions. Revegetating and rehabilitating disturbed ground as soon as practicable following the completion of earthworks will mitigate the potential for dust generation.
- To minimise dust generation, stockpiled material shall be kept to a minimum as much as practicable. If required, watering (using water carts) of exposed areas where dust is causing nuisance shall be undertaken. Vehicle speed should be limited, covering dusty loads and reducing drop height when moving soil will also minimise dust generation.

Stabilisation & Dis-establishment

Upon completion of earthworks, exposed areas will be stabilised by using clean topsoil and mulch materials as per GD05 requirements to minimise site laden runoff discharging into the existing watercourse that is within close proximity. Once 80% stabilisation of areas have been achieved, the erosion and control measures can be progressively dis-established.

5 CONSTRUCITON PROGRAMME

All erosion and sediment control devices shall be in place and fully operational, prior to the commencement of earthworks. Works will take approximately 15 weeks to complete.

The ESCP shall evolve as the nature of land disturbing activities and the areas affected change over time.

6 OPERATION & MAINTENANCE

The erosion and sediment control devices shall be maintained in accordance with GD05 requirements. This includes weekly monitoring of erosion and sediment controls and additional inspections within 24 hours of a heavy rainstorm event. Any maintenance identified in these inspections shall be undertaken as soon as practicable. The erosion and sediment control devices along with a monitoring and maintenance regime will serve to minimise adverse effects resulting from the storm events.

Please also refer to Appendix C for ESC Construction Quality Checklists.

Control Type	Inspection and Maintenance Requirements	Frequency
Stabilised Entranceway	• Maintain entranceway to prevent sediment from leaving construction site. Several applications of new aggregate may be required during the life of the entranceway. Should any sediment be tracked out onto the adjacent right of way and public road, street sweeping may be required.	As required
Clean Runoff Diversion / Silt Socks	• Inspect weekly and after rainfall event for areas of ponding, scour and breach. Repair immediately. • Remove accumulated sediment where this is a risk of overtopping.	Weekly As required
Silt fence	• Check that silt fences are toed in correctly. • Check for tears and other damage. • Any areas of collapse, decomposition or ineffectiveness are to be replaced immediately. • Remove silt build ups when bulges develop or when deposition reaches 50% of the silt fence height.	Daily Daily As required As required

Sediment Retention Pond	• Inspect daily and after rainfall events of breach and damages, including spillway geocloth and riprap. Repair immediately. • Clean out SRPs before accumulated sediment volume of reaches 20% of the total SRP volume. • Maintain access to the forebay at all times. Clean out the forebay after each runoff event	Daily As required As required
Stabilising Areas (post construction)	• Check that all stabilised areas have 80% cover. • Identify areas that require stabilisation.	Weekly

7 REVIEW PROCEDURES

Regular inspections will be undertaken by Council earthworks monitoring officer, project engineer and Construction project manager to ensure the Erosion and Sediment Control Plan is functioning as designed and approved. This plan is to be reviewed and evolved by the Site Manager and Construction Project Manager/Engineer, as continuous improvement or corrective actions from audits, inspections and liaison with the Council. The Site Manager and Construction Project Manager has the overall responsibility for the construction site work and the effectiveness of the sediment controls.

We request Auckland Council review the enclosed documentation and approve the proposal. A final ESCP will be provided upon request before start of earthworks. Please find plans and calculations enclosed in the Appendices.

8 ENVIRONMENTAL OBJECTIVES

8.1 Surface Runoff Control

Clean water diversion channels and silt socks will be built around the site, prior to continuation of the earthworks, to divert the clean stormwater runoff away from the site and to minimise the clean surface runoff (or flood water) entering the site affecting the earthworks activity. A 1-meter wide (some 0.20m deep) overflow channel lining with non-woven geotextile (BIDIM A14 min.) will be formed within the site (along site boundary) where necessary to convey stormwater east and north of the site to the existing public stormwater drainage along Compass Point Way and Pigeon Mountain Road.

8.2 Stormwater Quality

During the earthworks stage, the erosion measures will be in place to filter the laden site runoff, prior to discharging into the existing gully and stormwater network. The measures will be inspected regularly, especially after each heavy rainstorm, so to maintain quality performance of the devices. If excessive debris and sediment is observed at the outfall/spillway, flocculant treatment at forebay shall be discussed with the Council's monitoring officer.

9 REQUIREMENTS

9.1 Statutory Requirements

- Environmental Management and Regulation of Auckland Unitary Plan
- NZS 4431:1989 “Code of practice for earth fill for residential development”
- NZS 4402:1988 “Method of testing soils for civil engineering purposes – Soil Test”
- GD05 June 2016 “Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region)

9.2 Contractual Requirements

The Consent Holder and the Contractor(s) are legally required to undertake a number of tasks, before, during and after the construction activities. The Contractor(s) is required to ensure they are familiar with the obligations under this EMP.

The list below is an example of what should be prepared by the Contractor(s):

- Site specific documents (Specification for Earthworks);
- Monthly Contractor Reports – advising the management team any comments and environment issues raised and public feedback (if any);
- Earthworks Compliance Meeting – to be conducted by Environmental staff to review EMP and report finding to the management team; and
- Feedback Register – to be available onsite to record feedback from public, Council staff and complaints etc.

10 PLAN AMENDMENTS

It is expected that throughout the course of work there will be opportunities to amend the certified EMP to cope with the site condition and construction constraints.

Any amendments required on this EMP shall be discussed and agreed with the Team Leader Compliance Monitoring South, Auckland Council. Agreement shall be done in writing. Implementation shall only be occurred once the agreement in writing has been released by the Team Leader Compliance Monitoring South, Auckland Council.

11 EMERGENCY RESPONSE PROCEDURE

In the event of an Environmental incident, the emergency response procedures that will be prepared by the Contractor group should be followed. The Emergency Contacts should include, but not be limited to:

- Emergency Contracts (Main Contractor)
- Engineering to the Contract (Airey Consultants Ltd.)
- Contractor Site Supervisor (Main Contractor)
- Compliance Officer (Monitoring Officer, Auckland Council)

12 ENVIRONMENTAL IMPACT

This section identifies the main activities associated with the construction.

12.1 Earthworks Activities

12.1.1 Main Earthworks Activities

The main earthworks activity within the subject site include the following:

- Site establishment / clearance
- Construction of erosion and sediment control measures
- Bulk earthworks onsite
- Installation of underground services infrastructures
- Formation of jointly owned access lot by forming/rolling subgrade for the basecourse installation in the later stage
- Commission / Decommission erosion and sediment control measures
- Reinstatement of the disturbed area

The main earthworks activities within the sites have been split into 4 stages to minimise the ground disturbance area and to reduce the size of the sediment retention pond (SRP). The maximum disturbed area at any given time is 6,400m². The earthworks volumes are estimated to be 4,076 m³ of cut and 6,690 m³ of fill. The most practical location of the SRP is the north-eastern corner of the site, which is on top of a bank. With Halfmoon Bay Marina shops located across the road, a bigger SRP is not recommended to settle the debris or discharge the clean runoff. Reason being, if there is an unfortunate situation of the bank failing, the runoff captured in the pond would discharge across the road and potentially inundate the shops.

In reference to 3 Pigeon Mountain Road Preliminary Design and Groundwater Drawdown Assessment Report by Total Ground Engineering, ground water is at least 3m below ground level for most boreholes during winter. Ground water of 1m below ground level was encountered in the northwestern corner of the site. With majority of the drainage designed to be less than 3m depth, ground water is unlikely to be encountered. Should ground water be encountered during the installation of underground infrastructure in the northwestern corner of the site, water pumps will be utilised to pump the groundwater to the forebay of the SRP. This will minimise the volume of sediment laden water from entering the public piped system.

The work is to be undertaken in the following stages:

Stage 1

- Site establishment
- Install cess-pit protections with filter bags (or equivalent)
- Extend public stormwater drain in Pigeon Mountain Road for the Sediment retention pond (SRP).
- Install silt fence along norther/eastern boundaries and stage 1 boundaries.
- Install silt sock along top of western retaining wall and southern boundary.
- Install stabilised accessway.
- Excavate and form SRP.
- Connect primary spillway of SRP to the newly installed 1050mmØ manhole east of the site to discharge the filtered runoff.
- Form the emergency spillway of SRP, lined with geo-cloth and riprap, to release overflows to road reserve.
  - Ensure a very high standard of stabilisation with well-compacted fill material.
  - Ensure geotextile is pinned at 0.5m centres over the full area of the emergency spillway.
  - Ensure rip rap is nicely placed at spillway outlet over the geotextile.
- Installation of Dirty Water Diversion channel to divert sediment runoff to SRP.
- Installation of Clean Water Diversion channels along common accessway and stage boundaries.
- Install Field Cesspit and temporary drain (non-perforated flexi drain) to SRP discharge pipe.
- Commence earthworks operation
  - Cut to fill operation (including any boundary retaining wall installation.)
  - Construct future JOAL base-course
  - Stabilise disturbed areas progressively with hay, mulch, geocloth or metal as required.

Stage 2

- Check and repair clean/dirty water diversion bund/channels and replace geocloth as necessary
- Install additional Field Cesspit and temporary drain (non-perforated flexi drain) to SRP discharge pipe as required.
- Check existing and install new silt fences where necessary.
- Check cess-pit protections
- Commence Stage 2 earthworks operation
  - Cut to fill operation
  - Construct future JOAL base-course
  - Stabilise disturbed areas progressively with hay, mulch, geocloth or metal as required.

Stage 3

- Check and repair clean/dirty water diversion bund/channels and replace geocloth as necessary
- Install additional Field Cesspit and temporary drain (non-perforated flexi drain) to SRP discharge pipe as required.
- Check existing and install new silt fences where necessary.

- Check cess-pit protections
- Remove temporary field cesspit and drain line across stabilised construction access
- Commence Stage 3 earthworks operation
    - Cut to fill operation
    - Construct future JOAL base-course
    - Stabilise disturbed areas progressively with hay, mulch, geocloth or metal as required.

Stage 4

- Check and repair clean water diversion bund/channels and replace geocloth as necessary
- Check existing and repair silt fences where necessary.
- Check cess-pit protections
- Install public drainage as approved under EPA.
    - If ground water is encountered, set up water pumps and discharge water to forebay of SRP.
- Stabilise disturbed site progressively with hay, mulch, geocloth or metal as required.

Stage 5

- Decommission and remove all primary erosion & sediment control devices
    - Sediment Retention Pond (SRP)
        - Remove vegetation, structures, and sediments within SRP when the water level reaches down to 20% mark (1st decant riser).
        - Dewater the SRP in fine weather using high-capacity sludge pumps to the Envirosieve dewatering tubes (Cirtex civil or equal) to the existing SW manholes on Pigeon Mountain Road.
        - Deposit the sludge / sediment in an approval Council's disposal location so to minimise direct discharge to the receiving environments.
        - Filling of SRP to bring the site to the proposed site levels.
        - Reinstate the disturbed area with topsoil, grass and mulch.
    - Clean water diversion channels
    - Dirty water diversion channels
- Check existing and repair silt fences where necessary.
- Check cess-pit protections
- Construct northeastern retaining walls and complete final filling behind retaining walls.
- All the disturbed areas shall be reinstated with topsoil, grass and mulch to comply with the Council's requirements.

12.1.2 Minor Earthworks Activities

Some minor earthworks activity outside the include the construction of pathways, individual pedestrian accessways and installation of drainage infrastructure. The disturbed area outside the subject site is approximately 470 m² (225 m² within Ara Tai Reserve and 245 m² within Pigeon Mountain Road berm). The earthworks volumes estimated within Ara Tai Reserve is 19 m³ of cut and 8 m³ of fill. The earthworks volumes estimated within Pigeon Mountain Road berm is 35 m³ of cut. All drainage installation will be undertaken at short lengths to allow any excavation is backfilled and compacted at the end of the day to minimise surface debris runoffs and ensure public safety. Construction of footpaths and pedestrian accessways will have minimal earthworks. The preparation of footpaths and pedestrian accessways involves the compaction of basecourse/bedding materials. Consequently, any rainfall that may take place before the concrete is poured will have minimal sediment runoff.

The installation of public drainage outside the site will be undertaken in the following on a daily basis:

- Site establishment (inc. traffic management)
- Install/check cess-pit protections with filter bags (or equivalent)
- Excavate trench for the length of drainage pipes planned for the day.
- Install the drainage pipes.
- Back fill and compact the trench excavation.
- Check public safety warnings before end of the day and repeat steps until works in berm is completed.

The installation of footpath and accessway outside the site will be undertaken in the following:

- Site establishment (inc. traffic management)
- Install/check cess-pit protections with filter bags (or equivalent)
- Excavate (200mm) the length of footpath planned for the day.
- Install 100mm compacted base course.
- Box up the footpath/accessway in preparation for concrete pour.
- Check public safety warnings before end of the day and repeat steps until full length of footpath/accessway is ready for concrete pour.

12.2 Potential Adverse Effects

If not managed properly, the construction activities above can lead to adverse impact to the existing environment. The potential effects can be of the following:

- Erosion by exposing unstable surface
- Laden site runoff discharging into surrounding watercourses, contaminating the water quality
- Dust / Air
- Excessive noise
- Loss of topsoil due to poor handling
- Poor visual effect

12.3 Dust and Odour Control

Dust and odour may become a problem during certain weather condition, causing disturbance to surrounding properties. If it comes an issue, the Contractor shall employ appropriate control measures to avoid, remedy and mitigate the potential adverse effects. The following measures can be employed to minimise the effects:

- Spraying water (during dry water) to keep the dusts down
- Construction of stabilised haul road to minimise vehicle tracks and dusts
- The stockpile, material storage area shall be stabilised and properly managed
- Site work shall be managed in an effective manner to ensure that there shall not be any dusts

and objectionable odour at or beyond the site boundary.

12.4 Noise Control

The earthworks operation always creates construction noise, mainly due to the heavy machineries. All practicable measures shall be in place to keep the noise to an acceptance level.

Heavy machinery or plant can only be operated during the consented period on the Resource Consents. Working outside the certified hours shall not be permitted.

13 CONSTRUCTION PROGRAMME

The program below provides indicative timing for the key portions of the earthworks activities. The program should be updated monthly through the construction period. Updated program shall be submitted to the Manager, Environmental Management and Regulation, Auckland Council for record:

Description	Estimated Programme*
Stage 1	5 weeks
Stage 2	2.5 weeks
Stage 3	2.5 weeks
Stage 4	3 weeks
Stage 5	2 weeks

*** weather permitting**

Report prepared by
AIREY CONSULTANTS LTD

Weng

Samson Weng
Civil Engineer
BE Hons (Civil)

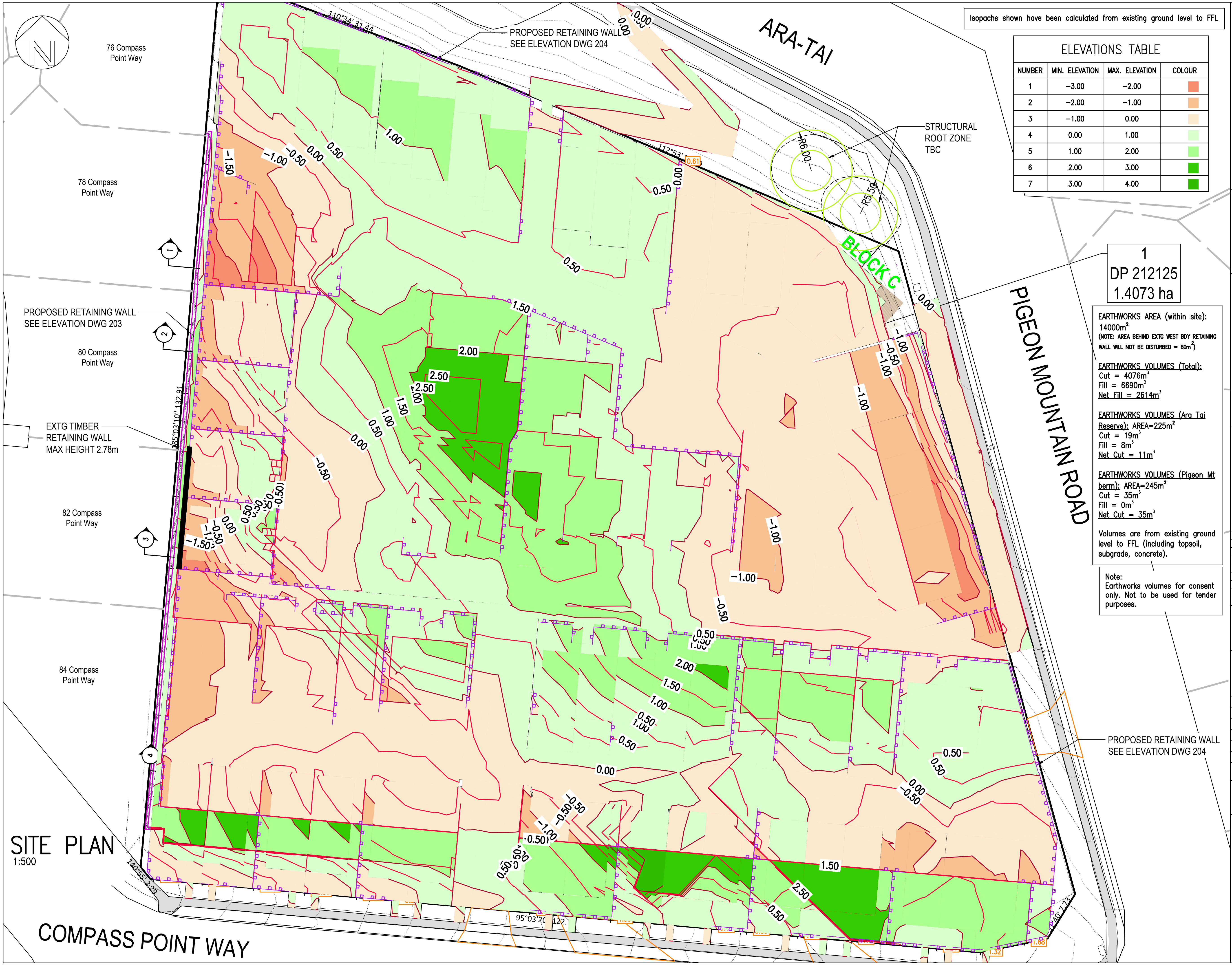
Reviewed and approved by
AIREY CONSULTANTS LTD

Royden Tsui

Royden Tsui
Associate Director
CPEng(NZ), CMEngNZ, IntPE(NZ), MEPM (hons), BE (Civil)

Appendix A

- Erosion & Sediment Control Plans



SITE PLAN

1:500

Isopachs shown have been calculated from existing ground level to FFL

ELEVATIONS TABLE

NUMBER	MIN. ELEVATION	MAX. ELEVATION	COLOUR
1	−3.00	−2.00	🟥
2	−2.00	−1.00	🟧
3	−1.00	0.00	🟨
4	0.00	1.00	🟩
5	1.00	2.00	🟩
6	2.00	3.00	🟩
7	3.00	4.00	🟩

EARTHWORKS AREA (within site):
14000m²
(NOTE: AREA BEHIND EXTG WEST BDY RETAINING WALL WILL NOT BE DISTURBED = 80m²)

EARTHWORKS VOLUMES (Total):
Cut = 4076m³
Fill = 6690m³
Net Fill = 2614m³

EARTHWORKS VOLUMES (Ara Tai Reserve): AREA=225m²
Cut = 19m³
Fill = 8m³
Net Cut = 11m³

EARTHWORKS VOLUMES (Pigeon Mt berm): AREA=245m²
Cut = 35m³
Fill = 0m³
Net Cut = 35m³

Volumes are from existing ground level to FFL (including topsoil, subgrade, concrete).

Note:
Earthworks volumes for consent only. Not to be used for tender purposes.

Airey
CIVIL, STRUCTURAL AND FIRE ENGINEERS

AIREY CONSULTANTS LTD
TEL: (09) 534 6523 www.aireys.co.nz
TAKAPUNA **BOTANY** QUEENSTOWN

CLIENT:
HND HMB LTD

JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY
4	S92 REVISIONS - 87 DWELLINGS	26/03/2024	LP
3	SECTION 3 RELOCATED	08/02/2024	JC
2	S92 REVSIONS - 88 LOTS	05/02/2024	LP
1	S92 - LAYOUT/LEVELS REVISED	20/10/2023	LP

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
RESOURCE CONSENT

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 22/05/23
SCALE: 1:500 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
SITE PLAN
EARTHWORKS

JOB No: 220571-1
SHEET No: 200
REV: 4

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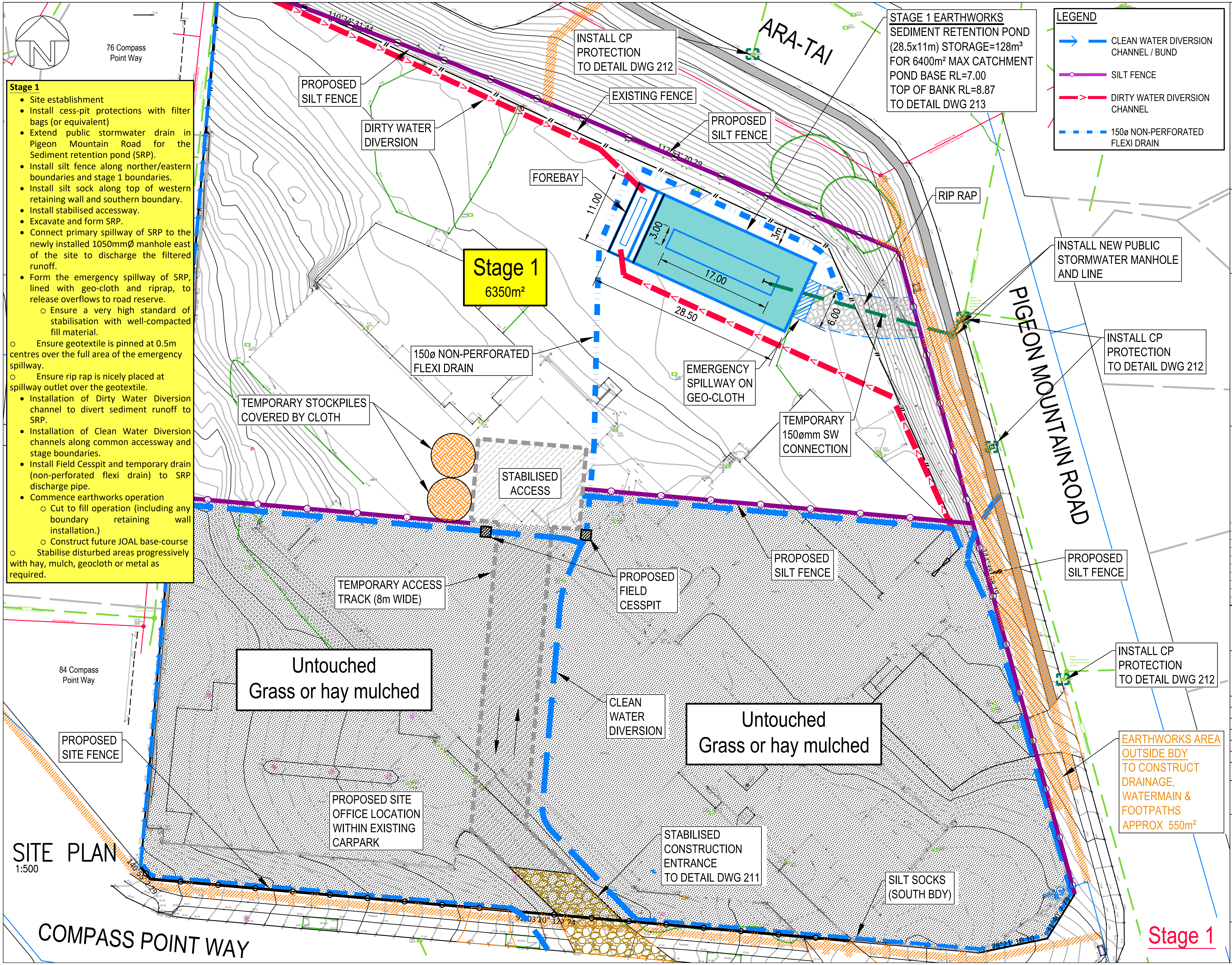

Stage 1

- Site establishment
- Install cess-pit protections with filter bags (or equivalent)
- Extend public stormwater drain in Pigeon Mountain Road for the Sediment retention pond (SRP).
- Install silt fence along norther/eastern boundaries and stage 1 boundaries.
- Install silt sock along top of western retaining wall and southern boundary.
- Install stabilised accessway.
- Excavate and form SRP.
- Connect primary spillway of SRP to the newly installed 1050mmØ manhole east of the site to discharge the filtered runoff.
- Form the emergency spillway of SRP, lined with geo-cloth and riprap, to release overflows to road reserve.
    - Ensure a very high standard of stabilisation with well-compacted fill material.

○ Ensure geotextile is pinned at 0.5m centres over the full area of the emergency spillway.

○ Ensure rip rap is nicely placed at spillway outlet over the geotextile.

- Installation of Dirty Water Diversion channel to divert sediment runoff to SRP.
- Installation of Clean Water Diversion channels along common accessway and stage boundaries.
- Install Field Cesspit and temporary drain (non-perforated flexi drain) to SRP discharge pipe.
- Commence earthworks operation
    - Cut to fill operation (including any boundary retaining wall installation.)
    - Construct future JOAL base-course

○ Stabilise disturbed areas progressively with hay, mulch, geocloth or metal as required.

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CIVIL, STRUCTURAL AND FIRE ENGINEERS

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TEL: (09) 534 6523 www.aireys.co.nz
TAKAPUNA **BOTANY** QUEENSTOWN

CLIENT:
HND HMB LTD

JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY
2	S92 - STAGE 1 AREA ADDED	19/03/2024	LP
1	S92 SHADING ADDED	20/11/2023	LP

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
RESOURCE CONSENT

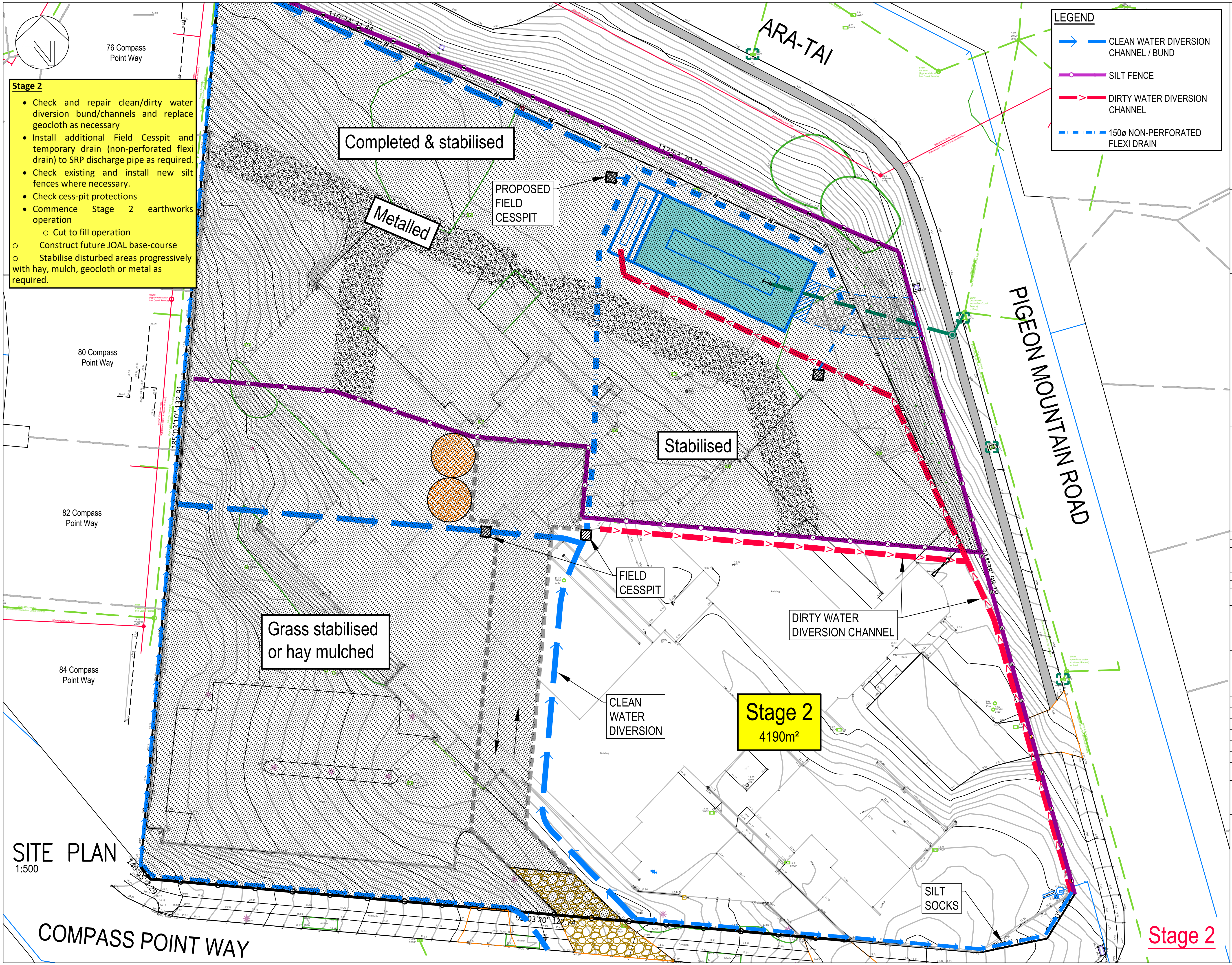
DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 31/08/2023
SCALE: 1:500 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
SITE PLAN
SEDIMENT CONTROL
EARTHWORKS STAGING
STAGE 1

JOB No:	SHEET No:	REV:
220571-1	201a	2



SITE PLAN

1:500

Stage 2

- Check and repair clean/dirty water diversion bund/channels and replace geocloth as necessary
- Install additional Field Cesspit and temporary drain (non-perforated flexi drain) to SRP discharge pipe as required.
- Check existing and install new silt fences where necessary.
- Check cess-pit protections
- Commence Stage 2 earthworks operation
  - ○ Cut to fill operation

○ Construct future JOAL base-course

○ Stabilise disturbed areas progressively with hay, mulch, geocloth or metal as required.

LEGEND

→ ▬	CLEAN WATER DIVERSION CHANNEL / BUND
─○─	SILT FENCE
▬ > ▬	DIRTY WATER DIVERSION CHANNEL
─ · ─	150ø NON-PERFORATED FLEXI DRAIN

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TEL: (09) 534 6523 www.aireys.co.nz

TAKAPUNA **BOTANY** QUEENSTOWN

CLIENT:

HND HMB LTD

JOB TITLE:

3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY
2	S92 - STAGE 2 AREA ADDED	19/03/2024	LP
1	S92 SHADING ADDED	20/11/2023	LP

DRAWING STATUS:

FINAL

ISSUE PURPOSE:

RESOURCE CONSENT

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 31/08/2023
SCALE: 1:500 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:

5 0 5 10 15 20 25

DRAWING TITLE:

SITE PLAN
SEDIMENT CONTROL
EARTHWORKS STAGING
STAGE 2

JOB No:	SHEET No:	REV:
220571-1	201b	2

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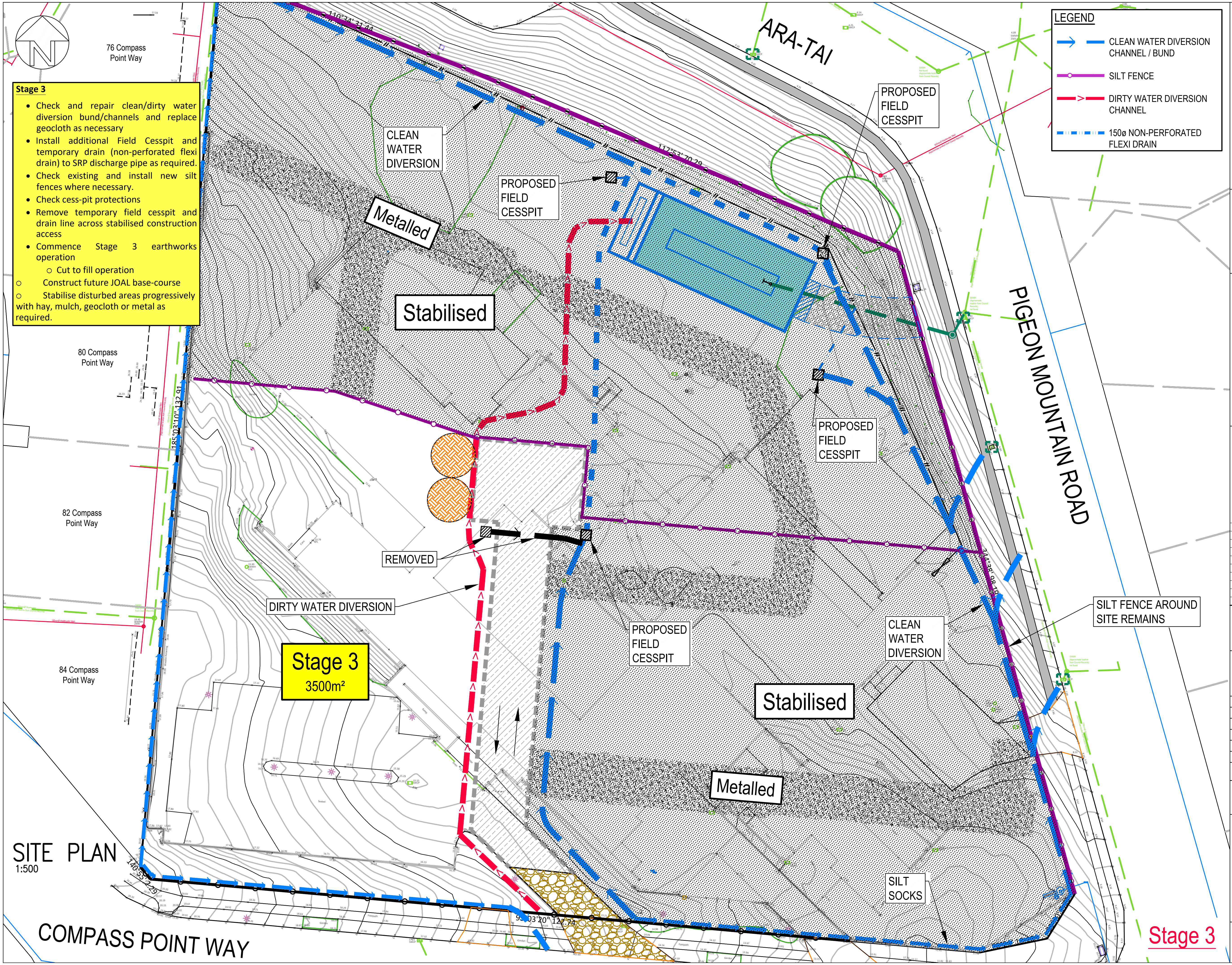

Stage 3

- Check and repair clean/dirty water diversion bund/channels and replace geocloth as necessary
- Install additional Field Cesspit and temporary drain (non-perforated flexi drain) to SRP discharge pipe as required.
- Check existing and install new silt fences where necessary.
- Check cess-pit protections
- Remove temporary field cesspit and drain line across stabilised construction access
- Commence Stage 3 earthworks operation
    - ○ Cut to fill operation

○ Construct future JOAL base-course

○ Stabilise disturbed areas progressively with hay, mulch, geocloth or metal as required.

SITE PLAN

1:500

LEGEND

→ – –	CLEAN WATER DIVERSION CHANNEL / BUND
—○—	SILT FENCE
—>—	DIRTY WATER DIVERSION CHANNEL
–·–·–	150ø NON-PERFORATED FLEXI DRAIN

Airey

CIVIL, STRUCTURAL AND FIRE ENGINEERS

AIREY CONSULTANTS LTD
TEL: (09) 534 6523 www.aireys.co.nz
TAKAPUNA **BOTANY** QUEENSTOWN

CLIENT:
HND HMB LTD

JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY
2	S92 - STAGE 3 AREA ADDED	19/03/2024	LP
1	S92 SHADING ADDED	20/11/2023	LP

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
RESOURCE CONSENT

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 31/08/2023
SCALE: 1:500 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
SITE PLAN
SEDIMENT CONTROL
EARTHWORKS STAGING
STAGE 3

JOB No:	SHEET No:	REV:
220571-1	201c	2

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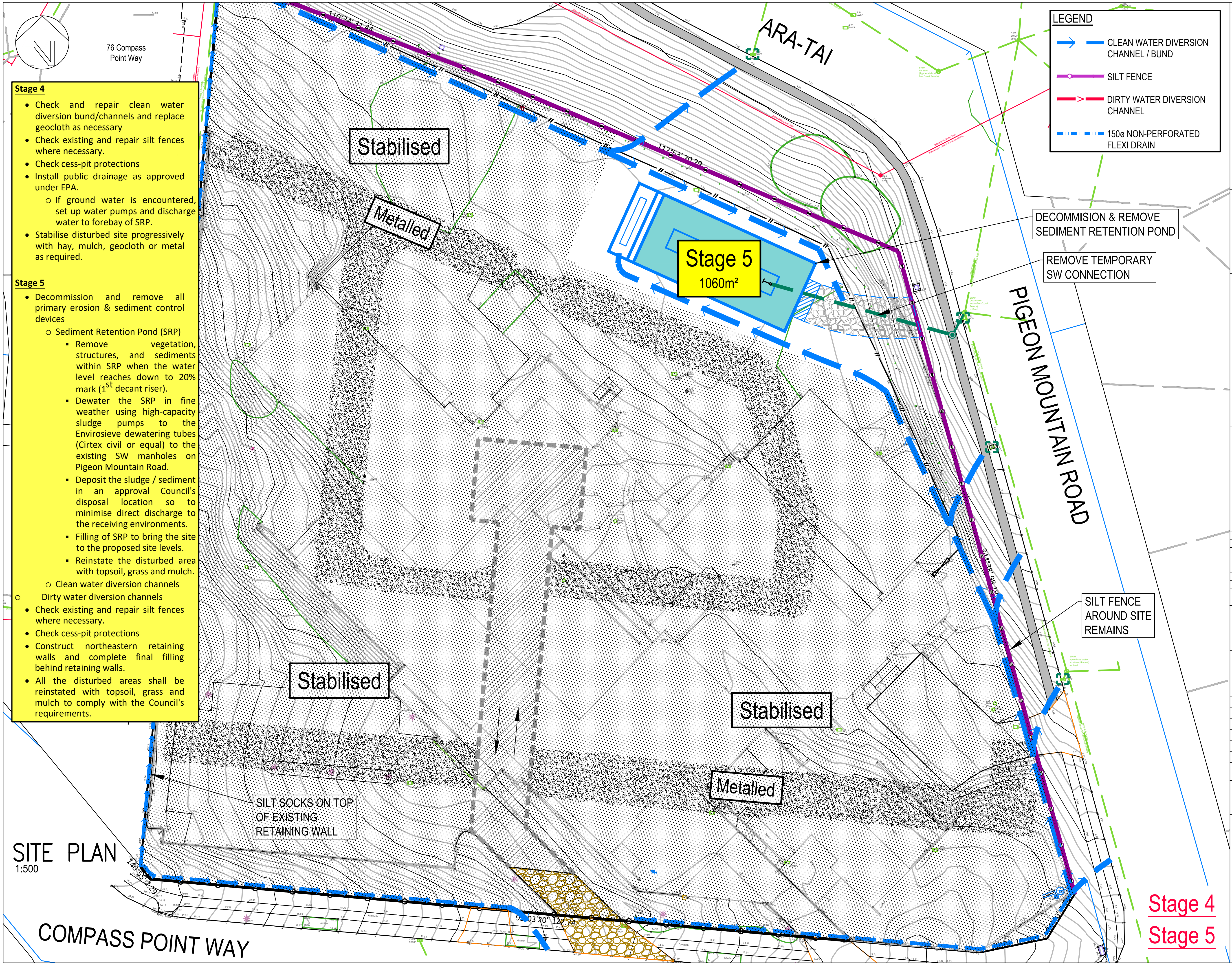

Stage 4

- Check and repair clean water diversion bund/channels and replace geocloth as necessary
- Check existing and repair silt fences where necessary.
- Check cess-pit protections
- Install public drainage as approved under EPA.
  - ○ If ground water is encountered, set up water pumps and discharge water to forebay of SRP.
- Stabilise disturbed site progressively with hay, mulch, geocloth or metal as required.

Stage 5

- Decommission and remove all primary erosion & sediment control devices
  - ○ Sediment Retention Pond (SRP)
    - ▪ Remove vegetation, structures, and sediments within SRP when the water level reaches down to 20% mark (1st decant riser).
    - ▪ Dewater the SRP in fine weather using high-capacity sludge pumps to the Envirosieve dewatering tubes (Cirtex civil or equal) to the existing SW manholes on Pigeon Mountain Road.
    - ▪ Deposit the sludge / sediment in an approval Council's disposal location so to minimise direct discharge to the receiving environments.
    - ▪ Filling of SRP to bring the site to the proposed site levels.
    - ▪ Reinstate the disturbed area with topsoil, grass and mulch.
  - ○ Clean water diversion channels
- ○ Dirty water diversion channels
- Check existing and repair silt fences where necessary.
- Check cess-pit protections
- Construct northeastern retaining walls and complete final filling behind retaining walls.
- All the disturbed areas shall be reinstated with topsoil, grass and mulch to comply with the Council's requirements.

LEGEND

→ —	CLEAN WATER DIVERSION CHANNEL / BUND
—○—	SILT FENCE
—>—	DIRTY WATER DIVERSION CHANNEL
-·-·-	150ø NON-PERFORATED FLEXI DRAIN

SITE PLAN
1:500

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CIVIL, STRUCTURAL AND FIRE ENGINEERS

AIREY CONSULTANTS LTD
TEL: (09) 534 6523 www.aireys.co.nz
TAKAPUNA **BOTANY** QUEENSTOWN

CLIENT:
HND HMB LTD

JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY
2	S92 - STAGE 5 AREA ADDED	19/03/2024	LP
1	S92 SHADING ADDED	20/11/2023	LP

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
RESOURCE CONSENT

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 31/08/2023
SCALE: 1:500 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
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DRAWING TITLE:
SITE PLAN
SEDIMENT CONTROL
EARTHWORKS STAGING
STAGE 4 & 5

JOB No:	SHEET No:	REV:
220571-1	201d	2

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Appendix B

- Engineering Calculations

ENGINEERING CALCULATIONS

FOR

Client:	HND HMB Ltd
Address:	3 Pigeon Mountain Road, Half Moon Bay
Job No:	220571/01
Date:	26 March 2024
Design Engineer:	Samson Weng
Reviewed by:	Royden Tsui
Contact Phone:	(09) 534 6523
Email:	samsonw@aireys.co.nz

Airey Civil, Structural and Fire Engineers	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Rd Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** SW **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 15/11/2023

USLE Calculations

Stage All
Area : Entire Site
Type of Work: All Earthworks, including Bulk Cut/Fill, driveway and building foundation

Exposed Area: 1.41 ha , factor 1/3 for stockpile and pond areas= 1.88 ha

Rainfall Erosion Index **(R)** = 0.00828 (0.628 x p)**2.2 x 1.7 p = 75 mm
= 67 J/ha 2yr ARI for Halfmoon Bay, 24h

Soil Erodibility Factor **(K)**

Assumption

Parameters: -SILT 70 %
-some CLAY 20 %
-minor sand 10 %
-0% organic and granular

Areas
a 1.41
b

Hence K = 0.82 t/ unit R

Slope/ Steepness Factor **(LS)**

Initial Case	a	7.70	%	1.88	ha	Areas +1/3 for
	b		%		ha	stockpile
Final Case	a	3.50	%			
	b		%			

				Slope Length		NN
Assume slope of :	7.70	%	Area a	188	m	0.5
		%	Area b		m	0.2
		%		Note: longest runoff route used		

LS a = 2.34
LS b = 0.00

Ground cover factor **(C)** = 1.00 Assume Bare Site
Roughness Factor **(P)** = 1.32 Assume worst case - Compacted and Smooth

Sediment Generated **(A)** = R*K*LS*C*P

A Area a =	170.8	t / ha / yr
A Area b =	0.0	t / ha / yr
A Area c =	0.0	t / ha / yr

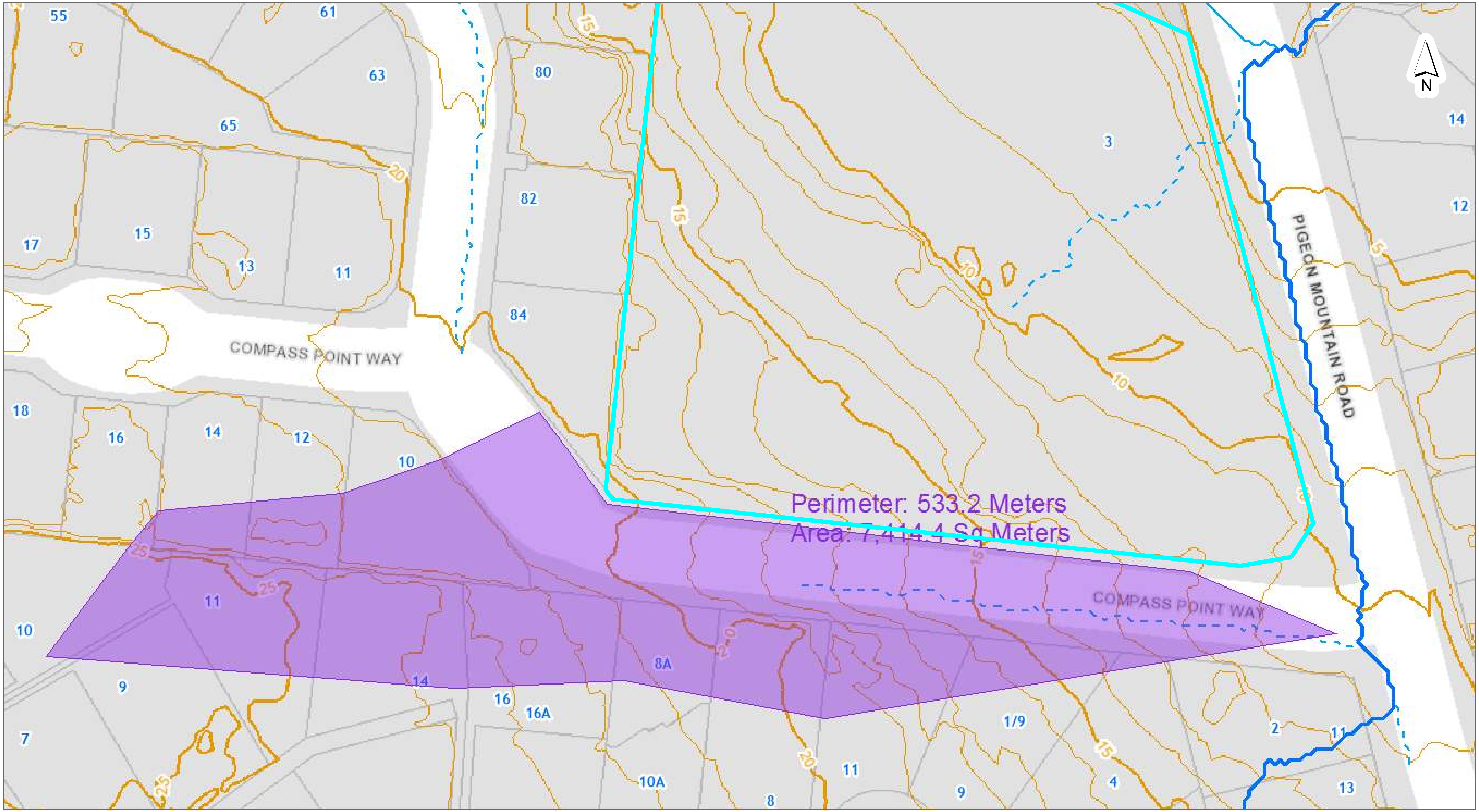
Area of Exposure a 1.8764 ha
b 0 ha

Sediment Delivery Ratio a 0.70 American sources state that SDR rates range mostly from 0.1 to 0.7
b

Sediment Control Measure Efficiency 75 % Silt Fence (around the earthworks extent) , Earth Bunds and Sediment Pond

Duration of exposure (yrs) 15 weeks
0.31 years

Sediment Yield	Area a	17.53	tons
	Area b	0.00	tons
	Area c	0.00	tons
	Total for this area and type of work =	**17.53**	tons

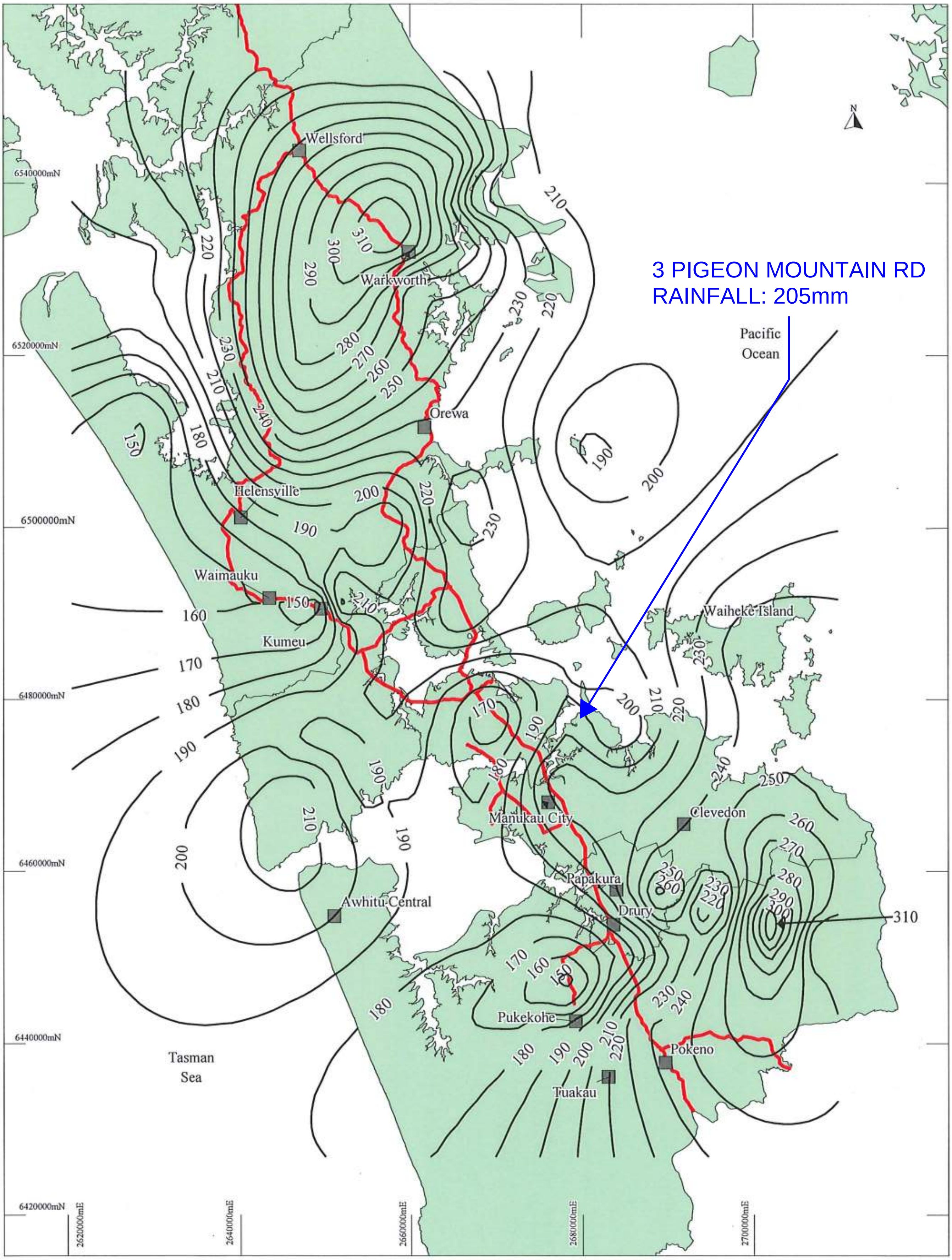


Compass Point OLFP Catchment

Scale @ A4
= 1:1,000

Date Printed:
9/08/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau



3 PIGEON MOUNTAIN RD
RAINFALL: 205mm

Legend: — 90 — Rainfall Contour (mm)
State Highways

Auckland **Regional** Council

Figure A.6
100 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)
(Revised 25/08/1999)

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\100yrari.wor Date: 25/08/1999

Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Rd Half Moon Bay		**Job No:** 220517/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	17/01/2022

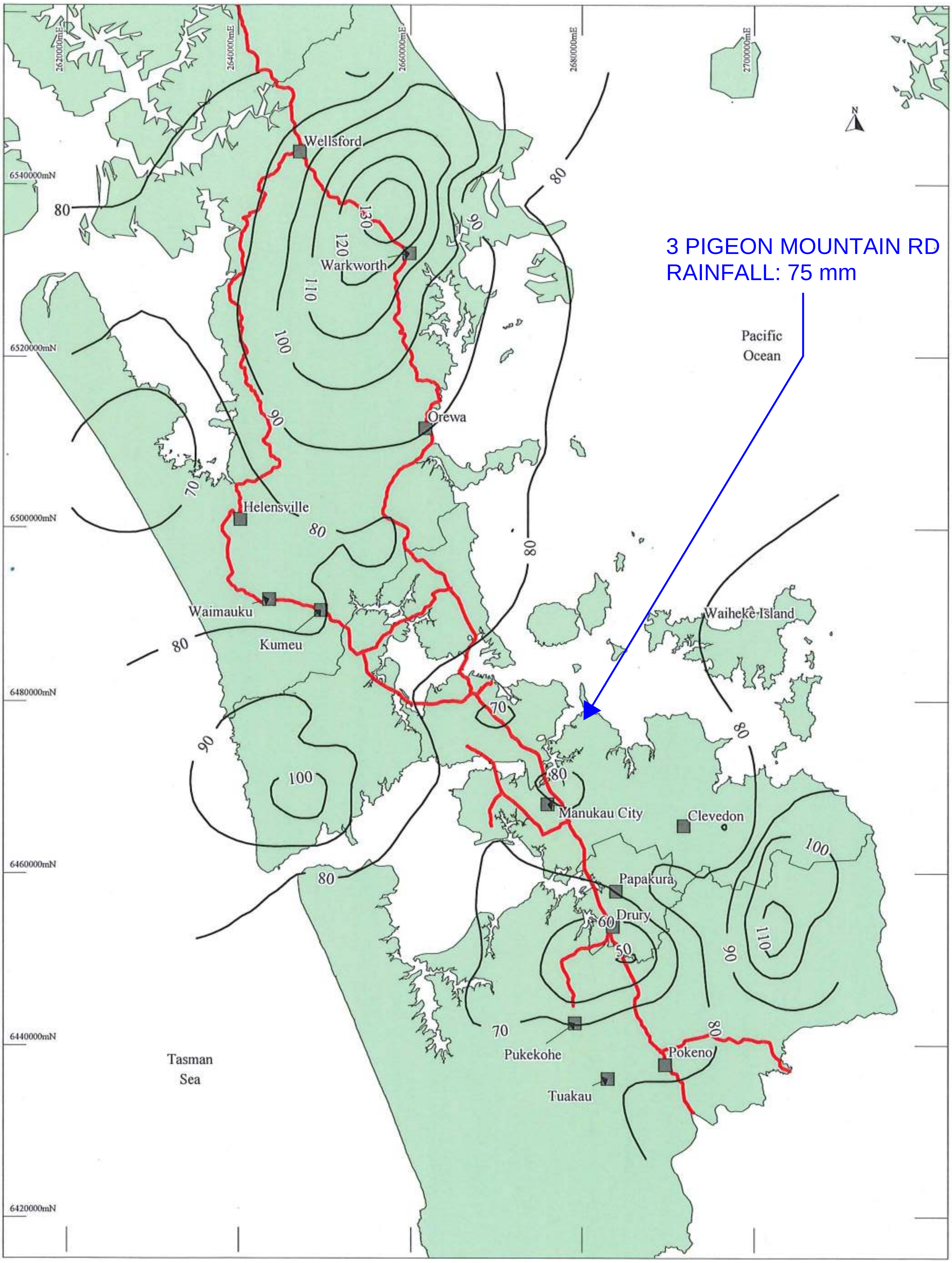
TP108 Rainfall

Rainfall Depth	205	mm
ARI	100	years

Duration hr	**Duration** mins	**Depth** mm	**Intensity** mm/hr (Q_{10})
0.166	10.0	27.58	**166.17**
0.333	20.0	42.42	127.38
0.5	30	52.32	104.64
1	60	73.75	73.75
2	120	99.61	49.80
6	360	152.28	25.38
12	720	195.38	16.28
24	1440	**239.44**	10.06

ARI	Ratio
2	9.0%
5	11.3%
10	13.2%
20	15.1%
50	16.8%
100	16.8%

ARI:	100
Ratio:	16.8%



3 PIGEON MOUNTAIN RD
RAINFALL: 75 mm

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\2yrari.wor Date: 25/08/1999

Legend: — 70 — Rainfall Contour (mm)

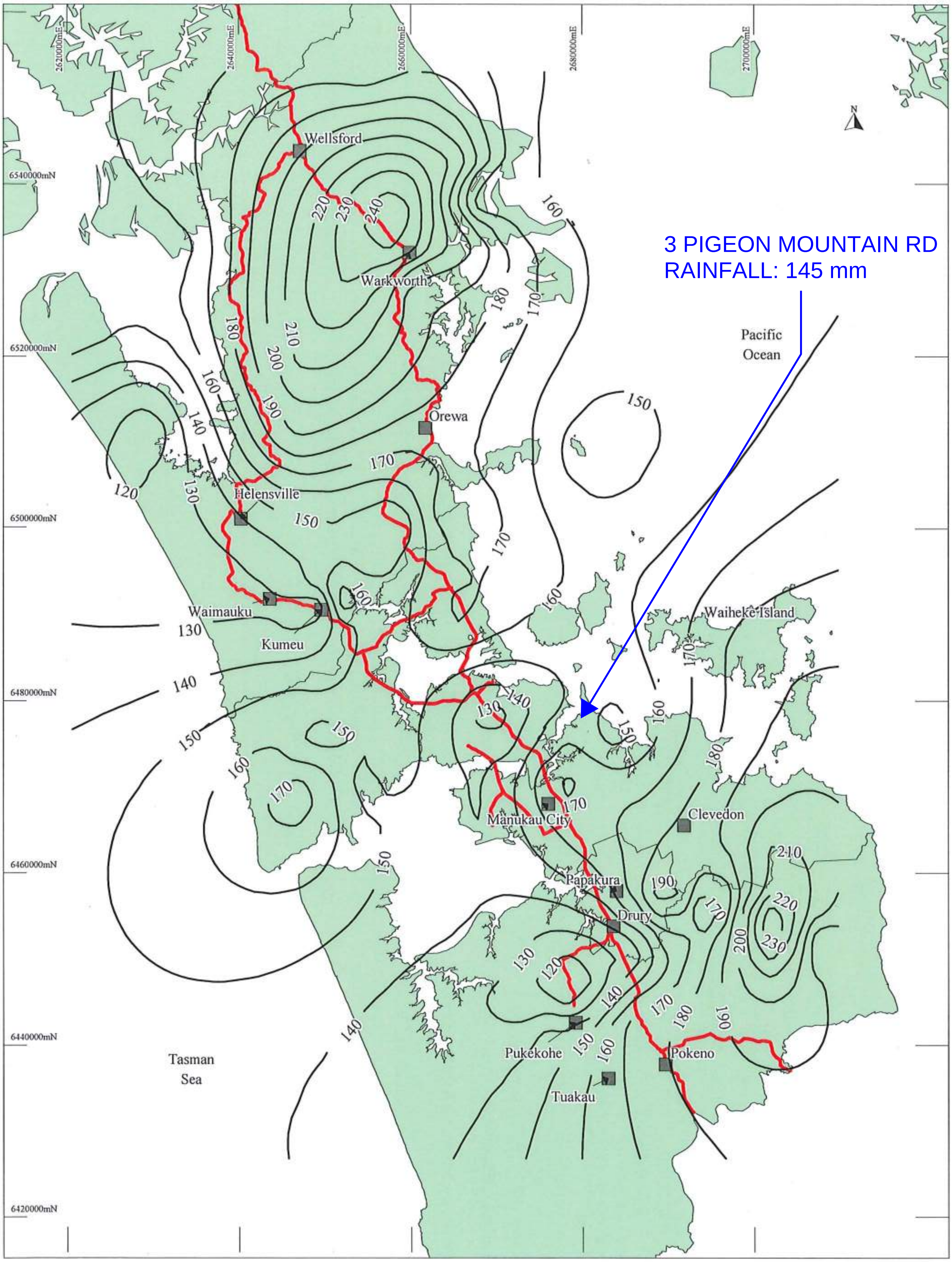
State Highways

Auckland **Regional** Council

Figure A.1
2 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)

(Revised 25/08/1999)



3 PIGEON MOUNTAIN RD
RAINFALL: 145 mm

Legend: — 90 — Rainfall Contour (mm)

🟥 State Highways

Auckland **Regional** Council

Figure A.4
20 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)

(Revised 25/08/1999)

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\20yrari.wor Date: 25/08/1999

Airey **Civil, Structural and Fire Engineers** Takapuna **Botany** Queenstown	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
	Reviewed By:	RCHT	09 534 6523	8/08/2023

TP108 Rainfall

Rainfall Depth	145	mm
ARI	20	years

Duration hr	**Duration** mins	**Depth** mm	**Intensity** mm/hr (Q_{10})
0.166	10.0	19.23	**115.83**
0.333	20.0	29.57	88.79
0.5	30	36.47	72.93
1	60	51.40	51.40
2	120	69.43	34.71
6	360	106.15	17.69
12	720	136.19	11.35
24	1440	166.90	7.01

ARI	Ratio
2	9.0%
5	11.3%
10	13.2%
20	15.1%
50	16.8%
100	16.8%

ARI:	20
Ratio:	15.1%

Maximum Diversion Catchment

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 1
CALCS. BY: SW
DATE: 09/08/2023

PIPE FLOW CALCULATIONS

REFERENCE

Overland Flow Rate

$Q = 2.78\ C\ i\ A$

Rational Formula

Storm Scenario		**5%**	AEP
Coefficent of Runoff	C	**0.65**	
Rainfall Intensity	i	**115.8**	mm/hr
Area of Runoff	A	**0.64**	ha
Overland Runoff Rate	**Q**	**134**	**l/s**

Design Capacity

$V_d = {}^{1}/n\ R^{2/3}\ S^{1/2}$

Manning's Formula

Pipe Material		**PE**		
Pipe Size		**150**	mm	
Pipe Slope	S	**7.00%**		
Number of Barrels		**1**		
Manning's n	n	0.011		
Pipe Design Flow	Q_d	**47.6**	**l/s**	**NG**

Pipe Flow Charateristics

Flow Ratio	q/Q	2.81	
Approx Depth Ratio	d/D	12329.02	
Approx Velocity Ratio	v/V	-6156.00	
Approx Pipe Flow Velocity	**V**	**-16588.59**	**m/s**

Compass Point OLFP

CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road,
Half Moon Bay
JOB No.: 220571/01

SHEET No.: 1
CALCS. BY: SW
DATE: 09/08/2023

PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate

$Q = 2.78\ C\ i\ A$ — *Rational Formula*

Storm Scenario		**1%**	AEP	
Coefficent of Runoff	C	**0.65**		
Rainfall Intensity	i	**166.2**	mm/hr	
Area of Runoff	A	**0.74**	ha	*OLFP Catchment*
Overland Runoff Rate	**Q**	**222**	**l/s**	

Design Capacity

$V_d = {}^{1}/n\ R^{2/3}\ S^{1/2}$ — *Manning's Formula*

Pipe Material		**Concrete**		
Pipe Size			mm	
Pipe Slope	S			
Number of Barrels		**1**		
Manning's n	n	0.012		
Pipe Design Flow	**Q_d**	**0.0**	**l/s**	**NG**

Pipe Flow Charateristics

Flow Ratio	q/Q	#DIV/0!	
Approx Depth Ratio	d/D	#DIV/0!	
Approx Velocity Ratio	v/V	#DIV/0!	
Approx Pipe Flow Velocity	**V**	**#DIV/0!**	**m/s**

Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** **Reviewed By:**	SW RCHT	**Phone:** 09 534 6523	**Date:** 24/08/2023

CHANNEL CAPACITY CALCULATIONS

1% AEP Compass Point Runoff

INPUTS

Case (A or B)	B

Case A

Flow (m^3/s)	0.222

Case B

Slope (S_o)	0.072	
Water level (m)	9.08	0.08
Top of Embankment	9.38	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity
0	9.15	0.013	
0	9	0.013	
4	9.08	0.013	
8	9	0.013	
8	9.15	0.013	
-1			

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.

$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	0.754	OK
Velocity (m/s)	2.357	
S_o or S_f	0.0720	
Energy (m)	9.363	
Froude No	3.762	
Bed Stress (Pa)	27.693	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.79	

Geometry for wetted conditions

Depth (d-m)	9.080
Area (A-m^2)	0.320
Width (B-m)	8.000
Perimeter (P-m)	8.162

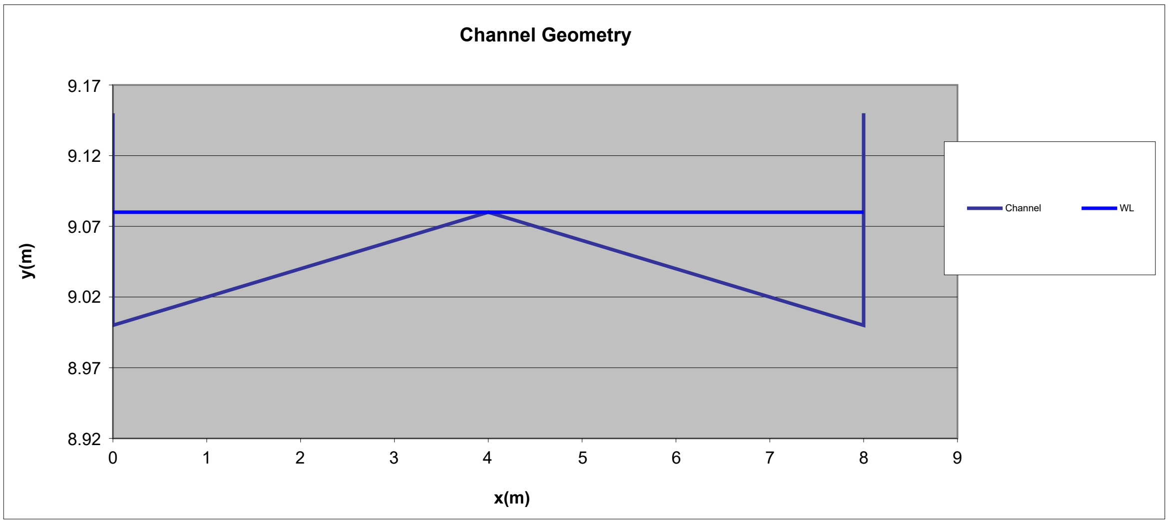
Critical Flow Conditions

Flow (m^3/s)	0.200	INCREASE CHANNEL
Velocity (m/s)	0.626	
Energy (m)	9.100	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5

1% AEP SURFACE RUNOFF CONTAINED WITHIN CARRIAGEWAY



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	24/08/2023

CHANNEL CAPACITY CALCULATIONS

Clearn/Dirty Water Diversion Channel Capacity

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	0.134	
Case B		
Slope (S_o)	0.020	
Water level (m)	8.89	0.09
Top of Embankment	9.19	

Channel Geometry x (m)	 y (m)	Mannings "n" value	Sinuosity
0	9	0.02	
0.6	8.8	0.02	
1.6	8.8	0.02	
2.2	9.2	0.02	
-1			

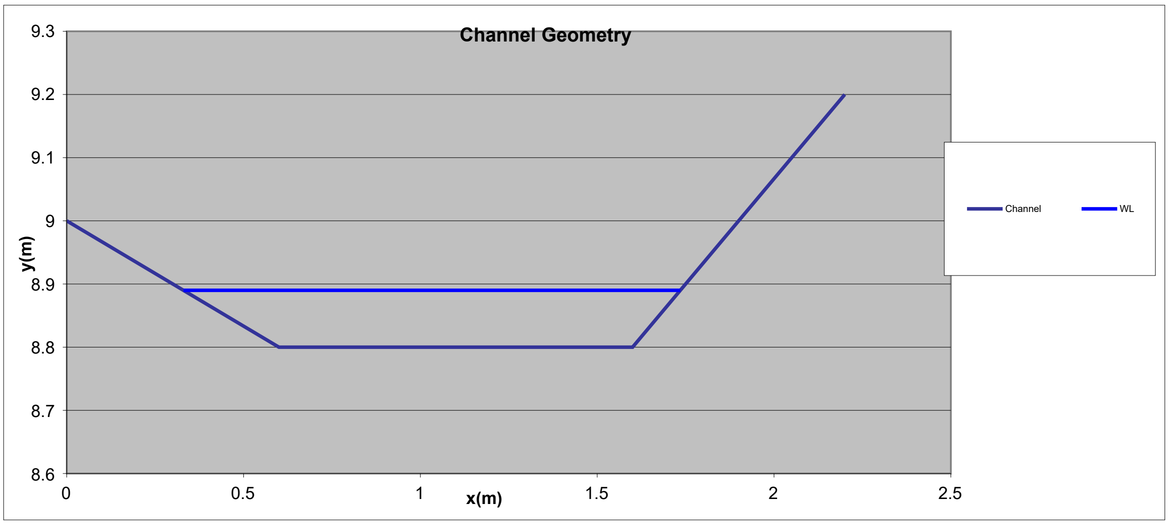
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	**0.135**	OK
Velocity (m/s)	1.245	
S_o or S_f	0.0200	
Energy (m)	8.969	
Froude No	1.432	
Bed Stress (Pa)	14.676	
Equivalent "n"	0.020	
Equivalent k_s(mm)	16.84	
Geometry for wetted conditions		
Depth (d-m)	8.890	
Area (A-m^2)	0.108	
Width (B-m)	1.405	
Perimeter (P-m)	1.447	
Critical Flow Conditions		
Flow (m^3/s)	**0.094**	INCREASE CHANNEL
Velocity (m/s)	0.869	
Energy (m)	8.929	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



CLIENT: HND HMB Ltd
PROJECT: 3 Pigeon Mountain Road
JOB No.: 220571/01

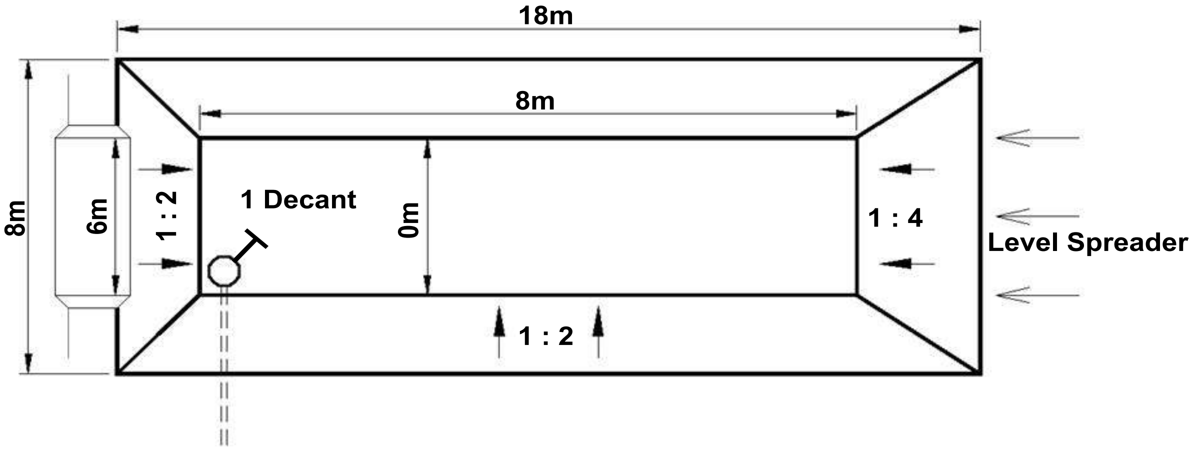
SHEET No.: 1
CALCS. BY: SW
DATE: 07/08/2023

SEDIMENT POND CALCULATIONS					**REFERENCE**
Catchment Details					*Auckland Council* *TP-90*
Catchment Area	A	**0.18**	ha	**NG**	*0.3ha - 5.0ha*
Sand Soils		**No**			
Catchment Length		**< 200m**			
Catchment Slope		**< 10%**			
Pond Volume Required	**V**	**35**	**m^3**		*(2% of catchment)*
100 Year Flow Rate					
Coefficient of Runoff	c	**0.65**			
1% AEP Rainfall	i_{100}	**178.33**	mm/hr		
100 Year Flow Rate	**Q**	**0.06**	**m^3/s**		*Rational Formula*
Pond Design					
Pond Depth	d	**1.10**	m		*1.0m to 2.0m*
Pond Side Slope	1 :	**2**			*1:2 - 1:3*
Inlet Batter Slope	1 :	**4**			*1:3 max.*
Dimension Ratio	1 W :	**3**	L		*1 W : 3 - 5 L*
Storage Level Width	W	4.7	m		
Storage Level Length	L	14.1	m		
Base Width		0.3	m	**OK**	
Base Length		7.5	m		
Dead Storage Volume		11	m^3		*(30% total volume)*
Dead Storage Depth		**0.62**	m		
Live Storage Volume		24.5	m^3		*(70% total volume)*
Live Storage Depth		0.48	m		
Decant Details					
Decant Rate		0.5	l/s		*3.0 l/s/ha*
No. Decants Required		**1**			*4.5 l/s/decant*
Holes Per Decant Required		**23**	**of 200**		
100 Year Spillway Details					
Spillway Width		**6**	**m**		*Max. of 6m or pond base*
Spillway Flow Depth		**0.03**	**m**		$Q = 1.7 L h^{3/2}$

SEDIMENT POND CALCULATIONS	REFERENCE

Pond Construction Parameters

Catchment Area	**0.18**	**ha**
Pond Volume	**35**	**m^3**
Pond Base Level	**19.95**	**m RL**
Pond Top Embankment Level	**21.68**	**m RL**
Decant 1 Level	20.57	m RL
Decant 2 Level	N/A	
Decant 3 Level	N/A	
Spillway Level	21.05	m RL
Level Spreader Level	21.55	m RL
Emergency Spillway Level	21.35	m RL
Pond Internal Batter Slope	1 : 2	
Pond Base Dimensions	**0m wide x 8m long**	
Pond Embankment Dimensions	**8m wide x 18m long**	



Holes Per Decant Required: **23 of 200**

Appendix C

- ESCP Checklists

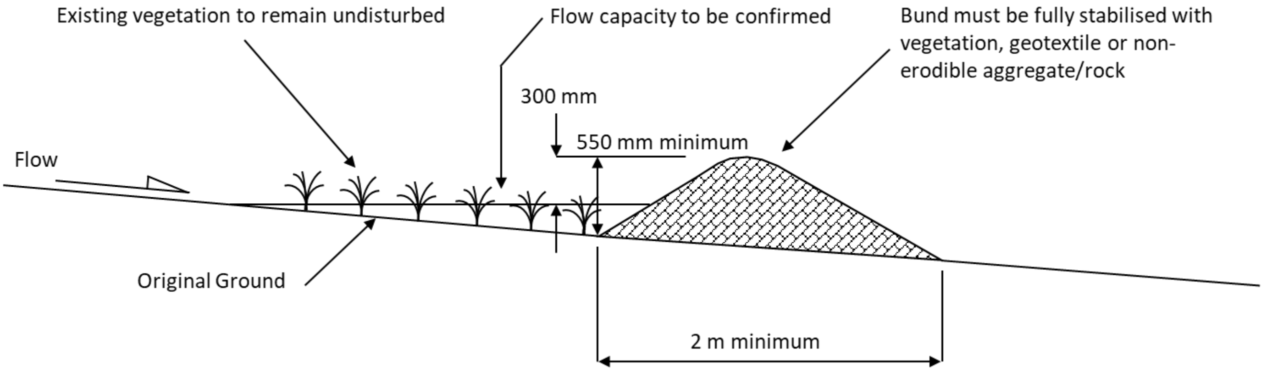
Appendix C1.0 ESC construction quality checklists

Appendix C1.1 A ‘Clean water’ or ‘dirty water’ diversion channel and bund

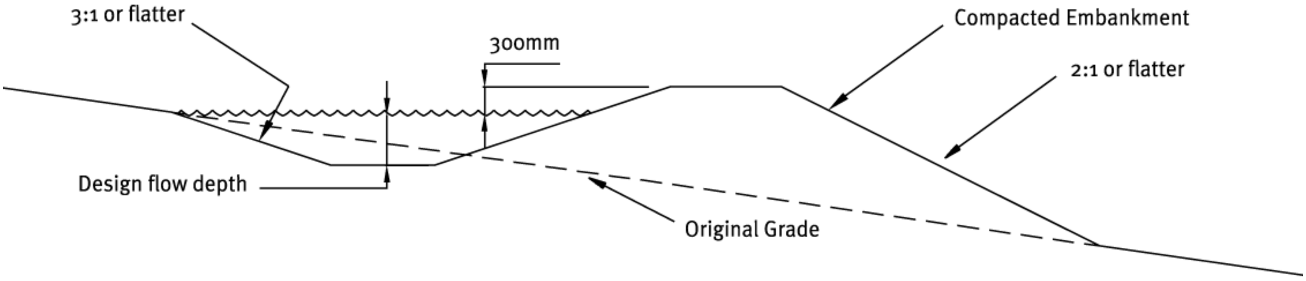
Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer Figures over page and Section E2.1 and E2.2 of GD05 for further details)	Yes ✓	No (X) (add comments to explain)
Route avoids trees, services, fence lines or other natural or built features		
Channels are trapezoidal or parabolic in shape		
Internal side slopes are no steeper than 3:1 External side slopes are no steeper than 2:1		
Drains are constructed with a uniform grade along the invert (as sudden decreases may cause sediment to accumulate causing the bank to overtop)		
Bunds are well compacted		
Outlets are stable and protected as needed		
Diversions are stabilised to prevent erosion		
In some instances this may require specific geotechnical design to ensure the stability and integrity of the structure		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.



Cross Section



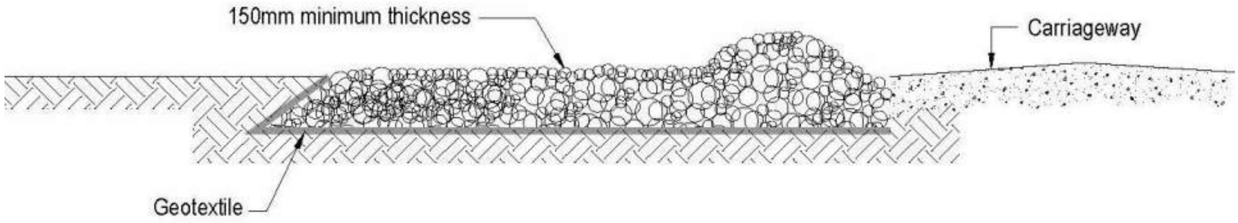
Cross Section

Appendix C1.5 Stabilised entranceway

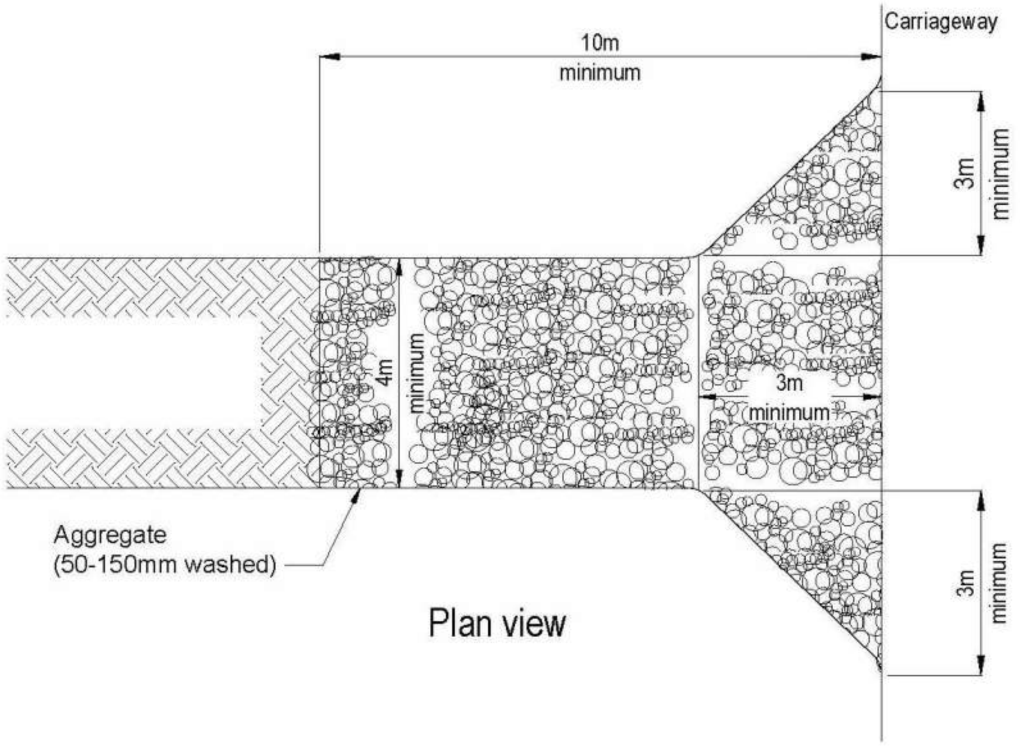
Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer figures below and Section E2.6 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
Area has been cleared of unsuitable material and smooth graded		
Woven geotextile has been placed over the area, and is properly pinned and overlapped, as necessary		
At least 10 m of aggregate has been placed (extending from site boundary), 4 m wide and minimum 150 mm deep, using 50-150 mm washed aggregate		
Vehicles cannot bypass the entranceway		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.



Side elevation



Plan view

Appendix C1.7 Topsoiling and grass seeding

Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer figures below and Section E3.1 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
Water is diverted away from the slope face prior to slope roughening		
A good seed bed has been prepared, which is loose, uniform and free of large clods		
The soil surface is not compacted		
Greater than 100 mm of topsoil has been applied		
Fertiliser has been applied according to manufacturer's recommendations or following the guidelines in the Table below		
Seed has been applied uniformly at the required rate (see Table below)		
Site conditions and time of year are appropriate for germination. As outlined in Section E3.4 of GD05, mulching has been undertaken in conjunction with the seeding programme during dry or cold periods		
Adequate watering has been provided		
Grass strike ensures site coverage is > 80%		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.

Typical seed and fertiliser application rates

	Typical seed mix[1]	Application rate
Temporary seeding	Annual Ryegrass	100-250 kg/ha
Permanent seeding	Perennial Ryegrass – 70% Fescues/Cocksfoot – 20% Clover/Lotus – 5% Browntop – 5%	200-400 kg/ha
Fertiliser application	N:P:K (15:10:10)	200-800 kg/ha
Maintenance fertiliser	N:P:K (15:10:10) and Urea	As required

Note 1**:** In all circumstances ensure that the seed and fertiliser application rates and mix is appropriate for your site. Always discuss with your seed and fertiliser supplier prior to utilisation.

Appendix C1.8 Hydroseeding

Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer Section E3.2 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
A hydroseeding contractor has been consulted to ensure correct application, and the manufacturer's recommendations have been followed		
Adequate watering has been provided		
Grass strike ensures site coverage is > 80%		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.

Appendix C1.10 Mulching

Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer Section E3.4 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
Straw or hay mulch is unrotted material and has been applied at a rate that provides a completed cover of the soil surface. This is typically in the order 4,000-6,000 kg/ha. Mulch material is relatively free of weeds and does not contain noxious weed species. A list of noxious weeds can be obtained from Auckland Council		
If wind is a problem, mulch is either crimped or bound to prevent blowing		
Hydro mulch contains a minimum of 80% virgin or recycled wood and has been applied in accordance with the manufacturer's specifications. The application rate will range from 2,200 kg/ha – 2,800 kg/ha depending on the slope gradient. The coverage should not exceed slope length < 150 m		
Wood chip is applied at rates of 10,000 kg/ha – 13,000 kg/ha		
If stockpiling woodchips on site, stockpiles are turned every so often to reduce the risk of heating		

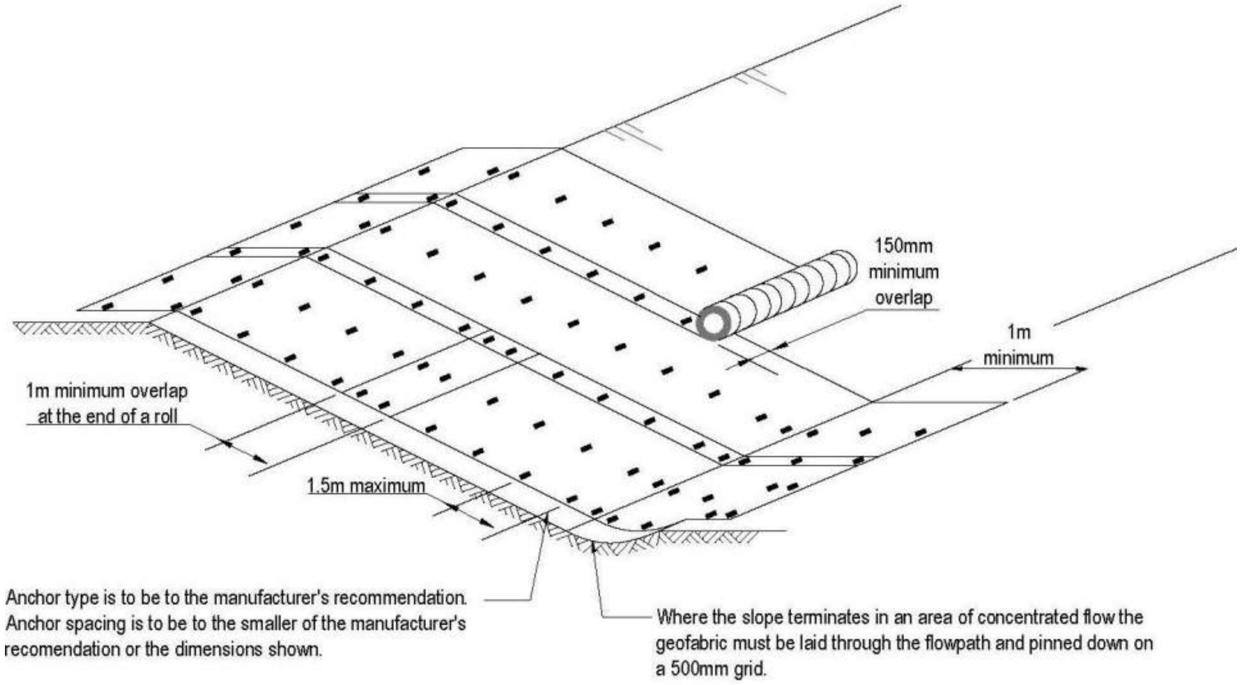
Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.

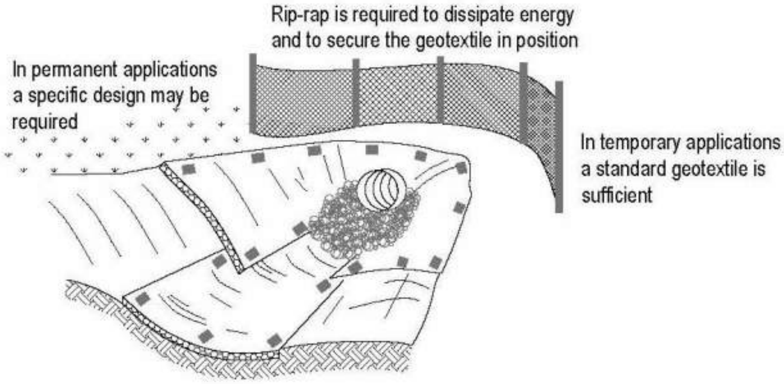
Appendix C1.11 Geotextiles and erosion control blankets

Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer figure over page and Section E3.5 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
Site is prepared to ensure complete contact of the blanket or matting with the soil		
Area is graded and shaped for installation		
All rocks, clods, vegetation or other obstructions are removed		
Seedbed is prepared by loosening 50 mm to 75 mm of topsoil		
Area is seeded prior to blanket installation unless specified otherwise		
Wire staples, stake pins or wooden stakes have been placed to anchor mats and blankets to the ground. Proper sized anchoring materials have been used		
On slopes, the blanket was started at the top of the slope and rolled down-slope		
Blanket edges are overlapped		
In channels, there is an anchor trench >150 mm deep x 150 mm across at the lower end of the project		
Intermittent check slots are installed at 8-10 m intervals		
Side fabric edges are keyed in at least 100 mm deep x 100 mm wide		
Channel fabric has been started at the downstream end with upstream geotextile overlapping < 75 mm		
Upstream end has been keyed in >300 mm x 150 mm wide		
Turf reinforcement matting has been seeded and filled with soil if specified		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.


150mm
minimum
overlap
1m
minimum
1m minimum overlap
at the end of a roll
1.5m maximum
Anchor type is to be to the manufacturer's recommendation. Anchor spacing is to be to the smaller of the manufacturer's recomendation or the dimensions shown.
Where the slope terminates in an area of concentrated flow the geofabric must be laid through the flowpath and pinned down on a 500mm grid.

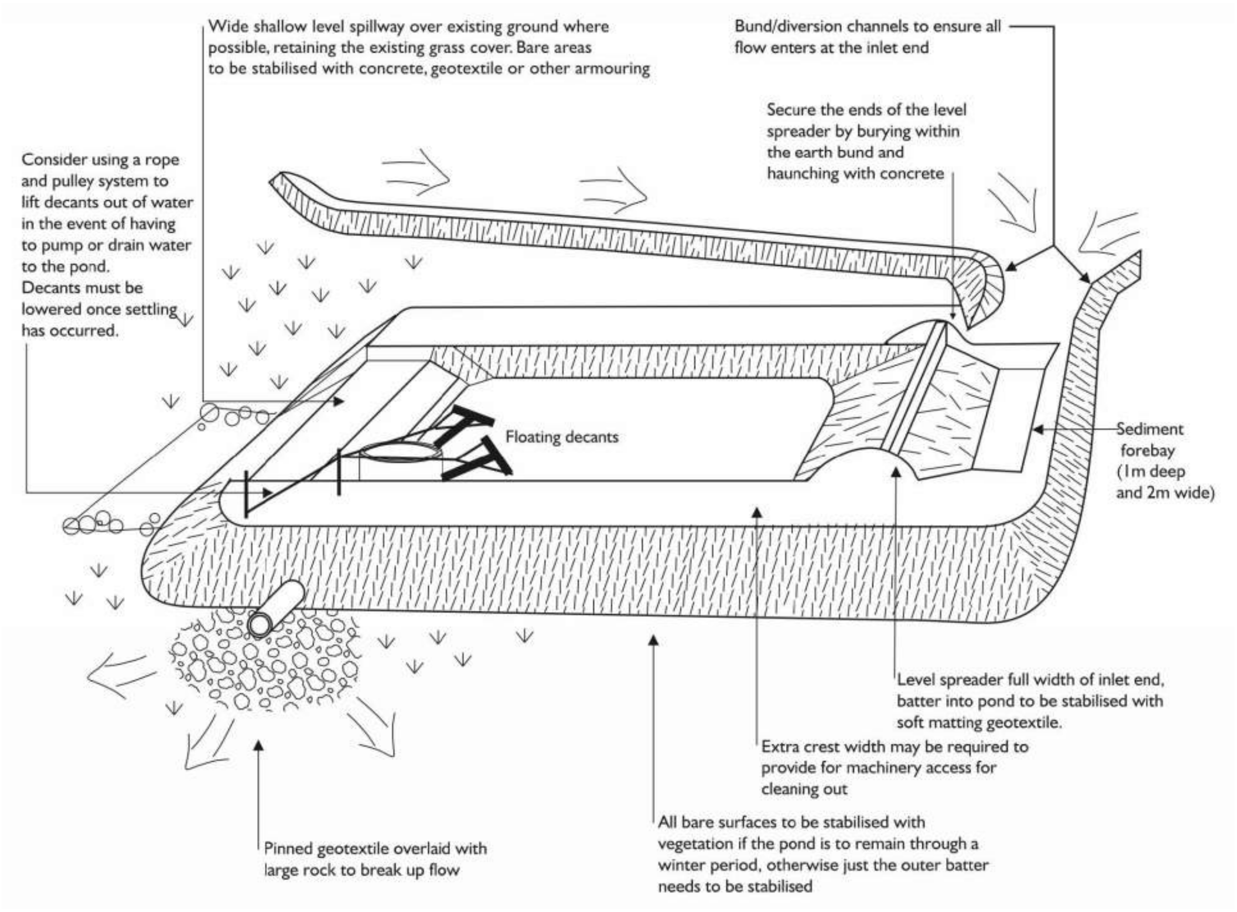

Rip-rap is required to dissipate energy and to secure the geotextile in position
In permanent applications a specific design may be required
In temporary applications a standard geotextile is sufficient

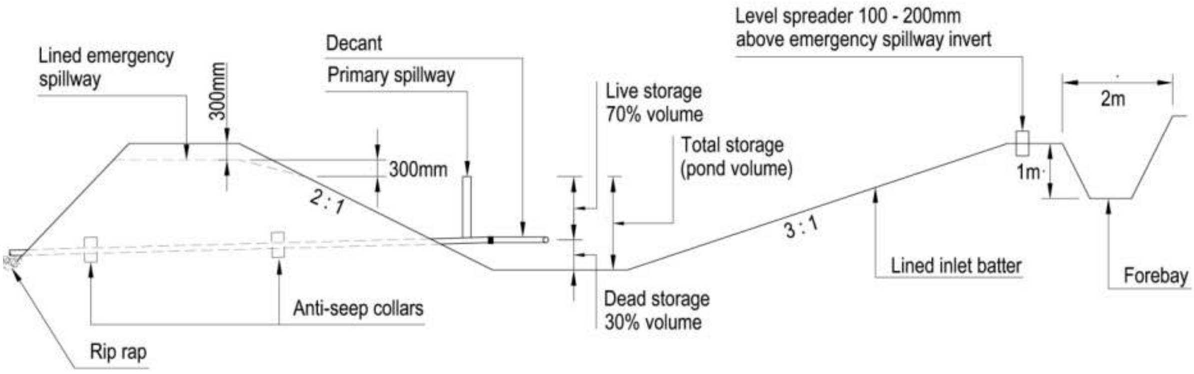
Appendix C1.12 Sediment retention pond

Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer figure over page and Section F1.1 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
Sediment control has been implemented down-slope of the proposed sediment retention pond		
Areas are cleared of proposed fill or topsoil or other suitable material down to competent material		
Only approved fill material has been used		
Fill has been placed and compacted in layers as per the engineering recommendations, and appropriate testing has been undertaken to confirm compliance		
Fill embankment has been constructed 10% higher than the design height to allow for settlement		
Pipework and anti-seep collars or filter collars have been installed during construction of the embankment, with good compaction around pipes		
The emergency spillway has been constructed as per instructions in Section F1.1.2 of GD05		
A level spreader has been installed and stabilised		
The decant and pulley system is securely attached to the horizontal pipework, with all connections watertight. Manhole risers have been placed on a firm foundation of concrete or compacted soil		
Inlets and outlets are protected with fabric		
Baffles are installed when the pond's length to width ratio < 3:1		
An all-weather access track is provided for maintenance		
All elevations have been checked to ensure proper function and rectify any inaccuracies		
Both internal and external batters and the emergency spillway have been stabilised in accordance with the approved erosion and sediment control plan		
An as-built assessment has been undertaken at the completion of construction and any discrepancies with the design rectified		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.





SRP cross - section

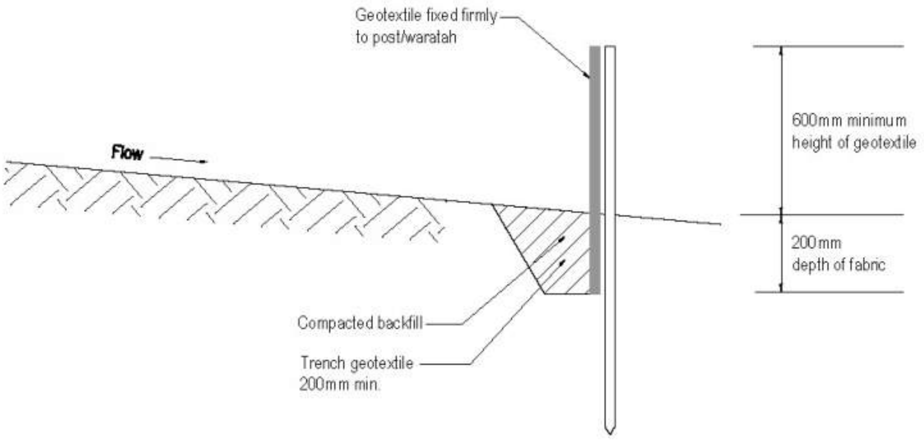
Appendix C1.14 Silt fence

Contractor:	Date: Time:	Consent #:	Site:

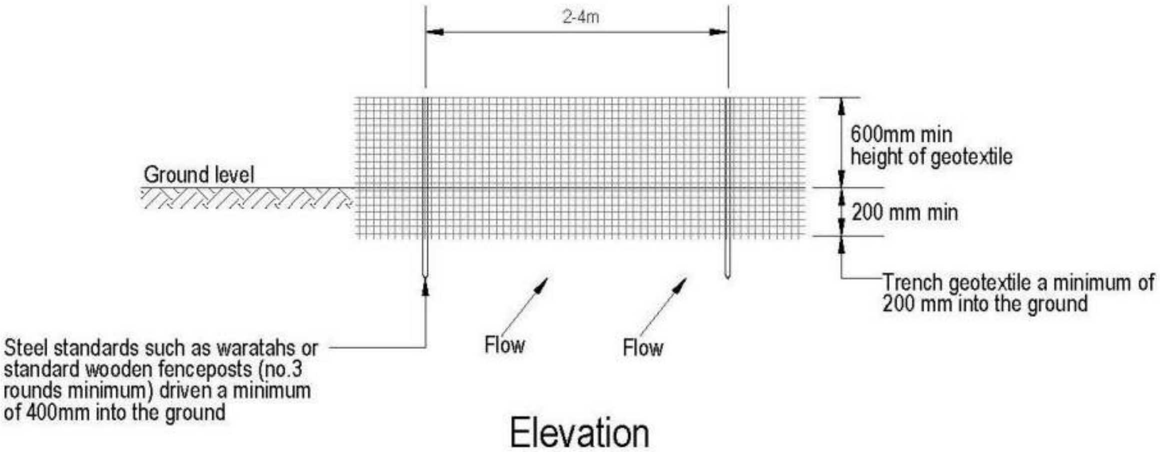
Construction checklist (refer Table and Figure over page and Section F1.3 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
The silt fence material used is appropriate to the site conditions and in accordance with the manufacturer’s specifications		
Silt fences have been installed along the contour		
A trench of a minimum of 100 mm wide and 200 mm deep has been excavated along the proposed line of the silt fence		
Supporting posts /steel waratahs are installed at least 1.5 m length and 2-4 m apart		
Support posts/waratahs are installed on the down-slope edge of the trench, with silt fence fabric on the up-slope side of the support posts to the full depth of the trench. The trench is backfilled with compacted soil		
The top of the silt fence fabric is reinforced with a support made of high tensile 2.5 mm diameter galvanised wire. The wire is tensioned using permanent wire strainers attached to angled waratahs at the end of the silt fence		
The silt fence fabric is doubled over and fastened to the wire with silt fence clips at 500 mm spacings		
Where ends of the silt fence fabric come together, they are overlapped, folded and stapled/screwed to prevent sediment bypass		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.

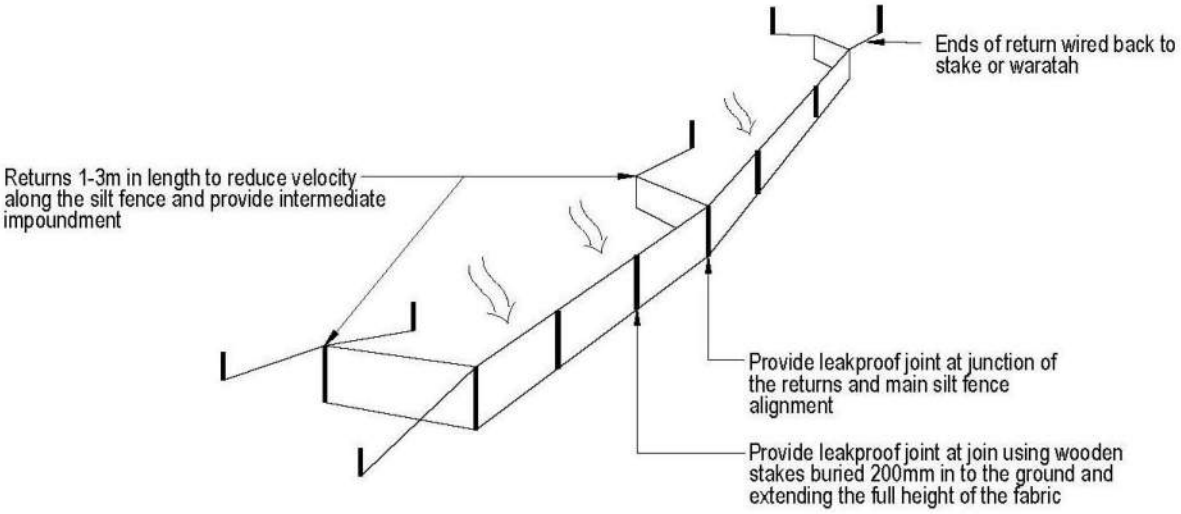
Slope steepness %	Slope length (m) (maximum)	Spacing of returns (m)	Silt fence length (m) (maximum)
Flatter than 2%	Unlimited	N/A	Unlimited
2 – 10%	40	60	300
10 – 20%	30	50	230
20 – 33%	20	40	150
33 – 50%	15	30	75
> 50%	6	20	40



Cross section



Elevation



Silt fence with returns and support wire

Appendix C1.16 Silt sock

Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer Figure below and Section F1.5 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
Silt socks are installed on the contour. Where this is not possible, or where there are long sections of silt sock, short silt sock returns are installed, projecting up-slope from the silt sock to minimise concentration of flows. Returns are a minimum of 2 m in length		
Silt socks are overlapped by >1 m and joined by a sleeve where more than one length of silt sock is used		
Silt sock "wings" are installed at either end of the silt sock, projecting a sufficient length up-slope to prevent outflanking		
The silt sock is pegged and secured, depending on the application		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.

Appendix C1.17 Stormwater inlet protection

Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer Figure below and Section F1.6 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
An emergency bypass is included		
The device does not allow water to bypass its intended flow path		
The device is removed as soon as possible following the completion of works		

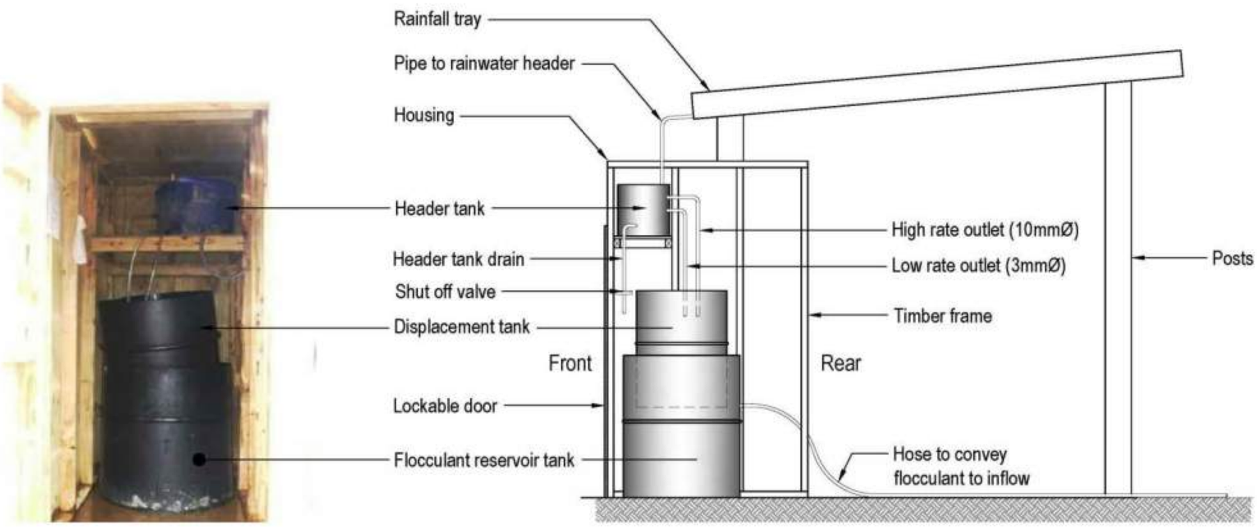
Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.

Appendix C1.18 Flocculant treatment - rainfall activated shed

Contractor:	Date: Time:	Consent #:	Site:

Construction checklist (refer Figure over page and Section F2.0 of GD05 for further details)	Yes (✓)	No (X) (Add comments to explain)
All components are on site including: • Rainfall catchment tray • Header tank • Displacement tank • Flocculant reservoir tank		
The design approach has been followed – this should provide sizing of the various elements and pipe sizes. Check that the flocculant volume has been based on site soil testing		
Rainfall tray has been constructed and sealed along any joints and graded at approximately a 10:1 slope with a drain to the header tank at the low end		
The header tank is installed properly with pipe sizes and elevations done according to plans		
The displacement tank has capacity to hold runoff from the 50% AEP event		
The flocculant reservoir tank is larger than the displacement tank and of sufficient capacity to dose a large storm		
The flocculant tank outlet is a 20 mm hose located at the point that will retain flocculant for the dosing of runoff from the 50% AEP event w/out displacement		
The dosing point of the outlet into the sediment diversion channel is at least 5 m upstream of the forebay		

Note: The purpose of this checklist is for contractors to complete on-site self-checks of construction quality for ESC practices. This is not a compliance or as-built checklist.


Rainfall tray
Pipe to rainwater header
Housing
Header tank
Header tank drain
Shut off valve
Displacement tank
Front
Rear
Lockable door
Flocculant reservoir tank
High rate outlet (10mmØ)
Low rate outlet (3mmØ)
Posts
Timber frame
Hose to convey flocculant to inflow

Appendix H

- s92 Responses

Job No: 220571/01
24/10/2023

SECTION 92 REQUEST TRACKING TABLE

3 PIGEON MOUTNAIN ROAD

	Item	Suggested Action/Response
	WW	
1.	The applicant/developer to carry out and present report on wastewater assessment to the nearest existing 300mm diameter sewer pipe as per Watercare CoP.	It is not possible to carry out assessment to the nearest existing 300mmØ sewer pipe as the existing WW drainage discharges into a Wastewater Pump Station (GIS ID 961653.)
	SW	
	SMP	
1.	There is no SMP checklist provided. Please ask the applicant to complete the checklist in the attachment.	Please refer to SMP-Rev 1. Checklist is attached as appendix B
	NDC requirement: Schedule 4	
2.	So basically, the development has not provided any treatment. Not acceptable.	Please refer to SMP-Rev 1.
	Stream Hydrology	
3.	Retention and detention need to be addressed in the SMP, even if it is not required as the site is discharging directly to the coast via pipe network.	Please refer to SMP-Rev 1. Detention systems are now proposed.
	Flooding	
4.	Zone: Residential - Residential - Mixed Housing Suburban Zone. Maximum imperviousness allowed 60%. Site is increasing imperviousness from ***** to 67.59%. Please state what is the existing imperviousness?	Please refer to SMP-Rev 1. The existing impervious areas measures to 5632.4m² (40.02%). The post imperviousness is approximately 66.47%. Detention systems are now proposed to limit the site runoff to no greater than existing site runoff for the 10% AEP rainfall events.
	Flooding 10% AEP: Mitigation needed for large brown field.	

5.	Flooding 10% AEP: For a large brownfield the capacity assessment of the full network downstream after the connection up to the outlet is needed as per NDC. Only the pipe to first manhole after the connection is presented. Also, the contributing catchment area is not correctly represented. The runoff coefficient is not correct. Not sure how the existing connection pipe slopes are calculated but for 300mm its not matching with as-builts. Not acceptable.	The 300mmØ drain (2000633032) grade was calculated from as-built plan obtained from property files. As per as-built plan, the subject site is currently connected to the public network via a stormwater connection off SWMH 2000234285. The two immediate pipes to first manhole already shows the pipe network is at capacity, hence, there isn't much point assessing the full network capacity assessment. Detention systems are now proposed to limit the site runoff to no greater than existing site runoff for the 10% AEP rainfall events.
6.	The proposal disregarded any attenuation stating location of the development 250m away from the coast. This principle is only applies for a very large catchment. Not applicable for subject catchment. Attenuation is needed. Not acceptable.	Please refer to SMP-Rev 1. Detention systems are now proposed to limit the site runoff to no greater than existing site runoff for the 10% AEP rainfall events
7.	The proposal is also exceeding the maximum zone impervious limit to 7.6%. Attenuation is needed. Not acceptable.	Please refer to SMP-Rev 1. Detention systems are now proposed to limit the site runoff to no greater than existing site runoff for the 10% AEP rainfall events
	Flooding 1% AEP: Mitigation needed for large brown field.	
8.	Cannot assess the post development overland flow path properly. Cannot understand properly the impact of the overflow due to development at downstream. If the change is adverse, then mitigation is needed. Please clearly demonstrate the impact with care, proper references, and adequate information. A proper map showing the post development overland flow path alignment and changes of flow to existing condition is needed.	Please refer to OLFP Assessment-Rev 1. Post Development Depth-Velocity products for overland flows within and discharging from the subject site are all less than 0.4 m^2/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The increase in 1% AEP runoff from the site is **95L/s** (431 - 336). This equates to around **2.2% increase only (**0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina

		business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow.
9.	Please provide assessment of flow paths within the subdivision.	Please refer to OLFP Assessment-Rev 1. The post developed areas have been split into 12 smaller catchments to assess the overland flow paths within the subdivision. Post Development overland flow depths are all less than 100mm and the Depth-Velocity products are all less than 0.4 m^2/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai.
10.	Please provide assessment flow paths exiting the site for both pre and post development scenarios. Assessment will need to cover the entire site.	Please refer to OLFP Assessment-Rev 1.
11.	Please show post development overland flow path in a map. Cannot understand the statement without a proper map. Please also show the delineated catchment for each of overflows in map.	Please refer to Catchment plan in the appendix of OLFP Assessment-Rev 1. The post developed areas have been split into 12 smaller catchments to assess the overland flow paths within the subdivision.
12.	Please provide reference locations for all the cross-section provided in Overland Flow path calculation, Appendix-A in infrastructure report. Cannot understand where these cross-sections are taken. Please use Map. Also please include long sections.	Please refer to OLFP Assessment-Rev 1. The post developed areas have been split into 12 smaller catchments to assess the overland flow paths within the subdivision. Please refer to OLFP Plans.
13.	Demonstrate the changes from existing condition. Need to understand the change to existing condition otherwise cannot complete the assessment.	Please refer to OLFP Assessment-Rev 1. Post Development Depth-Velocity products for overland flows within and discharging from the subject site are all less than 0.4 m^2/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered

		safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The increase in 1% AEP runoff from the site is **95L/s** (431 - 336). This equates to around **2.2% increase only (**0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow.
14.	I understand the affected overflows will originate from site but need to clearly demonstrate the downstream impacts due to the increase in impervious area. Will the flood level downstream increase from existing flood level. What is the impact on downstream property floor levels?	Please refer to OLFP Assessment-Rev 1. Post Development Depth-Velocity products for overland flows within and discharging from the subject site are all less than 0.4 m^2/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The increase in 1% AEP runoff from the site is **95L/s** (431 - 336). This equates to around **2.2% increase only (**0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow.
15.	Any modification to overland flow will trigger assessment against E36.9. Please submit E36.9 assessment. Please identify and quantify the risk and hazard (v*d) for the common accessways where the overflows will pass through. Guide line attached can be used to complete the assessment.	Please refer to OLFP Assessment-Rev 1. Post Development Depth-Velocity products for overland flows within and discharging from the subject site are all less than 0.4 m^2/s. As per Pedestrian and Motorist Flood Safety Study (GNS Science Report 2010/51, Nov 2010), the flow paths are considered safe to pedestrian and motorist and safe to discharge across the pedestrian footpaths along Pigeon Mountain Road and Ara-tai. The increase in 1% AEP runoff from the site is **95L/s** (431 - 336). This equates to around **2.2% increase only (**0.095/4.375) for the 1% AEP overland flow across Pigeon Mountain

		Road and into the Halfmoon Bay Marina business complex car park. This small increase in flow across the Marina Carpark has negligible increase in the depth of overland flow.
16.	Any new assets to be vested to Council need to be clear in the SMP.	Please refer to SMP-Rev 1. The new assets proposed to be vested with Council are: • SW1 up to SW Filter 1 – 33.7m (11.6+22.1) of 300mmØ uPVC SN16 and 1 x SWMH • SW4 up to SW Filters 2– 28.8m (3.8+25) of 300mmØ uPVC SN16 and 1 x SWMH • SW5 and SW 6 up to SW Filter 3 – 76.6m (68.9+7.7) of 300mmØ uPVC SN16 and 1 x SWMH .
17.	A manhole or chamber is needed instead of end cap according to SW CoP Table 7 and 9.	This can be addressed at EPA stage.
18.	Drainage plan will be checked in details during EPA stage.	Noted with thanks

Yours faithfully
AIREY CONSULTANTS LTD

Weng

Samson Weng
Civil Engineer
BE Hons (Civil)

Reviewed and approved by
AIREY CONSULTANTS LTD

Royden Tsui

Royden Tsui
Associate Director
CPEng(NZ), CMEngNZ, IntPE(NZ), MEPM (hons), BE (Civil)

Job No: 220665/01
29 May 2024

Auckland Council
Private Bag 92 300
Victoria Street West
AUCKLAND 1141

Dear Sir/Madam,

EPA Consent number:	BUN60419132
Address:	3 Pigeon Mountain Road
Description:	87 Residential Dwelling Development

We respond to your s92 RFI dated 15/May/2024 requesting further information with respect to the above development. We respond to the items relevant to our inputs as below:

Wastewater

"There is a likely network constraint at the Half Moon Bay Marina Pump Station, and additional flows from this development application (with a PWWF of 3.85 l/s) will likely result in a significant increase in the frequency and volume of overflows from the Engineered Overflow Point (EOP), and as such the impact of the proposed development is considered more than minor. Appropriate network upgrades will need to be identified in consultation with Watercare but are likely to involve an upgrade of the pump station (subject to sufficient capacity being available in the downstream transmission network), and/or provision of additional network storage."

The comments from WSL are noted and it is agreed that additional investigation will be undertaken at the EPA stage.

The following preliminary comments are noted.

The calculated **Existing** Peak Wastewater Design flow for the site is **0.75 L/s** and the calculated **Post-Development** Peak Wastewater Design flow for the site (87 dwellings @ 3 people each as per WSL COP) is **3.64 L/s**. This is an **increase of 2.89 L/s**.

A review of last Watercare's published Network Discharge Consent (**NDC**) **Annual Reports** from 2020 to 2023 indicates that the Half Moon Bay Marina Wastewater Pump Station (ID# DPHMB) Overflow (ID# 1168) did not overflow within the reported timeframes. Anecdotal information indicated that the DPHMB Overflow has an average annual spill frequency of less than one when the NDC application was lodged. This information suggests that the pump station is performing within the acceptable limits of the NDC (i.e. an average of two or less per annum) and is not currently constrained. In addition, the report notes that the pump station has **4-8 hours storage** and the **public health risk and ecological risk** from an overflow is **low to very low**, respectively.

Auckland-wide Network Discharge Consent 2020-2021 Annual Report
Auckland-wide Network Discharge Consent 2021-2022 Annual Report
Auckland-wide Network Discharge Consent 2022-2023 Annual Report

It would be much appreciated if Watercare could share their wastewater pump station data for overflow frequency, pump performance, volume and flowrate…etc. with us for discussion.

At this stage, it is our belief the DPHMB is not constrained based on Watercare's published information. However, if the pump station is confirmed to be constrained and increases the public health and/or ecological risk above the consent limits, there are several different methods that can be considered to mitigate the additional peak design flows. A possibility is to install a holding tank offering additional storage with a submersible pump to capture the sewage and pump it back to the wastewater pump station during off-peak hours. This should minimize any effect from the additional sewage discharge to the transmission network.

We consider this should be further assessed during the EPA stage. Subject to the pump station data providing us, we will carry out investigation in the next phase to assess what will be the most appropriate and feasible option for the Developer, Council and Watercare.

Stormwater

1. The development is exceeding the imperviousness limit to 64.83%. Need attenuation for the additional area up to 1%AEP**.**

Note that the total impervious area is **68.4%**.

As per AUP E8.6.1 (3)(b), diversion and discharge must not result in or increase the inundation of buildings on other properties in events up to the 1% AEP rainfall events. Please refer to the pre and post flooding analysis for Pigeon Mountain Road and Marina Car Park (s92 queries 7 and 8). The increase in runoff has **negligible increase in flood depths** as outlined in our reply to item 7 below. Consequently, the increase in imperviousness does not result in or increase the inundation of building on other properties for the 1% AEP rainfall event and, thus, 1% AEP attenuation is considered not necessary.

Moreover, as we discussed previously, the **GD01** suggests that detention of 10% and 1% AEP rainfall events is not required for developments that are located within the lower half of the catchment (or for which a validated flood modelling study has shown that the development does not increase downstream flooding). To satisfy your request earlier, we allowed detention for the difference between pre- and post-development runoff in a 10% AEP rainfall event in our stormwater design.

Because we proposed the detention, the site is located in the lower half of the catchment and the increase in runoff is considered minimal, it is our opinion, therefore, that the stormwater detention outcomes have been mitigated as required under the AUP.

2. Keeping SW assets private (yellow highlighted SW lines) serving multiple properties inside the fee simple subdivision is a deviation of SW CoP. Hence not acceptable. The attenuation and treatment devices need to be separated from the main line and to be vested to council. Detail engineering can be checked at EAP stage.

The design of development has taken an inter-disciplinary approach to develop a fit for purpose stormwater management solution, taking into account the constraints of the site to deliver housing that is economically viable. This has included specialised input from land surveyors, urban designer and geotechnical experts.

As per AUP requirement, the development requires appropriate stormwater attenuation and quality treatments.

The proposed solution of Stormwater 360 filters and communal attenuation storage tanks has been determined to be the best practical option for servicing the development with stormwater. Alternative options were considered by the designers, but they did not meet the overall requirements for the development, as explained further in this s92 reply. It is noted that the stormwater quality effects of the development are mitigated by the proposed solution, as the Stormwater 360 filters are an “approved” stormwater treatment device by Auckland Council.

In addition, the use of centralised proprietary devices minimises the number of devices and land required, that subsequently minimises the carbon footprint of the development. As less material is required, there will be less construction ground disturbance and it minimises crew mobilisation for construction, maintenance, and operation. This is consistent with the requirement of **minimising of carbon footprint** as set out in the **Stormwater Bylaw 2015** (as at 30 May 2022) and consistent with **Auckland Council’s climate change policy to reduce greenhouse gas emissions**.

Therefore, it is our opinion that the stormwater treatment and attenuation outcomes have been mitigated as required under the AUP.

However, as Healthy Waters will not accept the vesting of the “approved” Stormwater 360 devices or communal attenuation tanks, the proposed stormwater network is required to be remain private. As the private system will not be servicing any upstream catchment in the future, there is no risk of the system being connected to by others.

The development will have a residents’ society (or similar) in place to operate and maintain the jointly owned assets. The arrangement is similar to that of looking after the jointly owned accessway or communal rubbish collection and does not hinder the development’s proposed FEE SIMPLE arrangement. Therefore, the potential effects of a privately operated stormwater systems have been appropriately mitigated, as the proposed solution using Stormwater 360 filters and communal attenuation storage tanks is specifically tailored for this development.

3. The stormfilter360 is a high cost maintenance device that will impact on the occupants. It is requested to explore other more cheaper, sustainable and natural devices (like swale & tree pit combination) for water quality treatment of hardstand areas. The roof water treatment can be excluded from stormfilter 360, instead inert roof material with non-potable reuse for irrigation can be considered as BPO. This may also reduce water consumption that will be needed for the green area**.**

Noted. However, we have taken an integrated approach to the design of the stormwater system considering all of the constraints and requirements for the development. Therefore, we consider Stormwater 360 filters are preferable due to the following reasons:

- Swale needs lots of space & area which we do not have in our situation.
- Tree pits (e.g. Filterra or similar) are even going to be more expensive, as we will need to put down not just one but multiple numbers of them in the driveway (i.e. one is required at each catchpit). Eventually, they will all add up to be similar or even more expensive than stormwater 360 filters.
- Additionally, it is noted that the site has substantial common areas which will be managed by a Residents Association (including landscaped areas and hard surfaces).
- The development is also for 87 dwellings. It is considered that the cost can be easily shared by the development.

In view of the above, we consider that the treatment by stormwater 360 devices is the best practical option and is far more suitable in this instance.

4. The build over, yellow highlighted lines shown below on new pipes SW 1 and SW4 (missing from the plan but shown in the long section for SW4, the black * line shown below) are not recommended as per SW CoP and will only be considered by Auckland Council in exceptional circumstances where no suitable alternative exists. Please change the building footprint or divert the pipe or provide other solution to avoid build over**.**

This item is considered to be an EPA issue and we propose to resolve this at the EPA stage.

Building over new pipes are proposed for the following reasons:

- The proposed development is a medium intensity development to the Half Moon Bay. Consequently, no other suitable alternative exists in this circumstance.
- An alternative is to concentrate flows to one single downstream pipe, which is not recommended as this will overload the already at capacity pipes.
- The new dwellings being built over the pipes will have pile bridging to the Council's requirement to prevent loading the stormwater pipes.

To facilitate the operation & maintenance for these pipes, they will be encased within a larger concrete pipe to i) provide extra protection for the pipes, and ii) facilitate pipe replacement when needed in the future.

5. There is already public assets existing along proposed pipe SW5. Asset duplication is not acceptable. Please use the existing line to avoid duplication**.**

This item is considered to be an EPA issue and we propose to resolve this at the EPA stage.

Nevertheless, the existing 230mmØ concrete pipe to the east is at capacity and its condition is unknown. Subjected to CCTV condition survey and further investigations, we could work with the Council to look into potentially redirecting the flows from the 230mmØ concrete pipe to new stormwater pipes under the pedestrian footpath.

6. The existing public pipe on the east (installation 1975) is very old in compared to pipe on the west (installation 2003). Council data base do not have information on the pipe condition at west. It is advised to conduct a CCTV investigation from the site connection location up to the final outlet if possible or at least where maximum loading exerted such as parking area, cross-ways, roads etc. to understand the pipe condition. The pipe may need replacement/upgradation if the condition is very bad. Council may contribute depending on the budget availability and feasibility study**.**

This item is considered to be an EPA issue and we propose to resolve this at the EPA stage.

Nevertheless, the existing 230mmØ concrete pipe to the east is at capacity and its condition is unknown. Subjected to detailed CCTV condition survey and further investigations, we could work with the Council to look into potentially redirecting the flows from the 230mmØ concrete pipe to new stormwater pipes under the pedestrian footpath.

Any pipes further downstream of stormwater manhole 2000323535 is outside the scope of our investigation, as 10% AEP stormwater attenuations are provided for the development as per the Council's request in the early stage.

7. All the overland flows will concentrate at the intersection of Pigeon and ATA-TAI road will flow into the Halfmoon bay parking area. It is advised to conduct overland flow path assessment at the intersection to understand that it will be safe and will not cause any flooding problem or damages. Risk and hazard need to be identified and assessed. There area a lot guidance document available to do this. It is suggested to use Australian Disaster Resilience Handbook Collection GUIDELINE 7-3 (attached). The Risk and hazard assessment shall be done for all the overland flows on all existing and developed flow paths to ensure safety**.**

Please refer to Pigeon Mountain Road Overland flow/flood assessment based on topographical survey received. The pre- and post-development flood depths are determined to be only some 227mm and 229mm, respectively. It is in our opinion, the 2mm increase in flood depth is negligible.

The depth-velocity product for flow in Ara-Tai/Pigeon Mountain Road:

Existing – 0.227 * 1.543 = 0.350 m^2/s

Post – 0.23 * 1.551 = 0.355 m^2/s

As per GNS Science Report 2010/51 (Nov, 2010), Depth and Velocity product >0.4 m^2/s is considered significant hazard to small children. Additionally, vehicles become unstable if flood depth is greater than 0.3m. Flow depths for pre- and post-development scenarios are less than 0.3m. The DV products are determined to be less than 0.4 m^2/s.

Consequently, the post development flow does not change the hazard classification and it is considered **low hazard** for children, adults and vehicles.

8. The overland flow path assessment at Marina Carpark is only showing the post development flood level but does not includes the predevelopment flood level. Requested to add the predevelopment flood level to compare**.**

Please refer to Marina Carpark Overland flow/flood assessment based on topographical survey received. The pre- and post-development flood depths are determined to be 116mm and 117mm respectively. It is in our opinion, the 1mm increase in flood depth is negligible.

The depth-velocity product for flow for Marina Carpark:

Existing – 0.116 * 1.409 = 0.163 m^2/s

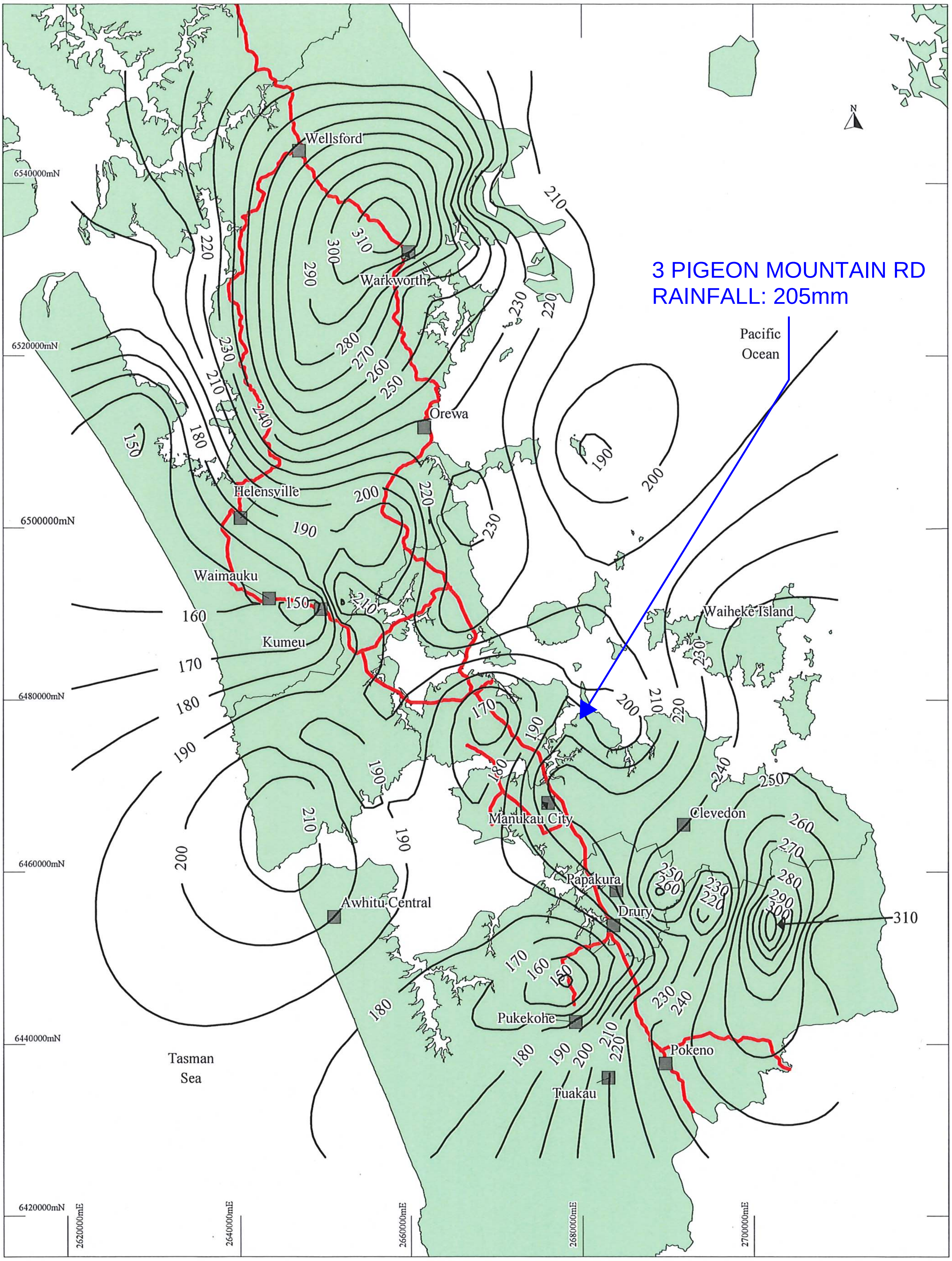
Post – 0.117 * 1.418 = 0.166 m^2/s

As per GNS Science Report 2010/51 (Nov, 2010), Depth and Velocity product >0.4 m^2/s is considered significant hazard to small children. Additionally, vehicles become unstable if flood depth is greater than 0.3m. Flow depths for pre- and post-development scenarios are less than 0.3m. The DV products are determined to be less than 0.4 m^2/s.

Consequently, the post development flow does not change the hazard classification and is considered **low hazard** for children, adults and vehicles.

I trust this meets with your approval. Please do not hesitate to contact us should you have any queries or require further information.

Yours Faithfully AIREY CONSULTANTS LTD	Reviewed and approved by AIREY CONSULTANTS LTD
Weng	Royden Tsui
Samson Weng **Civil Engineer** BE Hons (Civil)	**Royden Tsui** **Associate Director** CPEng(NZ), CMEngNZ, IntPE(NZ), MEPM (hons), BE (Civil)



3 PIGEON MOUNTAIN RD
RAINFALL: 205mm

Legend: — 90 — Rainfall Contour (mm)

State Highways

Auckland **Regional** Council

Figure A.6
100 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)

(Revised 25/08/1999)

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\100yrari.wor Date: 25/08/1999

Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Rd Half Moon Bay		**Job No:** 220517/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	17/01/2022

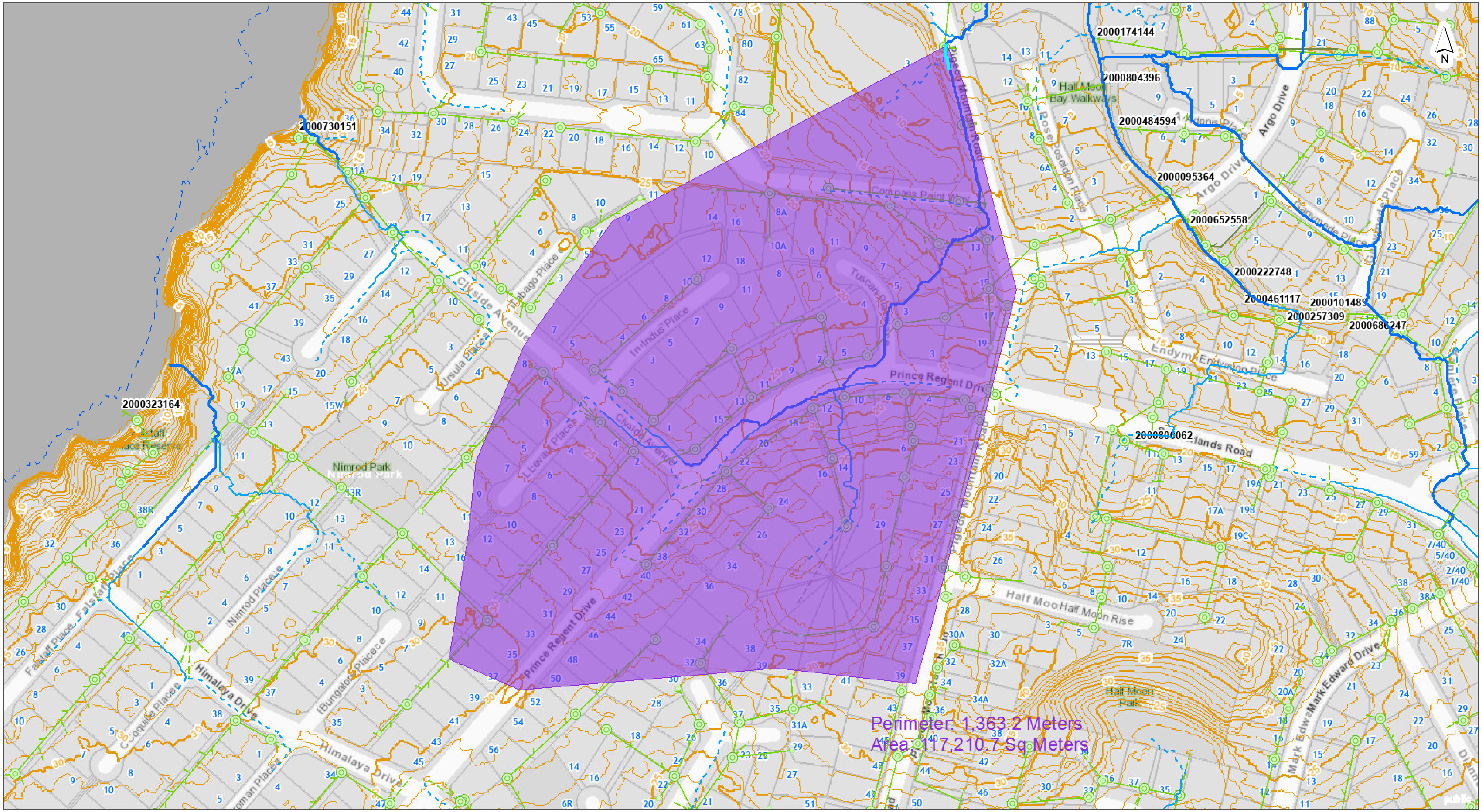
TP108 Rainfall

Rainfall Depth	205	mm
ARI	100	years

Duration hr	**Duration** mins	**Depth** mm	**Intensity** mm/hr (Q_{10})
0.166	10.0	27.58	**166.17**
0.333	20.0	42.42	127.38
0.5	30	52.32	104.64
1	60	73.75	73.75
2	120	99.61	49.80
6	360	152.28	25.38
12	720	195.38	16.28
24	1440	**239.44**	10.06

ARI	Ratio
2	9.0%
5	11.3%
10	13.2%
20	15.1%
50	16.8%
100	16.8%

ARI:	100
Ratio:	16.8%



DISCLAIMER:
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Height datum: Auckland 1946.

PMR OLFP CATCHMENT

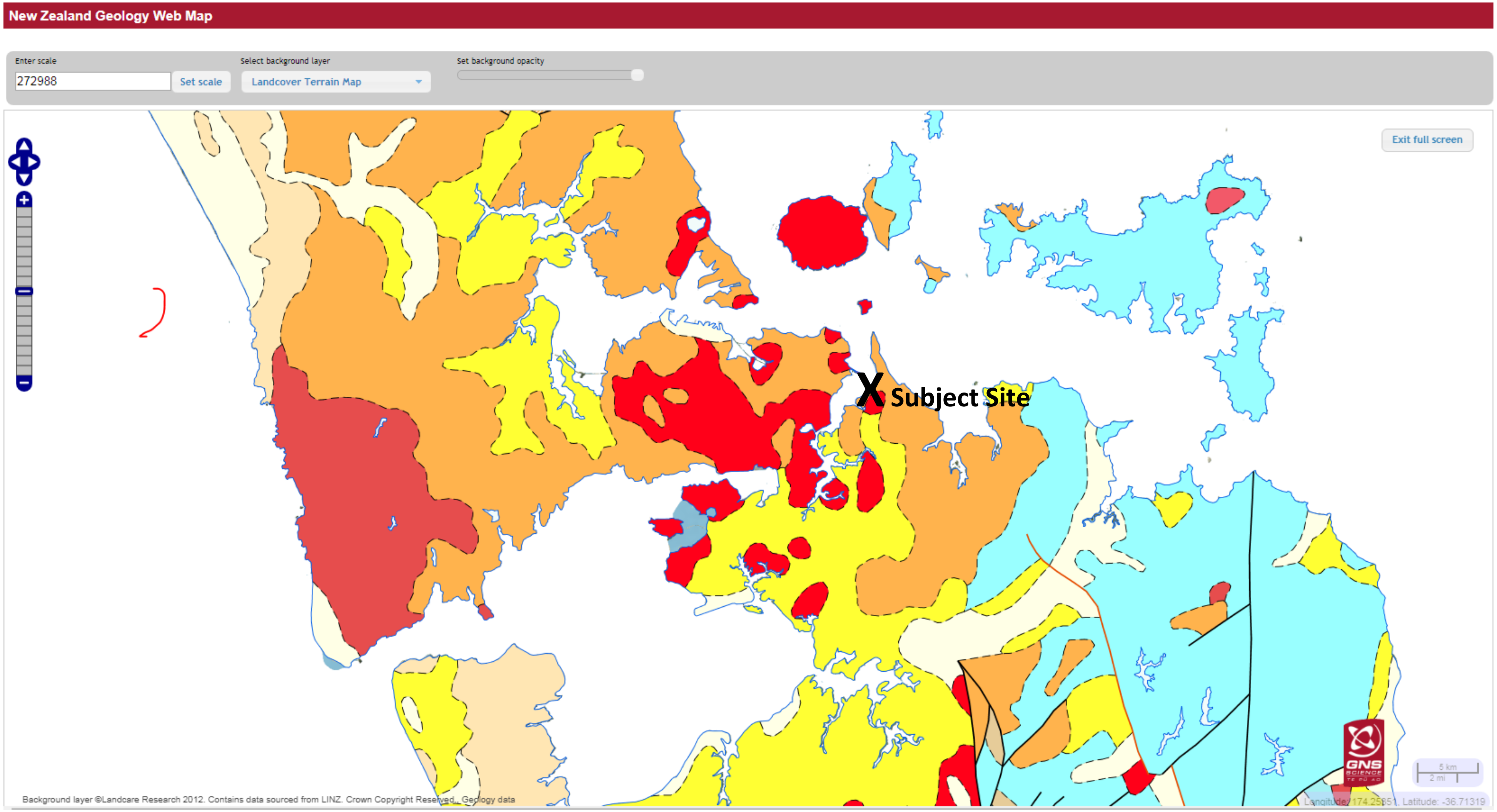
0 25 50 75
Meters

Scale @ A3
= 1:2,500

Date Printed:
17/02/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau

GNS - Auckland Geology Map: 3 Pigeon Mountain Road, Half Moon Bay, Auckland



Enter scale: 272988

Select background layer: Landcover Terrain Map

Background layer ©Landcare Research 2012. Contains data sourced from LINZ. Crown Copyright Reserved., Geology data

BROWN AREAS: **TP108 Clay - Runoff Curve Number CN=74**

Plot symbol	eM
Name	Waitemata Group
Description	Interbedded, graded sandstone and siltstone or mudstone, massive mudstone and sandstone; local intercalated volcanic grit, breccia and conglomerate, and minor bioclastic limestone.
Geologic history	Early Miocene
Simple name	Zealandia Megasequence Mainly Marine Sedimentary Rocks (Neogene)

Airey

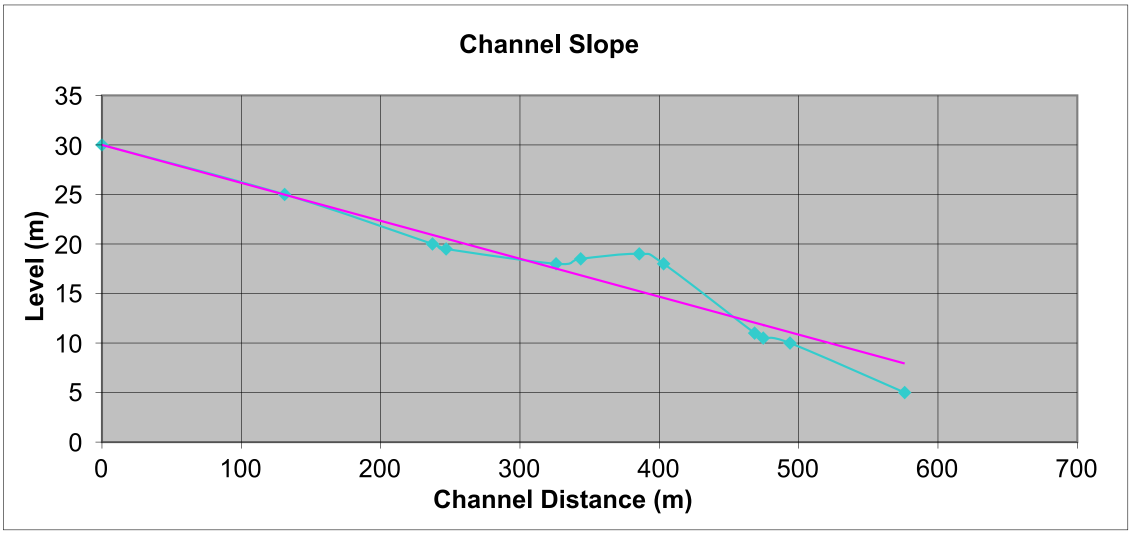
Civil, Structural
and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	8/09/2023

CATCHMENT SLOPE ANALYSIS
SLOPE CALCULATIONS - EQUAL AREA METHOD - TP10 FOR PMR OLFP

Description	Level (m)	Incremental distance (m)	Running distance (m)	"Area" from TP108	Average Slope Level
Inlet point	30	0	0		30
	25	131.1	131.1	3605.25	25
	20	106.1	237.2	2387.25	21
	19.5	9.8	247	193.55	21
	18	78.9	325.9	1479.375	18
	18.5	17.7	343.6	323.025	17
	19	42	385.6	787.5	15
	18	17.5	403.1	323.75	15
	11	65.3	468.4	946.85	12
	10.5	6.2	474.6	66.65	12
	10	19.2	493.8	196.8	11
	5	82.3	576.1	617.25	8
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
				0	30
Channel length (m)			**576.1**	10927.25	
Average Channel Slope	**-0.03830**				



Airey Civil, Structural and Fire Engineers Takapuna **Botany** Queenstown	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By: SW	**Phone:**	**Date:**
	Reviewed By: RCHT	09 534 6523	15/05/2023

Hydrographs- SCS Method:

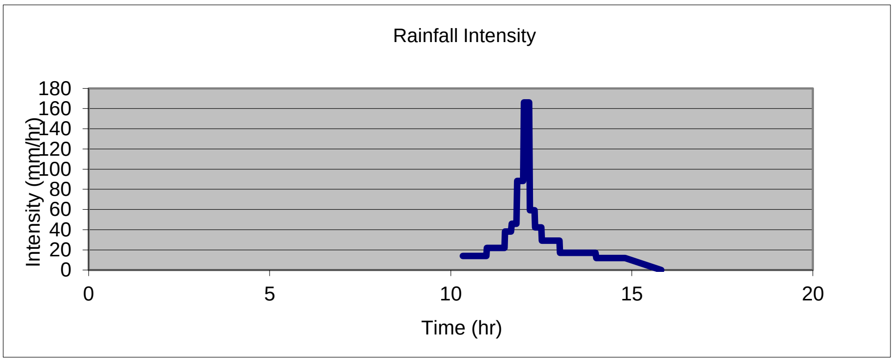
Rainfall Depth (mm) 239.44 100 YEAR ARI

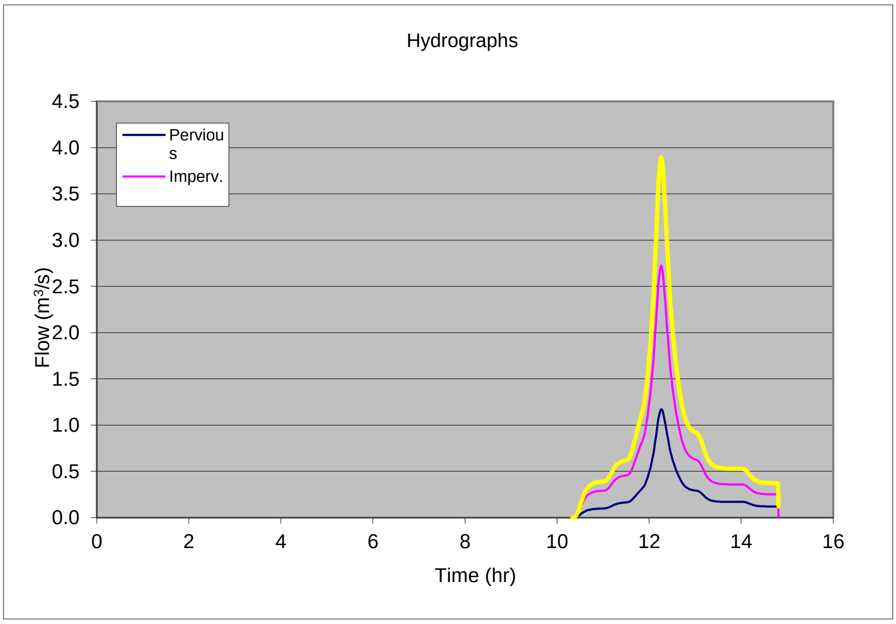
Catchment Data	Pervious Ar	Impervious A
Area (ha)	4.10	7.62
Runoff No (CN)	74	98
Initial Loss (Ia-mm)	5	0
Channel Length (L-m)	576.1	576.1
Channel Slope (Sc-m/m)	0.0383	0.0383
Channel Factor (CF-0.6 to 1.0)	0.8	0.6
Time of Concentration (tc-min)	16.7	16.7
Soil storage (S-mm)	89.2	5.2

Notes:

1. Inputs
2. Typical inputs for CN, Ia, CF are in 'Typical Inputs' Sheet.
3. Method based on ARC TP108.
4. Maximum Impervious area = 65% for Urban areas to AUP H2.

Outputs			Total
Runoff (mm)	169.8	234.4	211.8
Peak Flow (m^3/s)	1.172	2.726	**3.897**
Time (hr) at Peak Flow	12.26	12.26	12.26
Rainfall (mm/h) over tc	131.55	131.55	131.55
Runoff Coefficient - Peak	0.78	0.98	0.91
Runoff Coefficient - Volume	0.71	0.98	0.88





Airey

Civil, Structural
and Fire Engineers

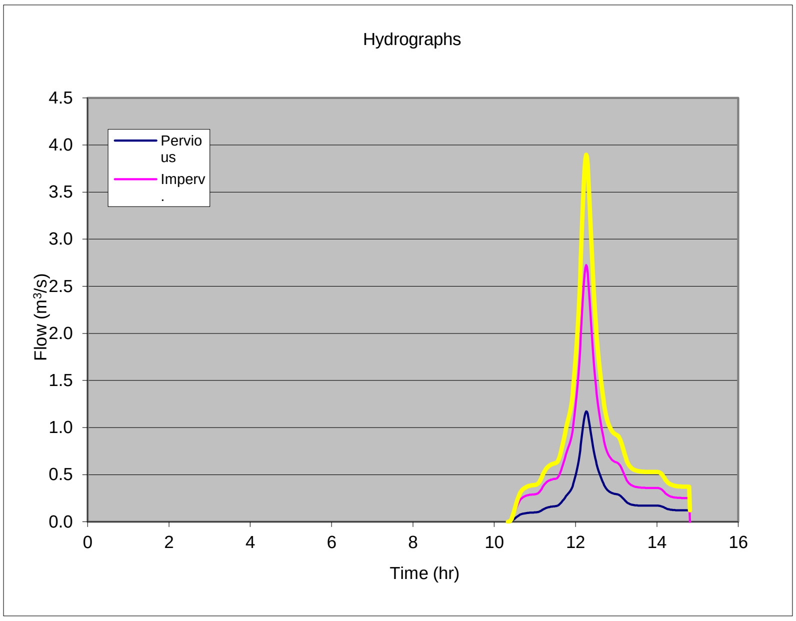
Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road Bombay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	15/05/2023

Hydrographs- SCS Method:

Total Hydrograph in tabular form: (based on simualtion from above)

Volumetric error in scaling 1.84%



Time (hr)	Flow (m^3/s)
10.336	0.000
10.891	0.384
11.121	0.432
11.298	0.574
11.447	0.615
11.578	0.653
11.696	0.849
11.805	1.061
11.907	1.275
12.002	1.735
12.092	2.388
12.178	3.337
12.260	3.897
12.310	3.704
12.360	3.255
12.412	2.753
12.465	2.309
12.519	1.977
12.574	1.709
12.631	1.480
12.689	1.286
12.749	1.135
12.810	1.035
12.874	0.977
12.940	0.943
13.008	0.922
13.079	0.891
13.153	0.802
13.230	0.686
13.311	0.604
13.397	0.563
13.488	0.543
13.587	0.534
13.694	0.531
13.812	0.529
13.946	0.529
14.105	0.511
14.313	0.403
14.813	0.121
-1.000	0.000

Airey Civil, Structural and Fire Engineers	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Road		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** SW **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 11/10/2023

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project Whole Site **By** SW **Date** 11/10/2023

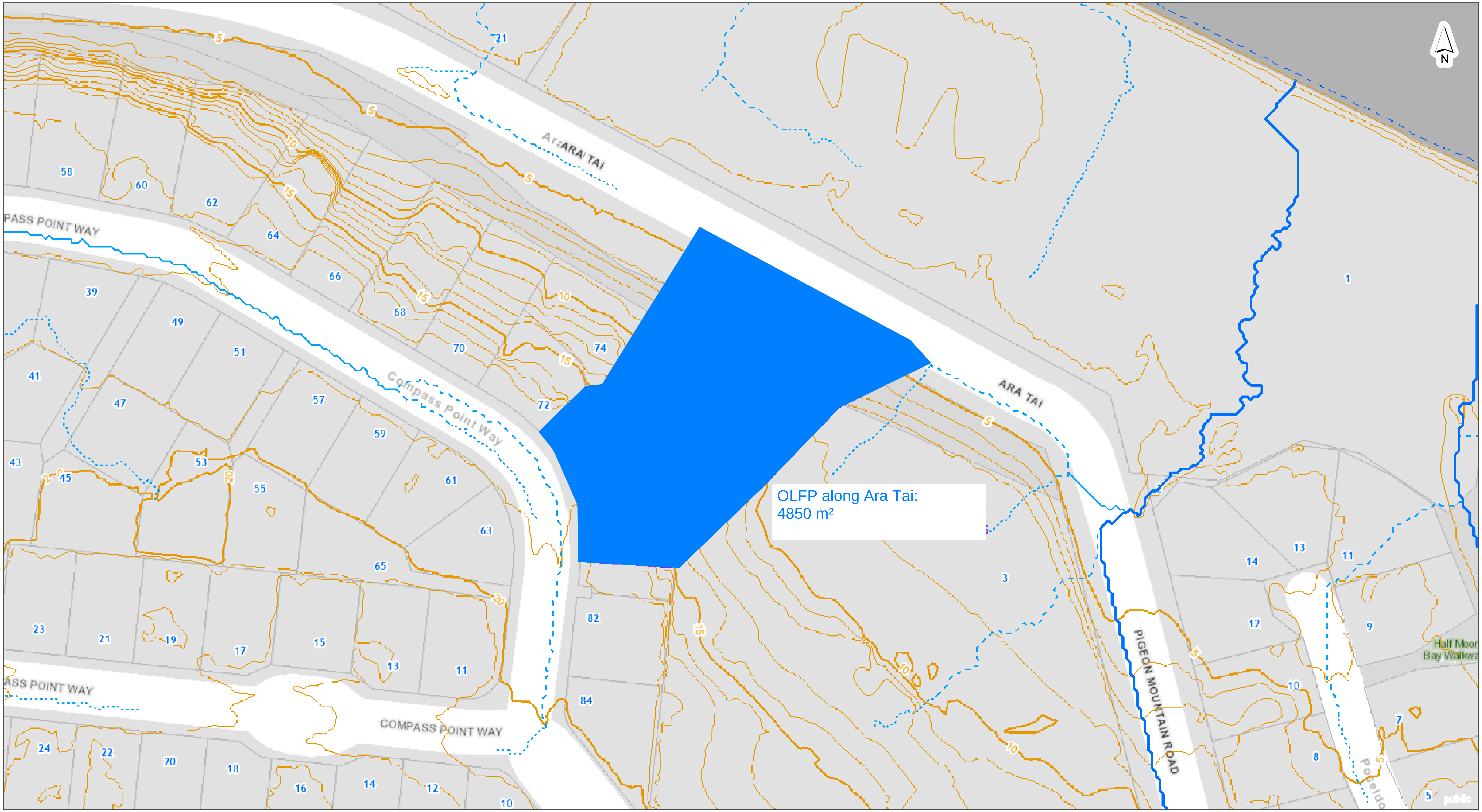
Location 3 PMR **Checked** RCHT **Date**

Circle One [✓ **Present**] **Developed**

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.298	0.27
	Impervious areas - Pavement	0.85	0.265	0.23
	Pervious areas	0.3	0.844	0.25
				0.00
				0.00
			1.4073	0.75

$$C_{(\text{weighted})} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.75}{1.41} = 0.53$$



OLFP along Ara Tai:
4850 m²

OLFP along Ara-Tai

0 10 20 30
Meters

Scale @ A3
= 1:1,000

Date Printed:
16/10/2023

Auckland Council
Te Kaunihera o Tāmaki Makaurau

PIPE FLOW CALCULATIONS	**REFERENCE**

Overland Flow Rate

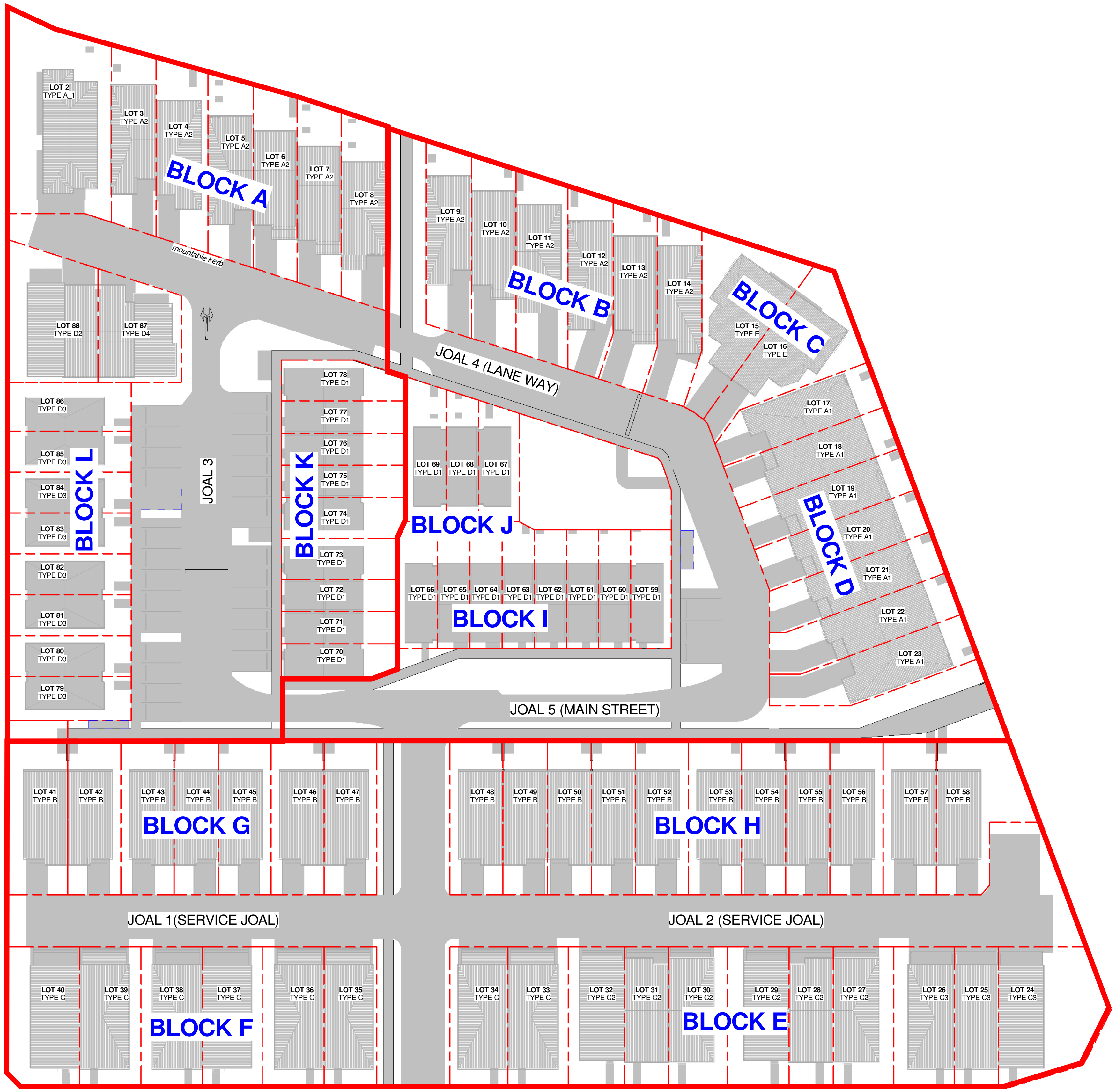
Q = 2.78 C i A

Rational Formula

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.53**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**1.41**	ha
Overland Runoff Rate	**Q**	**336**	**l/s**

PIPE FLOW CALCULATIONS	REFERENCE
Overland Flow Rate Q = 2.78 C i A	*Rational Formula*

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.65**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**0.49**	ha
Overland Runoff Rate	**Q**	**142**	**l/s**



IMPERVIOUS SPACE

NAME	AREA
BIKE STORAGE AREA	
BIKE STORAGE AREA	12 m²
BINS	
BINS	26 m²
BLOCK A	
TYPE A_1	112 m²
TYPE A-2	440 m²
FOOTPATH	11 m²
DRIVEWAYS / CAR PARK	86 m²
BLOCK B	
TYPE A-2	441 m²
FOOTPATH	14 m²
DRIVEWAYS / CAR PARK	96 m²
BLOCK C	
TYPE E-1	180 m²
BLOCK D	
TYPE A-1	505 m²
FOOTPATH	13 m²
DRIVEWAYS / CAR PARK	121 m²
BLOCK E	
TYPE C-3	348 m²
TYPE C-2	81 m²
TYPE C-1	457 m²
BLOCK F	
TYPE C-1	557 m²

IMPERVIOUS SPACE

NAME	AREA
BLOCK G	
TYPE B-1	529 m²
BLOCK H	
TYPE B-1	828 m²
BLOCK I	
TYPE D-1	311 m²
FOOTPATH	9 m²
DRIVEWAYS / CAR PARK	120 m²
BLOCK J	
TYPE D-1	117 m²
FOOTPATH	5 m²
BLOCK K	
TYPE D-1	351 m²
DRIVEWAYS / CAR PARK	143 m²
BLOCK L	
TYPE D-1	520 m²
DRIVEWAYS / CAR PARK	118 m²
COMMON FOOTPATH	
FOOTPATH	568 m²
FOOTPATH	
IMPERVIOUS AREA	121 m²
ROAD	
DRIVEWAYS	2354 m²
AREA TOTAL	9595 m²

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

IMPERVIOUS AREA:		**COMPLIANCE**
MIX HOUSING SUB-URBAN ZONE REQUIREMENT:	**60% MAX NET SITE AREA (8442㎡)**	
PROPOSED AREA:	68.2% (9595㎡)	NO
PREVIOUS AREA:	67.2% (9457㎡)	

S92 RESPONSE

asc architects

3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (IMPERVIOUS AREA)

N

Project No. :	**JOB NO. 22924**
Scale:	**1 : 300@ A1**
Date:	**15/05/2024**
Revison:	**H**

RA0201

Airey **Civil, Structural and Fire Engineers**	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** **Reviewed**	SW RCHT	**Phone:** 09 534 6523	**Date:** 21/05/2024

Adapted TP108 Worksheet 1: Weighted C Coefficient for Rational Method

Project	Whole Site	**By**	SW	**Date**	21/05/2024
Location	3 PMR	**Checked**	RCHT	**Date**	

Circle One **Present** [✓ **Developed**]

1. Runoff C Coefficient

	Cover Description (cover, type, treatment, and hydrologic condition)	Coefficient C	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	0.9	0.538	0.48
	Impervious areas - Pavement	0.85	0.422	0.36
	Pervious areas	0.3	0.448	0.13
				0.00
				0.00
			1.4073	0.98

$$C_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{0.98}{1.41} = 0.69$$

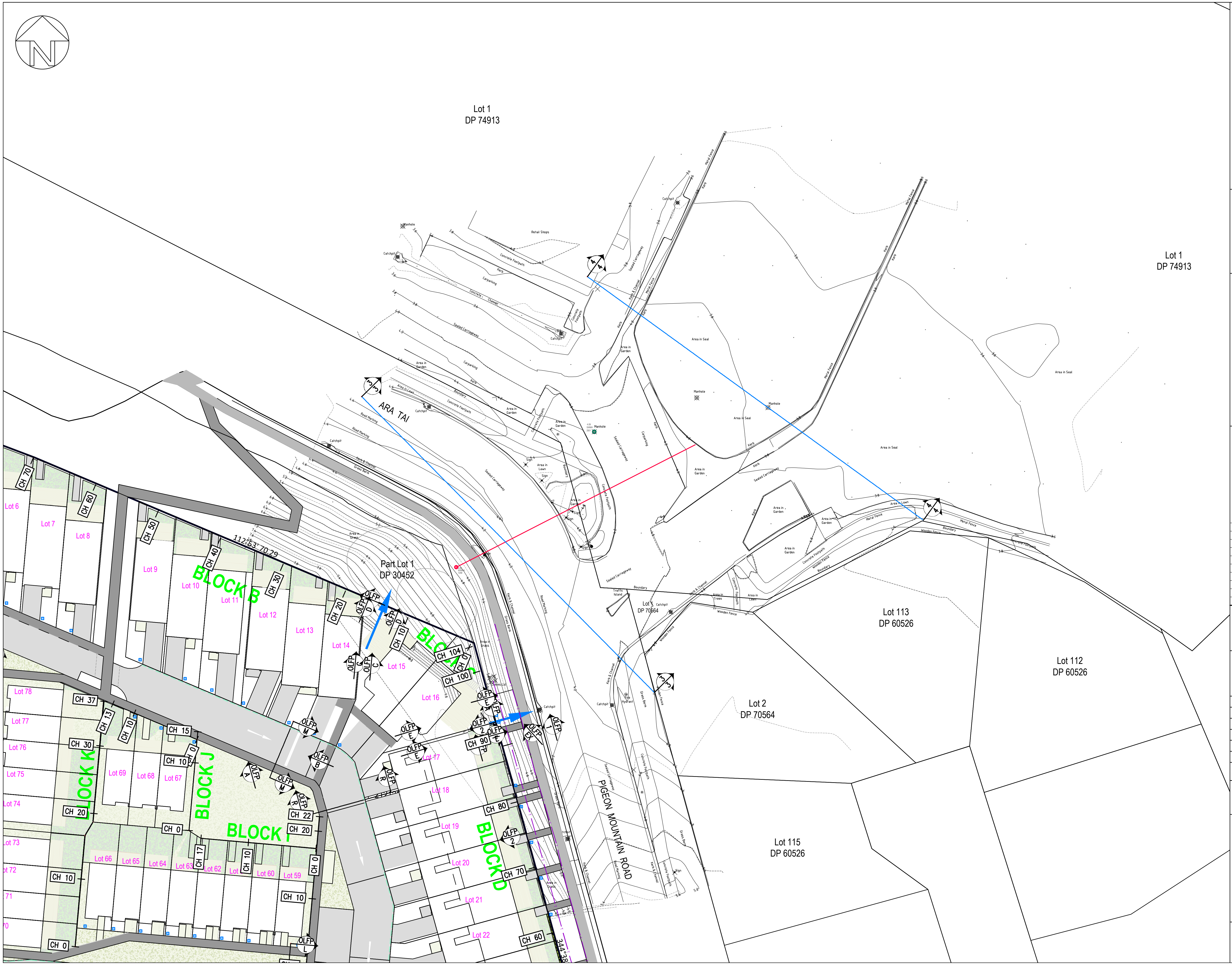
PIPE FLOW CALCULATIONS	REFERENCE

Overland Flow Rate

Q = 2.78 C i A

Rational Formula

Storm Scenario		**1%**	AEP
Coefficent of Runoff	C	**0.69**	
Rainfall Intensity	i	**162.1**	mm/hr
Area of Runoff	A	**1.41**	ha
Overland Runoff Rate	**Q**	**437**	**l/s**



CIVIL, STRUCTURAL AND FIRE ENGINEERS

AIREY CONSULTANTS LTD
TEL: (09) 534 6523 www.aireys.co.nz
TAKAPUNA **BOTANY** QUEENSTOWN

CLIENT:
HND HMB LTD

JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
OLFP CALCS

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 21/05/2024
SCALE: 1:250 @ A3

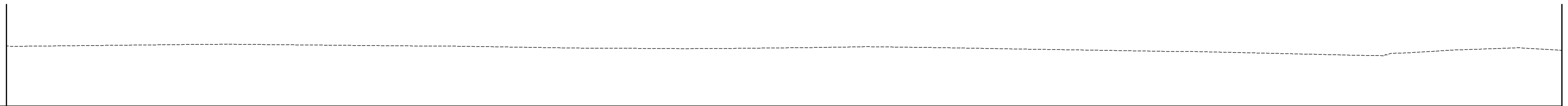
DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
SITE PLAN
OVERLAND FLOWPATH
POST DEVELOPMENT

JOB No:	SHEET No:	REV:
220571-1	OLFP03	-

J:\220000\220571 3 Pigeon Mountain Rd\CAD\WORKING DRAWINGS\3 PIGEON MOUNTAIN RD 220571-1 Drainage.dwg, 21/05/2024 10:10:35 am, DWG To PDF.pc3



DATUM 2.00

EXISTING LEVEL	4.38	4.38	4.40	4.42	4.44	4.43	4.41	4.39	4.37	4.36	4.33	4.30	4.29	4.27	4.27	4.29	4.31	4.34	4.32	4.29	4.25	4.22	4.19	4.16	4.13	4.08	4.04	4.00	4.15	4.25	4.28	4.20
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00	52.00	54.00	56.00	58.00	60.00	61.29

SECTION OLFP – EX 3–3

DATUM 2.00

EXISTING LEVEL	3.94	3.78	3.71	3.70	3.76	3.82	3.84	3.86	3.87	3.89	3.88	3.86	3.84	3.82	3.80	3.79	3.77	3.75	3.75	3.95	3.76	3.77	3.78	3.79	3.79	3.78	3.77	3.79	3.83	4.01	4.00	3.98
DISTANCE (m)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00	52.00	54.00	56.00	58.00	60.00	61.14

SECTION OLFP – EX 4–4

Airey
CIVIL, STRUCTURAL AND FIRE ENGINEERS

AIREY CONSULTANTS LTD
TEL: (09) 534 6523 www.aireys.co.nz

TAKAPUNA **BOTANY** QUEENSTOWN

CLIENT:
HND HMB LTD

JOB TITLE:
3 PIGEON MOUNTAIN ROAD
HALF MOON BAY

NOTES:

REV	AMENDMENT	DATE	BY

DRAWING STATUS:
FINAL

ISSUE PURPOSE:
OLFP CALCS

DESIGN: SW
DRAWN: LP
CHECKED: RT
DATE: 21/05/2024
SCALE: 1:100 @ A3

DO NOT SCALE FROM DRAWINGS

ORIGINAL SIZE:
5 0 5 10 15 20 25

DRAWING TITLE:
OLFP CROSS-SECTIONS

JOB No:	SHEET No:	REV:
220571-1	OLFP06	-

J:\220000\220571 3 Pigeon Mountain Rd\CAD\WORKING DRAWINGS\3 PIGEON MOUNTAIN RD 220571-1 Drainage.dwg, 21/05/2024 10:06:00 am, DWG To PDF.pc3

Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd			**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay			**Job No:** 220571/01
	Calc's By:	SW	**Phone:**		**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523		23/05/2024

CHANNEL CAPACITY CALCULATIONS EXISTING Ara-Tai/PMR Carriageway

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	4.375	<- 3.897+0.142+0.336
Case B		
Slope (S_o)	0.008	
Water level (m)	4.23	0.227
MFFL	4.73	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	4.38	0.013		Carriageway
0	4.38	0.013		Carriageway
8	4.44	0.013		Carriageway
26	4.27	0.013		Carriageway
28	4.27	0.013		Carriageway
54	4	0.013		Carriageway
56	4.15	0.013		Carriageway
58	4.25	0.013		Carriageway
60	4.28	0.013		Carriageway
-1				

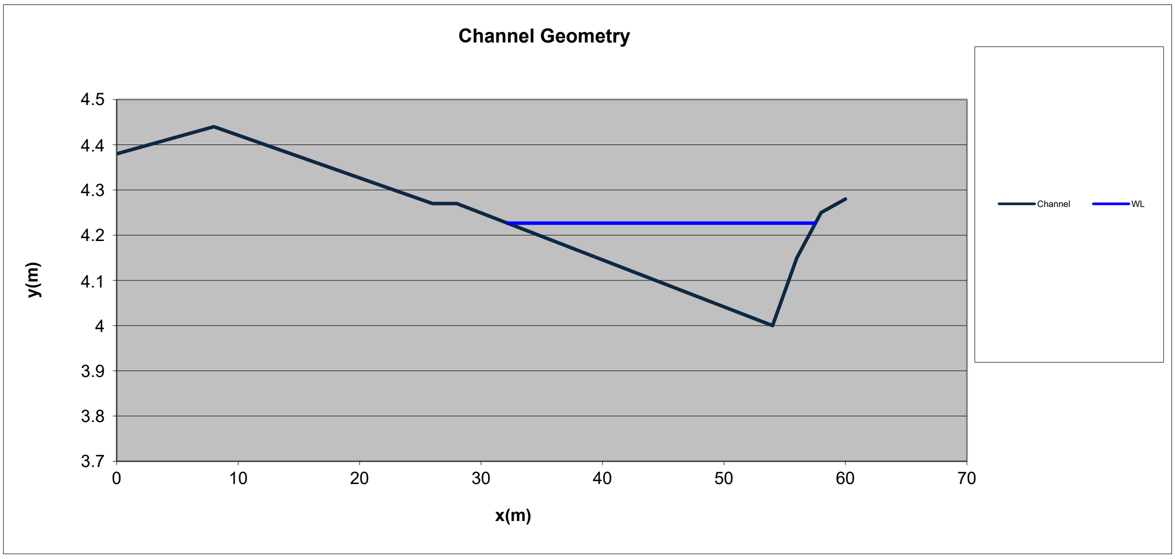
The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	4.376	OK
Velocity (m/s)	1.543	
S_o or S_f	0.0076	
Energy (m)	4.348	
Froude No	1.473	
Bed Stress (Pa)	8.313	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.64	
Geometry for wetted conditions		
Depth (d-m)	4.227	
Area (A-m^2)	2.836	
Width (B-m)	25.362	
Perimeter (P-m)	25.370	
Critical Flow Conditions		
Flow (m^3/s)	2.971	INCREASE CHANI
Velocity (m/s)	1.047	
Energy (m)	4.283	
Typical "n" values		
Concrete	0.013	
Gunite	0.017	
Smooth earth	0.02	
Clean channel	0.03	
Natural Channel	0.035-0.065	
Floodplain	0.05-0.15	
Overland flow (grass)	0.2-0.5	



Airey Civil, Structural and Fire Engineers Takapuna **Botany** Queenstown	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
	Reviewed By:	RCHT	09 534 6523	23/05/2024

CHANNEL CAPACITY CALCULATIONS POST DEV Ara-Tai/PMR Carriageway

INPUTS

Case (A or B) B

Case A

Flow (m^3/s) 4.476 <-3.897+0.142+0.437

Case B

Slope (S_o) 0.008

Water level (m) 4.23 0.229

MFFL 4.73

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	4.38	0.013		Carriageway
0	4.38	0.013		Carriageway
8	4.44	0.013		Carriageway
26	4.27	0.013		Carriageway
28	4.27	0.013		Carriageway
54	4	0.013		Carriageway
56	4.15	0.013		Carriageway
58	4.25	0.013		Carriageway
60	4.28	0.013		Carriageway
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	4.476	INCREASE CHANI
Velocity (m/s)	1.551	
S_o or S_f	0.0076	
Energy (m)	4.351	
Froude No	1.475	
Bed Stress (Pa)	8.382	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.64	

Geometry for wetted conditions

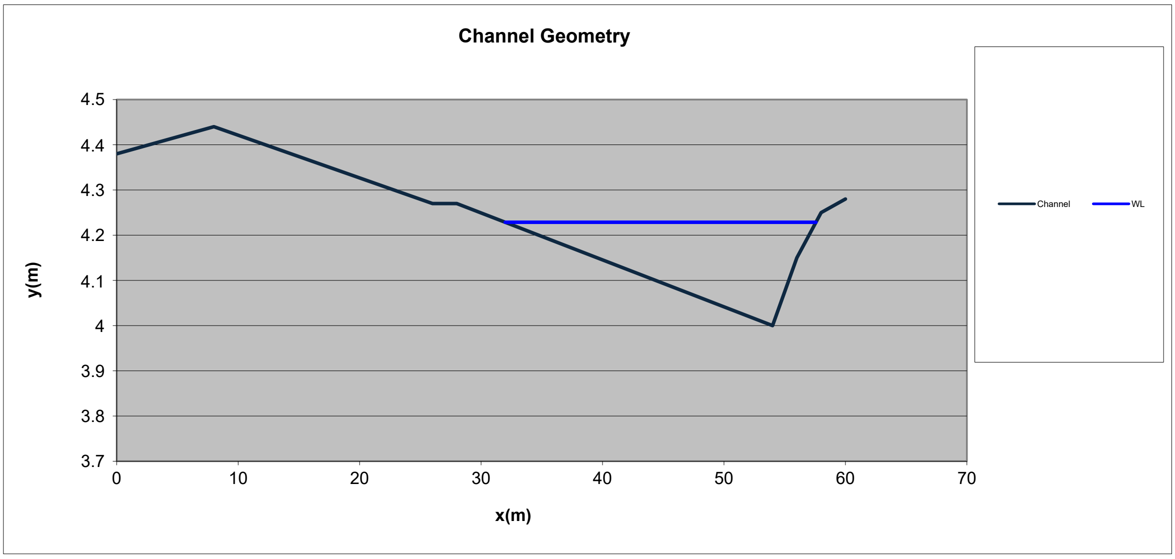
Depth (d-m)	4.229
Area (A-m^2)	2.885
Width (B-m)	25.584
Perimeter (P-m)	25.593

Critical Flow Conditions

Flow (m^3/s)	3.034	INCREASE CHANI
Velocity (m/s)	1.052	
Energy (m)	4.285	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd			**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay			**Job No:** 220571/01
Calc's By:	SW	**Phone:**		**Date:**
Reviewed By:	RCHT	09 534 6523		23/05/2024

CHANNEL CAPACITY CALCULATIONS EXISTING Marina Carpark

INPUTS

Case (A or B) B

Case A

Flow (m^3/s) 4.375 <- 3.897+0.142+0.336

Case B

Slope (S_o) 0.013

Water level (m) 3.87 0.116

MFFL 4.37

Channel Geometry		Mannings	Sinuosity	
x (m)	y (m)	"n" value		
0	3.94	0.013		building
8	3.76	0.013		carpark
10	3.82	0.013		carpark
18	3.89	0.013		carpark
34	3.75	0.013		carpark
36	3.75	0.013		carpark
40	3.76	0.013		carpark
56	3.83	0.013		carpark
58	4.01	0.013		carpark
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	4.375	OK
Velocity (m/s)	1.409	
S_o or S_f	0.0130	
Energy (m)	3.967	
Froude No	1.761	
Bed Stress (Pa)	8.321	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.75	

Geometry for wetted conditions

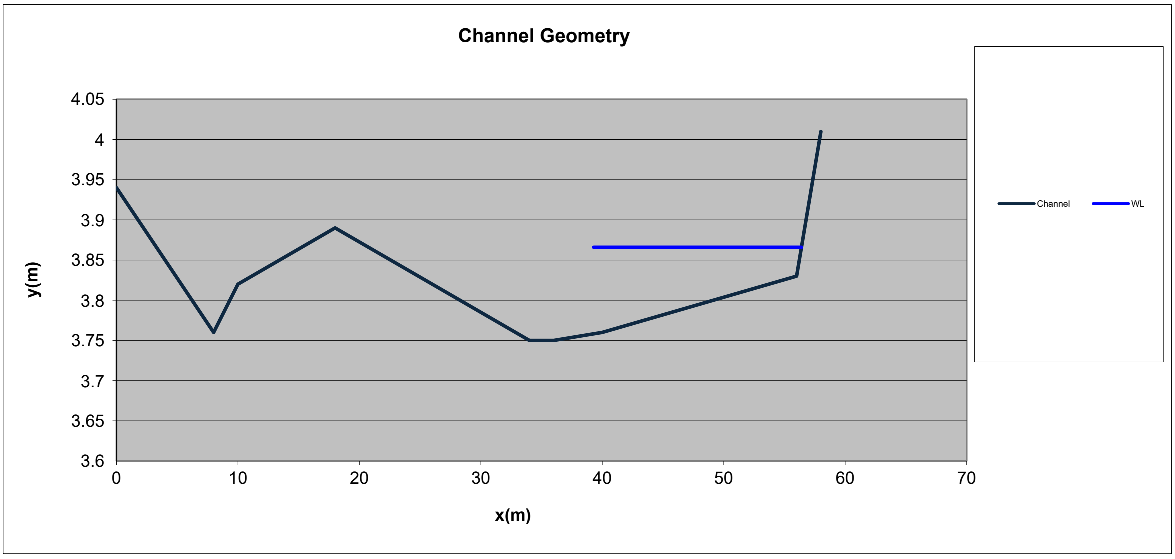
Depth (d-m)	3.866
Area (A-m^2)	3.106
Width (B-m)	47.597
Perimeter (P-m)	47.602

Critical Flow Conditions

Flow (m^3/s)	2.485	INCREASE CHAN
Velocity (m/s)	0.800	
Energy (m)	3.899	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	23/05/2024

CHANNEL CAPACITY CALCULATIONS POST DEV Marina Carpark

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	4.476	<-3.897+0.142+0.437
Case B		
Slope (S_o)	0.013	
Water level (m)	3.87	0.117
MFFL	4.37	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	3.94	0.013		building
8	3.76	0.013		carpark
10	3.82	0.013		carpark
18	3.89	0.013		carpark
34	3.75	0.013		carpark
36	3.75	0.013		carpark
40	3.76	0.013		carpark
56	3.83	0.013		carpark
58	4.01	0.013		carpark
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

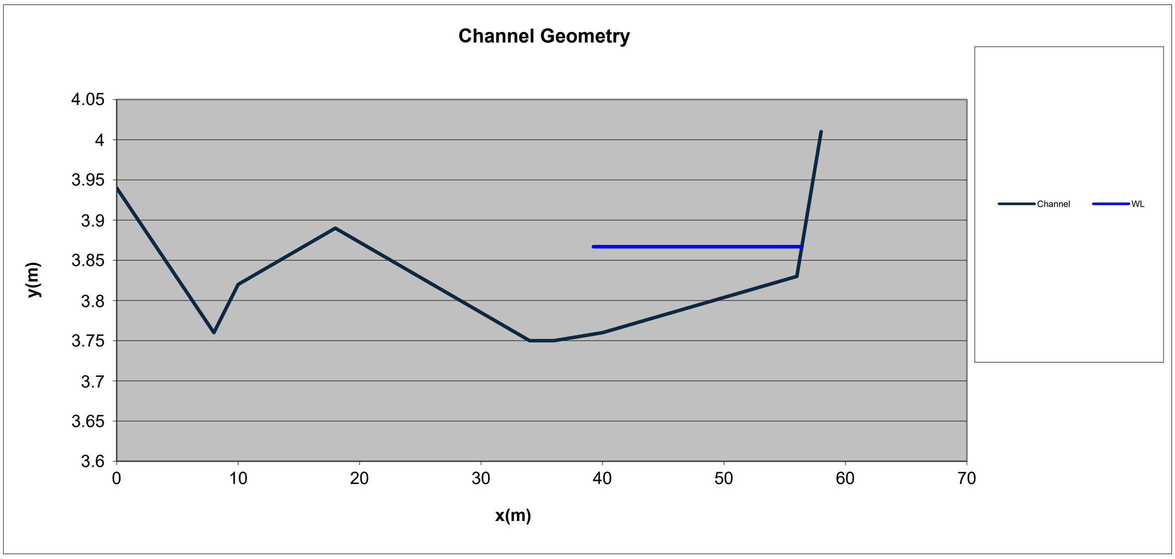
OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	4.476	OK
Velocity (m/s)	1.418	
S_o or S_f	0.0130	
Energy (m)	3.969	
Froude No	1.764	
Bed Stress (Pa)	8.404	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.75	

Geometry for wetted conditions	
Depth (d-m)	3.867
Area (A-m^2)	3.157
Width (B-m)	47.899
Perimeter (P-m)	47.903

Critical Flow Conditions		
Flow (m^3/s)	2.538	INCREASE CHANI
Velocity (m/s)	0.804	
Energy (m)	3.900	

Typical "n" values	
Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey

Job No: 220665/01
15 July 2024

Auckland Council
Private Bag 92 300
Victoria Street West
AUCKLAND 1141

Dear Sir/Madam,

EPA Consent number:	BUN60419132
Address:	3 Pigeon Mountain Road
Description:	87 Residential Dwelling Development

We respond to your s92 RFI dated 10/July/2024 requesting further information with respect to the above development. We respond to the items relevant to our inputs as below:

Stormwater

1. TP 108 method should be used.

   a. 10% AEP flows

      As per industry practice and multiple literatures, Rational Method computes the peak flow only and is accurate for small drainage areas, being less than 20 acres (or 80,000 m²). In this instance, the subject site is 14,073 m² in area and the use of rational method is considered as acceptable. Nevertheless, TP108 (or SCS method) has been adopted with the draft CoP v4 climate change factors and temporal pattern applied to identify the **minimum** 10% AEP attenuation volume required. From SCS hydrograph, it is noted that the peak discharges for the pre-development and post-development scenarios are **0.2232 m³/s** and **0.3006 m³/s** respectively. The **minimum mitigation volume** to be provided is hence the total difference in runoff volumes for the time intervals where the post-development peak runoff exceeds or is close to the pre-development peak runoff. From our assessment, the minimum mitigation required is hence 59.11 m³, let say **60.0 m³**. Please refer to appendix for SCS calculations and hydrograph for 10% AEP runoff.

      We are comfortable for stormwater mitigation be conditioned in the RC approval along the lines of:

      > The consent holder must ensure that stormwater runoff from the total site area is managed to ensure that the post-development stormwater runoff does not exceeds the pre-development runoff for the 10% AEP rainfall events.

b. and c. 1% AEP flows

The request is for us to undertake an overland flow path assessment for 3.8 °C climate change, rather than 2.1 °C climate change. We note that the current operative SW COP (V3) requires calculations based on 2.1 degrees, which is what we have based the previous assessment on. There is a draft SW COP (Version 4) that is currently out for consultation, which is where the 3.8 °C reference is from. This document has not yet been adopted, and as mentioned is currently still being consulted on. However, in the interest of progressing this application, we have undertaken the **1% AEP flows assessment based on the 3.8 °C climate change numbers**. We provide this on a without prejudice basis, given the status of the document.

With the upstream overland flow path catchment is greater than 80,000m² (132,200 m²), TP108 (or SCS method) has been adopted to compute the 1% AEP Peak runoff rate to examine the effect on the downstream catchment, being Pigeon Mountain Road and Half Moon Bay Marina Business Complex. The public stormwater system has been **assumed to be 100% blocked** in our assessment. The impervious area for the catchment is based on the permitted areas of 40% building coverage and 60% imperviousness. Based on our TP108 method assessment, the peak discharges for the 1% AEP pre-development and post-development scenarios are **4.424 m³/s** and **4.567 m³/s** respectively. This is an increase of **3.23%** ((4.567-4.424)/4.424) in peak discharge only.

As per AUP E8.6.1 (3)(b), diversion and discharge must not result in or increase the inundation of buildings on other properties in events up to the 1% AEP rainfall events. Please refer to the pre and post flooding analysis for Pigeon Mountain Road and Marina Car Park (s92 queries 7 and 8). The increase in runoff has **negligible increase in flood depths (1mm)** as outlined in our reply to item 7 and 8 below. Consequently, the increase in imperviousness does not result in or increase the inundation of building on other properties for the 1% AEP rainfall event and, thus, 1% AEP attenuation is considered not necessary.

Moreover, as we discussed previously, the **GD01** suggests that detention of 10% and 1% AEP rainfall events is not required for developments that are located within the lower half of the catchment (or for which a validated flood modelling study has shown that the development does not increase downstream flooding). To satisfy your request earlier, we allowed detention for the difference between pre- and post-development runoff in a 10% AEP rainfall event in our stormwater design. Because we proposed the 10% AAEP detention, the site is located in the lower half of the catchment and the increase in 1% AEP runoff is considered minimal, it is our opinion, therefore, that the stormwater detention outcomes have been mitigated as required under the AUP.

7. All the overland flows will concentrate at the intersection of Pigeon and ATA-TAI road will flow into the Halfmoon bay parking area. It is advised to conduct overland flow path assessment at the intersection to understand that it will be safe and will not cause any flooding problem or damages. Risk and hazard need to be identified and assessed. There area a lot guidance document available to do this. It is suggested to use Australian Disaster Resilience Handbook Collection GUIDELINE 7-3 (attached). The Risk and hazard assessment shall be done for all the overland flows on all existing and developed flow paths to ensure safety**.**

   Please refer to Pigeon Mountain Road Overland flow/flood assessment based on topographical survey received and **TP108 method**. The pre- and post-development flood depths are determined to be only some 230mm and 231mm, respectively. It is in our opinion, the 1mm increase in flood depth is negligible.

   The depth-velocity product for flow in Ara-Tai/Pigeon Mountain Road:

   Existing – 0.230 * 1.558 = 0.358 m^2/s

   Post – 0.23 1* 1.562 = 0.361 m^2/s

   As per GNS Science Report 2010/51 (Nov, 2010), Depth and Velocity product >0.4 m^2/s is considered significant hazard to small children. Additionally, vehicles become unstable if flood depth is greater than 0.3m. Flow depths for pre- and post-development scenarios are less than 0.3m. The DV products are determined to be less than 0.4 m^2/s.

   Consequently, the post development flow does not change the hazard classification and it is considered **low hazard** for children, adults and vehicles.

8. The overland flow path assessment at Marina Carpark is only showing the post development flood level but does not includes the predevelopment flood level. Requested to add the predevelopment flood level to compare**.**

   Please refer to Marina Carpark Overland flow/flood assessment based on topographical survey received and **TP108 method**. The pre- and post-development flood depths are determined to be 117mm and 118mm respectively. It is in our opinion, the 1mm increase in flood depth is negligible.

   The depth-velocity product for flow for Marina Carpark:

   Existing – 0.117 * 1.418 = 0.166 m^2/s

   Post – 0.118 * 1.427 = 0.168 m^2/s

   As per GNS Science Report 2010/51 (Nov, 2010), Depth and Velocity product >0.4 m^2/s is considered significant hazard to small children. Additionally, vehicles become unstable if flood depth is greater than 0.3m. Flow depths for pre- and post-development scenarios are less than 0.3m. The DV products are determined to be less than 0.4 m^2/s.

   Consequently, the post development flow does not change the hazard classification and is considered **low hazard** for children, adults and vehicles.

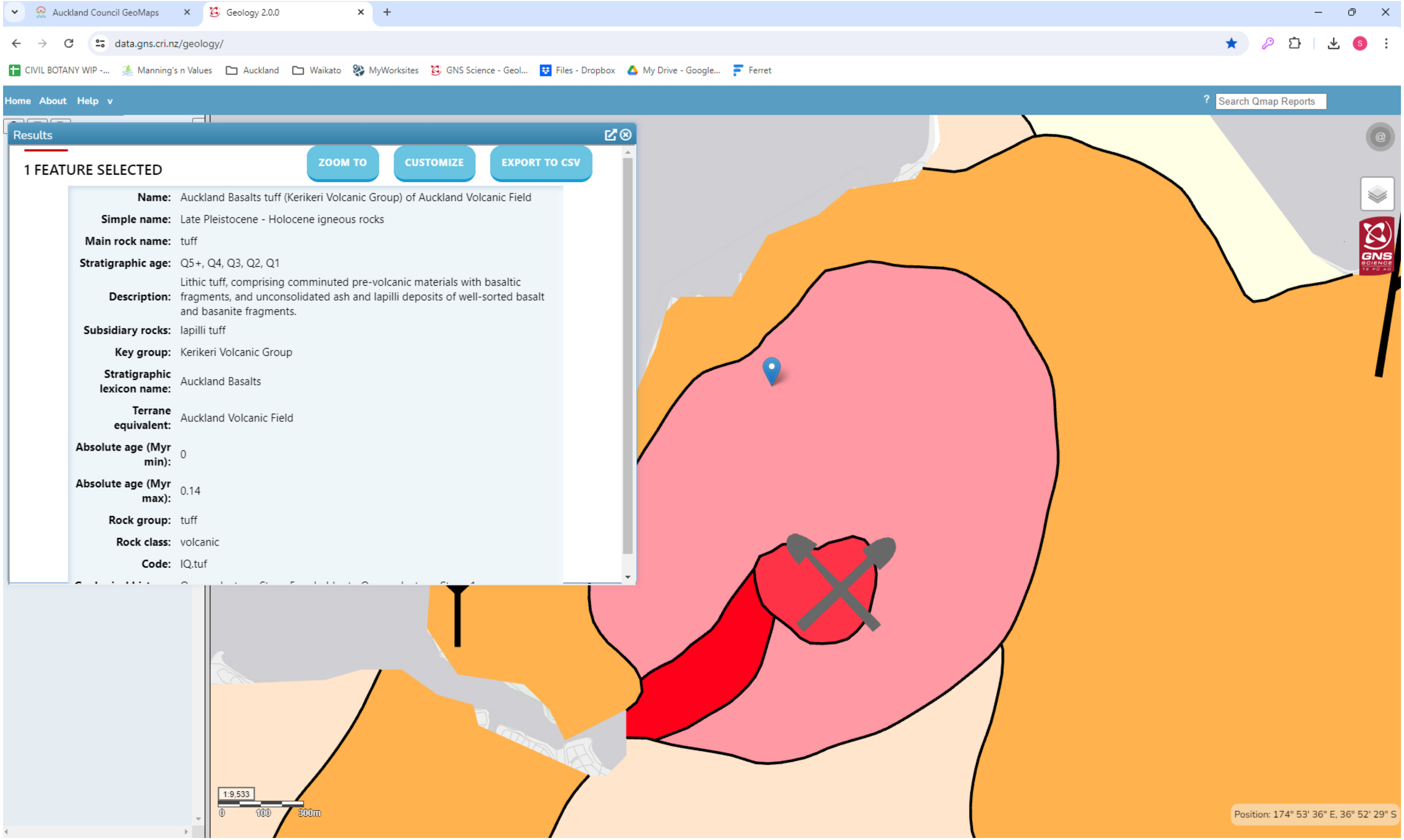
I trust this meets with your approval. Please do not hesitate to contact us should you have any queries or require further information.

Yours Faithfully AIREY CONSULTANTS LTD	Reviewed and approved by AIREY CONSULTANTS LTD
Weng	Royden Tsui
Samson Weng **Civil Engineer** BE Hons (Civil)	**Royden Tsui** **Associate Director** CPEng(NZ), CMEngNZ, IntPE(NZ), MEPM (hons), BE (Civil)

Ecl.

- Revised calculations based on TP108/SCS Calculation Methods

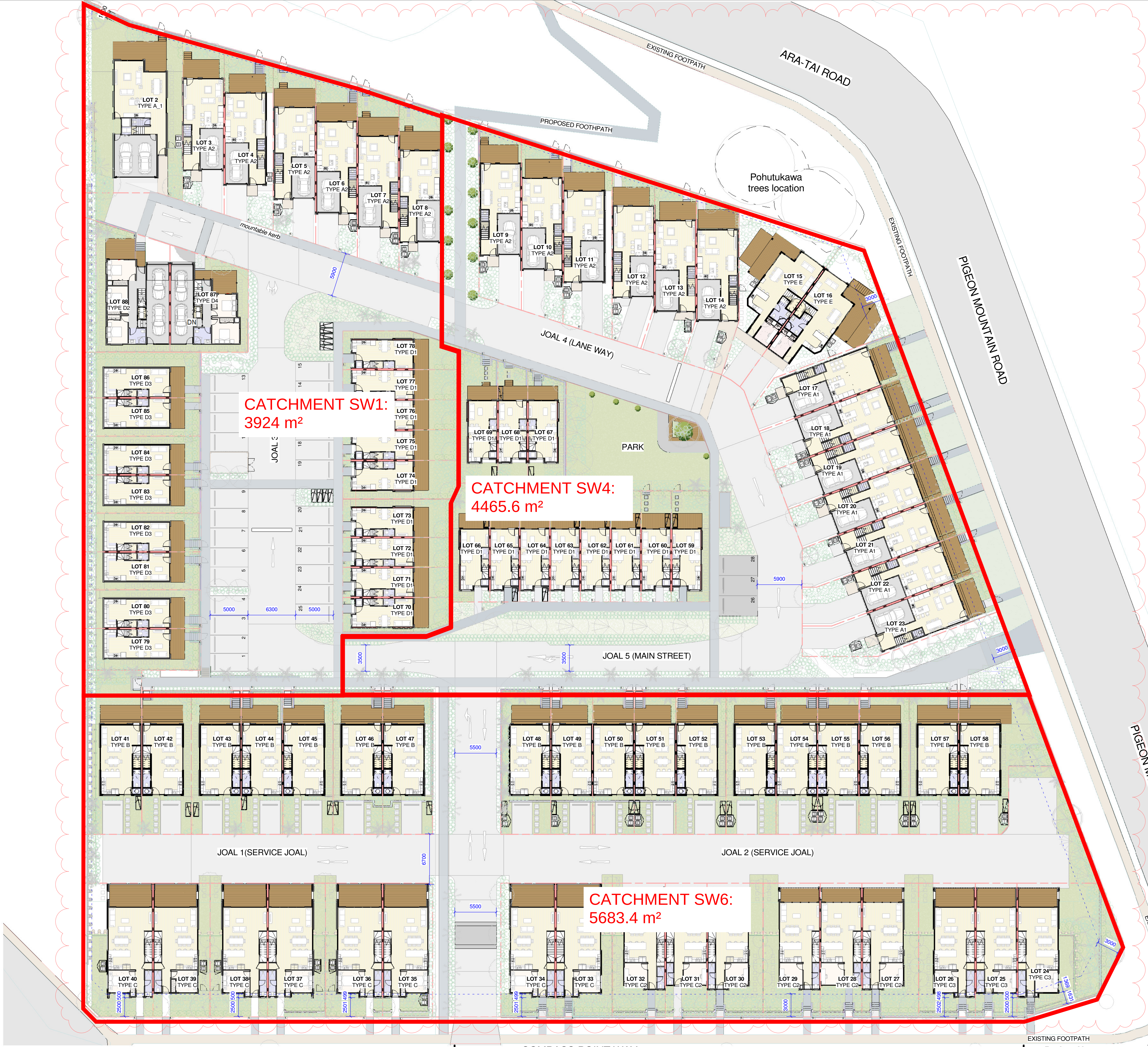
GNS Geology Map – Accessed 10/07/2024

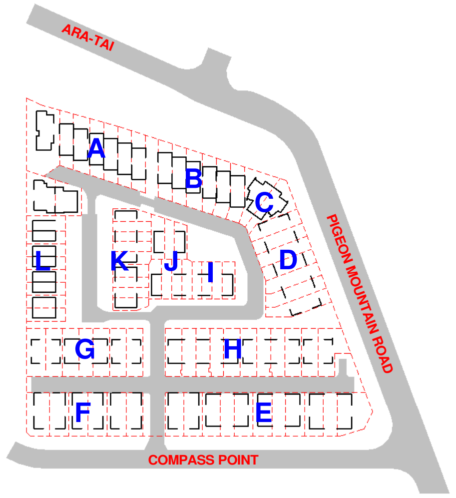


1 FEATURE SELECTED

Name:	Auckland Basalts tuff (Kerikeri Volcanic Group) of Auckland Volcanic Field
Simple name:	Late Pleistocene - Holocene igneous rocks
Main rock name:	tuff
Stratigraphic age:	Q5+, Q4, Q3, Q2, Q1
Description:	Lithic tuff, comprising comminuted pre-volcanic materials with basaltic fragments, and unconsolidated ash and lapilli deposits of well-sorted basalt and basanite fragments.
Subsidiary rocks:	lapilli tuff
Key group:	Kerikeri Volcanic Group
Stratigraphic lexicon name:	Auckland Basalts
Terrane equivalent:	Auckland Volcanic Field
Absolute age (Myr min):	0
Absolute age (Myr max):	0.14
Rock group:	tuff
Rock class:	volcanic
Code:	lQ.tuf

Site underlain by Auckland Volcanic Field (Tuff/Basalts) – TP108 Group A Soil – Urban Lawns – Curve Number 39





S92 RESPONSE

asc architects

3 PIGEON MOUNTAIN ROAD

COMPASS POINT WAY

PROPOSED GROUND LEVEL FLOOR PLAN

N

Project No. :	**JOB NO. 22924**
Scale:	**As indicated@ A1**
Date:	**15/05/2024**
Revison:	**H**

RA0151

BUILDING COVERAGE BY...

UNIT	AREA	TOTAL UNITS
BLOCK A		
A2	70 m²	1
A2	70 m²	1
A2	70 m²	1
A2	71 m²	1
A2	71 m²	1
A2	72 m²	1
A2	100 m²	1
	524 m²	7
BLOCK B		
A2	70 m²	1
A2	70 m²	1
A2	71 m²	1
A2	71 m²	1
A2	72 m²	1
A2	72 m²	1
	426 m²	6
BLOCK C		
E	83 m²	1
E	83 m²	1
	167 m²	2
BLOCK D		
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
A1	73 m²	1
	511 m²	7
BLOCK E		
C	73 m²	1
C	74 m²	1
C	74 m²	1
C	74 m²	1
C	79 m²	1
C	81 m²	1
C3	73 m²	1
C3	74 m²	1
C3	91 m²	1
C3	91 m²	1
C-2	81 m²	1
	866 m²	11
BLOCK F		
C	91 m²	1
C	91 m²	1
C	91 m²	1
C	91 m²	1
C	91 m²	1
C	91 m²	1
	548 m²	6
BLOCK G		
B	60 m²	1
B	61 m²	1
B	61 m²	1
B	61 m²	1
B	61 m²	1
B	61 m²	1
B	61 m²	1
	426 m²	7

BUILDING COVERAGE BY...

UNIT	AREA	TOTAL UNITS
BLOCK H		
B	60 m²	1
B	60 m²	1
B	60 m²	1
B	60 m²	1
B	60 m²	1
B	61 m²	1
B	61 m²	1
B	61 m²	1
B	61 m²	1
B	61 m²	1
B	61 m²	1
	668 m²	11
BLOCK I		
D	37 m²	1
D	37 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
	300 m²	8
BLOCK J		
D	37 m²	1
D	37 m²	1
D	38 m²	1
	112 m²	3
BLOCK K		
D	37 m²	1
D	37 m²	1
D	37 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
	337 m²	9
BLOCK L		
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	38 m²	1
D	92 m²	1
D	99 m²	1
	494 m²	10
TOTAL AREA:	5379 m²	87

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

BUILDING COVERAGE:		**COMPLIANCE**
MIX HOUSING SUB-URBAN ZONE REQUIREMENT:	**40% MAX NET SITE AREA (5628㎡)**	
PROPOSED AREA:	38.2% (5376㎡)	YES
PREVIOUS BUILDING COVERAGE:	*40.5%(5702m²)*	

S92 RESPONSE

asc architects

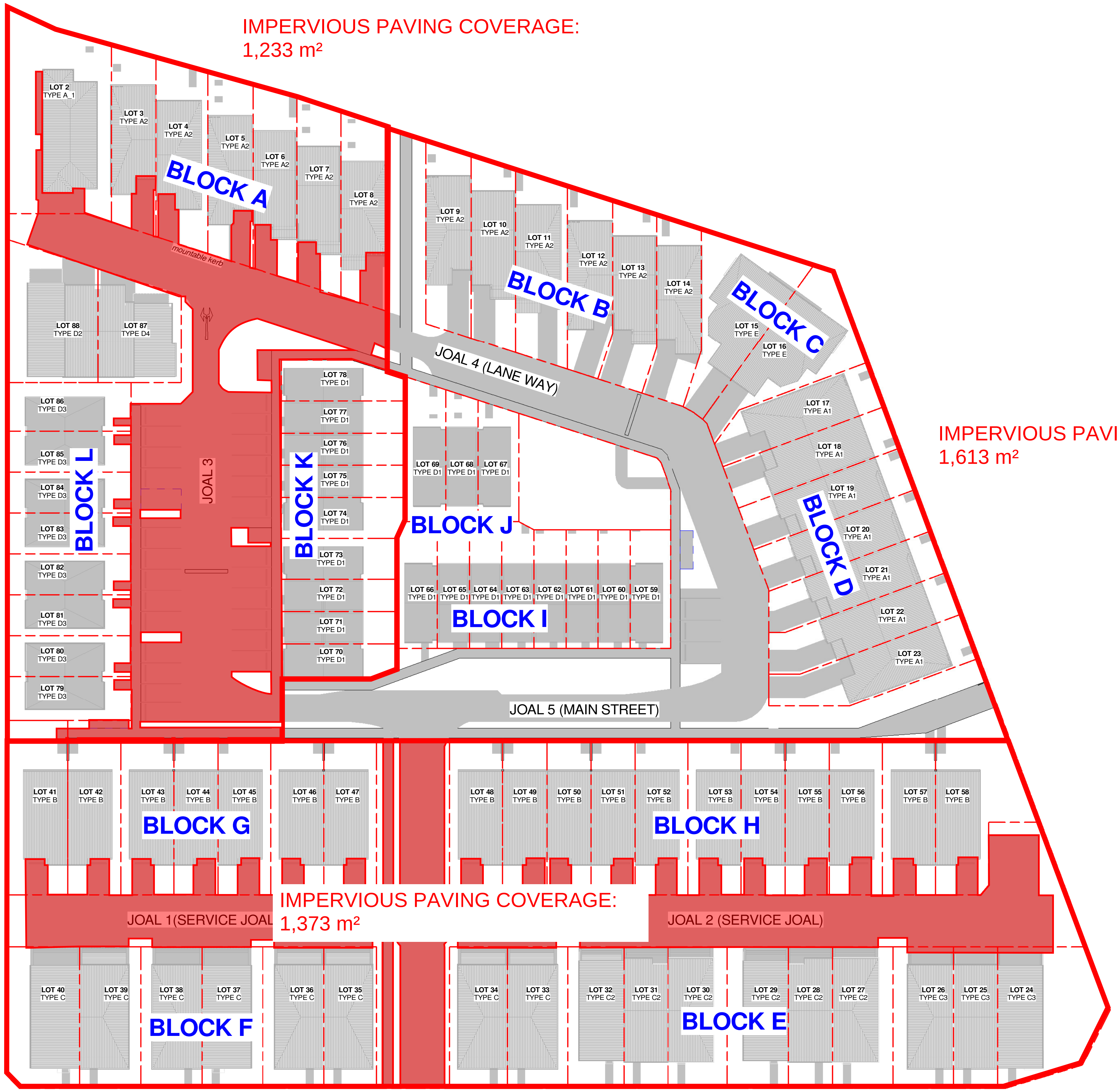
3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (BUILDING COVERAGE)

N

Project No. : **JOB NO. 22924**
Scale: **1 : 300@ A1**
Date: **15/05/2024**
Revison: **H**

RA0200



IMPERVIOUS SPACE	
NAME	AREA
BIKE STORAGE AREA	
BIKE STORAGE AREA	12 m²
BINS	
BINS	26 m²
BLOCK A	
TYPE A_1	112 m²
TYPE A-2	440 m²
FOOTPATH	11 m²
DRIVEWAYS / CAR PARK	86 m²
BLOCK B	
TYPE A-2	441 m²
FOOTPATH	14 m²
DRIVEWAYS / CAR PARK	96 m²
BLOCK C	
TYPE E-1	180 m²
BLOCK D	
TYPE A-1	505 m²
FOOTPATH	13 m²
DRIVEWAYS / CAR PARK	121 m²
BLOCK E	
TYPE C-3	348 m²
TYPE C-2	81 m²
TYPE C-1	457 m²
BLOCK F	
TYPE C-1	557 m²

IMPERVIOUS SPACE	
NAME	AREA
BLOCK G	
TYPE B-1	529 m²
BLOCK H	
TYPE B-1	828 m²
BLOCK I	
TYPE D-1	311 m²
FOOTPATH	9 m²
DRIVEWAYS / CAR PARK	120 m²
BLOCK J	
TYPE D-1	117 m²
FOOTPATH	5 m²
BLOCK K	
TYPE D-1	351 m²
DRIVEWAYS / CAR PARK	143 m²
BLOCK L	
TYPE D-1	520 m²
DRIVEWAYS / CAR PARK	118 m²
COMMON FOOTPATH	
FOOTPATH	568 m²
FOOTPATH	
IMPERVIOUS AREA	121 m²
ROAD	
DRIVEWAYS	2354 m²
AREA TOTAL	9595 m²

3 PIGEON MOUNTAIN TOTAL AREA: 14070㎡

IMPERVIOUS AREA:		**COMPLIANCE**
MIX HOUSING SUB-URBAN ZONE REQUIREMENT:	**60% MAX NET SITE AREA (8442㎡)**	
PROPOSED AREA:	68.2% (9595㎡)	NO
PREVIOUS AREA:	67.2% (9457㎡)	

S92 RESPONSE

asc architects

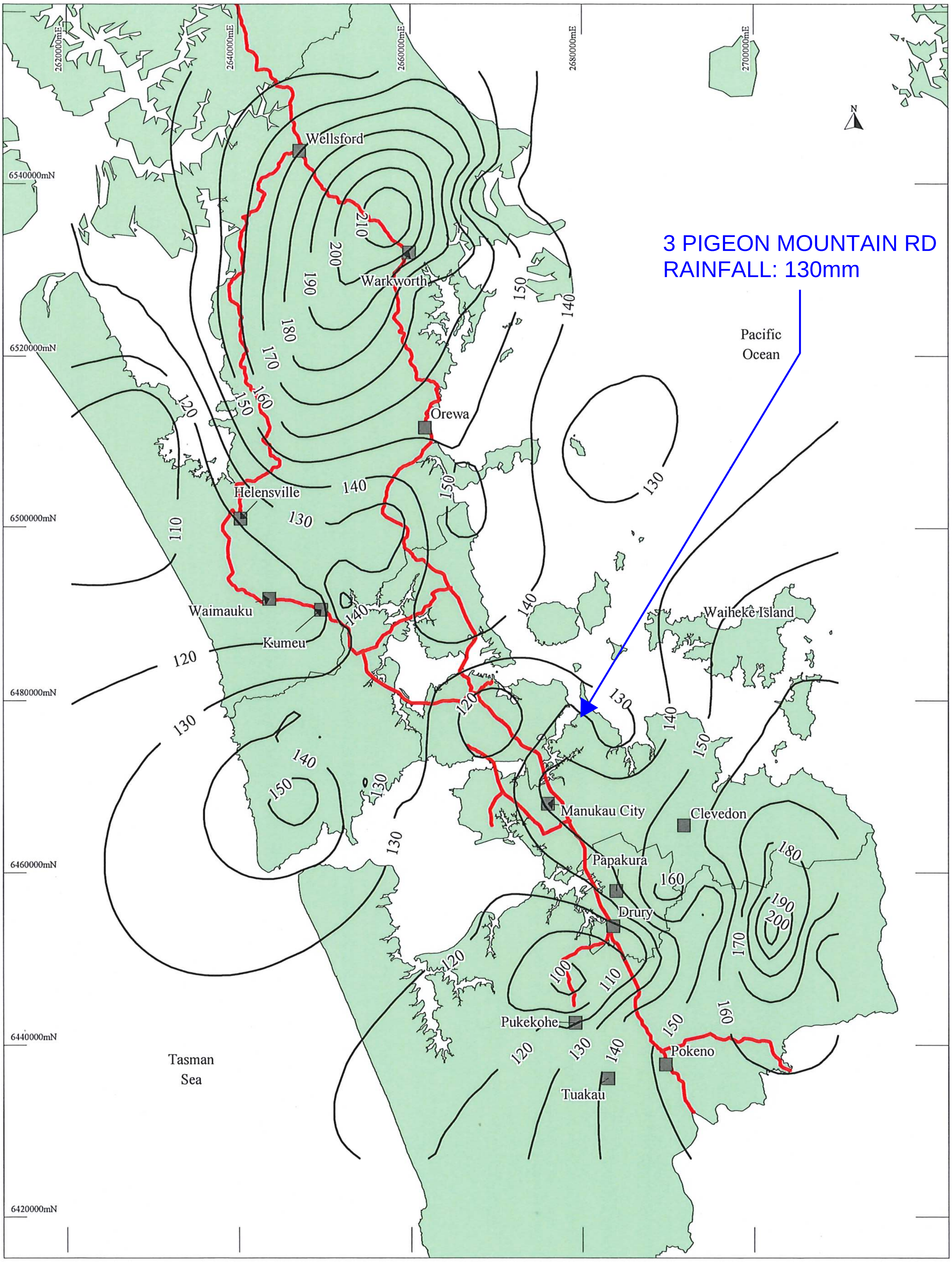
3 PIGEON MOUNTAIN ROAD

SITE PLANNING AREA (IMPERVIOUS AREA)

N

Project No. :	**JOB NO. 22924**
Scale:	**1 : 300@ A1**
Date:	**15/05/2024**
Revison:	**H**

RA0201



3 PIGEON MOUNTAIN RD
RAINFALL: 130mm

Legend: — 90 — Rainfall Contour (mm)

State Highways

Auckland **Regional** Council

Figure A.3
10 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)

(Revised 25/08/1999)

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\10yrari.wor Date: 25/08/1999

Airey

Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd			**Sheet No:** 1	
Job:	3 Pigeon Mountain Rd Half Moon Bay			**Job No:** 220571/01	
Calc's By:	SW	**Phone:**		**Date:**	
Reviewed By:	RCHT	09 534 6523		10/07/2024	

TP108 Rainfall

Rainfall Depth	130	mm
ARI	10	years

Duration	**Duration**	**Depth**	**Intensity**
hr	mins	mm	mm/hr (Q_{10})
0.166	10.0	17.52	**105.56**
0.333	20.0	26.95	80.92
0.5	30	33.23	66.47
1	60	46.85	46.85
2	120	63.27	31.64
6	360	96.74	16.12
12	720	124.11	10.34
24	1440	**152.10**	6.39

ARI	Ratio	
2	15.1%	2.1d CC
5	16.4%	2.1d CC
10	17.0%	2.1d CC
20	17.2%	2.1d CC
50	17.6%	2.1d CC
100	32.7%	3.8d CC

ARI: 10
Ratio: 17.0%

As per SW CoP V4

Airey **Civil, Structural and Fire Engineers** Takapuna **Botany** Queenstown	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By: SW **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 15/07/2024

TP108 Worksheet 1: Runoff Parameters and Time of Concentration

Project 87 New Dwellings **By** SW **Date** 15/07/2024

Location 3 Pigeon Mountain Road **Checked** RCHT **Date** 15/07/2024

Circle One [✓ **Present**] **Developed**

FROM SITE ONLY

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and Classification	Cover Description (cover, type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	98	0.298	29.20
	Impervious areas - Paving	98	0.265	25.99
Volcanic Basalt	Pervious areas	39	0.8441	32.92
				0.00
				0.00
			1.4073	88.12

$$\mathbf{CN}_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{88.12}{1.41} = 62.61$$

$$\mathbf{Ia}_{(weighted)} = \frac{\textit{5 x pervious area}}{\textit{total area}} = \frac{4.2203}{1.41} = 3.00$$

2. Time of Concentration

Channelisation factor, **C** = 0.8 (from Table 4.2)

Catchment length, **L** = 0.087 km (along drainage path, see Sheet 4)

Catchment slope, $\mathbf{S_c}$ = 0.104 (see Sheet 4)

$$\text{Runoff factor, } \frac{CN}{200-CN} = \frac{62.61}{137.39} \quad 0.46$$

$$\mathbf{t_c} = 0.14\ C\ L^{0.66} \left[\frac{CN}{200-CN}\right]^{-0.55} Sc^{-0.30} = 0.17 \text{ hrs}$$

SCS Lag for HEC-HMS $\mathbf{t_p} = 2/3\ \mathbf{t_c} = 0.17$ hrs

Airey **Civil, Structural and Fire Engineers**	**Client:** HND HMB Ltd		**Sheet No:** 2
	Job: 3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** SW **Reviewed I** RCHT	**Phone:** 09 534 652	**Date:** 15/07/2024

TP108 Worksheet 2:Graphical Peak Flow Rate

Project	87 New Dwellings	**By**	SW	**Date**	15/07/2024
Location	3 Pigeon Mountain Road	**Checked**	RCHT	**Date**	15/07/2024

Status [✓ **Present**] **Developed**

1. Data

Catchment area, **A** = 0.0141 km^2

Runoff curve number, **CN** = 62.61 (from Worksheet 1)

Initial abstraction, **Ia** = 3.00 mm (from Worksheet 1)

Time of concentration, **t$_c$** = 0.17 hrs (from Worksheet 1)

2. Calculate storage

S = [(1000/CN)-10] 25.4 = 151.66 mm

		Storm #1	Storm#2	Storm#3	
3. Average recurrence interval,	**ARI** =	10	100		yr
4. 24hr rainfall depth	**P$_{24}$** =	152.1	272.04		mm
5. Compute	**c*** = (P$_{24}$-2Ia)/(P$_{24}$-2Ia+2S) =	0.33	0.47		
6. Specific flow rate,	**q*** (from figure 5.1) =	0.088	0.115		
7. Peak flow rate,	**q$_p$** = q* A P$_{24}$ =	0.188	0.440		m^3/s
8. Runoff depth,	**Q$_{24}$** = (P$_{24}$-Ia)^2/[(P$_{24}$-Ia)+S] =	73.92	172.05		mm
9. Runoff volume,	**V$_{24}$** =1000 Q$_{24}$ A =	1040	2421		m^3

Figure 5.1 Specific Flow Rate

Pre-Development

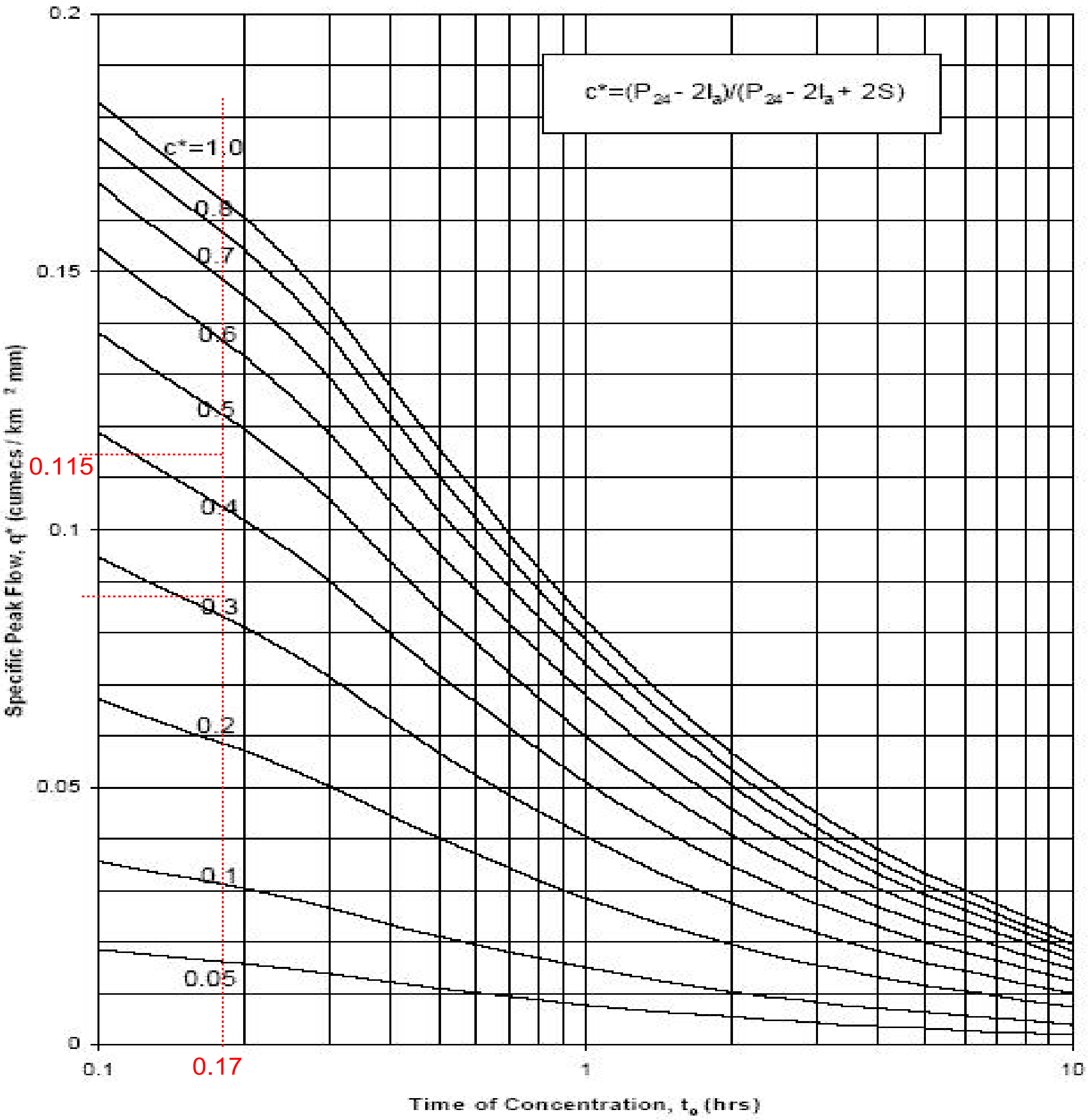


Figure 5.1 - Specific Peak Flow Rate

Airey Civil, Structural and Fire Engineers	**Client:** HND HMB Ltd		**Sheet No:** 7
	Job: 3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** SW **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 15/07/2024

TP108 Worksheet 1: Runoff Parameters and Time of Concentration

Project	87 New Dwellings	**By**	SW	**Date**	15/07/2024
Location	3 Pigeon Mountain Road	**Checked**	RCHT	**Date**	15/07/2024

Circle One **Present** [✓ **Developed**]

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and Classification	Cover Description (cover, type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof	98	0.538	52.68
	Impervious areas - Paving	98	0.422	41.35
Volcanic Basalt	Pervious areas	39	0.4478	17.46
				0.00
				0.00
			1.4073	111.50

$$\mathbf{CN}_{(\text{weighted})} = \frac{\textit{total product}}{\textit{total area}} = \frac{111.50}{1.41} = 79.23$$

$$\mathbf{Ia}_{(\text{weighted})} = \frac{\textit{5 x pervious area}}{\textit{total area}} = \frac{2.239}{1.41} = 1.59$$

2. Time of Concentration

Channelisation factor, **C** = 0.8 (from Table 4.2)

Catchment length, **L** = 0.087 km (along drainage path, see Sheet 4)

Catchment slope, $\mathbf{S_c}$ = 0.104 (see Sheet 4)

$$\text{Runoff factor, } \frac{\text{CN}}{\text{200-CN}} = \frac{79.23}{120.77} \quad 0.66$$

$$\mathbf{t_c} = 0.14\ C\ L^{0.66} \left[\frac{\text{CN}}{\text{200-CN}}\right]^{-0.55} Sc^{-0.30} = 0.17 \text{ hrs}$$

SCS Lag for HEC-HMS $\mathbf{t_p} = 2 / 3\ \mathbf{t_c} = 0.17$ hrs

TP108 Worksheet 2:Graphical Peak Flow Rate

Project	87 New Dwellings	**By**	SW	**Date**	15/07/2024
Location	3 Pigeon Mountain Road	**Checked**	RCHT	**Date**	15/07/2024

Status Present [✓ **Developed**]

1. Data

151

Catchment area, **A** = 0.0141 km^2 (see Sheet 4)
Runoff curve number, **CN** = 79.23 (from Worksheet 2)
Initial abstraction, **Ia** = 1.59 mm (from Worksheet 1)
Time of concentration, t_c = 0.17 hrs (from Worksheet 1)

2. Calculate storage

S = [(1000/CN)-10] 25.4 = 66.60 mm

		Storm #1	**Storm#2**	**Storm#3**	
3. Average recurrence interval,	**ARI** =	10	100		yr
4. 24hr rainfall depth	P_{24} =	152.1	272.04		mm
5. Compute	$c^* = (P_{24}-2Ia)/(P_{24}-2Ia+2S)$ =	0.53	0.67		
6. Specific flow rate,	**q*** (from figure 5.1) =	0.125	0.145		
7. Peak flow rate,	$q_p = q^* A P_{24}$ =	0.268	0.56		m^3/s
8. Runoff depth,	$Q_{24} = (P_{24}-Ia)^2/[(P_{24}-Ia)+S]$ =	104.34	217.01		mm
9. Runoff volume,	$V_{24} = 1000\, Q_{24}\, A$ =	1468	3054		m^3

Airey **Civil, Structural and Fire Engineers**

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 6
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed	RCHT	09 534 6523	15/07/2024

Figure 5.1 Specific Flow Rate

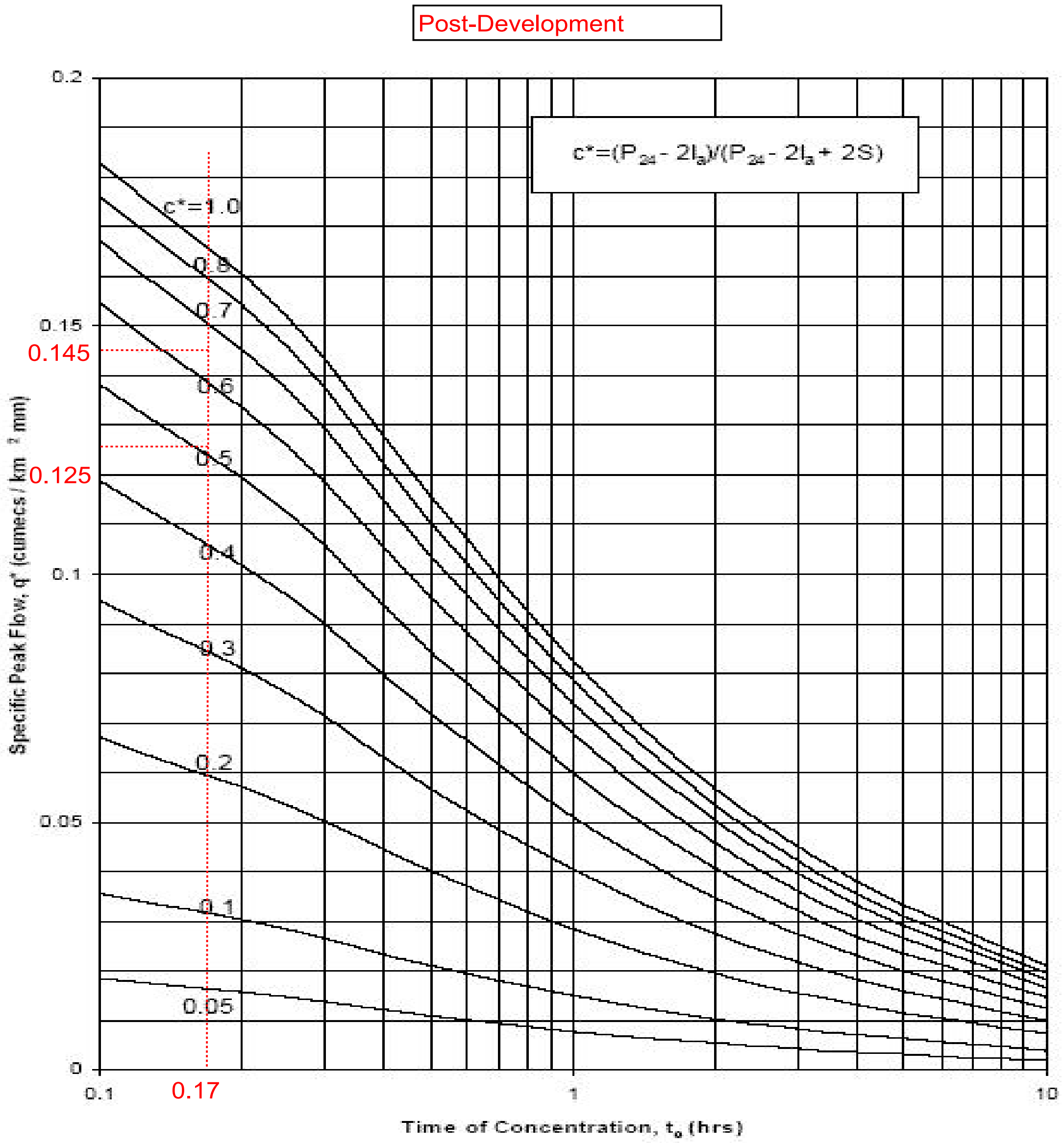


Figure 5.1 - Specific Peak Flow Rate

Airey Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 7
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed	RCHT	09 534 6523	15/07/2024

Slope by Equal Area Method

Elevation (m)	**Increment x (m)**	**Total x (m)**	**h (m)**	**Δx (m)**	**h (m)**	**ΔA (m2)**
16	0		10			
15	9.22	9.22	9	9.22	9.5	87.59
14	5.55	14.77	8	5.55	8.5	47.175
13	2.7	8.25	7	2.7	7.5	20.25
12	7.73	10.43	6	7.73	6.5	50.245
11	4.2	11.93	5	4.2	5.5	23.1
10	5.61	9.81	4	5.61	4.5	25.245
9	22.01	27.62	3	22.01	3.5	77.035
8	22.16	44.17	2	22.16	2.5	55.4
7	3.74	25.9	1	3.74	1.5	5.61
6	4.13	7.87	0	4.13	0.5	2.065
			Total:	87.05		393.715

Slope = 10.39% $\frac{\Delta A}{\Delta x}$

Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	15/07/2024

Hydrographs- SCS Method:

Pre-dev Site Runoff

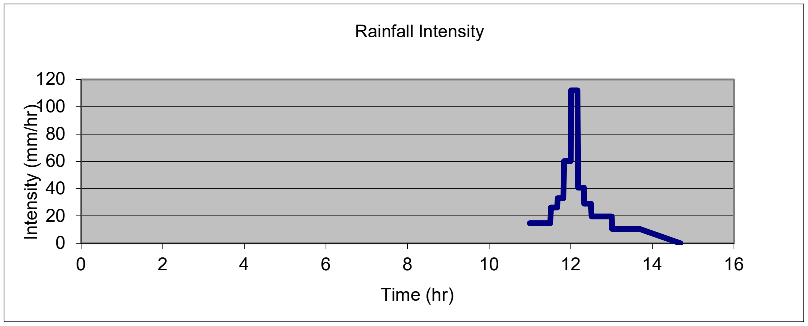
Rainfall Depth (mm)	152.1	10 YEAR ARI

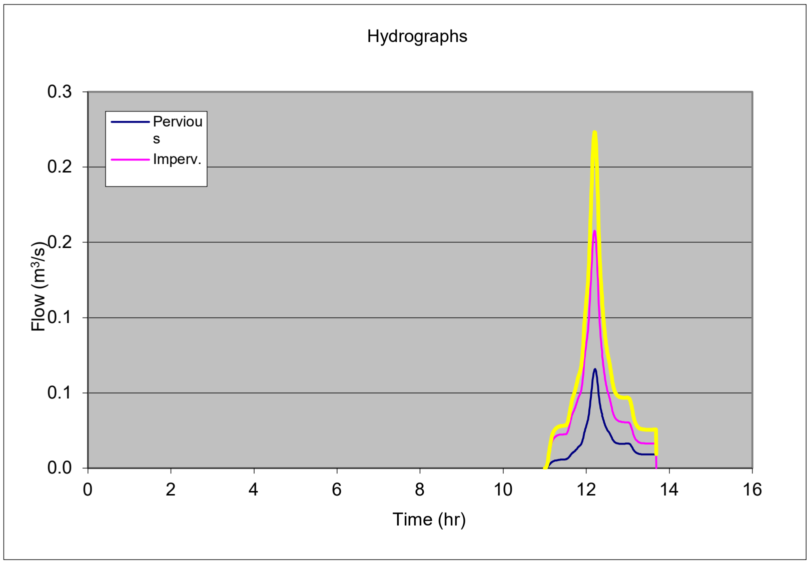
Notes:

1. Inputs
2. Typical inputs for CN, Ia, CF are in 'Typical Inputs' Sheet.
3. Method based on ARC TP108.
4. Maximum Impervious area = 65% for Urban areas to AUP H2.

Catchment Data	**Pervious Are**	**Impervious A**
Area (ha)	0.84	0.56
Runoff No (CN)	39	98
Initial Loss (Ia-mm)	5	0
Channel Length (L-m)	87	87
Channel Slope (Sc-m/m)	0.104	0.104
Channel Factor (CF-0.6 to 1.0)	0.8	0.6
Time of Concentration (tc-min)	10.0	10.0
Soil storage (S-mm)	397.3	5.2

Outputs			**Total**
Runoff (mm)	39.7	147.1	82.7
Peak Flow (m^3/s)	0.066	0.158	**0.2232**
Time (hr) at Peak Flow	12.21	12.20	12.20
Rainfall (mm/h) over tc	102.48	102.48	102.48
Runoff Coefficient - Peak	0.27	0.98	0.56
Runoff Coefficient - Volume	0.26	0.97	0.54





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Civil, Structural and Fire Engineers

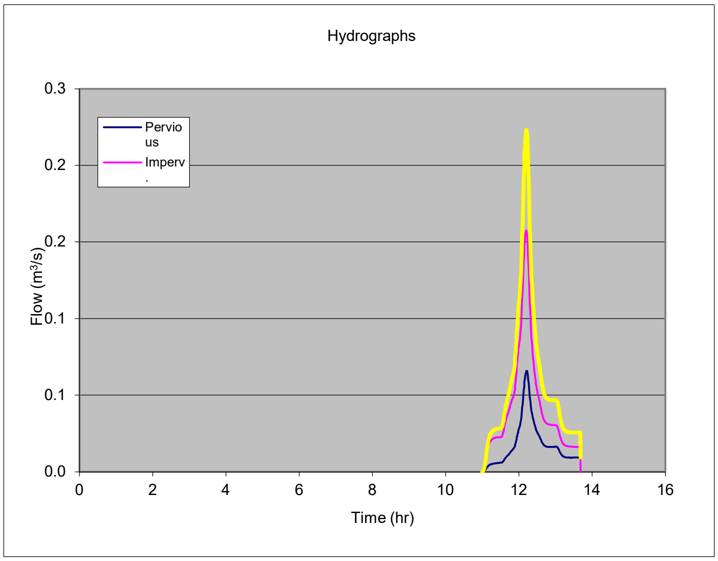
Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:**	1
Job:	3 Pigeon Mountain Road Bombay		**Job No:**	220571/01
Calc's By:	SW	**Phone:**	**Date:**	
Reviewed By:	RCHT	09 534 6523	15/07/2024	

Hydrographs- SCS Method:

Total Hydrograph in tabular form: (based on simualtion from above)

Volumetric error in scaling 1.94%



Time (hr)	Flow (m^3/s)	Volume (m^3)
11.001	0.000	0.000
11.347	0.028	17.217
11.491	0.028	14.459
11.601	0.037	12.866
11.694	0.048	14.144
11.776	0.057	15.445
11.850	0.064	16.084
11.918	0.080	17.590
11.981	0.104	20.912
12.040	0.122	24.157
12.096	0.159	28.440
12.150	0.202	34.716
12.201	0.223	39.057
12.230	0.217	22.921
12.259	0.196	21.952
12.290	0.168	19.762
12.320	0.143	17.224
12.352	0.124	15.105
12.384	0.111	13.647
12.417	0.100	12.542
12.451	0.089	11.532
12.486	0.081	10.683
12.522	0.075	10.107
12.559	0.070	9.715
12.597	0.063	9.227
12.637	0.057	8.592
12.678	0.052	8.057
12.721	0.049	7.818
12.767	0.048	7.864
12.814	0.047	8.095
12.864	0.047	8.474
12.917	0.047	8.989
12.975	0.047	9.656
13.037	0.046	10.439
13.106	0.039	10.556
13.184	0.030	9.677
13.277	0.027	9.421
13.398	0.026	11.350
13.690	0.009	18.348

Civil, Structural
and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	15/07/2024

Hydrographs- SCS Method:

Post-dev Site Runoff

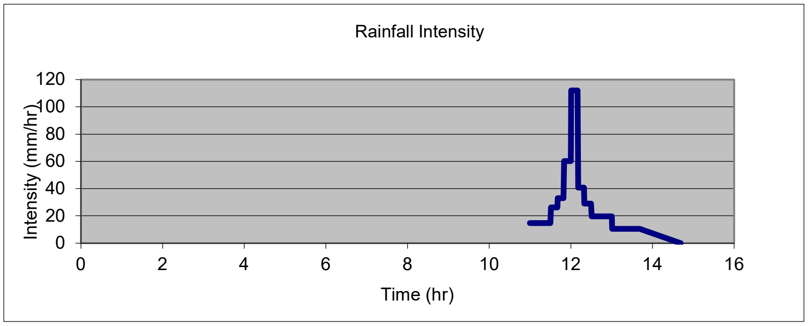
Rainfall Depth (mm) 152.1 10 YEAR ARI

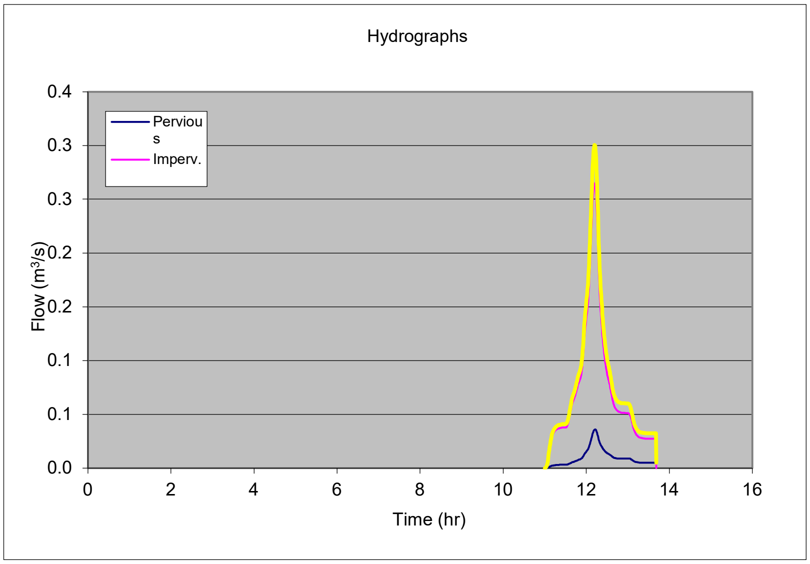
Notes:

1. Inputs
2. Typical inputs for CN, Ia, CF are in 'Typical Inputs' Sheet.
3. Method based on ARC TP108.
4. Maximum Impervious area = 65% for Urban areas to AUP H2.

Catchment Data	**Pervious Are**	**Impervious A**
Area (ha)	0.46	0.95
Runoff No (CN)	39	98
Initial Loss (Ia-mm)	5	0
Channel Length (L-m)	87	87
Channel Slope (Sc-m/m)	0.104	0.104
Channel Factor (CF-0.6 to 1.0)	0.8	0.6
Time of Concentration (tc-min)	10.0	10.0
Soil storage (S-mm)	397.3	5.2

Outputs			**Total**
Runoff (mm)	39.7	147.1	111.9
Peak Flow (m^3/s)	0.036	0.265	**0.3006**
Time (hr) at Peak Flow	12.21	12.20	12.20
Rainfall (mm/h) over tc	102.48	102.48	102.48
Runoff Coefficient - Peak	0.27	0.98	0.75
Runoff Coefficient - Volume	0.26	0.97	0.74





Civil, Structural and Fire Engineers

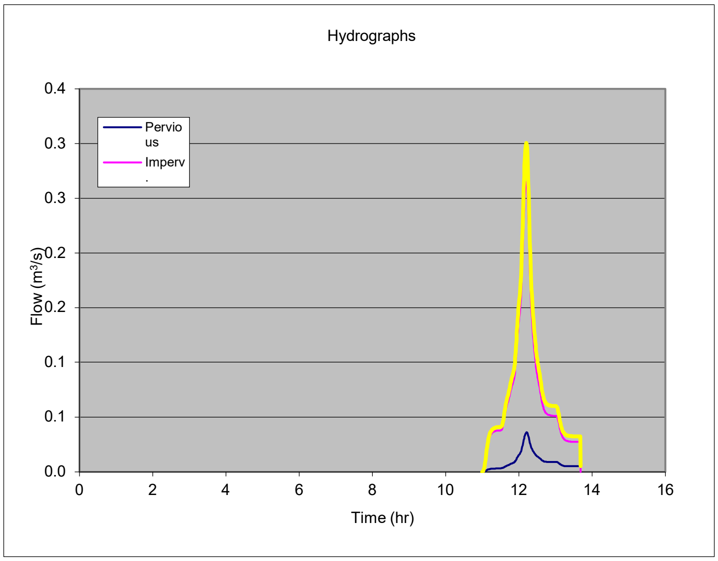
Takapuna **Botany** Queenstown

Client: HND HMB Ltd
Sheet No: 1
Job: 3 Pigeon Mountain Road
Bombay
Job No: 220571/01
Calc's By: SW **Phone:**
Reviewed By: RCHT 09 534 6523
Date: 15/07/2024

Hydrographs- SCS Method:

Total Hydrograph in tabular form: (based on simualtion from above)

Volumetric error in scaling 2.36%



Time (hr)	Flow (m^3/s)	Volume (m^3)
11.001	0.000	0.000
11.347	0.040	25.031
11.491	0.041	20.960
11.601	0.053	18.542
11.694	0.069	20.274
11.776	0.081	22.020
11.850	0.091	22.804
11.918	0.112	24.783
11.981	0.145	29.261
12.040	0.169	33.565
12.096	0.218	39.172
12.150	0.274	47.372
12.201	0.301	52.831
12.230	0.291	30.812
12.259	0.262	29.398
12.290	0.224	26.378
12.320	0.189	22.917
12.352	0.164	20.033
12.384	0.147	18.039
12.417	0.131	16.528
12.451	0.117	15.154
12.486	0.106	14.002
12.522	0.098	13.214
12.559	0.091	12.673
12.597	0.083	12.012
12.637	0.074	11.166
12.678	0.067	10.452
12.721	0.064	10.125
12.767	0.062	10.168
12.814	0.061	10.452
12.864	0.060	10.923
12.917	0.060	11.570
12.975	0.060	12.409
13.037	0.059	13.392
13.106	0.050	13.521
13.184	0.038	12.378
13.277	0.034	12.030
13.398	0.033	14.467
13.690	0.005	19.815

Airey

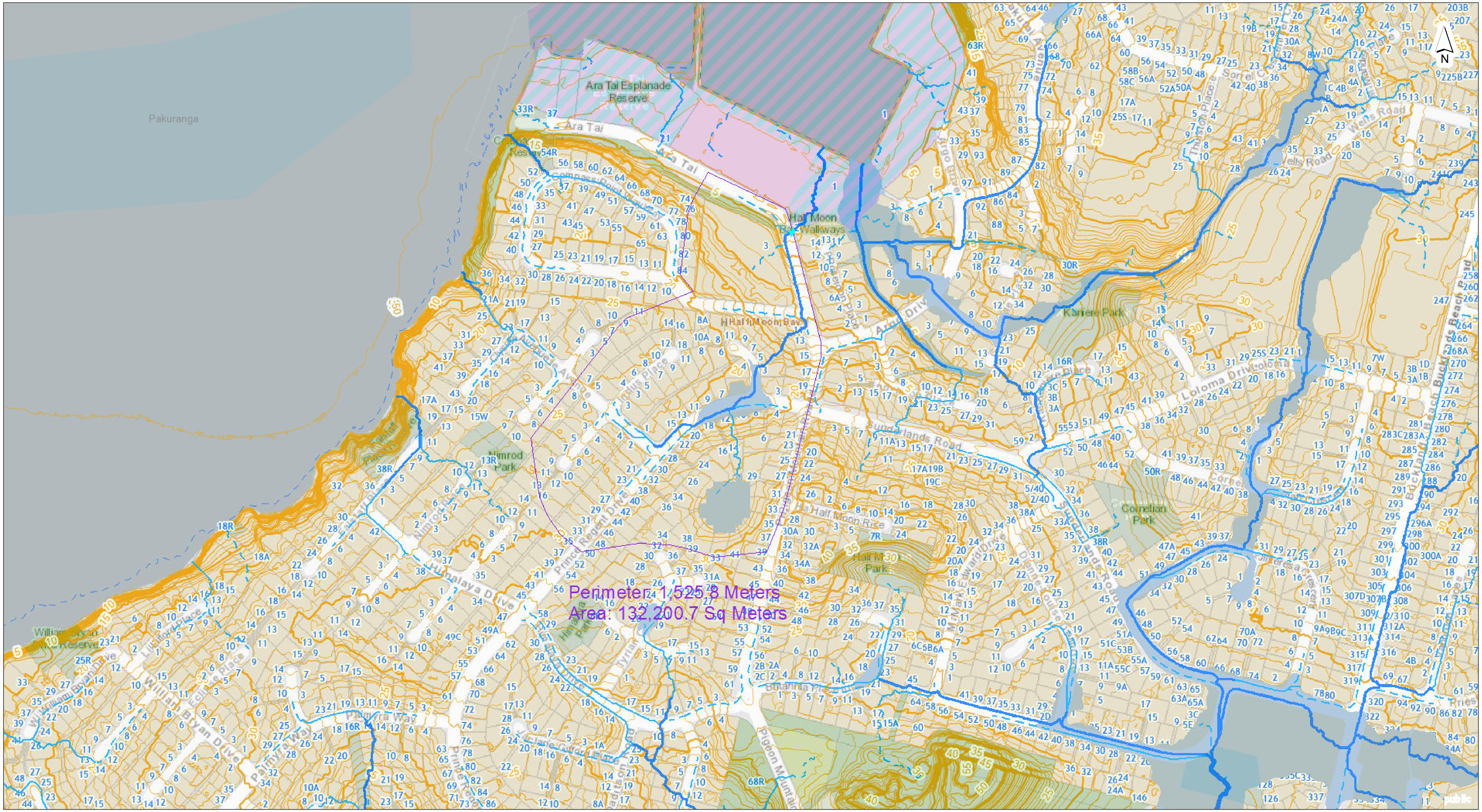
Civil, Structural
and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd		**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Calc's By:	SW	**Phone:**	**Date:**
Reviewed By:	RCHT	09 534 6523	16/07/2024

Hydrographs- SCS Method Runoff Difference

Pre Devleopment			Post Development			Difference
Time (hr)	**Flow (m^3/s)**	**Volume (m^3)**	**Time (hr)**	**Flow (m^3/s)**	**Volume (m^3)**	**Volume (m^3)**
11.918	0.080	17.590	11.918	0.112	24.783	7.193
11.981	0.104	20.912	11.981	0.145	29.261	8.349
12.040	0.122	24.157	12.040	0.169	33.565	9.408
12.096	0.159	28.440	12.096	**0.218**	39.172	10.732
12.150	0.202	34.716	12.150	**0.274**	47.372	12.656
12.201	**0.223**	39.057	12.201	**0.301**	52.831	13.774
12.230	0.217	22.921	12.230	**0.291**	30.812	7.890
12.259	0.196	21.952	12.259	**0.262**	29.398	7.446
12.290	0.168	19.762	12.290	**0.224**	26.378	6.616
12.320	0.143	17.224	12.320	0.189	22.917	5.694
12.352	0.124	15.105	12.352	0.164	20.033	4.928
12.384	0.111	13.647	12.384	0.147	18.039	4.392
					Miimum Mitigation Volume (m^3)	**59.114**

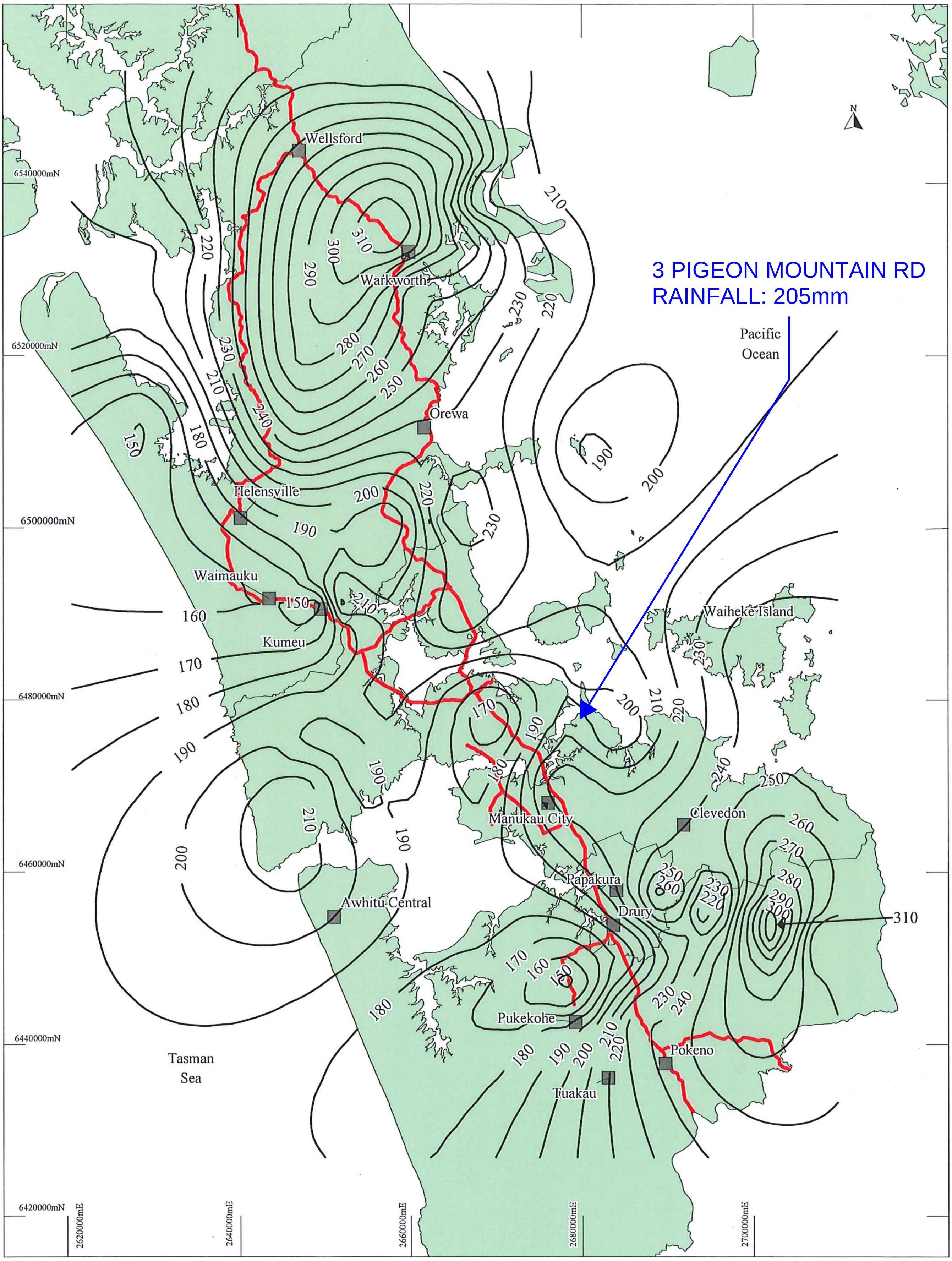


OLFP Catchment to Marina Carprt

0 50 100 150
Meters

Scale @ A3
= 1:5,000

Date Printed:
12/07/2024



Legend: — 90 — Rainfall Contour (mm)

State Highways

Auckland **Regional** Council

Figure A.6
100 Year ARI
Daily Rainfall Depth

Scale: 1:600,000 (at A4)

(Revised 25/08/1999)

Workspace: N:(civil)\25\2507757\gis\mapinfo\wor\100yrari.wor Date: 25/08/1999

Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Rd Half Moon Bay		**Job No:** 220517/01
	Calc's By:	SW	**Phone:**	**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523	15/07/2024

TP108 Rainfall

Rainfall Depth	205	mm
ARI	100	years

Duration hr	**Duration** mins	**Depth** mm	**Intensity** mm/hr (Q_{10})
0.166	10.0	31.34	**188.79**
0.333	20.0	48.19	144.72
0.5	30	59.44	118.88
1	60	83.79	83.79
2	120	113.17	56.58
6	360	173.01	28.84
12	720	221.98	18.50
24	1440	**272.04**	11.43

ARI	Ratio	
2	15.1%	2.1d CC
5	16.4%	2.1d CC
10	17.0%	2.1d CC
20	17.2%	2.1d CC
50	17.6%	2.1d CC
100	32.7%	3.8d CC

ARI:	100
Ratio:	32.7%

As per SW CoP V4

Airey **Civil, Structural and Fire Engineers** Takapuna **Botany** Queenstown	**Client:** HND HMB Ltd		**Sheet No:** 1
	Job: 3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By: SW **Reviewed** RCHT	**Phone:** 09 534 6523	**Date:** 15/07/2024

TP108 Worksheet 1: Runoff Parameters and Time of Concentration

Project	Marina Carpark OLF	**By**	SW	**Date**	15/07/2024
Location	3 Pigeon Mountain Road	**Checked**	RCHT	**Date**	15/07/2024

Circle One [✓ **Present**] **Developed**

Whole Catchment

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and Classification	Cover Description (cover, type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof (Site + 40% of rest of catchment (MHSU Zone))	98	5.020	491.91
	Impervious areas - Paving (Site + 20% of rest of catchment (MHSU Zone, 60%-40%))	98	2.628	257.52
Tuff/Basalt	Pervious areas	39	5.573	217.34
				0.00
				0.00
			13.220	966.77

$$\mathbf{CN}_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{966.77}{13.22} = 73.13$$

$$\mathbf{Ia}_{(weighted)} = \frac{\textit{5 x pervious area}}{\textit{total area}} = \frac{27.86384}{13.22} = 2.11$$

2. Time of Concentration

Channelisation factor, **C** = 0.8 (from Table 4.2)

Catchment length, **L** = 0.576 km (along drainage path, see Sheet 4)

Catchment slope, $\mathbf{S_c}$ = 0.048 (see Sheet 4)

$$\text{Runoff factor, } \frac{CN}{200\text{-}CN} = \frac{73.13}{126.87} \quad 0.58$$

$$\mathbf{t_c} = 0.14\ C\ L^{0.66} \left[\frac{CN}{200\text{-}CN}\right]^{-0.55} Sc^{-0.30} = 0.26 \text{ hrs}$$

SCS Lag for HEC-HMS $\mathbf{t_p}$ = 2 / 3 $\mathbf{t_c}$ = 0.17 hrs

Airey Civil, Structural and Fire Engineers Takapuna **Botany** Queenstown	**Client:** HND HMB Ltd		**Sheet No:** 2
	Job: 3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By: SW **Reviewed I** RCHT	**Phone:** 09 534 652	**Date:** 15/07/2024

TP108 Worksheet 2:Graphical Peak Flow Rate

Project	Marina Carpark OLF	**By**	SW	**Date**	15/07/2024
Location	3 Pigeon Mountain Road	**Checked**	RCHT	**Date**	15/07/2024

Status [✓ **Present**] **Developed**

1. Data

Catchment area, **A** = 0.1322 km^2

Runoff curve number, **CN** = 73.13 (from Worksheet 1)

Initial abstraction, **Ia** = 2.11 mm (from Worksheet 1)

Time of concentration, $\mathbf{t_c}$ = 0.26 hrs (from Worksheet 1)

2. Calculate storage

S = [(1000/CN)-10] 25.4 = 93.33 mm

		Storm #1	Storm#2	Storm#3	
3. Average recurrence interval,	**ARI** =	10	100		yr
4. 24hr rainfall depth	$\mathbf{P_{24}}$ =	152.1	272.04		mm
5. Compute	**c*** = $(P_{24}-2Ia)/(P_{24}-2Ia+2S)$ =	0.44	0.59		
6. Specific flow rate,	**q*** (from figure 5.1) =	0.102	0.123		
7. Peak flow rate,	$\mathbf{q_p} = q^* \, A \, P_{24}$ =	2.051	4.424		m^3/s
8. Runoff depth,	$\mathbf{Q_{24}} = (P_{24}-Ia)^2/[(P_{24}-Ia)+S]$ =	92.46	200.58		mm
9. Runoff volume,	$\mathbf{V_{24}} = 1000 \, Q_{24} \, A$ =	12223	26517		m^3

Figure 5.1 Specific Flow Rate

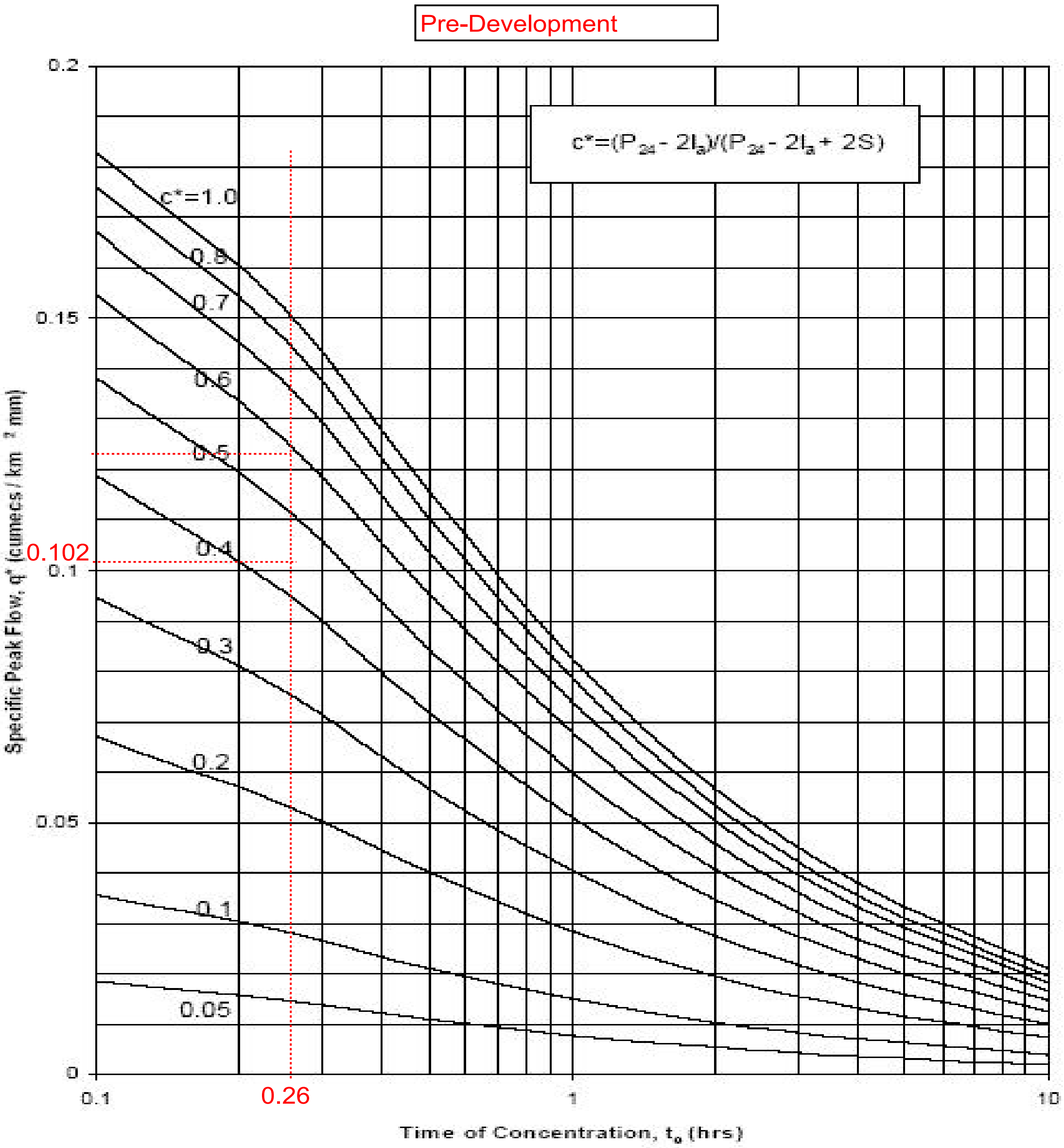


Figure 5.1 - Specific Peak Flow Rate

Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 7
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** **Reviewed**	SW RCHT	**Phone:** 09 534 6523	**Date:** 15/07/2024

TP108 Worksheet 1: Runoff Parameters and Time of Concentration

Project	Marina Carpark OLF	**By**	SW	**Date**	15/07/2024
Location	3 Pigeon Mountain Road	**Checked**	RCHT	**Date**	15/07/2024

Circle One **Present** [✓ **Developed**]

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and Classification	Cover Description (cover, type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
				0.00
	Impervious areas - Roof (Site + 40% of rest of catchment (MHSU Zone))	98	5.263	515.75
	Impervious areas - Paving (Site + 20% of rest of catchment (MHSU Zone, 60%-40%))	98	2.784	272.88
Tuff/Basalt	Pervious areas	39	5.1729	201.74
				0.00
				0.00
			13.2201	990.37

$$CN_{(weighted)} = \frac{\textit{total product}}{\textit{total area}} = \frac{990.37}{13.22} = \boxed{74.91}$$

$$Ia_{(weighted)} = \frac{\textit{5 x pervious area}}{\textit{total area}} = \frac{25.86454}{13.22} = \boxed{1.96}$$

2. Time of Concentration

Channelisation factor, **C** = 0.8 (from Table 4.2)
Catchment length, **L** = 0.576 km (along drainage path, see Sheet 4)
Catchment slope, S_c = 0.048 (see Sheet 4)

$$\text{Runoff factor, } \frac{CN}{200\text{-}CN} = \frac{74.91}{125.09} \quad \boxed{0.60}$$

$$t_c = 0.14\,C\,L^{0.66}\left[\frac{CN}{200\text{-}CN}\right]^{-0.55} Sc^{-0.30} = \boxed{0.26}\ \text{hrs}$$

SCS Lag for HEC-HMS $t_p = 2/3\ t_c = \boxed{0.17}$ hrs

Airey Civil, Structural and Fire Engineers	**Client:** HND HMB Ltd		**Sheet No:** 5
	Job: 3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** SW **Reviewed** RCHT	**Phone:** 09 534 652	**Date:** 15/07/2024

TP108 Worksheet 2:Graphical Peak Flow Rate

Project	Marina Carpark OLF	**By**	SW	**Date**	15/07/2024
Location	3 Pigeon Mountain Road	**Checked**	RCHT	**Date**	15/07/2024

Status **Present** [✓ **Developed**]

1. Data

Catchment area, **A** = 0.1322 km^2 (see Sheet 4)

Runoff curve number, **CN** = 74.91 (from Worksheet 2)

Initial abstraction, **Ia** = 1.96 mm (from Worksheet 1)

Time of concentration, $\mathbf{t_c}$ = 0.26 hrs (from Worksheet 1)

2. Calculate storage

S = [(1000/CN)-10] 25.4 = 85.06 mm

		Storm #1	**Storm#2**	**Storm#3**	
3. Average recurrence interval,	**ARI** =	10	100		yr
4. 24hr rainfall depth	$\mathbf{P_{24}}$ =	152.1	272.04		mm
5. Compute	**c*** = $(P_{24}-2Ia)/(P_{24}-2Ia+2S)$ =	0.47	0.61		
6. Specific flow rate,	**q*** (from figure 5.1) =	0.105	0.127		
7. Peak flow rate,	$\mathbf{q_p}$ = q* A P_{24} =	2.111	4.567		m^3/s
8. Runoff depth,	$\mathbf{Q_{24}}$ = $(P_{24}-Ia)^2/[(P_{24}-Ia)+S]$ =	95.85	205.40		mm
9. Runoff volume,	$\mathbf{V_{24}}$ =1000 Q_{24} A =	12671	27154		m^3

Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd		**Sheet No:** 6
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
Takapuna **Botany** Queenstown	**Calc's By:** **Reviewed**	SW RCHT	**Phone:** 09 534 6523	**Date:** 15/07/2024

Figure 5.1 Specific Flow Rate

Post-Development

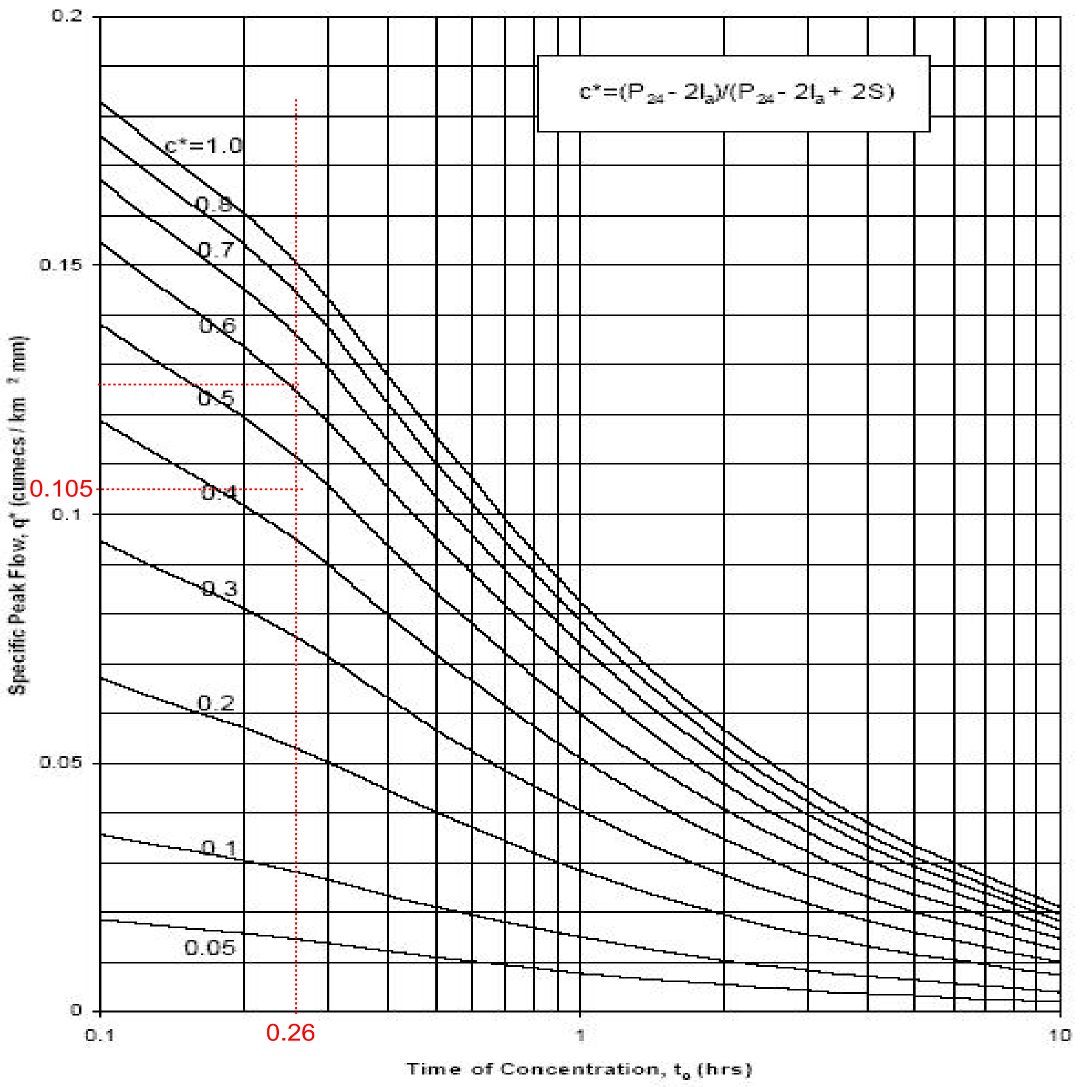


Figure 5.1 - Specific Peak Flow Rate

Airey Civil, Structural and Fire Engineers	Client: HND HMB Ltd		Sheet No: 7
	Job: 3 Pigeon Mountain Road Half Moon Bay		Job No: 220571/01
Takapuna **Botany** Queenstown	Calc's By: SW Reviewed RCHT	Phone: 09 534 6523	Date: 15/07/2024

Slope by Equal Area Method

Elevation (m)	Increment x (m)	Total x (m)	h (m)	Δx (m)	h (m)	ΔA (m2)
30	0		25			
25	131.1	131.1	20	131.1	22.5	2949.75
20	106.1	237.2	15	106.1	17.5	1856.75
19.5	9.8	115.9	14.5	9.8	14.75	144.55
18	78.9	88.7	13	78.9	13.75	1084.875
18.5	17.7	96.6	13.5	17.7	13.25	234.525
19	42	59.7	14	42	13.75	577.5
18	17.5	59.5	13	17.5	13.5	236.25
11	65.3	82.8	6	65.3	9.5	620.35
10.5	6.2	71.5	5.5	6.2	5.75	35.65
10	19.2	25.4	5	19.2	5.25	100.8
5	82.3	101.5	0	82.3	2.5	205.75

Total: 576.1 8046.75

Slope = 4.85% $\frac{\Delta A}{\Delta x}$

Airey Civil, Structural and Fire Engineers	**Client:**	HND HMB Ltd			**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay			**Job No:** 220571/01
	Calc's By:	SW	**Phone:**		**Date:**
Takapuna **Botany** Queenstown	**Reviewed By:**	RCHT	09 534 6523		15/07/2024

CHANNEL CAPACITY CALCULATIONS EXISTING Ara-Tai/PMR Carriageway

INPUTS

Case (A or B)	B	
Case A		
Flow (m^3/s)	4.424	
Case B		
Slope (S_o)	0.008	
Water level (m)	4.23	0.230
MFFL	4.73	

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	4.38	0.013		Carriageway
0	4.38	0.013		Carriageway
8	4.44	0.013		Carriageway
26	4.27	0.013		Carriageway
28	4.27	0.013		Carriageway
54	4	0.013		Carriageway
56	4.15	0.013		Carriageway
58	4.25	0.013		Carriageway
60	4.28	0.013		Carriageway
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

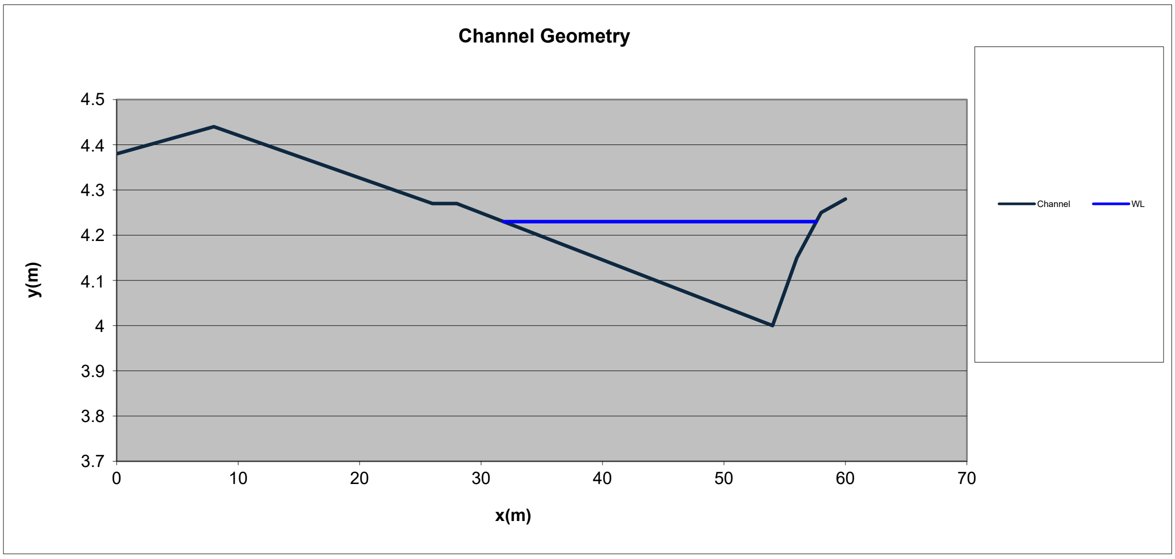
OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	4.550	OK
Velocity (m/s)	1.558	
S_o or S_f	0.0076	
Energy (m)	4.354	
Froude No	1.477	
Bed Stress (Pa)	8.433	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.64	

Geometry for wetted conditions	
Depth (d-m)	4.230
Area (A-m^2)	2.921
Width (B-m)	25.748
Perimeter (P-m)	25.757

Critical Flow Conditions		
Flow (m^3/s)	3.082	INCREASE CHANI
Velocity (m/s)	1.055	
Energy (m)	4.287	

Typical "n" values	
Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd			**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay			**Job No:** 220571/01
Calc's By:	SW	**Phone:**		**Date:**
Reviewed By:	RCHT	09 534 6523		15/07/2024

CHANNEL CAPACITY CALCULATIONS POST DEV Ara-Tai/PMR Carriageway

INPUTS

Case (A or B) B

Case A

Flow (m^3/s) 4.567

Case B

Slope (S_o) 0.008

Water level (m) 4.23 0.231

MFFL 4.73

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	4.38	0.013		Carriageway
0	4.38	0.013		Carriageway
8	4.44	0.013		Carriageway
26	4.27	0.013		Carriageway
28	4.27	0.013		Carriageway
54	4	0.013		Carriageway
56	4.15	0.013		Carriageway
58	4.25	0.013		Carriageway
60	4.28	0.013		Carriageway
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	4.604	OK
Velocity (m/s)	1.562	
S_o or S_f	0.0076	
Energy (m)	4.355	
Froude No	1.478	
Bed Stress (Pa)	8.469	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.64	

Geometry for wetted conditions

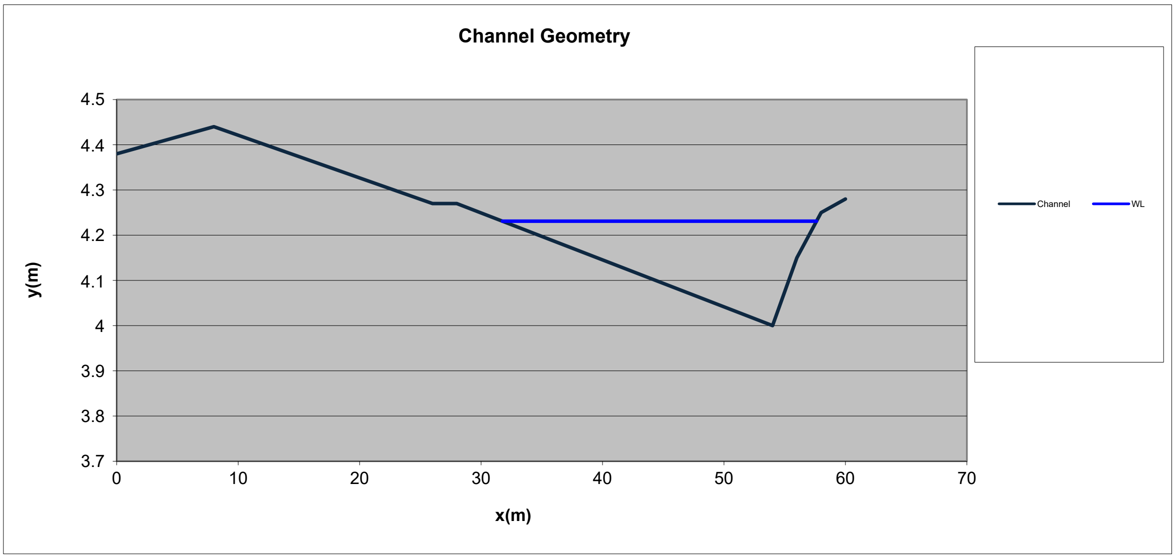
Depth (d-m)	4.231
Area (A-m^2)	2.947
Width (B-m)	25.864
Perimeter (P-m)	25.873

Critical Flow Conditions

Flow (m^3/s)	3.115	INCREASE CHANI
Velocity (m/s)	1.057	
Energy (m)	4.288	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey Civil, Structural and Fire Engineers Takapuna **Botany** Queenstown	**Client:**	HND HMB Ltd		**Sheet No:** 1
	Job:	3 Pigeon Mountain Road Half Moon Bay		**Job No:** 220571/01
	Calc's By:	SW	**Phone:**	**Date:**
	Reviewed By:	RCHT	09 534 6523	15/07/2024

CHANNEL CAPACITY CALCULATIONS EXISTING Marina Carpark

INPUTS

Case (A or B)	B
Case A	
Flow (m^3/s)	4.424
Case B	
Slope (S_o)	0.013
Water level (m)	3.87
MFFL	4.37

0.117

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	3.94	0.013		building
8	3.76	0.013		carpark
10	3.82	0.013		carpark
18	3.89	0.013		carpark
34	3.75	0.013		carpark
36	3.75	0.013		carpark
40	3.76	0.013		carpark
56	3.83	0.013		carpark
58	4.01	0.013		carpark
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.
$n=(\sum(P_1 n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.
Default value is 1.0.

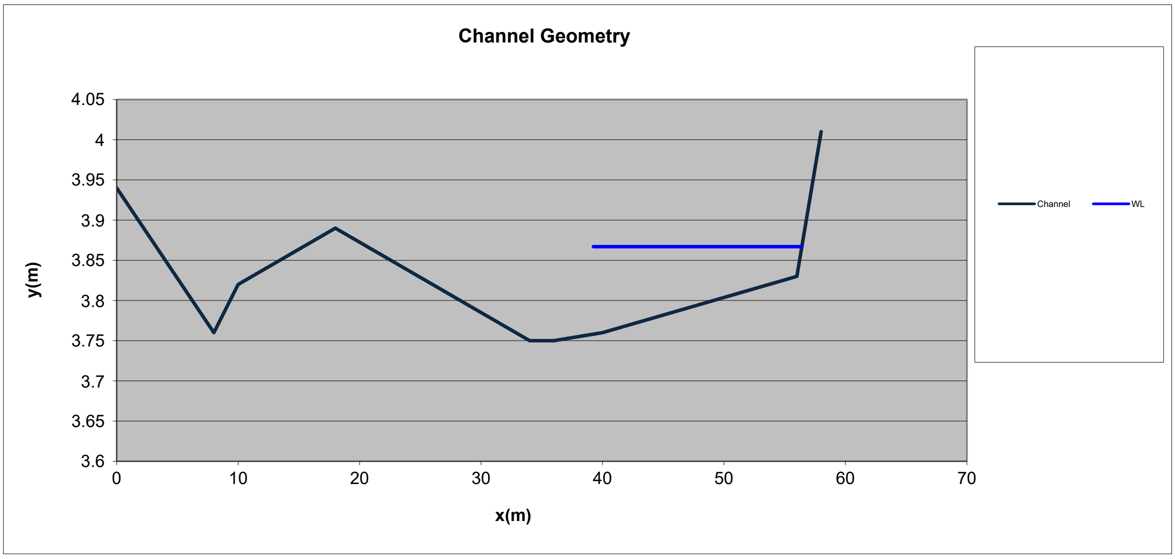
OUTPUTS

Normal Flow Conditions		
Flow (m^3/s)	4.480	OK
Velocity (m/s)	1.418	
S_o or S_f	0.0130	
Energy (m)	3.970	
Froude No	1.764	
Bed Stress (Pa)	8.407	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.75	

Geometry for wetted conditions	
Depth (d-m)	3.867
Area (A-m^2)	3.158
Width (B-m)	47.910
Perimeter (P-m)	47.914

Critical Flow Conditions		
Flow (m^3/s)	2.540	INCREASE CHANI
Velocity (m/s)	0.804	
Energy (m)	3.900	

Typical "n" values	
Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5



Airey **Civil, Structural and Fire Engineers**

Takapuna **Botany** Queenstown

Client:	HND HMB Ltd			**Sheet No:** 1
Job:	3 Pigeon Mountain Road Half Moon Bay			**Job No:** 220571/01
Calc's By:	SW	**Phone:**		**Date:**
Reviewed By:	RCHT	09 534 6523		15/07/2024

CHANNEL CAPACITY CALCULATIONS POST DEV Marina Carpark

INPUTS

Case (A or B) B

Case A

Flow (m^3/s) 4.567

Case B

Slope (S_o)	0.013		
Water level (m)	3.87		0.118
MFFL	4.37		

Channel Geometry x (m)	y (m)	Mannings "n" value	Sinuosity	
0	3.94	0.013		building
8	3.76	0.013		carpark
10	3.82	0.013		carpark
18	3.89	0.013		carpark
34	3.75	0.013		carpark
36	3.75	0.013		carpark
40	3.76	0.013		carpark
56	3.83	0.013		carpark
58	4.01	0.013		carpark
-1				

The table can input 10 (x,y) co-ordinates.
The (x,y) pairs should be in order
Terminate list by making x = -1.0

Flow distribution is based on velocity and energy gradient common to all parts of the channel. i.e.

$n=(\sum(P_1n_1^{1.5}+....)/P)^{0.67}$

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o. Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m^3/s)	4.576	OK
Velocity (m/s)	1.427	
S_o or S_f	0.0130	
Energy (m)	3.972	
Froude No	1.766	
Bed Stress (Pa)	8.484	
Equivalent "n"	0.013	
Equivalent k_s(mm)	1.75	

Geometry for wetted conditions

Depth (d-m)	3.868
Area ($A-m^2$)	3.207
Width (B-m)	48.194
Perimeter (P-m)	48.198

Critical Flow Conditions

Flow (m^3/s)	2.591	INCREASE CHANI
Velocity (m/s)	0.808	
Energy (m)	3.901	

Typical "n" values

Concrete	0.013
Gunite	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5