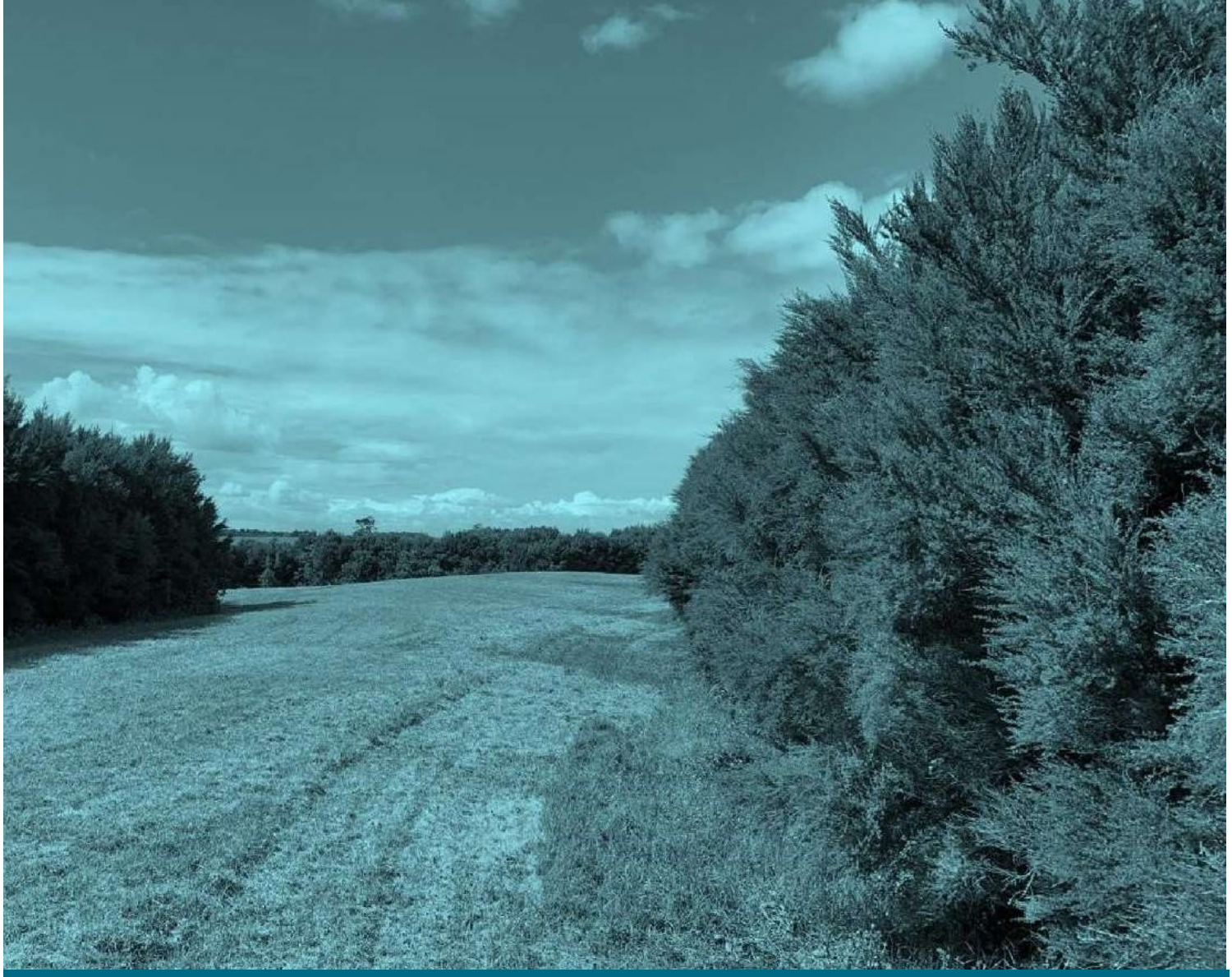


Glenbrook Beach Substation

Infrastructure Design Report

21074-RPT-01/ Revision 2.0/ 7-Sep-2022

INSPIRED. AGILE. GENUINE.

ERGO CONSULTING

Document history and status

Revision	Date	Author	Reviewed by	Approved by	Status
1.0	23/03/22	SRG	AW	SRG	discussion
2.0	07/09/22	SRG	MS	SRG	For consent

Revision details

Revision	Details
1.0	For discussion
2.0	NoR Consent application

Table of Contents

1. Introduction

This summary report covers the civil site considerations for the development of a substation at Lot 1003, 27 McLarin Road, Glenbrook Beach. The proposed works is for a 33-11kV indoor switchroom and two outdoor 33-11kV transformers. Lot 1003 is a super-lot within the Kahawhai Development, and is approximately 3358m2 in size.

Counties Energy are allowing for the development with increased load in the area.

A concept design of the substation layout has been determined, subject to change, which provides an indication of size, earthworks, infrastructure needs and is to inform the planning for the site. Based on this, the site is suitable for the development of a new substation.

The conceptual layout can be found in Appendix 1.

1.1 Summary of Site Works

The proposed summary for the substation at lot 1003 27 McLarin Road:

- Construction of an 11kV & 33kV switchroom building, to house GIS switchgear, plus associated protection, control and ancillary panels.
- Construction of two 33-11kV transformer bays.
- Civil site works such as earthworks, stormwater drainage, wastewater drainage and driveways.
- Fencing of the site.

1.2 Site Location & Description

The proposed site is Lot 1003 of the 27 McLarin Road subdivision.

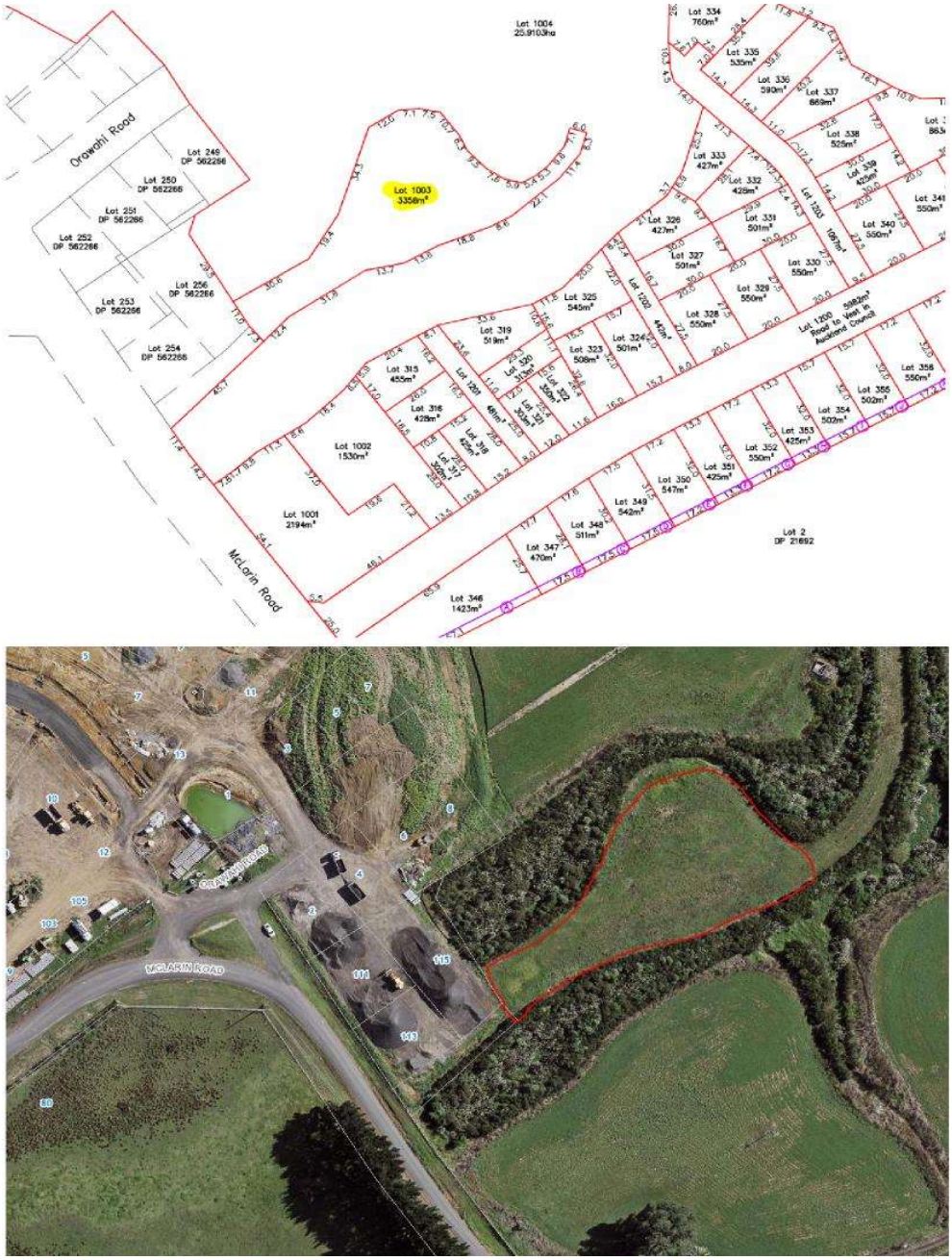


Figure 1.2.1 : Lot 1003 27McLarin Road.

The site is currently a being developed as part of the overall subdivision works for the Kahawhai Point development. The site is likely to be #117 McLarin Road.

2. Concept Substation

The following is the conceptual substation development to aid the planning for the site.

The substation will develop for the middle of the site and have two outdoor transformer bays and a 140m2 switchroom building.

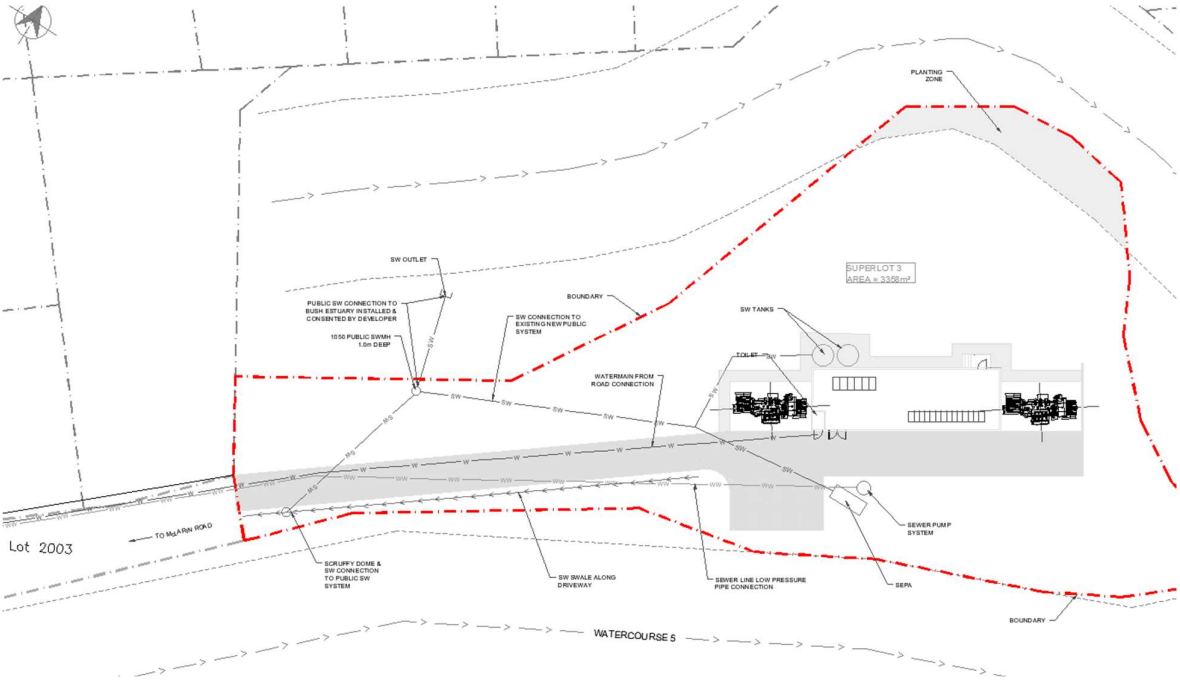


Figure 2.1: Concept Substation Layout

2.1 Switchroom Building

The switchroom building will be in the middle of the substation site. This is similar to the Counties Energy substation at Waiuku. The building will be a single storey with a full cable basement below.

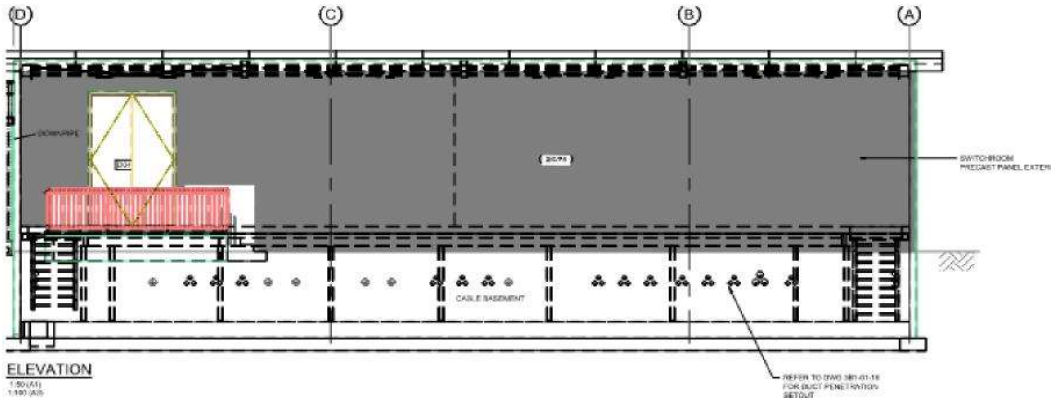


Figure 2.1.1 : Example substation building elevation

The building will house:

- 11kV & 33kV switchgear
- Protection/control and ancillary panels
- Ripple plant
- Toilet

The building will be a precast concrete structure, approximately 21m long by 7.0m wide, with a full basement.

2.2 Transformer Bay

Two transformers will be installed at the site, with concrete foundations and bunding around the perimeter. Where the transformers are close to the boundaries, fire walls will be installed.

3. Three Waters

3.1 Stormwater

3.1.1 Stormwater Discharge

It is proposed that rainwater from the site pavements and roofs will be discharged to the public stormwater system discharging into the gully running past the site. A stormwater connection for the site will be provided by Kahawhai Development Limited on the western side of the site.

3.1.2 Site Coverage

The site impermeable and coverage areas are as follows:

Substation Coverage – 3358m2		
Name	**m2**	**Percentage of Area**
Impermeable Site Coverage (Driveways, Buildings)	790m2	24%
Permeable landscaped area	2256m2	76%
TOTAL	3358m2	

3.1.3 Stormwater Management - Retention

The site is required to have hydraulic neutrality, based on the subdivision planning regulations for a SMAF 1 area. The requirements are for detention of the impervious areas for the 95% percentile rainfall event and release over 24 hours.

A covenant for the site also requires 3000 litres of water be available for re-use at the site.

3.1.4 Stormwater Management - Treatment

The site will have low volumes of traffic and will not have any particular requirement for stormwater treatments. Counties Energy propose to install a stormwater swale along the driveway of the site to provide treatment from the driveway areas.

3.1.5 Transformer Oil Management

The transformers on the site will each contain approximately 10,000 litres of oil. It is proposed to provide bunding around the transformers which will provide emergency containment of the volume of oil, plus either 10% extra oil and a contingency for rain or fire-fighting water. The rainwater from the transformer bunded area will be reticulated through a proprietary oil plate separator during normal operation.

3.1.6 Flooding & Overland Flow Paths

Auckland Council GIS maps do not indicate any flooding risk at the site, but do indicate flooding in the drainage gullies either side of the site.

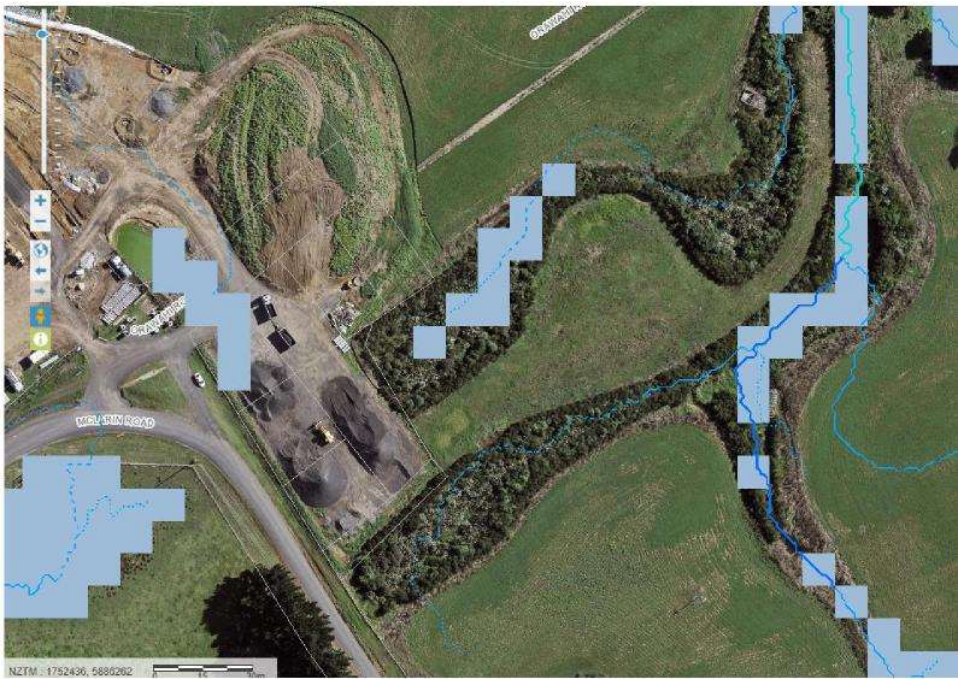


Figure 3.1.5 : Auckland GIS Flood Risk & OLFP

A walk over assessment of the site has been carried out by a civil engineer and there is little risk of global or local flooding. The substation site and location of the proposed development is slighting raised above the surrounding ground level.

3.2 Wastewater

The site is part of a new subdivision development which will be installing a new public low pressure sewer system in McLarin Road.

3.2.1 Sewer Connection

The sewer connection from the site to the low pressure sewer will be via a pump station in the substation site to a proprietary connection to the public waste water line.

3.2.2 Wastewater Loading

The substation site will be an unoccupied facility with a single toilet facility. The substation will have 2-3 maintenance visits per week and therefore the wastewater flows will be insignificant. The #1003 super lot has been modelled by GHD (Letter report 3 February 2022 – ref 125464340) as having three residential sites which would have significantly higher flows than will occur from the substation.

3.3 Water Supply

The site is part of a new subdivision development and will be installing a new public water supply system in McLarin Road.

3.3.1 Water Connection

A new metered water supply connection will be made to the public watermain. A watermain for the site will be installed along the shared access to the substation toilet.

3.3.2 Water Demand

The substation site will be an unoccupied facility with a single toilet facility. The substation will have 2-3 maintenance visits per week and therefore the water demand will be insignificant. The #1003 super lot has been modelled by Riley Consultants (Report "Civil Engineering Assessment Kahawai Point Stage 5, 127 McLarin Road" – dated 15 February 2022, appended to this report) as 540l/day which exceeds the likely demand for the substation of 10l/day.

4. Site Access

4.1 Vehicle Crossing & Shared Access

A residential concrete vehicle crossing and shared access have been constructed for the site off McLarin Road.

4.2 Driveway

A 4.0m wide asphalt driveway will be installed adjacent to the southern boundary to the substation building.

4.3 Carparking

The substation will be an un-manned site, but will be visited regularly by maintenance staff. Four carparks are proposed for the site to accommodate maintenance vehicles.

5. Earthworks & Soil Conditions

5.1 Soil & Geotechnical Conditions

A geotechnical investigation for the site has been carried out by Engineering Geology, and their report dated 25 March 2022 is appended to this report.

The site is suitable for development as a substation, with no particular areas of concern.

No significant earthquake or liquefaction risks was identified at the site.

5.2 Earthworks

The proposed earth works at the site will be related to clearance of building platforms and excavation for the building basement.

The earthworks volumes are as follows:

Cut to waste	700 m3
Imported Fill	325 m3
Area of earthworks	900 m2

Extent of earthworks are shown in the figure below:

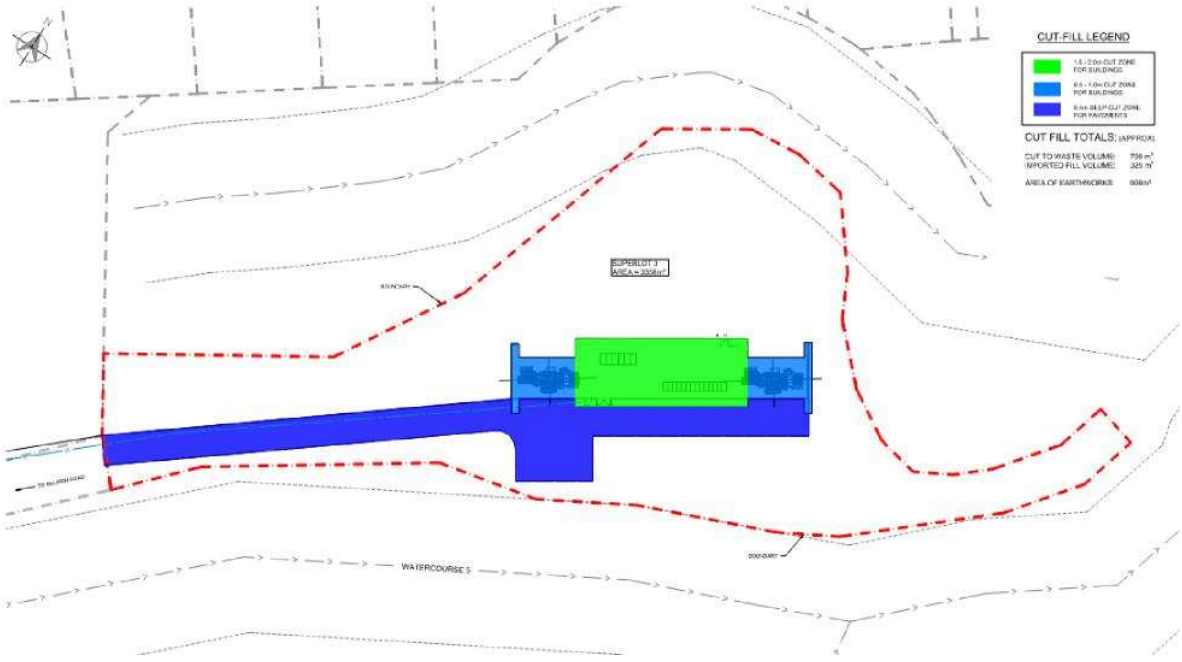


Figure 5.3.1 : Possible earthworks area

5.3 Silt & Sediment Control

The area and volume of earthworks are not significant for this development. Due to the conceptual nature of design a specific ESCP has not been developed. This will be developed during the future stages of the project.

6. Other Considerations

6.1 Acoustics

An acoustic assessment for the site has not been undertaken due to the early stages of the design. The transformers will be placed approximately 40m from the residential property boundaries and this will likely mitigate any noise issues to these properties.

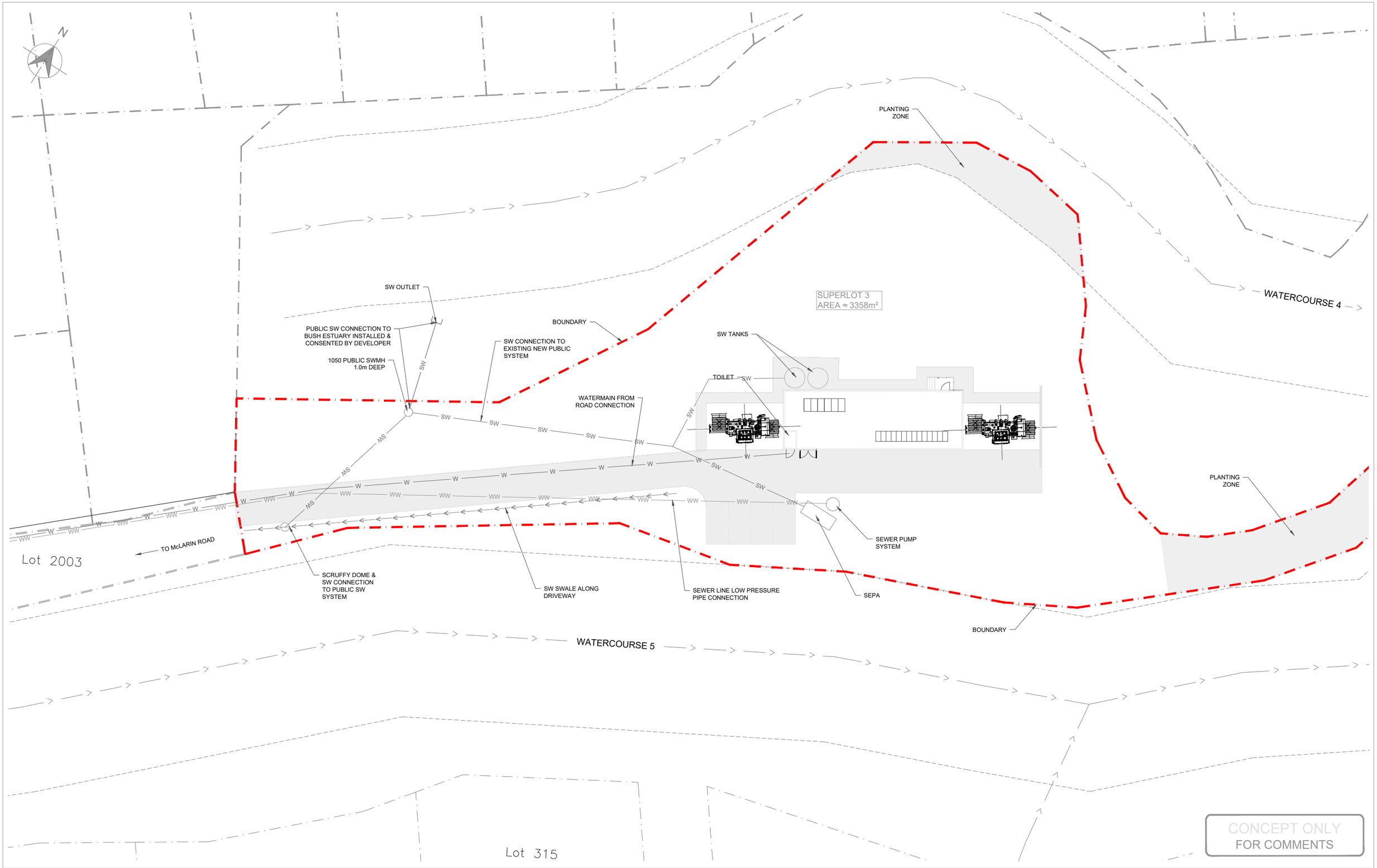
A full acoustic assessment will be produced during the detailed design of the site.

6.2 Fire Engineering

The concept design has considered that that the transformers require to be 20m from any boundary or dwelling, or appropriate fire walls installed. A fire assessment & report will be carried out during the detailed design of the site.

7. Appendices

Appendix 1. Concept Site Plans



REV	DESCRIPTION	DSN	DATE	APP	REV	DESCRIPTION	DSN	DATE	APP
1	ISSUED FOR REVIEW	NS	18.3.22	SG					
2	UPDATED SW OUTLET LOCATION	SG	03.4.22	SG					
3	DRAWING TO DEVELOPER	SRG	03.6.22	SRG					

DRAWN NS	MAR'22
DESIGNED SG	MAR'22
CHECKED	
RECOMND	
APPROVED	

Counties Energy

ZONE SUBSTATION

GLENBROOK CONCEPT
PROPOSED CONCEPT SWITCHROOM LAYOUT PLAN

SIZE	SCALE	FOLDER
A1	1:200 @A1 1:400 @A3	-

GLB–SK1 | 3

FILE NAME GLB_SK01.dwg

Appendix 2. Geotechnical Report

Engineering Geology Ltd
+64 9 486 2546
info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz

Ref: 9484

Date: 25 March 2022

Ergo Consulting Limited
116 McLarin Road
Glenbrook
AUCKLAND 1023

Attention: Mr S Gaskin

Dear Steve,

RE: PROPOSED SUBSTATION DEVELOPMENT
116 MCLARIN ROAD, GLENBROOK
Geotechnical Assessment

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for a proposed Substation development at the above address for our client Ergo Consultants Ltd.

The investigation has been carried out to assess the subsoil conditions and provide geotechnical recommendations for the proposed development. We understand that our report will be used for the foundation design and will be submitted to Auckland Council as part of a Building Consent application.

2.0 SITE DESCRIPTION

The property is party of larger block of land currently titled Lot 5000 DP 562266 and 1/2 SH LOT 2003 DP 562266. The lot has a total area of about 35Ha. It is located 85m south of the intersection of McLarin Road with Orawahi Road. The local topography within the property slopes from the centre of the property outwards at an average slope of about 1H:11V.

The Auckland Council GIS database shows no public underground services located within the property.

3.0 PROPOSED DEVELOPMENT

We understand that it is proposed to construct a new switch room and transformer yard on the site. The new switch room may have a cable basement of up to 2 m depth.

4.0 GEOLOGY

According to the 1:250,000 scale geological map of Auckland published by the Institute of Geological and Nuclear Science the subject site is underlain by the East Coast Bays Formation of the Waitemata Group. These deposits are characterised by a series of inter-bedded mudstone and sandstones deposited around 20 million years ago and are found under much of the Auckland Metropolitan area. In situ weathering of the usually dark-grey bedrock material has created in most locations, an overburden comprising mixtures of silts, clays and sands, being predominantly orange, brown and grey in colour and often containing hard

dark-brown iron oxide (limonitic) concentrations. Ground conditions encountered on site comprised residual soil of the Waitemata Group consistent with the geological map.

5.0 SITE INVESTIGATION

Our fieldwork was carried out on 15th March 2022. The fieldwork comprised an inspection of the site by a geotechnical technician and the drilling of four hand auger boreholes, designated BH1 to BH4. The boreholes were all drilled to a maximum target depth of 4.8m.

The boreholes were 50 mm in diameter and the *in situ*, undrained shear strengths of the subsoils were measured in the boreholes at approximately 0.3m intervals with a hand operated Pilcon shear vane. Soils recovered from the investigation boreholes was logged in general accordance with the New Zealand Geotechnical Societies "Guideline for the Field Description of Soil and Rock" dated 2005.

The location of the boreholes in relation to the proposed building site and the boundaries of the property are shown on Drawing 9484-1. Descriptions of the soils encountered in the boreholes, along with measured shear vane strengths are presented on the attached borehole log sheets.

6.0 SUBSOIL CONDITIONS

Topsoil was encountered to depths of between 0.3 m and 0.5 m across the site. Below the topsoil, the boreholes encountered residual soil down to the base of the boreholes. Shear vane strengths recorded in-situ ranged from a low of 111kPa to a high of 200kPa + (the maximum able to be measured on the dial).

7.0 GROUND WATER

Groundwater was encountered on the day of drilling at 4.3 m in BH1 with BH2, BH3 and BH4 remaining dry. We anticipate that during periods of wetter weather, the static water level may rise within 1-2 m of the ground surfaces. Given the shallow depth of the underlying transitional materials it is also probable that a shallow perched water table may develop following prolonged or heavy rainfall.

8.0 SITE SOIL CLASS (1170)

In accordance with AS/NZS1170.0 the site soils fall within the Class C classification.

9.0 BUILDING IMPORTANCE LEVEL

We understand that the switchboard building has been designated as having an Importance Level 4 (IL4) in accordance with AS/NZS1170.

10.0 LIQUEFACTION AND LATERAL SPREADING RISK

The hand auger boreholes found that the underlying residual soils comprise very stiff to hard silty clays. Due to the age and plastic nature of the soils, we do not anticipate any liquefaction risk.

11.0 DISCUSSION

The soil type encountered on the site comprised East Coast Bays Formation of the Waitemata Group. These soils are known to be particularly susceptible to volume changes due to changes in the moisture content (i.e. shrink/swell). We therefore recommend that shallow foundations may be designed in accordance with AS2870:2011 for class H1 soils. In this case we recommend that shallow strip and pad foundations should be designed in accordance with AS2870:2011 H1 soil having a minimum depth of embedment of 0.9m.

For lightly loaded structures, not exceeding an average distributed ground bearing pressure of 30kPa, settlement is unlikely to be an issue and therefore shallow foundation may be adopted. For structures with larger foundation loadings, piled foundations are required. Foundations should be designed in accordance with the recommendations within this report.

Where weaker soils are encountered in the foundations, undercut maybe required and the footing brought back to invert level either with well compacted hardfill or with Site Concrete.

We understand that a cable basement may be required. Due to possible shallow groundwater table, any basement excavation should be designed as fully tanked and make provision for buoyancy. For design purposes, the groundwater table depth should be assumed to be approximately 1m from the ground surface. Due to the depth of the groundwater table measured in excess of the proposed basement excavation, it is not anticipated that groundwater drawdown in either the temporary or permanent cases will be an issue and do not require an assessment with respect to the Auckland Councils Unitary Plan.

The basement cut should be adequately retained or battered back to a slope of no greater than 1V:1H as per our recommendations below. It is considered that where batter slopes can't be formed due to proximity to the boundary, then temporary retaining may be required.

12.0 GEOTECHNICAL RECOMMENDATIONS

Based on our discussion above, our geotechnical recommendations for the proposed development are as follows:

1) Prior to construction on site the final building foundation and earthwork plans should be reviewed and approved by a Geotechnical Engineer to ensure that our recommendations have been correctly interpreted.

2) All foundations, floor slabs and services into the building must be designed for class H1 soils in terms of AS2870:2011.

3) Foundations may generally comprise conventional shallow strip or pad footings designed under Ultimate Limit State design for a dependable bearing pressure of 150 kPa (300 kPa ultimate). Footings should be designed as per recommendation 3 above and taken down at least 0.9m below cut ground levels as a precaution against settlement affects associated with seasonal soil shrinkage. If weak ground (such as that encountered within BH6) is encountered in footing excavations, they should be undercut to competent ground and brought back to footing invert level with either well compacted hard fill or mass concrete, subject to specific recommendations by a Geotechnical Engineer.

4) Floor slabs on level cut ground may be cast-on-grade provided all vegetation, topsoil and any weak soils are removed and subject to the review and approval of the sub-grade by a Geotechnical Engineer and should be designed for the special provisions of Class H1 soils. The subgrade surface under any foundation and floor slab should not be allowed to dry out or be remoulded by construction work and should be protected with a layer of basecourse, or similar, immediately following excavation and trimming to the design profile. Floor slabs should not be poured on subgrades which have been allowed to dry out and desiccate. Should cracking of clay subgrades of more than 10mm be observed, the advice of a Geotechnical Engineer should be obtained before placing hardfill or pouring slabs.

5) Care should be taken with disposal of storm water to prevent any uncontrolled concentrated discharge of water which could exacerbate shrinkage and swell movement. Stormwater from roofs, footpaths and the driveway should be piped to discharge into existing public services, in accordance with Auckland Council requirements.

6) The soils on the site are considered to be highly susceptible to seasonal shrinkage and swelling. The effects of which can be exacerbated by trees (especially exotic varieties), hedges and plants having a high-water demand, which, should not be planted near the building as they can withdraw moisture from the soil and cause any shallow foundations and ground bearing floor slabs to settle. As a guide to class H1 soils, trees should be planted no closer to the building than the mature height of the tree.

7) Our experience with the soils in this area indicates that when they are exposed to the weather or heavy machinery trafficking their strengths may be significantly compromised, particularly during wet site conditions. We recommend that a CBR value of 3% is adopted for the design of pavements within the site. We also recommend that the carpark and building platform areas are only trimmed to final levels immediately prior to metalling and that at all times the site is shaped to avoid water ponding during rain.

8) During building excavation, earthworks and foundation construction the site should be examined by a Geotechnical Engineer or Engineering Geologist to confirm the nature of the subgrade and measure foundation and soil strengths, test fill compaction as well as to provide advice on any other geotechnical issues which may become apparent during construction.

   Where Engineering Geology Ltd is required to carry out site inspections during construction and provide certification or a Producer Statement – Construction Review, it is requested that we be supplied a copy of the Building Consent Conditions. We request that a minimum notification of 24 hours be given for any site inspections and note that we will be unable to issue a Producer Statement without site inspections at the appropriate stages during construction.

   We note that site inspections during construction and associated certification are not included within the budget for the preparation of the geotechnical report and will be subject to additional costs

13.0 LIMITATIONS

Recommendations and opinions in this report are based on the data from four hand auger boreholes. While the nature and continuity of the subsoil conditions away from the boreholes is inferred it is possible that actual conditions could vary from those assumed. Should variations in subsoil conditions from those described in this report be found to exist, then it is essential that Engineering Geology Ltd be contacted as it may affect the design parameters recommended above.

This report has been prepared solely for the benefit of Ergo Consultants Limited as our client with respect to the brief to assess the subsoil conditions for the proposed development and Engineering Geology Ltd accepts no liability to any other party in relation to this report. The reliance by other parties on the information or opinions contained in this report shall, without our prior review and agreement in writing, be at such parties' sole risk.

We would be pleased to provide any further advice you may require.

Yours faithfully
ENGINEERING GEOLOGY LIMITED

Prepared by: Reviewed by:

C. Lee (Geotechnical Engineer) P. Carter (CPEng)

Enclosure: Borehole log Terminology
Borelogs – BH's 1 to 4
Drawings 9484-1

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PO Box 301054, Albany, Auckland 0752
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HAND AUGER LOG

BOREHOLE No.: BH1

SHEET 1 OF 1

Job No.: 9484

PROJECT: 116 Mclarin Road
LOCATION: 116 Mclarin Road, Glen Brook
RL GROUND:
DATUM: Auckland 1946

DATE: 15/03/2022
HOLE DEPTH: 4.8m
COORDINATES: East 1752329.3 North 5886166.0
GRID: NZTM 2000

GEOLOGICAL UNIT	SOIL MATERIAL DESCRIPTION	DEPTH / RL	GRAPHIC LOG	DEPTH (m)	MOISTURE CONDITION	CONSISTENCY / DENSITY	SAMPLES	WATER CONTENT (%)	SEEPAGE / WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Field Vane (BS 1377) ○ Remoulded Field Vane	FIELD TESTS
TS	Organic SILT; light brown. Hard, moist, low plasticity.	0.0									
		0.3									SV: 0.3m, UTP
Waitemata Group	Silty CLAY; dark brown. Hard, moist, moderate plasticity.	-0.3									SV: 0.6m, UTP
						H					SV: 0.9m, UTP
				1							
		1.1									
	light brown	-1.1									SV: 1.2m, 200+ kPa
		1.4									
	light grey, orange	-1.4									SV: 1.5m, 200+ kPa
		1.6									
	trace sand (f)	-1.6									
		1.8									SV: 1.8m, 179 / 69 kPa (2.6)
	very stiff	-1.8									
		1.9									
	Clayey SILT; light grey, orange. Very stiff, moist, low plasticity.	-1.9		2	M						SV: 2.1m, 166 / 62 kPa (2.7)
											SV: 2.4m, 168 / 75 kPa (2.2)
		2.5									
	light grey	-2.5									SV: 2.7m, 145 / 74 kPa (2.0)
				3							SV: 3.0m, 139 / 79 kPa (1.8)
						VSt					SV: 3.3m, 146 / 72 kPa (2.0)
		3.4									
	light grey, orange	-3.4									SV: 3.6m, 142 / 63 kPa (2.3)
		3.8									
	light grey	-3.8									SV: 3.9m, 132 / 54 kPa (2.4)
		4.0									
	wet	-4.0		4	W						SV: 4.2m, 126 / 60 kPa (2.1)
		4.3							4.30m, 15/03/2022		
	saturated, seepage encountered @4.3m	-4.3			S						SV: 4.5m, 120 / 46 kPa (2.6)
		4.8									SV: 4.8m, 123 / 49 kPa (2.5)

EOH: 4.80 m

NOTES:
E.O.B 4.8m (Target Depth). Coordinates gathered from Google Earth.

LOGGED: SK
CHECKED:
DRILL TYPE: 50mm Hand Auger

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HAND AUGER LOG

BOREHOLE No.: BH2

SHEET 1 OF 1

Job No.: 9484

PROJECT: 116 Mclarin Road
LOCATION: 116 Mclarin Road, Glen Brook
RL GROUND:
DATUM: Auckland 1946

DATE: 15/03/2022
HOLE DEPTH: 4.8m
COORDINATES: East 1752363.9 North 5886190.0
GRID: NZTM 2000

GEOLOGICAL UNIT	SOIL MATERIAL DESCRIPTION	DEPTH / RL	GRAPHIC LOG	DEPTH (m)	MOISTURE CONDITION	CONSISTENCY / DENSITY	SAMPLES	WATER CONTENT (%)	SEEPAGE / WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa)	FIELD TESTS
TS	Organic SILT; light brown. Hard, moist, low plasticity.	0.0									
		0.3									SV: 0.3m, UTP
Waitemata Group	Silty CLAYL; light brown. Hard, moist, moderate plasticity.	-0.3				H					SV: 0.6m, 200+ kPa
				1							SV: 0.9m, 200+ kPa
											SV: 1.2m, UTP
	light grey, orange	1.4									
	very stiff	-1.4									SV: 1.5m, 168 / 54 kPa (3.1)
		1.5									
		-1.5									
		1.7									
	Clayey SILT; light grey, orange. Very stiff, moist, low plasticity.	-1.7									SV: 1.8m, 146 / 45 kPa (3.2)
				2	M				Groundwater Not Encountered		SV: 2.1m, 126 / 42 kPa (3.0)
	light grey	2.2									
		-2.2									SV: 2.4m, 115 / 46 kPa (2.5)
											SV: 2.7m, 123 / 48 kPa (2.6)
	light grey, orange	2.9									
		-2.9		3		VSt					SV: 3.0m, 119 / 43 kPa (2.8)
		3.2									
	light grey	-3.2									SV: 3.3m, 126 / 48 kPa (2.6)
											SV: 3.6m, 112 / 46 kPa (2.4)
											SV: 3.9m, 108 / 49 kPa (2.2)
				4							SV: 4.2m, 112 / 62 kPa (1.8)
	wet	4.4			W						
		-4.4									SV: 4.5m, 115 / 65 kPa (1.8)
		4.8									SV: 4.8m, 111 / 57 kPa (1.9)

EOH: 4.80 m

NOTES:
E.O.B 4.8m (Target Depth). Coordinates gathered from Google Earth.

LOGGED: SK
CHECKED:
DRILL TYPE: 50mm Hand Auger

EGL
Geotechnical, Earthquake and Dam Engineers
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HAND AUGER LOG

BOREHOLE No.: BH3

SHEET 1 OF 1

Job No.: 9484

PROJECT: 116 Mclarin Road
LOCATION: 116 Mclarin Road, Glen Brook
RL GROUND:
DATUM: Auckland 1946

DATE: 15/03/2022
HOLE DEPTH: 4.8m
COORDINATES: East 1752389.6 North 5886198.8
GRID: NZTM 2000

GEOLOGICAL UNIT	SOIL MATERIAL DESCRIPTION	DEPTH / RL	GRAPHIC LOG	DEPTH (m)	MOISTURE CONDITION	CONSISTENCY / DENSITY	SAMPLES	WATER CONTENT (%)	SEEPAGE / WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Field Vane (BS 1377) ○ Remoulded Field Vane	FIELD TESTS
TS	Organic SILT; light brown. Hard, moist, low plasticity.	0.0	TS								SV: 0.3m, UTP
		0.5									
Waitemata Group	Silty CLAY; light brown. Hard, moist, moderate plasticity.	-0.5				H					SV: 0.6m, UTP
				1							SV: 0.9m, 200+ kPa
	very stiff	-1.2									SV: 1.2m, 169 / 80 kPa (2.1)
		1.2									SV: 1.5m, 157 / 72 kPa (2.2)
	Clayey SILT; light brown. Very stiff, moist, low plasticity.	-1.6									SV: 1.8m, 154 / 69 kPa (2.2)
		1.6		2							SV: 2.1m, 151 / 57 kPa (2.6)
	light grey	-2.2			M				Groundwater Not Encountered		SV: 2.4m, 139 / 60 kPa (2.3)
		2.2									SV: 2.7m, 129 / 54 kPa (2.4)
				3		VSt					SV: 3.0m, 119 / 48 kPa (2.5)
	Silty CLAY; light grey. Very stiff, moist, low plasticity.	-3.1									SV: 3.3m, 123 / 51 kPa (2.4)
		3.1									SV: 3.6m, 128 / 49 kPa (2.6)
	Clayey SILT; light grey. Very stiff, moist, low plasticity.	-3.5									SV: 3.9m, 136 / 54 kPa (2.5)
		3.5		4							SV: 4.2m, 142 / 57 kPa (2.5)
											SV: 4.5m, 137 / 54 kPa (2.5)
		4.8									SV: 4.8m, 126 / 51 kPa (2.5)

EOH: 4.80 m

NOTES:
E.O.B 4.8m (Target Depth). Coordinates gathered from Google Earth.

LOGGED: SK
CHECKED:
DRILL TYPE: 50mm Hand Auger

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HAND AUGER LOG

BOREHOLE No.: BH4

SHEET 1 OF 1

Job No.: 9484

PROJECT: 116 Mclarin Road
LOCATION: 116 Mclarin Road, Glen Brook
RL GROUND:
DATUM: Auckland 1946

DATE: 15/03/2022
HOLE DEPTH: 4.8m
COORDINATES: East 1752374.6 North 5886213.2
GRID: NZTM 2000

GEOLOGICAL UNIT	SOIL MATERIAL DESCRIPTION	DEPTH / RL	DEPTH (m)	MOISTURE CONDITION	CONSISTENCY / DENSITY	FIELD TESTS
TS	Organic SILT; light brown. Hard, moist, low plasticity.	0.0 / 0.3				
Waitemata Group	Silty CLAY; light brown. Hard, moist, moderate plasticity.	-0.3			H	SV: 0.3m, UTP SV: 0.6m, UTP SV: 0.9m, UTP
	light grey, orange	1.1 / -1.1	1			SV: 1.2m, 200+ kPa
	very stiff	1.5 / -1.5			VSt	SV: 1.5m, 169 / 80 kPa (2.1)
	light brown, orange	1.6 / -1.6				SV: 1.8m, 165 / 72 kPa (2.3)
	Clayey SILT; orange, red. Very stiff, moist, low plasticity.	1.9 / -1.9	2			
	hard	2.1 / -2.1			H	SV: 2.1m, 200+ kPa
	orange	2.3 / -2.3		M		SV: 2.4m, 200+ kPa
	very stiff	2.7 / -2.7				SV: 2.7m, 157 / 54 kPa (2.9)
	light grey	2.9 / -2.9	3			SV: 3.0m, 139 / 59 kPa (2.4) SV: 3.3m, 134 / 54 kPa (2.5)
					VSt	SV: 3.6m, 128 / 46 kPa (2.8)
			4			SV: 3.9m, 136 / 49 kPa (2.8)
						SV: 4.2m, 119 / 42 kPa (2.8) SV: 4.5m, 122 / 48 kPa (2.5)
		4.8				SV: 4.8m, 112 / 38 kPa (2.9)

Groundwater Not Encountered

CORRECTED VANE SHEAR STRENGTH (kPa)
● Field Vane (BS 1377)
○ Remoulded Field Vane
50 100 150

EOH: 4.80 m

NOTES:
E.O.B 4.8m (Target Depth). Coordinates gathered from Google Earth.

LOGGED: SK
CHECKED:
DRILL TYPE: 50mm Hand Auger

Notes:
1. This drawing is for Information only and it is not issued for Construction.
2. The location and alignment of the structures, boundaries and the underground and above ground services shown in this drawing are approximate only and shall be verified and confirmed on site prior to any excavation and construction work.

Legend

- BH1 — Hand Auger Borehole
- Lot Boundary
- SW — Stormwater Line
- SS — Wastewater Line
- 15 — Contours 0.5m Interval

Reference:
???
Site Plan
Job No. ????
Date: ?? 2013

Auckland Council GIS Database

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116 McLarin Road, Borehole Location Plan

Drawing No.	9484–1
Date:	Mar 2022
Drawn:	SK/CL
Scale:	1:600 (A3)
Filename:	9484.dwg

Appendix 3. Riley Consultants Report (with GHD Sewer Modelling Report appended)

RILEY CONSULTANTS

CIVIL ENGINEERING ASSESSMENT
KAHAWAI POINT STAGE 5
127 MCLARIN ROAD, GLENBROOK

Engineers and Geologists

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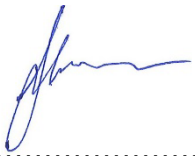
CIVIL ENGINEERING ASSESSMENT
KAHAWAI POINT STAGE 5
127 MCLARIN ROAD, GLENBROOK

Report prepared for: Kahawai Point Development Ltd

Report prepared by: Luke Gordon, Principal Engineer, CPEng

……..

Report reviewed and approved by: Steven James, Project Director, CPEng



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Report reference: 210359-J

Date: 15 February 2022

Copies to: Kahawai Point Development Ltd Electronic copy

Riley Consultants Ltd Electronic copy

Issue:	Details:	Date:
1.0	Civil Engineering Assessment	10 February 2022
2.0	Re-Issue	15 February 2022

Contents

Appendices

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CIVIL ENGINEERING ASSESSMENT
KAHAWAI POINT STAGE 5
127 MCLARIN ROAD, GLENBROOK

1.0 Introduction

The following report has been prepared by Riley Consultants Ltd (RILEY) at the request of Kahawai Point Development Ltd (KPDL). It presents the results of a civil engineering assessment to support a land use resource consent application to Auckland Council (Council). This assessment outlines the proposed infrastructure required to develop a residential subdivision at the above address. The subdivision will form part of the wider precinct development known as Kahawai Point, of which Stages 1-3 are complete and Stage 4 is under construction.

A separate application has been lodged with Council for an earthworks resource consent for the development (BUN60390577), RILEY have prepared two reports in support of that application:

- RILEY Ref: 210359-B Stage 5 Earthworks Assessment
- RILEY Ref: 210359-H Section 92 Response – Earthworks

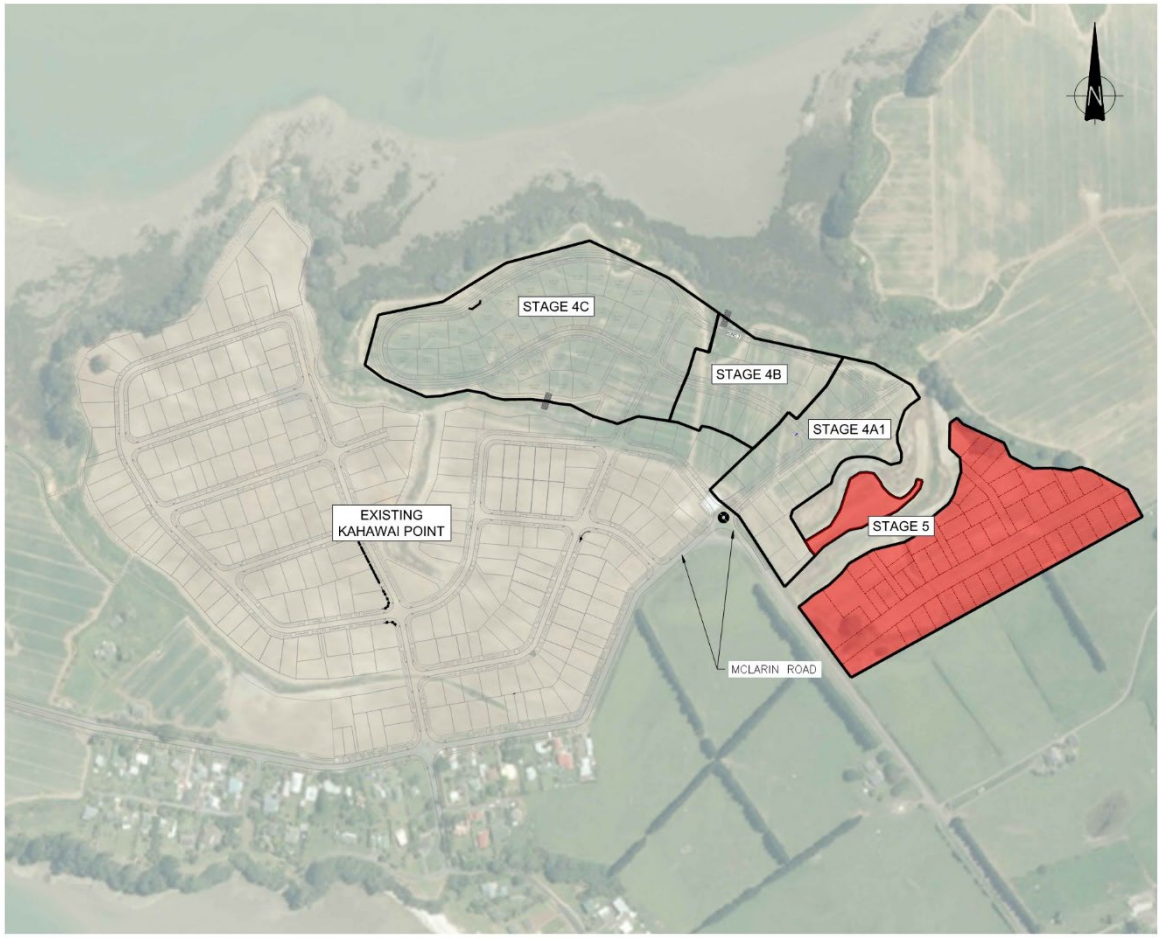
2.0 Site Description and Proposed Development

The main development area (the site) is approximately 4ha, located at the south-western corner of 127 McLarin Road. McLarin Road borders the site to the west. The ground is gently to moderately sloping, and generally falls towards two watercourses, which border the site to the north. The watercourses are identified as Watercourse 5 and 6 on the RILEY and Boffa Miskell (Boffa) plans. Auckland Geomaps identifies an overland flow path (OLFP) entering the site's southern boundary and discharging into Watercourse 5 to the north. The OLFP is identified as Watercourse 5A on the attached drawings and is classed as an ephemeral stream in the Boffa Ecology Report (submitted with the earthwork consent application). The development also includes an additional ~ 3,400m^2 strip of land located to the north of Watercourse 5, and south of Watercourse 4.

Part of the site is currently being used as a site compound relating to construction works on Stage 4. There is a large clay stockpile and smaller topsoil stockpile located centrally in the site, and a sediment pond to the north, with the remainder of the site comprising pastureland.

The location of the site in relation to the wider development is shown in Figure 1. Refer RILEY Dwg: 210359-351 in Appendix F for the existing site plan.

Figure 1: Site Location



The proposed development will consist of a total of 52 lots, comprising 48 standard residential lots, one residential superlot, two commercial lots, and one superlot (Superlot 3) – which is to be located on the strip of land to north of Watercourse 5. The standard residential lots vary in size from 300m^2 to 860m^2 approximately. A new road will be formed running west/east and adjoining McLarin Road via a new roundabout intersection. The road will provide access to the proposed lots and in the future, it is envisaged the road will be extended to access additional stages of the wider development to the east. Watercourse 5A will be filled in and overland flow re-routed through the site, whilst watercourse will be unaffected by earthworks. A 3.0m wide coastal shared path is proposed running the length of Watercourse 5 (southern side), in accordance with precinct plans, refer to Boffa plans for further details of this path.

Refer RILEY Dwg: 210359-352 for the development layout.

3.0 Proposed Engineering Works

The following sections outlines the proposed engineering works to be undertaken in relation to the development and include a consideration of the following:

i) Roading
ii) Stormwater and Overland Flow Paths
iii) Wastewater
iv) Water Supply

3.1 Roading

3.1.1 Roading Layout and Design

As noted above, a new (public) road will be formed which will provide access to the new lots from McLarin Road, the road location is in accordance with the Glenbrook 3 precinct plan. A new roundabout will be formed where the new road intersects with McLarin Road. Commercial Lot 1 and Superlot 3 will be accessed directly from McLarin Road by vehicle crossings, whilst the balance of lots will be accessed from the new road. Most of the lots will have direct access onto the new road through individual vehicle crossings, however, there are 16 rear lots which will be accessed by three new jointly owned access lots (JOAL) which will connect to the new road. It is proposed to provide four off-street parallel car parks along the new road alignment. Refer to RILEY Dwg: 210359-352 for the roading and car park layout.

The new road will be approximately 360m and will have a vertical longitudinal geometry which is gently to moderately sloping, falling to a sag point at approximately chainage 125m at a max grade of 5%. The sag point corresponds with an overland flow path which runs south-north through the site. Refer to RILEY Dwgs: 210359-355 and -356 for the road and JOAL long sections.

The proposed roundabout design has been developed by the transportation engineers Eliga and PTM Consultants, in consultation with Auckland Transport (AT). Refer to the PTM/Eliga drawings for further details of the McLarin Road intersection.

3.1.2 Road Cross Section

A 17.0m wide road reserve is proposed, the road section has been developed by PTM/Eliga in consultation with AT. The road cross section is shown on RILEY Dwg: 210359-357, and consists of the following:

- 7.0m wide carriageway way (2 x 3.5m lanes)
- 2 x 2.2m wide berm/tree pit/parking/rain garden corridor
- 2 x 1.8m wide footpath
- 2 x 1.0m wide rear service berm

In addition, the 1.8m wide footpath will continue along the eastern side of McLarin Road along the site frontage, creating a link back to existing Stage 4 footpath further to the north.

3.1.3 JOAL Cross Section

As noted above, three No. JOAL's are proposed to access the rear lots. The JOAL cross sections are shown on RILEY Dwg: 210359-358, and consists of the following:

- JOAL 1 and 2: 8.0m total width:
    - 0.5m berm,
    - 5.5m carriageway,
    - 2.0m tree pit/rain garden corridor
- JOAL 3: 9.5m total width:
    - 1.5m footpath,
    - 2.0m tree pit/rain garden corridor

- 5.5m carriageway,
- 0.5m berm.

3.1.4 Surface Water Collection and Treatment

Surface runoff collected within the Road reserve and JOAL's will be directed by kerb and channel and discharge overland into one of ten rain garden devices. Five of the rain gardens will be located in the berm areas of the road reserves (including one on McLarin Road) and will be owned and maintained by AT. The other five will be located within the JOAL berms and will be privately owned. Refer RILEY Dwg: 210359-360 for the preliminary raingarden locations.

Rain gardens were also utilised on Stage 4, however for Stage 5 the number of rain gardens has been minimized, and thus the catchment area and size of the devices has increased compared to Stage 4. We understand this is an AT general preference to have fewer and larger devices. Equally, prefabricated rain garden modules will be avoided for the public rain gardens, in favour of a non-modular in-situ design, in accordance with AT preferences.

The larger device size and non-modular design will optimise the ongoing maintenance efficiency and treatment performance of the public rain gardens. James Taylor of AWA Environmental (acting on behalf of AT's stormwater consultant), has provided provisional approval of the raingarden concept, refer correspondence in Appendix D.

The private raingardens within the JOALS will have much less contaminant load (less traffic) and therefore less maintenance requirements compared to the public ones. The private rain gardens may consist of modular units (subject to detailed design).

The typical public rain garden details are shown on RILEY Dwg: 210359-363 and discussed further in Section 3.2.3.

3.1.5 Overhead Power Relocation

An overhead power pole located on McLarin Road clashes with the proposed roundabout intersection and thus will require relocation. Counties Energy Ltd (CEL) have advised they intend to underground the overhead lines on McLarin Road, and potentially divert the cables to the other side of the road. The diversion/undergrounding works will form part of the subdivision power reticulation works, details of which will be developed with CEL and confirmed at EPA stage.

Refer to RILEY Dwg: 210359-351 and -352 for the location of the overhead power lines requiring diversion.

3.2 Stormwater

3.2.1 Overland Flow Paths

The development finished contours will maintain (approximately) the existing catchment areas to Watercourse 5 and 6 (which will be unaffected by the earthworks), thus mimicking the existing flow patterns on the site and maintaining base flow to those watercourses. As discussed, there is an existing OLFP (Watercourse 5A) that enters the site at the southern boundary (149 McLarin Road), and discharges to Watercourse 5 to the north – refer location in Figures 2 and 3. The existing OLFP will be filled and alignment within the site modified slightly to align with the proposed lot boundaries. The proposed finished surface has been developed to maintain the existing OLFP entry and exit points from the site and ensure the spill level (RL 20.25m) at the southern boundary entry point is not increased, thus ensuring no additional localised flooding within 149 McLarin Road property.

A grassed trapezoidal channel will be formed as part of the bulk earthworks to accommodate overland flow. The channel will be divided into two segments, OLFP 1, which will run from the southern boundary to the (future) road reserve, and OLFP 2 from the new road reserve to Watercourse 5. The channel centreline will be aligned with the proposed lot boundaries, such that 50% of the channel cross section lies within each lot. The channels have been specifically designed to convey the 1% Annual Exceedance Probability (AEP) flows based on RILEY hydrological assessment and considers the post-development flows from the future residential development at the site.

The proposed road has been designed with a sag point coinciding with OLFP 1, such that most of the new road overland flow will be directed through OLFP 2. A small catchment at either end of the new road which will drain to the west (McLarin Road), and to the east.

OLFP 1 and 2 details are presented in the tables below and shown on RILEY Dwg: 210359-360, the overland flow path layout is shown on RILEY Dwg: 210359-361. RILEY OLFP calculations are included in Appendix C.

Figure 2: Overland Flow Path (Council Geomaps)

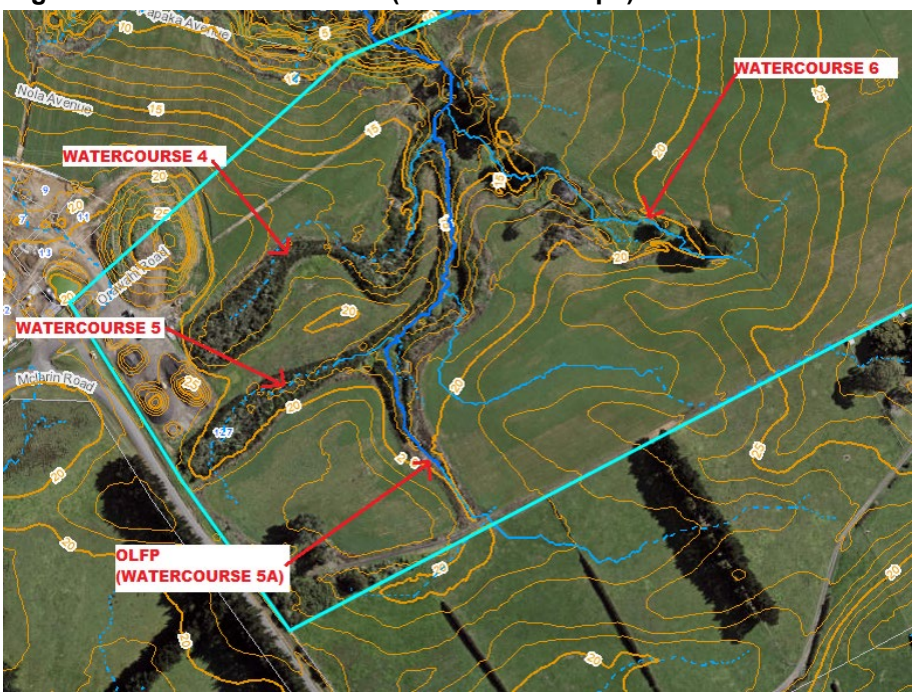


Figure 3: Existing OLFP (Watercourse 5a) – Looking Upstream

Table 1: OLFP Hydrological Analysis

Name	127 McLarin Road Catchment Area m^2 (impervious)*	127 McLarin Road Catchment Area m^2 (pervious)*	149 McLarin Road Catchment Area m^2 (impervious)	149 McLarin Road Catchment Area m^2 (pervious)	1% AEP Flow (m^3/s)
OLFP 1	0	3,394	0	23,566	0.696
OLFP 2	9,855	9,385	0	23,566	1.083

*Post development – Stage 5 subdivision

Table 2: OLFP – Trapezoidal Channel Design

Name	Surface Material	Longitudinal Gradient	Base Width	Side Slopes	1% AEP Water Depth	Water Surface Flow Width	1% AEP Velocity
OLFP 1	grass	1%	0.5m	1:5	0.32m	3.7m	1.06m/s
OLFP 2	grass	1%	0.5m	1:5	0.39m	4.4m	1.19m/s

At the northern extent of OLFP 2 (where it connects to Watercourse 5) the proposed gradient of the flow path increases to approximately 1v:4h. To mitigate the potential for localised scour during flood events, it is proposed to line this section of the OLFP with gabion rock (Dn 200mm, 400mm thick) on a geotextile membrane.

3.2.2 Stormwater Management

In accordance with the Council approved Kahawai Point Stormwater Management Plan (SMP) prepared by CKL (July 2016), mitigation measures are required to achieve the following stormwater outcomes for the development:

- Retention of runoff generated from impervious area from the 5mm runoff event in accordance with Auckland Unitary Plan Stormwater Management Area Flow 1 (SMAF 1) rules.

- Detention of runoff generated from impervious area from the 95% percentile rainfall event and release over a 24-hour period, in accordance with SMAF 1 rules.
- Stormwater treatment for high use roads >5,000 vehicles per day, i.e., treatment of the water quality volume (10mm/hr rainfall) in accordance with the requirements of GD01.

Stormwater flood attenuation is not required considering there are no flood prone properties downstream of the site (Watercourse 5 and 6 discharge directly to the CMA).

The above requirements were confirmed by Mark Iszard (Healthy Waters) in the pre-application meeting with Council held on 20 September 2021.

With respect to the roads and JOALS it is proposed the above outcomes will be achieved through a series of 'at source' rain gardens. 'Point of discharge' communal devices servicing a consolidated catchment (such as wetlands) were also considered, however the site geometry and contours does not lend itself to this approach. Instead, multiple outlets to the downstream watercourses with smaller sub catchments is preferred.

The proposed road and JOALS do not meet the threshold of high use roads, however treatment of runoff from these areas will be provided via the rain gardens which will also achieve the retention and detention requirements. The section of McLarin Road fronting the site (eastern side only) will also be serviced by a rain garden.

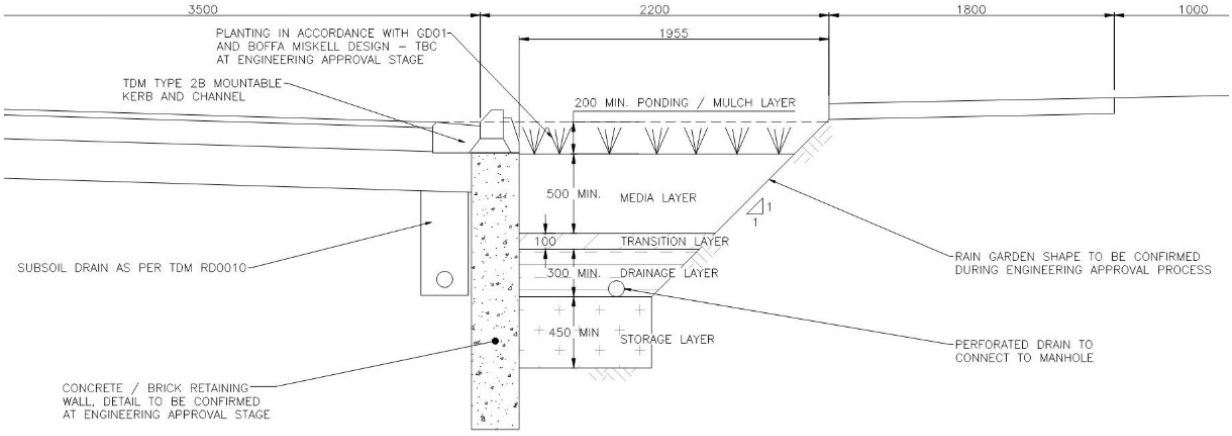
The individual lots will be required to employ at-source stormwater mitigation to achieve the retention and detention requirements above. It is expected that such requirements will be covenanted on the lot titles, as such, stormwater management within the lots is not addressed further within this report.

3.2.3 Raingardens

As noted in Section 3.1.4, a total of ten rain gardens are proposed – five public (located in road reserve berms) and five private (located in JOAL berms). The rain gardens will provide the retention, detention, and treatment requirements outlined in Section 3.4, for the road reserve and JOAL catchment areas.

An indicative cross section for the public raingarden is shown on RILEY Dwg: 210359-363 and in Figure 4. A structural in-situ wall is envisaged for the road-side to withstand the surcharge load from vehicles and to maximise the storage volume, whilst a batter slope can be employed on the footpath side. Details will be confirmed at EPA stage.

Figure 4: Public Raingarden Indicative Cross Section



A preliminary design has been undertaken to size the raingardens based on the above cross section and in accordance with GD01 guidelines. This assessment was undertaken to confirm that the design parameters can be achieved within the spaces allocated for the raingardens. A soil permeability rate of 0.123L/m^2/min has been adopted for the design, based on the CKL SMP and previous site testing (refer Section 3.2.3 of the SMP).

The raingarden preliminary sizes are presented in Table 3, and supporting calculations are included in Appendix B. Only raingarden 1 does not quite achieve the minimum ponding and infiltration footprint requirements as setout in GD01 for SMAF 1. The size of Raingarden 1 is limited by the width of the berm and distance between the adjacent lot vehicle crossings. Given the proposed raingarden size would be only marginally non-compliant, we believe it is the best practicable option and suitable in this case. All other GD01 design criteria (in terms of volumes) are easily met by all the proposed raingardens (refer attached calculations). We note that despite SMAF 1 being referenced within the SMP, the property is not shown to have a SMAF area overlay in the Unitary Plan GeoMaps viewer.

Boffa will prepare a planting and soil media specification for the rain gardens based on the device footprint and runoff volume. This will be confirmed at EPA stage.

Table 3: Raingardens Preliminary Design

ID	Location (refer plan)	Impervious Catchment Area [(1)] (m^2)	Length[(2)] (m)	Width[(2)] (m)	Depth (m)	Ponding Footprint Ratio [(2)]	Infiltration Footprint Ratio [(3)]	Compliance with SMAF 1[(4)]
1	Road Reserve Sag Point (north)	1090	17.59	2.96	1.55	4.8%	3.2%	No
2	Road Reserve Sag Point (south)	1135	20.11	2.96	1.55	5.2%	3.5%	Yes
3	Road Reserve (north)	405	14.00	1.96	1.55	6.8%	3.5%	Yes
4	Road Reserve (south)	415	14.00	1.96	1.55	6.6%	3.5%	Yes
5	JOAL 1 (north)	155	6.20	2.00	1.55	8.0%	3.6%	Yes

ID	Location (refer plan)	Impervious Catchment Area [1] (m^2)	Length[2] (m)	Width[2] (m)	Depth (m)	Ponding Footprint Ratio [2]	Infiltration Footprint Ratio [3]	Compliance with SMAF 1[4]
6	JOAL 1 (south)	155	6.20	2.00	1.55	8.0%	3.6%	Yes
7	JOAL 2	290	7.30	2.60	1.55	8.0%	3.6%	Yes
8	JOAL 3 (north)	430	7.00	3.60	1.55	5.9%	3.5%	Yes
9	JOAL 3 (south)	290	10.10	2.00	1.55	7.0%	3.5%	Yes
10	McLarin Road	540	16.05	2.12	1.55	6.3%	3.5%	

(1) Based on roading, kerb, and footpath areas from civil design
(2) Ratio of ponding area (measured at top of media layer) to impervious catchment area
(3) Ratio of infiltration area (measured at top of storage layer) to impervious catchment area
(4) SMAF 1 ponding footprint ratio = Min 5%, infiltration footprint ratio = min 3.5%

Refer RILEY Dwg: 210359-360 for the preliminary rain garden locations.

3.2.4 Stormwater Reticulation and Outfalls

Overflow form the stormwater management devices (e.g., raingardens) will be piped to one of seven new stream outfalls (discharging to Watercourse 5 and 6). The pipes will be designed to convey flows from the 10% AEP rainfall event including climate change (in accordance with Council SWCoP v3) for the full site catchment, plus a portion of the 127 McLarin Road property upstream and a portion of McLarin Road fronting the site.

The preliminary stormwater reticulation layout is shown on RILEY Dwg: 210359-360. The pipe sizes will be confirmed at EPA stage, however, preliminary sizing of the pipes beneath the proposed OLFP (which includes runoff from127 McLarin Road) has been completed and is shown in Table 4. Refer Appendix B for calculations.

Table 4: Example Stormwater Pipe Sizing:

Pipe Ref:	Catchment Area (Ha)	10yr-24hr rainfall depth* (mm)	Q_{10} (m^3/s)	Pipe Slope	Pipe Size (mm)
1a	2.59	136	0.318	1%	525
1b	3.72	136	0.561	1%	600

*Rainfall depth inclusive of climate change

The proposed number and location of the stream outfalls has largely been dictated by the existing site terrain, proposed lot and JOAL configuration, desire to mimic the existing flow patterns and maintain baseflows to the watercourses. As a result, several outfalls along the Watercourse 5 and 6 alignments are proposed, rather than single large outfall at the downstream end of those watercourses – in order to maintain some flow to the upper reaches of the watercourses.

A preliminary design of the stormwater outfalls has been undertaken in accordance with TR2013-018. A traditional concrete wingwall with rock rip-rap energy dissipation is proposed as shown in Figure 5 and RILEY Dwg: 210359-362. This is consistent with outfalls approved and constructed in Stage 4 of the development, and the details provided in the CKL SMP. The outfall pipe size and flow velocities have been determined based on an assumed 1% pipe slope. Refer Appendix B for calculations.

The outfall details are presented in Table 5. Refer to RILEY Dwg: 210359-361 for the outfall locations and catchment areas.

Figure 5: Stormwater Outfall Typical Detail

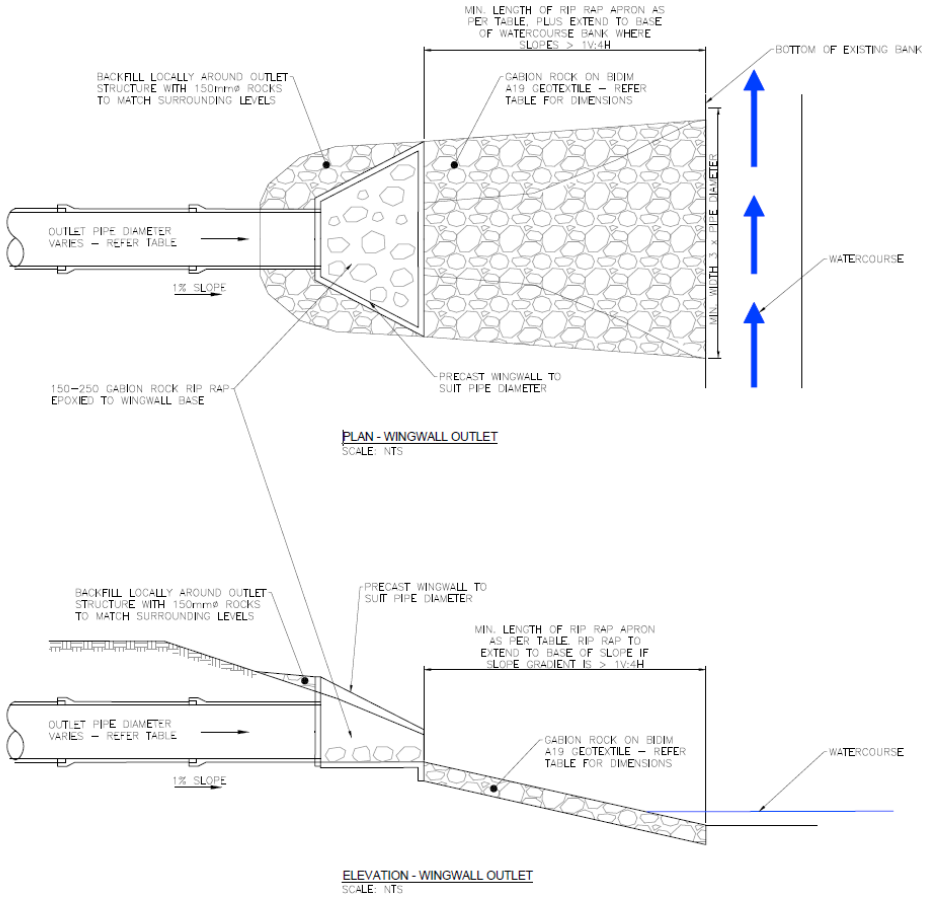


Table 5: Preliminary Stormwater Outfall Design

Outlet Ref:	Catchment Area (m^2)	Pipe Dia. (mm)	Rip Rap Apron Length (m)	Gabion Rock Size Dn_{50} (mm)	Rock Thickness (mm)
1	37,253	600	6.07	150	300
2	5,825	375	5.41	150	300
3	3,411	300	2.77	150	300
4	7,345	375	3.88	150	300
5	2,724	300	2.97	150	300
6	2,623	300	2.97	150	300
7	785	225	2.25	150	300

3.3 Wastewater

3.3.1 Existing Network and Capacity

The nearest public wastewater infrastructure is a pressure sewer network recently completed for Stage 4 which terminates with a 50mm and 90mm dia pipes on McLarin Road to the north-west of the site. From there wastewater flows to the gravity network on Hill Road where it then falls to the Glenbrook Beach pump station before being pumped to Clarks Beach Treatment facility.

Stage 5 will be developed immediately upon receipt of consent but depending on market demand. Watercare had previously agreed that KPDL can develop a further 100 lots beyond the Stage 1 and 2 based on an assumed wastewater demand per lot. 12 lots have been developed in Stage 3A and B, and 83 have been developed in Stage 4. However, wastewater metering of the Kahawai Point pressure network (meter located upstream of connection to gravity system on Hill Road) has returned a significantly lower actual wastewater demand (<120 L/person/day) than previously assumed (220 L/person/day). On this basis, there is sufficient capacity within the existing network to service the full Stage 5 development and most of the future Stage 6 development.

KPDL is working with Watercare on the design and consenting of the Southwestern Upgrade (SWU) which is anticipated at the end of 2024. The wastewater flow monitoring (Hill Road meter) will continue until such time that the SWU is completed.

3.3.2 Proposed Demand

The wastewater demand for Stage 5 subdivision based on Watercare's standard flow allowance of 180L/p/d and an assumed three-person average occupancy per property, is as follows (Noting that KPDL actual measurements conclude 2.5 persons per household and 120L/p/d)

Table 6: Design Wastewater Volumes

	No.	L/property/day	ADWF (m^3/day)
Residential Lots	48	540	25.92
Residential Superlot	1	1620(1)	1.62
Superlot(2)	1	540(2)	0.54
Commercial(3)	2	1,667(3)	3.33
		Total	**31.41**

(1) Assuming superlot lot is subdivided into 3 lots in the future
(2) Likely the superlot will be developed with a single user/owner, assume wastewater demand equivalent to one residential lot.
(3) Assumed GFA of 200 sqm per commercial lot - assume majority is dry retail/office where toilets are provided to customers (WSL CoP Table 5.1.3 – 1 person per 15m^2 floor area and 65L/p/day), with say 75m2 wet retail per lot (15L/day/m^2)

3.3.3 Proposed Network

Wastewater disposal from the site will be discharged via a new pressure sewer network, discharging to a recently completed pressure sewer network on McLarin Road. From there wastewater will flow to the gravity network on Hill Road where it will fall to the Glenbrook Beach pump station before being pumped to Clarks Beach Treatment facility.

The Stage 5 pressure sewer network has been designed by GHD and is shown on RILEY Dwg: 210359-364. Refer to the GHD pressure sewer network assessment report attached in Appendix A for further details. The Stage 5 development will be serviced by two DN50 mm pipes on either side of the road and discharge into a DN75 mm pipe within McLarin Road and ultimately connect to the existing DN90 mm pipe on McLarin Road. As part of the subdivision works, each Stage 5 lot will be provided with an individual boundary kit for future connections to the public network. Each lot/dwelling will be serviced by a private onsite pumpstation, which will be specified at building consent stage. The DN75 mm pipe will also be utilized for the future Stage development network (anticipated to be approx. 80 lots) to the east of the site.

3.4 Water Supply

3.4.1 Existing Network

The nearest public water infrastructure for Stage 5 is a 200mm main on McLarin Road located to the south of the site (located opposite No. 140 McLarin Road), and a recently constructed 50mm main which terminates outside Superlot 3 on McLarin Road.

3.4.2 Proposed Demand

The water demand for Stage 5 subdivision based on Watercare's standard flow allowance of 220L/p/d and an assumed 3-person average occupancy per property, is as follows:

Table 6: Design Water Supply Volumes

	No.	L/property/day	Daily Water Demand (m^3/day)
Residential Lots	48	660	31.68
Residential Superlot	1	1980(1)	1.98
Superlot(2)	1	660(2)	0.66
Commercial	2	1,667(3)	3.33
		Total	**37.65**

(1) Assuming lot is subdivided into three lots in the future
(2) Likely the superlot will be developed with a single user/owner, assume wastewater demand equivalent to one residential lot.
(3) Assumed GFA of 200 sqm per commercial lot - assume majority is dry retail/office where toilets are provided to customers (WSL CoP Table 6.1.b – 1 person per 15m^2 floor area and 65 L/p/day), with say 50m2 wet retail per lot (15 L/day/m^2)

3.4.3 Proposed Network

The proposal is to utilise the existing 200mm McLarin Road water main and extend it to reticulate the water network throughout the subdivision. A connection will also be made back to the 50mm main on McLarin Road to create a looped watermain system. It is proposed to reticulate a pipe network consisting of a 150mmNB PE (Polyethylene) pipe and 63mmNB PE pipes, with each proposed lot to be serviced by individual water services connection and meters from the water mains.

A total of four new hydrants are proposed at regular spacings in accordance with New Zealand Fire Service standard: SNZ PAS 4509. We understand from assessments undertaken in previous stages that there is adequate water pressure within the public water supply system to meet firefighting standards.

The proposed watermain layout is shown on RILEY Dwg: 210359-365.

4.0 Conclusions

A 52 Lot subdivision comprising 48 residential lots, two commercial lots, and two super lots is proposed at 127 McLarin Road. The development will include construction of a new road and intersection with McLarin Road, and 3 x JOALS to access rear lots off the newly created road. The development is Stage 5 of the wider Kahawai Point development. The below is a summary of the civil engineering considerations.

4.1 Stormwater

- An existing overland flow path dissects the property running south-north through the property. The flow path will be filled in and re-routed through the site via an engineered grass swale designed to convey flows from the 1% AEP rainfall event.
- The site will be recontoured to facilitate the subdivision, however catchment areas to the two downstream watercourses will remain approximately the same as currently.
- A Stormwater Management Plan has been prepared by CKL for the wider Kahawai Point development. Stormwater mitigation measures are proposed for the roads in general accordance with the SMP, to achieve:
    - Retention of 5mm rainfall
    - Detention of 24-hr 95th % rainfall event.
    - Stormwater treatment to TP10 requirements (now GD01)
- 'At source' rain garden devices are proposed to achieve the mitigation requirements for roads and JOALS as per above. Stormwater mitigation for the individual lots will be the responsibility of the individual lot owners.
- Stormwater from roads and lots will be conveyed through a public piped reticulation which will discharge to the downstream watercourse's via a number of specifically designed stormwater outfalls which will include energy dissipation measures.

4.2 Wastewater

- The existing public pressure sewer network (completed for Stage 4) will be extended along McLarin Road and into the site to service Stage 5 lots.
- GHD has completed a capacity assessment and design of the pressure sewer network extension. GHD's report is appended.
- GHD have concluded that there is sufficient capacity within the downstream network for all of Stage 5 lots plus approximately 80 lots to the east (part of future development stage/s). The proposed network extension is sized for the future stage/s to connect into.
- Individual connections (and boundary kits) will be created for each lot.

4.3 Water Supply

- The public watermain network will be extended along McLarin Road (from both directions) and into the site to service Stage 5 lots (and future stages beyond). By connecting the two existing networks on McLarin Road, a looped network will be created.
- A watermains will be extended along both sides of the new subdivision road and will deliver domestic supply to the new lots. Four proposed hydrants will satisfy the fire-fighting requirements for the subdivision.
- Individual connections (and meters) will be created for each lot.

5.0 Limitation

This report has been prepared solely for the benefit of Kahawai Point Development Ltd as our client with respect to the brief and Auckland Council in processing the consent. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal or planning opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate advice.

APPENDIX A

GHD Low Pressure Sewer Report

27 Napier Street, GHD Centre Level 3
Freemans Bay, Auckland 1010
New Zealand
www.ghd.com

Our ref: 12546340

03 February 2022

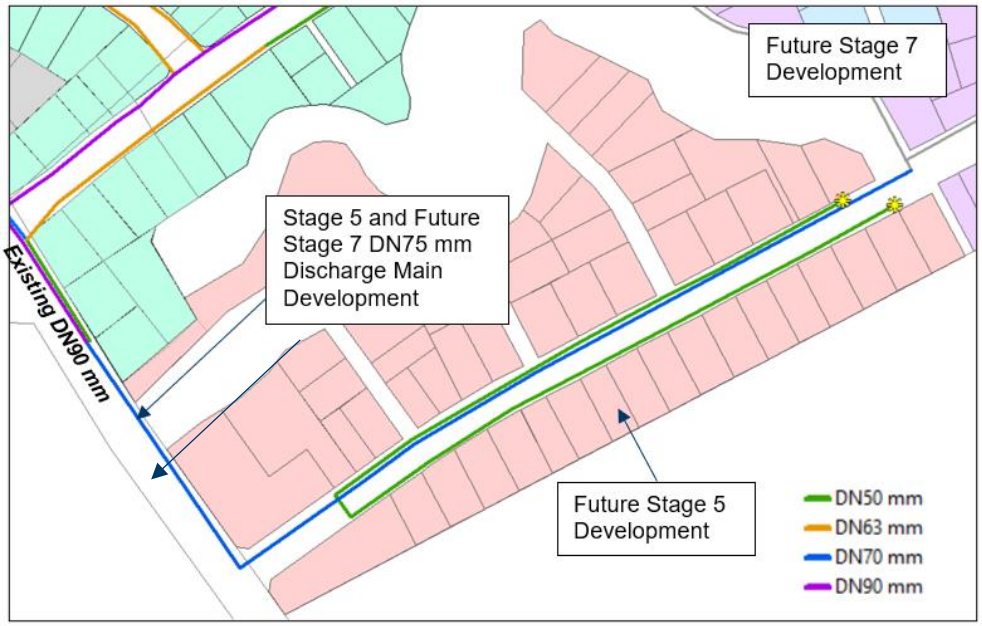
Bernie Chote
Kahawai Point Developments Ltd
PO BOX 301
Waiuku
2341

Pressure Sewer Network Assessment – Stage 5 Kahawai Point Development

Dear Bernie,

Further to your enquiries regarding the Stage 5 development at Kahawai Point, we have assessed the network design to assess the network's performance. The purpose of this assessment was to confirm that the proposed reticulation installed under Stage 5 achieved the design performance parameters as set out by Watercare (WSL) for Engineering Plan Approval.

The proposed Stage 5 development consists of 52 lots, comprising 48 standard residential lots, 1 residential superlot (we have assumed this lot may be subdivided in the future into as many as 3 residential lots), 2 commercial lots, and one further superlot (Superlot 3, with one owner). The Stage 5 development will be serviced by two DN50 mm pipes on either side of the road and discharge into a DN75 mm pipe within McLarin Road and ultimately connect to an existing DN90 mm pipe (Appendix A). The DN75 mm pipe will also be utilized for the future Stage 7 network (anticipated to be approx. 80 lots). This assessment is to evaluate that the proposed Stage 5 network and the common Stage 7 discharge main conforms to the WSL design specification.



1. Pressure Sewer Network Assessment

A dynamic model of the proposed Stage 5 pressure sewer network has been developed using Innovyze InfoWorks ICM (Version 7) dynamic hydraulic modelling software package.

As per the Watercare Code of Practice (Part 5 Wastewater), for pressure sewer design:

> **Section 5.3.12.3.3** – *The design flows shall be calculated in accordance with section 5.3.5 and as revised below:*
>
> *a) Peak flows will be based on average daily flow (ADWF) with an added capacity safety factor of 1.2 per dwelling unit.*
>
> *b) Wet weather flows shall be excluded.*

Therefore, the average daily flow per property has been identified as **540 L/property/day**, with a safety factor of 1.2 per dwelling.

However, it is common for actual network flows to be lower than the predicted 540 L/property/day. Metering of other similar residential areas suggests that an average wastewater flow per person is 140 L/person/day. It is therefore recommended to also assess a pressure sewer network performance under a lower flow scenario (**420 L/property/day)** to ensure the network can reach self-cleansing velocities and acceptable wastewater retention times.

The objective of the network assessment is to ensure that the proposed development's pressure sewer network and discharge main will:

- Achieve minimum self-cleansing velocities (above 0.9 m/s).
- Operate within acceptable pump heads (less than 40 m).
- Discharge wastewater from the network within an acceptable period (wastewater detention time) to avoid septicity and corrosion (less than 8 hours).
- Achieve sufficient air movement to avoid the need for air valves.

The network design will be assessed for the following flow scenarios:

Normal Flow Operating Scenario (648 L/property/day)

This scenario will be used as the basis for confirmation of the network's pipe sizes and pipe network layouts. The results from this scenario run are used for:

- Calculating system wastewater retention times.
- Reviewing pipe velocities and ability to achieve minimum velocities/durations.
- Reviewing maximum head at individual pump units.

Low Flow Operating Scenario (420 L/property/day)

A lower baseline loading to be applied for all residential connections. The results from this scenario run are used for:

- Confirming the robustness of the system for achieving minimum velocity conditions and sensitivity of the network's retention times.

2. Hydraulic Assessment for Stage 5

Self-Cleansing Velocities

Maximum velocities do not exceed 2 m/s, and the minimum self-cleansing velocity of 0.9 m/s is achieved (Appendix B) by most pipes. Minimum self-cleaning velocities for pipe sections at some pipe section extremities do not meet the required 0.9 m/s for the low flow scenario (Appendix C). The DN75 mm and DN 90 mm discharge main are also below the requirement at 0.8 and 0.7 m/s respectively. However, all pipes are above 0.6 m/s. The DN50 mm pipe sections are already at the minimum pipe diameter allowed (DN50 mm) and cannot be further reduced. Furthermore, previous research by Popovic (2015)[1] concluded that velocities of 0.6 m/s and higher were sufficient for self-cleansing of pressure sewer pipes. Although these velocities do not meet the Watercare CoP requirements, it is considered that self-cleaning will still be achieved. Once the Stage 7 development is connected the DN75 mm line velocity increases to 1.2 m/s.

Maximum Pump Heads

The total dynamic heads are well within the acceptable pump operation range:

Scenario	Maximum Pump Dynamic Head Range (m)
Stage 5 Development Only	22.2 to 34.5
Stage 5 Development (Stage 7 Connected)	33.2 to 44.2

The expected maximum network pressure of 35 m for the lowest elevation pump within Stage 5 is lower than the maximum permitted pressure of 40 m. Once the Stage 7 development is included the Stage 5 maximum pump head increases to 44.2 m, however these maximum pump heads over 40 m are less than 5 mins per day.

Wastewater Retention

Wastewater age is calculated to analyse the network's risk to odour and septicity and whether any mitigation measures are required.

The wastewater age calculations consider both:

- Retention time in the collection tank before pumping, and
- Travel time in the pipework system.

The total average age of wastewater leaving the network is a sum of the wastewater time in the development reticulation network and within the collection tank:

Table 1 Wastewater Age Assessment

Scenario	The total average age of wastewater leaving the network (hrs)	Time in Reticulation Network (hrs)	Time in Collection Tank (hrs)
Design Stage 5	3.3	1.9	1.4
Design Stage 5 (Low Flow)	5.1	2.9	2.2

According to the Pressure Sewer Code of Australia (**WSA 07-2007-1.1**), a wastewater age between 4 to 8 hours indicates a medium risk of septicity. A wastewater age of more than 8 hours indicates a high risk of septicity.

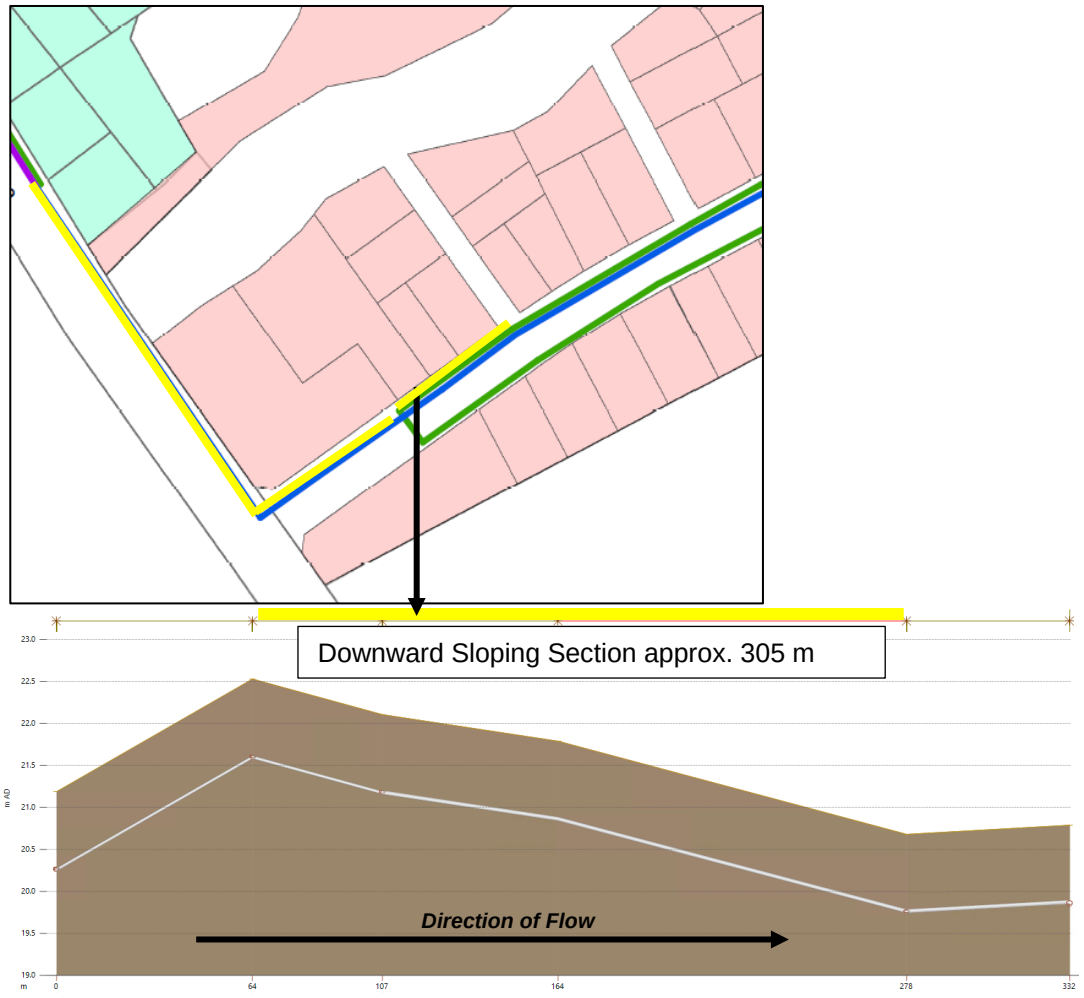
[1] Popovic, P. (2015). *Pressurized Sewage Systems and Self-Cleansing Process.* Oslo: Norwegian University of Life Sciences.

For the development, the maximum expected wastewater retention time in the collection tank and network are expected to be approximately 3 to 7 hrs. This is acceptable, according to the WSL standard of less than 8 hours.

Air Management

Within pressure sewer networks, combination air-release/vacuum break valves are required at significant high points to purge air daily from the network. Air valves may also be required on downward sloping pipes where a sufficient velocity and duration of flow is not achieved to move the air to the next air valve or the downstream upward sloping pipe section.

For the Stage 5 Development's discharge path to the DN75 mm network in McLarin Road, one downward sloping pipe section has been identified:



For a gas pocket to be successfully transported downstream to the next air valve or system outlet, there needs to be a continuous flow duration above the minimum velocity for a time long enough for the air pocket to move beyond any intermediate low points in the pipe. If a sufficient duration to move the gas along a downward sloping pipe gradient to either an air valve or an upward sloping pipe cannot be reliability achieved daily, then an air valve will be required.

The potential for gas collection is to be estimated for a system using the Walski et al equation:

Scenario	Length (m)	Diameter (mm)	V_{MINREQ}(m/s)	T_{MINREQ}(mins)	$T_{ACHIEVED}$ at V_{MIN} (mins)	$T_{ACHIEVED}$ at V_{MIN} (mins) Low Flow
Pipe Section	305	DN50 to DN75	0.35	2 to 8	11 to 16	9 to 12

The model results indicate that a long enough time is achieved for the transportation of gas pockets along the downward sloping section (even for the low flow scenario), and therefore an air valve is not required.

3. Pressure Sewer Network Layout

Air Valves

As discussed above, air valves are not required for the proposed development's pressure sewer network.

Flushing Points

Two flushing points will be located at the start of each DN50 mmpipe run, as shown in Appendix A.

Isolation Valves

Isolation valves are to be provided at branch line intersections, on each line upstream of the tee. These will enable each line to be isolated as required for maintenance or connection of additional boundary kits.

4. Conclusions

A hydraulic design of the Kahawai Point Stage 5 Development was completed. The assessment has shown that the Stage 5 design network:

- Some pipe sections do not achieve the minimum self-cleansing velocity of 0.9 m/s. However, all pipes are above 0.6 m/s. These pipe sections are already at the minimum pipe diameter allowed (DN50 mm) and cannot be further reduced. Although these velocities do not meet the Watercare CoP requirements, it is considered that self-cleaning will still be achieved.
- Operates within acceptable pump heads.
- Discharges wastewater from the network within an acceptable period of time (wastewater detention time) to avoid septicity and
- The proposed network layout does not require air valves.

For the Stage 5 and the future Stage 7 development, it is recommended that the proposed DN75 mm line (located within the Stage 5 development) be connected to the existing DN90 mm line currently within McLarin Road. It is noted that this line does not meet the minimum self-cleansing velocity requirement of 0.9 m/s when only the Stage 5 development is connected, the velocity increases to 1.2 m/s once Stage 7 is connected. However, velocities are above 0.6 m/s. Pumps within the future Stage 7 development are within acceptable pump heads (subject to the final design).

5. Recommendations

It is recommended that the Kahawai Point Stage 5 Development pressure sewer network be granted EPA approval.

Yours sincerely
For and on behalf of GHD Ltd

Teresa Scott
Senior Water Engineer

Robert White
Technical Director

APPENDIX B

Stormwater Design Calculations

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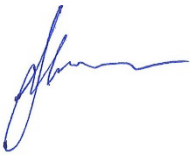
STORMWATER
DESIGN CALCULATIONS

Prepared for:	Kahawai Point Developments Ltd
Prepared by:	Morris Kleinjan, Intermediate Civil Engineer  ……
Checked by:	Luke Gordon, Principal Engineer, CPEng  ……
Reviewed and approved for issue by:	Steven James, Project Director, CPEng  ……
Project reference:	210359-J
Date:	10 February 2022

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STORMWATER
DESIGN CALCULATIONS

Prepared for: Kahawai Point Developments Ltd

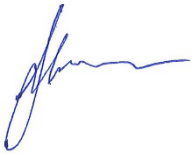
Prepared by: Aditya Raamkumar, Civil Engineer

……..

Checked by: Luke Gordon, Principal Engineer, CPEng

……..

Reviewed and approved for issue by: Steven James, Project Director, CPEng



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Project reference: 210359-J

Date: 10 February 2022

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Summary:

		Length	Width	Depth	Area
		L	W	D	A
		(m)	(m)	(m)	(m^2)
RG1	RG1 - Road 1 - Sag Point - Northside	17.59	2.96	1.55	51.98
RG2	RG1 - Road 1 - Sag Point - Southside	20.11	2.96	1.55	59.43
RG3	RG 3 - Road 1 - JOAL 3 - Northside	14.00	1.96	1.55	27.37
RG4	RG4 - Road 1 - JOAL 3 - Southside	14.00	1.96	1.55	27.37
RG5	RG5 - JOAL 1 - North	6.20	2.00	1.55	12.40
RG6	RG6 - JOAL 1 - South	6.20	2.00	1.55	12.40
RG7	RG7 - JOAL 2	7.30	2.60	1.55	18.98
RG8	RG8 - JOAL 3 - Nort (Irregular)	7.00	3.60	1.55	25.20
RG9	RG9 - JOAL 3 - South	10.10	2.00	1.55	20.20
RG10	RG10 - McLarin Road	16.00	2.22	1.55	35.52

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden Location/Name: RG1 - Road 1 - Sag Point - Northside

Parameters		Units		References
Catchment Areas				
Total		1860	m²	Based on Civil Design - refer to catchment drawing
Impervious		1090	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		770	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		15.9	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1, Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108. TP108 hydrological calculations completed separately. Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016. Post-development pervious areas - CN = 74. Impervious areas CN = 98.
Post-development		26.2	m³	
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		54.50	m²	Calculated
Design Footprint Area		51.98	m²	Calculated - see table below
Area Check		NO	-	However SMAF 2 target of >3.5% is achieved
Footprint Percentage Achieved		4.8%	-	Calculated
Storage				
Available Volume		5.43	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		38.15	m²	Calculated
Design Footprint Area		34.46	m²	Calculated - see table below
Footprint Area Check		NO	-	
Footprint Percentage Achieved		3.2%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
$K_{SUBSOIL}$		7.38	mm/hr	
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		5.43	m³	Calculated
Infiltration Volume Capacity		18.31	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		5.43	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.47	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		4.85	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		20.88	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		5.45	m³	Calculated = 5mm x impervious area
Available Volume		5.90	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth				Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}	D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria	Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)	(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	N/A		100%	100%	0.00
	Top	17.590	17.590	2.955	2.955					51.98			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Ponding	Total					0.200	:	200	N/A		100%	100%	9.93
	Top	17.590	17.590	2.955	2.955					51.98			
	Slope (1:H)	VERT	1	1	1								
Media	Total					0.500	:	500	N/A		30%	30%	6.27
	Top	17.190	17.190	2.755	2.755					47.36			
	Slope (1:H)	VERT	1	1	1								
Transition	Total					0.100	:	100	100		30%	30%	1.06
	Top	16.190	16.190	2.255	2.255					36.51			
	Slope (1:H)	VERT	1	1	1								
Drainage	Total					0.300	:	200	300		35%	35%	3.62
	Top	15.990	15.990	2.155	2.155					34.46			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Storage	Total					0.450	:	450	N/A		35%	35%	5.43
	Top	15.990	15.990	2.155	2.155					34.46			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Total						1.550							

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden
Location/Name: RG1 - Road 1 - Sag Point - Southside

Parameters		Units		References
Catchment Areas				
Total		1850	m²	Based on Civil Design - refer to catchment drawing
Impervious		1135	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		715	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		15.8	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1,
Post-development		27.1	m³	Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108. TP108 hydrological calculations completed separately. Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016. Post-development pervious areas - CN = 74 - Impervious areas CN = 98
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		56.75	m²	Calculated
Design Footprint Area		59.43	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		5.2%	-	Calculated
Storage				
Available Volume		6.28	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		39.73	m²	Calculated
Design Footprint Area		39.89	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.5%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management*
$K_{SUBSOIL}$		7.38	mm/hr	*Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		6.28	m³	Calculated
Infiltration Volume Capacity		21.20	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		6.28	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.53	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		5.63	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		24.01	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		5.68	m³	Calculated = 5mm x impervious area
Available Volume		6.82	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth				Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}	D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria	Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)	(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	N/A		100%	100%	0.00
	Top	20.110	20.110	2.955	2.955					59.43			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Ponding	Total					0.200	:	200	N/A		100%	100%	11.37
	Top	20.110	20.110	2.955	2.955					59.43			
	Slope (1:H)	VERT	1	1	1								
Media	Total					0.500	:	500	N/A		30%	30%	7.22
	Top	19.710	19.710	2.755	2.755					54.30			
	Slope (1:H)	VERT	1	1	1								
Transition	Total					0.100	:	100	100		30%	30%	1.23
	Top	18.710	18.710	2.255	2.255					42.19			
	Slope (1:H)	VERT	1	1	1								
Drainage	Total					0.300	:	200	300		35%	35%	4.19
	Top	18.510	18.510	2.155	2.155					39.89			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Storage	Total					0.450	:	450	N/A		35%	35%	6.28
	Top	18.510	18.510	2.155	2.155					39.89			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Total						1.550							

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden
Location/Name: RG 3 - Road 1 - JOAL 3 - Northside

Parameters		Units		References
Catchment Areas				
Total		655	m²	Based on Civil Design - refer to catchment drawing
Impervious		405	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		250	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		5.6	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1,
Post-development		9.7	m³	Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108.
				TP108 hydrological calculations completed separately.
				Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan*
				prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
				Post-development pervious areas - CN = 74 , Impervious areas CN = 98
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		20.25	m²	Calculated
Design Footprint Area		27.37	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		6.8%	-	Calculated
Storage				
Available Volume		2.26	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		14.18	m²	Calculated
Design Footprint Area		14.32	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.5%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management*
$K_{SUBSOIL}$		7.38	mm/hr	*Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		2.26	m³	Calculated
Infiltration Volume Capacity		7.61	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		2.26	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.25	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		2.08	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		10.03	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		2.03	m³	Calculated = 5mm x impervious area
Available Volume		2.50	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth				Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}	D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria	Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)	(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	N/A		100%	100%	0.00
	Top	14.000	14.000	1.955	1.955					27.37			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Ponding	Total					0.200	:	200	N/A		100%	100%	5.12
	Top	14.000	14.000	1.955	1.955					27.37			
	Slope (1:H)	VERT	1	1	1								
Media	Total					0.500	:	500	N/A		30%	30%	2.96
	Top	13.600	13.600	1.755	1.755					23.87			
	Slope (1:H)	VERT	1	1	1								
Transition	Total					0.100	:	100	100		30%	30%	0.45
	Top	12.600	12.600	1.255	1.255					15.81			
	Slope (1:H)	VERT	1	1	1								
Drainage	Total					0.300	:	200	300		35%	35%	1.50
	Top	12.400	12.400	1.155	1.155					14.32			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Storage	Total					0.450	:	450	N/A		35%	35%	2.26
	Top	12.400	12.400	1.155	1.155					14.32			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Total						1.550							

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden
Location/Name: RG4 - Road 1 - JOAL 3 - Southside

Parameters		Units		References
Catchment Areas				
Total		655	m²	Based on Civil Design - refer to catchment drawing
Impervious		415	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		240	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		5.6	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1,
Post-development		9.9	m³	Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108.
				TP108 hydrological calculations completed separately.
				Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan*
				prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
				Post-development pervious areas - CN = 74 , Impervious areas CN = 98
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		20.75	m²	Calculated
Design Footprint Area		27.37	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		6.6%	-	Calculated
Storage				
Available Volume		2.26	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		14.53	m²	Calculated
Design Footprint Area		14.32	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.5%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management*
$K_{SUBSOIL}$		7.38	mm/hr	*Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		2.26	m³	Calculated
Infiltration Volume Capacity		7.61	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		2.26	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.25	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		2.23	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		10.03	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		2.08	m³	Calculated = 5mm x impervious area
Available Volume		2.50	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth				Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}	D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria	Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)	(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	N/A		100%	100%	0.00
	Top	14.000	14.000	1.955	1.955					27.37			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Ponding	Total					0.200	:	200	N/A		100%	100%	5.12
	Top	14.000	14.000	1.955	1.955					27.37			
	Slope (1:H)	VERT	1	1	1								
Media	Total					0.500	:	500	N/A		30%	30%	2.96
	Top	13.600	13.600	1.755	1.755					23.87			
	Slope (1:H)	VERT	1	1	1								
Transition	Total					0.100	:	100	100		30%	30%	0.45
	Top	12.600	12.600	1.255	1.255					15.81			
	Slope (1:H)	VERT	1	1	1								
Drainage	Total					0.300	:	200	300		35%	35%	1.50
	Top	12.400	12.400	1.155	1.155					14.32			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Storage	Total					0.450	:	450	N/A		35%	35%	2.26
	Top	12.400	12.400	1.155	1.155					14.32			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Total						1.550							

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden Location/Name: RG5 - JOAL 1 - North

Parameters		Units		References
Catchment Areas				
Total		260	m²	Based on Civil Design - refer to catchment drawing
Impervious		155	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		105	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		2.2	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1,
Post-development		3.7	m³	Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108. TP108 hydrological calculations completed separately. Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016. Post-development pervious areas - CN = 74 , Impervious areas CN = 98
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		7.75	m²	Calculated
Design Footprint Area		12.40	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		8.0%	-	Calculated
Storage				
Available Volume		0.87	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		5.43	m²	Calculated
Design Footprint Area		5.52	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.6%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management*
$K_{SUBSOIL}$		7.38	mm/hr	*Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		0.87	m³	Calculated
Infiltration Volume Capacity		2.93	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		0.87	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.11	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		0.73	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		4.27	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		0.78	m³	Calculated = 5mm x impervious area
Available Volume		0.98	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth					Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}		D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria		Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)		(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	:	N/A		100%	100%	0.00
	Top	6.200	6.200	2.000	2.000						12.40			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Ponding	Total					0.200	:	200	:	N/A		100%	100%	2.28
	Top	6.200	6.200	2.000	2.000						12.40			
	Slope (1:H)	VERT	1	1	1									
Media	Total					0.500	:	500	:	N/A		30%	30%	1.23
	Top	5.800	5.800	1.800	1.800						10.44			
	Slope (1:H)	VERT	1	1	1									
Transition	Total					0.100	:	100	:	100		30%	30%	0.18
	Top	4.800	4.800	1.300	1.300						6.24			
	Slope (1:H)	VERT	1	1	1									
Drainage	Total					0.300	:	200	:	300		35%	35%	0.58
	Top	4.600	4.600	1.200	1.200						5.52			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Storage	Total					0.450	:	450	:	N/A		35%	35%	0.87
	Top	4.600	4.600	1.200	1.200						5.52			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Total						1.550								

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden
Location/Name: RG6 - JOAL 1 - South

Parameters		Units		References
Catchment Areas				
Total		225	m²	Based on Civil Design - refer to catchment drawing
Impervious		155	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		70	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		1.9	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1,
Post-development		3.7	m³	Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108.
				TP108 hydrological calculations completed separately.
				Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan*
				prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
				Post-development pervious areas - CN = 74 , Impervious areas CN = 98
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		7.75	m²	Calculated
Design Footprint Area		12.40	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		8.0%	-	Calculated
Storage				
Available Volume		0.87	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		5.43	m²	Calculated
Design Footprint Area		5.52	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.6%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management*
$K_{SUBSOIL}$		7.38	mm/hr	*Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		0.87	m³	Calculated
Infiltration Volume Capacity		2.93	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		0.87	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.11	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		1.03	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		4.27	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		0.78	m³	Calculated = 5mm x impervious area
Available Volume		0.98	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth				Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}	D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria	Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)	(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	N/A		100%	100%	0.00
	Top	6.200	6.200	2.000	2.000					12.40			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Ponding	Total					0.200	:	200	N/A		100%	100%	2.28
	Top	6.200	6.200	2.000	2.000					12.40			
	Slope (1:H)	VERT	1	1	1								
Media	Total					0.500	:	500	N/A		30%	30%	1.23
	Top	5.800	5.800	1.800	1.800					10.44			
	Slope (1:H)	VERT	1	1	1								
Transition	Total					0.100	:	100	100		30%	30%	0.18
	Top	4.800	4.800	1.300	1.300					6.24			
	Slope (1:H)	VERT	1	1	1								
Drainage	Total					0.300	:	200	300		35%	35%	0.58
	Top	4.600	4.600	1.200	1.200					5.52			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Storage	Total					0.450	:	450	N/A		35%	35%	0.87
	Top	4.600	4.600	1.200	1.200					5.52			
	Slope (1:H)	VERT	VERT	VERT	VERT								
Total						1.550							

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden
Location/Name: RG7 - JOAL 2

Parameters		Units		References
Catchment Areas				
Total		445	m²	Based on Civil Design - refer to catchment drawing
Impervious		290	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		155	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		3.8	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1,
Post-development		6.9	m³	Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108. TP108 hydrological calculations completed separately. Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016. Post-development pervious areas - CN = 74 Impervious areas CN = 98
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		14.50	m²	Calculated
Design Footprint Area		18.98	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		6.5%	-	Calculated
Storage				
Available Volume		1.62	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		10.15	m²	Calculated
Design Footprint Area		10.26	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.5%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management*
$K_{SUBSOIL}$		7.38	mm/hr	*Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		1.62	m³	Calculated
Infiltration Volume Capacity		5.45	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		1.62	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.17	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		1.65	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		7.01	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		1.45	m³	Calculated = 5mm x impervious area
Available Volume		1.79	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth					Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}		D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria		Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)		(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	:	N/A		100%	100%	0.00
	Top	7.300	7.300	2.600	2.600						18.98			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Ponding	Total					0.200	:	200	:	N/A		100%	100%	3.55
	Top	7.300	7.300	2.600	2.600						18.98			
	Slope (1:H)	VERT	1	1	1									
Media	Total					0.500	:	500	:	N/A		30%	30%	2.06
	Top	6.900	6.900	2.400	2.400						16.56			
	Slope (1:H)	VERT	1	1	1									
Transition	Total					0.100	:	100	:	100		30%	30%	0.32
	Top	5.900	5.900	1.900	1.900						11.21			
	Slope (1:H)	VERT	1	1	1									
Drainage	Total					0.300	:	200	:	300		35%	35%	1.08
	Top	5.700	5.700	1.800	1.800						10.26			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Storage	Total					0.450	:	450	:	N/A		35%	35%	1.62
	Top	5.700	5.700	1.800	1.800						10.26			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Total						1.550								

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden Location/Name: RG8 - JOAL 3 - North

Parameters		Units		References
Catchment Areas				
Total		565	m²	Based on Civil Design - refer to catchment drawing
Impervious		430	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		135	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		4.8	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1, Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108. TP108 hydrological calculations completed separately. Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016. Post-development pervious areas - CN = 74 , Impervious areas- CN = 98
Post-development		10.4	m³	
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		21.50	m²	Calculated
Design Footprint Area		25.20	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		5.9%	-	Calculated
Storage				
Available Volume		2.38	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		15.05	m²	Calculated
Design Footprint Area		15.12	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.5%	-	
Minimum Infiltration Rate		0.033	L/ m²/min	
	>	2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
$K_{SUBSOIL}$		7.38	mm/hr	
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		2.38	m³	Calculated
Infiltration Volume Capacity		8.03	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		2.38	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.23	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		3.45	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		9.70	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		2.15	m³	Calculated = 5mm x impervious area
Available Volume		2.61	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth					Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}		D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria		Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)		(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	:	N/A		100%	100%	0.00
	Top	7.000	7.000	3.600	3.600						25.20			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Ponding	Total					0.200	:	200	:	N/A		100%	100%	4.76
	Top	7.000	7.000	3.600	3.600						25.20			
	Slope (1:H)	VERT	1	1	1									
Media	Total					0.500	:	500	:	N/A		30%	30%	2.88
	Top	6.600	6.600	3.400	3.400						22.44			
	Slope (1:H)	VERT	1	1	1									
Transition	Total					0.100	:	100	:	100		30%	30%	0.47
	Top	5.600	5.600	2.900	2.900						16.24			
	Slope (1:H)	VERT	1	1	1									
Drainage	Total					0.300	:	200	:	300		35%	35%	1.59
	Top	5.400	5.400	2.800	2.800						15.12			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Storage	Total					0.450	:	450	:	N/A		35%	35%	2.38
	Top	5.400	5.400	2.800	2.800						15.12			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Total						1.550								

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden Location/Name: RG9 - JOAL 3 - South

Parameters		Units		References
Catchment Areas				
Total		400	m²	Based on Civil Design - refer to catchment drawing
Impervious		290	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		110	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		3.4	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1, Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108. TP108 hydrological calculations completed separately. Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
Post-development		6.9	m³	
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		14.50	m²	Calculated
Design Footprint Area		20.20	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		7.0%	-	Calculated
Storage				
Available Volume		1.61	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		10.15	m²	Calculated
Design Footprint Area		10.20	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.5%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
$K_{SUBSOIL}$		7.38	mm/hr	
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		1.61	m³	Calculated
Infiltration Volume Capacity		5.42	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		1.61	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.18	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		2.05	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		7.29	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		1.45	m³	Calculated = 5mm x impervious area
Available Volume		1.79	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth					Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}		D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria		Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)		(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	:	N/A		100%	100%	0.00
	Top	10.100	10.100	2.000	2.000						20.20			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Ponding	Total					0.200	:	200	:	N/A		100%	100%	3.76
	Top	10.100	10.100	2.000	2.000						20.20			
	Slope (1:H)	VERT	1	1	1									
Media	Total					0.500	:	500	:	N/A		30%	30%	2.14
	Top	9.700	9.700	1.800	1.800						17.46			
	Slope (1:H)	VERT	1	1	1									
Transition	Total					0.100	:	100	:	100		30%	30%	0.32
	Top	8.700	8.700	1.300	1.300						11.31			
	Slope (1:H)	VERT	1	1	1									
Drainage	Total					0.300	:	200	:	300		35%	35%	1.07
	Top	8.500	8.500	1.200	1.200						10.20			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Storage	Total					0.450	:	450	:	N/A		35%	35%	1.61
	Top	8.500	8.500	1.200	1.200						10.20			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Total						1.550								

RILEY Ref: 210359
Project: Kahawai Point
Stage: 5
Date: 2/02/2022
Design By: Morris Kleinjan
Reviewed By: LDG
Task: Rain Garden Design - as per GD01

Key	
##	Input Design Variable
##	Input Design Requirement
##	Output Design Variable
##	Output Design Requirement

Background: Kahawai Point is a subdivision located within Glenbrook, Auckland. Stage 5 is located south-east of Stage 4 and east of McLarin Road.

Requirements: GD01: Stormwater Management Devices Guide

Rain Garden Location/Name: RG10 - McLarin Road

Parameters		Units		References
Catchment Areas				
Total		800	m²	Based on Civil Design - refer to catchment drawing
Impervious		540	m²	Based on Civil Design - includes roading, kerb, & footpath areas
Pervious		260	m²	Calculated
95th% 24hr Rainfall Depth		32	mm	as per GD01, B1.7.1, Table 10 & Figure 6 for SMAF 1
Runoff Volumes				
Pre-development		10.1	m³	Pre-development and post-development runoff volumes calculated as per GD01, Section B1 - Design Processes, § B1.7.1, Tables 10 & 11 for SMAF 1 (95th percentile rainfall event as per GD01, § B1.7.1, Figure 6) using TP108. TP108 hydrological calculations completed separately. Pre-development pervious areas - CN = 81 as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016. Post-development pervious areas - CN = 74 , Impervious areas CN = 98
Post-development		12.9	m³	
Ponding				
Required Footprint Percentage	≥	5.0%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		27.00	m²	Calculated
Design Footprint Area		35.52	m²	Calculated - see table below
Area Check		OKAY	-	
Footprint Percentage Achieved		6.6%	-	Calculated
Storage				
Available Volume		3.22	m³	Calculated
Infiltration				
Required Footprint Percentage	≥	3.5%	-	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Required Footprint Area		18.90	m²	Calculated
Design Footprint Area		20.45	m²	Calculated - see table below
Footprint Area Check		OKAY	-	
Footprint Percentage Achieved		3.8%	-	
Minimum Infiltration Rate	>	0.033	L/ m²/min	
		2.00	mm/hr	GD01, Section C3 - Bioretention, § C3.2.3, Table 48 - SMAF 1
Available Infiltration Rate		0.123	L/ m²/min	Estimated permeability rate based on on-site testing as per *Kahawai Point Special Housing Area Stormwater Management Plan* prepared by Stormwater Solutions Consulting Limited (CKL LTD) dated 7th July, 2016.
$K_{SUBSOIL}$		7.38	mm/hr	
		0.007	m/hr	
Infiltration Rate Check		OKAY	-	
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
		72	hrs	GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Storage Volume		3.22	m³	Calculated
Infiltration Volume Capacity		10.87	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 10
Infiltration Volume Check		OKAY	-	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infil. vol. capacity must ≥ than storage vol.
Infiltration Volume		3.22	m³	RILEY interpretation of GD01, Section C3, § C3.2.3, Equation 10 - Infiltration vol. = storage volume.
Evapotranspiration				
Time Period		3	days	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Rate		0.003	m/day	GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Volume		0.32	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 11
Detention				
Required Volume		0.10	m³	Calculated = postdev vol - predev vol - retention volume
Available Volume		13.49	m³	Calculated from table below and GD01, Section C3 - Bioretention, § C3.2.3, Equation 8
Volume Check		OKAY	-	
Retention				
Required Runoff Depth		5	mm	GD01, Section B1 - Design Processes, § B1.7.1, Table 10 - SMAF 1 & 2
		0.005	m	Calculated
Required Volume		2.70	m³	Calculated = 5mm x impervious area
Available Volume		3.54	m³	Calculated - GD01, Section C3 - Bioretention, § C3.2.3, Equation 12
Volume Check		OKAY	-	

Rain Garden Geometry Design

Layer		Length		Width		Depth					Area	Void Space		Volume
		L_{FRONT}	L_{REAR}	W_{SIDE-1}	W_{SIDE-2}	D		D_{MIN}		D_{MAX}	A			$V_{AVAILABLE}$
		Design	Design	Design	Design	Design		Criteria		Criteria	Design	Design	Criteria	Design
		(m)	(m)	(m)	(m)	(m)		(mm)		(mm)	(m²)	-	-	(m³)
Freeboard	Total					0.000	:	0	:	N/A		100%	100%	0.00
	Top	16.000	16.000	2.220	2.220						35.52			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Ponding	Total					0.200	:	200	:	N/A		100%	100%	6.70
	Top	16.000	16.000	2.220	2.220						35.52			
	Slope (1:H)	VERT	1	1	1									
Media	Total					0.500	:	500	:	N/A		30%	30%	4.01
	Top	15.600	15.600	2.020	2.020						31.51			
	Slope (1:H)	VERT	1	1	1									
Transition	Total					0.100	:	100	:	100		30%	30%	0.64
	Top	14.600	14.600	1.520	1.520						22.19			
	Slope (1:H)	VERT	1	1	1									
Drainage	Total					0.300	:	200	:	300		35%	35%	2.15
	Top	14.400	14.400	1.420	1.420						20.45			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Storage	Total					0.450	:	450	:	N/A		35%	35%	3.22
	Top	14.400	14.400	1.420	1.420						20.45			
	Slope (1:H)	VERT	VERT	VERT	VERT									
Total						1.550								

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Project No:	**210359**	**Page**	**1**	of	**7**
Project:	**Kawahai Point Stage 5 – 127 McLarin Road, Glenbrook**				
Calc:	**AR**	**Date:**	**20/12/2021**		
Check:	**LDG**	**Date:**	**8/02/2022**		
Description:	**Stormwater reticulation design**				

Background:

- A new residential subdivision is proposed at the above address, bulk earthworks are proposed to develop the site contours to facilitate development.
- New stormwater reticulation is proposed to service the development and discharge stormwater via new outfall pipe structures.
- The site is currently undeveloped (greenfield).
- A resource consent is required for the earthworks and future development.
- Refer RILEY DWG: 210359-360 for the preliminary stormwater layout, and 210359-361 for the stormwater catchments...

Objective:

- Design suitably sized stormwater reticulation network to convey stormwater for the 10year storm event from the future development and upstream catchment (149 McLarin Road), taking into consideration the proposed development contours.
- Design the proposed outfall structures – rock riprap apron.
- It is intended that these calculations provide supporting information for resource consent application.

Design Philosophy:

- Undertake design to calculate the size of stormwater outfall pipes (2,3,4,5,6 & 7), and pipes 1a and 1b (which will convey flow from 149 McLarin Road). All of the proposed pipes are designed to be at 1% gradient.
- Capacity of the pipe is calculated using Colebrook-White formula
- Modelling undertaken using HEC-HMS 4.6 and in accordance with AC Stormwater Code of Practice and TP 108.
    - Design rainfall depth from TP108 including climate change factors as per Auckland Council CoP Version 3.0.
- Area Coverage
    - Residential lot- 65% impervious coverage
    - Commercial lot- 90% impervious coverage
    - Road- 72% impervious coverage
    - JOAL 1- 77% impervious coverage, JOAL 2 & 3- 78% impervious coverage
    - 127 McLarin Road – 0% impervious coverage
- The new outfall structures are designed using Auckland Council TR2013-018.

Catchment Assessment:

Soil Conditions

- Curve number (CN), initial abstraction (I_a), lag time (t_p)

	CN	I_a (mm)	t_p (min)
Impervious	98	0	6.7
Pervious	74	5	6.7

- CN value based on Group C Hydrological Soil Classification and Table 3.3 in ARC TP108 (conservative). Initial abstraction based on Table 3.1 in ARC TP108.
- t_p = time of concentration (t_c) x 2/3. (assume 10 minutes for t_c)

  = 6.67 minutes

Note

For catchment 1: Time of concentration= 13.33 minutes

Rainfall Depth

Storm Event	10% AEP	1%AEP
P_{24}, mm	120	180
Climate change factor	13.2%	16.8%
24-hour Rainfall Depths (mm) including climate change effects	136	210

HEC-HMS Model

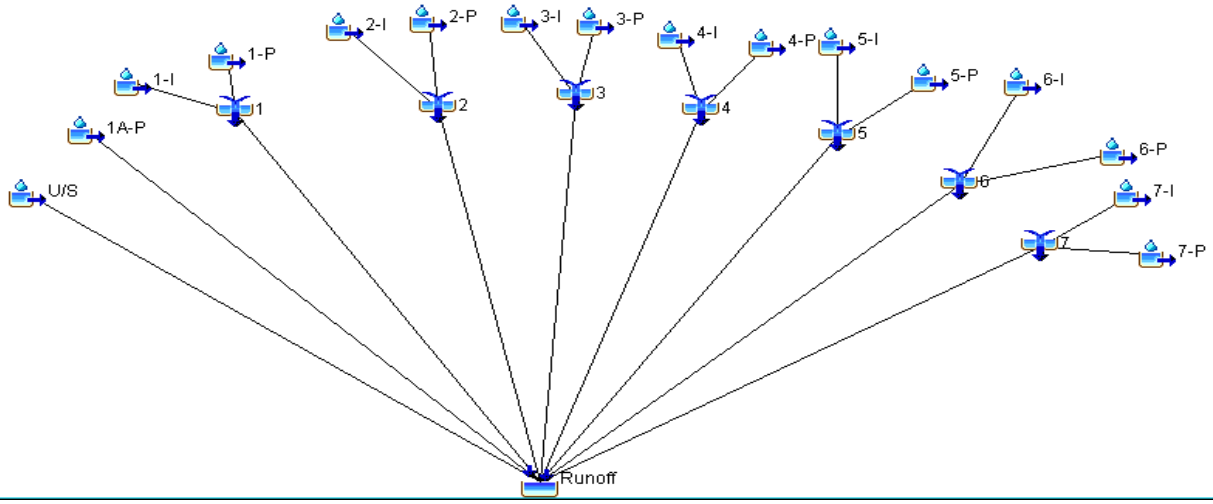


Fig1: HEC-HMS model layout

Catchment Assessment Results

- **10%AEP**

Project: Kahawai-SW catchment Simulation Run: 10Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 08Feb2022, 00:10:48

Basin Model: Basin 1
Meteorologic Model: 10Year
Control Specifications: Control 1

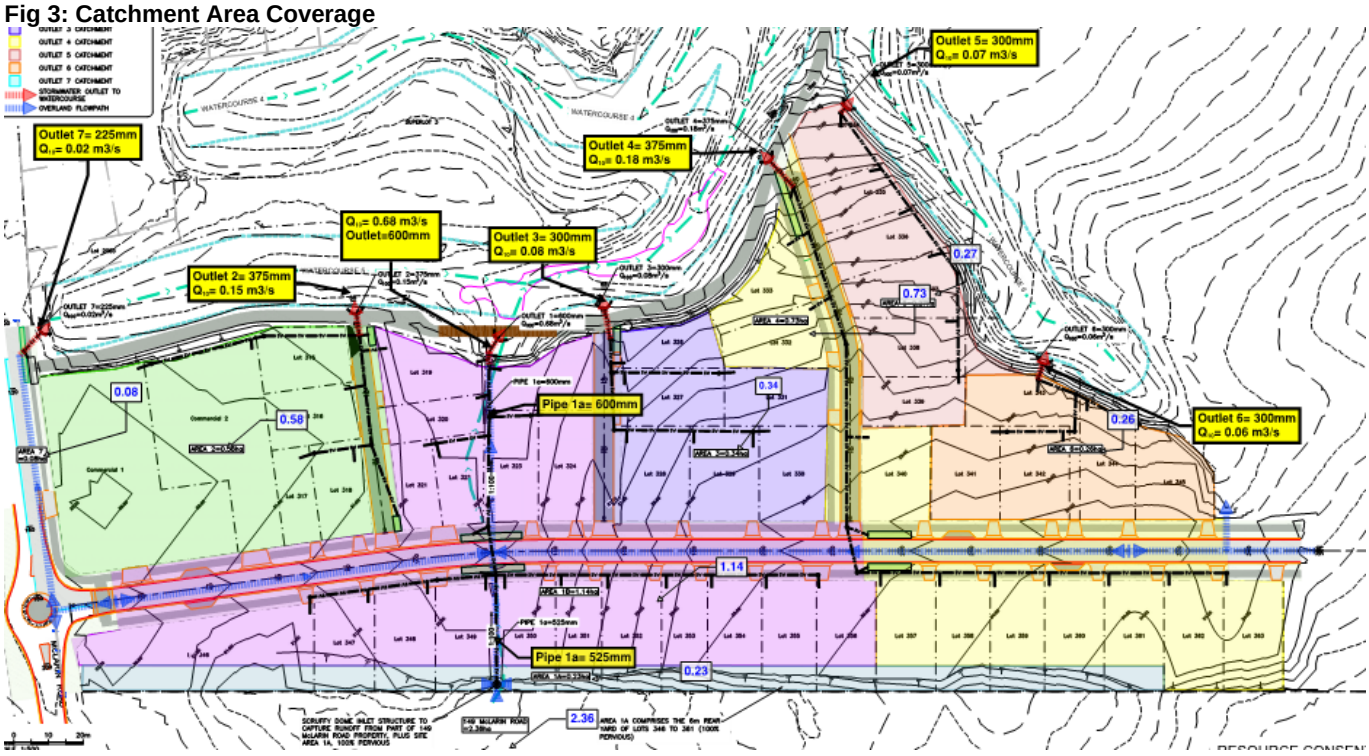
Show Elements: Initial Select... Volume Units: MM / 1000 M3 Sorting: Hydrol...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
U/S	0.023566	0.28251	01Jan2000, 12:19	1.8171
1	0.011354	0.24325	01Jan2000, 12:12	1.3519
4	0.007345	0.15367	01Jan2000, 12:12	0.8504
2	0.005825	0.12641	01Jan2000, 12:12	0.7042
3	0.003411	0.06929	01Jan2000, 12:12	0.3814
5	0.002724	0.05534	01Jan2000, 12:12	0.3046
6	0.002623	0.05329	01Jan2000, 12:12	0.2933
1A-P	0.002333	0.03529	01Jan2000, 12:13	0.1805
7	0.000785	0.01771	01Jan2000, 12:12	0.0993

Fig2: HEC-HMS model output

Catchment Area

Fig 3: Catchment Area Coverage



Proposed Stormwater pipe outfall

Table 2: Proposed Stormwater pipe sizes

Pipe	Diameter (mm)	Catchment	Catchment Area (m^2)	Flow (L/s)	Capacity (L/s)
1A	525	U/S (127 McLarin Rd), 1A	25,899	318	484
1B	600	U/S (127 McLarin Rd), 1A, 1B	37,253	561	688
Outlet 2	375	2	5,825	126	199
Outlet 3	300	3	3,411	69	111
Outlet 4	375	4	7,345	154	199
Outlet 5	300	5	2,724	55	111
Outlet 6	300	6	2,623	53	111
Outlet 7	225	7	785	18	51

Note:

- All the above pipes are designed at 1% gradient.
- The capacity of the pipes is calculated using Colebrook-white formula.

Proposed Pipe Capacities

Fig 4: Colebrook-white formula (1% gradient) - 525mm pipe

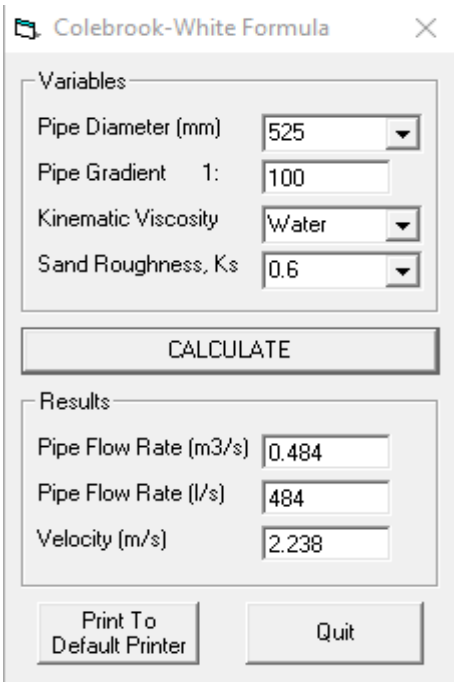


Fig 5: Colebrook-white formula (1% gradient)- 600mm pipe

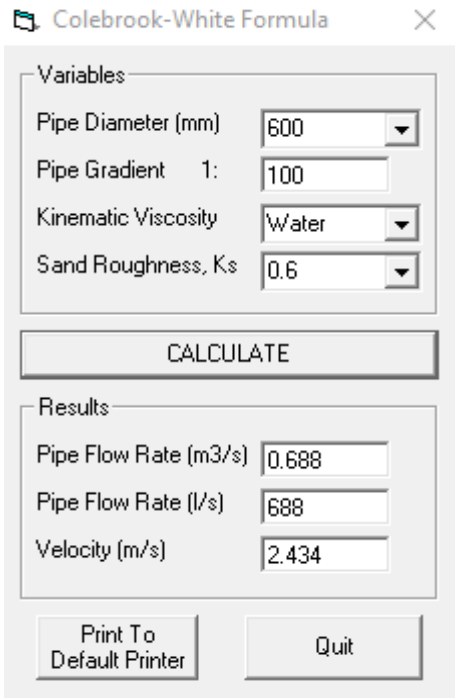


Fig 6: Colebrook-white formula (1% gradient)- 375mm pipe

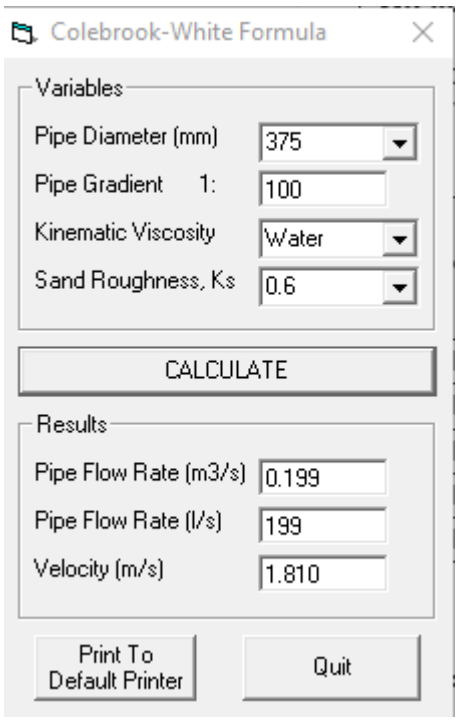


Fig 7: Colebrook-white formula (1% gradient)- 300mm pipe

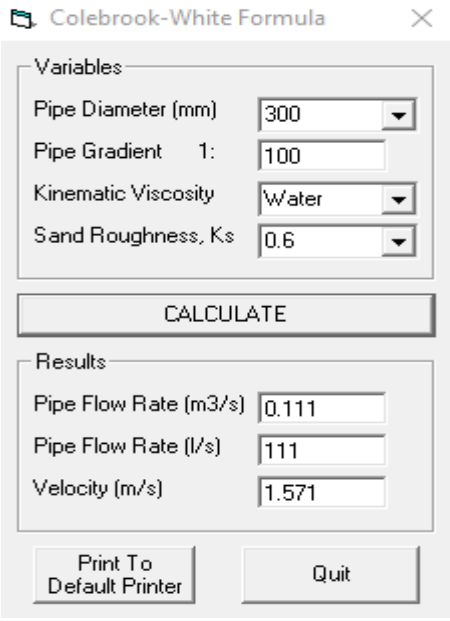
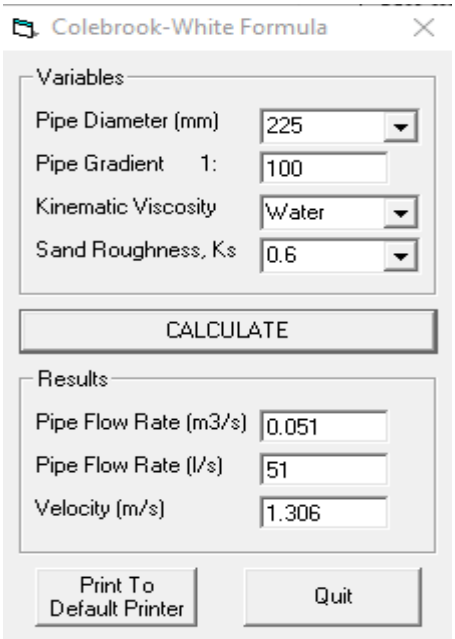


Fig 8: Colebrook-white formula (1% gradient)- 225mm pipe



Conclusion

Therefore, the pipes (indicated in Table 2) laid at 1% gradient will have adequate capacity to discharge the stormwater for a 10Year storm event.

Proposed Stormwater pipe outfall

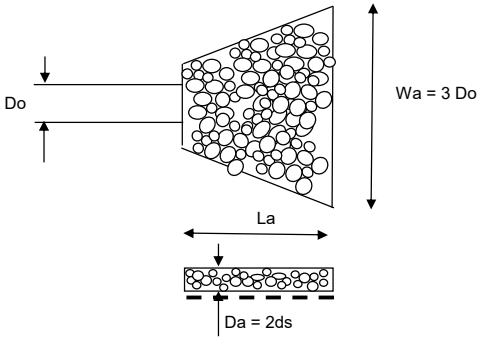
- It is proposed to construct 7 new stormwater outfall structures to discharge stormwater to the existing watercourse.
- The new outfall will convey peak stormwater flows for a 10-Year storm event.
- For practical reasons, it is intended that all of the outfall structures will have a minimum gabion rock size of 150mm dia.
- Individual rock rip rap structure design spreadsheets has been appended with this calculation.

Table 3: Proposed Stormwater Outfall Structures

Outlet Ref:	Catchment Area (m^2)	Pipe Dia. (mm)	Flows (L/s)	Rip Rap Apron Length (m)	Gabion Rock Size Dn_{50} (mm)	Rock Thickness (mm)
1b	37,253	600	561	6.07	150	300
2	5,825	375	126	5.41	150	300
3	3,411	300	69	2.77	150	300
4	7,345	375	154	3.88	150	300
5	2,724	300	55	2.97	150	300
6	2,623	300	53	2.97	150	300
7	785	225	18	2.25	150	300

RIPRAP DESIGN (TR2013-018)

Outfall 1b



Job No.	210359
Project	Kahawai Point Stage 5
Date	8/02/2022
Prepared By:	AR
Reviewed By:	LDG

Diameter of stone

d_s = $0.25 \times D_0 \times F_0$

where

d_s =	riprap diameter (m)	=	**0.20**	
D_0 =	pipe diameter (m)	=	0.6	
d_p =	depth of flow in pipe (m)	=	0.42	based on Q_{10} design flow and Colebrook White Calculator
V =	velocity of flow in pipe (m/s)	=	2.7	based on Q_{10} design flow and Colebrook White Calculator
F_0 =	Froude number = $V/(g \times d_p)^{0.5}$	=	**1.33**	

Results

Thickness of stone layer , $D_a = 2d_s$ = **0.40** m

Width of area protected is 3 times the diameter of pipe. $W_a = 3D_0$ = **1.80** m

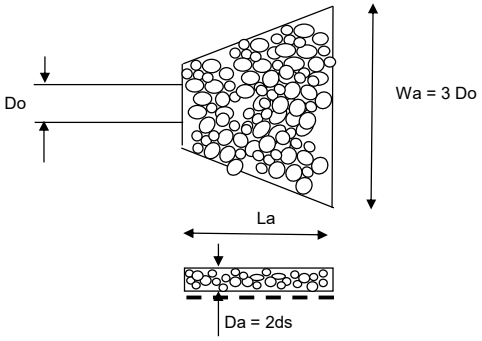
Height of stone is the crown of pipe + 300mm

Length of outfall protection (Apron length, m), $L_a = D_0 (8 + 17 \times \text{Log} F_0)$ = **6.07** m

RIPRAP DESIGN (TR2013-018)

Outfall 2

Job No.	210359
Project	Kahawai Point Stage 5
Date	8/02/2022
Prepared By:	AR
Reviewed By:	LDG



Diameter of stone

d_s = $0.25 \times D_0 \times F_0$

where

d_s =	riprap diameter (m)	=	**0.22**
D_0 =	pipe diameter (m)	=	0.375
d_p =	depth of flow in pipe (m)	=	0.225
V =	velocity of flow in pipe (m/s)	=	3.55
F_0 =	Froude number = $V/(g \times d_p)^{0.5}$	=	**2.39**

Results

Thickness of stone layer , $D_a = 2d_s$ = **0.45** m

Width of area protected is 3 times the diameter of pipe. $W_a = 3D_0$ = **1.13** m

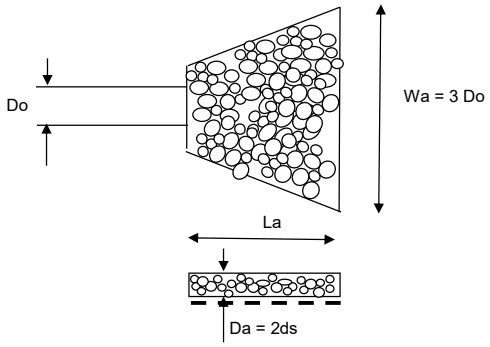
Height of stone is the crown of pipe + 300mm

Length of outfall protection (Apron length, m), $L_a = D_0 (8 + 17 \times \text{Log} F_0)$ = **5.41** m

RIPRAP DESIGN (TR2013-018)

Outfall 3

Job No.	210359
Project	Kahawai Point Stage 5
Date	8/02/2022
Prepared By:	AR
Reviewed By:	LDG



Diameter of stone

d_s = $0.25 \times D_0 \times F_0$

where

d_s =	riprap diameter (m)	=	**0.09**
D_0 =	pipe diameter (m)	=	0.3
d_p =	depth of flow in pipe (m)	=	0.18
V =	velocity of flow in pipe (m/s)	=	1.571
F_0 =	Froude number = $V/(g \times d_p)^{0.5}$	=	**1.18**

Results

Thickness of stone layer , $D_a = 2d_s$ = **0.18** m

Width of area protected is 3 times the diameter of pipe. $W_a = 3D_0$ = **0.90** m

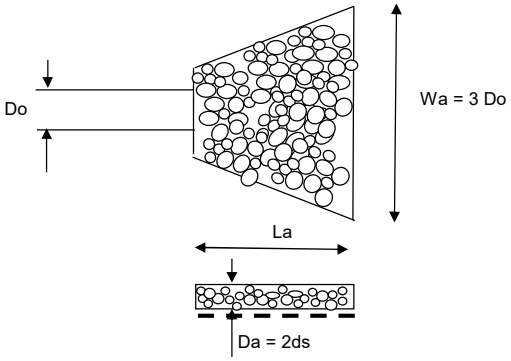
Height of stone is the crown of pipe + 300mm

Length of outfall protection (Apron length, m), $L_a = D_0 (8 + 17 \times \text{Log} F_0)$ = **2.77** m

RIPRAP DESIGN (TR2013-018)

Outfall 4

Job No.	210359
Project	Kahawai Point Stage 5
Date	8/02/2022
Prepared By:	AR
Reviewed By:	LDG



Diameter of stone

d_s = $0.25 \times D_0 \times F_0$

where

d_s =	riprap diameter (m)	=	**0.13**
D_0 =	pipe diameter (m)	=	0.375
d_p =	depth of flow in pipe (m)	=	0.263
V =	velocity of flow in pipe (m/s)	=	2.21
F_0 =	Froude number = $V/(g \times d_p)^{0.5}$	=	**1.38**

Results

Thickness of stone layer , $D_a = 2d_s$ = **0.26** m

Width of area protected is 3 times the diameter of pipe. $W_a = 3D_0$ = **1.13** m

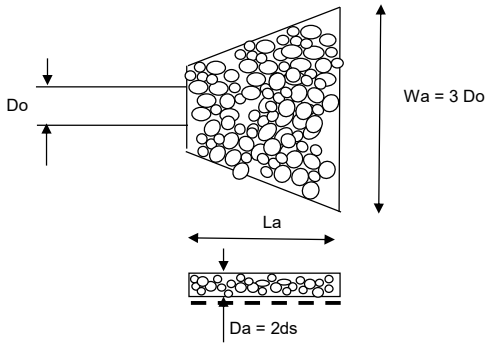
Height of stone is the crown of pipe + 300mm

Length of outfall protection (Apron length, m), $L_a = D_0 (8 + 17 \times \text{Log} F_0)$ = **3.88** m

RIPRAP DESIGN (TR2013-018)

Outfall 5

Job No.	210359
Project	Kahawai Point Stage 5
Date	8/02/2022
Prepared By:	AR
Reviewed By:	LDG



Diameter of stone

d_s = $0.25 \times D_0 \times F_0$

where

d_s =	riprap diameter (m)	=	**0.10**
D_0 =	pipe diameter (m)	=	0.3
d_p =	depth of flow in pipe (m)	=	0.15
V =	velocity of flow in pipe (m/s)	=	1.571
F_0 =	Froude number = $V/(g \times d_p)^{0.5}$	=	**1.30**

Results

Thickness of stone layer , $D_a = 2d_s$ = **0.19** m

Width of area protected is 3 times the diameter of pipe. $W_a = 3D_0$ = **0.90** m

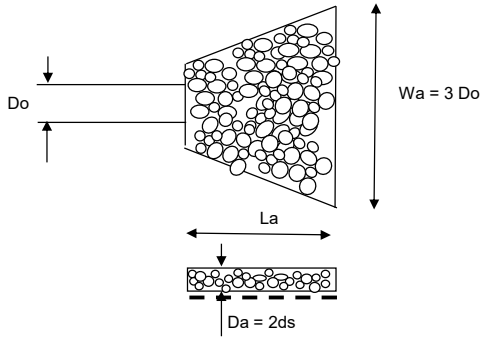
Height of stone is the crown of pipe + 300mm

Length of outfall protection (Apron length, m), $L_a = D_0 (8 + 17 \times \text{Log} F_0)$ = **2.97** m

RIPRAP DESIGN (TR2013-018)

Outfall 6

Job No.	210359
Project	Kahawai Point Stage 5
Date	8/02/2022
Prepared By:	AR
Reviewed By:	LDG



Diameter of stone

d_s = $0.25 \times D_0 \times F_0$

where

d_s =	riprap diameter (m)	=	**0.10**
D_0 =	pipe diameter (m)	=	0.3
d_p =	depth of flow in pipe (m)	=	0.15
V =	velocity of flow in pipe (m/s)	=	1.571
F_0 =	Froude number = $V/(g \times d_p)^{0.5}$	=	**1.30**

Results

Thickness of stone layer , $D_a = 2d_s$ = **0.19** m

Width of area protected is 3 times the diameter of pipe. $W_a = 3D_0$ = **0.90** m

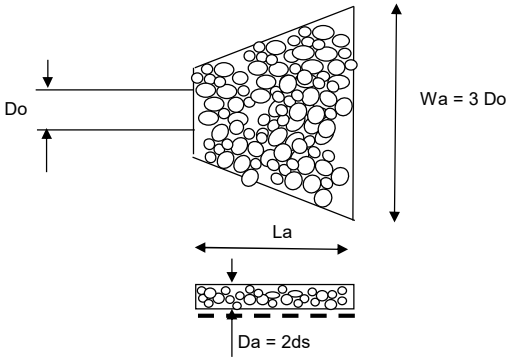
Height of stone is the crown of pipe + 300mm

Length of outfall protection (Apron length, m), $L_a = D_0 (8 + 17 \times \text{Log} F_0)$ = **2.97** m

RIPRAP DESIGN (TR2013-018)

Outfall 7

Job No. 210359
Project Kahawai Point Stage 5
Date 8/02/2022
Prepared By: AR
Reviewed By: LDG



Diameter of stone

d_s = $0.25 \times D_0 \times F_0$

where

d_s =	riprap diameter (m)	=	**0.07**
D_0 =	pipe diameter (m)	=	0.225
d_p =	depth of flow in pipe (m)	=	0.101
V =	velocity of flow in pipe (m/s)	=	1.306
F_0 =	Froude number = $V/(g \times d_p)^{0.5}$	=	**1.31**

Results

Thickness of stone layer , $D_a = 2d_s$ = **0.15** m

Width of area protected is 3 times the diameter of pipe. $W_a = 3D_0$ = **0.68** m

Height of stone is the crown of pipe + 300mm

Length of outfall protection (Apron length, m), $L_a = D_0 (8 + 17 \times \text{Log} F_0)$ = **2.25** m

USER TO ENTER DETAILS IN HIGHLIGHTED CELLS
GRADIENT SET TO CALCULATED OR SPECIFIED VALUE

RILEY CONSULTANTS

Pipe No **1b**

Roughness	0.6	mm		SPECIFY GRADIENT	
Diam(mm)	600	mm	0.0006	1 in	100
Gradient	0.01	m/m	0.6		
Kahawai Point Stage 5					
Stormwater Outfalls				Gradient	0.010

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
0.01	0.1202009	0.0004786	0.0039813	0.112	0.0101827	0.0038071	-1.8541881	0.207	0.10	6	119
0.02	0.1702765	0.0013495	0.0079252	0.158	0.0051154	0.0013556	-2.1890296	0.345	0.47	12	168
0.03	0.2088996	0.0024716	0.0118314	0.193	0.0034265	0.0007432	-2.3798993	0.459	1.13	18	205
0.04	0.2416295	0.0037936	0.0157000	0.222	0.0025822	0.0004862	-2.5130931	0.558	2.12	24	235
0.05	0.2706161	0.0052853	0.0195307	0.248	0.0020757	0.0003504	-2.615087	0.647	3.42	30	262
0.1	0.3861007	0.0147151	0.0381121	0.346	0.0010637	0.0001285	-2.9236292	1.011	14.88	60	360
0.15	0.4772393	0.0265949	0.0557265	0.418	0.0007275	7.27E-05	-3.0968059	1.295	34.44	90	428
0.2	0.5563771	0.0402566	0.0723548	0.477	0.0005603	4.914E-05	-3.2150679	1.532	61.67	120	480
0.25	0.6283185	0.0552766	0.0879755	0.525	0.0004608	3.665E-05	-3.3032351	1.736	95.96	150	520
0.3	0.6955677	0.0713406	0.1025646	0.567	0.0003953	2.912E-05	-3.3722401	1.913	136.47	180	550
0.35	0.7596622	0.088193	0.1160950	0.604	0.0003492	2.418E-05	-3.42785	2.069	182.47	210	572
0.4	0.821663	0.1056131	0.1285358	0.635	0.0003154	2.075E-05	-3.4734585	2.206	232.98	240	588
0.45	0.8823773	0.1234017	0.1398514	0.662	0.0002899	1.829E-05	-3.5112102	2.326	287.03	270	597
0.5	0.9424778	0.1413717	0.1500000	0.686	0.0002703	1.646E-05	-3.5425226	2.431	343.67	300	600
0.55	1.0025782	0.1593416	0.1589319	0.706	0.0002551	1.509E-05	-3.5683536	2.520	401.54	330	597
0.6	1.0632925	0.1771302	0.1665865	0.723	0.0002434	1.407E-05	-3.5893469	2.595	459.65	360	588
0.65	1.1252934	0.1945504	0.1728886	0.737	0.0002345	1.33E-05	-3.6059101	2.656	516.73	390	572
0.7	1.1893879	0.2114027	0.1777408	0.747	0.0002281	1.276E-05	-3.6182515	2.702	571.21	420	550
0.75	1.2566371	0.2274667	0.1810123	0.754	0.000224	1.242E-05	-3.6263813	2.733	621.67	450	520
0.8	1.3285785	0.2424868	0.1825160	0.757	0.0002221	1.227E-05	-3.6300684	2.747	666.11	480	480
0.85	1.4077163	0.2561484	0.1819603	0.756	0.0002228	1.232E-05	-3.6287095	2.742	702.36	510	428
0.9	1.4988549	0.2680282	0.1788220	0.749	0.0002267	1.265E-05	-3.620955	2.713	727.16	540	360
0.95	1.6143395	0.277458	0.1718709	0.734	0.0002359	1.342E-05	-3.6032773	2.646	734.15	570	262
1	**1.8849556**	**0.2827433**	**0.1500000**	**0.686**	**0.0002703**	**1.646E-05**	**-3.5425226**	**2.431**	**687.35**	**600**	**0**

USER TO ENTER DETAILS IN HIGHLIGHTED CELLS
GRADIENT SET TO CALCULATED OR SPECIFIED VALUE

RILEY CONSULTANTS

Pipe No **2.000**
Roughness 0.6 mm
Diam(mm) 375 mm
Gradient 0.01 m/m
Kahawai Point Stage 5
Stormwater Outfalls

0.0006
0.375

SPECIFY GRADIENT
1 in 100
Gradient 0.010

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
0.01	0.0751256	0.0001869	0.0024883	0.088	0.0162923	0.007705	-1.6198363	0.143	0.03	4	75
0.02	0.1064228	0.0005271	0.0049532	0.125	0.0081847	0.0027435	-1.9614536	0.245	0.13	8	105
0.03	0.1305623	0.0009655	0.0073947	0.152	0.0054824	0.001504	-2.1557436	0.328	0.32	11	128
0.04	0.1510184	0.0014819	0.0098125	0.175	0.0041315	0.0009839	-2.2911163	0.402	0.60	15	147
0.05	0.1691351	0.0020646	0.0122067	0.196	0.0033212	0.0007091	-2.3946609	0.469	0.97	19	163
0.1	0.2413129	0.0057481	0.0238201	0.273	0.001702	0.0002601	-2.7072793	0.740	4.25	38	225
0.15	0.2982746	0.0103886	0.0348291	0.331	0.001164	0.0001471	-2.8823569	0.953	9.90	56	268
0.2	0.3477357	0.0157252	0.0452218	0.377	0.0008965	9.945E-05	-3.0017691	1.131	17.79	75	300
0.25	0.3926991	0.0215924	0.0549847	0.415	0.0007373	7.418E-05	-3.0907203	1.284	27.72	94	325
0.3	0.4347298	0.0278674	0.0641029	0.449	0.0006324	5.893E-05	-3.1602976	1.417	39.49	113	344
0.35	0.4747889	0.0344504	0.0725594	0.477	0.0005587	4.893E-05	-3.2163433	1.535	52.88	131	358
0.4	0.5135394	0.0412551	0.0803349	0.502	0.0005046	4.2E-05	-3.262293	1.638	67.58	150	367
0.45	0.5514858	0.0482038	0.0874071	0.524	0.0004638	3.701E-05	-3.3003163	1.729	83.34	169	373
0.5	0.5890486	0.0552233	0.0937500	0.542	0.0004324	3.332E-05	-3.3318468	1.807	99.79	188	375
0.55	0.6266114	0.0622428	0.0993324	0.558	0.0004081	3.055E-05	-3.3578531	1.875	116.71	206	373
0.6	0.6645578	0.0691915	0.1041166	0.572	0.0003894	2.847E-05	-3.3789855	1.931	133.61	225	367
0.65	0.7033084	0.0759962	0.1080554	0.582	0.0003752	2.693E-05	-3.3956566	1.977	150.24	244	358
0.7	0.7433674	0.0825792	0.1110880	0.590	0.0003649	2.583E-05	-3.4080773	2.012	166.15	263	344
0.75	0.7853982	0.0888542	0.1131327	0.596	0.0003583	2.513E-05	-3.4162588	2.036	180.91	281	325
0.8	0.8303615	0.0947214	0.1140725	0.598	0.0003554	2.482E-05	-3.4199692	2.046	193.80	300	300
0.85	0.8798227	0.100058	0.1137252	0.597	0.0003565	2.494E-05	-3.4186017	2.042	204.32	319	268
0.9	0.9367843	0.1046985	0.1117638	0.592	0.0003627	2.56E-05	-3.4107981	2.020	211.49	338	225
0.95	1.0089622	0.108382	0.1074193	0.581	0.0003774	2.717E-05	-3.3930067	1.970	213.51	356	163
1	**1.1780972**	**0.1104466**	**0.0937500**	**0.542**	**0.0004324**	**3.332E-05**	**-3.3318468**	**1.807**	**199.58**	**375**	**0**

USER TO ENTER DETAILS IN HIGHLIGHTED CELLS

GRADIENT SET TO CALCULATED OR SPECIFIED VALUE

RILEY CONSULTANTS

Pipe No **3.000**

Roughness 0.6 mm

Diam(mm) 300 mm

Gradient 0.01 m/m

Kahawai Point Stage 5

Stormwater Outfalls

0.0006

0.3

SPECIFY GRADIENT

1 in 100

Gradient 0.010

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
0.01	0.0601005	0.0001196	0.0019907	0.079	0.0203654	0.0107681	-1.5067716	0.119	0.01	3	60
0.02	0.0851382	0.0003374	0.0039626	0.112	0.0102308	0.0038341	-1.8518615	0.207	0.07	6	84
0.03	0.1044498	0.0006179	0.0059157	0.136	0.006853	0.002102	-2.0479359	0.279	0.17	9	102
0.04	0.1208148	0.0009484	0.0078500	0.157	0.0051644	0.0013751	-2.1844567	0.343	0.33	12	118
0.05	0.135308	0.0013213	0.0097654	0.175	0.0041515	0.0009911	-2.2888237	0.401	0.53	15	131
0.1	0.1930503	0.0036788	0.0190560	0.245	0.0021274	0.0003636	-2.6036253	0.637	2.34	30	180
0.15	0.2386196	0.0066487	0.0278633	0.296	0.001455	0.0002056	-2.779732	0.822	5.47	45	214
0.2	0.2781886	0.0100641	0.0361774	0.337	0.0011206	0.000139	-2.8997701	0.977	9.83	60	240
0.25	0.3141593	0.0138192	0.0439877	0.372	0.0009216	0.0001037	-2.9891496	1.111	15.35	75	260
0.3	0.3477838	0.0178352	0.0512823	0.401	0.0007905	8.235E-05	-3.0590402	1.227	21.88	90	275
0.35	0.3798311	0.0220482	0.0580475	0.427	0.0006984	6.838E-05	-3.1153249	1.330	29.32	105	286
0.4	0.4108315	0.0264033	0.0642679	0.449	0.0006308	5.87E-05	-3.1614619	1.420	37.49	120	294
0.45	0.4411887	0.0308504	0.0699257	0.468	0.0005798	5.172E-05	-3.1996346	1.499	46.24	135	298
0.5	0.4712389	0.0353429	0.0750000	0.485	0.0005405	4.656E-05	-3.2312852	1.568	55.42	150	300
0.55	0.5012891	0.0398354	0.0794659	0.499	0.0005102	4.269E-05	-3.2573878	1.627	64.81	165	298
0.6	0.5316463	0.0442826	0.0832933	0.511	0.0004867	3.979E-05	-3.278597	1.676	74.22	180	294
0.65	0.5626467	0.0486376	0.0864443	0.521	0.000469	3.763E-05	-3.2953276	1.716	83.46	195	286
0.7	0.594694	0.0528507	0.0888704	0.528	0.0004562	3.61E-05	-3.3077919	1.747	92.33	210	275
0.75	0.6283185	0.0568667	0.0905061	0.533	0.0004479	3.513E-05	-3.316002	1.767	100.48	225	260
0.8	0.6642892	0.0606217	0.0912580	0.535	0.0004442	3.469E-05	-3.3197253	1.777	107.72	240	240
0.85	0.7038581	0.0640371	0.0909801	0.534	0.0004456	3.485E-05	-3.318353	1.773	113.54	255	214
0.9	0.7494275	0.0670071	0.0894110	0.530	0.0004534	3.577E-05	-3.3105222	1.754	117.53	270	180
0.95	0.8071698	0.0693645	0.0859355	0.519	0.0004718	3.796E-05	-3.2926683	1.710	118.61	285	131
1	**0.9424778**	**0.0706858**	**0.0750000**	**0.485**	**0.0005405**	**4.656E-05**	**-3.2312852**	**1.568**	**110.84**	**300**	**0**

USER TO ENTER DETAILS IN HIGHLIGHTED CELLS

GRADIENT SET TO CALCULATED OR SPECIFIED VALUE

RILEY CONSULTANTS

Pipe No **4.000**

Roughness 0.6 mm

Diam(mm) 375 mm

Gradient 0.01 m/m

Kahawai Point Stage 5

Stormwater Outfalls

0.0006

0.375

SPECIFY GRADIENT

1 in 100

Gradient 0.010

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH _(mm)__
0.01	0.0751256	0.0001869	0.0024883	0.088	0.0162923	0.007705	-1.6198363	0.143	0.03	4	75
0.02	0.1064228	0.0005271	0.0049532	0.125	0.0081847	0.0027435	-1.9614536	0.245	0.13	8	105
0.03	0.1305623	0.0009655	0.0073947	0.152	0.0054824	0.001504	-2.1557436	0.328	0.32	11	128
0.04	0.1510184	0.0014819	0.0098125	0.175	0.0041315	0.0009839	-2.2911163	0.402	0.60	15	147
0.05	0.1691351	0.0020646	0.0122067	0.196	0.0033212	0.0007091	-2.3946609	0.469	0.97	19	163
0.1	0.2413129	0.0057481	0.0238201	0.273	0.001702	0.0002601	-2.7072793	0.740	4.25	38	225
0.15	0.2982746	0.0103886	0.0348291	0.331	0.001164	0.0001471	-2.8823569	0.953	9.90	56	268
0.2	0.3477357	0.0157252	0.0452218	0.377	0.0008965	9.945E-05	-3.0017691	1.131	17.79	75	300
0.25	0.3926991	0.0215924	0.0549847	0.415	0.0007373	7.418E-05	-3.0907203	1.284	27.72	94	325
0.3	0.4347298	0.0278674	0.0641029	0.449	0.0006324	5.893E-05	-3.1602976	1.417	39.49	113	344
0.35	0.4747889	0.0344504	0.0725594	0.477	0.0005587	4.893E-05	-3.2163433	1.535	52.88	131	358
0.4	0.5135394	0.0412551	0.0803349	0.502	0.0005046	4.2E-05	-3.262293	1.638	67.58	150	367
0.45	0.5514858	0.0482038	0.0874071	0.524	0.0004638	3.701E-05	-3.3003163	1.729	83.34	169	373
0.5	0.5890486	0.0552233	0.0937500	0.542	0.0004324	3.332E-05	-3.3318468	1.807	99.79	188	375
0.55	0.6266114	0.0622428	0.0993324	0.558	0.0004081	3.055E-05	-3.3578531	1.875	116.71	206	373
0.6	0.6645578	0.0691915	0.1041166	0.572	0.0003894	2.847E-05	-3.3789855	1.931	133.61	225	367
0.65	0.7033084	0.0759962	0.1080554	0.582	0.0003752	2.693E-05	-3.3956566	1.977	150.24	244	358
0.7	0.7433674	0.0825792	0.1110880	0.590	0.0003649	2.583E-05	-3.4080773	2.012	166.15	263	344
0.75	0.7853982	0.0888542	0.1131327	0.596	0.0003583	2.513E-05	-3.4162588	2.036	180.91	281	325
0.8	0.8303615	0.0947214	0.1140725	0.598	0.0003554	2.482E-05	-3.4199692	2.046	193.80	300	300
0.85	0.8798227	0.100058	0.1137252	0.597	0.0003565	2.494E-05	-3.4186017	2.042	204.32	319	268
0.9	0.9367843	0.1046985	0.1117638	0.592	0.0003627	2.56E-05	-3.4107981	2.020	211.49	338	225
0.95	1.0089622	0.108382	0.1074193	0.581	0.0003774	2.717E-05	-3.3930067	1.970	213.51	356	163
1	**1.1780972**	**0.1104466**	**0.0937500**	**0.542**	**0.0004324**	**3.332E-05**	**-3.3318468**	**1.807**	**199.58**	**375**	**0**

USER TO ENTER DETAILS IN HIGHLIGHTED CELLS
GRADIENT SET TO CALCULATED OR SPECIFIED VALUE

RILEY CONSULTANTS

Pipe No **5.000**
Roughness 0.6 mm
Diam(mm) 300 mm
Gradient 0.01 m/m
Kahawai Point Stage 5
Stormwater Outfalls

0.0006
0.3

SPECIFY GRADIENT
1 in 100
Gradient 0.010

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
0.01	0.0601005	0.0001196	0.0019907	0.079	0.0203654	0.0107681	-1.5067716	0.119	0.01	3	60
0.02	0.0851382	0.0003374	0.0039626	0.112	0.0102308	0.0038341	-1.8518615	0.207	0.07	6	84
0.03	0.1044498	0.0006179	0.0059157	0.136	0.006853	0.002102	-2.0479359	0.279	0.17	9	102
0.04	0.1208148	0.0009484	0.0078500	0.157	0.0051644	0.0013751	-2.1844567	0.343	0.33	12	118
0.05	0.135308	0.0013213	0.0097654	0.175	0.0041515	0.0009911	-2.2888237	0.401	0.53	15	131
0.1	0.1930503	0.0036788	0.0190560	0.245	0.0021274	0.0003636	-2.6036253	0.637	2.34	30	180
0.15	0.2386196	0.0066487	0.0278633	0.296	0.001455	0.0002056	-2.779732	0.822	5.47	45	214
0.2	0.2781886	0.0100641	0.0361774	0.337	0.0011206	0.000139	-2.8997701	0.977	9.83	60	240
0.25	0.3141593	0.0138192	0.0439877	0.372	0.0009216	0.0001037	-2.9891496	1.111	15.35	75	260
0.3	0.3477838	0.0178352	0.0512823	0.401	0.0007905	8.235E-05	-3.0590402	1.227	21.88	90	275
0.35	0.3798311	0.0220482	0.0580475	0.427	0.0006984	6.838E-05	-3.1153249	1.330	29.32	105	286
0.4	0.4108315	0.0264033	0.0642679	0.449	0.0006308	5.87E-05	-3.1614619	1.420	37.49	120	294
0.45	0.4411887	0.0308504	0.0699257	0.468	0.0005798	5.172E-05	-3.1996346	1.499	46.24	135	298
0.5	0.4712389	0.0353429	0.0750000	0.485	0.0005405	4.656E-05	-3.2312852	1.568	55.42	150	300
0.55	0.5012891	0.0398354	0.0794659	0.499	0.0005102	4.269E-05	-3.2573878	1.627	64.81	165	298
0.6	0.5316463	0.0442826	0.0832933	0.511	0.0004867	3.979E-05	-3.278597	1.676	74.22	180	294
0.65	0.5626467	0.0486376	0.0864443	0.521	0.000469	3.763E-05	-3.2953276	1.716	83.46	195	286
0.7	0.594694	0.0528507	0.0888704	0.528	0.0004562	3.61E-05	-3.3077919	1.747	92.33	210	275
0.75	0.6283185	0.0568667	0.0905061	0.533	0.0004479	3.513E-05	-3.316002	1.767	100.48	225	260
0.8	0.6642892	0.0606217	0.0912580	0.535	0.0004442	3.469E-05	-3.3197253	1.777	107.72	240	240
0.85	0.7038581	0.0640371	0.0909801	0.534	0.0004456	3.485E-05	-3.318353	1.773	113.54	255	214
0.9	0.7494275	0.0670071	0.0894110	0.530	0.0004534	3.577E-05	-3.3105222	1.754	117.53	270	180
0.95	0.8071698	0.0693645	0.0859355	0.519	0.0004718	3.796E-05	-3.2926683	1.710	118.61	285	131
1	**0.9424778**	**0.0706858**	**0.0750000**	**0.485**	**0.0005405**	**4.656E-05**	**-3.2312852**	**1.568**	**110.84**	**300**	**0**

USER TO ENTER DETAILS IN HIGHLIGHTED CELLS
GRADIENT SET TO CALCULATED OR SPECIFIED VALUE

RILEY CONSULTANTS

Pipe No **6.000**
Roughness 0.6 mm
Diam(mm) 300 mm
Gradient 0.01 m/m
Kahawai Point Stage 5
Stormwater Outfalls

0.0006
0.3

SPECIFY GRADIENT
1 in 100
Gradient 0.010

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
0.01	0.0601005	0.0001196	0.0019907	0.079	0.0203654	0.0107681	-1.5067716	0.119	0.01	3	60
0.02	0.0851382	0.0003374	0.0039626	0.112	0.0102308	0.0038341	-1.8518615	0.207	0.07	6	84
0.03	0.1044498	0.0006179	0.0059157	0.136	0.006853	0.002102	-2.0479359	0.279	0.17	9	102
0.04	0.1208148	0.0009484	0.0078500	0.157	0.0051644	0.0013751	-2.1844567	0.343	0.33	12	118
0.05	0.135308	0.0013213	0.0097654	0.175	0.0041515	0.0009911	-2.2888237	0.401	0.53	15	131
0.1	0.1930503	0.0036788	0.0190560	0.245	0.0021274	0.0003636	-2.6036253	0.637	2.34	30	180
0.15	0.2386196	0.0066487	0.0278633	0.296	0.001455	0.0002056	-2.779732	0.822	5.47	45	214
0.2	0.2781886	0.0100641	0.0361774	0.337	0.0011206	0.000139	-2.8997701	0.977	9.83	60	240
0.25	0.3141593	0.0138192	0.0439877	0.372	0.0009216	0.0001037	-2.9891496	1.111	15.35	75	260
0.3	0.3477838	0.0178352	0.0512823	0.401	0.0007905	8.235E-05	-3.0590402	1.227	21.88	90	275
0.35	0.3798311	0.0220482	0.0580475	0.427	0.0006984	6.838E-05	-3.1153249	1.330	29.32	105	286
0.4	0.4108315	0.0264033	0.0642679	0.449	0.0006308	5.87E-05	-3.1614619	1.420	37.49	120	294
0.45	0.4411887	0.0308504	0.0699257	0.468	0.0005798	5.172E-05	-3.1996346	1.499	46.24	135	298
0.5	0.4712389	0.0353429	0.0750000	0.485	0.0005405	4.656E-05	-3.2312852	1.568	55.42	150	300
0.55	0.5012891	0.0398354	0.0794659	0.499	0.0005102	4.269E-05	-3.2573878	1.627	64.81	165	298
0.6	0.5316463	0.0442826	0.0832933	0.511	0.0004867	3.979E-05	-3.278597	1.676	74.22	180	294
0.65	0.5626467	0.0486376	0.0864443	0.521	0.000469	3.763E-05	-3.2953276	1.716	83.46	195	286
0.7	0.594694	0.0528507	0.0888704	0.528	0.0004562	3.61E-05	-3.3077919	1.747	92.33	210	275
0.75	0.6283185	0.0568667	0.0905061	0.533	0.0004479	3.513E-05	-3.316002	1.767	100.48	225	260
0.8	0.6642892	0.0606217	0.0912580	0.535	0.0004442	3.469E-05	-3.3197253	1.777	107.72	240	240
0.85	0.7038581	0.0640371	0.0909801	0.534	0.0004456	3.485E-05	-3.318353	1.773	113.54	255	214
0.9	0.7494275	0.0670071	0.0894110	0.530	0.0004534	3.577E-05	-3.3105222	1.754	117.53	270	180
0.95	0.8071698	0.0693645	0.0859355	0.519	0.0004718	3.796E-05	-3.2926683	1.710	118.61	285	131
1	**0.9424778**	**0.0706858**	**0.0750000**	**0.485**	**0.0005405**	**4.656E-05**	**-3.2312852**	**1.568**	**110.84**	**300**	**0**

USER TO ENTER DETAILS IN HIGHLIGHTED CELLS

GRADIENT SET TO CALCULATED OR SPECIFIED VALUE

RILEY CONSULTANTS

Pipe No **7.000**

Roughness 0.6 mm

Diam(mm) 225 mm

Gradient 0.01 m/m

Kahawai Point Stage 5

Stormwater Outfalls

0.0006

0.225

SPECIFY GRADIENT

1 in 100

Gradient 0.010

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	(32mgi)^.5	Ks 14.8m	1.255v m(32..)^.5	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
0.01	0.0450753	6.73E-05	0.0014930	0.068	0.0271539	0.0165786	-1.3591958	0.093	0.01	2	45
0.02	0.0638537	0.0001898	0.0029719	0.097	0.0136411	0.005903	-1.7089835	0.165	0.03	5	63
0.03	0.0783374	0.0003476	0.0044368	0.118	0.0091374	0.0032362	-1.9075067	0.225	0.08	7	77
0.04	0.0906111	0.0005335	0.0058875	0.136	0.0068859	0.0021171	-2.0456154	0.278	0.15	9	88
0.05	0.101481	0.0007432	0.0073240	0.152	0.0055353	0.0015258	-2.1511263	0.326	0.24	11	98
0.1	0.1447877	0.0020693	0.0142920	0.212	0.0028366	0.0005597	-2.4689897	0.523	1.08	23	135
0.15	0.1789647	0.0037399	0.0208975	0.256	0.00194	0.0003166	-2.6465525	0.678	2.54	34	161
0.2	0.2086414	0.0056611	0.0271331	0.292	0.0014941	0.000214	-2.7674804	0.808	4.57	45	180
0.25	0.2356194	0.0077733	0.0329908	0.322	0.0012288	0.0001596	-2.8574705	0.919	7.14	56	195
0.3	0.2608379	0.0100323	0.0384617	0.347	0.001054	0.0001268	-2.9278086	1.017	10.20	68	206
0.35	0.2848733	0.0124021	0.0435356	0.370	0.0009312	0.0001053	-2.9844352	1.103	13.68	79	215
0.4	0.3081236	0.0148518	0.0482009	0.389	0.0008411	9.038E-05	-3.0308407	1.179	17.51	90	220
0.45	0.3308915	0.0173534	0.0524443	0.406	0.000773	7.963E-05	-3.0692276	1.245	21.60	101	224
0.5	0.3534292	0.0198804	0.0562500	0.420	0.0007207	7.169E-05	-3.1010504	1.303	25.90	113	225
0.55	0.3759668	0.0224074	0.0595994	0.432	0.0006802	6.573E-05	-3.1272915	1.352	30.29	124	224
0.6	0.3987347	0.0249089	0.0624699	0.443	0.000649	6.125E-05	-3.1486109	1.394	34.72	135	220
0.65	0.421985	0.0273586	0.0648332	0.451	0.0006253	5.793E-05	-3.1654269	1.428	39.07	146	215
0.7	0.4460205	0.0297285	0.0666528	0.457	0.0006082	5.558E-05	-3.1779541	1.453	43.20	158	206
0.75	0.4712389	0.0319875	0.0678796	0.462	0.0005972	5.408E-05	-3.1862052	1.471	47.05	169	195
0.8	0.4982169	0.0340997	0.0684435	0.463	0.0005923	5.341E-05	-3.189947	1.478	50.40	180	180
0.85	0.5278936	0.0360209	0.0682351	0.463	0.0005941	5.366E-05	-3.1885679	1.476	53.17	191	161
0.9	0.5620706	0.0376915	0.0670583	0.459	0.0006046	5.508E-05	-3.1806981	1.459	54.99	203	135
0.95	0.6053773	0.0390175	0.0644516	0.450	0.000629	5.845E-05	-3.1627541	1.422	55.48	214	98
1	**0.7068583**	**0.0397608**	**0.0562500**	**0.420**	**0.0007207**	**7.169E-05**	**-3.1010504**	**1.303**	**51.81**	**225**	**0**

APPENDIX C

Overland Flow Path Calculations

RILEY CONSULTANTS LTD
New Zealand
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4 Fred Thomas Drive, Takapuna, Auckland 0622
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CHRISTCHURCH
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Tel: +64 3 379 4402 Fax: +64 3 379 4403

KAHAWAI POINT – STAGE 5
127 MCLARIN ROAD, GLENBROOK
OVERLAND FLOW PATH DESIGN CALCULATIONS

Prepared for:	Kahawai Point Development Ltd
Prepared by:	Aditya Raamkumar, Civil Engineer  ……..
Checked by:	Morris Kleinjan, Civil Engineer  ……..
Reviewed and approved for issue by:	Steven James, Project Director, CPEng  ……..
Project reference:	210359
Date:	28 October 2021

RILEY CONSULTANTS	4 Fred Thomas Drive, Takapuna, Auckland 0622 PO Box 100253, North Shore, Auckland 0745 Tel: 09 489 7872 Email: riley@riley.co.nz	**Project No:**	**210359**	**Page**	**1**	of	**6**
		Project:	**Kawahai Point Stage 5 – 127 McLarin Road, Glenbrook**				
	22 Moorhouse Avenue, Addington, Christchurch 8011 PO Box 4355, Christchurch 8140 Tel: 03 379 4402 Email: rileychch@riley.co.nz	**Calc:**	**AR**	**Date:**	**04/10/2021**		
		Check:	**MK**	**Date:**	**28/10/2021**		
Description:	**Overland Flow Path Calculations**						

Background:

- A new residential subdivision is proposed at the above address, bulk earthworks are proposed to develop the site contours to facilitate development.
- The bulk earthworks will result in modification to existing overland flow paths (OLFP) through the site. The flow path is shown in figure 1 below – the Ecology Report identifies it as 'Watercourse 5A'
- The site is currently undeveloped (greenfield).
- A resource consent is required for the earthworks and future development.
- Refer RILEY DWG: 210359-303 for proposed development and OLFP details.

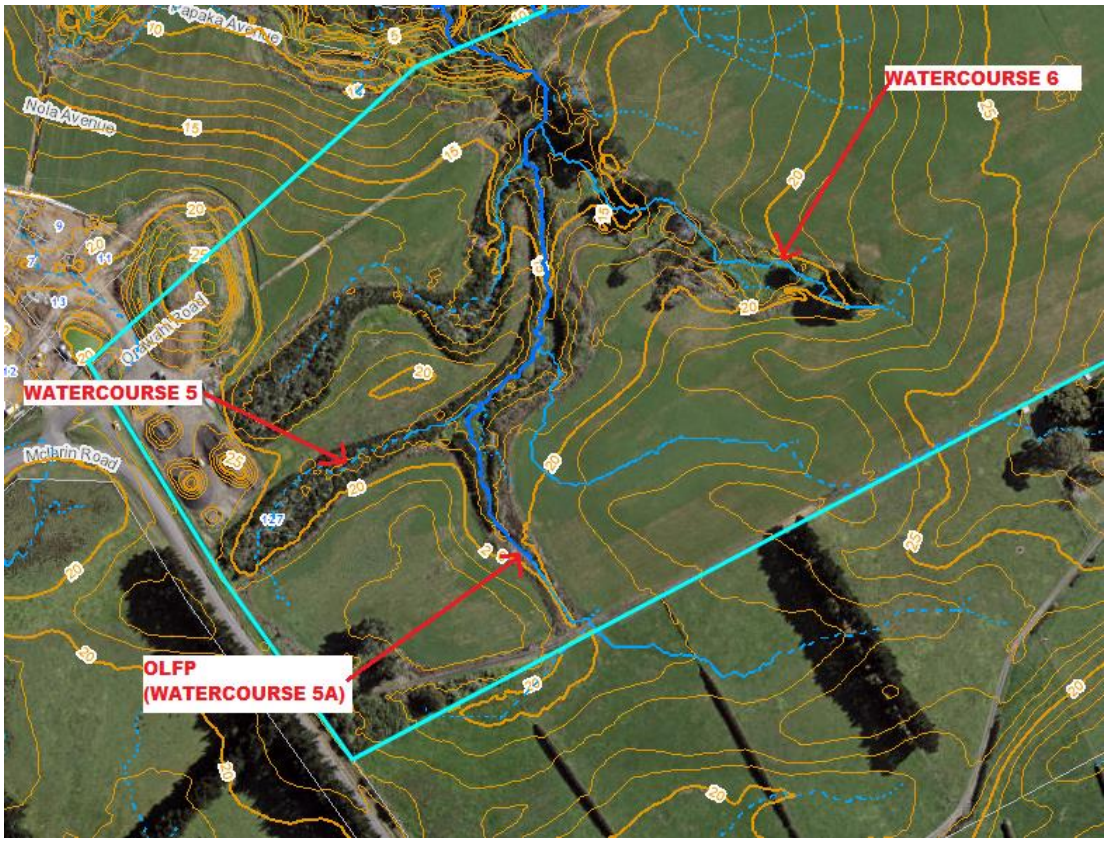
Objective:

- Design suitably sized swales to convey overland flow from the 100year storm event from the future development and upstream catchment (OLFP '5A'), taking into consideration the proposed development contours.
- It is intended that these calculations provide supporting information for resource consent application.

Design Philosophy:

- Undertake preliminary design options for Trapezoidal shaped swales, split into two sections:
  - Swale 1 – southern site boundary to future road reserve.
  - Swale 2 – future road reserve to downstream watercourse
- Consider the post development runoff from the site and future primary (piped) stormwater reticulation
- Modelling undertaken using HEC-HMS 4.6 and in accordance with AC Stormwater Code of Practice and TP 108.
  - Design rainfall depth from TP108 including climate change factors as per Auckland Council CoP.

Figure 1 – existing OLFP '5A' as shown on Council Geomaps



Catchment Assessment:

Soil Conditions

- Curve number (CN), initial abstraction (I_a), lag time (t_p)

	CN	I_a (mm)	t_p (min)
Impervious	98	0	6.7
Pervious	74	5	6.7

- CN value based on Group C Hydrological Soil Classification and Table 3.3 in ARC TP108 (conservative). Initial abstraction based on Table 3.1 in ARC TP108.
- t_p = time of concentration (t_c) x 2/3. (assume 10 minutes for t_c)
  = 6.67 minutes

Note

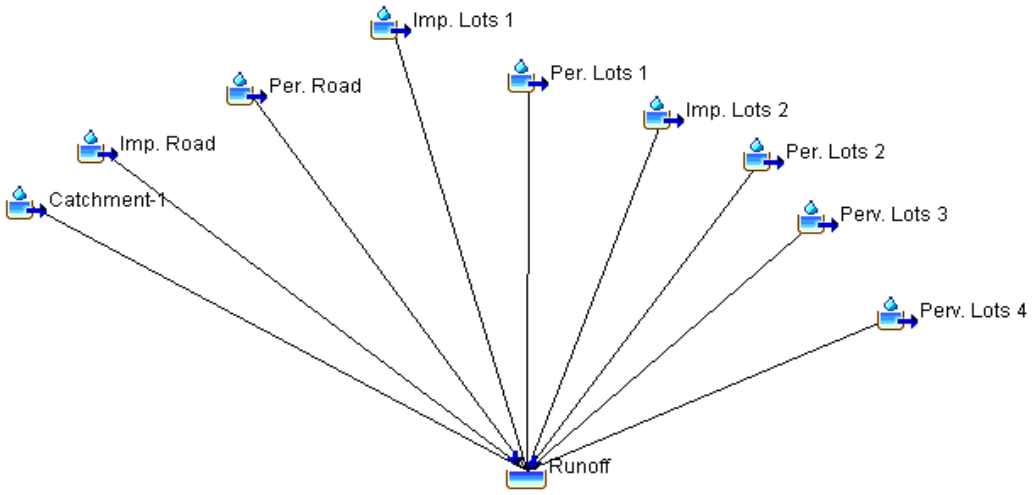
For catchment 1: Time of concentration= 20 minutes

Rainfall Depth

Storm Event	10% AEP	1%AEP
P_{24}, mm	120	180

Climate change factor	30.8%	32.7%
24-hour Rainfall Depths (mm) including climate change effects	157	239

HEC-HMS Model



Catchment Assessment Results

- **1%AEP**

Project: Kahawai Point S5 Simulation Run: 100Year

Start of Run: 01Jan2000, 00:00 Basin Model: Basin 1
End of Run: 02Jan2000, 00:00 Meteorologic Model: 100Year
Compute Time: 04Oct2021, 07:17:41 Control Specifications: Control 1

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrol...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Catchment-1	0.023566	0.61657	01Jan2000, 12:19	167.92
Runoff	0.042806	1.20575	01Jan2000, 12:14	173.50
Imp. Lots 2	0.004369	0.14342	01Jan2000, 12:13	168.44
Imp. Road	0.003553	0.14510	01Jan2000, 12:12	232.89
Per. Lots 2	0.002353	0.07724	01Jan2000, 12:13	168.44
Per. Road	0.002145	0.07042	01Jan2000, 12:13	168.44
Perv. Lots 3	0.001952	0.06408	01Jan2000, 12:13	168.44
Imp. Lots 1	0.001933	0.06346	01Jan2000, 12:13	168.44
Perv. Lots 4	0.001894	0.06218	01Jan2000, 12:13	168.44
Per. Lots 1	0.001041	0.03417	01Jan2000, 12:13	168.44

- **10%AEP**

Project: Kahawai Point S5 Simulation Run: 10Year

Start of Run: 01Jan2000, 00:00 Basin Model: Basin 1
End of Run: 02Jan2000, 00:00 Meteorologic Model: 10Year
Compute Time: 04Oct2021, 07:17:36 Control Specifications: Control 1

Show Elements: All Eleme... Volume Units: MM 1000 M3 Sorting: Hydrol...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Catchment-1	0.023566	0.34893	01Jan2000, 12:19	2.2426
Runoff	0.042806	0.69389	01Jan2000, 12:14	4.2792
Imp. Lots 2	0.004369	0.08148	01Jan2000, 12:13	0.4172
Imp. Road	0.003553	0.09514	01Jan2000, 12:12	0.5388
Per. Lots 2	0.002353	0.04388	01Jan2000, 12:13	0.2247
Per. Road	0.002145	0.04001	01Jan2000, 12:13	0.2048
Perv. Lots 3	0.001952	0.03641	01Jan2000, 12:13	0.1864
Imp. Lots 1	0.001933	0.03605	01Jan2000, 12:13	0.1846
Perv. Lots 4	0.001894	0.03532	01Jan2000, 12:13	0.1808
Per. Lots 1	0.001041	0.01942	01Jan2000, 12:13	0.0994

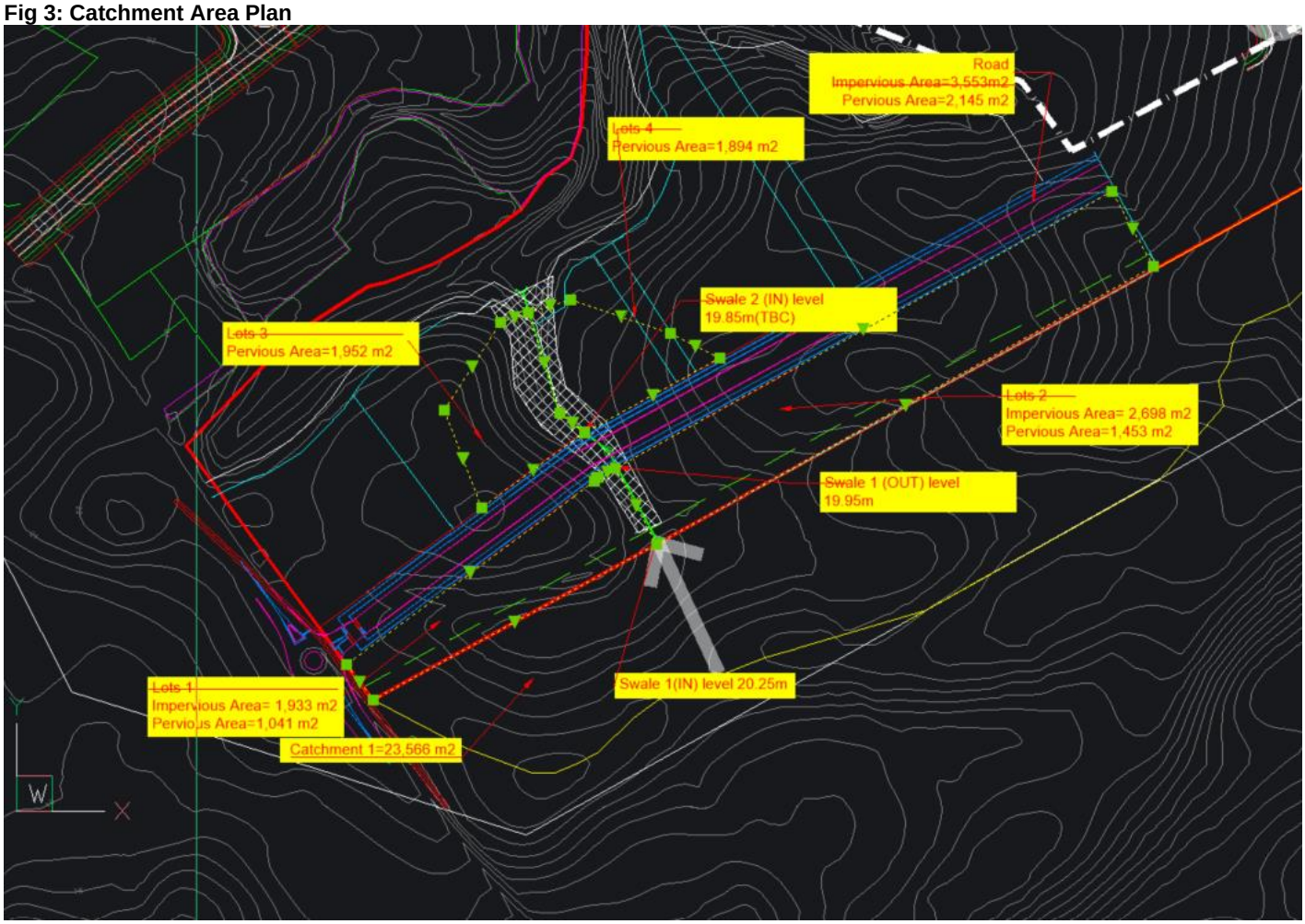
Swale design summary

Catchment Area

Fig 2: Catchment Area Coverage

Swale 1			Swale 2		
Storm	Catchment	Swale 1 Flow(L/s)	Storm	Catchment	Swale 2 Flow(L/s)
	Catchment 1	616.57		Swale 1	696.33
100Year	Lots 1(P)	34.17		I.Road	145.1
	Lots 2(P)	77.24		P.Road	70.42
50% of	{-}Lots1(P)	9.71	100Year	Lots3(P)	64.08
10Year	{-}Lots2(P)	21.94		Lots4(P)	62.18
				Lots1 (I)	63.46
	Flow L/s	**696.33**		Lots2(I)	143.42
				{-}I.Road	47.57
				{-}P.Road	20
			50% of	{-}Lots3(P)	18.2
			10Year	{-}Lots4(P)	17.67
				{-}Lots1(I)	18
				{-}Lots2(I)	40.74
				Flow L/s	**1082.81**

Fig 3: Catchment Area Plan



Note:
For calculation of runoff from the future development – assume future primary drainage sized for 10 year flow and pipe size >= 600mm dia. – assume 50% blocked (in accordance with Council SWCoP), i.e. deduct 50% of 10 year flow from the calculated 100year flow to determine the secondary overland flowrate - see above

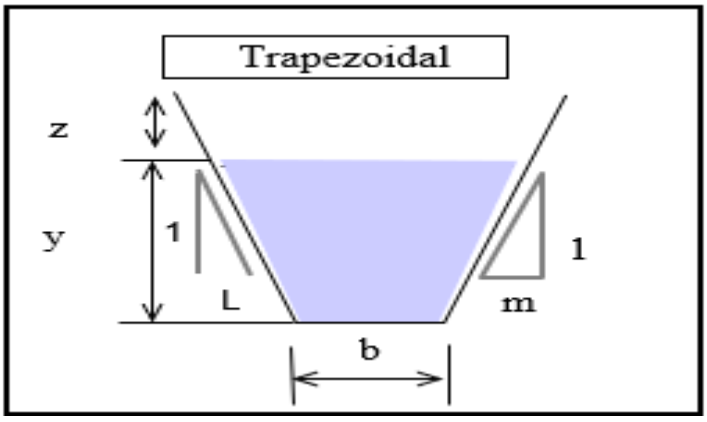
Swale design

- A preliminary design for a Trapezoidal shape swale has been undertaken.
- A manning constant of 0.03 has been assumed for grass (GD01)

Table 2: Proposed swale depths

		Trapezoidal (Base =0.5m)	
Swale	**Flow(L/s)**	**Channel gradient (%)**	**Depth (m)**
1	696	**1.0**	**0.32**
2	1083	**1.0**	**0.39**

Resultant swale dimensions:



Freeboard(Z)= 0m
Side slope (L, m) = 5m
Bed width(b)= 0.5m
Channel gradient- Swale 1= 1%, Swale 2= 1%
1 % AEP flow velocity = Swale 1= 1.057 m/s, Swale 2= 1.190 m/s
Depth - Swale 1= 0.32m, Swale 2= 0.39m
1% AEP flow width – Swale 1 = 3.7m, Swale 2 = 4.4m

APPENDIX D

Correspondence with Auckland Transport Consultant

Luke Gordon

From: Amit Patel <Amit.Patel@ptmconsultants.co.nz>
Sent: Tuesday, 8 February 2022 12:30 PM
To: Luke Gordon
Subject: [External] FW: Stage 5a Draft RC - Urban Design & Landscape

Hi Luke
Response below
(sorry for the delay in getting this to you)

Amit Patel
Director / Principal Consultant - **MEngSt (Transp), Bcom, Grad Dip (Mgt), MEngNZ, PRINCE2® Registered Practitioner**
Mobile: 021 231 7624
Email: Amit.Patel@ptmconsultants.co.nz

From: James Taylor <james.taylor@awa.kiwi>
Sent: Wednesday, 2 February 2022 8:50 AM
To: Amit Patel <Amit.Patel@ptmconsultants.co.nz>
Cc: Cathy Bebelman (AT) <cathy.bebelman@at.govt.nz>
Subject: RE: Stage 5a Draft RC - Urban Design & Landscape

Hi Amit,

I can only speak to AT's general expectations for the raingardens based on the sketches provided. These devices will of course still subject to the usual EPA review processes.

I don't see any further issues at this stage though.

Cheers,
James

From: Amit Patel <Amit.Patel@ptmconsultants.co.nz>
Sent: Tuesday, 1 February 2022 4:27 pm
To: James Taylor <james.taylor@awa.kiwi>
Cc: Cathy Bebelman (AT) <cathy.bebelman@at.govt.nz>
Subject: RE: Stage 5a Draft RC - Urban Design & Landscape

Good Afternoon James

Sorry for the late reply.
I can confirm that we will not proceed with the GPT and these will be removed.

Can you confirm that this will cover off the requirements.

Amit Patel
Director / Principal Consultant - **MEngSt (Transp), Bcom, Grad Dip (Mgt), MEngNZ, PRINCE2® Registered Practitioner**
Mobile: 021 231 7624
Email: Amit.Patel@ptmconsultants.co.nz

From: James Taylor <james.taylor@awa.kiwi>
Sent: Wednesday, 26 January 2022 8:21 AM
To: Amit Patel <Amit.Patel@ptmconsultants.co.nz>
Cc: Cathy Bebelman (AT) <cathy.bebelman@at.govt.nz>
Subject: RE: Stage 5a Draft RC - Urban Design & Landscape

Hi Amit,

Pre-treatment is not necessary for these raingardens as they are not too large, and the surrounding land-use is unlikely to generate debris or sediment loads that would justify the additional maintenance costs of a pre-treatment GPT. Directly in-letting surface water onto the raingardens in this type of application is appropriate. Suggest you remove the GPT's unless there's a good reason to justify their use here.

Cheers,

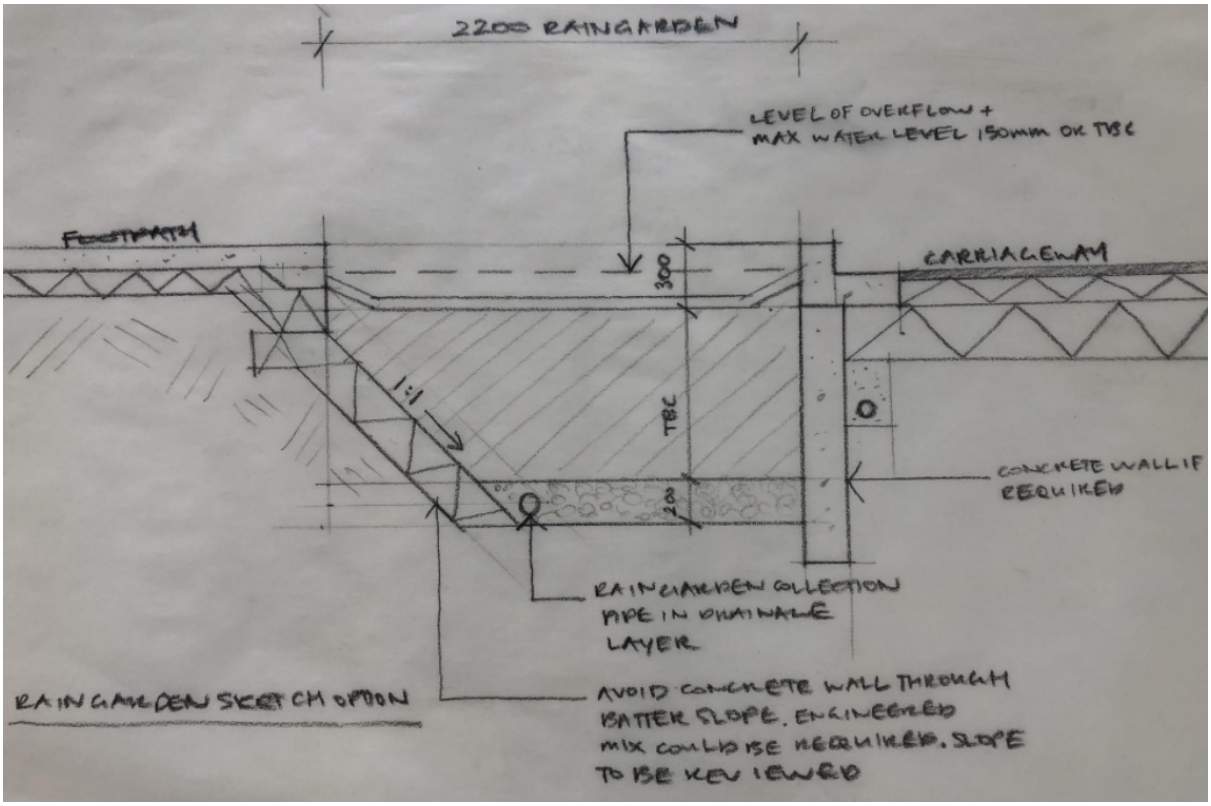
JAMES TAYLOR
WATER INFRASTRUCTURE ENGINEER
a: Level 9 (Biz Dojo), 4 Williamson Ave, Grey Lynn, Auckland 1021
m: +64 27 7388 205 e: james.taylor@awa.kiwi w: www.awa.kiwi

From: Amit Patel <Amit.Patel@ptmconsultants.co.nz>
Sent: Tuesday, 25 January 2022 4:29 pm
To: James Taylor <james.taylor@awa.kiwi>
Cc: Cathy Bebelman (AT) <cathy.bebelman@at.govt.nz>
Subject: RE: Stage 5a Draft RC - Urban Design & Landscape

Good afternoon James and happy new year.

Following on from our conversation the team have worked on the design for the SW. A gross pollutant trap (GPT) will be considered as an additional pre-treatment option (removal of course sediment and debris) before the surface water enters the rain gardens. The GPT may consist of (for example) a simple catchpit-like structure with internal submerged baffle and sump, to collect and retain the sediment. Details will be determined at Engineering Plan Approval (EPA) stage.

Would this be satisfactory to you?



Amit Patel
Director / Principal Consultant - **MEngSt (Transp), Bcom, Grad Dip (Mgt), MEngNZ, PRINCE2® Registered Practitioner**
Mobile: 021 231 7624
Email: Amit.Patel@ptmconsultants.co.nz

From: James Taylor <james.taylor@awa.kiwi>
Sent: Monday, 20 December 2021 3:27 PM
To: Amit Patel <Amit.Patel@ptmconsultants.co.nz>
Subject: RE: Stage 5a Draft RC - Urban Design & Landscape

Hi Amit,

No problem conceptually looks good, as per our discussion a couple weeks back. Couple of notes though to be considered through the detailed design phase though:

- 2.2m berm width will be relatively tight for the raingardens, is a concrete structure going to be required to support the road, or is there sufficient space for battered slopes? If concrete structures, note that raingardens with larger soil volumes and surface area provide for better plant health. Compartmentalizing the raingardens with concrete support walls can create small cells with many of the issues we have with precast structures stacked end to end. Sufficiently wide berms to provide space for battered slope devices would be preferable.
- The Boffa plans shows some kind of GPT device before discharge into the raingarden. Given the road is relatively low volume residential, is a GPT necessary?
- Trees within raingardens are not typically appropriate, as the raingardens need to be very large to allow for maintenance to occur without damaging the tree.

Kind Regards,

JAMES TAYLOR
WATER INFRASTRUCTURE ENGINEER
a: Level 9 (Biz Dojo), 4 Williamson Ave, Grey Lynn, Auckland 1021
m: +64 27 7388 205 e: james.taylor@awa.kiwi w: www.awa.kiwi

From: Amit Patel <Amit.Patel@ptmconsultants.co.nz>
Sent: Friday, 17 December 2021 4:00 pm
To: James Taylor <james.taylor@awa.kiwi>
Subject: RE: Stage 5a Draft RC - Urban Design & Landscape

Sorry…James, shows where my mind is…I hit send to early!
I was just wondering if the rain garden design is ok.
I was keen to wrap this up before Christmas

Amit Patel
Director / Principal Consultant - **MEngSt (Transp), Bcom, Grad Dip (Mgt), MEngNZ, PRINCE2® Registered Practitioner**
Mobile: 021 231 7624
Email: Amit.Patel@ptmconsultants.co.nz

From: Amit Patel
Sent: Friday, 17 December 2021 3:59 PM
To: James Taylor <james.taylor@awa.kiwi>
Subject: FW: Stage 5a Draft RC - Urban Design & Landscape

Hi James
Sorry for the pre christmas email – I bet you are keen to wind down now!

I have attached the rain garden concept as per our discussion before.

Amit Patel
Director / Principal Consultant - **MEngSt (Transp), Bcom, Grad Dip (Mgt), MEngNZ, PRINCE2® Registered Practitioner**
Mobile: 021 231 7624
Email: Amit.Patel@ptmconsultants.co.nz

From: Bernie Chote <bernie@rangatu.co.nz>
Sent: Friday, 17 December 2021 12:41 PM
To: 'Sagar Kariya' <sagar.kariya@eliga.co.nz>; Amit Patel <Amit.Patel@ptmconsultants.co.nz>
Subject: FW: Stage 5a Draft RC - Urban Design & Landscape

Please confirm the raingarden concepts page 20 are what AT will accept

From: Dave Parker <Dave.Parker@boffamiskell.co.nz>
Sent: Friday, 17 December 2021 12:21 pm
To: Bernie Chote <bernie@rangatu.co.nz>; 'John Duthie (Tattico)' <john.duthie@tattico.co.nz>
Cc: Luke Gordon <lgordon@riley.co.nz>; Morris Kleinjan <mkleinjan@riley.co.nz>; 'Sagar Kariya' <sagar.kariya@eliga.co.nz>; Ben Clark <Ben.Clark@boffamiskell.co.nz>; Eddie Sides <Eddie.Sides@boffamiskell.co.nz>
Subject: Stage 5a Draft RC - Urban Design & Landscape

Hi Bernie and John,

Please see attached the draft Stage 5a RC package for urban design and landscape as well as the CAD dwg file. A high resolution version of the document can also be downloaded here: https://boffa-my.sharepoint.com/:b:/g/personal/davep_boffamiskell_co_nz/EbLx7zmTxWlGkiMnDeBVrj8BFcZYcU_rUm3thGicxweXtQ?e=dOIg0G

As mentioned through the week there are still a few things to resolve such as:

- The stage 5a path connection with stage 4 including temporary footpath until road to stage 6 is completed. This will define the extent of riparian planting works also
- Updated counties lot boundary and compensation planting areas to be updated once CAD is available
- Kerb and footpath alignment to be updated where stage 5a meets stage 4

Bernie, we have kept the mention of nature play in the community space as a high level comment with the intent of developing this further following RC.

Once we've received comments over the Christmas break, we can make any updates in January. Please note I'm not back in the office until 17th Jan but Ben will be back on the 13th.

Regards

Dave Parker | Landscape Architect | Associate Principal | Registered NZILA Landscape Architect

E: dave.parker@boffamiskell.co.nz | D: +64 9 359 5319 | M: +64 27 306 6506 | LEVEL 3 | 82 WYNDHAM STREET | AUCKLAND 1010 | NEW ZEALAND

APPENDIX E

Watercare Planning Assessment Forms

Development Application Form – Water Supply/Wastewater Planning Assessment		
Date of Application	**02/02/2021**	
Address of Development	**127 McLarin Road, Glenbrook**	
Layout Plan of Proposed Development clearly showing: • Aerial photograph • Road names • Boundary of development • Preferred point of connection to existing water supply and wastewater asset	Refer attached drawings	
	Description	**Comment**
Current Land Use	Unoccupied (Greenfield)	
Proposed Land Use	Residential and commercial	
Total Development Area (Ha.)	*4ha*	
Number of Residential Households (Consent & Ultimate)	Up to 51 residential lots/households, plus 1 superlot, plus 2 commercial lots	.

Refer to Water and Wastewater Code of Practice for Land Development and Subdivision Section 6 Water Supply

Water Supply Development Assessment		
Average and Peak Residential Demand (L/s)	Avg=0.40 L/s Peak=2 L/s	*Including 1x superlot (assumed to be equivalent of 1 household).* *220l/p/d, 3 persons per lot.* *Peaking factor of 5 applied.*
Average and Peak Non-Residential Demand (L/s)	Avg=0.04 L/s Peak=0.2 L/s	*Assumed GFA of 200 sqm per commercial lot - assume majority is dry retail/office where toilets are provided to customers (WSL CoP Table 6.1.b – 1 person per 15m^2 floor area and 65L/p/day), with say 50m2 wet retail per lot (15L/day/m^2)* *Peaking factor of 5 applied.*
Non Residential Demand Typical Daily Consumption Profile/Trend		*e.g., 24 hr operation/10 hr (9am - 5pm)/Filling on-site storage at certain frequency)*
Fire- fighting Classification required by the proposed site	FW2	*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 and time; location of hydrants tested, and pressure logged; static pressure; flow; residual pressure*
Sprinkler System in building?	☐ Yes ☐ No	*unknown*
Further Water Supply comments		

Refer to Water and Wastewater Code of Practice for Land Development and Subdivision Section 5 Wastewater

Wastewater Development Assessment		
Peak DWF and WWF Residential Design Flows (L/s)	DWF= 0.99 L/s	*Including 1x superlot (assumed to be equivalent of 1 household).* *Based on 180/l/p/d and 3 persons per lot.* *Peaking factor of 3 applied.* *WWF not applicable – pressure system*
Peak DWF and WWF Non-Residential Design Flows (L/s)	DWF= 0.12 L/s	*Assumed GFA of 200 sqm per commercial lot - assume majority is dry retail/office where toilets are provided to customers (WSL CoP Table 5.1.3 – 1 person per 15m^2 floor area and 65L/p/day), with say 75m2 wet retail per lot (15 L/day/m^2)* *Peaking factor of 3 applied.* *WWF not applicable – pressure system*
Non-Residential Discharge Profile / Trend (i.e., Operations)		*e.g., 24 hr operation / 10 hr (9am – 5pm) /Other*
New Assets Required for Development	DN50mm and DN75mm pressure pipes	*Refer RILEY Dwg 210359-364*
Sewer Capacity Check		*Refer GHD capacity Report - attached*
Further Wastewater comments		

For internal Watercare use only

Date Application Received	
Application Ref No.	
Assigned Connections Engineer	
Prior Developer Correspondence with Watercare	
Neighbouring developments to consider in capacity assessment	

APPENDIX F

RILEY Dwgs:
210359-350 to -374
(23No.)

KAHAWAI POINT DEVELOPMENTS LIMITED

KAHAWAI POINT, GLENBROOK

KAHAWAI POINT - STAGE 5

RESOURCE CONSENT DRAWINGS - FEBRUARY 2022

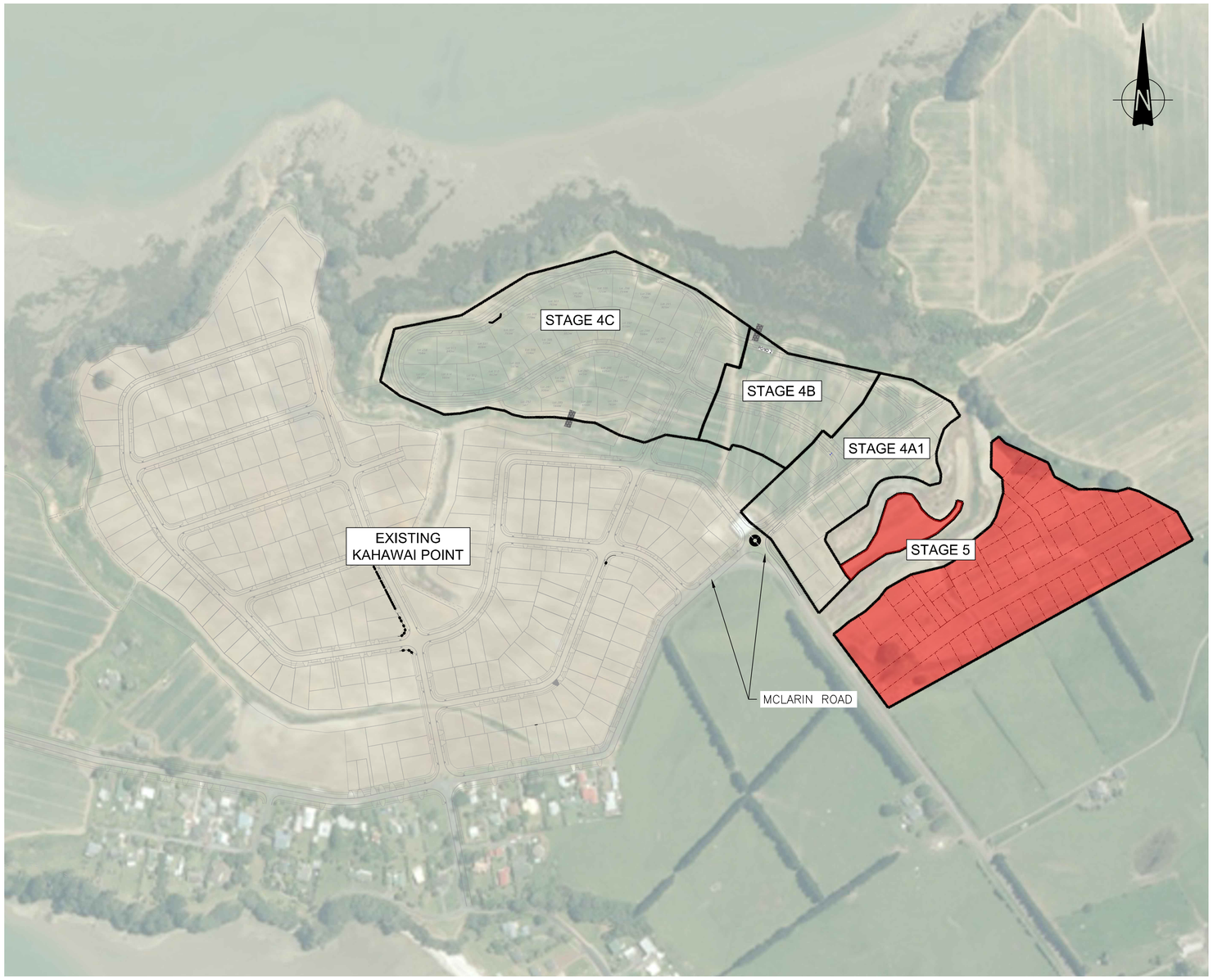
DRAWING NO.	DRAWING TITLE	REV
210359-350	DRAWING LIST AND LOCALITY PLAN	2
210359-351	EXISTING SITE PLAN	2
210359-352	OVERALL PROPOSED ENGINEERING PLAN	2
210359-353	SUPERLOT 3 LAYOUT	1
210359-355	ROAD LONG SECTION	1
210359-356	JOAL LONG SECTIONS	1
210359-357	ROAD TYPICAL CROSS SECTION	1
210359-358	JOAL TYPICAL CROSS SECTION	1
210359-360	STORMWATER LAYOUT	2
210359-361	STORMWATER CATCHMENT AND OVERLAND FLOWPATH PLAN	2
210359-362	STORMWATER OUTFALL TYPICAL DETAILS	1
210359-363	RAIN GARDEN PRELIMINARY DETAILS AND SIZES	1
210359-364	LOW PRESSURE SEWER LAYOUT	2
210359-365	WATER SUPPLY LAYOUT	2
210359-366	STANDARD DETAILS- SHEET 1	1
210359-367	STANDARD DETAILS- SHEET 2	1
210359-368	STANDARD DETAILS- SHEET 3	1
210359-369	STANDARD DETAILS- SHEET 4	1
210359-370	STANDARD DETAILS- SHEET 5	1
210359-371	STANDARD DETAILS- SHEET 6	1
210359-372	STANDARD DETAILS- SHEET 7	1
210359-373	STANDARD DETAILS- SHEET 8	1
210359-374	STANDARD DETAILS- SHEET 9	1

GENERAL NOTES:

1. ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH THE DRAWINGS & SPECIFICATIONS AND APPROVALS (RESOURCE CONSENT, BUILDING CONSENT AND ENGINEERING APPROVALS).
2. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THE LATEST REVISION DRAWINGS ARE ON SITE.
3. ALL DRAWINGS AND SPECIFICATIONS TO BE READ IN CONJUNCTION WITH OTHER PROJECT SPECIALISTS DOCUMENTATION.
4. ALL EARTHWORKS, INCLUDING TRENCHING FOR SERVICES, ARE TO BE FULLY SUPPORTED.
5. DO NOT SCALE OR DIMENSION FROM THESE DRAWINGS.
6. TOPOGRAPHICAL SURVEY INFORMATION SOURCED FROM DRONE SURVEYS UNDERTAKEN BY SURVEY WORX AND BM SURVEYS (MOST RECENTLY OCTOBER 2021), GULLY CONTOURS SOURCED FROM AUCKLAND COUNCIL GEOMAPS.
7. LEVELS ARE IN TERMS OF LINZ AUCKLAND VERTICAL DATUM 1946. CO-ORDINATES ARE IN TERMS OF MT EDEN 2000.
8. ALL WORK & MATERIALS TO BE IN ACCORDANCE WITH COUNCIL STANDARDS & SPECIFICATIONS.
9. THE CONTRACTOR IS TO LOCATE & PROTECT ALL EXISTING SERVICES, INCLUDING POWER, TELECOM, GAS, WATER, STORMWATER & WASTEWATER BEFORE COMMENCING WORKS. LIAISE WITH RESPECTIVE SERVICE AUTHORITIES FOR ASSISTANCE.
10. ANY DISCREPANCIES BETWEEN THE DRAWINGS & SITE CONDITIONS ARE TO BE NOTIFIED TO THE ENGINEER IMMEDIATELY.
11. ALL NEW PIPEWORK SHALL BE PROTECTED AGAINST DAMAGE DURING CONSTRUCTION.
12. ALL WORKS TO BE SET OUT ON SITE PRIOR TO CONSTRUCTION. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER PRIOR TO COMMENCEMENT.
13. CONTRACTOR TO GIVE NOTICE TO THE ENGINEER PRIOR TO BACKFILLING ANY WORK.
14. THE CONTRACTOR MUST BE SATISFIED THAT THE WORKS HAVE BEEN COMPLETED IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATION PRIOR TO REQUESTING AN INSPECTION.
15. IT IS THE CONTRACTOR'S RESPONSIBILITY TO LIAISE WITH THE ENGINEER TO SATISFY THEMSELVES THEY CLEARLY UNDERSTAND WHEN ALL INSPECTIONS ARE REQUIRED.
16. ALL WORKS SHALL COMPLY WITH THE HEALTH & SAFETY PLAN SUBMITTED BY THE CONTRACTOR.

SEDIMENT CONTROL NOTES:

1. EARTHWORKS AND SEDIMENT CONTROL REPORT DRAWINGS TO BE READ IN CONJUNCTION WITH RILEY REPORT REF: 210359-B.
2. ALL E&SC MEASURES ARE TO BE IN ACCORDANCE WITH THE EROSION AND SEDIMENT CONTROL GUIDE FOR LAND DISTURBANCE ACTIVITIES IN THE AUCKLAND REGION (GD05).
3. THE CONTRACTOR (AND THEIR SUB-CONTRACTORS) SHALL BE RESPONSIBLE FOR PROVIDING ADEQUATE SEDIMENT AND EROSION CONTROL MEASURES TO PROTECT DOWNSTREAM ENVIRONMENTS FROM EXCESSIVE SEDIMENTATION AND WATER QUALITY DEGRADATION. THE CONTRACTOR SHALL PREPARE SEDIMENT CONTROL LAYOUT PLANS ACCORDING WITH THE E&SCP AND PROVIDE COPIES TO THE SITE ENGINEER AND COUNCIL REPRESENTATIVE FOR APPROVAL PRIOR TO COMMENCING ANY EARTHWORKS ACTIVITIES.
4. CONTRACTOR WILL BE REQUIRED TO LIAISE WITH COUNCIL REPRESENTATIVE PRIOR TO AND DURING CONSTRUCTION TO ENSURE SEDIMENT CONTROL MEASURES ARE SUFFICIENT.
5. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED BEFORE COMMENCING ANY EARTHWORKS.



STAGE LOCATION
SCALE: NTS

NOTE: AERIAL IMAGE SOURCED FROM LINZ

RESOURCE CONSENT

REV	DATE	ISSUE	BY
2	22.02.22	REVISED ISSUE FOR RESOURCE CONSENT	MD
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
LG	LG	S. JAMES
DRAWN	CAD CHECK	
MD	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		22 / 02 / 22

RILEY CONSULTANTS
www.riley.co.nz

KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	DRAWING LIST AND LOCALITY PLAN

ACENZ
ISO 9001 GCS

CADFILE	210359-350.dwg
SCALE (A1)	N.T.S.
ORIG. SHEET SIZE	A1
DRAWING No.	210359-350
REV.	2

300 Original size mm
200
150
100
50
30
10
0

F:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CAD\5.4 CURRENT\210359-350.DWG

LEGEND

- 18.00 EXISTING CONTOURS
- FUTURE LOT BOUNDARY
- PROPOSED EARTHWORKS BOUNDARY
- WATERCOURSE
- WATERCOURSE 10m OFFSET
- WETLAND BOUNDARY (FROM BOFFA MISKELL)
- WETLAND BDY 10m OFFSET (FROM BOFFA MISKELL)
- RETAINED TREES

NOTES:

1. TOPOGRAPHICAL SURVEY INFORMATION SOURCED FROM DRONE SURVEYS UNDERTAKEN BY SURVEY WORX AND BM SURVEYS (MOST RECENTLY OCTOBER 2021), GULLY CONTOURS SOURCED FROM AUCKLAND COUNCIL GEOMAPS.

WATERCOURSE 4

WATERCOURSE 4

SUPERLOT 3

Lot 2003

WATERCOURSE 5

Lot 315

Lot 319

SITE COMPOUND AND CONSTRUCTION ENTRANCE

McLARIN ROAD OVERHEAD POWERLINES

Commercial 2

Lot 316

Lot 320

WATERCOURSE 5A (OVERLAND FLOW PATH)

Commercial 1

Lot 317

Lot 318

Lot 321

Lot 322

EXISTING CLAY STOCKPILE (EXCESS MATERIAL FROM STAGE 4), VOLUME 30,500m³ AS PER SURVEY DATA PROVIDED 05/10/2021

Lot 325

Lot 326

Lot 327

Lot 328

Lot 329

Lot 330

Lot 331

Lot 333

Lot 334

Lot 335

Lot 336

Lot 337

EXISTING SEDIMENT POND

WATERCOURSE 6

Lot 338

Lot 339

Lot 340

Lot 341

Lot 342

Lot 343

Lot 344

Lot 345

EXISTING TOPSOIL AND UNSUITABLE STOCKPILE FROM STAGE 4 SITE STRIP. STOCKPILE NOT INCLUDED AS PART OF EXISTING SURFACE – MATERIAL TO BE RESPREAD IN STAGE 4 AREAS

Lot 342

Lot 348

Lot 349

Lot 350

Lot 351

Lot 352

Lot 353

Lot 354

Lot 355

Lot 356

Lot 357

Lot 358

Lot 359

Lot 360

Lot 361

Lot 362

Lot 363

McLARIN ROAD

5 0 10 20m

SCALE 1:500

RESOURCE CONSENT

REV	DATE	ISSUE	BY
2	22.02.22	UPDATED LAYOUT	MD
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
LG	LG	S. JAMES
DRAWN	CAD CHECK	
MD	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		22 / 02 / 22

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KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	EXISTING SITE PLAN

ACENZ ISO 9001 GCS

CADFILE	210359-351.dwg
SCALE (A1)	1:500
ORIG. SHEET SIZE	A1
DRAWING No.	210359-351
REV.	2

LEGEND

- 18.00 EXISTING CONTOURS
- PROPOSED CONTOURS
- EXISTING BOUNDARY
- FUTURE LOT BOUNDARY
- RAIN GARDEN

STAGE 4A1

STAGE 5

SHARED PATH TO BE EXTENDED TO TIE IN WITH STAGE 4A1 FOOTPATH – REFER BOFFA MISKELL DOCUMENTATION FOR DETAILS

WATERCOURSE 4

WATERCOURSE 5

WATERCOURSE 6

SUPERLOT 3

3.0m SHARED PATH

BOARDWALK – MAX. 1.0m ABOVE EXISTING GROUND

NEW ROAD

MCLARIN ROAD

JOAL 1

JOAL 2

JOAL 3

Commercial 1

Commercial 2

Lot 2003

Lot 315

Lot 316

Lot 317

Lot 318

Lot 319

Lot 320

Lot 321

Lot 322

Lot 323

Lot 324

Lot 325

Lot 326

Lot 327

Lot 328

Lot 329

Lot 330

Lot 331

Lot 332

Lot 333

Lot 334

Lot 335

Lot 336

Lot 337

Lot 338

Lot 339

Lot 340

Lot 341

Lot 342

Lot 343

Lot 344

Lot 345

Lot 346

Lot 347

Lot 348

Lot 349

Lot 350

Lot 351

Lot 352

Lot 353

Lot 354

Lot 355

Lot 356

Lot 357

Lot 358

Lot 359

Lot 360

Lot 361

Lot 362

Lot 363

OVERHEAD POWER LINES TO BE RELOCATED TO WESTERN SIDE OF MCLARIN ROAD TO RESOLVE CLASH WITH POWERPOLE AND NEW INTERSECTION. SUBJECT TO AGREEMENT WITH COUNTIES ENERGY LTD.

REFER ELIGA DOCUMENTATION FOR ROUNDABOUT DESIGN

OVERVIEW PLAN
SCALE 1:2500

SCHEME PLAN
SCALE 1:500

5 0 10 20m SCALE 1:500

25 0 50 100m SCALE 1:2500

RESOURCE CONSENT

REV	DATE	ISSUE	BY
2	22.02.22	UPDATED LAYOUT	MD
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
LG	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		22 / 02 / 22

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KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	OVERALL PROPOSED ENGINEERING PLAN

ACENZ ISO 9001 GCS

CADFILE	210359–352.dwg
SCALE (A1)	AS SHOWN
ORIG. SHEET SIZE	A1
DRAWING No.	210359-352
REV.	2

T:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CAD\5.4 CURRENT\210359-352.DWG

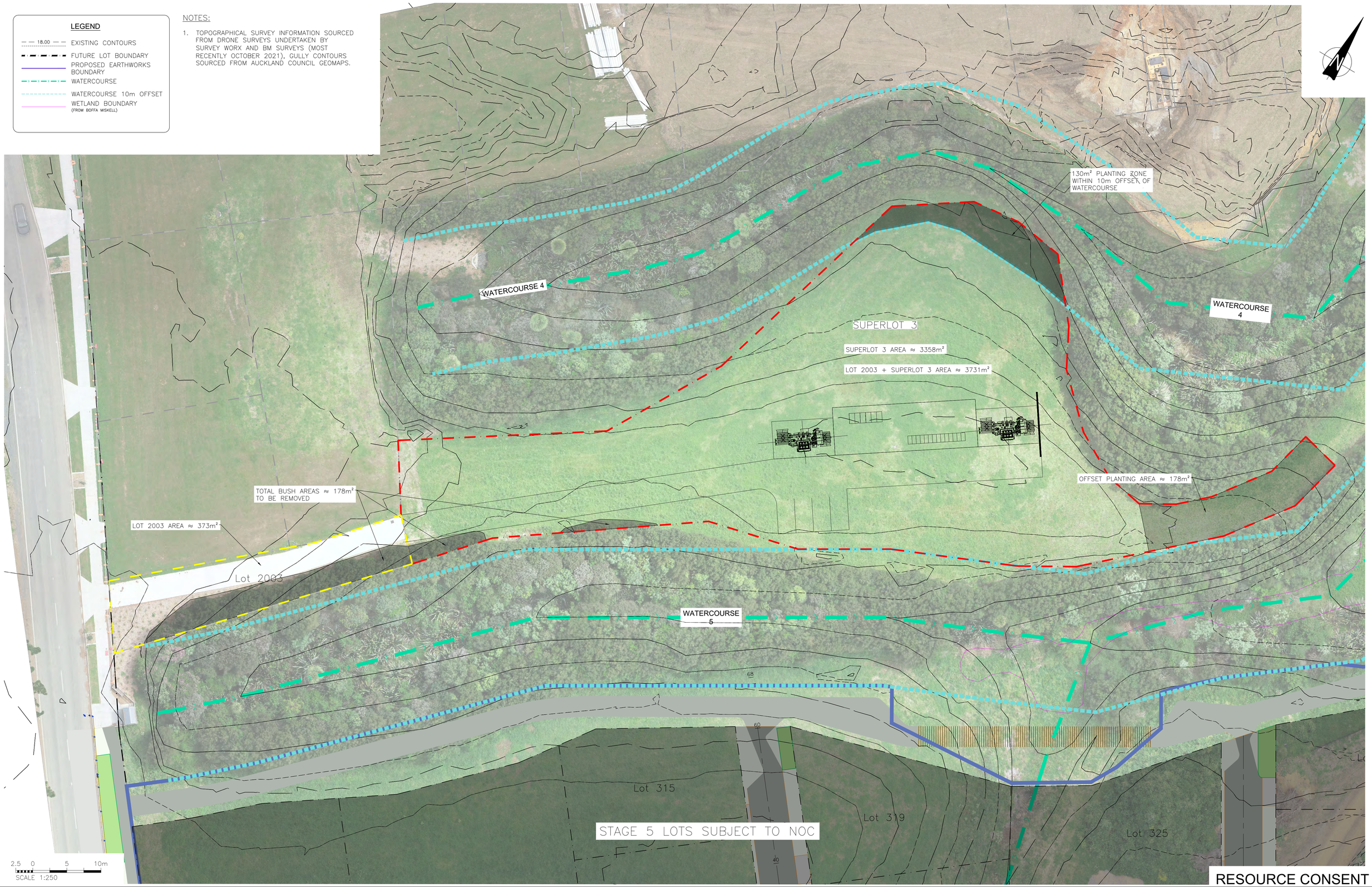
Original size mm

LEGEND

- 18.00 — EXISTING CONTOURS
- FUTURE LOT BOUNDARY
- PROPOSED EARTHWORKS BOUNDARY
- WATERCOURSE
- WATERCOURSE 10m OFFSET
- WETLAND BOUNDARY (FROM BOFFA MISKELL)

NOTES:

1. TOPOGRAPHICAL SURVEY INFORMATION SOURCED FROM DRONE SURVEYS UNDERTAKEN BY SURVEY WORX AND BM SURVEYS (MOST RECENTLY OCTOBER 2021), GULLY CONTOURS SOURCED FROM AUCKLAND COUNCIL GEOMAPS.



RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
MK	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
JAN 2022		04 / 02 / 22

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KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	SUPERLOT 3 LAYOUT

ACENZ ISO 9001 CERTIFIED GCS

CADFILE	210359-353.dwg
SCALE (A1) 1:250	ORIG. SHEET SIZE A1
DRAWING No.	REV.
210359-353	1

Original size mm 300 200 150 100 50 30 10 0

Z:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CAD\5.4 CURRENT\210359-353.DWG

LONG SECTION - ROAD 1

HORIZONTAL SCALE 1:500

VERTICAL SCALE 1:100

SCALE 1:100 (1 0 2 4m)

SCALE 1:500 (5 0 10 20m)

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
MK	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
JAN 2022		04 / 02 / 22

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KAHAWAI POINT

CLIENT: KAHAWAI POINT DEVELOPMENTS LIMITED

ADDRESS: KAHAWAI POINT, GLENBROOK

PROJECT: KAHAWAI POINT - STAGE 5

SHEET TITLE: ROAD LONG SECTION

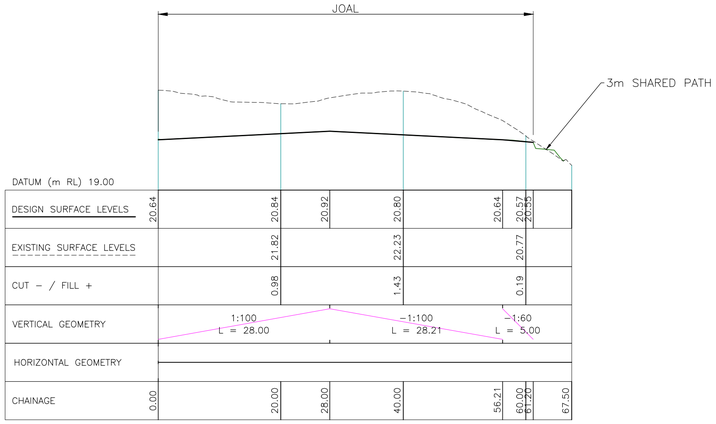
ACENZ · ISO 9001 · GCS

CADFILE: 210359-355.dwg

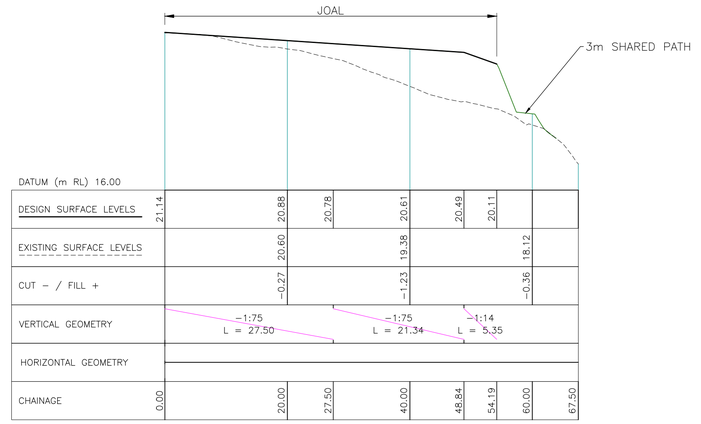
SCALE (A1): AS SHOWN | ORIG. SHEET SIZE: A1

DRAWING No.: 210359-355 | REV.: 1

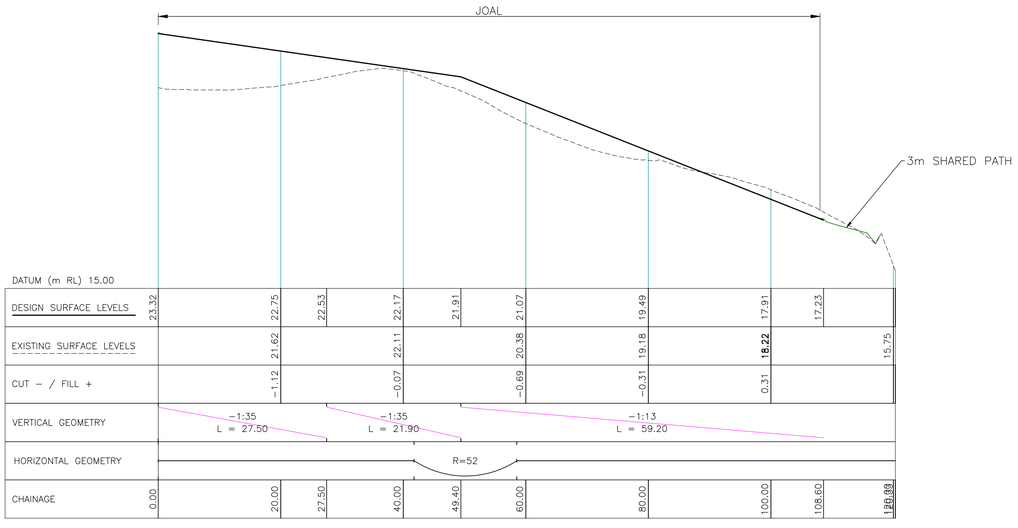
Z:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CADD\5.4 CURRENT\210359-355.DWG



LONG SECTION - JOAL 1
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



LONG SECTION - JOAL 2
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100



LONG SECTION - JOAL 3
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

1 0 2 4m
SCALE 1:100

5 0 10 20m
SCALE 1:500

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
MK	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
JAN 2022		04 / 02 / 22

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KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	JOAL LONG SECTIONS

ACENZ
ISO 9001 REGISTERED GCS

CADFILE	210359–356.dwg
SCALE (A1)	ORIG. SHEET SIZE
AS SHOWN	A1
DRAWING No.	REV.
210359-356	1

Z:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CAD\5.4 CURRENT\210359–356.DWG

Original size mm
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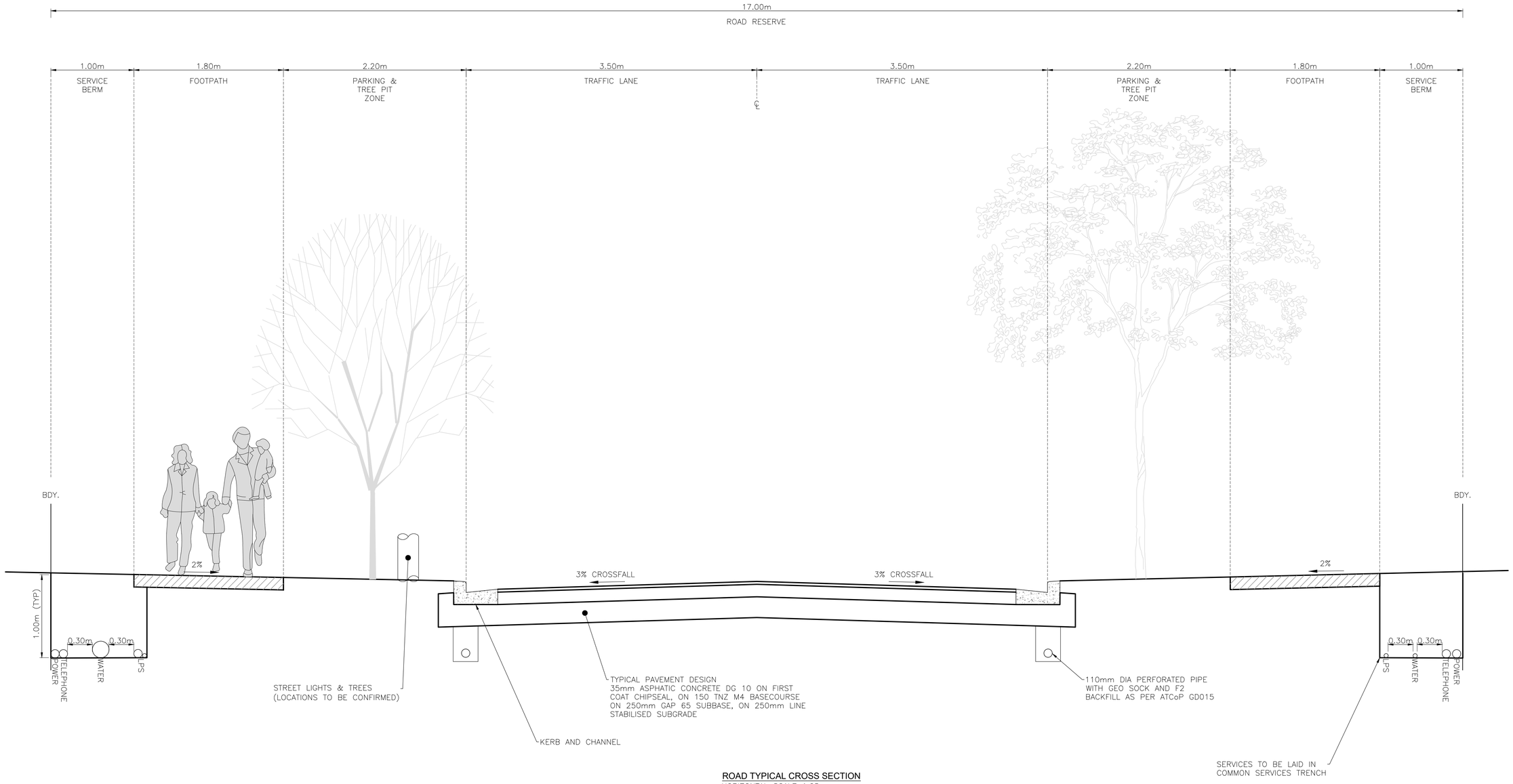

ROAD TYPICAL CROSS SECTION
HORIZONTAL SCALE 1:25

250 0 500 1000mm
SCALE 1:25

Original size mm
300 200 150 100 50 30 10 0

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
LG	FY	S. JAMES
DRAWN	CAD CHECK	
ZL		
DATE DRAWN		ISSUE DATE
JAN 2022		04 / 02 / 22

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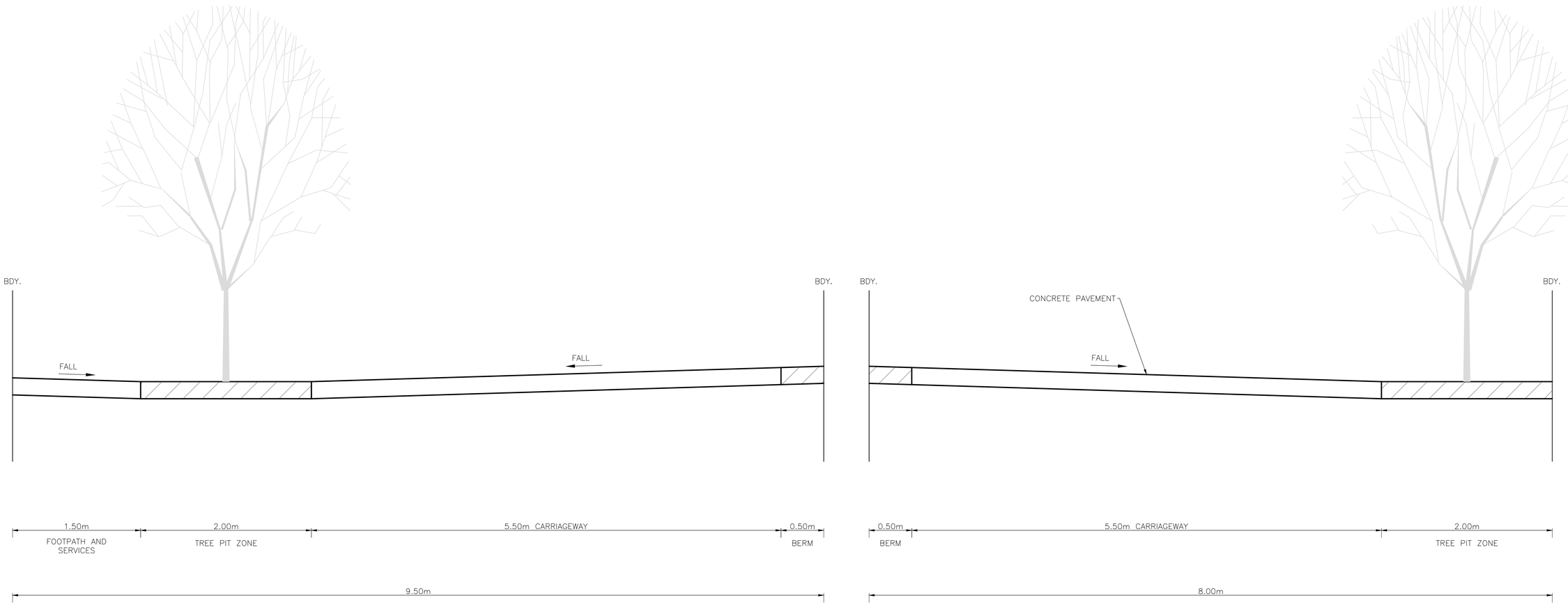
KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	ROAD TYPICAL CROSS SECTION

ACENZ
ISO 9001 GCS

CADFILE	210359-357.dwg
SCALE (A1)	AS SHOWN
ORIG. SHEET SIZE	A1
DRAWING No.	210359-357
REV.	1

Z:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CADD\5.4 CURRENT\210359-357.DWG



JOAL 3 TYPICAL CROSS SECTION
HORIZONTAL SCALE 1:25

JOAL 1 AND 2 TYPICAL CROSS SECTION
HORIZONTAL SCALE 1:25

250 0 500 1000mm
SCALE 1:25

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
LG	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
JAN 2022		04 / 02 / 22

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KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	JOAL TYPICAL CROSS SECTION

ACENZ
ISO 9001 GCS

CADFILE	210359-358.dwg
SCALE (A1)	1:25
ORIG. SHEET SIZE	A1
DRAWING No.	210359-358
REV.	1

Original size mm
300 200 150 100 50 30 10 0

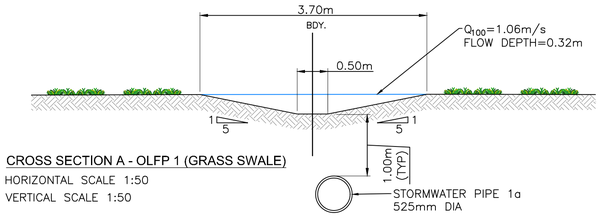
Z:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CADD\5.4 CURRENT\210359-358.DWG

LEGEND

- 18.00 EXISTING CONTOURS
- DESIGN CONTOURS
- PROPOSED TOP OF BATTER
- FUTURE LOT BOUNDARY
- EXISTING WATERCOURSE
- WATERCOURSE 10m OFFSET
- WETLAND BOUNDARY (FROM BOFFA MISKELL)
- SW INDICATIVE STORMWATER NETWORK
- STORMWATER OUTLET WINGWALL AND RIP-RAP APRON
- STORMWATER OUTLET CATCHMENT
- RAINGARDEN
- PROPOSED OVERLAND FLOWPATH
- RETAINED TREES

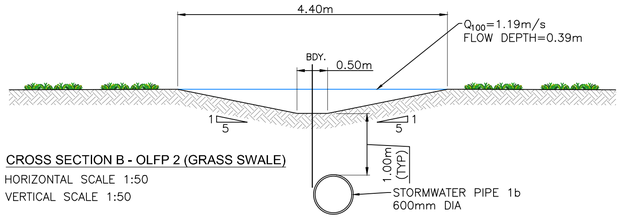
CROSS SECTION A - OLFP 1 (GRASS SWALE)

HORIZONTAL SCALE 1:50
VERTICAL SCALE 1:50



CROSS SECTION B - OLFP 2 (GRASS SWALE)

HORIZONTAL SCALE 1:50
VERTICAL SCALE 1:50



WATERCOURSE 4
SUPERLOT 3
EXISTING WATERCOURSE AND 10m OFFSET LINE
FUTURE 3.0m SHARED FOOTPATH WITH 1.5m PLANTED BATTER EACH SIDE
WATERCOURSE 5
WATERCOURSE 6
OUTLET 1 600mmø
OUTLET 2 375mmø
OUTLET 3 300mmø
OUTLET 4 375mmø
OUTLET 5 300mmø
OUTLET 6 300mmø
OUTLET 7 225mmø
RAINGARDEN 1
RAINGARDEN 2
RAINGARDEN 3
RAINGARDEN 4
RAINGARDEN 5
RAINGARDEN 6
RAINGARDEN 7
RAINGARDEN 8
RAINGARDEN 9
RAINGARDEN 10
RAISED BOARDWALK
OVERLAND FLOWPATH OUTFALL: DN 200mmø GABION ROCK APRON (400mm THICK) ON CLASS C GEOTEXTILE
EXISTING FLOWPATH TO BE DIVERTED AS SHOWN (1:100 LONGITUDINAL GRADIENT)
INDICATIVE 17m WIDE ROAD RESERVE
INDICATIVE STORMWATER WETLAND LOCATION (FUTURE DEVELOPMENT STAGE)
SCRUFFY DOME INLET
MCLARIN ROAD
SWMH-1 1500
SWMH-2 1500
SWMH-3 1350
SWMH-4 1050
Commercial 1
Commercial 2
Lot 2003
Lot 315
Lot 316
Lot 318
Lot 319
Lot 320
Lot 321
Lot 322
Lot 323
Lot 324
Lot 325
Lot 326
Lot 327
Lot 328
Lot 329
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Lot 354
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Lot 356
Lot 357
Lot 358
Lot 359
Lot 360
Lot 361
Lot 362
Lot 363

SCALE 1:500

RESOURCE CONSENT

REV	DATE	ISSUE	BY
2	22.02.22	UPDATED LAYOUT	MD
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
LG	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		22 / 02 / 22

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KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	STORMWATER LAYOUT

ACENZ ISO 9001 GCS

CADFILE	210359-360.dwg
SCALE (A1)	1:500
ORIG. SHEET SIZE	A1
DRAWING No.	210359-360
REV.	2

T:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CADD\5.4 CURRENT\210359-360.DWG

Original size mm

LEGEND

- EXISTING CONTOURS
- DESIGN CONTOURS
- PROPOSED TOP OF BATTER
- FUTURE LOT BOUNDARY
- WATERCOURSE
- WATERCOURSE 10m OFFSET
- WETLAND BOUNDARY (FROM BOFFA MISKELL)
- OUTLET 1A CATCHMENT
- OUTLET 1B CATCHMENT
- OUTLET 2 CATCHMENT
- OUTLET 3 CATCHMENT
- OUTLET 4 CATCHMENT
- OUTLET 5 CATCHMENT
- OUTLET 6 CATCHMENT
- OUTLET 7 CATCHMENT
- STORMWATER OUTLET TO WATERCOURSE
- OVERLAND FLOWPATH

WATERCOURSE 4
WATERCOURSE 5
WATERCOURSE 6
SUPERLOT 3
OUTLET 1=600mm Q_{100}=0.68m³/s
OUTLET 2=375mm Q_{100}=0.15m³/s
OUTLET 3=300mm Q_{100}=0.08m³/s
OUTLET 4=375mm Q_{100}=0.18m³/s
OUTLET 5=300mm Q_{100}=0.07m³/s
OUTLET 6=300mm Q_{100}=0.06m³/s
OUTLET 7=225mm Q_{100}=0.02m³/s
AREA 1A=0.23ha
AREA 1B=1.14ha
AREA 2=0.58ha
AREA 3=0.34ha
AREA 4=0.73ha
AREA 5=0.27ha
AREA 6=0.26ha
AREA 7 =0.08ha
149 McLARIN ROAD =2.36ha
PIPE 1a=525mm
PIPE 1b=600mm
SWMH-1 1500
SWMH-2 1500
SWMH-3 1350
SWMH-4 1050
DN 675 SW 1:200
DN 675 SW 1:100
DN 525 SW 1:100
Commercial 1
Commercial 2
McLARIN ROAD
Lot 2003
Lot 315
Lot 316
Lot 317
Lot 318
Lot 319
Lot 320
Lot 321
Lot 322
Lot 323
Lot 324
Lot 326
Lot 327
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Lot 360
Lot 361
Lot 362
Lot 363

SCRUFFY DOME INLET STRUCTURE TO CAPTURE RUNOFF FROM PART OF 149 McLARIN ROAD PROPERTY, PLUS SITE AREA 1A, 100% PERVIOUS

AREA 1A COMPRISES THE 6m REAR YARD OF LOTS 346 TO 361 (100% PERVIOUS)

SCALE 1:500 (5 0 10 20m)

RESOURCE CONSENT

REV	DATE	ISSUE	BY
2	22.02.22	UPDATED LAYOUT	MD
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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LG	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		22 / 02 / 22

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KAHAWAI POINT

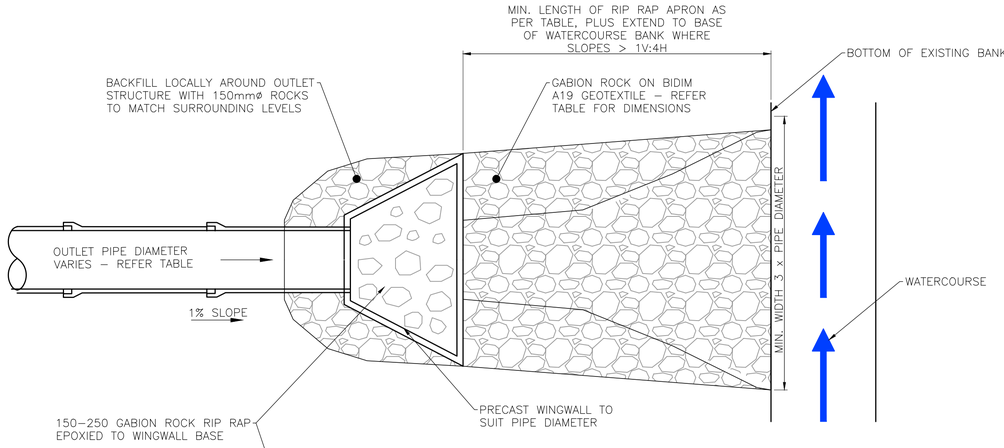
CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	STORMWATER CATCHMENT AND OVERLAND FLOWPATH PLAN

ACENZ ISO 9001 GCS

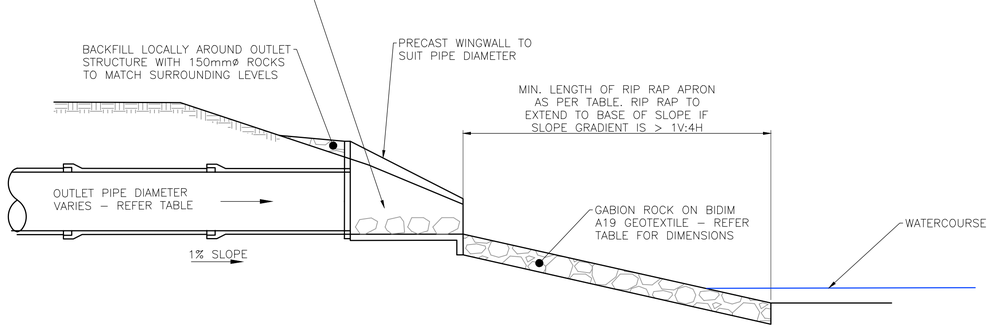
CADFILE	210359-361.dwg
SCALE (A1)	1:500
ORIG. SHEET SIZE	A1
DRAWING No.	210359-361
REV.	2

T:\2021 JOBS\210359 KAHAWAI POINT WAIUKU\5.0 CAD\5.4 CURRENT\210359-361.DWG

300 Original size mm



PLAN - WINGWALL OUTLET
SCALE: NTS



ELEVATION - WINGWALL OUTLET
SCALE: NTS

STORMWATER OUTLET PRELIMINARY DESIGN:					
OUTLET	PIPE DIA. (mm)	MIN. APRON LENGTH (m)	MIN. APRON WIDTH (m)	GABION ROCK DIA. (mm)	ROCK LAYER THICKNESS (mm)
1	600	6.07	1.80	150	300
2	375	5.41	1.13	150	300
3	300	2.77	0.90	150	300
4	375	3.88	1.13	150	300
5	300	2.97	0.90	150	300
6	300	2.97	0.90	150	300
7	225	2.25	0.68	150	300

RESOURCE CONSENT

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DESIGN	DES CHECK	APPROVED FOR ISSUE
MK	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		04 / 02 / 22

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KAHAWAI POINT

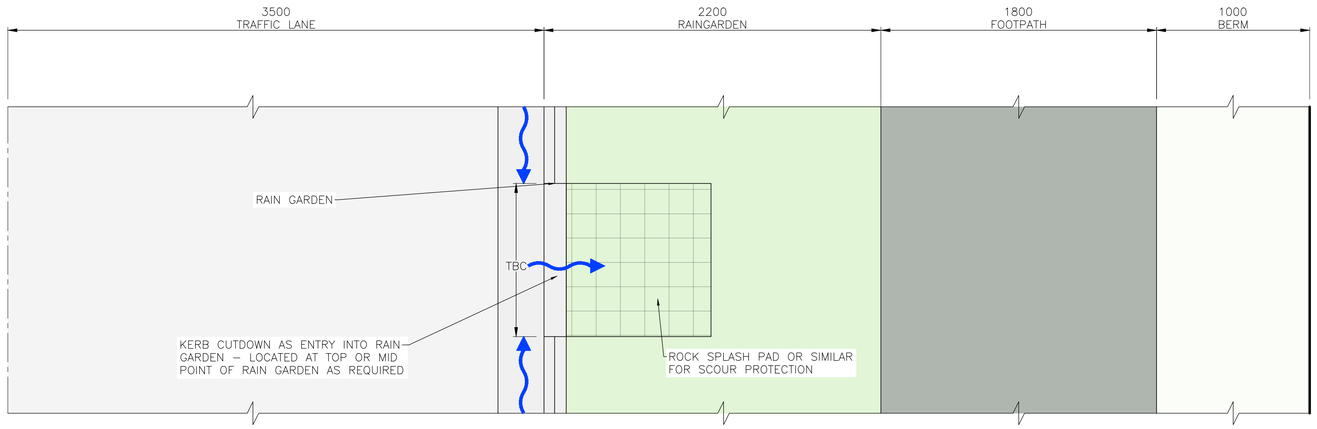
CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	STORMWATER OUTFALL TYPICAL DETAILS

ACENZ
ISO 9001 CERTIFIED GCS

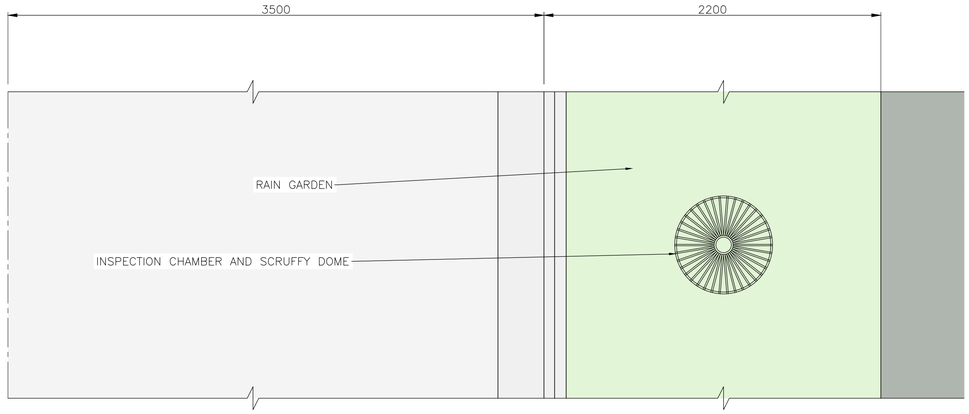
CADFILE	210359–362.dwg
SCALE (A1) 1:25	ORIG. SHEET SIZE A1
DRAWING No.	REV.
210359-362	1

Z:\2021 JOBS\210359 KAHAWAI POINT, MAUKU\5.0 CADD\5.4 CURRENT\210359–362.DWG

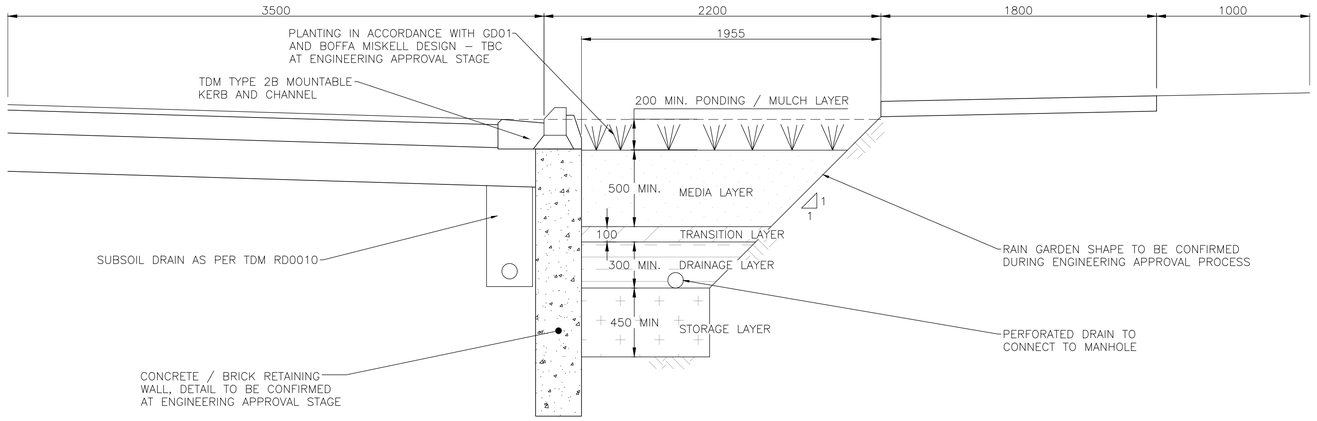
Original size mm
300 200 150 100 50 30 10 0



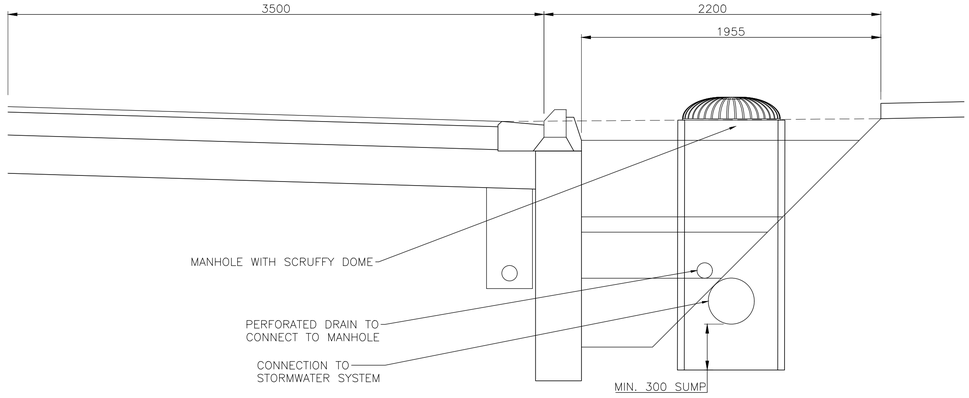
RAIN GARDEN DETAIL - KERB ENTRY POINT
SCALE 1:20



RAIN GARDEN DETAIL - OVERFLOW DRAINAGE
SCALE 1:20



RAIN GARDEN DETAIL - TYPICAL CROSS SECTION
SCALE 1:20



RAIN GARDEN DETAIL - TYPICAL OVERFLOW DRAINAGE
SCALE 1:20

ID.	LOCATION	LENGTH (m)	WIDTH (m)	AREA (m^2)
RG1	ROAD 1 - SAG POINT - NORTH	17.59	2.96	51.98
RG2	ROAD 1 - SAG POINT - SOUTH	18.13	2.96	59.43
RG3	ROAD 1 - JOAL 3 - NORTH	14.00	1.96	27.37
RG4	ROAD 1 - JOAL 3 - SOUTH	14.00	1.96	27.37
RG5	JOAL 1 - NORTH	6.20	2.00	12.40
RG6	JOAL 1 - SOUTH	6.20	2.00	12.40
RG7	JOAL 2	7.30	2.60	18.98
RG8	JOAL 3 - NORTH (IRREGULAR)	7.00	3.60	25.20
RG9	JOAL 3 - SOUTH	10.10	2.00	20.20
RG10	M^{c}LARIN ROAD	16.05	2.10	33.95

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.

200 0 400 800mm
SCALE 1:20

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
MK	LG	S. JAMES
DRAWN	CAD CHECK	
MK	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		04 / 02 / 22

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KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	RAIN GARDEN PRELIMINARY DETAILS AND SIZES

ACENZ
ISO 9001 GCS

CADFILE	210359-363.dwg
SCALE (A1) 1:20	ORIG. SHEET SIZE A1
DRAWING No. 210359-363	REV. 1

Z:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CADD\5.4 CURRENT\210359-363.DWG

Original size mm
300 200 150 100 50 30 10 0

LEGEND

- SITE BOUNDARY
- FUTURE LOT BOUNDARIES
- GENERAL BOUNDARIES
- PROPOSED CONTOURS
- WATERCOURSE
- 75 PROPOSED 75ø OD PE80 SDR11
- 50 PROPOSED 50ø OD PE80 SDR11
- PROPOSED REDUCER
- PROPOSED ISOLATION VALVE
- PROPOSED FLUSHING PIT
- PROPOSED BOUNDARY KIT
- BLANK CAP

NOTES:

1. ALL 75ø AND 90ø PIPEWORK IS TO BE PE100 PN12.5. ALL OTHER PIPEWORK MAY BE PE80 PN12.5 PIPEWORK TO THE SIZES SHOWN ON THE DRAWINGS.
2. ALL CONNECTIONS ARE TO BE MADE BY ELECTROFUSION UNLESS SPECIFICALLY INSTRUCTED OTHERWISE BY THE MANUFACTURER.
3. ALL LOT CONNECTIONS ARE TO BE TERMINATED WITH A BOUNDARY VALVE KIT READY FOR THE INSTALLATION OF THE LOT PIPEWORK ABD PUMP STATION. BOUNDARY KIT LIDS SHALL BE PAINTED RED.
4. CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCY BETWEEN THE DESIGN AND THE INSTALLED WORKS.
5. ALL WORK SHALL COMPLY WITH THE RELEVANT COUNCIL AND WATERCARE ENGINEERING CODES OF PRACTICE FOR LAND DEVELOPMENT.
6. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH NZS 4404. WHERE THIS IS IN CONFLICT WITH THE COUNCIL APPROVED STANDARDS, THEN THE COUNCIL STANDARDS SHALL TAKE PRECEDENCE.
7. ALL LPS ROAD CROSSINGS SHALL BE PLACED IN 100ø PVC DUCTS. THE TRENCH SHALL BE HARDFILL BACKFILLED.
8. CONNECTIONS TO THE EXISTING SANITARY SEWER SYSTEMS SHALL ONLY BE MADE AFTER THE NEW LINES HAVE BEEN PRESSURE TESTED AND ACCEPTED BY THE ENGINEER. CONNECTIONS SHALL BE MADE BY APPROVED LICENCED CONTRACTORS.

5 0 10 20m
SCALE 1:500

RESOURCE CONSENT

REV	DATE	ISSUE	BY
2	22.02.22	UPDATED LAYOUT	MD
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
LG	LG	S. JAMES
DRAWN	CAD CHECK	
MD	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		22 / 02 / 22

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KAHAWAI POINT

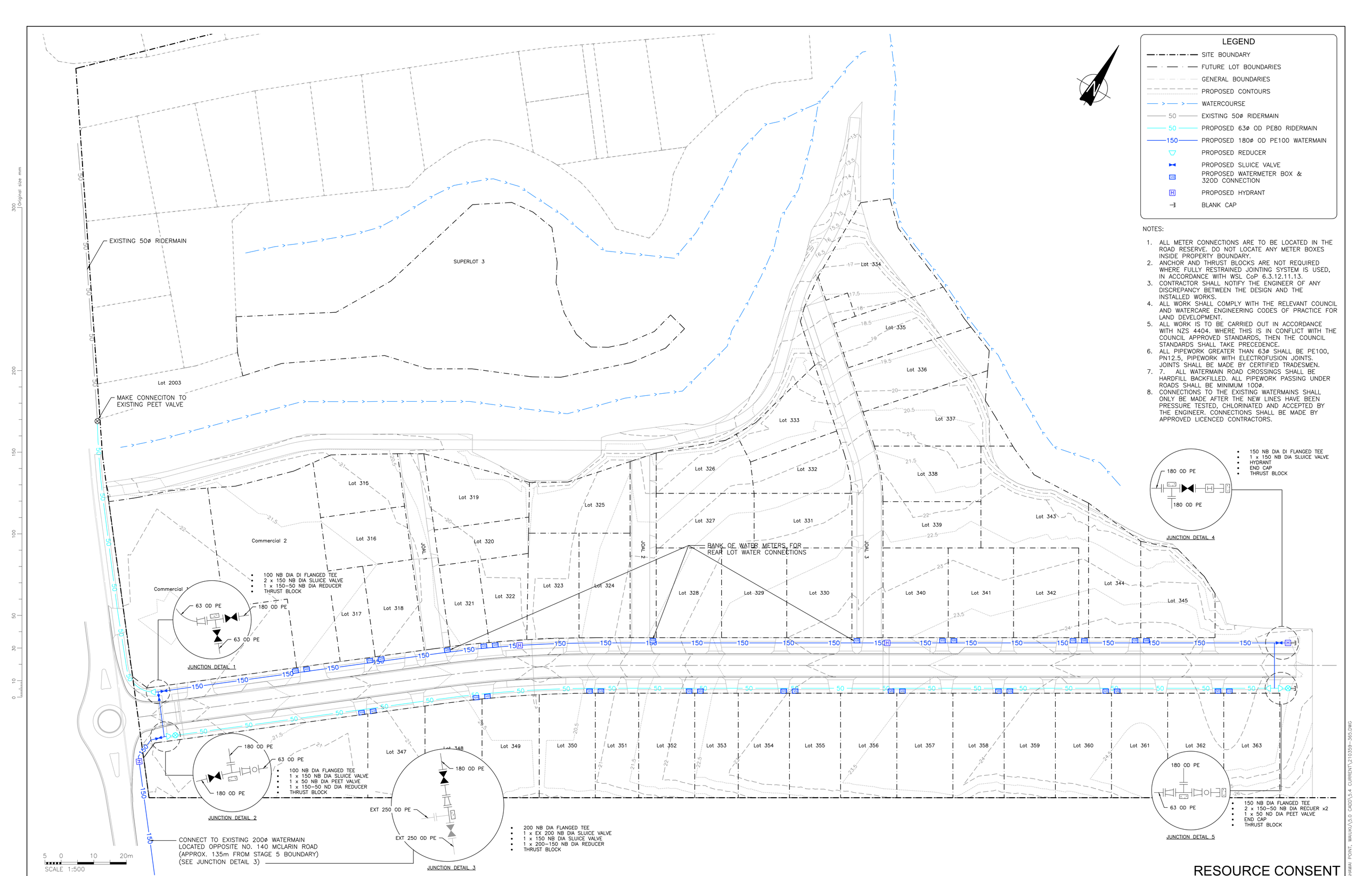
CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	LOW PRESSURE SEWER LAYOUT

ACENZ ISO 9001 GCS

CADFILE	210359–364.dwg
SCALE (A1)	1:500
ORIG. SHEET SIZE	A1
DRAWING No.	210359-364
REV.	2

Original size mm 300 200 150 100 50 30 10 0

T:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CAD\5.4 CURRENT\210359-364.DWG



NOTES:

1. ALL METER CONNECTIONS ARE TO BE LOCATED IN THE ROAD RESERVE. DO NOT LOCATE ANY METER BOXES INSIDE PROPERTY BOUNDARY.
2. ANCHOR AND THRUST BLOCKS ARE NOT REQUIRED WHERE FULLY RESTRAINED JOINTING SYSTEM IS USED, IN ACCORDANCE WITH WSL CoP 6.3.12.11.13.
3. CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCY BETWEEN THE DESIGN AND THE INSTALLED WORKS.
4. ALL WORK SHALL COMPLY WITH THE RELEVANT COUNCIL AND WATERCARE ENGINEERING CODES OF PRACTICE FOR LAND DEVELOPMENT.
5. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH NZS 4404. WHERE THIS IS IN CONFLICT WITH THE COUNCIL APPROVED STANDARDS, THEN THE COUNCIL STANDARDS SHALL TAKE PRECEDENCE.
6. ALL PIPEWORK GREATER THAN 63ø SHALL BE PE100, PN12.5, PIPEWORK WITH ELECTROFUSION JOINTS. JOINTS SHALL BE MADE BY CERTIFIED TRADESMEN.
7. ALL WATERMAIN ROAD CROSSINGS SHALL BE HARDFILL BACKFILLED. ALL PIPEWORK PASSING UNDER ROADS SHALL BE MINIMUM 100ø.
8. CONNECTIONS TO THE EXISTING WATERMAINS SHALL ONLY BE MADE AFTER THE NEW LINES HAVE BEEN PRESSURE TESTED, CHLORINATED AND ACCEPTED BY THE ENGINEER. CONNECTIONS SHALL BE MADE BY APPROVED LICENCED CONTRACTORS.

RESOURCE CONSENT

REV	DATE	ISSUE	BY
2	22.02.22	UPDATED LAYOUT	MD
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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KAHAWAI POINT

CLIENT	KAHAWAI POINT DEVELOPMENTS LIMITED
ADDRESS	KAHAWAI POINT, GLENBROOK
PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	WATER SUPPLY LAYOUT

ACENZ ISO 9001 GCS

CADFILE	210359-365.dwg
SCALE (A1)	1:500
ORIG. SHEET SIZE	A1
DRAWING No.	210359-365
REV.	2

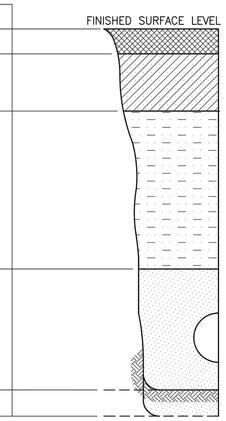
Original size mm 300 200 150 100 50 30 10 0

I:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CAD\5.4 CURRENT\210359-365.DWG

NOTES:

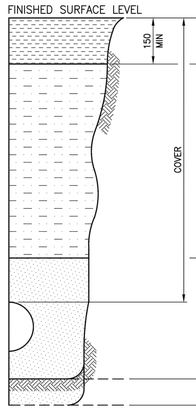
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. EMBEDMENT, TRENCH FILL AND COMPACTION SHALL MEET THE REQUIREMENT OF DESIGN DRAWINGS OR SPECIFICATIONS.
3. SIDES OF EXCAVATION SHALL BE KEPT VERTICAL TO AT LEAST 150mm ABOVE THE PIPE.

MATERIAL	ZONE
TO AUCKLAND TRANSPORT REQUIREMENTS	SURFACE COURSE
TO MATCH EXISTING ROAD BASE OR TO AUCKLAND TRANSPORT REQUIREMENTS	ROAD BASE
TRENCH FILL MATERIALS IN ACCORDANCE WITH SW02 AND SW03, COMPACTED IN LAYERS OF NOT MORE THAN 300mm OR AS SPECIFIED	TRENCH FILL (AS SPECIFIED IN DESIGN DRAWINGS)
EMBEDMENT MATERIAL IN ACCORDANCE WITH SW02 AND SW03	EMBEDMENT
	OVER-EXCAVATION



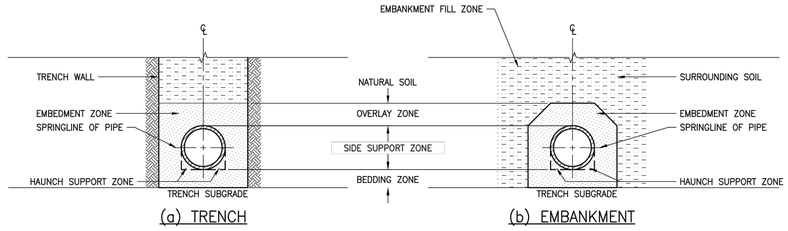
VEHICULAR LOADING (CARRIAGEWAY)

ZONE	MATERIAL
TOPSOIL OR PAVEMENT	ORIGINAL OR IMPORTED MATERIAL TO MATCH EXISTING
TRENCH FILL (AS SPECIFIED IN DESIGN DRAWINGS)	INORGANIC FILL MATERIAL PLACED IN LAYERS NOT MORE THAN 300mm OR AS SPECIFIED
EMBEDMENT	EMBEDMENT MATERIAL IN ACCORDANCE WITH SW02 AND SW03
OVER-EXCAVATION	

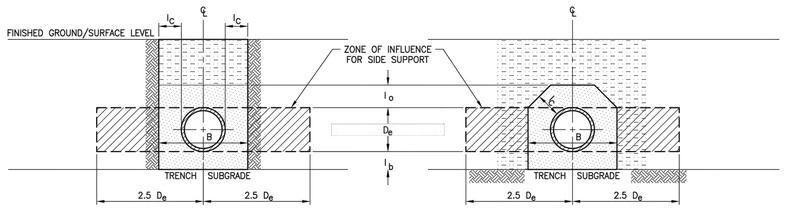


NO VEHICULAR LOADING (NON CARRIAGEWAY)
INCLUDES LOCATIONS WHERE OCCASIONAL VEHICLE LOADING OCCURS

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW01.DWG	AUCKLAND COUNCIL EMBEDMENT & TRENCHFILL TYPICAL ARRANGEMENT	ENVIRONMENTAL-SW ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP SHEET: 1 OF 1 DRAWING No.: SW01 REV: 2



(a) TRENCH (b) EMBANKMENT

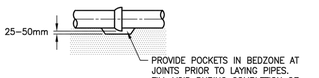


(a) TRENCH (b) EMBANKMENT

MINIMUM EMBEDMENT ZONE DIMENSIONS				
D_e (mm)	MINIMUM DIMENSION (mm)			
	I_b	I_c	I_o	$B=D_e+2I_c$
$75 \le D_e \le 150$	75	100	100	275 – 350
$150 < D_e \le 300$	100	150	150	450 – 600
$300 < D_e \le 450$	100	200	150	700 – 850
$450 < D_e \le 900$	150	300	150	1050 – 1500
$900 < D_e \le 1500$	150	350	200	1600 – 2200
$1500 < D_e \le 4000$	150	$0.25D_e$	300	2250 – 6000

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SW01.
2. FLEXIBLE PIPES INCLUDES PVC, GRP, PP AND PE.
3. PLACEMENT OF EMBEDMENT, TRENCHFILL, & COMPACTION SHALL MEET THE REQUIREMENTS OF DRAWINGS AND SPECIFICATIONS.
4. EXCAVATE OR COMPACT TRENCH FLOOR TO PROVIDE A FLAT FIRM BASE TO SUPPORT BEDDING MATERIAL AND MINIMISE PIPELINE SETTLEMENT. REPLACE EXCAVATED MATERIAL WITH SUITABLE GRANULAR MATERIAL FOR BEDDING.
5. ENSURE THAT THE BEDDING IS DEEP ENOUGH SO THAT PIPE JOINT PROJECTIONS (SOCKETS, FLANGES) DO NOT TOUCH THE TRENCH FLOOR (SEE DETAIL BELOW).
6. BEDDING MATERIALS SHALL BE GAP/SAP < 12.
7. THIS DRAWING IS BASED ON AS/NZS 2566 PART 2: 2002 "BURIED FLEXIBLE PIPELINES & INSTALLATION" AND REPRODUCED WITH THE PERMISSION OF STANDARDS NEW ZEALAND.



PIPE JOINT BEDDING POCKETS
FOR JOINT PROJECTIONS

DEFINITIONS OF SYMBOLS USED:

- B TRENCH WIDTH
- D_e EXTERNAL DIAMETER OF PIPELINE.
- I_b DEPTH OF BEDDING UNDER BARREL OF PIPELINE.
- I_c MINIMUM DISTANCE BETWEEN SPRINGLINE OF PIPE AND PERMANENT SIDE OF TRENCH.
- I_o MINIMUM DEPTH OF COVER OVER SOFFIT OF PIPELINE.

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW02.DWG	AUCKLAND COUNCIL PIPE EMBEDMENTS STANDARD EMBEDMENT FOR FLEXIBLE PIPES	ENVIRONMENTAL-SW ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP SHEET: 1 OF 1 DRAWING No.: SW02 REV: 2

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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ACENZ ISO 9001 GCS

CADFILE	210359-366-374.dwg
SCALE (A1)	NTS
ORIG. SHEET SIZE	A1
DRAWING No.	210359-366
REV.	1

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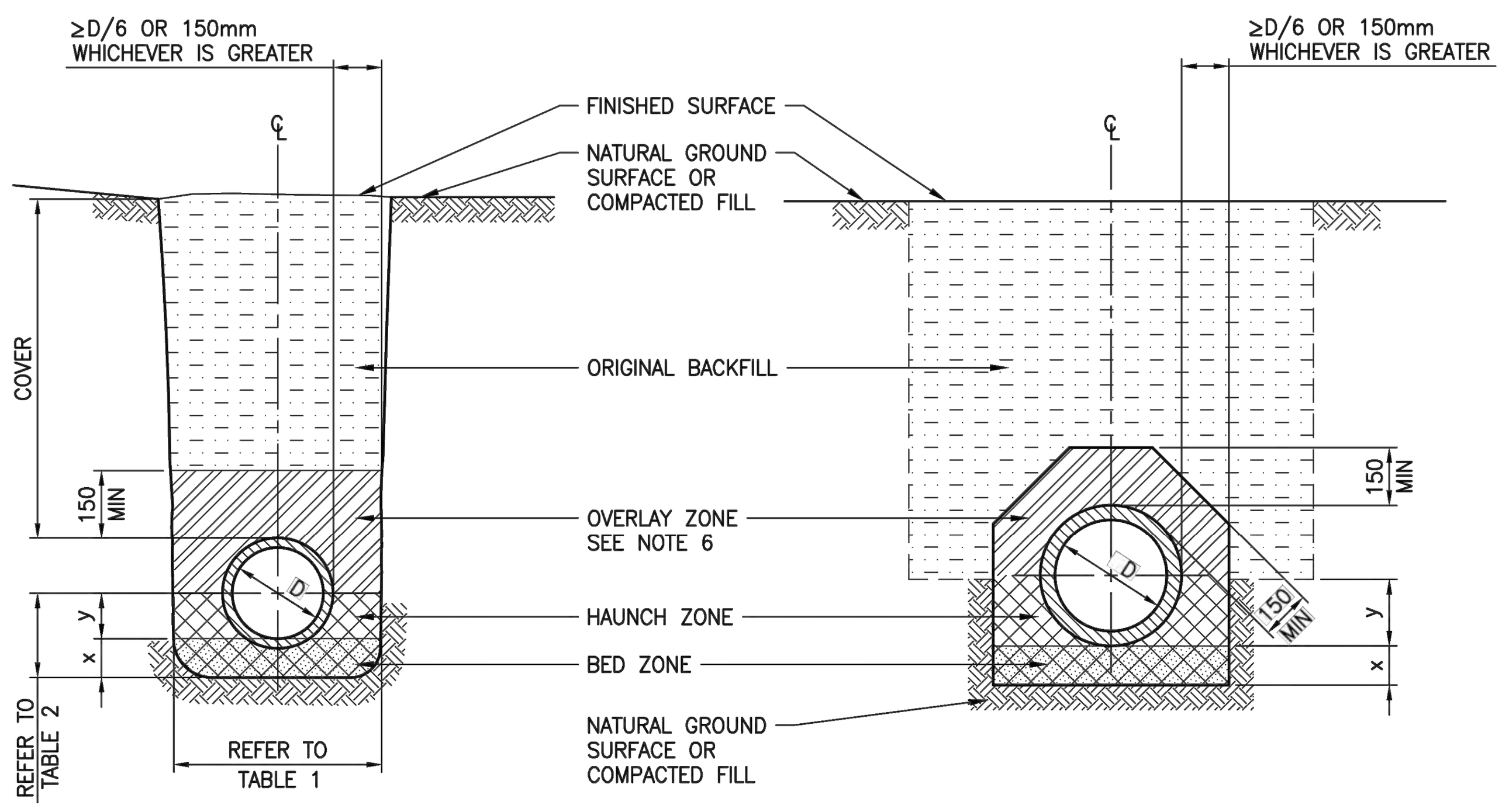


TRENCH CONDITION

EMBANKMENT CONDITION

H2 TYPE BEDDING – CONCRETE PIPES

NOTES:

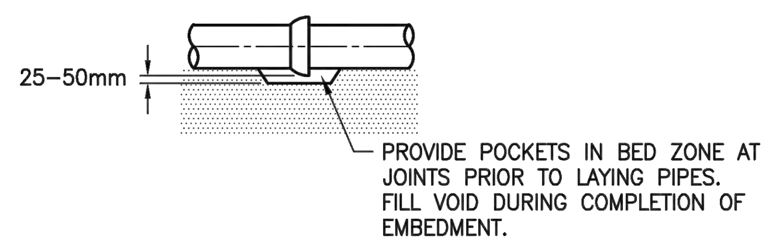
1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SW01.
2. CONCRETE PIPE CLASS SHALL BE DESIGNED IN ACCORDANCE WITH AS/NZS 3725: 2007, USING H2 BEDDING, TO CONSTRUCTION OR FINAL CONDITION LOADINGS, WHICHEVER IS GREATER.
3. PLACEMENT OF EMBEDMENT, TRENCHFILL, & COMPACTION SHALL MEET THE REQUIREMENTS OF DRAWINGS AND SPECIFICATIONS.
4. EXCAVATE OR COMPACT TRENCH FLOOR TO PROVIDE A FLAT FIRM BASE TO SUPPORT BEDDING MATERIAL AND MINIMISE PIPELINE SETTLEMENT.
REPLACE EXCAVATED MATERIAL WITH SUITABLE GRANULAR MATERIAL FOR BEDDING.
5. ENSURE BEDDING IS DEEP ENOUGH THAT PIPE JOINT PROJECTIONS (SOCKETS) DO NOT TOUCH TRENCH FLOOR (SEE DETAIL BELOW).
6. OVERLAY ZONE TO BE GAP65. OTHER INORGANIC FILL MATERIAL MAY BE SPECIFIED FOR NON–CARRIAGEWAY AREAS.
7. MATERIAL SHALL BE COMPACTED AS NECESSARY TO PREVENT EXCESSIVE SETTLEMENT IN THE GROUND SURFACE LEVEL OVER THE INSTALLED PIPE.
8. WHERE REQUIRED BY SITE CONDITIONS SPECIFIC DESIGN OF PIPE EMBEDMENT MAY BE REQUIRED. THIS SHOULD BE UNDERTAKEN IN ACCORDANCE WITH AS/NZS 3725: 2007 TO THE APPROVAL OF AUCKLAND COUNCIL.
9. EMBEDMENT FOR 'RIGID PIPES' OTHER THAN CONCRETE IS SUBJECT TO SPECIFIC DESIGN AND APPROVAL.

TABLE 1

MAXIMUM PERMISSIBLE TRENCH WIDTHS (IF TRENCH WIDER, USE EMBANKMENT CONDITION)															
NORMAL INTERNAL PIPE DIAMETER (mm)	150	225	300	375	450	525	600	675	750	825	900	975	1050	1200	>1200
MAXIMUM TRENCH WIDTH (mm)	600	600	700	800	900	1000	1100	1200	1300	1400	1500	1500	1600	1800	OD+700

TABLE 2

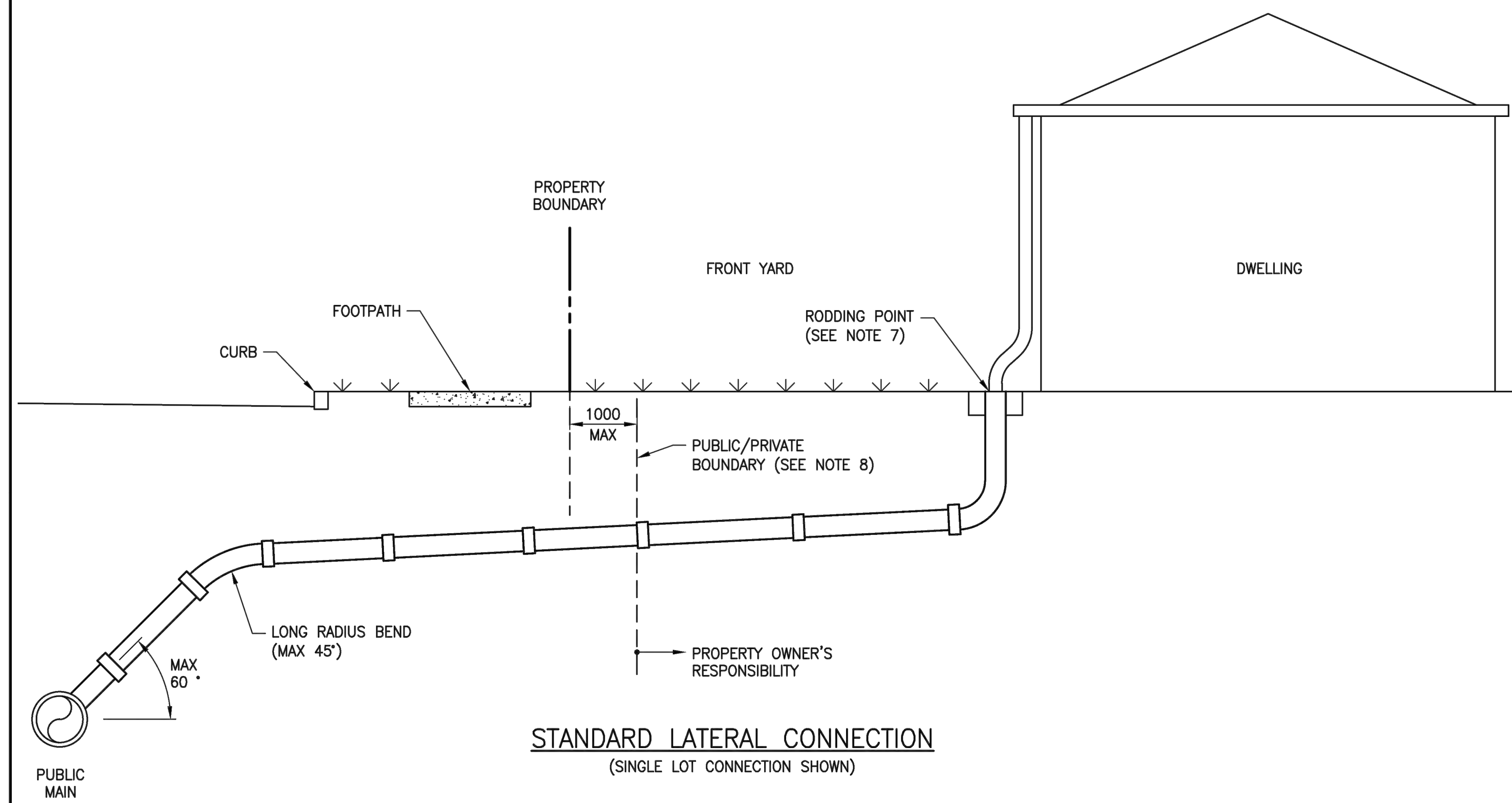
H2 SUPPORT TYPE	MINIMUM DEPTH (mm)	
	x BED ZONE (mm)	y HAUNCH ZONE (mm)
	100 IF D ≤ 1500 150 IF D > 1500	0.3D



PIPE JOINT BEDDING POCKETS

FOR JOINT PROJECTIONS

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC–STD–SW03.DWG	AUCKLAND COUNCIL PIPE EMBEDMENTS STANDARD EMBEDMENT FOR CONCRETE PIPES	ENVIRONMENTAL–SW Auckland Council	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET SWCoP SHEET 1 OF 1 DRAWING No. SW03 REV 2

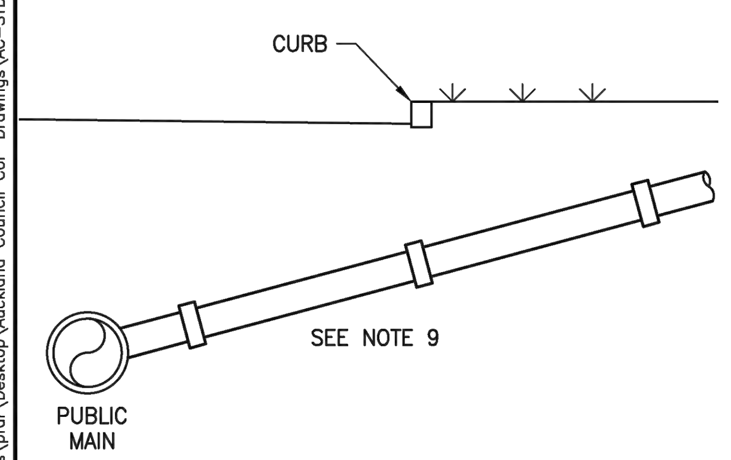


STANDARD LATERAL CONNECTION

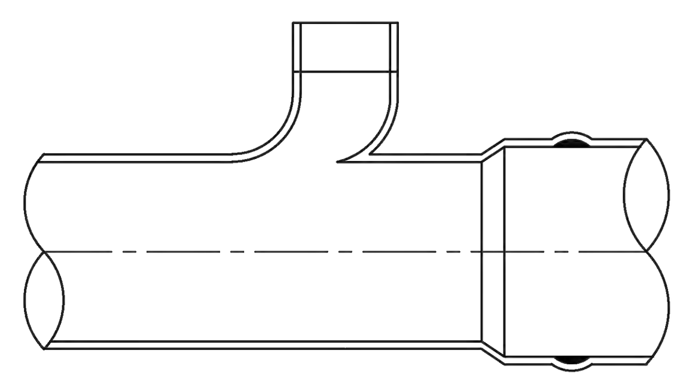
(SINGLE LOT CONNECTION SHOWN)

NOTES:

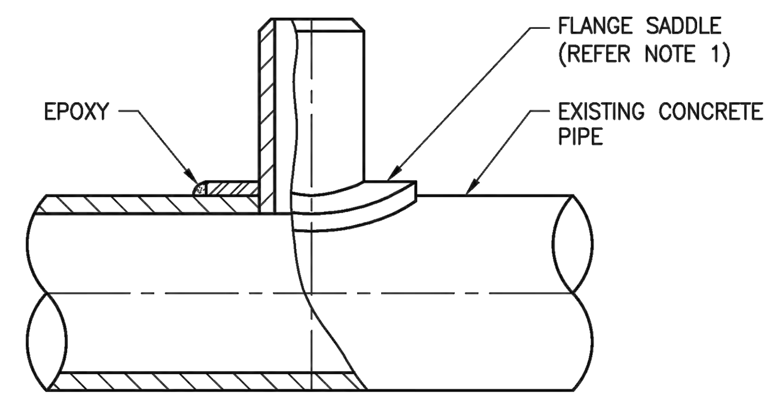
1. MAXIMUM LATERAL DIAMETER SHALL BE LESS THAN HALF THE DIAMETER OF THE MAIN PIPE, FOR SADDLE OR JUNCTION CONNECTIONS.
2. FOR A CONNECTION TO A PE MAIN A JUNCTION SHALL BE CUT IN WITH 'ELECTROFUSION' COUPLERS. ALTERNATIVELY A SADDLE MAY BE ELECTROFUSED INTO PIPE. SPECIFIC APPROVAL FROM AUCKLAND COUNCIL IS REQUIRED TO SADDLE INTO A PE MAIN.
3. IF THE LATERAL DIAMETER IS GREATER THAN HALF THE DIAMETER OF THE MAIN PIPE, THE JUNCTION SHALL ALWAYS BE THROUGH A CHAMBER.
4. FOR SADDLE INSERTS THE HOLE IN THE EXISTING PIPE SHALL BE DRILLED. NO PROTRUSION WILL BE ALLOWED INSIDE THE BORE.
5. WHERE THE PRIVATE CONNECTION PIPE CANNOT BE CONSTRUCTED DUE TO PHASING OF THE DEVELOPMENT, THE POINT OF CONNECTION SHALL BE MARKED BY A BLUE 25mm DIA uPVC TUBE. SEE SECTION 4.3.11.
6. WHEN THE PIPELINE BEING CONNECTED TO THE PUBLIC MAIN IS LARGER THAN 300mm DIAMETER, OR WHERE THE PIPE SERVES MORE THAN THREE LOTS, THE CONNECTION SHALL BE MADE AT A MANHOLE.
7. A RODDING POINT SHALL BE PROVIDED ON THE PRIVATE LATERAL TO ALLOW CCTV ACCESS.
8. PUBLIC/PRIVATE BOUNDARY SHALL BE EITHER 1.0m INSIDE PRIVATE BOUNDARY OR AT THE FIRST PIPE JOINT, WHICHEVER IS THE LEAST.
9. THE CENTRELINE OF THE LATERAL SHALL BE ABOVE THE SPRING LINE OF THE MAIN.



ALTERNATIVE LATERAL CONNECTION



REINFORCED PVC JUNCTION



VITREOUS CLAY SADDLE ONTO CONCRETE MAIN

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC–STD–SW04.DWG	AUCKLAND COUNCIL STORMWATER SERVICE CONNECTIONS PVC AND CONCRETE PIPE	ENVIRONMENTAL–SW Auckland Council	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET SWCoP SHEET 1 OF 1 DRAWING No. SW04 REV 2

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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LG	LG	S. JAMES
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CADFILE 210359–366–374.dwg	
SCALE (A1) NTS	ORIG. SHEET SIZE A1
DRAWING No. 210359-367	REV. 1

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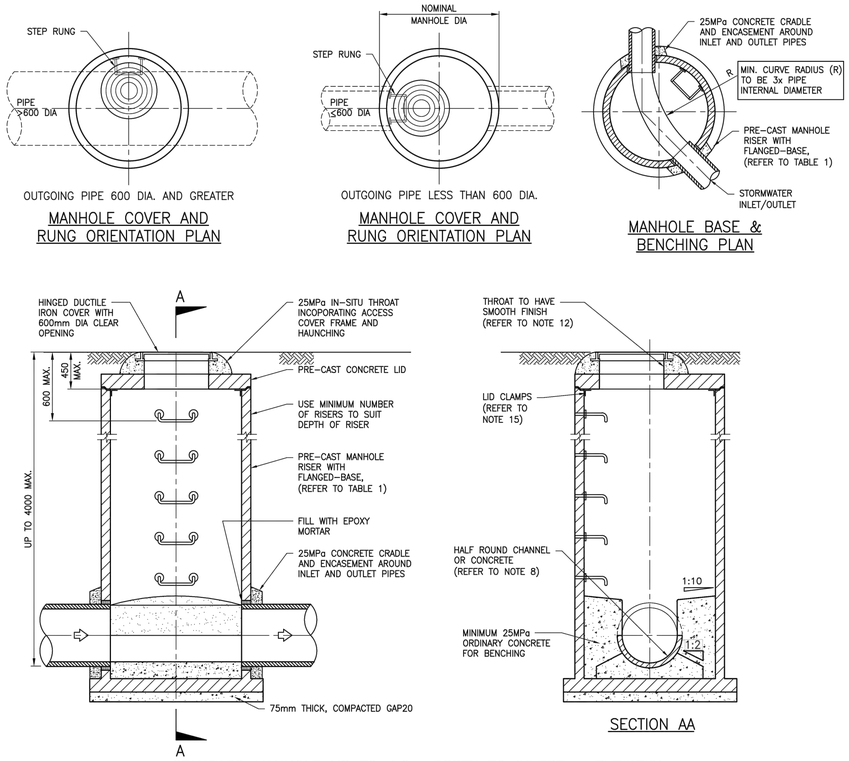


NOTES:

1. SAFE LANDING IS REQUIRED ON BENCHING AT BASE OF RUNGS.
2. ACCESS TO THE MANHOLE SHALL BE CLEAR OF ANY INCOMING PIPES.
3. SEE SECTION 4.3.10.9 OF THE SWCoP FOR 'MANHOLE COVER REQUIREMENTS'.
4. FOR PIPES <450 DIA, ALL PRE-CAST MANHOLE RISERS SHALL BE 1050mm DIA MAXIMUM. IF DEFLECTION ANGLE IS >90° THEN SPECIFIC DESIGN OF THE RISERS IS REQUIRED.
5. FOR PIPE DIAMETERS ≤600mm, ONE FLEXIBLE JOINT IS REQUIRED WITHIN 600mm OF THE RISER WALL. PIPE DIAMETERS GREATER THAN 600mm MAY NOT REQUIRE A FLEXIBLE JOINT.
6. MANHOLES SHALL BE DESIGNED TO USE THE MINIMUM NUMBER OF RISERS AND THE MINIMUM RISER HEIGHT SHALL BE 300mm. NO RISERS SHALL BE CUT DOWN TO HEIGHT.
7. FOR OUTLET PIPES WITH DIAMETERS GREATER THAN 600mm, REFER TO DRAWING SW09 FOR 'RECESSED RUNGS'.
8. WHERE HALF-ROUND CHANNELS ARE NOT AVAILABLE, THE CHANNEL SHALL BE FORMED WITH 25MPa CONCRETE, VIBRATED AND FINISHED SMOOTH. PLASTERING IS NOT PERMITTED.
9. ALL MANHOLE OPENINGS SHALL BE CUT WITH CONCRETE SAW. SLEDGE HAMMERS SHALL NOT BE USED.
10. FOR CONNECTIONS TO MANHOLES REFER TO SECTION 4.3.10.7 OF THE SWCoP.
11. MANHOLES WITH DEPTH TO INVERT LESS THAN 1.5m SHALL HAVE A CENTRALLY LOCATED COVER.
12. THE INSIDE OF THE MANHOLE THROAT SHALL BE PAINTED BLUE. RAISED THROATS ARE PERMITTED, BUT ARE SUBJECT TO SPECIFIC DESIGN.
13. ALL JOINTS BETWEEN RISERS SHALL BE EPOXIED. BUTYL MASTIC MAY BE USED IF APPROVED BY AUCKLAND COUNCIL.
14. WHERE A MANHOLE RISER IS GREATER THAN 2.4m IN HEIGHT ABOVE THE BENCHING, A REDUCER SLAB AND 1050mm RISER MAY BE USED FROM THAT POINT. SPECIFIC DESIGN IS REQUIRED.
15. CONCRETE MANHOLE LIDS SHALL BE FIXED DOWN USING CLAMPS. NO EPOXY OR MASTIC SEAL SHALL BE USED ON LIDS.
16. COVER/FRAME SHALL BE BOLTED TO LID SLAB WITH SS DYNABOLTS AND SEALED WITH EPOXY MORTAR.
17. MANHOLE CONCRETE LIDS AND CAST IRON COVERS SHALL BE DESIGNED IN ACCORDANCE WITH SECTIONS 4.3.10.3 AND 4.3.10.9 OF THE SWCoP.

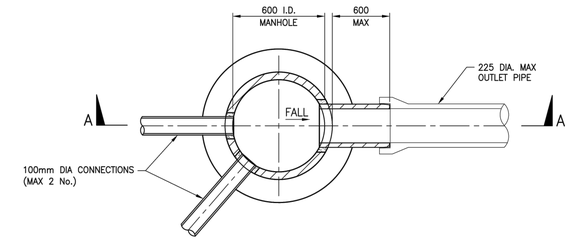
TABLE 1

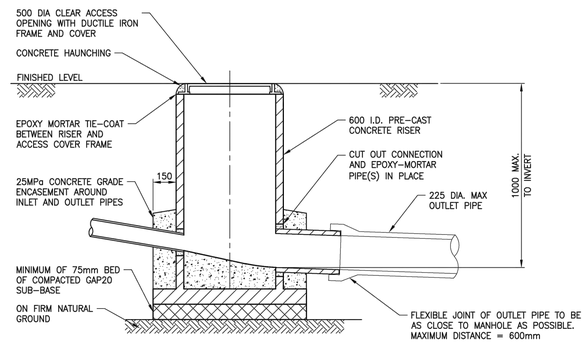
MINIMUM MANHOLE RISER DIAMETER

PIPE DIA	DEFLECTION					
	0°	15°	30°	45°	60°	75°
450	1050	1050	1050	1200	1500	1800
525	1050	1050	1200	1200	1500	1800
600	1200	1200	1500	1500	1800	1800
750	1500	1500	1800	1800	SD*	SD*
825	1800	1800	1800	SD*	SD*	SD*
900	1800	1800	SD*	SD*	SD*	SD*
1050	SD*	SD*	SD*	SD*	SD*	SD*

SD*: SPECIFIC DESIGN.
>75° DEFLECTION SHALL REQUIRE 'SPECIFIC DESIGN' FOR MANHOLE RISERS FOR ANY DIAMETER OF PIPE >375mm

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW05.DWG	AUCKLAND COUNCIL STANDARD STORMWATER MANHOLE SUITABLE FOR UP TO 4.0m DEPTH TO INVERT	ENVIRONMENTAL-SW	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP SHEET: 1 OF 1 DRAWING No.: SW05 REV: 2





NOTES:

1. NON-ACCESS CHAMBER, SUITABLE FOR OUTLET INVERT DEPTH OF LESS THAN 1000mm.
2. MAXIMUM OUTLET PIPE DIAMETER SHALL BE 225mm.
3. MAXIMUM NUMBER OF CONNECTIONS SHALL BE TWO 100mm DIA INLET CONNECTIONS PER NON-ACCESS CHAMBER. ADDITIONAL CONNECTIONS MAY BE ALLOWED WITH APPROVAL FROM AUCKLAND COUNCIL.
4. BENCHING WITHIN NON-ACCESS CHAMBERS IS NOT MANDATORY.

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW06.DWG	AUCKLAND COUNCIL STORMWATER MANHOLES – NON-ACCESS CHAMBER TYPICAL DETAIL (OUTLET INVERT DEPTH LESS THAN 1000mm)	ENVIRONMENTAL-SW	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP SHEET: 1 OF 1 DRAWING No.: SW06 REV: 2

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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SHEET TITLE	STANDARD DETAILS- SHEET 3

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CADFILE	210359-366-374.dwg
SCALE (A1)	NTS
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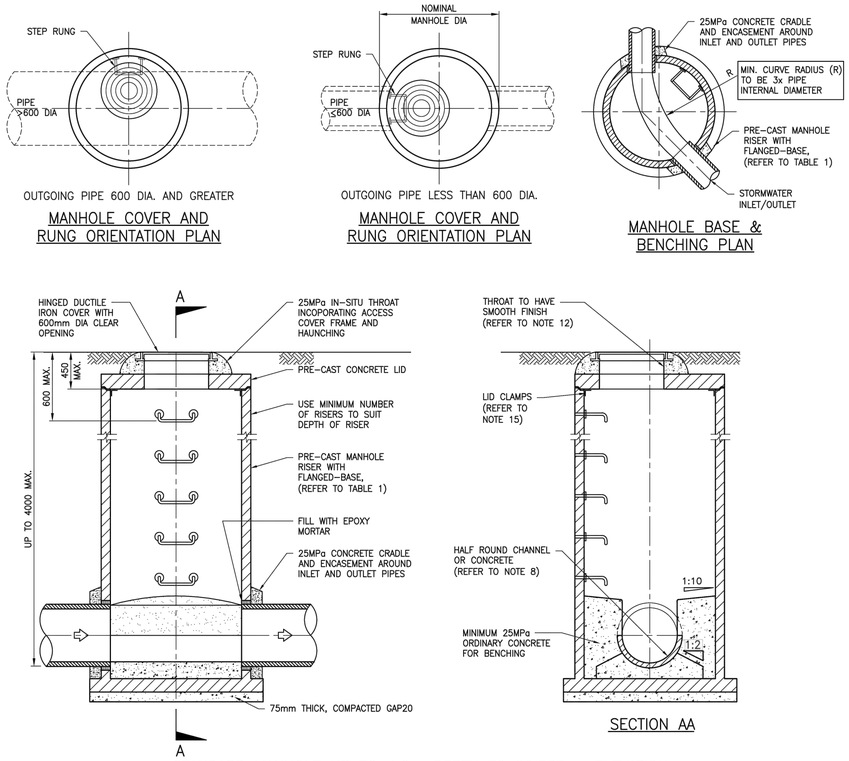

NOTES:

1. SAFE LANDING IS REQUIRED ON BENCHING AT BASE OF RUNGS.
2. ACCESS TO THE MANHOLE SHALL BE CLEAR OF ANY INCOMING PIPES.
3. SEE SECTION 4.3.10.9 OF THE SWCoP FOR 'MANHOLE COVER REQUIREMENTS'.
4. FOR PIPES <450 DIA, ALL PRE-CAST MANHOLE RISERS SHALL BE 1050mm DIA MAXIMUM. IF DEFLECTION ANGLE IS >90° THEN SPECIFIC DESIGN OF THE RISERS IS REQUIRED.
5. FOR PIPE DIAMETERS ≤600mm, ONE FLEXIBLE JOINT IS REQUIRED WITHIN 600mm OF THE RISER WALL. PIPE DIAMETERS GREATER THAN 600mm MAY NOT REQUIRE A FLEXIBLE JOINT.
6. MANHOLES SHALL BE DESIGNED TO USE THE MINIMUM NUMBER OF RISERS AND THE MINIMUM RISER HEIGHT SHALL BE 300mm. NO RISERS SHALL BE CUT DOWN TO HEIGHT.
7. FOR OUTLET PIPES WITH DIAMETERS GREATER THAN 600mm, REFER TO DRAWING SW09 FOR 'RECESSED RUNGS'.
8. WHERE HALF-ROUND CHANNELS ARE NOT AVAILABLE, THE CHANNEL SHALL BE FORMED WITH 25MPa CONCRETE, VIBRATED AND FINISHED SMOOTH. PLASTERING IS NOT PERMITTED.
9. ALL MANHOLE OPENINGS SHALL BE CUT WITH CONCRETE SAW. SLEDGE HAMMERS SHALL NOT BE USED.
10. FOR CONNECTIONS TO MANHOLES REFER TO SECTION 4.3.10.7 OF THE SWCoP.
11. MANHOLES WITH DEPTH TO INVERT LESS THAN 1.5m SHALL HAVE A CENTRALLY LOCATED COVER.
12. THE INSIDE OF THE MANHOLE THROAT SHALL BE PAINTED BLUE. RAISED THROATS ARE PERMITTED, BUT ARE SUBJECT TO SPECIFIC DESIGN.
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16. COVER/FRAME SHALL BE BOLTED TO LID SLAB WITH SS DYNABOLTS AND SEALED WITH EPOXY MORTAR.
17. MANHOLE CONCRETE LIDS AND CAST IRON COVERS SHALL BE DESIGNED IN ACCORDANCE WITH SECTIONS 4.3.10.3 AND 4.3.10.9 OF THE SWCoP.

TABLE 1

MINIMUM MANHOLE RISER DIAMETER

PIPE DIA	DEFLECTION					
	0°	15°	30°	45°	60°	75°
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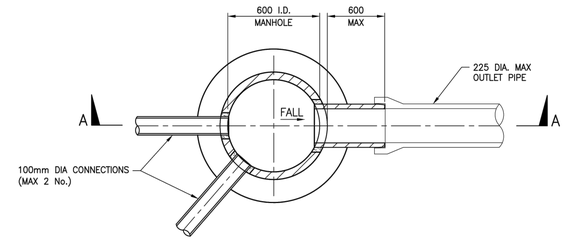
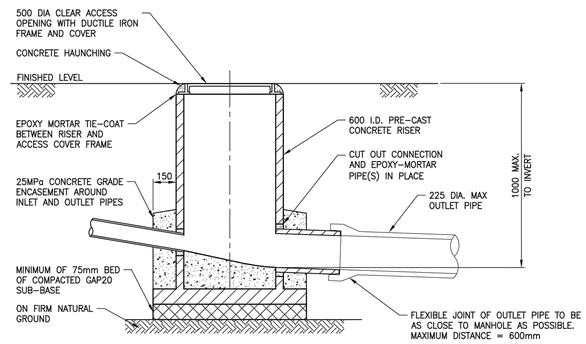
525	1050	1050	1200	1200	1500	1800
600	1200	1200	1500	1500	1800	1800
750	1500	1500	1800	1800	SD*	SD*
825	1800	1800	1800	SD*	SD*	SD*
900	1800	1800	SD*	SD*	SD*	SD*
1050	SD*	SD*	SD*	SD*	SD*	SD*

SD*: SPECIFIC DESIGN.
>75° DEFLECTION SHALL REQUIRE 'SPECIFIC DESIGN' FOR MANHOLE RISERS FOR ANY DIAMETER OF PIPE >375mm

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW05.DWG	AUCKLAND COUNCIL STANDARD STORMWATER MANHOLE SUITABLE FOR UP TO 4.0m DEPTH TO INVERT	ENVIRONMENTAL-SW Auckland Council	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP; SHEET: 1 OF 1 DRAWING No.: SW05; REV: 2





NOTES:

1. NON-ACCESS CHAMBER, SUITABLE FOR OUTLET INVERT DEPTH OF LESS THAN 1000mm.
2. MAXIMUM OUTLET PIPE DIAMETER SHALL BE 225mm.
3. MAXIMUM NUMBER OF CONNECTIONS SHALL BE TWO 100mm DIA INLET CONNECTIONS PER NON-ACCESS CHAMBER. ADDITIONAL CONNECTIONS MAY BE ALLOWED WITH APPROVAL FROM AUCKLAND COUNCIL.
4. BENCHING WITHIN NON-ACCESS CHAMBERS IS NOT MANDATORY.

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW06.DWG	AUCKLAND COUNCIL STORMWATER MANHOLES – NON-ACCESS CHAMBER TYPICAL DETAIL (OUTLET INVERT DEPTH LESS THAN 1000mm)	ENVIRONMENTAL-SW Auckland Council	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP; SHEET: 1 OF 1 DRAWING No.: SW06; REV: 2

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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DRAWN	CAD CHECK	
ZL	FY	
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SHEET TITLE	STANDARD DETAILS- SHEET 4

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CADFILE	210359-366-374.dwg
SCALE (A1) NTS	ORIG. SHEET SIZE A1
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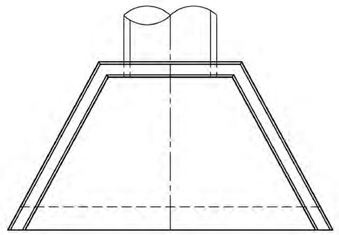
210359-369	1



PLAN

A

A

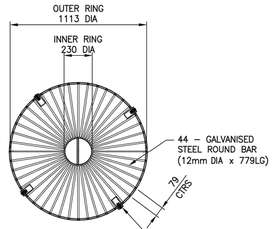
FRONT ELEVATION

SECTION AA

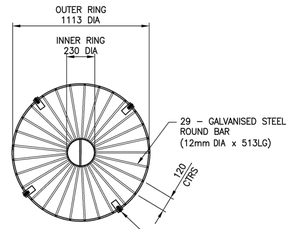
NOTES:

1. THIS DRAWING IS INTENDED TO PROVIDE AN OVERVIEW OF A TYPICAL CONFIGURATION FOR INLET/OUTLET STRUCTURES. WHERE STANDARD PRE-CAST PRODUCTS ARE NOT SUITABLE, SPECIFIC DESIGN IS REQUIRED.
2. DESIGN OF PRE-CAST INLET/OUTLET STRUCTURES SHALL INCLUDE ASSESSMENT OF THE STRUCTURE LOCATION AND THE VISIBILITY OF THE STRUCTURE. IT MAY BE NECESSARY TO SPECIFICALLY DESIGN THE STRUCTURE AND USE BASALT ROCKS EMBEDDED IN CONCRETE OR APPROVED ALTERNATIVE IN HIGH VISIBILITY AREAS.
3. FOR OUTLET STRUCTURES, SPECIFIC DESIGN OF SCOUR PREVENTION AND ENERGY DISSIPATION WILL BE REQUIRED IN ACCORDANCE WITH AUCKLAND COUNCIL TECHNICAL REPORT TR2013/018. ENERGY DISSIPATORS MAY INCLUDE BAFFLES, ROCK RIP-RAP OR RENO MATTRESSES (OR GABIONS).
4. FOR INLET STRUCTURES, SPECIFIC DESIGN OF SCOUR PREVENTION MEASURES SHALL BE REQUIRED IN ACCORDANCE WITH AUCKLAND COUNCIL TECHNICAL REPORT TR2013/018.
5. ALL CONCRETE SHALL BE ORDINARY GRADE 40MPa.
6. THERE SHALL BE AT LEAST TWO BARS OF REINFORCING (WHETHER MESH OR MILD STEEL BARS), OVER THE TOP OF THE PIPE.
7. ALL REINFORCING BARS SHALL BE "GRADE 500E" AND MESH SHALL BE "GRADE 500L".
8. THE ENGINEER SHALL ENSURE THE STRUCTURE IS PLACED ON ADEQUATE FOUNDATION MATERIAL.
9. FENCING AROUND INLET/OUTLET STRUCTURES IS REQUIRED UNLESS IT CAN BE DEMONSTRATED THAT HUMAN ACCESS TO THE INLET/OUTLET STRUCTURE IS UNLIKELY AND/OR THE HEIGHT OF THE STRUCTURE IS LESS THAN 1.2m. FENCING SHALL BE IN ACCORDANCE WITH DRAWING SW20.
10. INLETS TO THE STORMWATER NETWORK SHALL BE FITTED WITH A SAFETY GRILLE. THE GRILLE SHALL BE SPECIFICALLY DESIGNED AND REQUIRES AUCKLAND COUNCIL APPROVAL. FOR CULVERT INLETS, A RISK ASSESSMENT SHOULD BE COMPLETED TO DECIDE WHETHER A SAFETY GRILLE IS REQUIRED. SEE SECTION 4.3.9.9 FOR FURTHER DETAILS.

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW19.DWG	AUCKLAND COUNCIL STORMWATER INLET/OUTLET STRUCTURES TYPICAL CONFIGURATION	ENVIRONMENTAL-SW Auckland Council	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP SHEET: 1 OF 1 DRAWING No.: SW19 REV: 2



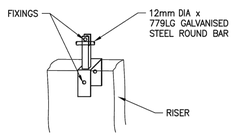
PLAN



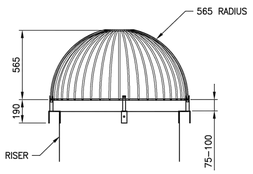
PLAN

NOTES:

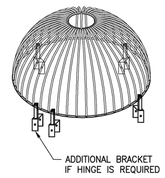
1. THE SCRUFFY DOME GRILLE PROVIDES A DEBRIS SCREEN. TYPICAL LOCATIONS FOR SCRUFFY DOMES INCLUDE PARKS, WETLANDS AND OVERLAND FLOW PATHS.
2. LOCKABLE HINGED VERSIONS ARE AVAILABLE AND MAY BE SPECIFIED WHERE NEEDED.
3. A MINIMUM OF 450mm SUMP DEPTH SHALL BE PROVIDED IN THE MANHOLE.
4. THERE SHALL BE NO SCRUFFY DOME GRILLES IN FOOTPATHS, DRIVEWAYS OR ROADWAYS.
5. SCRUFFY DOME BRACKETS SHALL BE BOLTED TO THE RISER WITH GALVANISED STEEL BOLTS (CLEAR OF RISER REINFORCING).
6. PAINTING MAY BE REQUIRED IN CERTAIN LOCATIONS.
7. FOR SCRUFFY DOMES ON RISERS GREATER THAN 1050mm DIA, SPECIFIC DESIGN IS REQUIRED.



FIXING BRACKET

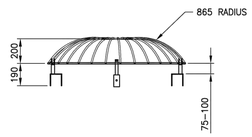


ELEVATION



ISOMETRIC VIEW

TYPE 1



ELEVATION

ISOMETRIC VIEW

TYPE 2

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW21.DWG	AUCKLAND COUNCIL DEBRIS CONTROL SCREEN FOR 1050 DIA RISER SCRUFFY DOME TYPICAL DETAIL	ENVIRONMENTAL-SW Auckland Council	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP SHEET: 1 OF 1 DRAWING No.: SW21 REV: 2

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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LG	LG	S. JAMES
DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
DEC 2021		04 / 02 / 22

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PROJECT	KAHAWAI POINT - STAGE 5
SHEET TITLE	STANDARD DETAILS- SHEET 5

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CADFILE	210359-366-374.dwg
SCALE (A1)	NTS
ORIG. SHEET SIZE	A1
DRAWING No.	210359-370
REV.	1

Z:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CAD\05.4 CURRENT\210359-366-374.DWG

Original size mm
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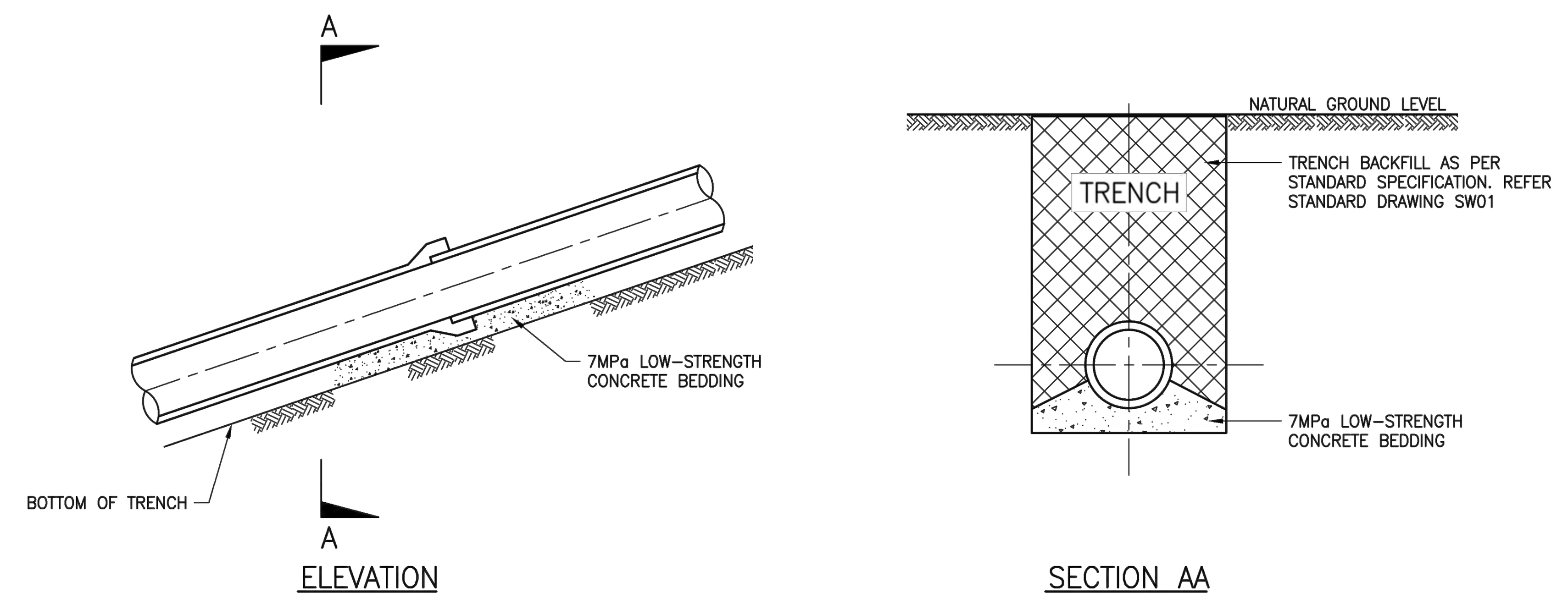
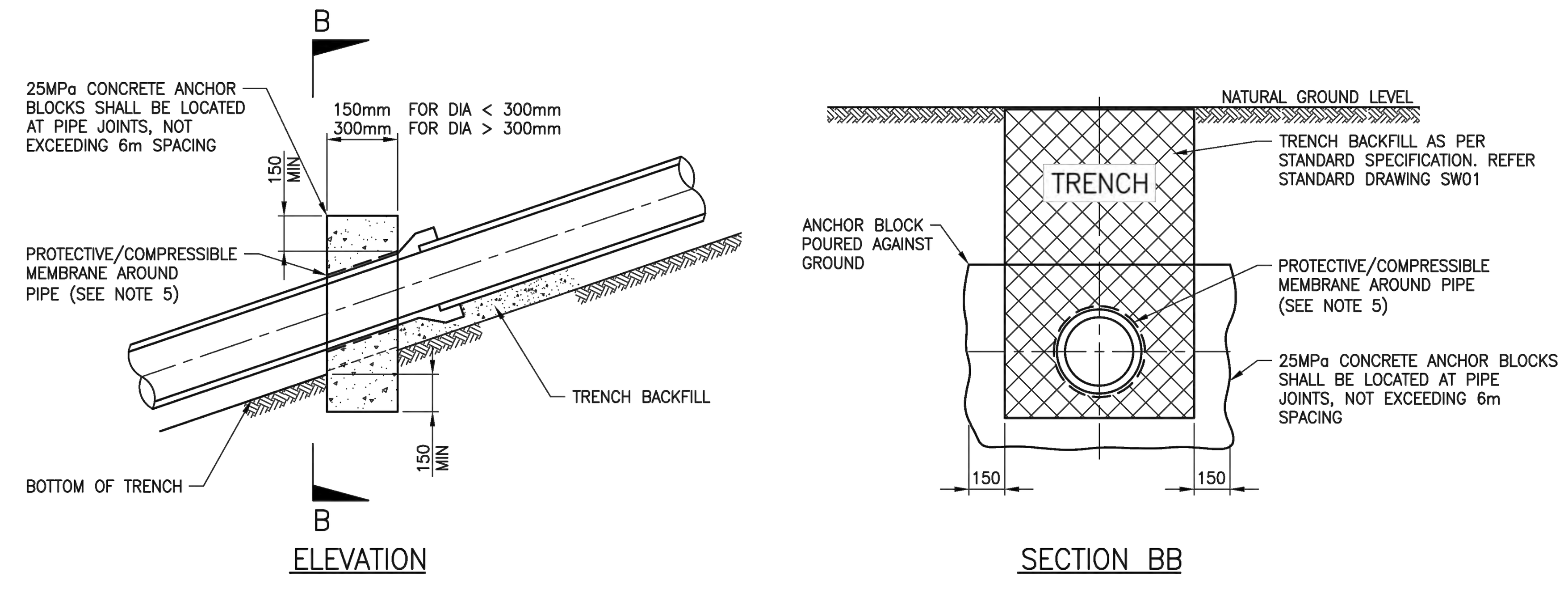


BEDDING FOR PIPES ON GRADIENTS BETWEEN 10% AND 20%



ANCHOR BLOCKS FOR PIPES ON GRADIENT > 20%

NOTES:

1. USE LOW-STRENGTH CONCRETE (7MPa) BEDDING FOR PIPES ON GRADIENTS BETWEEN 10% AND 20%.
2. USE ANCHOR BLOCKS FOR PIPES ON GRADIENTS STEEPER THAN 20% (1 IN 5).
3. SPECIFIC DESIGN AND SPACING MAY BE NEEDED FOR PIPES ON GRADIENTS >30% OR WHERE GROUNDWATER IS CONSIDERED SIGNIFICANT.
4. ANCHOR BLOCK TO BE CONSTRUCTED ON LOWER SIDE OF JOINT.
5. FLEXIBLE PIPE SHALL BE WRAPPED FOR LENGTH OF THE ANCHOR BLOCK AT THE CONCRETE INTERFACE. WRAPPING SHALL BE COMPRESSIBLE MATERIAL, (e.g. DENSO TAPE OR POLYETHYLENE FILM).
6. WHERE PIPES ARE EMBEDDED IN LOW-STRENGTH CONCRETE, A TRANSVERSE EXPANSION JOINT SHALL BE PROVIDED AT EACH JOINT.
7. FOR FLEXIBLE PIPELINES, UP TO 300mm DIA, ON GRADIENTS OF 10% AND GREATER, REQUIRED BENCHING DEPTHS WITHIN THE DOWNSTREAM MANHOLE CAN BE REDUCED, BY THE REDUCTION OF THE GRADIENT IMMEDIATELY OUTSIDE THE MANHOLE. THIS MAY BE ACHIEVED BY INSTALLING A MANUFACTURED, PRE-FORMED BEND WITH VERTICAL RADIUS MIN. 8x INSIDE PIPE DIAMETER.

STORMWATER CODE OF PRACTICE STANDARD DETAILS REVISION: 2 REV DATE: 1 NOVEMBER 2015 CAD FILENAME: AC-STD-SW23.DWG	AUCKLAND COUNCIL STORMWATER LINES STEEP GRADIENTS AND ANCHOR BLOCKS	ENVIRONMENTAL-SW Auckland Council	ORIGINAL SCALE A3 SCALE: N.T.S. DRAWING SET: SWCoP SHEET: 1 OF 1 DRAWING No.: SW23 REV: 2

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

DESIGN	DES CHECK	APPROVED FOR ISSUE
LG	LG	S. JAMES
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SHEET TITLE	STANDARD DETAILS- SHEET 6

CADFILE	210359-366-374.dwg
SCALE (A1)	NTS
ORIG. SHEET SIZE	A1
DRAWING No.	210359-371
REV.	1

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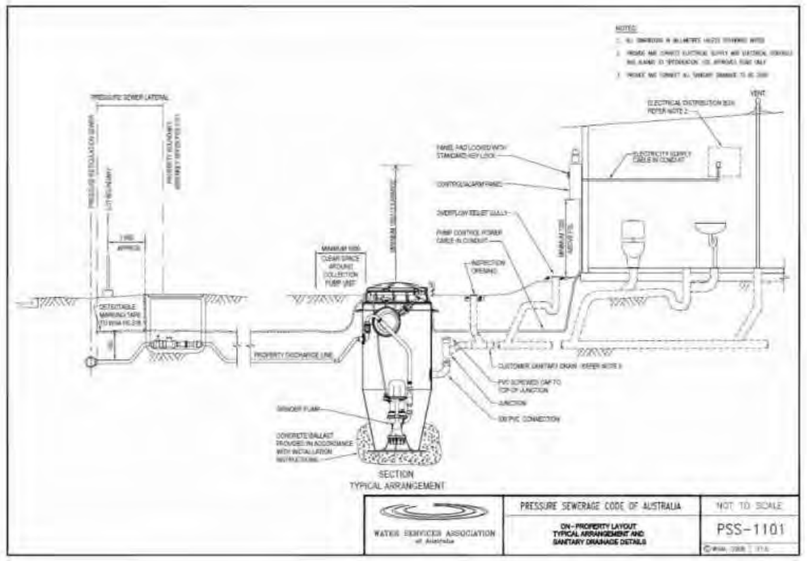

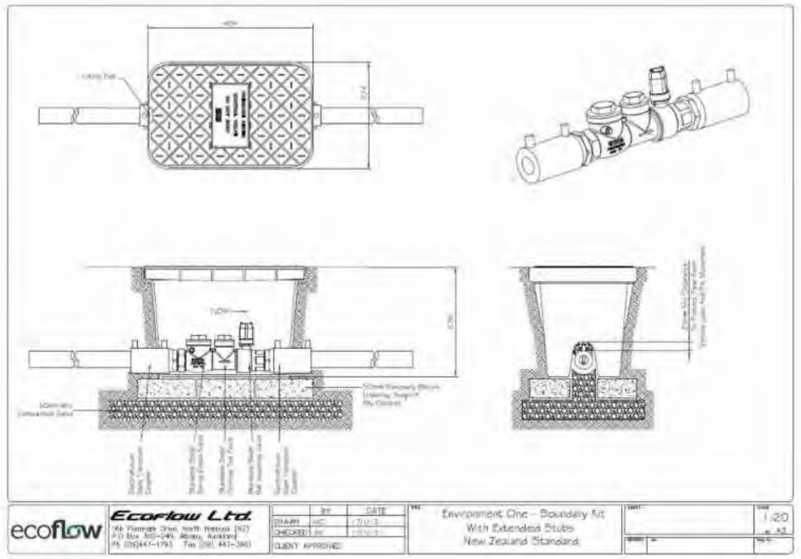

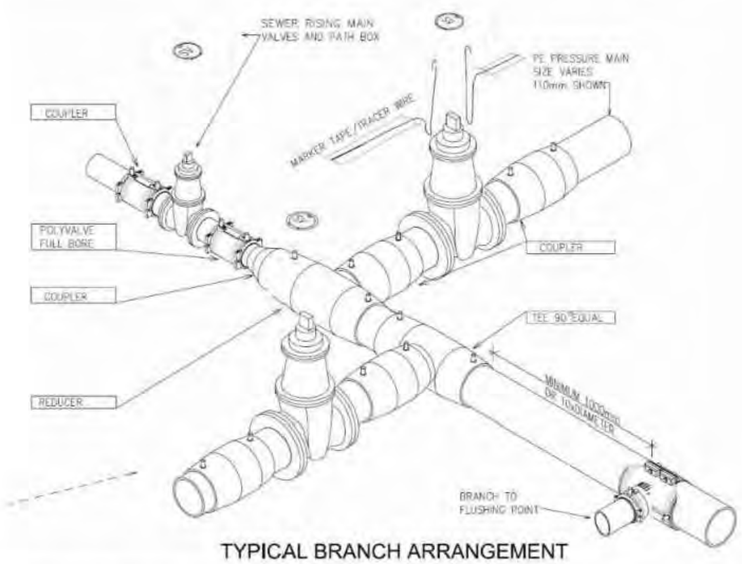

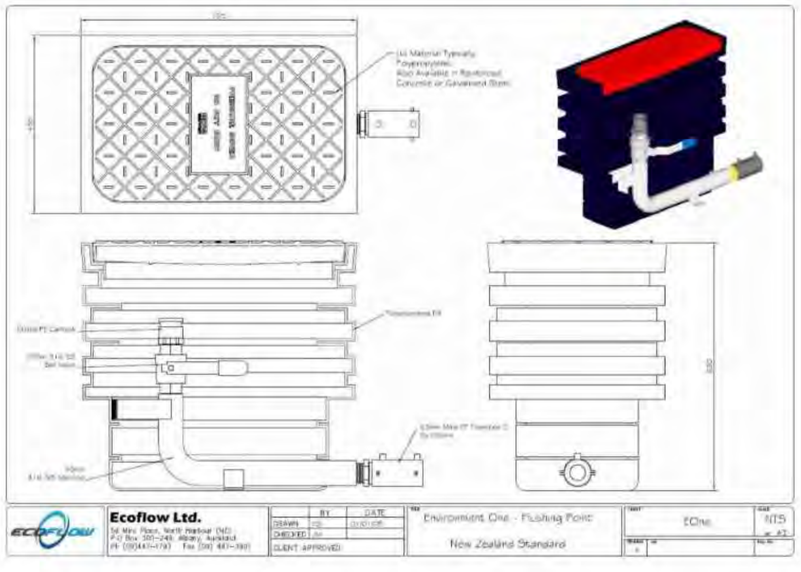

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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LG	LG	S. JAMES
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DATE DRAWN		ISSUE DATE
DEC 2021		04 / 02 / 22

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SHEET TITLE	STANDARD DETAILS- SHEET 7

ACENZ ISO 9001 GCS

CADFILE	210359-366-374.dwg
SCALE (A1)	ORIG. SHEET SIZE
NTS	A1
DRAWING No.	REV.
210359-372	1

Original size mm 300 200 150 100 50 30 10 0

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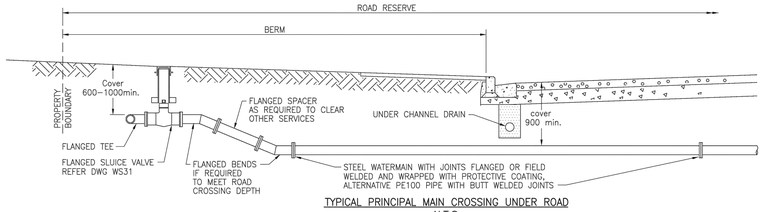
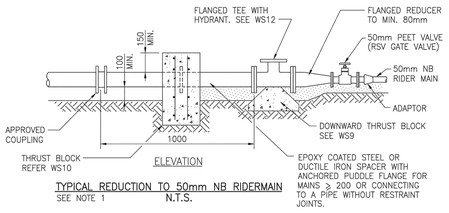


TYPICAL PRINCIPAL MAIN CROSSING UNDER ROAD
N.T.S.



ELEVATION

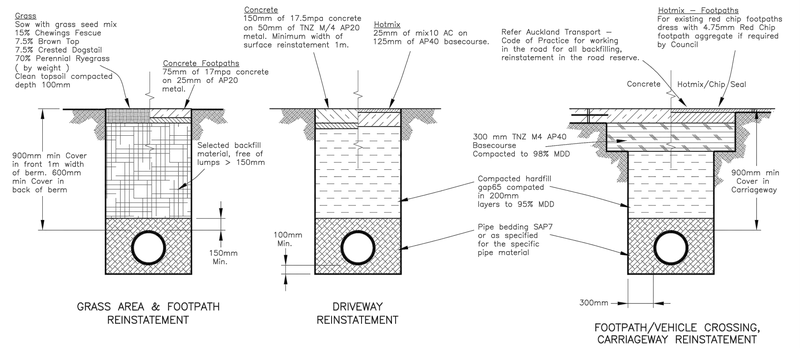
TYPICAL REDUCTION TO 50mm NB RIDERMAIN
SEE NOTE 1 N.T.S.

NOTES
1. FOR AN ALTERNATIVE RIDERMAIN CONNECTION SEE WS5.
2. PIPE AND BENDS TO BE SUPPORTED AN CORROSION PROTECTED.
3. ALL SPECIAL FITTINGS INCLUDING TEES AND BENDS TO BE FLANGED DUCTILE IRON OR AN ACCEPTED PROPRIETARY ALTERNATIVE.

O:\----\ EGCADFI \ 2017 \ WATER & WASTEWATER NETWORK STD DWGS \ 2010069.004C .DWG

ROAD CROSSING DETAILS AND PRINCIPAL MAIN TO RIDER MAIN CONNECTIONS

SCALE:	N.T.S.
ISSUE DATE:	13-07-2018
DWG No.	2010069.004C
REFERENCE No.	WS 4



GRASS AREA & FOOTPATH REINSTATEMENT

DRIVEWAY REINSTATEMENT

FOOTPATH/VEHICLE CROSSING, CARRIAGEWAY REINSTATEMENT

NOTES
1. Trench reinstatement within the road reserve shall comply with the Auckland Transport requirements.
2. Backfill is to be compacted in 200mm, layers to obtain maximum density, as per standard specifications.
3. Where concrete or other stabilized layers exist in the roadway, the trench shall be reinstated with similar material or as directed by the roading engineer.
4. Minimum cover in carriageway for watermains 900mm. 900mm cover in front 1m of berm and Minimum 600mm in the back of berm.
5. Fill shall be clean, Non-contaminated material. Recycled material is not acceptable.
6. Pipe bedding shall be compacted to AS/NZS 2566.2 clause 5.6.3 for compaction control.
7. Alternative embedment details by specific design for pipe at steep grades, inadequate trench foundation and erosion is not covered by this drawing.

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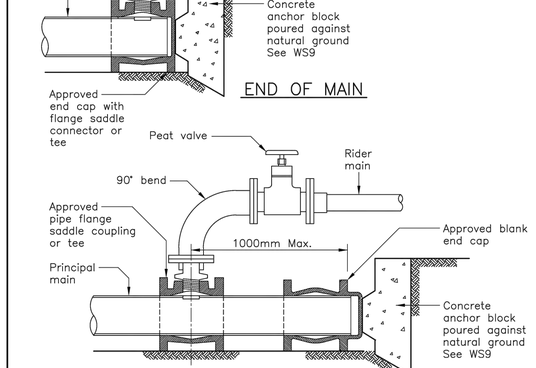
TYPICAL TRENCH REINSTATEMENT AND BEDDING DETAILS FOR WATER SUPPLY

SCALE:	N.T.S.
ISSUE DATE:	28-09-2017
DWG No.	2010069.001D
REFERENCE No.	WS 2



END OF MAIN

NEAR END OF MAIN

AT TEE JUNCTION

Notes
1. Tapping saddles are only allowed on principal mains up to DN300mm. A reducing Tee shall be used for 300mm and over.

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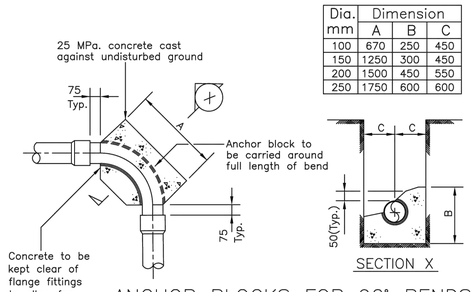
RIDER MAIN ALTERNATIVE CONNECTION

SCALE:	N.T.S.
ISSUE DATE:	13-07-2018
DWG No.	2010069.036C
REFERENCE No.	WS 5

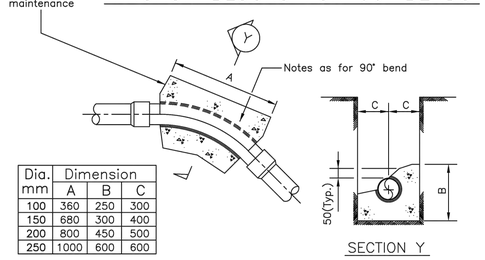
Notes :
1. Thrust block dimensions are based on firm soil conditions.
2. The dimensions to be increased or decreased for variation in soil conditions.
3. Allowable bearing stress used – 100KPa.
4. As built locations to be obtained prior to backfill.
5. Protective membrane (Polythene) between concrete & pipe.
6. 75mm clearance between fittings/flanges and concrete casting.
7. All fittings to be wrapped with a suitable wrapping system.



Dia. mm	Dimension A	B	C
100	670	250	450
150	1250	300	450
200	1500	450	550
250	1750	600	600

SECTION X

ANCHOR BLOCKS FOR 90° BENDS



Dia. mm	Dimension A	B	C
100	360	250	300
150	680	300	400
200	800	450	500
250	1000	600	600

SECTION Y

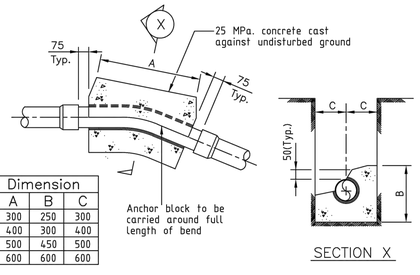
ANCHOR BLOCKS FOR 45° BENDS

O:\----\ EGCADFI \ 2017 \ WATER & WASTEWATER NETWORK STD DWGS \ 2010069.013B .DWG

ANCHOR BLOCK DETAILS FOR 90° & 45° BENDS

SCALE:	N.T.S.
ISSUE DATE:	10-02-2017
DWG No.	2010069.013B
REFERENCE No.	WS 8

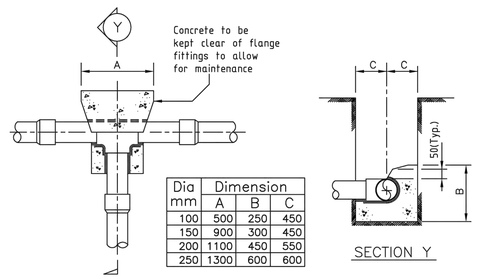
Notes :
1. Thrust block dimensions are based on firm soil conditions.
2. The dimensions to be increased or decreased for variation in soil conditions.
3. Allowable bearing stress used - 100KPa.
4. As built locations to be obtained prior to backfill.
5. Protective membrane (Polythene) between concrete & pipe.
6. 75mm clearance between fittings/flanges and concrete casting.
7. All fittings to be wrapped with a suitable wrapping system.



Dia mm	Dimension A	B	C
100	300	250	300
150	400	300	400
200	500	450	500
250	600	600	600

SECTION X

ANCHOR BLOCKS FOR 22½° & 11¼° BENDS



Dia mm	Dimension A	B	C
100	500	250	450
150	900	300	450
200	1100	450	550
250	1300	600	600

SECTION Y

ANCHOR BLOCKS TEE JUNCTION & END CAPS

O:\----\ EGCADFI \ 2017 \ WATER & WASTEWATER NETWORK STD DWGS \ 2010069.014B .DWG

ANCHOR BLOCK DETAILS FOR 22½° & 11¼° BENDS AND TEE JUNCTION

SCALE:	N.T.S.
ISSUE DATE:	10-02-2017
DWG No.	2010069.014B
REFERENCE No.	WS 9

RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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SHEET TITLE	STANDARD DETAILS- SHEET 8

ACENZ ISO 9001 GCS

CADFILE	210359-366-374.dwg
SCALE (A1) NTS	ORIG. SHEET SIZE A1
DRAWING No.	REV.
210359-373	1

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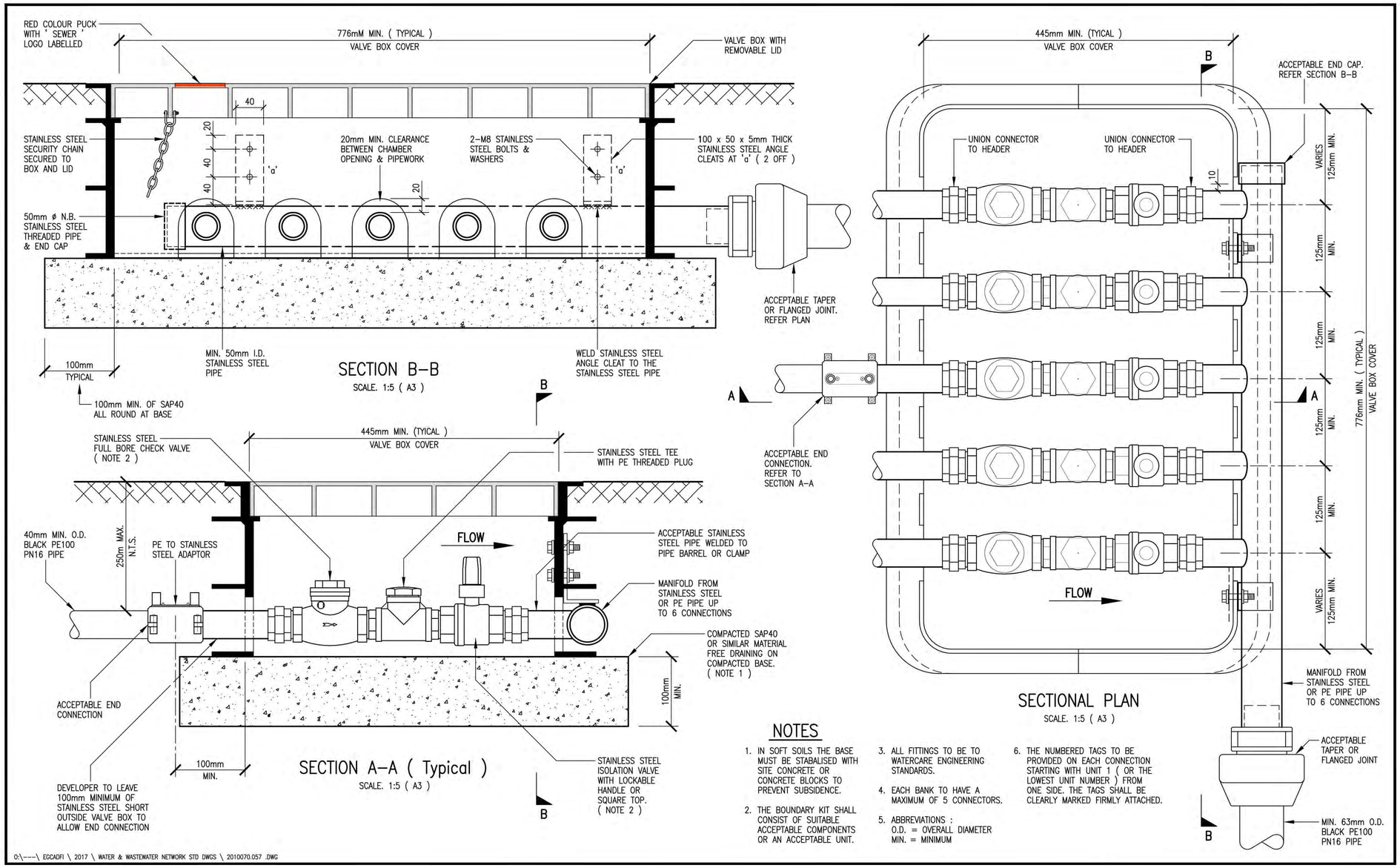

NOTES

1. IN SOFT SOILS THE BASE MUST BE STABALISED WITH SITE CONCRETE OR CONCRETE BLOCKS TO PREVENT SUBSIDENCE.
2. THE BOUNDARY KIT SHALL CONSIST OF SUITABLE ACCEPTABLE COMPONENTS OR AN ACCEPTABLE UNIT.
3. ALL FITTINGS TO BE TO WATERCARE ENGINEERING STANDARDS.
4. EACH BANK TO HAVE A MAXIMUM OF 5 CONNECTORS.
5. ABBREVIATIONS : O.D. = OVERALL DIAMETER MIN. = MINIMUM
6. THE NUMBERED TAGS TO BE PROVIDED ON EACH CONNECTION STARTING WITH UNIT 1 (OR THE LOWEST UNIT NUMBER) FROM ONE SIDE. THE TAGS SHALL BE CLEARLY MARKED FIRMLY ATTACHED.

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RESOURCE CONSENT

REV	DATE	ISSUE	BY
1	09.02.22	ISSUED FOR RESOURCE CONSENT	ZL

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DRAWN	CAD CHECK	
ZL	FY	
DATE DRAWN		ISSUE DATE
JAN 2022		04 / 02 / 22

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SHEET TITLE	STANDARD DETAILS- SHEET 9

ACENZ ISO 9001 GCS

CADFILE	210359–366–374.dwg
SCALE (A1)	ORIG. SHEET SIZE
NTS	A1
DRAWING No.	REV.
210359-374	1

Z:\2021 JOBS\210359 KAHAWAI POINT, WAIUKU\5.0 CADD\5.4 CURRENT\210359–366–374.DWG

Original size mm