

Appendix 2

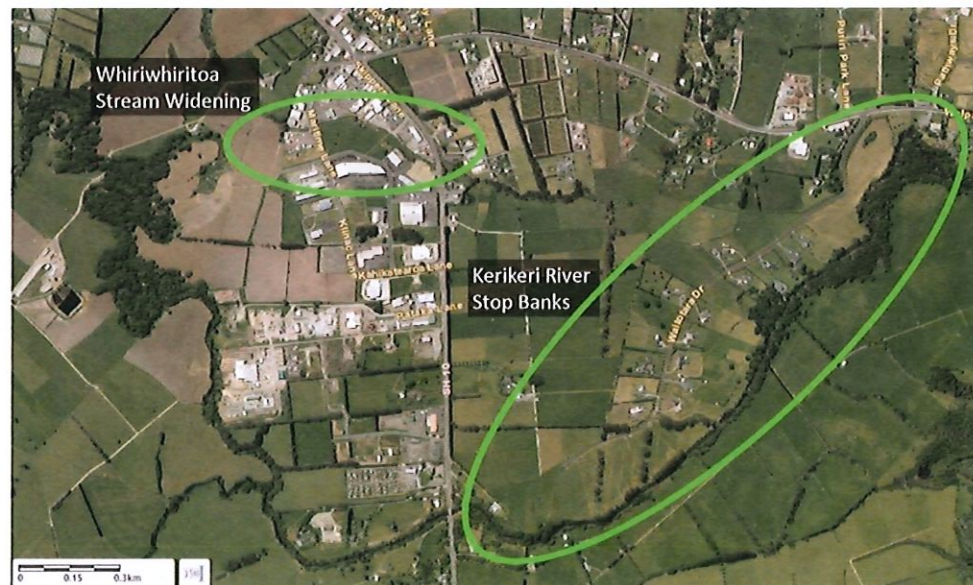
Erosion and Sediment Control Plan

Erosion and Sediment Control Whiriwhiritoa Cut & Kerikeri Stopbank Works

For Northland Regional Council

Supporting report for Resource Consent Applications
Haigh Workman Reference 8667

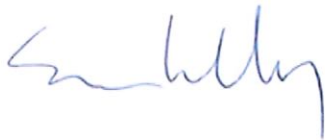
November 2020



Revision History

Revision N ^o	Issued By	Description	Date
A	Sean Kelly	First Issue	25 November 2020

Prepared by

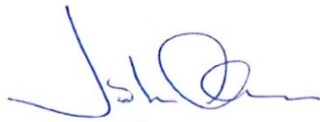


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Approved by



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1 Introduction

1.1. Site Description

A flood mitigation scheme is proposed for the Waipapa township and neighbouring Kerikeri River (along Waitotara Drive). This comprises of two areas of works, outlined in Figure 1 below, and as described in the following subsections.

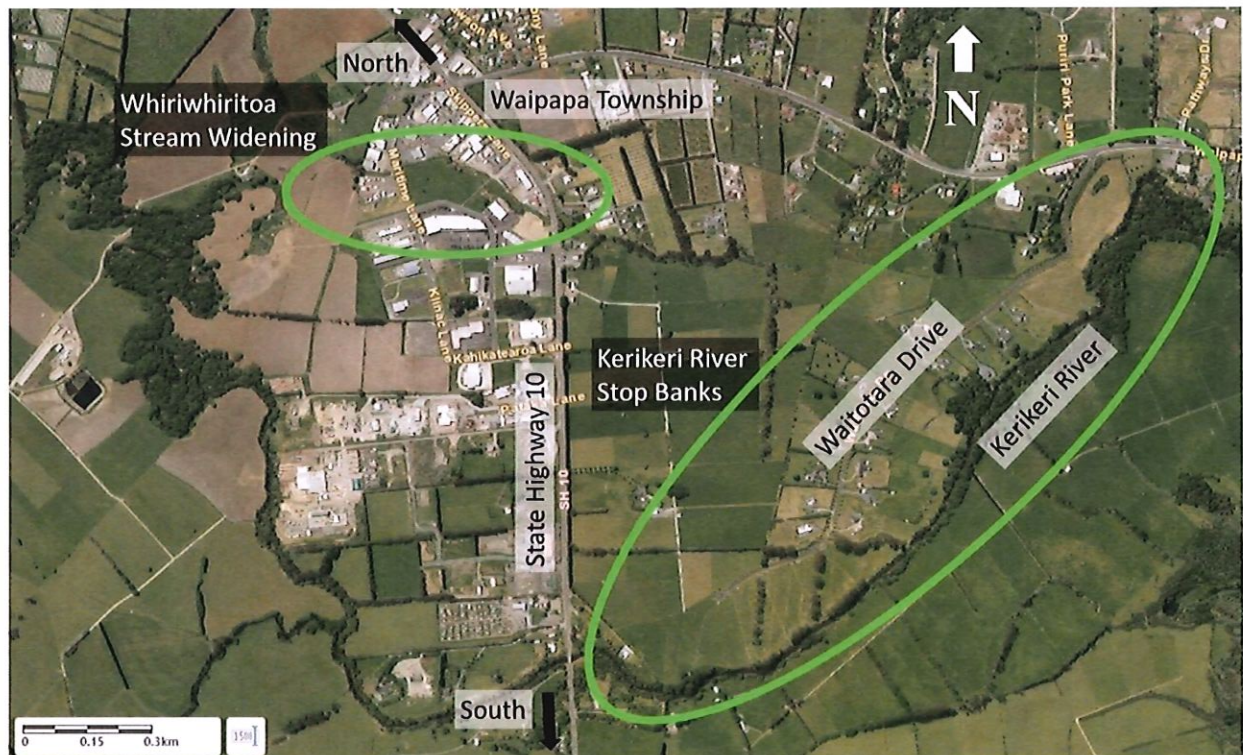


Figure 1 – Areas of Proposed Works

1.2. General

Northland Regional Council (NRC) requires detailed design for improving flood flow conveyance of the Whiriwhiritoa Stream between Maritime Lane Bridge and State Highway 10.

In addition, NRC requires preparation of resource consent* application for the implementation of the Whiriwhiritoa flood flow improvement works and stopbank works adjacent to the left bank of the Kerikeri River near Waitotara Drive.

* NRC has obtained a Resource Consent for the Waitotara Drive Stopbanks works, however this consent has been forfeited.

1.3. Background Whiriwhiritoa Stream:

It is proposed to improve channel capacity of the Whiriwhiritoa Stream between Maritime Lane Bridge and State Highway 10.

This reach has three significant crossing structures:

- a) Private culvert with 2mh x 5mw x 4.5ml – to be removed



Figure 2 – Culvert to be removed

- b) A new bridge at Maritime Lane
- c) Skipper Lane foot path bridge with 2mh x 5mw x 1.5ml culvert



Figure 3 – Footbridge to remain

Calculations of the existing major culvert in Whiriwhiritoa Stream at State Highway 10 indicates a flow restriction of 43 m³/s.



The existing channel capacity is as low as $9.4 \text{ m}^3/\text{s}$ before flooding into adjacent properties. The new channel capacity recommended is not less than $43 \text{ m}^3/\text{s}$. The improved channel conveyance is to reduce flooding into adjoining properties. The design flow of $43 \text{ m}^3/\text{s}$ also matches the capacity of the culvert beneath State Highway 10.

The conveyance beneath the proposed bridge at Maritime Lane is to be designed to ensure $43 \text{ m}^3/\text{s}$ flow conveyance. The increased capacity is to be achieved with some channel widening, and modification of base-gradient of the stream.

The design within this report recommends improvement, where necessary (widening varies) of the subject section of Whiriwhiritoa Stream to convey a design flow rate of $43 \text{ m}^3/\text{s}$.

Detailed drawings are listed in 'Appendix A - Construction Drawings'. The area of works for Whiriwhiritoa Stream Widening are shown in figure 5 above.

1.4. Background Waitotara Drive Stopbanks:

A significant storm event creates overland flow both from the right bank and left bank of Kerikeri River. The overland flow from right bank drains towards Rainbow Falls and the overland flow from left bank floods parts of the land near Waitotara Drive. Stopbanks are proposed to be constructed in different strategic sections of the left bank of the river so as to reduce overflow of the left bank of the river.

NRC has completed the detailed design (by others) of the stopbanks, see Appendix A. NRC has also obtained a Resource Consent for these works however this consent has been forfeited.

The area of works for the proposed Kerikeri River Stopbanks are shown in Figure 6 below.

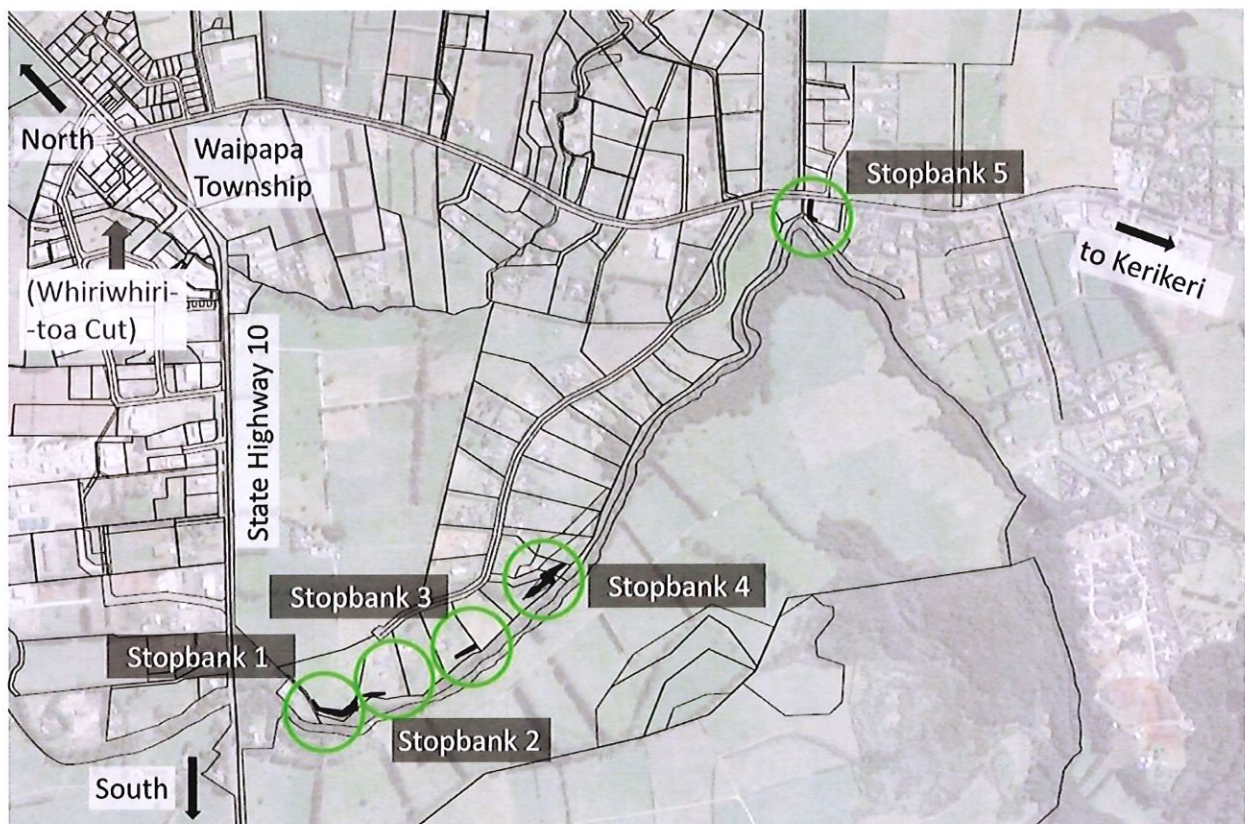


Figure 6 – Proposed Kerikeri River Stopbanks

1.5. Statutory Basis

It is expected that the provisions within this Erosion & Sediment Control Report will be required to be complied with as a condition of both the FNDC and NRC resource consents. Compliance with the conditions of consent is to be a term of the relevant contracts.

1.6. District Plan Zoning

Far North District Council (FNDC) district plan zoning is shown on Figure 7 below:

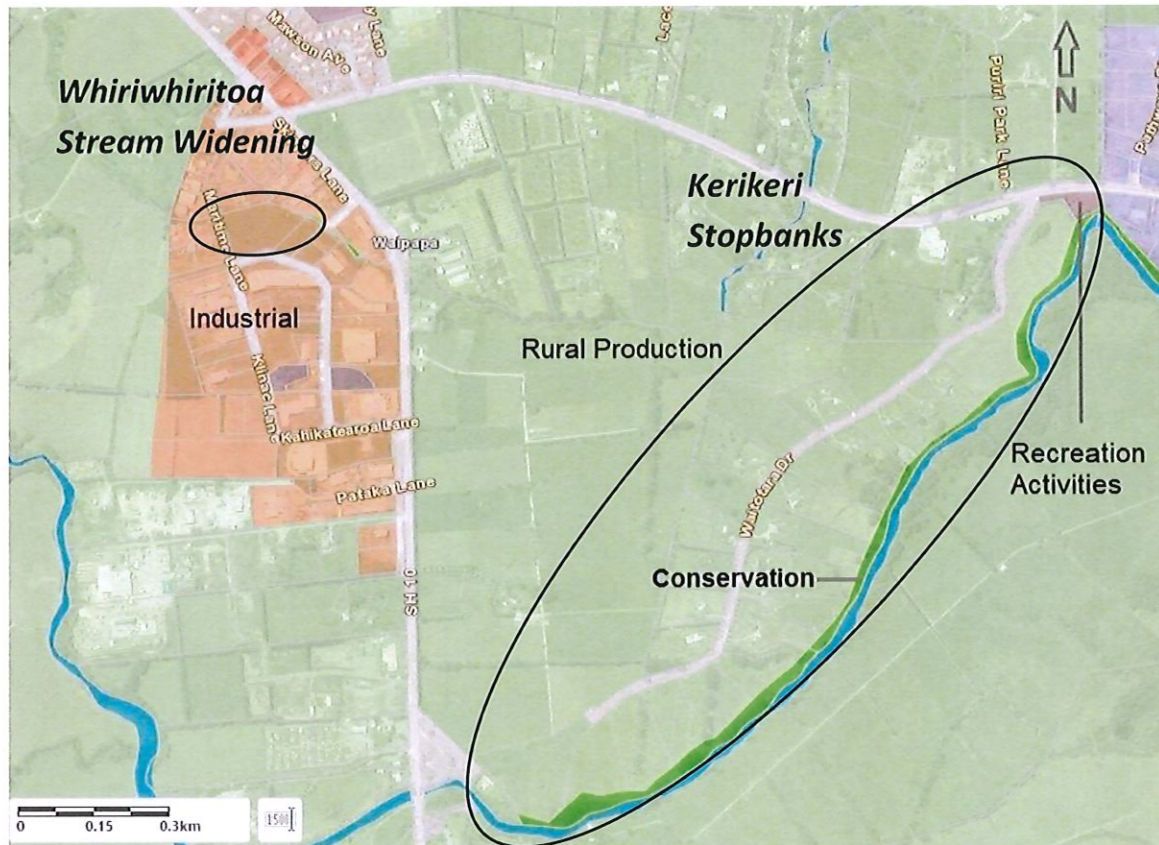


Figure 7 – Far North District Council District Plan Zoning

2 Geology

1.7. Published Geology – Whiriwhiritoa Cut

The Whiriwhiritoa Cut site is indicated to be directly underlain by soils of the Undulating Terraces and Lowlands comprising Kamo Clay Loam (KO) in the West and Waipapa Clay (YF) in the East. Soil deposits at the site are typically described and categorised as imperfectly to very poorly drained.

The NZMS 290 sheet P04/05 geology map identifies the site to be underlain by Alluvium (A1₂), comprising 'mud, sand and gravel with minor peat, forming river bed and flood plain deposits up to 10 m above stream or sea level, in places forming a thick (1 - 3 m) veneer over rugged surfaces of lava flows (F6₁, F6₂); unconsolidated to very soft. Unweathered'.

The soil deposits are indicated by GNS Mapping to be underlain by solid geology comprising basalt lava flows with older flows and flow remnants (Pvb) of the Kerikeri Volcanic Groups, late Pliocene to late Miocene (c. 1.7 to 1.8 million years). Pvb are described by the GNS map as '*basalt lava flows, older flows and flow remnants*'.

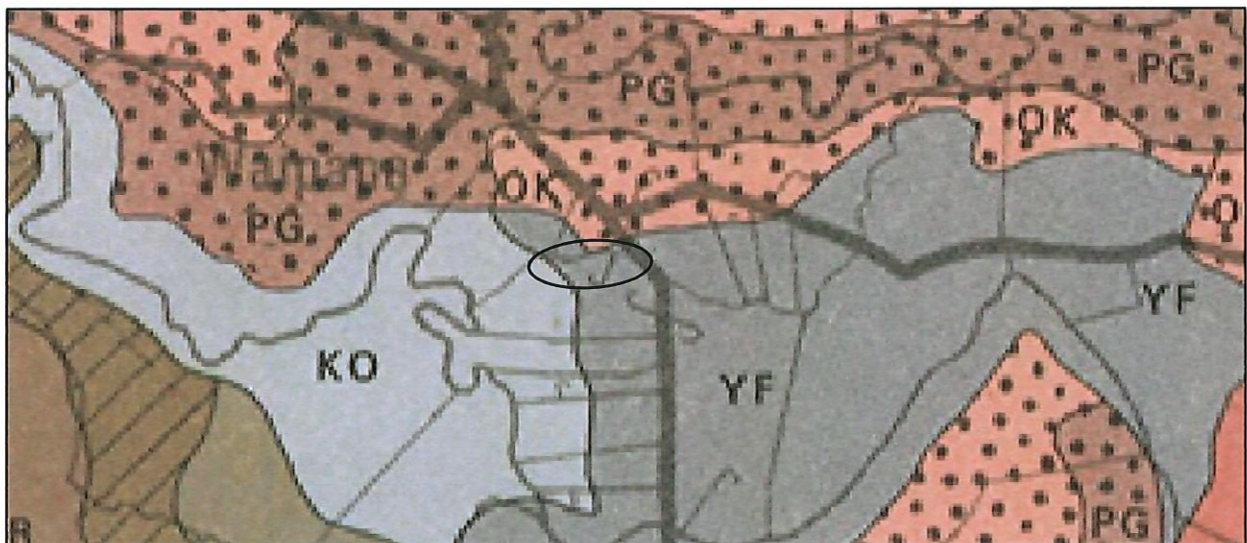


Figure 8 – Proposed Kerikeri River Stopbanks

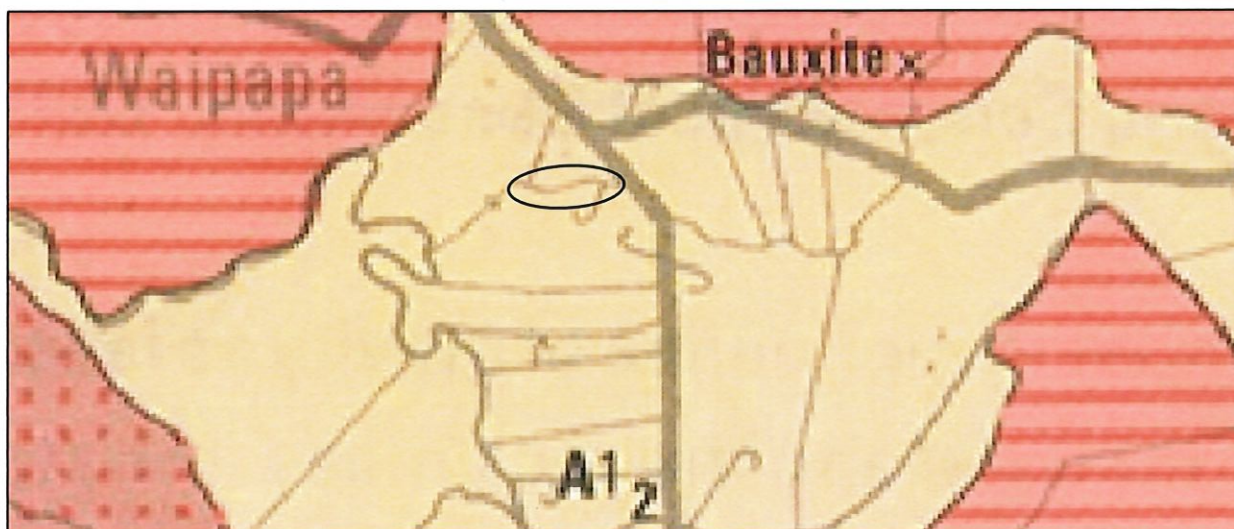


Figure 9 – NZMS 290 Sheet PO4/05 Rock Map

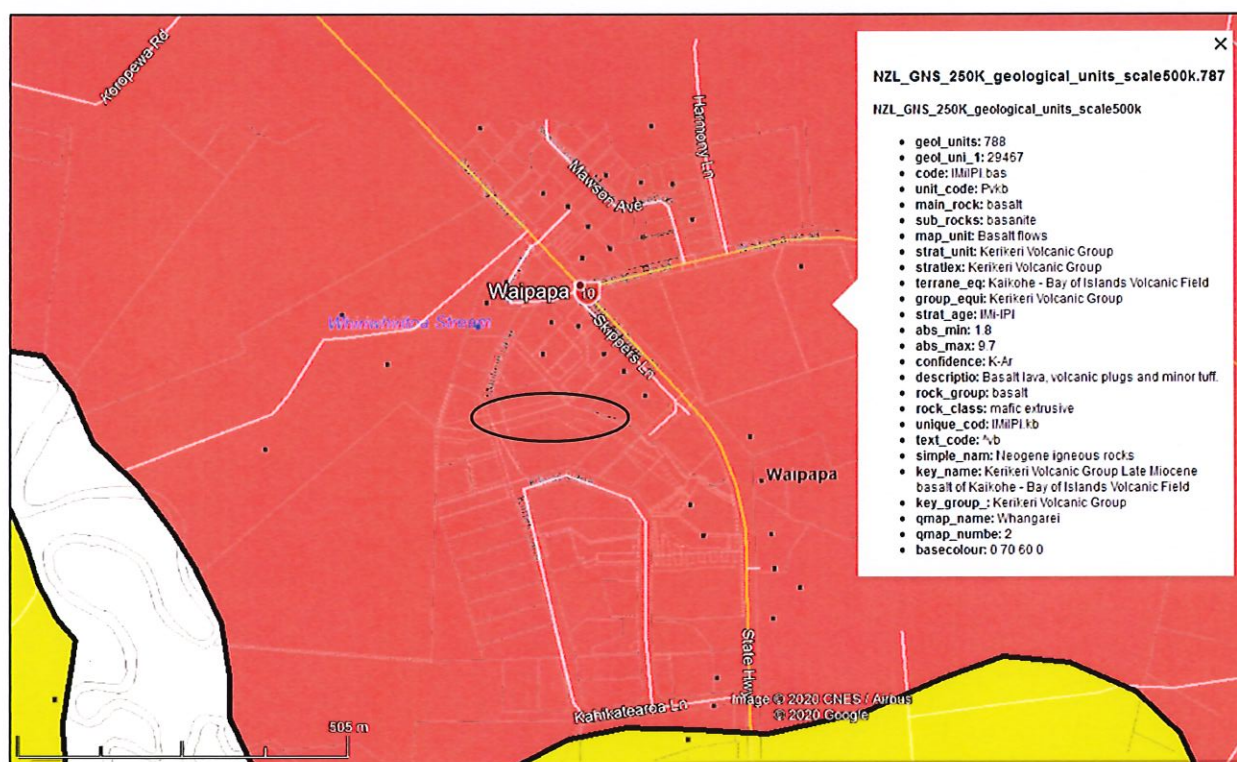


Figure 10 – GNS Rock Map overlay on Google Earth Pro

1.8. Published Geology – Kerikeri Stopbanks

The Kerikeri Stopbanks site is indicated to be directly underlain by soils of the Undulating Terraces and Lowlands of Waipapa Clay (YF). Soil deposits at the site are typically described and categorised as imperfectly to very poorly drained.

The NZMS 290 sheet P04/05 geology map identifies the site to be underlain by Alluvium (A1₂), comprising 'mud, sand and gravel with minor peat, forming river bed and flood plain deposits up to 10 m above stream or sea level, in places forming a think (1 - 3 m) veneer over rugged surfaces of lava flows (F6₁, F6₂); unconsolidated to very soft. Unweathered'.

The soil deposits are indicated by GNS Mapping to be underlain by solid geology comprising basalt lava flows with older flows and flow remnants (Pvb) of the Kerikeri Volcanic Groups, late Pliocene to late Miocene (c. 1.7 to 1.8 million years). Pvb are described by the GNS map as '*basalt lava flows, older flows and flow remnants*'.

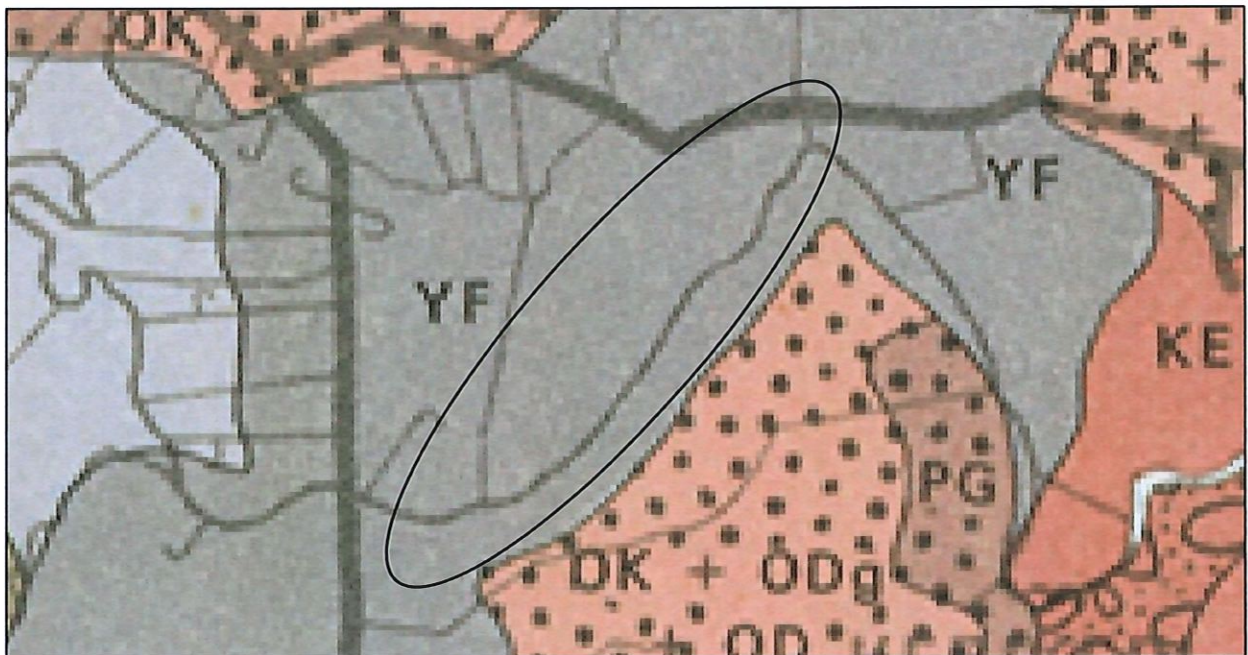


Figure 11 – NZMS 290 Sheet P04/05 Soil Map

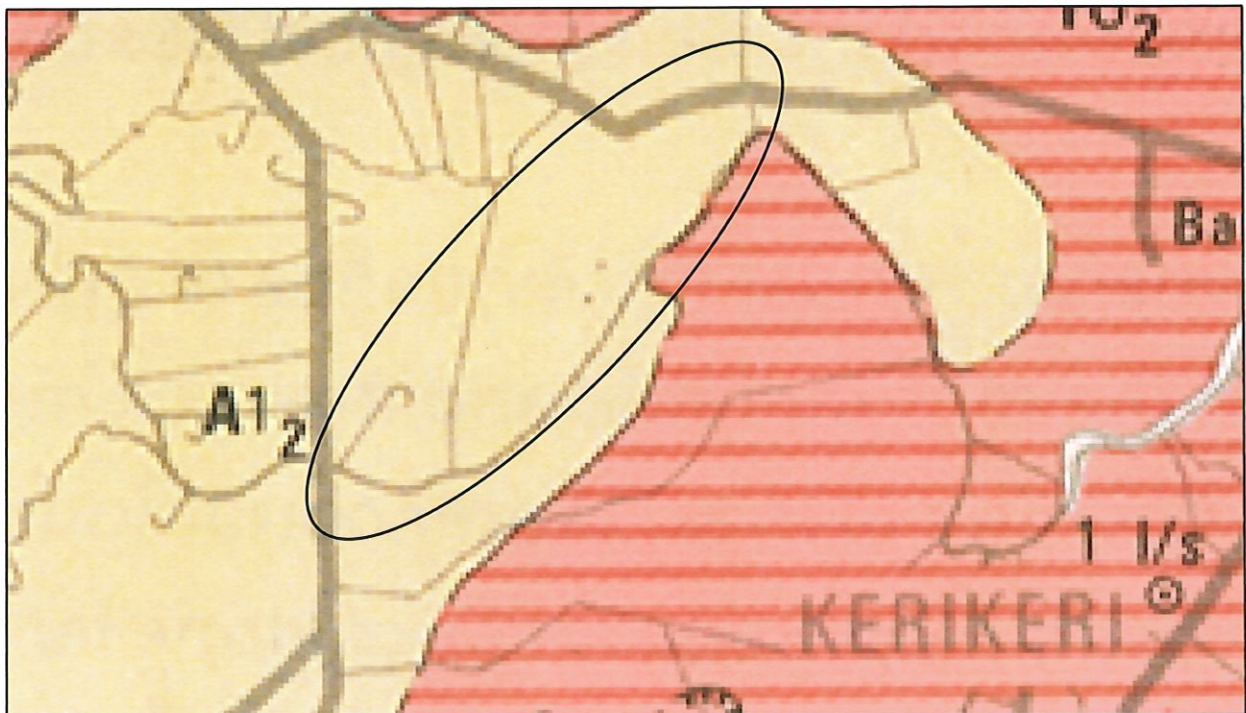


Figure 12 – NZMS 290 Sheet PO4/05 Rock Map

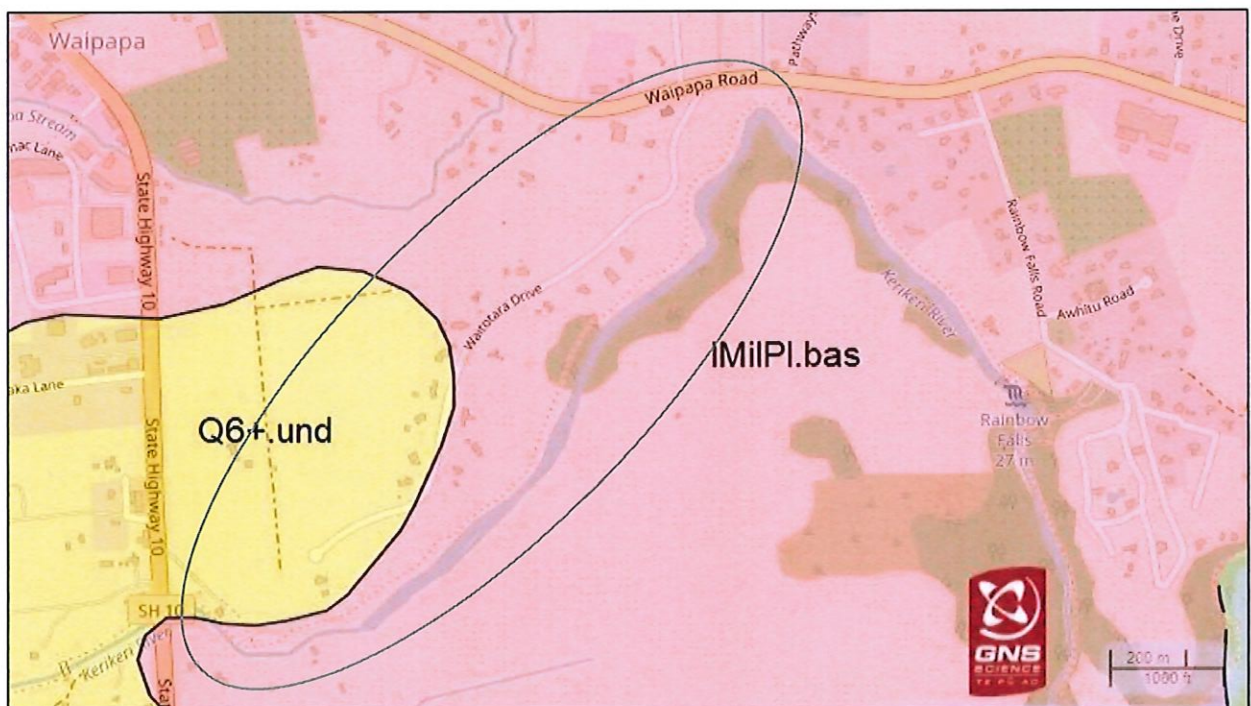


Figure 13 – GNS Rock Map overlay on Open Street Map

Code	Q6+.und	IMiIPI.bas
Key name	OIS6+ (Early Pleistocene - Middle Pleistocene) estuary, river and swamp deposits	Kerikeri Volcanic Group Late Miocene basalt of Kaikohe - Bay of Islands Volcanic Field
Simple name	Early Pleistocene - Middle Pleistocene undifferentiated estuary, river and swamp deposits	Neogene igneous rocks
Main rock name	mud	basalt
Stratigraphic age	Q14+-Q6	IMi-IPI
Description	Partly consolidated mud, sand, gravel and peat or lignite of alluvial, colluvial, lacustrine, swamp and estuarine origins.	Basalt lava, volcanic plugs and minor tuff.
Subsidiary rocks	sand gravel peat lignite	basanite
Key group	Early Pleistocene - Middle Pleistocene sediments	Kerikeri Volcanic Group
Stratigraphic lexicon name	Tauranga Group	Kerikeri Volcanic Group
Terrane equivalent		Kaikohe - Bay of Islands Volcanic Field
Absolute age (min)	0.128 million years	1.8 million years
Absolute age (max)	1.8 million years	9.7 million years
Rock group	mudstone	basalt
Rock class	clastic sediment	mafic extrusive
QMAP sheet name	Whangarei	Whangarei

Table 1 - GNS Geology Properties

3 Proposed Development

The proposed development comprises the construction of:

- Whiriwhiritoa Stream Widening – predominantly cut
- Kerikeri River Stopbanks – predominantly fill.

Whiriwhiritoa Stream Widening

The Whiriwhiritoa Stream Widening which involves a combined total of 2,905 m³ of earthworks over one earthworks season is to comprise:

- 2765 m³ excavation
- 140 m³ earth fill
- 2625 m³ balance
- 4127 m² 2D area of earthworks

In developing the erosion and sediment control plan, the drawing was prepared and circulated with the consultation. Amendments were made to the drawing following internal review from the Northland Regional Council. As the works are adjacent to a watercourse, the philosophy for sediment control is to prevent water from entering the site and picking up sediment.

In terms of effects, as the disturbed areas are very small, the actual sediment picked up by water (rain) falling on the site will be minimal. It should also be noted that some deposition of sediment (accretion) – the opposite of erosion is expected after completion of the works. Accretion usually occurs on the inside of bends where water velocities drop.

Detailed earthworks quantities are tabulated on the appended Construction Drawings P1 and P2 of the drawing set in Appendix A.

The erosion and sediment control plan are labelled “Erosion and Sediment Control, Whiriwhiritoa Stream, Project 8667, Drawing EP1, Sheet 1 of 6.

Kerikeri River Stopbanks

Stopbanks along the Waitotara Drive section of the Kerikeri River which involves a combined total of 2,130 m³ of earthworks over one earthworks season is to comprise:

Table 2 – Outline of Proposed Kerikeri River Stopbanks

Stop Bank No.	Maximum Height *	Average Height *	Fill Quantity	Plan Area	Legal Descriptions
#1	2.0 m	1.3 m	1,240 m ³	1370 m ²	Lot 17 DP 333643
#2	1.0 m	< 1.0 m	150 m ³	290 m ²	Lot 16 DP 333643
#3	0.8 m	< 0.8 m	200 m ³	300 m ²	Lot 14 DP 333643
#4	4.5 m	1.1 m	1,400 m ³	1800 m ²	Lot 12 DP 333643
#5	1.5m	< 1.5 m	150 m ³	500 m ²	Lot 3 DP 171508
Total			3140 m ³	4260 m ²	

- Windrow topsoil (earth bunds) – 850 m³ cut
- 3140 m³ earth fill
- 3140 m³ borrow (import material from Whiriwhiritoa cut and locally borrowed material)
- 850 m³ reinstate topsoil – fill
- 7890 m³ total earthwork volumes
- 4260 m² 2D area of earthworks

As above, when developing the erosion and sediment control plan the drawings were prepared and circulated for consultation. Amendments were made to the drawing following internal review from the Northland Regional Council and feedback from residents.

There is a slightly philosophy from the Whiriwhiritoa cut at the stopbank sites. The proposed works are sufficiently set back from the Kerikeri River to allow construction of topsoil bunding around disturbed areas. Each stopbank is essentially flat. The bunding is to prevent water leaving the disturbed areas. Each stopbank is truncated by a drain or a gully beneath the stopbank. Each drain or gully is to be piped. The piped drain will allow water upstream of the stopbank to pass beneath the site without picking up sediment – the clean water diversion through the disturbed areas. In addition to the topsoil bunding, a silt fence will be constructed at each culvert inlet/outlet to pick up any loose sediment from the bunding.

Following construction of the stopbanks, the topsoil bunds will be pushed up over the stopbanks for regrassing and reinstatement. Silt fences are to be removed following grass strike.

In terms of effects, as the disturbed areas are very small, the actual sediment picked up by water (rain) falling on the site will be minimal. Rain water is to soak away from disturbed areas. There is to be no sediment discharge from the stopbanks.

Detailed earthworks quantities are tabulated above and marked on the appended Construction Drawings SP1 SP2 and SP3 of the drawing set in Appendix A.

The erosion and sediment control plan are labelled "Erosion and Sediment Control, Project 8667, Drawing EP2, EP3, EP4 and EP5, Sheets 2, 3, 4 and 5.

4 Limitations

This report has been prepared for the use of Northland Regional Council with respect to the brief outlined to us. This report is to be used by our Client, their Consultants and awarded Contractor and may be relied upon for erosion and sediment control. Furthermore, this report may be utilised in the preparation of resource consent applications with local authorities. The information and opinions contained within this report shall not be used in other context for any other purpose without prior review and agreement by Haigh Workman Ltd.

Appendix A – Drawings

Refer to drawing sets:

“Whiriwhiritoa Stream Cut and Waitotara Drive Stopbanks” dated September 2020, Ref 8667
(Construction Drawings)

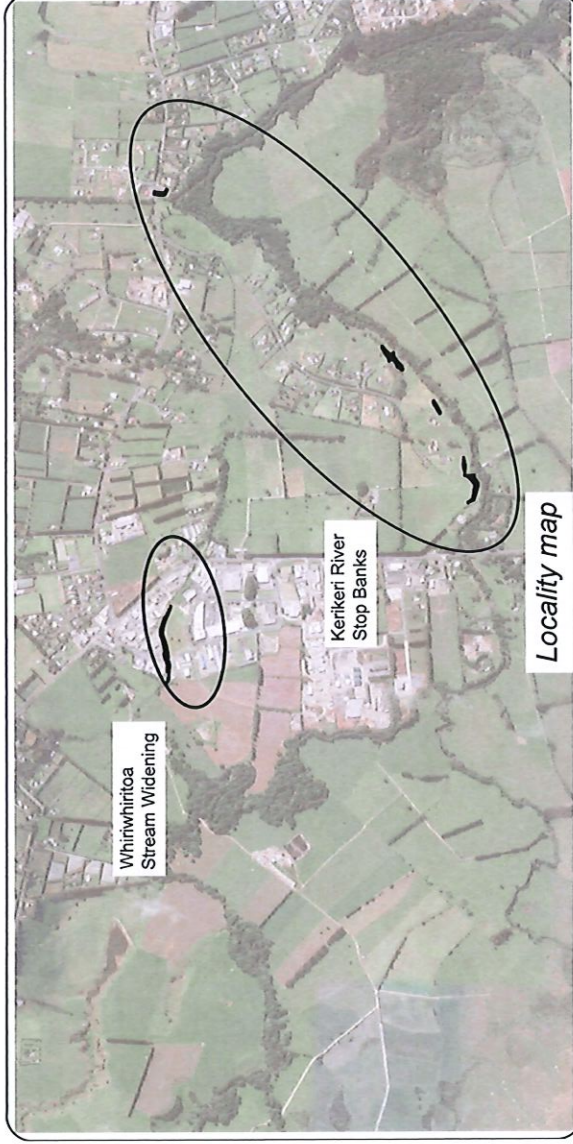
With particular reference to:

Erosion & Sediment Control Plans:

ESCP – Whiriwhiritoa Stream -----	EP1
ESCP – Stopbanks 1 & 2 -----	EP2
ESCP – Stopbank 3 -----	EP3
ESCP – Stopbank 4 -----	EP4
ESCP – Stopbank 5 -----	EP5
ESCP – Typical Details -----	EP6

CONTRACT 20/19

WHIRIWHIRITOA STREAM CUT and WAITOTARA DRIVE STOPBANKS for NORTHLAND REGIONAL COUNCIL



Index

WHIRIWHIRITOA STREAM

Site Features Plan P1
Whirihiritoa Cut - Proposed Earthworks Plan P2
Whirihiritoa Cut - Longitudinal Section LS1
Whirihiritoa Cut - Cross Sections CS1 - 2

WAITOTARA DRIVE

Stopbank Plan - Stopbank 1 & 2 SP1
Stopbank Plan - Stopbank 3 SP2
Stopbank Plan - Stopbank 4 SP3
Stopbank Plan - Stopbank 5 SP4

EROSION & SEDIMENT CONTROL PLANS

ESCP - Whirihiritoa Stream EP1
ESCP - Stopbanks 1 & 2 EP2
ESCP - Stopbank 3 EP3
ESCP - Stopbank 4 EP4
ESCP - Stopbank 5 EP5
ESCP - Typical Details EP6

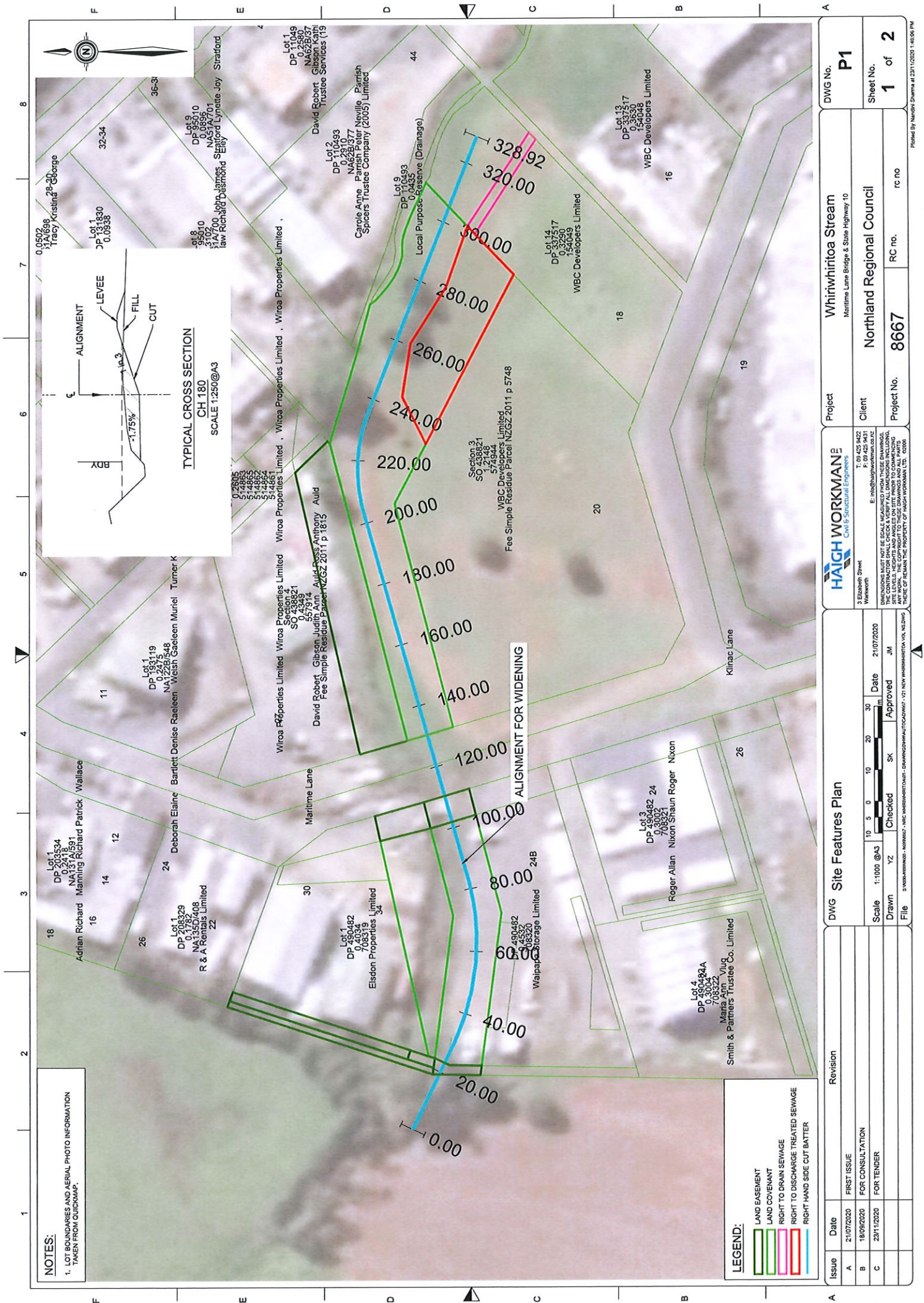


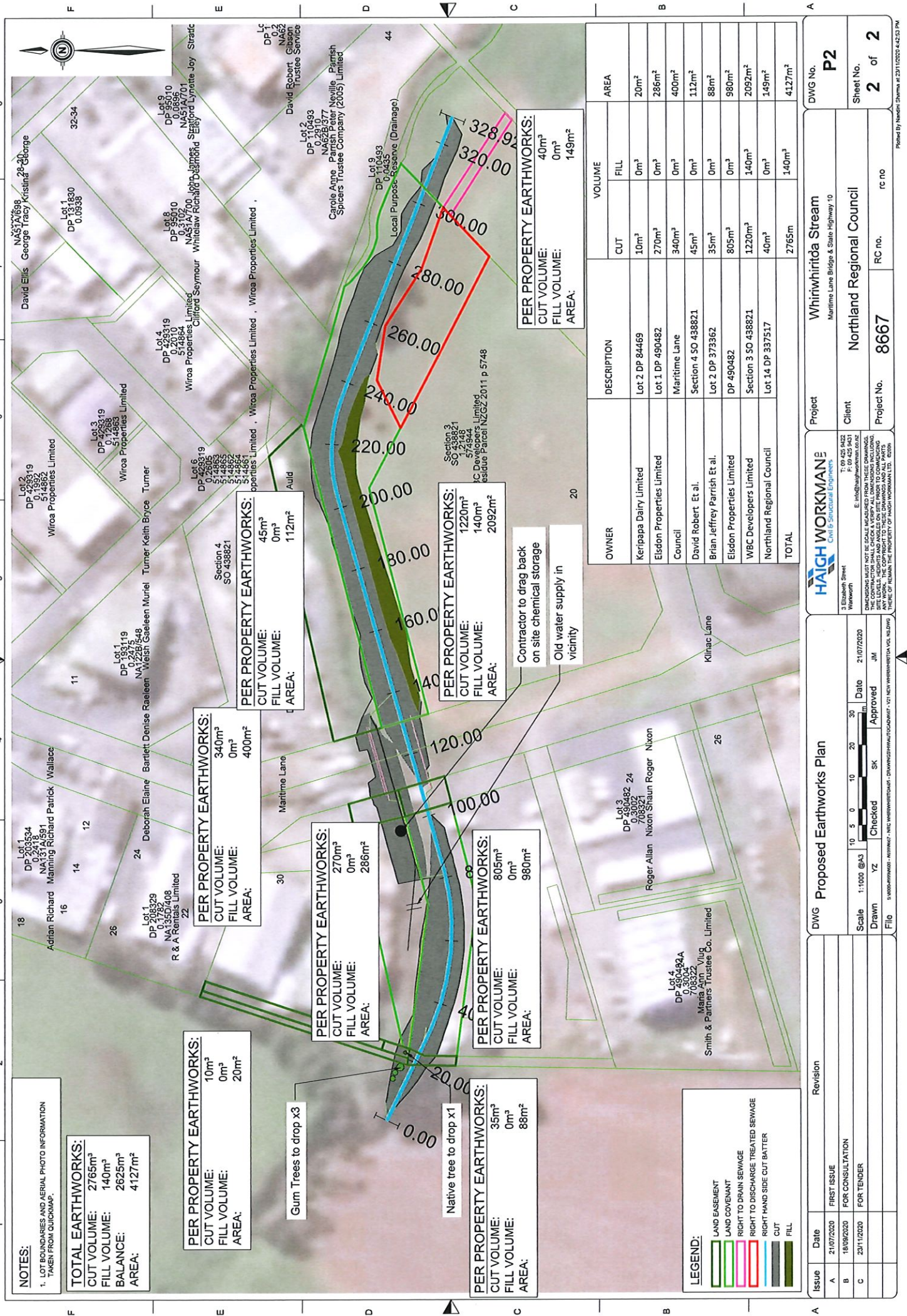
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Warkworth

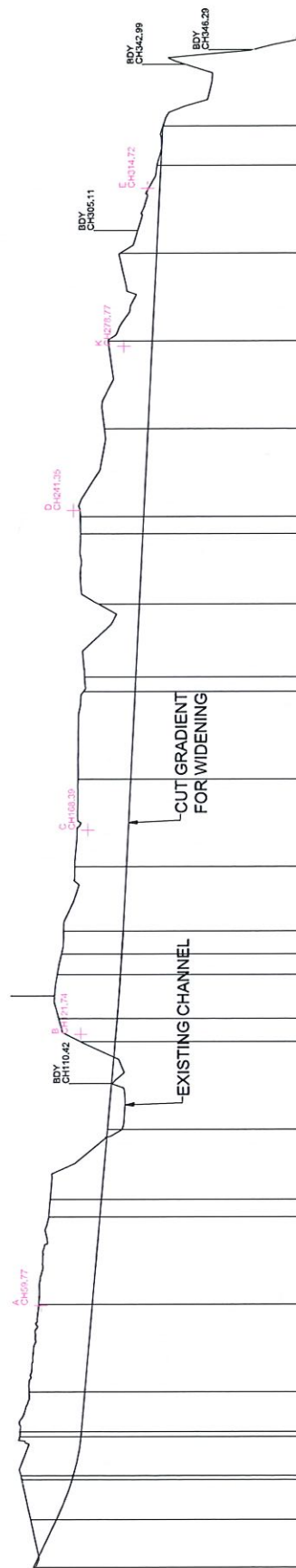
T: 09 425 9422
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Job No. 8667

For Approval
24 November 2020

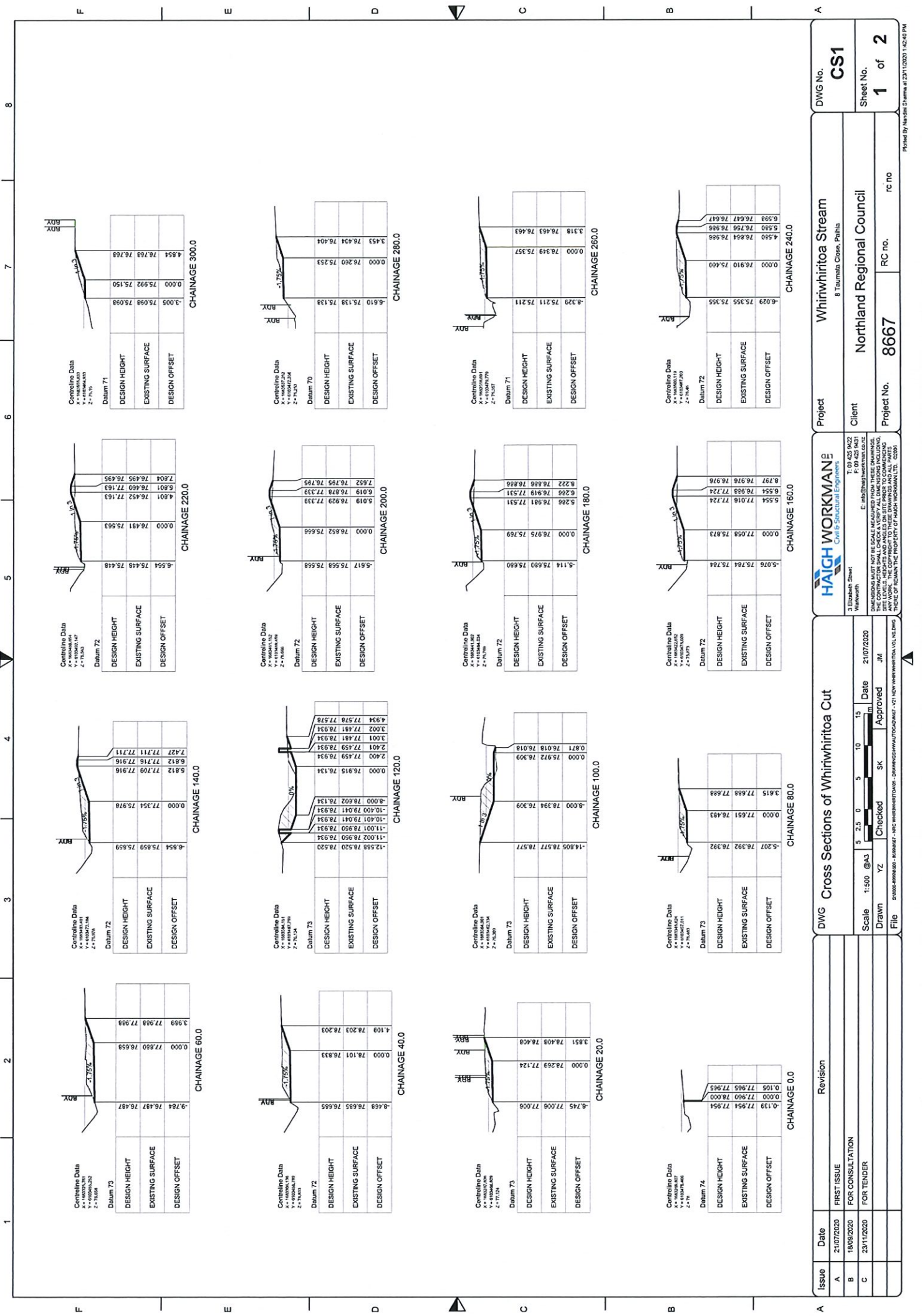






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			75.00	
			75.00	

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Issue

Date

Revision

A

21/07/2020

FIRST ISSUE

B

18/09/2020

FOR CONSULTATION

C

23/11/2020

FOR TENDER

DWG No.

CS1

Project

Whirihiritoa Stream

Client

Northland Regional Council

Project No.

8667

RC no.

rc no

Sheet No.

1 of 2

HAIGH WORKMAN

3 Elizabeth Street

NEW ZEALAND

09 425 9422

info@haighworkman.co.nz

Scale

1:500 @A3

Drawn

YZ

Checked

SK

Approved

JM

Date

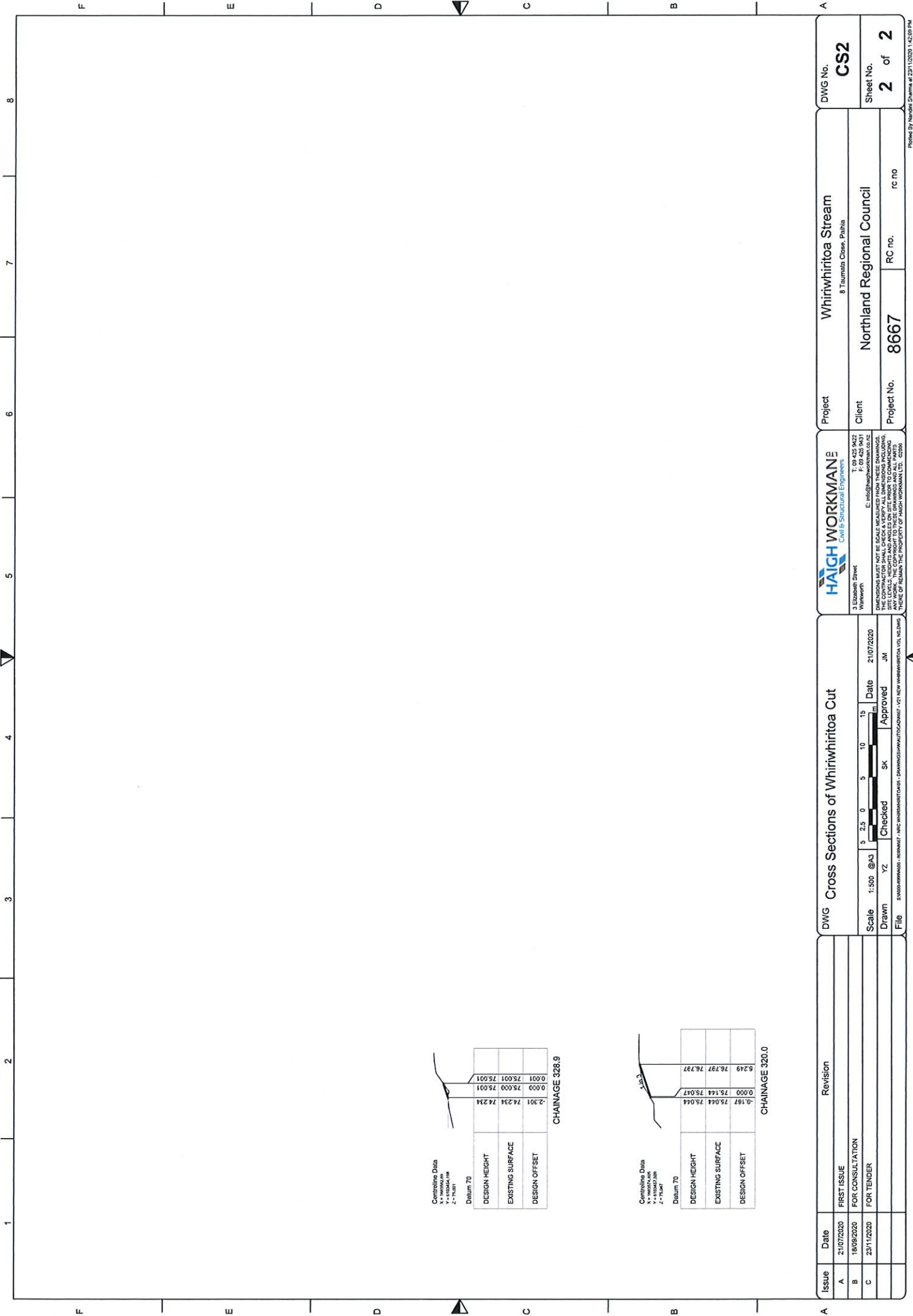
21/07/2020

File

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Datum 70

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Issue	Date	21/07/2020	Revision
	A	FIRST ISSUE	
	B	FOR CONSULTATION	
	C	FOR TENDER	
DWG		Cross Sections of Whiriwhiritoa Cut	
Project		Whiriwhiritoa Stream	
Client		Northland Regional Council	
Project No.		8667	
RC no.		rc no	
Sheet No.		2 of 2	
DWG No.		CS2	

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Dimensions must not be scaled. Measure from these drawings. All levels, heights and angles are to be confirmed with the client. These drawings are the property of Haigh Workman Ltd. ©2020

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STOPBANK CUT/FILL SUMMARY

Stopbank	Net Fill (m³)	2D Area (m²)
Stopbank #1	1240m³	1370m²
Stopbank #2	150m³	290m²

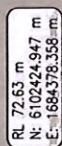
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Sheet No. 1 of 4		Client Northland Regional Council	
Project No. 8667		RC no. rc no	
DWG Stopbank Plan - Stopbank 1 & 2			
Issue	Date	Revision	
A	24/07/2020	STOPBANK 1 & 2 HAWTHORN GEDDES CONSENT DRAWINGS REMAIN UNCHANGED	
B	18/09/2020	FOR TENDER	
Scale 1: @A3		Drawn YZ	Checked SK
Date 24/07/2020		Approved JM	File
3 Elizabeth Street Whirinwhitoa E: info@hatchworkman.co.nz F: 09 425 1425 F: 09 425 1431 E: info@hatchworkman.co.nz			
DIMENSIONS MUST NOT BE SCALE MEASURED FROM THESE DRAWINGS. DIMENSIONS MUST BE CHECKED ON SITE PRIOR TO COMMENCING ANY WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY CONSENTS AND PERMITS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY CONSENTS AND PERMITS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY CONSENTS AND PERMITS.			

STOPBANK CUT/FILL SUMMARY

Stopbank	Net Fill (m ³)	2D Area (m ²)
Stopbank #3	200m ³	300m ²

NOTE: Stopbank boundaries based on NRC defined stopbank footprints. All crest widths to be 1.5m. All culvert locations to be confirmed on site. Setout points are to centrelines

USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.



STOP BANK 3
CREST LEVEL 72.95 RL
BATTER 1:3.5

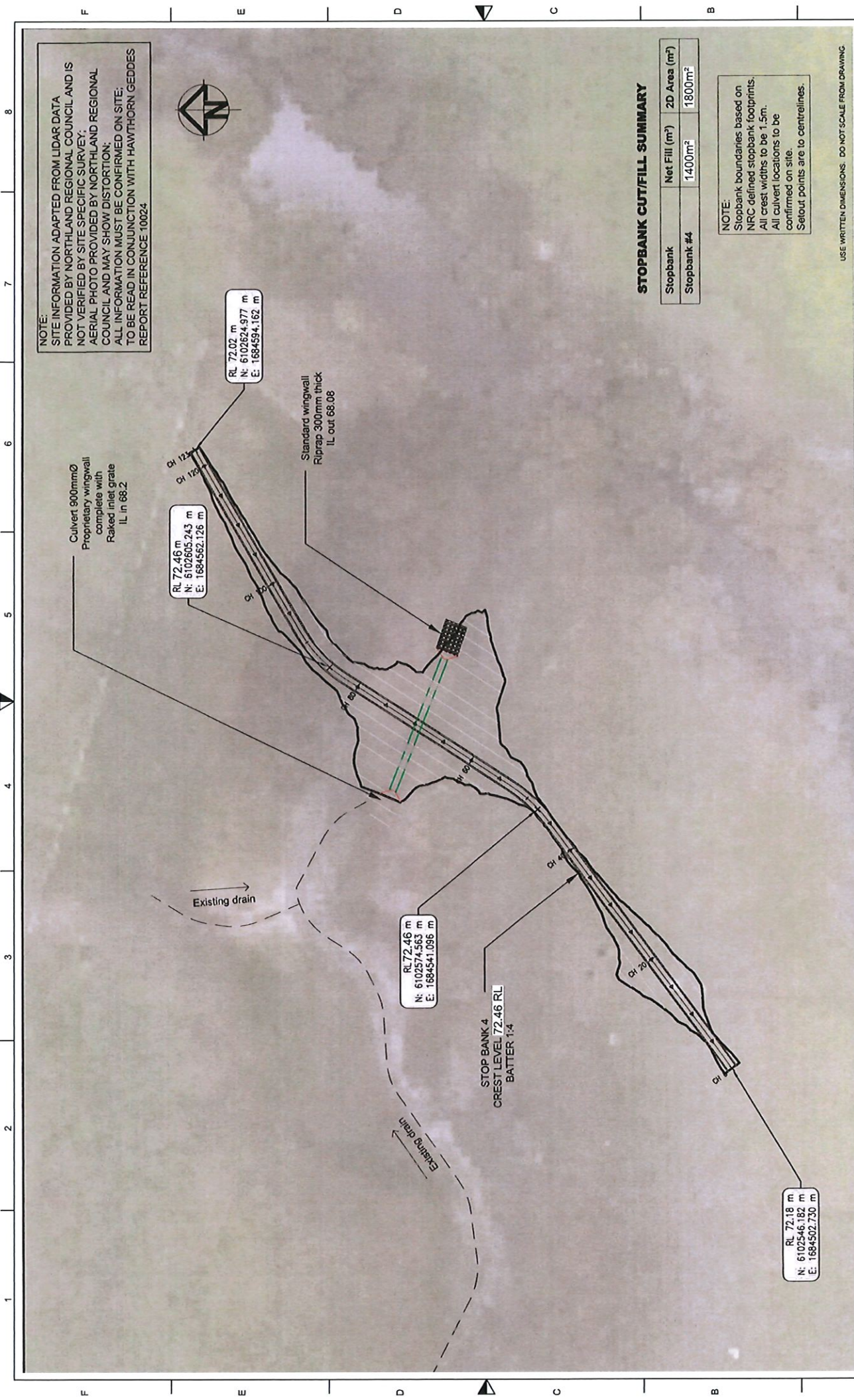
Deepen existing drain to 72.0m RL

Culvert 300mmØ
Proprietary wingwall
complete with
Raked inlet grate
IL in 72.0

RL 72.59 m
N: 6102398.884 m
E: 1684331.517 m

Standard wingwall
Riprap 300mm thick
IL out 71.95

[illegible]



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Project

Whinwhiria Stream
8 Taumata Close, Pahiia

Client

Northland Regional Council

Project No.

8667

RC no.

rc no.

DWG No.

SP3

Sheet No.

3 of 4

DWG Stopbank Plan - Stopbank 4

Scale 1:500 @A3

Drawn YZ

Checked SK

Approved JM

Date 24/07/2020

File S:\004-099100 - NURMIET - NRC WHINWHIRIA\DWG\1001 HS WHINWHIRIA FINALLING

Issue

Date

Revision

A

24/07/2020

STOPBANK 4 LEVELS AMENDED

B

18/09/2020

FOR TENDER

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Nurmi Sharma at 18/09/2020 9:37:40 AM



NOTE:
SITE INFORMATION ADAPTED FROM LIDAR DATA
PROVIDED BY NORTHLAND REGIONAL COUNCIL AND IS
NOT VERIFIED BY SITE SPECIFIC SURVEY.
AERIAL PHOTO PROVIDED BY NORTHLAND REGIONAL
COUNCIL AND MAY SHOW DISTORTION.
ALL INFORMATION MUST BE CONFIRMED ON SITE.
TO BE READ IN CONJUNCTION WITH HAWTHORN GEDDES
REPORT REFERENCE 10024

NOTE:
Stopbank boundaries based on
NRC defined stopbank footprints

USE WRITTEN DIMENSIONS. DO NOT SCALE FROM DRAWING.

A	Issue	Revision		DWG Stopbank Plan - Stopbank 5										Project		Whirihiritoa Stream		DWG No.			
	A	24/07/2020	STOPBANK 5 HAWTHORN GEDDES CONSENT DRAWINGS REMAIN UNCHANGED												Client		Northland Regional Council		Sheet No.		
	B	18/09/2020	FOR TENDER												Project No.		8667		4 of 4		
															RC no.				4 of 4		
															Project No.				4 of 4		
														Client		Northland Regional Council		rc no		4 of 4	
														Project No.		8667		rc no		4 of 4	
														RC no.						4 of 4	
														Project No.						4 of 4	
														RC no.						4 of 4	
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NOTES:
1. LOT BOUNDARIES AND AERIAL PHOTO INFORMATION
TAKEN FROM QUICKMAP.

TOTAL EARTHWORKS:
CUT VOLUME: 2765 m³
FILL VOLUME: 140 m³
COMBINED: 2905m³
BALANCE: 2625 m³
AREA: 4127 m²

LEGENDS:

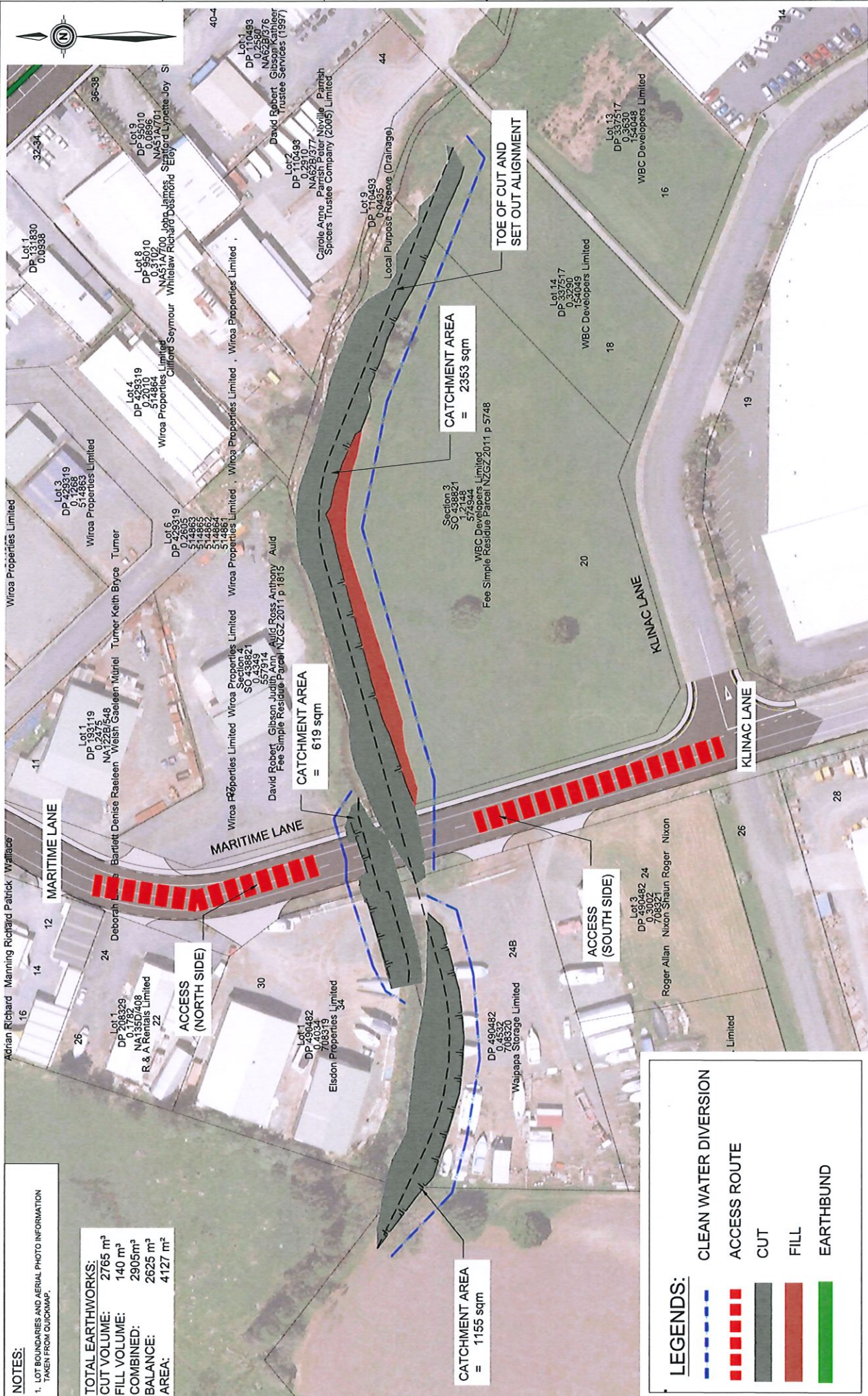
- CLEAN WATER DIVERSION
- ACCESS ROUTE
- CUT
- FILL
- EARTHBUND

CATCHMENT AREA
= 1155 sqm

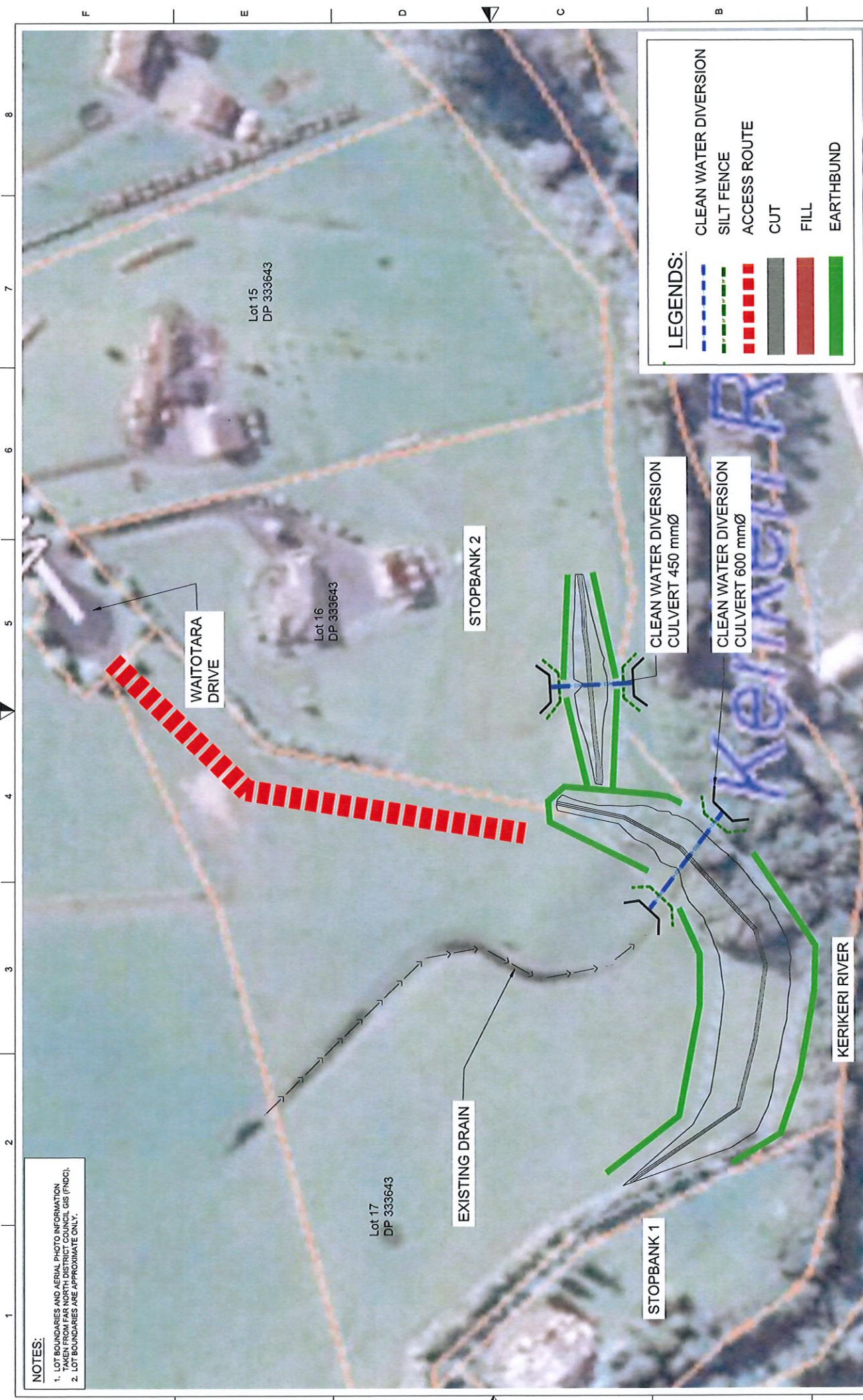
CATCHMENT AREA
= 619 sqm

CATCHMENT AREA
= 2353 sqm

TOE OF CUT AND
SET OUT ALIGNMENT



DWG		Erosion and Sediment Control Whirihiritoa Stream		Project		Whirihiritoa Stream Maritime Lane Bridge & State Highway 10		DWG No. EP1	
Revision				Client		Northland Regional Council		Sheet No. 1 of 6	
Date				Project No.		8667		RC no.	
A		FIRST ISSUE		3 Elizabeth Street Wellington P: 09 425 9422 F: 09 425 9422 E: info@hatchworkman.co.nz					
B		FOR CONSULTATION		DISCLAIMER: THIS DOCUMENT IS THE PROPERTY OF HATCHWORKMAN ENGINEERING LTD. IT IS TO BE USED FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED. IT IS NOT TO BE REPRODUCED, COPIED, OR USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN PERMISSION OF HATCHWORKMAN ENGINEERING LTD. ANY WORK, THE COPYRIGHT TO THESE DRAWINGS AND ALL PARTS THEREOF, REMAINS THE PROPERTY OF HATCHWORKMAN LTD. 202008					
C		FOR TENDER		Scale 1:1000 @A3					
				10 5 0 10 20 30 m					
				Date 09/09/2020					
				Drawn NS		Checked JM		Approved JM	
				File					
				E:\000-APPEND - APPEND - WHIRIWHIRITOA - DRAWING\HWAITOC\DWG07 - V111 NS (E)EP.DWG					



NOTES:
1. LOT BOUNDARIES AND AERIAL PHOTO INFORMATION
TAKEN FROM FAR NORTH DISTRICT COUNCIL GIS (FNDCI).
2. LOT BOUNDARIES ARE APPROXIMATE ONLY.

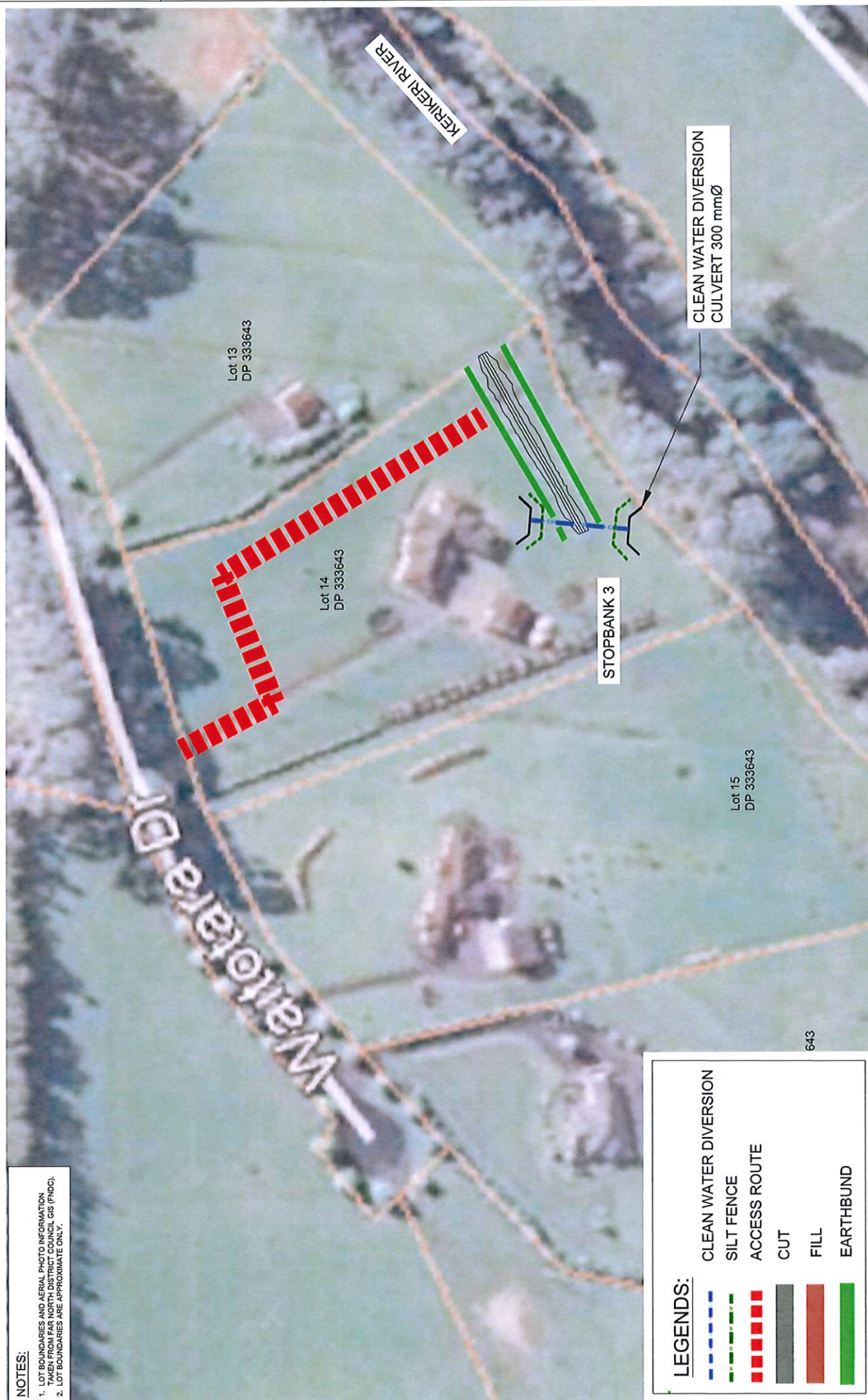
LEGENDS:

- CLEAN WATER DIVERSION
- SILT FENCE
- ACCESS ROUTE
- CUT
- FILL
- EARTHBUND

Issue		Date	Revision
A	FIRST ISSUE	09/09/2020	
B	FOR TENDER	18/09/2020	
Drawn		NS	Checked
Scale		1:1000 @A3	10 5 0 10 20 30 m
Date		09/09/2020	Approved
File		JM	
DWG Erosion & Sediment Control Plan Stopbanks 1 & 2			
Project		Kerikeri River Stop Banks	
Client		Northland Regional Council	
Project No.		8667	RC no.
DWG No.		EP2	Sheet No.
			2 of 6

NOTES:

1. LOT BOUNDARIES AND AERIAL PHOTO INFORMATION TAKEN FROM FAR NORTH DISTRICT COUNCIL GIS (FNDCI).
2. LOT BOUNDARIES ARE APPROXIMATE ONLY.



LEGENDS:

- CLEAN WATER DIVERSION
- SILT FENCE
- ACCESS ROUTE
- CUT
- FILL
- EARTHBOUND

Issue	Date	Revision
A	09/09/2020	FIRST ISSUE
B	19/09/2020	FOR TENDER

DWG	Erosion & Sediment Control Plan	Stopbank 3
Scale	1:1000 @A3	10 5 0 10 20 30 m
Drawn	NS	Checked JM
Approved	JM	Date 09/09/2020
File		

HAIGH WORKMAN	Project	Kerikeri River Stop Banks	DWG No.	EP3
3 Elizabeth Street Newmarket T: 09 452 9425 F: 09 452 9431 E: info@haighworkman.co.nz	Client	Northland Regional Council	Sheet No.	3 of 6
HAIGH WORKMAN Civil & Structural Engineers	Project No.	8667	RC no.	rc no
HAIGH WORKMAN Civil & Structural Engineers				

Elevation

Silt fence with support wire

Cross-section

Standard fabric joint

Cross Section

'CLEAN WATER' DIVERGING CHANNEL & BUND (REFER TO GD05 SECTION E.2.1)
N.T.S

Issue	Date	Revision	DWG	Erosion and Sediment Control Typical Details	<
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