Whirinaki Resilience Project

State Highway 2 & North Shore Road Raising

Preliminary Design Report

Prepared for Hawkes Bay Regional Council by Civil & Transportation Design Ltd (CTD)

8 August 2025

Rev2

Contents

1. Introduction

1.1 General

Civil & Transportation Design Ltd (CTD) have been engaged by Hawkes Bay Regional Council (HBRC) to undertake the engineering design of the proposed road raising of State Highway 2 (SH2), and North Shore Road, Whirinaki.

The project has been generated as part of the HBRC Flood Resilience Project to provide flood protection to the community of Whirinaki and industrial area of Pan Pac and surrounding properties. As part of the project, a new stop bank is proposed to run alongside the existing Whirinaki stream from the Pan Pac site out to the Esk river mouth SH2. The proposed stop bank alignment intersects with SH2 and North Shore Road, and as such the road is required to be raised to match the stop bank level.

This report documents the design parameters for the road raising works. The stop bank design is completed by others.

1.2 Site Locality and Details

The location of the road raising sites are shown on Figure 1 below, with the crest of the SH2 raising at RP 10.020 and approximately 67m into North Shore Road, Whirinaki.

The extent of roading works on SH2 as shown on Figure 2 below is approximately 426m long (002-0626-B from RP 9.806 to RP 10.232). The AADT of this section of SH2 is 5,400 with 20% heavy vehicles[1] and the One Network Road Classification (ONRC) of SH2 is Regional. The posted speed limit of this section of SH2 is 100 km/h.

The extent of works on North Shore Road as shown on Figure 3 below is approximately 145m. The AADT of North Shore Road is 375 with 11.5% heavy vehicles[1], the ONRC is Access, and the posted speed limit of North Shore Road is 50 km/h.

[1] Mobileroad.org

Figure 1 - Site Locations

Figure 2 - SH2 Extent of Works

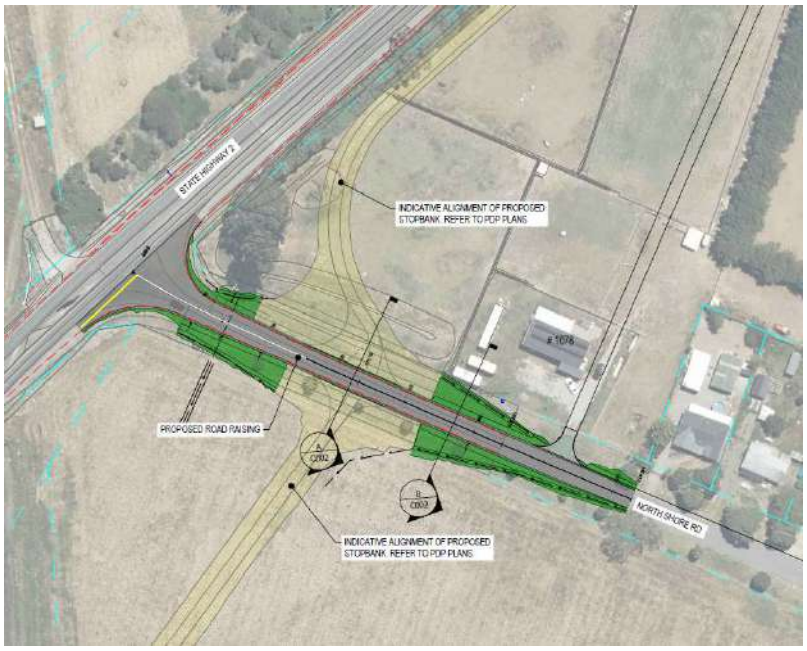


Figure 3 - North Shore Road Extent of Works

2. Design Philosophy

The general design philosophy is to ensure the road level matches the proposed stop bank level where the stopbank intersects the road, to provide the required flood resilience. To match the proposed stopbank height, SH2 is required to be raised in excess of 1.9m and North Shore Road is required to be raised approximately 1.3m. The longitudinal road gradients to the crest of the lift shall be compatible with state highway traffic ensuring safe design geometry is achieved.

The proposed road design will utilise the footprint of the current road alignments.

The road cross sections have been configured to match current cross sections ensuring compliance with relevant safety and design standards. Safety improvements will be implemented where possible.

3. Design Standards

The following design standards have been referred to during the design:

- Austroads Guide to Road Design (AGRD) Parts 3, 4, & 4a,
- NZTA State Highway Geometric Design manual (SHGDM)
- Hastings District Council Engineering Code of Practice (HDC ECOP)
- Traffic control devices manual (TCD)
- NZTA Guidelines for visibility at driveways (RTS6)

4. Design Speed

This section of SH2 has a posted speed limit of 100 km/h and the mean operating speed is estimated at 90 – 94 km/h[2]. A design speed of 100 km/h has been adopted for SH2.

[2] NZTA Megamaps

The posted speed limit on North shore Road is 50 km/h and the mean operating speed is estimated at <30km/h[2]. A design speed of 50km/h has been adopted for the majority of North Shore Road with a 40km/h design speed adopted at approach to the intersection with SH2.

5. Design Cross Section

5.1 SH2

The design cross section on SH2 aims to replicate the existing road cross section and in accordance with NZTA SHGDM Figure 6.3, Group 1. The design cross section comprises two 3.5m traffic lanes with a 1.5m sealed shoulder and 500mm unsealed shoulder.

A 1:6 fill batter of varying width then interfaces from the shoulder to a road side drain.

5.2 North Shore Rd

The design cross section on North Shore Road matches the existing cross section with two 2.75m lanes in accordance with table C4 of the HDC ECOP widening out to 3.5m at the intersection. A 0.5m sealed shoulder is proposed. Similarly to SH2, a 1:6 fill slope interfaces to a road side drain.

6. Road Geometry

6.1 Horizontal Alignment

The design centreline of both SH2 and North Shore Road match the existing straight alignment with no kinks or curves proposed.

On SH2 the design ties in near an existing curve at the northern end, where superelevation is currently being developed. The design surface matches the existing superelevation. Based on a 100 km/h design speed the superelevation runoff has been calculated using a warp rate of 2.5% per second.

6.2 Vertical Alignment

Following the AGRD Part 3 guidelines, the vertical design alignment follows the following design parameters:

Gradient

- Desirable maximum gradient is 3 -5%
- Minimum gradient is 0.5%.
- Desirable maximum gradient on approaches to intersections is 3%.

Crest curves

- Vertical curve K values are based desirable minimum values as per Table 8.7 of AGRD Part 3, with a reaction time of 2.0 seconds to satisfy stopping sight distance in the first instance. Minimum curve length to satisfy appearance criteria has also been applied.
- The design speed for crest vertical curve selection is 100km/h for SH2 and 50km/h on North Shore Road.
- The minimum crest curve K value for SH2 is 60.8.
- The minimum crest curve K value for North Shore Road is 6.8.

Sag Curves

- Sag vertical curves have been designed to satisfy comfort, headlight sight distance, and aesthetics criteria in accordance with Figure 8.9 of AGRD Part 3 and based on a design speed of 100km/h for SH2 and 50km/h (40km/h on approach to the intersection) on North Shore Road.
- The minimum sag curve K value for SH2 is 42.
- The minimum sag curve K value for North Shore Road is 7 (4 at the intersection).

7. Stormwater

The road has been designed to ensure that the road will shed stormwater run-off from the road and is captured in roadside drains. Minimum culvert size on SH2 will be 375mm and traversable headwalls are proposed.

The stormwater design including reporting, calculations and culvert sizing will be completed by others.

8. Sight Distance

Sight distance has been assessed in accordance with AGRD Part 3, Part 4a and RTS6 for the design speeds referenced above. All sight distance requirements are achieved.

As documented in section 6 - Road Geometry, the vertical alignment has been designed to satisfy safe stopping distance sight lines.

Sightlines at access locations on SH2 (Contact Energy entrance and the access to 1076) have been assessed using SISD requirements both horizontally and vertically for a design speed of 100 km/h with 248m required.

Sightlines for the access to 1078 on North Shore road has been assessed in accordance with RTS 6 both horizontally and vertically for a design speed of 50 km/h with 40m required.

Approach sight distance (ASD) at the intersection of North Shore Road has also been assessed and achieved in accordance with AGRD Part 4a for a design speed of 50 km/h with 55m required.

9. Pavement Design

A full pavement design has been completed by Pinnacles Civil and the pavement design report is appended to this report.

A summary of the pavement design is below:

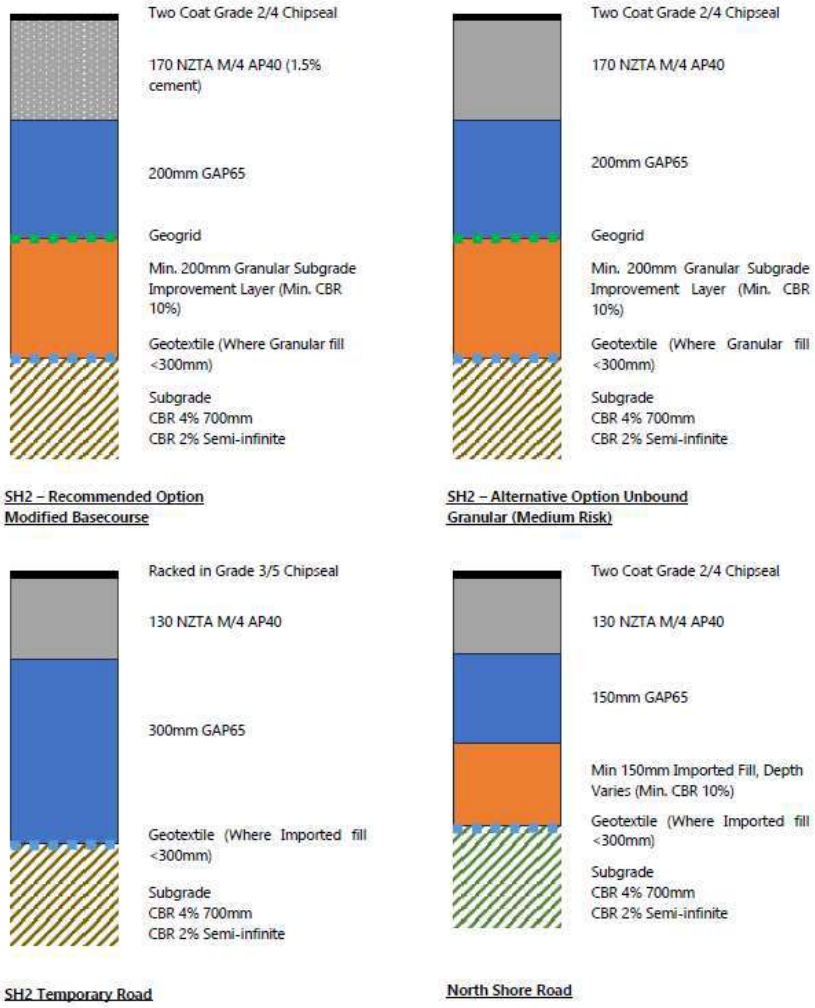


Figure 4 - Pavement Design Summary (Source: Pinnacles Pavement Design Report)

10. Road Marking and Signage

Road marking has been proposed in accordance with TCD Manual and will match the existing layout. New signage will be installed where required to replace old signage. The road marking and signage design will be finalised prior to detailed design.

11. Utility Services

Clashes with utility services have been avoided where possible, however the proposed design will require several power poles, light poles and telecoms infrastructure to be relocated. A section of existing watermain is required to be raised / relocated. The design of this watermain is to be complete by others.

Liaison with the affected utility operators will continue throughout detailed design as the layout is refined and more certainty of service relocation and/or protection requirements are known.

12. Geotechnical

A geotechnical assessment of the proposed road fill will be completed by others before detailed design. Several boreholes and CPT test pits have been completed to inform this report. Any recommendations from this assessment will be incorporated into the detailed design.

13. Land Requirements

Land acquisition is proposed in several locations along the project route to accommodate the proposed road footprint and roadside drains. A preliminary land acquisition plan has been completed, and land acquisition is under negotiation with the respective property owners. Proposed property boundaries will be finalised during detailed design.

14. Safe System Audit

A safe system audit will be undertaken on the preliminary design drawings. Any issues raised will be addressed in accordance with the safe system audit process.

15. Risk Assessment

A project risk assessment will be undertaken and documented by HBRC.

16. Safety in design

Safety in design is currently underway and will be complete prior to the issue of final detailed design.

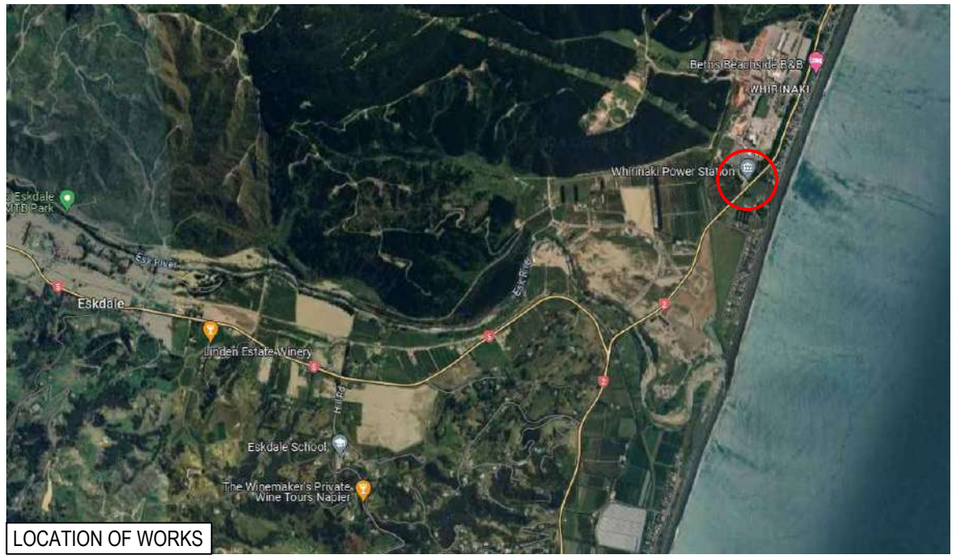
17. Departure from Standards

No departure from standards have been identified.

Appendices

Preliminary Design Drawings

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT
STATE HIGHWAY 2 RAISING



LOCATION OF WORKS

SHEET NO	SHEET TITLE	REV
G001	COVER SHEET & DRAWING INDEX	A
C001	OVERALL PLAN	A
C002	TYPICAL SECTIONS - SHEET 1 OF 1	A
C101	PLAN & LONGITUDINAL SECTION - SH2 (SHEET 1 OF 2)	A
C102	PLAN & LONGITUDINAL SECTION - SH2 (SHEET 2 OF 2)	A
C201	CROSS SECTIONS - SH2 (SHEET 1 OF 10)	A
C202	CROSS SECTIONS - SH2 (SHEET 2 OF 10)	A
C203	CROSS SECTIONS - SH2 (SHEET 3 OF 10)	A
C204	CROSS SECTIONS - SH2 (SHEET 4 OF 10)	A
C205	CROSS SECTIONS - SH2 (SHEET 5 OF 10)	A
C206	CROSS SECTIONS - SH2 (SHEET 6 OF 10)	A
C207	CROSS SECTIONS - SH2 (SHEET 7 OF 10)	A
C208	CROSS SECTIONS - SH2 (SHEET 8 OF 10)	A
C209	CROSS SECTIONS - SH2 (SHEET 9 OF 10)	A
C210	CROSS SECTIONS - SH2 (SHEET 10 OF 10)	A
C301	SERVICES PLAN	A
C401	SIGHTLINES PLAN - SHEET 1 OF 5	A
C402	SIGHTLINES PLAN - SHEET 2 OF 5	A
C403	SIGHTLINES PLAN - SHEET 3 OF 5	A
C404	SIGHTLINES PLAN - SHEET 4 OF 5	A
C405	SIGHTLINES PLAN - SHEET 5 OF 5	A
C501	PLAN AND LONGITUDINAL SECTION -TEMPORARY BYPASS ROAD - (SHEET 1 OF 2)	A
C502	PLAN AND LONGITUDINAL SECTION -TEMPORARY BYPASS ROAD - (SHEET 1 OF 2)	A

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

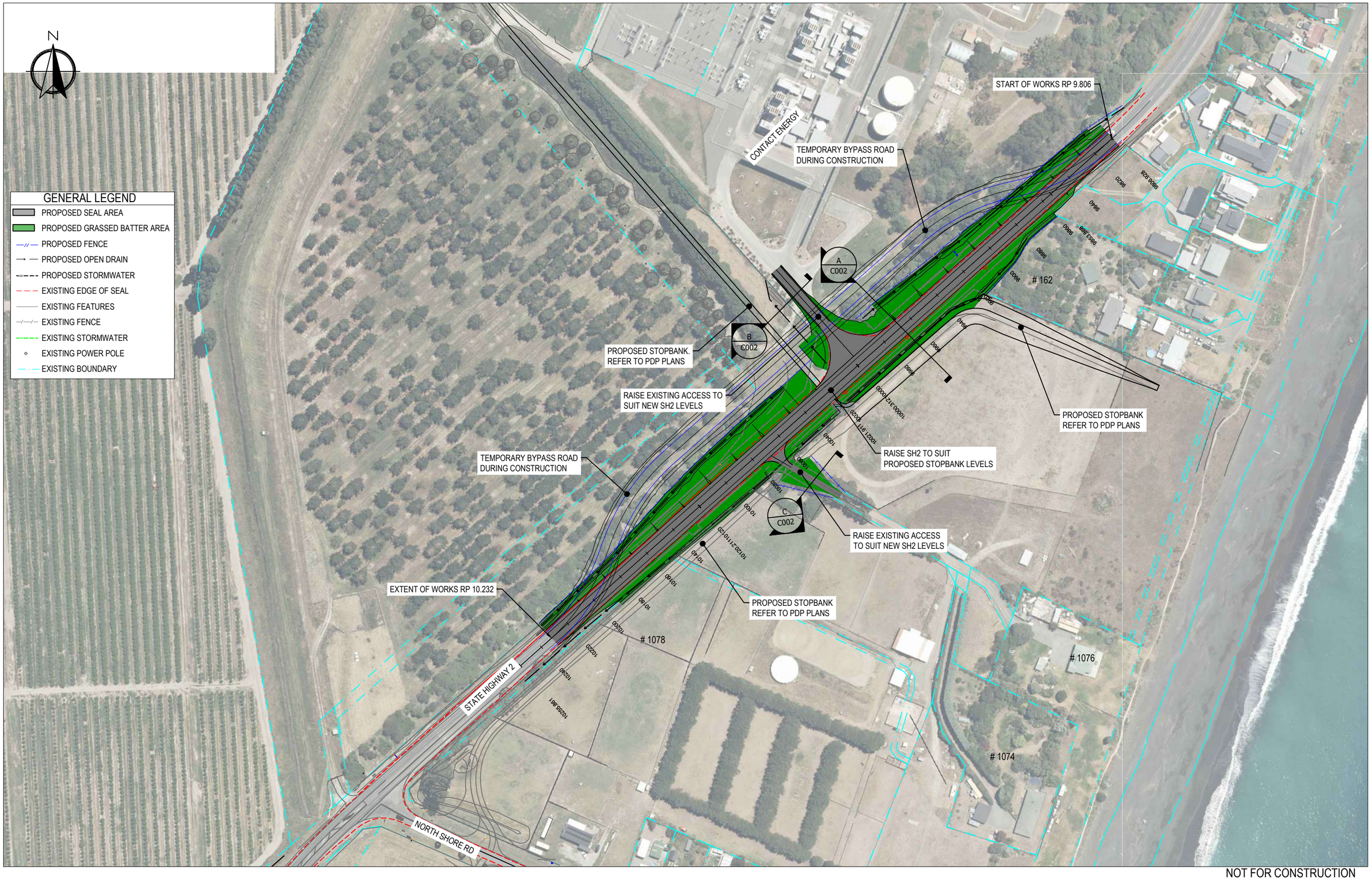
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
COVER SHEET & DRAWING INDEX

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: AS SHOWN
DRAWING NO.: 24-05-04-G001
REV: A



NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

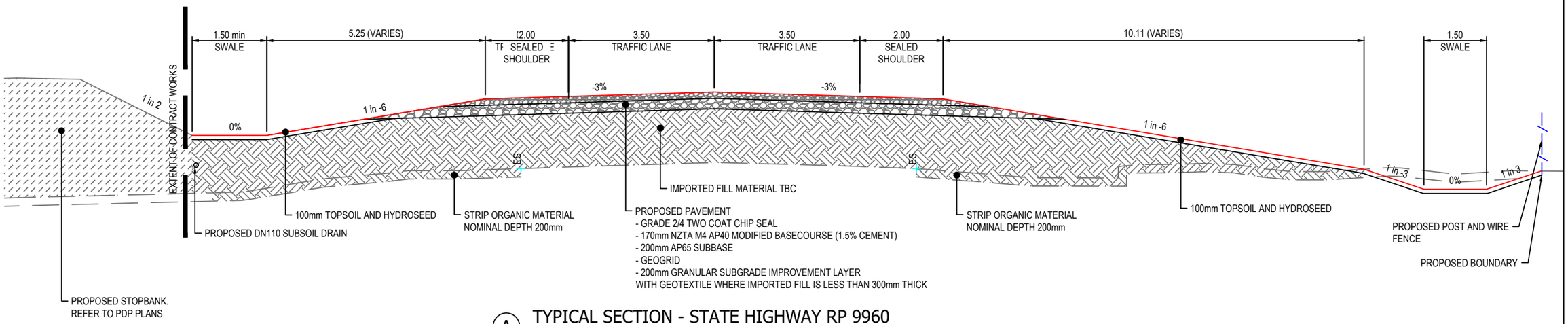
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

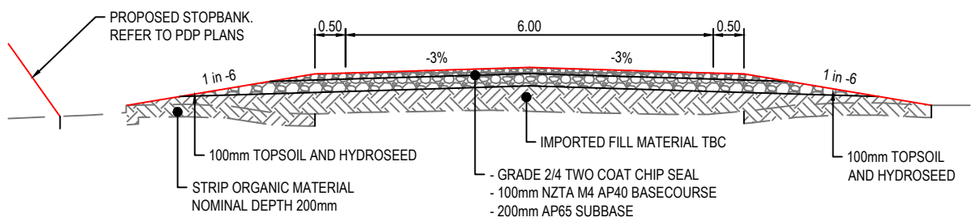
HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
OVERVIEW PLAN

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:1000
DRAWING NO.: 24-05-04-C001
REV: A



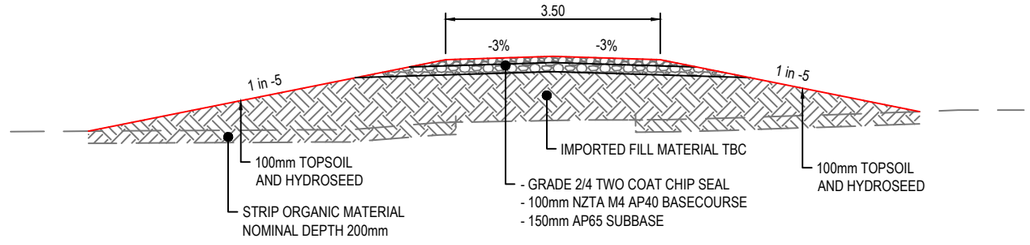
A TYPICAL SECTION - STATE HIGHWAY RP 9960

Scale: 1:50



B TYPICAL SECTION - CONTACT ENERGY ENTRANCE

Scale: 1:50



C TYPICAL SECTION - ACCESS TO 1076

Scale: 1:50

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
			-		
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

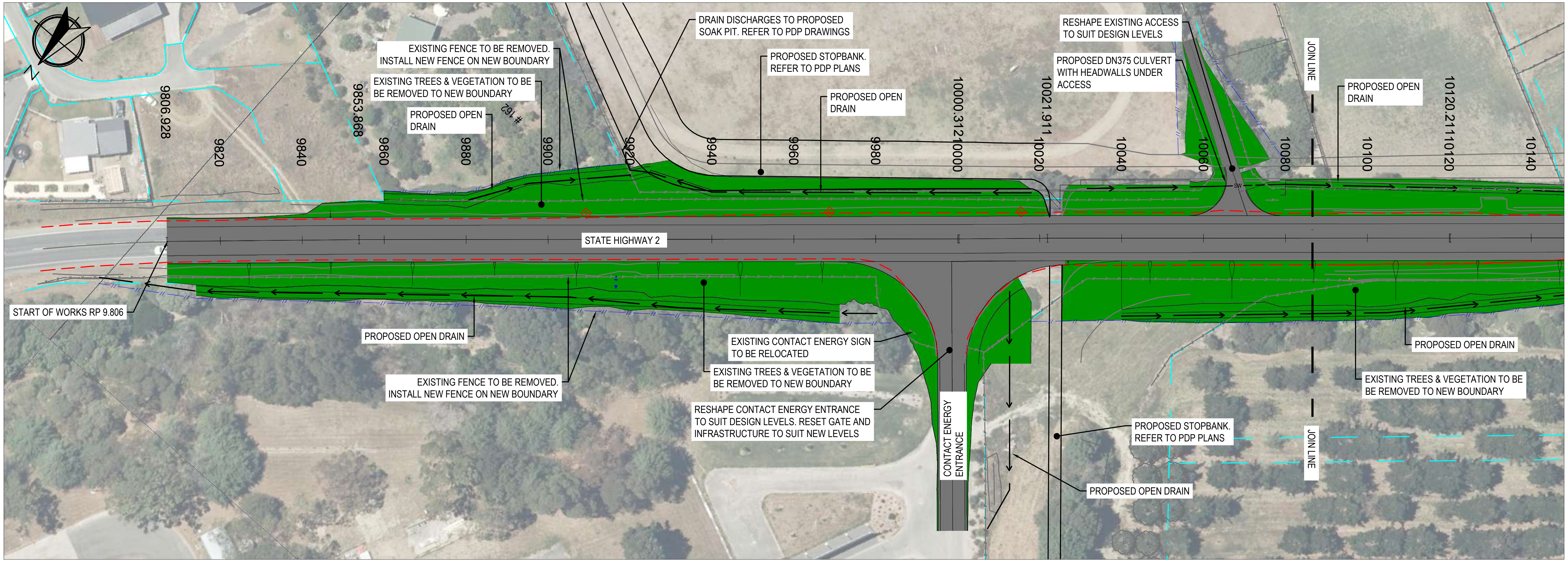
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

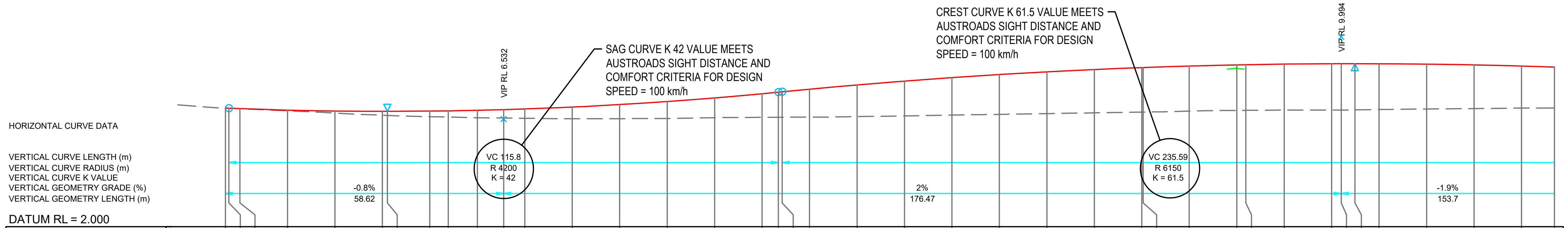
CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
TYPICAL SECTIONS
SHEET 1 OF 1

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: AS SHOWN
DRAWING NO.: 24-05-04-C002
REV: A





DATUM RL = 2.000

FINISHED SURFACE LEVEL	6.998	6.992	6.974	6.912	6.874	6.859	6.859	6.869	6.879	6.902	6.931	6.959	7.040	7.145
EXISTING SURFACE LEVEL	6.996	6.989	6.968	6.882	6.788	6.696	6.688	6.636	6.617	6.588	6.576	6.566	6.544	6.552
CUT / FILL DEPTH	0.002	0.003	0.005	0.030	0.086	0.164	0.171	0.233	0.262	0.314	0.355	0.393	0.495	0.593
CHAINAGE	9806.928	9807.645	9810	9820	9830	9840	9841.035	9850	9853.868	9860	9865.546	9870	9880	9890
SUPERELEVATION														

FINISHED SURFACE LEVEL	7.273	7.425	7.601	7.668	7.683	7.794	7.972	8.135	8.281	8.411	8.524	8.622	8.703	8.705
EXISTING SURFACE LEVEL	6.558	6.589	6.606	6.610	6.611	6.616	6.636	6.667	6.700	6.733	6.763	6.795	6.827	6.828
CUT / FILL DEPTH	0.715	0.836	0.995	1.058	1.072	1.178	1.336	1.468	1.581	1.678	1.761	1.826	1.876	1.878
CHAINAGE	9900	9910	9920	9923.446	9924.219	9930	9940	9950	9960	9970	9980	9990	10000	10000.312
SUPERELEVATION														

FINISHED SURFACE LEVEL	8.768	8.816	8.824	8.849	8.865	8.866	8.867	8.865	8.848	8.815	8.767	8.723
EXISTING SURFACE LEVEL	6.868	6.897	6.900	6.914	6.912	6.911	6.919	6.934	6.956	6.976	6.993	6.997
CUT / FILL DEPTH	1.900	1.919	1.924	1.935	1.953	1.955	1.947	1.930	1.892	1.840	1.774	1.726
CHAINAGE	10010	10020	10021.911	10030	10040	10042.012	10044.892	10050	10060	10070	10080	10086.928
SUPERELEVATION												

A1 SCALE: H 1:500, V 1:100

LONGITUDINAL SECTION RS04

GENERAL LEGEND

▨	PROPOSED SEAL AREA
🟩	PROPOSED GRASSED BATTER AREA
—//—	PROPOSED FENCE
—→—	PROPOSED OPEN DRAIN
- - -	PROPOSED STORMWATER
— —	EXISTING EDGE OF SEAL
——	EXISTING FEATURES
—/—/—	EXISTING FENCE
—SW—	EXISTING STORMWATER
○	EXISTING POWER POLE
——	EXISTING BOUNDARY

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

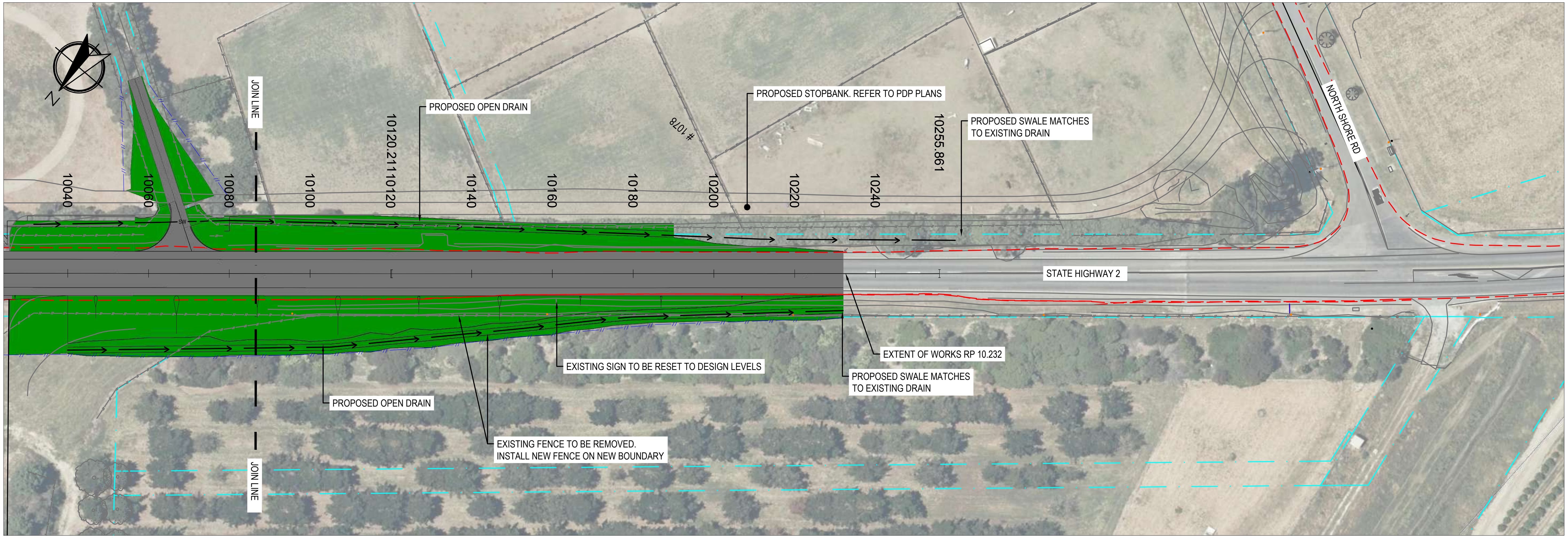
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

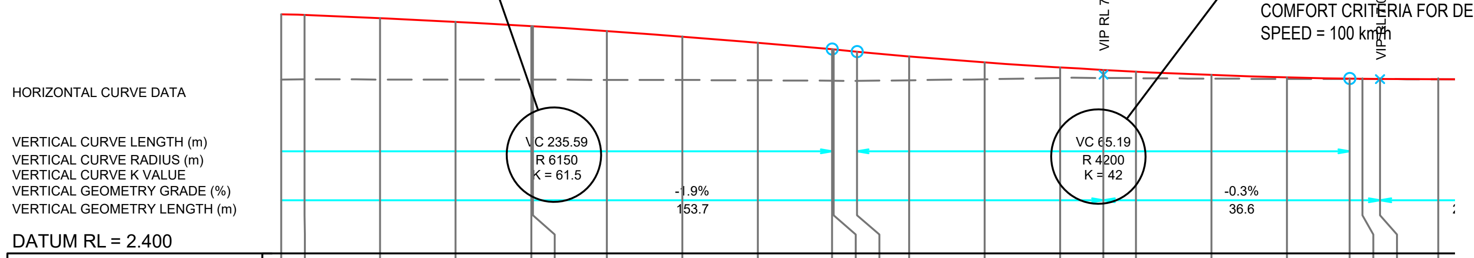
HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
PLAN AND LONGITUDINAL SECTION - SH2
SHEET 1 OF 2

DRAWING STATUS:
PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:500 H, 1:100 V
DRAWING NO. 24-05-04-C101
REV A



CREST CURVE K 61.5 VALUE MEETS AUSTROADS SIGHT DISTANCE AND COMFORT CRITERIA FOR DESIGN SPEED = 100 km/h

SAG CURVE K 42 VALUE MEETS AUSTROADS SIGHT DISTANCE AND COMFORT CRITERIA FOR DESIGN SPEED = 100 km/h



DATUM RL = 2.400

FINISHED SURFACE LEVEL	8.723	8.701	8.620	8.522	8.408	8.405	8.278	8.131	7.969	7.793	7.789
EXISTING SURFACE LEVEL	6.997	6.998	6.996	6.994	6.991	6.991	6.987	6.982	6.975	6.963	6.963
CUT / FILL DEPTH	1.726	1.703	1.624	1.528	1.417	1.415	1.290	1.149	0.994	0.830	0.826
CHAINAGE	10086.928	10090	10100	10110	10120	10120.211	10130	10140	10150	10159.804	10160
SUPERELEVATION											

FINISHED SURFACE LEVEL	7.731	7.608	7.450	7.315	7.249	7.204	7.117	7.054	7.019	7.014	7.006	7.003
EXISTING SURFACE LEVEL	6.961	6.977	7.002	7.036	7.036	7.030	7.019	7.009	7.008	7.007	7.006	7.004
CUT / FILL DEPTH	0.770	0.631	0.447	0.279	0.213	0.174	0.098	0.045	0.011	0.007	0.000	-0.002
CHAINAGE	10163.117	10170	10180	10190	10195.712	10200	10210	10220	10228.306	10230	10232.312	10240
SUPERELEVATION												

A1 SCALE: H 1:500, V 1:100

LONGITUDINAL SECTION RS04

GENERAL LEGEND

▨	PROPOSED SEAL AREA
🟩	PROPOSED GRASSED BATTER AREA
—//—	PROPOSED FENCE
→ —	PROPOSED OPEN DRAIN
----	PROPOSED STORMWATER
- - -	EXISTING EDGE OF SEAL
——	EXISTING FEATURES
—/—/—	EXISTING FENCE
----	EXISTING STORMWATER
○	EXISTING POWER POLE
— · —	EXISTING BOUNDARY

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

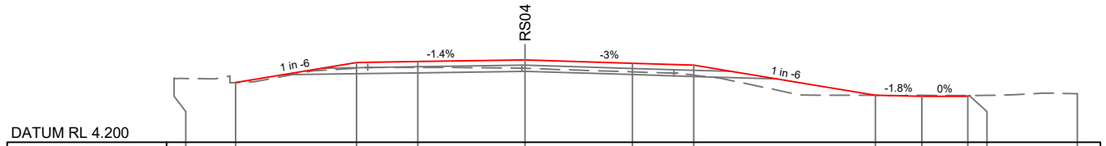
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
PLAN AND LONGITUDINAL SECTION - SH2
SHEET 2 OF 2

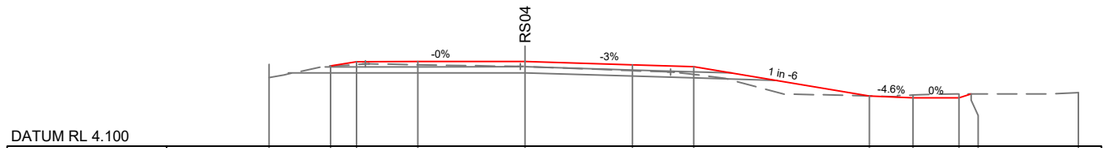
DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:500 H, 1:100 V
DRAWING NO. 24-05-04-C102
REV A



DATUM RL 4.200

FINISHED SURFACE LEVEL		6.146		6.804	6.832	6.882	6.777	6.717		5.730	5.703	5.703	5.727	
CUT / FILL		0.000		0.191	0.193	0.271	0.280	0.327		0.000	-0.029	-0.024	0.000	
EXISTING SURFACE LEVEL	6.302	6.146		6.613	6.640	6.611	6.497	6.390		5.730	5.732	5.726	5.727	5.786
OFFSET FROM CENTRELINE	-11.446	-9.446		-5.500	-3.500	0.000	3.500	5.500		11.423	12.944	14.444	14.516	18.016

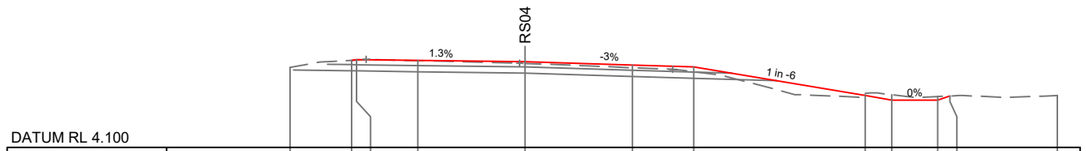
CH 9855



DATUM RL 4.100

FINISHED SURFACE LEVEL			6.716	6.857	6.858	6.859	6.754	6.694		5.739	5.673	5.673	5.804	
CUT / FILL			0.000	0.096	0.103	0.164	0.192	0.255		0.000	-0.095	-0.130	0.000	
EXISTING SURFACE LEVEL	6.770		6.716	6.762	6.755	6.696	6.562	6.439		5.739	5.768	5.803	5.804	5.844
OFFSET FROM CENTRELINE	-8.349		-6.349	-5.500	-3.500	0.000	3.500	5.500		11.232	12.654	14.154	14.547	18.047

CH 9840



DATUM RL 4.100

FINISHED SURFACE LEVEL			6.937	6.964	6.937	6.890	6.785	6.725		5.792	5.643	5.643	5.776	
CUT / FILL			0.000	0.019	0.008	0.052	0.089	0.157		0.064	-0.175	-0.113	0.000	
EXISTING SURFACE LEVEL	6.705		6.937	6.945	6.929	6.837	6.696	6.568		5.728	5.817	5.755	5.776	5.790
OFFSET FROM CENTRELINE	-7.663		-5.663	-5.500	-3.500	0.000	3.500	5.500		11.098	11.958	13.458	13.858	17.358

CH 9825

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

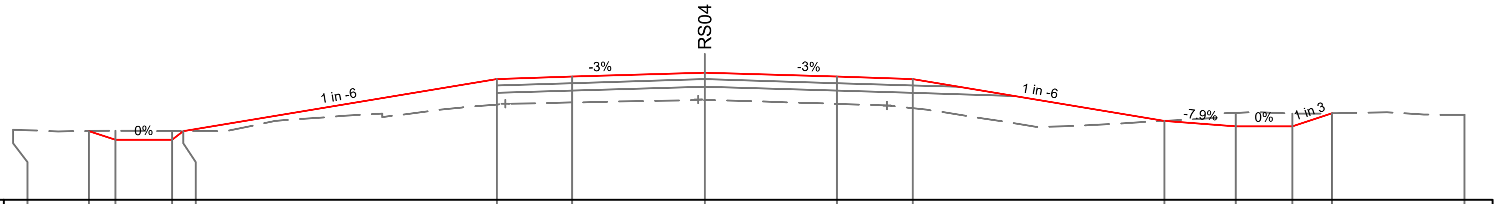
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 1 OF 10

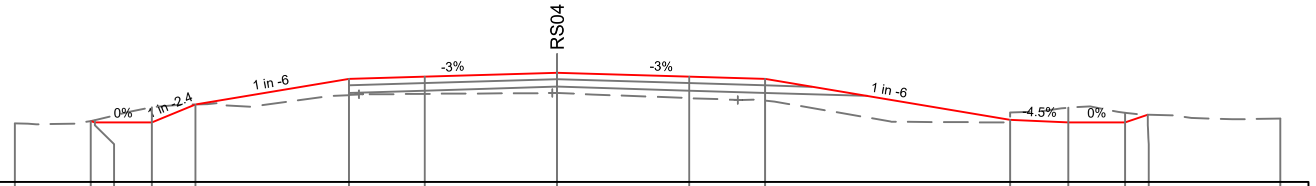
DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO. 24-05-04-C201
REV A



DATUM RL 3.900

FINISHED SURFACE LEVEL		5.728	5.492	5.492	5.725	7.108	7.168	7.273	7.168	7.108	5.997	5.847	5.847	6.197	
CUT / FILL		0.000	-0.244	-0.233	-0.000	0.680	0.685	0.715	0.722	0.778	0.000	-0.360	-0.346	0.000	
EXISTING SURFACE LEVEL	5.757	5.728	5.736	5.725	5.725	6.428	6.483	6.558	6.446	6.330	5.997	6.207	6.193	6.197	6.156
OFFSET FROM CENTRELINE	-18.300	-16.300	-15.592	-14.092	-13.799	-5.500	-3.500	0.000	3.500	5.500	12.165	14.058	15.558	16.606	20.106

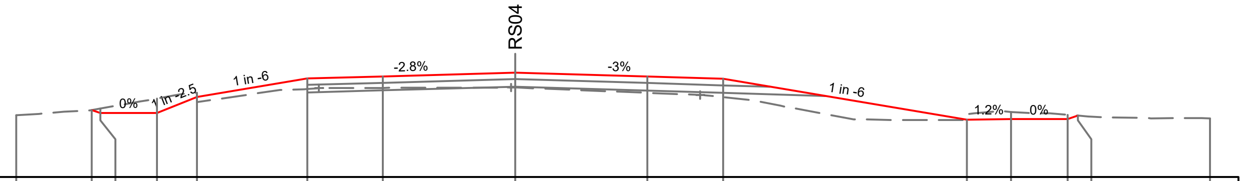
CH 9900



DATUM RL 4.200

FINISHED SURFACE LEVEL		5.811	5.771	5.771	6.246	6.924	6.984	7.089	6.984	6.924	5.844	5.775	5.775	5.976	
CUT / FILL		0.000	-0.066	-0.404	-0.000	0.427	0.456	0.540	0.568	0.577	0.073	-0.386	-0.256	0.000	
EXISTING SURFACE LEVEL	5.744	5.811	5.837	6.175	6.246	6.497	6.528	6.549	6.416	6.347	5.771	6.161	6.031	5.976	5.877
OFFSET FROM CENTRELINE	-14.339	-12.339	-12.221	-10.721	-9.566	-5.500	-3.500	0.000	3.500	5.500	11.981	13.520	15.020	15.624	19.124

CH 9885



DATUM RL 4.200

FINISHED SURFACE LEVEL		5.967	5.891	5.891	6.317	6.804	6.860	6.959	6.854	6.794	5.718	5.733	5.733	5.823	
CUT / FILL		0.000	-0.115	-0.383	-0.107	0.278	0.304	0.393	0.428	0.483	0.013	-0.189	-0.111	0.000	
EXISTING SURFACE LEVEL	5.830	5.967	6.007	6.275	6.424	6.526	6.556	6.566	6.426	6.311	5.705	5.921	5.843	5.823	5.749
OFFSET FROM CENTRELINE	-13.208	-11.208	-10.982	-9.482	-8.426	-5.500	-3.500	0.000	3.500	5.500	11.955	13.121	14.621	14.892	18.392

CH 9870

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD
CIVIL & TRANSPORTATION DESIGN

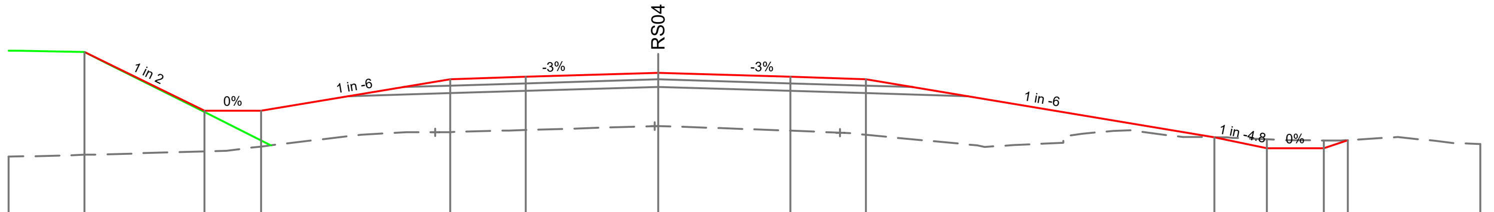
HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 2 OF 10

DRAWING STATUS:
PRELIMINARY

PLOT DATE: 08.08.2025
SCALE AT A1: 1:100 H, 1:100 V

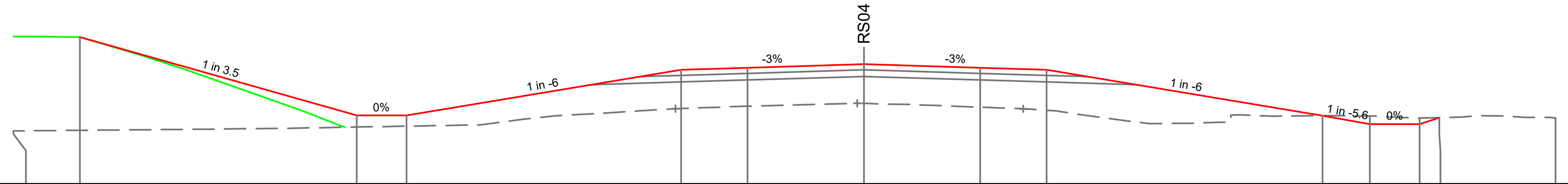
DRAWING NO. 24-05-04-C202
REV A



DATUM RL 4.300

FINISHED SURFACE LEVEL		8.608	7.055	7.055	7.890	7.950	8.055	7.950	7.890	6.355	6.065	6.065	6.279	
CUT / FILL		2.715	1.077	0.944	1.397	1.405	1.403	1.423	1.470	0.000	-0.234	-0.207	0.000	
EXISTING SURFACE LEVEL	5.844	5.892	5.978	6.111	6.493	6.546	6.652	6.528	6.420	6.355	6.299	6.273	6.279	6.176
OFFSET FROM CENTRELINE	-17.181	-15.181	-12.004	-10.504	-5.500	-3.500	0.000	3.500	5.500	14.715	16.109	17.609	18.251	21.751

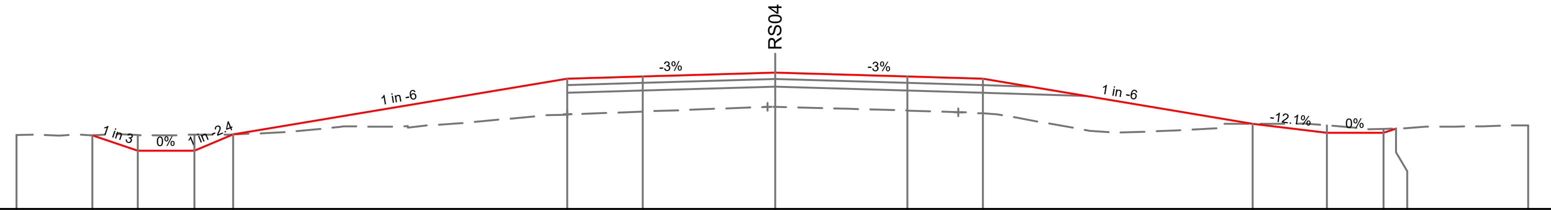
CH 9945



DATUM RL 4.200

FINISHED SURFACE LEVEL		8.608	6.252	6.252	7.629	7.689	7.794	7.689	7.629	6.245	5.993	5.993	6.190	
CUT / FILL		2.801	0.346	0.320	1.166	1.157	1.178	1.184	1.218	0.000	-0.248	-0.183	0.000	
EXISTING SURFACE LEVEL	5.787	5.807	5.906	5.932	6.463	6.532	6.616	6.505	6.410	6.245	6.241	6.175	6.190	6.179
OFFSET FROM CENTRELINE	-25.591	-23.591	-15.266	-13.766	-5.500	-3.500	0.000	3.500	5.500	13.804	15.224	16.724	17.315	20.815

CH 9930



DATUM RL 3.900

FINISHED SURFACE LEVEL		5.848	5.447	5.447	5.872	7.345	7.405	7.510	7.405	7.345	6.157	5.920	5.920	6.030	
CUT / FILL		0.000	-0.408	-0.419	-0.000	0.946	0.927	0.910	0.900	0.916	0.000	-0.192	-0.100	0.000	
EXISTING SURFACE LEVEL	5.861	5.848	5.855	5.866	5.872	6.399	6.478	6.601	6.505	6.430	6.157	6.112	6.020	6.030	6.112
OFFSET FROM CENTRELINE	-20.069	-18.069	-16.866	-15.366	-14.340	-5.500	-3.500	0.000	3.500	5.500	12.633	14.596	16.096	16.426	19.926

CH 9915

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 3 OF 10

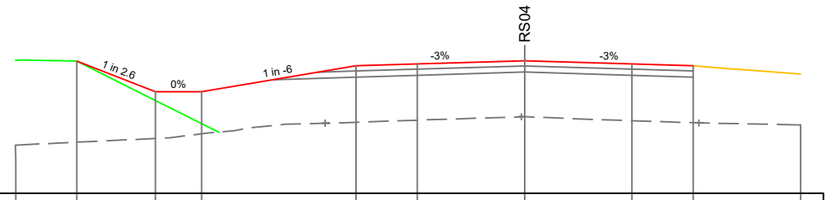
DRAWING STATUS:
PRELIMINARY

PLOT DATE:
08.08.2025

SCALE AT A1:
1:100 H, 1:100 V

DRAWING NO.
24-05-04-C203

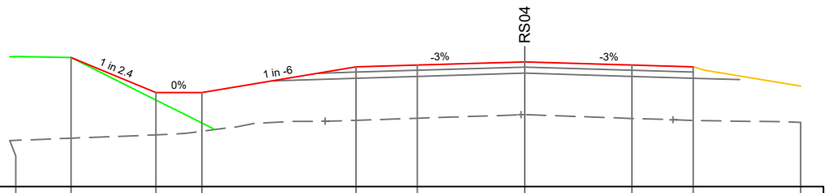
REV
A



DATUM RL 4.300

FINISHED SURFACE LEVEL		8.608	7.615	7.615	8.457	8.517	8.622	8.517	8.457		
CUT / FILL		2.641	1.526	1.376	1.840	1.833	1.826	1.850	1.855		
EXISTING SURFACE LEVEL	5.871	5.966	6.088	6.239	6.617	6.683	6.795	6.666	6.601	6.530	
OFFSET FROM CENTRELINE	-16.687	-14.607	-12.041	-10.541	-5.500	-3.500	0.000	3.500	5.500	9.000	

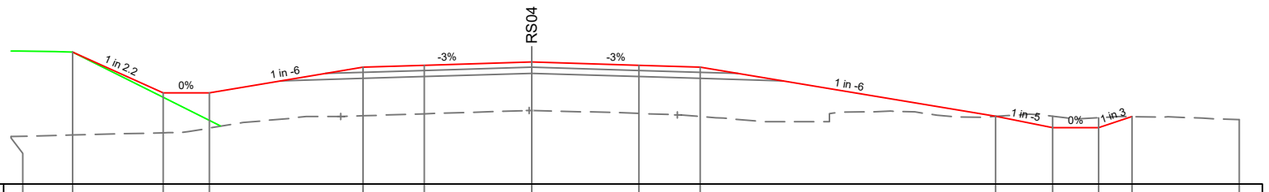
CH 9990



DATUM RL 4.400

FINISHED SURFACE LEVEL		8.608	7.468	7.468	8.305	8.365	8.470	8.365	8.305		
CUT / FILL		2.627	1.379	1.260	1.740	1.734	1.721	1.742	1.745		
EXISTING SURFACE LEVEL	5.903	5.981	6.089	6.207	6.565	6.631	6.748	6.622	6.559	6.497	
OFFSET FROM CENTRELINE	-16.793	-14.793	-12.029	-10.529	-5.500	-3.500	0.000	3.500	5.500	9.000	

CH 9975



DATUM RL 4.300

FINISHED SURFACE LEVEL		8.608	7.277	7.277	8.116	8.176	8.281	8.176	8.116	6.511	6.138	6.138	6.501		
CUT / FILL		2.706	1.303	1.153	1.589	1.583	1.581	1.571	1.611	0.000	-0.375	-0.327	0.000		
EXISTING SURFACE LEVEL	5.852	5.901	5.974	6.124	6.527	6.593	6.700	6.605	6.505	6.511	6.513	6.465	6.501	6.401	
OFFSET FROM CENTRELINE	-16.978	-14.978	-12.016	-10.516	-5.500	-3.500	0.000	3.500	5.500	15.131	16.994	18.494	19.983	23.083	

CH 9960

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

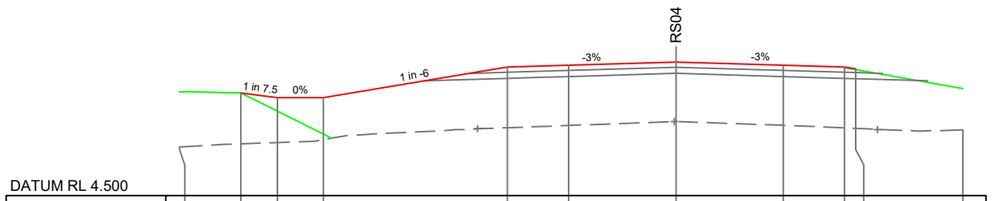
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 4 OF 10

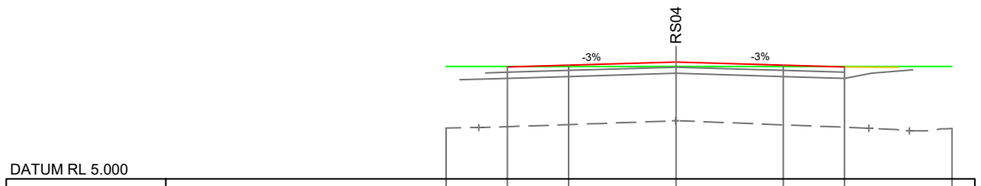
DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO. 24-05-04-C204
REV A



DATUM RL 4.500

FINISHED SURFACE LEVEL		7.852	7.694	7.694	8.694	8.754	8.859	8.754	8.694	8.634		
CUT / FILL		1.663	1.463	1.364	1.978	1.965	1.945	1.959	1.985	1.941		
EXISTING SURFACE LEVEL	6.084	6.189	6.231	6.330	6.715	6.788	6.914	6.795	6.709	6.693	6.642	
OFFSET FROM CENTRELINE	-16.193	-14.193	-13.000	-11.500	-5.500	-3.500	0.000	3.500	5.500	5.860	9.360	

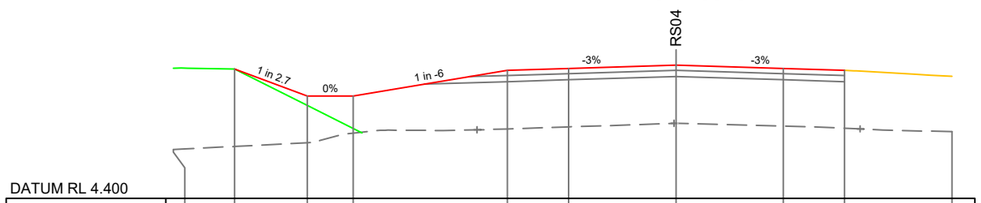
CH 10035



DATUM RL 5.000

FINISHED SURFACE LEVEL		8.651	8.711	8.816	8.711	8.651	
CUT / FILL		1.947	1.939	1.919	1.947	1.966	
EXISTING SURFACE LEVEL	6.663	6.704	6.773	6.897	6.764	6.686	6.645
OFFSET FROM CENTRELINE	-7.500	-5.500	-3.500	0.000	3.500	5.500	9.000

CH 10020



DATUM RL 4.400

FINISHED SURFACE LEVEL		8.610	7.735	7.735	8.572	8.632	8.737	8.632	8.572	
CUT / FILL		2.521	1.527	1.211	1.911	1.905	1.896	1.882	1.888	
EXISTING SURFACE LEVEL	5.993	6.088	6.208	6.524	6.661	6.727	6.842	6.751	6.685	6.576
OFFSET FROM CENTRELINE	-16.396	-14.396	-12.026	-10.526	-5.500	-3.500	0.000	3.500	5.500	9.000

CH 10005

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

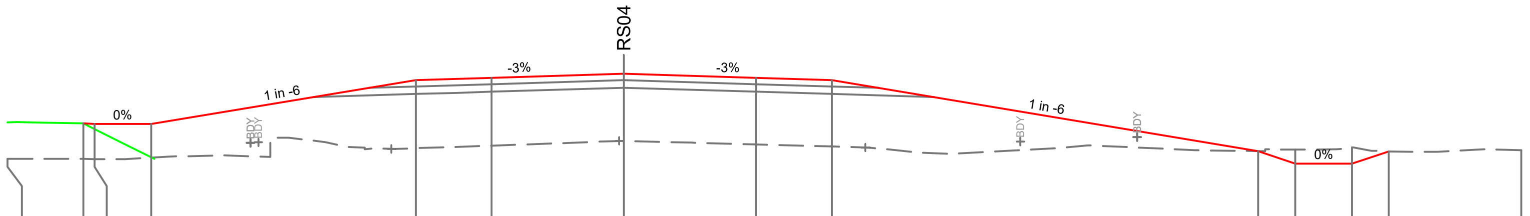
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 5 OF 10

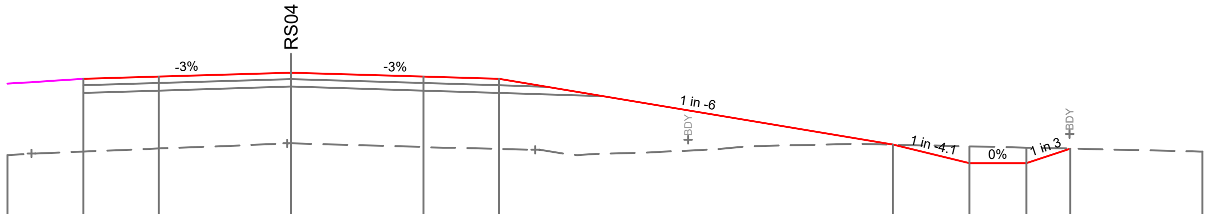
DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO. 24-05-04-C205
REV A



DATUM RL 4.800

FINISHED SURFACE LEVEL		7.455	7.435	7.435	8.602	8.662	8.767	8.662	8.602	6.722	6.385	6.385	6.710	
CUT / FILL		0.944	0.924	0.887	1.805	1.798	1.774	1.763	1.759	0.000	-0.377	-0.431	0.000	
EXISTING SURFACE LEVEL	6.516	6.511	6.511	6.548	6.797	6.864	6.993	6.898	6.843	6.722	6.762	6.816	6.710	6.745
OFFSET FROM CENTRELINE	-16.296	-14.296	-14.000	-12.500	-5.500	-3.500	0.000	3.500	5.500	16.779	17.761	19.261	20.235	23.735

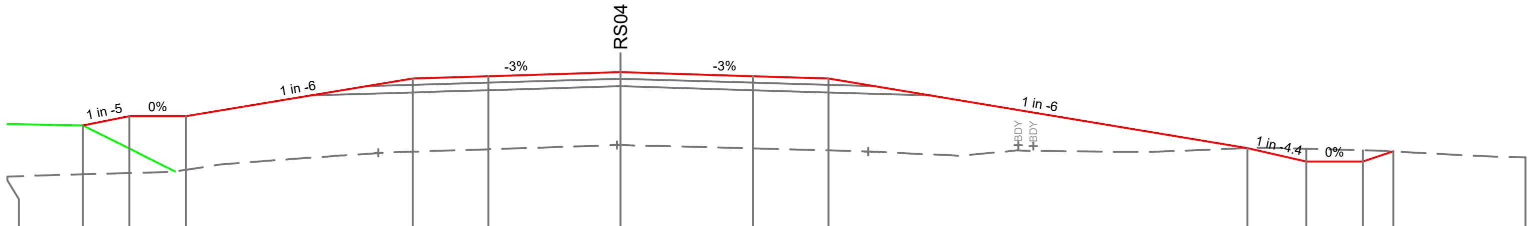
CH 10080



DATUM RL 4.900

FINISHED SURFACE LEVEL		8.669	8.729	8.834	8.729	8.669	6.931	6.441	6.441	6.828	
CUT / FILL		1.918	1.899	1.868	1.860	1.848	0.000	-0.445	-0.412	0.000	
EXISTING SURFACE LEVEL	6.658	6.751	6.829	6.966	6.869	6.821	6.931	6.887	6.854	6.828	6.749
OFFSET FROM CENTRELINE	-7.500	-5.500	-3.500	0.000	3.500	5.500	15.927	17.951	19.451	20.612	24.112

CH 10065



DATUM RL 4.500

FINISHED SURFACE LEVEL		7.455	7.699	7.699	8.700	8.760	8.865	8.760	8.700	6.852	6.497	6.497	6.765	
CUT / FILL		1.298	1.510	1.422	1.940	1.937	1.930	1.916	1.909	0.000	-0.336	-0.298	0.000	
EXISTING SURFACE LEVEL	6.097	6.157	6.189	6.277	6.760	6.823	6.934	6.843	6.791	6.852	6.833	6.795	6.765	6.605
OFFSET FROM CENTRELINE	-16.227	-14.227	-13.000	-11.500	-5.500	-3.500	0.000	3.500	5.500	16.588	18.141	19.641	20.444	23.944

CH 10050

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

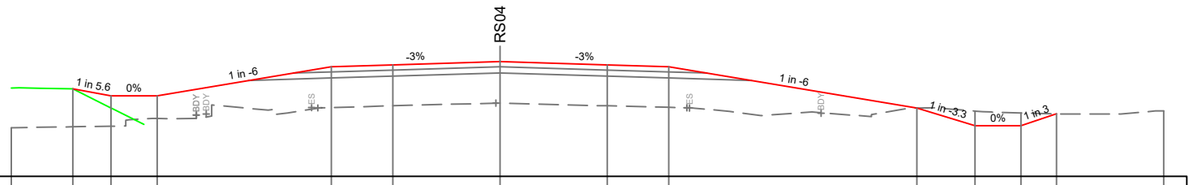
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 6 OF 10

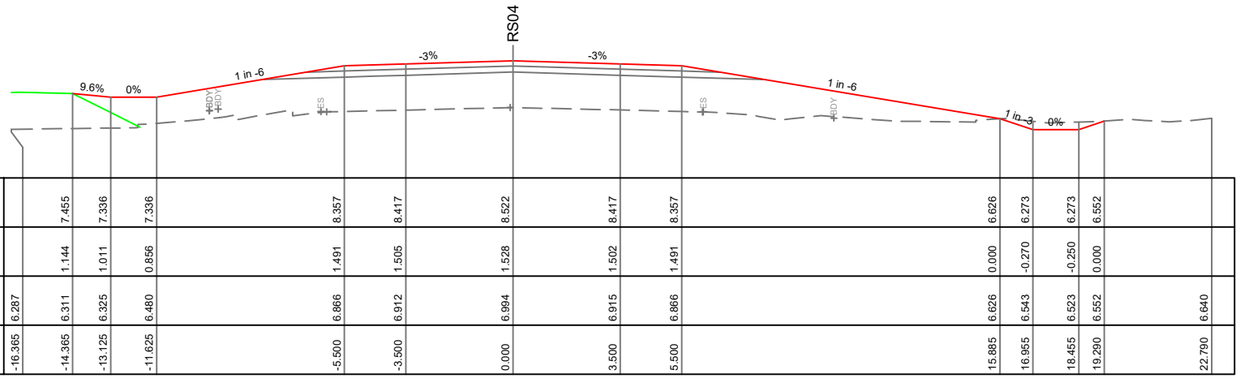
DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO. 24-05-04-C206
REV A



DATUM RL 4.600

FINISHED SURFACE LEVEL		7.455	7.232	7.232	8.180	8.240	8.345	8.240	8.180	6.831	6.255	6.255	6.642			
CUT / FILL		1.236	0.993	0.742	1.335	1.335	1.356	1.337	1.326	0.000	-0.475	-0.416	0.000			
EXISTING SURFACE LEVEL	6.188	6.219	6.238	6.490	6.845	6.905	6.989	6.903	6.854	6.831	6.730	6.671	6.642	6.734		
OFFSET FROM CENTRELINE	-15.939	-13.939	-12.687	-11.187	-5.500	-3.500	0.000	3.500	5.500	13.595	15.493	16.993	18.152	21.652		

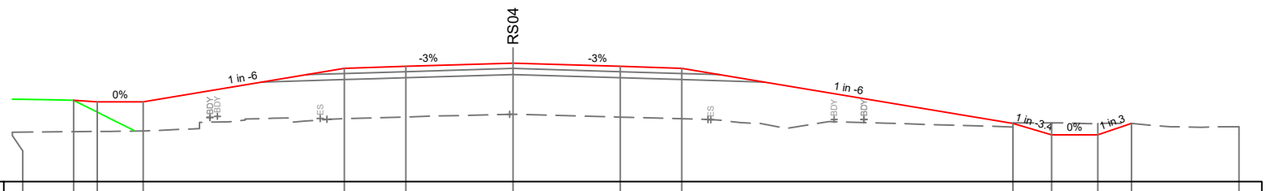
CH 10125



DATUM RL 4.700

FINISHED SURFACE LEVEL		7.455	7.336	7.336	8.357	8.417	8.522	8.417	8.357	6.626	6.273	6.273	6.552			
CUT / FILL		1.144	1.011	0.856	1.491	1.505	1.528	1.502	1.491	0.000	-0.270	-0.250	0.000			
EXISTING SURFACE LEVEL	6.287	6.311	6.325	6.480	6.866	6.912	6.994	6.915	6.866	6.626	6.543	6.523	6.552	6.640		
OFFSET FROM CENTRELINE	-16.365	-14.365	-13.125	-11.625	-5.500	-3.500	0.000	3.500	5.500	15.885	16.955	18.455	19.290	22.790		

CH 10110



DATUM RL 4.800

FINISHED SURFACE LEVEL		7.455	7.404	7.404	8.498	8.558	8.663	8.558	8.498	6.696	6.329	6.329	6.698			
CUT / FILL		1.026	0.968	0.951	1.647	1.648	1.665	1.652	1.645	-0.019	-0.385	-0.367	0.000			
EXISTING SURFACE LEVEL	6.413	6.429	6.435	6.453	6.851	6.909	6.998	6.905	6.853	6.715	6.714	6.696	6.698	6.589		
OFFSET FROM CENTRELINE	-16.331	-14.331	-13.562	-12.063	-5.500	-3.500	0.000	3.500	5.500	16.309	17.571	19.071	20.177	23.677		

CH 10095

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

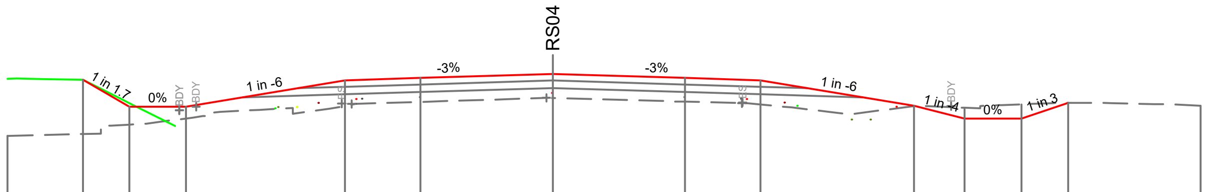
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 7 OF 10

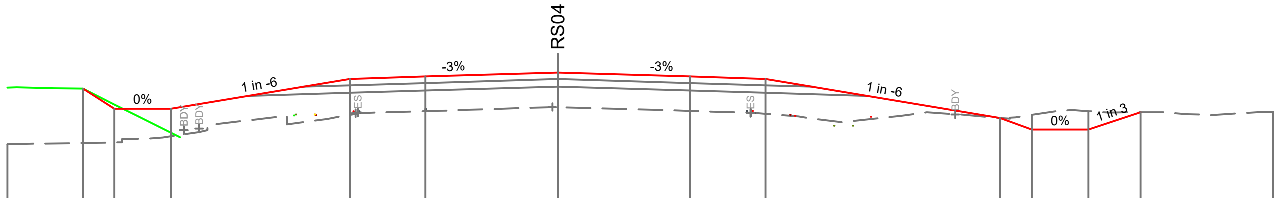
DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO.: 24-05-04-C207
REV: A



DATUM RL 4.400

FINISHED SURFACE LEVEL		7.455	6.742	6.742	7.443	7.503	7.608	7.503	7.443	6.767	6.429	6.429	6.844	
CUT / FILL		1.430	0.471	0.308	0.677	0.632	0.631	0.625	0.642	0.000	-0.292	-0.379	0.000	
EXISTING SURFACE LEVEL	5.977	6.025	6.271	6.434	6.766	6.872	6.977	6.878	6.801	6.767	6.720	6.808	6.844	6.774
OFFSET FROM CENTRELINE	-14.433	-12.433	-11.207	-9.707	-5.500	-3.500	0.000	3.500	5.500	9.561	10.903	12.403	13.647	17.147

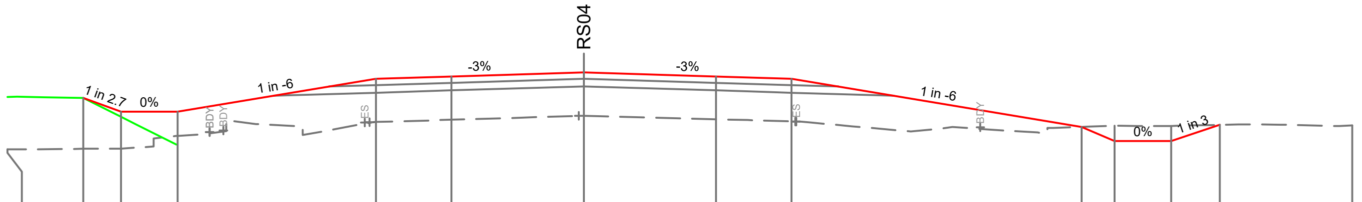
CH 10170



DATUM RL 4.400

FINISHED SURFACE LEVEL		7.455	6.928	6.928	7.716	7.776	7.881	7.776	7.716	6.682	6.371	6.371	6.832	
CUT / FILL		1.435	0.894	0.732	0.952	0.914	0.912	0.908	0.926	0.000	-0.390	-0.490	0.000	
EXISTING SURFACE LEVEL	5.988	6.020	6.033	6.196	6.764	6.862	6.969	6.868	6.790	6.682	6.761	6.860	6.832	6.836
OFFSET FROM CENTRELINE	-14.563	-12.563	-11.729	-10.229	-5.500	-3.500	0.000	3.500	5.500	11.702	12.542	14.042	15.424	18.924

CH 10155



DATUM RL 4.500

FINISHED SURFACE LEVEL		7.455	7.091	7.091	7.966	8.026	8.131	8.026	7.966	6.687	6.313	6.313	6.743	
CUT / FILL		1.348	0.977	0.643	1.148	1.148	1.149	1.135	1.129	0.000	-0.404	-0.399	0.000	
EXISTING SURFACE LEVEL	6.092	6.107	6.115	6.448	6.818	6.878	6.982	6.891	6.837	6.687	6.717	6.712	6.743	6.725
OFFSET FROM CENTRELINE	-15.250	-13.250	-12.250	-10.750	-5.500	-3.500	0.000	3.500	5.500	13.177	14.050	15.550	16.839	20.339

CH 10140

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 8 OF 10

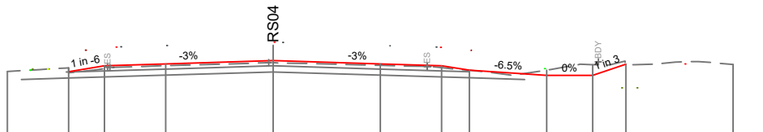
DRAWING STATUS:
PRELIMINARY

PLOT DATE:
08.08.2025

SCALE AT A1:
1:100 H, 1:100 V

DRAWING NO.
24-05-04-C208

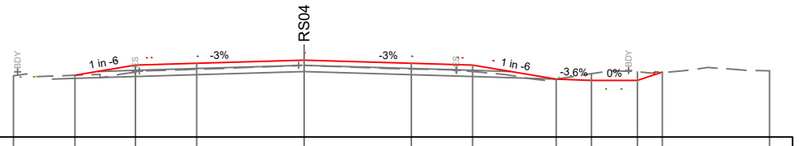
REV
A



DATUM RL 4.600

FINISHED SURFACE LEVEL		6.723	6.917	6.977	7.082	6.977	6.917	6.766	6.602	6.602	6.963		
CUT / FILL		-0.122	0.100	0.062	0.068	0.049	0.067	0.000	-0.171	-0.349	0.000		
EXISTING SURFACE LEVEL	6.730	6.845	6.817	6.915	7.014	6.928	6.850	6.766	6.773	6.951	6.963	6.955	
OFFSET FROM CENTRELINE	-8.665	-6.665	-5.500	-3.500	0.000	3.500	5.500	6.405	8.923	10.423	11.506	15.006	

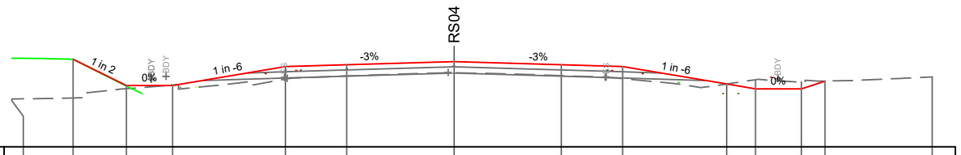
CH 10215



DATUM RL 4.700

FINISHED SURFACE LEVEL		6.710	7.039	7.099	7.204	7.099	7.039	6.585	6.544	6.544	6.813		
CUT / FILL		-0.000	0.223	0.192	0.174	0.182	0.206	0.000	-0.215	-0.276	0.000		
EXISTING SURFACE LEVEL	6.694	6.710	6.816	6.907	7.030	6.917	6.833	6.585	6.759	6.820	6.813	6.852	
OFFSET FROM CENTRELINE	-9.475	-7.475	-5.500	-3.500	0.000	3.500	5.500	8.222	9.377	10.877	11.684	15.184	

CH 10200



DATUM RL 4.600

FINISHED SURFACE LEVEL		7.455	6.600	6.600	7.214	7.274	7.379	7.274	7.214	6.648	6.487	6.487	6.744		
CUT / FILL		1.263	0.107	-0.009	0.405	0.366	0.360	0.354	0.392	0.000	-0.303	-0.227	0.000		
EXISTING SURFACE LEVEL	6.161	6.192	6.493	6.609	6.809	6.908	7.019	6.920	6.823	6.648	6.789	6.714	6.744	6.877	
OFFSET FROM CENTRELINE	-14.424	-12.424	-10.686	-9.186	-5.500	-3.500	0.000	3.500	5.500	8.896	9.830	11.330	12.101	15.601	

CH 10185

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

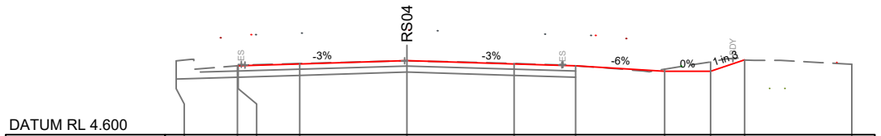
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

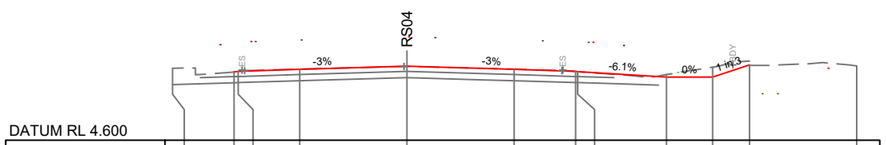
HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 9 OF 10

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO.: 24-05-04-C209
REV: A



DATUM RL 4.600													
FINISHED SURFACE LEVEL		6.838	6.842	6.902	7.007	6.902	6.842	6.667	6.667	7.035			
CUT / FILL		-0.000	0.002	-0.013	0.001	-0.013	-0.000	-0.068	-0.302	0.004			
EXISTING SURFACE LEVEL	7.002	6.838	6.840	6.916	7.007	6.916	6.843	6.736	6.969	7.031	6.995		
OFFSET FROM CENTRELINE	-7.526	-5.526	-5.500	-3.500	0.000	3.500	5.500	8.410	9.910	11.013	14.513		

CH 10232



DATUM RL 4.600													
FINISHED SURFACE LEVEL		6.825	6.849	6.909	7.014	6.909	6.849	6.837	6.659	6.659	7.060		
CUT / FILL		-0.000	0.010	-0.007	0.007	-0.008	0.006	0.000	-0.082	-0.322	0.017		
EXISTING SURFACE LEVEL	6.946	6.825	6.839	6.916	7.007	6.917	6.843	6.837	6.741	6.982	7.043	7.020	
OFFSET FROM CENTRELINE	-7.643	-5.643	-5.500	-3.500	0.000	3.500	5.500	5.572	8.470	9.970	11.172	14.672	

CH 10230

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

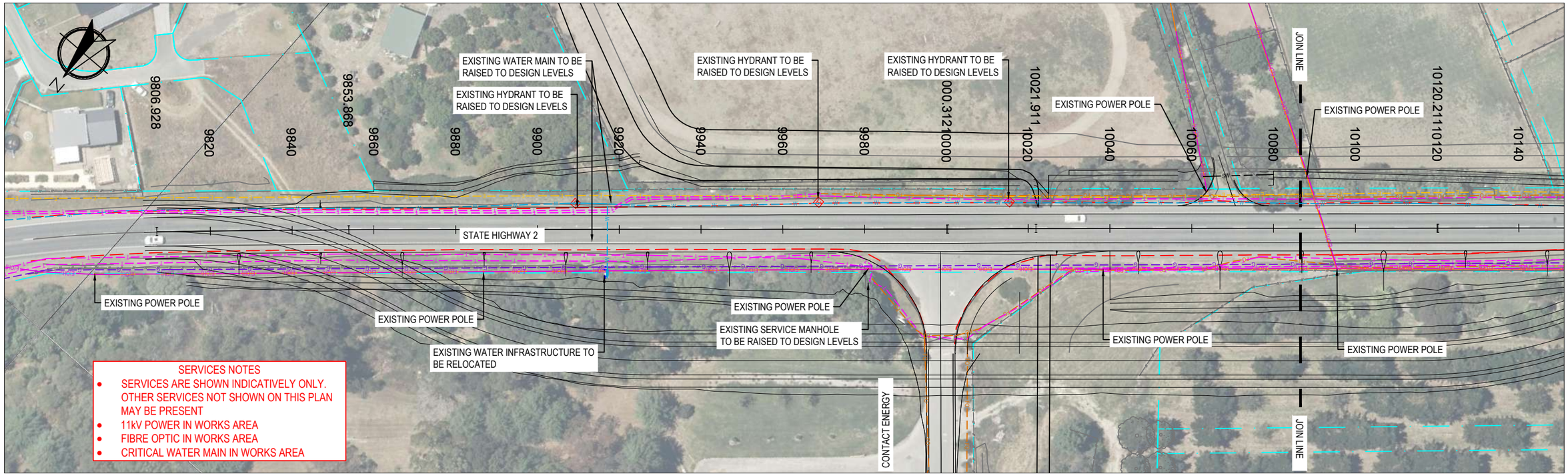
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

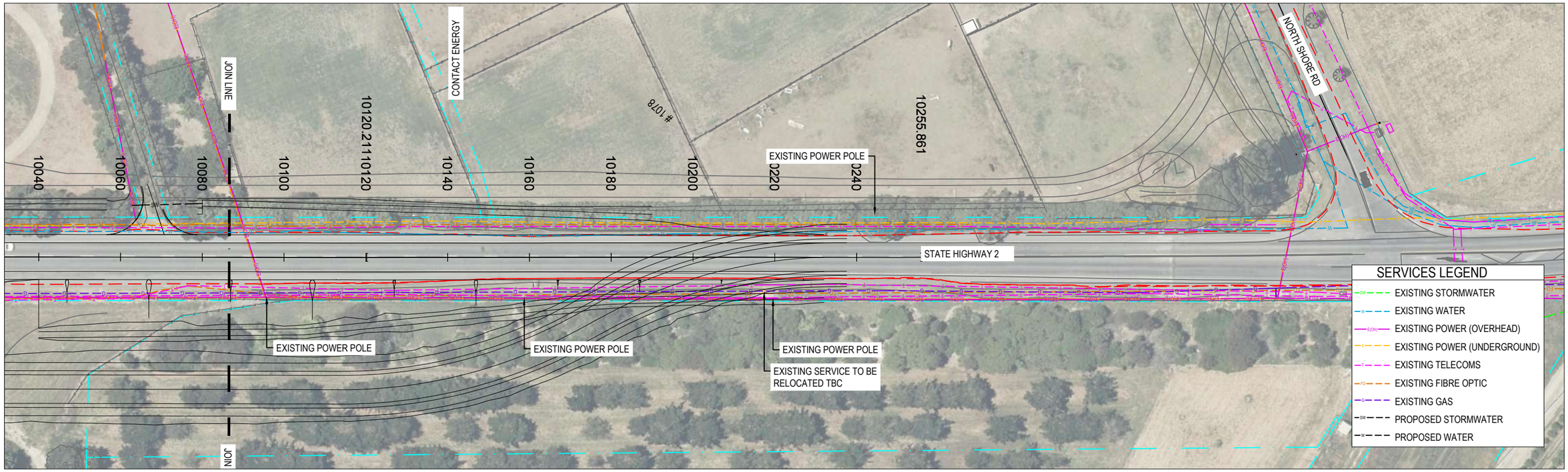
CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
CROSS SECTIONS - SH2
SHEET 10 OF 10

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO. 24-05-04-C210
REV A





NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

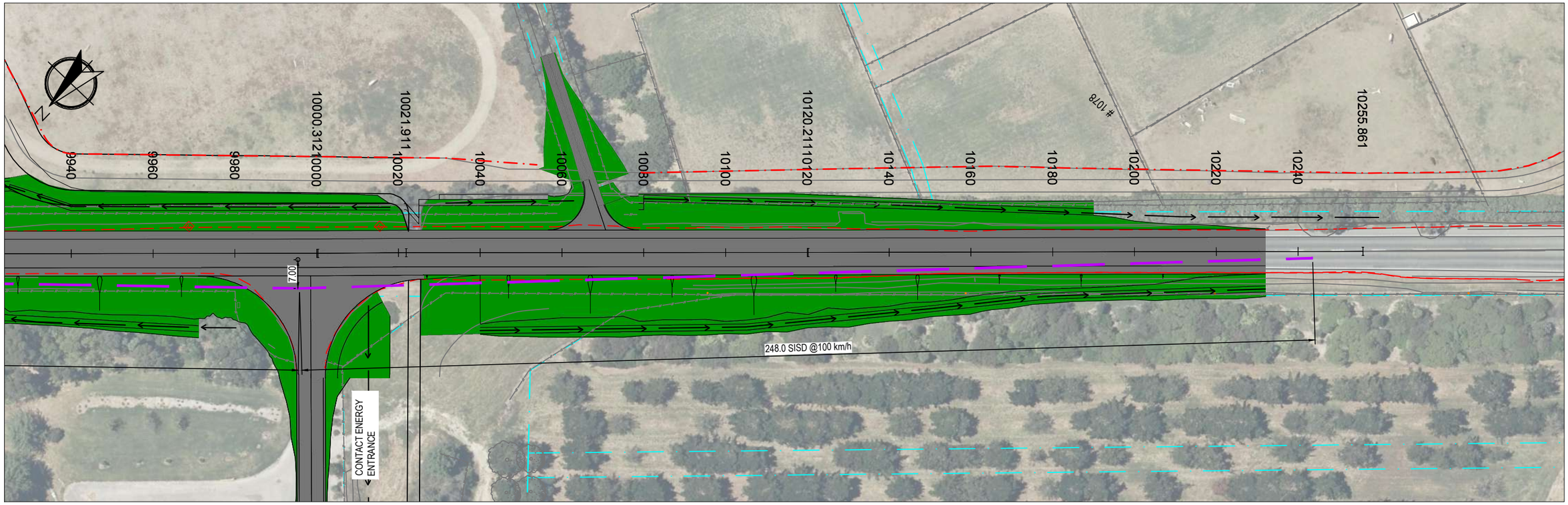
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

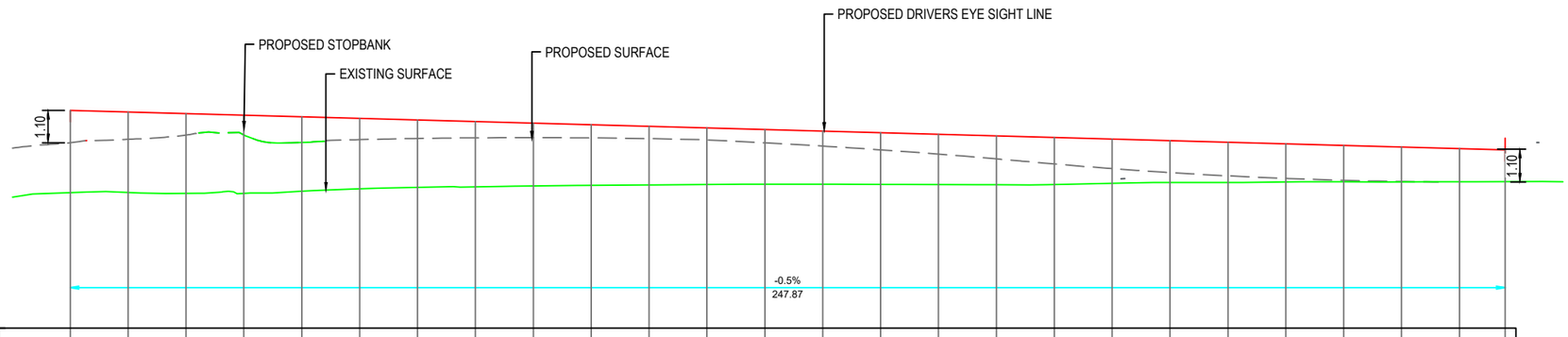
CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
SERVICES PLAN

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:500
DRAWING NO. 24-05-04-C301
REV A





HORIZONTAL CURVE DATA

VERTICAL CURVE LENGTH (m)
VERTICAL CURVE RADIUS (m)

VERTICAL GEOMETRY GRADE (%)
VERTICAL GEOMETRY LENGTH (m)

DATUM RL = 1.900

CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	247.874
SIGHTLINE LEVEL	9.418	9.363	9.308	9.253	9.198	9.144	9.089	9.034	8.979	8.924	8.870	8.815	8.760	8.705	8.650	8.596	8.541	8.486	8.431	8.377	8.322	8.267	8.212	8.157	8.103	8.059
DESIGN SURFACE LEVEL	8.304	8.420	8.567	8.570	8.312	8.410	8.450	8.472	8.479	8.470	8.444	8.401	8.302	8.188	8.057	7.909	7.745	7.570	7.409	7.273	7.160	7.071	7.006	6.964		
CUT / FILL DEPTH	1.114	0.943	0.741	0.684	0.887	0.734	0.639	0.562	0.500	0.455	0.426	0.414	0.458	0.517	0.594	0.687	0.795	0.916	1.022	1.104	1.162	1.196	1.207	1.193		

A1 SCALE: H 1:500, V 1:100

LONGITUDINAL SECTION CONTACT ENTRANCE LOOKING SOUTH WEST

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

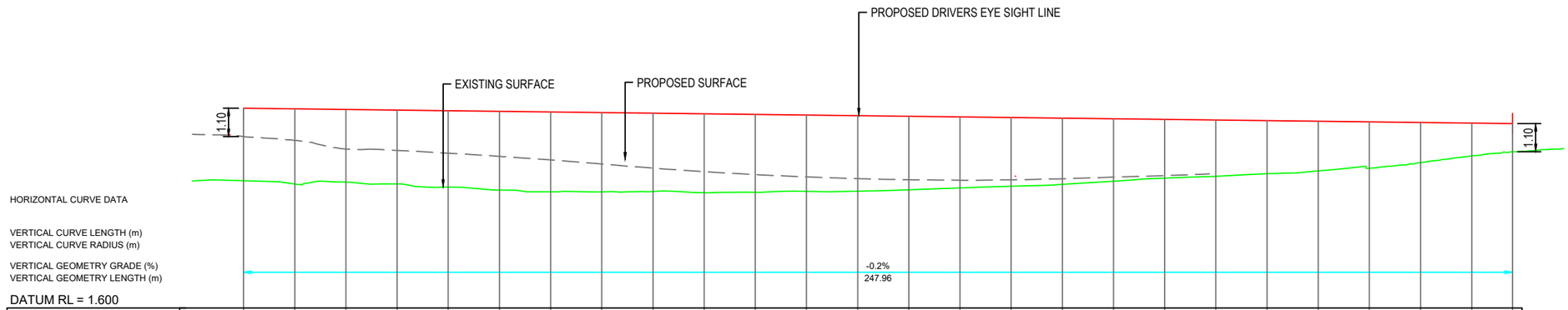
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
SIGHTLINES PLAN
CONTACT ENERGY ENTRANCE SISD LOOKING SOUTH

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:500
DRAWING NO.: 24-05-04-C401
REV: A



HORIZONTAL CURVE DATA

VERTICAL CURVE LENGTH (m)
VERTICAL CURVE RADIUS (m)

VERTICAL GEOMETRY GRADE (%)
VERTICAL GEOMETRY LENGTH (m)

DATUM RL = 1.600

SIGHTLINE LEVEL	9.411	9.387	9.362	9.338	9.314	9.290	9.266	9.242	9.218	9.194	9.170	9.146	9.122	9.098	9.073	9.049	9.025	9.001	8.977	8.953	8.929	8.905	8.881	8.857	8.833	8.813
DESIGN SURFACE LEVEL	8.304	8.154	7.818	7.765	7.656	7.531	7.389	7.232	7.071	6.933	6.818	6.728	6.661	6.618	6.598	6.614	6.656	6.722	6.778							
CUT / FILL DEPTH	1.107	1.233	1.545	1.573	1.658	1.759	1.877	2.010	2.147	2.261	2.351	2.418	2.461	2.480	2.475	2.435	2.369	2.279	2.199							
CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	247.962

A1 SCALE: H 1:500, V 1:100

LONGITUDINAL SECTION CONTACT ENTRANCE LOOKING NORTH EAST

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

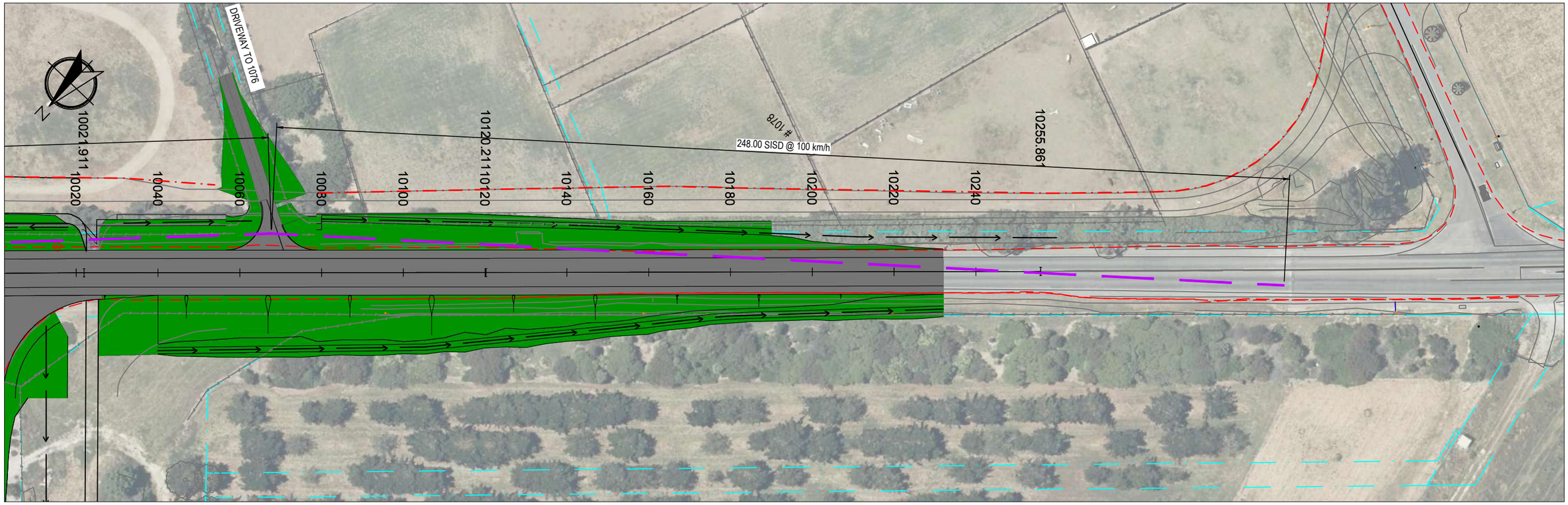
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

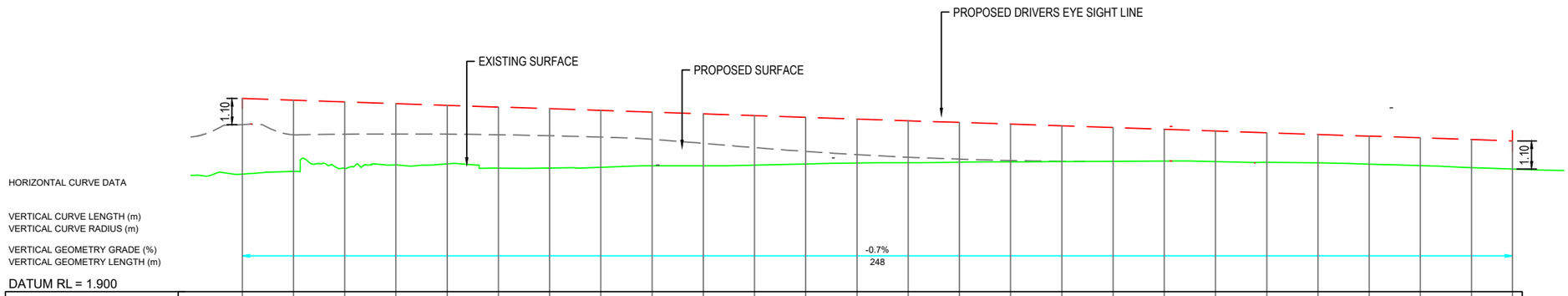
CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
SIGHTLINES PLAN
CONTACT ENERGY ENTRANCE SISD LOOKING NORTH

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:500
DRAWING NO.: 24-05-04-C402
REV: A





DATUM RL = 1.900

SIGHTLINE LEVEL	9.437	9.370	9.304	9.237	9.170	9.103	9.037	8.970	8.903	8.836	8.770	8.703	8.636	8.570	8.503	8.436	8.369	8.303	8.236	8.169	8.102	8.036	7.969	7.902	7.835	7.782
DESIGN SURFACE LEVEL	8.416	8.021	8.045	8.054	8.046	8.022	7.984	7.930	7.846	7.688	7.521	7.373	7.249	7.148	7.071	7.018	6.988									
CUT / FILL DEPTH	1.021	1.350	1.258	1.183	1.124	1.081	1.053	1.040	1.057	1.149	1.249	1.330	1.388	1.422	1.432	1.418	1.381									
CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	248

A1 SCALE: H 1:500, V 1:100

LONGITUDINAL SECTION 1076 ACCESS LOOKING SOUTH

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

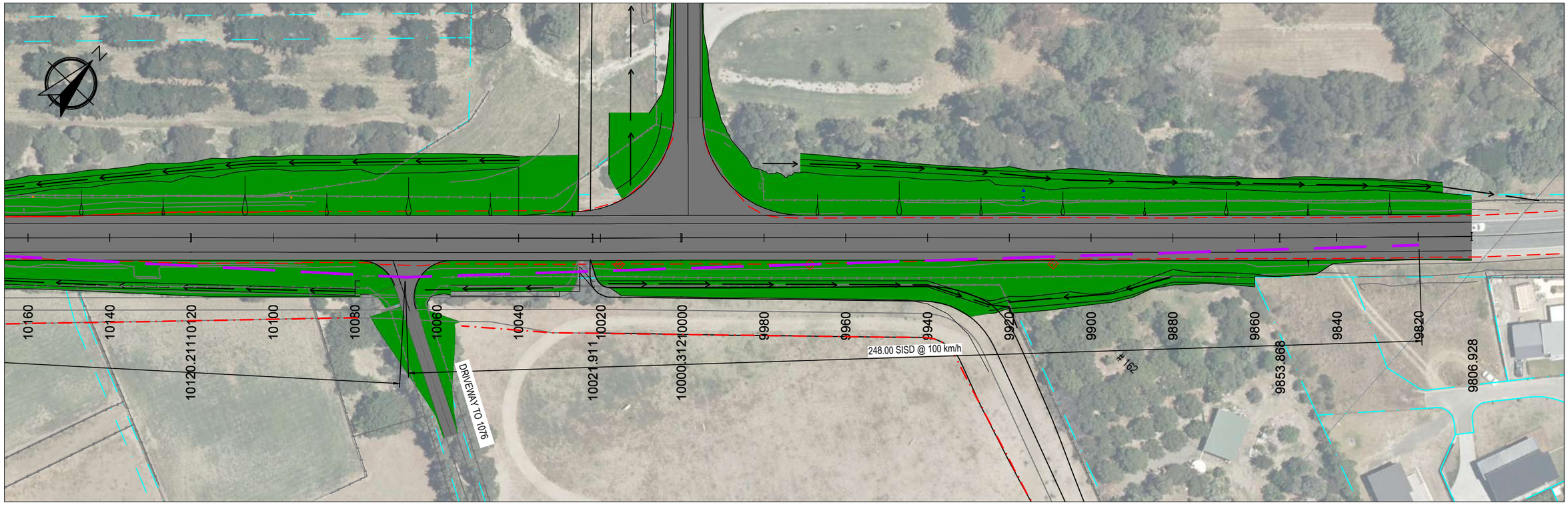
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

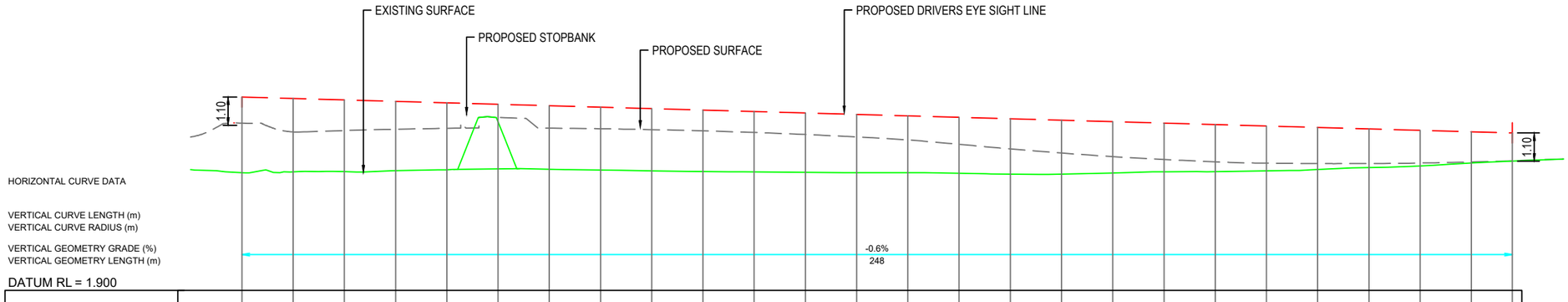
CIVIL & TRANSPORTATION DESIGN

TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
SIGHTLINES PLAN
1076 ACCESS SISD LOOKING SOUTH

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:500
DRAWING NO. 24-05-04-C403
REV A





HORIZONTAL CURVE DATA

VERTICAL CURVE LENGTH (m)
VERTICAL CURVE RADIUS (m)

VERTICAL GEOMETRY GRADE (%)
VERTICAL GEOMETRY LENGTH (m)

DATUM RL = 1.900

SIGHTLINE LEVEL	9.437	9.381	9.324	9.268	9.212	9.155	9.099	9.042	8.986	8.930	8.873	8.817	8.760	8.704	8.648	8.591	8.535	8.478	8.422	8.366	8.309	8.253	8.196	8.140	8.084	8.039
DESIGN SURFACE LEVEL	8.416	8.078	8.131	8.182	8.217	8.638	8.222	8.201	8.168	8.121	8.056	7.977	7.881	7.768	7.596	7.415	7.254	7.117	7.003	6.914	6.860	6.842	6.847	6.867	6.907	6.949
CUT / FILL DEPTH	1.021	1.303	1.194	1.086	0.995	0.517	0.876	0.841	0.818	0.808	0.817	0.839	0.879	0.936	1.052	1.176	1.280	1.361	1.419	1.452	1.450	1.410	1.350	1.273	1.177	1.089
CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	248

A1 SCALE: H 1:500, V 1:100

LONGITUDINAL SECTION 1076 ACCESS LOOKING NORTH

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

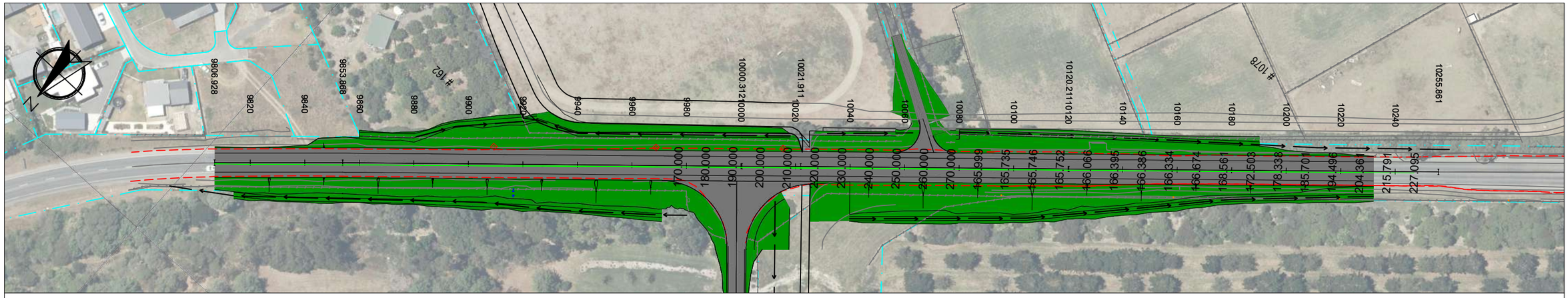
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CIVIL & TRANSPORTATION DESIGN

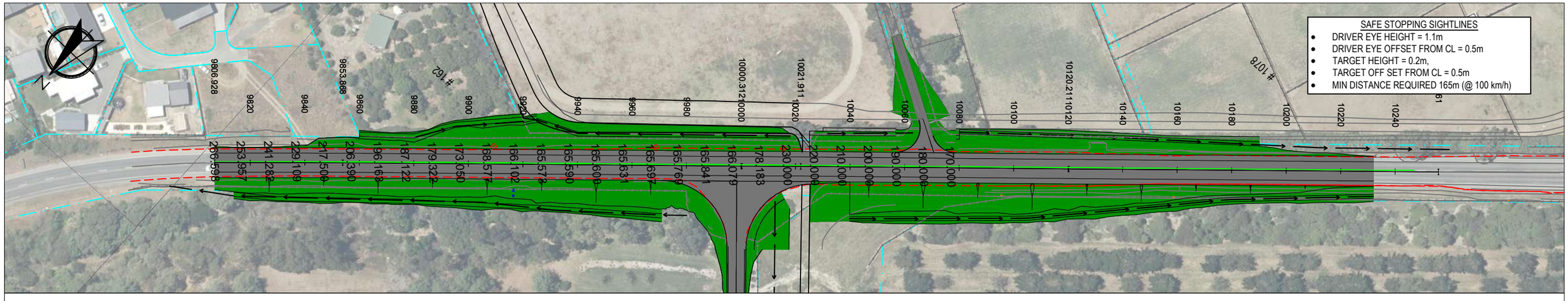
HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
SIGHTLINES PLAN
1076 ACCESS SISD LOOKING NORTH

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:500
DRAWING NO. 24-05-04-C404
REV A



SSD SIGHTLINES LOOKING NORTH



SSD SIGHTLINES LOOKING SOUTH

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

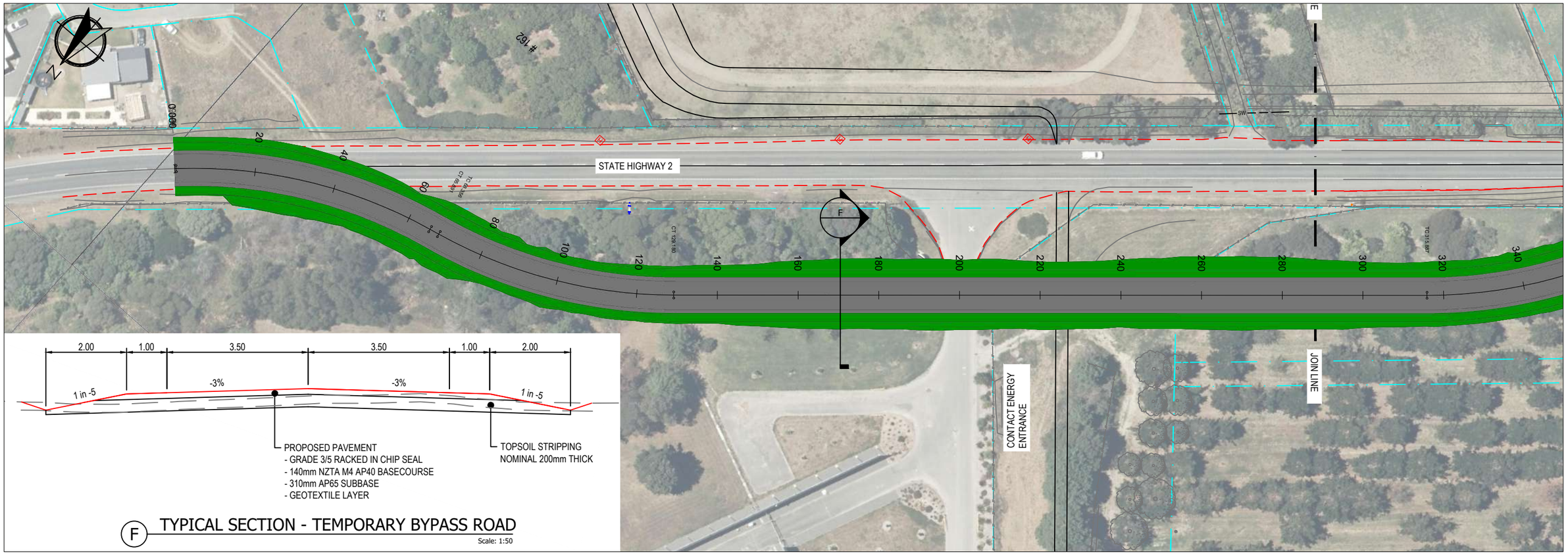
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

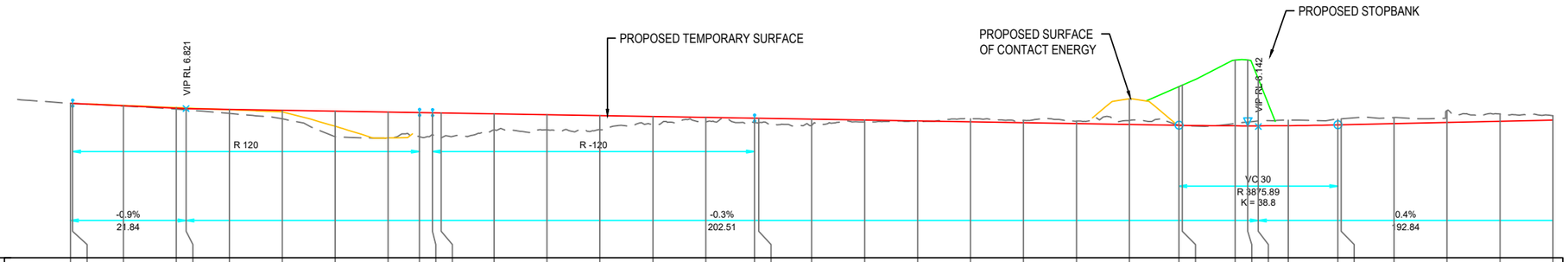
HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
SIGHTLINES PLAN
SAFE STOPPING DISTANCE SIGHTLINES

DRAWING STATUS: PRELIMINARY
PLOT DATE: 08.08.2025
SCALE AT A1: 1:750
DRAWING NO.: 24-05-04-C405
REV: A



F TYPICAL SECTION - TEMPORARY BYPASS ROAD

Scale: 1:50



FINISHED SURFACE LEVEL	7.025	7.021	6.931	6.838	6.821	6.793	6.760	6.726	6.693	6.673	6.665	6.659	6.626	6.592	6.559	6.525	6.492
EXISTING SURFACE LEVEL	7.019	7.016	6.924	6.802	6.776	6.639	6.436	5.758	5.718	5.766	5.832	5.716	6.011	6.021	6.027	6.213	6.316
CUT / FILL DEPTH	0.006	0.005	0.007	0.036	0.045	0.155	0.324	0.968	0.974	0.907	0.833	0.943	0.615	0.571	0.532	0.312	0.176
CHAINAGE	0	0.388	10	20	21.838	30	40	50	60	65.891	68.356	70	80	90	100	110	120
SUPERELEVATION																	

FINISHED SURFACE LEVEL	6.461	6.458	6.425	6.391	6.358	6.324	6.290	6.257	6.223	6.192	6.190	6.171	6.170	6.171	6.178	6.208	6.210	6.254	6.298	6.342	6.386
EXISTING SURFACE LEVEL	6.294	6.286	6.193	6.314	6.337	6.437	6.377	6.348	6.374	6.197	6.184	6.263	6.315	6.352	6.385	6.423	6.434	6.482	6.745	6.619	6.553
CUT / FILL DEPTH	0.167	0.172	0.232	0.077	0.020	-0.113	-0.086	-0.092	-0.150	-0.005	0.006	-0.092	-0.145	-0.181	-0.208	-0.216	-0.224	-0.227	-0.447	-0.277	-0.168
CHAINAGE	129.18	130	140	150	160	170	180	190	200	209.351	210	220	222.348	224.351	230	239.351	240	250	260	270	280
SUPERELEVATION																					

A1 SCALE: H 1:500, V 1:100

LONGITUDINAL SECTION RS05

GENERAL LEGEND

▨	PROPOSED SEAL AREA
🟩	PROPOSED GRASSED BATTER AREA
—//—	PROPOSED FENCE
→—	PROPOSED OPEN DRAIN
—SW—	PROPOSED STORMWATER
— — —	EXISTING EDGE OF SEAL
——	EXISTING FEATURES
—/—/—	EXISTING FENCE
—SW—	EXISTING STORMWATER
○	EXISTING POWER POLE
——	EXISTING BOUNDARY

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25

	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

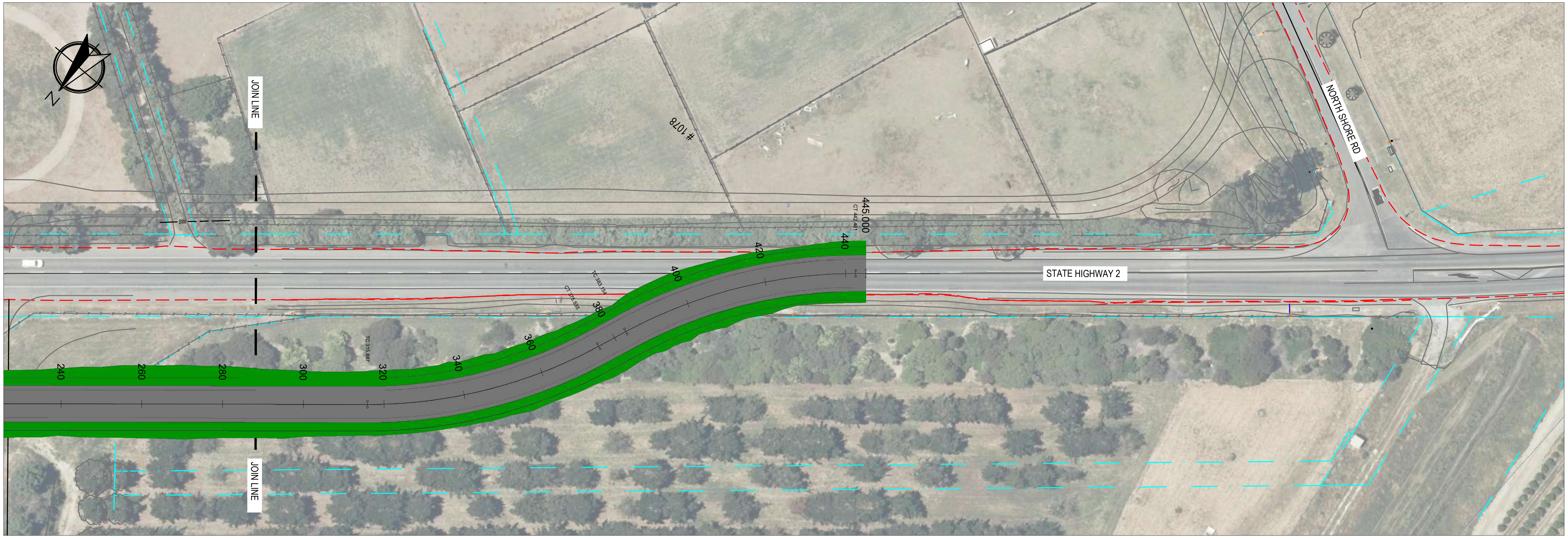
CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
PLAN AND LONGITUDINAL SECTION - TEMPORARY BYPASS ROAD
SHEET 1 OF 2

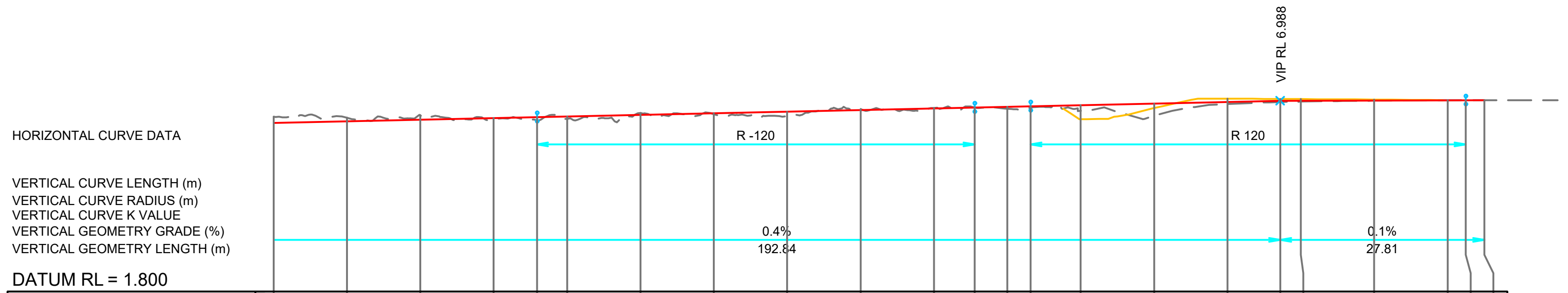
DRAWING STATUS:
PRELIMINARY

PLOT DATE: 08.08.2025
SCALE AT A1: 1:500 H, 1:100 V
DRAWING NO. 24-05-04-C501
REV A



GENERAL LEGEND

▨	PROPOSED SEAL AREA
🟩	PROPOSED GRASSED BATTER AREA
—//—	PROPOSED FENCE
→	PROPOSED OPEN DRAIN
--■--	PROPOSED STORMWATER
- -	EXISTING EDGE OF SEAL
—	EXISTING FEATURES
-/-/-	EXISTING FENCE
- - -	EXISTING STORMWATER
∘	EXISTING POWER POLE
—	EXISTING BOUNDARY



FINISHED SURFACE LEVEL	6.386	6.430	6.474	6.518	6.543	6.561	6.605	6.649	6.693	6.737	6.781	6.805	6.825	6.838	6.868	6.912	6.956	6.988	6.989	6.995	7.001	7.002	7.004
EXISTING SURFACE LEVEL	6.553	6.526	6.594	6.501	6.455	6.496	6.652	6.624	6.559	6.764	6.795	6.808	6.772	6.799	6.717	6.581	6.901	6.955	6.966	6.992	7.006	7.005	7.004
CUT / FILL DEPTH	-0.168	-0.097	-0.120	0.017	0.088	0.065	-0.047	0.025	0.134	-0.027	-0.014	-0.003	0.053	0.039	0.152	0.331	0.055	0.033	0.024	0.003	-0.005	-0.002	0.000
CHAINAGE	280	290	300	310	315.887	320	330	340	350	360	370	375.535	380	383.154	390	400	410	417.187	420	430	440	442.461	445
SUPERELEVATION																							

A1 SCALE: H 1:500, V 1:100

LONGITUDINAL SECTION RS05

NOT FOR CONSTRUCTION

A	PRELIMINARY DESIGN ISSUED	JO	SG		05.08.25
REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE

	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S. GREEN
APPROVED	

CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - STATE HIGHWAY 2 RAISING
PLAN AND LONGITUDINAL SECTION - TEMPORARY BYPASS ROAD
SHEET 2 OF 2

DRAWING STATUS:
PRELIMINARY

PLOT DATE: 08.08.2025
SCALE AT A1: 1:500 H, 1:100 V

DRAWING NO.: 24-05-04-C502
REV: A

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI FLOOD RESILIENCE PROJECT
NORTH SHORE ROAD RAISING

SHEET NO	SHEET TITLE	REV
G001	COVER SHEET & DRAWING INDEX	A
C001	OVERALL PLAN	A
C002	TYPICAL SECTIONS	A
C101	PLAN & LONGITUDINAL SECTION - NORTH SHORE RD	A
C201	CROSS SECTIONS - NORTH SHORE RD (SHEET 1 OF 2)	A
C202	CROSS SECTIONS - NORTH SHORE RD (SHEET 2 OF 2)	A
C301	SERVICES PLAN	A
C401	SIGHTLINES PLAN - SHEET 1 OF 3	A
C402	SIGHTLINES PLAN - SHEET 2 OF 3	A
C403	SIGHTLINES PLAN - SHEET 3 OF 3	A

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

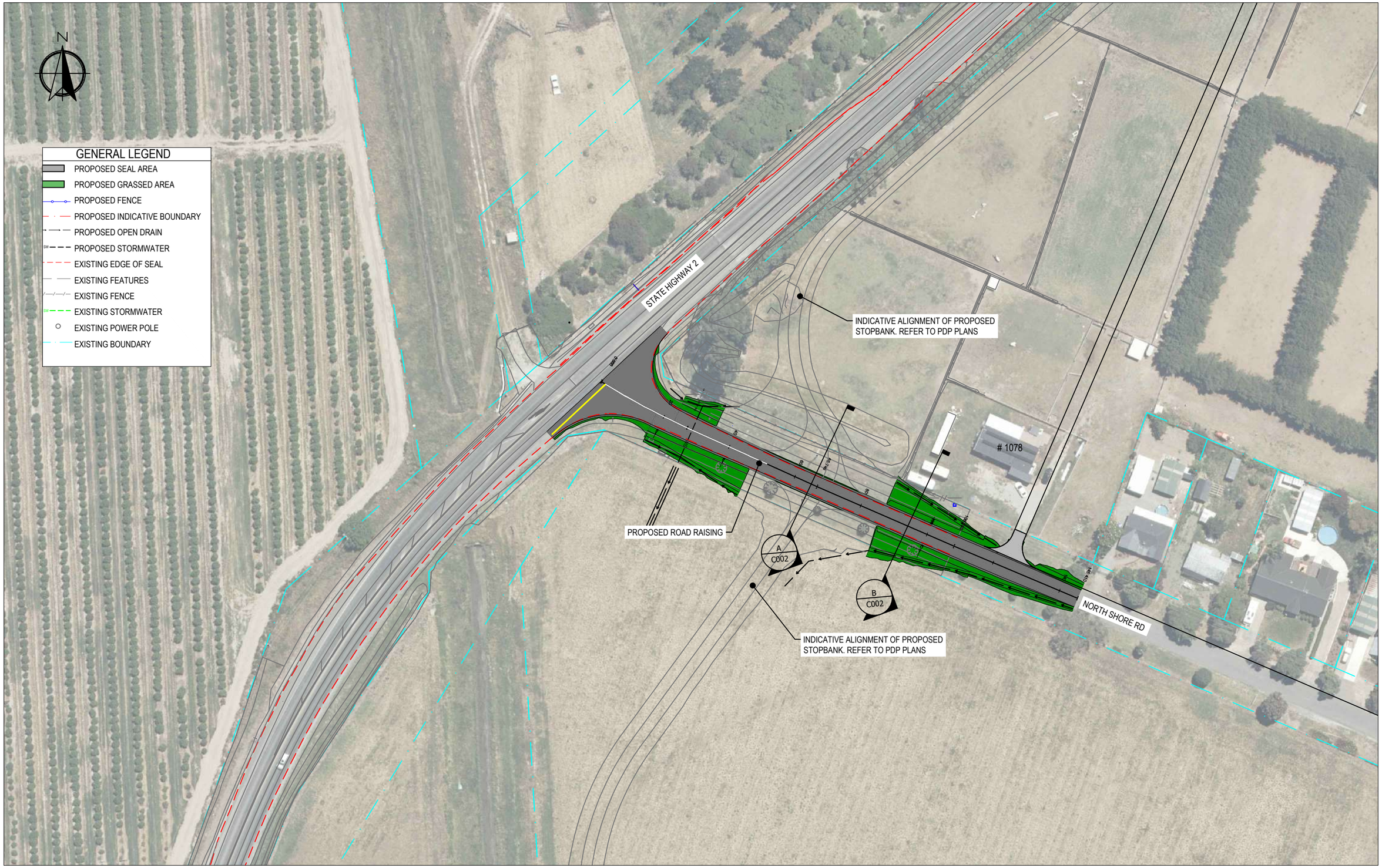
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
COVER SHEET & DRAWING INDEX

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: AS SHOWN
DRAWING NO.: 24-05-02-G001
REV: A



NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

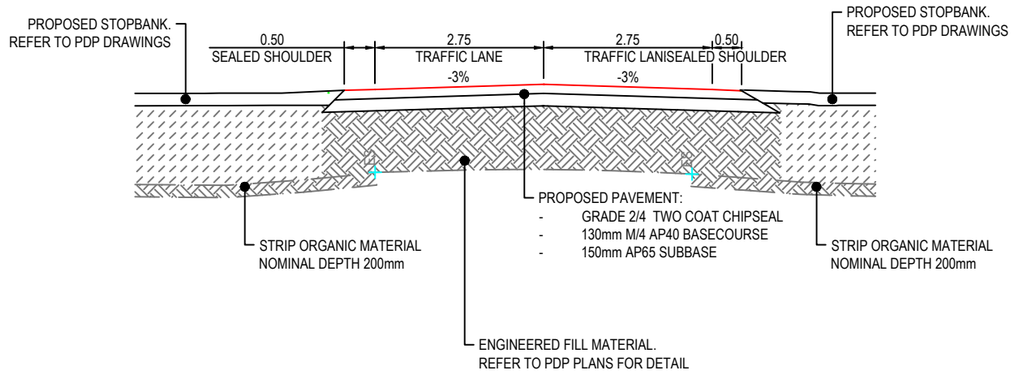
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

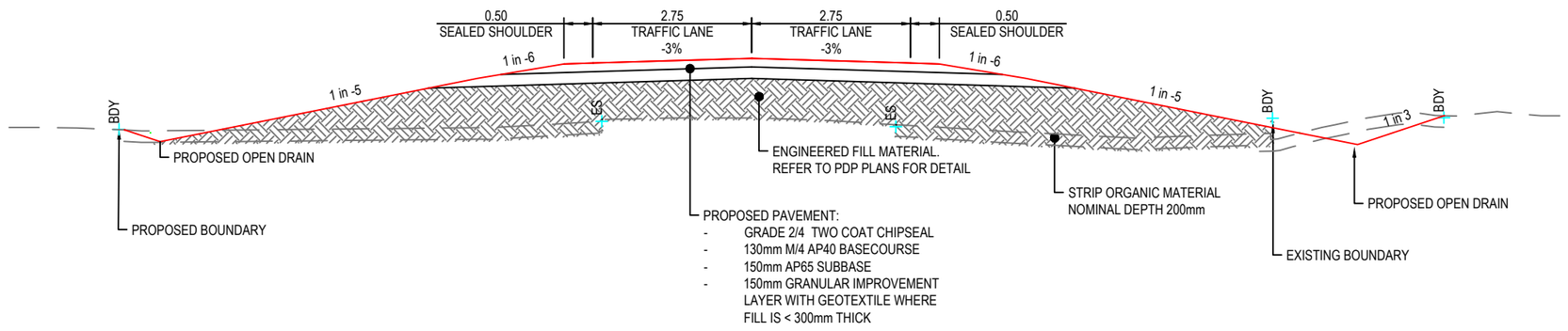
HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
OVERVIEW PLAN

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: 1:500
DRAWING NO.: 24-05-02-C001
REV: A



A TYPICAL SECTION
Scale: 1:50



B TYPICAL SECTION
Scale: 1:50

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

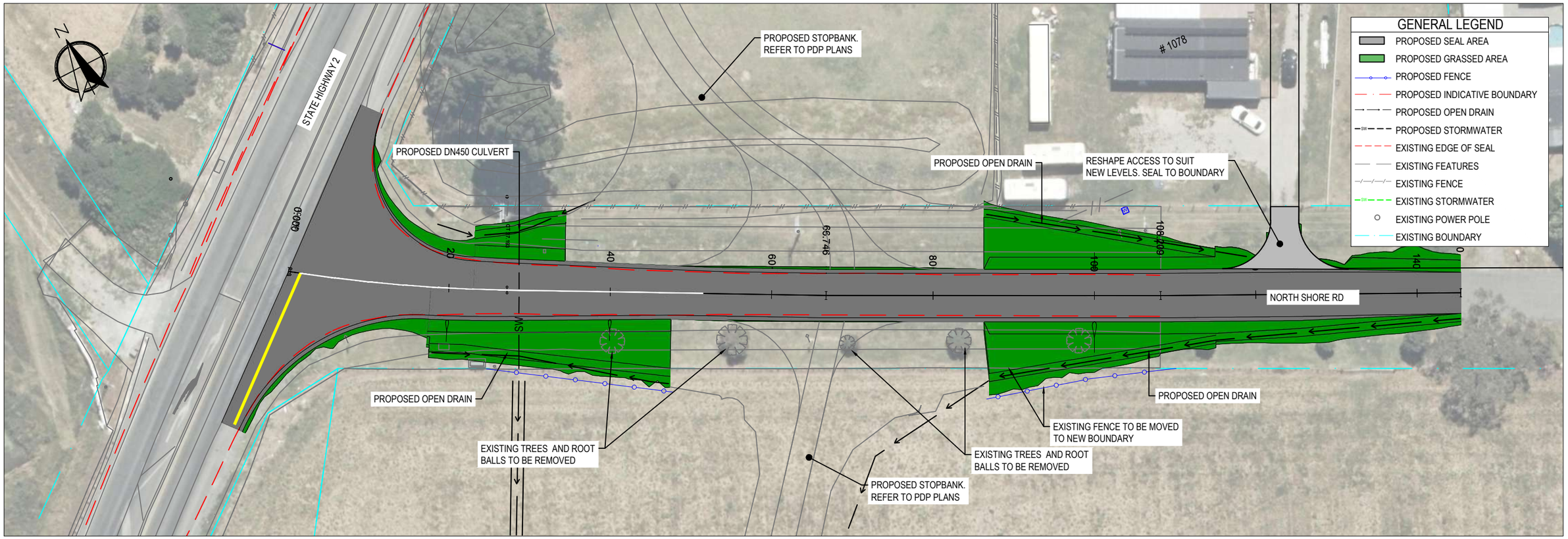
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

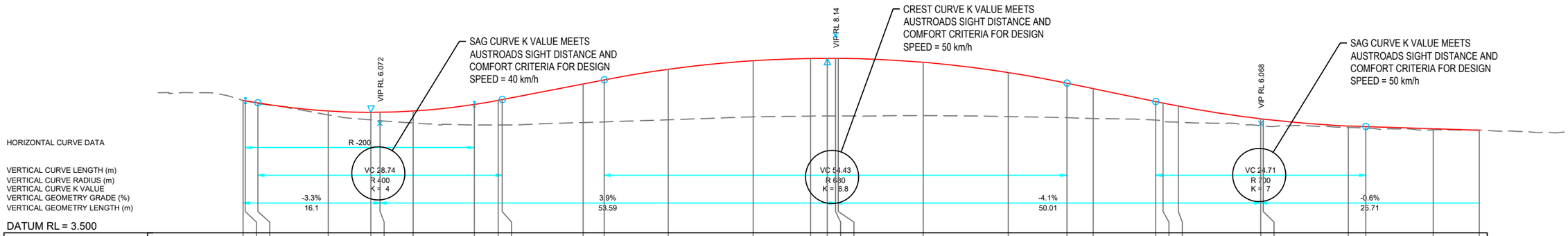
CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
TYPICAL CROSS SECTIONS

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: AS SHOWN
DRAWING NO.: 24-05-02-C002
REV: A





DATUM RL = 3.500

FINISHED SURFACE LEVEL	6.607	6.599	6.550	6.360	6.328	6.330	6.359	6.513	6.609	6.626
EXISTING SURFACE LEVEL	6.607	6.598	6.535	6.269	6.150	6.132	6.078	6.031	6.032	6.032
CUT / FILL DEPTH	-0.000	0.001	0.014	0.091	0.178	0.197	0.282	0.482	0.576	0.594
CHAINAGE	0	0.243	1.726	10	15.028	16.097	20	27.193	30	30.468

FINISHED SURFACE LEVEL	6.994	7.090	7.339	7.540	7.593	7.596	7.596	7.595	7.503	7.263	7.012
EXISTING SURFACE LEVEL	6.088	6.104	6.153	6.223	6.239	6.244	6.243	6.242	6.250	6.229	6.202
CUT / FILL DEPTH	0.906	0.986	1.185	1.317	1.354	1.353	1.353	1.353	1.252	1.034	0.811
CHAINAGE	40	42.47	50	60	66.746	68.718	69.683	70	80	90	96.897

FINISHED SURFACE LEVEL	6.884	6.580	6.544	6.474	6.177	6.169	6.007	5.992	5.943	5.910
EXISTING SURFACE LEVEL	6.181	6.146	6.110	6.099	6.013	6.007	5.971	5.956	5.915	5.910
CUT / FILL DEPTH	0.702	0.434	0.434	0.376	0.164	0.162	0.036	0.036	0.028	0.000
CHAINAGE	100	107.341	108.209	110	119.698	120	130	132.055	140	145.41

A1 SCALE: H 1:250, V 1:50

LONGITUDINAL SECTION RS02

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

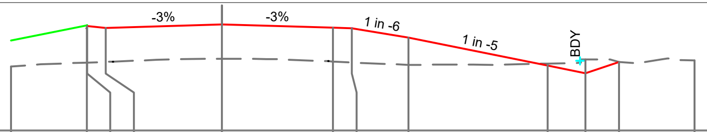
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
PLAN AND LONGITUDINAL SECTION - NORTH SHORE ROAD

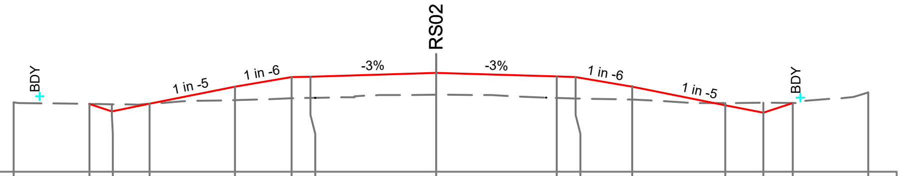
DRAWING STATUS:
PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: 1:250
DRAWING NO. 24-05-02-C101
REV A



DATUM RL 4.200

FINISHED SURFACE LEVEL		6.887	6.953	6.902	6.994	6.906	6.891	6.641	5.906	5.706	6.002	
CUT / FILL		0.900	0.966	0.900	0.906	0.893	0.901	0.715	-0.055	-0.362	0.000	
EXISTING SURFACE LEVEL	5.885	5.987	5.987	6.002	6.088	6.013	5.990	5.926	5.961	6.068	6.002	6.046
OFFSET FROM CENTRELINE	-5.575	-3.575	-3.564	-3.075	0.000	2.942	3.442	4.942	8.618	9.618	10.507	12.507

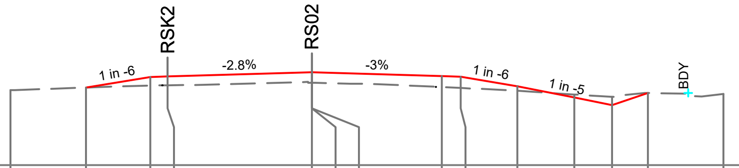
CH 40



DATUM RL 4.000

FINISHED SURFACE LEVEL		5.789	5.592	5.792	6.244	6.494	6.509	6.609	6.513	6.498	6.248	5.754	5.554	5.815	
CUT / FILL		0.000	-0.189	0.000	0.358	0.556	0.558	0.576	0.567	0.567	0.343	-0.056	-0.263	0.000	
EXISTING SURFACE LEVEL	5.826	5.789	5.781	5.792	5.886	5.938	5.951	6.032	5.946	5.931	5.905	5.811	5.818	5.815	6.091
OFFSET FROM CENTRELINE	-11.179	-9.179	-8.586	-7.586	-5.325	-3.825	-3.325	0.000	3.192	3.692	5.192	7.659	8.659	9.440	11.440

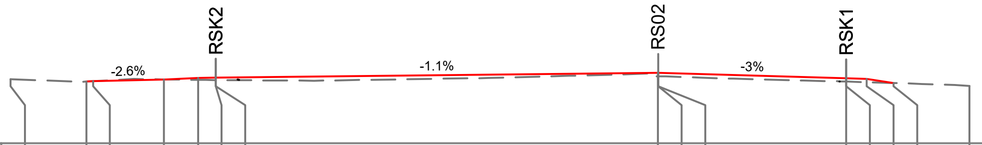
CH 30



DATUM RL 3.900

FINISHED SURFACE LEVEL		5.955	6.238	6.252	6.359	6.359	6.359	6.256	6.241	5.991	5.691	5.491	5.808	
CUT / FILL		0.000	0.230	0.239	0.282	0.282	0.282	0.290	0.298	0.122	-0.081	-0.219	0.000	
EXISTING SURFACE LEVEL	5.889	5.955	6.008	6.014	6.078	6.078	6.078	5.966	5.943	5.869	5.772	5.710	5.808	5.784
OFFSET FROM CENTRELINE	-7.972	-5.972	-4.271	-3.816	0.000	0.000	0.000	3.442	3.942	5.442	6.942	7.942	8.892	10.892

CH 20

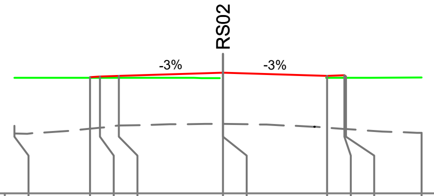


DATUM RL 4.500

FINISHED SURFACE LEVEL		6.133	6.136	6.185	6.228	6.228	6.228	6.361	6.360	6.360	6.213	6.213	6.199	6.089	
CUT / FILL		0.007	-0.001	0.000	0.056	0.061	0.061	0.092	0.091	0.091	0.085	0.085	0.087	-0.000	
EXISTING SURFACE LEVEL	6.188	6.127	6.137	6.185	6.172	6.167	6.167	6.269	6.269	6.269	6.128	6.128	6.111	6.089	6.014
OFFSET FROM CENTRELINE	-17.123	-15.123	-14.942	-13.071	-12.168	-11.700	-11.700	-0.002	0.000	0.000	4.973	4.973	5.510	6.229	8.229

CH 10

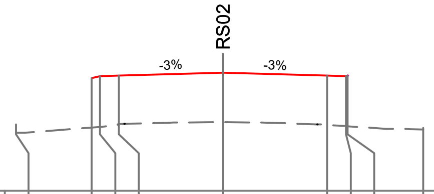
LEGEND	
— — —	EXISTING SURFACE
🟥	PROPOSED ROAD SURFACE
🟩	PROPOSED STOPBANK SURFACE



DATUM RL 4.400

FINISHED SURFACE LEVEL		7.480	7.498	7.513	7.595	7.595	7.513	7.525	7.498	
CUT / FILL		1.369	1.361	1.317	1.353	1.353	1.370	1.416	1.392	
EXISTING SURFACE LEVEL	6.190	6.111	6.137	6.196	6.242	6.242	6.142	6.109	6.105	6.007
OFFSET FROM CENTRELINE	-5.513	-3.513	-3.250	-2.750	0.000	0.000	2.750	3.206	3.250	5.250

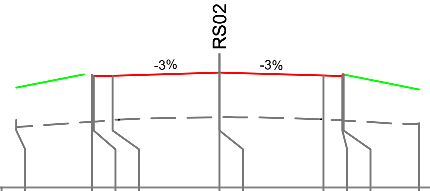
CH 70



DATUM RL 4.400

FINISHED SURFACE LEVEL		7.395	7.443	7.458	7.540	7.458	7.443	7.464	
CUT / FILL		1.312	1.342	1.286	1.317	1.306	1.323	1.347	
EXISTING SURFACE LEVEL	6.165	6.083	6.100	6.172	6.223	6.152	6.119	6.117	6.073
OFFSET FROM CENTRELINE	-5.473	-3.473	-3.250	-2.750	0.000	2.750	3.250	3.294	5.294

CH 60



DATUM RL 4.300

FINISHED SURFACE LEVEL		7.277	7.239	7.254	7.339	7.339	7.256	7.241	7.295	
CUT / FILL		1.244	1.202	1.168	1.185	1.185	1.159	1.171	1.226	
EXISTING SURFACE LEVEL	6.079	6.033	6.037	6.086	6.153	6.153	6.097	6.070	6.068	5.997
OFFSET FROM CENTRELINE	-5.378	-3.378	-3.325	-2.825	0.000	0.000	2.750	3.250	3.285	5.285

CH 50

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

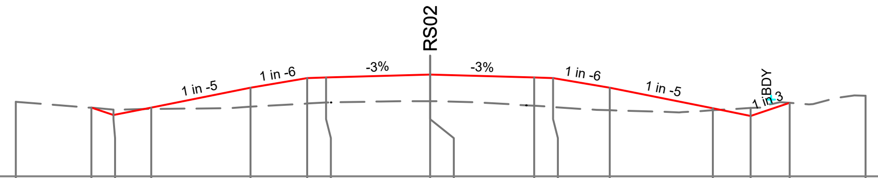
CTD
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
CROSS SECTIONS
SHEET 1 OF 2

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO. 24-05-02-C201
REV A

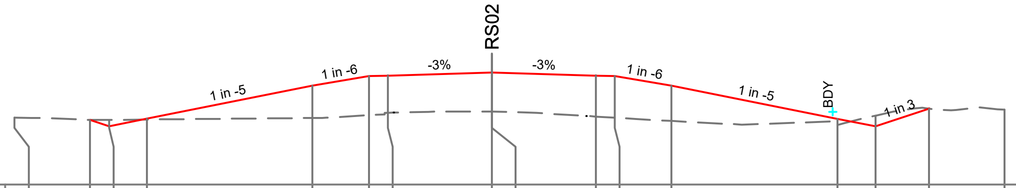
LEGEND
- ╌ EXISTING SURFACE
- 🟥 PROPOSED ROAD SURFACE
- 🟩 PROPOSED STOPBANK SURFACE



DATUM RL 4.200

FINISHED SURFACE LEVEL		6.005	5.811	6.011	6.536	6.786	6.801	6.884	6.884	6.801	6.786	6.536	5.990	5.790	6.135	
CUT / FILL		0.000	-0.148	0.040	0.503	0.672	0.661	0.702	0.702	0.744	0.761	0.597	0.054	-0.207	0.000	
EXISTING SURFACE LEVEL	6.162	6.005	5.960	5.972	6.034	6.115	6.140	6.181	6.181	6.057	6.025	5.939	5.937	5.997	6.135	6.320
OFFSET FROM CENTRELINE	-10.957	-8.957	-8.376	-7.376	-4.750	-3.250	-2.750	0.000	0.000	2.750	3.250	4.750	7.479	8.479	9.513	11.513

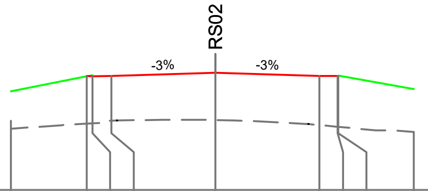
CH 100



DATUM RL 4.300

FINISHED SURFACE LEVEL		6.008	5.840	6.040	6.916	7.166	7.181	7.263	7.263	7.181	7.166	6.916	6.036	5.836	6.308	
CUT / FILL		0.000	-0.168	0.023	0.856	1.034	0.983	1.034	1.034	1.084	1.099	0.935	0.161	-0.285	0.000	
EXISTING SURFACE LEVEL	6.063	6.008	6.008	6.018	6.059	6.132	6.198	6.229	6.229	6.097	6.067	5.980	5.875	6.121	6.308	6.275
OFFSET FROM CENTRELINE	-12.629	-10.629	-10.126	-9.126	-4.750	-3.250	-2.750	0.000	0.000	2.750	3.250	4.750	9.149	10.149	11.567	13.567

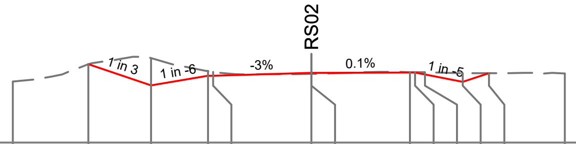
CH 90



DATUM RL 4.400

FINISHED SURFACE LEVEL		7.418	7.405	7.420	7.503	7.420	7.416	7.405	
CUT / FILL		1.264	1.241	1.190	1.252	1.302	1.344	1.335	
EXISTING SURFACE LEVEL	6.235	6.155	6.164	6.231	6.250	6.118	6.072	6.070	5.937
OFFSET FROM CENTRELINE	-5.406	-3.406	-3.250	-2.750	0.000	2.750	3.233	3.250	5.250

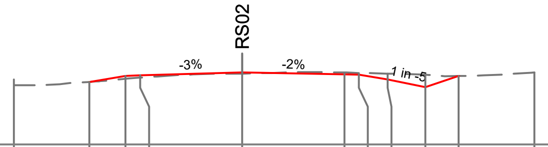
CH 80



DATUM RL 4.100

FINISHED SURFACE LEVEL		6.166	5.611	5.861	5.865	5.943	5.943	5.947	5.947	5.902	5.702	5.934	
CUT / FILL		0.000	-0.722	-0.127	-0.103	0.028	0.028	-0.014	-0.012	-0.054	-0.226	0.000	
EXISTING SURFACE LEVEL	5.713	6.166	6.333	5.988	5.968	5.915	5.915	5.960	5.959	5.956	5.928	5.934	5.922
OFFSET FROM CENTRELINE	-7.905	-5.905	-4.239	-2.739	-2.604	0.000	0.000	2.604	2.739	3.006	4.006	4.702	6.702

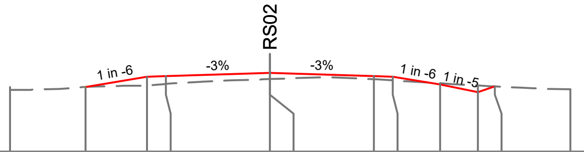
CH 140



DATUM RL 4.100

FINISHED SURFACE LEVEL		5.755	5.915	5.926	6.007	5.953	5.945	5.818	5.618	5.913	
CUT / FILL		-0.000	0.075	0.057	0.036	-0.051	-0.047	-0.156	-0.325	0.000	
EXISTING SURFACE LEVEL	5.819	5.755	5.840	5.869	5.971	6.004	5.992	5.975	5.943	5.913	6.003
OFFSET FROM CENTRELINE	-6.045	-4.045	-3.089	-2.704	0.000	2.704	3.089	3.849	4.849	5.733	7.733

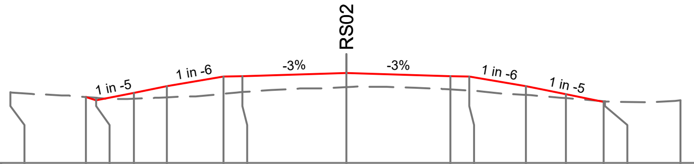
CH 130



DATUM RL 4.100

FINISHED SURFACE LEVEL		5.800	6.072	6.087	6.169	6.169	6.087	6.072	5.863	5.663	5.813	
CUT / FILL		-0.000	0.235	0.206	0.162	0.162	0.081	0.100	-0.034	-0.175	0.000	
EXISTING SURFACE LEVEL	5.800	5.800	5.837	5.881	6.007	6.007	6.006	5.972	5.897	5.838	5.813	5.740
OFFSET FROM CENTRELINE	-6.879	-4.879	-3.250	-2.750	0.000	0.000	2.750	3.250	4.503	5.503	5.952	7.952

CH 120



DATUM RL 4.100

FINISHED SURFACE LEVEL		5.840	5.752	5.952	6.127	6.377	6.392	6.474	6.392	6.377	6.127	5.915	5.715	5.725	
CUT / FILL		0.000	-0.065	0.159	0.296	0.452	0.421	0.376	0.351	0.365	0.232	0.101	-0.013	0.000	
EXISTING SURFACE LEVEL	5.963	5.840	5.817	5.793	5.831	5.925	5.971	6.099	6.041	6.012	5.895	5.814	5.728	5.725	5.751
OFFSET FROM CENTRELINE	-8.890	-6.890	-6.625	-5.625	-4.750	-3.250	-2.750	0.000	2.750	3.250	4.750	5.809	6.809	6.839	8.839

CH 110

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

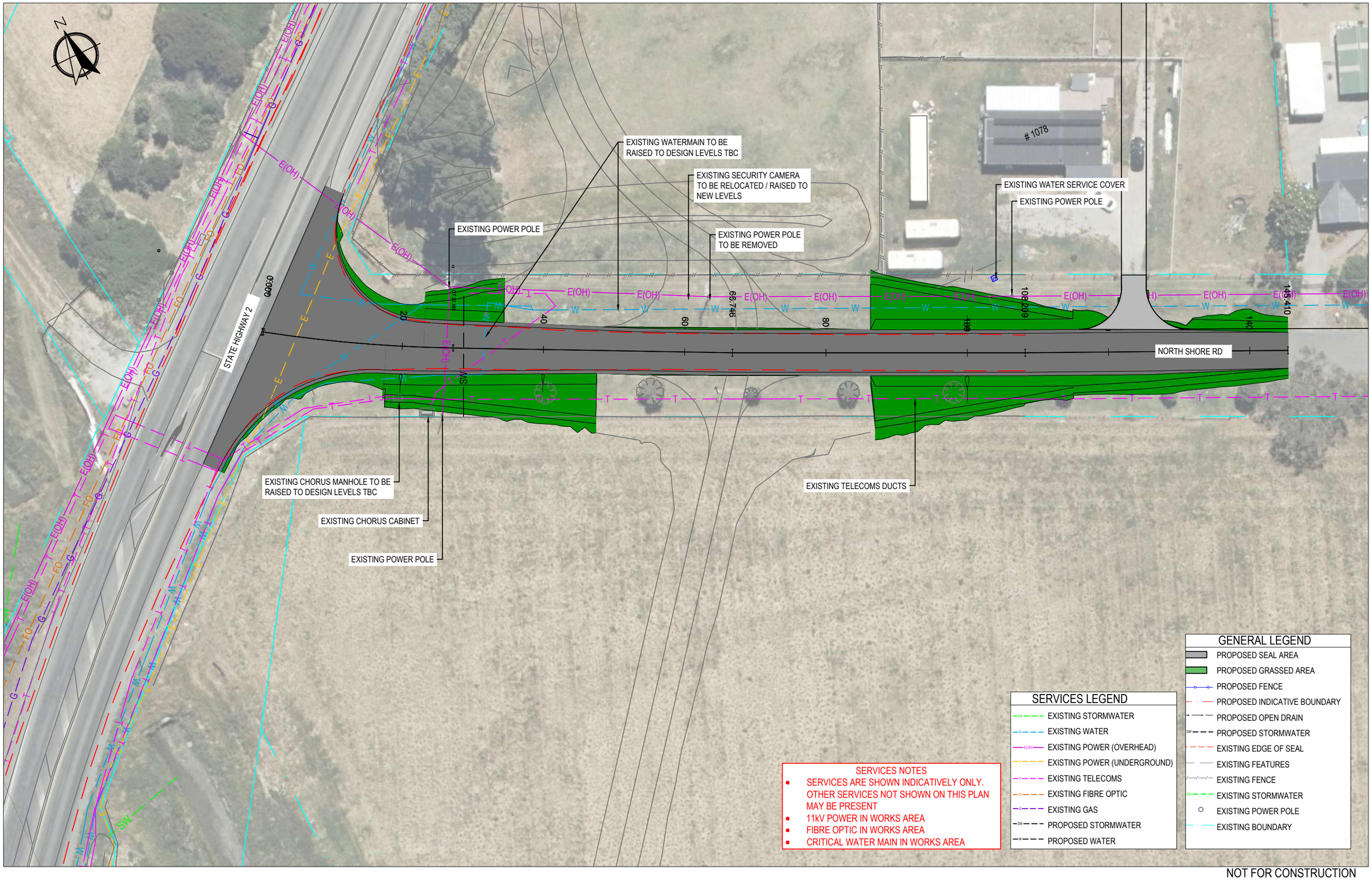
CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING

CROSS SECTIONS
SHEET 2 OF 2

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: 1:100 H, 1:100 V
DRAWING NO. 24-05-02-C202
REV A



SERVICES NOTES

- SERVICES ARE SHOWN INDICATIVELY ONLY. OTHER SERVICES NOT SHOWN ON THIS PLAN MAY BE PRESENT
- 11kV POWER IN WORKS AREA
- FIBRE OPTIC IN WORKS AREA
- CRITICAL WATER MAIN IN WORKS AREA

SERVICES LEGEND

- EXISTING STORMWATER
- EXISTING WATER
- EXISTING POWER (OVERHEAD)
- EXISTING POWER (UNDERGROUND)
- EXISTING TELECOMS
- EXISTING FIBRE OPTIC
- EXISTING GAS
- PROPOSED STORMWATER
- PROPOSED WATER

GENERAL LEGEND

- PROPOSED SEAL AREA
- PROPOSED GRASSED AREA
- PROPOSED FENCE
- PROPOSED INDICATIVE BOUNDARY
- PROPOSED OPEN DRAIN
- PROPOSED STORMWATER
- EXISTING EDGE OF SEAL
- EXISTING FEATURES
- EXISTING FENCE
- EXISTING STORMWATER
- EXISTING POWER POLE
- EXISTING BOUNDARY

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

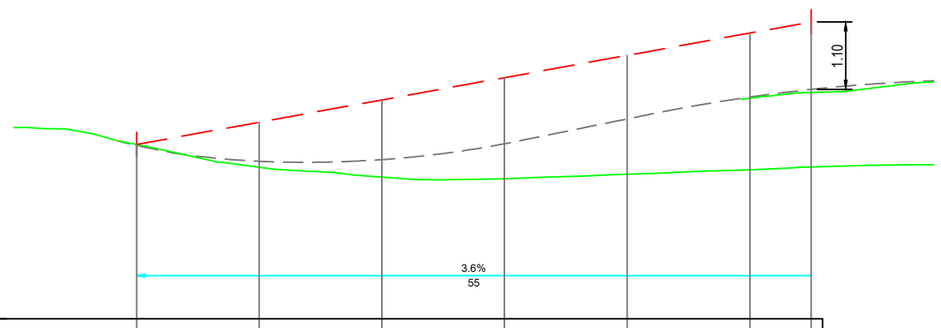
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
SERVICES PLAN

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: 1:250
DRAWING NO.: 24-05-02-C301
REV: A



HORIZONTAL CURVE DATA

VERTICAL CURVE LENGTH (m)
VERTICAL CURVE RADIUS (m)

VERTICAL GEOMETRY GRADE (%)
VERTICAL GEOMETRY LENGTH (m)

DATUM RL = 3.700

SIGHTLINE LEVEL	6.538	6.901	7.264	7.628	7.991	8.354	8.536
DESIGN SURFACE LEVEL	6.524	6.265	6.292	6.550	6.955	7.312	7.436
CUT / FILL DEPTH	0.014	0.636	0.973	1.078	1.036	1.043	1.100
CHAINAGE	0	10	20	30	40	50	55

A1 SCALE: H 1:250, V 1:50

LONGITUDINAL SECTION SA ASD NORTH SHORE RD

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

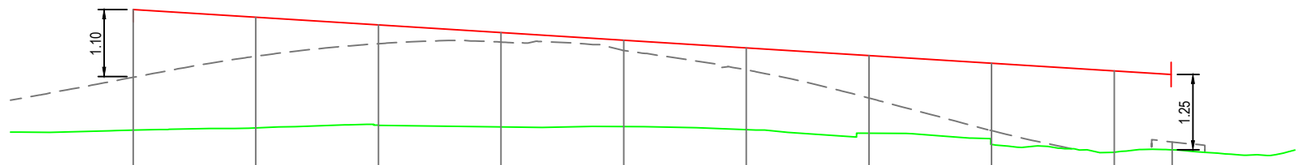
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
SIGHTLINES PLAN
SHEET 1 OF 3

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: 1:250
DRAWING NO.: 24-05-02-C401
REV: A



HORIZONTAL CURVE DATA

VERTICAL CURVE LENGTH (m)
VERTICAL CURVE RADIUS (m)

VERTICAL GEOMETRY GRADE (%) -1.2%
VERTICAL GEOMETRY LENGTH (m) 84.64

DATUM RL = 3.300

SIGHTLINE LEVEL	8.024	7.899	7.774	7.649	7.525	7.400	7.275	7.150	7.025		
DESIGN SURFACE LEVEL	6.921	7.264	7.469	7.495	7.359	7.042	6.584	6.052			5.867
CUT / FILL DEPTH	1.103	0.635	0.306	0.154	0.166	0.358	0.691	1.099			
CHAINAGE	0	10	20	30	40	50	60	70	80		84.733

A1 SCALE: H 1:250, V 1:50

LONGITUDINAL SECTION ACCESS TO 1078 SIGHTLINE

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

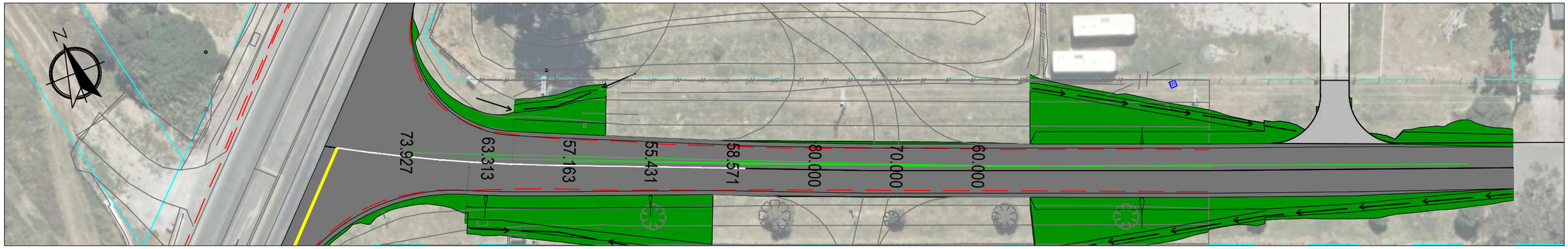
	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

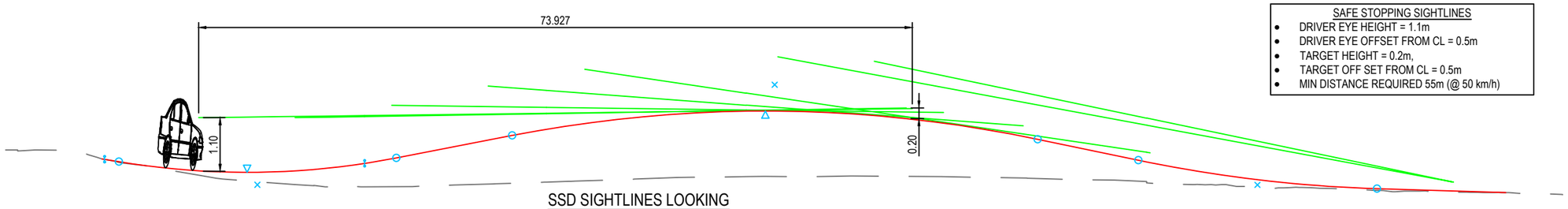
CTD CIVIL & TRANSPORTATION DESIGN

HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
SIGHTLINES PLAN
SHEET 2 OF 3

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: 1:250
DRAWING NO.: 24-05-02-C402
REV: A

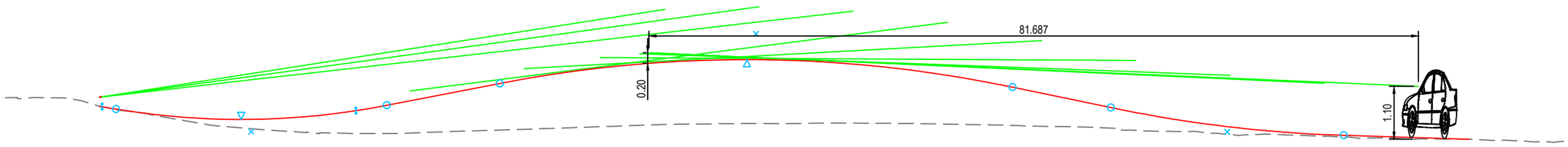




SAFE STOPPING SIGHTLINES
- DRIVER EYE HEIGHT = 1.1m
- DRIVER EYE OFFSET FROM CL = 0.5m
- TARGET HEIGHT = 0.2m,
- TARGET OFF SET FROM CL = 0.5m
- MIN DISTANCE REQUIRED 55m (@ 50 km/h)

SSD SIGHTLINES LOOKING EAST

SCALE 1:250 H, 1:100 V



SSD SIGHTLINES LOOKING WEST

SCALE 1:250 H, 1:100 V

NOT FOR CONSTRUCTION

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	PRELIMINARY DESIGN ISSUED	JO	SG		01.08.25

	NAME
DESIGNED	J. ORRINGE
DRAWN	J. ORRINGE
REVIEWED	S.GREEN
APPROVED	

CTD CIVIL & TRANSPORTATION DESIGN

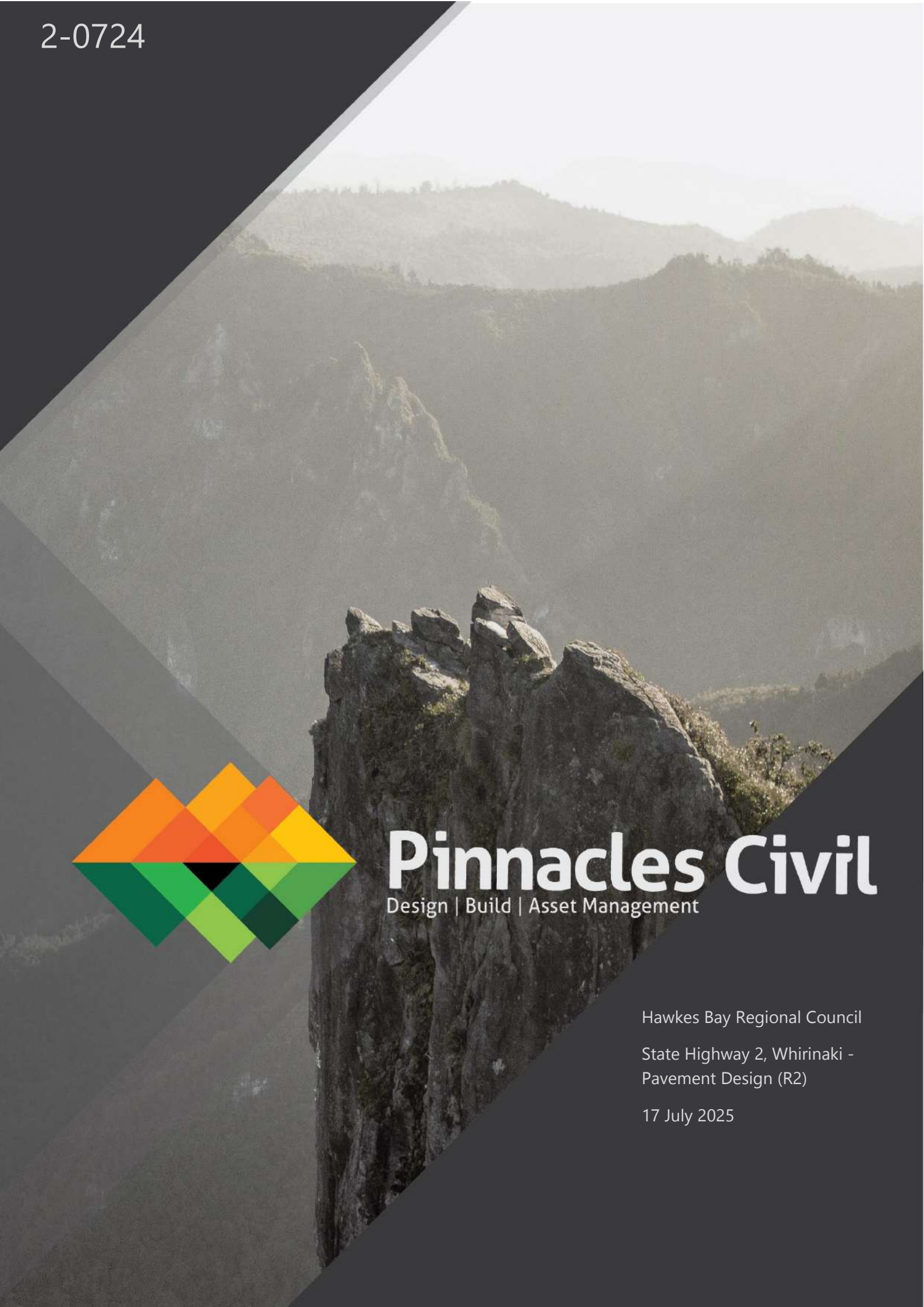
HAWKES BAY REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

HAWKES BAY REGIONAL COUNCIL
WHIRINAKI RESILIENCE PROJECT - NORTH SHORE ROAD RAISING
SIGHTLINES PLAN
SHEET 3 OF 3

DRAWING STATUS: PRELIMINARY
PLOT DATE: 01.08.2025
SCALE AT A1: 1:250
DRAWING NO.: 24-05-02-C403
REV: A

Pavement Design Report

2-0724



Pinnacles Civil

Design | Build | Asset Management

Hawkes Bay Regional Council

State Highway 2, Whirinaki - Pavement Design (R2)

17 July 2025

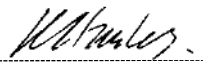
Prepared by:

Te Iwa Fisher

Senior Project Manager

Pinnacles Civil Group Ltd
PO Box 183
Waihi
www.pinnaclescivil.co.nz

Reviewed by:



Ryan Stanley
Managing Director - Hamilton

Approved for Release:

Brad Laurenson
General Manager - Waihi

Date:	17/07/2025
Reference:	2-0724
Status:	Final (R2)

Contents

Executive Summary

This pavement design is a revision of the previous report (Pinnacles Civil, 2024). The changes have been made based on changes to the geometric designs and the extents. We have assumed that the subgrade condition at the northern extent of the previous design continue through to the new extents of the project.

There is still significant overlay on both North Shore Road and SH2. We have also added an additional pavement design for a temporary pavement along SH2.

Based on the available traffic data the design traffic loadings are:

- State Highway 2:
  - **N_{DT} = 1.17 x 10^7** Heavy Vehicle Axle Groups,
  - 6.96 x 10^6 ESA
- North Shore Road:
  - **N_{DT} = 6.32 x 10^5** Heavy Vehicle Axle Groups,
  - 3.86 x 10^5 ESA
- State Highway 2 Temporary Road:
  - **N_{DT} = 1.7 x 10^6** Heavy Vehicle Axle Groups,
  - 1.01 x 10^6 ESA

Our design subgrade model consists of the following design CBRs:

- State Highway 2:
  - Tie ins/cut/at grade/fill <300mm = **700mm 4%, semi-infinite 2%**
  - Imported Engineered Fill (>300mm) = **10%**
  - Temporary Road = **700mm 4%, semi-infinite 2%**
- North Shore Road:
  - Western Tie in/cut/at grade/fill <300mm = **700mm 4%, semi-infinite 2%**
  - Imported Engineered Fill (>300mm) = **10%**
  - Eastern Tie in = **8%**

We recommend the following Pavement Designs:

- State Highway 2
  - Grade 2/4 Two Coat, First Coat Chipseal
  - 170mm NZTA M/4 AP40 modified basecourse (1.5% cement)
  - 200mm GAP65 subbase
  - Geogrid
  - 200mm Granular Subgrade Improvement layer where imported granular fill is less than 300mm thick.
  - Geotextile where imported fill is less than 300mm thick
- North Shore Road
  - Grade 2/4 Two Coat, First Coat Chipseal
  - 130mm NZTA M/4 AP40 basecourse

    - 150mm GAP65 subbase
    - 150mm Granular Subgrade Improvement layer where imported granular fill is less than 300mm thick.
    - Geotextile where imported fill is less than 300mm thick
- State Highway 2 – Temporary Road
    - Grade 3/5 Racked in First Coat Chipseal
    - 140mm NZTA M/4 AP40 basecourse
    - 310mm GAP65 subbase
    - Geotextile

Revision Register

Date of Issue	Changes	Rev
16/07/24	First Issue	R0
17/07/25	Revised Pavement Design based on revised geometric design	R1
17/04/25	Minor amendments to executive summary	R2

1. Introduction

This report is an update of a previous report (Pinnacles Civil, 2024) outlining the pavement design for the State Highway 2 (SH2) road raising project located at Whirinaki near Eskdale.

The design extents have changed. The previous design started south of North Shore Road and now starts north of North Shore Road and extends approximately 300m north of its previous extents. The road level is raised up to approximately 1.93m.

The revised design still involves raising of North Shore Road which intersects with SH2 within the site.

Figure 1 below shows the site extents and a comparison between the previous design and the new.

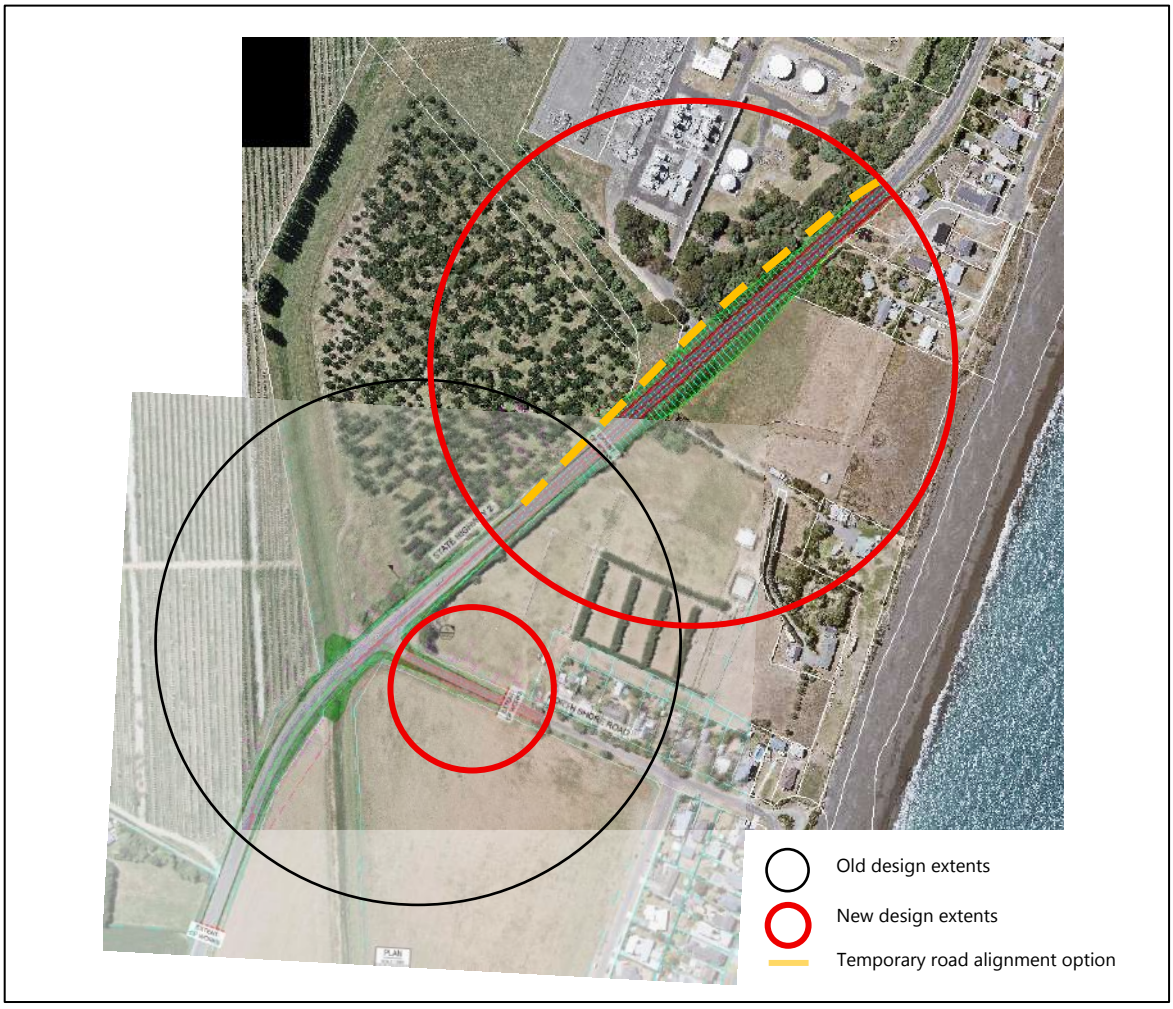


Figure 1: Site Extents

2. Standards

The following standards have been utilised for this project:

- New Zealand Guide to Pavement Evaluation and Treatment Design

- New Zealand Guide to Structural Pavement Design
- Austroads Guide to Pavement Technology
- Chipsealing in New Zealand
- Applicable NZTA Specifications

3. Site Information

Table 1 - Site Information

Site Information	Site Name: **State Highway 2** Location: SH2 RS0626 B/10.173 – 10.654 Classification: Regional Site Length (m): 474m Seal width: Pavement date: 1974 Current Traffic (AADT): 5341 (19.8% HCV) Latest Surfacing Date: Grade 2/4 Rack seal, 2020, north of North Shore Rd. Grade 3/5 Two coat, 2022, south of North Shore Rd.
	Site Name: **North Shore Road** Location: RP 0 – 112m Classification: 0-67m: Secondary collector, 67m onwards: Access Site Length (m): 112m Current Traffic (AADT): 440 (11.5% HCV) Latest Surfacing Date: Grade 4 Single coat 1999

4. Geology

The New Zealand Geology Web Map (1:250k Geology), produced by GNS Science, shows that the soil in this location can generally be described as Holocene shoreline deposits, gravel, mud and sandstone.

5. Pavement Investigation

5.1 Test Pit Locations

There were no additional test pits undertaken for the revised report. The updated geotechnical testing indicates that the ground conditions are like those encountered further south. As such we have assumed similar ground conditions for the revised design are the same as those encountered previously. Figure 1 below shows the location of test pit investigations.

Figure 2 - Test Pit Locations

5.2 Test Pit Summary

Test pits were completed in February 2024 as part of NZTA maintenance. Further test pits were completed in May 2024 to collect data in the locations that weren't collected in February. Tables 1 to 3 below summarises the test pit information.

Table 2 - 2024 Test Pit Summary

Test Pit	Location	Existing Pavement Depth (mm)	Subgrade Layer Thickness (mm)	Representative CBR_{SG} (10th percentile)	Comments
February 2024 State Highway Test Pits					
TP01	SH2 0626/10555,	520	500	13	
			250	8	

Test Pit	Location	Existing Pavement Depth (mm)	Subgrade Layer Thickness (mm)	Representative CBR_{SG} (10th percentile)	Comments
	RHS, LWP		Semi-infinite	15	
TP02	SH2 0626/10419, RHS, RWP	630	100	16	Scala depth = 100mm then refusal
TP03	SH2 0626/10340, LHS, LWP	400	500	12	Weakest pavement found in this area, however, will be under 2.4m of fill under the current design
			200	4	
			Semi-infinite	2	
TP04	SH2 0626/10505, LHS, RWP	500	Semi-infinite	23	Scala depth = 150mm then refusal
May 2024 State Highway/North Shore Rd Test Pits					
TP01	SH2 0626/10640, LHS, 1.2m offset from CL	310	Semi-infinite	11	
TP02	SH2 0626/10220, RHS, 1.4m offset from CL	380	100	8	
			Semi-infinite	16	
TP03	SH2 0626/10160, LHS, 1.2m offset from CL	350	350	8	
			Semi-infinite	14	
TP04	North shore Rd RP110 LHS 1m offset from CL	140	Semi-infinite	8	

State Highway 2 comprised of the following pavement:

Table 3 - SH2 Pavement Material Summary

Layer	Type	Thickness	Comments
Surfacing	Two coat chip seal	20mm to 100mm	This section of state highway appears to have been previously raised, with a second layer of seal between 200mm and 400mm below the existing chipseal layer
Basecourse	AP40	40mm to 230mm	Gravel, sandy with some silt, angular to sub angular, non-plastic, tightly packed and moist.
Subbase	AP65	100mm to 480mm	Sub-angular to rounded gravel, some silt, gap graded and moist.
Subgrade	NA	NA	Sandy, some silty with some gravel, moist, loose blueish grey. Subgrade strength is variable with CBRs below 4 in some locations and above 38+ in others.
Total Pavement Thickness		310 to 620mm	

North Shore Road comprised of the following pavement:

Table 4 - North Shore Rd Pavement Material Summary

Layer	Type	Thickness	Comments
Surfacing	Two coat chip seal	40mm	
Basecourse	AP40	100mm	Gravel, sandy with some silt, sub rounded to sub angular, non-plastic, tightly packed, brown in colour and moist.
Subbase	NA	NA	A separate subbase material was not encountered in the test pit on North Shore Rd
Subgrade	NA	NA	Sand, silty with traces of gravel, moist, loose greyish brown. Subgrade strength was between CBR 8 and 12.
Total Pavement Thickness		140mm	

Table 3: North Shore Rd Pavement Summary

5.3 Lab Testing Results

Samples of basecourse were recovered for particle size distribution, plasticity index testing and sand equivalent. The results of the laboratory testing are summarised in Table 2 and Figures 4 & 5 below, with the full reports attached as Appendix D.

Table 5 - Lab Testing Summary

Test	Layer	Sample Location	Result	Comment
PI	Basecourse	TP1 (May 24)	Non plastic for all	
		TP4 (May 24)		
	Subbase	TP1 (Feb 24)		
		TP2 (Feb 24)		
	Subgrade	TP1 (Feb 24)		
		TP3 (Feb 24)		

Test	Layer	Sample Location	Result	Comment
PSD	Basecourse	May 2024: TP1, TP2, TP3, TP4	Grading of test pit base course sample see figures 4 & 5.	Poor grading: For basecourse compared to M/4 AP40 grading curves, the material sits on the fine side of the curves and is mostly outside of the grading curve limits. TP 1 & 2 fits briefly within the curve limits but it sits predominantly towards the fine side (>10mm stone)
	Subbase	Feb 2024: TP2, TP3		Poor grading: For subbase compared to WHAP65 grading curves, the material sits on the fine side of the curves and is all outside of the grading curve limits.
SE	Basecourse	TP2 (Feb 24)	48	All test pit samples are above the minimum requirement of 25 for WHAP40 material specification however TP3 (May 2024) still below the minimum of 40 for a M/4 material. This result contributes to the basecourse from this test pit being **sensitive to moisture ingress.** TP 2 & 3 (Feb 2024) are above the minimum of 25 for WHAP40 and 40 for a M/4 material and therefore meet the sand equivalent requirements for a M/4 AP40.
		TP3 (Feb 24)	40	
		TP3 (May 24)	30	
Subgrade CBR (Remoulded)	Basecourse	TP3 (May 24)	60%	
	Subbase	TP1 (Feb 24)	30%	
	Subgrade	TP1 (Feb 24)	17%	
		TP3 (Feb 24)	25%	
		TP3 (May 24)	9%	
		TP4 (May 24)	25%	

Test	Layer	Sample Location	Result	Comment
Indirect Tensile Strength	Basecourse	TP1,2 & 3 Combined (May 24)	**1% cement:** ITS: 370-390kpa dry, 399-403kpa wet, TSR: 106% **3% cement:** ITS: 1260-1269kpa dry, 946-1011kpa wet, TSR: 77%	Existing pavement material reactive to addition of cement.
		Feb 24	**2% cement:** ITS 759.5kpa dry, 657kpa wet TSR: 87%	
	Subbase	Feb 2024 Combined	**3% cement:** ITS 677kpa dry, 636kpa wet, TSR: 94%	
Clay Index	Natural fines	TP2 (Feb 24)	3.1	All results are above the maximum of a clay index of 3 for a M/4 material.
		TP3 (Feb 24)	3.8	

Table 4: Whirinaki SH2/North Shore Rd Laboratory Results

Note: The "NZ Guide to Pavement Evaluation and Treatment Design" was released 27 June 2017 and requires testing for this site to Investigation Level 3.

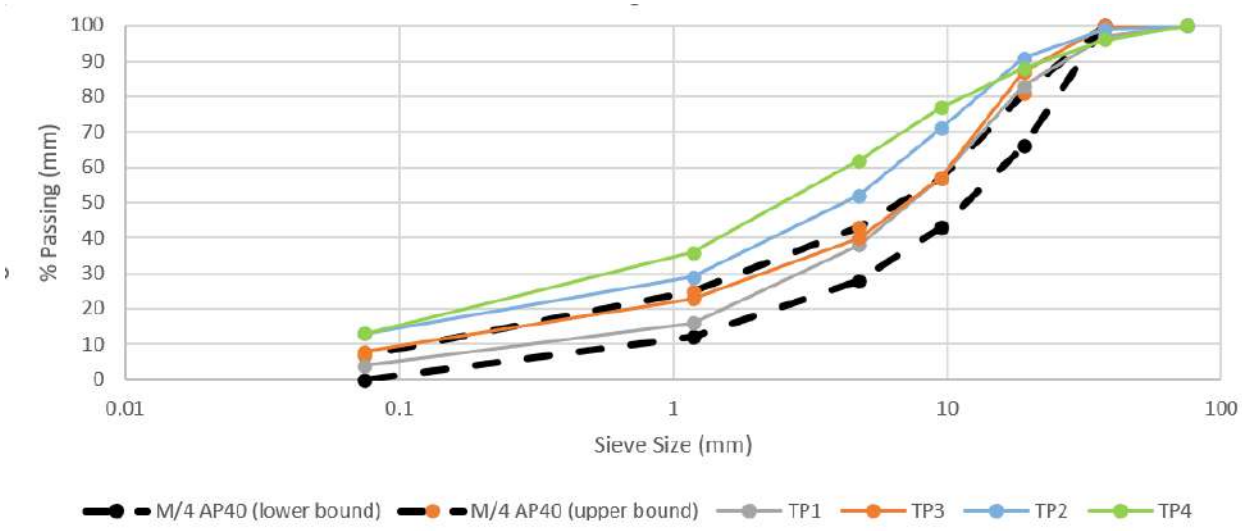


Figure 3: Grading Summary – Basecourse (May 2024)

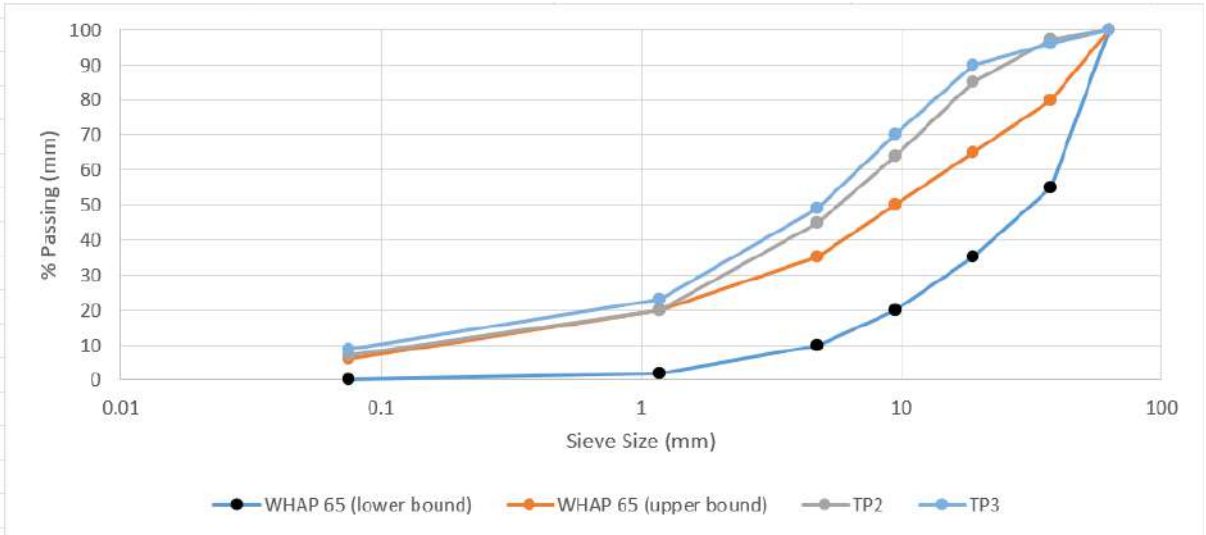


Figure 4: Grading Summary – Subbase (February 2024)

5.4 Interpretation of Inspection and Testing Data

The visual observations and test data highlights the following key factors:

- Compared to the M/4 AP40 grading envelope the base course generally sits on the fine side of the grading envelope. Rutting and shoving can be attributed to a lack of shear strength likely contributed to by the fine grading of the basecourse.
- Fines testing shows all layers are not plastic and have a high Sand Equivalent (SE). This, combined with the PI results, means the pavement is unlikely to be sensitive to moisture ingress.
- Test pits suggest that there is a reasonable depth of pavement over most of the site (i.e., it generally increases where subgrade strengths are lower).

6. Pavement Design

6.1 Design Traffic Loading

The traffic loading design for a 25-year design life for both State Highway 2 and North Shore Road have been calculated as shown below:

State Highway 2: $\mathbf{N_{DT} = 1.17 \times 10^7}$ Heavy Vehicle Axle Groups, 6.96 x 10^6 ESA

North Shore Road: $\mathbf{N_{DT} = 6.32 \times 10^5}$ Heavy Vehicle Axle Groups, 3.86 x 10^5 ESA

State Highway 2 Temporary Road: $\mathbf{N_{DT} = 1.7 \times 10^6}$ Heavy Vehicle Axle Groups, 1.01 x 10^6 ESA

The parameters used in the design traffic loading calculations are shown in Table 5 below:

Table 6 - Design Traffic Inputs

Parameter	Road Section	
	State Highway 2: RP10180 to RP10654m	**North Shore Road: RP0 to RP112m**
Design Period	25 Years	
AADT	2490	363
HCV	20.1%	11.5%
HCV Growth Rate (Per annum)	3%	3.2%
Lane Distribution Factor	1	
Direction Factor	0.5	
ESA/HCV	2.09	
N_{DT}	1.17×10^7	6.32×10^5
Design ESA	6.96×10^6	3.86×10^5

Refer to Appendix B for full traffic loading design calculations.

6.2 Design Subgrade

The design subgrade based on the field and laboratory tests is as follows:

Table 7 - Design Subgrade Model

Extents	Design Subgrade CBR (%)
North Shore Road Eastern Tie-in	8%
SH2 Tie-ins and North Shore Road Western Tie-in	700mm - 4% Semi-infinite - 2%
SH2 Fill	10%
SH2 Temporary Road	2%

6.3 Pavement Design

Most of the site will be raised using suitable engineered fill constructed in accordance with TNZ F/1. The fill is to have a minimum CBR of 10% and compacted to B/2 subbase specification.

Our pavement designs generally have a consistent thickness of Basecourse and subbase throughout with additional subgrade improvement where overlay is less than 300mm. This allows for simplicity in construction.

For the permanent SH2 leg, we recommend modification of the existing basecourse. This takes the pavement from a medium risk to a low-risk pavement type.

25 year design traffic volume (ESAs)	Less than 5×10^6	Between 5×10^6 and 1×10^7	Between 1×10^7 to 5×10^7	Greater than 5×10^7
Continuously Reinforced Concrete Pavement	Unlikely to be economic	Unlikely to be economic	Unlikely to be economic	Low risk
Structural Asphalt	Unlikely to be economic	Unlikely to be economic	Low risk	Low risk
Modified aggregate overlay basecourse and bound subbase	Unlikely to be economic	Low risk	Low risk	Medium risk
Foamed bitumen basecourse	Low risk	Low risk	Low risk	Medium risk
Modified aggregate base only	Low risk	Low risk	Medium risk	High risk
Unbound aggregate overlay	Low risk	Medium risk	High risk	High risk

Figure 5 - NZTA Structural Pavement Design Guide Table 7

The pavement thicknesses are as follows:

Table 8 - Pavement Thicknesses

	SH2			SH2 Temporary Road		
	Basecourse (mm)	**Subbase (mm)**	**SIL (mm)**	**Basecourse (mm)**	**Subbase (mm)**	**SIL (mm)**
Undercut to <300mm overlay	170	200	200	140	310	0
Overlay >300mm			0			

	North Shore Road		
	Basecourse (mm)	**Subbase (mm)**	**SIL (mm)**
Undercut to <300mm overlay	130	150	150
Overlay >300mm			0

Refer to Figure 6 for pavement design diagrams detailing the design from Table 6.

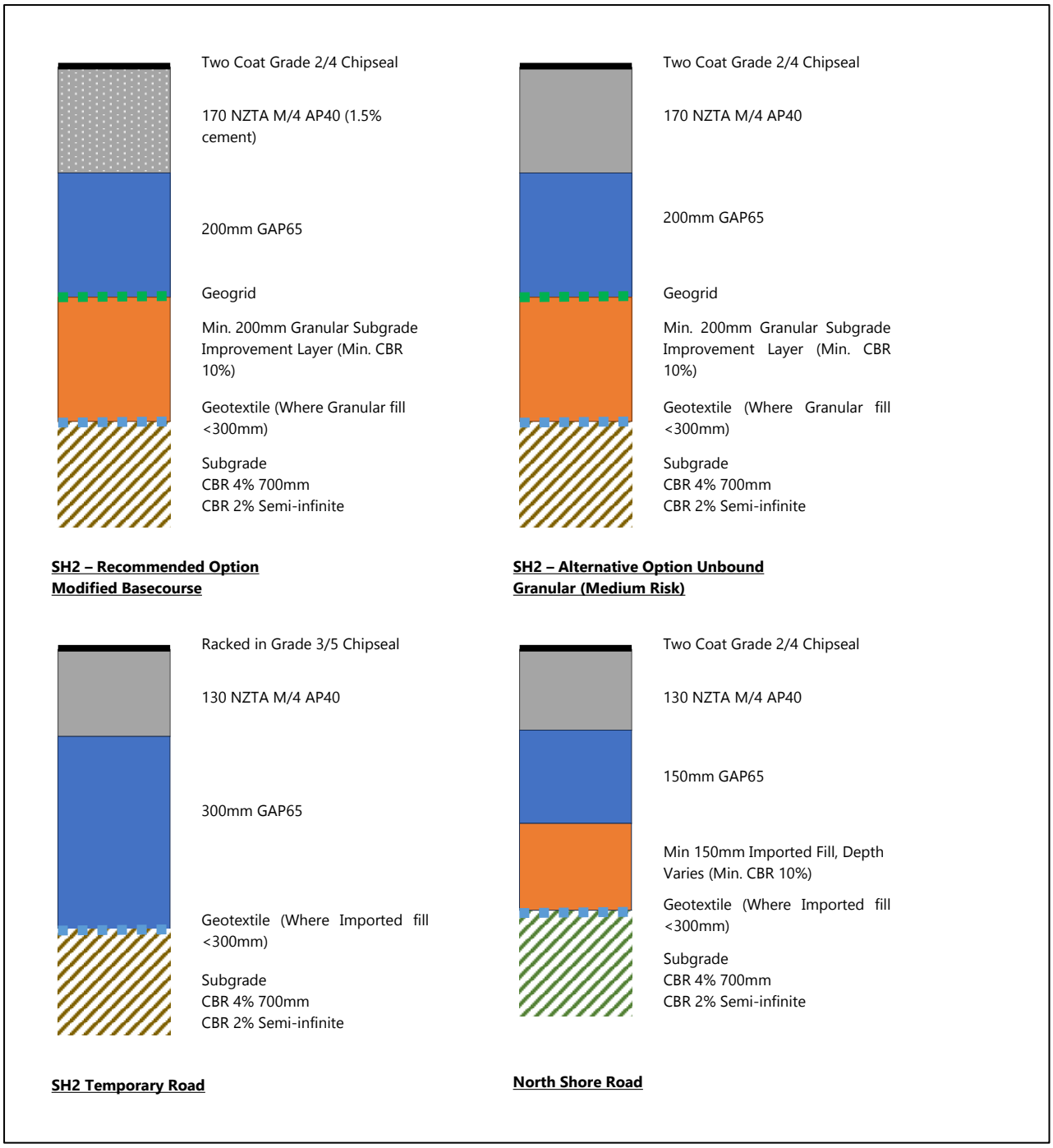


Figure 6 - Pavement Designs

7. Conclusion

The pavement design(s) recommended in section 6 of this report provide low risk pavement designs capable of providing for the growth in traffic and ground conditions. We have provided an alternative design which provides a medium risk option and negates the need for modification of the existing basecourse.

8. References

Pinnacles Civil. (2024). *State Highway 2 Whirinaki - Pavement Design.* Waihi, New Zealand: Pinnacles Civil.

APPENDIX A- Circly Outputs

CIRCLY - Version 7.0 (21 June 2024)

Job Title: SH2_Whirinaki

Design Method: Austroads 2017

NDT (cumulative heavy vehicle axle groups over design period): 1.17E+07

Traffic Load Distribution:

ID: 01N00463 - Decreasing
Name: 01N00463 - SH1N - Drury - Decreasing - N
ESA/HVAG: 0.605

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00
2	SAST53	SAST53	Vertical Force	102.4	0.80	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00
1	SAST53	1	0.0	0.0	1.00E+00	0.00
2	SAST53	1	2130.0	0.0	1.00E+00	0.00

Details of Layered System:

ID: SH2_WhirinakiA1 Title: SH2 Whirinaki - Unbound Granular Design

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Gran_350	Aniso.	3.50E+02	0.35	2.59E+02	1.75E+02	0.35
2	rough	Gran_150	Aniso.	1.50E+02	0.35	1.11E+02	7.50E+01	0.35
3	rough	subsltCB10	Aniso.	1.00E+02	0.35	7.41E+01	5.00E+01	0.35
4	rough	Sub_CBR4	Aniso.	4.00E+01	0.45	2.76E+01	2.00E+01	0.45
5	rough	Sub_CBR2	Aniso.	2.00E+01	0.45	1.38E+01	1.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Shift Factor
3	top	subsltCB10	EZZ	0.009150	7.000	
4	top	Sub_CBR4	EZZ	0.009150	7.000	
5	top	Sub_CBR2	EZZ	0.009150	7.000	

Reliability Factors:
Project Reliability: Austroads 90%

Layer No.	Reliability Factor	Material Type
3	1.00	Subgrade (Selected Material) (Austroads 2017)
4	1.00	Subgrade (Austroads 2017)
5	1.00	Subgrade (Austroads 2017)

Details of Layers to be sublayered:
Layer no. 1: Austroads (2004) sublayering
Layer no. 2: Austroads (2004) sublayering
Layer no. 3: Austroads (2004) sublayering

Strains:

Layer No.	Thickness	Material ID	Axle	Unitless Strain
3	200.00	subsltCB10		
			SADT(80):	7.909E-04
4	700.00	Sub_CBR4		
			SADT(80):	9.067E-04
5	0.00	Sub_CBR2		
			SADT(80):	4.342E-04

Results:

Layer No.	Thickness	Material ID	Axle Group	CDF
1	170.00	Gran_350		n/a
2	200.00	Gran_150		n/a
3	200.00	subsltCB10	Total:	2.553E-01
4	700.00	Sub_CBR4	Total:	6.647E-01
5	0.00	Sub_CBR2	Total:	3.839E-03

CIRCLY - Version 7.0 (21 June 2024)

Job Title: SH2_Whirinaki

Design Method: Austroads 2017

NDT (cumulative heavy vehicle axle groups over design period): 1.01E+06

Traffic Load Distribution:

ID: 01N00463 - Decreasing
Name: 01N00463 - SH1N - Drury - Decreasing - N
ESA/HVAG: 0.605

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00
2	SAST53	SAST53	Vertical Force	102.4	0.80	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00
1	SAST53	1	0.0	0.0	1.00E+00	0.00
2	SAST53	1	2130.0	0.0	1.00E+00	0.00

Details of Layered System:

ID: SH2_WhirinakiA2 Title: SH2 Whirinaki - Temp Road -Unbound Granular Design

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Gran_350	Aniso.	3.50E+02	0.35	2.59E+02	1.75E+02	0.35
2	rough	Gran_150	Aniso.	1.50E+02	0.35	1.11E+02	7.50E+01	0.35
3	rough	Sub_CBR4	Aniso.	4.00E+01	0.45	2.76E+01	2.00E+01	0.45
4	rough	Sub_CBR2	Aniso.	2.00E+01	0.45	1.38E+01	1.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Shift Factor
3	top	Sub_CBR4	EZZ	0.009150	7.000	
4	top	Sub_CBR2	EZZ	0.009150	7.000	

Reliability Factors:
Project Reliability: Austroads 90%

Layer No.	Reliability Factor	Material Type
3	1.00	Subgrade (Austroads 2017)
4	1.00	Subgrade (Austroads 2017)

Details of Layers to be sublayered:
Layer no. 1: Austroads (2004) sublayering
Layer no. 2: Austroads (2004) sublayering

Strains:

Layer No.	Thickness	Material ID	Axle	Unitless Strain
3	700.00	Sub_CBR4	SADT(80):	1.324E-03
4	0.00	Sub_CBR2	SADT(80):	5.300E-04

Results:

Layer No.	Thickness	Material ID	Axle Group	CDF
1	140.00	Gran_350		n/a
2	310.00	Gran_150		n/a
3	700.00	Sub_CBR4	Total:	8.126E-01
4	0.00	Sub_CBR2	Total:	1.338E-03

CIRCLY - Version 7.0 (21 June 2024)

Job Title: SH2_Whirinaki

Design Method: Austroads 2017

NDT (cumulative heavy vehicle axle groups over design period): 6.32E+05

Traffic Load Distribution:

ID: 01N00463 - Decreasing
Name: 01N00463 - SH1N - Drury - Decreasing - N
ESA/HVAG: 0.605

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00
2	SAST53	SAST53	Vertical Force	102.4	0.80	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00
1	SAST53	1	0.0	0.0	1.00E+00	0.00
2	SAST53	1	2130.0	0.0	1.00E+00	0.00

Details of Layered System:

ID: SH2_WhirinakiA3 Title: SH2 Whirinaki - NS Road -Unbound Granular Design

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Gran_350	Aniso.	3.50E+02	0.35	2.59E+02	1.75E+02	0.35
2	rough	Gran_150	Aniso.	1.50E+02	0.35	1.11E+02	7.50E+01	0.35
3	rough	Sub_CBR4	Aniso.	4.00E+01	0.45	2.76E+01	2.00E+01	0.45
4	rough	Sub_CBR2	Aniso.	2.00E+01	0.45	1.38E+01	1.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Shift Factor
3	top	Sub_CBR4	EZZ	0.009150	7.000	
4	top	Sub_CBR2	EZZ	0.009150	7.000	

Reliability Factors:
Project Reliability: Austroads 90%

Layer No.	Reliability Factor	Material Type
3	1.00	Subgrade (Austroads 2017)
4	1.00	Subgrade (Austroads 2017)

Details of Layers to be sublayered:
Layer no. 1: Austroads (2004) sublayering
Layer no. 2: Austroads (2004) sublayering

Strains:

Layer No.	Thickness	Material ID	Axle	Unitless Strain
3	700.00	Sub_CBR4	SADT(80):	1.424E-03
4	0.00	Sub_CBR2	SADT(80):	5.525E-04

Results:

Layer No.	Thickness	Material ID	Axle Group	CDF
1	130.00	Gran_350		n/a
2	300.00	Gran_150		n/a
3	700.00	Sub_CBR4	Total:	8.464E-01
4	0.00	Sub_CBR2	Total:	1.119E-03

CIRCLY - Version 7.0 (21 June 2024)

Job Title: SH2_Whirinaki

Design Method: Austroads 2017

NDT (cumulative heavy vehicle axle groups over design period): 1.17E+07

Traffic Load Distribution:

ID: 01N00463 - Decreasing
Name: 01N00463 - SH1N - Drury - Decreasing - N
ESA/HVAG: 0.605

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00
2	SAST53	SAST53	Vertical Force	102.4	0.80	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00
1	SAST53	1	0.0	0.0	1.00E+00	0.00
2	SAST53	1	2130.0	0.0	1.00E+00	0.00

Details of Layered System:

ID: SH2_WhirinaiA4 Title: SH2 Whirinaki - SH2 Fill -Unbound Granular Design

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Gran_350	Aniso.	3.50E+02	0.35	2.59E+02	1.75E+02	0.35
2	rough	Gran_150	Aniso.	1.50E+02	0.35	1.11E+02	7.50E+01	0.35
3	rough	Sub_CBR10	Aniso.	1.00E+02	0.45	6.90E+01	5.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Shift Factor
3	top	Sub_CBR10	EZZ	0.009150	7.000	

Reliability Factors:
Project Reliability: Austroads 90%

Layer No.	Reliability Factor	Material Type
3	1.00	Subgrade (Austroads 2017)

Details of Layers to be sublayered:
Layer no. 1: Austroads (2004) sublayering
Layer no. 2: Austroads (2004) sublayering

Strains:

Layer No.	Thickness	Material ID	Axle	Unitless Strain
3	0.00	Sub_CBR10		
			SADT(80):	8.119E-04

Results:

Layer No.	Thickness	Material ID	Axle Group	CDF
1	170.00	Gran_350		n/a
2	200.00	Gran_150		n/a
3	0.00	Sub_CBR10	Total:	3.067E-01

CIRCLY - Version 7.0 (21 June 2024)

Job Title: SH2_Whirinaki

Design Method: Austroads 2017

NDT (cumulative heavy vehicle axle groups over design period): 6.32E+05

Traffic Load Distribution:

ID: 01N00463 - Decreasing
Name: 01N00463 - SH1N - Drury - Decreasing - N
ESA/HVAG: 0.605

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA750-Full	ESA750-Full	Vertical Force	92.1	0.75	0.00
2	SAST53	SAST53	Vertical Force	102.4	0.80	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA750-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA750-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA750-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA750-Full	1	1965.0	0.0	1.00E+00	0.00
1	SAST53	1	0.0	0.0	1.00E+00	0.00
2	SAST53	1	2130.0	0.0	1.00E+00	0.00

Details of Layered System:

ID: SH2_Whirinaki_A4 Title: SH2 Whirinaki - NS Road -Unbound Granular Design in fill

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	Gran_350	Aniso.	3.50E+02	0.35	2.59E+02	1.75E+02	0.35
2	rough	Gran_150	Aniso.	1.50E+02	0.35	1.11E+02	7.50E+01	0.35
3	rough	subsltCB10	Aniso.	1.00E+02	0.35	7.41E+01	5.00E+01	0.35
4	rough	Sub_CBR4	Aniso.	4.00E+01	0.45	2.76E+01	2.00E+01	0.45
5	rough	Sub_CBR2	Aniso.	2.00E+01	0.45	1.38E+01	1.00E+01	0.45

Performance Relationships:

Layer No.	Location	Material ID	Component	Perform. Constant	Perform. Exponent	Shift Factor
3	top	subsltCB10	EZZ	0.009150	7.000	
4	top	Sub_CBR4	EZZ	0.009150	7.000	
5	top	Sub_CBR2	EZZ	0.009150	7.000	

Reliability Factors:
Project Reliability: Austroads 90%

Layer No.	Reliability Factor	Material Type
3	1.00	Subgrade (Selected Material) (Austroads 2017)
4	1.00	Subgrade (Austroads 2017)
5	1.00	Subgrade (Austroads 2017)

Details of Layers to be sublayered:
Layer no. 1: Austroads (2004) sublayering
Layer no. 2: Austroads (2004) sublayering
Layer no. 3: Austroads (2004) sublayering

Strains:

Layer No.	Thickness	Material ID	Axle	Unitless Strain
3	150.00	subsltCB10		
			SADT(80):	1.337E-03
4	700.00	Sub_CBR4		
			SADT(80):	1.434E-03
5	0.00	Sub_CBR2		
			SADT(80):	5.545E-04

Results:

Layer No.	Thickness	Material ID	Axle Group	CDF
1	130.00	Gran_350		n/a
2	150.00	Gran_150		n/a
3	150.00	subsltCB10	Total:	5.455E-01
4	700.00	Sub_CBR4	Total:	8.869E-01
5	0.00	Sub_CBR2	Total:	1.148E-03

APPENDIX B- Design Traffic Loading

Historical Traffic Data and Projections

Pinnacles Civil
Design | Build | Asset Management

Project No.: 2-0724 Date: 7/07/2025
Project Description: SH2 Whirinaki Pavement Rehabilitation

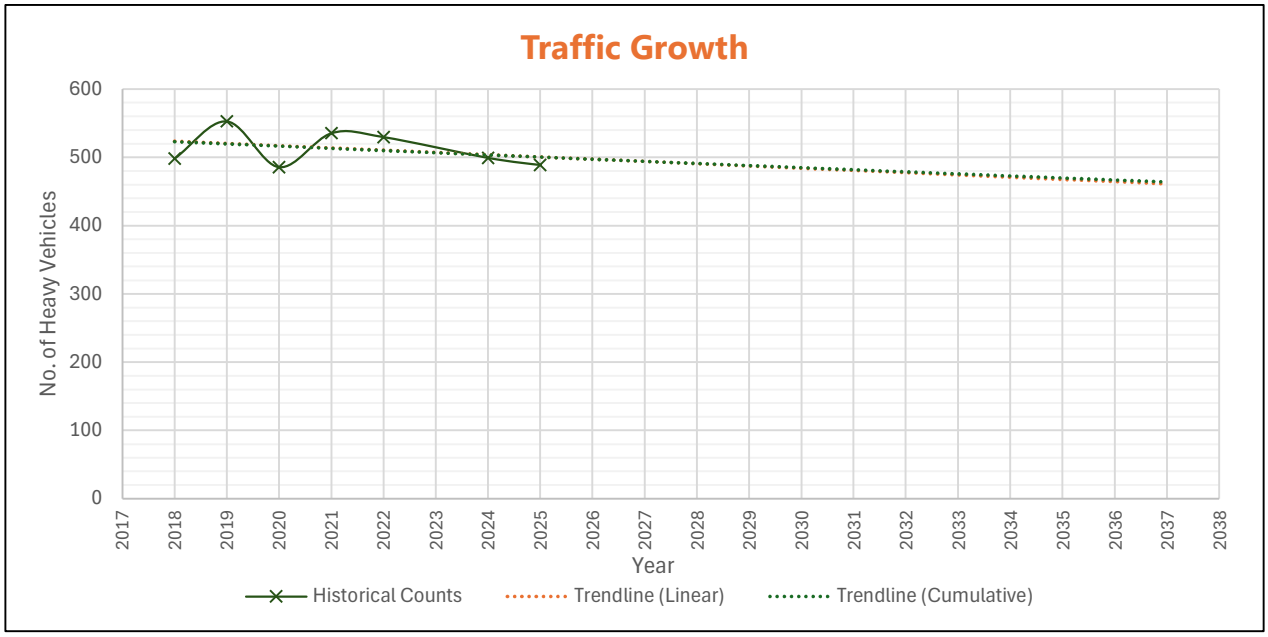
Traffic Data

Traffic Data Source: NZTA Opendata Portal

Year	AADT	%HV	No.HV
2018	2480	20%	498.44
2019	2749	20%	552.593
2020	2417	20%	485.723
2021	2663	20%	535.268
2022	2635	20%	529.704
2024	2484	20%	499.245
2025	2431	20%	488.651

Start Year (n): 2025

	Linear	Cumulative
$AADT_n$	2490	2489
$No.HV_n$	501	500
$\%HV_n$	20.1%	20.1%
R_n	-0.7%	-0.6%



Designed by: Te Iwa Fisher
Date: 7/7/25
Designer Signature:

Reviewed by: Ryan Stanley
Date: 16/7/25
Reviewer Signature:

Design Traffic Calculation

Pinnacles Civil
Design | Build | Asset Management

Project No.:	2-0724	Date:	7/07/2025
Project Description:	SH2 Whirinaki Pavement Rehabilitation		
	North Shore Road		

Design Traffic Inputs

Design Period	**P**	25	Initial Daily HV (per lane)	**N_i**	20.8725
Annual Average Daily Traffic	**AADT**	363	Cumulative Growth Factor	**CGF**	37.4
Direction Factor	**DF**	0.5	Linear Growth Factor	**LGF**	34.6
% Heavy Vehicles	**%HV**	11.5			
Lane Distribution Factor	**LDF**	1	Cumulative or Linear Growth		Cumulative
Heavy Vehicle Growth Rate	**R**	3.2	Number of Design HV	**N_{HV}**	2.85E+05

Heavy Vehicle Capacity

Passenger Car Equivalent	**E_{HV}**	2.5	Maximum Daily Vehicles	**C_{Veh}**	9.01E+04
Max hourly vol. of Passenger Cars	**C_{PC}**	2200	Max. HV Volume	**HV_{max}**	3.78E+06
No. of Lanes	**N_{lanes}**	2			

Traffic Load Distribution

Traffic Load Distribution	**TLD**	Drury_N	
Number of Axle Groups/HV	**N_{HVAG}**	3.5	
Cumulative HV Axle Groups	**N_{DT}**	9.98E+05	HVAG

ESA/HVAG	0.598
ESA/HV	2.09

Design Traffic Outputs

Corrected Number of Design HV	**$N_{HV(Corr.)}$**	2.85E+05	Heavy Vehicles
Corrected Number of HV Axle Groups	**$N_{DT(Corr.)}$**	**9.98E+05**	HVAG
		Use this value in Circly	
Design Equivalent Standard Axles	**DESA**	**5.96E+05**	ESA

Designed by:	Te Iwa Fisher	Reviewed by:	Ryan Stanley
Date:	7/7/25	Date:	16/7/25
Designer Signature:		Reviewer Signature:	

Design Traffic Calculation

Pinnacles Civil
Design | Build | Asset Management

Project No.: 2-0724 Date: 45845
Project Description:

Heavy Vehicle Capacity Table

Year	Growth Type	Cumu. HV	Annual HV	Max HV	Corrected HV	Corrected Cumu. HV
1	Cumulative	7.62E+03	7.62E+03	3.78E+06	7.62E+03	7.62E+03
2	Cumulative	1.55E+04	7.86E+03	3.78E+06	7.86E+03	1.55E+04
3	Cumulative	2.36E+04	8.11E+03	3.78E+06	8.11E+03	2.36E+04
4	Cumulative	3.20E+04	8.37E+03	3.78E+06	8.37E+03	3.20E+04
5	Cumulative	4.06E+04	8.64E+03	3.78E+06	8.64E+03	4.06E+04
6	Cumulative	4.95E+04	8.92E+03	3.78E+06	8.92E+03	4.95E+04
7	Cumulative	5.87E+04	9.20E+03	3.78E+06	9.20E+03	5.87E+04
8	Cumulative	6.82E+04	9.50E+03	3.78E+06	9.50E+03	6.82E+04
9	Cumulative	7.80E+04	9.80E+03	3.78E+06	9.80E+03	7.80E+04
10	Cumulative	8.81E+04	1.01E+04	3.78E+06	1.01E+04	8.81E+04
11	Cumulative	9.86E+04	1.04E+04	3.78E+06	1.04E+04	9.86E+04
12	Cumulative	1.09E+05	1.08E+04	3.78E+06	1.08E+04	1.09E+05
13	Cumulative	1.20E+05	1.11E+04	3.78E+06	1.11E+04	1.20E+05
14	Cumulative	1.32E+05	1.15E+04	3.78E+06	1.15E+04	1.32E+05
15	Cumulative	1.44E+05	1.18E+04	3.78E+06	1.18E+04	1.44E+05
16	Cumulative	1.56E+05	1.22E+04	3.78E+06	1.22E+04	1.56E+05
17	Cumulative	1.69E+05	1.26E+04	3.78E+06	1.26E+04	1.69E+05
18	Cumulative	1.82E+05	1.30E+04	3.78E+06	1.30E+04	1.82E+05
19	Cumulative	1.95E+05	1.34E+04	3.78E+06	1.34E+04	1.95E+05
20	Cumulative	2.09E+05	1.39E+04	3.78E+06	1.39E+04	2.09E+05
21	Cumulative	2.23E+05	1.43E+04	3.78E+06	1.43E+04	2.23E+05
22	Cumulative	2.38E+05	1.48E+04	3.78E+06	1.48E+04	2.38E+05
23	Cumulative	2.53E+05	1.52E+04	3.78E+06	1.52E+04	2.53E+05
24	Cumulative	2.69E+05	1.57E+04	3.78E+06	1.57E+04	2.69E+05
25	Cumulative	2.85E+05	1.62E+04	3.78E+06	1.62E+04	2.85E+05
26	Cumulative	3.02E+05	1.67E+04	3.78E+06	1.67E+04	3.02E+05
27	Cumulative	3.19E+05	1.73E+04	3.78E+06	1.73E+04	3.19E+05
28	Cumulative	3.37E+05	1.78E+04	3.78E+06	1.78E+04	3.37E+05
29	Cumulative	3.55E+05	1.84E+04	3.78E+06	1.84E+04	3.55E+05
30	Cumulative	3.74E+05	1.90E+04	3.78E+06	1.90E+04	3.74E+05
31	Cumulative	3.94E+05	1.96E+04	3.78E+06	1.96E+04	3.94E+05
32	Cumulative	4.14E+05	2.02E+04	3.78E+06	2.02E+04	4.14E+05
33	Cumulative	4.35E+05	2.09E+04	3.78E+06	2.09E+04	4.35E+05
34	Cumulative	4.57E+05	2.15E+04	3.78E+06	2.15E+04	4.57E+05
35	Cumulative	4.79E+05	2.22E+04	3.78E+06	2.22E+04	4.79E+05
36	Cumulative	5.02E+05	2.29E+04	3.78E+06	2.29E+04	5.02E+05
37	Cumulative	5.26E+05	2.37E+04	3.78E+06	2.37E+04	5.26E+05
38	Cumulative	5.50E+05	2.44E+04	3.78E+06	2.44E+04	5.50E+05
39	Cumulative	5.75E+05	2.52E+04	3.78E+06	2.52E+04	5.75E+05
40	Cumulative	6.01E+05	2.60E+04	3.78E+06	2.60E+04	6.01E+05

Design Traffic Calculation

Pinnacles Civil
Design | Build | Asset Management

Project No.:	2-0724	Date:	
Project Description:	SH2 Whirinaki Pavement Reconstruction		
	SH2		

Design Traffic Inputs

Design Period	**P**	25	Initial Daily HV (per lane)	**N_i**	250.245
Annual Average Daily Traffic	**AADT**	2490	Cumulative Growth Factor	**CGF**	36.5
Direction Factor	**DF**	0.5	Linear Growth Factor	**LGF**	34.0
% Heavy Vehicles	**%HV**	20.1			
Lane Distribution Factor	**LDF**	1	Cumulative or Linear Growth		Cumulative
Heavy Vehicle Growth Rate	**R**	3.0	Number of Design HV	**N_{HV}**	3.33E+06

Heavy Vehicle Capacity

Passenger Car Equivalent	**E_{HV}**	2.5	Maximum Daily Vehicles	**C_{Veh}**	8.11E+04
Max hourly vol. of Passenger Cars	**C_{PC}**	2200	Max. HV Volume	**HV_{max}**	5.95E+06
No. of Lanes	**N_{lanes}**	2			

Traffic Load Distribution

Traffic Load Distribution	**TLD**	Drury_N	
Number of Axle Groups/HV	**N_{HVAG}**	3.5	
Cumulative HV Axle Groups	**N_{DT}**	1.17E+07	HVAG

ESA/HVAG	0.598
ESA/HV	2.09

Design Traffic Outputs

Corrected Number of Design HV	**$N_{HV(Corr.)}$**	3.33E+06	Heavy Vehicles
Corrected Number of HV Axle Groups	**$N_{DT(Corr.)}$**	**1.17E+07**	HVAG
		Use this value in Circly	
Design Equivalent Standard Axles	**DESA**	**6.96E+06**	ESA

Designed by:	Te Iwa Fisher	Reviewed by:	Ryan Stanley
Date:	7/7/25	Date:	16/7/25
Designer Signature:		Reviewer Signature:	

Design Traffic Calculation

Pinnacles Civil
Design | Build | Asset Management

Project No.: 2-0724 Date:
Project Description:

Heavy Vehicle Capacity Table

Year	Growth Type	Cumu. HV	Annual HV	Max HV	Corrected HV	Corrected Cumu. HV
1	Cumulative	9.13E+04	9.13E+04	5.95E+06	9.13E+04	9.13E+04
2	Cumulative	1.85E+05	9.41E+04	5.95E+06	9.41E+04	1.85E+05
3	Cumulative	2.82E+05	9.69E+04	5.95E+06	9.69E+04	2.82E+05
4	Cumulative	3.82E+05	9.98E+04	5.95E+06	9.98E+04	3.82E+05
5	Cumulative	4.85E+05	1.03E+05	5.95E+06	1.03E+05	4.85E+05
6	Cumulative	5.91E+05	1.06E+05	5.95E+06	1.06E+05	5.91E+05
7	Cumulative	7.00E+05	1.09E+05	5.95E+06	1.09E+05	7.00E+05
8	Cumulative	8.12E+05	1.12E+05	5.95E+06	1.12E+05	8.12E+05
9	Cumulative	9.28E+05	1.16E+05	5.95E+06	1.16E+05	9.28E+05
10	Cumulative	1.05E+06	1.19E+05	5.95E+06	1.19E+05	1.05E+06
11	Cumulative	1.17E+06	1.23E+05	5.95E+06	1.23E+05	1.17E+06
12	Cumulative	1.30E+06	1.26E+05	5.95E+06	1.26E+05	1.30E+06
13	Cumulative	1.43E+06	1.30E+05	5.95E+06	1.30E+05	1.43E+06
14	Cumulative	1.56E+06	1.34E+05	5.95E+06	1.34E+05	1.56E+06
15	Cumulative	1.70E+06	1.38E+05	5.95E+06	1.38E+05	1.70E+06
16	Cumulative	1.84E+06	1.42E+05	5.95E+06	1.42E+05	1.84E+06
17	Cumulative	1.99E+06	1.47E+05	5.95E+06	1.47E+05	1.99E+06
18	Cumulative	2.14E+06	1.51E+05	5.95E+06	1.51E+05	2.14E+06
19	Cumulative	2.29E+06	1.55E+05	5.95E+06	1.55E+05	2.29E+06
20	Cumulative	2.45E+06	1.60E+05	5.95E+06	1.60E+05	2.45E+06
21	Cumulative	2.62E+06	1.65E+05	5.95E+06	1.65E+05	2.62E+06
22	Cumulative	2.79E+06	1.70E+05	5.95E+06	1.70E+05	2.79E+06
23	Cumulative	2.96E+06	1.75E+05	5.95E+06	1.75E+05	2.96E+06
24	Cumulative	3.14E+06	1.80E+05	5.95E+06	1.80E+05	3.14E+06
25	Cumulative	3.33E+06	1.86E+05	5.95E+06	1.86E+05	3.33E+06
26	Cumulative	3.52E+06	1.91E+05	5.95E+06	1.91E+05	3.52E+06
27	Cumulative	3.72E+06	1.97E+05	5.95E+06	1.97E+05	3.72E+06
28	Cumulative	3.92E+06	2.03E+05	5.95E+06	2.03E+05	3.92E+06
29	Cumulative	4.13E+06	2.09E+05	5.95E+06	2.09E+05	4.13E+06
30	Cumulative	4.35E+06	2.15E+05	5.95E+06	2.15E+05	4.35E+06
31	Cumulative	4.57E+06	2.22E+05	5.95E+06	2.22E+05	4.57E+06
32	Cumulative	4.80E+06	2.28E+05	5.95E+06	2.28E+05	4.80E+06
33	Cumulative	5.03E+06	2.35E+05	5.95E+06	2.35E+05	5.03E+06
34	Cumulative	5.27E+06	2.42E+05	5.95E+06	2.42E+05	5.27E+06
35	Cumulative	5.52E+06	2.50E+05	5.95E+06	2.50E+05	5.52E+06
36	Cumulative	5.78E+06	2.57E+05	5.95E+06	2.57E+05	5.78E+06
37	Cumulative	6.04E+06	2.65E+05	5.95E+06	2.65E+05	6.04E+06
38	Cumulative	6.32E+06	2.73E+05	5.95E+06	2.73E+05	6.32E+06
39	Cumulative	6.60E+06	2.81E+05	5.95E+06	2.81E+05	6.60E+06
40	Cumulative	6.89E+06	2.89E+05	5.95E+06	2.89E+05	6.89E+06

Design Traffic Calculation

Pinnacles Civil
Design | Build | Asset Management

Project No.:	2-0724	Date:	7/7/25
Project Description:	SH2 Whirinaki Pavement Reconstruction		
	SH2 - Temporary Road		

Design Traffic Inputs

Design Period	P	5	Initial Daily HV (per lane)	N_i	250.245
Annual Average Daily Traffic	AADT	2490	Cumulative Growth Factor	CGF	5.3
Direction Factor	DF	0.5	Linear Growth Factor	LGF	5.3
% Heavy Vehicles	%HV	20.1			
Lane Distribution Factor	LDF	1	Cumulative or Linear Growth		Cumulative
Heavy Vehicle Growth Rate	R	3.0	Number of Design HV	N_{HV}	4.85E+05

Heavy Vehicle Capacity

Passenger Car Equivalent	E_{HV}	2.5	Maximum Daily Vehicles	C_{Veh}	8.11E+04
Max hourly vol. of Passenger Cars	C_{PC}	2200	Max. HV Volume	HV_{max}	5.95E+06
No. of Lanes	N_{lanes}	2			

Traffic Load Distribution

Traffic Load Distribution	TLD	Drury_N	
Number of Axle Groups/HV	N_{HVAG}	3.5	
Cumulative HV Axle Groups	N_{DT}	1.70E+06	HVAG

ESA/HVAG	0.598
ESA/HV	2.09

Design Traffic Outputs

Corrected Number of Design HV	$N_{HV(Corr.)}$	4.85E+05	Heavy Vehicles
Corrected Number of HV Axle Groups	$N_{DT(Corr.)}$	**1.70E+06**	HVAG
		Use this value in Circly	
Design Equivalent Standard Axles	DESA	**1.01E+06**	ESA

Designed by:	Te Iwa Fisher	Reviewed by:	Ryan Stanley
Date:	7/7/25	Date:	16/7/25
Designer Signature:		Reviewer Signature:	

Design Traffic Calculation

Pinnacles Civil
Design | Build | Asset Management

Project No.: 2-0724 Date:
Project Description:

Heavy Vehicle Capacity Table

Year	Growth Type	Cumu. HV	Annual HV	Max HV	Corrected HV	Corrected Cumu. HV
1	Cumulative	9.13E+04	9.13E+04	5.95E+06	9.13E+04	9.13E+04
2	Cumulative	1.85E+05	9.41E+04	5.95E+06	9.41E+04	1.85E+05
3	Cumulative	2.82E+05	9.69E+04	5.95E+06	9.69E+04	2.82E+05
4	Cumulative	3.82E+05	9.98E+04	5.95E+06	9.98E+04	3.82E+05
5	Cumulative	4.85E+05	1.03E+05	5.95E+06	1.03E+05	4.85E+05
6	Cumulative	5.91E+05	1.06E+05	5.95E+06	1.06E+05	5.91E+05
7	Cumulative	7.00E+05	1.09E+05	5.95E+06	1.09E+05	7.00E+05
8	Cumulative	8.12E+05	1.12E+05	5.95E+06	1.12E+05	8.12E+05
9	Cumulative	9.28E+05	1.16E+05	5.95E+06	1.16E+05	9.28E+05
10	Cumulative	1.05E+06	1.19E+05	5.95E+06	1.19E+05	1.05E+06
11	Cumulative	1.17E+06	1.23E+05	5.95E+06	1.23E+05	1.17E+06
12	Cumulative	1.30E+06	1.26E+05	5.95E+06	1.26E+05	1.30E+06
13	Cumulative	1.43E+06	1.30E+05	5.95E+06	1.30E+05	1.43E+06
14	Cumulative	1.56E+06	1.34E+05	5.95E+06	1.34E+05	1.56E+06
15	Cumulative	1.70E+06	1.38E+05	5.95E+06	1.38E+05	1.70E+06
16	Cumulative	1.84E+06	1.42E+05	5.95E+06	1.42E+05	1.84E+06
17	Cumulative	1.99E+06	1.47E+05	5.95E+06	1.47E+05	1.99E+06
18	Cumulative	2.14E+06	1.51E+05	5.95E+06	1.51E+05	2.14E+06
19	Cumulative	2.29E+06	1.55E+05	5.95E+06	1.55E+05	2.29E+06
20	Cumulative	2.45E+06	1.60E+05	5.95E+06	1.60E+05	2.45E+06
21	Cumulative	2.62E+06	1.65E+05	5.95E+06	1.65E+05	2.62E+06
22	Cumulative	2.79E+06	1.70E+05	5.95E+06	1.70E+05	2.79E+06
23	Cumulative	2.96E+06	1.75E+05	5.95E+06	1.75E+05	2.96E+06
24	Cumulative	3.14E+06	1.80E+05	5.95E+06	1.80E+05	3.14E+06
25	Cumulative	3.33E+06	1.86E+05	5.95E+06	1.86E+05	3.33E+06
26	Cumulative	3.52E+06	1.91E+05	5.95E+06	1.91E+05	3.52E+06
27	Cumulative	3.72E+06	1.97E+05	5.95E+06	1.97E+05	3.72E+06
28	Cumulative	3.92E+06	2.03E+05	5.95E+06	2.03E+05	3.92E+06
29	Cumulative	4.13E+06	2.09E+05	5.95E+06	2.09E+05	4.13E+06
30	Cumulative	4.35E+06	2.15E+05	5.95E+06	2.15E+05	4.35E+06
31	Cumulative	4.57E+06	2.22E+05	5.95E+06	2.22E+05	4.57E+06
32	Cumulative	4.80E+06	2.28E+05	5.95E+06	2.28E+05	4.80E+06
33	Cumulative	5.03E+06	2.35E+05	5.95E+06	2.35E+05	5.03E+06
34	Cumulative	5.27E+06	2.42E+05	5.95E+06	2.42E+05	5.27E+06
35	Cumulative	5.52E+06	2.50E+05	5.95E+06	2.50E+05	5.52E+06
36	Cumulative	5.78E+06	2.57E+05	5.95E+06	2.57E+05	5.78E+06
37	Cumulative	6.04E+06	2.65E+05	5.95E+06	2.65E+05	6.04E+06
38	Cumulative	6.32E+06	2.73E+05	5.95E+06	2.73E+05	6.32E+06
39	Cumulative	6.60E+06	2.81E+05	5.95E+06	2.81E+05	6.60E+06
40	Cumulative	6.89E+06	2.89E+05	5.95E+06	2.89E+05	6.89E+06

APPENDIX C- Test Pit Reports

PAVEMENT INVESTIGATION LOG
TEST REPORT

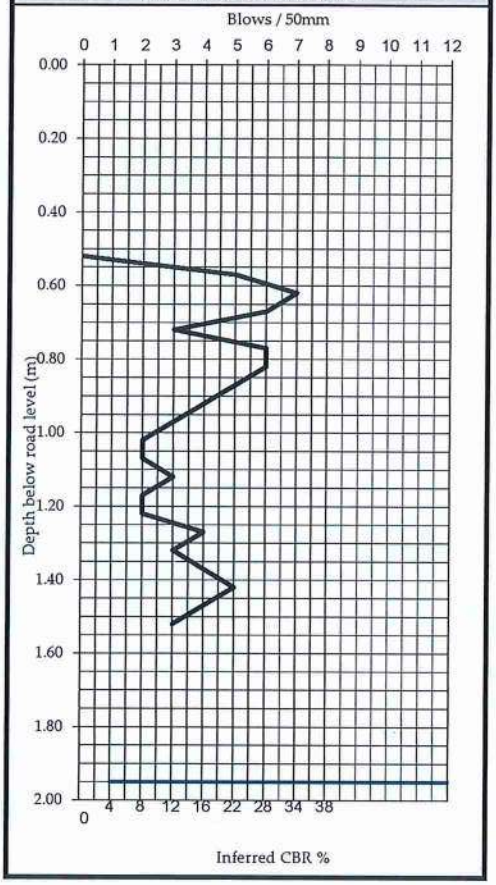
Project :	Esk River Bridge North
Location :	SH2 0626 / 10555 , RHS, LWP
Client :	Higgins Contractors Ltd
Contractor :	WSP Napier Test Laboratory
Sampled by :	WSP Napier Test Laboratory
Date Sampled :	08/02/24
Sampling method :	NZS4407:2015:2.4.8

Pavement pit number : TP_1

Project No :	2-L0689.23
Lab Ref No :	NA 7451-1
Client Ref No :	

Depth (mm)	Pavement Description
100	CHIP SEAL "Flushed"
120	GRAVEL, sandy, silty, grey, moist, max size 40mm, angular to rounded, tightly packed, non plastic.
270	GRAVEL, sandy, minor silt, brown, moist, max size 65mm, sub angular to rounded, tightly packed, non plastic.
290	CHIP SEAL
370	GRAVEL, sandy, silty, brownish grey, moist, max size 40mm, angular to rounded, tightly packed, non plastic.
600	GRAVEL, sandy, trace clay, brown, moist, max size 65mm, angular to rounded, tightly packed, low plasticity.
720	SAND with minor clay, blueish grey, stiff, moist, moderately plastic
	End of test pit at 720mm

Scala Penetrometer



Basecourse sample recovered at :	100-120mm
Subbase sample recovered at :	120-270mm and 290-370mm
Subgrade sample recovered at :	600-720mm
Depth at which scala penetrometer started :	520mm

Test Methods	Notes
Determination of Penetration Resistance of a Soil, NZS 4402 : 1988, Test 6.5.2 Inferred CBR values taken from Austroads Pavement Design Manual 2004	

Date tested : 08/02/24
Date reported : 09/02/24

Approved J. Crichton

Designation : *Laboratory Manager*
Date : 09/02/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

PAVEMENT INVESTIGATION LOG
TEST REPORT

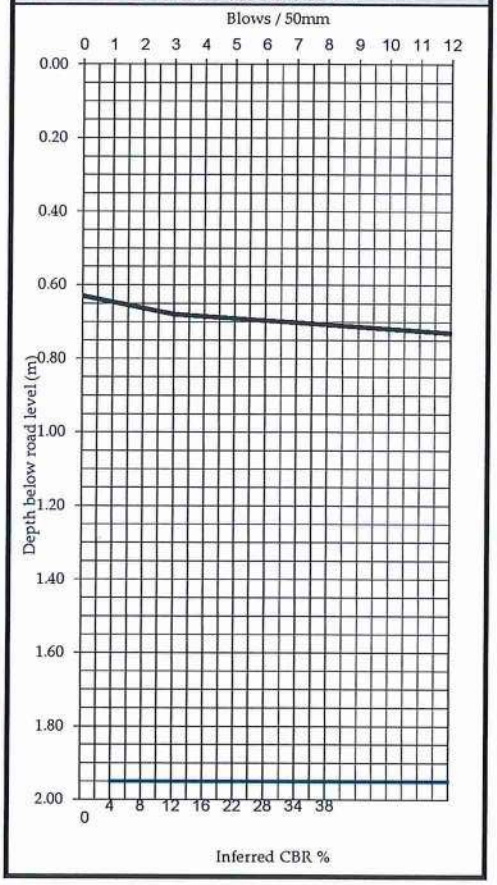
Project :	Esk River Bridge North
Location :	SH2 0626 / 10419 , RHS, RWP
Client :	Higgins Contractors Ltd
Contractor :	WSP Napier Test Laboratory
Sampled by :	WSP Napier Test Laboratory
Date Sampled :	08/02/24
Sampling method :	NZS4407:2015:2.4.8

Pavement pit number : TP_2

Project No :	2-L0689.23
Lab Ref No :	NA 7451-2
Client Ref No :	

Depth (mm)	Pavement Description
20	CHIP SEAL "Flushed"
170	GRAVEL, sandy, some silt and seal, brown, moist, max size 40mm, angular to sub rounded, tightly packed, non plastic. "Stabilised"
300	GRAVEL, sandy, some silt and seal, blueish grey, moist, max size 65mm, angular to sub rounded, tightly packed, low plasticity.
320	CHIP SEAL
630	GRAVEL, sandy, greyish brown, moist, max size 65mm, sub angular to sub rounded, tightly packed.
	End of test pit at 630mm Scala refused at 730mm

Scala Penetrometer



Basecourse sample recovered at :	20-170mm
Subbase sample recovered at :	170-300mm and 320- 630mm
Subgrade sample recovered at :	Nil
Depth at which scala penetrometer started :	630mm

Test Methods	Notes
Determination of Penetration Resistance of a Soil, NZS 4402 : 1988, Test 6.5.2 Inferred CBR values taken from Austroads Pavement Design Manual 2004	

Date tested : 08/02/24
Date reported : 09/02/24

Approved J. Crichton

Designation : *Laboratory Manager*
Date : 09/02/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

PAVEMENT INVESTIGATION LOG TEST REPORT

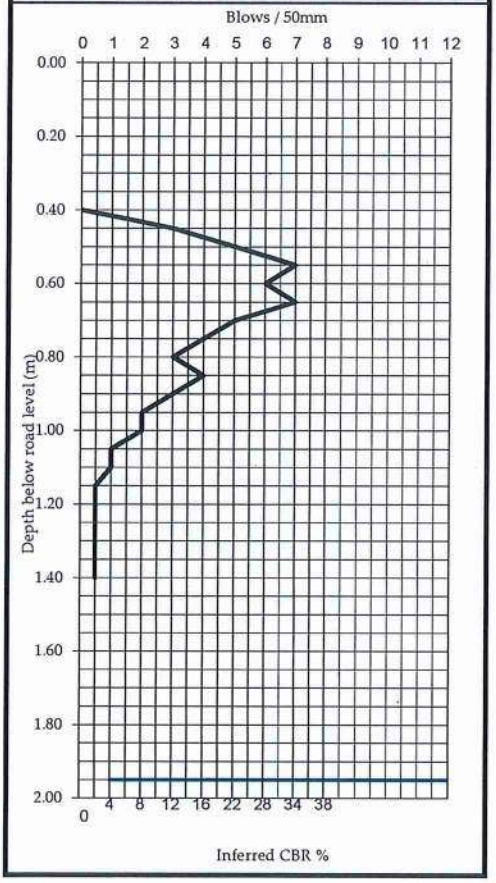
Project :	Esk River Bridge North
Location :	SH2 0626 / 10340, LHS, LWP
Client :	Higgins Contractors Ltd
Contractor :	WSP Napier Test Laboratory
Sampled by :	WSP Napier Test Laboratory
Date Sampled :	08/02/24
Sampling method :	NZS4407:2015:2.4.8

Pavement pit number : TP_3

Project No :	2-L0689.23
Lab Ref No :	NA 7451-3
Client Ref No :	

Depth (mm)	Pavement Description
80	CHIP SEAL "Flushed"
120	GRAVEL, sandy, silty, brownish grey, moist, max size 40mm, crushed, tightly packed, non plastic.
240	CHIP SEAL
400	GRAVEL, sandy, minor silt, brown, moist, max size 65mm, sub angular to rounded, tightly packed.
500	SAND, yellow, dense, moist
	End of test pit at 500mm

Scala Penetrometer



Basecourse sample recovered at :	Nil
Subbase sample recovered at :	240 -400mm
Subgrade sample recovered at :	400-500mm
Depth at which scala penetrometer started :	400mm

Test Methods	Notes
Determination of Penetration Resistance of a Soil, NZS 4402 : 1988, Test 6.5.2 Inferred CBR values taken from Austroads Pavement Design Manual 2004	

Date tested : 08/02/24
Date reported : 09/02/24

Approved J. Crichton

Designation : *Laboratory Manager*
Date : 09/02/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

PAVEMENT INVESTIGATION LOG
TEST REPORT

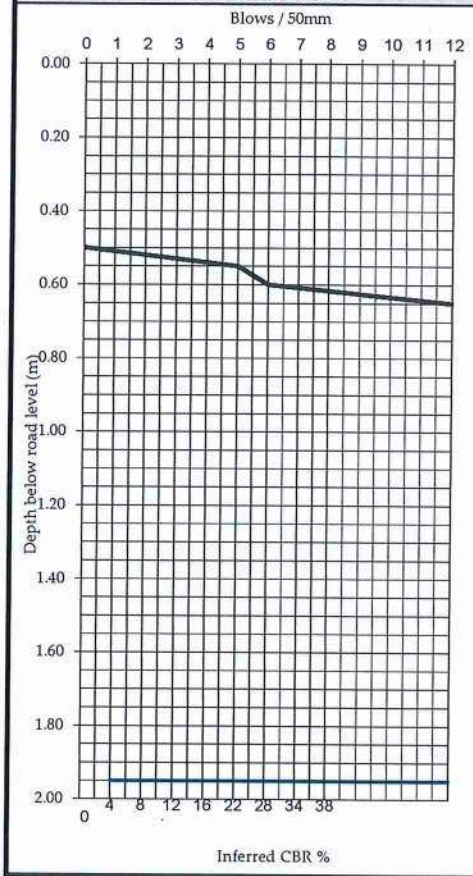
Project :	Esk River Bridge North
Location :	SH2 0626 / 10505, LHS, RWP
Client :	Higgins Contractors Ltd
Contractor :	WSP Napier Test Laboratory
Sampled by :	WSP Napier Test Laboratory
Date Sampled :	08/02/24
Sampling method :	NZS4407:2015:2.4.8

Pavement pit number : TP_4

Project No :	2-L0689.23
Lab Ref No :	NA 7451-4
Client Ref No :	

Depth (mm)	Pavement Description
70	CHIP SEAL "Flushed"
130	GRAVEL, sandy, silty, brownish grey, moist, max size 40mm, angular to sub rounded, tightly packed, non plastic. "Stabilised"
370	GRAVEL, sandy, minor silt, brown, moist, max size 65mm, sub angular to rounded, tightly packed.
400	CHIP SEAL
500	GRAVEL, sandy, greyish brown, moist, max size 65mm, angular to sub rounded, tightly packed.
	End of test pit at 500mm Scala refused at 650mm

Scala Penetrometer



Basecourse sample recovered at :	70 -130mm
Subbase sample recovered at :	400-500mm
Subgrade sample recovered at :	Nil
Depth at which scala penetrometer started :	500mm

Test Methods	Notes
Determination of Penetration Resistance of a Soil, NZS 4402 : 1988, Test 6.5.2 Inferred CBR values taken from Austroads Pavement Design Manual 2004	

Date tested : 08/02/24
Date reported : 09/02/24

Approved J. Crichton

Designation : *Laboratory Manager*
Date : 09/02/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

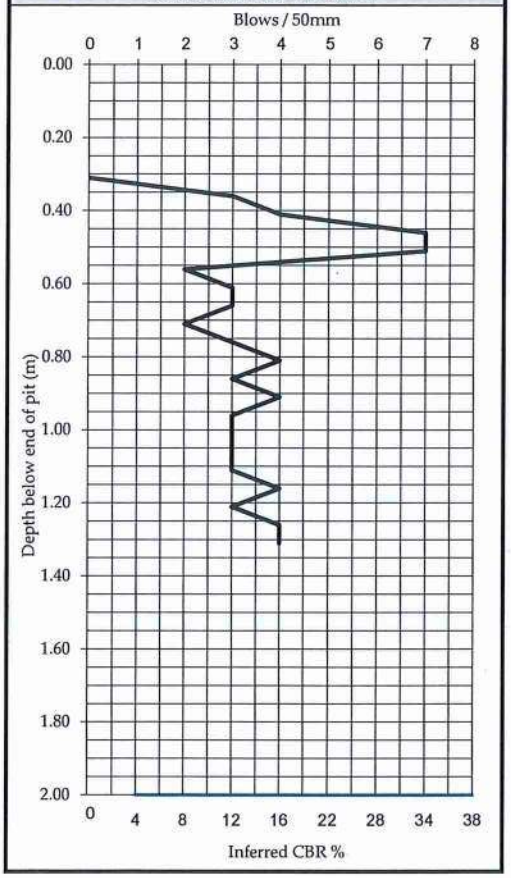
PAVEMENT INVESTIGATION LOG TEST REPORT

Project :	Pavement Investigation
Location :	Whirinaki, SH2
Client :	H. Donnelly
Pit Location	RP 10640 LHS 1.2m off-set from Centre-Line
Sampled by :	WSP Napier Laboratory
Contractor:	WSP Napier Laboratory
Date Sampled :	04/05/24
Sampling method :	NZS4407:2015.2.4.8
Sample description :	Pavement Pit Material
Pavement pit number :	TP 1

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Depth (mm)	Pavement Description
30	Chipseal (Semi-Flush)
260	GRAVEL, sandy with traces of silt, stabilized, max size AP40, non-plastic, moist, angular to sub-angular, "greywacke"
280	Chipseal
310	GRAVEL, sandy with minor silt, moist, non-plastic, max size, tightly packed AP40, sub-angular to sub-rounded, "greywacke"
580	SAND, silty, grey, loosely packed, non-plastic, moist
	End of test pit at 580mm

Scala Penetrometer



Basecourse sample recovered at :	30mm - 260mm
Subbase sample recovered at :	280mm - 310mm
Subgrade sample recovered at :	310mm - 580mm
Depth at which scala penetrometer started :	310mm

Test Methods	Notes
Inferred CBR values taken from Austroads Pavement Design Manual 2004 Determination of Penetration Resistance of Soiul, NZS 4402: 1986, Test 6.5.2	

Date tested : 04/06/24
Date reported : 06/06/24

Approved J. Crichton

Designation : *Laboratory Manager*
Date : 06/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

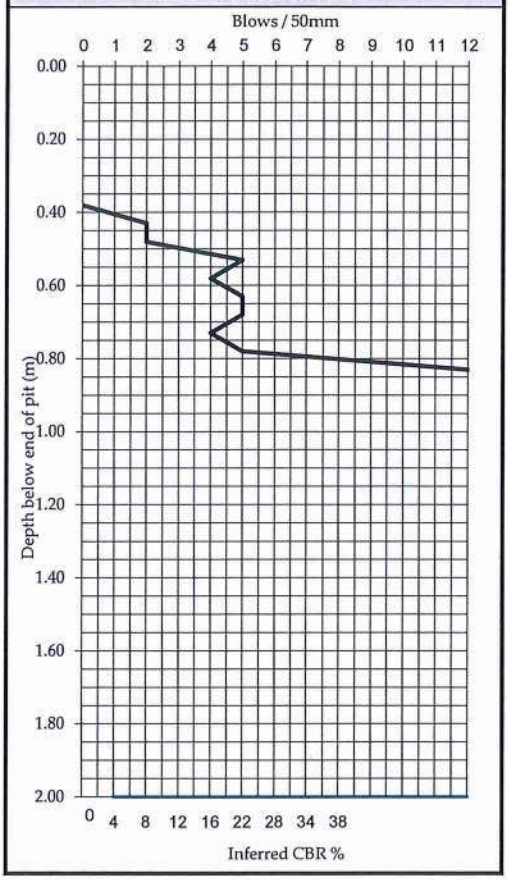
PAVEMENT INVESTIGATION LOG
TEST REPORT

Project :	Pavement Investigation
Location :	Whirinaki, SH2
Client :	H. Donnelly
Pit Location	RP 10220 RHS 1.4m off-set from Centre-Line
Sampled by :	WSP Napier Laboratory
Contractor:	WSP Napier Laboratory
Date Sampled :	04/05/24
Sampling method :	NZS4407:2015.2.4.8
Sample description :	Pavement Pit Material
Pavement pit number :	TP 2

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Depth (mm)	Pavement Description
40	Chipseal (Semi-Flush)
160	GRAVEL, sandy with some silt, max size AP40, non-plastic, tightly packed, moist, angular to sub-angular, brown.
200	Chipseal
380	Sand, silty with somegravel, tightly packed, moist, non-plastic, max size AP65, sub-rounded to rounded, brown.
500	Sand with some gravel, moist, loose, greyish-brown
	End of test pit at 500mm Scala Refusal at 830mm

Scala Penetrometer



Basecourse sample recovered at :	40mm - 160mm
Subbase sample recovered at :	200mm - 380mm
Subgrade sample recovered at :	380mm - 500mm
Depth at which scala penetrometer started :	380mm

Test Methods	Notes
Inferred CBR values taken from Austroads Pavement Design Manual 2004 Determination of Penetration Resistance of Soiul, NZS 4402: 1986, Test 6.5.2	

Date tested : 04/06/24
Date reported : 06/06/24

Approved J. Crichton J.C.

Designation : *Laboratory Manager*
Date : 06/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

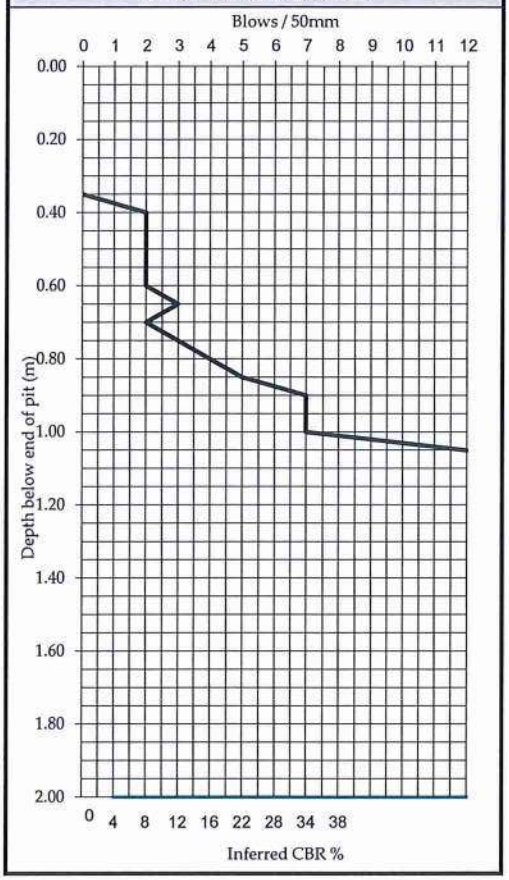
PAVEMENT INVESTIGATION LOG
TEST REPORT

Project :	Pavement Investigation
Location :	Whirinaki, SH2
Client :	H. Donnelly
Pit Location	RP 10160 LHS 1.2m off-set from Centre-Line
Sampled by :	WSP Napier Laboratory
Contractor:	WSP Napier Laboratory
Date Sampled :	04/05/24
Sampling method :	NZS4407:2015.2.4.8
Sample description :	Pavement Pit Material
Pavement pit number :	TP 3

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Depth (mm)	Pavement Description
40	Chipseal (Semi-Flush)
180	GRAVEL, sandy with some silt, max size AP40, non-plastic, tightly packed, moist, angular to sub-angular, brown.
230	Chipseal
350	GRAVEL, sandy with minor silt, tightly packed, moist, non-plastic, max size AP65, sub-rounded to rounded, brown.
500	Sand, silty with some gravel, moist, loose, greyish-brown
	End of test pit at 500mm Scala Refusal at 1.05m

Scala Penetrometer



Basecourse sample recovered at :	40mm - 180mm
Subbase sample recovered at :	230mm - 350mm
Subgrade sample recovered at :	350mm - 500mm
Depth at which scala penetrometer started :	350mm

Test Methods	Notes
Inferred CBR values taken from Austroads Pavement Design Manual 2004 Determination of Penetration Resistance of Soiul, NZS 4402: 1986, Test 6.5.2	

Date tested : 04/06/24
Date reported : 06/06/24

Approved J. Crichton

Designation : *Laboratory Manager*
Date : 06/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

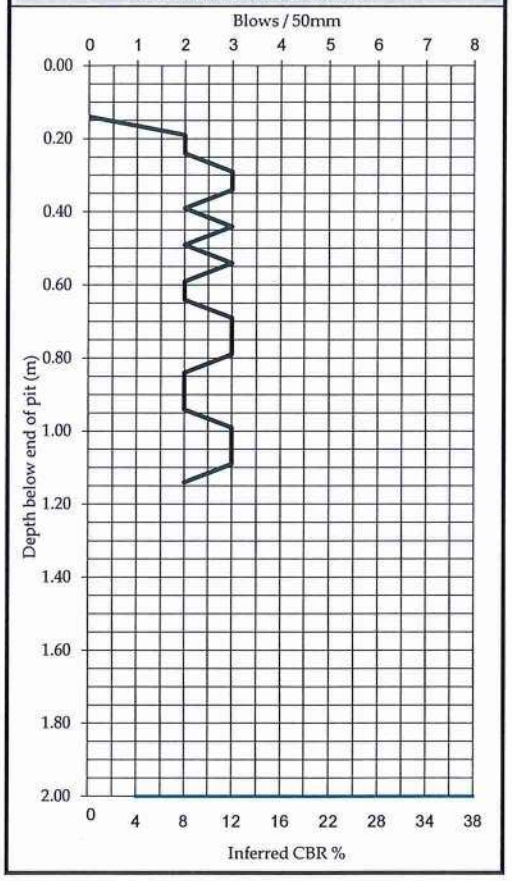
PAVEMENT INVESTIGATION LOG
TEST REPORT

Project :	Pavement Investigation
Location :	North Shore Rd, Whirinaki
Client :	H. Donnelly
Pit Location	RP 110 LHS 1.0m off-set from Centre-Line
Sampled by :	WSP Napier Laboratory
Contractor:	WSP Napier Laboratory
Date Sampled :	04/05/24
Sampling method :	NZS4407:2015.2.4.8
Sample description :	Pavement Pit Material
Pavement pit number :	TP 4

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Depth (mm)	Pavement Description
40	Chipseal (Semi-Flush)
140	GRAVEL, sandy with some silt, max size AP40, non-plastic, tightly packed, moist, sub-rounded to sub-angular, brown.
300	Sand, silty traces of gravel, moist, loose, greyish-brown
	End of test pit at 300mm

Scala Penetrometer



Basecourse sample recovered at :	Nil
Subbase sample recovered at :	40mm - 140mm
Subgrade sample recovered at :	140mm - 300mm
Depth at which scala penetrometer started :	140mm

Test Methods	Notes
Inferred CBR values taken from Austroads Pavement Design Manual 2004 Determination of Penetration Resistance of Soiul, NZS 4402: 1986, Test 6.5.2	

Date tested : 04/06/24
Date reported : 06/06/24

Approved J. Crichton

Designation : *Laboratory Manager*
Date : 06/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

APPENDIX D – Laboratory Tests

INDIRECT TENSILE STRENGTH TEST REPORT

Project :	**Hawkes Bay NOC Materials Testing**
Location :	**"Esk River Bridge North 1"**
Client :	**B. Jones, PO Box 421, Napier**
Contractor :	**Higgins (HB) Ltd**
Sampled by :	**WSP Napier Laboratory**
Date sampled :	**24/06/20**
Sampling method :	**NZS 4407 : 2015, Test 2.4.8**
Sample description :	**Sandy Gravel with minor silt "Basecourse"**
Sample condition :	**Modified with 2% Cement**

Project No :	**2-L0408.17**
Lab Ref No :	**NA3572**
Client Ref No :	**BJ-063068**

Test Results

"Basecourse" with 2% cement

	ITS (kPa / Dry)	ITS (kPa / Wet)
	770	681
	749	633
Average ITS (Indirect Tensile Strength)	**759.5**	**657**
TSR (Tensile Strength Retained)	**87** **%**	

Test Method

Specification for indirect tensile strength testing of modified and bound pavement materials, NZTA Specification - June 2016

Date tested : 27/08/20
Date reported : 31/08/20

Approved **J Crichton**

Designation : *Assistant Laboratory Manager*
Date : 31/08/20

WSP Opus
Napier Laboratory
Quality Management Systems Certified to ISO 9001

90 Prebensen Drive
Private Bag 6019, Hawkes Bay Mail Centre,
Napier 4142, New Zealand

Telephone +64 6 833 5590
Website www.wsp-opus.co.nz

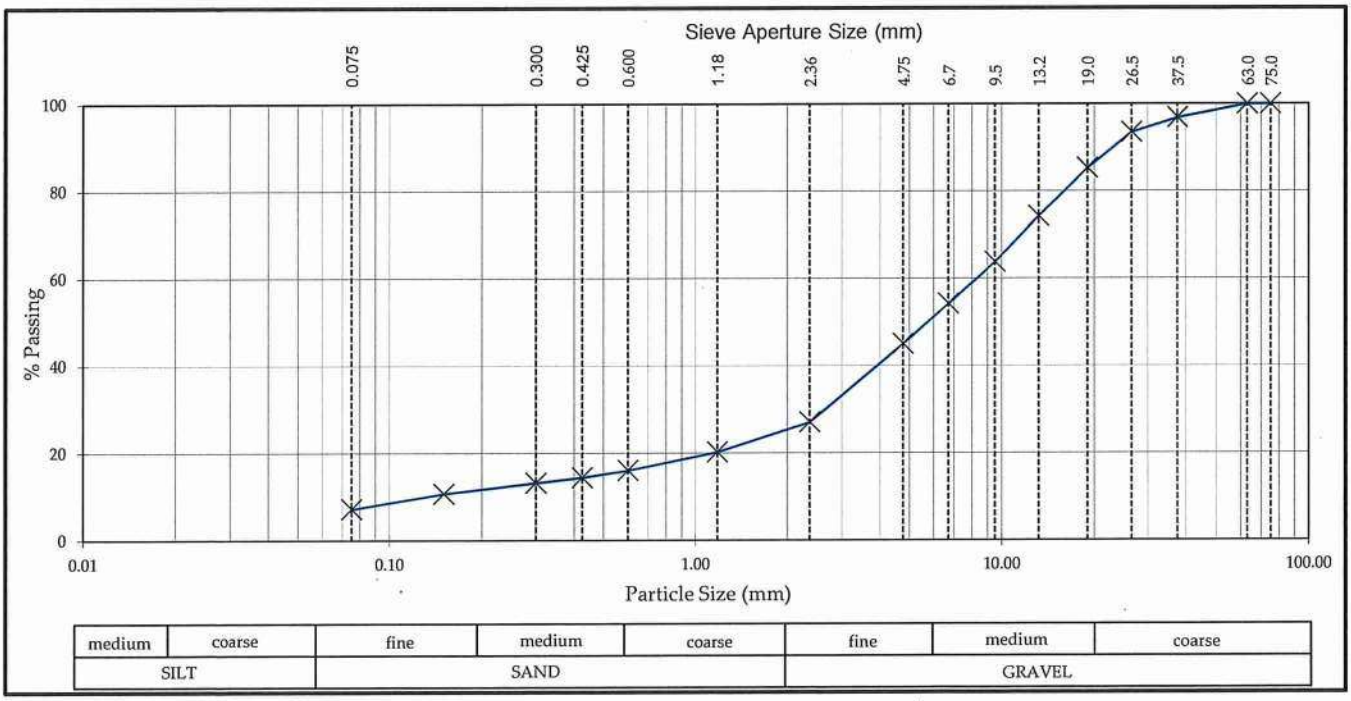
WET SIEVE ANALYSIS
TEST REPORT

Project :	NOC Pavement Pits 2020-2021
Location :	Esk River Bridge North - 1
Client :	Higgins (HB) Ltd
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24-06-20
Sampling method :	NZS 4407 : 2015, test 2.4.8
Sample description :	Sandy Gravel with minor silt
Sample :	Subbase
Test Pit :	Test Pit 2
Depth (mm) :	180-370

Project No :	2-L0408.17
Lab Ref No :	NA 3572 1
Client Ref No :	BJ 063068

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	100	19.00	85	4.75	45	0.425	14
63.00	100	13.20	74	2.36	27	0.300	13
37.50	97	9.50	64	1.18	20	0.150	11
26.50	94	6.70	54	0.600	16	0.075	7



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: Ex. pavement materials Fraction tested: Whole Dispersant Used: Nil *Fraction passing finest sieve is by difference.*

Date tested : 07-08-20
Date reported : 10-08-20

Approved J. Crichton

Designation : *Assistant Laboratory Manager*
Date : 11-08-20

WSP
Napier (Prebensen Dr)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd, Onekawa
10 Cadbury Rd, Onekawa, 4110, Napier, New Zealand

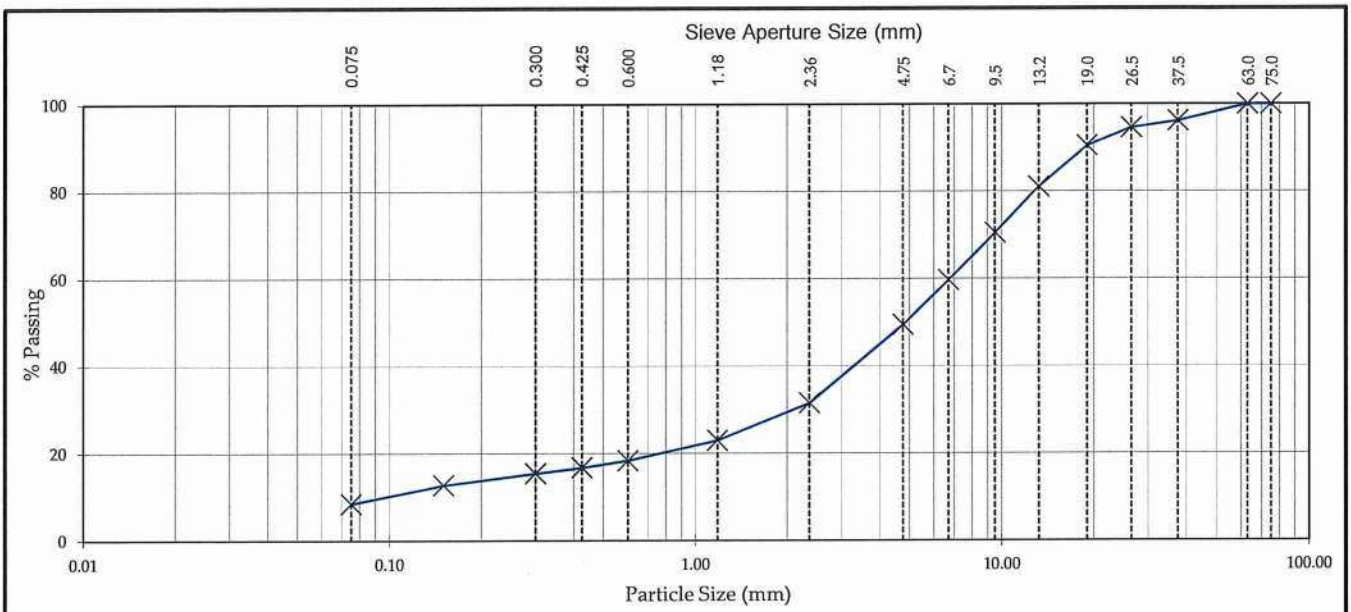
Telephone +64 6 833 5590
Website www.wsp.com/nz

WET SIEVE ANALYSIS
TEST REPORT

Project :	NOC Pavement Pits 2020-2021
Location :	Esk River Bridge North - 1
Client :	Higgins (HB) Ltd
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24-06-20
Sampling method :	NZS 4407 : 2015, test 2.4.8
Sample description :	Sandy Gravel with minor silt
Sample :	Subbase
Test Pit :	Test Pit 3
Depth (mm) :	290-430

Project No :	2-L0408.17
Lab Ref No :	NA 3572 2
Client Ref No :	BJ 063068

Sieve Analysis							
Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
75.00	100	19.00	90	4.75	49	0.425	17
63.00	100	13.20	81	2.36	31	0.300	15
37.50	96	9.50	70	1.18	23	0.150	13
26.50	95	6.70	60	0.600	18	0.075	9



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: Ex. pavement materials Fraction tested: Whole Dispersant Used: Nil *Fraction passing finest sieve is by difference.*

Date tested : 07-08-20
Date reported : 10-08-20

Approved J. Crichton J. C.

Designation : *Assistant Laboratory Manager*
Date : 11-08-20

WSP
Napier (Prebensen Dr)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd, Onekawa
10 Cadbury Rd, Onekawa, 4110, Napier, New Zealand

Telephone +64 6 833 5590
Website www.wsp.com/nz

PLASTICITY INDEX FOR AGGREGATES
TEST REPORT

Project :	NOC Pavement Pits 2020-21
Location :	Esk River Bridge North -1
Client :	Higgins Contractors Ltd
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24-06-2020
Sampling method :	NZS 4407 : 2015, test 2.4.8
Sample description :	Existing Pavement materials
Source :	Esk River Bridge North -1

Project No :	2-L0408.17
Lab Ref No :	NA3572
Client Ref No :	BJ 063068

Test Results		
Lab Ref. No :	NA3572	NA3572
Pit No :	Test Pit 2	Test Pit 1
Sample Description :	Subbase	Subbase
Depth (mm) :	180 -370	150 - 340
Cone penetration limit :	24	26
Plastic limit :	N.A	N.A
Plasticity index :	N.P	NP
Soil fraction :	Passing through 425µm test seive	
Linear Shrinkage (%) :	3	4

Test Methods		Notes :
Cone Penetration	NZS 4407 : 2015 : Test 3.2	N.A denotes - Non Attainable
Plastic Limit	NZS 4407 : 2015 : Test 3.3	N.P denotes - Non Plastic
Plasticity Index	NZS 4407 : 2015 : Test 3.4	
Linear Shrinkage	NZS 4402 : 1986 : Test 2.6	

Date tested : 10/08/2020
Date reported : 31/8/2020

Approved J. Crichton

Designation : *Assistant Laboratory Manager*
Date : 31/8/2020

J. Cr.

WSP
Napier (Prebensen Dr)
10 Cadbury Rd, Onekawa
10 Cadbury Rd, Onekawa, 4110, Napier, New Zealand
Telephone +64 6 833 5590
Website www.wsp.com/nz

SAND EQUIVALENT TEST REPORT

Project :	Hawkes Bay NOC Materials Testing
Location :	"Esk River Bridge North -1"
Client :	B. Jones, PO Box 421, Napier
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24/06/20
Sampling method :	NZS 4407 : 2015, Test 2.4.8
Sample description :	Sandy Gravel with minor silt " Subbase "

Project No :	2-L0408.17
Lab Ref No :	NA3572
Client Ref No :	BJ 063068

Test Results		
Test pit number / depth (mm)	3 / 290 -430	2 / 180 -370
Sand Equivalent :	40	48
Method of shaking :	Hand	Hand
Method of preparation :	Brushed	Brushed

Test Method
NZS 4407 : 2015, Test 3.6

Date tested : 10/08/20
Date reported : 31/08/20 This report may only be reproduced in full

Approved J Crichton

Designation : *Assistant Laboratory Manager*
Date : 31/08/20

WSP
Napier (Prebensen Dr)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd, Onekawa
10 Cadbury Rd, Onekawa, 4110, Napier,
New Zealand

Telephone +64 6 833 5590
Website www.wsp.com/nz

CLAY INDEX
TEST REPORT

Project :	NOC Pavement Pits 2020-2021
Location :	Esk River Bridge North -1
Client :	Higgins (HB) Ltd
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24/06/2020
Sampling method :	NZS 4407:2015, test 2.4.8
Sample description :	Existing Pavement Materials
Sample condition :	Prepared by WSP Napier Lab
Source :	TP3; 2/626/10970, IWP, LHS 1.1 m to CL

Project No :	2-L0408.17
Lab Ref No :	NA3572B WA1
Client Ref No :	BJ 063068

Test Results	
Clay index :	3.8 Tests carried out on natural fines

Test Method
NZS 4407 : 2015, Test 3.5

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.
All information supplied by Client.

Date tested : 10/08/2020
Date reported : 10/08/2020

IANZ Approved Signatory
R Jones
Designation : *Laboratory Manager*
Date : 13/08/2020

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

WSP
Whanganui (Pacific Place)
Quality Management Systems Certified to ISO 9001

16 Pacific Place
PO Box 654, 4541, Whanganui, New Zealand

Telephone +64 6 349 6640
Website www.wsp.com/nz

CLAY INDEX
TEST REPORT

Project :	NOC Pavement Pits 2020-2021
Location :	Esk River Bridge North -1
Client :	Higgins (HB) Ltd
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24/06/2020
Sampling method :	NZS 4407:2015, test 2.4.8
Sample description :	Existing Pavement Materials
Sample condition :	Prepared by WSP Napier Lab
Source :	TP2; 2/626/10840, OWP, LHS 2.7 m to CL

Project No :	2-L0408.17
Lab Ref No :	NA3572A WA1
Client Ref No :	BJ 063068

Test Results

Clay index :	3.1
	Tests carried out on natural fines

Test Method

NZS 4407 : 2015, Test 3.5

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full.
All information supplied by Client.

Date tested : 10/08/2020
Date reported : 10/08/2020

IANZ Approved Signatory
R Jones
Designation : *Laboratory Manager*
Date : 13/08/2020

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

WSP
Whanganui (Pacific Place)
Quality Management Systems Certified to ISO 9001

16 Pacific Place
PO Box 654, 4541, Whanganui, New Zealand

Telephone +64 6 349 6640
Website www.wsp.com/nz

CALIFORNIA BEARING RATIO (REMOULDED)
TEST REPORT

Project :	NOC Pavement Pits 2020-2021
Location :	Esk River Bridge North -1
Client :	Higgins Contractors Ltd
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24/06/2020
Sampling method :	NZS 4407 : 2015, test 2.4.8
Sample description :	Existing Pavement

Project No :	2-L0408.17
Lab Ref No :	NA 3572
Client Ref No :	BJ 063068

Test Results

Sample ID		NA3572
Test Pit No		Test Pit 1
Depth (mm)		150-340
Sample condition at test		Soaked
Sample description		Subbase
Curing time	days	0
Soaking time	days	3
Passing 19mm	%	82
Surcharge mass	kg	4.0
Lime additive	%	0
Cement additive	%	0
Swell	%	0
Penetration	mm	2.5 / 5
Water content as received	%	3.9
Water content as compacted	%	3.9
Water content after testing	%	8.1
Dry density	t/m³	2.05
CBR value	%	**30**

Test Methods		Notes	
CBR	NZS : 4407 : 2015 : 3.15	Material Used	Passing 19mm sieve
Water Content	NZS : 4407 : 2015 : 3.1	Rate of penetration	1mm/min
Compaction	NZS : 4402 : 1986 : 4.1.1 (Standard)		

Date tested : 13/08/2020
Date reported : 31/08/2020

Approved J. Crichton

Designation : *Assistant Laboratory Manager*
Date : 31/08/2020

WSP
Napier (Prebensen Dr)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd, Onekawa
10 Cadbury Rd, Onekawa, 4110, Napier, New Zealand

Telephone +64 6 833 5590
Website www.wsp.com/nz

INDIRECT TENSILE STRENGTH TEST REPORT

Project :	**Hawkes Bay NOC Materials Testing**
Location :	**"Esk River Bridge North 1"**
Client :	**B. Jones, PO Box 421, Napier**
Contractor :	**Higgins (HB) Ltd**
Sampled by :	**WSP Napier Laboratory**
Date sampled :	**24/06/20**
Sampling method :	**NZS 4407 : 2015, Test 2.4.8**
Sample description :	**Sandy Gravel "Subbase"**
Sample condition :	**Modified with 3% Cement**

Project No :	**2-L0408.17**
Lab Ref No :	**NA3572**
Client Ref No :	**BJ-063068**

Test Results

"Subbase" with 3% cement

	ITS (kPa / Dry)	ITS (kPa / Wet)
	710	602
	644	670
Average ITS (Indirect Tensile Strength)	**677**	**636**
TSR (Tensile Strength Retained)	**94** **%**	

Test Method

Specification for indirect tensile strength testing of modified and bound pavement materials, NZTA Specification - June 2016

Date tested : 27/08/20
Date reported : 31/08/20

Approved **J Crichton**

Designation : *Assistant Laboratory Manager*
Date : 31/08/20

WSP Opus
Napier Laboratory
Quality Management Systems Certified to ISO 9001

90 Prebensen Drive
Private Bag 6019, Hawkes Bay Mail Centre,
Napier 4142, New Zealand

Telephone +64 6 833 5590
Website www.wsp-opus.co.nz

CALIFORNIA BEARING RATIO (REMOULDED)
TEST REPORT

Project :	NOC Pavement Pits 2020-2021
Location :	Esk River Bridge North -1
Client :	Higgins Contractors Ltd
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24/06/2020
Sampling method :	NZS 4407 : 2015, test 2.4.8
Sample description :	Existing Pavement

Project No :	2-L0408.17
Lab Ref No :	NA 3572
Client Ref No :	BJ 063068

Test Results

Sample ID		NA3573	NA3573
Test Pit No		Test Pit 1	Test Pit 3
Depth (mm)		420-610	430 -580
Sample condition at test		Soaked	Soaked
Sample description		Subgrade	Subgrade
Curing time	days	0	0
Soaking time	days	3	3
Passing 19mm	%	100	100
Surcharge mass	kg	4.0	4.0
Lime additive	%	0	0
Cement additive	%	0	0
Swell	%	0	0
Penetration	mm	5	2.5 / 5
Water content as received	%	13.6	15.5
Water content as compacted	%	13.6	15.5
Water content after testing	%	22.3	20.9
Dry density	t/m^3	1.67	1.72
CBR value	%	17	25

Test Methods		Notes	
CBR	NZS : 4402 : 1986 : 6.1.1	Material Used	Whole Soil
Water Content	NZS : 4402 : 1986 : 2.1	Rate of penetration	1mm/min
Compaction	NZS : 4402 : 1986 : 4.1.1 (Standard)		

Date tested : 13/08/2020
Date reported : 31/08/2020

Approved J. Crichton

Designation : *Assistant Laboratory Manager*
Date : 321/08/2020

WSP
Napier (Prebensen Dr)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd, Onekawa
10 Cadbury Rd, Onekawa, 4110, Napier, New Zealand

Telephone +64 6 833 5590
Website www.wsp.com/nz

PLASTICITY INDEX FOR AGGREGATES
TEST REPORT

Project :	NOC Pavement Pits 2020-21
Location :	Esk River Bridge North -1
Client :	Higgins Contractors Ltd
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	24-06-2020
Sampling method :	NZS 4407 : 2015, test 2.4.8
Sample description :	Existing Pavement materials
Source :	Esk River Bridge North -1

Project No :	2-L0408.17
Lab Ref No :	NA3572
Client Ref No :	BJ 063068

Test Results		
Lab Ref. No :	NA3572	NA3572
Pit No :	Test Pit 1	Test Pit 3
Sample Description :	Subgrade	Subgrade
Depth (mm) :	420 -610	430 -580
Cone penetration limit :	30	31
Plastic limit :	N.A	N.A
Plasticity index :	N.P	NP
Soil fraction :	Passing through 425µm test sieve	
Linear Shrinkage (%) :	1	2

Test Methods		Notes :
Cone Penetration	NZS 4407 : 2015 : Test 3.2	N.A denotes - Non Attainable
Plastic Limit	NZS 4407 : 2015 : Test 3.3	N.P denotes - Non Plastic
Plasticity Index	NZS 4407 : 2015 : Test 3.4	
Linear Shrinkage	NZS 4402 : 1986 : Test 2.6	

Date tested : 07/08/2020
Date reported : 31/8/2020

Approved J. Crichton

Designation : *Assistant Laboratory Manager*
Date : 31/8/2020

WSP
Napier (Prebensen Dr)

10 Cadbury Rd, Onekawa
10 Cadbury Rd, Onekawa, 4110, Napier, New Zealand

Telephone +64 6 833 5590
Website www.wsp.com/nz

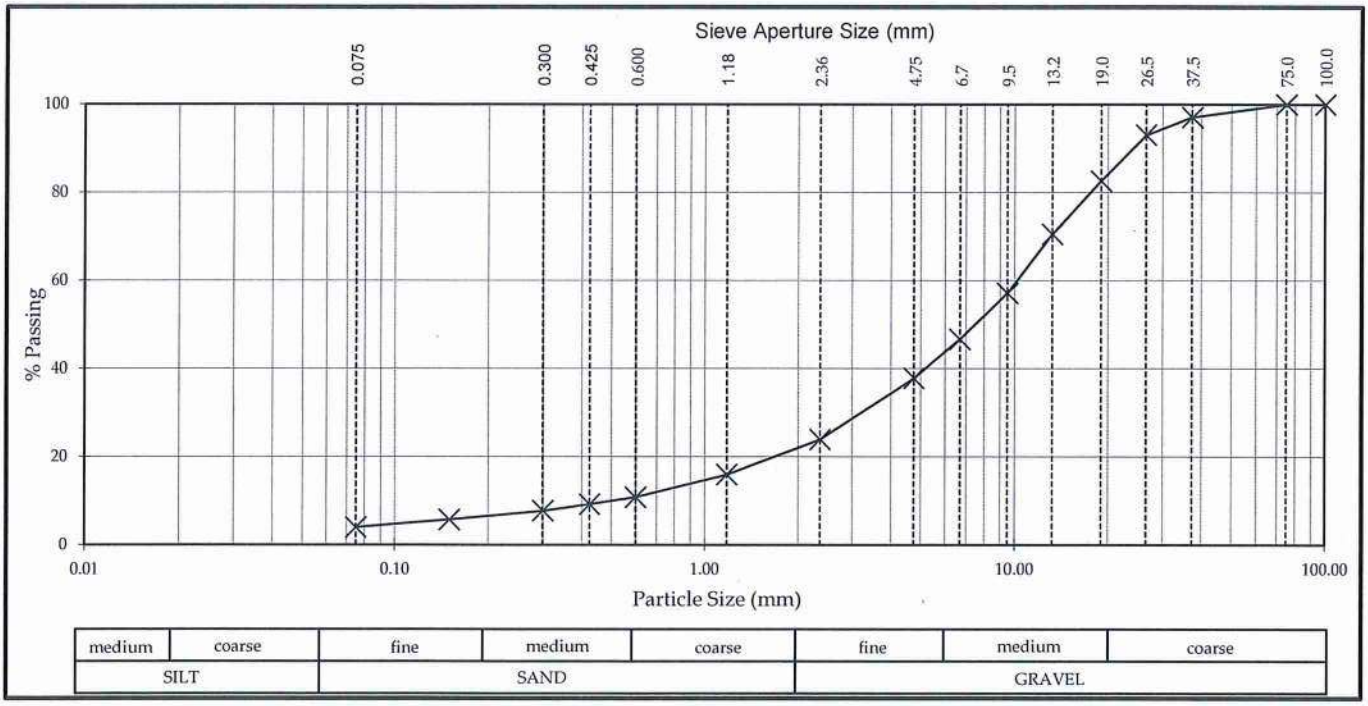
WET SIEVE ANALYSIS
TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki , SH2
Client :	H.Donnelly
Contractor :	WSP Napier Lab
Sampled by :	WSP Napier Lab
Date sampled :	4/05/24
Sampling method :	NZS4407:2015: Test 2.4.8
Sample description :	Base course - Existing Pavement Material
Sample condition	Moist
Source:	TP1 (30mm-260mm)
RP	10640,LHS

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
100.00	100	19.00	83	4.75	38	0.425	9
75.00	100	13.20	71	2.36	24	0.300	8
37.50	97	9.50	57	1.18	16	0.150	6
26.50	93	6.70	47	0.600	11	0.075	4



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: Oven-dried Fraction tested: Whole Dispersant Used: Nil *Fraction passing finest sieve is by difference.*

Date tested : 19/06/24
Date reported : 26/06/24

Approved Jason Crichton J.C.

Designation : *Laboratory Manager*
Date : 26/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

PLASTICITY INDEX FOR AGGREGATES
TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki, SH2
Client :	H.Donnelly
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	4/05/24
Sampling method :	NZS4407: 2015: Test 2.4.8
Sample description :	Base course - Existing pavement material
Sample condition :	As Received
Source:	TP1 (30mm-260mm)

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Test Results	
	PN00028021
Cone penetration limit :	38
Plastic limit :	Unable to Roll Threads
Plasticity index :	NP
Sample fraction :	Fraction passing 425µm test sieve
As received water content : %	6.0

Test Methods	
Water Content	NZS 4407 : 2015 Test 3.1
Cone Penetration	NZS 4407 : 2015 : Test 3.2
Plastic Limit	NZS 4407 : 2015 : Test 3.3
Plasticity Index	NZS 4407 : 2015 : Test 3.4

Date tested : 19/06/24
Date reported : 26/06/24

Approved

Jason Crichton J. C.
Designation : *Laboratory Manager*
Date : 26/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

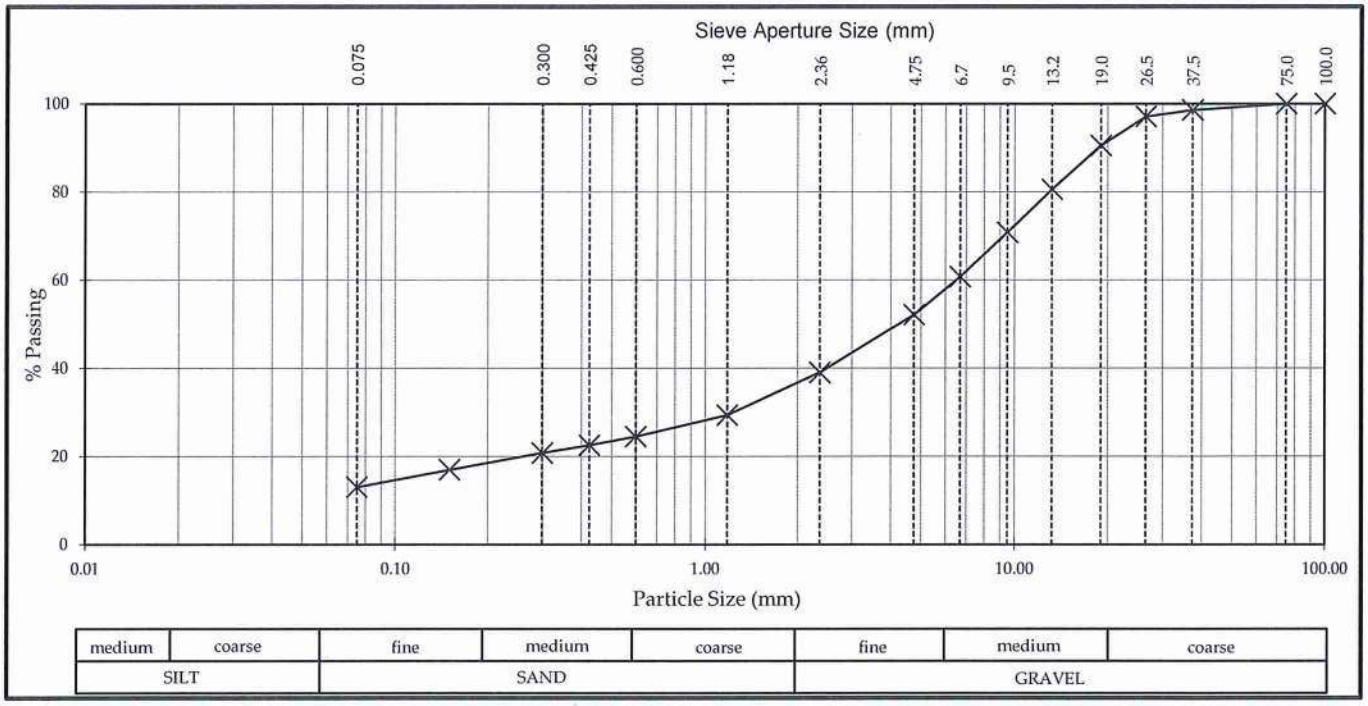
WET SIEVE ANALYSIS
TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki , SH2
Client :	H.Donnelly
Contractor :	WSP Napier Lab
Sampled by :	WSP Napier Lab
Date sampled :	4/05/24
Sampling method :	NZS4407:2015: Test 2.4.8
Sample description :	Sub-Base - Existing Pavement Material
Sample condition	Moist
Source:	TP2 (200-380mm)
RP	10220,RHS

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
100.00	100	19.00	91	4.75	52	0.425	23
75.00	100	13.20	81	2.36	39	0.300	21
37.50	99	9.50	71	1.18	29	0.150	17
26.50	97	6.70	61	0.600	24	0.075	13



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: Oven-dried Fraction tested: Whole Dispersant Used: Nil *Fraction passing finest sieve is by difference.*

Date tested : 19/06/24
Date reported : 26/06/24

Approved Jason Crichton J.C.

Designation : *Laboratory Manager*
Date : 26/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

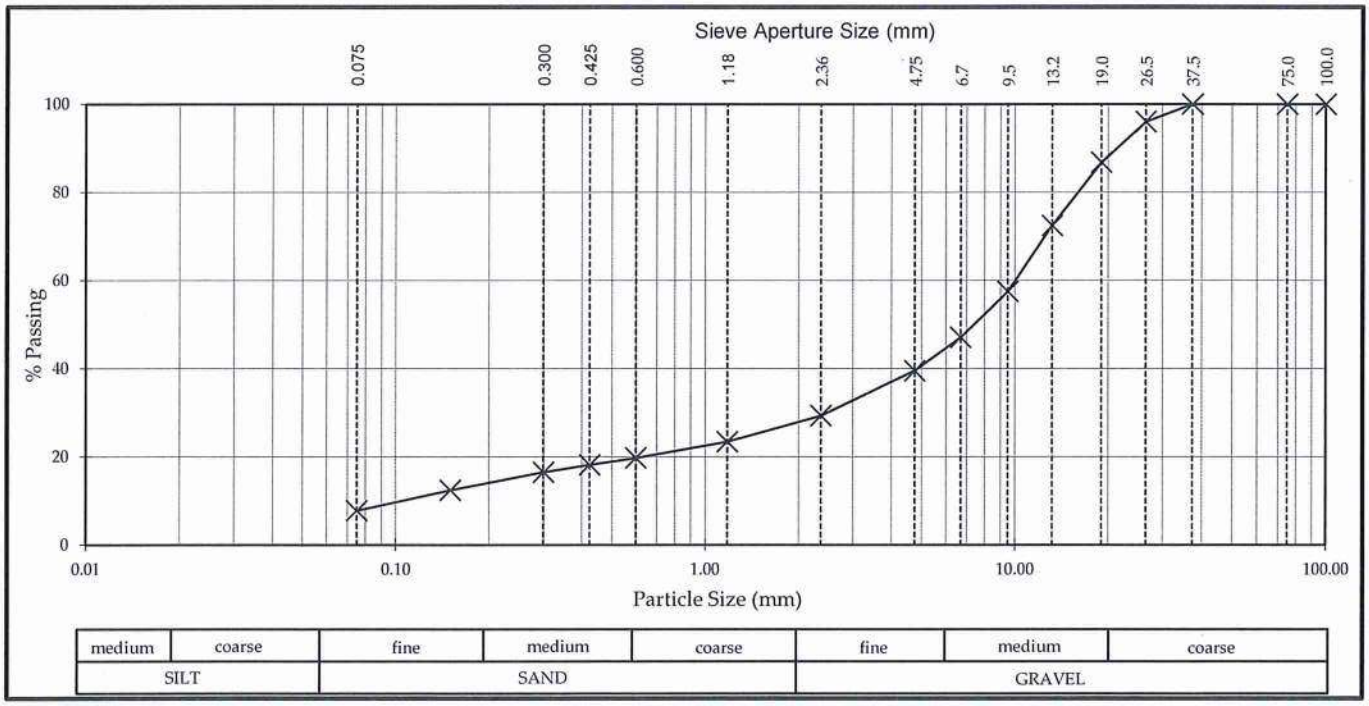
WET SIEVE ANALYSIS
TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki , SH2
Client :	H.Donnelly
Contractor :	WSP Napier Lab
Sampled by :	WSP Napier Lab
Date sampled :	4/05/24
Sampling method :	NZS4407:2015: Test 2.4.8
Sample description :	Base course - Existing Pavement Material
Sample condition	Moist
Source:	TP3 (40mm-180mm)
RP	10160,LHS

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
100.00	100	19.00	87	4.75	40	0.425	18
75.00	100	13.20	72	2.36	29	0.300	16
37.50	100	9.50	57	1.18	23	0.150	12
26.50	96	6.70	47	0.600	20	0.075	8



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: Oven-dried Fraction tested: Whole Dispersant Used: Nil *Fraction passing finest sieve is by difference.*

Date tested : 19/06/24
Date reported : 26/06/24

Approved Jason Crichton

Designation : *Laboratory Manager*
Date : 26/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

CALIFORNIA BEARING RATIO (REMOULDED)
TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki, SH2
Client :	H. Donnelly
Contractor :	WSP Napier Lab
Sampled by :	WSP Napier Lab
Date sampled :	04/05/24
Sampling method :	NZS4407:2015.2.4.8
Sample description :	Base course - Existing pavement material
Sample condition :	As Received
Depth:	40mm-180mm

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Test Results

Sample ID		TP3
Position		10160,LHS
Sample condition at compaction		Moist
Sample condition at test		Soaked
Sample description		Base course
Curing time	days	0
Soaking time	days	4
Passing 19mm	%	87
Surcharge mass	kg	4.0
Lime additive	%	0
Cement additive	%	0
Swell	%	0
Penetration	mm	5
Water content as received	%	5.1
Water content as compacted	%	4.9
Water content after testing	%	7.7
Dry density	t/m^3	1.88
CBR value	%	60

Test Methods		Notes	
CBR	NZS : 4407 : 2015 : 3.15	Material Used	Passing 19mm sieve
Water Content	NZS : 4407 : 2015 : 3.1	Rate of penetration	1mm/min
Compaction	NZS : 4402 : 1986 : 4.1.1 (Standard)		

Date tested : 24/06/24
Date reported : 26/06/24

Approved J.Crichton

Designation : *Laboratory Manager*
Date : 26/06/24

J. C.

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

SAND EQUIVALENT TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki, SH2
Client :	H. Donnelly
Contractor :	WSP Napier Lab
Sampled by :	WSP Napier Lab
Date sampled :	04/05/24
Sampling method :	NZS4407:2015 Test 2.4.8
Sample description :	Base course- Existing pavement material
Sample condition :	Tested as received
Source :	Testpit 3 (40mm-180mm)

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Test Results	
Client Ref. No	
Sand Equivalent :	30
Method of shaking :	Hand
Method of preparation :	Air dried

Test Method
NZS 4407 : 2015, Test 3.6

Date tested : 19/06/24
Date reported : 26/06/24 This report may only be reproduced in full

Approved Jason Crichton J.C.

Designation : *Laboratory Manager*
Date : 26/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

CALIFORNIA BEARING RATIO (REMOULDED) TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki, SH2
Client :	H.Donnelly
Contractor :	WSP Napier Lab
Sampled by :	WSP Napier Lab
Date sampled :	04/05/24
Sampling method :	NZS4407:2015.2.4.8
Sample description :	Subgrade - Existing pavement material
Sample condition :	As Received
Depth:	350mm-500mm

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Test Results

Sample ID		TP3
Position		10160,LHS
Sample condition at compaction		Moist
Sample condition at test		Soaked
Sample description		Subgrade
Curing time	days	0
Soaking time	days	4
Passing 19mm	%	100
Surcharge mass	kg	4.0
Lime additive	%	0
Cement additive	%	0
Swell	%	0
Penetration	mm	5
Water content as received	%	34.6
Water content as compacted	%	34.6
Water content after testing	%	15.2
Dry density	t/m^3	1.35
CBR value	%	**9**

Test Methods		Notes	
CBR	NZS : 4402 : 1986 : 6.1.1	Material Used	Whole Soil
Water Content	NZS : 4402 : 1986 : 2.1	Rate of penetration	1mm/min
Compaction	NZS : 4402 : 1986 : 4.1.1 (Standard)		

Date tested : 24/06/24
Date reported : 26/06/24

Approved J.Crichton

Designation : *Laboratory Manager*
Date : 26/06/24

J.C.

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

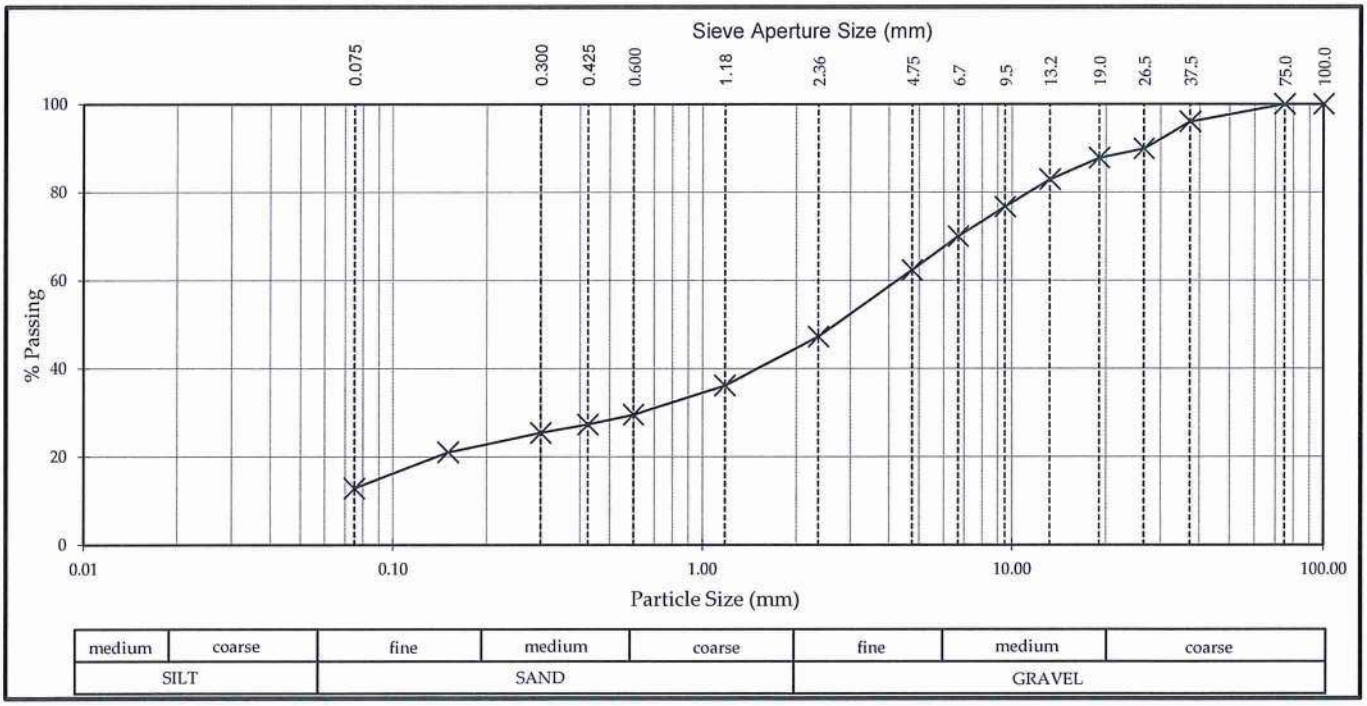
WET SIEVE ANALYSIS
TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki , SH2
Client :	H.Donnelly
Contractor :	WSP Napier Lab
Sampled by :	WSP Napier Lab
Date sampled :	4/05/24
Sampling method :	NZS4407:2015: Test 2.4.8
Sample description :	Base course - Existing Pavement Material
Sample condition	Moist
Source:	TP4 (40mm-140mm)
RP	110,LHS

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Sieve Analysis

Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing	Size (mm)	% Passing
100.00	100	19.00	88	4.75	62	0.425	27
75.00	100	13.20	83	2.36	47	0.300	25
37.50	96	9.50	77	1.18	36	0.150	21
26.50	90	6.70	70	0.600	30	0.075	13



Test Method	Notes
NZS 4407 : 2015 Test 3.8.1	History: Oven-dried Fraction tested: Whole Dispersant Used: Nil *Fraction passing finest sieve is by difference.*

Date tested : 19/06/24
Date reported : 26/06/24

Approved Jason Crichton

Designation : *Laboratory Manager*
Date : 26/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

PLASTICITY INDEX FOR AGGREGATES
TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki, SH2
Client :	H.Donnelly
Contractor :	WSP Napier Laboratory
Sampled by :	WSP Napier Laboratory
Date sampled :	4/05/24
Sampling method :	NZS4407: 2015: Test 2.4.8
Sample description :	Base course - Existing pavement material
Sample condition :	As Received
Source:	TP4 (40mm-140mm)

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Test Results	
	PN00028021
Cone penetration limit :	24
Plastic limit :	Unable to Roll Threads
Plasticity index :	NP
Sample fraction :	Fraction passing 425µm test sieve
As received water content : %	6.9

Test Methods	
Water Content	NZS 4407 : 2015 Test 3.1
Cone Penetration	NZS 4407 : 2015 : Test 3.2
Plastic Limit	NZS 4407 : 2015 : Test 3.3
Plasticity Index	NZS 4407 : 2015 : Test 3.4

Date tested : 19/06/24
Date reported : 26/06/24

Approved

Jason Crichton

Designation : *Laboratory Manager*
Date : 26/06/24

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

CALIFORNIA BEARING RATIO (REMOULDED)
TEST REPORT

Project :	Whirinaki Road AWPT
Location :	Whirinaki, SH2
Client :	H.Donnelly
Contractor :	WSP Napier Lab
Sampled by :	WSP Napier Lab
Date sampled :	04/05/24
Sampling method :	NZS4407:2015.2.4.8
Sample description :	Subgrade - Existing pavement material
Sample condition :	As Received
Depth:	140mm-300mm

Project No :	2-L0054.09
Lab Ref No :	NA8004
Client Ref No :	PN00028021

Test Results

Sample ID		TP4
Position		110,LHS
Sample condition at compaction		Moist
Sample condition at test		Soaked
Sample description		Subgrade
Curing time	days	0
Soaking time	days	4
Passing 19mm	%	88
Surcharge mass	kg	4.0
Lime additive	%	0
Cement additive	%	0
Swell	%	0
Penetration	mm	5
Water content as received	%	11.2
Water content as compacted	%	11.2
Water content after testing	%	9.5
Dry density	t/m^3	1.71
CBR value	%	25

Test Methods		Notes	
CBR	NZS : 4402 : 1986 : 6.1.1	Material Used	Passing 19mm sieve
Water Content	NZS : 4402 : 1986 : 2.1	Rate of penetration	1mm/min
Compaction	NZS : 4402 : 1986 : 4.1.1 (Standard)		

Date tested : 24/06/24
Date reported : 26/06/24

Approved J.Crichton

Designation : *Laboratory Manager*
Date : 26/06/24

J.C.

WSP
Napier (Cadbury Rd)
Quality Management Systems Certified to ISO 9001

10 Cadbury Rd
Private Bag 6019 , Hawkes Bay Mail Centre, 4142, Napier, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

INDIRECT TENSILE STRENGTH (ITS) REPORT

Project:	Whirinaki Road AWPT
Location:	Whirinaki,SH2
Client:	H.Donnelly
Contractor:	WSP Napier Laboratory
Sampled by:	WSP Napier Laboratory
Sampling method:	NZS4407: 2015 Test 2.4.8
Date sampled:	04/05/24
Sample description:	Basecourse
Sample source:	Pavement Pits 1, 2 and 3 combined
Sample condition:	Moist
Date received:	04/05/24
Additive details:	1% Cement

Project number:	2-L0054.09
Lab ref number:	NA8004
Client ref number:	PN00028021
Client sample ID:	-

Test details

Compaction location:	Laboratory
Date compacted:	20/06/2024
Curing method:	Standard T/19 curing
Material used:	Material passing 37.5mm sieve
Sample mixing method:	Hand mixed

Sample water content:	
As received	5.7%
As compacted	5.7%

Test results

Sample details					
Lab ref number	1	2	3	4	-
Sample ID	ITS A	ITS B	ITS C	ITS D	-
Post curing density - measure after 40°C oven curing, and before Wet/Dry curing.					
Sample height (mm)	133	133	135	134	-
Sample diameter (mm)	152	152	151	151	-
Sample mass (g)	5435	5442	5574	5540	-
Sample bulk density (kg/m³)	2247	2259	2304	2314	-
Sample dry density (kg/m³)	2126	2137	2180	2189	-
Test condition	Dry	Dry	Soaked	Soaked	-
As tested density					
Sample mass (g)	5435.4	5442.2	5584.3	5550.4	-
Sample bulk density (kg/m³)	2247	2259	2308	2318	-
Sample water content (%)	5.4	5.4	6.0	5.9	-
Sample dry density (kg/m³)	2133	2144	2178	2190	-
ITS					
Load (P) (kN)	11.7	12.4	12.9	12.6	-
ITS (kPa)	**370**	**390**	**403**	**399**	-
TSR (%)	**106**				

WSP
Napier Laboratory
Quality Management Systems Certified to ISO 9001

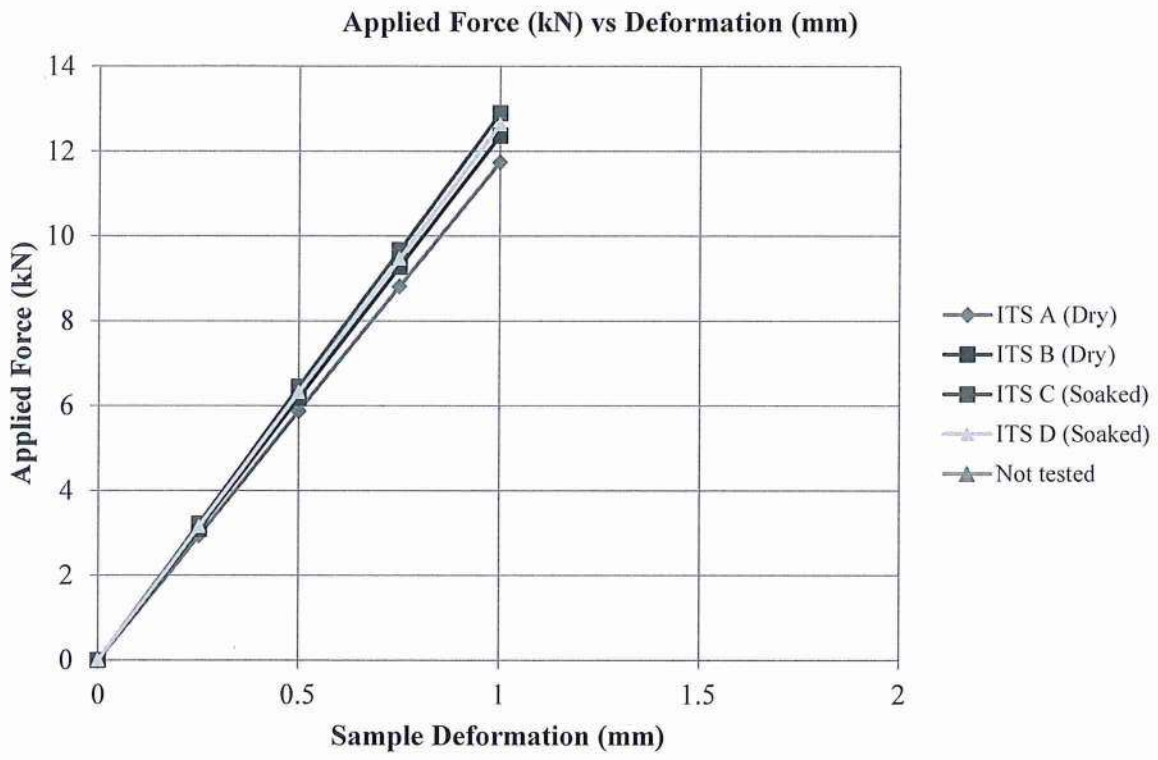
10 Cadbury Road, Napier
Private Bag 6019, Hawkes Bay Mail Centre,
Napier 4142, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

INDIRECT TENSILE STRENGTH (ITS) REPORT

Project number:	2-L0054.09
Lab ref number:	NA8004
Client ref number:	PN00028021
Client sample ID:	-

ITS Graph



Test Methods

Indirect Tensile (ITS) set of 5: ITS from NZTA T/19 Jan 2020 (Not IANZ Accredited)
NZ Vibrating Hammer Compaction: NZS4402: 1986: Test 4.1.3 (see notes)
Water content: NZS4407: 2015: Test 3.1

Notes

ITS Loading rate was 1mm/minute
Sample at estimated optimum water content
Constant temperature room used for curing.
Split moulds used
OWC not tested, single moisture range tested

Date tested: 25/06/24
Date reported: 26/06/24

Approved by: J. Crichton
Designation: Laboratory Manager
Date Approved: 26/06/24

WSP
Napier Laboratory
Quality Management Systems Certified to ISO 9001
10 Cadbury Road, Napier
Private Bag 6019, Hawkes Bay Mail Centre,
Napier 4142, New Zealand
Telephone +64 6 833 5100
Website www.wsp.com/nz

INDIRECT TENSILE STRENGTH (ITS) REPORT

Project:	Whirinaki Road AWPT
Location:	Whirinaki,SH2
Client:	H.Donnelly
Contractor:	WSP Napier Laboratory
Sampled by:	WSP Napier Laboratory
Sampling method:	NZS4407: 2015 Test 2.4.8
Date sampled:	04/05/24
Sample description:	Basecourse
Sample source:	Pavement Pits 1, 2 and 3
Sample condition:	Moist
Date received:	04/05/24
Additive details:	3% Cement

Project number:	2-L0054.09
Lab ref number:	NA8004
Client ref number:	PN00028021
Client sample ID:	-

Test details

Compaction location:	Laboratory
Date compacted:	20/06/2024
Curing method:	Standard T/19 curing
Material used:	Material passing 37.5mm sieve
Sample mixing method:	Hand mixed

Sample water content:	
As received	5.7%
As compacted	5.1%

Test results

Sample details					
Lab ref number	1	2	3	4	-
Sample ID	ITS A	ITS B	ITS C	ITS D	-
Post curing density - measure after 40°C oven curing, and before Wet/Dry curing.					
Sample height (mm)	131	129	122	127	-
Sample diameter (mm)	151	153	153	151	-
Sample mass (g)	5588	5541	5265	5433	-
Sample bulk density (kg/m³)	2379	2345	2359	2390	-
Sample dry density (kg/m³)	2264	2231	2245	2274	-
Test condition	Dry	Dry	Soaked	Soaked	-
As tested density					
Sample mass (g)	5588.4	5541.3	5294.5	5462.7	-
Sample bulk density (kg/m³)	2379	2345	2372	2403	-
Sample water content (%)	4.1	4.2	5.3	5.1	-
Sample dry density (kg/m³)	2287	2251	2252	2287	-
ITS					
Load (P) (kN)	39.1	39.3	29.5	28.5	-
ITS (kPa)	**1260**	**1269**	**1011**	**946**	-
TSR (%)	**77**				

WSP
Napier Laboratory
Quality Management Systems Certified to ISO 9001

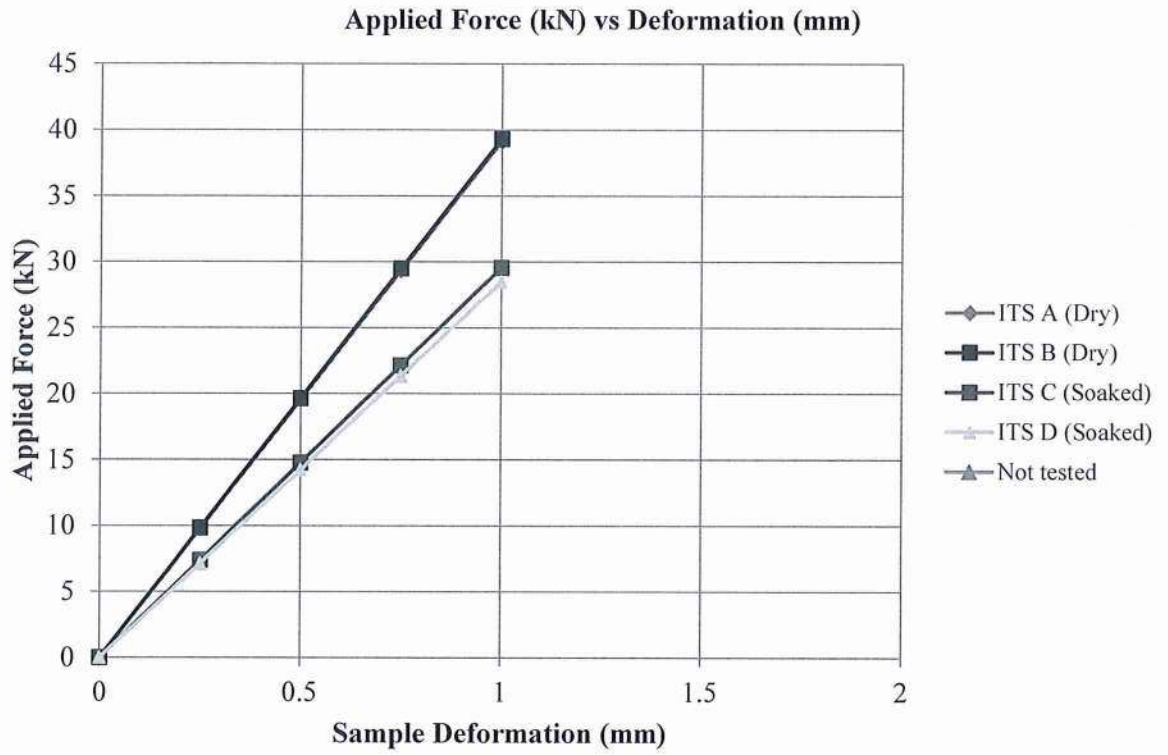
10 Cadbury Road, Napier
Private Bag 6019, Hawkes Bay Mail Centre,
Napier 4142, New Zealand

Telephone +64 6 833 5100
Website www.wsp.com/nz

INDIRECT TENSILE STRENGTH (ITS) REPORT

Project number:	2-L0054.09
Lab ref number:	NA8004
Client ref number:	PN00028021
Client sample ID:	-

ITS Graph



Test Methods

Indirect Tensile (ITS) set of 5: ITS from NZTA T/19 Jan 2020 (Not IANZ Accredited)
NZ Vibrating Hammer Compaction: NZS4402: 1986: Test 4.1.3 (see notes)
Water content: NZS4407: 2015: Test 3.1

Notes

ITS Loading rate was 1mm/minute
Sample at estimated optimum water content
Constant temperature room used for curing.
Split moulds used
OWC not tested, single moisture range tested

Date tested: 25/06/24
Date reported: 26/06/24

Approved by: J. Crichton J.C.
Designation: Laboratory Manager
Date Approved: 26/06/24

WSP
Napier Laboratory
Quality Management Systems Certified to ISO 9001
10 Cadbury Road, Napier
Private Bag 6019, Hawkes Bay Mail Centre,
Napier 4142, New Zealand
Telephone +64 6 833 5100
Website www.wsp.com/nz