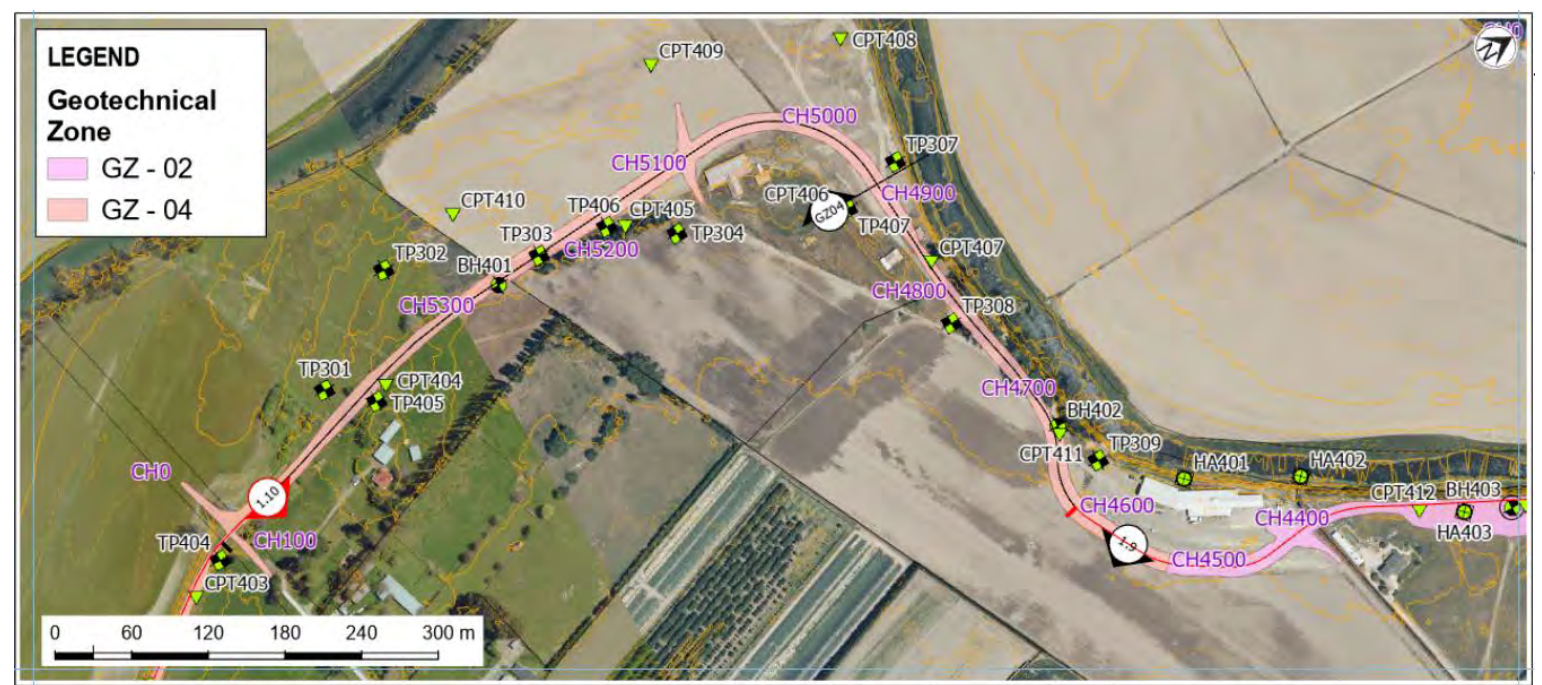
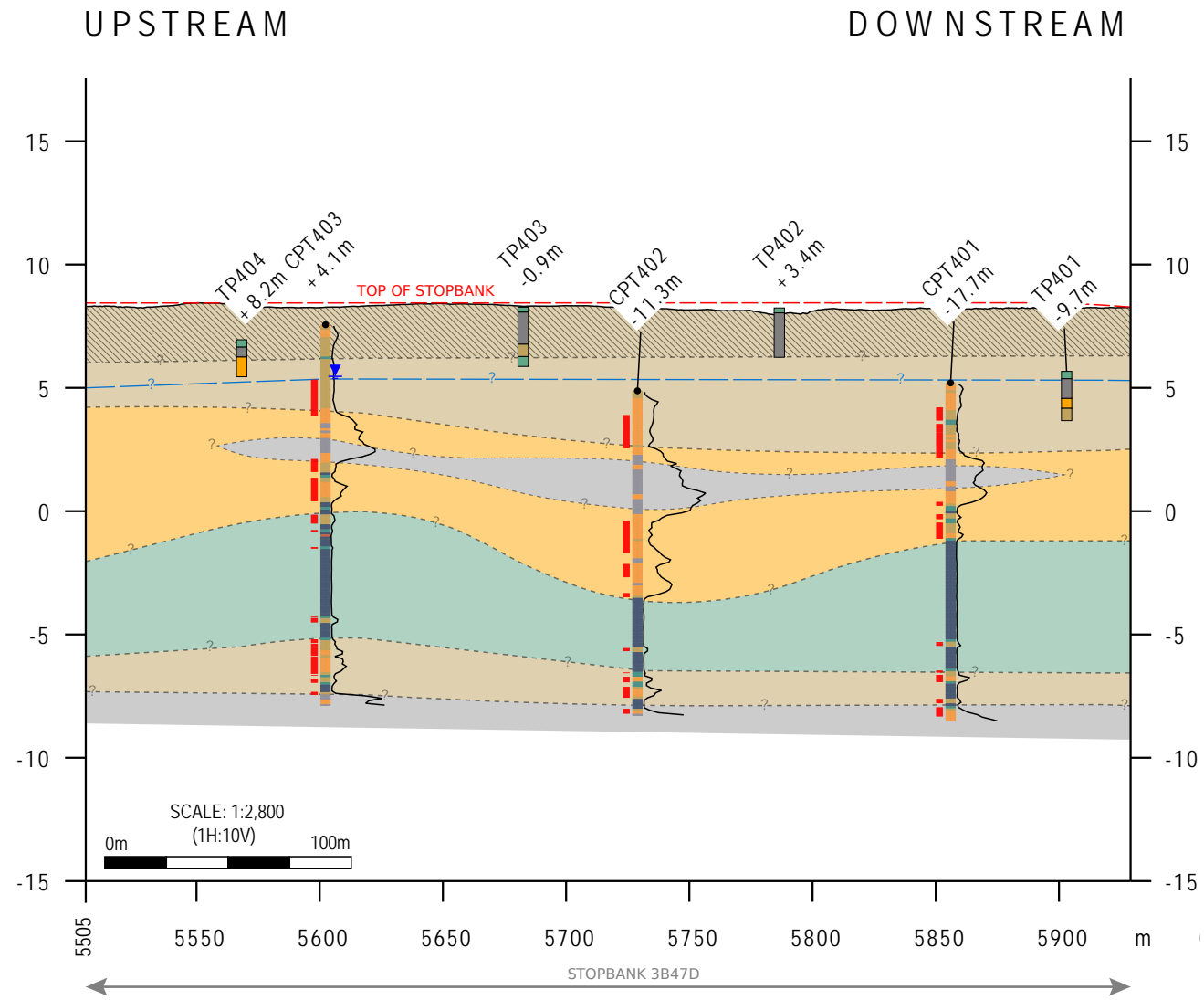


LITHOLOGY		BOREHOLE	
	EXISTING STOPBANK FILL (SILTY SAND)	0	SPT 'N' VALUE
HOLOCENE RIVER DEPOSITS			CONE RESISTANCE, qc
	CLAY DOMINATED (IC 3 TO 3.6)		LIQUEFIABLE LAYERS (ULS FOS <1)
	SILT DOMINATED (IC 2.6 TO 3)		MEASURED GROUNDWATER LEVEL (DECEMBER 2024)
	SAND DOMINATED (IC 1.3 TO 2)		INFERRED GROUNDWATER LEVEL
	GRAVEL DOMINATED (IC < 1.3)		LONG SECTION JOIN LINE



1. THE CONE PENETRATION TEST SOIL BEHAVIOUR INDEX (IC) HAS BEEN DERIVED USING THE METHODOLOGY DESCRIBED IN ROBERTSON AND WRIDE, 1998.
2. INVESTIGATIONS OVER 40M OFFSET FROM THE SECTION ALIGNMENT HAVE BEEN COLOUR GREY
3. ELEVATION LEVELS ARE WITHIN NZVD16 VERTICAL DATUM
4. WE HAVE GROUPED THE UNITS BASED ON THE DOMINANT GEOLOGICAL UNIT AND WHAT IS LIKELY TO LEAD TO MORE CONSERVATIVE CONDITIONS IN OUR MODELLING

PROJECT No.	1017353.2403	CLIENT	<b>HAWKES BAY REGIONAL COUNCIL</b>
DESIGNED	BRTA Aug.25	PROJECT	<b>PAKOWHAI SECONDARY STOPBANK</b>
DRAWN	BRTA Aug.25	TITLE	GEOLOGICAL LONG SECTION 1.9
CHECKED	DAMI Sep.25	SCALE (A3)	AS SHOWN
APPROVED	DATE	FIG No.	1.9
		REV	1



<b>LITHOLOGY</b>		<b>BOREHOLE</b>	
	EXISTING STOPBANK FILL (SILTY SAND)	0	SPT 'N' VALUE
<b>HOLOCENE RIVER DEPOSITS</b>			CONE RESISTANCE, qc
	CLAY DOMINATED (IC 3 TO 3.6)		LIQUEFIABLE LAYERS (ULS FOS <1)
	SILT DOMINATED (IC 2.6 TO 3)		MEASURED GROUNDWATER LEVEL (DECEMBER 2024)
	SILTY SAND DOMINATED (IC 2 TO 2.6)		INFERRED GROUNDWATER LEVEL
	SAND DOMINATED (IC 1.3 TO 2)		LONG SECTION JOIN LINE
	GRAVEL DOMINATED (IC < 1.3)		

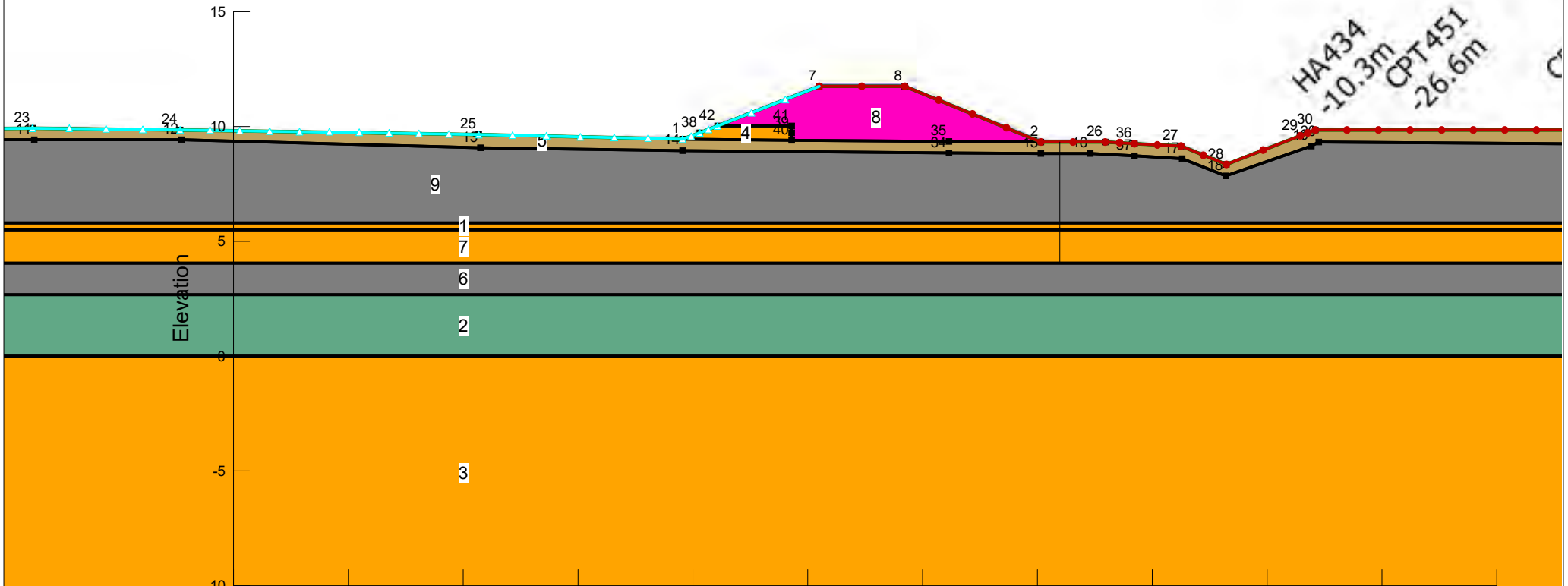


1. THE CONE PENETRATION TEST SOIL BEHAVIOUR INDEX (IC) HAS BEEN DERIVED USING THE METHODOLOGY DESCRIBED IN ROBERTSON AND WRIDE, 1998.
2. INVESTIGATIONS OVER 40M OFFSET FROM THE SECTION ALIGNMENT HAVE BEEN COLOUR GREY
3. ELEVATION LEVELS ARE WITHIN NZVD16 VERTICAL DATUM
4. WE HAVE GROUPED THE UNITS BASED ON THE DOMINANT GEOLOGICAL UNIT AND WHAT IS LIKELY TO LEAD TO MORE CONSERVATIVE CONDITIONS IN OUR MODELLING

PROJECT No. 1017353.2403		
DESIGNED	BRTA	Aug.25
DRAWN	BRTA	Aug.25
CHECKED	DAMI	Sep.25
APPROVED	DATE	

CLIENT	<b>HAWKES BAY REGIONAL COUNCIL</b>
PROJECT	<b>PAKOWHAI SECONDARY STOPBANK</b>
TITLE	<b>GEOLOGICAL LONG SECTION 1.10</b>
SCALE (A3)	AS SHOWN
FIG No.	1.10
REV	1

Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Ky'/Kx' Ratio	Rotation (°)
■	1. Stopbank Fill	Saturated / Unsaturated	Sandy SILT / SILT (FILL MATERIAL)	Sandy SILT / SILT (Fill)	0.25	0
■	2. Silty SAND / Sandy SILT	Saturated / Unsaturated	Silty SAND / Sandy SILT	Silty SAND / Sandy SILT	1	0
■	3. SAND	Saturated / Unsaturated	SAND	SAND	1	0
■	4. SILT	Saturated / Unsaturated	SILT	SILT	1	0
■	5. Gravel	Saturated / Unsaturated	Gravel	Gravel	1	0



Title: GZ-01 (CH160) - Cross Section

Job Number: 1017353.2403

Comments:

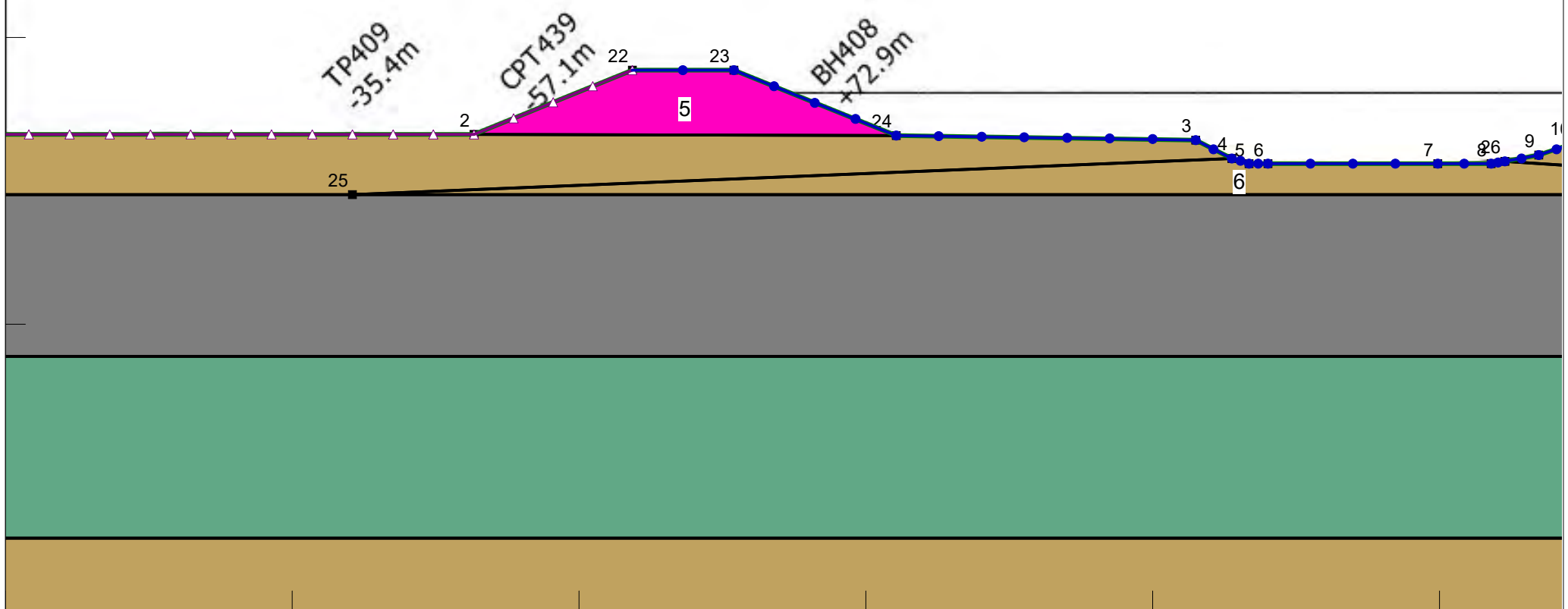
Scale: 1:250 @ A4

Analysed by: MIBU

Checked by:

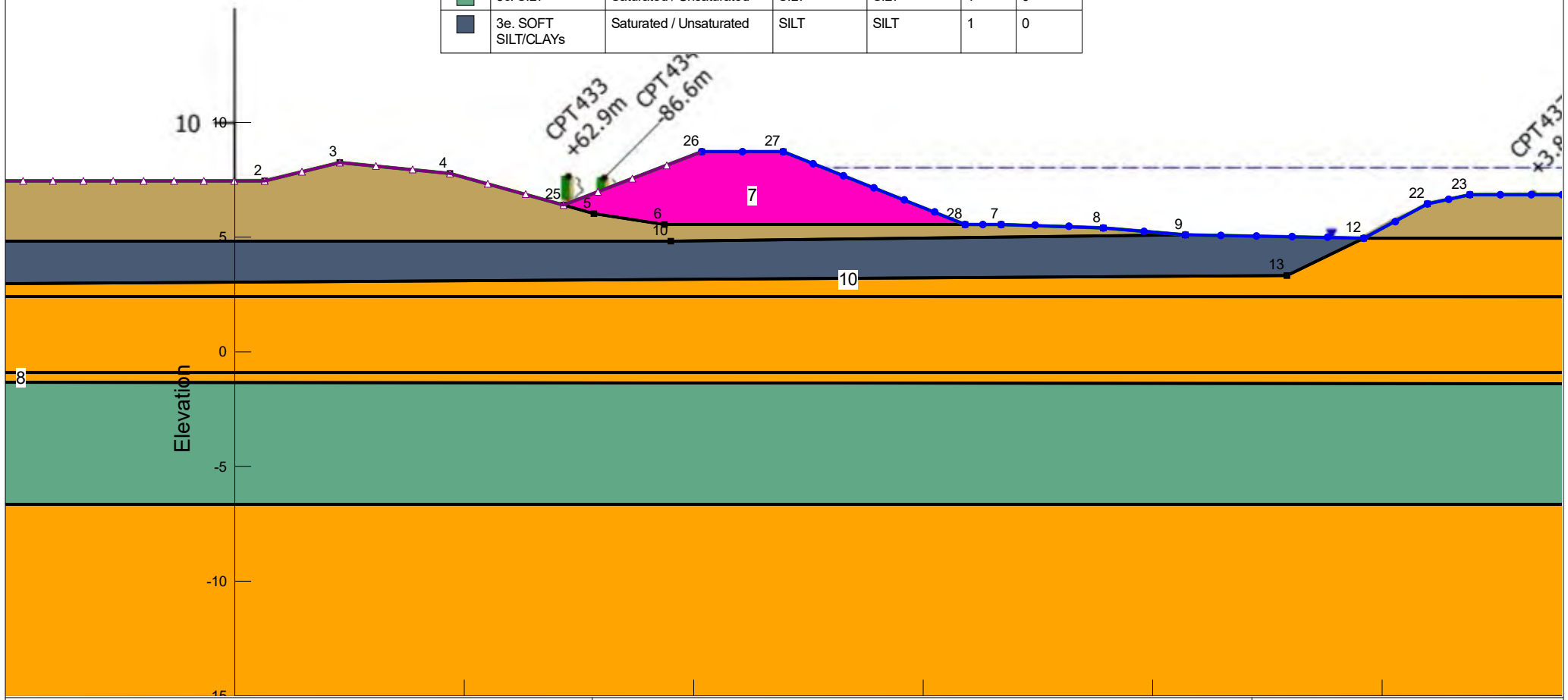
Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Ky/Kx' Ratio	Rotation (°)
■	1. Stopbank Fill	Saturated / Unsaturated	Sandy SILT / SILT (FILL MATERIAL)	Sandy SILT / SILT (Fill)	0.25	0
■	2. Silty SAND / Sandy SILT	Saturated / Unsaturated	Silty SAND / Sandy SILT	Silty SAND / Sandy SILT	1	0
■	4. SILT	Saturated / Unsaturated	SILT	SILT	1	0
■	5. Gravel	Saturated / Unsaturated	Gravel	Gravel	1	0

A



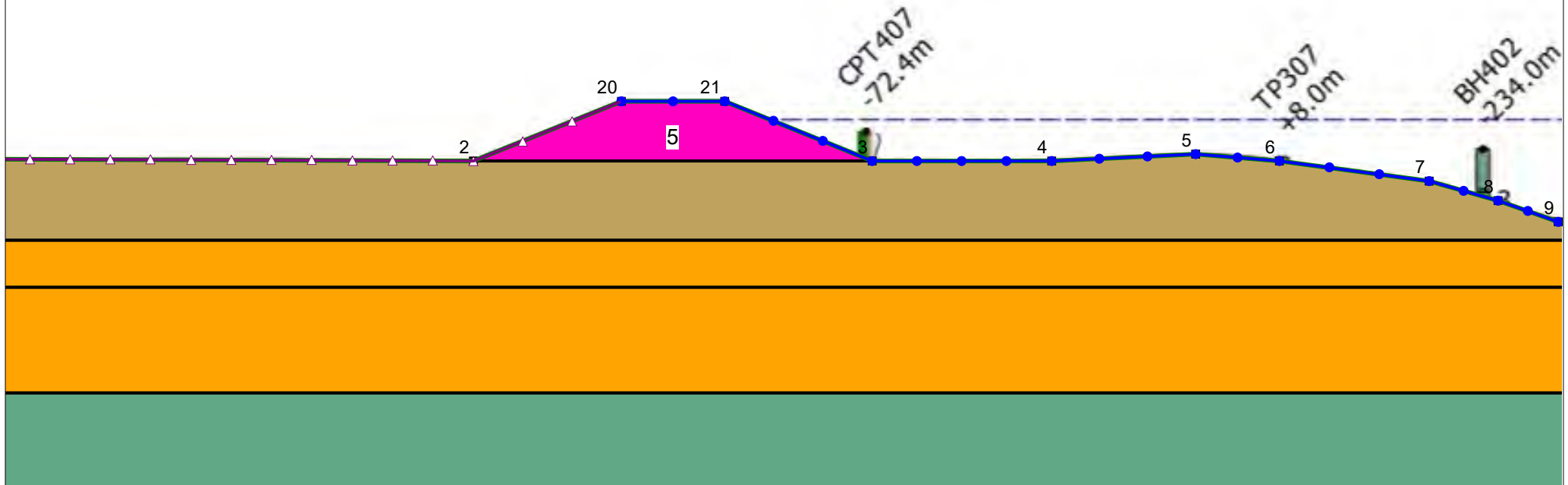
	Title: Title: GZ-02 (CH1610) - Cross Section		Job Number: 1017353.2403
			Analysed by: MIBU
	Comments:	Scale: 1:200 @ A4	Checked by:

Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Ky'/Kx' Ratio	Rotation (°)
█	1. Stopbank Fill	Saturated / Unsaturated	Sandy SILT / SILT (FILL MATERIAL)	Sandy SILT / SILT (Fill)	0.25	0
█	3a. Silty SAND / Sandy SILT	Saturated / Unsaturated	Silty SAND / Sandy SILT	Silty SAND / Sandy SILT	1	0
█	3b. SAND	Saturated / Unsaturated	SAND	SAND	1	0
█	3c. SILT	Saturated / Unsaturated	SILT	SILT	1	0
█	3e. SOFT SILT/CLAYS	Saturated / Unsaturated	SILT	SILT	1	0



Title: GZ_3 (CH2155) - Cross Section		Job Number: 1017353.2403
Comments:		Analysed by: MIBU
Scale: 1:250 @ A4		Checked by:

Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Ky'/Kx' Ratio	Rotation (°)
■	1. Stopbank Fill	Saturated / Unsaturated	Sandy SILT / SILT (FILL MATERIAL)	Sandy SILT / SILT (Fill)	0.25	0
■	2. Silty SAND / Sandy SILT	Saturated / Unsaturated	Silty SAND / Sandy SILT	Silty SAND / Sandy SILT	1	0
■	3. SAND	Saturated / Unsaturated	SAND	SAND	1	0
■	4. SILT	Saturated / Unsaturated	SILT	SILT	1	0



Title: GZ-04 (CH4910) - Cross Section

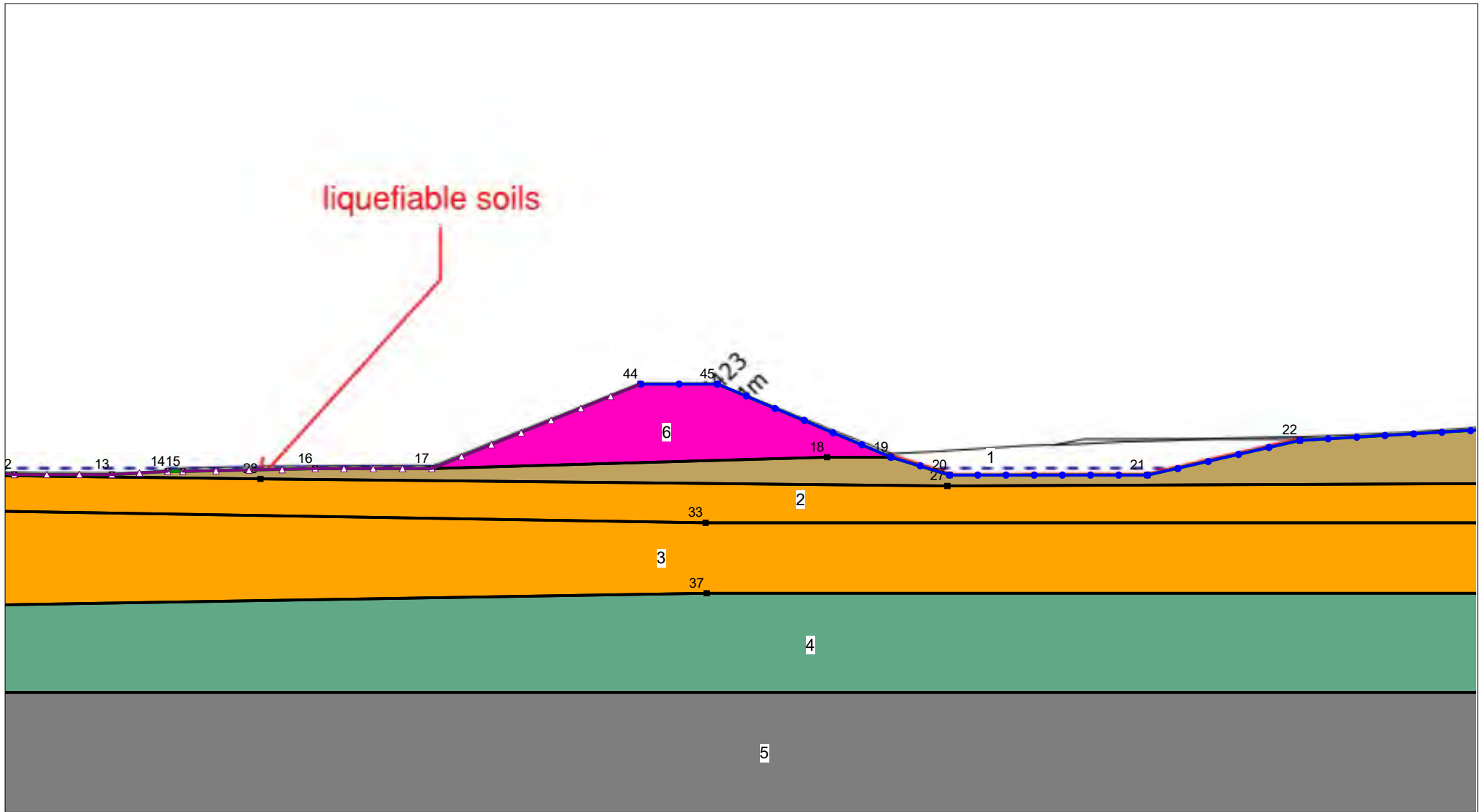
Job Number: 1017353.2403

Analysed by: MIBU

Comments:

Scale: 1:200 @ A4

Checked by:



Title: GZ-05 (CH3715) - Cross Section

Job Number: 1017353.2403

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by:

## **Appendix B      Liquefaction Assessment**

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- **Summary of Liquefaction Results**
- **TTGD Liquefaction Outputs**

**Table Appendix B.1: Summary of liquefaction vulnerability**

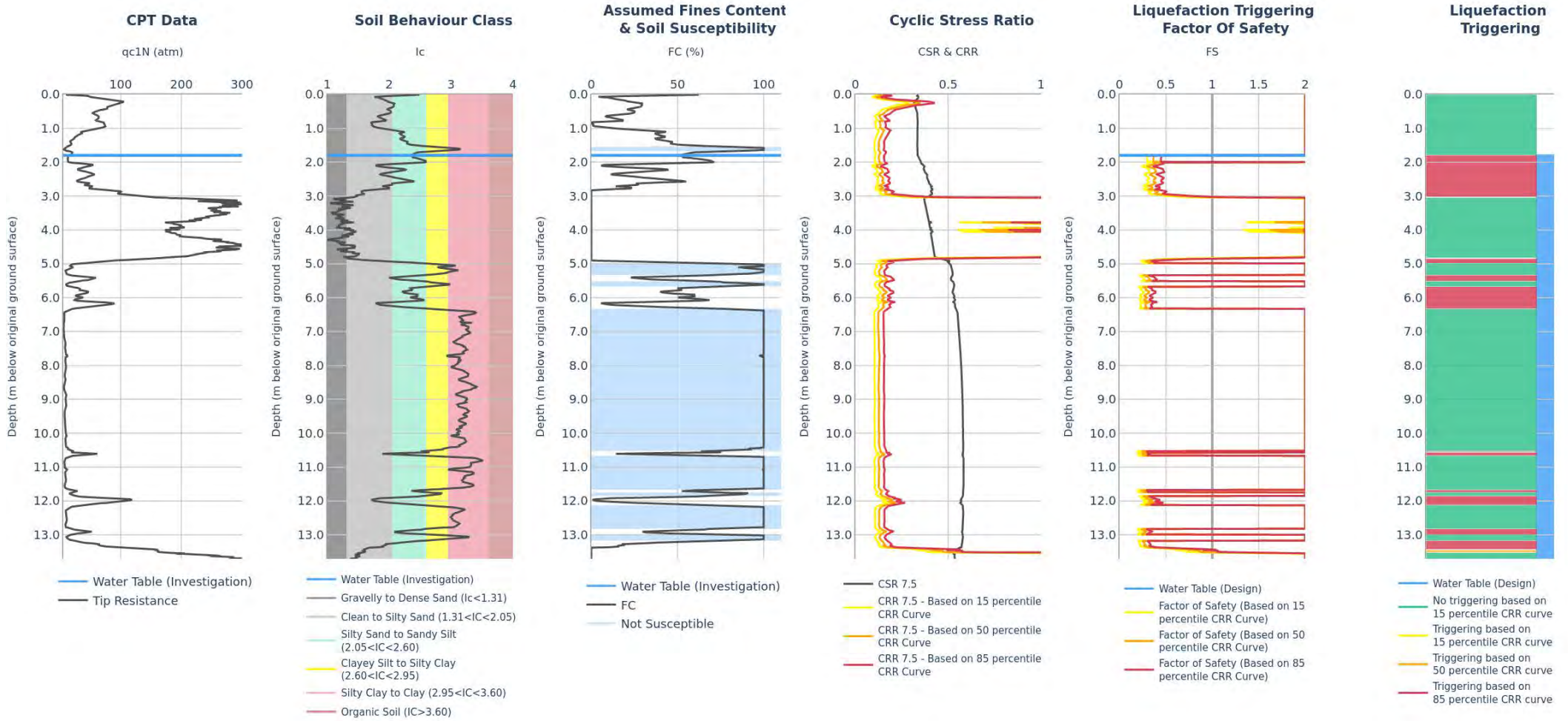
CPT ID	Stopbank ID (Based on Civil ID)	Approx. Chainage (m)	Expected liquefaction vulnerability	
			SLS	ULS
CPT401	3B50	5856	Minor	Moderate
CPT402		5729	Minor	Moderate
CPT403		5602	Minor	Minor to moderate
CPT404		5377	Minor	Moderate
CPT405		5150	Minor	Minor to moderate
CPT406		4908	None	Minor to moderate
CPT407		4833	Minor	Moderate
CPT408		4976	Minor	Moderate
CPT409		5064	None	Minor to moderate
CPT410		5257	Minor	Minor
CPT411		4666	Minor	Minor to moderate
CPT412		4311	Minor to moderate	Severe
CPT413		4228	Minor	Moderate
CPT414		4109	Minor	Moderate to severe
CPT415		3922	Minor	Minor to moderate
CPT416		3876	Minor	Moderate to severe
CPT417		3844	Minor	Moderate to severe
CPT417a		3819	Minor	Moderate to severe
CPT418		3807	Minor to moderate	Severe
CPT419		3767	Minor	Moderate to severe
CPT420		3720	Minor	Minor to moderate
CPT421		3878	Minor to moderate	Moderate to severe
CPT422		3819	Minor	Severe
CPT423		3755	Minor	Moderate to severe
CPT424		3656	Minor to moderate	Severe
CPT425		3493	Minor to moderate	Severe
CPT426		3305	Minor to moderate	Severe
CPT427		2958	Minor	Moderate to severe
CPT428		2771	Minor	Moderate to severe
CPT429		2614	Minor to moderate	Moderate to severe
CPT430		2467	Minor	Minor to moderate
CPT431		2348	Minor	Minor to moderate
CPT432		2252	Minor	Minor to moderate
CPT433		2211	Minor	Severe
CPT434		2065	Minor	Minor to moderate
CPT435	1989	Minor	Moderate to severe	

CPT ID	Stopbank ID (Based on Civil ID)	Approx. Chainage (m)	Expected liquefaction vulnerability	
			SLS	ULS
CPT436		1836	Minor	Moderate
CPT437		2156	Minor	Minor to moderate
CPT438		1818	Minor	Moderate
CPT439		1535	Minor	Moderate
CPT440		1095	Minor	Minor to moderate
CPT441		728	Minor	Minor to moderate
CPT442		514	Minor	Minor to moderate
CPT444	3B4C	46	Minor	Minor to moderate
CPT445		448	Minor	Moderate to severe
CPT446		1057	None	None
CPT447		1436	None	Minor
CPT448		1844	Minor	Moderate to severe
CPT449	3B47	729	Minor	Moderate to severe
CPT450		383	Minor	Minor to moderate
CPT451		138	None	Minor
CPT452		107	Minor	Minor to moderate

Note:

1. Crust thickness is measured to the top of the CPT trace (i.e. using existing ground levels) and therefore excludes any additional crust provided by the increased embankment height.

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT401	CPT_TT262848	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

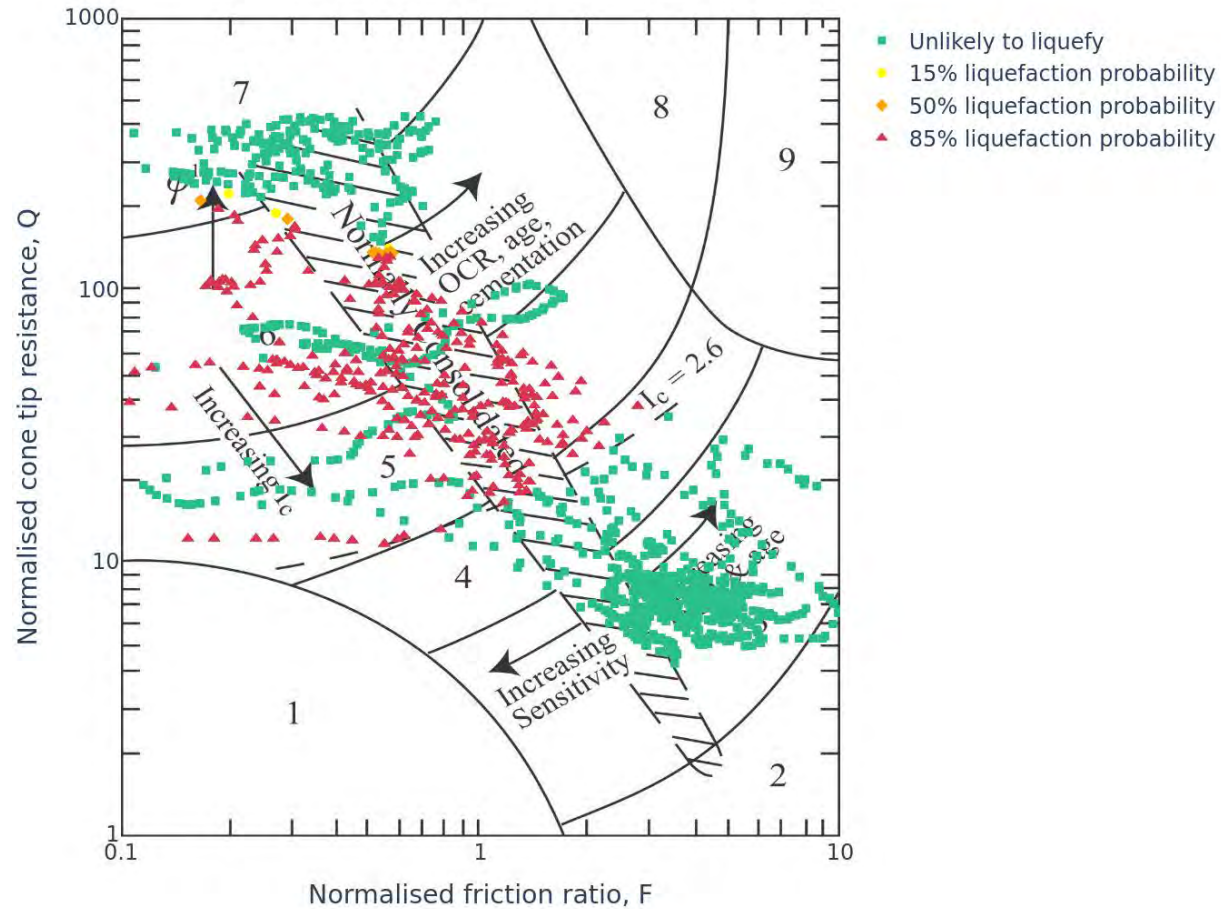
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	82	3.2	15	21	1.9	13
50%	82	3.2	13	21	1.9	12
85%	81	3.1	12	21	1.9	10

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



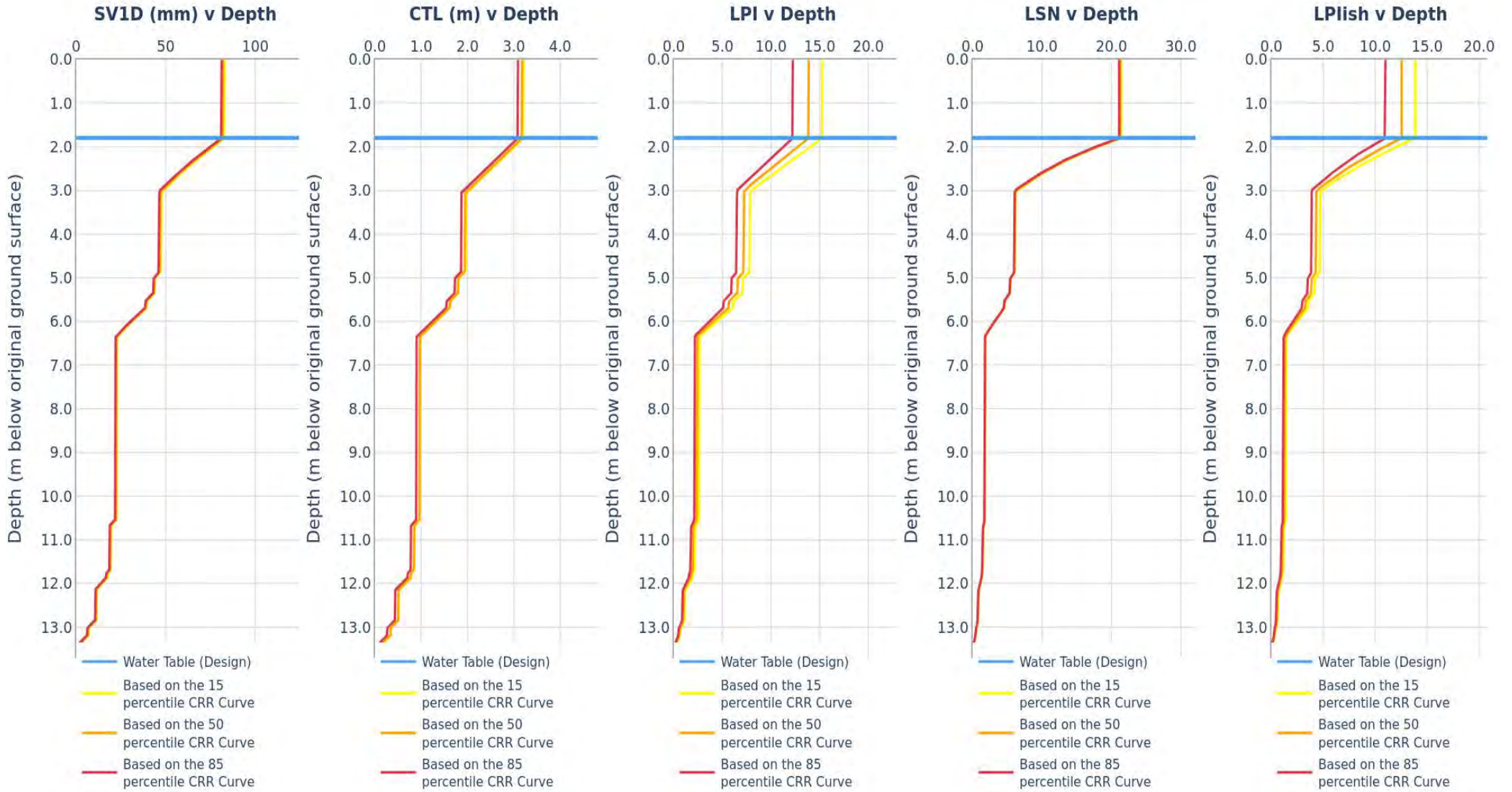
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 2/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

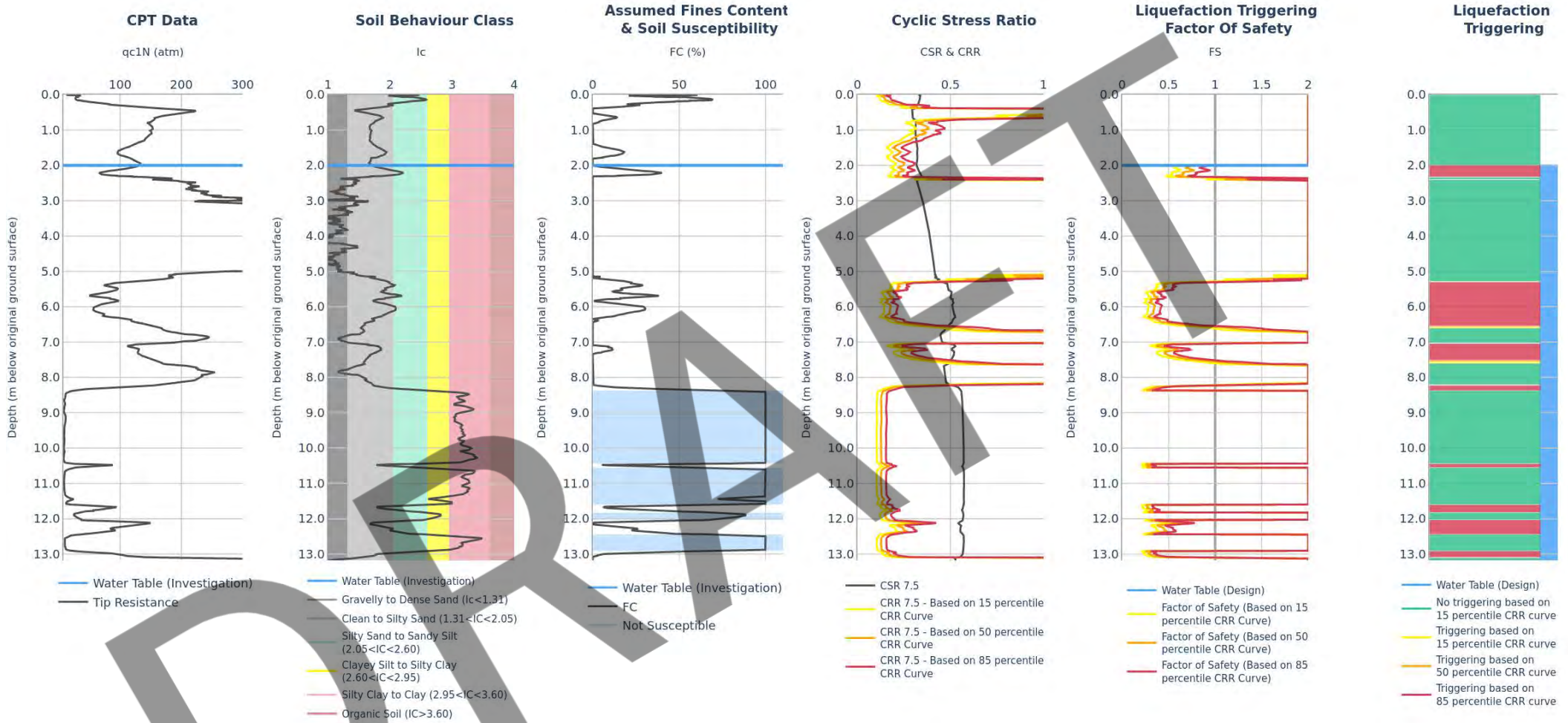


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT401	CPT_TT262848	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT402	CPT_TT262849	10/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

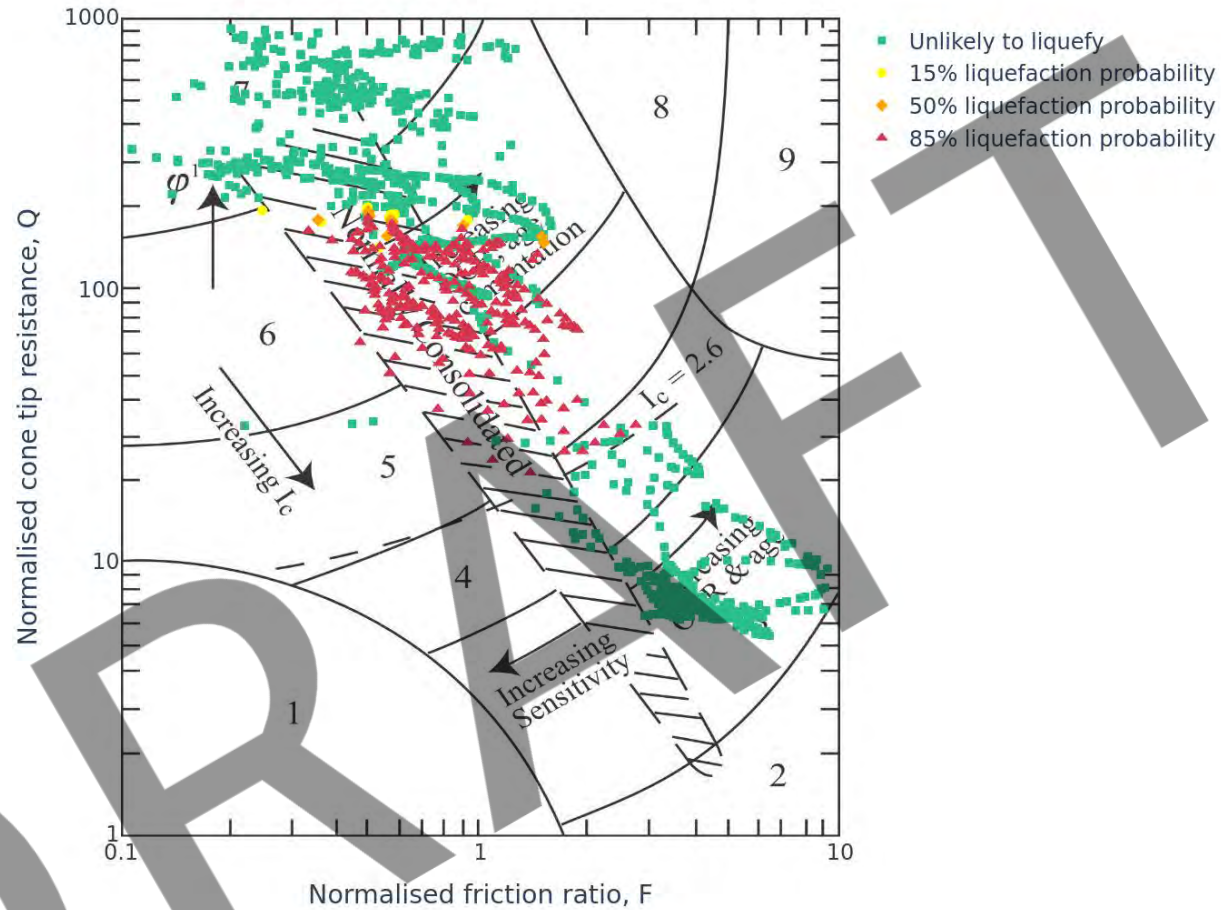
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	68	3.3	12	11	2.1	8
50%	66	3.2	10	10	2.1	6
85%	62	3.1	8	9	2.1	5

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



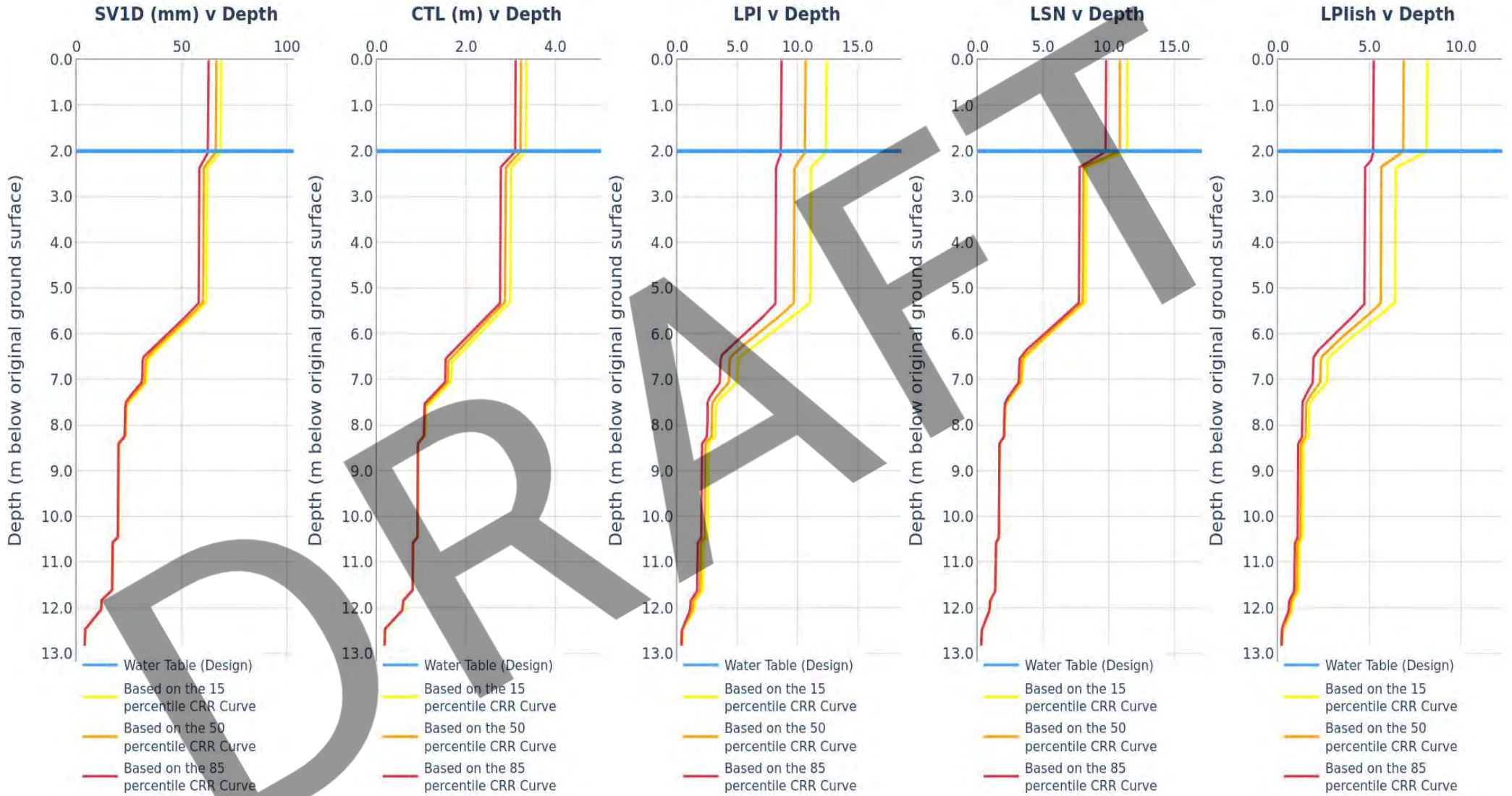
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

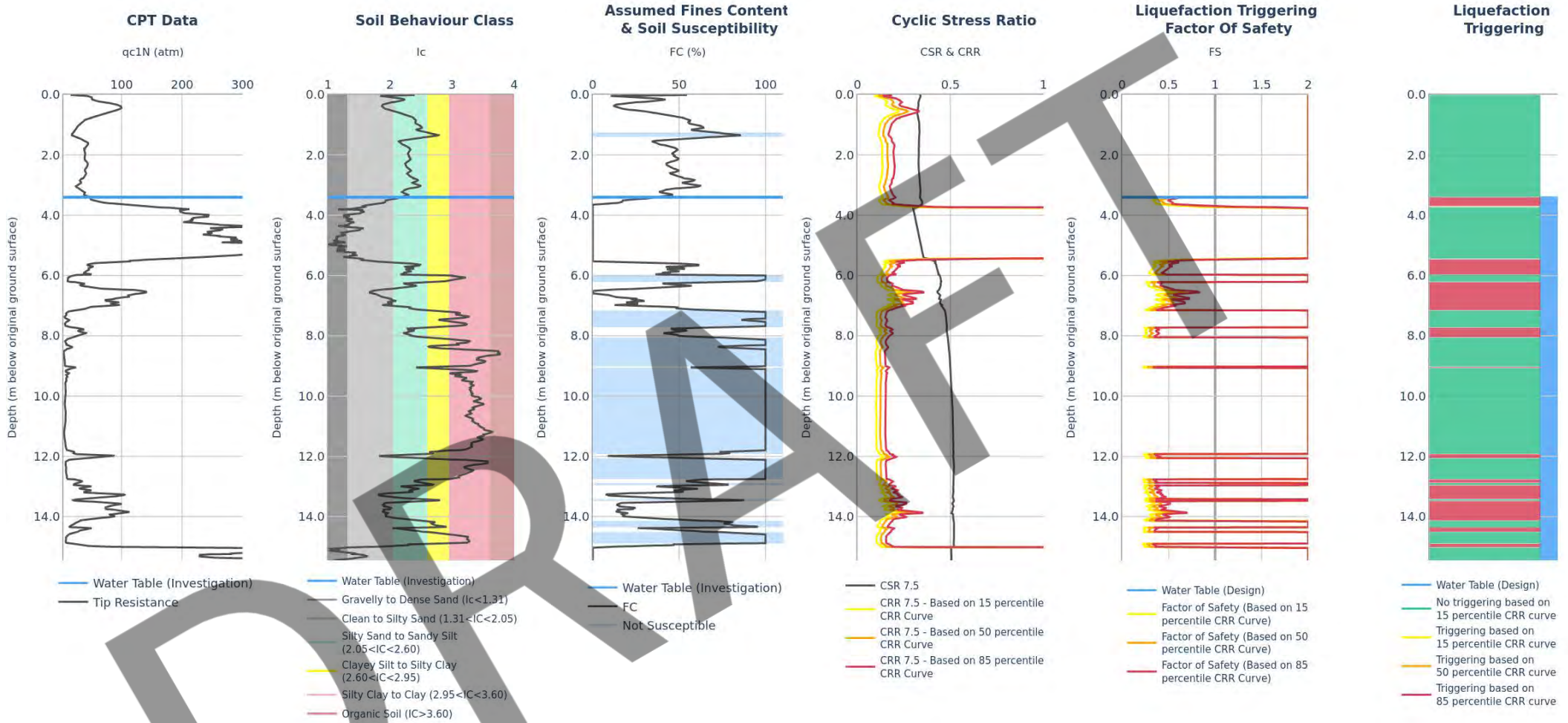


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT402	CPT_TT262849	10/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT403	CPT_TT262850	10/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

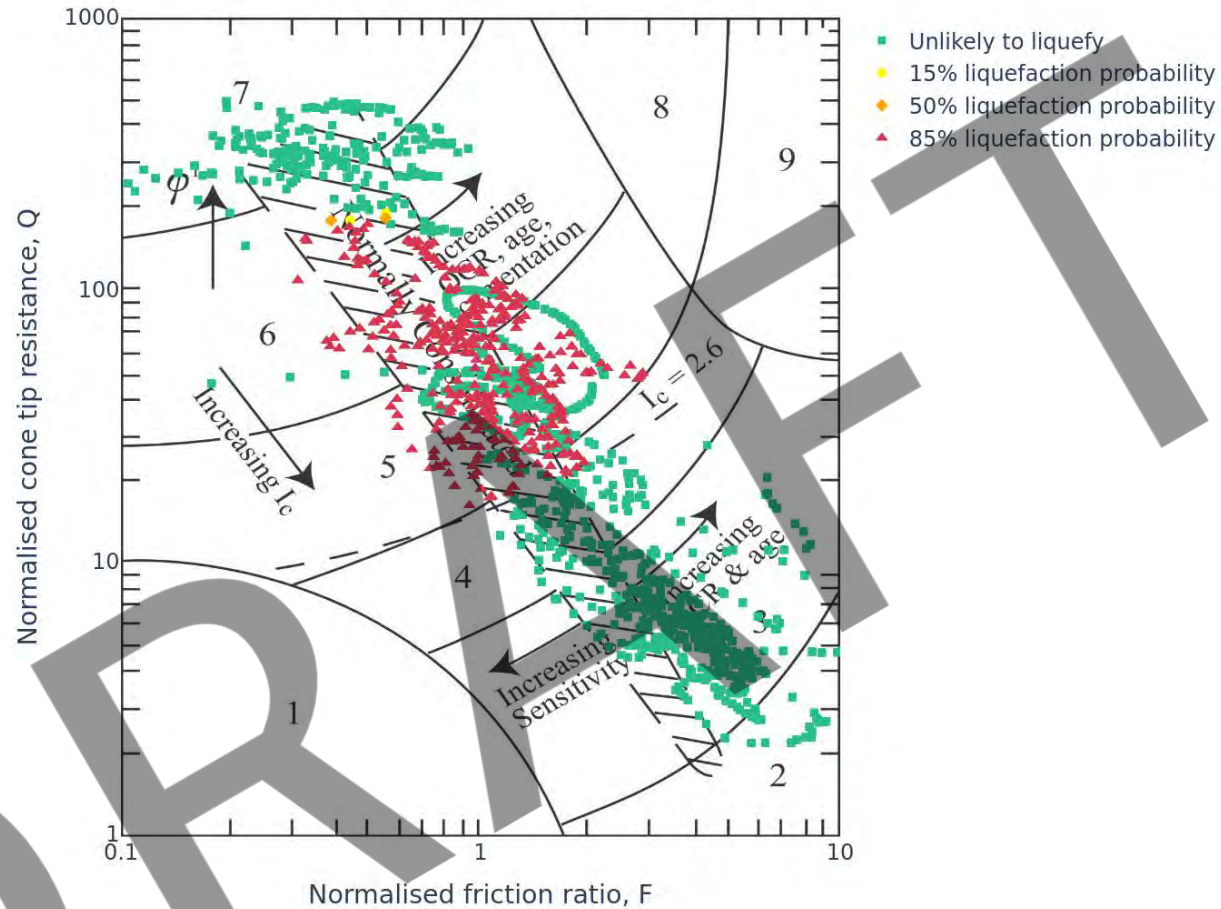
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	87	3.8	13	11	3.5	8
50%	87	3.8	11	11	3.5	7
85%	85	3.8	9	10	3.5	6

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 7/20


## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



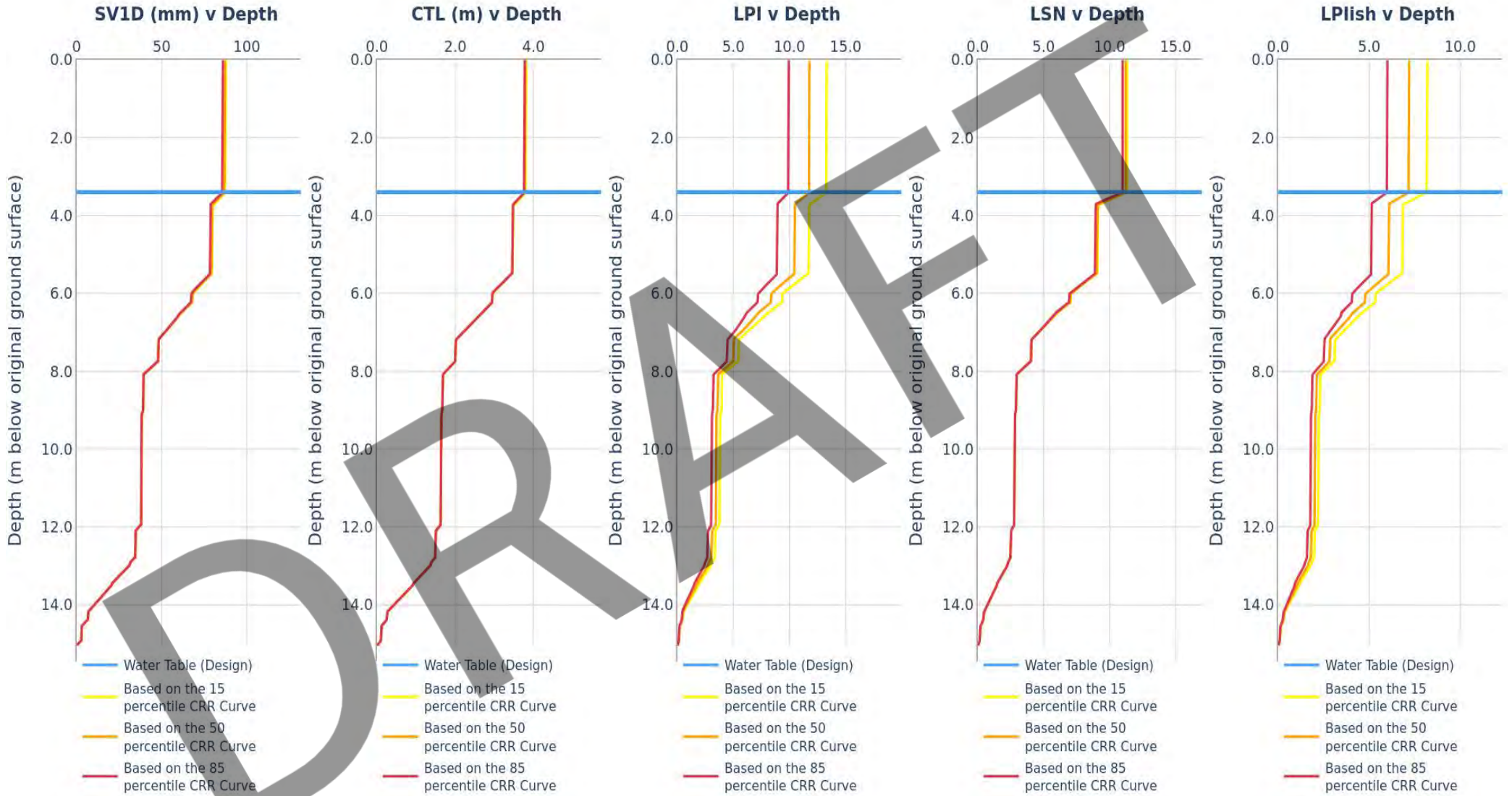
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 8/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

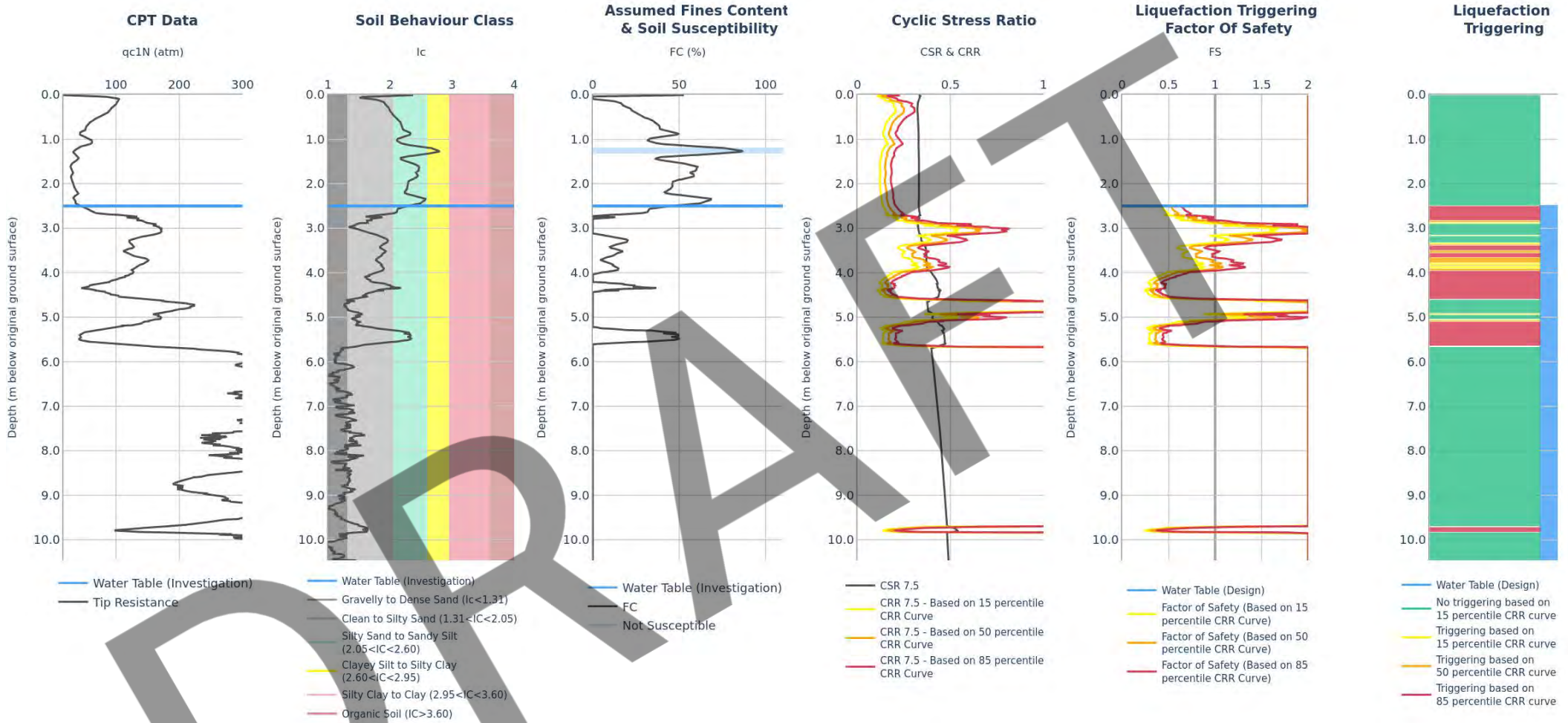


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT403	CPT_TT262850	10/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT404	CPT_TT262851	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

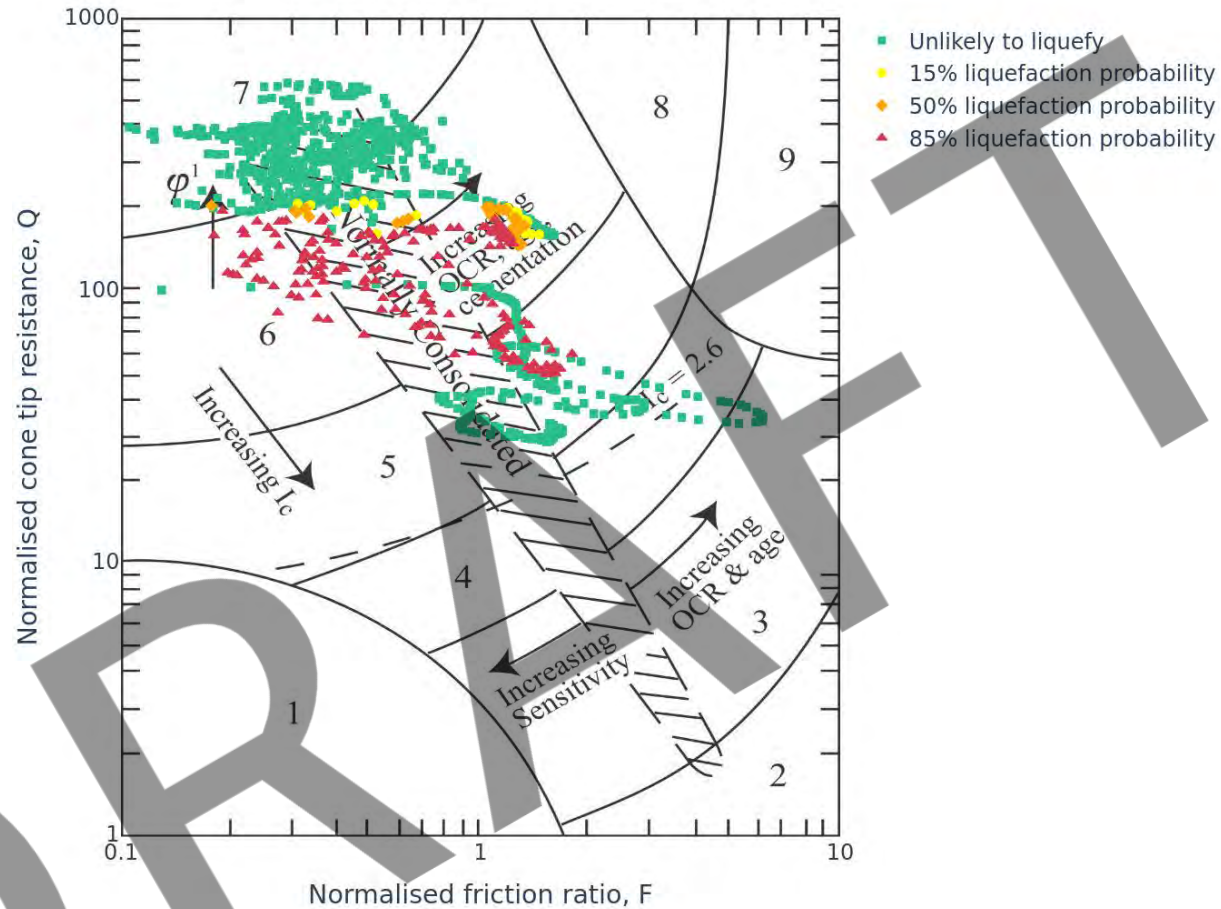
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	48	2.5	9	11	2.6	7
50%	43	2.2	7	10	2.6	5
85%	38	1.8	5	9	2.6	3

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 10/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



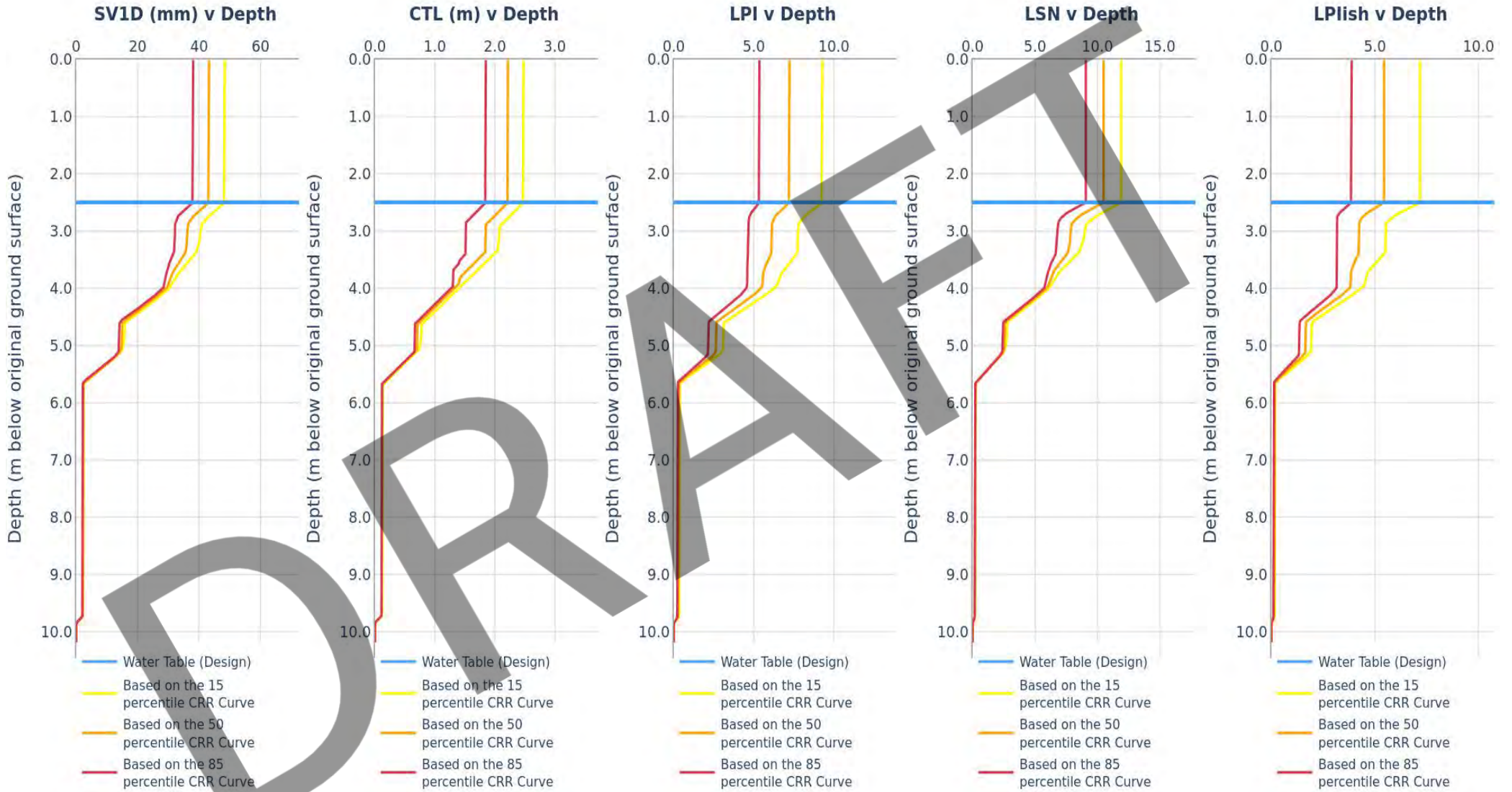
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 11/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

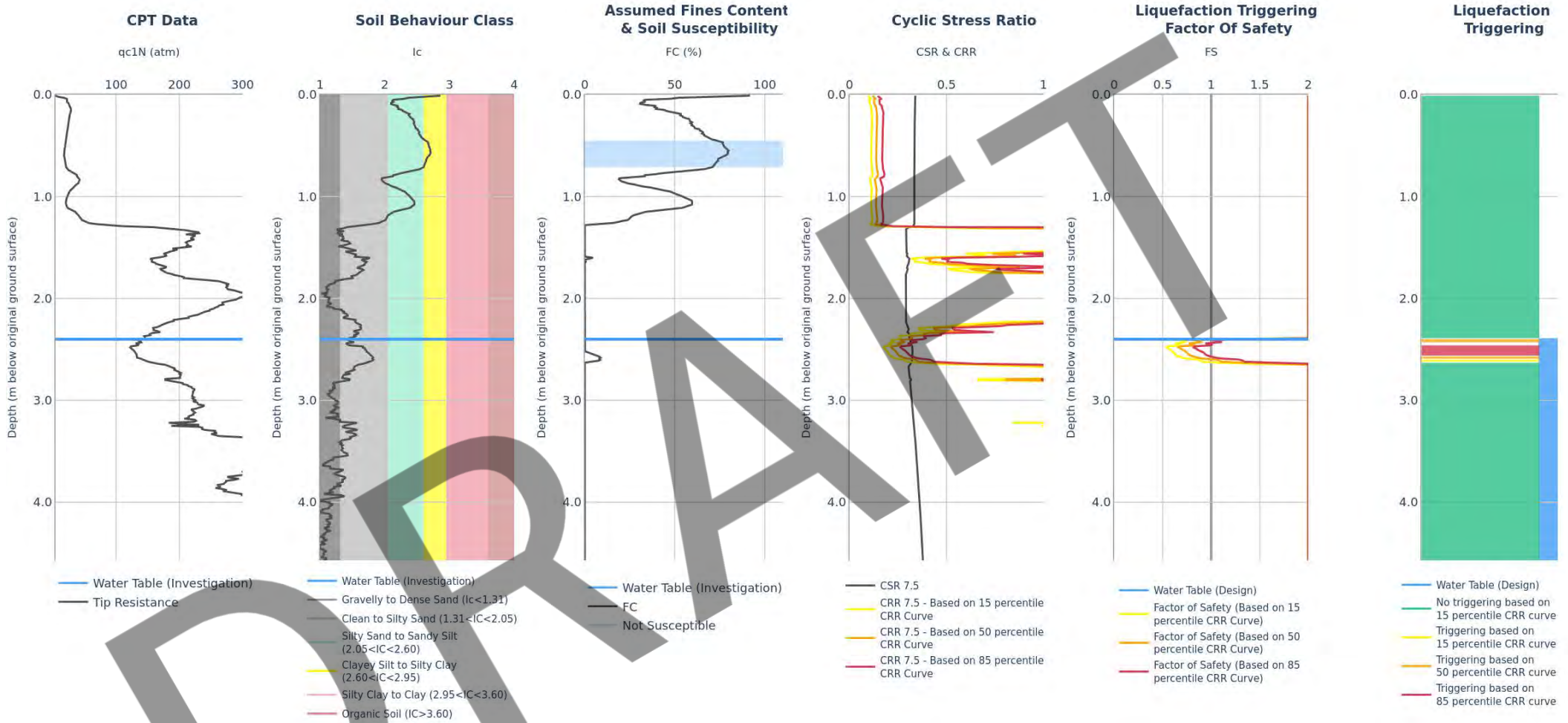


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT404	CPT_TT262851	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT410	CPT_TT262856	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

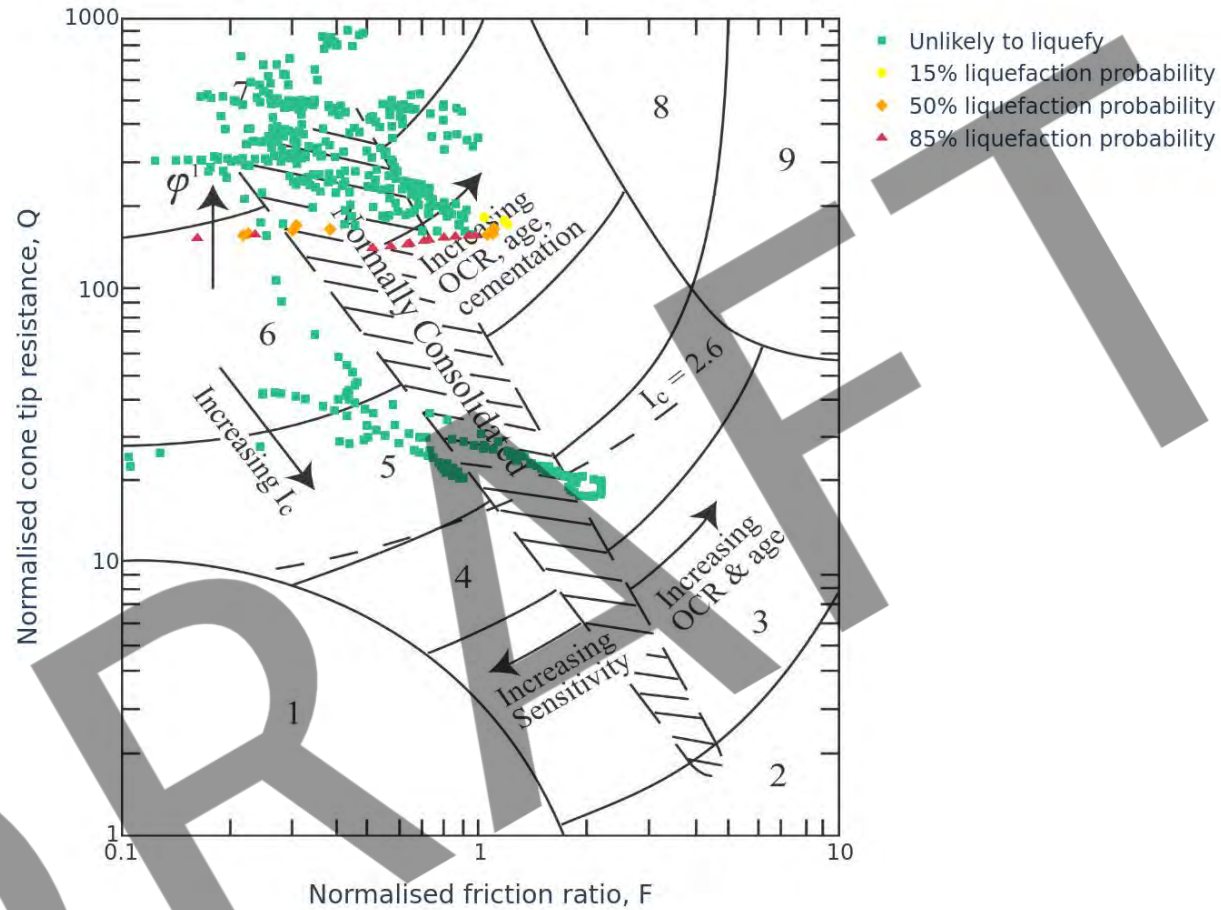
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	3	0.2	0	1	2.5	0
50%	2	0.2	0	1	2.5	0
85%	1	0.1	0	0	2.5	0

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



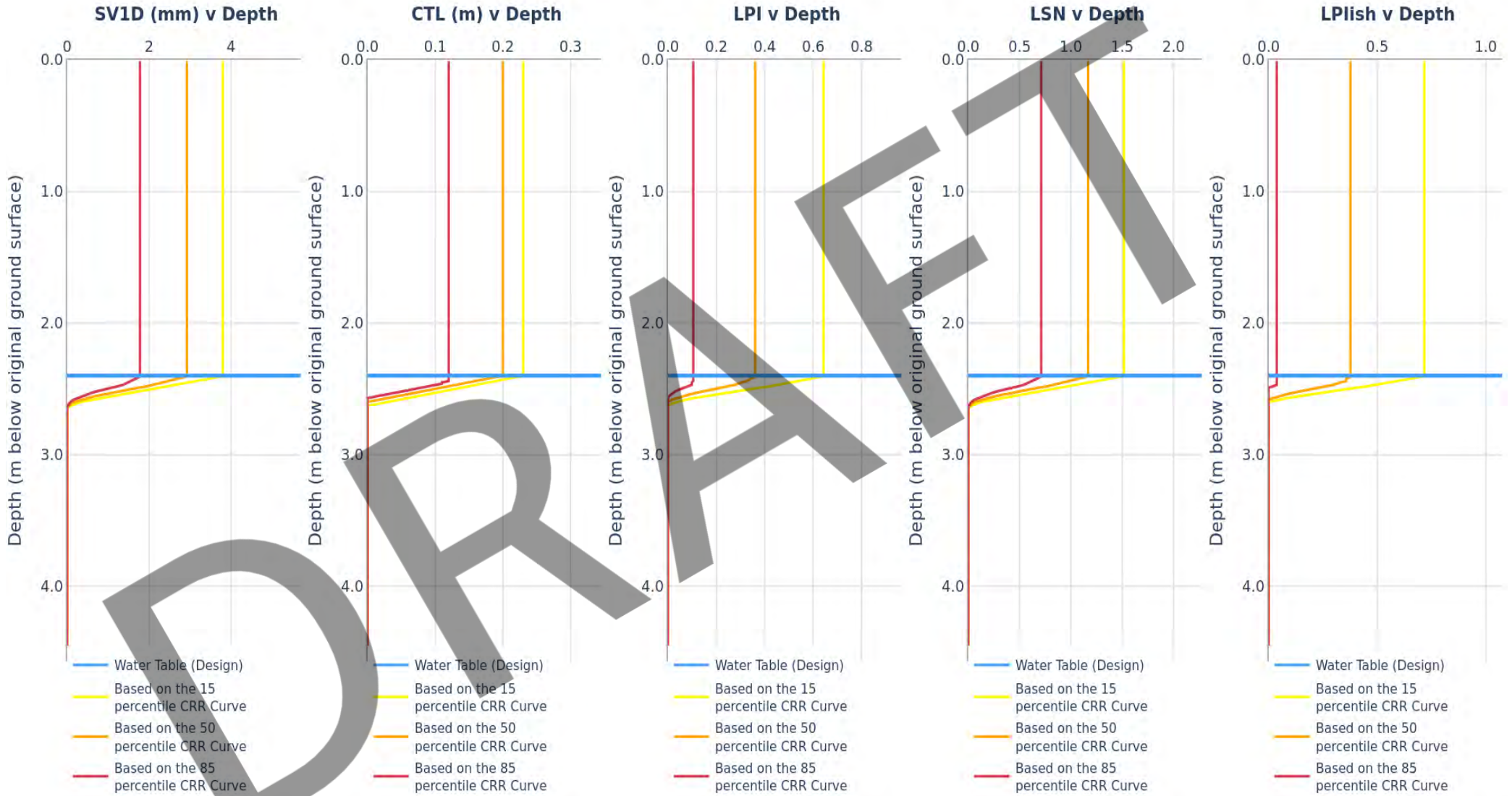
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 14/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

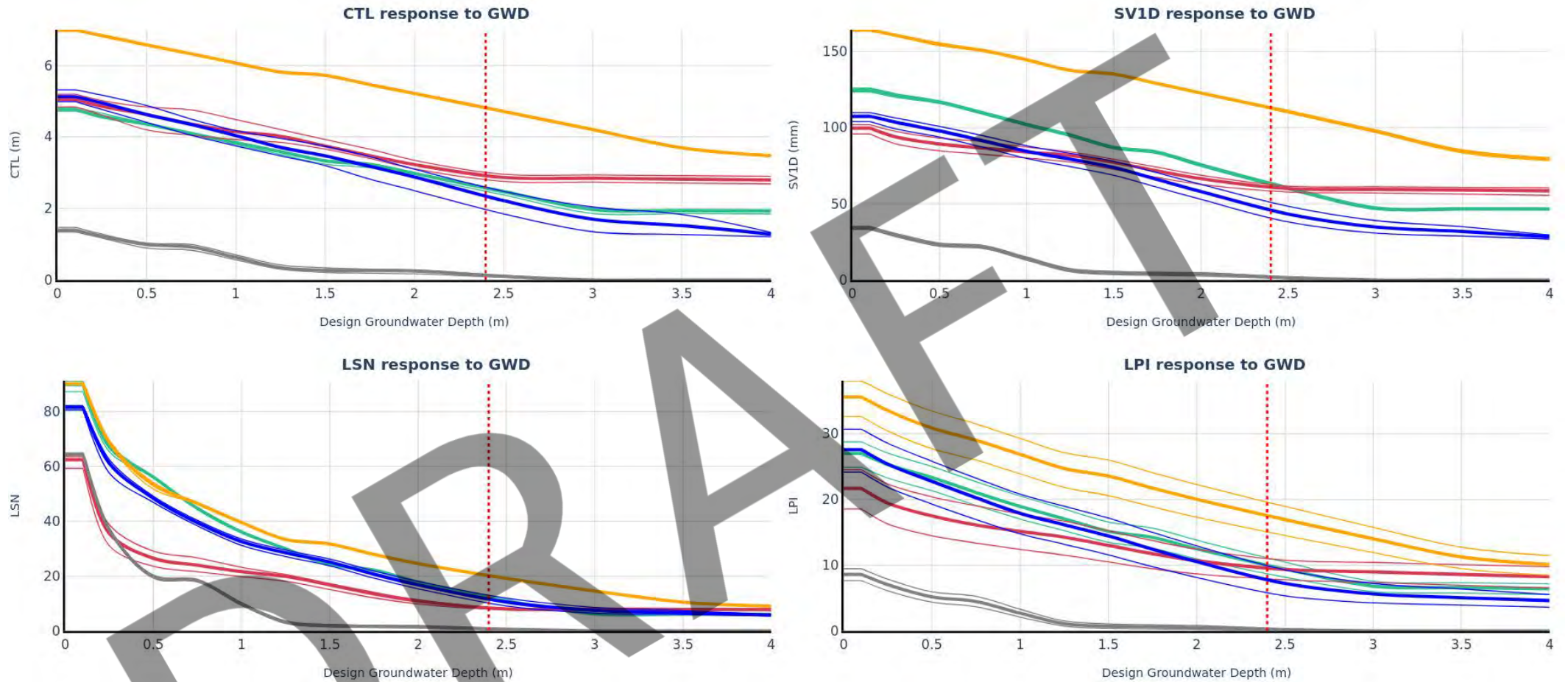


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT410	CPT_TT262856	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/20


# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



**Input**

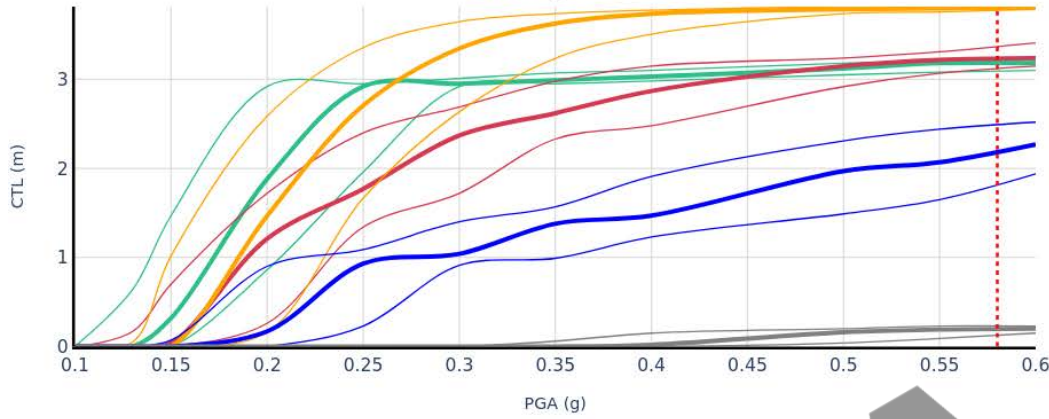
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT401	CPT_TT262848	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT402	CPT_TT262849	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT403	CPT_TT262850	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT404	CPT_TT262851	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT410	CPT_TT262856	02/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

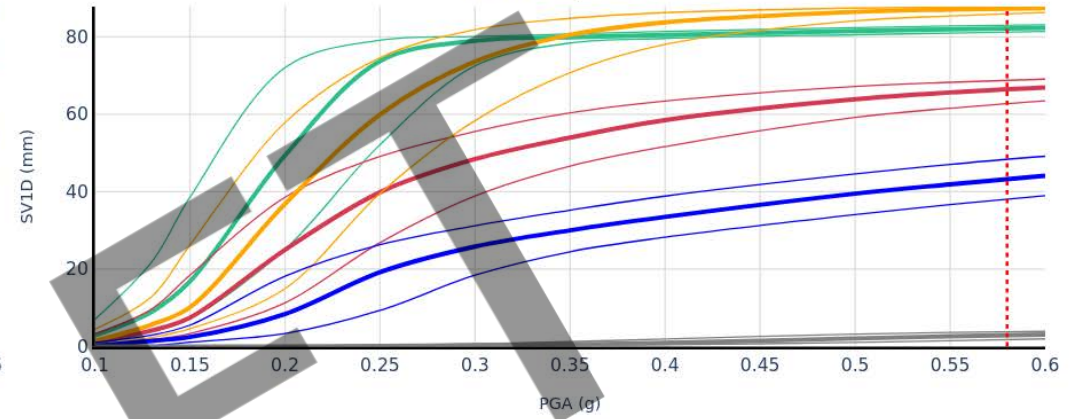
	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 16/20

# PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

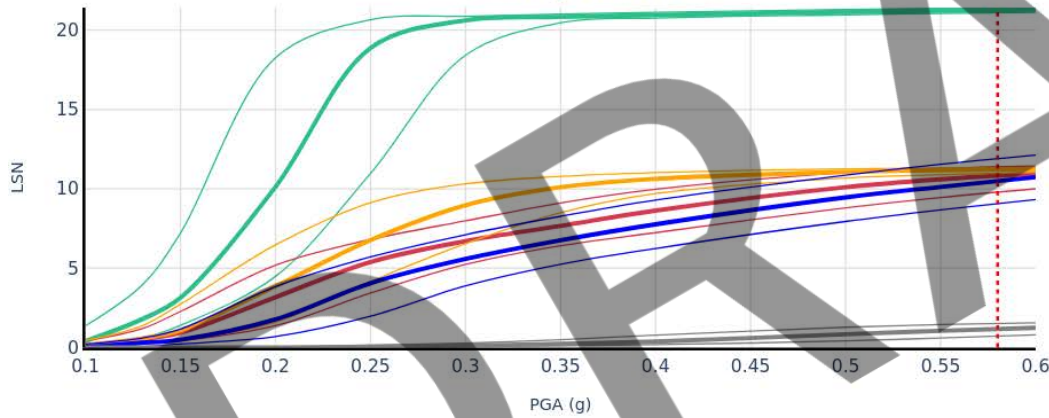
**CTL response to PGA**



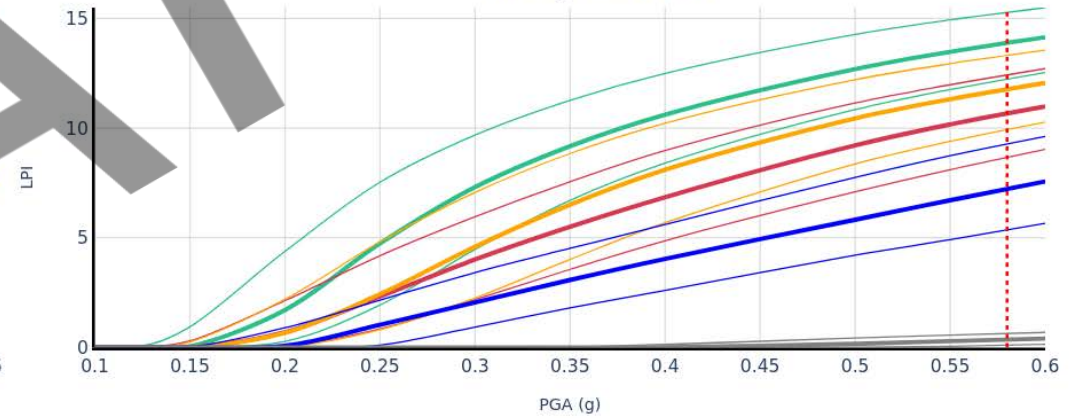
**SVID response to PGA**



**LSN response to PGA**




**LPI response to PGA**



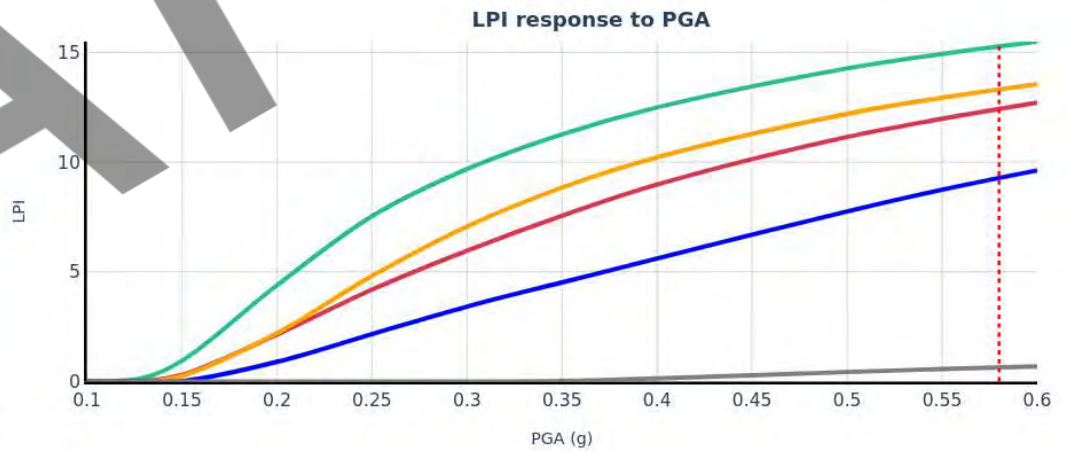
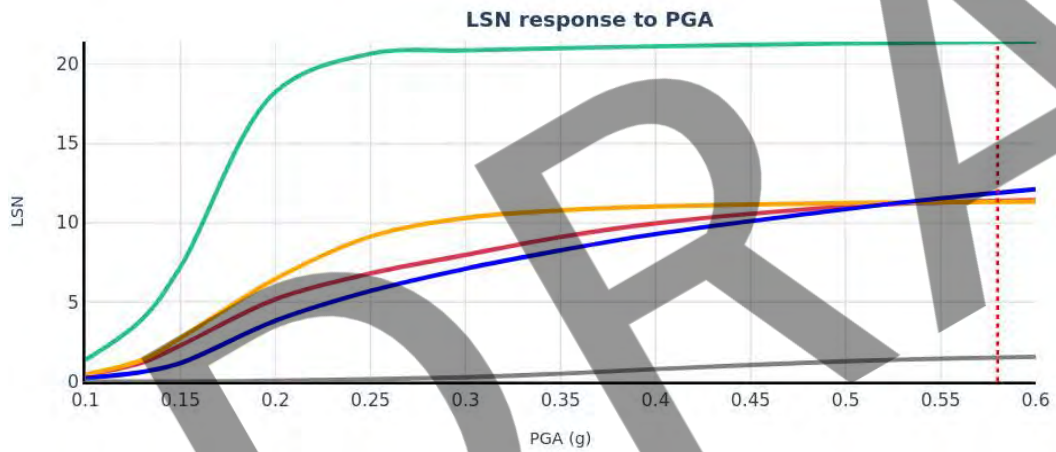
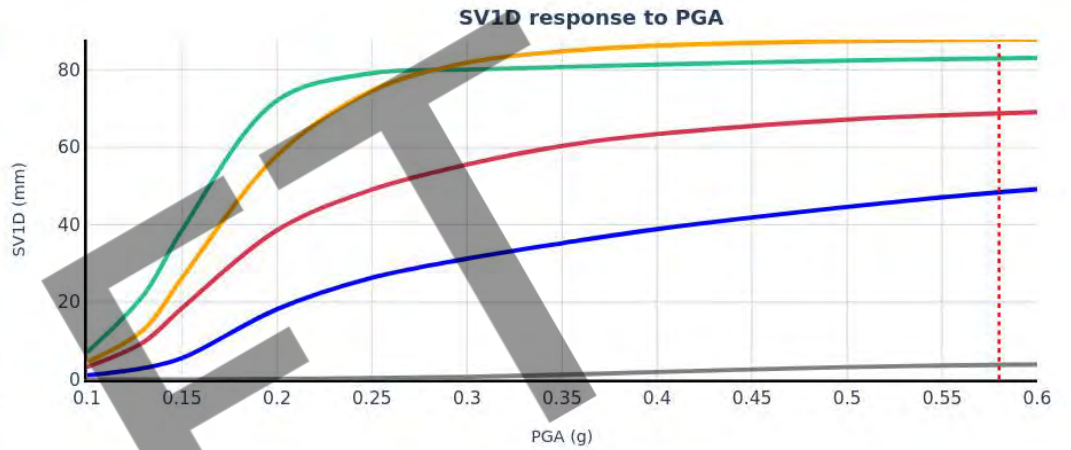
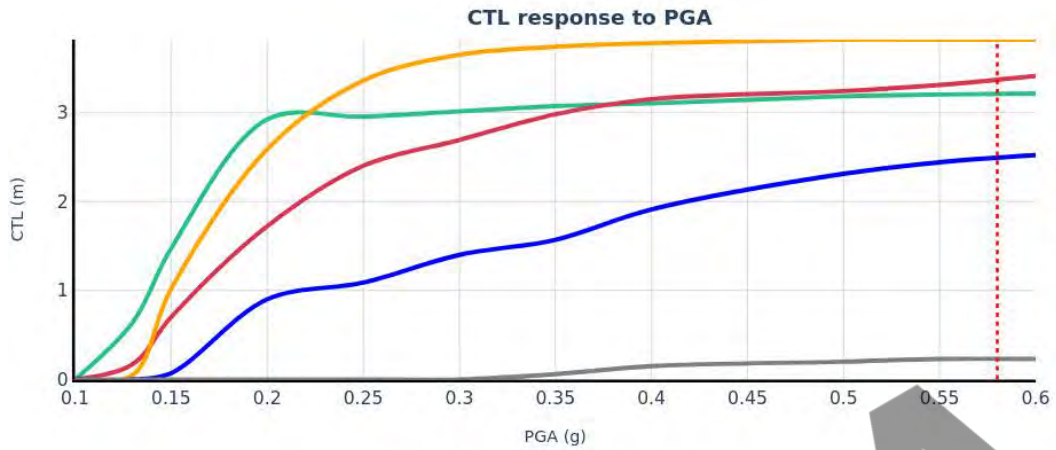
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT401	CPT_TT262848	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT402	CPT_TT262849	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT403	CPT_TT262850	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT404	CPT_TT262851	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT410	CPT_TT262856	02/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 17/20

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT401	CPT_TT262848	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT402	CPT_TT262849	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT403	CPT_TT262850	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT404	CPT_TT262851	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT410	CPT_TT262856	02/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 18/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262848	TTGD 262849	TTGD 262850
CPT Name	CPT_TT262848_Raw01.Pakowhai	CPT_TT262849_Raw01.Pakowhai	CPT_TT262850_Raw01.Pakowhai
Run Description	CPT401	CPT402	CPT403
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	1.8	2.0	3.4
Depth to groundwater for design (m)	1.8	2.0	3.4
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	13.708	13.176	15.451
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	13.708	13.176	15.451
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262848	CPT401	0.0	0.0	0.0
TTGD 262848	CPT401	0.0	13.71	2.6
TTGD 262849	CPT402	0.0	0.0	0.0
TTGD 262849	CPT402	0.0	13.71	2.6
TTGD 262850	CPT403	0.0	0.0	0.0
TTGD 262850	CPT403	0.0	15.45	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262848	CPT401	0.0	13.71	0.0 CFC
TTGD 262849	CPT402	0.0	13.71	0.0 CFC
TTGD 262850	CPT403	0.0	15.45	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262848	CPT401	0.0	0.0001	18.0
TTGD 262848	CPT401	0.0001	13.71	18.0
TTGD 262849	CPT402	0.0	0.0001	18.0
TTGD 262849	CPT402	0.0001	13.71	18.0
TTGD 262850	CPT403	0.0	0.0001	18.0
TTGD 262850	CPT403	0.0001	15.45	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 19/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262851	TTGD 262856
CPT Name	CPT_TT262851_Raw01	CPT_TT262856_Raw01
Run Description	CPT404	CPT410
EQ PGA (g)	0.58	0.58
EQ Magnitude	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.5	2.4
Depth to groundwater for design (m)	2.5	2.4
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	10.463	4.57
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	10.463	4.57
Inverse filtering applied?	No	No
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262851	CPT404	0.0	0.0	0.0
TTGD 262851	CPT404	0.0	13.71	2.6
TTGD 262856	CPT410	0.0	0.0	0.0
TTGD 262856	CPT410	0.0	13.71	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

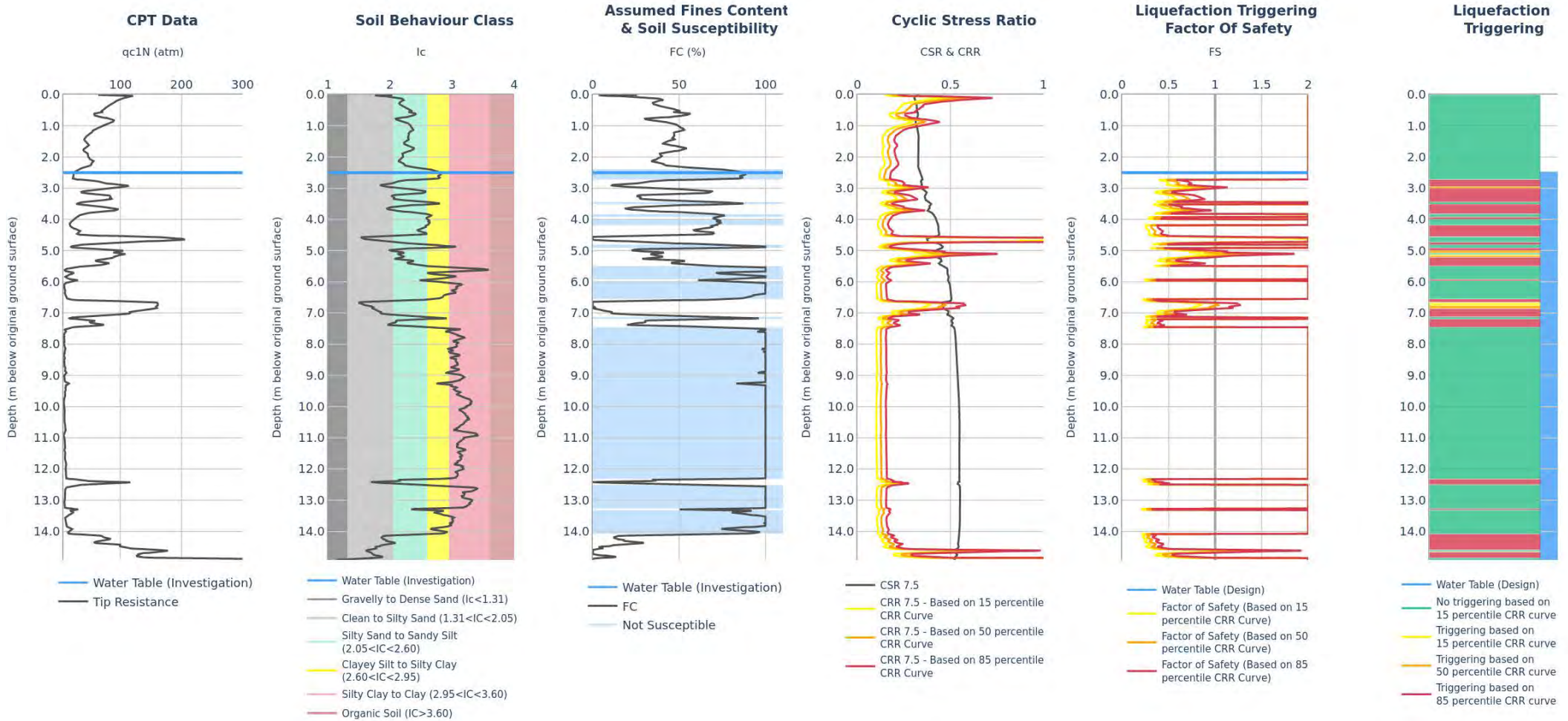
ID	Run description	From (m)	To (m)	Fc
TTGD 262851	CPT404	0.0	13.71	0.0 CFC
TTGD 262856	CPT410	0.0	13.71	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262851	CPT404	0.0	0.0001	18.0
TTGD 262851	CPT404	0.0001	13.71	18.0
TTGD 262856	CPT410	0.0	0.0001	18.0
TTGD 262856	CPT410	0.0001	13.71	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 20/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT405	CPT_TT262962	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

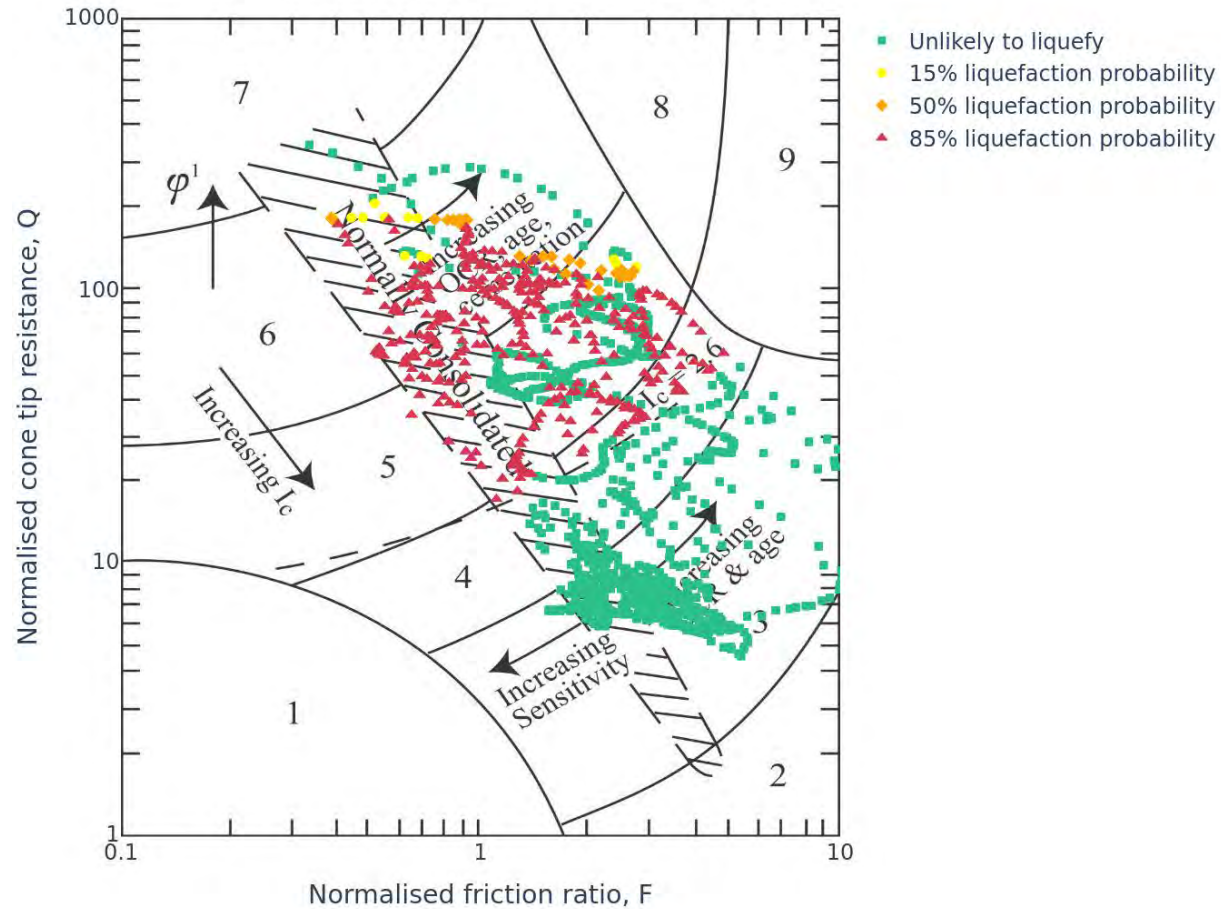
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	79	3.9	13	14	2.8	10
50%	76	3.7	11	14	2.8	8
85%	70	3.4	8	13	2.8	6

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			


## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



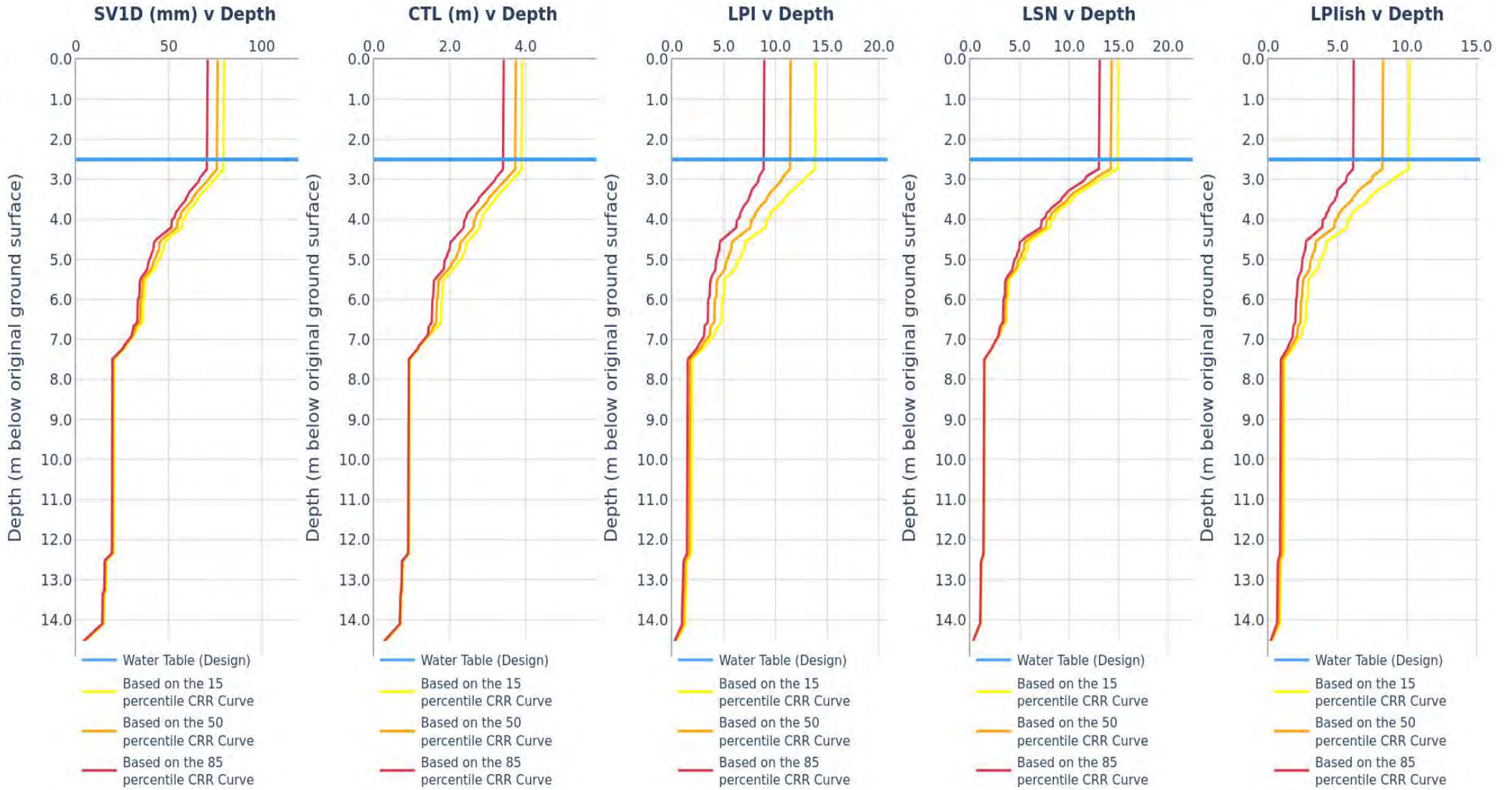
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 2/18

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

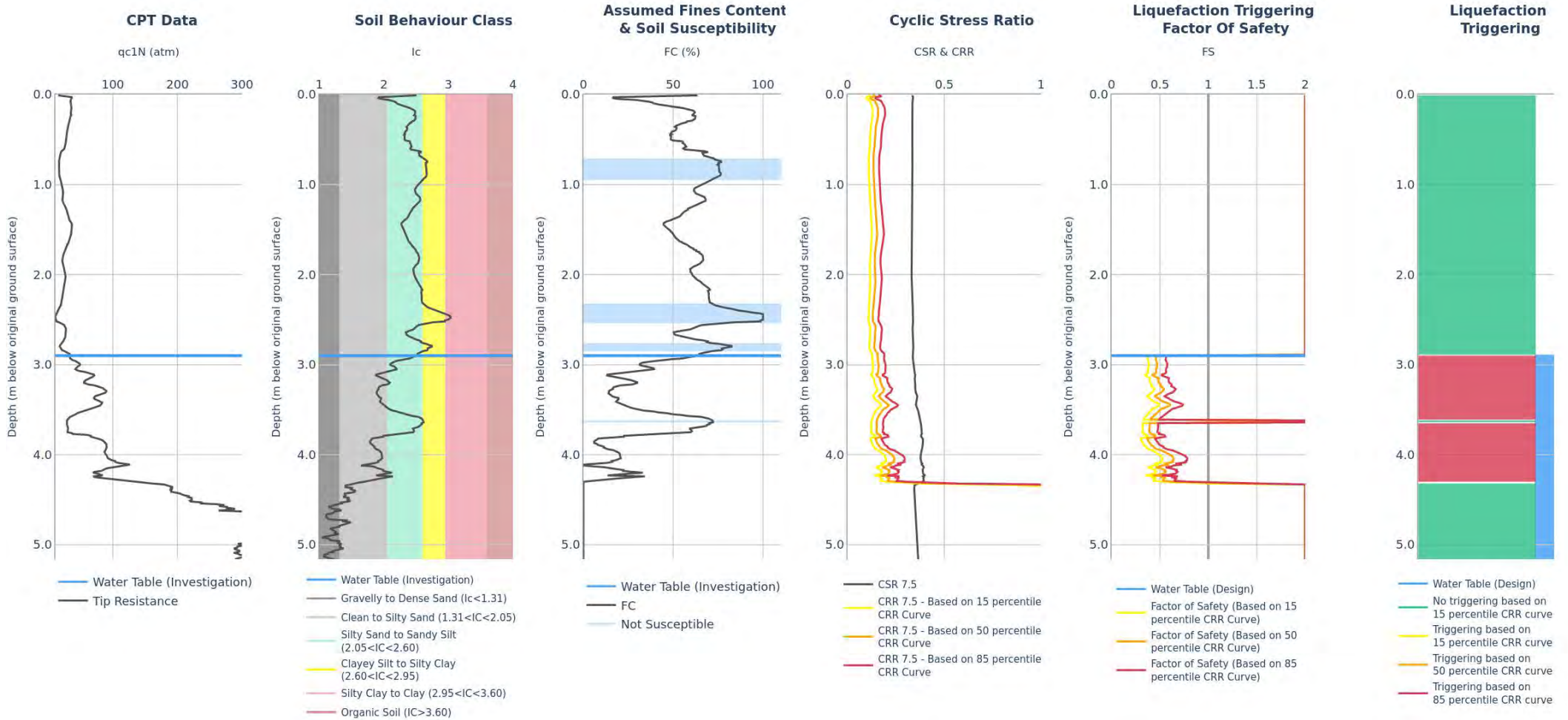


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT405	CPT_TT262962	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/18

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT409	CPT_TT262855	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

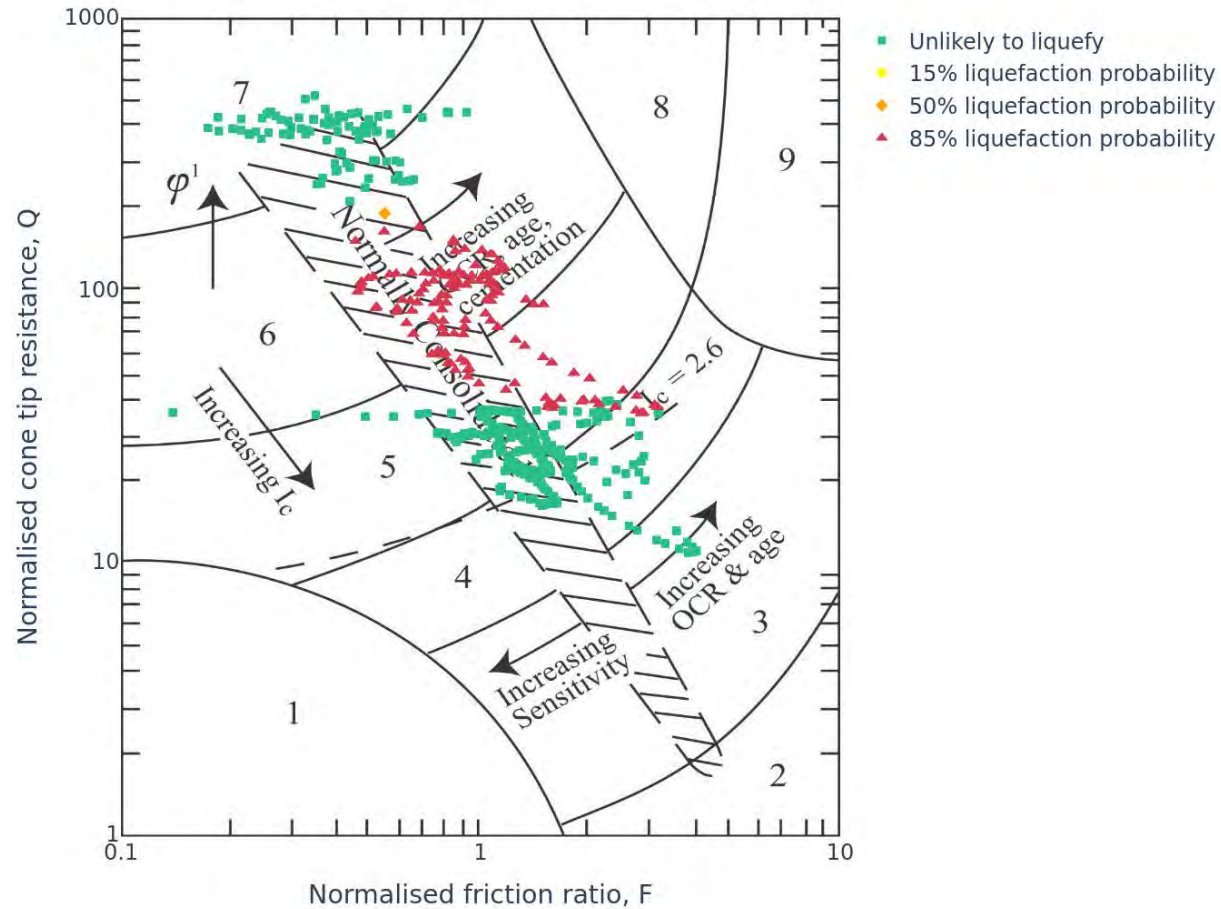
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	31	1.4	6	8	3.0	5
50%	31	1.4	5	8	3.0	5
85%	30	1.4	4	8	3.0	4

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



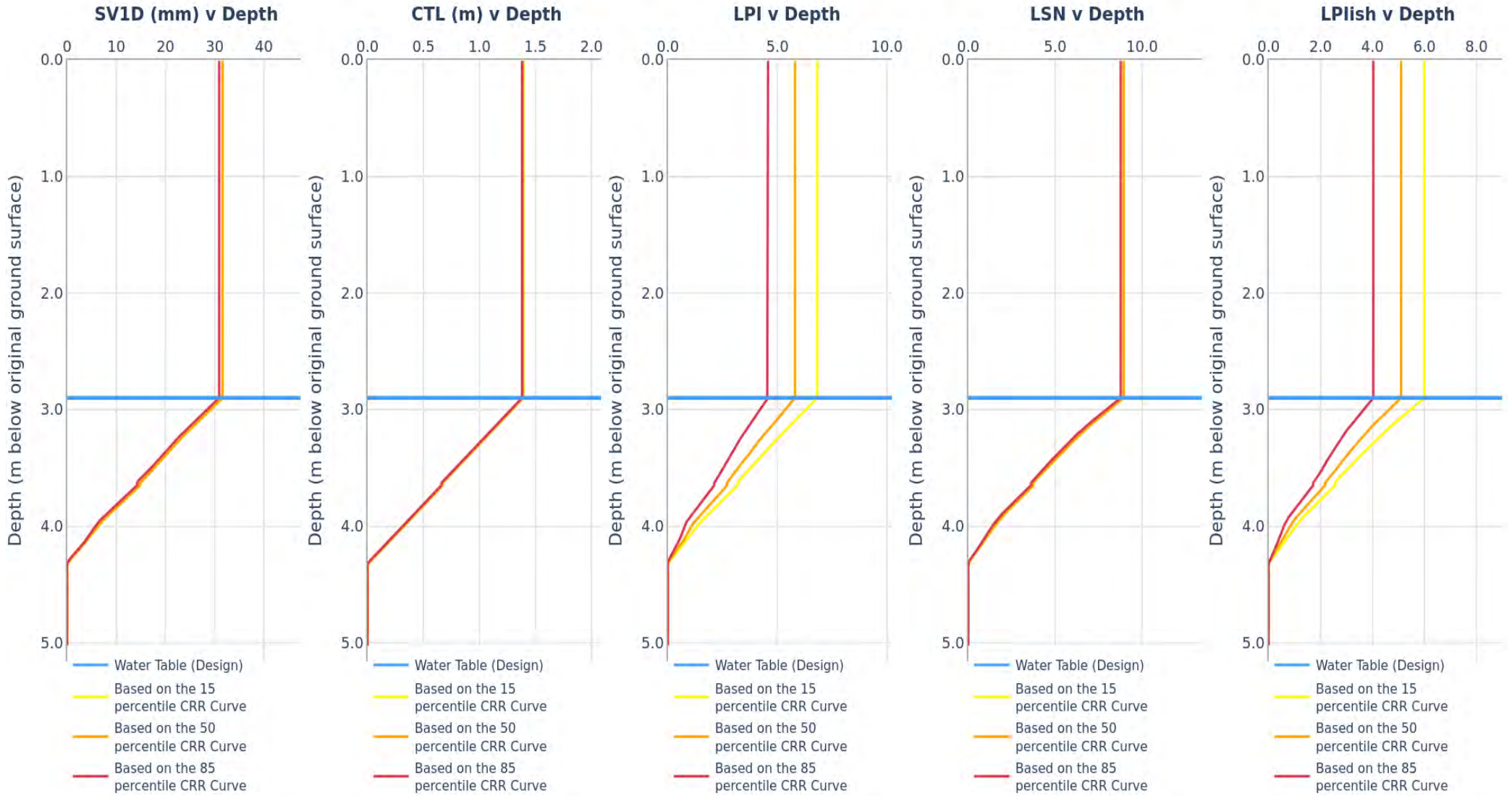
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 5/18

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

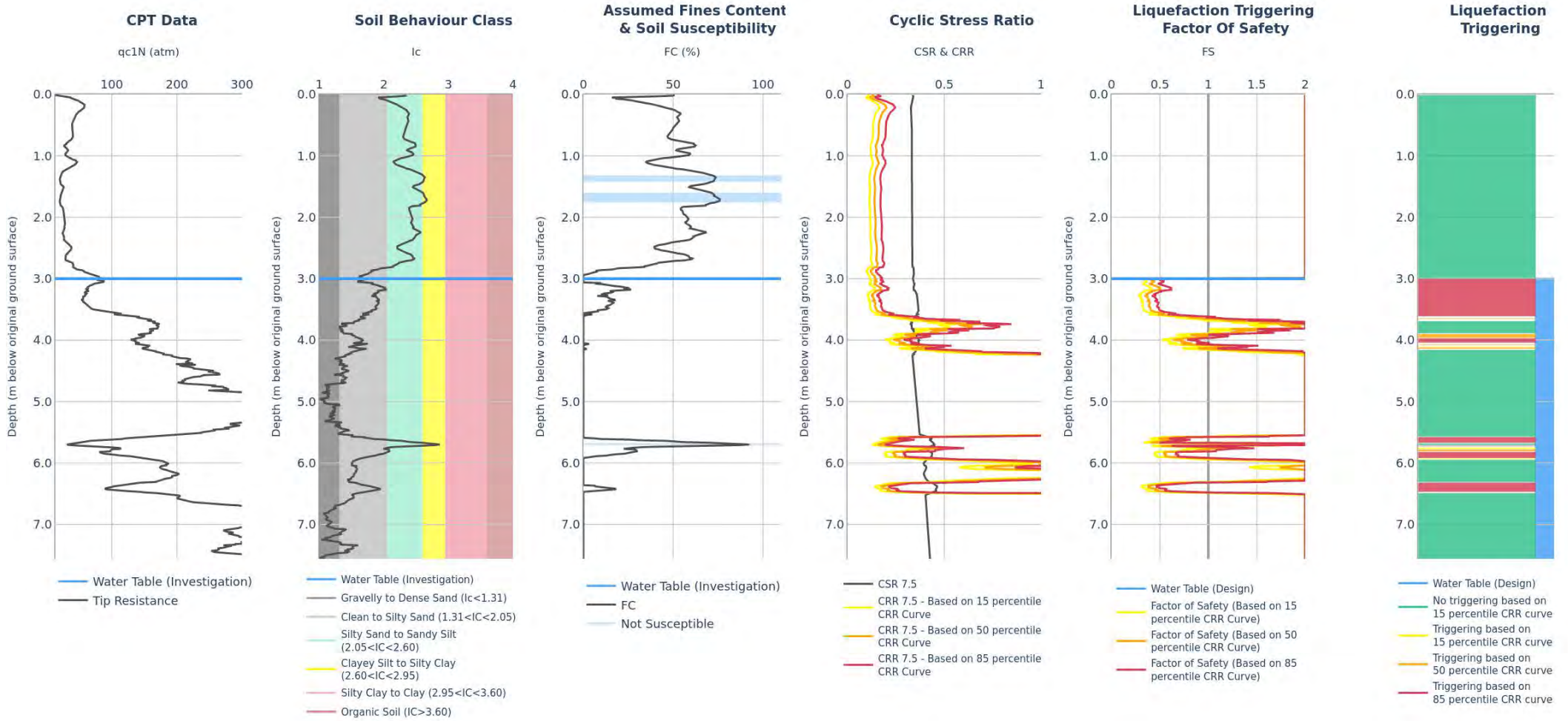


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT409	CPT_TT262855	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/18

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT408	CPT_TT262854	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

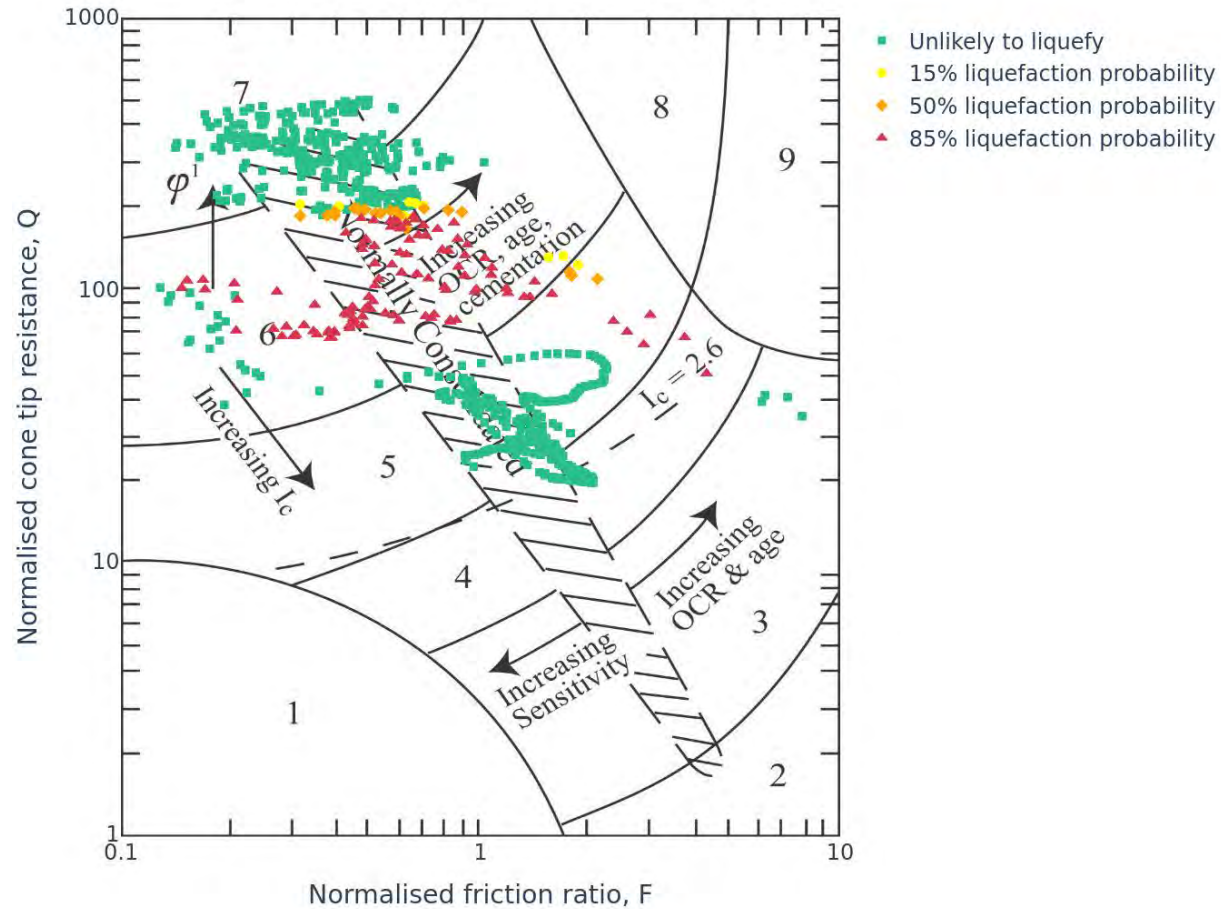
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	30	1.4	5	7	3.1	4
50%	28	1.3	4	7	3.1	3
85%	25	1.1	3	6	3.1	2

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 7/18

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



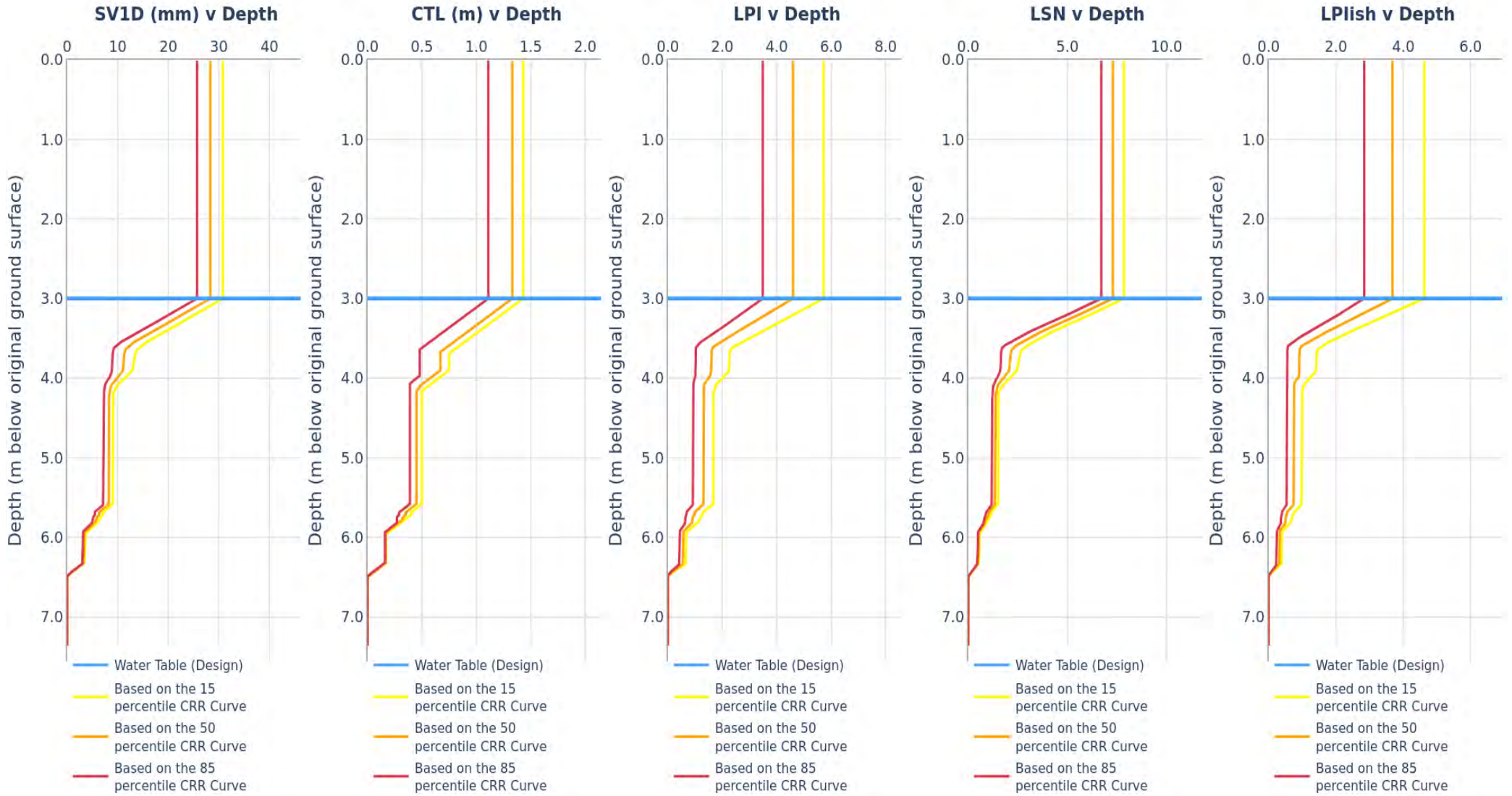
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 8/18

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

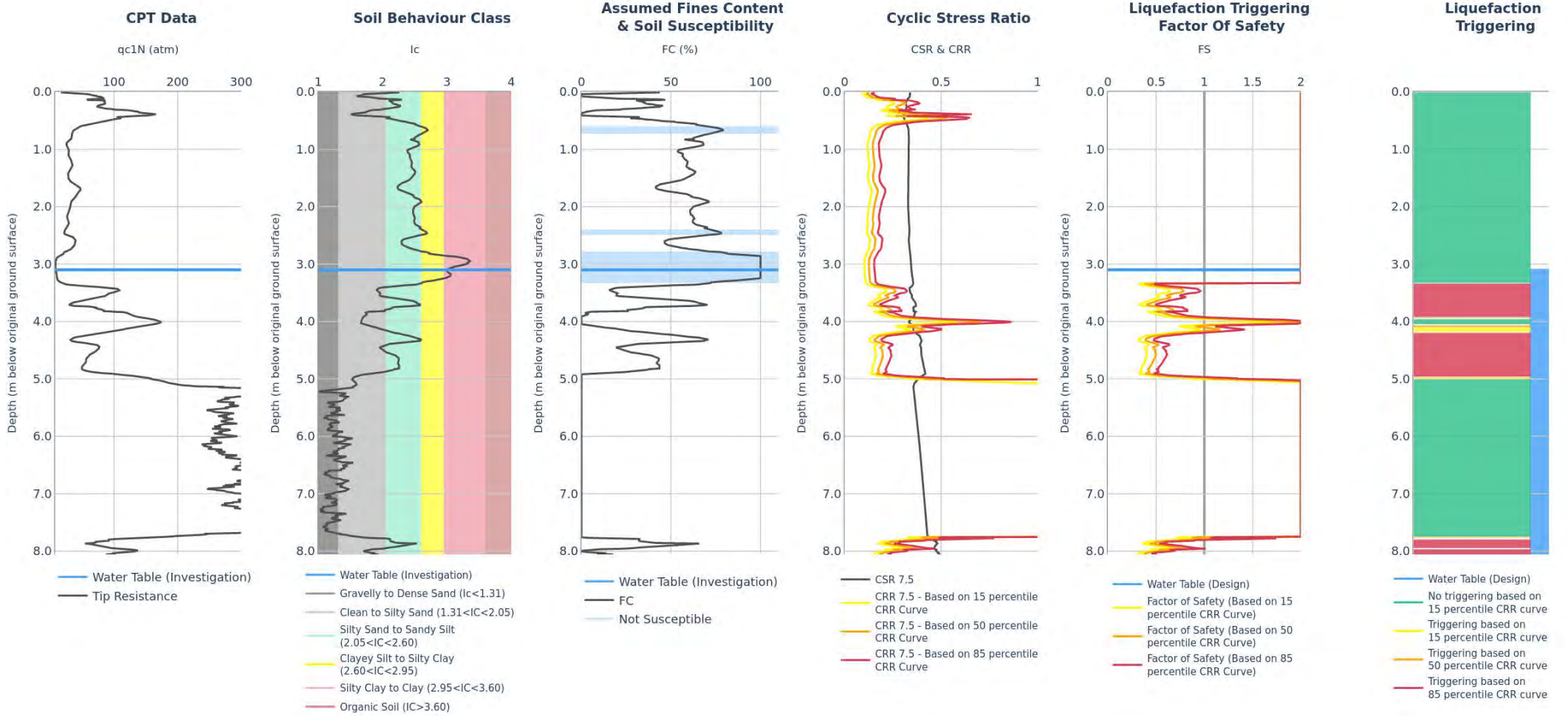


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT408	CPT_TT262854	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/18

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT406	CPT_TT262852	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

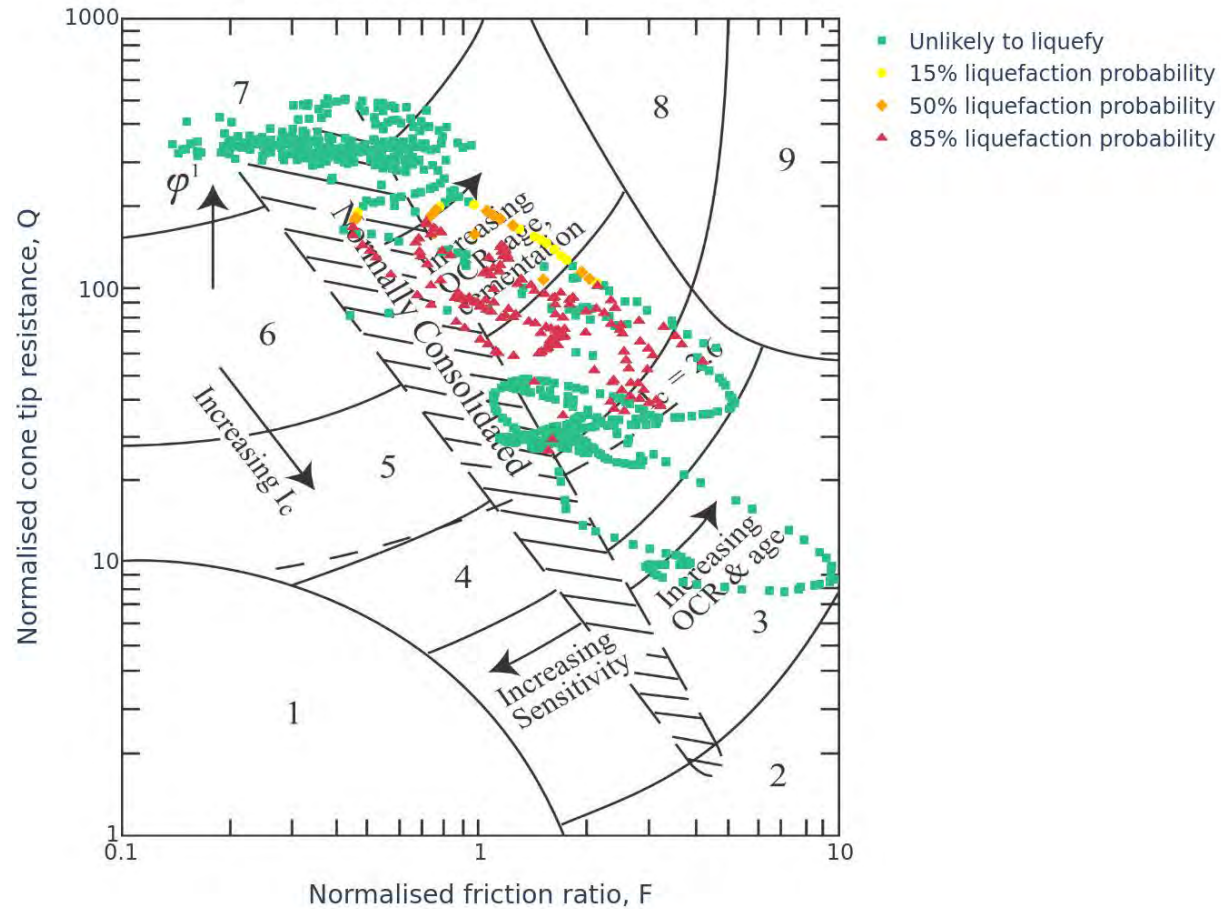
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	36	1.9	7	8	3.4	5
50%	34	1.7	5	7	3.4	4
85%	31	1.6	4	7	3.4	2

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 10/18

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

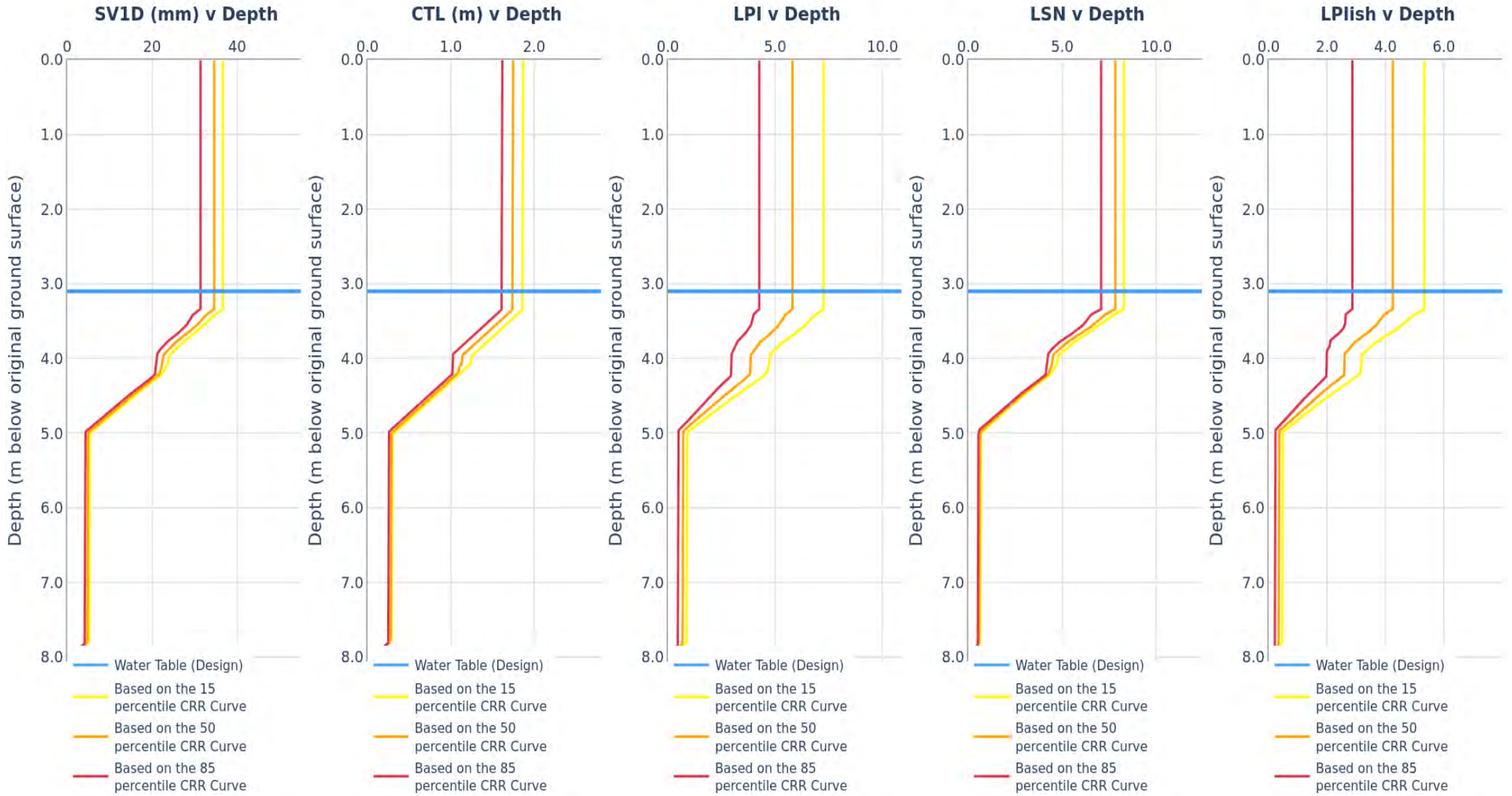


- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |
- \*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 11/18

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

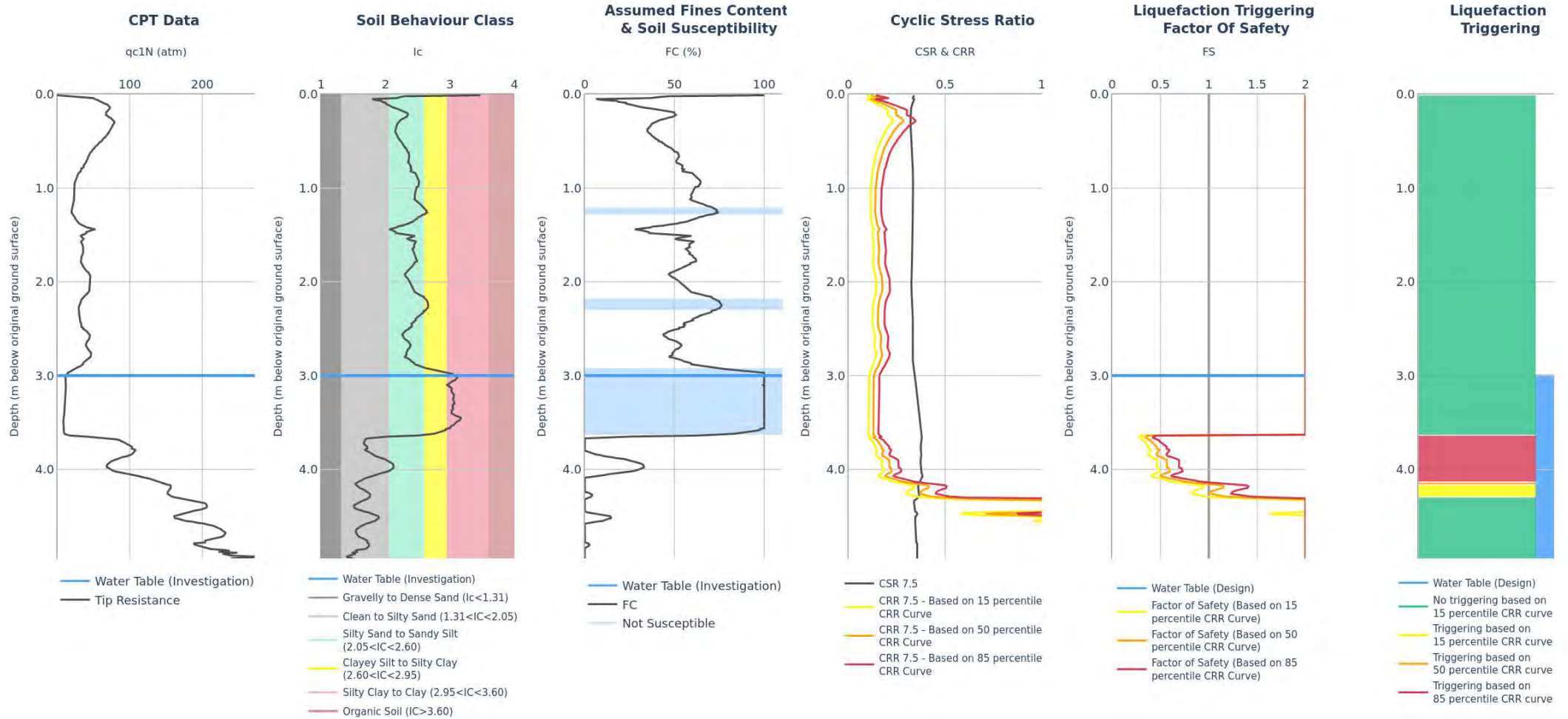


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT406	CPT_TT262852	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/18

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT407	CPT_TT262853	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

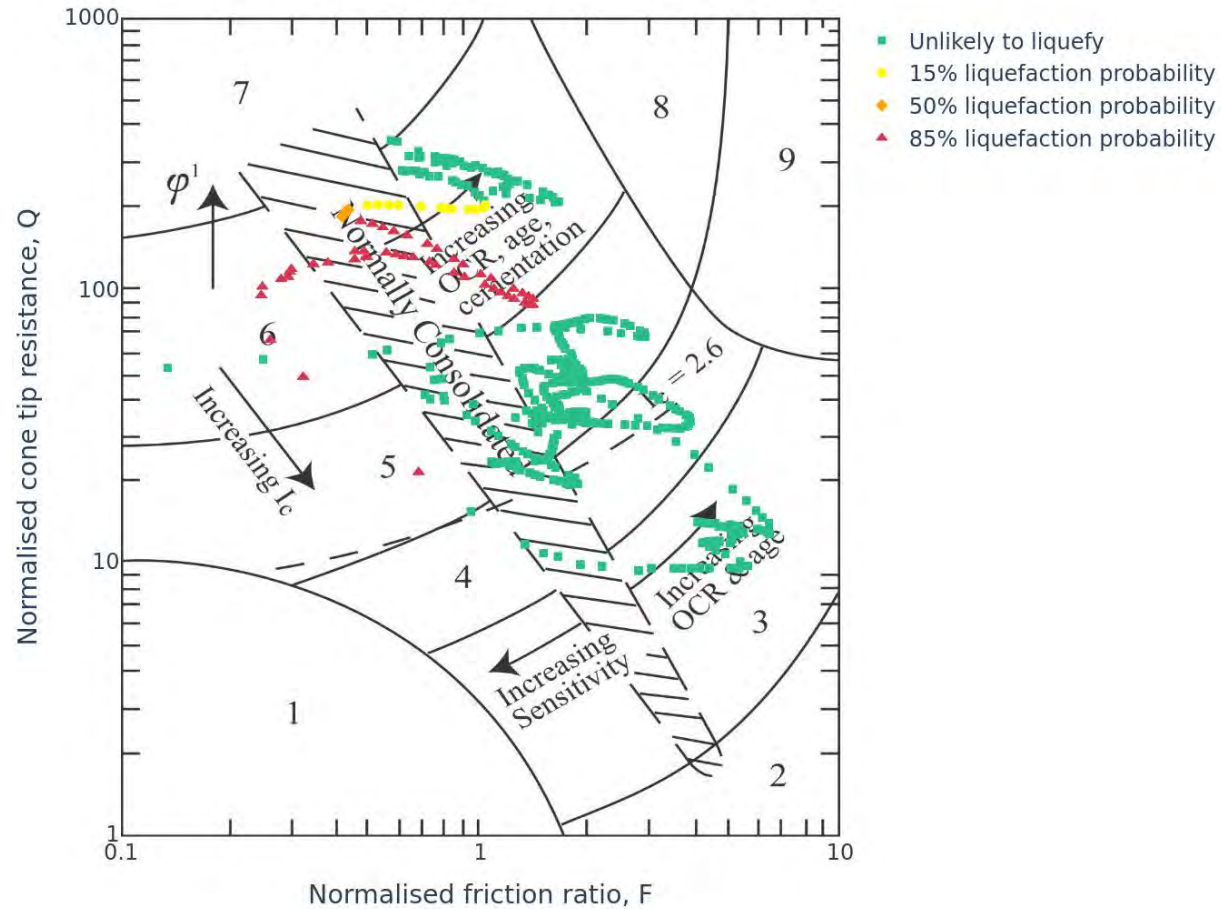
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	12	0.7	2	3	3.7	1
50%	11	0.5	1	3	3.7	1
85%	11	0.5	1	2	3.7	1

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 13/18


## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



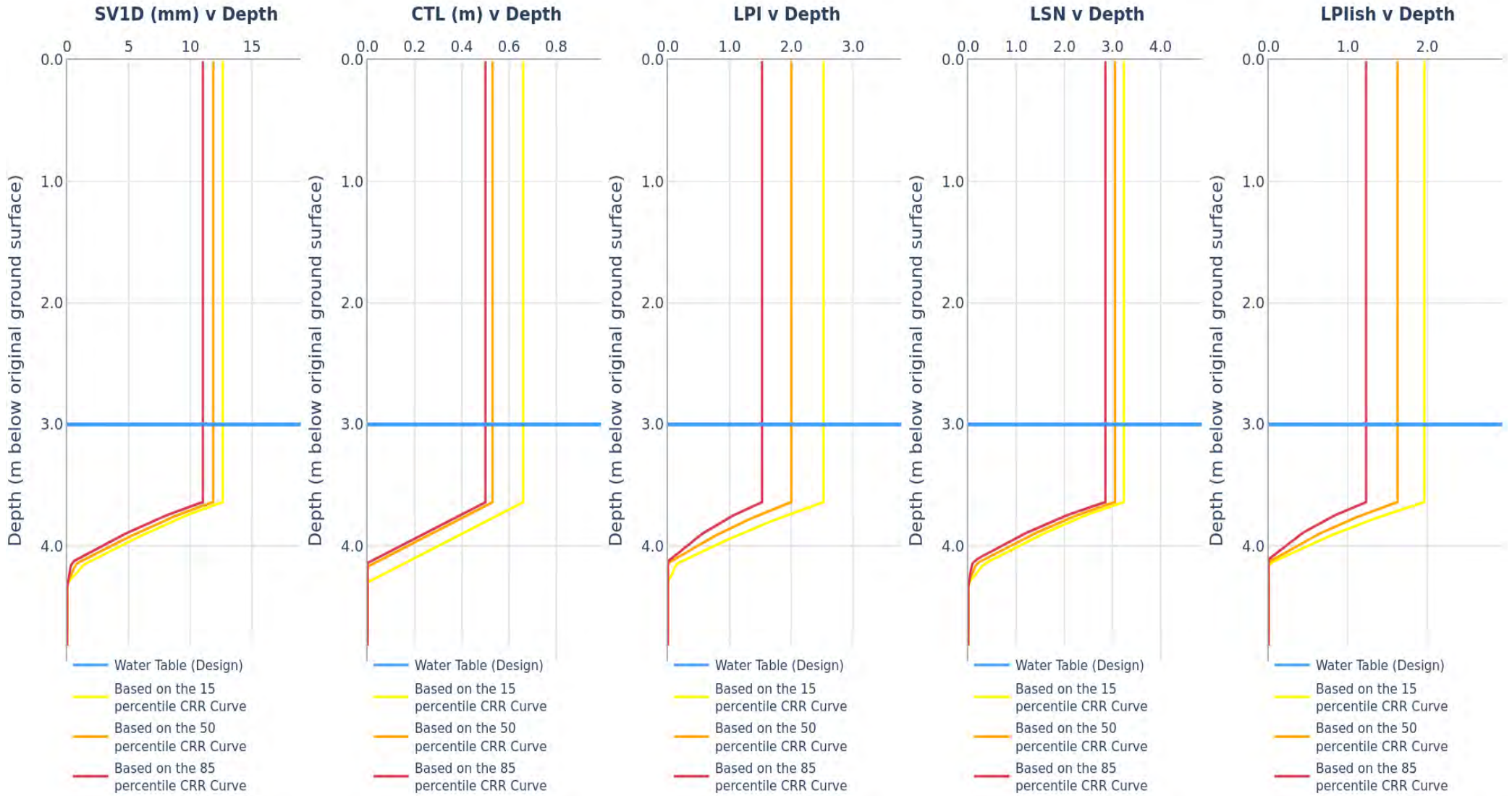
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 14/18

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT407	CPT_TT262853	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/18

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**


NZGD ID	TTGD 262962	TTGD 262855	TTGD 262854
CPT Name	CPT_TT262962_Raw01	CPT_TT262855_Raw01	CPT_TT262854_Raw01
Run Description	CPT405	CPT409	CPT408
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.5	2.9	3.0
Depth to groundwater for design (m)	2.5	2.9	3.0
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	14.916	5.16	7.559
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	14.916	5.16	7.559
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Ic
TTGD 262962	CPT405	0.0	0.0	0.0
TTGD 262962	CPT405	0.0	14.92	2.6
TTGD 262855	CPT409	0.0	0.0	0.0
TTGD 262855	CPT409	0.0	14.92	2.6
TTGD 262854	CPT408	0.0	0.0	0.0
TTGD 262854	CPT408	0.0	14.92	2.6


**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262962	CPT405	0.0	14.92	0.0 CFC
TTGD 262855	CPT409	0.0	14.92	0.0 CFC
TTGD 262854	CPT408	0.0	14.92	0.0 CFC

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 16/18

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262962	CPT405	0.0	0.0001	18.0
TTGD 262962	CPT405	0.0001	14.92	18.0
TTGD 262962	CPT405	14.92	14.92	18.0
TTGD 262855	CPT409	0.0	0.0001	18.0
TTGD 262855	CPT409	0.0001	14.92	18.0
TTGD 262855	CPT409	14.92	14.92	18.0
TTGD 262854	CPT408	0.0	0.0001	18.0
TTGD 262854	CPT408	0.0001	14.92	18.0
TTGD 262854	CPT408	14.92	14.92	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 17/18

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262852	TTGD 262853
CPT Name	CPT_TT262852_Raw01	CPT_TT262853_Raw01
Run Description	CPT406	CPT407
EQ PGA (g)	0.58	0.58
EQ Magnitude	7.1	7.1
Depth to groundwater at time of Investigation (m)	3.1	3.0
Depth to groundwater for design (m)	3.1	3.0
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	8.057	4.95
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	8.057	4.95
Inverse filtering applied?	No	No
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262852	CPT406	0.0	0.0	0.0
TTGD 262852	CPT406	0.0	14.92	2.6
TTGD 262853	CPT407	0.0	0.0	0.0
TTGD 262853	CPT407	0.0	14.92	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

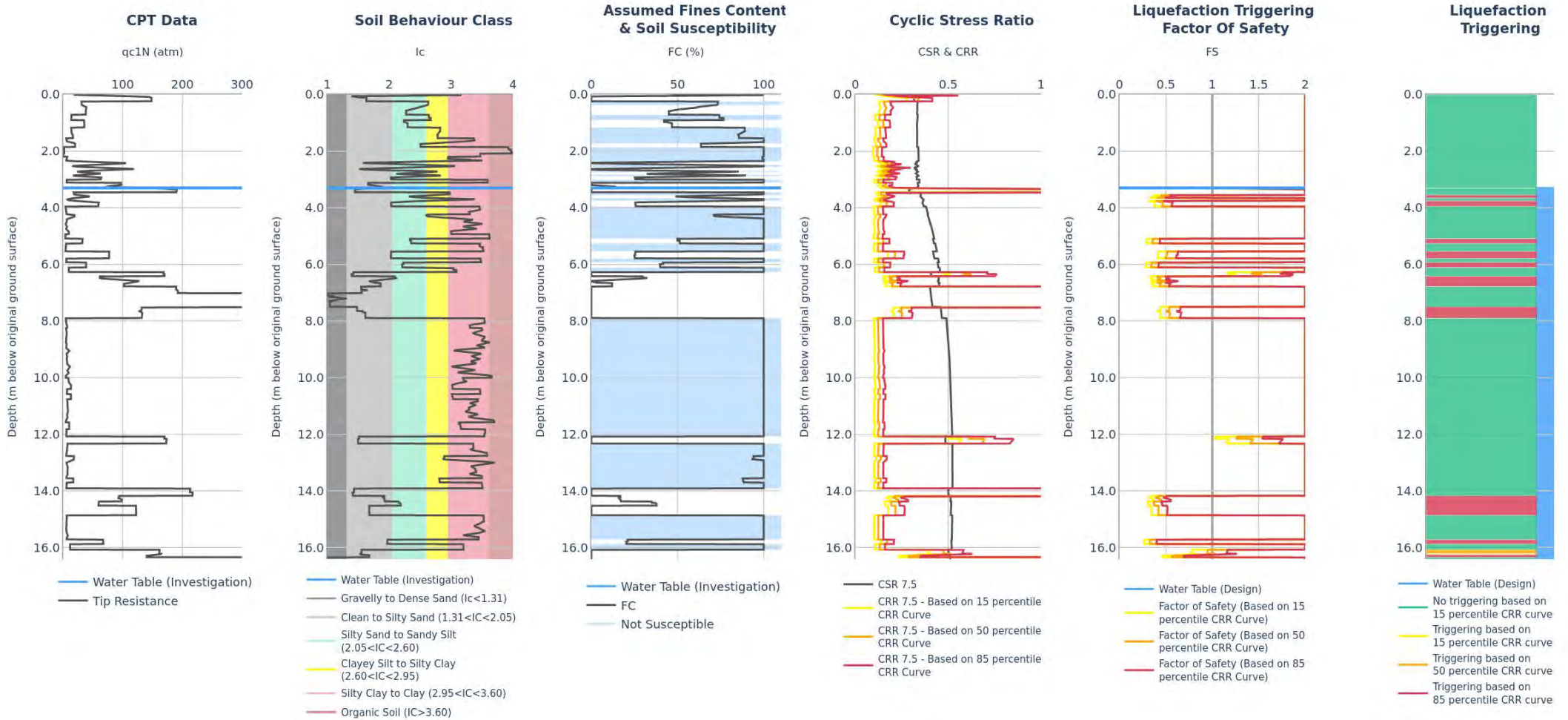
ID	Run description	From (m)	To (m)	Fc
TTGD 262852	CPT406	0.0	14.92	0.0 CFC
TTGD 262853	CPT407	0.0	14.92	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262852	CPT406	0.0	0.0001	18.0
TTGD 262852	CPT406	0.0001	14.92	18.0
TTGD 262852	CPT406	14.92	14.92	18.0
TTGD 262853	CPT407	0.0	0.0001	18.0
TTGD 262853	CPT407	0.0001	14.92	18.0
TTGD 262853	CPT407	14.92	14.92	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 18/18

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Inverse filter Qc/Fs data (10 cm²).*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT411	CPT_TT262857	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

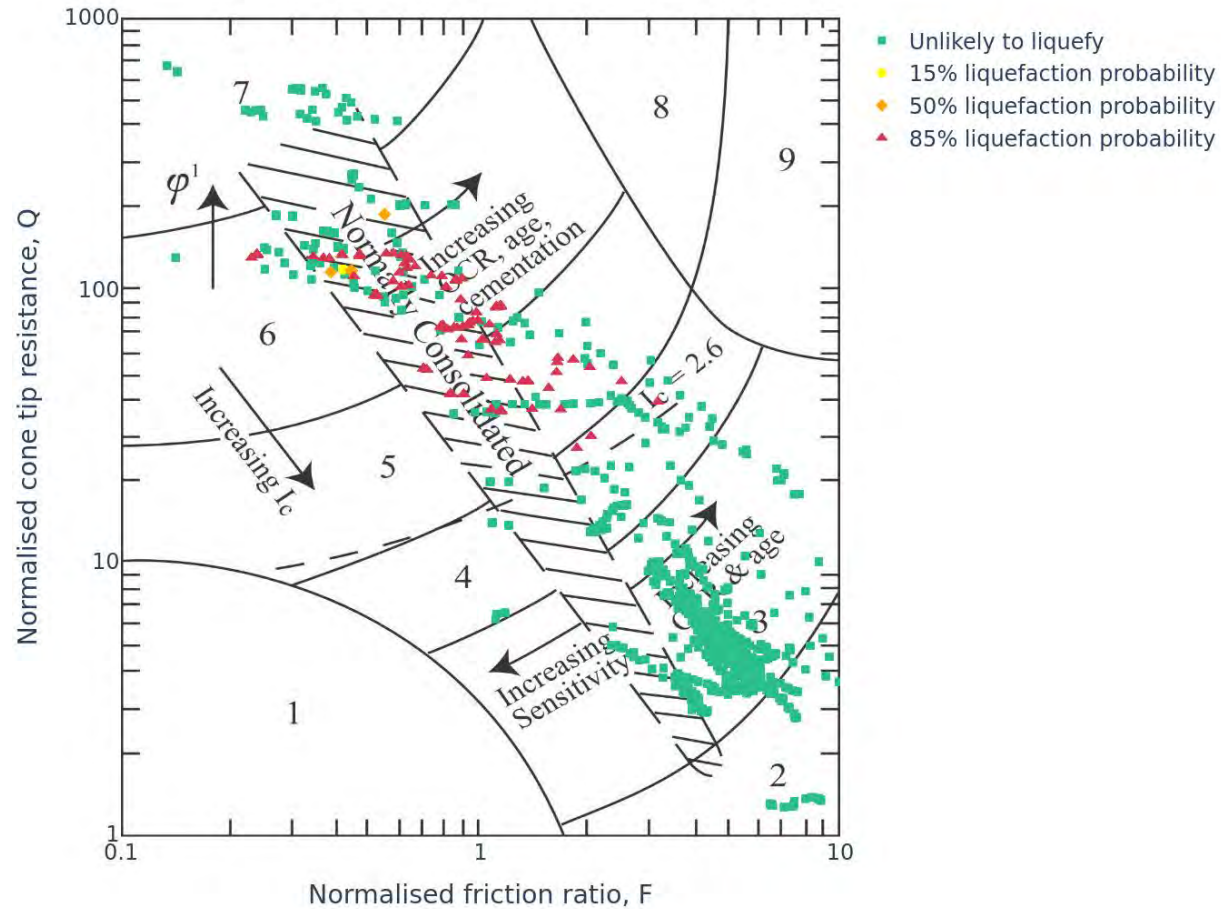
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	58	2.8	8	8	3.6	5
50%	57	2.8	7	7	3.6	5
85%	55	2.6	6	7	3.6	4

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 1/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



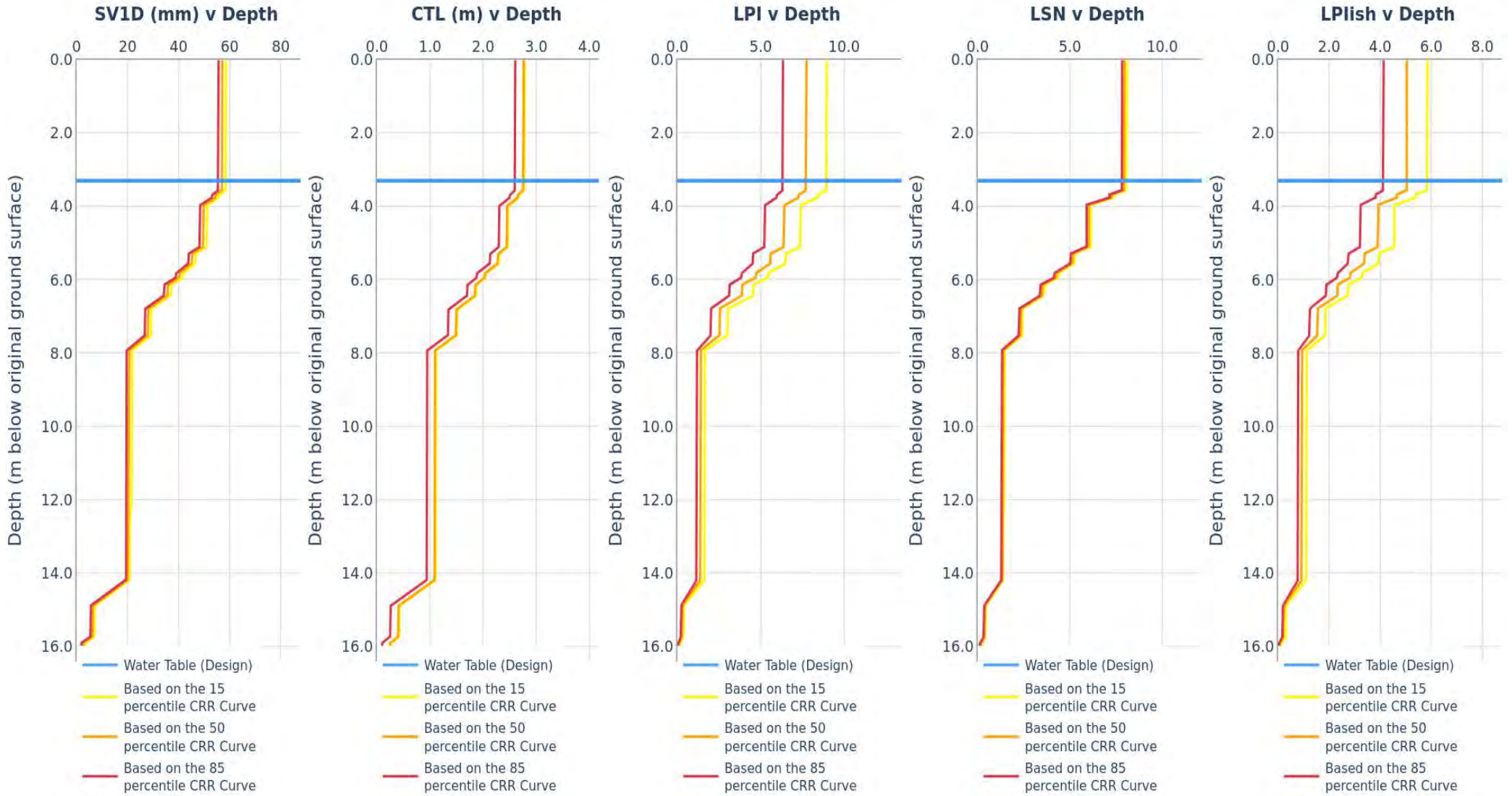
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 2/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

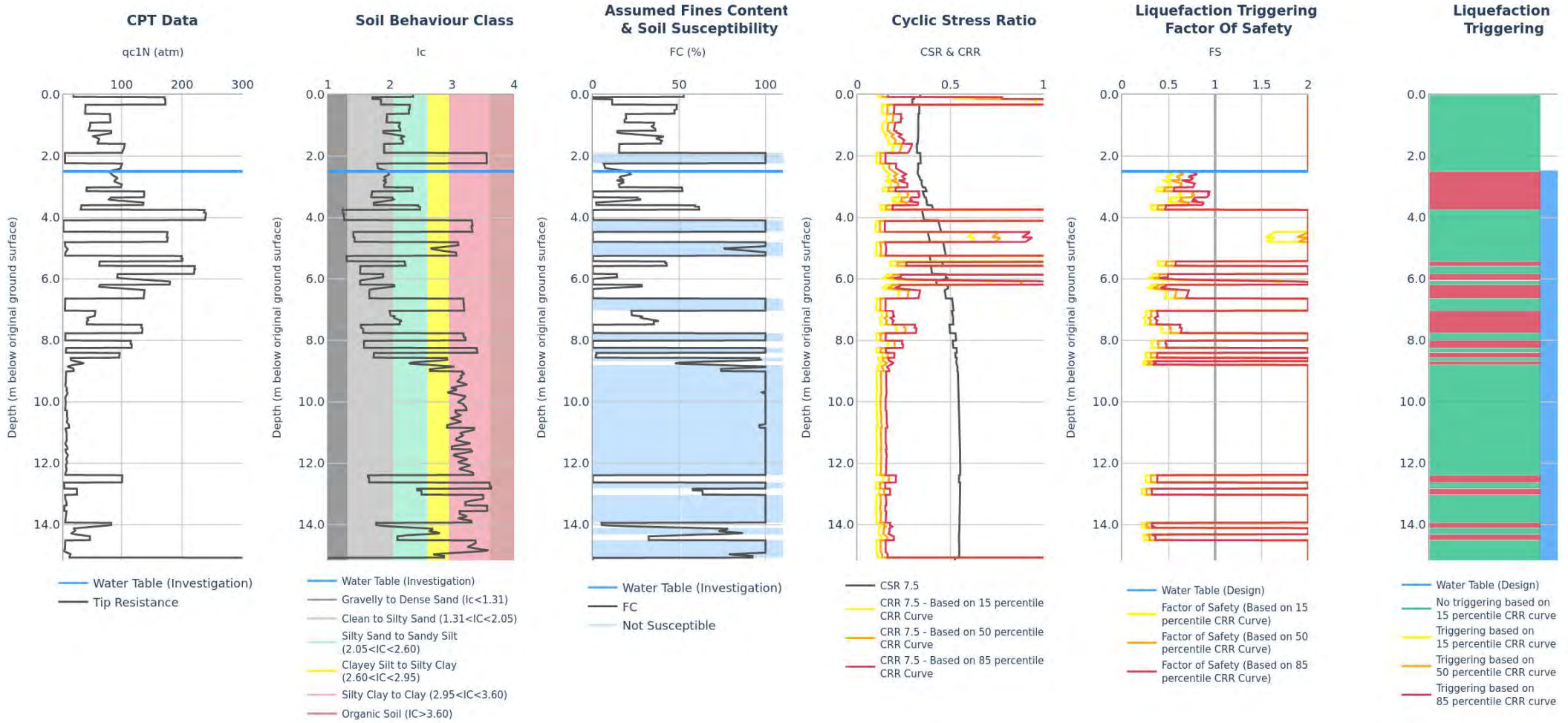


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT411	CPT_TT262857	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Inverse filter Qc/Fs data (10 cm<sup>2</sup>).*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT412	CPT_TT262858	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

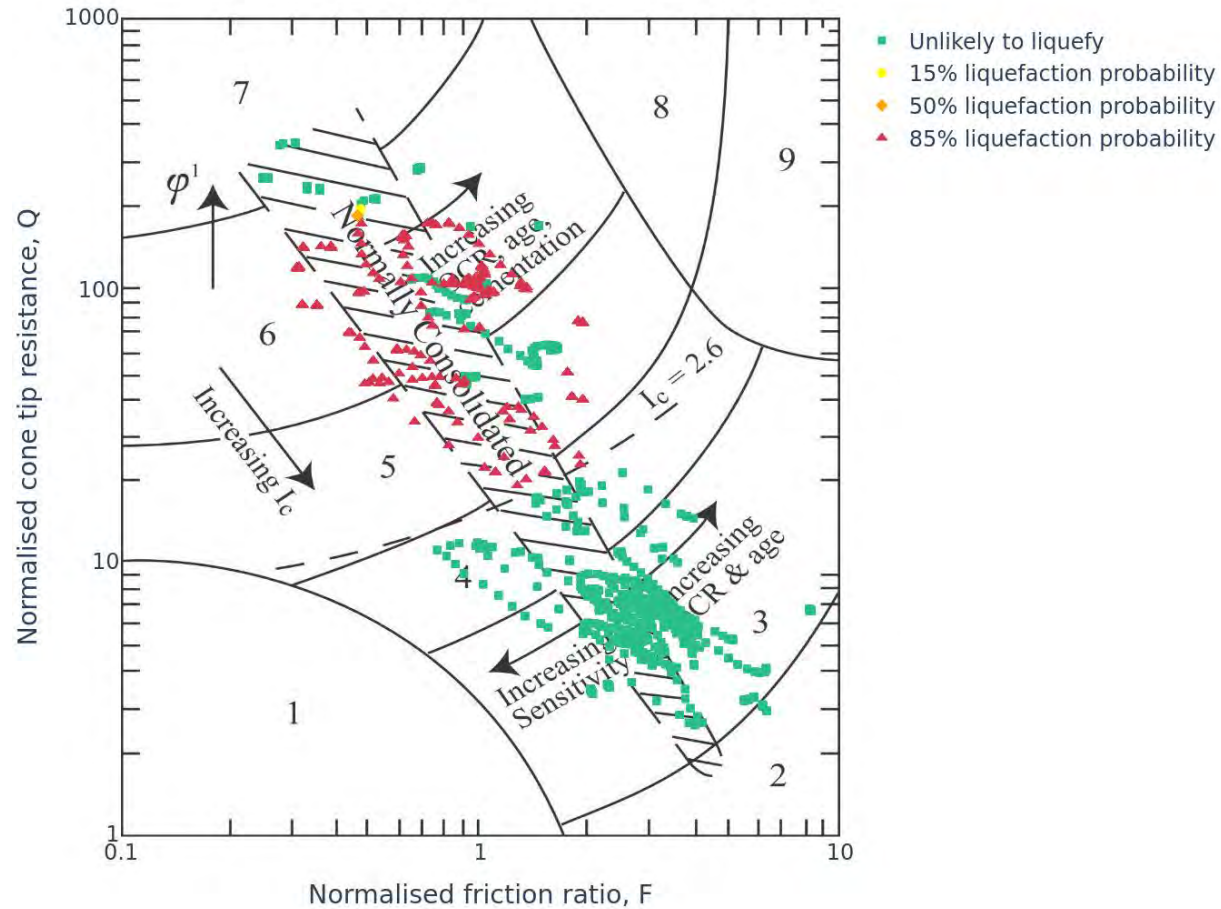
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	90	4.1	16	16	2.6	11
50%	89	4.1	13	15	2.6	9
85%	84	4.1	10	14	2.6	7

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



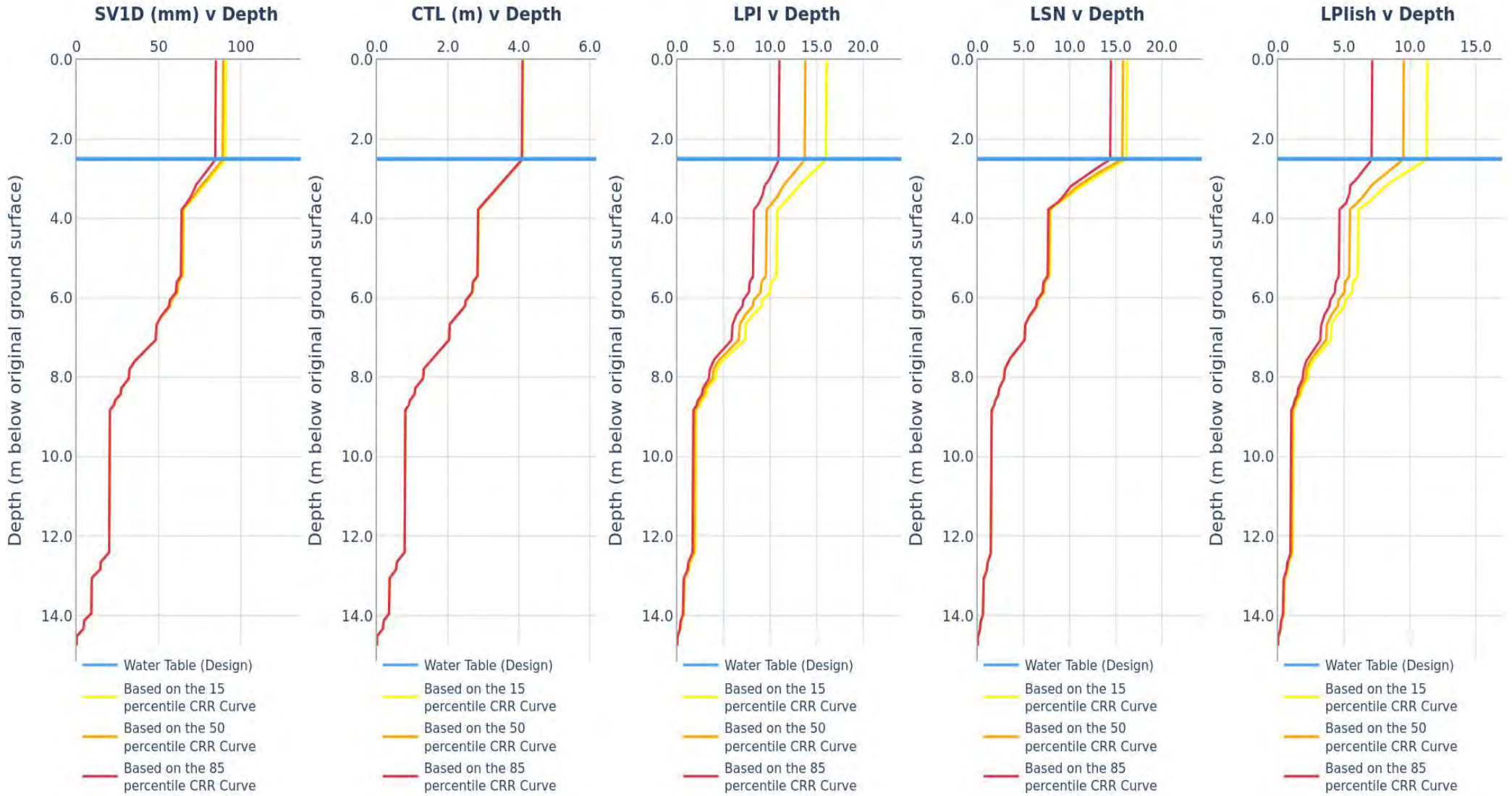
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 5/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

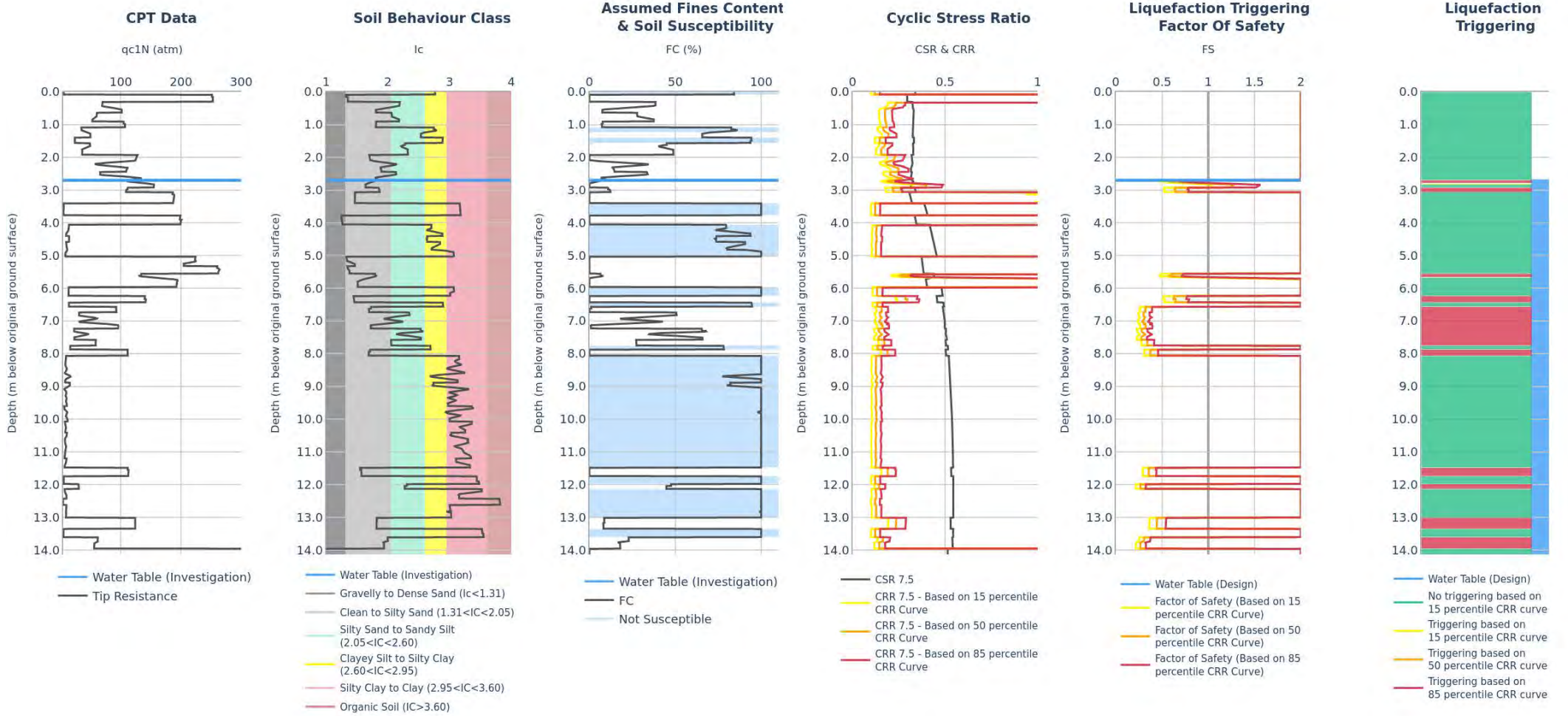


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT412	CPT_TT262858	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Inverse filter Qc/Fs data (10 cm<sup>2</sup>).*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT413	CPT_TT262859	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

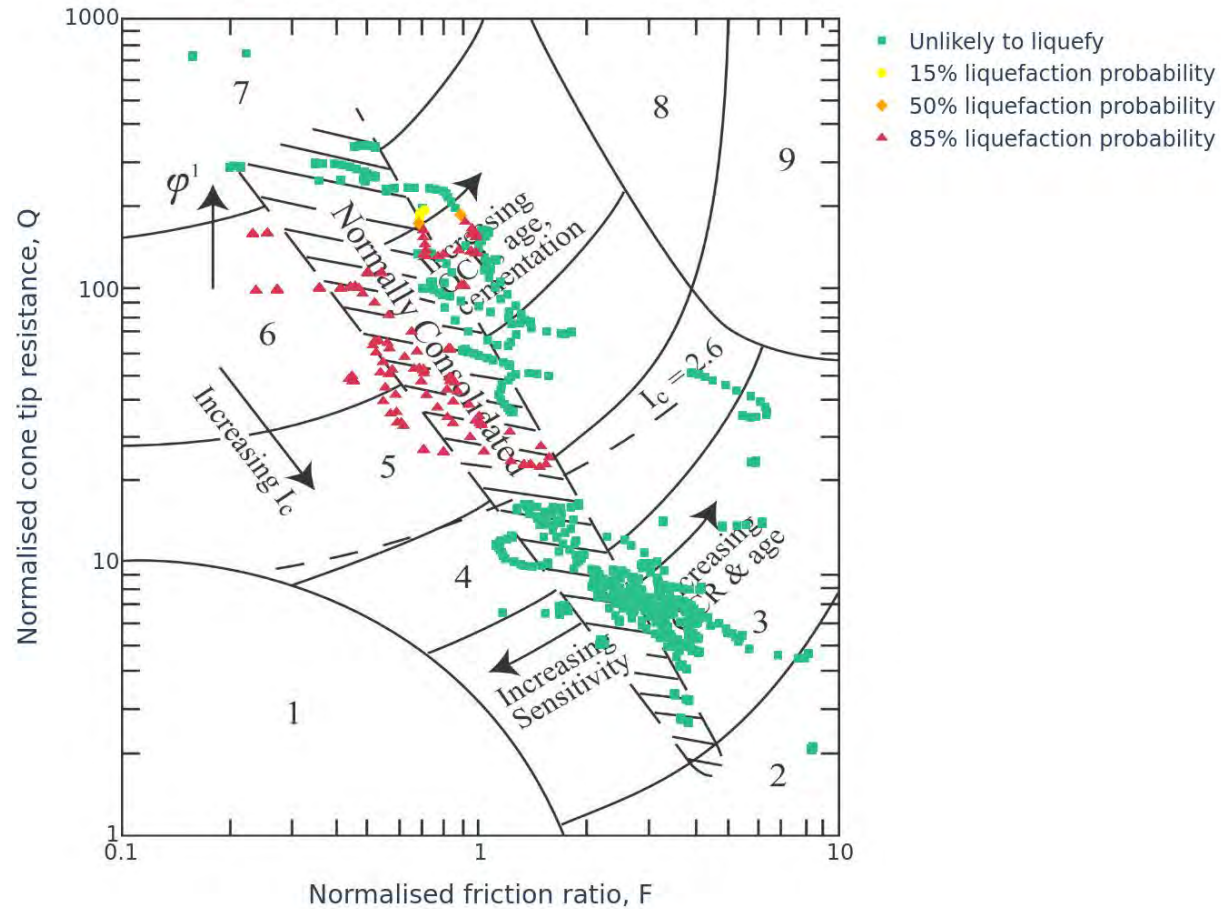
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	70	3.1	11	9	2.8	6
50%	70	3.0	10	9	2.8	5
85%	67	3.0	8	8	2.9	4

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 7/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



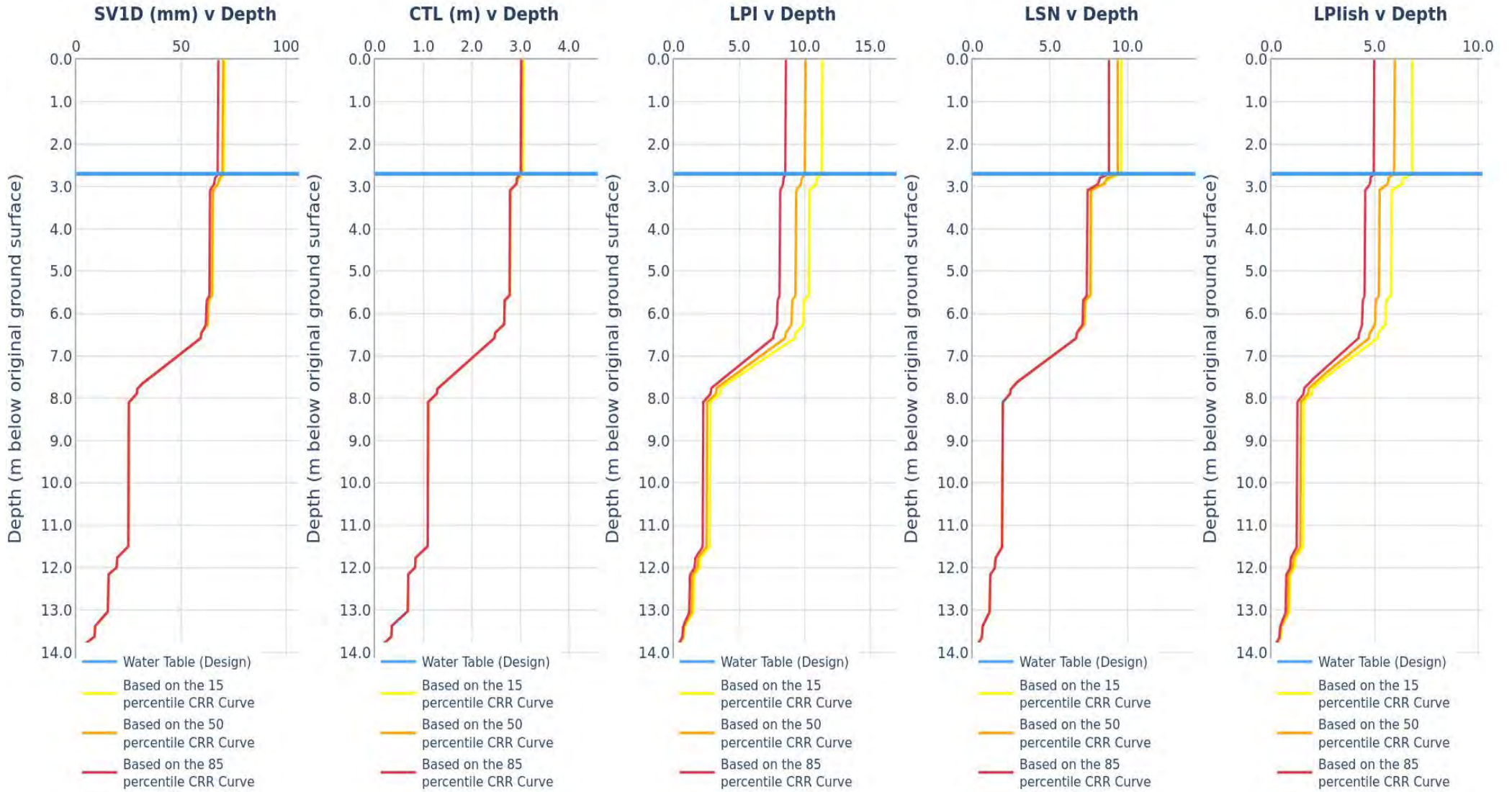
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 8/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

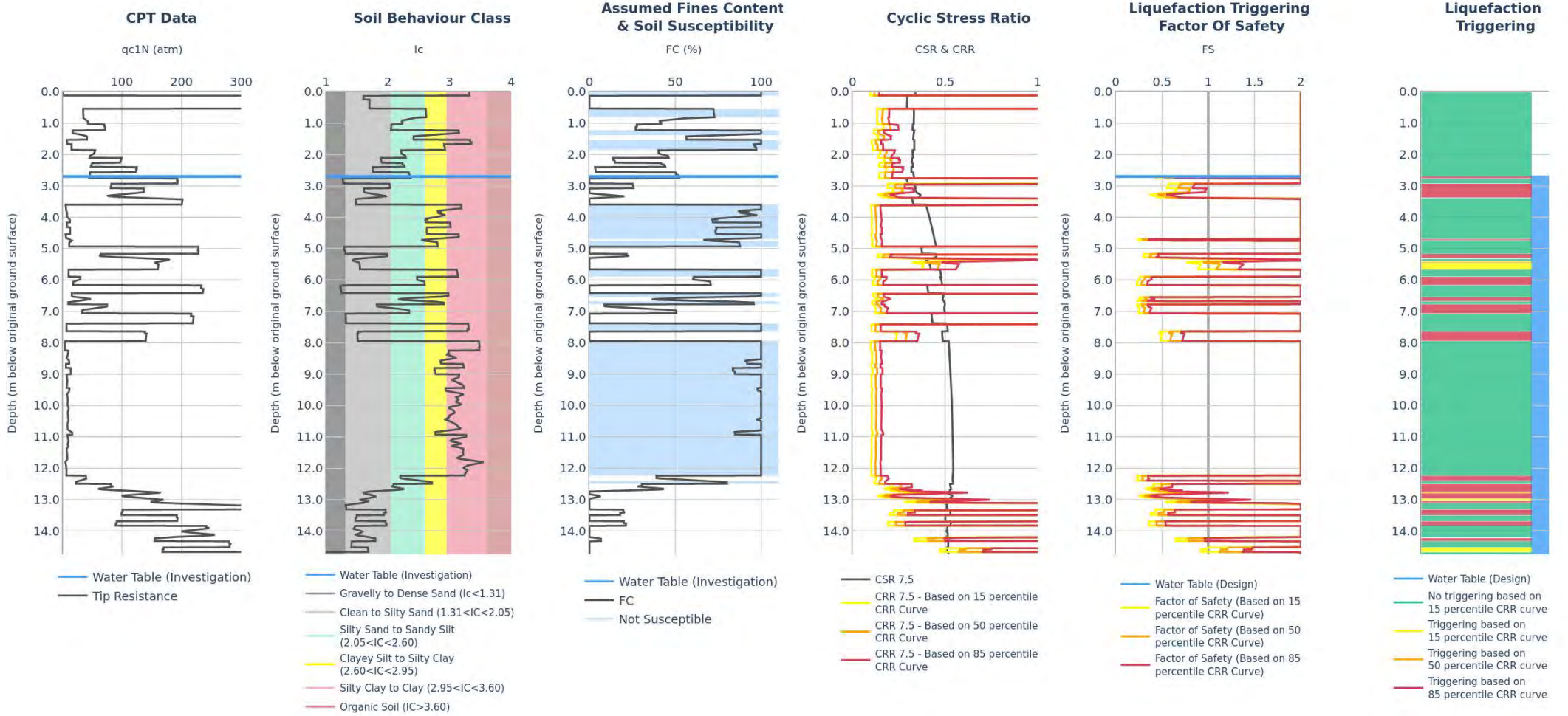


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT413	CPT_TT262859	02/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Inverse filter Qc/Fs data (10 cm<sup>2</sup>).*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT414	CPT_TT262860	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

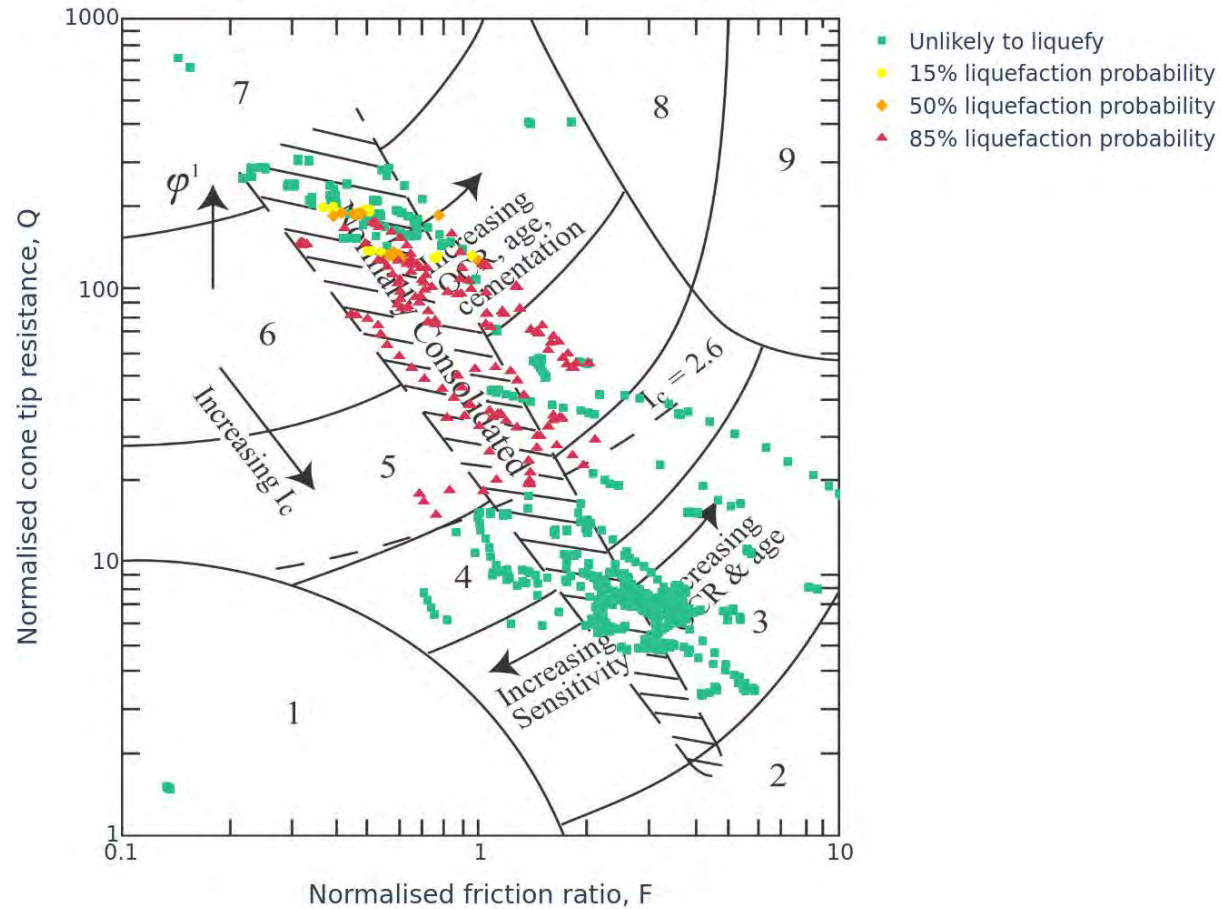
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	64	3.4	10	10	3.0	6
50%	60	2.9	8	9	3.0	5
85%	55	2.8	6	8	3.0	3

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 10/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



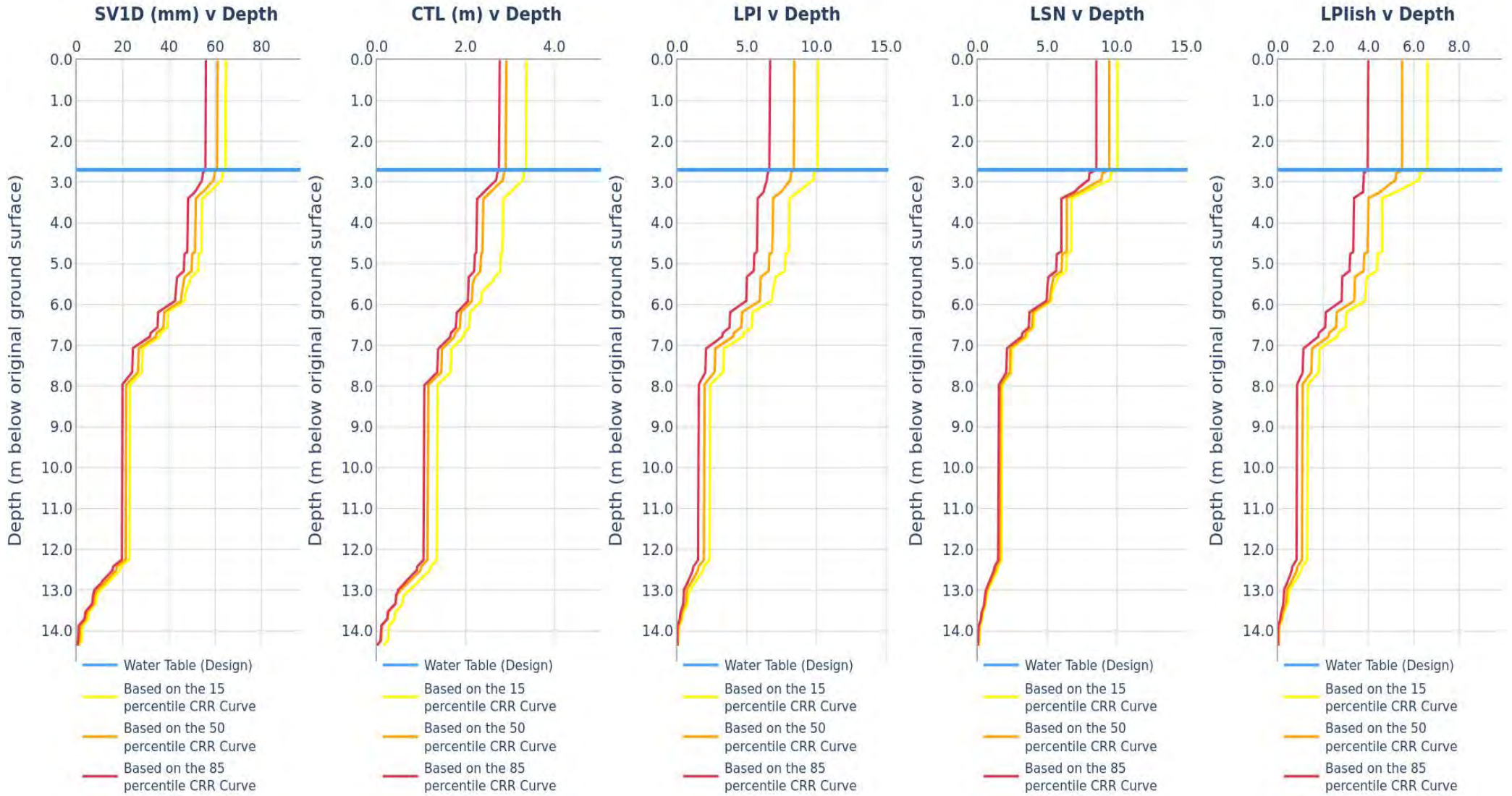
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 11/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

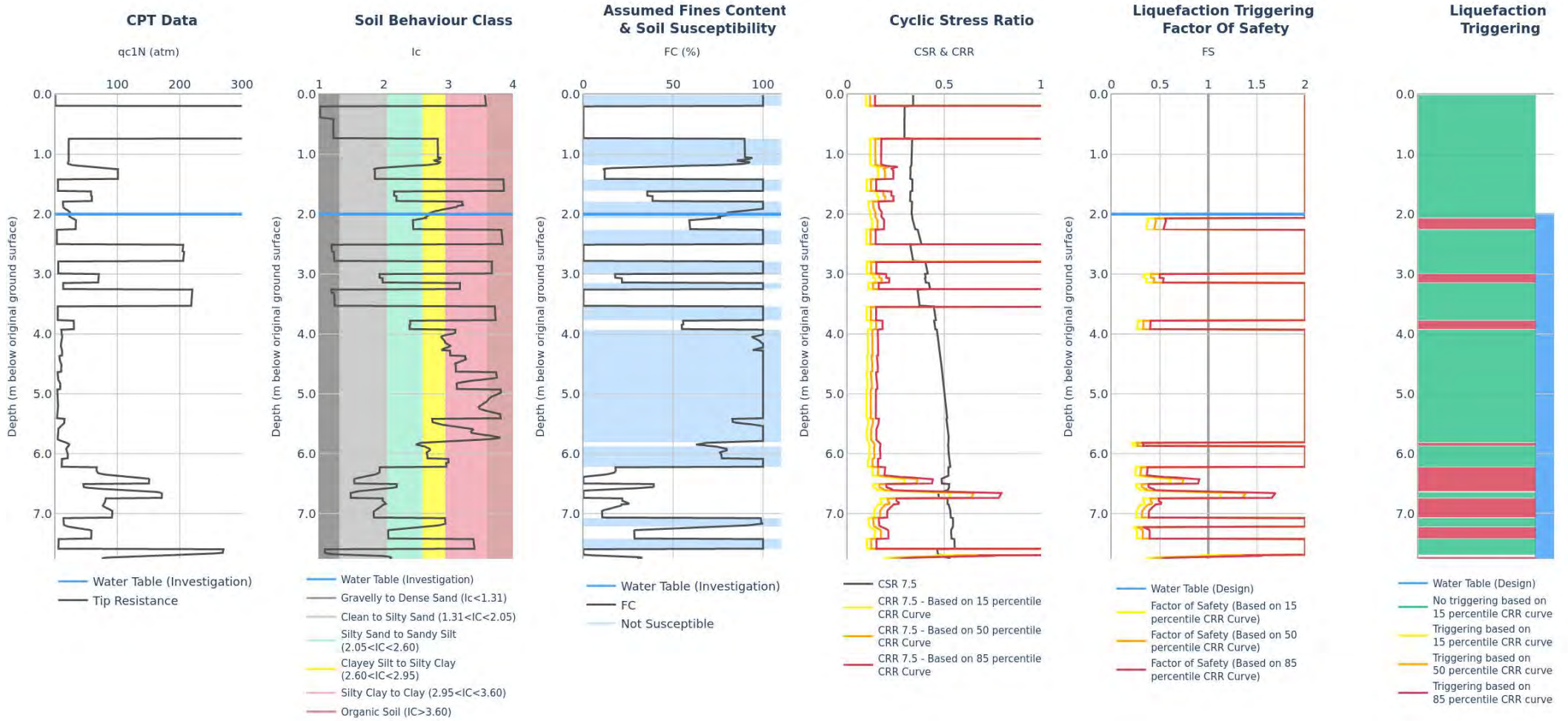


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT414	CPT_TT262860	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Inverse filter Qc/Fs data (10 cm<sup>2</sup>).*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT415	CPT_TT262861	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

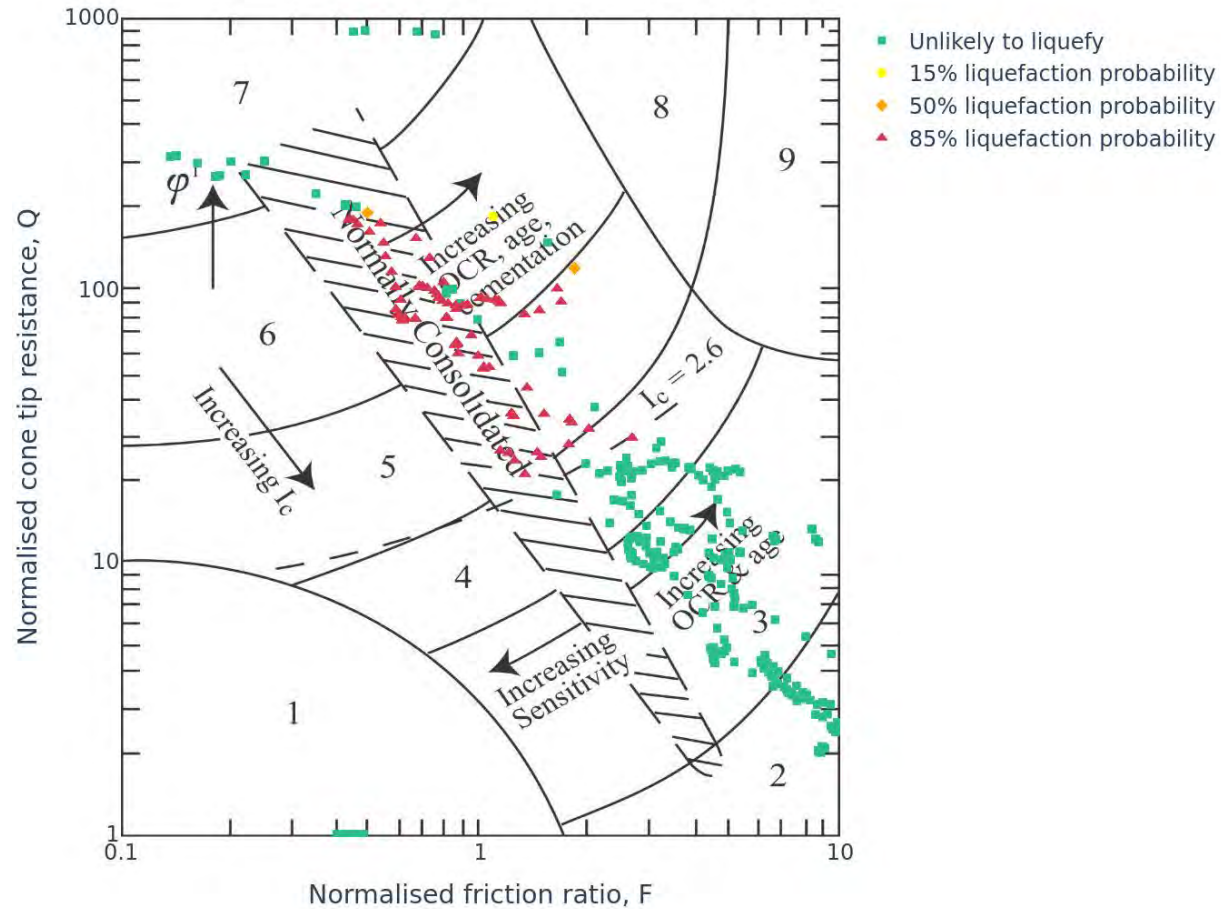
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	36	1.6	7	7	2.2	5
50%	35	1.5	6	7	2.2	5
85%	34	1.5	5	7	2.2	4

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 13/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



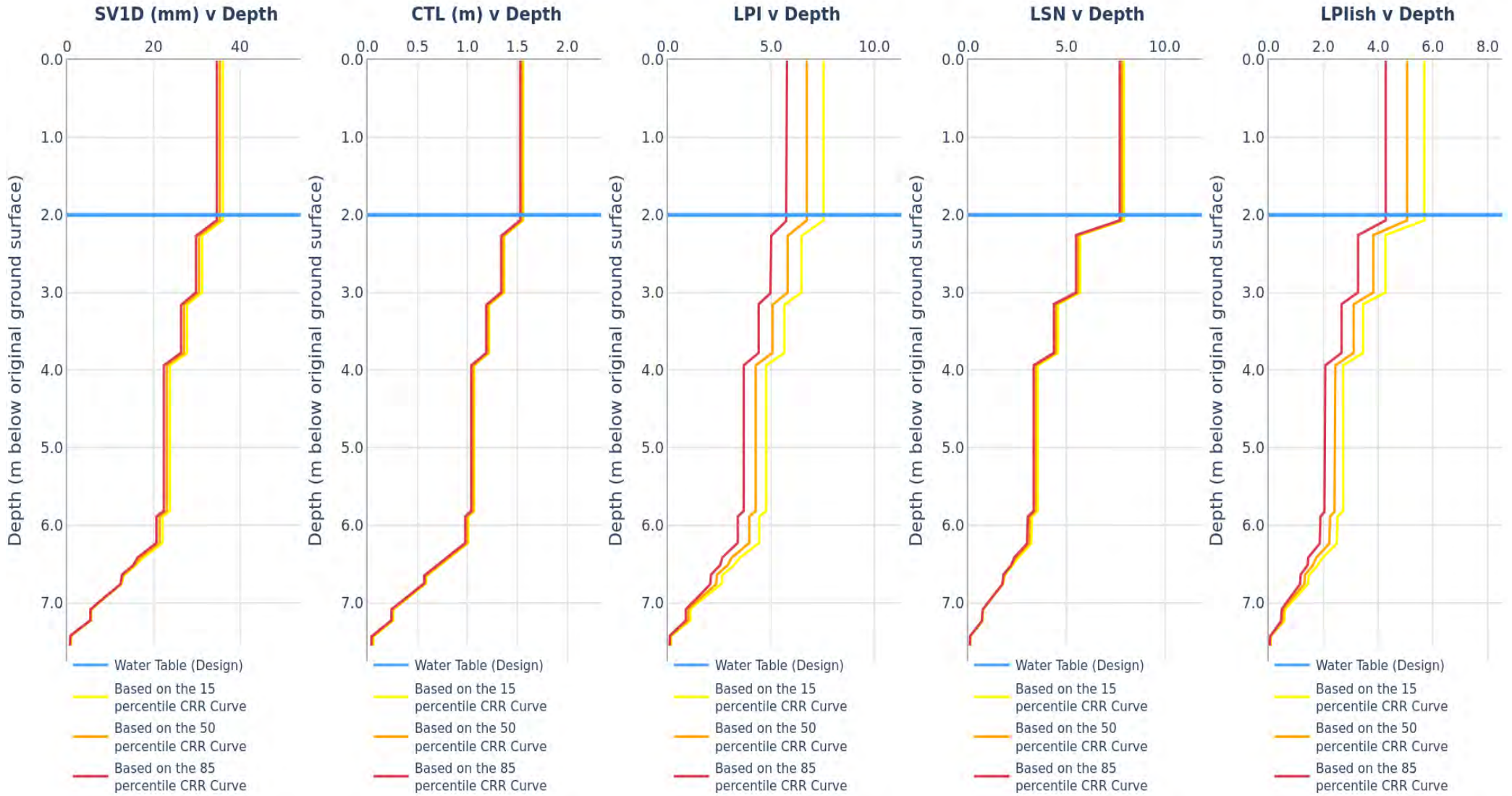
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 14/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

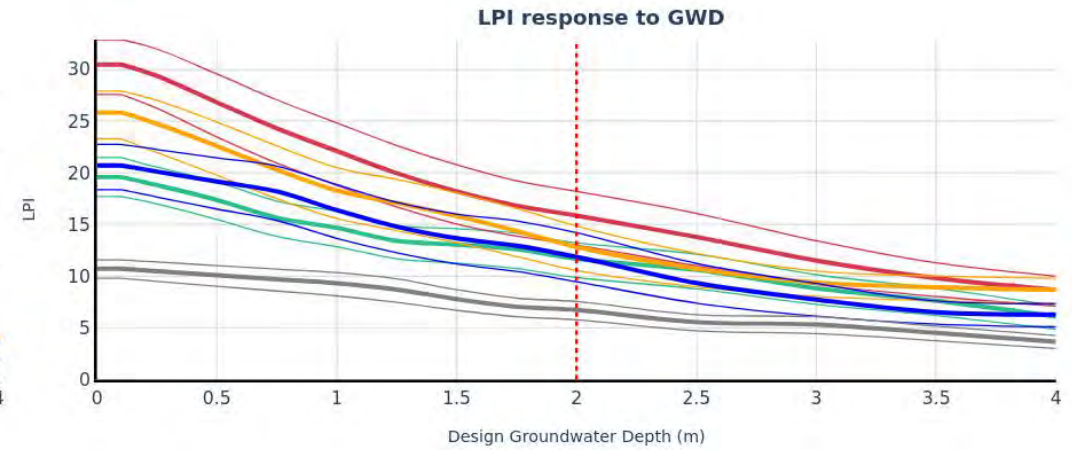
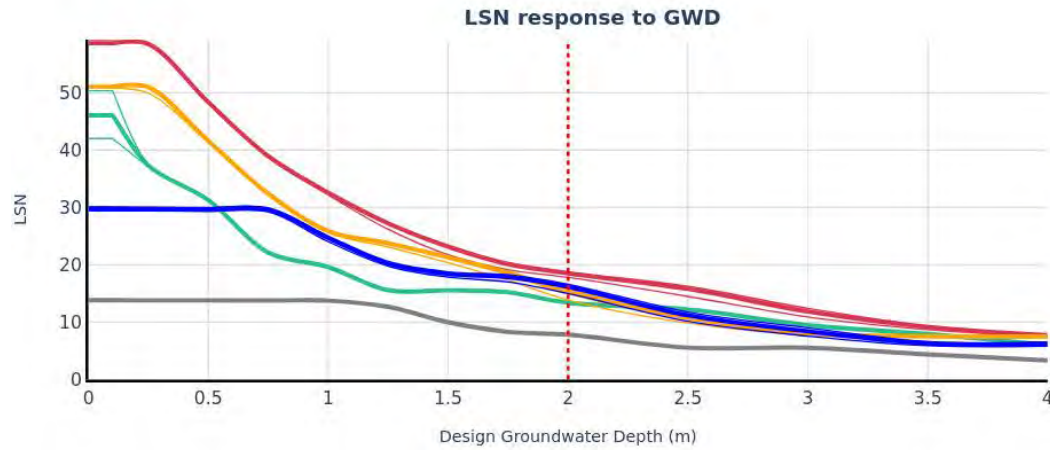
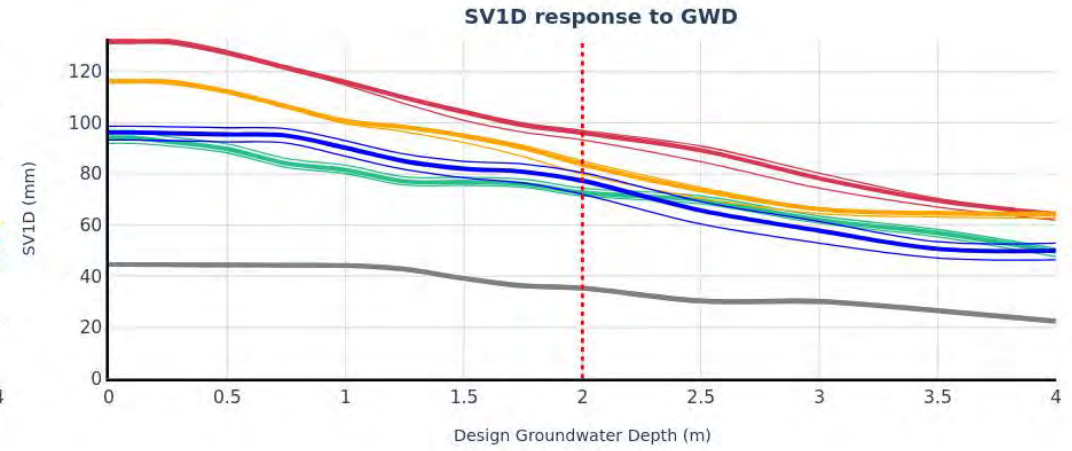
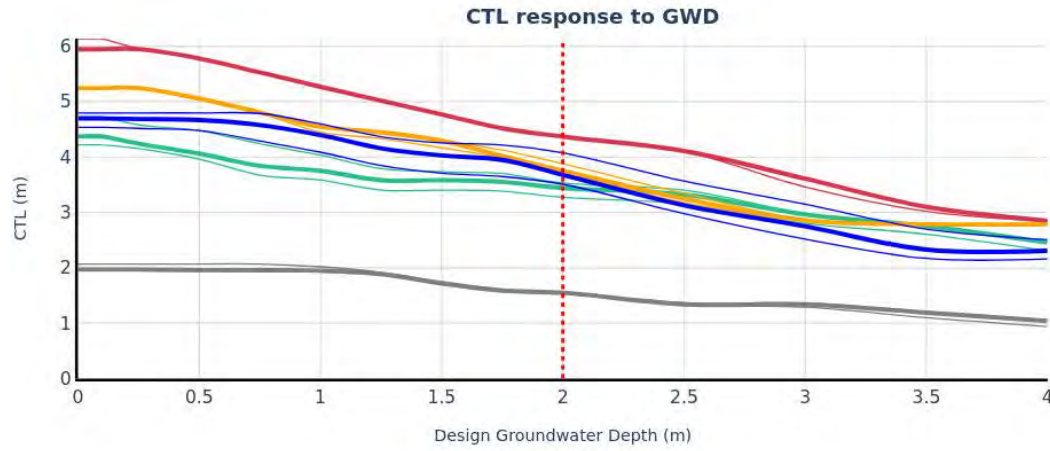


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT415	CPT_TT262861	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/20

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



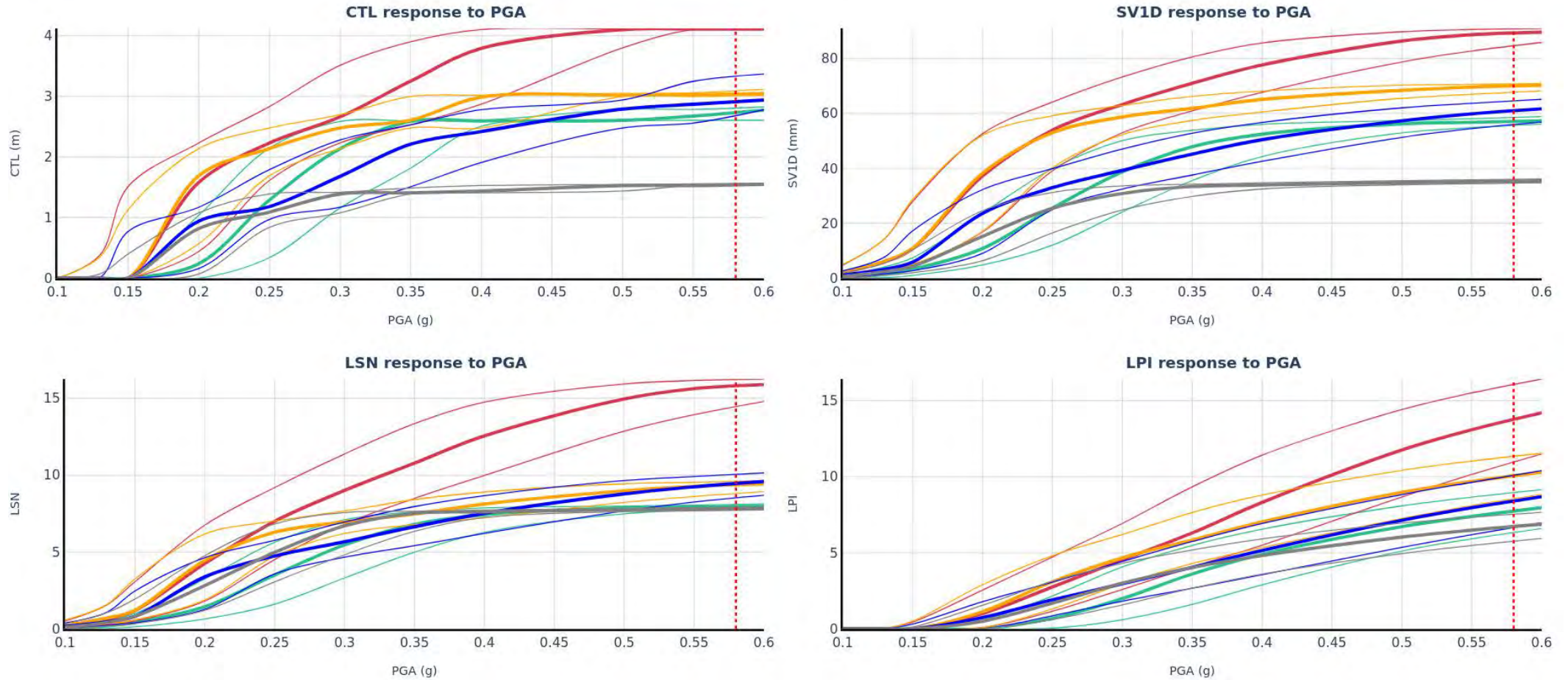
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT411	CPT_TT262857	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT412	CPT_TT262858	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT413	CPT_TT262859	02/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT414	CPT_TT262860	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT415	CPT_TT262861	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 16/20


## PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



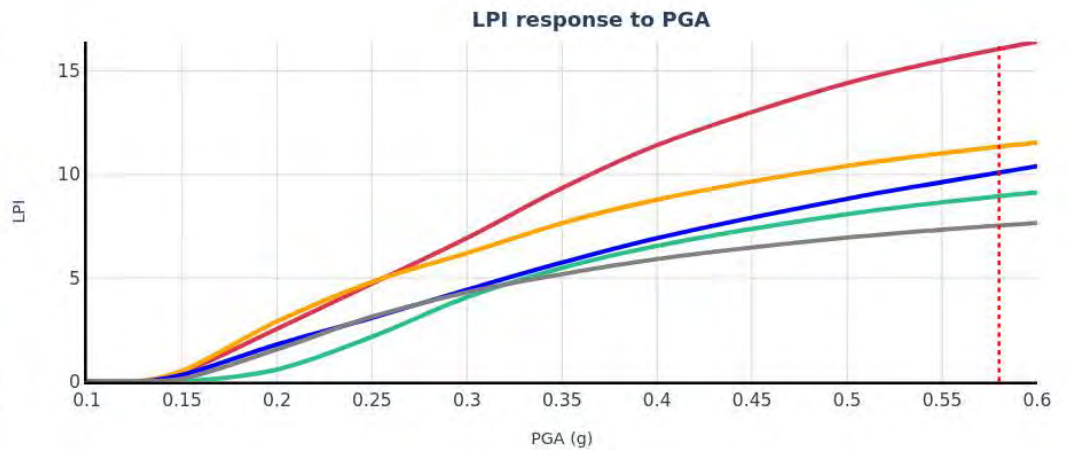
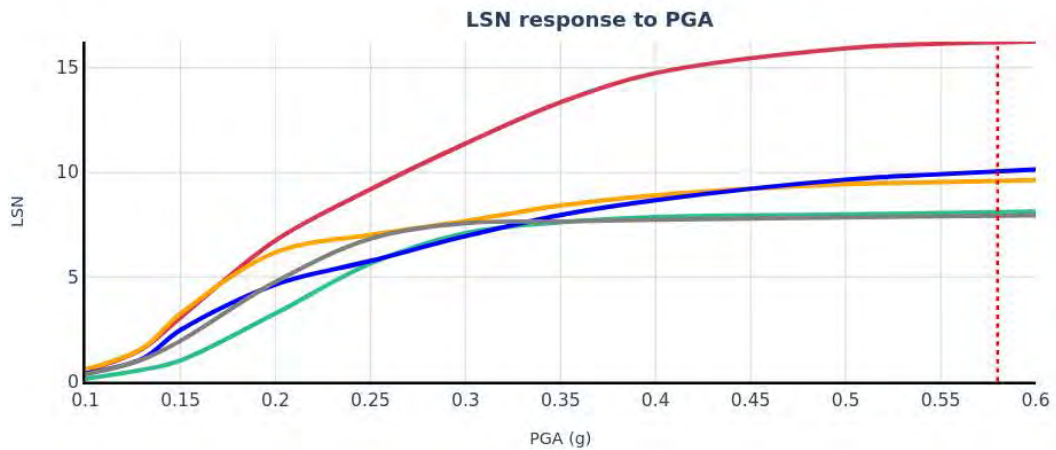
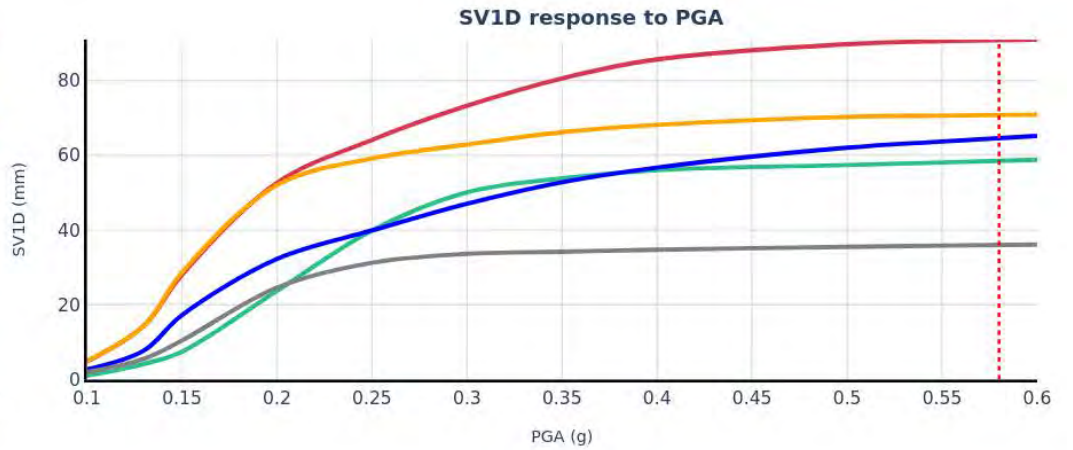
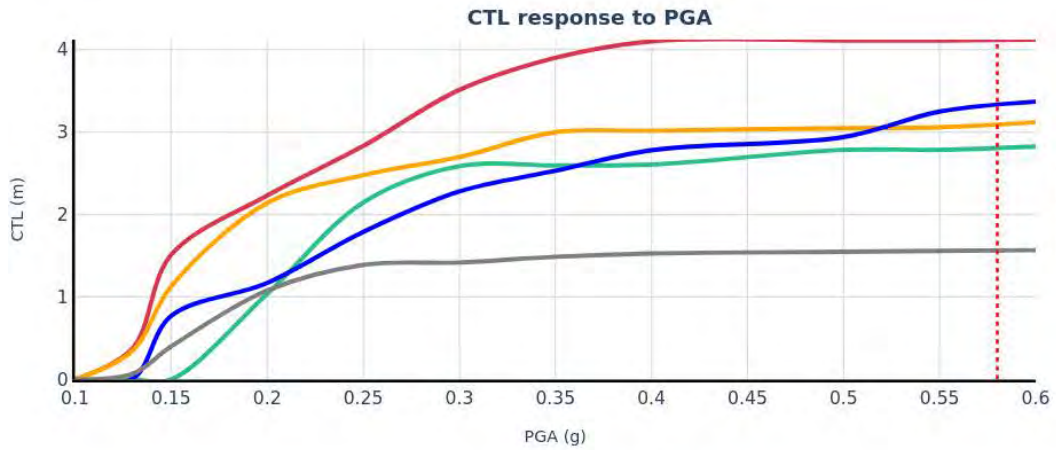
### Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT411	CPT_TT262857	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT412	CPT_TT262858	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT413	CPT_TT262859	02/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT414	CPT_TT262860	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT415	CPT_TT262861	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 17/20

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT411	CPT_TT262857	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT412	CPT_TT262858	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT413	CPT_TT262859	02/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT414	CPT_TT262860	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT415	CPT_TT262861	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 18/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262857	TTGD 262858	TTGD 262859
CPT Name	CPT_TT262857_Raw01	CPT_TT262858_Raw01	CPT_TT262859_Raw01
Run Description	CPT411	CPT412	CPT413
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	3.3	2.5	2.7
Depth to groundwater for design (m)	3.3	2.5	2.7
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	16.414	15.159	14.135
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	16.414	15.159	14.135
Inverse filtering applied?	Yes (10 cm <sup>2</sup> )	Yes (10 cm <sup>2</sup> )	Yes (10 cm <sup>2</sup> )
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262857	CPT411	0.0	0.0	0.0
TTGD 262857	CPT411	0.0	16.41	2.6
TTGD 262858	CPT412	0.0	0.0	0.0
TTGD 262858	CPT412	0.0	16.41	2.6
TTGD 262859	CPT413	0.0	0.0	0.0
TTGD 262859	CPT413	0.0	16.41	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262857	CPT411	0.0	16.41	0.0 CFC
TTGD 262858	CPT412	0.0	16.41	0.0 CFC
TTGD 262859	CPT413	0.0	16.41	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262857	CPT411	0.0	0.0001	18.0
TTGD 262857	CPT411	0.0001	16.41	18.0
TTGD 262858	CPT412	0.0	0.0001	18.0
TTGD 262858	CPT412	0.0001	16.41	18.0
TTGD 262859	CPT413	0.0	0.0001	18.0
TTGD 262859	CPT413	0.0001	16.41	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 19/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262860	TTGD 262861
CPT Name	CPT_TT262860_Raw01	CPT_TT262861_Raw01
Run Description	CPT414	CPT415
EQ PGA (g)	0.58	0.58
EQ Magnitude	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.7	2.0
Depth to groundwater for design (m)	2.7	2.0
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	14.747	7.755
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	14.747	7.755
Inverse filtering applied?	Yes (10 cm <sup>2</sup> )	Yes (10 cm <sup>2</sup> )
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262860	CPT414	0.0	0.0	0.0
TTGD 262860	CPT414	0.0	16.41	2.6
TTGD 262861	CPT415	0.0	0.0	0.0
TTGD 262861	CPT415	0.0	16.41	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

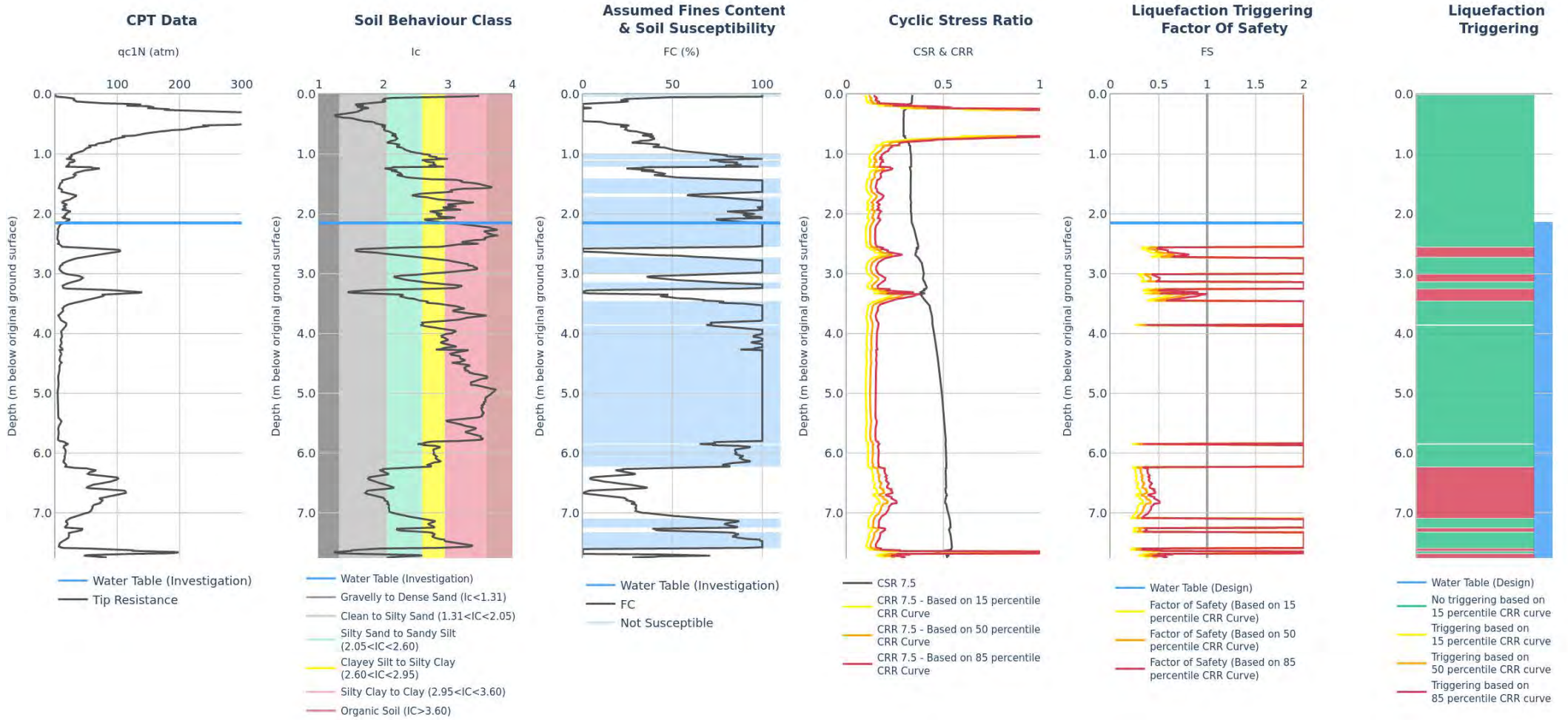
ID	Run description	From (m)	To (m)	Fc
TTGD 262860	CPT414	0.0	16.41	0.0 CFC
TTGD 262861	CPT415	0.0	16.41	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262860	CPT414	0.0	0.0001	18.0
TTGD 262860	CPT414	0.0001	16.41	18.0
TTGD 262861	CPT415	0.0	0.0001	18.0
TTGD 262861	CPT415	0.0001	16.41	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 20/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT415	CPT_TT262861	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

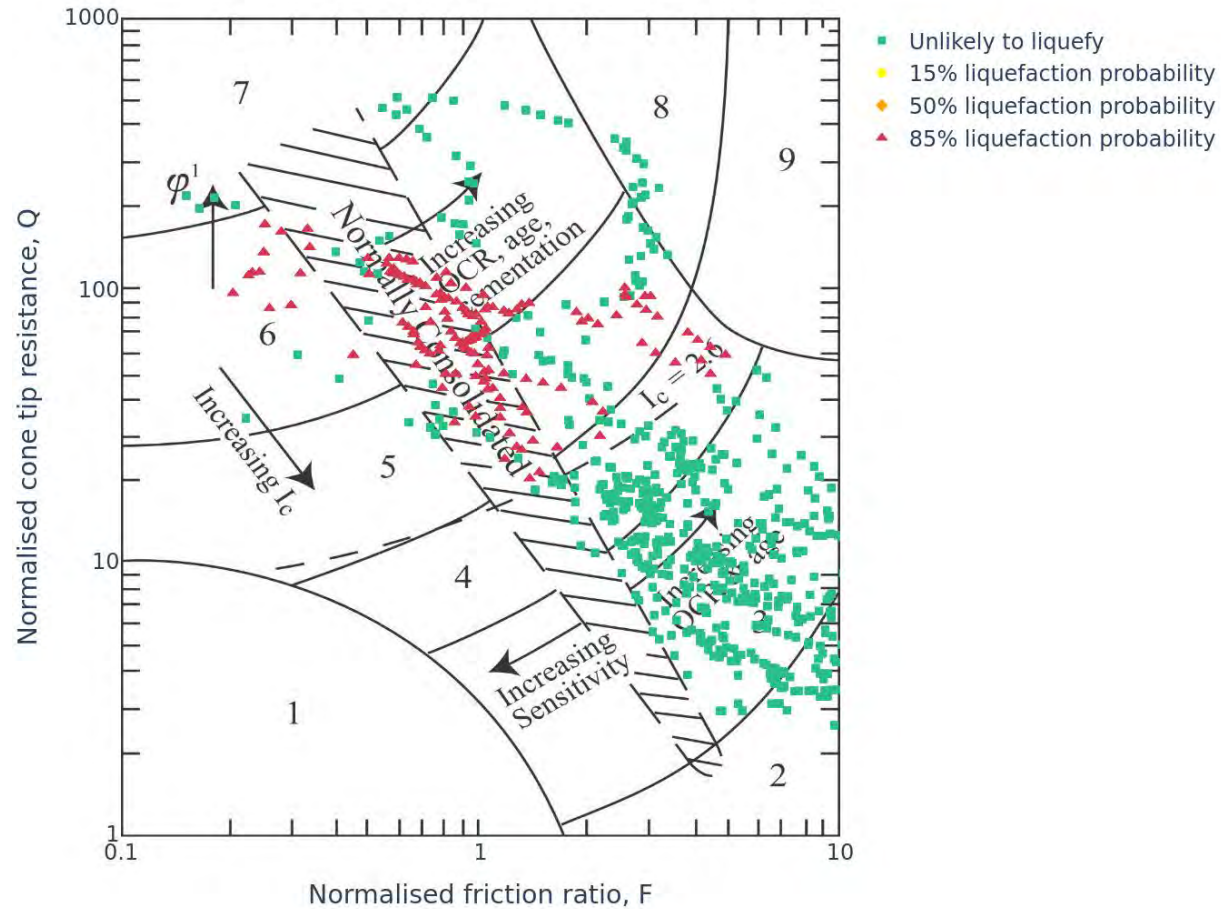
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	35	1.6	7	7	2.6	5
50%	35	1.6	6	7	2.6	4
85%	34	1.6	5	7	2.6	3

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



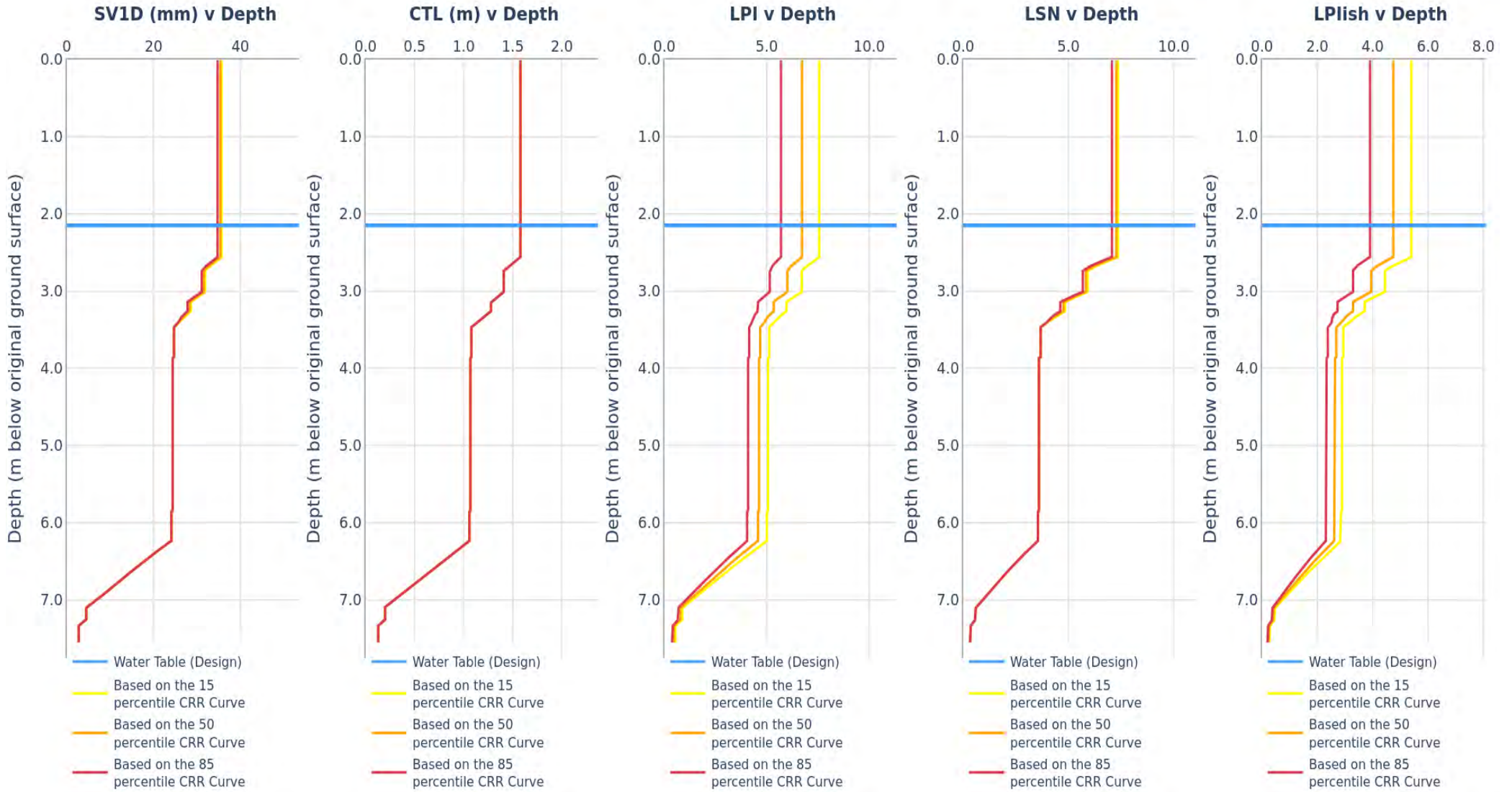
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

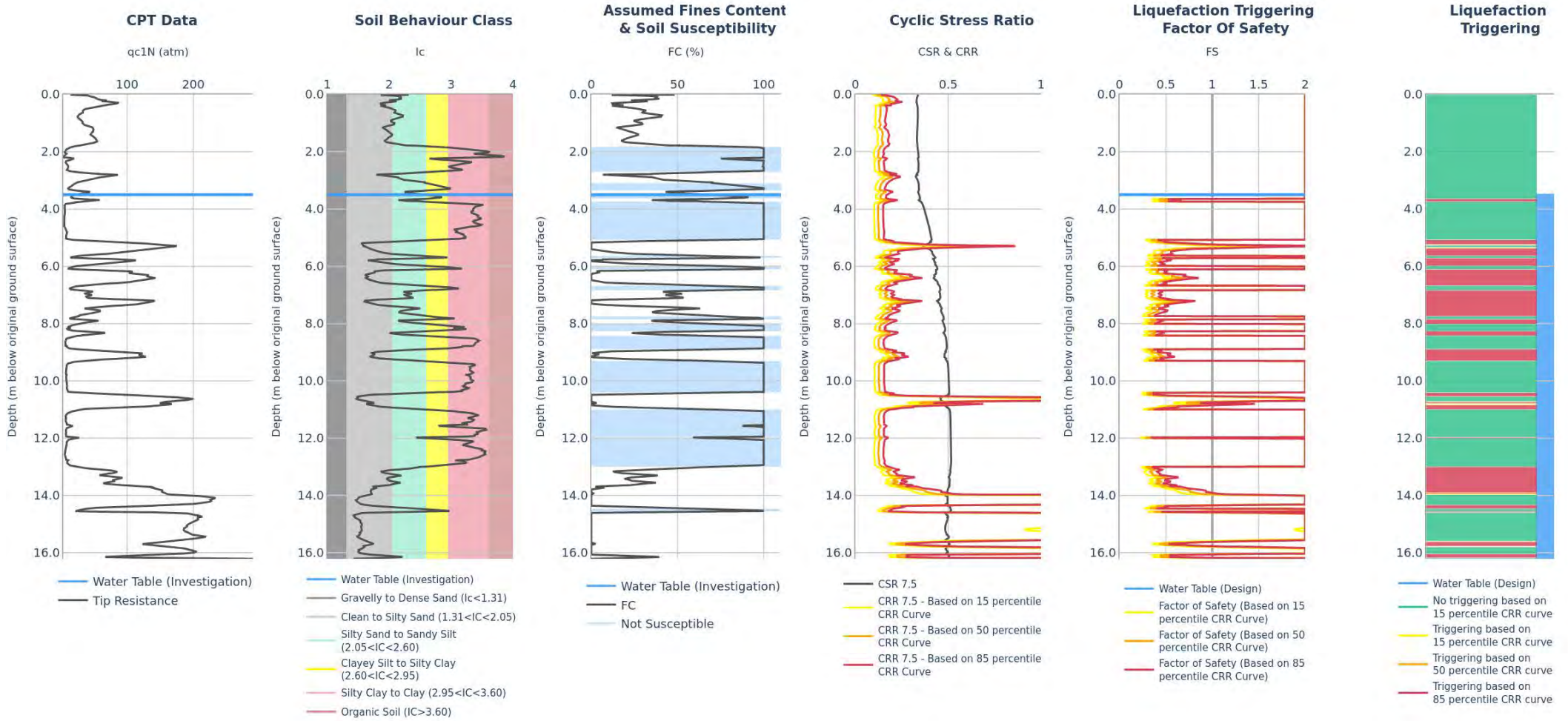


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT415	CPT_TT262861	03/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT416	CPT_TT262862	13/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

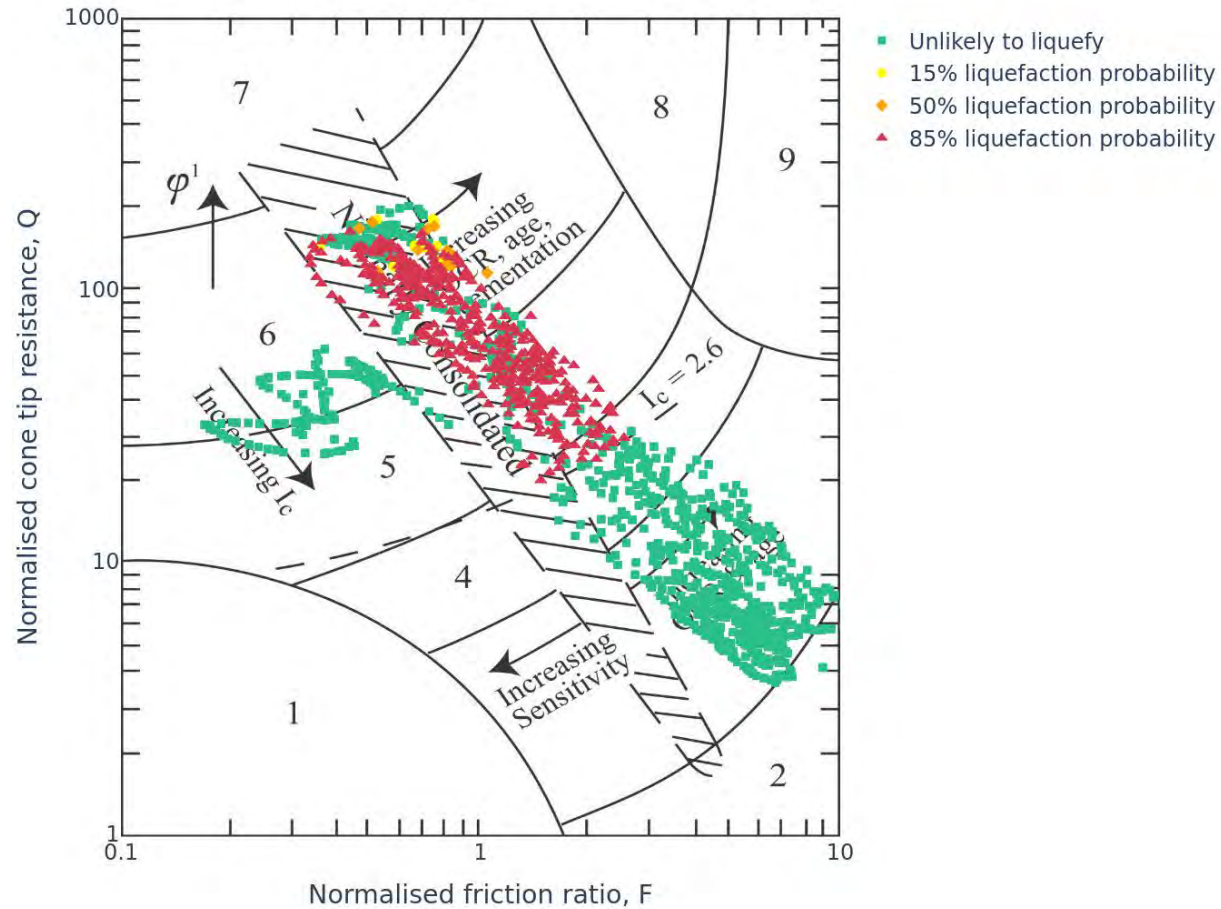
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	104	5.0	16	12	3.7	9
50%	101	4.9	14	12	3.7	8
85%	97	4.7	11	12	3.7	6

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



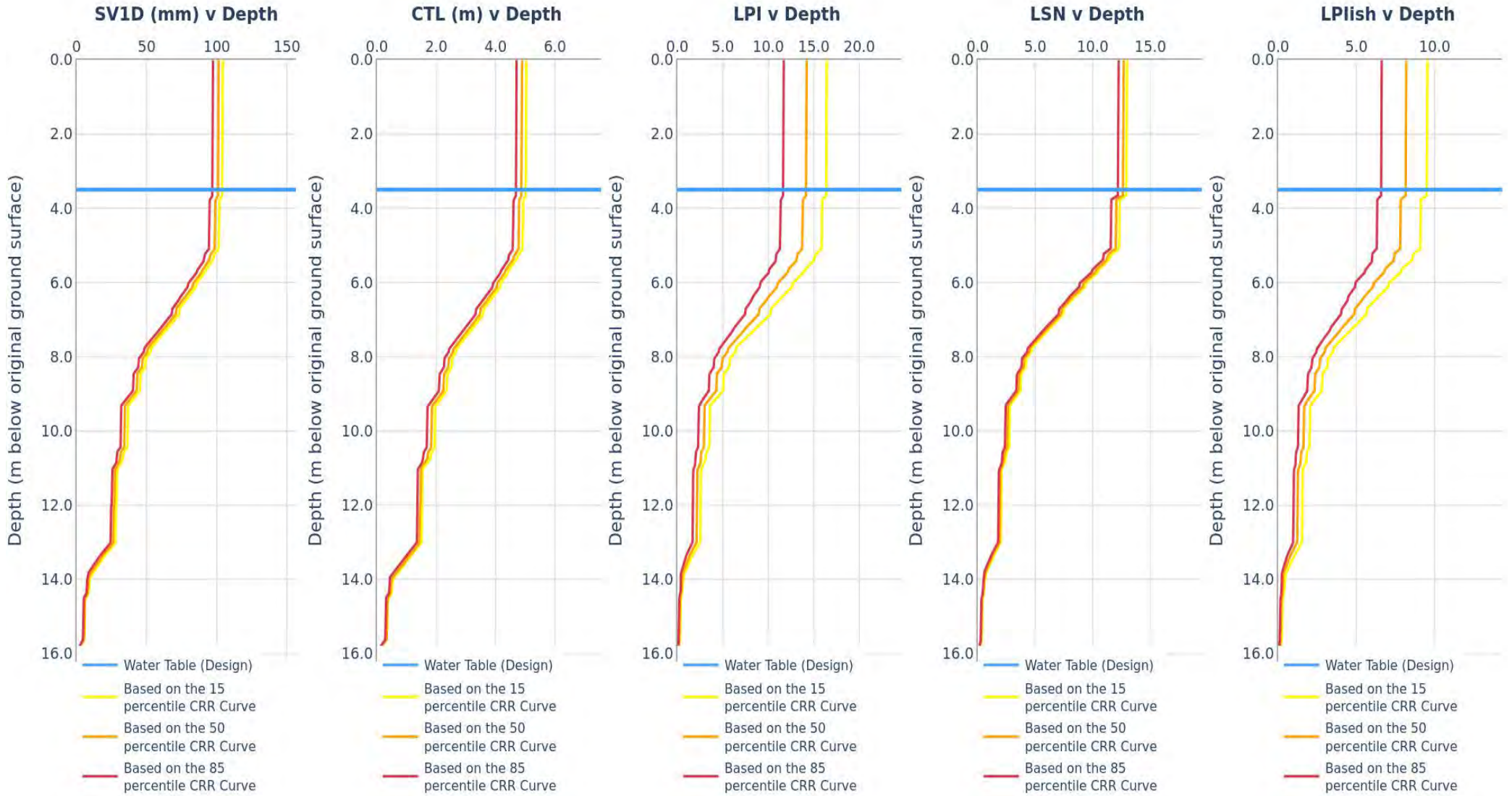
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 5/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

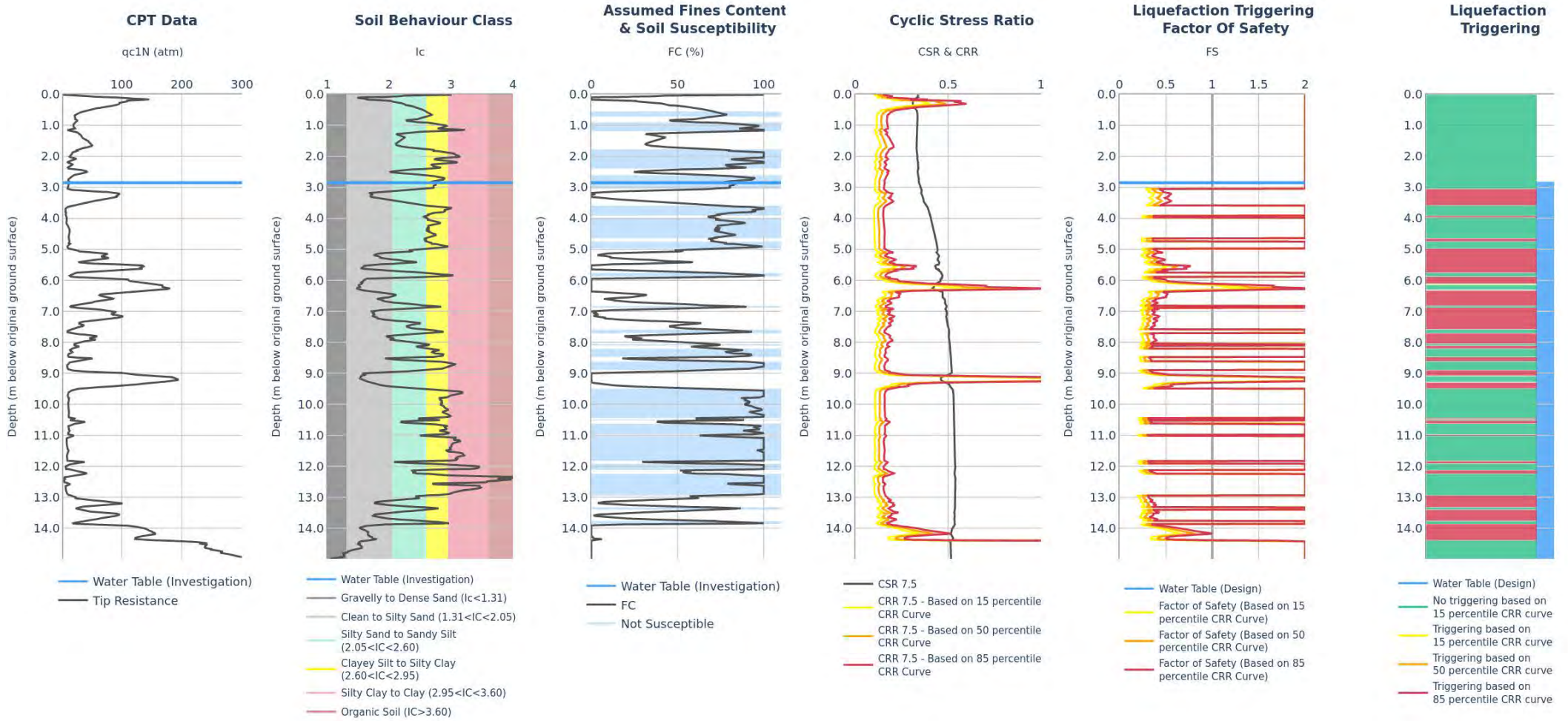


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT416	CPT_TT262862	13/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT417	CPT_TT262863	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

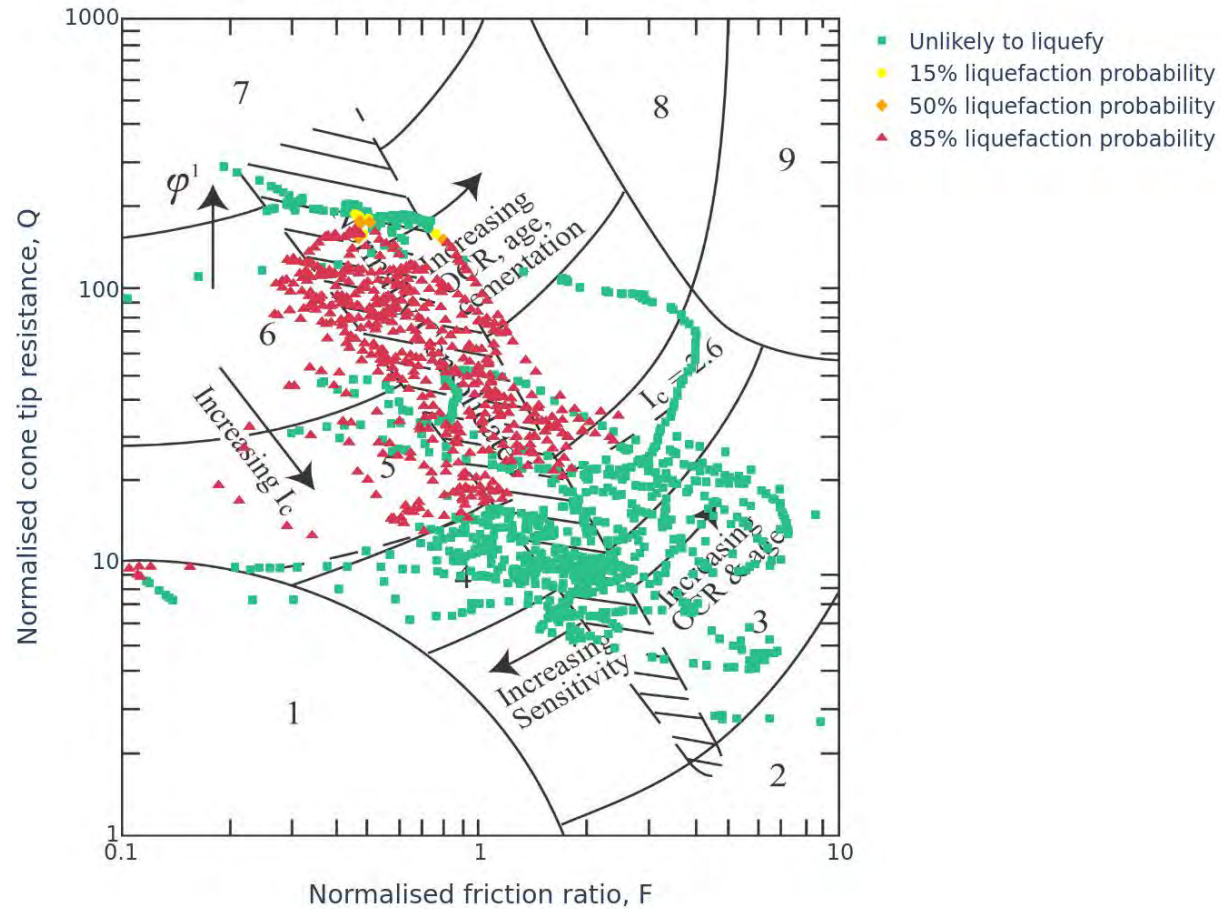
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	137	5.6	22	20	3.1	14
50%	136	5.6	20	20	3.1	12
85%	133	5.5	17	19	3.1	11

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 7/27

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



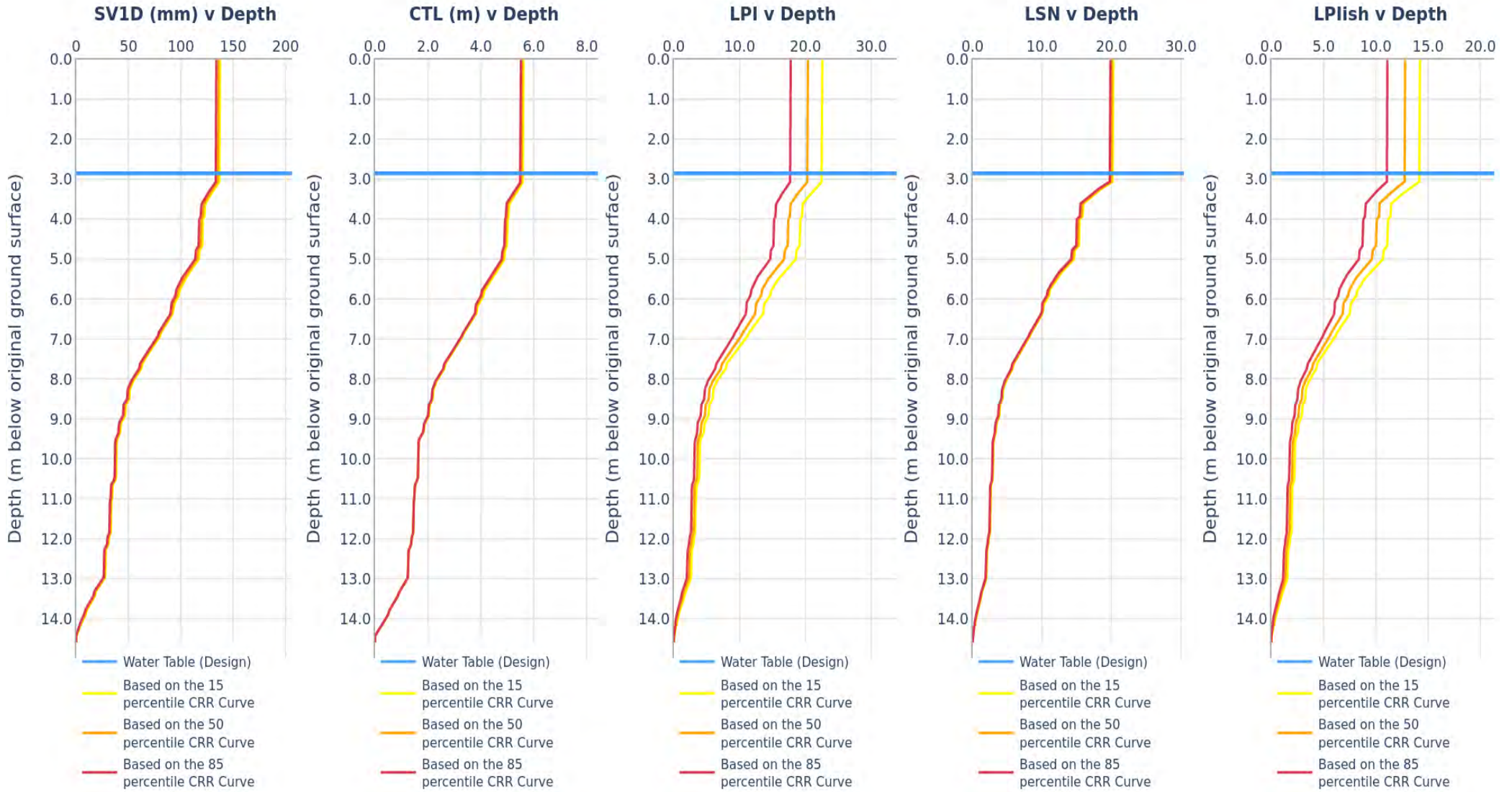
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

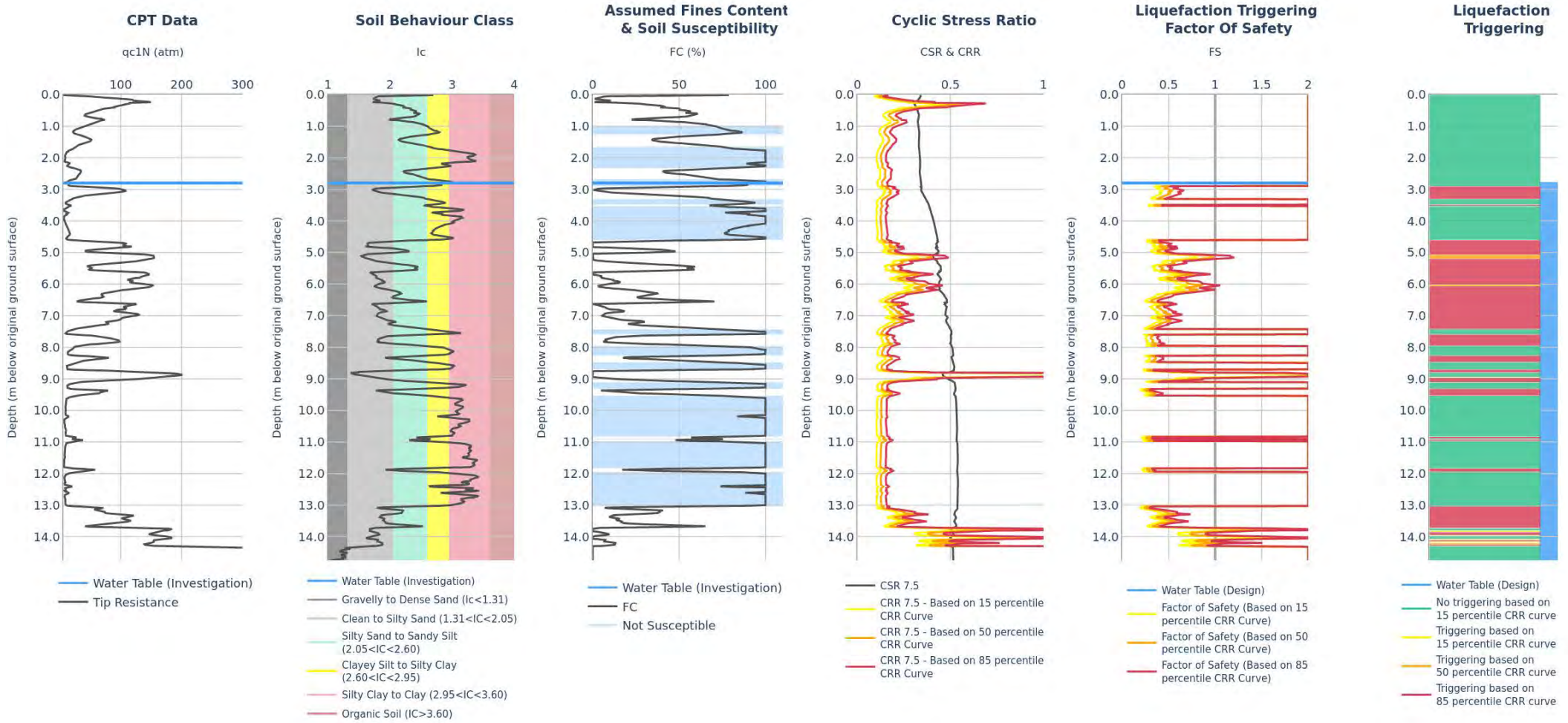


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT417	CPT_TT262863	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT417a	CPT_TT262864	13/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

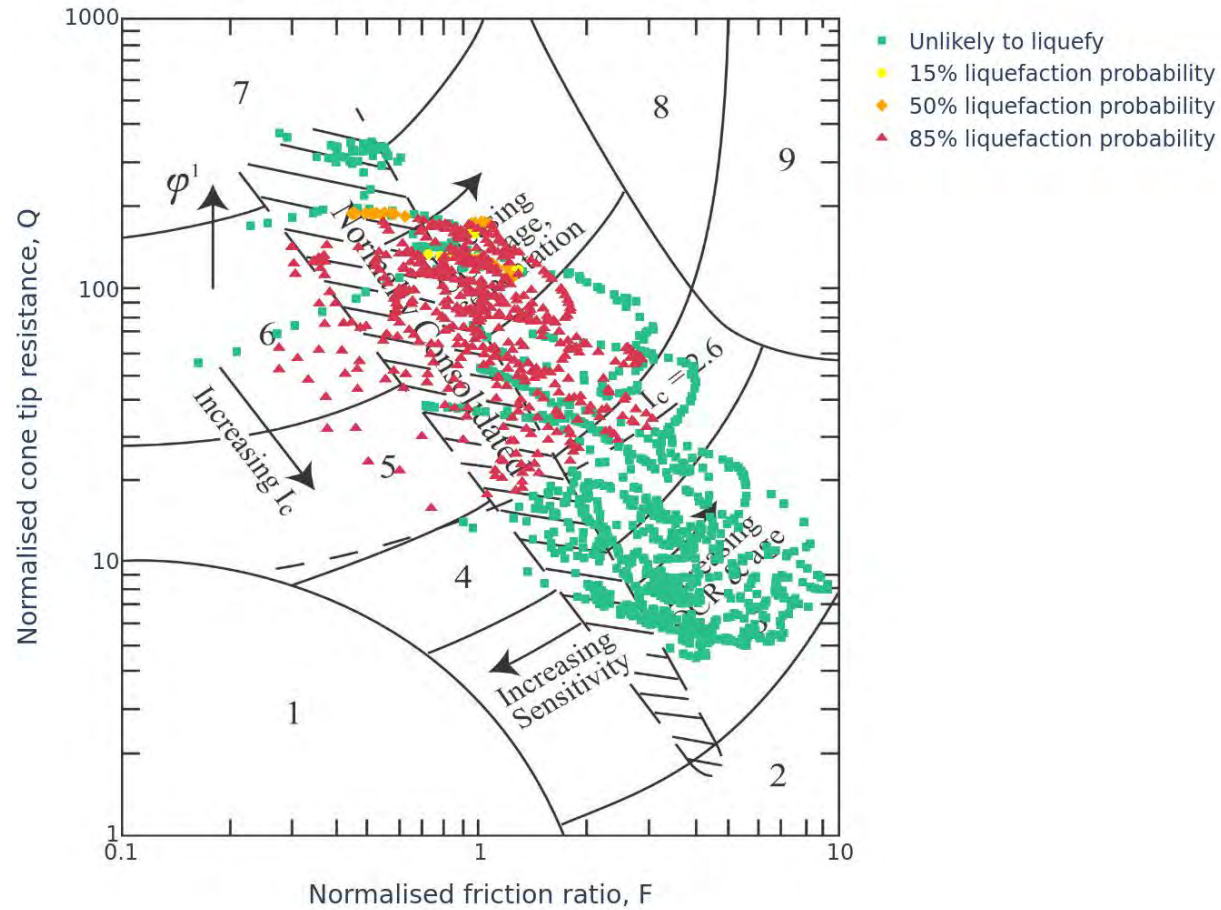
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	116	5.6	20	17	3.0	12
50%	112	5.5	17	17	3.0	10
85%	107	5.2	14	16	3.0	8

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



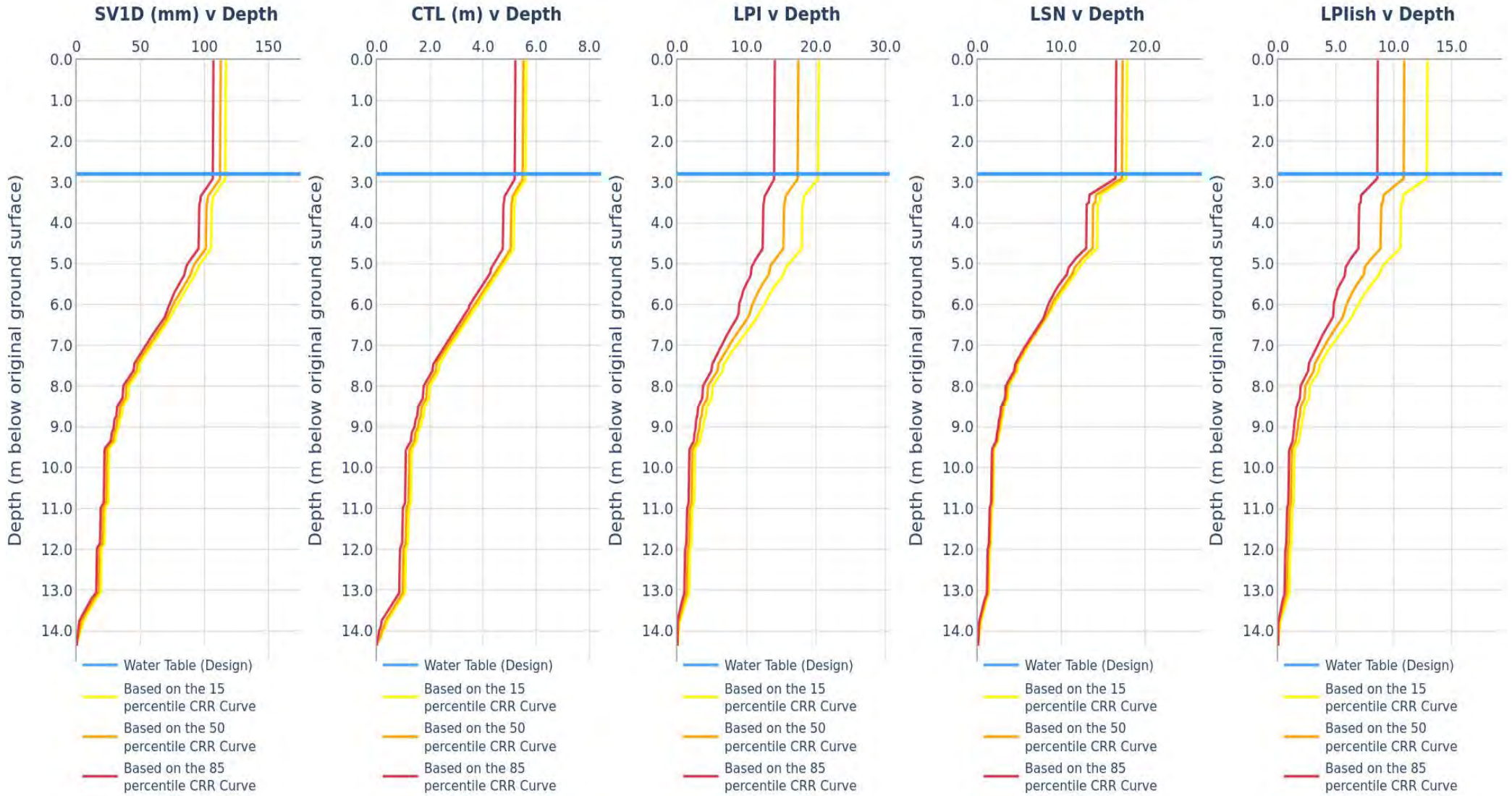
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 11/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

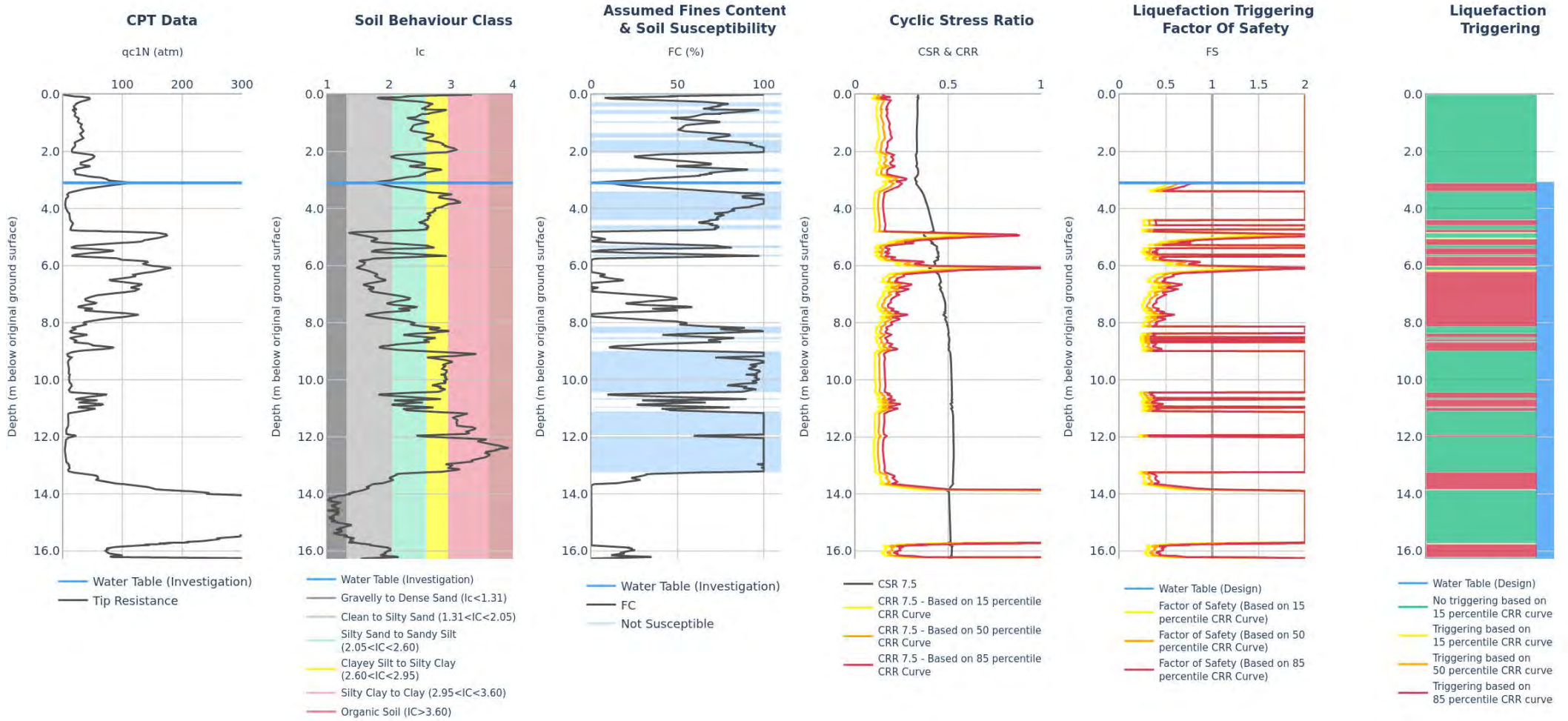


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT417a	CPT_TT262864	13/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT418	CPT_TT262865	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

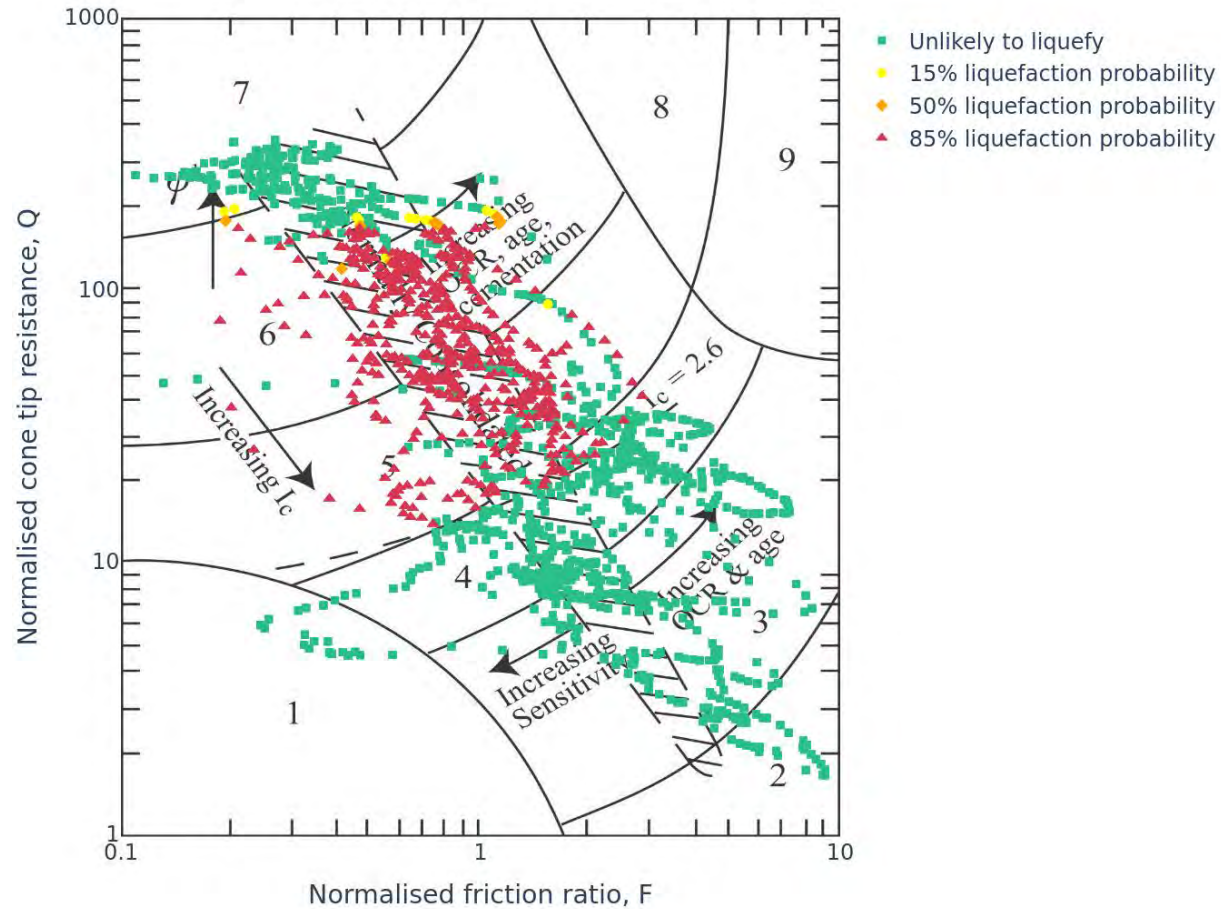
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	128	5.7	20	17	3.2	12
50%	126	5.5	18	17	3.2	11
85%	123	5.4	15	17	3.2	9

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			


## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



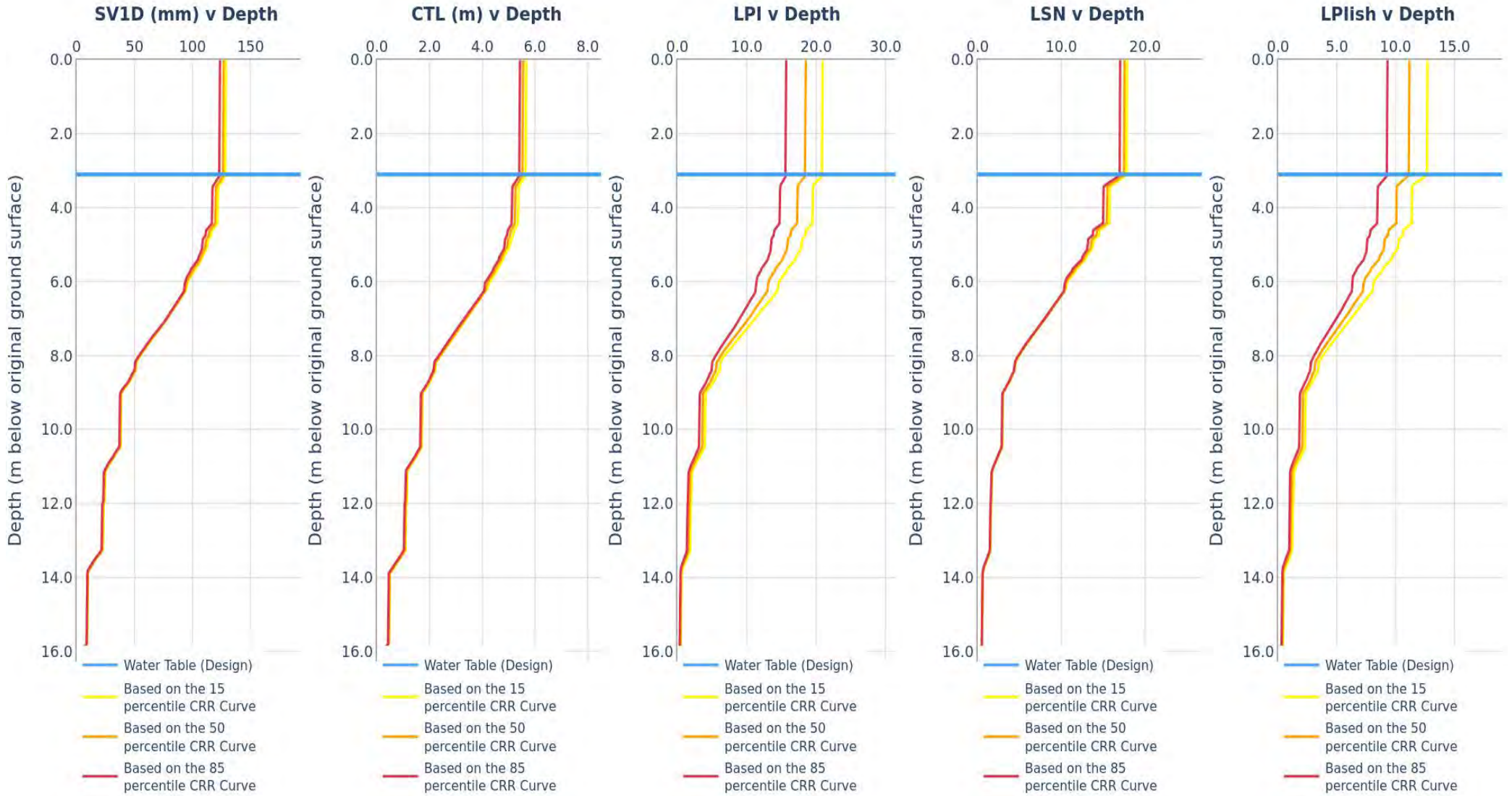
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 14/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

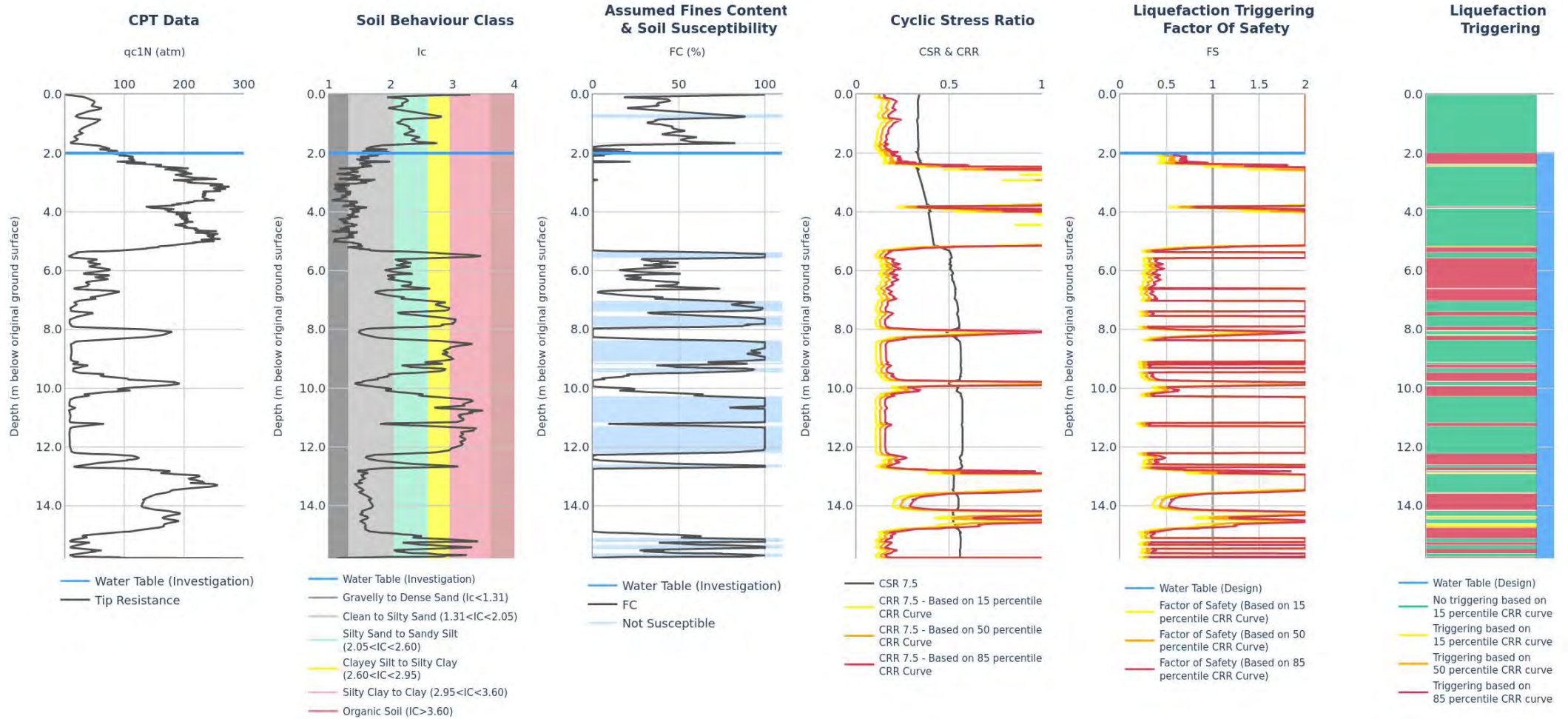


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT418	CPT_TT262865	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT421	CPT_TT262868	05/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

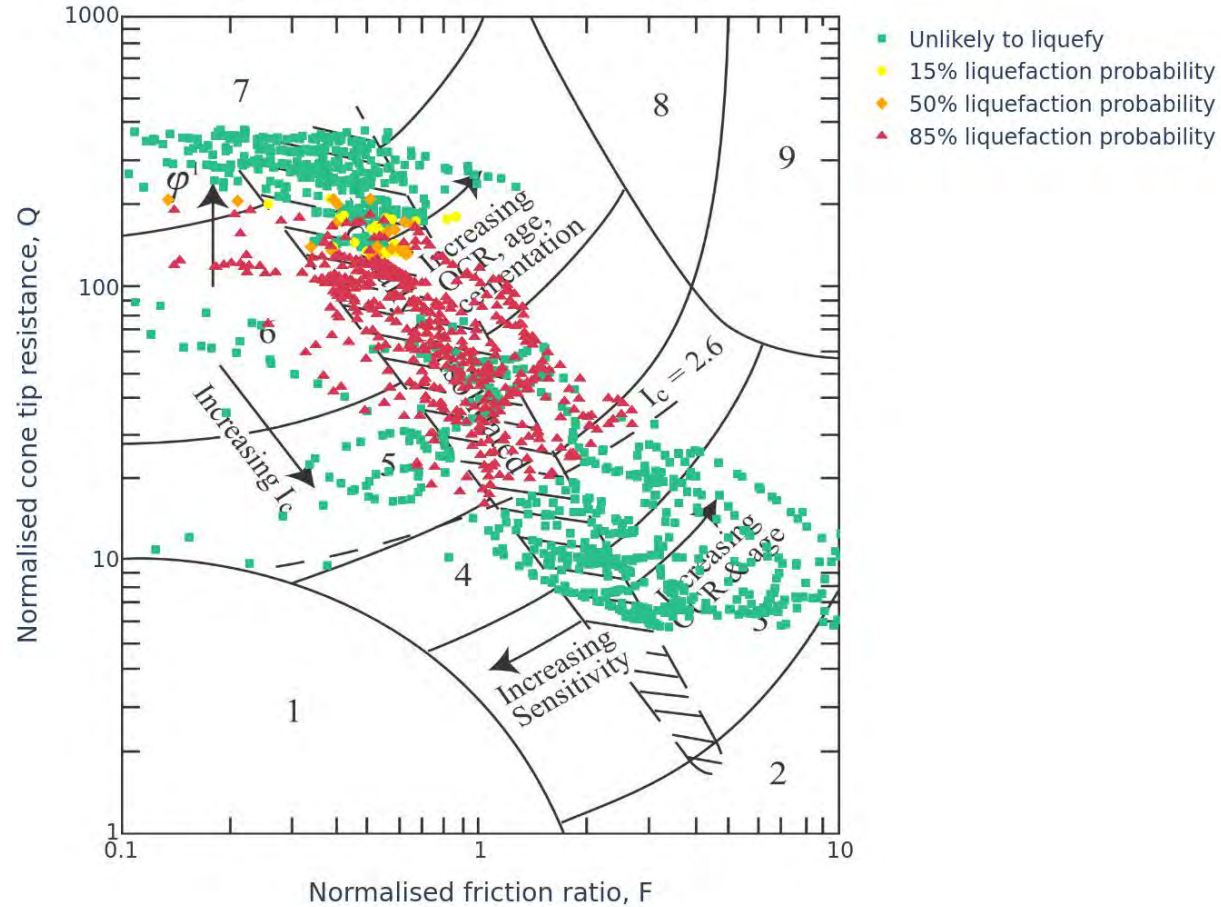
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	122	5.7	19	17	2.1	12
50%	118	5.3	16	16	2.1	10
85%	114	5.1	14	15	2.1	9

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 16/27

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



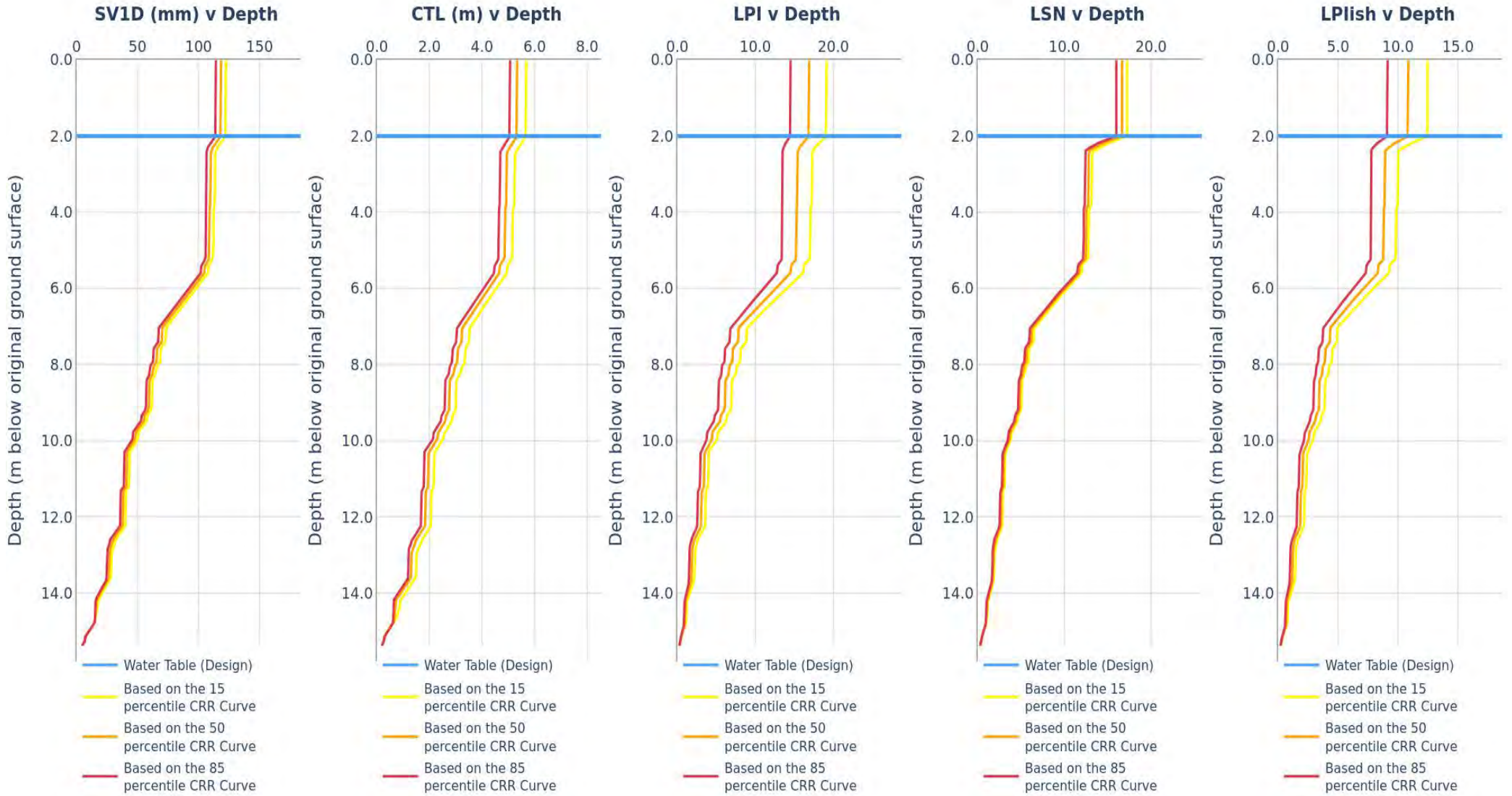
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 17/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

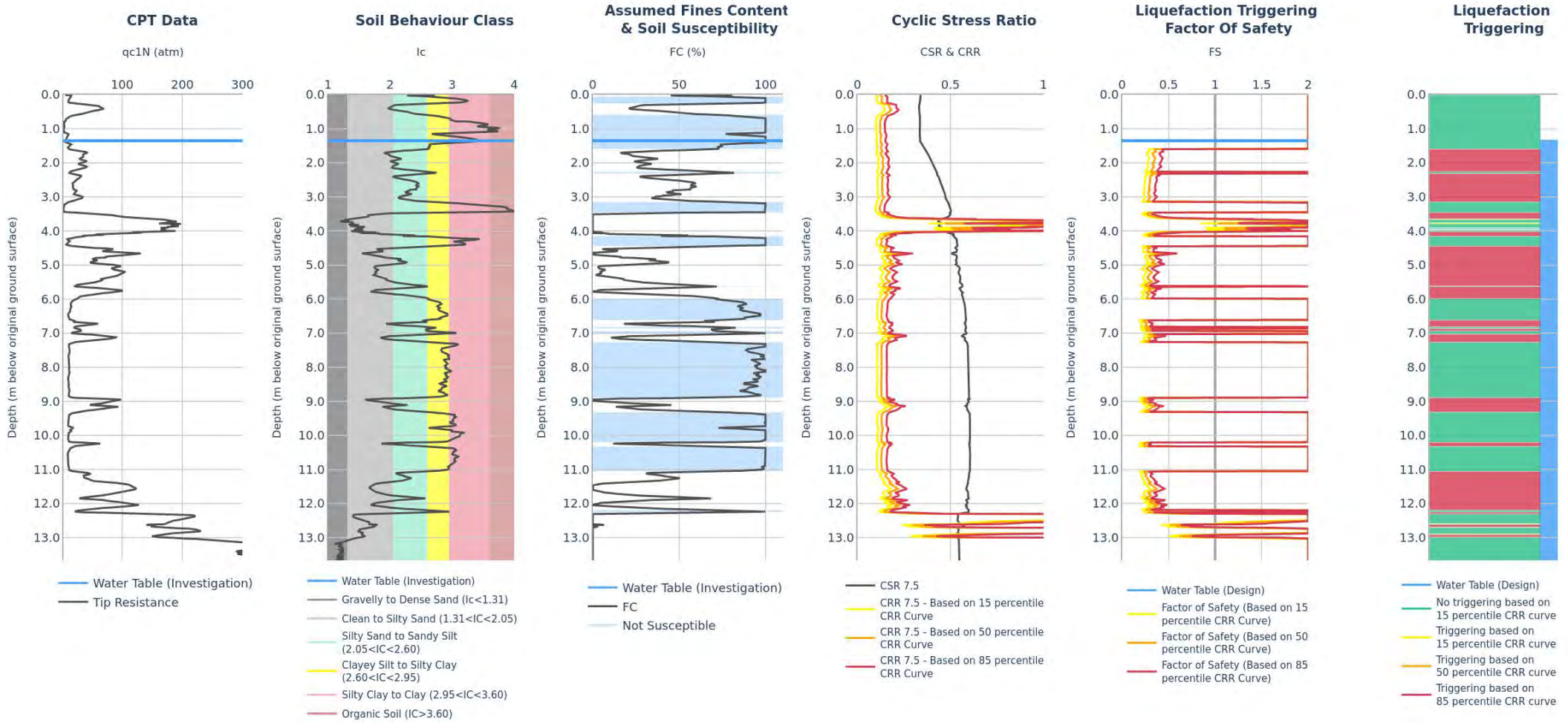


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT421	CPT_TT262868	05/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 18/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT422	CPT_TT262869	10/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

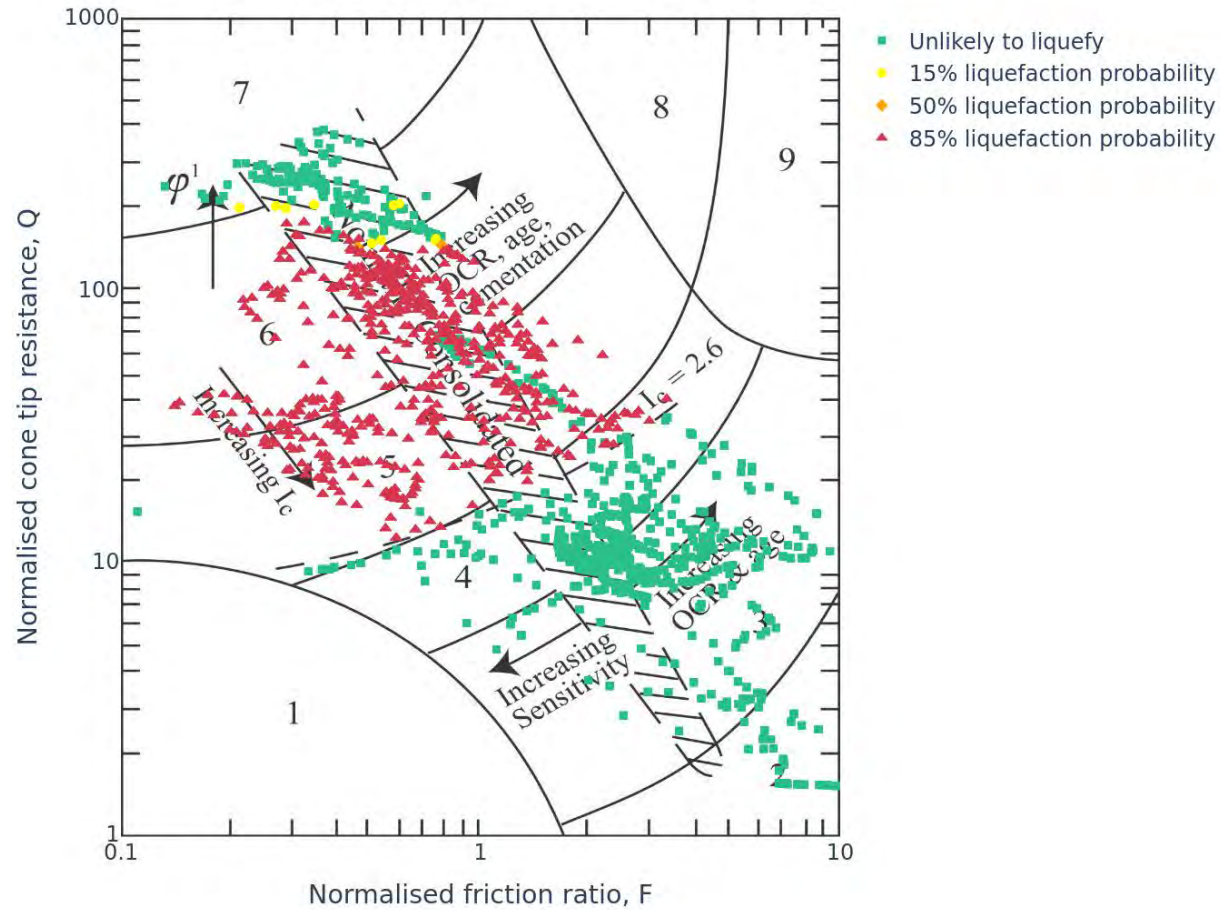
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	147	5.9	29	35	1.7	24
50%	146	5.8	26	35	1.7	22
85%	144	5.7	24	34	1.7	20

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



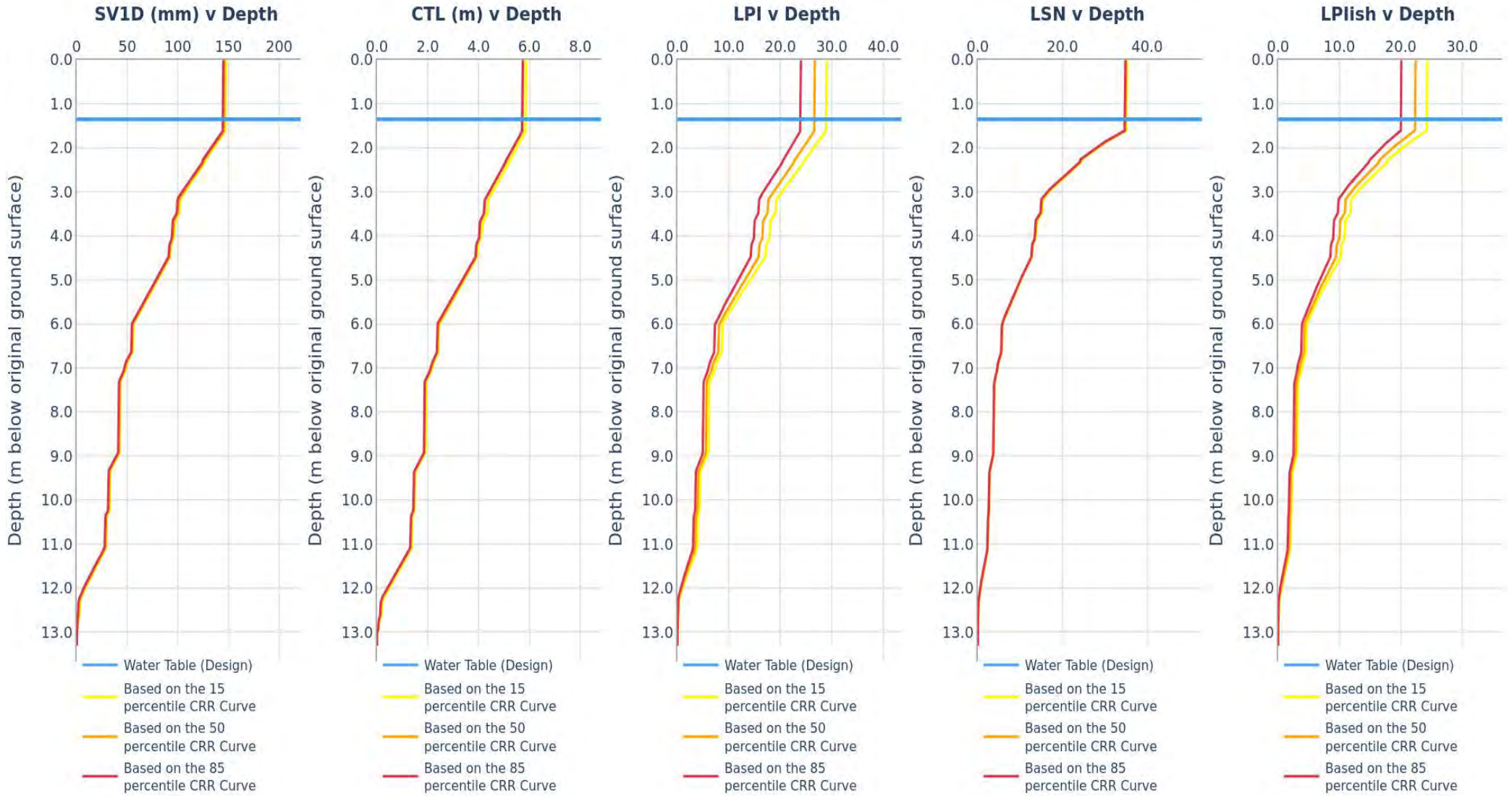
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 20/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

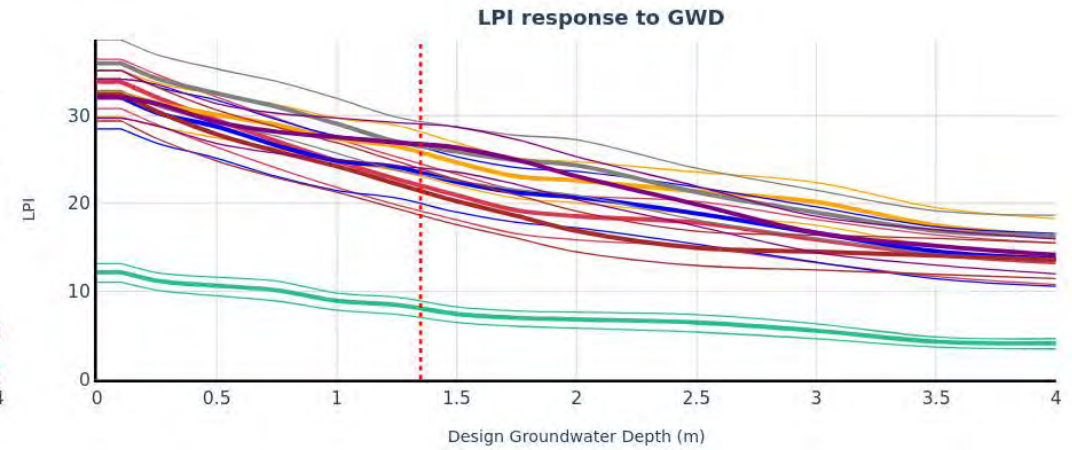
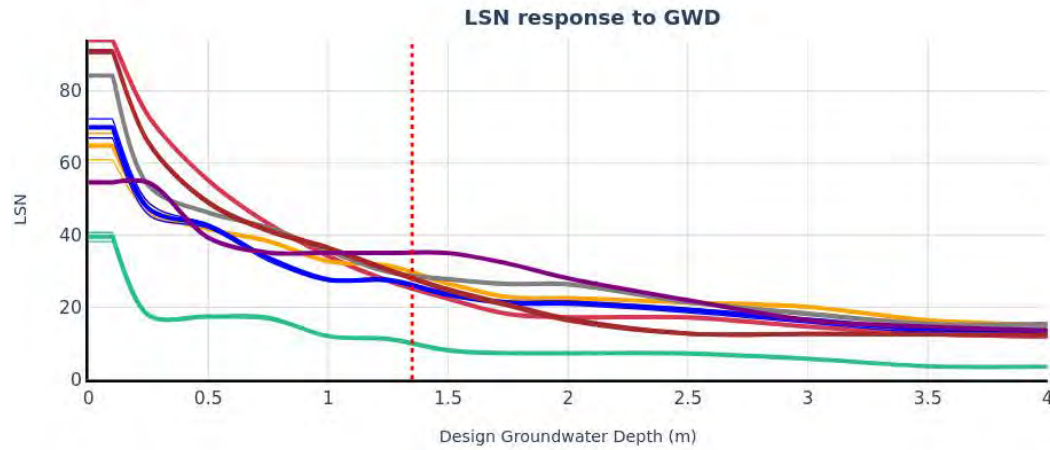
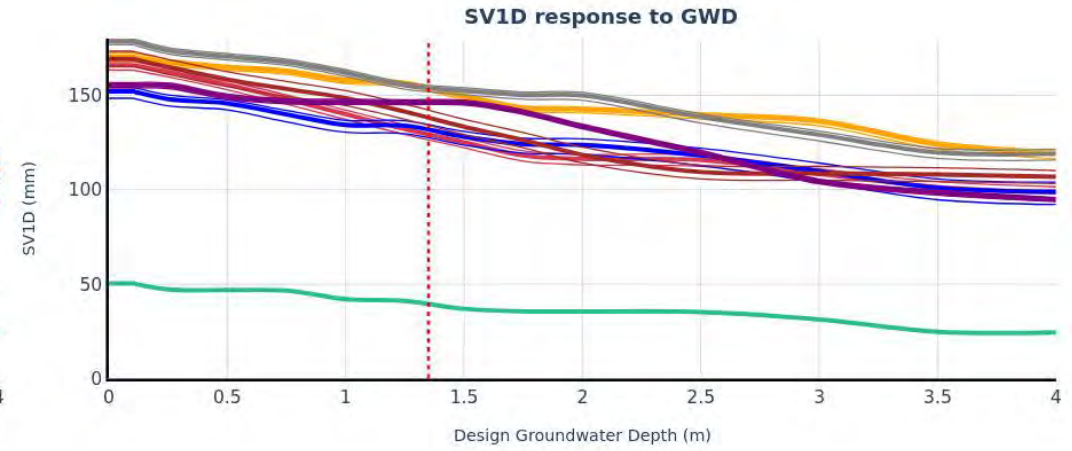
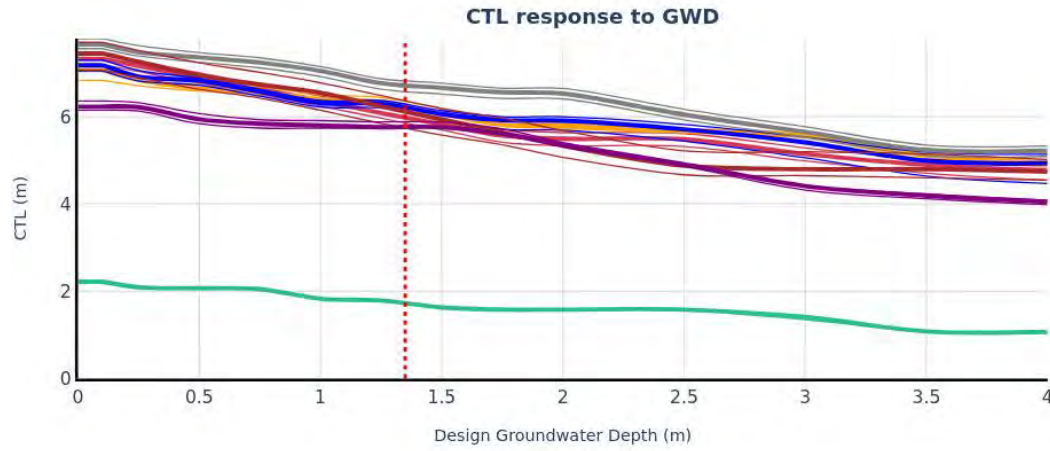


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT422	CPT_TT262869	10/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 21/27

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



**Input**

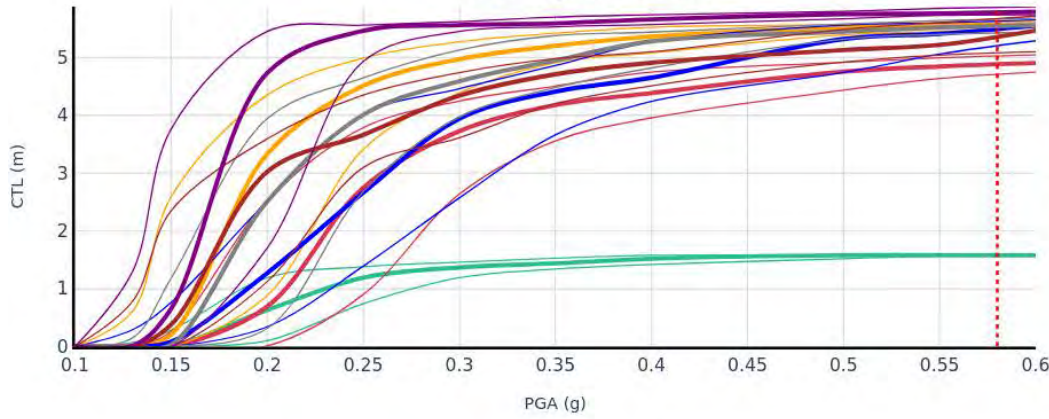
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT415	CPT_TT262861	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT416	CPT_TT262862	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT417	CPT_TT262863	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT417a	CPT_TT262864	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT418	CPT_TT262865	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT421	CPT_TT262868	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT422	CPT_TT262869	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

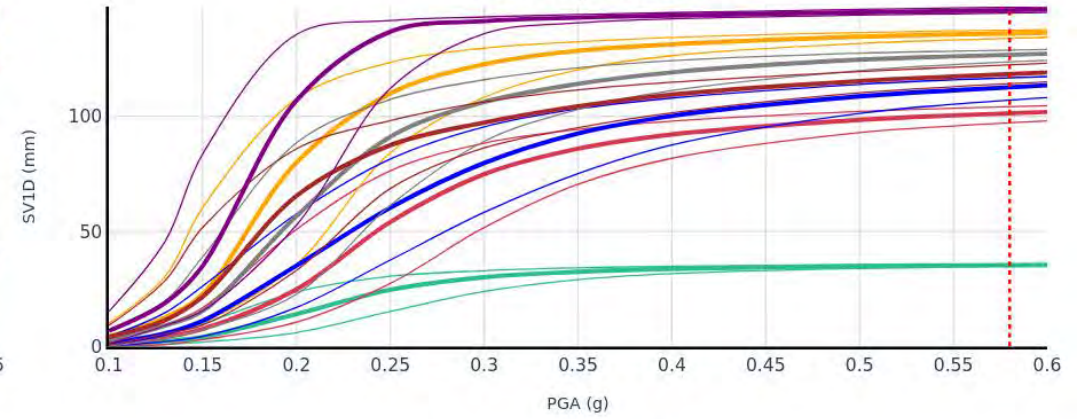
	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 22/27

# PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

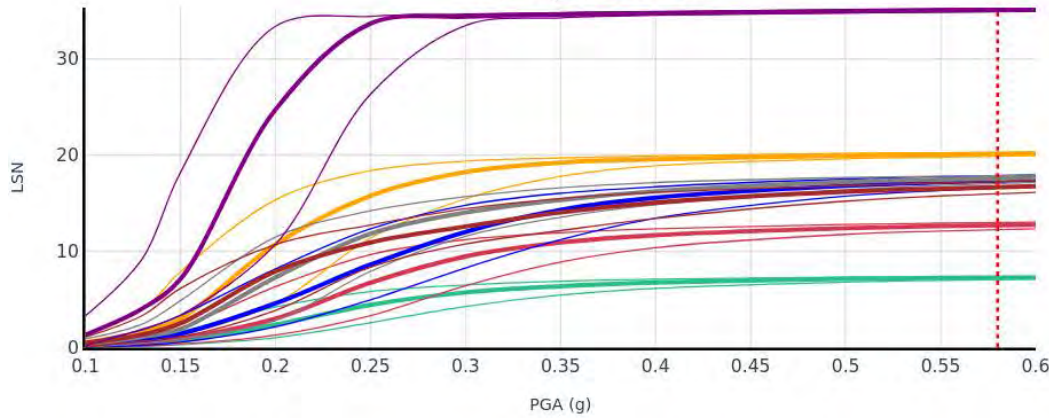
CTL response to PGA



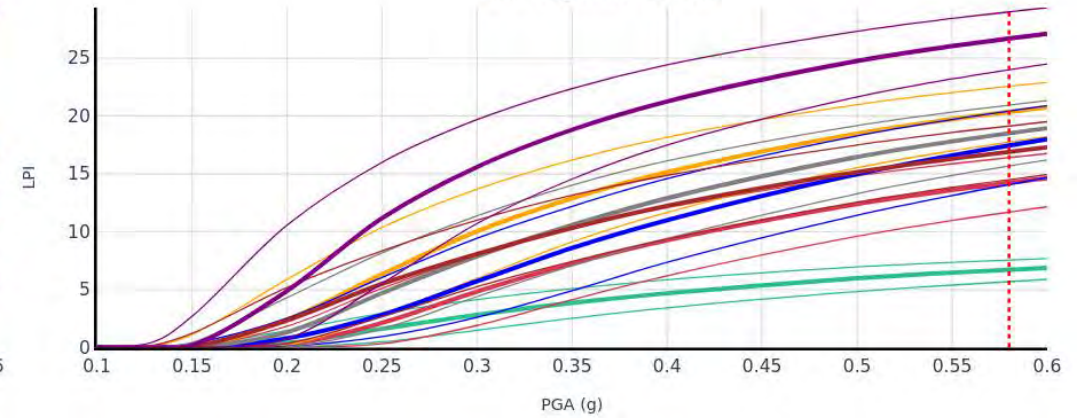
SVID response to PGA



LSN response to PGA




LPI response to PGA



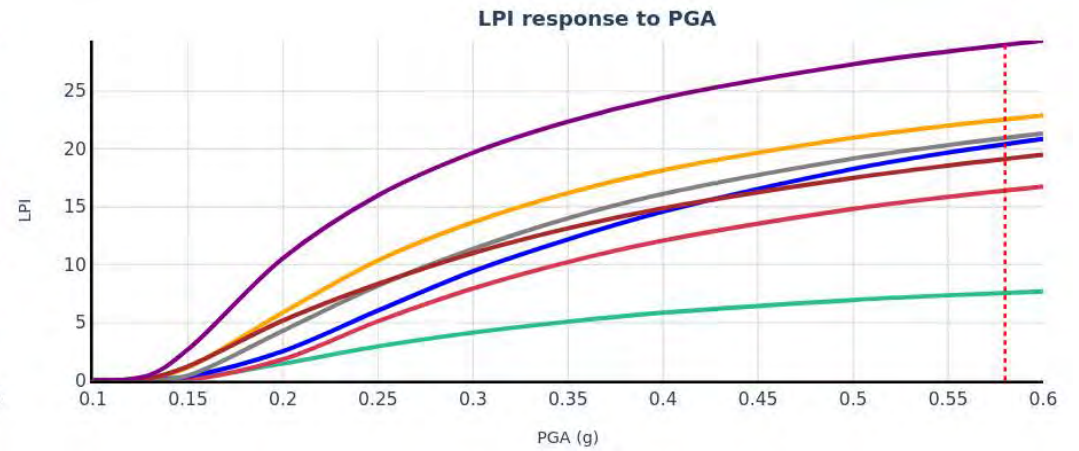
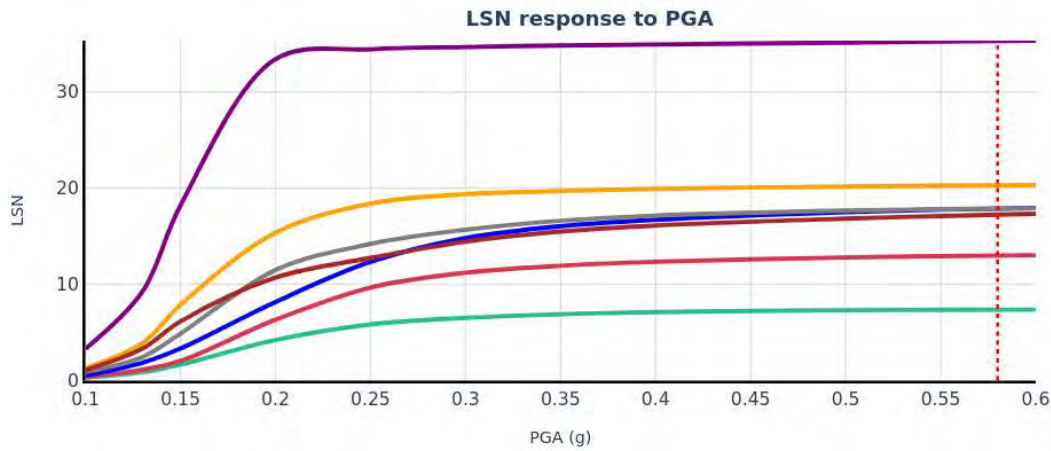
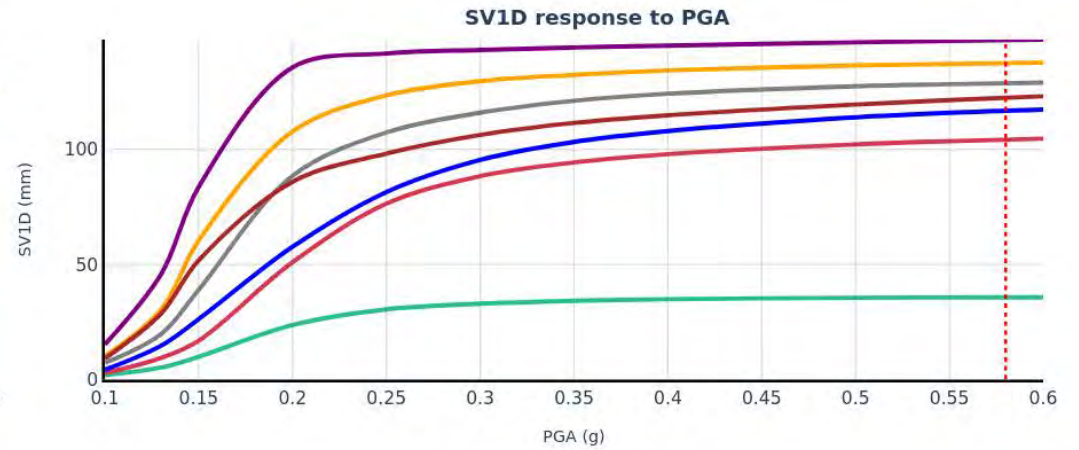
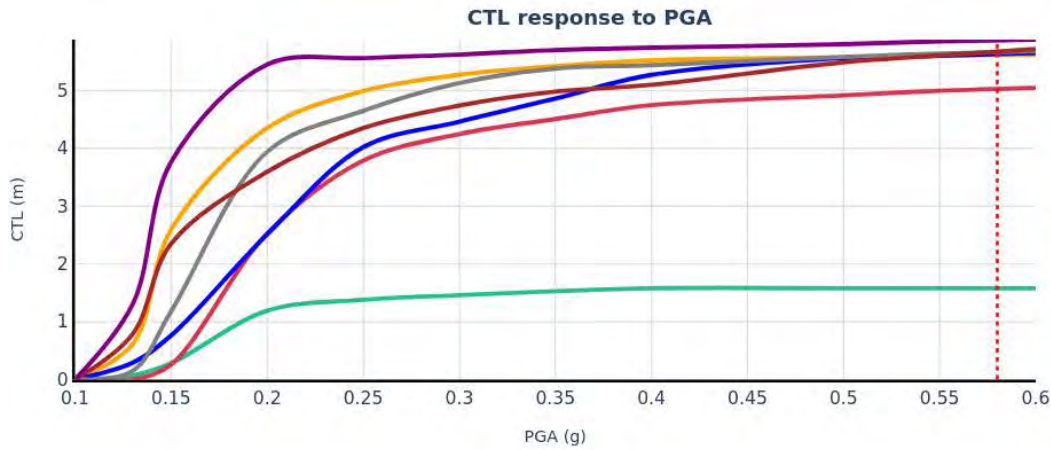
Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT415	CPT_TT262861	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT416	CPT_TT262862	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT417	CPT_TT262863	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT417a	CPT_TT262864	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT418	CPT_TT262865	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT421	CPT_TT262868	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT422	CPT_TT262869	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 23/27

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT415	CPT_TT262861	03/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT416	CPT_TT262862	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT417	CPT_TT262863	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT417a	CPT_TT262864	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT418	CPT_TT262865	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT421	CPT_TT262868	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT422	CPT_TT262869	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 24/27

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262861	TTGD 262862	TTGD 262863
CPT Name	CPT_TT262861_Raw01	CPT_TT262862_Raw01	CPT_TT262863_Raw01
Run Description	CPT415	CPT416	CPT417
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.15	3.5	2.85
Depth to groundwater for design (m)	2.15	3.5	2.85
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	7.755	16.211	14.988
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	7.755	16.211	14.988
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262861	CPT415	0.0	0.0	0.0
TTGD 262861	CPT415	0.0	7.76	2.6
TTGD 262862	CPT416	0.0	0.0	0.0
TTGD 262862	CPT416	0.0	16.21	2.6
TTGD 262863	CPT417	0.0	0.0	0.0
TTGD 262863	CPT417	0.0	14.99	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262861	CPT415	0.0	7.76	0.0 CFC
TTGD 262862	CPT416	0.0	16.21	0.0 CFC
TTGD 262863	CPT417	0.0	14.99	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262861	CPT415	0.0	0.0001	18.0
TTGD 262861	CPT415	0.0001	7.76	18.0
TTGD 262862	CPT416	0.0	0.0001	18.0
TTGD 262862	CPT416	0.0001	16.21	18.0
TTGD 262863	CPT417	0.0	0.0001	18.0
TTGD 262863	CPT417	0.0001	14.99	18.0

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 25/27

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262864	TTGD 262865	TTGD 262868
CPT Name	CPT_TT262864_Raw01	CPT_TT262865_Raw01	CPT_TT262868_Raw01
Run Description	CPT417a	CPT418	CPT421
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.8	3.1	2.0
Depth to groundwater for design (m)	2.8	3.1	2.0
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	14.748	16.273	15.791
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	14.748	16.273	15.791
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262864	CPT417a	0.0	0.0	0.0
TTGD 262864	CPT417a	0.0	14.75	2.6
TTGD 262865	CPT418	0.0	0.0	0.0
TTGD 262865	CPT418	0.0	16.27	2.6
TTGD 262868	CPT421	0.0	0.0	0.0
TTGD 262868	CPT421	0.0	15.79	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262864	CPT417a	0.0	14.75	0.0 CFC
TTGD 262865	CPT418	0.0	16.27	0.0 CFC
TTGD 262868	CPT421	0.0	15.79	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262864	CPT417a	0.0	0.0001	18.0
TTGD 262864	CPT417a	0.0001	14.75	18.0
TTGD 262865	CPT418	0.0	0.0001	18.0
TTGD 262865	CPT418	0.0001	16.27	18.0
TTGD 262868	CPT421	0.0	0.0001	18.0
TTGD 262868	CPT421	0.0001	15.79	18.0

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 26/27

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262869
CPT Name	CPT_TT262869_Raw01
Run Description	CPT422
EQ PGA (g)	0.58
EQ Magnitude	7.1
Depth to groundwater at time of Investigation (m)	1.35
Depth to groundwater for design (m)	1.35
Pre-drill depth (m)	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	13.667
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	13.667
Inverse filtering applied?	No
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262869	CPT422	0.0	0.0	0.0
TTGD 262869	CPT422	0.0	13.67	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

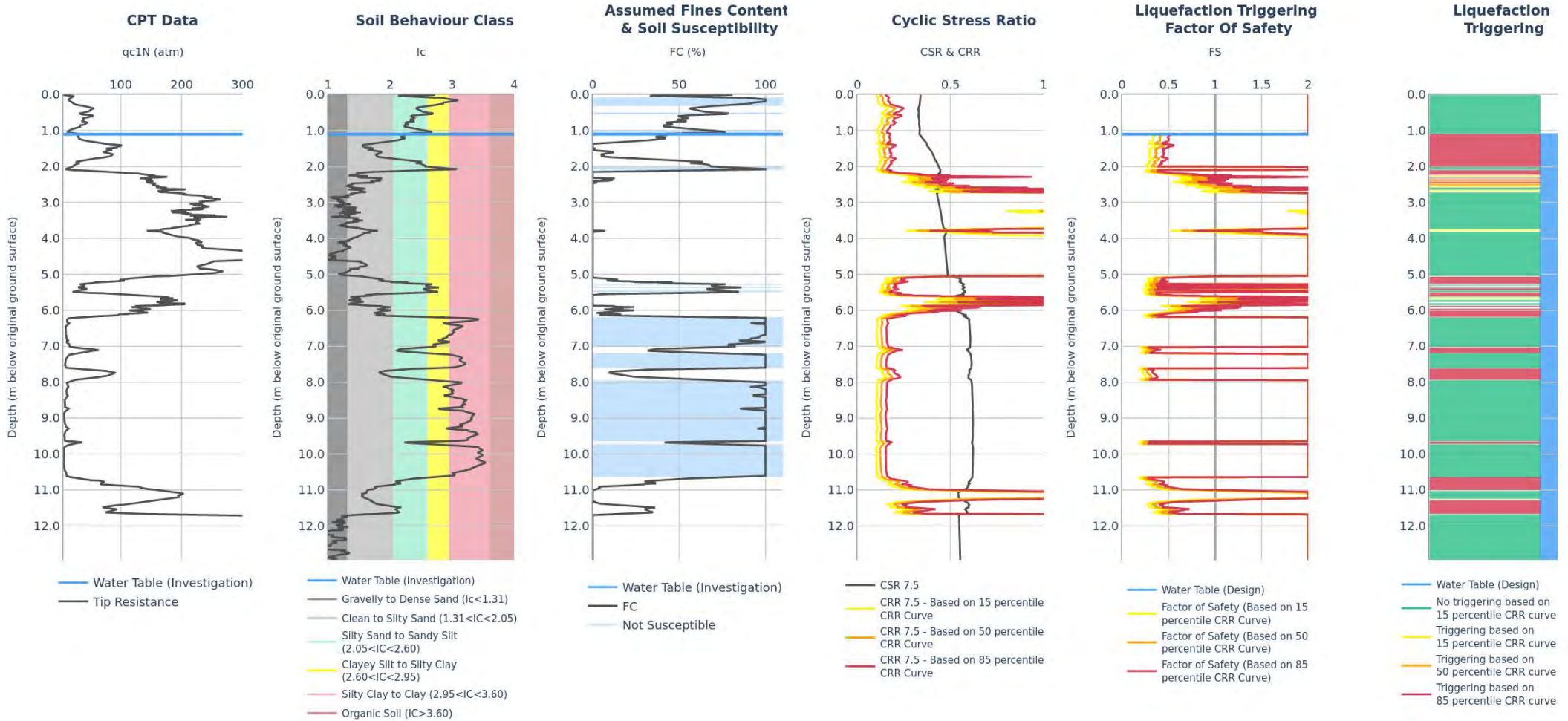
ID	Run description	From (m)	To (m)	Fc
TTGD 262869	CPT422	0.0	13.67	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262869	CPT422	0.0	0.0001	18.0
TTGD 262869	CPT422	0.0001	13.67	18.0

	CLIENT	HBRC	LOCATION	Pakowhai Hawkes Bay	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 27/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT423	CPT_TT262870	10/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

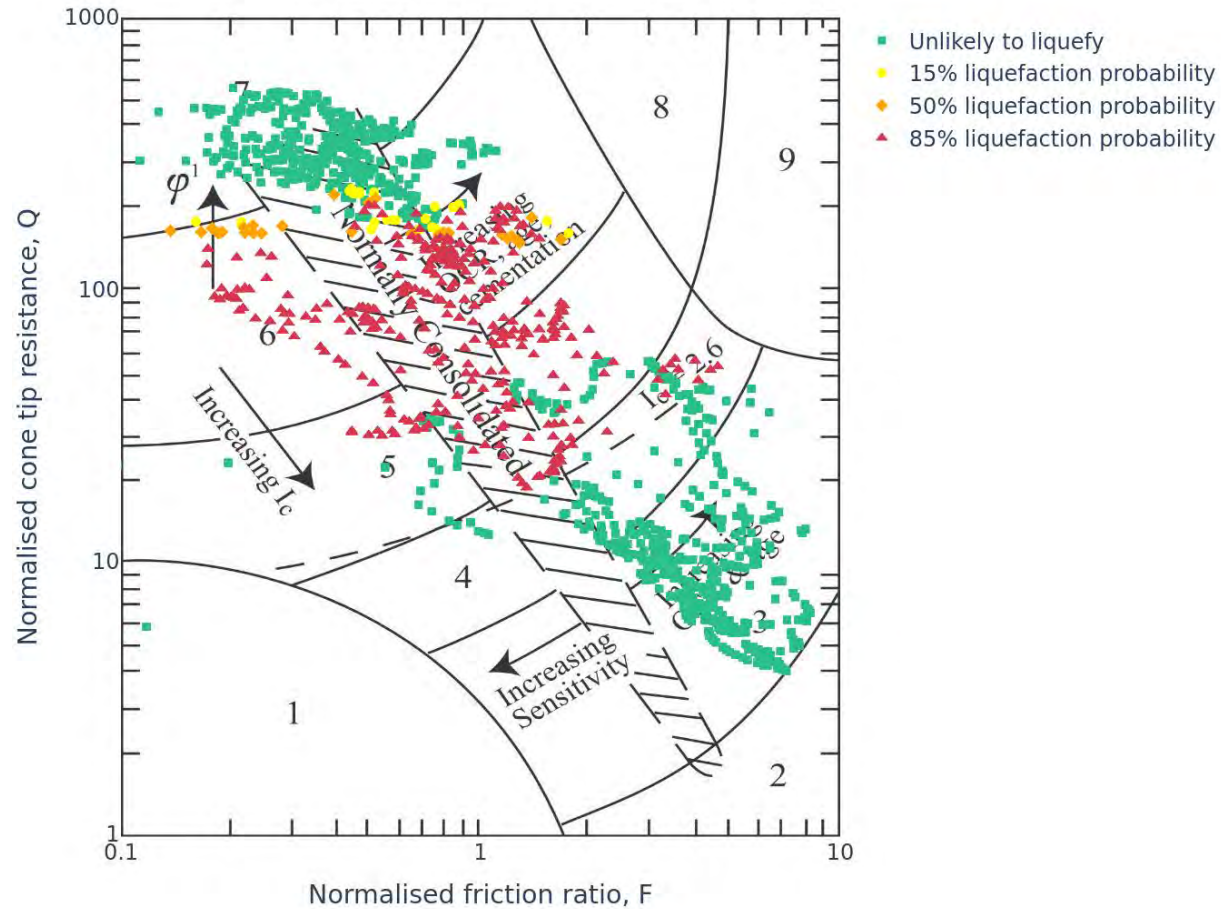
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	77	3.7	15	25	1.2	17
50%	74	3.4	13	24	1.2	15
85%	70	3.2	11	24	1.2	12

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



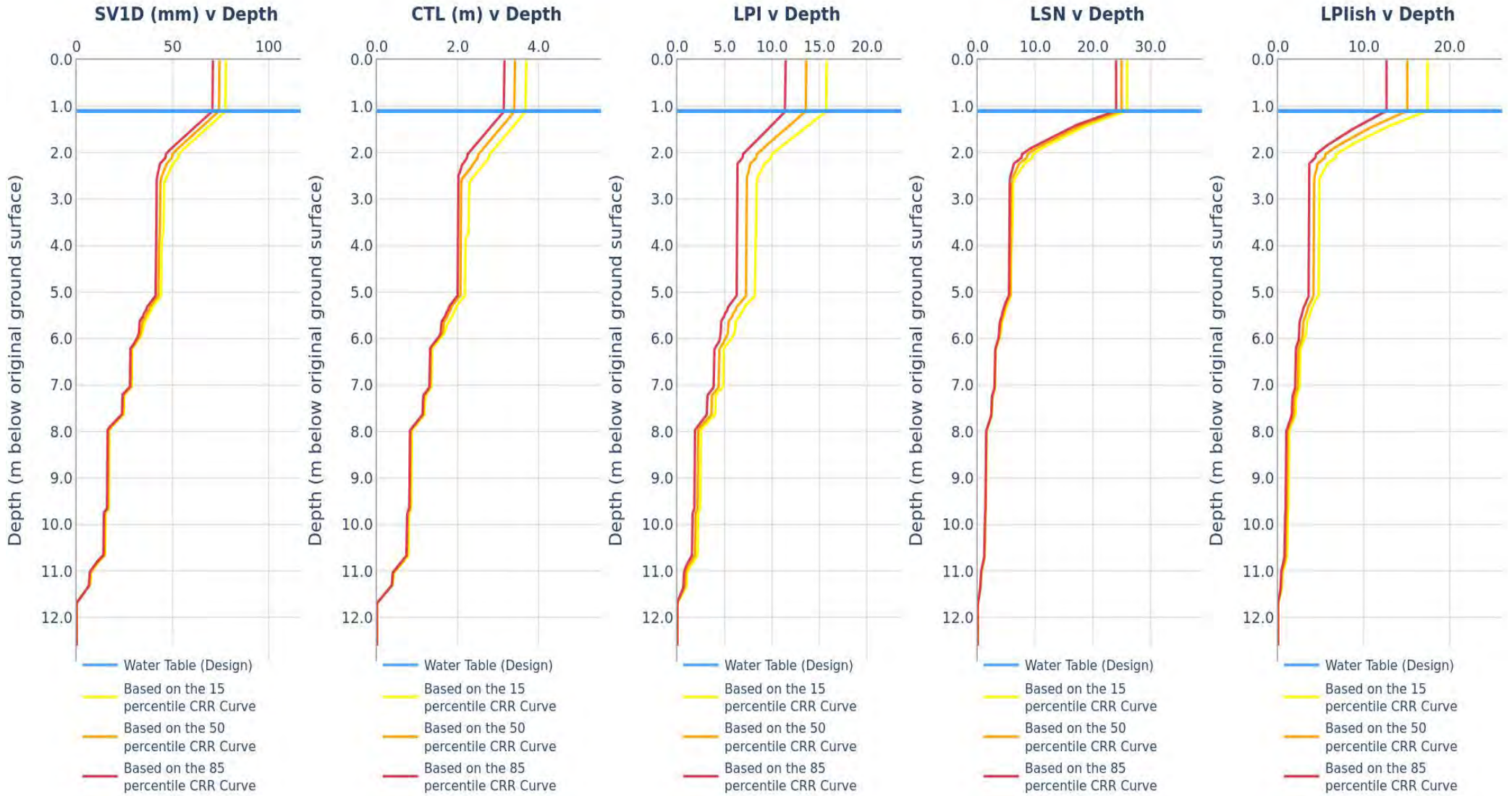
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 2/17

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

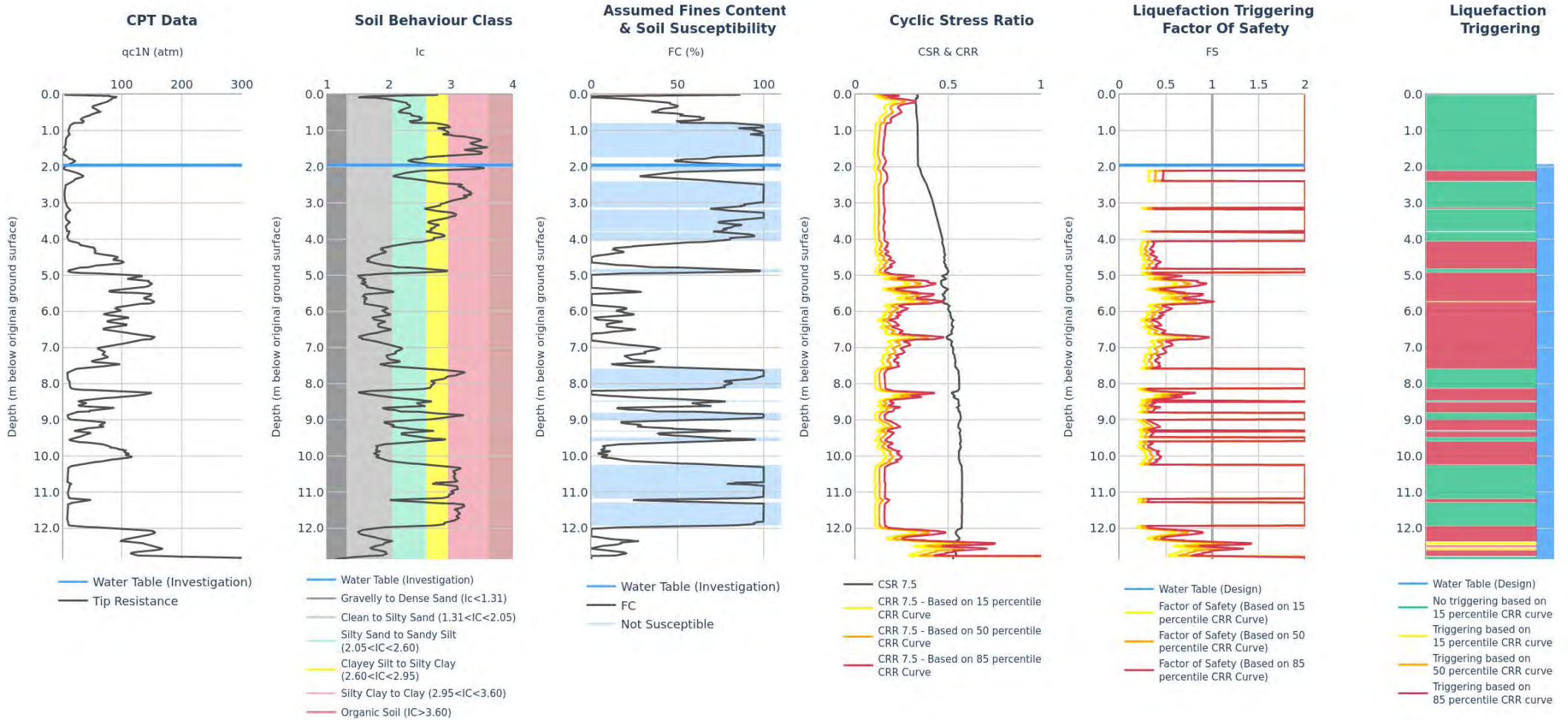


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT423	CPT_TT262870	10/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/17

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT419	CPT_TT262866	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

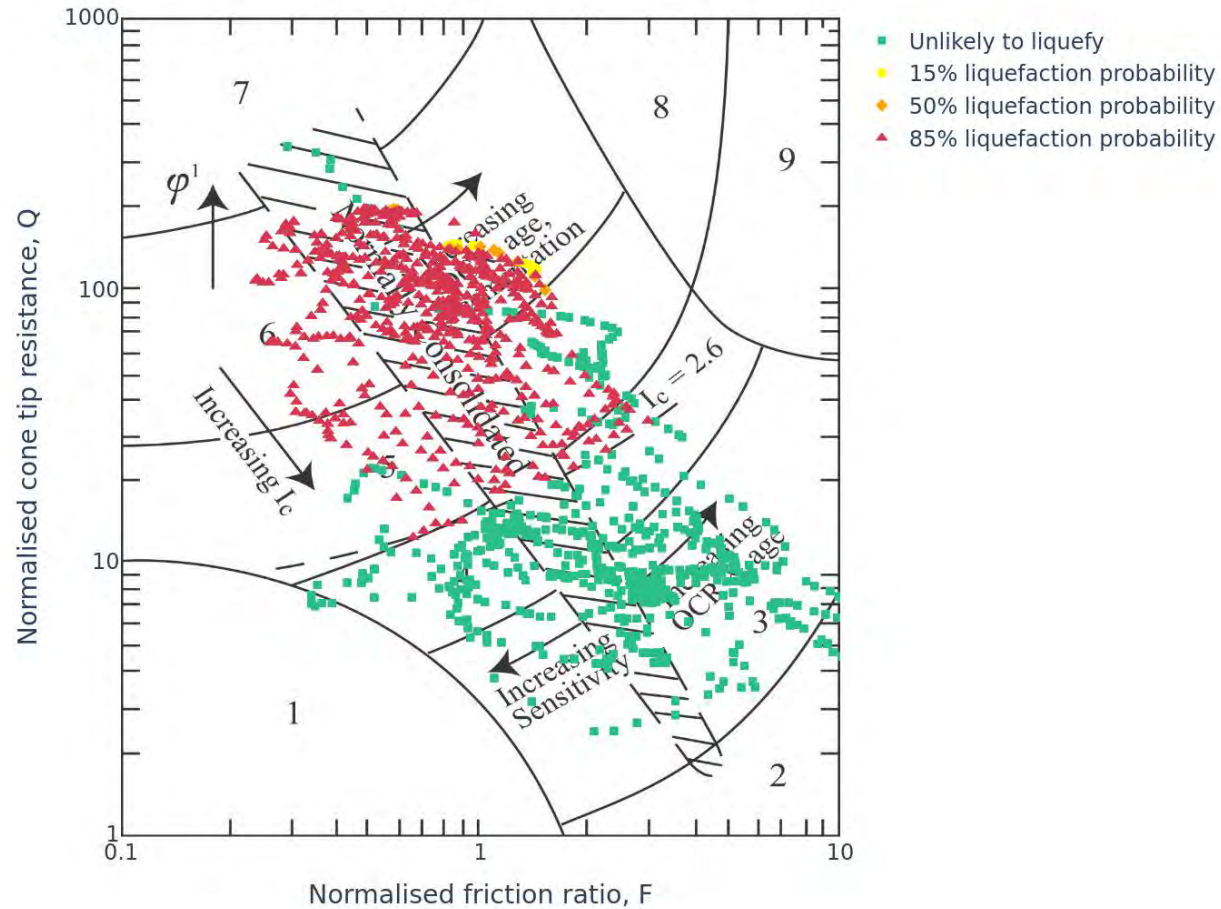
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	140	6.5	26	23	2.2	17
50%	137	6.3	23	22	2.2	15
85%	132	6.2	19	22	2.2	12

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 4/17

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



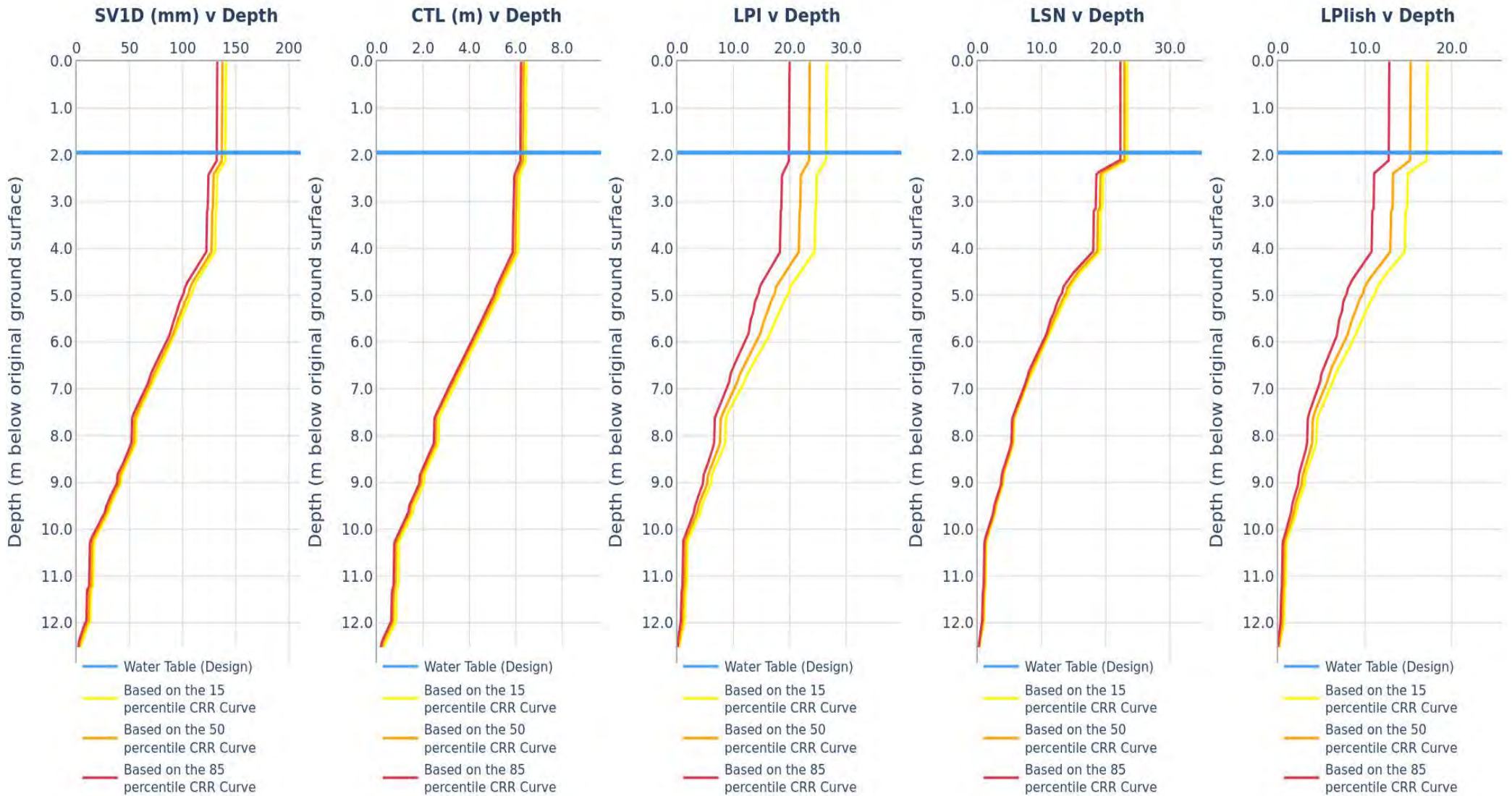
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 5/17

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

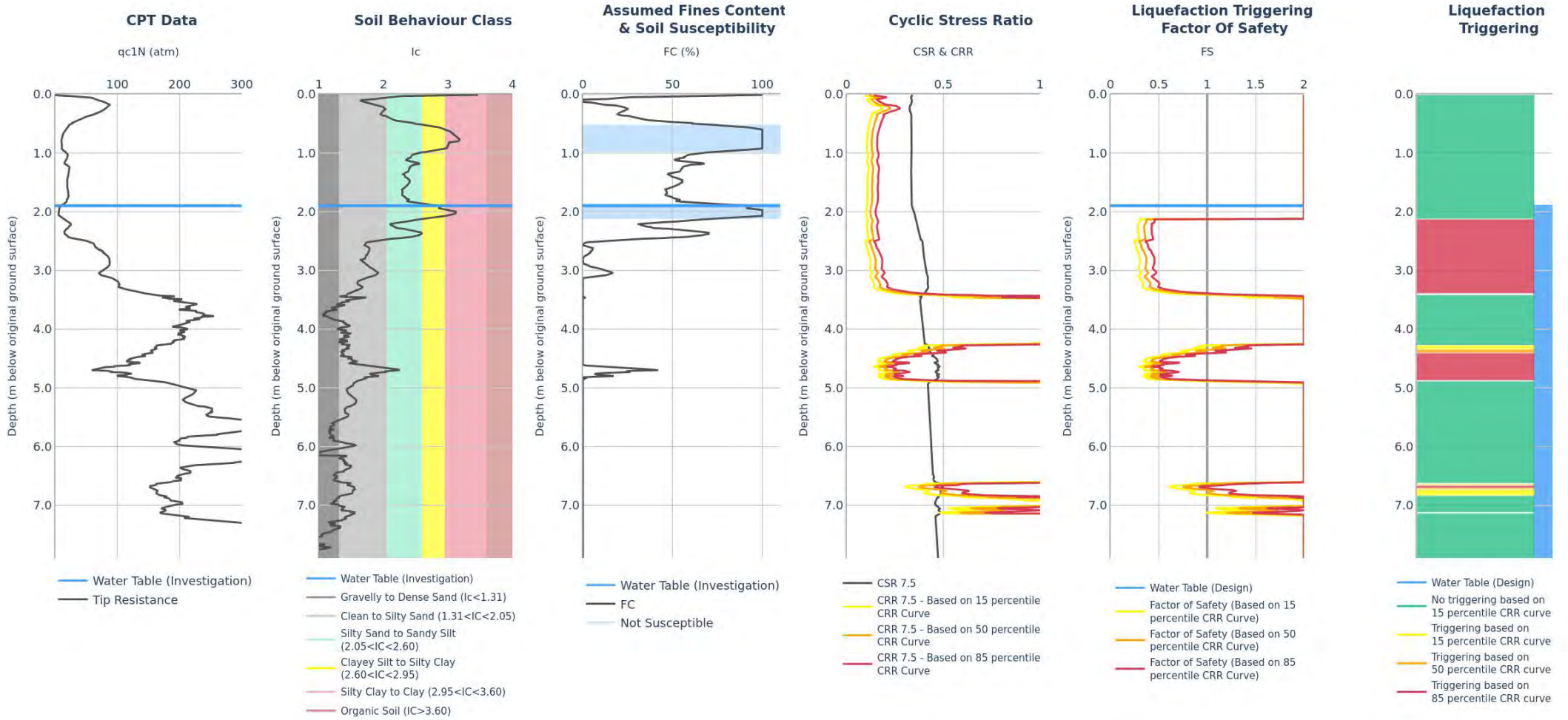


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT419	CPT_TT262866	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/17

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT420	CPT_TT262867	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

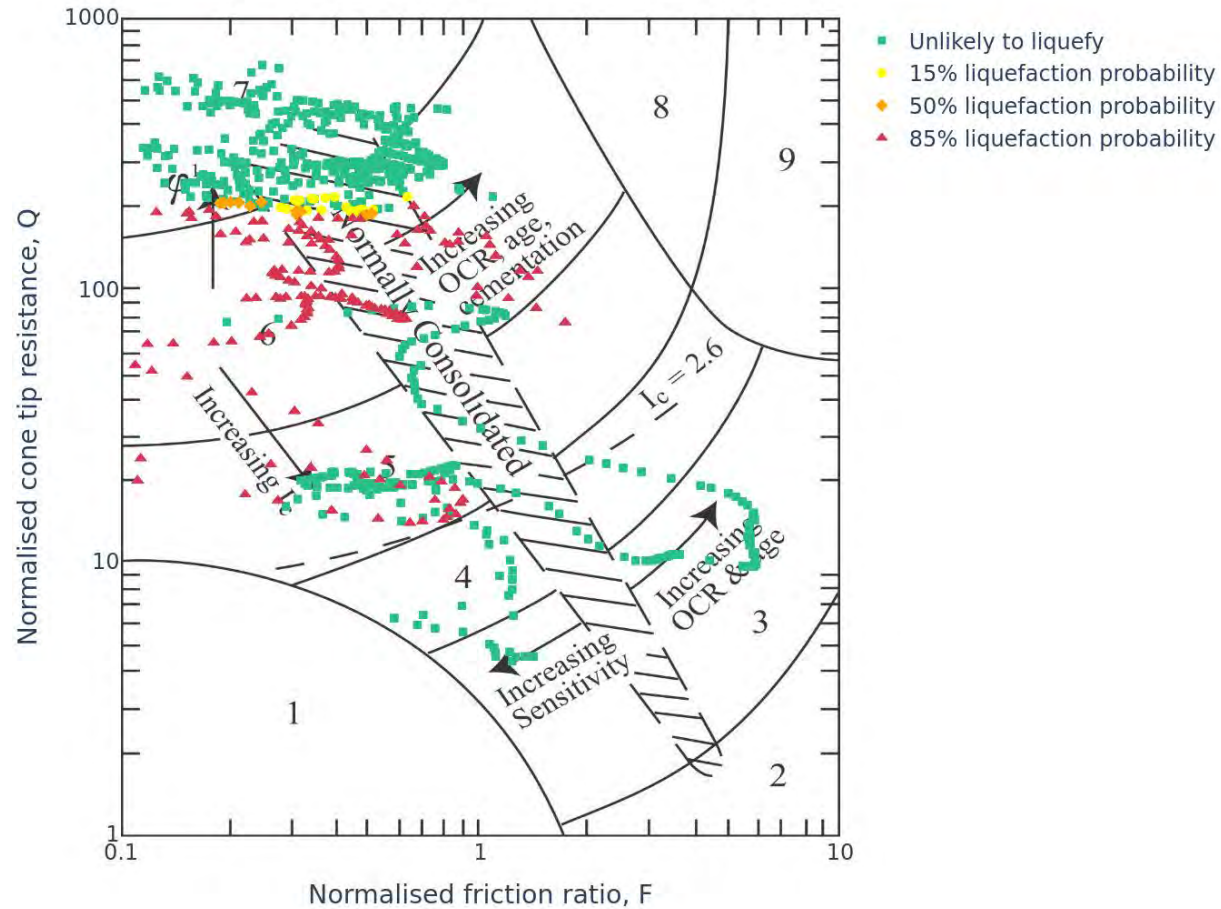
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	48	2.1	10	16	2.2	10
50%	46	1.9	8	15	2.2	8
85%	44	1.8	7	15	2.2	7

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 7/17

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



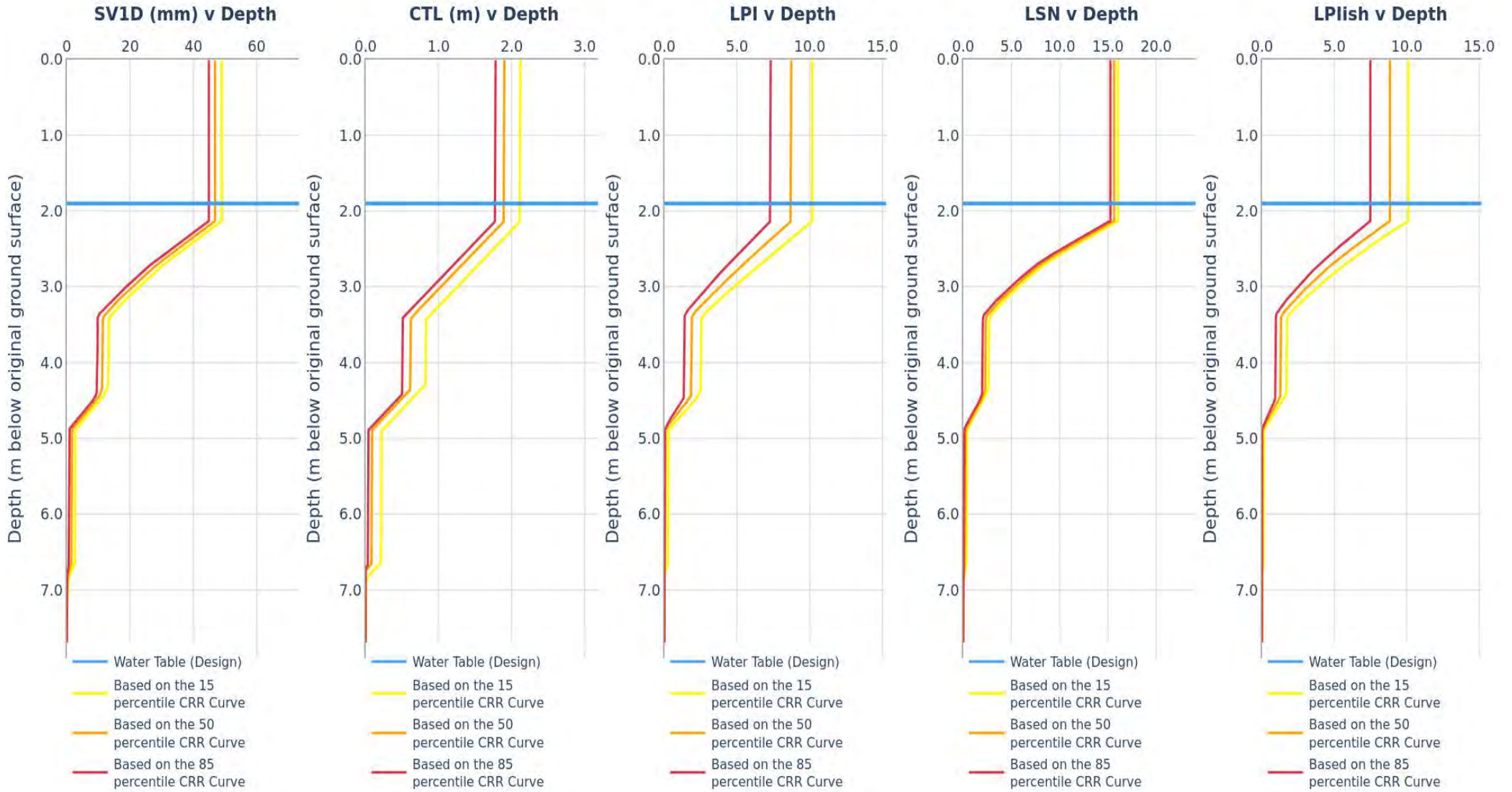
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 8/17

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

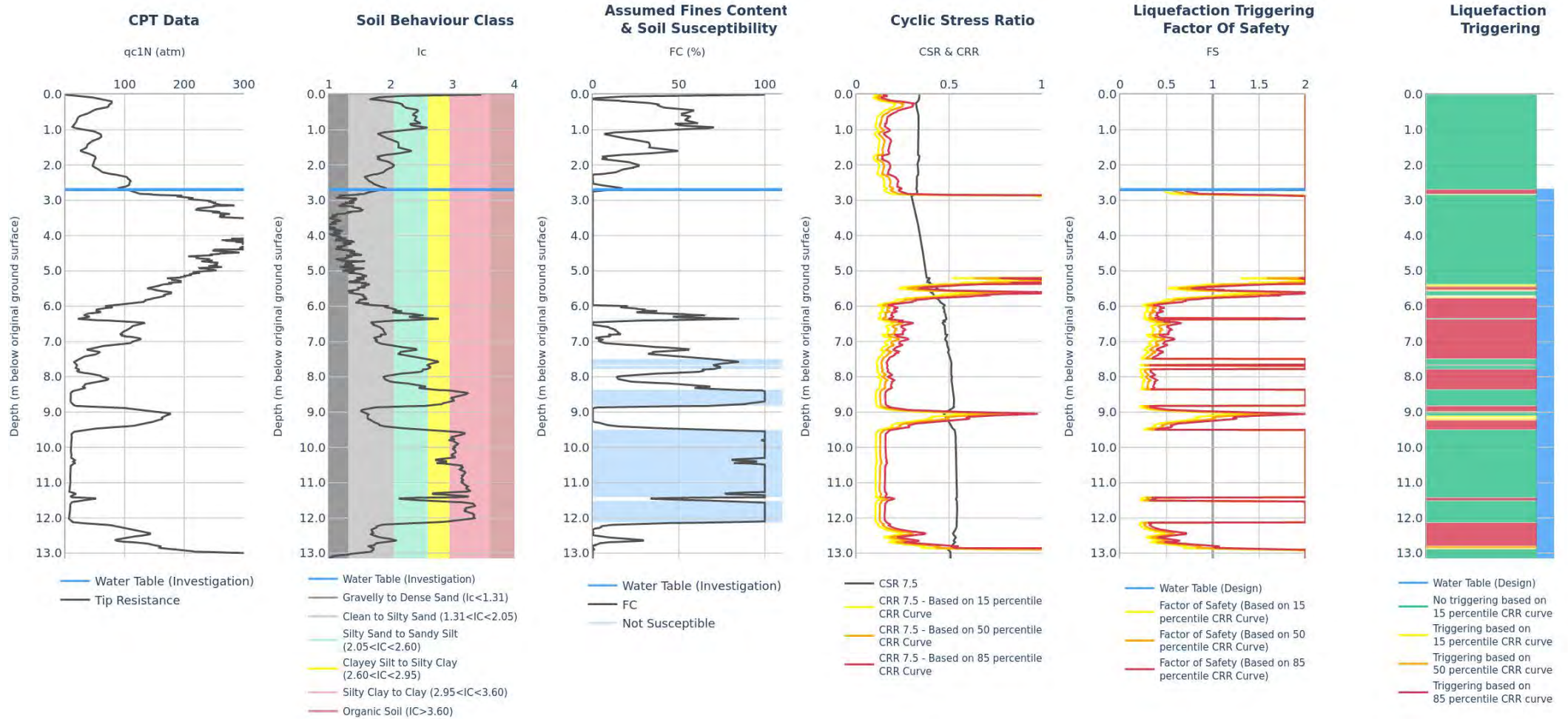


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT420	CPT_TT262867	04/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/17

## CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT424	CPT_TT262871	05/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

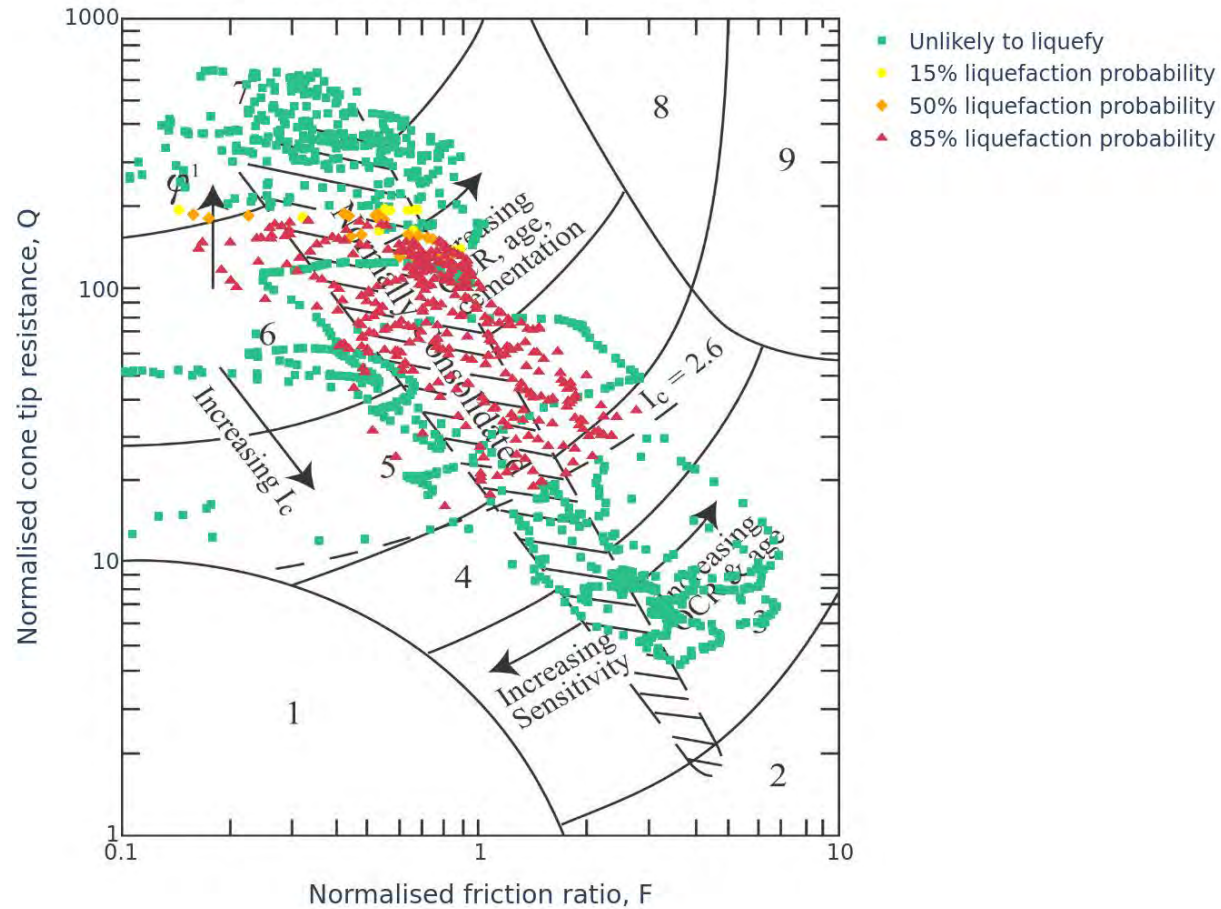
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	86	4.1	14	11	2.8	8
50%	83	3.9	12	11	2.8	7
85%	80	3.7	10	10	2.8	6

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 10/17

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



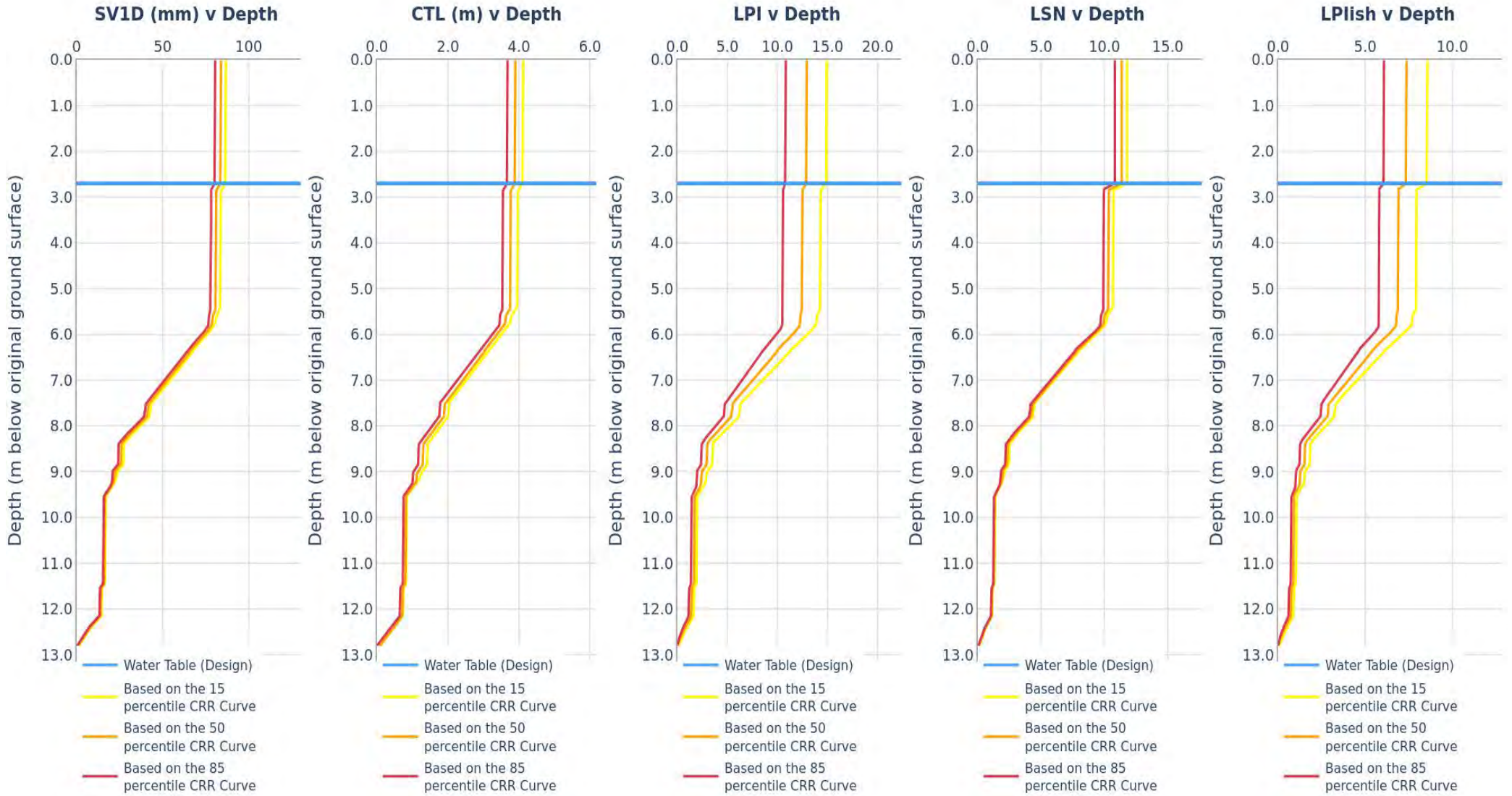
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Secondary Stopbank Design			
	COMMENT	nan			Page 11/17

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



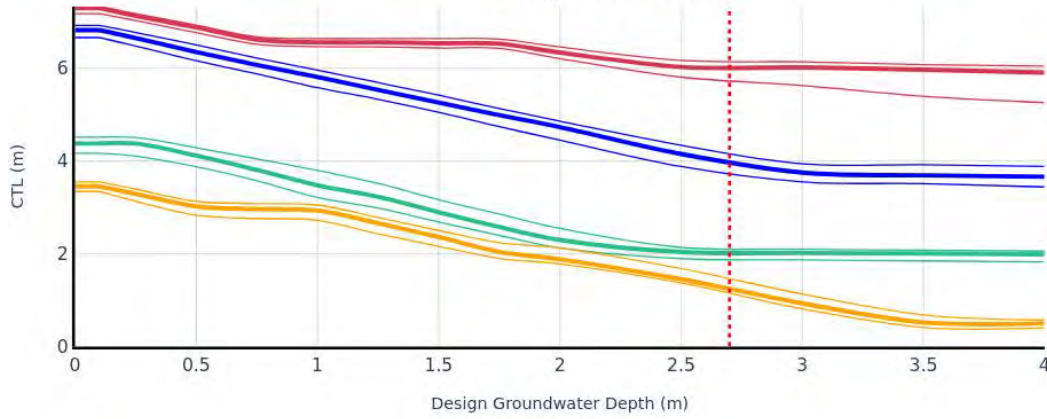
Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT424	CPT_TT262871	05/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

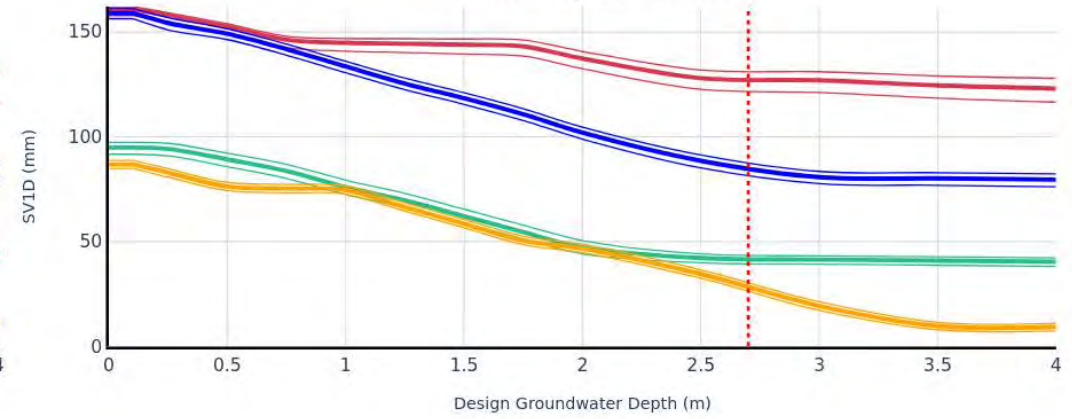
	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/17

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

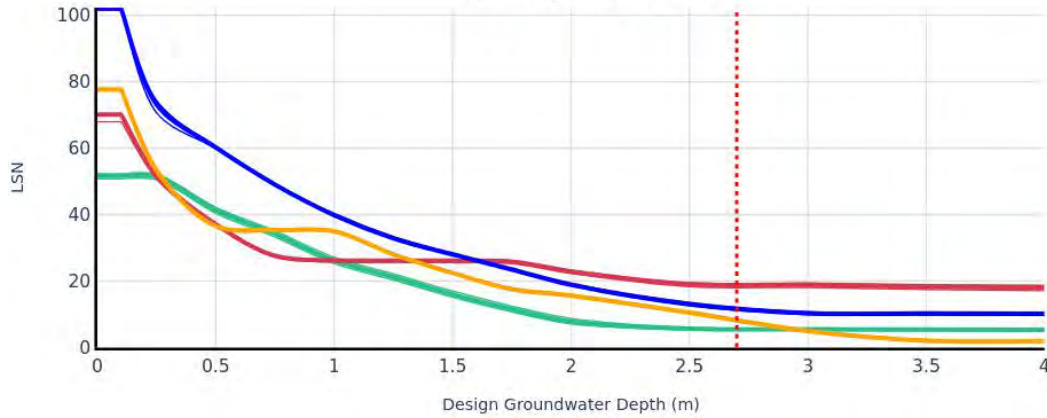
**CTL response to GWD**



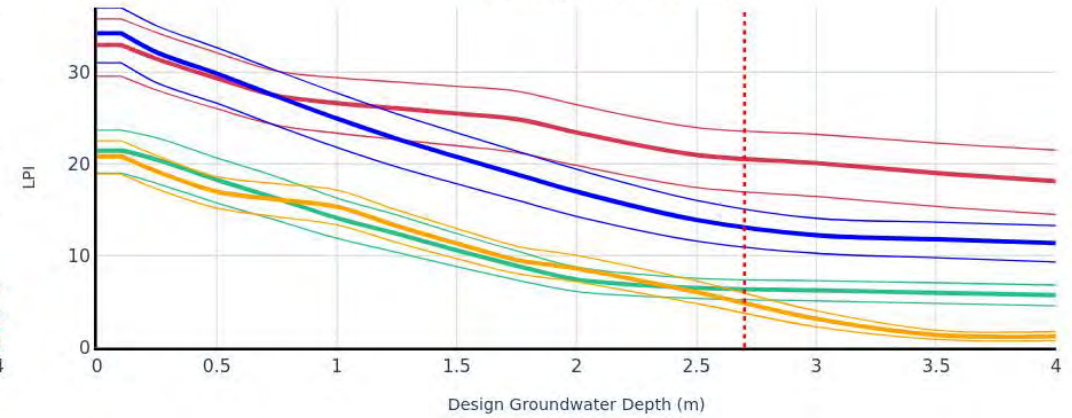
**SV1D response to GWD**



**LSN response to GWD**




**LPI response to GWD**



**Input**

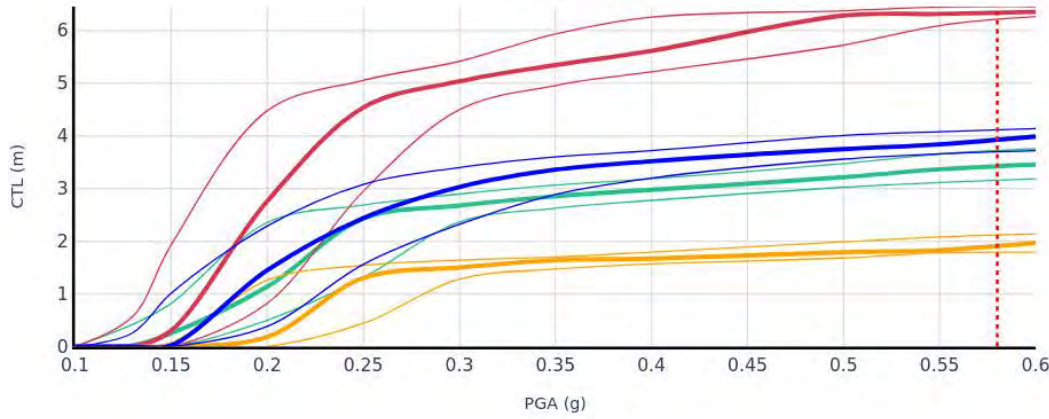
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT423	CPT_TT262870	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT419	CPT_TT262866	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT420	CPT_TT262867	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT424	CPT_TT262871	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

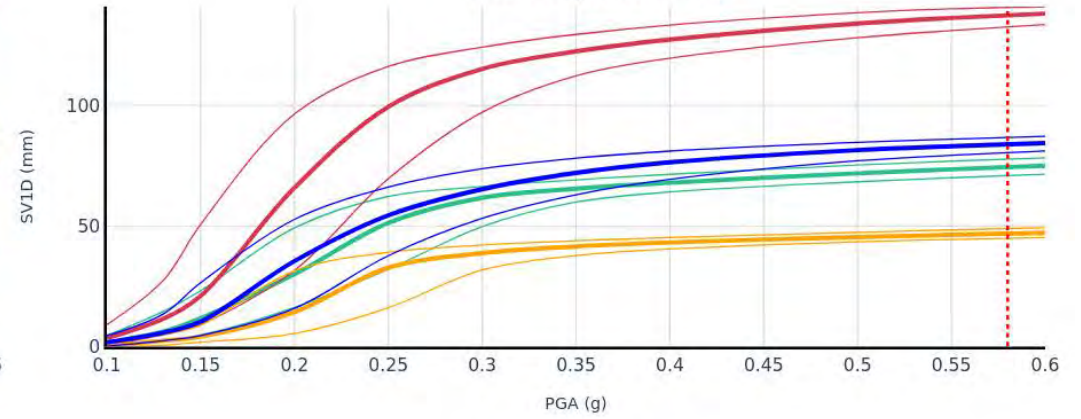
	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 13/17

## PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

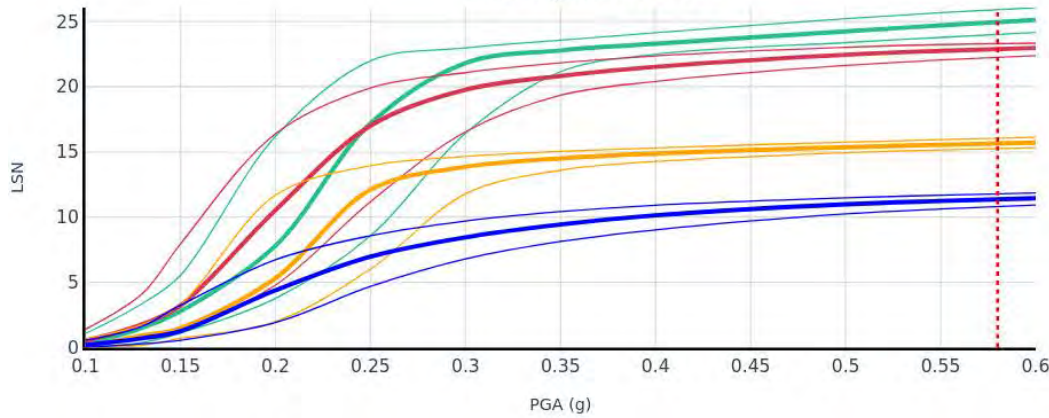
**CTL response to PGA**



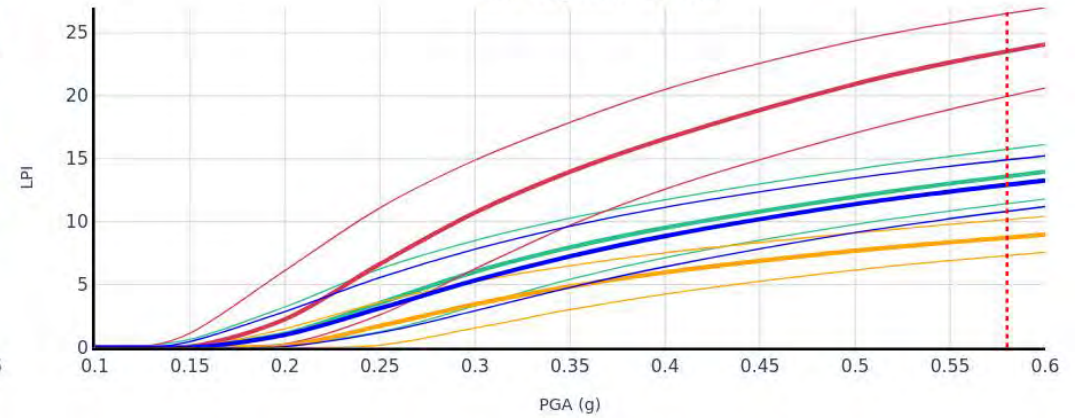
**SVID response to PGA**



**LSN response to PGA**



**LPI response to PGA**



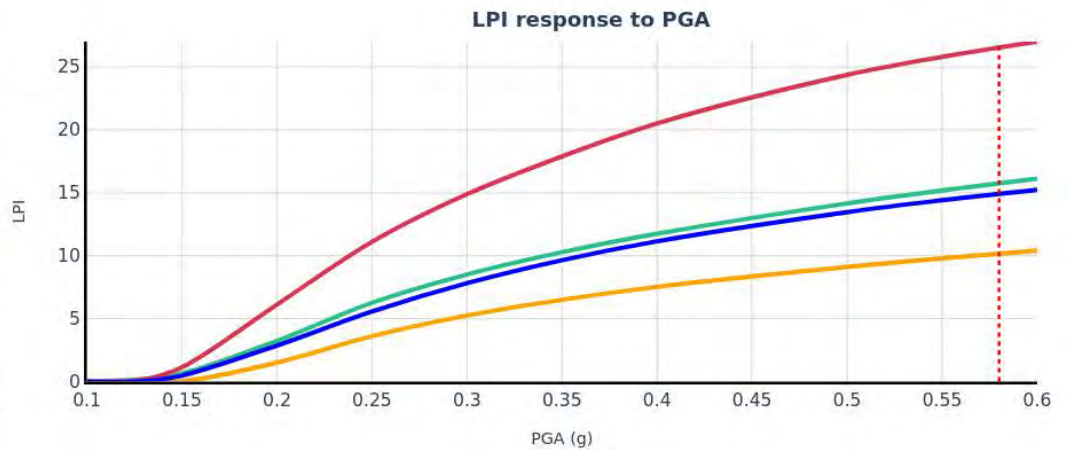
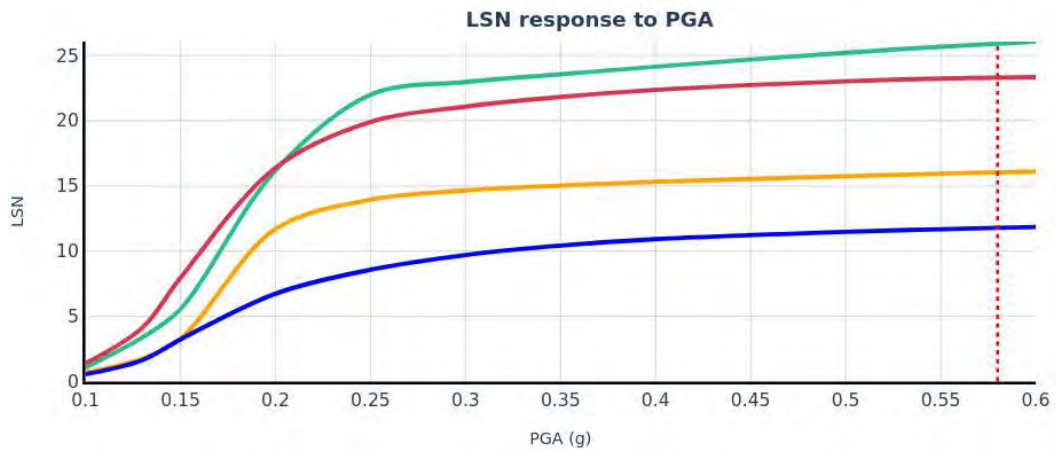
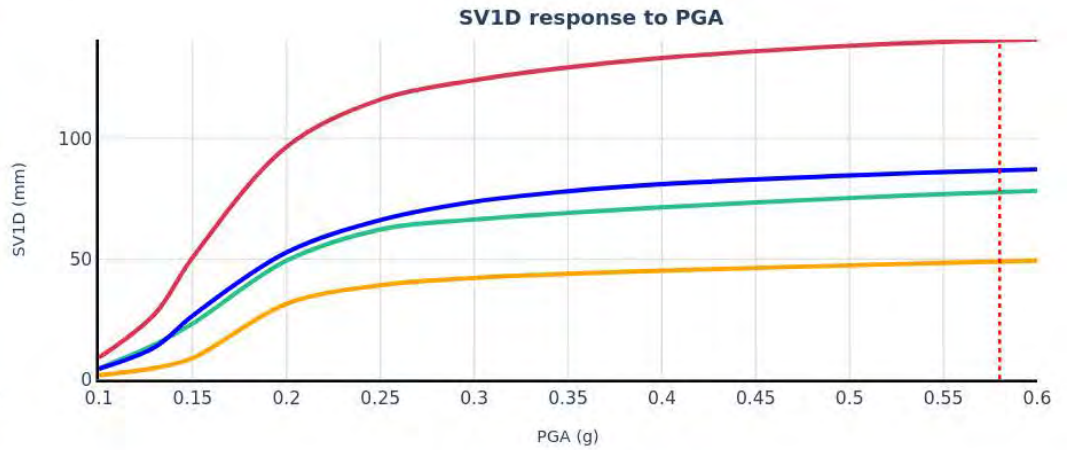
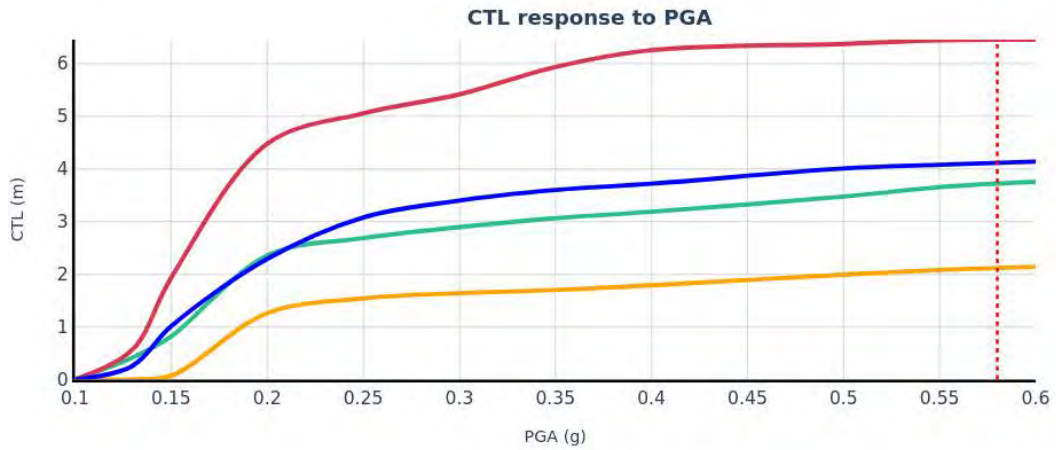
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT423	CPT_TT262870	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT419	CPT_TT262866	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT420	CPT_TT262867	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT424	CPT_TT262871	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 14/17

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT423	CPT_TT262870	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT419	CPT_TT262866	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT420	CPT_TT262867	04/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT424	CPT_TT262871	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/17

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262870	TTGD 262866	TTGD 262867
CPT Name	CPT_TT262870_Raw01	CPT_TT262866_Raw01	CPT_TT262867_Raw01
Run Description	CPT423	CPT419	CPT420
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	1.1	1.95	1.9
Depth to groundwater for design (m)	1.1	1.95	1.9
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	12.946	12.854	7.898
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	12.946	12.854	7.898
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262870	CPT423	0.0	0.0	0.0
TTGD 262870	CPT423	0.0	12.95	2.6
TTGD 262866	CPT419	0.0	0.0	0.0
TTGD 262866	CPT419	0.0	12.95	2.6
TTGD 262867	CPT420	0.0	0.0	0.0
TTGD 262867	CPT420	0.0	12.95	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262870	CPT423	0.0	12.95	0.0 CFC
TTGD 262866	CPT419	0.0	12.95	0.0 CFC
TTGD 262867	CPT420	0.0	12.95	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262870	CPT423	0.0	0.0001	18.0
TTGD 262870	CPT423	0.0001	12.95	18.0
TTGD 262866	CPT419	0.0	0.0001	18.0
TTGD 262866	CPT419	0.0001	12.95	18.0
TTGD 262867	CPT420	0.0	0.0001	18.0
TTGD 262867	CPT420	0.0001	12.95	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 16/17

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262871
CPT Name	CPT_TT262871_Raw01
Run Description	CPT424
EQ PGA (g)	0.58
EQ Magnitude	7.1
Depth to groundwater at time of Investigation (m)	2.7
Depth to groundwater for design (m)	2.7
Pre-drill depth (m)	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	13.147
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	13.147
Inverse filtering applied?	No
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262871	CPT424	0.0	0.0	0.0
TTGD 262871	CPT424	0.0	13.15	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

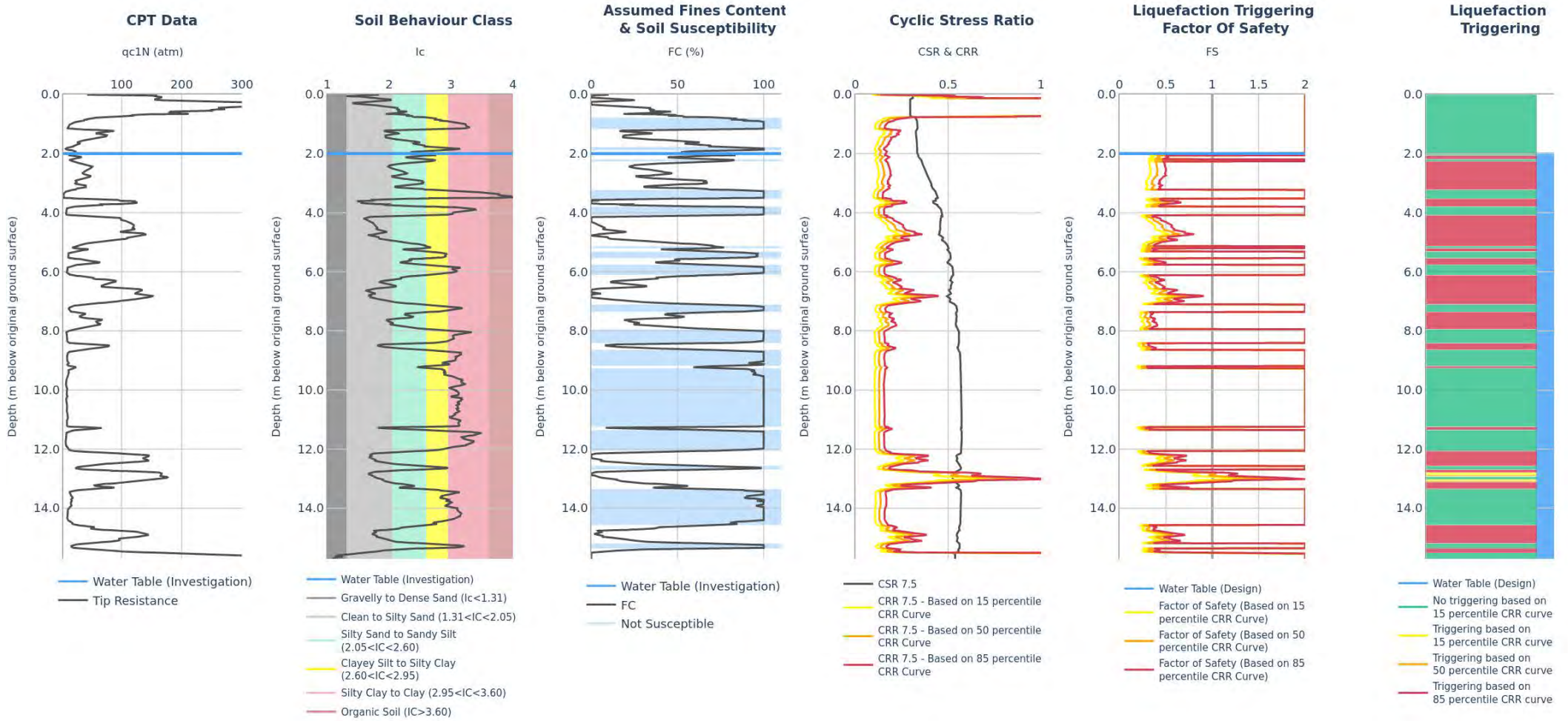
ID	Run description	From (m)	To (m)	Fc
TTGD 262871	CPT424	0.0	13.15	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262871	CPT424	0.0	0.0001	18.0
TTGD 262871	CPT424	0.0001	13.15	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Secondary Stopbank Design	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 17/17

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT425	CPT_TT262872	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

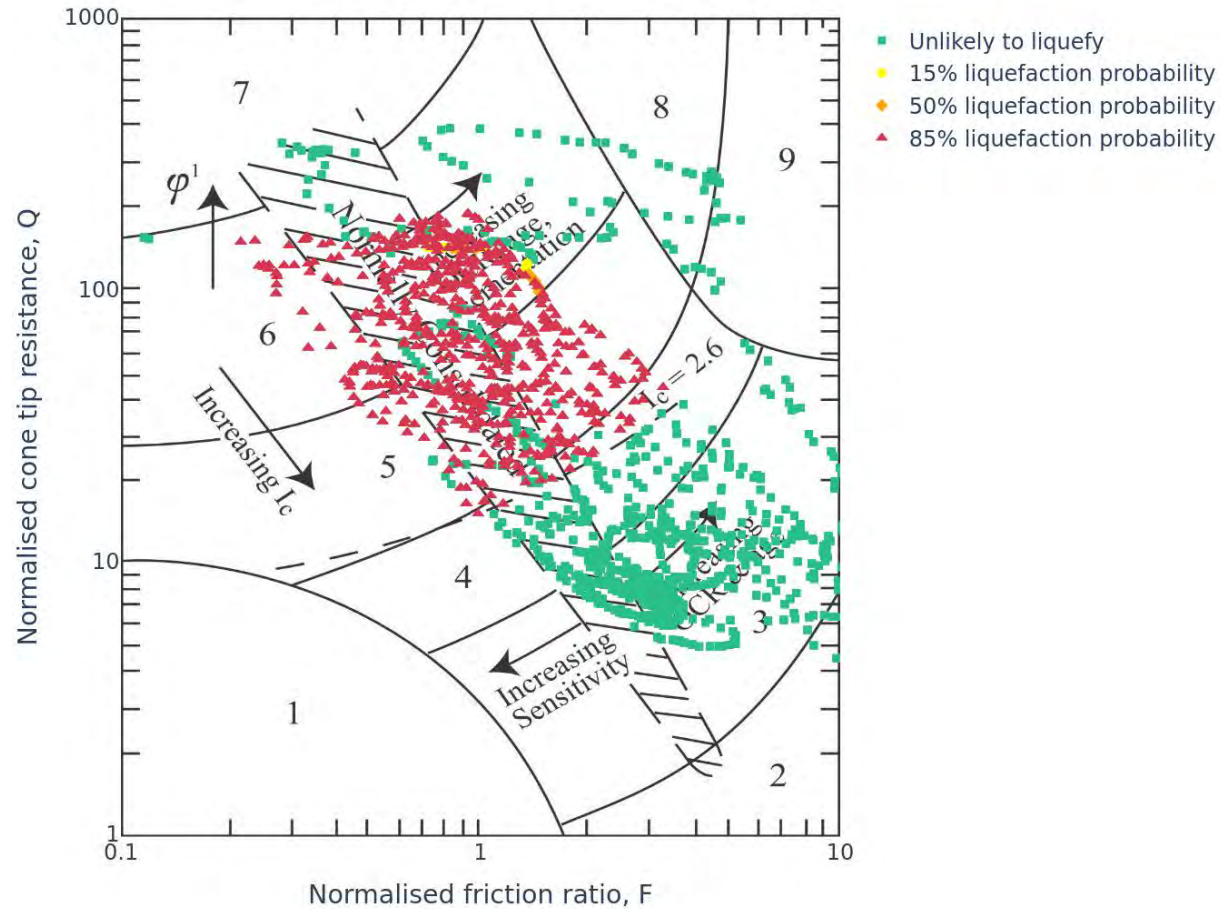
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	145	6.6	26	27	2.1	20
50%	144	6.4	23	27	2.1	18
85%	141	6.3	20	27	2.1	15

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 1/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



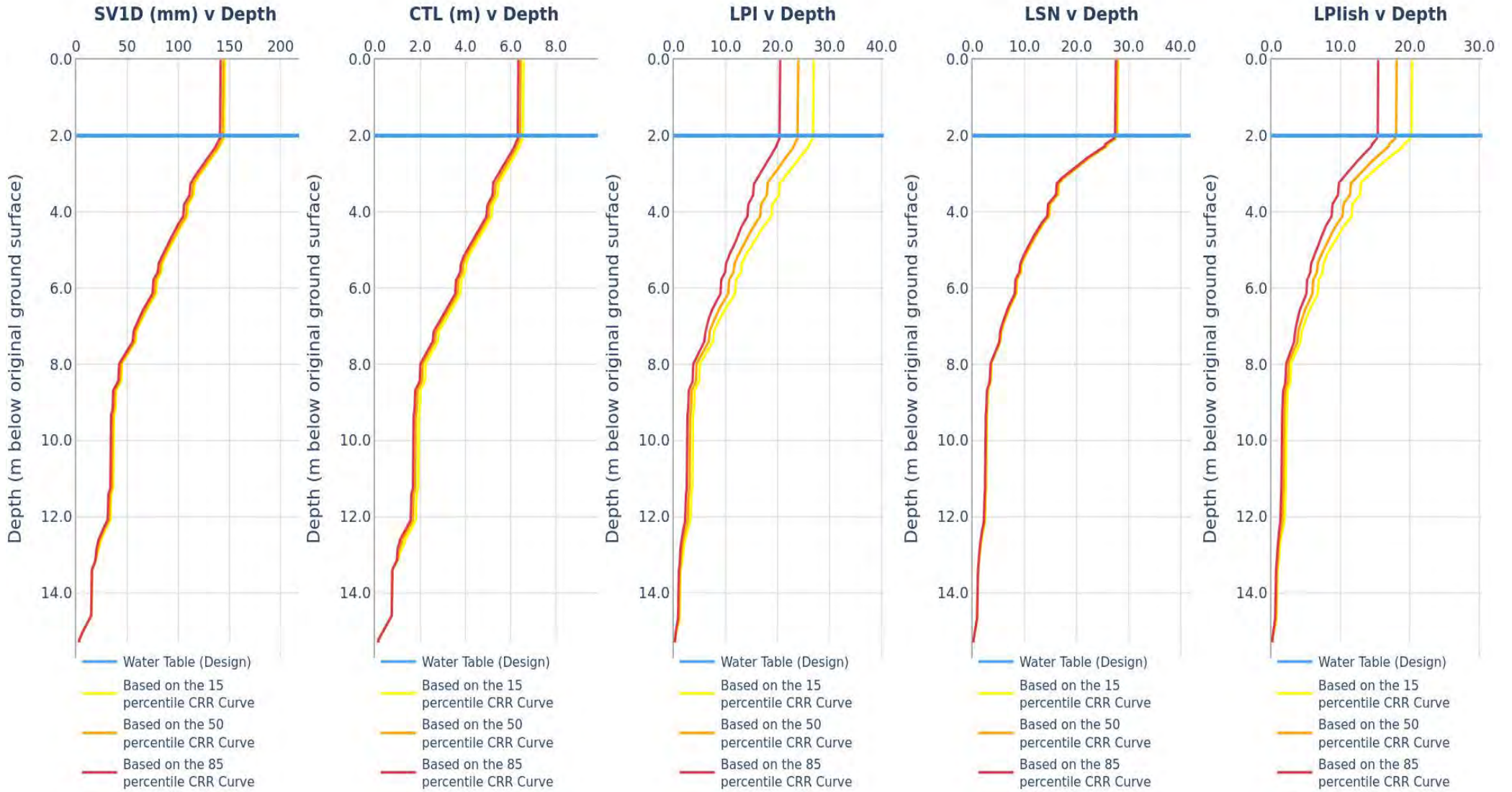
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 2/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

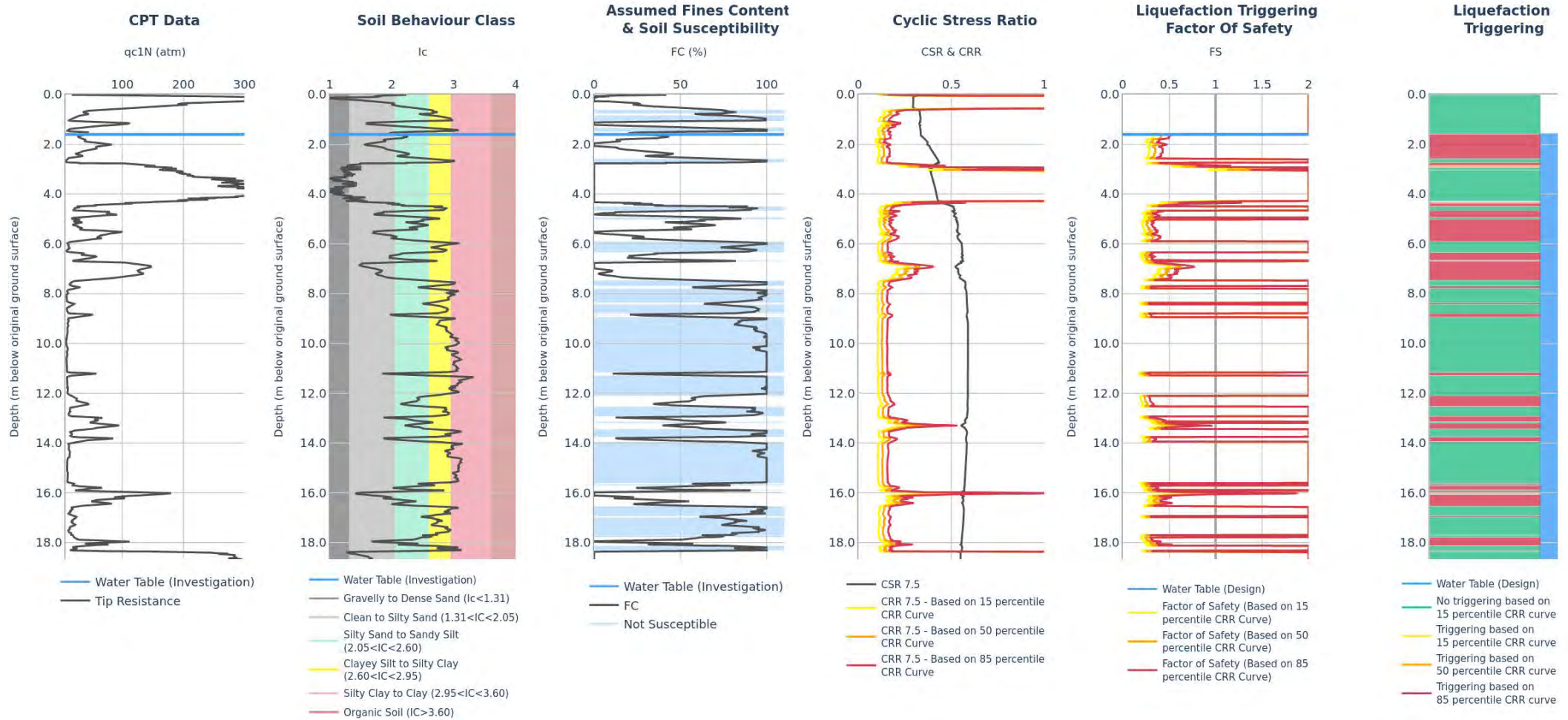


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT425	CPT_TT262872	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT426	CPT_TT262873	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

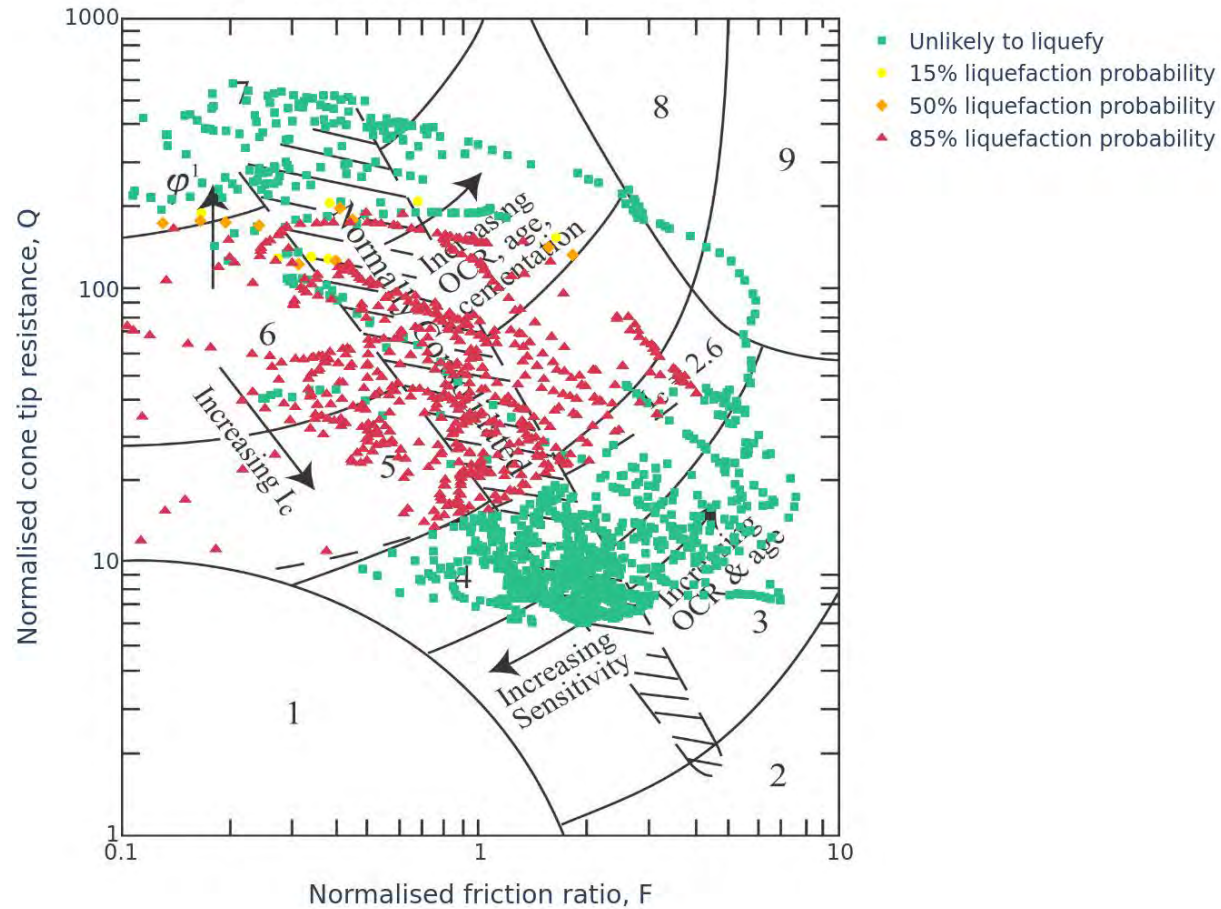
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	157	6.4	25	31	1.7	21
50%	156	6.3	22	31	1.7	18
85%	154	6.2	20	30	1.7	16

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



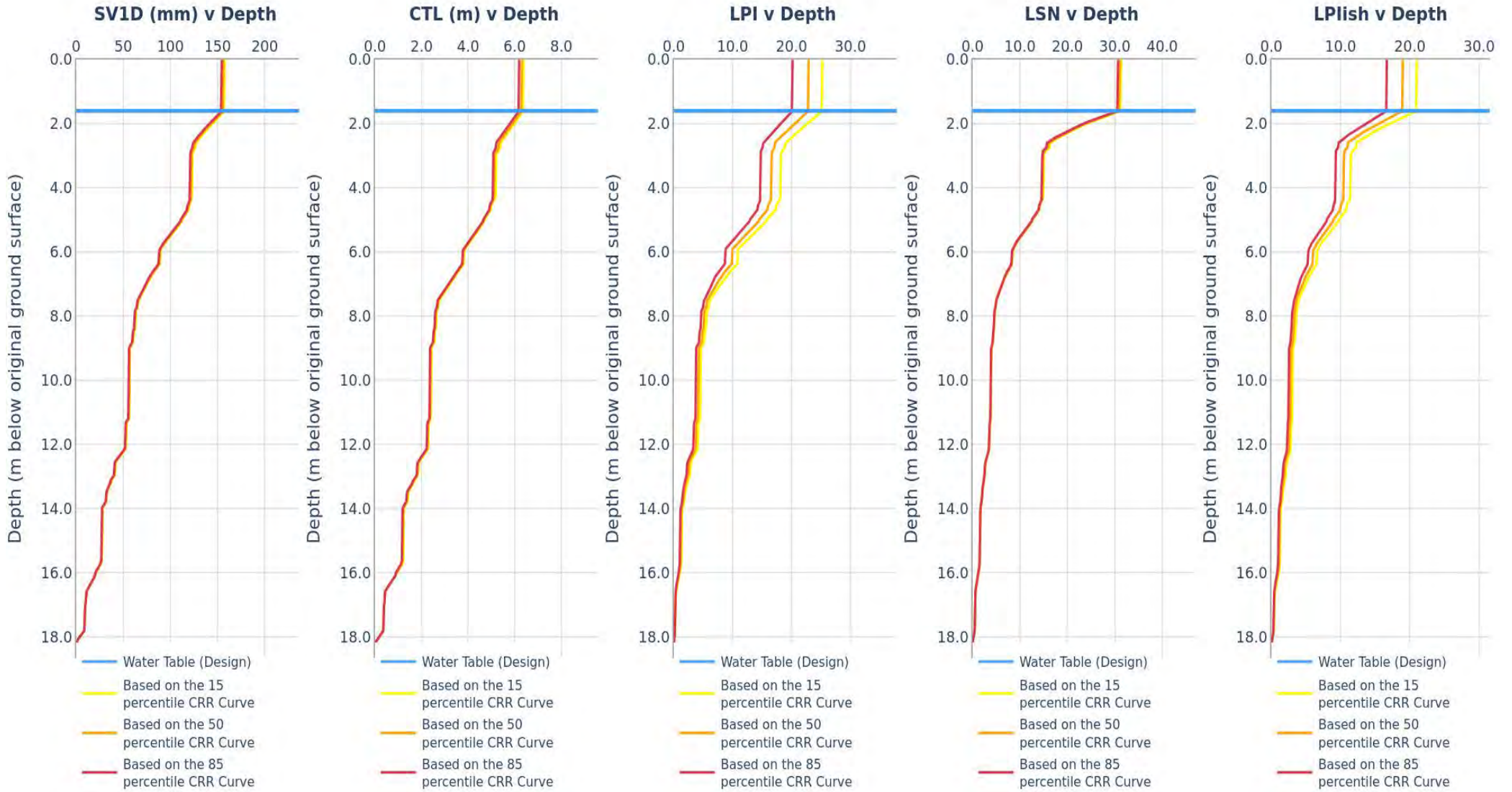
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

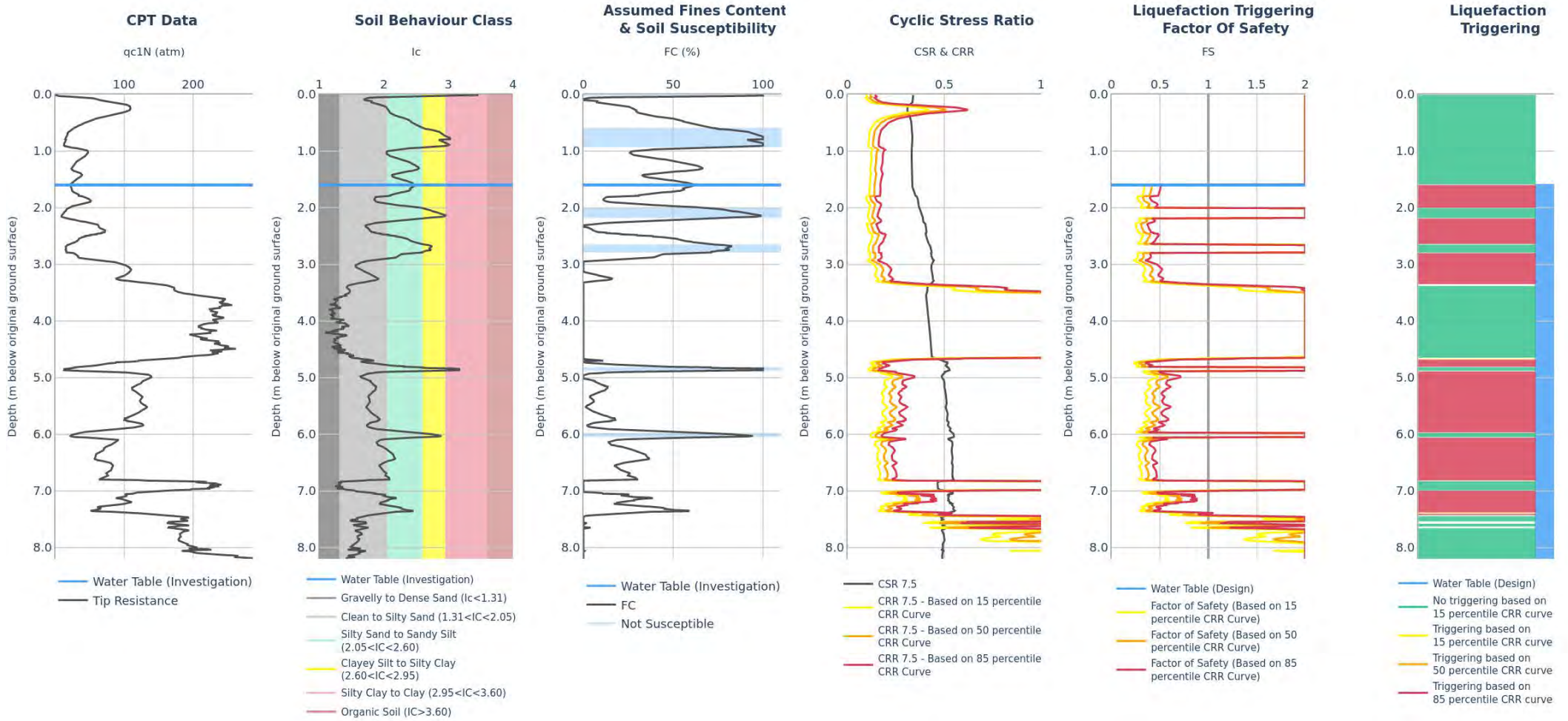


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT426	CPT_TT262873	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT427	CPT_TT262874	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

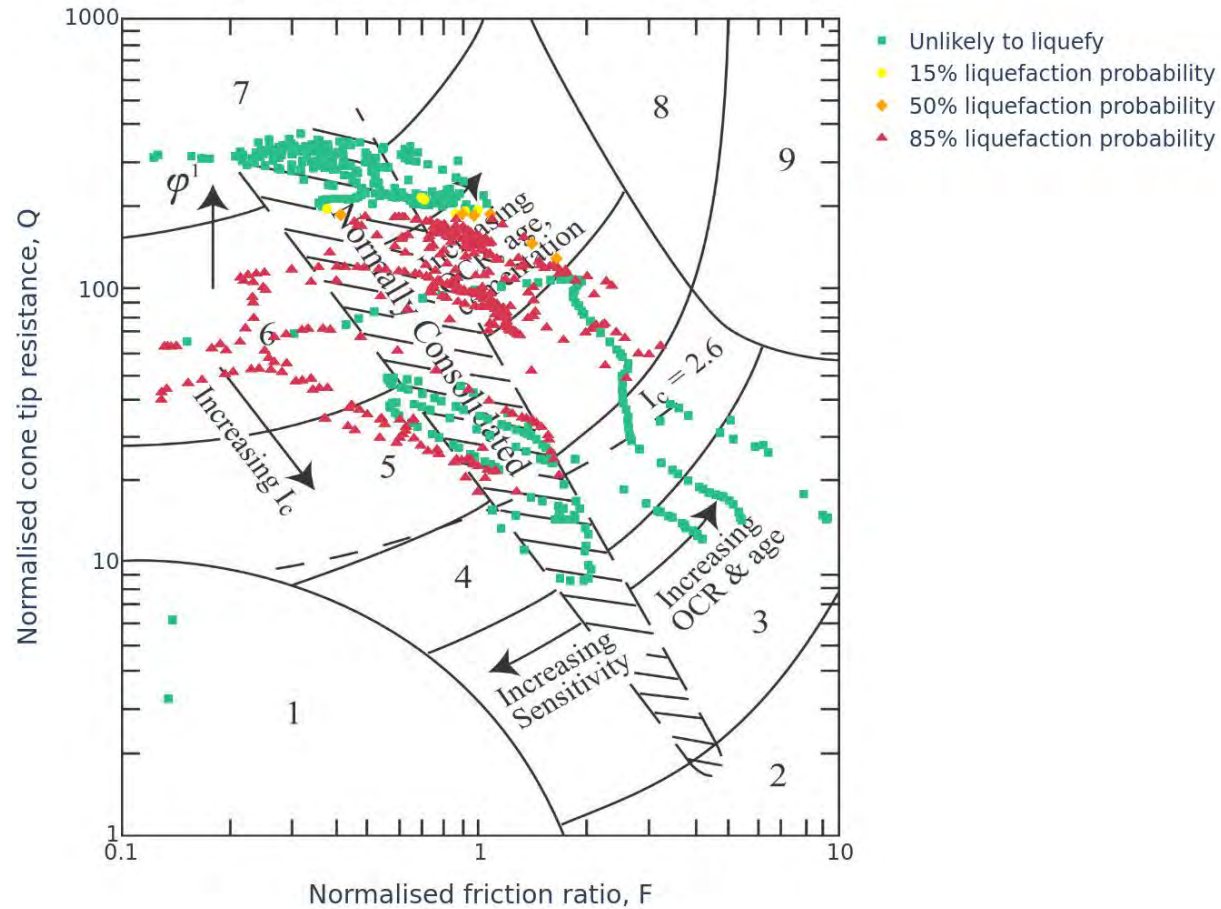
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	88	4.0	19	25	1.7	17
50%	87	3.9	17	25	1.7	15
85%	85	3.8	14	24	1.7	13

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 7/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



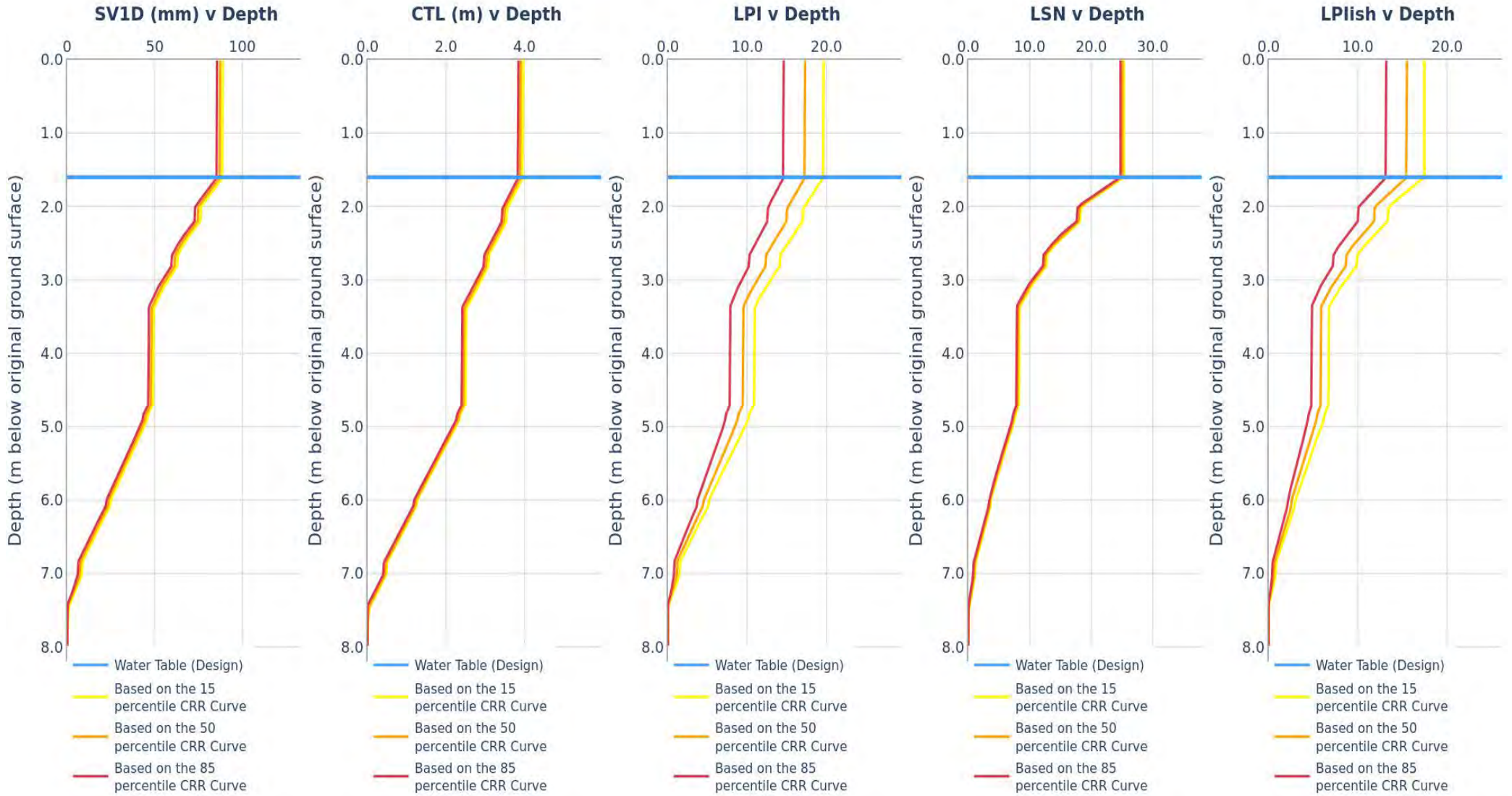
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 8/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

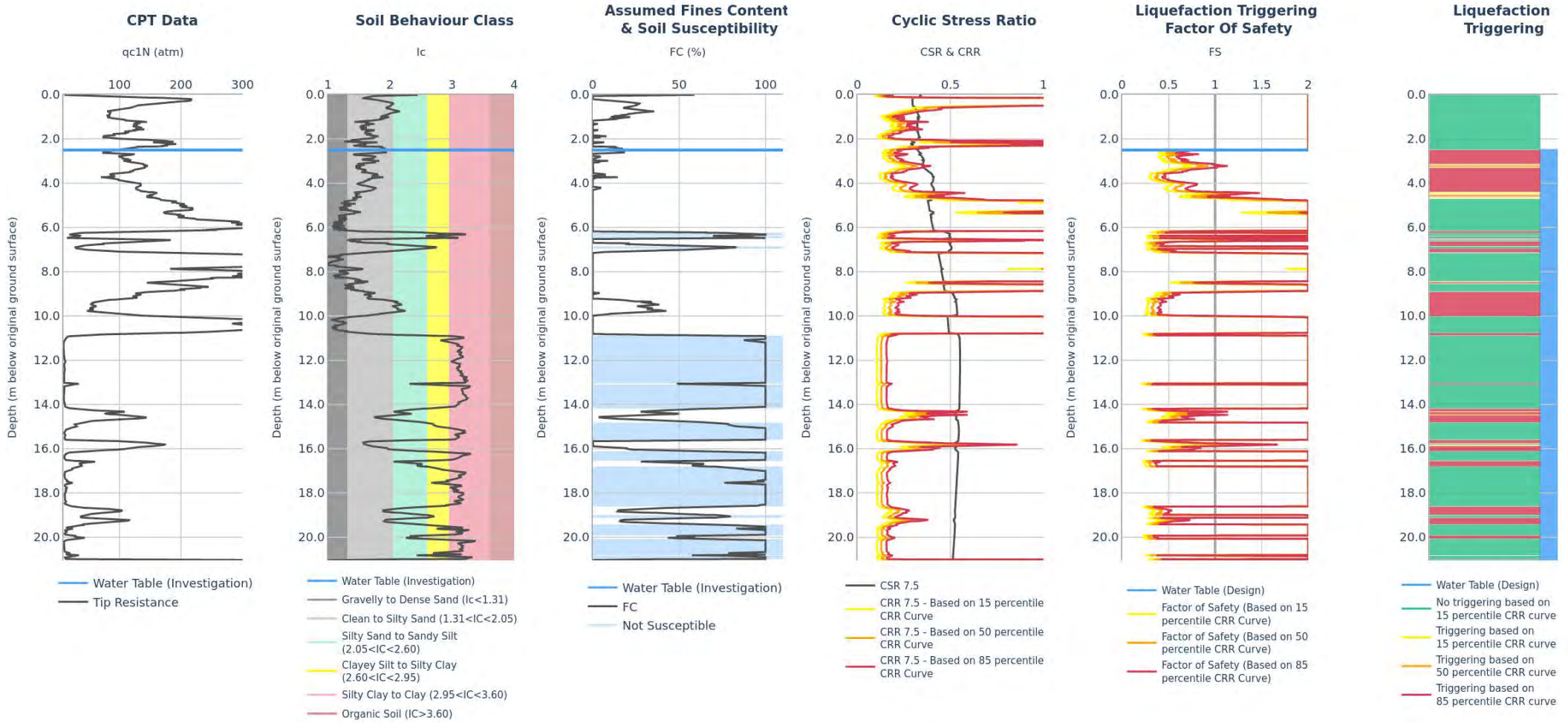


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT427	CPT_TT262874	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT428	CPT_TT262875	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

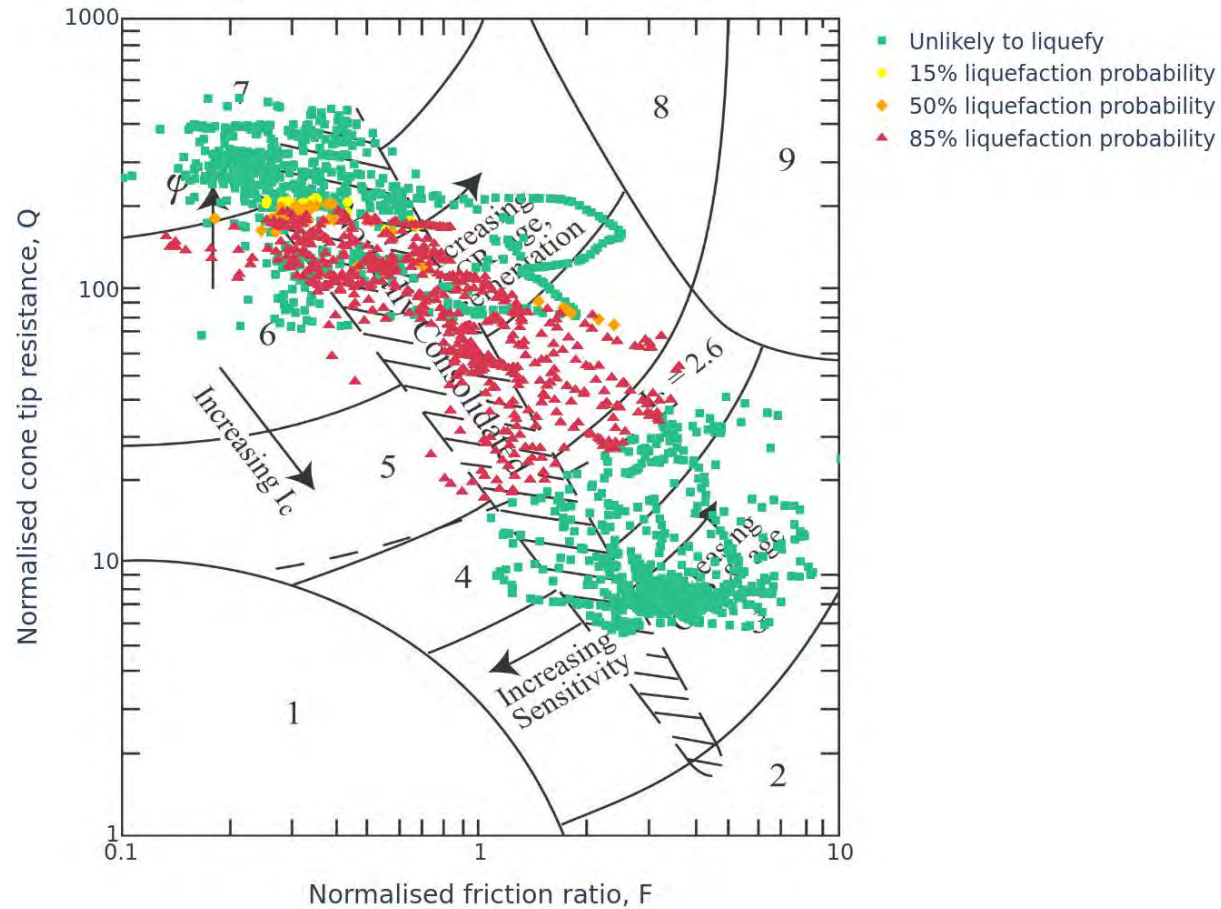
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	129	6.4	18	20	2.6	13
50%	124	6.2	14	19	2.6	11
85%	116	5.8	11	17	2.6	8

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 10/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



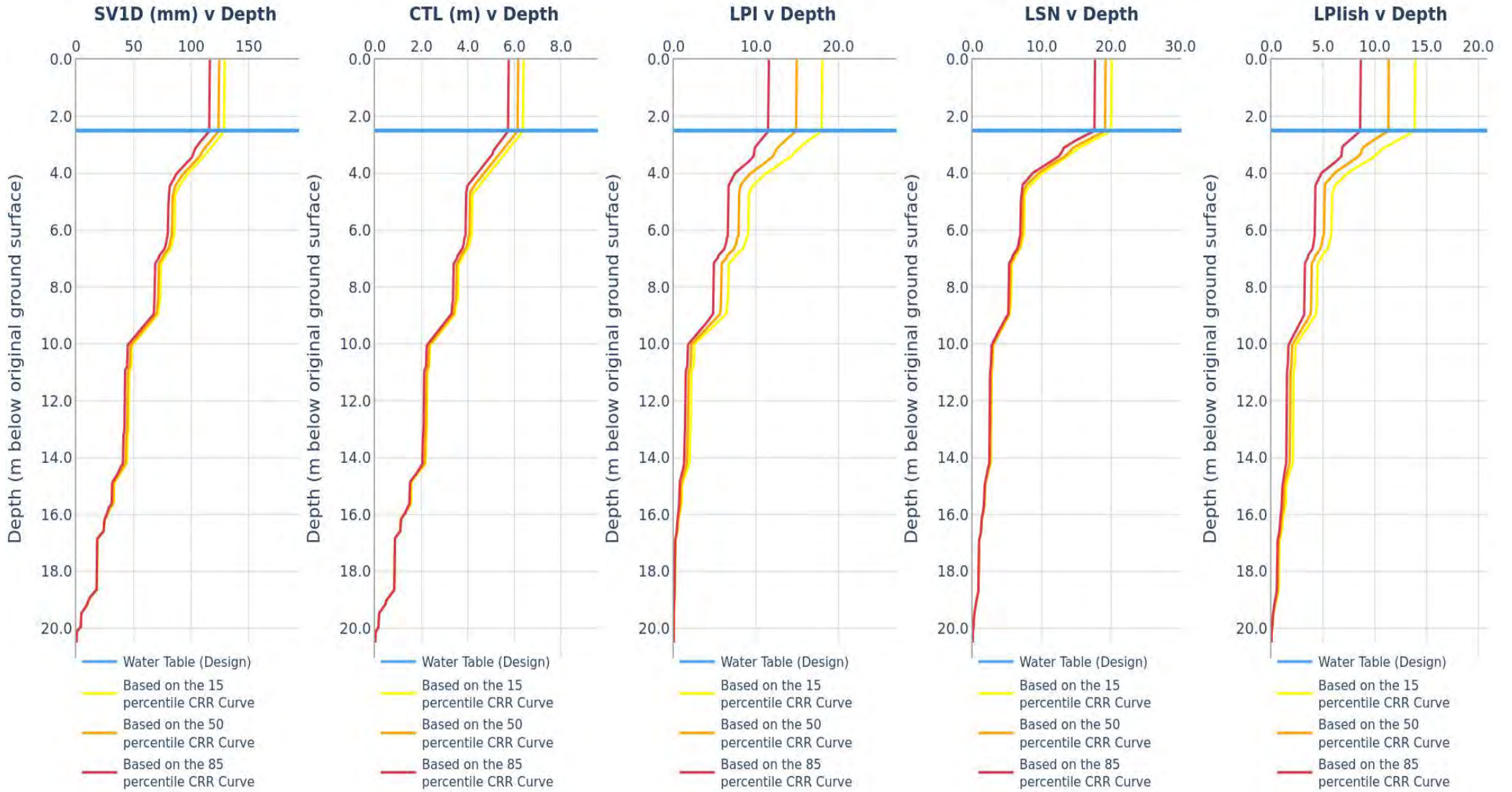
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 11/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

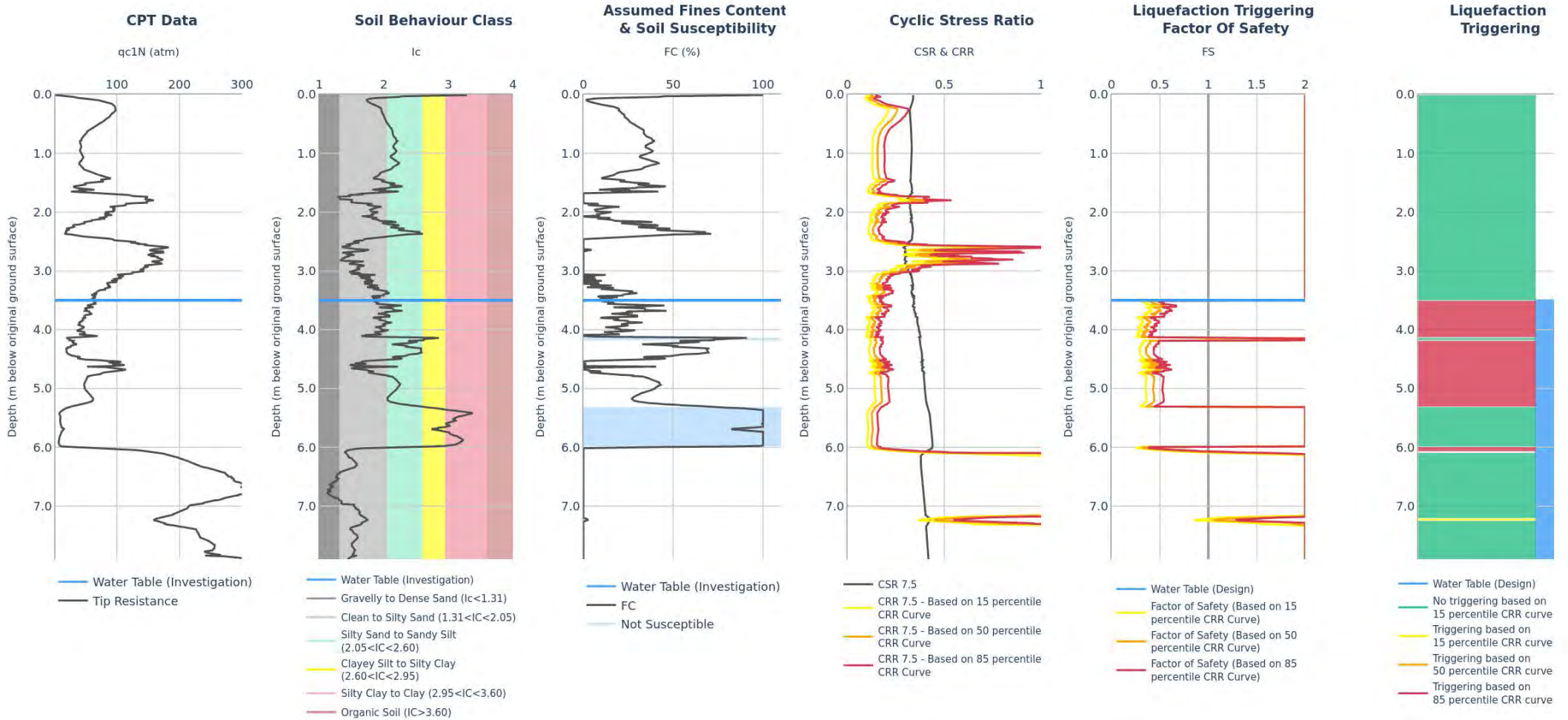


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT428	CPT_TT262875	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT429	CPT_TT262876	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

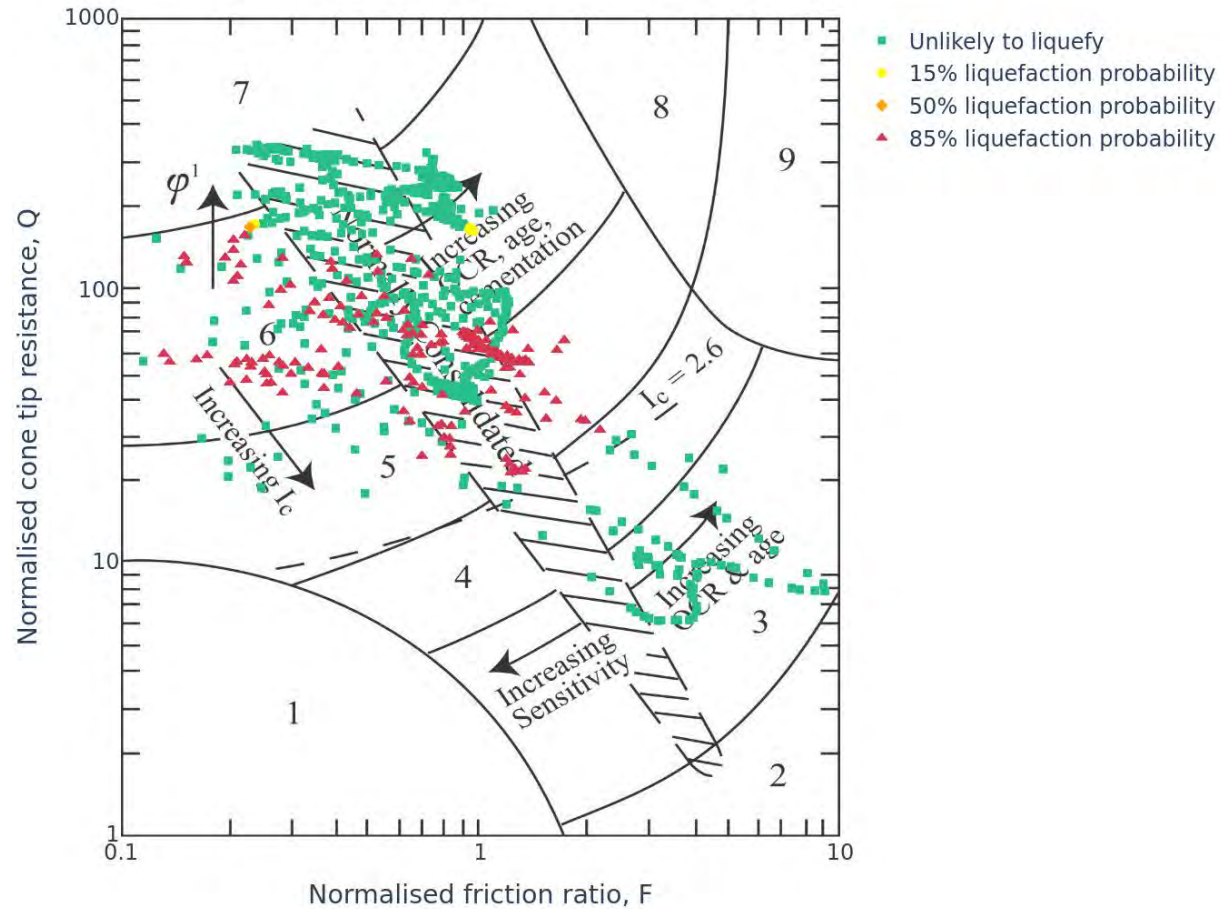
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	48	1.9	9	10	3.6	7
50%	47	1.8	8	10	3.6	6
85%	47	1.8	7	10	3.6	5

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



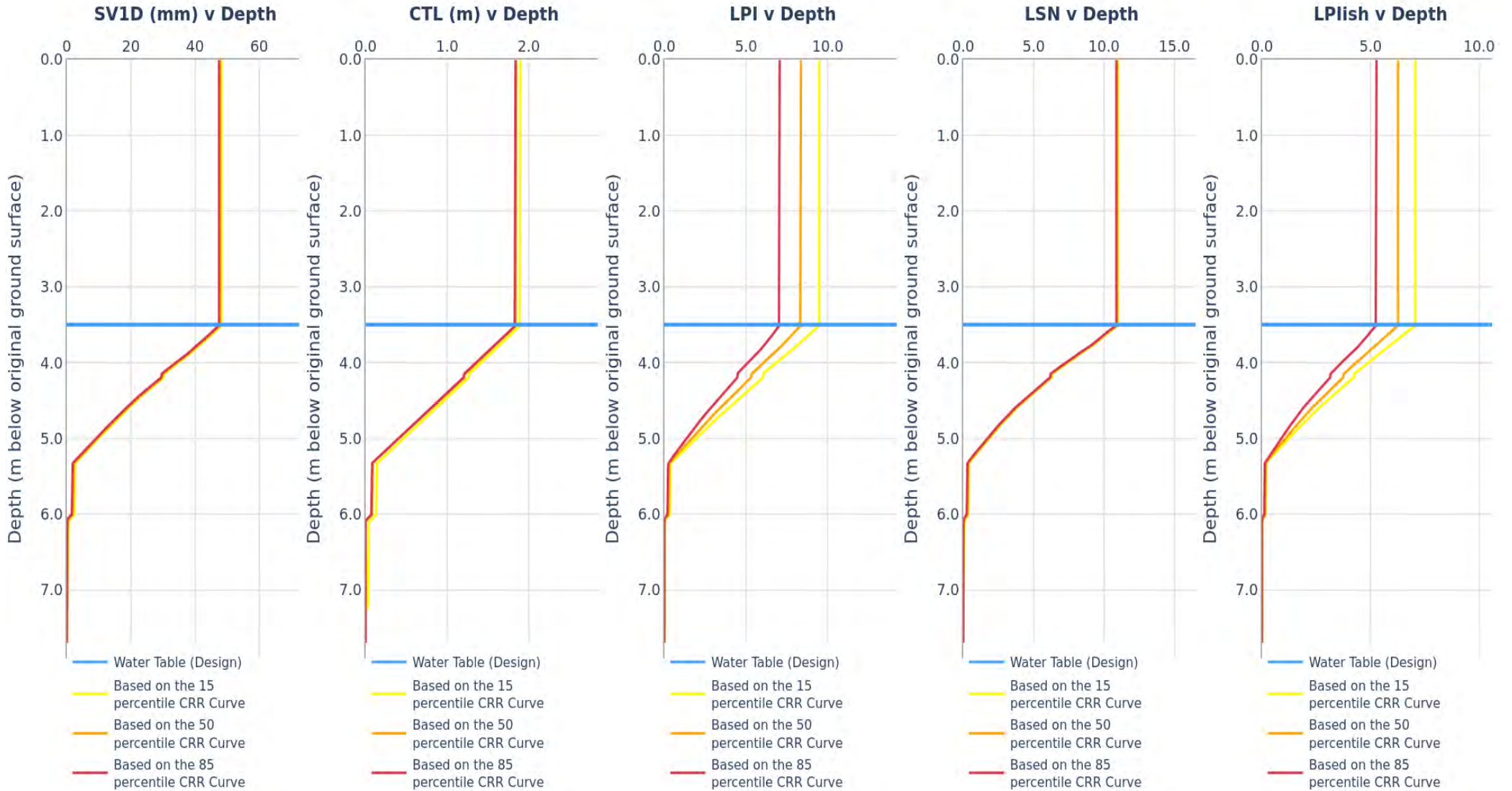
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 14/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

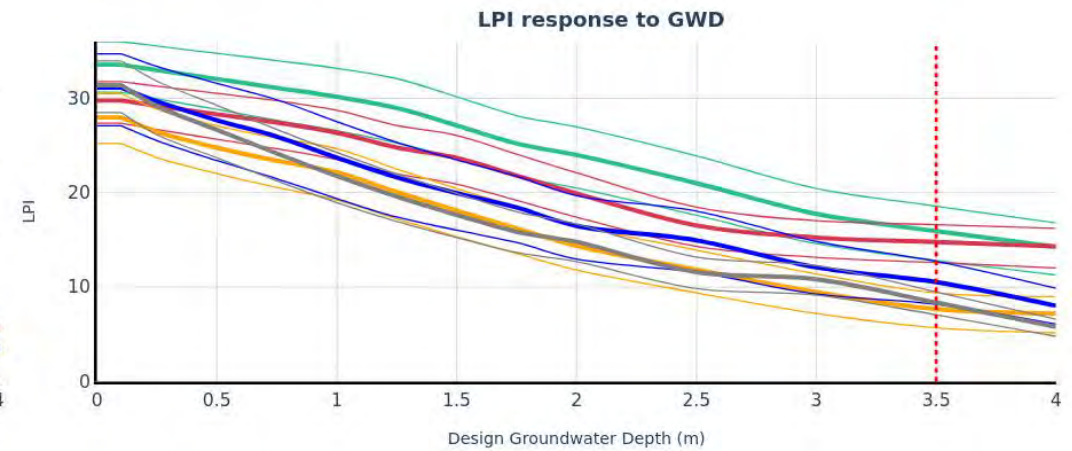
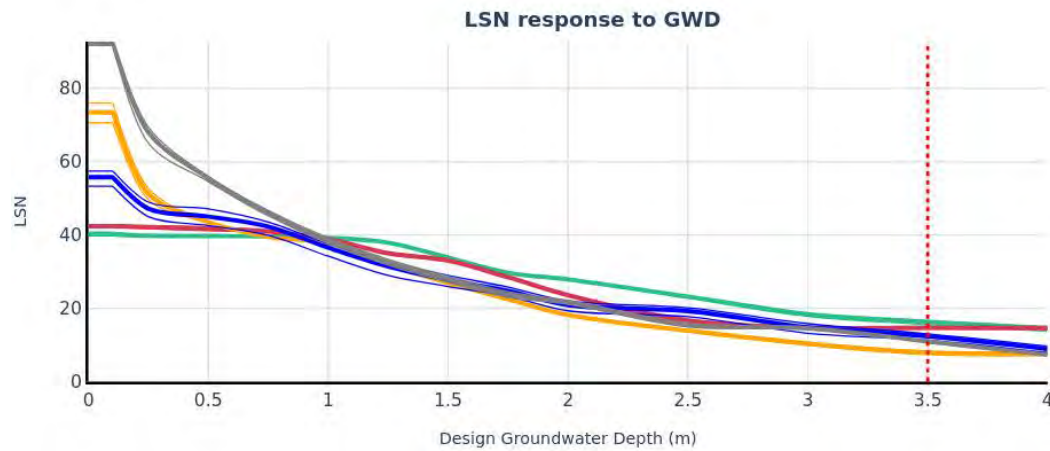
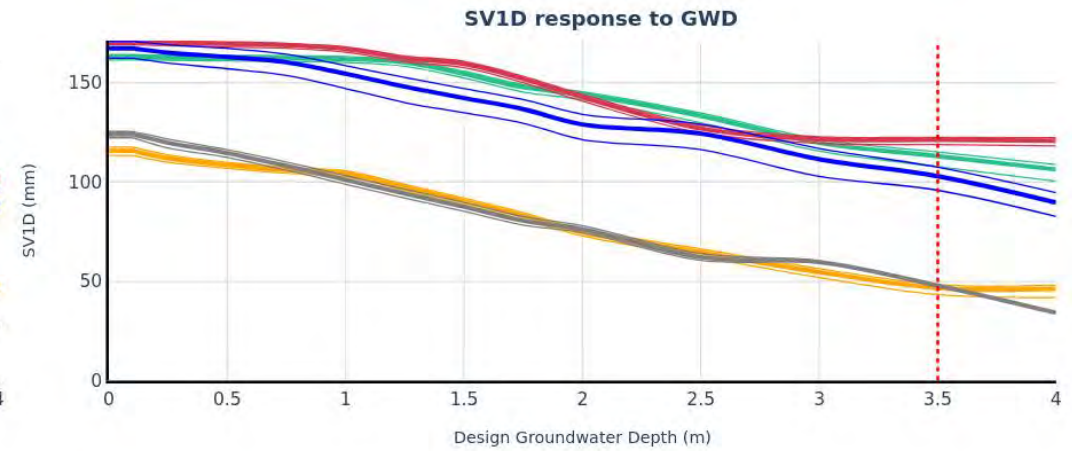
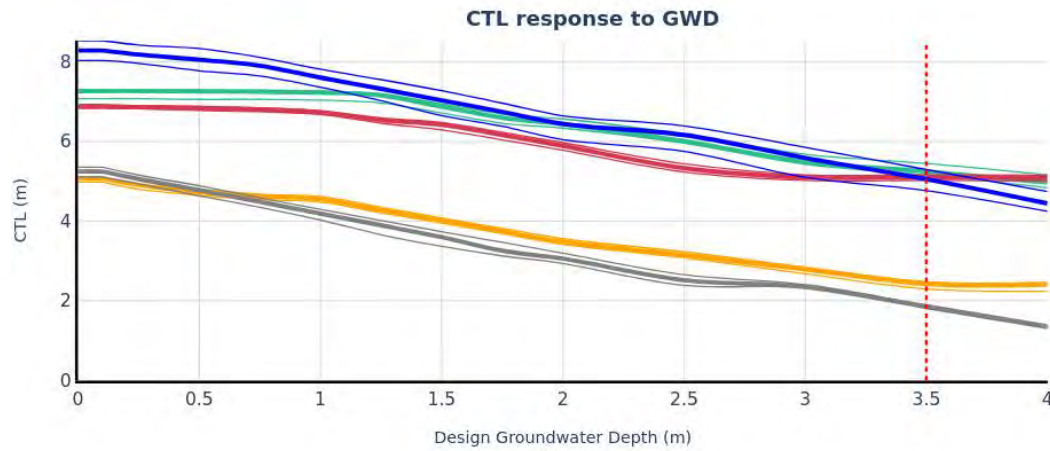


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT429	CPT_TT262876	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/20

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



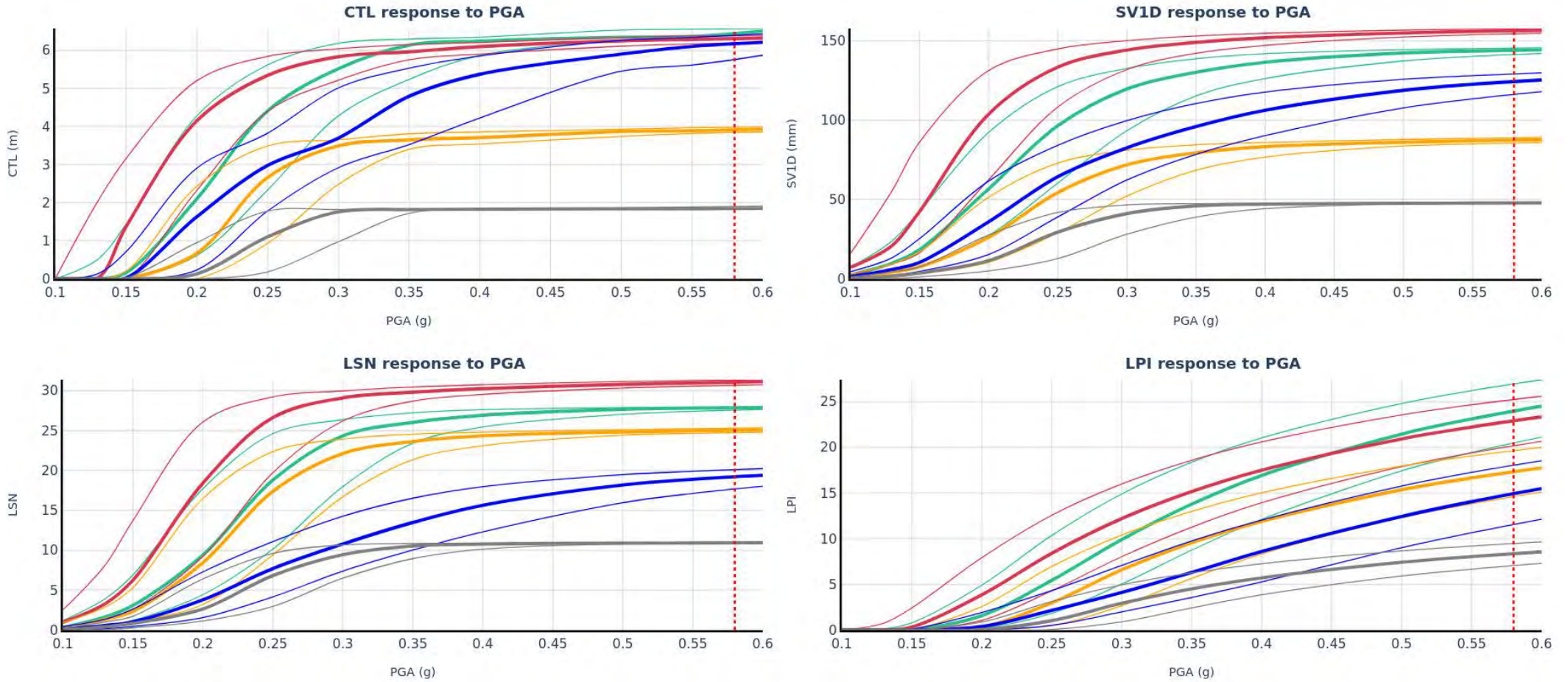
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT425	CPT_TT262872	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT426	CPT_TT262873	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT427	CPT_TT262874	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT428	CPT_TT262875	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT429	CPT_TT262876	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 16/20


# PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



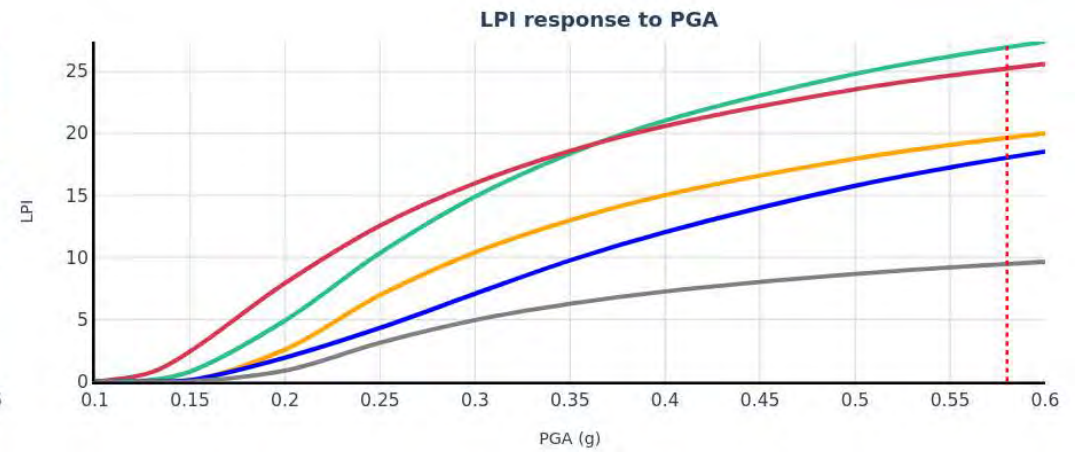
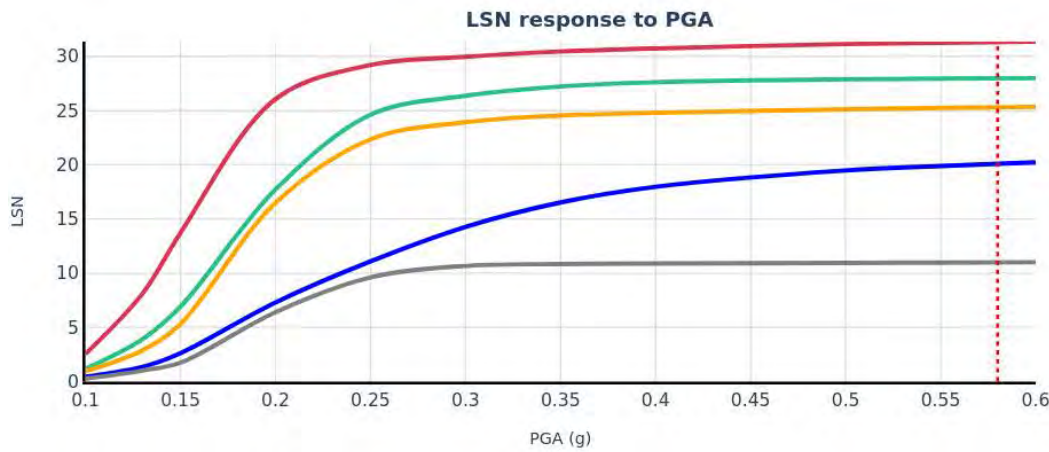
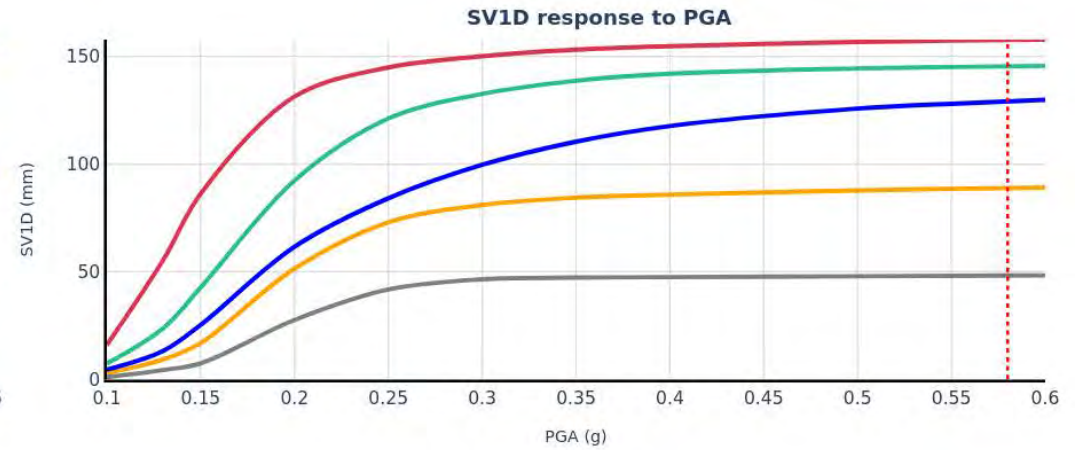
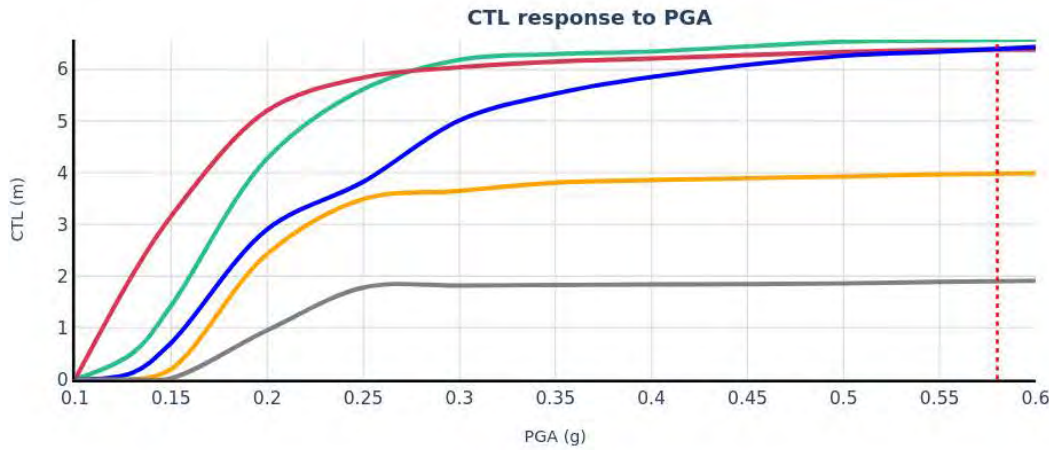
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT425	CPT_TT262872	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT426	CPT_TT262873	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT427	CPT_TT262874	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT428	CPT_TT262875	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT429	CPT_TT262876	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 17/20

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT425	CPT_TT262872	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT426	CPT_TT262873	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT427	CPT_TT262874	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT428	CPT_TT262875	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT429	CPT_TT262876	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 18/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262872	TTGD 262873	TTGD 262874
CPT Name	CPT_TT262872_Raw01	CPT_TT262873_Raw01	CPT_TT262874_Raw01 (1)
Run Description	CPT425	CPT426	CPT427
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.0	1.6	1.6
Depth to groundwater for design (m)	2.0	1.6	1.6
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	15.712	18.666	8.199
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	15.712	18.666	8.199
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262872	CPT425	0.0	0.0	0.0
TTGD 262872	CPT425	0.0	15.71	2.6
TTGD 262873	CPT426	0.0	0.0	0.0
TTGD 262873	CPT426	0.0	18.67	2.6
TTGD 262874	CPT427	0.0	0.0	0.0
TTGD 262874	CPT427	0.0	15.71	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262872	CPT425	0.0	15.71	0.0 CFC
TTGD 262873	CPT426	0.0	18.67	0.0 CFC
TTGD 262874	CPT427	0.0	15.71	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262872	CPT425	0.0	0.0001	18.0
TTGD 262872	CPT425	0.0001	15.71	18.0
TTGD 262873	CPT426	0.0	0.0001	18.0
TTGD 262873	CPT426	0.0001	18.67	18.0
TTGD 262874	CPT427	0.0	0.0001	18.0
TTGD 262874	CPT427	0.0001	15.71	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 19/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262875	TTGD 262876
CPT Name	CPT_TT262875_Raw01	CPT_TT262876_Raw01
Run Description	CPT428	CPT429
EQ PGA (g)	0.58	0.58
EQ Magnitude	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.5	3.5
Depth to groundwater for design (m)	2.5	3.5
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	21.046	7.903
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	21.046	7.903
Inverse filtering applied?	No	No
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262875	CPT428	0.0	0.0	0.0
TTGD 262875	CPT428	0.0	21.05	2.6
TTGD 262876	CPT429	0.0	0.0	0.0
TTGD 262876	CPT429	0.0	15.71	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

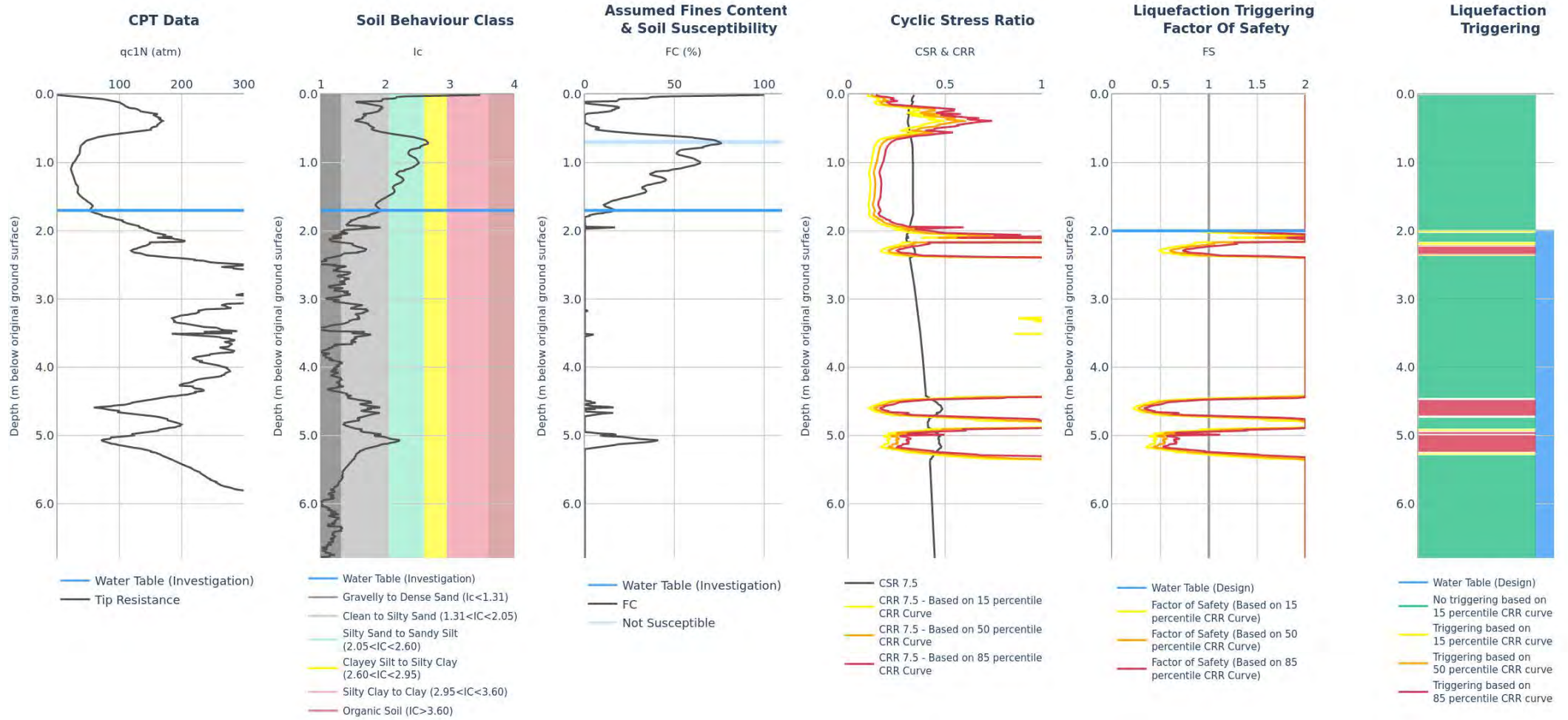
ID	Run description	From (m)	To (m)	Fc
TTGD 262875	CPT428	0.0	21.05	0.0 CFC
TTGD 262876	CPT429	0.0	15.71	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262875	CPT428	0.0	0.0001	18.0
TTGD 262875	CPT428	0.0001	21.05	18.0
TTGD 262876	CPT429	0.0	0.0001	18.0
TTGD 262876	CPT429	0.0001	15.71	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 20/20

## CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT430	CPT_TT262877	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

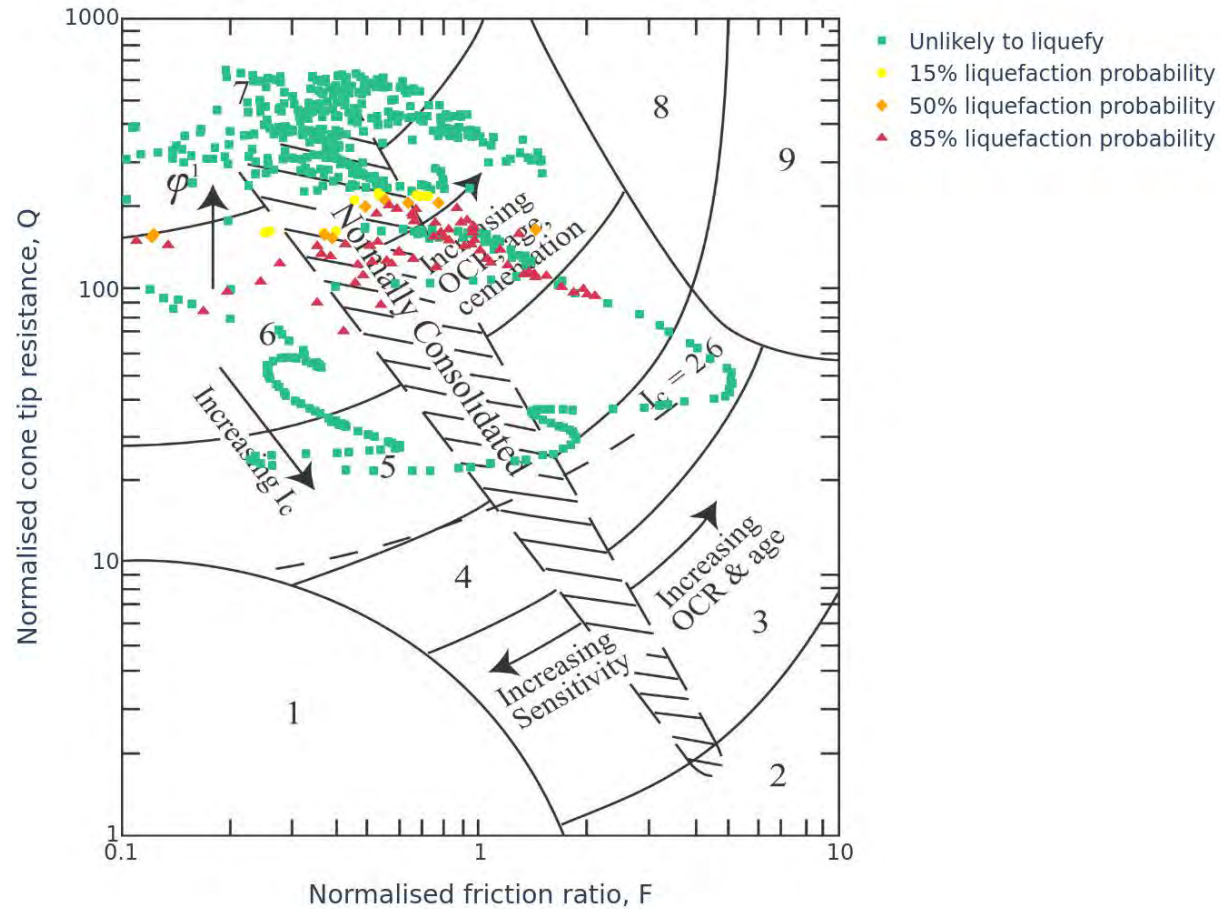
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	15	0.9	3	4	2.2	2
50%	14	0.7	2	3	2.3	1
85%	12	0.6	1	2	2.3	1

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 1/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



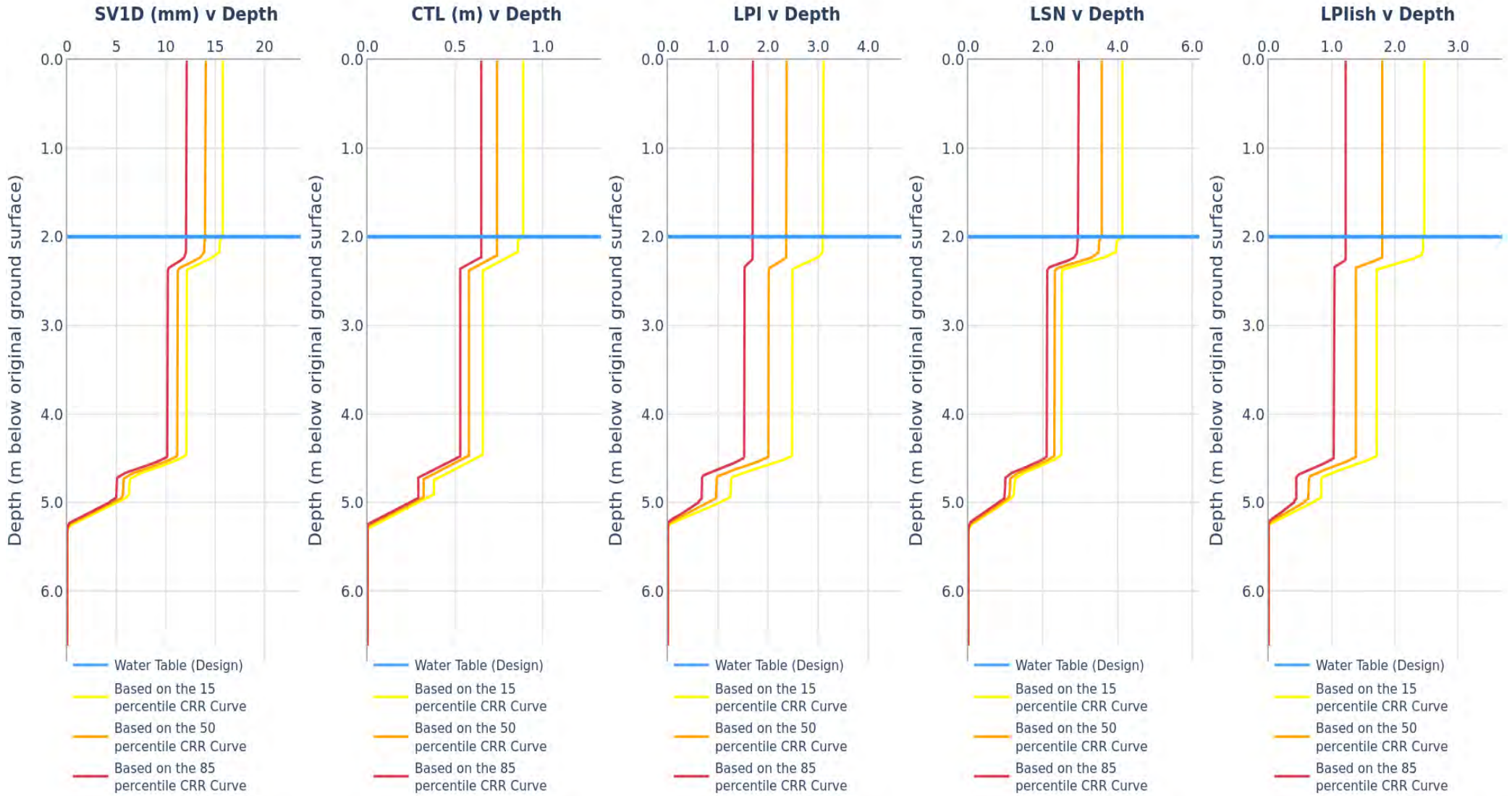
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 2/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

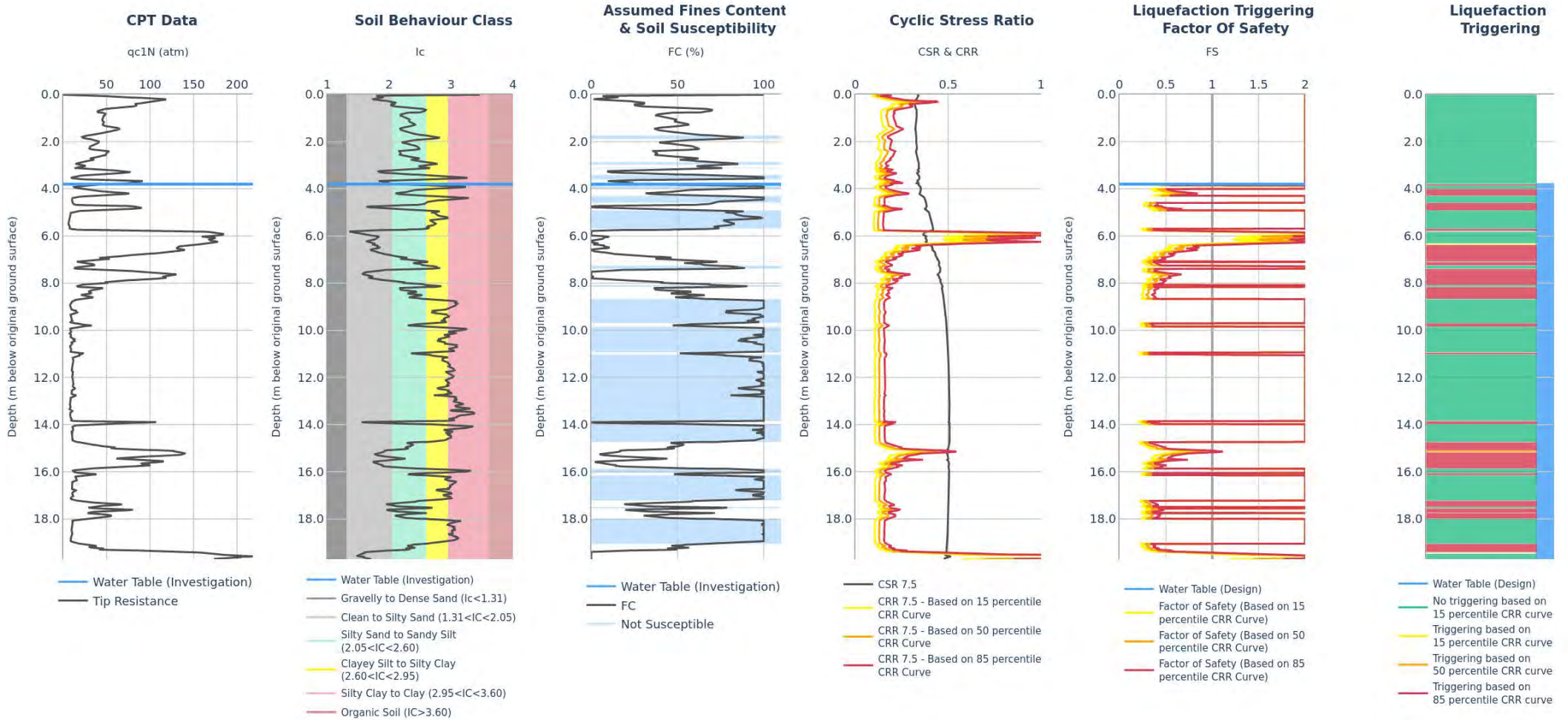


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT430	CPT_TT262877	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT431	CPT_TT262963	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

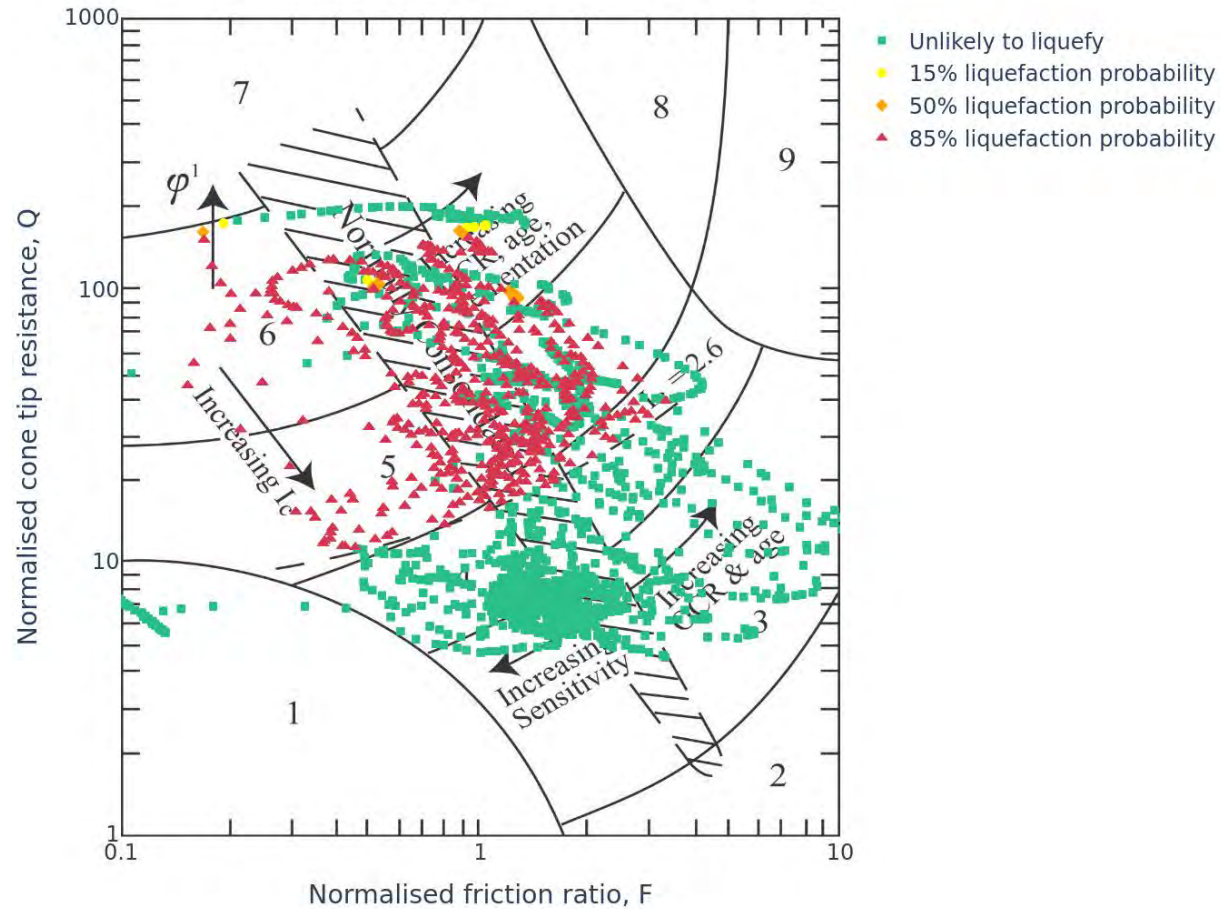
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	131	5.6	15	14	4.0	10
50%	129	5.5	14	14	4.0	9
85%	126	5.4	11	14	4.0	7

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 4/20


## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



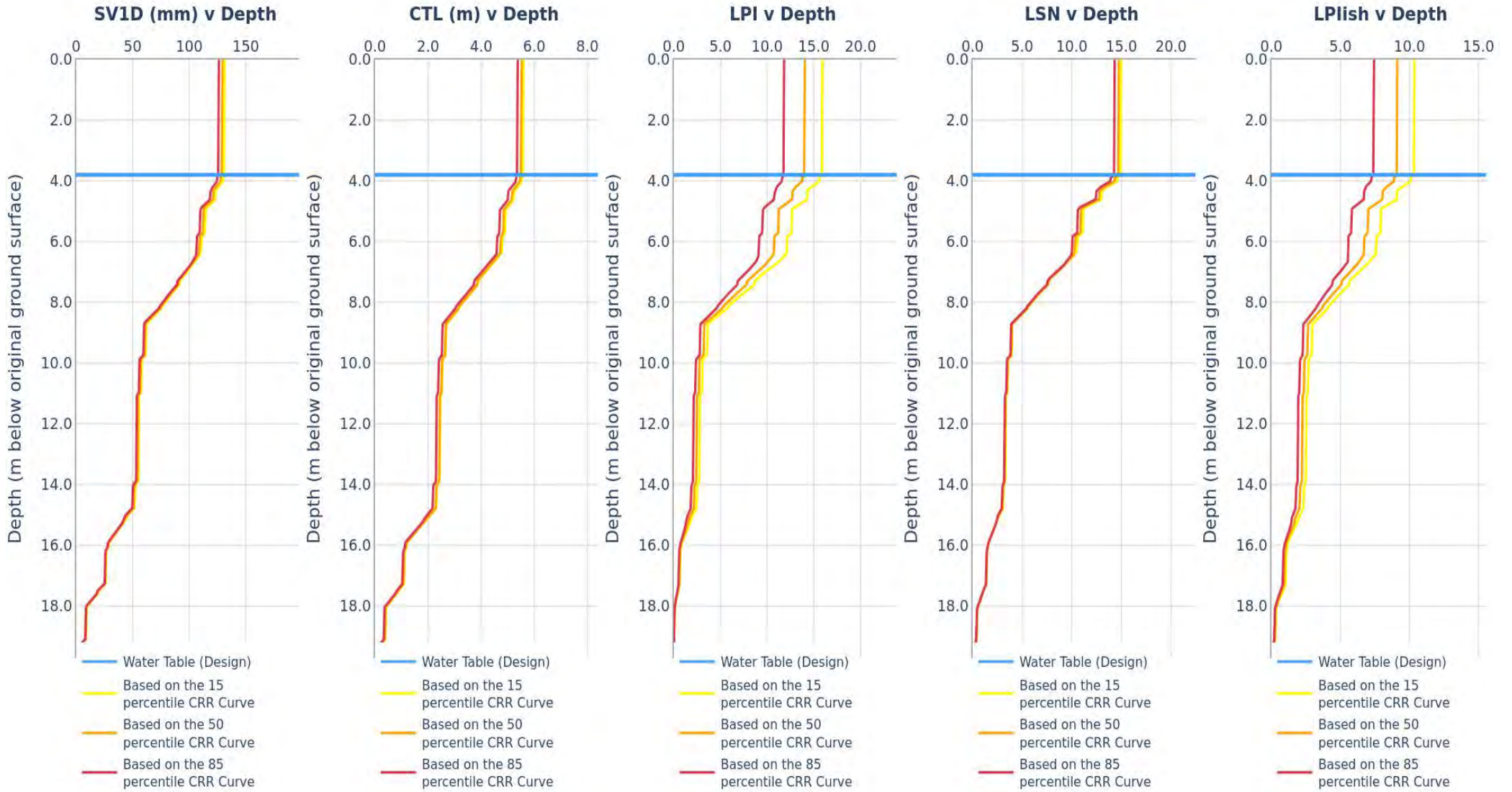
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

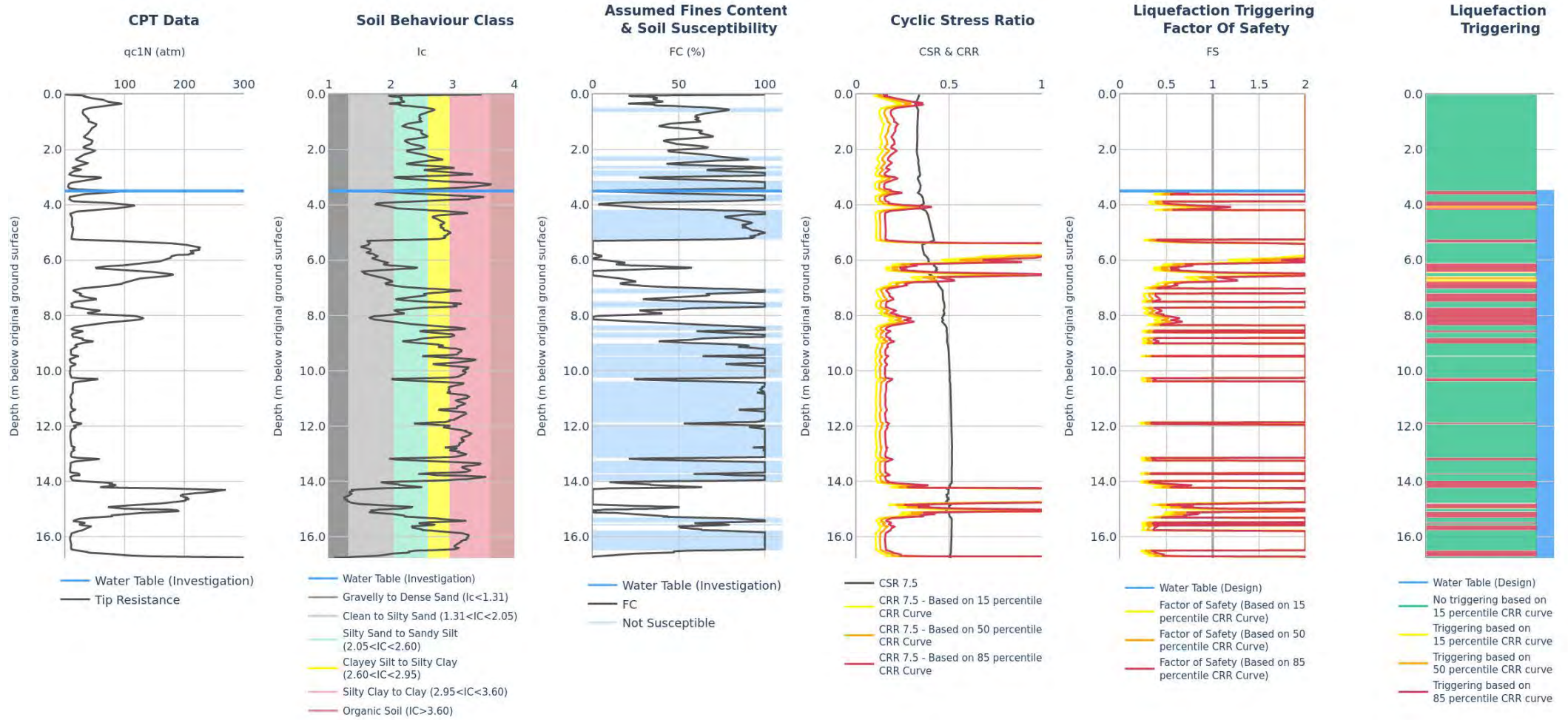


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT431	CPT_TT262963	06/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT432	CPT_TT262942	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

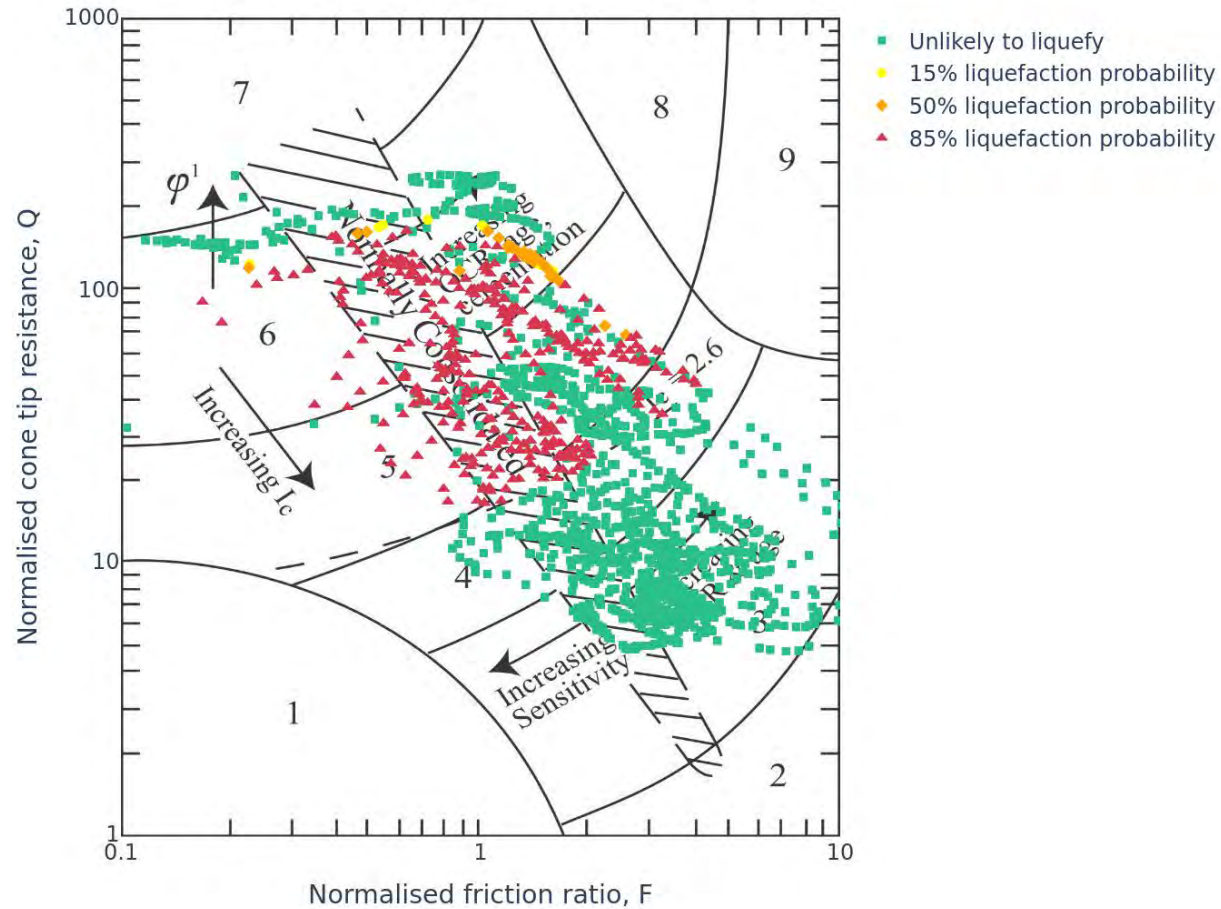
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	87	4.0	12	11	3.6	7
50%	84	3.9	10	10	3.6	6
85%	80	3.6	8	9	3.6	5

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	<b>CLIENT</b>	Hawkes Bay Regional council	<b>LOCATION</b>	Pakowhai	<b>DATE:</b> 17/09/2025
	<b>PROJECT</b>	Pakowhai Secondary Stopbanks			<b>ANALYSED:</b> MIBU
	<b>TITLE</b>	Pakowhai Secondary Stopbanks	<b>JOB NUMBER</b>	1017353.2403	
	<b>COMMENT</b>	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



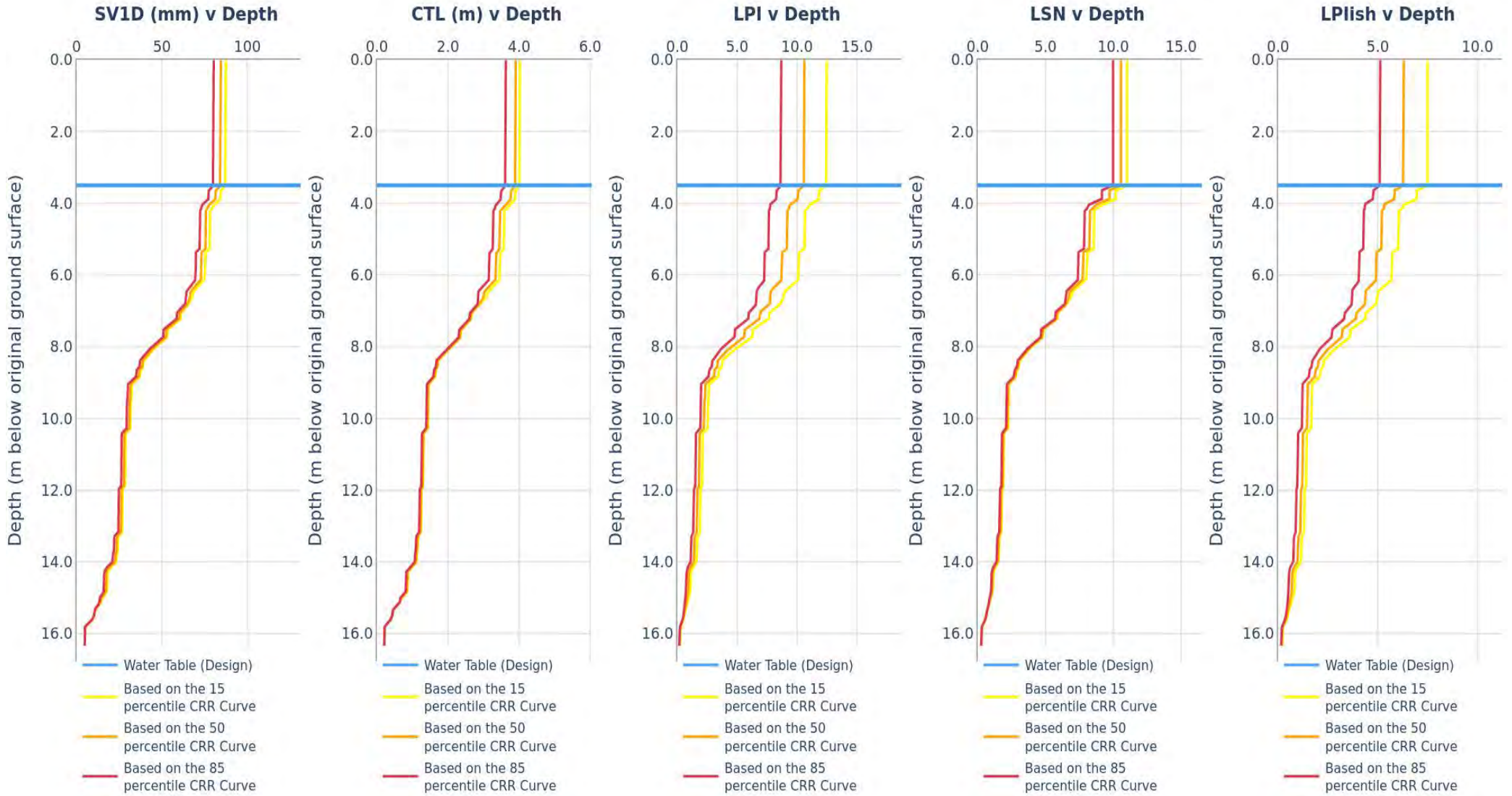
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 8/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

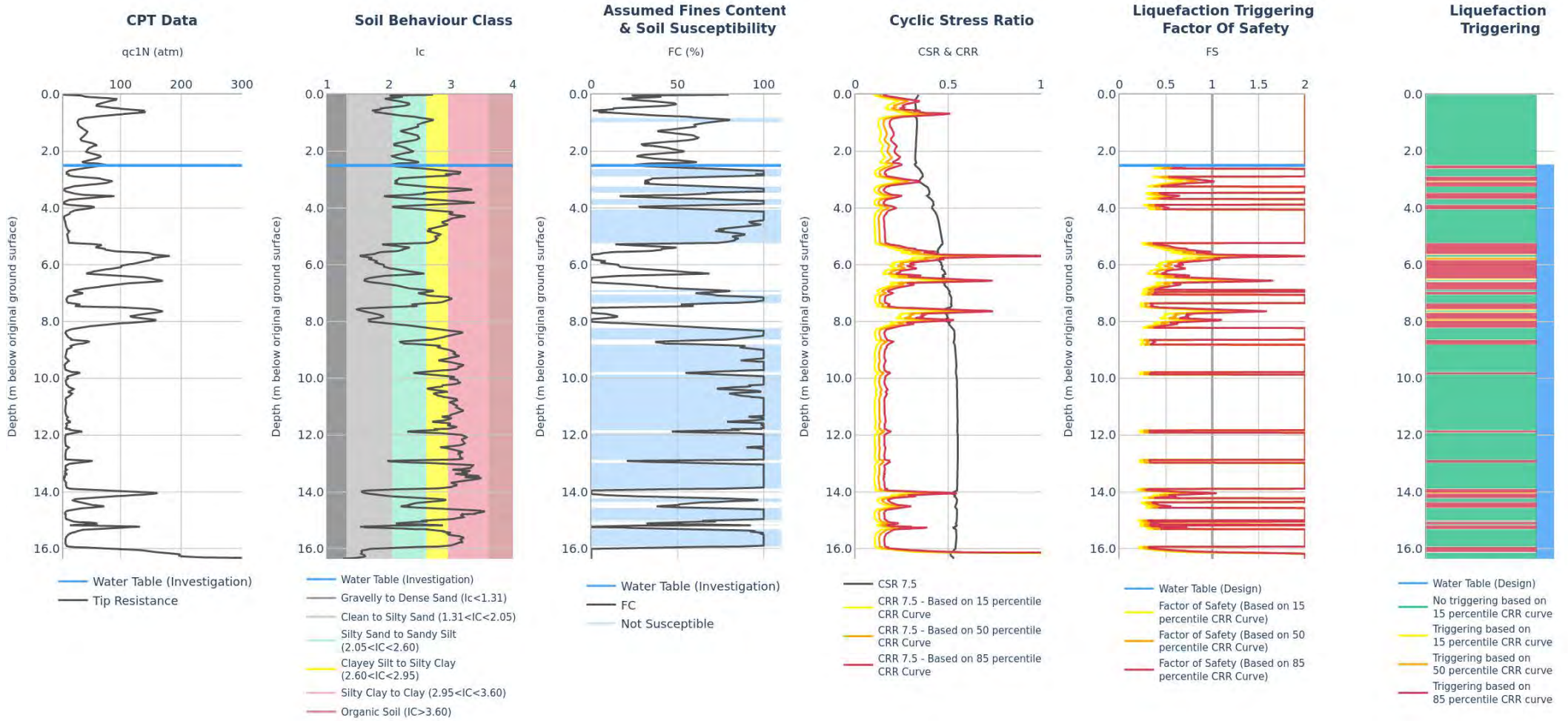


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT432	CPT_TT262942	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/20

## CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT433	CPT_TT262943	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

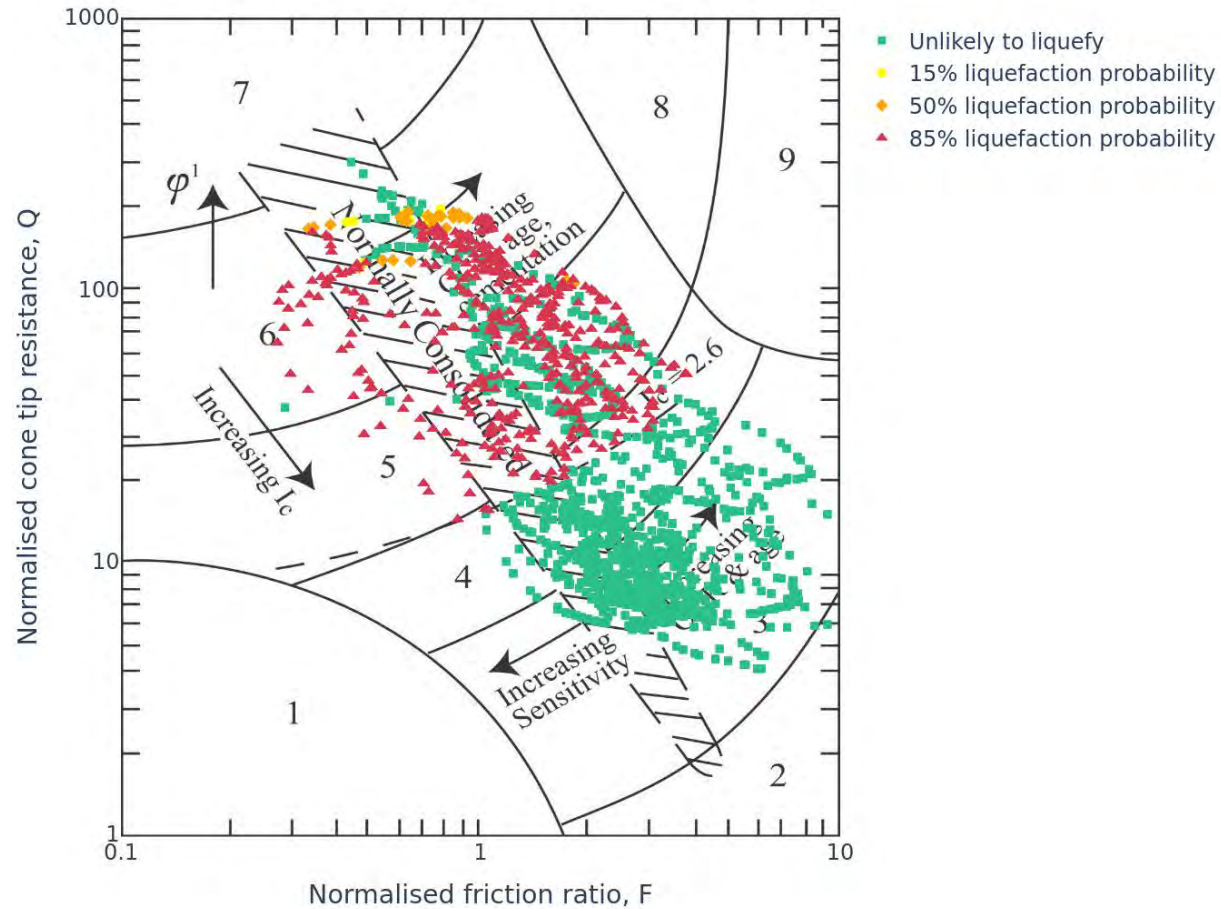
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	98	4.7	16	15	2.6	10
50%	94	4.6	13	14	2.6	9
85%	88	4.3	10	13	2.6	7

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 10/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



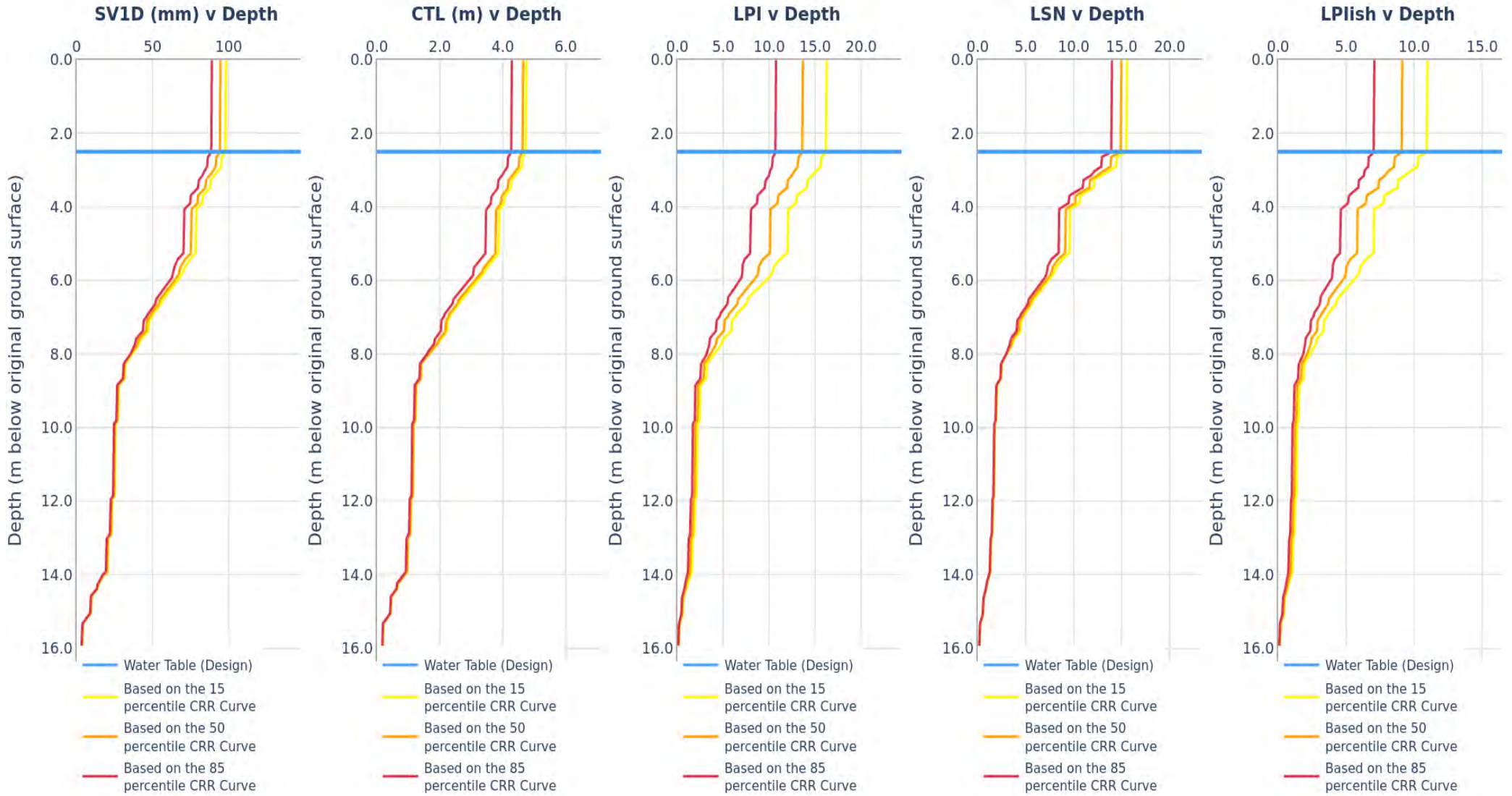
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 11/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

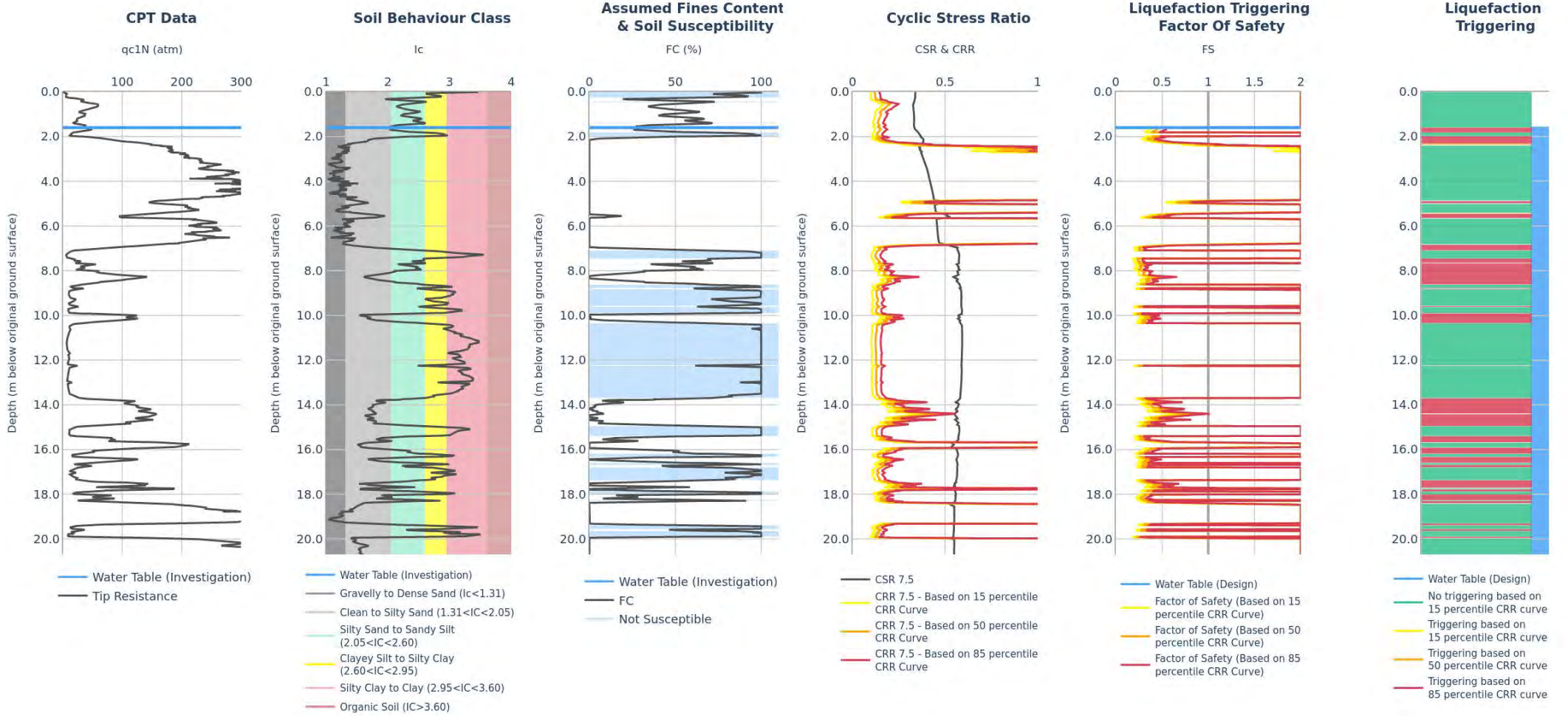


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT433	CPT_TT262943	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT437	CPT_TT262947	05/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

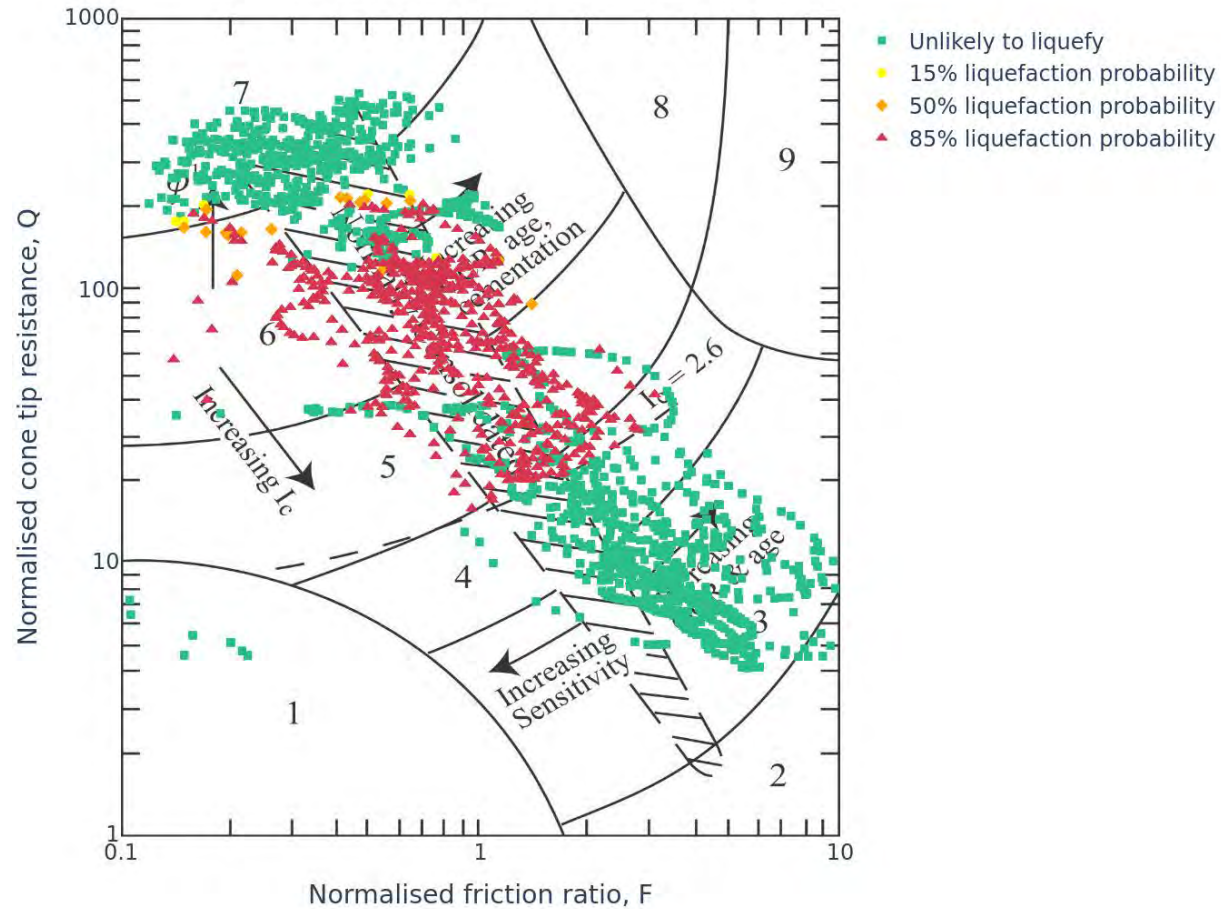
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	136	6.3	17	18	1.7	13
50%	133	6.2	15	18	1.7	11
85%	129	6.0	13	17	1.7	10

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 13/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



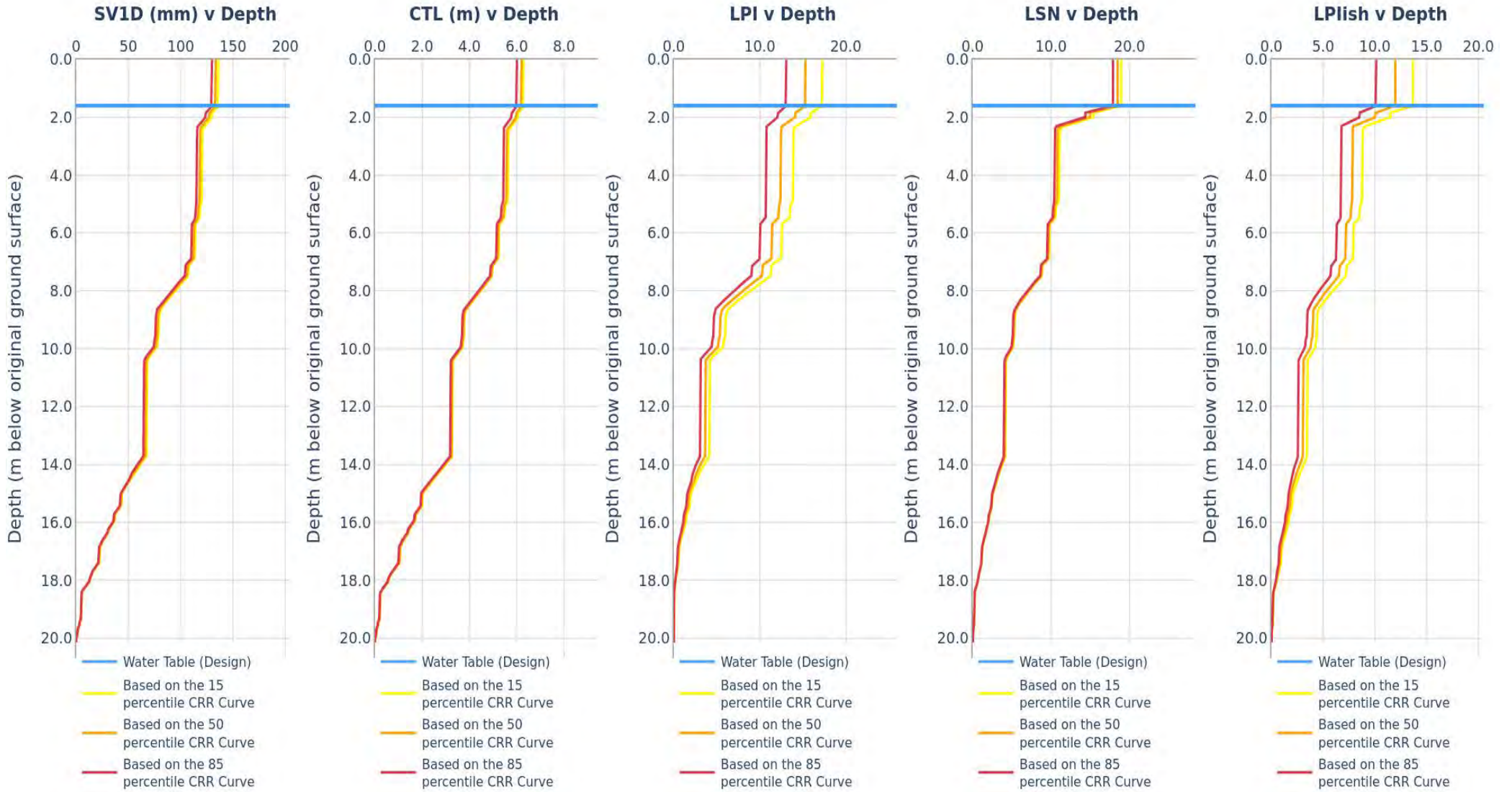
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 14/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

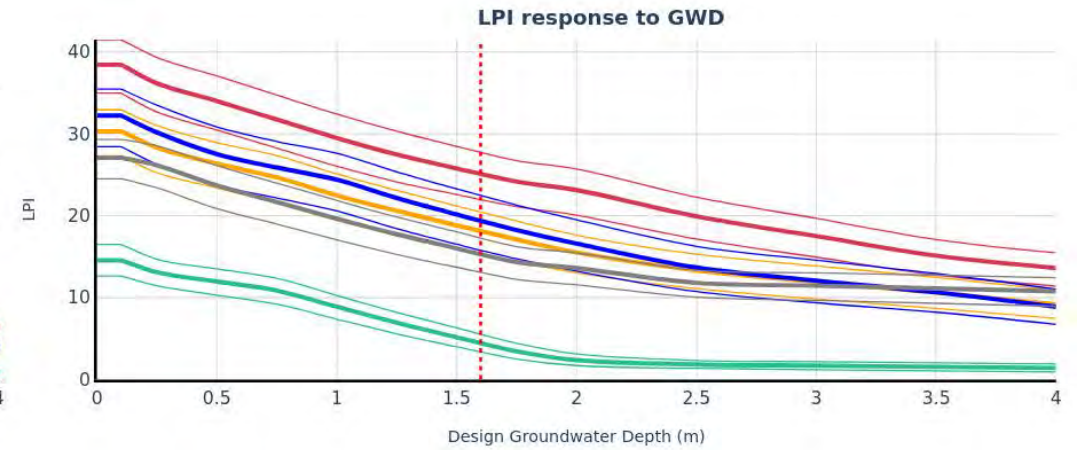
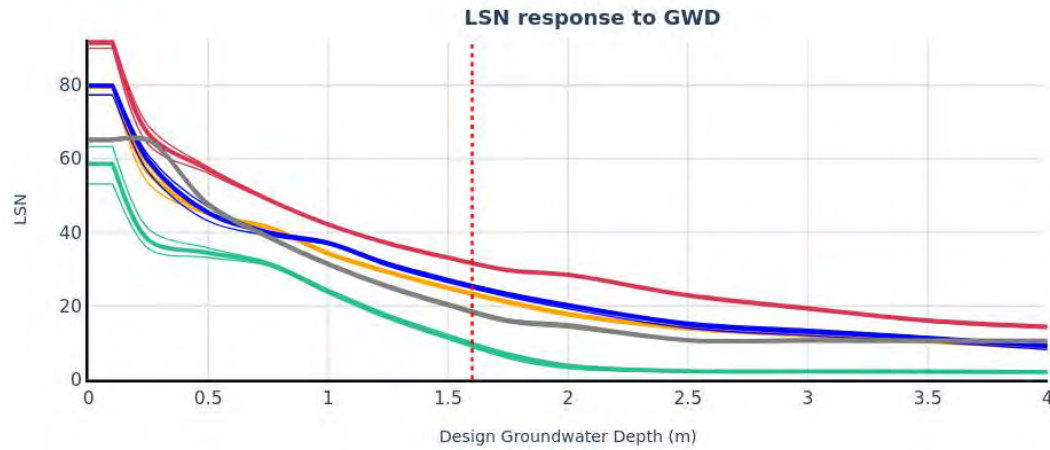
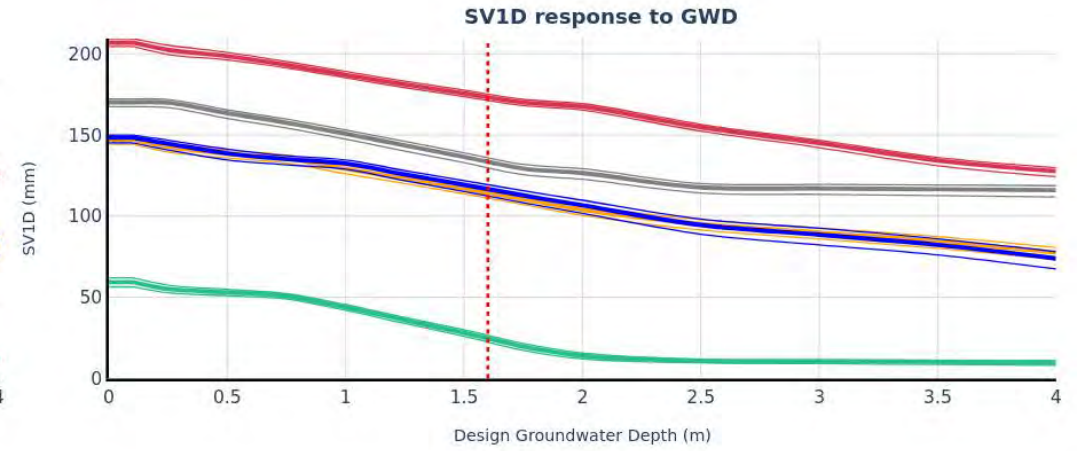
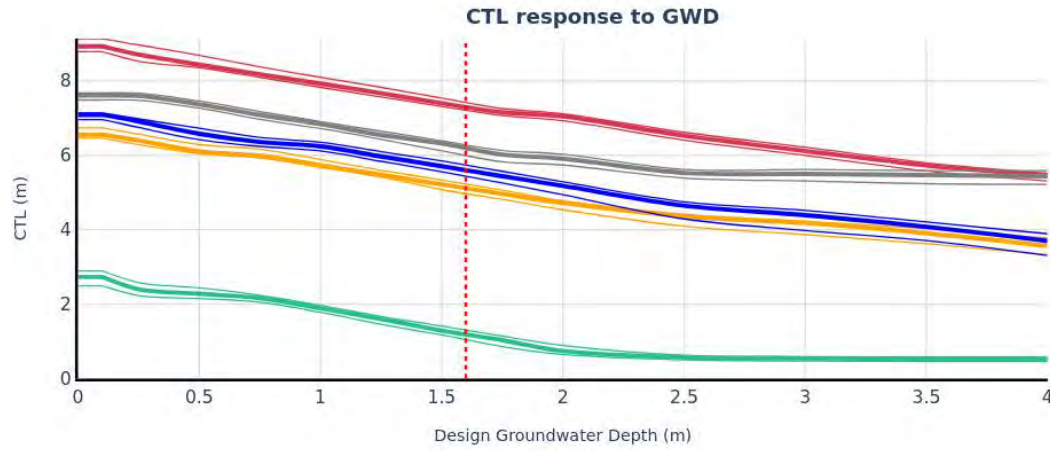


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT437	CPT_TT262947	05/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/20

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



**Input**

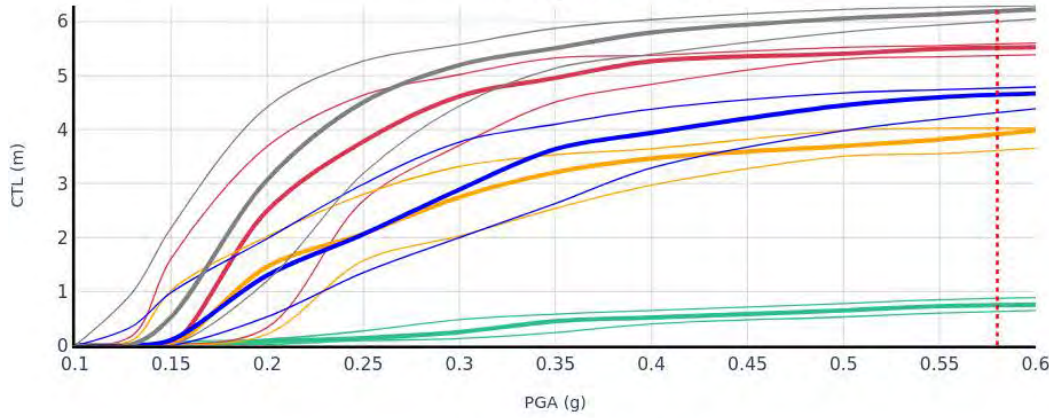
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT430	CPT_TT262877	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT431	CPT_TT262963	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT432	CPT_TT262942	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT433	CPT_TT262943	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT437	CPT_TT262947	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

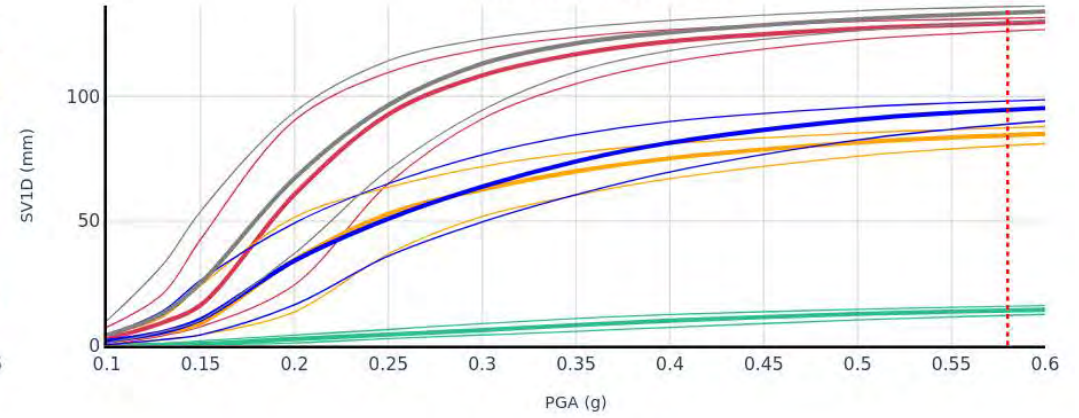
	<i>CLIENT</i>	<i>Hawkes Bay Regional council</i>	<i>LOCATION</i>	<i>Pakowhai</i>	<i>DATE: 17/09/2025</i>
	<i>PROJECT</i>	<i>Pakowhai Secondary Stopbanks</i>			<i>ANALYSED: MIBU</i>
	<i>TITLE</i>	<i>Pakowhai Secondary Stopbanks</i>	<i>JOB NUMBER</i>	<i>1017353.2403</i>	
	<i>COMMENT</i>	<i>nan</i>			<i>Page 16/20</i>

# PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

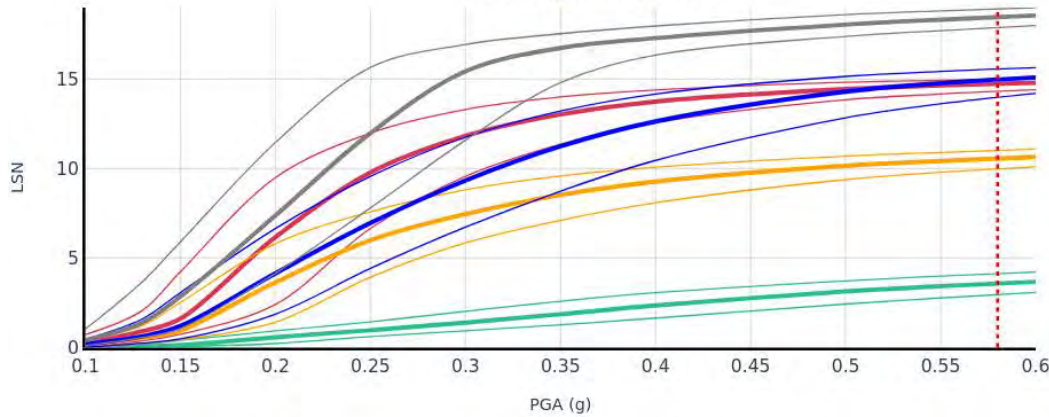
**CTL response to PGA**



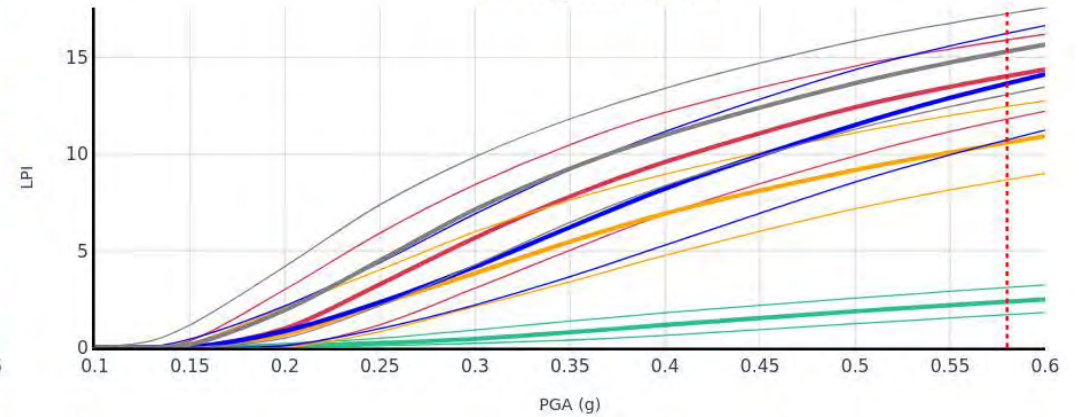
**SVID response to PGA**



**LSN response to PGA**




**LPI response to PGA**



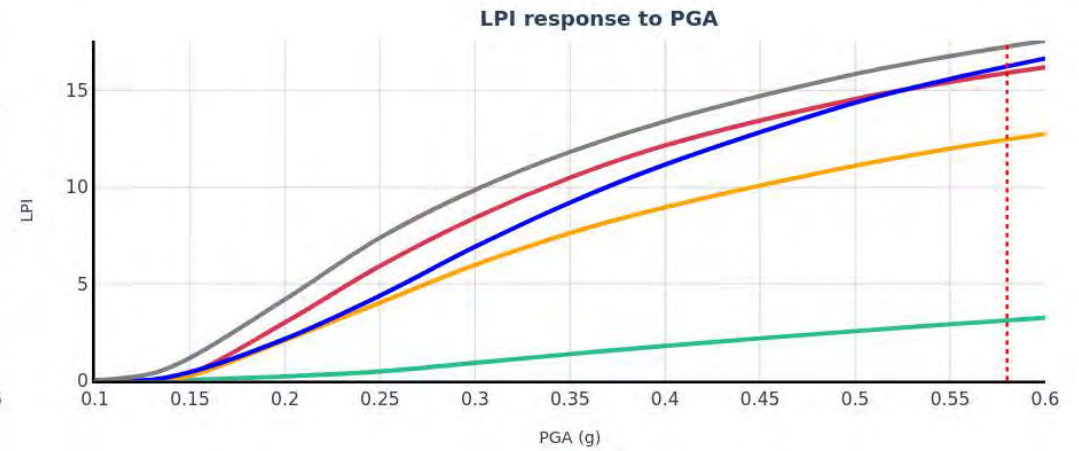
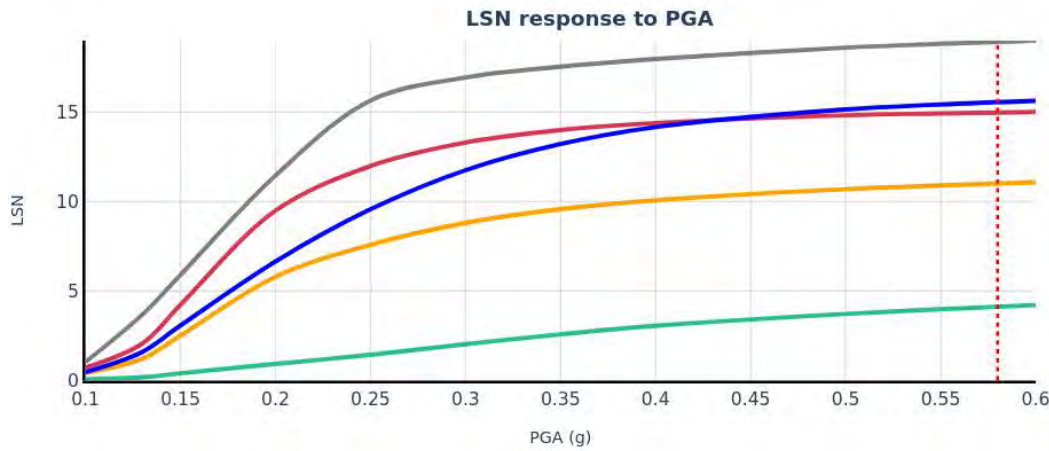
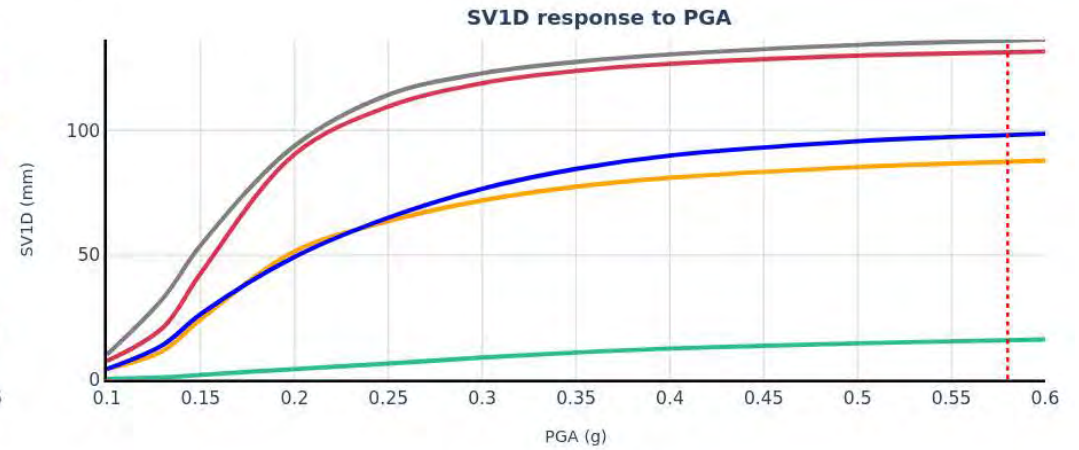
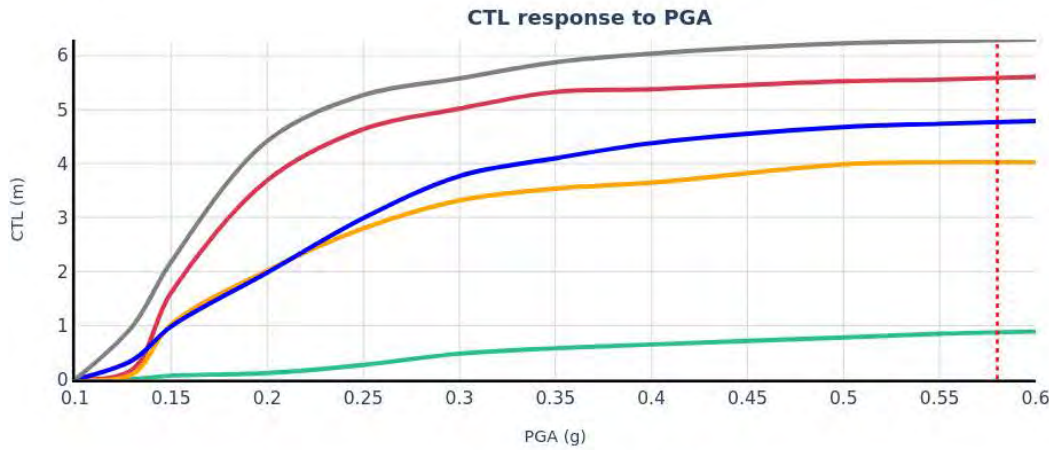
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT430	CPT_TT262877	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT431	CPT_TT262963	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT432	CPT_TT262942	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT433	CPT_TT262943	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT437	CPT_TT262947	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.


	<i>CLIENT</i>	<i>Hawkes Bay Regional council</i>	<i>LOCATION</i>	<i>Pakowhai</i>	<i>DATE: 17/09/2025</i>
	<i>PROJECT</i>	<i>Pakowhai Secondary Stopbanks</i>			<i>ANALYSED: MIBU</i>
	<i>TITLE</i>	<i>Pakowhai Secondary Stopbanks</i>	<i>JOB NUMBER</i>	<i>1017353.2403</i>	
	<i>COMMENT</i>	<i>nan</i>			<i>Page 17/20</i>

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT430	CPT_TT262877	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT431	CPT_TT262963	06/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT432	CPT_TT262942	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT433	CPT_TT262943	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT437	CPT_TT262947	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 18/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262877	TTGD 262963	TTGD 262942
CPT Name	CPT_TT262877_Raw01	CPT_TT262963_Raw01	CPT_TT262942_Raw01
Run Description	CPT430	CPT431	CPT432
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	1.7	3.8	3.5
Depth to groundwater for design (m)	2.0	3.8	3.5
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	6.794	19.708	16.773
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	6.794	19.708	16.773
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262877	CPT430	0.0	0.0	0.0
TTGD 262877	CPT430	0.0	6.79	2.6
TTGD 262963	CPT431	0.0	0.0	0.0
TTGD 262963	CPT431	0.0	19.71	2.6
TTGD 262942	CPT432	0.0	0.0	0.0
TTGD 262942	CPT432	0.0	16.77	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262877	CPT430	0.0	6.79	0.0 CFC
TTGD 262963	CPT431	0.0	19.71	0.0 CFC
TTGD 262942	CPT432	0.0	16.77	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262877	CPT430	0.0	0.0001	18.0
TTGD 262877	CPT430	0.0001	6.79	18.0
TTGD 262963	CPT431	0.0	0.0001	18.0
TTGD 262963	CPT431	0.0001	19.71	18.0
TTGD 262942	CPT432	0.0	0.0001	18.0
TTGD 262942	CPT432	0.0001	16.77	18.0

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 19/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262943	TTGD 262947
CPT Name	CPT_TT262943_Raw01	CPT_TT262947_Raw01
Run Description	CPT433	CPT437
EQ PGA (g)	0.58	0.58
EQ Magnitude	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.5	1.6
Depth to groundwater for design (m)	2.5	1.6
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	16.358	20.691
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	16.358	20.691
Inverse filtering applied?	No	No
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262943	CPT433	0.0	0.0	0.0
TTGD 262943	CPT433	0.0	16.36	2.6
TTGD 262947	CPT437	0.0	0.0	0.0
TTGD 262947	CPT437	0.0	20.69	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

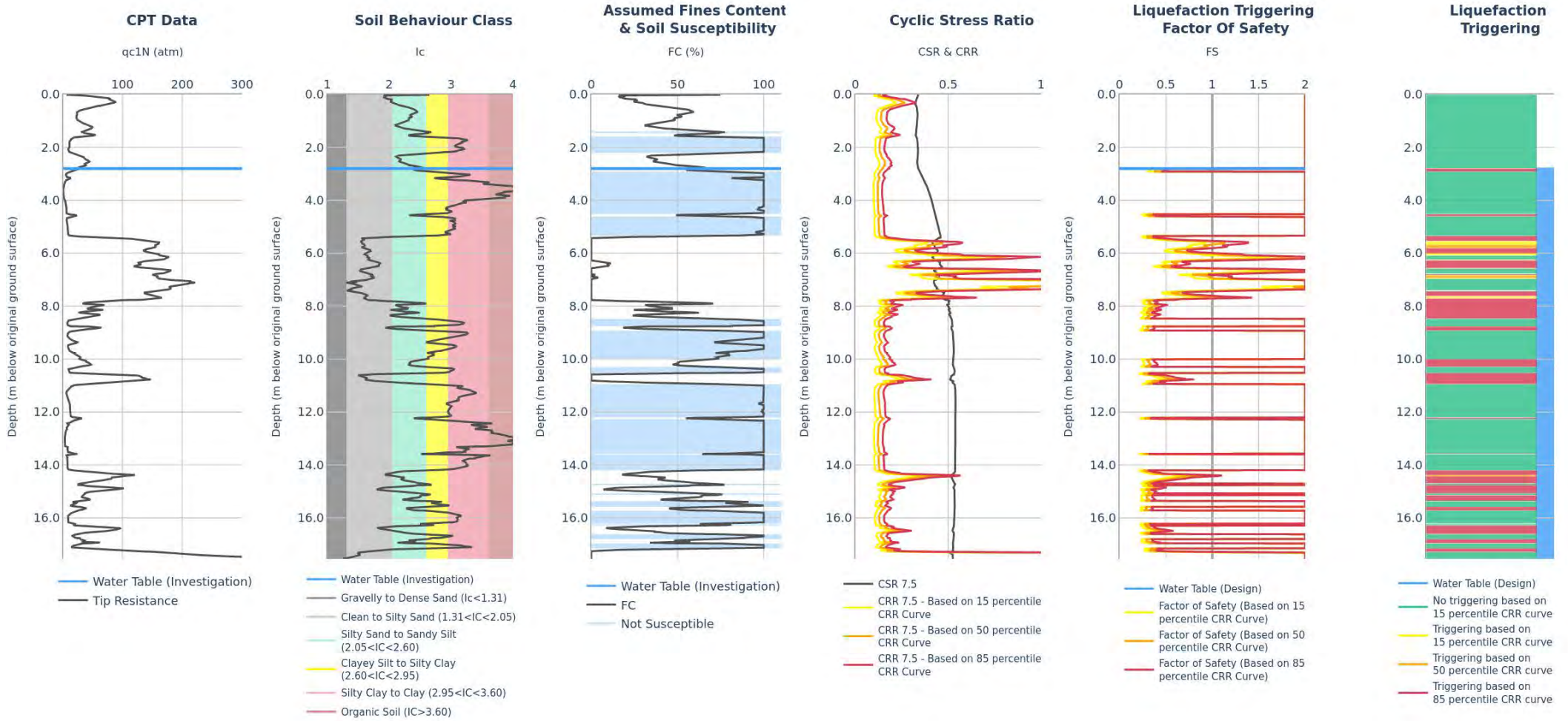
ID	Run description	From (m)	To (m)	Fc
TTGD 262943	CPT433	0.0	16.36	0.0 CFC
TTGD 262947	CPT437	0.0	20.69	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262943	CPT433	0.0	0.0001	18.0
TTGD 262943	CPT433	0.0001	16.36	18.0
TTGD 262947	CPT437	0.0	0.0001	18.0
TTGD 262947	CPT437	0.0001	20.69	18.0

	CLIENT	Hawkes Bay Regional council	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 20/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT434	CPT_TT262944	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

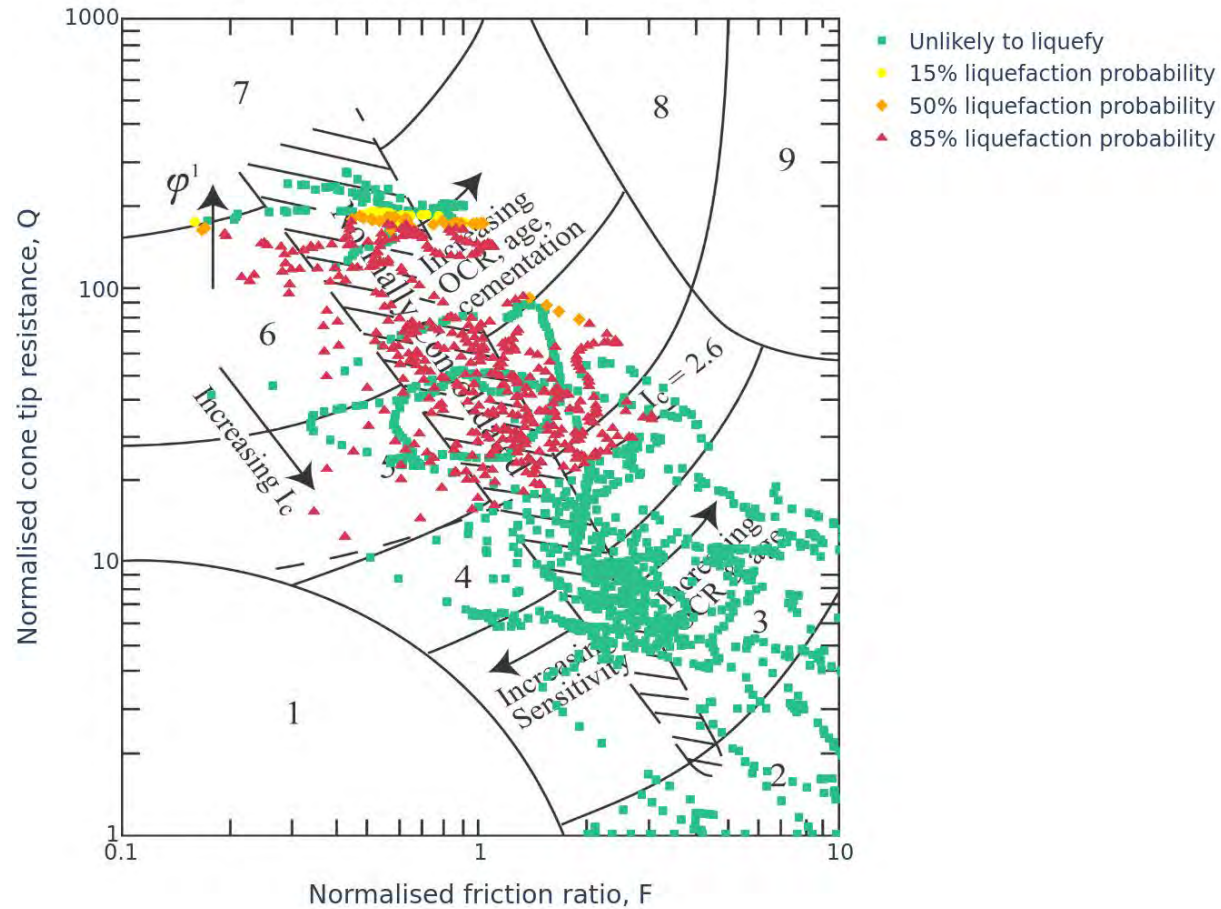
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	110	5.3	14	12	2.9	8
50%	105	5.0	12	11	2.9	7
85%	100	4.5	9	11	2.9	6

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



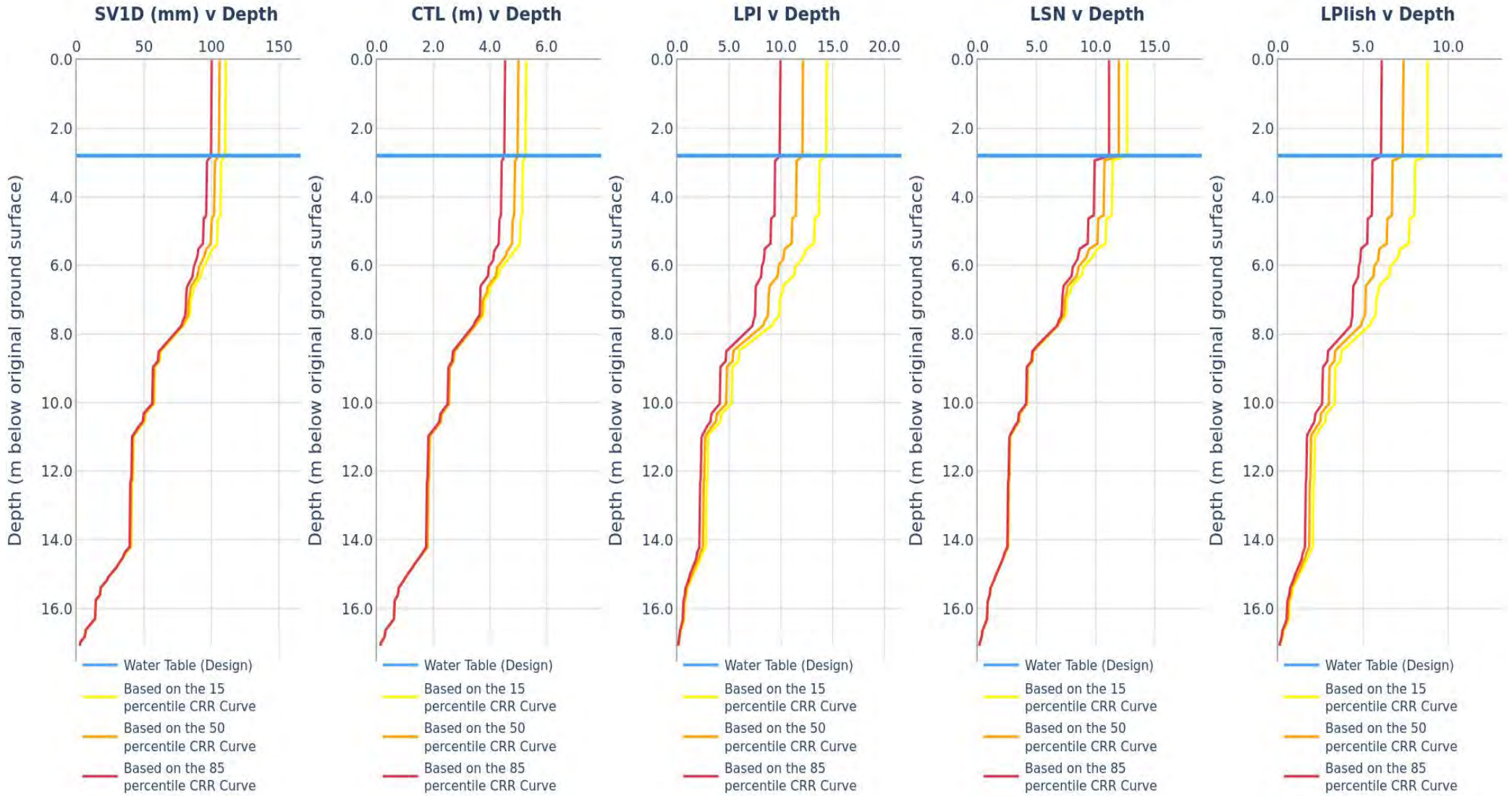
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 2/7

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



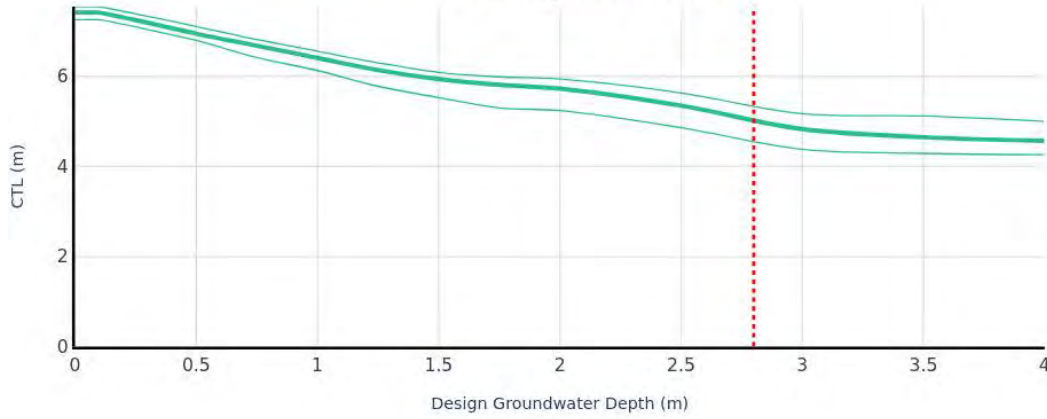
Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT434	CPT_TT262944	09/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

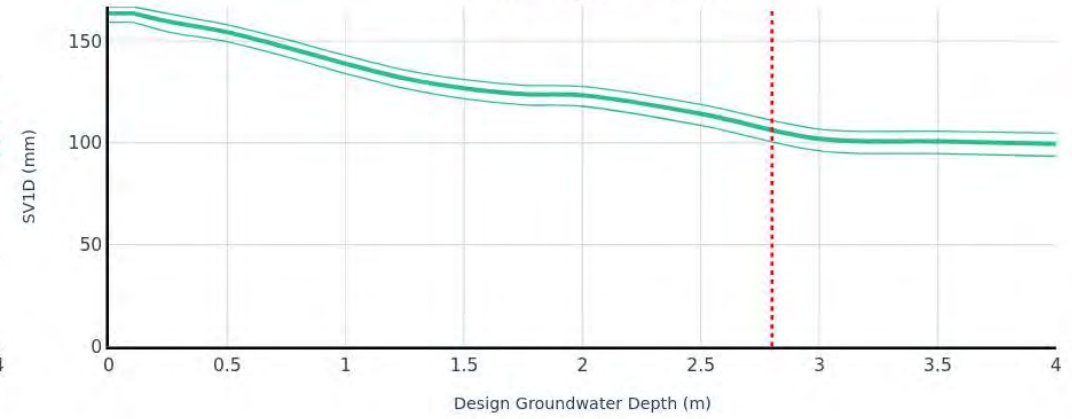
	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/7

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

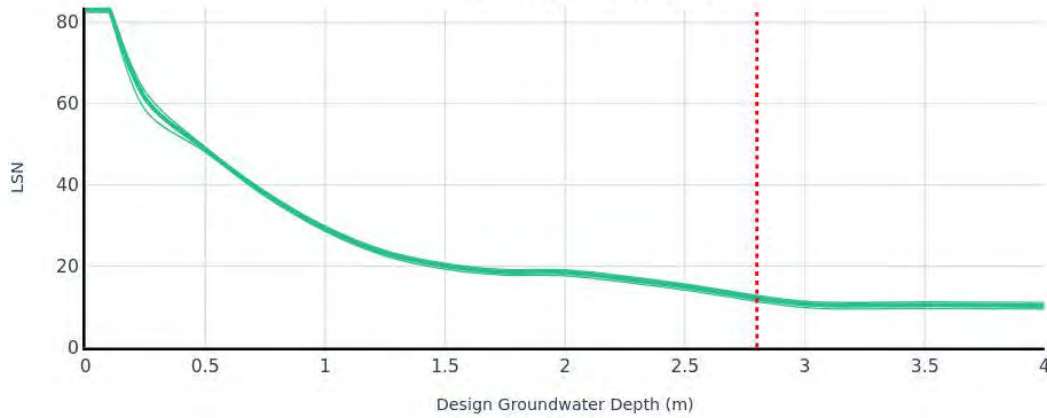
**CTL response to GWD**



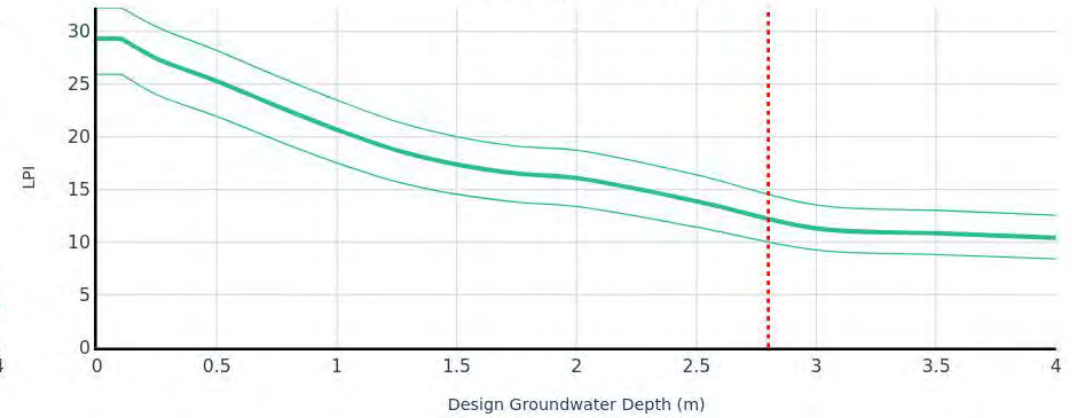
**SV1D response to GWD**



**LSN response to GWD**




**LPI response to GWD**



**Input**

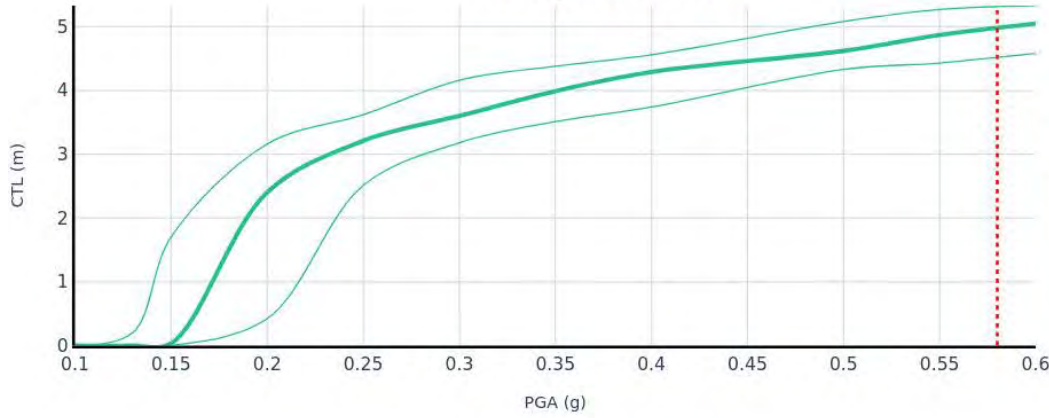
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT434	CPT_TT262944	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

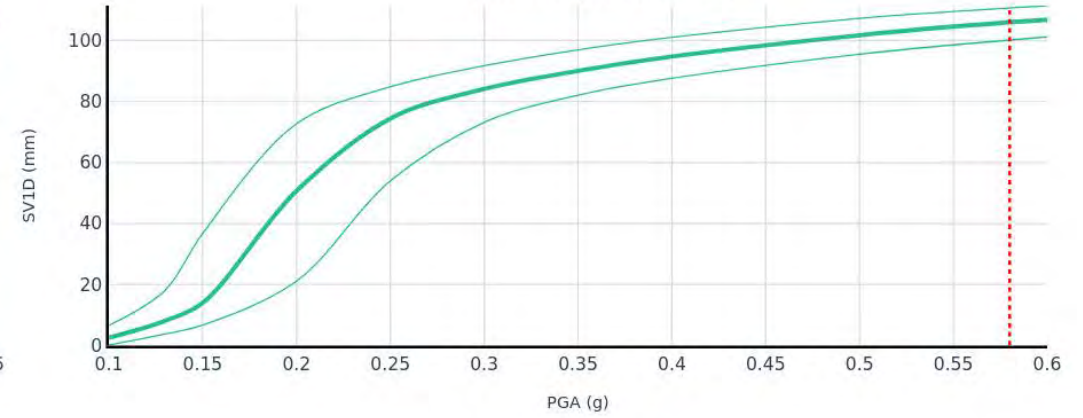
	<i>CLIENT</i>	<i>HBRC</i>	<i>LOCATION</i>	<i>Pakowhai</i>	<i>DATE: 11/09/2025</i>
	<i>PROJECT</i>	<i>Pakowhai Secondary Stopbank</i>			<i>ANALYSED: MIBU</i>
	<i>TITLE</i>	<i>Pakowhai Secondary Stopbanks</i>	<i>JOB NUMBER</i>	<i>1017353.2403</i>	
	<i>COMMENT</i>	<i>nan</i>			<i>Page 4/7</i>

## PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

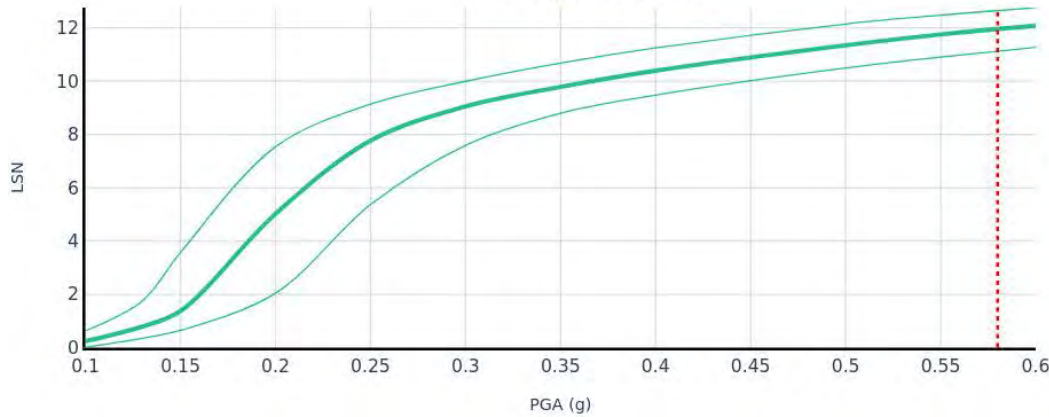
**CTL response to PGA**



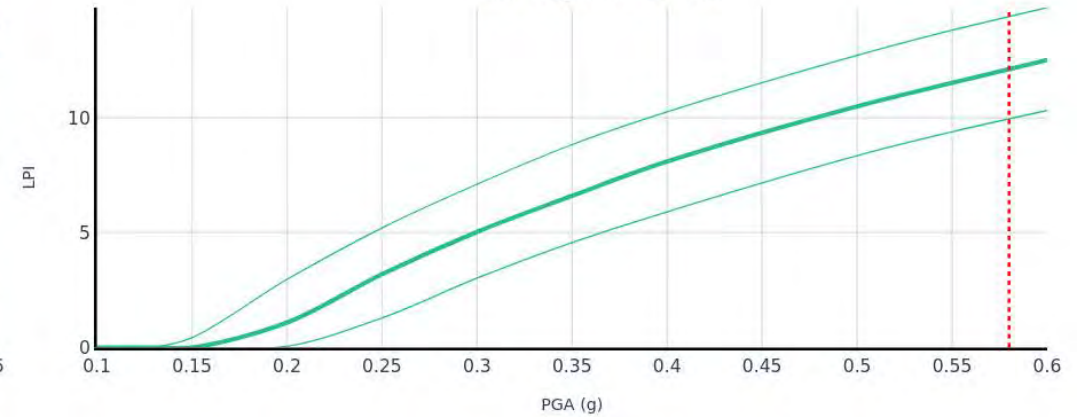
**SVID response to PGA**



**LSN response to PGA**




**LPI response to PGA**



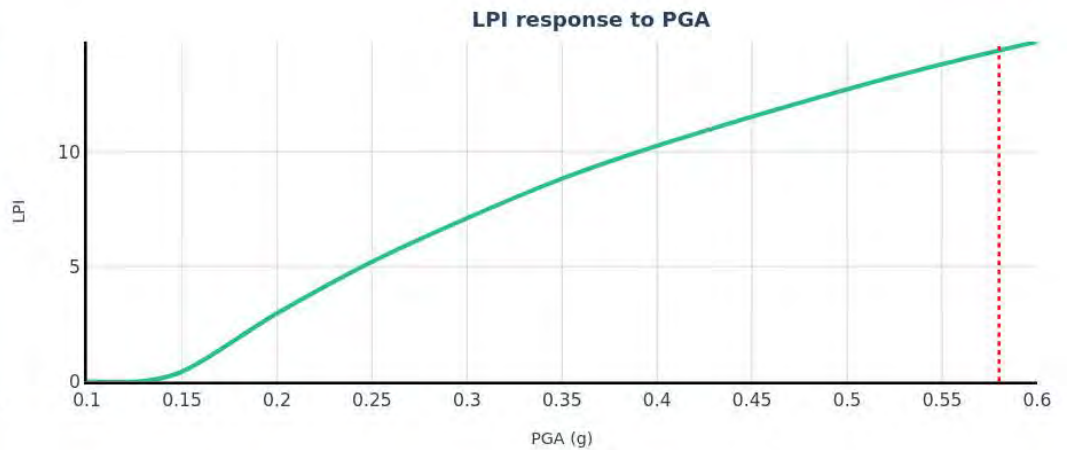
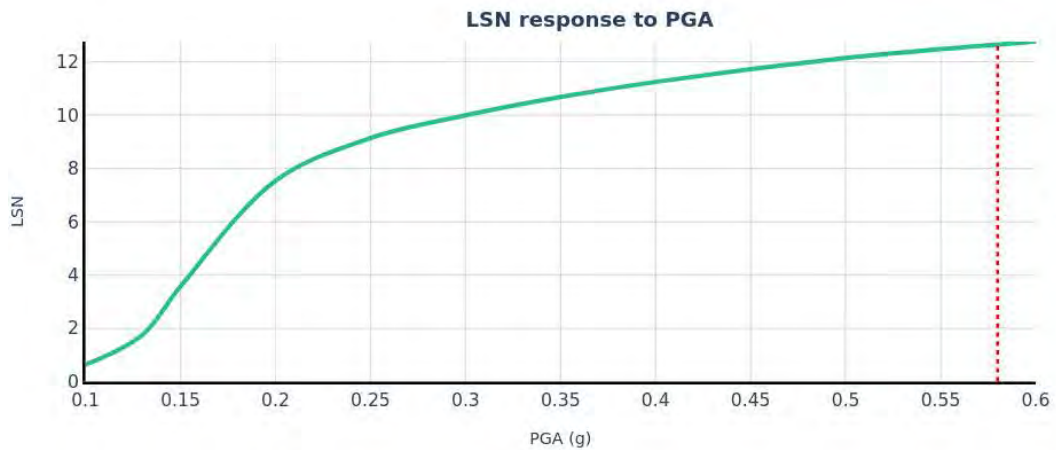
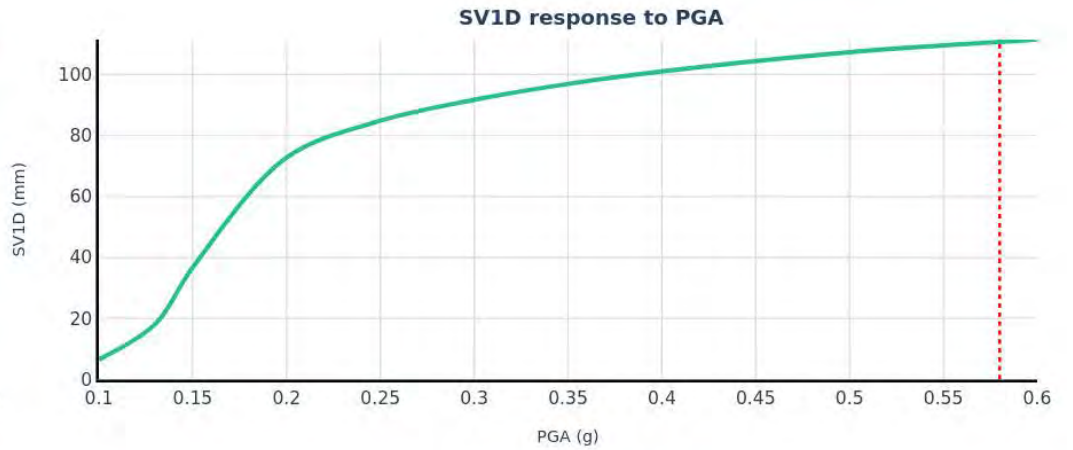
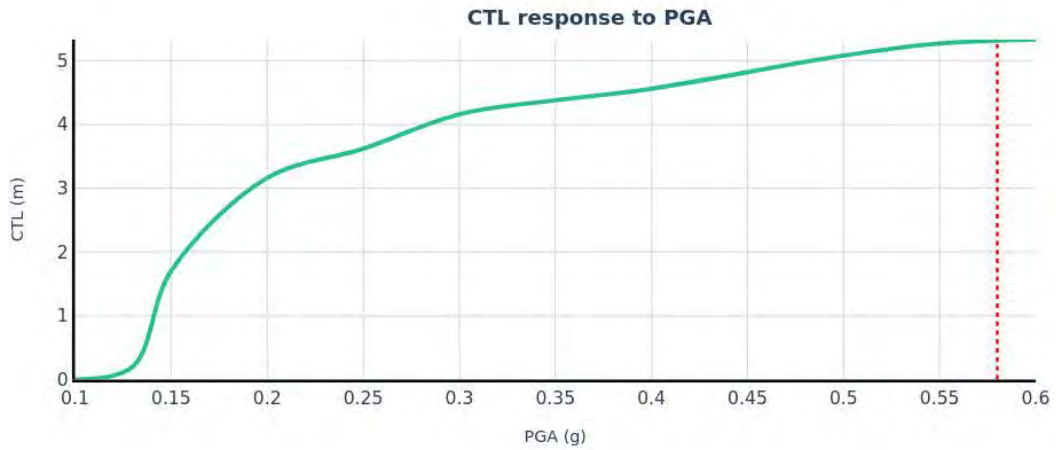
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT434	CPT_TT262944	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 5/7

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT434	CPT_TT262944	09/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/7

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262944
CPT Name	CPT_TT262944_Raw01
Run Description	CPT434
EQ PGA (g)	0.58
EQ Magnitude	7.1
Depth to groundwater at time of Investigation (m)	2.8
Depth to groundwater for design (m)	2.8
Pre-drill depth (m)	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	17.545
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	17.545
Inverse filtering applied?	No
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262944	CPT434	0.0	0.0	0.0
TTGD 262944	CPT434	0.0	17.55	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

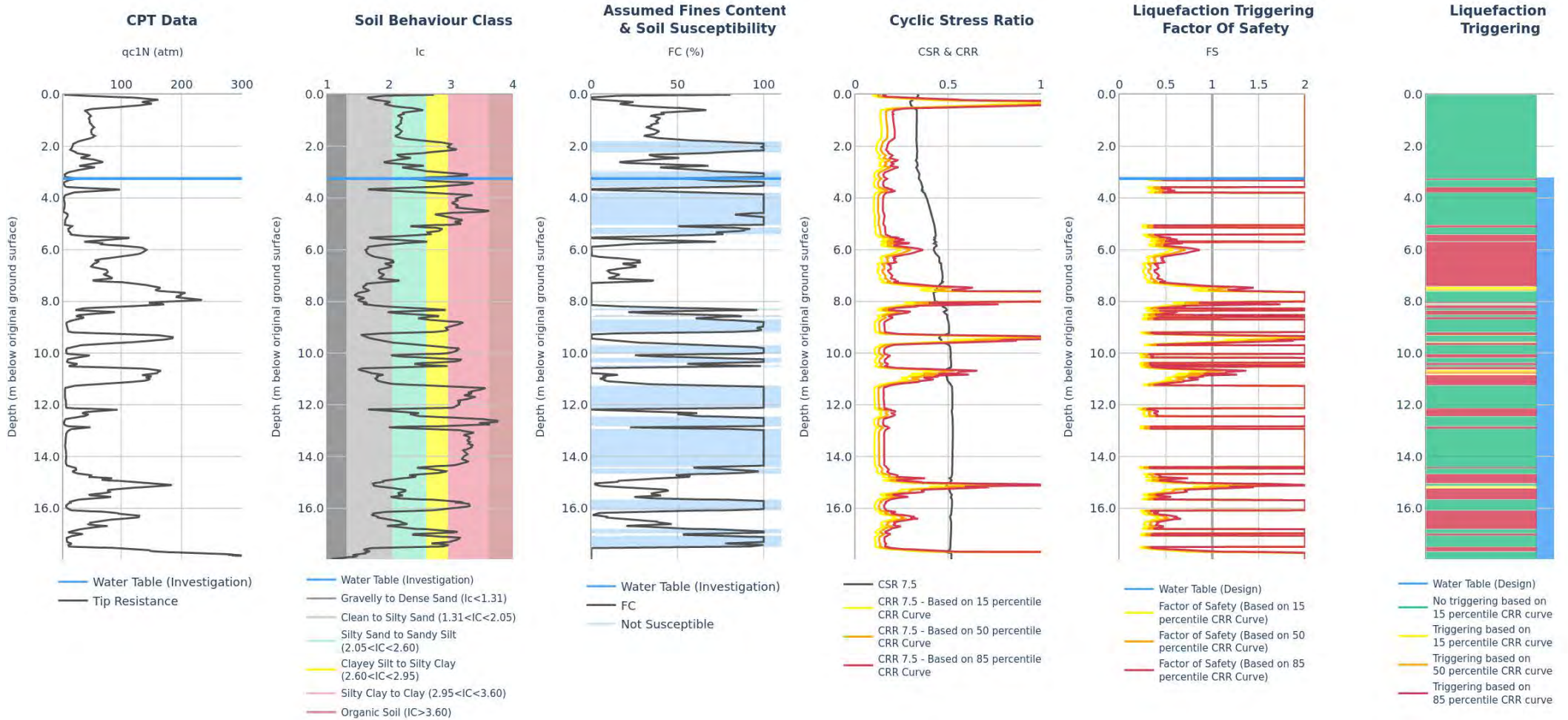
ID	Run description	From (m)	To (m)	Fc
TTGD 262944	CPT434	0.0	17.55	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262944	CPT434	0.0	0.0001	18.0
TTGD 262944	CPT434	0.0001	17.55	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 7/7

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT435	CPT_TT262945	10/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

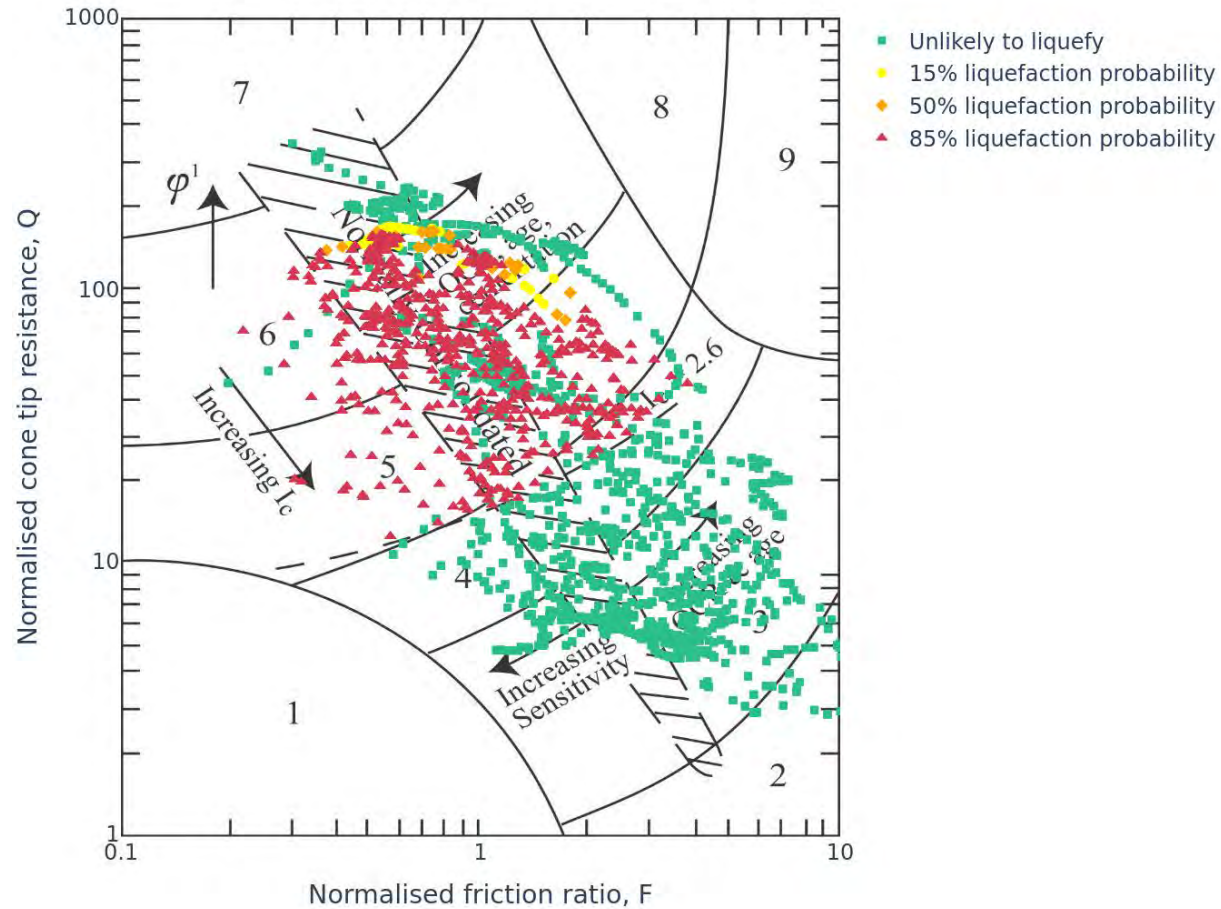
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	139	6.6	19	16	3.6	11
50%	135	6.2	16	16	3.6	10
85%	129	6.0	13	15	3.6	8

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 1/27

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



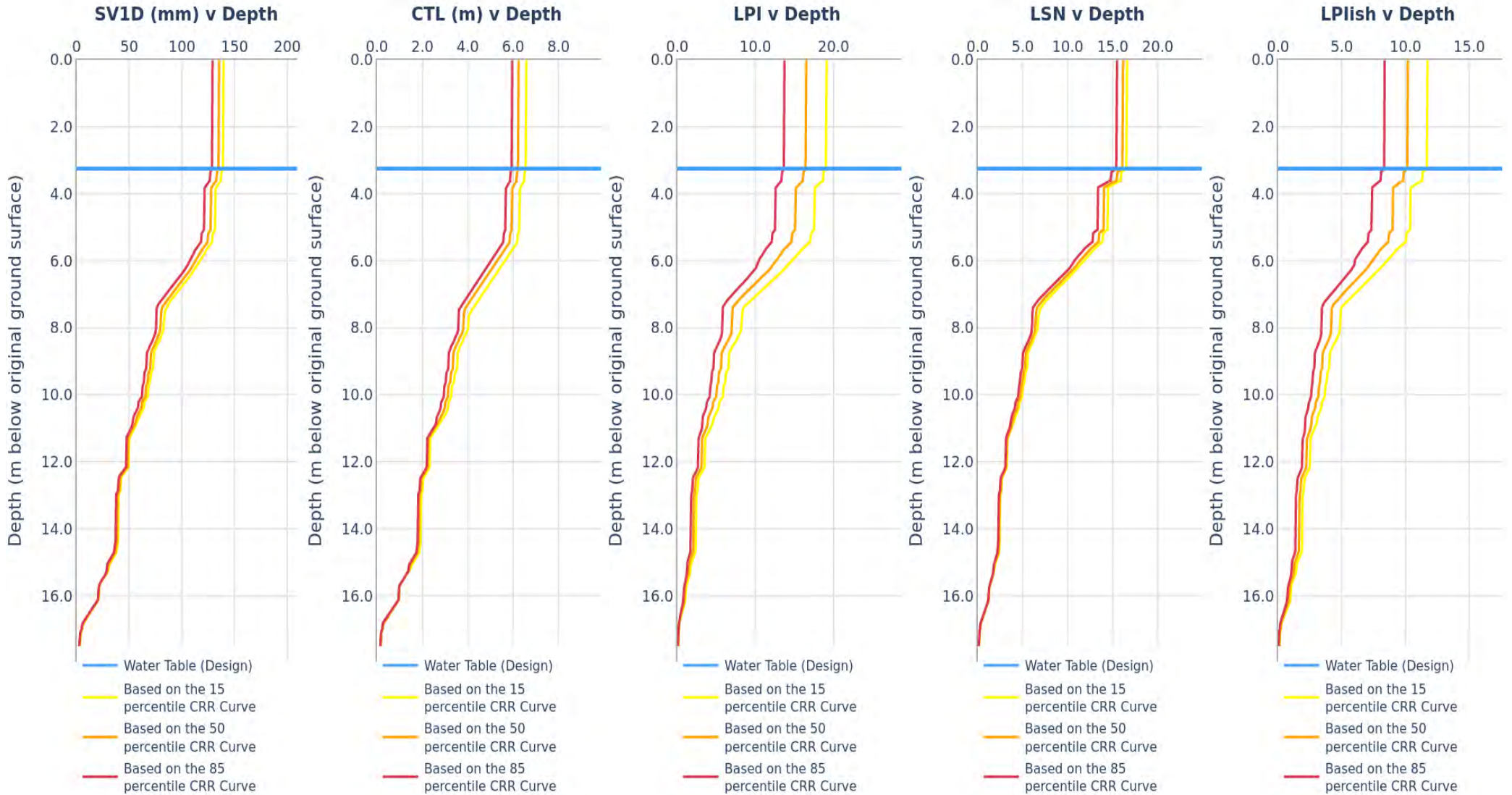
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 2/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

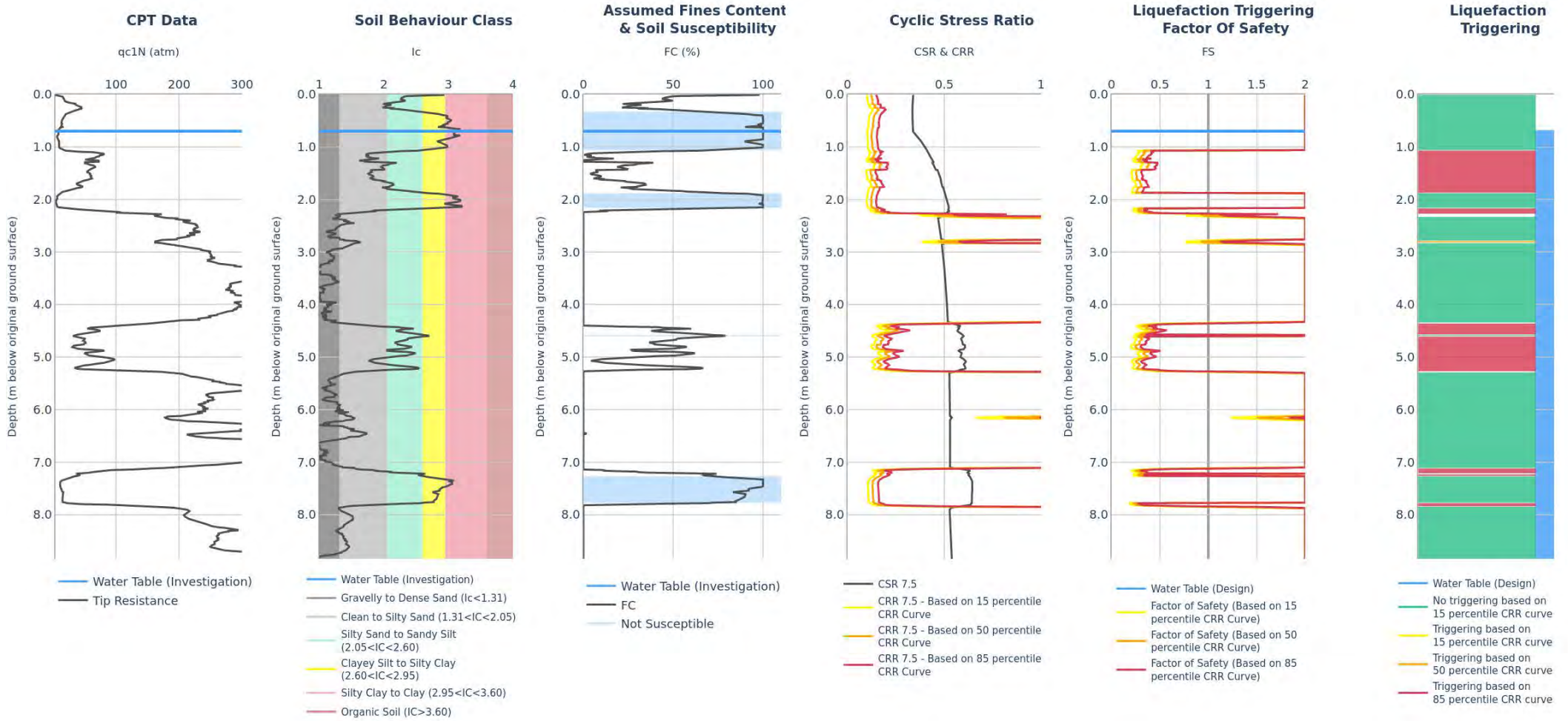


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT435	CPT_TT262945	10/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT438	CPT_TT262948	05/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

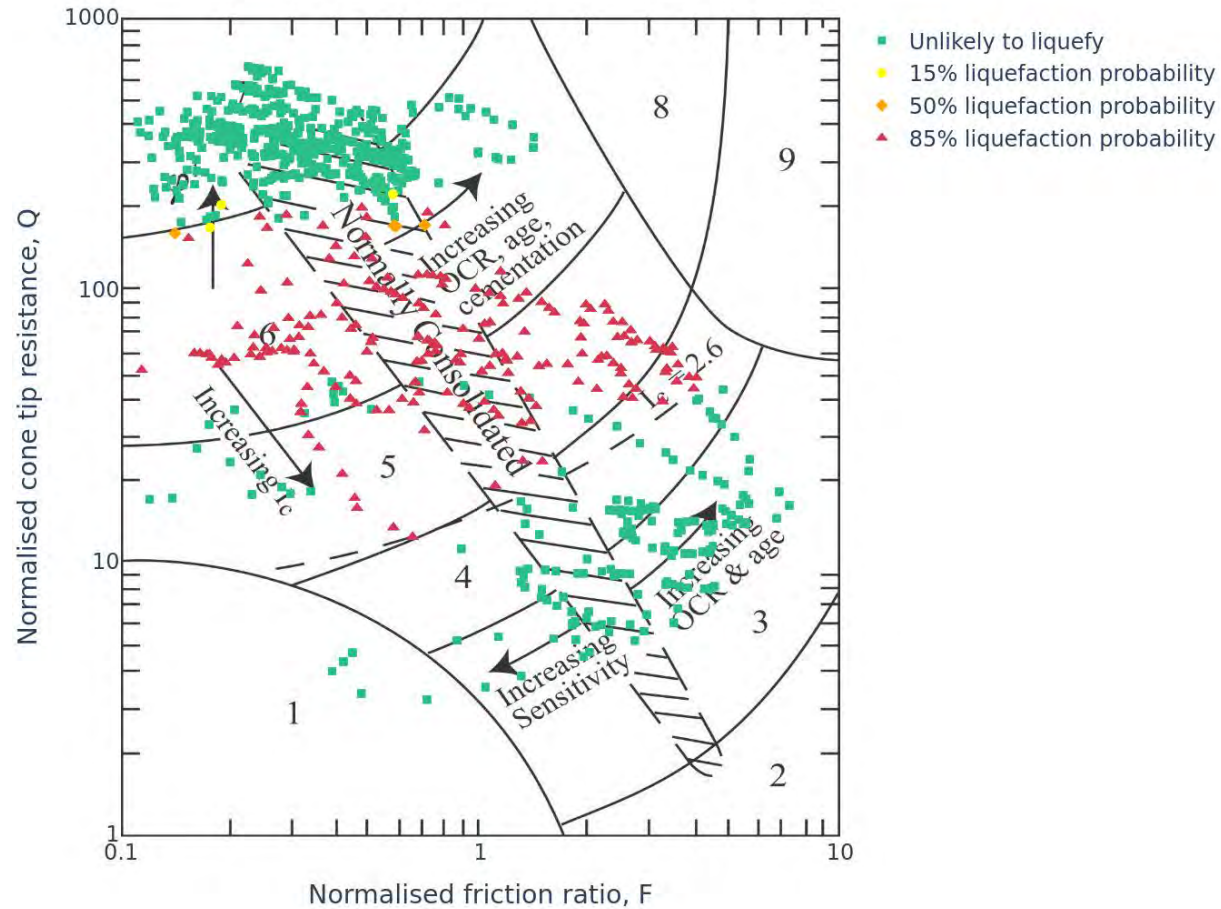
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	52	2.1	12	23	1.2	15
50%	51	2.1	11	22	1.2	14
85%	50	2.0	10	22	1.2	12

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



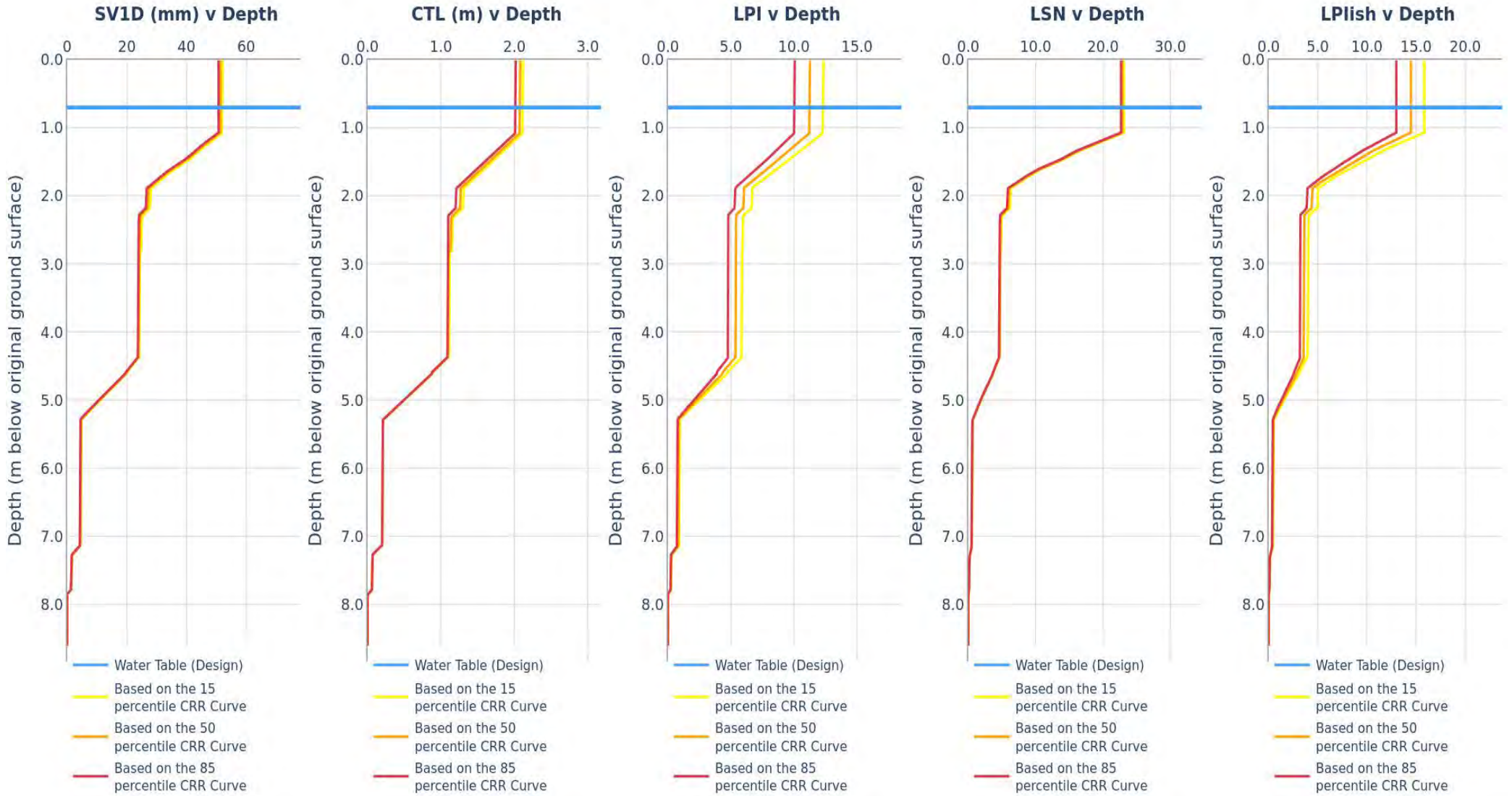
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 5/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

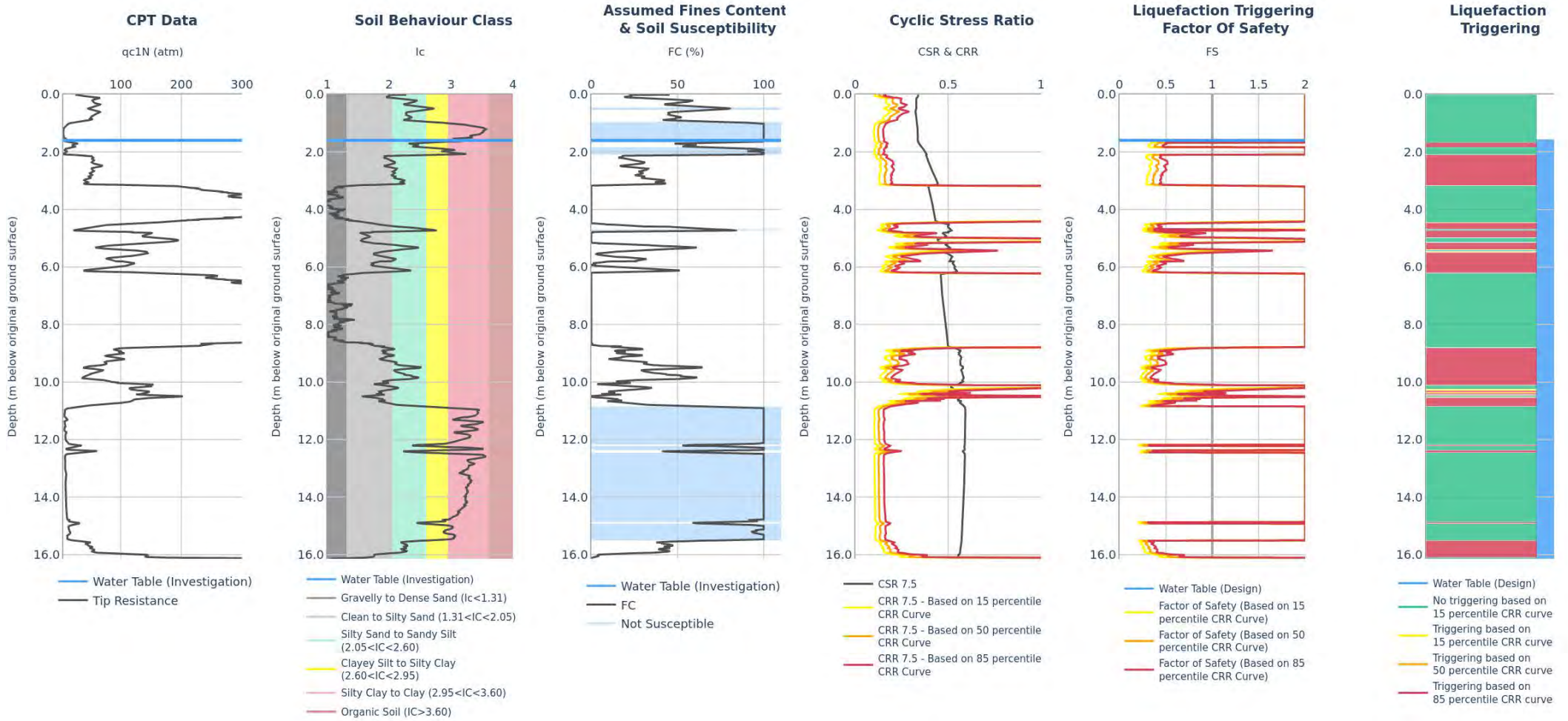


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT438	CPT_TT262948	05/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT436	CPT_TT262946	10/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

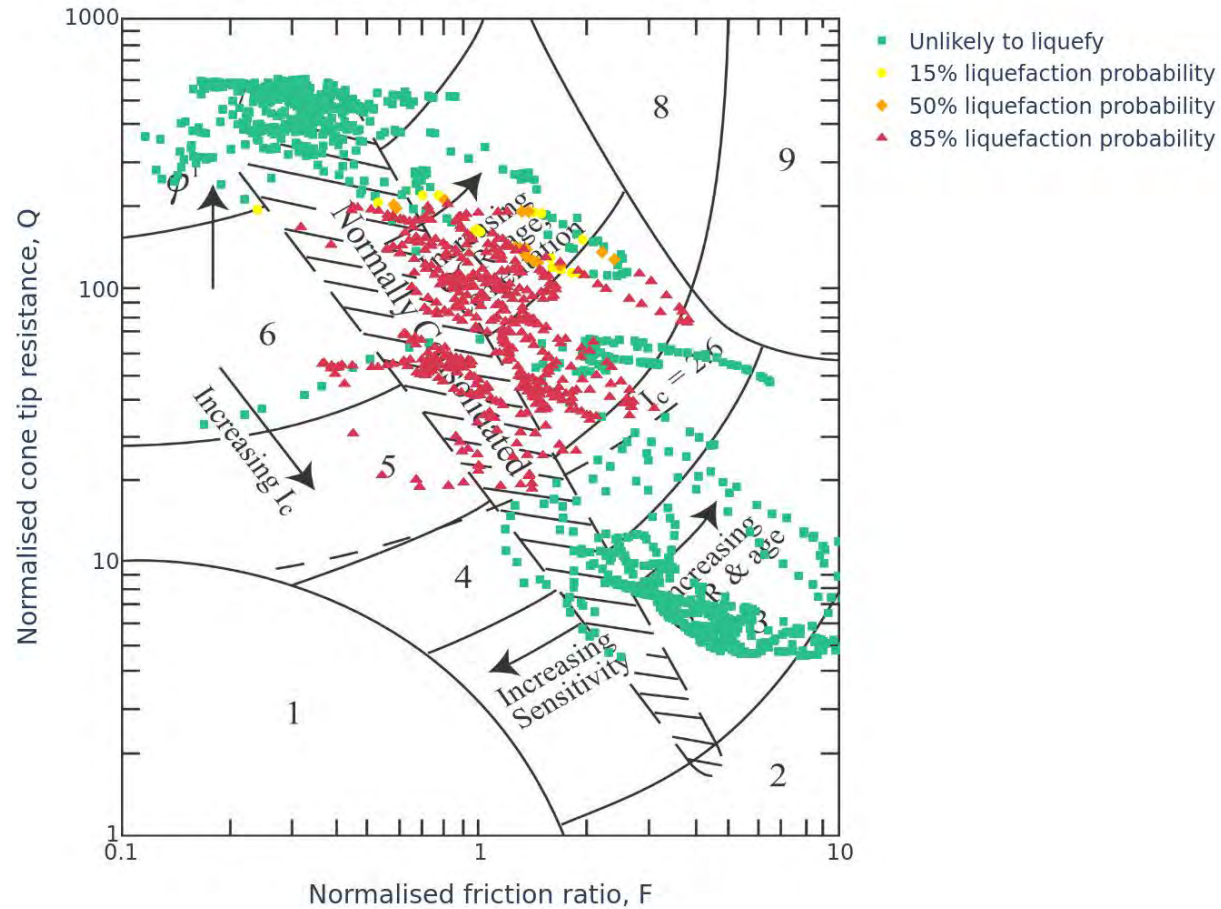
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	112	5.4	21	23	1.8	16
50%	110	5.2	18	22	1.8	14
85%	106	5.1	15	22	1.8	12

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



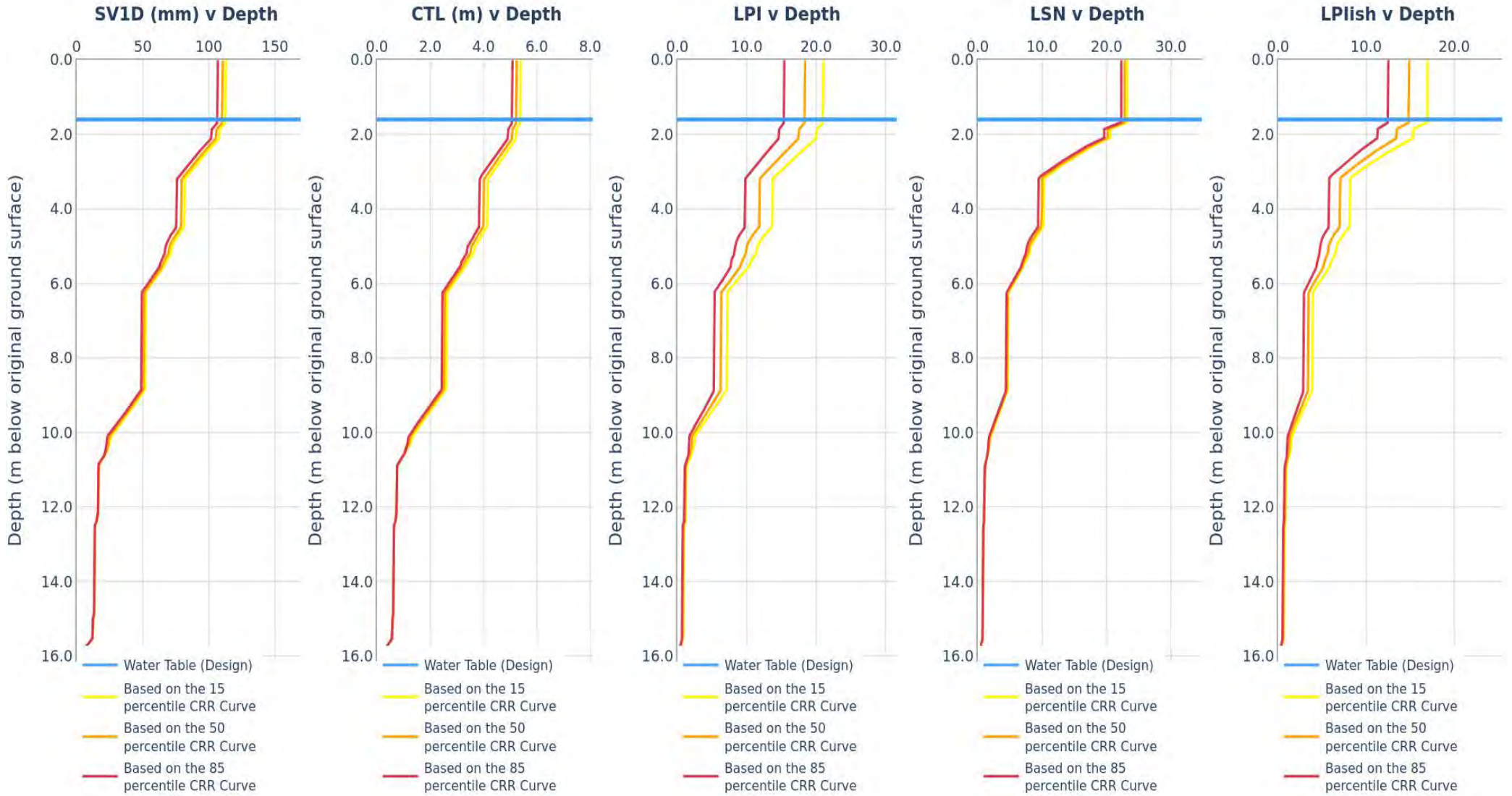
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 8/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

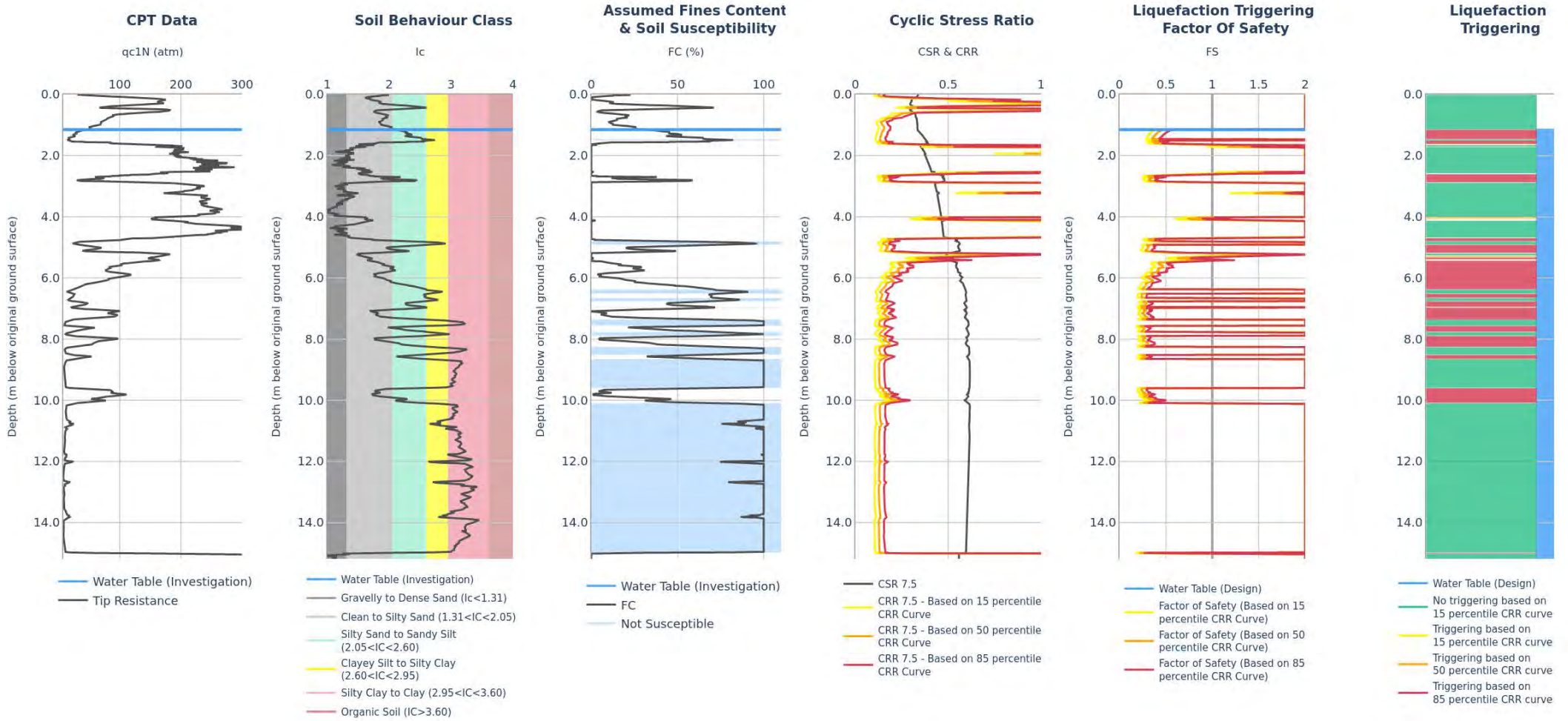


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT436	CPT_TT262946	10/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT439	CPT_TT262949	10/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

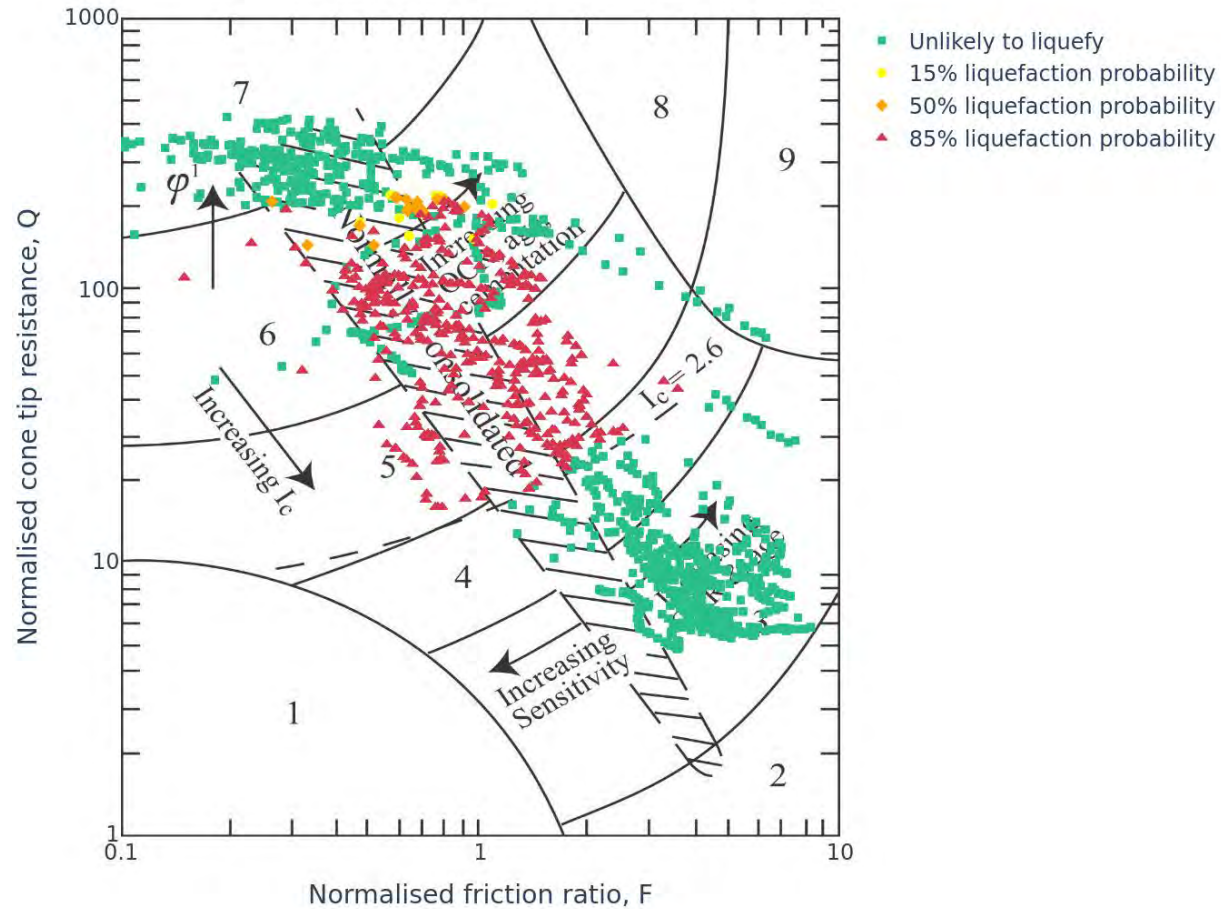
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	99	4.3	20	23	1.2	16
50%	97	4.2	18	23	1.2	15
85%	95	4.1	16	22	1.2	13

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



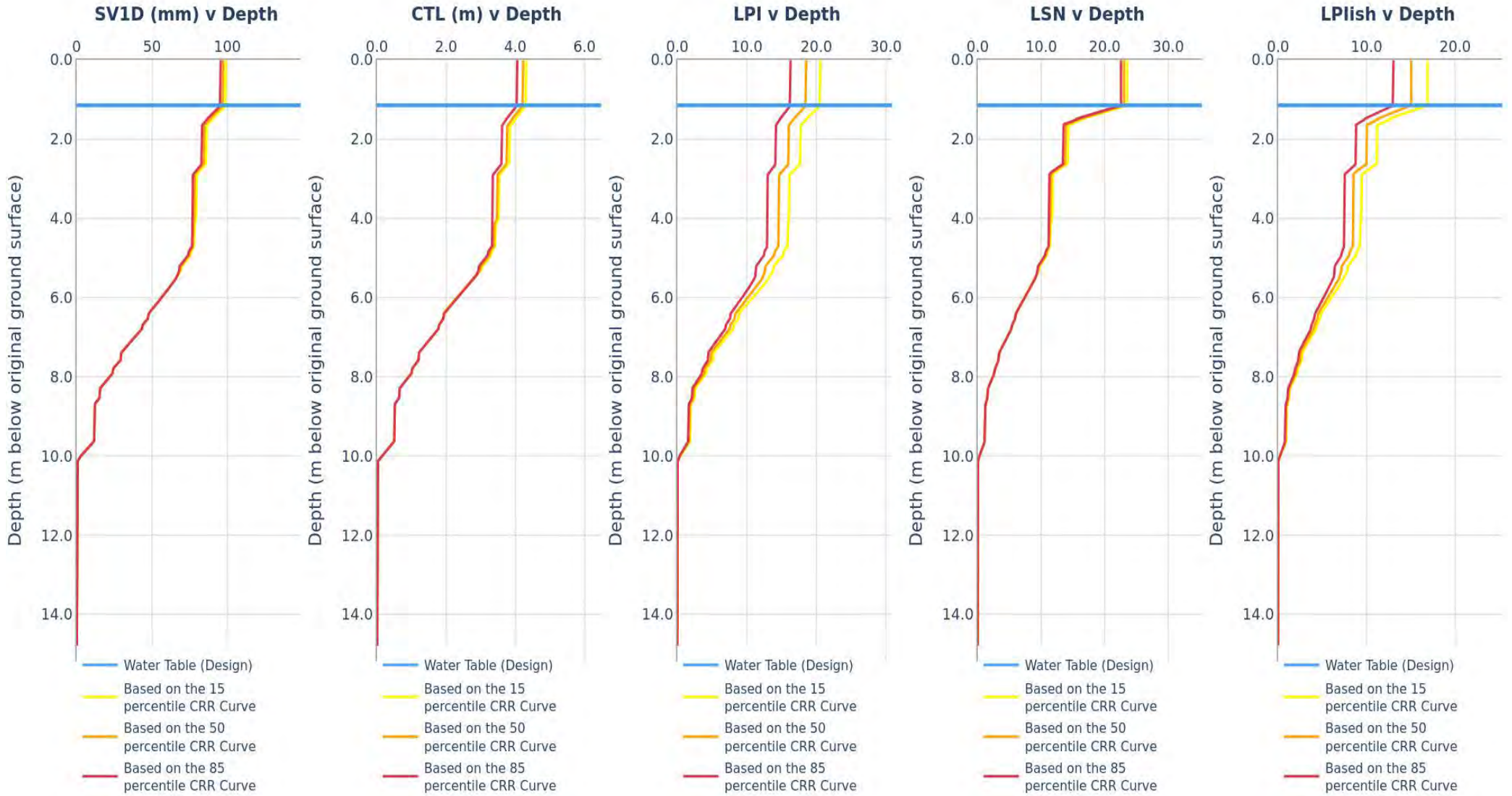
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 11/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

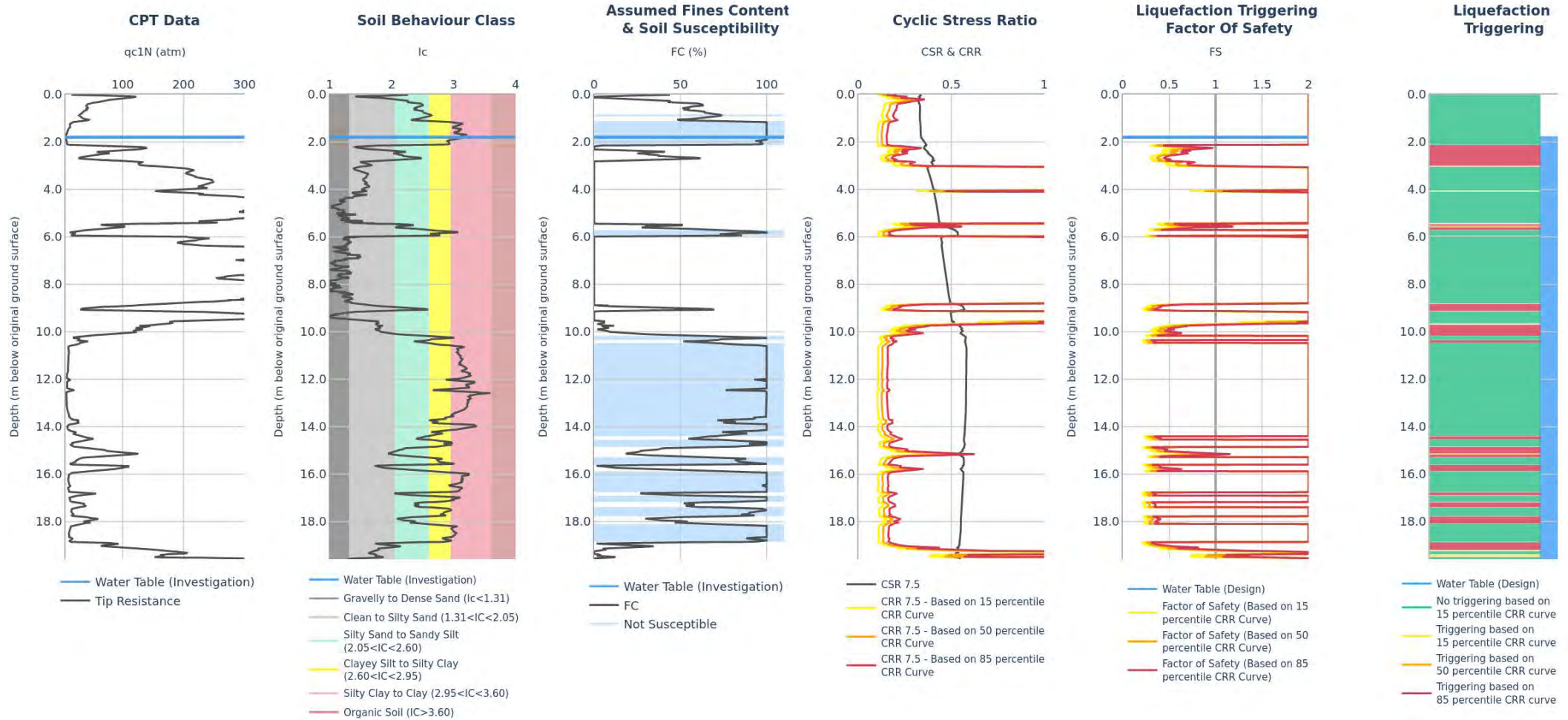


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT439	CPT_TT262949	10/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT440	CPT_TT262950	13/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

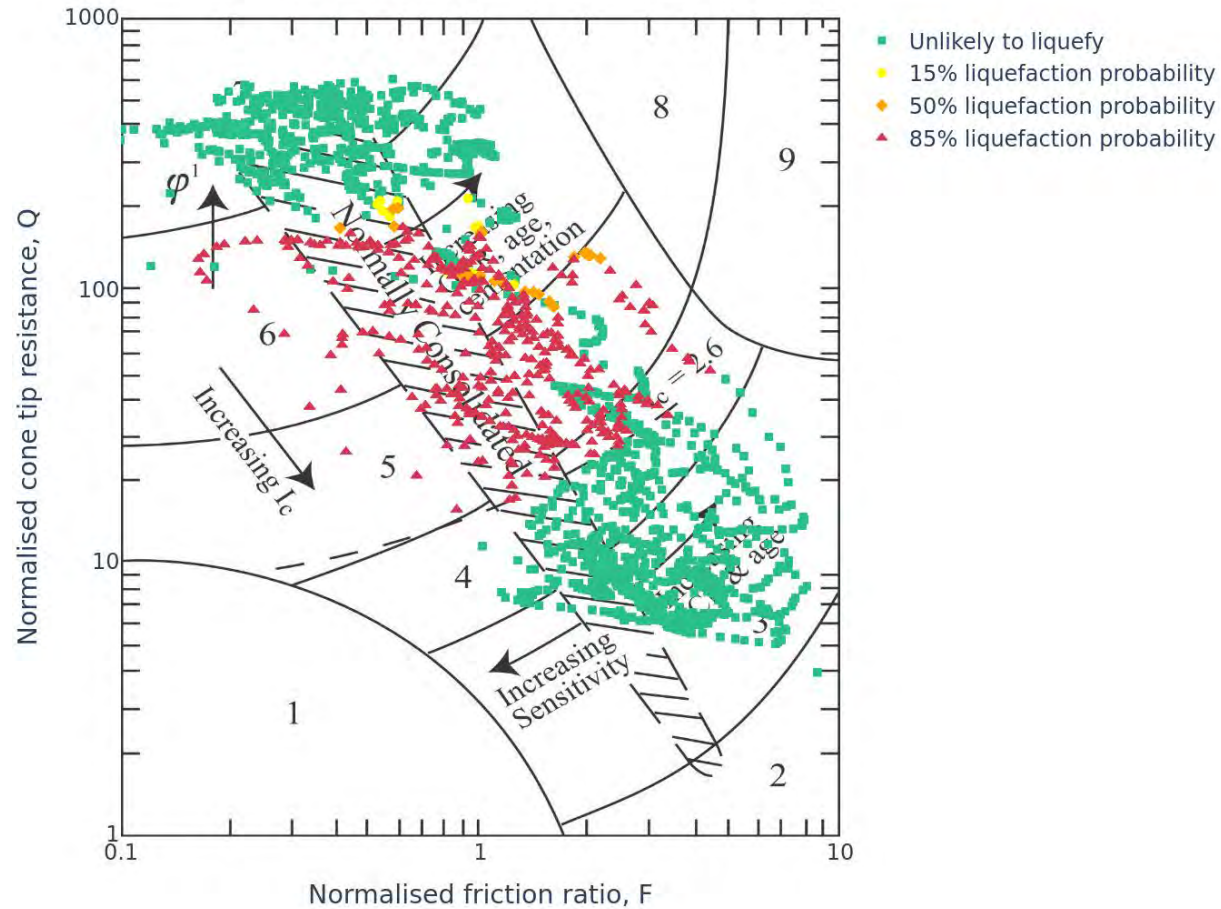
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	86	4.2	10	13	2.2	9
50%	83	4.0	9	12	2.2	7
85%	79	3.8	7	11	2.2	6

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 13/27

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



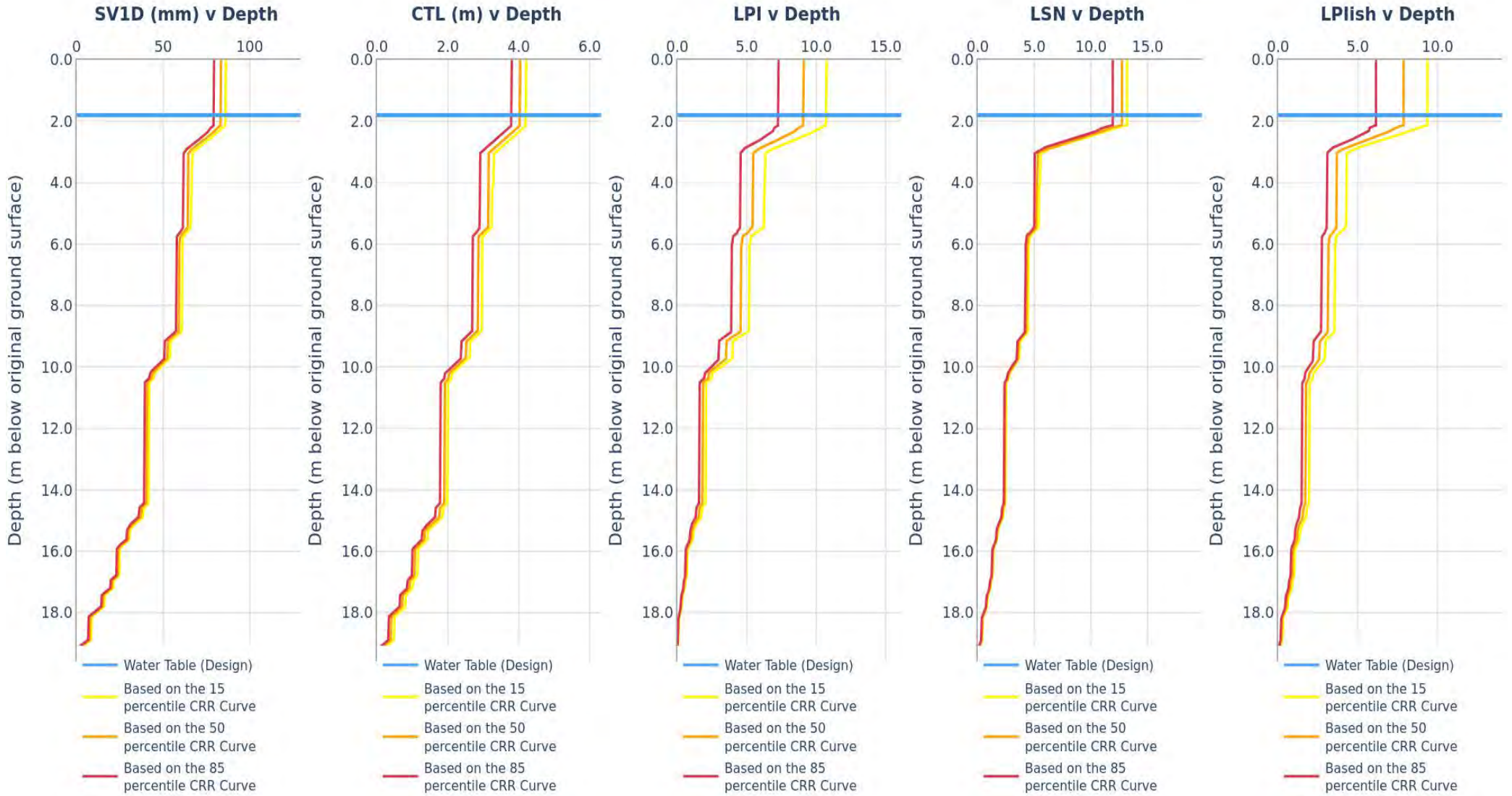
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 14/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

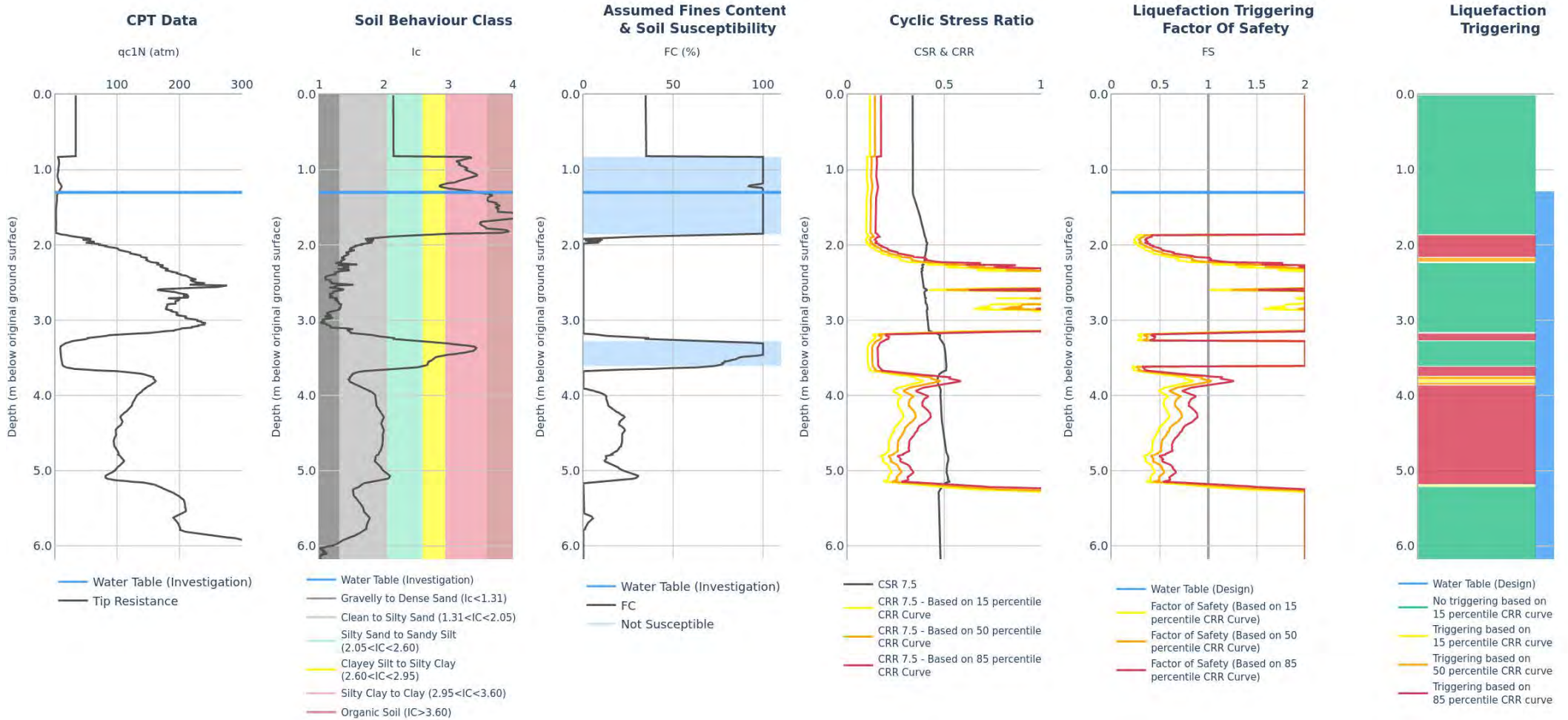


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT440	CPT_TT262950	13/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/27

## CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT441	CPT_TT262951	11/12/2024	0.82	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

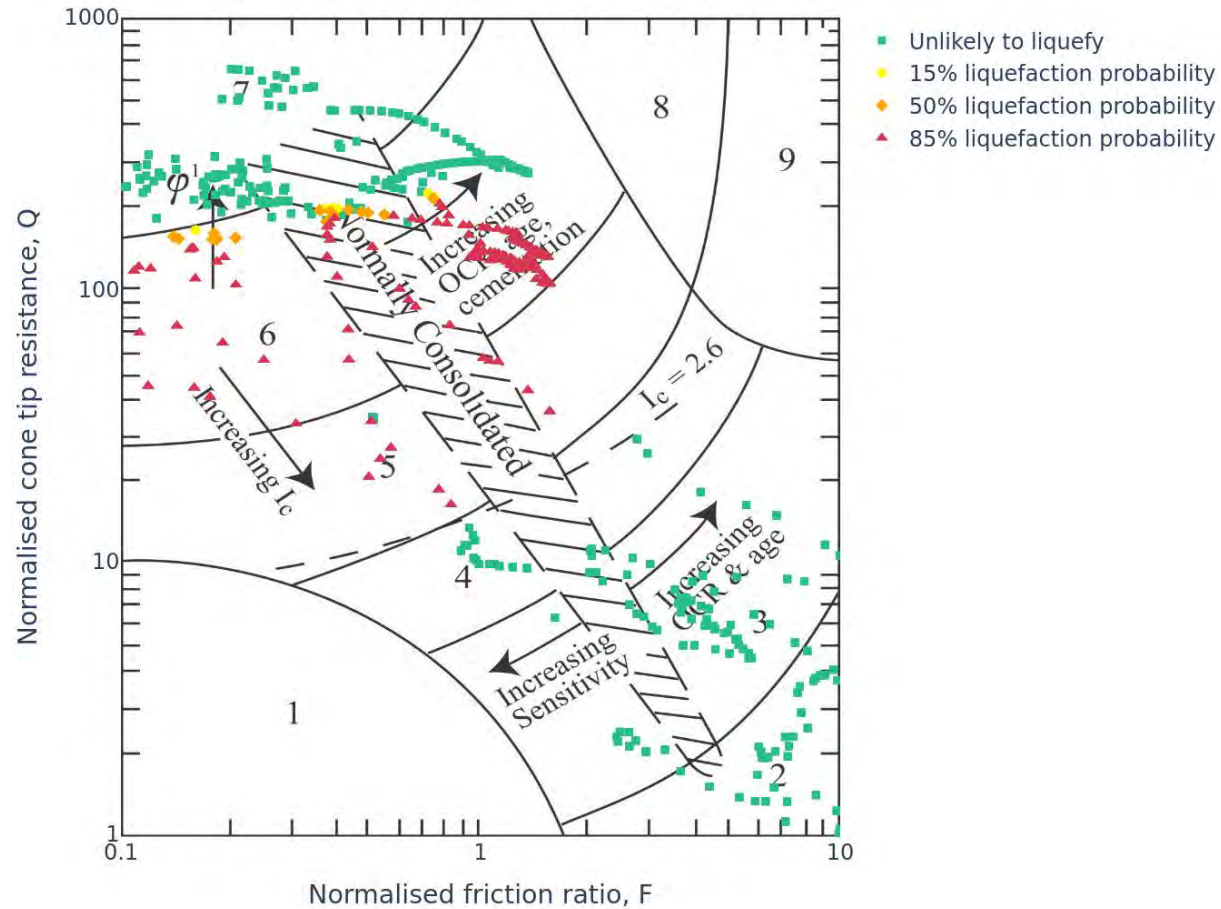
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	40	2.1	8	11	2.0	8
50%	37	2.0	7	11	2.0	6
85%	33	1.8	5	10	2.0	4

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



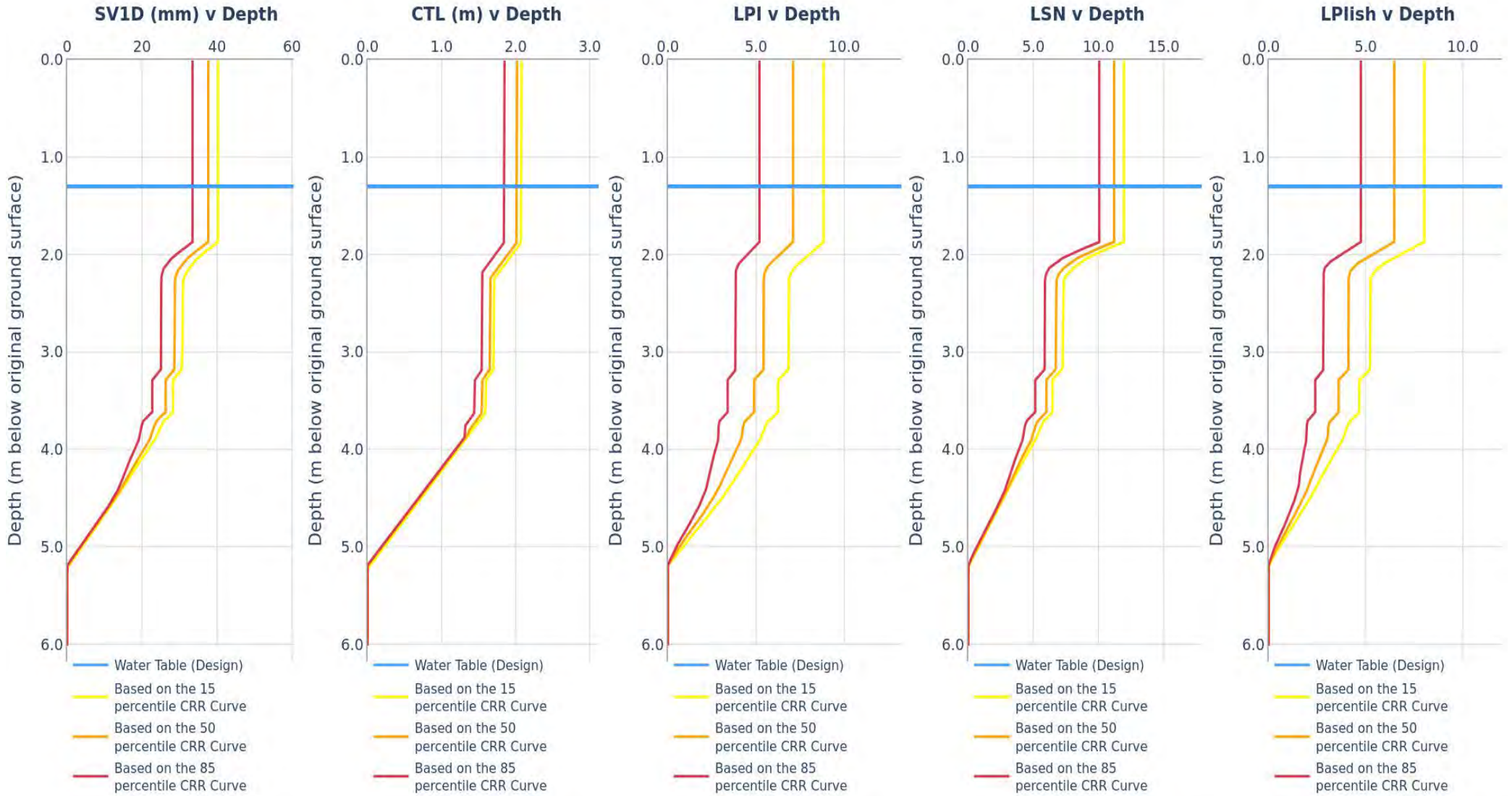
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 17/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

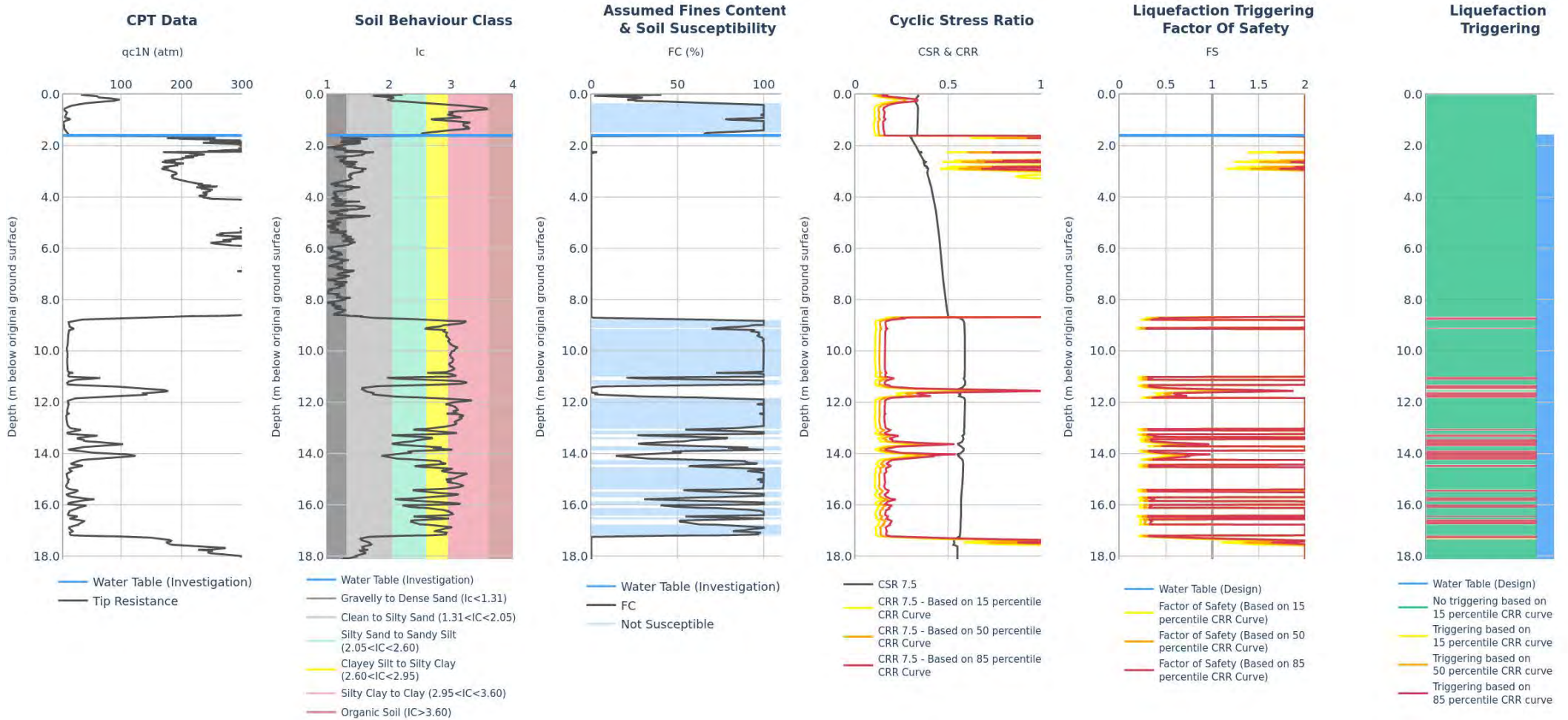


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT441	CPT_TT262951	11/12/2024	0.82	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 18/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT442	CPT_TT262952	11/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

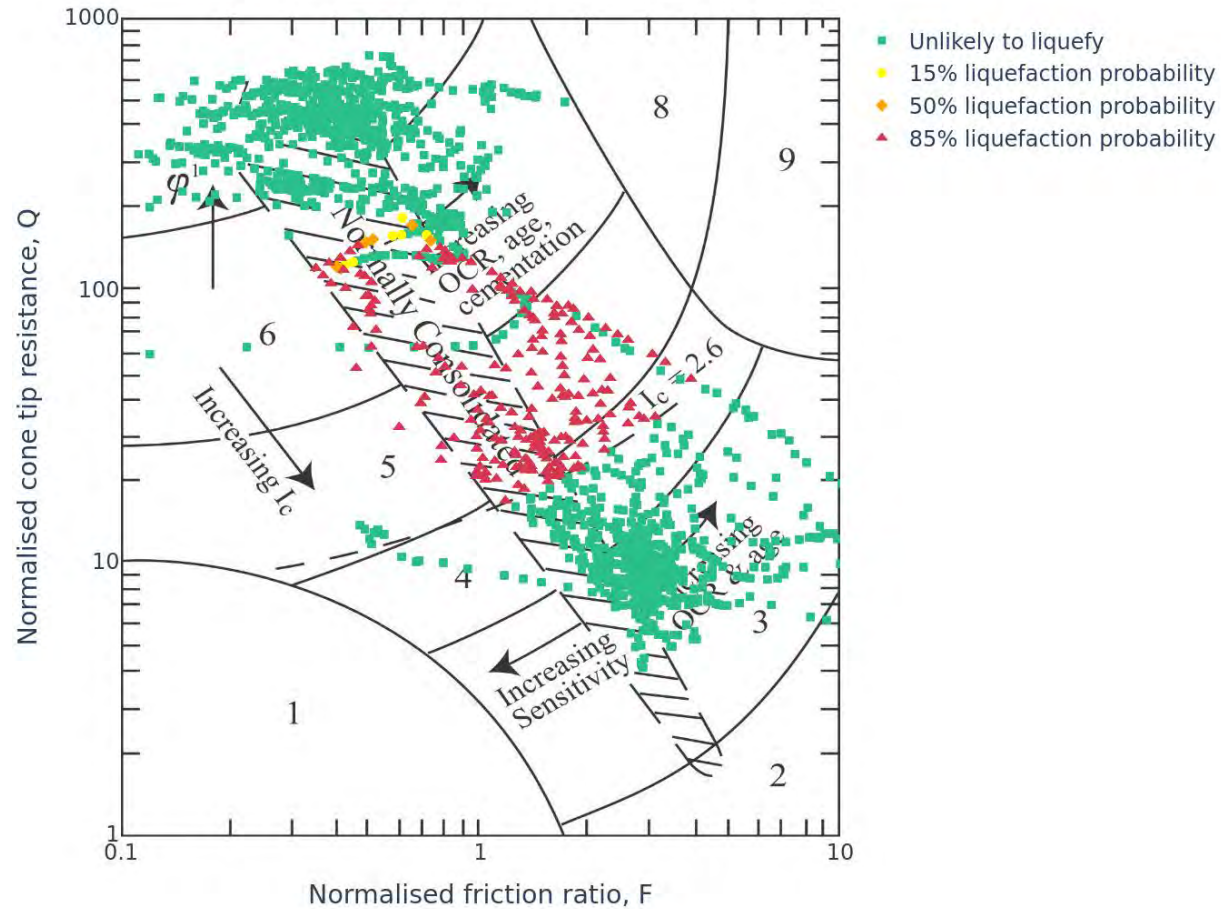
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	52	2.4	4	4	8.8	0
50%	51	2.3	4	3	8.8	0
85%	49	2.2	3	3	8.8	0

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 19/27

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



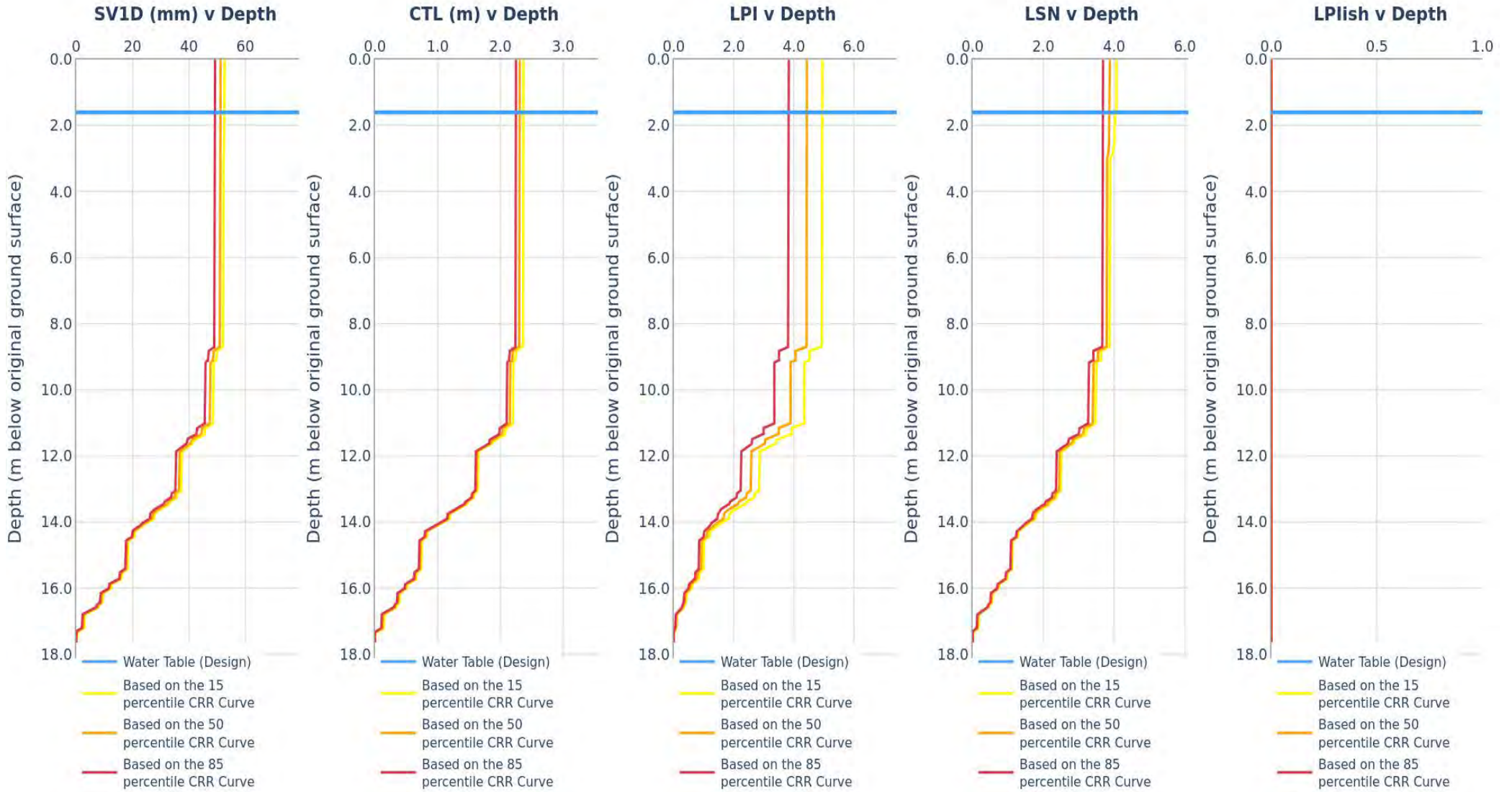
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 20/27

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

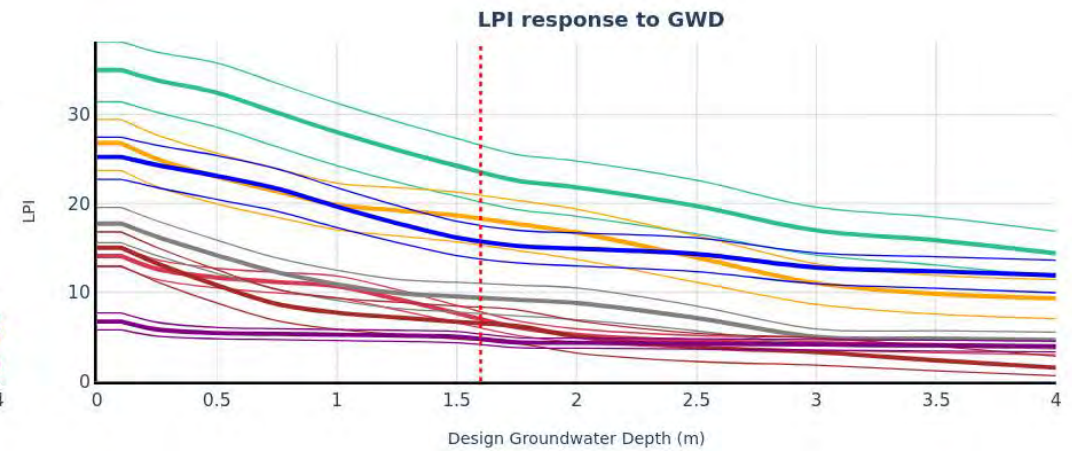
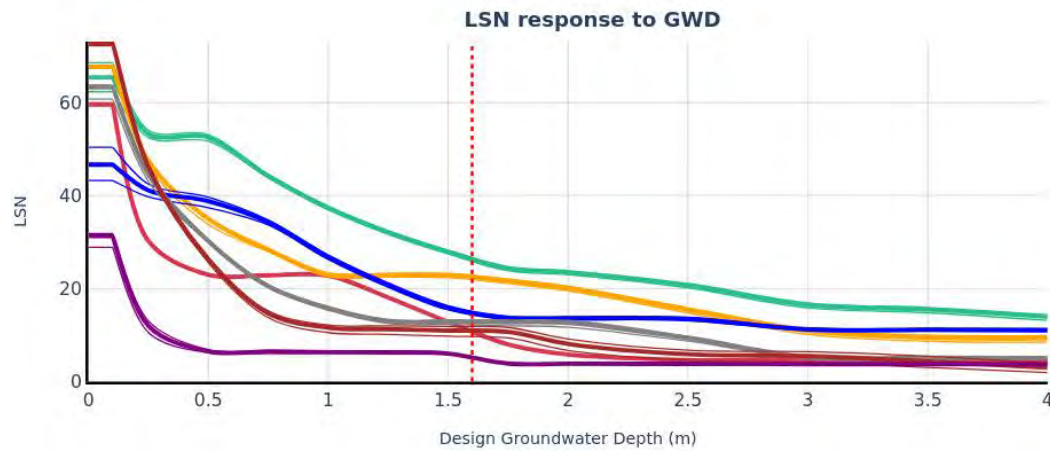
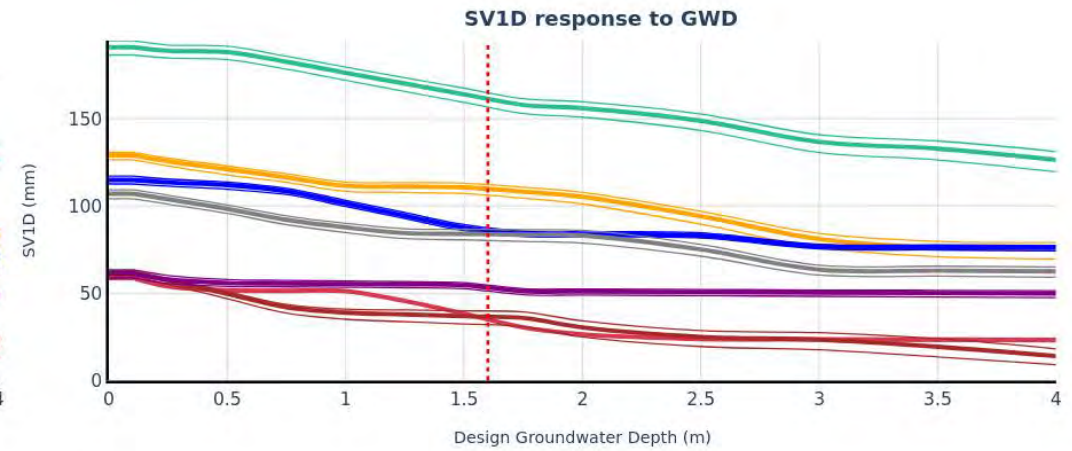
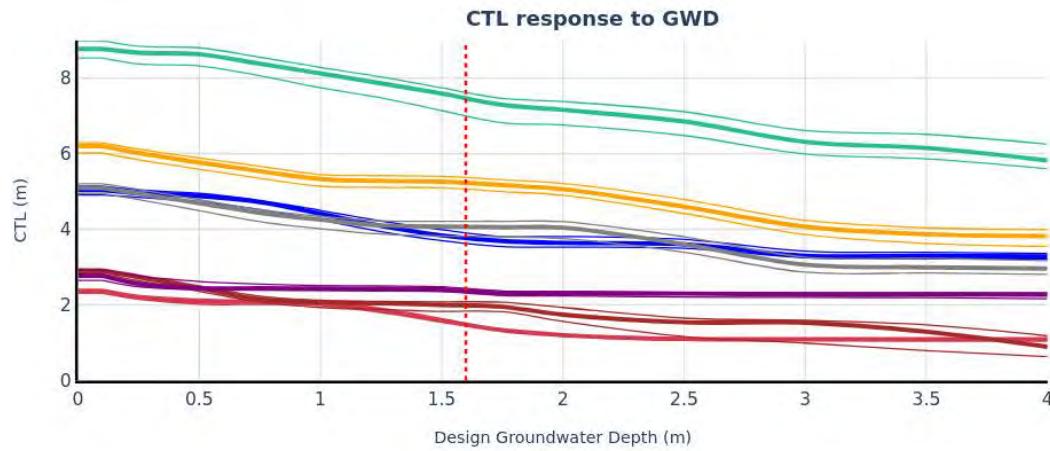


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT442	CPT_TT262952	11/12/2024	0.0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 21/27

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



**Input**

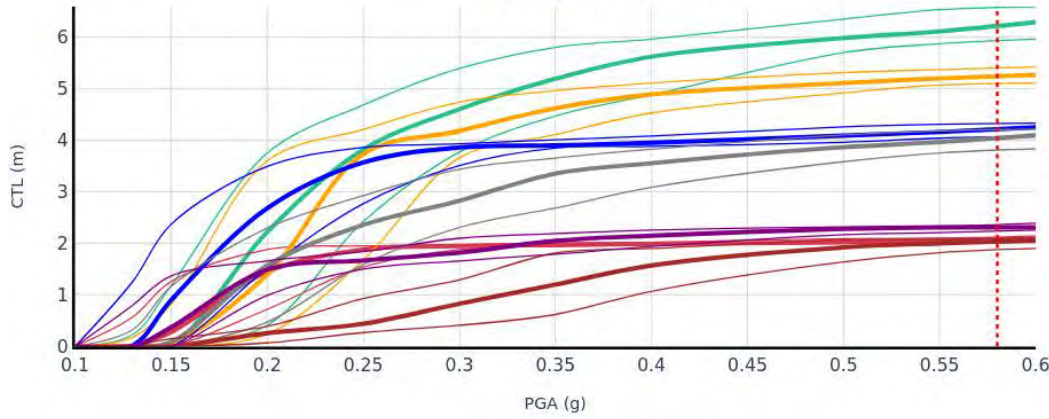
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT435	CPT_TT262945	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT438	CPT_TT262948	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT436	CPT_TT262946	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT439	CPT_TT262949	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT440	CPT_TT262950	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT441	CPT_TT262951	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT442	CPT_TT262952	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

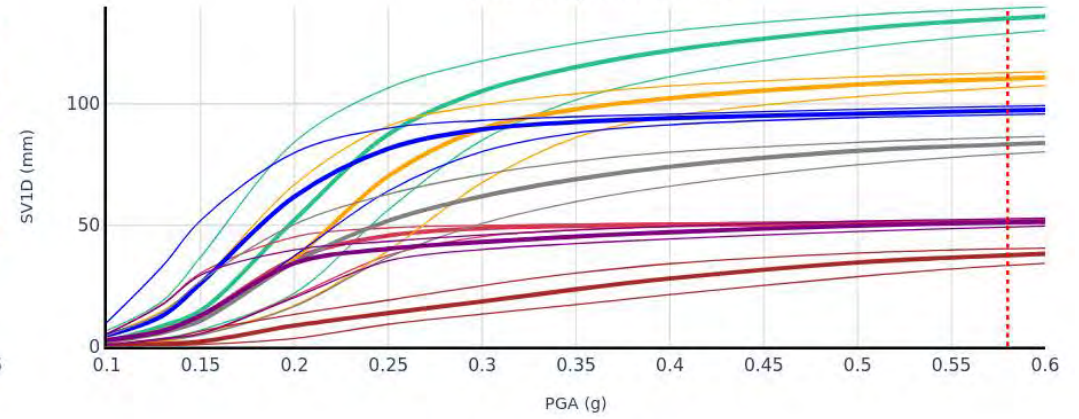
	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 22/27

# PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

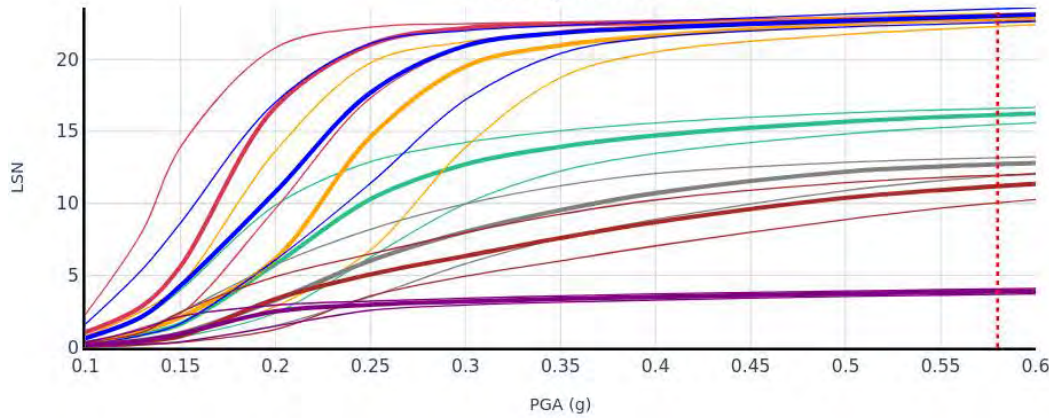
**CTL response to PGA**



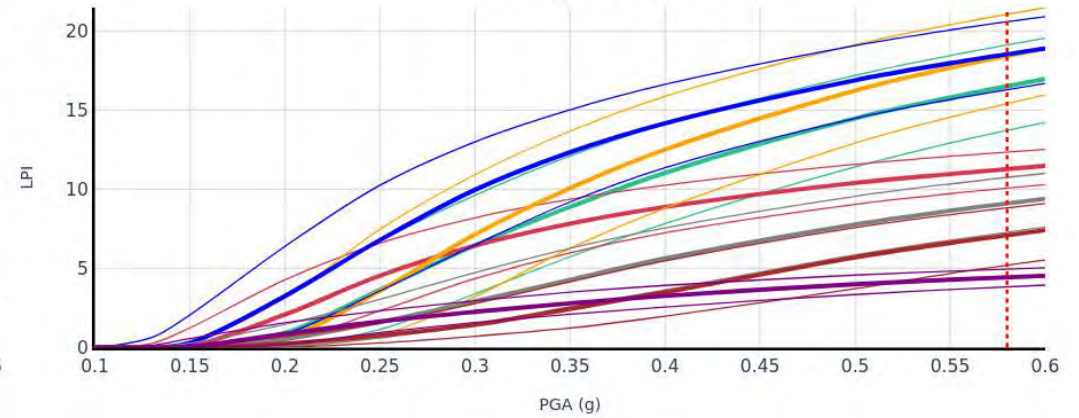
**SV1D response to PGA**



**LSN response to PGA**




**LPI response to PGA**



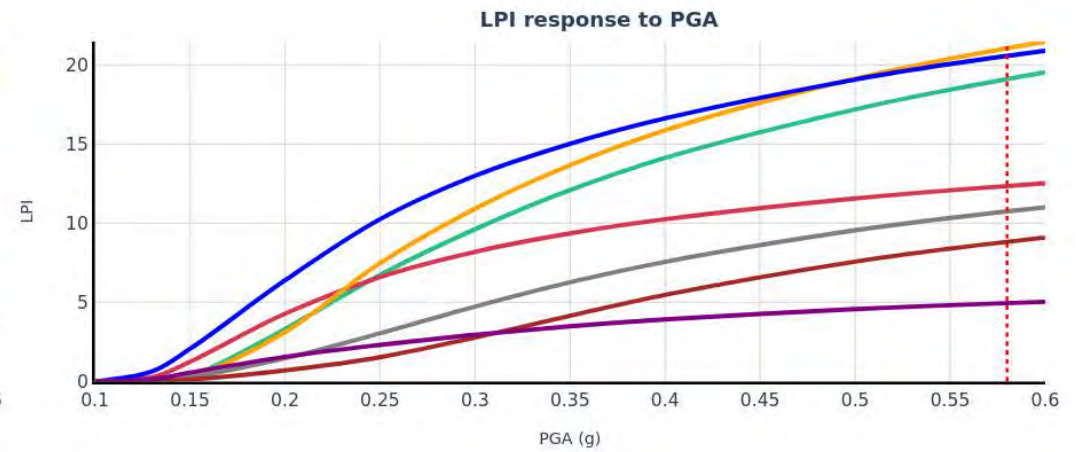
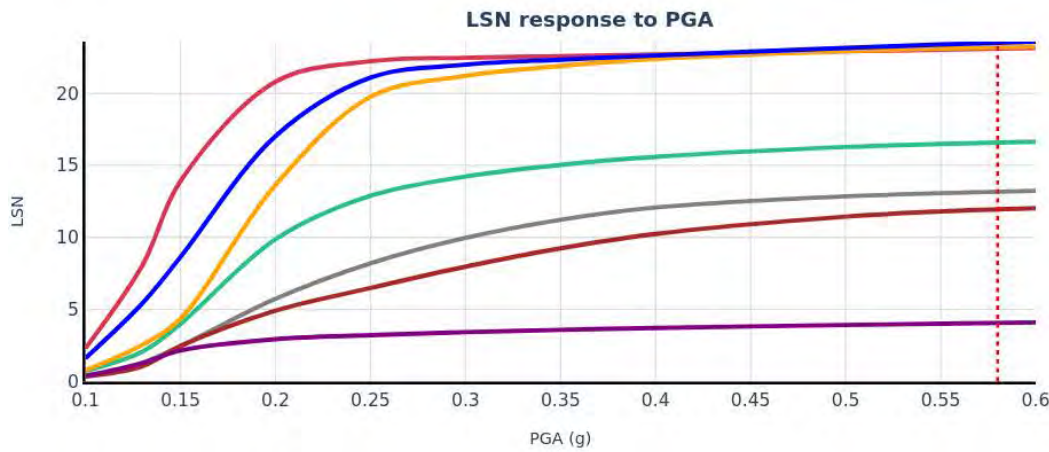
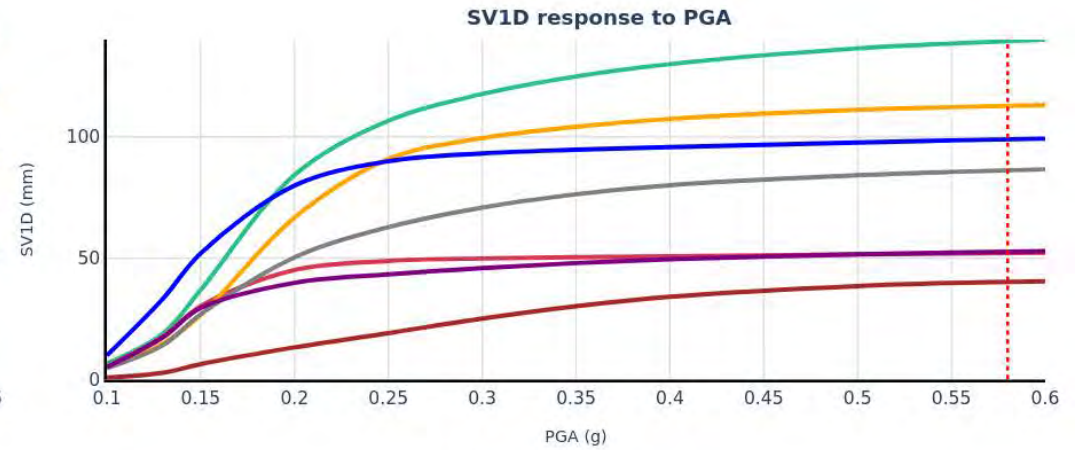
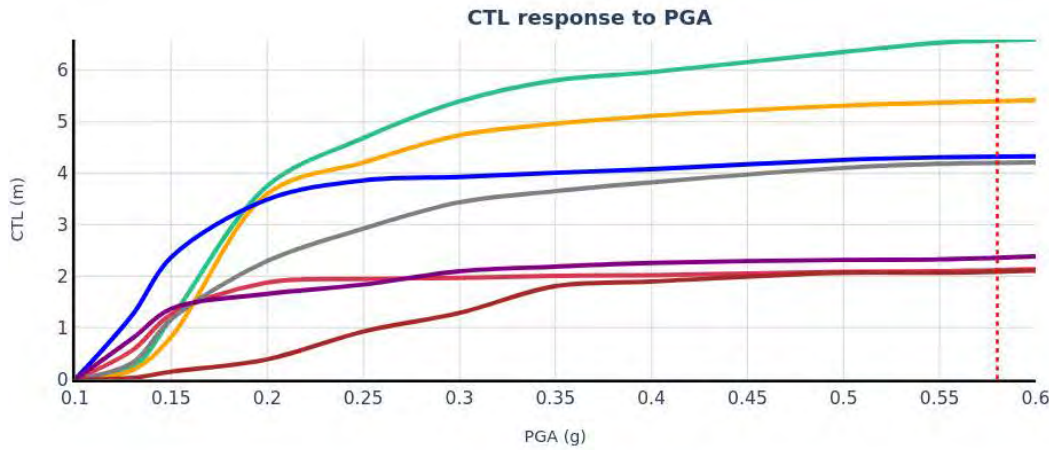
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT435	CPT_TT262945	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT438	CPT_TT262948	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT436	CPT_TT262946	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT439	CPT_TT262949	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT440	CPT_TT262950	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT441	CPT_TT262951	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT442	CPT_TT262952	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.


	<i>CLIENT</i>	HBRC	<i>LOCATION</i>	Pakowhai	<i>DATE: 17/09/2025</i>
	<i>PROJECT</i>	Pakowhai Secondary Stopbanks			<i>ANALYSED: MIBU</i>
	<i>TITLE</i>	Pakowhai Secondary Stopbanks	<i>JOB NUMBER</i>	1017353.2403	
	<i>COMMENT</i>	nan			<i>Page 23/27</i>

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT435	CPT_TT262945	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT438	CPT_TT262948	05/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT436	CPT_TT262946	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT439	CPT_TT262949	10/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT440	CPT_TT262950	13/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT441	CPT_TT262951	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT442	CPT_TT262952	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 24/27

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262945	TTGD 262948	TTGD 262946
CPT Name	CPT_TT262945_Raw01	CPT_TT262948_Raw01	CPT_TT262946_Raw01
Run Description	CPT435	CPT438	CPT436
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	3.25	0.7	1.6
Depth to groundwater for design (m)	3.25	0.7	1.6
Pre-drill depth (m)	0.0	0.0	0.0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	17.969	8.838	16.145
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	17.969	8.838	16.145
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262945	CPT435	0.0	0.0	0.0
TTGD 262945	CPT435	0.0	17.97	2.6
TTGD 262948	CPT438	0.0	0.0	0.0
TTGD 262948	CPT438	0.0	17.97	2.6
TTGD 262946	CPT436	0.0	0.0	0.0
TTGD 262946	CPT436	0.0	17.97	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262945	CPT435	0.0	17.97	0.0 CFC
TTGD 262948	CPT438	0.0	17.97	0.0 CFC
TTGD 262946	CPT436	0.0	17.97	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262945	CPT435	0.0	0.0001	18.0
TTGD 262945	CPT435	0.0001	17.97	18.0
TTGD 262948	CPT438	0.0	0.0001	18.0
TTGD 262948	CPT438	0.0001	17.97	18.0
TTGD 262946	CPT436	0.0	0.0001	18.0
TTGD 262946	CPT436	0.0001	17.97	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 25/27

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262949	TTGD 262950	TTGD 262951
CPT Name	CPT_TT262949_Raw01	CPT_TT262950_Raw01	CPT_TT262951_Raw01
Run Description	CPT439	CPT440	CPT441
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	1.15	1.8	1.3
Depth to groundwater for design (m)	1.15	1.8	1.3
Pre-drill depth (m)	0.0	0.0	0.82
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	15.185	19.586	6.177
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	15.185	19.586	6.177
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262949	CPT439	0.0	0.0	0.0
TTGD 262949	CPT439	0.0	17.97	2.6
TTGD 262950	CPT440	0.0	0.0	0.0
TTGD 262950	CPT440	0.0	19.59	2.6
TTGD 262951	CPT441	0.0	0.0	0.0
TTGD 262951	CPT441	0.0	17.97	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262949	CPT439	0.0	17.97	0.0 CFC
TTGD 262950	CPT440	0.0	19.59	0.0 CFC
TTGD 262951	CPT441	0.0	17.97	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262949	CPT439	0.0	0.0001	18.0
TTGD 262949	CPT439	0.0001	17.97	18.0
TTGD 262950	CPT440	0.0	0.0001	18.0
TTGD 262950	CPT440	0.0001	19.59	18.0
TTGD 262951	CPT441	0.0	0.0001	18.0
TTGD 262951	CPT441	0.0001	17.97	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 26/27

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262952
CPT Name	CPT_TT262952_Raw01
Run Description	CPT442
EQ PGA (g)	0.58
EQ Magnitude	7.1
Depth to groundwater at time of Investigation (m)	1.6
Depth to groundwater for design (m)	1.6
Pre-drill depth (m)	0.0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	18.12
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	18.12
Inverse filtering applied?	No
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262952	CPT442	0.0	0.0	0.0
TTGD 262952	CPT442	0.0	18.12	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

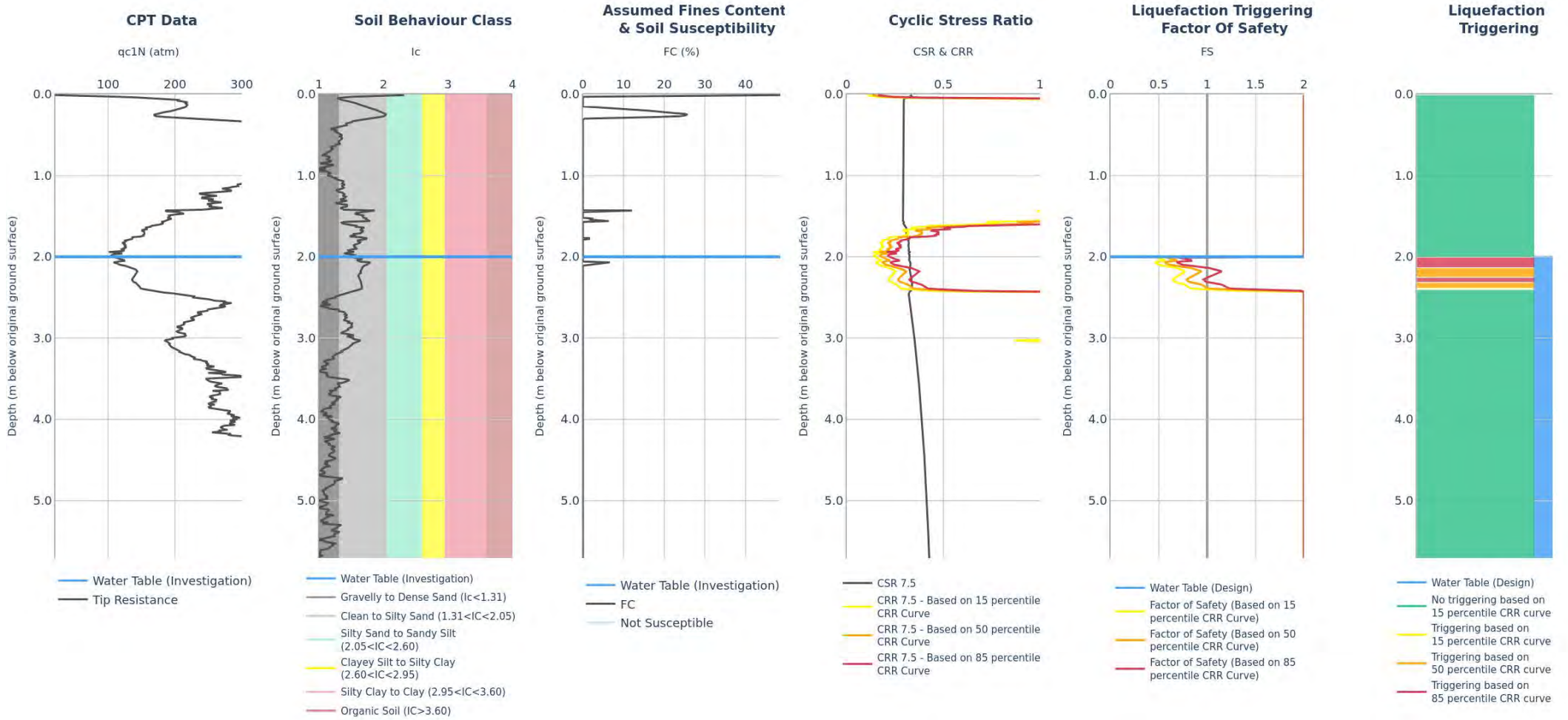
ID	Run description	From (m)	To (m)	Fc
TTGD 262952	CPT442	0.0	18.12	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262952	CPT442	0.0	0.0001	18.0
TTGD 262952	CPT442	0.0001	18.12	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 17/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 27/27

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT447	CPT_TT262956	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

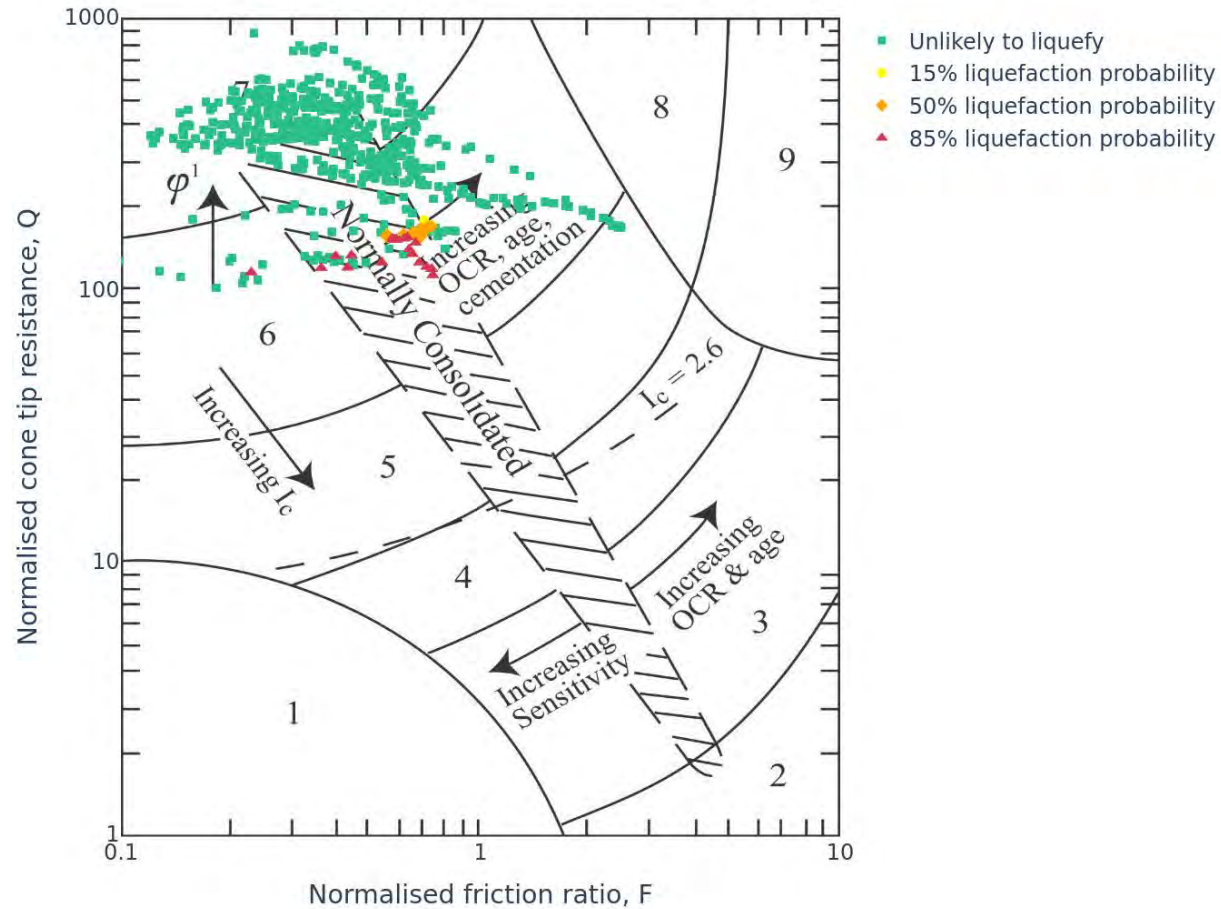
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	6	0.4	1	2	2.1	1
50%	5	0.4	0	2	2.1	0
85%	3	0.2	0	1	2.1	0

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 1/17

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



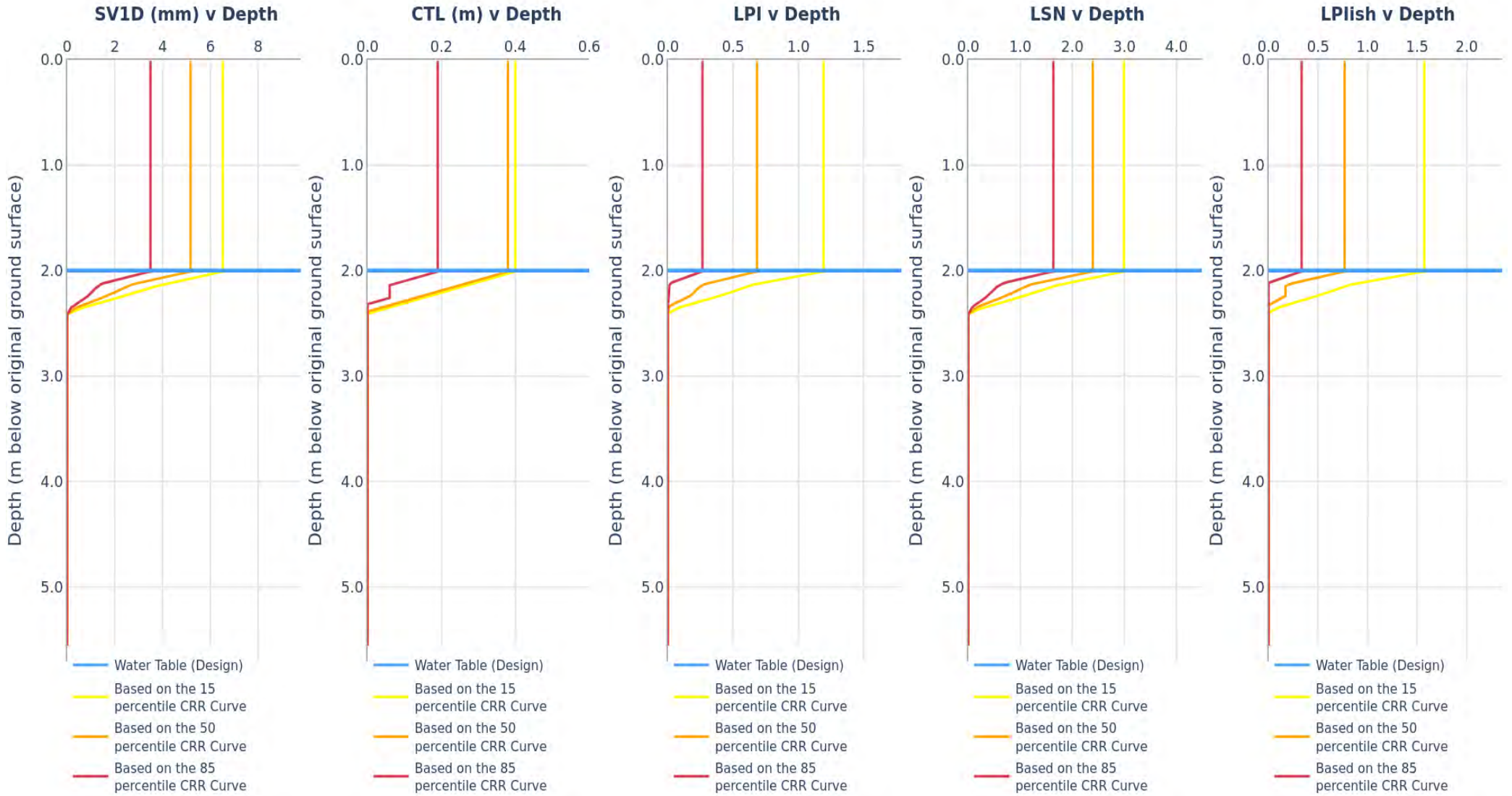
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 2/17

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

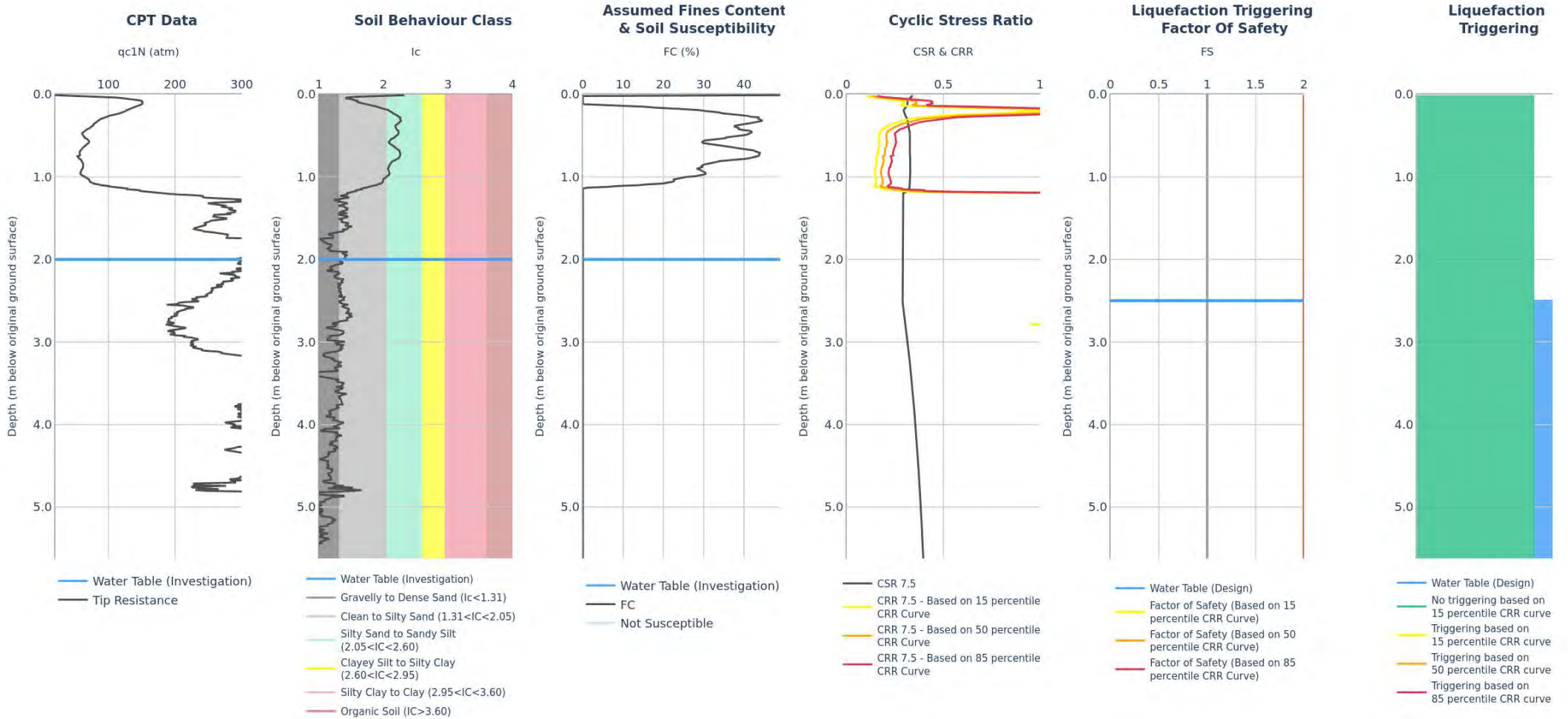


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT447	CPT_TT262956	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/17

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT446	CPT_TT262955	11/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

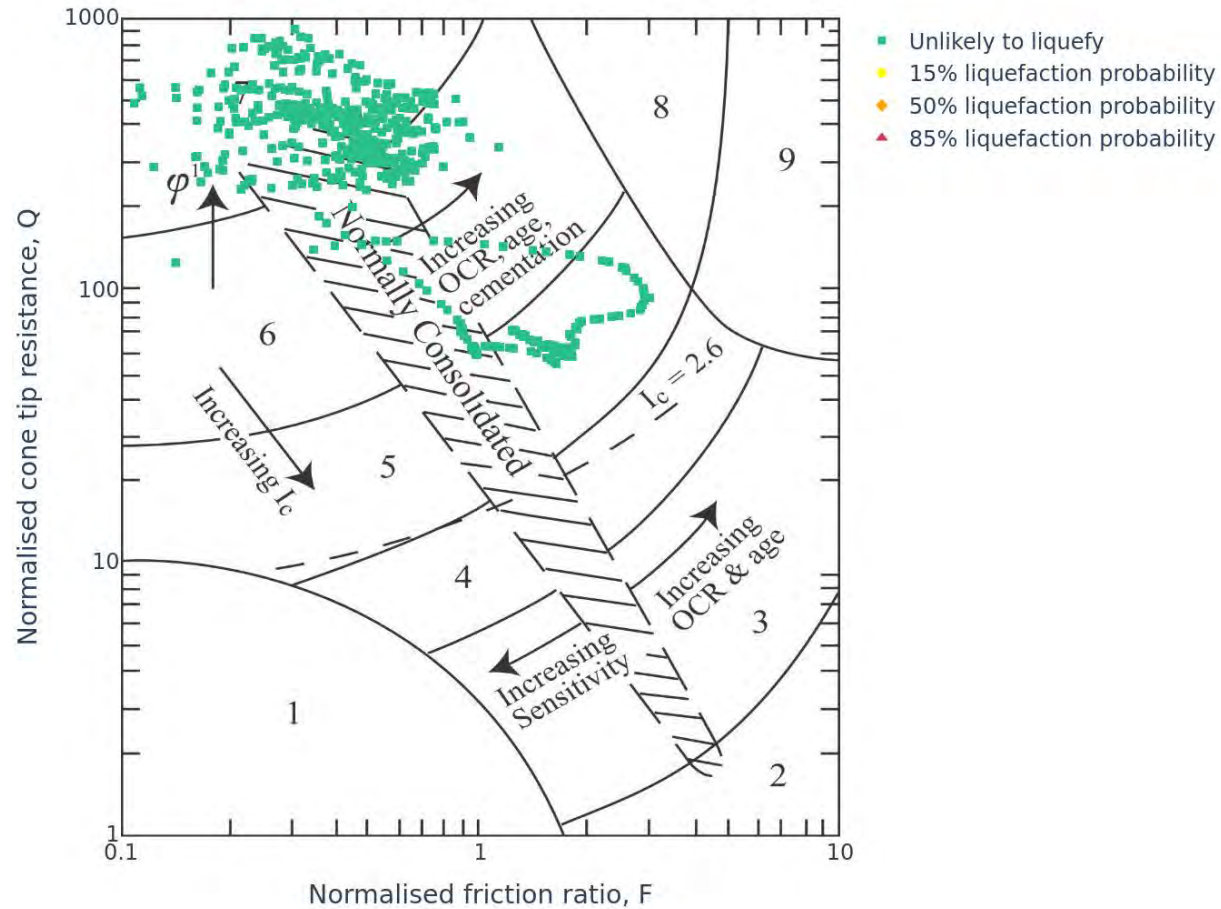
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	0	0.0	0	0	5.6	0
50%	0	0.0	0	0	5.6	0
85%	0	0.0	0	0	5.6	0

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



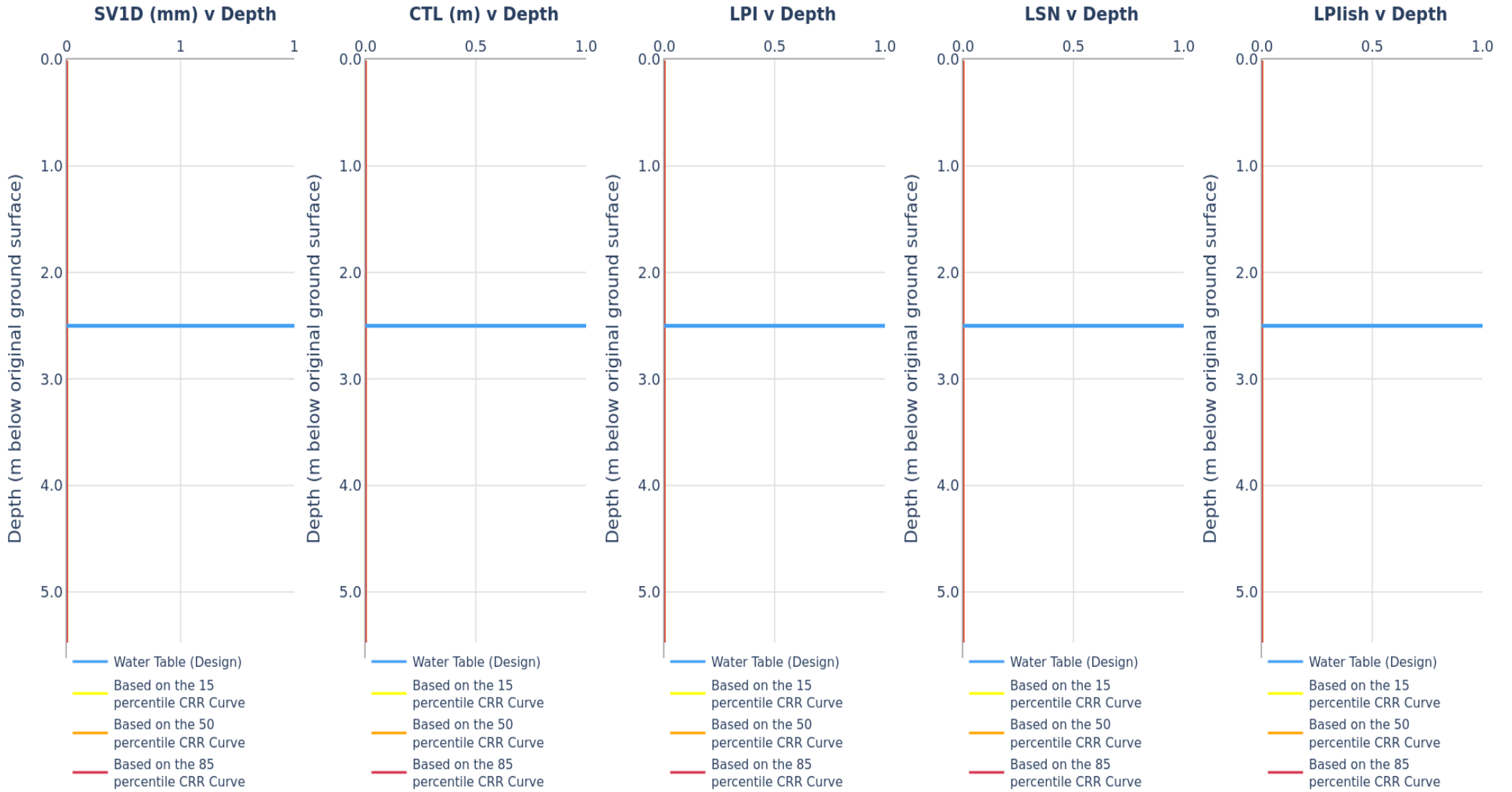
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 5/17

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

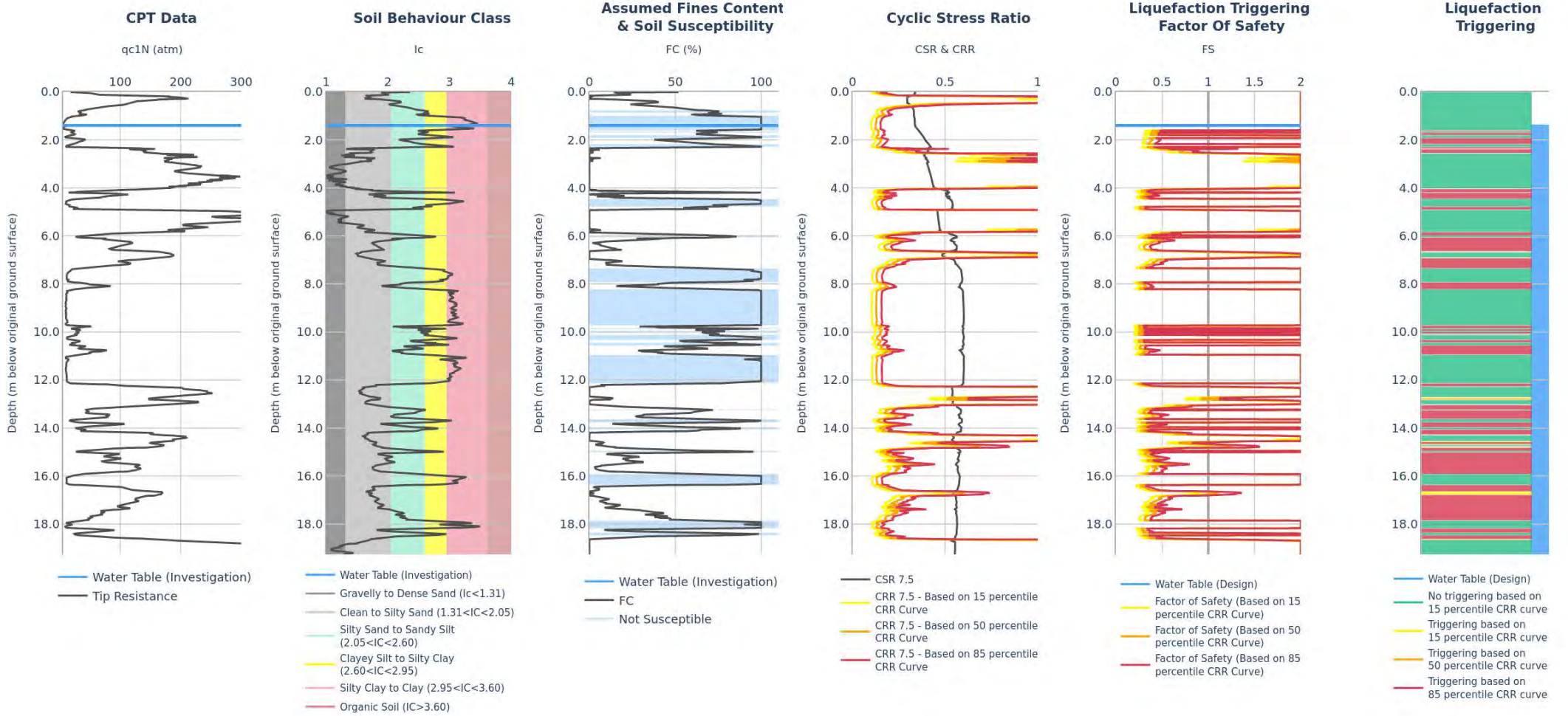


**Input**

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT446	CPT_TT262955	11/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/17

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

Note: Raw Qc/Fs data used.

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT445	CPT_TT262954	11/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

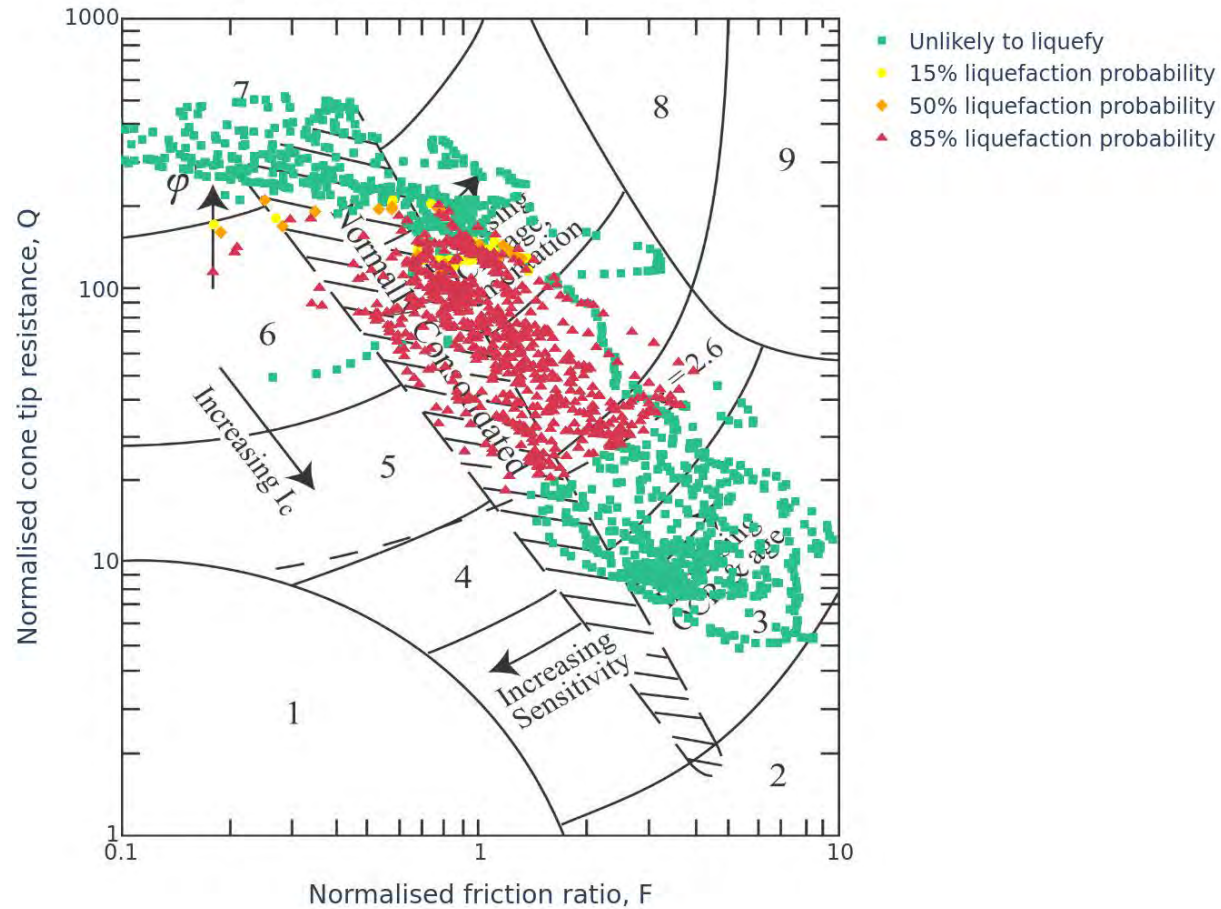
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	161	7.9	21	22	1.7	16
50%	157	7.5	19	21	1.7	14
85%	152	7.2	16	21	1.7	12

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 7/17

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



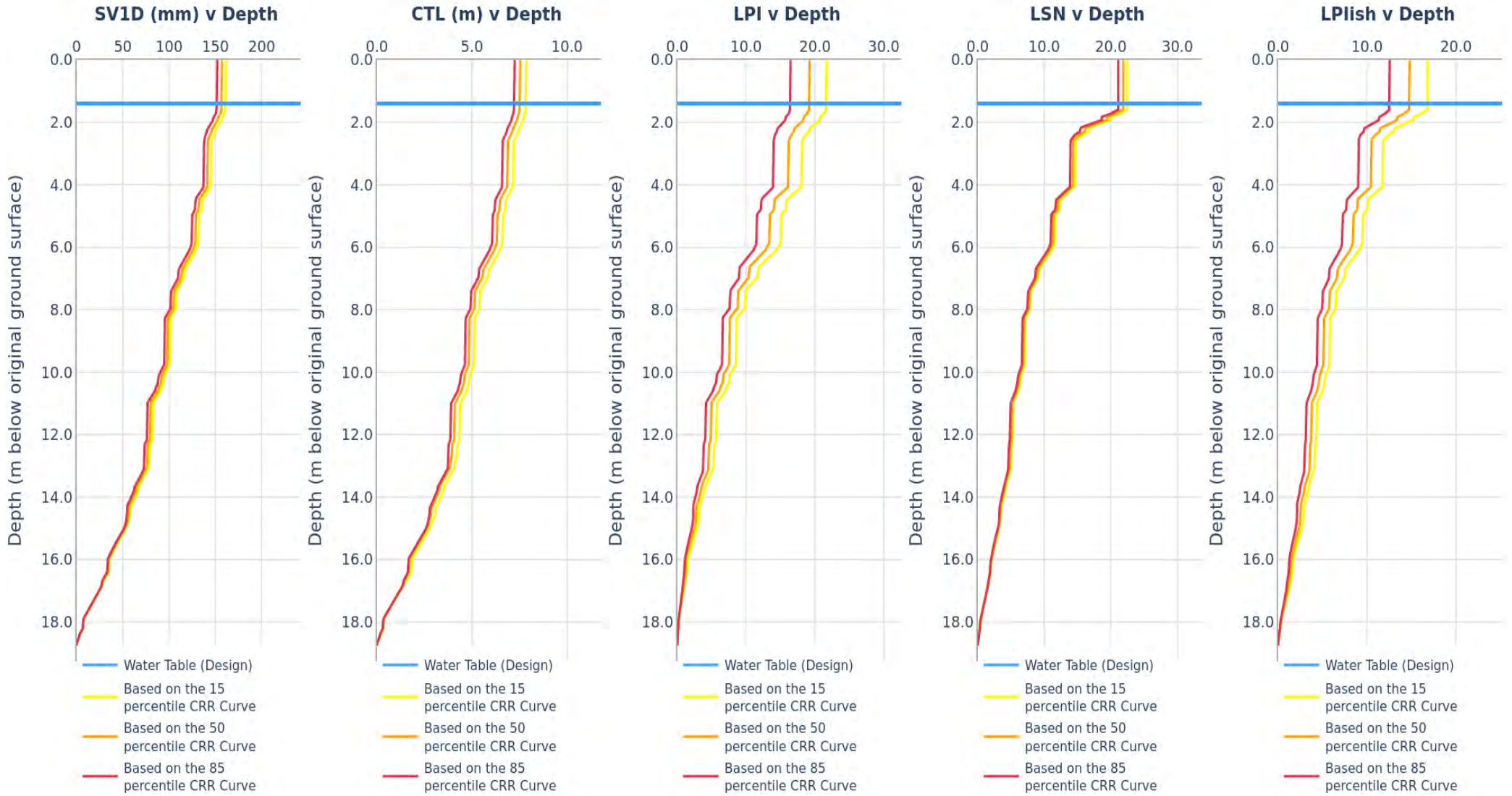
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 8/17

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

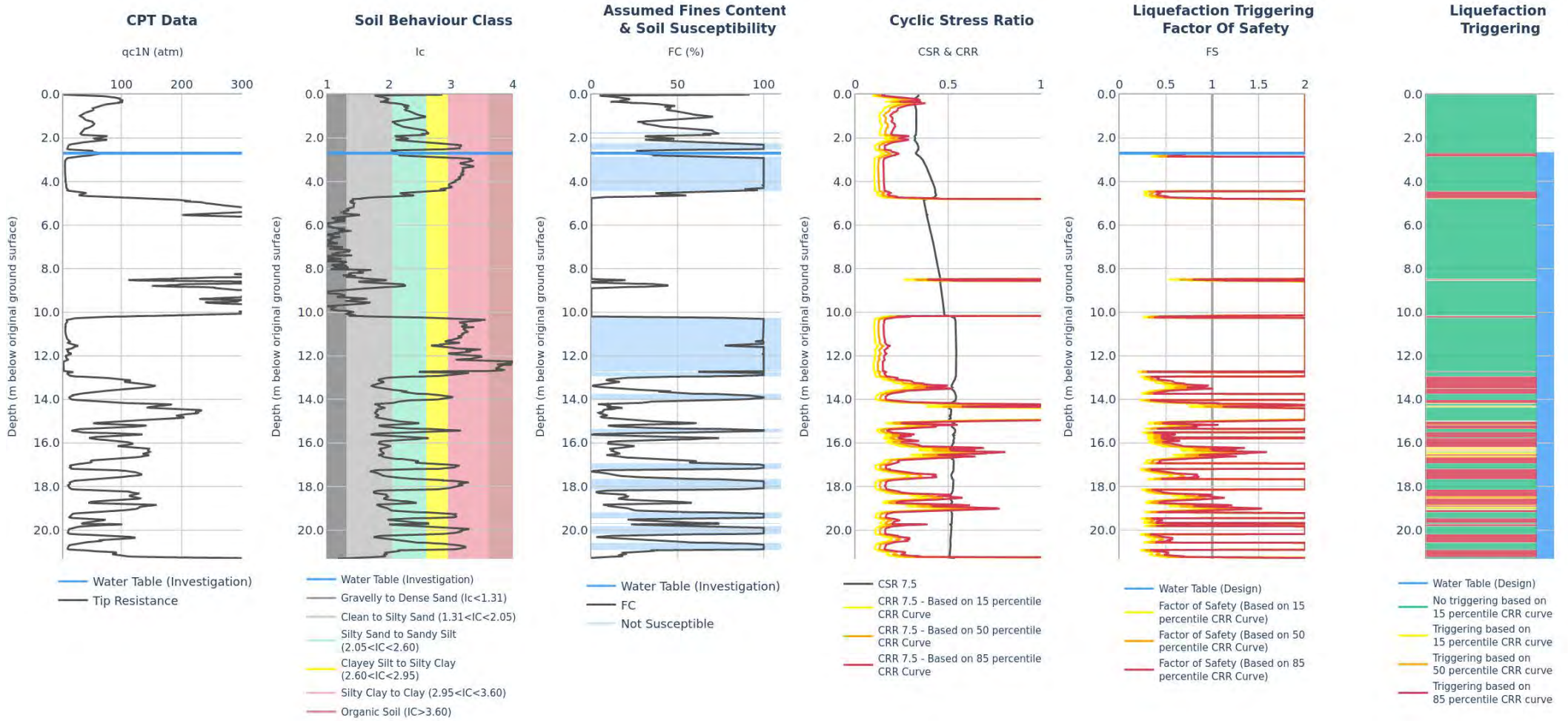


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT445	CPT_TT262954	11/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/17

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT444	CPT_TT262953	11/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

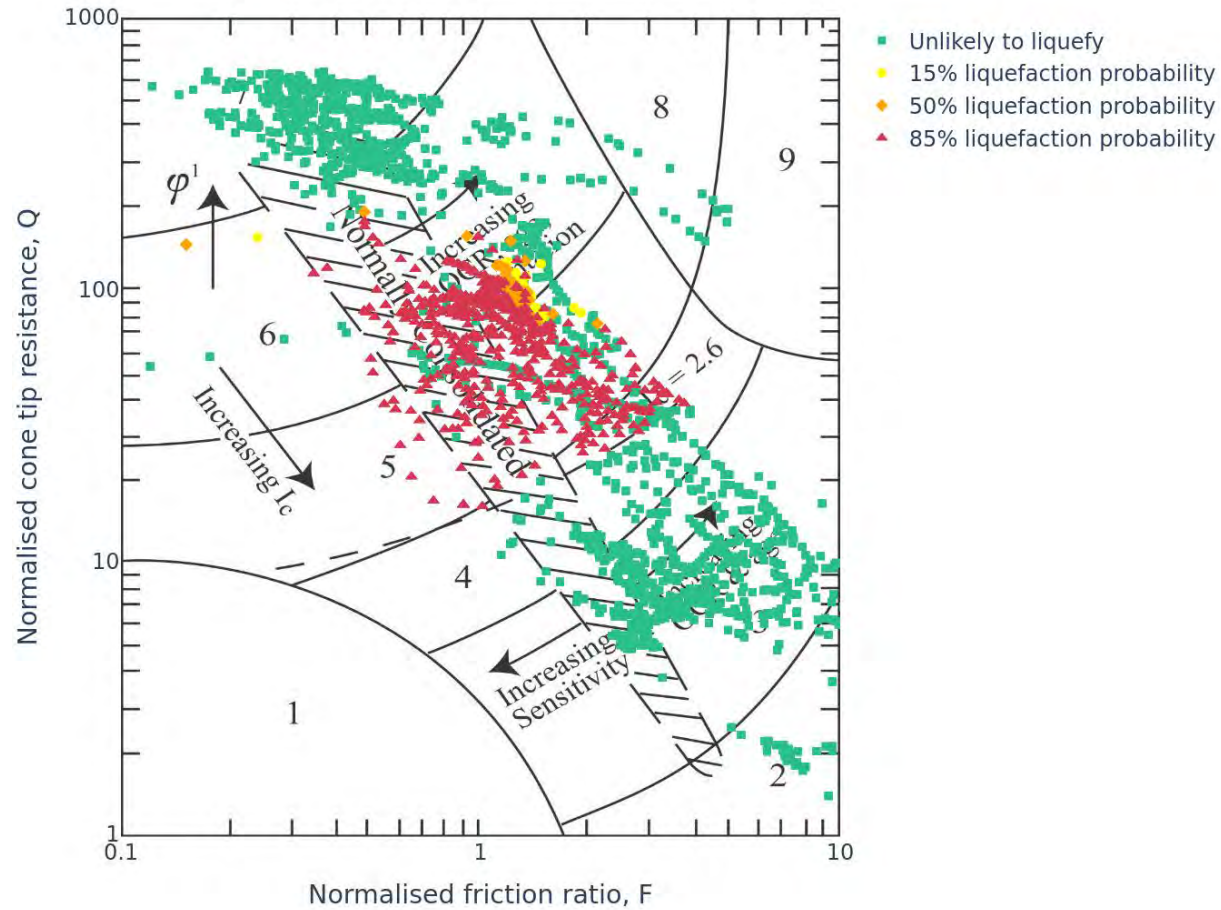
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	112	6.0	7	9	2.8	6
50%	106	5.7	6	8	2.8	5
85%	97	5.1	4	8	2.8	4

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



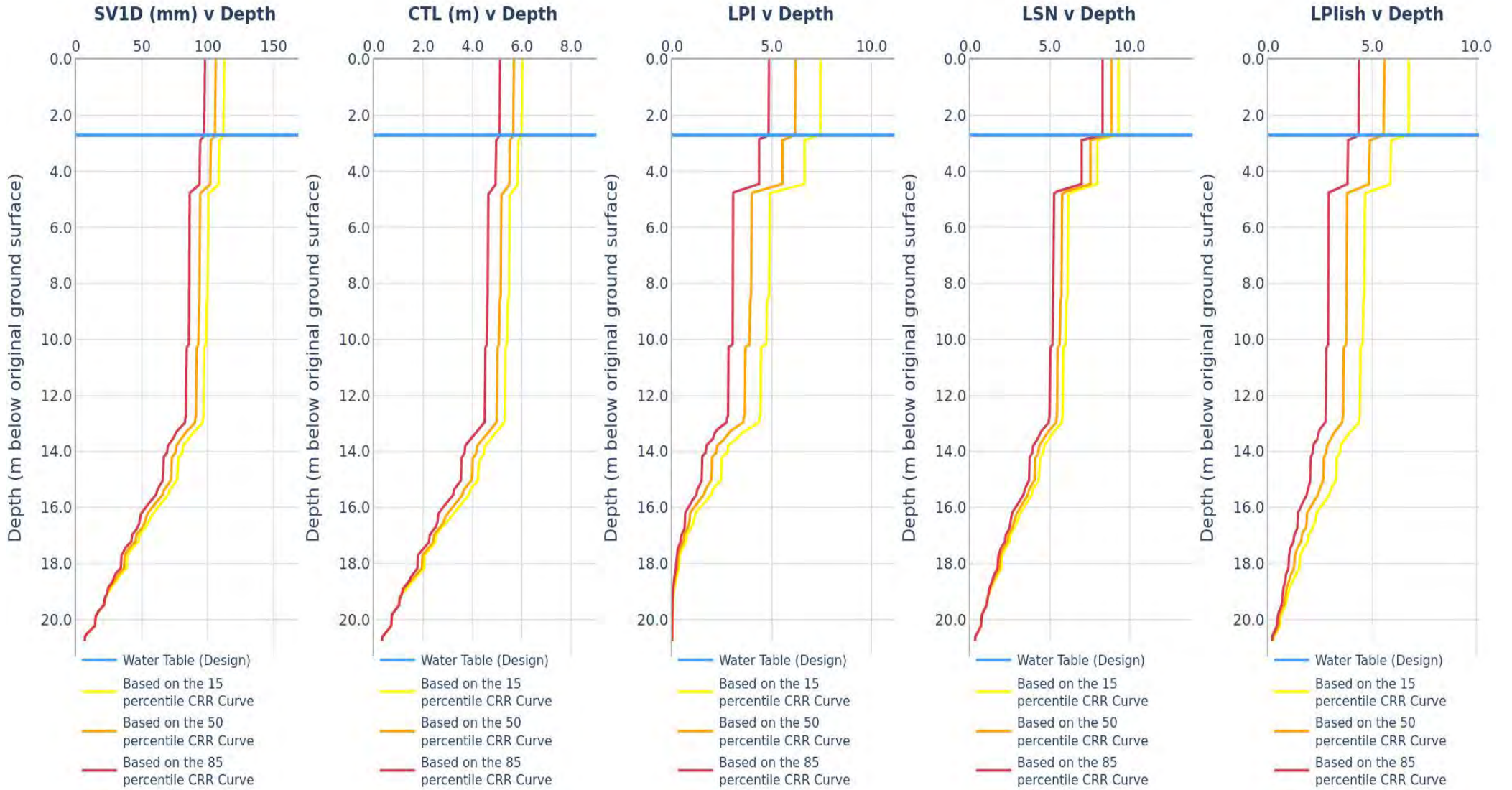
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks			
	COMMENT	nan			Page 11/17

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

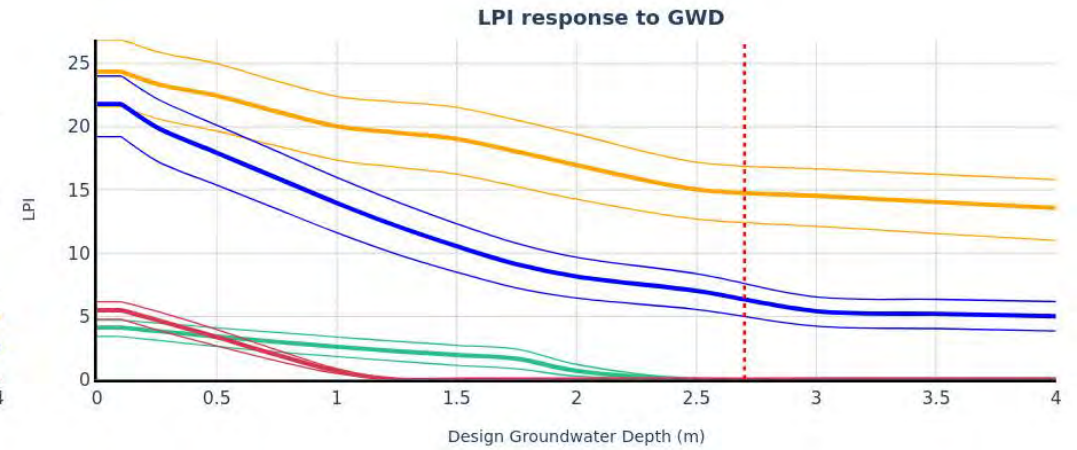
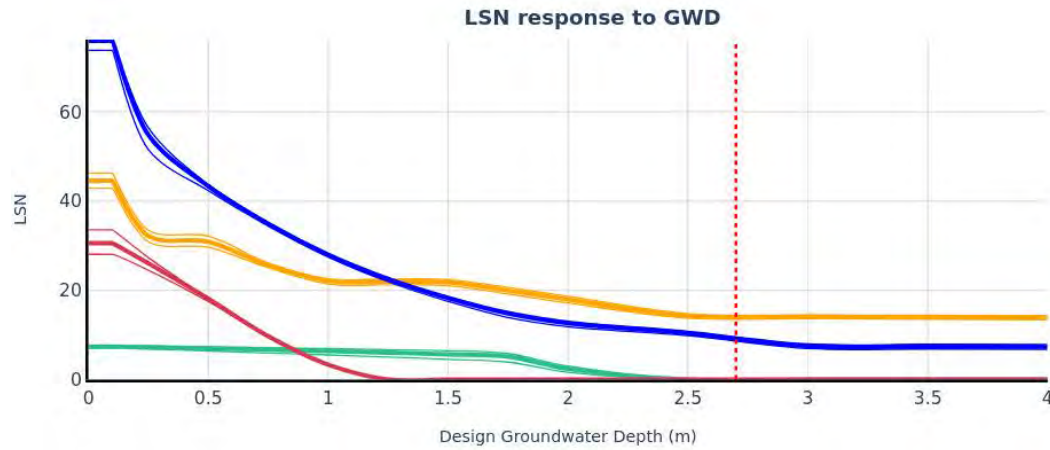
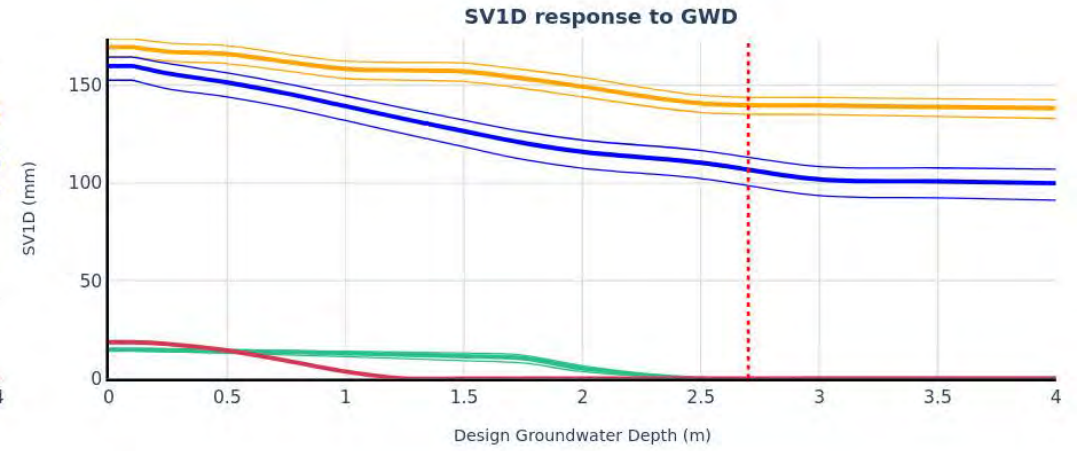
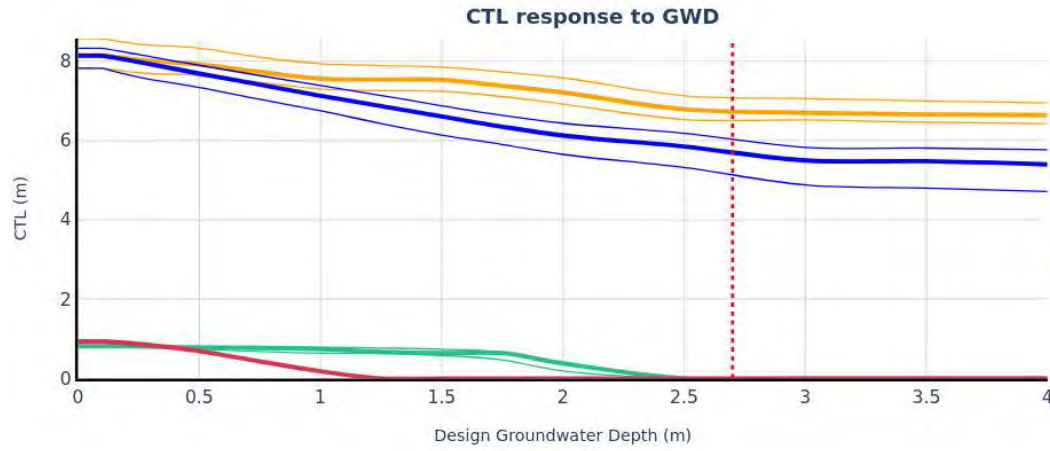


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT444	CPT_TT262953	11/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/17

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



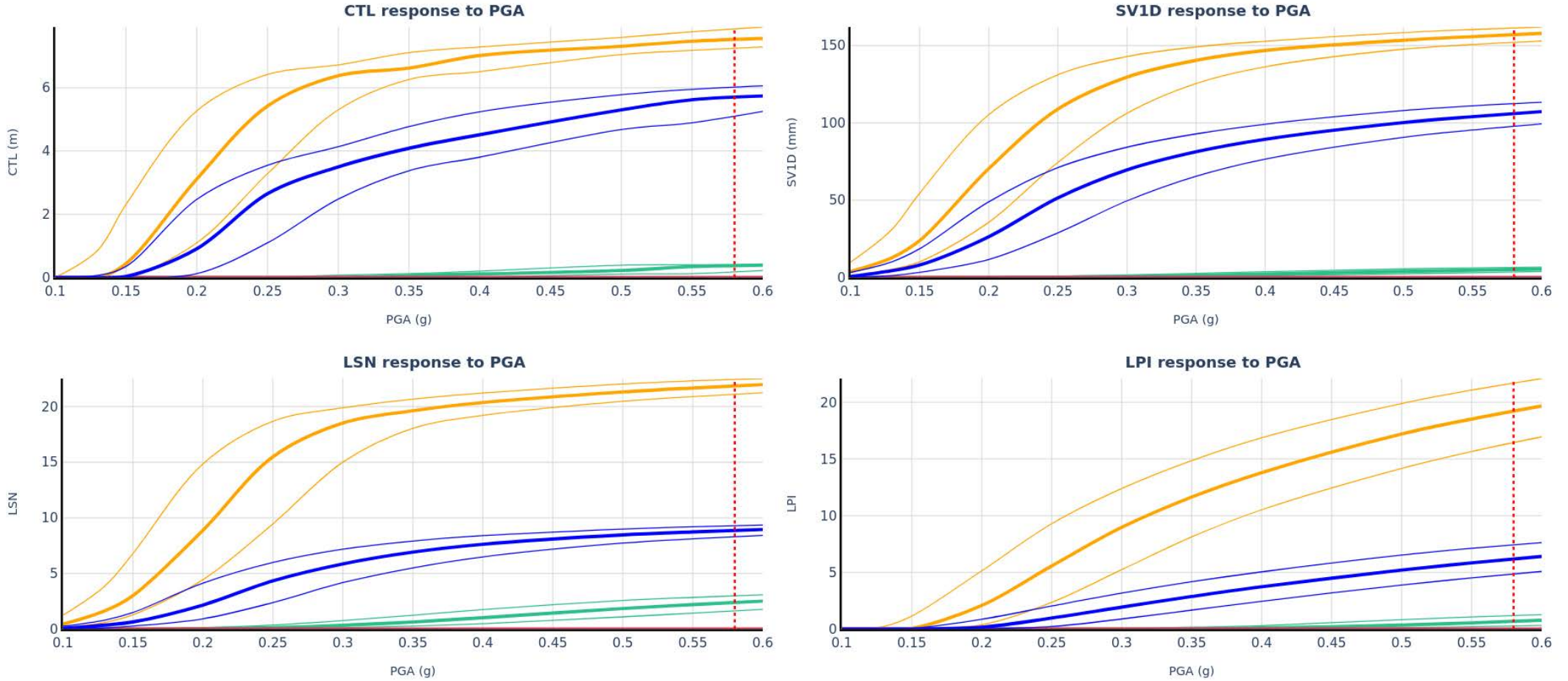
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT447	CPT_TT262956	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT446	CPT_TT262955	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT445	CPT_TT262954	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT444	CPT_TT262953	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 13/17


# PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



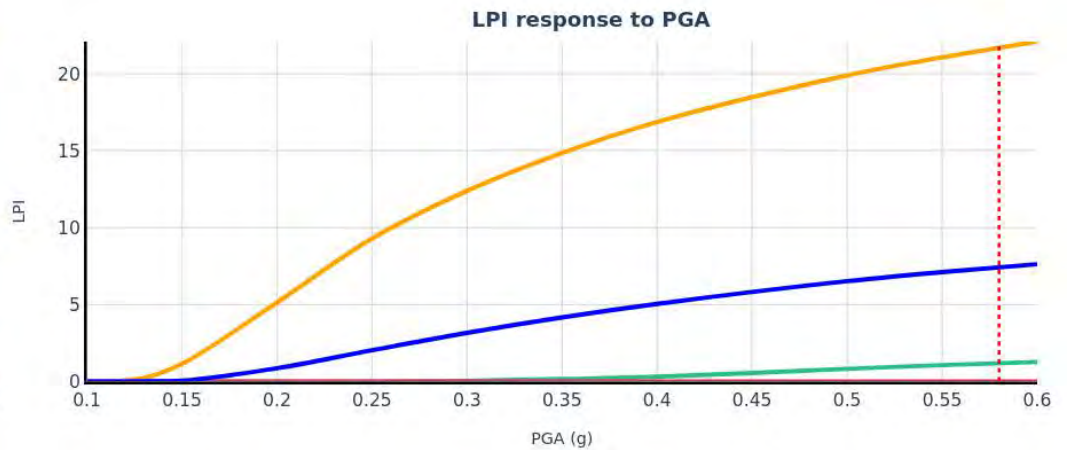
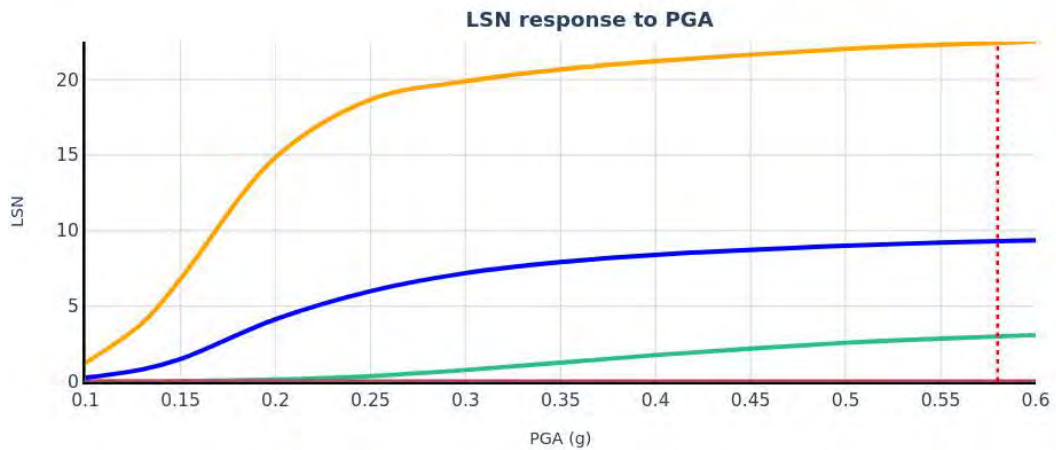
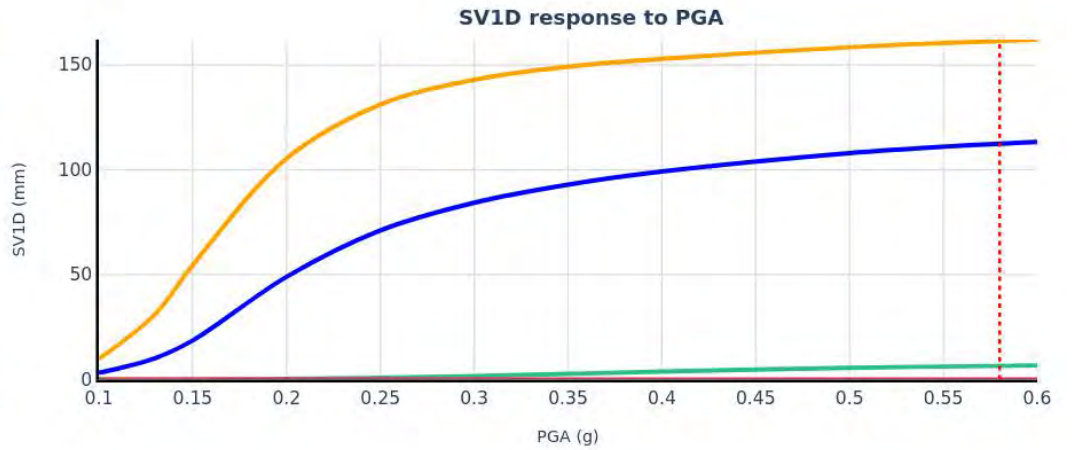
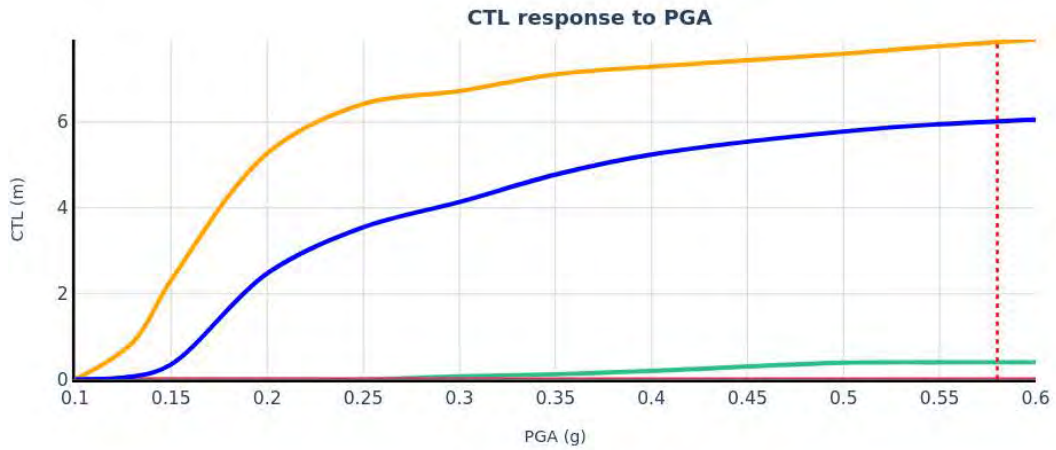
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT447	CPT_TT262956	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT446	CPT_TT262955	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT445	CPT_TT262954	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT444	CPT_TT262953	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 14/17

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT447	CPT_TT262956	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT446	CPT_TT262955	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT445	CPT_TT262954	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT444	CPT_TT262953	11/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/17

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262956	TTGD 262955	TTGD 262954
CPT Name	CPT_TT262956_Raw01	CPT_TT262955_Raw01	CPT_TT262954_Raw01
Run Description	CPT447	CPT446	CPT445
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.0	2.0	1.4
Depth to groundwater for design (m)	2.0	2.5	1.4
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	5.707	5.621	19.262
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	5.707	5.621	19.262
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262956	CPT447	0.0	0.0	0.0
TTGD 262956	CPT447	0.0	5.71	2.6
TTGD 262955	CPT446	0.0	0.0	0.0
TTGD 262955	CPT446	0.0	5.71	2.6
TTGD 262954	CPT445	0.0	0.0	0.0
TTGD 262954	CPT445	0.0	19.26	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262956	CPT447	0.0	5.71	0.0 CFC
TTGD 262955	CPT446	0.0	5.71	0.0 CFC
TTGD 262954	CPT445	0.0	19.26	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262956	CPT447	0.0	0.0001	18.0
TTGD 262956	CPT447	0.0001	5.71	18.0
TTGD 262955	CPT446	0.0	0.0001	18.0
TTGD 262955	CPT446	0.0001	5.71	18.0
TTGD 262954	CPT445	0.0	0.0001	18.0
TTGD 262954	CPT445	0.0001	19.26	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 16/17

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262953
CPT Name	CPT_TT262953_Raw01
Run Description	CPT444
EQ PGA (g)	0.58
EQ Magnitude	7.1
Depth to groundwater at time of Investigation (m)	2.7
Depth to groundwater for design (m)	2.7
Pre-drill depth (m)	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	21.316
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	21.316
Inverse filtering applied?	No
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262953	CPT444	0.0	0.0	0.0
TTGD 262953	CPT444	0.0	21.32	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

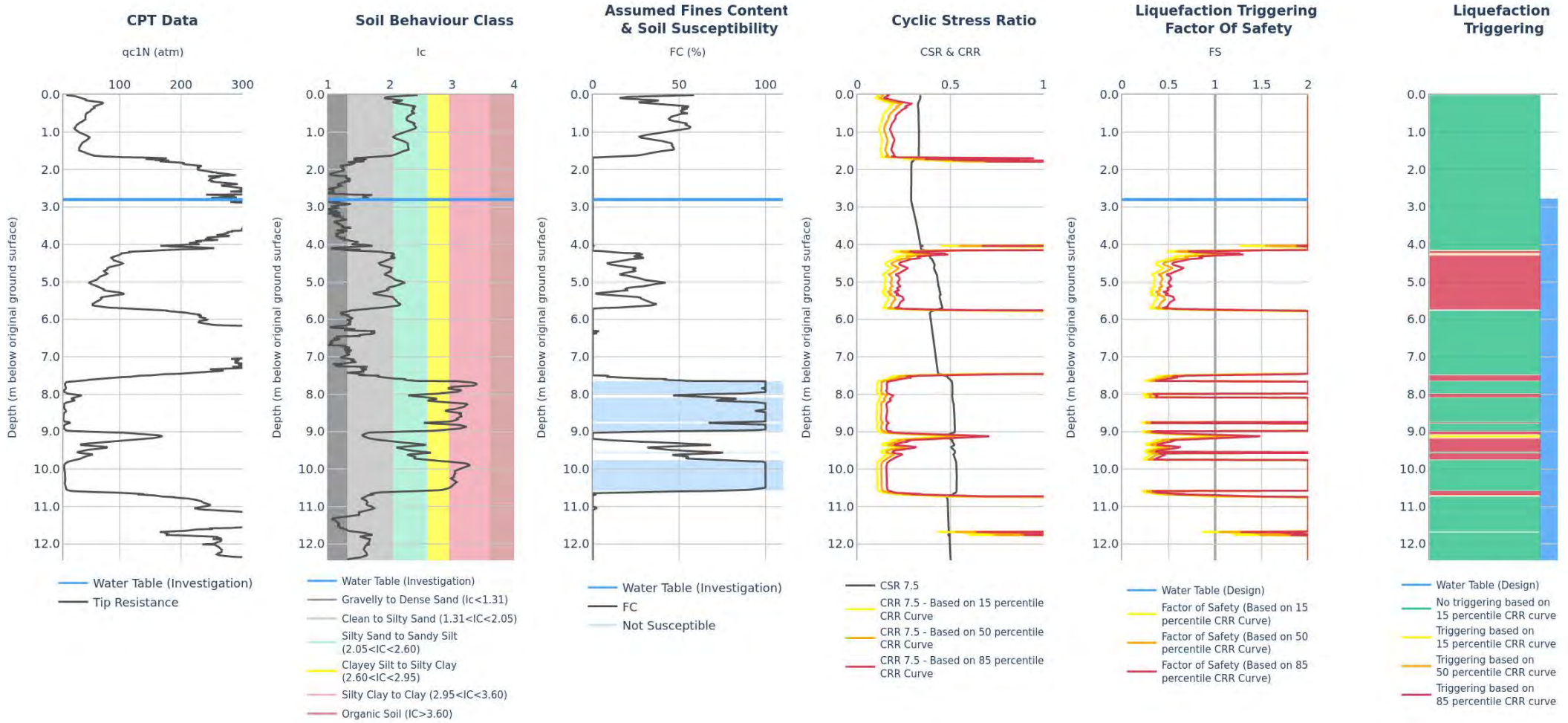
ID	Run description	From (m)	To (m)	Fc
TTGD 262953	CPT444	0.0	21.32	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262953	CPT444	0.0	0.0001	18.0
TTGD 262953	CPT444	0.0001	21.32	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbanks			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbanks	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 17/17

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT452	CPT_TT262960	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

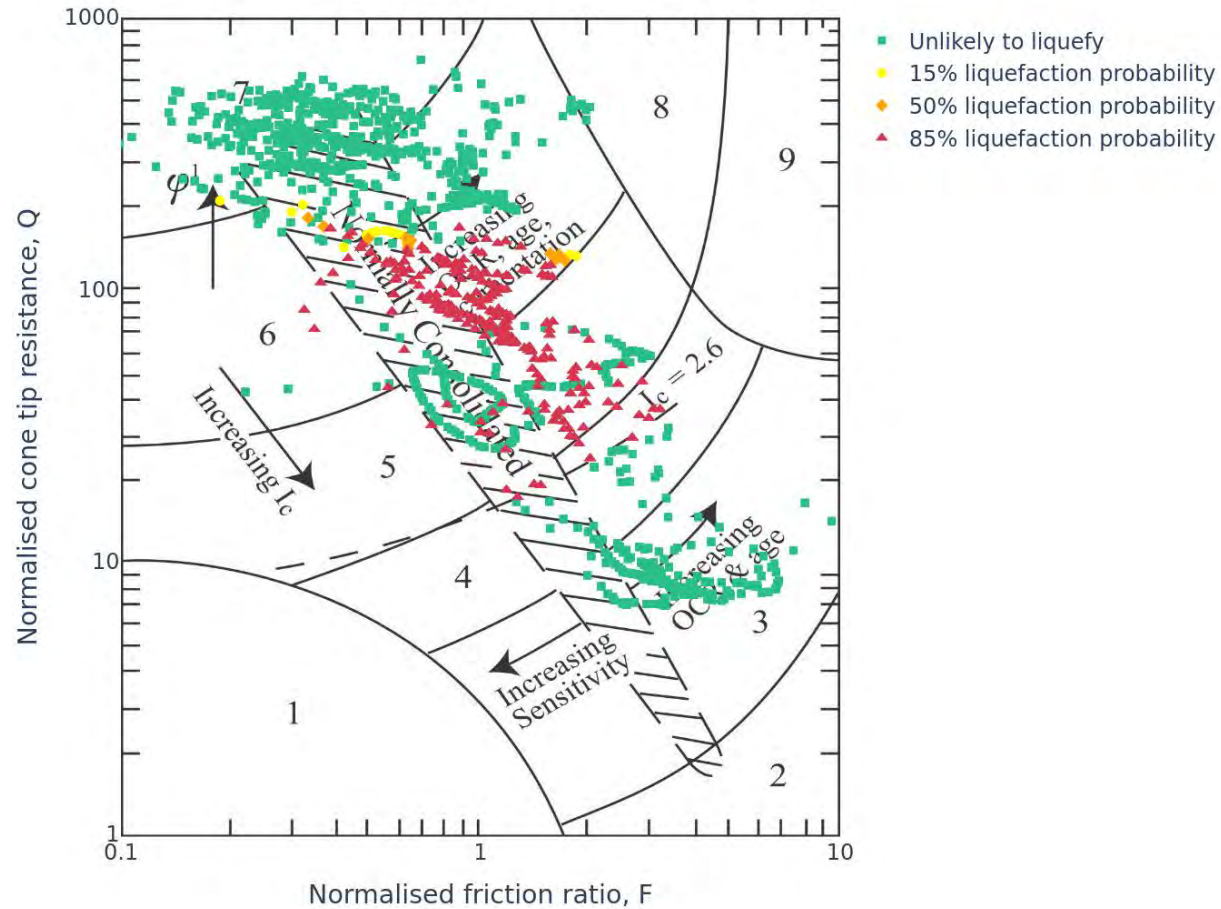
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	57	2.8	11	9	4.2	6
50%	56	2.7	9	9	4.3	5
85%	54	2.6	7	8	4.3	4

**Reviewed by**

CPT inversion	DAMI
Groundwater	DAMI
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



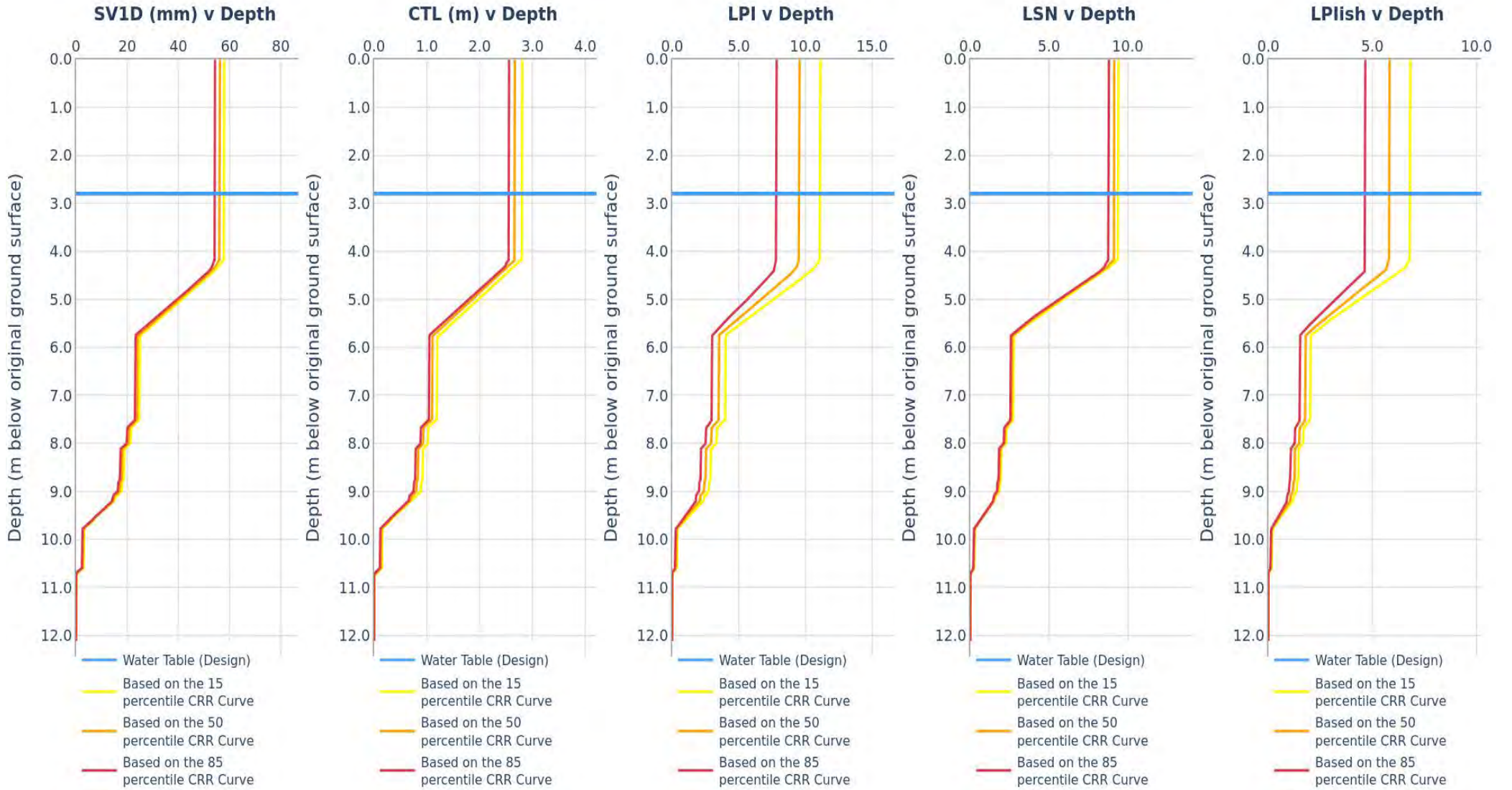
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank			
	COMMENT	nan			Page 2/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

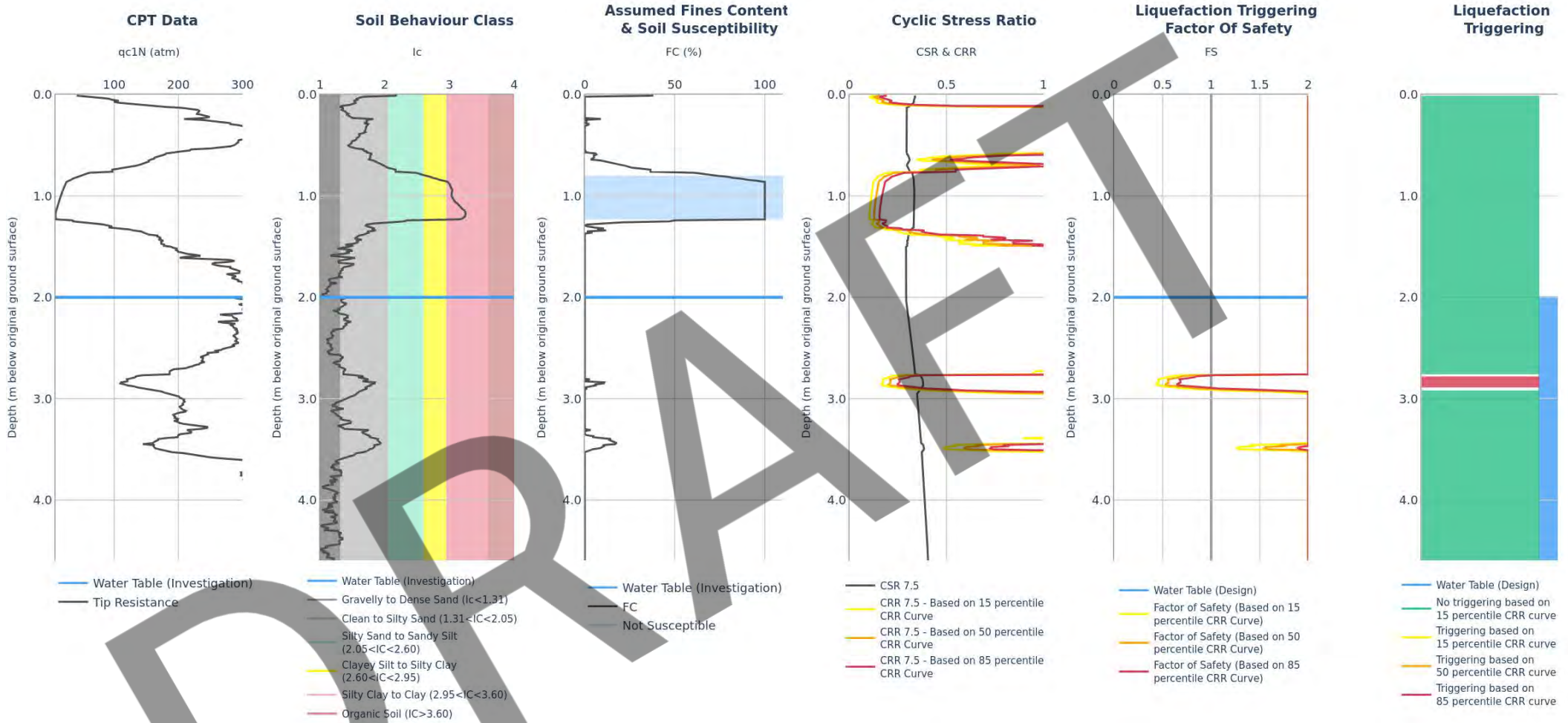


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT452	CPT_TT262960	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 3/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT451	CPT_TT262959	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

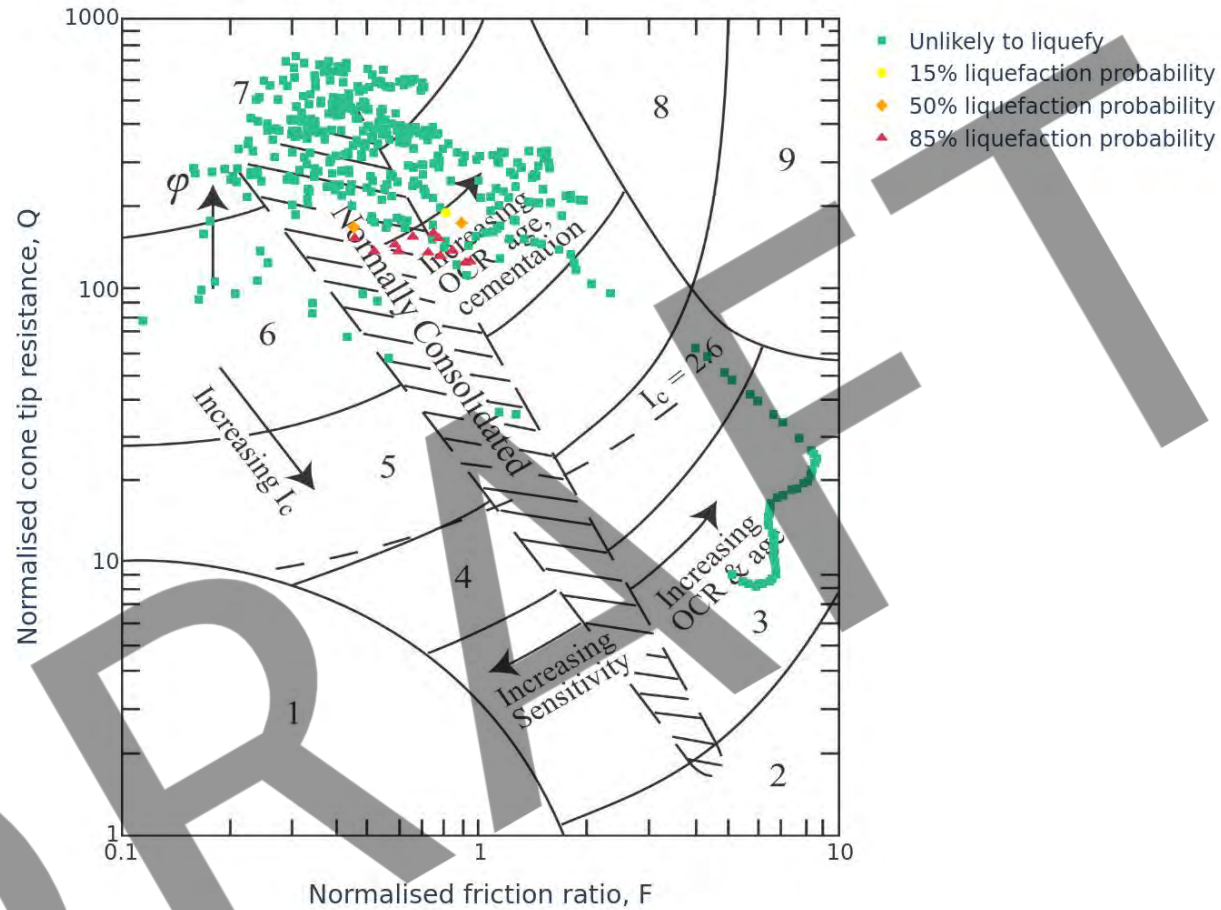
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	2	0.2	0	1	2.9	0
50%	2	0.1	0	0	2.9	0
85%	2	0.1	0	0	2.9	0

**Reviewed by**

CPT inversion	DAMI
Groundwater	
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 4/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



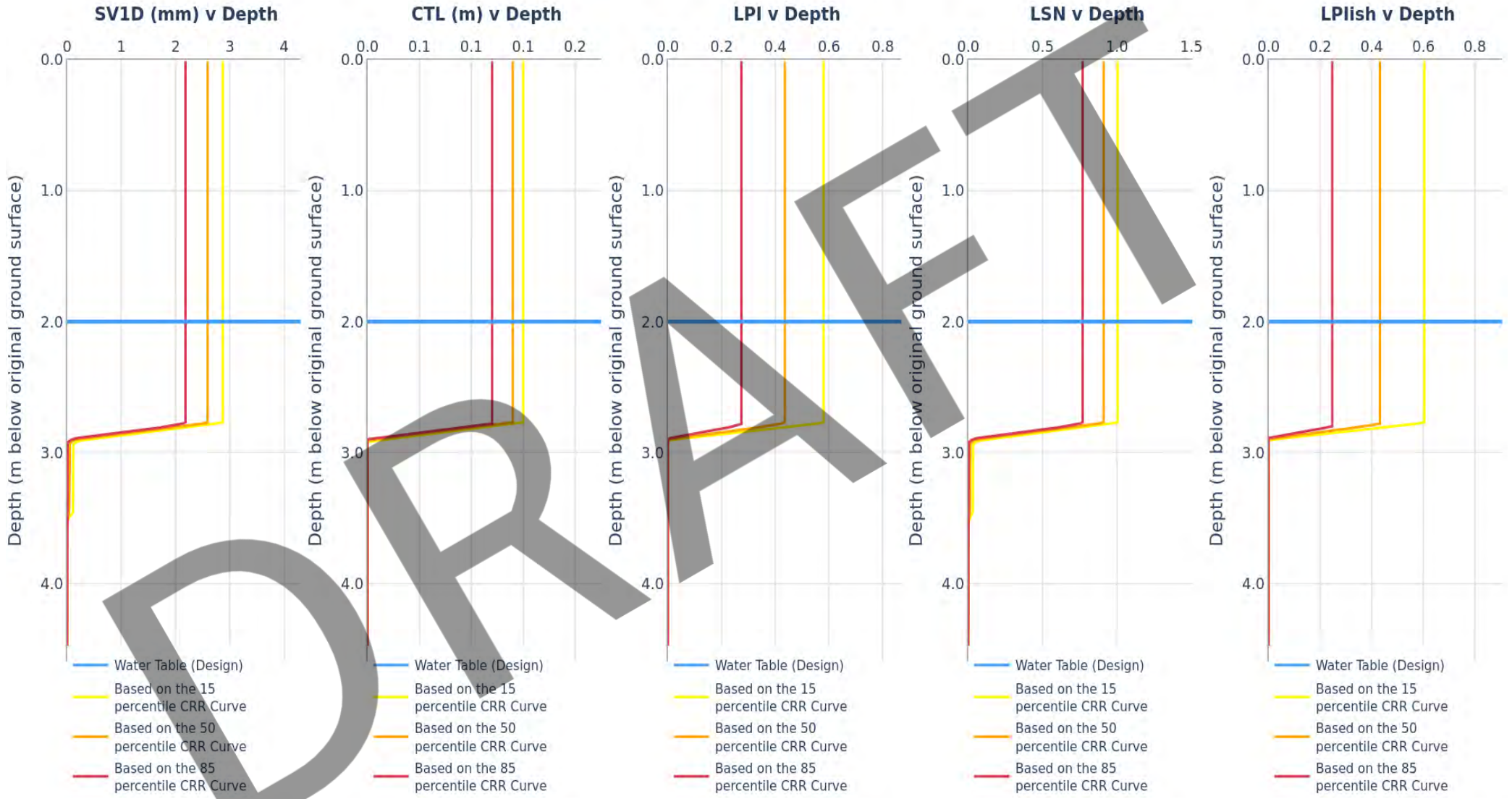
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank			
	COMMENT	nan			Page 5/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

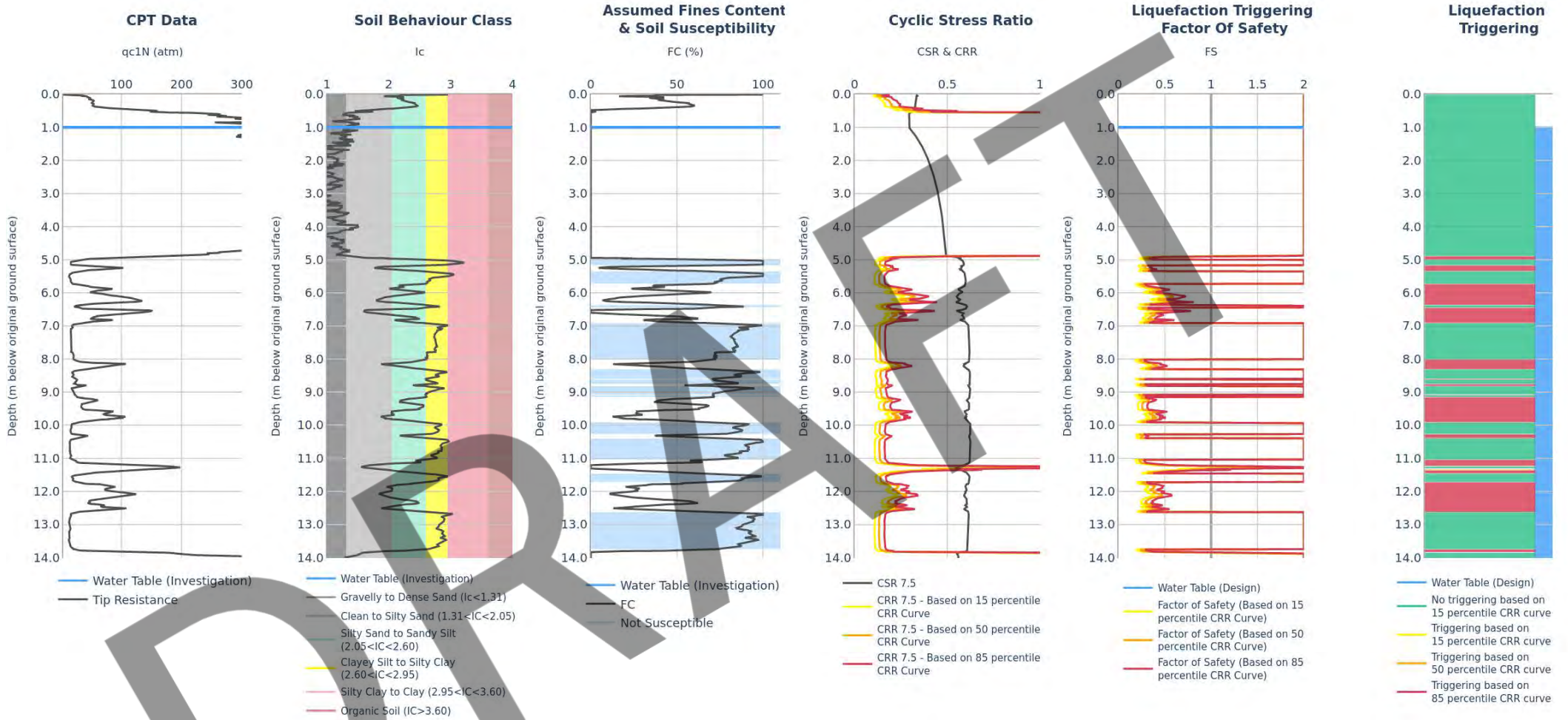


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT451	CPT_TT262959	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 6/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT450	CPT_TT262958	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

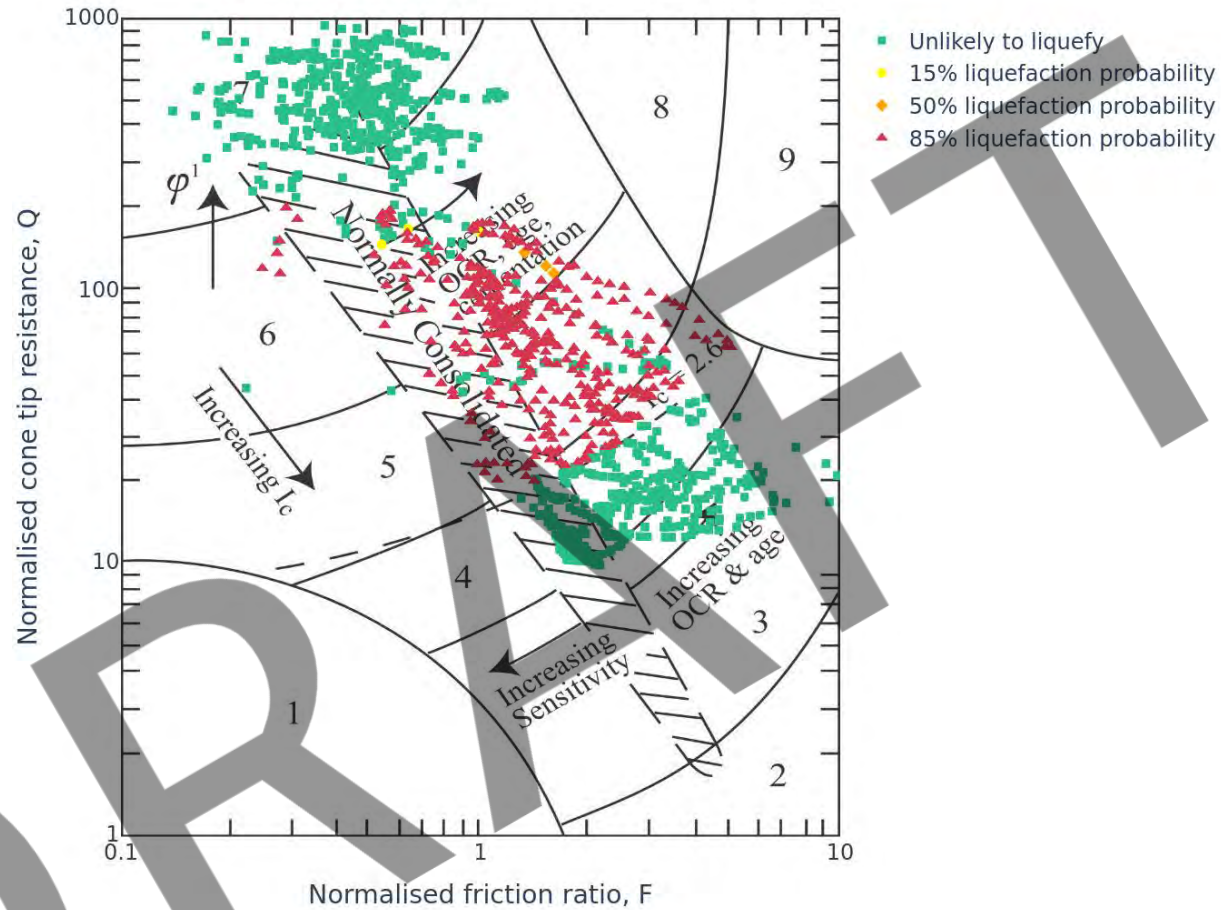
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	85	4.0	15	10	5.0	8
50%	85	4.0	14	10	5.0	7
85%	84	4.0	12	10	5.0	6

**Reviewed by**

CPT inversion	DAMI
Groundwater	
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



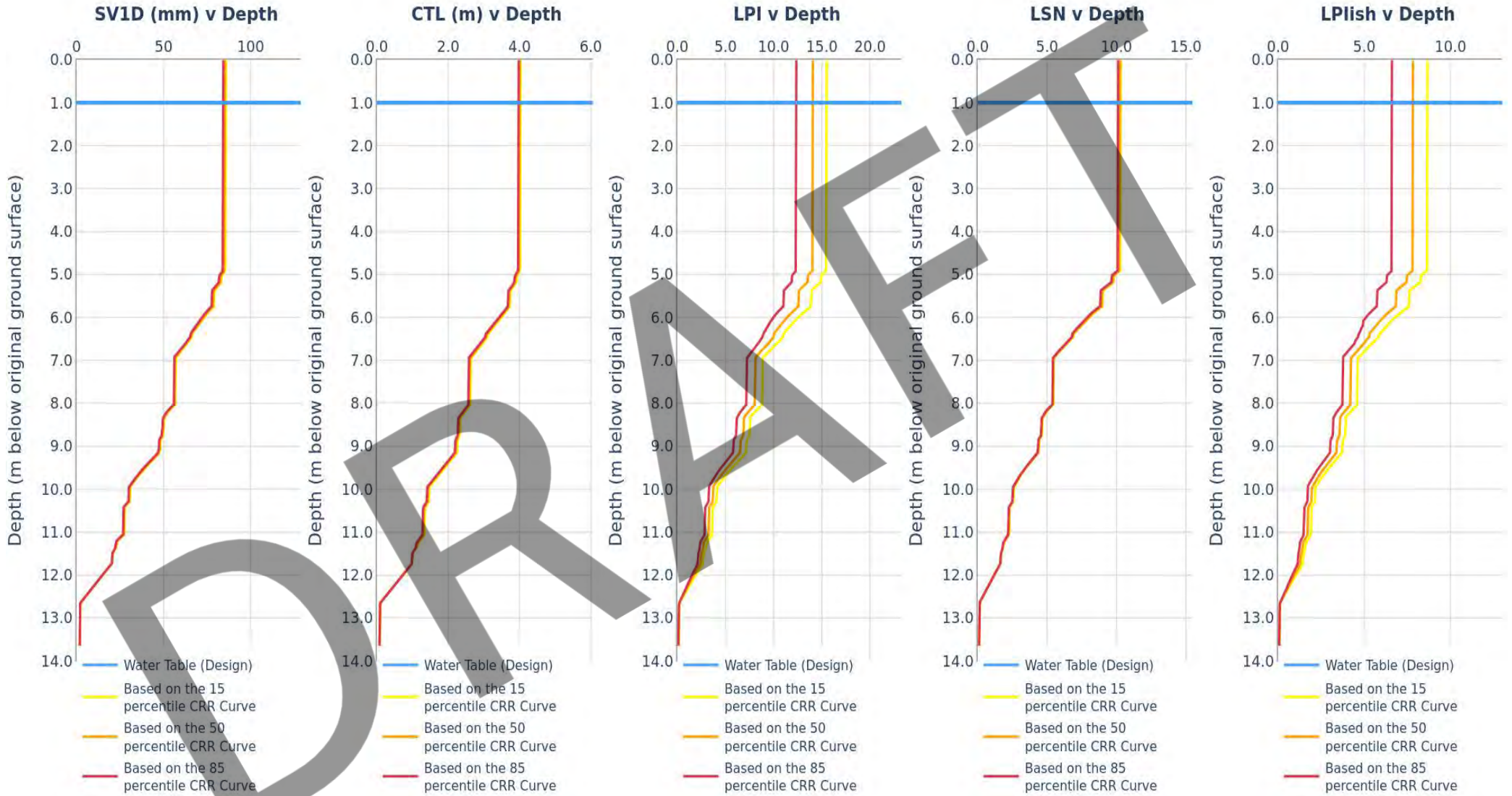
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank			
	COMMENT	nan			

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

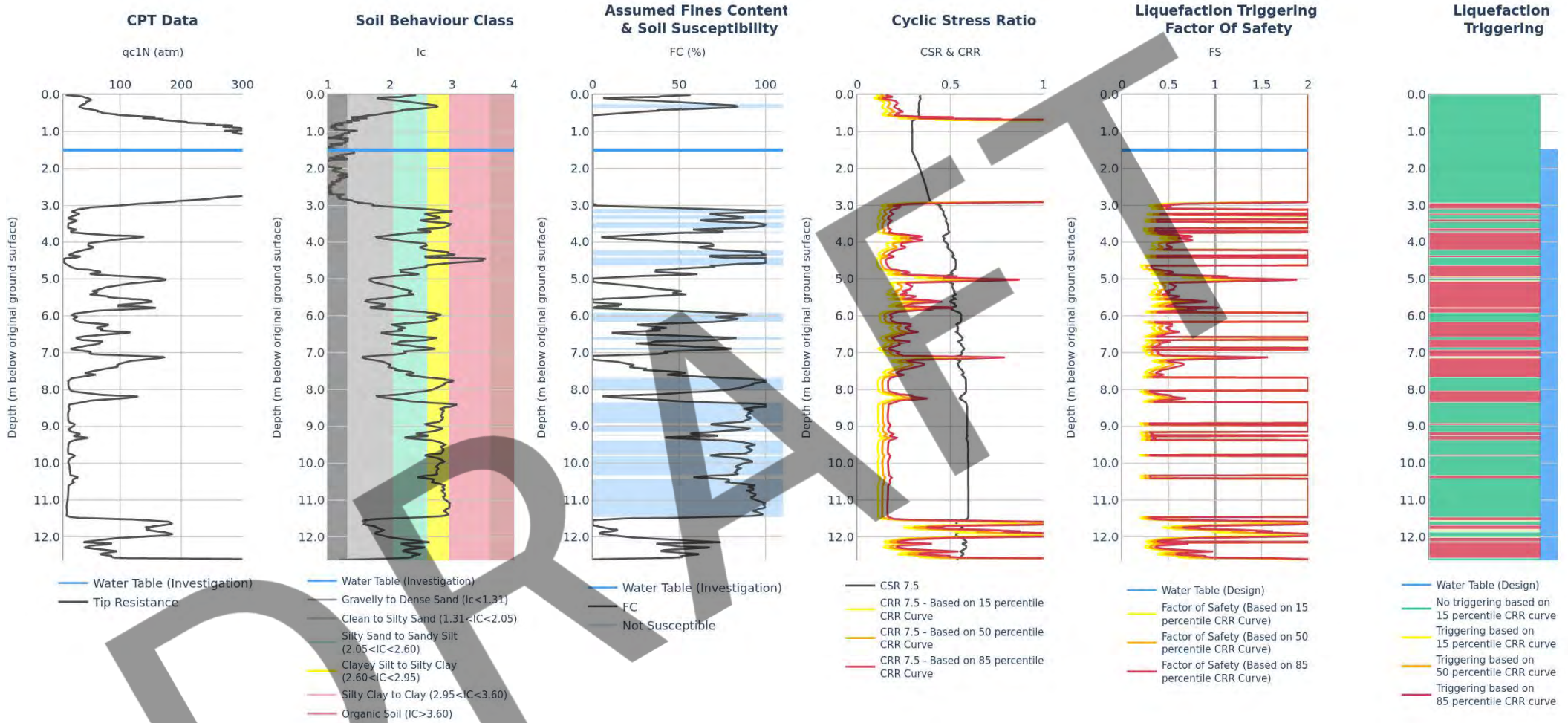


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT450	CPT_TT262958	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 9/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT449	CPT_TT262957	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

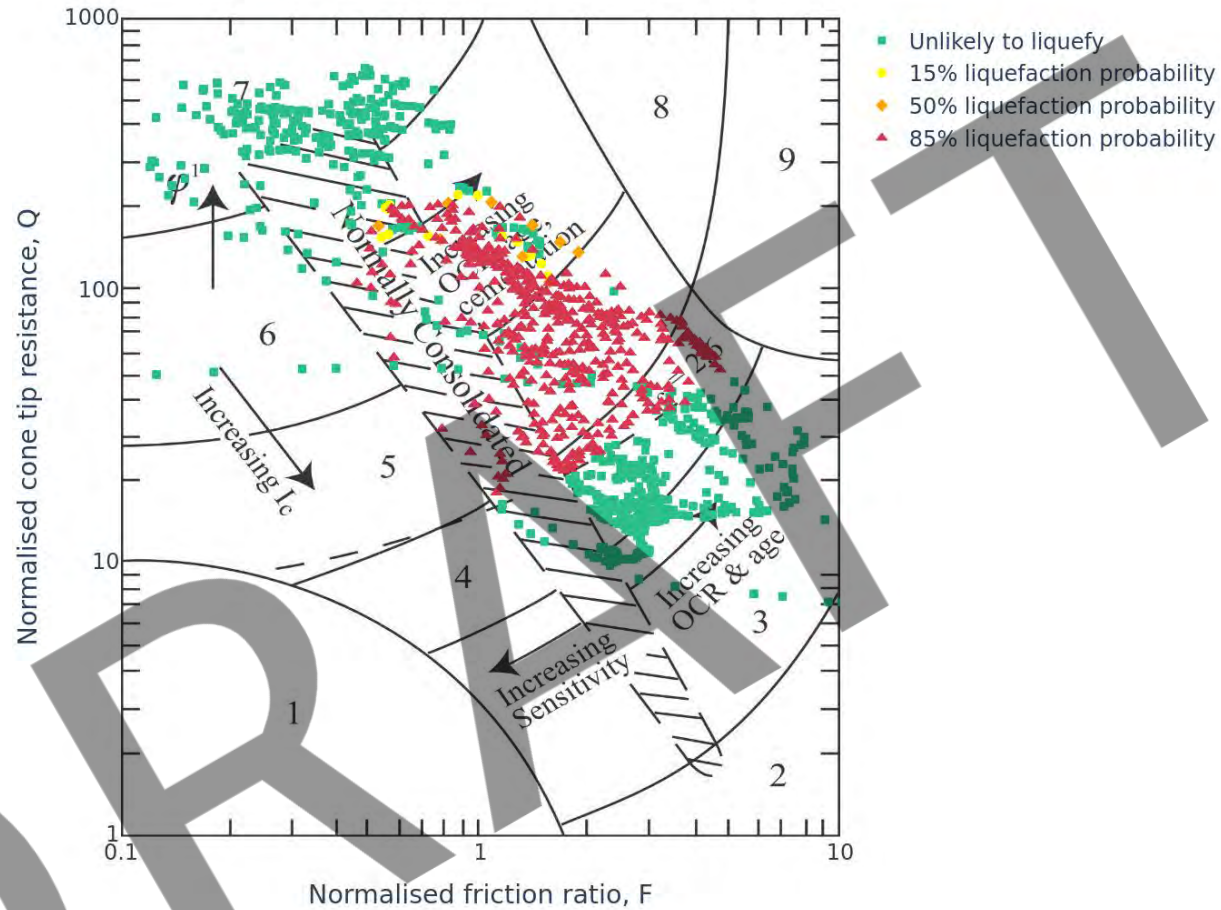
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	101	4.9	20	16	3.0	13
50%	98	4.8	17	16	3.0	11
85%	95	4.7	15	15	3.0	9

**Reviewed by**

CPT inversion	DAMI
Groundwater	
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 10/20

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

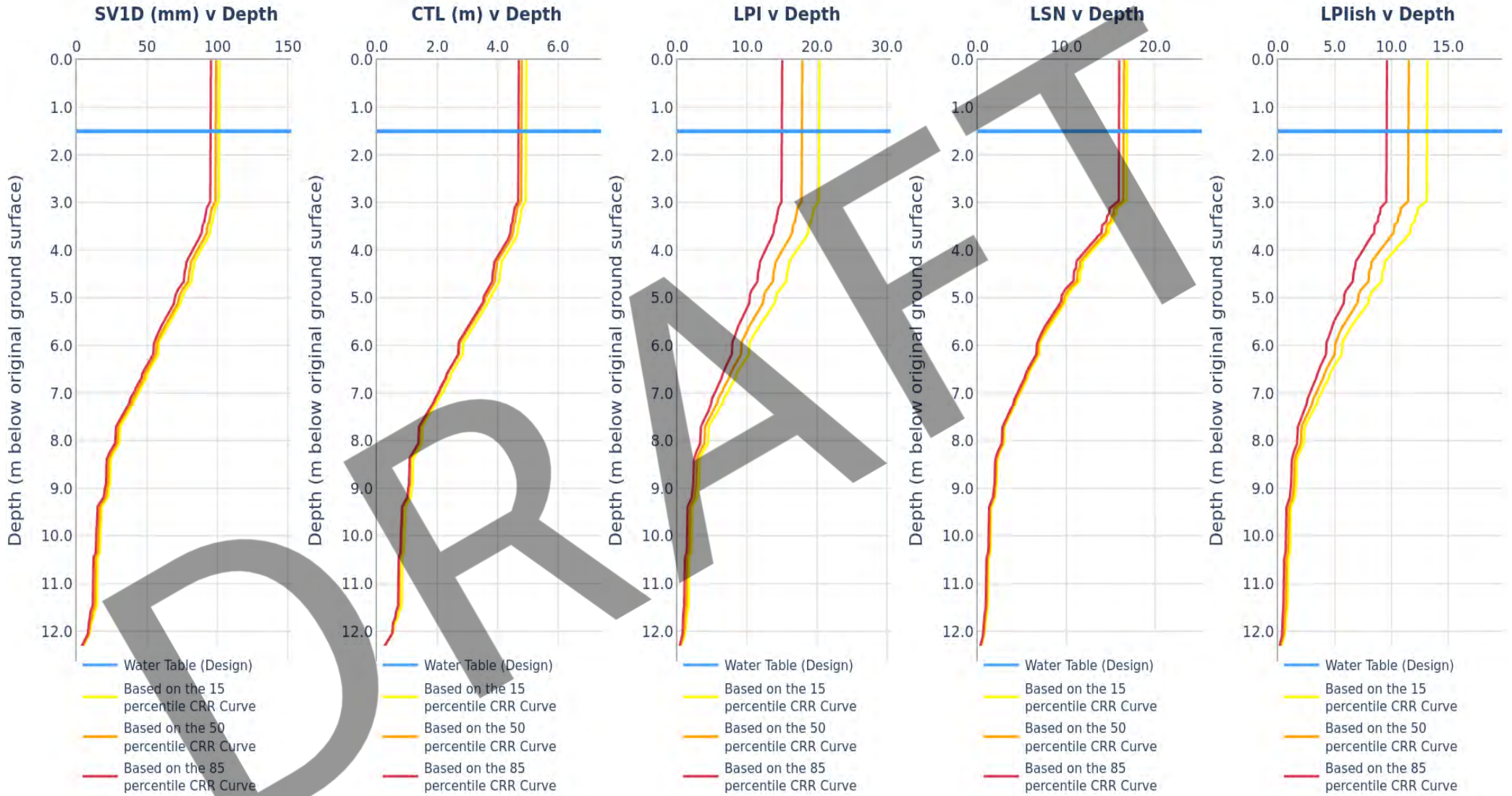


- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |
- \*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank			
	COMMENT	nan			Page 11/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

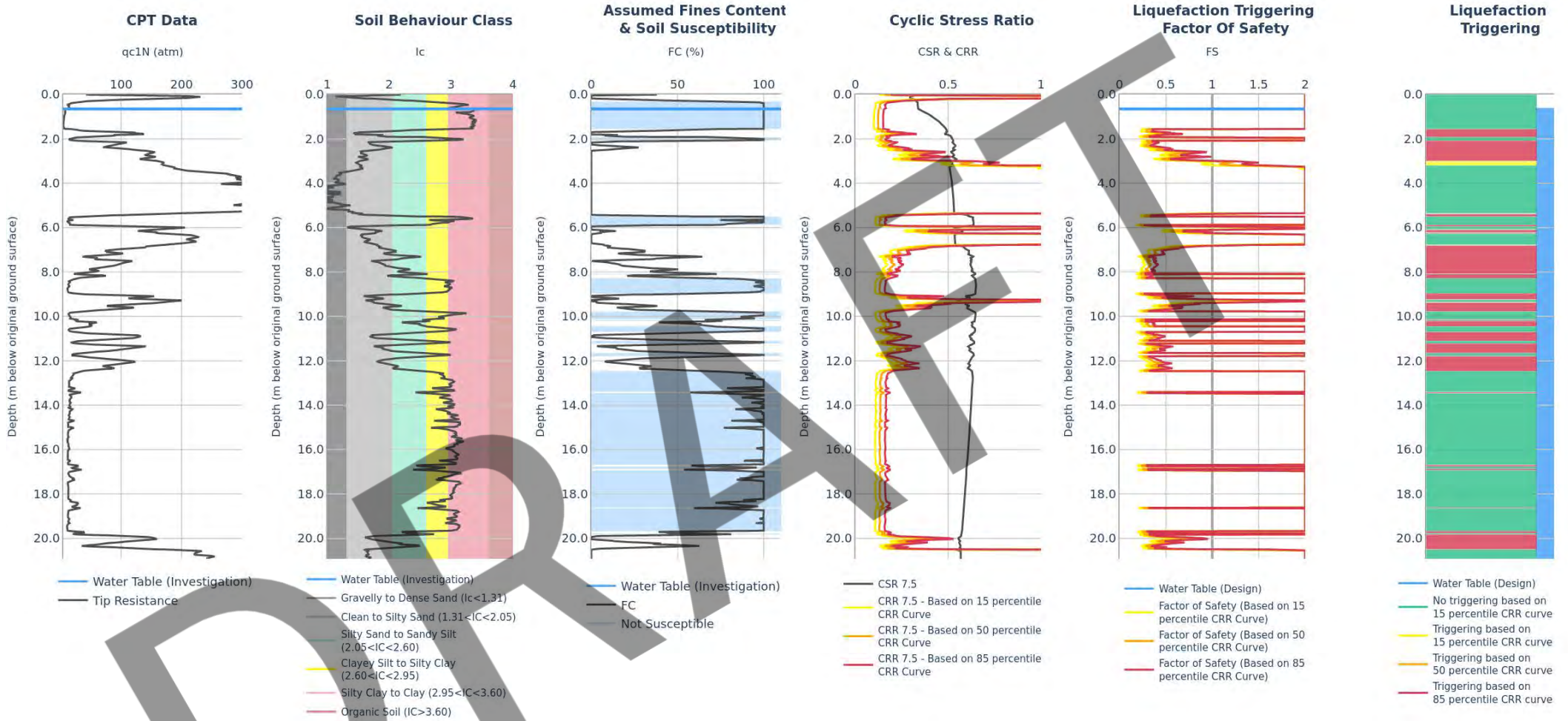


Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT449	CPT_TT262957	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 12/20

# CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



**Input**

*Note: Raw Qc/Fs data used.*


Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT448	CPT_TT262964	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

**Output**

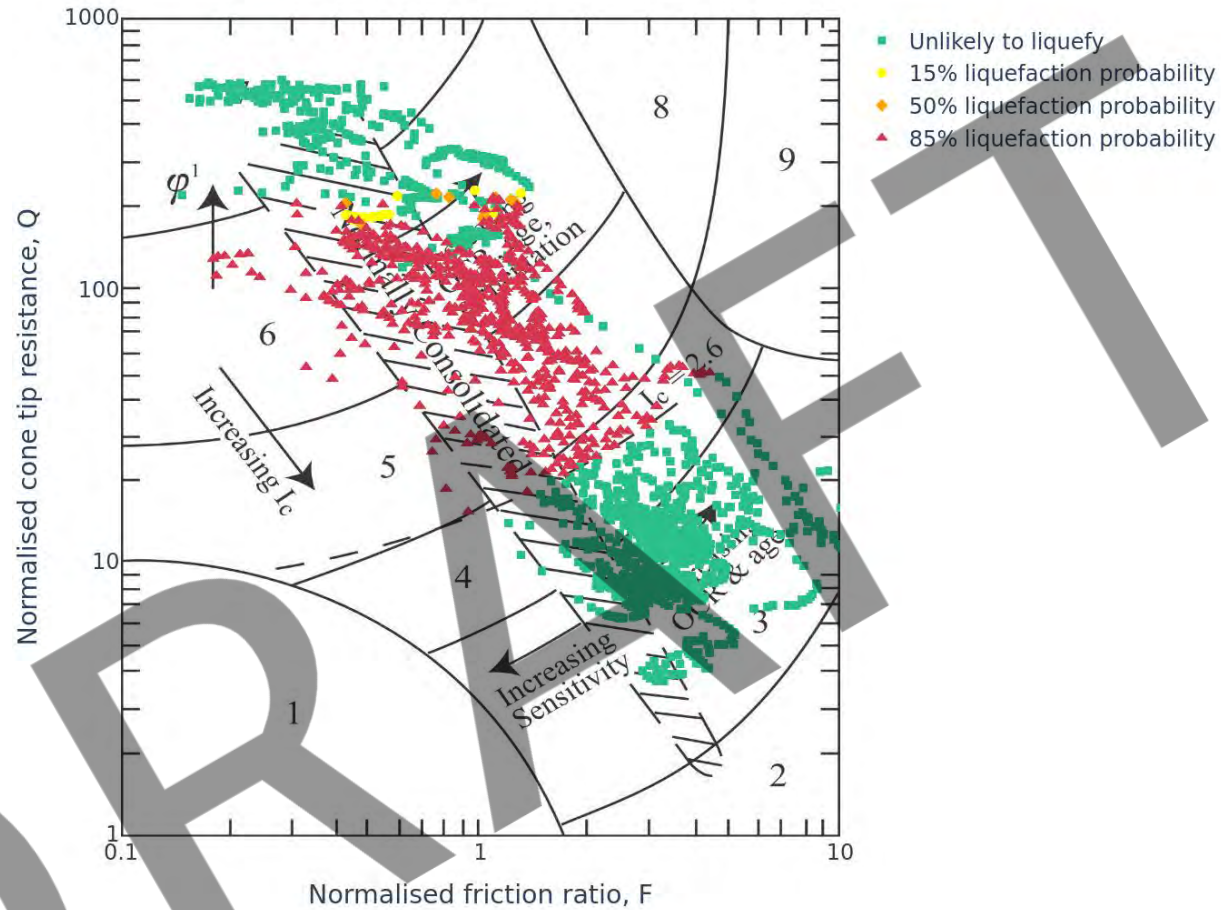
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPlish
15%	136	6.8	23	23	1.7	18
50%	133	6.6	20	23	1.7	16
85%	128	6.5	17	22	1.7	13

**Reviewed by**

CPT inversion	DAMI
Groundwater	
Stress	DAMI
Susceptibility	DAMI
Triggering	DAMI
Consequence	DAMI

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			

## SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



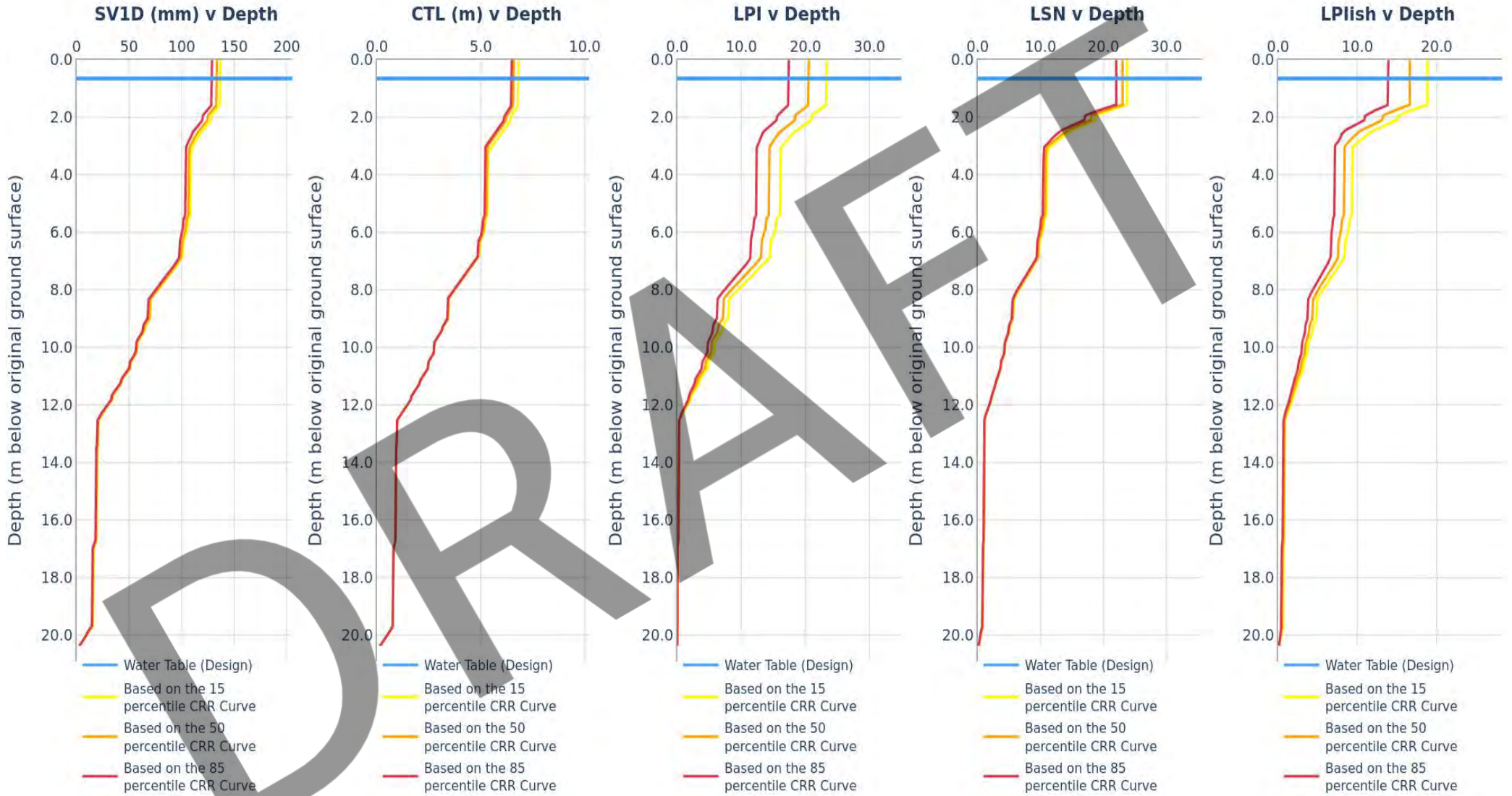
- |  |                                     |
|--|-------------------------------------|
| 1. Sensitive, fine grained                   | 6. Sands - clean sand to silty sand |
| 2. Organic soils - peats                     | 7. Gravelly sand to dense sand      |
| 3. Clays - silty clay to clay                | 8. Very stiff sand to clayey sand   |
| 4. Silt mixtures - clayey silt to silty clay | 9. Very stiff, fine grained *       |
| 5. Sand mixtures - silty sand to sandy silt  |                                     |

\*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)


	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank			
	COMMENT	nan			Page 14/20

## LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



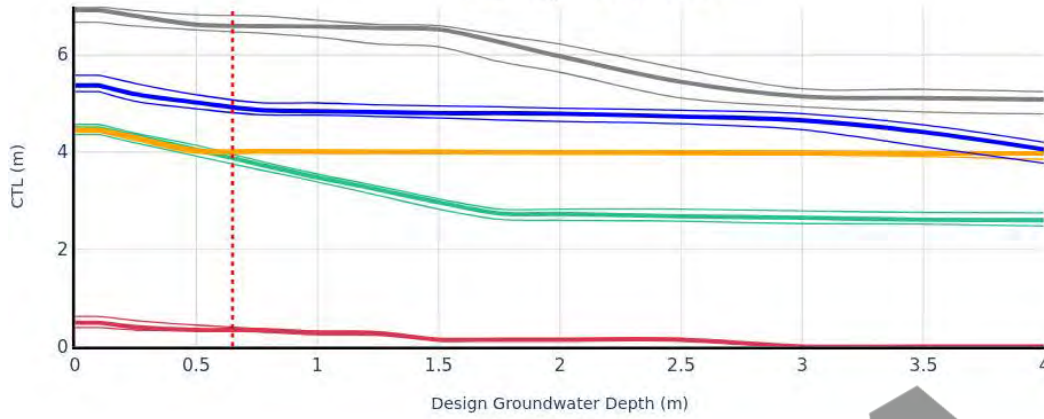
Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT448	CPT_TT262964	12/12/2024	0	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

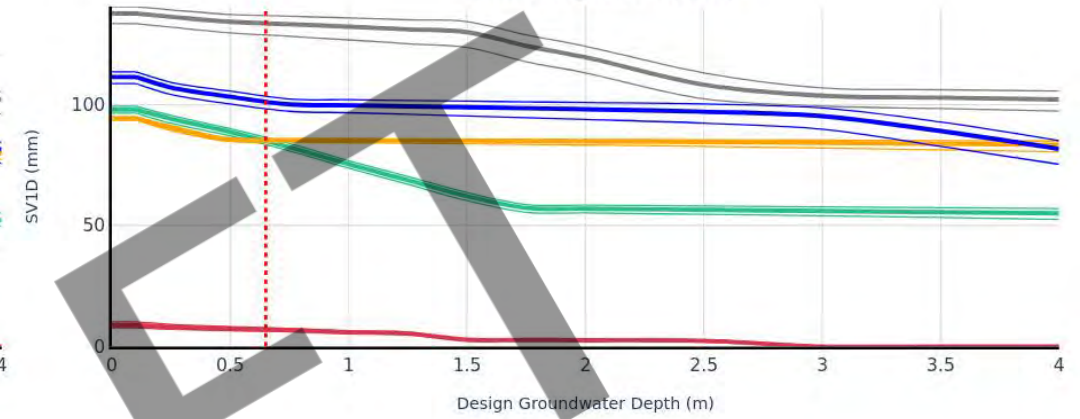
	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 15/20

# GROUNDWATER DEPTH SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

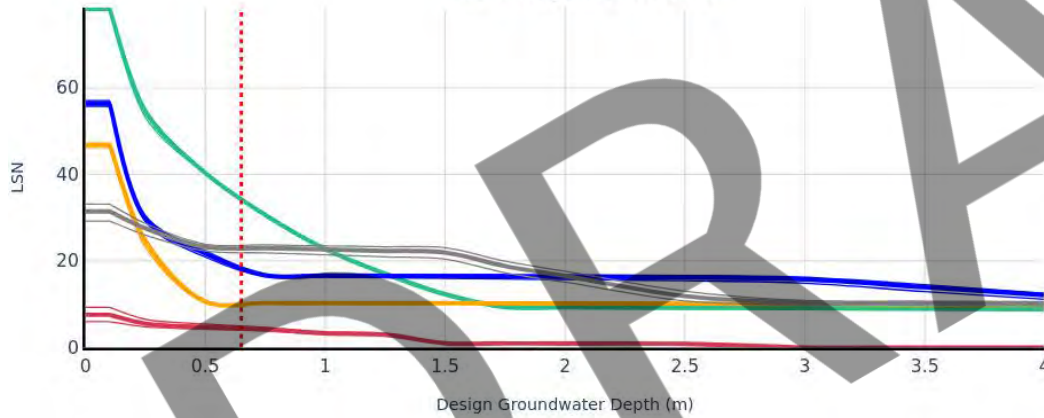
**CTL response to GWD**



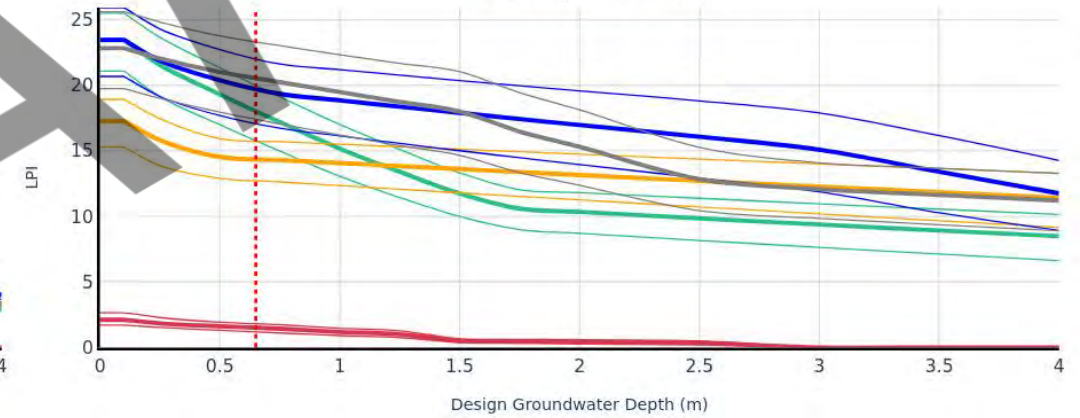
**SV1D response to GWD**



**LSN response to GWD**




**LPI response to GWD**



**Input**

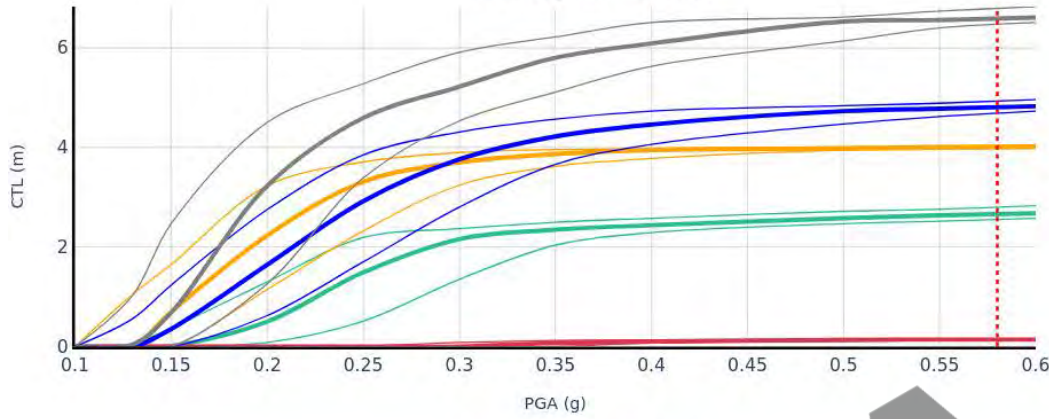
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT452	CPT_TT262960	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT451	CPT_TT262959	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT450	CPT_TT262958	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT449	CPT_TT262957	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT448	CPT_TT262964	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

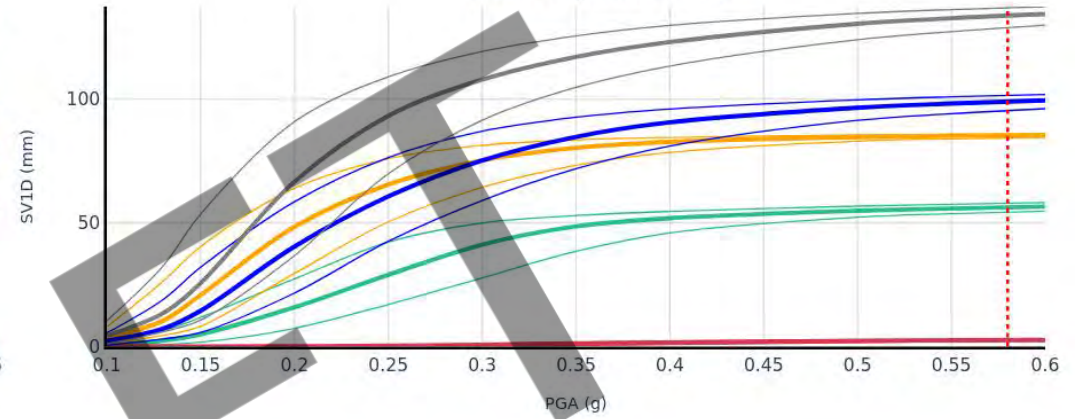
	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 16/20

# PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

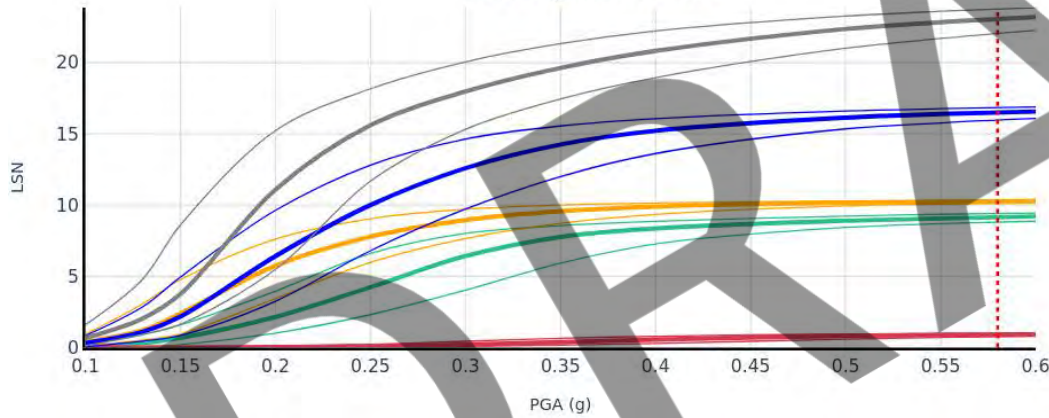
**CTL response to PGA**



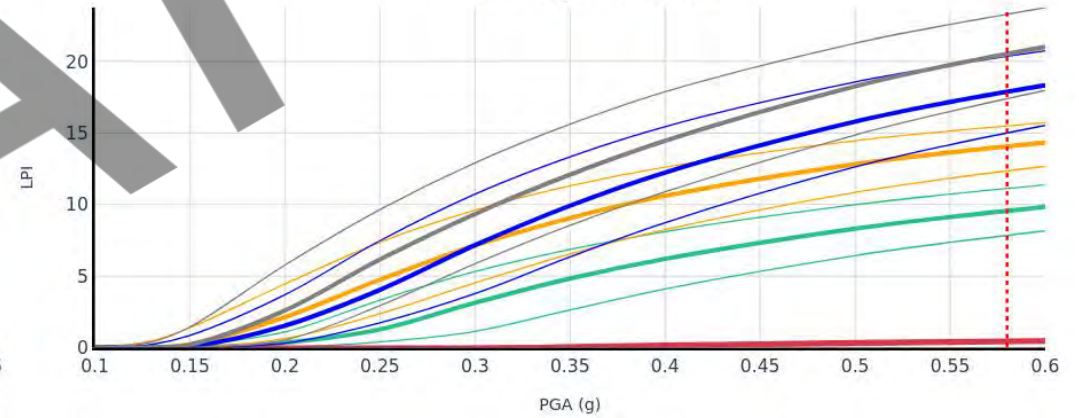
**SVID response to PGA**



**LSN response to PGA**




**LPI response to PGA**



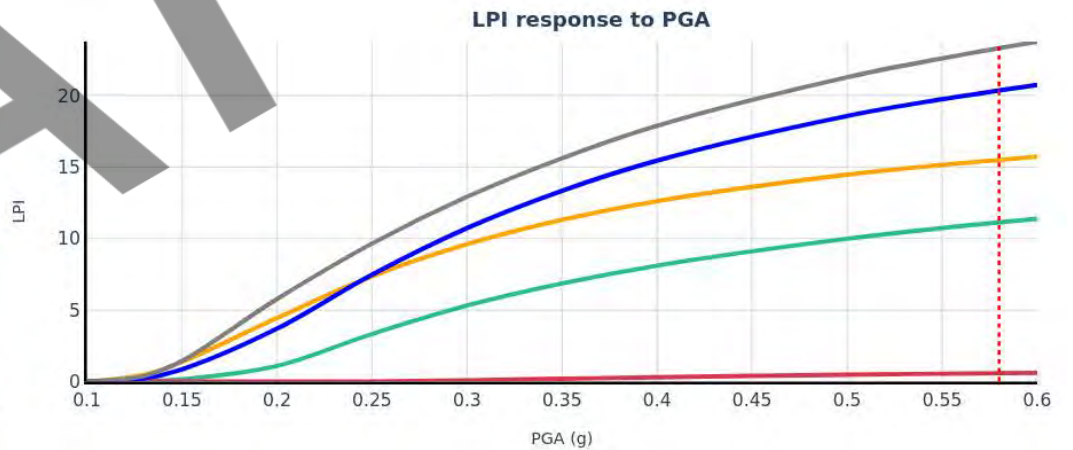
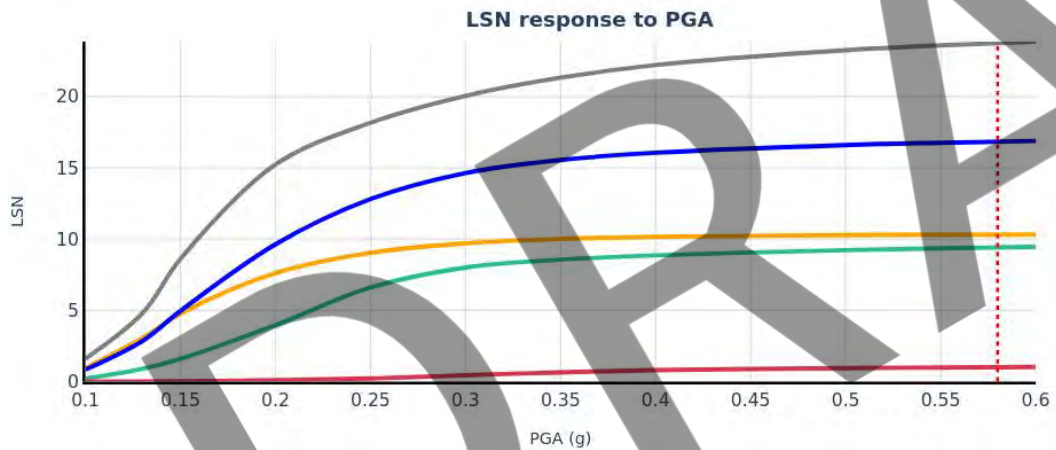
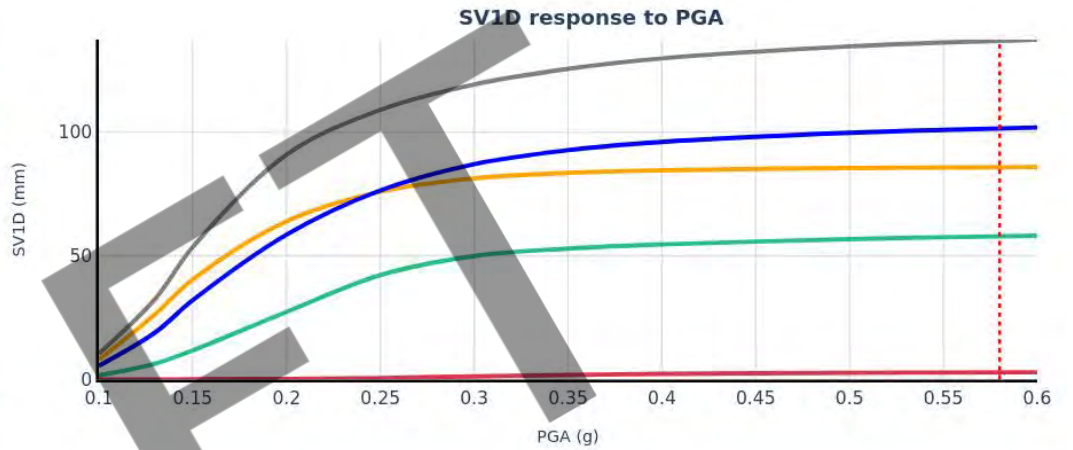
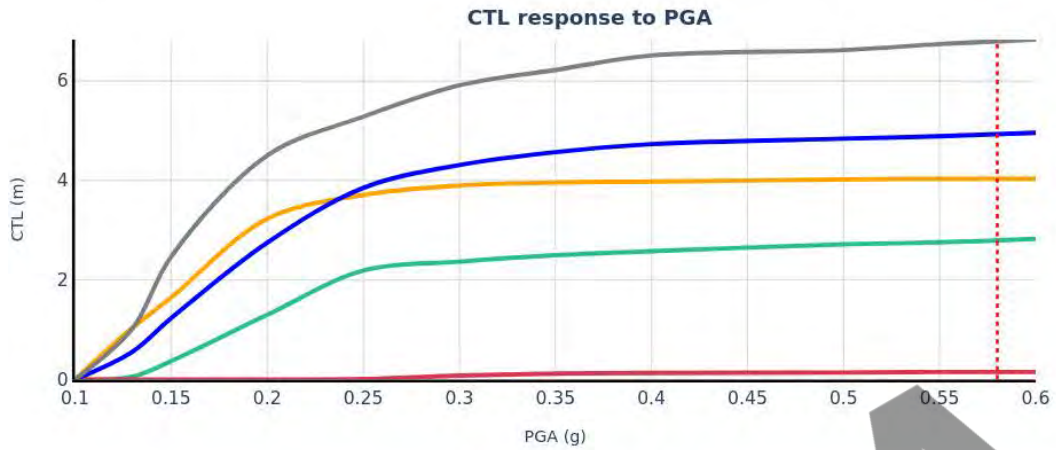
**Input**

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT452	CPT_TT262960	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT451	CPT_TT262959	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT450	CPT_TT262958	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT449	CPT_TT262957	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT448	CPT_TT262964	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 17/20

**PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT  
BASED ON 15 PERCENTILE CRR CURVE**



Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT452	CPT_TT262960	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT451	CPT_TT262959	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT450	CPT_TT262958	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT449	CPT_TT262957	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A
CPT448	CPT_TT262964	12/12/2024	7.1	0.58	BI-2014	ZRB-2002	None	N/A	N/A

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 18/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262960	TTGD 262959	TTGD 262958
CPT Name	CPT_TT262960_Raw01	CPT_TT262959_Raw01	CPT_TT262958_Raw01
Run Description	CPT452	CPT451	CPT450
EQ PGA (g)	0.58	0.58	0.58
EQ Magnitude	7.1	7.1	7.1
Depth to groundwater at time of Investigation (m)	2.8	2.0	1.0
Depth to groundwater for design (m)	2.8	2.0	1.0
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	12.438	4.595	14.013
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	12.438	4.595	14.013
Inverse filtering applied?	No	No	No
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262960	CPT452	0.0	0.0	0.0
TTGD 262960	CPT452	0.0	12.44	2.6
TTGD 262959	CPT451	0.0	0.0	0.0
TTGD 262959	CPT451	0.0	12.44	2.6
TTGD 262958	CPT450	0.0	0.0	0.0
TTGD 262958	CPT450	0.0	14.01	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262960	CPT452	0.0	12.44	0.0 CFC
TTGD 262959	CPT451	0.0	12.44	0.0 CFC
TTGD 262958	CPT450	0.0	14.01	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262960	CPT452	0.0	0.0001	18.0
TTGD 262960	CPT452	0.0001	12.44	18.0
TTGD 262959	CPT451	0.0	0.0001	18.0
TTGD 262959	CPT451	0.0001	12.44	18.0
TTGD 262958	CPT450	0.0	0.0001	18.0
TTGD 262958	CPT450	0.0001	14.01	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 19/20

## SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

**Table 1 Summary of inputs for liquefaction analysis**

NZGD ID	TTGD 262957	TTGD 262964
CPT Name	CPT_TT262957_Raw01	CPT_TT262964_Raw01
Run Description	CPT449	CPT448
EQ PGA (g)	0.58	0.58
EQ Magnitude	7.1	7.1
Depth to groundwater at time of Investigation (m)	1.5	0.65
Depth to groundwater for design (m)	1.5	0.65
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	12.636	20.921
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	12.636	20.921
Inverse filtering applied?	No	No
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m <sup>3</sup> )	N/A	N/A

**Table 2 Summary of Ic inputs for liquefaction analysis**


ID	Run description	From (m)	To (m)	Ic
TTGD 262957	CPT449	0.0	0.0	0.0
TTGD 262957	CPT449	0.0	12.64	2.6
TTGD 262964	CPT448	0.0	0.0	0.0
TTGD 262964	CPT448	0.0	20.92	2.6

**Table 3 Summary of Fc inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Fc
TTGD 262957	CPT449	0.0	12.64	0.0 CFC
TTGD 262964	CPT448	0.0	20.92	0.0 CFC

**Table 4 Summary of soil density inputs for liquefaction analysis**

ID	Run description	From (m)	To (m)	Unit Weight (kN/m <sup>3</sup> )
TTGD 262957	CPT449	0.0	0.0001	18.0
TTGD 262957	CPT449	0.0001	12.64	18.0
TTGD 262964	CPT448	0.0	0.0001	18.0
TTGD 262964	CPT448	0.0001	20.92	18.0

	CLIENT	HBRC	LOCATION	Pakowhai	DATE: 11/09/2025
	PROJECT	Pakowhai Secondary Stopbank			ANALYSED: MIBU
	TITLE	Pakowhai Secondary Stopbank	JOB NUMBER	1017353.2403	
	COMMENT	nan			Page 20/20

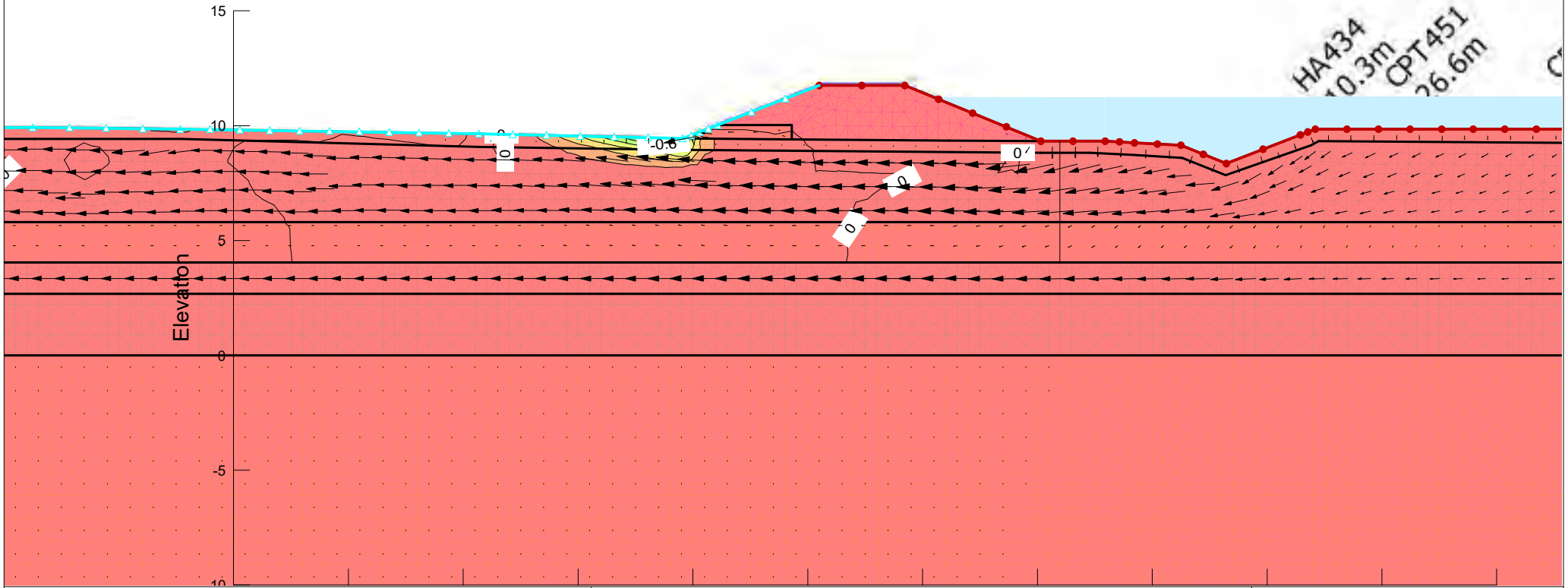
## **Appendix C      Slope/Seepage Modelling Outputs**

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Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Ky'/Kx' Ratio	Rotation (°)
█	1. Stopbank Fill	Saturated / Unsaturated	Sandy SILT / SILT (FILL MATERIAL)	Sandy SILT / SILT (Fill)	0.25	0
█	2. Silty SAND / Sandy SILT	Saturated / Unsaturated	Silty SAND / Sandy SILT	Silty SAND / Sandy SILT	1	0
█	3. SAND	Saturated / Unsaturated	SAND	SAND	1	0
█	4. SILT	Saturated / Unsaturated	SILT	SILT	1	0
█	5. Gravel	Saturated / Unsaturated	Gravel	Gravel	1	0

Water Y-Gradient

- █ ≤ -1 - -0.9
- █ -0.9 - -0.8
- █ -0.8 - -0.7
- █ -0.7 - -0.6
- █ -0.6 - -0.5
- █ -0.5 - -0.4
- █ -0.4 - -0.3
- █ -0.3 - -0.2
- █ -0.2 - -0.1
- █ ≥ -0.1



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: CH160\_Steady\_state

Analysed by: MIBU

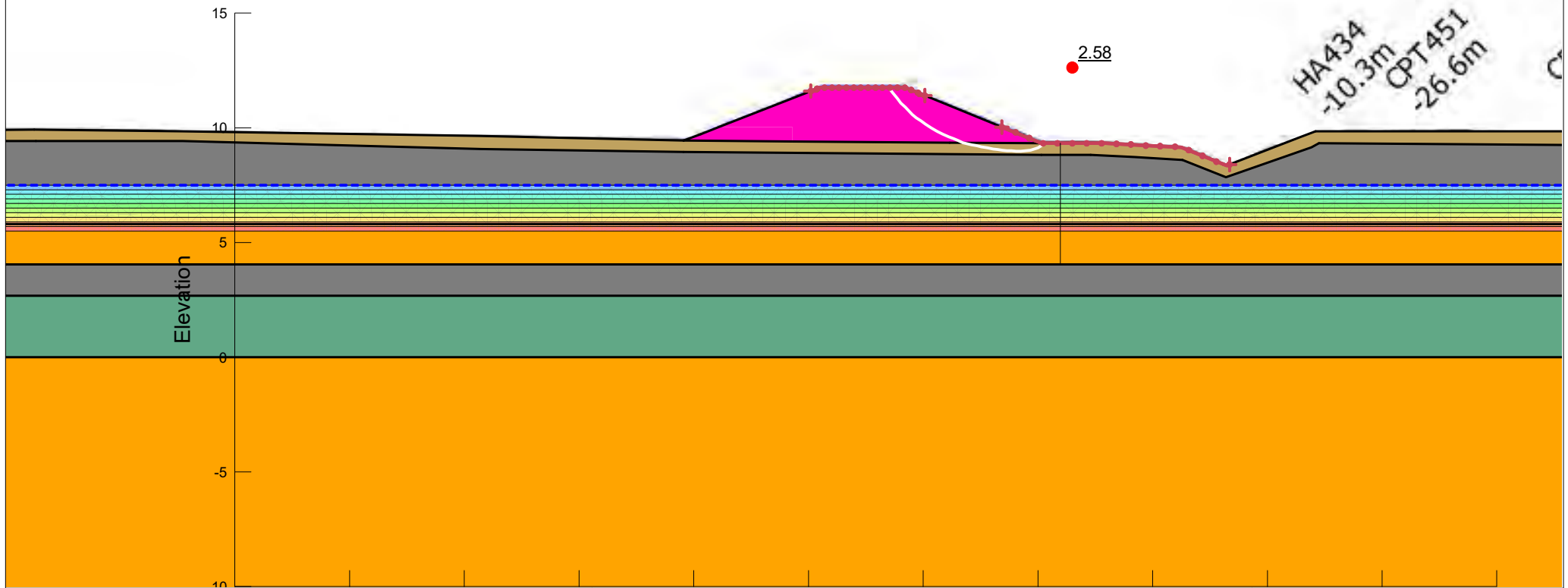
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

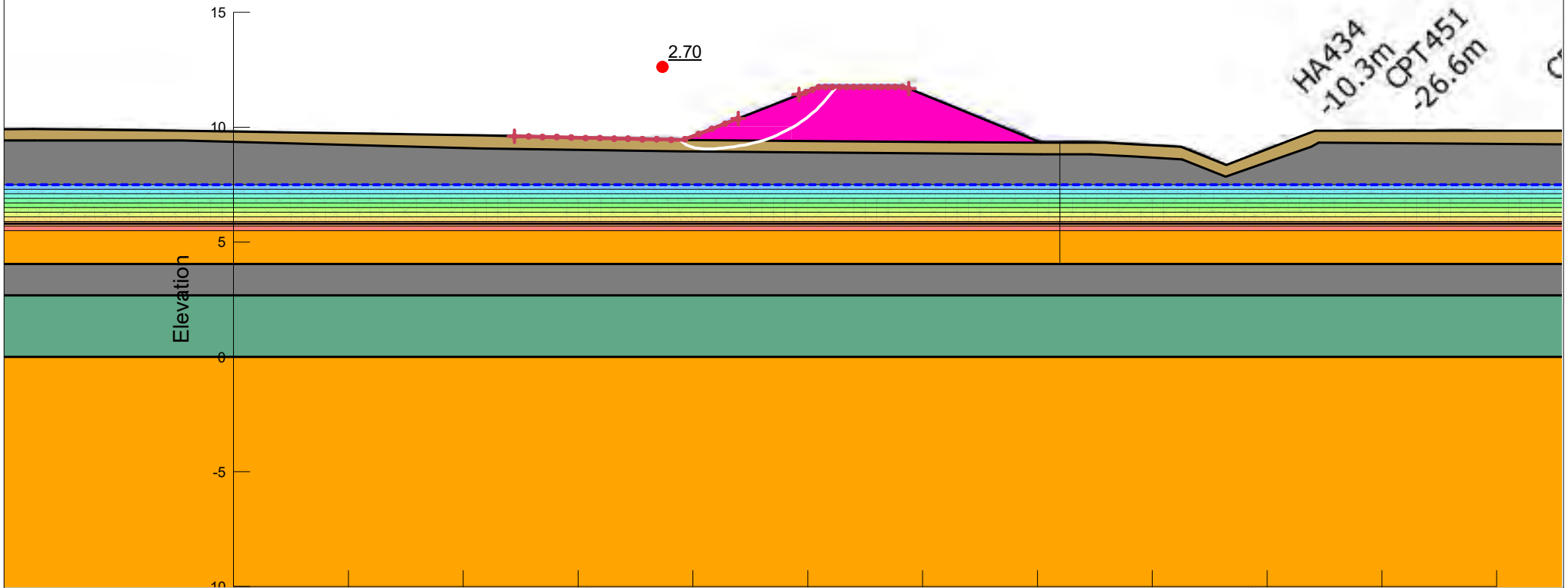
Water Pressure Head	
<span style="color: blue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)	Job Number: 1017353.2403
Analysis: 1a. Static RS	Analysed by: MIBU
Comments:	Checked by: DAMI
Scale: 1:250 @ A4	

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: lightblue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: darkorange;">■</span>	1.6 - 1.8 m
<span style="color: red;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 1b. Static LS

Analysed by: MIBU

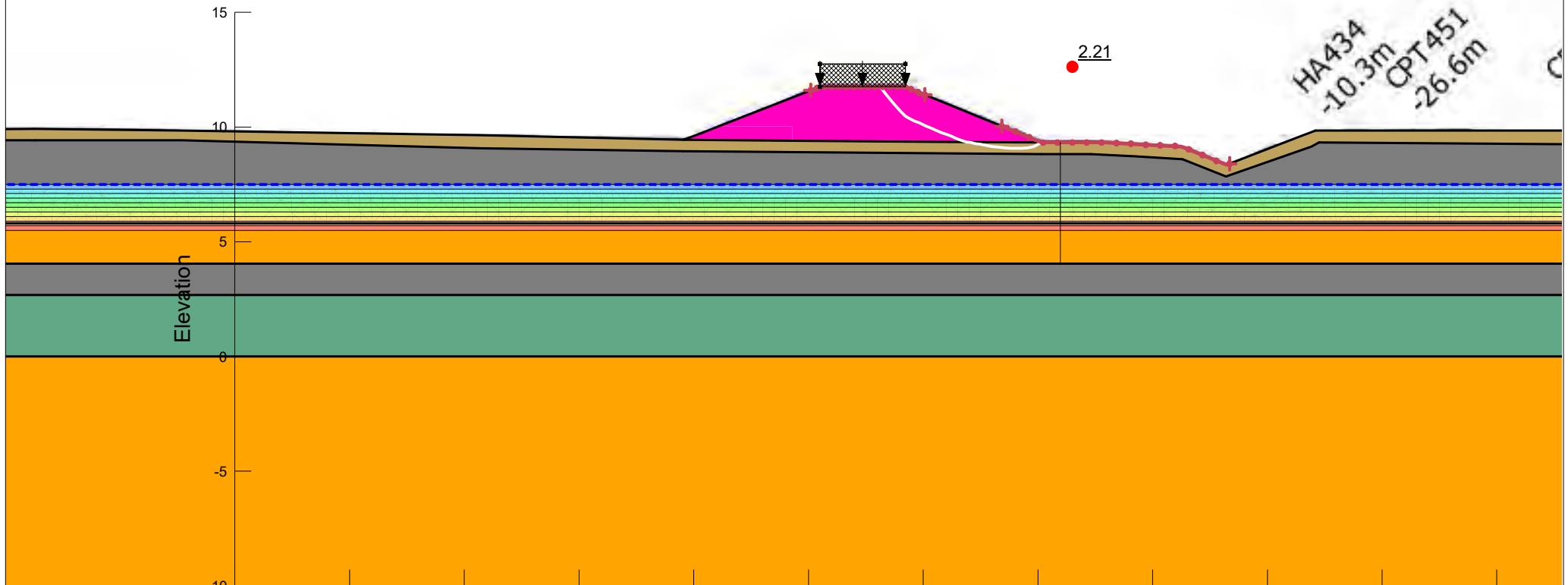
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

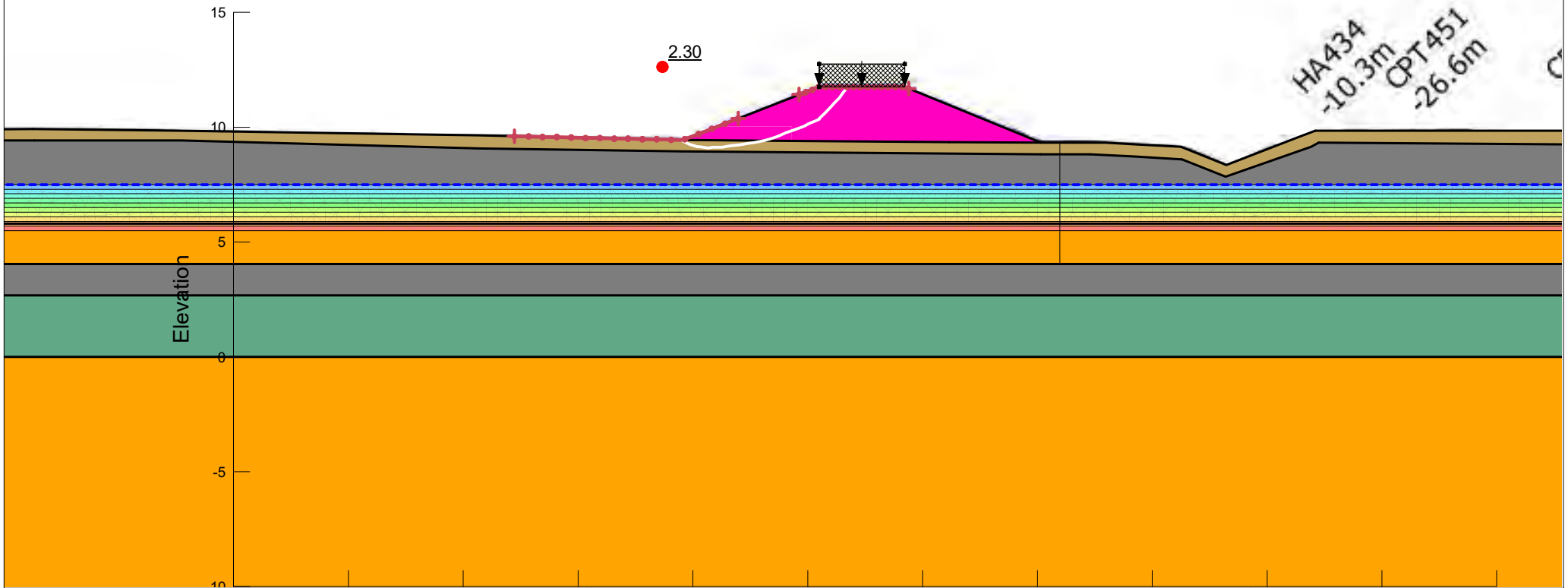
Water Pressure Head	
<span style="color: lightblue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)		Job Number: 1017353.2403
Analysis: 1c. Static Traffic Load RS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: lightblue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: darkorange;">■</span>	1.6 - 1.8 m
<span style="color: red;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 1d. Static Traffic Load LS

Analysed by: MIBU

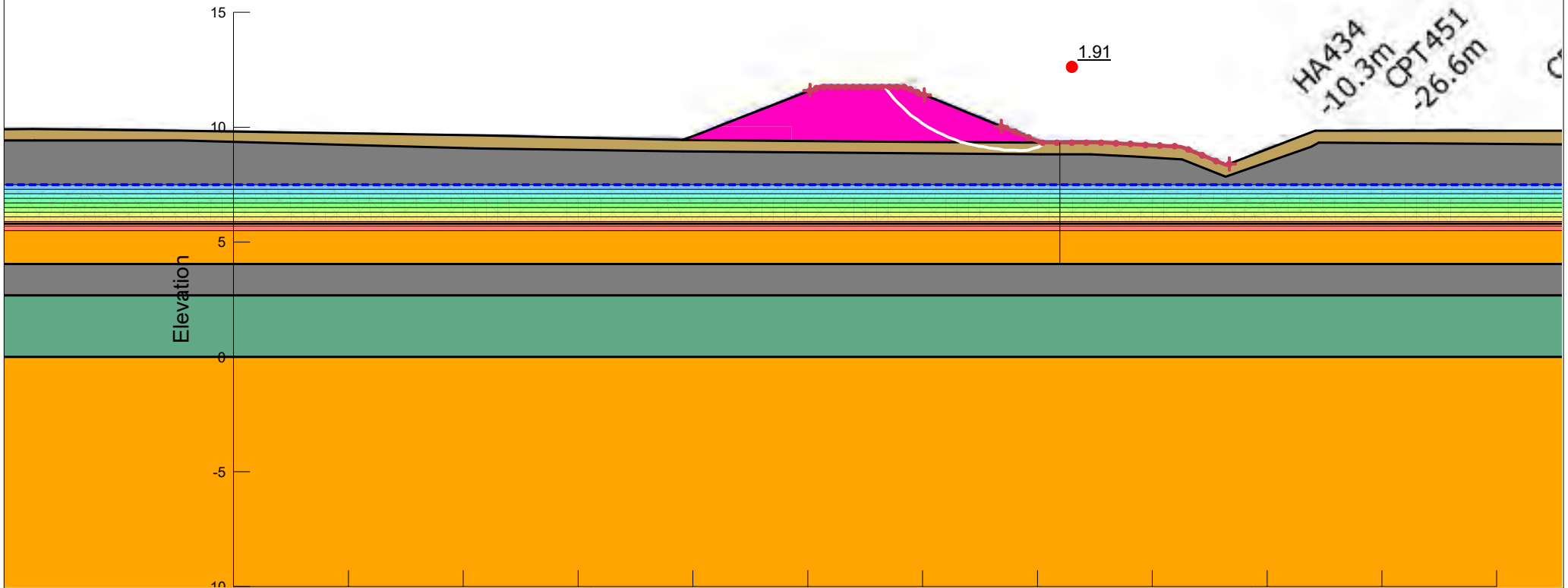
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Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: blue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 2a. Seismic SLS - RS

Analysed by: MIBU

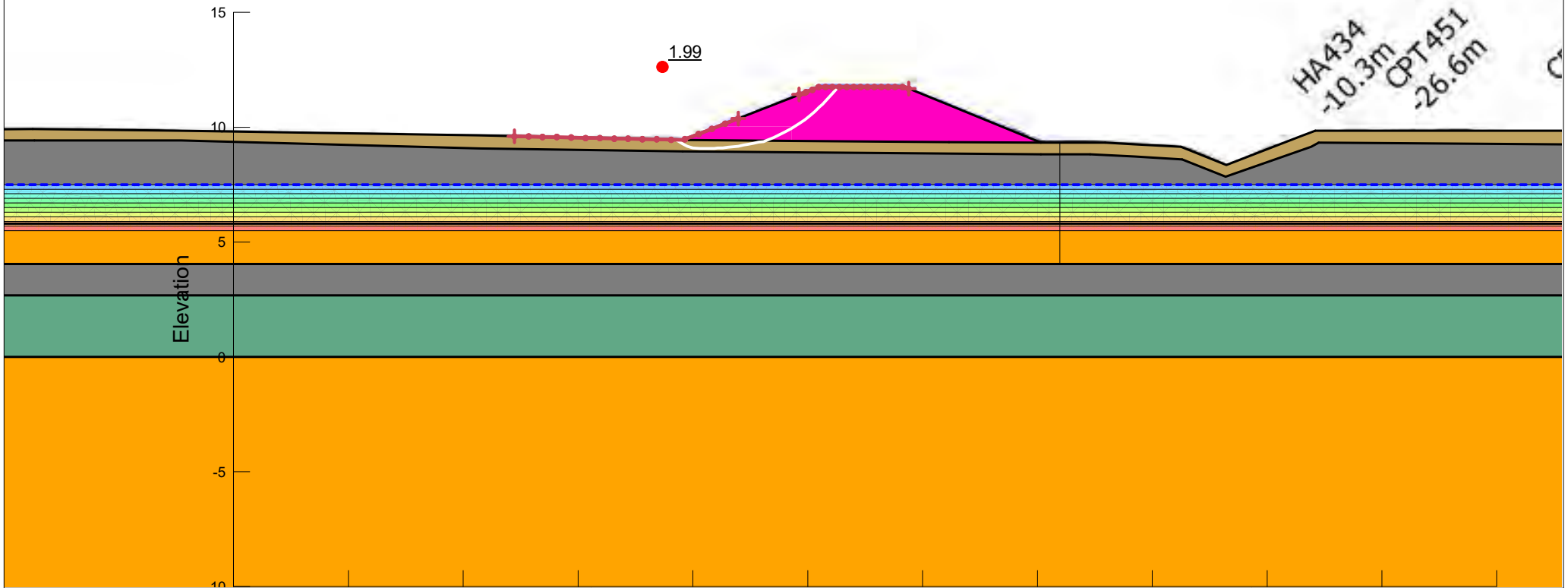
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: blue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 2b. Seismic SLS - LS

Analysed by: MIBU

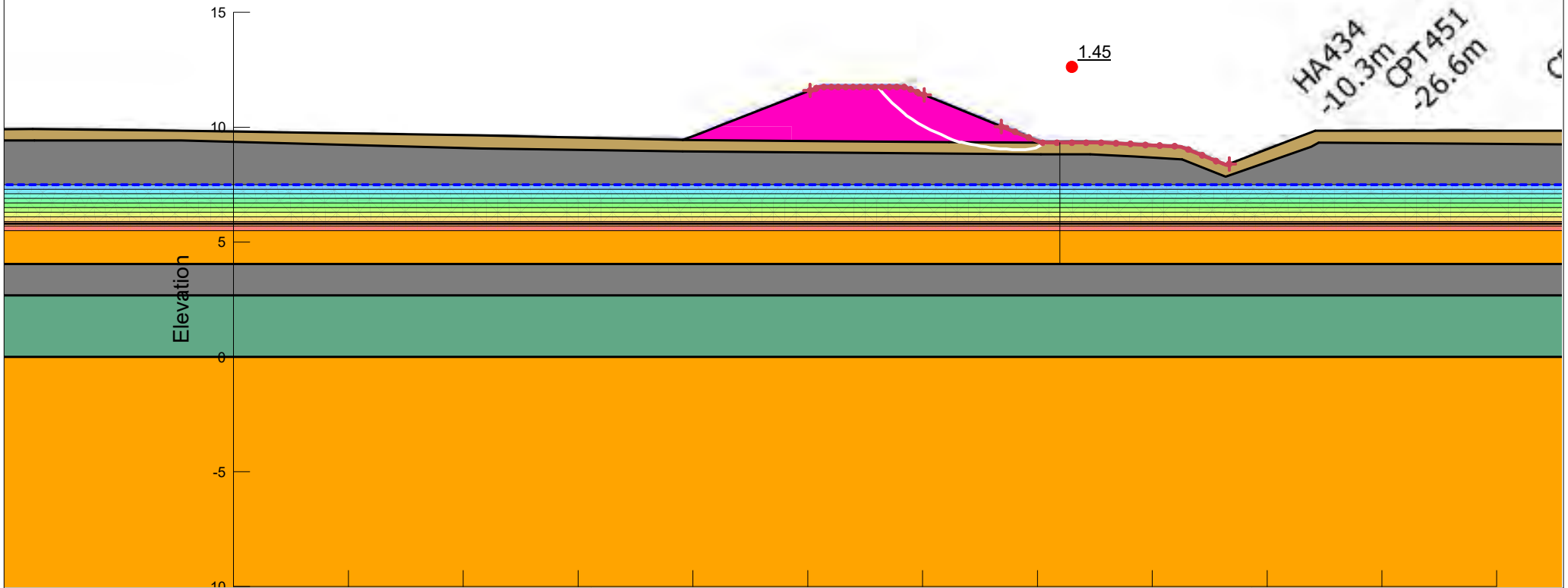
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: blue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 3a. Seismic ILS - RS

Analysed by: MIBU

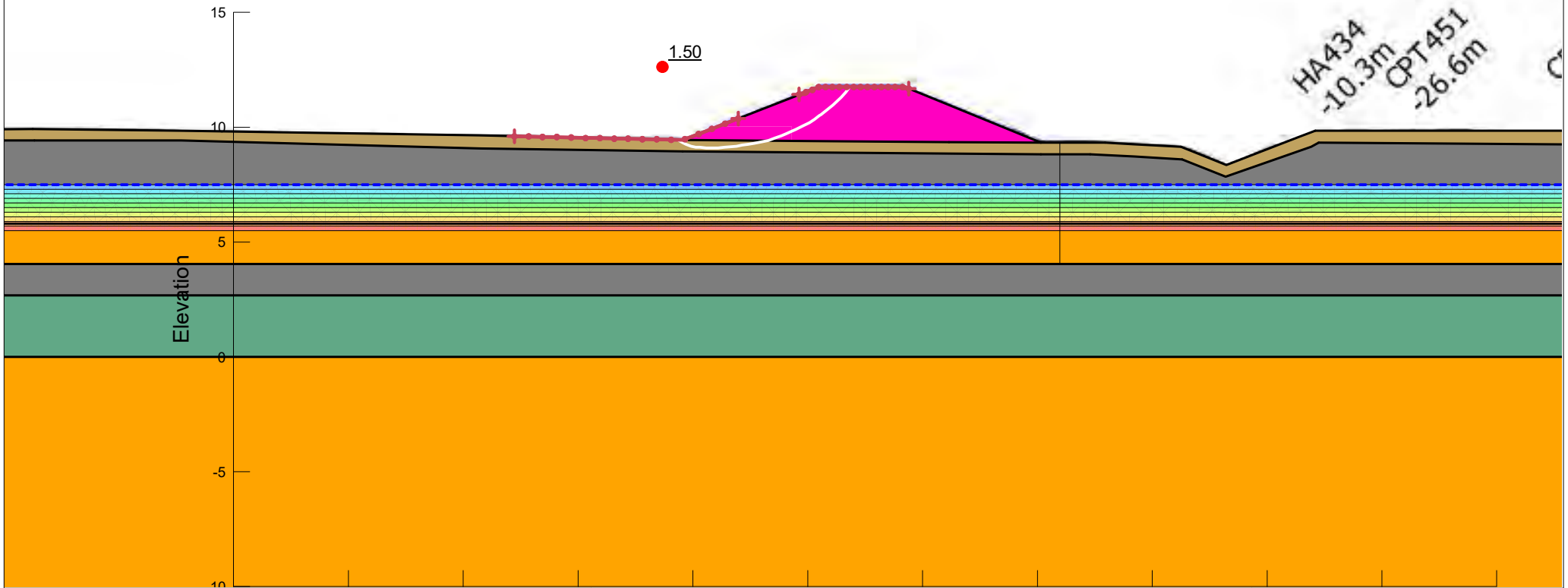
Comments:

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Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: lightblue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: darkorange;">■</span>	1.6 - 1.8 m
<span style="color: red;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 3b. Seismic ILS - LS

Analysed by: MIBU

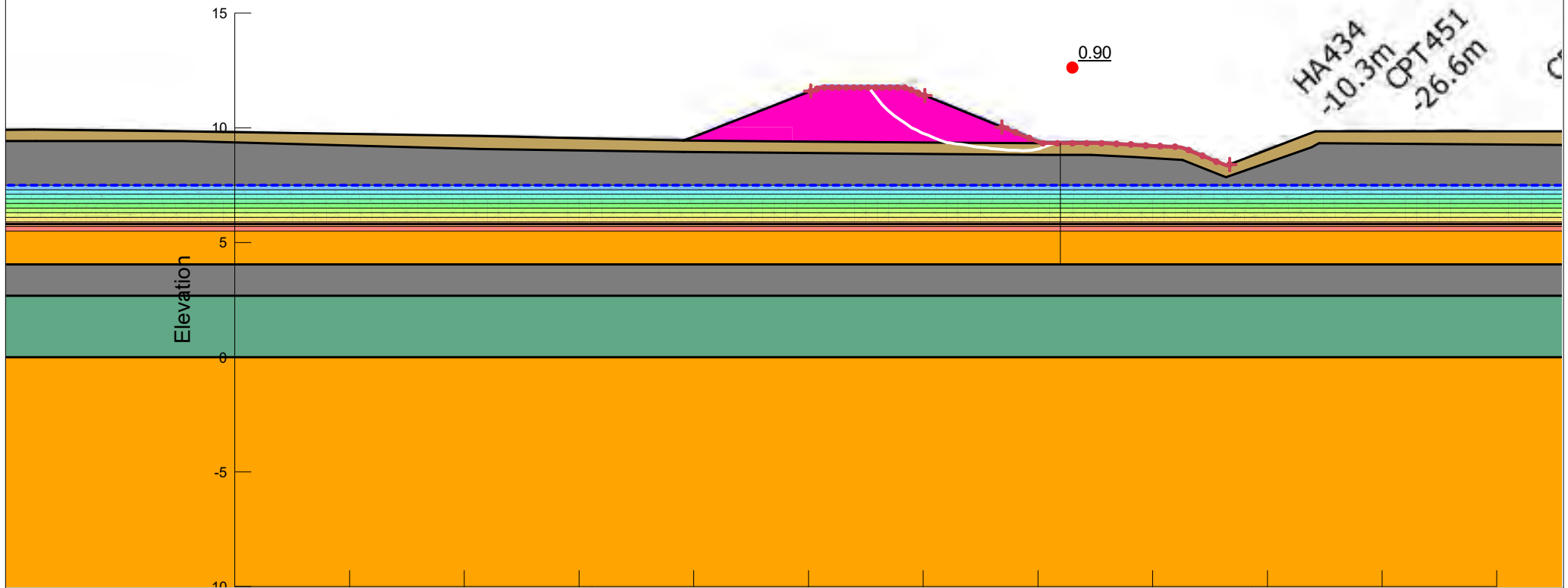
Comments:

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Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: blue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 4a - 1. Seismic ULS - WS

Analysed by: MIBU

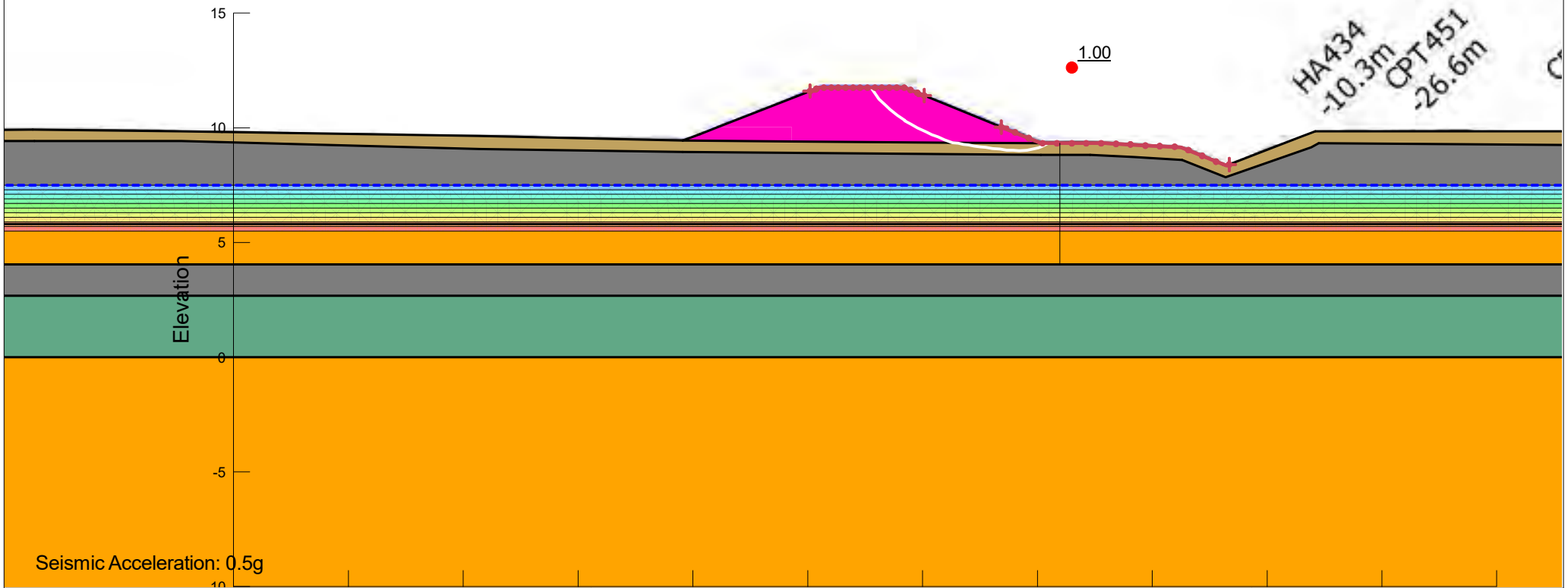
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: blue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 4a - 2. Seismic ULS - WS (yield)

Analysed by: MIBU

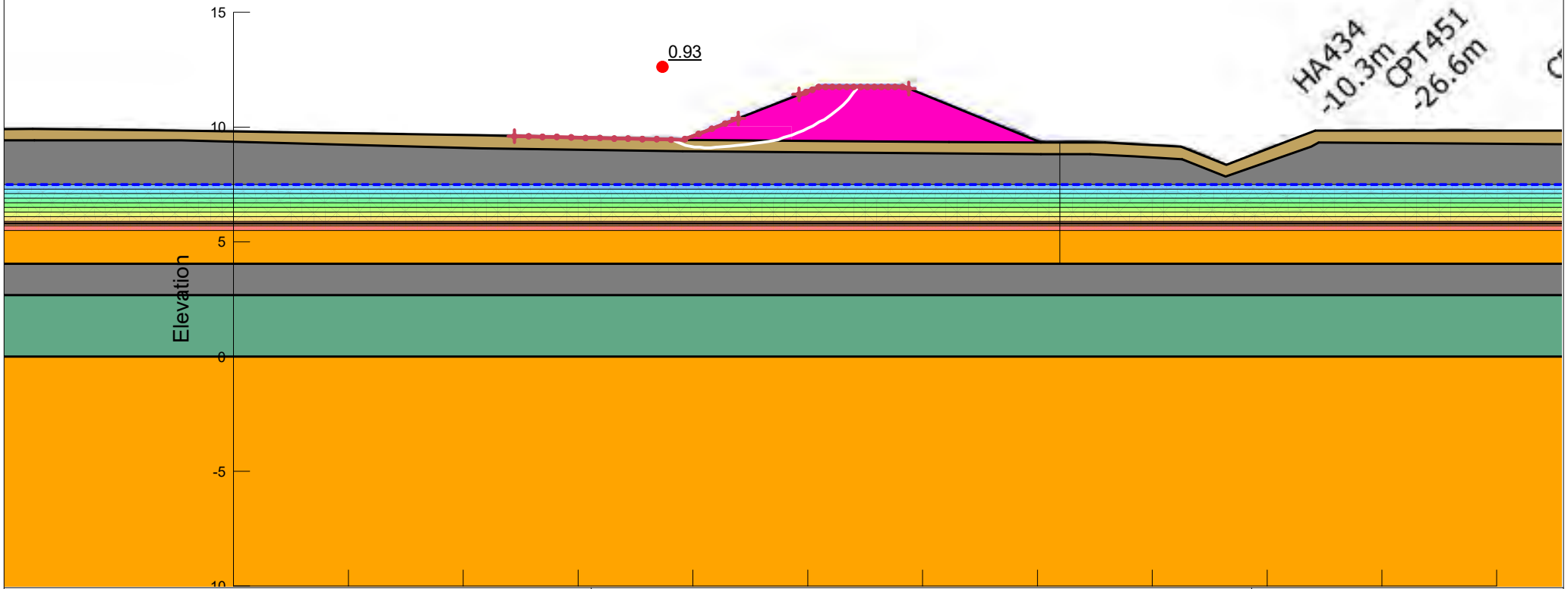
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: lightblue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: darkorange;">■</span>	1.6 - 1.8 m
<span style="color: red;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 4b - 1. Seismic ULS - LS

Analysed by: MIBU

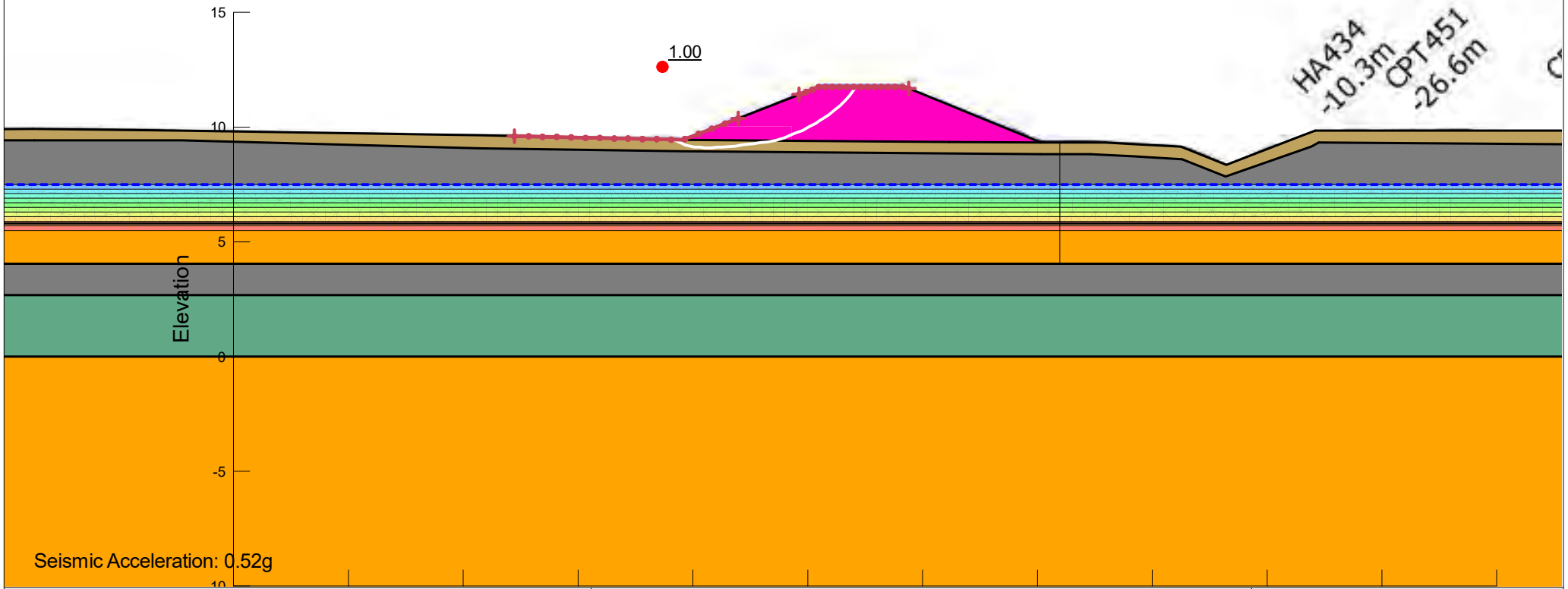
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
█	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
█	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
█	3. SAND	Mohr-Coulomb	18	0	32	0
█	4. SILT	Mohr-Coulomb	16	2	28	0
█	5. Gravel	Mohr-Coulomb	18	0	36	0

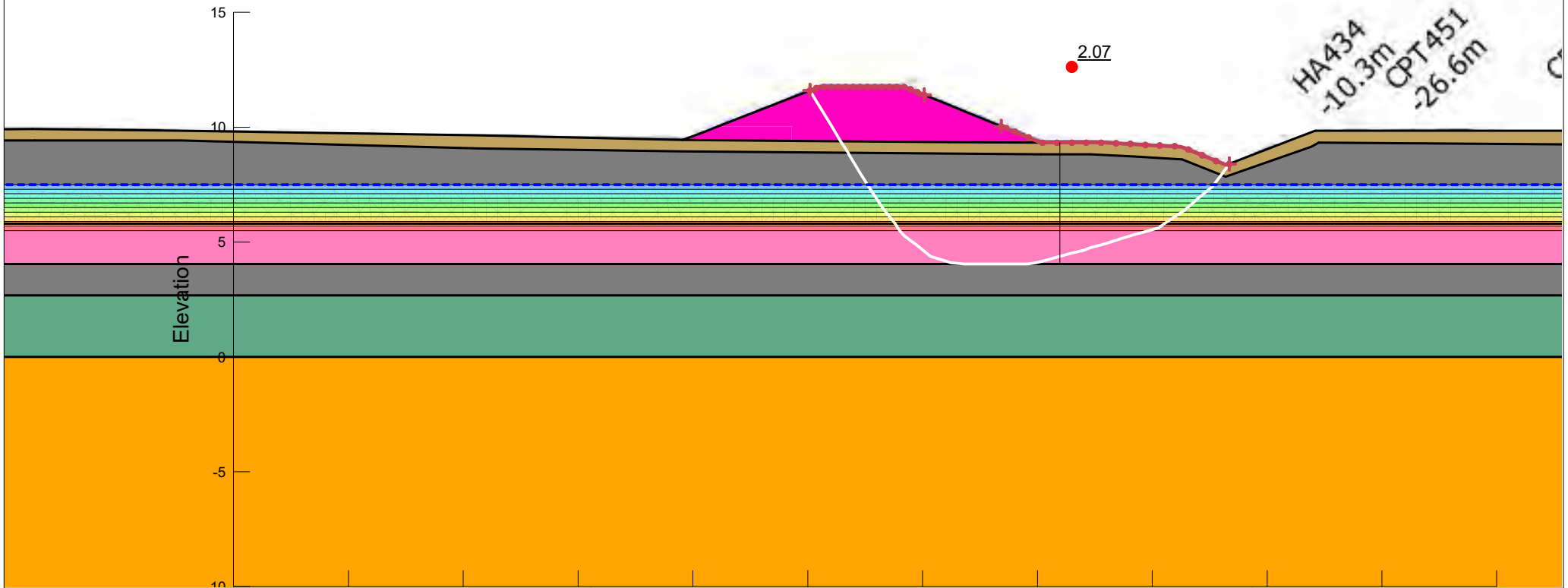
Water Pressure Head	
█	0 - 0.2 m
█	0.2 - 0.4 m
█	0.4 - 0.6 m
█	0.6 - 0.8 m
█	0.8 - 1 m
█	1 - 1.2 m
█	1.2 - 1.4 m
█	1.4 - 1.6 m
█	1.6 - 1.8 m
█	1.8 - 2 m



Title: GZ-01 (CH160)		Job Number: 1017353.2403
Analysis: 4b - 2. Seismic ULS - LS (yield)		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
█	1. Stopbank Fill	Mohr-Coulomb	16			4	32	0
█	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18			2	31	0
█	3. SAND	Mohr-Coulomb	18			0	32	0
█	3. SAND (liquefied)	SHANSEP	18	2	0.1			
█	4. SILT	Mohr-Coulomb	16			2	28	0
█	5. Gravel	Mohr-Coulomb	18			0	36	0

Water Pressure Head	
█	0 - 0.2 m
█	0.2 - 0.4 m
█	0.4 - 0.6 m
█	0.6 - 0.8 m
█	0.8 - 1 m
█	1 - 1.2 m
█	1.2 - 1.4 m
█	1.4 - 1.6 m
█	1.6 - 1.8 m
█	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 5a. Liquefied WS

Analysed by: MIBU

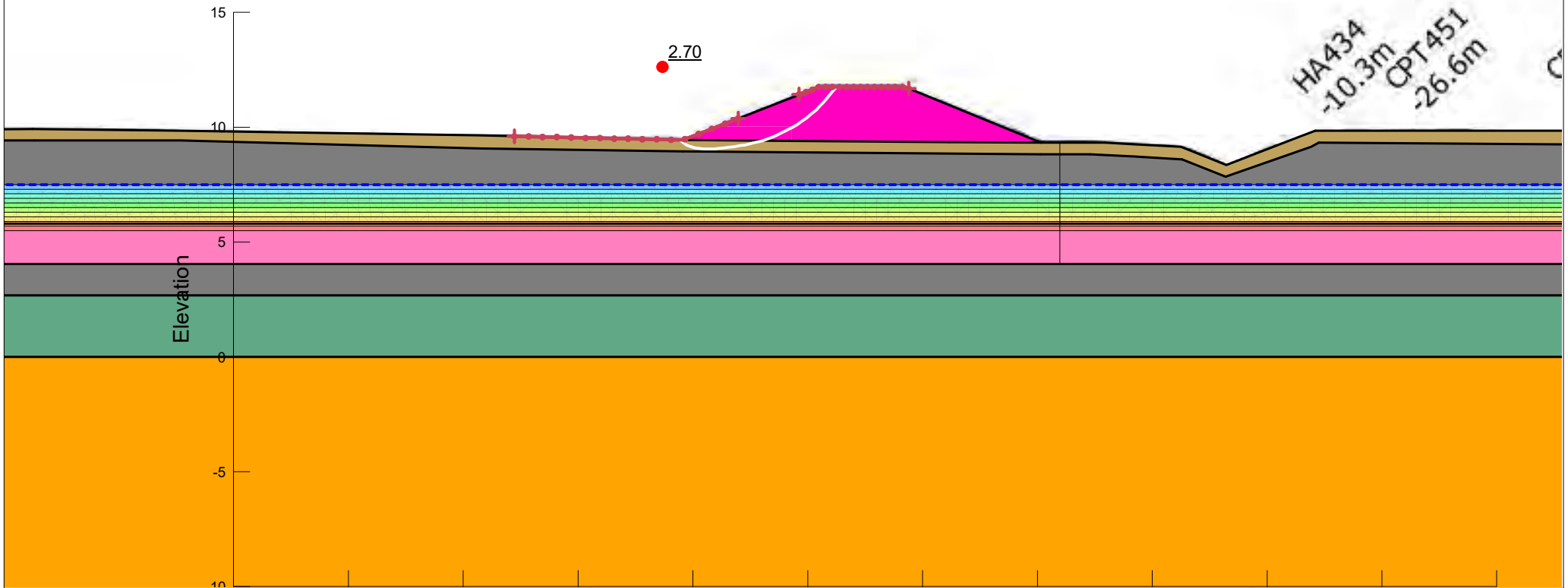
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16			4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18			2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18			0	32	0
<span style="color: pink;">■</span>	3. SAND (liquefied)	SHANSEP	18	2	0.1			
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16			2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18			0	36	0

Water Pressure Head	
<span style="color: lightblue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: darkorange;">■</span>	1.6 - 1.8 m
<span style="color: red;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 5b. Liquefied LS

Analysed by: MIBU

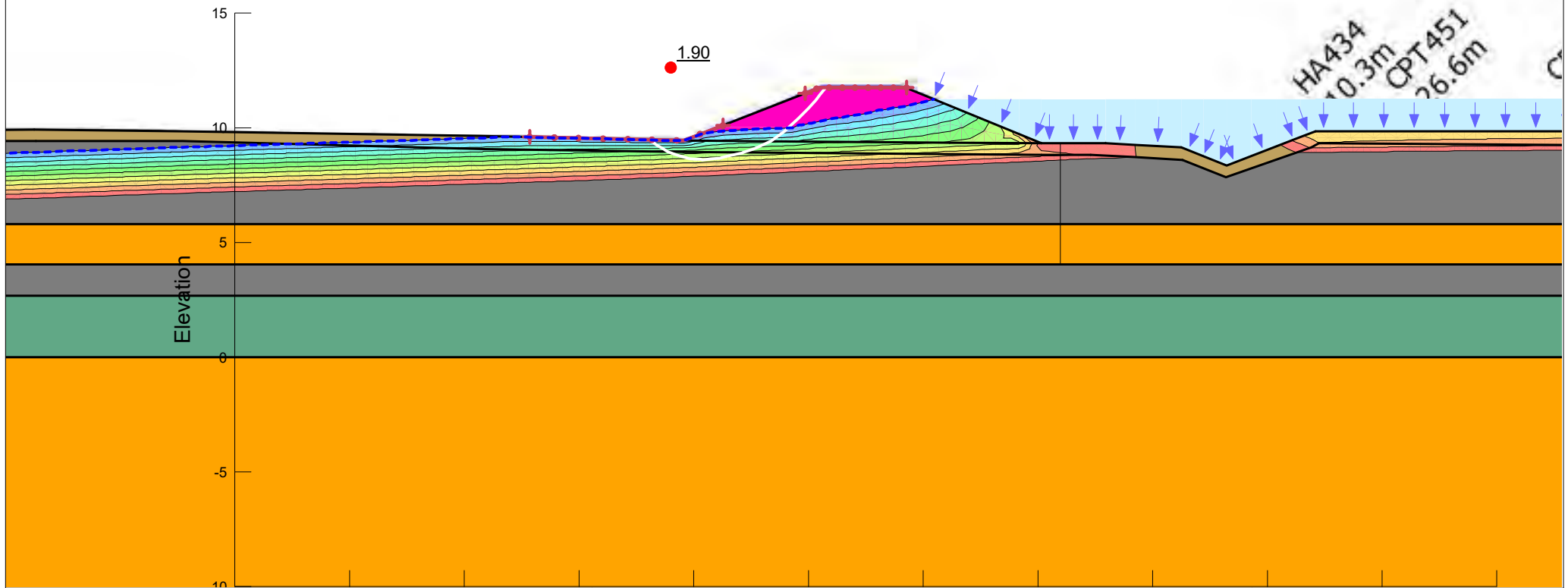
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: lightblue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 6a-1. Constant Seepage LS

Analysed by: MIBU

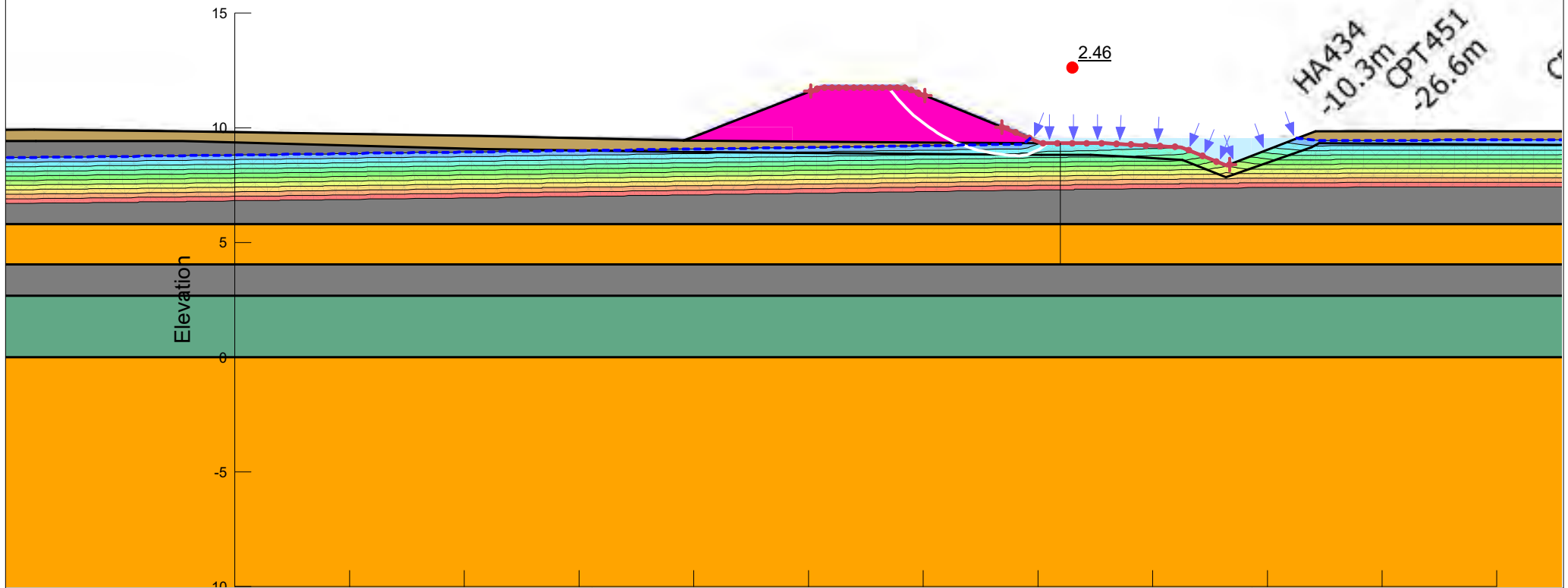
Comments:

Scale: 1:250 @ A4

Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: lightblue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: teal;">■</span>	0.4 - 0.6 m
<span style="color: lightgreen;">■</span>	0.6 - 0.8 m
<span style="color: green;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: lightorange;">■</span>	1.6 - 1.8 m
<span style="color: red;">■</span>	1.8 - 2 m



Title: GZ-01 (CH160)

Job Number: 1017353.2403

Analysis: 6b. Flood event drawdown WS (CH160)

Analysed by: MIBU

Comments:

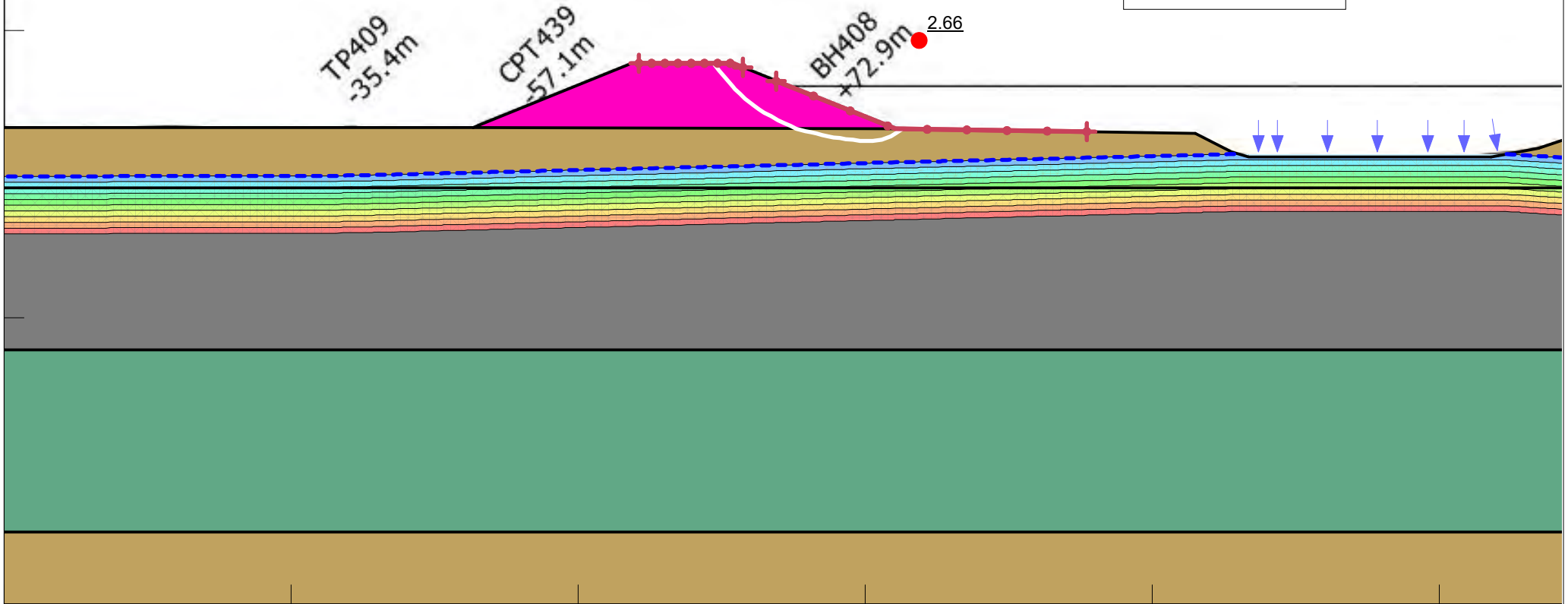
Scale: 1:250 @ A4

Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

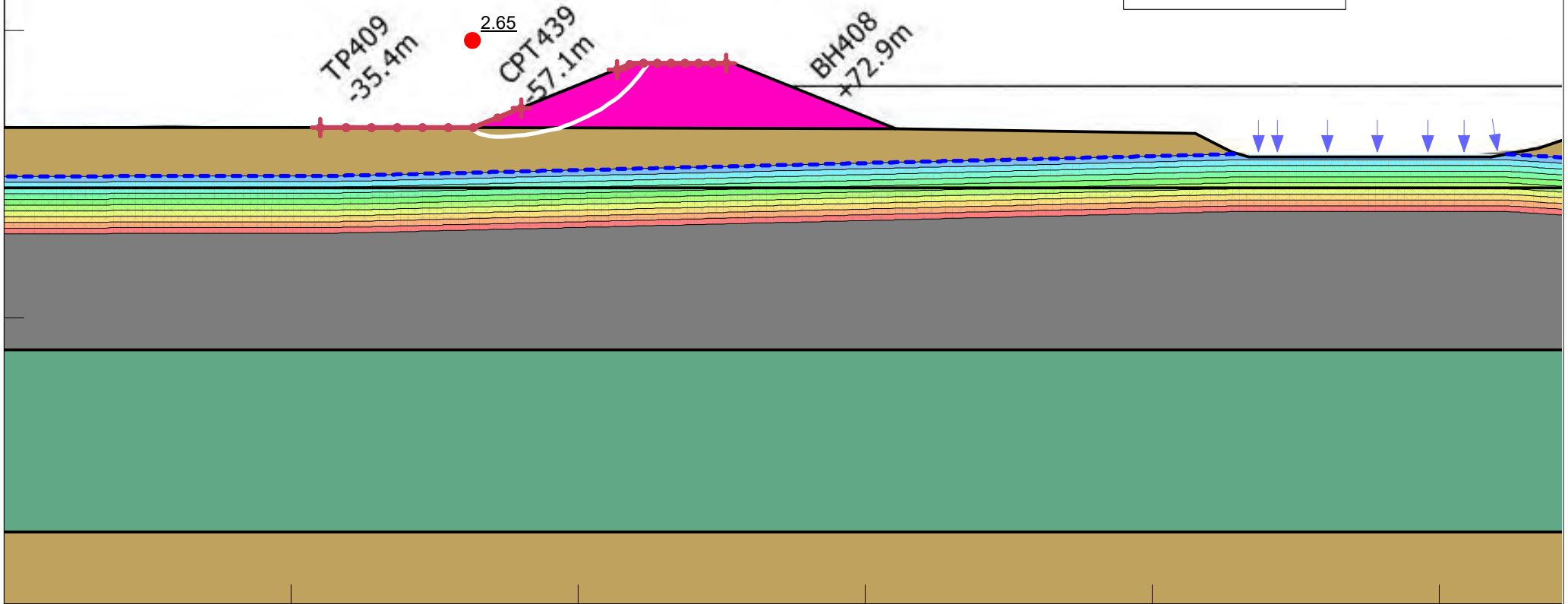


Title: Title: GZ-02 (CH1610)		Job Number: 1017353.2403
Analysis: 1.a Static RS		Analysed by: MIBU
Comments:	Scale: 1:200 @ A4	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

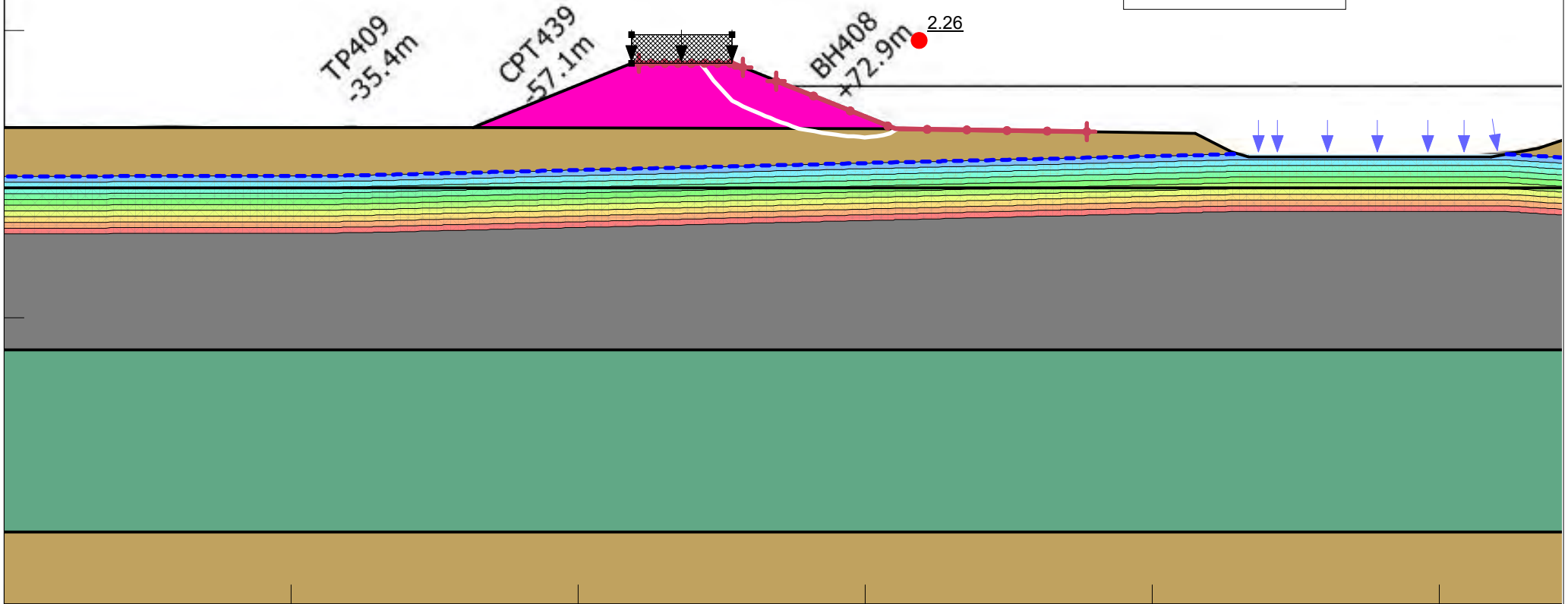


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 1.b Static LS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

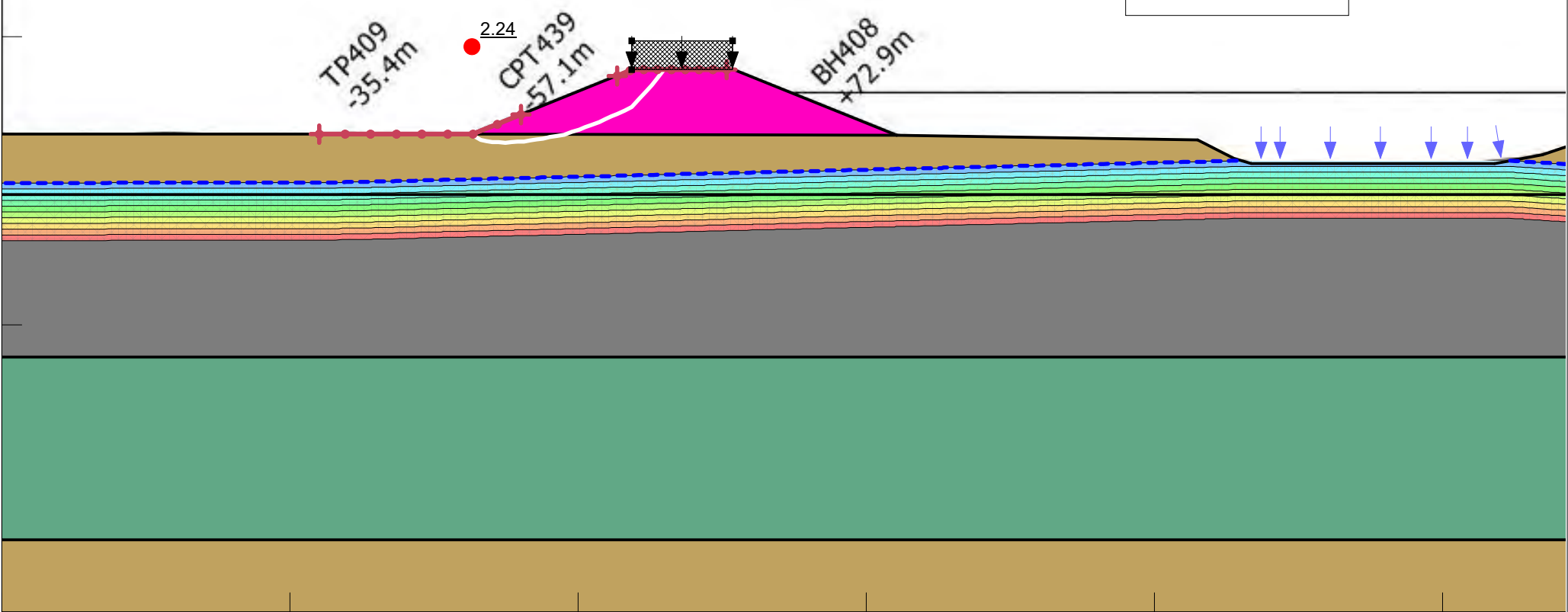


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 1.c Static _traffic RS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

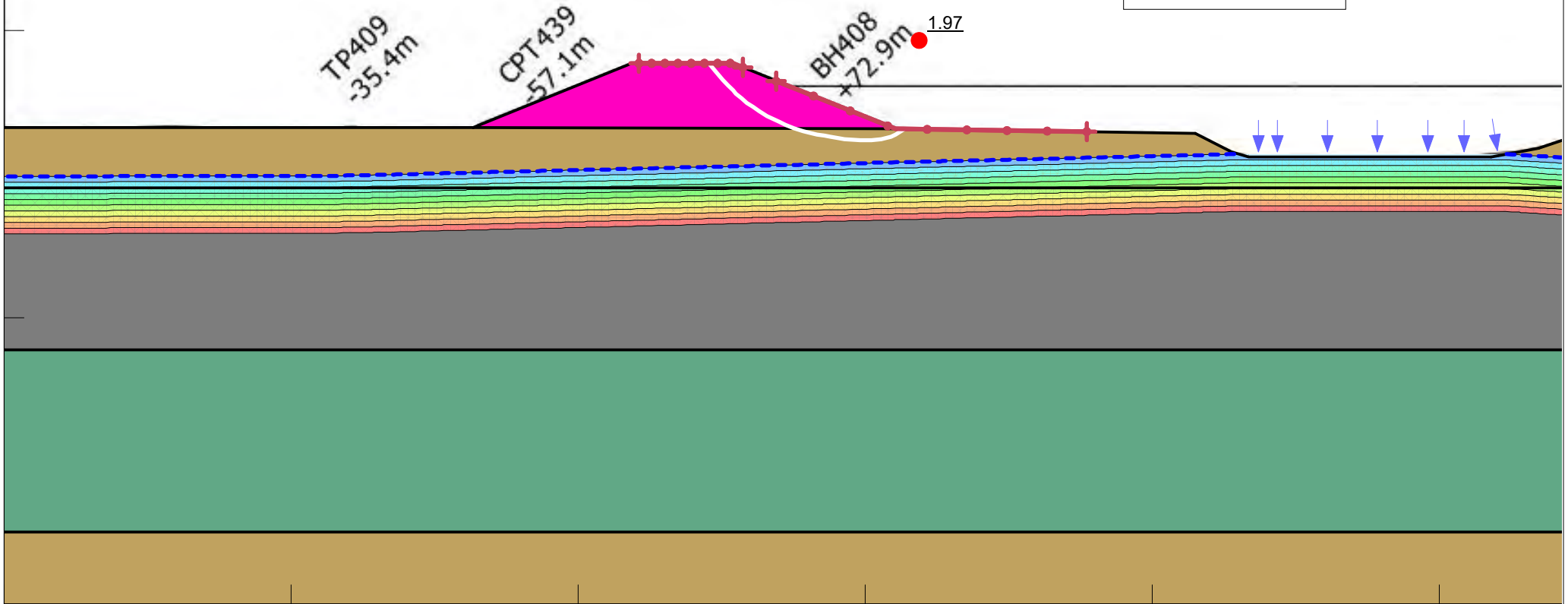


Title: Title: GZ-02 (CH1610)		Job Number: 1017353.2403
Analysis: 1.d Static_traffic_LS		Analysed by: MIBU
Comments:	Scale: 1:200 @ A4	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

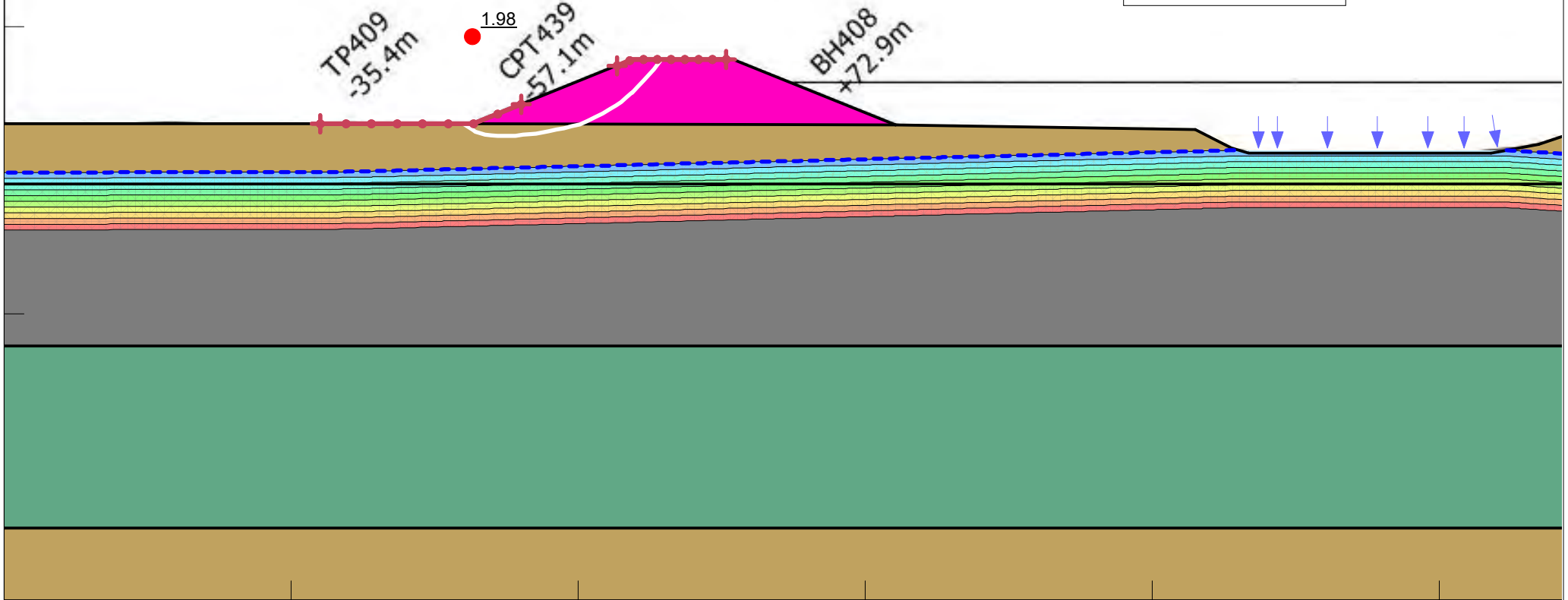


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 2.a Seismic SLS RS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: grey;">■</span>	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
<span style="color: blue;">■</span>	0 - 0.2 m
<span style="color: cyan;">■</span>	0.2 - 0.4 m
<span style="color: lightgreen;">■</span>	0.4 - 0.6 m
<span style="color: green;">■</span>	0.6 - 0.8 m
<span style="color: limegreen;">■</span>	0.8 - 1 m
<span style="color: yellowgreen;">■</span>	1 - 1.2 m
<span style="color: yellow;">■</span>	1.2 - 1.4 m
<span style="color: orange;">■</span>	1.4 - 1.6 m
<span style="color: red;">■</span>	1.6 - 1.8 m
<span style="color: darkred;">■</span>	1.8 - 2 m

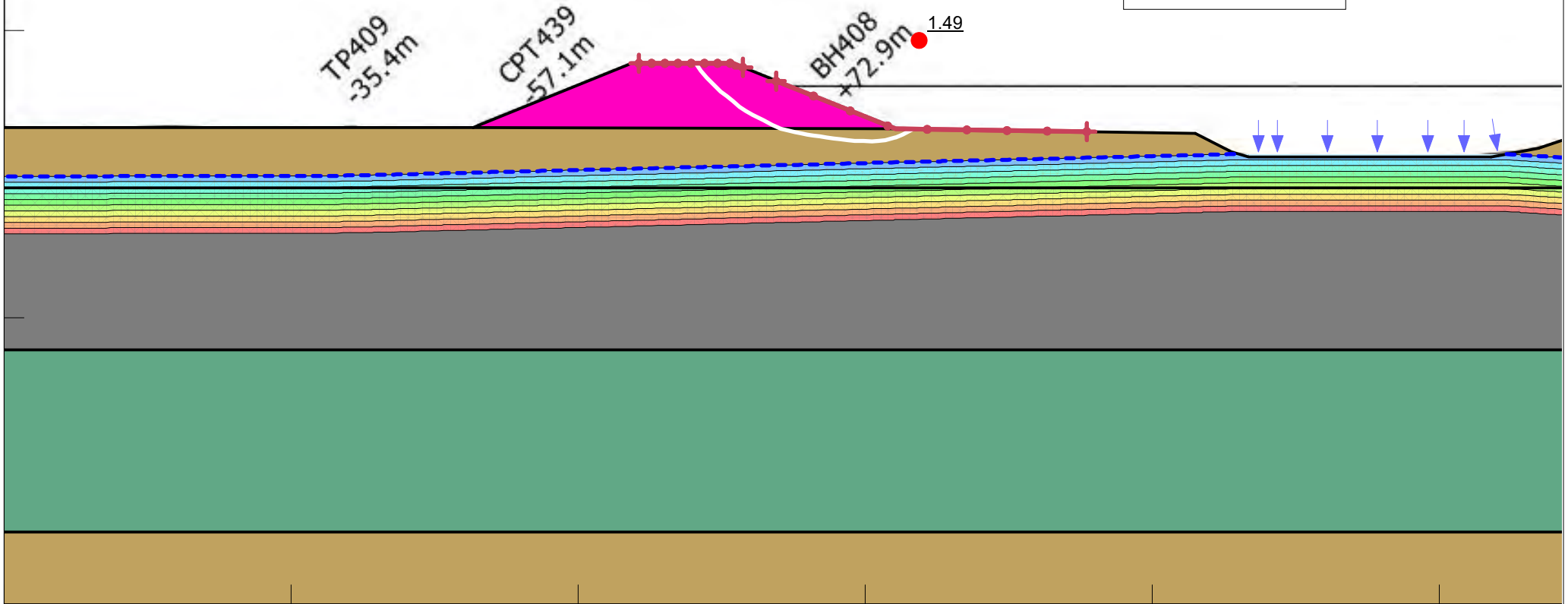


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 2.b Seismic SLS LS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

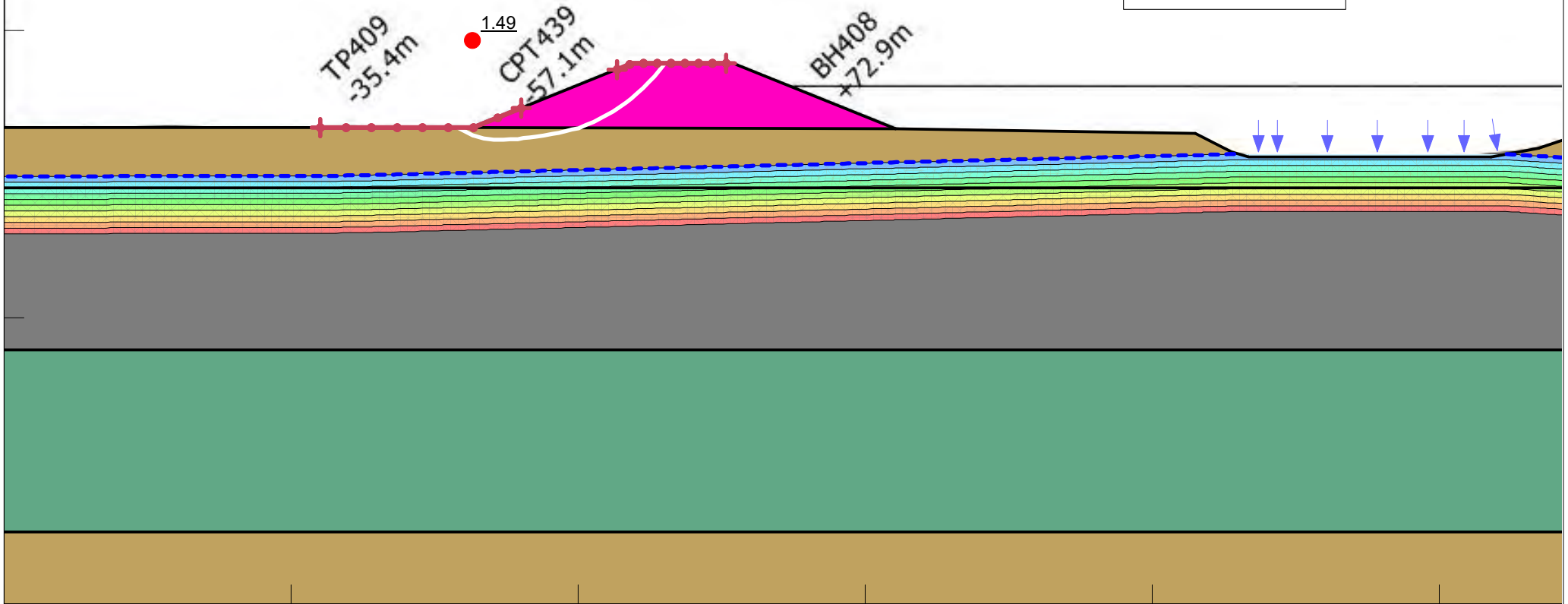


Title: Title: GZ-02 (CH1610)		Job Number: 1017353.2403
Analysis: 3.a Seismic ILS RS		Analysed by: MIBU
Comments:	Scale: 1:200 @ A4	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

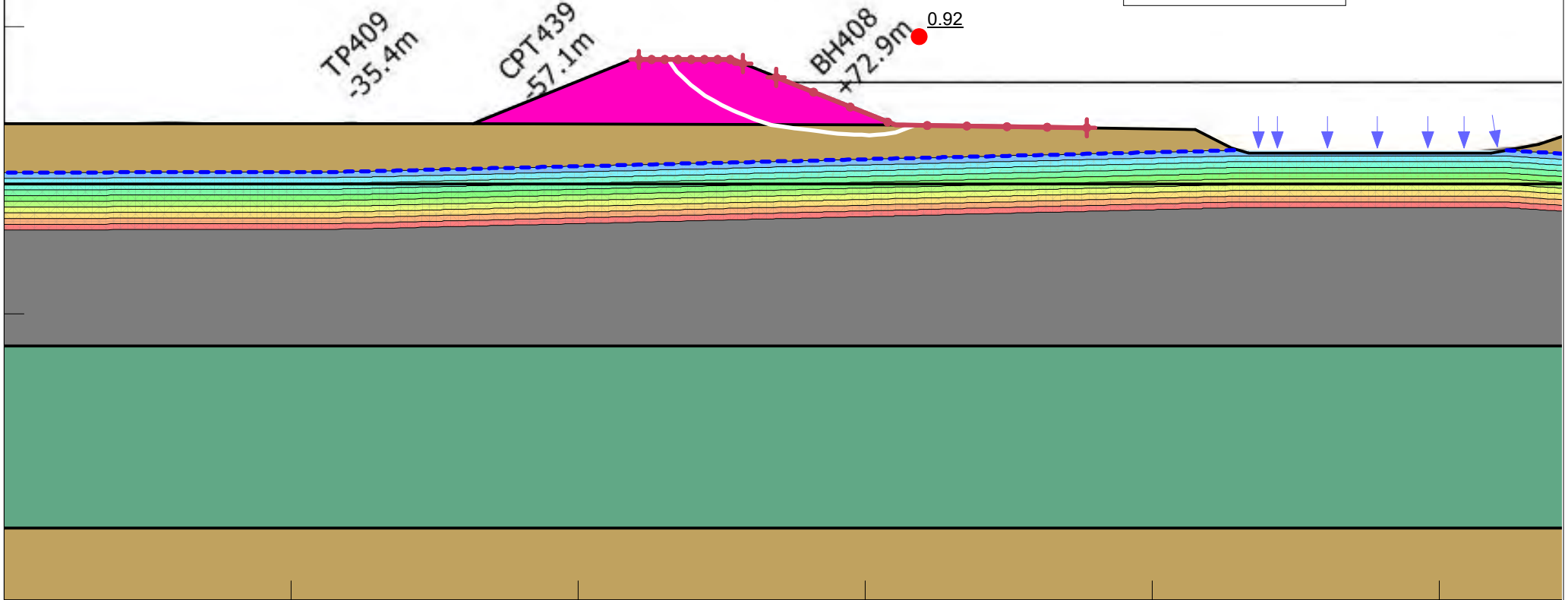


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 3.b Seismic ILS LS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

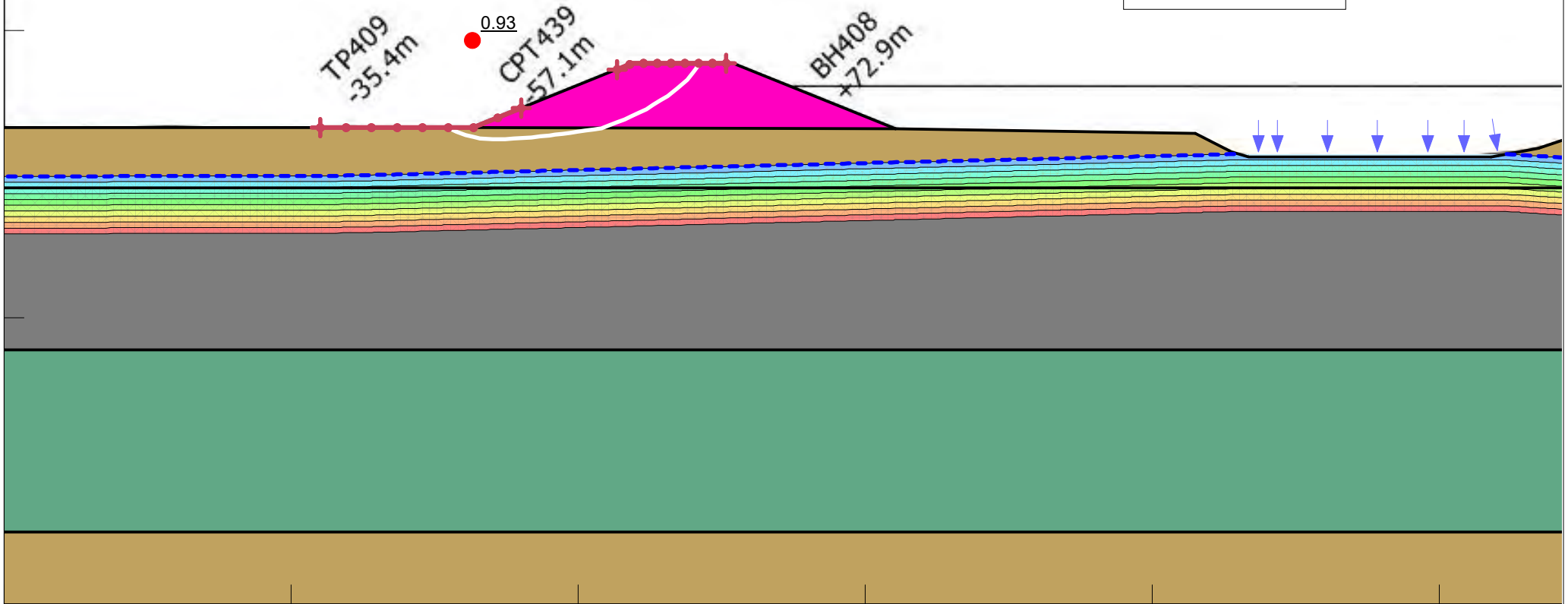


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 4.a Seismic ULS RS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

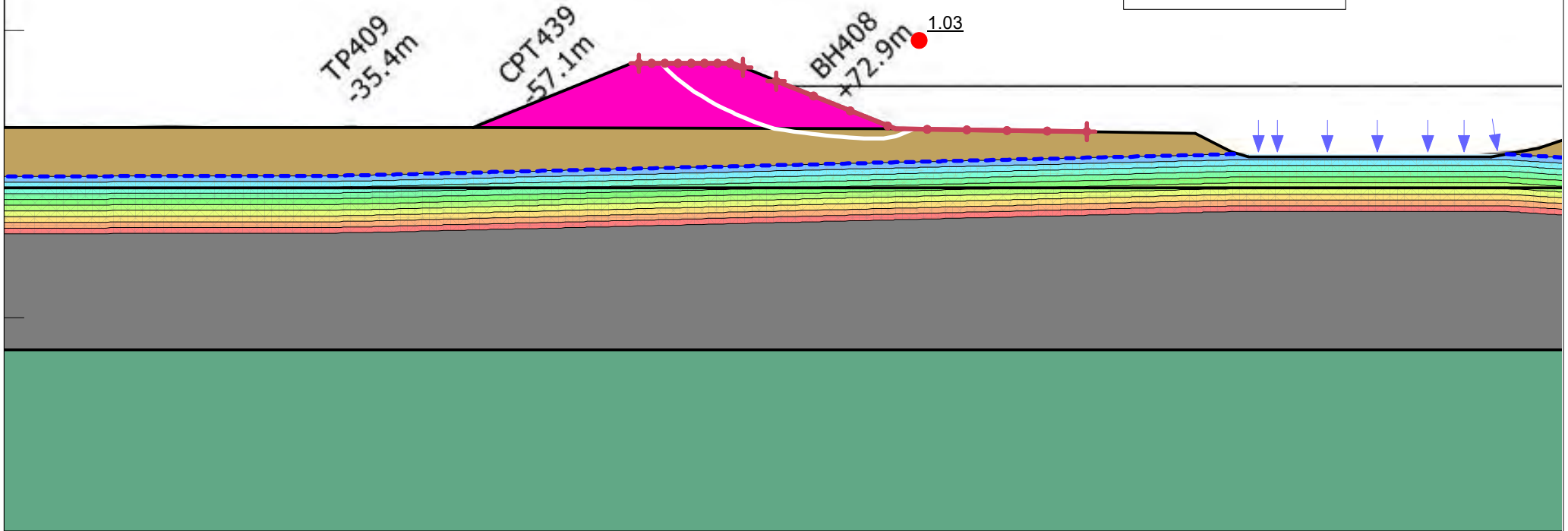


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 4.b Seismic ULS LS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m



Horz Seismic Coef.: 0.52g

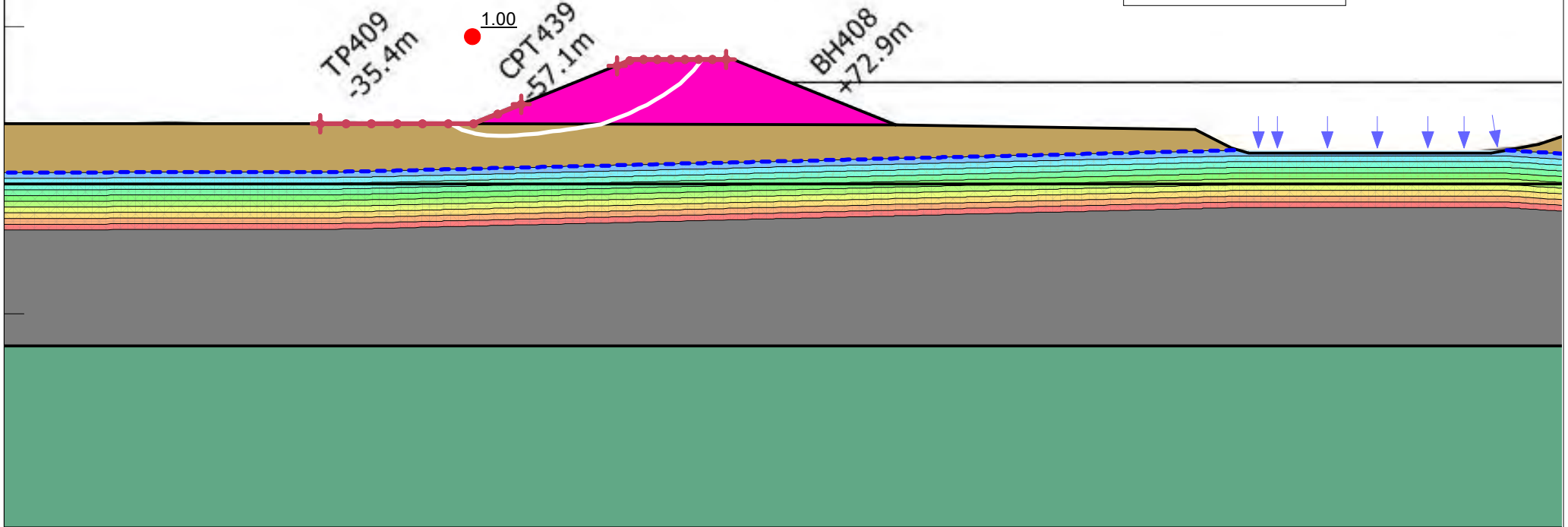


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 4.c Seismic ULS RS (yield)	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m



Horz Seismic Coef.: 0.52g

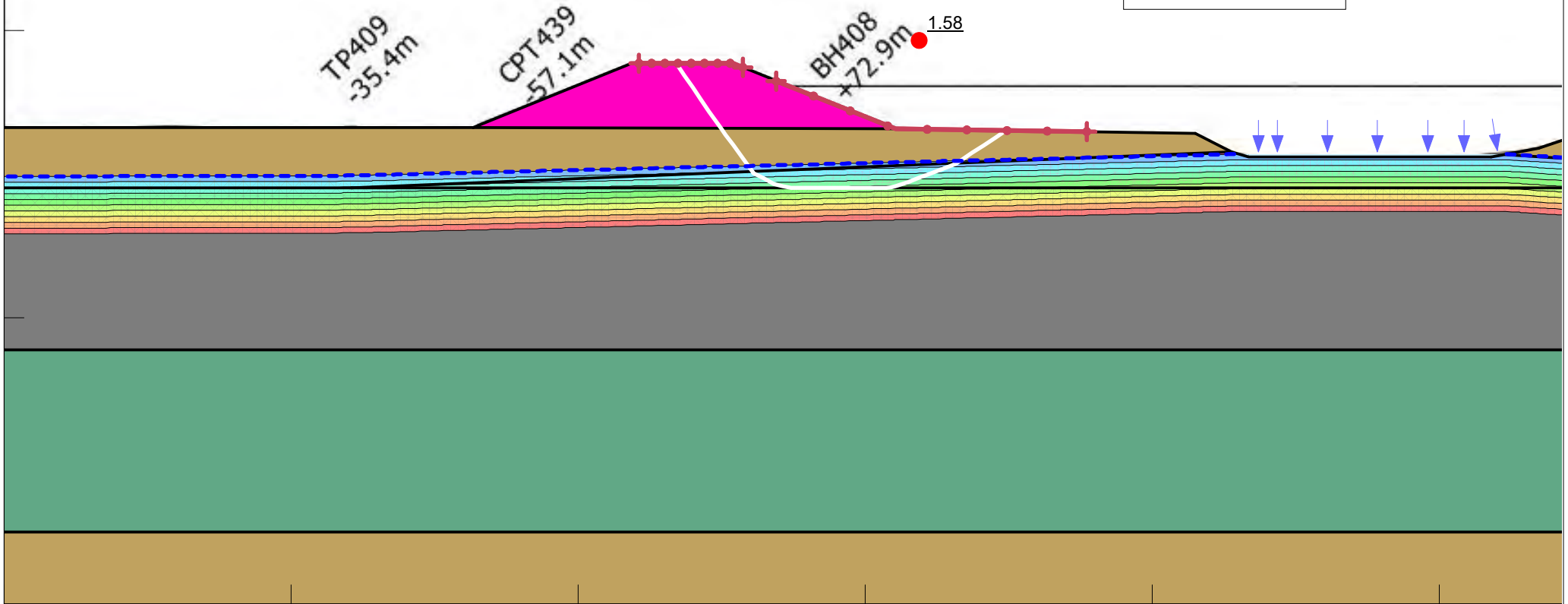


Title: Title: GZ-02 (CH1610)		Job Number: 1017353.2403
Analysis: 4.d Seismic ULS LS (yield)		Analysed by: MIBU
Comments:	Scale: 1:200 @ A4	Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16			4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18			2	31	0
■	3. SAND (liquefied)	SHANSEP	18	2	0.1			
■	4. SILT	Mohr-Coulomb	16			2	28	0
■	5. Gravel	Mohr-Coulomb	18			0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

A

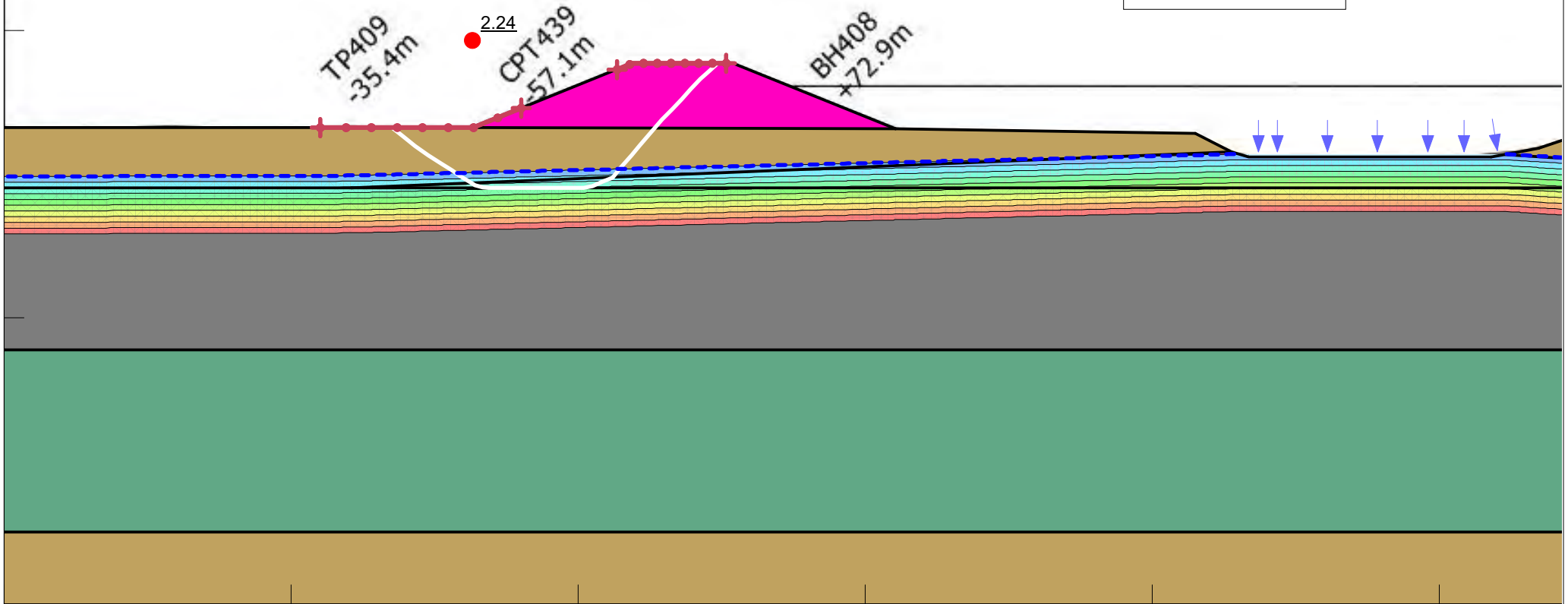


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 5.a Post Seismic - Liquefied RS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16			4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18			2	31	0
■	3. SAND (liquefied)	SHANSEP	18	2	0.1			
■	4. SILT	Mohr-Coulomb	16			2	28	0
■	5. Gravel	Mohr-Coulomb	18			0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

A

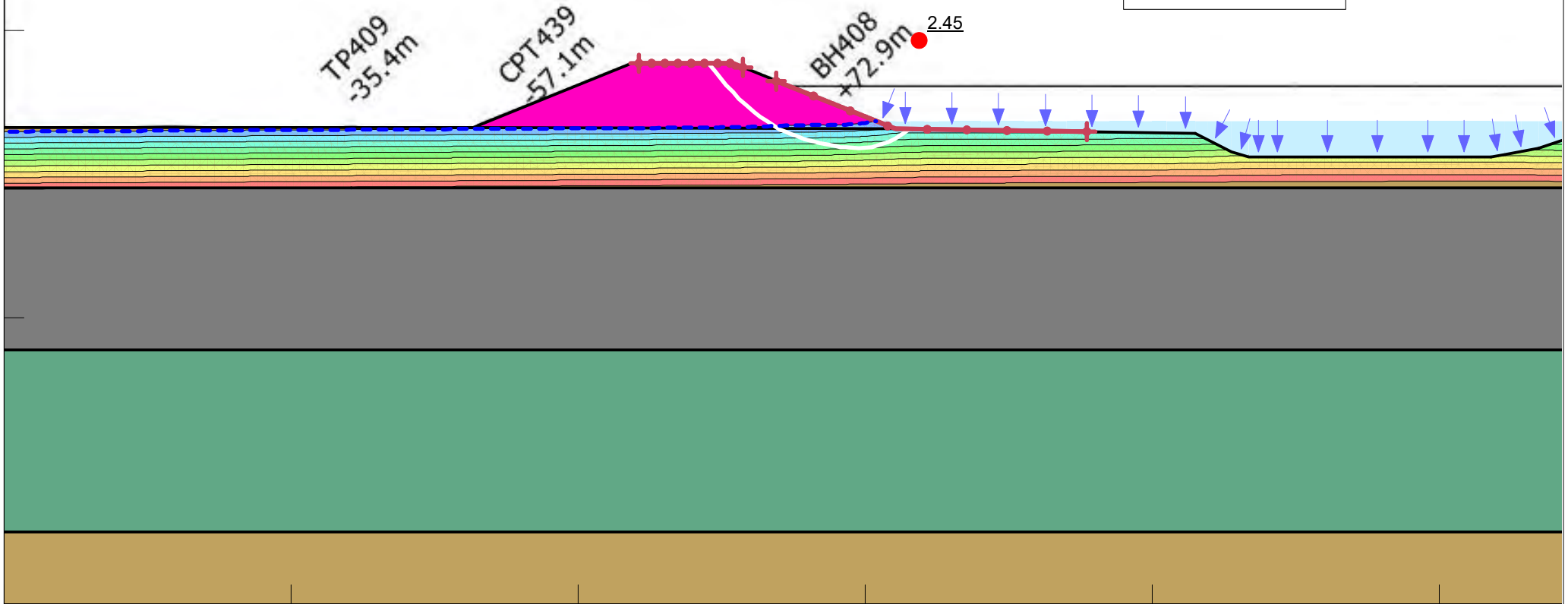


Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 5.b Post-Seismic - Liquefied LS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

A

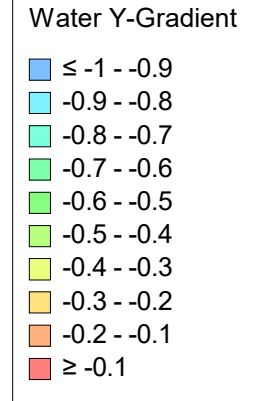
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

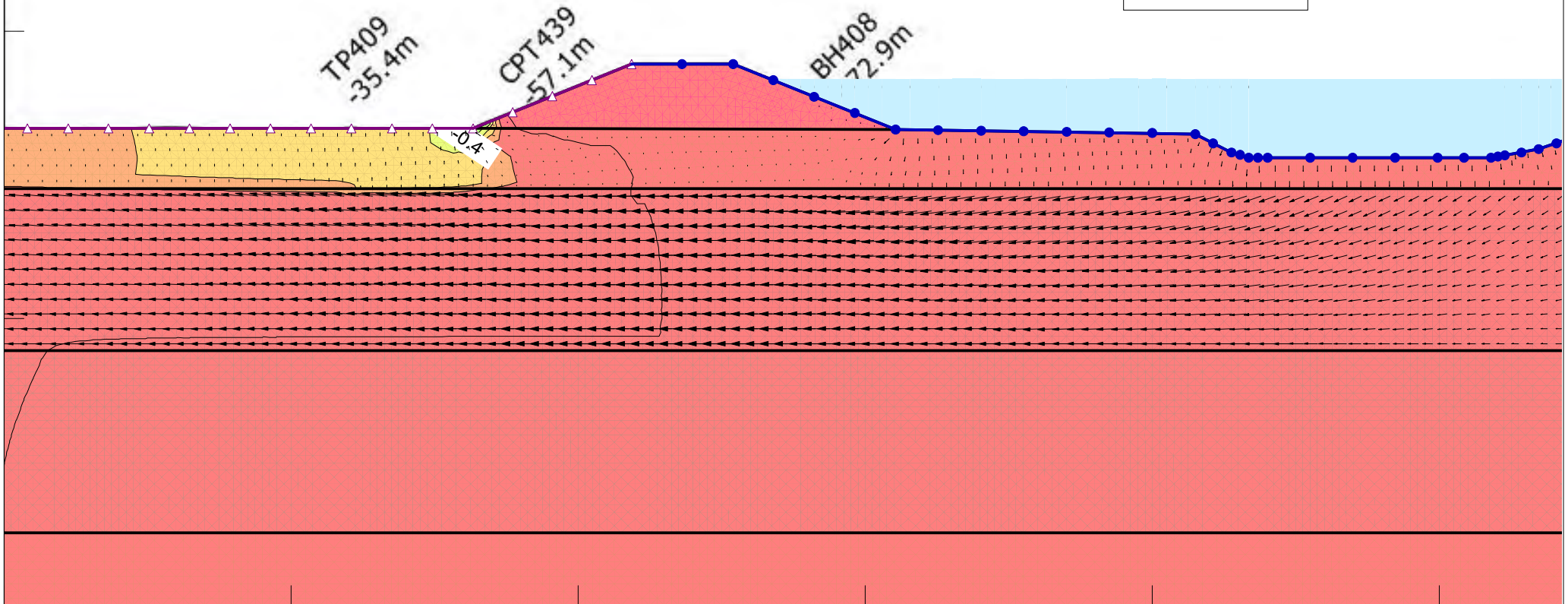


Title: Title: GZ-02 (CH1610)		Job Number: 1017353.2403
Analysis: 6.a Rapid Drawdown RS		Analysed by: MIBU
Comments:	Scale: 1:200 @ A4	Checked by: DAMI

Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Ky/Kx Ratio	Rotation (°)
■	1. Stopbank Fill	Saturated / Unsaturated	Sandy SILT / SILT (FILL MATERIAL)	Sandy SILT / SILT (Fill)	0.25	0
■	2. Silty SAND / Sandy SILT	Saturated / Unsaturated	Silty SAND / Sandy SILT	Silty SAND / Sandy SILT	1	0
■	4. SILT	Saturated / Unsaturated	SILT	SILT	1	0
■	5. Gravel	Saturated / Unsaturated	Gravel	Gravel	1	0



A

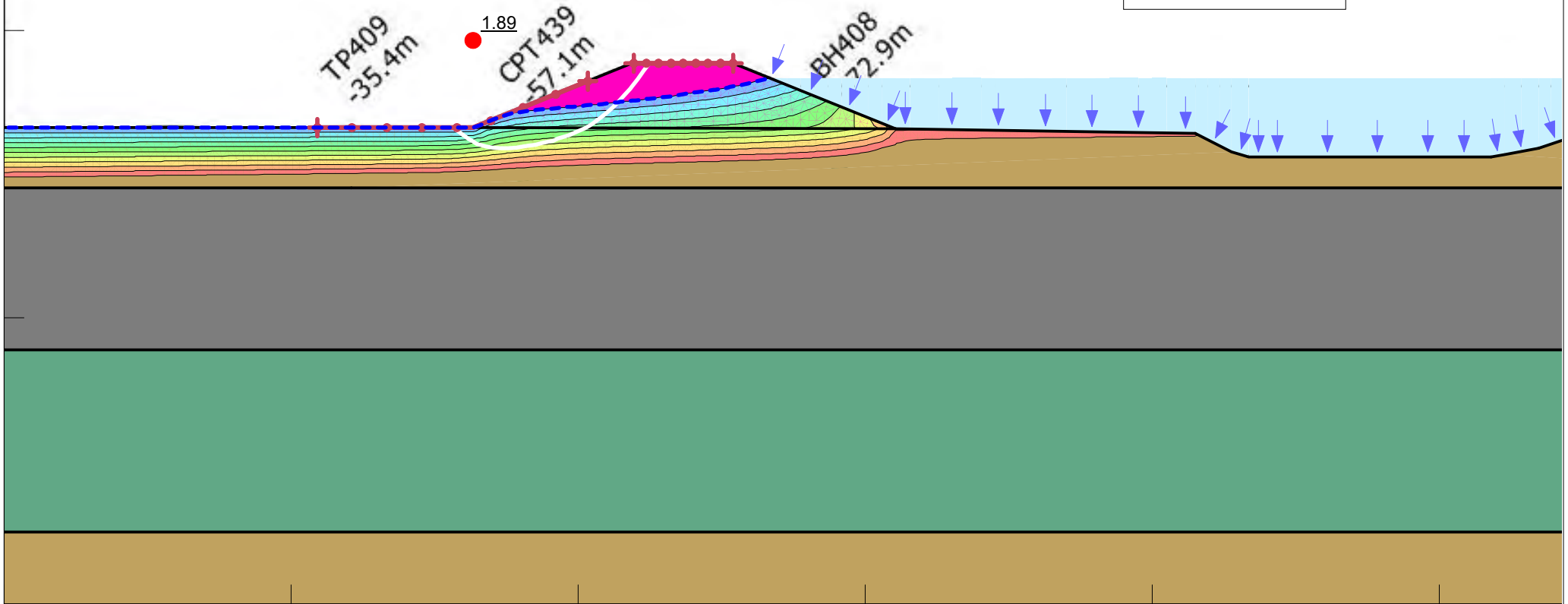


Title: Title: GZ-02 (CH1610)		Job Number: 1017353.2403
Analysis: 6b. Constant Seepage LS		Analysed by: MIBU
Comments:	Scale: 1:200 @ A4	Checked by: DAMI

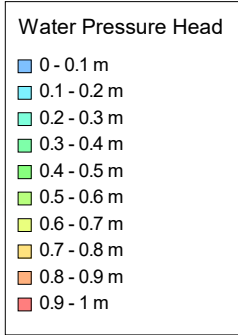
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
■	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
■	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
■	4. SILT	Mohr-Coulomb	16	2	28	0
■	5. Gravel	Mohr-Coulomb	18	0	36	0

Water Pressure Head	
■	0 - 0.2 m
■	0.2 - 0.4 m
■	0.4 - 0.6 m
■	0.6 - 0.8 m
■	0.8 - 1 m
■	1 - 1.2 m
■	1.2 - 1.4 m
■	1.4 - 1.6 m
■	1.6 - 1.8 m
■	1.8 - 2 m

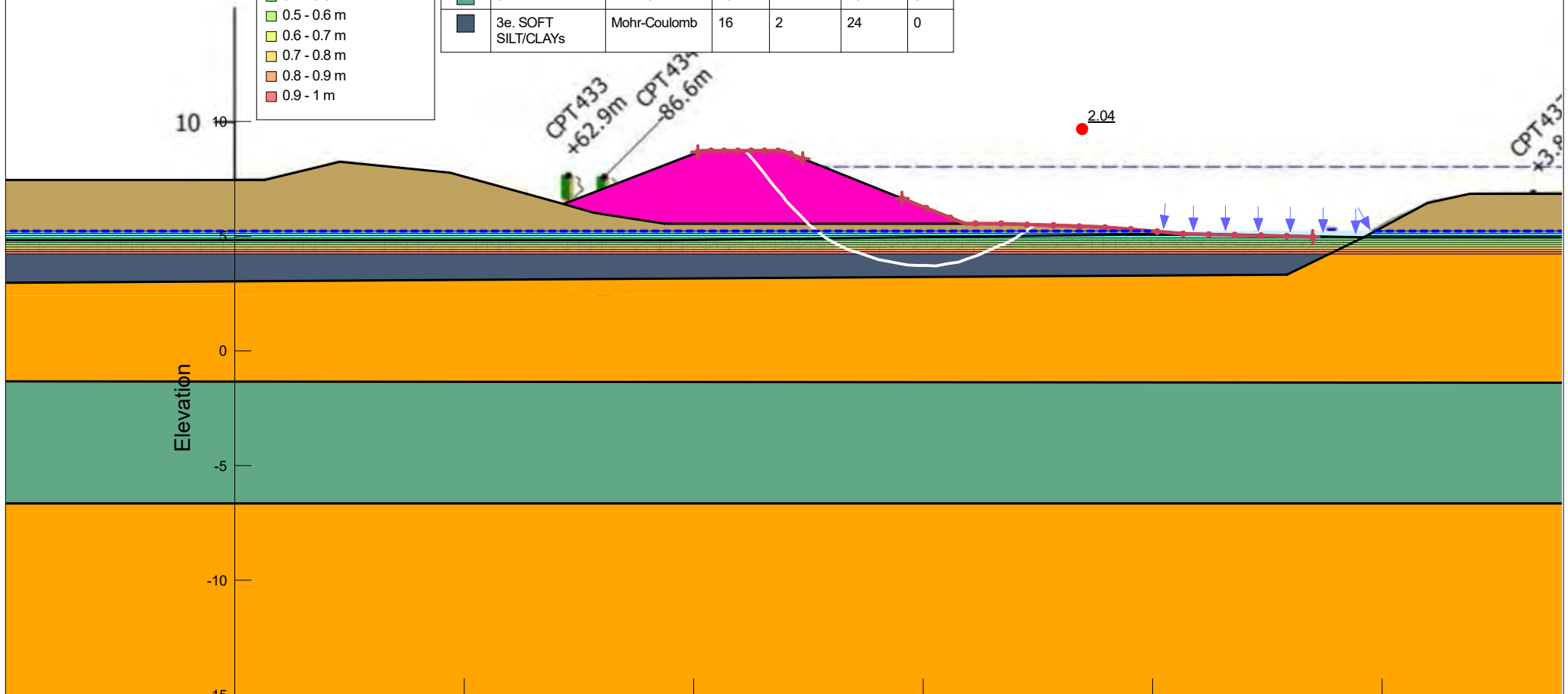
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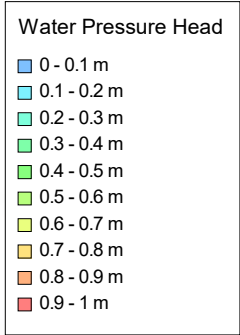
Title: Title: GZ-02 (CH1610)	Job Number: 1017353.2403
Analysis: 6b. Constant Seepage LS_Stability	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI



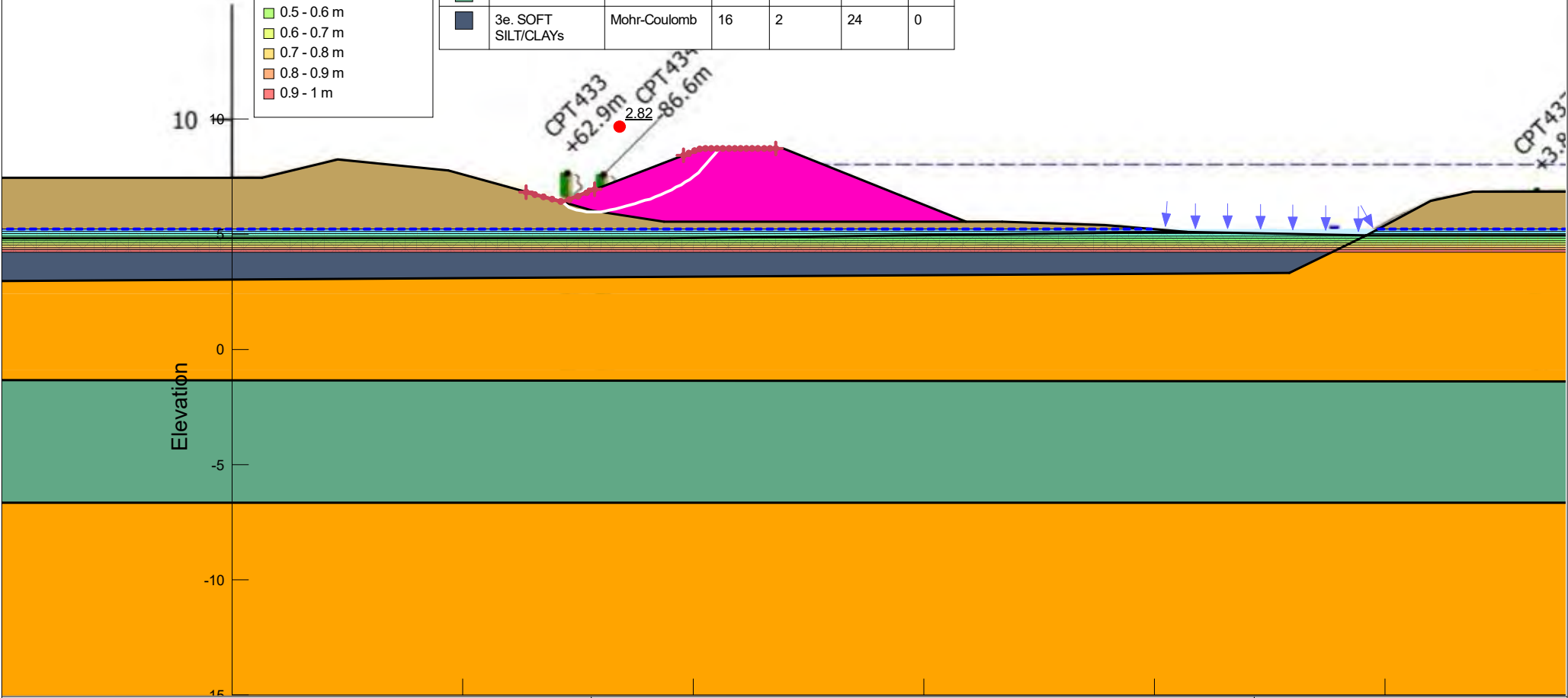
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



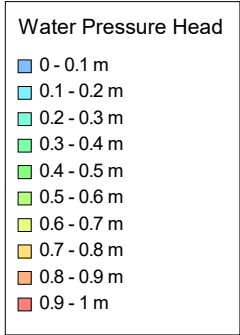
Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 1.a. Static RS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



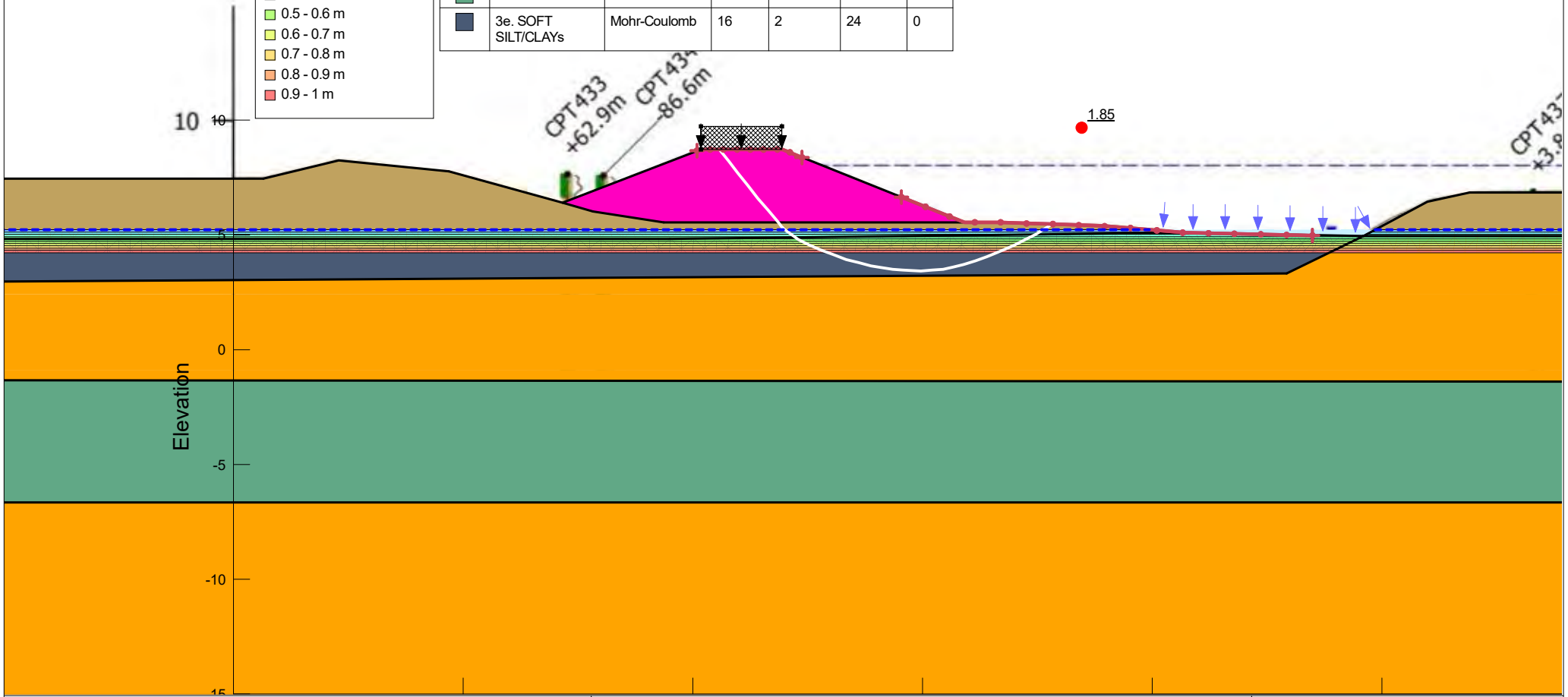
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



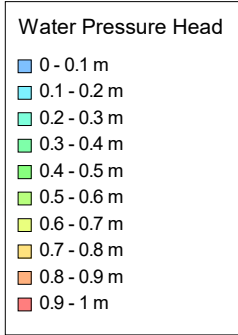
Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 1.b. Static LS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



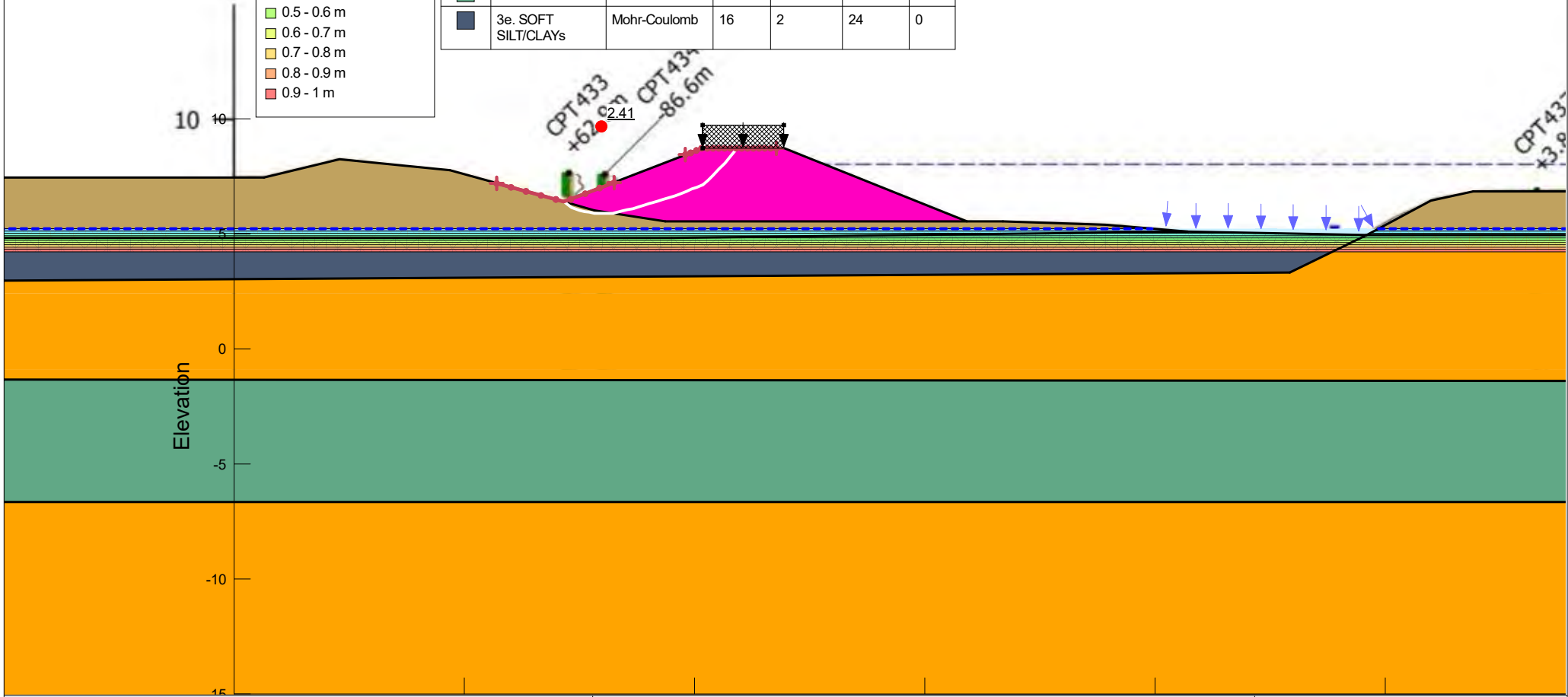
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



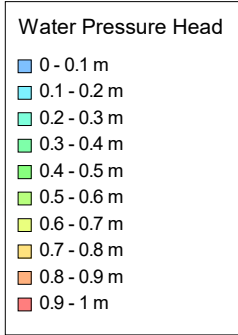
Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 1.c. Static traffic RS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



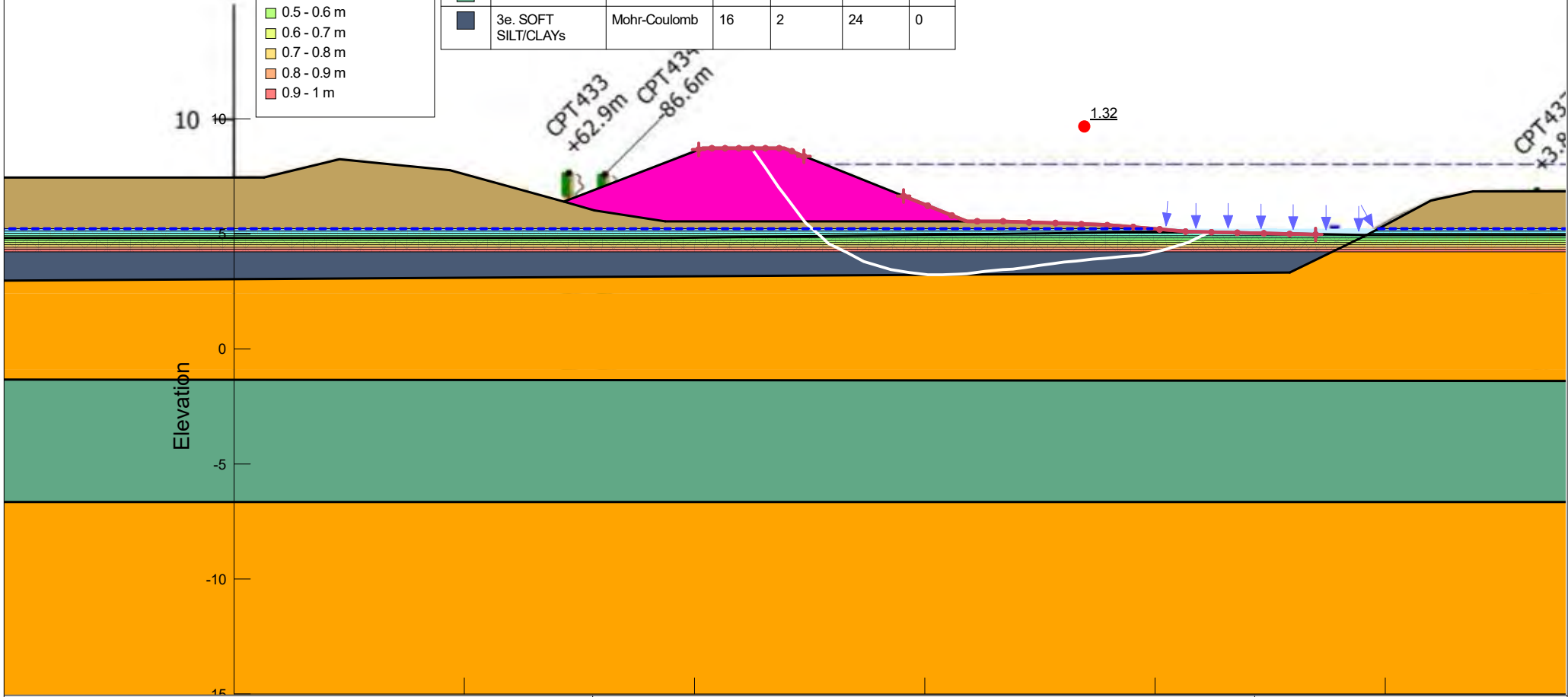
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 1.d. Static traffic LS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



Title: 25.08.24\_CH2155\_GZ\_3 (CH2155)

Job Number: 1017353.2403

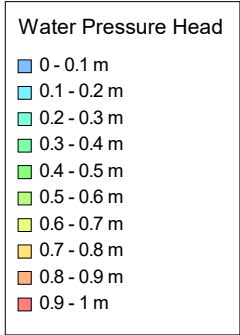
Analysis: 2.a. Seismic SLS RS

Analysed by: MIBU

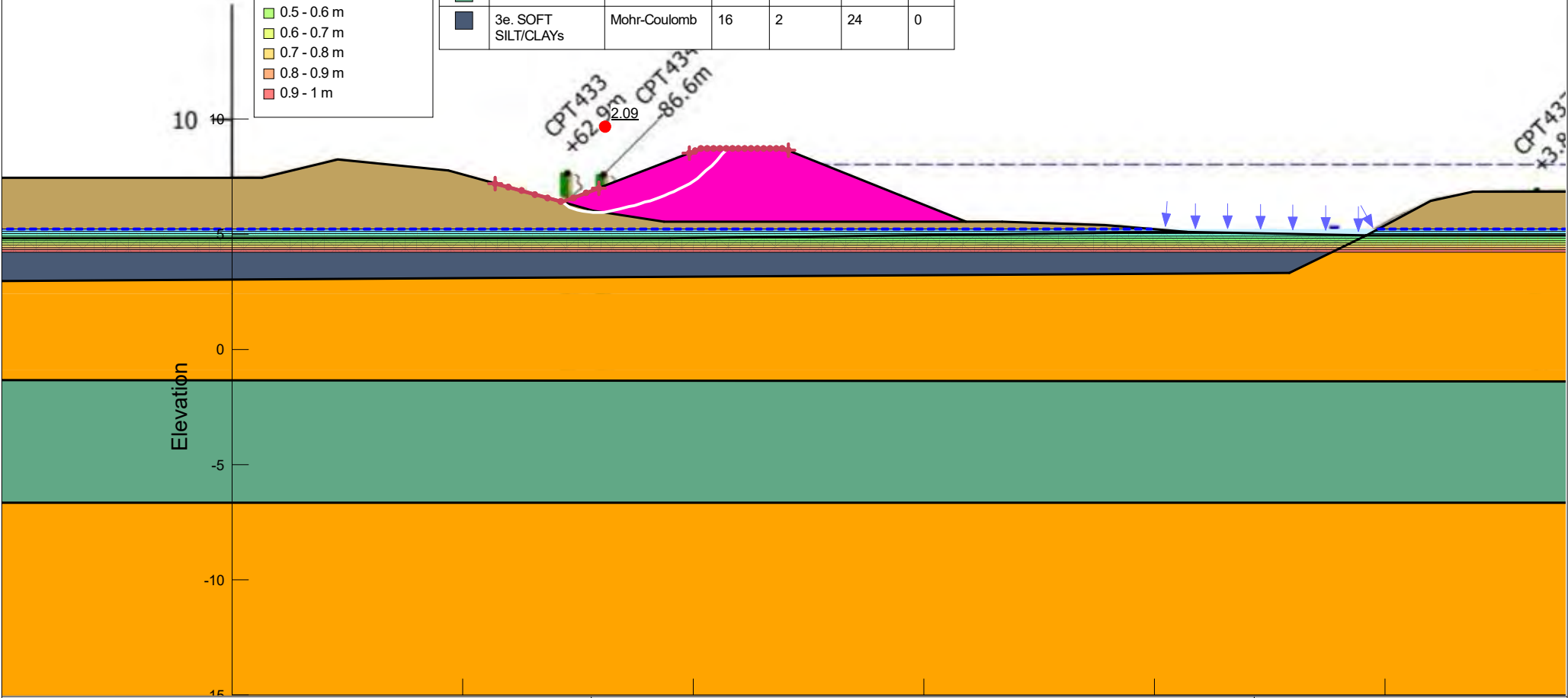
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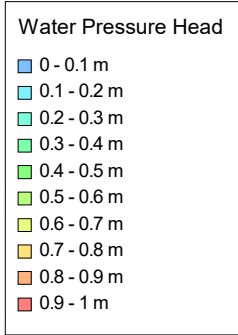
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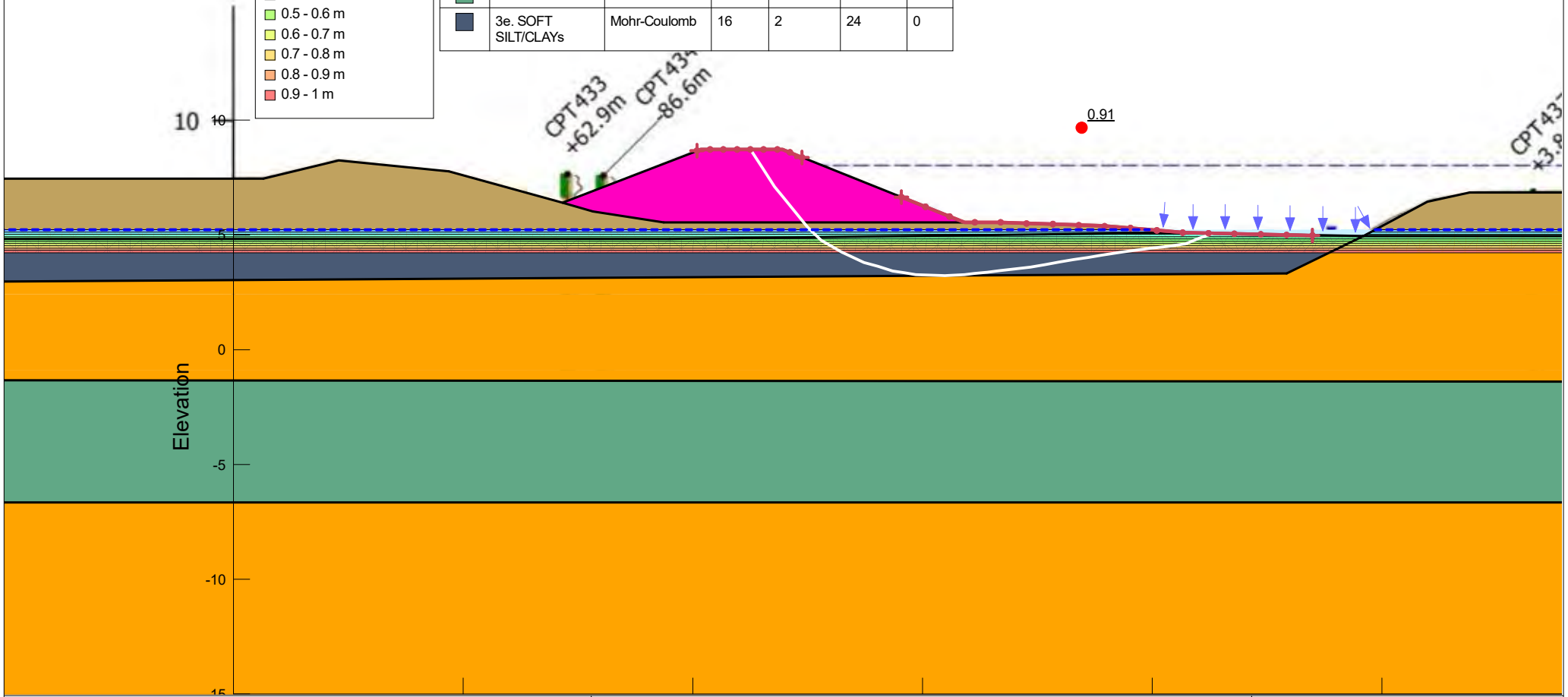
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



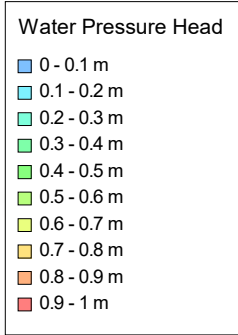
Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 2.b. Seismic SLS LS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



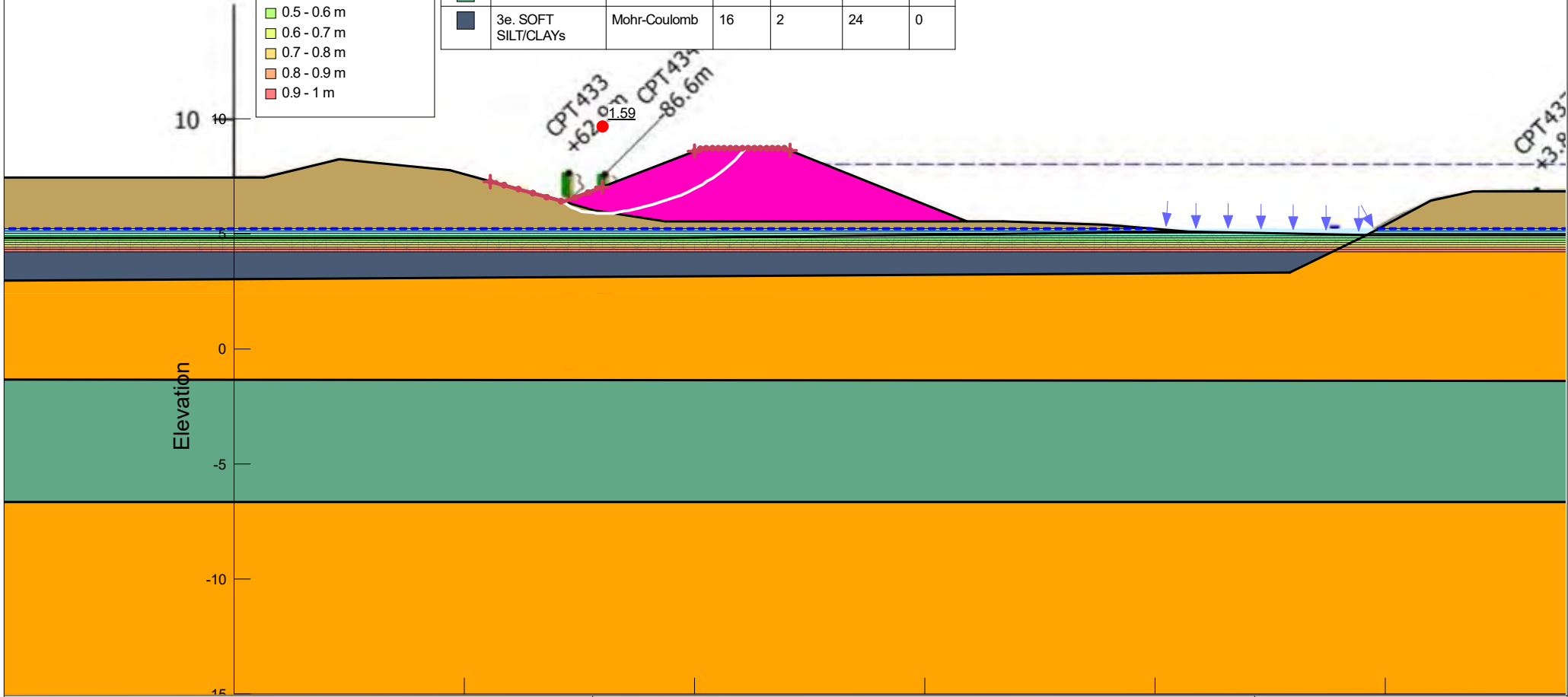
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



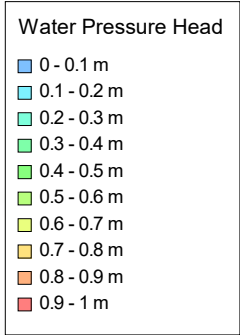
Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 3.a. Seismic ILS RS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



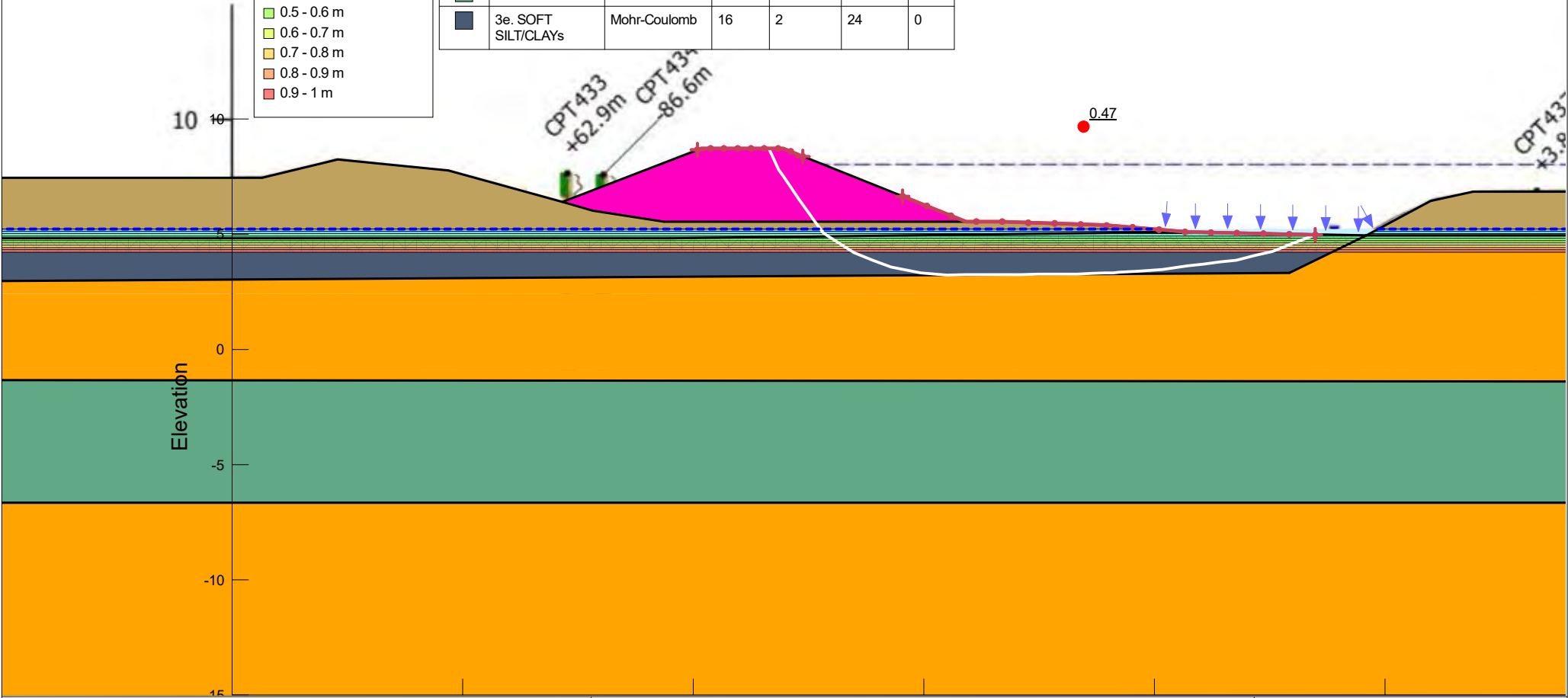
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



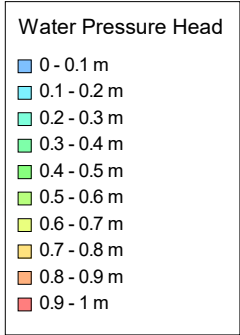
Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 3.b. Seismic ILS LS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



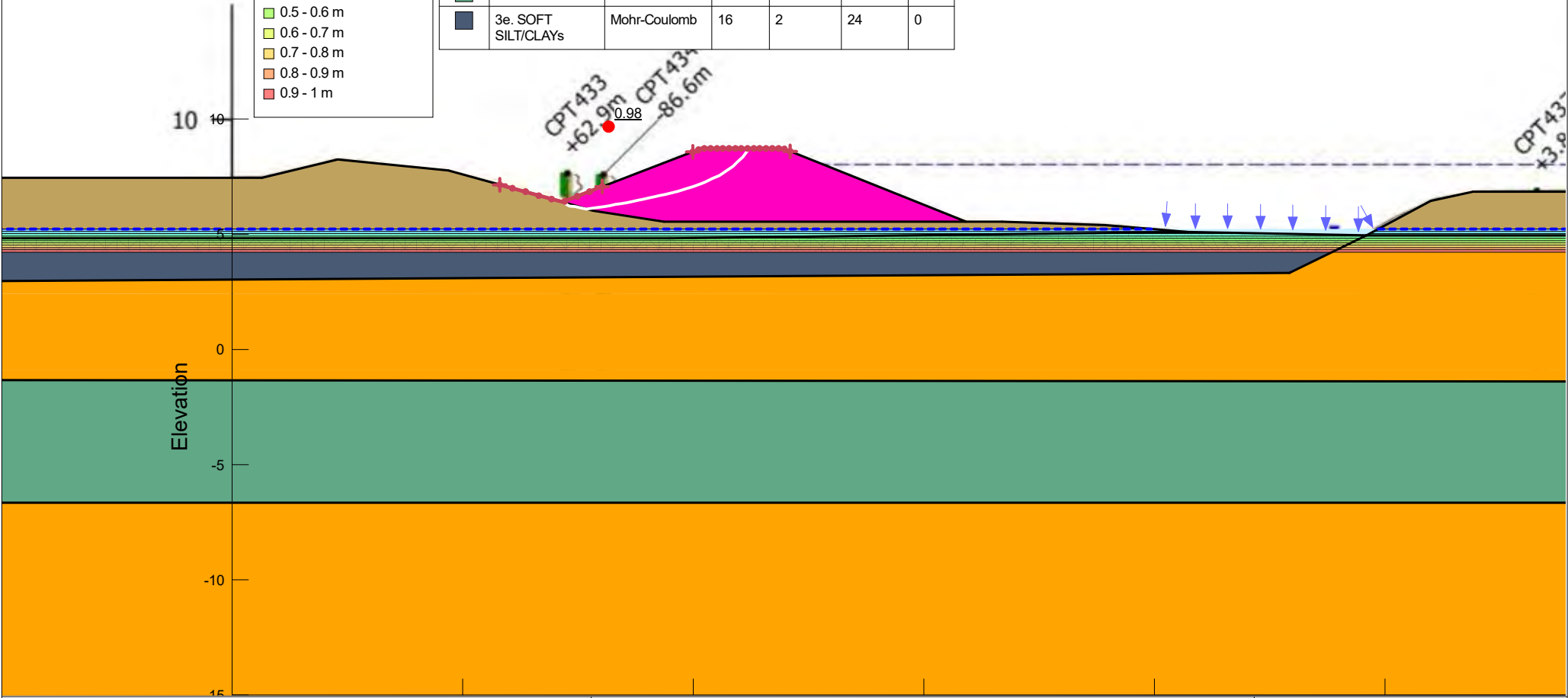
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



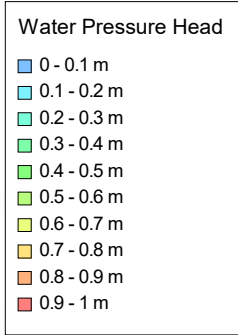
Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 4.a. Seismic ULS RS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



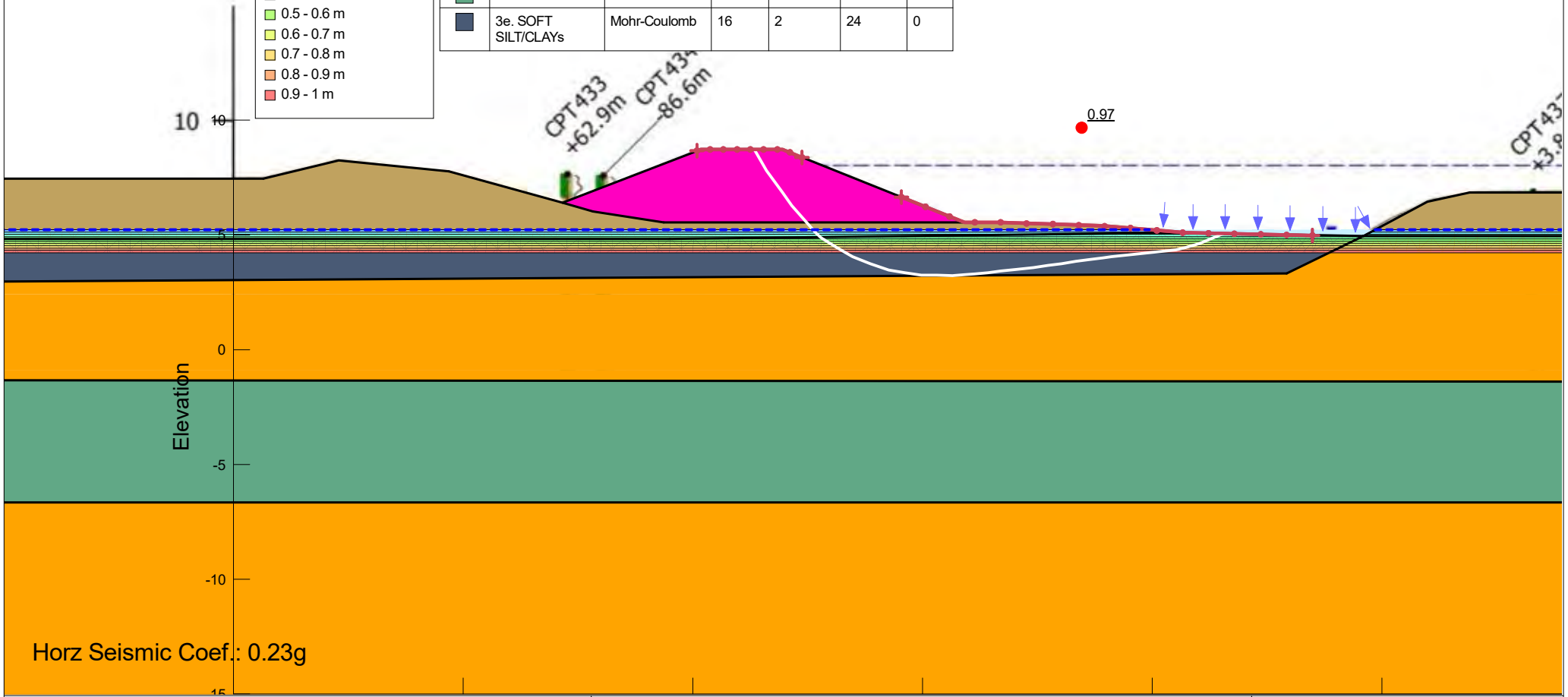
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



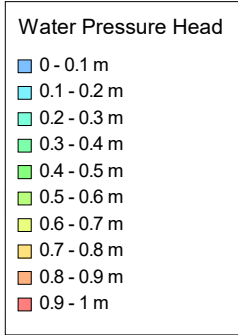
Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 4.b. Seismic ULS LS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



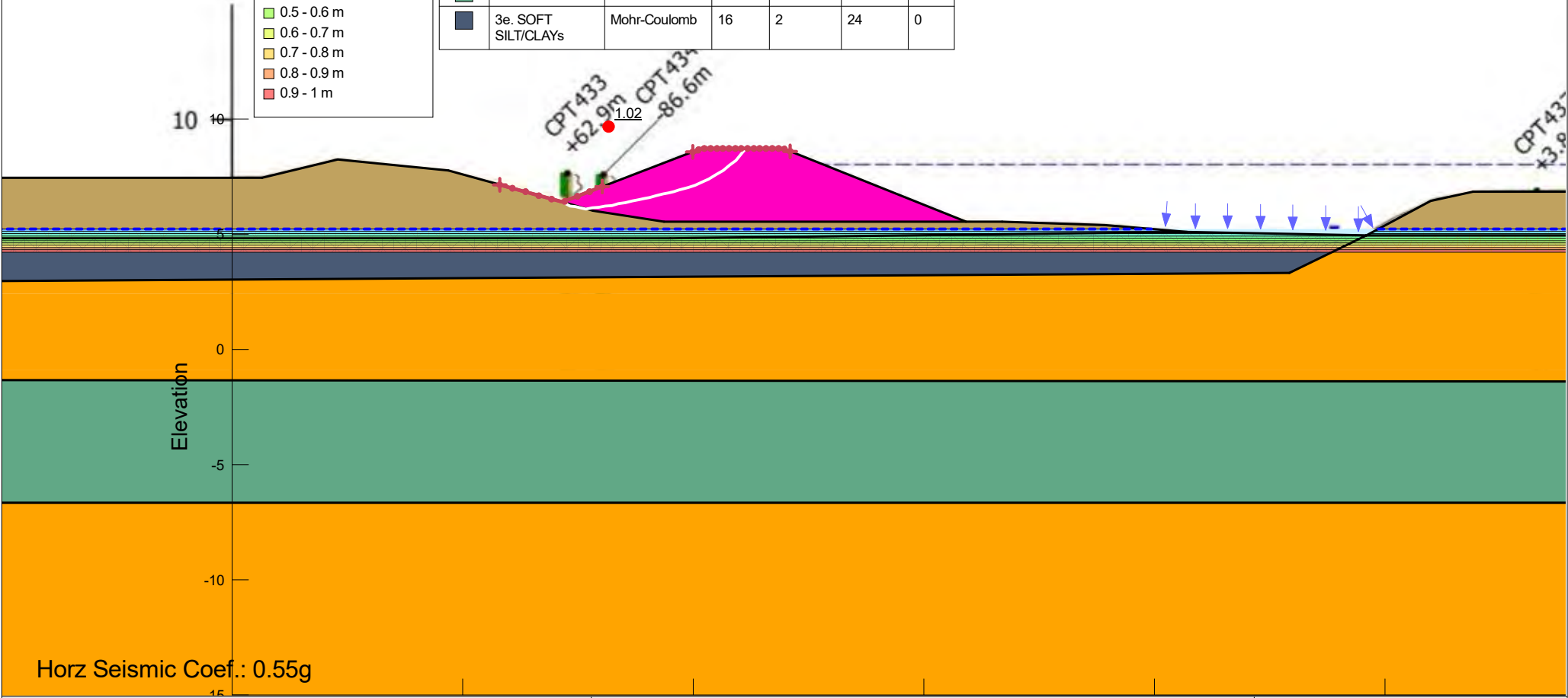
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



Title: GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 4.c. Seismic ULS RS (yield)		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



Horz Seismic Coef.: 0.55g

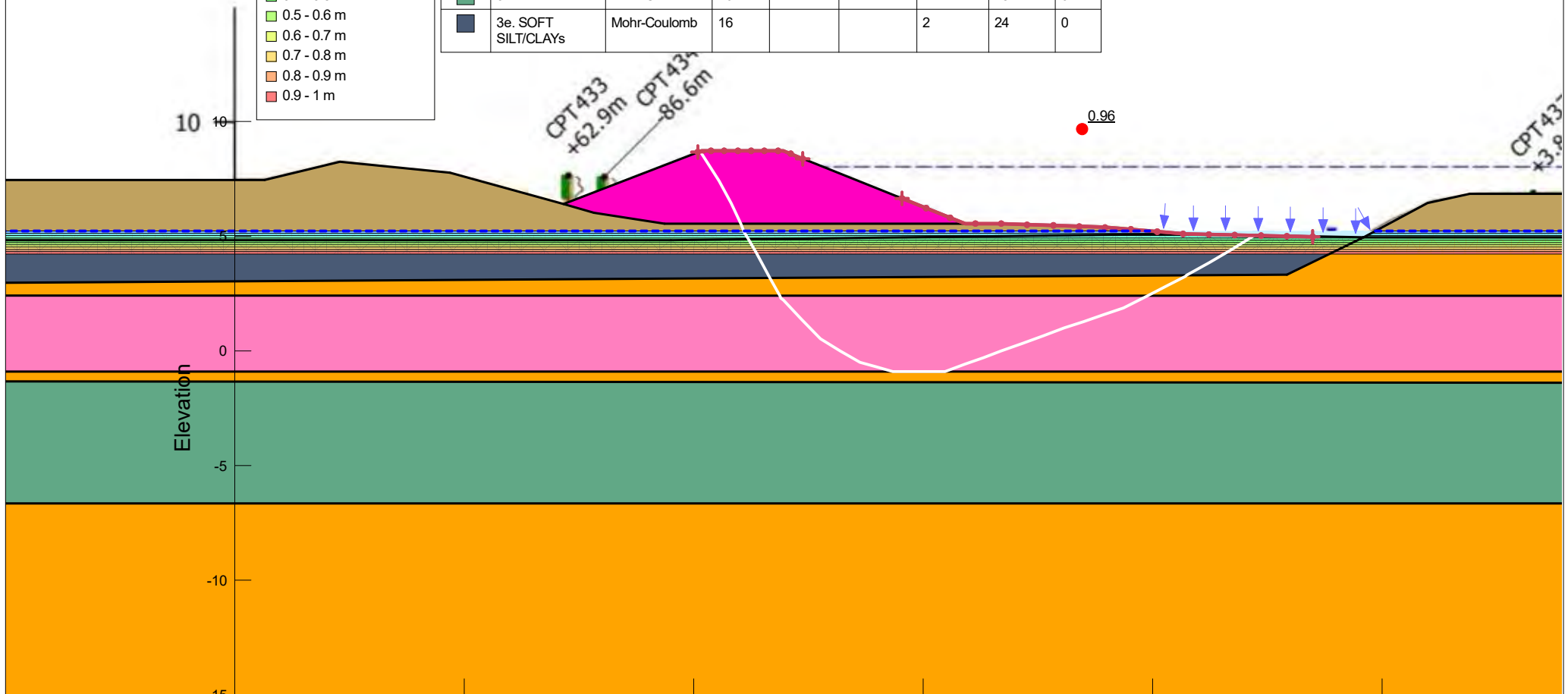


Title: GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 4.d. Seismic ULS LS (yield)		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16			4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18			2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18			0	32	0
<span style="color: pink;">■</span>	3b. SAND (liquefied)	SHANSEP	18	2	0.1			
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16			2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYS	Mohr-Coulomb	16			2	24	0

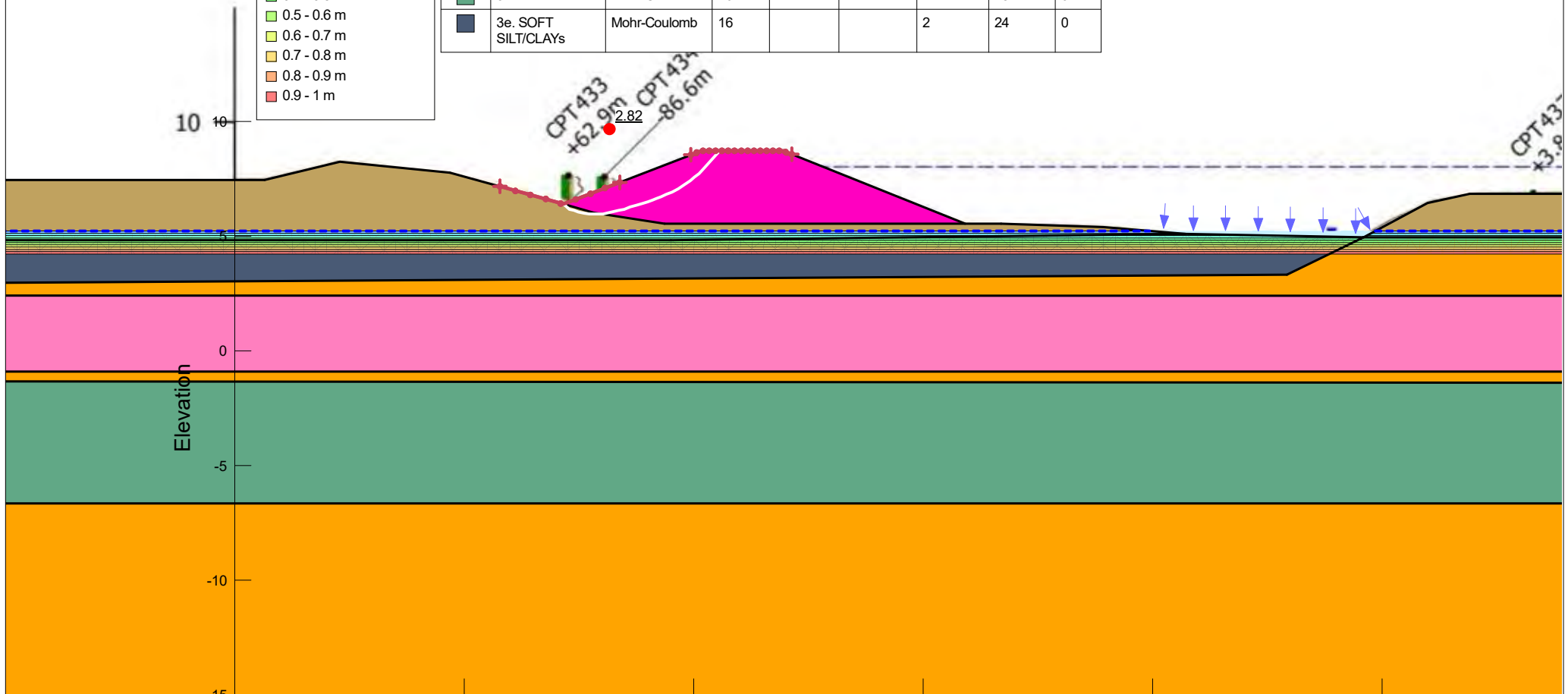
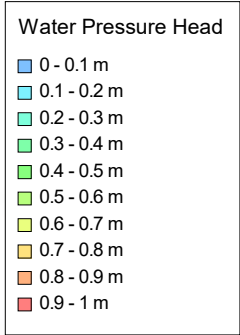
Water Pressure Head

<span style="color: lightblue;">■</span>	0 - 0.1 m
<span style="color: cyan;">■</span>	0.1 - 0.2 m
<span style="color: lightgreen;">■</span>	0.2 - 0.3 m
<span style="color: green;">■</span>	0.3 - 0.4 m
<span style="color: limegreen;">■</span>	0.4 - 0.5 m
<span style="color: yellowgreen;">■</span>	0.5 - 0.6 m
<span style="color: yellow;">■</span>	0.6 - 0.7 m
<span style="color: orangeyellow;">■</span>	0.7 - 0.8 m
<span style="color: orange;">■</span>	0.8 - 0.9 m
<span style="color: red;">■</span>	0.9 - 1 m

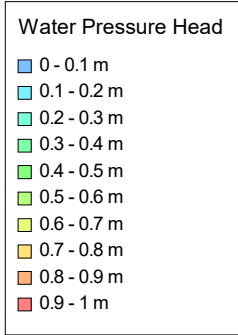


Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 5.a. Post-seismic - liquefied RS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI

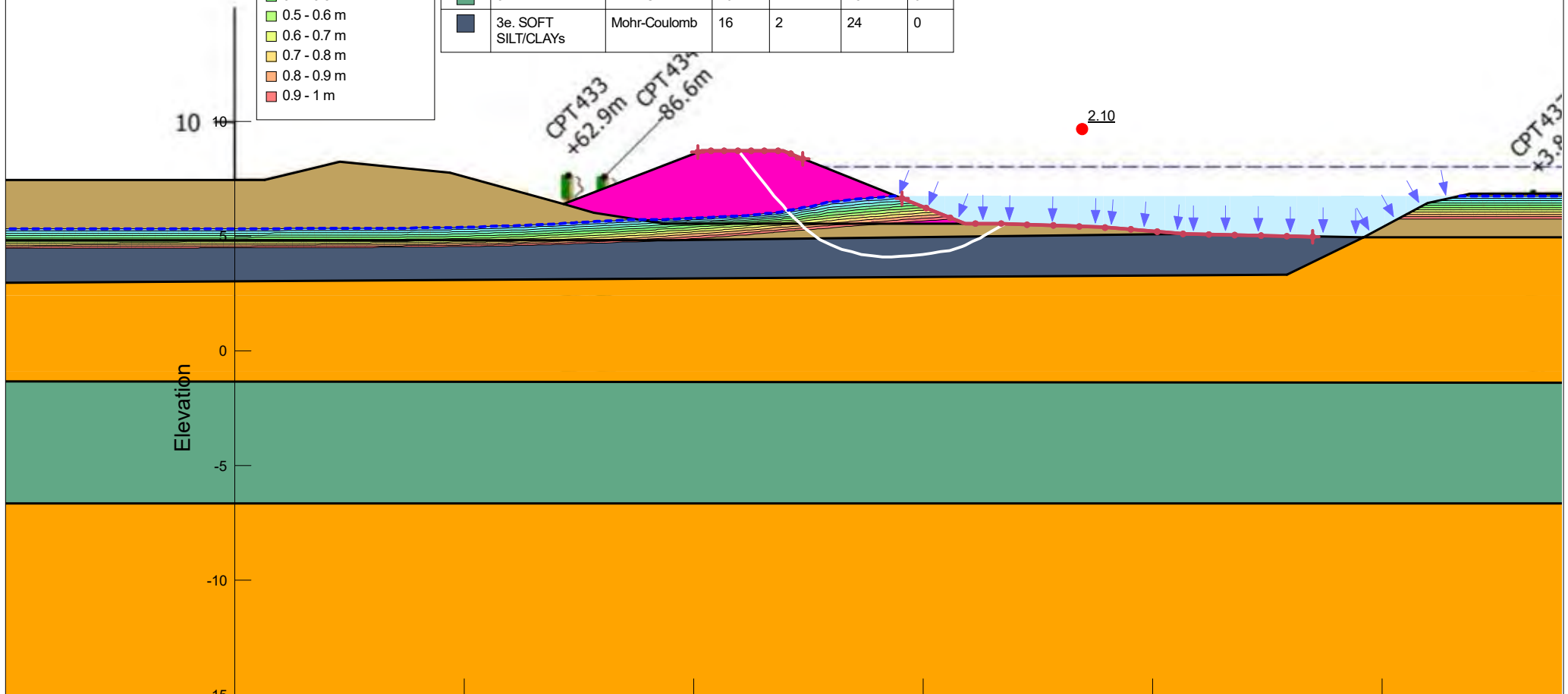
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16			4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18			2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18			0	32	0
<span style="color: pink;">■</span>	3b. SAND (liquefied)	SHANSEP	18	2	0.1			
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16			2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYS	Mohr-Coulomb	16			2	24	0



Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 5.b. Post-seismic - liquefied LS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0



Title: 25.08.24\_CH2155\_GZ\_3 (CH2155)

Job Number: 1017353.2403

Analysis: 6.a. Rapid Drawdown RS

Analysed by: MIBU

Comments:

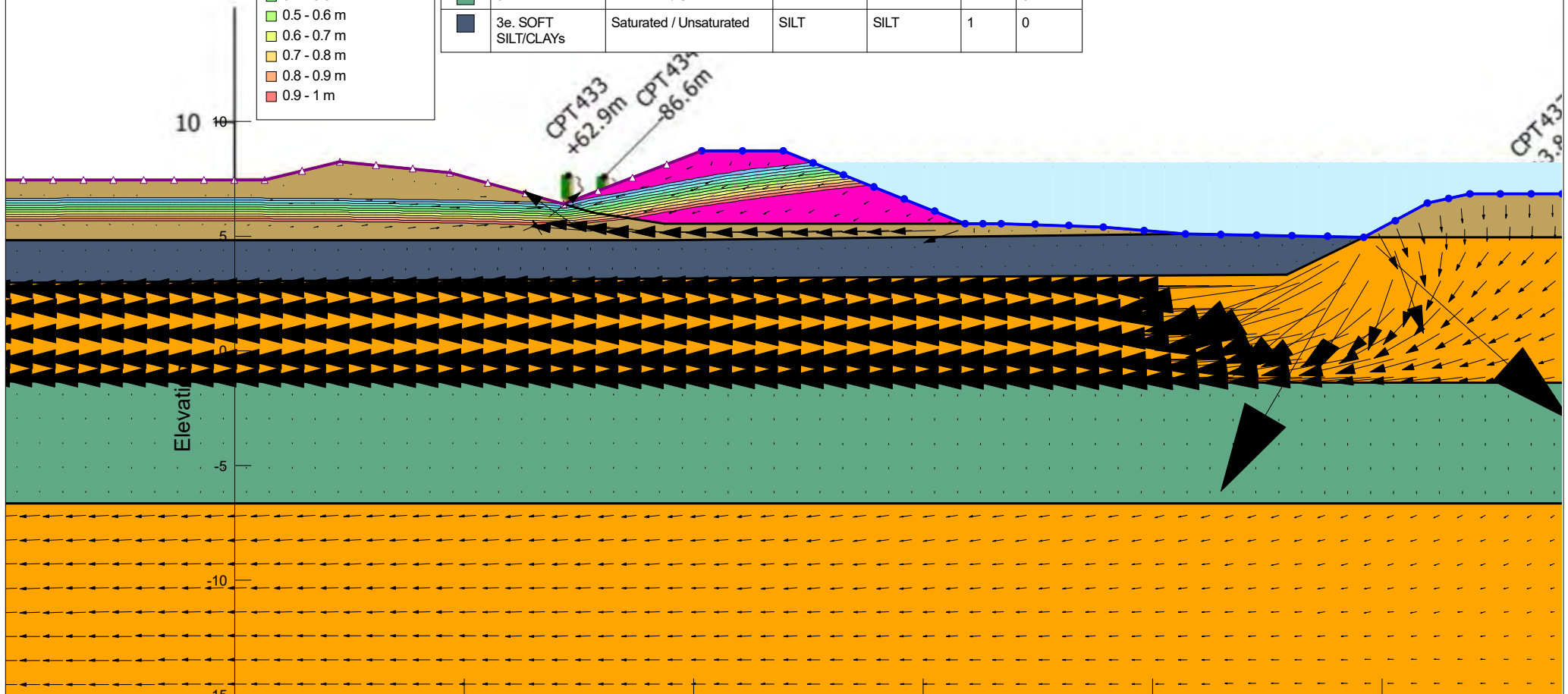
Scale: 1:250 @ A4

Checked by: DAMI

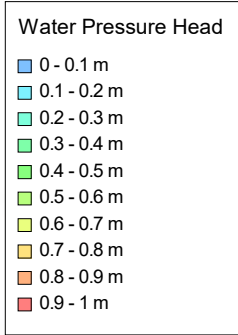
Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Ky'/Kx' Ratio	Rotation (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Saturated / Unsaturated	Sandy SILT / SILT (FILL MATERIAL)	Sandy SILT / SILT (Fill)	0.25	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Saturated / Unsaturated	Silty SAND / Sandy SILT	Silty SAND / Sandy SILT	1	0
<span style="color: orange;">■</span>	3b. SAND	Saturated / Unsaturated	SAND	SAND	1	0
<span style="color: teal;">■</span>	3c. SILT	Saturated / Unsaturated	SILT	SILT	1	0
<span style="color: darkblue;">■</span>	3e. SOFT SILT/CLAYs	Saturated / Unsaturated	SILT	SILT	1	0

**Water Pressure Head**

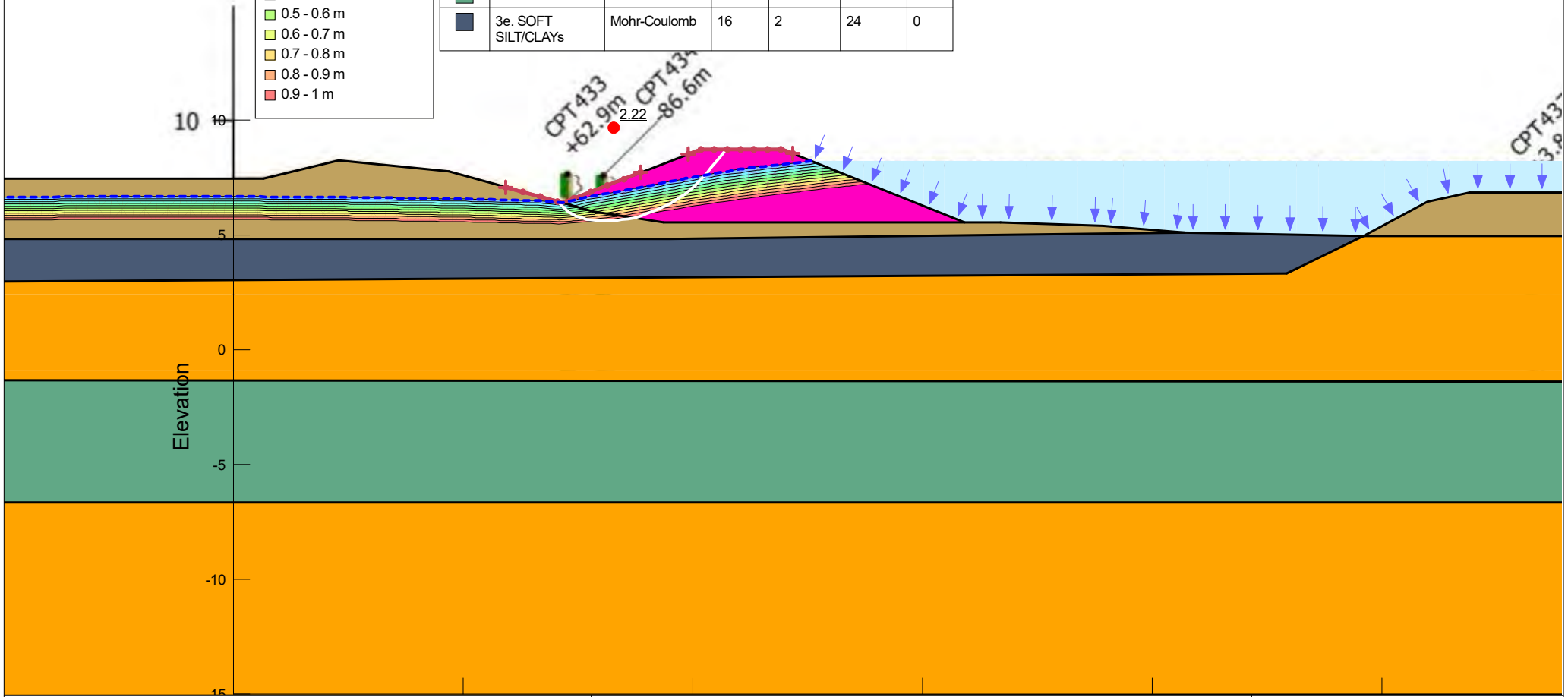
- 0 - 0.1 m
- 0.1 - 0.2 m
- 0.2 - 0.3 m
- 0.3 - 0.4 m
- 0.4 - 0.5 m
- 0.5 - 0.6 m
- 0.6 - 0.7 m
- 0.7 - 0.8 m
- 0.8 - 0.9 m
- 0.9 - 1 m



Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 6b. Constant Seepage		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI



Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	3a. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3b. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	3c. SILT	Mohr-Coulomb	16	2	28	0
<span style="color: blue;">■</span>	3e. SOFT SILT/CLAYs	Mohr-Coulomb	16	2	24	0

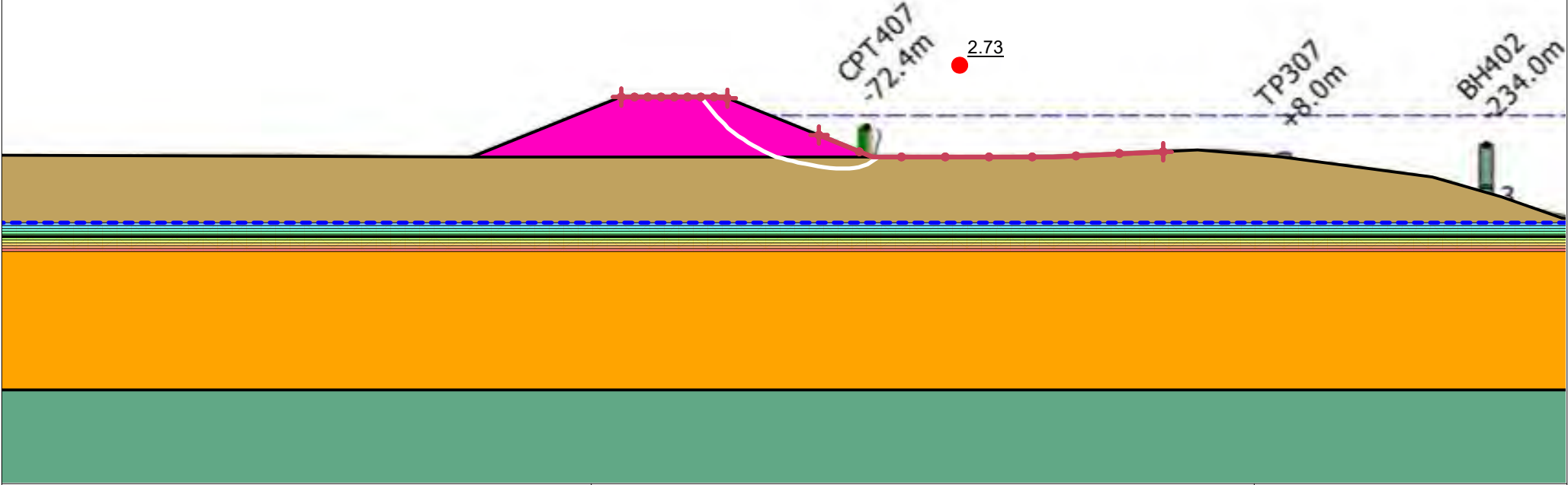


Title: 25.08.24_CH2155_GZ_3 (CH2155)		Job Number: 1017353.2403
Analysis: 6b. Constant_Seepage_LS		Analysed by: MIBU
Comments:	Scale: 1:250 @ A4	Checked by: DAMI

Water Pressure Head

0 - 0.1 m
0.1 - 0.2 m
0.2 - 0.3 m
0.3 - 0.4 m
0.4 - 0.5 m
0.5 - 0.6 m
0.6 - 0.7 m
0.7 - 0.8 m
0.8 - 0.9 m
0.9 - 1 m

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 1.a Static RS

Analysed by: MIBU

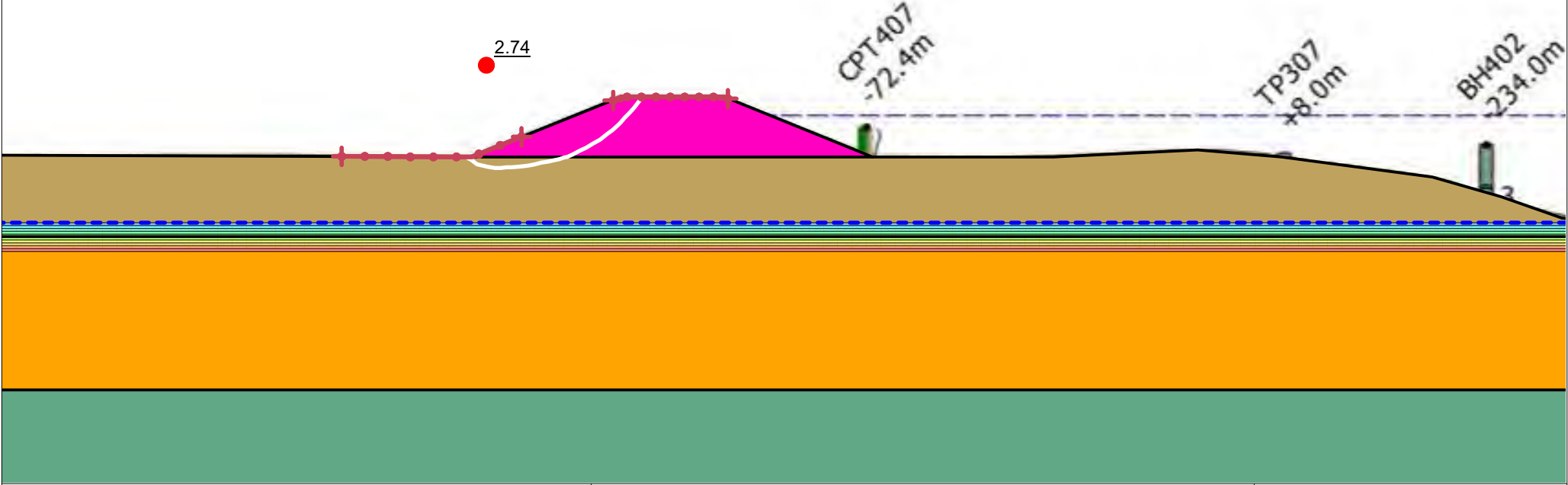
Comments:

Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head	
0 - 0.1 m	
0.1 - 0.2 m	
0.2 - 0.3 m	
0.3 - 0.4 m	
0.4 - 0.5 m	
0.5 - 0.6 m	
0.6 - 0.7 m	
0.7 - 0.8 m	
0.8 - 0.9 m	
0.9 - 1 m	

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 1.b Static LS

Analysed by: MIBU

Comments:

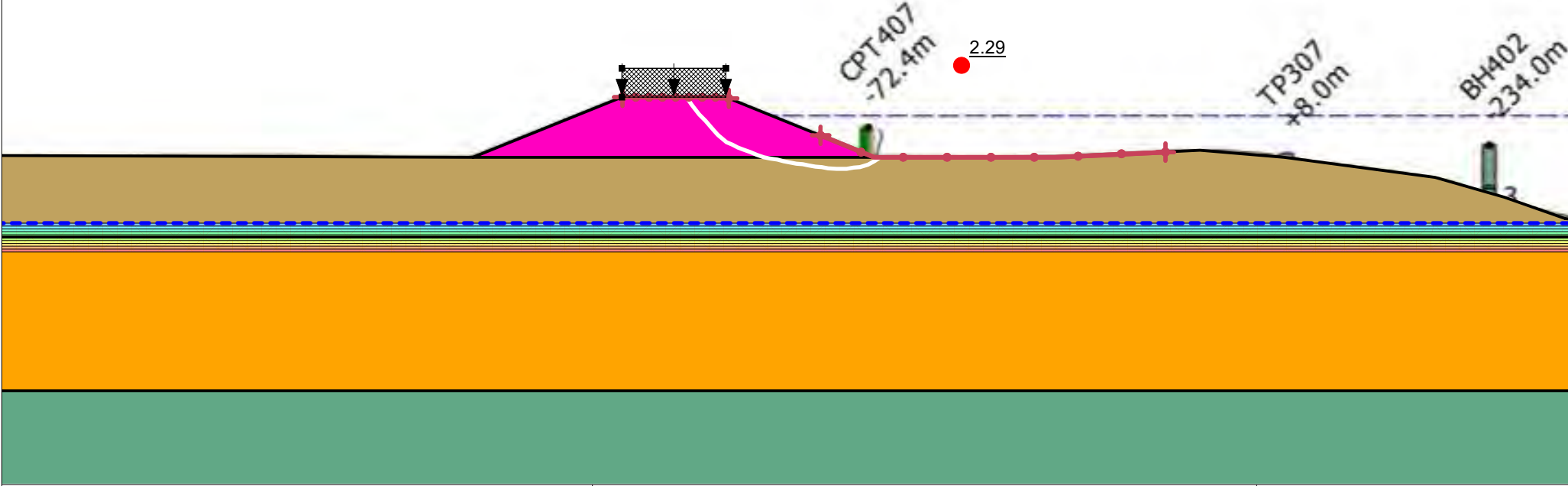
Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head

0 - 0.1 m
0.1 - 0.2 m
0.2 - 0.3 m
0.3 - 0.4 m
0.4 - 0.5 m
0.5 - 0.6 m
0.6 - 0.7 m
0.7 - 0.8 m
0.8 - 0.9 m
0.9 - 1 m

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
█	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
█	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
█	3. SAND	Mohr-Coulomb	18	0	32	0
█	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 1.c Static traffic RS

Analysed by: MIBU

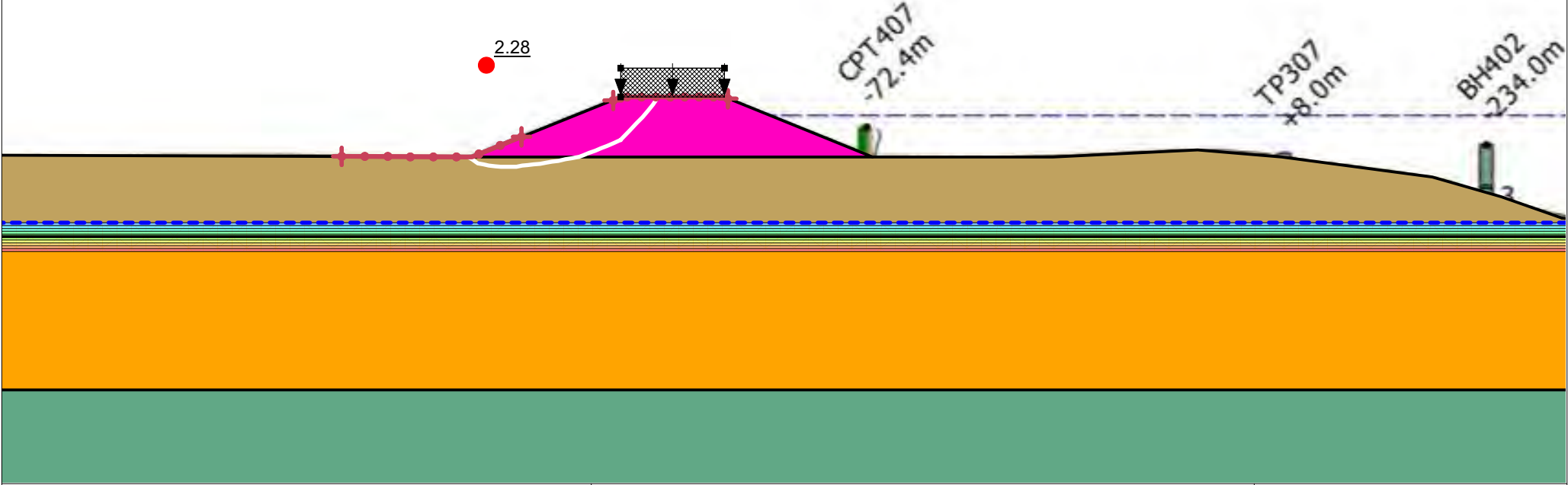
Comments:

Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head	
0 - 0.1 m	
0.1 - 0.2 m	
0.2 - 0.3 m	
0.3 - 0.4 m	
0.4 - 0.5 m	
0.5 - 0.6 m	
0.6 - 0.7 m	
0.7 - 0.8 m	
0.8 - 0.9 m	
0.9 - 1 m	

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 1.d Static traffic LS

Analysed by: MIBU

Comments:

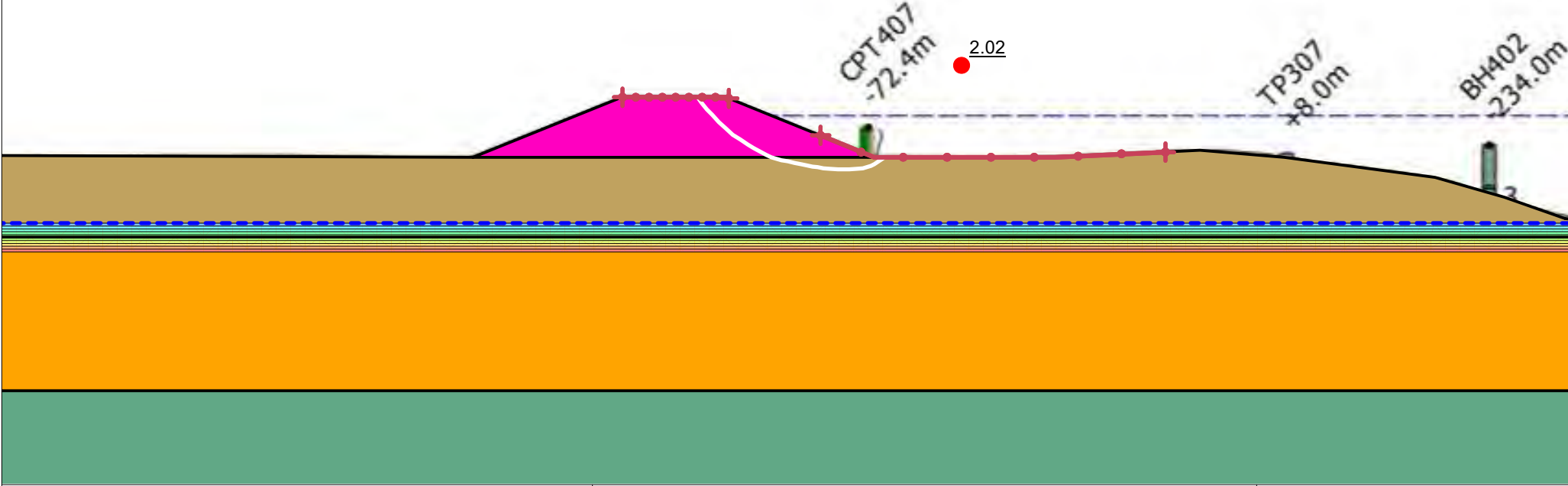
Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head

0 - 0.1 m
0.1 - 0.2 m
0.2 - 0.3 m
0.3 - 0.4 m
0.4 - 0.5 m
0.5 - 0.6 m
0.6 - 0.7 m
0.7 - 0.8 m
0.8 - 0.9 m
0.9 - 1 m

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 2.a Seismic SLS RS

Analysed by: MIBU

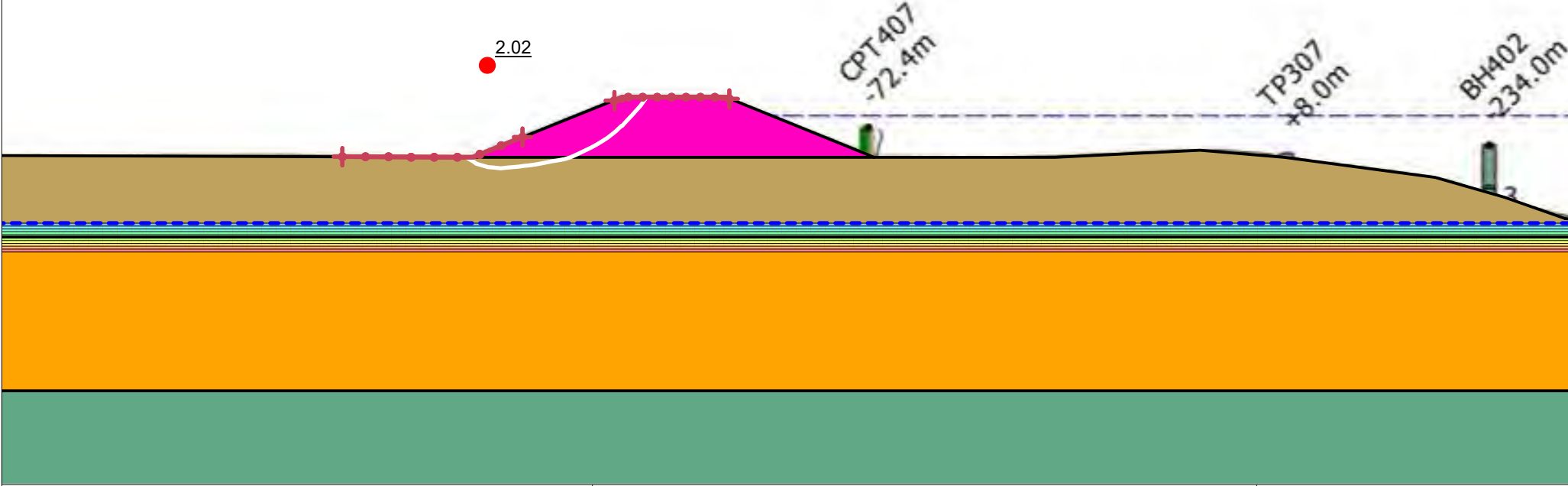
Comments:

Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head	
0 - 0.1 m	
0.1 - 0.2 m	
0.2 - 0.3 m	
0.3 - 0.4 m	
0.4 - 0.5 m	
0.5 - 0.6 m	
0.6 - 0.7 m	
0.7 - 0.8 m	
0.8 - 0.9 m	
0.9 - 1 m	

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 2.b Seismic SLS LS

Analysed by: MIBU

Comments:

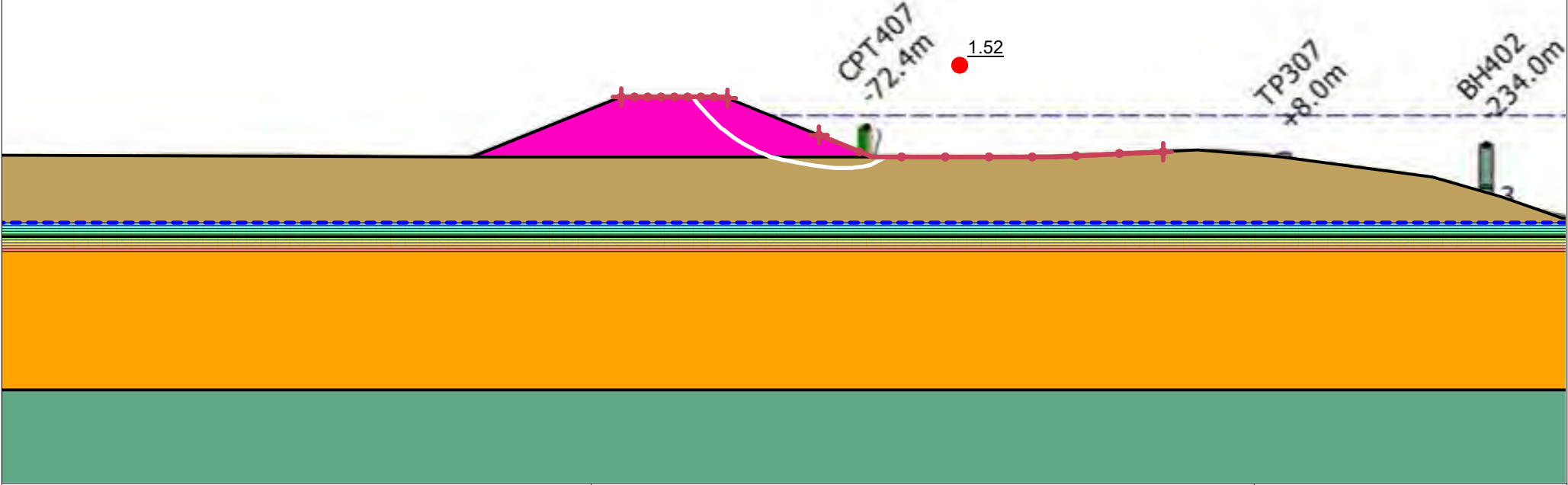
Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head

0 - 0.1 m
0.1 - 0.2 m
0.2 - 0.3 m
0.3 - 0.4 m
0.4 - 0.5 m
0.5 - 0.6 m
0.6 - 0.7 m
0.7 - 0.8 m
0.8 - 0.9 m
0.9 - 1 m

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 3.a Seismic ILS RS

Analysed by: MIBU

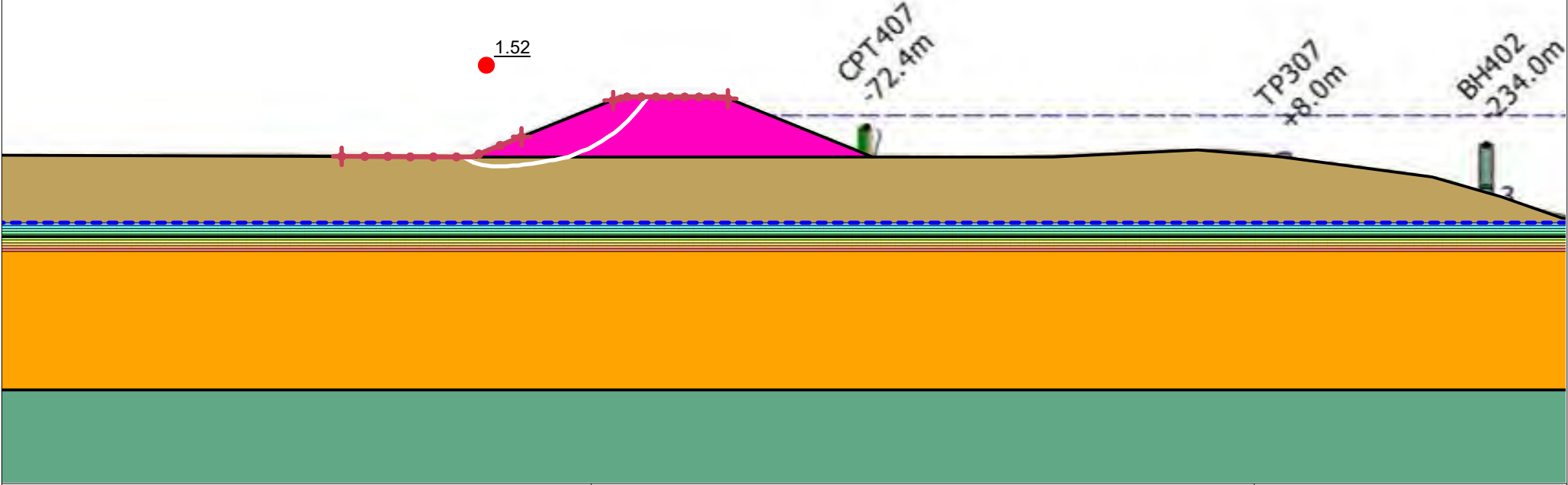
Comments:

Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head	
0 - 0.1 m	
0.1 - 0.2 m	
0.2 - 0.3 m	
0.3 - 0.4 m	
0.4 - 0.5 m	
0.5 - 0.6 m	
0.6 - 0.7 m	
0.7 - 0.8 m	
0.8 - 0.9 m	
0.9 - 1 m	

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

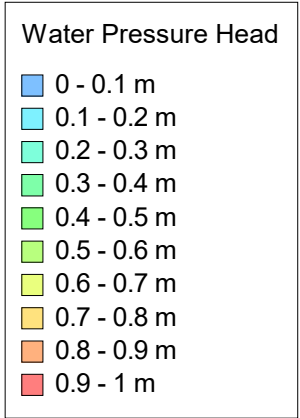
Analysis: 3.b Seismic ILS LS

Analysed by: MIBU

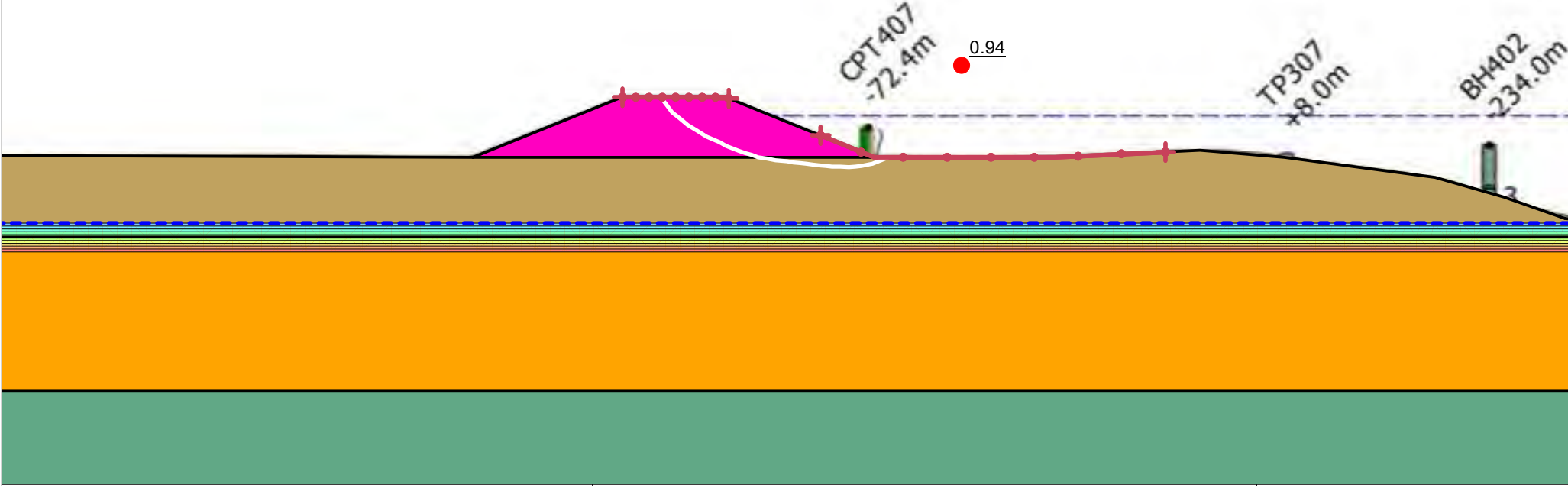
Comments:

Scale: 1:200 @ A4

Checked by: DAMI



Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 4.a Seismic ULS RS

Analysed by: MIBU

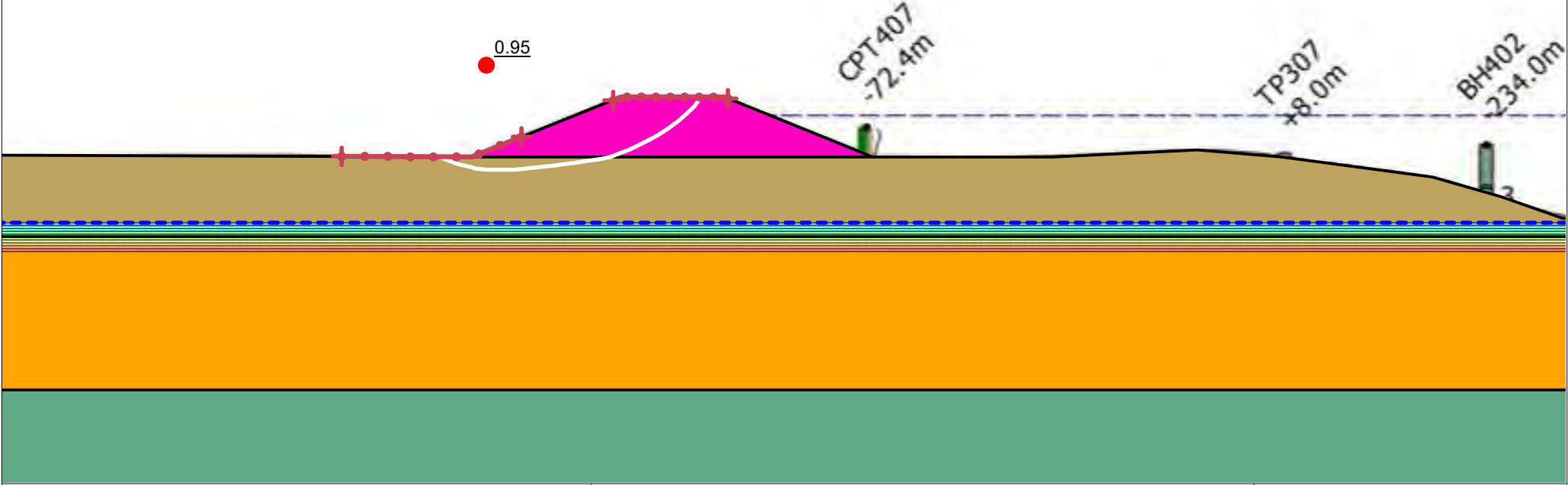
Comments:

Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head	
0 - 0.1 m	
0.1 - 0.2 m	
0.2 - 0.3 m	
0.3 - 0.4 m	
0.4 - 0.5 m	
0.5 - 0.6 m	
0.6 - 0.7 m	
0.7 - 0.8 m	
0.8 - 0.9 m	
0.9 - 1 m	

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 4.b Seismic ULS LS

Analysed by: MIBU

Comments:

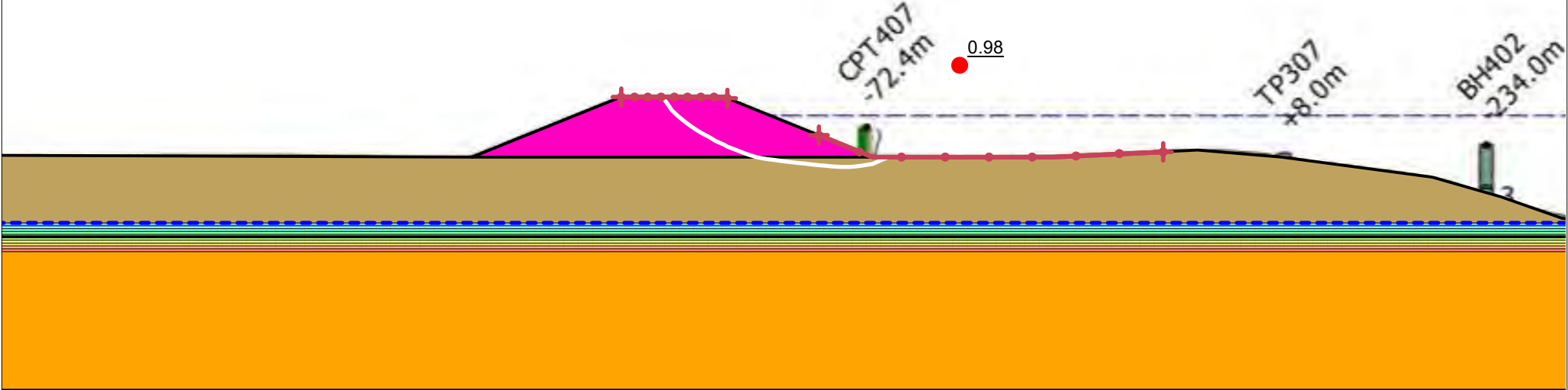
Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head

0 - 0.1 m
0.1 - 0.2 m
0.2 - 0.3 m
0.3 - 0.4 m
0.4 - 0.5 m
0.5 - 0.6 m
0.6 - 0.7 m
0.7 - 0.8 m
0.8 - 0.9 m
0.9 - 1 m

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



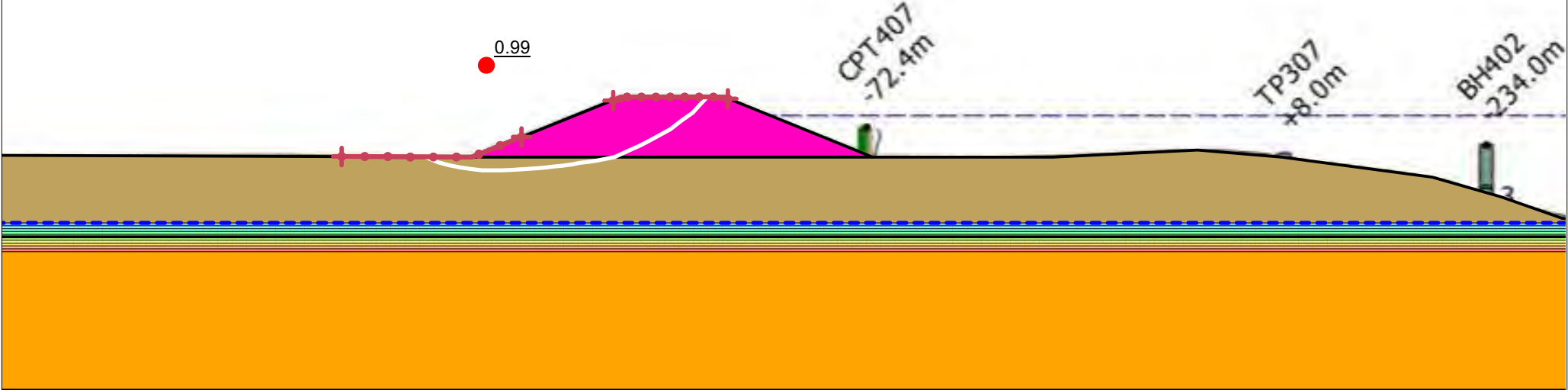
Horz Seismic Coef.: 0.55



Title: GZ-04 (CH4910)	Job Number: 1017353.2403
Analysis: 4.c Seismic ULS RS (yield)	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

Water Pressure Head	
0 - 0.1 m	
0.1 - 0.2 m	
0.2 - 0.3 m	
0.3 - 0.4 m	
0.4 - 0.5 m	
0.5 - 0.6 m	
0.6 - 0.7 m	
0.7 - 0.8 m	
0.8 - 0.9 m	
0.9 - 1 m	

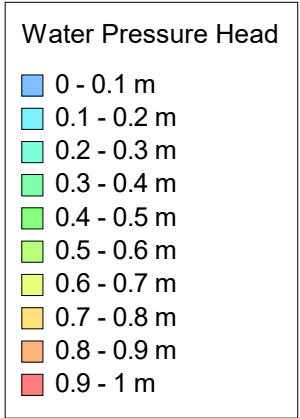
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
█	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
█	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
█	3. SAND	Mohr-Coulomb	18	0	32	0
█	4. SILT	Mohr-Coulomb	16	2	28	0



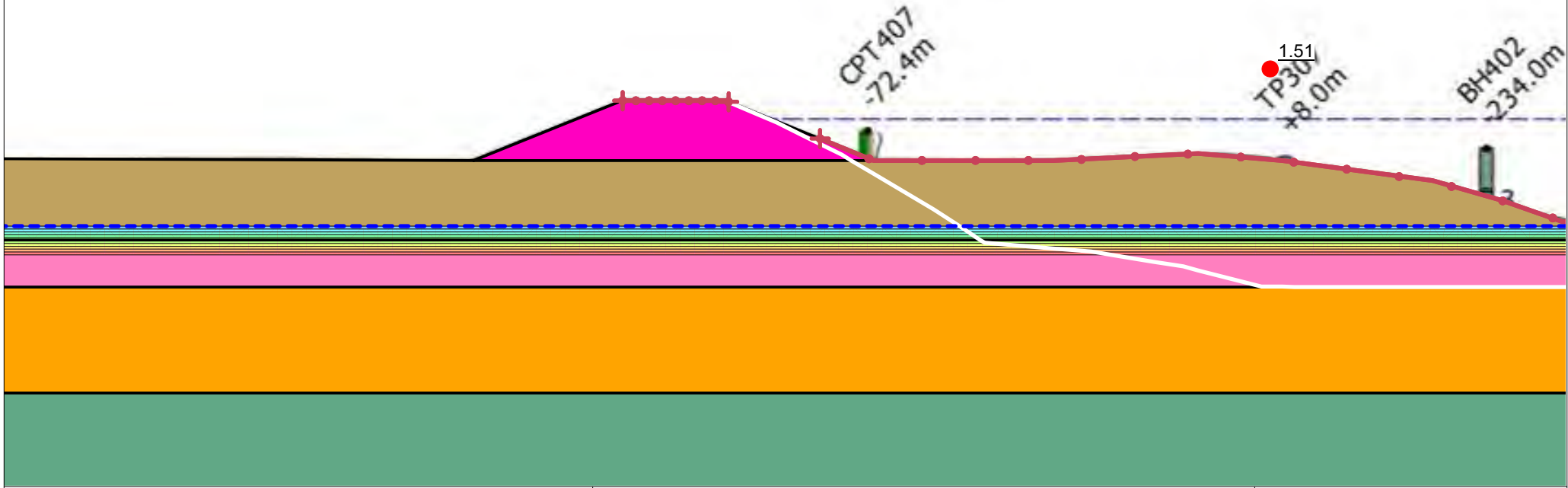
Horz Seismic Coef.: 0.55



Title: GZ-04 (CH4910)	Job Number: 1017353.2403
Analysis: 4.d Seismic ULS LS (yield)	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI



Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16			4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18			2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18			0	32	0
<span style="color: pink;">■</span>	3. SAND (liquefied)	SHANSEP	18	2	0.1			
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16			2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

Analysis: 5.a Post Seismic Liquefied RS

Analysed by: MIBU

Comments:

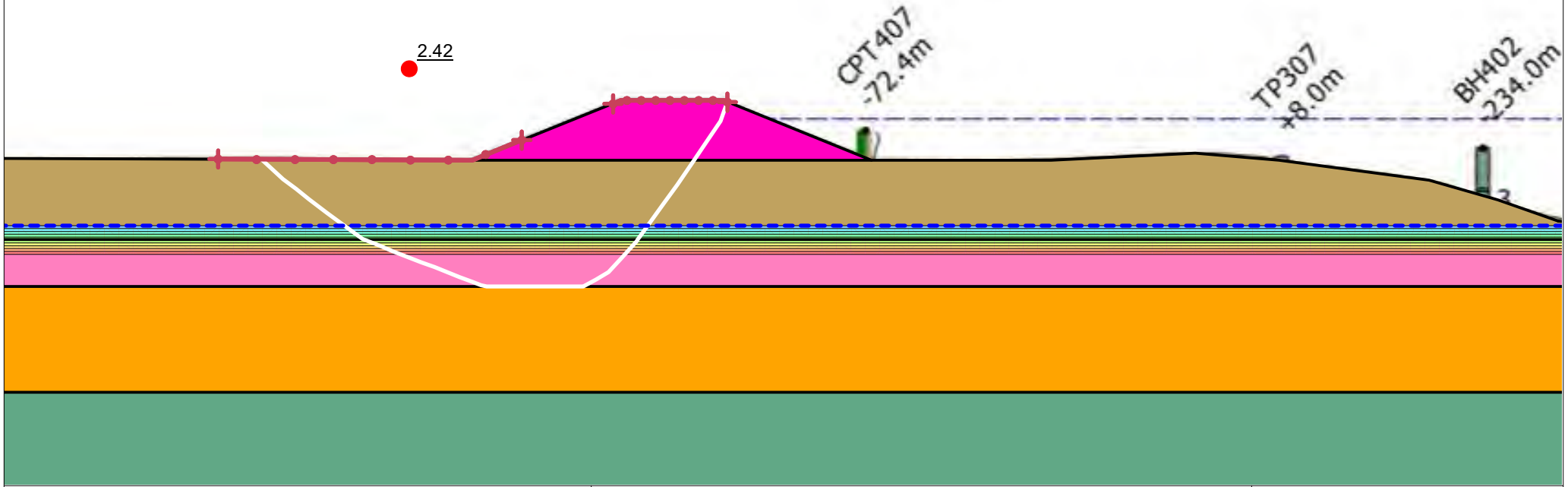
Scale: 1:200 @ A4

Checked by: DAMI

Water Pressure Head

- 0 - 0.1 m
- 0.1 - 0.2 m
- 0.2 - 0.3 m
- 0.3 - 0.4 m
- 0.4 - 0.5 m
- 0.5 - 0.6 m
- 0.6 - 0.7 m
- 0.7 - 0.8 m
- 0.8 - 0.9 m
- 0.9 - 1 m

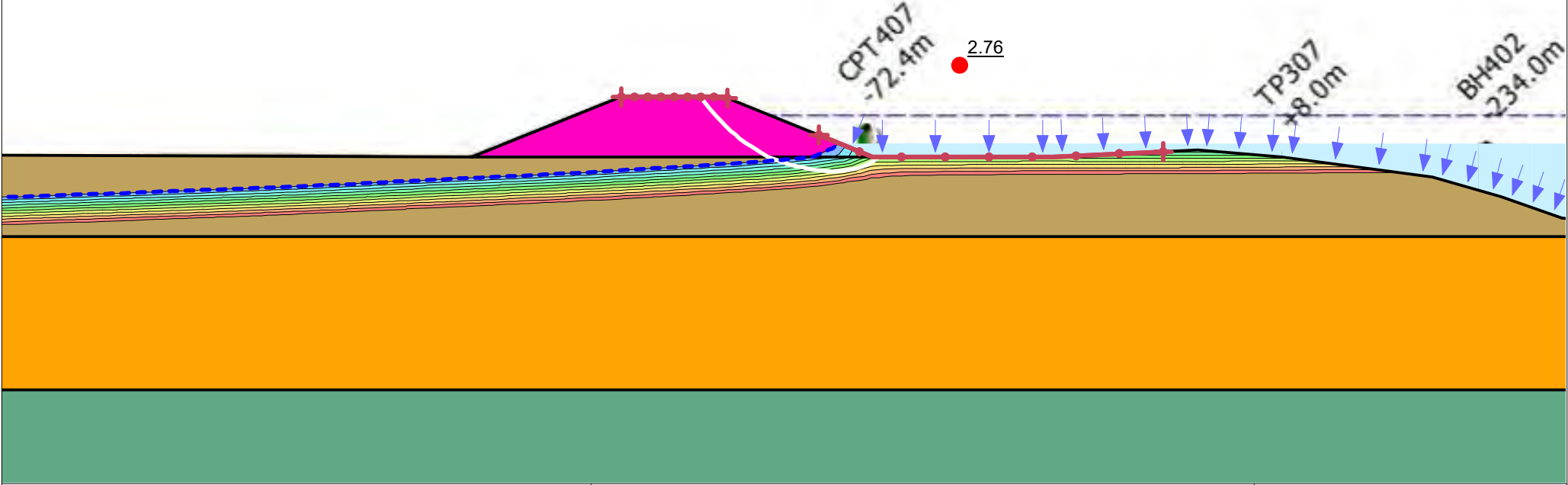
Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Minimum Strength (kPa)	Tau/Sigma Ratio	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16			4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18			2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18			0	32	0
<span style="color: pink;">■</span>	3. SAND (liquefied)	SHANSEP	18	2	0.1			
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16			2	28	0



Title: GZ-04 (CH4910)	Job Number: 1017353.2403
Analysis: 5.b Post Seismic Liquefied LS	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI

Water Pressure Head	
0 - 0.1 m	
0.1 - 0.2 m	
0.2 - 0.3 m	
0.3 - 0.4 m	
0.4 - 0.5 m	
0.5 - 0.6 m	
0.6 - 0.7 m	
0.7 - 0.8 m	
0.8 - 0.9 m	
0.9 - 1 m	

Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)

Job Number: 1017353.2403

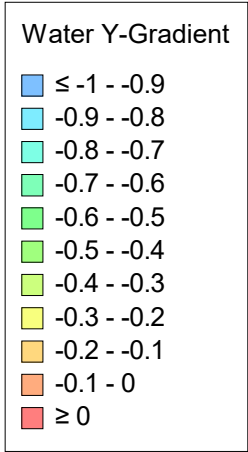
Analysis: 6.a Rapid Drawdown RS

Analysed by: MIBU

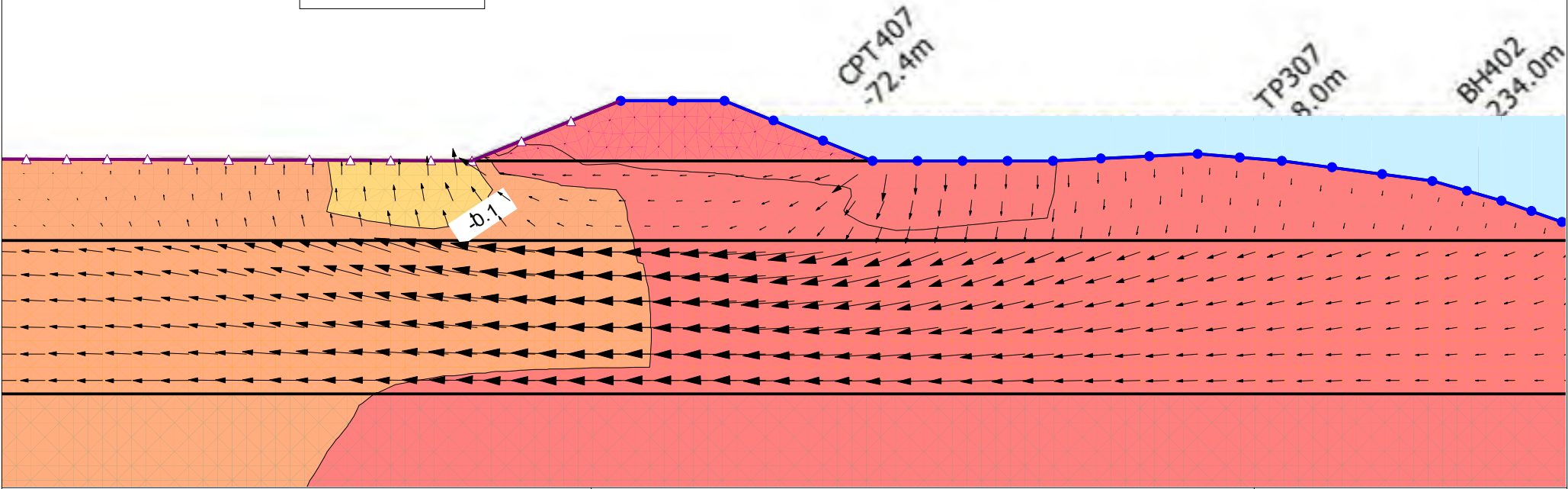
Comments:

Scale: 1:200 @ A4

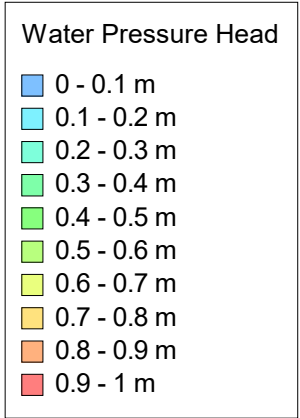
Checked by: DAMI



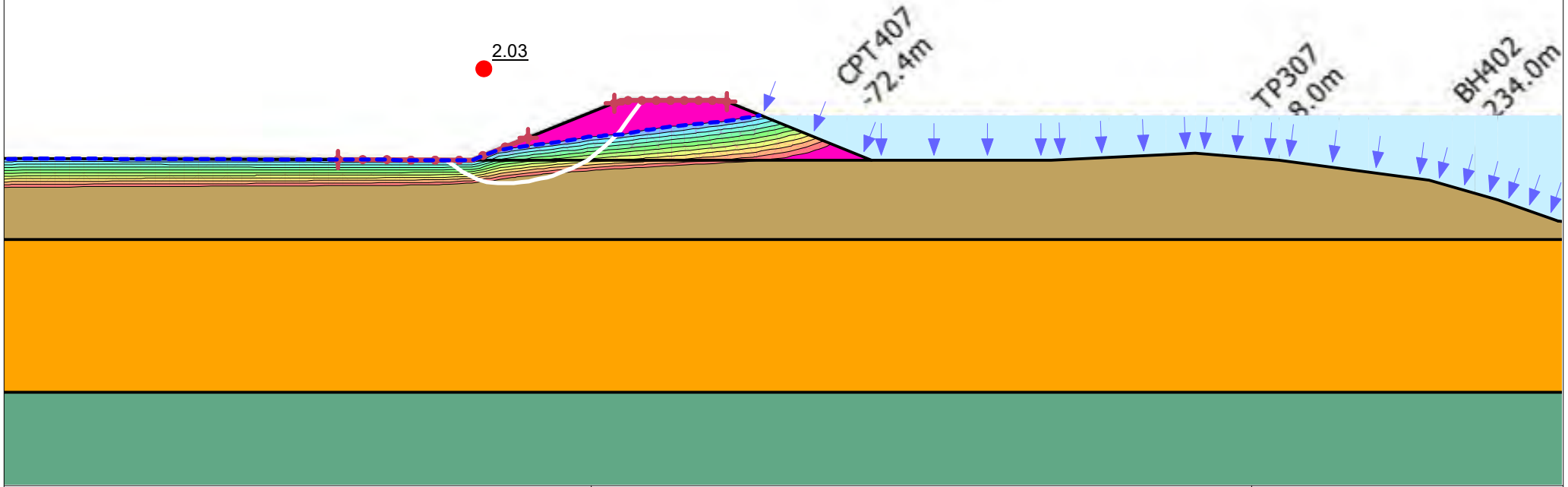
Color	Name	Hydraulic Material Model	Vol. WC. Function	K-Function	Ky'/Kx' Ratio	Rotation (°)
█	1. Stopbank Fill	Saturated / Unsaturated	Sandy SILT / SILT (FILL MATERIAL)	Sandy SILT / SILT (Fill)	0.25	0
█	2. Silty SAND / Sandy SILT	Saturated / Unsaturated	Silty SAND / Sandy SILT	Silty SAND / Sandy SILT	1	0
█	3. SAND	Saturated / Unsaturated	SAND	SAND	1	0
█	4. SILT	Saturated / Unsaturated	SILT	SILT	1	0



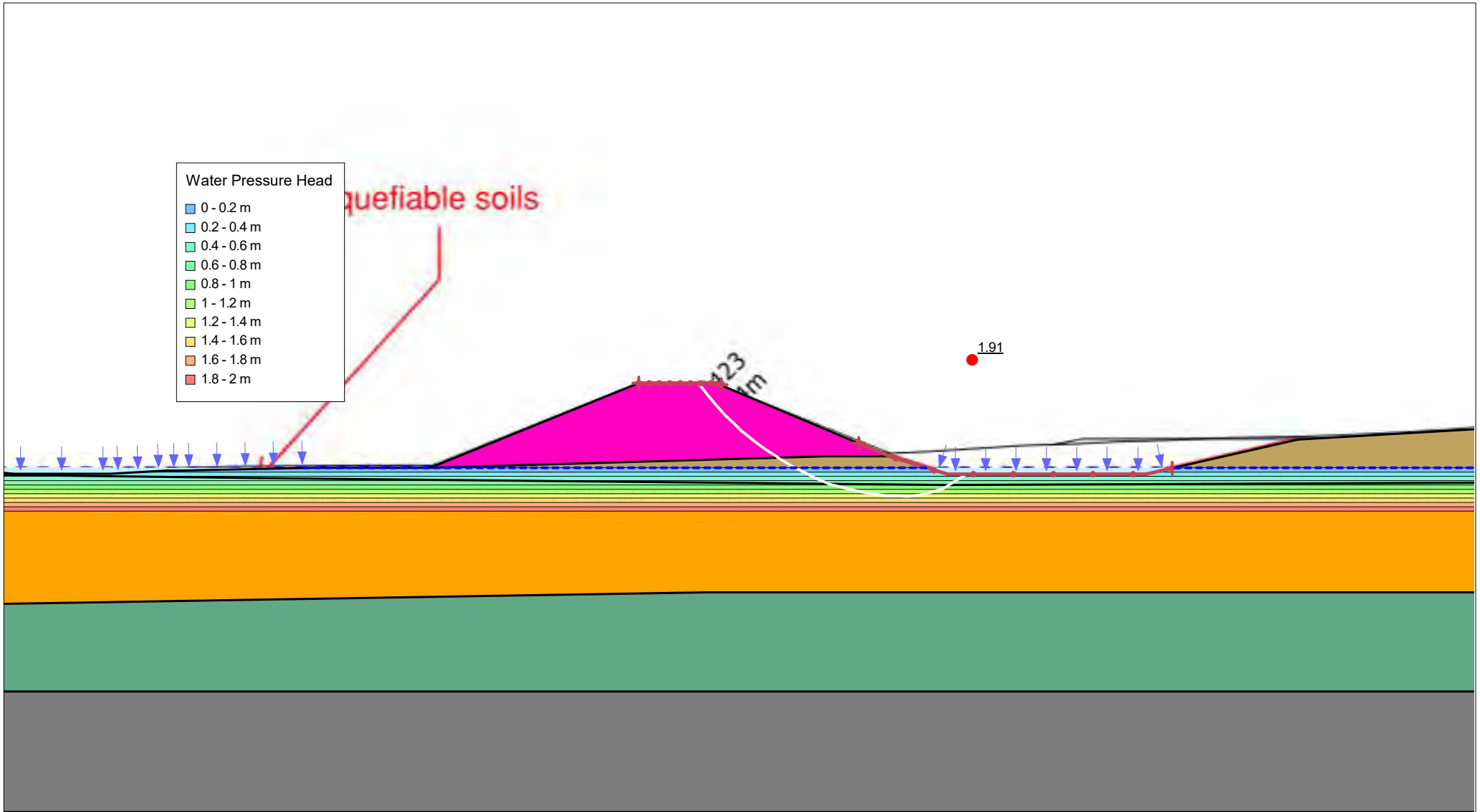
Title: GZ-04 (CH4910)		Job Number: 1017353.2403
Analysis: 6b. Constant Seepage LS		Analysed by: MIBU
Comments:	Scale: 1:200 @ A4	Checked by: DAMI



Color	Name	Slope Stability Material Model	Unit Weight (kN/m <sup>3</sup> )	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
<span style="color: magenta;">■</span>	1. Stopbank Fill	Mohr-Coulomb	16	4	32	0
<span style="color: brown;">■</span>	2. Silty SAND / Sandy SILT	Mohr-Coulomb	18	2	31	0
<span style="color: orange;">■</span>	3. SAND	Mohr-Coulomb	18	0	32	0
<span style="color: green;">■</span>	4. SILT	Mohr-Coulomb	16	2	28	0



Title: GZ-04 (CH4910)	Job Number: 1017353.2403
Analysis: 6b. Constant Seepage LS_stability	Analysed by: MIBU
Comments:	Scale: 1:200 @ A4
	Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

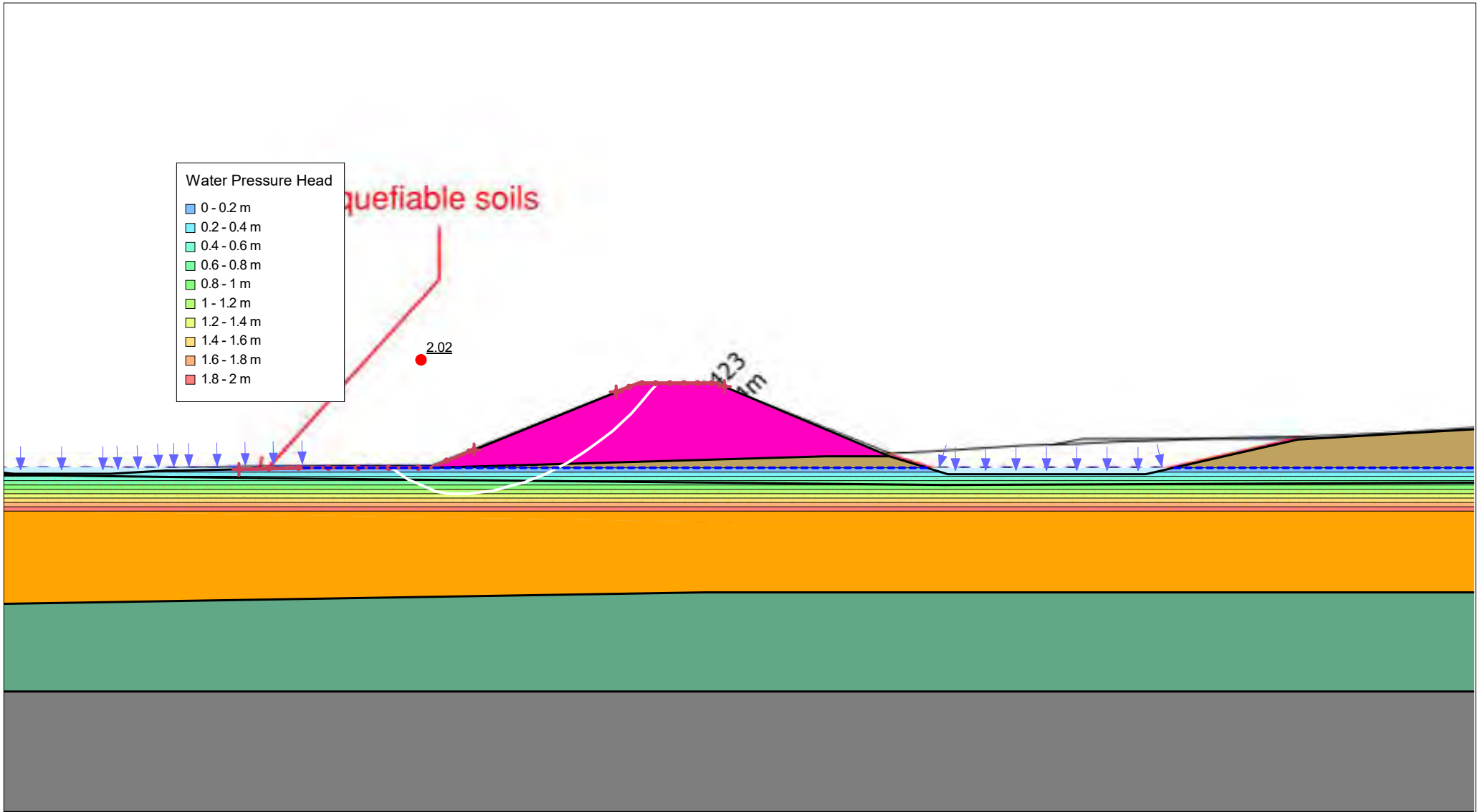
Analysis: 1.a. Static RS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

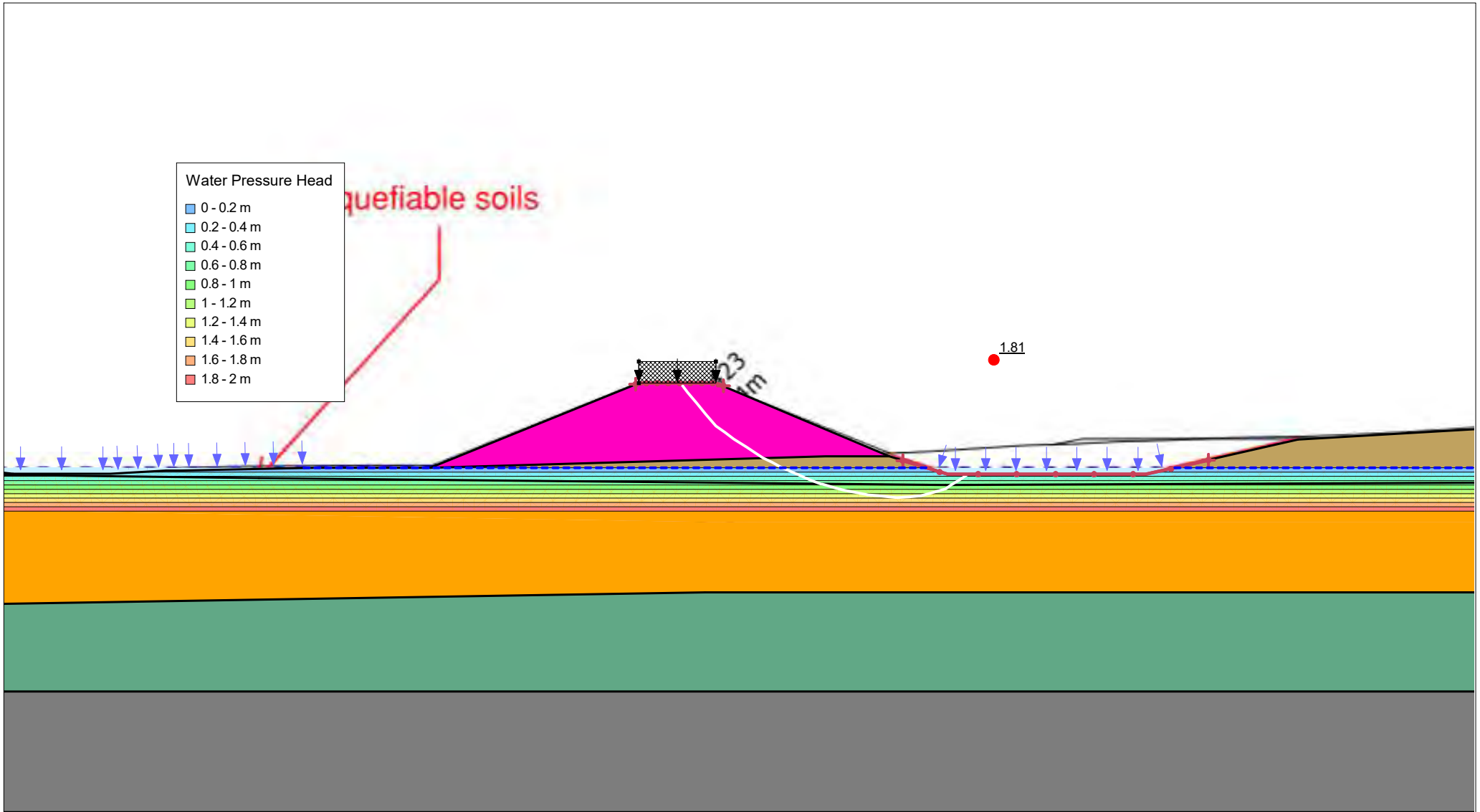
Analysis: 1.b. Static LS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

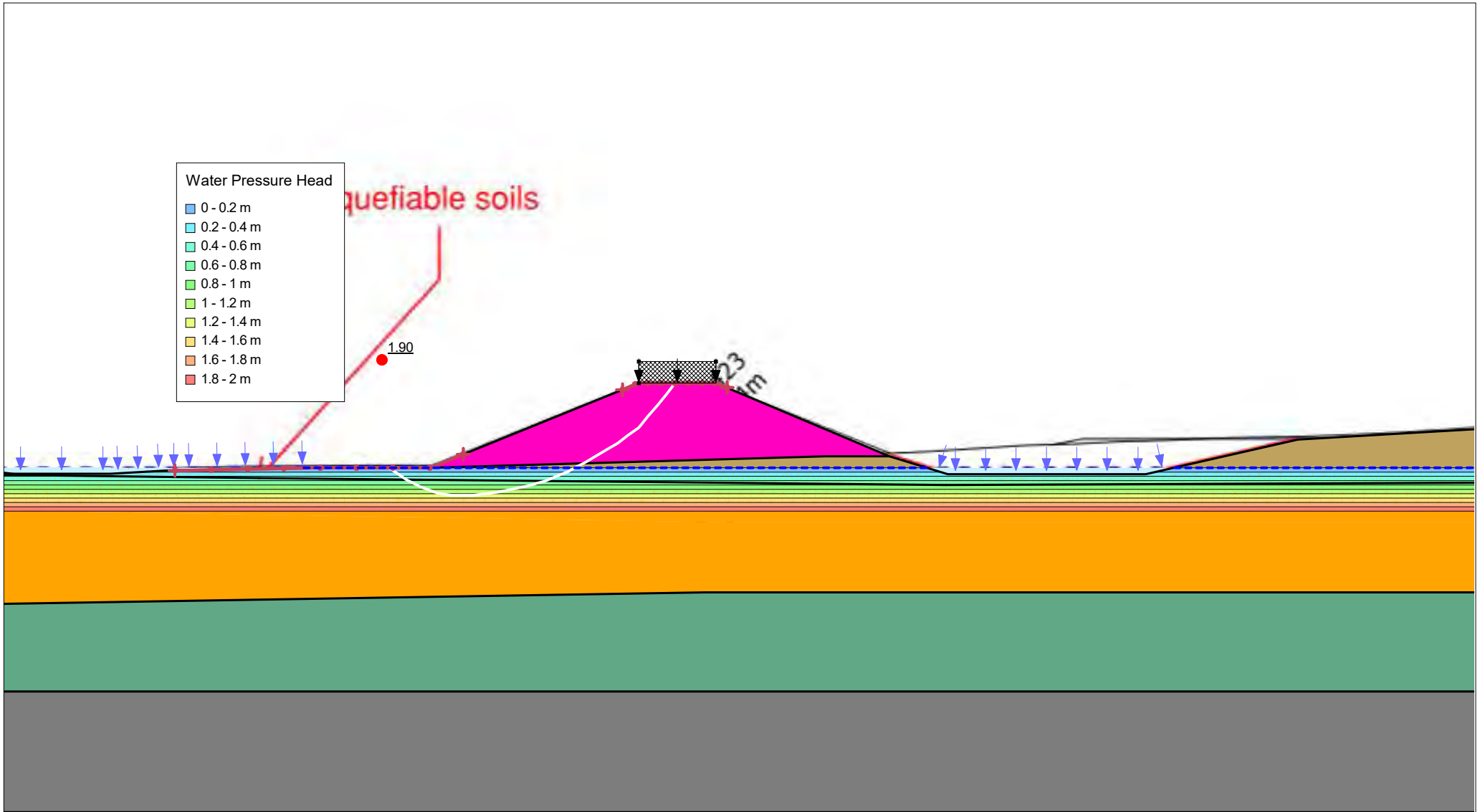
Analysis: 1.c. Static traffic RS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

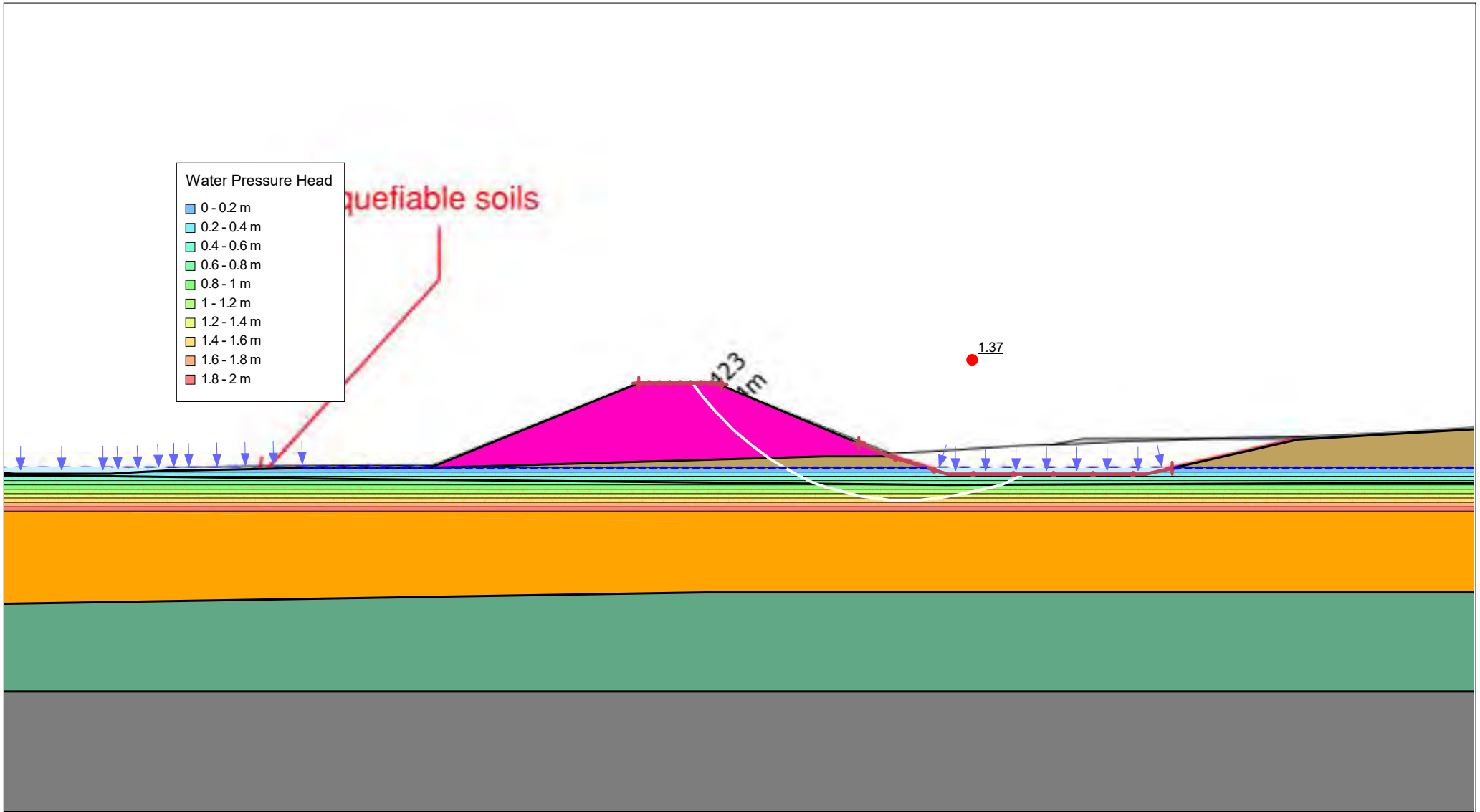
Analysis: 1.d. Static traffic LS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

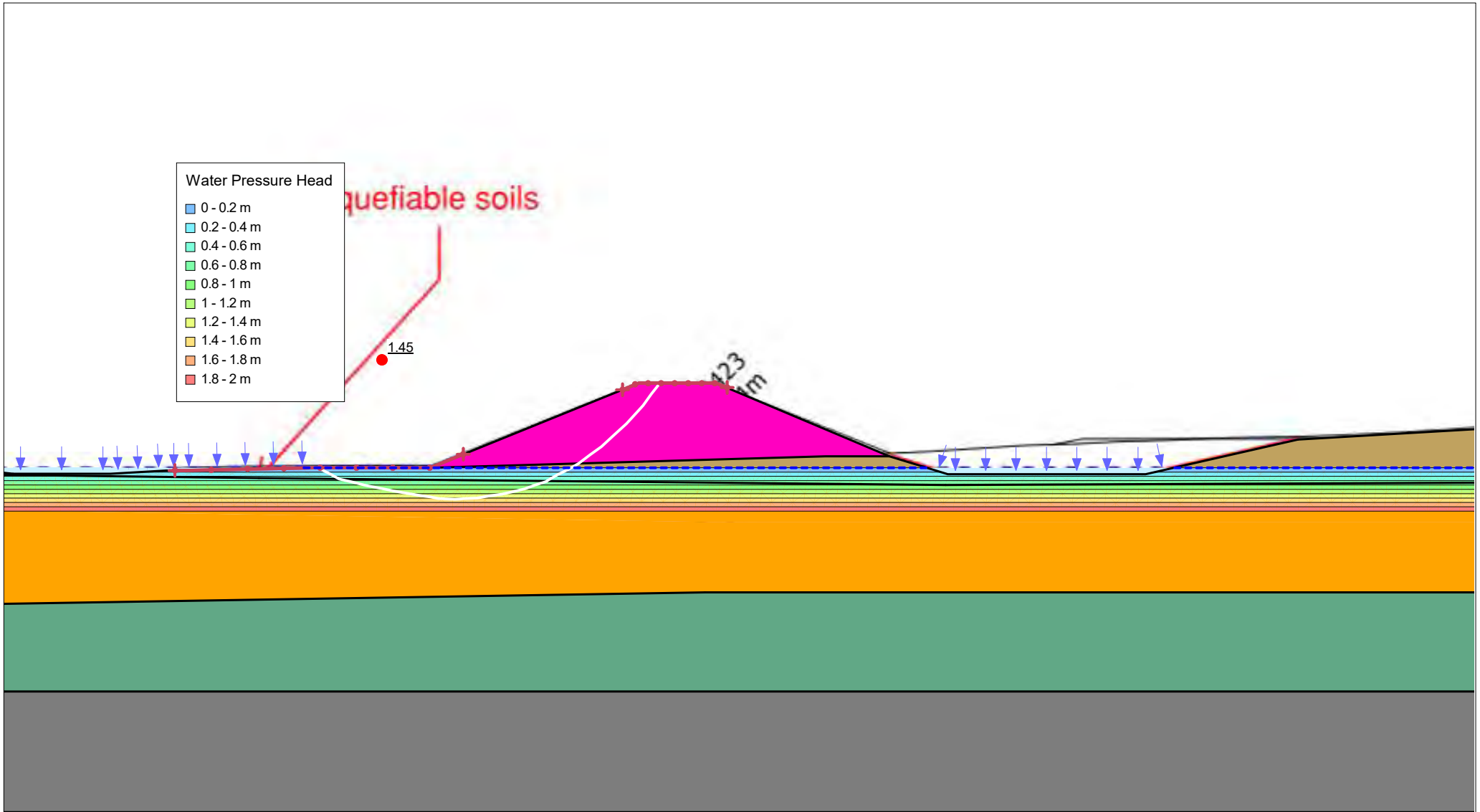
Analysis: 2.a. Seismic SLS RS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

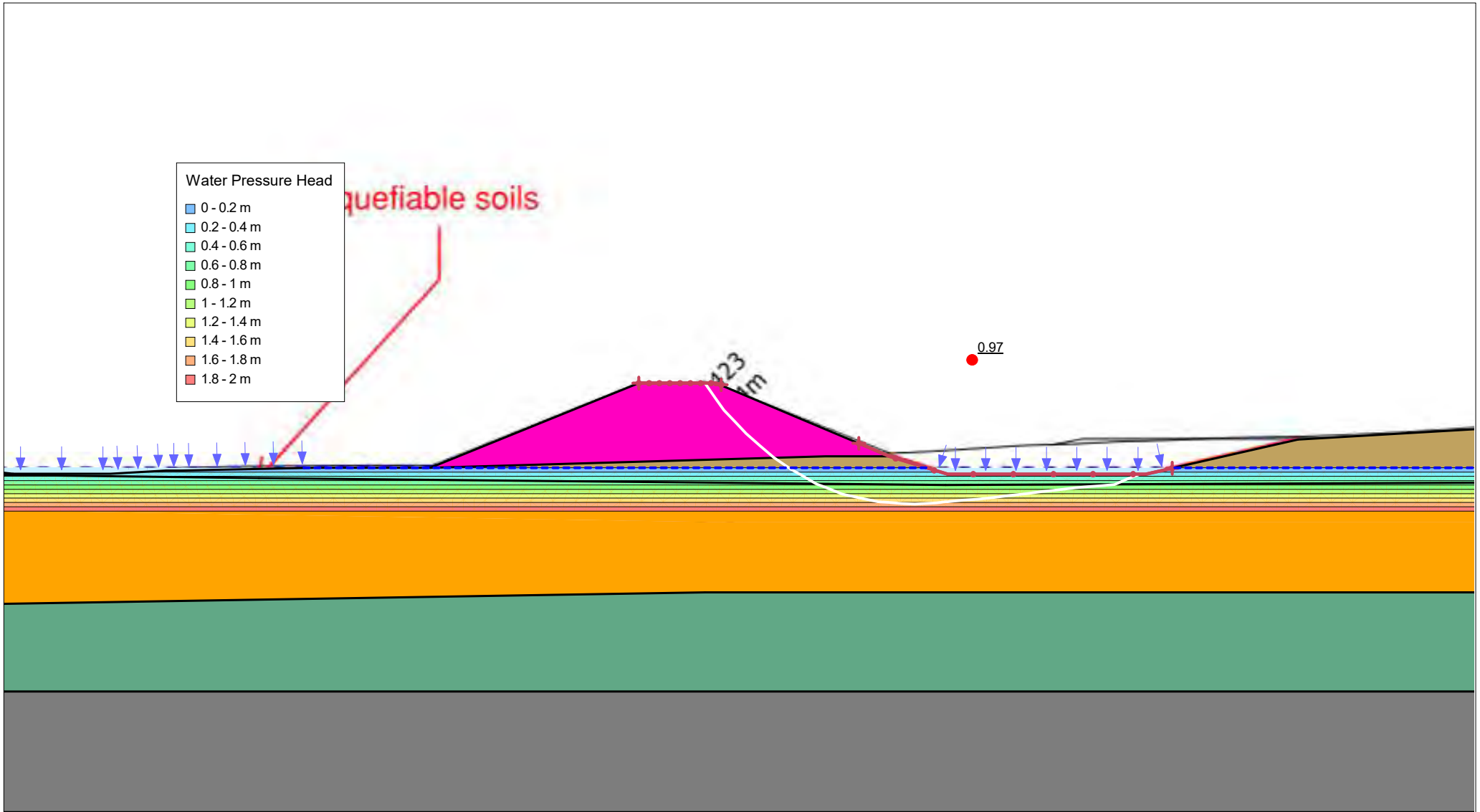
Analysis: 2.b. Seismic SLS LS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

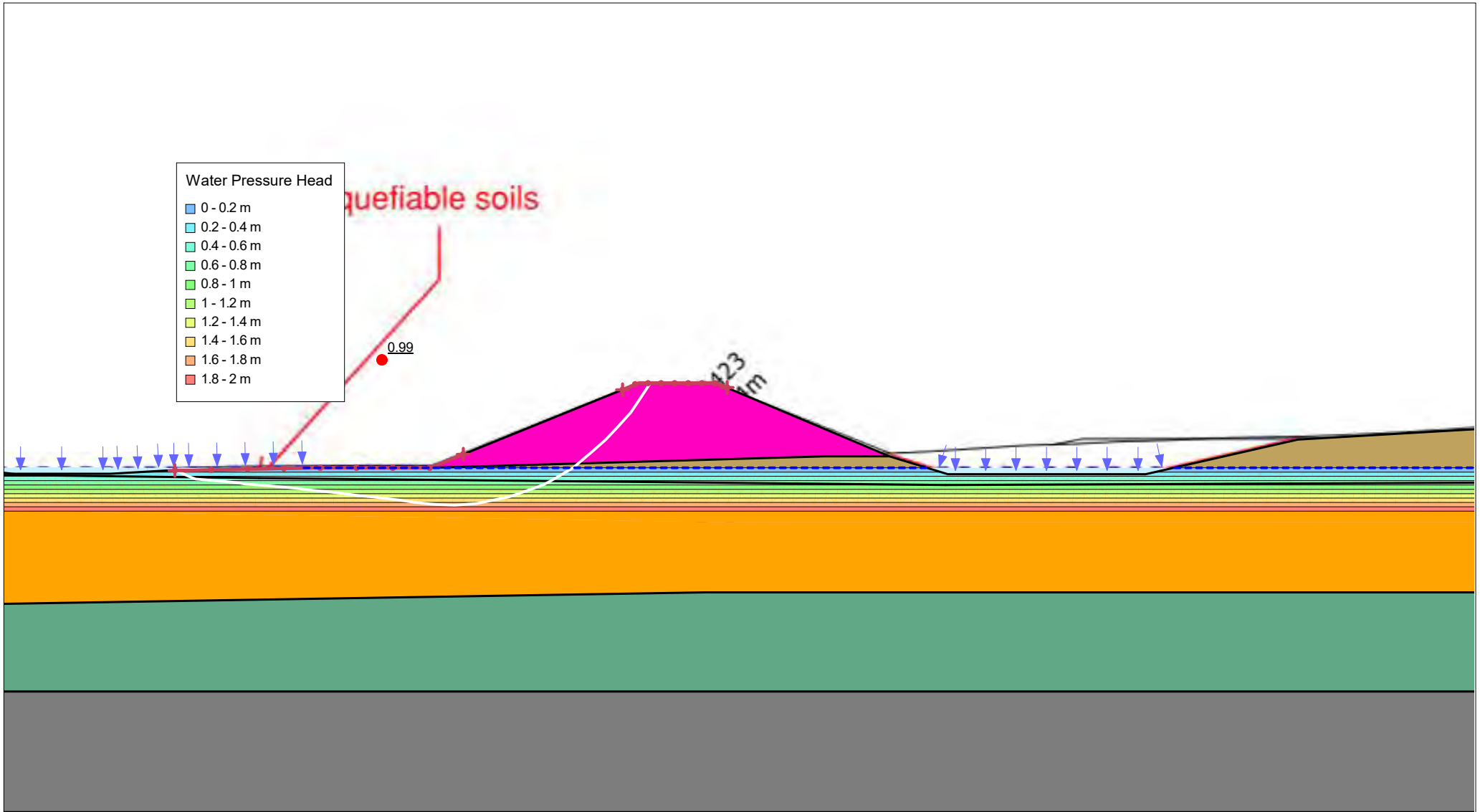
Analysis: 3.a. Seismic ILS RS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

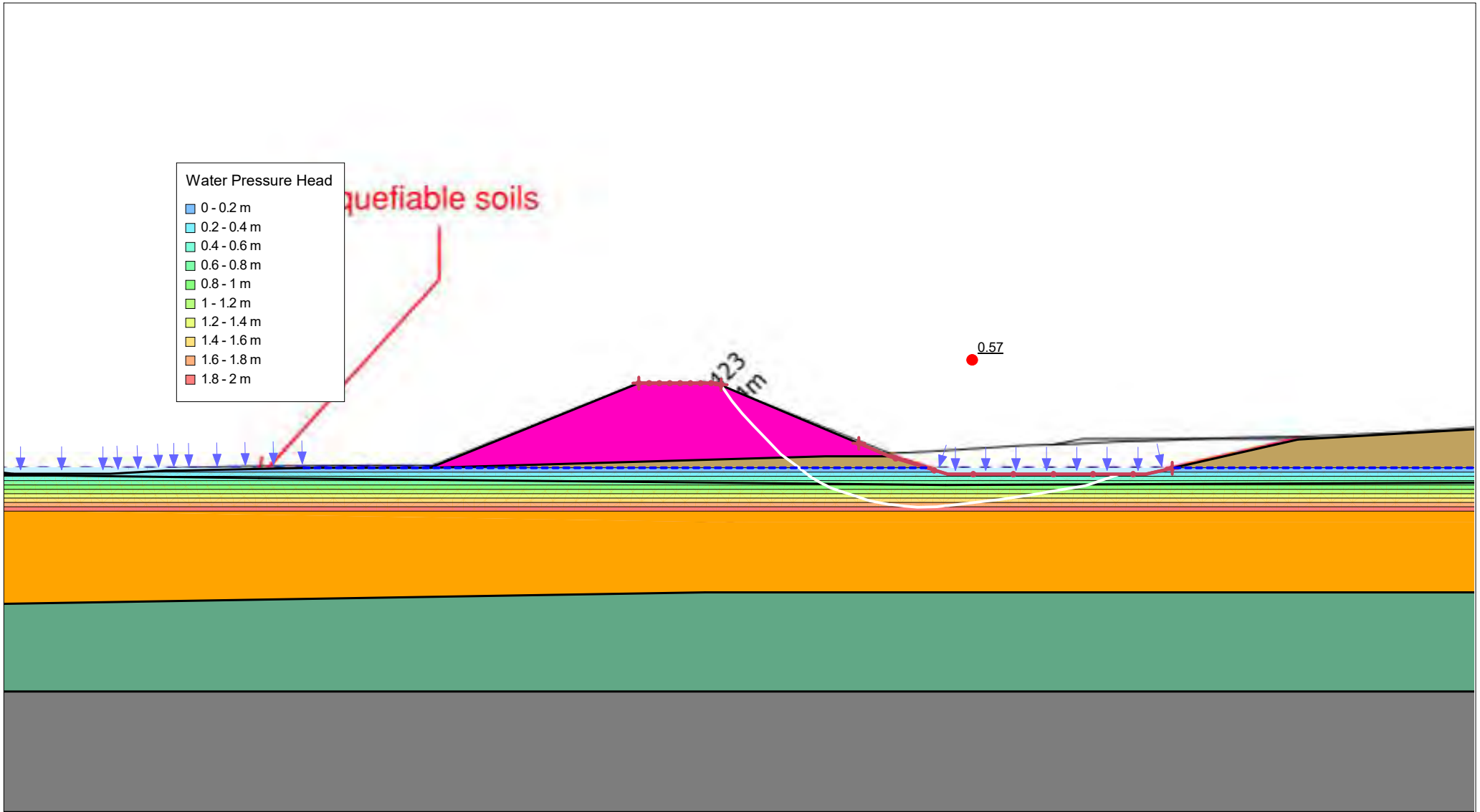
Analysis: 3.b. Seismic ILS LS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

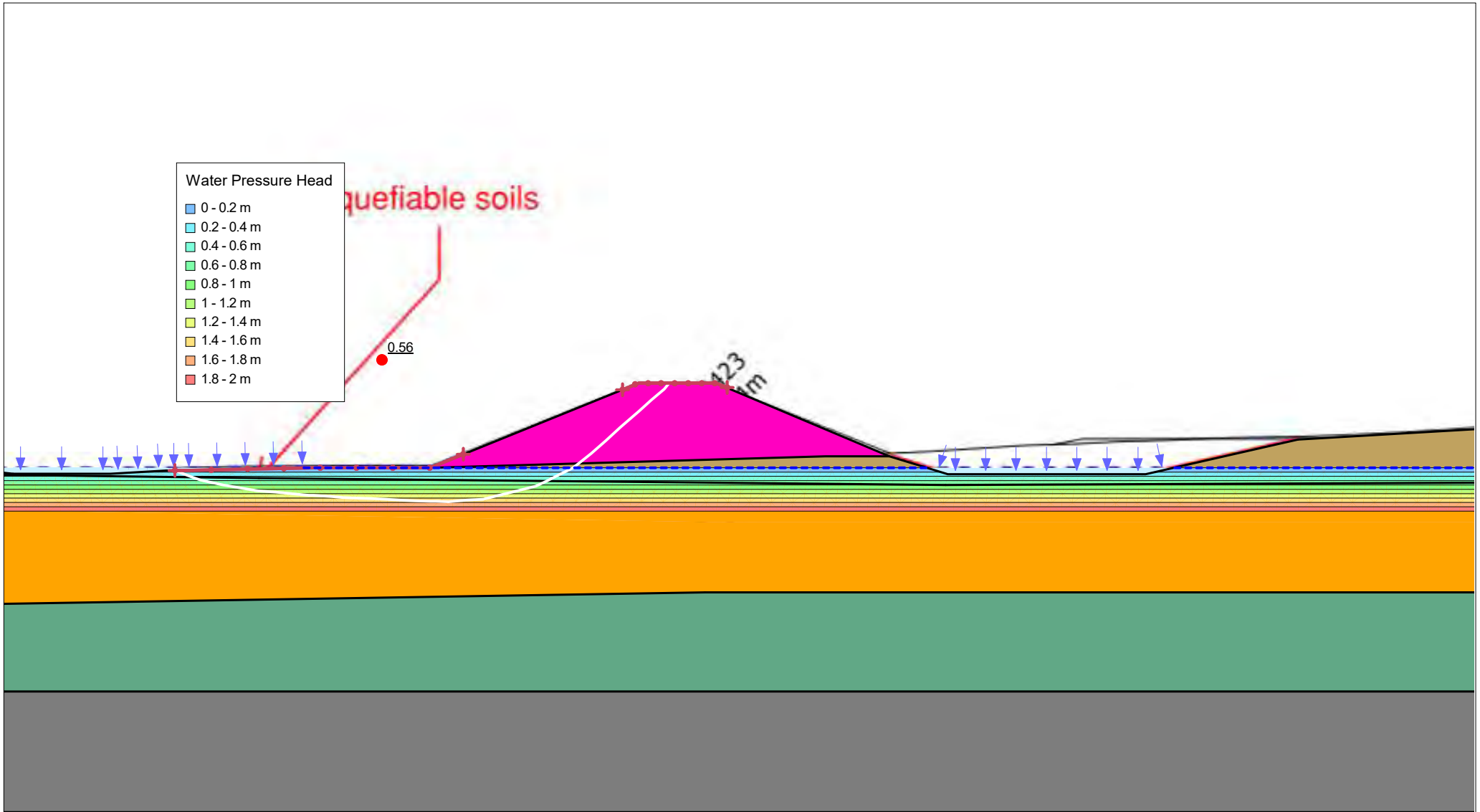
Analysis: 4.a. Seismic ULS RS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

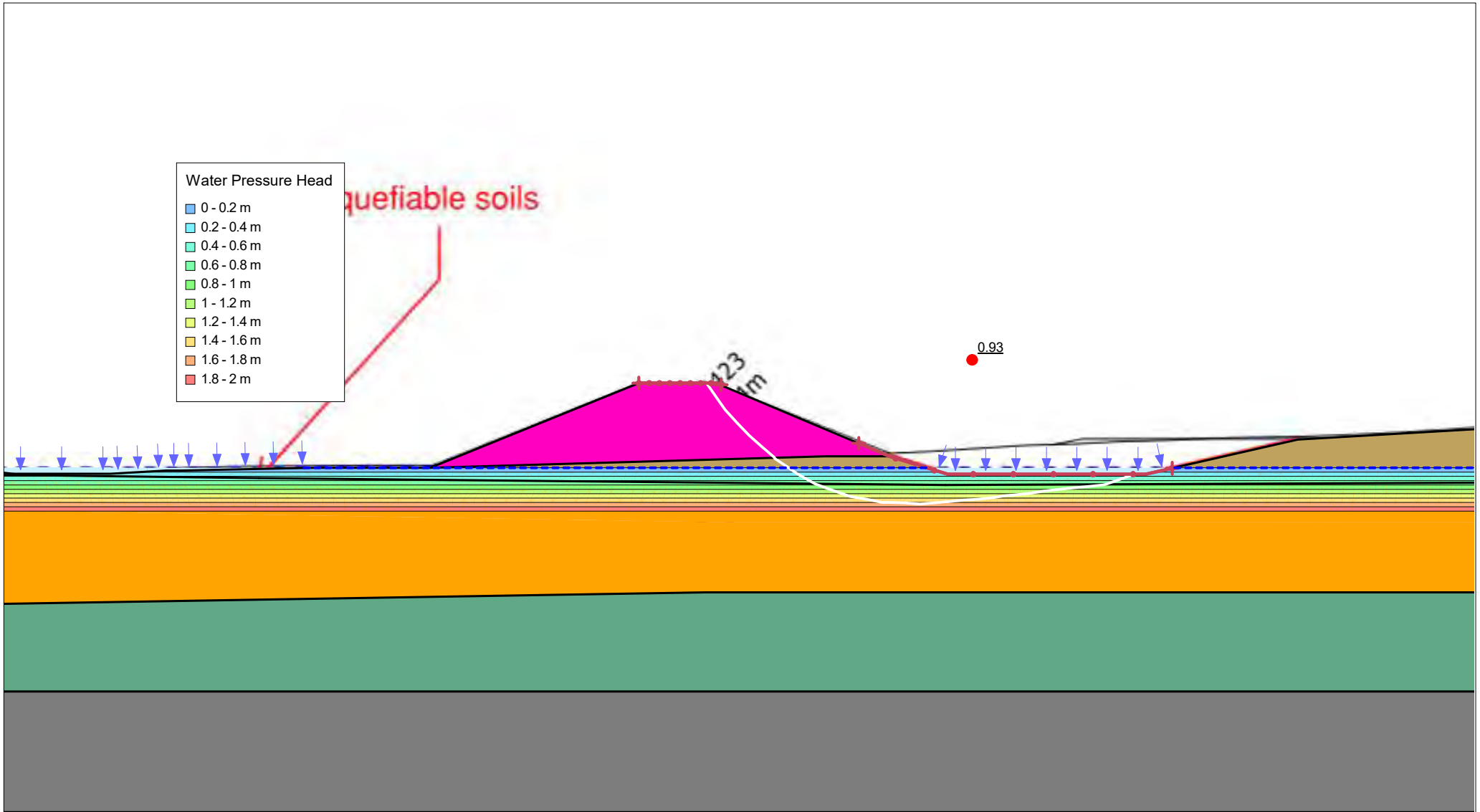
Analysis: 4.b. Seismic ULS LS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Horz Seismic Coef.: 0.25g



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

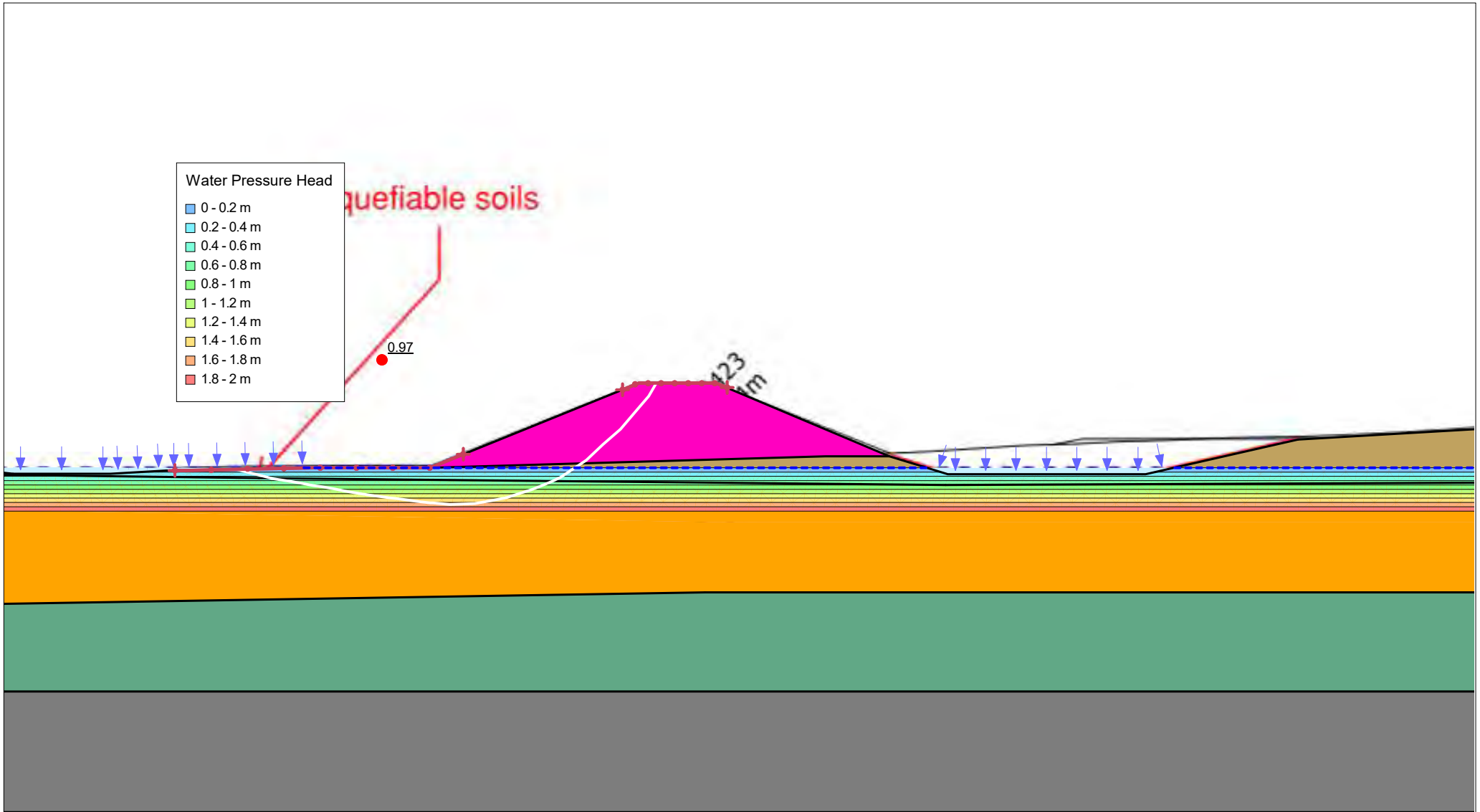
Analysis: 4.c. Seismic ULS RS (yield)

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Horz Seismic Coef.: 0.26g



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

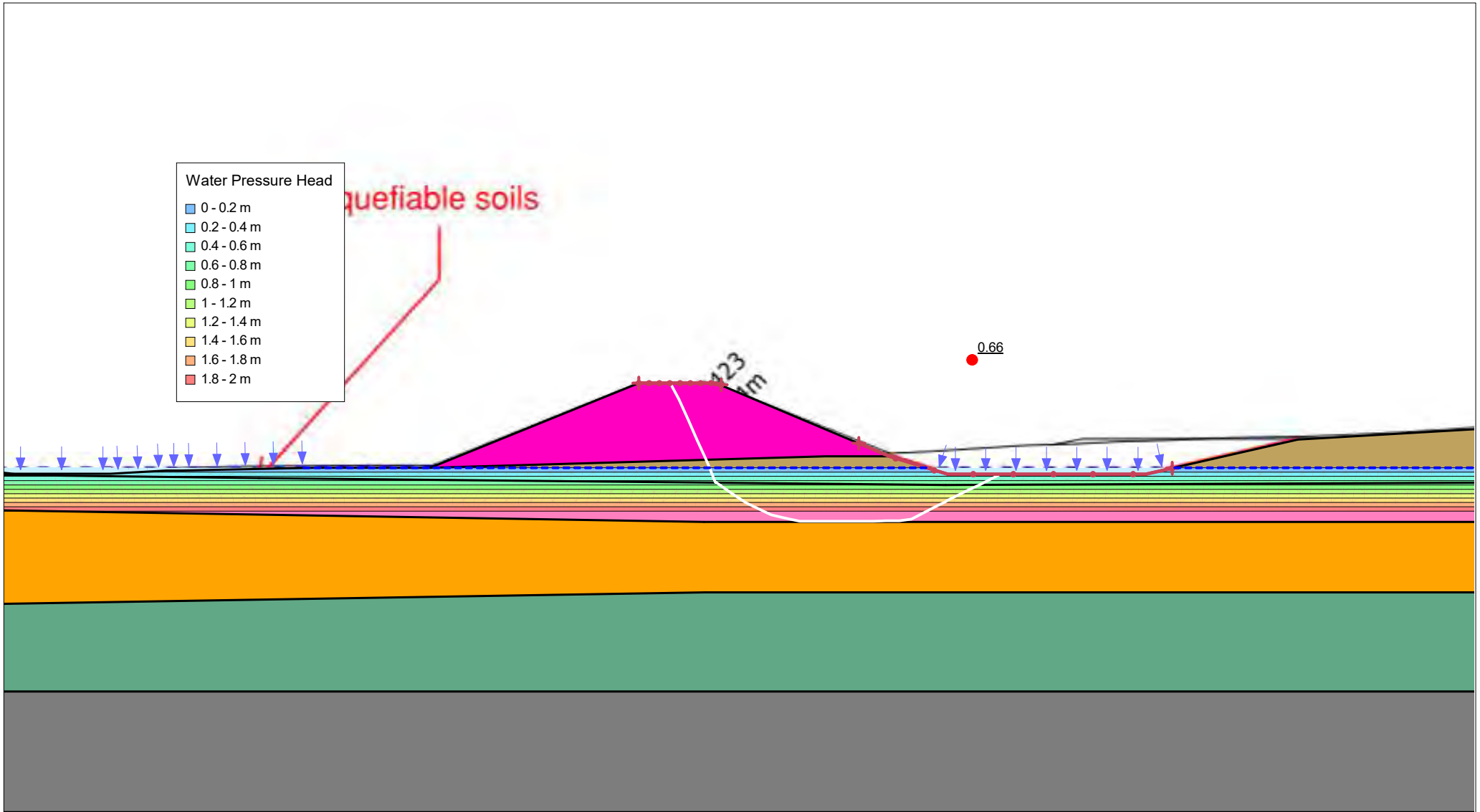
Analysis: 4.d. Seismic ULS LS (yield)

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

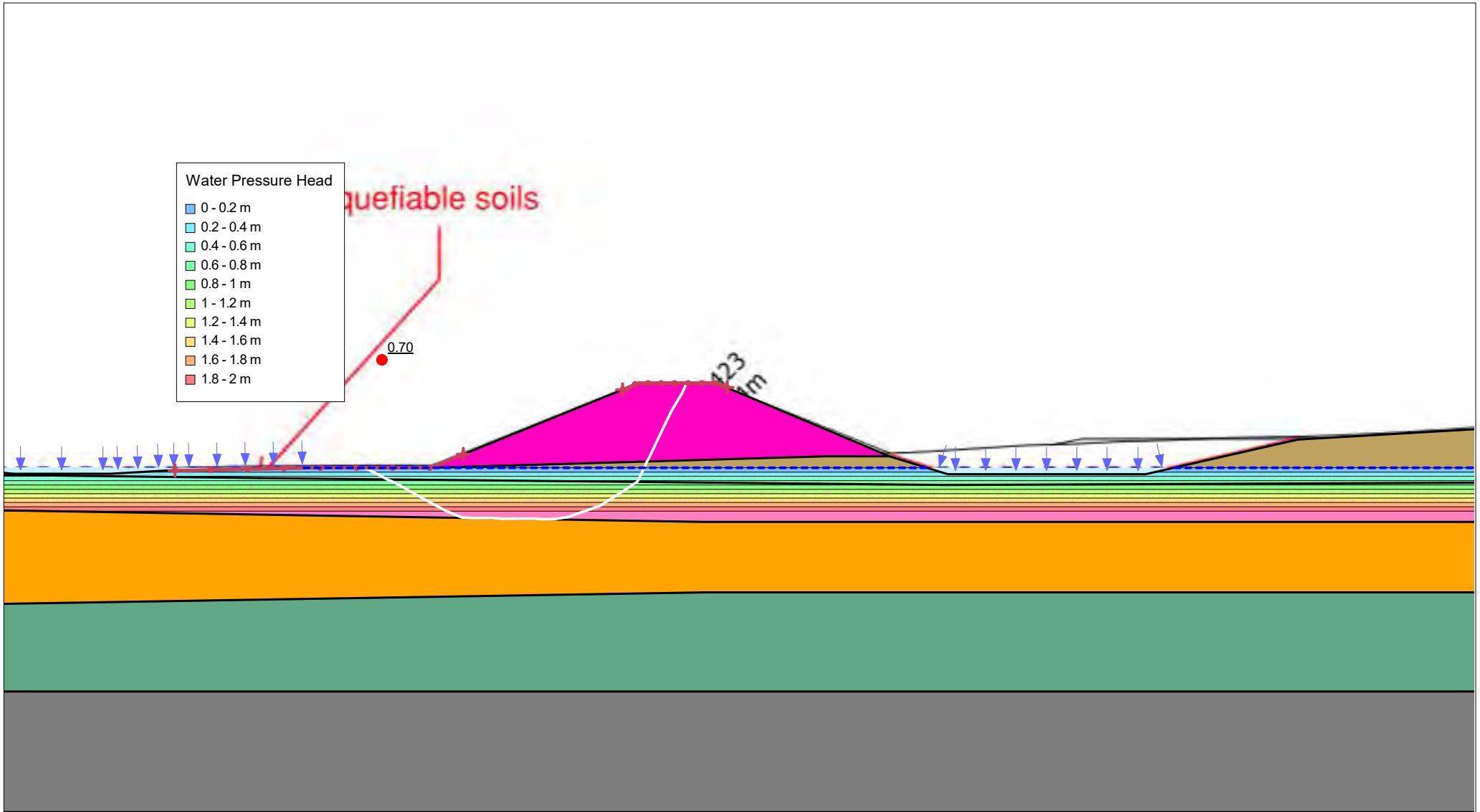
Analysis: 5.a. Post-seismic liquefied RS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

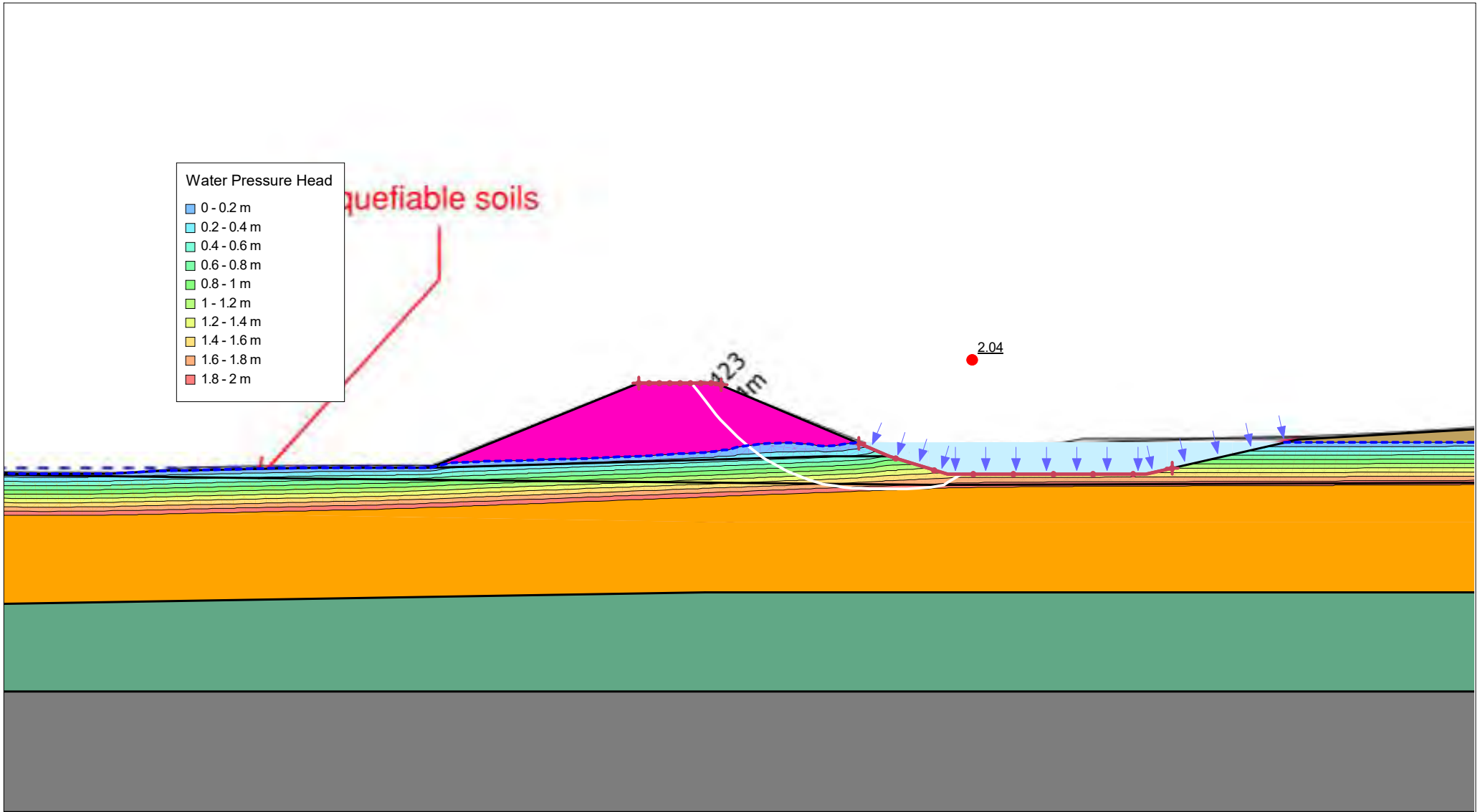
Analysis: 5.b. Post-seismic liquefied LS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

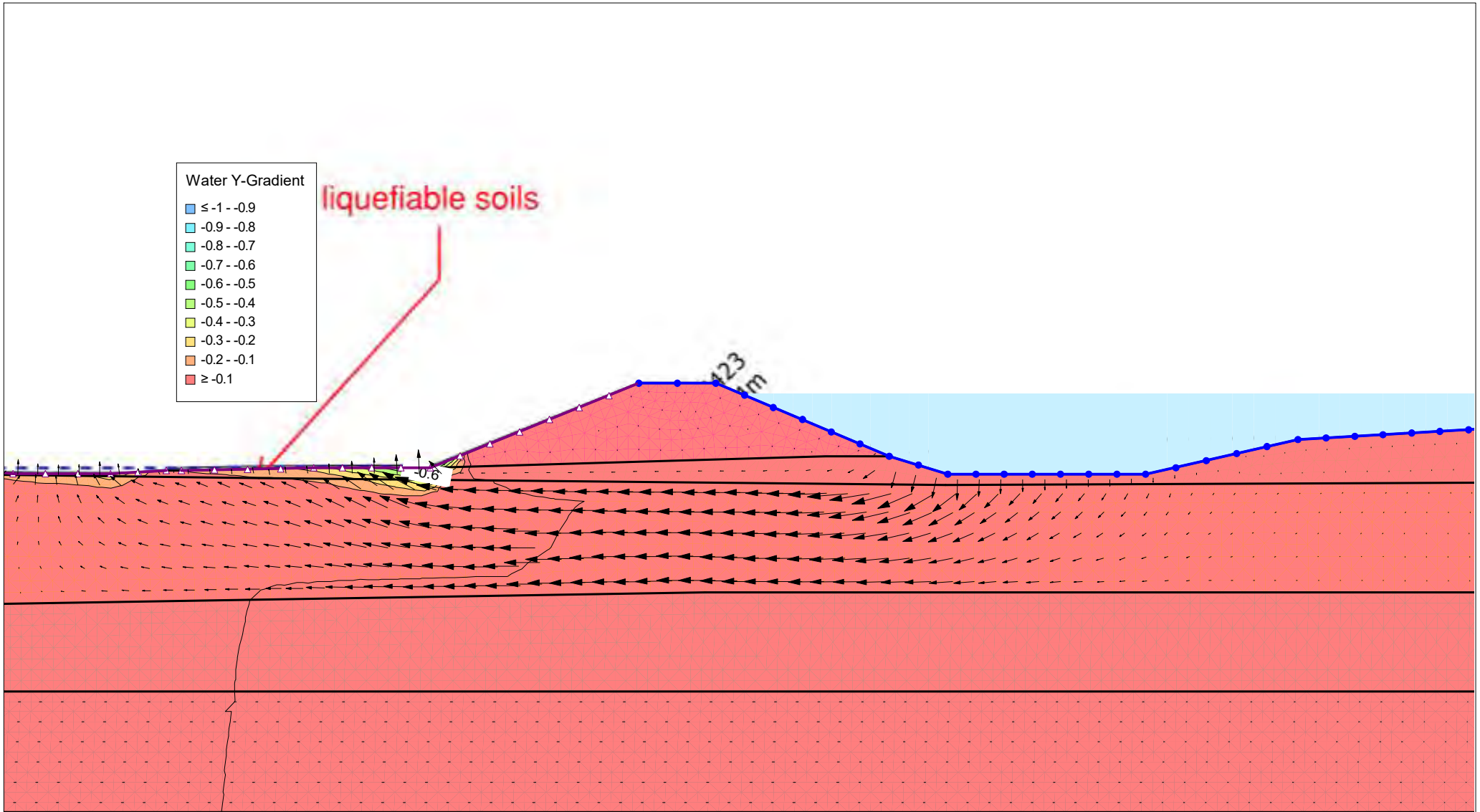
Analysis: 6.a. Rapid Drawdown RS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

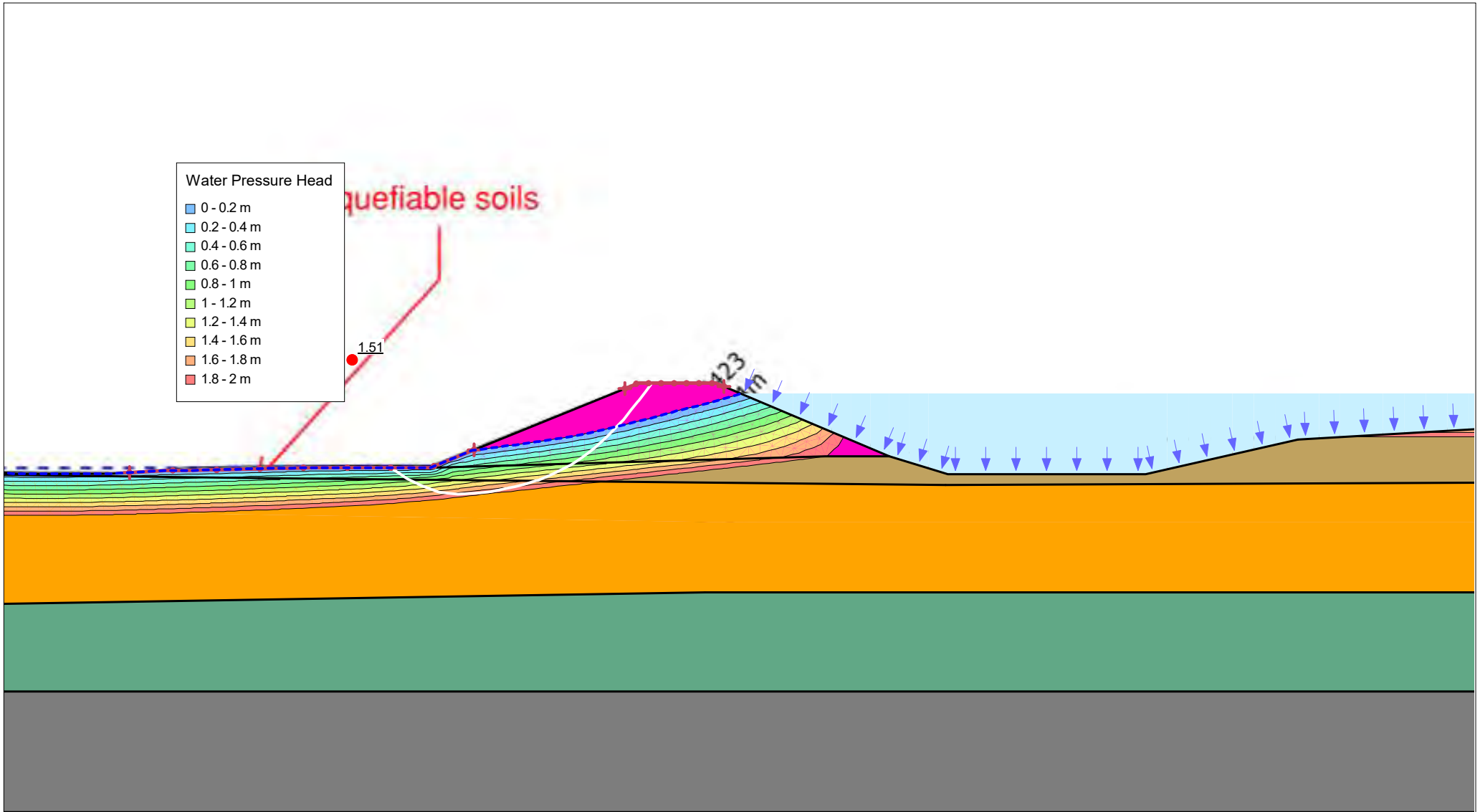
Analysis: 6b. Constant Seepage LS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI



Title: GZ-05 (CH3715)

Job Number: 1017353.2403

Analysis: 6b. Constant Seepage\_stability LS

Analysed by: MIBU

Comments:

Scale: 1:250 @ A4

Checked by: DAMI

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