

SAM PROPERTY

BLACK SWAMP ROAD, MANGAWHAI

GEOTECHNICAL ASSESSMENT REPORT FOR A PROPOSED PLAN CHANGE

INITIA REF P-001431 REV B

SEPTEMBER 2024

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1. Introduction

1.1 General

Initia Limited has been engaged by SAM Property Ltd to undertake limited geotechnical investigations and to provide preliminary geotechnical assessment of the proposed Plan Change Application for land at Black Swamp Road, Mangawhai.

This Geotechnical Assessment Report (GAR) has been prepared to provide geotechnical advice to support submission for a *Proposed Plan Change (PPC) application* to Kaipara District Council. Conclusions and advice presented in this report are based on Initia site-specific geotechnical investigations which are presented as part of this report.

It must be noted that the Plan Change area covers a much larger area than the site extents recently investigated by Initia. We understand that the area to the south of Black Swamp Road has been assessed by another geotechnical consultant. Accordingly, Initia will not comment on this block of land. Based on the proposed Plan Change zone map provided to us by Aspire Consulting Engineers, the site will split into the following development categories:

- Rural Lifestyle Zone (146,870m²)
- Large Lot Residential (66,950m²)
- Low Density Residential (513,630m²)
- Medium Density Residential (125,650m²)
- Neighbourhood Centre Zone (26,550m²)
- Mixed Use Zone (22,350,²)

An extract of this plan is presented in Figure 1-2 below.



Figure 1-1 Proposed Plan Change Zoning



This report outlines the findings from an initial geotechnical desktop study and result of recent sitespecific investigations undertaken by Initia. This information has been used to review the ground conditions of the site for the proposed plan change and to provide comment on the likely implication any geotechnical hazards may have on the development of this site in the future.

1.2 Scope of Work

Given that this is for a Plan Change, we have assessed the site for the typical geotechnical constraints that may affect developments.

Our scope of work for the project is outlined below:

- Site specific ground investigations.
- Development of a subsurface model of the site.
- Earthwork considerations and reusability of encountered subsoils.
- Assessment of the site subsoil class in accordance with NZS1170.5.
- Liquefaction susceptibility and consequential effects.
- Road pavement and floor slab considerations.

General comments and advice are provided for ground improvement works, liquefaction and consequential effects and/or for risks related to foundation design. Detailed design of those elements is however outside the scope of works covered in this report but should be carried out for any Resource and Building Consent applications in the future.

1.3 Project Overview

1.3.1 Site Description

The proposed site is located off Black Swamp Road, Mangawhai, and is legally identified as Lot 1 DP 29903, Lot 3 DP 177202, and Section 3 Block IV Mangawhai SD. The site is located approximately 1.5 km from the Mangawhai township.

The site is currently utilised as farmland used for grazing cattle. The neighbouring properties are used for agricultural purposes. A minor estuary of the Mangawhai Harbour is located approximately 60 m from the southern boundary. A site location plan showing the site area assessed by Initia is presented in 2 below. As discussed previously the additional Plan Change area to the south of Black Swamp Rd is being assessed by another geotechnical consultant.





Figure 1-2: Black Swamp Road Proposed Plan Change area assessed by Initia (Kaipara GIS excerpt)



2. Geological Overview and Site Investigation

2.1 Published Geology

Based on review of the published geological map and our general knowledge of ground conditions in the area, the site is mapped as being underlain by Late Pleistocene River deposits (OIS5), which are typically described as poorly consolidated mud, sand, gravel and peat deposits of alluvial, swamp and estuarine origins. Holocene River deposits are mapped to the north of the subject site, which is typically described as unconsolidated to poorly consolidated mud, sand, gravel and peat deposits of alluvial, solution and lacustrine origins.



Figure 2-1: Mangawhai Geological Map Excerpt (Sourced: GNS Webapp)

2.2 Ground Investigation

Initia has undertaken two rounds of ground investigations at the site area that we are assessing:

- The first round of ground investigation was carried out on the 22nd June 2022. Investigations comprised 12 no. Test Pits dug by a local contractor and 12 no. Cone Penetration Tests undertaken by Underground Investigations Ltd.
- A second round of ground investigation was carried out between 21st and 22nd of February 2024 included 22 no. Test Pits dug by a local contractor and 18 no. Cone Penetration Tests undertaken by Underground Investigations Ltd.

The test pits were undertaken under the supervision of an Initia geotechnical engineer who logged the arisings in general accordance with the NZGS guidelines. Upon completion the test pits were backfilled using excavated spoil and track rolled.

All investigation locations were surveyed using a handheld GPS unit. The site investigation locations are shown on Figure 1431-G01 in Appendix A. The test pit and cone penetration test logs are attached in Appendix B. A summary of the investigations is outlined in Table 2-1 below.



Site Investigation	Coord	linates ¹	Ground Surface	Termination			
ID	Easting (mE)	Northing (mN)	Elevation ² (mRL)	Depth (mbgl)			
TP01	1743276.2	6000781.6	7.0	1.9			
TP02	1743096.5	6000761.6	5.0	2.7			
TP03	1743341.2	6000695.3	7.0	2.7			
TP04	1743164.7	6000647.9	6.0	1.7			
TP05	1743065.4	6000585.5	5.0	2.3			
TP06	1743267.7	6000554.9	7.0	2.1			
TP07	1743166.5	6000464.5	6.0	2.2			
TP08	1742997.4	6000422.9	7.0	2.3			
TP09	1743180.8	6000356.8	6.0	2.0			
TP10	1742934.0	6000345.4	7.0	2.3			
TP11	1743142.7	6000250.3	6.0	2.1			
TP12	1743057.5	6000204.3	6.0	2.0			
TP101	1743393.1	6000718.7	6.2	3.0			
TP102	1743193.8	6000843.6	6.3	3.0			
TP103	1743044.5	6000790.7	4.5	2.8			
TP104	1743066.8	6000684.5	4.5	2.4			
TP105	1743008.6	6000588.2	4.4	2.2			
TP106	1743100.9	6000515.1	4.7	2.8			
TP107	1743050.6	6000355.7	4.2	2.2			
TP108	1742898.7	6000408.0	4.2	2.3			
TP109	1742845.5	6000263.8	3.4	1.6			
TP110	1742947.4	6000239.1	3.7	2.3			
TP111	1743130.3	6000175.9	3.8	1.8			
TP112	1743220.7	6000175.1	3.7	2.0			
TP113	1743246.7	6000320.0	4.2	2.1			
TP114	1743345.5	6000542.6	7.0	2.4			
TP115	1742818.4	6000276.9	3.6	2.2			
TP116	1742882.6	6000446.2	4.4	2.2			
TP117	1742787.1	6000364.2	4.0	2.3			
TP118	1742824.5	6000460.1	4.5	2.1			
TP119	1742681.2	6000356.8	3.4	2.0			
TP120	1742741.6	6000491.9	4.2	1.8			
TP121	1743252.3	6000426.3	4.6	2.3			
TP122	1743195.0	6000728.8	4.7	2.3			
CPT01	1743058.3	6000846.8	3.0	29.2			
CPT02	1743411.6	6000768.1	7.7	0.9			
CPT03	1743182.1	6000732.2	4.6	10.1			
CPT04	1743005.9	6000672.8	4.4	0.7			
CPT05	1743344.8	6000584.9	6.0	0.6			
CPT06	1743134.3	6000527.8	4.5	0.6			
CPT07	1742942.2	6000503.8	4.5	1.0			
CPT08	1743280.4	6000397.0	4.5	0.7			
CPT09	1743079.1	6000368.5	4.2	1.3			

 Table 2-1: Geotechnical Investigation Summary

Site Investigation	Coord	linates ¹	Ground Surface	Termination
ID	Easting (mE)	Northing (mN)	Elevation ² (mRL)	Depth (mbgl)
CPT10	1743004.0	6000295.3	4.1	17.4
CPT11	1742852.4	6000258.3	3.5	28.8
CPT12	1743194.9	6000165.8	3.7	13.9
CPT101	1743294.8	6000811.6	6.3	9.1
CPT102	1743106.6	6000775.9	4.6	1.1
CPT103	1743393.2	6000721.8	6.3	8.8
CPT104	1743247.7	6000655.3	5.0	1.2
CPT105	1743153.6	6000648.3	4.4	0.8
CPT106	1743008.4	6000589.7	4.6	3.2
CPT107	1743065.9	6000453.9	4.1	0.5
CPT108	1743225.5	6000490.4	4.6	19.9
CPT110	1743244.4	6000321.7	4.2	13.3
CPT112	1743094.2	6000184.5	3.9	13.8
CPT113	1742944.3	6000240.8	3.7	3.8
CPT115	1742882.3	6000444.8	4.5	6.9
CPT117	1742791.8	6000372.1	4.1	6.6
CPT118	1742687.8	6000359.1	3.4	4.2

Notes: 1. Coordinate System: NZTM2000. Coordinates determined using handheld GPS (+/-500mm). 2. Datum: NZTM2000. Reduced levels determined using site contours (+/-500mm).

It should be noted that have not undertaken any geotechnical investigation in the fields adjacent to the Riverside Holiday Park and the Estuary at the time of writing this report. A plan showing our test locations is presented in Appendix A.



3. Geotechnical Ground Conditions

The geotechnical model presented in this report is based on available information obtained from recent geotechnical investigation. The nature and continuity of the subsoils away from the available site investigation is inferred and it must be appreciated that the actual conditions may vary from the assumed model.

3.1 Geological Units and Site Stratigraphy

Results and interpretation of the geotechnical investigations indicated the subsurface conditions at the site consists of Late Pleistocene River Deposits, which comprise the following:

- Topsoil (**TS**), encountered as black SILT, with some rootlets, firm, non-plastic. The topsoil was generally between 200 to 400 mm thick.
- Late Pleistocene River Deposits (Riv1, Riv2 and Riv3).
 - **Riv1**: Black organic sandy SILT/ fibrous Peat, soft, non-plastic, moist. This unit directly underlies the topsoil layer and varies between 200 mm to 1200 mm thick, with an average thickness of 500 mm.
 - Riv2: Brown HARDPAN SAND, moist, strongly cemented, breaks into large blocks. This hardpan layer typically underlies the organic sandy SILT and is generally between 100 mm to 800 mm thick, with an average of 400 mm thick. Hardpan is typical on low lying areas of Mangawhai such as the subject site. Hardpan consists of chemically altered soils that form a dense and relatively impermeable layer of cemented soil typically within 1 to 2 m of the ground surface. Groundwater can become perched at the surface of this layer due to its impermeable nature.
 - **Riv3**: Brown/grey SAND, moist to wet, uniformly graded, fine to medium, tightly packed. This unit underlies the hardpan unit and extends to an unproven depth below the existing ground surface (expected to extend to bedrock at significant depths).

A summary of the site stratigraphy and layer thicknesses, a description of the various units and measured in situ strength test results are presented in Table 3-1 below. Two geological sections through the site are presented in Appendix A.

Geol. Unit	Soil type and description	Depth to top of unit (mbgl)	Layer thickness (m) [Typical]	Cone resistance typical range [Typical] qc (MPa)
Topsoil	Black, SILT with some rootlets. Firm, non-plastic, moist.	0.0	0.2 - 0.4 [0.3]	1 - 2
River	Riv1: Black organic sandy SILT / Fibrous PEAT, soft, moist, high organic content.	0.2 - 0.4	0.2 - 1.2 [0.5]	0.5 - 1
Late Pleistocene River Deposits	Riv2: Brown HARDPAN SAND, strongly cemented, moist.	0.4 - 1.4	0.1 - 0.8 [0.4]	25 - 50 [30]
Late Plo	Riv3: Brown/grey SAND, tightly packed, fine to medium, moist to wet.	0.2 - 1.6	Unproven.	5 - 20 [8]

Table 3-1: Site Stratigraphy and In Situ Testing Summary



We have never investigated the land to the North, adjacent to the campground and estuary.

The geological map indicates that a younger soil type comprising Holocene River deposits is present in this Zone of the Plan Change. In addition, this area of the site is subjected to Coastal Inundation overlay due to its proximity to the coastline and lower elevation. However, given the geological unit, we would expect this area to comprise of interbedded Sands and Silts, and maybe pockets/layers of organic material.

3.2 Groundwater

Groundwater levels were recorded within the Initia test pits. The groundwater was recorded between 0.4 to 2.2 m below the existing ground level (begl) with a typical groundwater level of 1.5 m begl.

The groundwater results indicate the regional groundwater level at the site is likely controlled by the Mangawhai Harbour with a gentle gradient inland. The measured groundwater elevation will likely fluctuate up to 1 m in response to rainfall, seasonal trends and tidal fluctuations.

Given the presence of the hardpan layer, surface groundwater may get perched on this layer during the winter months.

For the purposes of liquefaction assessment, a typical groundwater depth of 1.5 m below existing ground level has been adopted.



4. Geotechnical Considerations for Potential Future Development

4.1 General

The following geotechnical considerations are considered relevant to the proposed plan change of the proposed site to the north of Black Swamp Road only:

- Earthwork considerations and ground improvement.
- Site subsoil class and seismicity.
- Liquefaction susceptibility and consequential effects.
- Foundation considerations for residential dwellings.
- Settlements due to proposed filling and other surcharging (e.g. building loads).
- Road Pavement and floor slabs.

The principle geotechnical risk that will constrain development at the site is settlement and the low bearing capacity of the soft compressible organic SILT & fibrous PEAT layers (Riv1) of the Late Pleistocene River deposits.

The recommendations and opinions contained in this report are based on geotechnical investigation undertaken to date. However, it must be appreciated that the actual conditions may vary from the assumed model. Should ground conditions differ to those outlined in this report, the recommendations within this report should be reviewed.

4.2 Earthworks Considerations

It is understood that any development would need to undertake bulk earthworks for the site and construct civil infrastructure (services and roading) to facilitate building at the site.

The upper Late Pleistocene River deposits soft organic sandy SILT & Fibrous PEAT (Riv1) is an organic rich material comprising of very low strength and prone to high settlements. The soft nature of this material means it is not a suitable building platform material or infrastructure such as roads/footpaths.

It is recommended that the soft organic sandy SILT & Fibrous PEAT (Riv1) layer is undercut and replaced over all development platforms and proposed infrastructure zones. This ground improvement will mitigate the major geotechnical risks to the project. The soft organic sandy SILT & Fibrous PEAT (Riv1) layer is typically 200 mm to 1200 mm thick, with a typical thickness of 500 mm. This layer should be excavated and replaced with imported compacted engineered fill.

4.2.1 Reusability of Site Won Material

Potential use for the material excavated from site are detailed in Table 4-1.

Table 4-1: Summary of reusability of site won fill materials

Geological unit	Extent of material on site	Potential re-uses for fill
Topsoil	Approximately 200 to 400 mm thick across the site.	Landscaping fill
Late Pleistocene River deposits Organic sandy SILT / Fibrous PEAT (Riv1)	Directly underlying topsoil from approximately 200 to 1200mm thick.	Landscaping fill



4.2.2 Acid Sulphate

The Pleistocene River Deposit organic sandy SILT / Fibrous PEAT (Riv1) contains significant amount of organic matter that may have been influenced by seawater during times of high sea levels. These soils may contain sulphate and sulphide rich soils and groundwater which can present a risk to concrete and proposed infrastructure. It is recommended that the organic soil is excavated and replaced, which will mitigate any acid sulphate risk to the project.

4.2.3 Engineered Fill Specification

Earthworks should be undertaken in accordance with the recommendations in NZS 4431:1989 and NZS4404:2010.

It is considered that fill will be required to both replace the organic sandy SILT & Fibrous PEAT material (Riv1) and to potentially raise the site levels to mitigate flood risk. Prior to any filling works being undertaken, all topsoil, and any other unsuitable materials should be stripped from the area of proposed filling and stockpiled for later use or disposed of offsite. Testing and certification of any placed material would be required. Preliminary compaction criteria for cohesive and granular fill material are detailed below:

Cohesive Fill

	Undrained Shear Strength	Minimum value: Average value:	120 kPa 140 kPa (5 consecutive tests)						
	And								
	Air voids	Maximum value: Average value:	12% 10 % (5 consecutive tests)						
Granula	ar fill								
	Maximum Dry Density (MDD):	Minimum density:	92% MDD						
		Average CIV:	95% (5 consecutive tests)						
	<u>Or</u>								
	Clegg Hammer (CIV):	Average Clegg Impact \	/alue (CIV): 25 (5 consecutive tests)						
		Minimum Clegg Impact	pact Value (CIV): 22						

Exposed subgrade should be protected from excessive plant movements and surface water ingress to reduce the risk to strength loss which may result in the requirement for undercutting and additional filling. Material proposed to use as fill on site should be reviewed by the geotechnical engineer prior to importing to site.

4.3 Seismic Considerations

4.3.1 Site Subsoil Class

The site is underlain by Late Pleistocene River deposits to proven depths greater than 20 m. An historic well drilled in close proximity to the area indicates the depth to bedrock is up to 60 m below ground level. Based on our knowledge, the area is expected to be underlain by soils overlying rock to a depth expected to be greater than 50 to 60 m. On these bases, the site should be considered **Site Subsoil Class D – Deep Soil**, in accordance with NZS1170.5:2004.



4.3.2 Design Seismic Parameters

Design peak ground acceleration and associated magnitude for serviceability (SLS), intermediate (ILS) and ultimate (ULS) limit states have been estimated in accordance with MBIE Geotechnical Module 1 guidelines and NZTA Bridge Manual 3rd Edition, 3rd Amendment, based on the following design assumptions:

- Design Life of 50 years.
- Importance Level IL2 (normal structures and structures not in other importance levels).
- Annual probability of exceedance for SLS of 1 in 25 years.
- Annual probability of exceedance for ILS of 1 in 100 years.
- Annual probability of exceedance for ULS of 1 in 500 years.

The design seismic parameters to be adopted for design are presented in Table 4-2 below.

Table 4-2: Design Peak Ground Acceleration (PGA) and associated magnitude (M_w) Summary

Design Seismic Parameters	Serviceability Limit State (SLS)	Intermediate Limit State (ILS)	Ultimate Limit State (ULS)
Peak Ground Acceleration (PGA)	0.05	0.09	0.19
Effective Earthquake Magnitude (M _w)	5.9	5.9	6.5

4.4 Liquefaction

Liquefaction occurs when soil loses shear resistance under cyclic loading (cyclic shear strains). For liquefaction to develop, the following conditions must be present:

- Material with the potential to densify under cyclic loading (typically loose sand).
- Saturated ground (i.e. material beneath the groundwater table).
- Sufficient cyclic shear loading (usually due to a seismic event).

A liquefaction triggering assessment was undertaken using the site-specific CPT data and CLiq software package. The Boulanger & Idriss (2014) method was adopted with an assumed groundwater level of 1.5 m begl. The default Soil Behaviour Type Index cut-off I_c = 2.6 was adopted when assessing the liquefaction susceptibility of soils.

Based on the site investigation and interpreted stratigraphic units, the saturated sands of the Late Pleistocene River Deposits (Riv3) are considered susceptible to liquefaction based on their composition and location beneath the ground water table.

The general performance levels for potentially liquefied deposits at the site are estimated, in accordance with the MBIE Guidelines Module 3, based on the review of the liquefaction severity number (LSN), liquefaction potential index (LPI) and free field settlements estimated by the Zhang et al (2002) method. The LSN and LPI values are damage indices that quantify liquefaction induced damage by combining effects of the severity of liquefaction, thickness of identified liquefied soils and their location within the soil profile. Table 4-3 presents a summary of the liquefaction susceptibility and triggering assessment results for SLS, ILS and ULS design cases based on the site-specific CPT data.



Design Case Scenario	LSN [Typical]	LPI [Typical]	Index Settlement [Typical] (mm)	Performance Level (MIBE Guidelines Module 3)
25-year (SLS)	0	0	0	L0 (Insignificant)
100-year (ILS)	<1	0	<5	LO (Insignificant)
500-year (ULS)	10 - 35 [20]	5 - 15 [7]	50 - 200 [100]	L2 (Moderate) to L3 (High)

Table 4-3: Liquefaction Assessment Summary

Note: LSN = Liquefaction Severity Number, LPI = Liquefaction Potential Index

Based on the MBIE guidelines and the analyses results, the LSN, LPI and index settlement classifications indicates that the site has an insignificant risk of liquefaction occurring under a SLS (25-year) and ILS (100-year) seismic events. The analysis indicates a moderate to high risk of liquefaction under an ULS (500-year) seismic loading.

Liquefaction under ULS loading could result in vertical settlements on the order of 100 to 200 mm, this range is in general accordance with the settlements estimated using the Zhang et al (2002) method. It is noted that the predicted settlements should be treated as proxy for damage only and do not reflect a reliable estimate of actual settlements. The liquefaction assessment outputs are presented in Appendix C (for the ULS case only).

The predicted liquefaction under ULS seismic loading events could lead to moderate to significant damage of the building foundations and floor slab, therefore, liquefaction mitigation measures are recommended for the proposed development.

The Late Pleistocene Age River deposit soft organic sandy SILT & fibrous PEAT (Riv1) is expected to be susceptible to cyclic softening from seismic loading. Cyclic softening is the reduction in strength of soft "clay-like" soils under cyclic loading. The cyclic softening hazard is expected to be mitigated through excavation and replacement of this layer.

It is assumed that the organic sandy SILT & fibrous PEAT (Riv1) layer will be excavated and replaced with compacted engineered fill. The compacted engineered fill and the underlying hardpan layer will aid to 'raft over' any underlying liquefaction effects to lower the potential risk to foundation performance in an earthquake event.

Lateral Spread Assessment

Given the significant distance to any free face and the absence of sloping ground there is a low risk of lateral spread effects at the proposed site. Nevertheless, a lateral stretch assessment has been undertaken to assess the effect of the estuary located approximately 60 m south of our nearest investigation location, with an assumed free face of 2m. The lateral spread assessment indicates <10 mm of lateral displacement would occur at this investigation point. Given that the PPC is indicating development areas close to the estuary, it is highly likely that a buffer zone may have to be applied to the estuary to prevent property being adversely affected by lateral spread.

Alternatively, detail ground improvements can be designed to fully mitigate this risk.

Liquefaction Mitigation Away from the Estuary

Assuming the organic sandy SILT & fibrous PEAT (Riv1) layer is excavated and replaced with compacted engineered fill. The ground improvement of compacted engineered fill and the underlying hardpan layer will help to mitigate underlying liquefaction effects. In addition to this ground improvement the proposed residential structures should be designed to accommodate vertical movements due to liquefaction under seismic loading. Based on the predicted liquefaction induced vertical settlements between 100 and 200 mm, it is recommended that a TC2 foundation system is utilised to mitigate the risk of liquefaction effects (in accordance with Canterbury Residential MBIE technical Guidance – Part A).

4.5 Road Pavements

All topsoil and soft organic sandy SILT & fibrous PEAT (Riv1) material should be excavated and replaced with compacted engineered fill beneath all infrastructure. The pavements founded on the engineered fill should achieve a subgrade CBR of 4% across the majority of the site.

Undercutting of any weak, organic materials identified during construction may be required where present. The prepared subgrade should be inspected, and proof rolled under the supervision of a geotechnical engineer prior to placing subbase/basecourse layers.

It is important that the subgrade be protected from trafficking and disturbance during construction, particularly during the winter months and periods of poor weather. Subgrade stabilisation, upper 300 mm, could also be undertaken to reduce subbase/basecourse layer thicknesses. Drainage should also be maintained to ensure water does not pond at the subgrade/sub-base or basecourse interface during construction.



5. Further Works

The scope of geotechnical investigations and analyses undertaken to date has been suitable to support a due diligence and proposed plan change only. Additional geotechnical investigations, analyses and reporting will be required to support the design and Resource Consenting of earthworks, pavements and building foundations. The extent of work depends upon the nature and extent of final proposed development, but it is expected to include:

- Additional investigations in the area adjacent to the holiday park and estuary
- Inputs into an earthworks specification
- Specific foundation design and construction specifications should be assessed at detailed design, based on the proposed development.
- Review and comment on other geotechnical aspects on the future structural and civil drawings should also be provided prior to Resource and Building Consent.

6. Conclusions

The following key geotechnical conclusions can be made to support the *Proposed Plan Change (PPC) application* for the Black Swamp development in Managwhai:

Subsurface Conditions

- The site is covered by a thin layer of topsoil. The topsoil is underlain by Late Pleistocene River Deposits Formation comprising of organic sandy SILT/ fibrous PEAT between 200 to 1200 mm thick. A strongly cemented hardpan SAND layer underlies the organic silt / fibrous PEAT between 100 to 800 mm thick. Tightly packed SAND underlies the hardpan layer for significant depth (depth unproven by current ground investigations).
- 2. Observations within the completed ground investigations indicate that a groundwater level likely sits approximately at 1.5 m below the existing ground level.

Earthwork Conditions

- 3. The upper topsoil and organic sandy SILT/Fibrous PEAT (Riv1) are organic rich materials with a low strength and will be prone to high settlements when loaded. This material is unsuitable for proposed development building platforms and infrastructure. It is recommended that this material is excavated and replaced with engineered fill. This will mitigate the major geotechnical risks to the project.
- 4. The Organic sandy SILT / Fibrous PEAT (Riv1) may contain sulphate and sulphide rich soils which can present a risk to concrete and proposed infrastructure. It is recommended that the organic soil is excavated and replaced, which will mitigate any acid sulphate risk to the project.
- 5. Proposed engineered fill specification is presented in section 4.2.3.

Seismic Considerations

- 6. We consider the site to be of Site Subsoil 'Class D Deep Soils'.
- 7. The sites geotechnical seismic design parameters are presented in Table 4-2.
- 8. The sandy Holocene Aged and Late Pleistocene River Deposits (Riv3) are considered susceptible to liquefaction due to material composition and groundwater depth.
- 9. The results of the liquefaction analysis indicate there is negligible risk of liquefaction under a SLS & ILS seismic event.
- 10. Under a ULS seismic event the liquefaction assessment indicates a moderate to high risk of liquefaction. The predicted liquefaction induced settlement of 100 to 200 mm could lead to damage of the proposed buildings foundations and floor slabs.
- 11. A buffer zone may be required adjacent to the estuary to prevent a lateral spread affecting property, alternatively, ground improvements can be designed to mitigate this risk
- 12. It is recommended that a TC2 foundation system is utilised to mitigate the risk of liquefaction effects away from the lateral spread zones. The TC2 foundation system should comprise of one of the options detailed in Part A of the MBIE Technical Guidance.

Pavements and Subgrade Preparation

- 13. Assuming all topsoil and soft organic sandy SILT & fibrous PEAT (Riv1) material is excavated and replaced with compacted engineered fill, all infrastructure founded on the engineered fill should achieve a subgrade CBR of 4% across the majority of the site.
- 14. The prepared subgrade should be inspected, and proof rolled under the supervision of a geotechnical engineer prior to placing sub-base/basecourse layers.



7. Applicability

This report has been prepared for our client, SAM Property, with respect to the brief provided to us. The advice and recommendations presented in this report should not be applied to any other project or used in any other context without prior written approval from Initia Limited.

Report prepared by:

Report reviewed by:

A.D. Ponhat ____

Bruno Souza Engineering Geologist

Andy Pomfret Senior Geotechnical Engineer/Director



Document control record

Report Ti	tle	Black Swamp Road, Mang Geotechnical Assessment	Report									
Initia Proj	ect	for a Proposed Plan Change P-001431										
Reference												
Client		SAM Property										
Revision	Date	Revision detail	Author	Reviewer	Approved by							
А	26/03/24	Draft for client review	A. McDonald	A. Pomfret	A. Pomfret							
В	24/09/24	Draft for client review	A. Pomfret	A. Pomfret	A. Pomfret							
Current R	evision	B										



Appendix A Figures













Develpment Area - Mangawhai East







Low Density Residential

Rural Lifestyle Zone

MANGAWHAIEAST

Appendix B Ground Investigation Logs



			TE	ST	PIT L	0	G											но	LEN	IO.: TP01	
		CLIENT: Sam Property Lin PROJECT: Mangawhai DD			SITE LOC	ATI	ON:	Rayr	nond	Bull	Rd							Pro	ject	Ref.: -00143	81
INITIA INITIA CO-ORDINATES: 1743276mE, 6 Co-ordinate system: NZTM200 Location method: GPSH					N ELEVATION: 7m CONTRACTOR: Local Contractor Datum: NZTM MACHINE: Zaxis 130 LCN Hitach Level method: CONTOUR OPERATOR: Flynn								i E L	ND OGQ	RT DA DATE GED I	TE: 22/06/ E: 22/06/ BY: KNB BY: AF	06/2022 2022				
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2		ALA 6	Blow	/s / 0r						ANE		EAR (kPa Vand	a)	Values	WATER
Topsoil	Sandy SILT, with some rootlet Non-plastic; moist.	s; dark brown.		0.2 -	***** ***** ***** ****** ****** ****** ****																
	Silty SAND, with some clay; lig Low plasticity; moist; sand, fin			0.4 -	× × ×																
		0.7m: grades to brown	-	0.6 - 0.8 -																	
Late Pleistocene river deposits				1.0 -																	
Late Pleistoc	SAND; light orange brown. Moist; uniformly graded; sand packed.	, fine to medium; Tightly		1.2 - 1.4 -	-																
				1.6 -																	02/06/2022
	EOH: 1.90m		-	— 1.8 - —																	▼
				2.0 - 2.2 -	-																
				2.4 - 	-																
				2.6 - 2.8 -	-																
				- -										RKS					L		
					Water inflow	al D	ase 0	n iest	рі. Г	σοι ρ	ni ien		alea	at 1.5	, indi	ומנו	arget	uept			
							Sta	anding	ATE		evel				11]]			d Au		TYPE	

Ver 2: Generated with CORE-GS by Geroc - Test Pit_Initia - 8/07/2022 10:05:00 am

			TE	EST	PIT L	OG				HOLE N	0.: TP02			
		CLIENT: Sam Property Lin PROJECT: Mangawhai D			SITE LOC	ATION: R	aymond Bull F	Rd		Project Ref.: P-001431				
 GEO	N I T I A	CO-ORDINATES: 1743097mE Co-ordinate system: NZTM2 Location method: GPSH		762mN	ELEVATIO Datum: N Level met	ZTM		ACTOR: Local C E: Zaxis 130 LC 'OR: Flynn		START DA END DATE LOGGED E CHECKED	2022			
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	SCA	L A PENETR (Blows / 0mi	HEAR STRE (kPa) Vane:	WATER					
Topsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.			S S S S S S S S S S S S S S S S S S S									
	PEAT (FIBROUS); dark brown Soft; moist; contains minor ka rootlets.	n. uri gum, kauri logs and		0.2 - 0.4 - 								22/06/2022		
				0.6 - 0.8 -	市市 市市市 市市							▼.		
osits	SAND, with some silt, with tra Moist; HARDPAN. Strongly ce Tightly packed.			1.0 1.2	_									
Pleistocene River Deposits	SAND; brown. Moist to wet; uniformly graded Tightly packed.	l; sand, fine to medium;	_	1.4 - 1.6 -										
				1.8 2.0 - 	-									
				2.2 - 2.4 -										
	EOH: 2.70m			2.6										
					-									
					Water inflow target depth.	at sides of f	test pit at 0.6m	REMARKS	Test pit tern	ninated at 2.7ı	nbgl at			
Checke	ed By: APK						rel	н	TIGATION and Auger est Pit					

Ver 2: Generated with CORE-GS by Geroc - Test Pit_Initia - 8/07/2022 10:05:01 am

			TE	EST	PIT L	0	G	İ											ŀ	IOLI		D.: TP03		
		CLIENT: Sam Property Lin PROJECT: Mangawhai DE			SITE LOC	CAT	101	N: F	Rayr	mon	d Bı	ull R	d						Р	roje	ct R		1	
	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1743341mE, Co-ordinate system: NZTM20 Location method: GPSH	60006	695mN	ELEVATIO Datum: N Level met	IZTN	N		OUR	M	ACH	IINE	: Za	axis	130		ontra N Hita							
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND		S 2	6 CA	6		ows /	0mr	OM n) 2 14			8	VA G	_	(k V	t Pa) ane:		IGTH Values	WATER	
Topsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.		-	S TS TS TS TS TS TS TS TS TS T																			
	SAND; light orange brown with orange veins. Moist; uniformly graded; sand packed.		-	0.2 - 																				
Late Pleistocene river deposits		m: grades to light orangish brown	-	- 0.6 - - 0.8 - - 1.0 - - 1.2 - - 1.4 - - 1.6 - - 1.8 - - 2.2 - 																			Groundwater Not Encountered	
2	EOH: 2.70m			2.6 -	_																			
				2.8 - 	_																			
			1	· · ·			: 1	1							ARK		I							
				No groundwa	 			W . nding	' AT g W:					i at 2	/ml		VES	TIG	ATIC Auger		ΓΥΡΕ	_		

			TEST	PIT L	OG	HOLE NO.: TP04
	N	CLIENT: Sam Property Lir PROJECT: Mangawhai DI		SITE LOC	CATION: Raymond Bull Rd	Project Ref.: P-001431
 GEO	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1743165mE Co-ordinate system: NZTM2 Location method: GPSH	, 6000648mN	ELEVATI Datum: N Level me		tractor START DATE: 22/06/2022
	MATERIAL DES (See Classification & Symbole		SAMPLES DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm) 2 4 6 8 10 12 14 16 18	VANE SHEAR STRENGTH (kPa) Vane: 요. 안 안 안 안 Values
Topsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.	-	S S S S S S S S S S S S S S S S S S S		
Late Pleistocene river deposits	PEAT (FIBROUS); dark brown Soft; moist; contains minor ka rootlets. SAND, with some silt, with tra- Moist; HARDPAN. Strongly ce Tightly packed. EOH: 1.70m	uri gum, kauri logs and	0.2 - 0.4 - 0.4 - 0.6 - 0.8 - 1.0 - 1.2 - 1.4 - 1.4 - 1.6 - 1.8 - 2.0 - 2.2 - 2.4 - 2.6 - 2.8 - 2.8			
					REMARKS	
				vvater inflow	WATER ▼ Standing Water Level ↓ Out flow ↓ In flow	INVESTIGATION TYPE

			TE	EST	PIT L	T LOG													HOLE NO.: TP05					
		CLIENT: Sam Property Lir PROJECT: Mangawhai DI			SITE LOO	AT	ION:	Ray	ymoi	nd Bı	ull R	d						P	roje	ect R P-(Ref.: 00143	1		
 GEO	N I T I A	CO-ORDINATES: 1743065mE Co-ordinate system: NZTM2 Location method: GPSH		585mN	ELEVATION: 5m CONTRACTOR: Local Contractor Datum: NZTM MACHINE: Zaxis 130 LCN Hitach Level method: CONTOUR OPERATOR: Flynn																			
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND			CAL	(B	lows /	0mm	ו)	ETE		8	VAI	_	(I V	kPa) /ane:		NGTH Values	WATER		
Topsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.		0.2 -	STARA STARA																			
	Organic sandy SILT; dark brov Soft; non-plastic; moist; sand,	vn. fine.		0.4 - 0.6 -	B B B B Composition Composition <thcompositettttttt<ttttt<tttttttttttt<ttttt<tttttt< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>22/06/2022</td></thcompositettttttt<ttttt<tttttttttttt<ttttt<tttttt<>																	22/06/2022		
Pleistocene river deposits	SAND, with some silt; brown. Moist; HARDPAN. Strongly ce Tightly packed.	mented, breaks into blocks.		0.8 - 1.0 - 1.2 -																				
Late Pleistocene	SAND; brown. Moist; uniformly graded; sand packed.	, fine to medium; Tightly			-																			
	EOH: 2.30m			1.8 - 2.0 - 2.2 -																				
				2.4 - 2.6 - 2.8 -	-																			
				-	-																			
					Water inflow				st pit	t at 0.	7mb		MA nd ba			st pit	at 2.	3mbg	gl. Te:	st pit i	terminat	ed		
					at 2.3mbgl a	t tarç	get d		VAT	ĒR					_	IN	VES	STIG	ΞΑΤΙ	ON .	TYPE	_		
Checke	ed By: APK					<	\$∙	tandir ut flov ı flow	w	/ater	Leve	9						land . est P	-	er	Pa	ige 1 of		

	NI		TE	EST	PIT L	00	6					TEST PIT LOG ted SITE LOCATION: Raymond Bull Rd												
		CLIENT: Sam Property Li PROJECT: Mangawhai D			SITE LOC	ATIC	N: R	aymo	nd Bu	ıll Rd	l					Р		TP06 Ref.: -00143	81					
GEO.	N I T I A	CO-ORDINATES: 1743268ml Co-ordinate system: NZTM: Location method: GPSH	E, 60005	555mN	ELEVATIO Datum: N Level met	ZTM		N	CONT MACH OPER	INE:	Zaxi	is 130					06/2022 2022							
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2	SCAI	(B	ENE llows /	0mm))	TER			NE S	(k ∨a	Pa) ane:	ENGTH Values	WATER					
Topsoil	Sandy SILT, with some rootlet: Firm; non-plastic; moist.	s; dark brown.			S S TS TS S S S S S S S S S S S S S S S																			
posits	Organic sandy SILT; dark brov Soft; non-plastic; moist to wet;	vn. sand, fine.		- 0.2 - - 0.4 - - 0.6 - - 0.8 - - 0.8 -	x x														22/06/2022					
Late Pleistocene river deposits	SAND, with some silt; brown. Dry to moist; HARDPAN. Stro blocks. Tightly packed.	ngly cemented, breaks into																						
	SAND; brown. Moist; uniformly graded; sand packed. EOH: 2.10m	fine to medium; Tightly		2.0 2.2 2.4 2.4 2.6 2.8																				
					-																			
				<u> </u>	Vater inflow	at sid	es of	test n	i i i			IAR		I nated	at 2	i 1mbal	i at tare	et denth	I					
						₹		WA T ding V low				pir I	-		VES		ATION .uger		_					

			TE	ST	PIT LO)G					HOLE	NO.: TP07	
	IN	CLIENT: Sam Property I PROJECT: Mangawhai			SITE LOC	TION: F	Raymor	id Bull Rd			Project		4
EO	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1743166n Co-ordinate system: NZTM Location method: GPSH	nE, 60004	64mN	ELEVATIO Datum: NZ Level meti	ontractor N Hitachi	START DATE: 22/06/2						
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	SCA	LA PE (Bi	HEAR STR (kPa) Vane:	WATER				
lopsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.			A A A A A A A A A A A A A A A A A A A			10 12 14	16 18	-100			
	PEAT (FIBROUS); dark browr Soft; moist; contains minor ka rootlets.	n. uri gum, kauri logs and		0.4	e Viete viete voor e e voor e e e e e e e e e e e e e e e e e e								▼.
	SAND, with some silt; brown. Moist; HARDPAN. Strongly ce Tightly packed.	mented, breaks into blocks.		0.8 1.0 	- -								
	SAND; brown. Moist; uniformly graded; sand packed.	, fine to medium; Tightly			-								
					-								
	EOH: 2.20m			2.2	-								
				2.4	-								
				2.8	-								
								RE	MARKS	<u> </u>			
					Vater inflow a	t sides of	test pit	at 0.4mbgl. Te	es pit termir	nated at 2.2	mbgl at targe	et depth.	
		Carlos and					WAT	ER	_	INVES	TIGATION		
						▼ Star Out	flow	ater Level			and Auger est Pit		

		TEST PIT LOG															HOLE NO.: TP08							
		CLIENT: Sam Property Lim PROJECT: Mangawhai DD			SITE LOC	ΑΤΙΟ	ON:	Rayr	non	d Bu	III Ro	ł					Project Ref.: P-001431							
GEO	N I T I A	CO-ORDINATES: 1742997mE, Co-ordinate system: NZTM20 Location method: GPSH	60004	423mN	ELEVATIO Datum: N Level met	ZTM		TOUR	M	АСН	INE	: Za	xis 1	ocal (30 LC			El L(START DATE: 22/06/2022 END DATE: 22/06/2022 LOGGED BY: KNB CHECKED BY: APK						
	MATERIAL DESC (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2	SC	ALA 6		ws /	0mm)		R 18				(kPa Vane)	NGTH Values	WATER			
Topsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.		_	TS WTS WTS WTS WTS WTS WTS WTS W																			
Late Pleistocene river deposits	Organic sandy SILT; dark brov Soft; non-plastic; moist; sand, SAND; brown. Moist; HARDPAN. Strongly ce SAND; brown. Moist; uniformly graded; sand, packed. 2 EOH: 2.30m	mented, breaks into blocks.		- 0.2 · · · · · · · · · · · · · · · · · · ·																	▲ 22/06/2022			
	2011.2.0011			2.4																				
				2.6	-																			
					Water inflow depth.		Sta	W. nding	' ATI g Wa	ER		and :		RKS gl. Tes				GAT Aug	ION	at targe	t			
			TE	ST	PIT L	OG			Н	OLE NO TI	.: P09													
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	IN	CLIENT: Sam Property L PROJECT: Mangawhai I			SITE LOC	ATION: Ray	mond Bull Rd		Pr	oject Re														
 Geo [.]	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1743181m Co-ordinate system: NZTM Location method: GPSH	E, 60003	357mN	ELEVATIC Datum: Na Level met	ТМ	CONTRACTOR: L MACHINE: Zaxis 1 OPERATOR: Flynr	30 LCN Hit	achi ENE LOC	ART DATE D DATE: 2 GGED BY	E: 22/06 22/06/20 : KNB	6/2022 022												
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	SCALA 2 4 6	(Blows / 0mm) 8 10 12 14 16	ĸ		Pa) ine:	GTH /alues	WATER												
Topsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.			U U U U U U U U U U U U U U U U U U U																			
	Organic sandy SILT; dark brov Soft; non-plastic; moist; sand,	vn. fine.		0.2	х х х х х х х х х х х х х х х х х х х																			
	SAND, with some silt; brown. Moist; HARDPAN. Strongly ce Tightly packed.	mented, breaks into blocks.		0.6 																				
e river deposits	SAND; brown. Moist; uniformly graded; sand packed.	, fine to medium; Tightly		 1.0																				
Late Pleistocene river deposits				1.2								22/06/2022												
	SAND; light grey. Wet; uniformly graded; sand, packed.	fine to medium; Loosely		1.6								▼.												
	EOH: 2.00m		_																					
				2.2	-																			
				2.4 	-																			
				2.8	-																			
							REMA	RKS																
					Vater inflow ole collapse		at sides of test pit at 1.	ōmbgl. Test p	bit terminate	d at 1.5mb	ogl due t	to												
						W	ATER	IN	VESTIG		YPE	_												
		North St.				✓ Standin ✓ Out flow	g Water Level v		Hand A			-												

			TE	EST	PIT L	0	G										н	OLE	NO.: TP10	
	IN	CLIENT: Sam Property L PROJECT: Mangawhai I			SITE LOC	ATI	ON:	Rayı	mond I	Bull F	Rd						Pr		t Ref.: P-0014:	
GEO.	N I T I A	CO-ORDINATES: 1742934m Co-ordinate system: NZTM Location method: GPSH	E, 60003	345mN	ELEVATIO Datum: N Level met	ZTN	1	NTOUR	MAC	CHIN	E: Za	axis	130 I		ontrac I Hita		ENI LOC	ART D D DAT GGED	ATE: 22/ E: 22/06 BY: KNE D BY: AI	'06/2022 /2022 3
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2		ALA 6	PEN (Blows		m)			3	VAN -20	-	(k Va	Pa) ane:	RENGTH	WATER
Topsoil	Sandy SILT, with some rootlets Firm; non-plastic; moist.	s; dark brown.			U U U U U U U U U U U U U U U U U U U															
	Organic sandy SILT; dark brov Soft; non-plastic; moist; sand,	vn. fine.	_	0.2 0.4																
	SAND, with some silt; brown. Moist; HARDPAN. Strongly ce blocks. Tightly packed.	mented, breaks down into		0.6 0.8																
Late Pleistocene river deposits	SAND; light orange brown. Moist; uniformly graded; sand packed.	, fine to medium; Tightly		1.0 1.2																
Late Pleistocen				1.4	-															
				1.8	-															22/06/2022
	EOH: 2.30m			2.0	-															▼.
				2.4 2.6	-															
				2.8	-															
				-	Water inflow	; ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;	idec	i i	<u></u>	: : 2mb:						2 2	i ibal c	: t tarac	t denth	•
					The second se	at 5					<u></u> н. те	ar bu								
	ed By: APK					<		andin ut flow	ATEF g Wate		el			_] н	TIG/ and A est Pit	uger		age 1 of

			TE	EST I	PIT LO	C	ì				 		нс	DLE N	0.: TP11	
		CLIENT: Sam Property Lin PROJECT: Mangawhai DD			SITE LOC	ATIO	N: Ray	/mond Bu	ıll Rd				Pro	oject		1
GEO.	N I T I A	CO-ORDINATES: 1743143mE, Co-ordinate system: NZTM20 Location method: GPSH	6000		ELEVATIC Datum: N2 Level met	тм		MACH	IINE: Z	OR : Lo Zaxis 13 : Flynn			end Log	RT DA DATE GED E	TE: 22/06/2 3Y: KNB BY: AP	06/2022 2022
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	S 2	5 CAL	A PENE (Blows /	0mm)	METEF 14 16	VA		(kP Var	a)	Values	WATER
Topsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.			S WTS S WTS S WTS S WTS											
	Organic sandy SILT; dark brow Soft; non-plastic; moist; sand,	vn. fine.	_	0.2												
	SAND, with some silt; brown. Moist; HARDPAN. Strongly ce blocks. Tightly packed.	mented, breaks down into	-	0.8	* * * * * * * * * *											
Late Pleistocene river deposits	SAND; brown. Moist; uniformly graded; sand packed.	, fine to medium; Tightly		 1.0												
Late Pleistoce				- 1.2	-											22/06/2022
	SAND; light grey. Wet; uniformly graded; sand, packed.	fine to medium; Loosely		1.6 1.8												▼.
	EOH: 2.10m			2.0 -												
				2.2												
				2.4	-											
				2.6	-											
					-											
					/ater inflow a	▼	v	VATER	f test p	tit at 1.7		VES		TION	mbgl due	e to
Checke	ed By: APK														Pa	ge 1 of 1

			TE	EST	PIT L	OG			HOLEN	IO.: TP12	
		CLIENT: Sam Property L PROJECT: Mangawhai D			SITE LOO	ATION: Rayr	nond Bull Rd		Project		
 Geo	N I T I A	CO-ORDINATES: 1743058m Co-ordinate system: NZTM Location method: GPSH	E, 60002	204mN	ELEVATI Datum: N Level me	ZTM	CONTRACTOR: Local C MACHINE: Zaxis 130 LC OPERATOR: Flynn		START DA END DATE LOGGED E CHECKED	TE: 22/06/ 22/06/20 BY: KNB	6/2022 022
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	SCALA 2 4 6	PENETROMETER (Blows / 0mm) 8 10 12 14 16 18	VANE S	HEAR STRE (kPa) Vane:	NGTH	WATER
Topsoil	Sandy SILT, with some rootlet Firm; non-plastic; moist.	s; dark brown.			S TS TS TS TS TS TS TS TS TS TS TS TS TS						
	Organic sandy SILT; dark brow Soft; moist; sand, fine.	vn.		0.2	₩ ×						
deposits	SAND, with some silt; brown. Moist; HARDPAN. Strongly ce Tightly packed.	mented, breaks into blocks.		0.8	****						
Late Pleistocene river deposits	SAND; brown. Moist; uniformly graded; sand packed.	, fine to medium; Tightly		1.0 1.2	-						
Late	SAND; light orange brown.			1.4 1.6 1.8							22/06/2022
	Moist; uniformly graded; sand packed. EOH: 2.00m	, fine to medium; tightly		2.0 2.2 2.2 2.4							•
				2.6	-						
1	190 M		1				REMARKS				
					water inflow	W	pit. Test pit terminated at 2m	INVES	TIGATION land Auger	TYPE	-

			TE	ST	PIT L	0	G																ŀ	101		10.: TP1(01	
		CLIENT: Sam Property Lim PROJECT: Mangawhai DD			SITE LOC	ATI	ON	I: F	Ray	mo	nd	Bu	II R	d									P	roje		Ref.: -001		
GEO.	N I T I A	CO-ORDINATES: 1743393mE, Co-ordinate system: NZTM20 Location method: GPSH	60007	719mN	ELEVATIO Datum: N2 Level met	ZTN	1		FOUF	M	AN	сн	INE	= : Z	Zax	is ´	130	cal () L(ntra	cto		EN LO	D D GGI	T DA ATE ED E		21/02 2/20 JM	2/2024 024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND			C <i>A</i>	۸L	(E	PEN Blow	s / (0mı	n)							NE	-100	(k	(Pa) ane:		ENGT		WATER
Topsoil	SILT, with some rootlets, with Firm; non-plastic; moist.	trace sand; dark brown.		0.2	۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳																							
	Sandy SILT, with some orangi Firm; non-plastic; moist; sand, rootlets.	ics; dark brown. fine to medium; Orangics,		0.4																								
	SAND; brown. Wet; uniformly graded; sand, f	fine to medium, tightly packed.		0.8	-																							
		1.0m: grades to grey.	-	- 1.0 -	-																							
				1.2																								
Pleistocene river deposits					-																							
Late Pleistocene				1.8																								
Ľ				2.0	-																							~
				2.2																								
				2.6	-																							
				2.8																								
	EOH: 3.00m													R	REN	۸A	R	KS										
					Vater inflow	at 2	: m a	and	l po	olin	ig a	t ba	ase	of	test	: pit	t. T	est	pit	tern	nina	ated	at	3 m	at ta	rget d	epth.	
		1, St.					Z ≈ 4 0		ndin	ıg V	TEI Vate		.eve	əl		-							nd A	Auge		ТҮР	E	_

			TE	ST	PIT LO	CG			HOLE N	0.: P102	
		CLIENT: Sam Property Lim PROJECT: Mangawhai DD			SITE LOC	ATION: Raym	nond Bull Rd		Project R		
GEO.	N I T I A	CO-ORDINATES: 1743194mE, Co-ordinate system: NZTM20 Location method: GPSH	60008	344mN	ELEVATIO Datum: NZ Level meti	TM	CONTRACTOR: Local Co MACHINE: Zaxis 130 LCN OPERATOR: Luke		START DAT END DATE: LOGGED B CHECKED	E: 21/02/ 21/02/202 Y: AJM	24
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND		PENETROMETER (Blows / 0mm) 8 10 12 14 16 18	VANE SI	HEAR STRE (kPa) Vane: ଦୁ ଦ	NGTH Values	WATER
Topsoil	SILT, with some rootlets; black Firm; non-plastic; moist.	ς.			2 2 2 2 2 2 2 2 2 2 2 2 2 2						
	Sandy SILT; orange. Firm; non-plastic; moist; sand, Organic SILT, with some sand Soft; non-plastic; moist; Organ medium.	; black.	-								
osits	SAND; dark brown. Moist; HARDPAN. Strongly ce	mented.		 1.4	x x x y w x x y x x x						Groundwater Not Encountered
Late Pleistocene river deposits	SAND; brown. Moist; uniformly graded; sand, packed. EOH: 3.00m	fine to medium, tightly									Groundwater I
				N	lo Groundwa		REMARKS d. Test pit terminated at 3 m a	INVES	TIGATION	TYPE	

 $\rm Ver~2_{\circ}$ Generated with CORE-GS by Geroc - Test Pit_Initia - 12/03/2024 4:22: 19 pm

			TE	EST	PIT L	OG										нс	DLE	NO.: TP103	
		CLIENT: Sam Property Lir PROJECT: Mangawhai DI			SITE LOC	ATION	l: Ray	ymon	d Bul	l Rd						Pro	ject	Ref.: -00143	
GEO.	N I T I A	CO-ORDINATES: 1743045mE Co-ordinate system: NZTM2 Location method: GPSH	, 60007	791mN	ELEVATIO Datum: N2 Level met	ZTM		M	асні	NE:	Zaxis	s 130		ontrac N		END LOGO	RT DA DATE GED I	TE: 21/0 : 21/02/ BY: AJM BY: AF	02/202 2024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	S 2	CAL	(Blo	ows/C						IE S⊦ 01	IEAR (kPa Van	a)	ENGTH Values	WATER
Topsoil	SILT, with some rootlets; black Firm; non-plastic; moist.	Χ.		0.2	т												- r		
	Organic SILT, with some sand Soft; non-plastic; moist; organ to medium.	; black. ic, roots and wood; sand, fine		0.4	TS W W W W W W W W														
	Silty SAND; brown. Non-plastic; moist; sand, fine t	to medium; densely packed.	— В	0.8															
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		1.2	-														
_	SAND; brown. Wet; uniformly graded; sand, f	īne to medium, tightly packed.		1.4	-														
				1.8	-														
				2.2 	-														
	EOH: 2.80m			2.6 	-														
				-	Water inflow	at 1.2 n	n and	poolir	ng at t			IARI st pit.		pit terr	ninate	ed at 2	8 m a	at target o	depth.
						\triangleleft	V Standii Out flo n flow	w		evel			_	IN\ 	Ha	TIGA nd Aug st Pit		TYPE	

			TES	T PIT L	OG						но	LE NO.: TP104	Ļ
	N	CLIENT: Sam Property Lir PROJECT: Mangawhai DI		SITE LOO	CATION	: Raymo	ond Bull R	d			Proje	ect Ref.: P-00143	31
 Geo	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1743067mE Co-ordinate system: NZTM2 Location method: GPSH	, 6000685r	nN ELEVATI Datum: N Level me	IZTM	r	CONTRAC	: Zaxis	130 LCI		END D LOGG	T DATE: 21/0 ATE: 21/02/ ED BY: AJM KED BY: AF	02/2024 2024 I
	MATERIAL DES (See Classification & Symbol		SAMPLES	DEPTH (m) LEGEND		(E	PENETR Blows / Omn 8 10 12			VANE	(kPa) Vane:		WATER
Topsoil	SILT, with some rootlets; blac Firm; non-plastic; moist.	к.		15									
	Organic SILT, with some sanc Soft; non-plastic; moist; Orgar kauri logs; sand, fine to mediu	nic, Fibrous roots and large		0.4 <u>IS</u> <u>w</u> × <u>w</u> × <u>x</u> × <u>x} × x} × <u>x</u> </u>									
Late Pleistocene river deposits	SAND; dark brown. Wet; HARDPAN, strongly cerr	nented.		1.0 × × × × × × × × × × × × × × × × × × ×									<u>}</u>
	SAND; brown. Wet; uniformly graded; sand, f	ine to medium, tightly packed.		1.8 									
	EOH: 2.40m			2.4									
		A CARLEN		Water inflow	/ at 1 m a	and poolin	ig at base	REM/		t termina	ted at 2.4 r	m at target de	epth.
						Out flow	TER Vater Leve		-		S TIGAT Hand Auge Test Pit	ION TYPE	

Ver 2; Generated with CORE-GS by Geroc - Test Pit_Initia - 12/03/2024 4:22:21 pm

			TE	EST	PIT L	OG			HOLI	E NO.: TP105	
	IN	CLIENT: Sam Property Lin PROJECT: Mangawhai DI			SITE LOC	ATION: Rayn	nond Bull Rd		-	ct Ref.: P-00143	1
GEO	N I T I A	CO-ORDINATES: 1743009mE Co-ordinate system: NZTM2 Location method: GPSH	, 60005	588mN	ELEVATIO Datum: N Level met	ZTM	CONTRACTOR: Local Co MACHINE: Zaxis 130 LCN OPERATOR: Luke		START END DA LOGGE	DATE: 21/0: TE: 21/02/2 D BY: AJM ED BY: APP	2/2024 2024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	SCALA 2 4 6	PENETROMETER (Blows / 0mm) 8 10 12 14 16 18			RENGTH	WATER
Topsoil	SILT, with minor rootlets; blac Firm; non-plastic; moist.	k.			TS ** ** ****** ****** ****** TS **** TS **** ******						
	Organic SILT, with some sanc Soft; non-plastic; moist; Orgar medium.	l; dark brown. lic, Fibrous roots; sand, fine to		0.4							
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		0.6	- -						
ver deposits				1.0	-						
Late Pleistocene river deposits	SAND; brown. Wet; uniformly graded; sand, 1	fine to medium, tightly packed.	-								
				1.6 1.8	-						
	EOH: 2.20m			2.0							~
				2.2							
				2.6	-						
					-		REMARKS				
					Vater inflow	at 2.1 m and po	ooling at base of test pit. Test	pit termina	ated at 2.2	m at target de	epth.
							ATER	۲	STIGATIC land Auger	ON TYPE	_

			TE	EST	PIT L	00	G											н		NO.: TP106	
	N	CLIENT: Sam Property Li PROJECT: Mangawhai D			SITE LOC	ATI	ON:	Ra	ymo	nd B	ull R	d						Pro	oject	Ref.:	
 Geo	N I T I A	CO-ORDINATES: 1743101ml Co-ordinate system: NZTM: Location method: GPSH	E, 6000	515mN	ELEVATIO Datum: N Level met	ZTM	1		N	IACI	HINE	: Za	ixis '	130 L		ntrac		END LOG	RT D/ DAT GED	ATE: 21/0 E: 21/02/2 BY: AJM D BY: AP)2/2024 2024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2			. АР (В	lows	/ 0mr	n)		ER 5 18		VAN	-	IEAF (kP Var 031	Pa)	ENGTH Values	WATER
Topsoil	SILT, with some rootlets; black Firm; non-plastic; moist.	K.		0.2	۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳																
	Organic SILT, with some sand Firm; non-plastic; moist; Organ to medium.	; black. nic, Fibrous roots; sand, fine	в																		
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.	-	0.6																	
r deposits				 - 1.0 - 																	
Late Pleistocene river deposits	SAND; greyish brown. Wet; uniformly graded; sand, f	ine to medium, tightly packed.		 1.4	-																
				1.6	-																
				2.0																	
	EOH: 2.80m		_																		
				2.4	-																
					_																
	in the second											RE	EMA	RK	5 5						
					Vater inflow	at 2.	.2 m		pool			e of	test	pit. Te	est p					at target c	lepth.
Check	red By: APK					<	St }- Oi ≻ In	tandi ut flo	ing W ow			el	_				Ha	nd Au st Pit	ıger		

	N I		TE	EST	PIT LO	00	•										ŀ	HOLE	E NO TP	.: •107	
	IN	CLIENT: Sam Property Lir PROJECT: Mangawhai DI	C		SITE LOC													_	ct Re P-00	f.: 0143 ⁻	
 GEO	N I T I A	CO-ORDINATES: 1743051mE Co-ordinate system: NZTM2 Location method: GPSH		356mN	ELEVATIC Datum: N2 Level met	ZТМ			MA	сні	NE:	Zaxi	s 13	cal C 0 LCI	ontra N	ictor	EN LO	D DA GGE	TE: 2 D BY:	: 21/0 :1/02/2 : AJM Y : API	
	MATERIAL DES (See Classification & Symbol		SAMPLES	DEPTH (m)	LEGEND	2	SC / 4	۹LA 6	(Blo	ws / 0)mm)		TER				((Pa) ′ane:	REN	GTH /alues	WATER
Topsoil	SILT, with some rootlets; blac Firm; non-plastic; moist.	k.		0.2	TS W W W TS W W W W TS W W W TS W TS W W TS W W W TS W W W TS W W																
	Organic SILT, with some sand Soft; non-plastic; moist; Organ medium.	l; black. nic, fibrous roots; sand, fine to		0.4	<u> <u> </u> <u></u></u>																
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		0.6 0.8	- - -																
Late Pleistocene river deposits	SAND; brown. Wet; uniformly graded; sand, t	fine to medium, tightly packed.		1.0 1.2	_																
Late Pleistoc				1.4	- - -																
				1.8	_																
	EOH: 2.20m		_	2.0	_																~
				2.4																	
				2.6 -	-																
		THE STATES										REN	IAR	KS							
					Water inflow a	T	Sta		ATE	ĒR		of te	st pit.	. Test			STIG	Auger	יד אכ	-	epth.
Check	ed By: APK						- In f								Ľ	<u> </u>				Pa	ge 1 of

	N I		TE	EST	PIT L	0	G														но	LE N	10.: TP108	
	IN	CLIENT: Sam Property Lir PROJECT: Mangawhai DI CO-ORDINATES: 1742899mE	D ., 60004	408mN	SITE LOO	ON:	4.2		Rayr	C	ONT	RA	СТ					ntra	ctor	s	TAR	P-	Ref.: -00143 TE: 21/0	02/202
GEO [.]	N I I A TECHNICAL SPECIALISTS	Co-ordinate system: NZTM2 Location method: GPSH	.000	1	Datum: N Level me			ONT	OUR		ACH					30 L				L	ogo	GED E	: 21/02/ 3Y: AJM BY: AF	
	MATERIAL DES (See Classification & Symbol		SAMPLES	DEPTH (m)	LEGEND		S	СА 4	LA 6		ENE ows / 10	0m	m)	ЛЕТ 1 <u>4</u>							AR (kPa Vane	I)	Values	WATER
Topsoil	SILT, with some rootlets; blac Firm; non-plastic; moist.	k.		0.2	「 また。																			
	Organic SILT, with some sand Soft; non-plastic; moist; Orgar medium.	t; black. hic, fibrous roots; sand, fine to		0.4																				
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.	-	0.6 	<u>**</u> ***																			
deposits	SAND; brown. Wet; uniformly graded; sand, '	fine to medium, tightly packed.	-	1.0	_																			
Late Pleistocene river deposits				1.2 1.4	-																			
Late				1.6	-																			
				1.8 2.0	-																			~
	EOH: 2.30m		_	2.2 	-																			
				2.4	-																			
				2.8	-																			
		A PAR	1	· _			: :			: :	: :		R	EM	AF	RKS	: }		:			•		
					Water inflow	at 2	2 m a	and	poc	oling	at b	ase	of t	est ı	pit.	Test	t pit	term	ninat	ted a	t 2.3	m at 1	target de	pth.
									W	AT	ER							IN	VE	STI	GAT	rion	TYPE	
						<	▼ % ↓ ∿	Dut	iding flow	g Wa	ater	Lev	el				_				d Aug			

			TE	EST	PIT L	00	G															нс	DLE	NO.: TP1		
	N	CLIENT: Sam Property Lin PROJECT: Mangawhai DE			SITE LOC	ATI	ON:	Ra	aym	iond	d Bu	ull F	۲d									Pro		Ref. 2-00	:	1
GEO.	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1742846mE, Co-ordinate system: NZTM20 Location method: GPSH	60002	264mN	ELEVATIO Datum: N. Level met	ZTM				MA	ACH	IIN	E: Z	Zaxi	is 1	130			trac	tor	E L	ND DG(RT D DAT GED	ATE: E: 21/ BY: /	21/0 /02/2 AJM	2/202 024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2					ws /		m)				8	`	AN وي			AR (kP Van	a)	RENG	TH	WATER
Topsoil	Sandy SILT, with minor rootle Firm; non-plastic; moist.	ts; black.		0.2.	۲S																	<u> </u>	3			
	Oragnic SILT; black. Firm; non-plastic; moist; Oragi	nic, fibrous roots.		0.4	× × × × × × × × × × × × × × × × × × ×																					
sits	SAND; reddish brown. Moist; HARDPAN, strongly ce	mented.		0.6 ·	_																					
Late Pleistocene river deposits	SAND; brown. Wet; uniformly graded; sand, t	fine to medium, tightly packed.		0.8	_																					
Late Pleistoc				1.0 - 	_																					
					_																					
	EOH: 1.60m			1.6 -	_																					\succ
				1.8 ·	_																					
				2.0 ·	_																					
				2.2 ·	_																					
				2.6 -	-																					
				2.8 -	_																					
				Γ									R	REN	۸N	R	s									
					Water inflow	at 1.	.6 m	and	i po	olin	g at	bas	se o	of te	est p	pit.	Test	t pil	t terr	min	ated	at 1	.6 m	at targ	get de	epth.
	1/								WA	ΑTE	R								IN\	/E	STI	GA	τιο	N TY	PE	_
							si 1-0	ut fl	ow	Wa	iter I	Lev	el						 ✓ 	=	Hand Fest		ger			

	N I		TE	EST	PIT L	OG	;												нс		NO.: TP110)
	IN	CLIENT: Sam Property Li PROJECT: Mangawhai D	D		SITE LOC															Р	Ref.: -0014:	
GEO.	N I T I A	CO-ORDINATES: 1742947mt Co-ordinate system: NZTM2 Location method: GPSH		239mN	ELEVATIO Datum: N Level met	ZTM			МА	сні	NE:	Zax	tis 1	30		ontra N	ictor	E L	ND OG(DATE GED I	ATE: 21/ E: 21/02/ BY: AJN BY: AF	/2024 I
010	MATERIAL DES (See Classification & Symbol		SAMPLES	DEPTH (m)	LEGEND		SCA	((Blow	/s / C	mm)							SHE	AR (kPa Van	STR a) e:	ENGTH	VATER
Topsoil	SILT, with minor rootlets; blac Firm; non-plastic; moist.	k.			TS	2	4	6	8	10	12	14	16		5		G	10		200	values	
	Orangic sandy SILT; black. Soft; non-plastic; moist; Orang medium.	gic, rootlets, sand, fine to	_	0.4																		
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		0.6 -																		
				0.8 _	-																	
Late Pleistocene river deposits	SAND; dark brown. Wet; uniformly graded; sand, i	fine to medium, tightly packed.		1.0 	-																	
e Pleistocene riv				1.4 _	-																	
Late				1.6 _	-																	
				1.8 -	-																	
				2.0 - 																		
	EOH: 2.30m		_	2.4 _																		
				2.6 _	-																	
				2.8 -	-																	
		. 1		-								REI	MA	RK	S							
					Water inflow	at 2 m	and	pooli	ing a	t ba	se o	ftesi	t pit.	. Te:	st pi	t terr	ninat	ted a	t 2.3	m at	target de	epth.
		- Ton						WA	ΛTE	R						IN	IVE	STI	GA [.]	TION	I TYPE	
	×					♦	Stan Out i In flo	ding flow			evel		-		-			Hano Test	d Au			

			TE	EST	PIT L	0	G															H	OLI		0.: P11	1	
	N	CLIENT: Sam Property Lin PROJECT: Mangawhai DD			SITE LOC	ATI	ON	Ra	aym	ond	l Bu	II R	d									Pro	-	ct F	Ref.: 0014		
GEO	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1743130mE, Co-ordinate system: NZTM20 Location method: GPSH	6000	176mN	ELEVATIO Datum: N. Level met	ZT№	1			MA	ONT ACH PER	INE	: Z	Zaxi	is 1	30			trac	tor	E	ND OG	RT DA GE	DA1 TE: D B	TE: 2 ⁻ 21/0 Y: AJ BY: <i>A</i>	1/02 2/20 M	2/202)24
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND						NE ws / 10	0mr	n)			R	8	,	AV 20			AF (kP Var	Pa)		NGTH Value		WATER
Topsoil	SILT, with some rootlets; black Firm; non-plastic; moist.	k.		0.2	۳.5 ۳.5 ۳.5 ۳.5 ۳.5 ۳.5 ۳.5 ۳.5																		1				
	Organic SILT, with some sand Soft; non-plastic; moist; Orgar medium.		-	0.4 ·																							
its	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.	-	- 0.6 - 0.8																							
Late Pleistocene river deposits	SAND; grey. Wet; uniformly graded; sand, f packed.	îne to medium, loosely		1.0	-																						
Late Pleist				1.2 ·	_																						
				1.6	-																						<u> </u>
	EOH: 1.80m		-		_			· · · · · · · · · · · · · · · · · · ·																			
				2.0 ·	_																						
				2.4 ·	_																						
				2.6	_																						
				2.8	_								R	EN	/A	RK	s										
					Water inflow collapse and	at 1 sigr	.6 m nifica	and ant u	d po inde	olin	g at ning	bas	6e o	of te	st p	Dit. 7	Tesi	t pil	t ter	min	ateo	l at	1.8	m dı	ue to v	vall	
						<	zs 1-0 ≻Ir	tanc out fl	ow			eve	əl]	STI Hand Test	d Au			TYP		- je 1

			TE	EST	PIT L	00)												HOL	E N.	0.: P112	
	N	CLIENT: Sam Property L PROJECT: Mangawhai			SITE LOC	ATIO	N:	Rayr	non	d Bu	ll Ro	ł						P	roje		Ref.: 00143	1
GEO.	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1743221n Co-ordinate system: NZTM Location method: GPSH	nE, 60001	175mN	ELEVATIO Datum: N2 Level met	ZTM			M	асн	INE	: Zax	kis 1	30 L		ntrac	tor	EN LO	D D GGI	T DAT ATE: ED B	TE: 21/0 21/02/2 Y: AJM BY: AP)2/2024 2024
	MATERIAL DES (See Classification & Symbol		SAMPLES	DEPTH (m)	LEGEND	2	SC/	ALA 6		ws /	0mm)		R 5 18		NAV 20		SHEA (I	AR S kPa) ′ane:	TRE	NGTH	WATER
Topsoil	SILT, with minor rootlets; blac Firm; non-plastic; moist.	k.			TS 															<u>7</u>		
	Organic SILT; black. Soft; non-plastic; moist; Orgar SAND; brown. Moist; HARDPAN, strongly ce			0.2 0.4																		
er deposits	SAND; grey. Wet; uniformly graded; sand, packed.			0.6 0.8 1.0																		Groundwater Not Encountered
Late Pleistocene river deposits				1.2 1.4	-																	Groundwater
				1.6 1.8	-																	
	EOH: 2.00m			2.0																		
				2.4	-																	
				2.8	-																	
		30 - 20					::	::	::	::	::	RE	MA	RK	: S	:			:	:		
					Test pit termi	nated	l at 2	m d	ue to	o pit v	wall (colla	pse.									
						\triangleleft		nding t flow			.evel	l	-		_	ואי]н	and .	Auge		TYPE	

			Т	EST	PIT L	0	G																но	LE	NO TP	.: 113	
		CLIENT: Sam Property Lim PROJECT: Mangawhai DD			SITE LOC	ATI	ON	: R	ayn	nor	nd E	Bull	Rd									F	Proj		Re ⁻ -00	f.:)143	61
 GEO	N I T I A	CO-ORDINATES: 1743247mE, Co-ordinate system: NZTM20 Location method: GPSH		320mN	ELEVATIO Datum: N Level met	ZTN	1		OUR	М	AC	HIN	NE:	Za	xis	13			ontra I	acto	or	EN LC	ID E DGG	DAT GED	E: 2 BY:	: 21/(1/02/: AJM (: AF	
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	:		CA	LA		EN ows	/ Or	nm							ANI -20	E S	(kPa /ane	I)		GTH alues	WATER
Topsoil	SILT, with some rootlets; black Firm; non-plastic; moist.	K.		0.2	TS **** **TS ** ***TS ***TS ***** TS**** *TS***																						
	Organic SILT, with some sand Soft; non-plastic; moist; Organ sand, fine to medium.	; black. iic, fibrous roots and wood;	-	0.4	× × × × × × × × × × × × × × × × × × ×																						
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		0.6	- -																						
Late Pleistocene river deposits	SAND; brown. Wet; uniformly graded; sand, f	ine to medium, tightly packed.		 - 1.0 - 	-																						
Late Pleistocen	1.4m: gr	ades to grey and loosely packed.			-																						
				1.6 	-																						
	EOH: 2.10m		-	2.0	-																						>-
				2.2	-																						
				2.6 	-																						
				2.8	-									RE	M	AR	K	5									
					Vater inflow	at 2	.1 m																			-	depth.
	ed By: APK					<	Z s ∱ C ≻ Ir	Stan Dut 1	ding	g W	'ER		vel						וו 	•v	н	TIC and est F	Aug		<u>יד א</u>	(PE	age 1 of

	N I		TES	T PIT L	_OG	HOLE NO.: TP114
	IN	CLIENT: Sam Property Lin PROJECT: Mangawhai DE CO-ORDINATES: 1743346mE,)		CATION: Raymond Bull Rd	Project Ref.: P-001431 ontractor START DATE: 21/02/2024
 GEC	N I T I A	Co-ordinate system: NZTM20 Location method: GPSH		Datum:		
	MATERIAL DES (See Classification & Symbol		SAMPLES	LEGEND	SCALA PENETROMETER (Blows / 0mm) 2 4 6 8 10 12 14 16 18	VANE SHEAR STRENGTH (kPa) H Vane: Vane: Q Q Q Q Q Q Q Q Q
Topsoil	SILT, with some rootlets; blac Firm; non-plastic; moist.	k.				
	SAND; dark brown. Moist; sand, fine to medium, ti	ightly packed.).4		
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		0.6		
	SAND; greyish brown. Wet; uniformly graded; sand, f	fine to medium, tightly packed.		 1.0		ountered
Late Pleistocene river deposits				- -		Groundwater Not Encountered
Late Pleistoce				1.4 — — 1.6 —		U U U U U U U U U U U U U U U U U U U
				 I.8		
				2.0		
	EOH: 2.40m			2.2		
- - -				2.8		
				No ground	REMARKS	n at target depth.
					WATER	INVESTIGATION TYPE
1	ed By: APK	VA CON			← Out flow → In flow	Test Pit Page 1 of

			TE	EST	PIT L	00	G			-	-	_		_	_				-	Н	IOL	E N T	0.: P115	
		CLIENT: Sam Property Lir PROJECT: Mangawhai DI			SITE LOC	ΑΤΙ	ON:	Ra	aymo	ond	Bu	l Ro	ł							Pr	oje	ct R		
GEO	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1742818mE Co-ordinate system: NZTM2 Location method: GPSH	, 60002	277mN	ELEVATIO Datum: N2 Level met	ZTM	1			MA	СН	NE	Za	xis	130	al Co LCN		acto			D DA	DAT ATE: D B	E: 22/0 22/02/2 Y: AJM BY: AP)2/202 2024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2				Blow	/s / ()mm				8	V			IEA (k	R S Pa)	TRE	NGTH Values	WATER
Topsoil	SILT, with some rootlets; blac Firm; non-plastic; moist.	k.		0.2 -	₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩																-			
	Organic SILT, with some sanc Soft; non-plastic; moist; Orgar medium.	l; black. nic, fibrous roots; sand, fine to		0.4 - 0.6 -	w w T × × × × × × × × × × × × × × × × × × × × × × × × × × × × × × × × × × × ×																			
	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		0.8 -																				
Late Pleistocene river deposits	SAND; grey. Wet; uniformly graded; sand, f	fine to medium, tightly packed.		1.0 - 																				
Late Pleistocer				1.4 -	_ 																			
				1.6 - 								· · · · · · · · · · · · · · · · · · ·												
				2.0 -	-																			
	EOH: 2.20m		-	2.2 - 																				
				2.6 -	-																			
	B (BPR), 1947000 (COSH)			2.8 -	_								DE		D	0								
					Water inflow	at 2.	.2 m	and	i poc	bling	jat∣	pase	RE e of t				: pit 1	term	inate	ed at	2.2	m at	target c	lepth.
						<	₽ 0					evel		_		-			На	r IG/ nd A st Pit	ugei		TYPE	

			TE	EST	PIT L	00	3													нс		NO.: TP11	6
	IN	CLIENT: Sam Property Lin PROJECT: Mangawhai DE			SITE LOC	ATIC	DN:	Ray	/mo	nd E	Bull	Rd							1	Pro	ject	Ref.:	
 GEO ^T	N I T I A	CO-ORDINATES: 1742883mE Co-ordinate system: NZTM2 Location method: GPSH	60004	446mN	ELEVATIC Datum: N Level met	ZTM			N	ЛАС	HIN	IE:	Zax	is 1	30 L		ntrac	ctor	EI L(ND DGC	RT D/ DAT GED	ATE: 22 E: 22/0 BY: AJ D BY: A	2/02/20 2/2024 M
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2	SC		(B	lows	s / On	nm)			R 18		VAI			AR (kPa Van	a)	ENGTH	
Topsoil	SILT, with some rootlets; black Firm; non-plastic; moist. SAND; reddish brown. Moist; HARDPAN, strongly cer			0.2 · 0.4 · 0.6 ·	2 2 2 2 2 2 2 2 2 2 2 2 2 2																		
deposits	SAND; greyish brown.		_		- - - -																		
Late Pleistocene river deposits	Wet; uniformly graded; sand, f	îne to medium, tightly packed.		- 1.2 · · · · · · · · · · · · · · · · · · ·																			
	EOH: 2.20m			2.0 - 2.2 - 	-																		λ
				2.6 · 2.8 · 2.8 ·	-																		
		N. The Content				<u> </u>	<u>: :</u>	: :		<u>: :</u>	<u>: :</u>	: : F	REN	i i MAI	RKS	: S			:	:			
					Water inflow	at 2.2	2 m :			ling :		ase	of te	est p	it. Te	est p						at targe	
	d By: APK					\triangleleft	- Οι	andi ut flo flow	ng V w			vel		-			_] +	Hand Test	Au			Page 1

			TE	EST	PIT L	OG	HOLE NO.: TP117
		CLIENT: Sam Property Lin PROJECT: Mangawhai DD)			ATION: Raymond Bull Rd	Project Ref.: P-001431
 GEO	N I T I A	CO-ORDINATES: 1742787mE, Co-ordinate system: NZTM20 Location method: GPSH		ī	ELEVATIO Datum: N2 Level met		START DATE: 22/02/2024 END DATE: 22/02/2024 LOGGED BY: AJM CHECKED BY: APK
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	(Blows / 0mm)	SHEAR STRENGTH (kPa) Vane: ∇_{1} ∇_{2} ∇_{3} Values
Topsoil	SILT, with some rootlets; black Firm; non-plastic; moist.	k.		0.2_	۳ ۲۶ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳ ۳		
	Organic SILT, with some sand Firm; non-plastic; moist; orgar medium.	l; black. nic, fibrous roots; sand, fine to		0.4 	w w x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x		
S	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		0.8 - 	 		
Late Pleistocene river deposits	SAND; greyish brown. Wet; uniformly graded; sand, f	fine to medium, tightly packed.	-	1.2 - 			
				1.6 1.8 2.0	- - - -		
	EOH: 2.30m		_	2.2_	-		
				2.4 _ 2.6 _	-		
				2.8 - 	-		
	REA STATE					REMARKS	
					Water inflow	▼ Standing Water Level	nated at 2.3 m at target depth. STIGATION TYPE Hand Auger Test Pit

			TE	EST	PIT L	OG								Н	OLE N	IO.: TP118	
		CLIENT: Sam Property Lir PROJECT: Mangawhai DI			SITE LOC	ATION:	Raym	ond Bu	ull Rd					Pro	oject l		
G EO	N I T I A	CO-ORDINATES: 1742825mE Co-ordinate system: NZTM2 Location method: GPSH		460mN	ELEVATIO Datum: N Level met	ZTM		MACH	IINE:	Zaxis	Local (130 L((e		ractor	END LOG	DATE	TE: 22/0 : 22/02/2 SY: AJM BY: AP	2024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	SC	(PENE (Blows / 8 10	0mm)			~		(kF		Values	WATER
Topsoil	SILT, with minor rootlets; blac Firm; non-plastic; moist.	k.		0.2													
	Organic SILT, with some sand Soft; non-plastic; moist; Orgar medium.	l; black. nic, fibrous roots; sand, fine to		0.4 0.6 0.8	本												
Late Pleistocene river deposits	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.		1.0													
Late	SAND; light brown. Wet; uniformly graded; sand, f	îne to medium, tightly packed.		1.6	-												
	EOH: 2.10m			2.2													
				2.6 2.8	-												
		A GALLER		L	1	::::	: : :	:::			ARKS		:	: :	:		I
				V	Vater inflow	at 2 m an ▼ Sta √- Ou	WA	ATER		test p	ıt. Test				TION uger	TYPE	pth.

	51		TE	EST	PIT L	OG	;											HOL	.E N T	0.: P119	
	IN	CLIENT: Sam Property Lin PROJECT: Mangawhai DE)		SITE LOC													_	ect R P-(lef.: 00143	1
 Geo	N I T I A	CO-ORDINATES: 1742681mE Co-ordinate system: NZTM2 Location method: GPSH		357mN	ELEVATIO Datum: N2 Level met	ZTM			MA	СНІМ	NE: 2	Zaxis	s 13(cal C) LC	ontra N	actor	EN LC	ID DA	ATE: ED B	TE: 22/0 22/02/2 Y: AJM BY: AP	2024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	2	SCA 4	6 6	(Blow	rs / Or	nm)		TER				(AR S kPa) /ane:		NGTH Values	WATER
Topsoil	SILT, with minor rootlets; blac Firm; non-plastic; moist.	k.		0.2	TS **** **TS ***TS ***TS ** TS **** **TS *** **TS ***																
	Organic SILT, with some sanc Firm; non-plastic; moist; Orga medium.			0.4	w w																htered
Late Pleistocene river deposits	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.																			Groundwater Not Encountered
	SAND; light brown. Wet; uniformly graded; sand, f	fine to medium, tightly packed.	-	1.6	-																
				2.0																	
				2.6	_																
													IAR	ke							
				1	No groundwa	T	Star	W ²	ATE	R	term						STIC Hand	Auge		TYPE	_
Chack	ed By: APK	No. No.					· Out · In flo								Ŀ	✓ [−]	Test F	Pit			ige 1 of

			TE	EST	PIT L	OG			HOLE	NO.: TP120	
		CLIENT: Sam Property Lim PROJECT: Mangawhai DD			SITE LOC	ATION: Ray	mond Bull Rd		Project	Ref.: -00143	1
 Geo	N I T I A TECHNICAL SPECIALISTS	CO-ORDINATES: 1742742mE, Co-ordinate system: NZTM20 Location method: GPSH	60004	492mN	ELEVATIO Datum: Na Level met	ZTM	CONTRACTOR: Local Co MACHINE: Zaxis 130 LCN R OPERATOR: Luke		START DA END DATE LOGGED I CHECKED	TE: 22/0 :: 22/02/2 BY: AJM	2/2024 2024
	MATERIAL DES (See Classification & Symbole		SAMPLES	DEPTH (m)	LEGEND	SCAL	A PENETROMETER (Blows / 0mm) 8 10 12 14 16 18	VANE S	HEAR STRI (kPa) Vane: ଓ ଜୁ ଚ	ENGTH Values	WATER
Topsoil	SILT, with minor rootlets; blac Firm; non-plastic; moist.	k.		0.2	TS						
	Sandy SILT, with some organi Soft; non-plastic; moist; sand, rootlets.	ics; black. fine to medium; Organics,		0.4 - 0.6 -							ountered
Late Pleistocene river deposits	SAND; dark brown. Moist; HARDPAN, strongly ce	mented.			_						Groundwater Not Encountered
		fine to medium, tightly packed.	-	1.6	-						
	EOH: 1.80m			- 1.8 - - 2.0 - - 2.2 - - 2.4 - - 2.6 - - 2.8 - 			REMARKS				
Chose	ed By: APK				No groundwa	V	ed. Test pit terminated at 1.8 m /ATER ng Water Level	INVES	TIGATION and Auger est Pit		ge 1 of f

			TE	EST	ST PIT LOG													HOLE NO.: TP121									
		CLIENT: Sam Property Lir PROJECT: Mangawhai DI													Project Ref.: P-001431												
EO	N I T I A TECHNICAL SPECIALISTS		426mN	ELEVATION: 4.6m CONTRACTOR: Local Contra Datum: NZTM MACHINE: Zaxis 130 LCN Level method: CONTOUR OPERATOR: Luke									racto	or													
MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)				DEPTH (m)	LEGEND	2		SCALA			In the second se	/ 0m	nm)						V	AN	E S 001-	HE/ (AR \$ kPa /ane	STRE)	ENGTH		
Insdoi	SILT, with minor rootlets; blac Firm; non-plastic; moist.	k.		0.2	т <u>с</u> т т т т т т т т т т т т т																						
	Silty PEAT (FIBROUS), with s Soft; non-plastic; moist; peat (sand, fine to medium.		0.4	★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★																							
				0.8	传传× 4 乐 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4																						
	SAND; dark brown. Moist; HARDPAN, strongly cemented.		-																								
SAND; brownish grey. Saturated; uniformly graded; sand, fine to medium, tightly packed.			1.4 1.6	-																							
				1.8	-																						
	EOH: 2.30m				-																						
				2.4	-																						
				2.8	-																						
					Vater inflow a	at 2.	2 m	and	d pa	olin	la a	t ba					st p		erm	inat	ed a	at 2.3	3 m	at tar	aet der	oth.	
																									·		
		A							w/		ER				_			_	I	NV	ES	TIG	GAT	ION	түр	<u> </u>	
						<	۲o	tano lut fl n flov	ow	Wa	ater	Lev	/el		-			-		 ✓ 	-	and est F		er			

		<u> </u>								Т	E	ST	PI	TL	0	G													T	нс	DLE	NC T	D.: P12	2	
				P	PROJ	JECT	: Ma	angav	erty Li whai D	D				LOC																Pro	-	t Ro P-0	ef.:)014	31	
CO-ORDINATES: 1743195ml Co-ordinate system: NZTM: Location method: GPSH MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)							Da	tum: N2					CONTRACTOR: Local Contractor MACHINE: Zaxis 130 LCN OPERATOR: Luke							otor	END DATE: 21/02 END DATE: 21/02 LOGGED BY: AJI CHECKED BY: A					2/2024 M									
							tails)			SAMPLES		DEPTH (m)		LEGEND	2	so	CAL	(Blov	/s / (Dmm	1)		ER			VA		SHE	EAR (kP Van	a)	1	IGTH Value:	5	WATER
;; T	T (FI	ist.		S); bl	ack.), root	s and	kauri	i logs;			_ 0.2 _ _ 0.4 _		т.																	<u> </u>				
	dium											- 0.6 - 0.8 - 1.0	······································	 × 本 ※ 本																					
	wn. N, st	tron	igly c	ceme	ented.						_	- 1.2 - - 1.4 -		AR AR AR																					_
ra	ı grey	ed; s	sand	l, fine	e to m	nediun	n, tigh	ntly pa	acked.			- 1.6 - - 1.8 - - 2.0 -																							
												-2.2 -																							
						2.31	n: grad	des to g	grey.			- 2.4 - - 2.6 -	_																						
												- 2.8 -																							
	a	and	1	-14		1		142										<u> </u>			<u> </u>	RE	EM	AR	ĸs	: ;		<u> </u>		<u> </u>					
				a long the long to									 Wate	er inflow				WA	TE	R			pit.	Tes	st pi	t ter			STI	GA	TIC				-
Ver 2 Generated with CORE-GS by Genco - Test Pit Initia - 12/03/2024 4:22:43 pm Checked Bit: 4:22:43 pm Checked Bit: 4:22:43 pm																<	↓ <	▼ Stand		▼ Standing Wat	→ Out flow	▼ Standing Water Leve	▼ Standing Water Level	✓ Standing Water Level	▼ Standing Water Level			▼ Standing Water Level Hand Au <- Out flow	▼ Standing Water Level Hand Auger <- Out flow	▼ Standing Water Level Hand Auger <- Out flow	▼ Standing Water Level Hand Auger ← Out flow ✓ Test Pit ► In flow ✓	▼ Standing Water Level Hand Auger <- Out flow			

Checked By: APK

Appendix C Liquefaction Assessment (CLiq)





Project title : P-001431

Location : Black Swamp Road, Mangawhai



Overall Liquefaction Severity Number report

Major expression of liquefaction Moderate to severe exp. of liquefaction Moderate expression of liquefaction Minor expression of liquefaction Little to no expression of liquefaction

Total CPT number: 12 8% little liquefaction 58% minor liquefaction 25% moderate liquefaction 8% moderate to major liquefaction 0% major liquefaction 0% severe liquefaction



Project title : P-001431

Location : Black Swamp Road, Mangawhai



Overall Liquefaction Potential Index report



Project title : P-001431

Location : Black Swamp Road, Mangawhai



Overall vertical settlements report



Location: Black Swamp Road, Mangawhai

Initia Ltd Unit 6, Level 1/114 Saint Georges Bay Road, Parnell, Auckland 1052 Initia.co.nz

Project: P-001431

CPT: CPT01

Total depth: 29.20 m



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:49 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq



Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:49 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

CPT: CPT01

Total depth: 29.20 m



Project: P-001431

Location: Black Swamp Road, Mangawhai

Cone resistance Friction Ratio Pore pressure SBT Plot Soil Behaviour Type 0. 0 0-0. Sensitive fine grained Clay Silty sand & sandy silt 0.5 0.5 0.5 0.5 0.5 Sand & silty sand 1 1 -1-1. 1 Silty sand & sandy silt Silty sand & sandy silt \bigtriangledown 1.5 1.5 1.5 1.5 -1.5 Insitu Sand & silty sand 2 -2. 2 -2 -2 -Silty sand & sandy silt Clay & silty clay 2.5 -2.5 2.5 2.5 -2.5 -3-3 -3 – 3 3. 3.5-3.5 3.5 3.5 3.5 4-4 4 4. 4 4 4.5 4.5 -Depth (m) 2.2 4.5 -5 -5.5 -Depth (m) Depth (m) Depth (m) 5. 5 -5 5 Sand & silty sand 5.5-5.5 5.5 6-6. 6-6-6-6.5 -6.5 6.5 6.5 6.5-7-7-7. 7-7-7.5 7.5 7.5 7.5 -7.5-Silty sand & sandy silt 8 8 8-8-8-Sand & silty sand Silty sand & sandy silt 8.5 8.5 8.5 8.5 -8.5-Sand & silty sand Very dense/stiff soil Silty sand & sandy silt 9 9. 9 9. 9. Sand & silty sand Sand & silty sand Silty sand & sandy silt Sand & silty sand 9.5 9.5 9.5 9.5 9.5 10. 10 10 10. 10silty sar 20 30 40 50 8 10 100 200 300 2 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 0 10 0 2 4 6 0 3 4 qt (MPa) Rf (%) u (kPa) Ic(SBT) SBT (Robertson et al. 1986) Analysis method: Use fill: B&I (2014) G.W.T. (in-situ): 1.50 m No Clay like behavior Fines correction method: B&I (2014) G.W.T. (earthq.): 1.50 m Fill height: N/A applied: Points to test: Based on Ic value Average results interval: 3 Fill weight: N/A Limit depth applied: Yes Earthquake magnitude M...: 6.50 Ic cut-off value: 2.60 Trans. detect. applied: Limit depth: 15.00 m Yes Peak ground acceleration: 0.19 Unit weight calculation: Based on SBT K_{α} applied: No MSF method: Method based

CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:49 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

CPT: CPT03

Total depth: 10.12 m



Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:49 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

CPT: CPT03

Total depth: 10.12 m



Location: Black Swamp Road, Mangawhai

Initia Ltd Unit 6, Level 1/114 Saint Georges Bay Road, Parnell, Auckland 1052 Initia.co.nz

Project: P-001431

CPT: CPT10

Total depth: 17.44 m



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:50 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq



Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:50 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

CPT: CPT10

Total depth: 17.44 m

6


Initia Ltd Unit 6, Level 1/114 Saint Georges Bay Road, Parnell, Auckland 1052 Initia.co.nz

Project: P-001431

CPT: CPT11

Total depth: 28.76 m





Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:52 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq CPT: CPT11

Total depth: 28.76 m



Initia Ltd Unit 6, Level 1/114 Saint Georges Bay Road, Parnell, Auckland 1052 Initia.co.nz

Project: P-001431

CPT: CPT12

Total depth: 13.92 m



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:52 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq



Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:52 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

CPT: CPT12

Total depth: 13.92 m



Initia Ltd Unit 6, Level 1/114 Saint Georges Bay Road, Parnell, Auckland 1052 Initia.co.nz

Project: P-001431

CPT: CPT101

Total depth: 9.13 m



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:53 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq



Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:53 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

CPT: CPT101

Total depth: 9.13 m



Initia Ltd Unit 6, Level 1/114 Saint Georges Bay Road, Parnell, Auckland 1052 Initia.co.nz

Project: P-001431

CPT: CPT103

Total depth: 8.79 m



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:54 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq



Project: P-001431

Location: Black Swamp Road, Mangawhai



CPT: CPT103

Total depth: 8.79 m



Initia Ltd Unit 6, Level 1/114 Saint Georges Bay Road, Parnell, Auckland 1052 Initia.co.nz

Project: P-001431

CPT: CPT108

Total depth: 19.93 m



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:55 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq



Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:55 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

CPT: CPT108

Total depth: 19.93 m



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Project: P-001431

CPT: CPT110

Total depth: 13.32 m



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:57 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq



Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:57 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

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CPT: CPT110

Total depth: 13.32 m



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Project: P-001431

CPT: CPT112

Total depth: 13.77 m



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Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:58 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

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CPT: CPT112 Total depth: 13.77 m



Project: P-001431

CPT: CPT115

Total depth: 6.88 m



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:37:59 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401 1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liguefaction.clg



Initia Ltd

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Project: P-001431

Location: Black Swamp Road, Mangawhai



CPT: CPT115 Total depth: 6.88 m



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Project: P-001431

CPT: CPT117

Total depth: 6.59 m



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Project: P-001431

Location: Black Swamp Road, Mangawhai



CLiq v.3.5.2.22 - CPTU data presentation & interpretation software - Report created on: 21/03/2024, 4:38:00 pm Project file: C:\Users\Alex MacDonald\Initia Limited\Initia Limited Team Site - 1401_1500\P-001431 - Black Swamp Development\Working Material\3. Analysis\Liquefaction.clq

CPT: CPT117

Total depth: 6.59 m