ENGINEERING ASSESSMENT AND DESIGN REPORT

43 Albert Street, Hamilton

Martin Cameron

25 JULY 2025

PROJECT NO. 16537

TITUS
CONSULTING ENGINEERS

Approved for issue by:

X

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Anthony Richardson CPEng 1026340
Principal Project Engineer

DOCUMENT HISTORY AND STATUS

Rev.	Issued To	Date	Prepared	Reviewed	Approved
A	Martin Cameron	18/04/2025	MF	JV	TR
B	Martin Cameron	24/04/2025	MF	JV	TR

RECORD OF REVISION CHANGES

Revision A: First Issue.

Revision B: Updated section 6, Stormwater Assessment and Design – Stormwater device adjusted to manage existing and proposed roofed areas.

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1 INTRODUCTION

Titus Consulting Engineers has been engaged by Martin Cameron to prepare an 'Engineering Assessment and Design Report' for a proposed extension for an existing dwelling at 43 Albert Street, Hamilton. It is understood this report will be used as part of a Building Consent application for the proposed development.

Requirements detailed within the Hamilton City Council Plan, Waikato Regional Council Plan, Consent Notices and Subdivisional Reports have been duly considered in the report and its recommendations.

The report includes the following:

- Background Information
- Site and Ground Investigation
- Geotechnical Assessment
- Foundation Recommendations
- Stormwater Assessment and Design

The following technical documentation has been used in the preparation of the report:

- The Building Code
- NZS1170.5:2004
- NZS3604:2011
- MBIE/ NZGS Canterbury Guidance Modules
- AS/NZS 1547/2012
- WLASS RITS

The report is subject to revision based on any unsighted planning requirements.

2 BACKGROUND INFORMATION

Background information as summarised in the following sections, has been reviewed in preparation of this report.

2.1 Historical Imagery

An investigation of historical imagery relating to the site has been conducted using the Retrolens database. The investigation indicates the site land use has been farmland.

There are no indications of previous slope instability.

2.2 New Zealand Geotechnical Database

There are no relevant entries within the New Zealand Geotechnical Database to the site.

2.3 Previous Reports and Consent Notices

No previous reports, consent notices, or planning requirements are noted for the site.

2.4 Geological Setting

According to GNS Science (GNS Science, 2018), the underlying geological formation of this site is OIS3-OIS2 (Late Pleistocene) river deposits (Hinuera Formation), as shown in Appendix D. This was deposited between 0.012ma and 0.027ma. This formation is described as "Cross-bedded pumice sand, silt and gravel with interbedded peat."

2.5 Seismic Hazard

The NZ Active Faults database (GNS Science, 2017) indicates that the nearest active fault is the Kerepehi Fault approximately 38km to the northeast of the site. The Kerepehi Fault is described as a normal fault with a recurrence interval between 2,000 and up to and including 3,500 years.

Recent research (Moon, 2017) has suggested some evidence for several potentially active faults in the vicinity of Hamilton City. However, their presence has only been inferred through geophysical techniques and information regarding their activity is extremely limited.

Design earthquake magnitude and ground acceleration are determined in accordance with MBIE Guidelines Module 1 (NZGS/MBIE, 2021). The following design parameters have been adopted:

- Site Soil Class D (Deep Soil site) based on NZS1170.5:2004.
- Importance Level 2 based on Table 3.2 of AS/NZS1170.0:2002.
- 50-year Building Design Life.

Seismic parameters determined for the site are detailed in Table 1 below.

Table 1: Seismic parameters (NZGS/MBIE, 2021)

Module 1 MBIE/NZGS					
Importance Level 2					
Design Life:			50 Years		
Ground Acceleration (SLS)		**Ground Acceleration (ULS)**		**Ground Acceleration (INT)**	
Hamilton		Hamilton		Hamilton	
Class D		Class D		Class D	
1/25		1/500		1/100	
M_{eff}	5.9	M_{eff}	5.9	M_{eff}	5.9
PGA, a_{max} (g)	**0.06**	PGA, a_{max} (g)	**0.25**	PGA, a_{max} (g)	**0.12**

3 SITE AND GROUND INVESTIGATION

3.1 Site Investigation

The site is located approximately 2km to the southeast of Hamilton centre. The site is currently a residential lot. The site is bordered by other residential lots with Albert Street to the south. The area near the proposed foundation is flat. No retaining walls were noted on the site.

There are no significant water courses or gullies on the site. The proposed works will not influence the existing stormwater overland flow path/s (OLFP).

HCC has mapped a low flood hazard on a small portion of the south western side of the site. This is outside of the proposed works area, and the works will not affect the flooding.

Figure 1: Site Photo

3.2 Ground Investigation

The site assessment conducted on 4th of April 2025 included the following:

- General site walkover
- Hand Auger (HA) Tests: 3
- Scala Penetrometer (SP) Tests: 3

- Shear Vane (SV) Tests: 2
- Percolation Test (PT): 1

Test locations are shown in Appendix A.

Topsoil was found between 300mm and 400mm below the ground level. Underlying soils consist predominantly of sand. The hand augers showed a top layer of orange silt found to a depth of 1.2m. The underlying soils found on site are gravelly sand from 0.8m to the base of the boreholes. In HA1, the borehole had to be terminated early due to the hole collapsing between 2.1m to 2.4m. Soil investigation logs are attached in Appendix B.

The ground water table was not found within 2.4m of the surface (tested early-April).

No soft clays were found on the site (kPa < 25).

No peat soils were found on the site.

Soakage testing (as per requirements of E1/VM1) yielded a raw soakage rate of 960mm/hr.

4 GEOTECHNICAL ASSESSMENT

This section details findings of a site and soils assessment in accordance with NZS3604:2011 cl. 3.1.3.1 “Determination of “Good Ground’” and the New Zealand Building Code – B1 (NZBC). This requires soils to have a minimum Geotechnical Ultimate Bearing Capacity of (GUBC) of 300 kPa (Allowable Bearing Capacity of 100 kPa for a Factor of Safety of 3) below foundations. For cohesionless soils, 5 blows per 100mm down to a depth of twice the footing width or 3 blows per 100mm at greater depths is required for bearing. For cohesive soils a GUBC of 300kPa is indicated by soils having a minimum undrained shear strength Su of 60kPa.

The investigation focussed on assessing the following key items:

- The bearing capacity of the soil in accordance with the NZBC.
- Potentially compressible ground causing static settlement. Including organic materials (peat/topsoil), un-engineered fill, soft cohesive materials or loose granular materials.
- Potentially expansive soils. Primarily cohesive materials capable of swelling and contracting due to seasonal variations in water content.
- Risk of potential movement. Including slope instability, soils erosion and effects from tree roots, any of which have the potential to cause movement in excess of 25mm.
- Liquefaction in accordance with the MBIE Canterbury Guidance.

Foundations outside of the scope of NZS 3604:2011, the NZBC or proprietary specifications would require *Specific Engineering Design* (SED).

4.1 Bearing Capacity

The ground investigation indicates that dense sands are present at a depth of 900mm below the ground level that are capable of providing a GUBC of >300kPa. Ultimate Bearing capacity of 200kPa is available below the topsoil.

4.2 Static Settlement

Based on the building weight, proposed foundation type, ground improvement, and the absence of soft or organic material immediately beneath the building footprint; the assessed differential static settlements are estimated to be less than 25mm over a horizontal distance of 6m (1 in 240), as required by the Building Code, Appendix B Sections B1/VM4, clause B1.0.2.

4.3 Soil Expansivity

Ground investigations indicate near surface soils comprise of sand and do not contain potentially expansive clays. Accordingly, and in the absence of laboratory shrinkage tests, the soil behaviour has been considered as ‘little to no ground movement from moisture changes’ (A Class) in accordance with AS2870:2011. No mitigation of shrink/swell effects on foundations is considered necessary.

4.4 Slope Stability

The slope on site complies with clause 3.1.2 (b) of NZS 3604:2011 with respect to building foundations located near the top of a bank. As such no further considerations of slope stability are required.

4.5 Liquefaction Assessment

A comparison between the conditions required for the triggering of liquefaction and conditions found on site is shown in Table 2 below.

Table 2: Conditions for liquefaction occurrence

Soil conditions considered susceptible to liquefaction occurrence	Site
Holocene to Late Pleistocene sediments	Yes
Cohesionless	Yes
Non-cohesive silt to medium to fine sand	Yes
Loosely packed	Some Layers
Shallow water table (<4m)	Possible
Thick non-liquefiable crust at the ground surface	Unlikely

Tonkin & Taylor (2019) state in Hamilton City Council Liquefaction Desktop Study that in this formation liquefaction damage is possible. Since there is medium to high liquefaction vulnerability during or following a ULS seismic event, it is recommended that the site be classified as TC3.

This site is not located within 100m of a free face less than 2.0m high or within 200m of a face greater than 2.0m high. Consequently, lateral spread at this location can be considered as being unlikely (MBIE 2017).

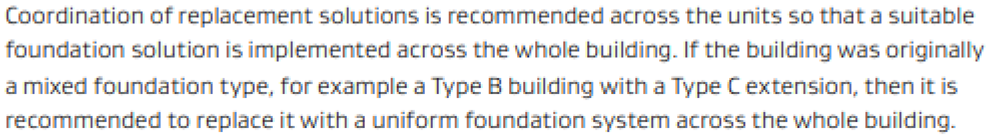
4.6 Good Ground Assessment

“Good Ground” in terms of NZS3604:2011 was not found on site due to the liquefaction potential.

5 FOUNDATION RECOMMENDATIONS

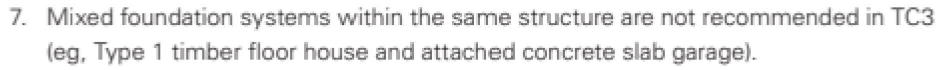
The following foundations options are suitable given the soil conditions on site, however, are subject to the specific requirements of each of the foundation options as stated below.

Due to this development being an extension to an existing dwelling it is recommended that a similar foundation (to the existing building) system is used and designed by a CPEng structural engineer, unless an exact match can be made to a foundation complying with the building code. Settlements are expected to be exacerbated if different foundation types are present under a single structure. This is based on the following passage from Part E (Section 22.3) of the Canterbury Guidance (specifically for multi-unit dwellings where floors are being rebuilt.



Coordination of replacement solutions is recommended across the units so that a suitable foundation solution is implemented across the whole building. If the building was originally a mixed foundation type, for example a Type B building with a Type C extension, then it is recommended to replace it with a uniform foundation system across the whole building.

It is also noted within Part C (Section 11.2 Item 7) of the Canterbury guidance that:



7. Mixed foundation systems within the same structure are not recommended in TC3 (eg, Type 1 timber floor house and attached concrete slab garage).

In all cases, any cut to fill earthworks required to establish a suitable building platform should be carried out in accordance with NZS4431:2022.

These recommendations should be considered in conjunction with any other subdivisional reports for the site. Any discrepancies between consultant recommendations shall be clarified prior to finalising the works on site.

5.1 SED Piled Foundation

Shallow piled foundations in accordance with engineer’s design is acceptable. The designer shall consider the bearing capacity of the soils and the liquefaction risk.

Table 3: SED Piled Foundation Recommendation

Minimum depth of borehole excavation	900mm (300kPa) 500mm = below topsoil (200kPa)
Base of Borehole bearing standard	300kPa – 5 blows / 100mm (Scala) 200kPa – 2 blows / 100mm (Scala)
Construction Monitoring / Inspection Schedule	1 – bottom of borehole excavations
Foundation type	SED Piles
Comments	

These recommendations should be considered in conjunction with the structural foundation design and reviewed by an appropriately qualified engineer.

A suitably qualified engineer should be engaged to perform construction monitoring in compliance with the Building Code and as specified above.

5.2 Specific Engineering Design Foundation

Alternative foundations may be considered and are required to be designed by a suitably qualified engineer.

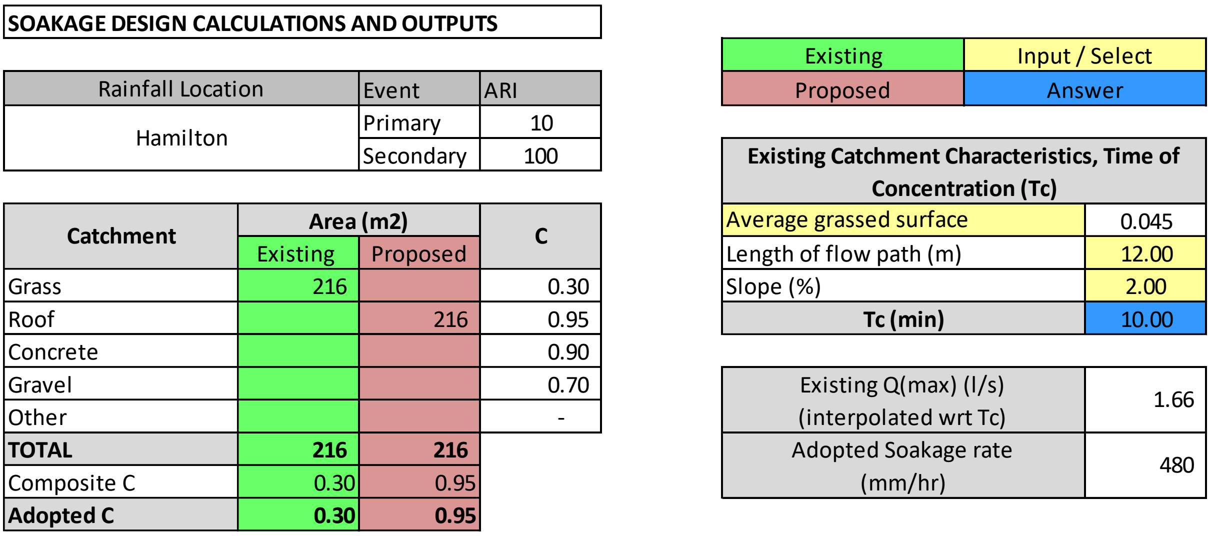
Titus Consulting Engineers shall be engaged to perform inspections in compliance with the Building Code.

6 STORMWATER ASSESSMENT AND DESIGN

6.1 Design Parameters

- Lot Size: 559m^2
- Proposed roof area: 89m^2
- Existing roof area: 127 m^2
- Total design roof area: 216 m^2
- Land is sloping: Residental: Towards the road (10yr ARI adopted)
- Design storms:
  - Primary: 10yr ARI
  - Secondary: 100yr ARI
- Rainfall data: Ruakura Rainfall Data
- Climate change: RCP6.0 (2081-2100)
- Raw soakage rate: 960mm/hr (tested 4th of April 2025) – Refer to Appendix C for results.
- Adopted soakage rate: 480mm/hr

Figure 2 below summarises the catchment characteristics that have been adopted.



SOAKAGE DESIGN CALCULATIONS AND OUTPUTS

Rainfall Location	Event	ARI
Hamilton	Primary	10
	Secondary	100

Catchment	Area (m2)		C
	Existing	Proposed	
Grass	216		0.30
Roof		216	0.95
Concrete			0.90
Gravel			0.70
Other			-
TOTAL	**216**	**216**	
Composite C	0.30	0.95	
Adopted C	**0.30**	**0.95**	

Existing	Input / Select
Proposed	Answer

Existing Catchment Characteristics, Time of Concentration (Tc)	
Average grassed surface	0.045
Length of flow path (m)	12.00
Slope (%)	2.00
Tc (min)	10.00

Existing Q(max) (l/s) (interpolated wrt Tc)	1.66
Adopted Soakage rate (mm/hr)	480

Figure 2: Stormwater Design Parameters

6.2 Design Results

The recommendations below are for the proposed site development.

Refer to Appendix E for the stormwater calculations and Appendix F for the indicative stormwater plan and typical details.

6.2.1 Soakage Trench

It is proposed that a soakage trench is constructed to enable disposal of water from all the roof areas to ground during the design storm. All proposed roof water should be routed to the soakage trench. The overflow from the soakage trench will discharge to the council connection.

The soakage trench can either be constructed with 40-60mm clean rock or proprietary stormwater crates as follows:

- A rock filled trench shall be **1.0**m deep and a minimum of **10.1**m^2 in plan area.
- A proprietary crate system (StormPocket or similar) shall be **0.80**m deep (2 layers) and a minimum of **6.7**m^2 in plan area.

The location of the **rock filled trench** underneath paved trafficable areas (for domestic residential driveways only) is acceptable on the basis that an adequate pavement as described below is constructed in areas where vehicle loads are expected over the soakage trench, extending a minimum of 1.5m wider than the trench extents:

- Base Material: (Fill over top of soakage trench) - 200mm GAP 40 compacted to 102% RDD.
- Surface - 125mm Concrete 25Mpa with SE62 Steel reinforcing Mesh - on 50mm chairs.
- Sawcuts at a maximum 6m spacing, as per NZS 3604 Cl. 7.5.8.6.4 are to be provided.

The location of a **propriety crate system** underneath paved trafficable areas (for domestic residential driveways only) is acceptable provided that manufacturers specifications are followed.

Subsurface water drains shall be sized in accordance with Acceptable Solutions and Verification Methods for New Zealand Building Code Clause E1 Surface Water (E1/AS1) Section 3.

6.2.2 Secondary Flow Path

The stormwater runoff from the proposed roof surfaces has been designed to be routed via the soakge trench. The overflow from these devices shall discharge to the council connection with secondary overflow via the bubble up and flow to the road.

6.3 Operation and Maintenance

It is recommended that first flush devices are installed upstream of the soakage trench and that these devices are regularly checked and cleaned along with the catchpits and overflow pipes.

Any catchpits installed are required to have 90° bends at the inlets and outlets.

6.4 Construction Monitoring Inspection Schedule

Titus Consulting Engineers shall inspect the storm water system during construction. All key components of the stormwater system shall be inspected, including the installation of underground devices and outlets.

7 REFERENCES

AS/NZS 1170.0:2002 - Structural Design Actions, Part 0: General Principles –Standards New Zealand, Wellington, New Zealand.

AS/NZS 1170.5:2004 - Structural Design Actions, Part 5: Earthquake Actions –Standards New Zealand, Wellington, New Zealand.

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NZS 3604:2011 – Timber Framed Buildings – New Zealand Standards, Wellington, New Zealand.

NZS 4402:1986 – Methods of Testing Soils for Civil Engineering Purposes – New Zealand Standards, Wellington, New Zealand.

NZS 4431:2022 – Code of Practice for Earth Fill for Residential Development – New Zealand Standards, Wellington, New Zealand.

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8 LIMITATIONS

This report does not assess risk of contamination of soils. This report does not provide, a foundation design, an assessment of flood risk or a FFL recommendation.

Testing portrays a limited percentage of ground conditions at 43 Albert Street, Hamilton and may not be representative of all soils present on site.

Assessment of the water table depth and moisture content is subject to seasonal variation.

On site wastewater disposal systems which rely on soakage to ground are subject to performance deterioration over time and temporary inundation due to perched or shallow water tables which may occur after periods of heavy rain. Additionally, inundation of distribution boxes or septic tanks may cause systems to temporarily backup and stop functioning. These conditions are generally temporary and normalise with pumping out of the system and once elevated water table levels have subsided. The client accepts responsibility for the maintenance, operation, and remediation of the system under the above-mentioned conditions.

During excavation and construction, the site should be examined by a suitably qualified engineer in order to assess whether the exposed subsoils are compatible with the inferred soil conditions on which the recommendations have been based and potentially further investigation and design rationalisation may be required.

This report has been prepared solely for Martin Cameron, its professional advisors and local authorities in relation to 43 Albert Street, Hamilton. No liability is accepted for its use for any other purpose or by any other entity. Reliance by other parties or future owners of the property on the information or opinions contained in the report shall be verified with Titus Consulting Engineers. This report should be read and understood in its entirety, including Appendices, prior to construction or development.

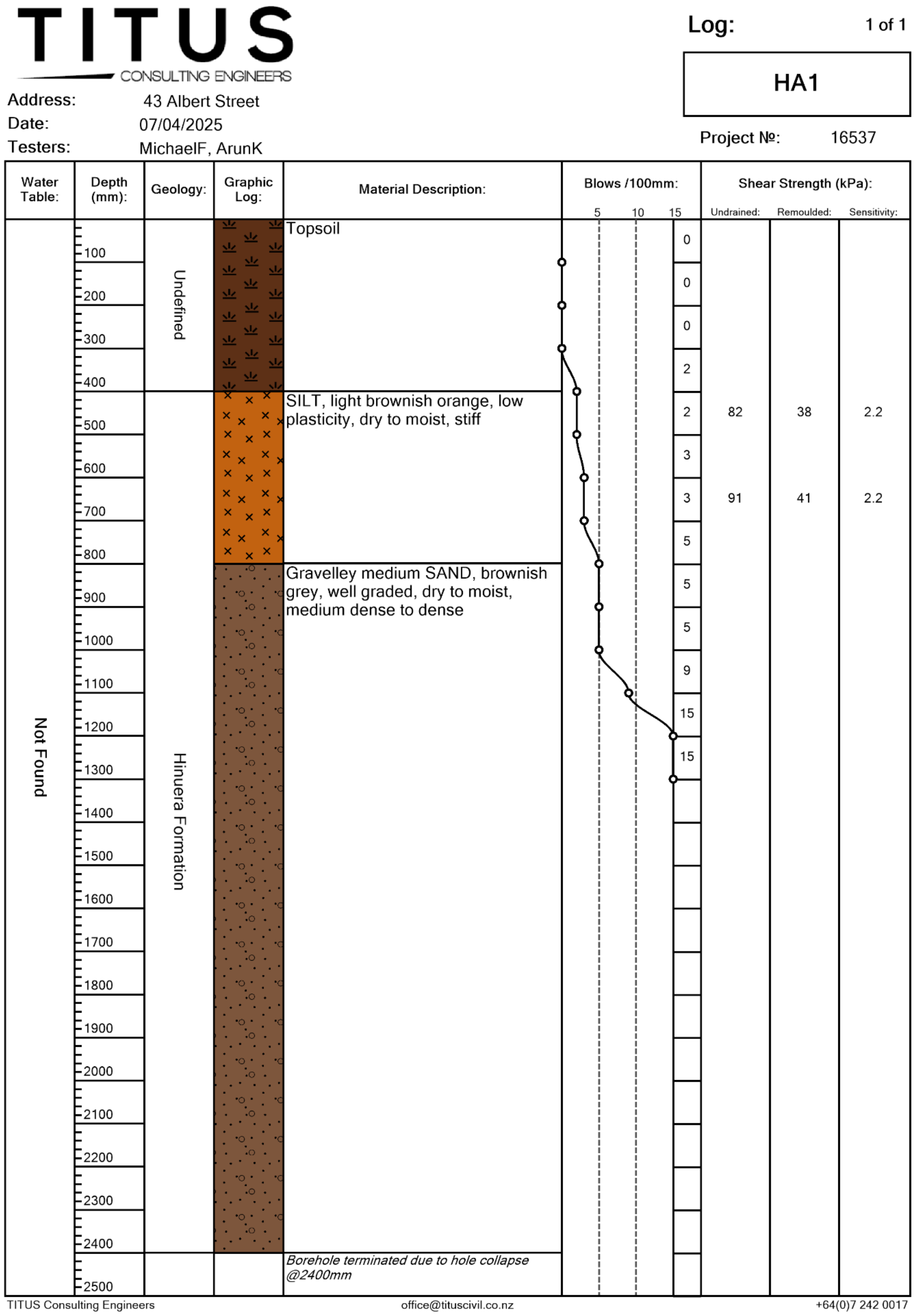
Should you be in any doubt as to the recommendations of this report it is essential that you discuss these issues with Titus Consulting Engineers prior to proceeding with any work based on this report.

The recommendations in this report do not supersede recommendations of other engineering reports and shall be considered in conjunction with all other information available for the site.

APPENDICES

APPENDIX A – Test Locations

APPENDIX B – Ground Investigation Logs



Log: 1 of 1

HA1

Address: 43 Albert Street
Date: 07/04/2025
Testers: MichaelF, ArunK
Project №: 16537

Water Table: Not Found

Depth (mm):	Geology:	Material Description:	Blows /100mm:	Undrained:	Remoulded:	Sensitivity:
100	Undefined	Topsoil	0			
200			0			
300			0			
400			2			
500	Hinuera Formation	SILT, light brownish orange, low plasticity, dry to moist, stiff	2	82	38	2.2
600			3			
700			3	91	41	2.2
800			5			
900		Gravelley medium SAND, brownish grey, well graded, dry to moist, medium dense to dense	5			
1000			5			
1100			9			
1200			15			
1300			15			
1400						
1500						
1600						
1700						
1800						
1900						
2000						
2100						
2200						
2300						
2400						
2500		*Borehole terminated due to hole collapse @2400mm*				

TITUS Consulting Engineers office@tituscivil.co.nz +64(0)7 242 0017

TITUS CONSULTING ENGINEERS

Log: 1 of 1

HA2

Address: 43 Albert Street
Date: 07/04/2025
Testers: MichaelF, ArunK

Project №: 16537

Water Table:	Depth (mm):	Geology:	Graphic Log:	Material Description:	Blows /100mm:	Shear Strength (kPa): Undrained:	Remoulded:	Sensitivity:
Not Found	100	Undefined		Topsoil	0			
	200				0			
	300				0			
	400	Hinuera Formation		Fine SAND with some gravel, light brownish orange, well graded, moist, loose to medium dense	4			
	500				2			
	600				2			
	700				4			
	800				2			
	900				3			
	1000				6			
	1100				4			
	1200				5			
	1300			*End of Borehole @1200mm*	6			
	1400				6			
	1500				7			
	1600				5			
	1700				8			
	1800							
	1900							
	2000							
	2100							

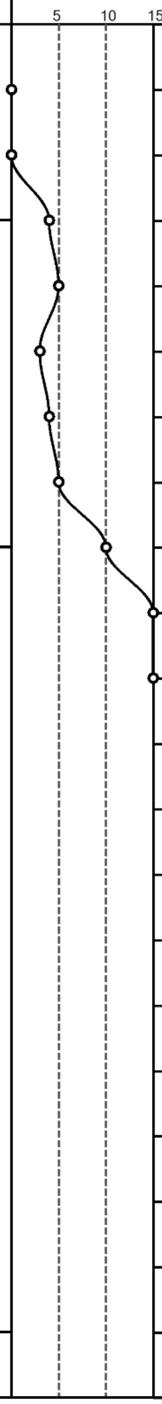
Log: 1 of 1

HA3

Address: 43 Albert Street
Date: 07/04/2025
Testers: MichaelF, ArunK

Project №: 16537

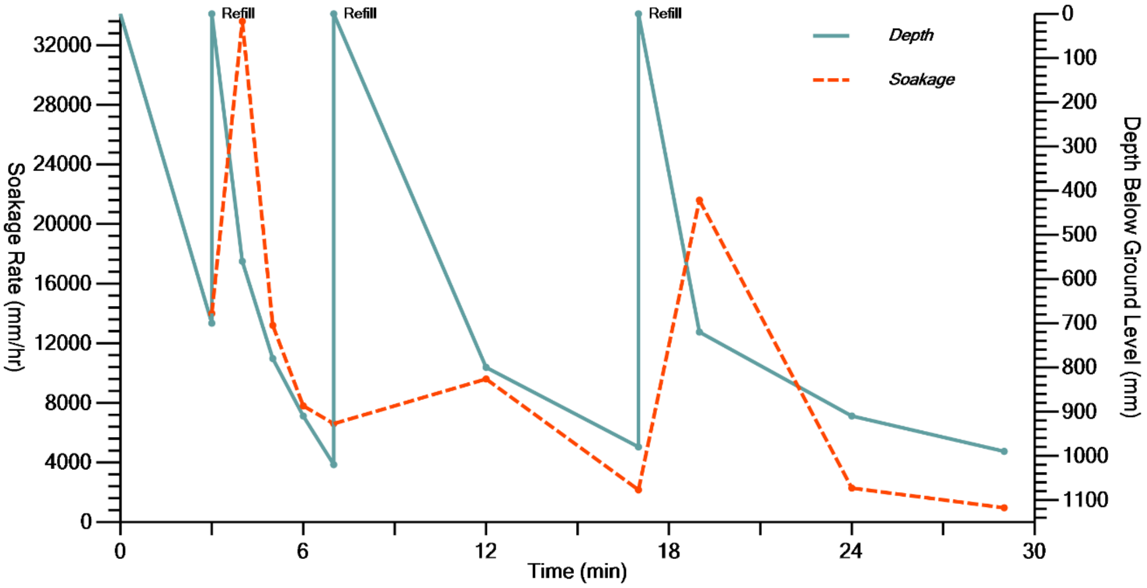
Water Table:	Depth (mm):	Geology:	Graphic Log:	Material Description:	Blows /100mm:	Shear Strength (kPa):		
						Undrained:	Remoulded:	Sensitivity:
Not Found	100	Undefined		Topsoil	0			
	200				0			
	300				4			
	400	Hinuera Formation		SILT, light brownish orange, low plasticity, dry to moist	5			
	500				3			
	600				4			
	700				5			
	800				10			
	900			Gravelley medium SAND, brownish grey, well graded, dry to moist, dense	15			
	1000				15			
	1100							
	1200							
	1300							
	1400							
	1500							
	1600							
	1700							
	1800							
	1900							
	2000							
	2100			*End of Borehole @2000mm*				



APPENDIX C – Percolation Test

Percolation Test Sheet

Project ID	16537
Address	43 Albert Street



Reading	Time Elapsed (min)	Drop (mm)	Soakage Rate (mm/hr)	Refill
1	3	700	14000	
2	4	560	33600	✔
3	5	220	13200	
4	6	130	7800	
5	7	110	6600	
6	12	800	9600	✔
7	17	180	2160	
8	19	720	21600	✔
9	24	190	2280	
10	29	80	960	

Log	HA2
Date	07/04/2025
Staff	MichaelF, ArunK
BH Depth	1200 mm
Ground Water	Not Encountered
Main Soil Type	SAND
Seasonal Variation	Conservative
Raw Soakage	960 mm/hr

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APPENDIX D – Underlying Geology

Name:	OIS3-OIS2 (Late Pleistocene) river deposits (Hinuera Formation)
Simple name:	Late Pleistocene river deposits
Main rock name:	sand
Stratigraphic age:	Q3, Q2
Description:	Cross-bedded pumice sand, silt and gravel with interbedded peat.
Subsidiary rocks:	silt, gravel, peat, pumice

APPENDIX E – Calculation Sheet

SOAKAGE DESIGN CALCULATIONS AND OUTPUTS

Existing	Input / Select
Proposed	Answer

Rainfall Location	Event	ARI
Hamilton	Primary	10
	Secondary	100

Catchment	**Area (m2)**		**C**
	Existing	Proposed	
Grass	216		0.30
Roof		216	0.95
Concrete			0.90
Gravel			0.70
Other			-
TOTAL	**216**	**216**	
Composite C	0.30	0.95	
Adopted C	**0.30**	**0.95**	

Existing Catchment Characteristics, Time of Concentration (Tc)	
Average grassed surface	0.045
Length of flow path (m)	12.00
Slope (%)	2.00
Tc (min)	10.00

Existing Q(max) (l/s) (interpolated wrt Tc)	1.66
Adopted Soakage rate (mm/hr)	480

ARI	10									
Duration(min)	10	20	30	60	120	360	720	1440	2880	4320
Intensity	92.3	63.1	50.1	33.3	21.7	10.6	6.6	4.1	2.4	1.8
Intensity CC	112.0	76.6	60.8	40.4	26.2	12.5	7.7	4.6	2.7	2.0
Existing Q (l/s)	1.7	1.1	0.9	0.6	0.4	0.2	0.1	0.1	0.0	0.0
Proposed Q (l/s)	6.4	4.4	3.5	2.3	1.5	0.7	0.4	0.3	0.2	0.1

ARI	10									
Duration	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
Depth EX	15.4	21.0	25.0	33.3	43.4	63.9	79.6	97.4	117.0	129.0
Depth CC	18.7	25.5	30.4	40.4	52.4	75.1	91.9	110.0	130.0	143.0
Existing Vol m3	1.0	1.4	1.6	2.2	2.8	4.1	5.2	6.3	7.6	8.4
Proposed Vol m3	3.8	5.2	6.2	8.3	10.8	15.4	18.9	22.6	26.7	29.3

40/60 Clean Rock										
Depth	1	Voids	0.38							
Duration	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
Vsoak /m2	0.08	0.16	0.24	0.48	0.96	2.88	5.76	11.52	23.04	34.56
Vstore /m2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Vtotal /m2	0.5	0.5	0.6	0.9	1.3	3.3	6.1	11.9	23.4	34.9
Trench size m2	8.3	9.7	**10.1**	9.6	8.0	4.7	3.1	1.9	1.1	0.8

StormPocket										
Depth	0.8	Voids	0.95	No. layers	2					
Duration	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
Vsoak /m2	0.08	0.16	0.24	0.48	0.96	2.88	5.76	11.52	23.04	34.56
Vstore /m2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Vtotal /m2	0.8	0.9	1.0	1.2	1.7	3.6	6.5	12.3	23.8	35.3
Trench size m2	4.6	5.7	6.2	**6.7**	6.3	4.2	2.9	1.8	1.1	0.8

APPENDIX F – Engineering Plans & Typical Details

Attached separately