APPENDIX E: INFRASTRUCTURE REPORT



FAST TRACK REFERRAL - SOUTHWEST INDUSTRIAL SPRINGS ROAD, HALSWELL CHRISTCHURCH

INFRASTRUCTURE REPORT

PROJECT INFORMATION

CLIENT	Puna Property Holdings Limited & Foddercube Products (Nth. Canty.) Limited
PROJECT	Southwest Industrial 290, 300, 318, 374, 376 Springs Road, Christchurch - Fast Track Development

DOCUMENT CONTROL

DATE OF ISSUE	26/08/2026
REVISION	B
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1. Introduction

1.1. Background

Maven Canterbury Ltd have been engaged by Puna Property Holdings Ltd & Foddercube Products (Nth. Canty.) Ltd to undertake infrastructure design in support of the proposed industrial rezoning development named Southwest Industrial, at Springs Road (290/300/318/320/374/376), Halswell, Christchurch.

The approach for the infrastructure design has been split into two blocks, Block A comprising of 290/300/318/320 Springs Road, and Block B being 374 & 376 Springs Road. A site plan is included in Appendix A.

1.2. Purpose of Report

The purpose of this report is to provide the developer an initial assessment of the earthworks, roading, and three waters infrastructure to service the proposed development. This report is to be read in conjunction with the associated high-level concept engineering drawings and calculations.

1.3. Site Description

The development area is a 21.5-hectare block of land located within the Christchurch District, currently zoned Industrial Heavy (290/300) and Rural Urban Fringe (318/320/374/376). The site is bound by the Christchurch Southern Motorway (SH 76) to the north, Springs Road to the east, Marshs Road to the south, and an industrial development to the west.

The site is generally flat with slight fall towards Springs Road confirmed via an initial drone topographical survey.

The site is predominantly green pasture, with a small portion of the overall development comprising of a commercial operation (plant nursery) and associated parking lot along Marshs Road. There is an existing self-service fuel station to the east of 300 Springs Road which is independent of this development. The undeveloped section of land directly northeast of the site (290 Springs Road) does not form part of this development and is owned by a separate entity.

1.4. Legal Description

The development site is split across multiple parcels of land, and the legal descriptions for these parcels of land are listed in table 1 below:

Table 1: Lot Descriptions

Address	Lot Description	Area (Ha)
290 Springs Road, Halswell, Christchurch	Section 2 SO 556764	0.4251
300 Springs Road, Halswell, Christchurch	Section 4 SO 562497	2.504
320 Springs Road, Halswell, Christchurch	Section 7 SO 482614	2.127
318 Springs Road, Halswell, Christchurch	Lot 1 DP 82095	4.000
374 Springs Road, Halswell, Christchurch	Section 6 SO 550060	5.2329
376 Springs Road, Halswell, Christchurch	Section 4 SO 550060	7.2185
	Total Area (Ha)	21.5075

1.5. Geotechnical

Babbage Consultants Ltd have undertaken geotechnical assessments and reports for the subject site (Appendix C), split into the two separate design blocks (A&B). Percolation tests were also completed by Babbage to assess suitability for stormwater soakage solutions.

1.5.1. Ground Conditions - Soils

The Babbage Block A Geotechnical Assessment Report (Doc No. 200048525) was completed on 11th September 2024. The ground conditions were found to be consistent throughout the entire area (8.63 ha). Their findings of the subsurface conditions can be seen in Figure 1.

Soil Type	Approximate Depth to Base of Stratum (m)												
	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10	TP11	TP12	TP13
Topsoil	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Silt	-	0.8	1.4	0.8	1.0	0.6	0.6	1.0	0.6	0.9	0.8	0.7	0.9
Silty Sand	1.2	-	-	-	1.5	0.9	0.9	1.2	0.8	-	-	-	-
Sandy Silt/Silt	-	-	-	-	-	-	-	-	-	-	-	-	-
Sandy Gravel	2.3*	1.8*	2.6*	2.2*	2.5*	2.0*	2.0*	2.2*	2.1*	2.0*	2.1*	1.9*	2.0*
	TP14	TP15	TP16	TP17	TP18	TP19	TP20	TP21	TP22	TP23	TP24	TP25	
Topsoil	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.3	0.4	
Silt	1.4	0.6	0.7	-		0.9	0.9	0.8	-	-	-	-	
Silty Sand	-	-	-	-	1.0	-	-	1.0	3.1*	-	3.0*	-	
Sandy Silt/Silt	-	-	-	0.7		-	-	1.2		1.0		3.0*	
Sandy Gravel	2.5*	1.7*	1.7*	1.7*	2.7*	1.9*	2.0*	2.4*		2.0*			

*final depth of the exploratory hole

Sand lens in TP11 from 1.2-1.6m, and TP18 from 1.3-1.6m

Figure 1: Block A Summary of encountered ground conditions (Source Babbage Consultants Ltd Report)

Groundwater was not encountered during their investigation and has been advised it is expected to be located at approximately 6-8m depth below ground.

As part of this geotechnical investigation, percolation tests at four separate test pits were also conducted.

The Babbage Block B Geotechnical Assessment Report (Doc No. 200050752) was completed on 02nd December 2025. The ground conditions were found to be consistent throughout the entire area (12.45 ha). Their findings of the subsurface conditions can be seen in Figure 2.

Soil Type	Approximate Depth to Base of Stratum (m)												
	HA01	HA02	HA03	HA04	HA05	HA06	HA07	HA08	HA09	HA10	HA11	HA12	HA13
Topsoil/fill	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.25	0.2
Interbedded sand and silt mixtures	0.8^	3.0*	3.0*	3.0*	1.0*	3.0*	1.0*	3.0*	3.0*	3.0*	1.0*	3.0*	1.0*
Saturated soil	-	-	-	-	-	2.7	-	-	-	2.9	-	-	-
	HA14	HA15	HA16	HA17	HA18	HA19	HA20	HA21 (TP)	HA22 (TP)	HA23 (TP)	HA24	HA25	
Topsoil/fill	0.2	0.2	0.3	0.25	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.45	
Interbedded sand and silt mixtures	3.0*	3.0*	3.0*	3.0*	1.0*	3.0*	3.0*	1.0*	2.0*	1.0*	3.0*	1.0*	
Saturated soil	-	-	-	2.8	--	2.8	2.9	-	-	-	-	-	-

^ Refusal on assumed gravel

*Target depth

Figure 2: Block B Summary of encountered ground conditions (Source Babbage Consultants Ltd Report)

Groundwater was not encountered during their investigation, although saturated soils were encountered in some test pits. Groundwater depth of approximately 9m has been noted in the report, in accordance with Environment Canterbury's (ECan) wells within the vicinity.

1.5.2. Ground Conditions – Infiltration

Babbage Consultants Ltd conducted percolation tests at multiple locations within the entire development site.

The test results can be seen in Figure 3, where TP0A/TP0B/TP0G/TP0H are within proposed Block A area and TP0C/TP0F/TP0D/TP0D1/TP0E within proposed Block B area. These rates have been reviewed and incorporated into the preliminary stormwater design.

Test Location	Final Depth (m)	Depth to saturated soils (m)	Infiltration Rate (k)	
			$m^3/s/m^2$	mm/hour
TP0A	4.10	-	Rapid Drainage	Rapid Drainage
TP0B	3.45	-	Rapid Drainage	Rapid Drainage
TP0C	5.70	-	9.9×10^{-4}	3548
TP0D-1	4.05	-	1.8×10^{-5}	66
TP0D-2	5.05	-	7.5×10^{-5}	269
TP0D1	4.50	-	5.5×10^{-5}	197
TP0E	5.10	-	3.0×10^{-4}	1090
TP0F	4.90	3.8*	1.2×10^{-5}	41
TP0G	3.30	3.7*	Rapid Drainage	Rapid Drainage
TP0H	3.75	-	3.7×10^{-4}	1331
				*perched water

Figure 3: Summary of soakage test results (Source Babbage Consultants Ltd Report)

1.6. Site Contamination

Preliminary and Detailed Site Investigations (PSI and DSI) have been completed on the site by KPES Ltd, generally indicating the site is environmentally low risk with potential for some asbestos in existing buildings.

KPES advises the prepared Site Management Plan will be required to be adhered to for this development to ensure satisfactory measures are implemented.

1.7. Ecology

A high-level ecological assessment has been undertaken by Aquatic Ecology. No wetlands or significant vegetation were identified onsite. It has been recommended further in-depth assessment(s) take place prior to construction.

1.8. Proposed Development

The Springs Road development comprises of 36 proposed industrial lots, two lots for stormwater strategy and associated roading lots interlinking the development to Marshs and Springs Road.

The site is predominantly zoned Rural Urban Fringe, with one of the existing lots being zoned Industrial Heavy. Through this fast-track application, the proposal seeks to rezone the entirety of the development to Industrial General. Refer to Landplay Ltd documentation for further information on this.

The development will comprise of industrial allotments of varying sizes, providing for a range of uses. The nature of this proposal is for a vacant development.

2. Earthworks

2.1. Sediment and Erosion Control

Christchurch City Council (CCC) approved erosion and sediment controls will be implemented in accordance with standard practises and ECan toolbox and guidelines. These measures may include silt fences, stabilised entrance, clean and dirty water diversion, sediment retention ponds, and stockpile management. Regular inspection and maintenance of controls will be undertaken throughout construction. It is noted that construction will be possible within any season.

Erosion and sediment controls should be in place before earthworks commence and checked onsite by the local authority and/or a suitably qualified engineer. Sediment and erosion control drawings will be provided prior to construction for approval by CCC.

2.2. Preliminary Earthworks

The approach to the bulk earthworks required for the development will be in general accordance with the Babbage Geotechnical report guidance and recommendations. However, it is anticipated that majority of earthworks will be related to the roading and stormwater aspects, to minimize disturbance across site where not required. Localized bulk earthworks will be required within individual lots to ensure a minimum gradient of 1:300 is achieved towards the road reserves.

The Geotech testing identified a topsoil depth of up to 400mm to be expected across site, based on their sampling. Any bulk earthworks would need to be completed in accordance with NZS 4431, including topsoil removal, subgrade testing, bulk filling or cutting, and testing by a suitably qualified person. Bulk earthworks will ideally be completed using site won material, to limit the need for importing material to site.

General quantities for this bulk strip are estimated at 15,000m^3 for the roading corridor and stormwater management areas. It will be proposed that site materials are reused on site, where practical, to limit offsite movements. Excess topsoil may be used within designated landscaping areas. A detailed bulk earthworks and proposed ground level design will be completed during the substantive stage.

It is expected that future built-form on each industrial site will require its own bulk earthworks, in accordance with the nature and scale of the proposed activity.

3. Roading and Access

3.1. Existing

The development site currently has vehicular access through three different locations off Springs Road and one off Marshs Road. None of these current access points are anticipated for reuse for the proposed development and will be removed.

An existing cycleway runs along the north and west site boundaries, joining to both Marshs and Springs Road. This cycleway changes to a shared cycle/pedestrian pathway along Springs Road and partially along Marshs Road. The cycleway adjoining the western boundary is the Little River Link Cycleway.

3.2. Proposed

A roading corridor layout has been identified on the scheme plan by Landplay (Planner). Novo Group are undertaking the high-level report and traffic assessment for this development, including the two intersections required, at Springs Road and Marshs Road.

The two new intersections will be assessed/modelled by Novo Group, who will confirm the level of upgrading required at each of the two, for roading and shared paths. No connectivity to the Christchurch Southern Motorway proposed.

The internal roading network proposed will loop around the development to directly service majority of the industrial lots. One right-of-way (ROW) is proposed off this main roading corridor to access rear lots. All new vehicle crossings, roads, and ROWs will be designed and constructed in accordance to CCC's Construction Standard Specification (CSS), Infrastructure Design Standard (IDS) and the District Plan (DP). The main roading corridor will have a minimal legal width of 18m, minimal carriageway width of 12m, minimum of two lanes, and will include footpath and associated berm(s) on either side of the carriageway. ROWs will achieve the minimum widths specified within the DP.

The road(s) will be designed with a central crown and crossfall towards either side of the road to kerb and channels. The kerb and channels will convey stormwater runoff from the road(s) to corresponding sumps and/or first-flush stormwater treatment systems, at grades no flatter than 1:500.

The roading development area will require a full topsoil scrape due to the current surface/usage conditions. Surface for all roading and ROWs will provisionally be asphalt finish of 55mm AC14, over suitable metal layers. Pavement design will be confirmed at detailed design stage, ultimately designed to relevant CCC standards and subgrade CBR. Individual lots will be formed to achieve a minimum 1:300 crossfall from the rear to the road frontage, directing secondary flow paths to the road.

The existing shared cycle/pedestrian path along Springs Road will be incorporated into the new intersection design by Novo Group Ltd.

Streetlighting and landscaping will be incorporated into the roading corridor design and be designed and constructed in accordance with usual CCC requirements.

4. Stormwater

4.1. Existing Public Infrastructure

The is currently no public stormwater infrastructure within the vicinity of the subject site. Treatment/conveyance swales are present along the northeast corner of the site; however, these are not anticipated for use by the development. There is an existing soakpit to the south of the proposed Springs Road intersection that will need to be considered by Novo during the intersection layout. There is a water course that runs along the Marshs Road berm, by the development's southern boundary. This water course will be retained but not anticipated for use by the development.



Figure 4: Existing Stormwater in proximity to the development (CCC 3-Waters Map)

4.2. Proposed Strategy

The development will be split into two areas, being referred to as Block A and Block B, within this report. Each block will deal with its associated stormwater discharge separately, treating and disposing of the respective runoff within its allocated stormwater management areas.

The overall stormwater strategy may change as design develops through the detailed design stages; however, the strategy is to introduce stormwater conveyance and treatment systems, prior to onsite ground disposal. All lots will require future onsite disposal based on the nature and scale of proposed activity, up to and including the 2% AEP event. In excess of this will be captured within the roading stormwater management areas, using the roading corridor as conveyance and overland flow.

An area for first-flush treatment will be provided, as per the Christchurch City Council Waterways, Wetlands and Drainage Guidelines (WWDG), followed by a by-pass into a storage basin (or similar).

Babbage Consultants Ltd have conducted percolation tests throughout the subject site to determine suitable soakage rates for the stormwater disposal to ground solution(s). Preliminary calculations for the stormwater basins have been undertaken to ensure the dedicated stormwater management lots will be sufficient for the disposal solutions (Appendix B). Any stormwater disposal systems will be sized to ensure capacity for the 1% (1-in-100 year) AEP up to and including the 24hour rainfall event.

All stormwater infrastructure will be designed in accordance with the CCC CSS, IDS and NZBC E1: Surface Water.

4.3. Flooding

The CCC online flood viewer does not register the site as being within the Flood Management Area (FMA). However, it does show parts of the site being affected by the 10, 50 and 200-year rainfall events as per Figure 5.

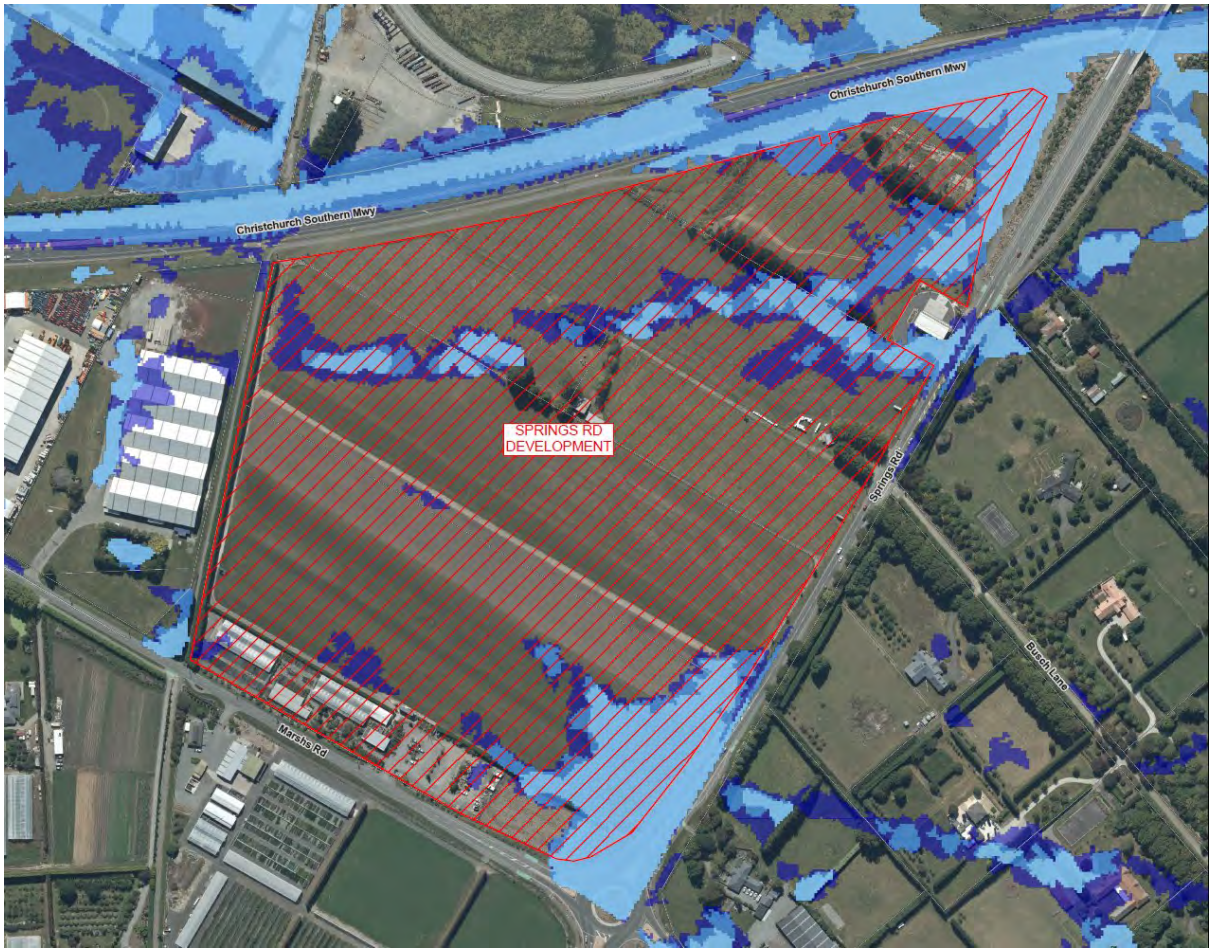


Figure 5: CCC Flood Modelling GIS data (blue areas)

During the detailed design process, a floor level assessment of the area will be requested from CCC to determine any floor level requirements.

5. Wastewater

5.1. Existing Public Infrastructure

CCC have existing wastewater infrastructure to the north, east, and adjoining site; being within Halswell Junction Road, Richmond Avenue, and Springs Road respectively.

The existing 175mm pressure main within Springs Road is owned by Selwyn District Council (SDC) and connected to CCC infrastructure.



Figure 6 - Existing Wastewater in proximity to the development (GRIP)

5.2. Proposed Wastewater

CCC have indicated that existing network constraints are anticipated for the northern network within Halswell Junction Road. Network constraints for unzoned and zoned land, are not uncommon, however regulated discharge can be considerably easier to accommodate for industrial development, compared to residential development, through controlled intensification. No network assessment has been advised for connection to the east. In usual accordance, existing network modelling will be required from CCC for all parties to understand network constraints and opportunities for the various options.

The wastewater strategy for the development will be to install a 63mm PE80 PN16 low pressure wastewater main within the proposed road reserve. Exact connection points will be confirmed at the detailed design stage. Each lot will be serviced via a 40mm PE100 PN16 low pressure lateral from the low pressure main, with a boundary kit at the lot boundary within the berm.

With a low-pressure wastewater internal network proposed for the reticulation, each site can have storage incorporated as part of future built form, as well as restricted discharge that can be remotely monitored. Discharge from each site can also be delayed to off-peak times to mitigate against overloading the existing network.

An alternative to a low-pressure internal system, is a gravity network that discharges to a common pump station before leaving the overall development through a low-pressure main. The same principle

additional storage and timed discharge can be applied, however for a development of this scale, a gravity solution is less preferable.

Decentralised wastewater options of ground disposal of wastewater were not explored due to the cumulative effects of a development of this scale, nor was a combined operation of 'sucking and trucking' from site. Both these options however cannot be ruled out and may require further investigation during substantive application stage, noting these are options are used elsewhere around local and national developments.

A preliminary wastewater demand calculation for the development has been completed based on CCC IDS Part 6, found in Appendix B. Maximum flow (MF) for the development (excluding stormwater management lots) has been calculated to be 32.9 l/s. These calculations are in accordance with *Industrial Heavy* classification from IDS. Reducing the average flow rate to *Industrial Park* classification lowers the MF to 8.1L/s.

Design and location of all wastewater low-pressure infrastructure will be in accordance with the CCC CSS/IDS. A final option for wastewater servicing has yet been adopted and will require ongoing discussions with CCC and SDC to explore capacity opportunities based on network modelling. Manageable solutions can be achieved through various mechanisms of controlling discharge rates, storage, upgrades, or decentralization.

6. Water Supply

6.1. Existing Public Infrastructure

CCC have reticulated water supply in the area, however these are only 25mm and 50mm submains directly adjacent to the development, and a 63mm submain further north. None of these submains will be suitable to service the proposed industrial development, with their current size.

There is a 250mm main approximately 360m north of the development, within Springs Road, as well as a 560mm trunk main located 330m northeast, within Crown owned land.

CCC GIS data does not show any existing firefighting provision in close proximity to the site.

There are four existing bores onsite used for existing domestic supply. These bores will be decommissioned after construction phase. The bores are identified as:

- M36/2806
- M36/3325
- M36/2805
- M36/4471



Figure 7 - Existing CCC Water Supply in proximity to the development (Grip)

6.2. Proposed Water

Overall, the strategy within the development will be to install a 200mm PE100 PN12.5 watermain within the carriageway. Individual 63mm PE80 PN12.5 connections to each lot will be provided. Any submains required through the design process will be installed within berm/footpath. The water supply proposal is yet to be confirmed through discussions and network modelling of the existing network with/by CCC. The network modelling will outline any constraints and any upgrades that may be required.

Fire supply provisions will need to be incorporated into the overall water supply strategy, through the installation of fire hydrants at appropriate locations. Each future lot may require additional onsite fire provision depending on the built-form activity.

There are currently two options to enable the supply of water for this development, as follows.

Option 1 – Extend the existing 250mm main north of the development along Springs Road. This will include work within the Southern Motorway Overbridge.

Option 2 – Provide a connection off the existing 560mm trunk main northeast of the development and extend to the development. This option would likely avoid any work within the Southern Motorway and limited to footpath/berm until crossing Springs Road.

Both options need to be analyzed and discussed with CCC.

Design and location of all water supply will be in accordance with the CCC CSS/IDS and will require approvals and network modelling by CCC. As Marshs Road is the boundary between CCC and SDC, it is not anticipated to provide any connection out to Marshs Road for future extension. High level calculations have been completed as per Appendix B.

7. Services

7.1. Power

Consultation with Orion will be ongoing to confirm power capacity and supply strategy throughout detailed design. All lots will need to be provided with a power supply connection at the boundary. Power reticulation will be installed within the berms, including distribution boxes and transformers as needed.

The development will require streetlighting to be installed and located within the road reserve.

Initial serviceability confirmation from Orion is provided as Appendix D.

7.2. Communications

Enable are the fibre service providers within this area. They have confirmed that full UFB fibre can be delivered to the development (Appendix D). Design and implementation will be confirmed further with Enable as the development progresses.

8. Conclusion

From the preliminary work to date, the development can be serviced accordingly. Coordination with Territorial Authorities, further calculations and detailed design work for the three waters and earthworks is ongoing and will be reported at the substantive application stage.

Stormwater drainage can be provided for the Springs Road Industrial development through stormwater discharge to ground strategies. Overland and secondary flow paths will be managed through the development.

Wastewater drainage can be provided for the Springs Road Industrial development through low-pressure main, connecting into existing infrastructure in the vicinity.

Water supply can be provided for the Springs Road Industrial development though water supply networks upgrades.

The project does not rely on local authority funding any necessary infrastructure upgrades. The scope, cost, and delivery responsibility for any upgrades will be discussed and investigated with the relevant authorities as design progresses.

Appendix A – Drawings



NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL STANDARDS.
2. COORDINATES IN TERMS OF NZ GEODETIC DATUM
3. LEVELS IN TERMS OF THE NZ VERTICAL DATUM
4. ORIGIN OF LEVELS = SM XXXX SO XXXX(XXXX) PUBLISHED RL=XX.XX, SOURCED FROM THE LINZ DIGITAL GEODETIC DATABASE.
5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.

SW MANAGEMENT AREAS ARE INDICATIVE ONLY AND SUBJECT TO SIZING

LEGEND

- EX INTERNAL BDY
- EX ABBUTAL
- PR BDY
- PR LOT BDY
- PR 3m LANDSCAPING PERIMETER
- PR ROAD
- PR RIGHT OF WAY
- PR SW MANAGEMENT

Rev	Description	By	Date
B	CONCEPT	AR	06/2026
A	DRAFT	AR	06/2026

	By	Date
Survey	-	-
Design	AR	11/2025
Drawn	AR	03/2025
Checked	AR	06/2026

landplay

Project
INDUSTRIAL REZONING SPRINGS ROAD, CHCH FOR PUNA PROPERTY HOLDINGS LTD

Title
PROPOSED CONCEPT PLAN

Project no.	000000		
Scale	1:2500 @ A3		
Cad file	C100 - CONCEPT.DWG		
Drawing no.	C100	Rev	A

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SOUTHWEST INDUSTRIAL
SPRINGS ROAD, CHRISTCHURCH

FOR
PUNA PROPERTY HOLDINGS LTD (PPHL)
& FODDERCUBE PRODUCTS (NTH.CANTY) LTD (FPL)



SHT.NO.	SHEET TITLE
C200-1	EXISTING CONTOURS PLAN
C300-1	PROPOSED ROADING PLAN
C400-1	PROPOSED STORMWATER DRAINAGE PLAN
C450-1	PROPOSED STORMWATER CATCHMENT PLAN
C500-1	PROPOSED WASTEWATER DRAINAGE PLAN
C510-1	PROPOSED WASTEWATER CONNECTION OPTIONS
C600-1	PROPOSED WATER SUPPLY PLAN
C610-1	PROPOSED WATER SUPPLY CONNECTION OPTIONS

LOCALITY PLAN

PROJECT NUMBER : 786001

ISSUED DATE : JUNE 2026

DATE: 9/1/26 FILE PATH: F:\MAVEN_CHC\PROJECTS\786001 - 300 SPRINGS ROAD\C-ACAD\000 - COVER.DWG



NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL STANDARDS.
2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT PLEASANT 2000.
3. LEVELS IN TERMS OF NEW ZEALAND VERTICAL DATUM 2016 (NZVD16).
4. ORIGIN OF LEVELS = PIN 1 SO 456270(EKQ6) PUBLISHED RL=22.952m, SOURCED FROM LINZ DIGITAL GEODETIC DATABASE.
5. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY THEIR OPERATIONS.
6. THE CONTRACTOR SHALL COMPLY WITH ALL RELEVANT HEALTH AND SAFETY REQUIREMENTS.
7. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.
8. SEDIMENT CONTROL SHALL BE INSTALLED AND OPERATIONAL BEFORE EARTHWORKS START ONSITE IN ACCORDANCE WITH COUNCIL STANDARDS.
9. INDICATIVE PLAN ONLY. FURTHER DETAIL TO BE INCLUDED AT SUBSTANTIVE APPLICATION STAGE.

Legend

- PR SITE BDY
- EX BDY ABUTTALS
- PR LOT BDY
- PR ROAD BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

Rev	Description	By	Date
B	CONCEPT	JAD	06/2026
A	CONCEPT	JAD	05/2026

	By	Date
Survey	MAVEN	11/2025
Design	JAD	05/2026
Drawn	JAD	05/2026
Checked	SE	06/2026

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Project

SOUTHWEST INDUSTRIAL SPRINGS ROAD, CHRISTCHURCH FOR PPHL & FPL

Title

EXISTING CONTOURS PLAN

Project no.	786001		
Scale	1:2500 @ A3		
Cad file	C200 - EARTHWORKS.DWG		
Drawing no.	C200-1	Rev	B

FOR REFERRAL

DATE ISSUED PLOTTED 5 MAY 26 BY JAD C:\STORAGE\DESIGN\786001 - STORAGE\DRAWINGS\DWG\C200-1 EARTHWORKS.DWG

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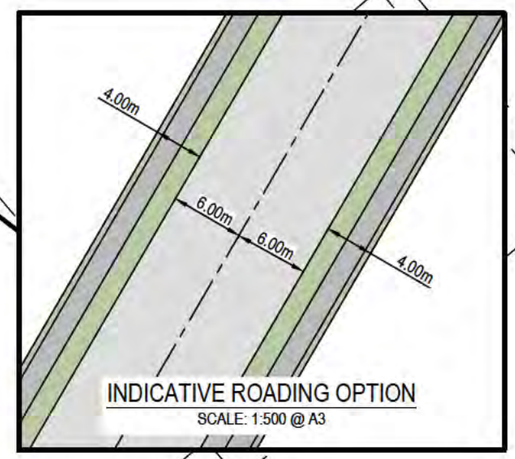
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INTERSECTION
DESIGN TBC BY
TRAFFIC ENGINEER

INTERSECTION
DESIGN TBC BY
TRAFFIC ENGINEER



INDICATIVE ROADING OPTION
SCALE: 1:500 @ A3

FOR REFERRAL

NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL STANDARDS.
2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT PLEASANT 2000.
3. LEVELS IN TERMS OF NEW ZEALAND VERTICAL DATUM 2016 (NZVD16).
4. ORIGIN OF LEVELS = PIN 1 SO 456270(EKQ6) PUBLISHED RL=22.952m, SOURCED FROM LINZ DIGITAL GEODETIC DATABASE.
5. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY THEIR OPERATIONS.
6. THE CONTRACTOR SHALL COMPLY WITH ALL RELEVANT HEALTH AND SAFETY REQUIREMENTS.
7. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.
8. INDICATIVE PLAN ONLY. FURTHER DETAIL TO BE INCLUDED AT SUBSTANTIVE APPLICATION STAGE.

Legend
- PR SITE BDY
- EX BDY ABUTTALS
- PR LOT BDY
- PR ROAD CENTRELINE
- PR ASPHALT ROAD
- PR CONCRETE FOOTPATH
- PR LANDSCAPING
- PR SW MANAGEMENT AREA

Rev	Description	By	Date
B	CONCEPT	JAD	06/2026
A	CONCEPT	JAD	05/2026

	By	Date
Survey	MAVEN	11/2025
Design	JAD	05/2026
Drawn	JAD	05/2026
Checked	SE	06/2026

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Project
SOUTHWEST INDUSTRIAL SPRINGS ROAD, CHRISTCHURCH FOR PPHL & FPL

Title
PROPOSED ROADING PLAN

Project no.	786001		
Scale	1:2500 @ A3		
Cad file	C300 - ROADING.DWG		
Drawing no.	C300-1	Rev	B



NOTES

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7. INDICATIVE PLAN ONLY. FURTHER DETAIL TO BE INCLUDED AT SUBSTANTIVE APPLICATION STAGE.

Legend

- PR SITE BDY
- EX BDY ABUTTALS
- PR LOT BDY
- EX STORMWATER
- PR STORMWATER
- PR SW FLOW DIRECTION
- EX / PR SWMH
- EX SCRUFFY DOME
- EX SWCP SINGLE / DOUBLE
- EX HEADWALL
- PR SW OUTLET

Rev	Description	By	Date
B	CONCEPT	JAD	06/2026
A	CONCEPT	JAD	05/2026

	By	Date
Survey	MAVEN	11/2025
Design	JAD	05/2026
Drawn	JAD	05/2026
Checked	SE	06/2026

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Project

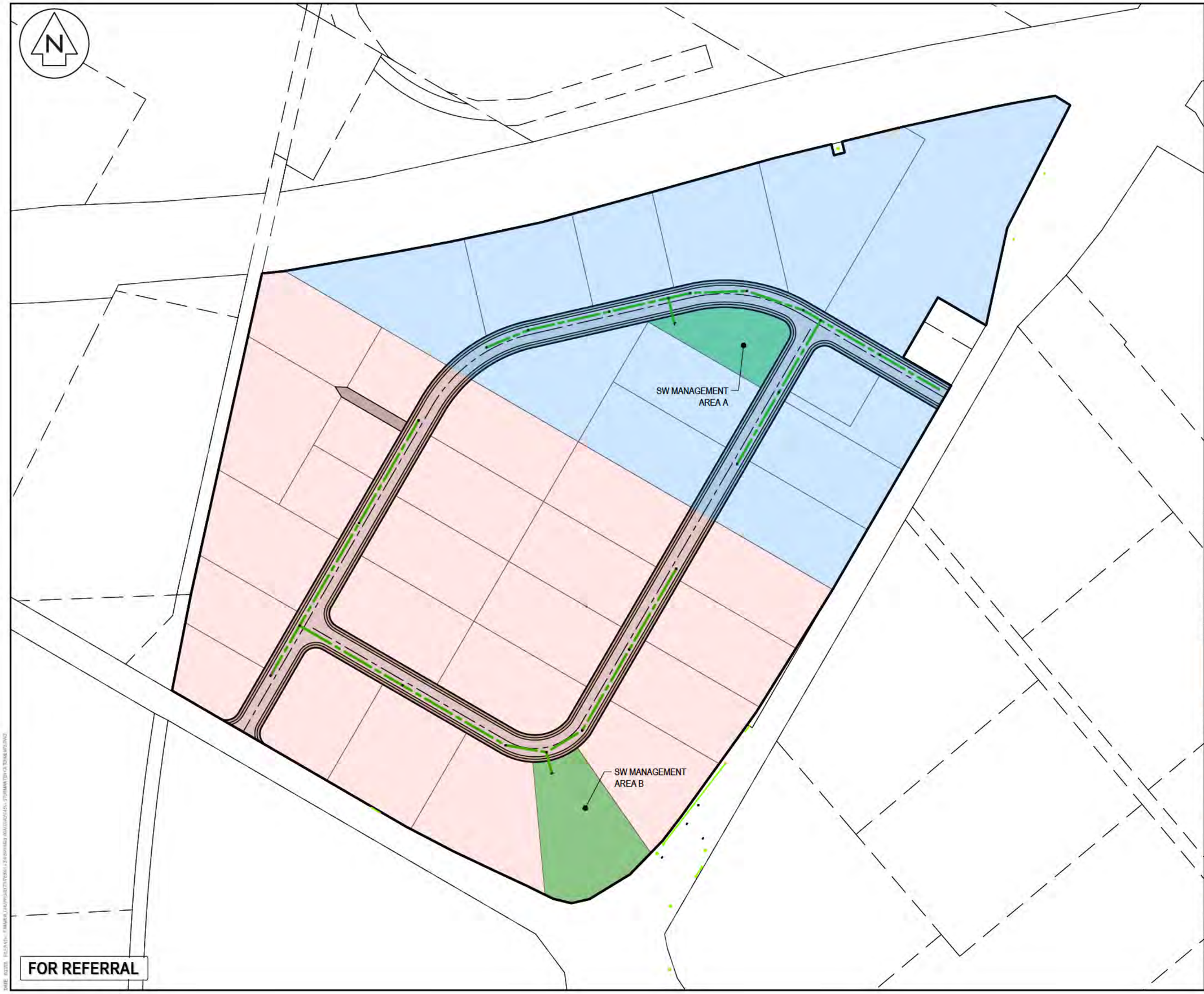
SOUTHWEST INDUSTRIAL SPRINGS ROAD, CHRISTCHURCH FOR PPHL & FPL

Title

PROPOSED STORMWATER DRAINAGE PLAN

Project no.	786001		
Scale	1:2500 @ A3		
Cad file	C400 - STORMWATER.DWG		
Drawing no.	C400-1	Rev	B

FOR REFERRAL



NOTES

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7. INDICATIVE PLAN ONLY. FURTHER DETAIL TO BE INCLUDED AT SUBSTANTIVE APPLICATION STAGE.

Legend

- PR SITE BDY
- EX BDY ABUTTALS
- PR LOT BDY
- EX SW
- PR SW
- PR CATCHMENT A
- PR CATCHMENT B
- EX / PR SWMH
- EX SCRUFFY DOME
- EX SWCP SINGLE / DOUBLE
- EX HEADWALL
- PR SW OUTLET

Rev	Description	By	Date
B	CONCEPT	JAD	06/2026
A	CONCEPT	JAD	05/2026

	By	Date
Survey	MAVEN	11/2025
Design	JAD	05/2026
Drawn	JAD	05/2026
Checked	SE	06/2026

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SOUTHWEST INDUSTRIAL SPRINGS ROAD, CHRISTCHURCH FOR PPHL & FPL

Title

PROPOSED STORMWATER CATCHMENT PLAN

Project no.	786001		
Scale	1:2500 @ A3		
Cad file	C450 - STORMWATER CATCHMENTS.DWG		
Drawing no.	C450-1	Rev	B

FOR REFERRAL

N

EX 175mm WW PRESSURE MAIN
SELWYN DISTRICT COUNCIL ASSET

FOR REFERRAL

NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL STANDARDS.
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Legend
- PR SITE BDY
- EX BDY ABUTTALS
- PR LOT BDY
- EX WASTEWATER
- PR WASTEWATER
- EX / PR WWMH
- PR WW FLOW DIRECTION

Rev	Description	By	Date
B	CONCEPT	JAD	06/2026
A	CONCEPT	JAD	05/2026

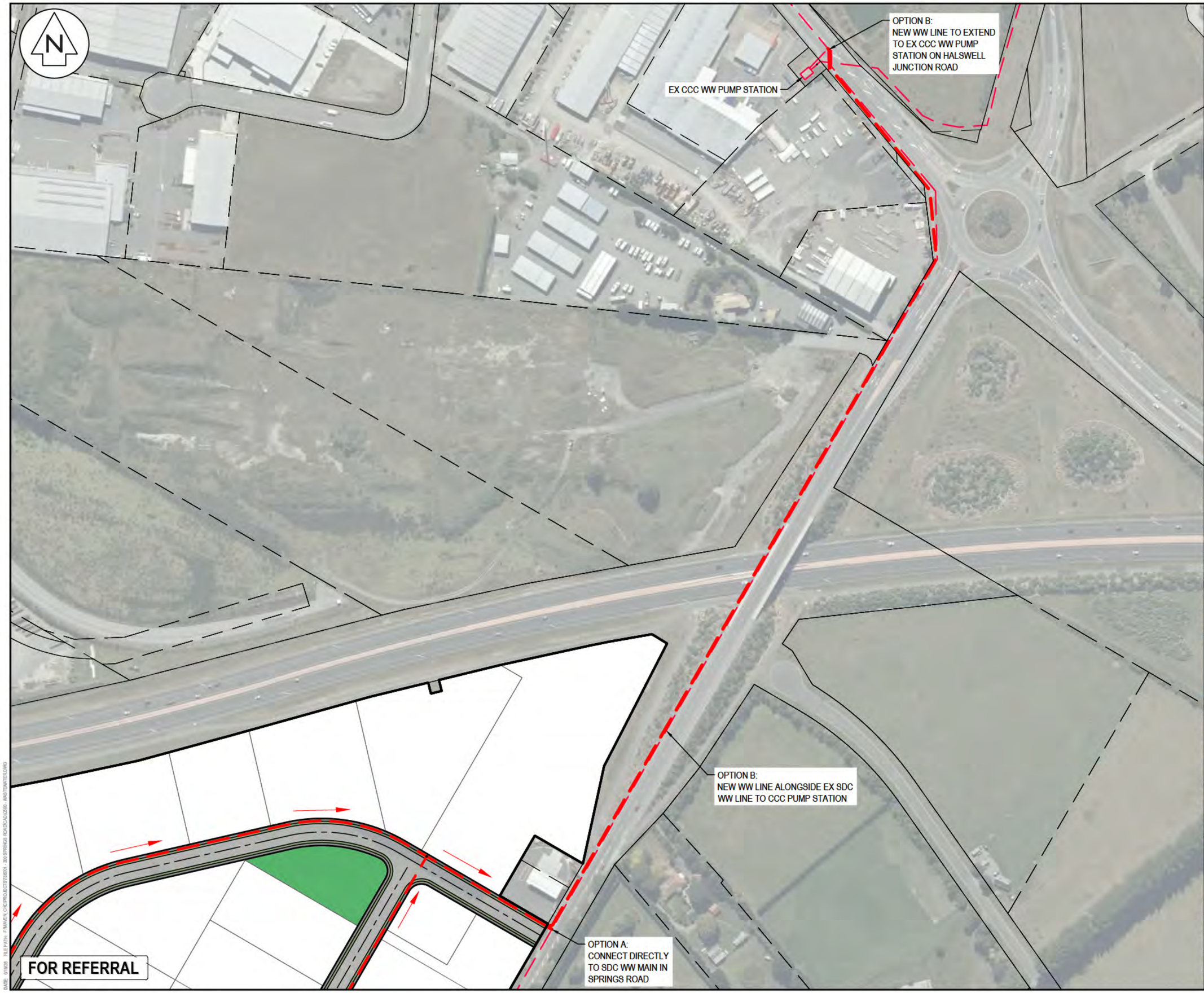
	By	Date
Survey	MAVEN	11/2025
Design	JAD	05/2026
Drawn	JAD	05/2026
Checked	SE	06/2026

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Project
SOUTHWEST INDUSTRIAL SPRINGS ROAD, CHRISTCHURCH FOR PPHL & FPL

Title
PROPOSED WASTEWATER DRAINAGE PLAN

Project no.	786001		
Scale	1:2500 @ A3		
Cad file	C500 - WASTEWATER.DWG		
Drawing no.	C500-1	Rev	B



NOTES

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Legend

- PR SITE BDY
- EX BDY ABUTTALS
- PR LOT BDY
- EX WASTEWATER
- PR WASTEWATER
- PR CONNECTION OPTIONS
- EX / PR WWMH
- PR WW FLOW DIRECTION

Rev	Description	By	Date
B	CONCEPT	JAD	06/2026
A	CONCEPT	JAD	05/2026

	By	Date
Survey	MAVEN	11/2025
Design	JAD	05/2026
Drawn	JAD	05/2026
Checked	SE	06/2026

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Project

SOUTHWEST INDUSTRIAL SPRINGS ROAD, CHRISTCHURCH FOR PPHL & FPL

Title

PROPOSED WASTEWATER CONNECTION OPTIONS

Project no.	786001		
Scale	1:2500 @ A3		
Cad file	C500 - WASTEWATER.DWG		
Drawing no.	C510-1	Rev	B

DATE: 6/1/26 FILE PATH: F:\MAVEN_CHC\PROJECTS\786001 - 303 SPRINGS ROAD\C-ADD\500 - WASTEWATER.DWG



NOTES

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Legend

- PR SITE BDY
- EX BDY ABUTTALS
- PR LOT BDY
- EX WATER SUPPLY
- PR WATER SUPPLY
- EX WATER METER
- EX VALVE

Rev	Description	By	Date
B	CONCEPT	JAD	06/2026
A	CONCEPT	JAD	05/2026

	By	Date
Survey	MAVEN	11/2025
Design	JAD	05/2026
Drawn	JAD	05/2026
Checked	SE	06/2026

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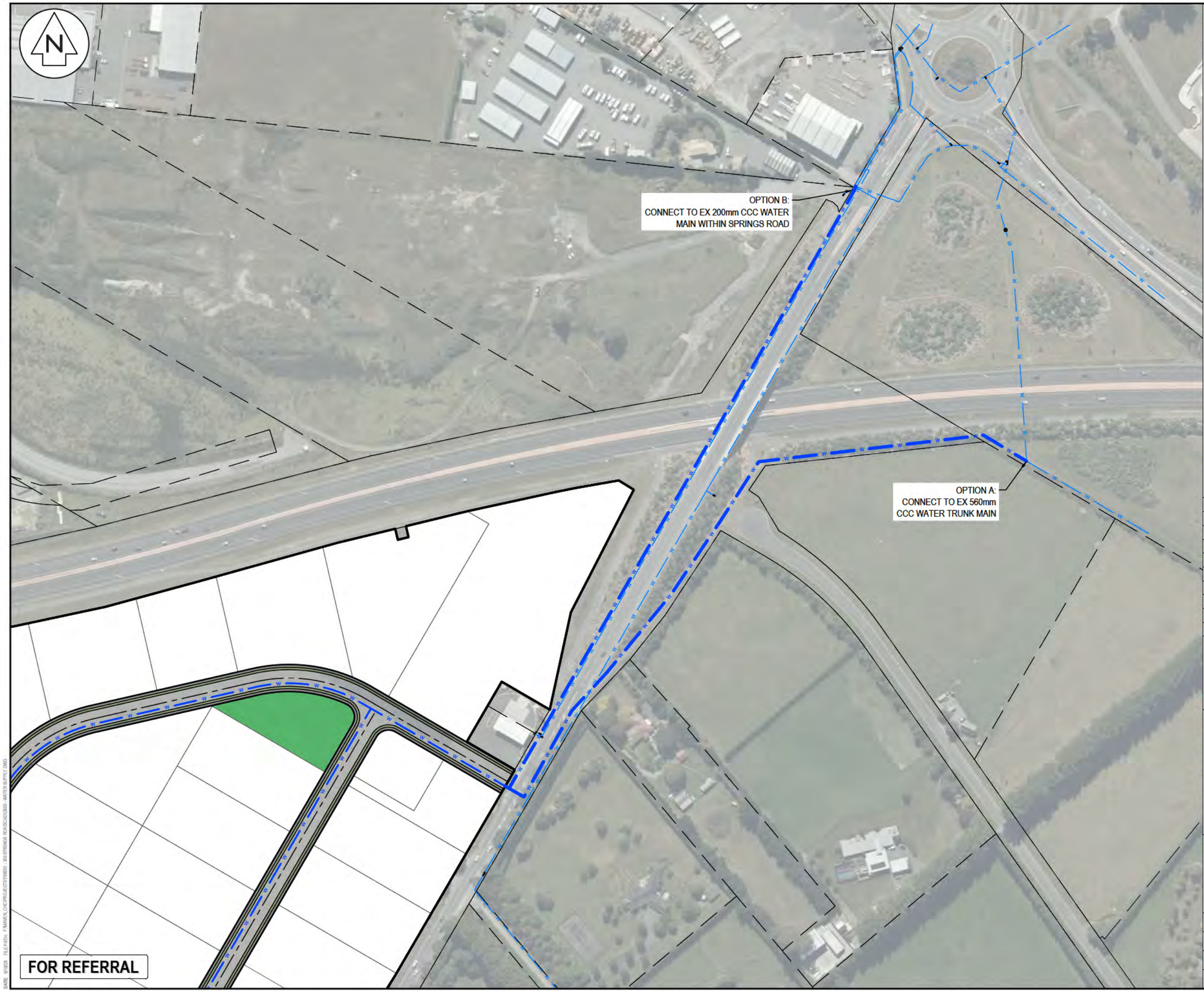
Project

SOUTHWEST INDUSTRIAL SPRINGS ROAD, CHRISTCHURCH FOR PPHL & FPL

Title

PROPOSED WATER SUPPLY PLAN

Project no.	786001		
Scale	1:2500 @ A3		
Cad file	C600 - WATER SUPPLY.DWG		
Drawing no.	C600-1	Rev	B



NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH CHRISTCHURCH CITY COUNCIL STANDARDS.
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Legend

- PR SITE BDY
- EX BDY ABUTTALS
- PR LOT BDY
- EX WATER SUPPLY
- PR WATER SUPPLY
- PR CONNECTION OPTIONS
- WM EX WATER METER
- EX VALVE

Rev	Description	By	Date
B	CONCEPT	JAD	06/2026
A	CONCEPT	JAD	05/2026

	By	Date
Survey	MAVEN	11/2025
Design	JAD	05/2026
Drawn	JAD	05/2026
Checked	SE	06/2026

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Project

SOUTHWEST INDUSTRIAL SPRINGS ROAD, CHRISTCHURCH FOR PPHL & FPL

Title

PROPOSED WATER SUPPLY CONNECTION OPTIONS

Project no.	786001		
Scale	1:2500 @ A3		
Cad file	C600 - WATER SUPPLY.DWG		
Drawing no.	C610-1	Rev	B

DATE: 6/1/26 FILE PATH: F:\MAVEN_CHC\PROJECTS\786001 - 300 SPRINGS ROAD\C-DOS\600 - WATER SUPPLY.DWG

Appendix B – Calculations

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK A 10yr Infiltration and Storage	786001	1	B	22-Jun	JAD	MJ	22-Jun

Post Development

	Pervious	Impervious
Area (m2)	41550	48950
C	0.35	0.9

	BLOCK A POST		
Total Area:	90500	m2	
Road Area:	10600	m2	
Landscape:	3200	m2	(Post SW management areas)
Lot Area:	76700	m2	(50% of post lot area to be pervious)

Block A SW management area:	3200	m2	
Infiltration:	1331	mm/hr	
Factored Infiltration:	444	mm/hr	(FOS of 3 applied)
Assumed Storage:	1056	m3	(1/3 of SW management area)
First Flush depth:	25	mm	
Block A First Flush volume:	1224	m3	(Hardstand only)
Block A First Flush volume:	1101	m3	(CCC WWDG 6.4 - Equations 6-2 and 6-3)

	NIWA HIRDS		Post-Development		Infiltration	Storage	
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Infiltration (m3)	Storage Required (m3)	Sufficient Storage? (m3)
	10	69.10	1124.75	337.42	157.75	179.68	YES
	20	47.80	778.04	466.83	315.50	151.33	YES
	30	38.60	628.30	565.47	473.24	92.22	YES
1hr	60	26.60	432.97	779.35	946.49	-167.14	YES
2hr	120	18.10	294.62	1060.61	1892.98	-832.36	YES
6hr	360	9.44	153.66	1659.48	5678.93	-4019.45	YES
12hr	720	6.10	99.29	2144.67	11357.87	-9213.20	YES
24hr	1440	3.85	62.67	2707.20	22715.73	-20008.53	YES

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK A 50yr Infiltration and Storage	786001	2	B	22-Jun	JAD	MJ	22-Jun

Post Development

	Pervious	Impervious
Area (m2)	41550	48950
C	0.35	0.9

	BLOCK A	POST	
Total Area:	90500	m2	
Road Area:	10600	m2	
Landscape:	3200	m2	(Post SW management areas)
Lot Area:	76700	m2	(50% of post lot area to be pervious)

Block A SW management area:	3200	m2	
Infiltration:	1331	mm/hr	
Factored Infiltration:	444	mm/hr	(FOS of 3 applied)
Assumed Storage:	1056	m3	(1/3 of SW management area)
First Flush depth:	25	mm	
Block A First Flush volume:	1224	m3	(Hardstand only)
Block A First Flush volume:	1101	m3	(CCC WWDG 6.4 - Equations 6-2 and 6-3)

	NIWA HIRDS		Post-Development		Infiltration	Storage	
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Infiltration (m3)	Storage Required (m3)	Sufficient Storage? (m3)
	10	111.00	1806.76	542.03	157.75	384.28	YES
	20	75.40	1227.29	736.38	315.50	420.88	YES
	30	60.20	979.88	881.89	473.24	408.65	YES
1hr	60	41.00	667.36	1201.25	946.49	254.76	YES
2hr	120	27.50	447.62	1611.43	1892.98	-281.55	YES
6hr	360	14.00	227.88	2461.10	5678.93	-3217.84	YES
12hr	720	8.90	144.87	3129.11	11357.87	-8228.76	YES
24hr	1440	5.52	89.85	3881.50	22715.73	-18834.23	YES

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK A 100yr Infiltration and Storage	786001	3	B	22-Jun	JAD	MJ	22-Jun

Post Development

	Pervious	Impervious
Area (m2)	41550	48950
C	0.35	0.9

BLOCK A	**POST**		
Total Area:	90500	m2	
Road Area:	10600	m2	
Landscape:	3200	m2	(Post SW management areas)
Lot Area:	76700	m2	(50% of post lot area to be pervious)

Block A SW management area:	3200	m2	
Infiltration:	1331	mm/hr	
Factored Infiltration:	444	mm/hr	(FOS of 3 applied)
Assumed Storage:	1056	m3	(1/3 of SW management area)
First Flush depth:	25	mm	
Block A First Flush volume:	1224	m3	(Hardstand only)
Block A First Flush volume:	1101	m3	(CCC WWDG 6.4 - Equations 6-2 and 6-3)

	NIWA HIRDS		Post-Development		Infiltration	Storage	
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Infiltration (m3)	Storage Required (m3)	Sufficient Storage? (m3)
	10	132.00	2148.58	644.57	157.75	486.82	YES
	20	89.40	1455.17	873.10	315.50	557.61	YES
	30	71.20	1158.93	1043.04	473.24	569.79	YES
1hr	60	48.20	784.56	1412.20	946.49	465.71	YES
2hr	120	32.10	522.49	1880.98	1892.98	-12.00	YES
6hr	360	16.20	263.69	2847.84	5678.93	-2831.09	YES
12hr	720	10.20	166.03	3586.17	11357.87	-7771.70	YES
24hr	1440	6.32	102.87	4444.03	22715.73	-18271.70	YES

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK B 10yr Infiltration and Storage	786001	4	B	22-Jun	JAD	MJ	22-Jun

Post Development

	Pervious	Impervious
Area (m2)	57995	66405
C	0.35	0.9

	BLOCK A	POST	
Total Area:	124400	m2	
Road Area:	14400	m2	
Landscape:	5990	m2	(Post SW management areas)
Lot Area:	104010	m2	(50% of post lot area to be pervious)

Block A SW management area:	5990	m2	
Infiltration:	1090	mm/hr	
Factored Infiltration:	363	mm/hr	(FOS of 3 applied)
Assumed Storage:	1976.7	m3	(1/3 of SW management area)
First Flush depth:	25	mm	
Block A First Flush volume:	1660	m3	(Hardstand only)
Block A First Flush volume:	1494	m3	(CCC WWDG 6.4 - Equations 6-2 and 6-3)

	NIWA HIRDS		Post-Development		Infiltration	Storage	
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Infiltration (m3)	Storage Required (m3)	Sufficient Storage? (m3)
	10	69.10	1536.76	461.03	241.82	219.21	YES
	20	47.80	1063.06	637.83	483.64	154.20	YES
	30	38.60	858.45	772.61	725.46	47.15	YES
1hr	60	26.60	591.57	1064.83	1450.91	-386.08	YES
2hr	120	18.10	402.54	1449.14	2901.82	-1452.69	YES
6hr	360	9.44	209.94	2267.38	8705.47	-6438.09	YES
12hr	720	6.10	135.66	2930.30	17410.93	-14480.64	YES
24hr	1440	3.85	85.62	3698.90	34821.87	-31122.97	YES

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK B 50yr Infiltration and Storage	786001	5	B	22-Jun	JAD	MJ	22-Jun

Post Development

	Pervious	Impervious
Area (m2)	57995	66405
C	0.35	0.9

	BLOCK A	POST	
Total Area:		124400	m2
Road Area:		14400	m2
Landscape:		5990	m2
Lot Area:		104010	m2

(Post SW management areas)
(50% of post lot area to be pervious)

Block A SW management area:	5990	m2	
Infiltration:	1090	mm/hr	
Factored Infiltration:	363	mm/hr	(FOS of 3 applied)
Assumed Storage:	1976.7	m3	(1/3 of SW management area)
First Flush depth:	25	mm	
Block A First Flush volume:	1660	m3	(Hardstand only)
Block A First Flush volume:	1494	m3	(CCC WWDG 6.4 - Equations 6-2 and 6-3)

	NIWA HIRDS		Post-Development		Infiltration	Storage	
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Infiltration (m3)	Storage Required (m3)	Sufficient Storage? (m3)
	10	111.00	2468.60	740.58	241.82	498.76	YES
	20	75.40	1676.87	1006.12	483.64	522.48	YES
	30	60.20	1338.83	1204.94	725.46	479.49	YES
1hr	60	41.00	911.83	1641.29	1450.91	190.38	YES
2hr	120	27.50	611.59	2201.73	2901.82	-700.10	YES
6hr	360	14.00	311.36	3362.64	8705.47	-5342.83	YES
12hr	720	8.90	197.93	4275.35	17410.93	-13135.58	YES
24hr	1440	5.52	122.76	5303.36	34821.87	-29518.51	YES

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK B 100yr Infiltration and Storage	786001	6	B	22-Jun	JAD	MJ	22-Jun

Post Development

	Pervious	Impervious
Area (m2)	57995	66405
C	0.35	0.9

BLOCK A	**POST**		
Total Area:	124400	m2	
Road Area:	14400	m2	
Landscape:	5990	m2	(Post SW management areas)
Lot Area:	104010	m2	(50% of post lot area to be pervious)

Block A SW management area:	5990	m2	
Infiltration:	1090	mm/hr	
Factored Infiltration:	363	mm/hr	(FOS of 3 applied)
Assumed Storage:	1976.7	m3	(1/3 of SW management area)
First Flush depth:	25	mm	
Block A First Flush volume:	1660	m3	(Hardstand only)
Block A First Flush volume:	1494	m3	(CCC WWDG 6.4 - Equations 6-2 and 6-3)

	NIWA HIRDS		Post-Development		Infiltration	Storage	
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Infiltration (m3)	Storage Required (m3)	Sufficient Storage? (m3)
	10	132.00	2935.63	880.69	241.82	638.87	YES
	20	89.40	1988.22	1192.93	483.64	709.30	YES
	30	71.20	1583.46	1425.12	725.46	699.66	YES
1hr	60	48.20	1071.95	1929.51	1450.91	478.60	YES
2hr	120	32.10	713.89	2570.01	2901.82	-331.81	YES
6hr	360	16.20	360.28	3891.05	8705.47	-4814.42	YES
12hr	720	10.20	226.84	4899.84	17410.93	-12511.09	YES
24hr	1440	6.32	140.55	6071.96	34821.87	-28749.91	YES

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK A 10yr ARI - NIWA HIRDS RCP 8.5 - 2081-2100	786001	1	B	22-Jun	JAD	MJ	22-Jun

Pre-Development

	Pervious	Impervious
Area (m2)	87622	2878
C	0.35	0.9

Post Development

	Pervious	Impervious
Area (m2)	41550	48950
C	0.35	0.9

BLOCK A	PRE	POST	
Total Area:	90500	90500	m2
Road Area:	0	10600	m2
Landscape:	87622	3200	*m2
Lot Area:	2878	76700	**m2

*Post SW management areas

**50% of post lot area to be pervious

Rational Method Q = CIA/3600

			Pre-Development		Post-Development		
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Flow Rate (l/s)	Total Runoff Volume (m3)	Difference in Runoff Volume (m3)
	10	69.1	638.4	383.0	1124.7	674.8	291.8
	20	47.8	441.6	529.9	778.0	933.7	403.7
	30	38.6	356.6	641.9	628.3	1130.9	489.1
1hr	60	26.6	245.7	884.7	433.0	1558.7	674.0
2hr	120	18.1	167.2	1203.9	294.6	2121.2	917.3
6hr	360	9.4	87.2	1883.7	153.7	3319.0	1435.2
12hr	720	6.1	56.4	2434.5	99.3	4289.3	1854.9
24hr	1440	3.9	35.6	3073.0	62.7	5414.4	2341.4

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK A 50yr ARI - NIWA HIRDS RCP 8.5 - 2081-2100	786001	2	B	22-Jun	JAD	MJ	22-Jun

Pre-Development

	Pervious	Impervious
Area (m2)	87622	2878
C	0.35	0.9

Post Development

	Pervious	Impervious
Area (m2)	41550	48950
C	0.35	0.9

BLOCK A	PRE	POST	
Total Area:	90500	90500	m2
Road Area:	0	10600	m2
Landscape:	87622	3200	*m2
Lot Area:	2878	76700	**m2

*Post SW management areas

**50% of post lot area to be pervious

Rational Method Q = CIA/3600

			Pre-Development		Post-Development		
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Flow Rate (l/s)	Total Runoff Volume (m3)	Difference in Runoff Volume (m3)
	10	111.0	1025.5	615.3	1806.8	1084.1	468.8
	20	75.4	696.6	835.9	1227.3	1472.8	636.9
	30	60.2	556.1	1001.1	979.9	1763.8	762.7
1hr	60	41.0	378.8	1363.6	667.4	2402.5	1038.9
2hr	120	27.5	254.1	1829.2	447.6	3222.9	1393.7
6hr	360	14.0	129.3	2793.7	227.9	4922.2	2128.5
12hr	720	8.9	82.2	3551.9	144.9	6258.2	2706.3
24hr	1440	5.5	51.0	4406.0	89.8	7763.0	3357.0

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK A 100yr ARI - NIWA HIRDS RCP 8.5 - 2081-2100	786001	3	B	22-Jun	JAD	MJ	22-Jun

Pre-Development

	Pervious	Impervious
Area (m2)	87622	2878
C	0.35	0.9

Post Development

	Pervious	Impervious
Area (m2)	41550	48950
C	0.35	0.9

BLOCK A	PRE	POST	
Total Area:	90500	90500	m2
Road Area:	0	10600	m2
Landscape:	87622	3200	*m2
Lot Area:	2878	76700	**m2

*Post SW management areas

**50% of post lot area to be pervious

Rational Method Q = CIA/3600

			Pre-Development		Post-Development		
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Flow Rate (l/s)	Total Runoff Volume (m3)	Difference in Runoff Volume (m3)
	10	132.00	1219.46	731.67	2148.58	1289.15	557.47
	20	89.40	825.90	991.09	1455.17	1746.21	755.12
	30	71.20	657.77	1183.98	1158.93	2086.07	902.09
1hr	60	48.20	445.29	1603.03	784.56	2824.40	1221.37
2hr	120	32.10	296.55	2135.16	522.49	3761.96	1626.80
6hr	360	16.20	149.66	3232.67	263.69	5695.68	2463.01
12hr	720	10.20	94.23	4070.77	166.03	7172.33	3101.57
24hr	1440	6.32	58.39	5044.56	102.87	8888.07	3843.51

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK B 10yr ARI - NIWA HIRDS RCP 8.5 - 2081-2100	786001	4	B	22-Jun	JAD	MJ	22-Jun

Pre-Development

	Pervious	Impervious
Area (m2)	112964	11436
C	0.35	0.9

Post Development

	Pervious	Impervious
Area (m2)	57995	66405
C	0.35	0.9

BLOCK B	PRE	POST	
Total Area:	124400	124400	m2
Road Area:	0	14400	m2
Landscape:	112964	5990	*m2
Lot Area:	11436	104010	**m2

*Post SW management areas

**50% of post lot area to be pervious

Rational Method Q = CIA/3600

			Pre-Development		Post-Development		
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Flow Rate (l/s)	Total Runoff Volume (m3)	Difference in Runoff Volume (m3)
	10	69.1	956.5	573.9	1536.8	922.1	348.2
	20	47.8	661.6	794.0	1063.1	1275.7	481.7
	30	38.6	534.3	961.7	858.5	1545.2	583.5
1hr	60	26.6	368.2	1325.5	591.6	2129.7	804.2
2hr	120	18.1	250.5	1803.8	402.5	2898.3	1094.4
6hr	360	9.4	130.7	2822.4	209.9	4534.8	1712.4
12hr	720	6.1	84.4	3647.5	135.7	5860.6	2213.1
24hr	1440	3.9	53.3	4604.3	85.6	7397.8	2793.5

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK B 50yr ARI - NIWA HIRDS RCP 8.5 - 2081-2100	786001	5	B	22-Jun	JAD	MJ	22-Jun

Pre-Development

	Pervious	Impervious
Area (m2)	112964	11436
C	0.35	0.9

Post Development

	Pervious	Impervious
Area (m2)	57995	66405
C	0.35	0.9

BLOCK B	PRE	POST	
Total Area:	124400	124400	m2
Road Area:	0	14400	m2
Landscape:	112964	5990	*m2
Lot Area:	11436	104010	**m2

*Post SW management areas **50% of post lot area to be pervious

Rational Method Q = CIA/3600

			Pre-Development		Post-Development		
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Flow Rate (l/s)	Total Runoff Volume (m3)	Difference in Runoff Volume (m3)
	10	111.0	1536.4	921.9	2468.6	1481.2	559.3
	20	75.4	1043.7	1252.4	1676.9	2012.2	759.9
	30	60.2	833.3	1499.9	1338.8	2409.9	910.0
1hr	60	41.0	567.5	2043.0	911.8	3282.6	1239.6
2hr	120	27.5	380.6	2740.6	611.6	4403.5	1662.8
6hr	360	14.0	193.8	4185.7	311.4	6725.3	2539.6
12hr	720	8.9	123.2	5321.8	197.9	8550.7	3228.9
24hr	1440	5.5	76.4	6601.5	122.8	10606.7	4005.3

MAVEN CANTERBURY	Job Title:	300 Springs Road, Halswell	Job Number	Sheet	Rev	Date	Author	Checked	Date
	Calc Title:	BLOCK B 100yr ARI - NIWA HIRDS RCP 8.5 - 2081-2100	786001	6	B	22-Jun	JAD	MJ	22-Jun

Pre-Development

	Pervious	Impervious
Area (m2)	112964	11436
C	0.35	0.9

Post Development

	Pervious	Impervious
Area (m2)	57995	66405
C	0.35	0.9

BLOCK B	PRE	POST	
Total Area:	124400	124400	m2
Road Area:	0	14400	m2
Landscape:	112964	5990	*m2
Lot Area:	11436	104010	**m2

*Post SW management areas **50% of post lot area to be pervious

Rational Method Q = CIA/3600

			Pre-Development		Post-Development		
	Rainfall Duration t (min)	Rainfall Intensity I (mm/hr)	Flow Rate (l/s)	Total Runoff Volume (m3)	Flow Rate (l/s)	Total Runoff Volume (m3)	Difference in Runoff Volume (m3)
	10	132.0	1827.1	1096.3	2935.6	1761.4	665.1
	20	89.4	1237.4	1484.9	1988.2	2385.9	900.9
	30	71.2	985.5	1773.9	1583.5	2850.2	1076.3
1hr	60	48.2	667.2	2401.8	1072.0	3859.0	1457.2
2hr	120	32.1	444.3	3199.1	713.9	5140.0	1941.0
6hr	360	16.2	224.2	4843.5	360.3	7782.1	2938.6
12hr	720	10.2	141.2	6099.2	226.8	9799.7	3700.5
24hr	1440	6.3	87.5	7558.2	140.6	12143.9	4585.7

MAVEN CANTERBURY		Job Number	Sheet	Rev	
		786001	1	B	
Job Title	300 Springs Road, Christchurch	Author	Date	Checked	Date
Calc Title	Wastewater Demand Calc	JAD	22-Jun	MJ	22-Jun

As per CCC IDS Part 6 Assumed Industrial Heavy (IH) zoning
Equation 1 for sites larger than 15ha
MF = P/A x SPF x ASF ASF = Unit ASF x Area
P/A = 1.8 SPF = 2.78 Unit ASF = 0.38 l/s/ha

Lot	Area (ha)	ASF (l/s)	**MF (l/s)**
1	0.210	0.080	0.399
2	0.283	0.108	0.538
3	0.492	0.187	0.936
4	0.492	0.187	0.936
5	0.488	0.185	0.928
6	0.481	0.183	0.915
7	0.466	0.177	0.886
8	0.548	0.208	1.042
9	0.643	0.244	1.223
10	0.560	0.213	1.065
11	0.467	0.177	0.888
12	0.269	0.102	0.512
13	0.344	0.131	0.654
14	0.541	0.206	1.029
15	0.250	0.095	0.475
16	0.200	0.076	0.380
17	0.612	0.233	1.164
18	0.254	0.097	0.483
19	0.470	0.179	0.894
20	0.684	0.260	1.301
21	0.544	0.207	1.034
22	0.415	0.158	0.789
23	0.628	0.239	1.194
24	0.858	0.326	1.632
25	1.612	0.613	3.065
26	0.471	0.179	0.896
27	0.471	0.179	0.896
28	0.471	0.179	0.896
29	0.471	0.179	0.896
30	0.471	0.179	0.896
31	0.478	0.182	0.909
32	0.494	0.188	0.939
33	0.471	0.179	0.896
34	0.471	0.179	0.896
35	0.466	0.177	0.886
36	0.511	0.194	0.972
Total			**34.336**

Site total including roads and sw management areas

Site	21.070	8.007	**40.065**

MAVEN CANTERBURY	Job Number 786001	Sheet 1	Rev A
Job Title: 300 Springs Road Calc Title: Preliminary Water Demand - Industrial Demand	Author JAD	Date 11/05/2026	Checked 22-May

Industrial Demands (CCC IDS)

Demand	0.7	l/s/lot	(CCC IDS 7.5.2 Chart 2)
Number of Lots	40		(Approx as still conceptual)
Total Demand	**28**	**l/s**	

Friction Loss in meters per pipe length (using Hazen-Williams formula) and Velocities in Pipelines

$$H_f = \frac{L \times Q^{1.852}}{(0.278^{1.852} \times C^{1.852} \times D^{4.87})}$$

C= 140 (Assumed Polyethylene Pipe)

L= 1500 m (Assumed 1.5km from main connection to furthest site connection)

Flow (l/s)	Flow (m^3/day)	Approx. ID 150		Approx. ID 200		Approx. ID 300		Approx. ID 375		Approx. ID 400		Approx. ID 600	
		Friction	Velocity	Friction	Velocity	Friction	Velocity	Friction	Velocity	Friction	Velocity	Friction	Velocity
20.0	1,728	12.504	1.131	3.080	0.636	0.428	0.283	0.144	0.181	0.105	0.159	0.015	0.071
22.0	1,901	14.917	1.244	3.675	0.700	0.510	0.311	0.172	0.199	0.126	0.175	0.017	0.078
24.0	2,074	17.526	1.358	4.317	0.764	0.599	0.339	0.202	0.217	0.148	0.191	0.020	0.085
26.0	2,246	20.326	1.471	5.007	0.827	0.695	0.368	0.234	0.235	0.171	0.207	0.024	0.092
28.0	2,419	23.317	1.584	5.744	0.891	0.797	0.396	0.269	0.253	0.196	0.223	0.027	0.099
30.0	2,592	26.494	1.697	6.527	0.955	0.906	0.424	0.306	0.272	0.223	0.239	0.031	0.106
32.0	2,765	29.858	1.810	7.356	1.018	1.021	0.453	0.344	0.290	0.252	0.255	0.035	0.113
34.0	2,938	33.406	1.923	8.230	1.082	1.142	0.481	0.385	0.308	0.281	0.270	0.039	0.120
36.0	3,110	37.136	2.036	9.148	1.145	1.270	0.509	0.428	0.326	0.313	0.286	0.043	0.127
38.0	3,283	41.047	2.149	10.112	1.209	1.404	0.537	0.473	0.344	0.346	0.302	0.048	0.134
40.0	3,456	45.138	2.263	11.120	1.273	1.544	0.566	0.521	0.362	0.380	0.318	0.053	0.141
42.0	3,629	49.407	2.376	12.171	1.336	1.690	0.594	0.570	0.380	0.416	0.334	0.058	0.148
44.0	3,802	53.852	2.489	13.266	1.400	1.842	0.622	0.621	0.398	0.454	0.350	0.063	0.156
46.0	3,974	58.473	2.602	14.405	1.464	2.000	0.651	0.675	0.416	0.493	0.366	0.068	0.163
48.0	4,147	63.268	2.715	15.586	1.527	2.164	0.679	0.730	0.434	0.533	0.382	0.074	0.170
50.0	4,320	68.237	2.828	16.810	1.591	2.333	0.707	0.787	0.453	0.575	0.398	0.080	0.177
52.0	4,493	73.378	2.941	18.076	1.655	2.509	0.735	0.846	0.471	0.618	0.414	0.086	0.184
54.0	4,666	78.690	3.055	19.385	1.718	2.691	0.764	0.908	0.489	0.663	0.430	0.092	0.191
56.0	4,838	84.173	3.168	20.736	1.782	2.878	0.792	0.971	0.507	0.709	0.445	0.098	0.198
58.0	5,011	89.825	3.281	22.128	1.845	3.072	0.820	1.036	0.525	0.757	0.461	0.105	0.205
60.0	5,184	95.645	3.394	23.562	1.909	3.271	0.848	1.103	0.543	0.806	0.477	0.112	0.212
62.0	5,357	101.633	3.507	25.037	1.973	3.476	0.877	1.172	0.561	0.856	0.493	0.119	0.219
64.0	5,530	107.788	3.620	26.553	2.036	3.686	0.905	1.243	0.579	0.908	0.509	0.126	0.226
66.0	5,702	114.110	3.733	28.111	2.100	3.902	0.933	1.316	0.597	0.961	0.525	0.133	0.233
68.0	5,875	120.596	3.846	29.709	2.164	4.124	0.962	1.391	0.615	1.016	0.541	0.141	0.240
70.0	6,048	127.247	3.960	31.347	2.227	4.351	0.990	1.468	0.634	1.072	0.557	0.149	0.247
72.0	6,221	134.062	4.073	33.026	2.291	4.584	1.018	1.546	0.652	1.129	0.573	0.157	0.255
74.0	6,394	141.041	4.186	34.745	2.355	4.823	1.046	1.627	0.670	1.188	0.589	0.165	0.262
76.0	6,566	148.181	4.299	36.504	2.418	5.067	1.075	1.709	0.688	1.248	0.605	0.173	0.269
78.0	6,739	155.484	4.412	38.303	2.482	5.317	1.103	1.794	0.706	1.310	0.620	0.182	0.276
80.0	6,912	162.948	4.525	40.142	2.545	5.572	1.131	1.880	0.724	1.373	0.636	0.191	0.283
82.0	7,085	170.573	4.638	42.020	2.609	5.833	1.160	1.968	0.742	1.437	0.652	0.199	0.290
84.0	7,258	178.358	4.752	43.938	2.673	6.099	1.188	2.057	0.760	1.503	0.668	0.209	0.297
86.0	7,430	186.302	4.865	45.895	2.736	6.371	1.216	2.149	0.778	1.569	0.684	0.218	0.304
88.0	7,603	194.406	4.978	47.891	2.800	6.648	1.244	2.243	0.796	1.638	0.700	0.227	0.311
90.0	7,776	202.667	5.091	49.927	2.864	6.931	1.273	2.338	0.815	1.707	0.716	0.237	0.318
92.0	7,949	211.087	5.204	52.001	2.927	7.218	1.301	2.435	0.833	1.778	0.732	0.247	0.325
94.0	8,122	219.664	5.317	54.114	2.991	7.512	1.329	2.534	0.851	1.851	0.748	0.257	0.332
96.0	8,294	228.398	5.430	56.265	3.055	7.810	1.358	2.635	0.869	1.924	0.764	0.267	0.339
98.0	8,467	237.289	5.543	58.456	3.118	8.114	1.386	2.737	0.887	1.999	0.780	0.277	0.346
100.0	8,640	246.335	5.657	60.684	3.182	8.424	1.414	2.842	0.905	2.075	0.795	0.288	0.354
102.0	8,813	255.537	5.770	62.951	3.245	8.739	1.442	2.948	0.923	2.153	0.811	0.299	0.361
104.0	8,986	264.894	5.883	65.256	3.309	9.059	1.471	3.056	0.941	2.232	0.827	0.310	0.368
106.0	9,158	274.406	5.996	67.599	3.373	9.384	1.499	3.165	0.959	2.312	0.843	0.321	0.375
108.0	9,331	284.071	6.109	69.980	3.436	9.714	1.527	3.277	0.977	2.393	0.859	0.332	0.382
110.0	9,504	293.891	6.222	72.399	3.500	10.050	1.556	3.390	0.996	2.476	0.875	0.344	0.389

MAVEN CANTERBURY	Job Number 786001	Sheet 2	Rev A
Job Title 300 Springs Road Calc Title Preliminary Water Demand - Fire Demand	Author JAD	Date 11/05/2026	Checked 22-May

Total Demand (CCC IDS and SNZ PAS 4509)

Demand	28	l/s	(From sheet 1)
Fire Flow	75	l/s	(Assumed FW5 Fire fighting classification - non sprinklered)
Total	**103**	**l/s**	

Friction Loss in meters per pipe length (using Hazen-Williams formula) and Velocities in Pipelines

$$H_f = \frac{L \times Q^{1.852}}{(0.278^{1.852} \times C^{1.852} \times D^{4.87})}$$

C= 140 (Assumed Polyethylene Pipe)

L= 1500 m (Assumed 2km from main connection to furthest site connection)

Flow (l/s)	Flow (m^3/day)	Approx. ID 150		Approx. ID 200		Approx. ID 300		Approx. ID 375		Approx. ID 400		Approx. ID 600	
		Friction	Velocity	Friction	Velocity	Friction	Velocity	Friction	Velocity	Friction	Velocity	Friction	Velocity
20.0	1,728	12.504	1.131	3.080	0.636	0.428	0.283	0.144	0.181	0.105	0.159	0.015	0.071
22.0	1,901	14.917	1.244	3.675	0.700	0.510	0.311	0.172	0.199	0.126	0.175	0.017	0.078
24.0	2,074	17.526	1.358	4.317	0.764	0.599	0.339	0.202	0.217	0.148	0.191	0.020	0.085
26.0	2,246	20.326	1.471	5.007	0.827	0.695	0.368	0.234	0.235	0.171	0.207	0.024	0.092
28.0	2,419	23.317	1.584	5.744	0.891	0.797	0.396	0.269	0.253	0.196	0.223	0.027	0.099
30.0	2,592	26.494	1.697	6.527	0.955	0.906	0.424	0.306	0.272	0.223	0.239	0.031	0.106
32.0	2,765	29.858	1.810	7.356	1.018	1.021	0.453	0.344	0.290	0.252	0.255	0.035	0.113
34.0	2,938	33.406	1.923	8.230	1.082	1.142	0.481	0.385	0.308	0.281	0.270	0.039	0.120
36.0	3,110	37.136	2.036	9.148	1.145	1.270	0.509	0.428	0.326	0.313	0.286	0.043	0.127
38.0	3,283	41.047	2.149	10.112	1.209	1.404	0.537	0.473	0.344	0.346	0.302	0.048	0.134
40.0	3,456	45.138	2.263	11.120	1.273	1.544	0.566	0.521	0.362	0.380	0.318	0.053	0.141
42.0	3,629	49.407	2.376	12.171	1.336	1.690	0.594	0.570	0.380	0.416	0.334	0.058	0.148
44.0	3,802	53.852	2.489	13.266	1.400	1.842	0.622	0.621	0.398	0.454	0.350	0.063	0.156
46.0	3,974	58.473	2.602	14.405	1.464	2.000	0.651	0.675	0.416	0.493	0.366	0.068	0.163
48.0	4,147	63.268	2.715	15.586	1.527	2.164	0.679	0.730	0.434	0.533	0.382	0.074	0.170
50.0	4,320	68.237	2.828	16.810	1.591	2.333	0.707	0.787	0.453	0.575	0.398	0.080	0.177
52.0	4,493	73.378	2.941	18.076	1.655	2.509	0.735	0.846	0.471	0.618	0.414	0.086	0.184
54.0	4,666	78.690	3.055	19.385	1.718	2.691	0.764	0.908	0.489	0.663	0.430	0.092	0.191
56.0	4,838	84.173	3.168	20.736	1.782	2.878	0.792	0.971	0.507	0.709	0.445	0.098	0.198
58.0	5,011	89.825	3.281	22.128	1.845	3.072	0.820	1.036	0.525	0.757	0.461	0.105	0.205
60.0	5,184	95.645	3.394	23.562	1.909	3.271	0.848	1.103	0.543	0.806	0.477	0.112	0.212
62.0	5,357	101.633	3.507	25.037	1.973	3.476	0.877	1.172	0.561	0.856	0.493	0.119	0.219
64.0	5,530	107.788	3.620	26.553	2.036	3.686	0.905	1.243	0.579	0.908	0.509	0.126	0.226
66.0	5,702	114.110	3.733	28.111	2.100	3.902	0.933	1.316	0.597	0.961	0.525	0.133	0.233
68.0	5,875	120.596	3.846	29.709	2.164	4.124	0.962	1.391	0.615	1.016	0.541	0.141	0.240
70.0	6,048	127.247	3.960	31.347	2.227	4.351	0.990	1.468	0.634	1.072	0.557	0.149	0.247
72.0	6,221	134.062	4.073	33.026	2.291	4.584	1.018	1.546	0.652	1.129	0.573	0.157	0.255
74.0	6,394	141.041	4.186	34.745	2.355	4.823	1.046	1.627	0.670	1.188	0.589	0.165	0.262
76.0	6,566	148.181	4.299	36.504	2.418	5.067	1.075	1.709	0.688	1.248	0.605	0.173	0.269
78.0	6,739	155.484	4.412	38.303	2.482	5.317	1.103	1.794	0.706	1.310	0.620	0.182	0.276
80.0	6,912	162.948	4.525	40.142	2.545	5.572	1.131	1.880	0.724	1.373	0.636	0.191	0.283
82.0	7,085	170.573	4.638	42.020	2.609	5.833	1.160	1.968	0.742	1.437	0.652	0.199	0.290
84.0	7,258	178.358	4.752	43.938	2.673	6.099	1.188	2.057	0.760	1.503	0.668	0.209	0.297
86.0	7,430	186.302	4.865	45.895	2.736	6.371	1.216	2.149	0.778	1.569	0.684	0.218	0.304
88.0	7,603	194.406	4.978	47.891	2.800	6.648	1.244	2.243	0.796	1.638	0.700	0.227	0.311
90.0	7,776	202.667	5.091	49.927	2.864	6.931	1.273	2.338	0.815	1.707	0.716	0.237	0.318
92.0	7,949	211.087	5.204	52.001	2.927	7.218	1.301	2.435	0.833	1.778	0.732	0.247	0.325
94.0	8,122	219.664	5.317	54.114	2.991	7.512	1.329	2.534	0.851	1.851	0.748	0.257	0.332
96.0	8,294	228.398	5.430	56.265	3.055	7.810	1.358	2.635	0.869	1.924	0.764	0.267	0.339
98.0	8,467	237.289	5.543	58.456	3.118	8.114	1.386	2.737	0.887	1.999	0.780	0.277	0.346
100.0	8,640	246.335	5.657	60.684	3.182	8.424	1.414	2.842	0.905	2.075	0.795	0.288	0.354
102.0	8,813	255.537	5.770	62.951	3.245	8.739	1.442	2.948	0.923	2.153	0.811	0.299	0.361
104.0	8,986	264.894	5.883	65.256	3.309	9.059	1.471	**3.056**	**0.941**	2.232	0.827	0.310	0.368
106.0	9,158	274.406	5.996	67.599	3.373	9.384	1.499	3.165	0.959	2.312	0.843	0.321	0.375
108.0	9,331	284.071	6.109	69.980	3.436	9.714	1.527	3.277	0.977	2.393	0.859	0.332	0.382
110.0	9,504	293.891	6.222	72.399	3.500	10.050	1.556	3.390	0.996	2.476	0.875	0.344	0.389

Appendix C – Geotechnical Report(s)

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374 & 376 Springs Road, Halswell, Christchurch

Geotechnical Assessment Report

for: Puna Property Holdings Limited



Job No: 67592#CHGE
Version: Final, Rev 0
Document No: 200050752
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A report prepared for Puna Property Holdings Limited by Babbage Consultants. December 2025.

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1 INTRODUCTION

Babbage Consultants Limited (Babbage) has been engaged by Puna Property Holdings Limited ("the client") to undertake a geotechnical assessment of a site across three adjacent lots 374 and 376 Springs Road, Halswell (Secs 4,6 SO 550060). There are no preliminary plans for the proposed building locations and therefore a general investigation was undertaken to provide reasonable coverage of the site.

This report is based on the scope of works summarised in Table 1.

Table 1 - Scope of geotechnical investigation and assessment

Desktop study of public and provided information	• Information available on the New Zealand Geotechnical Database (NZGD) • GNS Science Active Fault Database • Institute of Geological and Nuclear Sciences (GNS) Geological Maps (QMAP) • Christchurch City Council (CCC) records, reports, maps and other information
Site-specific fieldwork investigation	• Site specific investigations comprising hand auger and test pits with Scala penetrometer testing
Geotechnical assessment	• Assessment of the variation of ground conditions beneath the site and description of soil types encountered • An assessment of ground related natural hazards • Any relevant geotechnical hazards and foundation design considerations • Selection of geotechnical parameters for the purposes of foundation design • Discussion and recommendations regarding foundations, soil bearing capacities, and site subsoil class

2 SITE DESCRIPTION

2.1 Location

A site location plan is included in Appendix A, and has a total area of approximately 12.45 hectares.

The site comprises a largely open paddock with a garden centre and nursery to the south-west and is accessed off Springs Road. Historical imagery from Canterbury Maps indicates the site was undeveloped, being large open fields since 1940, with the removal of a shelter belt that crossed the site by 1964. The garden centre along Springs road was progressively developed since 1994 though to 2010 and has remained fairly consistent since.

There are no minor or major waterways within 1.0 km of the site, however an open drain is noted along Springs Road.

2.2 Land Categorisation

The area in which the property is located is designated as “Rural and unmapped” and does not therefore have an MBIE Technical Category for the purposes of foundation selection for residential properties.

The Liquefaction Vulnerability Map available on Canterbury Maps classifies the site as being in an area where ‘Liquefaction Damage is Unlikely’.

3 BACKGROUND INFORMATION

3.1 Geological and Hydrogeological Setting

The GNS 1:250,000 Geological Map of New Zealand QMAP describes the natural deposits as geological unit Q1, “Holocene river deposits” comprising, “Modern river floodplain/low-level degradation terrace. Unweathered, variably sorted gravel/sand/silt/clay”.

Babbage has previously undertaken an investigation on a property to the north during a previous stage of the project in August 2024. This investigation found topsoil overlying layers of firm to stiff silt and medium dense sand, with dense to very dense sandy gravels encountered between 0.8 m and 1.5 m depth.

The nearest geotechnical investigation data available on the New Zealand Geotechnical Database (NZGD) is a series of hand augers located to the south-east, associated with a roading upgrade. Investigation NZGD:ID 150450 encountered topsoil to 0.2 m, overlaying interbedded silt and sandy silt to 2.85 m, where the test encountered refusal on assumed gravel.

The nearest Environment Canterbury Well record, located at the southern end of property, along Marshes Road (M36/4471) shows sand to a depth of 3.5 m, with sandy gravels to at least 21.0 m depth. An initial groundwater depth was encountered at 6.80 m below ground level. Borehole M36/7336 is a well located 280 m west of the site, and has a recent recorded groundwater depth of 8.92 m.

3.2 Geographical Setting

Black Maps, 1856 are historical maps of the area, these maps indicate that the site location and surrounding area at that time was “Herbaceous (fern/grass/herbs)” but predominantly grass. There does not appear to be (or have been) geographical features onsite or features nearby that would pose a geotechnical constraint.

4 GEOTECHNICAL INVESTIGATION

4.1 Methodology

A site walkover and geotechnical investigation was undertaken on 5th – 7th November 2025. The fieldwork comprised 22 hand augers and 3 excavated test pits, generally with accompanying Scala penetrometer tests. All the investigation locations were logged by an experienced Engineering Geologist from Babbage Consultants.

The investigation locations were selected to provide good general coverage of the site, with target depths of hand augers ranging between 1.0 m and 3.0 m. The test pits were taken to depths of between 1.0 m and 2.0 m bgl.

The approximate location of the exploratory holes is shown on the Geotechnical Investigation Plan included in Appendix B.

4.2 Investigation Findings

Ground conditions were found to be relatively consistent across the site, with the exception of HA07 which encountered shallow gravel at 0. 7 m depth.

The investigation found topsoil/gravel fill that was generally 0.3 m thick, but up 0.45 m in localised areas, which overlays interbedded firm silt and loose to medium dense sand to at least 3.0 m bgl. While the gravel was generally not encountered during the investigation, based on nearby NZGD records and historical well logs medium dense to dense gravel is anticipated at approximately 3.5 m depth and extend to some depth beneath the site (at least 20 m and likely considerably more).

Testing within the garden centre (HA23, HA24, and HA25) encountered gravel fill over buried topsoil to depths between 0.30 and 0.45 m.

Saturated soils were encountered at five locations between 2.7 m and 2.9 m and was absent in the remainder of the testing. It is unknown if the saturated soils are associated with a low permeability layer or the ground water. Groundwater monitoring within ECAN wells suggest long-term groundwater depth of approximately 9 m below ground level.

The ground conditions identified from the investigations are summarised in Table 2 below.

Table 2: Summary of encountered ground conditions

Soil Type	Approximate Depth to Base of Stratum (m)												
	HA01	**HA02**	**HA03**	**HA04**	**HA05**	**HA06**	**HA07**	**HA08**	**HA09**	**HA10**	**HA11**	**HA12**	**HA13**
Topsoil/fill	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.25	0.2
Interbedded sand and silt mixtures	0.8^	3.0*	3.0*	3.0*	1.0*	3.0*	1.0*	3.0*	3.0*	3.0*	1.0*	3.0*	1.0*
Saturated soil	-	-	-	-	-	2.7	-	-	-	2.9	-	-	-
	HA14	**HA15**	**HA16**	**HA17**	**HA18**	**HA19**	**HA20**	**HA21 (TP)**	**HA22 (TP)**	**HA23 (TP)**	**HA24**	**HA25**	
Topsoil/fill	0.2	0.2	0.3	0.25	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.45	
Interbedded sand and silt mixtures	3.0*	3.0*	3.0*	3.0*	1.0*	3.0*	3.0*	1.0*	2.0*	1.0*	3.0*	1.0*	
Saturated soil	-	-	-	2.8	--	2.8	2.9	-	-	-	-	-	-

^ Refusal on assumed gravel

*Target depth

A detailed description of the soil profiles encountered at the test locations can be found in the investigation logs in Appendix C. The descriptive terms used are in general accordance with the NZ Geotechnical Society's "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes" December 2005.

4.3 Design Soil Profile and Soil Parameters

A summary of the soil profile and their design parameters are presented in Table 3.

Table 3 - Generalised soil profile and estimated parameters

Soil Unit	Description	Depth to the base of the stratum (m)	Unit Weight, γ, (kN/m³)	Internal Friction Angle, ϕ′, (°)	Effective Cohesion c′ (kPa)	Undrained shear strength (kPa)	Elastic Modulus, E (MPa)
1	Topsoil	0.3	16.0	-	-	-	-
2	Interbedded Silt firm, or loose sand	3.5	16.5	28	2	40	5
8	Sandy gravel, medium dense to dense	>20	19.0	38	0	-	20

5 HAZARD ASSESSMENT

5.1 Flood Risk

The Christchurch City Council (CCC) Floor Level Viewer bases floor level information on the most recent assessment of flood modelling results. The site does not currently lie within the District Plan Flood Management Area; however, flooding extents for 10-year return period and above are present within the site, particularly across the north-west and south-east corners of the site.

As the Floor Level Viewer indicates that predicted flood levels for 1 in 10-year, 1 in 50-year, and 1 in 200-year events have not been assessed, it is recommended that CCC be contacted to obtain the necessary guidance prior to building consent application.

5.2 Active Faults

Based on the GNS Active Fault Database, there are no nearby faults affecting the site. The nearest active fault is the Greendale Fault, located 12km to the northwest and the site is not within the Greendale Fault avoidance zone.

5.3 Liquefaction Potential

Canterbury Maps presents information about the liquefaction susceptibility in eastern Canterbury. This information has been drawn from many sources following the Canterbury Earthquake Sequence (CES) and then gathered together in one place for ease of access.

The Vulnerability Map tool shows how liquefaction vulnerability varies across Christchurch as well as describing the likelihood and severity of ground damage, and the reliability of the known ground conditions. The site is mapped within an area where “Liquefaction damage is unlikely”.

The shallow soil profile consists of silt and sand overlying sandy gravels which are anticipated to be present from 3.5 m (based on the nearby machine borehole and NZGD testing). The sandy gravel is not considered to be liquefiable as this soil type is generally too dense to liquefy.

Saturated soil was encountered as shallow as 2.8 m, with competent gravel soils anticipated from 3.5 m depth extending to at least 20m depth (and likely deeper). Consequently, the risk of liquefaction at the site is considered to be low.

There was no evidence of liquefaction at the site from aerial and satellite imagery or site visit data (Canterbury Maps) following the September 2010 and February 2011 earthquakes [the two largest at this location in the Canterbury Earthquake Sequence (CES)].

6 DISCUSSION AND RECOMMENDATIONS

6.1 Bearing Capacity

The shallow soils comprise topsoil that range in thickness between 0.3 m and 0.45 m, with firm silt below. Considering the above, the natural non-organic soils below the topsoil/fill is anticipated to achieve a geotechnical ultimate bearing capacity (GUBC) of 200 kPa.

Should localised organic soil, buried topsoil, non-engineered fill or soft soils (below the anticipated GUBC) be identified below the building platform, localised over-excavation and reinstatement with engineered fill may be required.

A strength reduction factor of 0.5 shall be applied to the above GUBC value in combination with imposed factored static loads, and a strength reduction factor of 0.8 for seismic overstrength load combinations.

6.2 Static Settlement

Given the generally firm nature of the natural non-organic soils immediately below the topsoil/fill, and provided that future structures are designed using the above geotechnical ultimate bearing capacities and on an approved bearing strata, the risk of significant static settlement is considered low. However, it is recommended that further assessment of static settlement is undertaken if the ground is raised by more than 400 mm.

6.3 Foundations Considerations

Geotechnical assessment indicates that the site is underlain by natural soils comprising topsoil over sandy silts and silty sands. The medium dense to dense sandy gravel was only encountered at one location (HA07) at 0.7 m depth and is anticipated to be at a depth of 3.5 m bgl across the remainder of the site.

Conventional strip and pad footings can be used for proposed buildings, founded within the natural sand and silt encountered beneath the topsoil/fill, which was generally 0.3 m thick, and up to 0.45 m (bgl).

As the nature of the development is yet to be determined (at the time of writing), the following is a generic assessment for the purposes of preliminary evaluation.

It is recommended that:

- A geotechnical ultimate bearing capacity (GUBC) be assumed as 200kPa for strip footings and isolated pad footings that are founded within the natural soils.
- In general, a ground bearing slab can be adopted and placed on the natural material beneath the topsoil with a minimum thickness of 150 mm of compacted hardfill beneath it; the actual thickness will depend on the finished floor levels of individual buildings, and the depth of topsoil strip.

- Specific geotechnical design parameters for slab designs (modulus of subgrade reaction) can only be determined once the nature of the development has been determined, and the specific load bearing requirements are known.
- Strength reduction factors of 0.5 for factored static loads and 0.8 for seismic overload cases should be applied to the recommended GUBC for pad and strip foundations.
- While the risk of static and liquefaction induced settlement is considered low, future buildings should be designed to accommodate static settlements up to 25 mm over a 6 m horizontal span.

6.4 Earthworks

Following the topsoil stripping (up to 400 mm) and prior to any filling and the slab construction, there should be:

- Proof rolling of the exposed subgrade;
- Inspection of the formation by a suitably qualified geotechnical specialist; and
- Replacement of any unsuitable or soft material with compacted hardfill or AP65.

Where future development of the site requires general filling, this should be compacted hardfill or AP65. The fill should be compacted in layers not exceeding 200mm thickness and compacted to 95% of the laboratory maximum dry density provided by the supplier. Compaction verification should be undertaken using calibrated Nuclear Density Meters (NDM).

6.5 External Paved Areas

The external areas around the site may be concrete or asphalt hardstanding with sub-base thicknesses, material type, and compaction requirements based on the specific designs and final design levels. All deleterious soil layers should be stripped from the hardstanding areas where high storage and traffic loads are to be expected with the exposed formation providing a maximum design CBR value of 4%.

It is recommended that the exposed formation be proof rolled and any localised soft or otherwise unsuitable materials be removed and replaced with compacted AP65. Elsewhere, where concrete or asphalt hardstanding is to be provided for light traffic and car park purposes, the depth of site strip will be determined either by the topsoil removal requirement or by the specific sub-base design whichever is thicker.

6.6 General Considerations

A site subsoil Class D (deep or soft soil) in accordance with NZS 1170.5:2004 should be adopted for design purposes at this location.

Finished floor level requirements will need to be checked for the proposed development as this may affect foundation embedment, and volumes of filling required to form the building platform to the design elevation.

Once each building within the proposed development has been designed, Babbage should review the structural drawings, including foundation sizes, embedment, and imposed loads to ensure all foundation types are compliant with the recommendations provided.

If excavations are to be left open prior to concrete pouring, these should be covered to protect the natural formation from rainfall induced softening.

At the time of construction an appropriate level of monitoring by a geotechnical specialist shall be undertaken to confirm that the encountered founding soils are consistent with those encountered during the geotechnical investigation.

6.7 Further Geotechnical Testing

Whilst the ground conditions across the site have been found to be relatively consistent, the spatial distribution of the testing locations does not rule out isolated areas where the ground conditions may vary from those identified.

It is recommended that once the site layout and development requirements have been established, the findings of this report be re-assessed for building specific relevance and if necessary, further geotechnical investigations undertaken. This may also be required for Building Consent purposes.

As indicated above further development specific percolation testing may be required.

APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of Puna Property Holdings Limited as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk. Babbage accepts no responsibility or liability for the consequences of this report being used for any purpose or project other than that for which it was commissioned, or by any party with whom an agreement has not been executed.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts and should not be scaled. They are provided for the purposes of this report only and may not be used for construction purposes or any other purpose for which they are not intended. Sources for map and plan compositions may include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Babbage Consultants Limited.

Reliability of Investigation

Where Babbage have undertaken site specific geotechnical investigations, the recommendations and opinions in this report are based on the data derived from the exploratory holes or tests undertaken specifically for those investigations as described herein.

The nature and continuity of subsoil conditions away from such exploratory holes or tests are inferred and it must be appreciated that actual conditions could vary considerably from those assumed and which have not therefore been taken into account in this report.

The comments made regarding groundwater conditions are based on observations made at the time the field work was carried out. It should be noted that groundwater levels will vary owing to seasonal, tidal, seismic and weather-related effects.

Where planned and undertaken by Babbage, the scope of the investigation was selected on the basis of specific requirements of the Client and may be inappropriate to another form of development, scheme or other requirement.

During excavation and construction, the site should be examined by a Geotechnical Engineer or Engineering Geologist competent to judge whether the exposed subsoils are compatible with the inferred conditions on which the report has been based. It is possible that the nature of the exposed subsoils may require further investigation and the modification of the design based upon this report.

If during construction or excavation subsoil conditions are found to vary from those described in this report it is essential that Babbage are contacted as any such variations may affect the design parameters and recommendations provided.

Reliability of Third-Party Data and Information

Where factual information has been provided to Babbage by the Client including reports, documents, drawings, photographs, and/or geotechnical investigations undertaken by third parties, and on the basis of which Babbage has been requested to provide recommendations and opinions, Babbage does not accept any liability whatsoever for the consequences of any errors or omissions in the information supplied, and has accepted such information in good faith as being reasonably representative of the conditions at the site.

As a user of Data extracted from the New Zealand Geotechnical Database (NZGD) Babbage (the User) is required to advise the Client of the following:

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Appendix A

Site Location Plan



Legend

Site Boundary

0 100 m 200 m

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Produced by **Datanest.earth**

Title: Site Location Plan		
Client: Tuatara Structures		Size: A4
Project: Geotechnical Investigation	Drawn: -	Figure: -
Date: Invalid date	Checked: -	
Proj No: 67592	Scale: 1:7000	Version: -

Appendix B

Geotechnical Investigation Plan



Legend

- Testing Location (Shallow)
- Testing Location (Deep)
- Site Boundary

0 25 m 50 m

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Produced by **Datanest.earth**

Title: Investigation Plan		
Client: Tuatara Structures		Size: A4
Project: Geotechnical Investigation	Drawn: -	Figure: -
Date: 13-11-2025	Checked: -	
Proj No: 67592	Scale: 1:2500	Version: -

Appendix C

Geotechnical Investigation Logs

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Geotechnical Log - Hand Auger

HA01

UTM	: 59G	Drill Rig	:	Job Number	: 67592
Latitude	: -43.56584	Driller Supplier	:	Client	: Tuatara Structures
Longitude	: 172.51915	Logged By	: DP	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 0.7 m BGL	Date	: 05/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1, 0.2, 0.3	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.3m - 0.7m: SILT with some fine to medium sand; light yellow. firm; moist; low plasticity.		0.4, 0.5, 0.6				0.5	
Terminate 0.7 m Practical refusal was reached at 0.7 m. Refusal on assumed gravel							



Depth: 0 m - 0.0 - 0.7 m

Borehole No: HA02

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 06/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.2m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1					
0.2m - 0.7m: Silty fine SAND; light yellow. loose; moist.		0.2					
		0.3					
		0.4					
		0.5					
		0.6					
		0.7					
0.7m - 1.5m: with trace silt, sand is fine to medium.		0.8					
		0.9					
		1.0					
		1.1					
		1.2					
		1.3					
		1.4					
1.5m - 2m: becoming silty fine to medium sand.		1.5					
		1.6					
		1.7					
		1.8					
		1.9					
2m - 2.5m: SILT; light yellow. firm; wet; low plasticity.		2.0					
		2.1					
		2.2					
		2.3					
		2.4					
2.5m - 2.9m: fine to medium SAND; light orange. medium dense; wet.		2.5					
		2.6					
		2.7					
		2.8					
2.9m - 3m: becoming dense.		2.9					
HA02 Terminate at 3 m (Target depth was reached at 3 m.)							



Depth: 0.0 m - 3.0m

Borehole No: HA03

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 06/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.3m - 0.7m: Sandy SILT; light yellow. firm; moist; low plasticity; sand, fine.							
0.7m - 2m: Silty fine to medium SAND; light yellow. loose; moist.							
2m - 2.2m: SILT; light yellow. firm; wet; low plasticity.							
2.2m - 2.5m: fine to medium SAND; light yellow. loose to medium dense; moist.							
2.5m - 3m: SILT; light yellow. firm to stiff; moist; low plasticity.							
HA03 Terminate at 3 m (Target depth was reached at 3 m.)							



Depth: 0.0 m - 3.0 m

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Geotechnical Log - Hand Auger

HA04

Coordinate System	: EPSG:2193	Drill Rig	:	Job Number	: 67592
Easting (m)	: 0.00	Driller Supplier	:	Client	: Tuatara Structures
Northing (m)	: 0.00	Logged By	: DP	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m BGL	Date	: 06/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1 0.2 0.3					
0.3m - 1.2m: SILT with some fine sand; light yellow. firm; moist; low plasticity.		0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2					
1.2m - 2.5m: fine to medium SAND; light yellow. loose to medium dense; dry.		1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5					
2.5m - 3m: becoming silty fine to medium sand wet.		2.6 2.7 2.8 2.9					
Terminate 3 m Target depth was reached at 3 m.							



Depth: 0.0 m - 3.0 m

Borehole No: HA05

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 1 m	Date	: 06/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1					
0.3m - 0.7m: Silty fine SAND; light yellow. loose; dry.		0.2					
0.7m - 1m: becoming silty fine sand.		0.3					
		0.4					
		0.5				0.5	
		0.6					
		0.7					
		0.8					
		0.9					
		1.0					
HA05 Terminate at 1 m (Target depth was reached at 1 m.)							



Depth: 0.0 m - 1.0 m

Borehole No: HA06

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: Alex Baldwin	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	:	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 06/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; dry; low plasticity. [TOPSOIL]		0.1 0.2 0.3					
0.3m - 0.8m: SILT with some fine sand; light yellow. firm; dry; low plasticity.		0.4 0.5 0.6 0.7					
0.8m - 1.6m: Silty fine to medium SAND; light yellow. loose to medium dense; wet.		0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5					
1.6m - 2m: SILT; light yellow. firm to stiff; wet; low plasticity.		1.6 1.7 1.8 1.9 2.0					
2m - 2.5m: fine to medium SAND; light yellow. loose to medium dense; wet.		2.1 2.2 2.3 2.4 2.5					
2.5m - 2.7m: SILT; light yellow. firm; wet; low plasticity.		2.6 2.7					
2.7m - 3m: becoming saturated.		2.8 2.9					
HA06 Terminate at 3 m (Target depth was reached at 3 m.)							



Depth: 0.0 m - 3.0 m

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Geotechnical Log - Hand Auger

HA07

Coordinate System	: EPSG:2193	Drill Rig	:	Job Number	: 67592
Easting (m)	: 0.00	Driller Supplier	:	Client	: Tuatara Structures
Northing (m)	: 0.00	Logged By	: DP	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 1 m BGL	Date	: 06/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; dry; low plasticity. [TOPSOIL]		0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.3m - 1m: Sandy SILT; light yellow. firm; moist; low plasticity; sand, fine.							
Terminate 1 m Target depth.							



Depth: 0.0 m - 1.0 m

Borehole No: HA08

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 06/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1 0.2 0.3					
0.3m - 0.6m: Sandy SILT; light yellow. firm; moist; low plasticity; sand, fine to medium.		0.4 0.5 0.6					
0.6m - 0.9m: fine to medium SAND with some silt; light yellow. loose; moist.		0.7 0.8 0.9					
0.9m - 1.2m: becoming wet.		1.0 1.1 1.2					
1.2m - 1.8m: Sandy SILT; light yellow firm; wet; low plasticity; sand, fine.		1.3 1.4 1.5 1.6 1.7 1.8					
1.8m - 2m: fine to medium SAND; light yellow loose; wet.		1.9 2.0					
2m - 2.5m: becoming fine to coarse sand.		2.1 2.2 2.3 2.4 2.5					
2.5m - 3m: SILT; light yellow. firm; wet; low plasticity.		2.6 2.7 2.8 2.9					
HA08 Terminate at 3 m (Target depth.)							

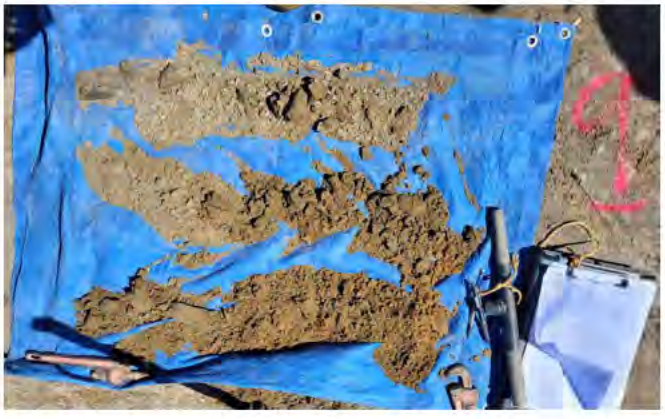


Depth: 0.0 m - 3.0 m

Borehole No: HA09

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 10/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; dry; low plasticity. [TOPSOIL]		0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.3m - 0.7m: Silty fine SAND; light yellow. loose; moist.							
0.7m - 1.2m: becoming silty fine to medium SAND.							
1.2m - 1.5m: becoming fine to coarse.							
1.5m - 2.5m: Sandy SILT; light yellow. firm; wet; low plasticity; sand, fine.							
2.5m - 3m: sand becomes fine to medium.							
HA09 Terminate at 3 m (Target depth)							



Depth: 0.0 m - 3.0 m

Borehole No: HA10

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 06/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.3m - 1m: Silty fine to medium SAND; light yellow. loose; moist.							
1m - 1.8m: becoming fine grained sand.							
1.8m - 2.5m: SILT; light yellow. firm; wet; low plasticity.							
2.5m - 2.9m: fine to coarse SAND with some silt; light orange yellow. medium dense; wet.							
2.9m - 3m: becoming saturated.							
HA10 Terminate at 3 m (Target depth.)							



Depth: 0.0 m - 3.0 m

Borehole No: HA11

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 1 m	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.2m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.2m - 0.6m: Sandy SILT; light yellow. firm; moist; low plasticity; sand, fine.		0.2 0.3 0.4 0.5				0.5	
0.6m - 1m: fine SAND with some silt; light yellow. loose; moist.		0.6 0.7 0.8 0.9 1.0					
HA11 Terminate at 1 m (Target depth)							



Depth: 0.0 m - 1.0 m

Borehole No: HA12

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.25m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1					
0.25m - 0.6m: SILT; light yellow. firm; moist; low plasticity.		0.6					
0.6m - 1.2m: fine SAND; light yellow. loose; moist.		1.2					
1.2m - 1.8m: becoming silty fine sand.		1.8					
1.8m - 2.2m: SILT; light yellow. firm to stiff; moist; low plasticity.		2.2					
2.2m - 3m: fine to medium SAND; light yellow. medium dense; moist.		3					
HA12 Terminate at 3 m (Target depth.)							



Depth: 0.0 m - 3.0 m

Borehole No: HA13

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 1 m	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.2m: Organic SILT; brown. firm; moist; low plasticity. [TOPSOIL]		0.1	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.2m - 0.4m: SILT; light yellow. firm; moist; low plasticity.		0.2					
0.4m - 1m: fine SAND; light yellow. loose; moist.		0.3					
		0.4					
		0.5				0.5	
		0.6					
		0.7					
		0.8					
		0.9					
		1.0					
HA13 Terminate at 1 m (Target depth)							

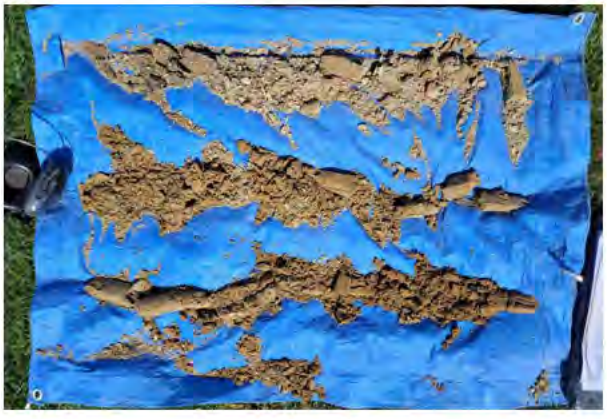


Depth: 0.0 m - 1.0 m

Borehole No: HA14

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.2m: Organic SILT; brown. firm; moist; low plasticity. [TOPSOIL]		0.1					
0.2m - 0.4m: SILT; light yellow. firm; moist; low plasticity.		0.2					
0.4m - 1.3m: Silty fine SAND; light yellow. loose; moist.		0.3 – 1.3					
1.3m - 1.7m: silt is absent.		1.4 – 1.7					
1.7m - 2.5m: SILT with some fine silt; light yellow. stiff; wet; low plasticity.		1.8 – 2.5					
2.5m - 3m: fine to medium SAND; light yellow orange loose to medium dense; wet.		2.6 – 2.9					
HA14 Terminate at 3 m (Target depth)							



Depth: 0.0 m - 3.0 m

Borehole No: HA15

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.2m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1					
0.2m - 0.4m: SILT; light yellow firm; moist; low plasticity.		0.2					
0.4m - 3m: Silty fine SAND; light yellow loose; moist.		0.3					
		0.4					
		0.5					
		0.6					
		0.7					
		0.8					
		0.9					
		1.0					
		1.1					
		1.2					
		1.3					
		1.4					
		1.5					
		1.6					
		1.7					
		1.8					
		1.9					
		2.0					
		2.1					
		2.2					
		2.3					
		2.4					
		2.5					
		2.6					
		2.7					
		2.8					
		2.9					
HA15 Terminate at 3 m (Target depth)							



Depth: 0.0 m - 3.0 m

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HA16

UTM	: 59G	Drill Rig	:	Job Number	: 67592
Latitude	: -43.56774	Driller Supplier	:	Client	: Tuatara Structures
Longitude	: 172.51864	Logged By	: DP	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m BGL	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; dry; low plasticity. [TOPSOIL]		0.1 0.2 0.3	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.3m - 1.5m: Silty fine SAND; light yellow. loose; moist.		0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4					
1.5m - 1.7m: SILT; light yellow. firm; moist; low plasticity.		1.5 1.6					
1.7m - 2m: Silty fine to medium SAND; loose to medium dense; moist.		1.7 1.8 1.9 2.0					
2m - 2.5m: SILT; light yellow. firm; moist; low plasticity.		2.1 2.2 2.3 2.4 2.5					
2.5m - 2.9m: fine SAND with some silt; light yellow. loose to medium dense; wet.		2.6 2.7 2.8					
2.9m - 3m: SILT; light yellow. firm; wet; low plasticity.		2.9					
Terminate 3 m Target depth							



Depth: 0.0 m - 3.0 m

Borehole No: HA17

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.25m: Organic SILT; brown. firm; dry; low plasticity. [TOPSOIL]		0.1					
0.25m - 1m: Sandy SILT; light yellow. firm; moist; low plasticity; sand, fine.		0.2 – 1.0					
1m - 1.8m: Silty fine to medium SAND; light yellow. loose; moist.		1.1 – 1.8					
1.8m - 2.8m: SILT some sand; light yellow. firm; moist; low plasticity.		1.9 – 2.8					
2.8m - 3m: becoming saturated.		2.9				▽	
HA17 Terminate at 3 m (Target depth)							



Depth: 0.0 m - 3.0 m

Borehole No: HA18

Coordinate System : EPSG:2193	Driller Rig	:	Job Number	: 67592	
Easting :	Driller Supplier	:	Client	: Tuatara Structures	
Northing :	Logged By	: DP	Project	: Geotechnical Investigation	
RL : Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand	
Total Depth : 1 m	Date	: 07/11/2025	Loc Comment :		

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; brown. firm; dry; low plasticity. [TOPSOIL]		0.1	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.3m - 0.7m: Silty fine SAND; light yellow. loose; moist.		0.2					
0.7m - 1m: Becoming silty fine - medium sand, wet.		0.3					
		0.4					
		0.5				0.5	
		0.6					
		0.7					
		0.8					
		0.9					
		1.0					
HA18 Terminate at 1 m (Target depth)							



Depth: 0.0 m - 1.0 m

Borehole No: HA19

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; dry; low plasticity. [TOPSOIL]		0.1					
0.3m - 0.3m: Sandy SILT; light yellow. firm; moist; low plasticity		0.2					
0.6m - 1.2m: Silty fine SAND; light yellow. loose to medium dense; moist.		0.3					
1.2m - 1.5m: becoming light grey.		0.4					
1.5m - 2.5m: SILT; light grey. firm; wet; low plasticity.		0.5					
2.5m - 2.8m: fine to medium SAND; light orange. medium dense to dense; moist.		0.6					
2.8m - 3m: becoming saturated.		0.7					
		0.8					
		0.9					
		1.0					
		1.1					
		1.2					
		1.3					
		1.4					
		1.5					
		1.6					
		1.7					
		1.8					
		1.9					
		2.0					
		2.1					
		2.2					
		2.3					
		2.4					
		2.5					
		2.6					
		2.7					
		2.8					
		2.9					
HA19 Terminate at 3 m (Target depth, groundwater encountered at 2.8 m)							



Depth: 0.0 m - 3.0 m

Borehole No: HA20

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m	Date	: 07/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.1 0.2 0.3					
0.3m - 0.7m: Sandy SILT; light yellow. firm; moist; low plasticity		0.4 0.5 0.6 0.7					
0.7m - 1.8m: Silty fine SAND; light yellow loose; moist.		0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8					
1.8m - 2.7m: SILT; firm; wet; low plasticity.		1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7					
2.7m - 2.9m: Silty fine to coarse SAND; dense; wet.		2.8 2.9					
2.9m - 3m: becoming saturated.							
HA20 Terminate at 3 m (Target depth, groundwater at 2.9 m)							



Depth: 0.0 m - 3.0 m

Borehole No: HA21 (Test pit)

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 1.1 m	Date	: 11/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.4m: fine GRAVEL with some silt and cobbles; light grey loose medium dense; dry. [FILL]		0.1 0.2 0.3 0.4	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
0.4m - 0.6m: Silty fine SAND; light yellow. loose; moist.		0.5 0.6				0.5	
0.6m - 0.8m: SILT; light yellow. stiff; moist; low plasticity.		0.7 0.8					
0.8m - 1.1m: fine SAND; light yellow. loose to medium dense; moist.		0.9 1.0 1.1				1.0	
HA21 (Test pit) Terminate at 1.1 m (Target depth)							



Depth: 0 m - 1.1 m

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HA22 (Test pit)

Coordinate System	: EPSG:2193	Drill Rig	:	Job Number	: 67592
Easting (m)	: 0.00	Driller Supplier	:	Client	: Tuatara Structures
Northing (m)	: 0.00	Logged By	: DP	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 2 m BGL	Date	: 08/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: fine GRAVEL with some cobbles; light grey loose medium dense; dry. [FILL]		0.1					
0.3m - 0.6m: Sandy SILT; light yellow. firm; moist; low plasticity; sand, fine.		0.2, 0.3, 0.4, 0.5				0.5	
0.6m - 1m: Silty medium to coarse SAND; light yellow. loose to medium dense; moist.		0.6, 0.7, 0.8, 0.9, 1.0				1.0	
1m - 1.6m: with some silt, sand is fine.		1.1, 1.2, 1.3, 1.4, 1.5				1.5	
1.6m - 2m: SILT; light yellow wet; low plasticity.		1.6, 1.7, 1.8, 1.9					
Terminate 2 m Target depth & maximum reach of excavator							



Depth: 0.0 m - 2.0 m

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Geotechnical Log - Hand Auger

HA23 (Test pit)

Coordinate System	: EPSG:2193	Drill Rig	:	Job Number	: 67592
Easting (m)	: 0.00	Driller Supplier	:	Client	: Tuatara Structures
Northing (m)	: 0.00	Logged By	: DP	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 1 m BGL	Date	: 11/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.1m: fine GRAVEL with some silt; light grey loose; wet. [FILL]		0.1					
.1m - 0.3m: Sandy fine to coarse GRAVEL; light grey medium dense; moist; sand, fine to coarse. [FILL]		0.2					
0.3m - 0.4m: Organic SILT; brown. firm; moist; low plasticity. [TOPSOIL]		0.3					
0.4m - 1m: SILT with some fine sand; light yellow. firm; moist; low plasticity.		0.4					
		0.5				0.5	
		0.6					
		0.7					
		0.8					
		0.9					
Terminate 1 m Target depth		1.0					



Depth: 0.0 m - 1.0 m

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Geotechnical Log - Hand Auger

HA24

UTM	: 59G	Drill Rig	:	Job Number	: 67592
Latitude	: -43.56848	Driller Supplier	:	Client	: Tuatara Structures
Longitude	: 172.51912	Logged By	: DP	Project	: Geotechnical Investigation
Ground Elevation	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 3 m BGL	Date	: 08/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.15m: fine GRAVEL with some silt; light grey loose; wet. [FILL]		0.1					
0.15m - 0.3m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.2					
0.3m - 0.7m: Sandy SILT; light yellow. firm; moist; low plasticity; sand, fine.		0.3					
		0.4					
		0.5					
		0.6					
0.7m - 1.8m: Silty fine SAND; light yellow. loose; moist.		0.7					
		0.8					
		0.9					
		1.0					
		1.1					
		1.2					
		1.3					
		1.4					
		1.5					
		1.6					
		1.7					
		1.8					
1.8m - 2.5m: becoming wet.		1.9					
		2.0					
		2.1					
		2.2					
		2.3					
		2.4					
		2.5					
2.5m - 2.8m: SILT with some fine sand; light yellow. firm; wet; low plasticity.		2.6					
		2.7					
		2.8					
2.8m - 3m: fine to medium SAND; light yellow. saturated.		2.9					
Terminate 3 m Target depth							



Depth: 0.0 m - 3.0 m

Borehole No: HA25

Coordinate System : EPSG:2193		Driller Rig	:	Job Number	: 67592
Easting	:	Driller Supplier	:	Client	: Tuatara Structures
Northing	:	Logged By	: DP	Project	: Geotechnical Investigation
RL	: Not Surveyed	Reviewed By	: DP	Location	: 376 Springs Road, Hornby South, Christchurch, New Zealand
Total Depth	: 1 m	Date	: 11/11/2025	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	NZS4403:1986 Test 6.5.2 (blows per 100mm)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - .1m: fine GRAVEL with some silt; light grey loose; wet. [FILL]		0.1	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15				
.1m - 0.2m: Sandy fine to coarse GRAVEL; light grey medium dense; wet; sand, fine to coarse. [FILL]		0.2					
0.2m - 0.45m: Organic SILT; light brown. firm; moist; low plasticity. [TOPSOIL]		0.3					
		0.4					
0.45m - 1m: SILT; light yellow. firm; moist; low plasticity.		0.5				0.5	
		0.6					
		0.7					
		0.8					
		0.9					
		1.0					
HA25 Terminate at 1 m (Target depth)							



Depth: 0.0 m - 1.0 m

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300/318/320 Springs Road, Halswell, Christchurch

Geotechnical Assessment Report

for: Puna Property Holdings Limited



Job No: 67592#CHGE
Version: Preliminary DRAFT
Document No: 200048525
Date of Issue: 11/09/2024

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A report prepared for Puna Property Holdings Limited by Babbage Consultants. September 2024.

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1 INTRODUCTION

Babbage Consultants Limited (Babbage) has been engaged by Puna Property Holdings Limited ("the client") to undertake a geotechnical assessment of a site across three adjacent lots on Springs Road (300/318/320 Springs Road), Halswell. There are no preliminary plans for the proposed building locations and therefore a general investigation was undertaken to provide reasonable coverage of the site.

This report is based on the scope of works summarised in Table 1.

Table 1 - Scope of geotechnical investigation and assessment

Desktop study of public and provided information	• Information available on the New Zealand Geotechnical Database (NZGD)[1] • GNS Science Active Fault Database[2] • Institute of Geological and Nuclear Sciences (GNS) Geological Maps (QMAP)[3] • Christchurch City Council (CCC) records, reports, maps and other information
Site-specific fieldwork investigation	• Test pit (TP) investigations • Scala penetrometer (SP) tests • Soakage (ST) tests
Geotechnical assessment	• Assessment of the variation of ground conditions beneath the site and description of soil types encountered • Selection of geotechnical parameters for the purposes of foundation design • Any relevant geotechnical hazards and foundation design considerations • Discussion and recommendations regarding foundations, soil bearing capacities, and site subsoil class • An assessment of ground related natural hazards

2 SITE DESCRIPTION

2.1 Location

A site location plan is included in Appendix B. The site is located on three separate lots comprising a total area of approximately 8.63 hectares (86,300m^2). A brief site identification for is detailed in Table 2 below:

Table 2: Site identification

Site Address	Legal Description	Site Area
300 Springs Road	Secs 1,2,3,4,6 SO 497260	~25,000m^2 (~2.50ha)*
318 Springs Road	Lot 1 DP82095	~40,000m^2 (~4.00ha)
320 Springs Road	Sec 7 SO482614	~21,300m^2 (~2.13ha)

*It should be noted that 300 Springs Road spans the new Christchurch Southern Motorway (SH 76) and this relates to the portion of the site to the south-east of the highway.

The sites are adjacent to each other, and are flanked to the south-east by Springs Road and to the north by the Christchurch Southern Motorway. Bounding the sites (318 and 320) to the south is agricultural land. A fuel station lies at the south-east corner of 300 Springs Road (312 Springs Road), and there is a small plot of undeveloped land immediately to the north-west. From a visual perspective the sites appear generally flat, but there is no current topographical survey.

Historical imagery from Canterbury Maps[4] indicates the site has been previously developed with a farm or residential building at the north of 300 Springs Road (now demolished). An old concrete foundation associated with the previous dwelling was observed during the site visit. No 318 has an existing abandoned building near the main access track opposite Busch Lane, with further abandoned farm buildings in the south-west corner. There are currently no existing buildings on No 320. The vast majority of each of the sites is former agricultural grassland with rows of mature trees in places.

An overhead power line extends along the access track to No 318 as far as the boundary with No 320.

There are no minor or major waterways within 1.0km of the sites.

2.2 Land Categorisation

The area in which the property is located is designated as “Rural and unmapped” and does not therefore have an MBIE Technical Category for the purposes of foundation selection for residential properties.

The Liquefaction Vulnerability Map available on Canterbury Maps classifies the site as being in an area where ‘Liquefaction Damage is Unlikely’.

3 BACKGROUND INFORMATION

3.1 Geological and Hydrogeological Setting

The GNS 1:250,000 Geological Map of New Zealand QMAP describes the natural deposits as geological unit Q1, “Holocene river deposits” comprising, “Modern river floodplain/low-level degradation terrace. Unweathered, variably sorted gravel/sand/silt/clay”.

The closest public investigation information are two test pits located along the eastern boundary, and one test pit north of the site, these indicated silts and sands up to ~1.8m depth, underlain by sandy gravel to the full depth investigated. Groundwater was not encountered in these test pits.

The nearest Environment Canterbury Well record, located immediately to the east of Springs Road opposite No 318 (M36/3782) shows silty clay to a depth of 4.4m and then sandy gravels to at least 19.4m depth. An initial groundwater depth was encountered at 6.53m below ground level (16.07m Lyttelton Verical Datum - LVD). The GNS Groundwater Model for Christchurch suggests a similar median groundwater elevation.

3.2 Geographical Setting

Black Maps, 1856[5] are historical maps of the area, these maps indicate that the site location and surrounding area at that time was "Herbaceous (fern/grass/herbs)" but predominantly grass. There does not appear to be (or have been) geographical features onsite or features nearby that would pose a geotechnical constraint.

4 GEOTECHNICAL INVESTIGATION

4.1 Methodology

A site walkover and geotechnical investigation was undertaken on 28, 29, and 30 August 2024. The fieldwork comprised 25 machine excavated test pits (TP), with accompanying scala penetrometer tests (SP). In addition, soakage (percolation) testing was undertaken at four locations adjacent to TP03, TP09, TP19 and TP24. All the test pits, and soakage tests were logged by an experienced Engineering Geologist from Babbage.

The investigation locations were selected to provide good general coverage of the site. The TP's were taken to depths of between 1.7-3.1m bgl, with SP's being extended to depths of between 0.7-1.9m, either to practical refusal or target depth. The soakage pits were excavated adjacent to the geotechnical test pits to a consistent depth of 2.0m.

The approximate location of the exploratory holes are shown on the Geotechnical Investigation Plan included in Appendix CB.

4.2 Investigation Findings

Ground conditions were found to be relatively consistent across the entire site area (8.63 Hectares), except locally near the south-west boundary of No 318 (TP22, TP24 and TP25).

The investigation found topsoil overlying layers of medium dense sand, silty sand and sandy silt, and then dense and very dense sandy gravels. Nearby historical well records suggest that the sandy gravels extend to some depth beneath the site (at least 20m and likely considerably more).

The average topsoil depth found on No 300 was 315mm and on Nos 320/318 was 330mm. This is relatively thick compared to typical averages within the Christchurch area, which generally tends to be around 250-300mm. This is likely due to the site's previous agricultural history.

The depth to the sandy gravel layer from existing ground level varied and was typically between 0.0-1.5m (average 1.1m) on 300 Springs Road, and (apart from the south-west corner of No 318) was typically between 0.6-1.4m (average 0.9m) on Nos 320/318.

At the south-west corner of No 318 near the boundary, the sandy gravel was not encountered in three test pits which all terminated at about 3.0m depth. This appears to be an ancient buried channel in the gravels filled with medium dense silty sand and sandy silt.

No groundwater was encountered in any of the test pits and is expected to lie at about 6-8m depth.

The ground conditions identified from the investigations are summarised in Table 3 below:

Table 3: Summary of encountered ground conditions

Soil Type	Approximate Depth to Base of Stratum (m)												
	TP01	**TP02**	**TP03**	**TP04**	**TP05**	**TP06**	**TP07**	**TP08**	**TP09**	**TP10**	**TP11**	**TP12**	**TP13**
Topsoil	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Silt	-	0.8	1.4	0.8	1.0	0.6	0.6	1.0	0.6	0.9	0.8	0.7	0.9
Silty Sand	1.2	-	-	-	1.5	0.9	0.9	1.2	0.8	-	-	-	-
Sandy Silt/Silt	-	-	-	-	-	-	-	-	-	-	-	-	-
Sandy Gravel	2.3*	1.8*	2.6*	2.2*	2.5*	2.0*	2.0*	2.2*	2.1*	2.0*	2.1*	1.9*	2.0*
	TP14	**TP15**	**TP16**	**TP17**	**TP18**	**TP19**	**TP20**	**TP21**	**TP22**	**TP23**	**TP24**	**TP25**	
Topsoil	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.3	0.4	
Silt	1.4	0.6	0.7	-		0.9	0.9	0.8	-	-	-	-	
Silty Sand	-	-	-	-	1.0	-	-	1.0	3.1*	-	3.0*	-	
Sandy Silt/Silt	-	-	-	0.7		-	-	1.2		1.0		3.0*	
Sandy Gravel	2.5*	1.7*	1.7*	1.7*	2.7*	1.9*	2.0*	2.4*		2.0*			
*final depth of the exploratory hole Sand lens in TP11 from 1.2-1.6m, and TP18 from 1.3-1.6m													

A detailed description of the soil profiles encountered at the test locations can be found in the investigation logs in Appendix D. The descriptive terms used are in general accordance with the NZ Geotechnical Society's "*Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*" December 2005.

5 PERCOLATION TESTING

Percolation tests were undertaken in specific excavations adjacent to TP03, TP09, TP19, and TP24 typically within dense sandy gravel soil to provide indicative infiltration rates for the site. Table 4 below presents a summary of the test results at each location:

Table 4: Summary of soakage test results

Test Location	Test Number	Final Depth (m)	Depth to Gravels (m)	Infiltration Rate (k)	
				$m^3/s/m^2$	mm/hour
TP03	ST01	2.00	1.40	7.5×10^{-5}	270
TP09	ST01	2.00	0.80	5.0×10^{-5}	180
TP19	ST01	2.00	0.90	4.9×10^{-4}	1750
TP24	ST01	2.00	n/a	4.6×10^{-6}	16

The infiltration rate between the four testing locations was found to be variable despite the majority of the tests being undertaken within the sandy gravel. Exceptionally the percolation test adjacent to TP24 was undertaken in silty sand, hence the slower infiltration rate. The reduction in infiltration between the sandy gravel layers is unknown but may be attributed to locally denser soil or a nearby low-permeability soil layer.

The infiltration rates in the sandy gravels in TP03 and TP09 were towards the lower expectation in sandy gravels, whilst in TP19 it was much higher (but not free draining). The infiltration rate in the silty sand (TP24) was very much lower and this is as expected for this soil type.

Should a permanent soak pit solution for storm water drainage be adopted, given the variability in infiltration rate, together with the size of the site, it is recommended that further building location specific testing is undertaken once the scale of the development has been determined.

The calculation output is attached as Appendix E.

6 HAZARD ASSESSMENT

6.1 Flood Risk

The Christchurch City Council (CCC) Floor Level Viewer bases floor level information on the most recent assessment of flood modelling results. The site does not currently lie within the District Plan Flood Management Area; however, it indicates that predicted flood levels for 1:50, and 1:200 year floods have not been assessed.

It is recommended that CCC be contacted to obtain the necessary guidance prior to building consent application.

6.2 Active Faults

Based on the GNS Active Fault Database[2], there are no nearby faults affecting the site. The nearest active fault is the Greendale Fault, located 12km to the northwest and the site is not within the Greendale Fault avoidance zone.

6.3 Liquefaction Potential

Canterbury Maps presents information about the liquefaction susceptibility in eastern Canterbury. This information has been drawn from many sources following the Canterbury Earthquake Sequence, and then gathered together in one place for ease of access.

The Vulnerability Map tool shows how liquefaction vulnerability varies across Christchurch as well as describing the likelihood and severity of ground damage, and the reliability of the known ground conditions. The site is mapped within an area where "Liquefaction damage is unlikely".

Sandy gravels are not considered to be liquefiable as they are generally too dense to liquefy. As the groundwater is expected to lie at 6-8m depth below proposed ground levels and the dense sandy gravels are known to extend to at least 20m depth (and likely deeper), the risk of liquefaction at the site risk is considered to be negligible.

There was no evidence of liquefaction at the site from aerial and satellite imagery or site visit data (Canterbury Maps) following the September 2010 and February 2011 earthquakes [the two largest at this location in the Canterbury Earthquake Sequence (CES)].

7 DISCUSSION AND RECOMMENDATIONS

7.1 Foundations Considerations

Geotechnical assessment of the full area of 300/320/318 Springs Road indicates that the site is underlain by natural soils comprising topsoil over sandy silts and silty sands which in turn overlie sandy gravels which are known to extend to some depth. The depth to the gravel horizon typically varied across the site from 0.6m to 1.5m below existing ground level (bgl). Exceptionally in the south-west corner of No 318 near the boundary, the sandy gravel was not encountered at three test pit locations where medium dense silty sand and sandy silt was encountered to the full depth excavated.

The main geotechnical consideration that will influence the choice of foundation system will be the shear strength, compressibility, and thickness of the silty sands and sandy silts overlying the sandy gravel horizon. This will influence the geotechnical ultimate bearing capacity and the estimated differential settlement between foundations placed directly on the sandy gravels and those where the depth to the sandy gravels is the greatest.

Conventional strip and pad footings can be used for the proposed buildings, founded within the natural soils beneath the topsoil at a depth not less than 0.5m below existing ground level (bgl).

The geotechnical ultimate bearing capacity will depend on the shape, size and depth of each footing together with local soil strengths at each proposed building location. As the nature of the development is yet to be determined (at the time of writing), the following is a generic assessment for the purposes of preliminary evaluation.

It is recommended that:

- A generic geotechnical ultimate bearing capacity (G-UBC) be assumed as 300kPa for strip footings and 350kPa for isolated pad footings founded within the natural soils overlying the sandy gravel horizon. This should ensure that total settlements under static loading will be less than 15mm everywhere across the site, including the deeper silts and sands towards the south-west corner of No 318.
- Where the sandy gravels are likely to provide the bearing stratum for footings, a generic G-UBC can be assumed as 500kPa for all footing types.
- On the basis of the above, it is estimated that the maximum *differential* settlement between strips and pads founded on the gravels and those founded on the deepest layer of interbedded silty sands and sandy silts will be less than 10mm. It is recommended that foundation systems be designed to accommodate this amount of potential movement.
- In general, a ground bearing slab can be adopted and placed on the natural material beneath the topsoil with a minimum thickness of 150mm of compacted hardfill beneath it; the actual thickness will depend on the finished floor levels of individual buildings, and the depth of topsoil strip.
- Specific geotechnical design parameters for slab designs (modulus of subgrade reaction) can only be determined once the nature of the development has been determined, and the specific load bearing requirements are known.
- Strength reduction factors of 0.5 for factored static loads and 0.8 for seismic overload cases should be applied to the recommended G-UBC for pad and strip foundations.

7.2 Earthworks

Following the topsoil stripping (up to 400mm) and prior to any filling and the slab construction, there should be:

- Proof rolling of the exposed subgrade;
- Inspection of the formation by a suitably qualified geotechnical specialist; and
- Replacement of any unsuitable or soft material with compacted hardfill or AP65.

Where future development of the site requires general filling, this should be compacted hardfill or AP65. The fill should be compacted in layers not exceeding 200mm thickness, and compacted to 95% of the laboratory maximum dry density provided by the supplier. Compaction verification should be undertaken using calibrated Nuclear Density Meters (NDM).

7.3 External Paved Areas

The external areas around the site may be concrete or asphalt hardstanding with sub-base thicknesses, material type, and compaction requirements based on the specific designs and final design levels. All deleterious soil layers should be stripped from the hardstanding areas where high storage and traffic loads are to be expected with the exposed formation providing a maximum design CBR value of 6%.

For the area of the likely main access road adjacent to the existing service station at 312 Springs Road, a maximum design CBR value of 7% can be adopted.

It is recommended that the exposed formation be proof rolled and any localised soft or otherwise unsuitable materials be removed and replaced with compacted AP65. Elsewhere, where concrete or asphalt hardstanding is to be provided for light traffic and car park purposes, the depth of site strip will be determined either by the topsoil removal requirement or by the specific sub-base design whichever is thicker.

7.4 General Considerations

A site subsoil Class D (deep or soft soil) in accordance with NZS 1170.5:2004[6] should be adopted for design purposes at this location.

Finished floor level requirements will need to be checked for the proposed development as this may affect foundation embedment, and volumes of filling required to form the building platform to the design elevation.

For the design of permanent soak pits for stormwater disposal, the infiltration rates were found to be highly variable (see Section 5 above), it is therefore recommended that further building location specific testing is undertaken once the scale of the development has been determined. It is also recommended that the area towards the south west corner of No 318 near the boundary, where the sandy gravel was not encountered, be avoided for permanent soakage pit design. This appears to be an ancient buried channel in the gravels filled with medium dense silty sand and sandy silt.

Once each building within the proposed development has been designed, Babbage should review the structural drawings, including foundation sizes, embedment, and imposed loads to ensure all foundation types are compliant with the recommendations provided.

If excavations are to be left open prior to concrete pouring, these should be covered to protect the natural formation from rainfall induced softening.

At the time of construction an appropriate level of monitoring by a geotechnical specialist shall be undertaken to confirm that the encountered founding soils are consistent with those encountered during the geotechnical investigation.

7.5 Further Geotechnical Testing

Whilst the ground conditions across the site have been found to be relatively consistent, the spatial distribution of the test pits does not rule out isolated areas where the ground conditions may vary from those identified. It is recommended that once the site layout and development requirements have been established, the findings of this report be re-assessed for building specific relevance and if necessary further geotechnical investigations undertaken. This may also be required for Building Consent purposes.

As indicated above further development specific percolation testing will be required.

Report Limitations

This type of report will always be produced within certain limits and attention is therefore drawn to the Notes on Limitations included as Appendix A.

We trust that the above information is sufficient for your present purposes. Should you have any queries please do not hesitate to contact the writers.

References

[1] New Zealand Geotechnical Database (NZGD), a web-based service owned by the Earthquake Commission on behalf of the Crown. http://www.nzgd.org.nz/

[2] GNS Science. (2016). New Zealand Active Faults database 1:250,000 scale. GNS Science. https://data.gns.cri.nz/af

[3] GNS Science. (2017) 1:250,000 Scale Geological Map of New Zealand (QMAP) – available via NZGD Map Layer CGD5120 (revised 24 Oct 2017)

[4] Canterbury Maps, Historical Aerial Imagery, https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery

[5] Canterbury Maps. Historical Aerial Imagery, 1856 black maps open web data

[6] New Zealand Standard (NZS) 1170.5:2004. Structural design actions - Part 5: Earthquake actions - New Zealand. Standards New Zealand. 2004.

Appendix A

Notes on Limitations

Applicability and Limitations

Restrictions of Intended Purpose

Babbage Consultants Limited (Babbage) has prepared this report solely for the benefit of the Client with respect to the Client's brief. The reliance by other parties on the information or opinions contained in this report shall, without our prior review and agreement in writing, be at such party's sole risk. Babbage accepts no responsibility or liability for the consequences of this report being used for any purpose or project other than that for which it was commissioned, or by any party with whom an agreement has not been executed.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions. Where opinions or judgements are to be relied on they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts and should not be scaled. They are provided for the purposes of this report only and may not be used for construction purposes or any other purpose for which they are not intended. Sources for map and plan compositions may include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Babbage Consultants Limited.

Reliability of Investigation

Where Babbage have undertaken site specific geotechnical investigations, the recommendations and opinions in this report are based on the data derived from the exploratory holes or tests undertaken specifically for those investigations as described herein.

The nature and continuity of subsoil conditions away from such exploratory holes or tests are inferred and it must be appreciated that actual conditions could vary considerably from those assumed and which have not therefore been taken in to account in this report.

The comments made regarding groundwater conditions are based on observations made at the time the field work was carried out. It should be noted that groundwater levels will vary owing to seasonal, tidal, seismic and weather-related effects.

Where planned and undertaken by Babbage, the scope of the investigation was selected on the basis of specific requirements of the Client and may be inappropriate to another form of development, scheme or other requirement.

During excavation and construction, the site should be examined by a Geotechnical Engineer or Engineering Geologist competent to judge whether the exposed subsoils are compatible with the

inferred conditions on which the report has been based. It is possible that the nature of the exposed subsoils may require further investigation and the modification of the design based upon this report.

If during construction or excavation subsoil conditions are found to vary from those described in this report it is essential that Babbage are contacted as any such variations may affect the design parameters and recommendations provided.

Reliability of Third-Party Data and Information

Where factual information has been provided to Babbage by the Client including reports, documents, drawings, photographs, and/or geotechnical investigations undertaken by third parties, and on the basis of which Babbage has been requested to provide recommendations and opinions, Babbage does not accept any liability whatsoever for the consequences of any errors or omissions in the information supplied, and has accepted such information in good faith as being reasonably representative of the conditions at the site.

As a user of Data extracted from the New Zealand Geotechnical Database (NZGD) Babbage (the User) is required to advise the Client of the following:

> *The User provides or uses Data from the NZGD and the Data was uploaded into that database without charge and strictly on the basis that any use is at the User's sole risk; no warranty or representation whatsoever (including as to its accuracy, adequacy, completeness, or fitness for any purpose) is provided in connection with the Data; and neither the Data Provider, the Owner or any other Person providing Data to the NZGD accepts any liability (including in negligence) in relation to it; and where any Data includes any other disclaimer or requirement relating to its use, the User will not use that Data unless it accepts or agrees to that disclaimer or requirement.*

Babbage does not accept any liability whatsoever for the Data extracted from the NZGD, and the opinions and recommendations provided by Babbage as a result of the use of this Data are given in good faith and are accepted by the Client on this basis.

Appendix B

Site Location Plan





Legend

Site Boundary

0 50 m 100 m

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Produced by **Datanest.earth**

Title: Site Location Plan		
Client: Puna Property Holdings		Size: A4
Project: 300 Springs Road	Drawn: JEG	Figure: B
Date: 02-09-2024	Checked: GD	
Proj No: 67592#CHGE	Scale: 1:5000	Version: Final

Appendix C

Geotechnical Investigation Plan



Legend

- Soakage Test Location
- Test Pit Locations
- Site Boundary

0 50 m 100 m

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Produced by **Datanest.earth**

Title: Geotechnical Investigation Plan		
Client: Puna Property Holdings		Size: A4
Project: 300 Springs Road	Drawn: JEG	Appendix: C
Date: 03-09-2024	Checked: GD	
Proj No: 67592#CHGE	Scale: 1:3000	Version: Final

Appendix D

Investigation Records

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP01

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	6, 8, 8			Groundwater Not Encountered
SAND wtih some silt; grey brown, mottled orange. Dense; dry; sand, fine to medium.		0.5	10, 8, 8, 11, 6, 7, 11, 9, 9			
Sandy GRAVEL with some cobbles; grey. Very dense to dense; moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0 / 1.5	12, 25 >>			
EOH: 2.3m		2.0 / 2.5 / 3.0				

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.3m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

Produced with Core-GS by Geroc

Created: 11/09/2024 8:11:51 AM

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP02

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]		0	1, 2, 2			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	3, 2, 3, 5, 5			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	7, 14, 25 >>			
EOH: 1.8m		1.5				
		2.0				
		2.5				
		3.0				

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	1.8m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP03

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 2, 2			Groundwater Not Encountered
SILT; brown, mottled orange. Moist; low plasticity.		0.5	3, 3, 3, 3, 3, 4, 7			
1.0m: becomes light brown		1.0	10, 12, 12, 15			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.5	25 >>			
EOH: 2.6m		2.0				
		2.5				
		3.0				

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.6m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP04

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 3, 3, 3			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	4, 4, 4, 5			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	10, 25 >>			
EOH: 2.2m		1.5				
		2.0				
		2.5				
		3.0				

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.2m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

Created: 11/09/2024 8:11:55 AM

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP05

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 2, 2			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	3, 2, 3, 5, 5, 3, 4			
SAND with some silt; grey, mottled orange. Medium dense; moist; sand, fine to coarse.		1.0	5, 5, 6, 5			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.5	10, 10, 12, 25 >>			
EOH: 2.5m		2.0, 2.5, 3.0				

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.5m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP06

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	2, 2, 5			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	9, 13, 15			
Silty SAND; grey brown, mottled orange. Medium dense; moist; sand, fine to medium.			18, 18, 25 >>			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0				
		1.5				
EOH: 2m		2.0				
		2.5				
		3.0				

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP07

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]		0	1, 1, 2			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	3, 3, 6			
Silty SAND; grey brown, mottled orange. Medium dense; moist; sand, fine to medium.			5, 4, 4			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	7, 10, 25 >>			
EOH: 2m		1.5, 2.0, 2.5, 3.0				

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP08

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]		0	1, 1			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	3, 3, 4, 3, 3, 5, 4, 4			
SAND with some silt; grey brown, mottled orange. Medium dense; dry; sand, fine to medium.		1.0	7, 5, 6, 8, 7			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.5	25 >>			
EOH: 2.2m		2.0, 2.5, 3.0				

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Scala Penetrometer: 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.2m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP09

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 3, 3			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	5, 5, 4, 3			
Silty SAND; grey brown, mottled orange. Medium dense; moist; sand, fine to medium.			25 >>			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0				
		1.5				
		2.0				
EOH: 2.1m		2.5				
		3.0				

Scala Penetrometer: NZS4402:1986 Test 6.5.2 (Blows per 100mm); 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.1m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP10

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

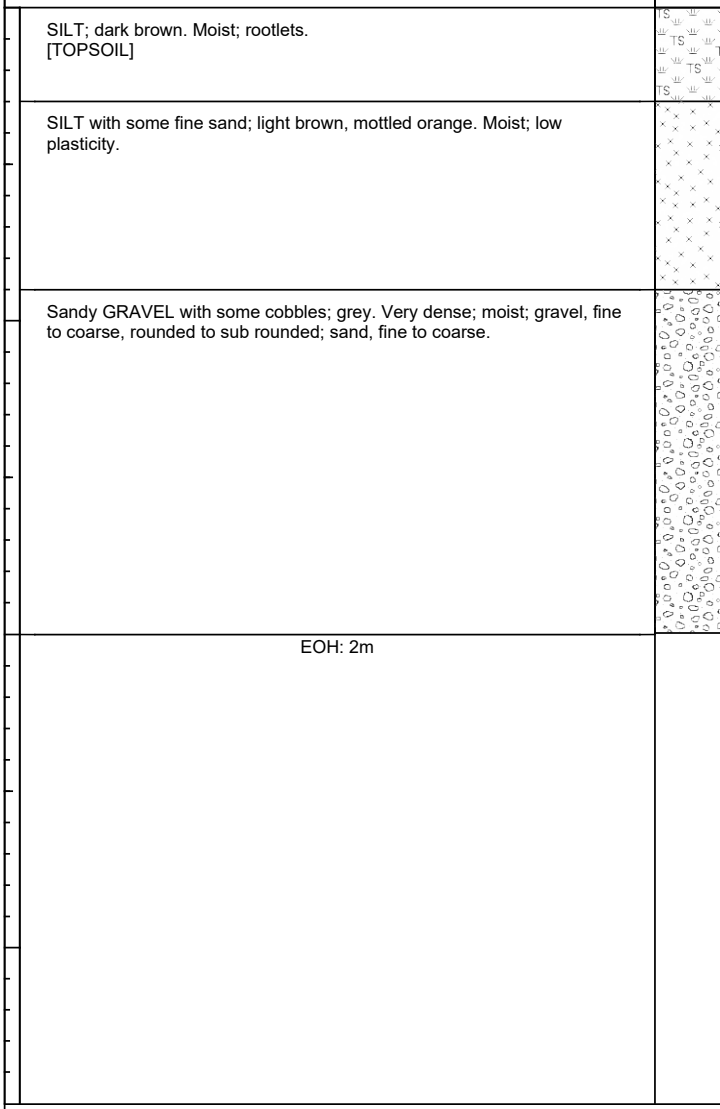
Legend | **Depth (m)** | **Scala Penetrometer** (NZS4402:1986 Test 6.5.2, Blows per 100mm) | **Samples** | **Installation** | **Water**

SILT; dark brown. Moist; rootlets.
[TOPSOIL]

SILT with some fine sand; light brown, mottled orange. Moist; low plasticity.

Sandy GRAVEL with some cobbles; grey. Very dense; moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.

EOH: 2m



Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP11

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 1			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	3, 3, 3, 2, 2, 3			
Sandy GRAVEL with some cobbles; grey. Very dense; moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	16, 25 >>			
SAND with some silt; grey. Dry to moist; sand, fine to coarse.		1.5				
Sandy GRAVEL with some cobbles; grey. Moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		2.0				
EOH: 2.1m		2.5				
		3.0				

Scala Penetrometer: 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.1m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP12

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	2			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	4, 3, 4, 3			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	25 >>			
EOH: 1.9m		1.5, 2.0, 2.5, 3.0				

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Scala Penetrometer: 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	1.9m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP13

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

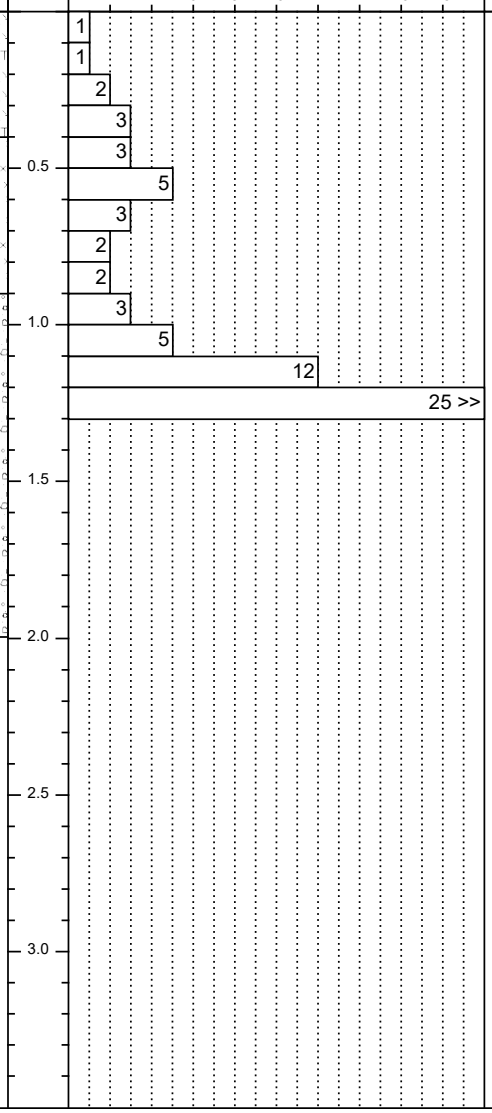
Legend | Depth (m) | Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm) | Samples | Installation | Water

SILT; dark brown. Moist; rootlets.
[TOPSOIL]

SILT; light brown, mottled orange. Moist; low plasticity.

Sandy GRAVEL with some cobbles; grey. Very dense; dry; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.

EOH: 2m



Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP14

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	3, 3, 5			
Sandy SILT; light brown, mottled orange. Moist; low plasticity; sand, fine.			4, 6, 8, 7			
SILT; light brown, mottled orange. Dry; low plasticity; some rootlets.		1.0	14, 8, 9, 7			
Sandy cobbley GRAVEL; grey. Very dense; moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.5	25 >>			
EOH: 2.5m		2.0, 2.5, 3.0				

Scala Penetrometer: NZS4402:1986 Test 6.5.2 (Blows per 100mm); 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.5m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP15

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 2, 1			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	4, 5			
Sandy GRAVEL with some cobbles; grey. Very dense; moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	19, 25 >>			
EOH: 1.7m		1.5				
		2.0				
		2.5				
		3.0				

Scala Penetrometer: NZS4402:1986 Test 6.5.2 (Blows per 100mm); 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	1.7m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP16

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Legend | **Depth (m)** | **Scala Penetrometer** (NZS4402:1986 Test 6.5.2, (Blows per 100mm)) | **Samples** | **Installation** | **Water**

Depth (m)	Description	Scala Penetrometer (Blows per 100mm)
0.0	SILT; dark brown. Moist; rootlets. [TOPSOIL]	1, 2, 2
0.3	SILT; light brown, mottled orange. Moist; low plasticity.	5, 5, 3, 4
0.8	Sandy GRAVEL with some cobbles; grey. Very dense; moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.	16, 25 >>
1.7	EOH: 1.7m	

Groundwater Not Encountered

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	1.7m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP17

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 1			Groundwater Not Encountered
Sandy SILT; light brown, mottled orange. Moist; low plasticity.		0.5	2, 2, 3, 3, 4			
Sandy GRAVEL with some cobbles; grey. Very dense to dense; moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	25 >>			
EOH: 1.7m		1.5				
		2.0				
		2.5				
		3.0				

Scala Penetrometer: NZS4402:1986 Test 6.5.2 (Blows per 100mm); 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	1.7m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP18

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]		0	2			
SAND with some silt; light brown. Medium dense; moist; sand, fine to medium.		0.5	4, 4, 3, 3, 4, 3, 3			
Sandy GRAVEL; greyish brown. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	25 >>			Groundwater Not Encountered
SAND wtih some silt; grey. Moist; sand, fine to coarse.		1.5				
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		2.0				
		2.5				
EOH: 2.7m		3.0				

Scala Penetrometer: NZS4402:1986 Test 6.5.2 (Blows per 100mm); 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.7m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP19

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Legend | Depth (m) | Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm) | Samples | Installation | Water

Depth (m)	Description	Scala Penetrometer (Blows per 100mm)
0.0	SILT; dark brown. Moist; rootlets. [TOPSOIL]	1, 1, 3, 3
0.5	SILT; light brown, mottled orange. Moist; low plasticity.	6, 8, 8, 7, 6
1.0	Sandy GRAVEL with some cobbles; grey. Dense to very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.	12, 11, 12, 14, 12
1.5		25 >>
	EOH: 1.9m	
2.0		
2.5		
3.0		

Groundwater Not Encountered

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	1.9m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP20

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 2, 3, 3			Groundwater Not Encountered
SILT with some fine sand; light brown, mottled orange. Moist; low plasticity.		0.5	5, 3, 3, 2, 6			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	25 >>			
EOH: 2m		1.5, 2.0, 2.5, 3.0				

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Scala Penetrometer: 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP21

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 2, 3, 2			Groundwater Not Encountered
SILT; light brown, mottled orange. Moist; low plasticity.		0.5	3, 4, 3, 4			
Silty SAND; grey brown, mottled orange. Medium dense; moist; sand, fine to medium.			5, 5			
SILT; light brown, mottled orange. Moist; low plasticity.		1.0	6, 14			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.5	25 >>			
EOH: 2.4m		2.0, 2.5, 3.0				

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2.4m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP22

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Legend | Depth (m) | Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm) | Samples | Installation | Water

Depth (m)	Description	Scala Penetrometer (Blows per 100mm)
0.0	SILT; dark brown. Moist; rootlets. [TOPSOIL]	1, 1
0.5	Silty SAND; grey brown, mottled orange. Medium dense; moist; sand, fine to medium.	2, 3, 3, 2, 2, 3, 2, 2, 3, 4, 4, 4, 3, 6, 5, 3, 4
2.5	Sandy SILT; grey brown. Moist; low plasticity.	
2.5	Silty SAND; grey brown, mottled orange. Moist; sand, fine to medium.	
3.1	EOH: 3.1m	

Groundwater Not Encountered

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	3.1m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE

Test Label: TP23

Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]		0	1, 1			
Sandy SILT; light brown, mottled orange. Moist; low plasticity; sand, fine.		0.5	2, 2, 3, 4, 2, 3, 2, 5			
Sandy GRAVEL with some cobbles; grey. Very dense; dry to moist; gravel, fine to coarse, rounded to sub rounded; sand, fine to coarse.		1.0	25 >>			Groundwater Not Encountered
EOH: 2m		1.5, 2.0, 2.5, 3.0				

Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)

Scala Penetrometer: 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	2m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

Produced with Core-GS by Geroc

Created: 11/09/2024 8:12:16 AM

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE
Test Label: TP24
Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 2, 1			Groundwater Not Encountered
Silty SAND; grey brown, mottled orange. Medium dense; moist; sand, fine to medium.		0.5	3, 3, 2, 3, 3, 4, 3			
		1.0	4, 6, 5, 5, 5			
		1.5	6, 5, 5, 5			
		2.0				
		2.5				
EOH: 3m		3.0				

Scala Penetrometer: NZS4402:1986 Test 6.5.2 (Blows per 100mm); scale 2 4 6 8 10 12 14 16 18

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	3m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

Created: 11/09/2024 8:12:17 AM

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TEST PIT INVESTIGATION LOG

Job Number: 67592#CHGE
Test Label: TP25
Sheet: 1 of 1

Client:	Project:	Location:	Date:
Puna Property Holdings	300 Springs Road, Halswell	300 Springs Road, Halswell, Christcurch	28/08/2024

Geological Field Description	Legend	Depth (m)	Scala Penetrometer (NZS4402:1986 Test 6.5.2, Blows per 100mm)	Samples	Installation	Water
SILT; dark brown. Moist; rootlets. [TOPSOIL]	TS	0	1, 1, 2, 2			Groundwater Not Encountered
Sandy SILT; grey, mottled orange. Moist; non plastic.		0.5	3, 4, 3, 4, 4, 4, 4			
		1.0	7, 6, 5, 5, 5, 5, 6, 7			
		1.5				
		2.0				
		2.5				
EOH: 3m		3.0				

Comments:





Contractor:		Logged By:	JEG	Hole Depth:	3m
Plant Used:	5T Excavator	Checked By:	GD	Termination:	Target Depth

Produced with Core-GS by Geroc

Created: 11/09/2024 8:12:18 AM

EXPLANATION OF TERMS AND SYMBOLS

These pages present an explanation of the terms and symbols used on the log sheets entitled “Summary of Soil Profile and Testing”. The materials, boundaries and conditions have been interpreted at the test hole locations only and could differ elsewhere on the site.

1. DEPTH / ELEVATION

This column refers to the depth below the ground surface existing at the time of drilling. The corresponding elevations are shown with respect to the datum noted where survey information is available.

2. SOIL AND ROCK SYMBOL

This column contains the standard soil and rock symbols used by Babbage for the materials encountered in the boreholes as shown below:

 Fill	 Clay	 Boulders
 Asphalt	 Silt	 Sandstone
 Concrete	 Sand	 Siltstone
 Topsoil	 Gravel	 Volcanic Rock
 Peat or Organic Soil	 Cobbles	 Uncertain Material

3. SOIL AND ROCK DESCRIPTION

The terms used to describe the soils and rocks are generally in accordance with the NZ Geotechnical Society’s “***Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes***” December 2005.

*The **soils** are generally described in the following order:*

Major soil type, minor soil type/s, consistency (for cohesive soils) or density (for cohesionless soils), plasticity, structure and/or particle shapes, colour, moisture condition, minor inclusions, other significant aspects (e.g. geological description).

*Where rock is encountered, the **rock material** and the **rock mass** are described in the following order:*

Major rock type, texture and fabric, strength, weathering, colour, discontinuity type, discontinuity spacing, discontinuity orientation, discontinuity opening, discontinuity roughness, geological description (if this can be determined).

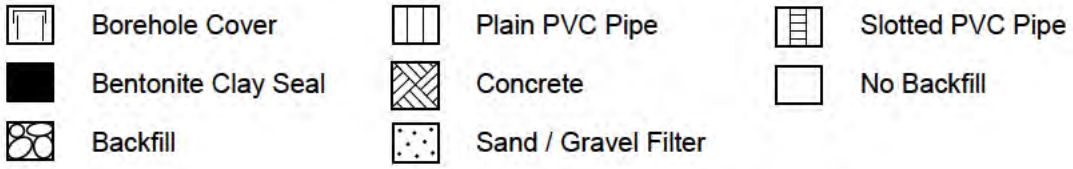
Where no field or laboratory tests are carried out, the soils and rock descriptions are based on handling and visual assessment of the recovered samples. **Any design based on such descriptions should allow for the generic nature of the descriptions.**

4. GEOLOGIC UNIT

This column divides the soil and/or rock encountered in the borehole into units that have been formally described and published by geologists (determined from geological maps), or informal units describing what general categories the materials belong to eg. fill, weathered rock, alluvium, etc.

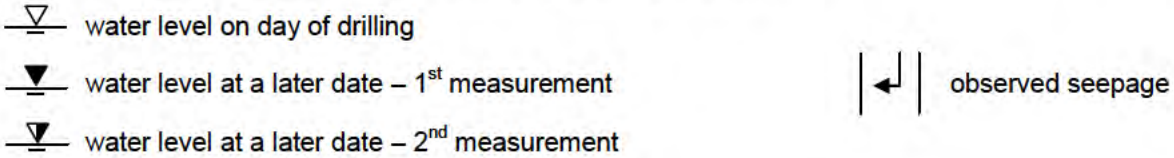
5. PIEZOMETER

This column graphically displays what happens to the hole on completion of drilling – ie. whether the hole is backfilled, left open with a plug, or if a piezometer/standpipe is installed.



6. GROUNDWATER

The groundwater level, or the depth at which free water was observed in the borehole, or any seepage observed in the borehole, are denoted by the symbols given below.



The level is the water level in an open hole unless otherwise indicated.

N in the column indicates the water level could not be recorded due to drilling water/mud, rain or hole caving.
NR in this column indicates that no record of the groundwater level was taken.
D in this column indicates that the hole was dry.
F in this column indicates when free water in the hole was first noticed.

7. SOIL SAMPLES

Condition

This column indicates the depth, length and condition of each sample taken. The following symbols are used to represent the condition of the samples.



Type *(and sample number)*

The type of sample and its sequential number is indicated in this column as follows:

A	auger sample	**P**	piston tube sample
B	block or bulk sample	**S**	standard penetration test (SPT) sample
D	disturbed sample (eg. open barrel core)	**T**	thin-walled tube sample
J	jar sample	**W**	wash or air return sample
GW	ground water sample	**O**	other (see text)

Disturbed soils samples are transported and stored in plastic bags. Machine borehole disturbed samples are transported and stored in core boxes. Tube samples are sealed with plastic bags in the field and with wax on return to the laboratory.

Method

EXPLANATION OF TERMS AND SYMBOLS

This refers to the particular drilling/sampling technique:

HA	hand auger	**TU**	push-tube
HD	hand dug	**SSA**	solid stem machine auger
HSA	hollow stem machine auger	**SPT**	standard penetration test
EX	hydraulic excavator	**SP**	scala penetrometer
OB	open barrel	**TT**	triple tube
PP	pneumatic percussion	**WD**	wash drill
VAC	vacuumed	**SD**	sonic vibration drilling

Recovery

This column gives the sample recovery as a percentage of the sampled length for open barrel and triple tube core runs, and also split spoon SPT tests. If nothing is shown, the sample recovery was not measured.

8. TEST RESULTS

Penetration Resistance

The Penetration Resistance is the number of blows required to drive either a 50mm (outside diameter) open end "spilt spoon" or "Raymond" sampler the final 300mm of a 450mm penetration using a 64kg weight falling 760mm. The number of blows required to drive the sampler the final 300mm is referred to as the **"N" value**. The test is referred to as the **Standard Penetration Test or SPT**. The number of blows for each 150mm penetration of the test, or part-penetration when driving is terminated due to hard ground, are given in the "Other Tests" column, e.g. 15, 36, 46 for 55mm would indicate 15 blows for the first 150mm, 36 blows for the second 150mm and 46 blows for a further 55mm penetration and a N value of greater than 50 would be reported.

In some cases a solid steel 60º cone is used for this test (a **solid nose Standard Penetration Test**). For these cases the penetration resistance is reported as an **"S" value** is reported in this column.

Water Content and Atterberg Limits

The moisture or water content, plastic limit and liquid limit of the recovered soil sample, as determined in the laboratory in accordance with the test procedures set out in NZS4402, is plotted against depth. The abbreviations and graphic symbols are defined as follows:

●	w	natural moisture content
×	w_P	plastic limit
+	w_L	liquid limit

Other Tests

The following abbreviations are used to indicate the type of test undertaken:

COM	Compaction Test	pp	Pocket penetrometer strength	
*CON	Consolidation test	*Q	Consolidated undrained triaxial test	
G	Specific gravity or solid density of particles	qu	Unconfined compressive strength	
k	Permeability coefficient	*SB	Shear box test	
LS	Linear shrinkage	SP	Scala penetrometer	
OC	Organic content	*ST	Swelling test	
*PSD	Particle size distribution	SV	Vane shear strength:	(U) – undisturbed (R) – remoulded

*These tests are usually summarised separately.

9. REMARKS

Any additional observations or relevant information such as weather conditions, piezometer design, daily drilling progress, survey co-ordinates of the borehole, problems encountered during drilling, etc.

Appendix E

Soakage Testing Output

Project: 300 Springs Road **Date:** 30/08/2024

Test Pit 3 **Test No** 1

Width 0.8
Depth 2
Length 2.2

Reading No	Minutes	Depth (m)
1	0	1.21
2	0.5	1.24
3	1	1.27
4	1.5	1.29
5	2	1.31
6	2.5	1.32
7	3	1.34
8	3.5	1.36
9	4	1.37
10	4.5	1.38
11	5	1.39
12	6	1.41
13	7	1.43
14	8	1.44
15	9	1.46
16	10	1.48
17	15	1.54
18	20	1.59
19	25	1.64
20	30	1.68
21	35	1.71
22	40	1.75
23	50	1.79
24	60	1.83

Volume Outflow= **0.546** **m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **4.64** **m^2**

Time of Outflow= **1560** **seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **7.5E-05** **m/s** **($m^3/s/m^2$)** **271.4** **(mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
1.365	m	25% depth	9	1.365	4	10	1.375	4.5
1.675	m	75% depth	20	1.675	30	21	1.705	35

Depth		Time	
1.365	m	240	seconds
1.675	m	1800	seconds

Project: 300 Springs Road **Date:** 30/08/2024

Test Pit 9 **Test No** 1

Width 0.8
Depth 2
Length 2.5

Reading No	Minutes	Depth (m)
1	0	0.20
2	0.5	0.24
3	1	0.27
4	1.5	0.30
5	2	0.31
6	2.5	0.34
7	3	0.36
8	3.5	0.38
9	4	0.40
10	4.5	0.41
11	5	0.43
12	6	0.45
13	7	0.48
14	8	0.50
15	9	0.52
16	10	0.54
17	15	0.65
18	20	0.72
19	25	0.77
20	30	0.83
21	35	0.87
22	40	0.91
23	50	0.96
24	60	1.01

Volume Outflow= **0.810** **m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **11.21** **m^2**

Time of Outflow= **1450** **seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **5.0E-05** **m/s** **($m^3/s/m^2$)** **179.5** **(mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
0.403	m	25% depth	9	0.395	4	10	0.41	4.5
0.808	m	75% depth	19	0.77	25	20	0.825	30

Depth		Time	
0.403	m	255	seconds
0.808	m	1705	seconds

Project: 318/320 Springs Road **Date:** 30/08/2024

Test Pit 19 **Test No** 1

Width 0.8
Depth 2
Length 2.5

Reading No	Minutes	Depth (m)
1	0	0.50
2	0.5	0.55
3	1	0.61
4	1.5	0.67
5	2	0.73
6	2.5	0.78
7	3	0.83
8	3.5	0.88
9	4	0.93
10	4.5	0.95
11	5	0.99
12	6	1.06
13	7	1.11
14	8	1.17
15	9	1.48
16	10	1.64
17	15	1.77
18	20	1.84

Volume Outflow= **1.340** **m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **7.48** **m^2**

Time of Outflow= **364** **seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **4.9E-04** **m/s** **($m^3/s/m^2$)** **1772.6** **(mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
0.835	m	25% depth	7	0.825	3	8	0.88	3.5
1.505	m	75% depth	15	1.48	9	16	1.64	10

Depth		Time	
0.835	m	185	seconds
1.505	m	549	seconds

Project: 318/320 Springs Road **Date:** 30/08/2024

Test Pit 24 **Test No** 1

Width 0.8
Depth 2
Length 2.3

Reading No	Minutes	Depth (m)
1	0	0.22
2	0.5	0.23
3	1	0.23
4	1.5	0.24
5	2	0.24
6	2.5	0.24
7	3	0.24
8	3.5	0.25
9	4	0.25
10	4.5	0.25
11	5	0.25
12	6	0.25
13	7	0.26
14	8	0.26
15	9	0.26
16	10	0.26
17	15	0.28
18	20	0.29
19	25	0.30
20	30	0.30
21	35	0.31
22	40	0.32
23	50	0.33
24	60	0.34

Volume Outflow= **0.112** **m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **12.50** **m^2**

Time of Outflow= **1958** **seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **4.6E-06** **m/s** **($m^3/s/m^2$)** **16.5** **(mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
0.251	m	25% depth	10	0.249	4.5	11	0.251	5
0.312	m	75% depth	21	0.308	35	22	0.315	40

Depth		Time	
0.251	m	293	seconds
0.312	m	2250	seconds

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Tuatara Structures
10A Abros Place
Christchurch 8053

Job No: 67592#CHGE

9 March 2026

For the attention of Ryley Drake

Dear Ryley,

374-376 SPRINGS ROAD, HORNBY

RE: Soakage Test Results

An onsite investigation has been undertaken to determine the soakage rate of the near surface soils at nine locations across the site. The locations of the soakage tests were chosen by the project Civil engineer for the purpose of estimating soil permeability variations across the site so that the design of permanent soakage pits can be optimised.

Investigation Observations

The onsite investigation used a combination of test pits and machine auger holes to undertake the soakage tests. The five southern test pits (TP0C, TP0D, TP0D1, TP0E, and TP0F) encountered a surficial layer of interbedded silts and sandy silts with a minimum thickness of approximately 3 m, underlain by cobbly silt.

The northern test pits (TP0A, TP0B, TP0G, and TP0H) encountered the gravelly/cobbly layer at shallower depths. A surficial layer of interbedded silts and sandy silts was also present; however, it was thinner than that observed in the southern area, with a thickness generally less than 1.6 m.

Two of the test pits (TP0E and TP0F) encountered perched water above an approximately 0.5 m thick clay layer, which is underlain by cobbly silts. Regional groundwater is anticipated to occur at depths greater than 6 m below ground level (bgl).

Observations during excavation indicated that the first metres within the gravelly/cobbly silt layer generally exhibited limited drainage, with the infiltration behaviour largely controlled by the silt content. With increasing depth the silt content was observed to reduce, resulting in improved infiltration rates.

At several locations, the test depth had to be increased by at least one metre due to little or no drawdown of the water level at the initial, shallow test depth. This generally resulted in an increased soakage rate.

Soakage Test Results

Where possible, the base of the percolation test was the depth to saturated soils, with the sidewalls influencing the tests being gravel fill. The exception to the above is TP01, with the testing undertaken above the water table at 1.2 m depth.

A summary of the soakage test results is presented in Table 1.

Table 1: Summary of soakage test results

Test Location	Final Depth (m)	Depth to saturated soils (m)	Infiltration Rate (k)	
			$m^3/s/m^2$	mm/hour
TP0A	4.10	-	Rapid Drainage	Rapid Drainage
TP0B	3.45	-	Rapid Drainage	Rapid Drainage
TP0C	5.70	-	9.9×10^{-4}	3548
TP0D-1	4.05	-	1.8×10^{-5}	66
TP0D-2	5.05	-	7.5×10^{-5}	269
TP0D1	4.50	-	5.5×10^{-5}	197
TP0E	5.10	-	3.0×10^{-4}	1090
TP0F	4.90	3.8*	1.2×10^{-5}	41
TP0G	3.30	3.7*	Rapid Drainage	Rapid Drainage
TP0H	3.75	-	3.7×10^{-4}	1331
				*perched water

Report Limitations

This type of report will always be produced within certain limits and attention is drawn to the appended Notes on Limitations.

Prepared by	
	Sofia Gorosito BSc(Hons)
	Geotechnical Engineer
Reviewer(s)	
	Scott McHardy BEng(Hons), CPEng, CMEngNZ, IntPE(NZ)
	Senior Geotechnical Engineer South Island Geotechnical Team Leader

Appended

Notes on Limitations

Test Pit Log

Soakage Test Results

APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of Tuatara Structures as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk. Babbage accepts no responsibility or liability for the consequences of this report being used for any purpose or project other than that for which it was commissioned, or by any party with whom an agreement has not been executed.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts and should not be scaled. They are provided for the purposes of this report only and may not be used for construction purposes or any other purpose for which they are not intended. Sources for map and plan compositions may include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Babbage Consultants Limited.

Reliability of Investigation

Where Babbage have undertaken site specific geotechnical investigations, the recommendations and opinions in this report are based on the data derived from the exploratory holes or tests undertaken specifically for those investigations as described herein.

The nature and continuity of subsoil conditions away from such exploratory holes or tests are inferred and it must be appreciated that actual conditions could vary considerably from those assumed and which have not therefore been taken into account in this report.

The comments made regarding groundwater conditions are based on observations made at the time the field work was carried out. It should be noted that groundwater levels will vary owing to seasonal, tidal, seismic and weather-related effects.

Where planned and undertaken by Babbage, the scope of the investigation was selected on the basis of specific requirements of the Client and may be inappropriate to another form of development, scheme or other requirement.

During excavation and construction, the site should be examined by a Geotechnical Engineer or Engineering Geologist competent to judge whether the exposed subsoils are compatible with the inferred conditions on which the report has been based. It is possible that the nature of the exposed subsoils may require further investigation and the modification of the design based upon this report.

If during construction or excavation subsoil conditions are found to vary from those described in this report it is essential that Babbage are contacted as any such variations may affect the design parameters and recommendations provided.

Reliability of Third-Party Data and Information

Where factual information has been provided to Babbage by the Client including reports, documents, drawings, photographs, and/or geotechnical investigations undertaken by third parties, and on the basis of which Babbage has been requested to provide recommendations and opinions, Babbage does not accept any liability whatsoever for the consequences of any errors or omissions in the information supplied, and has accepted such information in good faith as being reasonably representative of the conditions at the site.

As a user of Data extracted from the New Zealand Geotechnical Database (NZGD) Babbage (the User) is required to advise the Client of the following:

> *The User provides or uses Data from the NZGD and the Data was uploaded into that database without charge and strictly on the basis that any use is at the User's sole risk; no warranty or representation whatsoever (including as to its accuracy, adequacy, completeness, or fitness for any purpose) is provided in connection with the Data; and neither the Data Provider, the Owner or any other Person providing Data to the NZGD accepts any liability (including in negligence) in relation to it; and where any Data includes any other disclaimer or requirement relating to its use, the User will not use that Data unless it accepts or agrees to that disclaimer or requirement.*

Babbage does not accept any liability whatsoever for the Data extracted from the NZGD, and the opinions and recommendations provided by Babbage as a result of the use of this Data are given in good faith and are accepted by the Client on this basis.



Legend

- New proposed soakage test location
- Site Boundary

0 50 m 100 m

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Produced by **Datanest.earth**

Title: Soakage testing		
Client: Tuatara Structures		Size: A4
Project: 300 Springs Road	Drawn:	Figure No.: 1
Date: 11-02-2026	Checked:	
Proj No: 67592#CHGE - 2	Scale: 1:3000	Version: draft

Testpit No: TP0A

UTM	: 59G	**Excavator**	:	**Job Number**	: 67592#CHGE - 2
Latitude	: -43.56539	**Excavator Supplier**	:	**Client**	: Tuatara Structures
Longitude	: 172.52514	**Logged By**	: SG	**Project**	: 300 Springs Road
Elevation	: Not Surveyed	**Reviewed By**	: SM	**Location**	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 4.1 m	**Date**	: 25/02/2026	**Loc Comment**	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.4m: SILT; dark brown slightly moist; medium plasticity. [TOPSOIL]		0.1 – 0.4				
0.4m - 1.4m: SILT; light brown stiff; slightly moist; medium plasticity.		0.4 – 1.4				
1.4m - 2.4m: Cobbly SILT with some sand; grey firm; slightly moist; low plasticity; cobbles.		1.4 – 2.4				
2.4m - 3.4m: Gravelly SILT with some sand; grey slightly moist; low plasticity; gravel.		2.4 – 3.4				
3.4m - 4.1m: Gravelly fine to coarse SAND with some silt; grey medium dense; slightly moist; rounded; gravel, medium to coarse.		3.4 – 4.0				
TP0A Terminate at 4.1 m (was reached at 4.1 m. A layer with higher permeability was reached.)						



Depth: 0 m - 4.1 m

Testpit No: TP0B

UTM	: 59G	**Excavator**	:	**Job Number**	: 67592#CHGE - 2
Latitude	: -43.56577	**Excavator Supplier**	:	**Client**	: Tuatara Structures
Longitude	: 172.52283	**Logged By**	: SG	**Project**	: 300 Springs Road
Elevation	: Not Surveyed	**Reviewed By**	: SM	**Location**	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 3.45 m	**Date**	: 24/02/2026	**Loc Comment**	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.2m: SILT; dark brown firm; moist; medium plasticity. [TOPSOIL]		0.1				
0.2m - 1.6m: SILT with some sand, sand fine; light brown stiff; dry; medium plasticity.		0.2 – 1.6		-		
1.6m - 3.45m: Gravelly fine to coarse SAND with some silt; grey medium dense; moist; rounded; gravel, medium to coarse.		1.6 – 3.4				
TP0B Terminate at 3.45 m (Target depth was reached at 3.45 m. A layer with higher permeability was reached.)						



Depth: 0 m - 3.45 m

Borehole No: TP0C

UTM	: 59G	**Driller Rig**	: Mechanical auger	**Job Number**	: 67592#CHGE - 2
Latitude	: -43.56615	**Driller Supplier**	:	**Client**	: Tuatara Structures
Longitude	: 172.51986	**Logged By**	: SG	**Project**	: 300 Springs Road
Elevation	: Not Surveyed	**Reviewed By**	: SM	**Location**	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 5.7 m	**Date**	: 24/02/2026	**Loc Comment**	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.2m: SILT; dark brown soft; moist; medium plasticity. [TOPSOIL]		0.1 – 0.2				
0.3m - 4.0m: Sandy SILT interbedded silts and sandy silts; light brown firm; moist; medium plasticity; sand, fine.		0.3 – 3.9		-		
4.0m - 4.5m: Silty CLAY; blueish grey, firm; saturated (perched water); high plasticity.		4.0 – 4.4				
4.5m - 4.8m: Sandy SILT with some gravels, rounded; grey firm; moist; medium plasticity; sand, fine.		4.5 – 4.8				
4.8m - 5.7m: Cobbly fine to coarse SAND with some silt; grey medium dense; moist; rounded; cobbles.		4.8 – 5.6				
TP0C Terminate at 5.7 m (was reached at 5.7 m. A layer with higher permeability was reached.)						



Depth: 0 m - 5.7 m

Testpit No: TP0D

UTM	: 59G	**Excavator**	:	**Job Number**	: 67592#CHGE - 2
Latitude	: -43.56786	**Excavator Supplier**	:	**Client**	: Tuatara Structures
Longitude	: 172.52004	**Logged By**	: SG	**Project**	: 300 Springs Road
Elevation	: Not Surveyed	**Reviewed By**	: SM	**Location**	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 5.2 m	**Date**	: 20/02/2026	**Loc Comment**	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.25m: SILT; dark brown moist; medium plasticity. [TOPSOIL]		0.1				
0.25m - 0.85m: SILT some sand, interbedded sandy silt and silt; light brown firm; moist; medium plasticity.		0.2 – 0.8		-		
0.85m - 1.0m: Sandy SILT; light brown firm; moist; medium plasticity; sand, fine.		0.9 – 1.0				
1.0m - 1.4m: Silty fine SAND; light brown medium dense; moist; rounded.		1.1 – 1.4				
1.4m - 3.6m: Sandy SILT; blueish brown with some reddish dots firm; moist; medium plasticity; sand, fine.		1.5 – 3.6				
3.6m - 5.05m: Cobbly SILT with some sand, sand increasing with depth; grey firm; moist; low plasticity; cobbles.		3.7 – 5.1				
TP0D Terminate at 5.2 m (Target depth was reached at 5.2 m. A layer with higher permeability was reached.)						



Depth: 0 m - 5.2 m

Borehole No: TP0D1

UTM	: 59G	**Driller Rig**	:	**Job Number**	: 67592#CHGE - 2
Latitude	: -43.56773	**Driller Supplier**	: Mechanical auger	**Client**	: Tuatara Structures
Longitude	: 172.51841	**Logged By**	: SG	**Project**	: 300 Springs Road
Elevation	: Not Surveyed	**Reviewed By**	: SM	**Location**	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 4.5 m	**Date**	: 24/02/2026	**Loc Comment**	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.25m: Organic SILT; dark brown soft; moist; low plasticity. [TOPSOIL]		0.1 0.2				
0.25m - 2.6m: SILT; light brown soft; moist; medium plasticity.		0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8		-		
2.6m - 2.8m: SILT trace of sand; blueish brown with some reddish spots soft; moist; low plasticity.						
2.8m - 3.4m: Silty fine SAND with some gravels. Gravels rounded, rivel gravels well graded; brownish grey medium dense; moist; rounded.		2.9 3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4.0 4.1 4.2				
4.2m -increasing sand (medium to coarse), trace of silt		4.3 4.4				
TP0D1 Terminate at 4.5 m (Target depth was reached at 4.5 m. A layer with higher permeability was reached.)						



Depth: 0 m - 4.5 m

Testpit No: TP0E

UTM	: 59G	**Excavator**	:	**Job Number**	: 67592#CHGE - 2
Latitude	: -43.56906	**Excavator Supplier**	:	**Client**	: Tuatara Structures
Longitude	: 172.52156	**Logged By**	: SG	**Project**	: 300 Springs Road
Elevation	: Not Surveyed	**Reviewed By**	: SM	**Location**	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 5.1 m	**Date**	: 20/02/2026	**Loc Comment**	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: SILT; dark brown soft to firm; moist; medium plasticity. [TOPSOIL]		0.1 0.2 0.3				
0.3m - 1m: SILT with trace of sand, sand fine; light brown soft; moist; medium plasticity.		0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9		-		
1m - 1.9m: SILT with some sand; light brown firm; moist; medium plasticity.						
1.9m - 3m: Clayey SILT; blueish brown with reddish spots firm; very moist; high plasticity.		2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7				
3m - 3.7m: Sandy SILT; light brown, with reddish dots firm; very moist; low plasticity; sand, fine.						
3.7m - 3.9m: CLAY; blueish grey, perched water firm; saturated; high plasticity.		3.8 3.9 4.0 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 5.0				
3.9m - 5.1m: Cobbly fine to coarse SAND with some silt; grey medium dense; moist; rounded; cobbles.						
TP0E Terminate at 5.1 m (Target depth was reached at 5.1 m. A layer with higher permeability was reached.)						



Depth: 0 m - 5.1 m

Borehole No: TP0F

UTM	: 59G	Driller Rig	: Mechanical auger	Job Number	: 67592#CHGE - 2
Latitude	: -43.56765	Driller Supplier	:	Client	: Tuatara Structures
Longitude	: 172.52253	Logged By	: SG	Project	: 300 Springs Road
Elevation	: Not Surveyed	Reviewed By	: SM	Location	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 4.9 m	Date	: 24/02/2026	Loc Comment	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.3m: SILT; soft to firm; moist; medium plasticity. [TOPSOIL]		0.1 0.2				
0.3m - 3.8m: Sandy SILT; light brown soft to firm; moist; medium plasticity; sand, fine.		0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7		-		
3.8m - 4.2m: Silty CLAY; bluish grey with reddish spots, perched water firm; saturated; high plasticity.		3.8 3.9 4.0 4.1				
4.2m - 4.9m: Cobbly SILT some sand, sand increasing with depth; grey firm; moist; low plasticity; cobbles.		4.2 4.3 4.4 4.5 4.6 4.7 4.8				
TP0F Terminate at 4.9 m (Target depth was reached at 4.9 m. A layer with higher permeability was reached.)						

Testpit No: TP0G

UTM	: 59G	**Excavator**	:	**Job Number**	: 67592#CHGE - 2
Latitude	: -43.56650	**Excavator Supplier**	:	**Client**	: Tuatara Structures
Longitude	: 172.52260	**Logged By**	: SG	**Project**	: 300 Springs Road
Elevation	: Not Surveyed	**Reviewed By**	: SM	**Location**	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 3.3 m	**Date**	: 24/02/2026	**Loc Comment**	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.35m: SILT; dark brown firm; moist; medium plasticity. [TOPSOIL]		0.1 0.2 0.3				
0.35m - 0.7m: Sandy SILT; light brown firm; moist; medium plasticity; sand, fine.		0.4 0.5 0.6 0.7				
0.7m - 0.9m: Gravelly SILT with some sand; greyish brown firm; moist; low plasticity; gravel, medium to coarse.		0.8 0.9				
0.9m - 3.3m: Sandy medium to coarse GRAVEL with some silt; grey medium dense; moist; rounded; sand, fine to coarse.		1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2				
TP0G Terminate at 3.3 m (Target depth was reached at 3.3 m. A layer with higher permeability was reached.)						



Depth: 0 m - 3.3 m

Testpit No: TP0H

UTM	: 59G	**Excavator**	:	**Job Number**	: 67592#CHGE - 2
Latitude	: -43.56613	**Excavator Supplier**	:	**Client**	: Tuatara Structures
Longitude	: 172.52420	**Logged By**	: SG	**Project**	: 300 Springs Road
Elevation	: Not Surveyed	**Reviewed By**	: SM	**Location**	: 300 Springs Road, Halswell, Christchurch, New Zealand
Total Depth	: 3.75 m	**Date**	: 25/02/2026	**Loc Comment**	:

Geological Field Description: Field Description of Soil and Rock: Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes (NZ Geotechnical Society, December 2005)	Legend	Depth (m)	Samples	Shear Vane: NZGS 2001 Guideline for Hand Held Shear Vane Test (Corrected)	Water	Comments
0m - 0.35m: SILT; dark brown soft to firm; dry; medium plasticity. [TOPSOIL]		0.1 – 0.3				
0.35m - 0.85m: SILT with some sand; light brown stiff; dry; medium plasticity.		0.4 – 0.8				
0.85m - 3.0m: Gravelly SILT with some sand, sand fine; gey firm; dry; low plasticity; gravel.		0.9 – 3.0				
3.0m - 3.75m: Silty fine to coarse GRAVEL with some sand; grey medium dense; dry; rounded.		3.0 – 3.7				
3.4m: poorly graded gravels, rounded, medium to coarse						
TP0H Terminate at 3.75 m (Target depth was reached at 3.75 m. A layer with higher permeability was reached.)						



Depth: 0 m - 3.75 m

Project: 300 Springs Road **Date:** 25/02/2026

Test Pit TP0A **Test No** 1

Width 0.70 m
Depth 4.10 m Cobbly Sand
Length 1.50 m

An initial trial test was undertaken at 3.8 m bgl, where a low infiltration rate was observed. The test pit was subsequently extended to 4.1 m bgl, at which depth a higher infiltration rate was encountered.
Water was pumped into the test pit using two water trucks operating simultaneously, with both pumps running. After approximately 3 minutes of pumping, the water level reached 0.65 m on the measuring rule. The test commenced immediately thereafter. The water fully dissipated within approximately 1 minute.

Reading No	Minutes	Depth (m)
1	0	3.45
2	0.17	3.525
3	0.33	3.59
4	0.50	3.62
5	0.67	3.705
6	0.83	3.85
7	1.00	4.1

Volume Outflow= **0.341 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **2.48 m^2**

Time of Outflow= **26 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **5.3E-03 m/s** **($m^3/s/m^2$)** **19052.4 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
3.613	m	25% depth	3	3.59	0.33333333	4	3.62	0.5
3.938	m	75% depth	6	3.85	0.83333333	7	4.1	1

Depth		Time	
3.613	m	28	seconds
3.938	m	54	seconds

Project: 300 Springs Road **Date:** 24/02/2026

Test Pit TP0B **Test No** 1

Width 0.70 m
Depth 3.45 m Cobbly Silt
Length 1.50 m

Water was pumped into the test pit using two water trucks operating simultaneously, with both pumps running. After 2minutes of pumping water, the level just reached the 0.5 m mark on the measuring rule. The test commenced immediately thereafter. The water fully dissipated within approximately one minute.

Reading No	Minutes	Depth (m)
1	0	2.92
2	0.2	2.98
3	0.3	3.05
4	0.5	3.11
5	0.7	3.19
6	0.8	3.25
7	1.0	3.32
8	1.2	3.45

Volume Outflow= **0.278 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **2.22 m^2**

Time of Outflow= **39 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **3.2E-03 m/s** **($m^3/s/m^2$)** **11523.7 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
3.053	m	25% depth	3	3.05	0.33333333	4	3.11	0.5
3.318	m	75% depth	6	3.25	0.83333333	7	3.32	1

Depth		Time	
3.053	m	20	seconds
3.318	m	60	seconds

Project: 300 Spring Road **Date:** 24/02/2026

Test Pit TP0C **Test No** 1

Width 0.40 m
Depth 5.52 m Cobbly Silty Sand
Length 0.40 m

The borehole was advanced using a mechanical auger, producing a 400 mm diameter hole. The auger length was 1.7 m, and two 2 m extension rods were used; the full auger assembly (auger and extension rods) was fully embedded in the ground during drilling. The measured depth was 5.5m+TS. The discrepancy between the drilled and measured depth is attributed to borehole wall collapse and soil sloughing upon withdrawal of the auger, together with unrecovered material inherent to the augering method. Approximately 0.2 m of remoulded ground is estimated to be present below the recorded base of the borehole.

Reading No	Minutes	Depth (m)
1	0	2.22
2	0.50	3.79
3	0.67	4.23
4	0.83	4.62
5	1.5	4.82
6	2	4.9
7	2.5	4.96
8	3	4.94
9	3.5	4.99
10	4	5.03
11	4.5	5.08
12	5	5.13
13	6	5.28
14	7	5.42
15	8	5.49
16	9	5.52

Volume Outflow= **0.207 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **4.27 m^2**

Time of Outflow= **49 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **9.9E-04 m/s** **($m^3/s/m^2$)** **3548.4 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
3.045 m	25% depth		1	2.22	0	2	3.79	0.5
4.695 m	75% depth		4	4.62	0.83333333	5	4.82	1.5

Depth	Time
3.045 m	16 seconds
4.695 m	65 seconds

Project: 300 Springs Road **Date:** 20/02/2026

Test Pit TP0D **Test No** 1 @ 4.05mbgl

Width 0.85 m
Depth 3.80 m Cobbly Silt
Length 2.70 m

Reading No	Minutes	Depth (m)
1	0	2.77
2	0.2	2.76
3	0.3	2.79
4	0.5	2.77
5	0.8	2.77
6	1	2.78
7	1.5	2.78
8	2	2.79
9	2.5	2.79
10	3	2.8
11	3.5	2.805
12	4	2.81
13	4.5	2.82
14	5	2.82
15	6	2.825
16	7	2.835
17	8	2.84
18	9	2.850
19	10	2.860
19	15	2.895
20	20	2.961
21	25	2.940
21	30	2.970
22	40	3.01
23	50	3.07
23	60	3.1
24	75	3.14
25	90	3.18
25	105	3.23
26	120	3.265
27	135	3.31
27	150	3.325
28	165	3.34
29	180	3.375

Volume Outflow= **0.706 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **7.46 m^2**

Time of Outflow= **5157 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **1.8E-05 m/s** **($m^3/s/m^2$)** **66.0 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
2.914	m	25% depth	20	2.895	15	21	2.961	20
3.221	m	75% depth	28	3.18	90	29	3.23	105

Depth		Time	
2.914	m	985	seconds
3.221	m	6143	seconds

Project: 300 Springs Road **Date:** 20/02/2026

Test Pit TP0D **Test No** 2 @5.05mbgl

Width 0.90 m
Depth 4.80 m Cobbly Silt
Length 1.90 m

TP was dug down up to 4.8m+TP
Water was pumped into the TP until it reached a height of 0.93 m and remained constant for 2 minutes without any rise in water level. The test then commenced.

Reading No	Minutes	Depth (m)
1	0	3.87
2	0.17	3.88
3	0.33	3.89
4	0.50	3.9
5	0.67	3.91
6	0.83	3.91
7	1	4.8
8	1.5	3.93
9	2	3.94
10	2.5	3.94
11	3	3.95
12	3.5	3.96
13	4	3.97
14	4.5	3.98
15	5	3.99
16	6	3.995
17	7	4
18	8	4.01
19	9	4.025
19	10	4.04
20	11	4.06
21	20	4.09
21	25	4.18
22	30	4.26
23	40	4.28
23	50	4.39
24	60	4.47
25	66	4.8

Volume Outflow= **0.795 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **4.31 m^2**

Time of Outflow= **2465 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **7.5E-05 m/s** **($m^3/s/m^2$)** **269.2 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
4.103	m	25% depth	22	4.09	20	23	4.18	25.00
4.568	m	75% depth	27	4.47	60	28	4.80	66.00

Depth		Time	
4.103	m	1242	seconds
4.568	m	3706	seconds

Project: 300 Spring Road **Date:** 24/02/2026

Test Pit TP0D1 **Test No** 1

Width 0.40 m
Depth 4.30 m Cobbly Silty Sand
Length 0.40 m

The borehole was advanced using a mechanical auger, producing a 400 mm diameter hole. The auger length was 1.7 m, and two 2 m extension rods were used; the full auger assembly (auger and extension rods) was fully embedded in the ground during drilling. The measured depth was 4.3+TS m. The discrepancy between the drilled and measured depth is attributed to borehole wall collapse and soil sloughing upon withdrawal of the auger, together with unrecovered material inherent to the augering method. Approximately 1.4 m of remoulded ground is estimated to be present below the recorded base of the borehole.

Reading No	Minutes	Depth (m)
1	0	0.100
2	0.17	0.220
3	0.33	0.310
4	0.67	0.440
5	1	0.540
6	1.5	0.810
7	2	0.970
8	2.5	1.110
9	3	1.260
10	3.5	1.410
11	4	1.540
12	4.5	1.670
13	5	1.770
14	6	1.950
15	7	2.145
16	8	2.290
17	9	2.420
18	10	2.540
18	15	3.090
19	20	3.415
19	25	3.685
20	30	4.110
21	35	4.300

Volume Outflow= **0.264 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **5.40 m^2**

Time of Outflow= **890 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **5.5E-05 m/s** **($m^3/s/m^2$)** **197.6 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
1.150	m	25% depth	8	1.11	2.5	9	1.26	3
3.250	m	75% depth	19	3.09	15	20	3.415	20

Depth		Time	
1.150	m	158	seconds
3.250	m	1048	seconds

Project: 300 Springs Road **Date:** 20/02/2026

Test Pit TP0E **Test No** 1

Width 1.20 m
Depth 5.10 m Cobbly Silt
Length 1.50 m

The entire available water supply (1,000 L tank) was utilised. However, due to the dimensions of the test pit (1.2 m × 3.0 m × 5.1 m) and the associated water demand, it was not possible to flood the entire excavation. Any discrepancy in dimensions relates to the wetted area measured, which was less than the overall test pit area.

Reading No	Minutes	Depth (m)
1	0	4.220
2	0.2	4.230
3	0.3	4.235
4	0.5	4.240
5	0.7	4.245
6	0.8	4.250
7	1	4.255
8	1.5	4.270
9	2	4.290
10	2.5	4.300
11	3	4.310
12	3.5	4.330
13	4	4.350
14	4.5	4.370
15	5	4.390
16	6	4.415
17	7	4.445
18	8	4.470
19	9	4.490
19	10	4.520
20	11	4.550
21	12	4.580
21	13	4.700
22	14	4.735
23	15	4.770
23	16	4.810
24	17	4.860
25	18	4.935
25	19	5.010
26	20	5.075
27	21	5.100

Volume Outflow= **0.792 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **4.18 m^2**

Time of Outflow= **626 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **3.0E-04 m/s** **($m^3/s/m^2$)** **1090.7 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
4.440	m	25% depth	16	4.415	6	17	4.445	7
4.880	m	75% depth	27	4.86	17	28	4.935	18

Depth		Time	
4.440	m	410	seconds
4.880	m	1036	seconds

Project: 300 Spring Road **Date:** 24/02/2026

Test Pit TP0F **Test No** 1

Width 0.40 m
Depth 4.60 m Cobbly Silt
Length 0.40 m

The measured depth was 4.6+TS m. Approximately 0.5 m of remoulded ground is estimated to be present below the recorded base of the borehole.
Test stopped at 1.5hrs

Reading No	Minutes	Depth (m)
1	0	0.57
2	0.17	0.66
3	0.33	0.67
4	0.67	0.72
5	0.83	0.75
6	1	0.77
7	1.5	0.84
8	2	0.89
9	2.5	0.95
10	3	1.01
11	3.5	1.05
12	4	1.1
13	4.5	1.15
14	5	1.19
15	6	1.27
16	7	1.34
16	8	1.42
17	9	1.47
17	10	1.52
18	15	1.78
18	20	2.01
19	25	2.18
19	30	2.36
20	40	2.59
20	50	2.79
21	60	2.95
21	70	3.07
22	80	3.18
22	90	3.26
23	100	3.35

Volume Outflow= **0.175 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **6.76 m^2**

Time of Outflow= **2239 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **1.2E-05 m/s** **($m^3/s/m^2$)** **41.5 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
1.265	m	25% depth	14	1.19	5	15	1.27	6
2.655	m	75% depth	24	2.59	40	25	2.79	50

Depth		Time	
1.265	m	356	seconds
2.655	m	2595	seconds

Project: 300 Springs Road **Date:** 24/02/2026

Test Pit TP0G **Test No** 1

Width 0.70 m
Depth 3.30 m Cobbly Silt
Length 1.50 m

Water was pumped into the test pit using two water trucks operating simultaneously, with both pumps running. Once the water level reached the 0.6 m mark on the measuring rule, no further rise in water level was observed. The test commenced immediately thereafter. The water fully dissipated within approximately one minute.

Reading No	Minutes	Depth (m)
1	0.00	2.7
2	0.17	2.75
3	0.33	2.8
4	0.50	2.82
5	0.67	2.86
6	0.83	2.9
7	1.00	2.94
8	1.17	3.3

Volume Outflow= **0.315 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **2.37 m^2**

Time of Outflow= **28 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **4.7E-03 m/s** **($m^3/s/m^2$)** **16887.6 (mm/hour)**

		Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
2.850 m	25% depth	4	2.82	0.5	5	2.86	0.66666667
3.150 m	75% depth	7	2.94	1	8	3.3	1.16666667

Depth	Time
2.850 m	37 seconds
3.150 m	66 seconds

Project: 300 Springs Road **Date:** 25/02/2026

Test Pit TP0H **Test No** 1

Width 0.60 m
Depth 3.75 m Cobbly Silt
Length 2.00 m

An initial trial test was undertaken at 2.15 m bgl, where a low infiltration rate was observed. The test pit was subsequently extended to 3.75 m bgl, at which depth a higher infiltration rate was encountered.

Water was pumped into the test pit using two water trucks operating simultaneously, with both pumps running. After approximately 3 minutes of pumping, the water level reached 1.2 m on the measuring rule. The test commenced immediately thereafter. The water fully dissipated within approximately 10 minutes.

Reading No	Minutes	Depth (m)
1	0.00	2.60
2	0.17	2.63
3	0.33	2.65
4	0.50	2.67
5	0.67	2.68
6	0.83	2.70
7	1.00	2.72
8	1.50	2.75
9	2.00	2.80
10	2.50	2.85
11	3.00	2.90
12	3.50	2.94
13	4.00	3.00
14	4.50	3.03
15	5.00	3.05
16	6.00	3.12
17	7.00	3.18
18	8.00	3.23
19	9.00	3.27
20	10.00	3.34
21	11.00	3.75

Volume Outflow= **0.690 m^3** (between 75% and 25% of the effective depth)

Mean Surface Area= **4.19 m^2**

Time of Outflow= **445 seconds** (between 75% and 25% of the effective depth)

Soil Infiltration Rate= **3.7E-04 m/s** **($m^3/s/m^2$)** **1330.9 (mm/hour)**

			Reading No	Depth (m)	Time (mins)	Reading No	Depth (m)	Time (mins)
2.888	m	25% depth	10	2.85	2.5	11	2.9	3
3.463	m	75% depth	20	3.34	10	21	3.75	11

Depth		Time	
2.888	m	173	seconds
3.463	m	618	seconds

Auckland

Address | Level 4, 68 Beach Road, Auckland 1010

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Appendix D – Orion and Enable letters

20.05.2026 **Reference** ORN1030096

Gasper Weber
383 Colombo Street
christchurch
christchurch 8023

Dear Gasper

Proposed subdivision – TBC Springs Road Hornby Christchurch or Lot No. & DP

Thank you for your request for a letter to confirm there is capacity on the Orion network to service the electrical needs of your proposed subdivision.

This letter is not suitable for 224 clearance purposes.

I confirm:

1. Orion has the capacity on the network to meet your request.

2. There are no specific connections available for this subdivision however:

    a. A connection can be made available for 37 lots of dwellings subject to alteration to the Orion network; and

    b. *It is likely Orion will need to either upgrade existing network or lay new cables to create these connections. We recommend the developer engages an authorised Orion subdivision designer to help you through this process and submit a suitable design proposal so that your development may connect to the Orion network.*

    c. There will be costs associated in providing the connection(s). The costs payable will be in accordance with the Orion *subdivision* policy and will be the responsibility of the property owner.

    d. The next step will be to apply for a connection online at www.oriongroup.co.nz under “get connected”.

3. Orion will request an easement in gross for all over boundary existing network not currently secured by way of easement at the developers cost prior to the issuing 224 clearance.

4. To comply with Orion’s network security conditions an alternative feed from adjoining developments may also be required.

5. All proposed new structures near or under existing overhead lines (eg house, sheds, carports, garages or any other structures) must comply with the distances stated in the New Zealand Electrical Code of Practice for Electrical Safe Distances 2001 (NZECP34:2001).

6. **IMPORTANT:** This Capacity Letter will expire upon the earlier of the date upon which a connection for each of the lots for the development has been approved and livened or 6 months from the date of this letter in the case of a residential/rural subdivisions or, 12 months in the case of a commercial/industrial subdivision.

All terms and conditions will be subject to current Orion policies and practices.

Please contact me if you require any further information.

Yours faithfully

Peter Johnson
Contract Mgr Connections (NS)
Email s 9(2)(a)
Phone s 9(2)(a)



enable
fibre broadband

Puna Property Holdings Limited
Unit 4, 35 Sir William Pickering Drive, Burnside
8051 Christchurch

25 March 2026

Ben Halsey
s 9(2)(a)
s 9(2)(a)

UFB Fibre delivery to 300-376 Springs Road Prebbleton

In response to your email requesting confirmation from Enable of fibre delivery to the proposed lots at 300,318, 320, 374, 376 Springs Road, Halswell. I am pleased to be able to confirm the following:

These lots can be provisioned to provide full UFB fibre from Enable. Standard design, implementation and fees will apply.

I trust that the above confirmation allows you to continue the planning and consenting of this lot. Please let me know if you require any other information.

Yours sincerely



Chris Gant
Business Development Manager
s 9(2)(a)
s 9(2)(a)

Enable Networks Limited
Iwikau, Level 3
93 Cambridge Terrace
Christchurch, 8013
New Zealand