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GEOTECHNICAL REPORT FOR SUBDIVISION

42237 / ALMA ROAD SUBDIVISION (LOT 2 DP 428237)

/ MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT

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Davis Ogilvie & Partners Ltd

QUALITY ASSURANCE

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DISCLAIMER

This report has been prepared at the specific instructions of the Ministry of Business, Innovation & Employment in connection with the proposed subdivision of a property at Lot 2 DP 428237, Alma Road, Westport. This report provides a geotechnical assessment of the land underlying the site, specifically to identify any geotechnical constraints that may exist, and makes recommendations regarding the subdivision.

Davis Ogilvie did not perform a complete assessment of all possible conditions or circumstances that may exist at the site. Conditions may exist which were undetectable given the limited investigation of the site. Variations in conditions may occur between test locations, and there may be conditions onsite which have not been revealed by the investigation, which have not been taken into account in the report.

Davis Ogilvie's opinions are based upon information that existed at the time of the production of the document. Assessments made in this report are based on the conditions found onsite and published sources detailing the recommended investigation methodologies described. No warranty is included; either expressed or implied that the actual conditions will conform to the assessments contained in this report.

Davis Ogilvie has provided an opinion based on observations, site investigations, and analysis methodologies current at the time of reporting. The report cannot be used to assess the effect of any future changes in the site, or surroundings, the report cannot be used if there are changes in the referenced guidelines, analysis methodologies, laws or regulations.

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Should anyone wish to discuss the content of this report with Davis Ogilvie & Partners Ltd, they are welcome to contact us on (03) 548 4425 or at Level 1, 42 Oxford Street, Richmond.

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1.0 INTRODUCTION

Davis Ogilvie and Partners Limited (Davis Ogilvie) was commissioned by the Ministry of Business, Innovation & Employment to undertake a geotechnical investigation and reporting for the proposed subdivision of land at Lot 2 DP 428237, Alma Road, Westport. The aim of the investigation was to assess the underlying ground conditions and report as to the suitability of the land for subdivision and construction of new residential dwellings. An assessment of natural hazards as required by Section 106 of the Resource Management Act 1991 was undertaken. This report also provides general recommendations for future residential foundations.

1.1 Site Description

The site is located on a raised alluvial terrace approximately 400 m west of the Buller River near Westport, as shown in Figure 1 below. The site is bound by Alma Road to the south and a mix of residential and rural land to the west and north, and a Buller District Council (BDC) Gravel Reserve partially within the site boundary. The site has an area of approximately 7 ha and is currently undeveloped. The main development area consists of mainly grassland for the purpose of grazing cattle and sheep.

The site elevation ranges from 19 to 17 m RL. The nearby Buller River has an elevation of 1 m to 3 m RL (relative to NZVD2016)[1]. The site includes flat to slightly undulating topography with natural channels running south to the north adjacent to the the western and eastern boundaries.

Topographic maps of the site[2] show a meandering stream running east of the proposed development area that which is fed from an arm of Gillows Dam, some 1km upstream to the southwest.

[1] Elevation data obtained from LINZ layer https://data.linz.govt.nz/layer/105446-west-coast-westport-lidar-1m-dem-2020/
[2] http://gis.westcoast.govt.nz/WestMaps/

Figure 1: General locality map of the Alma Road Subdivision (indicated by a star).

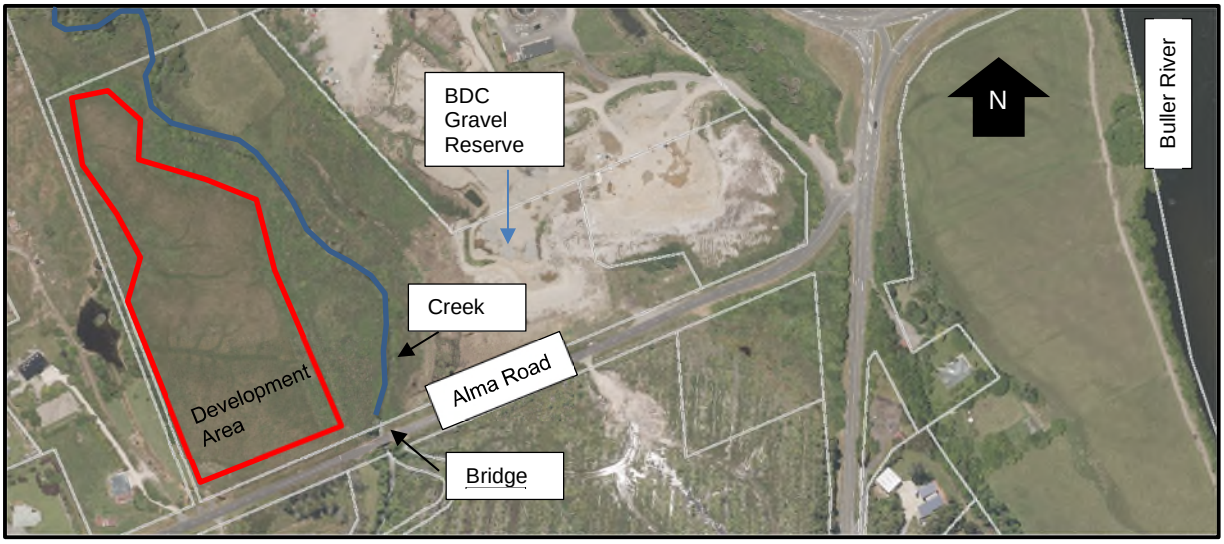


Figure 2: Location of the site and surrounding area. Base map obtained from WestMaps. NTS

A geotechnical site plan (DWG G01A) showing the positions of the features onsite is attached to this report (Appendix A). A photo of the site from the November 2021 walkover is provided below in Figure 3.

Figure 3: View looking northwest showing flat to slightly undulating ground surface.

1.2 Proposed Subdivision

It has been proposed to subdivide the property (~ 7 ha) into a twenty two-lot subdivision covering approximately 3 ha (Refer to Figure 4 and Appendix D). At the time of testing, no confirmed plans for any potential buildings were available, and we have therefore provided only general foundation recommendations. Additional testing may be required for building consent purposes.

Figure 4: Proposed subdivision (image supplied to Davis Ogilvie October 2021 by client).

2.0 DESKTOP STUDY

A summary of available background information on the site is provided below.

2.1 Geology

The published geology of the site is identified as Bradshaws Gravel Member, which is described as upper Pleistocene aged granitic river gravel and sands of the Waites Formation. The age of the Waites Formation is given as probably greater than 45,000 years[3].

According to the GNS Active Fault Database, the Lower Buller Fault, approximately 8.5 km to the southeast, is the nearest active fault to the area.[4] The age of last movement on the fault is unknown and its recurrence interval is not known.

The West Coast is a seismically active part of the country with the Alpine Fault presenting the greatest hazard to buildings and infrastructure. The Alpine Fault is located approximately 75 km to the east of the site. The Alpine Fault is classed as a 'major fault' in AS/NZS 1170.5, with associated faults bounding the western side of the Southern Alps (such as the Hope Fault. The Alpine Fault has a recurrence interval in the order of 291±23 years (Cochran et al. 2017[5]). The last major fault rupture occurred in 1717, and recent research suggests the probability of a rupture of the central section of the Alpine Fault occurring within the next 50 years to be in the order of 75%[6].

Historically other earthquakes have produced ground shaking in the area, such as the Murchison and Inangahua Earthquakes. The June 1929 Murchison Earthquake (M7.8), for example, resulted in an intensity of shaking between VIII to IX in the Buller Region.[7] The most recent significant earthquake, the January 1991 Buller Earthquakes, consisted of two earthquakes (M6 and M6.1), causing several slips on main West Coast routes and liquefaction in central Westport.

2.2 Liquefaction Potential

A regional liquefaction assessment prepared by Buller District Council as part of their Lifelines Study[8] identifies the site area as Zone 2 described as having a "very small risk of liquefaction of small, isolated areas within this zone".

[3] Nathan, S. (1976). Geological Map of New Zealand 1:25,000 Sheets s23/9 & S24/7 Foulwind and Westport.
[4] GNS Active faults Database. www. Data.gns.cri.nz/af/ (accessed 8/11/21).
[5] Cochran et al. 2017. A plate boundary earthquake record from a wetland adjacent to the Alpine fault in New Zealand refines hazard estimates. Earth and Planetary Science Letters. Volume 464, 15 April 2017, Pages 175-188.
[6] Jamie D. Howarth, Nicolas C. Barth, Sean J. Fitzsimons, Keith Richards-Dinger, Kate J. Clark, Glenn P. Biasi, Ursula A. Cochran, Robert M. Langridge, Kelvin R. Berryman, Rupert Sutherland. Spatiotemporal clustering of great earthquakes on a transform fault controlled by geometry. *Nature Geoscience*, 2021.
[7] Downes, G.L., 1995. Atlas of isoseismal maps of New Zealand Earthquakes. GNS Monograph 11.
[8] Buller District Council (2006), Buller District Council Lifelines Study, Alpine Fault Earthquake Scenario dated June 2006

2.3 Flood Hazards

The site is not included in the West Coast Regional Council flood hazard map for the Buller River.[9]

A 2010 NIWA report prepared for West Coast Regional Council[9] does not show the site as being inundated in a 1% AEP flood of the Buller River. The average rainfall for Westport is 2046 mm[10] , and during the time of our site visit, surface water was common across much of the site. The Buller River did not flood the site in the recent July 2021 storm event.

We are not aware of any flood hazard maps specific to the meandering streams alongside the site. These streams have a large catchment extending at least 4 km south of the site and includes the Gillows Dam lake and wetland areas 800 m south-east of the site.

2.4 Site History

An overview of the site history has been ascertained from the historic aerial imagery available on WestMaps[11], Google Earth and Retrolens[12]. Based on current aerials, the land has remained unaltered since the earliest available imagery, the early 1940s, which shows the site covered in grass as observed on site.

Buller District Council or the West Coast Regional Council should be contacted to see if there are any records of contamination at the site.

2.5 Previous Investigations

The New Zealand Geotechnical Database (NZGD) shows no record of relevant geotechnical investigations within a 1-kilometre radius of the property.[13]

2.6 Buller District Council Services

West Coast Maps does not show any council services (sewer, stormwater, and water) within the site. Other underground services such as power and telecommunications should be expected adjacent to or at the site.

[9] West Coast Regional Council. www.gis.westcoast.govt.nz/WestMapsViewer/?map=6345cb866c8d44d5a37d4aa6f1ae5bb2. Accessed 12.11.21.
[10] Macara, G.R. The Climate and Weather of the West Coast. NIWA Science and Technology Series Number 72. 38p.
[11] http://gis.westcoast.govt.nz/WestMaps/
[12] https://retrolens.co.nz/
[13] NZ Geotechnical Database www.nzgd.org.nz (accessed 30.9.21).

3.0 GEOTECHNICAL SITE INVESTIGATION

A geotechnical investigation was undertaken by Davis Ogilvie on 9 and 10 November 2021 within the limits of the proposed subdivision. The investigation comprised a site walkover and visual assessment, fifteen test pits (TPs) dug with a 5-tonne mechanical excavator and fifteen Dynamic Cone Penetrometer (DCPs) tests. Test pits were excavated to a maximum depth of 2.5 m below Existing Ground Level (EGL), where they met effective refusal. Test locations are shown in the geotechnical site plan (DWG G01A), and the test pit logs are provided in Appendix B. Inferred geologic stratigraphy of the site can be found attached as DWG G02A.

3.1 Testing Completed Onsite

The ground conditions encountered were generally in accordance with those described in the published geological map and were reasonably uniform across the site. The soil profile can be summarised as topsoil overlying a mix of soft to stiff clay with varying gravel content and soft buried topsoil to approximately 0.8 to 1.1 m depth over medium dense silty sands or sands and medium dense to very dense sandy gravel, encountered to the maximum depth of the tests at 2.4 m depth.

A generalised soil profile based on the test pits is provided in Table 1. Refer to Cross Sections provided in Appendix A for additional details.

Table 1: Summary of Inferred Soil Profile

Inferred Geological Unit	Summary of Soil Type and Relative Density / Consistency	Depth range to the top of layer (m)	Thickness range (m)	DCP (blows/ 100 mm)
Topsoil	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet.	0 – 0.45	0 - 0.45	0 - 1
Uncontrolled FILL	CLAY with rootlets; grey. Very soft to stiff, wet to saturated, highly plastic, non-sensitive.	0.2 – 0.45	0.5 – 0.8	0 - 35** (0 – 3 Typical)
Buried Topsoil	Organic silty, clayey, GRAVEL/SAND with rootlets; dark brown. Wet.	0.8 – 1.1	0.1 – 0.4	2 – 30 ***
Waites Formation	Silty SAND; blueish grey to yellow. Moderately to well packed, medium dense to dense, moist to wet, well graded to uniform.	0.9 - 1.4	0.3 – 1.3	3 - 30
	Sandy GRAVEL with some cobbles and silt; grey to yellow. Moist to saturated, rounded to subangular, moderately weathered. sand, well graded, fine to coarse.	1.0 – 2.4	-*	30+

* Geological base unit. True thickness can be determined by deep earth geophysical investigation techniques not included within the scope.
** Isolated gravels encountered during testing but not typical.
*** Presence of gravels created a disparity of results. If no gravels were encountered during testing, results were generally 3 – 7 blows per 100mm.

3.2 Groundwater

Static groundwater was not encountered in the other test pits, to the maximum depth of 2.2m bgl.

Groundwater inflows (seepages) were encountered within our test pits at various depths throughout the site.

4.0 NATURAL HAZARDS

Section 106 of the Resource Management Act (RMA) requires an assessment of the potential for material damage to land from natural hazards. These aspects are addressed in the following section based on published information and our observations onsite. Our recommendations regarding these natural hazards are discussed in Section 5.0, and a 'Statement of Professional Opinion on the Suitability of Land for Subdivision' is provided in Appendix C.

4.1 Erosion

As the site is relatively flat, the risk of surface erosion to much of the site is considered low.

The only evidence of possible erosion observed on site was within the eastern banks adjacent to the Alma Road Bridge. Erosion of the creek banks associated with the high flows is possible, affecting nearby dwellings. Recommendations for building offsets from the stream banks are provided in Section 5.1.

Appropriate controls on stormwater and overland flow from hardstanding areas associated with the proposed development will be required and are detailed further in Section 5.6.

4.2 Falling Debris and Slippage

The majority of the site is relatively flat with greater than 2H:1V creek batter along the northern and eastern development boundary. There was no evidence of rockfall, or other debris observed onsite or within our geotechnical test excavations.

Minor slumping of creek banks could occur during a large seismic or storm event or as a result of erosion. Future development must ensure sufficient building offsets from the crest of all existing and proposed drainage channels. Recommendations for building offsets are provided in Section 5.1.

4.3 Land Subsidence

Liquefaction

Liquefaction can occur in loose silty to sandy soils, especially those that are saturated and loose, such as those deposited by rivers or estuaries. Typically, only young (Quaternary) deposits liquefy as older deposits tend to be sufficiently firm. The effects of liquefaction include the upward movement of soils and water as boils, subsidence and lateral spreading.

Based on the geotechnical investigation and published maps, the proposed subdivision is underlain by Pleistocene aged river deposits with static groundwater deeper than 2.2 m. Therefore, it is classified as having low liquefaction vulnerability in terms of MBIE guidance[14].

Static Settlement

Our DCP test results indicate that the shallow soils underlying the site do not meet the definition of "Good Ground" in terms of NZS3604:2011. There is a high risk of settlement of buildings and infrastructure due to the presence of thick layers of potentially compressible peat and organic-rich soils. Therefore, foundations will require a specific engineering design in line with the recommendations detailed in Section 5.0 of this report to mitigate static settlement and bearing capacity failure risk.

4.4 Flooding / Inundation

We consider the risk of flooding from the Buller River very low because the elevated ridge east of State Highway 67 near Pakihi Road and Rimu Terrace should deflect any floodwaters to the north.

The site is near a creek with impermeable soils at the surface, making it vulnerable to inundation or flooding, posing a potential hazard to future development. We considered the risk of surface flooding from local waterways during intense rainfall events to be moderate.

Appropriate surface water management and design should be undertaken to inform the design of the subdivision and potential future dwellings. Floor levels for dwellings will need council approved Finished Floor Levels (FFL) as part of their design.

4.5 Seismicity

There are no mapped active faults within the site. Therefore, the risk of the proposed development being affected by fault rupture is considered low. Seismic shaking is a risk and is expected to be mitigated through appropriate design in accordance with NZS1170.5:2004.

[14] Ministry of Business, Innovation and Employment (2017). Planning and engineering guidance for potentially liquefaction-prone land Resource Management Act and Building Act aspects.

5.0 DEVELOPMENT CONSIDERATIONS AND RECOMMENDATIONS

The site is considered geotechnically suitable for the proposed development subject to the recommendations of this report being incorporated into the design and construction of earthworks, infrastructure and future buildings at the site. We have provided a statement of suitability for subdivision in Appendix C which includes these recommendations.

5.1 Development Layout

Due to the potential for erosion and shallow instability, we recommend that all buildings be located at least 10 m from the creek banks. Remediation of minor erosion may be required following large storm events. Notwithstanding, the above offsets from proposed swales should comply with these requirements will require specific investigation and design under the supervision of suitably qualified Geo-professional.

5.2 Design Criteria: NZS 1170.5 Site Soil Class

From a geotechnical perspective, we consider Site Subsoil Class D as appropriate for the site.

5.3 Foundation Recommendations

Our test pit and DCP results indicated “Good ground” in terms of NZS3604:2011 was encountered approximately between 1.0 and 1.5 m below existing ground level (EGL). However, depths across the site are likely to vary. Therefore, they will require site-specific testing investigation by a suitably qualified Geo-professional (geotechnical engineer or engineering geologist) once building footprint locations are known to confirm the depth to suitable natural soils.

Therefore, we recommend potential dwellings are founded on timber pile foundations designed by a chartered professional engineer practising in foundation design. Those foundations should bear on the underlying dense natural soils. It is recommended that foundations extend through uncontrolled fill, organic or otherwise soft or unsuitable soils to found on the underlying natural soils provided that these have sufficient strength at the site.

If a slab-on-grade foundation is preferred, all topsoil, uncontrolled fill, organic, soft, or otherwise unsuitable soils must be removed to the top of dense natural soils and replaced with engineered fill in accordance with NZS 4431:1989 “Code of Practice for Earth Fill for Residential Development”.

Setbacks should be in place for buildings near existing drainage channels or slopes, in accordance with Figure 3.1 of NZS 3604:2011.

During construction, all pile excavations and/or stripped areas below proposed concrete slab foundations or engineered fill should be inspected and approved by a Geo-professional to confirm that the ground conditions and bearing capacity are consistent with those described in this report or are otherwise suitable for residential foundations.

5.4 Earthworks

The following geotechnical recommendations are provided for earthworks at the site:

- No permanent cuts and fill shall be made steeper than 27 degrees (2H:1V) except with specific approval by a suitably qualified Geo-professional familiar with the site.
- All engineered fills shall be placed in accordance with NZS 4431:1989 with adequate stripping, benching, and drainage under the direction of the Geo-professionals.
- Prior to placing engineered fill, the ground shall be stripped of all topsoil, uncontrolled fill, organic, soft, or otherwise unsuitable soils. The stripped surface must be inspected by a Geo-professional.
- Any proposed cuts or fill greater than 1.0 m above/below current ground levels should be specifically assessed by a Geo-professional.
- Prior to the use of any material as fill (either site-won or imported), bulk samples should be collected and supplied to an IANZ accredited geotechnical laboratory to assess the particle size distribution, compaction properties and maximum dry density. This information should be reviewed by a Geo-professional to confirm the suitability of this material for use as fill. Field compaction trials and additional laboratory analysis may also be required.

5.5 Test pits

Test Pits were located by hand held GPS and were sited to minimise impact to subsequent development where possible to do so. However, if test pits are located within the zone of influence of proposed hardstanding areas, engineered fills, services or building foundations, they should be undercut and backfilled with site concrete or engineered fill in accordance with NZS4431:1989.

5.6 Pavement and Roading

Geotechnical recommendations for paving and roading design are provided below:

- The DCP results have been used to provide a preliminary classification and assessment of the subgrade CBR for road and pavement design. A preliminary subgrade CBR of 2%[15] for silty subgrades or a CBR of 15% for gravelly subgrades following removal of topsoil, silty soils and any otherwise unsuitable/soft material, subject to confirmation during construction.

[15] CBR determined from DCP blow counts referenced against Table 5.11 of Look, B. G. (2007). Handbook of Geotechnical Investigation and Design. Tables, Taylor & Francis Group, London, UK, 356.

- We recommend that bulk samples are collected for dry sieve analysis, and assessment of CBR at an IANZ accredited laboratory to confirm the preliminary value presented above and determine if it is appropriate to use a higher or lower CBR for pavement and roading design. Alternatively, in-situ testing and sampling could be conducted at the construction stage to confirm pavement design assumptions.
- All roading design and construction shall be carried out in accordance with NZS4404:2010 and the conditions of the resource consents.
- A suitably qualified person shall conduct a subgrade inspection during roadway construction to confirm the pavement design assumptions.

5.7 Infrastructure Design

All retaining walls over 1.0 m in height shall be designed by a chartered professional engineer. All retaining walls shall be fully drained.

5.8 Dewatering, Erosion, and Sediment Control

Dewatering and earthworks erosion and sediment controls should comply with NZ4404:2010, the conditions of the resource consents, and must be appropriately designed and implemented prior to any earthworks on the site.

6.0 ONSITE DISPOSAL OF STORMWATER AND HOUSEHOLD EFFLUENT

The Regional Land and Water Plan[16] provides a framework for the integrated and sustainable management of the West Coast's natural and physical resources as they apply in the context of land and water. Onsite disposal of stormwater and household effluent in rural zoned properties is covered by the Plan. The Plan contains permitted activity rules for activities that have no more than minor adverse effects on the environment. For other activities, resource consent is required.

This section is provided for information only from a geotechnical perspective and we suggest these matters are discussed further with a suitably experienced and qualified civil engineer.

Rules in the Plan which must be adhered to for the development at Alma Road include:

- Rule 63: Discharge of stormwater from reticulated systems.
- Rule 71: Discharge of any contaminant, or water to water, not complying with Rules 63 to 70.
- Rule 79: Onsite discharge of sewage effluent.
- Rule 81: Discharge of stormwater runoff.
- Rule 91: Discharge to land discretionary activity Rule.

[16] The West Coast Regional Council, May 2014. Regional Land and Water Plan.

6.1 Stormwater Management

Stormwater needs to be adequately controlled on the site to prevent localised erosion and inundation. The construction of a soakage system will require onsite soakage testing and engineer design.

An option for managing runoff from hardstanding areas may consist of a suitably sized and located retention tank and/or drainage channels incorporated into the design at the building consent stage. From any proposed impervious surfaces, effective disposal of stormwater may consist of discharging runoff into the existing drainage pathways.

6.2 On-Site Wastewater Management

The system chosen for a residential dwelling shall be approved by the WCRC / BDC and be designed and installed by a suitably qualified and experienced person in accordance with the requirements of AS/NZS 1547:2012 *"On site Domestic Wastewater Management"*.

7.0 PLAN REVIEW AND CONSTRUCTION MONITORING

The following work should be completed by a geo-professional for this specific project: Prior to building consent:

- A geotechnical review of the civil and foundation design, and earthworks (cut/fill) plans. This is to ensure that the recommendations given in this report have been correctly interpreted and incorporated into the design.
- Review of stormwater and wastewater network plans, including any deep excavations required.

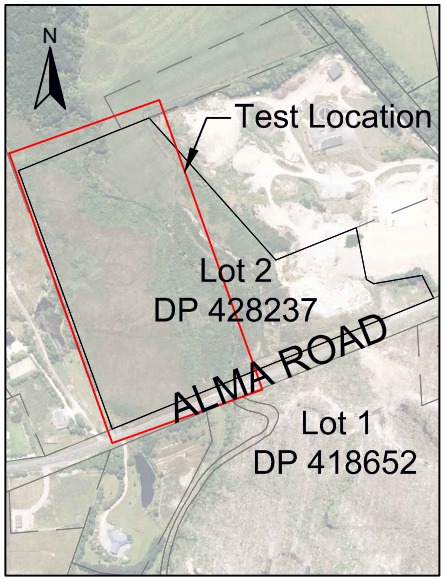
During construction:

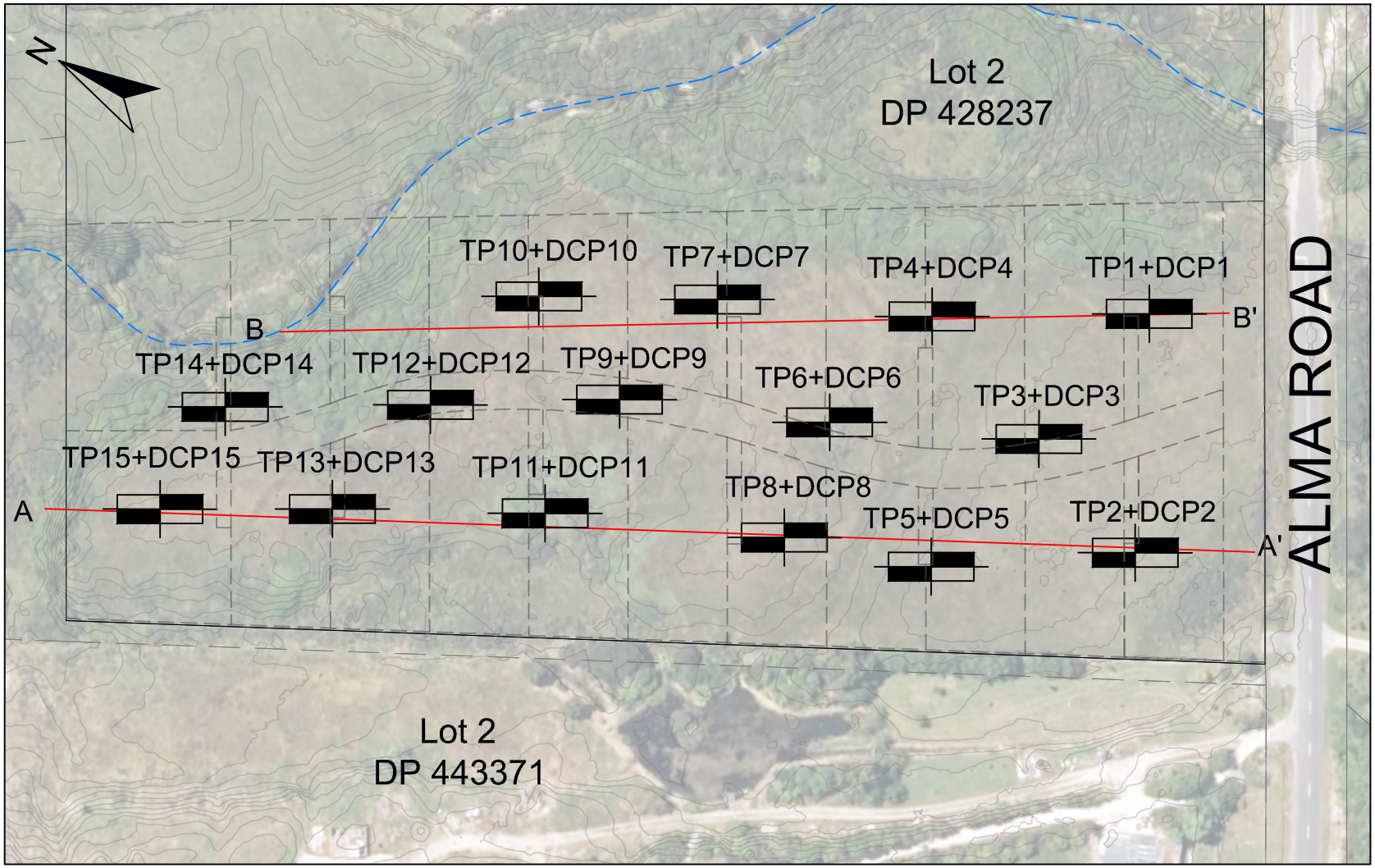
- Inspection of all excavations onsite prior to the placement of any engineering fill or construction of any foundation to confirm the ground conditions, suitability of underlying soils and design bearing capacity are consistent with those described in this report.
- Review and approval of particle size distribution, compaction properties and maximum dry density curves for all proposed fill types.
- Regular inspection during fill placement construction.
- Provide site reports to summarise site inspection observations.
- Provide technical advice during construction to support the construction team.

If encountered ground conditions vary from expected, the design Geo-professional should be consulted.

APPENDIX A

Geotechnical Site Plan and Cross Sections

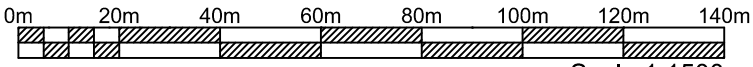




LEGEND

	Test pit and DCP locations (approximate)
	Proposed lot boundaries
	Property boundary (approximate)
	Cross section line (refer to DWG G02A)
	Lagoon Creek (approximate)

Test locations are approximate (scaled and aligned using aerial imagery). Aerial image and contours obtained from LINZ.Boundaries are indicative only, obtained from GRIP®. Proposed lot boundaries are approximate and scaled using the "Temp Village Plan" by Joseph and Associates Ltd within the "Temporary Accommodation Village Feasibility Study" prepared for MBIE.



Scale 1:1500

CAD ref: 42237.211201.JL.Geotechnical Plan

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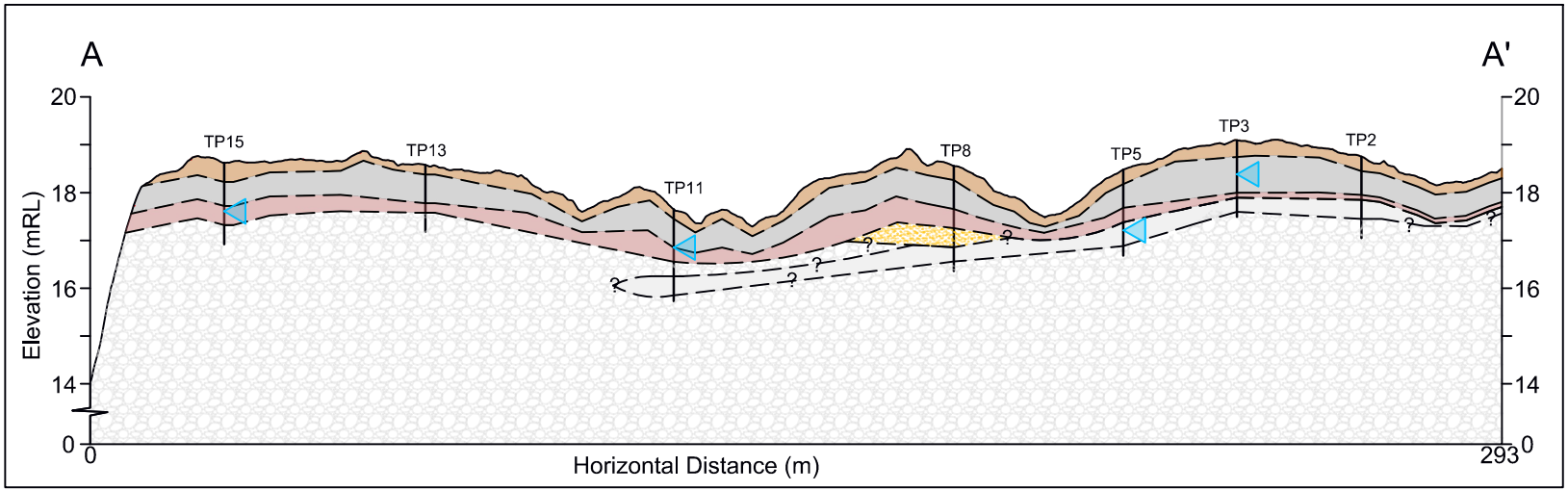
Geotechnical Site Plan
Alma Road & Buller Road
Lot 2 DP 428237

/ design	/ drawn	/ QA check	/ dwg
JL	JL	CVS	G01
/ scale @ A4	/ date	/ file	/ issue
1:1500	12/21	42237	A



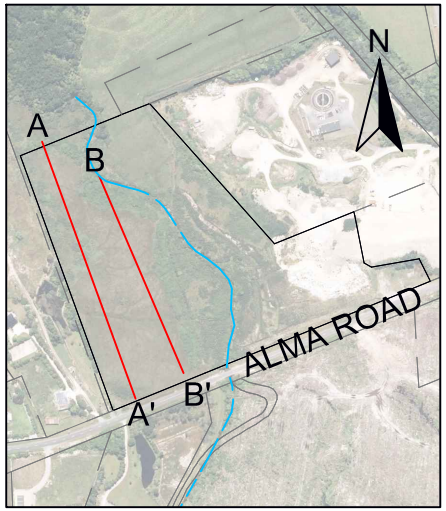


Figure 1. Cross section A - A'.

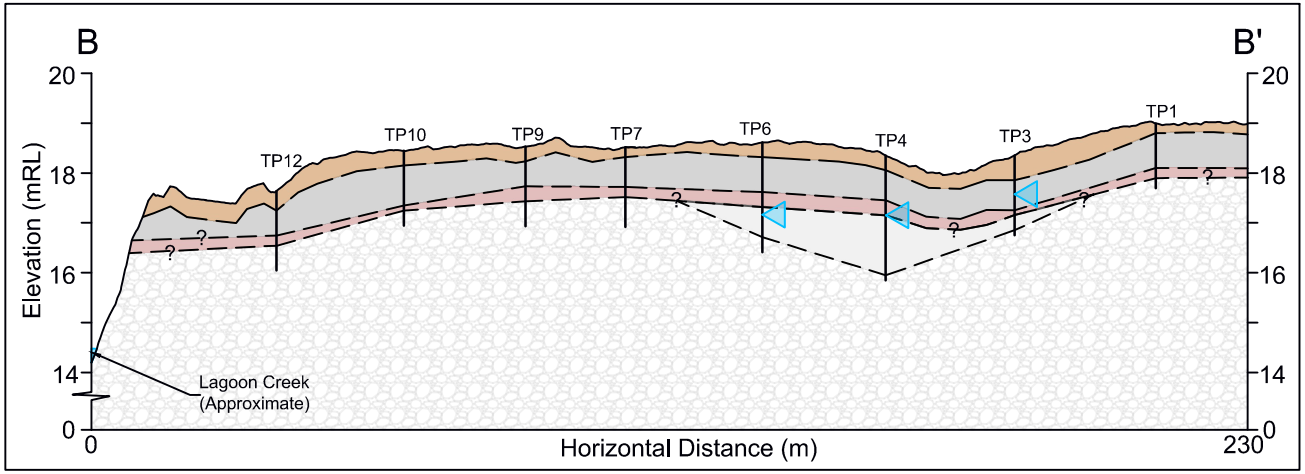


Figure 2. Cross section B - B'.

LEGEND

- Topsoil
- Clayey/Silty sand
- Clay (uncontrolled fill)
- Sand
- Buried topsoil
- Gravel
- Boundary layer - moderate confidence
- Davis Ogilvie test pit
- Boundary layer - low confidence
- Observed seepage

Test locations are approximate (scaled and aligned from G01A). Surface profile is determined from contours obtained from LINZ.Layers are categorized into soil types and NOT geological unit nor age. Layer boundaries are interpreted and estimated from test results and surface profile. Cross sections are schematic only, not to scale (NTS) and should not to be used for construction.

CAD ref: 42237.211126.JL.Geotechnical Plan

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Cross Sections
Alma Road / Buller Road, Westport
Lot 2 DP 428237

/ design	/ drawn	/ QA check	/ dwg
JL	JL	CVS	G02
/ scale @ A4	/ date	/ file	/ issue
NTS	11/21	42237	A

APPENDIX B

Test Pit and DCP Investigation Logs

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 1 + DCP 1**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 10:35 am
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 1.8

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 1 + DCP 1 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, moist. (TOPSOIL) [0.20m]	TS	TS	Groundwater Not Encountered		VS			0
0.5	CLAY with rootlets; grey. Very soft to firm, moist, highly plastic, non-sensitive.(UNCONTROLLED FILL) [0.70m]		CH		M	VS-F			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Wet, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.20m]	TS	TS		W	VL-MD			1.0
	Sandy GRAVEL with minor silt; yellow. Moderately packed, moist to wet, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.20m]		GW		M-W		30		
1.5	Test Pit terminated at 1.30m - Sufficient Information 1.1m - 1.2m: 100 mm thick mottled orange hardpan layer.								1.5
2.0									2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 2 + DCP 2**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 10:48 am
Excavation Method: 5.5T Digger
Width: 0.9 **Length:** 1.8

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 2 + DCP 2 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0.0	Organic CLAY with some silt and rootlets; dark brown. Soft, moist. (TOPSOIL) [0.30m]	TS	TS	Groundwater Not Encountered	M	VS			0.0
0.5	CLAY with rootlets; grey. Soft, moist, highly plastic, non-sensitive.(UNCONTROLLED FILL) [0.50m]		CH			VS-S			0.5
0.8	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Wet, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.10m]	TS	TS		W	L			0.8
1.0	Silty SAND; yellow. Moist, fine, uniform. [0.40m] 0.9m - 1.0m: 100 mm thick mottled orange hardpan layer.		SP		M	MD-D			1.0
1.5	Sandy GRAVEL with some cobbles and silt; grey. Moist, well graded, fine to coarse, rounded to subrounded, up to 200 mm diameter. (ALLUVIAL DEPOSITS) [0.40m]		GW				> 30		1.5
1.7	Test Pit terminated at 1.70m - Sufficient Information								1.7
2.0									2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 3 + DCP 3**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 11:05 am
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 1.8

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 3 + DCP 3 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets and large roots; dark brown. Very soft, moist. (TOPSOIL) [0.45m]	TS	TS		M	VS			0
0.5	CLAY with rootlets; grey. Very soft to firm, moist, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.65m]		CH	09/11/2021		VS-F			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Medium dense, saturated, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.10m]	TS	TS		S	MD			1.0
	SAND with some silt and clay; yellow. Medium dense to very dense, moderately packed, dry to moist, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.30m]		SW		D-M	MD-VD	> 22 / > 20 / > 15		
	1.2m - 1.3m: 100 mm thick mottled orange hardpan layer.								
1.5	Sandy GRAVEL with some cobbles and silt; grey. Dry to moist, well graded, fine to coarse, rounded to subrounded, up to 200 mm diameter. (ALLUVIAL DEPOSITS) [0.10m]		GW				> 30		1.5
	Test Pit terminated at 1.60m - Sufficient Information								
2.0									2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 4 + DCP 4**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 11:15 am
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 2.1

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 4 + DCP 4 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt, rootlets and large roots; dark brown. Soft, moist. (TOPSOIL) [0.30m]	TS	TS			VS			0
0.5	CLAY with rootlets; grey. Very soft to firm, moist, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.60m]		CH		M	VS-F			0.5
1.0	Organic clayey SAND with trace rootlets; dark brown. Loose to medium dense, wet, coarse, uniform. (BURIED TOPSOIL) [0.30m]	TS	TS	09/11/2021	W	L-MD			1.0
1.5	Clayey silty SAND with trace rootlets; light brown. Loose to medium dense, moist, fine, uniform. (ALLUVIAL DEPOSITS) [0.30m]		SC		M				1.5
2.0	Clayey silty SAND; blueish grey. Well packed, loose to dense, moist to wet, uniform, fine. (ALLUVIAL DEPOSITS) [0.90m]		SC		M-W	L-D	> 13 > 15 > 12 > 30		2.0
2.5	Sandy GRAVEL with minor silt; yellow. Moderately packed, moist to wet, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.10m]		GW						2.5
	Test Pit terminated at 2.50m - Sufficient Information								

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 5 + DCP 5**

Project:	Alma Road - Lot 2 DP 428237	**Date:**	09/11/21
Client:	MBIE & Buller District Council	**Time:**	11:40 am
Test Location:	Refer to Geotechnical Site Plan G01A	**Excavation Method:**	5.5T Digger
Coordinates:	**Elevation:** -	**Width:** 0.8	**Length:** 2

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 5 + DCP 5 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, moist. (TOPSOIL) [0.30m]	TS	TS		M	VS			0
0.5	CLAY with rootlets; grey. Very soft to firm, moist, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.50m]		CH			VS-F			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Moist, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.30m]	TS	TS			L			1.0
1.5	Clayey silty SAND; blueish grey. Well packed, medium dense, wet, uniform, fine. (ALLUVIAL DEPOSITS) [0.50m] 1.1m - 1.3m: Buried topsoil layer ends at this depth on the east side of the test pit.		SC	09/11/2021	W	D	> 11 > 11 > 11 > 20 > 30		1.5
2.0	Sandy GRAVEL with some cobbles and silt; grey. Wet, well graded, fine to coarse, rounded to subrounded, up to 200 mm diameter. (ALLUVIAL DEPOSITS) [0.10m] Test Pit terminated at 1.70m - Sufficient Information 1.6m - 1.7m: ~ 50 - 100 mm thick mottled orange hardpan layer.		GW			D-VD			2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 6 + DCP 6**

Project:	Alma Road - Lot 2 DP 428237	**Date:**	09/11/21
Client:	MBIE & Buller District Council	**Time:**	12:00 pm
Test Location:	Refer to Geotechnical Site Plan G01A	**Excavation Method:**	5.5T Digger
Coordinates:	**Elevation:** -	**Width:** 0.8	**Length:** 1.7

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 6 + DCP 6 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet. (TOPSOIL) [0.30m]		TS			VS			0
0.5	CLAY with rootlets; grey. Very soft to firm, wet, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.70m]		CH		W	VS-F			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Dense to very dense, wet, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.30m]		TS			D-VD	> 12 > 16 > 12		1.0
1.5	Clayey silty SAND; blueish grey. Well packed, dense, moist, uniform, fine. Interbedded with yellow alluvial sediments. (ALLUVIAL DEPOSITS) [0.60m] 1.3m - 1.5m: ~200 mm thick mottled orange hardpan layer.		SW	09/11/2021	M	D	> 11 > 13 > 30		1.5
2.0	Sandy GRAVEL with some cobbles and silt; grey. Moist, well graded, fine to coarse, rounded to subrounded, up to 200 mm diameter. (ALLUVIAL DEPOSITS) [0.30m]		GW						2.0
	Test Pit terminated at 2.20m - Sufficient Information								
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 7 + DCP 7**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 12:20 pm
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 1.7

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 7 + DCP 7 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet. (TOPSOIL) [0.20m]	TS	TS	Groundwater Not Encountered	W	VS			0
0.5	CLAY with rootlets; grey. Very soft to firm, wet, moist, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.60m]		CH			VS-F			0.5
1.0	Organic sandy clayey GRAVEL with minor cobbles and trace rootlets; dark brown. Wet, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.20m]	TS	TS				> 30		1.0
	Sandy GRAVEL with minor silt; yellow. Moderately packed, moist to wet, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.30m]		GW		M-W				
	1.0m - 1.1m: ~100 mm thick mottled orange hardpan layer.								
1.5	Sandy cobbley GRAVEL with some silt; grey. Moist, well graded, fine to coarse, rounded to subrounded, up to 200 mm diameter. (ALLUVIAL DEPOSITS) [0.30m]		GW		M				1.5
	Test Pit terminated at 1.60m - Sufficient Information								
2.0									2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 8 + DCP 8**

Project:	Alma Road - Lot 2 DP 428237	**Date:**	09/11/21
Client:	MBIE & Buller District Council	**Time:**	1:10 pm
Test Location:	Refer to Geotechnical Site Plan G01A	**Excavation Method:**	5.5T Digger
Coordinates:	**Elevation:** -	**Width:** 0.8	**Length:** 1.9

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 8 + DCP 8 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, moist. (TOPSOIL) [0.30m]		TS	Groundwater Not Encountered	M	VS			0
0.5	CLAY with rootlets; grey. Soft to firm, moist, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.60m]		CH			S-F			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Loose to medium dense, wet, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.40m]		TS		W	L-MD			1.0
1.5	SAND with minor silt; yellow. Moderately packed, medium dense to dense, moist to wet, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.40m] 1.3m - 1.4m: ~100 mm thick mottled orange hardpan layer. 1.6m - 1.7m: ~100 mm thick mottled orange hardpan layer.		SW		M-W	MD-D	> 17		1.5
2.0	Clayey silty SAND; blueish grey. Well packed, medium dense, moist to wet, uniform, fine. (ALLUVIAL DEPOSITS) [0.30m]		SP			MD	> 12 > 14		2.0
2.2	Sandy GRAVEL with some cobbles and silt; grey. Dry to moist, well graded, fine to coarse, rounded to subrounded, up to 200 mm diameter. (ALLUVIAL DEPOSITS) [0.20m]		GW		D-M		> 30		2.2
	Test Pit terminated at 2.20m - Sufficient Information								
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes: Sand and gravel layers dip East to West.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 9 + DCP 9**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 1:30 pm
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 1.6

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 9 + DCP 9 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet. (TOPSOIL) [0.30m]	TS	TS	Groundwater Not Encountered	W	VS			0
0.5	CLAY with rootlets; grey. Very soft to firm, wet, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.50m]		CH			VS-F			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Medium dense, wet, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.30m]	TS	TS						1.0
1.5	GRAVEL with some sand and minor silt; yellow. Moderately packed, medium dense, moist to wet, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.50m] 1.1m - 1.2m: ~100 mm thick mottled orange hardpan layer.		GW		M-W	MD	30		1.5
2.0	Test Pit terminated at 1.60m - Sufficient Information								2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 10 + DCP 10**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 1:40 pm
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 2.1

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 10 + DCP 10 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet. (TOPSOIL) [0.30m]	TS	TS	Groundwater Not Encountered	W	VS			0
0.5	CLAY with rootlets; grey. Very soft to soft, wet, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.80m]		CH			VS-S	> 21		0.5
	0.9m - 1.1m: Unit becomes a silty sand.								
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Loose, wet to saturated, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.10m]	TS	TS		W-S	L	> 30		1.0
	Sandy GRAVEL with some cobbles, minor silt and trace boulders; yellow. Moderately packed, medium dense to very dense, moist to wet, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse; boulders up to 400 mm. (ALLUVIAL DEPOSITS) [0.30m]		GW		M-W	MD-VD			
1.5	Test Pit terminated at 1.50m - Sufficient Information								1.5
	1.2m - 1.3m: ~100 mm thick mottled orange hardpan layer.								
2.0									2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 11 + DCP 11**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 1:55 pm
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 2.2

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 11 + DCP 11 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet. (TOPSOIL) [0.20m]		TS			VS			0
	CLAY with rootlets; grey. Very soft to soft, wet, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.60m]		CH		W	VS-S			
0.5									0.5
	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Medium dense, wet to saturated, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.30m]		TS	09/11/2021	W-S	MD	> 15		
1.0	Sandy GRAVEL with minor silt; yellow. Moderately packed, medium dense to dense, moist to wet, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.30m]		GW		M-W	MD-D	> 14		1.0
	1.1m - 1.2m: ~100 mm thick mottled orange hardpan layer.						> 20		
	Clayey silty SAND; blueish grey. Well packed, dense to very dense, wet, uniform, fine. (ALLUVIAL DEPOSITS) [0.40m]		SP		W	D-VD	> 30		
1.5									1.5
	Sandy GRAVEL with some cobbles and silt; grey. Moist, well graded, fine to coarse, rounded to subrounded, up to 200 mm diameter. (ALLUVIAL DEPOSITS) [0.10m]		GW		M				
	Test Pit terminated at 1.90m - Sufficient Information								
2.0									2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes: Sand content is greater on east side of test pit than the west side.

Mottling layer re-occurs at irregular intervals.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 12 + DCP 12**

Project:	Alma Road - Lot 2 DP 428237	**Date:**	09/11/21
Client:	MBIE & Buller District Council	**Time:**	2:15 pm
Test Location:	Refer to Geotechnical Site Plan G01A	**Excavation Method:**	5.5T Digger
Coordinates:	**Elevation:** -	**Width:** 0.8	**Length:** 3

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 12 + DCP 12 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet. (TOPSOIL) [0.40m]	TS	TS	Groundwater Not Encountered	W	VS			0
0.5	CLAY with rootlets; grey. Very soft to firm, wet, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.50m]		CH			VS-F			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Moist to wet, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.20m]	TS	TS		M-W		> 17		1.0
	Sandy GRAVEL with minor silt; yellow. Moderately packed, dry to moist, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.50m]		GW		D-M		> 30		
1.5	1.1m - 1.2m: Part of buried topsoil layer ends at 1.2 m and dips Northeast.								1.5
	Test Pit terminated at 1.60m - Sufficient Information								
2.0									2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes: Wall collapse occurred.

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 13 + DCP 13**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 2:30 pm
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 2

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 13 + DCP 13 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet. (TOPSOIL) [0.30m]	TS	TS	Groundwater Not Encountered	W	VS			0
0.5	CLAY with rootlets and large roots; grey. Very soft to firm, wet, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.50m]		CH			VS-F	V 35		0.5
	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Moist, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.20m]	TS	TS		M				
1.0	Sandy GRAVEL with minor silt; yellow. Moderately packed, moist to wet, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.40m]		GW		M-W				1.0
	1.0m - 1.1m: ~100 mm thick mottled orange hardpan layer.								
	Test Pit terminated at 1.40m - Sufficient Information								
1.5									1.5
2.0									2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 14 + DCP 14**

Project:	Alma Road - Lot 2 DP 428237	**Date:**	09/11/21
Client:	MBIE & Buller District Council	**Time:**	2:40 pm
Test Location:	Refer to Geotechnical Site Plan G01A	**Excavation Method:**	5.5T Digger
Coordinates:	**Elevation:** -	**Width:** 0.8	**Length:** 2.1

DEPTH (m)	STRATA DESCRIPTION	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 14 + DCP 14 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
	Organic CLAY with some silt and rootlets; dark brown. Very soft to soft, wet. (TOPSOIL) [0.30m]	TS	TS	Groundwater Not Encountered	W	VS-S			
0.5	CLAY with rootlets and large roots; grey. Very soft to firm, wet to saturated, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.60m]		CH			VS-F			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Saturated, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.20m]	TS	TS		S		> 30		1.0
	Sandy GRAVEL with minor silt; yellow. Moderately packed, moist to saturated, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.60m]		GW		M-S				
1.5	1.1m - 1.4m: Clayey silty SAND; blueish grey. Well packed, medium dense, moist to wet, uniform, fine. Unit pinches out towards the East.								1.5
	Test Pit terminated at 1.70m - Sufficient Information								
2.0									2.0
2.5									2.5

Logged By:	JL	**Notes:**	Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.
Plotted By:	JL		
Checked By:	GB		

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SHALLOW INVESTIGATION RESULTS

Job Nº / **GM42237**
Test Nº / **TP 15 + DCP 15**

Project: Alma Road - Lot 2 DP 428237
Client: MBIE & Buller District Council
Test Location: Refer to Geotechnical Site Plan G01A
Coordinates: **Elevation:** -

Date: 09/11/21
Time: 2:55 pm
Excavation Method: 5.5T Digger
Width: 0.8 **Length:** 2.1

DEPTH (m)	STRATA DESCRIPTION (Strata description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	Graphic Log	Geology / Unit	Water Table	Moisture Condition	Consistency / Density	BLOWS / 100 mm — TP 15 + DCP 15 (1 2 3 4 5 6 7 8 9)	SHEAR VANE / LAB SAMPLES	DEPTH (m)
0	Organic CLAY with some silt and rootlets; dark brown. Very soft, wet. (TOPSOIL) [0.40m]	TS	TS		W	VS			0
0.5	CLAY with rootlets; grey. Very soft to stiff, wet to saturated, highly plastic, non-sensitive. (UNCONTROLLED FILL) [0.50m]		CH		W-S	VS-St			0.5
1.0	Organic sandy clayey GRAVEL with trace rootlets; dark brown. Moist to wet, fine to medium, rounded to subangular; sand, well graded. (BURIED TOPSOIL) [0.40m]	TS	TS	09/11/2021	M-W		> 30		1.0
1.5	Sandy GRAVEL with minor silt; yellow. Moderately packed, dry to moist, well graded, rounded to subrounded, moderately weathered; sand, well graded, fine to coarse. (ALLUVIAL DEPOSITS) [0.20m] 1.3m - 1.4m: ~50 mm thick mottled orange hardpan layer.		GW		D-M				1.5
	Sandy GRAVEL with some cobbles and silt; grey. Moist, well graded, fine to coarse, rounded to subrounded, up to 200 mm diameter. (ALLUVIAL DEPOSITS) [0.20m]		GW		M				
2.0	Test Pit terminated at 1.70m - Sufficient Information								2.0
2.5									2.5

Logged By: JL
Plotted By: JL
Checked By: GB

Notes:

Dynamic Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

STATEMENT OF PROFESSIONAL OPINION ON THE SUITABILITY OF LAND FOR SUBDIVISION

Issued by: Davis Ogilvie and Partners Ltd

To: Ministry of Business, Innovation & Employment

To be supplied to: Buller District Council

In respect of: Proposed Subdivision Lot 2 DP 428237 held in Record of Title 511485

At: Alma Road, Westport

I, Christopher Sandoval, on behalf of Davis Ogilvie and Partners Ltd hereby confirm:

1. I am a suitably qualified and experienced geotechnical engineer and was retained by the owner/developer as the geotechnical engineer on the above proposed development.

2. The geotechnical assessment report, dated 3 December 2021 has been carried out in accordance with the Ministry of Business Innovation and Employment guidelines for geotechnical investigation, and includes:
   (i) Details of and the results of the site investigations.
   (ii) An assessment of natural hazards, ground conditions and geotechnical ultimate bearing capacity across the proposed new residential lots.
   (iii) Recommendations proposing measures to avoid, remedy or mitigate any potential hazards on the land subject to the application, in accordance with the provisions of Section 106 of the Resource Management Act 1991.

3. In my professional opinion, I consider that Council is justified in granting consent incorporating the following conditions:
   (i) Any dwelling planned for the site should be located away from the standing water channels and creeks that cross the site to reduce the risk of inundation, erosion and subsidence (static settlement in soft, organic rich material).
   (ii) Any structure proposed at a location which differ from that assessed during our investigation will require site specific geotechnical investigation.
   (iii) Any fill on which proposed structures are to bear is to be placed in accordance with NZS 4431:1989 or a specifically engineered gravel raft, under supervision of a suitably qualified and experienced geotechnical professional.

(iv) Ground shaking during earthquakes is a potential risk in the area. Appropriate seismic design in accordance with NZS 1170.5:2011 should be undertaken for any structure built on the proposed lots.

(v) There is some risk from inundation and erosion given the amount of precipitation on the West Coast, the flat nature of the site and the organic and clay-rich soils, that are generally poorly draining. Surface water management and design should be undertaken to inform the design of the subdivision and potential future dwellings.

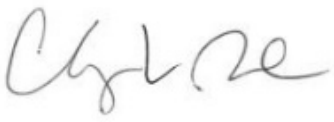
(vi) Stormwater runoff, drainage and wastewater disposal must be adequately controlled in accordance with the Regional Land and Water Plan and conform with Council requirements.

(vii) Finished floor level (FFL) requirements are to be confirmed with BDC at building consent stage.

4. This professional opinion is furnished to the territorial authority and the owner/developer for their purposes alone, on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.

5. This certificate shall be read in conjunction with the geotechnical report referred to in Clause 2 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

6. The geotechnical engineering firm issuing this statement holds a current policy of professional indemnity insurance of no less than $ 2 000 000. (Minimum amount of insurance shall be commensurate with the current amounts recommended by EngNZ, ACENZ, TNZ, INGENIUM.)



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Christopher Sandoval

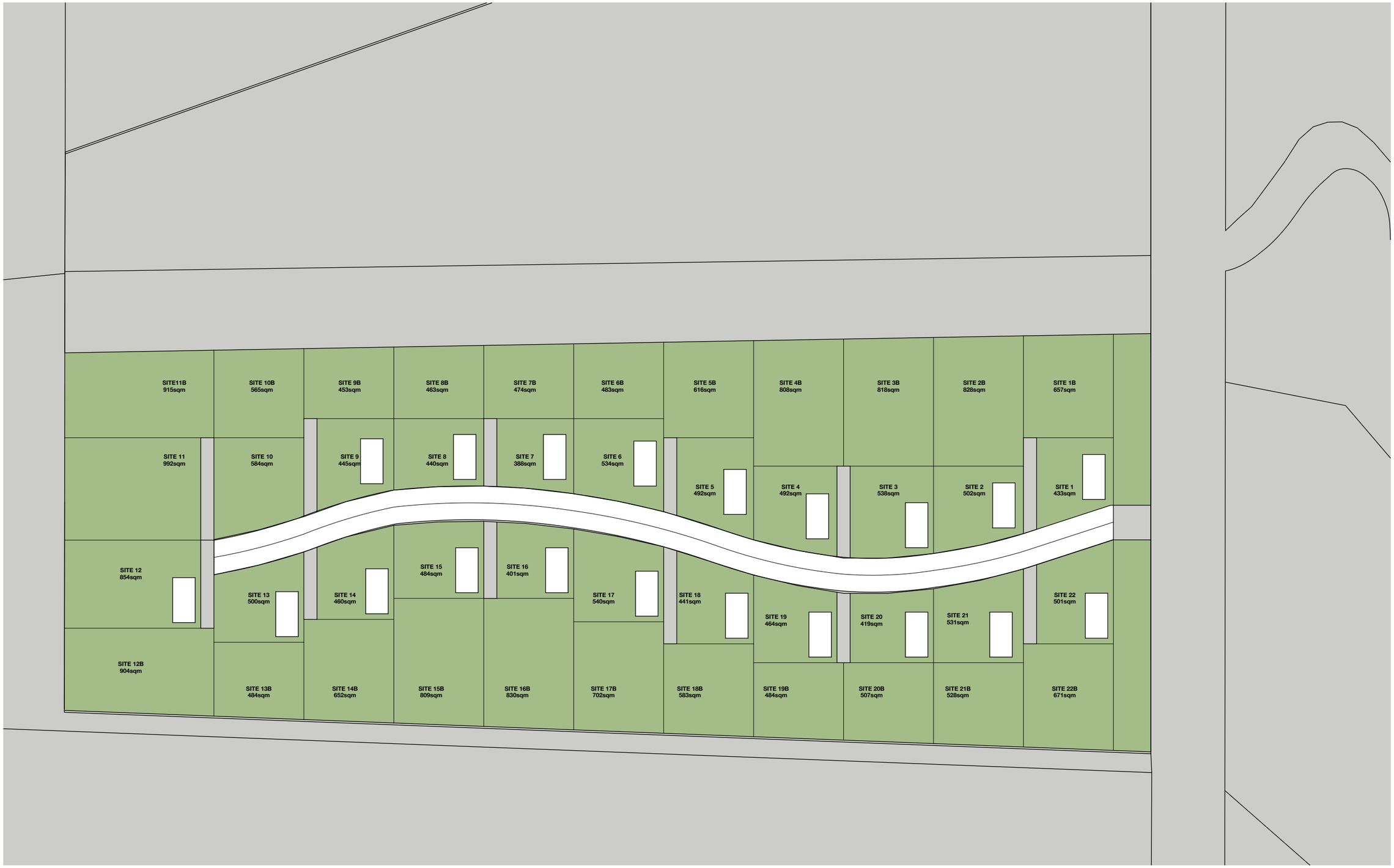
Date: 03 December 2021

Qualifications and experience:

Senior Geotechnical Engineer,

BSEng, MScEng, RCE (CA),

CMEngNZ, CPEng #1026535



TEMP VILLAGE PLAN scale 1:500