Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd

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BROOKSIDE ROAD PLAN CHANGE, ROLLESTON

GEOTECHNICAL INVESTIGATION REPORT

Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd

BROOKSIDE ROAD PLAN CHANGE, ROLLESTON

GEOTECHNICAL INVESTIGATION REPORT

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SUMMARY

The purpose of the geotechnical investigation reported herein was to determine the subsoil conditions beneath the subject site as they may affect future residential development, with particular regard to foundation design considerations, and to determine the suitability of the subject site for the residential development, in support of a submission to generally rezone the area from rural "Outer Plains" to "Living Z".

It is understood that it is proposed to request a plan change to the Operative District Plan seeking to rezone the above properties from rural "Outer Plains" to "Living Z", to enable subdivision of the site to create new residential lots, with a minimum net density of 12 households per hectare.

The approximate location and extent of the subject site is shown on the appended Fraser Thomas Ltd drawing G01082-01.

The subsoil information, presented in Appendix A of this report, indicates that the subject site is, in general, underlain by soils inferred to be alluvial sediments (sandy gravels) of Late Pleistocene age.

Foundation design recommendations are presented in Sections 9.0 and 10.0 of this report.

In general terms and within the limits of the investigation as outlined and reported herein, no unusual problems, from a geotechnical perspective, are anticipated with residential development at the subject site.

The site is, in general, considered suitable for its intended use, with satisfactory conditions for future residential building development, subject to the recommendations and qualifications reported herein, and provided the design and inspection of foundations are carried out as would be done under normal circumstances in accordance with the requirements of the relevant New Zealand Standard Codes of Practice.

BROOKSIDE ROAD PLAN CHANGE, ROLLESTON

GALLINA NOMINEES, HEINZ WATTIE PENSION FUND, AND BROOKSIDE ROAD RESIDENTIAL LTD

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation and appraisal undertaken for the proposed rezoning of the site at Brookside Road, Rolleston. The subject site (approximately 110 ha) comprises the following properties:

1. Lot 1 DP 82068; approx. 44.0 ha

2. Lot 1 DP 72132; approx. 9.45 ha

3. Lot 2 DP 72132; approx. 10.0 ha

4. Lot 3 DP 20007 approx. 24.47 ha

5. Lot 4 DP 20007; approx. 21.85 ha.

It is understood that it is proposed to request a plan change to the Operative Selwyn District Plan seeking to rezone the above properties from rural "Outer Plains" to "Living Z", to enable subdivision of the site to create new residential lots, with a minimum net density of 12 households per hectare.

The subject site is located between Brookside Road (to the north), Dunns Crossing Road (to the south-west) and Edwards Road (to the north-east). Existing rural properties abut the southern and south-western site boundaries.

The approximate location and extent of the subject site is shown on the appended Fraser Thomas Ltd drawing G01082-01.

The subsurface conditions underlying the subject site have been investigated by means of thirty machine excavated test pits and associated Dynamic Cone Penetrometer (DCP) scala tests and a review of existing water bore well logs.

A visual appraisal of the site and a study of geological maps have also been undertaken.

The purpose of the geotechnical investigation reported herein was to determine the subsoil conditions beneath the subject site as they may affect future residential development, with particular regard to foundation design considerations, and to determine the suitability of the subject site for the residential development, in support of a submission to generally rezone the area from rural "Outer Plains" to "Living Z".

2.0 PREVIOUS REPORTS

A previous report titled "Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts", dated December 2012, was prepared by the Institute of Geological and Nuclear Sciences Limited (GNS Science) for the Environment Canterbury Regional Council.

The December 2012 report was prepared in order to determine the parts of the Canterbury area which may be susceptible to the damaging effects of liquefaction induced ground deformations and areas where liquefaction induced damage is unlikely to occur.

Figure 2.1 presented in the December 2012 report, indicates that the subject site is sited in the zone where the December 2012 report indicates that damaging liquefaction induced ground deformation is considered to be "unlikely". The December 2012 report goes on to state the following with regard to the zone which the subject site is located within:

> *"…in this area there is little or no likelihood of damaging liquefaction occurring during strong ground shaking. This assessment area consists of the western part of the project area, and most of Banks Peninsula. Within this area, investigations in most cases can be designed primarily for other geotechnical hazards. Liquefaction however must at least be considered by the geotechnical professional in all cases."*

3.0 SUMMARY OF 2010/2011 DAMAGING CANTERBURY EARTHQUAKE EVENTS

The Canterbury region has been subjected to significant seismic activity over the period September 2010 to June 2011 and beyond.

The significant damaging earthquake events are considered to be the following:

(a) 4 September 2010 (Moment Magnitude (M_w 7.1, epicentre depth = 11km),

(b) 22 February 2011 (M_w 6.2, epicentre depth = 5km),

(c) 13 June 2011 (M_w 6.0, epicentre depth = 6km),

(d) 23 December 2011 (M_w 5.9, epicentre depth = 6km).

The cyclic loading associated with these earthquake events has resulted in significant land deformation and associated building damage throughout some areas of the Canterbury region.

4.0 GEOLOGY

In assessing the geology of the site, reference has been made to the Institute of Geological & Nuclear Sciences Geological Map 16, scale 1:250,000, "Christchurch".

This map indicates that the site is likely to be underlain by "brownish grey river alluvium", inferred to be of the Late Pleistocene Age.

The results of the machine excavated test pit investigations reported herein, in general, indicate that the surficial soils underlying the site are likely to comprise alluvial sediments of Late Pleistocene Age.

5.0 PROPOSED DEVELOPMENT

As discussed in Section 1.0 of this report, The subject site (approximately 110 ha) comprises the following properties:

(a) Lot 1 DP 82068; approx. 44.0 ha

(b) Lot 1 DP 72132; approx. 9.45 ha

(c) Lot 2 DP 72132; approx. 10.0 ha

(d) Lot 3 DP 20007 approx. 24.47 ha

(e) Lot 4 DP 20007; approx. 21.85 ha.

It is understood that it is proposed to request a plan change to the Operative Selwyn District Plan seeking to rezone the above properties from rural "Outer Plains" to "Living Z", to enable subdivision of the site to create new residential lots, with a minimum net density of 12 households per hectare.

6.0 FIELD INVESTIGATION

6.1 GENERAL

The field investigation comprised a visual appraisal, thirty machine excavated test pits and associated Dynamic Cone Penetrometer (DCP) scala tests.

The approximate locations of the investigation test positions are shown on Fraser Thomas Ltd drawing G01082-01.

6.2 RESULTS OF VISUAL APPRAISAL

A visual appraisal of the subject site was undertaken by a Fraser Thomas Ltd engineering geologist on 8 and 12 October 2021.

The subject site is located between Brookside Road (to the north), Dunns Crossing Road (to the south-west) and Edwards Road (to the north-east). Existing rural properties abut the southern and south-western site boundaries.

The approximate location and extent of the subject site is shown on the appended Fraser Thomas Ltd drawing G01082-01.

The topography within the subject site is generally flat.

The majority of the site comprises paddocks vegetated with grass.

Four existing single storey dwellings are located across the site. The dwellings all generally comprise light timber frame construction with mixed concrete brick and timber cladding, profiled metal roofs and generally appear to have suspended timber floors supported on shallow piles.

Each of the dwellings have detached garages and sheds, generally clad with profiled metal or stucco.

Seven existing poultry sheds, approximately 100m long, are located in the north-eastern part of the site (within Lots 3 and 4, DP 200007). Several ancillary buildings associated with the poultry sheds are also present in this part of the site.

An existing stockpile, overgrown with grass, inferred to comprise soil of unknown origin, was observed located along the western boundary of Lot 3, DP 20007.

Localised depressions and hummocky surface features, observed in the vicinity of the south-western ends of two poultry sheds, are inferred to be indicative of previously backfilled farm pits. Excavations of these features revealed building debris (including possible ACM), metal, glass bottles and animal bones.

The approximate inferred locations and extent of the existing structures and other site features are shown on drawing G01082-01.

It is understood, from conversations with the property owner, that a former 'offal pit' is located in the north-western corner of Lot 1, DP 72132. The offal pit is understood to have been backfilled with non-engineered fill material.

The approximate inferred location of the 'offal pit' is shown on drawing G01082-01.

An existing shallow water race generally extends through the south-western part of the site, and generally along the north-eastern boundaries of Lots 1 and 2 DP 72132. The water race banks are generally subvertical and approximately 0.8 m in vertical height. The water race ranges between approximately 6 m and 10 m wide. The water race banks are unretained, and generally vegetated. No obvious signs of any significant instability of the water race banks was observed, at the time of the investigation reported herein.

A review of historical aerial photographs indicate that the current path of the water race was established sometime before 1974. Aerial photography, from 1962, indicates that the water race originally crossed the south-western corner of Lot 3, DP 20007, at a different location to its present course. The original path of the water race, in this location, appears to have been backfilled, likely as part of poultry shed construction. The nature of the material placed to backfill this part of the water race is not reliably known. The approximate inferred location and extent of the existing water race, and the inferred 'backfilled' section, are shown on drawing G01082-01.

No obvious signs of any significant ground deformation, that could be attributed to liquefaction induced ground movement, were observed within the subject site, at the time of the investigation reported herein.

6.3 MACHINE EXCAVATED TEST PIT INVESTIGATION

Thirty machine excavated test pits, numbered TP1 to TP30 inclusive, were put down at the site, in order to determine the nature and extent of the subsoils underlying the site.

The test pits were inspected and logged by a qualified Fraser Thomas engineering geologist.

The test pits were excavated to depths ranging between approximately 1.5 m and 5.0 m below the ground surface existing at the time of the investigation reported herein (i.e. the existing ground surface).

The logs of Test Pits TP1 to TP30 inclusive are presented in Appendix A of this report.

Dynamic Cone Penetrometer (DCP) scala tests were carried out, from the existing ground surface, at the locations of Test Pits TP1, TP4, TP12, TP18, TP19, TP20, TP21, TP22, TP23 and TP30, in order to determine the consistency of the cohesionless soils encountered in the test pits.

The results of the DCP scala tests are also presented in Appendix A of this report.
The approximate locations of Test Pits TP1 to TP30 inclusive are shown on drawing G01082-01.

7.0 SUBSURFACE CONDITIONS

7.1 GENERAL

The subsoil information, presented in Appendix A of this report, indicates that the subject site is, in general, underlain by soils inferred to be alluvial sediments (sandy gravels) of Late Pleistocene Age.

It has been assumed that even though the various subsoil strata (depths, thicknesses, and locations of groundwater levels) have been determined only at the locations and within the depths of the various test positions recorded herein, these various subsurface features can be projected between the various test positions. Even though such inference is made, no guarantee can be given as to the validity of this inference or of the nature and continuity of these various subsurface features.

7.2 TOPSOIL

A surficial layer of topsoil, generally comprising gravelly silts, was encountered to a depth of between approximately 0.2 m and 0.3 m below the existing ground surface, at the locations of the test pits.

7.3 FARM PIT BACKFILL MATERIAL

As discussed in Section 6.2 of this report, localised depressions and hummocky surface features, inferred to be indicative of previously backfilled farm pits, were observed in the southern part of the Lot 3, DP 20007. Test Pits TP10 and TP13 were put down in the farm pit backfill material.

Material, generally comprising building debris (including possible ACM), metal, glass bottles and animal bones, was encountered, to depths ranging between approximately 0.8 m and 1.3 m below the existing ground surface.

Due to its nature, the backfill material is inferred to be non-engineered.

An ‘offal pit’ is also understood to be located in the north-western corner of Lot 1, DP 72132. The offal pit is understood to have been backfilled with non-engineered fill material.

7.4 ALLUVIAL SEDIMENTS

The results of the machine excavated test pit investigation reported herein indicate that the surficial topsoil at the site is generally underlain by a layer of material, generally comprising sandy gravels. These soils were generally encountered at depths ranging between approximately 0.2 m and 0.3 m below the existing ground surface, at the locations of the test pits. The sandy gravels were encountered to the extent of the test pits.

The results of the DCP tests undertaken in the sandy gravels, at the locations of the test positions, generally obtained DCP blow counts of between approximately 4 and greater than 25 blows per

50 mm penetration, corresponding to a SPT 'N' value of generally greater than 50, corresponding to a very dense consistency.

The logs of existing water bore well logs, presented in Appendix A of this report, put down in the vicinity of the subject site, have also been sourced from Environment Canterbury records.

The existing water bore logs indicate that sandy gravels are generally located at shallow depths, which is consistent with the subsoil conditions encountered at the subject site. The bore logs indicate that these sandy gravels generally extend to depths in excess of approximately 80 m below the ground surface. Based on the foregoing, it is, in our opinion, likely that the gravel soils underlying the site extend to significant depths below the existing ground surface.

The approximate locations of the existing water bore wells are shown on drawing G01082-01.

7.5 GROUNDWATER

Groundwater was not encountered during the investigations reported herein. However, based on information obtained from the existing water bore logs in the vicinity of the subject site, the groundwater level is inferred to be at a depth in excess of approximately 10 m below the existing ground surface, for analysis purposes.

8.0 LIQUEFACTION POTENTIAL ASSESSMENT

8.1 GENERAL

Liquefaction is defined as the phenomenon that occurs when soils are subject to a sudden loss in shear stiffness and strength associated with a reduction in effective stress due to cyclic loading (i.e. ground shaking associated with an earthquake).

The two main effects of liquefaction on soils are:

(a) Consolidation of the liquefied soils,

(b) Reduction in shear strength within the liquefied soils.

Liquefaction is considered to occur when the soils reach a condition of "zero effective stress". It is considered that only "sand like" soils can reach a condition of "zero effective stress" and therefore only "sand like" soils are considered to be liquefiable.

An indication that the underlying soils have been subject to liquefaction is the surface expression of ejected sand and water. This occurs as a result of the dissipation of excess pore water pressures generated within the liquefied soils as a result of the cyclic loading.

It should be noted that cohesive type materials or "clay like" soils are unlikely to be subject to liquefaction, as these soils (due to their nature) are unlikely to develop sufficient excess pore water pressures during cyclic loading to reach a condition of zero effective stress, i.e. the point of liquefaction.

However, "clay like" soils do develop some excess pore water pressures during cyclic loading which can result in consolidation settlement and a temporary reduction of the shear strength (i.e. softening) of the soils. Sensitive "clay like" soils are in particular susceptible to softening as a result of cyclic loading.

A liquefaction potential assessment has been undertaken for the soils underlying the subject site.

8.2 METHOD OF ANALYSIS

The New Zealand Geotechnical Society released Guidelines, in 2016, with the objective of summarising current best practice in earthquake geotechnical engineering with a focus on New Zealand conditions. The main purpose of the Guidelines is to promote consistency of approach to everyday engineering practice in New Zealand and, thus, improve geotechnical earthquake aspects of the performance of the built environment.

The Guidelines consists of six modules (identified as Modules 1 to 6 inclusive).

"Module 3: Identification Assessment and Mitigation of Liquefaction Hazards" of the Guidelines provides guidance on the identification of liquefaction hazards, and also provides details regarding different methodologies for determining theoretical liquefaction triggering.

The Module 3 guideline suggests a three-step process for the liquefaction assessment of sites, generally being:

(i) Step 1: Assessment of liquefaction susceptibility,

(ii) Step 2: Triggering of liquefaction,

(iii) Step 3: Consequences of liquefaction.

The Module 3 guideline refers to the methods suggested by "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils", dated October 2001. The guideline, among others, also refers to papers by Youd et al; Seed; Idriss; Boulanger; Robertson and Bray.

A liquefaction potential assessment of the soils underlying the subject site has been undertaken using the methods suggested by the Module 3 guideline.

8.3 ASSESSMENT OF LIQUEFACTION SUSCEPTIBILITY

The following soils are generally considered to be susceptible to liquefaction:

(a) Young (typically Holocene age) alluvial sediments (typically fluvial deposits laid down in a low energy environment) or man-made fills,

(b) Poorly consolidated/compacted sands and silty sands,

(c) Areas with a high groundwater level.

As discussed in Section 4.0 of this report, the geological map for the Christchurch area indicates that the site is likely to be underlain by "brownish grey river alluvium" inferred to be of Late Pleistocene age.

As discussed in Section 7.4 of this report, the results of the machine excavated test pit investigations, and our review of existing water bore well logs, indicate the site is generally underlain by very dense sandy gravels (encountered at shallow depths).

As discussed in Section 7.5 of this report, the groundwater level is inferred to be at a depth in excess of approximately 10 m below the existing ground surface, for analysis purposes.

Based on the foregoing, given the nature, age and consistency of the sediments underlying the subject site, i.e. unsaturated very dense sandy gravels of Late Pleistocene age, it is our opinion that the upper soils underlying the site are unlikely to be susceptible to liquefaction in response to a future large earthquake event and that the risk of any significant liquefaction induced ground deformation occurring at the site, in response to a large earthquake event, is considered to be low.

It is therefore our opinion that the subject site, for foundation design purposes, should be assumed to be within Foundation Technical Category 1 (TC1), as defined by the MBIE guidance document, and that it is unlikely that liquefaction induced ground deformation could occur within the area in response to a large earthquake event, and that the ground settlements within the area in response to seismic loading should be considered to be "within normally accepted tolerances" as defined by the MBIE December 2012 guidance document.

It should also be noted that our assessment of the liquefaction susceptibility of the soils underlying the subject site is consistent with the assessment provided in the GNS Science report, dated December 2012. As discussed in Section 2.0 of this report, Figure 2.1, presented in the December 2012 report, indicates that the subject site is sited within zone where damaging liquefaction induced ground deformation is considered to be "unlikely".

9.0 FOUNDATION DESIGN CONSIDERATIONS

9.1 GENERAL

It is our opinion that the soils underlying the subject site will exhibit only a low compressibility under the relatively light static foundation loads associated with a residential building development constructed in accordance with the requirements of NZS 3604: 2011, New Zealand Standard, Timber Framed Buildings.

It is, therefore, our opinion that settlement should not present a problem for future proposed residential development at the site, providing the inspection and design of foundations are carried out in accordance with the requirements of the relevant New Zealand Standard Codes of Practice, and in accordance with the recommendations presented in this report.

9.2 THE RISK OF THE PROPOSED DEVELOPMENT BEING ADVERSELY AFFECTED BY GROUND DEFORMATIONS ASSOCIATED WITH LIQUEFACTION

As discussed in Section 8.3 of this report, it is our opinion that the subject site, for foundation design purposes, should be assumed to be within Foundation Technical Category 1 (TC1), as defined by the MBIE guidance document, and that it is unlikely that liquefaction induced ground deformation could occur within the area in response to a large earthquake event, and that the ground settlements within the area in response to seismic loading should be considered to be "within normally accepted tolerances" as defined by the MBIE December 2012 guidance document.

Based on the foregoing, it is our opinion that an appropriate foundation solution for the site conditions would be a shallow foundation system designed in accordance with the requirements of NZS 3604: 2011, New Zealand Standard, Timber Framed Buildings (as modified by B1/AS1), founded in the underlying alluvial sediments.

Fraser Thomas Ltd should be engaged to inspect any foundation excavations, prior to the placement of any foundation materials, in order to confirm that the excavations are founded in competent alluvial sediments.

9.3 AREA INFERRED TO BE OVERLAIN BY STOCKPILE MATERIAL

As discussed in Section 6.2 of this report, an existing stockpile of material, overgrown with grass, inferred to comprise soil of unknown origin, was observed located along the western boundary of Lot 3, DP20007.

The approximate inferred location and extent of the existing stockpile is shown on drawing G01082-01.

There is in our opinion a risk, if the stockpile material is not appropriately removed from the site, that foundations and floors underlain by stockpile material may be subject to differential movement.

It is therefore recommended that any foundation excavations associated with any new structure be founded beneath any surficial stockpile material into the underlying natural alluvial sediments. It is also recommended that any surficial stockpile material be undercut from beneath the footprint of any proposed building.

It is recommended that Fraser Thomas Ltd be engaged to inspect, in particular, any foundation excavations and building subgrades located within the area inferred to be underlain by stockpile material, as shown on drawing G01082-01, in order to confirm that stockpile material has been removed from beneath the footprint of any proposed new building.

9.4 NON-ENGINEERED FILL MATERIAL

As discussed in Section 6.2 of this report, localised depressions and hummocky surface features, inferred to be indicative of previously backfilled farm pits, were observed in the southern part of the Lot 3, DP 20007. Test Pits TP10 and TP13 were put down in the farm pit backfill material.

Material, generally comprising building debris (including possible ACM), metal, glass bottles and animal bones, was encountered, to depths ranging between approximately 0.8 m and 1.3 m below the existing ground surface.

Due to its nature, the backfill material is inferred to be non-engineered.

An ‘offal pit’ is also understood to be located in the north-western corner of Lot 1, DP 72132. The offal pit is understood to have been backfilled with non-engineered fill material.

As discussed in Section 6.2 of this report, aerial photography, from 1962, indicates that the water race originally crossed the south-western corner of Lot 3, DP 20007, at a different location to its present course. The original path of the water race, in this location, appears to have been backfilled, likely as part of poultry shed construction. The nature of the material placed to backfill this part of the water race is not reliably known.

The approximate inferred location and extent of the backfilled farm pits, and the inferred ‘backfilled’ section of abandoned water race, are shown on drawing G01082-01.

There is, in our opinion, a risk that foundations founded on or within non-engineered fill material may be subject to differential settlement which may adversely affect any future proposed building development. It is therefore recommended that foundations located in this area be founded beneath any non-engineered fill material into competent natural ground or engineered fill.

Alternatively, the non-engineered fill material should be appropriately undercut/removed from site, as part of any proposed subdivisional earthworks.

Fraser Thomas Ltd should be engaged to inspect any foundation or undercut excavations, prior to the placement of any foundation of fill materials, in order to confirm that the excavations are founded in competent natural ground or engineered fill.

9.5 SHALLOW FOUNDATIONS LOCATED IN CLOSE PROXIMITY TO THE EXISTING WATER RACE AT THE SITE

As discussed in Section 6.2 of this report, an existing shallow water race generally extends through the south-western part of the site, and generally along the north-eastern boundaries of Lots 1 and 2 DP 72132. The approximate inferred location and extent of the existing water race, as it affects the subject site, is shown on the appended drawing G01082-01.

Recent alluvial sediments are likely to have been deposited in the base of the water race, and also possibly in the immediate vicinity of the water race.

Due to the likely variable nature of recent alluvial sediments and the likely presence of highly compressible sediments, there is, in our opinion, a risk that shallow building foundations founded on recent alluvial sediments may be subject to differential settlement.

In order to mitigate the risk of any proposed future shallow foundations being adversely affected by the settlement of recent alluvial sediments, it is recommended, unless further specific investigation and appraisal works are undertaken by a Chartered Professional Engineer experienced in geotechnical engineering, that shallow foundations associated with any proposed future dwellings at the site, be located no closer than a horizontal distance of 5 m from the crest of any water race side slopes at the site.

It should be noted, should the site be subject to residential development, that the subdivisional earthworks would likely involve the stripping of the water race and the backfilling of the water race with engineered fill material. Providing the earthworks are undertaken appropriately, the backfilling of the water race would result in the removal of the requirement for any horizontal offset from the water race, for shallow foundation design purposes.

10.0 ALLOWABLE FOUNDATION BEARING PRESSURES

10.1 GENERAL

In this section of the report, ultimate bearing capacity values and strength reduction factors are provided in order to allow calculation of design (dependable) foundation bearing capacities, in accordance with the limit state design methods outlined in AS/NZS 1170: 2002, Structural Design Actions, by applying the appropriate strength reduction factors, as provided in this report, and the factored load combinations required by AS/NZS 1170. Allowable foundation bearing pressures are also provided, based on conventional factors of safety, for cases where unfactored load combinations are being considered.

10.2 SHALLOW PAD OR BEAM FOUNDATIONS

A minimum ultimate static bearing capacity value for vertical loading of 300 kPa is recommended for shallow concrete pads or beam foundations, founded in the underlying alluvial sediments. It is recommended that a strength reduction factor (Φ_{bc}) of 0.5 be adopted for limit state design in

accordance with the requirements of AS/NZS 1170, resulting in a design (dependable) bearing capacity value of 150 kPa.

If unfactored load combinations are to be considered, the allowable foundation bearing pressures presented in Table 1 are recommended for shallow concrete pads or beam foundations, founded in the underlying alluvial sediments.

TABLE 1: ALLOWABLE FOUNDATION BEARING PRESSURES FOR SHALLOW CONCRETE PADS OR BEAM FOUNDATIONS FOUNDED IN THE UNDERLYING ALLUVIAL SEDIMENTS

Load Case	Factor of Safety	Allowable Bearing Pressure (kPa)
Dead Load and Permanent Live Load	3.0	100
Dead plus Live plus Transient Load	2.0	150

11.0 EXISTING SERVICE LINES

It is recommended that the location and depth of any buried services should be verified at the site prior to the commencement of foundation construction.

It is expected that any service line trenches would have been backfilled by conventionally acceptable means, which did not involve specific compaction. It would therefore be expected that some consolidation settlement of the service trench backfill could occur, which could result in lateral and vertical deformation of the undisturbed ground on each side of the trench backfill. The deformation is caused by the soil wedge behind the side wall of the trench moving downwards and inwards with time, towards the trench backfill as the backfill consolidates. The geometry of the soil wedge defines the theoretical zone of influence of the service trench backfill.

Due to the risk of consolidation settlement of the trench backfill occurring, it is recommended that, if any foundations of any proposed new building are located within the zone of influence of any existing service line, either the trench backfill be excavated and replaced with compacted hardfill or the foundations and floor of the proposed new building be designed to span across the trench backfill and the adjacent zone of influence.

The zone of influence is defined by a theoretical line projecting upwards in both directions from the centreline of the pipeline at the invert level of the pipeline at an angle of 45° to the vertical. The zone of influence is defined by the zone between the intersection point of the theoretical line and the ground surface on each side of the pipeline.

12.0 DEVELOPMENTAL EARTHWORKS

It is recommended that, unless the stability of any developmental earthworks (i.e. constructed for an access driveway, building platform or landscaping) is considered in detail by a chartered professional engineer experienced in geotechnical engineering, and particularly slope stability considerations, permanent fill end and cut slopes should be constructed to a maximum batter slope of 26° (1V:2H) with maximum batter heights of approximately 1.0 m. Any proposed higher permanent batter slopes should be subject to specific stability appreciation so as to determine stable limiting batter slopes.

It is recommended that any temporary excavated slopes be constructed to a maximum batter slope of 45° (1V:1H), with a maximum batter height of approximately one meter. It is recommended that any temporary excavation slopes not be left unsupported for a period exceeding one month. It is also recommended that stormwater run-off be diverted away from the crest of any proposed temporary excavation slopes.

13.0 STORMWATER AND EFFLUENT DISPOSAL

It is understood that issues relating to stormwater discharge and effluent disposal will be addressed by others.

14.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations should be read together and not be taken in isolation.

14.1 CONCLUSIONS

Our conclusions based on the field data obtained from the site and as presented in this report, our visual appraisal of the site, our study of the geological maps relating to the area and our professional judgement and opinions, are as follows:

(a) In general terms and within the limits of the investigation as outlined and reported herein, no unusual problems, from a geotechnical perspective, are anticipated with residential development at the subject site.

The site is, in general, considered suitable for its intended use, with satisfactory conditions for future residential building development, subject to the recommendations and qualifications reported herein, and provided the design and inspection of foundations are carried out as would be done under normal circumstances in accordance with the requirements of the relevant New Zealand Standard Codes of Practice.

In arriving at this conclusion and expressing this opinion, reliance has been based on the various topographical data as discussed herein and on subsoil information which has only been obtained at the locations and within the depths of the test positions reported herein. It has been assumed that this subsoil information can be projected between the various test positions. Even though such inference is made and forms the basis of the conclusions and opinions expressed herein, no guarantee can be given as to the validity of this inference or of the nature and continuity of the subsoils underlying the proposed subdivision.

(b) The purpose of the geotechnical investigation reported herein was to determine the subsoil conditions beneath the subject site as they may affect future residential development, with particular regard to foundation design considerations, and to determine the suitability of the subject site for the residential development, in support of a submission to generally rezone the area from rural "Outer Plains" to "Living Z".

(c) The results of the machine excavated test pit investigation reported herein indicate that the surficial topsoil at the site is generally underlain by a layer of material, generally comprising sandy gravels. These soils were generally encountered at depths ranging between approximately 0.2 m and 0.3 m below the existing ground surface, at the locations of the test pits. The sandy gravels were encountered to the extent of the test pits.

The results of the DCP tests undertaken in the sandy gravels, at the locations of the test positions, generally obtained DCP blow counts of between approximately 4 and greater than 25 blows per 50 mm penetration, corresponding to a SPT 'N' value of generally greater than 50, corresponding to a very dense consistency.

The logs of existing water bore well logs, presented in Appendix A of this report, put down in the vicinity of the subject site, have also been sourced from Environment Canterbury records. The existing water bore logs indicate that sandy gravels are generally located at shallow depths, which is consistent with the subsoil conditions encountered at the subject site. The bore logs indicate that these sandy gravels generally extend to depths in excess of approximately 80 m below the ground surface. Based on the foregoing, it is, in our opinion, likely that the gravel soils underlying the site extend to significant depths below the existing ground surface.

(d) Groundwater was not encountered during the investigations reported herein. However, based on information obtained from the existing water bore logs in the vicinity of the subject site, the groundwater level is inferred to be at a depth in excess of approximately 10 m below the existing ground surface, for analysis purposes.

(e) Given the nature, age and consistency of the sediments underlying the subject site, i.e. unsaturated very dense sandy gravels of Late Pleistocene age, it is our opinion that the upper soils underlying the site are unlikely to be susceptible to liquefaction in response to a future large earthquake event and that the risk of any significant liquefaction induced ground deformation occurring at the site, in response to a large earthquake event, is considered to be low.

It is therefore our opinion that the subject site, for foundation design purposes, should be assumed to be within Foundation Technical Category 1 (TC1), as defined by the MBIE guidance document, and that it is unlikely that liquefaction induced ground deformation could occur within the area in response to a large earthquake event, and that the ground settlements within the area in response to seismic loading should be considered to be "within normally accepted tolerances" as defined by the MBIE December 2012 guidance document.

(f) It is our opinion that the soils underlying the subject site will exhibit only a low compressibility under the relatively light static foundation loads associated with a residential building development constructed in accordance with the requirements of NZS 3604: 2011, New Zealand Standard, Timber Framed Buildings.

It is, therefore, our opinion that settlement should not present a problem for future proposed residential development at the site, providing the inspection and design of foundations are carried out in accordance with the requirements of the relevant New Zealand Standard Codes of Practice, and in accordance with the recommendations presented in this report.

14.2 RECOMMENDATIONS

Our recommendations based on the field data obtained from the site and as presented in this report, our visual appraisal of the site, our study of the geological maps relating to the area and our professional judgement and opinions, are as follows:

(a) It is our opinion that an appropriate foundation solution for the site conditions would be a shallow foundation system designed in accordance with the requirements of NZS 3604: 2011, New Zealand Standard, Timber Framed Buildings (as modified by B1/AS1), founded in the underlying alluvial sediments.

Fraser Thomas Ltd should be engaged to inspect any foundation excavations, prior to the placement of any foundation materials, in order to confirm that the excavations are founded in competent alluvial sediments.

(b) There is in our opinion a risk, if the stockpile material is not appropriately removed from the site, that foundations and floors underlain by stockpile material may be subject to differential movement. It is therefore recommended that any foundation excavations associated with any new structure be founded beneath any surficial stockpile material into the underlying natural alluvial sediments. It is also recommended that any surficial stockpile material be undercut from beneath the footprint of any proposed building.

It is recommended that Fraser Thomas Ltd be engaged to inspect, in particular, any foundation excavations and building subgrades located within the area inferred to be underlain by stockpile material, as shown on drawing G01082-01, in order to confirm that stockpile material has been removed from beneath the footprint of any proposed new building.

(c) There is, in our opinion, a risk that foundations founded on or within non-engineered fill material may be subject to differential settlement which may adversely affect any future proposed building development. It is therefore recommended that foundations located in this area be founded beneath any non-engineered fill material into competent natural ground or engineered fill. Alternatively, the non-engineered fill material should be appropriately undercut/removed from site, as part of any proposed subdivisional earthworks. The approximate inferred location and extent of the backfilled farm pits, and the inferred 'backfilled' section of abandoned water race, are shown on drawing G01082-01.

Fraser Thomas Ltd should be engaged to inspect any foundation or undercut excavations, prior to the placement of any foundation of fill materials, in order to confirm that the excavations are founded in competent natural ground or engineered fill.

(d) As discussed in Section 6.2 of this report, an existing shallow water race generally extends through the south-western part of the site, and generally along the north-eastern boundaries of Lots 1 and 2 DP 72132. The approximate inferred location and extent of the existing water race, as it affects the subject site, is shown on the appended drawing G01082-01.

In order to mitigate the risk of any proposed future shallow foundations being adversely affected by the settlement of recent alluvial sediments, it is recommended, unless further specific investigation and appraisal works are undertaken by a Chartered Professional Engineer experienced in geotechnical engineering, that shallow foundations associated with any proposed future dwellings at the site, be located no closer than a horizontal distance of 5 m from the crest of any water race side slopes at the site.

It should be noted, should the site be subject to residential development, that the subdivisional earthworks would likely involve the stripping of the water race and the backfilling of the water race with engineered fill material. Providing the earthworks are undertaken appropriately, the backfilling of the water race would result in the removal of the requirement for any horizontal offset from the water race, for shallow foundation design purposes.

(e) A minimum ultimate static bearing capacity value for vertical loading of 300 kPa is recommended for shallow concrete pads or beam foundations, founded in the underlying alluvial sediments. It is recommended that a strength reduction factor (Φ_{bc}) of 0.5 be adopted for limit state design in accordance with the requirements of AS/NZS 1170, resulting in a design (dependable) bearing capacity value of 150 kPa.

If unfactored load combinations are to be considered, the allowable foundation bearing pressures presented in Table 1 are recommended for shallow concrete pads or beam foundations, founded in the underlying alluvial sediments.

(f) It is recommended that the location and depth of any buried services should be verified at the site prior to the commencement of foundation construction.

Due to the risk of consolidation settlement of the trench backfill occurring, it is recommended that, if any foundations of any proposed new building are located within the zone of influence of any existing service line, either the trench backfill be excavated and replaced with compacted hardfill or the foundations and floor of the proposed new building be designed to span across the trench backfill and the adjacent zone of influence.

(g) It is recommended that, unless the stability of any developmental earthworks (i.e. constructed for an access driveway, building platform or landscaping) is considered in detail by a chartered professional engineer experienced in geotechnical engineering, and particularly slope stability considerations, permanent fill end and cut slopes should be constructed to a maximum batter slope of 26° (1V:2H) with maximum batter heights of approximately 1.0 m. Any proposed higher permanent batter slopes should be subject to specific stability appreciation so as to determine stable limiting batter slopes.

(h) It is recommended that any temporary excavated slopes be constructed to a maximum batter slope of 45^{o} (1V:1H), with a maximum batter height of approximately one meter. It is recommended that any temporary excavation slopes not be left unsupported for a period exceeding one month. It is also recommended that stormwater run-off be diverted away from the crest of any proposed temporary excavation slopes.

15.0 LIMITATIONS

The professional opinion expressed herein has been prepared solely for, and is furnished to our client, Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd, and Selwyn District Council for their purposes only with respect to the particular brief given to us, on the express condition that it will not be relied upon by any other person or for any other purposes without our prior written agreement, and relates to the conditions that exist up to and at the time of this report.

No liability is accepted by this firm or by any principal, or director, or any servant or agent of this firm, in respect of the use of this report by any other person, and any other person who relies upon any matter contained in this report does so entirely at its own risk. This disclaimer shall apply notwithstanding that this report may be made available to any person by any person in connection with any application for permission or approval, or pursuant to any requirement of law.

This report does not comment on stormwater management, flooding, root effects and land uses outside the specific site, which may be required to be assessed to complete a foundation design for building consent application purposes.

Notwithstanding the foregoing, if the circumstances at the subject site change with respect to topography or the proposed development concept, or the buildings are subject to further damaging earthquakes, or if a period of more than three years has elapsed since the date of this report, this report should not be used without our prior review and written agreement.

The conclusions and recommendations expressed herein should be read in conjunction with the remainder of this report and should not be referred to out of context with the remainder of this report.

Report prepared by:
FRASER THOMAS LTD.

S P GLADWIN
Engineering Geologist

Report reviewed and approved by:

M V REED
Director
Chartered Professional Engineer

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Machine Excavated Test Pits

Fraser Thomas
50 Years
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BOREHOLE AND TEST PIT LOGS SYMBOLS AND TERMS

SYMBOLS AND ABBREVIATIONS

RL	Reduced Level
EOH	End of Hole
•	Shear vane test result
UTP	Unable to Penetrate
SPT	Standard Penetration Test
N	SPT blows per 300mm penetration
35/90	35 blows per 90mm penetration after seating for SPT
(s)	Inclusive of seating blow count for SPT
GWL	Ground Water Level

Wf	Field water content
Wp	Plastic limit (%)
WL	Liquid Limit (%)
RQD	Rock Quality Designation
SG	Specific Gravity
%F	Percentage fines (<75 microns)
PSD	Particle size distribution
CONS	Consolidation test
COMP	Compaction test
UCS	Unconfined Compressive Strength
k	Permeability coefficient (m/s)
LS	Linear Shrinkage (%)
OC	Organic Content (%)

SOIL


TOPSOIL


CLAY


SILT


SAND


GRAVEL


COBBLES


BOULDERS


PEAT


FILL

CONSISTENCY TERMS

Cohesive Description	Undrained Shear Strength (kPa)
Very Soft	<12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	>200

RELATIVE DENSITY

Non-cohesive Description	SPT "N" Value
Very Loose	<4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

ROCK


LIMESTONE


MUDSTONE


SANDSTONE


CONGLOMERATE


BRECCIA


RYHOLITE


ANDESITE


BASALT

STRENGTH

Description	Unconfined Compressive Strength MPa
Extremely Weak	< 1
Very Weak	1 - 5
Weak	5 - 20
Moderately Strong	20 - 50
Strong	50 - 100
Very Strong	100 - 250
Extremely Strong	> 250

WEATHERING

UW - Unweathered (fresh rock)

SW - Slightly Weathered

MW - Moderately Weathered

HW - Highly Weathered

CW - Completely Weathered

RS - Residual Soil

SPACING OF DISCONTINUITIES

Term	Aperture (mm)
Very widely spaced	>2000
Widely spaced	600 to 2000
Moderately widely spaced	200 to 600
Closely spaced	60 to 200
Very closely spaced	20 to 60
Extremely closely spaced	<20

Notes

1. Based on New Zealand Geotechnical Society " Field Description of Soil and Rock,Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes" December 2005
2. Composite soil types are signified by combined symbols

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TEST PIT LOG

Hole No: TP1

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Description of Strata

SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]

GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist [ALLUVIAL SEDIMENTS]

1.3 m - 1.4 m: Lense of SAND (fine to medium)

2.3 m: trace boulders

EOTP: 4.40 m TARGET DEPTH

Geological Unit: T/S; Late Pleistocene Alluvial Sediments

Graphic Log: TS

Undrained Shear Strength (kPa)

Vane readings corrected as per BS 1377

● Shear Vane ○ Residual Shear Vane

50 100 150 200 Values

Dynamic Cone Penetrometer

Test Method: NZS 4402:1988, Test 6.5.2 (Blows / 50mm)

2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:

1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP2

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.30	EOTP: 2.30 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP3

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
4.4	EOTP: 2.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP4

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
1.0	1.0 m - 1.1 m: Lense of SAND (fine to medium)		
2.7	EOTP: 2.70 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP5

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.10	EOTP: 2.10 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Depth (m) 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2 4.4 4.6 4.8

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP6

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.0	1.9 m - 2.0 m: Lense of GRAVEL (fine to medium)		
3.0	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist		
4.4	EOTP: 4.40 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP7

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.0	EOTP: 2.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Depth (m) 0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2 4.4 4.6 4.8

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout..

Datum:

Coordinates:

Fraser Thomas
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TEST PIT LOG

Hole No: TP8

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.0	EOTP: 2.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Depth (m) 0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2 4.4 4.6 4.8

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP9

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 2.2	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.4	EOTP: 2.30 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP10

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0 – 1.2	SAND, some gravel (fine to coarse), brown and orangey brown, dry, rootlets, containing concrete cinderblocks, cow ribs, sheep bones, chicken skulls [NON ENGINEERED FILL]	Fill	
1.2 – 2.4	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.4	EOTP: 2.50 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP11

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 1.8	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.0	EOTP: 1.90 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP12

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 3.4	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS] 0.8 m - 0.9 m: SAND (fine to medium)	Late Pleistocene Alluvial Sediments	
3.40	EOTP: 3.40 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP13

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0 – 0.2	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL/FILL]	T/S	
0.2 – 0.8	GRAVEL (fine to coarse), sandy (fine to coarse), brown and orangey brown, dry, rootlets, containing rubbish comprising plastic push chair, clothes, metal, concrete fragments, glass bottles, potential asbestos contamination [NON ENGINEERED FILL]	Fill	
0.8 – 1.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
1.6	EOTP: 1.50 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP14

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 1.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
1.8	EOTP: 1.70 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP15

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 2.2	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.30	EOTP: 2.30 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP16

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 3.2	GRAVEL (medium to coarse, subrounded greywacke), some sand (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
3.2	EOTP: 3.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP17

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, trace gravel (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 2.2	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.30	EOTP: 2.30 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Depth (m): 0.2 0.4 0.6 0.8 **1.0** 1.2 1.4 1.6 1.8 **2.0** 2.2 2.4 2.6 2.8 **3.0** 3.2 3.4 3.6 3.8 **4.0** 4.2 4.4 4.6 4.8

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP18

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 2.0	GRAVEL (medium to coarse, subrounded greywacke), some sand (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.10	EOTP: 2.10 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP19

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
1.0	GRAVEL (medium to coarse, subrounded greywacke), some sand (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist		
1.4	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist		
3.2	EOTP: 3.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP20

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, trace gravel (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 2.2	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.4	EOTP: 2.30 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Depth (m)	Dynamic Cone Penetrometer (Blows / 50mm)	Groundwater
0.2	1	GWNE
0.4	1	
0.6	1	
0.8	2	
1.0	2	
1.2	2	
1.4	2	
1.6	4	
1.8	5	
2.0	15	
2.2		
2.4		
2.6		
2.8		
3.0		
3.2		
3.4		
3.6		
3.8		
4.0		
4.2		
4.4		
4.6		
4.8		

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP21

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		11/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
1.4	GRAVEL (medium to coarse, subrounded greywacke), some sand (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist		
2.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist		
4.0	EOTP: 4.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP22

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		11/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.4	GRAVEL (medium to coarse, subrounded greywacke), some sand (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist		
3.0	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist		
3.2	EOTP: 3.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP23

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		11/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	
0.4 – 2.4	GRAVEL (medium to coarse, subrounded greywacke), some sand (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.6	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets		
2.6	EOTP: 3.20 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP24

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, trace gravel (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 2.0	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.2	EOTP: 2.10 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP25

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, gravelly (fine to coarse), some sand (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	
0.4 – 3.8	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), some cobbles, yellowish brown to greyish brown, dense, moist, some rootlet [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
2.0	2.0 m - 2.1 m: Gravel (fine to medium)		
3.8	EOTP: 3.80 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP26

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		08/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, trace gravel (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 1.8	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Alluvial Sediments	
2.0	EOTP: 1.90 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Depth (m): 0.2 0.4 0.6 0.8 **1.0** 1.2 1.4 1.6 1.8 **2.0** 2.2 2.4 2.6 2.8 **3.0** 3.2 3.4 3.6 3.8 **4.0** 4.2 4.4 4.6 4.8

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP27

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		11/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, trace gravel (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 0.8	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
1.0	0.6 m - 0.7 m: SAND, gravelly (fine)		
2.0	EOTP: 2.10 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP28

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		11/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, trace gravel (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 4.8	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS] 0.6 m - 0.7 m: SAND, gravelly (fine)	Late Pleistocene Alluvial Sediments	

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile: EOTP: 5.00 m TARGET DEPTH

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

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TEST PIT LOG

Hole No: TP29

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		11/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.2	SILT, trace gravel (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.4 – 1.8	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS] 1.1 m - 1.2 m: Orangey brown lense	Late Pleistocene Alluvial Sediments	
2.0	EOTP: 2.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Test pit side walls stable throughout.

Datum:

Coordinates:

Fraser Thomas
ENGINEERS • RESOURCE MANAGERS • SURVEYORS

TEST PIT LOG

Hole No: TP30

Project No:	Project:	Shear Vane:	Date Excavated:	Logged By:	Checked By:
CH01082	Gallina Nominees, Heinz Wattie Pension Fund, and Brookside Road Residential Ltd Brookside Road Plan Change		11/10/2021	KT	

Depth (m)	Description of Strata	Geological Unit	Graphic Log
0.0	SILT, trace gravel (fine to coarse), dark brown, dry, rootlets [TOPSOIL]	T/S	TS
0.2	GRAVEL (fine to coarse, subrounded greywacke), sandy (fine to coarse), minor cobbles, trace boulders, yellowish brown to greyish brown, dense, moist, some rootlets [ALLUVIAL SEDIMENTS]	Late Pleistocene Alluvial Sediments	
1.1	1.1 m - 1.2 m: Orangey brown lense		
2.0	EOTP: 2.00 m TARGET DEPTH		

Undrained Shear Strength (kPa)
Vane readings corrected as per BS 1377
● Shear Vane ○ Residual Shear Vane
50 100 150 200 Values

Dynamic Cone Penetrometer
Test Method: NZS 4402:1988, Test 6.5.2
(Blows / 50mm)
2 4 6 8 10 12 14 16
1 2 2 30 >>

Groundwater: GWNE

Profile:

Excavation Method:

Remarks:
1. Groundwater not encountered on 8/10/2021.
2. Dynamic Cone Penetrometer (DCP) test performed from ground surface.
3. Test pit side walls stable throughout.

Datum:

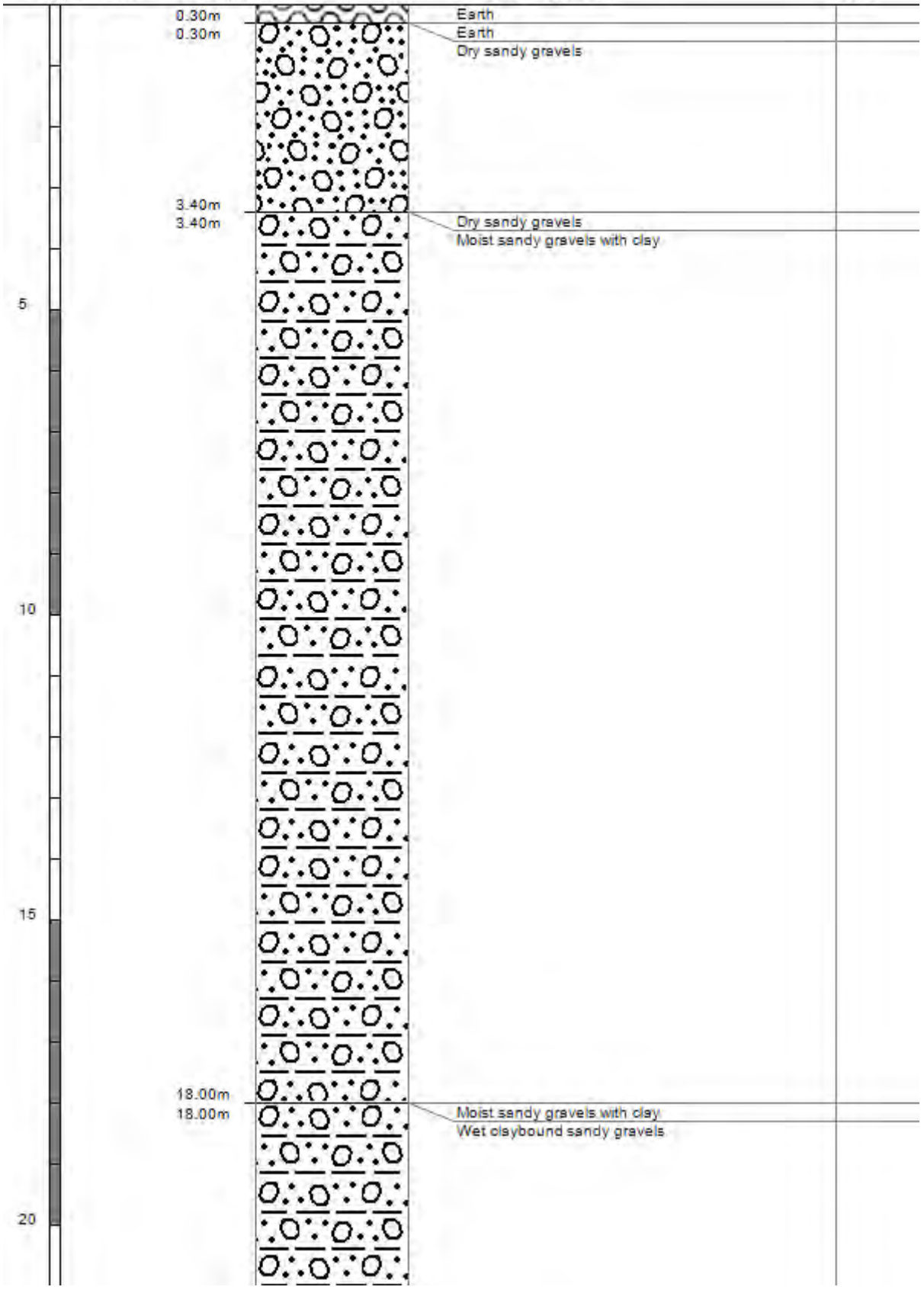
Coordinates:

ECan Borehole Logs

Borelog for well M36/7538

Grid Reference (NZTM): 1547229 mE, 5171000 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 48.8 m +MSD Accuracy: < 0.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary Rig
Borelog Depth: 42.0 m Drill Date: 07-Jan-2004

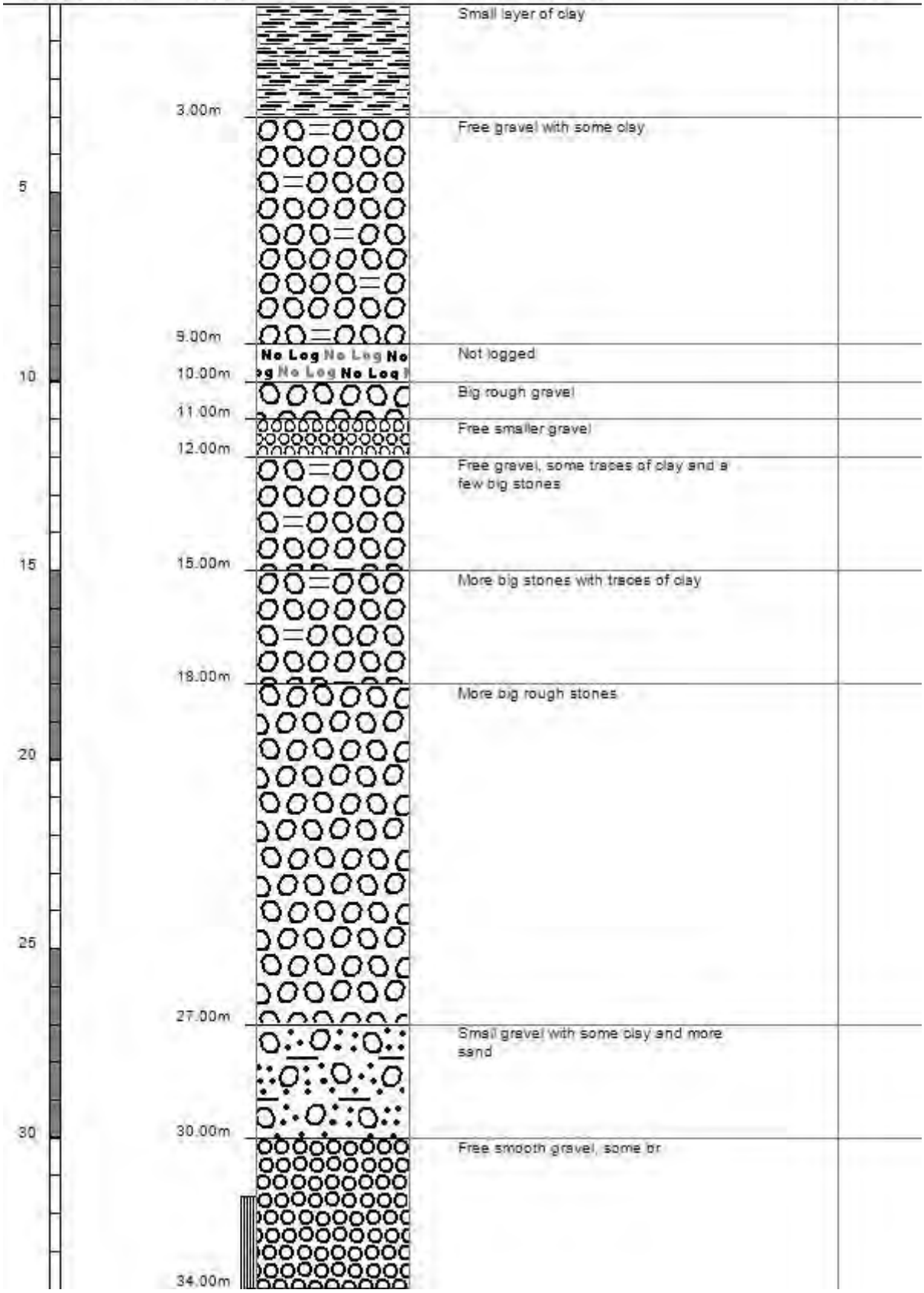
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/3065

Grid Reference (NZTM): 1548208 mE, 5171090 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 50.4 m +MSD Accuracy: < 2.5 m
Driller: Smith, J R & I G
Drill Method: Cable Tool
Borelog Depth: 34.0 m Drill Date: 20-Jul-1985

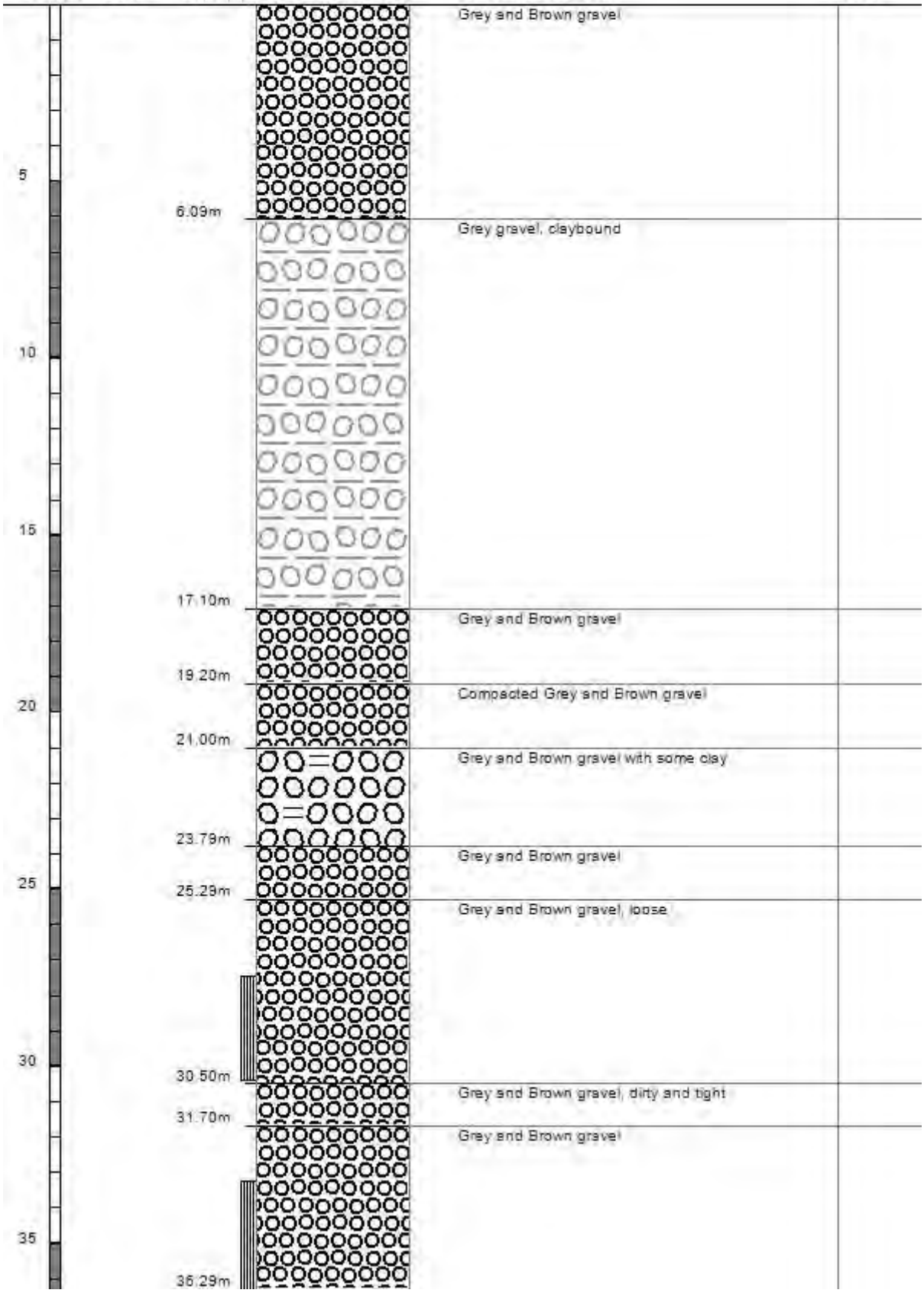
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/0015

Grid Reference (NZTM): 1548408 mE, 5170591 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 47.2 m +MSD Accuracy: < 2.5 m
Driller: A M Bisley & Co
Drill Method: Driven Pipe
Borelog Depth: 36.3 m Drill Date:

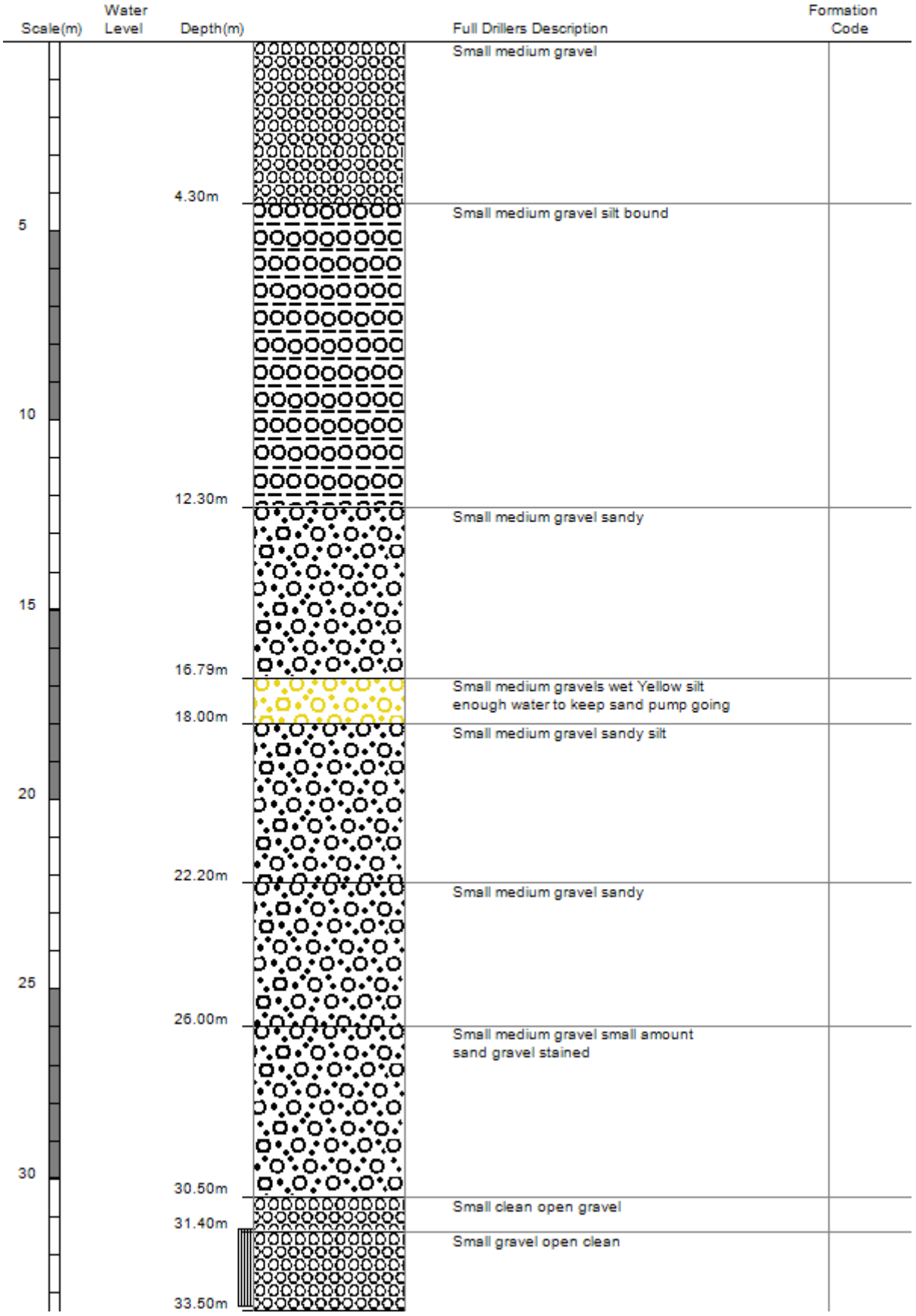
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/5047

Grid Reference (NZTM): 1548878 mE, 5170491 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 45.1 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 33.5 m Drill Date: 01-Dec-1995

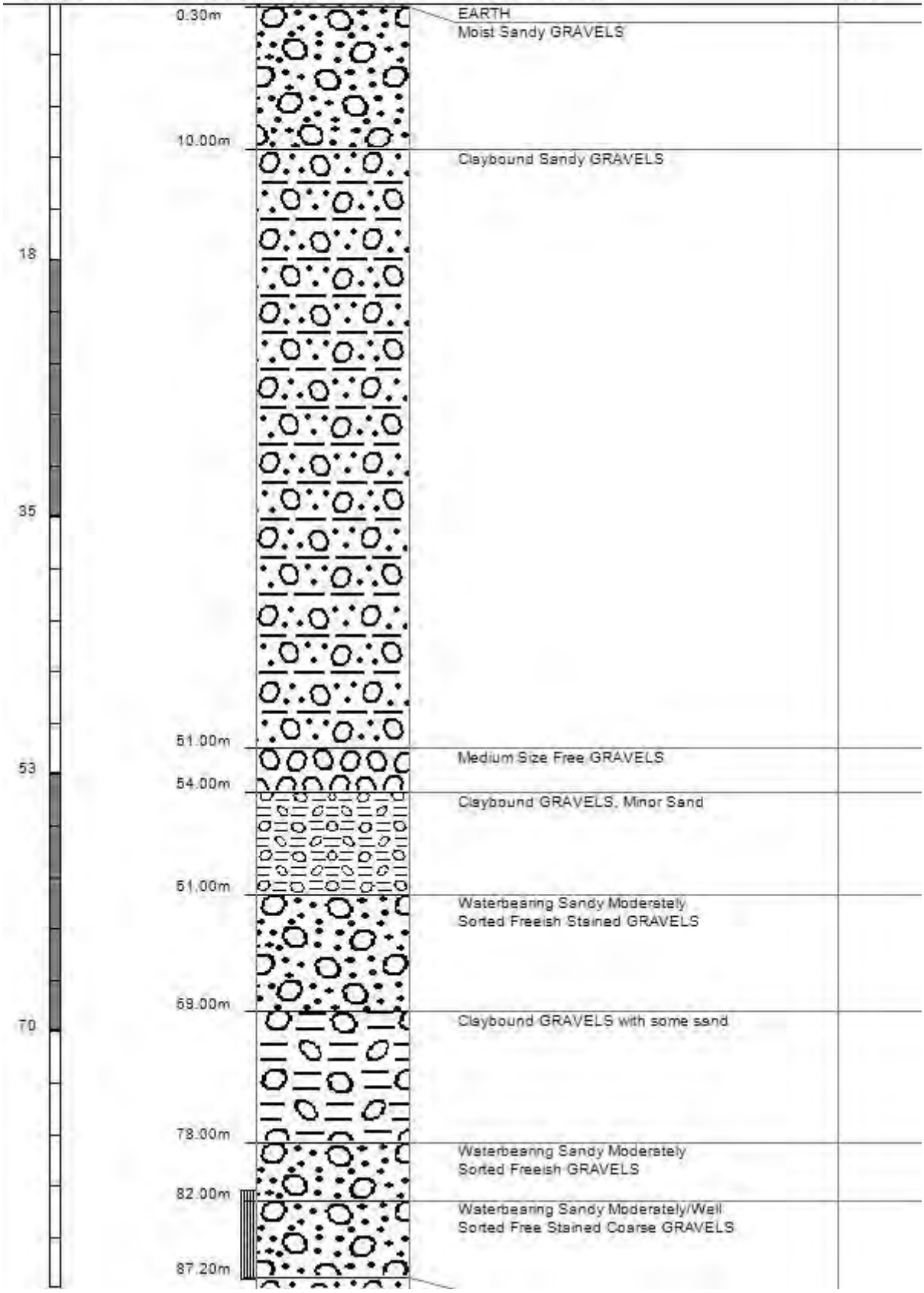
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well BX23/0144

Grid Reference (NZTM): 1548829 mE, 5170152 mN
Location Accuracy: 10 - 50m
Ground Level Altitude: m +MSD Accuracy:
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 88.0 m Drill Date: 07-Dec-2012

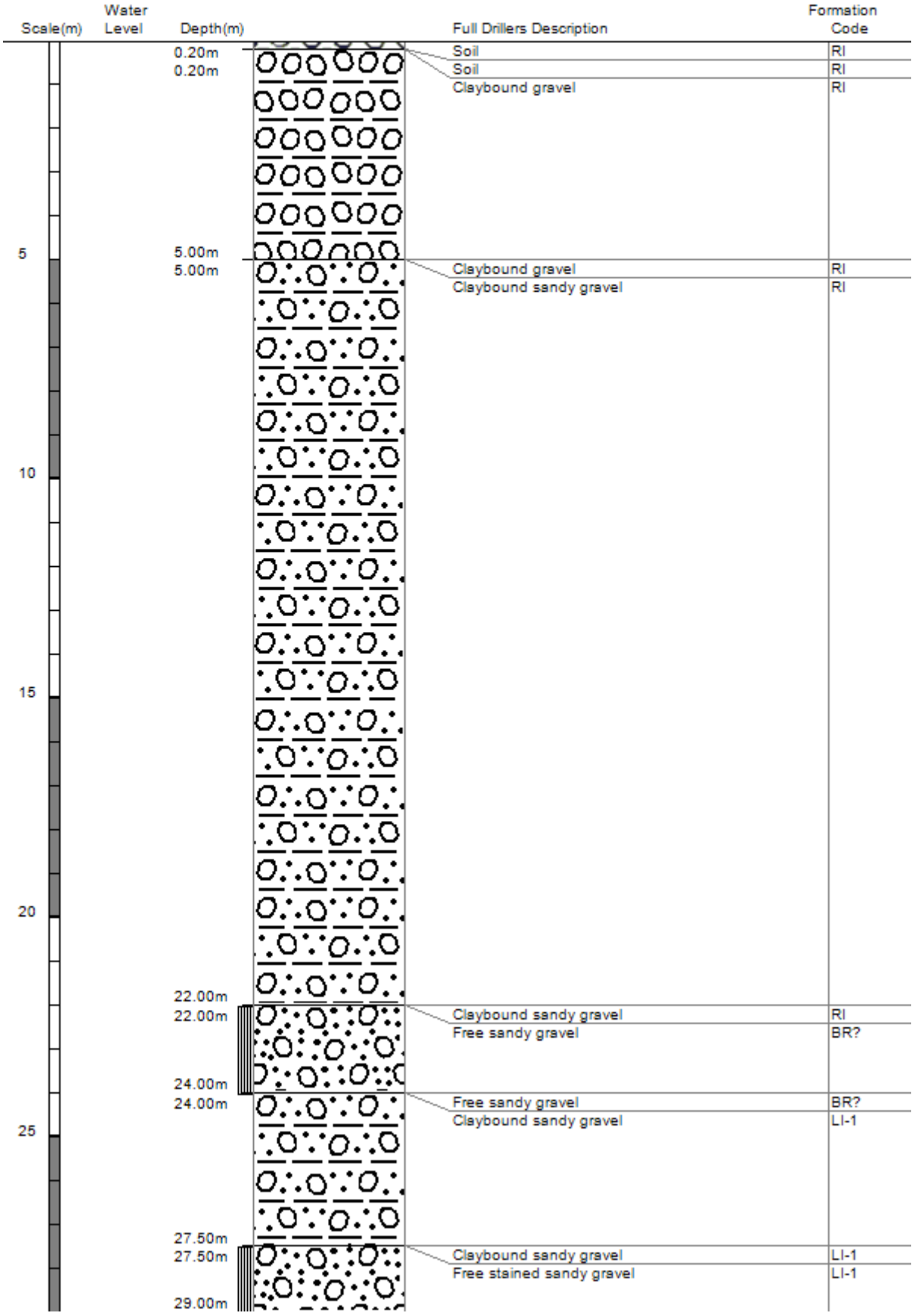
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/5881

Grid Reference (NZTM): 1548229 mE, 5169063 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 38.4 m +MSD Accuracy: < 0.5 m
Driller: Smiths Welldrilling
Drill Method: Rotary Rig
Borelog Depth: 29.0 m Drill Date: 25-Sep-1999

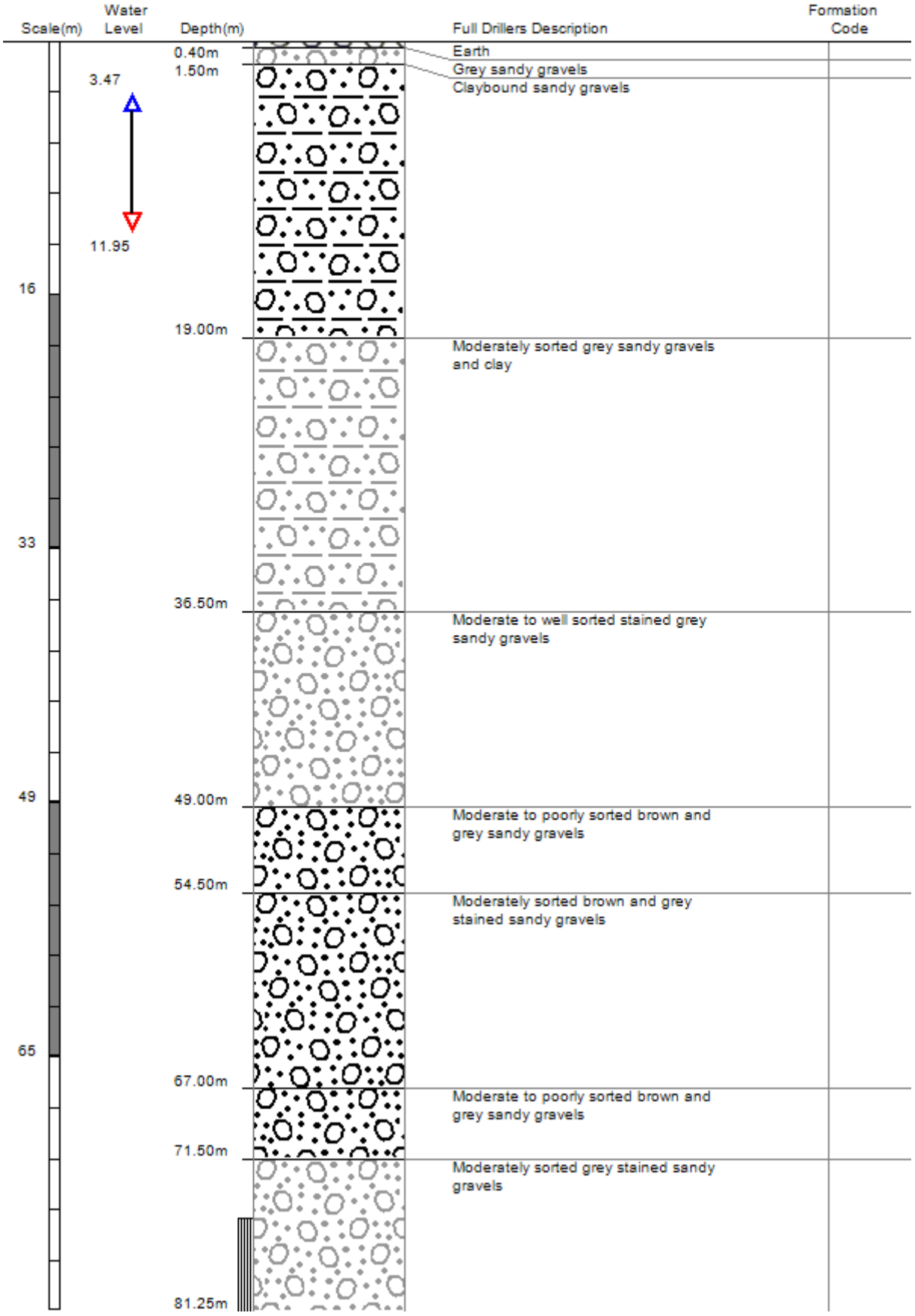
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/7361

Grid Reference (NZTM): 1547536 mE, 5169315 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 44.7 m +MSD Accuracy: < 2.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 81.3 m Drill Date: 24-Jun-2003

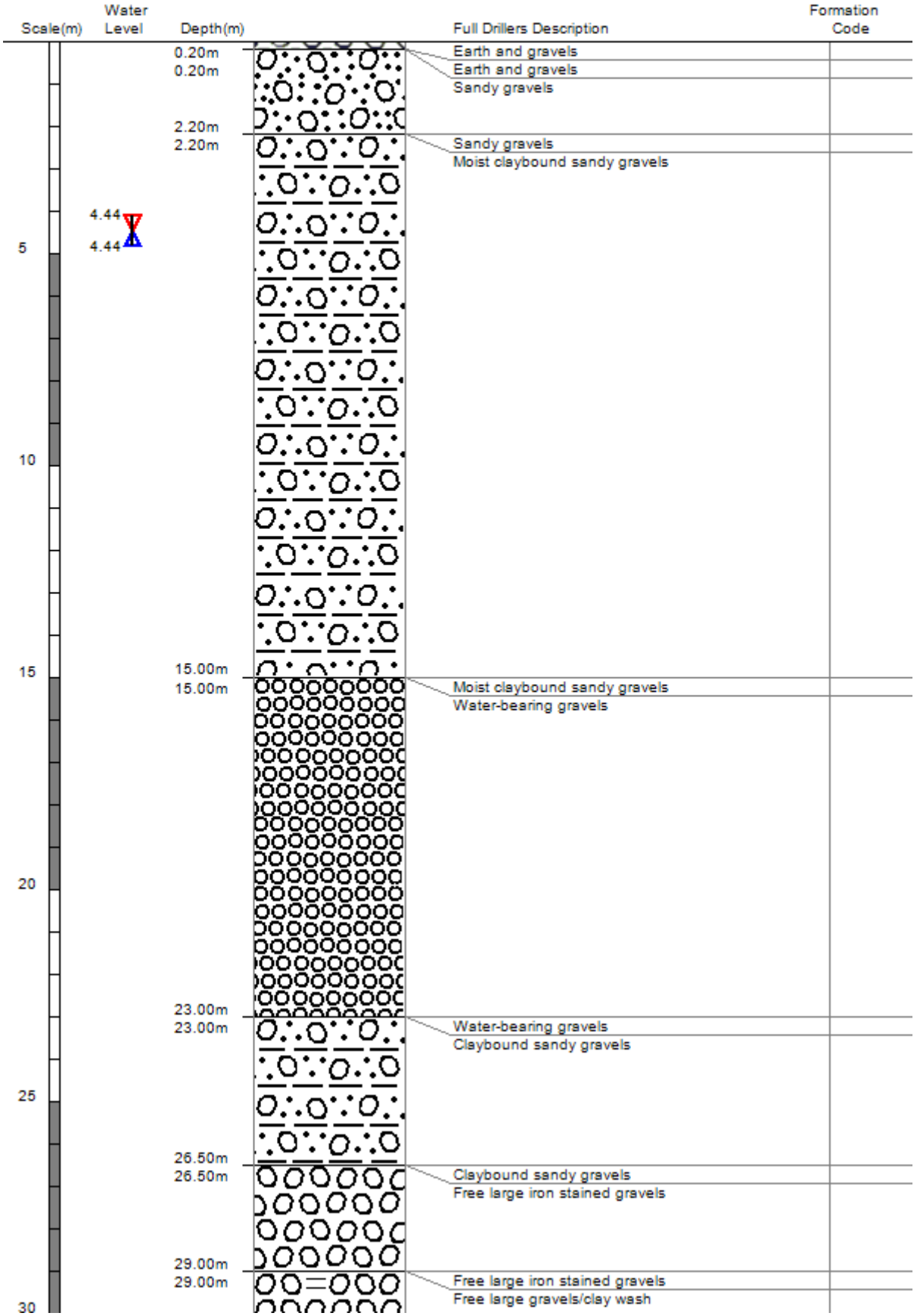
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/7225

Grid Reference (NZTM): 1547716 mE, 5170325 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 45.7 m +MSD Accuracy: < 0.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 60.0 m Drill Date: 25-Sep-2002

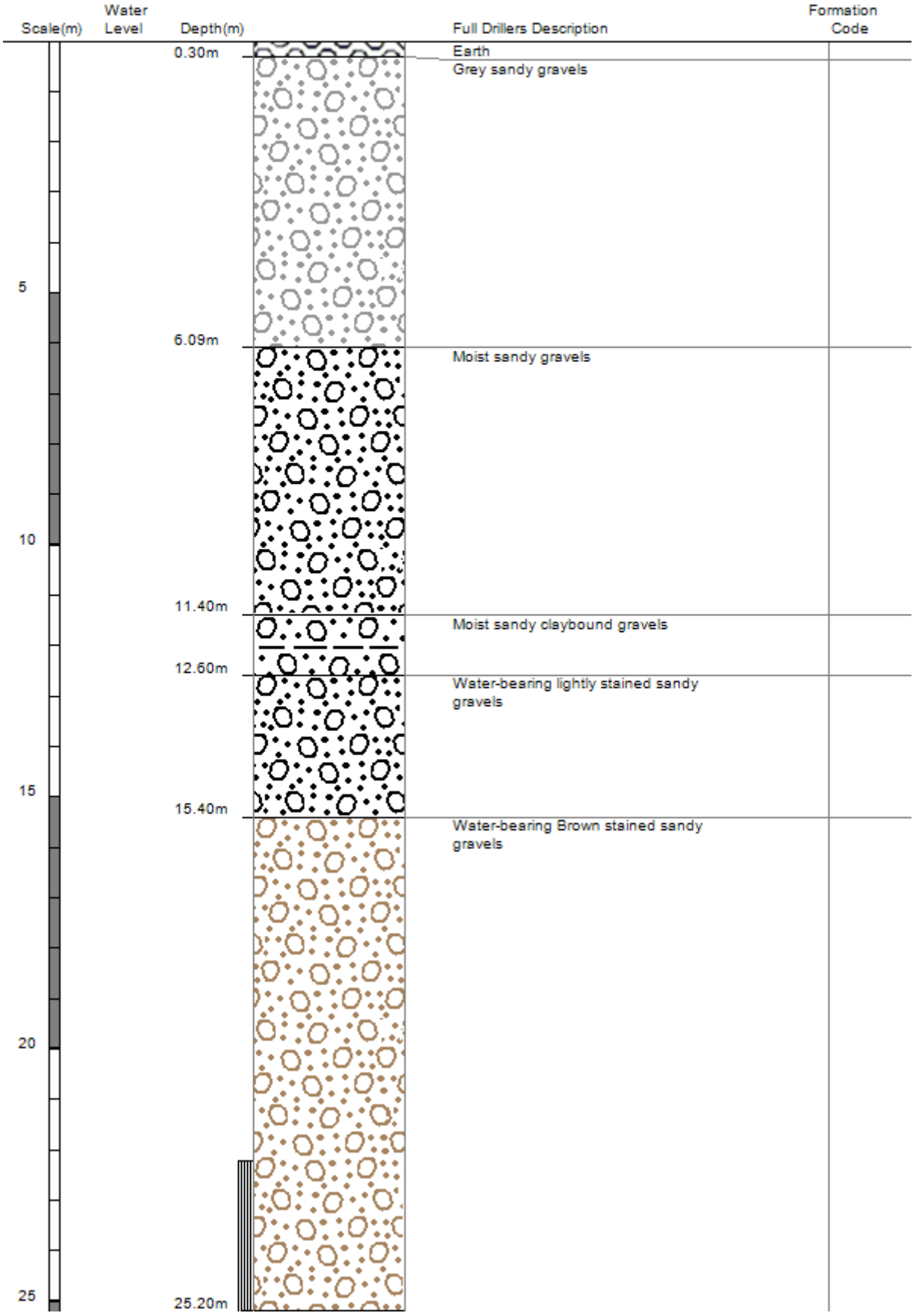
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

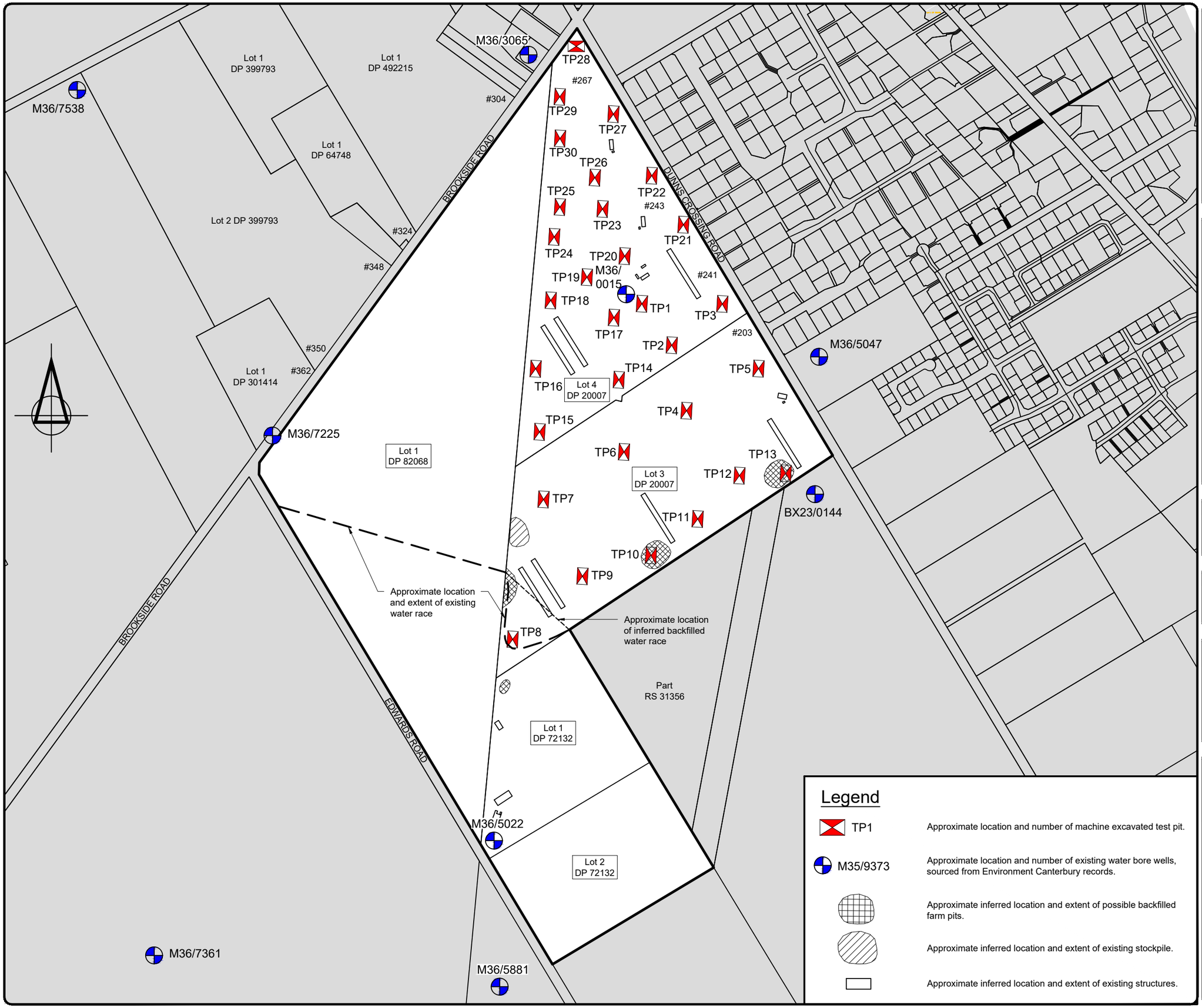


Borelog for well M36/5022

Grid Reference (NZTM): 1548158 mE, 5169498 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 41.1 m +MSD Accuracy: < 2.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 25.2 m Drill Date: 25-Apr-1996

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha





Legend

TP1	Approximate location and number of machine excavated test pit.
M35/9373	Approximate location and number of existing water bore wells, sourced from Environment Canterbury records.
	Approximate inferred location and extent of possible backfilled farm pits.
	Approximate inferred location and extent of existing stockpile.
	Approximate inferred location and extent of existing structures.

SURVEYED			APPROVED DATE
DESIGNED			MVR
DRAWN	KT	11/10/2021	
CAD	GS	13/10/2021	
CHECKED			

REVISION	CHANGES	CHECKED	DATE

NOTES

1. This plan has been adopted from Grip map. The location and extent of the site boundaries and site features are therefore considered to be approximate only.

CLIENT

GALLINA NOMINEES, HEINZ WATTIE PENSION FUND, AND BROOKSIDE ROAD RESIDENTIAL LTD

PROJECT

BROOKSIDE ROAD PLAN CHANGE, ROLLESTON

TITLE

SITE PLAN

Fraser Thomas

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SCALE 1:7500 (A3)

DRAWING No G01082-01 REVISION A

SHEET 1 of 1