



MILLWATER - PRECINCT 2 STAGE 2C

Geotechnical Completion Report

Prepared for

WFH Properties Ltd

Prepared by

Tonkin & Taylor Ltd

Date

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Executive summary

Tonkin + Taylor Ltd (T+T) was engaged by WFH Properties Ltd to monitor and provide earthworks certification for the 67 No. Residential Lots contained within Stage 2C of Precinct 2 in the Millwater Subdivision in Silverdale. Stage 2C comprises residential Lots 244 to 277, 281 to 303, 316, 324 to 330, 355 and 386 inclusive as shown on the Woods Final Contour As-Built Plans (Woods Ref 33209-02C-AB-100 and -101) in Appendix A1. This Geotechnical Completion Report contains information required for subdivisional earthworks completion reporting, as well as outlining geotechnical design issues that need to be considered for subsequent building design and construction on each residential Lot.

Previous geotechnical investigation work across the subdivision was undertaken by T+T and reported in:

- a 2000 and 2001 Preliminary feasibility reporting (Ref. [1] and [2]).
- b 2003 Major reconnaissance report covering land in the Silverdale North and Orewa West areas (Ref. [3]).
- c 2004 Geotechnical Investigation Report for the Wainui Road Subdivision (Ref. [4]), updated in October 2005 following scheme modifications (Ref. [5]).
- d 2006 Investigation report following purchase of Westlake property (Ref. [6]).
- e May 2014 Geotechnical Investigation Report for Precinct 2 (Ref. [7]).

Woods Ltd (Woods) undertook the engineering design for this stage and the overall subdivision.

Bulk earthworks commenced on site in 2007, temporarily ceased in late 2008, recommenced in 2013, and were completed by November 2015. Earthworks comprised the following:

- a Stripping of vegetation, organic materials and topsoil to stockpile.
- b Installation of gully and subsoil drains.
- c Cut to fill earthworks across the entire site, incorporating construction of 5 No. reinforced earth slopes (i.e. part of RE Slopes 204, 403, 406, 601 and 602), as shown on T+T Drawing 21854.001-P2S2C-101 in Appendix A2.

Stage 2C Civil earthworks commenced on site in November 2015 and were completed by June 2016, and comprised the following:

- a Minor cut to fill earthworks across parts of the site as part of final Lot development, as shown on the Woods Cut/Fill Contour As-Built Plans Earthworks Surface – Final Surface (Woods Ref 33209-02C-AB-112 and -113) in Appendix A1.
- b Construction of 2 No. timber pole retaining walls (i.e. Walls 310 and 311) in the location shown on the Woods Retaining Walls As-Built Plan (Woods Ref 33209-02C-AB-130) in Appendix A1.
- c Installation of roading and services.

Overall subdivisional soil types are moderately to highly expansive (Class M to H1), based on laboratory testing undertaken in accordance with AS 2870:2011. Due to this classification, soils lie outside the definition of good ground within NZS 3604:2011. Building foundations will require either specific foundation design for expansive soils or foundation design in accordance with AS 2870:2011. Subject to design issues outlined in Section 3, and CSIRO recommendations outlined in the appendices relating to expansive soils foundation design and home owner maintenance, each residential Lot is considered to have a building platform area generally suitable for domestic residential development subject to specific geotechnical assessment and foundation design due to the presence of expansive soils and where Lots contain, or are adjacent to, land with slopes steeper than 1 in 4 (V:H). Foundation design for residential development should proceed in accordance with Sections 6.5 to 6.10 of this report.

1 Introduction

1.1 General

Tonkin + Taylor Ltd (T+T) was engaged by WFH Properties Ltd to monitor and provide earthworks certification for the 67 No. Residential Lots contained within Stage 2C of Precinct 2 in the Millwater Subdivision in Silverdale. Stage 2C comprises residential Lots 244 to 277, 281 to 303, 316, 324 to 330, 355 and 386 inclusive as shown on the Woods Final Contour As-Built Plans (Woods Ref 33209-02C-AB-100 and -101) in Appendix A1.

Previous geotechnical investigation work across the subdivision was undertaken by T+T and reported in:

- a 2000 and 2001 Preliminary feasibility reporting (Ref. [1], [2]).
- b 2003 Major reconnaissance report covering land in the Silverdale North and Orewa West areas (Ref. [3]).
- c 2004 Geotechnical Investigation Report for the Wainui Road Subdivision (Ref. [4]), updated in October 2005 following scheme modifications (Ref. [5]).
- d 2006 Investigation report following purchase of Westlake property (Ref. [6]).
- e May 2014 Geotechnical Investigation Report for Precinct 2 (Ref. [7]).

The preliminary (Ref. [1], [2]) and investigation (Ref. [3], [4], [5], [6], [7]) reports noted the presence of existing instability comprising landsliding, soil creep and shallow slope movement across much of Precinct 2. These features were proposed to be stabilised, and/or undercut and replaced with engineered fill, during development works. While these stabilisation works are required across much of Precinct 2, stability analyses indicated that shear keys and geotechnical remediation works were not required to achieve satisfactory factors of safety against instability for the finished development of Stage 2C. This is generally as a result of the proposed earthworks essentially buttressing the potentially unstable areas with significant quantities (up to 13m depth) of engineered fill, as well as cuts of up to 13m depth through the original ridgelines.

Earthworks compaction control, in terms of minimum shear strengths and maximum air voids, was recommended, and, along with other recommendations, has been incorporated into our control of the works and, where applicable, included in completion reporting.

The scope of work covered by this completion report includes:

- a Review of geotechnical investigation reporting for the site;
- b Monitoring and certification of earthworks operations in compliance with NZS 4431:1989 (Ref. [8]);
- c Monitoring and certification of construction of 2 No. timber pole retaining walls and 5 No. reinforced earth slopes;
- d Assessment of soils for expansive conditions in accordance with AS 2870:2011 (Ref. [9]);
- e Certification of completed Lots for residential development in accordance with NZS 3604:2011 (Ref. [10]).

Woods Ltd (Woods) undertook subdivision engineering design and civil works construction observation. As-built plans showing final contours and cut and fill depths have been prepared by Woods and are attached in Appendix A1.

1.2 Description of Subdivision

The Millwater subdivision is situated to the north of the Silverdale Township, and west of the Metro Park East reserve area, and comprises approximately 260 hectares. The subdivision is bound to the south and west by Wainui Road, to the north by the Orewa Estuary and to the east by the Orewa Estuary and Millwater Parkway. The original site comprised a mix of farm properties and associated dwellings and existing residential developments.

The Precinct 2, Stage 2C area of the Millwater subdivision is located within what is known as Precinct 2 in the Silverdale North Structure Plan.

The Precinct 2 area is bound by Manuel Road to the northwest, Old Mill Road to the east, Wainui Road to the south and west, and Precinct 3 to the northeast. The overall Precinct 2 and Stage 2C areas are shown on T+T Drawing 21854.001-P2S2C-100 in Appendix A2.

Pre-development gradients within the Stage 2C area were gentle to moderately steep (1 in 3 to 1 in 15 (V:H)) with an overall fall to the south east.

Post-development gradients within the Stage 2C area remain gentle to moderately steep (1 in 3 to 1 in 15 (V:H)) and generally fall to the south east as before. In order to form more level building platforms, 2 No. timber pole retaining walls and 5 No. reinforced earth slopes of between 1 in 1.5 and 1 in 2 (V:H) have been constructed along some Lot boundaries as shown on T+T Drawing 21854.001-P2S2C-101.

Stage 2C is presently accessed from the existing Manuel and Wainui Roads.

1.3 Geological Setting

Published geological mapping and information indicates the Precinct 2 area is underlain by Northland Allochthon materials. In addition to the Northland Allochthon, our investigations identified the presence of alluvial materials on site.

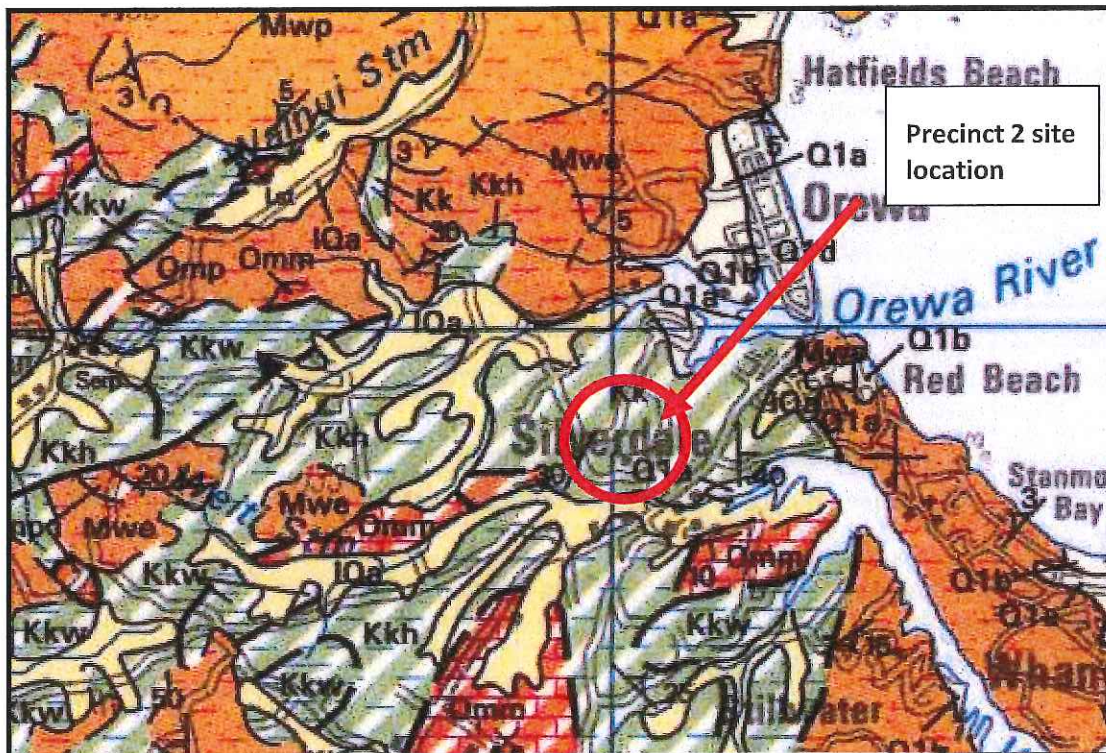


Figure 1 - Local Geology (from Edbrooke)

Land south of the Orewa River is located on an area of extensively deformed and sheared mudstones and muddy to sandy limestones described as Onerahi Chaos – Northland Allochthon material. Recent stream alluvium and slope colluvium derived from residual Northland Allochthon material is mapped towards the base of the gullies at the bottom of the slopes. Recent stream alluvium and discontinuous areas of older Pleistocene Age alluvium are also likely to be present overlying the Northland Allochthon.

Summary descriptions of geological units in Wainui/Manuel Roads area (after Kermode 1991) are as follows:

a Northland Allochthon

Deformed sediments, commonly known as Onerahi Chaos - Northland Allochthon: forms hummocky rolling hills covering more than 100 km² west of Whangaparaoa Peninsula. Mixture of undifferentiated deposits of various and widely sized (cm-km), randomly oriented blocks comprising conglomerate limestone, mudstone, alternating sandstone and mudstone, and serpentinite in a matrix of closely fractured and crushed, moderately soft, grey, brown, and greenish grey mudstone and some sandstone (calcareous or siliceous). Some of the large blocks, especially of limestone, have been mapped individually.

b Pleistocene Age Alluvium

Up to 20 m thick and from 3 to 10 m above present base level: forms higher coastal and valley terraces throughout the map area; in places locally discontinuous or absent. These alluvial deposits are typically very thinly to very thickly bedded, yellow-grey to orange-brown, angular to well rounded, mixed sizes (usually graded, coarse becoming fine upwards) of mud, sand and gravel, comprising rock fragments and weathered rock residue from the hinterland. They include some beds of black, humus-rich clay and white, pumice silt.

Geological cross-sections through the Precinct 2, Stage 2C area are enclosed as Drawing Number 21854.001–P2S2C–103 in Appendix A2. Borehole logs from the post-earthworks investigations are enclosed in Appendix E.

Fill material placed across the site to form the final design profile typically comprised site-won Northland Allochthon.

2 Earthworks Operations

2.1 Plant

Bulk earthworks were initially undertaken by Kerry Dines Ltd (KDL) in 2007 to 2008, with more recent bulk earthworks undertaken by Hick Bros Civil Construction Ltd (HBCCL) from 2013. Civil works have been completed by KDL. Various earthworks equipment was used to undertake the works, comprising D6 and D8 bulldozers and scoops, motor scrapers, tractors and discs, sheepsfoot compactors, padfoot rollers, and a number of 12 to 35 tonne excavators. This plant generally carried out all construction earthworks.

Specialist contractors and plant were brought on site for pavement construction. Certification of the pavement construction is beyond the scope of this report.

2.2 Construction Programme

Subdivisional earthworks commenced from 2007 and were initially undertaken by KDL. Works ceased during 2008 and then bulk earthworks operations restarted under HBCCL control in 2013. Final civil earthworks and construction for the residential Lots were under KDL's control and were undertaken progressively from November 2015 through to completion in June 2016.

Key Stage 2C earthworks components included:

- a Stripping of vegetation, organic materials and topsoil to stockpile.
- b Installation of gully and subsoil drains.
- c Cut to fill earthworks across the entire site, incorporating construction of 5 No. reinforced earth slopes (i.e. part of RE Slopes 204, 403, 406, 601 and 602), as shown on T+T Drawing 21854.001-P2S2C-101 in Appendix A2.

Key Stage 2C civil works components included:

- a Minor cut to fill earthworks across parts of the site as part of final Lot development, as shown on the Woods Cut/Fill Contour As-Built Plans Earthworks Surface – Final Surface (Woods Ref 33209-02C-AB-112 and -113) in Appendix A1.
- b Construction of 2 No. timber pole retaining walls (i.e. Walls 310 and 311) in the location shown on the Woods Retaining Walls As-Built Plan (Woods Ref 33209-02C-AB-130) in Appendix A1.
- c Installation of roading and services.

The earthworks, retaining walls, shear keys, undercuts and subsoil drainage as-built plans are included in Appendix A1 (Woods Drawings 33209-02C-AB-100 to 101, 110 to 115, 120 to 121 and 130), and show the earthworks undertaken across the site.

2.3 Compaction Control

Compaction control criteria, consisting of maximum allowable air voids and minimum allowable shear strengths, were used for cohesive fill control. The Technical Specification included in our Geotechnical Investigation Report (Ref. [4],[5],[6],[7]) included the following requirement for the subdivisional earthworks:

Minimum Shear Strength and Maximum Air Voids Method

Minimum Undrained Shear Strength (Measured by insitu vane – IANZ calibrated)

General fills:

Average value not less than 140 kPa

Minimum single value 110 kPa

High Strength Structural fills (Shear Keys & Reinforced Earth Fill Slopes):

Average value not less than 150 kPa

Minimum single value 120 kPa

Maximum Air Voids Percentage (as defined in NZS 4402:1986)

General fills:

Average value not more than 10%

Maximum single value 12%

High Strength Structural fills (Shear Keys & Reinforced Earth Fill Slopes):

Average value not more than 8%

Minimum single value 10%

The average corrected shear strength value was determined over any ten consecutive tests.

Regular in situ density, strength and water content tests were carried out on the filling at, or in excess of, the frequency recommended by NZS 4431:1989 (Ref. [8]). Test results are contained in Appendix E.

Quality Control (QC) testing showed that the results for the filling were consistently meeting the required undrained shear strength and air voids criteria, demonstrating that the water content of placed fill was consistently at, or close to, optimum. To the best of our knowledge, any problems encountered were rectified, where required, by close monitoring of the selection of borrow materials, discing and remixing of the available soil types and minor reworking.

3 Geotechnical Development Works

3.1 Subsoil Drainage

A network of subsoil drains has been installed within the original gully alignments across Precinct 2 during the original bulk earthworks, in addition to those drains installed as part of the reinforced earth slope and timber pole retaining wall construction.

The subsoil drains installed within the original gullies were excavated into the underlying rock to intercept groundwater and springs. The subsoil drains comprised 600mm to 1m wide trenches, installed in the base of the mucked out gully alignments, prior to placement of up to 13m of fill, and backfilled with:

- a 160mm diameter, Hiway grade, perforated Nexus pipes along the base of the trench.
- b SAP50 scoria over the top of the Nexus pipe to within 1m of the ground surface (at time of construction).
- c Bidim A19 geotextile filter-cloth over the top of the scoria.
- d Compacted, engineered fill within the top metre of the trench.

Subsoil drains installed as part of reinforced earth slope construction comprised the following:

- a 160mm diameter, Hiway grade, perforated Nexus pipes along the base of the rear of the reinforced soil block.
- b SAP50 scoria over the top of the Nexus pipe and up the back face of the reinforced soil block, to within 2.0 metres of the ground surface (at time of construction).
- c Bidim A19 geotextile filter-cloth over the top of the scoria prior to placement of the reinforced soil.

The gully drains discharge into the main downslope gully that runs centrally through Precinct 2. The reinforced earth slope drains were connected to the reticulated stormwater system.

In addition to the above, subsoil drains were installed as part of the timber pole retaining wall structures. Timber pole wall drainage comprised a 110mm diameter Nexus pipe covered in SAP50 scoria installed along the rear of the timber poles and brought through under the base of the wall to discharge into the reticulated stormwater system and a cap of engineering fill to limit seepage (surface).

The subsoil drainage system and connections are shown on the Woods Shear Key, Undercuts & Subsoil Drains As-Built Plans (Woods Ref 33209-02C-AB-120 and -121) in Appendix A1, and on T+T Drawing 21854.001-P2S2C-102 in Appendix A2.

3.2 Reinforced Earth Slope

Five reinforced earth (RE) slopes (i.e. part of RE Slopes 204, 403, 406, 601 and 602) were constructed during the recent bulk earthworks within Stage 2C.

The slopes comprise biaxial geogrids placed at 0.5m (vertical) intervals within the well compacted engineered earth fill, placed in accordance with the bulk earthworks specification (Section 2.3 above). The grids extend up to within 1.5m (vertical) of the slope crest. They have been placed at various lengths, starting at the face of the slope.

Typical cross-sections through the RE slopes are shown on T+T Drawing 21854.001-P2S2C-104 and 105 in Appendix A2.

The placement of the geogrid allows steeper finished gradients than is typically possible with bulk fills, and minimises the risk of instability across the face of the slope, particularly where finished gradients across the slopes are up to 1 in 1.5 (V:H).

Construction of the RE slopes comprised the following:

- a Foundation preparation;
- b Placement and compaction of fill to the required levels;
- c Placement of the geogrid layers, ensuring that the grid is held tightly in place;
- d Spreading of fill across the surface of the geogrid with lightweight plant;
- e Compaction and placement of further fill up to the level of the next grid layer;
- f Installation of Enkamat across the face of any slopes steeper than 1 in 2 (H:V) to assist in retention of the topsoil facing while vegetation is established.

The fill was placed and compacted beyond the limit of the final slope face and then trimmed back to ensure full compaction of the slope face was achieved, taking care not to damage the geo-grid.

As noted in Section 3.1, a drainage blanket was installed at the rear of the reinforced block of soil and comprised a minimum of 300mm thickness of SAP50 scoria, covered in Bidim A19 geotextile filtercloth and a cap of cohesive fill 2.0m in thickness. A 160mm diameter perforated Nexus pipe at the base of the drainage blanket provides a discharge outlet for any groundwater captured in the drainage blanket. The drainage pipe is connected into the stormwater system.

This slope has been designed to accommodate construction of a lightweight structure of up to 10kPa distributed load at the crest of the slope.

The reinforced earth slope drainage system is also shown on the T+T As-Built plans in Appendix A2.

3.3 Timber Pole Walls

2 No. timber pole retaining walls have been constructed across this stage of the subdivision, comprising Walls 310 and 311 at the locations shown on T+T Drawing 21854.001-P2S2C-101. All of these walls were designed by T+T and allow for the various design conditions encountered across the stage, including toe slopes, slope surcharges and vehicle surcharges, as appropriate. Construction drawings for Walls 310 and 311 were issued in September 2015 and a copy of these is included in Appendix A2. These walls were constructed during the Civils construction package by ICB Retaining & Construction Ltd (ICB) under KDL control.

The walls comprise high density timber poles installed to various depths dependent on design conditions. Inspections for these walls were undertaken by T+T staff to confirm pile hole diameter, depth and spacing, pile sizes, and installation of drainage materials and lagging, in accordance with the design drawings.

The drainage pipes from behind the walls are connected into the stormwater system, as shown on the Woods subsoil drainage as-built plan in Appendix A1.

These walls have been designed to accommodate a maximum 5kPa surcharge, although development immediately behind/above the walls is likely to be precluded by Council planning rules.

Certification of these walls in accordance with the relevant Engineering Approval is to be supplied under separate cover.

3.4 Undercuts

Earthworks operations across Lots 248 to 265, 298 to 299, 330, 355 and 386 resulted in exposure of the underlying Northland Allochthon rock materials. The rock has been undercut by 1m and replaced

with engineered, compacted fill, placed in accordance with the bulk earthworks specification (Section 2.3 above). The rock undercut has been undertaken to seal off the underlying rock from ingress of surface water flows, to reduce the potential effects of expansive soils as the rock weathers, and to allow for ease of construction of domestic service connections.

The extent of the undercut areas is shown on the Woods Shear Key, Undercuts & Subsoil Drains As-Built Plans (Woods Ref 33209-02C-AB-120 to 121) in Appendix A1.

4 Stability Analyses

As noted in Section 1, slope stability analyses undertaken during the investigation stage of the project indicated that shear keys were not required to achieve satisfactory factors of safety against slope instability for the finished development of Stage 2C.

Observations and monitoring were undertaken during bulk earthworks construction to confirm that the ground conditions exposed were consistent with the assumptions made in the stability analyses.

On the basis of our observations, we are satisfied that the design analyses remain valid for the completed works on the following basis:

- a the exposed ground conditions generally conform to those assumed for design;
- b the as-built profiles match design levels;
- c the earthworks monitoring shows compliance with specified criteria, upon which fill properties have been based.

5 Project Evaluation / Building Design Considerations

5.1 General

Ground conditions within Precinct 2, Stage 2C straddle a range of “design conditions” including cut ground, filled ground, expansive soils and constructed slopes up to 1 in 1.5 (V:H). The following sections set out relevant geotechnical design issues.

5.2 Bearing capacity for building foundations

All filled and natural ground within the influence of conventional residential shallow strip and pad foundation loads is assessed as generally having a geotechnical ultimate bearing capacity of 300kPa, as required by NZS 3604:2011. This corresponds to a factored (Ultimate Limit State) bearing capacity of 150kPa and working (Serviceability Limit State) bearing capacity of 100kPa.

Due to the presence of expansive soils, foundation conditions fall outside the definition of “good ground” contained in NZS 3604:2011. In terms of AS 2870:2011, the soils present are considered to lie within Site Class M and H1 (moderately to highly expansive) with characteristic surface movements anticipated to be in the range 20mm to 60mm. Due allowance should be made for expansive soils, as discussed in Section 5.12.

Where a geotechnical ultimate bearing capacity greater than 300kPa is required to support any dwelling constructed outside the scope of NZS 3604:2011, further specific site investigation and design of foundations will be required.

5.3 Building Limitation Zones

Steep slopes (steeper than 1 in 4 (V:H)) are present within, or immediately adjacent to, a number of the Lots in the Stage 2C area.

The steep slopes comprise reinforced earth fill with face gradients of between 1 in 1.5 and 1 in 2 (V:H), and are located in Lots 271 to 277, 281 to 284, 316, 324 to 330, 355 and 386. Construction within the flatter parts of these Lots is intended, and a Building Restriction Zone (“No Build Zone”) has been developed across the steeper sections of the Lots to ensure that the reinforcement of the slopes is not detrimentally affected by future development. The extent of the Building Restriction Zone associated with the RE slopes is shown on T+T Drawing 21854.001–P2S2C–110 (Building Limitation Plan) in Appendix A2. Excavation, fill placement and/or construction within this zone is not permitted.

Vegetation on slopes that are 1 in 4 (V:H) or steeper is recommended to reduce the potential for shallow slope instability and to minimise surface erosion. Where gradients are 1 in 4 (V:H) or steeper, there is potential for minor shallow creep of the topsoil layer. However, such creep is considered unlikely to detrimentally affect the global stability of the slope.

5.4 Settlement

Settlement plates were installed in the areas of greatest fill thickness, prior to fill placement, to monitor the settlement of the subgrade. Monitoring was undertaken from December 2014 through to April 2016. This monitoring shows that settlements of up to 123mm occurred during development of Stage 2C and adjacent areas. Most settlement (approximately 114mm) occurred from December 2014 to November 2015, with a further 9mm settlement by January 2016. There has been negligible movement through to the latest reading in late April 2016. We consider that settlement of the underlying soils is essentially complete under the current surcharge.

From our inspections during earthworks operations, and the results of compaction quality control testing, we consider that differential settlement induced by self-weight of engineered fill should now be largely complete. Further settlements should be within normally accepted design tolerances of 25mm, as outlined in NZS 3604:2011 (Ref. [10]), with respect to conventional building development.

In order to minimise the risk of ground settlements exceeding 25 mm, NZS 3604:2011 (Ref. [10]) allows a maximum fill surcharge of 600 mm over the building platform during future development. Filling in excess of this should be subject to specific foundation design and assessment.

5.5 Retaining walls

Due to the shallow grades across most of the Stage 2C Lots, it is not anticipated that significant retaining walls will be required. However, if walls are required, then retaining wall design will be dependent on the site specific requirements. For preliminary design we recommend the use of the following geotechnical design parameters:

$$\gamma = 18 \text{ kN/m}^3,$$

$$c' = 0 \text{ kPa},$$

$$\phi' = 30^\circ,$$

$$K_a = 0.30,$$

$$K_p = 3.33,$$

“Su” of 50kPa for the embedment soil (subject to confirmation during construction).

These values are based on level ground above and below the wall and will require appropriate amendment to allow for slope, traffic and other surcharges or toe slopes and the specific lot geometry and development requirements, as applicable.

All retaining walls should include a layer of free draining granular fill (with geotextile over the top) immediately behind the wall covered with a 0.3m thick (minimum) compacted clay fill cap, with intercepted groundwater seepage piped into the reticulated stormwater system.

Any walls greater than 1.5m retained height will require a geotechnical assessment, as a minimum, to check and confirm that the stability of the subject (or adjacent) Lot is not detrimentally affected. Retaining walls downslope of the RE slopes shall also take into account the load imposed by these slopes.

The existing timber pole retaining walls constructed within the Precinct 2 Stage 2C area are shown on the Woods Retaining Walls As-Built Plan (Woods Ref 33209-02C-AB-130). These walls have been designed to accommodate a maximum 5kPa surcharge, although development immediately behind/above the walls is likely to be precluded by Council planning rules. The presence of these walls should be taken into account for any proposed works downslope of the walls, specifically to ensure that any proposed cuts do not undermine the base of the walls. In general, earthworks should be limited to no closer than 1.5m from the toe of the walls.

For clarity, the Lots within Stage 2C that will need to consider the presence of the existing retaining walls during site development are:

- a Timber wall 310 – Lots 286, 288, 290, 292, 294 to 303 inclusive
- b Timber wall 311 – Lots 253 to 258 inclusive

5.6 Subsoil Drainage

Following gully muckouts and reinforced earth slope construction during initial bulk earthworks, groundwater drainage was installed using Nexus drains covered in geotextile cloth to permanently handle ground water flows.

The extent of the subsoil drainage systems are shown on the Woods Shear Key, Undercuts & Subsoil Drains As-Built Plans (Woods Ref 33209-02C-AB-120 to 121) in Appendix A1, and on T+T Drawing 21854.001-P2S2C-102 in Appendix A2.

This drainage system is relatively deep and located so that it is unlikely to be encountered during future residential site development and is expected to be maintenance free. Any deep excavations should take account of the presence of these drains nonetheless. If a drain is encountered, damaged, or identified as defective, repairs should be observed by a Chartered Professional (Geotechnical) Engineer familiar with this report, and notified to Auckland Council.

The subsoil drains running along the eastern boundary of Lot 330 and along the common boundary of Lots 283 and 284 are relatively shallow (approximately 1m below finished ground surface) and will need to be taken into account when undertaking residential design and construction on these sites. Piling of foundations to below a 45 degree zone of influence line extending up from the invert of the drains will be required in proximity to the drain in these Lots, to avoid surcharging the drain.

The Woods Shear Key, Undercuts & Subsoil Drains As-Built Plans (Woods Ref 33209-02C-AB-120 to 121) shows the location and invert of the subsoil drainage through this Stage.

5.7 Post Earthworks Investigations

Following the completion of earthworks operations, T+T have undertaken supplementary fieldwork to confirm the consistency of the natural subsoils and engineered fill. From the investigations, we confirm that the subsoils are considered to have a geotechnical ultimate bearing capacity of 300kPa, as required by NZS 3604:2011 (Ref. [10]). This corresponds to a factored (Ultimate Limit State) bearing capacity of 150kPa and working (Serviceability Limit State) bearing capacity of 100kPa. Associated borehole logs and site plan (T+T Drawing 21854.001-P2S2C-111) are attached in Appendix E.

5.8 Stormwater

Public stormwater services have been installed within the Precinct 2, Stage 2C. Stormwater and runoff from roofs, decks and paved areas, together with discharges from retaining wall drains and other subsoil drains must be connected directly into the public stormwater drainage network.

5.9 Service lines

Trench backfill has been compacted to minimise potential for future settlements. However, where building envelopes lie adjacent to or across service lines, all foundations should extend and be founded below the 45 degree zone of influence line from pipe inverts. This requirement is to avoid excessive pipe surcharges, and to allow for future maintenance of the system without detrimentally affecting adjacent structures. Subject to approval from Auckland Council, foundations may extend and bridge over service lines provided specific foundation design is undertaken.

A copy of the stormwater as-built plan (Woods Stormwater Drainage As-Built Overall Layout Plan, Woods Ref 33209-02C-AB-300) is included in Appendix A1.

5.10 Road subgrades

Based on the fill monitoring and site observations during development, filled and natural ground within the road and vehicle access Lots is considered generally suitable for the proposed residential pavements. Subgrade strength testing was carried out following excavation to formation levels along the road alignments. These subgrade test results were passed on to Woods for use in their pavement design. All road subgrades have been lime and cement stabilised to assist in pavement strengths, and to minimise the impact of expansive soils on road pavements.

For future road construction in other parts of the Precinct 2 Stage 2C development, within natural ground, a design CBR of 2% is considered appropriate while, within engineered fill areas, a design CBR of 7% is appropriate.

5.11 Topsoil

Following completion of topsoil spreading and grassing, topsoil depths were measured in each of the Lots and these are shown on T+T Drawing 21854.001-P2S2C-112 attached in Appendix E. Due to variations in placement depths and earth worked surface levels, topsoil depths may vary from those recorded.

5.12 Expansive soils

Expansive soils (or “reactive soils” using Australian terminology) are clay soils that undergo appreciable volume change upon changes in moisture content. The reactivity and the typical range of movement that could be expected from soils underlying any given building site depend on the amount of clay present, clay mineral type, and proportion, depth and distribution of clay throughout the soil profile. Moisture changes tend to occur slowly in clays and produce swelling upon wetting and shrinkage upon drying.

Apart from seasonal moisture changes (wet winters / dry summers) other factors that can influence soil moisture content include:

- a Influence of garden watering and site drainage;
- b The presence of large trees (especially fast growing Australian species such as eucalyptus) close to building envelopes, and;
- c Initial soil moisture conditions at construction time.

Visually, the surfaces of expansive soils are noted for developing extensive cracking during dry periods (especially late summer through autumn in Auckland) and can be locally identified by this feature when sites are excavated and left for a week or two to dry out. Further information on expansive soils is given in Appendices C and D of this report.

In order to assess for the presence of expansive soils within this stage of the development, representative soil samples were retrieved from near surface strata and tested by Geotechnics Ltd to determine soil shrinkage characteristics in accordance with AS 1289.7.1.1.

Based on the laboratory results (attached in Appendix E), the foundation soils on this stage of the subdivision lie outside the definition of ‘good ground’ as outlined in NZS 3604:2011 (Ref. [10]).

In terms of AS 2870:2011 (Ref. [9]), the soils present are considered to lie within Site Class M to H1 (moderately to highly expansive) with characteristic surface movements anticipated to be in the range of 20mm to 60mm.

Accordingly, building foundations on this stage of the subdivision will need to be subject to specific foundation design by a Chartered Professional Engineer familiar with the contents of this report and responsible for design of structural elements (including foundations) of the building. Reference should be made to AS 2870:2011 (Ref. [9]) for assistance.

6 Statement of Professional Opinion as to the Suitability of Land for Building Development

I, Mr C.J. Freer of Tonkin + Taylor Ltd, P O Box 5271, Wellesley St, Auckland, hereby confirm that:

- 6.1 I am a Chartered Professional Engineer experienced in the field of geotechnical engineering and an authorised representative of Tonkin + Taylor who was retained by WFH Properties Ltd as the Geotechnical Engineer on Precinct 2 Stage 2C (comprising residential Lots 244 to 277, 281 to 303, 316, 324 to 330, 355 and 386 inclusive) of the Millwater Residential Subdivision Development off the Millwater Parkway in Silverdale. Inspection and observation of the works have been carried out during construction by either myself or staff acting under my direction.
- 6.2 The extents of preliminary investigations are described in Tonkin + Taylor Ltd Precinct 2 Geotechnical Investigation Report Ref No. 21854.001 dated May 2014. The conclusions and recommendations of those documents have been re-evaluated in the preparation of this report. Details of all earthworks control tests performed are enclosed (Appendix E).
- 6.3 The Contractor has confirmed that the work undertaken has been completed in accordance with the drawings, specifications and any variations issued and is consistent with the inspections and observations carried out by Tonkin + Taylor Ltd. Complete Construction Certificates have been provided by the Contractors and are presented in Appendix B. Tonkin + Taylor Ltd accepts no liability for any errors or omissions represented by those documents.
- 6.4 On the basis of our observations and inspections together with the information supplied by others, including the Contractor's Construction Certificates, it is my professional opinion, not to be construed as a guarantee that:
 - 6.4.1 The earth fills shown on the attached Woods drawings, Project No 33209, Millwater, Precinct 2, Stage 2C, Drawing Numbers 33209-02C-AB-100 to -101 and -110 to 115, have been generally placed in compliance with NZS 4431:1989 (Ref. ([8])).
 - 6.4.2 The completed earthworks give due regard to land slope and foundation stability considerations.
- 6.5 **For Lots 244, 245, 248 to 265, 269 to 271 and 285 to 303 inclusive:**
 - 6.5.1 **Foundation design**
The filled and natural ground within residential Lot boundaries is considered generally suitable for the erection thereon of light timber framed, flexibly clad residential buildings subject to clauses 6.5.2 to 6.5.6.
 - 6.5.2 **Bearing capacity**
Foundation design for these Lots should limit geotechnical ultimate bearing capacity to 300 kPa (factored (ULS) 150 kPa, working (SLS) 100 kPa). This is as specified in NZS 3604:2011 (Ref. [10]).
 - 6.5.3 **Expansive soils**
Due to the presence of expansive clay soils, foundation soils lie outside the definition of 'good ground' in NZS 3604:2011 (Ref. [10]). Soils are considered to lie in Site Class M (moderately expansive) as defined in AS 2870:2011 (Ref. [9]) with anticipated characteristic surface ground movements of 20mm to 40mm. Clause 6.5.3.1 of this Geotechnical Completion Report may be used for expansive soil foundation design on this subdivision:

6.5.3.1 Specific foundation design for expansive soils

Specific foundation design should be undertaken by a Chartered Professional Engineer familiar with the contents of this report and responsible for design of structural elements (including foundations) of the building.

The minimum specific design requirements set for expansive soils within this clause are:

- i) Minimum foundation embedment of 600 mm following topsoil removal and benching of building platform areas to finished ground levels
- ii) Four bar steel reinforcing cages should be used
- iii) For buildings having brittle exterior cladding, for example brick veneer, stucco plaster, solid plaster, block work, styrofoam type cladding or sprayed plaster over harditex systems etc, the potential effects of seasonal ground movements need to be considered by the building designer.

The above minimum requirements within this clause may be superceded if individual engineers are able to demonstrate their specific design solutions are applicable to site soil conditions to the satisfaction of Auckland Council. Specific design may be undertaken by first principles or by reference to AS 2870:2011 (Ref. [9]), Section 4 and related documents.

6.5.4 Floor Slab Construction

Slab on grade construction is expected to be relatively straightforward across the subdivision, but problems can occur with slab construction on shrink/swell sensitive soils. In soils which become desiccated in summer, subsequent capillary moisture rise may cause dry soils to wet up and swell, causing slab uplift and building distress. Alternatively, construction during winter may result in subgrade soils with high moisture contents drying out through summer, with subsequent soil shrinkage and possible building deformation.

The structural engineer should take likely construction timeframes into account and confirm that their design and construction methodologies will accommodate the soil shrinkage or swelling that may occur.

The Contractor should ensure that the ground beneath the floor slab areas are suitably conditioned to ensure that the subgrade is neither too dry nor too wet prior to hardfill placement and concrete pouring to avoid undue shrink or swell movements.

6.5.5 Building maintenance - Owners responsibility

The owner is responsible for maintenance of the building and site and should be familiar with the performance and maintenance requirements set out in CSIRO sheet BTF18 Foundation Maintenance and Footing Performance: A Home Owners Guide. A copy of this sheet is included in Appendix D.

6.5.6 Retaining walls / Earthworks

No retaining wall construction in excess of 1.5 metres height and no earthworks involving fills in excess of 600mm depth should take place on these Lots unless endorsed by a suitable design undertaken by a Chartered Professional (Geotechnical) Engineer familiar with the contents of this report and responsible for design of structural elements of the building.

6.6 For Lots 272 to 277, 281 to 284, 316, 324 to 330 and 386 inclusive:

6.6.1 These Lots contain a "Building Line Restriction" relating to the reinforced earth slopes which form the 1 in 1.5(V:H) slopes along the Lot boundaries. The restriction zone is shown on T+T Drawing 21854.001-P2S2C-110 in Appendix A2. Excavation, filling and/or construction within this zone is not to be undertaken, to ensure stability of the slope is not compromised.

6.6.2 The presence of geogrids within the reinforced earth slopes is brought to the attention of future building and services designers. The topmost grid is located between 1 to 2 metres below the surface at the top of the slope, and does not generally extend more than 2 metres back from the crest of the slope. It is not expected that the grids will be encountered during future development of these Lots, however, the presence of the grids should be recognized. Any exposure and/or damage and subsequent repair to the grids during any future development must be observed and certified by a Chartered Professional Engineer (Geotechnical) familiar with the contents of this report.

Design of the reinforced earth slope has assumed a maximum distributed load of 10kPa (dead plus live loads) up to the edge of the Building Limitation Line.

6.6.3 Any cut or fill walls greater than 1.5m retained height, or of any height within 2m of the building restriction lines shown on T+T Drawing 21854.001-P2S2C-110 in Appendix A2, will require a geotechnical assessment, as a minimum, to ensure stability of the subject or adjacent Lot is not detrimentally affected.

6.6.4 Development outside of the Building Line Limitation zone may proceed in accordance with the recommendations outlined in Section 6.5.

6.7 For Lots 246, 247, 266, 267 and 268 inclusive

6.7.1 Foundation design

The filled and natural ground within residential Lot boundaries is considered generally suitable for the erection thereon of light timber framed, flexibly clad residential buildings subject to clauses 6.7.2 to 6.7.5.

6.7.2 Bearing capacity

Foundation design for these Lots should limit geotechnical ultimate bearing capacity to 300 kPa (factored (ULS) 150 kPa, working (SLS) 100 kPa). This is as specified in NZS 3604:2011 (Ref. [10]).

6.7.3 Expansive soils

Due to the presence of expansive clay soils, foundation soils lie outside the definition of 'good ground' in NZS 3604:2011 (Ref. [10]). Soils are considered to lie in Site Class H1 (highly expansive) as defined in AS 2870:2011 (Ref. [9]) with anticipated characteristic surface ground movements of 40mm to 60mm. Clause

6.7.3.1 of this Geotechnical Completion Report may be used for expansive soil foundation design on this subdivision:

6.7.3.1 Specific foundation design for expansive soils

Specific foundation design should be undertaken by a Chartered Professional Engineer familiar with the contents of this report and responsible for design of structural elements (including foundations) of the building.

The minimum specific design requirements set for expansive soils within this clause are:

- i) Minimum foundation embedment of 750 mm following topsoil removal and benching of building platform areas to finished ground levels
- ii) Four bar steel reinforcing cages should be used
- iii) For buildings having brittle exterior cladding, for example brick veneer, stucco plaster, solid plaster, block work, styrofoam type cladding or sprayed plaster over harditex systems etc, the potential effects of seasonal ground movements need to be considered by the building designer.

The above minimum requirements within this clause may be superseded if individual engineers are able to demonstrate their specific design solutions are applicable to site soil conditions to the satisfaction of Auckland Council. Specific design may be undertaken by first principles or by reference to AS 2870:2011 (Ref. [9]), Section 4 and related documents.

6.7.4 Floor Slab Construction

Slab on grade construction is expected to be relatively straightforward across the subdivision, but problems can occur with slab construction on shrink/swell sensitive soils. In soils which become desiccated in summer, subsequent capillary moisture rise may cause dry soils to wet up and swell, causing slab uplift and building distress. Alternatively, construction during winter may result in subgrade soils with high moisture contents drying out through summer, with subsequent soil shrinkage and possible building deformation.

The structural engineer should take likely construction timeframes into account and confirm that their design and construction methodologies will accommodate the soil shrinkage or swelling that may occur.

The Contractor should ensure that the ground beneath the floor slab areas are suitably conditioned to ensure that the subgrade is neither too dry nor too wet prior to hardfill placement and concrete pouring to avoid undue shrink or swell movements.

6.7.5 Building maintenance - Owners responsibility

The owner is responsible for maintenance of the building and site and should be familiar with the performance and maintenance requirements set out in CSIRO sheet BTF18 Foundation Maintenance and Footing Performance: A Home Owners Guide. A copy of this sheet is included in Appendix D.

6.7.6 Retaining walls / Earthworks

No retaining wall construction in excess of 1.5 metres height and no earthworks involving fills in excess of 600mm depth should take place on these Lots unless endorsed by a suitable design undertaken by a Chartered Professional (Geotechnical) Engineer familiar with the contents of this report and responsible for design of structural elements of the building.

6.8 For Lot 355

6.8.1 This Lot encompasses a relatively steep slope of up to 1 in 3 (V:H) gradient in the southwestern part of the site. Construction is expected to require cuts and/or fills to form suitable building platforms and it is likely that these works will extend into this steeper area. Accordingly, development within this Lot will require specific foundation investigation and design, undertaken by a Chartered Professional (Geotechnical) Engineer familiar with the contents of this report, to ensure stability of the surrounding slopes is not detrimentally affected.

6.8.2 This Lot also contains a Building Line Restriction relating to the presence of a reinforced earth slope, as detailed in section 6.6 above (see T+T Drawing 21854.001-P2S2C-110). Excavation, filling and/or construction within this zone is not to be undertaken, to ensure stability of the slope is not compromised.

6.8.3 The presence of geogrids within the reinforced earth slope is brought to the attention of future building and services designers. The topmost grid is located between 1 to 2 metres below the surface at the top of the slope, and does not generally extend more than 2 metres back from the crest of the slope. It is not expected that the grids will be encountered during future development of this Lot, however, the presence of the grids should be recognized. Any exposure and/or damage and subsequent repair to the grids during any future development must be observed and certified by a Chartered Professional Engineer (Geotechnical) familiar with the contents of this report.

Design of the reinforced earth slope has assumed a maximum distributed load of 10kPa (dead plus live loads) up to the edge of the Building Limitation Line.

6.8.4 Notwithstanding the above, development of this Lot may be undertaken in general accordance with Sections 6.5.1 to 6.5.5 of this report

6.9 Underfill (Subsoil) drainage

Underfill (Subsoil) drains have been installed during subdivisional development in the locations shown on the Woods Shear Key, Undercuts & Subsoil Drains As-Built Plans (Woods Ref 33209-02C-AB-120 to 121) in Appendix A1, and on T+T Drawing 21854.001-P2S2C-102 in Appendix A2. These drains are considered to be maintenance free. This drainage system is relatively deep and located so that it is unlikely to be encountered during future residential site development. Although future works are unlikely to encounter the drains, their location should be considered prior to designing deep foundations and, if damaged, repairs should be observed by a Chartered Professional (Geotechnical) Engineer familiar with this report, and notified to Auckland Council.

The subsoil drain running along the eastern boundary of Lot 330 and along the common boundary of Lots 283 and 284 are relatively shallow (approximately 1m below finished ground surface) and will need to be taken into account when undertaking residential design and construction on these sites. Piling of foundations to below a 45 degree zone of influence

line extending up from the invert of the drains will be required in proximity to the drain in these Lot, to avoid surcharging the drain.

The Woods Shear Key, Undercuts & Subsoil Drains As-Built Plans (Woods Ref 33209-02C-AB-120 to 121) shows the location and invert of the subsoil drains through these Lots.

6.10 Stormwater and Sanitary Sewer Lines

Where building envelopes lie adjacent to or across service lines, all foundations should extend and be founded below the 45 degree zone of influence line extending from pipe inverts. This requirement is to avoid excessive pipe surcharges, and to allow for future maintenance of the system without detrimentally affecting adjacent structures. Subject to approval from Auckland Council, foundations may extend and bridge over service lines provided specific foundation design is undertaken. A copy of the stormwater as-built plans are included in Appendix A1.

6.11 Road and Access Lots

Based on the fill monitoring and site observations undertaken during site development, the filled and natural ground within Precinct 2, Stage 2C is considered generally suitable for residential road and accessway construction. Scala penetrometer testing should be undertaken when road subgrades have been prepared to confirm subgrade strengths. Subject to such subgrade testing, for future road construction in other parts of the Precinct 2 Stage 2C development, within natural ground, a design CBR of 2% is considered appropriate, while within engineered fill areas, a design CBR of 7% is appropriate.

6.12 Unexpected ground conditions

Our assessment is based on interpolation between borehole positions, site observations and periodic earthworks control visits. Local variations in ground conditions may occur. Although unlikely, unfavourable ground conditions may be encountered during site benching and footing excavations. It is important that we be contacted in this eventuality, or in the event that any variation in subsoil conditions from those described in the report are found. Design assistance is available as required to accommodate any unforeseen ground conditions present.

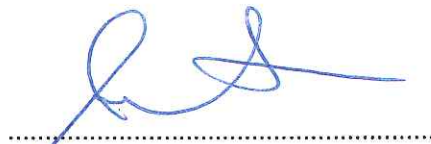
7 Applicability

This report has been prepared for the benefit of WFH Properties Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

It does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any dwelling, especially in cases where concrete blockwork and/or brick veneer or stucco plaster buildings are sited partly on fill or partly on natural ground, or where they are entirely sited on filling whose depth changes significantly across the building platform.

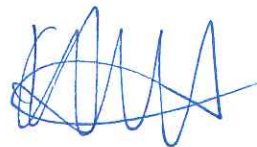
Tonkin & Taylor Ltd

Report prepared by:



Andrew Linton
Senior Geotechnical Engineer

Technical review by:



Andrew Stiles
Senior Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:

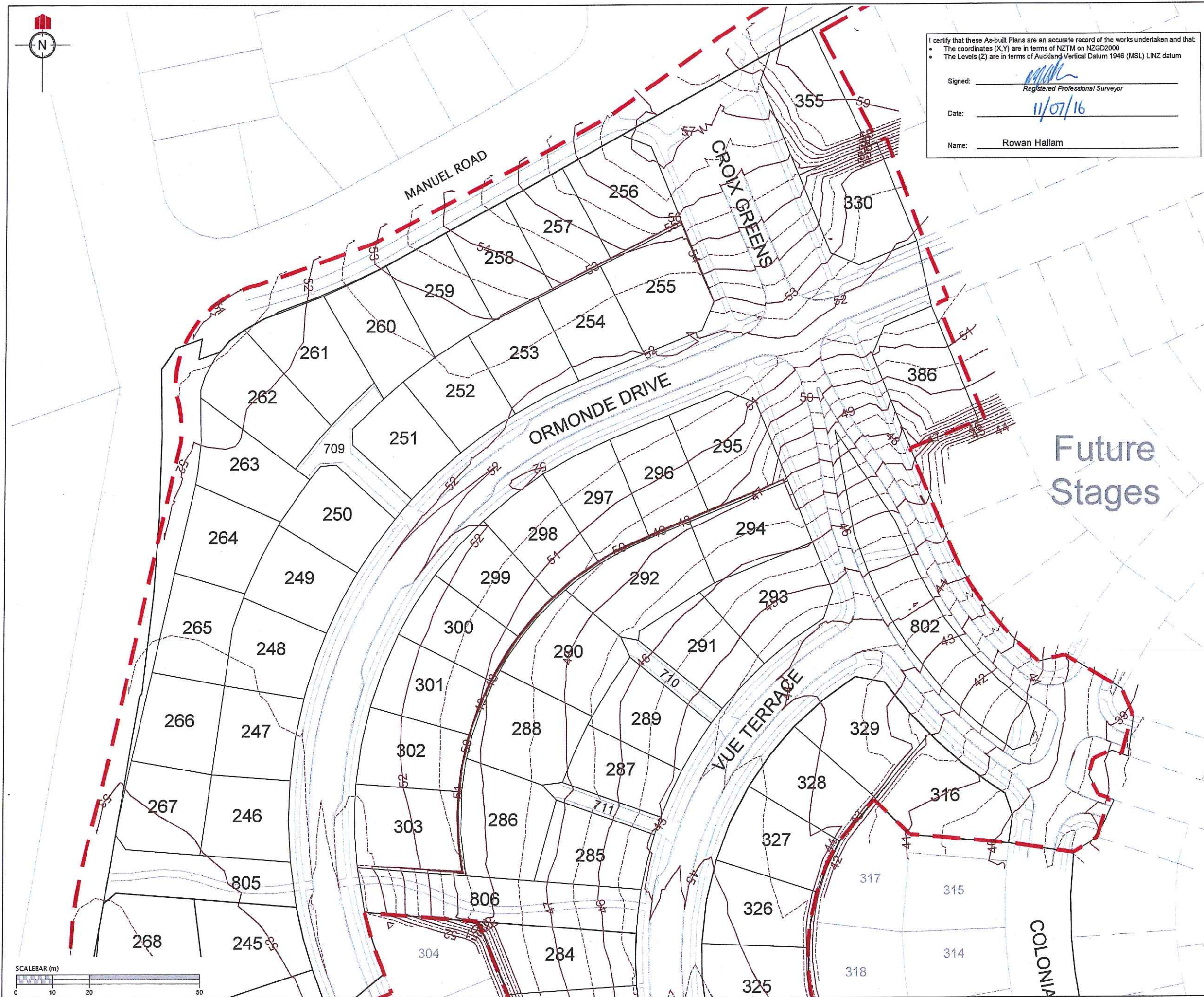


Chris Freer
Project Director BE (Civil), MIPENZ, C.P. Eng.

JXXL
p:\21854\21854.001 - precinct 2\gcr\stage 2c\ajl 130715 p2s2c-gcr final.docx

8 References

- [1] Tonkin & Taylor Ltd., October 2001. *Stoney Block*, T+T Ref. 18214.
- [2] Tonkin & Taylor Ltd., May 2001. *Silverdale Blocks, Silverdale, Geotechnical Issues – Future Medium Density Development*, T+T Ref. 18213.
- [3] Tonkin & Taylor Ltd., November 2003. *Silverdale North and Orewa West Blocks, Silverdale, Geotechnical Issues – Future Medium Density Development*, T+T Ref. 20914.
- [4] Tonkin & Taylor Ltd., November 2004. *Wainui Road Subdivision, Silverdale, Geotechnical Investigation Report*, T+T Ref. 21854.
- [5] Tonkin & Taylor Ltd., October 2005. *Wainui Road Subdivision, Silverdale, Geotechnical Investigation Report – Scheme Plan 7*, T+T Ref. 21854.
- [6] Tonkin & Taylor Ltd., March 2006. *Silverdale North – Westlake Block, Geotechnical Investigation Report*, T+T Ref. 21854.
- [7] Tonkin & Taylor Ltd., June 2014. *Millwater – Precinct 2, Geotechnical Investigation Report*. T+T Ref. 21854.001
- [8] New Zealand Standards, 1989. *NZS 4431:1989 Code of Practice for Earth Fill for Residential Development*.
- [9] Standards Australia, 2011. *AS 2870:2011 Residential slabs and footings*.
- [10] New Zealand Standards, 2011. *NZS 3604:2011 Timber Framed Buildings*.



I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: Rowan Hallam
Registered Professional Surveyor

Date: 11/07/16

Name: Rowan Hallam

REVISION DETAILS		NAME	DATE
1.	DRAWING ISSUED	AAC	6/07/2016

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- CONTOURS MAJOR
- CONTOURS MINOR
- STAGE BOUNDARIES
- LOT BOUNDARIES

CLIENT:

WFH
PROPERTIES

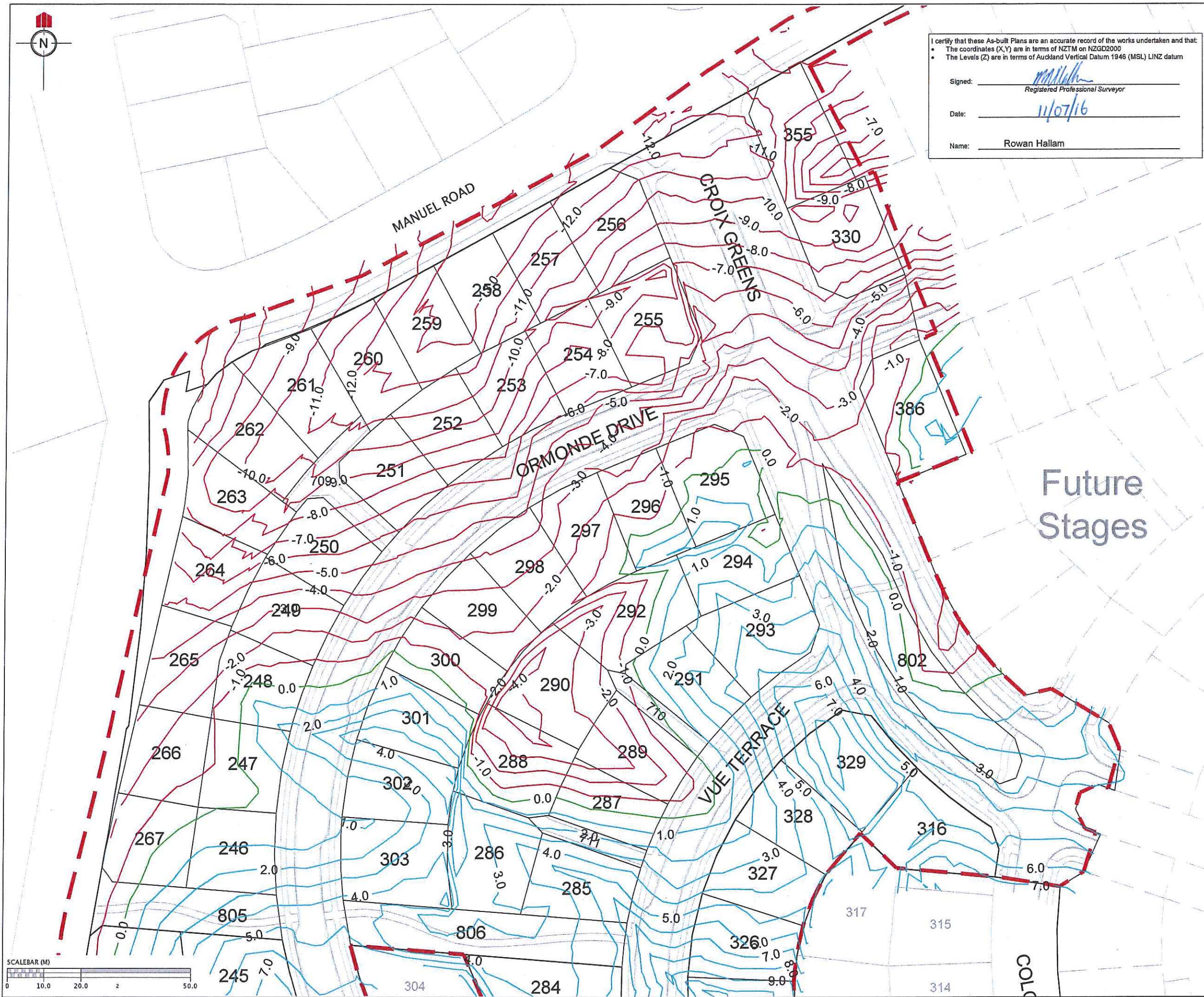
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**MILLWATER
PRECINCT 2
STAGE 2C**

**FINAL CONTOUR
AS-BUILT PLAN
Sheet 1 of 2**

AUCKLAND COUNCIL

DESIGNED: TX	DRAFT ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MA	SURVEYED: RZ
JOB NUMBER: 33209	SCALE: 1:1000 @ A3
ISSUED: MAY 2016	
DWG. NO. 33209-02C-AB-100	REV. 1



I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: Rowan Hallam
Registered Professional Surveyor

Date: 11/07/16

Name: Rowan Hallam

REVISION DETAILS	NAME	DATE
1. DRAWING ISSUED	AAC	06/07/16

NOTES

1. CONTOURS ARE AT 1.0 METRE INTERVALS

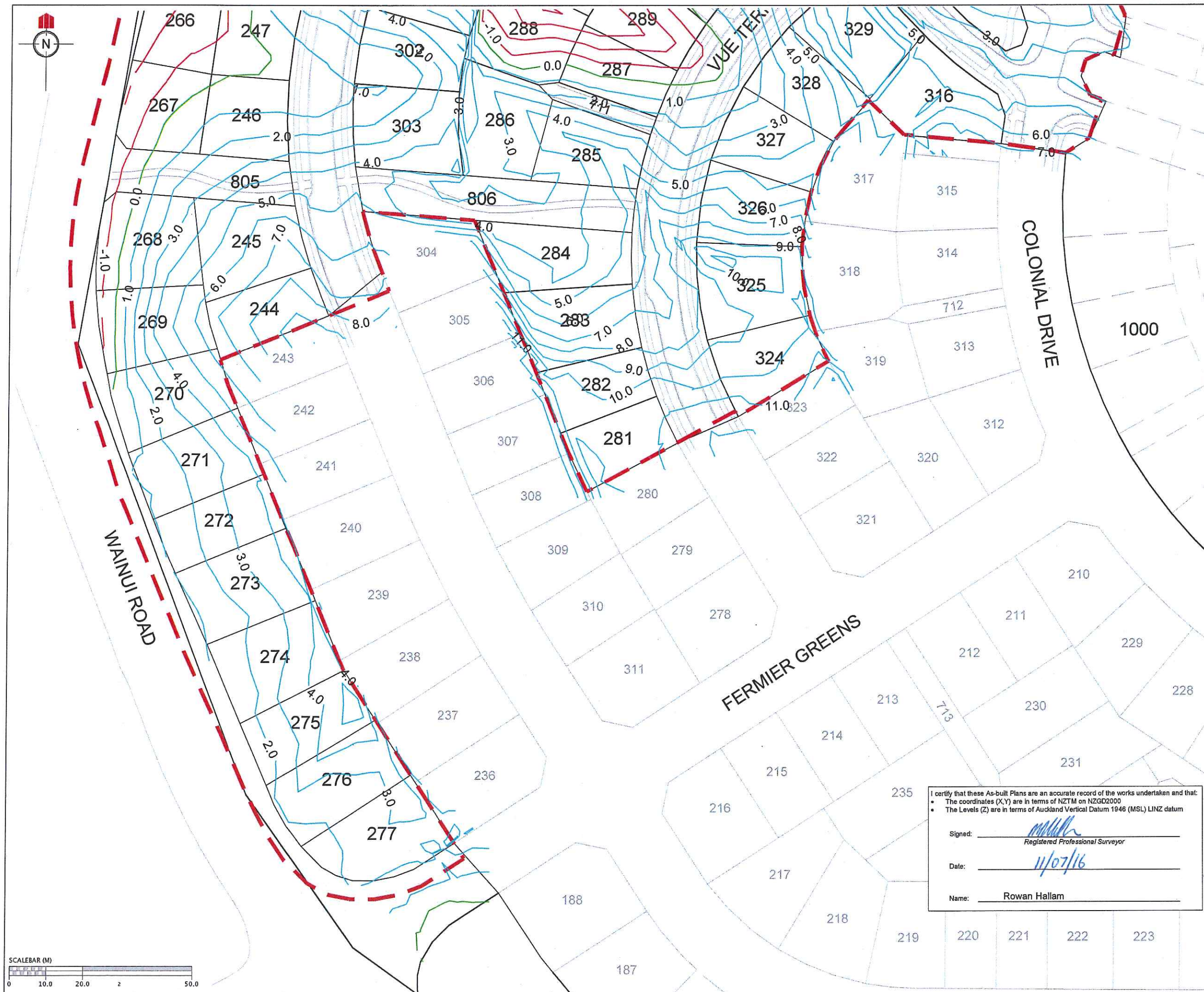
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	CUT CONTOUR
	FILL CONTOUR
	STAGE BOUNDARIES
	LOT BOUNDARIES



**MILLWATER
PRECINCT 2
STAGE 2C**

CUT/FILL CONTOUR AS-BUILT
ORIGINAL SURFACE -
EARTHWORKS SURFACE
Sheet 1 of 2
AUCKLAND COUNCIL

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MCH	SURVEYED: RZ
JOB NUMBER: 33209	SCALE: 1:1000 @ A3
ISSUED: MAY 2016	
DWG. NO. 33209-02C-AB-110	REV. 1



REVISION DETAILS	NAME	DATE
1. DRAWING ISSUED	AAC	06/07/16

NOTES
1. CONTOURS ARE AT 1.0 METRE INTERVALS

LEGEND	
	ZERO CONTOUR
	CUT CONTOUR
	FILL CONTOUR
	STAGE BOUNDARIES
	LOT BOUNDARIES

CLIENT:





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**MILLWATER
PRECINCT 2
STAGE 2C**

**CUT/FILL CONTOUR AS-BUILT
ORIGINAL SURFACE -
EARTHWORKS SURFACE**
Sheet 2 of 2
AUCKLAND COUNCIL

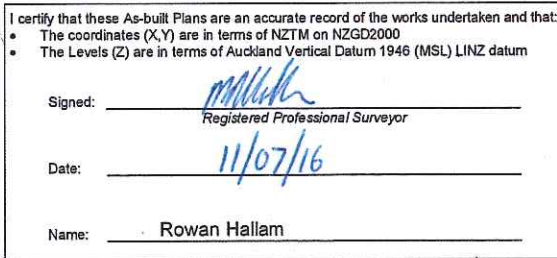
I certify that these As-built Plans are an accurate record of the works undertaken and that:
• The coordinates (X,Y) are in terms of NZTM on NZGD2000
• The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: 
Registered Professional Surveyor

Date: 

Name: Rowan Hallam






DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MCH	SURVEYED: RZ
JOB NUMBER: 33209	SCALE: 1:1000 @ A3
ISSUED: MAY 2016	
DWG. NO. 33209-02C-AB-111	REV. 1



NOTES

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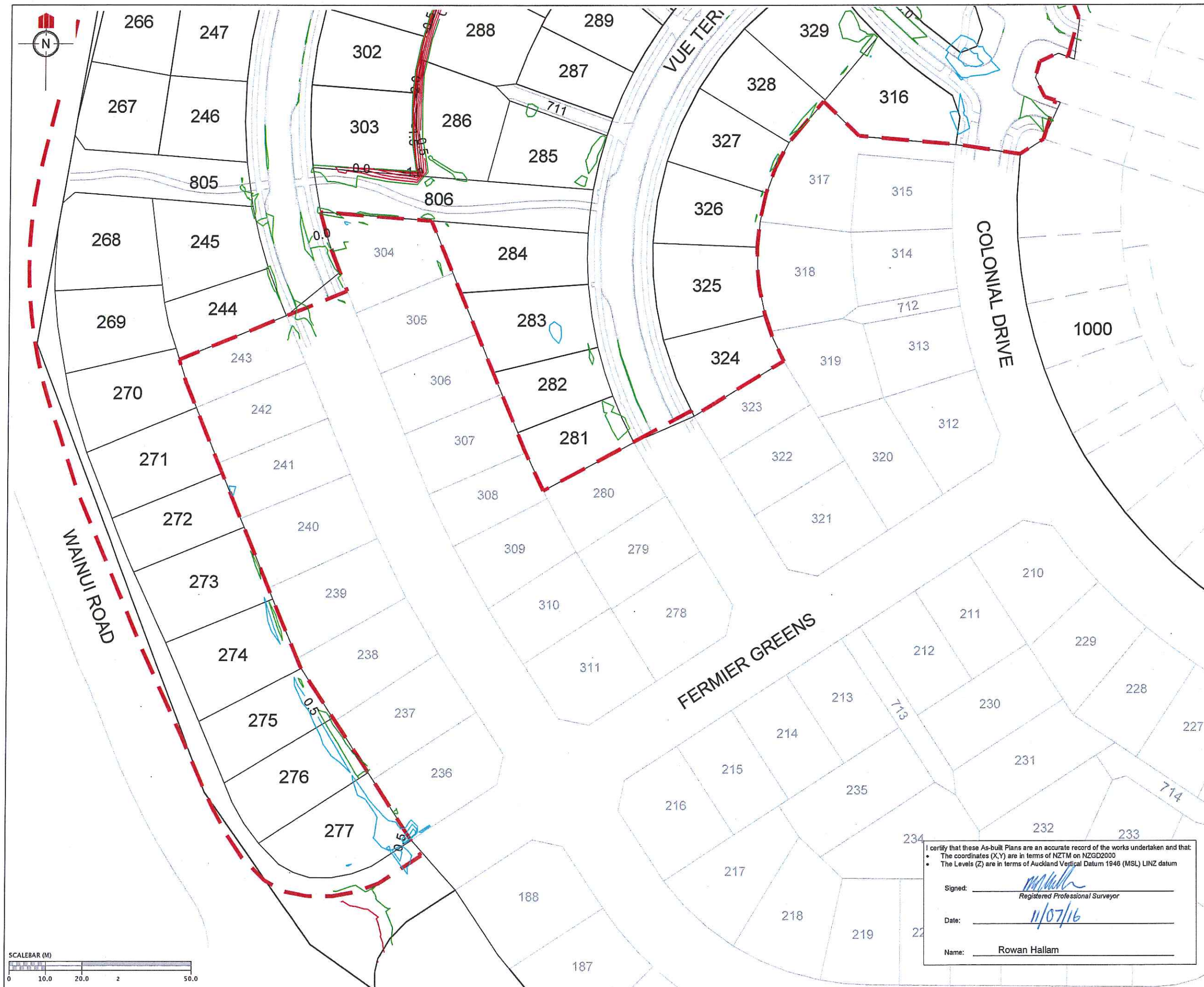
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	FILL CONTOUR
	STAGE BOUNDARIES
	LOT BOUNDARIES



CUT/FILL CONTOUR AS-BUILT
EARTHWORKS SURFACE - FINAL
SURFACE
Sheet 1 of 2
AUCKLAND COUNCIL

DESIGNED:	TX	ASBUILT	
CHECKED:	AC	DRAWN:	AAC
APPROVED:	MWH	SURVEYED:	RZ
JOB NUMBER:	33209	SCALE: 1:1000 @ A3	
ISSUED:	MAY 2016		
DWG. NO.		REV.	
33209-02C-AB-112		1	



REVISION DETAILS	NAME	DATE
1. DRAWING ISSUED	AAC	06/07/16

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

	ZERO CONTOUR
	CUT CONTOUR
	FILL CONTOUR
	STAGE BOUNDARIES
	LOT BOUNDARIES

CLIENT:



MILLWATER PRECINCT 2 STAGE 2C

CUT/FILL CONTOUR AS-BUILT
EARTHWORKS SURFACE - FINAL
SURFACE
Sheet 2 of 2

AUCKLAND COUNCIL

I certify that these As-built Plans are an accurate record of the works undertaken and that:

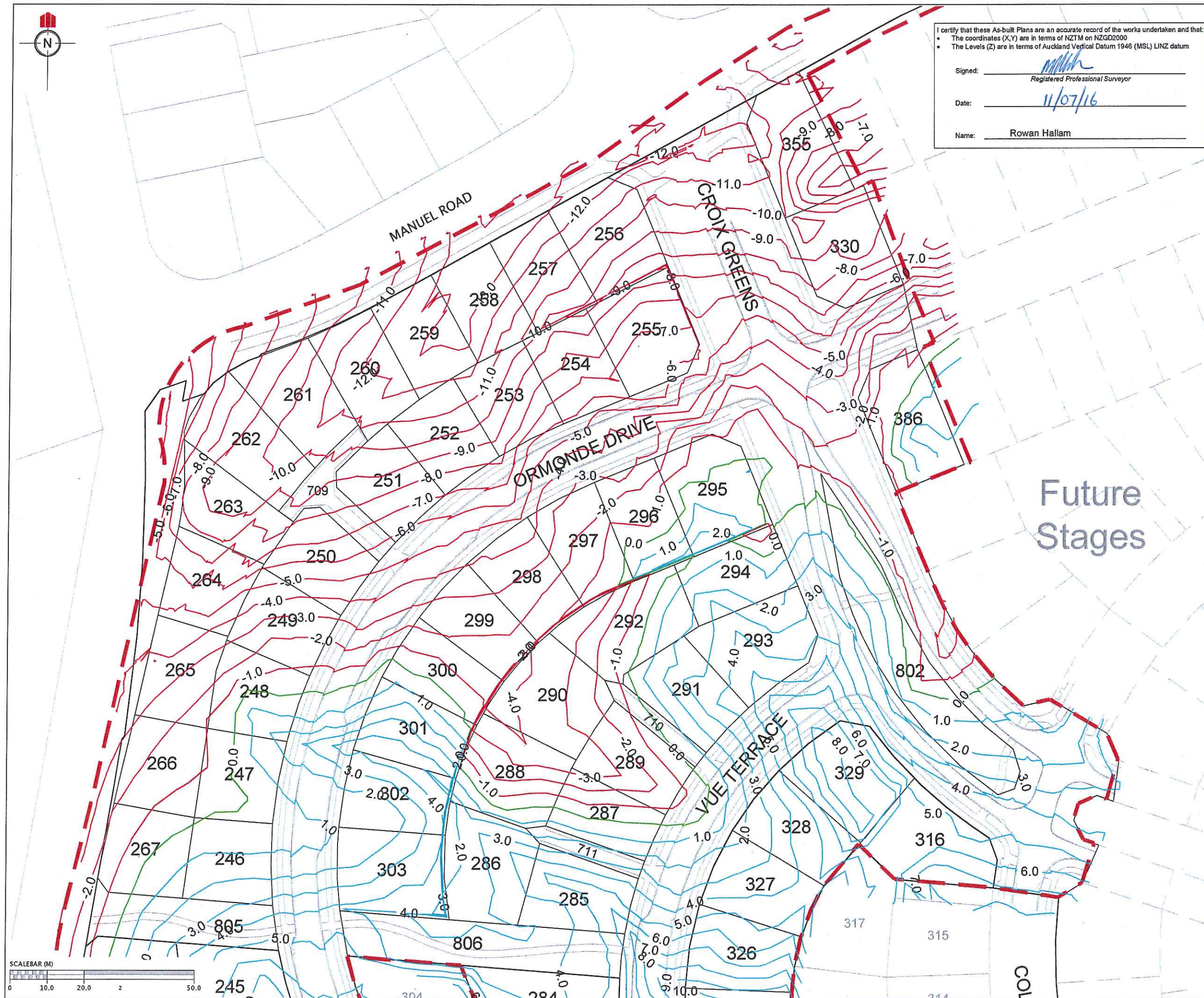
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed:
Registered Professional Surveyor

Date: 11/07/16

Name: Rowan Hallam

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MHA	SURVEYED: RZ
JOB NUMBER: 33209	SCALE: 1:1000 @ A3
ISSUED: MAY 2016	
DWG. NO. 33209-02C-AB-113	REV. 1



I certify that these As-built Plans are an accurate record of the works undertaken and that:

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Registered Professional Surveyor

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REVISION DETAILS	NAME	DATE
1. DRAWING ISSUED	AAC	06/07/16

NOTES

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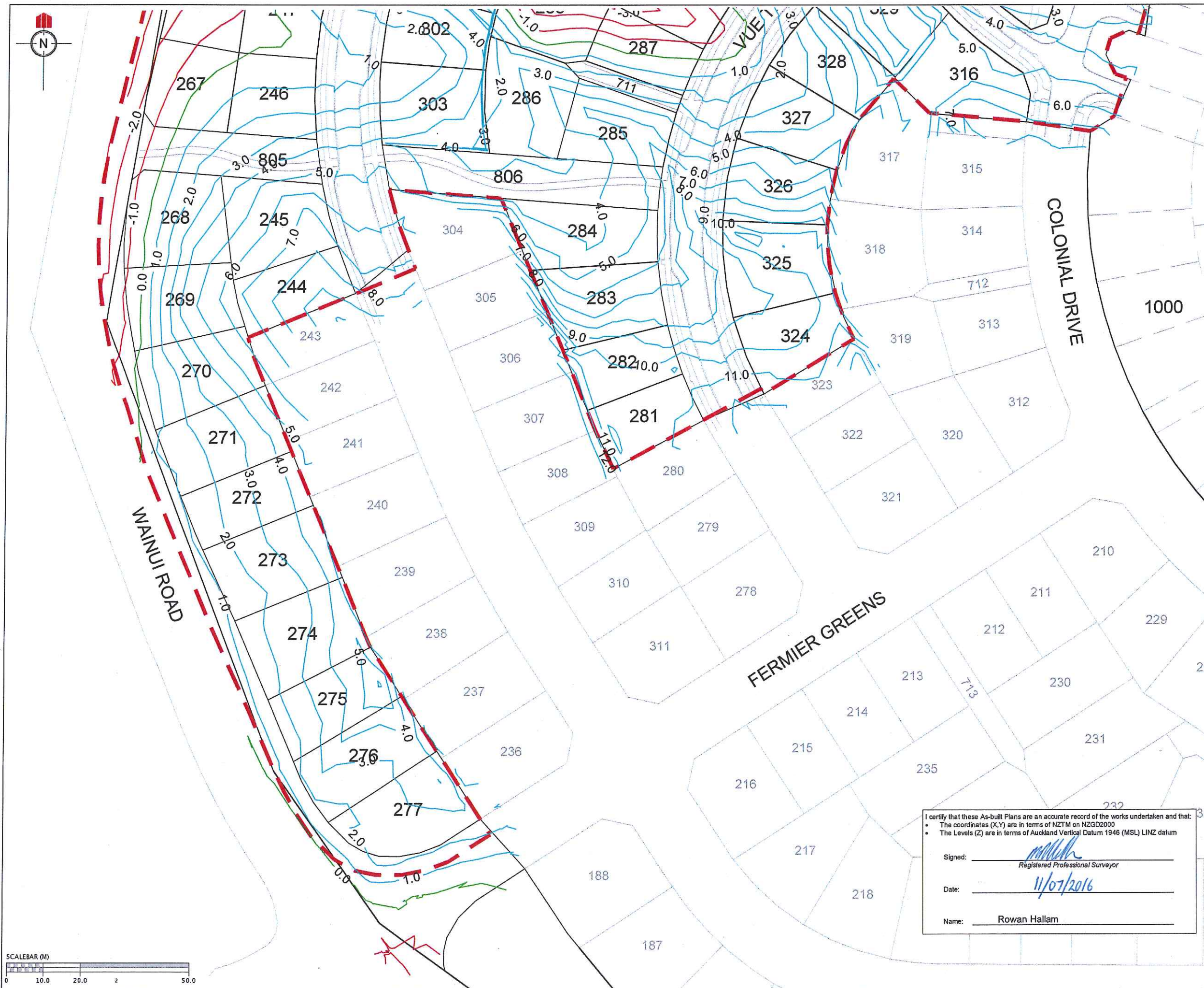
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	FILL CONTOUR
	STAGE BOUNDARIES
	LOT BOUNDARIES



MILLWATER PRECINCT 2 STAGE 2C

CUT/FILL CONTOUR AS-BUILT
ORIGINAL SURFACE - FINAL
SURFACE
Sheet 1 of 2
AUCKLAND COUNCIL

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MCH	SURVEYED: RZ
JOB NUMBER: 33209	SCALE: 1:1000 @ A3
ISSUED: MAY 2016	
DWG. NO. 33209-02C-AB-114	REV. 1



REVISION DETAILS		NAME	DATE
1.	DRAWING ISSUED	AAC	06/07/16

NOTES
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LEGEND	
	ZERO CONTOUR
	CUT CONTOUR
	FILL CONTOUR
	STAGE BOUNDARIES
	LOT BOUNDARIES

CLIENT:




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**MILLWATER
PRECINCT 2
STAGE 2C**

**CUT/FILL CONTOUR AS-BUILT
ORIGINAL SURFACE - FINAL
SURFACE**
Sheet 2 of 2
AUCKLAND COUNCIL



I certify that these As-built Plans are an accurate record of the works undertaken and that:

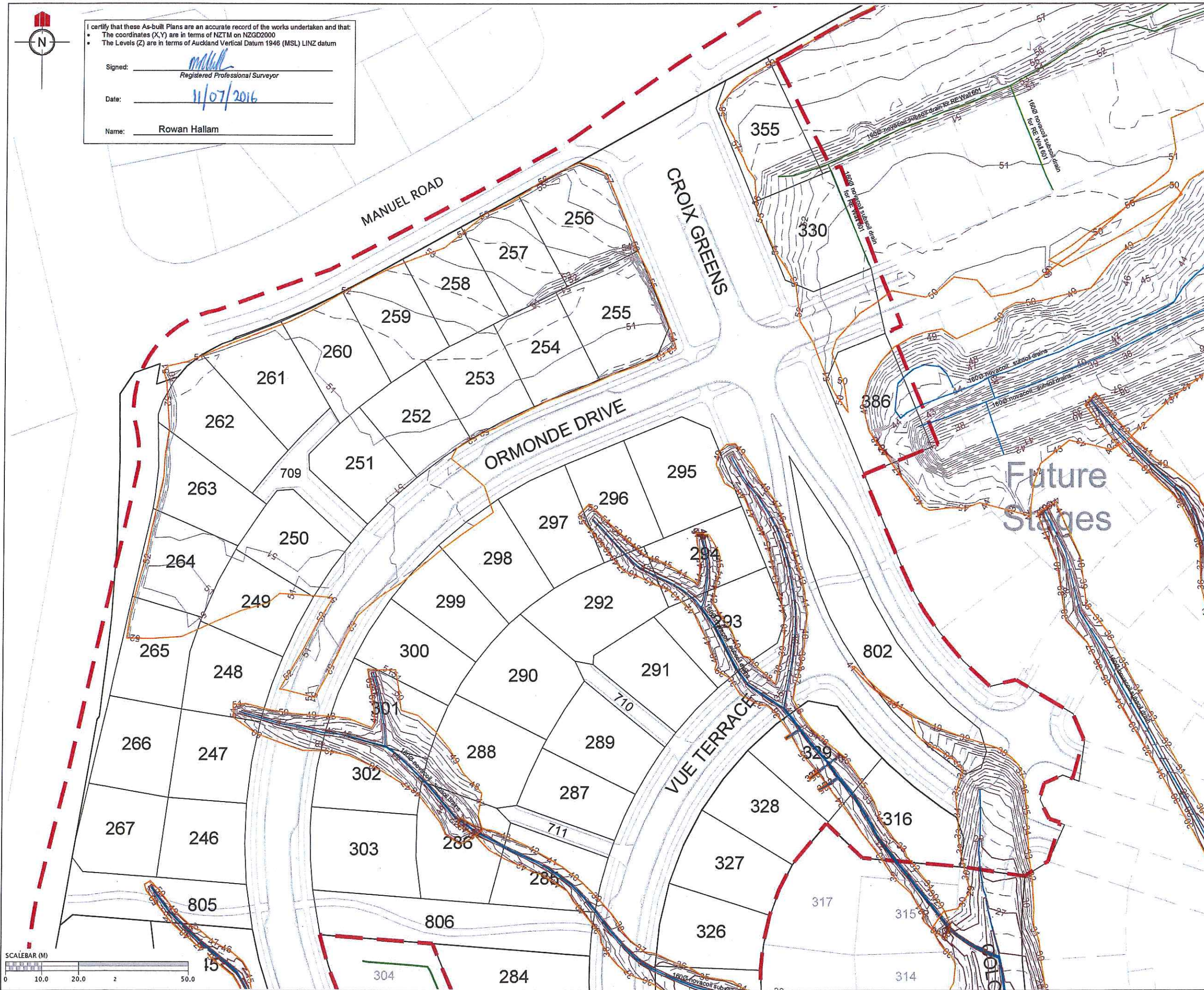
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: 
Registered Professional Surveyor

Date: 11/07/2016

Name: Rowan Hallam

DESIGNED: TX	ASBUILT
CHECKED: 	DRAWN: AAC
APPROVED: 	SURVEYED: RZ
JOB NUMBER: 33209	SCALE: 1:1000 @ A3
ISSUED: MAY 2016	
DWG. NO. 33209-02C-AB-115	REV. 1



REVISION DETAILS		NAME	DATE
1. DRAWING ISSUED		AAC	6/07/2016

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- NOVACOIL SUBSOIL DRAINS
- REINFORCED EARTH & RETAINING WALL SUBSOIL DRAINS
- EXISTING STORMWATER DRAINAGE
- NEW STORMWATER DRAINAGE
- STAGE BOUNDARIES
- LOT BOUNDARIES
- CONTOURS
- SHEAR KEY & UNDERCUT AREAS

CLIENT:

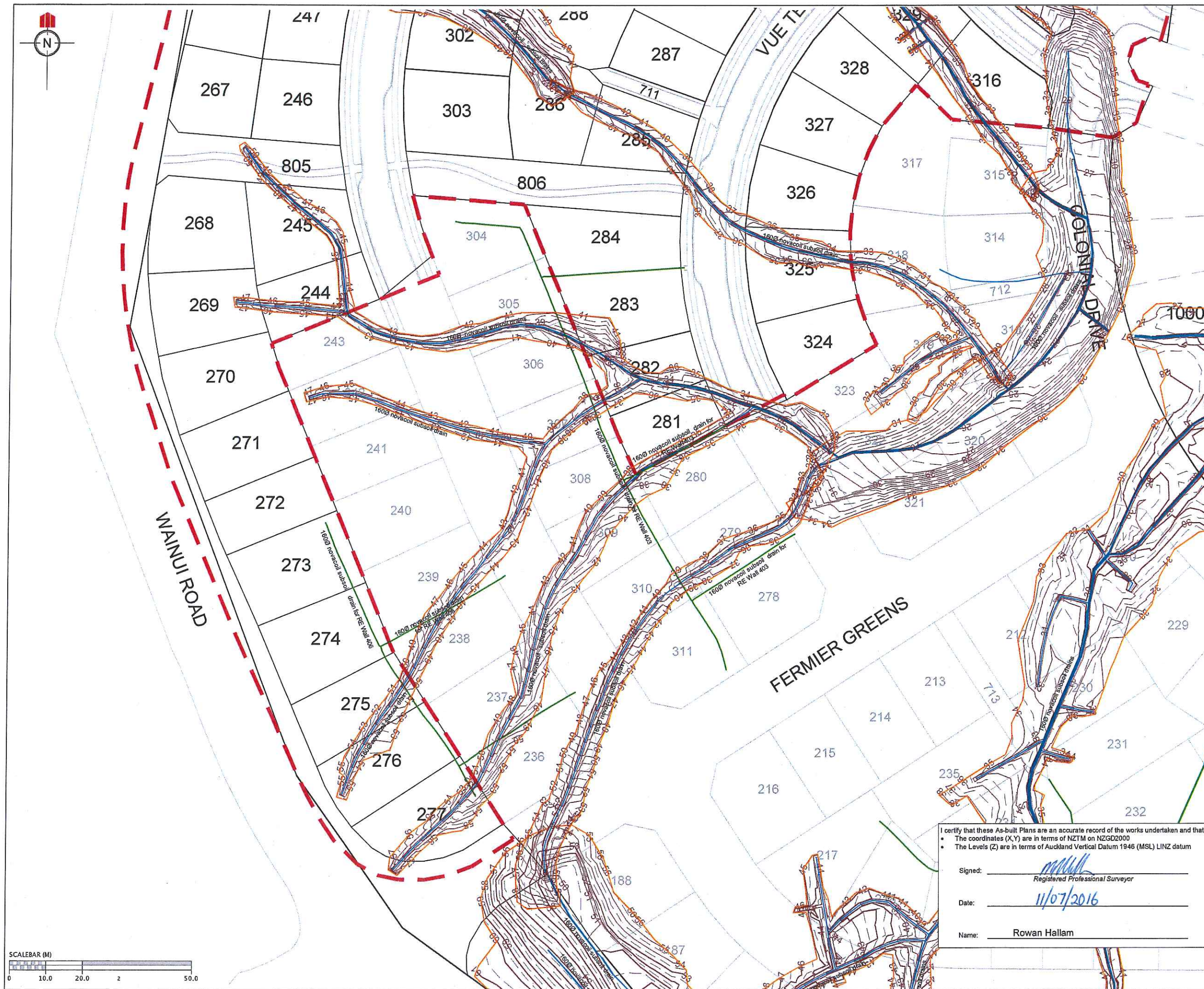


MILLWATER PRECINCT 2 STAGE 2C

SHEAR KEY, UNDERCUTS &
SUBSOIL DRAINS
AS-BUILT PLAN
Sheet 1 of 2

AUCKLAND COUNCIL

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MCH	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:1000 @ A3
ISSUED: May 2016	
DWG. NO. 33209-02C-AB-120	REV. 1



REVISION DETAILS	NAME	DATE
1. DRAWING ISSUED	AAC	6/07/2016

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- NOVACOIL SUBSOIL DRAINS
- REINFORCED EARTH & RETAINING WALL SUBSOIL DRAINS
- EXISTING STORMWATER DRAINAGE
- NEW STORMWATER DRAINAGE
- STAGE BOUNDARIES
- LOT BOUNDARIES
- CONTOURS
- SHEAR KEY & UNDERCUT AREAS

CLIENT:



MILLWATER PRECINCT 2 STAGE 2C

SHEAR KEY, UNDERCUTS &
SUBSOIL DRAINS
AS-BUILT PLAN
Sheet 2 of 2
AUCKLAND COUNCIL

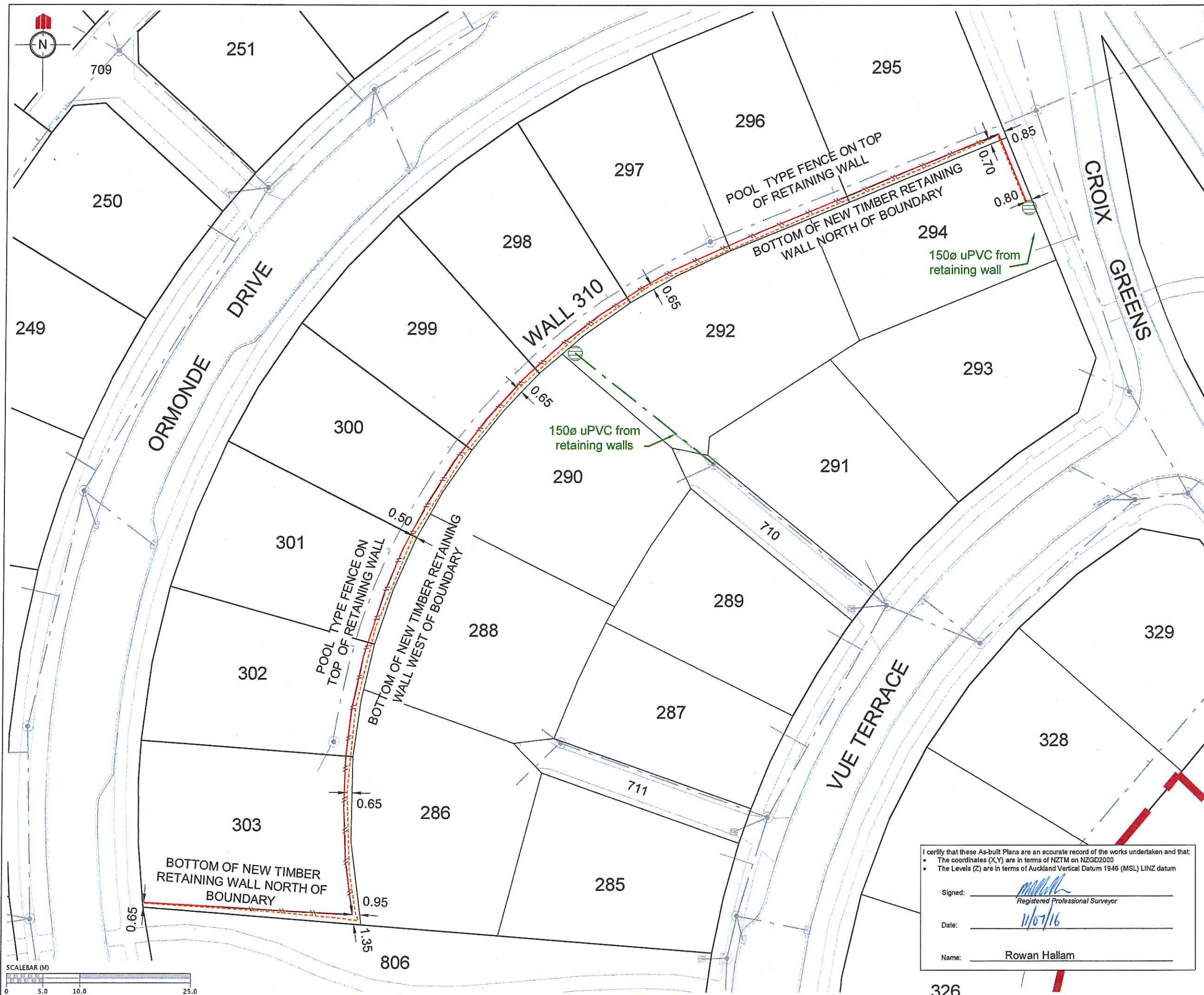
I certify that these As-built Plans are an accurate record of the works undertaken and that:
• The coordinates (X,Y) are in terms of NZTM on NZGD2000
• The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed:
Registered Professional Surveyor

Date: 11/07/2016

Name: Rowan Hallam

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MCH	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:1000 @ A3
ISSUED: May 2016	
DWG. NO. 33209-02C-AB-121	REV. 1



REVISION DETAILS		NAME	DATE
1.	DRAWING ISSUED	AAC	6/07/2016

LEGEND:

- BOTTOM FACE OF WALL
- TOP FACE OF WALL
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- FENCE
- STORMWATER LINE
- BOUNDARY

CLIENT:

WFH
PROPERTIES

WOODS
Engineers. Surveyors. Planners.

**MILLWATER
PRECINCT 2
STAGE 2C**

**RETAINING WALL
AS-BUILT
Sheet 1 of 2**

AUCKLAND COUNCIL

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- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: Rowan Hallam
Registered Professional Surveyor

Date: 11/07/16

Name: Rowan Hallam

DESIGNED: TX	AS-BUILT
CHECKED: <u>AL</u>	DRAWN: AAC
APPROVED: <u>MEH</u>	SURVEYED: woods
JOB NUMBER: 33209	SCALE: 1:500 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-02C-AB-150	REV. 1



REVISION DETAILS		NAME	DATE
1.	DRAWING ISSUED	AAC	6/07/2016

LEGEND:

- BOTTOM FACE OF WALL
- TOP FACE OF WALL
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- FENCE
- STORMWATER LINE
- BOUNDARY

CLIENT:

WFH
PROPERTIES

WOODS
Engineers, Surveyors, Planners.

**MILLWATER
PRECINCT 2
STAGE 2C**

**RETAINING WALL
AS-BUILT
Sheet 2 of 2**

AUCKLAND COUNCIL

I certify that these As-built Plans are an accurate record of the works undertaken and that:

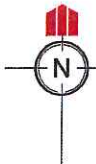
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

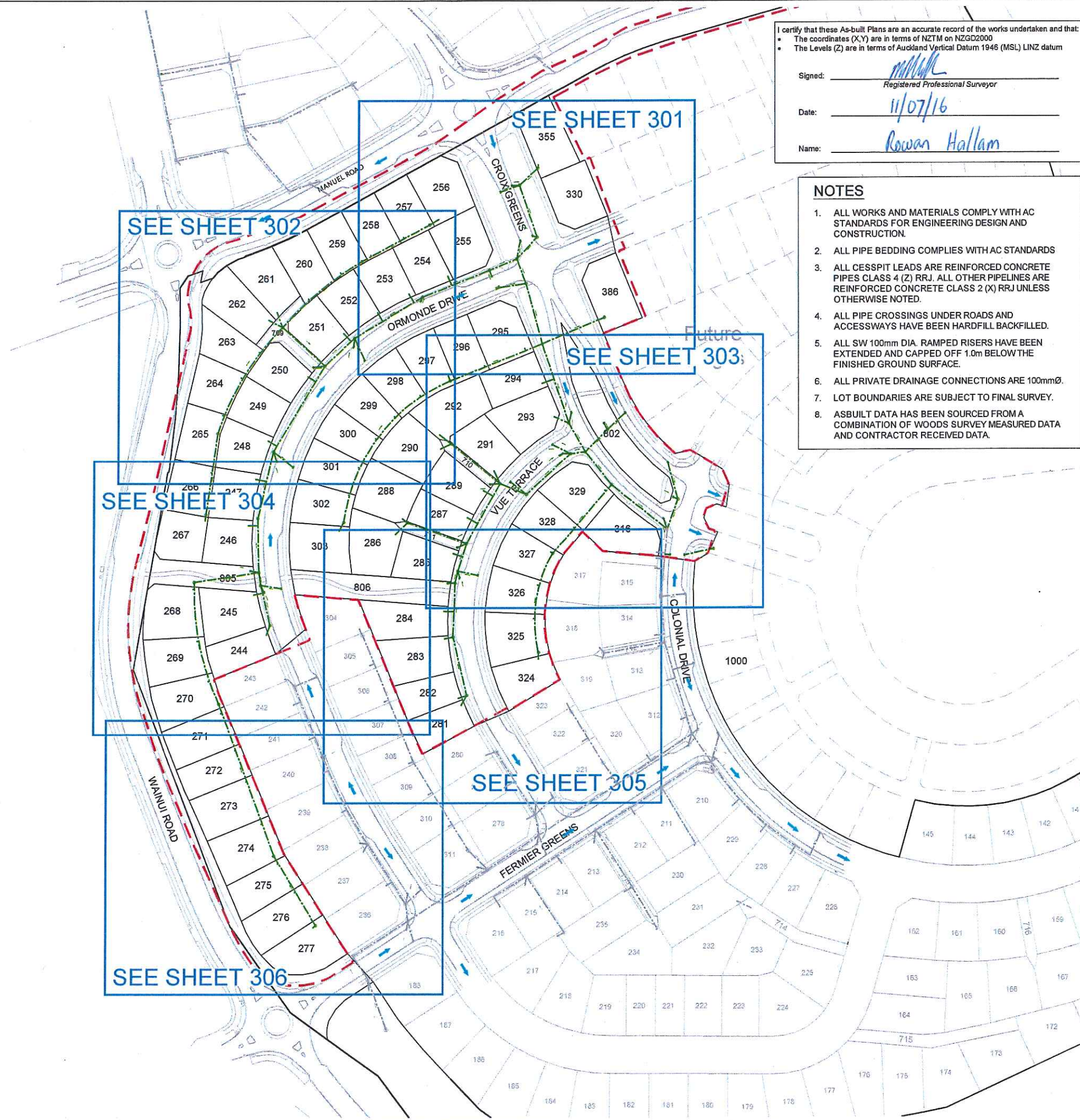
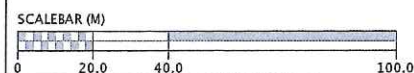
Date: 17/06/16

Name: Rowan Hallam

DESIGNED: TX	AS-BUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MW	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:500 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-02C-AB-151	REV. 1



SCHEDULE OF COORDINATES STORMWATER LOT CONNECTIONS			
Lot	mE	mN	length
Lot 244	1749096.03	5946757.16	4.3
Lot 245	1749090.09	5946776.44	4
Lot 246	1749087.33	5946809.78	4.6
Lot 247	1749090.87	5946832.22	5.1
Lot 248	1749096.82	5946850.64	4.6
Lot 249			
Lot 250	1749115.87	5946881.61	4.3
Lot 251	1749133.42	5946902.46	5
Lot 252	1749149.55	5946912.47	4.7
Lot 253	1749164.79	5946921.31	4.4
Lot 254	1749183.52	5946929.99	4.7
Lot 255			
Lot 256	1749179.15	5946957.33	4.5
Lot 257	1749162.15	5946948.57	0.5
Lot 258	1749146.28	5946939.94	0.4
Lot 259	1749131.73	5946931.70	0.9
Lot 260	1749116.06	5946919.04	0.7
Lot 261	1749100.79	5946912.58	7.1
Lot 262	1749096.91	5946908.82	6.8
Lot 263	1749092.22	5946893.45	0.6
Lot 264	1749083.64	5946881.00	0.75
Lot 265	1749074.82	5946862.97	0.7
Lot 266	1749069.29	5946835.33	0.45
Lot 267	1749066.50	5946812.19	2.5
Lot 268	1749060.65	5946779.21	0.6
Lot 269	1749062.83	5946754.10	0.7
Lot 270	1749068.15	5946734.85	0.6
Lot 271	1749074.28	5946719.45	0.6
Lot 272	1749081.00	5946701.63	0.4
Lot 273	1749086.47	5946686.57	0.4
Lot 274	1749093.81	5946666.30	0.5
Lot 275	1749101.64	5946647.15	0.5
Lot 276	1749110.00	5946633.42	0.4
Lot 277	1749118.92	5946616.53	0.9
Lot 281	1749190.31	5946723.36	4.5
Lot 282	1749188.88	5946726.63	3.4
Lot 283	1749182.23	5946755.31	3.5
Lot 284	1749181.97	5946768.56	4.8
Lot 285	1749186.28	5946796.23	4.8
Lot 286	1749158.56	5946805.57	7.6
Lot 287	1749193.11	5946813.49	5.9
Lot 288	1749162.02	5946813.01	3
Lot 289	1749200.87	5946826.52	5.5
Lot 290	1749180.32	5946846.78	4.9
Lot 291	1749205.96	5946836.12	6.4
Lot 292	1749179.68	5946853.52	6.6
Lot 293	1749235.17	5946862.08	6.9
Lot 294	1749229.12	5946878.35	6.1
Lot 295	1749220.70	5946895.10	1
Lot 296	1749201.28	5946886.91	0.6
Lot 297	1749183.74	5946881.86	1.95
Lot 298	1749170.35	5946872.39	0.6
Lot 299	1749157.90	5946862.30	0.6
Lot 300	1749148.84	5946851.55	0.5
Lot 301	1749140.60	5946837.71	0.6
Lot 302	1749135.82	5946824.46	0.5
Lot 303	1749131.38	5946807.29	4
Lot 324	1749227.57	5946745.54	2.5
Lot 325	1749225.13	5946764.97	0.6
Lot 326	1749227.16	5946781.05	0.8
Lot 327	1749233.46	5946796.93	0.5
Lot 328	1749244.47	5946808.85	0.4
Lot 329	1749259.47	5946826.67	0.6
Lot 330			
Lot 355	1749227.10	5946983.57	
Lot 386			



I certify that these As-built Plans are an accurate record of the works undertaken and that:

- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: Rowan Hallam
Registered Professional Surveyor

Date: 11/07/16

Name: Rowan Hallam

NOTES

- ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
- ALL PIPE BEDDING COMPLIES WITH AC STANDARDS
- ALL CESSPIT LEADS ARE REINFORCED CONCRETE PIPES CLASS 4 (Z) RRJ. ALL OTHER PIPELINES ARE REINFORCED CONCRETE CLASS 2 (X) RRJ UNLESS OTHERWISE NOTED.
- ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
- ALL SW 100mm DIA. RAMPED RISERS HAVE BEEN EXTENDED AND CAPPED OFF 1.0m BELOW THE FINISHED GROUND SURFACE.
- ALL PRIVATE DRAINAGE CONNECTIONS ARE 100mmØ.
- LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
- ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

REVISION DETAILS		NAME	DATE
1. DRAWING ISSUED		AAC	11/07/16

LEGEND

STORMWATER MANHOLE	
STORMWATER CESSPIT	
STORMWATER DOUBLE CESSPIT	
OVERLAND FLOW	
NEW STORMWATER	
EXISTING STORMWATER	
RETAINING WALL DRAINAGE	
STAGE BOUNDARY	

CLIENT:

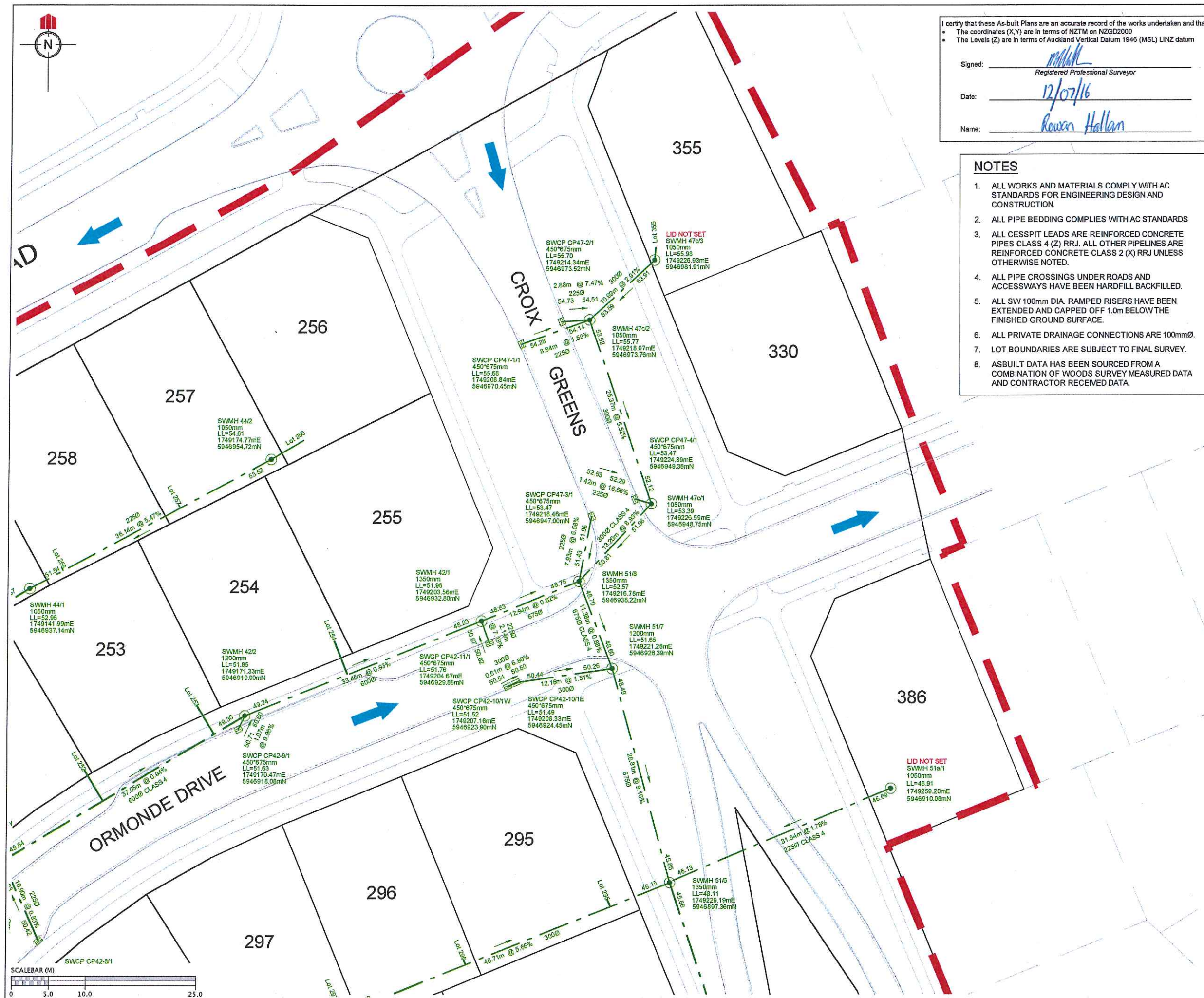


MILLWATER PRECINCT 2 STAGE 2C

STORMWATER AS-BUILT OVERALL LAYOUT Sheet 1 of 7

AUCKLAND COUNCIL

DESIGNED: TX	ASBUILT
CHECKED: <u>AC</u>	DRAWN: AAC
APPROVED: <u>MMH</u>	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:2000 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-2C-AB-300	REV. 1



I certify that these As-built Plans are an accurate record of the works undertaken and that:

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- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____
Registered Professional Surveyor

Date: 12/07/16

Name: Rowan Hallan

- NOTES**
- ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
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REVISION DETAILS	NAME	DATE
1. DRAWING ISSUED	AAC	11/07/16

LEGEND

STORMWATER MANHOLE

STORMWATER CESSPIT

STORMWATER DOUBLE CESSPIT

OVERLAND FLOW

NEW STORMWATER

EXISTING STORMWATER

RETAINING WALL DRAINAGE

STAGE BOUNDARY

CLIENT:

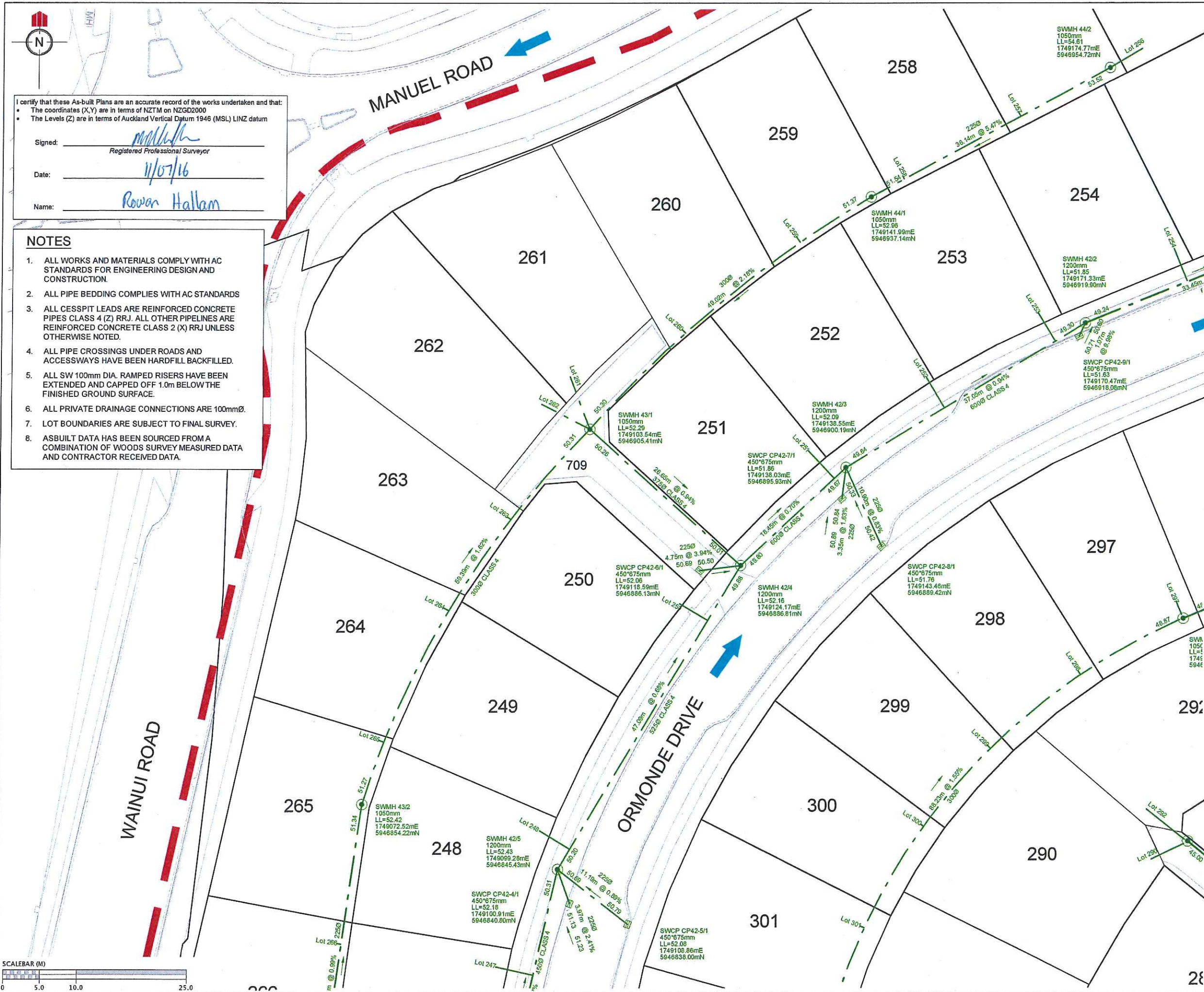
WFH
PROPERTIES

WOODS
Engineers. Surveyors. Planners.

**MILLWATER
PRECINCT 2
STAGE 2C**

STORMWATER AS-BUILT
Sheet 2 of 7

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MCH	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:500 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-2C-AB-301	REV. 1



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- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: Rowan Hallam
Registered Professional Surveyor

Date: 11/07/16

Name: Rowan Hallam

- NOTES**
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 - LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
 - ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

REVISION DETAILS	NAME	DATE
1. DRAWING ISSUED	AAC	11/07/16

LEGEND	
STORMWATER MANHOLE	⊙
STORMWATER CESSPIT	⊞
STORMWATER DOUBLE CESSPIT	⊞⊞
OVERLAND FLOW	→
NEW STORMWATER	---
EXISTING STORMWATER	---
RETAINING WALL DRAINAGE	---
STAGE BOUNDARY	---

CLIENT:

WFH
PROPERTIES

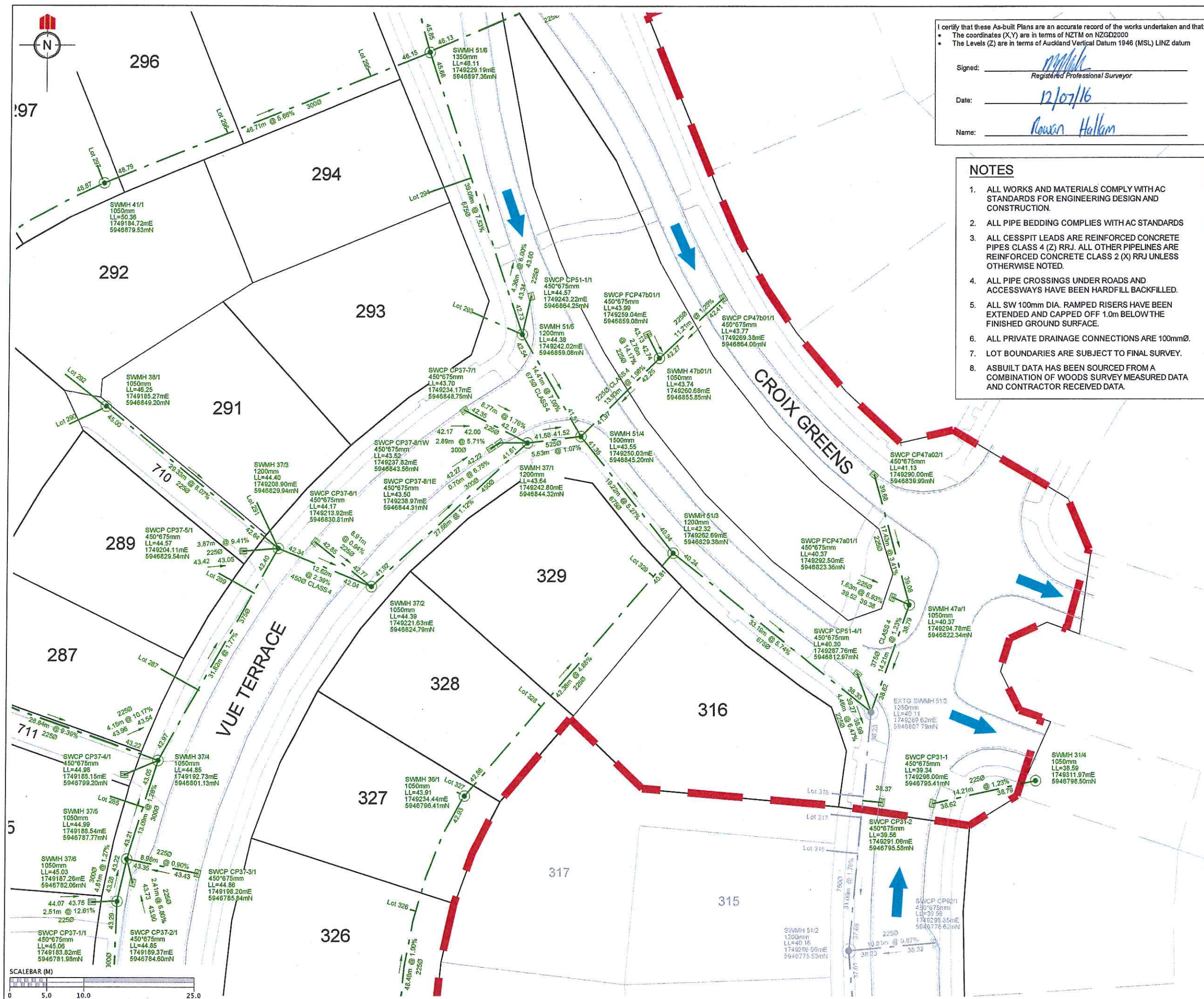
WOODS
Engineers, Surveyors, Planners.

**MILLWATER
PRECINCT 2
STAGE 2C**

STORMWATER AS-BUILT
Sheet 3 of 7

AUCKLAND COUNCIL

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MCH	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:500 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-2C-AB-302	REV. 1



REVISION DETAILS		NAME	DATE
1.	DRAWING ISSUED	AAC	11/07/16

LEGEND	
STORMWATER MANHOLE	
STORMWATER CESSPIT	
STORMWATER DOUBLE CESSPIT	
OVERLAND FLOW	
NEW STORMWATER	
EXISTING STORMWATER	
RETAINING WALL DRAINAGE	
STAGE BOUNDARY	

CLIENT:

WFH
PROPERTIES

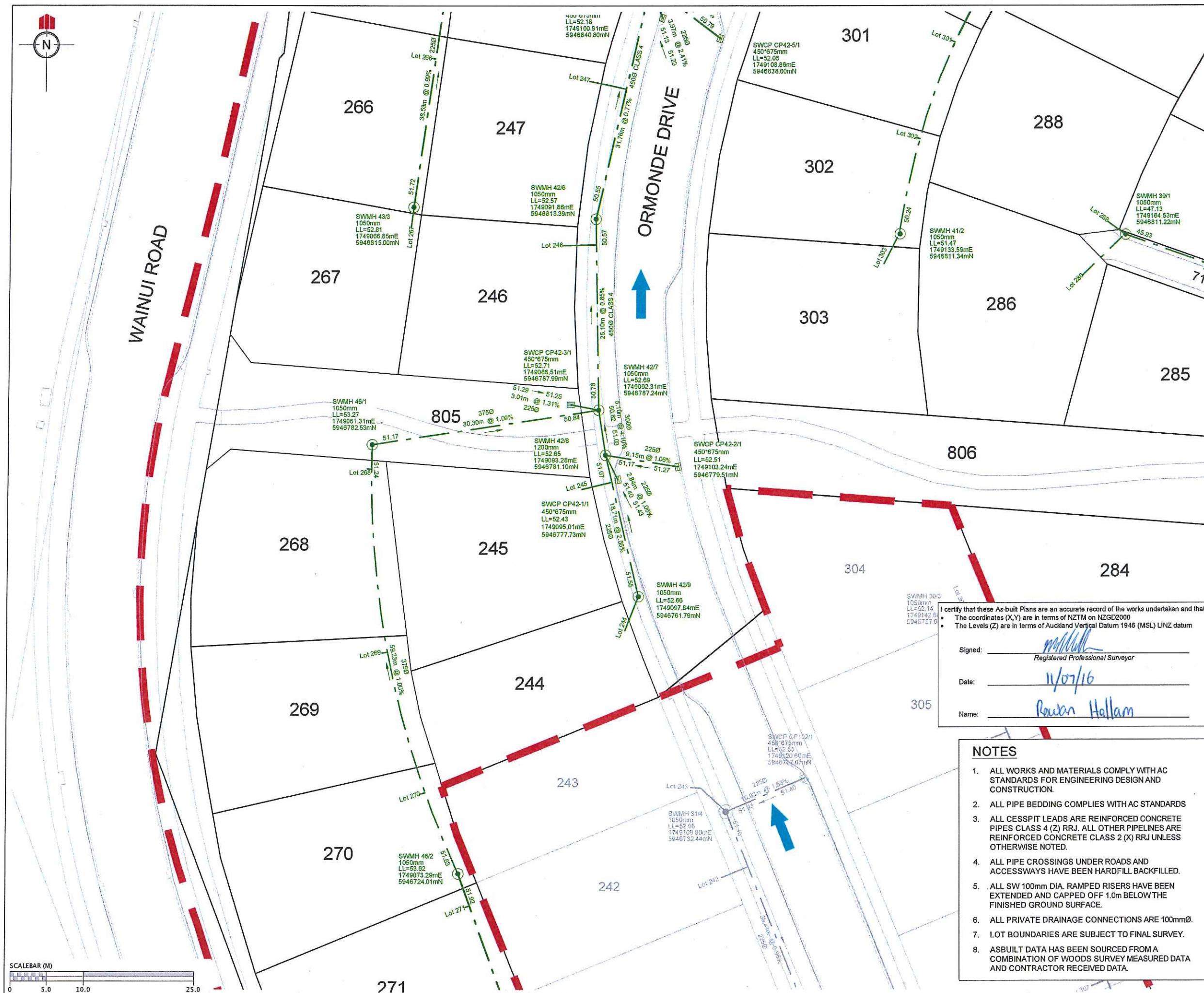
WOODS
Engineers. Surveyors. Planners.

**MILLWATER
PRECINCT 2
STAGE 2C**

**STORMWATER AS-BUILT
Sheet 4 of 7**

AUCKLAND COUNCIL

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MHA	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:500 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-2C-AB-303	REV. 1



REVISION DETAILS		NAME	DATE
1.	DRAWING ISSUED	AAC	11/07/16

LEGEND

STORMWATER MANHOLE

STORMWATER CESSPIT

STORMWATER DOUBLE CESSPIT

OVERLAND FLOW

NEW STORMWATER

EXISTING STORMWATER

RETAINING WALL DRAINAGE

STAGE BOUNDARY

CLIENT:

WFH
PROPERTIES

WOODS
Engineers. Surveyors. Planners.

**MILLWATER
PRECINCT 2
STAGE 2C**

**STORMWATER AS-BUILT
Sheet 5 of 7**

AUCKLAND COUNCIL

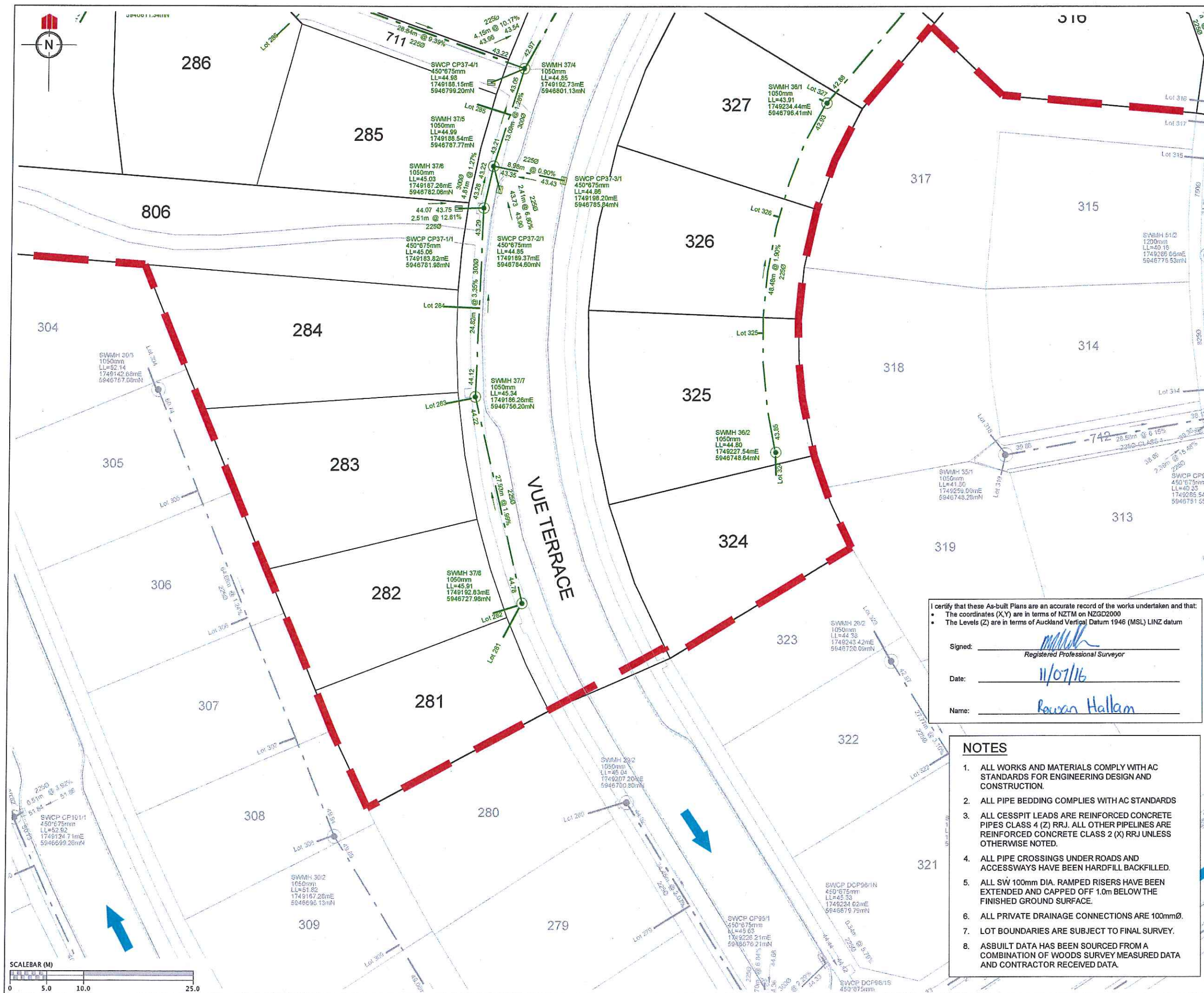
I certify that these As-built Plans are an accurate record of the works undertaken and that:

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- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed:
Date: 11/07/16
Name: Rowan Hallam

- NOTES**
- ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
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DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MRH	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:500 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-2C-AB-304	REV. 1



REVISION DETAILS		NAME	DATE
1. DRAWING ISSUED		AAC	11/07/16

LEGEND	
STORMWATER MANHOLE	
STORMWATER CESSPIT	
STORMWATER DOUBLE CESSPIT	
OVERLAND FLOW	
NEW STORMWATER	
EXISTING STORMWATER	
RETAINING WALL DRAINAGE	
STAGE BOUNDARY	

CLIENT:

WFH
PROPERTIES

WOODS
Engineers. Surveyors. Planners.

**MILLWATER
PRECINCT 2
STAGE 2C**

**STORMWATER AS-BUILT
Sheet 6 of 7**

AUCKLAND COUNCIL

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED:	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:500 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-2C-AB-305	REV. 1

I certify that these As-built Plans are an accurate record of the works undertaken and that:

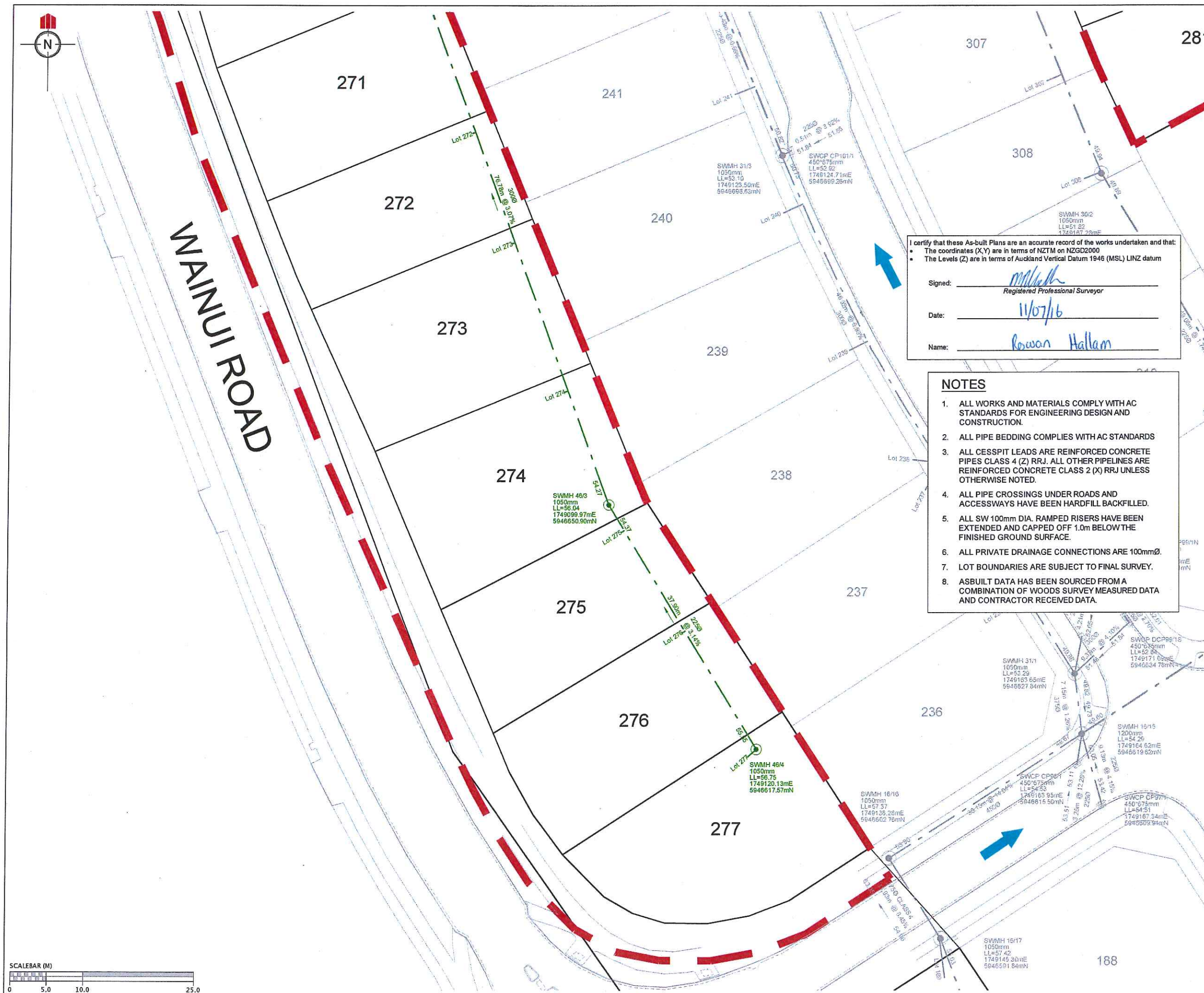
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- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed:
Registered Professional Surveyor

Date: 11/07/16

Name: Rouven Hallam

- NOTES**
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REVISION DETAILS		NAME	DATE
1. DRAWING ISSUED		AAC	11/07/16

LEGEND
STORMWATER MANHOLE
STORMWATER CESSPIT
STORMWATER DOUBLE CESSPIT
OVERLAND FLOW
NEW STORMWATER
EXISTING STORMWATER
RETAINING WALL DRAINAGE
STAGE BOUNDARY

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Signed: _____
Date: _____
Name: _____

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CLIENT:

WFH
PROPERTIES

WOODS
Engineers, Surveyors, Planners.

**MILLWATER
PRECINCT 2
STAGE 2C**

**STORMWATER AS-BUILT
Sheet 7 of 7**

AUCKLAND COUNCIL

DESIGNED: TX	ASBUILT
CHECKED: AC	DRAWN: AAC
APPROVED: MCH	SURVEYED: WOODS
JOB NUMBER: 33209	SCALE: 1:500 @ A3
ISSUED: JUNE 2016	
DWG. NO. 33209-2C-AB-306	REV. 1

Appendix A2: T+T Drawings

- **21854.001-P2S2C-100** **Drawing List and Site Location Plan**
- **21854.001-P2S2C-101** **Geotechnical Works Plan**
- **21854.001-P2S2C-102** **Geotechnical Works Subsoil Drain Plan**
- **21854.001-P2S2C-103** **Geological Cross Section 2**
- **21854.001-P2S2C-104** **Typical Reinforced Earth Slope Details**
- **21854.001-P2S2C-105** **RE Slope 601 and 603 Typical Cross Section Detail**
- **21854.001-P2S2C-110** **Building Limitation Plan**

Timber Pole Walls 310 and 311 Drawings

- **21854.001-P2S2C-110** **Geological Long Section Walls 310 and 311**
- **21854.001-P2S2C-120** **Typical Timber Pole Retaining Wall Details**
- **21854.001-P2S2C-121** **Standard Fence Panel Detail**

WFH PROPERTIES LTD
RESIDENTIAL SUBDIVISION
MILLWATER-PRECINCT 2 (STAGE 2C)
Completion Report

DRAWING Rev Title

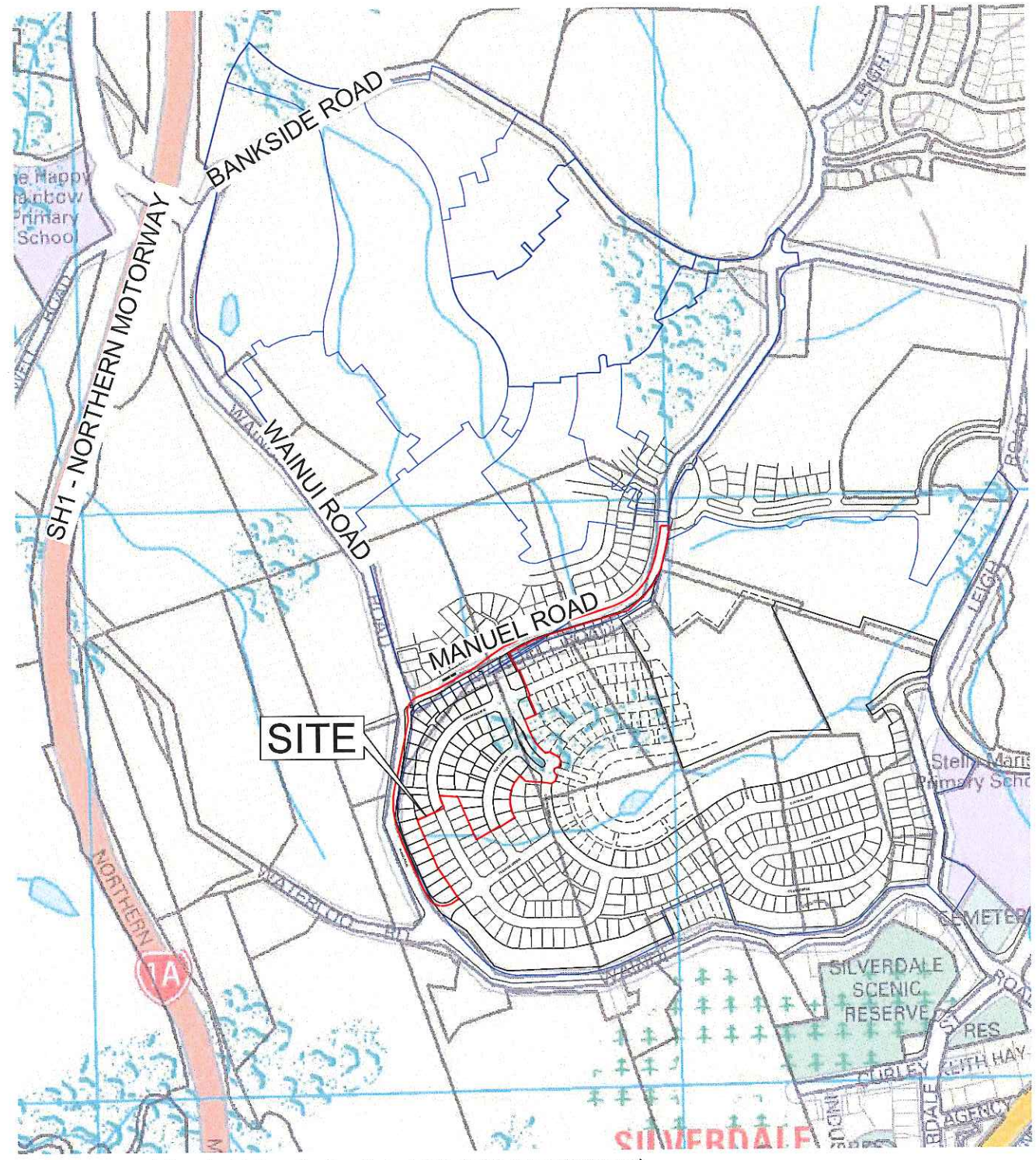
APPENDIX A2

- 21854.001-P2S2C-100 1 Drawing List and Site Location Plan
- 21854.001-P2S2C-101 1 Geotechnical Works Plan
- 21854.001-P2S2C-102 1 Geotechnical Works Subsoil Drain Plan
- 21854.001-P2S2C-103 1 Geological Cross Section 2
- 21854.001-P2S2C-104 1 Typical Reinforced Earth Slope Details
- 21854.001-P2S2C-105 1 RE Slope 601 and 603 Typical Cross Section Detail
- 21854.001-P2S2C-110 1 Building Limitation Plan

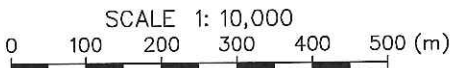
APPENDIX E

- 21854.001-P2S2C-111 1 Post Earthworks Investigation Plan
- 21854.001-P2S2C-112 1 Topsoil Depths Plan
- 21854.001-P2S2C-113 1 Earthworks Testing Location Plan

• Denotes drawing this issue: 15/07/2016



Street map sourced from Land Information New Zealand data (Crown Copyright Reserved).



LOCATION PLAN
SCALE 1: 10000

			DESIGNED :	JXXL	Jul. 16
			DRAWN :	JC	Jul. 16
			DESIGN CHECKED :		
			DRAFTING CHECKED :		
			CADFILE : \\21854.001-P2S2C- 100.dwg		
			APPROVED :		
			NOT FOR CONSTRUCTION		
			This drawing is not to be used for construction purposes unless signed as approved		
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NOTES :
1. All dimensions are in millimetres unless noted otherwise.

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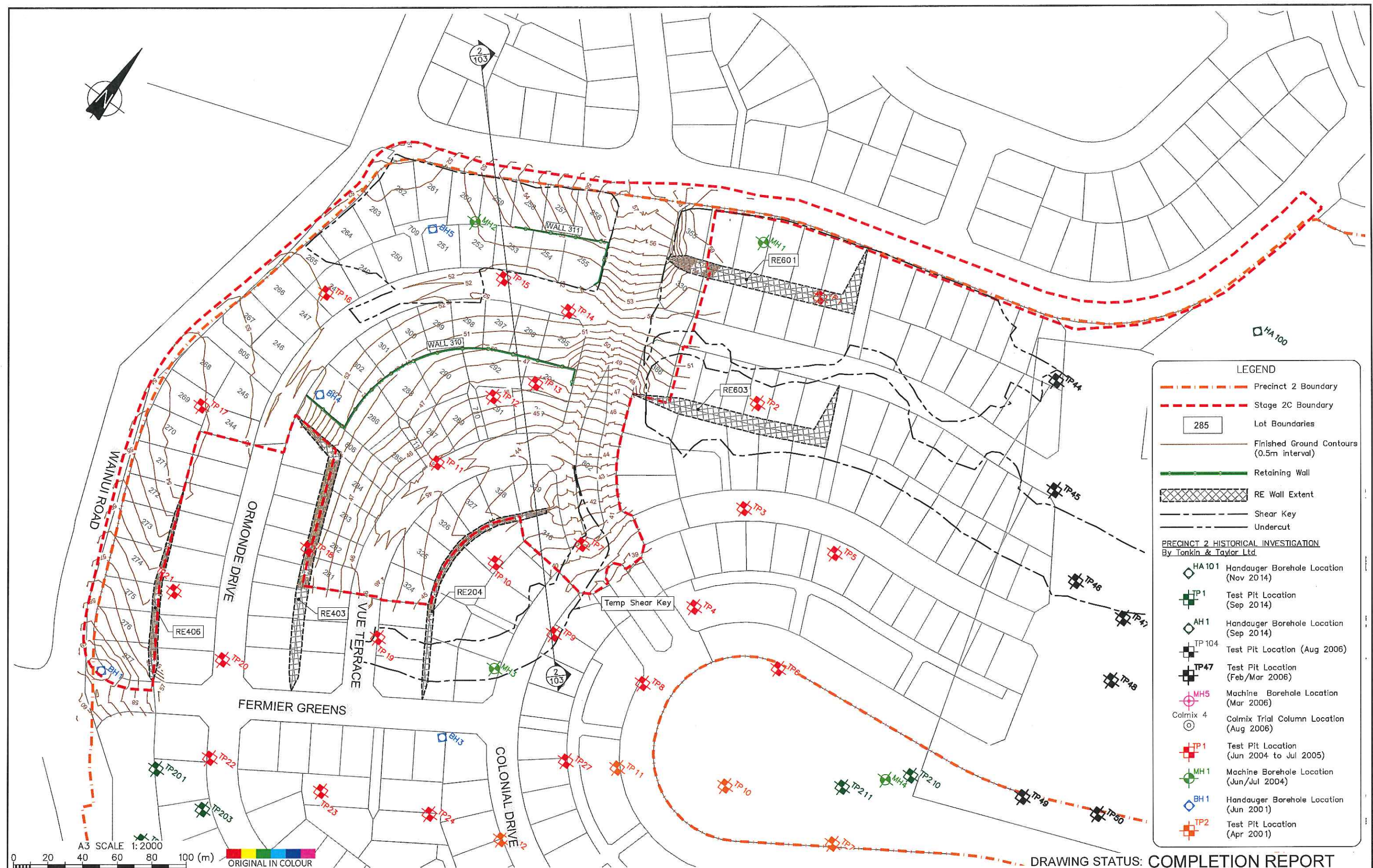
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DRAWING STATUS: COMPLETION REPORT

CLIENT, PROJECT		WFH PROPERTIES	
		RESIDENTIAL SUBDIVISION	
TITLE		MILLWATER - PRECINCT 2 (STAGE 2C)	
		Drawing List and Site Location Plan	
SCALES (AT A3 SIZE)		DWG. No.	REV.
1: 10000		21854.001-P2S2C-100	1

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LEGEND

- Precinct 2 Boundary
- Stage 2C Boundary
- Lot Boundaries
- Finished Ground Contours (0.5m interval)
- Retaining Wall
- RE Wall Extent
- Shear Key
- Undercut

PRECINCT 2 HISTORICAL INVESTIGATION
By Tonkin & Taylor Ltd

- HA 101 Handauger Borehole Location (Nov 2014)
- TP1 Test Pit Location (Sep 2014)
- AH1 Handauger Borehole Location (Sep 2014)
- TP104 Test Pit Location (Aug 2006)
- TP47 Test Pit Location (Feb/Mar 2006)
- MH5 Machine Borehole Location (Mar 2006)
- Colmix 4 Colmix Trial Column Location (Aug 2006)
- TP1 Test Pit Location (Jun 2004 to Jul 2005)
- MH1 Machine Borehole Location (Jun/Jul 2004)
- BH1 Handauger Borehole Location (Jun 2001)
- TP2 Test Pit Location (Apr 2001)

DRAWING STATUS: COMPLETION REPORT

				DESIGNED :	JXXL	Jun. 16	NOTES : 1. All dimensions are in millimeters unless noted otherwise. 2. Coordinate Datum: NZGD2000, New Zealand Transverse Mercator (NZTM2000). Level Datum: LINZ (MSL) Auckland Vertical Datum 1946 3. Asbuilt Plan supplied by WOODS, reference no. "33209-02C-AB-100 FINAL CONTOURS.dwg", dated 1 June 2016. 4. Retaining wall alignment supplied by WOODS, reference no. "33209-02C-AB-130-WALLS.dwg" dated 9 June 2016.
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				DRAFTING CHECKED :			
				CADFILE : \\21854.001-P2S2C-101.dwg			
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				NOT FOR CONSTRUCTION			
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CLIENT, PROJECT

WFH PROPERTIES
RESIDENTIAL SUBDIVISION

TITLE

MILLWATER - PRECINCT 2 (STAGE 2C)
Geotechnical Works Plan

SCALES (AT A3 SIZE)

1:2000

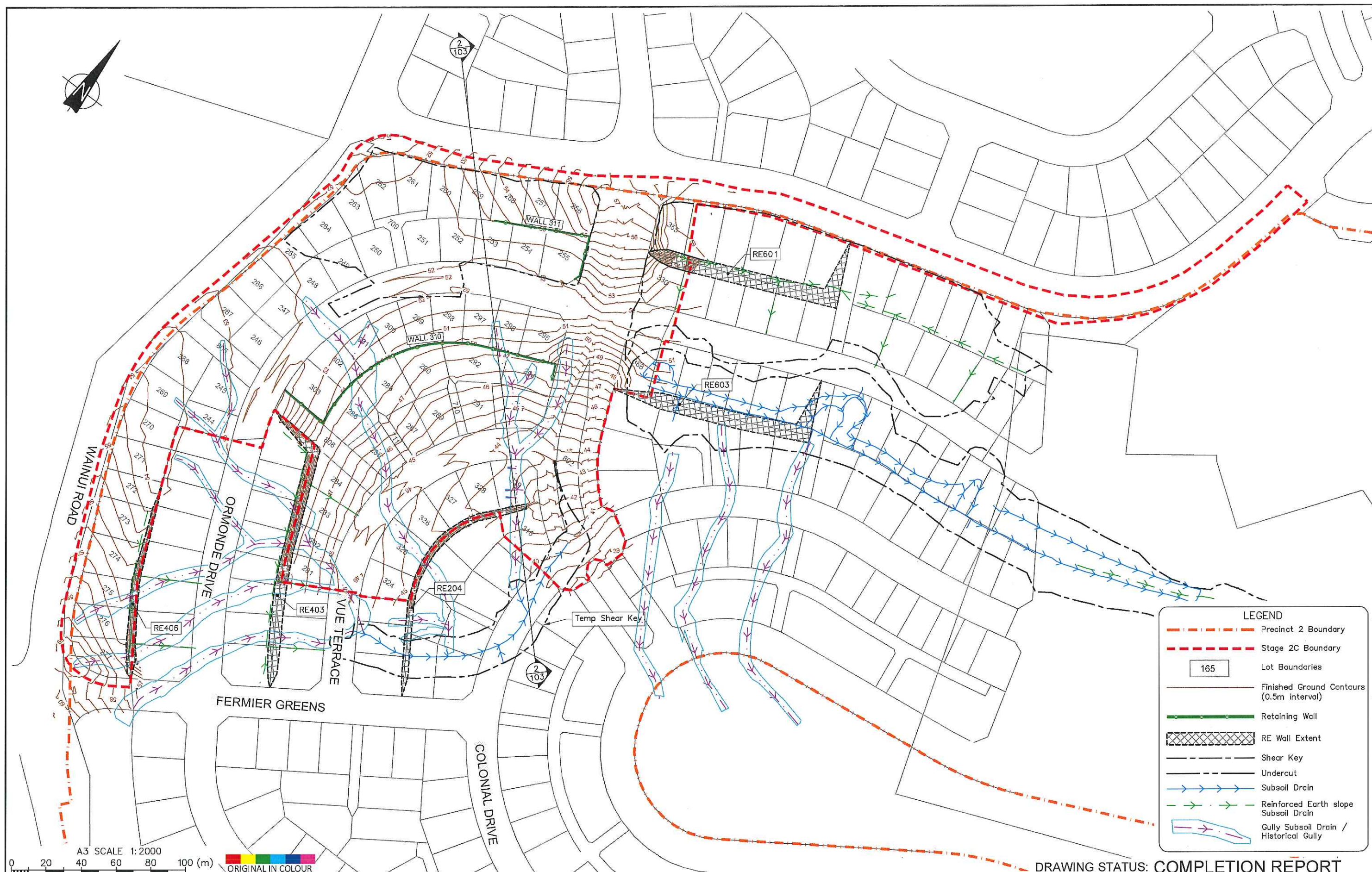
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21854.001-P2S2C-101

REV.

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				DRAFTING CHECKED :			
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				APPROVED :	NOT FOR CONSTRUCTION		
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- All dimensions are in millimeters unless noted otherwise.
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- Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
- Asbuilt Plan supplied by WOODS, reference no. "33209-02C-AB-100 FINAL CONTOURS.dwg", dated 1 June 2016.
- Retaining wall alignment supplied by WOODS, reference no. "33209-02C-AB-130-WALLS.dwg" dated 9 June 2016.

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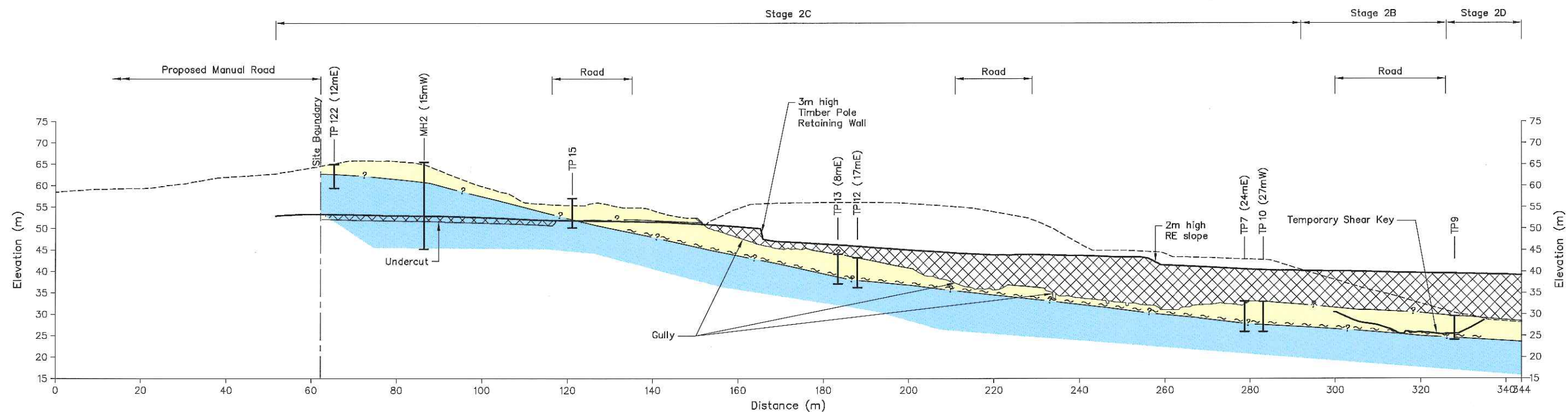
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MILLWATER - PRECINCT 2 (STAGE 2C)
Geotechnical Works Subsoil Drain Plan

SCALES (AT A3 SIZE)
1:2000

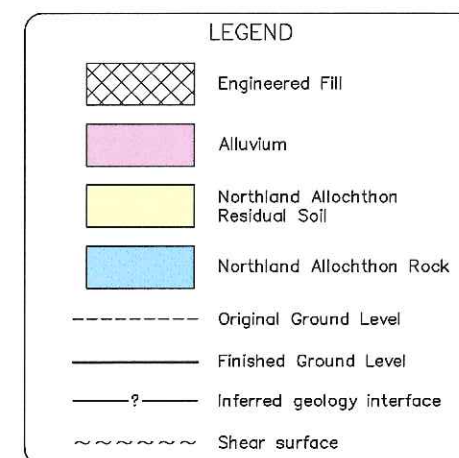
DWG. No.
21854.001-P2S2C-102

REV.
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SECTION 2
SCALE 1:1000



A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)

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				DRAFTING CHECKED :		
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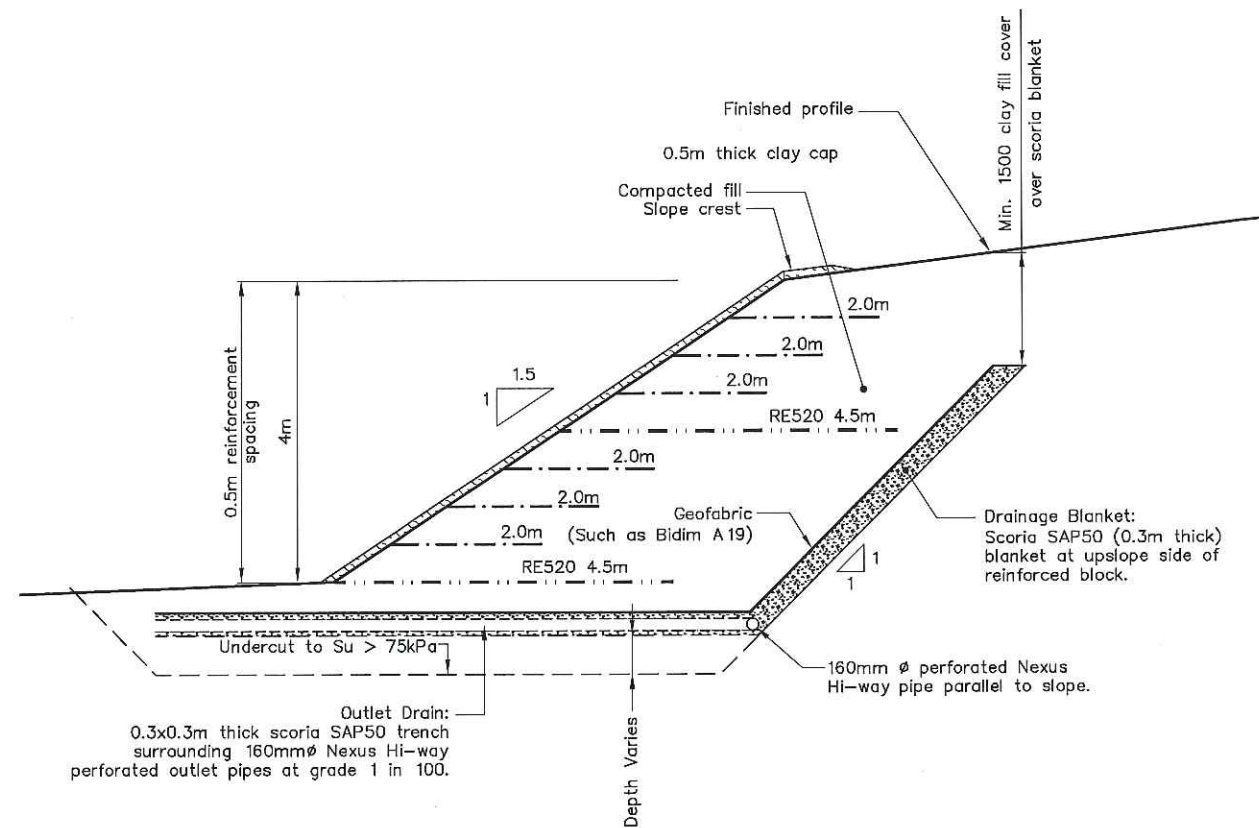
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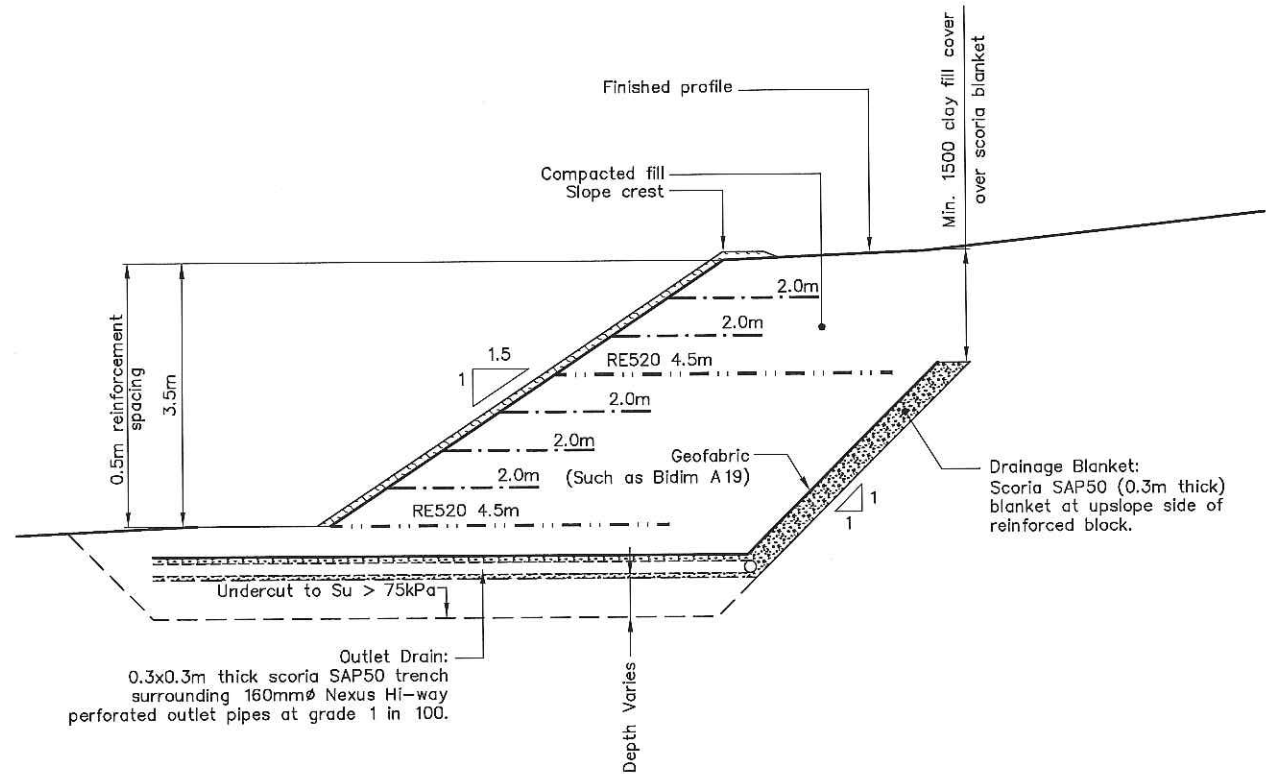
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CLIENT, PROJECT	WFH PROPERTIES RESIDENTIAL SUBDIVISION	
TITLE	MILLWATER - PRECINCT 2 (STAGE 2C) Geological Cross Section 2	
SCALE (AT A3 SIZE)	DWG. No.	REV.
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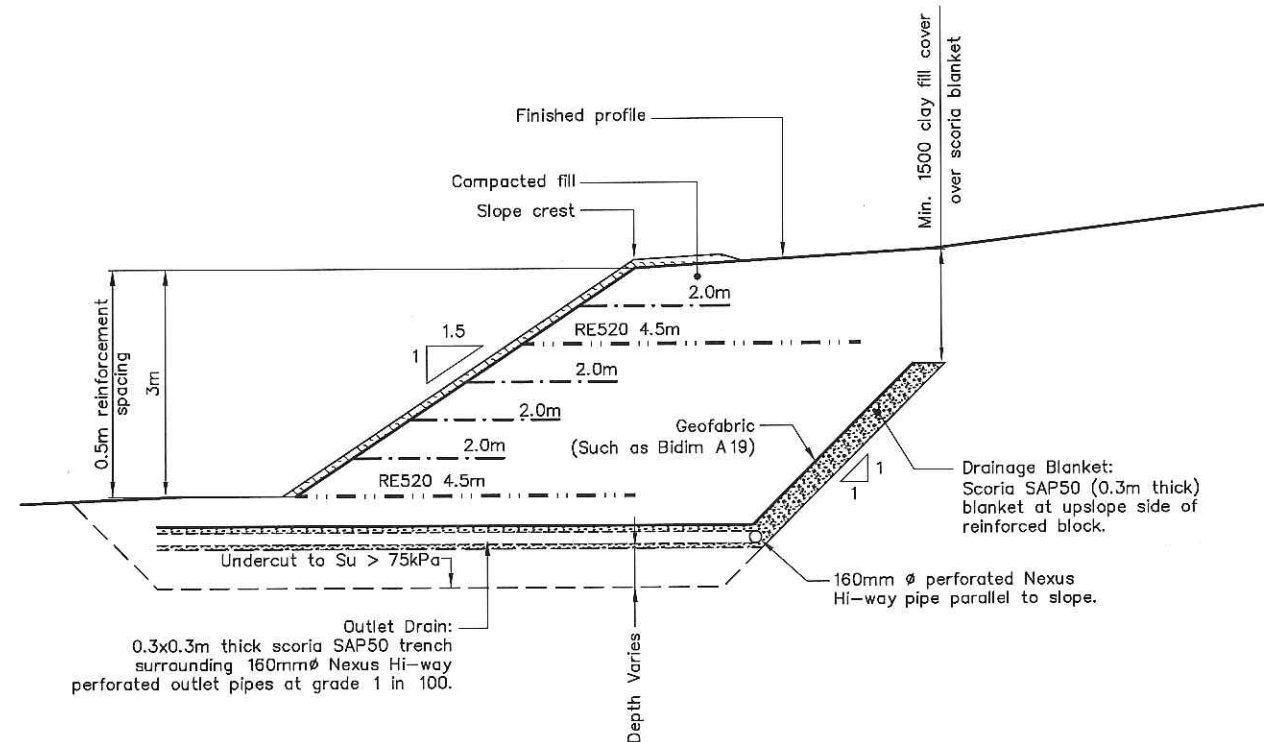
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TYPICAL REINFORCED EARTH SLOPE DETAIL (4m HIGH)
SCALE 1: 100



TYPICAL REINFORCED EARTH SLOPE DETAIL (3.5m HIGH)
SCALE 1: 100



TYPICAL REINFORCED EARTH SLOPE DETAIL (3m HIGH)
SCALE 1: 100

A3 SCALE 1: 100
0 1 2 3 4 5 (m)

LEGEND	
-----	2m long Tensar SS20 (secondary) reinforcement (number indicates grid length)
-----	4.5m long Tensar RE520 (primary) reinforcement (number indicates grid length)

				DESIGNED :	JXXL	Jun. 1
				DRAWN :	JC	Jun. 1
				DESIGN CHECKED :		
				DRAFTING CHECKED :		
				CADFILE : \\21854.001-P2S2C- 104.dwg		
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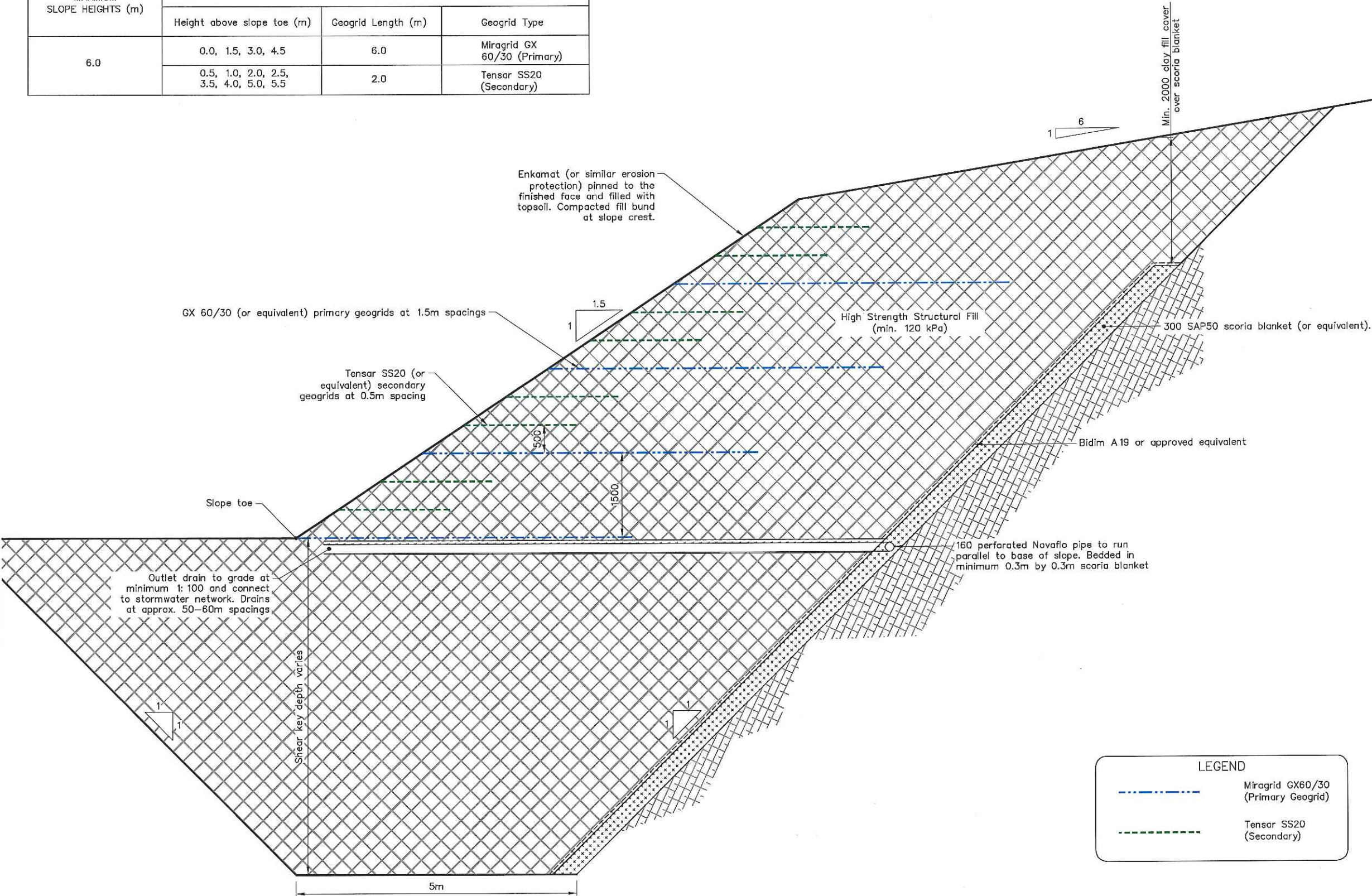
DRAWING STATUS: COMPLETION REPORT

CLIENT, PROJECT	WFH PROPERTIES RESIDENTIAL SUBDIVISION
TITLE	MILLWATER - PRECINCT 2 (STAGE 2C) Typical Reinforced Earth Slope Details
SCALES (AT A3 SIZE)	1: 100
DWG. No.	21854.001-P2S2C-104
REV.	1

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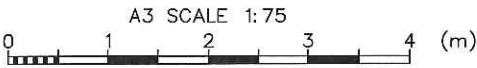
GEOGRIDS REQUIREMENTS FOR RE SLOPE 601 & 603

MAXIMUM SLOPE HEIGHTS (m)	GEOGRID REQUIREMENTS		
	Height above slope toe (m)	Geogrid Length (m)	Geogrid Type
6.0	0.0, 1.5, 3.0, 4.5	6.0	Miragrid GX 60/30 (Primary)
	0.5, 1.0, 2.0, 2.5, 3.5, 4.0, 5.0, 5.5	2.0	Tensor SS20 (Secondary)



- NOTES:
1. All dimensions are in millimetres unless noted otherwise.
 2. Foundation to be inspected by geotechnical engineer.
 3. The bottom geogrid layer has to start at the slope toe or below the slope toe.
 4. Geogrid spacing in wall is no more than 1.0m (vertical).
 5. All fill shall be placed and compacted according to fill specification.
 6. The Contractor shall ensure that temporary excavated faces are stable.
 7. Excavation in front of the wall to be reinstated with High Strength Structural Fill.
 8. All fill shall be spread using mechanical plant such as an excavator bucket or a dozer with an opening bucket, which causes the fill to cascade onto the grids.
 9. Compaction testing of backfill around grids is required (refer to specification).
 10. Geogrids shall be laid horizontally (perpendicular to wall) on compacted layers of fill. They shall be tensioned to remove all slack prior to back filling and anchored by either placing a small volume of fill on or staking the free end. They shall remain tensioned whilst the balance of fill is placed. No traffic or site plant shall be permitted to travel on the grids where cover is less than 100mm.
 11. The Engineer shall inspect and approve installation of at least the first layer of geogrid and other layers as necessary.
 12. Excavated subgrade to be inspected by Engineer and tested to confirm minimum $S_u > 120\text{KPa}$.

RE Slope 601 and 603 TYPICAL SECTION DETAILS
SCALE 1:75



LEGEND	
	Miragrid GX60/30 (Primary Geogrid)
	Tensor SS20 (Secondary)

DRAWING STATUS: COMPLETION REPORT

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				DRAWN :	JC	Mar. 16
				DESIGN CHECKED :		
				DRAFTING CHECKED :		
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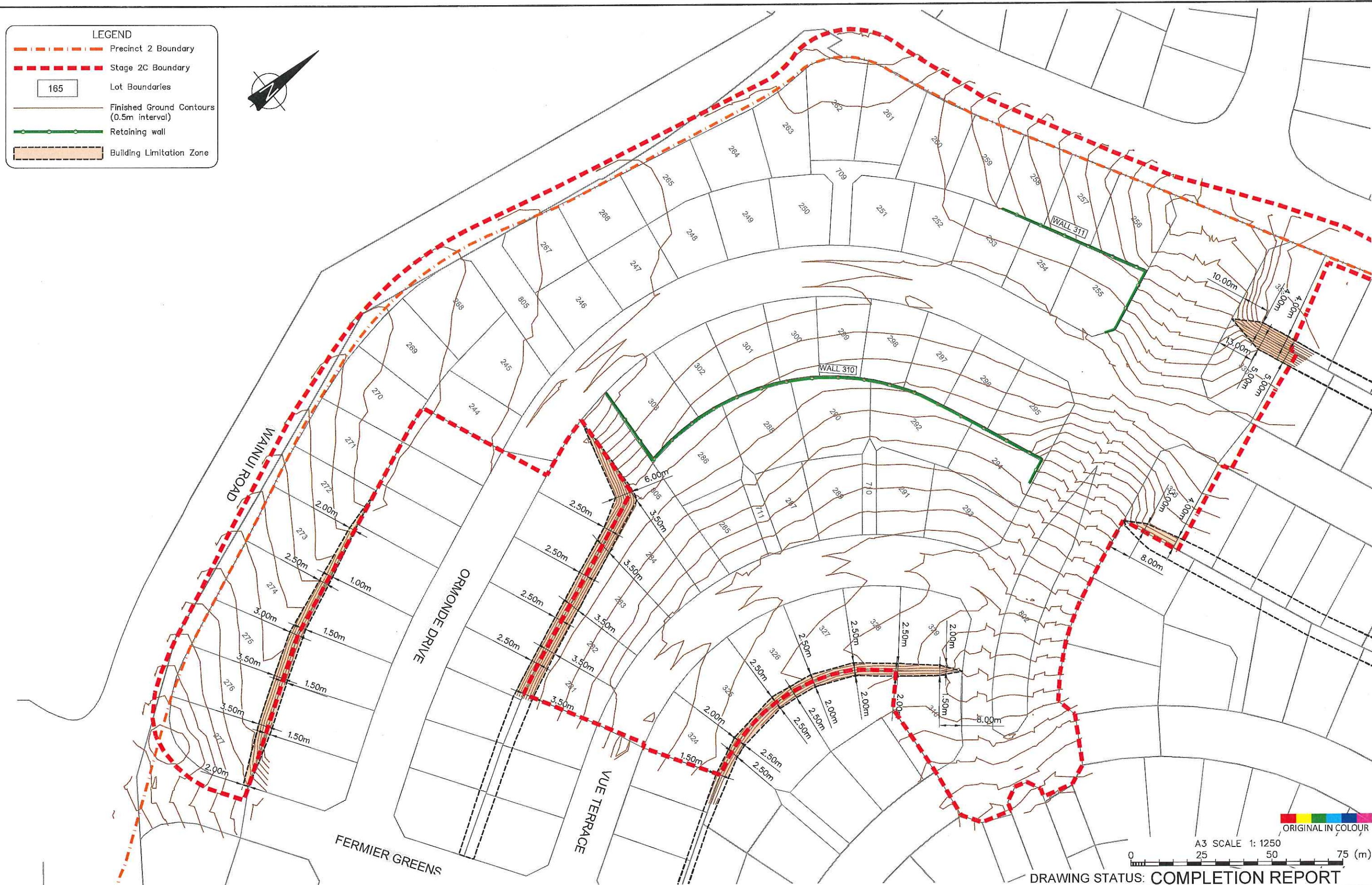
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CLIENT, PROJECT	WFH PROPERTIES LTD RESIDENTIAL SUBDIVISION		
TITLE	MILLWATER - PRECINT 2 (STAGE 2C) RE Slope 601 and 603 Typical Cross Section Detail		
SCALES (AT A3 SIZE)	1:75	DWG. No.	21854.001-P2S2C-105
		REV.	1

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LEGEND	
	Precinct 2 Boundary
	Stage 2C Boundary
	Lot Boundaries
	Finished Ground Contours (0.5m interval)
	Retaining wall
	Building Limitation Zone



ORIGINAL IN COLOUR

A3 SCALE 1: 1250
0 25 50 75 (m)

DRAWING STATUS: COMPLETION REPORT

				DESIGNED :	JXXL	Jul. 16
				DRAWN :	JC	Jul. 16
				DESIGN CHECKED :		
				DRAFTING CHECKED :		
				CADFILE : \\21854.001-P2S2C-110.dwg		
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1	Completion Report Issue			This drawing is not to be used for construction purposes unless signed as approved		
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NOTES :

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- Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
- Asbuilt Plan supplied by WOODS, reference no. "33209-02C-AB-100 FINAL CONTOURS.dwg", dated 1 June 2016.
- Retaining wall alignment supplied by WOODS, reference no. "33209-02C-AB-130-WALLS.dwg" dated 9 June 2016.

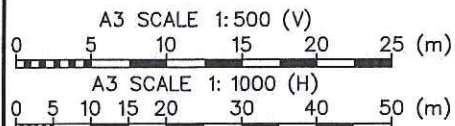
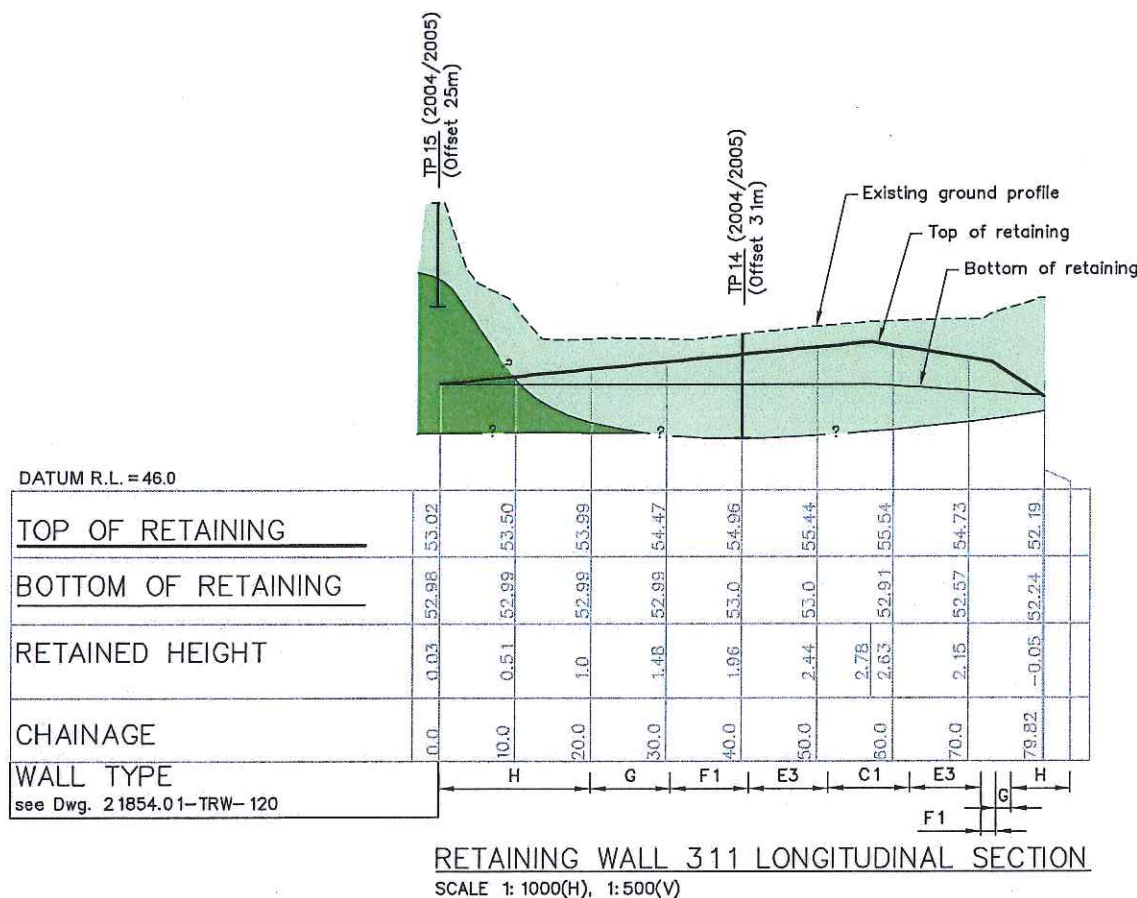
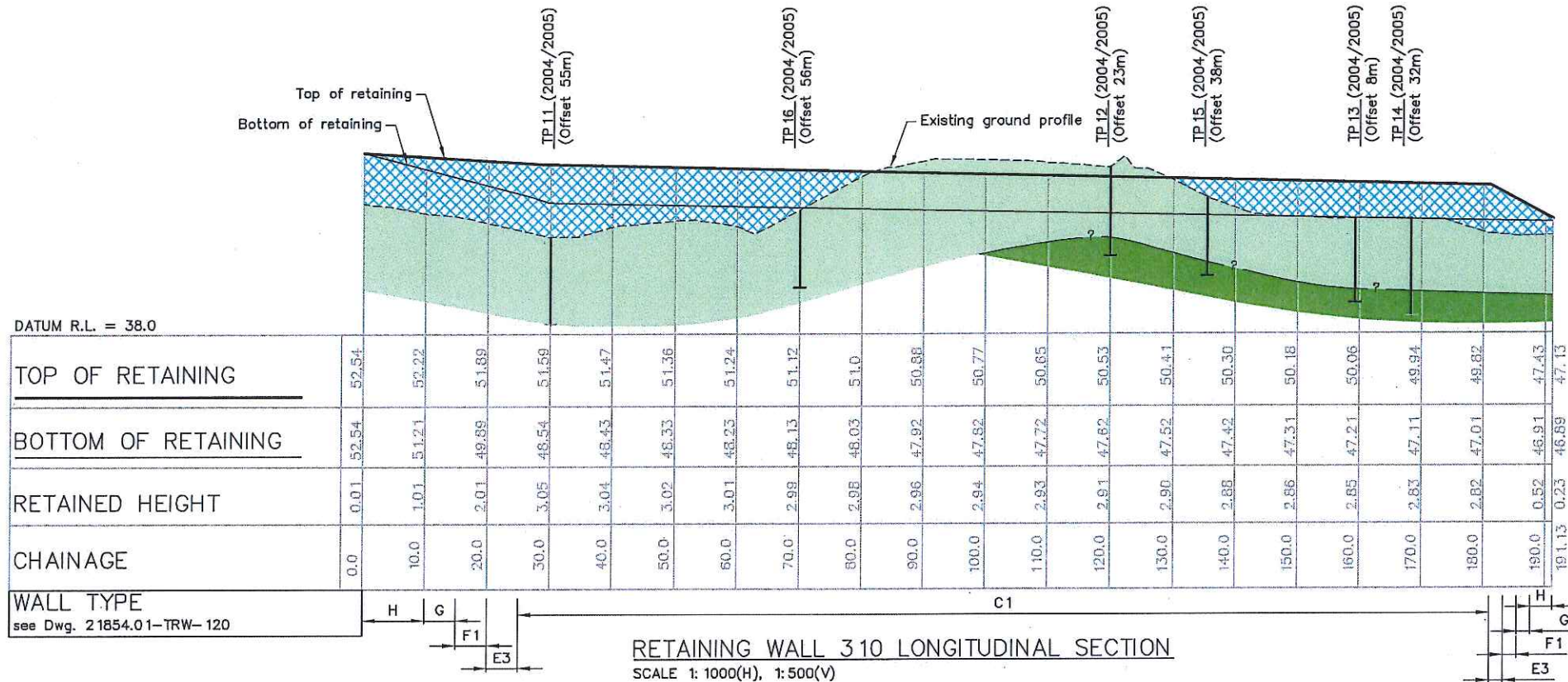
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CLIENT, PROJECT	WFH PROPERTIES RESIDENTIAL SUBDIVISION
TITLE	MILLWATER - PRECINCT 2 (STAGE 2C) Building Limitation Plan
SCALES (AT A3 SIZE)	1: 1250
DWG. No.	21854.001-P2S2C-110
REV.	1

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				DESIGN CHECKED :	AS	9/15
				DRAFTING CHECKED :	ES	9/15
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				APPROVED :	[Signature] 30/9/15	
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NOTES :	
1.	All dimensions are in metres unless noted otherwise.
2.	Sections supplied by WOODS, reference "retaining wall design_3d.dwg", dated Sep 2015.
REFERENCE :	

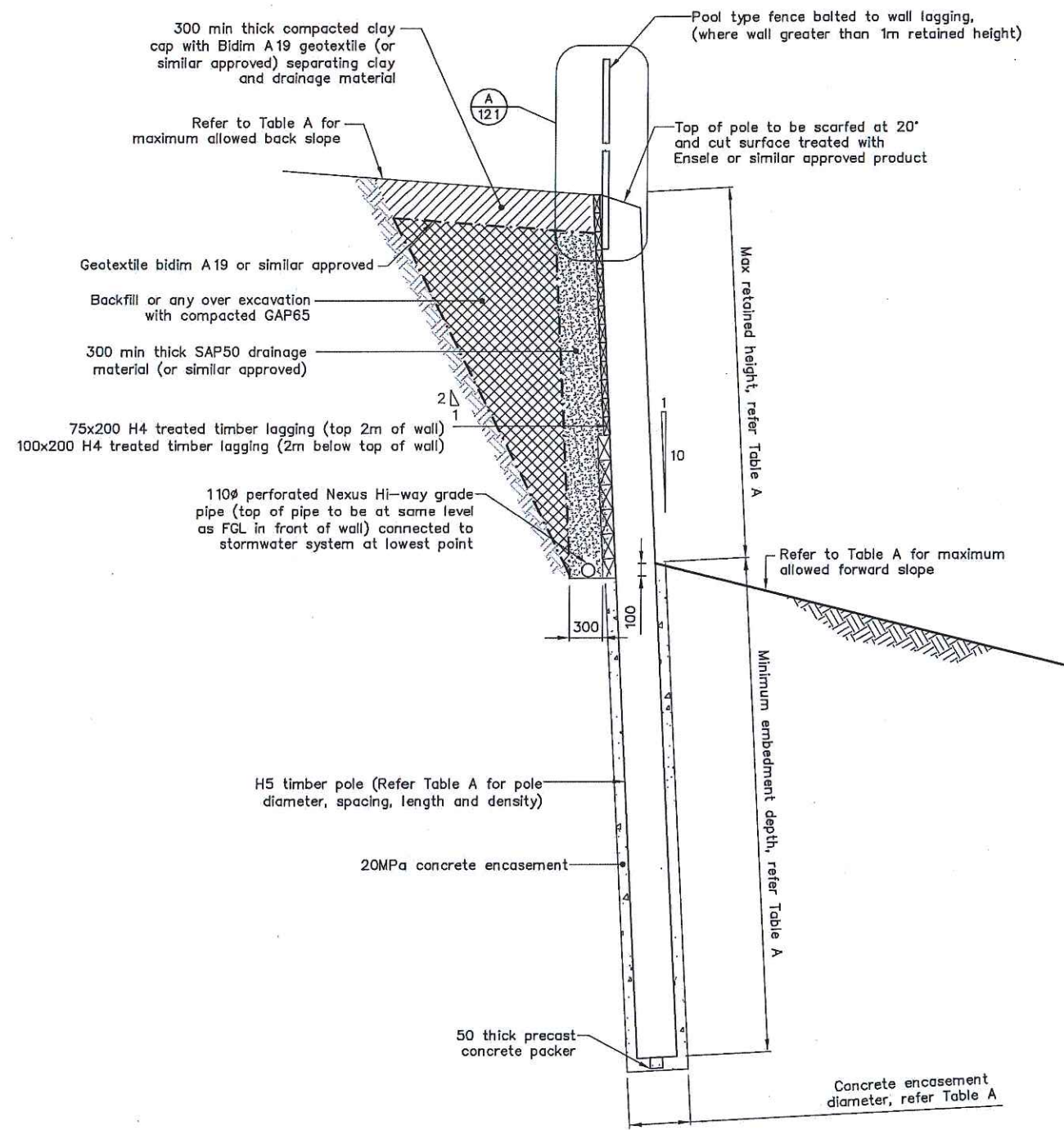
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DRAWING STATUS: CONSTRUCTION ISSUE

CLIENT, PROJECT	WFH PROPERTIES LTD MILLWATER PRECINCT 2	
TITLE	STAGE 2C RETAINING WALLS Geological Longsection Walls 310 and 311	
SCALES (AT A3 SIZE)	DWG. No.	REV.
AS SHOWN	21854.001-P2S2C-110	A

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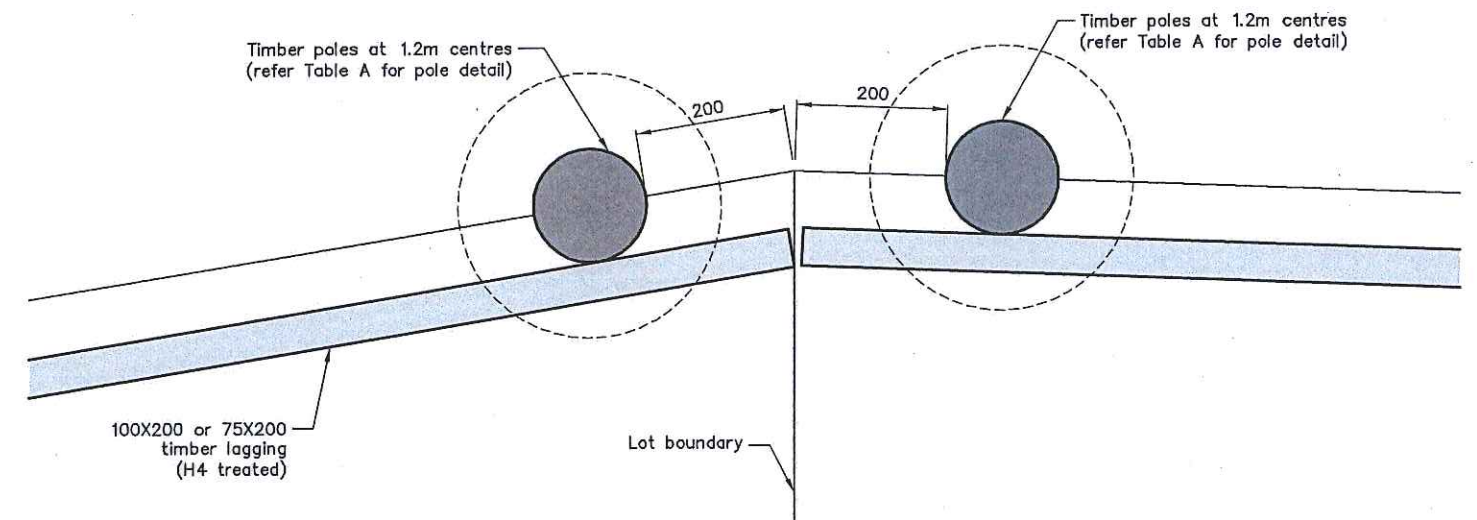
TYPICAL DETAIL - TIMBER POLE RETAINING WALL (TP)
SCALE 1:50
Refer to Table A

Table A: TIMBER POLE DETAIL TABLE

Wall No.	Wall Type	Pile Type	Retained Height (m)	Pile Length (m)	Minimum Embedment (m)	Pole/Pile Size SED (mm)	Pole (E) Density (GPa)	Pole Spacing C/C (m)	Minimum Hole Size (mm)	Maximum Backslope	Maximum Frontslope
310 and 311	C1	Timber Pole	≤ 3.0	9.0	6.0	400	12.1	1.2	550	1v:20h	1v:20h
	E3	Timber Pole	≤ 2.5	7.5	5	325	12.1	1.2	475	1v:20h	1v:20h
	F1	Timber Pole	≤ 2.0	6.0	4.0	225	12.1	1.2	375	1v:20h	1v:20h
	G	Timber Pole	≤ 1.5	4.2	2.7	200	12.1	1.2	350	1v:20h	1v:20h
	H	Timber Pole	≤ 1.0	2.4	1.4	150	12.1	1.2	300	1v:20h	1v:20h

NOTE

1. All poles shall be sourced from the same region and documentation shall be provided.
2. For each pole size, 10% of all poles shall be tested in accordance with the specification.
3. Retaining walls have been designed with 10kPa surcharge on upslope side for residential use purposes.
4. Design makes no provision for over excavation in front of wall (e.g. for service trenches). All such temporary excavations, if required, should be reviewed and confirmed as acceptable by a suitably qualified Geotechnical Engineer.



TYPICAL DETAIL AT LOT BOUNDARY
SCALE 1:10

A3 SCALE 1:50
0 0.5 1.0 1.5 2.0 2.5 (m)

				DESIGNED :	JXXL	Sep. 15
				DRAWN :	JATG	Sep. 15
				DESIGN CHECKED :		9/15
				DRAFTING CHECKED :		9/15
				CADFILE :	\\21854.001-P2S2C-120_121.dwg	
				APPROVED	10/5/15	
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A	Construction Issue			COPYRIGHT ON THIS DRAWING IS RESERVED		
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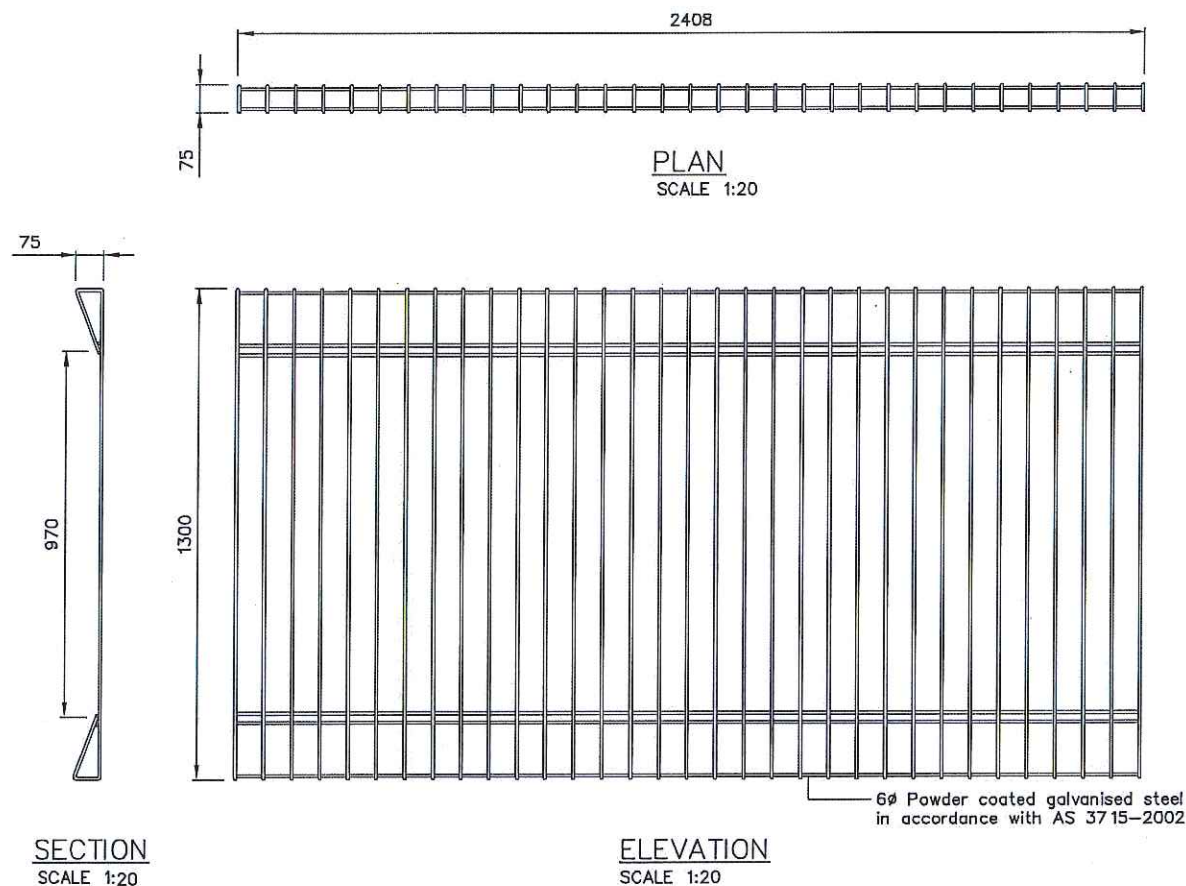
NOTES :
1. All dimensions are in millimetres unless noted otherwise.
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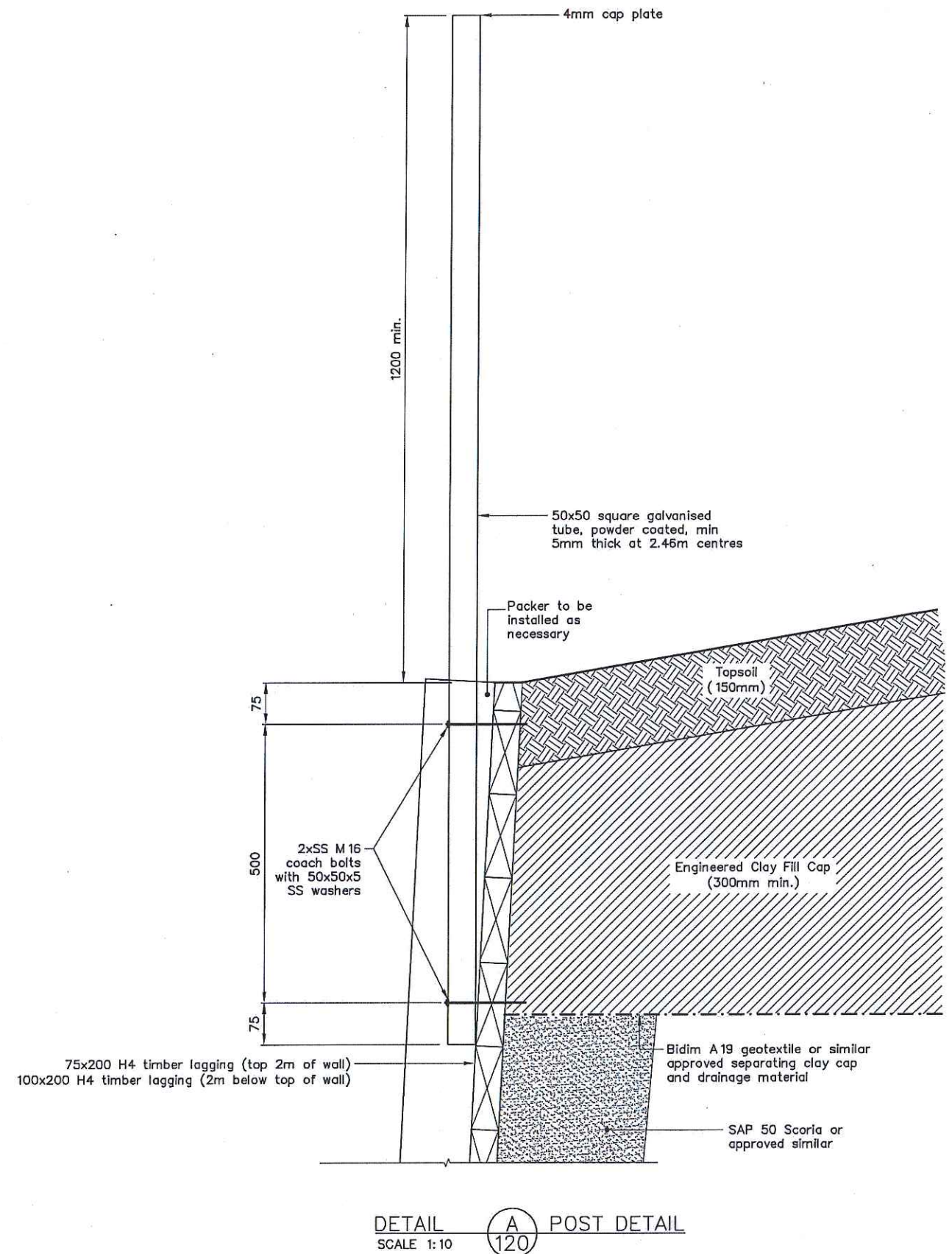
DRAWING STATUS: CONSTRUCTION ISSUE

CLIENT, PROJECT	WFH PROPERTIES LTD MILLWATER PRECINCT 2
TITLE	STAGE 2C RETAINING WALLS Typical Timber Pole Retaining Wall Detail
SCALE (AT A3 SIZE)	AS SHOWN
DWG. No.	21854.001-P2S2C-120
REV.	A

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A3 SCALE 1:20
0 0.2 0.4 0.6 0.8 1.0 (m)



				DESIGNED :	JXXL	Sep. 15
				DRAWN :	JATG	Sep. 15
				DESIGN CHECKED :	255	2/15
				DRAFTING CHECKED :	255	2/15
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				APPROVED :	255 30/9/15	
				This drawing is not to be used for construction purposes unless signed as approved		
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A	Construction Issue					
REVISION	DESCRIPTION	BY	DATE			

NOTES :

1. All dimensions are in millimetres unless noted otherwise.

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DRAWING STATUS: CONSTRUCTION ISSUE

CLIENT, PROJECT
WFH PROPERTIES LTD
MILLWATER PRECINCT 2

TITLE
STAGE 2C RETAINING WALLS
Standard Fence Panel Detail

SCALES (AT A3 SIZE)
AS SHOWN

DWG. No.
21854.001-P2S2C-121

REV.
A

Appendix B: Contractors Certificates

- **Hick Bros Ltd – Sixth Schedule (Bulk Earthworks)**
- **Kerry Dines Ltd – Sixth Schedule (Civil Earthworks)**
- **ICB Retaining & Construction Ltd – Producer Statement 3 (Timber Pole Retaining Walls Construction)**
- **Croft Pole Distributors Ltd – Timber Pole Grading and Treatment Certification**
- **Mike Cathcart Fencing Contractor Limited – Retaining wall fence PS3**

Schedule 6 – Form of Producer Statement – Construction

ISSUED BY	HICK BROS CIVIL CONSTRUCTION Ltd	(Contractor)
TO	WFH PROPERTIES Ltd	(Principal)
IN RESPECT OF	PRECINCT 2 STAGE 2 EW CONTRACT 33203-01	(Description of Contract Works)
AT	PRECINCT 2 – MILLWATER – SILVERDALE NORTH	(Address)

HICK BROS CIVIL CONSTRUCTION LTD (Contractor) has contracted to WFH PROPERTIES LTD (Principal) to carry out and complete certain building works in accordance with a Contract titled PRECINCT 2 STAGE 2 ("the Contract")

I ROB FENWICK (Duly Authorised Agent) a duly authorised representative of HBCLL (Contractor) believe on reasonable grounds that HBCLL (Contractor) has carried out and completed:

☒ All

☐ Part only as specified in the attached particulars of the contract works in accordance with the Contract



(Signature of Authorised Agent on behalf of)

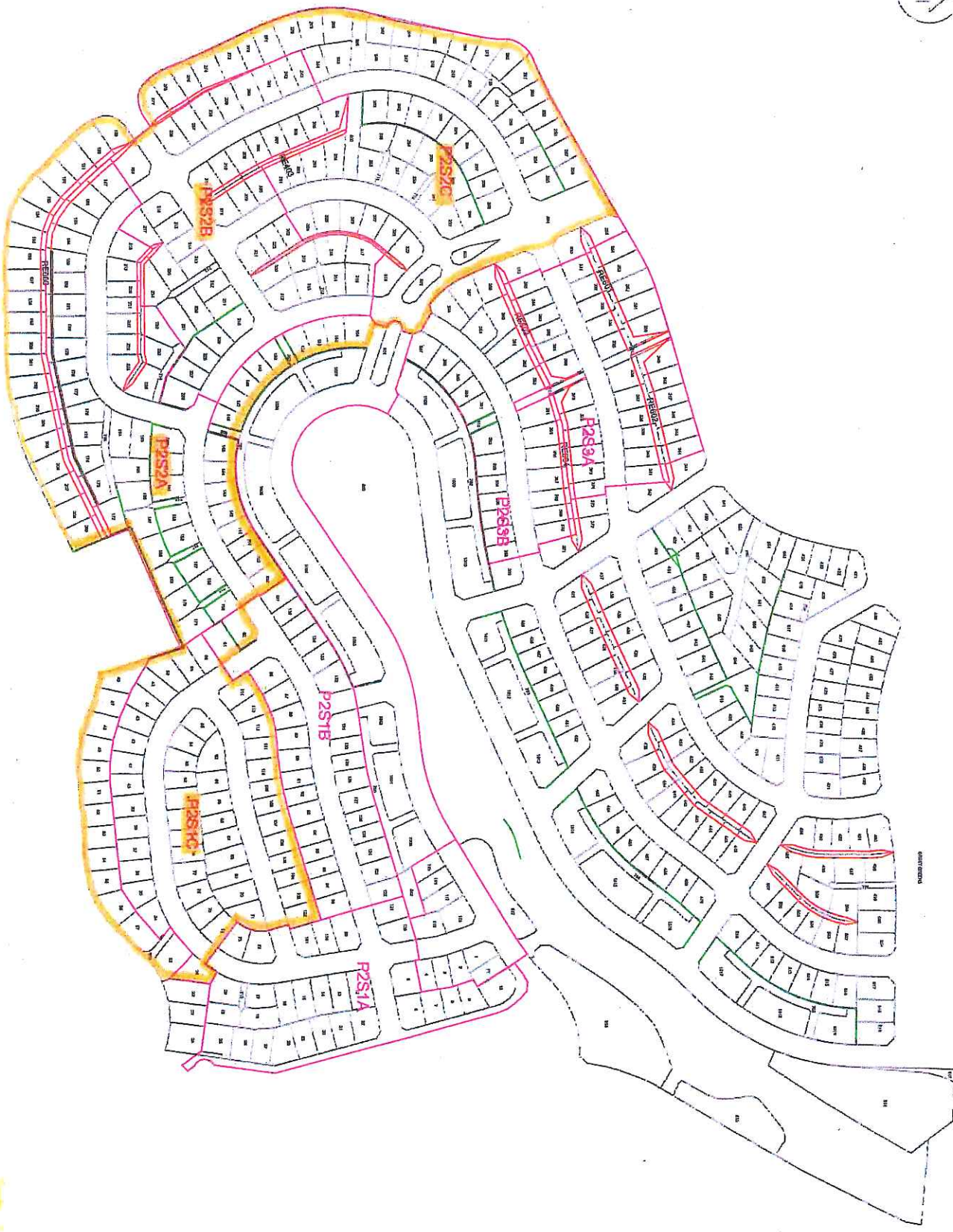
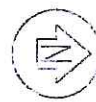
Date 16-12-2015

HICK BROS CIVIL CONSTRUCTION LTD

(Contractor)

42 FORGE ROAD, SILVERDALE.

(Address)



Scale 1:1000

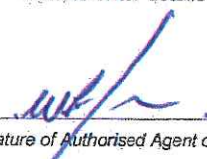
Schedule 6 – Form of Producer Statement – Construction

ISSUED BY	KERRY DINES LIMITED	(Contractor)
TO	WFH Properties Limited	(Principal)
IN RESPECT OF	Millwater P2 Stage 2C Contract, 33209	(Description of Contract Works)
AT	Croix Greens Millwater	(Address)

Kerry Dines Limited (Contractor) has contracted to WFH Properties Limited (Principal) to carry out and complete certain building works in accordance with a Contract titled **Precinct 2 Stage 2C Contract** ('the Contract')

I **William Robert Jones** (Duly Authorised Agent) a duly authorised representative of **Kerry Dines Limited** (Contractor) believe on reasonable grounds that **Kerry Dines Limited** (Contractor) has carried out and completed:

- ☒ All
- ☐ Part only as specified in the attached particulars of the contract works in accordance with the Contract
- Click to enter details of attached particulars*


(Signature of Authorised Agent on behalf of)

Kerry Dines Limited

(Contractor)

P.O. Box 12-140, Penrose, Auckland

(Address)

Date **20 June 2016**

SIXTH SCHEDULE

(NZS 3910:2003)

FORM OF PRODUCER STATEMENT CONSTRUCTION

ISSUED BY

ICB Retaining & Construction Limited

(Contractor)

TO

Dines Construction

(Principal)

IN RESPECT OF

**Millwater P2 Stage 2c Timber walls
BC# RC# RMA R62477 RDC 21352**

(Description of Contract Works)

AT

Lot description: Lot 1 DP 67675, Lot1 DP121041, Lot 2 DP35443, Lot 1 DP 340986, Part Allot 60 PSH of Waiwera, Lot 4 DP67675, Lot 2 DP206067, Lot1 DP86940, Lot 1 DP308959, Part Lot 2 DP308959, Sect 10 SP364653, Sec 3 SO457160, Sec4 SO 457160, Pt Allot 335 PSH of Waiwera, Lot 1 DP 42190, Lot 1001 DP472234.

Physical address Precinct 2 Silverdale North, Croix Greens

(Address)

ICB Retaining & Construction Ltd

(Contractor)

has contracted to

Dines Construction

(Principal)

to carry out and complete certain building works in accordance with a contract, titled

**Millwater P2 Stage 2c Timber walls
BC# RC# RMA R62477 RDC 21352**

(The Contract)

(The Project)

I,

Chris Burke

a duly authorised

(Duly Authorised Agent)

representative of

ICB Retaining & Construction Limited

(Contractor)

Believe on reasonable grounds that

ICB Retaining & Construction Limited

(Contractor)

has carried out and completed:

☐ All ☒ Part only as specified in the attached particulars of the building works in accordance with the **BC# RC# RMA R62477 RDC 21352** and any Authorised Instruction / Variations that have been issued during the course of the work.

(Signature of Authorised Agent on Behalf of)

8/4/2016

(Date)

ICB Retaining & Construction Limited

(Contractor)

PO Box 303 340, North Harbour, Auckland

(Address)



CROFT POLES
ROUND FOR GENERATIONS

Croft Pole Distributors Ltd

- State Highway 1
- RD1
- Kamo
- WHANGAREI

Ph: 64 9 4355040

Fax: 64 9 4355041

Website: www.croftpoles.co.nz

E-mail: ctc@ihug.co.nz

Producer Statement Construction Poles

Packing slip numbers

184807

187201

187294

188048

This statement is to confirm that construction poles supplied to

ICB RETAINING WALLS FOR JOB 5549 Kerry Dines - Millwater
Consisting of H5 HD Poles and H4 sawn timber.

were produced according to the requirements of

**NZS3605:2001. Timber Piles and Poles for Use in Building
HIGH DENSITY GRADE**

And treated to H5 Treatment Hazard Class as specified in NZS3605:2001.

Treatment was undertaken in accordance with NZS3640: 2003. Chemical
Preservation of Round and Sawn Timber

04/05/2016

D.A. Watson B.E. P.G.Dip. Bus
General Manager

Schedule 6 – Form of Producer Statement – Construction

ISSUED BY	Mike Cathcart Fencing Contractor Limited	(Contractor)
TO	Kerry Dines Limited	(Principal)
IN RESPECT OF	Millwater Precinct 2 Stage 2C Contract, 33209-01	(Description of Contract Works)
AT	Croix Greens, Millwater	(Address)

Mike Cathcart Fencing Contractor Ltd (Contractor) has contracted to Kerry Dines Limited (Principal) to carry out and complete certain building works in accordance with a Contract titled **Precinct 2 Stage 2C** ('the Contract')

I Mike Cathcart (Duly Authorised Agent) a duly authorised representative of Mike Cathcart Fencing Contractor Limited (Contractor) believe on reasonable grounds that Mike Cathcart Fencing Contractor Limited (Contractor) has carried out and completed:

- ☐ All
- ☒ Part only as specified in the attached particulars of the contract works in accordance with the Contract

Bulldog Fencing to top of Retaining walls 310 and 311

(Signature of Authorised Agent on behalf of)

Date **20 June 2016**

Mike Cathcart Fencing Contractor Ltd

(Contractor)

510 Waitakere Road, RD2 Henderson, Auckland 0782

(Address)

**Appendix C: NZS 3604:2011 Expansive Soils
(Extract)**

NZS 3604:2011 Expansive Soils (Extract)

Expansive soils tend to be moderately to highly plastic clays that undergo appreciable volume change upon changes in moisture content. Technically, they are defined in NZS 3604:2011 as those soils having a liquid limit of more than 50% and a linear shrinkage of more than 15%. Where soils are quite silty or sandy, shrink and swell is less of a problem, due to the lower clay contents.

Building damage resulting from expansive soil movement can range from relatively minor brick veneer cracking and internal cracking on wall corners and wall ceiling corners with attendant door and windows jamming, through to extensive cracking of foundation block framework, extensive internal visual cracking and significant warping of building frames. Damage is dependent on building construction and materials and is rarely of structural concern.

NZS 3604:2011 "Timber Framed Buildings" defines good ground as follows:

"Any soil or rock capable of permanently withstanding an ultimate bearing capacity of 300 kPa (i.e. an allowable bearing pressure of 100 kPa using a factor of safety of 3.0), but excludes:

- a) Potentially compressible ground such as topsoil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel which contains obvious voids;*
- b) Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2, and a linear shrinkage of more than 15% when tested in accordance with NZS 4402 Test 2.6, and*
- c) Any ground which could foreseeably experience movement of 25 mm or greater for any reason including one or a combination of: land instability, ground creep, subsidence, seasonal swelling and shrinking, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots."*

Foundations on expansive soils are outside the scope of NZS 3604:2011 as an acceptable solution to the New Zealand Building Code (NZBC). Specific engineering design of foundation elements is involved where expansive soils are present with a recommendation that AS 2870:2011 is used for building design. While not mandatory, AS 2870 designs will allow for a non-specific design foundation to be used without resorting to further ongoing investigation or design.

This geotechnical completion report has classified the soils present on this subdivision to be in Site Class M as per the requirements of AS 2870:2011. Descriptions of the various site classes, together with characteristic surface ground movements are outlined below.

Allowing for some correlation with NZS 3604, the various site classes applicable to NZ conditions are considered to be:

Characteristic Surface Movements	Site Class	Description
a) 20 mm (Note NZS 3604:2011 assumes movement of 25 mm as part of underlying design.)	Class A (sand) and/or Class S (Silts) Equivalent to NZS 3604:2011 “Good Ground” sites	Poor to slightly expansive
b) 20 mm – 40 mm	Class M	Moderately expansive
c) 40 mm – 60 mm	Class H1	Highly expansive
d) 60 mm – 75mm	Class H2	Highly expansive
e) > 75 mm	Class E	Extremely expansive

AS 2870 uses a range of factors to assess characteristic soil movement including:

- i. Building distress due to ground movement visible on adjacent structures,
- ii. Known soil properties and site specific testing to determine the shrink / swell index of a soil (Test 7.1.1 in AS 1289 – Methods of Testing Soils for Engineering Purposes).

AS 2870 is based on defining soil types into various hazard classes based on expected surface movement and depth of desiccation that could occur. It then applies various foundation designs and embedment depths based on the form of building construction (slab on ground, strip footing, stiffened raft, stiffened slab with deep edge beams, etc). AS2870 uses more reinforcing steel than NZ designs generally would to create stiffer foundations that are better able to tolerate ground movement.

The Australian approach also regards expansive soil to a considerable extent being a home owner maintenance issue and significant emphasis is put into ensuring that people understand the influence that trees and dry summers etc may have on foundation performance. See Appendix D.

**Appendix D: CSIRO – BTF18 – Foundation
Maintenance and Footing
Performance: A Homeowners Guide**

Foundation Maintenance and Footing Performance: A Homeowner's Guide



BTF 18
replaces
Information
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpend).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.

Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.

- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing

Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage

In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

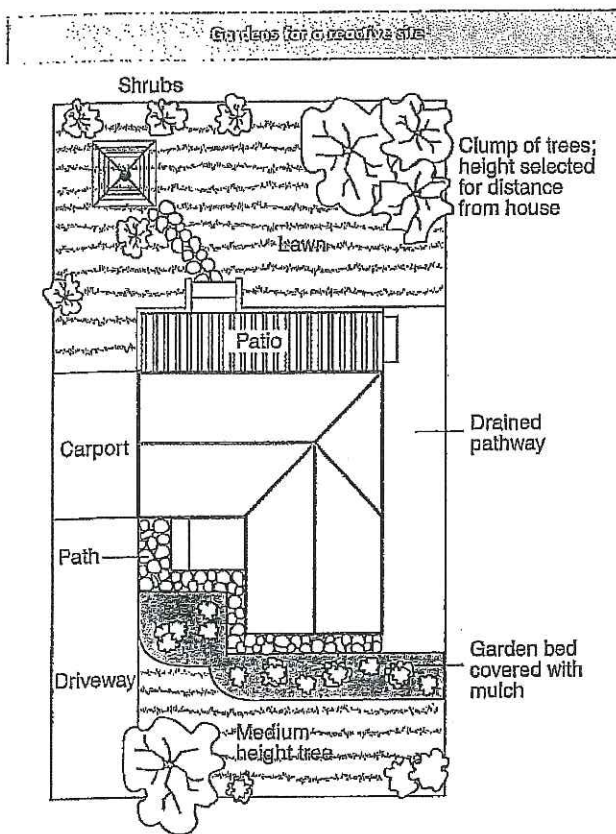
Protection of the building perimeter

It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weatherightness often impaired	5-15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably; some loss of bearing in beams. Service pipes disrupted	15-25 mm but also depend on number of cracks	4



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

The information in this and other issues in the series was derived from various sources and was believed to be correct when published.

The information is advisory. It is provided in good faith and not claimed to be an exhaustive treatment of the relevant subject.

Further professional advice needs to be obtained before taking any action based on the information provided.

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Appendix E: Test Results

- 21854.001-P2S2C-111 Post Earthworks Investigation Plan
- 21854.001-P2S2C-112 Topsoil Depths Plan
- 21854.001-P2S2C-113 Earthworks Testing Location Plan
- Soil Expansion Test Results
- Post Earthworks Investigation Borehole Logs (HA1 to HA16)
- Earthworks Test Results

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DRAWING STATUS: COMPLETION REPORT

				DESIGNED :	JXXL	Jul. 16
				DRAWN :	JC	Jul. 16
				DESIGN CHECKED :		
				DRAFTING CHECKED :		
				CADFILE : \\21854.001-P2S2C- 111.dwg		
				APPROVED :		
				NOT FOR CONSTRUCTION		
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1	Completion Report Issue					
REVISION	DESCRIPTION	BY	DATE			

NOTES :

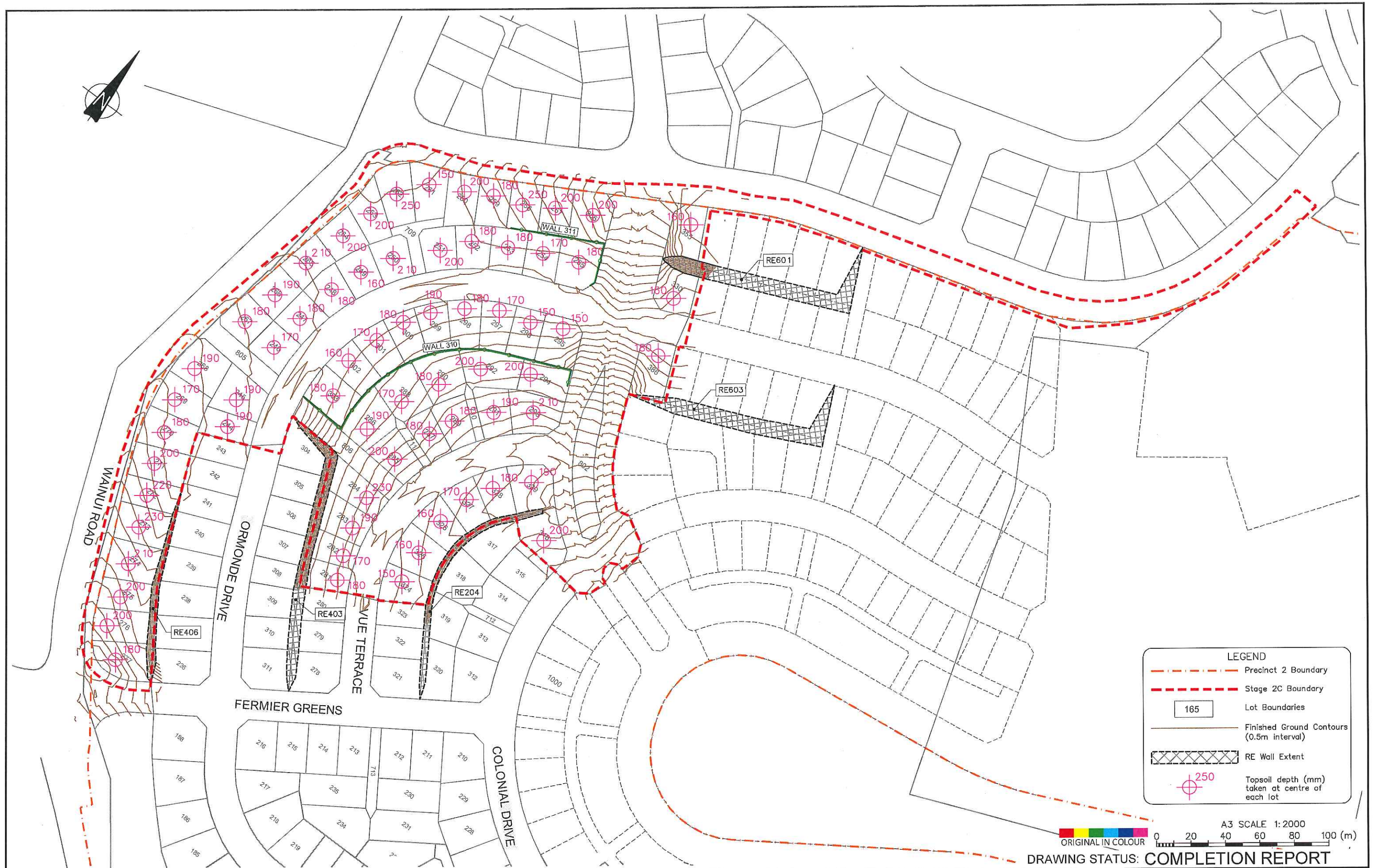
- All dimensions are in millimeters unless noted otherwise.
- Coordinate Datum: NZGD2000, New Zealand Transverse Mercator (NZTM2000).
Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
- Asbuilt Plan supplied by WOODS, reference no. "33209-02C-AB-100 FINAL CONTOURS.dwg", dated 1 June 2016.
- Retaining wall alignment supplied by WOODS, reference no. "33209-02C-AB-130-WALLS.dwg" dated 9 June 2016.

REFERENCE :

Tonkin+Taylor
105 Carlton Gore Road, Newmarket, Auckland
Tel. (09) 355 6000 Fax. (09) 307 0265
www.tonkintaylor.co.nz

CLIENT, PROJECT	WFH PROPERTIES RESIDENTIAL SUBDIVISION
TITLE	MILLWATER - PRECINCT 2 (STAGE 2C) Post Earthworks Investigation Plan
SCALE (AT A3 SIZE)	1:2000
DWG. No.	21854.001-P2S2C-111
REV.	1

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				DESIGNED :	JXXL	Jul. 16
				DRAWN :	JC	Jul. 16
				DESIGN CHECKED :		
				DRAFTING CHECKED :		
				CADFILE : \\21854.001-P2S2C- 112.dwg		
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REVISION	DESCRIPTION	BY	DATE			

NOTES :	
1.	All dimensions are in millimeters unless noted otherwise.
2.	Coordinate Datum: NZGD2000, New Zealand Transverse Mercator (NZTM2000). Level Datum: LINZ (MSL) Auckland Vertical Datum 1946
3.	Asbuilt Plan supplied by WOODS, reference no. "33209-02C-AB-100 FINAL CONTOURS.dwg", dated 1 June 2016.
4.	Retaining wall alignment supplied by WOODS, reference no. "33209-02C-AB-130-WALLS.dwg" dated 9 June 2016.
REFERENCE :	

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CLIENT, PROJECT		WFH PROPERTIES	
		RESIDENTIAL SUBDIVISION	
TITLE		MILLWATER - PRECINCT 2 (STAGE 2C)	
		Topsoil Depths Plan	
SCALES (AT A3 SIZE)		1:2000	
DWG. No.		21854.001-P2S2C-112	
REV.		1	

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DESIGNED :		JXXL	Jun. 16
DRAWN :		JC	Jun. 16
DESIGN CHECKED :			
DRAFTING CHECKED :			
CADFILE :		\\21854.001-P2S2C-113.dwg	
APPROVED :		NOT FOR CONSTRUCTION	
1 Completion Report Issue		This drawing is not to be used for construction purposes unless signed as approved	
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CLIENT, PROJECT		WFH PROPERTIES	
RESIDENTIAL SUBDIVISION		MILLWATER - PRECINCT 2 (STAGE 2C)	
TITLE		Earthworks Testing Location Plan	
SCALES (AT A3 SIZE)	DWG. No.	REV.	
1: 1250	21854.001-P2S2C-113	1	



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GEOTECHNICS

Site: Precinct 2, Stage 2C, Millwater

Page 1 of 4

Your Job No: 21854.001

Our Job No: 616830.001

Test Method Used: AS 1289.7.1.1 - 2003 Determination of the Shrink - Swell Index

SUMMARY OF SHRINK - SWELL TEST RESULTS

Lot No.:	244 (E3)	244 (E3)	248 (E5)	248 (E5)	258 (E7)	258 (E7)	261 (E6)	261 (E6)
DEPTH	0.4 - 0.6	0.9 - 1.1	0.4 - 0.6	0.9 - 1.1	0.4 - 0.6	0.9 - 1.1	0.4 - 0.6	0.9 - 1.1
Applied Pressure	55	55	55	55	55	55	55	55
Initial Water Content (%)	23.1	30.7	41.5	27.6	18.4	21.2	18.7	17.9
Bulk Density (t/m ³)	1.71	1.85	1.77	1.85	2.05	1.98	2.07	1.99
Dry Density (t/m ³)	1.39	1.42	1.25	1.45	1.73	1.63	1.74	1.69
Final Water Content (%)	24.6	31.5	43.3	28.8	20.1	22.6	20.2	18.6
Swelling Strain (%)	0.03	0.01	0.06	0.24	0.13	0.49	0.16	0.21
Initial Water Content (%)	24.5	24.0	32.2	35.2	16.8	14.0	19.6	20.6
Estimated Shrinkage Limit (%)	5.9	7.0	9.0	11.6	5.4	5.2	6.2	5.4
Shrinkage Strain (%)	1.3	2.4	6.8	3.6	1.8	2.7	1.0	4.5
Inert Material Estimate in the Soil Specimen (%)	0	0	0	0	0	0	0	0
Soil Crumbling During Shrinkage	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Cracking of the Shrinkage Specimen	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
SHRINK - SWELL INDEX (%)	0.7	1.3	3.8	2.1	1.0	1.6	0.6	2.5

Entered by: ST

Date: 3/05/2016

Checked by: MP

Date: 3/05/2016



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GEOTECHNICS

Site: Precinct 2, Stage 2C, Millwater

Page 2 of 4

Your Job No: 21854.001
Our Job No: 616830.001

Test Method Used: AS 1289.7.1.1 - 2003 Determination of the Shrink - Swell Index

SUMMARY OF SHRINK - SWELL TEST RESULTS

Lot No.:	267 (E4)	267 (E4)	273 (E2)	273 (E2)	277 (E1)	277 (E1)	281 (E10)	281 (E10)
DEPTH	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
Applied Pressure	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)
Initial Water Content	44.0	67.8	22.8	17.4	30.5	24.5	36.4	27.5
Bulk Density	1.76	1.59	1.96	2.10	1.86	1.93	1.84	1.87
Dry Density	1.22	0.95	1.60	1.79	1.43	1.55	1.35	1.47
Final Water Content	45.0	68.5	23.6	18.0	31.4	25.6	37.1	28.4
Swelling Strain	0.10	0.14	0.09	0.38	0.27	0.32	0.17	0.09
Initial Water Content	32.2	65.9	20.5	40.2	30.3	18.8	16.0	20.5
Estimated Shrinkage Limit	6.9	11.5	7.3	9.9	8.3	5.7	6.4	8.2
Shrinkage Strain	6.3	19.3	2.2	7.7	6.2	1.5	1.7	3.8
Inert Material Estimate in the Soil Specimen	0	0	0	0	0	0	0	0
Soil Crumbling During Shrinkage	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Cracking of the Shrinkage Specimen	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
SHRINK - SWELL INDEX	3.5	10.8	1.2	4.4	3.5	0.9	1.0	2.1

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Date: 3/05/2016

Checked by: MP

Date: 3/05/2016



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Site: Precinct 2, Stage 2C, Millwater

Page 3 of 4

Your Job No: 21854.001
Our Job No: 616830.001

Test Method Used: AS 1289.7.1.1 - 2003 Determination of the Shrink - Swell Index

SUMMARY OF SHRINK - SWELL TEST RESULTS

Lot No.:	286 (E9)	286 (E9)	291 (E12)	291 (E12)	295 (E13)	295 (E13)	299 (E8)	299 (E8)
DEPTH	(m)	(m)	0.9 - 1.1	0.4 - 0.6	0.9 - 1.1	0.4 - 0.6	0.9 - 1.1	0.4 - 0.6
Applied Pressure	(kPa)	(kPa)	55	55	55	55	55	55
SWELL TEST	Initial Water Content (%)	22.6	20.4	22.8	22.1	18.4	18.5	24.1
	Bulk Density (t/m ³)	1.94	2.06	1.96	1.95	1.99	2.05	1.86
	Dry Density (t/m ³)	1.58	1.71	1.60	1.60	1.68	1.73	1.50
	Final Water Content (%)	23.3	21.3	23.5	23.1	19.0	19.5	25.0
SHRINKAGE TEST	Swelling Strain (%)	0.18	0.25	0.65	0.68	0.03	0.03	0.03
	Initial Water Content (%)	22.1	27.2	25.8	25.7	18.0	17.6	25.1
	Estimated Shrinkage Limit (%)	7.7	12.3	7.0	8.6	6.8	4.7	9.1
	Shrinkage Strain (%)	2.9	0.8	2.3	3.5	2.2	2.7	4.2
SHRINK - SWELL INDEX	Inert Material Estimate in the Soil Specimen (%)	0	0	0	0	0	0	0
	Soil Crumbling During Shrinkage	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Cracking of the Shrinkage Specimen	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
		1.7	0.5	1.5	2.1	1.2	1.5	2.4

Entered by: ST

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See AS 1289.7.1.1 for Worked Example of Soil Swell Test Results

Site: Precinct 2, Stage 2C, Millwater

Page 4 of 4

Your Job No: 21854.001
Our Job No: 616830.001

Test Method Used: AS 1289.7.1.1 - 2003 Determination of the Shrink - Swell Index

SUMMARY OF SHRINK - SWELL TEST RESULTS

Lot No.:	316 (E16)	326 (E11)	355 (E4)	386 (E13)	
DEPTH	(m)	(m)	(m)	(m)	
Applied Pressure	(kPa)	(kPa)	(kPa)	(kPa)	
Initial Water Content	(%)	(%)	(%)	(%)	
Bulk Density	(t/m ³)	(t/m ³)	(t/m ³)	(t/m ³)	
Dry Density	(t/m ³)	(t/m ³)	(t/m ³)	(t/m ³)	
Final Water Content	(%)	(%)	(%)	(%)	
Swelling Strain	(%)	(%)	(%)	(%)	
Initial Water Content	(%)	(%)	(%)	(%)	
Estimated Shrinkage Limit	(%)	(%)	(%)	(%)	
Shrinkage Strain	(%)	(%)	(%)	(%)	
Inert Material Estimate in the Soil Specimen	(%)	(%)	(%)	(%)	
Soil Crumbling During Shrinkage					
Cracking of the Shrinkage Specimen					
SHRINK - SWELL INDEX	(%)	(%)	(%)	(%)	

Entered by: ST

Date: 3/05/2016

Checked by: MP

Date: 3/05/2016



Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No:HA1

Hole Location: LOT 277

SHEET 1 OF 1

PROJECT: Stage 2C		LOCATION: Millwater Precinct 2		JOB No: 21854.001														
CO-ORDINATES:		DRILL TYPE: 50mm HA		HOLE STARTED: 1/4/16														
R.L.:		DRILL METHOD: HA		HOLE FINISHED: 1/4/16														
DATUM:		DRILL FLUID:		DRILLED BY: geotechnics														
				LOGGED BY: rbe														
				CHECKED:														
GEOLOGICAL		ENGINEERING DESCRIPTION																
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL FILL														H				SILT, non plastic, moist, blackish brown (topsoil)
FILL						• >202/87kPa			0.5					VSt				SILT, non plastic, moist, grey with yellowish brown inclusions
						• 168/49kPa								H				clayey SILT, low plasticity, moist, yellowish brown, with grey inclusions
						• UTP			1.0									SILT, minor clay, non plastic, moist, grey
						• >202kPa								St				clayey SILT, low to medium plasticity, moist, yellowish brown and grey
						• 78/35kPa			1.5									
						• 98/32kPa								VSt				SILT, non plastic, moist, grey with yellowish brown inclusions
						• 189/71kPa			2.0									
						• 160/74kPa			2.5					H				clayey SILT, low plasticity, moist, yellowish brown, with grey inclusions
						• >202kPa												SILT, non plastic, dry to moist, grey with minor orange brown inclusions
						• >202kPa			3.0									clayey SILT, low plasticity, moist, yellowish brown with grey inclusions
FILL OR RESIDUAL SOIL											ML							clayey SILT, low to medium plasticity, moist, yellowish brown
																		END OF BOREHOLE 3.2m (target depth)

T+T DATA TEMPLATE.GDT 11b

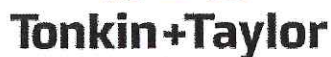
Log Scale 1:17.5

BORELOG 21854.001HA.GPJ 15-Jul-2016



SHEET 1 OF 1

THT DATATEMPLATE.GDT jlb



Hole Location: LOT 326

SHEET 1 OF 1

PROJECT: Stage 2C			LOCATION: Millwater Precinct 2			JOB No: 21854.001													
CO-ORDINATES:			DRILL TYPE: 50mm HA			HOLE STARTED: 4/4/16													
R.L.:			DRILL METHOD: HA			HOLE FINISHED: 4/4/16													
DATUM:			DRILL FLUID:			LOGGED BY: YA CHECKED:													
GEOLOGICAL						ENGINEERING DESCRIPTION													
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.			FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE / WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
FILL			Hole dry on completion												VSr				Topsoil
																			clayey SILT, slightly moist, low plasticity, brown, orange and grey
																			-grey
																			-brown, orange and grey
																H			-friable, dry, grey
																			-slightly moist, some orange inclusions
																			-orange brown with grey inclusions
																			-dry, friable, grey
																			-inclusions of moist, brown, cohesive clayey SILT
																			END OF BOREHOLE 3m (target depth)

BOREHOLE LOG

BOREHOLE No:HA12

Hole Location: LOT 291

SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001												
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 5/4/16												
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 5/4/16												
DATUM:				DRILL FLUID:				DRILLED BY: geotechnics												
								LOGGED BY: YA		CHECKED:										
GEOLOGICAL								ENGINEERING DESCRIPTION												
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.		FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION	
																			Soil type, minor components, plasticity or particle size, colour.	
																			ROCK DESCRIPTION	
																			Substance: Rock type, particle size, colour, minor components.	
																			Defects: Type, inclination, thickness, roughness, filling.	
FILL															H				Topsoil	
																			clayey SILT, slightly moist, brown, orange and grey	
										0.5									-grey and brown	
																			-trace fine gravel	
										1.0									-grey and yellowish brown	
										1.5										
										2.0										

T-T DATATEMPLATE.GDT ilb

BOREHOLE LOG

BOREHOLE No:HA13
Hole Location: LOT 295
SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001											
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 8/4/16											
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 8/4/16											
DATUM:				DRILL FLUID:				DRILLED BY: geotechnics											
								LOGGED BY: rbe											
								CHECKED:											
GEOLOGICAL				ENGINEERING DESCRIPTION															
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.		FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL FILL															VSt				SILT, minor clay, low plasticity, moist, dark brown (topsoil)
FILL															H				SILT, minor clay, low to no plasticity, moist, grey and yellowish brown
							• 145/68kPa								St				SILT, non plastic, moist, grey with minor white inclusions
							• >202kPa			0.5					VSt				clayey SILT, low plasticity, moist, grey and yellowish brown
							• 87/38kPa												clayey SILT, medium plasticity, moist, light whitish grey, minor yellowish brown mottles; minor gravel and grey inclusions
							• 132/61kPa			1.0					MC				clayey SILT, low to medium plasticity, moist, yellowish brown
RESIDUAL SOILS							• 104/43kPa			1.5					St				
							• 87/43kPa												
							• 121/26kPa			2.0					VSt				SILT, trace sand, non plastic, moist, yellowish orange brown
							• 110/38kPa			2.5									
							• >202kPa								H				clayey SILT, medium plasticity, moist, yellowish brown
WEATHERED NORTHLAND ALLOCHTHON							• UTP			3.0									SILT, nonplastic, moist, light pinkish brown-grey with rusty yellowish brown bands
																			END OF BOREHOLE 3.1m (target depth)

BOREHOLE LOG

BOREHOLE No: HA14

Hole Location: LOT 355

SHEET 1 OF 1

PROJECT: Stage 2C		LOCATION: Millwater Precinct 2		JOB No: 21854.001	
CO-ORDINATES:		DRILL TYPE: 50mm HA		HOLE STARTED: 5/4/16	
R.L.:		DRILL METHOD: HA		HOLE FINISHED: 5/4/16	
DATUM:		DRILL FLUID:		DRILLED BY: geotechnics	
GEOLOGICAL		ENGINEERING DESCRIPTION		LOGGED BY: YA	
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.		FLUID LOSS WATER CORE RECOVERY (%) METHOD CASING TESTS SAMPLES R.L. (m) DEPTH (m) GRAPHIC LOG		CLASSIFICATION SYMBOL MOISTURE / WEATHERING CONDITION STRENGTH/DENSITY CLASSIFICATION SHEAR STRENGTH (kPa) COMPRESSIVE STRENGTH (MPa) DEFECT SPACING (mm)	
				SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.	
FILL				VSt	Topsoil
					clayey SILT, slightly moist, light orange brown
					-dark grey and orange, mixed
				H	
					-dark grey
					-dry, friable, dark grey
NATURAL GROUND?					END OF BOREHOLE 2.1m (unable to auger)


BOREHOLE LOG

BOREHOLE No:HA15
Hole Location: LOT 386
SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001															
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 5/4/16															
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 5/4/16															
DATUM:				DRILL FLUID:				DRILLED BY: geotechnics															
								LOGGED BY: YA															
								CHECKED:															
GEOLOGICAL								ENGINEERING DESCRIPTION															
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.				FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION		
																					Soil type, minor components, plasticity or particle size, colour.		
																					ROCK DESCRIPTION		
																						Substance: Rock type, particle size, colour, minor components.	
																						Defects: Type, inclination, thickness, roughness, filling.	
FILL				Hole dry on completion																		Topsoil	
																						clayey SILT, slightly moist, friable, light brown	
																						0.5-	
																						-orange and grey	
																							1.0-
																							-dry, friable, grey
																							1.5-
																							-slightly moist, cohesive, brown
																							2.0-
																							-friable
																						-dry, friable, grey	
																						2.5	
																						END OF BOREHOLE 2.5m (unable to auger)	
																						3.0-	
																						4	

BOREHOLE LOG

BOREHOLE No:HA2
Hole Location: LOT 273
SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001																																																					
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 1/4/16																																																					
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 1/4/16																																																					
DATUM:				DRILL FLUID:				DRILLED BY: geotechnics																																																					
								LOGGED BY: rbe																																																					
								CHECKED:																																																					
GEOLOGICAL				ENGINEERING DESCRIPTION																																																									
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.				FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.																																								
TOPSOIL FILL																	II	0-200	0-200	0-200	SILT, non plastic, moist, dark brown (topsoil)																																								
FILL				Hole dry on completion					• >202kPa			0.5					VSt	0-200	0-200	0-200	SILT, some clay, low plasticity, moist, grey and yellowish brown																																								
																						• >202kPa			1.0	clayey SILT, low to medium plasticity, moist, grey and yellowish brown																																			
																											• 158/52kPa			1.5	clayey SILT, medium plasticity, moist, yellowish brown, with inclusions of grey silt																														
																																• 119/69kPa			2.0	SILT, non plastic, moist, grey																									
																																					• 137/56kPa			2.5	-dry to moist, grey with minor yellowish brown inclusions																				
																																										• >202kPa			3.0	SILT, minor clay, low to no plasticity, moist, yellowish brown and light greyish white, with grey inclusions															
																																															• >202kPa			3.5	SILT, non plastic, moist, grey										
																																																				• 185/64kPa			4.0	clayey SILT, low plasticity, moist, yellowish brown and brown					
																																																									• 171/80kPa			4.5	
			5.5																																																										
					END OF BOREHOLE 3.2m (target depth)																																																								

BOREHOLE LOG

BOREHOLE No:HA3
Hole Location: LOT 244
SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001											
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 1/4/16											
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 1/4/16											
DATUM:				DRILL FLUID:				DRILLED BY: geotechnics											
								LOGGED BY: rbe											
								CHECKED:											
GEOLOGICAL								ENGINEERING DESCRIPTION											
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.		FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL FILL																			SILT, non plastic, moist, dark brown (topsoil)
FILL																			SILT, minor clay, non plastic, moist, grey and yellowish brown
							• 166/84kPa			0.5									-friable, moist
							• UTP												-low plasticity, yellowish brown and grey
							• 171/52kPa			1.0									
							• 201/55kPa												
							• UTP			1.5									
							• UTP												-non plastic, grey with yellowish brown inclusions
							• 162/78kPa			2.0									
							• 188/72kPa			2.5									clayey SILT, low to medium plasticity, moist, yellowish brown with inclusions of grey silt
							• 113/52kPa												-non plastic
							• UTP			3.0									-low to no plasticity, grey
																			END OF BOREHOLE 3.2m (target depth)
										4									



SHEET 1 OF 1

BORELOG 21854.001HA.GPJ 15-Jul-2016

BOREHOLE LOG

BOREHOLE No: HA5
Hole Location: LOT 248
SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001											
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 5/4/16											
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 5/4/16											
DATUM:				DRILL FLUID:				DRILLED BY: geotechnics											
								LOGGED BY: YA											
								CHECKED:											
GEOLOGICAL								ENGINEERING DESCRIPTION											
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.		FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
FILL															H				clayey SILT, slightly moist, dark brown with orange and grey inclusions
										0.5					VSt				-light brown and orange
										1.0									-medium plasticity, moist; grey, yellow and light brown
										1.5									-moist, light grey, minor orange mottles
										2.0					St				
										2.5									
										3.0					VSt				END OF BOREHOLE 3m (target depth)
										4									

BOREHOLE LOG

BOREHOLE No:HA6
Hole Location: LOT 261
SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001									
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 1/4/16									
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 1/4/16									
DATUM:				DRILL FLUID:				DRILLED BY: geotechnics									
								LOGGED BY: rbe									
								CHECKED:									
GEOLOGICAL				ENGINEERING DESCRIPTION													
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE / WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL FILL													H				SILT, non plastic, moist, dark brown, (topsoil) minor yellowish brown inclusions
FILL						• >202kPa			0.5								clayey SILT, low plasticity, moist, yellowish brown
						• >202kPa											SILT, non plastic, moist, grey with minor orange brown inclusions
						• >202kPa			1.0								-red and grey, friable, hard to auger
						• >202kPa											
NORTHLAND ALLOCHTHON										x x x	ML						SILT, non plastic to friable, moist, red and grey, very hard to auger -dry, friable, very hard
									1.5								END OF BOREHOLE 1.4m (unable to auger)
									2.0								
									2.5								
									3.0								
									4								

BOREHOLE LOG

BOREHOLE No:HA7
Hole Location: LOT 258
SHEET 1 OF 1

PROJECT: Stage 2C		LOCATION: Millwater Precinct 2		JOB No: 21854.001														
CO-ORDINATES:		DRILL TYPE: 50mm HA		HOLE STARTED: 1/4/16														
R.L.:		DRILL METHOD: HA		HOLE FINISHED: 1/4/16														
DATUM:		DRILL FLUID:		DRILLED BY: geotechnics														
				LOGGED BY: rbe														
				CHECKED:														
GEOLOGICAL		ENGINEERING DESCRIPTION																
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL FILL														H				SILT, non plastic, moist, dark brown (topsoil)
FILL						• UTP								VSt				SILT, non plastic, moist, yellowish brown and grey
						• 189/49kPa			0.5									SILT, non plastic, moist, grey, with yellowish brown inclusions
						• UTP			1.0					H				SILT, non plastic, moist, grey and brown and reddish brown, with minor yellowish brown inclusions
NORTHLAND ALLOCHTHON						• UTP					ML							SILT, non plastic to friable, dry to moist, grey
						• UTP			1.5									
									2.0									END OF BOREHOLE 1.8m (unable to auger)
									2.5									
									3.0									
									4.0									



Hole Location: LOT 299

SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001			
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 5/4/16			
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 5/4/16			
DATUM:				DRILL FLUID:				LOGGED BY: YA CHECKED:			
GEOLOGICAL				ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.				FLUID LOSS WATER CORE RECOVERY (%) METHOD CASING	TESTS	SAMPLES R.L. (m) DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL MOISTURE / WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740 760 780 800 820 840 860 880 900 920 940 960 980 1000 1020 1040 1060 1080 1100 1120 1140 1160 1180 1200 1220 1240 1260 1280 1300 1320 1340 1360 1380 1400 1420 1440 1460 1480 1500 1520 1540 1560 1580 1600 1620 1640 1660 1680 1700 1720 1740 1760 1780 1800 1820 1840 1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140 2160 2180 2200 2220 2240 2260 2280 2300 2320 2340 2360 2380 2400 2420 2440 2460 2480 2500 2520 2540 2560 2580 2600 2620 2640 2660 2680 2700 2720 2740 2760 2780 2800 2820 2840 2860 2880 2900 2920 2940 2960 2980 3000 3020 3040 3060 3080 3100 3120 3140 3160 3180 3200 3220 3240 3260 3280 3300 3320 3340 3360 3380 3400 3420 3440 3460 3480 3500 3520 3540 3560 3580 3600 3620 3640 3660 3680 3700 3720 3740 3760 3780 3800 3820 3840 3860 3880 3900 3920 3940 3960 3980 4000 4020 4040 4060 4080 4100 4120 4140 4160 4180 4200 4220 4240 4260 4280 4300 4320 4340 4360 4380 4400 4420 4440 4460 4480 4500 4520 4540 4560 4580 4600 4620 4640 4660 4680 4700 4720 4740 4760 4780 4800 4820 4840 4860 4880 4900 4920 4940 4960 4980 5000 5020 5040 5060 5080 5100 5120 5140 5160 5180 5200 5220 5240 5260 5280 5300 5320 5340 5360 5380 5400 5420 5440 5460 5480 5500 5520 5540 5560 5580 5600 5620 5640 5660 5680 5700 5720 5740 5760 5780 5800 5820 5840 5860 5880 5900 5920 5940 5960 5980 6000 6020 6040 6060 6080 6100 6120 6140 6160 6180 6200 6220 6240 6260 6280 6300 6320 6340 6360 6380 6400 6420 6440 6460 6480 6500 6520 6540 6560 6580 6600 6620 6640 6660 6680 6700 6720 6740 6760 6780 6800 6820 6840 6860 6880 6900 6920 6940 6960 6980 7000 7020 7040 7060 7080 7100 7120 7140 7160 7180 7200 7220 7240 7260 7280 7300 7320 7340 7360 7380 7400 7420 7440 7460 7480 7500 7520 7540 7560 7580 7600 7620 7640 7660 7680 7700 7720 7740 7760 7780 7800 7820 7840 7860 7880 7900 7920 7940 7960 7980 8000 8020 8040 8060 8080 8100 8120 8140 8160 8180 8200 8220 8240 8260 8280 8300 8320 8340 8360 8380 8400 8420 8440 8460 8480 8500 8520 8540 8560 8580 8600 8620 8640 8660 8680 8700 8720 8740 8760 8780 8800 8820 8840 8860 8880 8900 8920 8940 8960 8980 9000 9020 9040 9060 9080 9100 9120 9140 9160 9180 9200 9220 9240 9260 9280 9300 9320 9340 9360 9380 9400 9420 9440 9460 9480 9500 9520 9540 9560 9580 9600 9620 9640 9660 9680 9700 9720 9740 9760 9780 9800 9820 9840 9860 9880 9900 9920 9940 9960 9980 10000 10020 10040 10060 10080 10100 10120 10140 10160 10180 10200 10220 10240 10260 10280 10300 10320 10340 10360 10380 10400 10420 10440 10460 10480 10500 10520 10540 10560 10580 10600 10620 10640 10660 10680 10700 10720 10740 10760 10780 10800 10820 10840 10860 10880 10900 10920 10940 10960 10980 11000 11020 11040 11060 11080 11100 11120 11140 11160 11180 11200 11220 11240 11260 11280 11300 11320 11340 11360 11380 11400 11420 11440 11460 11480 11500 11520 11540 11560 11580 11600 11620 11640 11660 11680 11700 11720 11740 11760 11780 11800 11820 11840 11860 11880 11900 11920 11940 11960 11980 12000 12020 12040 12060 12080 12100 12120 12140 12160 12180 12200 12220 12240 12260 12280 12300 12320 12340 12360 12380 12400 12420 12440 12460 12480 12500 12520 12540 12560 12580 12600 12620 12640 12660 12680 12700 12720 12740 12760 12780 12800 12820 12840 12860 12880 12900 12920 12940 12960 12980 13000 13020 13040 13060 13080 13100 13120 13140 13160 13180 13200 13220 13240 13260 13280 13300 13320 13340 13360 13380 13400 13420 13440 13460 13480 13500 13520 13540 13560 13580 13600 13620 13640 13660 13680 13700 13720 13740 13760 13780 13800 13820 13840 13860 13880 13900 1392	

BOREHOLE LOG

BOREHOLE No:HA9

Hole Location: LOT 286

SHEET 1 OF 1

PROJECT: Stage 2C				LOCATION: Millwater Precinct 2				JOB No: 21854.001										
CO-ORDINATES:				DRILL TYPE: 50mm HA				HOLE STARTED: 4/4/16										
R.L.:				DRILL METHOD: HA				HOLE FINISHED: 4/4/16										
DATUM:				DRILL FLUID:				DRILLED BY: geotechnics										
GEOLOGICAL				ENGINEERING DESCRIPTION														
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION
																		Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL														H				Topsoil
FILL																		clayey SILT, slightly moist, brown, orange and yellow
NATURAL GROUND?																		SILT, -friable, dry
																		-dark brown and grey
																		-light brown, dry
																		END OF BOREHOLE 1.25m (unable to auger)

Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor

T&T Job #: 21854.0010

Job #: 614089.000/1

Entered By: YA/RH/UEJ

Checked By:

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NZGS August 2001 Guidelines for hand held shear vane test.																			
URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (V)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments
												(UTP = Unable to penetrate)							
												Test 1	Test 2	Test 3	Test 4				
S15-080/6	2659887.869	6508308.439	59.015		TAJ	29/10/2015	1.98	1.61	23.6	2.7	2.7		196	196	196	196		P	
S15-082/1	2659845.626	6508251.471	59.594	Re Wall	TAJ	2/11/2015	2.13	1.88	13.6	2.7	5.1		196	196	196	196		P	
S15-082/2	2659975.182	6508267.522	60.156	Re Wall	TAJ	2/11/2015	2.17	1.91	13.6	2.7	3.3		196	196	196	196		P	
S15-082/5	2660172.586	6508562.989	22.808	Bonafr Gully	TAJ	2/11/2015	2.11	1.84	14.6	2.7	4.8		196	196	196	196		P	
S15-082/6	2660203.51	6508577.957	22.031	Bonafr Gully	TAJ	2/11/2015	1.94	1.52	27.0	2.7	2.4		196	196	196	196		P	
S15-082/7	2660137.66	6508567.12	22.917	Bonafr Gully	TAJ	2/11/2015	1.92	1.55	24.3	2.7	5.1		196	196	196	196		P	
S15-082/8	2659852.953	6508432.631	49.771	Re Wall 403	TAJ	2/11/2015	1.96	1.61	21.6	2.7	6.7		196	196	196	196		P	
S15-082/9	2659891.695	6508375.408	49.593	Re Wall 403	TAJ	2/11/2015	1.99	1.65	20.7	2.7	5.0		196	196	196	196		P	
S15-082/10	2660050.331	6508341.764	50.073	Below Wall 309	TAJ	2/11/2015	2.00	1.66	20.7	2.7	4.2		196	196	196	196		P	
S15-082/11	2660050.225	6508350.307	44.612	Below Wall 309	TAJ	2/11/2015	2.00	1.64	22.0	2.7	3.0		196	196	196	196		P	
S15-083/1	2660056.75	6508343.621	45.85	Below Wall 309	TAJ	3/11/2015	2.00	1.64	22.0	2.7	3.0		196	196	196	196		P	
S15-083/2	2660035.642	6508332.288	45.469	Below Wall 309	TAJ	3/11/2015	2.08	1.72	21.0	2.7	0.1		196	196	196	196		P	
S15-083/3	2659834.094	6508478.751	50.098	Re Wall 403	TAJ	3/11/2015	2.02	1.74	16.1	2.7	7.4		196	196	196	196		P	
S15-083/4	2660159.195	6508552.126	24.304	Bonafr Pond	TAJ	3/11/2015	1.98	1.63	21.6	2.7	4.4		196	196	196	196		P	
S15-083/5	2660203.528	6508567.715	23.202	Bonafr Pond	TAJ	3/11/2015	2.01	1.65	21.6	2.7	3.0		196	196	196	196		P	
S15-083/6	2659850.446	6508245.228	61.429	Re wall	TAJ	3/11/2015	2.05	1.67	22.3	2.7	0.5		196	196	196	196		P	
S15-084/1	2660148.911	6508553.547	24.915	Bonafr Pond	TAJ	5/11/2015	2.05	1.67	22.3	2.7	0.7		196	196	196	196		P	
S15-084/2	2660148.911	6508553.547	24.915	Bonafr Pond	TAJ	5/11/2015	2.05	1.72	19.3	2.7	3.1		196	196	196	196		P	
S15-084/5	2659928.8	6508299.666	45.199	Below Wall 309	TAJ	5/11/2015	2.05	1.72	19.3	2.7	3.3		196	196	196	196		P	
S15-084/6	2659961.078	6508305.844	46.933	Below Wall 309	TAJ	5/11/2015	2.01	1.77	13.6	2.7	10.2		196	196	196	196	Y	F	
S15-084/7	2659879.206	6508634.255	52.943	Undercut	TAJ	5/11/2015	2.04	1.70	20.1	2.7	2.9		196	196	196	196		P	
S15-084/8	2659898.35	6508634.652	51.581	Undercut	TAJ	5/11/2015	2.03	1.69	20.1	2.7	3.6		196	196	196	196		P	
S15-084/9	2659898.997	6508641.775	51.126	Undercut	TAJ	5/11/2015	2.01	1.77	13.6	2.7	10.2		196	196	196	196		P	
S15-084/10	2659931.096	6508254.303	62.71	RE Wall	TAJ	5/11/2015	2.05	1.66	23.6	2.7	0.0		196	196	196	196		P	
S15-085/1	2659942.123	6508448.923	50.799	Re Wall 403	TAJ	6/11/2015	1.93	1.51	27.8	2.7	2.2		196	196	196	196		P	
S15-085/2	2659942.123	6508448.923	50.815	Re Wall 403	TAJ	6/11/2015	1.94	1.52	27.8	2.7	1.7		196	196	196	196		P	
S15-085/3	2659881.129	6508411.085	50.597	Re Wall 403	TAJ	6/11/2015	1.89	1.52	24.5	2.7	6.4		196	196	196	196		P	
							1.99	1.62	24.5	2.7	6.7		196	196	196	196		P	
							2.08	1.88	10.7	2.7	10.2		196	196	196	196		P	
							2.10	1.90	10.7	2.7	9.5		196	196	196	196		P	
							1.91	1.53	24.6	2.7	5.6		196	196	196	196		P	
							1.92	1.54	24.6	2.7	4.9		196	196	196	196		P	
							2.12	1.81	17.1	2.7	2.2		196	196	196	196		P	
							2.11	1.81	17.1	2.7	2.3		196	196	196	196		P	
							2.04	1.72	18.4	2.7	4.6		196	196	196	196		P	
							2.03	1.71	18.4	2.7	5.1		196	196	196	196		P	
							1.96	1.63	20.3	2.7	6.7		196	196	196	196		P	
							1.96	1.63	20.3	2.7	6.6		196	196	196	196		P	

Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor

Job # 614089.000/1

T&T Job #: 21854.0010

Entered By: YARINJED

Checked By:

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NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (V)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
											Test 1	Test 2	Test 3	Test 4				
S15-085/4	2659579.283	6509377.675	50.924	Re Wall 403	TAJ	6/11/2015	1.93	1.57	22.6	2.7	6.2	196	196	196	196		P	
S15-085/5	2659945.48	6509241.544	52.357	Re Wall	TAJ	6/11/2015	1.92	1.57	22.6	2.7	6.5	196	196	196	196		P	
S15-085/6	2659954.667	6509311.976	44.213	Below Wall 309	TAJ	6/11/2015	2.02	1.70	18.5	2.7	2.9	196	196	196	196		P	
S15-085/7	2659974.509	6509313.926	45.246	Below Wall 309	TAJ	6/11/2015	1.99	1.64	21.3	2.7	4.2	196	196	196	196		P	
S15-085/8	2660089.002	6509609.809	17.989	Bonaif Pond	TAJ	6/11/2015	1.98	1.63	21.3	2.7	5.0	196	196	196	196		P	
S15-085/10	2660343.317	6509757.844	16.572	Bonaif Drainline	TAJ	6/11/2015	2.03	1.68	20.7	2.7	3.4	196	196	196	196		P	
S15-085/11	2660375.794	6509792.443	15.674	Bonaif Drainline	TAJ	6/11/2015	1.90	1.53	23.8	2.7	6.7	196	196	196	196		P	
S15-088/3	2659666.761	6509386.713	51.395	Re Wall 403	TAJ	9/11/2015	1.83	1.40	30.4	2.7	5.6	196	196	196	196		P	
S15-088/4	2659643.613	6508446.523	51.701	Re Wall 403	TAJ	9/11/2015	1.98	1.68	17.9	2.7	7.7	196	196	196	196		P	
S15-088/5	2659613.208	6508484.075	52.206	Re Wall 403	TAJ	9/11/2015	1.98	1.68	17.9	2.7	7.6	196	196	196	196		P	
S15-088/6	2659624.181	6508293.383	46.101	Below Wall 309	TAJ	9/11/2015	1.91	1.52	25.8	2.7	4.5	196	196	196	196		P	
S15-088/7	2659622.844	6508300.475	46.68	Below Wall 309	TAJ	9/11/2015	1.96	1.63	21.4	2.7	4.9	196	196	196	196		P	
S15-088/8	2660154.424	6508591.441	21.775	Bonaif Pond	TAJ	9/11/2015	2.04	1.68	21.3	2.7	2.0	196	196	196	196		P	
S15-090/1	2659902.042	6508292.518	44.223	Below wall 303	TAJ	10/11/2015	2.03	1.67	21.3	2.7	2.6	196	196	196	196		P	
S15-090/2	2659918.679	6508290.322	46.829	Below Wall 309	TAJ	10/11/2015	1.97	1.61	22.5	2.7	4.3	196	196	196	196		P	
S15-090/3	2660070.892	6508598.881	21.692	Bonaif Pond	TAJ	10/11/2015	1.96	1.60	22.5	2.7	4.7	196	196	196	196		P	
S15-090/4	2660172.627	6508512.305	21.312	Bonaif Pond	TAJ	10/11/2015	1.91	1.51	26.6	2.7	3.9	196	196	196	196		P	
S15-091	2660164.008	6508514.168	22.682	Bonaif Pond	TAJ	11/11/2015	1.94	1.53	26.6	2.7	2.7	196	196	196	196		P	
S15-092	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.93	1.62	19.6	2.7	8.4	196	196	196	196		P	
S15-093/1	2660172.627	6508512.305	21.312	Bonaif Pond	TAJ	10/11/2015	1.93	1.61	19.6	2.7	8.7	196	196	196	196		P	
S15-093/2	2660164.008	6508514.168	22.682	Bonaif Pond	TAJ	11/11/2015	1.92	1.59	21.1	2.7	7.8	196	196	196	196		P	
S15-093/3	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.93	1.60	21.1	2.7	7.2	196	196	196	196		P	
S15-093/4	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.94	1.62	19.6	2.7	7.8	196	196	196	196		P	
S15-093/5	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.94	1.62	19.6	2.7	8.1	196	196	196	196		P	
S15-093/6	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.96	1.51	24.4	2.7	7.3	196	196	196	196		P	
S15-093/7	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.90	1.52	24.4	2.7	6.4	196	196	196	196		P	
S15-093/8	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.82	1.30	39.6	2.7	0.2	196	196	196	196		P	
S15-093/9	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.80	1.29	39.6	2.7	1.1	196	196	196	196		P	
S15-093/10	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.76	1.24	42.1	2.7	2.1	196	196	196	196		P	
S15-093/11	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.77	1.24	42.1	2.7	1.6	196	196	196	196		P	
S15-093/12	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.95	1.56	25.1	2.7	3.3	196	196	196	196		P	
S15-093/13	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.96	1.57	25.1	2.7	2.5	196	196	196	196		P	
S15-093/14	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.76	1.25	40.1	2.7	3.3	196	196	196	196		P	
S15-093/15	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.87	1.40	33.5	2.7	1.5	196	196	196	196		P	
S15-094/1	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.86	1.42	31.3	2.7	3.1	196	196	196	196		P	
S15-094/2	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.87	1.42	31.3	2.7	2.7	196	196	196	196		P	
S15-094/3	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.94	1.55	25.5	2.7	3.2	196	196	196	196		P	
S15-094/4	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.94	1.54	25.5	2.7	3.4	196	196	196	196		P	
S15-094/5	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.76	1.27	39.5	2.7	3.6	196	196	196	196		P	
S15-094/6	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.77	1.27	39.5	2.7	3.6	196	196	196	196		P	
S15-094/7	2660164.008	6508514.166	22.682	Bonaif Pond	TAJ	11/11/2015	1.77	1.27	39.5	2.7	3.6	196	196	196	196		P	

Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job # 814089.000/1
Entered By: YAFHNUJED
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NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re-Test (V)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S15-094/8	2659227.463	6509248.821	34.84	Lot559(P733E1)	TAJ	14/11/2015	2.11	1.80	17.0	2.7	2.6	186	196	196	196	196		P	
S15-094/10	2659226.23	6509251.582	33.439	Lot559(P733E1)	TAJ	14/11/2015	2.11	1.81	17.0	2.7	2.5	186	196	196	196	196		P	
no gps				Above Wall 304	TAJ	18/11/2015	1.90	1.50	27.2	2.7	4.0	196	196	196	196	196		P	
no gps				Above Wall 304	TAJ	18/11/2015	1.97	1.60	23.1	2.7	3.9	196	196	196	196	196		P	
no gps				Above Wall 304	TAJ	18/11/2015	1.86	1.59	23.1	2.7	4.1	196	196	196	196	196		P	
no gps				Above Wall 304	TAJ	18/11/2015	2.03	1.61	25.1	2.7	88.1	196	196	196	196	196		P	
no gps				Above Wall 304	TAJ	18/11/2015	1.82	1.43	26.8	2.7	8.5	196	196	196	196	196		P	
S15-096/5	2659165.86	6509625.563	24.325	Bonair pond	TAJ	22/11/2015	2.06	1.70	21.0	2.7	1.4	196	196	196	196	196		P	
S15-096/6	2659167.638	6509617.585	24.079	Bonair pond	TAJ	22/11/2015	2.05	1.70	21.0	2.7	1.5	196	196	196	196	196		P	
S15-096/7	2659190.196	6509631.254	24.338	Bonair pond	TAJ	22/11/2015	2.07	1.75	18.1	2.7	3.4	196	196	196	196	196		P	
S15-096/8	2659684.896	6509497.657	30.05	Wall 304 Area	TAJ	22/11/2015	2.06	1.75	18.1	2.7	3.6	196	196	196	196	196		P	
S15-096/9	2659689.317	6508473.964	29.462	Wall 304 Area	TAJ	22/11/2015	1.91	1.49	28.6	2.7	2.5	196	196	196	196	196		P	
S15-096/10	2659651.996	6508504.105	30.359	Wall 304 Area	TAJ	22/11/2015	1.90	1.46	29.5	2.7	2.6	196	196	196	196	196		P	
S15-097/5	2659841.588	6508462.105	30.75	Wall 304 Area	TAJ	23/11/2015	1.91	1.48	29.5	2.7	1.8	196	196	196	196	196		P	
S15-097/6	2659851.044	6508480.694	30.18	Wall 304 Area	TAJ	23/11/2015	1.83	1.52	23.8	2.7	3.0	196	196	196	196	196		P	
S15-097/7	2659861.603	6508505.417	30.485	Wall 304 Area	TAJ	23/11/2015	2.13	1.83	16.2	2.7	2.6	196	196	196	196	196		P	
S15-097/8	2659870.031	6508528.306	30.694	Wall 304 Area	TAJ	23/11/2015	2.16	1.66	16.2	2.7	1.0	196	196	196	196	196		P	
S15-097/9	2659879.989	6508546.086	31.048	Wall 304 Area	TAJ	23/11/2015	1.94	1.50	29.2	2.7	0.4	196	196	196	196	196		P	
S15-098/1	2659883.411	6508506.496	30.775	Wall 304 Area	TAJ	24/11/2015	2.03	1.70	19.3	2.7	4.4	196	196	196	196	196		P	
S15-098/2	2659873.811	6508530.398	31.082	Wall 304 Area	TAJ	24/11/2015	2.00	1.68	19.3	2.7	5.4	196	196	196	196	196		P	
S15-098/3	2659884.907	6508556.848	31.699	Wall 304 Area	TAJ	24/11/2015	2.11	1.56	35.1	2.7	0.0	196	196	196	196	196		P	
S15-098/4	2659852.199	6508486.907	30.622	Wall 304 Area	TAJ	24/11/2015	2.03	1.45	40.2	2.7	0.0	196	196	196	196	196		P	
S15-098/5	2659851.503	6508463.844	30.511	Wall 304 Area	TAJ	24/11/2015	2.05	1.46	40.2	2.7	0.0	196	196	196	196	196		P	
S15-098/6	2659846.842	6508560.27	21.659	Bonair	TAJ	24/11/2015	1.95	1.58	24.5	2.7	3.7	196	196	196	196	196		P	
S15-099/1	2659840.734	6508451.612	31.331	Wall 304 Area	TAJ	25/11/2015	2.01	1.61	24.5	2.7	0.7	196	196	196	196	196		P	
S15-099/2	2659823.902	6508479.943	32.255	Wall 304 Area	TAJ	25/11/2015	1.96	1.57	25.1	2.7	2.6	196	196	196	196	196		P	
S15-099/3	2659830.595	6508524.486	32.981	Wall 304 Area	TAJ	25/11/2015	1.95	1.56	25.1	2.7	3.1	196	196	196	196	196		P	
S15-099/4	2659847.093	6508553.177	33.745	Wall 304 Area	TAJ	25/11/2015	2.06	1.69	21.3	2.7	0.0	196	196	196	196	196		P	
S15-099/5	2659871.178	6508555.235	32.007	Wall 304 Area	TAJ	25/11/2015	1.97	1.59	24.0	2.7	3.4	196	196	196	196	196		P	

Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 614085.000/1
Entered By: Y/RHN/JED
Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S15-1009/13	2660234.62	6508591.449	23.667	Bonaif	TAJ	26/11/2015	1.92	1.61	19.6	2.7		196	196	196	196		P		
S15-100/8	2659987.902	6508526.592	31.564	Wall 304 Area	TAJ	26/11/2015	2.08	1.88	10.7	2.7	10.4	196	196	196	196		P		
S15-100/9	26599816.81	6508501.653	34.289	Wall 304 Area	TAJ	26/11/2015	1.97	1.65	19.4	2.7	7.0	196	196	196	196		P		
S15-100/10	26599848.981	6508556.961	33.594	Wall 304 Area	TAJ	26/11/2015	1.97	1.60	22.9	2.7	4.2	196	196	196	196		P		
S15-100/11	26599835.812	6508446.018	31.415	Wall 304 Area	TAJ	26/11/2015	2.19	1.96	11.7	2.7	4.6	196	196	196	196		P		
S15-100/12	26599855.751	6508449.393	30.72	Wall 304 Area	TAJ	26/11/2015	2.05	1.70	21.5	2.7	0.3	196	196	196	196		P		
S15-100/13	2660226.356	6508586.059	25.294	Bonaif	TAJ	26/11/2015	1.93	1.57	23.1	2.7	5.8	151	196	196	182		P		
S15-100/14	26599546.12	6509525.382	33.697	Wall 304 Area	TAJ	26/11/2015	2.14	1.90	12.9	2.7	5.3	196	196	196	196		P		
S15-100/15	26599866.023	6508560.697	32.906	Wall 304 Area	TAJ	26/11/2015	2.11	1.87	12.9	2.7	6.5	196	196	196	196		P		
S15-101/1	26599855.737	6508409.36	33.47	Wall 304 Area	TAJ	27/11/2015	2.07	1.54	33.9	2.7	0.0	196	196	196	196		P		
S15-101/2	26599825.701	6508447.213	33.421	Wall 304 Area	TAJ	27/11/2015	2.09	1.90	9.9	2.7	11.0	196	196	196	196	Y	F		
S15-101/3	26599807.317	6508461.622	34.813	Wall 304 Area	TAJ	27/11/2015	2.09	1.91	9.9	2.7	10.6	196	196	196	196		P		
S15-101/4	26599816.315	6509532.404	34.925	Wall 304 Area	TAJ	27/11/2015	1.99	1.60	23.8	2.7	2.6	196	196	196	196		P		
S15-101/5	26599844.338	6509583.327	36.013	Wall 304 Area	TAJ	27/11/2015	2.12	1.76	20.8	2.7	0.0	196	196	196	196		P		
S15-101/6	26599839.35	6509586.289	36.541	Wall 304 Area	TAJ	27/11/2015	2.10	1.74	20.8	2.7	0.0	196	196	196	196		P		
S15-101/7	26599816.528	6509536.018	35.349	Wall 304 Area	TAJ	27/11/2015	2.09	1.60	29.6	2.7	0.0	196	196	196	196		P		
S15-101/8	26599834.285	6509731.1	52.465	Below Site Office	TAJ	27/11/2015	2.05	1.62	26.5	2.7	0.0	196	196	196	196		P		
S15-101/9	2659775.938	6509718.281	52.628	Below Site Office	TAJ	27/11/2015	2.12	1.75	21.0	2.7	0.0	196	196	196	196		P		
S15-102/1	26599815.148	6509565.178	36.84	Wall 304 Area	TAJ	30/11/2015	2.13	1.76	21.0	2.7	0.0	196	196	196	196		P		
S15-102/2	26599838.277	6508570.514	36.009	Wall 304 Area	TAJ	30/11/2015	2.29	2.09	11.7	2.7	0.1	196	196	196	196		P		
				Wall 304 Area	TAJ	30/11/2015	2.09	1.76	18.8	2.7	2.0	196	196	196	196		P		
				Wall 304 Area	TAJ	30/11/2015	2.09	1.75	19.4	2.7	4.1								



Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 614089.000/1
Entered By: YA/RH/NJED
Checked By:

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NZS 4407:1997 Field water content and field dry density using a nuclear densimeter
Test 4.2.1 Direct Transmission Mode

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³)	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re-Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
				Under Site Office	TAJ	30/11/2015	2.05	1.75	19.4	2.7	1.3								
S15-102/4	2659799.214	6508525.939	37.272	Wall 304 Area	TAJ	30/11/2015	1.74	1.18	47.4	2.7	0.2	196	196	196	196	196		P	
S15-102/5	2659808.903	6508719.308	52.812	Under Site Office	TAJ	30/11/2015	2.15	1.81	19.1	2.7	0.0	196	196	196	196	196		P	
S15-102/6	2659753.056	6508693.739	51.805	Under Site Office	TAJ	30/11/2015	1.96	1.82	21.4	2.7	5.5	196	196	196	196	196		P	
S15-103/1	2659887.946	6508554.906	32.58	Wall 304 Area	TAJ	1/12/2015	2.06	1.67	23.2	2.7	0.0	196	196	196	196	196		P	
S15-103/2	2659847.844	6508483.877	32.283	Wall 304 Area	TAJ	1/12/2015	1.90	1.44	31.4	2.7	1.3	196	196	196	196	196		P	
S15-103/3	2659662.544	6508425.517	32.357	Wall 304 Area	TAJ	1/12/2015	2.10	1.82	15.0	2.7	5.2	196	196	196	196	196		P	
S15-104/1	2659870.11	6508562.859	33.128	Wall 304 Area	TAJ	2/12/2015	2.08	1.81	15.0	2.7	5.0	196	196	196	196	196		F	
S15-104/2	2659842.909	6508522.807	33.165	Wall 304 Area	TAJ	2/12/2015	1.95	1.68	16.3	2.7	10.4	196	196	196	196	196		P	
S15-104/3	2659841.442	6508452.333	32.755	Wall 304 Area	TAJ	2/12/2015	1.96	1.68	16.3	2.7	10.3	196	196	196	196	196		F	
S15-104/4	2659859.624	6508419.773	32.997	Wall 304 Area	TAJ	2/12/2015	2.20	1.99	10.8	2.7	4.9	196	196	196	196	196		P	
S15-105/1	2659875.684	6508534.22	32.076	Wall 304 Area	TAJ	3/12/2015	2.22	2.01	10.8	2.7	4.0	196	196	196	196	196		P	
S15-105/2	2659852.988	6508508.478	32.413	Wall 304 Area	TAJ	3/12/2015	2.04	1.82	11.8	2.7	10.9	196	196	196	196	196		F	
S15-105/3	2659852.232	6508476.358	32.293	Wall 304 Area	TAJ	3/12/2015	2.04	1.82	11.8	2.7	11.0	196	196	196	196	196		P	
S15-105/4	2659863.03	6508449.797	31.896	Wall 304 Area	TAJ	3/12/2015	2.14	1.81	18.1	2.7	0.2	196	196	196	196	196		P	
S15-105/5	2659863.03	6508449.797	31.896	Wall 304 Area	TAJ	3/12/2015	2.06	1.85	10.9	2.7	11.2	196	196	196	196	196		P	
S15-105/6	2659856.337	6508508.108	55.344	Under Site Office	TAJ	3/12/2015	2.07	1.86	10.9	2.7	10.7	196	196	196	196	196		P	
S15-105/7	2659896.025	6508824.409	54.127	Under Site Office	TAJ	3/12/2015	2.10	1.82	15.4	2.7	4.7	196	196	196	196	196		P	
S15-106/8	2659857.73	6508418.986	33.373	Wall 304 Area	TAJ	4/12/2015	2.08	1.62	28.7	2.7	0.0	196	196	196	196	196		P	
S15-106/9	2659828.467	6509448.2	34.26	Wall 304 Area	TAJ	4/12/2015	2.08	1.62	28.7	2.7	0.0	196	196	196	196	196		P	
S15-106/10	2659814.712	6508468.601	35.167	Wall 304 Area	TAJ	4/12/2015	2.09	1.85	12.6	2.7	8.1	196	196	196	196	196		P	
S15-106/11	2659827.303	6508509.574	34.742	Wall 304 Area	TAJ	4/12/2015	2.07	1.86	11.6	2.7	9.7	196	196	196	196	196		P	
S15-106/12	2659842.5	6508538.719	34.342	Wall 304 Area	TAJ	4/12/2015	2.06	1.86	11.5	2.7	9.6	196	196	196	196	196		P	
S15-106/13	2659783.101	6508536.073	39.115	Shear Key	TAJ	4/12/2015	1.96	1.67	17.9	2.7	8.5	196	196	196	196	196		P	

NZS 4407:1991 Field water content and field dry density using a nuclear densimeter
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S15-108/14	2659888.944	6508472.239	35.652	Wall 304 Area Rctest	TAJ	4/12/2015	1.76	1.28	35.8	2.7	5.2	196	196	196	196	196		P	
S15-108/15	2659900.955	6508816.01	55.246	under site office	TAJ	4/12/2015	2.00	1.29	36.8	2.7	4.8	196	196	196	196	196		P	
S15-108/16	2659982.99	6508791.221	53.47	under site office	TAJ	4/12/2015	2.03	1.70	19.5	2.7	5.5	140	196	182	133	163		P	
S15-107/1	2659845.495	6508542.557	34.945	Wall 304 Area	TAJ	7/12/2015	1.98	1.81	22.6	2.7	3.8	196	182	196	196	193		P	
S15-107/2	2659824.688	6508472.628	35.035	Wall 304 Area	TAJ	7/12/2015	2.02	1.79	12.9	2.7	10.7	196	196	196	196	196		F	
S15-107/3	2659855.727	6508431.727	34.679	Wall 304 Area	TAJ	7/12/2015	2.07	1.89	22.4	2.7	0.0	196	196	196	196	196		P	
S15-107/4	2659862.131	6508516.261	33.146	Wall 304 Area	TAJ	7/12/2015	1.83	1.34	35.3	2.7	1.8	140	140	189	130	150		P	
S15-108/1	2659899.953	6508755.795	53.679	Re Wall below office	TAJ	8/12/2015	2.03	1.70	19.9	2.7	3.4	196	196	196	196	196		P	
S15-108/2	2659855.650	6508748.152	53.853	Re Wall below office	TAJ	8/12/2015	2.02	1.69	19.9	2.7	3.9	196	196	196	196	196		P	
S15-108/3	2659868.903	6508731.138	54.065	Re Wall below office	TAJ	8/12/2015	1.96	1.58	24.1	2.7	3.2	196	196	196	196	196		P	
S15-108/4	2659754.610	6508703.940	54.107	Re Wall below office	TAJ	8/12/2015	1.97	1.58	24.1	2.7	3.1	196	196	196	196	196		P	
S15-108/5	2659870.418	6508553.016	33.520	Wall 304 Area	TAJ	8/12/2015	2.05	1.79	14.4	2.7	7.7	196	196	196	196	196		P	
S15-108/6	2659857.677	6508524.100	33.456	Wall 304 Area	TAJ	8/12/2015	2.06	1.82	14.4	2.7	6.5	196	196	196	196	196		P	
S15-108/7	2659851.355	6508488.521	33.683	Wall 304 Area	TAJ	8/12/2015	1.93	1.49	28.9	2.7	1.5	196	196	196	196	196		P	
S15-109/1				Re Wall below office	TAJ	9/12/2015	1.98	1.57	26.3	2.7	0.7	196	196	196	196	196		P	
S15-109/2				Re Wall below office	TAJ	9/12/2015	1.99	1.57	26.3	2.7	0.4	196	196	196	196	196		P	
S15-109/3				Wall 304 Area	TAJ	9/12/2015	2.02	1.73	19.1	2.7	7.3	196	196	196	196	196		P	
S15-109/4				Wall 304 Area	TAJ	9/12/2015	2.03	1.74	16.4	2.7	6.9	196	196	196	196	196		P	
S15-109/5				Wall 304 Area	TAJ	9/12/2015	1.95	1.53	27.6	2.7	1.4	196	196	196	196	196		P	
S15-110/1	2659824.116	6508436.525	36.408	Wall 304 Area	TA	10/12/2015	1.97	1.54	27.6	2.7	0.5	196	196	196	196	196		P	
S15-110/2	2659855.653	6508424.723	35.215	Wall 304 Area	TAJ	10/12/2015	2.03	1.69	20.4	2.7	3.0	196	196	196	196	196		P	
S15-110/3	2659856.653	6508424.723	35.215	Wall 304 Area	TAJ	10/12/2015	2.03	1.69	20.4	2.7	3.3	196	196	196	196	196		P	
S15-110/4	2659894.675	6508759.094	55.473	Re Wall below office	TA	10/12/2015	1.98	1.57	26.3	2.7	0.9	196	196	196	196	196		P	
S15-110/5	2659825.319	6508736.501	55.693	Re Wall below office	TA	10/12/2015	2.17	1.89	9.3	2.7	7.8	196	196	196	196	196		P	
S15-110/6	2659826.701	6508500.838	35.587	Wall 304 Area	TA	10/12/2015	2.21	2.02	9.3	2.7	6.4	196	196	196	196	196		P	
S15-110/7	2659838.798	6508450.878	35.498	Wall 304 Area	TA	10/12/2015	1.88	1.42	32.5	2.7	1.2	167	168	119	177	158		P	
S15-110/8	2659869.635	6508411.504	35.086	Wall 304 Area	TA	10/12/2015	1.87	1.41	32.5	2.7	2.1	196	196	196	196	196		F	
							2.02	1.84	9.9	2.7	13.6	196	196	196	196	196	Y		
							1.99	1.81	9.9	2.7	14.8	196	196	196	196	196			
							2.04	1.60	27.4	2.7	0.0	196	196	196	196	196		P	
							2.04	1.67	27.9	2.7	0.0	196	196	196	196	196		P	
							2.00	1.56	27.9	2.7	0.0	196	196	196	196	196		P	
							2.19	1.92	14.2	2.7	1.9	196	196	196	196	196		P	
							2.16	1.89	14.2	2.7	2.9	196	196	196	196	196		P	
							1.94	1.49	29.9	2.7	0.1	166	182	136	170	163		P	
							1.94	1.49	29.9	2.7	0.2	196	196	196	196	196	Y		
							1.79	1.49	19.9	2.7	14.9	196	196	196	196	196		F	
							1.79	1.49	19.9	2.7	15.1								



Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 614089.000/1
Entered By: YARHNJED
Checked By:

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NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 42.1 Direct Transmission Mode

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³)	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
												Test 1	Test 2	Test 3	Test 4				
S15-110/9	2659872.582	6508448.137	34.081	Wall 304 Area	TAJ	10/12/2015	1.93	1.99	21.3	2.7	7.2	163	151	173	149	164		P	
S15-110/10	2659884.046	6508418.725	36.200	Wall 304 Area	TAJ	10/12/2015	1.94	1.80	21.3	2.7	6.9							P	
S15-110/11	2659874.176	6508401.897	35.144	Wall 304 Area	TAJ	10/12/2015	1.90	1.45	30.6	2.7	1.8	140	172	123	156	180		P	
S15-111/1	2659858.283	6508751.231	56.392	Wall 304 Area	TAJ	11/12/2015	1.91	1.63	17.1	2.7	11.6	148	141	154	186	160		F	
S15-111/2	2659905.921	6508762.023	58.386	Wall 304 Area	TAJ	11/12/2015	2.07	1.69	22.1	2.7	0.0	196	196	196	196	196		P	
S15-111/3				Undercut	TAJ	11/12/2015	1.98	1.55	27.5	2.7	0.0	196	196	196	196	196		P	
S15-111/4	2660014.165	6508816.164	52.451	Undercut	TAJ	11/12/2015	2.07	1.68	23.1	2.7	0.0	196	196	196	196	196		P	
S15-112/1	2659874.655	6508777.886	58.646	Above RE Wall	TAJ	12/12/2015	2.05	1.76	17.5	2.7	4.8	186	196	196	196	196		P	
S15-112/2	2659782.742	6508752.248	58.543	Above RE Wall	TAJ	12/12/2015	2.07	1.73	19.5	2.7	2.4	196	196	196	196	196		P	
S15-112/3	2659823.532	6508744.673	58.822	Re Wall	TAJ	12/12/2015	2.01	1.71	17.8	2.7	6.2	186	196	196	196	196		P	
S15-112/4	2659758.193	6508714.897	58.873	Re Wall	TAJ	12/12/2015	2.00	1.69	17.8	2.7	7.1	186	196	196	196	196		P	
S15-113/5	2659801.957	6508747.552	57.873	Behind Re Wall	TAJ	14/12/2015	2.03	1.82	25.1	2.7	0.0	196	196	196	196	196		P	
S15-113/6	2659777.009	6508738.217	58.055	Behind Re Wall	TAJ	14/12/2015	2.01	1.73	16.0	2.7	8.1	196	196	196	196	196		P	
S15-113/7	2659866.835	6508754.472	57.655	Re Wall	TAJ	14/12/2015	2.09	1.88	11.4	2.7	9.0	196	196	196	196	196	Y	F	
S15-113/8	2659907.957	6508766.321	57.692	Re Wall	TAJ	14/12/2015	1.93	1.56	24.2	2.7	4.8	196	196	196	196	196		P	
S15-113/9	2660193.262	6508690.797	28.476	Re Wall	TAJ	14/12/2015	2.13	1.82	16.9	2.7	2.0	196	196	196	196	196		P	
S15-113/10	2660163.212	6508710.140	30.101	Re Wall	TAJ	14/12/2015	2.12	1.82	16.9	2.7	2.0	196	196	196	196	196		P	
S15-114/1	2660081.015	6508392.911	34.808	2A Undercut	TAJ	15/12/2015	2.03	1.74	17.0	2.7	6.1	196	196	196	196	196		P	
S15-114/2	2659842.403	6508411.865	36.646	Wall 304 Area	TAJ	15/12/2015	2.04	1.74	17.0	2.7	5.6	196	196	196	196	196		P	
S15-114/3	2659883.082	6508454.510	36.084	Wall 304 Area	TAJ	15/12/2015	1.84	1.60	22.5	2.7	10.7	166	196	170	151	178		P	
S15-114/4	2659849.234	6508467.705	35.125	Wall 304 Area	TAJ	15/12/2015	1.87	1.53	22.5	2.7	9.0	196	196	196	196	196		P	
S15-114/5	2660059.723	6508395.768	35.662	Wall 304 Area	TAJ	15/12/2015	2.08	1.77	17.4	2.7	3.5	196	196	196	196	196		P	
S15-114/6	2659055.982	6508363.059	35.673	2A Undercut	TAJ	15/12/2015	2.00	1.60	25.0	2.7	0.0	126	182	184	140	158		P	
S15-114/7	2660161.538	6508718.062	32.095	Benair Hillside	TAJ	15/12/2015	2.07	1.65	25.5	2.7	0.0	196	196	196	196	196		P	
S15-114/8		Not Surveyed		Re Wall	TAJ	15/12/2015	2.08	1.65	25.5	2.7	0.0	196	196	196	196	196		P	
S15-114/9		Not Surveyed		Re Wall	TAJ	15/12/2015	1.99	1.65	20.2	2.7	5.3	196	196	196	196	196		P	
S15-115/13				Re Wall	TAJ	16/12/2015	1.97	1.64	20.2	2.7	6.2	196	196	196	196	196		P	
							2.00	1.40	42.5	2.7	0.0	196	196	196	196	196		P	
							1.99	1.40	42.5	2.7	0.0	196	196	196	196	196		P	
							1.98	1.60	23.6	2.7	2.7	166	196	196	196	196		P	
							2.00	1.61	23.6	2.7	2.1	196	196	196	196	196		P	
							2.10	1.80	16.5	2.7	3.5	196	196	196	196	196		P	
							2.11	1.81	16.5	2.7	3.0	196	196	196	196	196		P	
							2.04	1.68	21.3	2.7	1.9	196	196	196	196	196		P	
							2.04	1.68	21.3	2.7	1.9	196	196	196	196	196		P	
							1.99	1.70	17.3	2.7	7.7	196	196	196	196	196		P	
							1.99	1.70	17.3	2.7	7.5	196	196	196	196	196		P	

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Eastings	Northings	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³) assumed	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
											Test 1	Test 2	Test 3	Test 4				
S15-115/14				Re Wall	TAJ	18/12/2015	2.00	1.70	17.6	2.7	7.3	196	196	196	196		P	
S15-115/15				Mainfill	TAJ	18/12/2015	2.01	1.70	17.6	2.7	7.3	196	196	196	196		P	
S15-115/16				Mainfill	TAJ	18/12/2015	2.01	1.64	22.3	2.7	2.5	196	196	196	196		P	
S15-115/17				Mainfill	TAJ	18/12/2015	2.13	1.89	12.5	2.7	6.4	196	196	196	196		P	
S15-115/18				Mainfill	TAJ	18/12/2015	2.01	1.87	12.5	2.7	7.4	196	196	196	196		P	
S15-115/19				2A Undercut	TAJ	18/12/2015	2.01	1.59	26.9	2.7	0.0	196	196	196	196		P	
S15-115/20				2A Undercut	TAJ	18/12/2015	2.04	1.73	18.0	2.7	4.9	196	196	196	196		P	
S15-115/21				2A Undercut	TAJ	18/12/2015	2.04	1.73	18.0	2.7	4.8	196	196	196	196		P	
S15-115/22				Re Wall	TAJ	18/12/2015	1.88	1.49	25.1	2.7	5.8	196	196	196	196		P	
S15-115/23				Re Wall	TAJ	18/12/2015	1.92	1.53	25.2	2.7	4.7	196	196	196	196		P	
S15-115/24				Re Wall	TAJ	18/12/2015	1.82	1.53	25.2	2.7	4.6	196	196	196	196		P	
S15-115/25				Mainfill	TAJ	18/12/2015	1.96	1.49	31.2	2.7	0.0	196	196	196	196		P	
S15-115/26				Mainfill	TAJ	18/12/2015	1.96	1.48	31.2	2.7	0.0	196	196	196	196		P	
S15-115/27				Mainfill	TAJ	18/12/2015	2.00	1.58	25.2	2.7	0.0	196	196	196	196		P	
S15-115/28				Mainfill	TAJ	18/12/2015	2.01	1.60	25.2	2.7	0.0	196	196	196	196		P	
S15-115/29				Mainfill	TAJ	18/12/2015	1.97	1.53	28.6	2.7	0.0	196	196	196	196		P	
S15-115/30				Mainfill	TAJ	18/12/2015	1.98	1.54	28.6	2.7	0.0	196	196	196	196		P	
S15-115/31				Mainfill	TAJ	18/12/2015	2.11	1.89	11.9	2.7	7.7	196	196	196	196		P	
S15-115/32				Mainfill	TAJ	18/12/2015	2.12	1.89	11.9	2.7	7.4	196	196	196	196		P	
S15-115/33				Re Wall	TAJ	18/12/2015	2.19	2.01	8.7	2.7	7.9	196	196	196	196		P	
S15-115/34				Re Wall	TAJ	18/12/2015	1.97	1.62	22.1	2.7	4.4	196	196	196	196		P	
S15-115/35				Re Wall	TAJ	18/12/2015	1.96	1.62	22.1	2.7	4.2	196	196	196	196		P	
S15-115/36				Re Wall	TAJ	18/12/2015	1.97	1.57	25.5	2.7	2.0	154	196	173	196		P	
S15-115/37				Main fill	TAJ	18/12/2015	1.98	1.58	25.2	2.7	1.5	196	196	196	196		P	
S15-115/38				Main fill	TAJ	18/12/2015	2.04	1.61	26.9	2.7	0.0	168	196	113	151		P	
S15-115/39				Main fill	TAJ	18/12/2015	2.03	1.60	26.9	2.7	0.0	196	196	196	196		P	
S15-115/40				Main fill	TAJ	18/12/2015	2.20	1.97	11.4	2.7	4.6	196	196	196	196		P	
S15-115/41				Main fill	TAJ	18/12/2015	2.18	1.96	11.4	2.7	5.0	196	196	196	196		P	
S15-115/42				Shear Key	TAJ	18/12/2015	1.91	1.46	31.2	2.7	0.7	196	196	196	196		P	
S15-115/43				Shear Key	TAJ	18/12/2015	1.91	1.46	31.2	2.7	0.7	196	196	196	196		P	
S15-115/44				Shear Key	TAJ	18/12/2015	2.12	1.79	18.6	2.7	0.4	196	196	196	196		P	
S15-115/45				Shear Key	TAJ	18/12/2015	2.13	1.79	18.6	2.7	0.3	196	196	196	196		P	
S15-115/46				Shear Key	TAJ	18/12/2015	2.11	1.81	16.4	2.7	3.0	196	196	196	196		P	
S15-115/47				Shear Key	TAJ	18/12/2015	2.11	1.81	16.4	2.7	3.1	196	196	196	196		P	
S15-115/48				Shear Key	TAJ	18/12/2015	2.08	1.71	21.5	2.7	0.0	196	196	196	196		P	
S15-115/49				Shear Key	TAJ	18/12/2015	2.08	1.71	21.5	2.7	0.0	196	196	196	196		P	
S15-115/50				Shear Key	TAJ	18/12/2015	2.08	1.80	14.5	2.7	7.4	196	196	196	196		P	
S15-115/51				Shear Key	TAJ	18/12/2015	2.07	1.81	14.5	2.7	6.9	196	196	196	196		P	
S15-115/52				Shear Key	TAJ	18/12/2015	2.00	1.52	31.8	2.7	0.0	196	196	196	196		P	
S15-115/53				Shear Key	TAJ	18/12/2015	1.99	1.51	31.8	2.7	0.0	196	196	196	196		P	
S15-115/54				Shear Key	TAJ	18/12/2015	2.08	1.60	30.3	2.7	0.0	196	196	196	196		P	
S15-115/55				Shear Key	TAJ	18/12/2015	2.07	1.59	30.3	2.7	0.0	196	196	196	196		P	
S15-115/56				Shear Key	TAJ	18/12/2015	2.00	1.70	18.0	2.7	5.6	196	196	196	196		P	
S15-115/57				Shear Key	TAJ	18/12/2015	2.01	1.70	18.0	2.7	6.3	196	196	196	196		P	
S15-115/58				Shear Key	TAJ	18/12/2015	1.87	1.48	25.8	2.7	6.4	159	145	196	196		P	
S15-115/59				Shear Key	TAJ	18/12/2015	1.88	1.49	25.8	2.7	6.2	196	196	196	196		P	
S15-115/60				Shear Key	TAJ	18/12/2015	1.93	1.55	24.9	2.7	4.2	196	196	196	196		P	
S15-115/61				Undercut	TAJ	18/12/2015	1.93	1.54	24.9	2.7	4.4	196	196	196	196		P	
S15-115/62				Undercut	TAJ	18/12/2015	2.05	1.65	24.5	2.7	0.0	196	196	196	196		P	
S15-115/63				Undercut	TAJ	18/12/2015	2.05	1.65	24.5	2.7	0.0	196	196	196	196		P	



Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor

Job #: 614089.000/1

T&T Job #: 21854.0010

Entered By: YARHN/JED

Test 4.2.1 Direct Transmission Mode

Checked By:

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NZGS August 2007 Guidelines for hand held shear vane test.																			
URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
												Test 1	Test 2	Test 3	Test 4				
S15 120/2	2659873.593	6508784.686	59.491	Undercut	TAJ	22/12/2015	1.91	1.49	27.9	2.7	3.2	196	196	196	196	196		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S15 120/3	2659812.932	6508490.590	38.408	Mainfill	TAJ	22/12/2015	2.14	1.97	8.7	2.7	10.0	196	196	196	196	196		F	
S15 120/4	2659814.554	6508460.397	38.584	Mainfill	TAJ	22/12/2015	2.13	1.96	8.7	2.7	10.3	196	196	196	196	196		P	
S15 120/5	2659838.269	6508428.084	37.939	Mainfill	TAJ	22/12/2015	2.08	1.78	16.3	2.7	4.7	196	196	196	196	196		P	
S15 120/6	2660067.774	6508870.204	49.966	Undercut	TAJ	22/12/2015	2.05	1.77	16.4	2.7	5.6	196	196	196	196	196		P	
S15 120/7	2659787.433	6508632.368	42.007	Shear Key	TAJ	22/12/2015	2.05	1.77	16.4	2.7	5.3	196	196	196	196	196		P	
S15 120/10	2659812.964	6508646.363	41.298	Shear Key	TAJ	22/12/2015	1.84	1.43	28.9	2.7	5.9	196	196	196	196	196		P	
S15 120/11	2659787.047	6508637.002	42.114	Shear Key	TAJ	22/12/2015	1.83	1.42	28.9	2.7	6.4	196	196	196	196	196		P	
S15 121/1		Not Surveyed		Shear Key	TAJ	23/12/2015	2.07	1.51	37.4	2.7	0.0	196	196	196	196	196		P	
S15 121/2		Not Surveyed		Shear Key	TAJ	23/12/2015	1.94	1.41	37.4	2.7	0.0	196	196	196	196	196		P	
S15 121/3		Not Surveyed		Shear Key	TAJ	23/12/2015	1.98	1.57	25.8	2.7	1.1	196	196	196	196	196		P	
S15 121/4		Not Surveyed		Shear Key	TAJ	23/12/2015	1.98	1.57	25.8	2.7	1.3	196	196	196	196	196		P	
S15 121/1		Not Surveyed		Shear Key	TAJ	23/12/2015	1.97	1.64	20.7	2.7	5.8	196	196	196	196	196		P	
S15 121/2		Not Surveyed		Shear Key	TAJ	23/12/2015	1.98	1.65	19.9	2.7	6.2	196	196	196	196	196		P	
S15 121/3		Not Surveyed		Shear Key	TAJ	23/12/2015	1.96	1.61	21.7	2.7	5.6	196	196	196	196	196		P	
S15 121/4		Not Surveyed		Shear Key	TAJ	23/12/2015	1.97	1.61	22.1	2.7	4.8	196	196	196	196	196		P	
S15 121/1		Not Surveyed		Shear Key	TAJ	23/12/2015	2.00	1.70	17.5	2.7	7.2	196	196	196	196	196		P	
S15 121/2		Not Surveyed		Shear Key	TAJ	23/12/2015	1.99	1.71	16.7	2.7	8.2	196	196	196	196	196		P	
S15 121/3		Not Surveyed		Shear Key	TAJ	23/12/2015	2.07	1.79	15.7	2.7	5.6	196	196	196	196	196		P	
S15 121/4		Not Surveyed		Shear Key	TAJ	23/12/2015	2.07	1.80	15.3	2.7	5.9	196	196	196	196	196		P	

Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 614089.000/1
Entered By: YAR/HN/JED
Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

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URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 001/01	2659848.172	6508657.974	40.861	Shear Key	NTW	6/01/2016	2.07	1.82	13.8	2.7	7.6	198	126	196	194	178		P	
S16 001/02	2659816.613	6508645.306	41.527	Shear Key	NTW	6/01/2016	2.05	1.81	13.4	2.7	8.7								
S16 001/03	2659890.093	6508540.746	32.776	Fill Area	NTW	6/01/2016	2.02	1.79	15.9	2.7	5.3	196	195	195	195	196			
S16 001/04	2659866.059	6508516.564	34.381	Fill Area	NTW	6/01/2016	2.04	1.77	14.3	2.7	8.4	190	195	84	131	150			
S16 001/05	2660151.709	6510663.372	17.207	Shear Key	NTW	6/01/2016	2.08	1.76	15.6	2.7	6.1	158	123	109	154	136			
S16 001/06	2660139.035	6510665.706	16.584	Shear Key	NTW	6/01/2016	2.05	1.70	20.2	2.7	2.4	188	186	196	196	184			
S16 001/07				Shear Key	NTW	6/01/2016						168	182	173	182	171			
S16 001/08				Shear Key	NTW	6/01/2016						196	195	176	176	186			
S16 002/01	2659928.74	6508429.996	33.566	Main fill	NTW	6/01/2016	2.05	1.78	15.1	2.7	7.3	198	154	98	-	149			
S16 002/02	2659946.76	6508442.024	32.116	Main fill	NTW	6/01/2016	2.09	1.82	14.7	2.7	5.8	152	198	198	140	171			
S16 002/03	2659887.155	6508667.994	41.203	Shear Key	NTW	6/01/2016	2.01	1.78	13.1	2.7	10.3	198	195	195	195	196	Y		
S16 002/04	2659854.263	6508660.362	41.15	Shear Key	NTW	6/01/2016	2.02	1.78	13.1	2.7	10.5	195	193	196	-	195			
S16 002/05	2659802.892	6508643.325	42.539	Shear Key	NTW	6/01/2016	2.19	1.98	10.6	2.7	5.5	195	193	196	-	196			
S16 002/06	2660326.727	6510764.424	7.432	Shear Key	NTW	6/01/2016	2.07	1.79	15.9	2.7	5.5	196	195	196	-	196			
S16 002/07				Cooks	NTW	6/01/2016	2.05	1.77	16.0	2.7	6.2	196	195	196	-	196			
S16 002/08				Cooks	NTW	6/01/2016	2.08	1.84	13.3	2.7	7.5	196	195	196	-	196			
S16 002/09				Cooks	NTW	6/01/2016	2.08	1.83	13.6	2.7	7.5	196	195	196	-	196			
S16 002/10				Reserve	NTW	6/01/2016	1.98	1.66	19.1	2.7	6.8	198	154	196	196	186	Y	Retest for S16 002/02	
S16 002/11				Reserve	NTW	6/01/2016	1.97	1.66	18.7	2.7	7.4	127	120	109	-	119			
S16 002/12				Reserve	NTW	6/01/2016						196	195	155	190	184			
S16 002/13				Reserve	NTW	6/01/2016						196	196	184	179	189			
S16 002/14				Reserve	NTW	6/01/2016						80	124	87	195	122			
S16 003/01	2659857.079	6508666.733	41.041	Shear Key	NTW/A	7/01/2016						148	84	196	196	156			
S16 003/02	2659845.972	6508660.554	41.776	Shear Key	NTW/A	7/01/2016	2.13	1.87	13.9	2.7	4.8	196	196	196	196	196			
S16 003/03	2659787.087	6508640.478	42.266	Shear Key	NTW/A	7/01/2016	2.12	1.83	15.8	2.7	3.1	196	196	196	182	182			
S16 004/01				Cooks	NTW	8/01/2016	2.13	1.83	16.2	2.7	2.8	168	168	156	196	172			
S16 004/02				Cooks	NTW	8/01/2016	2.06	1.80	14.8	2.7	6.8	162	108	129	102	125			Cross beam G
				Cooks	NTW	8/01/2016	2.07	1.80	15.3	2.7	6.9	162	108	129	102	125			
				Cooks	NTW	8/01/2016						47	53	49	53	53			

Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 814089.000/1
Entered By: YARHINJED
Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densitometer
Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

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URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 005/01	2859949.303	6508575.512	42.601	Reserve	NTW	11/01/2016	-	-	-	-	-	112	140	101	195	137			
S16 005/02	2659964.649	6508565.638	42.954	Reserve	NTW	11/01/2016	-	-	-	-	-	195	120	179	195	173			
S16 005/03	2659985.738	6508538.279	34.078	Reserve	NTW	11/01/2016	-	-	-	-	-	195	155	195	134	171			
S16 006/01				Reserve	NTWCHM	12/01/2016	-	-	-	-	-	148	148	109	115	130			
S16 006/02				Reserve	NTWCHM	12/01/2016	-	-	-	-	-	78	138	138	195	138			
S16 006/03				Reserve	NTWCHM	12/01/2016	-	-	-	-	-	162	165	137	120	146			
S16 006/04				Reserve	NTWCHM	12/01/2016	-	-	-	-	-	109	123	173	195	150			
S16 006/05				Reserve	NTWCHM	12/01/2016	-	-	-	-	-	195	195	95	195	171			
S16 006/06				Reserve	NTWCHM	12/01/2016	-	-	-	-	-	195	195	195	185	194			
S16 006/07				Reserve	NTWCHM	12/01/2016	-	-	-	-	-	184	141	195	170	173			
S16 006/08				Reserve	NTWCHM	12/01/2016	-	-	-	-	-	155	125	115	195	158			
S16 006/09				Coolts	NTW	12/01/2016	-	-	-	-	-	82	94	89	130	99			
S16 006/10				Coolts	NTW	12/01/2016	-	-	-	-	-	124	101	101	137	115			
S16 006/11				Coolts	NTW	12/01/2016	-	-	-	-	-	115	120	115	103	114			Cross Beam between F & G
S16 006/12				Coolts	NTW	12/01/2016	-	-	-	-	-	87	113	80	-	93			
S16 006/13				Coolts	NTW	12/01/2016	-	-	-	-	-	122	142	85	84	108			
S16 006/14				Coolts	NTW	12/01/2016	-	-	-	-	-	73	101	115	88	94			
S16 006/15				Coolts	NTW	12/01/2016	-	-	-	-	-	67	88	95	115	92			
S16 006/16				Coolts	NTW	12/01/2016	-	-	-	-	-	61	73	84	123	85			Cross Beam F
S16 006/17				Coolts	NTW	12/01/2016	-	-	-	-	-	71	88	95	-	85			
S16 006/02	2859935.525	6508553.203	42.011	Shear Key	NTW	14/01/2016	2.05	1.85	11.80	2.7	9.8	195	195	195	195	195			
S16 006/03	2659784.06	6508641.779	43.634	Shear Key	NTW	14/01/2016	2.05	1.83	12.00	2.7	10.1	195	195	195	195	195			
S16 006/04	2659861.437	6508597.475	35.237	Shear Key	NTW		2.00	1.75	14.7	2.7	9.7	152	195	195	195	185			Very dry test pads
S16 006/05	2659827.805	6508573.984	35.803	Shear Key	NTW	14/01/2016	2.05	1.81	14.00	2.7	7.7	195	195	195	195	195			
S16 006/06				Shear Key	NTW	14/01/2016	2.01	1.67	20.30	2.7	4.1					#DIV/0!			
S16 006/07				Shear Key	NTW	14/01/2016	2.01	1.68	19.8	2.7	4.6					#DIV/0!			
S16 006/08				Shear Key	NTW	14/01/2016	1.95	1.80	15.3	2.7	4.1					#DIV/0!			
S16 006/09				Coolts	NTW	15/01/2016	-	-	-	-	-	70	60	53	64	62			



Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor

T&T Job #: 21854.0010

Job #: 614089.000/1

Entered By: YAF/RHN/JED
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NZS 4407:1984 Field water content and field dry density using a nuclear densimeter
Test 4.2.1 Direct Transmission Mode

NZGS August 2007 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³)	Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re-Test (1)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
												Test 1	Test 2	Test 3	Test 4				
S16 009/02				Cooks	NTW	15/01/2016	-	-	-	-	-	73	77	87	87	81			Cross Beam between E and F
S16 009/03				Cooks	NTW	15/01/2016	-	-	-	-	-	91	61	67	89	77			
S16 009/04				Cooks	NTW	15/01/2016	-	-	-	-	-	80	84	75	130	92			
S16 009/05				Cooks	NTW	15/01/2016	-	-	-	-	-	138	127	124	113	126			
S16 009/06				Cooks	NTW	15/01/2016	-	-	-	-	-	109	113	129	144	124			Grid E
S16 009/07				Cooks	NTW	15/01/2016	-	-	-	-	-	109	105	137	109	115			
S16 009/08				Cooks	NTW	15/01/2016	-	-	-	-	-	172	196	190	196	189			
S16 009/09				Cooks	NTW	15/01/2016	-	-	-	-	-	129	190	198	190	178			
S16 009/10				Cooks	NTW	15/01/2016	-	-	-	-	-	137	119	88	166	123			Above wall 304
S16 009/11				Cooks	NTW	15/01/2016	-	-	-	-	-	176	119	142	-	146			
S16 009/12	2659801.7	6508465.769	36.513	Above wall 304	BZZBNTW	15/01/2016	1.95	1.55	25.8	2.7	2.4	187	196	196	196	194			
S16 009/13	2659817.663	6508445.089	39.382	Above wall 304	BZZBNTW	15/01/2016	1.95	1.58	23.5	2.7	4.6	159	184	141	181	169			
S16 009/14	2659823.999	6508428.503	36.167	Above wall 304	BZZBNTW	15/01/2016	1.93	1.43	27.5	2.7	7.5	184	196	196	196	193			P
S16 009/15	2659845.093	6508403.436	36.134	Above wall 304	BZZBNTW	15/01/2016	2.07	1.80	14.6	2.7	6.8	196	196	196	196	196			
S16 009/16	2659883.68	6508600.258	36.561	Above wall 304	NTW	15/01/2016	1.87	1.61	15.9	2.7	14.6	196	186	196	196	196			
S16 009/17	2659822.274	6508592.317	36.846	Above wall 304	NTW	15/01/2016	2.00	1.73	15.1	2.7	9.6								
S16 009/1				Shear Key	BZZB	11/01/2016	2.16	1.96	16.1	2.7	1.1	196	196	196	165	193			P
S16 009/2				Shear Key	BZZB	11/01/2016	2.12	1.92	10.1	2.7	9.3	157	159	196	196	177			
S16 009/3				Main fill	BZZB	11/01/2016	2.05	1.76	17.2	2.7	4.5	196	196	196	196	196			
S16 009/1				Above Wall 304	NTW	15/01/2016	1.95	1.66	25.3	2.7	2.8	197	196	196	196	194			
S16 009/2				Above Wall 304	NTW	15/01/2016	1.95	1.56	24.9	2.7	3.4	159	184	141	181	169			P
S16 009/3				Above Wall 304	NTW	15/01/2016	1.93	1.41	29.9	2.7	5.9	184	196	196	196	193			
S16 009/4				Above Wall 304	NTW	15/01/2016	2.07	1.81	14.0	2.7	7.4	196	196	196	196	196			
S16 009/5				Above Wall 304	NTW	15/01/2016	1.99	1.74	14.1	2.7	10.9	196	196	196	196	196			
S16 009/6				Bottom Fill Area	NTW	15/01/2016	1.99	1.79	11.1	2.7	14.0	196	196	196	178	192			P
S16 009/7				Bottom Fill Area	NTW	15/01/2016	2.02	1.82	11.1	2.7	12.4	196	189	166	116	157			
S16 009/8				Bottom Fill Area	NTW	15/01/2016	2.07	1.81	14.5	2.7	6.5	196	189	166	116	157			
S16 009/8				Bottom Fill Area	NTW	15/01/2016	1.95	1.61	20.9	2.7	6.7	196	108	126	126	139			

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 0039				Bottom Fill Area	NTW	15/01/2016	1.97	1.88	17.0	2.7	9.2	196	196	133	112	159		P	
S16 0101	2659931.474	6508606.691	38.584	Below Shear Key	BZZB	16/01/2016	1.96	1.87	17.0	2.7	9.6	196	196	196	196	196		P	
S16 0102	2659958.562	6508604.592	38.178	Below Shear Key	BZZB	16/01/2016	1.99	1.44	31.0	2.7	2.0	196	196	196	196	196		P	
S16 0103	2660006.817	6508566.347	28.089	Below Reserve	BZZB	16/01/2016	1.90	1.50	26.9	2.7	4.3	196	196	196	196	196		P	
S16 0104	2659974.977	6508563.338	28.348	Below Reserve	BZZB	16/01/2016	2.01	1.59	26.1	2.7	0.0	154	196	196	196	196		P	
S16 0101	2659982.765	6508505.772	38.385	Below Shear Key	TAJ	18/01/2016	2.05	1.86	10.4	2.7	11.8	196	196	196	196	196		F	
S16 0102	2659965.006	6508593.788	38.474	Below Shear Key	TAJ	18/01/2016	2.05	1.87	10.4	2.7	11.4	196	196	196	196	196		F	
S16 0124	2659975.008	6508635.401	40.127	Below Shear Key	TAJ	19/01/2016	2.04	1.77	14.8	2.7	8.1	196	196	196	196	196		P	
S16 0125	2659845.927	6508621.57	40.608	Below Shear Key	TAJ	19/01/2016	2.05	1.79	14.4	2.7	7.9	196	196	196	196	196		P	
S16 0126	2659963.623	6508572.471	28.973	Above Pond	TAJ	19/01/2016	2.03	1.77	14.9	2.7	8.1	196	196	196	196	196		P	
S16 0127	2660006.829	6508569.856	27.127	Above Pond	TAJ	19/01/2016	2.02	1.73	16.7	2.7	7.1	196	196	196	196	196		P	
S16 0121	2659936.804	6508634.685	41.348	Beside Shear Key	TAJ	20/01/2016	1.90	1.56	22.0	2.7	6.0	196	196	196	196	196		P	
S16 0122	2659866.804	6508649.623	41.55	Beside Shear Key	TAJ	20/01/2016	1.84	1.59	22.0	2.7	6.0	196	196	196	196	196		P	
S16 0123	2659953.623	6508666.592	44.281	Shear Key	TAJ	20/01/2016	1.82	1.42	26.2	2.7	7.2	196	196	196	196	196		P	
S16 0124				Beside Shear Key	TAJ	20/01/2016	1.91	1.41	26.2	2.7	7.8	196	196	196	196	196		P	
S16 0125	2659979.723	6508608.726	30.258	Above reserve	TAJ	20/01/2016	1.91	1.50	27.5	2.7	3.5	196	196	196	196	196		P	
S16 0126	2659998.466	6508620.037	28.936	Above reserve	TAJ	20/01/2016	1.83	1.51	27.5	2.7	2.5	196	196	196	196	196		P	
S16 0127	2659775.152	6508641.597	47.037	Shear key	TAJ	20/01/2016	2.05	1.78	15.2	2.7	6.9	196	196	196	196	196		P	
S16 0131	2659977.845	6508616.427	31.377	Above reserve	TAJ	21/01/2016	2.06	1.78	15.2	2.7	6.8	196	196	196	196	196		P	
S16 0132	2659960.766	6508590.31	32.029	Above reserve	TAJ	21/01/2016	2.07	1.78	16.3	2.7	4.9	196	196	196	196	196		P	
S16 0133	2659797.027	6508649.583	43.833	above shearkey	TAJ	21/01/2016	2.05	1.73	18.4	2.7	4.1	196	196	196	196	196		P	
S16 0134	2659755.216	6508645.428	48.938	above shearkey	TAJ	21/01/2016	1.96	1.61	21.9	2.7	5.1	196	196	196	196	196		P	
S16 0141	2659762.182	6508650.37	49.528	shear key	TAJ	22/01/2016	2.03	1.71	18.7	2.7	4.9	196	196	196	196	196		P	
S16 0142	2659756.292	6508659.296	48.838	shear key	TAJ	22/01/2016	2.10	1.89	11.0	2.7	9.2	196	196	196	196	196	Y	F	
S16 0143	2660097.033	6508830.831	45.982	undercut	TAJ	22/01/2016	2.08	1.88	11.0	2.7	8.8	196	196	196	196	196	Y	F	
S16 0144	2660066.694	6508811.264	47.032	undercut	TAJ	22/01/2016	1.89	1.59	21.2	2.7	9.3	196	196	196	196	196		P	
S16 0145				shear key	TAJ	22/01/2016	1.96	1.48	34.1	2.7	0.0	196	196	196	196	196		P	
							1.95	1.45	34.1	2.7	0.0	196	196	196	196	196		P	
							2.04	1.87	21.9	2.7	1.5	186	196	196	196	196		P	
							1.92	1.57	21.9	2.7	7.4	196	196	196	196	196		P	
							2.02	1.71	17.7	2.7	6.2	196	196	196	196	196		P	
							2.06	1.75	17.7	2.7	4.4	196	196	196	196	196		P	

NZS August 2007 Guideline for hand held shear vane test.
Test 4.2.1 Direct Transmission Mode

NZGS August 2004 Guidelines for hand held shear vane test.																			
URN	Existing	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re-Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments
												(UTP = Unable to penetrate)							
												Test 1	Test 2	Test 3	Test 4				
s16 0146				shear key	TAJ	22/01/2016	1.97	1.56	26.3	2.7	1.5	196	196	196	196	196	P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.	
s16 0147				undercut	TAJ	22/01/2016	2.00	1.64	21.9	2.7	1.4		196	196	196	196	P		
s16 0161	2650055.317	6509795.009	47.528	Undercut	TAJ	23/01/2016	1.99	1.63	21.9	2.7	3.8	196	196	196	196	196	P		
s16 0166	2650088.863	6509825.666	48.397	Undercut	TAJ	23/01/2016	1.87	1.51	24.3	2.7	7.5	196	196	196	196	196	P		
s16 0157	2659847.68	6508658.761	45.47	shear key	TAJ	23/01/2016	1.87	1.50	24.3	2.7	7.7	196	196	196	196	196	P		
s16 0158	2659842.026	6509875.845	45.699	shear key	TAJ	23/01/2016	1.92	1.58	21.4	2.7	7.0	196	196	196	196	196	P		
s16 0163	2659765.958	6508647.946	48.223	Shear Key	NTW	25/01/2016	1.92	1.60	20.5	2.7	8.1	196	196	196	196	196	P		
s16 0164	2659794.432	6508660.506	48.204	Shear Key	NTW	25/01/2016	1.93	1.60	20.5	2.7	7.8	196	196	196	196	196	P		
s16 0165	2659852.257	6508698.355	48.776	Shear Key	NTW	25/01/2016	2.19	1.90	16.3	2.7	0.8	196	196	196	196	196	P		
s16 0166				Shear Key	NTW	25/01/2016	2.16	1.88	16.3	2.7	1.8	196	196	196	196	196	P		
s16 0167				Shear Key	NTW	25/01/2016	2.05	1.81	13.5	2.7	8.7	171	190	198	196	188	Y		
s16 0168				Shear Key	NTW	25/01/2016	2.08	1.83	13.5	2.7	7.5	196	196	196	196	196	F		
s16 0169				Shear Key	NTW	25/01/2016	2.01	1.83	10.0	2.7	13.9	UTP	UTP	UTP	UTP	#DNV/01	Y		
s16 0168				Above Reserve	NTW	25/01/2016	2.00	1.82	10.0	2.7	14.5	UTP	UTP	UTP	UTP	UTP	F		
s16 0166				Behind Shear Key	NTW	26/01/2016	2.13	1.89	12.8	2.7	5.9	196	196	196	196	196	P		
s16 0172	2659864.301	6508702.031	47.716	Behind Shear Key	NTW	26/01/2016	2.09	1.85	12.8	2.7	7.8	196	196	196	196	196	P		
s16 0173	2659843.463	6508687.387	47.639	Behind Shear Key	NTW	26/01/2016	1.88	1.32	42.1	2.7	0.0	168	140	172	124	161	P		
s16 0174	2659983.301	6508675.099	47.766	Behind Shear Key	NTW	26/01/2016	1.89	1.33	42.1	2.7	0.0	159	150	140	186	161	P		
s16 0175	2659983.733	6508621.745	31.514	Above Reserve	NTW	26/01/2016	2.01	1.64	22.5	2.7	2.3	139	152	196	159	162	P		
s16 0175	2659980.734	6508605.397	31.348	Above Reserve	NTW	26/01/2016	2.03	1.65	22.5	2.7	1.6	196	196	196	196	196	P		
s16 0181	2659839.931	6508675.996	48.898	Behind Shear Key	NTW	27/01/2016	2.00	1.68	19.2	2.7	5.5	196	196	196	196	196	P		
s16 0182	2659816.245	6508675.775	48.300	Behind Shear Key	NTW	27/01/2016	2.02	1.69	18.2	2.7	4.9	196	196	196	196	196	P		
s16 0183	2659842.861	6508677.579	48.034	Behind Shear Key	NTW	27/01/2016	1.91	1.63	17.4	2.7	11.3	144	48	115	78	97	Y		
s16 0184	2659820.362	6508675.077	48.993	Behind Shear Key	NTW	27/01/2016	1.90	1.62	17.4	2.7	11.7	144	48	115	78	97	Y		
s16 0201	2659865.163	6508698.120	48.212	Behind Shear Key	NTW	28/01/2016	1.99	1.58	20.0	2.7	10.0	137	186	117	179	167	Y		
s16 0202	2659843.744	6508687.998	48.282	Behind Shear Key	NTW	27/01/2016	1.88	1.56	20.0	2.7	10.9	89	98	101	75	91	Y		
s16 0203	2659997.238	6508622.495	32.135	Beside Reserve	NTW	28/01/2016	1.92	1.46	32.2	2.7	0.0	89	98	101	75	91	Y		
s16 0204	2660007.901	6508636.269	31.708	Beside Reserve	NTW	28/01/2016	1.92	1.46	32.2	2.7	0.0	89	98	101	75	91	Y		
s16 0205	2660095.169	6508655.449	20.732	Silt pond	NTW	28/01/2016	2.00	1.71	16.4	2.7	8.4	196	196	196	196	196	P		
s16 0206	2660098.241	6508657.007	20.058	Silt pond	NTW	28/01/2016	2.00	1.72	16.4	2.7	8.3	196	196	196	196	196	P		
					NTW	27/01/2016	1.97	1.60	22.9	2.7	4.1	196	196	196	196	196	P		
					NTW	28/01/2016	1.96	1.59	22.9	2.7	4.5	196	196	196	196	196	P		
					NTW	28/01/2016	2.03	1.62	25.1	2.7	0.0	154	196	196	183	182	P		
					NTW	28/01/2016	2.04	1.63	25.1	2.7	0.0	154	196	196	183	182	P		
					NTW	28/01/2016	1.92	1.60	20.6	2.7	8.0	196	196	196	196	196	P		
					NTW	28/01/2016	1.93	1.60	20.6	2.7	7.8	196	196	196	196	196	P		
					NTW	28/01/2016	2.03	1.81	12.4	2.7	10.7	167	198	137		163	Y		
					NTW	28/01/2016	2.02	1.80	12.4	2.7	11.1	167	198	137		163	Y		
					NTW	28/01/2016	1.86	1.56	19.2	2.7	12.4	81	98	81	166	114	Y		
					NTW	28/01/2016	1.97	1.57	19.2	2.7	11.7	81	98	81	166	114	Y		
					NTW	28/01/2016	2.05	1.72	19.0	2.7	3.7	196	196	196	196	196	P		
					NTW	28/01/2016	1.72	1.72	19.0	2.7	3.6	196	196	196	196	196	P		
					NTW	28/01/2016	1.98	1.58	25.3	2.7	1.7	176	134	136	169	154	P		
					NTW	28/01/2016	1.98	1.58	25.3	2.7	1.3	176	134	136	169	154	P		

Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job # 614039.000/1
Entered By: YAIRHN/JED
Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode

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URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 020/10	2659969.819	6508626.735	32.670	Behind Shear Key	TAJ	28/01/2016	2.04	1.76	16.1	2.7	6.7	196	196	196	196	196		P	
S16 020/11	2659975.882	6508614.710	32.538	Behind Shear Key	TAJ	28/01/2016	2.10	1.88	11.6	2.7	8.5	196	196	196	196	196		P	
S16 020/12	2660106.551	6508604.582	18.442	Beside reserve	TAJ	28/01/2016	2.00	1.68	18.9	2.7	5.8	205	198	127	115	161		P	
S16 020/13	2660089.956	6508593.841	20.471	Beside reserve	TAJ	28/01/2016	2.01	1.69	19.4	2.7	4.8	198	125	127	150	150		P	
S16 020/14	2659795.544	6508662.681	49.804	Silt pond	TAJ	28/01/2016	1.98	1.74	14.3	2.7	10.8	205	205	205	205	205	Y	F	
S16 020/15	2659771.944	6508660.627	50.029	Silt pond	TAJ	28/01/2016	1.94	1.54	26.2	2.7	2.6	205	205	205	205	205		P	
S16 021/1				Behind shear key	TAJ	29/01/2016	2.00	1.57	27.6	2.7	0.0	171	188	171	190	180		P	
S16 021/2				Behind shear key	TAJ	29/01/2016	1.97	1.64	20.6	2.7	5.7	205	205	205	205	205		P	
S16 022/1	2659809.528	6508665.193	51.047	Behind shear key	TAJ	30/01/2016	1.94	1.56	24.3	2.7	4.5	196	196	196	196	196		P	
S16 022/2	2659815.924	6508694.854	51.003	Behind shear key	TAJ	30/01/2016	2.02	1.53	31.4	2.7	0.0	196	196	196	196	196		P	
S16 024/1	2659949.621	6508674.087	37.015	shear key	TAJ	20/02/2016	2.00	1.67	19.6	2.7	5.3	205	157	150	139	163		P	
S16 024/2	2660070.070	6508690.536	22.476	Silt pond	TAJ	20/02/2016	2.03	1.81	12.1	2.7	11.2	205	205	205	205	205	Y	F	
S16 024/3	2660103.854	6508698.447	20.683	Silt pond	TAJ	20/02/2016	2.02	1.72	17.4	2.7	6.4	205	205	205	205	205		P	
S16 025/3	2659967.486	6508682.818	36.895	shear key	TAJ	30/02/2016	1.99	1.53	23.2	2.7	7.8	192	205	183	161	186		P	
S16 025/4	2660058.186	6508693.293	23.588	Silt pond	TAJ	30/02/2016	2.10	1.84	13.8	2.7	6.2	205	205	205	205	205		P	
S16 025/5	2660085.408	6508601.916	22.351	Silt pond	TAJ	30/02/2016	2.00	1.58	19.4	2.7	5.5	205	205	205	205	205		P	
S16 025/6	2660086.027	6508655.972	21.757	Silt pond	TAJ	30/02/2016	2.01	1.69	19.4	2.7	4.9	205	205	205	205	205		P	
S16 025/1	2660081.916	6508570.166	23.591	Silt pond	TAJ	40/02/2016	2.01	1.53	23.1	2.7	2.2	205	205	205	205	205		P	
S16 025/2	2660083.467	6508575.165	22.833	Silt pond	TAJ	40/02/2016	1.86	1.46	27.5	2.7	6.0	205	205	205	205	205		P	
S16 025/8	2659985.593	6508684.852	36.906	shear key	TAJ	40/02/2016	1.87	1.47	27.5	2.7	5.4	205	205	205	205	205		P	
S16 025/9	2659965.751	6508678.446	37.723	shear key	TAJ	40/02/2016	1.96	1.57	25.2	2.7	2.4	205	205	205	205	205		P	
S16 026/10	2659835.724	6508654.321	43.555	Wall 603	TAJ	40/02/2016	2.00	1.81	24.2	2.7	1.6	205	205	205	205	205		P	
S16 026/11	2659787.418	6508637.679	43.576	Wall 604	TAJ	40/02/2016	1.99	1.60	24.2	2.7	1.9	205	205	205	205	205		P	
S16 026/3	2660474.295	6510707.473	16.612	siltpond	TAJ	5/02/2016	1.79	1.27	41.3	2.7	0.8	205	135	159	142	160	Y	F	
S16 026/4	2660471.757	6510728.257	14.911	siltpond	TAJ	5/02/2016	1.78	1.26	41.3	2.7	1.1	205	205	205	205	205		F	
S16 025/5	2660018.914	6511087.887	12.047	siltpond	TAJ	5/02/2016	1.85	1.32	22.0	2.7	10.3	205	205	205	205	205		F	
S16 026/6	2660019.657	6511065.386	12.160	siltpond	TAJ	5/02/2016	2.07	1.68	23.4	2.7	0.0	205	205	205	205	205		F	
							2.06	1.67	23.4	2.7	0.0	205	205	205	205	205		P	
							2.03	1.69	20.0	2.7	3.5	205	205	205	205	205		P	
							2.01	1.68	20.0	2.7	4.4	205	205	205	205	205		P	
							1.99	1.68	18.1	2.7	7.1	205	205	205	205	205		P	
							1.97	1.67	18.1	2.7	7.9	205	205	205	205	205		P	
							1.88	1.46	28.7	2.7	4.0	205	205	205	205	205		P	
							1.88	1.46	28.7	2.7	4.1	205	205	205	205	205		P	

NZS 4407:1991 Field water content and field dry density using a nuclear densometer

Test 4.2.1 Direct Transmission Mode

NZGS August 2007 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Oven Solid Density (t/m ³)	Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re-Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments
												Test 1	Test 2	Test 3	Test 4				
s16 028/1	2659929.175	650867.593	41.007	shear key	TAJ	9/02/2016	2.02	1.63	23.9	2.7	0.8	205	205	205	205	205		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
s16 028/2	2659956.336	6508673.149	39.505	shear key	TAJ	9/02/2016	2.07	1.63	23.9	2.7	0.7	205	205	205	205	205		P	
s16 028/3	2660052.011	6508570.254	25.132	Silt pond	TAJ	9/02/2016	2.02	1.80	14.3	2.7	7.4	205	205	205	205	205		P	
s16 028/4	2660089.383	6508566.768	23.783	Silt pond	TAJ	9/02/2016	2.11	1.87	12.9	2.7	10.2	205	205	205	205	205		P	
s16 028/5	2660087.541	6508600.397	51.012	Silt pond	TAJ	9/02/2016	2.10	1.86	12.9	2.7	7.2	205	205	205	205	205		P	
s16 028/1	2659972.239	6508686.299	39.988	Shear Key	TAJ	10/02/2016	1.85	1.45	26.3	2.7	5.2	205	205	205	205	205		P	
s16 028/2	2659992.667	6508660.917	39.215	Shear Key	TAJ	10/02/2016	1.85	1.41	32.1	2.7	2.6	205	162	166	137	168		P	
s16 028/3	2660068.962	6508600.150	24.795	silt pond	TAJ	10/02/2016	1.87	1.50	24.5	2.7	7.6	192	205	205	171	193		P	
s16 028/4	2660100.060	6508608.888	23.835	Silt pond	TAJ	10/02/2016	1.91	1.54	24.3	2.7	5.6	205	205	205	205	205		P	
S16 028/1	2660149.876	6508844.767	40.343	Undercut	TAJ	11/02/2016	1.83	1.36	33.7	2.7	3.4	137	133	144	152	142		P	
S16 028/2	2660124.486	6508846.577	44.069	Undercut	TAJ	11/02/2016	1.73	1.25	36.7	2.7	6.2	140	137	133	150	140		P	
S16 028/3	2659944.877	6508676.525	41.325	Shear Key	TAJ	11/02/2016	1.78	1.35	36.0	2.7	1.8	205	171	150	147	168		P	
S16 028/4	26599826.078	6508656.706	45.481	RE Wall	TAJ	11/02/2016	2.01	1.67	20.3	2.7	4.3	205	205	205	205	205		P	
S16 028/5	26599806.379	6508646.331	45.588	Re Wall	TAJ	11/02/2016	1.99	1.65	20.3	2.7	5.2	205	205	205	205	205		P	
S16 028/6	2659945.723	6508662.688	41.161	Shear Key	TAJ	11/02/2016	2.03	1.72	17.7	2.7	5.8	205	205	205	205	205		P	
S16 028/7	2659937.238	6508672.302	41.284	Shear Key	TAJ	11/02/2016	1.84	1.48	30.1	2.7	0.6	150	150	150	150	150		P	
S16 028/8	2660123.598	6508630.511	24.849	Silt pond	TAJ	11/02/2016	1.84	1.41	30.1	2.7	5.2	150	150	150	150	150		P	
S16 028/9	2660092.461	6508626.002	25.821	Silt pond	TAJ	11/02/2016	1.91	1.52	25.7	2.7	4.6	150	152	150	150	151		P	
S16 028/10	2660070.529	6508614.760	25.928	Silt pond	TAJ	11/02/2016	1.91	1.52	25.7	2.7	4.8	205	205	205	205	205		P	
S16 028/11				Silt pond	TAJ	11/02/2016	1.97	1.57	25.3	2.7	2.0	205	205	205	205	205		P	
S16 030/1	2660097.532	6508622.519	25.814	Silt pond	TAJ	12/02/2016	1.98	1.58	25.3	2.7	1.4	205	205	205	205	205		P	
S16 030/2	2660065.177	6508612.079	25.692	Silt pond	TAJ	12/02/2016	1.91	1.49	28.3	2.7	2.8	164	154	157	161	159		P	
S16 030/3	2660045.100	6508606.733	27.383	Silt pond	TAJ	12/02/2016	1.85	1.38	34.5	2.7	3.3	205	205	205	205	205		P	
S16 030/4	2659929.033	6508678.800	42.123	Shear Key	TAJ	12/02/2016	1.85	1.38	34.5	2.7	1.2	205	205	205	205	205		P	
S16 030/5	2659954.929	6508665.725	41.084	Shear Key	TAJ	12/02/2016	1.85	1.38	34.5	2.7	1.2	205	205	205	205	205		P	
S16 030/6	2659801.314	6508645.853	48.443	RE Wall	TAJ	12/02/2016	1.82	1.39	31.2	2.7	5.2	205	205	205	205	205		P	
S16 030/7	2659814.295	6508648.149	45.590	RE Wall	TAJ	12/02/2016	1.81	1.38	31.2	2.7	6.7	205	205	205	205	205		P	
							1.94	1.76	10.7	2.7	16.3	205	205	205	205	205		F	Water Content Sample Potentially not representative
							1.89	1.48	28.2	2.7	3.5	205	205	205	205	205		F	
							1.89	1.47	28.2	2.7	3.9	205	205	205	205	205		P	

Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 614089.000/1
Entered By: YARIN/JED
Checked By:

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NZS 4407:1991 Field water content and field dry density using a nuclear densimeter

NZGS August 2003 Guidelines for hand held shear vane test

Test 4.2.1 Direct Transmission Mode

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³)	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)	Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments
S16 032/1	2659756.607	6508627.893	48.066	RE Wall	TAJ	15/02/2016	1.92	1.53	26.3	2.7	4.4	205	205		P	
S16 032/2	2659926.968	6508791.369	57.805	Undercut	TAJ	15/02/2016	1.91	1.53	25.3	2.7	4.8	205	205		P	
S16 032/6	2659920.140	6508656.228	47.658	RE wall	TAJ	16/02/2016	1.82	1.43	27.6	2.7	7.8	205	205		P	
S16 032/7	2659934.029	6508861.461	47.686	RE Wall	TAJ	16/02/2016	2.05	1.78	15.2	2.7	7.1	205	205		P	
S16 032/8	2660138.861	6508665.443	27.740	Silt pond	TAJ	16/02/2016	2.03	1.76	16.2	2.7	7.9	205	205		P	
S16 032/3	2659394.731	6511056.876	11.648	P5 Undercut 2	TAJ	16/02/2016	2.01	1.68	18.4	2.7	5.2	205	205		P	
S16 032/4	2659976.816	6511103.397	13.556	P5 Undercut 2	TAJ	16/02/2016	2.08	1.71	21.4	2.7	-0.2	205	205		P	
S16 032/5	2659962.571	651107.702	14.323	P5 Undercut 2	TAJ	16/02/2016	2.09	1.72	21.4	2.7	-0.6	205	205		P	
S16 032/9	2660103.322	6508650.122	27.607	Siltpond	TAJ	16/02/2016	1.77	1.33	33.4	2.7	6.6	171	205	180	188	
S16 032/10	2660005.078	6511092.159	13.255	P5 Undercut 2	TAJ	15/02/2016	1.76	1.32	33.4	2.7	7.3	140	205	164	179	
S16 032/11	2659965.548	6511106.238	15.171	P5 Undercut 2	TAJ	15/02/2016	1.81	1.34	35.7	2.7	2.8	205	205	205	205	
S16 029/1	2659972.299	6508662.299	38.988	Shear Key	TAJ	16/02/2016	1.82	1.35	34.7	2.7	3.0	205	205	205	205	
S16 029/2	2659992.667	6508669.917	38.215	Shear Key	TAJ	16/02/2016	1.83	1.36	34.7	2.7	2.5	205	205	205	205	
S16 029/3	2660068.662	6508600.160	24.795	Silt pond	TAJ	16/02/2016	1.86	1.41	32.1	2.7	5.2	205	205	166	137	168
S16 029/4	2660100.080	6508609.686	23.835	Silt pond	TAJ	16/02/2016	1.86	1.41	32.1	2.7	2.6	205	205	166	137	168
S16 031/1	2660125.257	6508645.683	25.622	Siltpond	TAJ	13/02/2016	1.86	1.41	32.1	2.7	2.6	205	205	166	137	168
S16 033/1				RE Wall	TAJ	16/02/2016	1.97	1.50	24.5	2.7	7.5	182	205	205	171	191
S16 033/2				RE Wall	TAJ	16/02/2016	1.91	1.54	24.3	2.7	5.6	205	205	205	205	205
S16 033/5				Silt pond	TAJ	16/02/2016	1.91	1.54	24.3	2.7	5.6	205	205	205	205	205
S16 033/6				Silt pond	TAJ	16/02/2016	1.93	1.58	21.9	2.7	6.6	205	205	205	205	205
S16 033/7				Silt pond	TAJ	16/02/2016	1.90	1.56	21.9	2.7	8.0	205	205	205	205	205
S16 033/8				Re Wall	TAJ	16/02/2016	1.81	1.55	23.4	2.7	6.4	193	205	205	189	189
S16 035/1	2660072.606	6508623.704	30.181	Silt pond	TAJ	22/02/2016	1.88	1.53	20.7	2.7	6.1	205	205	176	168	189
S16 035/2	2660049.801	6508621.535	30.676	Silt pond	TAJ	22/02/2016	1.98	1.64	20.7	2.7	5.4	205	205	205	205	205
S16 035/3	2660023.465	6508612.466	31.545	Silt pond	TAJ	22/02/2016	1.86	1.52	22.3	2.7	9.6	205	205	205	205	205
S16 035/4	2659920.329	6508658.004	48.090	Re wall	TAJ	22/02/2016	1.88	1.54	22.3	2.7	8.7	205	205	205	205	205
S16 035/5	2659811.009	6508651.941	48.138	Re wall	TAJ	22/02/2016	2.03	1.72	18.2	2.7	5.1	205	205	205	205	205
							2.05	1.73	18.2	2.7	4.4	205	205	205	205	205
							2.08	1.75	18.4	2.7	2.8	205	205	205	205	205
							2.07	1.75	18.4	2.7	3.2	205	205	205	205	205
							1.89	1.47	28.9	2.7	3.2	205	205	205	205	205
							1.85	1.46	28.9	2.7	3.8	205	205	205	205	205
							2.16	1.89	27.8	2.7	0.0	205	205	205	205	205
							2.16	1.89	27.8	2.7	0.0	205	205	205	205	205
							2.04	1.81	13.1	2.7	9.4	205	205	205	205	205
							2.05	1.81	13.1	2.7	9.3	205	205	205	205	205
							2.10	1.88	24.8	2.7	0.0	205	205	205	205	205
							2.10	1.88	24.8	2.7	0.0	205	205	205	205	205
							1.95	1.55	25.8	2.7	2.7	205	205	205	205	205
							1.94	1.55	25.8	2.7	2.9	205	205	205	205	205
							2.02	1.68	19.9	2.7	4.2	205	205	205	205	205
							2.02	1.69	19.9	2.7	4.0	205	205	205	205	205

Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 614089.0001
Entered By: YARHINJED
Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode

NZGS August 2007 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
												205	205	205	205				
S16 036/1	2660044.115	6508627.552	31.532	Silt pond	TAJ	23/02/2016	2.12	1.82	16.3	2.7	2.9	205	205	205	205	205		P	
S16 036/2	2660067.464	6508632.302	30.769	Silt pond	TAJ	23/02/2016	2.06	1.76	16.9	2.7	3.0	205	205	205	205	205		P	
S16 036/3	2660089.342	6508637.642	30.085	Silt pond	TAJ	23/02/2016	1.94	1.56	24.4	2.7	4.3	205	205	205	205	205		P	
S16 036/1	2650006.269	6508634.832	33.464	Silt pond	TAJ	24/02/2016	1.87	1.28	46.3	2.7	0.0	205	205	205	205	205		P	
S16 036/2	2660028.874	6508638.536	32.560	Silt pond	TAJ	24/02/2016	2.06	1.74	18.3	2.7	3.5	205	205	205	205	205		P	
S16 036/3	2660057.255	6508646.121	31.473	Silt pond	TAJ	24/02/2016	2.09	1.73	20.6	2.7	0.3	205	205	205	205	205		P	
S16 036/4	2660079.584	6508711.226	30.641	Shear Key	TAJ	24/02/2016	2.06	1.76	17.1	2.7	6.0	205	205	205	205	205		P	
S16 036/5	2660053.162	6508699.647	32.076	Shear Key	TAJ	24/02/2016	2.03	1.79	13.6	2.7	9.4	205	205	205	205	205		P	
S16 036/6	2659947.649	6508676.529	42.579	Above Shear Key	TAJ	24/02/2016	1.90	1.53	24.4	2.7	6.1	205	205	205	205	205		P	
S16 036/7	2659967.908	6508682.310	42.700	Above Shear Key	TAJ	24/02/2016	2.01	1.60	25.4	2.7	0.2	205	205	205	205	205		P	
S16 036/8	2660009.417	6508635.049	33.385	Above Shear Key	TAJ	24/02/2016	1.81	1.49	28.4	2.7	2.5	205	205	205	205	205		P	
S16 040/1	2660100.532	6508661.590	32.155	Silt pond	TAJ	25/02/2016	2.08	1.82	14.2	2.7	6.5	205	205	205	205	205		P	
S16 040/2	2660024.169	6508691.231	35.827	Shear Key	TAJ	25/02/2016	1.87	1.65	19.1	2.7	7.2	205	205	205	205	205		P	
S16 040/3	2659977.955	6508697.841	44.022	Above Shear Key	TAJ	25/02/2016	2.03	1.86	21.9	2.7	2.1	205	205	205	205	205		P	
S16 040/4	2659992.034	6508644.489	34.400	silt pond	TAJ	25/02/2016	2.07	1.76	17.5	2.7	4.9	205	205	205	205	205		P	
S16 040/5	2660054.030	6508700.274	33.688	shear Key	TAJ	25/02/2016	2.05	1.75	17.2	2.7	5.0	205	205	205	205	205		P	
S16 040/6	2659947.717	6508694.324	44.324	Above Shear Key	TAJ	25/02/2016	1.95	1.62	20.5	2.7	7.0	205	205	205	205	205		P	
S16 041/5	2660005.085	6508633.106	34.437	silt pond	TAJ	26/02/2016	2.04	1.79	14.0	2.7	7.1	205	205	205	205	205		P	
S16 041/6	2660056.721	6508646.576	33.011	silt pond	TAJ	26/02/2016	2.11	1.85	14.3	2.7	5.1	205	205	205	205	205		P	
S16 041/7	2660097.459	6508662.434	31.894	silt pond	TAJ	26/02/2016	2.10	1.79	17.3	2.7	2.8	205	205	205	205	205		P	
S16 041/8	2660121.572	6508726.036	34.606	shear Key	TAJ	26/02/2016	2.05	1.71	20.6	2.7	1.5	205	205	205	205	205		P	
S16 041/9	2660061.914	6508706.475	33.728	shear Key	TAJ	26/02/2016	2.05	1.67	22.4	2.7	0.7	205	205	205	205	205		P	
S16 041/10	2660044.268	6508700.466	34.715	shear Key	TAJ	26/02/2016	2.04	1.70	20.0	2.7	0.4	205	205	205	205	205		P	
S16 041/11	2659945.872	6508710.467	48.023	above shear key	TAJ	26/02/2016	2.03	1.74	16.9	2.7	6.2	205	205	205	205	205		P	
S16 043/1	2660064.863	6508653.633	33.316	silt pond	TAJ	3/03/2016	2.04	1.74	16.9	2.7	6.1	205	205	205	205	205		P	
S16 043/2	2660111.354	6508673.507	31.969	silt pond	TAJ	3/03/2016	2.14	1.89	12.4	2.7	6.1	205	205	205	205	205		P	
S16 043/3	2660022.726	6508668.663	38.056	shear key	TAJ	3/03/2016	2.13	1.86	12.9	2.7	6.2	205	205	205	205	205		P	
							2.11	1.87	12.9	2.7	6.8	205	205	205	205	205		P	
							2.13	1.76	20.9	2.7	0.0	205	205	205	205	205		P	
							2.12	1.76	20.9	2.7	0.0	205	205	205	205	205		P	



Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 614089.000/1
Entered By: YARHNJED
Checked By:

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NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode

NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (V)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 044/1		No GPS		Silt pond	TAJ	4/03/2016	2.09	1.74	19.7	2.7	1.1	205	205	205	205	205		P	
S16 044/2		No GPS		Silt pond	TAJ	4/03/2016	1.86	1.63	19.7	2.7	7.3	205	205	205	205	205		P	
S16 044/3		No GPS		Silt pond	TAJ	4/03/2016	2.09	1.80	15.9	2.7	4.7	205	205	205	205	205		P	
S16 044/4		No GPS		Silt pond	TAJ	4/03/2016	2.08	1.79	16.9	2.7	5.0	205	205	205	205	205		P	
S16 044/4		No GPS		shear key	TAJ	4/03/2016	2.08	1.83	13.7	2.7	7.1	205	205	205	205	205		P	
S16 044/5		No GPS		shear key	TAJ	4/03/2016	2.09	1.84	13.7	2.7	6.8	205	205	205	205	205		P	
S16 044/5		No GPS		shear key	TAJ	4/03/2016	2.18	1.96	10.9	2.7	6.0	205	205	205	205	205		P	
S16 044/6		No GPS		shear key	TAJ	4/03/2016	2.18	1.96	10.9	2.7	5.9	205	205	205	205	205		P	
S16 044/6		No GPS		shear key	TAJ	4/03/2016	2.08	1.77	16.5	2.7	4.6	205	205	205	205	205		P	
S16 044/6		No GPS		shear key	TAJ	4/03/2016	2.09	1.85	12.6	2.7	7.8	205	205	205	205	205		P	
S16 044/7		No GPS		above shear key	TAJ	4/03/2016	2.09	1.86	12.6	2.7	7.9	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	1.96	1.64	18.4	2.7	7.4	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	1.96	1.64	18.4	2.7	7.6	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	1.96	1.64	18.4	2.7	7.6	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	2.12	1.74	21.5	2.7	0.0	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	2.12	1.74	21.5	2.7	0.0	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	1.84	1.55	25.6	2.7	3.1	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	1.94	1.54	25.6	2.7	3.5	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	2.07	1.77	17.1	2.7	4.4	205	205	205	205	205		P	
S16 044/8		No GPS		above shear key	TAJ	4/03/2016	2.11	1.80	17.1	2.7	2.6	205	205	205	205	205		P	
S16 046/2		No GPS		silt pond	TAJ	9/03/2016	2.06	1.77	16.0	2.7	6.0	205	205	205	205	205		P	
S16 046/3		No GPS		silt pond	TAJ	9/03/2016	2.06	1.78	16.0	2.7	5.7	205	205	205	205	205		P	
S16 046/4		No GPS		silt pond	TAJ	9/03/2016	2.09	1.82	14.4	2.7	6.2	205	205	205	205	205		P	
S16 046/4		No GPS		silt pond	TAJ	9/03/2016	2.08	1.82	14.4	2.7	6.3	205	205	205	205	205		P	
S16 046/4		No GPS		silt pond	TAJ	9/03/2016	2.10	1.88	32.7	2.7	0.0	205	205	205	205	205		P	
S16 046/5		No GPS		shear key	TAJ	9/03/2016	2.10	1.68	32.7	2.7	0.0	205	205	205	205	205		P	
S16 046/5		No GPS		shear key	TAJ	9/03/2016	2.01	1.55	28.7	2.7	0.0	205	205	205	205	205		P	
S16 046/5		No GPS		shear key	TAJ	9/03/2016	2.00	1.54	28.7	2.7	0.0	205	205	205	205	205		P	
S16 046/6		No GPS		Re wall	TAJ	9/03/2016	2.02	1.67	21.0	2.7	3.2	205	205	205	205	205		P	
S16 046/6		No GPS		Re wall	TAJ	9/03/2016	2.01	1.66	21.0	2.7	3.4	205	205	205	205	205		P	
S16 046/7		No GPS		Re wall	TAJ	9/03/2016	2.03	1.64	31.9	2.7	0.0	205	205	205	205	205		P	
S16 047/1	2660066.678	6508656.757	37.115	Silt pond	TAJ	10/03/2016	2.02	1.53	31.9	2.7	0.0	205	205	205	205	205		P	
S16 047/2	2660041.911	6508647.396	37.583	Silt pond	TAJ	10/03/2016	1.95	1.41	31.4	2.7	3.8	205	205	205	205	205		P	
S16 047/3	2660010.128	6508640.327	38.214	Silt pond	TAJ	10/03/2016	1.99	1.69	17.9	2.7	7.3	185	185	168	205	189		P	
S16 047/4	2659889.639	6508681.816	45.117	Re Wall	TAJ	10/03/2016	2.01	1.70	17.8	2.7	6.6	205	205	205	205	205		P	
S16 047/5	2659931.48	6508682.326	44.979	Re Wall	TAJ	10/03/2016	1.94	1.59	22.3	2.7	5.8	205	205	205	205	205		P	
S16 047/6	2659976.169	6508690.564	44.995	Re Wall	TAJ	10/03/2016	1.95	1.60	22.3	2.7	5.2	205	205	205	205	205		P	
S16 047/7	2660068.323	6508718.446	38.211	Above RE Wall	TAJ	10/03/2016	2.03	1.72	17.9	2.7	5.4	205	205	205	205	205		P	
S16 047/8	2660058.741	6508715.901	39.449	Above RE Wall	TAJ	10/03/2016	2.02	1.72	17.9	2.7	5.7	205	205	205	205	205		P	
S16 047/9	2660241.702	6508564.706	19.299	Bonaire Road Silt Pond	TAJ	10/03/2016	1.97	1.61	21.7	2.7	6.2	205	205	205	205	205		P	
S16 047/13	2660036.602	6508657.367	38.277	Silt pond	TAJ	10/03/2016	1.97	1.62	21.7	2.7	4.9	205	205	205	205	205		P	
S16 047/14	2660000.400	6508646.000	38.735	Silt pond	TAJ	10/03/2016	1.96	1.59	23.1	2.7	4.4	205	205	205	205	205		P	
S16 047/14	2660000.400	6508646.000	38.735	Silt pond	TAJ	10/03/2016	1.94	1.59	23.1	2.7	5.2	205	205	205	205	205		P	
S16 047/14	2660000.400	6508646.000	38.735	Silt pond	TAJ	10/03/2016	1.90	1.40	35.2	2.7	0.0	161	205	144	137	162		P	
S16 047/14	2660000.400	6508646.000	38.735	Silt pond	TAJ	10/03/2016	1.89	1.40	35.2	2.7	0.0	205	205	205	205	205		P	
S16 047/14	2660000.400	6508646.000	38.735	Silt pond	TAJ	10/03/2016	2.08	1.71	20.6	2.7	1.5	205	205	205	205	205		P	
S16 047/14	2660000.400	6508646.000	38.735	Silt pond	TAJ	10/03/2016	2.05	1.70	20.6	2.7	2.1	205	205	205	205	205		P	
S16 047/14	2660000.400	6508646.000	38.735	Silt pond	TAJ	10/03/2016	2.00	1.67	19.4	2.7	5.5	205	205	205	205	205		P	



Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job #: 614089.0001
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NZS 4407:1991 Field water content and field dry density using a nuclear densometer
Test 4.2.1 Direct Transmission Mode

NZS 4407:1991 Direct Transmission Mode
Test 4.2.1 Direct Transmission Mode

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³)	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments
												Test 1	Test 2	Test 3	Test 4				
S16 047/15	2659985.904	6508640.814	39.249	Silt pond	TAJ	10/03/2016	2.06	1.87	19.4	2.7	5.6	205	205	205	205	205	F		
S16 047/16	2660238.391	6508564	19.987	Bonair Road Silt Pond	TAJ	10/03/2016	2.06	1.84	11.7	2.7	10.3	205	205	205	205	205	F		
S16 047/17				Re Wall	TAJ	11/03/2016	2.08	1.55	23.7	2.7	5.8	205	205	205	205	205	P		
S16 047/18				Re Wall	TAJ	11/03/2016	2.09	1.76	18.8	2.7	2.2	205	205	205	205	205	P		
S16 047/19				Re Wall	TAJ	11/03/2016	2.08	1.74	20.1	2.7	0.9	205	205	205	205	205	P		
S16 047/20				Re Wall	TAJ	11/03/2016	2.07	1.72	20.1	2.7	1.7	205	205	205	205	205	P		
S16 047/21				Re Wall	TAJ	11/03/2016	1.99	1.68	18.5	2.7	6.5	205	205	205	205	205	P		
S16 047/22				Above Re wall	TAJ	11/03/2016	2.01	1.70	18.5	2.7	5.8	205	205	205	205	205	P		
S16 047/23				Siltpond	TAJ	11/03/2016	2.07	1.63	26.6	2.7	0.0	205	205	205	205	205	P		
S16 047/24				Siltpond	TAJ	11/03/2016	2.08	1.64	26.8	2.7	0.0	205	205	205	205	205	P		
S16 047/25				Siltpond	TAJ	11/03/2016	1.90	1.51	26.0	2.7	4.8	205	205	205	205	205	P		
S16 047/26				Siltpond	TAJ	11/03/2016	1.90	1.51	26.0	2.7	5.0	205	205	205	205	205	P		
S16 047/27				Siltpond	TAJ	11/03/2016	1.83	1.30	40.6	2.7	0.0	205	205	205	205	205	P		
S16 047/28				Siltpond	TAJ	11/03/2016	1.82	1.29	40.6	2.7	0.0	205	205	205	205	205	P		
S16 047/29				Siltpond	TAJ	11/03/2016	1.99	1.68	18.7	2.7	6.4	205	205	205	205	205	P		
S16 047/30				Siltpond	TAJ	11/03/2016	1.98	1.66	18.7	2.7	7.3	205	205	205	205	205	P		
S16 047/31				Siltpond	TAJ	11/03/2016	1.89	1.41	34.4	2.7	0.0	205	205	205	205	205	P		
S16 047/32				Above re wall	TAJ	11/03/2016	1.89	1.40	34.4	2.7	0.0	205	205	205	205	205	P		
S16 047/33					TAJ	11/03/2016	2.02	1.72	17.6	2.7	6.1	205	205	205	205	205	P		
S16 047/34				Bonair Road Silt Pond	TAJ	11/03/2016	2.04	1.73	17.9	2.7	6.2	205	205	205	205	205	P		
S16 047/35				Re Wall	TAJ	14/03/2016	2.06	1.79	14.7	2.7	7.2	205	205	205	205	205	P		
S16 047/36				Re Wall	TAJ	14/03/2016	2.05	1.74	17.7	2.7	4.6	205	205	205	205	205	P		
S16 047/37				Re Wall	TAJ	14/03/2016	1.98	1.62	22.1	2.7	4.2	196	196	196	196	196	P		
S16 047/38				Re Wall	TAJ	14/03/2016	1.98	1.62	22.1	2.7	4.1	196	196	196	196	196	P		
S16 047/39				Undercut	TAJ	14/03/2016	1.93	1.67	23.2	2.7	5.5	196	196	196	196	196	P		
S16 047/40				Undercut	TAJ	14/03/2016	1.95	1.69	23.2	2.7	4.5	196	196	196	196	196	P		
S16 047/41				Undercut	TAJ	14/03/2016	1.91	1.50	27.3	2.7	3.6	196	196	196	196	196	P		
S16 047/42				Undercut	TAJ	14/03/2016	1.92	1.51	27.3	2.7	3.1	196	196	196	196	196	P		
S16 047/43				Undercut	TAJ	14/03/2016	2.12	1.92	10.8	2.7	8.3	196	196	196	196	196	P		
S16 047/44				Undercut	TAJ	14/03/2016	2.11	1.90	10.8	2.7	8.9	196	196	196	196	196	P		
S16 047/45				Undercut	TAJ	14/03/2016	2.08	1.73	16.7	2.7	3.4	196	196	196	196	196	P		
S16 047/46				Undercut	TAJ	14/03/2016	2.10	1.77	16.7	2.7	1.4	196	196	196	196	196	P		
S16 047/47				Undercut	TAJ	14/03/2016	2.14	1.91	11.5	2.7	7.1	196	196	196	196	196	P		
S16 047/48				Undercut	TAJ	14/03/2016	2.13	1.91	11.5	2.7	7.4	196	196	196	196	196	P		
S16 047/49				Undercut	TAJ	14/03/2016	1.98	1.62	22.4	2.7	3.8	196	196	196	196	196	P		
S16 047/50				Undercut	TAJ	14/03/2016	1.99	1.62	22.4	2.7	3.5	196	196	196	196	196	P		
S16 047/51				Undercut	TAJ	14/03/2016	1.97	1.57	25.7	2.7	1.7	143	148	151	134	144	P		
S16 047/52				Undercut	TAJ	14/03/2016	1.98	1.57	25.7	2.7	1.2	143	148	151	134	144	P		
S16 047/53				Undercut	TAJ	14/03/2016	1.88	1.44	30.2	2.7	3.2	186	146	176	166	176	P		
S16 047/54				Undercut	TAJ	14/03/2016	1.88	1.44	30.2	2.7	2.9	186	146	176	166	176	P		
S16 047/55				Undercut	TAJ	14/03/2016	1.95	1.47	32.3	2.7	0.0	196	196	196	196	196	P		
S16 047/56				Undercut	TAJ	14/03/2016	1.95	1.47	32.3	2.7	0.0	196	196	196	196	196	P		
S16 047/57				Re wall	TAJ	14/03/2016	1.98	1.64	21.3	2.7	4.6	196	196	196	196	196	P		
S16 047/58				Re wall	TAJ	14/03/2016	2.00	1.64	21.3	2.7	4.1	196	196	196	196	196	P		
S16 047/59				Re wall	TAJ	14/03/2016	2.03	1.76	15.8	2.7	7.2	196	196	196	196	196	P		
S16 047/60				Silt pond	TAJ	15/03/2016	2.02	1.74	15.8	2.7	7.9	196	196	196	196	196	P		
S16 047/61				Silt pond	TAJ	15/03/2016	2.19	1.91	14.5	2.7	2.0	196	196	196	196	196	P		
S16 047/62				Silt pond	TAJ	15/03/2016	2.18	1.90	14.5	2.7	2.0	196	196	196	196	196	P		
S16 047/63				Silt pond	TAJ	15/03/2016	2.01	1.75	14.8	2.7	9.2	196	196	196	196	196	P		
S16 047/64				Silt pond	TAJ	15/03/2016	2.02	1.76	14.8	2.7	8.8	196	196	196	196	196	P		
S16 047/65					TAJ	15/03/2016	2.18	1.93	12.8	2.7	3.8	196	196	196	196	196	P		

Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job # 614089.000/1
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NZS 4407:1991 Field water content and field dry density using a nuclear densitometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Eastings	Northings	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
				Silt pond	TAJ	16/03/2016	2.17	1.92	12.8	2.7	4.2					196		P	
S16 050/4	2660087.838	6508638.041	30.436	Re Wall	TAJ	16/03/2016	1.93	1.39	31.9	2.7	4.2	196	196	196	196	196		P	
S16 050/5	2660064.93	6508630.304	31.007	Re Wall	TAJ	16/03/2016	2.08	1.76	16.3	2.7	2.7	196	196	196	196	196		P	
S16 051/3	2660114.461	6508650.28	30.754	Silt pond	TAJ	16/03/2016	2.05	1.73	16.5	2.7	2.8	196	196	196	196	196		P	
S16 051/4	2660142.049	6508664.407	29.794	Silt pond	TAJ	16/03/2016	2.04	1.72	16.5	2.7	4.3	196	196	196	196	196		P	
S16 051/5	2660165.654	6508674.895	28.788	Silt pond	TAJ	16/03/2016	2.01	1.60	25.7	2.7	0.0	196	196	196	196	196		P	
S16 051/8	2660062.891	6508629.118	31.854	Silt pond	TAJ	16/03/2016	2.04	1.69	28.4	2.7	0.0	196	196	196	196	196		P	
S16 051/9	2660044.303	6508621.876	32.191	Silt pond	TAJ	16/03/2016	1.94	1.49	30.0	2.7	0.1	196	196	196	196	196		P	
S16 051/10	2660013.715	6508614.771	33.792	Silt pond	TAJ	16/03/2016	1.95	1.67	16.7	2.7	10.1	196	196	196	196	196	Y	F	
S16 051/11	2659975.825	6508607.17	34.718	Silt pond	TAJ	16/03/2016	1.88	1.43	31.5	2.7	2.0	196	196	196	196	196		F	
S16 051/12	2660103.651	6508725.588	35.973	Re wall	TAJ	16/03/2016	1.87	1.42	31.5	2.7	2.4	196	196	196	196	196		P	
S16 051/13	2660111.366	6508728.586	36.132	Re wall	TAJ	16/03/2016	2.09	1.74	19.7	2.7	1.0	196	196	196	196	196		P	
S16 052/4	2660042.89	6508615.15	33.338	Silt pond	TAJ	17/03/2016	2.08	1.75	19.7	2.7	0.7	196	196	196	196	196		P	
S16 052/5	2660041.438	6508622.542	33.164	Silt pond	TAJ	17/03/2016	2.01	1.69	19.1	2.7	5.3	196	196	196	196	196		P	
S16 052/6	2660011.894	6508613.908	34.146	Silt pond	TAJ	17/03/2016	2.00	1.68	19.1	2.7	5.6	196	196	196	196	196		P	
S16 052/7				Re wall 606	TAJ	17/03/2016	1.99	1.77	12.4	2.7	12.8	196	196	196	196	196	Y	F	
S16 052/8				Re wall 606	TAJ	17/03/2016	1.88	1.42	32.2	2.7	1.5	196	196	196	196	196		P	
S16 052/9				Silt pond	TAJ	17/03/2016	1.81	1.45	32.2	2.7	0.0	196	196	196	196	196		P	
S16 052/10				Silt pond	TAJ	17/03/2016	1.91	1.27	42.6	2.7	0.0	196	196	196	196	196		P	
S16 052/11	2660072.038	6508632.503	32.986	Silt pond	TAJ	18/03/2016	1.80	1.26	42.6	2.7	0.0	196	196	196	196	196		P	
S16 053/2	2660043.989	6508626.909	33.824	Silt pond	TAJ	18/03/2016	1.95	1.67	20.5	2.7	9.9	196	196	196	196	196	Y	F	
S16 053/3	2660022.786	6508619.486	34.502	Re wall	TAJ	18/03/2016	1.86	1.56	20.5	2.7	10.4	196	196	196	196	196		F	
S16 053/13	2660064.744	6508634.833	33.468	Shear key	TAJ	18/03/2016	1.87	1.54	21.3	2.7	10.3	196	196	196	196	196	Y	F	
S16 053/14	2660037.494	6508624.759	34.398	Shear key	TAJ	18/03/2016	1.95	1.62	21.3	2.7	5.7	196	196	196	196	196		P	
S16 053/15	2660013.175	6508621.413	35.134	Shear key	TAJ	18/03/2016	2.03	1.39	45.3	2.7	0.0	196	196	196	196	196		P	
S16 053/16	2660081.498	6508718.876	38.793	Retwall	TAJ	18/03/2016	2.17	1.88	16.3	2.7	0.9	196	196	196	196	196		P	
							2.17	1.88	16.3	2.7	1.4	196	196	196	196	196		P	
							2.07	1.74	18.8	2.7	2.7	196	196	196	196	196		P	
							2.08	1.75	18.8	2.7	2.2	196	196	196	196	196		P	
							2.04	1.72	18.5	2.7	4.4	196	196	196	196	196		P	
							2.05	1.73	18.5	2.7	4.1	196	196	196	196	196		P	
							2.11	1.77	18.9	2.7	0.8	196	196	196	196	196		P	

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³)	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re-Test (T)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments
												Test 1	Test 2	Test 3	Test 4				
S16 056/1	2660098.341	6508729.834	40.495	Re Wall	TAJ	18/03/2016	1.79	18.9	27.3	2.7	0.0	196	196	196	196	196	P		
S16 056/2	2660082.92	6508719.652	41.067	Re Wall	TAJ	19/03/2016	1.54	27.3	2.7	1.1	1.1	196	196	196	196	196	P		
S16 056/3	2660050.635	6508695.787	34.606	silt pond	TAJ	21/03/2016	1.55	26.4	2.7	1.4	1.7	196	196	196	196	196	P		
S16 056/4	2660011.032	6508625.872	35.693	silt pond	TAJ	21/03/2016	1.84	16.4	2.7	1.8	1.8	196	196	196	196	196	P		
S16 056/5	2660158.25	6508774.555	37.712	undercut	TAJ	21/03/2016	1.84	16.4	2.7	1.8	1.8	196	196	196	196	196	P		
S16 056/6	2660173.389	6508775.873	37.225	undercut	TAJ	21/03/2016	1.62	20.1	2.7	7.7	7.7	196	196	196	196	196	P		
S16 056/7	2660095.277	6508650.669	33.691	Silt pond	TAJ	22/03/2016	1.63	20.1	2.7	7.1	7.1	196	196	196	196	196	P		
S16 056/8	2660060.6	6508637.037	34.712	Silt pond	TAJ	22/03/2016	1.67	23.5	2.7	0.0	0.0	196	196	196	196	196	P		
S16 056/9	2660035.302	6508630.299	35.744	Silt pond	TAJ	22/03/2016	1.68	23.5	2.7	0.0	0.0	196	196	196	196	196	P		
S16 057/1	2660012.78	6508623.2	35.963	Silt pond	TAJ	22/03/2016	1.59	30.5	2.7	0.0	0.0	196	196	196	196	196	P		
S16 057/2	2659994.831	6508615.537	36.483	Silt pond	TAJ	22/03/2016	1.59	30.5	2.7	0.0	0.0	196	196	196	196	196	P		
S16 057/3	2660027.176	6511092.523	13	Silt pond	TAJ	29/03/2016	1.65	22.9	2.7	0.9	0.9	196	196	196	196	196	P		
S16 057/4				Silt pond	TAJ	29/03/2016	1.65	22.9	2.7	1.0	1.0	196	196	196	196	196	P		
S16 057/5				Silt pond	TAJ	29/03/2016	1.77	16.3	2.7	7.4	7.4	196	196	196	196	196	P		
S16 057/6				Silt pond	TAJ	29/03/2016	1.77	16.3	2.7	7.4	7.4	196	196	196	196	196	P		
S16 057/7				Silt pond	TAJ	29/03/2016	1.67	19.9	2.7	2.6	2.6	196	196	196	196	196	P		
S16 057/8				Re Wall	TAJ	29/03/2016	1.67	19.9	2.7	4.6	4.6	196	196	196	196	196	P		
S16 057/9				Re Wall	TAJ	29/03/2016	1.70	18.8	2.7	4.9	4.9	196	196	196	196	196	P		
S16 058/1				Re Wall	TAJ	29/03/2016	1.72	18.8	2.7	4.1	4.1	196	196	196	196	196	P		
S16 058/2				Re Wall	TAJ	29/03/2016	1.58	21.3	2.7	8.1	8.1	196	196	196	196	196	P		
S16 058/3				Re Wall	TAJ	29/03/2016	1.56	21.3	2.7	9.1	9.1	196	196	196	196	196	P		
S16 058/4				Re Wall	TAJ	29/03/2016	1.67	16.9	2.7	4.8	4.8	196	196	196	196	196	P		
S16 058/5				Re Wall	TAJ	29/03/2016	1.67	16.9	2.7	4.8	4.8	196	196	196	196	196	P		
S16 058/6				Beside reserve	TAJ	29/03/2016	1.63	18.7	2.7	9.0	9.0	196	196	196	196	196	P		
S16 058/7				Beside reserve	TAJ	29/03/2016	1.64	18.7	2.7	8.6	8.6	196	196	196	196	196	P		
S16 058/8				Beside reserve	TAJ	29/03/2016	1.74	16.4	2.7	3.4	3.4	196	196	196	196	196	P		
S16 058/9				Re Wall	TAJ	30/03/2016	1.75	16.4	2.7	3.2	3.2	196	196	196	196	196	P		
S16 058/10				Re Wall	TAJ	30/03/2016	1.69	17.7	2.7	7.3	7.3	196	196	196	196	196	P		
S16 058/11				Re Wall	TAJ	30/03/2016	1.61	22.8	2.7	3.5	3.5	196	196	196	196	196	P		
S16 059/1	2660087.352	6508728.643	42.037	Re Wall	TA	31/03/2016	1.63	22.8	2.7	2.6	2.6	196	196	196	196	196	P		
S16 059/2				Re Wall	TA	31/03/2016	1.57	26.3	2.7	0.6	0.6	196	196	196	196	196	P		
S16 059/3				Re Wall	TAJ	30/03/2016	1.57	26.3	2.7	0.6	0.6	196	196	196	196	196	P		
S16 059/4				Re Wall	TAJ	30/03/2016	1.52	22.9	2.7	3.2	3.2	196	196	196	196	196	P		
S16 059/5				Re Wall	TAJ	30/03/2016	1.62	22.9	2.7	2.9	2.9	196	196	196	196	196	P		
S16 059/6				Re Wall	TAJ	30/03/2016	1.55	19.7	2.7	11.5	11.5	196	196	196	196	196	P		
S16 059/7				Re Wall	TA	31/03/2016	1.60	19.7	2.7	5.3	5.3	196	196	196	196	196	P		
S16 059/8				Re Wall	TA	31/03/2016	1.75	17.1	2.7	6.0	6.0	196	196	196	196	196	P		
S16 059/9				Re Wall	TA	31/03/2016	1.74	17.1	2.7	6.0	6.0	196	196	196	196	196	P		
S16 059/10				Re Wall	TA	31/03/2016	1.60	20.6	2.7	8.0	8.0	196	196	196	196	196	P		

URN	Eastings	Northings	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Moisture content (%)	Solid Density (t/m ³)	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments
												Test 1	Test 2	Test 3	Test 4				
S16 0601/3	2659963.764	6508452.236	32.559	Beside reserve	TA	31/03/2016	1.91	1.58	20.6	2.7	8.7	196	196	196	196	196	P		
S16 0601/2	2659963.764	6508452.236	32.559	Beside reserve	TA	31/03/2016	1.98	1.63	21.7	2.7	4.5	196	196	196	196	196	P		
S16 0601/1	2659963.764	6508452.236	32.559	Beside reserve	TA	31/03/2016	2.00	1.64	21.7	2.7	3.5	196	196	196	196	196	P		
S16 0602/1	2659980.483	6508451.872	32.182	Beside reserve	TA	1/04/2016	2.04	1.73	16.3	2.7	4.4	196	196	196	196	196	P		
S16 0602/2	2659997.262	6508460.68	31.548	Beside reserve	TA	1/04/2016	2.06	1.74	16.3	2.7	3.8	196	196	196	196	196	P		
S16 0603/1	2660069.341	6508717.414	43.707	RE Wall	TA	1/04/2016	2.00	1.65	21.1	2.7	4.2	196	196	196	196	196	P		
S16 0603/2	2660069.341	6508717.414	43.707	RE Wall	TA	1/04/2016	2.04	1.73	18.0	2.7	5.2	196	196	196	196	196	P		
S16 0604/1	2660053.547	6508713.886	43.927	RE Wall	TA	1/04/2016	1.97	1.67	17.8	2.7	8.5	196	196	196	196	196	P		
S16 0604/2	2660053.547	6508713.886	43.927	RE Wall	TA	1/04/2016	1.96	1.67	17.8	2.7	8.7	196	196	196	196	196	P		
S16 0605/1	2660109.139	6508736.561	40.858	RE Wall	TA	4/04/2016	2.05	1.51	38.2	2.7	0.0	196	196	196	196	196	P		
S16 0605/2	2660076.735	6508722.627	43.117	RE Wall	TA	4/04/2016	2.06	1.51	38.2	2.7	0.0	196	196	196	196	196	P		
S16 0606/1	2660051.074	6508715.784	44.916	RE Wall	TA	4/04/2016	1.99	1.64	21.0	2.7	4.6	196	196	196	196	196	P		
S16 0606/2	2660109.679	6508621.051	26.935	Main Fill	TA	5/04/2016	1.98	1.63	19.4	2.7	8.3	196	196	196	196	196	P		
S16 0607/1	2660084.425	6508609.747	27.246	Main Fill	TA	5/04/2016	1.94	1.63	19.4	2.7	8.2	196	196	196	196	196	P		
S16 0607/2	2660084.425	6508609.747	27.246	Main Fill	TA	5/04/2016	1.94	1.63	19.4	2.7	8.2	196	196	196	196	196	P		
S16 0608/1	2660063.986	6508594.13	27.66	Main Fill	TA	5/04/2016	2.08	1.80	16.6	2.7	5.4	196	196	196	196	196	P		
S16 0608/2	2660096.959	6508602.77	26.678	Main Fill	TA	6/04/2016	2.09	1.81	16.6	2.7	4.9	196	196	196	196	196	P		
S16 0609/1	2660121.316	6508615.63	26.811	Main Fill (up a level)	TA	6/04/2016	2.11	1.82	16.5	2.7	4.2	196	196	196	196	196	P		
S16 0609/2	2660122.167	6508699.857	34.297	Main Fill (up a level)	TA	6/04/2016	2.18	1.92	13.6	2.7	3.0	196	196	196	196	196	P		
S16 0610/1	2660080.713	6508688.229	36.521	Main Fill	TA	6/04/2016	2.18	1.92	13.6	2.7	2.9	196	196	196	196	196	P		
S16 0610/2	2660115.462	6508608.516	27.255	Main Fill	TA	6/04/2016	2.14	1.89	13.1	2.7	5.4	196	196	196	196	196	P		
S16 0611/1				Main Fill	TA	6/04/2016	2.13	1.88	13.1	2.7	5.6	196	196	196	196	196	P		
S16 0611/2				Main Fill	TA	6/04/2016	2.02	1.66	22.1	2.7	2.2	196	196	196	196	196	P		
S16 0612/1				Main Fill	TA	6/04/2016	2.03	1.66	22.1	2.7	1.8	196	196	196	196	196	P		
S16 0612/2				Main Fill	TA	6/04/2016	2.13	1.77	20.2	2.7	0.0	196	196	196	196	196	P		
S16 0613/1				Main Fill	TA	6/04/2016	2.12	1.77	20.2	2.7	0.0	196	196	196	196	196	P		
S16 0613/2				Main Fill	TA	6/04/2016	2.06	1.85	11.5	2.7	10.2	196	196	196	196	196	F		
S16 0614/1				Main Fill	TA	6/04/2016	2.03	1.82	11.5	2.7	11.8	196	196	196	196	196	F		
S16 0614/2				Main Fill	TA	6/04/2016	2.04	1.83	11.5	2.7	11.4	196	196	196	196	196	F		
S16 0615/1				Main Fill	TA	6/04/2016	2.16	1.94	11.2	2.7	6.5	196	196	196	196	196	P		
S16 0615/2				Main Fill	TA	6/04/2016	2.17	1.95	11.2	2.7	5.8	196	196	196	196	196	P		
S16 0616/1				Main Fill	TA	7/04/2016	2.19	1.94	12.9	2.7	3.4	196	196	196	196	196	P		
S16 0616/2				Main Fill	TA	7/04/2016	2.19	1.94	12.9	2.7	3.2	196	196	196	196	196	Y		
S16 0617/1				Main Fill	TA	7/04/2016	2.15	1.93	11.0	2.7	7.1	196	196	196	196	196	Y		
S16 0617/2				Main Fill	TA	7/04/2016	2.13	1.92	11.0	2.7	7.7	196	196	196	196	196	P		
S16 0618/1				Main Fill	TA	7/04/2016	2.14	1.91	11.6	2.7	7.0	196	196	196	196	196	Y		
S16 0618/2				Main Fill	TA	7/04/2016	2.14	1.92	11.6	2.7	6.7	196	196	196	196	196	Y		
S16 0619/1				Beside reserve	TA	7/04/2016	2.08	1.71	21.2	2.7	0.2	196	196	196	196	196	P		
S16 0619/2				Beside reserve	TA	7/04/2016	2.07	1.71	21.2	2.7	0.4	196	196	196	196	196	P		
S16 0620/1				Beside reserve	TA	7/04/2016	2.02	1.78	13.8	2.7	9.8	196	196	196	196	196	P		
S16 0620/2				Beside reserve	TA	7/04/2016	2.02	1.77	13.8	2.7	9.9	196	196	196	196	196	P		
S16 0621/1				Beside reserve	TA	7/04/2016	2.11	1.77	18.0	2.7	0.9	196	196	196	196	196	P		
S16 0621/2				Beside reserve	TA	7/04/2016	2.09	1.76	19.0	2.7	1.4	196	196	196	196	196	P		
S16 0622/1				Beside reserve	TA	7/04/2016	2.12	1.87	13.5	2.7	5.7	196	196	196	196	196	P		
S16 0622/2				Beside reserve	TA	7/04/2016	2.11	1.86	13.5	2.7	5.9	196	196	196	196	196	P		
S16 0623/1				Main Fill	TA	7/04/2016	2.13	1.77	20.1	2.7	0.0	406	406	406	406	406	P		

Material was bladed, wet and reworked



Job: Silverdale PRECINCT 2

Client: Tonkin & Taylor

T&T Job #: 21854.0010

Job # 614089.000/1
Entered By: YA/RHN/JED
Checked By:

NZS 4407:1991 Field water content and field dry density using a nuclear densimeter
Test 4.2.1 Direct Transmission Mode

NZS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 064/9	2660101.994	6508619.674	28.058	Main Fill	TA	7/04/2016	2.13	1.77	20.1	2.7	0.0	196	196	196	196	196		P	
S16 064/10	2660011.719	6508584.23	31.991	Beside reserve	TA	7/04/2016	2.13	1.91	12.0	2.7	6.6	196	196	196	196	196		P	
S16 064/11	2659994.35	6508583.031	33.108	Beside reserve	TA	7/04/2016	2.07	1.82	27.7	2.7	0.0	196	196	196	196	196		P	
S16 065/1	2660136.663	6508636.013	27.111	Main Fill	TA	8/04/2016	2.07	1.76	17.8	2.7	3.5	196	196	196	196	196		P	
S16 065/2	2660106.895	6508625.992	28.353	Main Fill	TA	8/04/2016	2.08	1.77	17.9	2.7	3.0	196	196	196	196	196		P	
S16 065/3				Main Fill	TA	8/04/2016	2.14	1.87	14.8	2.7	3.2	196	196	196	196	196		P	
S16 065/4	2660033.553	6508580.267	31.04	Beside reserve	TA	8/04/2016	2.14	1.87	14.8	2.7	3.2	196	196	196	196	196		P	
S16 065/5	2660005.435	6508574.328	32.712	Beside reserve	TA	8/04/2016	2.01	1.88	19.6	2.7	4.9	196	196	196	196	196		P	
S16 065/6	2659997.104	6508593.678	33.377	Beside reserve	TA	8/04/2016	2.01	1.67	19.6	2.7	5.3	196	196	196	196	196		P	
S16 068/1	2660003.452	6508593.993	33.23	Beside reserve	TA	12/04/2016	2.07	1.59	25.9	2.7	0.0	196	196	196	196	196		P	
S16 068/2	2660021.766	6508596.68	34.156	Beside reserve	TA	12/04/2016	2.00	1.59	25.9	2.7	0.0	196	196	196	196	196		P	
S16 069/10				Beside reserve	TA	13/04/2016	2.05	1.64	20.1	2.7	6.0	196	196	196	196	196		P	
S16 069/11				Beside reserve	TA	13/04/2016	1.98	1.65	20.1	2.7	5.8	192	192	192	192	192		P	
S16 069/12				Beside reserve	TA	13/04/2016	2.16	1.91	13.3	2.7	3.9	192	192	192	192	192		P	
S16 069/13				Beside reserve	TA	13/04/2016	2.15	1.90	13.3	2.7	4.5	192	192	192	192	192		P	
S16 070/1	2660092.805	6508583.021	26.121	Beside reserve	TA	14/04/2016	2.12	1.80	17.6	2.7	1.5	192	192	192	192	192		P	
S16 070/2	2660050.887	6508568.071	27.622	Beside reserve	TA	14/04/2016	2.13	1.81	17.6	2.7	0.9	192	192	192	192	192		P	
S16 070/3	2660134.447	6508637.209	28.322	Beside reserve	TA	14/04/2016	2.05	1.75	17.3	2.7	4.9	192	192	192	192	192		P	
S16 070/4	2660108.806	6508631.198	29.551	Beside reserve	TA	14/04/2016	2.08	1.75	17.3	2.7	4.7	192	192	192	192	192		P	
S16 070/5	2660072.122	6508608.599	31.155	Beside reserve	TA	14/04/2016	1.98	1.61	23.1	2.7	3.2	192	192	192	192	192		P	
S16 071/1	2660065.618	6508571.301	27.485	Beside reserve	TA	15/04/2016	2.03	1.58	28.8	2.7	2.6	192	192	192	192	192		P	
S16 071/2	2660030.397	6508562.614	30.099	Beside reserve	TA	15/04/2016	1.99	1.62	23.1	2.7	0.0	192	192	192	192	192		P	
S16 071/6	2660093.935	6508616.785	30.675	Beside reserve	TA	15/04/2016	2.08	1.69	23.2	2.7	0.0	192	192	192	192	192		P	
S16 071/7	2660217.909	6508786.323	28.097	Re Wall	TA	15/04/2016	2.03	1.68	20.8	2.7	3.0	192	192	192	192	192		P	
S16 071/8	2660225.533	6508797.669	28.3	Re Wall	TA	15/04/2016	2.12	1.80	17.7	2.7	1.5	192	192	192	192	192		P	
S16 073/1	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	2.11	1.79	17.7	2.7	1.8	192	192	192	192	192		P	
S16 073/2	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	2.09	1.81	16.4	2.7	4.9	192	192	192	192	192		P	
S16 073/3	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	2.10	1.82	15.4	2.7	4.8	192	192	192	192	192		P	
S16 073/4	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	2.08	1.82	14.2	2.7	6.7	192	192	192	192	192		P	
S16 073/5	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	2.08	1.82	14.2	2.7	6.8	192	192	192	192	192		P	
S16 073/6	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	2.07	1.78	16.0	2.7	5.4	192	192	192	192	192		P	
S16 073/7	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	2.05	1.77	16.0	2.7	6.2	192	192	192	192	192		P	
S16 073/8	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	1.98	1.66	19.3	2.7	6.6	147	192	164	151	164		P	
S16 073/9	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	1.98	1.66	19.3	2.7	6.6	147	192	164	151	164		P	
S16 073/10	2660211.1	6508780.261	29.484	Re Wall	TA	19/04/2016	1.93	1.52	28.6	2.7	3.0	447	447	447	447	447		P	

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)	Average Shear Strength (kPa)	Re - Test (V)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments
S16 074/3	4000466.243	4000420.113	42.2103	Re Wall	TA	18/04/2016	1.94	1.64	26.6	2.7	2.3	147	164	176	P	
S16 074/3	2660037.64	6508818.956	29.012	Re Wall	TA	18/04/2016	1.91	1.50	27.3	2.7	3.6	147	147	164	P	
S16 074/1	2660098.223	6508591.766	27.752	Beside reserve	TA	20/04/2016	2.17	1.91	13.8	2.7	3.1	192	192	192	P	
S16 074/2	2660061.356	6508576.658	29.193	Beside reserve	TA	20/04/2016	2.16	1.91	13.8	2.7	2.7	192	192	192	P	
S16 074/3	2660016.819	6508557.236	30.704	Beside reserve	TA	20/04/2016	2.09	1.74	20.2	2.7	1.0	192	192	192	P	
S16 074/9	2660025.217	6511065.091	15.705	Beside reserve	TA	20/04/2016	2.13	1.80	18.8	2.7	-4.1	192	192	192	P	
S16 074/10	2660021.803	6511046.019	16.101	Undercut	TA	20/04/2016	2.04	1.74	17.1	2.7	5.7	192	192	192	P	
S16 074/11	2660020.024	6511040.076	15.606	Undercut	TA	20/04/2016	2.06	1.74	18.3	2.7	3.7	192	192	192	P	
S16 074/12	2660020.092	6511034.381	15.367	Undercut	TA	20/04/2016	2.07	1.75	18.3	2.7	3.3	192	192	192	P	
S16 074/13	2660017.716	6511026.978	15.693	Undercut	TA	20/04/2016	2.05	1.73	18.6	2.7	4.0	192	192	192	P	
S16 074/14	2660014.319	6511019.713	16.027	Undercut	TA	20/04/2016	2.09	1.77	17.7	2.7	2.8	192	192	192	P	
S16 074/23	2660032.804	6508560.552	31.226	Beside reserve	TA	21/04/2016	2.06	1.76	17.7	2.7	3.5	192	192	192	P	
S16 074/24	2660061.628	6508500.042	25.869	Silt pond	TA	21/04/2016	2.11	1.78	18.7	2.7	0.8	192	192	192	P	
S16 074/25	2660034.879	6508487.312	26.693	Silt pond	TA	21/04/2016	2.03	1.71	18.4	2.7	5.0	192	192	192	P	
S16 074/26	2660220.801	6508757.963	27.789	Undercut	TA	21/04/2016	1.94	1.57	23.5	2.7	4.6	192	192	192	P	
S16 074/27	2660228.12	6508772.053	27.153	Undercut	TA	21/04/2016	2.14	1.83	17.2	2.7	0.8	192	192	192	P	
S16 075/10	2660055.384	6508469.179	26.956	Beside reserve	TA	22/04/2016	1.96	1.54	27.7	2.7	0.5	151	151	192	P	
S16 075/11	2660037.281	6508488.558	27.23	Beside reserve	TA	22/04/2016	2.01	1.70	18.1	2.7	6.4	192	192	192	P	
S16 075/12	2660224.07	6508802.729	31.577	RE Wall	TA	22/04/2016	1.96	1.63	21.5	2.7	7.2	192	192	192	P	
S16 075/13	2660205.947	6508781.396	31.611	RE Wall	TA	22/04/2016	1.95	1.61	21.5	2.7	6.0	192	192	192	P	
S16 075/1	2660222.907	6508761.838	27.644	Undercut	TA	22/04/2016	2.06	1.63	26.1	2.7	-3.1	192	192	192	P	
S16 075/2	2660237.328	6508779.6	26.629	Undercut	TA	22/04/2016	2.04	1.62	26.1	2.7	-2.1	192	192	192	P	
S16 075/3	2660199.949	6508771.442	31.153	RE Wall	TA	22/04/2016	1.99	1.65	20.3	2.7	5.3	192	192	192	P	
S16 075/4	2660208.268	6508785.063	31.114	RE Wall	TA	22/04/2016	2.01	1.67	20.3	2.7	4.4	192	192	192	P	
S16 075/5	2660229.304	6508809.343	31.127	RE Wall	TA	22/04/2016	2.09	1.76	18.6	2.7	2.2	192	192	192	P	
S16 076/1				RE Wall	TA	26/04/2016	2.08	1.76	18.6	2.7	2.2	192	192	192	P	
S16 076/2				RE Wall	TA	26/04/2016	2.00	1.65	21.2	2.7	3.8	192	192	192	P	
S16 076/3				RE Wall	TA	26/04/2016	2.00	1.65	21.2	2.7	3.8	192	192	192	P	
S16 076/4				RE Wall	TA	26/04/2016	1.95	1.57	23.6	2.7	4.6	192	192	192	P	
S16 076/5				RE Wall	TA	26/04/2016	1.96	1.58	23.6	2.7	4.1	192	192	192	P	
S16 076/1				RE Wall	TA	26/04/2016	2.04	1.73	18.1	2.7	4.7	192	192	192	P	
S16 076/2				RE Wall	TA	26/04/2016	2.05	1.74	18.1	2.7	4.3	192	192	192	P	
S16 076/3				RE Wall	TA	26/04/2016	1.94	1.58	23.1	2.7	5.2	192	192	192	P	
S16 076/4				RE Wall	TA	26/04/2016	1.94	1.57	23.1	2.7	5.3	192	192	192	P	
S16 076/5				RE Wall	TA	26/04/2016	2.02	1.69	19.5	2.7	4.3	192	192	192	P	
S16 076/6				RE Wall	TA	26/04/2016	2.05	1.72	19.5	2.7	3.0	192	192	192	P	
S16 076/7				RE Wall	TA	26/04/2016	2.04	1.67	22.6	2.7	0.6	400	400	400	P	

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³)	Oven Calculated Air Voids (%)	Shear Strength (kPa)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 07701				RE Wall	TA	27/04/2016	2.05	1.67	22.6	2.7	0.4	192	192	192	192	192		P	
S16 07711				Beside reserve	TA	27/04/2016	2.07	1.69	22.6	2.7	-0.8	192	192	192	192	192		P	
S16 07712				Beside reserve	TA	27/04/2016	2.13	1.82	17.2	2.7	1.5	192	192	192	192	192		P	
S16 07713				RE Wall	TA	27/04/2016	1.88	1.88	17.8	2.7	7.8	192	192	192	192	192		F	
S16 07714				RE Wall	TA	27/04/2016	1.97	1.69	17.8	2.7	3.1	192	192	192	192	192		F	
S16 07715				RE Wall	TA	27/04/2016	1.97	1.59	23.7	2.7	3.3	192	192	192	192	192		P	
S16 07716				RE Wall	TA	27/04/2016	1.97	1.58	24.5	2.7	2.8	192	192	192	192	192		P	
S16 07717				RE Wall	TA	27/04/2016	1.81	1.42	27.4	2.7	8.4	192	192	192	192	192		P	
S16 07718				Beside reserve	TA	27/04/2016	1.80	1.41	27.4	2.7	9.0	192	192	192	192	192		P	
S16 07719				Beside reserve	TA	27/04/2016	2.04	1.74	17.3	2.7	5.6	192	192	192	192	192		P	
S16 07720				Beside reserve	TA	27/04/2016	2.02	1.72	17.3	2.7	6.5	192	192	192	192	192		P	
S16 07721				Beside reserve	TA	27/04/2016	1.93	1.54	25.3	2.7	4.0	192	192	192	192	192		P	
S16 07722				RE Wall	TA	27/04/2016	1.98	1.63	21.8	2.7	4.4	192	192	192	192	192	Y	P	
S16 07723				Undercut	TA	27/04/2016	1.84	1.30	41.0	2.7	-1.7	192	164	151	123	158		P	
S16 07724				Undercut	TA	27/04/2016	1.63	1.30	41.0	2.7	-1.2	192	164	151	123	158		P	
S16 07725				Undercut	TA	27/04/2016	2.17	1.89	15.3	2.7	1.3	192	164	151	123	158		P	
S16 07726				Undercut	TA	27/04/2016	1.79	1.28	40.4	2.7	1.0	192	164	151	123	158		P	
S16 07727				RE Wall	TA	28/04/2016	2.07	1.80	14.9	2.7	8.5	192	192	192	192	192		P	
S16 07728				RE Wall	TA	28/04/2016	2.05	1.78	14.9	2.7	7.5	192	192	192	192	192		P	
S16 07729				RE Wall	TA	28/04/2016	2.03	1.72	18.4	2.7	4.8	192	192	192	192	192		P	
S16 07730				RE Wall	TA	28/04/2016	2.01	1.63	23.4	2.7	1.4	192	192	192	192	192		P	
S16 07731				Beside reserve	TA	28/04/2016	2.01	1.63	23.4	2.7	1.3	192	192	192	192	192		P	
S16 07732				Beside reserve	TA	28/04/2016	1.91	1.61	18.7	2.7	10.1	192	192	192	192	192		P	
S16 07733				Beside reserve	TA	28/04/2016	1.80	1.60	18.7	2.7	10.5	192	192	192	192	192		P	
S16 07734				Beside reserve	TA	28/04/2016	1.95	1.64	19.0	2.7	8.1	192	192	192	192	192		P	
S16 07735				Undercut	TA	28/04/2016	1.97	1.66	18.0	2.7	7.0	192	192	192	192	192		P	
S16 07736				Undercut	TA	28/04/2016	2.05	1.75	17.3	2.7	4.9	192	192	192	192	192		P	
S16 07737				Undercut	TA	28/04/2016	1.85	1.65	18.1	2.7	9.0	192	192	192	192	192		P	
S16 07738				RE Wall	TA	28/04/2016	1.94	1.64	18.1	2.7	9.6	192	192	192	192	192		P	
S16 07739				RE Wall	TA	28/04/2016	2.08	1.79	16.5	2.7	4.3	192	192	192	192	192		P	
S16 07740				RE Wall	TA	28/04/2016	2.07	1.78	16.5	2.7	4.9	192	192	192	192	192		P	
S16 07741				RE Wall	TA	28/04/2016	2.06	1.71	20.5	2.7	1.4	192	192	192	192	192		P	
S16 07742				Undercut	TA	28/04/2016	2.03	1.69	20.5	2.7	2.9	192	192	192	192	192		P	
S16 07743				Undercut	TA	28/04/2016	2.05	1.75	17.3	2.7	4.8	192	192	192	192	192		P	
S16 07744				Undercut	TA	28/04/2016	2.04	1.76	15.4	2.7	7.5	192	192	192	192	192		P	
S16 07745				Undercut	TA	28/04/2016	2.05	1.77	15.4	2.7	7.0	192	192	192	192	192		P	
S16 07746				Undercut	TA	28/04/2016	2.03	1.61	25.6	2.7	0.0	192	192	192	192	192		P	
S16 07747				Beside reserve	TA	28/04/2016	2.02	1.61	25.6	2.7	0.0	192	192	192	192	192		P	
S16 07748				Beside reserve	TA	28/04/2016	2.05	1.77	16.0	2.7	6.3	192	192	192	192	192		P	
S16 07749				Beside reserve	TA	28/04/2016	2.04	1.71	16.3	2.7	3.5	192	192	192	192	192		P	
S16 07750				Beside reserve	TA	28/04/2016	2.04	1.71	19.3	2.7	3.6	192	192	192	192	192		P	
S16 07751				Beside reserve	TA	28/04/2016	2.01	1.64	23.2	2.7	1.5	192	192	192	192	192		P	

Job: Silverdale Precinct 2

Client: Tonkin & Taylor
T&T Job #: 21854.0010

Job # 614089.000/1
Entered By: YARINJED
Checked By:

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NZS 4407:1991 Field water content and field dry density using a nuclear densiometer
Test 4.2.1 Direct Transmission Mode
NZGS August 2001 Guidelines for hand held shear vane test.

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (Y)	pass / fail Specification > 140 kPa and < 10 % Air Voids	Comments These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
												Test 1	Test 2	Test 3	Test 4				
S16 082/4				Bestide reserve	TA	4/05/2016	2.03	1.65	23.2	2.7	0.7	192	192	192	192	192		P	
S16 083/1				Bestide reserve	TA	5/05/2016	1.97	1.70	15.9	2.7	10.1	192	192	192	192	192		P	
S16 083/2				Bestide reserve	TA	5/05/2016	1.90	1.51	25.7	2.7	5.4	192	151	176	192	178		P	
S16 083/5				Bestide reserve	TA	5/05/2016	1.87	1.49	25.7	2.7	6.5	192	192	192	192	192		P	
S16 083/6				Below Re Wall 403	TA	5/05/2016	2.03	1.75	15.8	2.7	7.5	192	192	192	192	192		P	
S16 083/7				Below Re Wall 403	TA	5/05/2016	2.01	1.71	17.4	2.7	7.7	192	192	192	192	192		P	
S16 083/8				Below Re Wall 403	TA	5/05/2016	2.15	1.81	19.0	2.7	-1.2	192	192	192	192	192		P	
S16 083/9				Below Re Wall 403	TA	5/05/2016	2.04	1.72	16.9	2.7	3.8	192	192	192	192	192		P	
S16 084/4				Bestide Reserve	TA	6/05/2016	2.03	1.71	18.9	2.7	4.5	192	192	192	192	192		P	
S16 084/5				Bestide Reserve	TA	6/05/2016	2.02	1.67	21.1	2.7	2.8	151	164	192	192	175		P	
S16 084/6				Bestide Reserve	TA	6/05/2016	2.00	1.65	21.1	2.7	4.0	192	192	192	192	192		P	
S16 084/7				Bestide Reserve	TA	6/05/2016	2.03	1.72	17.5	2.7	6.0	192	192	192	192	192		P	
S16 084/8				Bestide Reserve	TA	6/05/2016	2.03	1.72	17.5	2.7	6.0	192	192	192	192	192		P	
S16 084/9				Bestide Reserve	TA	6/05/2016	2.01	1.61	24.3	2.7	1.1	192	192	192	192	192		P	
S16 085/1				Bestide Reserve	TA	6/05/2016	2.04	1.64	24.3	2.7	-0.4	192	192	192	192	192		P	
S16 085/2				Bestide Reserve	TA	6/05/2016	2.08	1.77	17.6	2.7	3.6	192	192	192	192	192		P	
S16 085/3				Bestide Reserve	TA	6/05/2016	2.05	1.76	17.6	2.7	4.1	192	192	192	192	192		P	
S16 085/4				Bestide Reserve	TA	6/05/2016	2.02	1.69	19.9	2.7	4.0	192	192	192	192	192		P	
S16 085/5				Bestide Reserve	TA	6/05/2016	2.00	1.67	20.0	2.7	4.7	192	192	192	192	192		P	
S16 085/6				Re Wall	TA	6/05/2016	2.06	1.87	20.0	2.7	5.0	192	192	192	192	192		P	
S16 085/7				Re Wall	TA	6/05/2016	2.07	1.73	19.2	2.7	2.8	192	192	192	192	192		P	
S16 085/8				Re Wall	TA	6/05/2016	2.07	1.74	19.1	2.7	2.4	192	192	192	192	192		P	
S16 085/9				Re Wall	TA	6/05/2016	2.01	1.68	19.1	2.7	5.5	192	192	192	192	192		P	
S16 086/1				Re Wall	TA	6/05/2016	2.09	1.81	15.5	2.7	5.2	192	192	192	192	192		P	
S16 086/2				Re Wall	TA	6/05/2016	2.08	1.80	15.5	2.7	5.5	192	192	192	192	192		P	
S16 086/3				Re Wall	TA	6/05/2016	2.00	1.65	21.2	2.7	3.8	192	192	192	192	192		P	
S16 086/4				Re Wall	TA	6/05/2016	2.03	1.67	21.2	2.7	2.6	192	192	192	192	192		P	
S16 086/5				Re Wall	TA	6/05/2016	2.04	1.69	20.3	2.7	2.9	192	192	192	192	192		P	
S16 086/6				Re Wall	TA	6/05/2016	1.91	1.55	23.6	2.7	6.2	192	192	192	192	192		P	
S16 086/7				Re Wall	TA	6/05/2016	1.92	1.55	23.6	2.7	5.9	192	192	192	192	192		P	
S16 086/8				Re Wall	TA	6/05/2016	1.94	1.56	24.4	2.7	4.2	192	192	192	192	192		P	
S16 086/9				Re Wall	TA	6/05/2016	1.93	1.55	24.4	2.7	4.7	192	192	192	192	192		P	
S16 087/1	2660259.488	6508919.788	32.518	Re Wall	TA	10/05/2016	2.07	1.81	14.2	2.7	7.0	212	212	212	212	212		P	
S16 087/2	2660260.839	6508934.369	32.496	Re Wall	TA	10/05/2016	2.06	1.81	14.2	2.7	7.5	212	212	212	212	212		P	
S16 087/3	2659835.906	6508489.209	36.655	Lots	TA	10/05/2016	2.11	1.83	15.1	2.7	4.6	212	212	212	212	212		P	
S16 087/4	2659835.969	6508463.012	36.600	Lots	TA	10/05/2016	2.02	1.67	20.8	2.7	3.1	152	152	152	152	152		P	
S16 087/5	2659855.010	6508439.290	36.054	Lots	TA	10/05/2016	2.10	1.74	20.8	2.7	0.0	152	152	152	152	152		P	
S16 087/6	2659878.451	6508421.803	35.596	Lots	TA	10/05/2016	2.00	1.59	26.0	2.7	0.0	152	152	152	152	152		P	
S16 087/7	2660203.852	6508740.565	29.702	Underfoot	TA	11/05/2016	2.05	1.72	19.0	2.7	3.7	152	152	166	212	171		P	
S16 087/8	2660203.852	6508740.565	29.702	Underfoot	TA	11/05/2016	2.06	1.73	19.0	2.7	2.9	152	152	166	212	171		P	
S16 087/9	2660203.852	6508740.565	29.702	Underfoot	TA	11/05/2016	2.02	1.68	20.7	2.7	3.6	152	152	166	212	171		P	
S16 087/10	2660203.852	6508740.565	29.702	Underfoot	TA	11/05/2016	2.02	1.68	20.7	2.7	3.1	151	151	166	212	170		P	
S16 087/11	2660203.852	6508740.565	29.702	Underfoot	TA	11/05/2016	2.03	1.67	21.5	2.7	2.3	151	151	166	212	170		P	
S16 087/12	2660203.852	6508740.565	29.702	Underfoot	TA	11/05/2016	2.03	1.68	20.4	2.7	3.4	151	151	166	212	170		P	

NZS 4407:1991 Field water content and field dry density using a nuclear densimeter
Test 4.2.1 Direct Transmission Mode

URN	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m ³)	Oven Dry Density (t/m ³)	Oven Moisture content (%)	Solid Density (t/m ³) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate)				Average Shear Strength (kPa)	Re - Test (V)	pass / fail Specification > 140 kPa and < 10 % Air Voids)	Comments
	4000240.000	6508792.175	25.318	Undercut	TA	11/05/2016	2.03	1.68	20.4	2.7	3.4	Test 1 212	Test 2 212	Test 3 212	Test 4 212	181		P	These results have not yet passed our entire quality assurance process. They should be used with caution and may be subject to change.
S16 087/3	2660257.240			Undercut	TA	11/05/2016	2.01	1.69	18.3	2.7	6.2	212	181	166	168	181		P	
S16 088/1				Undercut	TA	12/05/2016	2.00	1.69	18.3	2.7	6.3	212	212	212	212	212		P	
							2.05	1.80	13.7	2.7	8.5	212	212	212	212	212		P	
							2.04	1.79	13.7	2.7	9.0	212	212	212	212	212		P	
S16 088/2				Undercut	TA	12/05/2016	2.12	1.86	14.4	2.7	4.6	212	212	212	212	212		P	
							2.13	1.86	14.4	2.7	4.4	212	212	212	212	212		P	
S16/088/1				Undercut - carpark	TA	13/05/2016	2.07	1.82	13.4	2.7	8.2	212	212	212	212	212		P	
							2.08	1.83	13.4	2.7	7.5	212	212	212	212	212		P	
S16 089/2				Undercut	TA	13/05/2016	1.94	1.46	32.5	2.7	0.0	212	212	212	212	212		P	
							1.94	1.46	32.5	2.7	0.0	212	212	212	212	212		P	
S16 089/3				Undercut	TA	13/05/2016	2.04	1.88	21.4	2.7	1.8	212	212	212	212	212		P	
							2.05	1.89	21.4	2.7	1.5	212	212	212	212	212		P	
S16 089/4				Undercut	TA	13/05/2016	1.95	1.66	17.8	2.7	9.1	212	212	212	212	212		P	
							1.96	1.67	17.8	2.7	8.7	212	212	212	212	212		P	
S16 089/5				Re Wall	TA	13/05/2016	2.03	1.70	20.0	2.7	3.3	212	212	212	212	212		P	
							2.03	1.69	20.0	2.7	3.6	212	212	212	212	212		P	
S16 089/6				Re Wall	TA	13/05/2016	2.02	1.69	19.8	2.7	3.9	212	212	212	212	212		P	
							2.03	1.69	19.8	2.7	3.9	212	212	212	212	212		P	
S16 089/9				Undercut - carpark	TA	13/05/2016	1.99	1.63	21.6	2.7	4.7	212	212	212	212	212		P	
							1.98	1.63	21.6	2.7	4.6	212	212	212	212	212		P	
S16 090/1				Undercut - carpark	TA	16/05/2016	1.88	1.40	33.8	2.7	0.6	128	136	151	212	157		P	
							1.87	1.40	33.8	2.7	0.8	129	136	151	212	157		P	
S16 090/2				Undercut - carpark	TA	16/05/2016	1.92	1.37	32.5	2.7	4.5	130	139	148	212	157		P	
							1.93	1.38	32.5	2.7	4.2	212	212	212	212	212		P	
S16 090/3				Undercut	TA	16/05/2016	2.05	1.73	18.4	2.7	4.2	212	212	212	212	212		P	
							2.05	1.73	18.4	2.7	4.2	212	212	212	212	212		P	
S16 091/6				Below Re Wall	TA	17/05/2016	2.06	1.58	30.2	2.7	0.0	212	212	212	212	212		P	
							2.06	1.58	30.2	2.7	0.0	212	212	212	212	212		P	
S16 091/7				Below Re Wall	TA	17/05/2016	2.01	1.70	18.4	2.7	5.7	212	212	212	212	212		P	
							2.00	1.69	18.4	2.7	6.3	212	212	212	212	212		P	
S16 091/8				Below Re Wall	TA	17/05/2016	2.01	1.73	16.0	2.7	8.2	212	212	212	212	212		P	
							2.01	1.73	16.0	2.7	8.1	212	212	212	212	212		P	
S16 091/9				Below Re Wall	TA	17/05/2016	1.96	1.57	25.8	2.7	1.1	212	212	212	212	212		P	
							1.97	1.58	25.8	2.7	1.7	212	212	212	212	212		P	
S16 092/1				Re Wall	TA	18/05/2016	1.86	1.42	30.2	2.7	4.2	199	202	185	190	194		P	
							1.85	1.42	30.2	2.7	4.4	212	212	212	212	212		P	
S16 093/1				Re Wall	TA	19/05/2016	1.97	1.49	31.5	2.7	0.0	214	214	214	214	214		P	
							1.96	1.49	31.5	2.7	0.0	214	214	214	214	214		P	
S16 093/2				Re Wall	TA	19/05/2016	2.06	1.76	17.5	2.7	4.4	214	214	214	214	214		P	
							2.08	1.76	17.5	2.7	4.2	214	214	214	214	214		P	
S16 093/6				Re Wall	TA	19/05/2016	2.00	1.64	22.0	2.7	3.1	153	153	168	214	172		P	
							2.01	1.65	22.0	2.7	2.7	168	168	199	214	167		P	
S16 093/7				Re Wall	TA	19/05/2016	2.03	1.64	23.8	2.7	0.1	168	168	199	214	167		P	
							2.03	1.64	23.8	2.7	0.4	168	168	199	214	167		P	
S16 093/8				Re Wall	TA	19/05/2016	1.96	1.53	27.7	2.7	0.7	166	166	199	214	167		P	
							1.97	1.54	27.7	2.7	0.2	166	166	199	214	167		P	