REPORT

Tonkin+Taylor

Millwater Subdivision

Arrans Hill Precinct - Stage 5

Prepared for
WFH Properties Ltd
Prepared by
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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 45 No. Residential Lots and 1 No. Super Lot contained within Stage 5 of Arrans Hill Precinct 5 at the Millwater Subdivision in Silverdale. Stage 5 comprises Residential Lots 54 to 78, and 174 to 195, Super Lot 803, Reserve Lots 604 and 802, and Road Lot 904 (part of Godfrey Drive and Davey Crescent within Stage 5) inclusive as shown on the Woods Final Surface As–Built Plan (Woods Ref 37505–05-100–AB) in Appendix A.

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) March 2013 Geotechnical Investigation Report for the North Bridge to Grand Drive (Ref. 4).
d) December 2015 Geotechnical Investigation Report for Arrans Hill Precinct 5 (Ref. 5).

Woods Ltd (Woods) undertook the engineering design for Stage 5 and the overall subdivision.

Subdivision earthworks commenced from February 2018 through to July 2019 under the control of Hick Bros Civil Construction Ltd (Hicks). Civil earthworks and construction for the residential Lots were under the control of JG Civil Ltd (JGCL) and were undertaken progressively from July 2019 through to completion in December 2019.

Key Stage 5 earthworks components included:

a) Stripping of vegetation, organic materials and topsoil to stockpile.
b) Installation of subsoil drains.
c) Removal of uncontrolled Motorway fill material at base of Reinforced Earth Slope 8 and within Lots 75 to 78 as shown in Woods Cut & Fill As–Built Plans (Woods Ref 37505–05–110-AB to –112–AB) in Appendix A.
d) Construction of 2 No. Palisade Walls as shown on T+T Drawings 21854.0031–AHP5S5–101 in Appendix B.
e) Construction of Reinforced Earth Slope 8 along the northern boundary of Lots 54 to 58, and 63 to 66, and Reinforced Earth Slope 4 along the southern boundary of Lots 174 to 181 as shown on T+T Drawings 21854.0031–AHP5S5–101 in Appendix B.
f) Construction of a Vegetated Reinforced Earthbatter along the western boundary of Lots 66 to 78 as shown on T+T Drawings 21854.0031–AHP5S5–101 in Appendix B.
g) Cut to fill earthworks across Stage 5 as shown on Woods Cut & Fill As–Built Plans (Woods Ref 37505–05–110-AB to –112–AB) in Appendix A.

Key Stage 5 civil works components included:

a) Minor cut to fill earthwork across parts of the site as part of Lot development.
b) Installation of roading and services.

Overall subdivisional soil types are highly expansive (Site class H1), based on laboratory testing undertaken in accordance with AS 2870:2011 (Ref. [7]). Due to this classification, soils lie outside the definition of good ground within NZS 3604:2011 (Ref. [8]). Building foundations will require either specific foundation design for expansive soils or foundation design in accordance with AS 2870:2011 (Ref. [7]). Subject to geotechnical constraints outlined in Section 3, and CSIRO recommendations

outlined in the Appendices relating to expansive soils foundation design and home owner maintenance, all the residential Lots within Stage 5 are considered to have a building platform area that is 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 45 No. Residential Lots and 1 No. Super Lot contained within Stage 5 of Arrans Hill Precinct 5 at the Millwater Subdivision in Silverdale. Stage 5 comprises Residential Lots 54 to 78, and 174 to 195, Super Lot 803, Reserve Lots 604 and 802, and Road Lot 904 (part of Godfrey Drive and Davey Crescent within Stage 5) inclusive as shown on the Woods Final Surface As–Built Plan (Woods Ref 37505–05-100–AB) in Appendix A.

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) March 2013 Geotechnical Investigation Report for the North Bridge to Grand Drive (Ref. 4).
d) December 2015 Geotechnical Investigation Report for Arrans Hill Precinct 5 (Ref. 5).

The scope of work covered by this geotechnical 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. 6), including undercuts and construction of 2 No. reinforced earth slopes (Reinforced Earth Slope 8 and Reinforced Earth Slope 4);
c) Monitoring and certification of construction of 2 No. Palisade Walls (Palisade Wall 4 and part of Palisade Wall 5);
d) Assessment of soils for expansive conditions in accordance with AS 2870:2011 (Ref. 7);
e) Certification of completed Lots for residential development in accordance with NZS 3604:2011 (Ref. 8).

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

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 Arrans Hill Precinct 5, Stage 5 area of the Millwater subdivision is located within what is known as Precinct 5 in the Orewa West Structure Plan. Arrans Hill Precinct 5 area is bound by State Highway 1 to the west, Grand Drive to the north, Arran Drive to the east, and the Orewa estuary to the south. The situation of Arrans Hill Precinct 5 and Stage 5 is shown on T+T Drawing 21854.0031–AHP5S5–100 in Appendix B.

Pre-development gradients within the Stage 5 were gentle to moderately steep (1 in 3, to 1 in 5 (V:H)) dipping north and south from the slope crest in the southern part of Stage 5. Post-development gradients have generally reduced the angle of the slope within the Lots to a gentle gradient (1 in 10, to 1 in 3 (V:H)). In order to form more level building platforms, steep reinforced

earth slopes of between 1 in 2 and 1 in 1.5 (V:H) have been constructed as shown on T+T Drawing 21854.0031–AHP5S5–101 in Appendix B.

1.3 Geological setting

Published geological mapping and information indicates the Arrans Hill Precinct 5 area is underlain by East Coast Bays Formation (ECBF) materials (Figure 1.1). In addition to the ECBF materials, our investigations identified the presence of alluvial and colluvial materials on site along the stream margins (Ref 4 and 5).

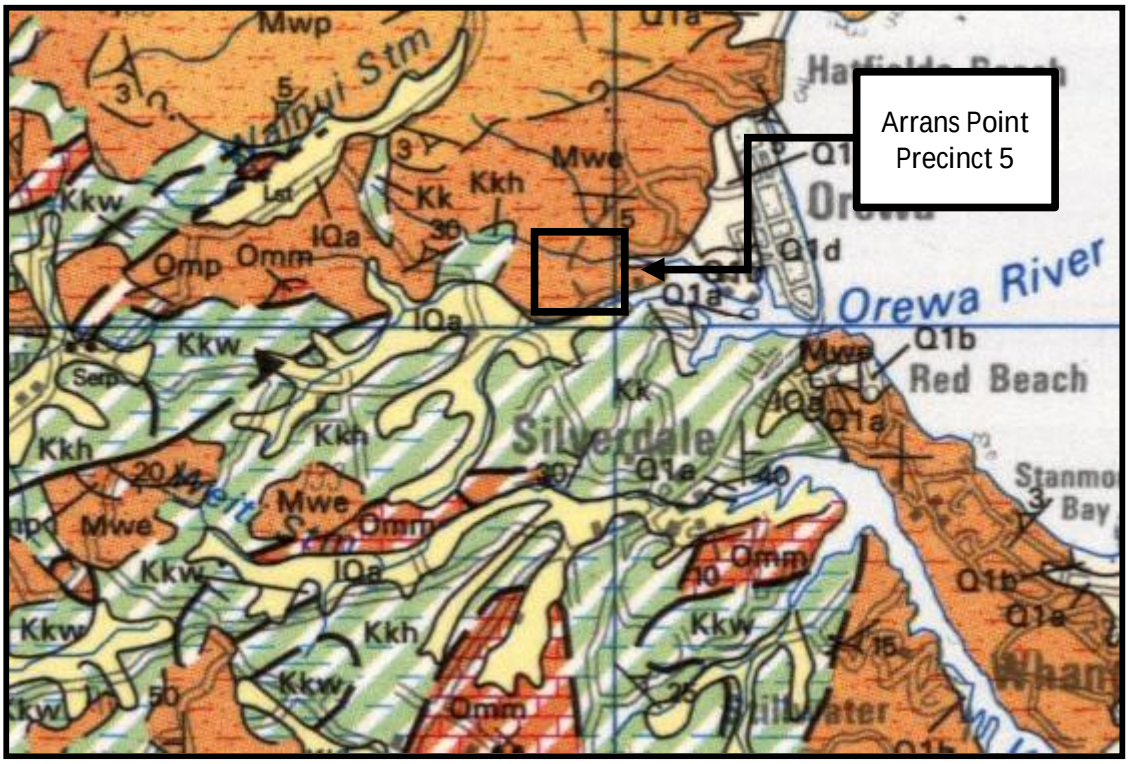

Figure 1.1: Local Geology (from Edbrooke)

Summary descriptions of geological units in the Arrans Point area (after Kermode 1991) are as follows:

a) East Coast Bays Formation

Alternating sandstone and mudstone with variable volcanic content (volcanic-poor lower in the sequence and mixed volcanic content higher) and interbedded volcaniclastic grit beds. This material typically shows a well-developed weathering profile of clay, silt or sand depending on the parent lithology.

b) Pleistocene Age Alluvium and Colluvium

Alluvium and Colluvium are generally observed on the lower slopes, along the edges of the tidal tributaries of the Orewa River - along the southern and eastern boundary of the site. In places, it is locally discontinuous or absent.

The 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.

Colluvium closely resembles the undisturbed residual soil materials, comprising a mix of clayey silts and silts, but is often of lesser strength due to the deformation and disturbance that has occurred during transportation down-slope.

Geological cross-sections through the Arrans Hill Precinct 5 Stage 5 area, based on site investigations and observations during construction, are enclosed as T+T Drawings 21854.0031–AHP5S5–103 to –105 in Appendix B.

Fill material placed across the site to form the final design profile typically comprised site-won East Coast Bays Formation materials.

2 Earthworks operations

2.1 Contractors and plant

Bulk earthworks were undertaken by Hick Bros Civil Construction Ltd (Hicks). Various areas of soft and/or wet materials were encountered during the works and were undercut and replaced with engineered fill. Much of this undercut material was considered suitable for re-use as engineered fill if conditioned appropriately. Accordingly, mixing of the cohesive fill materials with lime/cement to facilitate fill placement and compaction was undertaken by Hiway Stabilizers Ltd (Hiway) under Hicks' control.

Construction of the two palisade walls was undertaken by ICB Retaining and Construction Ltd (ICB), also under Hicks' control.

Civil works construction was completed by JG Civil Ltd (JGCL).

Various earthworks equipment was used to undertake the works, comprising motor scrapers, articulated dump trucks, tractors and discs, sheepsfoot compactors, padfoot rollers, and several 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

Subdivision earthworks commenced from February 2018 through to July 2019 under Hicks' control. Civil earthworks and construction for the residential Lots were under JGCL's control, and were undertaken progressively from July 2019 through to completion in December 2019.

Key Stage 5 earthworks components included:

a) Stripping of vegetation, organic materials and topsoil to stockpile.

b) Installation of subsoil drains.

c) Removal of uncontrolled Motorway fill material at base of Reinforced Earth Slope 8 and within Lots 75 to 78 as shown in Woods Cut & Fill As–Built Plans (Woods Ref 37505–05–110-AB to –112–AB) in Appendix A.

d) Construction of 2 No. Palisade Walls as shown on T+T Drawings 21854.0031–AHP5S5–101 in Appendix B.

e) Construction of Reinforced Earth Slope 8 along the northern boundary of Lots 54 to 58, and 63 to 66, and Reinforced Earth Slope 4 along the southern boundary of Lots 174 to 181 as shown on T+T Drawings 21854.0031–AHP5S5–101 in Appendix B.

f) Construction of a Vegetated Reinforced Earthbatter along the western boundary of Lots 66 to 78 as shown on T+T Drawings 21854.0031–AHP5S5–101 in Appendix B.

g) Cut to fill earthworks across Stage 5 as shown on Woods Cut & Fill As–Built Plans (Woods Ref 37505–05–110-AB to –112–AB) in Appendix A.

Key Stage 5 civil works components included:

c) Minor cut to fill earthwork across parts of the site as part of Lot development.

d) Installation of roading and services.

The earthworks, undercuts, palisade walls, reinforced earth slope and subsoil drainage as–built plans are included in Appendix A and Appendix B.

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 and 5) 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 (Undercuts & 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 (Undercuts & Reinforced Earth Fill Slopes):

Average value not more than	8%
Maximum single value	10%

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

Compaction control criteria consisting of minimum allowable Clegg Impact Values and minimum allowable in–situ dry density were used for cohesionless fill control. The Technical Specification included in our Geotechnical Investigation Report (Ref. 4 and 5) included the following requirement for the subdivisional earthworks:

Minimum Clegg Impact Value and Minimum In Situ Dry Density Method

Minimum Clegg Impact Value (Measured by Clegg Impact Hammer – IANZ calibrated)

General fills:

Average value not less than	20
Minimum single value	18

Minimum In-Situ Dry Density Percentage (as defined in NZS 4402:1986)

General fills:

Average value not less than	95%
Minimum single value	90%

The average Clegg Impact 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. 6). Test results are contained in Appendix F.

Quality Control (QC) testing showed that the results for the filling were consistently meeting the required undrained shear strength, Clegg Impact value, density 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

Subsoil drains were installed across Arrans Hill Precinct 5, Stage 5 during bulk earthworks as part of construction of Reinforced Earth Slope 8, Reinforced Earth Slope 4, and in areas of fill placement to create a level building platform. The subsoil drains installed were excavated into the underlying in-situ soil to intercept groundwater and springs.

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

a) 160mm diameter perforated Hiway grade Nexus drain pipes installed along the base of the rear of the reinforced soil block.

b) A minimum of 300mm cover of SAP50 scoria placed over the top of the Nexus pipe and across the entire rear 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 placed over the surface of the SAP50 scoria prior to placement of the reinforced soil to prevent contamination of the drainage aggregate with overlying bulk earthworks materials.

The subsoil drains outlet along Grand Drive or a tributary of the Orewa River, as shown on the Woods Undercut And Subsoil Drain As–Built Plan (Woods Ref 37505–05–120–AB) in Appendix A and on T+T Drawing 21854.0031–AHP5S5–102 in Appendix B.

3.2 Undercuts

Multiple undercuts were excavated across Stage 5 to improve ground conditions across the stage.

At the toe of Reinforced Earth Slope 8 a 2m deep and 5m wide (minimum) undercut was excavated into residual soil with an undrained shear strength greater than 75kPa to ensure a consistent subgrade. Uncontrolled Motorway Fill was discovered in the northwestern area of Stage 5 during the excavation for the undercut of Reinforced Earth Slope 8. Uncontrolled Motorway Fill overlying a buried topsoil layer was also discovered along the western site boundary within Lots 75 to 78. All Uncontrolled Motorway Fill was removed. The undercut was replaced with engineered, compacted fill, placed in accordance with the bulk earthworks specification (Section 2.3 above).

Undercut 1 was excavated at the western end of Reinforced Earth Slope 4 across Lots 178 to 181. The undercut was replaced with engineered, compacted fill, placed in accordance with the bulk earthworks specification (Section 2.3 above).

In addition, 0.6 - 1m deep undercuts were excavated to expose more competent soils (minimum shear strength of 75kPa) across the Residential Lots and Super Lots in Stages 5 due to exposure of some areas of unsuitable subgrade materials (i.e. soft and wet). The undercut was replaced with engineered, compacted fill, placed in accordance with the bulk earthworks specification (Section 2.3 above).

The extent of the undercut areas is shown on the Woods Undercut And Subsoil Drain As–Built Plan (Woods Ref 37505–05–120–AB) in Appendix A.

3.3 Palisade walls

Two Palisade Walls were constructed within Stage 5 to provide satisfactory factors of safety against slope instability, shown on T+T Drawing 21854.0031–AHP5S5–101 in Appendix B. Palisade Wall 4 was constructed along the western boundary of Residential Lots 65 to 74. Palisade Wall 5 was constructed along the toe of Reinforced Earth Slope 8 along the northern boundary of Lots 54 to 58. Both walls were constructed during bulk earthworks.

Palisade Wall 4 was constructed of 6m long 250UC73 steel piles at 1.5m centres in 20MPa concrete. Piles were installed in 600mm diameter bored pile holes. The top the steel pile is 1m below finished ground level.

Palisade Wall 5 comprises 6m long 250UC73 steel piles installed at 1.8m centres encased in 600mm diameter concreted holes.

Drilling for the palisade wall pile bores was inspected and logged by an Engineering Geologist to check that the base of the piles had been extended sufficiently to the target material.

Ground conditions exposed during construction of Palisade Walls 4 and 5 were generally as anticipated from the design stage of the development. The slope stability analysis results from the original design phase are discussed in Section 4.

3.4 Reinforced earth slopes

Reinforced Earth Slope 8 and Reinforced Earth Slope 4 were constructed during bulk earthworks phase of the development of Stage 5.

The foundations of Reinforced Earth Slope 8 are composed of engineered fill material from undercut and part of Palisade Wall 5, as outlined in Sections 3.2 and 3.3, and presented on T+T Drawing 21854.0031-111 to 112 in Appendix B. The foundations of Reinforced Earth Slope 4 are composed of engineered fill material, presented on T+T Drawing 21854.0031-110 in Appendix B.

The reinforced earth slopes comprise horizontally laid biaxial geogrids placed at 0.5m (vertical) intervals within the engineered, compacted earth fill. The grids extend up to within 1.5 (vertical) metres of the slope crest. The geogrid has been placed at various lengths between 2 to 14m long, starting at the face of the slope.

Typical cross–sections of the reinforced earth slopes are shown on T+T Drawings 21854.0031–AHP5S5–110 to –112 in Appendix B.

The placement of the geogrid allows steeper finished gradients than is possible with bulk fills and will minimise 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 slope comprised the following:

a) place drainage pipes and scoria blanket as required;
b) placement and compaction of fill, or excavation within natural ground, to the required levels;
c) placement of the geogrid, 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.

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.

As noted in Section 3.1, a drainage blanket was installed at the rear of the reinforced block of soil and comprises a minimum of 300mm thickness of SAP50 scoria, covered in Bidim A19 geotextile filtercloth and a cap of engineered cohesive fill 2m in thickness. A 160mm diameter perforated Hiway grade Nexus drain pipe was installed at the base of the drainage blanket and provides regular discharge outlets for any groundwater captured in the drainage blanket.

The slopes have been designed to accommodate surcharge of up to 10kPa distributed load at the crest of the slopes.

The slope faces will be subject to a planting covenant and Building Limitation Zone preventing construction within this area. Protection of the geogrids from damage also precludes construction across the slope faces and immediately adjacent to the slope crest. Accordingly, a Building Limitation Zone has been applied across the slopes (See Sections 5.4).

4 Stability analysis

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.

We are satisfied that the design stability 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 the Arrans Hill Precinct 5 Stage 5 areas 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 recommendations.

5.2 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. 8). 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 21854.0031–AHP5S5–121) are attached in Appendix F.

5.3 Bearing capacity for building foundations

From the investigation described in Section 5.2, we consider that all filled and natural ground within the site is assessed as generally having a geotechnical ultimate bearing capacity of 300kPa, as required by NZS 3604:2011 (Ref. 8). 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 (Ref. 8). In terms of AS 2870:2011 (Ref. 7), the soils present are considered to lie within Site Class H1 (highly expansive) with characteristic surface movements anticipated to be 40-60mm. 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 (Ref. 8), further specific site investigation and design of foundations will be required.

5.4 Building limitation zones

5.4.1 Reinforced earth slope

The steep slope across Lots 54 to 58 and Lots 63 to 66, and Lots 174 to 181 have been constructed as Reinforced Earth Slope 8 and Reinforced Earth Slope 4 respectively, with face gradients of between 1 in 1.5 and 1 in 2 (V:H). Construction within the flatter parts of these Lots is intended, and a Building Limitation Zone (i.e. "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 Limitation Zones associated with the RE Slopes are shown on T+T Drawing 21854.0031–AHP5S5–120 (Building Limitation Plan) in Appendix B. Excavation, fill placement and/or construction within this zone is not permitted.

Where slopes exceed gradients of 1 in 2 (V:H) we understand that slope protection, in the form of "Enkamat" or "Geocells" have been anchored to the face of the Reinforced Earth Slopes to function as a protective reinforcing layer for the topsoil and plant root system. The "Enkamat" or "Geocells" have been anchored to a "deadman" which is located within the Lot at the top of the slope. To ensure the anchor points are not damaged a no build zone extending 1m from the anchor points into the Lots has been delineated. This is shown on the Woods Reinforced Earth Batter & Slope

Stabilisation Plan (Woods Ref 37505–05–140–AB) and the Woods Deadman Covenent Diagram (Woods Ref 37505-05-123 to -124) Appendix A.

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.

5.4.2 Stage 5 western boundary and Palisade wall 4

During initial investigations it was found the western boundary of Stage 5 did not have an adequate factor of safety to prevent instability. To ensure the stability of the slope, Palisade Wall 4 has been constructed along the western boundary within Lots 65 to 74. A no build zone has also been delineated 5m back from the western site boundary across Lots 66 to 78 , where a Vegetated Reinforced Earthbatter has been constructed. The extent of the Building Limitation Zones along the Stage 5 western boundary is shown on T+T Drawing 21854.0031–AHP5S5–120 (Building Limitation Plan) in Appendix B.

5.5 Settlement

From our inspections during earthworks operations, the results of compaction quality control testing, and post construction survey monitoring, 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. [8]), with respect to conventional building development.

Monitoring points were installed across the top of the Reinforced Earth Slope 8 following completion of the construction works of the eastern section. The monitoring commenced in August 2018 and is ongoing at this date. The monitoring shows that while settlements of up to 16mm have occurred, there has been negligible movement since March 2019.

Construction of the eastern section of Reinforced Earth Slope 8 was completed in May 2019. settlement monitoring of this section of Reinforced Earth Slope 8 began in November 2019 and is ongoing at this date. No significant movement has been observed since monitoring began.

Monitoring points were installed across the top of the Reinforced Earth Slope 4 following completion of the construction works. The monitoring commenced in May 2019 and is ongoing at this date. The monitoring shows that while settlements of up to 16mm have occurred, there has been negligible movement since September 2019.

In order to minimise the risk of ground settlements exceeding 25mm, NZS 3604:2011 (Ref. [8]) allows a maximum fill surcharge of 600mm over the building platform during future development. Filling in excess of this thickness should be subject to specific foundation design and assessment.

5.6 Earthworks and retaining walls

All earthworks and retaining wall construction on the lots should comply with all requirements of the Resource Management Act (1991), the Building Act (2004) and the Auckland Unitary Plan.

All temporary and permanent cuts exceeding 1.5m in height, including cuts to be retained, should be specifically investigated by a suitably qualified geotechnical professional to confirm that the stability of the subject (or adjacent) Lot is not detrimentally affected. Retaining walls greater than 1.5m in height should be specifically investigated and designed by a Chartered Professional Engineer practising in geotechnical engineering.

Fill greater than 0.6m thick, and all fill proposed to be beneath structures (including hardstanding areas), should meet the requirements of NZS 4431:1989 – Code of Practice for Earthfill for Residential Development, and should include adequate stripping, benching, and underdrainage.

All fills greater than 0.6m thickness should be investigated and designed by a Chartered Professional Engineer practising in geotechnical engineering or by an experienced Engineering Geologist. The Engineer should consider the effect of the earthworks on global stability, i.e. the effect of the works on the stability of the lot and on the stability adjacent lots.

Due to the relatively shallow grades across most of the Stage 5 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 retaining wall design, we recommend the use of the following geotechnical design parameters for the retained soils:

- $\gamma = 18\ kN/m^3$,
- $c' = 0\ kPa$,
- $Ø' = 30°$,
- $K_a = 0.30$,
- $K_p = 3.33$,

We recommend an undrained shear strength, "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.

5.7 Subsoil drainage

Following undercutting during bulk earthworks, groundwater subsoil drainage was installed at select locations using Nexus subsoil drains covered in scoria and geotextile cloth to permanently handle ground water flows.

The extent of the subsoil drainage systems are shown on the Woods Undercut And Subsoil Drain As–Built Plan (Woods Ref 37505–05–120–AB) in Appendix A, and on T+T Drawing 21854.0031–AHP5S5–102 in Appendix B.

This subsoil 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 subsoil drains. 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.

5.8 Stormwater

Public stormwater services have been installed within Arrans Hill Precinct 5, Stage 5. Stormwater and runoff from roofs, decks and paved areas, together with discharges from future retaining wall drains and other subsoil drainage 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 and Wastewater As–Built Plans (Woods Ref 37505–05–300–AB to –306–AB and –400–AB to –406–AB) are included in Appendix A.

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 Arrans Hill Precinct 5, Stage 5 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 a representative number of the Lots and these are shown on T+T Drawing 21854.0031–AHP5S5–122 attached in Appendix F. 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 Appendix D and Appendix E of this report.

In order to assess for the presence of expansive soils within these stages 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 F), the foundation soils on these stages of the subdivision lie outside the definition of 'good ground' as outlined in NZS 3604:2011 (Ref. [8]).

In terms of AS 2870:2011 (Ref. [7]) and based on experience, the soils present are considered to be Site Class H1 (highly expansive) with characteristic surface movements anticipated of approximately 40-60mm.

On this basis foundation design may be carried out in accordance with AS 2870 or in accordance with NZS 3604 provided that in this latter case the minimum foundation depth below cleared ground level following topsoil removal and benching of building platform areas is 750mm.

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. [7]) for assistance.

6 Statement of professional opinion as to the suitability of land for building development

I, Mr A.P. Stiles 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 Arrans Hill Precinct 5 Stage 5 (comprising residential Lots 54 to 78, and 174 to 195, Super Lot 803 , Reserve Lots 604 and 802 , and Road Lot 904 inclusive) of the Millwater Residential Subdivision Development off Arran Drive 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 investigations are described in Tonkin + Taylor Ltd Geotechnical Investigation Report for Arrans Hill Precinct 5 Ref. No. 21854.0031 dated December 2015. 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 F).

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 C. 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 37505, Millwater, Arrans Hill Precinct 5 Stage 5, Drawing Numbers 37505–05–100–AB, –110–AB to –112–AB and –120–AB, have been generally placed in compliance with NZS 4431:1989 (Ref. 6).

6.4.2 The completed earthworks give due regard to land slope and foundation stability considerations.

6.5 For Lots 54 to 78, 174 to 195, and Super Lot 803, 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 6.6.2 to 6.6.6.

6.5.2 Bearing capacity

Foundation design for these Lots should limit geotechnical ultimate bearing capacity to 300kPa (factored (ULS) 150kPa, working (SLS) 100kPa). This is as specified in NZS 3604:2011 (Ref. 8).

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. 8). Soils are considered to lie in within Site Class H1 (highly expansive) as defined in AS 2870:2011 (Ref. 7) with anticipated characteristic surface ground movements of 40-60mm. Clause 6.6.3.1 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 750mm 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. 7), 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 is 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 E.

6.5.6 Retaining walls / Earthworks

No earth cuts and/or retaining wall construction in excess of 1.5 metres height, and no earthworks involving fills in excess of 600mm depth, or fill below the influence zone of foundations, 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 54 to 58, 63 to 66, and 174 to 181 inclusive:

6.6.1 These Lots contain a "Building Limitation Zone" relating to the reinforced earth slopes which forms the 1 in 1.5 to 1 in 2 (V:H) slopes along the Lot boundaries. The Building Limitation Zone is shown on T+T Drawing 21854.0031–AHP5S5–120 in Appendix B. Excavation, filling and/or construction within this zone is not to be undertaken, to ensure stability of the slopes 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 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.

6.6.3 Design of the reinforced earth slopes have assumed a maximum distributed load of 10kPa (dead plus live loads) up to the edge of the Building Limitation Zone.

6.6.4 Any cut or fill walls greater than 1.5m retained height, or of any height within 2m of the Building Limitation Zone shown on T+T Drawing 21854.0031–AHP5S5–120 in Appendix B, will require a geotechnical assessment, as a minimum, to ensure stability of the subject or adjacent Lot is not detrimentally affected.

6.6.5 Development outside of the Building Limitation Zone may proceed in accordance with the recommendations outlined in Sections 6.5.

6.7 For Lots 65 to 78 inclusive:

6.7.1 These Lots contain a "Building Limitation Zone" relating to the slope stability along the Stage 5 western boundary and Palisade Wall 4. A Vegetated Reinforced Earthbatter constructed along the Lot boundaries. The Building Limitation Zone is shown on T+T Drawing 21854.0031–AHP5S5–120 in Appendix B. Excavation, filling and/or construction within this zone is not to be undertaken, to ensure stability of the slopes is not compromised.

6.7.2 Development outside of the Building Limitation Zone may proceed in accordance with the recommendations outlined in Sections 6.5.

6.7 Underfill (Subsoil) drainage

Underfill (Subsoil) drains have been installed during subdivisional development in the locations shown on the Woods Undercut And Subsoil Drain As–Built Plan (Woods Ref 37505–05–120–AB) in Appendix A, and on T+T Drawing 21854.0031–AHP5S5–102 in Appendix B. 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.

6.8 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 and sanitary sewer as–built plans are included in Appendix B.

6.9 Road and Access Lots

Based on the fill monitoring and site observations undertaken during site development, the filled and natural ground within Arrans Hill Precinct 5 Stage 5 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 Stage 5 development, within natural ground, a design CBR of 2% is considered appropriate, while within engineered fill areas, a design CBR of 7% is appropriate.

6.10 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.

This suitability statement relates to the general suitability of the site; it does not remove the need for specific site investigation, design and inspection as required by the Building Code, NZS 3604:2011 and NZS 4431:1989.

7 Applicability

This report has been prepared for the exclusive use of our client 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, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Report prepared by:

.....

James Smith

Engineering Geologist

Authorised for Tonkin & Taylor Ltd by:

.....

Andrew Stiles

Project Director

Report prepared by:

.....

Jason Kelly

Project Manager

JASM
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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., March 2013. Millwater – North South Link, North Bridge to Grand Drive, Geotechnical Investigation Report, T+T Ref. 21854.012.

5 Tonkin & Taylor Ltd., December 2015. Millwater Subdivision Arrans Hill – Precinct 5 – Geotechnical Investigation Report, T+T Ref. 21854.0031.

6 New Zealand Standards, 1989. NZS 4431:1989 Code of Practice for Earth Fill for Residential Development.

7 Standards Australia, 2011. AS 2870:2011 Residential slabs and footings.

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

Appendix A: Woods drawings

CLIENT:

COUNCIL:

MILLWATER - ARRAN HILL
STAGE 5
ASBUILTS DRAWINGS

December 2019

DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224C APPLICATION TO COUNCIL. WFH PROPERTIES LTD AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE.

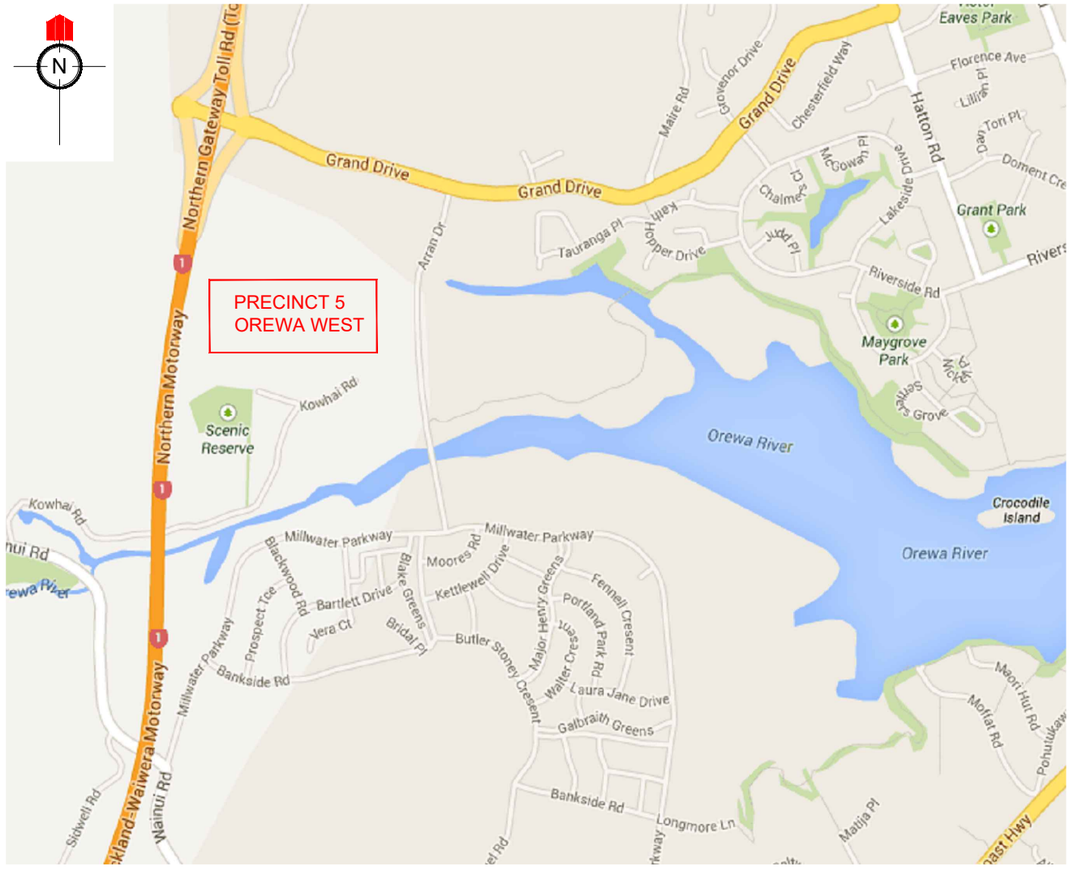
MILLWATER

WOODS
Engineers. Surveyors. Planners.
Urban Designers. Architects.

MILLWATER - ARRAN HILL
STAGE 5

CONTENT INDEX AND LOCALITY PLAN

SHEET NO.		SHEET TITLE
37505-05-	000	Plans Index and Location Plan
37505-05-	100	Final Contour Asbuilt Plan
37505-05-	110-112	Cut & Fill Asbuilt Original to Final Surface
37505-05-	120	Shear Key, Undercuts & Subsoil Drains Asbuilt Plan
37505-05-	123-124	Deadman
37505-05-	140	Slope Stabilisation Plan
37505-05-	200-203	Roading Asbuilt Plans
37505-05-	300-306	Stormwater Asbuilt Plans
37505-05-	400-406	Sanitary Sewer Asbuilt Plans
37505-05-	600-602	Watermain Asbuilt Plans



LOCATION PLAN

NOT TO SCALE

MILLWATER

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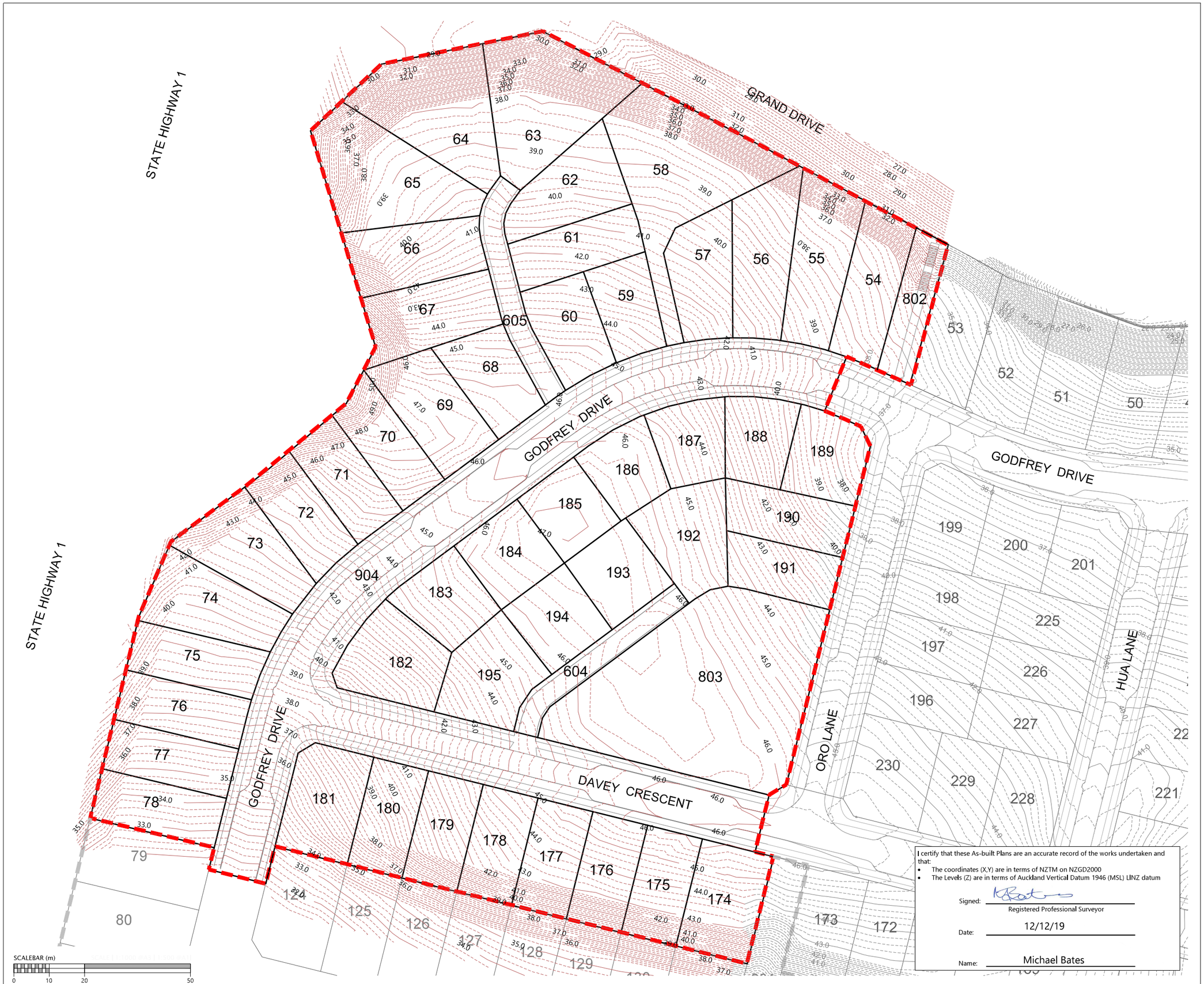
WFH PROPERTIES

WOODS
Engineers. Surveyors. Planners.
Urban Designers. Architects.



NOTES

1. NEW CONTOURS ARE AT 0.25m INTERVALS

LEGEND

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

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	12/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

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: 12/12/19

Name: Michael Bates

ARRAN HILL PRECINCT 5 STAGE 5

FINAL CONTOUR
ASBUILT PLAN
SHEET 1 OF 1

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-100-AB	

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WOODS
EST.1970

STATE HIGHWAY 1

GRAND DRIVE

GODFREY DRIVE

DAVEY CRESCENT

ORO LANE

HUA LANE

SCALEBAR (m)
0 10 20 50

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- ZERO CONTOUR
- CUT CONTOUR
- FILL CONTOUR
- STAGE BOUNDARIES
- LOT BOUNDARIES

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	12/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

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WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

CUT & FILL AS-BUILT
ORIGINAL TO LOWEST SURFACE

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

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Signed: _____
Registered Professional Surveyor

Date: 12/12/19

Name: Michael Bates

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
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DWG NO	37505-05-110-AB	

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WOODS
EST.1970

STATE HIGHWAY 1

GRAND DRIVE

GODFREY DRIVE

DAVEY CRESCENT

ORO LANE

HUA LANE

64 63 62 61 58 57 56 55 54 802 53 52 51 50
65 66 67 605 60 59
68 69 70 71 72 73 74 75 76 77 78 79 80
904 183 184 185 186 187 188 189 190 191 192 193 194 195 604 803 182 181 180 179 178 177 176 175 174 173 124 125 126 127 129
199 200 201 198 225 197 226 196 227 230 229 228

SCALEBAR (m)
0 10 20 50

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- ZERO CONTOUR
- CUT CONTOUR
- FILL CONTOUR
- STAGE BOUNDARIES
- LOT BOUNDARIES

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	12/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

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WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

CUT & FILL AS-BUILT LOWEST TO FINAL SURFACE

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: 12/12/19

Name: Michael Bates

STATUS	AS-BUILT	REV
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COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-111-AB	

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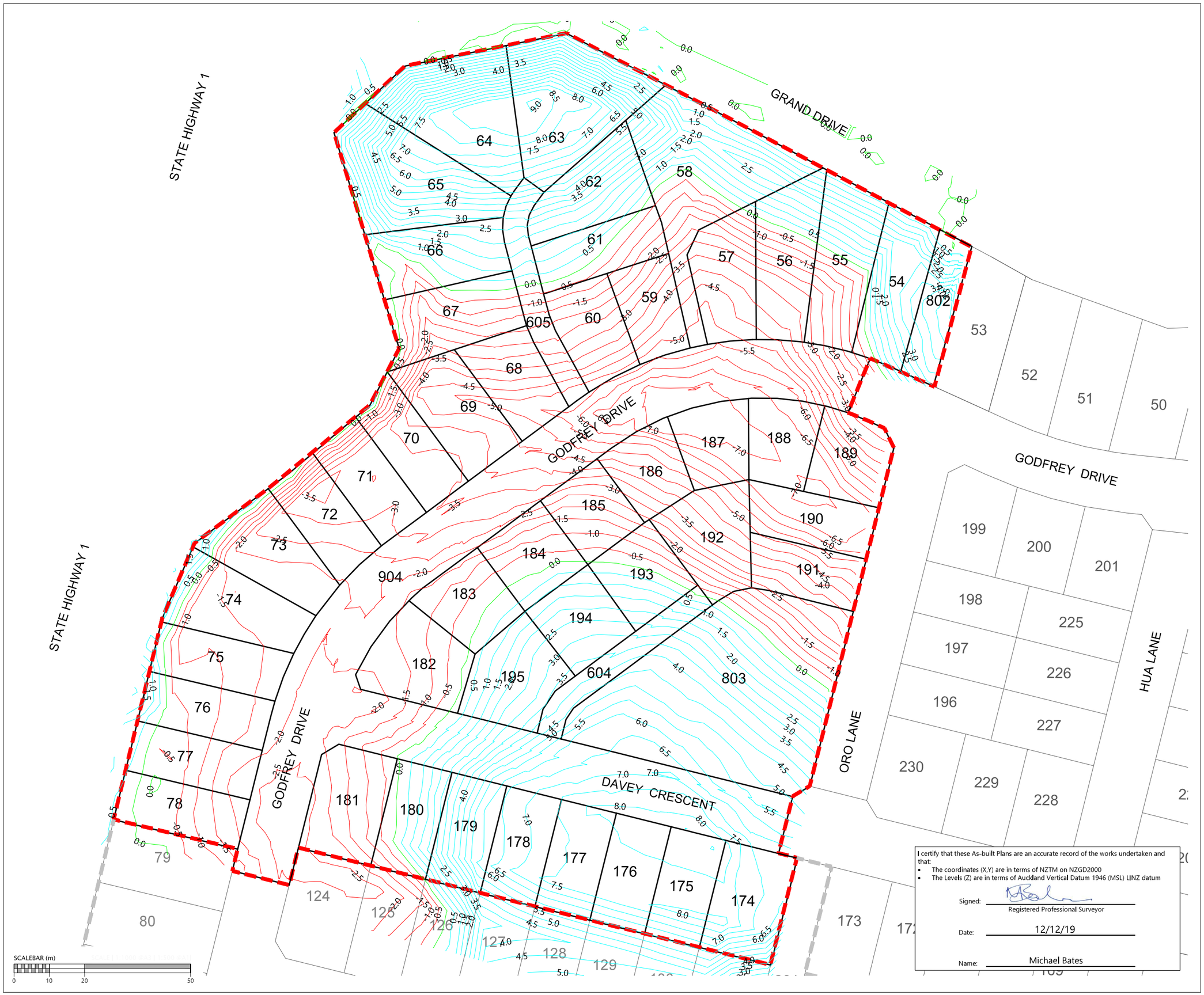

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS

LEGEND

- ZERO CONTOUR
- CUT CONTOUR
- FILL CONTOUR
- STAGE BOUNDARIES
- LOT BOUNDARIES

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	12/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

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

Signed: _____ Registered Professional Surveyor

Date: 12/12/19

Name: Michael Bates

ARRAN HILL PRECINCT 5 STAGE 5

CUT & FILL AS-BUILT ORIGINAL TO FINAL SURFACE

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-112-AB	

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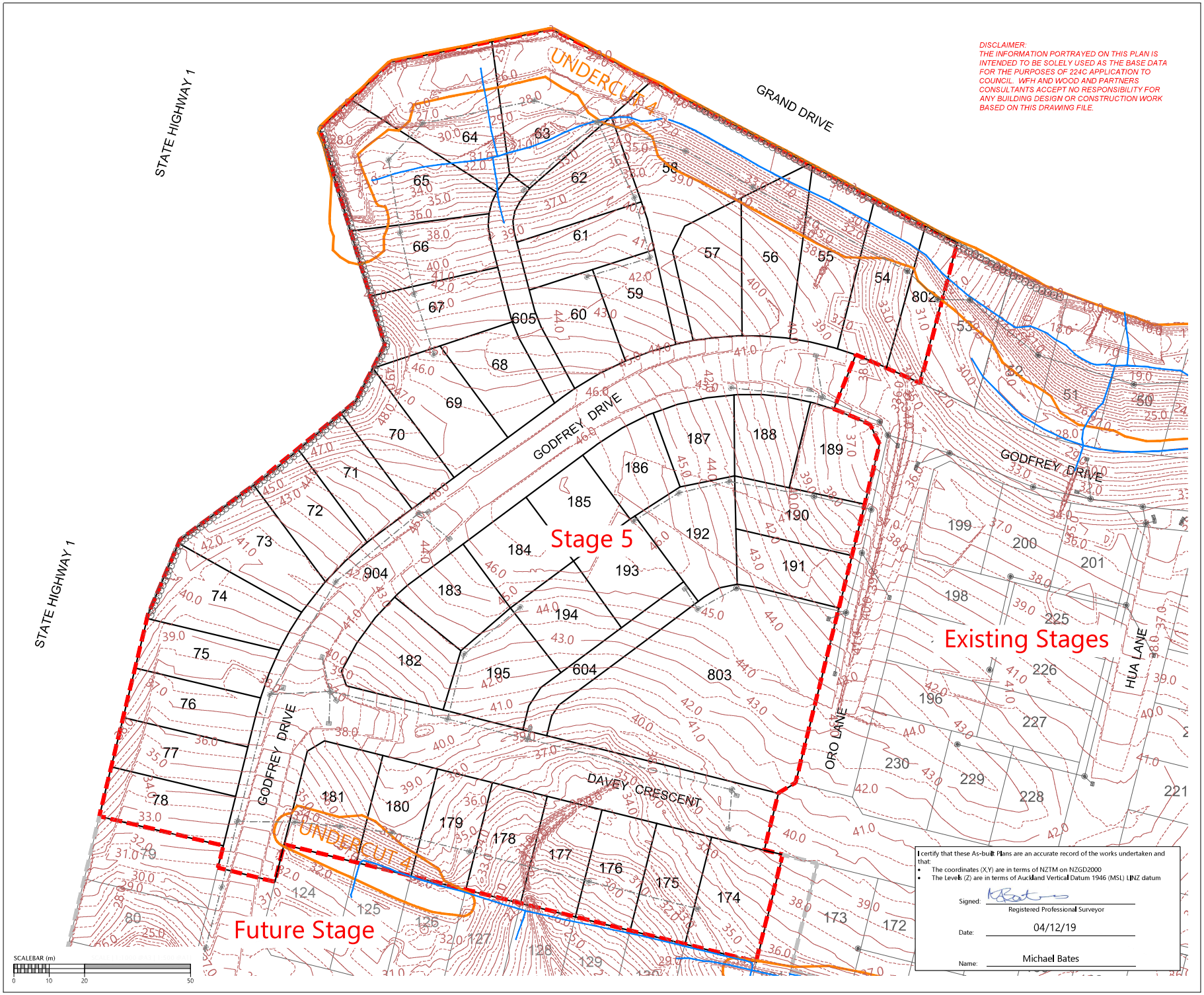

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WOODS
EST.1970

NOTES

1. CONTOURS ARE AT 0.5 METRE INTERVALS
2. SUBSOIL DATA SUPPLIED BY CONTRACTOR

LEGEND

- NOVACOIL 150Ø SUBSOIL DRAINS
- UPVC 150Ø SUBSOIL DRAINS
- EXISTING STORMWATER DRAINAGE
- NEW STORMWATER DRAINAGE
- STAGE BOUNDARIES
- LOT BOUNDARIES
- CONTOURS
- SHEAR KEY & UNDERCUT AREAS
- PALISADE WALL PILE AT BOTTOM OF SHEARKEY

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	04/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

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: 04/12/19

Name: Michael Bates

ARRAN HILL PRECINCT 5 STAGE 5

SHEAR KEY, UNDERCUT AND SUBSOIL DRAIN ASBUILT SHEET 1 OF 1

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-120-AB	

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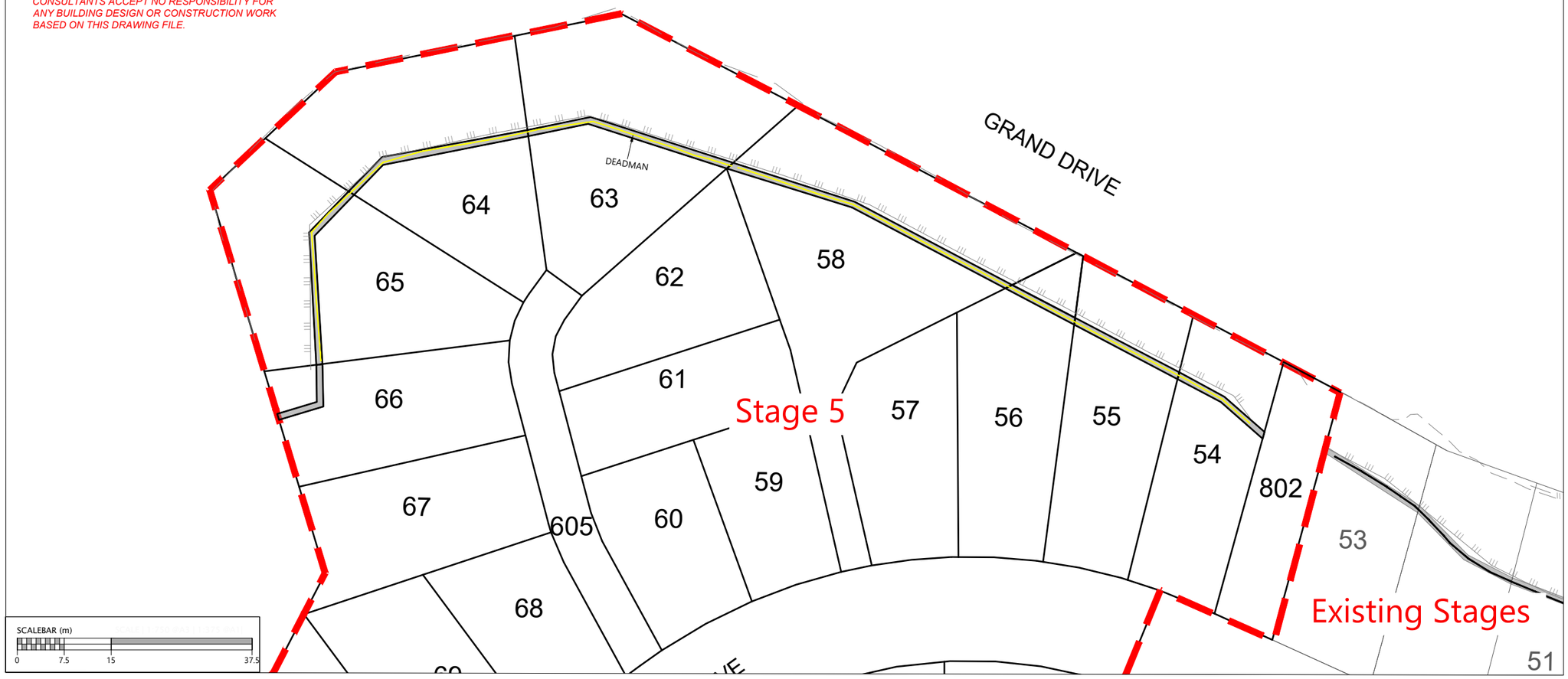
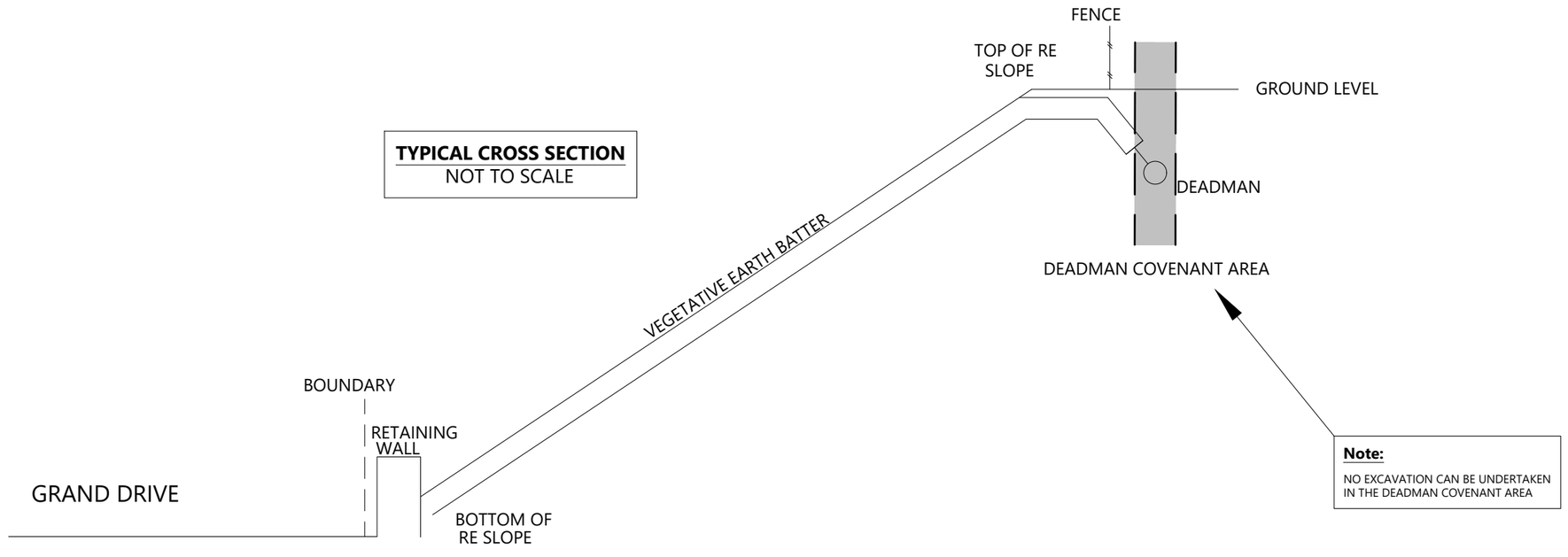


TYPICAL CROSS SECTION
NOT TO SCALE



Note:
NO EXCAVATION CAN BE UNDERTAKEN IN THE DEADMAN COVENANT AREA

WOODS
EST.1970

LEGEND:

- BOUNDARY
- DEADMAN COVENANT AREA
- TOP OF BANK
- FENCE
- STAGE EXTENTS
- DEADMAN

NOTES:
1. *DEADMAN LOCATION PROVIDED BY CONTRACTOR. LOT OWNER TO LOCATE AND PROTECT DEADMAN POSITION PRIOR TO ANY WORKS.*
2. *THE DIMENSIONS PROVIDED ARE A BEST FIT APPROXIMATION BASED ON LOCATIONS PROVIDED BY THE CONTRACTOR.*
3. *TITLE DIMENSIONS ARE SOURCED FROM DP 534851 - SEE CRF FOR CONFIRMATION OF DIMENSIONS.*

DISCLAIMER:
THIS DRAWING IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF THE CLIENT. WOODS ACCEPT NO RESPONSIBILITY FOR ANY SUBSEQUENT WORKS CARRIED OUT IN THIS AREA.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	05/12/19

SURVEYED	CONTRACTOR	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

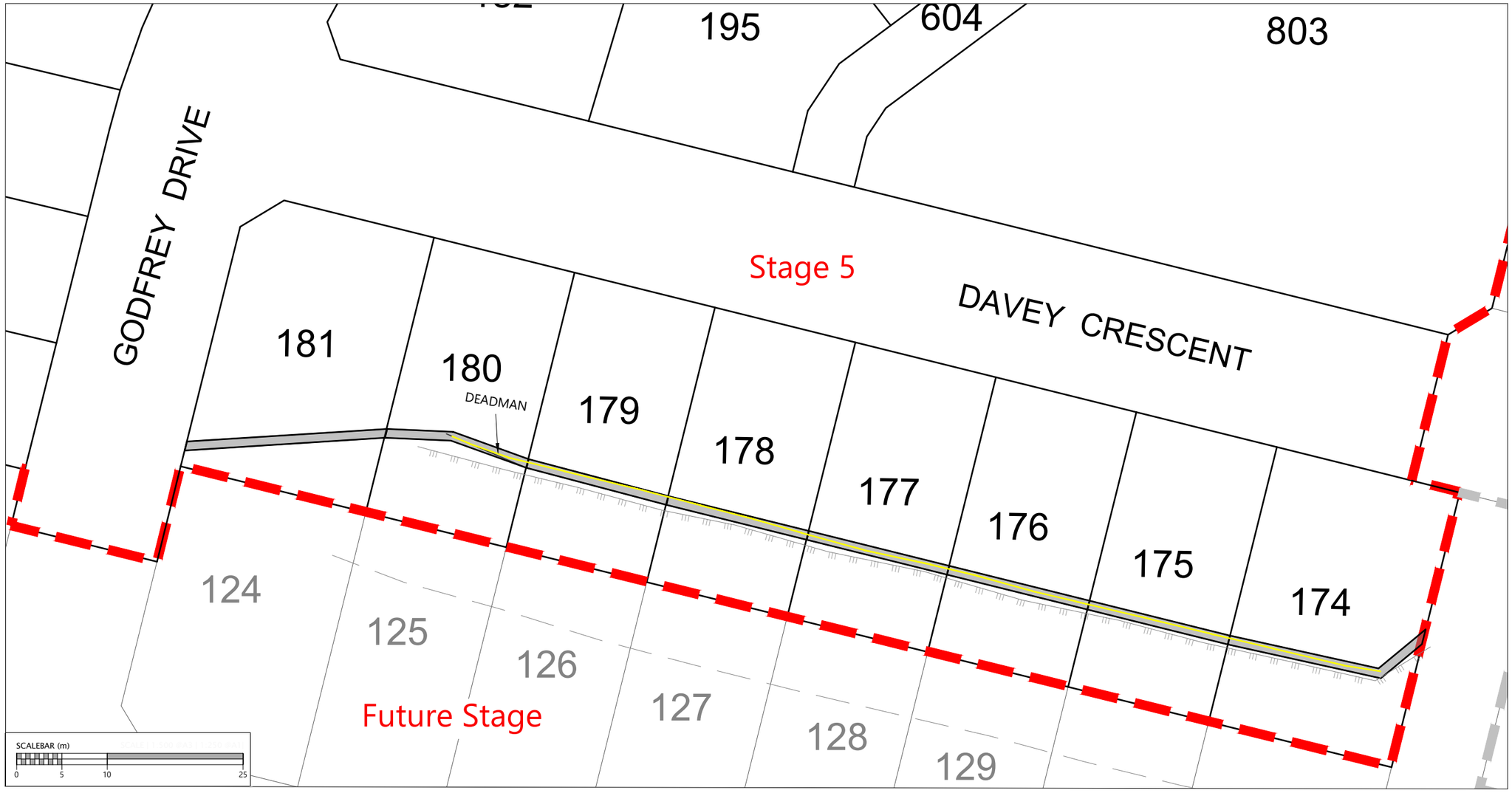
WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

DEADMAN COVENENT DIAGRAM
SHEET 1 OF 2

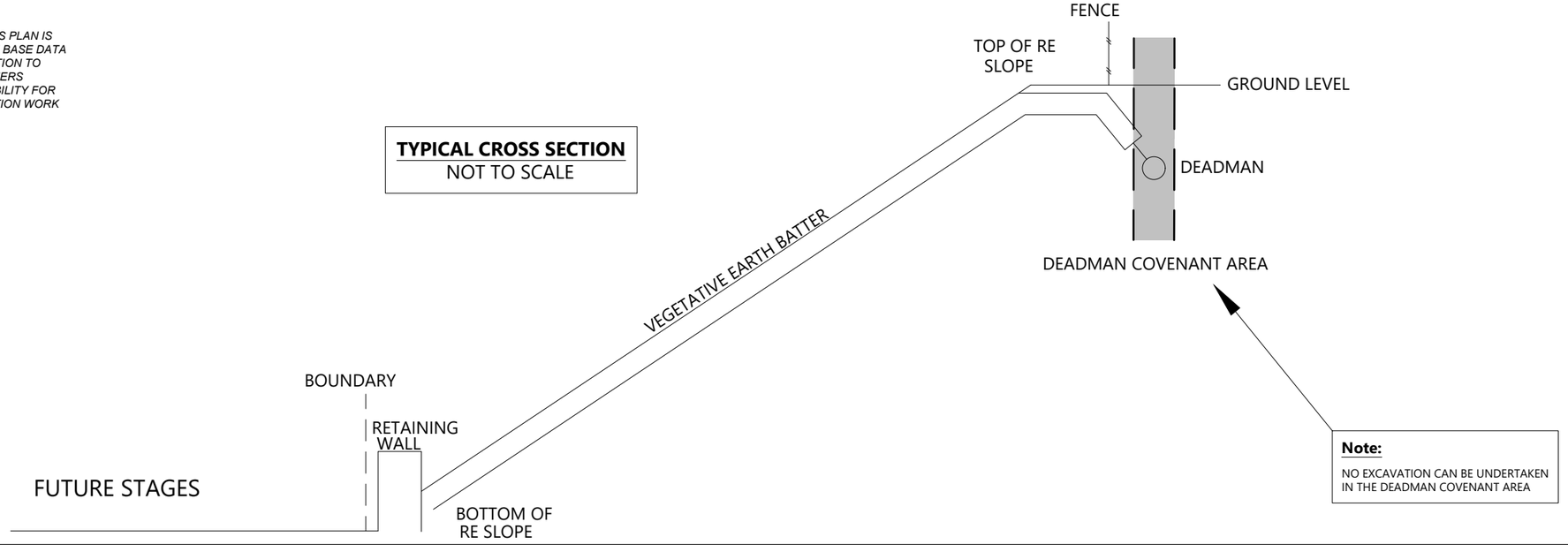
STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-123-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_PS_05_DEADMAN.DWG



DISCLAIMER:
THE INFORMATION PORTRAYED ON THIS PLAN IS INTENDED TO BE SOLELY USED AS THE BASE DATA FOR THE PURPOSES OF 224C APPLICATION TO COUNCIL. WFH AND WOOD AND PARTNERS CONSULTANTS ACCEPT NO RESPONSIBILITY FOR ANY BUILDING DESIGN OR CONSTRUCTION WORK BASED ON THIS DRAWING FILE.

TYPICAL CROSS SECTION
NOT TO SCALE



Note:
NO EXCAVATION CAN BE UNDERTAKEN IN THE DEADMAN COVENANT AREA

WOODS
EST.1970

LEGEND:

- BOUNDARY
- DEADMAN COVENANT AREA
- TOP OF BANK
- FENCE
- STAGE EXTENTS
- DEADMAN

NOTES:
1. *DEADMAN LOCATION PROVIDED BY CONTRACTOR. LOT OWNER TO LOCATE AND PROTECT DEADMAN POSITION PRIOR TO ANY WORKS.*
2. *THE DIMENSIONS PROVIDED ARE A BEST FIT APPROXIMATION BASED ON LOCATIONS PROVIDED BY THE CONTRACTOR.*
3. *TITLE DIMENSIONS ARE SOURCED FROM DP 534851 - SEE CRF FOR CONFIRMATION OF DIMENSIONS.*

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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	05/12/19

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DESIGNED	T&T	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

DEADMAN COVENENT DIAGRAM
SHEET 2 OF 2

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-124-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_DEADMAN.DWG

LEGEND:

- BOUNDARY
- SLOPE STABILISATION DEVICE
- TOP OF BANK
- BOTTOM OF BANK
- FENCE
- TOP OF WALL
- BOTTOM OF WALL

NOTES:

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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	05/12/19
2	FENCES ADDED	SK	12/12/19

SURVEYED	CONTRACTOR	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	T&T	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

REINFORCED EARTH BATTER, SLOPE STABILISATION & RETAINING WALL PLAN

STATUS	ASBUILT	REV
SCALE	1:1000 @ A3	2
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-140-AB	

DISCLAIMER:
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SCALEBAR (m)
0 10 20 50

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

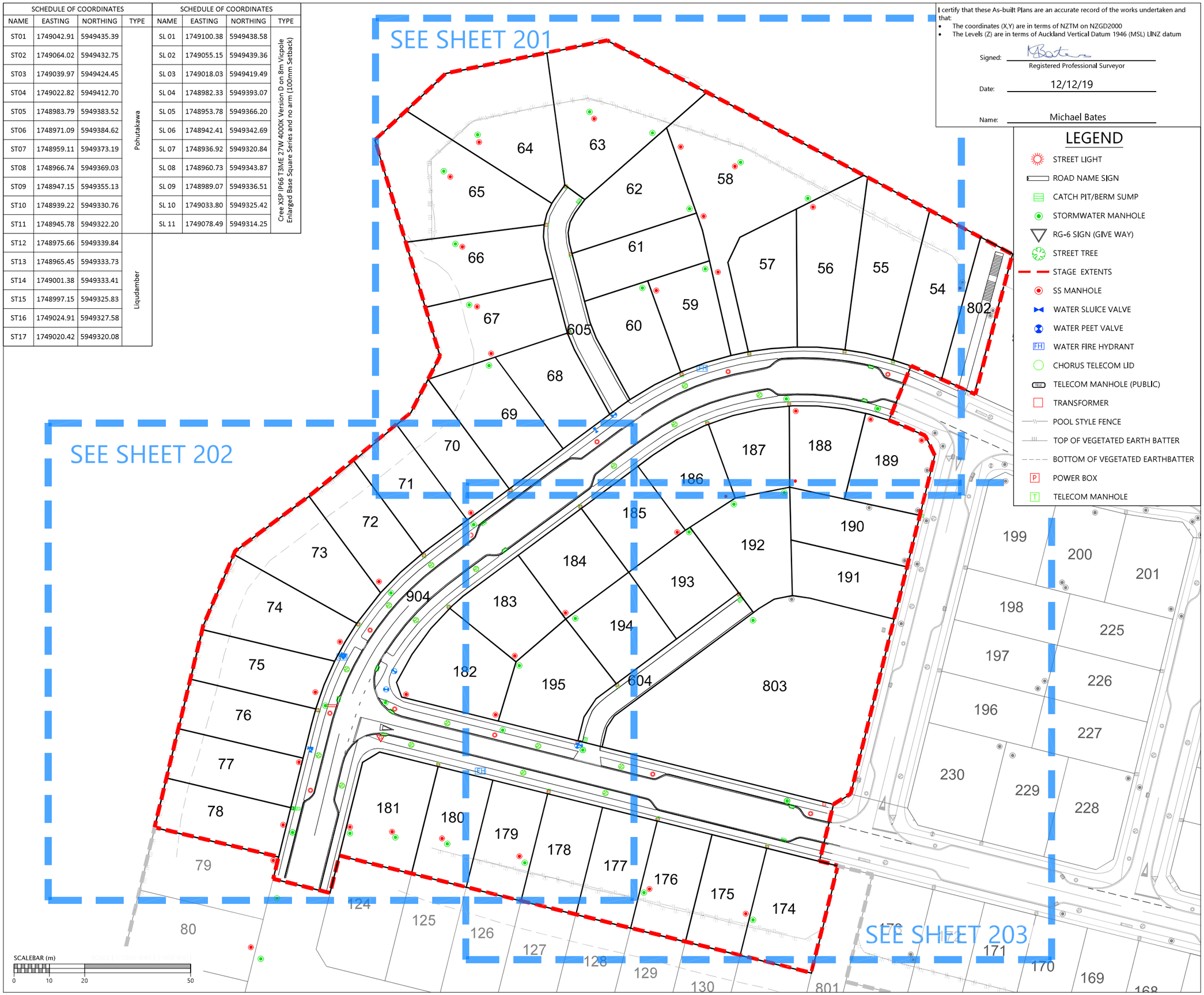
- The coordinates (X,Y) are in terms of NZTM on NZGD2000
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: KBates
Registered Professional Surveyor
Date: 12/12/19
Name: Michael Bates

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_RE SLOPE.DWG

SCHEDULE OF COORDINATES			
NAME	EASTING	NORTHING	TYPE
ST01	1749042.91	5949435.39	Pohutakawa
ST02	1749064.02	5949432.75	
ST03	1749039.97	5949424.45	
ST04	1749022.82	5949412.70	
ST05	1748983.79	5949383.52	
ST06	1748971.09	5949384.62	
ST07	1748959.11	5949373.19	
ST08	1748966.74	5949369.03	
ST09	1748947.15	5949355.13	
ST10	1748939.22	5949330.76	
ST11	1748945.78	5949322.20	
ST12	1748975.66	5949339.84	Liquidamber
ST13	1748965.45	5949333.73	
ST14	1749001.38	5949333.41	
ST15	1748997.15	5949325.83	
ST16	1749024.91	5949327.58	
ST17	1749020.42	5949320.08	

SCHEDULE OF COORDINATES				
NAME	EASTING	NORTHING	TYPE	
SL 01	1749100.38	5949438.58	Cree XSP IP66 T3ME 27W 4000K Version D on 8m Vicpole Enlarged Base Square Series and no arm (100mm Setback)	
SL 02	1749055.15	5949439.36		
SL 03	1749018.03	5949419.49		
SL 04	1748982.33	5949393.07		
SL 05	1748953.78	5949366.20		
SL 06	1748942.41	5949342.69		
SL 07	1748936.92	5949320.84		
SL 08	1748960.73	5949343.87		
SL 09	1748989.07	5949336.51		
SL 10	1749033.80	5949325.42		
SL 11	1749078.49	5949314.25		



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

Signed: _____
Registered Professional Surveyor

Date: 12/12/19

Name: Michael Bates

LEGEND

- STREET LIGHT
- ROAD NAME SIGN
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- RG-6 SIGN (GIVE WAY)
- STREET TREE
- STAGE EXTENTS
- SS MANHOLE
- WATER SLUICE VALVE
- WATER PEET VALVE
- WATER FIRE HYDRANT
- CHORUS TELECOM LID
- TELECOM MANHOLE (PUBLIC)
- TRANSFORMER
- POOL STYLE FENCE
- TOP OF VEGETATED EARTH BATTER
- BOTTOM OF VEGETATED EARTHBATTER
- POWER BOX
- TELECOM MANHOLE

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION ISSUE NOV 2005.
2. ALL ROADS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH APPROVED ENGINEERING PLANS.
3. ALL FINISHED ROAD SURFACES ARE ASHPHALT CONCRETE 30mm THICK.
4. ALL FOOTPATHS ARE 100mm THICK BRUSHED CONCRETE OR EXPOSED AGGREGATE AS NOTED.
5. ALL PIPE CROSSINGS UNDER ROADS HAVE BEEN HARDFILL BACKFILLED.
6. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY DATA AND CONTRACTOR RECEIVED DATA.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	12/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

ROADING AS-BUILT
OVERALL LAYOUT
SHEET 1 OF 4

STATUS	AS-BUILT	REV
SCALE	1:1000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-200-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_ROADING PLANS.DWG

SCHEDULE OF COORDINATES			
NAME	EASTING	NORTHING	TYPE
SL 01	1749100.38	5949438.58	Cree XSP IP66 T3ME 27W 4000K Version D on 8m Vicpole Enlarged Base Square Series and no arm (100mm Setback)
SL 02	1749055.15	5949439.36	
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SL 08	1748960.73	5949343.87	
SL 09	1748989.07	5949336.51	
SL 10	1749033.80	5949325.42	
SL 11	1749078.49	5949314.25	

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

Signed: _____
Registered Professional Surveyor

Date: 12/12/19

Name: Michael Bates

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ST17	1749020.42	5949320.08	

NOTES

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4. ALL FOOTPATHS ARE 100mm THICK BRUSHED CONCRETE OR EXPOSED AGGREGATE AS NOTED.
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LEGEND

- STREET LIGHT
- ROAD NAME SIGN
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- RG-6 SIGN (GIVE WAY)
- STREET TREE
- STAGE EXTENTS
- SS MANHOLE
- WATER SLUICE VALVE
- WATER PEET VALVE
- WATER FIRE HYDRANT
- CHORUS TELECOM LID
- TELECOM MANHOLE (PUBLIC)
- TRANSFORMER
- POOL STYLE FENCE
- TOP OF VEGETATED EARTH BATTER
- BOTTOM OF VEGETATED EARTHBATTER
- POWER BOX
- TELECOM MANHOLE

SCALEBAR (m)
0 5 10 25

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	12/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

ROADING AS-BUILT
SHEET 2 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-201-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_ROADING PLANS.DWG

SCHEDULE OF COORDINATES			
NAME	EASTING	NORTHING	TYPE
ST01	1749042.91	5949435.39	Pohutakawa
ST02	1749064.02	5949432.75	
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LEGEND

- STREET LIGHT
- ROAD NAME SIGN
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- RG-6 SIGN (GIVE WAY)
- STREET TREE
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- WATER SLUICE VALVE
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- TRANSFORMER
- POOL STYLE FENCE
- TOP OF VEGETATED EARTH BATTER
- BOTTOM OF VEGETATED EARTHBATTER
- POWER BOX
- TELECOM MANHOLE

SCALEBAR (m)

0 5 10 25

NOTES

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Signed: _____ Registered Professional Surveyor

Date: 12/12/19

Name: Michael Bates

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	12/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

ROADING AS-BUILT
SHEET 3 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-202-AB	

Document No. K\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_ROADING PLANS.DWG

LEGEND

- STREET LIGHT
- ROAD NAME SIGN
- CATCH PIT/BERM SUMP
- STORMWATER MANHOLE
- RG-6 SIGN (GIVE WAY)
- STREET TREE
- STAGE EXTENTS
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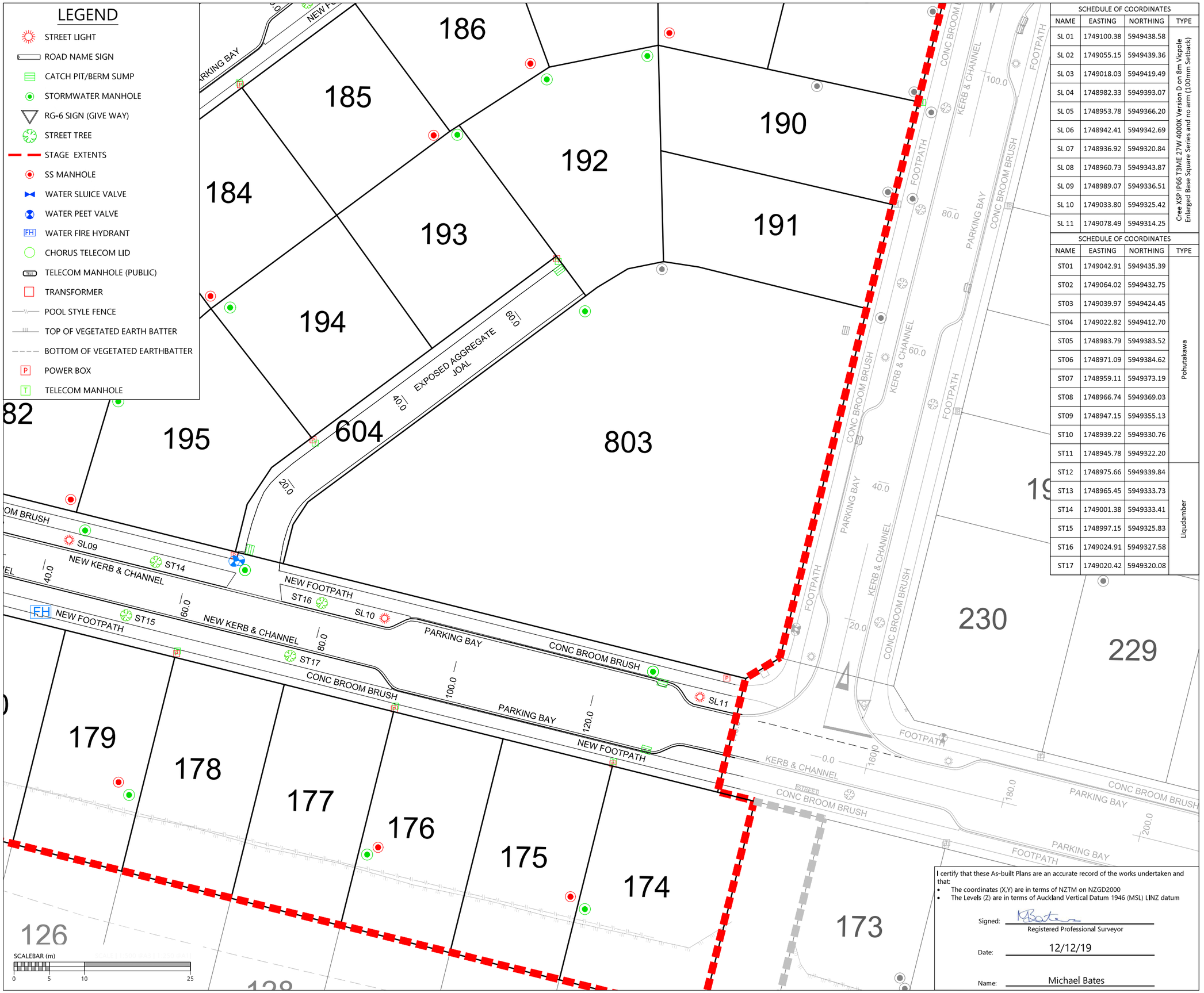

SCHEDULE OF COORDINATES

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ST15	1748997.15	5949325.83	
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Signed: _____ Registered Professional Surveyor

Date: 12/12/19

Name: Michael Bates

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	12/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

ROADING AS-BUILT
SHEET 4 OF 4

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-203-AB	

Document No. K\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_ROADING PLANS.DWG

SCHEDULE OF COORDINATES		
STORMWATER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 54	1749120.17	5949463.93
Lot 55	1749107.22	5949471.17
Lot 56	1749090.83	5949480.29
Lot 57	1749073.01	5949483.91
Lot 58	1749075.21	5949488.02
Lot 59	1749049.18	5949466.12
Lot 60	1749029.45	5949461.98
Lot 61	1749044.43	5949481.53
Lot 62	1749034.95	5949502.96
Lot 63	1749016.18	5949511.32
Lot 64	1748985.28	5949505.35
Lot 65	1748976.04	5949495.48
Lot 66	1748979.19	5949475.55
Lot 67	1748983.24	5949458.59
Lot 68	1748991.64	5949441.54
Lot 69	1748988.17	5949439.59
Lot 70	1748981.16	5949399.35
Lot 71	1748970.09	5949391.48
Lot 72	1748957.35	5949379.93
Lot 73	1748950.38	5949371.79
Lot 74	1748943.30	5949360.29
Lot 75	1748936.71	5949347.02
Lot 76	1748934.09	5949333.26
Lot 77	1748930.34	5949318.44
Lot 78	1748926.59	5949305.37
Lot 174	1749062.68	5949286.15
Lot 175	1749047.18	5949289.31
Lot 176	1749032.35	5949293.72
Lot 177	1749015.95	5949297.02
Lot 178	1749000.09	5949300.82
Lot 179	1748984.48	5949304.80
Lot 180	1748969.75	5949307.99
Lot 181	1748949.43	5949310.53
Lot 182	1748963.54	5949349.43
Lot 183	1748993.11	5949359.48
Lot 184	1749010.03	5949374.02
Lot 185	1749040.78	5949395.33
Lot 186	1749054.55	5949405.56
Lot 187	1749071.36	5949428.17
Lot 188	1749091.66	5949426.16
Lot 192	1749070.70	5949402.98
Lot 193	1749043.91	5949391.86
Lot 194	1749013.54	5949368.33
Lot 195	1748993.28	5949341.77

THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGES CONSTRUCTION		
Lot 189	1749108.54	5949419.91
Lot 190	1749107.73	5949397.52
Lot 191	1749105.20	5949384.78
THE FOLLOWING CONNECTIONS ARE TO SERVE LOTS IN FUTURE STAGES		
Lot 80	1748917.76	5949268.57
Lot 81	1748912.80	5949250.09
Lot 82	1748910.37	5949235.17
Lot 83	1748904.76	5949217.02
Lot 84	1748907.07	5949198.64
Lot 87	1749220.16	5949119.48
Lot 88	1749203.88	5949122.97
Lot 89	1749188.72	5949126.52
Lot 90	1749172.85	5949129.96
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Lot 93	1749124.25	5949142.09
Lot 94	1749108.92	5949145.75
Lot 95	1749092.56	5949149.74
Lot 96	1749077.20	5949153.75
Lot 97	1749050.55	5949160.60
Lot 98	1749030.60	5949165.38
Lot 99	1749015.21	5949169.19
Lot 100	1749000.18	5949173.09
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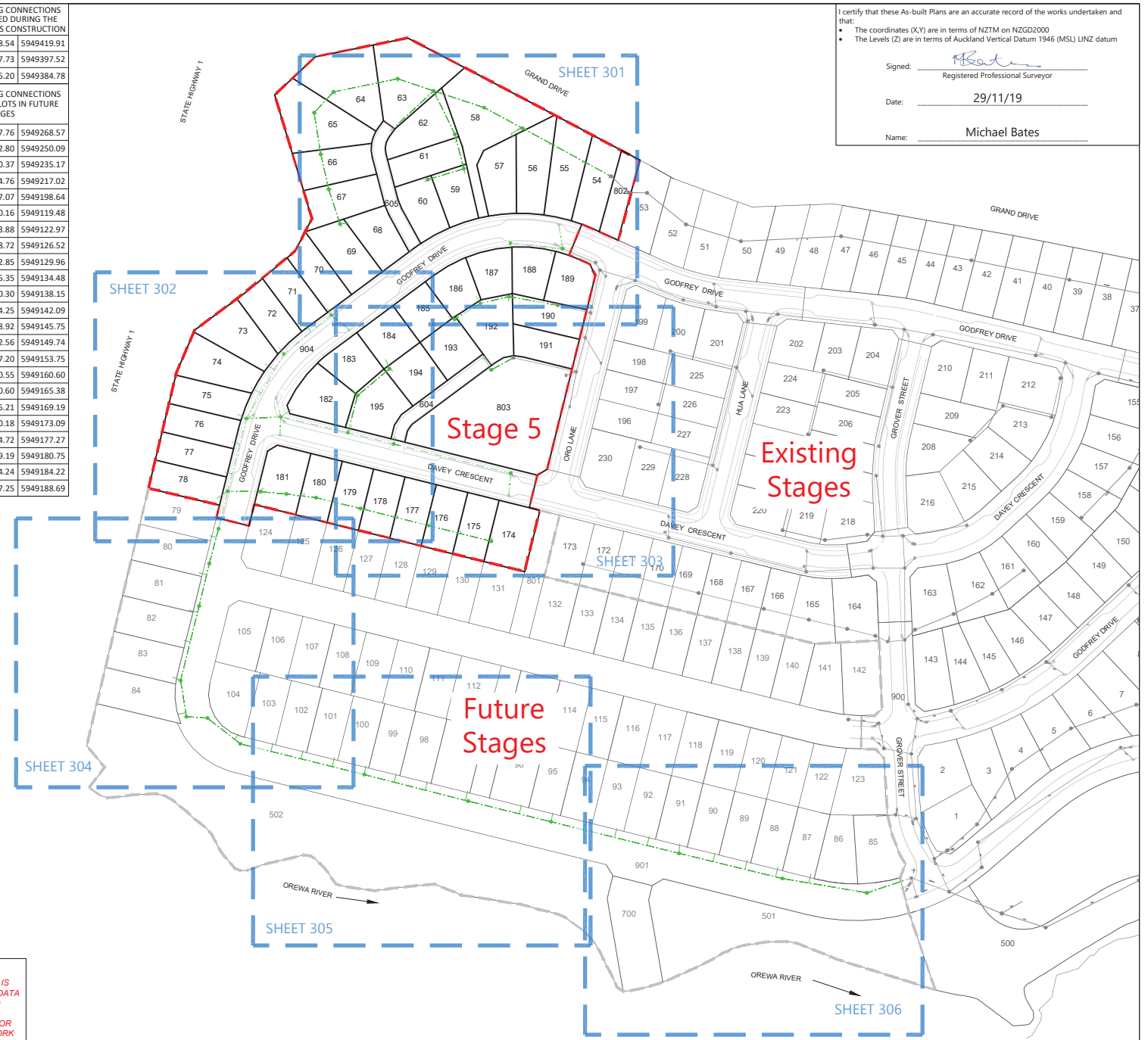
Lot 102	1748969.19	5949180.75
Lot 103	1748954.24	5949184.22
Lot 104	1748937.25	5949188.69



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

Signed: _____ Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL PIPE BEDDING COMPLIES WITH AC STANDARDS
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6. ALL PRIVATE DRAINAGE CONNECTIONS ARE 100mmø.
7. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

STORMWATER AS-BUILT OVERALL LAYOUT SHEET 1 OF 7

STATUS	AS-BUILT	REV
SCALE	1:2000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-300-AB	

DISCLAIMER:
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SCALEBAR (m)
0 20 40 100

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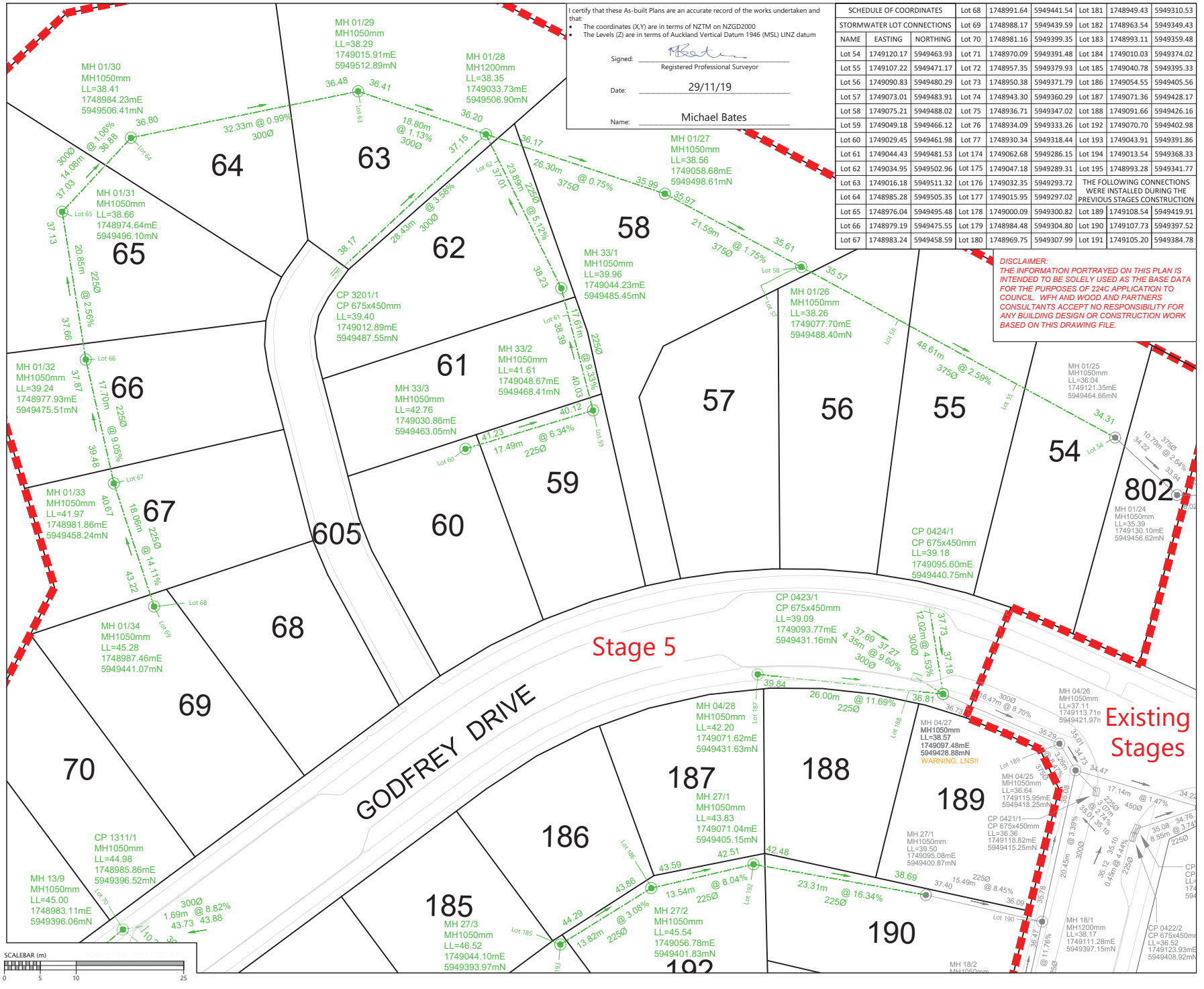

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Signed: _____
Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates

SCHEDULE OF COORDINATES			Lot 68	1748991.64	5949441.54	Lot 181	1748949.43	5949310.53
STORMWATER LOT CONNECTIONS			Lot 69	1748988.17	5949439.59	Lot 182	1748963.54	5949349.43
NAME	EASTING	NORTHING	Lot 70	1748981.16	5949399.35	Lot 183	1748993.11	5949359.48
Lot 54	1749120.17	5949463.93	Lot 71	1748970.09	5949391.48	Lot 184	1749010.03	5949374.02
Lot 55	1749107.22	5949471.17	Lot 72	1748957.35	5949379.93	Lot 185	1749040.78	5949395.33
Lot 56	1749090.83	5949480.29	Lot 73	1748950.38	5949371.79	Lot 186	1749054.55	5949405.56
Lot 57	1749073.01	5949483.91	Lot 74	1748943.30	5949360.29	Lot 187	1749071.36	5949428.17
Lot 58	1749075.21	5949488.02	Lot 75	1748936.71	5949347.02	Lot 188	1749091.66	5949426.16
Lot 59	1749049.18	5949466.12	Lot 76	1748934.09	5949333.26	Lot 192	1749070.70	5949402.98
Lot 60	1749029.45	5949461.98	Lot 77	1748930.34	5949318.44	Lot 193	1749043.91	5949391.86
Lot 61	1749044.43	5949481.53	Lot 174	1749062.68	5949286.15	Lot 194	1749013.54	5949368.33
Lot 62	1749034.95	5949502.96	Lot 175	1749047.18	5949289.31	Lot 195	1748993.28	5949341.77
Lot 63	1749016.18	5949511.32	Lot 176	1749032.35	5949293.72	THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGES CONSTRUCTION		
Lot 64	1748985.28	5949505.35	Lot 177	1749015.95	5949297.02			
Lot 65	1748976.04	5949495.48	Lot 178	1749000.09	5949300.82	Lot 189	1749108.54	5949419.91
Lot 66	1748979.19	5949475.55	Lot 179	1748984.48	5949304.80	Lot 190	1749107.73	5949397.52
Lot 67	1748983.24	5949458.59	Lot 180	1748969.75	5949307.99	Lot 191	1749105.20	5949384.78

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LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

NOTES

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REVISION DETAILS		BY	DATE
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DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

STORMWATER AS-BUILT SHEET 2 OF 7

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-301-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_STORMWATER.DWG

SCHEDULE OF COORDINATES		
STORMWATER LOT CONNECTIONS		
NAME	EASTING	NORTHING
Lot 54	1749120.17	5949463.93
Lot 55	1749107.22	5949471.17
Lot 56	1749090.83	5949480.29
Lot 57	1749073.01	5949483.91
Lot 58	1749075.21	5949488.02
Lot 59	1749049.18	5949466.12
Lot 60	1749029.45	5949461.98
Lot 61	1749044.43	5949481.53
Lot 62	1749034.95	5949502.96
Lot 63	1749016.18	5949511.32
Lot 64	1748985.28	5949505.35
Lot 65	1748976.04	5949495.48
Lot 66	1748979.19	5949475.55
Lot 67	1748983.24	5949458.59
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Lot 70	1748981.16	5949399.35
Lot 71	1748970.09	5949391.48
Lot 72	1748957.35	5949379.93
Lot 73	1748950.38	5949371.79
Lot 74	1748943.30	5949360.29
Lot 75	1748936.71	5949347.02
Lot 76	1748934.09	5949333.26
Lot 77	1748930.34	5949318.44
Lot 78	1748926.59	5949305.37
Lot 174	1749062.68	5949286.15
Lot 175	1749047.18	5949289.31
Lot 176	1749032.35	5949293.72
Lot 177	1749015.95	5949297.02
Lot 178	1749000.09	5949300.82
Lot 179	1748984.48	5949304.80
Lot 180	1748969.75	5949307.99
Lot 181	1748949.43	5949310.53
Lot 182	1748963.54	5949349.43
Lot 183	1748993.11	5949359.48
Lot 184	1749010.03	5949374.02
Lot 185	1749040.78	5949395.33
Lot 186	1749054.55	5949405.56
Lot 187	1749071.36	5949428.17
Lot 188	1749091.66	5949426.16
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Lot 190	1749107.73	5949397.52
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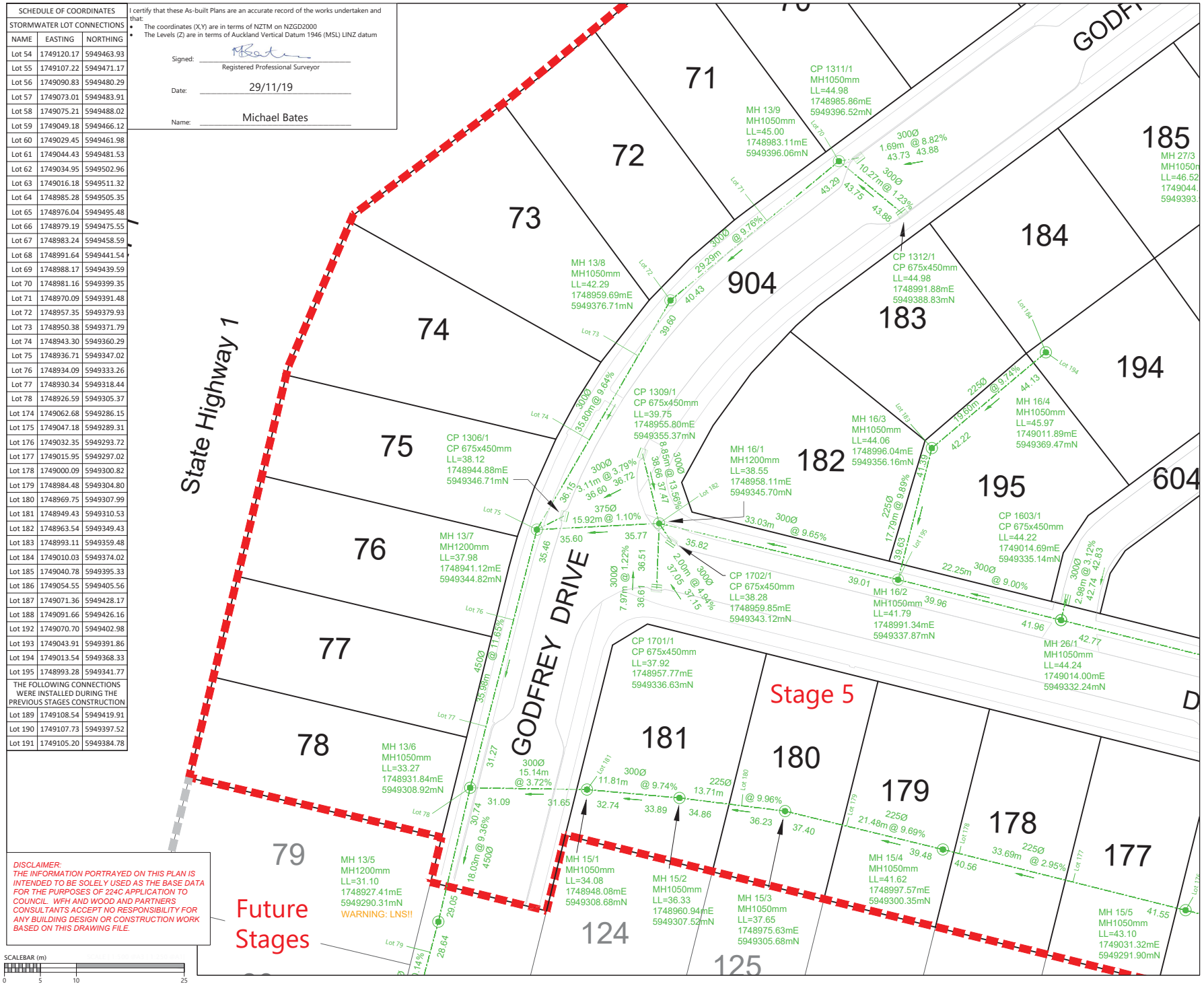
Signed: _____
Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates



SCALEBAR (m)
0 5 10 25

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WOODS
EST.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

NOTES

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DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

STORMWATER AS-BUILT
SHEET 3 OF 7

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-302-AB	

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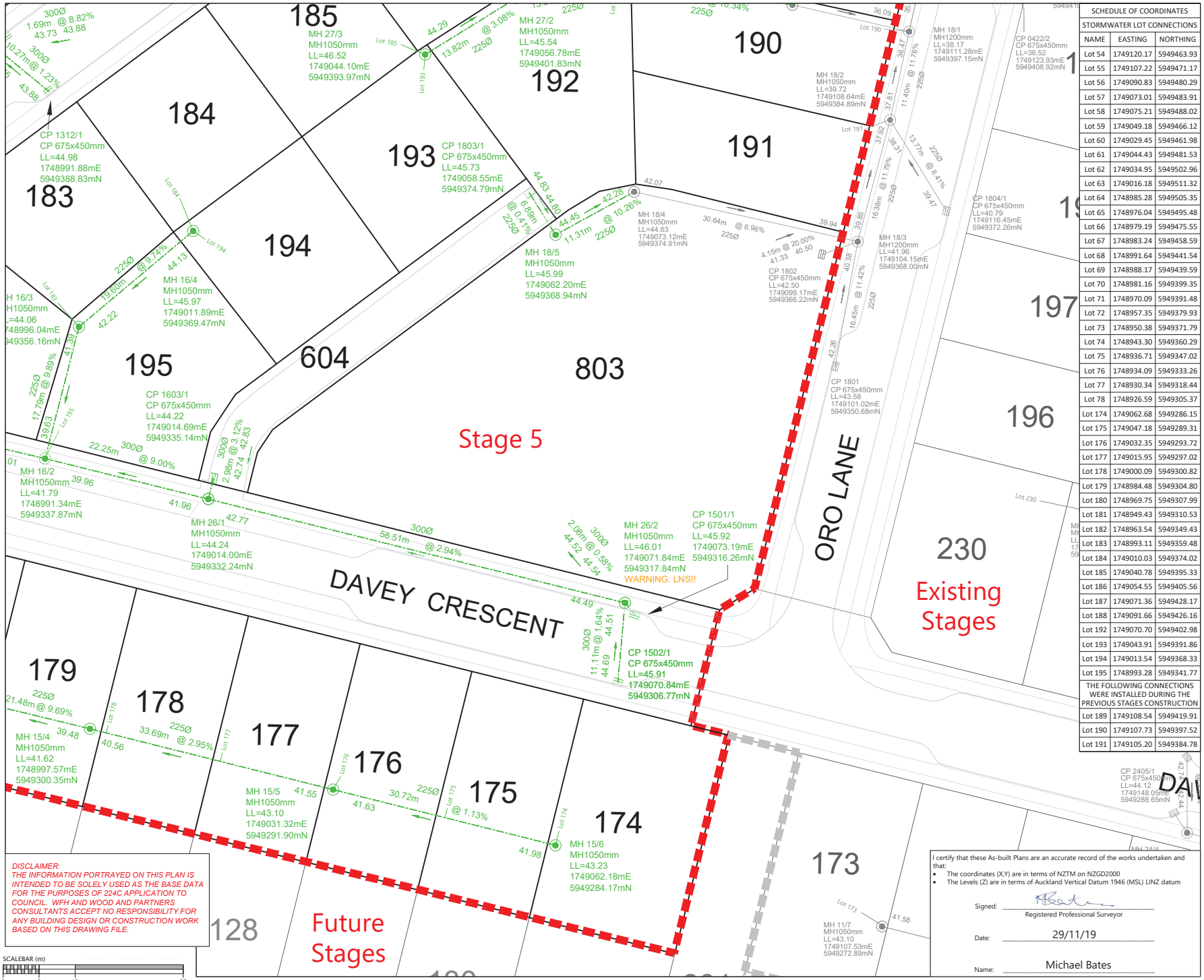

SCHEDULE OF COORDINATES		
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NAME	EASTING	NORTHING
Lot 54	1749120.17	5949463.93
Lot 55	1749107.22	5949471.17
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Lot 57	1749073.01	5949483.91
Lot 58	1749075.21	5949488.02
Lot 59	1749049.18	5949466.12
Lot 60	1749029.45	5949461.98
Lot 61	1749044.43	5949481.53
Lot 62	1749034.95	5949502.96
Lot 63	1749016.18	5949511.32
Lot 64	1748985.28	5949505.35
Lot 65	1748976.04	5949495.48
Lot 66	1748979.19	5949475.55
Lot 67	1748983.24	5949458.59
Lot 68	1748991.64	5949441.54
Lot 69	1748988.17	5949439.59
Lot 70	1748981.16	5949399.35
Lot 71	1748970.09	5949391.48
Lot 72	1748957.35	5949379.93
Lot 73	1748950.38	5949371.79
Lot 74	1748943.30	5949360.29
Lot 75	1748936.71	5949347.02
Lot 76	1748934.09	5949333.26
Lot 77	1748930.34	5949318.44
Lot 78	1748926.59	5949305.37
Lot 174	1749062.68	5949286.15
Lot 175	1749047.18	5949289.31
Lot 176	1749032.35	5949293.72
Lot 177	1749015.95	5949297.02
Lot 178	1749000.09	5949300.82
Lot 179	1748984.48	5949304.80
Lot 180	1748969.75	5949307.99
Lot 181	1748949.43	5949310.53
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Lot 183	1748993.11	5949359.48
Lot 184	1749010.03	5949374.02
Lot 185	1749040.78	5949395.33
Lot 186	1749054.55	5949405.56
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LEGEND

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NOTES

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DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

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Signed: Registered Professional Surveyor

Date: 29/11/19

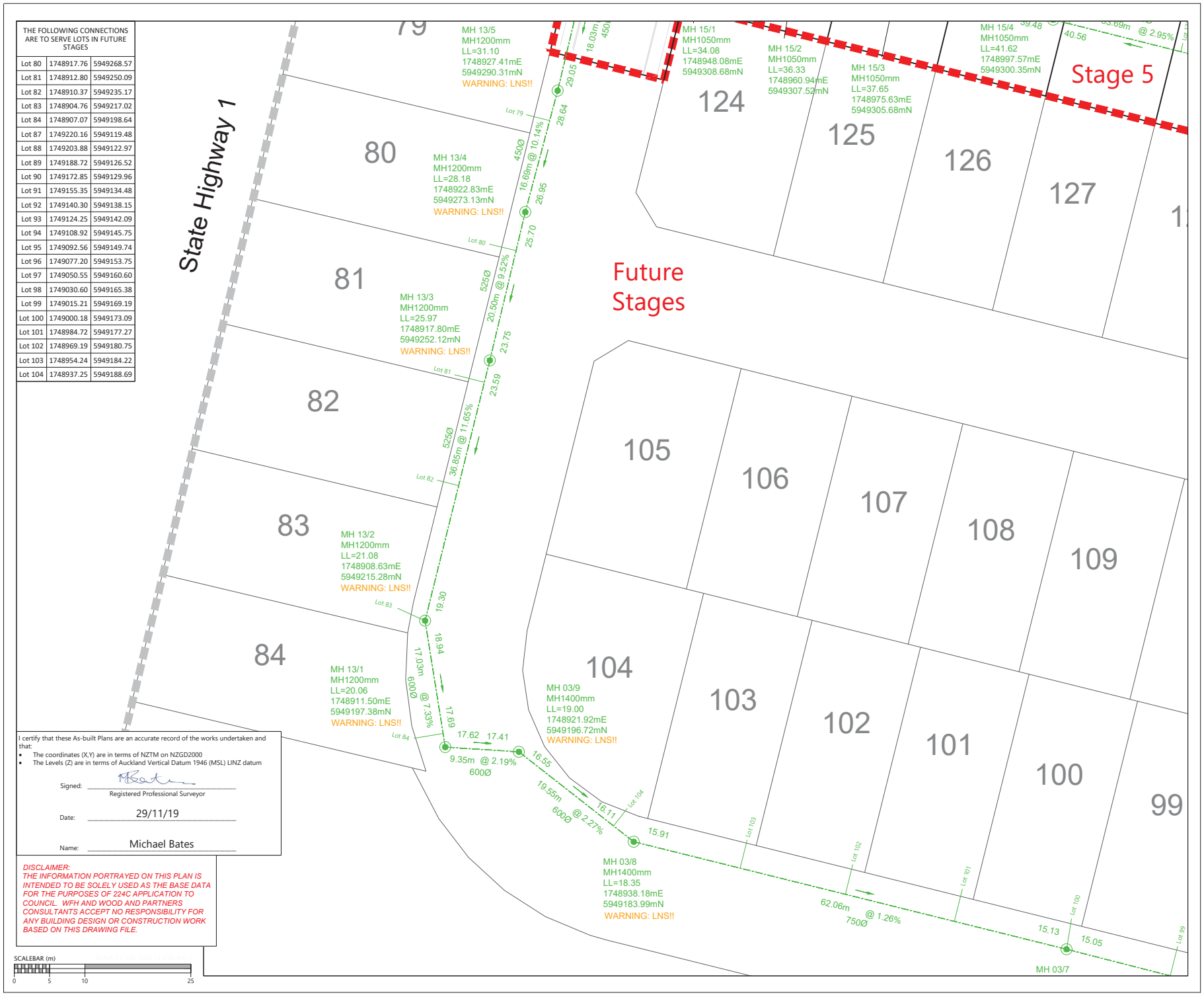
Name: Michael Bates

ARRAN HILL PRECINCT 5 STAGE 5

STORMWATER AS-BUILT SHEET 4 OF 7

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-303-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_STORMWATER.DWG



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SCALEBAR (m)
0 5 10 25

WOODS EST.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
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9. SOME INVERT LEVELS ARE MARK THE LEVELS AT THE ENTRY POINT OF DROP-PIPES INTO THE MH CHAMBER. THESE LEVELS HAVE BEEN CALCULATED FROM OBSERVATIONS TO THE TOP OF THE PIPE.

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

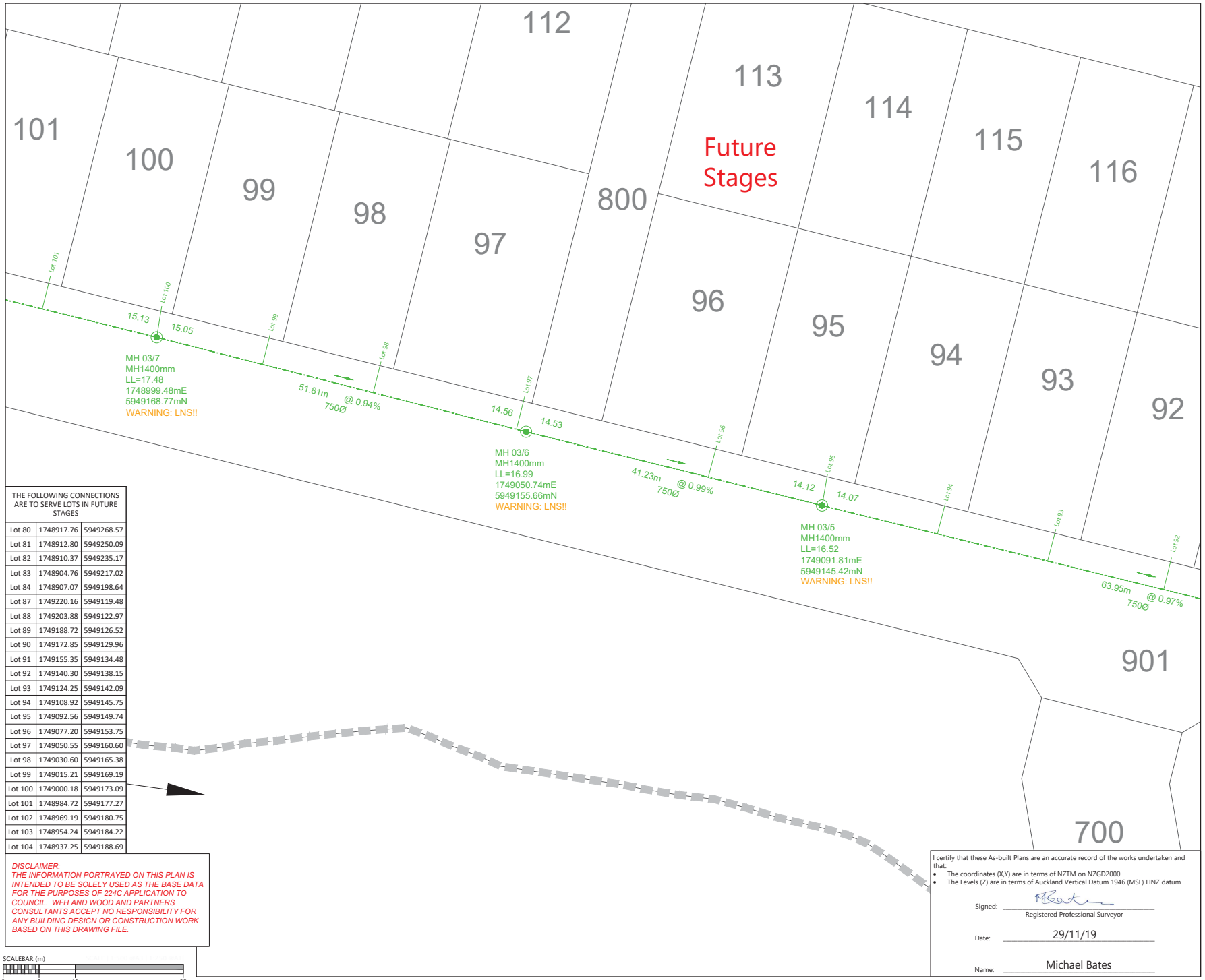
WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

STORMWATER AS-BUILT
SHEET 5 OF 7

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-303-AB	

Document No. K\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_STORMWATER.DWG



THE FOLLOWING CONNECTIONS ARE TO SERVE LOTS IN FUTURE STAGES		
Lot 80	1748917.76	5949268.57
Lot 81	1748912.80	5949250.09
Lot 82	1748910.37	5949235.17
Lot 83	1748904.76	5949217.02
Lot 84	1748907.07	5949198.64
Lot 87	1749220.16	5949119.48
Lot 88	1749203.88	5949122.97
Lot 89	1749188.72	5949126.52
Lot 90	1749172.85	5949129.96
Lot 91	1749155.35	5949134.48
Lot 92	1749140.30	5949138.15
Lot 93	1749124.25	5949142.09
Lot 94	1749108.92	5949145.75
Lot 95	1749092.56	5949149.74
Lot 96	1749077.20	5949153.75
Lot 97	1749050.55	5949160.60
Lot 98	1749030.60	5949165.38
Lot 99	1749015.21	5949169.19
Lot 100	1749000.18	5949173.09
Lot 101	1748984.72	5949177.27
Lot 102	1748969.19	5949180.75
Lot 103	1748954.24	5949184.22
Lot 104	1748937.25	5949188.69

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SCALEBAR (m)
0 5 10 25

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: 29/11/19

Name: Michael Bates

WOODS
EST.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL PIPE BEDDING COMPLIES WITH AC STANDARDS
3. ALL CESSPIT LEADS AND PIPES UNDER THE ROAD AND CARRIDGEWAYS ARE REINFORCED COACRETE PIPES CLASS 4 (Z) RRJ. ALL OTHER PIPELINES ARE REINFORCED COACRETE CLASS 2 (X) RRJ UNLESS OTHERWISE NOTED.
4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL SW 100mm DIA. RAMPED RISERS HAVE BEEN EXTENDED AND CAPPED OFF 1.0m BELOW THE FINISHED GROUND SURFACE.
6. ALL PRIVATE DRAINAGE CONNECTIONS ARE 100mmø.
7. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.
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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

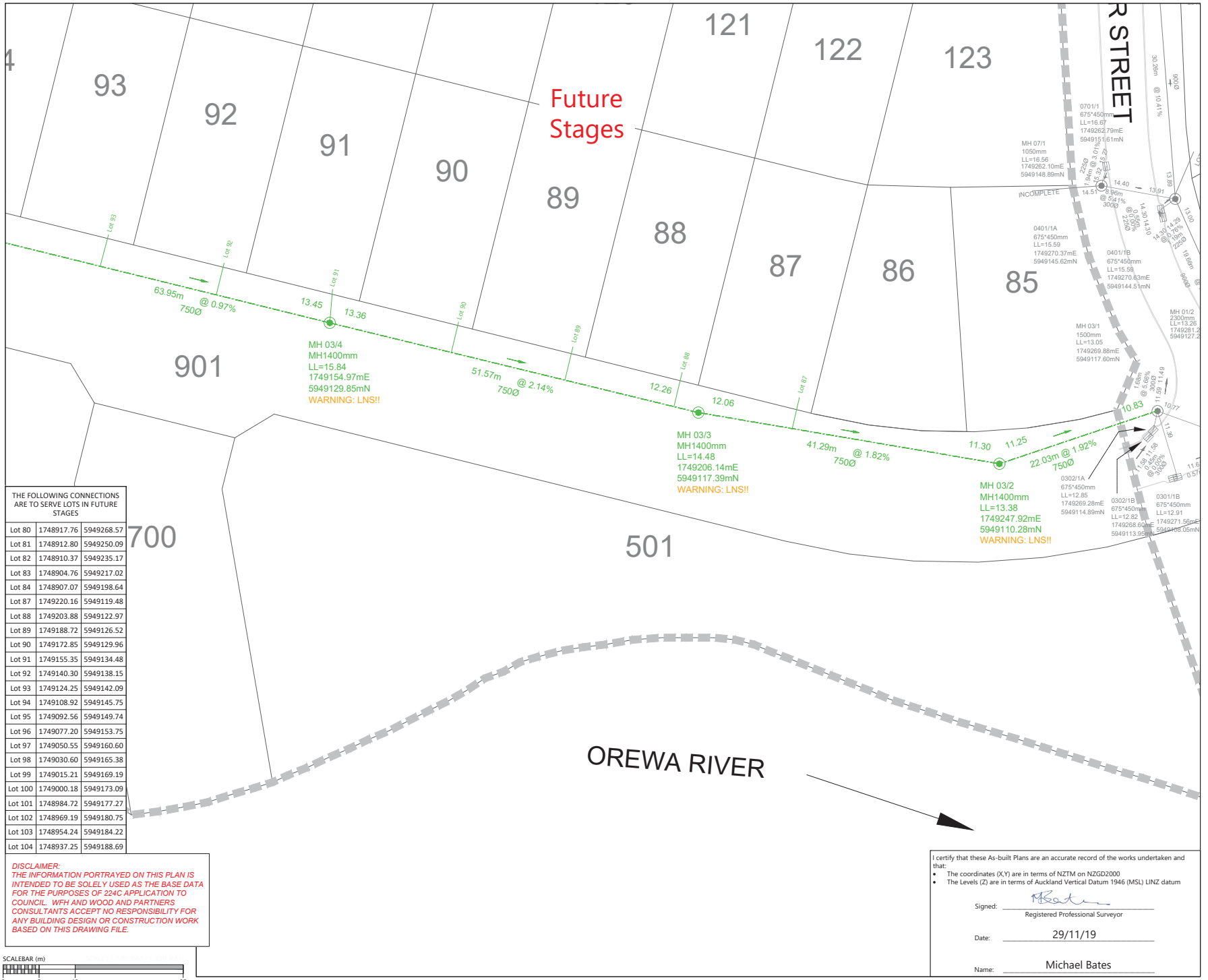
WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

STORMWATER AS-BUILT
SHEET 6 OF 7

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-303-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_STORMWATER.DWG



THE FOLLOWING CONNECTIONS ARE TO SERVE LOTS IN FUTURE STAGES		
Lot 80	1748917.76	5949268.57
Lot 81	1748912.80	5949250.09
Lot 82	1748910.37	5949235.17
Lot 83	1748904.76	5949217.02
Lot 84	1748907.07	5949198.64
Lot 87	1749220.16	5949119.48
Lot 88	1749203.88	5949122.97
Lot 89	1749188.72	5949126.52
Lot 90	1749172.85	5949129.96
Lot 91	1749155.35	5949134.48
Lot 92	1749140.30	5949138.15
Lot 93	1749124.25	5949142.09
Lot 94	1749108.92	5949145.75
Lot 95	1749092.56	5949149.74
Lot 96	1749077.20	5949153.75
Lot 97	1749050.55	5949160.60
Lot 98	1749030.60	5949165.38
Lot 99	1749015.21	5949169.19
Lot 100	1749000.18	5949173.09
Lot 101	1748984.72	5949177.27
Lot 102	1748969.19	5949180.75
Lot 103	1748954.24	5949184.22
Lot 104	1748937.25	5949188.69

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SCALEBAR (m)
0 5 10 25

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

Signed: _____
Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates

WOODS
EST.1970

LEGEND

- STORMWATER MANHOLE
- STORMWATER CESSPIT
- STORMWATER DOUBLE CESSPIT
- NEW STORMWATER
- EXISTING STORMWATER
- STAGE BOUNDARY

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AC STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL PIPE BEDDING COMPLIES WITH AC STANDARDS
3. ALL CESSPIT LEADS AND PIPES UNDER THE ROAD AND CARRIDGEWAYS ARE REINFORCED COACRETE PIPES CLASS 4 (Z) RRJ. ALL OTHER PIPELINES ARE REINFORCED COACRETE CLASS 2 (X) RRJ UNLESS OTHERWISE NOTED.
4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL SW 100mm DIA. RAMPED RISERS HAVE BEEN EXTENDED AND CAPPED OFF 1.0m BELOW THE FINISHED GROUND SURFACE.
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7. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

STORMWATER AS-BUILT
SHEET 7 OF 7

STATUS	AS-BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-303-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_STORMWATER.DWG

SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
WASTEWATER LOT CONNECTIONS		
Lot 54	1749119.07	5949463.11
Lot 55	1749105.62	5949469.95
Lot 56	1749089.66	5949478.68
Lot 57	1749073.58	5949483.26
Lot 58	1749074.68	5949486.45
Lot 59	1749049.35	5949466.21
Lot 60	1749030.72	5949460.92
Lot 61	1749044.67	5949482.03
Lot 62	1749035.64	5949504.3
Lot 63	1749015.98	5949509.94
Lot 64	1748986.48	5949504.11
Lot 65	1748978.01	5949495.49
Lot 66	1748980.17	5949476.63
Lot 67	1748984.37	5949459.24
Lot 68	1748991.87	5949441.87
Lot 69	1748989.09	5949439.11
Lot 70	1748980.9	5949401.48
Lot 71	1748969.61	5949390.96
Lot 72	1748957.24	5949381.28
Lot 73	1748949.77	5949371.21
Lot 74	1748942.82	5949359.69
Lot 75	1748936.15	5949346.31
Lot 76	1748933.55	5949332.38
Lot 77	1748930.13	5949317.94
Lot 78	1748925.83	5949304.75
Lot 174	1749063.22	5949285.84
Lot 175	1749048.15	5949290.24
Lot 176	1749031.49	5949294.53
Lot 177	1749017.3	5949298.23
Lot 178	1749000.87	5949302.2
Lot 179	1748985.46	5949306.36
Lot 180	1748969.72	5949309.76
Lot 181	1748950.16	5949311.88
Lot 182	1748965.57	5949348.63
Lot 183	1748995.51	5949360.33
Lot 184	1749008.21	5949372.95
Lot 185	1749039.03	5949395.72
Lot 186	1749053.27	5949403.74
Lot 187	1749071.74	5949427.08
Lot 188	1749090.41	5949424.33
Lot 189	1749108.59	5949419.81
Lot 192	1749069.46	5949405.09
Lot 193	1749042.37	5949390.98
Lot 194	1749012.14	5949367.93
Lot 195	1748992.99	5949342.85

THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 189	1749109.96	5949409.1
Lot 190	1749106.9	5949395.44
Lot 191	1749101.46	5949382.78
THE FOLLOWING CONNECTIONS ARE TO SERVE LOTS IN FUTURE STAGES		
Lot 79	1748922.38	5949287.02
Lot 80	1748917.30	5949269.85
Lot 81	1748913.67	5949253.06
Lot 82	1748909.57	5949234.85
Lot 83	1748904.92	5949217.16
Lot 84	1748905.91	5949197.32
Lot 104	1748938.12	5949189.95
Lot 103	1748953.57	5949185.72
Lot 102	1748968.32	5949182.00
Lot 101	1748985.90	5949177.57
Lot 100	1748999.73	5949174.25
Lot 99	1749016.64	5949169.98
Lot 98	1749030.36	5949166.48
Lot 97	1749049.90	5949161.61
Lot 96	1749078.10	5949154.38
Lot 95	1749094.10	5949150.42
Lot 94	1749109.75	5949146.66
Lot 93	1749125.41	5949143.02
Lot 92	1749140.97	5949139.00
Lot 91	1749159.17	5949135.02
Lot 90	1749172.51	5949131.76
Lot 89	1749187.90	5949128.16
Lot 88	1749204.51	5949124.18
Lot 87	1749220.08	5949120.47
Lot 86	1749228.93	5949119.11
Lot 85	1749262.03	5949121.84

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

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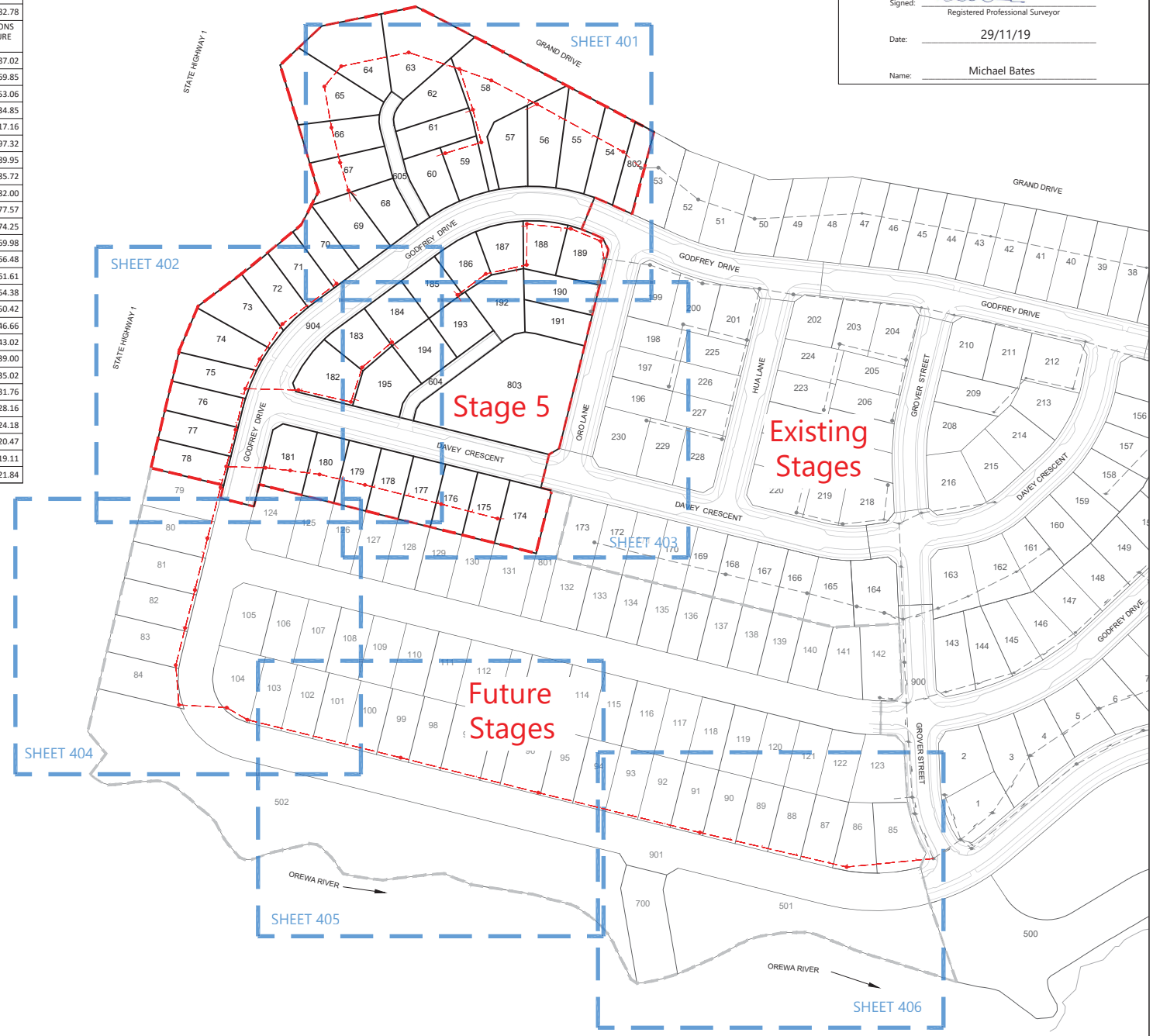
- The Levels (Z) are in terms of Auckland Vertical Datum 1946 (MSL) LINZ datum

Signed: _____ Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates



LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AUCKLAND COUNCIL & WATERCARE SERVICES LTD STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
2. ALL SANITARY SEWER LINES ARE 150mmØ uPVC CLASS SN16 UNLESS STATED OTHERWISE.
3. ALL PIPE BEDDING COMPLIES WITH WATERCARE STANDARDS.
4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL PRIVATE LOT CONNECTIONS ARE 100mmØ
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ALL PIPE AND MH DIAMETERS ARE INTERNAL, AND SHOWN IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.
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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

WASTEWATER AS-BUILT OVERALL LAYOUT SHEET 1 OF 7

STATUS	AS BUILT	REV
SCALE	1:2000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-400-AB	

DISCLAIMER:
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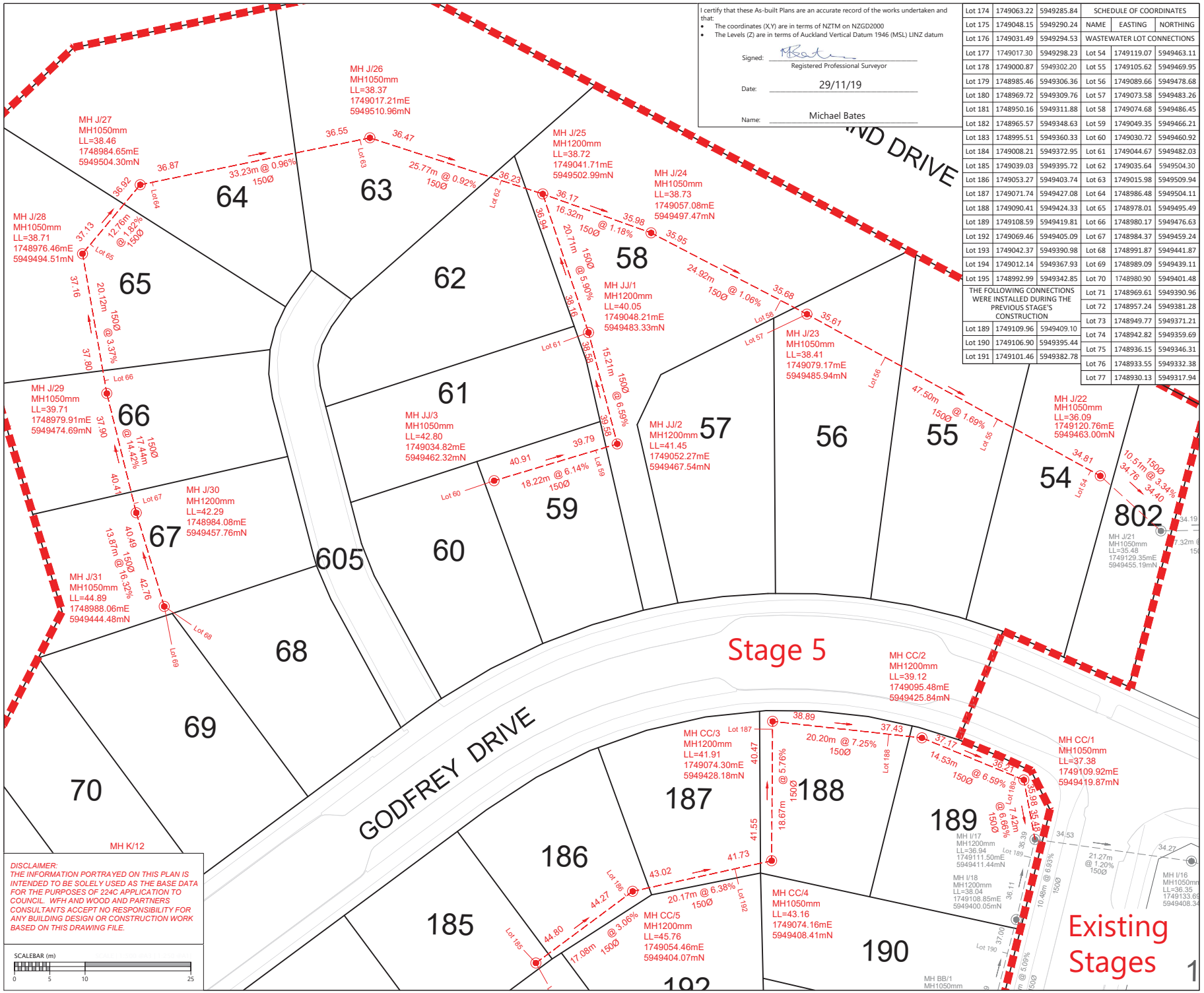
SCALEBAR (m)
0 20 40 100

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_SEWER.DWG



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Signed: _____
Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates

			SCHEDULE OF COORDINATES		
Lot 174	1749063.22	5949285.84	NAME	EASTING	NORTHING
Lot 175	1749048.15	5949290.24	WASTEWATER LOT CONNECTIONS		
Lot 176	1749031.49	5949294.53			
Lot 177	1749017.30	5949298.23	Lot 54	1749119.07	5949463.11
Lot 178	1749000.87	5949302.20	Lot 55	1749105.62	5949469.95
Lot 179	1748985.46	5949306.36	Lot 56	1749089.66	5949478.68
Lot 180	1748969.72	5949309.76	Lot 57	1749073.58	5949483.26
Lot 181	1748950.16	5949311.88	Lot 58	1749074.68	5949486.45
Lot 182	1748965.57	5949348.63	Lot 59	1749049.35	5949466.21
Lot 183	1748995.51	5949360.33	Lot 60	1749030.72	5949460.92
Lot 184	1749008.21	5949372.95	Lot 61	1749044.67	5949482.03
Lot 185	1749039.03	5949395.72	Lot 62	1749035.64	5949504.30
Lot 186	1749053.27	5949403.74	Lot 63	1749015.98	5949509.94
Lot 187	1749071.74	5949427.08	Lot 64	1748986.48	5949504.11
Lot 188	1749090.41	5949424.33	Lot 65	1748978.01	5949495.49
Lot 189	1749108.59	5949419.81	Lot 66	1748980.17	5949476.63
Lot 192	1749069.46	5949405.09	Lot 67	1748984.37	5949459.24
Lot 193	1749042.37	5949390.98	Lot 68	1748991.87	5949441.87
Lot 194	1749012.14	5949367.93	Lot 69	1748989.09	5949439.11
Lot 195	1748992.99	5949342.85	Lot 70	1748980.90	5949401.48
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION			Lot 71	1748969.61	5949390.96
			Lot 72	1748957.24	5949381.28
Lot 189	1749109.96	5949409.10	Lot 73	1748949.77	5949371.21
Lot 190	1749106.90	5949395.44	Lot 74	1748942.82	5949359.69
Lot 191	1749101.46	5949382.78	Lot 75	1748936.15	5949346.31
			Lot 76	1748933.55	5949332.38
			Lot 77	1748930.13	5949317.94

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

NOTES

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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

WASTEWATER AS-BUILT SHEET 2 OF 7

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-401-AB	

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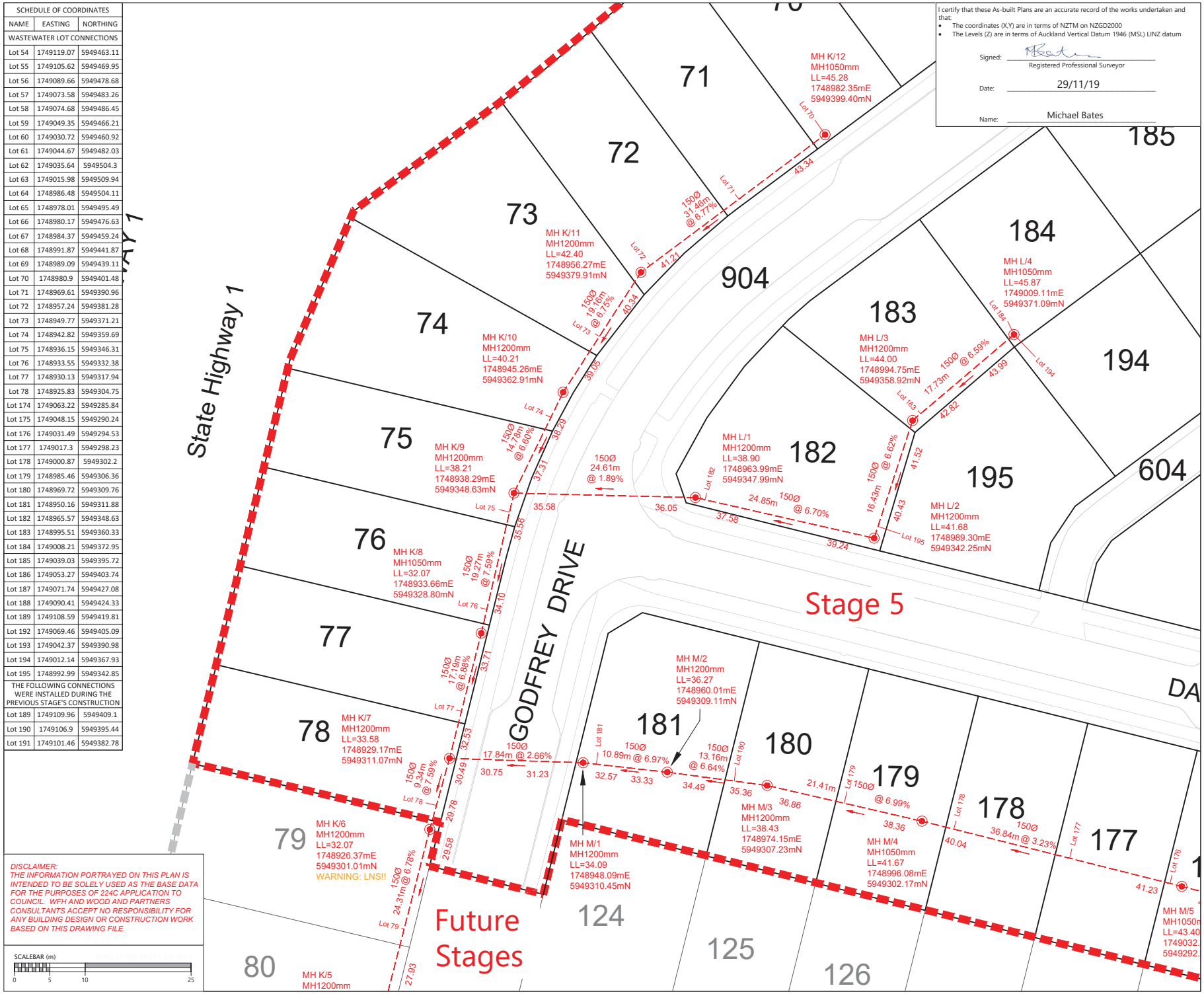
Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_SEWER.DWG



SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
WASTEWATER LOT CONNECTIONS		
Lot 54	1749119.07	5949463.11
Lot 55	1749105.62	5949469.95
Lot 56	1749089.66	5949478.68
Lot 57	1749073.58	5949483.26
Lot 58	1749074.68	5949486.45
Lot 59	1749049.35	5949466.21
Lot 60	1749030.72	5949460.92
Lot 61	1749044.67	5949482.03
Lot 62	1749035.64	5949504.3
Lot 63	1749015.98	5949509.94
Lot 64	1748986.48	5949504.11
Lot 65	1748978.01	5949495.49
Lot 66	1748980.17	5949476.63
Lot 67	1748984.37	5949459.24
Lot 68	1748991.87	5949441.87
Lot 69	1748989.09	5949439.11
Lot 70	1748980.9	5949401.48
Lot 71	1748969.61	5949390.96
Lot 72	1748957.24	5949381.28
Lot 73	1748949.77	5949371.21
Lot 74	1748942.82	5949359.69
Lot 75	1748936.15	5949346.31
Lot 76	1748933.55	5949332.38
Lot 77	1748930.13	5949317.94
Lot 78	1748925.83	5949304.75
Lot 174	1749063.22	5949285.84
Lot 175	1749048.15	5949290.24
Lot 176	1749031.49	5949294.53
Lot 177	1749017.3	5949298.23
Lot 178	1749000.87	5949302.2
Lot 179	1748985.46	5949306.36
Lot 180	1748969.72	5949309.76
Lot 181	1748950.16	5949311.88
Lot 182	1748965.57	5949348.63
Lot 183	1748995.51	5949360.33
Lot 184	1749008.21	5949372.95
Lot 185	1749039.03	5949395.72
Lot 186	1749053.27	5949403.74
Lot 187	1749071.74	5949427.08
Lot 188	1749090.41	5949424.33
Lot 189	1749108.59	5949419.81
Lot 192	1749069.46	5949405.09
Lot 193	1749042.37	5949390.98
Lot 194	1749012.14	5949367.93
Lot 195	1748992.99	5949342.85
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 189	1749109.96	5949409.1
Lot 190	1749106.9	5949395.44
Lot 191	1749101.46	5949382.78

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

Signed: _____ Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

NOTES

1. ALL WORKS AND MATERIALS COMPLY WITH AUCKLAND COUNCIL & WATERCARE SERVICES LTD STANDARDS FOR ENGINEERING DESIGN AND CONSTRUCTION.
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4. ALL PIPE CROSSINGS UNDER ROADS AND ACCESSWAYS HAVE BEEN HARDFILL BACKFILLED.
5. ALL PRIVATE LOT CONNECTIONS ARE 100mmØ
6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ALL PIPE AND MH DIAMETERS ARE INTERNAL, AND SHOWN IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
8. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.
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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

WASTEWATER AS-BUILT
SHEET 3 OF 7

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-402-AB	

DISCLAIMER:
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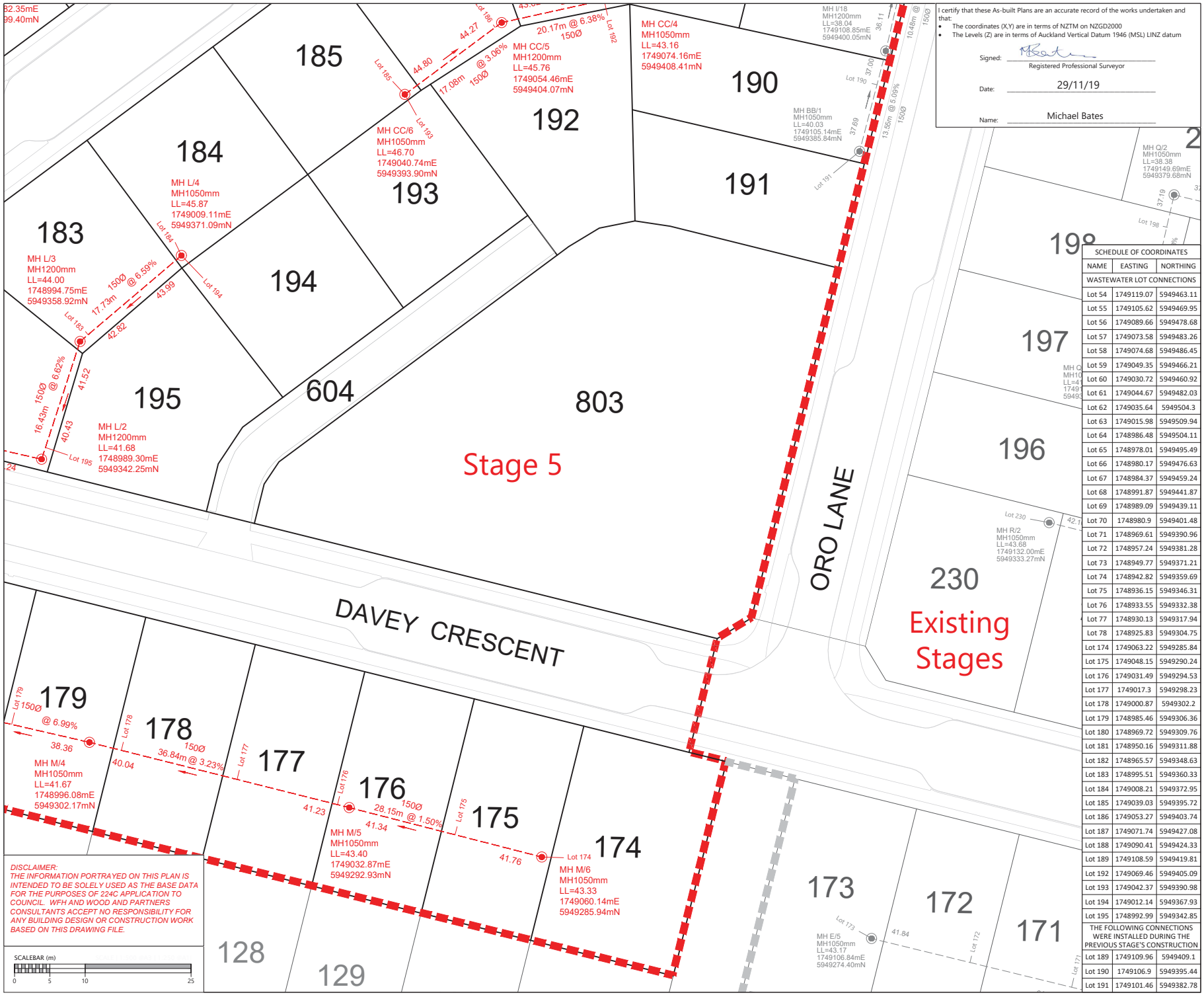
SCALEBAR (m) 0 5 10 25

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_SEWER.DWG



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Signed: _____
Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates

WOODS
EST.1970

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

NOTES

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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SCHEDULE OF COORDINATES

NAME	EASTING	NORTHING
WASTEWATER LOT CONNECTIONS		
Lot 54	1749119.07	5949463.11
Lot 55	1749105.62	5949469.95
Lot 56	1749089.66	5949478.68
Lot 57	1749073.58	5949483.26
Lot 58	1749074.68	5949486.45
Lot 59	1749049.35	5949466.21
Lot 60	1749030.72	5949460.92
Lot 61	1749044.67	5949482.03
Lot 62	1749035.64	5949504.3
Lot 63	1749015.98	5949509.94
Lot 64	1748986.48	5949504.11
Lot 65	1748978.01	5949495.49
Lot 66	1748980.17	5949476.63
Lot 67	1748984.37	5949459.24
Lot 68	1748991.87	5949441.87
Lot 69	1748989.09	5949439.11
Lot 70	1748980.9	5949401.48
Lot 71	1748969.61	5949390.96
Lot 72	1748957.24	5949381.28
Lot 73	1748949.77	5949371.21
Lot 74	1748942.82	5949359.69
Lot 75	1748936.15	5949346.31
Lot 76	1748933.55	5949332.38
Lot 77	1748930.13	5949317.94
Lot 78	1748925.83	5949304.75
Lot 174	1749063.22	5949285.84
Lot 175	1749048.15	5949290.24
Lot 176	1749031.49	5949294.53
Lot 177	1749017.3	5949298.23
Lot 178	1749000.87	5949302.2
Lot 179	1748985.46	5949306.36
Lot 180	1748969.72	5949309.76
Lot 181	1748950.16	5949311.88
Lot 182	1748965.57	5949348.63
Lot 183	1748995.51	5949360.33
Lot 184	1749008.21	5949372.95
Lot 185	1749039.03	5949395.72
Lot 186	1749053.27	5949403.74
Lot 187	1749071.74	5949427.08
Lot 188	1749090.41	5949424.33
Lot 189	1749108.59	5949419.81
Lot 192	1749069.46	5949405.09
Lot 193	1749042.37	5949390.98
Lot 194	1749012.14	5949367.93
Lot 195	1748992.99	5949342.85
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE PREVIOUS STAGE'S CONSTRUCTION		
Lot 189	1749109.96	5949409.1
Lot 190	1749106.9	5949395.44
Lot 191	1749101.46	5949382.78

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

WASTEWATER AS-BUILT
SHEET 4 OF 7

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-403-AB	

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SCALEBAR (m)
0 5 10 25

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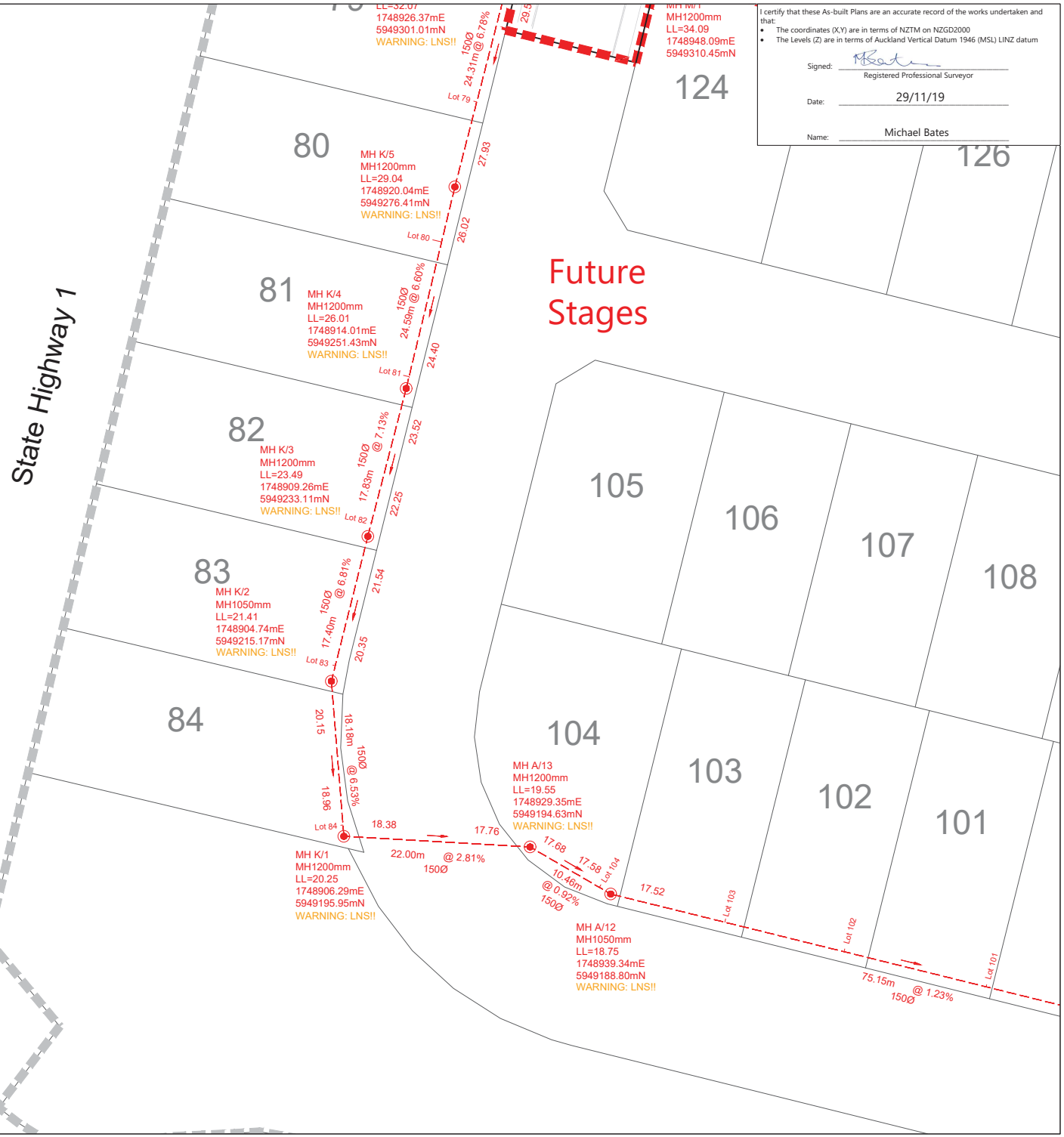
THE FOLLOWING CONNECTIONS ARE TO SERVE LOTS IN FUTURE STAGES		
Lot 79	1748922.38	5949287.02
Lot 80	1748917.30	5949269.85
Lot 81	1748913.67	5949253.06
Lot 82	1748909.57	5949234.85
Lot 83	1748904.92	5949217.16
Lot 84	1748905.91	5949197.32
Lot 104	1748938.12	5949189.95
Lot 103	1748953.57	5949185.72
Lot 102	1748968.32	5949182.00
Lot 101	1748985.90	5949177.57
Lot 100	1748999.73	5949174.25
Lot 99	1749016.64	5949169.98
Lot 98	1749030.36	5949166.48
Lot 97	1749049.90	5949161.61
Lot 96	1749078.10	5949154.38
Lot 95	1749094.10	5949150.42
Lot 94	1749109.75	5949146.66
Lot 93	1749125.41	5949143.02
Lot 92	1749140.97	5949139.00
Lot 91	1749159.17	5949135.02
Lot 90	1749172.51	5949131.76
Lot 89	1749187.90	5949128.16
Lot 88	1749204.51	5949124.18
Lot 87	1749220.08	5949120.47
Lot 86	1749228.93	5949119.11
Lot 85	1749262.03	5949121.84



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Signed: _____ Registered Professional Surveyor

Date: 29/11/19

Name: Michael Bates

WOODS EST.1970

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

NOTES

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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

WASTEWATER AS-BUILT SHEET 5 OF 7

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-404-AB	

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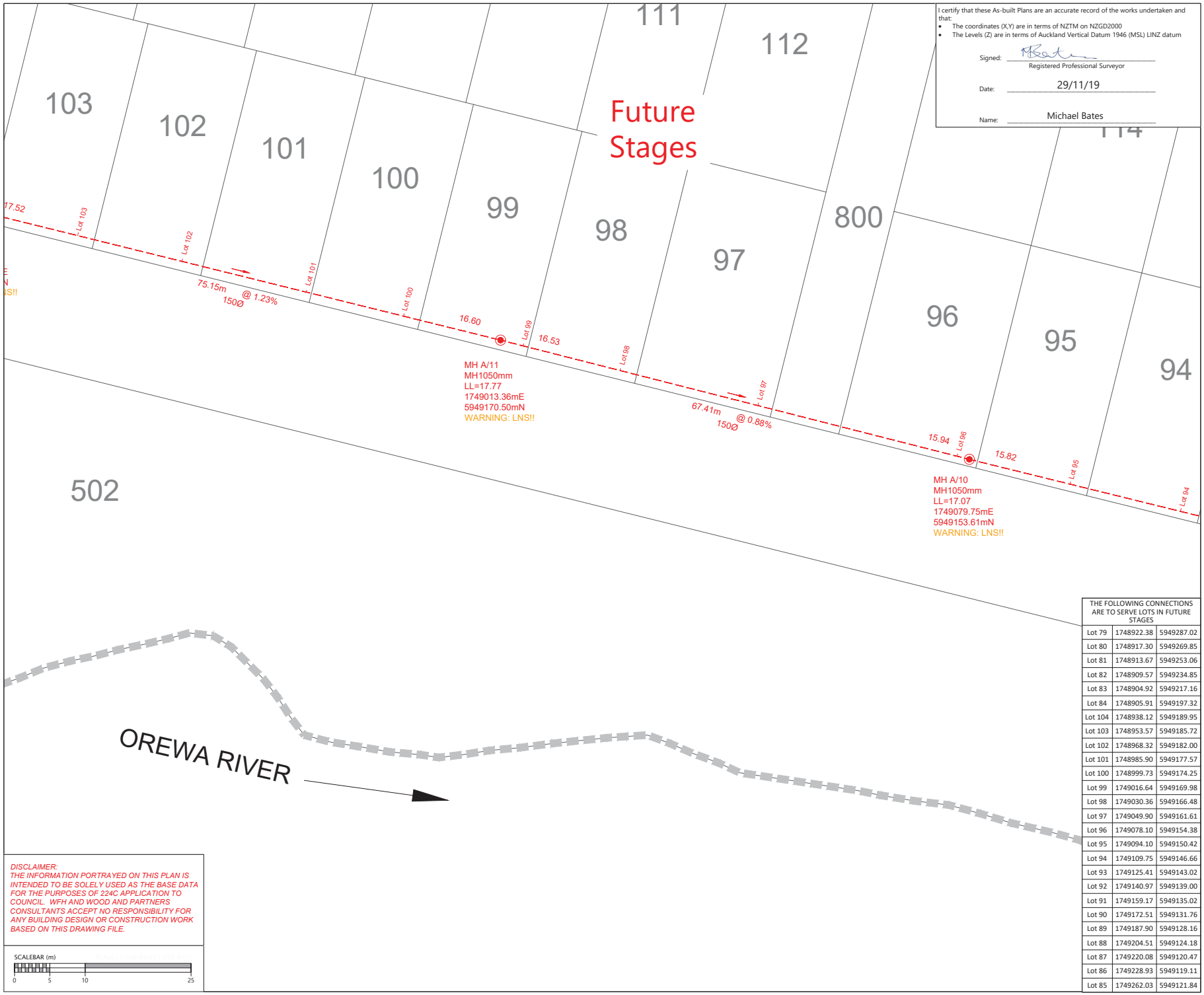
SCALEBAR (m)
0 5 10 25

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_SEWER.DWG



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Date: 29/11/19

Name: Michael Bates

WOODS EST.1970

LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

NOTES

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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

THE FOLLOWING CONNECTIONS ARE TO SERVE LOTS IN FUTURE STAGES

Lot 79	1748922.38	5949287.02
Lot 80	1748917.30	5949269.85
Lot 81	1748913.67	5949253.06
Lot 82	1748909.57	5949234.85
Lot 83	1748904.92	5949217.16
Lot 84	1748905.91	5949197.32
Lot 104	1748938.12	5949189.95
Lot 103	1748953.57	5949185.72
Lot 102	1748968.32	5949182.00
Lot 101	1748985.90	5949177.57
Lot 100	1748999.73	5949174.25
Lot 99	1749016.64	5949169.98
Lot 98	1749030.36	5949166.48
Lot 97	1749049.90	5949161.61
Lot 96	1749078.10	5949154.38
Lot 95	1749094.10	5949150.42
Lot 94	1749109.75	5949146.66
Lot 93	1749125.41	5949143.02
Lot 92	1749140.97	5949139.00
Lot 91	1749159.17	5949135.02
Lot 90	1749172.51	5949131.76
Lot 89	1749187.90	5949128.16
Lot 88	1749204.51	5949124.18
Lot 87	1749220.08	5949120.47
Lot 86	1749228.93	5949119.11
Lot 85	1749262.03	5949121.84

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

ARRAN HILL PRECINCT 5 STAGE 5

WASTEWATER AS-BUILT SHEET 6 OF 7

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-405-AB	

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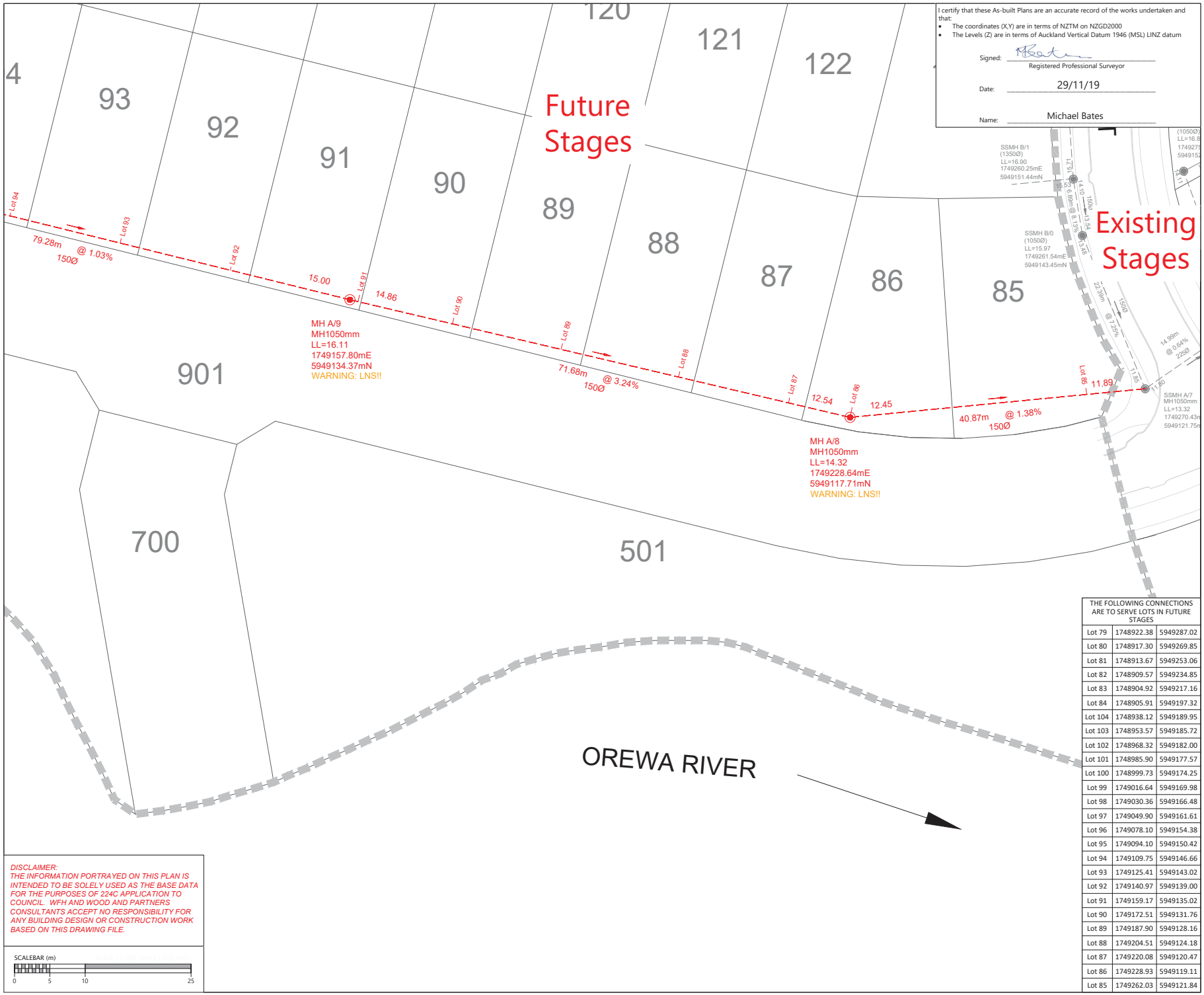
SCALEBAR (m)
0 5 10 25

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_SEWER.DWG



LEGEND

- NEW SANITARY SEWER MANHOLE
- NEW SANITARY SEWER
- EXISTING SANITARY SEWER
- STAGE BOUNDARY

NOTES

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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	29/11/19

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Lot 79	1748922.38	5949287.02
Lot 80	1748917.30	5949269.85
Lot 81	1748913.67	5949253.06
Lot 82	1748909.57	5949234.85
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Lot 84	1748905.91	5949197.32
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Lot 101	1748985.90	5949177.57
Lot 100	1748999.73	5949174.25
Lot 99	1749016.64	5949169.98
Lot 98	1749030.36	5949166.48
Lot 97	1749049.90	5949161.61
Lot 96	1749078.10	5949154.38
Lot 95	1749094.10	5949150.42
Lot 94	1749109.75	5949146.66
Lot 93	1749125.41	5949143.02
Lot 92	1749140.97	5949139.00
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Lot 90	1749172.51	5949131.76
Lot 89	1749187.90	5949128.16
Lot 88	1749204.51	5949124.18
Lot 87	1749220.08	5949120.47
Lot 86	1749228.93	5949119.11
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SCALEBAR (m)
0 5 10 25

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

ARRAN HILL PRECINCT 5 STAGE 5

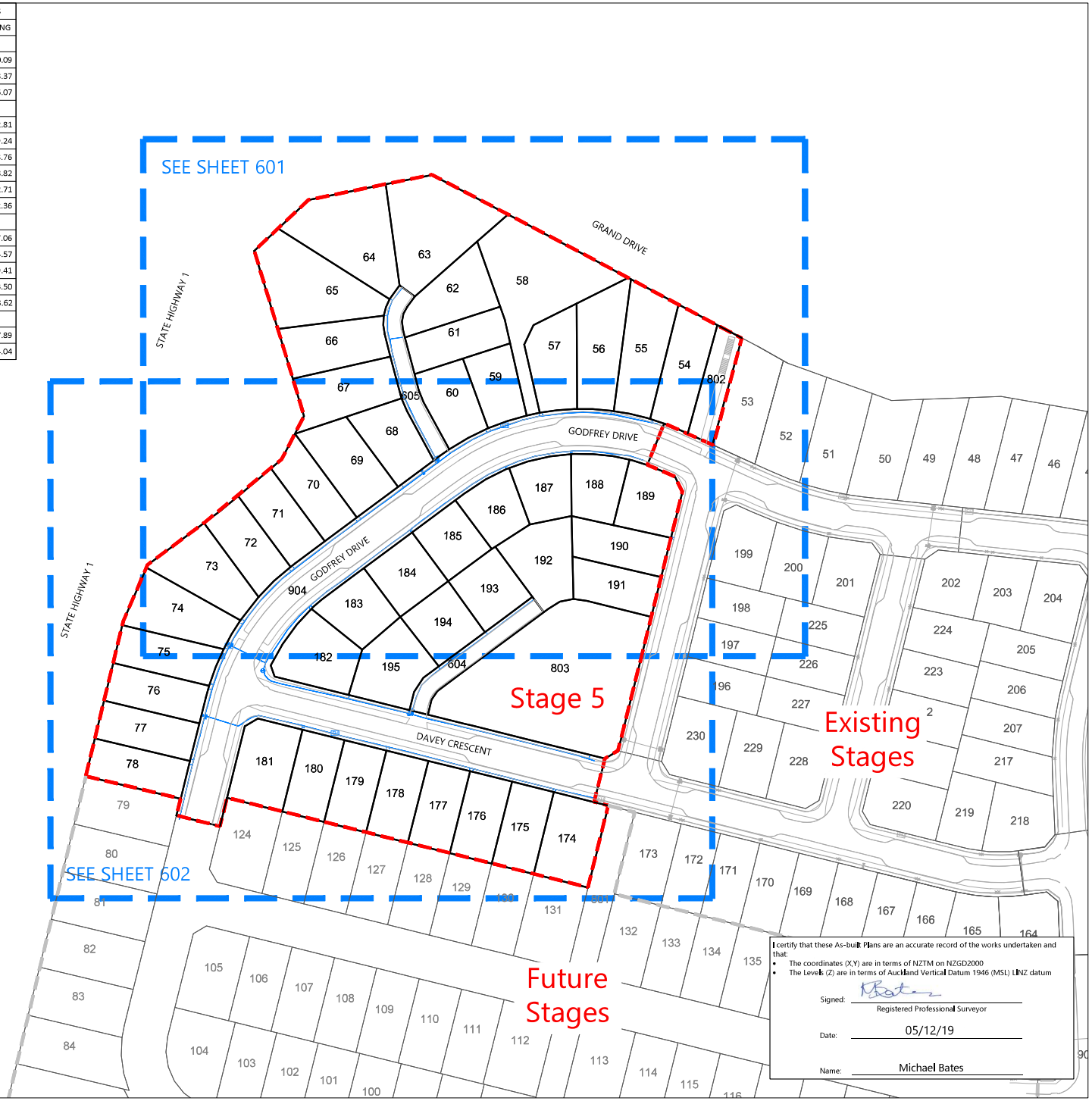
WASTEWATER AS-BUILT SHEET 7 OF 7

STATUS	AS BUILT	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-406-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_P5_05_SEWER.DWG

SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
WATERMAIN LOT CONNECTIONS		
WM54	1749102.60	5949442.27
WM55	1749088.57	5949444.87
WM56	1749087.34	5949445.16
WM57	1749061.85	5949444.53
WM58	1749060.73	5949444.38
WM59	1749042.57	5949438.69
WM60	1749041.00	5949438.16
WM61	1749010.19	5949472.94
WM62	1749010.18	5949472.94
WM63	1749010.25	5949491.48
WM64	1749005.24	5949487.25
WM65	1749002.93	5949481.00
WM66	1749005.52	5949465.80
WM67	1749009.53	5949450.38
WM68	1749010.11	5949417.84
WM69	1748994.25	5949406.00
WM70	1748992.91	5949405.16
WM71	1748969.55	5949387.76
WM72	1748968.33	5949386.76
WM73	1748950.95	5949368.26
WM74	1748950.15	5949367.01
WM75	1748939.27	5949344.49
WM76	1748938.52	5949342.60
WM77	1748932.00	5949316.46
WM78	1748931.40	5949314.64
WM174	1749066.62	5949304.89
WM175	1749065.87	5949305.17
WM176	1749036.12	5949312.46
WM177	1749034.88	5949312.86
WM178	1749005.02	5949320.50
WM179	1749003.98	5949320.71
WM180	1748973.49	5949328.20
WM181	1748972.83	5949328.21
WM182	1748975.68	5949372.36
WM183	1748976.49	5949373.17
WM184	1749013.05	5949400.95
WM185	1749013.55	5949401.41
WM186	1749048.49	5949424.34
WM187	1749072.25	5949430.02
WM188	1749072.77	5949429.98
WM192	1749058.58	5949375.83
WM193	1749040.78	5949364.06
WM194	1749023.57	5949351.33
WM195	1748990.28	5949339.95
WM803	1749079.30	5949317.76
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE CONSTRUCTION OF A PREVIOUS STAGE		
WM189	1749109.75	5949399.02
WM190	1749109.54	5949398.37
WM191	1749105.99	5949383.67

SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
FIRE HYDRANTS		
FH01	1749047.79	5949440.09
FH02	1748945.81	5949358.37
FH03	1748985.02	5949326.07
SLUICE VALVES		
SV01	1749017.61	5949422.81
SV02	1748946.27	5949359.24
SV03	1748945.95	5949358.76
SV04	1748946.37	5949358.82
SV05	1748936.87	5949332.71
SV06	1748937.11	5949332.36
PEET VALVES		
PV01	1749022.87	5949427.06
PV02	1748960.59	5949354.57
PV03	1748958.34	5949349.41
PV04	1749012.46	5949333.50
PV05	1749013.18	5949333.62
MANIFOLD BOXES		
MB01	1749022.42	5949427.89
MB02	1749013.55	5949334.04



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SCALEBAR (m)
0 15 30 75

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: 05/12/19
Name: Michael Bates

WOODS Est.1970

NOTES

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2. PIPE BEDDING COMPLIES WITH AC STD DETAIL DRAWING 18000 SHEET 4.4 UNLESS OTHERWISE NOTED.
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6. LOT BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
7. ASBUILT DATA HAS BEEN SOURCED FROM A COMBINATION OF WOODS SURVEY MEASURED DATA AND CONTRACTOR RECEIVED DATA.

LEGEND

- EXISTING WATERMAIN
- HIGH PESSURE WATERMAIN
- SLUICE VALVE
- PEET VALVE
- FIRE HYDRANT (FH)
- TAPPING BAND
- BLANK CAP
- MANIFOLD BOX (MB)
- LOT CONNECTION (WM181)
- STAGE BOUNDARY

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	05/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER PRECINCT 5
OREWA WEST
STAGE 5

WATERMAIN AS-BUILT
SHEET 1 OF 3

STATUS	AS-BUILT	REV
SCALE	1:1500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-600-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_PS_05_WATERMAIN.DWG

SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
WATERMAIN LOT CONNECTIONS		
WM54	1749102.60	5949442.27
WM55	1749088.57	5949444.87
WM56	1749087.34	5949445.16
WM57	1749061.85	5949444.53
WM58	1749060.73	5949444.38
WM59	1749042.57	5949438.69
WM60	1749041.00	5949438.16
WM61	1749010.19	5949472.94
WM62	1749010.18	5949472.94
WM63	1749010.25	5949491.48
WM64	1749005.24	5949487.25
WM65	1749002.93	5949481.00
WM66	1749005.52	5949465.80
WM67	1749009.53	5949450.38
WM68	1749010.11	5949417.84
WM69	1748994.25	5949406.00
WM70	1748992.91	5949405.16
WM71	1748969.55	5949387.76
WM72	1748968.33	5949386.76
WM73	1748950.95	5949368.26
WM74	1748950.15	5949367.01
WM75	1748939.27	5949344.49
WM76	1748938.52	5949342.60
WM77	1748932.00	5949316.46
WM78	1748931.40	5949314.64
WM174	1749066.62	5949304.89
WM175	1749065.87	5949305.17
WM176	1749036.12	5949312.46
WM177	1749034.88	5949312.86
WM178	1749005.02	5949320.50
WM179	1749003.98	5949320.71
WM180	1748973.49	5949328.20
WM181	1748972.83	5949328.21
WM182	1748975.68	5949372.36
WM183	1748976.49	5949373.17
WM184	1749013.05	5949400.95
WM185	1749013.55	5949401.41
WM186	1749048.49	5949424.34
WM187	1749072.25	5949430.02
WM188	1749072.77	5949429.98
WM192	1749058.58	5949375.83
WM193	1749040.78	5949364.06
WM194	1749023.57	5949351.33
WM195	1748990.28	5949339.95
WM803	1749079.30	5949317.76
THE FOLLOWING CONNECTIONS WERE INSTALLED DURING THE CONSTRUCTION OF A PREVIOUS STAGE		
WM189	1749109.75	5949399.02
WM190	1749109.54	5949398.37
WM191	1749105.99	5949383.67

SCHEDULE OF COORDINATES		
NAME	EASTING	NORTHING
FIRE HYDRANTS		
FH01	1749047.79	5949440.09
FH02	1748945.81	5949358.37
FH03	1748985.02	5949326.07
SLUICE VALVES		
SV01	1749017.61	5949422.81
SV02	1748946.27	5949359.24
SV03	1748945.95	5949358.76
SV04	1748946.37	5949358.82
SV05	1748936.87	5949332.71
SV06	1748937.11	5949332.36
PEET VALVES		
PV01	1749022.87	5949427.06
PV02	1748960.59	5949354.57
PV03	1748958.34	5949349.41
PV04	1749012.46	5949333.50
PV05	1749013.18	5949333.62
MANIFOLD BOXES		
MB01	1749022.42	5949427.89
MB02	1749013.55	5949334.04

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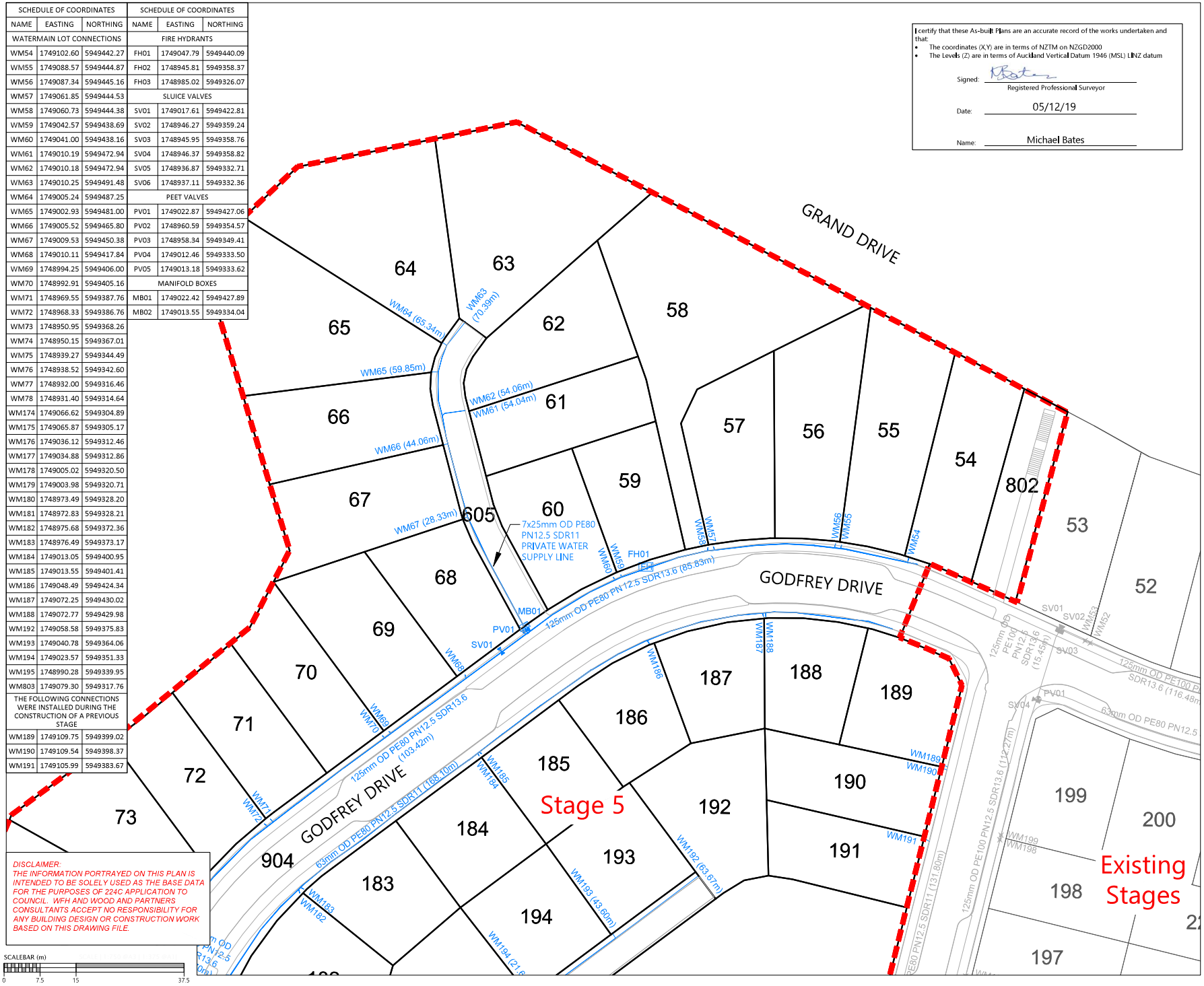
Signed: _____ Registered Professional Surveyor

Date: 05/12/19

Name: Michael Bates



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WOODS EST.1970

NOTES

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LEGEND

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- HIGH PESSURE WATERMAIN
- SLUICE VALVE
- PEET VALVE
- FIRE HYDRANT (FH)
- TAPPING BAND
- BLANK CAP
- MANIFOLD BOX (MB)
- LOT CONNECTION (WM181)
- STAGE BOUNDARY

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	05/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

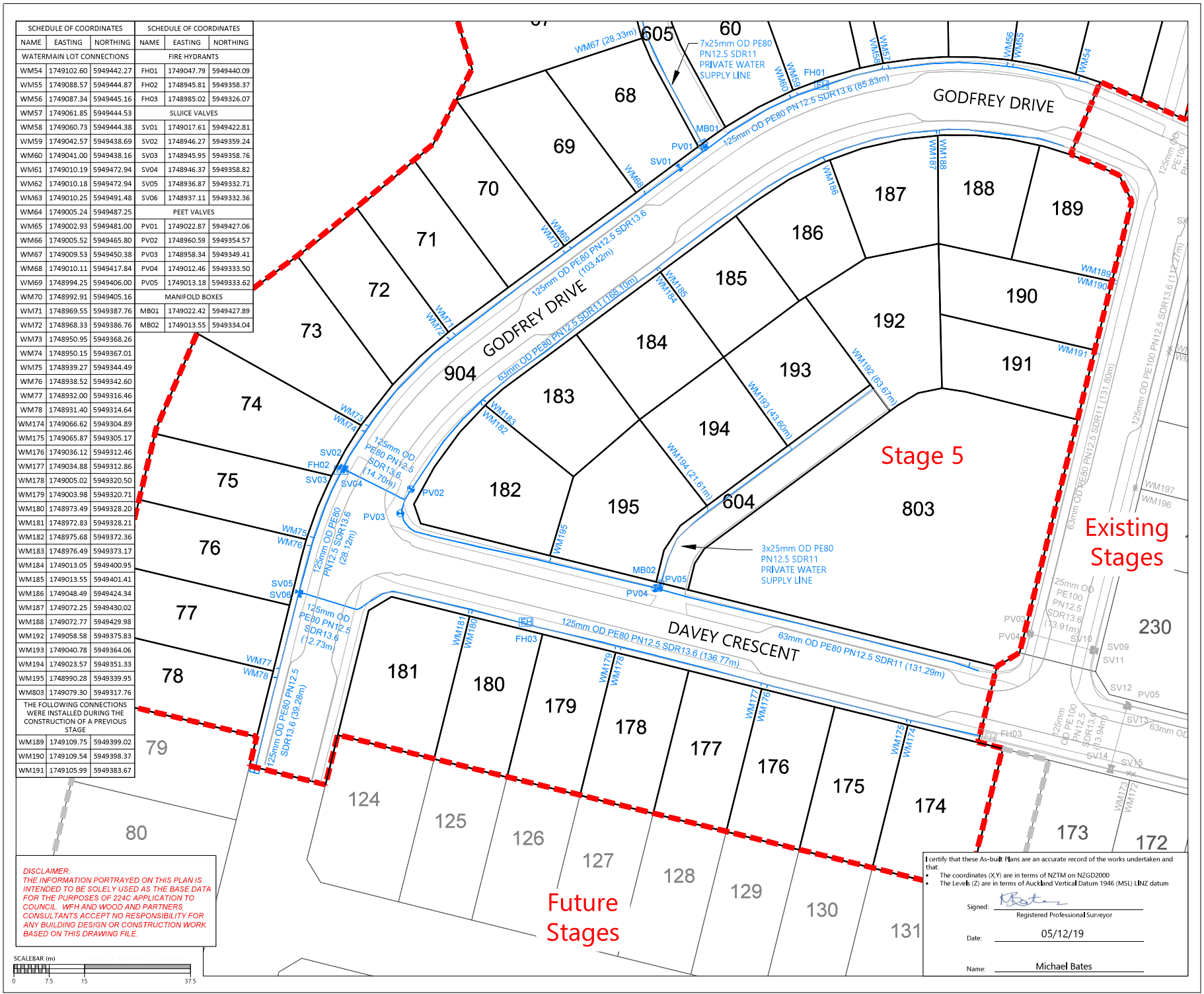
WFH PROPERTIES

MILLWATER PRECINCT 5
OREWA WEST
STAGE 5

WATERMAIN AS-BUILT
SHEET 2 OF 3

STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-601-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_PS_05_WATERMAIN.DWG



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SCALEBAR (m)
0 7.5 15 37.5

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Signed: _____ Registered Professional Surveyor
Date: 05/12/19
Name: Michael Bates

WOODS Est.1970

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- MANIFOLD BOX (MB)
- LOT CONNECTION WM181
- STAGE BOUNDARY

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	KR	05/12/19

SURVEYED	WOODS	WOODS Ltd LEVEL 1 BUILDING B, 8 NUGENT STREET, GRAFTON AUCKLAND 1023 09 308 9229
DESIGNED	MB	
DRAWN	SK	
CHECKED	AC	
APPROVED	MB	WOODS.CO.NZ

N

WFH PROPERTIES

MILLWATER PRECINCT 5
OREWA WEST
STAGE 5

WATERMAIN AS-BUILT
SHEET 3 OF 3

STATUS	AS-BUILT	REV
SCALE	1:750 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	37505-05-602-AB	

Document No. K:\37505 - ARRAN HILL PRECINCT 5 STAGE 5\PROJECT DATA\DRAWINGS\SURV\37505_PS_05_WATERMAIN.DWG

Appendix B: T+T drawings

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L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 5\21854.0031-AHP5S5-100.dwg 2019-Dec-13 3:43:07 PM Plotted By: JONALD CASTRO

WFH PROPERTIES LTD
MILLWATER - ARRANS HILL
PRECINCT 5 STAGE 5
COMPLETION REPORT ISSUE

DRAWING	Rev	Title
GENERAL		
● 21854.0031-AHP5S5-100	1	DRAWING LIST AND LOCATION PLAN
● 21854.0031-AHP5S5-101	1	GEOTECHNICAL WORKS PLAN
● 21854.0031-AHP5S5-102	1	GEOTECHNICAL WORKS SUBSOIL DRAIN PLAN
● 21854.0031-AHP5S5-103	1	GEOLOGICAL CROSS SECTIONS 1 & 2
● 21854.0031-AHP5S5-104	1	GEOLOGICAL CROSS SECTIONS 3 & 4
● 21854.0031-AHP5S5-105	1	GEOLOGICAL CROSS SECTION 5
● 21854.0031-AHP5S5-110	1	RE SLOPE 4 - TYPICAL SECTION
● 21854.0031-AHP5S5-111	1	RE SLOPE 8 - TYPICAL SECTION (SHEET 1)
● 21854.0031-AHP5S5-112	1	RE SLOPE 8 - TYPICAL SECTION (SHEET 2)
● 21854.0031-AHP5S5-113	1	PALISADE WALL 4 PLAN AND DETAILS
● 21854.0031-AHP5S5-120	1	BUILDING LIMITATION PLAN
● 21854.0031-AHP5S5-121	1	POST EARTHWORKS INVESTIGATION PLAN
● 21854.0031-AHP5S5-122	1	TOPSOIL DEPTHS PLAN
● 21854.0031-AHP5S5-123	1	EARTHWORKS TESTING LOCATION PLAN

LOCATION PLAN
SCALE 1:10,000

● Denotes drawing this issue: 13/12/2019

Tonkin+Taylor
Exceptional thinking together www.tonkintaylor.co.nz

REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

DESIGNED	JKK	Dec.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Dec.19	
DESIGN CHECKED	JASM	Dec.19	
DRAWING CHECKED	RBS	Dec.19	

NOT FOR CONSTRUCTION — APPROVED — DATE

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

CLIENT **WFH PROPERTIES LTD**
PROJECT **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 5
DRAWING LIST AND LOCATION PLAN
SCALE (A3) 1:10,000 DWG No. 21854.0031-AHP5S5-100 REV 1

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LEGEND

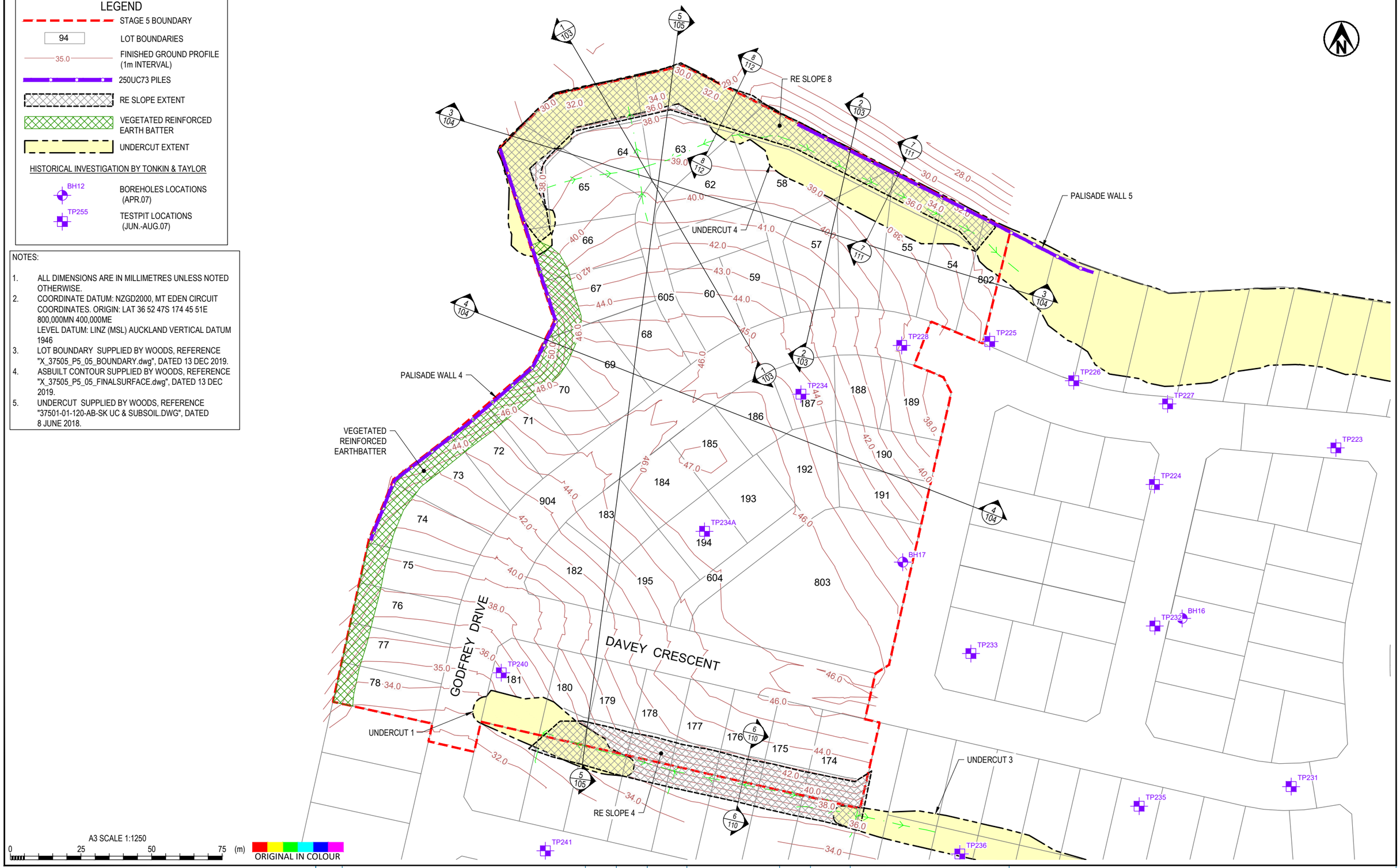
- STAGE 5 BOUNDARY
- 94 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- 250UC73 PILES
- RE SLOPE EXTENT
- VEGETATED REINFORCED EARTH BATTER
- UNDERCUT EXTENT

HISTORICAL INVESTIGATION BY TONKIN & TAYLOR

- BH12 — BOREHOLES LOCATIONS (APR.07)
- TP255 — TESTPIT LOCATIONS (JUN.-AUG.07)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_BOUNDARY.dwg", DATED 13 DEC 2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_FINALSURFACE.dwg", DATED 13 DEC 2019.
5. UNDERCUT SUPPLIED BY WOODS, REFERENCE "37501-01-120-AB-SK UC & SUBSOIL.DWG", DATED 8 JUNE 2018.



A3 SCALE 1:1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

DESIGNED	JKK	Dec.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Dec.19	
DESIGN CHECKED	JASM	Dec.19	
DRAWING CHECKED	RBS	Dec.19	

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APPROVED DATE

CLIENT **WFH PROPERTIES LTD**

PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
GEOTECHNICAL WORKS PLAN

SCALE (A3) 1:1250 DWG No. 21854.0031-AHP5S5-101 REV 1

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LEGEND

- STAGE 5 BOUNDARY
- 94 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- 250UC73 PILES
- RE SLOPE EXTENT
- VEGETATED REINFORCED EARTH BATTER
- UNDERCUT EXTENT
- REINFORCED EARTH SLOPE SUBSOIL DRAIN

NOTES:

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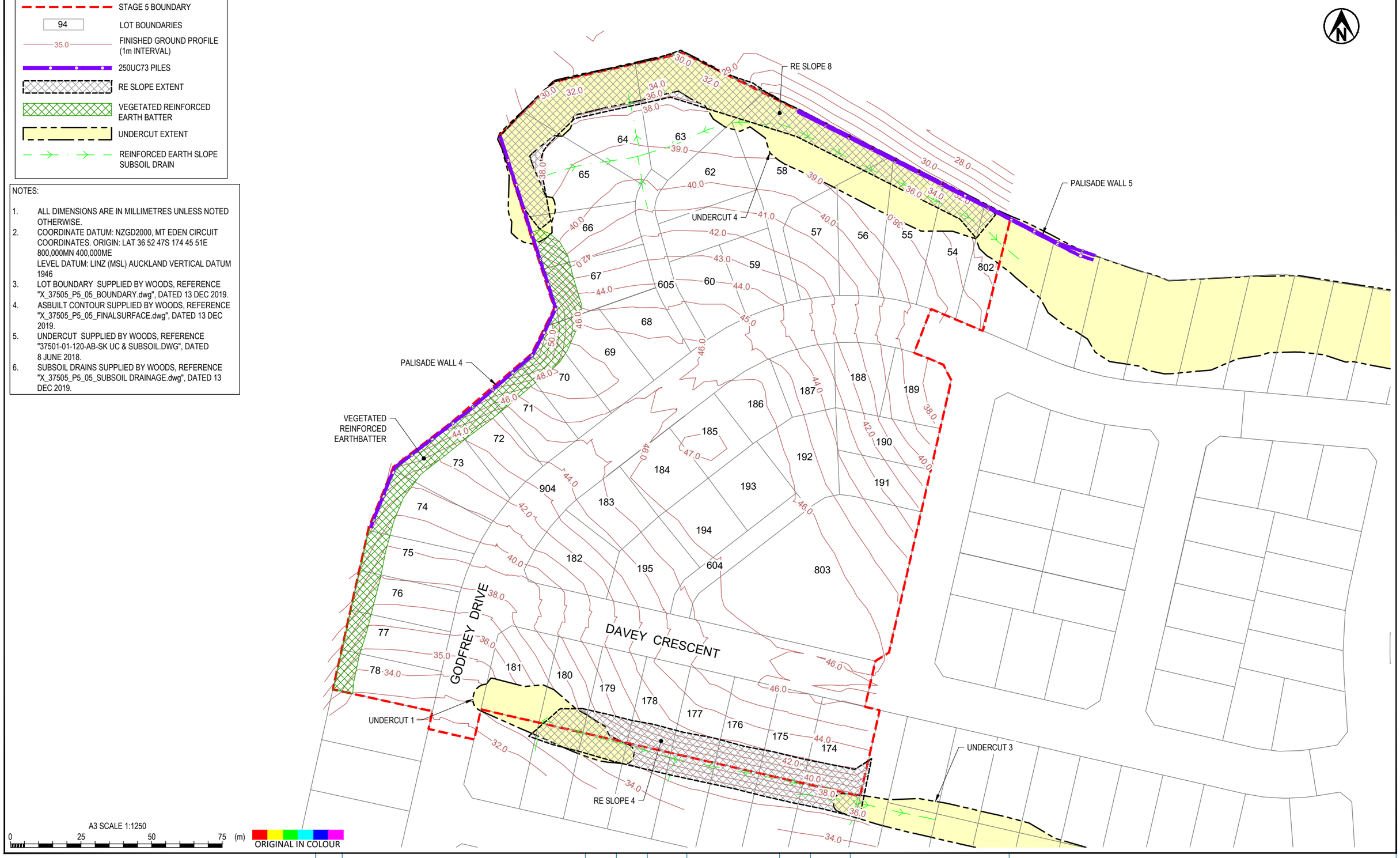

Tonkin+Taylor

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APPROVED DATE

CLIENT **WFH PROPERTIES LTD**

PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
GEOTECHNICAL WORKS SUBSOIL DRAIN PLAN

SCALE (A3) 1:1250 DWG No. 21854.0031-AHP5S5-102 REV 1

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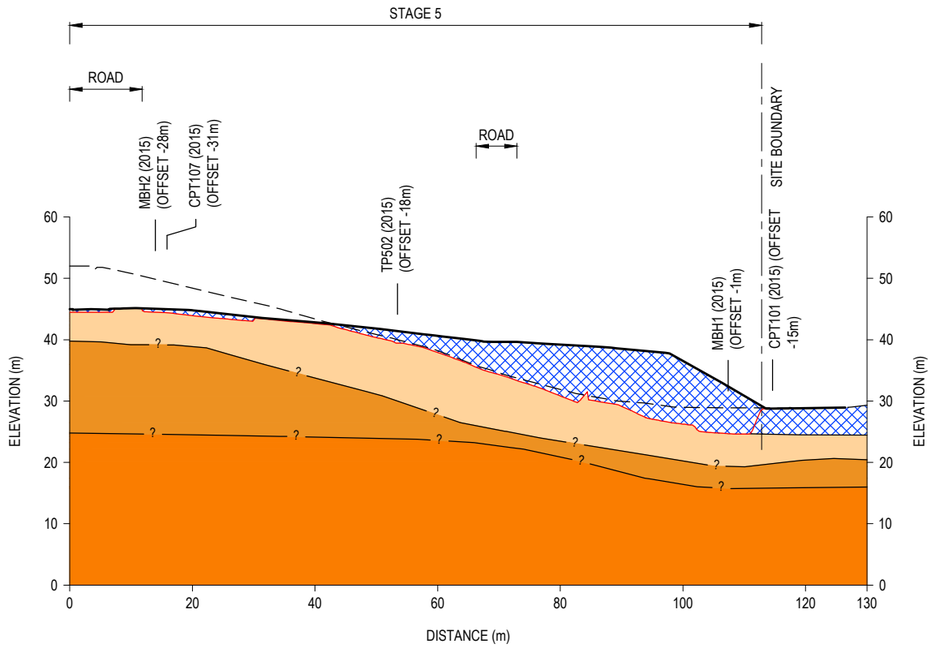
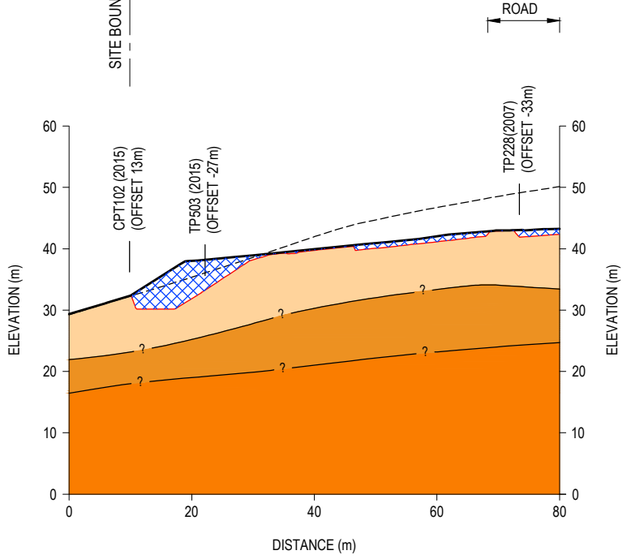
L:\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 5\21854.0031-AHP5S5-103_104.dwg 2019-Dec-13 3:43:24 PM Plotted By: JONALD CASTRO

LEGEND

- GROUND PROFILE PRIOR TO PRECINCT 5 COMMENCEMENT
- FINAL GROUND PROFILE
- UNDERCUT/LOWEST SURFACE
- ? GEOLOGICAL CONTACT
- ENGINEERED FILL
- RESIDUAL-WEATHERED ECBF
- HIGHLY WEATHERED ECBF
- SLIGHTLY WEATHERED ECBF



SECTION 1 / 101
SCALE 1: 1000



SECTION 2 / 101
SCALE 1: 1000

NOTE:

1. ALL GEOLOGICAL BOUNDARIES ARE APPROXIMATE AND INFERRED FROM POINT LOCATION DATA.
2. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_FINALSURFACE.dwg", DATED 13 DEC 2019.
3. UNDERCUT SUPPLIED BY WOODS, REFERENCE "37501-01-120-AB-SK UC & SUBSOIL.DWG", DATED 8 JUNE 2018.

A3 SCALE 1:1000

0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

Tonkin+Taylor

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

DESIGNED	JKK	Dec.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Dec.19	
DESIGN CHECKED	JASM	Dec.19	
DRAWING CHECKED	RBS	Dec.19	

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APPROVED DATE

CLIENT **WFH PROPERTIES LTD**

PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
GEOLOGICAL CROSS SECTIONS 1 & 2

SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S5-103 REV 1

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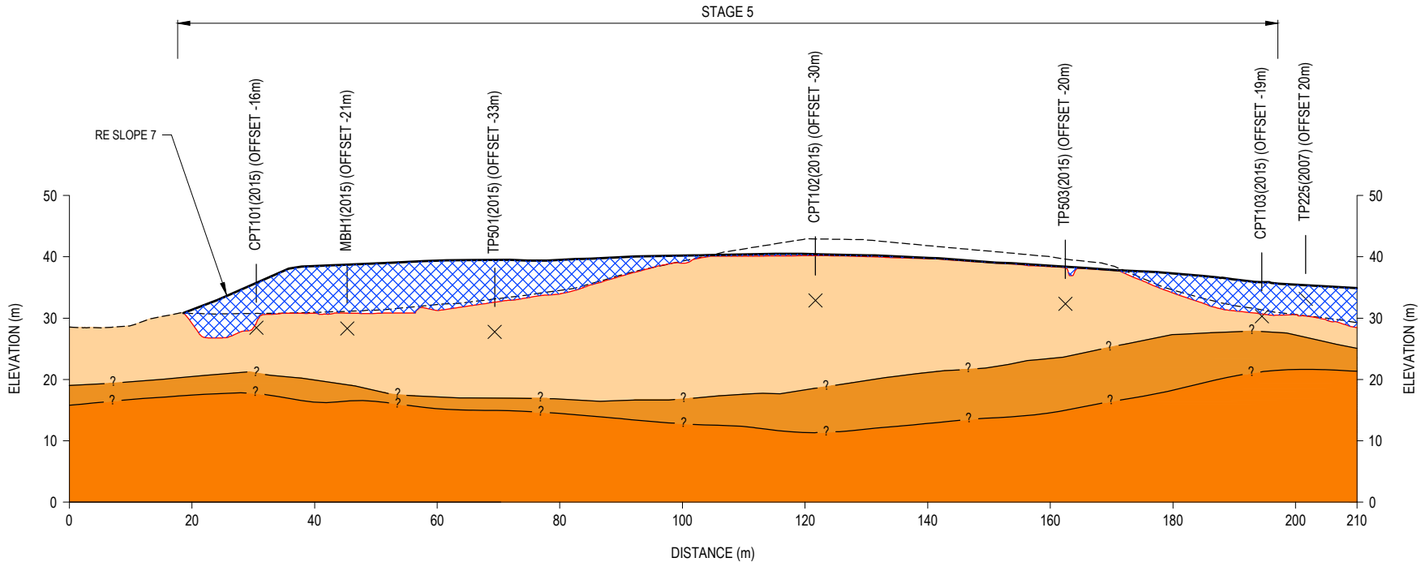
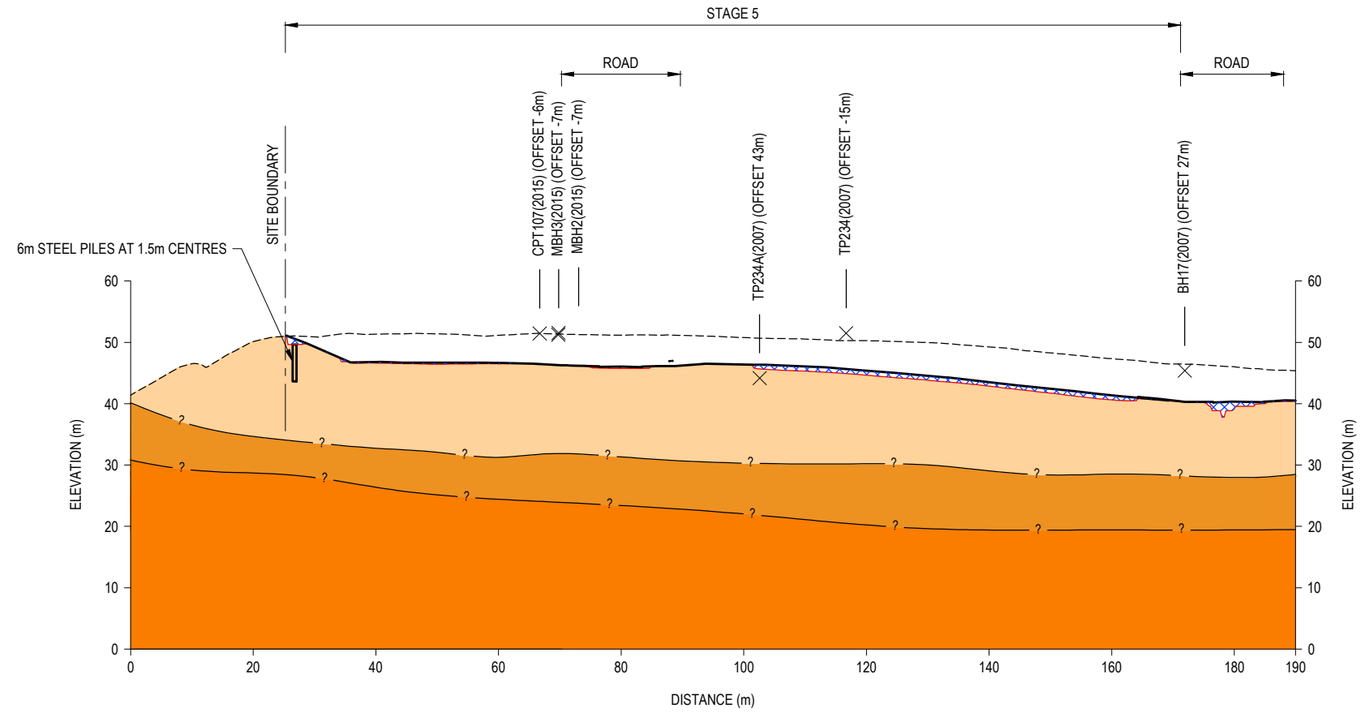
\\ttgroup.local\infrastructure\CAD\21854\21854.0031 - Orewa West Precinct 5\WorkingMaterial\CAD\DWG\GCR\STAGE 5\21854.0031-AHP5S5-103_104.dwg 2019-Dec-16 10:33:13 AM Plotted By: JONALD CASTRO

LEGEND

- GROUND PROFILE PRIOR TO PRECINCT 5 COMMENCEMENT
- FINAL GROUND PROFILE
- UNDERCUT/LOWEST SURFACE
- ? GEOLOGICAL CONTACT
- ENGINEERED FILL
- RESIDUAL-WEATHERED ECBF
- HIGHLY WEATHERED ECBF
- SLIGHTLY WEATHERED ECBF



SECTION 3
SCALE 1: 1000



SECTION 4
SCALE 1: 1000

NOTE:

1. ALL GEOLOGICAL BOUNDARIES ARE APPROXIMATE AND INFERRED FROM POINT LOCATION DATA.
2. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_FINALSURFACE.dwg", DATED 13 DEC 2019.
3. UNDERCUT SUPPLIED BY WOODS, REFERENCE "37501-01-120-AB-SK UC & SUBSOIL.DWG", DATED 8 JUNE 2018.

A3 SCALE 1:500

0 5 10 15 20 25 (m)

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

DESIGNED	JKK	Dec.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Dec.19	
DESIGN CHECKED	JASM	Dec.19	
DRAWING CHECKED	RBS	Dec.19	

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CLIENT **WFH PROPERTIES LTD**

PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
GEOLOGICAL CROSS SECTIONS 3 & 4

SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S5-104 REV 1

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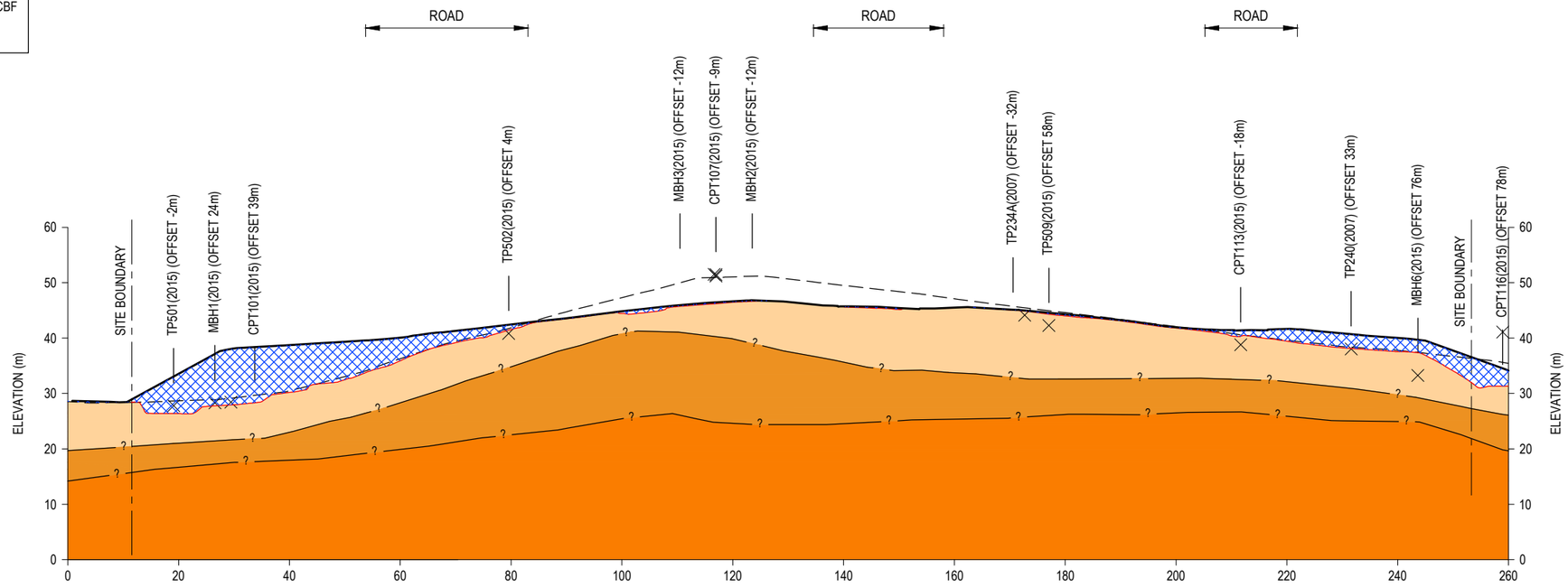
LEGEND

- GROUND PROFILE PRIOR TO PRECINCT 5 COMMENCEMENT
- FINAL GROUND PROFILE
- UNDERCUT/LOWEST SURFACE
- GEOLOGICAL CONTACT
- ENGINEERED FILL
- RESIDUAL-WEATHERED ECBF
- HIGHLY WEATHERED ECBF
- SLIGHTLY WEATHERED ECBF



SECTION 5/101
SCALE 1: 1000

NOTE:

1. ALL GEOLOGICAL BOUNDARIES ARE APPROXIMATE AND INFERRED FROM POINT LOCATION DATA.
2. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_FINALSURFACE.dwg", DATED 13 DEC 2019.
3. UNDERCUT SUPPLIED BY WOODS, REFERENCE "37501-01-120-AB-SK UC & SUBSOIL.DWG", DATED 8 JUNE 2018.

A3 SCALE 1:500

0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

DESIGNED	JKK	Dec.19
DRAWN	JC	Dec.19
DESIGN CHECKED	JASM	Dec.19
DRAWING CHECKED	RBS	Dec.19

DRAWING STATUS: COMPLETION REPORT

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PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
GEOLOGICAL CROSS SECTION 5

SCALE (A3) 1:1000 DWG No. 21854.0031-AHP5S5-105 REV 1

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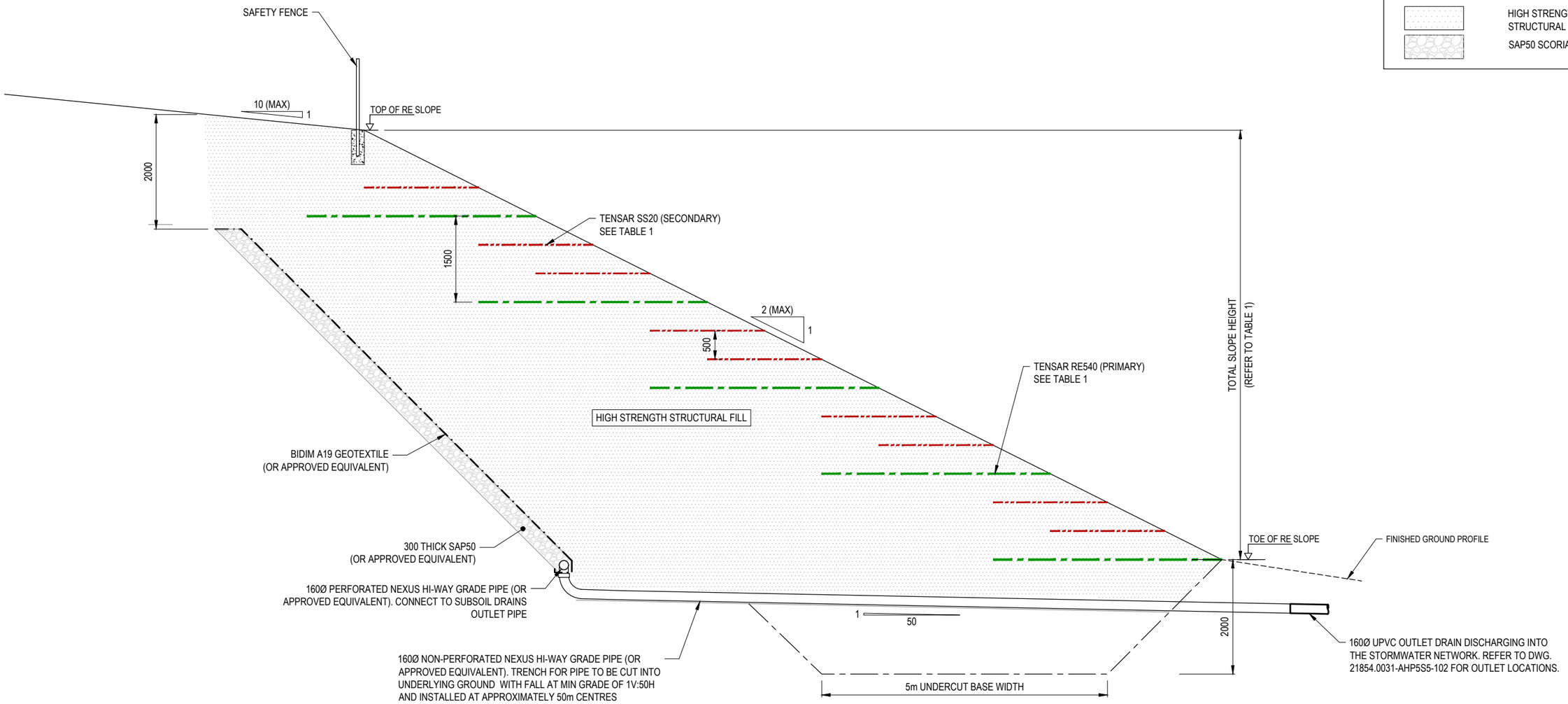
NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. WALL SETOUT AS PROVIDED BY WOODS AND CONFIRMED ON SITE BY THE ENGINEER.
3. SEE DWG.21854.0031-AHP5S5-101 FOR RE SLOPE 8 PLAN.

TABLE 1: REINFORCEMENT DETAIL FOR RE SLOPE 4

WALL TYPE	MAXIMUM TOTAL SLOPE HEIGHT (m)	MAX SLOPE	MAX FORWARD SLOPE	MAX BACK SLOPE	GEOGRID REQUIREMENTS		
					GEOGRID TYPE	GEOGRID LENGTH (m)	MAX VERTICAL SPACING (m)
RE SLOPE 4	H ≤ 8	1V:2H	1V:10H	1V:10H	TENSAR RE540	4.0	1.5
					TENSAR SS20	2.0	0.5

LEGEND
- BIDIM A19 GEOTEXTILE
- TENSAR SS20 (SECONDARY)
- TENSAR RE540 (PRIMARY)
- HIGH STRENGTH STRUCTURAL FILL
- SAP50 SCORIA



SECTION 6/101 RE SLOPE 4
SCALE 1: 75

A3 SCALE 1:75
0 1 2 3 4 (m)
ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

DESIGNED	JKK	Dec.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Dec.19	
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CLIENT **WFH PROPERTIES LTD**
PROJECT **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 5
RE SLOPE 4 - TYPICAL SECTION
SCALE (A3) 1:75 DWG No. 21854.0031-AHP5S5-110 REV 1

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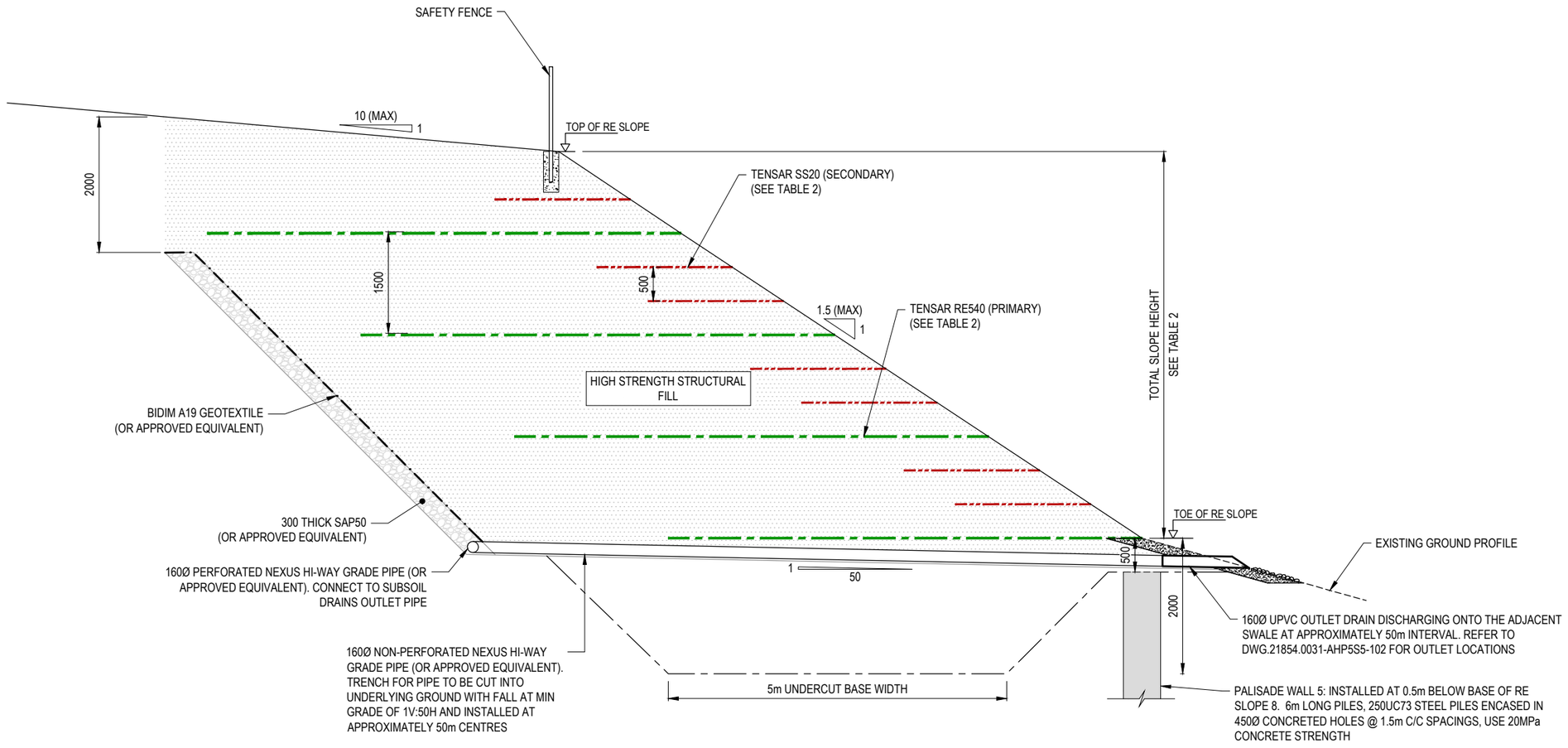
NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. WALL SETOUT AS PROVIDED BY WOODS AND CONFIRMED ON SITE BY THE ENGINEER.
3. SEE DWG.21854.0031-AHP5S5-101 FOR RE SLOPE 8 PLAN.

TABLE 2: REINFORCEMENT DETAIL FOR RE SLOPE 8

WALL TYPE	MAXIMUM TOTAL SLOPE HEIGHT (m)	MAX SLOPE	MAX BACK SLOPE	GEOGRID REQUIREMENTS		
				GEOGRID TYPE	GEOGRID LENGTH (m)	MAX VERTICAL SPACING (m)
RE SLOPES 8	H ≤ 5	1V:1.5H	1V:10H	TENSAR RE540	4.0	1.5
				TENSAR SS20	2.0	0.5
	5 < H ≤ 7	1V:1.5H	1V:10H	TENSAR RE540	7.0	1.5
				TENSAR SS20	2.0	0.5
	7 < H ≤ 9	1V:1.5H	1V:10H	TENSAR RE540	11.0	1.5
				TENSAR SS20	2.0	0.5
	9 < H ≤ 11	1V:1.5H	1V:10H	TENSAR RE540	14.0	1.5
				TENSAR SS20	2.0	0.5

LEGEND
- BIDIM A19 GEOTEXTILE
- TENSAR SS20 (SECONDARY)
- TENSAR RE540 (PRIMARY)
- HIGH STRENGTH STRUCTURAL FILL
- SAP50 SCORIA



SECTION 7/101 RE SLOPE 8 WITH PALISADE WALL 5
SCALE 1:75

A3 SCALE 1:75
0 1 2 3 4 (m)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

DESIGNED	JKK	Dec.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Dec.19	
DESIGN CHECKED	JASM	Dec.19	
DRAWING CHECKED	RBS	Dec.19	

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APPROVED DATE

CLIENT WFH PROPERTIES LTD
PROJECT MILLWATER - ARRANS HILL
TITLE PRECINCT 5 STAGE 5
RE SLOPE 8 - TYPICAL SECTION (SHEET 1)
SCALE (A3) 1:75 DWG No. 21854.0031-AHP5S5-111 REV 1

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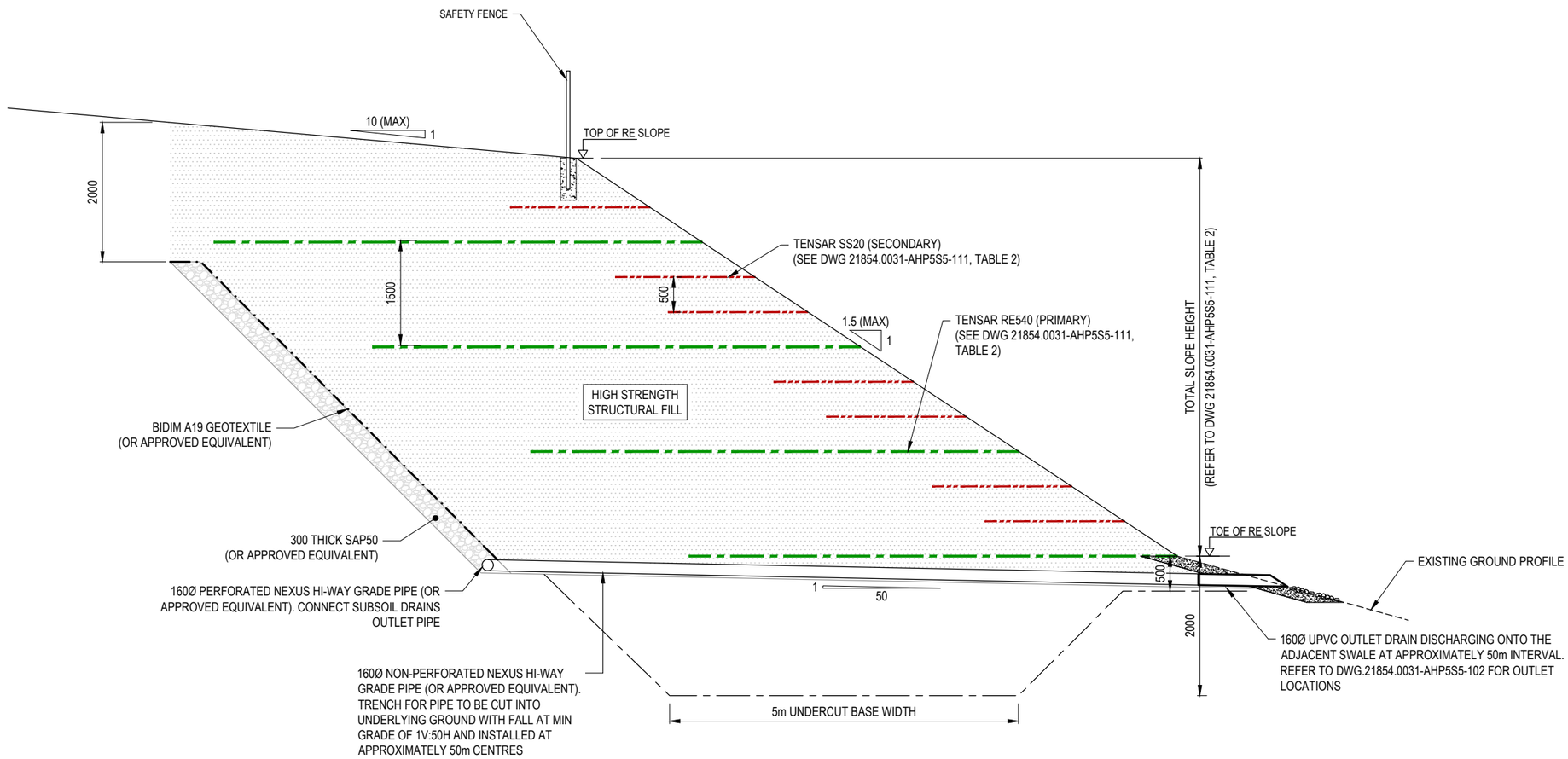
NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. WALL SETOUT AS PROVIDED BY WOODS AND CONFIRMED ON SITE BY THE ENGINEER.
3. SEE DWG.21854.0031-AHP5S5-101 FOR RE SLOPE 8 PLAN.

LEGEND
- BIDIM A19 GEOTEXTILE
- TENSAR SS20 (SECONDARY)
- TENSAR RE540 (PRIMARY)
- HIGH STRENGTH STRUCTURAL FILL
- SAP50 SCORIA



SECTION 8/101 RE SLOPE 8
SCALE 1:75

A3 SCALE 1:75
0 1 2 3 4 (m)
ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

DESIGNED	JKK	Dec.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Dec.19	
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DRAWING CHECKED	RBS	Dec.19	

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APPROVED DATE

CLIENT **WFH PROPERTIES LTD**
PROJECT **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 5
RE SLOPE 8 - TYPICAL SECTION (SHEET 2)
SCALE (A3) 1:75 DWG No. 21854.0031-AHP5S5-112 REV 1

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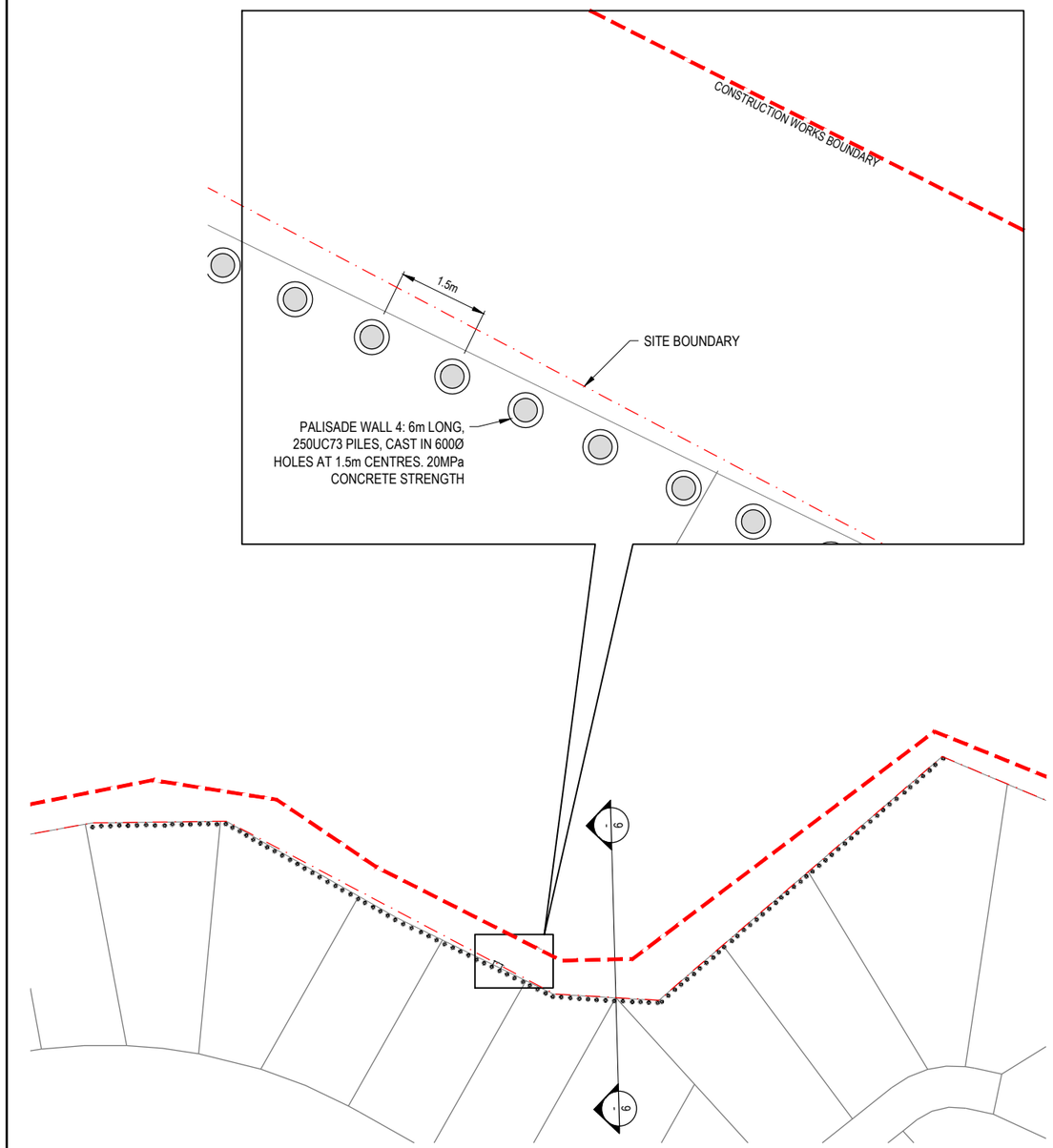
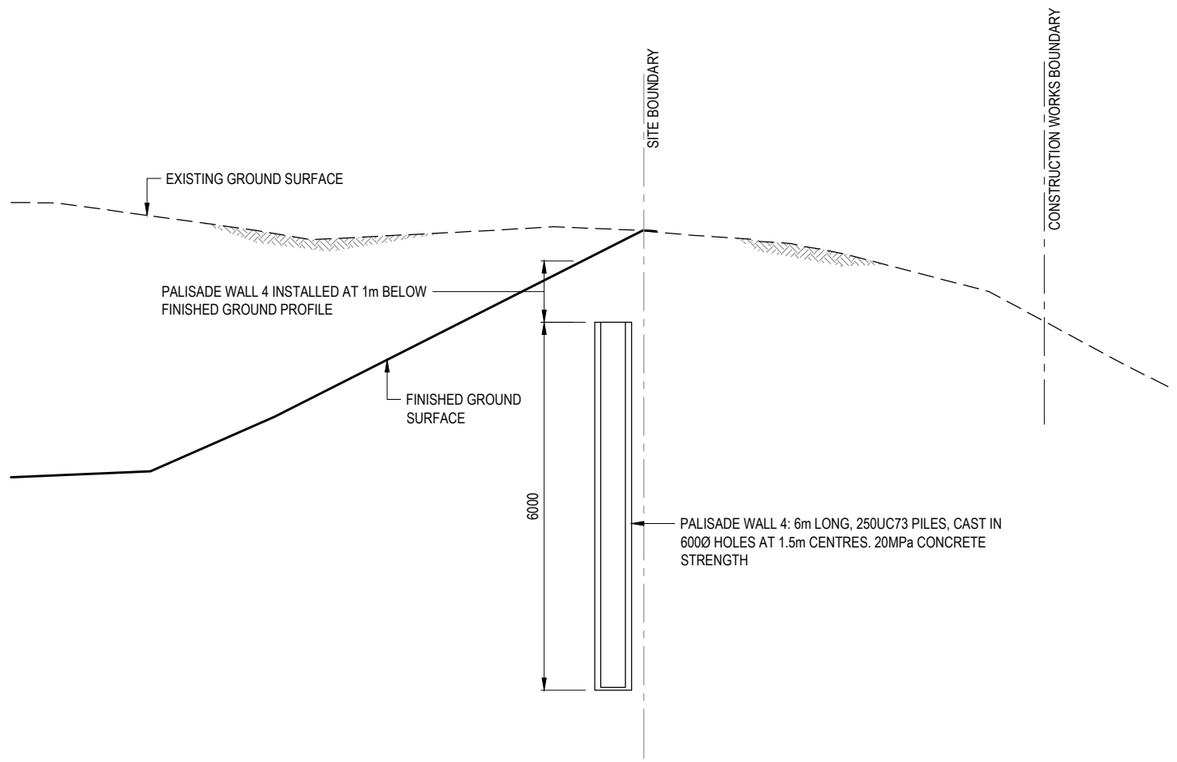


TYPICAL PALISADE WALL 4 PILE LAYOUT
SCALE 1:1000

LEGEND

- EXISTING GROUND
- PROPOSED GROUND PROFILE
- CONSTRUCTION WORKS BOUNDARY
- SITE BOUNDARY
- HIGH STRENGTH STRUCTURAL FILL OR CONCRETE



SECTION 9 - PALISADE WALL 4 TYPICAL DETAIL
SCALE 1: 100

A3 SCALE 1:75
0 1 2 3 4 (m)

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC	JKK	Dec.19

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DRAWING CHECKED	RBS	Dec.19	

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CLIENT **WFH PROPERTIES LTD**
PROJECT **MILLWATER - ARRANS HILL**
TITLE PRECINCT 5 STAGE 5
PALISADE WALL 4 PLAN AND DETAILS
SCALE (A3) AS SHOWN DWG No. 21854.0031-AHP5S5-113 REV 1

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LEGEND

- STAGE 5 BOUNDARY
- 94 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- 250UC73 PILES
- BUILDING LIMITATION ZONE

PALISADE WALL 5

PALISADE WALL 4

GODFREY DRIVE

DAVEY CRESCENT

A3 SCALE 1:1250

0 25 50 75 (m)

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
1	COMPLETION REPORT ISSUE	JC				

DESIGNED	JKK	Dec.19	DRAWING STATUS	COMPLETION REPORT
DRAWN	JC	Dec.19		
DESIGN CHECKED				
DRAWING CHECKED				

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PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
BUILDING LIMITATION PLAN

SCALE (A3) 1:1250 DWG No. 21854.0031-AHP5S5-120 REV 1

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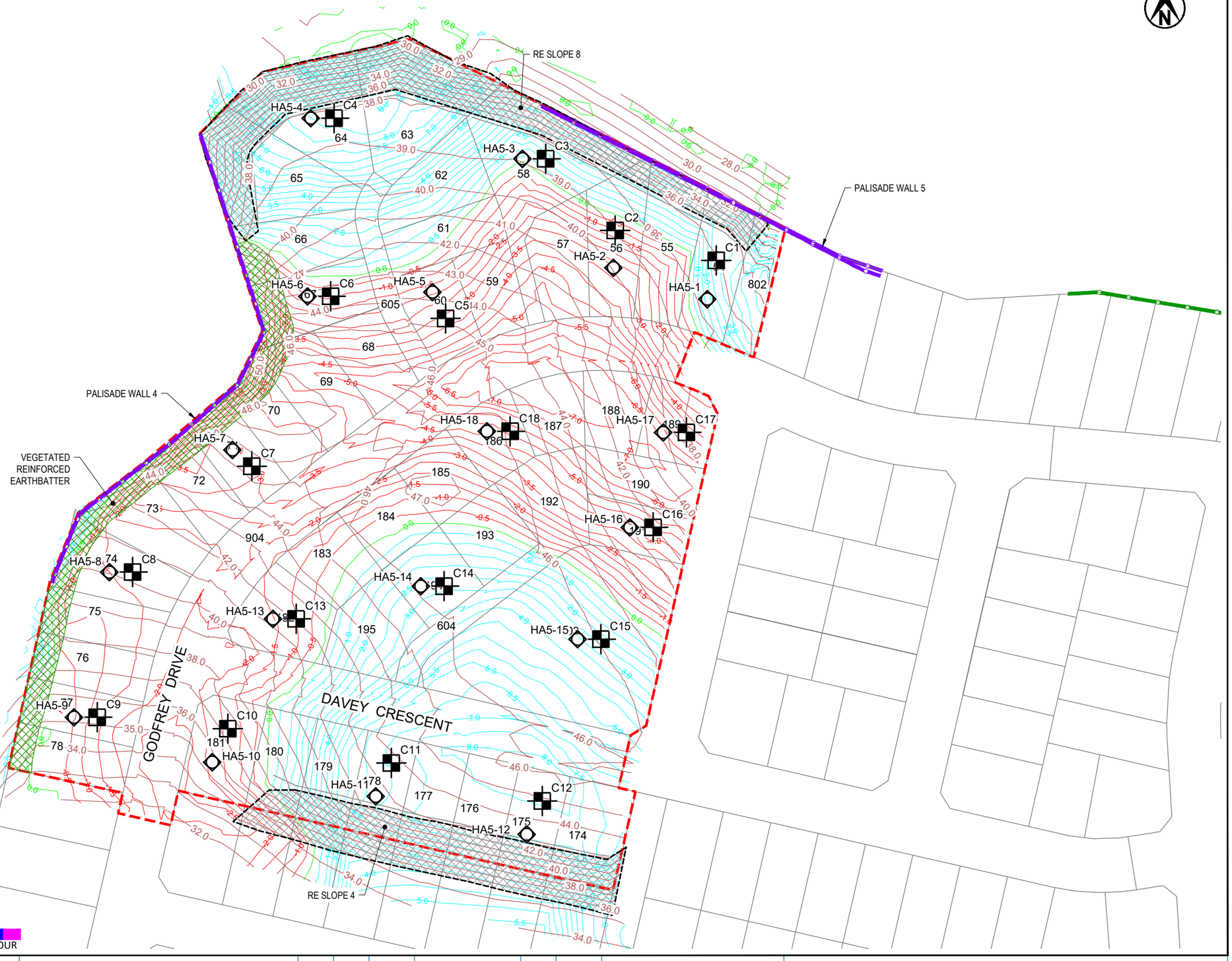
LEGEND

- STAGE 5 BOUNDARY
- 94 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- 250UC73 PILES
- RE SLOPE EXTENT
- VEGETATED REINFORCED EARTH BATTER
- 2.0 — FILL CONTOURS
- 0.0 — ZERO CONTOURS
- -2.0 — CUT CONTOURS
- C3 — EXPANSIVE SOIL TEST SAMPLES @ 0.5m AND 1.0m DEPTH
- HA3B-1 — HAND AUGER TO 3m DEPTH (FULLY LOGGED)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_BOUNDARY.dwg", DATED 13 DEC 2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_FINALSURFACE.dwg", DATED 13 DEC 2019.
5. CUTFILL CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_ORIGINAL FINAL.dwg", DATED 13 DEC 2019.



A3 SCALE 1:1250

0 25 50 75 (m)

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REV	DESCRIPTION	CAD	CHK	DATE
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CLIENT **WFH PROPERTIES LTD**

PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
POST EARTHWORKS INVESTIGATION PLAN

SCALE (A3) 1:1250 DWG No. 21854.0031-AHP5S5-121 REV 1

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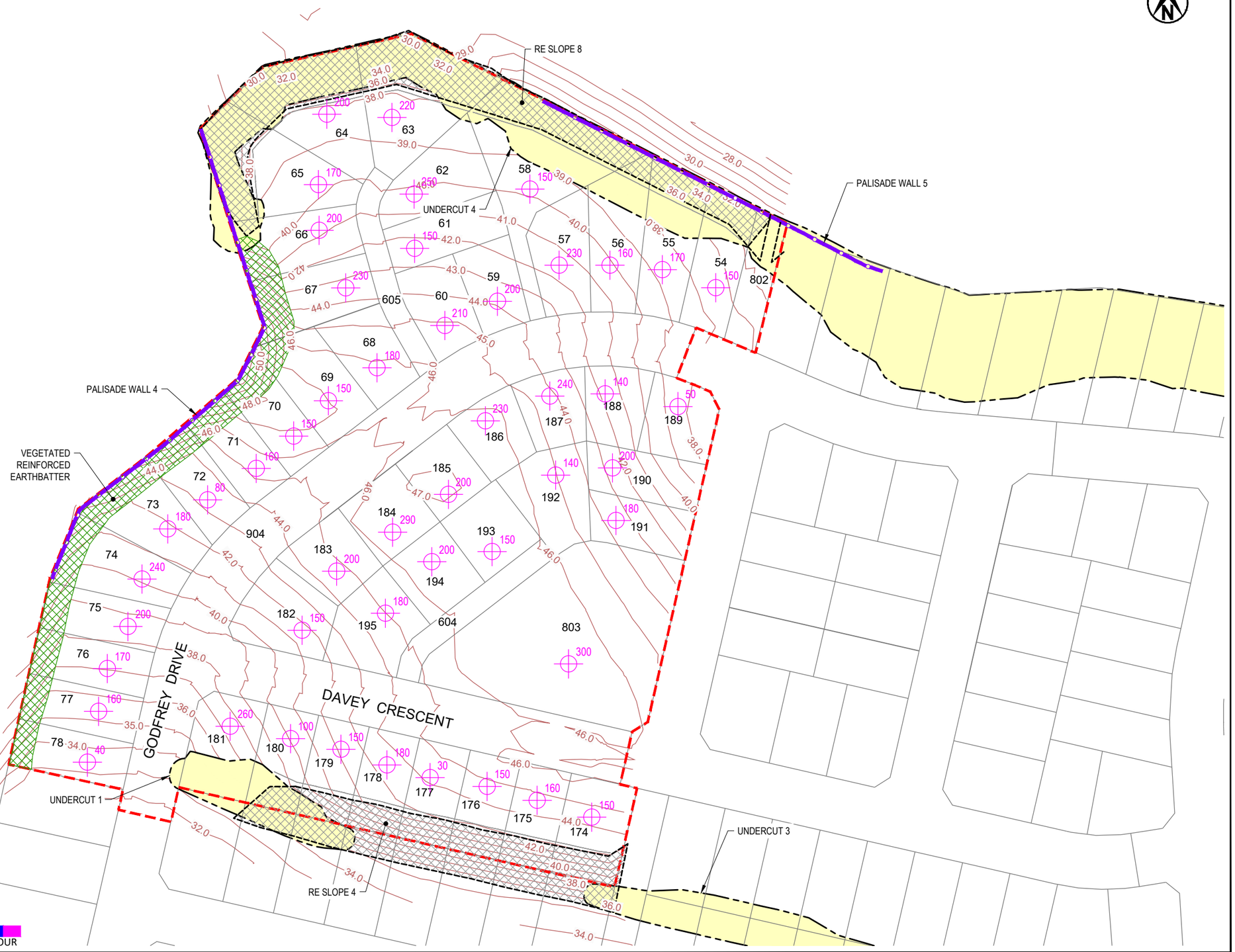
LEGEND

- STAGE 5 BOUNDARY
- 94 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- 250UC73 PILES
- RE SLOPE EXTENT
- VEGETATED REINFORCED EARTH BATTER
- UNDERCUT EXTENT
- 200 — TOPSOIL DEPTH (mm) TAKEN AT CENTRE OF EACH LOT

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
3. LOT BOUNDARY SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_BOUNDARY.dwg", DATED 13 DEC 2019.
4. ASBUILT CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_FINALSURFACE.dwg", DATED 13 DEC 2019.
5. UNDERCUT SUPPLIED BY WOODS, REFERENCE "37501-01-120-AB-SK UC & SUBSOIL.DWG", DATED 8 JUNE 2018.



A3 SCALE 1:1250

0 25 50 75 (m)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE	APPROVED	DATE
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DRAWING CHECKED	RBS	Dec.19	

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PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
TOPSOIL DEPTHS PLAN

SCALE (A3) 1:1250 DWG No. 21854.0031-AHP5S5-122 REV 1

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LEGEND

- STAGE 5 BOUNDARY
- 94 — LOT BOUNDARIES
- 35.0 — FINISHED GROUND PROFILE (1m INTERVAL)
- 250UC73 PILES
- RE SLOPE EXTENT
- VEGETATED REINFORCED EARTH BATTER
- 2.0 — FILL CONTOURS
- 0.0 — ZERO CONTOURS
- -2.0 — CUT CONTOURS
- S16 0816 — EARTHWORKS TESTING LOCATION (URN NUMBER)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. ORIGIN: LAT 36 52 47S 174 45 51E 800,000MN 400,000ME
   LEVEL DATUM: LINZ (MSL) AUCKLAND VERTICAL DATUM 1946
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5. CUTFILL CONTOUR SUPPLIED BY WOODS, REFERENCE "X_37505_P5_05_ORIGINAL FINAL.dwg", DATED 13 DEC 2019.

A3 SCALE 1:1250

0 25 50 75 (m)

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REV	DESCRIPTION	CAD	CHK	DATE
1	COMPLETION REPORT ISSUE	JC		

DESIGNED	JKK	Dec.19	DRAWING STATUS: COMPLETION REPORT
DRAWN	JC	Dec.19	
DESIGN CHECKED			
DRAWING CHECKED			

NOT FOR CONSTRUCTION

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

APPROVED DATE

CLIENT **WFH PROPERTIES LTD**

PROJECT **MILLWATER - ARRANS HILL**

TITLE PRECINCT 5 STAGE 5
EARTHWORKS TESTING LOCATION PLAN

SCALE (A3) 1:1250 DWG No. 21854.0031-AHP5S5-123 REV 1

Appendix C: Contractors certificates

- JG Civil PS3 – Millwater Precinct 5 – Stage 5 Civil works
- North Harbour Fencing PS3 - Millwater Precinct 5 – Stage 5 Fencing
- ICB Retaining & Construction Limited PS3 – Palisade Wall No. 4
- Hick Bros Civil Construction Limited PS3 – Precinct 5 – Stage 5 Earthworks

NZS 3910:2013 Conditions of contract for building and civil Engineering construction

Schedule 6 – Form of Producer Statement – Construction

ISSUED BY JG Civil Ltd *(Contractor)*

TO WFH PROPERTIES Ltd *(Principal)*

IN RESPECT OF Millwater Precinct 5 - Stage 5 Civil works *(Description of Contract Works)*

AT Arran Hill - Millwater *(Address)*

JG Civil Ltd (Contractor) has contracted to *WFH PROPERTIES Ltd (Principal)* to carry out and complete certain building works in accordance with a Contract titled *PRECINCT 5 - STAGE 5* ('the Contract')

I *Joel Giddy (Duly Authorised Agent)* a duly authorised representative of *JG Civil Ltd (Contractor)* believe on reasonable grounds that *JG Civil Ltd (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 10 December 2019

JG Civil Ltd

(Contractor)

180 Foundry Road, Silverdale

(Address)

FORM OF PRODUCER STATEMENT PS3 – CONSTRUCTION
At project completion, this form shall be completed by the building contractor and supplied to the Engineer.

ISSUED BY: NORTH HARBOUR FENCING
(Building Contractor)

TO: JG CIVIL
(Owner/Principal)

IN RESPECT OF: FENCING
(Description of Contract Works)

AT: Millwater Precinct 5 Stage 5.
(Address)

T/A:..... **BUILDING CONSENT No:**.....
(Territorial Authority / Building Consent Authority)

The above Building Contractor has contracted to the above Owner/Principal to carry out and complete certain building works in accordance with the contract, titled

Millwater STAGE 5 ("the contract")
(Title of building contract)

I SIMON NICHOLSON a duly authorised representative of the
(Builder's Authorised Agent)

above building contractor, believe on reasonable grounds that the above building contractor has carried out and completed

☑All ☐Part only as specified in the attached particulars

of the building works in accordance with the contract.

.....
(Signature of Authorised Agent on behalf of the Building Contractor)

4 DEC 19
(Date)

20A MANGA ROAD
SILVERDALE
(Address)

This producer statement is confirmation by the builder(s) that they have carried out the building work in accordance with the drawings, specifications (and site amendments) that are part of the contract / building consent documents.

Work covered by this statement should have been supervised and checked by suitably qualified trades-persons.

The Engineer requires this producer statement and a copy of the T/A's building consent conditions, to confirm that items of the contract that he has not personally examined, have in fact been built according to the documents, so that the Engineer may issue appropriate documents to the T/A for it to release the Code Compliance Certificate.

SIXTH SCHEDULE

(NZS 3910:2003)

FORM OF PRODUCER STATEMENT CONSTRUCTION

ISSUED BY **ICB Retaining & Construction Limited**
(Contractor)

TO **Hicks Bros Civil Contractors Ltd**
(Principal)

IN RESPECT OF **Palisade Wall no.4**
(Description of Contract Works)

AT **Millwater Subdivision, Arran Hill, Precinct 5, Orewa West**
(Address)

ICB Retaining & Construction Ltd
(Contractor)

has contracted to **Hicks Bros Civil Contractors Ltd**
(Principal)

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

Palisade Wall no.4 *(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 Building Consent No. and any Authorised Instruction / Variations that have been issued during the course of the work.

(Signature of Authorised Agent on Behalf of)

16 September 2019
(Date)

ICB Retaining & Construction Limited
(Contractor)

13 Volkner Place, Rosedale, Auckland 0632
(Address)

PS3 - FORM OF PRODUCER STATEMENT- CONSTRUCTION

ISSUED BY: HICK BROS CIVIL CONSTRUCTION LIMITED

TO: WFH Development Ltd

IN RESPECT OF: Precinct 5 Stage 5 Earthworks
AT: 157 Grand Drive, Orewa

HICK BROS CIVIL CONSTRUCTION LTD has contracted to WFH Development Ltd to carry out and complete certain building works in accordance with a contract, titled Precinct 5 Stage 5 Earthworks ("the contract")

I MATT THOMAS a duly authorized representative of HICK BROS CIVIL CONSTRUCTION LIMITED believe on reasonable grounds that HICK BROS CIVIL CONSTRUCTION LIMITED has carried out and completed all of the contract works in in accordance with the contract.

Date: 10th December 2019

(Signature of Authorized Agent on behalf of)

HICK BROS CIVIL CONSTRUCTION LIMITED
(Contractor)

42 FORGE ROAD, SILVERDALE
(Address)

Appendix D: 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 300kPa (i.e. an allowable bearing pressure of 100kPa 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 forseeably experience movement of 25mm 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 to H2 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 E.

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

Foundation Maintenance and Footing Performance: A Homeowner's Guide

CSIRO

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 perpends).

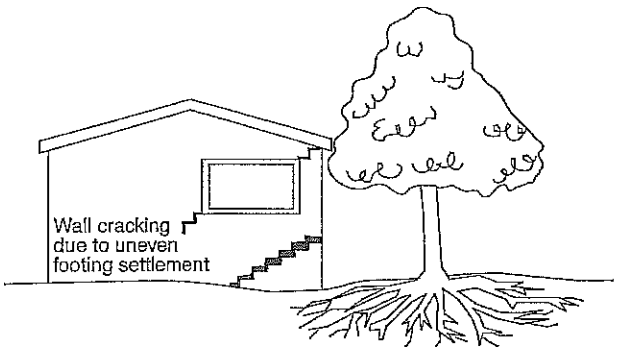
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

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.

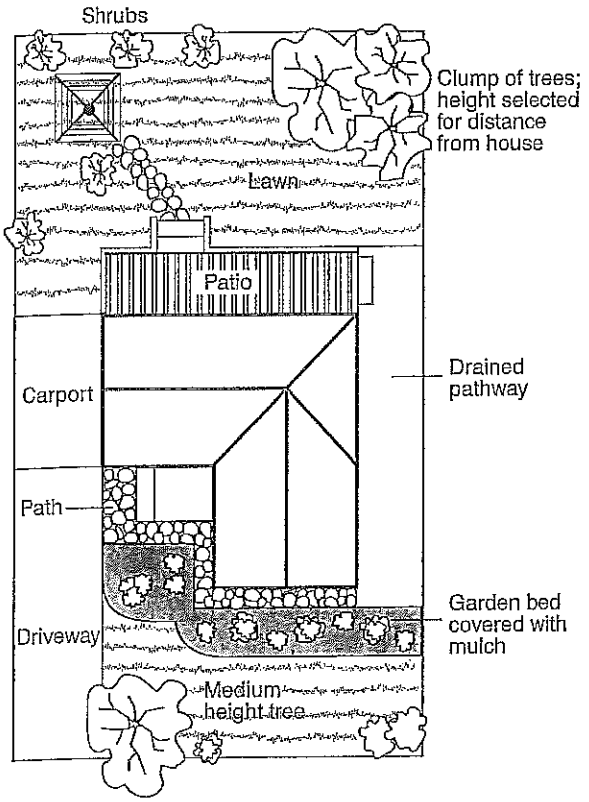
It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

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. Weathertightness 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 F: Test results

- Post earthworks geotechnical investigation logs
- Shrink/ swell laboratory test results
- Bulk earthworks test results

GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA01**

Hole Location: Lot 64

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949494.13 mN 1748998.86 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 01/10/2019
	DRILL METHOD: HA	HOLE FINISHED: 01/10/2019
R.L.: 38.03m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil							3	0	TS T	M	VSt		SILT; dark brown. Very stiff, moist, low plasticity.
					● 113/62 kPa						VSt-H		Clayey SILT; dark brown. Very stiff to hard, moist, low plasticity; with inclusions of non plastic silt.
					● 110/64 kPa			0.5					0.6m: low to medium plasticity
					● 126/95 kPa		37	1.0					
					● >192 kPa						H		SILT; reddish brown. Stiff to hard, moist, non -plastic; minor gravel.
Fill					● >192 kPa			1.5					1.8m: dry to moist, hard
					● UTP								
					● UTP		36	2.0					
					● 93/52 kPa						St-VSt		2.4m: moist, low to no plasticity, with dark brown inclusions
					● 176/89 kPa			2.5					
	DRY: 01/10/2019 after 2hrs				● >192 kPa		35	3.0					3.0m: minor dark brown inclusions
								3.5					3.2m: Target depth

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA02**

Hole Location: Lot 58

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5 | LOCATION: Millwater | JOB No.: 1100222.0000

CO-ORDINATES: (NZTM2000) 5949483.85 mN 1749057.90 mE

R.L.: 38.35m

DATUM NZVD2016

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 01/10/2019

HOLE FINISHED: 01/10/2019

DRILLED BY: GEOTECHNICS

LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Description and Additional Observations
Topsoil	SILT; dark brown. Moist, non-plastic.
Residual Soil	Clayey SILT; pink and white. Very stiff, moist; low to medium plasticity.
	Sandy SILT; pink mottled white. Very stiff, moist, non-plastic; sand, fine.
	SILT, some clay; pink mottled white. Very stiff, moist; low to no plasticity.
	1.3m: yellowish brown and pink with bands of rusty orange silt
	SILT; reddish brown and orange brown. Very stiff, moist, non-plastic.
	Clayey SILT; reddish brown and light grey. Stiff, moist, low plasticity.
	SILT, some clay; pink. Very stiff, moist, low plasticity.
	Clayey SILT; pinkish white. Very stiff, moist, low plasticity.
	SILT, some clay; reddish brown and orange brown. Very stiff, moist, non-plastic.
	3.2m: Target depth

WATER: DRY: 01/10/2019 after 1.25hrs

CORE RECOVERY (%)

METHOD

SCALA PENETROMETER (Blows/0mm): 1 2 3 4 5 6 7 8 9

TESTS: 104/47 kPa; 134/60 kPa; 119/48 kPa; 121/47 kPa; 107/38 kPa; 107/43 kPa; 85/36 kPa; 100/40 kPa; 106/54 kPa; 107/49 kPa

SAMPLES

RL (m): 38; 37; 36; 35

DEPTH (m): 0.5; 1.0; 1.5; 2.0; 2.5; 3.0; 3.5

GRAPHIC LOG

MOISTURE CONDITION / WEATHERING: M

STRENGTH/DENSITY CLASSIFICATION: VSt; St; VSt

SHEAR STRENGTH (kPa): 10 25 50 100 200

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA03**

Hole Location: Lot 67

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949451.92 mN 1748994.93 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 01/10/2019
		HOLE FINISHED: 01/10/2019
R.L.: 42.32m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: JOTI CHECKED: RBE

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil									TS T TS	M			Clayey SILT; dark brown. Very stiff, moist, low plasticity.
Residual Soil	DRY 01/10/2019				● 124/60 kPa ● 113/33 kPa ● 71/14 kPa ● 97/27 kPa ● 127/30 kPa ● 50/30 kPa ● 91/30 kPa ● 84/34 kPa ● 116/29 kPa ● UTP		42 41 40 39	0.5 1.0 1.5 2.0 2.5 3.0 3.5			VSt St St-VSt VSt	Silty CLAY; streaked white and red brown. Very stiff, moist; moderate plasticity. Clayey SILT; orange grey brown. Very stiff, moist, low plasticity. Silty CLAY; streaked white and red brown. Very stiff, moist; moderate plasticity. SILT; pink and white mottled. Very stiff, moist, low plasticity. SILT; mottled grey brown white. Very stiff, moist, non-plastic. SILT; pink. Stiff, moist; moderate plasticity. Clayey SILT; pink and white. Stiff, moist, high plasticity. SILT; light pink. Stiff to very stiff, moist; moderate plasticity. SILT; orange brown with white mottles. Very stiff, moist; non to low plasticity. 3.2m: Target depth

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA04**

Hole Location: Lot 60

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5		LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000)	5949449.64 mN 1749027.26 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 01/10/2019
		DRILL METHOD: HA	HOLE FINISHED: 01/10/2019
R.L.:	42.77m		DRILLED BY: GEOTECHNICS
DATUM	NZVD2016		LOGGED BY: JOTI CHECKED: RBE

GEOLOGICAL										ENGINEERING DESCRIPTION				
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations	
Topsoil									TS	M	H		Clayey SILT; grey brown. Hard, moist, low plasticity.	
													Clayey SILT; yellowish brown. Hard, moist; moderate plasticity.	
					● UTP					D-M	VSt		SILT; pink. Very stiff, dry to moist, non-plastic.	
					● 143/44 kPa			0.5		M			Clayey SILT; pink yellow brown. Very stiff, moist, low plasticity.	
					● 143/97 kPa		42	1.0		D			Clayey SILT; pink brown. Very stiff, dry, non-plastic.	
					● 124/37 kPa			1.5		M-W			Clayey SILT; red brown and white. Very stiff, moist to wet; moderate plasticity.	
Residual Soil					● 143/51 kPa		41	2.0		M			Clayey SILT; mottled pink, white and black. Very stiff, moist, low plasticity.	
					● 158/31 kPa									
					● 96/44 kPa			2.5			St		Clayey SILT; yellow brown. Stiff, moist, low plasticity.	
					● 101/50 kPa		40						2.9m: some pink coloring	
	DRY 01/10/2019				● 81/57 kPa			3.0						
													3.2m: Target depth	
							39	3.5						

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA05**

Hole Location: Lot 56

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949462.78 mN 1749079.53 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 01/10/2019
	DRILL METHOD: HA	HOLE FINISHED: 01/10/2019
R.L.: 38.74m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL												ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil									TS T	M	VSt		SILT; dark brown. Very stiff, moist, non-plastic.
													Clayey SILT; yellowish brown and reddish brown. Very stiff, moist; low to medium plasticity.
					121/66 kPa						H		SILT, some clay; light yellowish brown and reddish brown. Hard, dry to moist, non-plastic; minor gravel at base.
Fill					UTP			0.5					
					UTP		38						
								1.0			VSt		SILT, minor clay; reddish brown. Very stiff, moist, non-plastic.
					117/49 kPa								
					107/44 kPa			1.5					1.4m: minor clayey layers and bands of rusty orange brown silt
					122/58 kPa		37						1.9m: reddish brown and orange brown
Residual Soil					102/47 kPa			2.0					Clayey SILT; light greyish white mottled pink. Very stiff, moist, low plasticity.
					121/58 kPa			2.5					
					110/56 kPa		36						SILT, some clay; pink. Very stiff, moist; low to no plasticity.
	DRY: 01/10/2019 after 1 hour				0/- kPa			3.0					Clayey SILT; light greyish white mottled pink. Very stiff, moist, low plasticity.
													3.2m: Target depth
								3.5					
							35						

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA06**

Hole Location: Lot 54

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5		LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000)	5949443.68 mN 1749109.66 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 01/10/2019
		DRILL METHOD: HA	HOLE FINISHED: 01/10/2019
R.L.:	36.98m		DRILLED BY: GEOTECHNICS
DATUM	NZVD2016		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil					● 33/15 kPa				TS T TS T TS	M	F		SILT, some clay; dark brown with yellowish brown inclusions. Firm, moist, low plasticity.
Fill					● >192 kPa ● >192 kPa ● >192 kPa ● >192 kPa		36	0.5 1.0 1.5			H		SILT, some clay; yellowish brown and reddish brown. Hard, moist; low to no plasticity. Sandy SILT; reddish brown . Hard, moist, non-plastic; minor fine gravel. 1.4m: minor clay 1.5m: inclusions of grey siltstone 1.6m: non plastic, friable
Residual Soil	DRY: 01/10/2019 on completion				● 107/58 kPa ● 104/56 kPa ● 102/58 kPa ● 137/59 kPa ● 102/51 kPa		35 34	2.0 2.5 3.0			VSt		Clayey SILT; yellowish brown, pink and orange brown. Very stiff, moist, low plasticity. Clayey SILT; light greyish white mottled yellowish brown. Very stiff, moist, low plasticity. SILT, minor clay; yellowish brown mottled light greyish white. Very stiff, moist, non-plastic. 2.9m: trace sand
							33	3.5					3.2m: Target depth

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA07**

Hole Location: Lot 71

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949400.89 mN 1748967.51 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
	DRILL METHOD: HA	HOLE FINISHED: 30/09/2019
R.L.: 43.83m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: JOTI CHECKED: RBE

GEOLOGICAL											ENGINEERING DESCRIPTION				
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil									TS T	M	H		Clayey SILT; mottled dark brown. Hard, moist; non to low plasticity.
Fill					>200 kPa								SILT; pinkish brown. Hard, moist, non-plastic.
					148/97 kPa			0.5			VSt-H		Clayey SILT; yellow brown. Hard to very stiff, moist; low to moderate plasticity.
					>200 kPa		43			D			Sandy SILT; pink yellow brown. Very stiff to hard, dry, non-plastic; very friable, lime smell .
					UTP			1.0					
					UTP			1.5					
Residual Soil	DRY: 01/10/2019 on completion and overnight				60/39 kPa		42			M	St		Sandy SILT, some clay; pink some grey. Stiff, moist; non to low plasticity.
					86/47 kPa			2.0					Clayey SILT; pink and orange brown. Stiff, moist; non to low plasticty.
					98/44 kPa			2.5					
					114/60 kPa		41				VSt		Clayey SILT; pink with white mottles. Very stiff, moist, low plasticity.
					104/46 kPa			3.0		M-W			Clayey SILT; pink some brown and white. Very stiff, moist to wet; moderate plasticity.
													3.2m: Target depth
								3.5					
							40						

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA08**

Hole Location: Lot 186

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949402.60 mN 1749046.86 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
	DRILL METHOD: HA	HOLE FINISHED: 30/09/2019
R.L.: 44.84m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil									TS T TS	M	St		Clayey SILT; dark brown. Stiff, moist, low plasticity.
Fill					>192 kPa 151/69 kPa			0.5			VSt-H		Clayey SILT; reddish brown, yellowish brown and brown. Very stiff, moist, low plasticity. 0.5m: minor fine gravel
Residual Soil	DRY: 01/10/2019 overnight				UTP 69/30 kPa 70/33 kPa 78/33 kPa 81/34 kPa 82/48 kPa 74/41 kPa 113/52 kPa		44 43 42	1.0 1.5 2.0 2.5 3.0			St VSt		SILT; reddish brown. Stiff, moist, non-plastic. 1.2m: moist to wet, pink, brown and orange brown Clayey sandy SILT; pinkish brown. Stiff, moist, low plasticity. 2.3m: thin layer of hard rusty silt Clayey SILT; pink and orange brown. Very stiff, moist, low plasticity.
							41	3.5					3.2m: Target depth

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA09**

Hole Location: Lot 189

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5		LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000)	5949407.47 mN 1749094.85 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 01/10/2019
		DRILL METHOD: HA	HOLE FINISHED: 01/10/2019
R.L.:	37.97m		DRILLED BY: GEOTECHNICS
DATUM	NZVD2016		LOGGED BY: JOTI CHECKED: RBE

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Description and Additional Observations
Topsoil	Clayey SILT; grey brown. Hard, wet; low to moderate plasticity.
Fill	Clayey SILT; yellow brown some pink. Hard, wet, low plasticity; trace inclusions of grey siltstone.
	SILT; green brown. Hard, dry, non-plastic.
	SILT; pinkish red. Hard, dry, non-plastic.
	Silty SAND; yellow brown. Dry; well packed, hard to auger. Scala 41 blows for 100mm.
Residual Soil	SILT; white. Moist, low plasticity; Scala from 1.1m blows per 100mm: 3,1,2..
	SILT; yellow brown. Very stiff, moist, low plasticity.
	Clayey SILT; blue grey. Very stiff, moist, high plasticity.
	Clayey SILT; yellow brown. Very stiff, moist, high plasticity.
	Clayey SILT; light grey. Very stiff, moist, high plasticity.
	3.2m: Target depth

WATER: 01/10/2019 W/L after 0.75 hours

CORE RECOVERY (%)

METHOD

SCALA PENETROMETER (Blows/100mm): 1 2 3 4 5 6 7 8 9 — 41 >> — 3 — 1 — 2

TESTS: >200 kPa; UTP; UTP; 104/30 kPa; 111/37 kPa; 98/31 kPa; 118/43 kPa; 117/46 kPa; 101/33 kPa

SAMPLES

RL (m): 37, 36, 35, 34

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5

GRAPHIC LOG

MOISTURE CONDITION \ WEATHERING: W, D, M

STRENGTH/DENSITY CLASSIFICATION: H, L, VSt

SHEAR STRENGTH (kPa): 10, 25, 50, 100, 200

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA10**

Hole Location: Lot 191

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5 | LOCATION: Millwater | JOB No.: 1100222.0000

CO-ORDINATES: (NZTM2000) 5949379.03 mN 1749078.93 mE

R.L.: 42.61m

DATUM NZVD2016

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 30/09/2019

HOLE FINISHED: 30/09/2019

DRILLED BY: GEOTECHNICS

LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Description and Additional Observations
Topsoil	Clayey SILT; dark brown with yellowish brown inclusions. Very stiff, moist, low plasticity.
Fill	Clayey SILT; yellowish brown and pinkish brown with grey inclusions. Very stiff, moist, low plasticity.
Fill	SILT; pinkish brown. Very stiff to hard, moist, non-plastic.
Residual Soil	SILT; orange brown mottled white. Very stiff, moist; low to no plasticity. 1.3m: orange brown 1.4m: some clay, low plasticity
Residual Soil	Silty CLAY; yellowish brown. Stiff, moist; medium plasticity. 1.7m: light greyish brown
Residual Soil	Clayey SILT; dark grey. Very stiff, moist, low plasticity. 2.5m: light whitish brown 2.65m: veins of orange silt
Residual Soil	Sandy SILT; brown mottled light yellow. Very stiff to hard, moist, non-plastic. 3.1m: solid refusal, end of hole
	3.1m: Refusal

DEPTH (m)	RL (m)	MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION	TESTS	SCALA PENETROMETER (Blows/0mm)
0.5	42	M	VSt	113/48 kPa	
			VSt-H	>192 kPa	
1.0			VSt	>192 kPa	
				107/16 kPa	
1.5	41		St	62/27 kPa	
				97/34 kPa	
2.0			VSt	107/47 kPa	
				107/43 kPa	
2.5	40		H	161/27 kPa	
3.0				>192 kPa	
3.5	39				

WATER: DRY: 01/10/2019 on completion and overnight

CORE RECOVERY (%)

METHOD

SHEAR STRENGTH (kPa): 10, 25, 50, 100, 200

COMMENTS

Hole Depth 3.1m

Scale 1:20

Rev.: A

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GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA11**

Hole Location: Lot 194

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949363.38 mN 1749022.25 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
	DRILL METHOD: HA	HOLE FINISHED: 30/09/2019
R.L.: 44.78m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil									TS	M	VSt		Clayey SILT; brown and yellowish brown. Very stiff, moist, low plasticity.
											VSt-H		Clayey SILT; yellowish brown and pink with minor topsoil inclusions. Very stiff to hard, moist, low plasticity.
					>192 kPa								
					>192 kPa			0.5					0.5m: minor angular gravel
					126/75 kPa		44				VSt		SILT; pinkish. Very stiff, moist, non-plastic; friable, with brown inclusions and minor fine gravel.
					UTP			1.0					1.3m: minor clay, low plasticity, with fine grey sandstone gravel inclusions
Fill					187/82 kPa			1.5					1.5m: low plasticity, yellowish brown, red and light brown
					125/77 kPa		43						Clayey SILT; yellowish brown. Very stiff, moist; medium plasticity.
					150/88 kPa			2.0					2.3m: low plasticity, pink and yellowish brown, minor topsoil inclusions
					170/108 kPa			2.5					
	DRY: 01/10/2019 on completion and overnight				>192 kPa		42						2.8m: yellowish brown and brown, mixed
					174/115 kPa			3.0					
													3.2m: Target depth
							41	3.5					

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

HandAugerLog - 2/10/2019 11:18:26 a.m. - Produced with Core-GS by GeRoc

GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA12**

Hole Location: Lot 182

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949356.13 mN 1748977.31 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
	DRILL METHOD: HA	HOLE FINISHED: 30/09/2019
R.L.: 40.48m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Description and Additional Observations
Topsoil	Clayey SILT; dark brown. Very stiff, wet; medium plasticity.
	Silty CLAY; yellowish brown mottled light greyish white. Very stiff, moist; medium plasticity.
Residual Soil	Clayey SILT; yellowish brown mottled light greyish white. Very stiff to stiff, moist; medium plasticity.
	0.8m: low to medium plasticity
	0.9m: low plasticity
	2.1m: yellowish orange brown, trace sand, wet
	Clayey sandy SILT; dark grey. Stiff, moist to wet, low plasticity.
	3.2m: Target depth

WATER: 01/10/2019 W/L overnight

SCALA PENETROMETER (Blows/0mm): 1 2 3 4 5 6 7 8 9

TESTS: 104/56 kPa; 107/49 kPa; 104/52 kPa; 104/48 kPa; 82/34 kPa; 80/37 kPa; 74/30 kPa; 88/37 kPa; 55/19 kPa; 81/36 kPa

RL (m): 40, 39, 38, 37

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5

MOISTURE CONDITION / WEATHERING: M; M-W

STRENGTH/DENSITY CLASSIFICATION: VSt; St-VSt; St

SHEAR STRENGTH (kPa): 10, 25, 50, 100, 200

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

HandAugerLog - 2/10/2019 11:18:28 a.m. - Produced with Core-GS by GeRoc

GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA13**

Hole Location: Lot 74

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949369.06 mN 1748938.38 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
	DRILL METHOD: HA	HOLE FINISHED: 30/09/2019
R.L.: 39.13m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Description and Additional Observations
Topsoil	SILT; dark brown. Stiff, moist, non-plastic.
	Silty CLAY; yellowish brown. Stiff, moist; medium plasticity.
	Clayey SILT; yellowish brown. Stiff, moist; medium plasticity.
	0.9m: trace sand
Residual Soil	Clayey SILT; light greyish white mottled yellowish brown. Stiff, moist; medium plasticity.
	Sandy SILT; orange brown. Stiff, wet, low plasticity; sand, fine to medium.
	Clayey SILT; reddish brown and orange brown. Stiff, moist; medium plasticity.
	2.4m: orange brown, low to medium plasticity
	2.7m: orange brown and reddish brown, low
	3.2m: Target depth

WATER: 01/10/2019 W/L overnight

SCALA PENETROMETER (Blows/0mm): 1 2 3 4 5 6 7 8 9

TESTS: 85/36 kPa; 77/32 kPa; 92/44 kPa; 93/45 kPa; 78/30 kPa; 74/36 kPa; 74/37 kPa; 85/38 kPa; 74/38 kPa; 63/34 kPa

RL (m): 39, 38, 37, 36

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5

MOISTURE CONDITION / WEATHERING: M, W, M

STRENGTH/DENSITY CLASSIFICATION: St

SHEAR STRENGTH (kPa): 10, 25, 50, 100, 200

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

HandAugerLog - 2/10/2019 11:18:30 a.m. - Produced with Core-GS by GeRoc

GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA14**

Hole Location: Lot 77

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949325.66 mN 1748926.53 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
	DRILL METHOD: HA	HOLE FINISHED: 30/09/2019
R.L.: 34.10m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL											ENGINEERING DESCRIPTION				
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil							34	0	TS	M	VSt		Clayey SILT; dark brown. Very stiff, moist, low plasticity.
													Clayey SILT; yellowish brown. Very stiff, moist; medium plasticity.
					121/64 kPa								0.3m: yellowish brown and light greyish white, low plasticity, trace sand
					113/60 kPa			0.5					
					111/58 kPa								
							33	1.0					
					78/38 kPa						St		Clayey SILT; light brownish white and yellowish brown. Stiff, moist; medium plasticity.
Residual Soil					71/36 kPa			1.5					
					63/36 kPa								
								2.0					2.0m: yellowish brown
					58/27 kPa		32						
					60/27 kPa			2.5					
					55/27 kPa								2.7m: yellowish brown mottled white
	DRY: 01/10/2019 overnight				88/33 kPa			3.0		W			SILT; light whitish brown mottled orange brown. Wet, non-plastic; sandy from 3.1m; grey at 3.2m.
							31						3.2m: Target depth
								3.5					

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

HandAugerLog - 2/10/2019 11:18:32 a.m. - Produced with Core-GS by GeRoc

GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA15**

Hole Location: Lot 181

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949320.01 mN 1748966.19 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
	DRILL METHOD: HA	HOLE FINISHED: 30/09/2019
R.L.: 36.85m		DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: JOTI CHECKED: RBE

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Topsoil									TS T TS	M	VSt		Clayey SILT; yellow brown & dark brown mixed. Very stiff, moist; moderate plasticity.
Residual Soil	DRY: 01/10/2019 on completion and overnight				147/83 kPa 141/100 kPa 118/64 kPa 114/57 kPa 120/68 kPa 76/39 kPa 113/51 kPa 86/34 kPa 76/31 kPa 80/43 kPa		36 35 34	0.5 1.0 1.5 2.0 2.5 3.0			St VSt St		CLAY; yellow and white streaks. Very stiff, moist, high plasticity. Clayey SILT; yellow and white streaks. Very stiff to stiff, moist; moderate plasticity. 1.9m: Clayey SILT CLAY; light grey. Stiff, moist, high plasticity. Clayey SILT; grey some orange brown. Very stiff, moist to wet; moderate plasticity. CLAY & SILT; grey some orange brown. Stiff, moist to wet; moderate plasticity.
							33	3.5		M			CLAY; light grey. Stiff, moist, high plasticity. 3.2m: Target depth

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

HandAugerLog - 2/10/2019 11:18:33 a.m. - Produced with Core-GS by GeRoc

GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA16**

Hole Location: Lot 178

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5		LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000)	5949309.47 mN 1749010.41 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
		DRILL METHOD: HA	HOLE FINISHED: 30/09/2019
R.L.:	42.42m		DRILLED BY: GEOTECHNICS
DATUM	NZVD2016		LOGGED BY: JOTI CHECKED: RBE

GEOLOGICAL										ENGINEERING DESCRIPTION				
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Fill	DRY: 01/10/2019 on completion and overnight				●>200 kPa ●138/100 kPa ●>200 kPa ●UTP ●UTP ●167/84 kPa ●UTP ●>200 kPa ●>200 kPa ●UTP		42 41 40 39	0.5 1.0 1.5 2.0 2.5 3.0 3.5		D-M	H		SILT; orange brown. Hard, dry to moist, non-plastic.
										M			Clayey SILT, some gravel; green grey. Hard, moist; gravel, fine; non to low plasticity.
											VSt-H		SILT; yellow grey brown. Very stiff to hard, dry to moist, non-plastic; inclusions of grey sandstone. 1.0m: Black streaks, very friable
										D	H		Sandy SILT; yellow brown. Hard, dry, non-plastic; very friable.
										M	VSt		Clayey SILT; green grey brown. Very stiff, moist; low to moderate plasticity. 2.0m: Pinkish color
										D	H		Sandy SILT; yellow brown. Hard, dry, non-plastic; very friable. 2.5 - 2.6m: Gravelly SILT; dark grey. Dry, non-
										M			Clayey SILT, some gravel; green grey. Hard, moist, low plasticity.
													Clayey SILT; orange brown. Hard, moist, low plasticity.
													3.2m: Target depth

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

HandAugerLog - 2/10/2019 11:18:35 a.m. - Produced with Core-GS by GeRoc

GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA17**

Hole Location: Lot 175

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5	LOCATION: Millwater	JOB No.: 1100222.0000
CO-ORDINATES: (NZTM2000) 5949295.71 mN 1749055.49 mE	DRILL TYPE: 50mm hand auger	HOLE STARTED: 30/09/2019
		HOLE FINISHED: 30/09/2019
R.L.: 43.24m	DRILL METHOD: HA	DRILLED BY: GEOTECHNICS
DATUM NZVD2016		LOGGED BY: JOTI CHECKED: RBE

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	Description and Additional Observations
Fill	01/10/2019 Trace water after overnight				● 90/30 kPa ● >200 kPa ● 81/36 kPa ● >200 kPa ● >200 kPa ● UTP ● 98/30 kPa ● >200 kPa ● >200 kPa		43 42 41 40	0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5	TS T	M D-M	St VSt-H VSt VSt-H H St H		CLAY; brown grey. Stiff, moist; moderate plasticty. SILT; green grey. Stiff, moist; moderate plasticity. SILT; orange brown. Stiff, moist; moderate plasticity. SILT; mottled greyish orange brown. Hard to very stiff, dry to moist, non-plastic. SILT; pinkish brown. Very stiff, dry to moist, non-plastic. SILT; green brown grey. Very stiff to hard, dry to moist, non-plastic. SILT; pink orange brown. Hard, dry to moist, non-plastic. SILT; green grey orange brown. Hard, dry to moist, non-plastic. 1.8m: gravelly clayey SILT Clayey SILT; pink orange brown. Stiff to hard, dry to moist. 2.7m: gravelly clayey SILT 2.85m: gravel blocking hole, refusal 2.85m: Refusal

COMMENTS

Hole Depth 2.85m

Scale 1:20

Rev.: A

HandAugerLog - 2/10/2019 11:18:37 a.m. - Produced with Core-GS by GeRoc

GEOTECHNICS

HAND AUGER LOG

HOLE Id: **HA18**

Hole Location: Lot 803

SHEET: 1 OF 1

PROJECT: Orewa West Precinct 5 stage 5 | LOCATION: Millwater | JOB No.: 1100222.0000

CO-ORDINATES: (NZTM2000) 5949344.55 mN 1749061.31 mE

R.L.: 45.08m

DATUM NZVD2016

DRILL TYPE: 50mm hand auger

DRILL METHOD: HA

HOLE STARTED: 30/09/2019

HOLE FINISHED: 30/09/2019

DRILLED BY: GEOTECHNICS

LOGGED BY: RBE CHECKED: JOTI

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	TESTS	RL (m)	DEPTH (m)	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
Fill	DRY: 01/10/2019 on completion and overnight	● 84/38 kPa ● 136/63 kPa ● 107/47 kPa ● 145/52 kPa ● >192 kPa ● UTP ● >192 kPa ● 0/- kPa ● >192 kPa	45 44 43	0.5 1.0 1.5 2.0	M	St St-VSt	SILT, some clay; dark brown. Stiff, moist, low plasticity. Clayey SILT, trace gravel; yellowish brown and pink. Stiff to very stiff, moist, low plasticity; gravel, fine. 0.7m: pink, non plastic 1.0m: small grey inclusions and inclusions of topsoil 1.2m: light yellowish brown and pink, with grey inclusions
					D-M	VSt	Sandy SILT; yellowish brown. Very stiff, dry to moist, non-plastic.
					M	VSt-H	Clayey SILT; yellowish brown and light greyish white. Very stiff to hard, moist, low plasticity.
						H	SILT; yellowish brown and pink. Hard, moist, non-plastic. 2.1m: grey inclusions 2.2m: yellowish brown, non plastic 2.4m: yellowish brown and grey, minor inclusions grey gravel, fine
Residual Soil		● 118/77 kPa	42	3.0		VSt	Clayey SILT; yellowish brown mottled light greyish white; minor brown inclusions. Very stiff, moist; medium plasticity.
				3.5			3.2m: Target depth

SCALA PENETROMETER (Blows/0mm) 1 2 3 4 5 6 7 8 9

SHEAR STRENGTH (kPa) 10 25 50 100 200

COMMENTS

Hole Depth 3.2m

Scale 1:20

Rev.: A

HandAugerLog - 2/10/2019 11:18:39 a.m. - Produced with Core-GS by GeRoc

Our Ref: 1100250.0.0.0/ Rep 1
Customer Ref: 21854.0031
29 October 2019

Tonkin + Taylor
PO Box 5271, Wellesley Street,
Auckland 1141

Attention: Mr Jason Kelly

Dear Jason

Orewa West - Precinct 5 - Stage 5

Test Results

Samples from the above mentioned site have been tested as received according to your instructions and the results are included in this report.

If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of this page.

GEOTECHNICS LTD

Report prepared by:

Sim Tirunahari
I am the author of this document
2019.10.29 12:20:48 +13'00'

.....
Sim Tirunahari
Soils Laboratory Manager

Authorised for Geotechnics by:

.....
Steven Anderson
Project Director

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Report checked by:

.....
James Kimiangatau
Laboratory Technician

29-Oct-19
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GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100250.0.0.0**
QESTLab Work Order ID	**W19AK-0077**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000374	**HA No**	1
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm to stiff, orange brown mixed with light yellow, mottled red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	31.9
	Bulk Density	(t/m³)	1.84
	Dry Density	(t/m³)	1.39
	Final Water Content	(%)	32.5
	Swelling Strain	(%)	0.08
SHRINKAGE TEST	Initial Water Content	(%)	36.6
	Shrinkage Strain	(%)	5.9
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Minor
SHRINK - SWELL INDEX		(%)	3.3

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 29/10/2019

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

GEOTECHNICS

19 - 23 Morgan Street
Newmarket
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Geotechnics Project Number	**1100250.0.0.0**
QESTLab Work Order ID	**W19AK-0077**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000375	**HA No**	1
	Reference		**Top Depth**	1.0m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm to stiff, orange brown mixed with light yellow, mottled red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	33.3
	Bulk Density	(t/m³)	1.84
	Dry Density	(t/m³)	1.38
	Final Water Content	(%)	34.4
	Swelling Strain	(%)	0.26
SHRINKAGE TEST	Initial Water Content	(%)	33.5
	Shrinkage Strain	(%)	5.4
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Minor
SHRINK - SWELL INDEX		(%)	3.1

TEST REMARKS

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Approved Signatory Sim Tirunahari
Date 29/10/2019

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Geotechnics Project Number	**1100250.0.0.0**
QESTLab Work Order ID	**W19AK-0077**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000376	**HA No**	2
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm to stiff, light red mixed with pink-bluish grey, mottled dark brown.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	31.0
	Bulk Density	(t/m³)	1.88
	Dry Density	(t/m³)	1.44
	Final Water Content	(%)	32.5
	Swelling Strain	(%)	0.23
SHRINKAGE TEST	Initial Water Content	(%)	37.0
	Shrinkage Strain	(%)	5
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	2.8

TEST REMARKS

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Approved Signatory Sim Tirunahari
Date 29/10/2019

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GEOTECHNICS

19 - 23 Morgan Street
Newmarket
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New Zealand
p: + 64 9 356 3510

Geotechnics Project Number	**1100250.0.0.0**
QESTLab Work Order ID	**W19AK-0077**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000377	**HA No**	4
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm to stiff, orange brown mixed with red-light yellow, mottled black.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	25.4
	Bulk Density	(t/m³)	1.82
	Dry Density	(t/m³)	1.45
	Final Water Content	(%)	26.4
	Swelling Strain	(%)	0.55
SHRINKAGE TEST	Initial Water Content	(%)	35.3
	Shrinkage Strain	(%)	4.1
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Minor
SHRINK - SWELL INDEX		(%)	2.4

TEST REMARKS

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Approved Signatory Sim Tirunahari
Date 29/10/2019

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GEOTECHNICS

19 - 23 Morgan Street
Newmarket
Auckland 1023
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p: + 64 9 356 3510

Geotechnics Project Number	**1100250.0.0.0**
QESTLab Work Order ID	**W19AK-0077**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000378	**HA No**	4
	Reference		**Top Depth**	1.0m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with minor sand, firm to stiff, light yellowish orange brown mixed with red, mottled bluish grey-black.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	39.3
	Bulk Density	(t/m³)	1.87
	Dry Density	(t/m³)	1.34
	Final Water Content	(%)	39.8
	Swelling Strain	(%)	0.10
SHRINKAGE TEST	Initial Water Content	(%)	46.8
	Shrinkage Strain	(%)	2.2
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	1.3

TEST REMARKS

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Date 29/10/2019

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GEOTECHNICS

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Geotechnics Project Number	**1100250.0.0.0**
QESTLab Work Order ID	**W19AK-0077**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000379	**HA No**	6
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, few rootlets, firm to stiff, light yellowish brown mixed with dark grey, mottled orange-red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	41.3
	Bulk Density	(t/m³)	1.71
	Dry Density	(t/m³)	1.21
	Final Water Content	(%)	42.1
	Swelling Strain	(%)	-0.03
SHRINKAGE TEST	Initial Water Content	(%)	32.4
	Shrinkage Strain	(%)	2.1
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	1.1

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Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000380	**HA No**	6
	Reference		**Top Depth**	1.0m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with minor sand, firm to stiff, light yellowish brown, mottled orange-red-dark grey.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	31.8
	Bulk Density	(t/m³)	1.73
	Dry Density	(t/m³)	1.31
	Final Water Content	(%)	33.3
	Swelling Strain	(%)	-0.02
SHRINKAGE TEST	Initial Water Content	(%)	33.8
	Shrinkage Strain	(%)	3.5
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	1.9

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Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000381	**HA No**	7
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm to stiff, light yellowish brown, mottled orange-red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	39.1
	Bulk Density	(t/m³)	1.77
	Dry Density	(t/m³)	1.27
	Final Water Content	(%)	40.8
	Swelling Strain	(%)	0.18
SHRINKAGE TEST	Initial Water Content	(%)	38.8
	Shrinkage Strain	(%)	6.3
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Minor
SHRINK - SWELL INDEX		(%)	3.5

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Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000382	**HA No**	7
	Reference		**Top Depth**	1.0m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm, light yellowish brown mixed with light bluish grey, mottled orange red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	42.8
	Bulk Density	(t/m³)	1.75
	Dry Density	(t/m³)	1.23
	Final Water Content	(%)	44.5
	Swelling Strain	(%)	0.54
SHRINKAGE TEST	Initial Water Content	(%)	38.5
	Shrinkage Strain	(%)	3.2
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	2.0

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000383	**HA No**	8
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, stiff, light yellowish brown, mottled light red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	37.5
	Bulk Density	(t/m³)	1.81
	Dry Density	(t/m³)	1.32
	Final Water Content	(%)	38.8
	Swelling Strain	(%)	0.15
SHRINKAGE TEST	Initial Water Content	(%)	30.7
	Shrinkage Strain	(%)	4.3
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	2.5

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000384	**HA No**	8
	Reference		**Top Depth**	1.0m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with minor sand, stiff, light red mixed with light yellow-grey		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	36.0
	Bulk Density	(t/m³)	1.74
	Dry Density	(t/m³)	1.28
	Final Water Content	(%)	37.2
	Swelling Strain	(%)	0.04
SHRINKAGE TEST	Initial Water Content	(%)	35.2
	Shrinkage Strain	(%)	0.97
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	0.6

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000385	**HA No**	9
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with minor sand, stiff, light red mixed with light yellow.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	30.6
	Bulk Density	(t/m³)	1.85
	Dry Density	(t/m³)	1.42
	Final Water Content	(%)	31.6
	Swelling Strain	(%)	0.09
SHRINKAGE TEST	Initial Water Content	(%)	30.9
	Shrinkage Strain	(%)	3
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	1.7

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000386	**HA No**	12
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, stiff, light yellowish brown mixed with light bluish grey, mottled red-orange.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	46.5
	Bulk Density	(t/m³)	1.68
	Dry Density	(t/m³)	1.15
	Final Water Content	(%)	49.1
	Swelling Strain	(%)	0.41
SHRINKAGE TEST	Initial Water Content	(%)	46.2
	Shrinkage Strain	(%)	5.4
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	3.1

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000387	**HA No**	14
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm to stiff, light bluish grey with light yelllowish brown, mottled orange-red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	36.8
	Bulk Density	(t/m³)	1.77
	Dry Density	(t/m³)	1.29
	Final Water Content	(%)	38.2
	Swelling Strain	(%)	0.16
SHRINKAGE TEST	Initial Water Content	(%)	37.3
	Shrinkage Strain	(%)	2.8
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	1.6

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000388	**HA No**	14
	Reference		**Top Depth**	1.0m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm to stiff, light bluish grey with light yelllowish brown, mottled orange-red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	35.4
	Bulk Density	(t/m³)	1.77
	Dry Density	(t/m³)	1.31
	Final Water Content	(%)	36.2
	Swelling Strain	(%)	0.03
SHRINKAGE TEST	Initial Water Content	(%)	45.5
	Shrinkage Strain	(%)	5.8
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	3.3

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000389	**HA No**	16
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, stiff, grey, mottled orange-red-black.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	31.0
	Bulk Density	(t/m³)	1.86
	Dry Density	(t/m³)	1.42
	Final Water Content	(%)	32.5
	Swelling Strain	(%)	0.37
SHRINKAGE TEST	Initial Water Content	(%)	30.1
	Shrinkage Strain	(%)	2.4
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	1.4

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000390	**HA No**	17
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, stiff, grey mixed with light red, mottled orange-black.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	30.9
	Bulk Density	(t/m³)	1.79
	Dry Density	(t/m³)	1.37
	Final Water Content	(%)	33.1
	Swelling Strain	(%)	0.36
SHRINKAGE TEST	Initial Water Content	(%)	31.9
	Shrinkage Strain	(%)	5.6
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	3.2

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000391	**HA No**	17
	Reference		**Top Depth**	1.0m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, stiff, grey mixed with light yelllowish brown, mottled orange-red.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	36.7
	Bulk Density	(t/m³)	1.77
	Dry Density	(t/m³)	1.29
	Final Water Content	(%)	37.9
	Swelling Strain	(%)	0.04
SHRINKAGE TEST	Initial Water Content	(%)	27.6
	Shrinkage Strain	(%)	2.9
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	1.6

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TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000392	**HA No**	18
	Reference		**Top Depth**	0.5m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, firm to stiff, light reddish brown mixed with grey, mottled orange.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	37.3
	Bulk Density	(t/m³)	1.77
	Dry Density	(t/m³)	1.29
	Final Water Content	(%)	38.2
	Swelling Strain	(%)	0.05
SHRINKAGE TEST	Initial Water Content	(%)	30.8
	Shrinkage Strain	(%)	4.9
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Major
SHRINK - SWELL INDEX		(%)	2.7

TEST REMARKS

• Results apply only to sample tested. • This report may be reproduced only in full. • Sample description is not covered under our scope of IANZ accreditation. • Samples not destroyed during testing will be retained for one month from the date of this report before being discarded.

Approved Signatory Sim Tirunahari
Date 29/10/2019

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

GEOTECHNICS

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Newmarket
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New Zealand
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Geotechnics Project Number	**1100250.0.0.0**
QESTLab Work Order ID	**W19AK-0077**
Customer Project ID	**21854.0031**

Determination of the Shrink - Swell Index - AS 1289 Test 7.1.1 - 2003

TEST DETAILS

LOCATION	**Description**	Orewa West - Precinct 5 - Stage 5		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S19AK000393	**HA No**	18
	Reference		**Top Depth**	1.0m
	Sampled By		**Bottom Depth**	
	Description	clayey SILT with trace of sand, stiff, light reddish brown, mottled light yellow-grey-black.		
SPECIMEN	**Reference**	N/A	**Depth**	N/A
	Description	N/A		

TEST RESULTS

APPLIED PRESSURE		(kPa)	25
SWELL TEST	Initial Water Content	(%)	32.1
	Bulk Density	(t/m³)	1.78
	Dry Density	(t/m³)	1.35
	Final Water Content	(%)	33.7
	Swelling Strain	(%)	0.04
SHRINKAGE TEST	Initial Water Content	(%)	29.2
	Shrinkage Strain	(%)	3.5
	Inert Material Estimate in the Soil Specimen	(%)	0
	Soil Crumbling During Shrinkage		None
	Cracking of the Shrinkage Specimen		Moderate
SHRINK - SWELL INDEX		(%)	1.9

TEST REMARKS

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Approved Signatory Sim Tirunahari
Date 29/10/2019

IANZ ACCREDITED LABORATORY

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GEOTECHNICS

Job: Precent 5 Arrans Hill - Stage 5

Client: Tonkin & Taylor

URN	New No.	Easting	Northing	RL	Location	Tech.	Date	Nuclear Wet Density (t/m^3)	Oven Dry Density (t/m3)	Oven Moisture content (%)	Solid Density (t/m3) assumed	Oven Calculated Air Voids (%)	Shear Strength (kPa) (UTP = Unable to penetrate) Test 1	Test 2	Test 3	Test 4	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.
S18 079-2		2659617.105	6511151.953	36.252	RE Wall 7	ELHO	16/05/2018	1.79	**1.30**	**37.5**	2.7	**3.0**	146	160	190	204	**175**		**P**	
								1.79	**1.30**	**37.5**	2.7	**3.1**								
S18 078-1		2659595.476	6511188.428	37.704	RE Wall 7	ELHO	15/05/2018	1.80	**1.35**	**33.4**	2.7	**5.0**	175	175	204	204	**190**		**P**	
								1.81	**1.35**	**33.4**	2.7	**4.6**								
S18 077-2		2659613.209	6511171.562	36.307	RE Wall 7	ELHO	11/05/2018	1.80	**1.34**	**34.6**	2.7	**4.4**	204	204	204	204	**204**		**P**	
								1.79	**1.33**	**34.6**	2.7	**4.9**								
S18 076-4		2659585.599	6511200.968	40.302	RE Wall 7	ELHO	10/05/2018	1.84	**1.40**	**31.8**	2.7	**3.8**	204	204	204	204	**204**		**P**	
								1.84	**1.40**	**31.8**	2.7	**3.7**								
S18 076-1		2659616.98	6511171.473	35.818	RE Wall 7	ELHO	10/05/2018	1.82	**1.39**	**31.1**	2.7	**5.6**	204	204	204	204	**204**		**P**	
								1.81	**1.38**	**31.1**	2.7	**5.7**								
S18 075-4		2659575.496	6511204.82	35.882	RE Wall 7	ELHO	9/05/2018	1.77	**1.32**	**34.3**	2.7	**5.8**	204	204	204	204	**204**		**P**	
								1.79	**1.33**	**34.3**	2.7	**5.2**								
S18 074-2		2659572.258	6511213.32	35.065	RE Wall 7	ELHO	8/05/2018	1.82	**1.36**	**34.2**	2.7	**3.3**	204	204	204	204	**204**		**P**	
								1.82	**1.36**	**34.2**	2.7	**3.4**								
S18 074-1		2659597.917	6511194.324	35.101	RE Wall 7	ELHO	8/05/2018	1.86	**1.45**	**28.5**	2.7	**5.0**	204	204	204	204	**204**		**P**	
								1.86	**1.45**	**28.5**	2.7	**5.3**								
S18 073-6		2659625.174	6511178.005	34.195	RE Wall 7	ELHO	7/05/2018	1.79	**1.36**	**32.0**	2.7	**6.3**	175	175	190	190	**183**		**P**	
								1.78	**1.35**	**32.0**	2.7	**6.7**								
S18 072-5		2659580.451	6511210.457	33.877	RE Wall 7	ELHO	4/05/2018	1.74	**1.29**	**34.4**	2.7	**7.8**	204	204	204	204	**204**		**P**	
								1.75	**1.30**	**34.4**	2.7	**7.0**								
S18 069-3		2659591.604	6511206.018	32.471	RE Wall 7	SABY	27/04/2018	1.90	**1.47**	**29.0**	2.7	**3.0**	175	190	190	204	**190**		**P**	
								1.87	**1.43**	**30.4**	2.7	**3.5**								
S18 068-7		2659583.429	6511210.059	32.504	RE Wall 7	SABY	26/04/2018	1.89	**1.52**	**24.5**	2.7	**6.4**	204	204	204	204	**204**		**P**	
								1.88	**1.49**	**26.4**	2.7	**5.6**								
S18 068-6		2659571.399	6511216.007	32.047	RE Wall 7	SABY	26/04/2018	1.84	**1.47**	**25.6**	2.7	**8.0**	204	204	204	204	**204**		**P**	
								1.89	**1.52**	**23.8**	2.7	**7.3**								
S18 068-4		2659570.2	6511217.272	31.439	RE Wall 7 Far End	SABY	26/04/2018	1.84	**1.38**	**33.4**	2.7	**3.1**	204	204	204	204	**204**		**P**	
								1.84	**1.38**	**32.8**	2.7	**3.5**								
S18 068-3		2659567.834	6511218.755	30.84	RE Wall 7 Far End	SABY	26/04/2018	1.82	**1.36**	**33.8**	2.7	**3.5**	204	204	204	204	**204**	**Y**	**P**	Re-test for s18 068-2
								1.83	**1.36**	**34.8**	2.7	**2.5**								
S18 068-2		2659561.364	6511221.766	31.275	RE Wall 7 Far End	SABY	26/04/2018	1.73	**1.32**	**30.5**	2.7	**10.5**	204	204	204	204	**204**		**F**	Voids
								1.75	**1.35**	**30.0**	2.7	**9.6**								
S18 060-1		2659600.838	6511199.887	30.301	RE Wall 7	CBEN	12/04/2018	1.88	**1.51**	**24.4**	2.7	**7.3**	204	204	204	204	**204**		**P**	
								1.88	**1.51**	**24.4**	2.7	**7.1**								
S18 059-5		2659617.834	6511191.659	30.448	RE Wall 7	CBEN	9/04/2018	1.90	**1.49**	**27.9**	2.7	**3.4**	204	204	204	204	**204**		**P**	
								1.90	**1.49**	**27.9**	2.7	**3.6**								
S18 059-2		2659606.786	6511198.005	30.784	RE Wall 7	CBEN	9/04/2018	1.89	**1.49**	**26.6**	2.7	**4.9**	204	204	204	204	**204**		**P**	
								1.89	**1.49**	**26.6**	2.7	**5.2**								

S18 028-3		2659555.32	6511042.229	42.615	Gully 4	ELHO	20/02/2018	1.90	**1.48**	**28.9**	2.7	**2.7**	204	204	204	204	**204**		**P**	
								1.90	**1.47**	**28.9**	2.7	**2.8**								
S18 008-4		2659529.027	6511046.59	35.652	Gully 4	ELHO	17/01/2018	1.91	**1.50**	**27.3**	2.7	**3.7**	204	204	204	204	**204**		**P**	
								1.92	**1.51**	**27.3**	2.7	**3.1**								
S18 007-3		2659517.356	6511055.405	41.058	Gully 4	ELHO	16/01/2018	1.86	**1.40**	**32.7**	2.7	**2.4**	204	204	204	204	**204**		**P**	
								1.86	**1.40**	**32.7**	2.7	**2.2**								
S17 156-7		2659561.373	6511008.518	39.764	Gully 4	CBEN	24/11/2017	1.84	**1.40**	**31.2**	2.7	**4.3**	204	204	204	204	**204**		**P**	
								1.84	**1.40**	**31.2**	2.7	**4.2**								
S17 156-6		2659527.696	6511017.641	39.986	Gully 4	CBEN	24/11/2017	1.81	**1.39**	**30.6**	2.7	**6.1**	204	204	204	204	**204**		**P**	
								1.82	**1.40**	**30.6**	2.7	**5.6**								
S17 156-5		2659535.061	6511044.424	40.400	Gully 4	CBEN	24/11/2017	1.83	**1.46**	**24.9**	2.7	**9.5**	204	204	204	204	**204**		**P**	
								1.83	**1.47**	**24.9**	2.7	**9.1**								
S17 152-6		2659578.946	6511005.271	39.960	Gully 4	CBEN	20/11/2017	1.76	**1.27**	**38.9**	2.7	**3.6**	146	160	160	160	**157**		**P**	
								1.78	**1.28**	**38.9**	2.7	**2.9**								
S17 152-4		2659534.737	6511035.242	39.950	Gully 4	CBEN	20/11/2017	1.81	**1.36**	**33.0**	2.7	**4.7**	146	160	146	175	**157**		**P**	
								1.80	**1.35**	**33.0**	2.7	**5.1**								
S17 151-3		2659544.389	6511007.650	39.775	Shear Key 2	CBEN	17/11/2017	1.81	**1.35**	**33.7**	2.7	**4.2**	160	160	175	204	**175**		**P**	
								1.81	**1.35**	**33.7**	2.7	**4.3**								
S17 149-1		2659570.541	6511002.266	40.309	Gully 4	CBEN	15/11/2017	1.88	**1.38**	**36.8**	2.7	**0.0**	146	160	175	190	**168**		**P**	
								1.88	**1.38**	**36.8**	2.7	**0.0**								
S17 052-3		2659552.294	6511007.862	38.912	S Gully	CBEN	22/03/2017	1.88	**1.43**	**31.3**	2.7	**2.0**	214	214	214	214	**214**		**P**	
								1.89	**1.44**	**31.3**	2.7	**1.5**								
S17 052-2		2659549.515	6511025.831	39.624	S Gully	CBEN	22/03/2017	1.84	**1.39**	**32.2**	2.7	**3.7**	214	214	214	214	**214**		**P**	
								1.84	**1.39**	**32.2**	2.7	**3.9**								
S17 052-1		2659519.71	6511018.623	38.315	S Gully	CBEN	22/03/2017	1.90	**1.48**	**28.4**	2.7	**3.0**	214	214	214	214	**214**		**P**	
								1.91	**1.49**	**28.4**	2.7	**2.7**								
S17 048-9		2659532.325	6511006.293	38.332	S Gully	CBEN	17/03/2017	1.88	**1.43**	**31.9**	2.7	**1.7**	214	214	183	183	**199**		**P**	
								1.89	**1.43**	**31.9**	2.7	**1.4**								
S17 048-8		2659542.362	6511028.496	38.976	S Gully	CBEN	17/03/2017	1.88	**1.42**	**32.1**	2.7	**1.8**	183	177	199	214	**193**		**P**	
								1.89	**1.43**	**32.1**	2.7	**1.0**								
S17 048-4		2659498.991	6511026.322	37.759	S Gully	CBEN	17/03/2017	1.96	**1.48**	**32.7**	2.7	**0.0**	214	206	183	214	**204**		**P**	
								1.95	**1.47**	**32.7**	2.7	**0.0**								
S17 048-3		2659541.306	6511010.305	38.347	S Gully	CBEN	17/03/2017	1.91	**1.47**	**30.1**	2.7	**1.4**	183	183	124	199	**172**		**P**	
								1.91	**1.47**	**30.1**	2.7	**1.4**								
S17 048-2		2659528.602	6511032.563	38.163	S Gully	CBEN	17/03/2017	1.92	**1.51**	**27.4**	2.7	**2.6**	214	214	214	214	**214**		**P**	
								1.92	**1.51**	**27.4**	2.7	**2.8**								
S17 048-10		2659517.493	6511028.504	38.604	S Gully	CBEN	17/03/2017	1.91	**1.43**	**33.9**	2.7	**0.0**	214	214	183	153	**191**		**P**	
								1.91	**1.43**	**33.9**	2.7	**0.0**								
S17 047-3		2659537.386	6511007.294	37.509	S Gully	CBEN	16/03/2017	1.85	**1.40**	**32.2**	2.7	**3.0**	153	214	214	196	**194**		**P**	
								1.85	**1.40**	**32.2**	2.7	**3.1**								
S17 047-4		2659550.695	6511028.101	38.711	S Gully	CBEN	16/03/2017	1.91	**1.49**	**28.4**	2.7	**2.5**	214	170	214	188	**197**		**P**	
								1.94	**1.51**	**28.4**	2.7	**1.1**								
S17 047-6		2659548.298	6511015.699	38.417	S Gully	CBEN	16/03/2017	1.92	**1.46**	**31.4**	2.7	**0.0**	214	214	214	214	**214**		**P**	
								1.93	**1.47**	**31.4**	2.7	**0.0**								
S17 041-7		2659519.678	6511020.281	39.357	Gully 4	CBEN	6/03/2017	1.98	**1.56**	**26.9**	2.7	**0.4**	153	191	199	214	**189**		**P**	
								1.98	**1.56**	**26.9**	2.7	**0.1**								
S17 041-8		2659510.611	6511014.29	37.529	Gully 4	CBEN	6/03/2017	1.84	**1.44**	**27.5**	2.7	**6.8**	168	183	214	214	**195**		**P**	
								1.83	**1.43**	**27.5**	2.7	**7.4**								
S17 041-4		2659521.091	6511034.899	37.917	Gully 4	CBEN	6/03/2017	2.01	**1.66**	**21.2**	2.7	**3.5**	214	214	214	214	**214**		**P**	
								2.02	**1.67**	**21.2**	2.7	**2.8**								

S17 041-2		2659550.165	6510998.849	36.935	Gully 4	CBEN	6/03/2017	1.97	**1.57**	**25.3**	2.7	**2.0**	214	214	214	214	**214**		**P**	
								1.97	**1.57**	**25.3**	2.7	**2.1**								
S17 041-3		2659521.336	6511004.794	36.865	Gully 4	CBEN	6/03/2017	1.94	**1.58**	**22.8**	2.7	**5.6**	214	214	137	145	**178**		**P**	
								1.94	**1.58**	**22.8**	2.7	**5.2**								
S17 027-7		2659492.065	6511021.745	36.177	S Gully	CBEN	10/02/2017	1.94	**1.54**	**25.9**	2.7	**3.1**	214	214	214	214	**214**		**P**	
								1.95	**1.55**	**25.9**	2.7	**2.5**								
S17 027-8		2659516.965	6511031.654	37.367	S Gully	CBEN	10/02/2017	1.89	**1.46**	**29.5**	2.7	**3.0**	214	214	214	214	**214**		**P**	
								1.89	**1.46**	**29.5**	2.7	**3.0**								
S17 027-1		2659491.061	6511240.257	28.819	SW Shear Key	CBEN	10/02/2017	1.92	**1.52**	**26.1**	2.7	**3.8**	176	188	199	214	**194**		**P**	
								1.91	**1.51**	**26.1**	2.7	**4.4**								
S17 027-2		2659497.933	6511028.079	36.847	S Gully	CBEN	10/02/2017	1.88	**1.43**	**31.2**	2.7	**2.1**	214	214	214	214	**214**		**P**	
								1.88	**1.43**	**31.2**	2.7	**2.2**								
S17 027-3		2659515.869	6511027.205	36.843	S Gully	CBEN	10/02/2017	1.85	**1.37**	**34.9**	2.7	**1.2**	214	214	214	214	**214**		**P**	
								1.86	**1.38**	**34.9**	2.7	**0.7**								
S17 027-4		2659562.138	6511005.632	36.403	S Gully	CBEN	10/02/2017	1.97	**1.58**	**24.8**	2.7	**2.5**	214	214	214	214	**214**		**P**	
								1.97	**1.58**	**24.8**	2.7	**2.3**								
S17 025-3		2659534.316	6511015.759	36.348	S Gully	CBEN	8/02/2017	2.00	**1.58**	**26.2**	2.7	**0.0**	214	214	214	214	**214**		**P**	
								1.99	**1.57**	**26.2**	2.7	**0.5**								
S17 025-4		2659554.716	6511004.367	36.028	S Gully	CBEN	8/02/2017	1.88	**1.45**	**29.3**	2.7	**3.8**	214	214	214	214	**214**		**P**	
								1.89	**1.46**	**29.3**	2.7	**3.1**								
S17 025-5		2659465.963	6511227.34	29.883	NW Undercut	CBEN	8/02/2017	1.89	**1.49**	**27.5**	2.7	**4.1**	214	214	214	214	**214**		**P**	
								1.89	**1.48**	**27.5**	2.7	**4.6**								
S17 025-6		2659501.53	6511241.675	28.558	NW Undercut	CBEN	8/02/2017	1.87	**1.46**	**27.7**	2.7	**5.3**	168	183	214	214	**195**		**P**	
								1.86	**1.46**	**27.7**	2.7	**5.6**								
S17 025-7		2659510.82	6511017.175	36.225	S Gully	CBEN	8/02/2017	1.95	**1.54**	**26.2**	2.7	**2.5**	214	214	214	214	**214**		**P**	
								1.94	**1.54**	**26.2**	2.7	**2.9**								
S17 025-2		2659493.018	6511008.618	35.09	S Gully	CBEN	8/02/2017	2.02	**1.59**	**27.2**	2.7	**0.0**	214	214	214	214	**214**		**P**	
								2.03	**1.60**	**27.2**	2.7	**0.0**								
S17 025-10		2659467.186	6511230.519	30.295	S Gully	CBEN	8/02/2017	1.85	**1.44**	**27.9**	2.7	**6.2**	214	214	214	214	**214**		**P**	
								1.84	**1.44**	**27.9**	2.7	**6.7**								
S17 025-11		2659491.061	6511240.257	28.819	S Gully	CBEN	8/02/2017	1.85	**1.46**	**26.4**	2.7	**7.3**	214	214	214	214	**214**		**P**	
								1.83	**1.45**	**26.4**	2.7	**8.1**								
S17 024-2		2659516.899	6511032.496	36.822	S Gully	TA	7/02/2017	1.98	**1.58**	**25.0**	2.7	**1.7**	214	214	214	214	**214**		**P**	
								2.00	**1.60**	**25.0**	2.7	**0.8**								
S17 024-3		2659524.229	6510999.726	35.251	S Gully	TA	7/02/2017	1.95	**1.54**	**26.0**	2.7	**2.7**	214	214	214	214	**214**		**P**	
								1.95	**1.55**	**26.0**	2.7	**2.4**								
S17 024-4		2659457.105	6511215.694	30.644	S Gully	TA	7/02/2017	1.90	**1.51**	**25.7**	2.7	**5.2**	183	168	214	199	**191**		**P**	
								1.90	**1.51**	**25.7**	2.7	**5.1**								
S17 024-5		2659472.514	6511234.35	28.378	S Gully	TA	7/02/2017	1.89	**1.51**	**25.0**	2.7	**6.2**	214	214	199	214	**210**		**P**	
								1.88	**1.51**	**25.0**	2.7	**6.6**								
S17 024-6		2659501.049	6511241.785	26.378	S Gully	TA	7/02/2017	1.91	**1.50**	**27.3**	2.7	**3.7**	214	214	214	214	**214**		**P**	
								1.92	**1.51**	**27.3**	2.7	**3.1**								
S17 024-7		2659489.142	6511240.96	28.153	NW Undercut	TA	7/02/2017	1.92	**1.36**	**41.4**	2.7	**0.0**	137	145	153	183	**155**		**P**	
								1.94	**1.37**	**41.4**	2.7	**0.0**								
S17 024-8		2659467.941	6511231.111	29.211	NW Undercut	TA	7/02/2017	1.93	**1.56**	**23.8**	2.7	**5.1**	214	214	214	214	**214**		**P**	
								1.94	**1.56**	**23.8**	2.7	**4.9**								
S17 024-9		2659492.812	6511019.431	35.818	S Gully	TA	7/02/2017	1.93	**1.53**	**25.8**	2.7	**3.7**	214	214	214	214	**214**		**P**	
								1.93	**1.53**	**25.8**	2.7	**3.8**								
S17 024-10		2659516.582	6511022.49	36.578	S Gully	TA	7/02/2017	1.98	**1.60**	**23.7**	2.7	**2.9**	214	214	214	214	**214**		**P**	
								2.00	**1.62**	**23.7**	2.7	**1.8**								

S17 022-3		2659497.614	6511013.333	35.59	S Gully	TA	3/02/2017	2.02	**1.57**	**28.6**	2.7	**0.0**	214	214	214	214	**214**		**P**	
								2.04	**1.58**	**28.6**	2.7	**0.0**								
S17 022-4		2659516.852	6511031.194	36.566	S Gully	TA	3/02/2017	1.98	**1.53**	**29.1**	2.7	**0.0**	214	214	214	214	**214**		**P**	
								1.99	**1.54**	**29.1**	2.7	**0.0**								
S17 022-5		2659539.046	6511006.057	34.994	S Gully	TA	3/02/2017	1.94	**1.56**	**23.9**	2.7	**4.7**	214	214	214	214	**214**		**P**	
								1.94	**1.57**	**23.9**	2.7	**4.6**								
S17 020-8		2659504.542	6511015.255	35.757	S Gully	CB	1/02/2017	2.00	**1.62**	**23.9**	2.7	**1.5**	214	214	214	214	**214**		**P**	
								2.00	**1.61**	**23.9**	2.7	**1.6**								
S17 020-5		2659519.378	6511021.547	35.778	S Gully	CB	1/02/2017	1.98	**1.61**	**23.0**	2.7	**3.5**	214	214	214	214	**214**		**P**	
								2.00	**1.62**	**23.0**	2.7	**2.6**								
S17 019-4		2659535.4	6511019.492	35.31	S Gully	CB	31/01/2017	1.97	**1.55**	**27.0**	2.7	**0.8**	214	214	214	214	**214**		**P**	
								1.96	**1.55**	**27.0**	2.7	**1.0**								
S17 019-12		2659491.307	6511009.885	35.041	S Gully	CB	31/01/2017	1.93	**1.55**	**25.1**	2.7	**4.0**	214	214	214	214	**214**		**P**	
								1.92	**1.53**	**25.1**	2.7	**4.8**								
S17 019-13		2659543.311	6511010.222	35.091	S Gully	CB	31/01/2017	1.95	**1.56**	**25.4**	2.7	**2.9**	214	214	214	214	**214**		**P**	
								1.97	**1.57**	**25.4**	2.7	**2.0**								
S17 017-7		2659496.382	6511009.431	34.75	S Gully	TA	27/01/2017	1.93	**1.53**	**26.3**	2.7	**3.2**	214	214	214	214	**214**		**P**	
								1.92	**1.52**	**26.3**	2.7	**3.7**								
S17 017-8		2659524.661	6511000.411	33.998	S Gully	TA	27/01/2017	1.90	**1.41**	**34.9**	2.7	**0.0**	214	214	214	199	**210**		**P**	
								1.87	**1.39**	**34.9**	2.7	**0.3**								
S17 017-9		2659537.563	6511007.73	34.264	S Gully	TA	27/01/2017	1.89	**1.44**	**31.3**	2.7	**1.5**	199	186	214	214	**203**		**P**	
								1.90	**1.45**	**31.3**	2.7	**1.2**								
S17 017-3		2659496.942	6511010.271	34.613	S Gully	TA	27/01/2017	1.95	**1.52**	**28.5**	2.7	**0.5**	214	214	214	214	**214**		**P**	
								1.96	**1.53**	**28.5**	2.7	**0.0**								
S17 017-4		2659519.479	6511023.042	35.491	S Gully	TA	27/01/2017	1.95	**1.52**	**28.7**	2.7	**0.4**	168	168	214	214	**191**		**P**	
								1.95	**1.52**	**28.7**	2.7	**0.4**								
S17 017-5		2659535.444	6511013.03	34.567	S Gully	TA	27/01/2017	1.87	**1.45**	**28.6**	2.7	**4.6**	214	214	214	214	**214**		**P**	
								1.86	**1.45**	**28.6**	2.7	**5.1**								
S17 016-9		2659509.178	6511029.781	35.923	S Gully	TA	26/01/2017	1.89	**1.46**	**29.0**	2.7	**3.3**	153	153	186	214	**177**		**P**	
								1.90	**1.47**	**29.0**	2.7	**2.9**								
S17 016-10		2659541.766	6510995.885	33.41	S Gully	TA	26/01/2017	1.91	**1.43**	**32.9**	2.7	**0.0**	137	141	153	168	**150**		**P**	
								1.89	**1.42**	**32.9**	2.7	**0.4**								
S17 016-7		2659524.527	6511008.547	34.034	S Gully	TA	26/01/2017	1.91	**1.45**	**31.6**	2.7	**0.2**	147	153	162	186	**162**		**P**	
								1.92	**1.46**	**31.6**	2.7	**0.0**								
S17 015-8		2659517.033	6511027.236	35.393	S Gully	PO	25/01/2017	1.89	**1.40**	**34.7**	2.7	**0.0**	165	186	186	214	**188**		**P**	
								1.88	**1.40**	**34.7**	2.7	**0.0**								
S17 015-9		2659517.84	6511008.035	34.343	S Gully	PO	25/01/2017	1.88	**1.39**	**34.9**	2.7	**0.0**	168	186	214	214	**196**		**P**	
								1.89	**1.40**	**34.9**	2.7	**0.0**								
S17 015-10		2659543.878	6511007.12	33.958	S Gully	PO	25/01/2017	1.93	**1.51**	**27.5**	2.7	**2.3**	214	214	214	214	**214**		**P**	
								1.93	**1.51**	**27.5**	2.7	**2.4**								
S17 014-5		2659506.069	6511020.806	33.924	S Gully	PO	24/01/2017	1.91	**1.42**	**34.8**	2.7	**0.0**	199	214	214	214	**210**		**P**	
								1.94	**1.44**	**34.8**	2.7	**0.0**								
S17 014-12		2659498.947	6511006.04	33.625	S Gully	PO	24/01/2017	1.95	**1.50**	**30.0**	2.7	**0.0**	214	214	214	214	**214**		**P**	
								1.95	**1.50**	**30.0**	2.7	**0.0**								
S17 012-2		2659507.47	6511018.027	33.745	S Gully	PO	20/01/2017	1.98	**1.61**	**23.3**	2.7	**3.1**	214	214	214	214	**214**		**P**	
								1.99	**1.61**	**23.3**	2.7	**2.7**								
S17 012-3		2659521.829	6511007.595	32.852	S Gully	PO	20/01/2017	1.96	**1.53**	**28.1**	2.7	**0.3**	214	214	214	214	**214**		**P**	
								1.94	**1.51**	**28.1**	2.7	**1.5**								
S17 012-14		2659501.526	6511011.749	33.695	S Gully	PO	20/01/2017	1.95	**1.52**	**28.5**	2.7	**0.4**	214	214	214	214	**214**		**P**	
								1.96	**1.53**	**28.5**	2.7	**0.0**								

S17 012-15		2659545.779	6510995.167	32.332	S Gully	PO	20/01/2017	1.88	**1.39**	**35.3**	2.7	**0.0**	214	214	214	214	**214**		**P**	
								1.88	**1.39**	**35.3**	2.7	**0.0**								
S17 011-4		2659543.032	6511005.969	30.443	S Gully	PO	18/01/2017	1.96	**1.54**	**27.4**	2.7	**0.8**	214	214	214	214	**214**		**P**	
								1.96	**1.54**	**27.4**	2.7	**0.8**								
S17 011-11		2659514.228	6511014.844	33.772	S Gully	PO	18/01/2017	1.98	**1.54**	**28.7**	2.7	**0.0**	214	214	214	214	**214**		**P**	
								1.97	**1.53**	**28.7**	2.7	**0.0**								
S17 010-7		2659539.786	6511008.514	32.598	S Gully	PO	17/01/2017	1.90	**1.51**	**25.4**	2.7	**5.6**	214	214	214	214	**214**		**P**	
								1.91	**1.52**	**25.4**	2.7	**5.0**								
S17 010-8		2659507.168	6511017.484	33.624	S Gully	PO	17/01/2017	1.98	**1.57**	**25.7**	2.7	**1.3**	214	214	214	214	**214**		**P**	
								1.99	**1.58**	**25.7**	2.7	**0.9**								
S17 010-13		2659516.906	6511005.565	32.839	S Gully	PO	17/01/2017	1.92	**1.56**	**23.1**	2.7	**6.3**	214	214	214	214	**214**		**P**	
								1.93	**1.57**	**23.1**	2.7	**5.8**								
S17 009-14		2659510.999	6511012.007	32.955	S Gully	PO	16/01/2017	1.96	**1.55**	**26.4**	2.7	**1.8**	214	214	214	214	**214**		**P**	
								1.96	**1.55**	**26.4**	2.7	**1.7**								
S16 185-8		2659524.708	6510966.189	22.729	North Gully	TA	13/12/2016	1.85	**1.43**	**29.1**	2.7	**5.3**	214	214	214	214	**214**		**P**	
								1.85	**1.43**	**29.1**	2.7	**5.3**								
S16 185-6		2659517.258	6511043.692	36.819	Above North Gully	TA	13/12/2016	1.84	**1.37**	**34.7**	2.7	**1.9**	214	214	214	214	**214**		**P**	
								1.84	**1.37**	**34.7**	2.7	**1.8**								

GEOTECHNICS

Job: Precent 5 Arrans Hill

Client: Tonkin & Taylor

Job #	21854.0031
Entered By	CBEN
Checked By	JLON
Approved By	-

URN	Tech.	Date	Location	GPS Coordination			Material	Test Type	NDM 0°			NDM 90°			AVERAGE NDM			Solid Density (t/m³) Assumed	Oven Moisture content (%)	Final Corrected		Shear Vane Reading (kPa)					Retest URN	PASS / FAIL	Comments
				Easting	Northing	RL		NDM / SV	Wet Density (t/m³)	Moisture Content (%)	Air Voids (%)	Wet Density (t/m³)	Moisture Content (%)	Air Voids (%)	Wet Density (t/m³)	Moisture Content (%)	Air Voids (%)			Oven Dry Density (t/m³)	Average Air Voids (%)	Reading 1	Reading 2	Reading 3	Reading 4	Average SV (4 x Tests)		(P) Pass / (F) Fail	
S19 036-1	JLON	20/02/2019	RE Wall 4	2659532.272	6510925.491	28.783	clayey SILT	NDM / SV	1.76	33.9	7.0	1.75	33.5	7.3	1.75	33.7	7.2	2.7	34.5	1.30	6.7	154	184	184	215	184		P	
S19 047-2	JLON	6/03/2019	RE Wall 4	2659441.675	6511022.006	33.119	clayey SILT	NDM / SV	1.82	33.5	3.6	1.82	30.8	5.4	1.82	32.2	4.5	2.7	33.7	1.36	3.5	154	154	144	169	155		P	
S19 047-3	JLON	6/03/2019	RE Wall 4	2659454.149	6511016.943	34.089	clayey SILT	NDM / SV	1.77	37.6	4.0	1.77	41.3	1.8	1.77	39.5	2.9	2.7	40.0	1.26	2.6	169	184	154	154	165		P	
S19 048-1	JLON	7/03/2019	RE Wall 4	2659448.881	6511024.736	34.763	clayey SILT	NDM / SV	1.79	31.7	6.7	1.78	32.0	7.0	1.78	31.9	6.8	2.7	30.5	1.37	7.7	UTP	UTP	UTP	UTP	UTP		P	
S19 048-4	JLON	7/03/2019	RE Wall 4	2659478.794	6511008.884	35.52	clayey SILT	NDM / SV	1.80	31.2	6.5	1.80	32.7	5.6	1.80	32.0	6.0	2.7	32.2	1.36	5.9	215	215	215	215	215		P	
S19 049-1	JLON	8/03/2019	RE Wall 4	2659469.176	6511017.908	35.93	clayey SILT	NDM / SV	1.82	38.4	1.0	1.81	38.5	1.1	1.82	38.5	1.0	2.7	31.8	1.38	5.2	193	193	193	193	193		P	
S19 050-2	JLON	11/03/2019	RE Wall 4	2659549.738	6510991.009	36.539	clayey SILT	NDM / SV	1.77	31.9	7.4	1.77	30.9	8.0	1.77	31.4	7.7	2.7	33.1	1.33	6.6	215	215	215	215	215		P	
S19 050-3	JLON	11/03/2019	RE Wall 4	2659507.869	6511002.285	36.485	clayey SILT	NDM / SV	1.88	29.1	3.5	1.90	28.5	2.9	1.89	28.8	3.2	2.7	26.7	1.50	4.7	184	184	169	184	180		P	
S19 051-1	JLON	12/03/2019	RE Wall 4	2659473.435	6511018.081	37.636	clayey SILT	NDM / SV	1.87	31.6	2.6	1.87	31.5	2.4	1.87	31.6	2.5	2.7	32.8	1.41	1.7	UTP	UTP	UTP	UTP	UTP		P	
S19 051-5	JLON	12/03/2019	RE Wall 4	2659516.231	6511003.076	37.728	clayey SILT	NDM / SV	1.88	29.6	3.3	1.90	28.8	3.1	1.89	29.2	3.2	2.7	30.6	1.45	2.2	184	184	215	169	188		P	
S19 052-1	JLON	13/03/2019	RE Wall 4	2659552.946	6510994.149	38.484	clayey SILT	NDM / SV	1.74	33.4	7.9	1.74	34.0	7.7	1.74	33.7	7.8	2.7	35.8	1.28	6.5	169	200	200	184	188		P	
S19 052-3	JLON	13/03/2019	RE Wall 4	2659493.021	6511009.635	38.791	clayey SILT	NDM / SV	1.87	27.0	5.6	1.88	29.3	3.3	1.88	28.2	4.5	2.7	26.8	1.48	5.4	215	184	215	184	200		P	
S19 053-1	JLON	14/03/2019	RE Wall 4	2659509.702	6511007.239	39.104	clayey SILT	NDM / SV	1.79	31.5	6.9	1.80	29.5	7.5	1.79	30.5	7.2	2.7	29.3	1.39	8.0	215	215	215	215	215		P	
S19 053-2	JLON	14/03/2019	RE Wall 4	2659560.011	6510994.425	38.216	clayey SILT	NDM / SV	1.84	26.3	8.0	1.85	27.2	6.6	1.84	26.8	7.3	2.7	27.9	1.44	6.5	215	215	215	215	215		P	
S19 055-1	SAWE	15/03/2019	RE Wall 4	2659521.648	6511006.781	39.499	clayey SILT	NDM / SV	1.81	30.6	6.3	1.80	30.5	6.6	1.81	30.6	6.5	2.7	31.4	1.37	5.9	184	200	184	215	196		P	
S19 055-2	SAWE	15/03/2019	RE Wall 4	2659508.179	6511008.403	40.25	clayey SILT	NDM / SV	1.81	30.4	6.3	1.81	30.2	6.8	1.81	30.3	6.6	2.7	31.2	1.38	6.0	215	215	215	215	215		P	
S19 055-4	SAWE	15/03/2019	RE Wall 4	2659566.201	6510995.931	40.677	clayey SILT	NDM / SV	1.76	33.8	7.1	1.76	33.7	6.8	1.76	33.8	6.9	2.7	32.2	1.33	7.9	215	215	215	215	215		P	
S19 056-1	SAWE	16/03/2019	RE Wall 4	2659526.565	6511004.254	41.194	clayey SILT	NDM / SV	1.78	31.3	7.4	1.80	31.5	6.0	1.79	31.4	6.7	2.7	36.4	1.31	3.5	215	215	215	215	215		P	
S19 056-2	SAWE	16/03/2019	RE Wall 4	2659565.247	6510997.753	40.067	clayey SILT	NDM / SV	1.80	30.6	7.0	1.81	30.7	6.3	1.80	30.7	6.6	2.7	29.8	1.39	7.2	215	215	215	215	215		P	
S19 057-1	SAWE	18/03/2019	REWall 4	2659513.281	6511010.773	42.153	clayey SILT	NDM / SV	1.89	26.8	4.6	1.90	26.5	4.5	1.90	26.7	4.6	2.7	24.8	1.52	6.0	215	215	215	215	215		P	
S19 057-2	SAWE	18/03/2019	REWall 4	2659566.069	6510998.214	42.668	clayey SILT	NDM / SV	1.82	36.9	1.6	1.82	37.6	1.1	1.82	37.3	1.4	2.7	37.2	1.33	1.4	215	215	215	215	215		P	
S19 057-4	SAWE	18/03/2019	RE Wall 4	2659550.785	6511002.381	43.076	clayey SILT	NDM / SV	1.82	32.5	4.7	1.82	32.9	4.3	1.82	32.7	4.5	2.7	35.9	1.34	2.4	215	215	215	215	215		P	
S19 058-1	JLON	19/03/2019	RE Wall 4	2659510.44	6511013.514	44.295	clayey SILT	NDM / SV	1.84	29.6	5.2	1.83	28.8	6.3	1.84	29.2	5.8	2.7	28.7	1.43	6.1	215	215	215	215	215		P	
S19 060-1	JLON	26/03/2019	Undercut Bellow RE Wall 8	2659515.785	6511237.417	28.348	clayey SILT	NDM / SV	1.87	24.1	7.9	1.88	24.2	7.3	1.88	24.2	7.6	2.7	24.9	1.50	7.0	215	215	215	215	215		P	
S19 060-2	JLON	26/03/2019	Undercut Bellow RE Wall 8	2659522.555	6511231.762	29.179	clayey SILT	NDM / SV	1.87	26.5	5.9	1.90	24.1	6.4	1.89	25.3	6.1	2.7	24.0	1.52	7.1	UTP	UTP	UTP	UTP	UTP		P	
S19 061-1	JLON	27/03/2019	Undercut Bellow RE Wall 8	2659491.296	6511232.81	27.431	clayey SILT	NDM / SV	1.78	32.2	6.6	1.79	31.9	6.4	1.79	32.1	6.5	2.7	29.8	1.38	8.0	215	215	215	215	215		P	
S19 061-2	JLON	27/03/2019	Undercut Bellow RE Wall 8	2659478.524	6511228.342	26.929	clayey SILT	NDM / SV	1.85	26.8	6.6	1.86	27.4	6.0	1.86	27.1	6.3	2.7	26.3	1.47	6.9	UTP	UTP	UTP	UTP	UTP		P	
S19 061-3	JLON	27/03/2019	Undercut Bellow RE Wall 8	2659502.702	6511231.694	27.575	clayey SILT	NDM / SV	1.88	26.5	5.7	1.86	25.9	7.2	1.87	26.2	6.4	2.7	24.3	1.50	7.9	215	215	215	215	215		P	
S19 065-1	JLON	4/04/2019	RE Wall 8	2659501.63	6511243.714	28.379	clayey SILT	NDM / SV	1.89	27.9	3.9	1.89	28.4	3.7	1.89	28.2	3.8	2.7	28.4	1.47	3.6	215	215	215	215	215		P	
S19 066-1	JLON	5/04/2019	RE Wall 8	2659528.16	6511236.344	29.764	clayey SILT	NDM / SV	1.91	28.7	2.6	1.88	28.2	4.4	1.89	28.5	3.5	2.7	27.1	1.49	4.5	215	215	215	215	215		P	
S19 066-2	JLON	5/04/2019	RE Wall 8	2659466.46	6511232.933	30.345	clayey SILT	NDM / SV	1.90	30.7	1.6	1.91	27.3	3.7	1.90	29.0	2.6	2.7	28.7	1.48	2.8	215	215	215	215	215		P	
S19 067-1	JLON	9/04/2019	RE Wall 8	2659496.551	6511241.128	30.715	clayey SILT	NDM / SV	1.80	30.8	6.5	1.82	31.9	4.7	1.81	31.4	5.6	2.7	29.7	1.40	6.7	215	215	215	215	215		P	
S19 068-1	JLON	10/04/2019	RE Wall 8	2659518.811	6511235.936	31.237	clayey SILT	NDM / SV	1.85	30.5	4.3	1.83	32.0	4.1	1.84	31.3	4.2	2.7	27.4	1.45	6.9	169	184	215	215	196		P	
S19 068-2	JLON	10/04/2019	RE Wall 8	2659474.741	6511233.476	31.601	clayey SILT	NDM / SV	1.85	30.3	4.4	1.85	29.4	5.0	1.85	29.9	4.7	2.7	27.2	1.45	6.6	215	215	215	215	215		P	
S19 069-1	JLON	15/04/2019	RE Wall 8	2659499.649	6511234.403	32.003	clayey SILT	NDM / SV	1.89	30.2	2.4	1.88	27.8	4.6	1.88	29.0	3.5	2.7	30.7	1.44	2.3	215	215	215	215	215		P	
S19 069-2	JLON	15/04/2019	RE Wall 8	2659462.064	6511223.763	32.612	clayey SILT	NDM / SV	1.86	28.7	5.0	1.87	29.0	4.2	1.87	28.9	4.6	2.7	27.7	1.46	5.4	215	215	215	215	215		P	
S19 070-1	CBEN	16/04/2019	RE Wall 8	2659504.552	6511237.811	33.12	clayey SILT	NDM / SV	1.83	29.1	6.3	1.81	29.6	6.7	1.82	29.4	6.5	2.7	32.9	1.37	4.2	154	184	169	154	165		P	
S19 070-2	CBEN	16/04/2019	RE Wall 8	2659495.384	6511222.687	32.853	clayey SILT	NDM / SV	1.89	29.7	2.6	1.89	28.4	3.6	1.89	29.1	3.1	2.7	33.1	1.42	0.3	154	154	169	169	162		P	
S19 071-1	CBEN	17/04/2019	RE Wall 8	2659477.711	6511228.464	35.034	clayey SILT	NDM / SV	1.84	27.7	6.7	1.84	27.3	7.2	1.84	27.5	7.0	2.7	28.1	1.43	6.5	138	215	154	169	169		P	
S19 071-2	CBEN	17/04/2019	RE Wall 8	2659526.478	6511231.32	33.552	clayey SILT	NDM / SV	1.88	31.4	1.8	1.89	28.9	3.4	1.89	30.2	2.6	2.7	32.2	1.43	1.2	154	138	184	154	158		P	
S19 072-1	CBEN	18/04/2019	RE Wall 8	2659510.488	6511232.387	34.089	clayey SILT	NDM / SV	1.82	27.9	7.5	1.83	28.5	6.7	1.83	28.2	7.1	2.7	28.6	1.42	6.8	152	138	132	165	147		P	
S19 073-1	CBEN	26/04/2019	RE Wall 8	2659479.69	6511227.444	34.634	clayey SILT	NDM / SV	1.87	33.0	1.6	1.85	35.8	0.7	1.86	34.4	1.1	2.7	34.2	1.39	1.3	184	215	215	215	207		P	
S19 073-2	CBEN	26/04/2019	RE Wall 8	2659509.384	6511234.321	34.659	clayey SILT	NDM / SV	1.76	33.9	6.5	1.76	33.2	7.1	1.76	33.6	6.8	2.7	37.0	1.29	4.8	154	169	184	215	181		P	
S19 073-1	CBEN	29/04/2019	RE Wall 8	2659527.633	6511226.651	35.439	clayey SILT	NDM / SV	1.82	35.7	2.2	1.82	37.9	1.1	1.82	36.8	1.7	2.7	39.4	1.31	0.1	154	169	169	154	162		P	
S19 073-2	CBEN	29/04/2019	RE Wall 8	2659506.649	6511220.941	35.5	clayey SILT	NDM / SV	1.83	35.2	2.0	1.83	36.3	1.8	1.83	35.8	1.9	2.7	34.1	1.36	2.9	169	169	154	169	165		P	

GEOTECHNICS

Job: Precent 5 Arrans Hill

Client: Tonkin & Taylor

Job #	21854.0031
Entered By	CBEN
Checked By	JLON
Approved By	-

URN	Tech.	Date	Location	GPS Coordination			Material	Test Type	NDM 0°			NDM 90°			AVERAGE NDM			Solid Density (t/m³) Assumed	Oven Moisture content (%)	Final Corrected		Shear Vane Reading (kPa)					Retest URN	PASS / FAIL	Comments
				Easting	Northing	RL		NDM / SV	Wet Density (t/m³)	Moisture Content (%)	Air Voids (%)	Wet Density (t/m³)	Moisture Content (%)	Air Voids (%)	Wet Density (t/m³)	Moisture Content (%)	Air Voids (%)			Oven Dry Density (t/m³)	Average Air Voids (%)	Reading 1	Reading 2	Reading 3	Reading 4	Average SV (4 x Tests)		(P) Pass / (F) Fail	
S19 074-1	CBEN	30/04/2019	RE Wall 8	2659481.609	6511228.614	36.111	clayey SILT	NDM / SV	1.76	36.9	5.1	1.75	35.3	6.3	1.76	36.1	5.7	2.7	36.4	1.29	5.5	165	152	138	193	162		P	
S19 075-1	CBEN	1/05/2019	RE Wall 8	2659478.492	6511224.959	36.524	clayey SILT	NDM / SV	1.78	35.4	4.8	1.78	33.2	6.0	1.78	34.3	5.4	2.7	40.0	1.27	2.0	154	169	154	184	165		P	
S19 076-1	CBEN	2/05/2019	RE Wall 8	2659506.728	6511227.273	37.832	clayey SILT	NDM / SV	1.73	38.7	5.4	1.72	37.2	6.7	1.73	38.0	6.1	2.7	38.0	1.25	6.0	193	193	193	193	193		P	
S19 077-3	CBEN	3/05/2019	RE Wall 8	2659527.843	6511217.883	36.943	clayey SILT	NDM / SV	1.85	30.7	3.9	1.85	30.6	4.3	1.85	30.7	4.1	2.7	33.3	1.39	2.4	152	165	152	193	166		P	
S19 078-1	CBEN	6/05/2019	RE Wall 8	2659498.821	6511226.385	38.449	clayey SILT	NDM / SV	1.81	31.3	5.8	1.81	33.0	4.9	1.81	32.2	5.3	2.7	33.7	1.35	4.3	138	193	165	193	172		P	
S19 078-2	CBEN	6/05/2019	RE Wall 8	2659504.902	6511212.539	39.321	clayey SILT	NDM / SV	1.81	31.6	5.7	1.81	31.5	5.5	1.81	31.6	5.6	2.7	33.3	1.36	4.5	138	132	152	138	140		P	
S19 079-1	CBEN	7/05/2019	RE Wall 8	2659494.892	6511214.624	38.805	clayey SILT	NDM / SV	1.84	30.3	4.8	1.82	31.4	5.1	1.83	30.9	4.9	2.7	30.5	1.40	5.2	138	138	132	165	143		P	
S19 079-2	CBEN	7/05/2019	RE Wall 8	2659526.37	6511206.581	39.661	clayey SILT	NDM / SV	1.82	28.1	7.3	1.83	30.6	5.3	1.83	29.4	6.2	2.7	30.5	1.40	5.5	193	165	138	138	159		P	
S19 080-1	CBEN	8/05/2019	RE Wall 8	2659519.653	6511203.261	39.847	clayey SILT	NDM / SV	1.80	33.2	5.3	1.79	33.8	5.0	1.80	33.5	5.1	2.7	34.8	1.33	4.3	152	152	138	138	145		P	
S19 080-2	CBEN	8/05/2019	RE Wall 8	2659504.056	6511188.797	38.771	clayey SILT	NDM / SV	1.79	31.8	6.4	1.80	32.6	5.6	1.80	32.2	6.0	2.7	32.7	1.35	5.7	165	152	138	138	148		P	
S19 081-1	CBEN	9/05/2019	RE Wall 8	2659499.664	6511195.577	40.196	clayey SILT	NDM / SV	1.78	37.0	3.9	1.78	37.6	3.4	1.78	37.3	3.6	2.7	38.2	1.29	3.1	179	152	152	165	162		P	
S19 081-2	CBEN	9/05/2019	RE Wall 8	2659527.246	6511194.506	46.465	clayey SILT	NDM / SV	1.77	34.7	5.6	1.77	32.4	7.0	1.77	33.6	6.3	2.7	37.7	1.29	3.8	138	152	165	152	152		P	
S19 087-3	CBEN	21/05/2019	NW Pond	2659430.781	6511061.376	35.844	clayey SILT	NDM / SV	1.78	37.8	3.2	1.79	38.0	2.6	1.79	37.9	2.9	2.7	43.3	1.25	0.0	138	138	165	124	141		P	
S19 087-4	CBEN	21/05/2019	NW Pond	2659439.853	6511056.867	36.77	clayey SILT	NDM / SV	1.80	38.1	2.2	1.77	40.0	2.4	1.79	39.1	2.3	2.7	43.6	1.24	0.0	152	138	138	138	142		P	

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