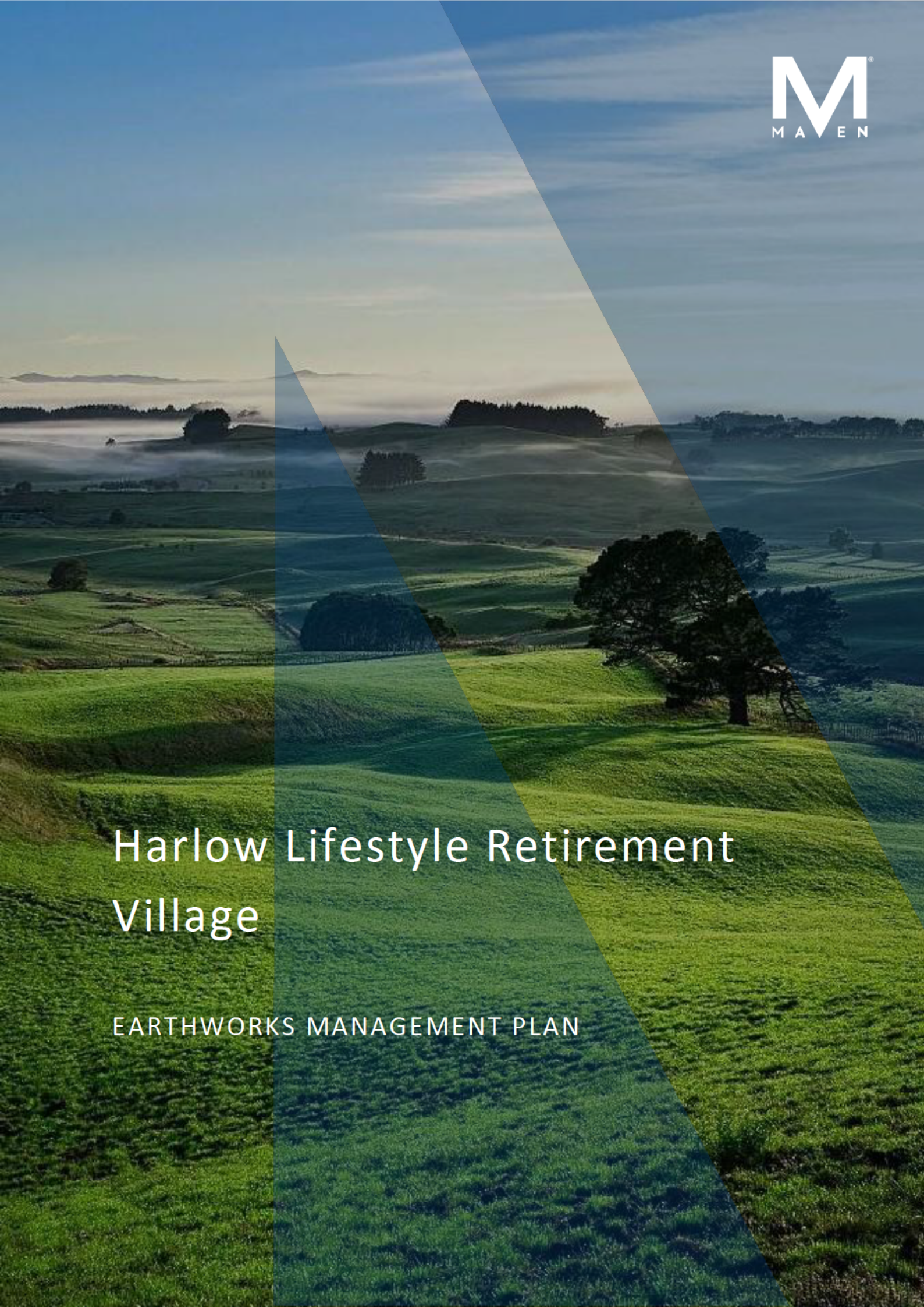
Appendix 19b – Earthworks Management Plan



Harlow Lifestyle Retirement Village

EARTHWORKS MANAGEMENT PLAN

PROJECT INFORMATION

CLIENT	Harlow Lifestyle Village Ltd
PROJECT	411001

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19 Kaimiro Street, Pukete
New Zealand
Phone 07 242 0601
www.maven.co.nz

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1. Statement of Experience

Author

My name is Sean McDonald. I am a Senior Engineer and Team Leader at Maven Waikato Ltd ("Maven"), a firm of consulting engineers and surveyors based in Hamilton. I have been employed by Maven since 2025. I hold a Bachelor of Engineering Technology (Highways) which I graduated form in 2006, hold a New Zealand Certificate of Engineering "Civil" (NZCE) and I am a member of Engineering New Zealand.

I have over 29 years of experience in the field of civil engineering including as a civil engineering technician, New Zealand army engineer, council engineer and consulting engineer, with over 20years' of experience post degree. Since obtaining my degree I have worked on a variety of civil projects including State Highway works, 3 Waters Infrastructure works, Residential Land Development, Commercial and Industrial Land Development and major Infrastructure projects such as the upgrade of the Port Botany (Sydney) Naphtha Storage Facilities, the Transpower upgrade and extension of the Whakamuru Substation, the Central Government Rotorua Youth Justice Facility and Contact Energy's new Tauhara Geothermal power station.

I confirm that I have read and understood the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023, and agree to comply with its requirements.

I acknowledge that, as an expert, I have an overriding duty to assist the decision-maker impartially on matters within my area of expertise. In preparing this report, I have exercised my independent professional judgement, and the opinions expressed in this report are my own. I understand that my duty as an expert is not to advocate for the interests of the applicant or any other party.

I confirm that the matters addressed in this report are within my area of expertise, except where I expressly identify that I have relied upon information, assessments or opinions provided by others. I have made all reasonable enquiries and have not knowingly omitted any material facts known to me that might alter or detract from the opinions expressed in this report.

Reviewer

I am Min Shon, a Senior Civil Engineer and Team Leader at Maven Waikato Ltd. I hold a Master of Civil Engineering from the University of Auckland and am a Chartered Professional Engineer (CPEng) registered with Engineering New Zealand. I have over six (6) years of professional experience in civil engineering, with particular experience in land development, including earthworks, roading, and three waters infrastructure design.

I confirm that I have read and understood the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023, and agree to comply with its requirements.

I acknowledge that, as an expert, I have an overriding duty to assist the decision-maker impartially on matters within my area of expertise. In preparing this report, I have exercised my independent professional judgement, and the opinions expressed in this report are my own. I understand that my duty as an expert is not to advocate for the interests of the applicant or any other party.

I confirm that the matters addressed in this report are within my area of expertise, except where I expressly identify that I have relied upon information, assessments or opinions provided by others. I have made all reasonable enquiries and have not knowingly omitted any material facts known to me that might alter or detract from the opinions expressed in this report.

2. Introduction

2.1. Purpose of this Report

The Earthworks Management Plan (EWMP) relates to the Harlow Lifestyle Retirement Village (Harlow LRV or the Project) Residential Development at 2025 Ōhaupō Road, Te Awamutu. The EWMP outlines the methodology associated with the proposed earthworks onsite.

2.2. Site Description

The site consists of circa 25.78 hectares of land located to the west of Ōhaupō Road (SH3) and on the northern fringe of the Te Awamutu urban boundary. The site is currently used as rural land mainly as a dry stock farm however current State Highway access restrictions prevent the site from more extension farming operations. The landholding includes two parcels held in One Record of Title, Part Lot 1 Deposited Plan 35654 and Lot 1 Deposited Plan 36696 with a combined area of circa 25.78ha.

The Project seeks approval for a substantive application under the FTAA for a comprehensively master planned and staged Residential development. This includes all necessary resource consents under the Resource Management Act 1991.

The Harlow LRV Development provides for the establishment of approximately 414 units, together with infrastructure devices including centralised raingardens, artificial wetlands, 3 water drainage infrastructure and roading. The Harlow LRV Development is underpinned by a series of design principles, with a focus on creating a well-connected, legible, and diverse residential area on Te Awamutu's northern fringe. This is supported via a coordinated and connected roading and pedestrian/cycle network, and stormwater outcomes, as well as varying retirement unit sizes and types, in conjunction with the serviced apartments, managed care facility and community facilities which have been proposed to meet the growing and changing needs of the greater Waikato retirement lifestyle market.

The Harlow LRV Development includes substantial enabling works to establish developable land, including:

- bulk earthworks across the site;
- retaining structures
- roading networks
- new wastewater and water supply infrastructure including new wastewater pumpstations;
- an integrated stormwater management system consisting of conveyance systems such as piped stormwater infrastructure, as well as integrated detention/attenuation and treatment devices that will be combined into artificial wetlands.

The site location is shown in figure 1 below.

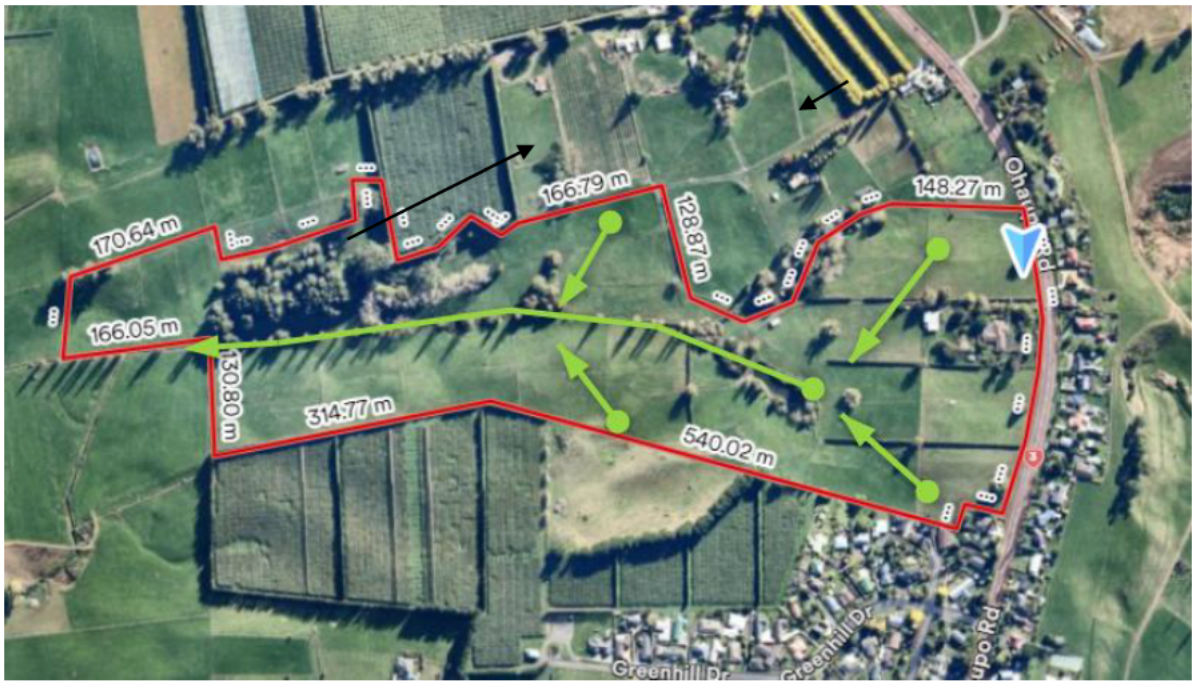


Figure 1: Site Locality

2.3. Legal Description

The site consists of two parcels held in One Record of Title as shown in Table 2. The site can be accessed by State Highway 3 (Ōhaupō Road) to the east.

Address	Lot Description	Area (Ha)
2025 Ōhaupō Road, Te Awamutu 3800	PT LOT 1 DP 35654 LOT 1 DPS 36696 BKL II PUNIU SD	25.7824
Made up Off		
Parcel ID 4352868	Part Lot 1 DP 35654	16.6614
Parcel ID 4538250	Lot 1 DPS 36696	9.121
	Total Area (Ha)	**25.7824**

Table 1: Lot Description Table

3. Geotechnical Investigation

A Geotechnical Suitability Report has been prepared by Titus Consulting Engineers (Ref No: C3102) and BTW Company (Ref No: Rev A – 24/11/2022) for the Harlow Lifestyle Village. The site is characterised by rolling hill with Walton Subgroup (Hamilton Ash) and the low-lying areas consisting of Holocene swamp deposits (Alluvium) and saturated clay. The investigations confirm that compressible ground conditions are present across the low-lying portions of the site.

The geotechnical assessment showed that fill-induced settlement within the low-lying areas could be significant with preliminary predicted settlements of approximately up to 40mm without mitigation or preloading. Ground Improvement pf up to 5m of backfill is recommended for the low-lying areas of the site to avoid any surface expression of liquefaction. No ground improvement is necessary for the rolling hills.

Backfilling will be undertaken progressively within the identified soft-ground areas. Settlement monitoring will be established prior to loading and maintained throughout the earthworks, duration and removal subject to geotechnical review and agreed hold points. The observational approach allows the surcharge programme to be refined in response to measured settlement behaviour and ground conditions meaning throughout the phase a refined approach of backfill will be incorporated into the phasing of earthworks.

The general site geological composition, from greatest to least %, is as follows:

- Hamilton ash formation; stiff to very stiff clayey silt, with varying degrees of clay and silt
- Walton subgroup; weathered residual soil of very stiff silt with clay and/or fine sand and weathered pumice gravel
- Hinuera formation; low-density sandy soils over denser sand layers
- Low density colluvium at slope toes, gullies and stream channels
- Expected historic farm filling

The Hamilton ash formation soils encountered on site have been assessed for re-use suitability and are generally suitable to achieve the requirements to be re-used as engineered fill across site. For further information of the existing soil typology and suitability, see Appendix E in the Infrastructure Report.

3.1. Landforms

The site's landform is composed of three major geomorphologies; alluvial plains, gully landforms and low hills landform. The site slopes have been classed, in approximately 5m squares, as below:

Landscape Unit	Total %
Near level to gently undulating	19
Undulating land	42
Rolling land	35
Hilly land	3
Steep land	1
Total	100

Table 2: Landform Unit Composition

3.2. Ground Water

The preliminary geotechnical investigations were undertaken to provide full coverage of the Harlow Village development area. The investigations cover assessed ground water levels, soil soakage capacity, liquefaction potential, and lateral spreading risks, ensuring comprehensive data for stormwater management, earthworks, Roading and foundation design (see Appendix E in the Infrastructure Report).

1. 211365 Rev A (dated 24/11/2022)

The site is characterised as rolling low hills bisected east-to-west by a central gully that feeds two existing ponds, wetlands, and a small stream, which ultimately flows into the surrounding alluvial plains. Overall, underlain by Walton Subgroup along the low hills and the gullies, low-lying areas are underlain by the Hinuera Formation, flanked by rolling hills to the north and south, comprised of Hamilton ashes, with ground water levels varying seasonally and across different areas.

The findings provide crucial insights into the site's Geotechnical behaviour, have informed the design completed to date and will inform future design considerations. The key findings are summarised below.

Ground Water Levels

- Depths recorded 0.2m below existing ground level in low lying areas
- Groundwater was not encountered within 2m of the surface across the elevated low hills of the site.

4. Earthworks and Sediment Control

Earthworks will be undertaken as required throughout the proposed development area in different development phases and will include cut to fill operations for the following activities;

- Construction of building platforms
- Construction of structural retaining walls
- Construction of roading corridors & intersections
- Construction of artificial stormwater wetland ponds & raingardens
- Excavations for road pavement construction
- Excavation for stormwater pipe networks
- Excavations for wastewater pipe networks
- Excavations for wastewater pumpstations
- Excavations for water supply networks
- Excavations for services & utilities trenches

The Harlow LRV Development will be constructed in 5 earthwork stages. Within each development stage, the earthworks areas will be further divided into different sub-catchment areas where specific erosion and sediment control measures are to be adopted.

4.1. Design Standards

Proposed measures for erosion and sediment control have been designed in accordance with Waikato Regional Council's Guide for Soil Disturbing Activities TR2009/02, best practice solutions.

4.2. Earthworks Onsite Progress and Future Programme

Earthworks will be undertaken in stages, and it is envisaged that all earthworks will be completed within five to six (5-6) earthworks seasons depending on overall project staging and earthwork season weather. Applications for Winter Works will only be lodged if required.

It is proposed that the bulk earthworks operation will comprise of five separated work sections (Stage 1, 2, 3, 4, and NZTA Corridor). Stage 1 will be run concurrently with the NZTA corridor works, with Stage 1 works completion dependant on the completion of the NZTA corridor works. Excess material from Stage 1 can be stockpiled on Stage 2 to be removed off-site once both Stage 1 and the NZTA Corridor works are complete if required. It is anticipated that the combined duration of the NZTA Corridor works and the Stage 1 Earthworks will take 18 to 24months to complete.

Stage 2, 3, and 4 can run independently of each other and/or concurrently, however critical culvert crossings and associated earthworks within Stage 2 will need to be completed prior to either Stage 3 or 4 commencing. It is anticipated that each of the 2 will take 12 to 18months to complete, however stg age 3 and 4 are anticipated to take approximately 12months each to complete.

Works are intended to be carried out in the following steps:

- Install silt control measures, as shown on Engineering Drawings or agreed plans provided at Preconstruction meeting
    - Installation of stabilized site entrances, sediment retention ponds, decanting earth bunds, clean and dirty water diversion bunds, silt fencing and wellpoint dewatering devices.
- Cut/Fill bulk earthworks to areas outside of the NZTA Corridor
- Formation of either temporary SH3 traffic diversion or partial construction of proposed 4-arm SH3 roundabout
- Once SH3 traffic is diverted – the bulk earthworks within the NZTA Corridor
- Once SH3 proposed 4-arm SH3 roundabout completed all traffic rediverted to new SH3 alignment and completion of Stage 1 Cut/Fill earthworks
- Installation of Structural Retaining walls
- Installation of deeper drainage infrastructure
    - Wastewater Pumpstations
    - Artificial Stormwater Wetland Ponds
- Install drainage infrastructure systems, outlets, and riprap
- Form channel and building platform areas concurrently as site is stabilised
- Stabilise Road corridors by placing the subgrade improvement layer of grey/brown rock ready for civil construction to place
- Removal of any stockpiled material
    - If stockpiled on Stage 2
- Retain and maintain silt control measures until completion.

4.3. Earthworks Summary

As mentioned in the above section, the bulk earthworks on site will be divided into five separate work sections. These are from Stage 1, 2, 3, 4, and NZTA Corridor including artificial stormwater wetlands, and wastewater pumpstations. Please refer to the earthworks drawings for detail attached in Appendix A.

- Stage 1
    - Bulk Earthworks
    - New SH3 Road Corridor/Roundabout (Partial offline construction)
    - Structural Retaining Walls
    - Artificial Stormwater Wetland A construction
    - Culver Construction
    - Eastern Wastewater Pumpstation (A) construction
- NZTA Corridor
    - Bulk Earthworks
    - New SH3 Road alignment/tie in
    - New Roundabout (Partial online construction)
    - Stormwater treatment/attenuation basin (dry)
- Stage 2
    - Bulk Earthworks
    - Structural Retaining Walls
    - Artificial Stormwater Wetland B & C construction
    - Culvert Construction
- Stage 3
    - Bulk Earthworks
    - Structural Retaining Walls
    - Artificial Stormwater Wetland E construction
- Stage 4
    - Bulk Earthworks
    - Structural Retaining Walls
    - Artificial Stormwater Wetland D construction

4.4. Total Earthworks

Bulk Subgrade Earthworks (topsoil stripping inclusive)	
Total area of ground disturbance	206,187 m^2 (20.15ha)
Total volume of CUT	282,050 m^3
Total volume of FILL	115,153 m^3
Total Volume of FILL with Compaction Factor (1.25)	143,942 m^3
Maximum CUT and FILL depth	7.0m FILL / 6.5m CUT
Total Volume (Excess Cut)	138,108 m^3
Bulk Topsoil Volumes	
Topsoil stripping (200 mm)	48,253 m^3
Topsoil Respread (150mm)	38,336 m^3
Total Excess Topsoil	9,917 m^3
Assumed Cut to Waste Volumes	
Assumed Cut to Waste Unsuitable	45,146 m^3
Assumed Cut to Waste Clean fill Material	82,232 m^3
Other	
Assumed Imported Granular Pavement	26,846 m^3

Table 3: Summary of Total Earthworks

4.4.1. Stage 1 Earthworks

Bulk Subgrade Earthworks (topsoil stripping inclusive)	
Total area of ground disturbance	89,211 m^2 (8.92ha)
Total volume of CUT	153,967m^3
Total volume of FILL	62,189 m^3
Total Volume of FILL with Compaction Factor (1.25)	77,736 m^3
Maximum CUT and FILL depth	7.0m FILL / 6.5m CUT
Total Volume (Excess Cut)	76,231 m^3
Bulk Topsoil Volumes	
Topsoil stripping (200 mm)	19,753 m^3
Topsoil Respread (150mm)	19,610 m^3
Total Excess Topsoil	143 m^3
Assumed Cut to Waste Volumes	
Assumed Cut to Waste Unsuitable (15%)	23,095 m^3
Assumed Cut to Waste Clean fill Material	53,136 m^3
Other	
Assumed Imported Granular Pavement	7,765 m^3

Table 4: Summary of Stage 1 Earthworks

4.4.2. NZTA Corridor Earthworks

Bulk Subgrade Earthworks (topsoil stripping exclusive)	
Total area of ground disturbance	8,953 m^2 (0.86ha)
Total volume of CUT	8,111m^3
Total volume of FILL	35 m^3
Total Volume of FILL with Compaction Factor (1.25)	44 m^3
Maximum CUT and FILL depth	0.5 FILL / 2.0m CUT
Total Volume (Excess Cut)	8,067 m^3
Bulk Topsoil Volumes	
Topsoil stripping (200 mm)	NA
Topsoil Respread (150mm)	NA
Total Excess Topsoil	NA
Assumed Cut to Waste Volumes	
Assumed Cut to Waste Granular Material (50%)	4,055 m^3
Assumed Cut to Waste Clean fill Material	4,012 m^3
Other	
Assumed Imported Granular Pavement	4,843 m^3

Table 5: Summary of NZTA Corridor Earthworks

4.4.3. Stage 2 Earthworks

Bulk Subgrade Earthworks (topsoil stripping inclusive)	
Total area of ground disturbance	76,471 m^2 (7.65ha)
Total volume of CUT	72,506m^3
Total volume of FILL	42,340 m^3
Total Volume of FILL with Compaction Factor (1.25)	52,924 m^3
Maximum CUT and FILL depth	4.0m FILL / 5.0m CUT
Total Volume (Excess Cut)	19,582 m^3
Bulk Topsoil Volumes	
Topsoil stripping (200 mm)	19,016 m^3

Topsoil Respread (150mm)	12,813 m^3
Total Excess Topsoil	6,203 m^3
Assumed Cut to Waste Volumes	
Assumed Cut to Waste Unsuitable (15%)	10,876 m^3
Assumed Cut to Waste Clean fill Material	8,706 m^3
Other	
Assumed Imported Granular Pavement	8,116 m^3

Table 6: Summary of Stage 2 Earthworks

4.4.4. Stage 3 Earthworks

Bulk Subgrade Earthworks (topsoil stripping inclusive)	
Total area of ground disturbance	22,460 m^2 (2.25ha)
Total volume of CUT	29,089m^3
Total volume of FILL	7,706 m^3
Total Volume of FILL with Compaction Factor (1.25)	9,633 m^3
Maximum CUT and FILL depth	3.5m FILL / 5.0m CUT
Total Volume (Excess Cut)	19,456 m^3
Bulk Topsoil Volumes	
Topsoil stripping (200 mm)	7,269 m^3
Topsoil Respread (150mm)	4,491 m^3
Total Excess Topsoil	2,778 m^3
Assumed Cut to Waste Volumes	
Assumed Cut to Waste Unsuitable (15%)	4,363 m^3
Assumed Cut to Waste Clean fill Material	15,093 m^3
Other	
Assumed Imported Granular Pavement	1,168 m^3

Table 7: Summary of Stage 3 Earthworks

4.4.5. Stage 4 Earthworks

Bulk Subgrade Earthworks (topsoil stripping inclusive)	
Total area of ground disturbance	9,092 m^2 (0.91ha)
Total volume of CUT	18,376m^3
Total volume of FILL	2,883 m^3
Total Volume of FILL with Compaction Factor (1.25)	3,604 m^3
Maximum CUT and FILL depth	3.0m FILL / 4.5m CUT
Total Volume (Excess Cut)	14,772 m^3
Bulk Topsoil Volumes	
Topsoil stripping (200 mm)	2,216 m^3
Topsoil Respread (150mm)	1,422 m^3
Total Excess Topsoil	794 m^3
Assumed Cut to Waste Volumes	
Assumed Cut to Waste Unsuitable (15%)	2,756 m^3
Assumed Cut to Waste Clean fill Material	12,016 m^3
Other	
Assumed Imported Granular Pavement	1,315 m^3

Table 8: Summary of Stage 4 Earthworks

4.5. Stockpiles between Stages

Bulk earthworks are expected to generate a surplus of CUT material in all five Stages. The following stockpile approach will be adopted:

Stage	Net Cut/Fill	Action
Stage 1	Surplus Cut 76,231 m³ • 23,095 *m³ Unsuitable Cut to Waste* • 53,136 *m³ Suitable for Clean Fill*	Excess Clean Fill and Stripped Topsoil material can be stockpiled on Stage 2 It is expected that Unsuitable material will be cut directly off site
NZTA Corridor	Surplus Cut 8,067 m³ • 4,055 *m³ Unsuitable Cut to Waste* • 4,012*m³ Suitable for Clean Fill*	Excess Clean Fill and Stripped Topsoil material can be stockpiled on Stage 2 It is expected that either the existing granular pavement or Unsuitable material will be cut directly off site
Stage 2	Surplus Cut 19,582 m³ • 10,876 *m³ Unsuitable Cut to Waste* • 8,705 *m³ Suitable for Clean Fill*	Excess Clean Fill and Stripped Topsoil material can be stockpiled on Stage 1 (If Stage 1 SRP 1D and associated controls are left in place) or stockpiled progressively on Stage 2 within the proposed controls. It is expected that Unsuitable material will be cut directly off site
Stage 3	Surplus Cut 19,456 m³ • 4,363 *m³ Unsuitable Cut to Waste* • 15,093 *m³ Suitable for Clean Fill*	Excess Clean Fill and Stripped Topsoil material can be stockpiled on Stage 4 (If Stage 2 SRP 2D and associated controls are left in place) It is expected that Unsuitable material will be cut directly off site
Stage 4	Surplus Cut 14,722 m³ • 2,756 *m³ Unsuitable Cut to Waste* • 12,016 *m³ Suitable for Clean Fill*	It is expected that both Surplus Clean Fill & Unsuitable material will be cut directly off site

Table 9: Summary of Stockpiles between Stages

4.5.1. Stockpiling Details

Stockpiles will be limited to a height specified by the Geotechnical Engineer, with 2:1 side slopes, and protected with silt fences and toe bunds.

Stabilisation of stockpiles using hydroseeding or mulch will occur within seven days of stockpiling.

Stockpiles will be placed within the final earthworks Stage 1, 2 & 4 footprint, ensuring minimal double handling, and avoiding contamination of clean catchments. Refinement to the filling strategy would see fill material being placed and engineered to avoid further handling or segregation.

Note: All stockpiling and reuse operations will be tracked with GPS or site logs to ensure material origin, volume, and placement areas are accurately recorded for the final Earthworks Completion Report.

4.6. Stockpile Locations

During the earthworks operations, all excavated materials generated will be stockpile on the final earthworks Stage 1, 2 & 4 footprint as detailed in section 5.1 table 9 and section 4.5.1 above. These stockpile locations have been strategically selected to ensure minimal disruption to ongoing works and to facilitate efficient rehandling during subsequent stages. The stored material will be reused as cut to waste off site to either an approved facility or other proposed development within the wider area that require clean fill as part of their development (such as the proposed Southern Links Corridor projects or Managed fill operation in Cambridge). Proper erosion and sediment control measures will be implemented around stockpiles to prevent environmental impacts and maintain site safety and accessibility.

Please refer to Appendix A – Earthworks Drawings for further details.

5. Existing and Proposed Erosion Control

As the site is currently a sloped site falling to a central drainage corridor (gully) with multiple existing wetland areas, multiple sediment controls and devices need to be constructed onsite. Below we have outlined the general principles and philosophies that will be adopted for any current controls and/or future proposed controls.

All proposed controls are in general accordance with the Waikato Regional Council best practice erosion and sediment control measures as per WRC TR2009/02 guidelines.

Silt and erosion control measures shall remain in place and operational until the contributing catchment has been permanently stabilised and there is no longer a reasonable risk of sediment discharge from the relevant earthworks area. Removal of temporary controls shall be undertaken progressively and only following inspection by the Engineer or appropriately delegated person confirming that the area is adequately stabilised and that the controls are no longer required.

The site will be progressively stabilised with topsoil and grass seed as earthwork levels are achieved. Silt control measures will only be removed once the site is determined by the engineer to be stable in terms of silt run-off.

5.1. Proposed Controls

The following system of silt and sediment control protection measures are proposed: below sections covers the methodology for various stages of the development. For clarity, refer to staging plans (C230-SERIES ESC PLAN'S) as part of this application, in conjunction with the below staging works methodology.

5.2. Potential Environmental Impacts

During the earthworks there is a risk of dust nuisance during dry and windy weather. To manage potential dust effects, the following management measures are proposed:

1. That a maximum earthworks area of 10ha shall be opened at any one time.
2. Earthworks shall be effectively stabilised using the following methods:
    a. Topsoiling and grassing
    b. Hydroseeding
    c. Using hay or straw mulching
3. An adequate supply of water for dust control and effective means of application is always available on-site during earthworks, until such time as the site is fully stabilised.

4. Sufficient water will be available for dust mitigation with water storage tanks retained on site until it is fully stabilised. The water tanks will be re-charged via truck and trailer water cart.
5. In the event dust control management is ineffective, the contractor shall employ the use of soil stabilisers (such as polymers or similar) or weatherproof cover where possible.

6. Additional Information

6.1. Fill Compaction

Each layer of material shall be compacted throughout its whole area and depth to achieve:

Not less than the following percentages of maximum dry density obtainable for the material by standard compaction at optimum moisture content determined by NZS 4402, Pt 2P: Test 14:		Clays and Silty Clays	Sands and Gravel
A	Within 500mm of the finished carriageway sub grade levels and within 3m of batter edges	98%	100%
B	Elsewhere	95%	97%
Clays		Air Voids % (as defined NZS 4402: Part 1)	Undrained Shear (measured by in-situ vane)
A	Within 500mm of road subgrade levels and within 3 meters	Average value less than 8% (any 10 tests) Maximum single value 10%	Average value not less than 170 KPa minimum single value 140 KPa
B	General Fill	Average value less than 10% (any 10 tests) Maximum single value 12%	Average value not less than 150 KPa minimum single value 110 KPa
C	Reserve Areas deeper than 600mm below finished formation level	Maximum value 15%	Minimum value 75 KPa

Table 10: Fill Compaction Requirements by Soil Types

6.2. Monitoring

All sediment control measures will be checked to ensure that they are performing as intended.

A site walk over shall be undertaken daily before leaving the site to identify any corrective maintenance required. A more thorough inspection will be undertaken at the end of each week, or before and after a forecast major storm event, to identify any preventative and/or corrective maintenance required.

A regular program of sediment, debris and trash removal will be undertaken to ensure sediment control measures do not become blocked and ensure they function as proposed. Any large floating matter including any organic matter, i.e., fallen tree litter, reaching the pond or discharge structures is to be removed immediately.

Specific monitoring and maintenance of each mitigation method is included below:

6.2.1. Decant Bund

- Inspect every day and before every forecasted rainfall event. Inspect for correct operation after every runoff event. Immediately repair any damage caused by erosion or construction equipment.
- Inspect Level Spreaders after every rainfall until vegetation is established and promptly undertake any necessary repairs. Ensure vegetation is kept in a healthy and vigorous condition.
- Clean out before the volume of accumulated sediment reaches 20% of the total volume. To assist in gauging sediment loads, clearly mark 20% volume height on the riser.
- Clean out with high-capacity sludge pumps, or with excavators (long reach excavators if needed) loading onto sealed tip trucks or to a secure area.
- Deposit the sediment in such a location so that is does not lead to a direct discharge to receiving environments. Stabilise all disposal sites as required.

6.2.2. Retention Pond

- Chemical treatment will be provided to the pond if 100mm of water clarity is not achieved before discharge, this will be achieved by dossing/flocculation.

6.2.3. Diversion Drains / Clean Water Cut-off Bunds

- Inspect after every rainfall event and during periods of prolonged rainfall for scour and areas where they may breach.
- Repair immediately if required to ensure that the design capacity is maintained.
- Remove any accumulated sediment deposited in the Runoff Diversion Channel / Bund due to low gradients and velocities.
- Carefully check outlets to ensure that these remain free from scour and erosion.

6.2.4. Silt Fence

- Inspect Silt Fences at least once a week and after each rainfall. Make any necessary repairs when bulges occur, or sediment accumulation reaches 50% of the fabric height.
- Any areas of collapse, decomposition or ineffectiveness need to be immediately replaced.
- Remove sediment deposits as necessary to continue to allow for adequate sediment storage and reduce pressure on the Silt Fence. Ensure that the sediment is removed to a secure area.
- Do not remove Silt Fence materials and sediment deposition until the catchment area has been appropriately stabilised. Stabilise the area of the removed Silt Fence.

6.2.5. Silt Socks

- Inspect Filter Socks at least once a week and after each rainfall. Make any necessary repairs when necessary.

6.2.6. Stabilised Vehicle Entrance

- Maintain the Stabilised Construction Entrance in a condition to prevent sediment form leaving the construction site. After each rainfall inspect any structure used to trap sediment for the Stabilised Construction Entrance and clean out, as necessary.

6.3. Stabilisation

Stabilisation of earthworked areas shall be undertaken progressively as final ground levels are reached or where works are temporarily paused for more than 14 days. The following stabilisation measures and timing are proposed in line with the following Waikato Regional Council guidelines:

Condition	Stabilisation Method	Timeframe
Final earthwork levels achieved	Topsoil and grass seeding	Within 5 working days
Temporary pause in work >14 days	Hydroseeding or straw mulching	Within 7 calendar days
Final surface not expected within 60 days	Polymer stabilisation or erosion control matting	Within 10 working days
Post-winter shutdown	Stabilisation of all exposed area	Before 30 April annually

Table 11: Stabilisation Measures and Timing in WRC Guidelines

Maintenance: All stabilised areas will be monitored weekly and after heavy rainfall (>20mm/hr) to ensure full vegetation cover (minimum 80%) is achieved. Any bare patches or erosion will be repaired promptly with mulching or swift remedial action.

Appendix A – Earthworks Drawings