CIVIL INFRASTRUCTURE REPORT



Rangitoopuni Forest
Riverhead, Auckland

Fast Track Referral (Lots 2-8)

CIVIL ENGINEERING • SURVEYING • LAND DEVELOPMENT

PROJECT INFORMATION

CLIENT:	Rangitoopuni Land Holdings Limited Partnership
PROJECT:	147019

DOCUMENT CONTROL

DATE OF ISSUE:	20 May 2026
REVISION	A
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1. OVERVIEW

1.1 Project

The purpose of this report is to provide an assessment of the infrastructure associated with the proposed redevelopment of the Riverhead Forest (Lots 2-8). Te Kawerau ā Maki in partnership with Avant Property Development Limited under Rangitoopuni Development Limited Partnership (RDLP) proposes to develop the Rangitoopuni Forest project within Riverhead Forest, Auckland. The Project is of national significance and will deliver a substantial development comprising:

- Approximately 3,446 – 4,212 (+/- 10%) residential bush lots
- Four community hubs, including small scale commercial/retail
- A Rangitoopuni Forest Park / sanctuary / open space network, including regenerating native forest and providing amenity for public use comprising approximately 575 hectares
- Opportunities for marae and papakāinga housing
- Private infrastructure owned and operated by Te Kawerau ā Maki
- Protection and enhancement of riparian margins and wetland areas
- Extensive landscaping and native planting, including large-scale ngahere restoration over time
- All associated activities and infrastructure necessary to enable the development including earthworks, roading, creation of open space areas, stream works, and onsite stormwater, wastewater, and water supply facilities.

As shown in Figure 1 (below) the Rangitoopuni Forest Indicative Masterplan establishes a clear framework for the integrated development of the Project, guided by Te Kawerau ā Maki values, aspirations, and long-term intergenerational outcomes.

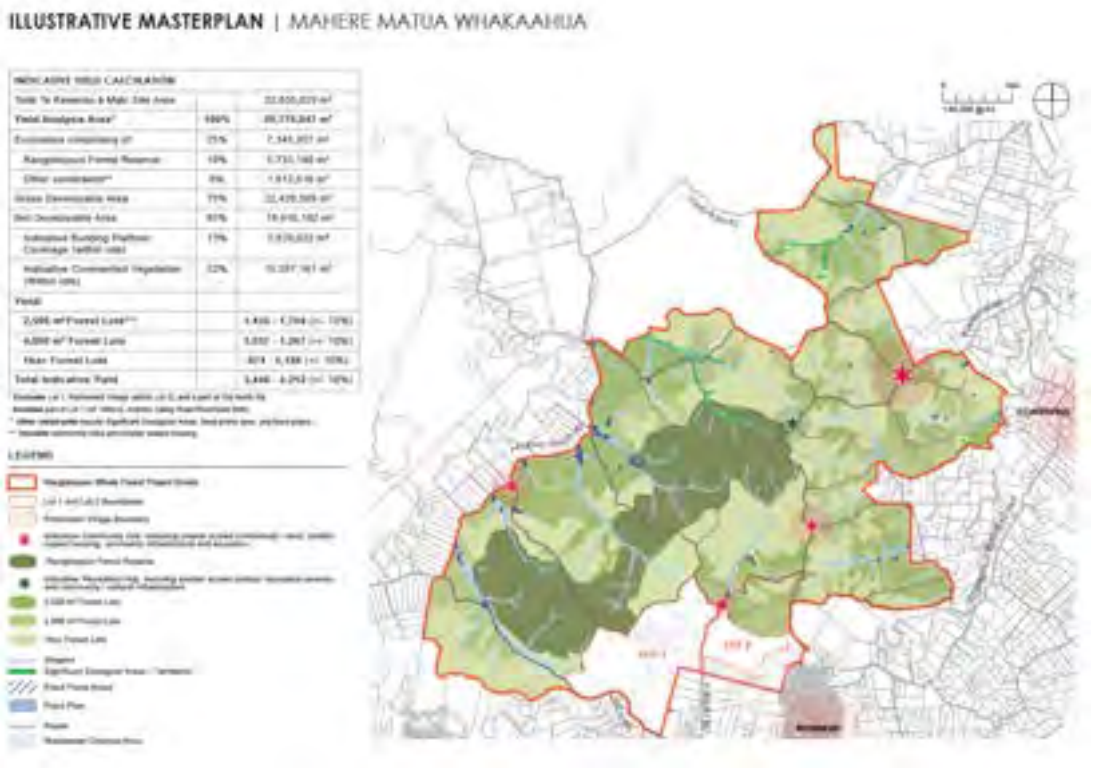


Figure 1: Boffa Miskell Masterplan

The information provided herein relates to stormwater, wastewater, water supply, and other service infrastructure and the potential capacity to service the proposed development.

Maven has undertaken flood modelling to confirm that there are no downstream effects from the development. This modelling is consistent with the approach taken with the approved Fast Track consent within Lots 1-2 (FTAA-2505-1055). The modelling has indicated the proposed location of catchment devices, and likely sizing.

This report provides information in support of the Fast Track application, and further reporting and engineering design will be required before lodgement of a substantive application(s). The calculations and assessments included in this report are 'desktop' analysis and are preliminary in nature based on information available at time of issue.

1.2 Legal Description

Applicant	Rangitoopuni Land Holdings Limited Partnership
Legal Description	Lots 2-8 DP 590677
Site Area	173.61 ha (Lot 2, only part), 338.19 ha (Lot 3), 155.57 ha (Lot 4), 305.07 ha (Lot 5), 428.01 ha (Lot 6), 1559.77 ha (Lot 7), 92.28 ha (Lot 8)

1.3 FTAA-2505-1055 – Rangitoopuni

Lots 1 and 2 DP 590677 formed the application site for the now approved Fast Track consent (FTAA-2505-1055 – Rangitoopuni). This consent approved the creation of 208, 1ha countryside living (CSL) lots, alongside a 300-unit Retirement Village. Stages 1-3 of the CSL is now under construction. The topography and general layout of Lots 1-2 are largely comparable to that of the wider forest holding. Maven's approach to civil design and flood mitigation closely follows that of the approved consent.

1.4 Site Description

The subject site forms part of the wider Riverhead (Rangitoopuni) Forest holdings. The site is located between Riverhead Township to the south-east, and Kumeu/Huapai to the south-west. The northern and north-eastern areas of the forest back onto Dairy Flat, with the eastern areas backing onto Coatesville. The western extent of the forest is defined by Ararimu Valley Road.

The site is well connected, having ease of connections to SH16 and the Northwestern motorway. Primary entrances to the wider Forest include Forestry Road (to be upgraded under FTAA-2505-1055), Old North Road, Ararimu Valley Road, Blackbridge Road, Escot Road, Robinson Road and Mill Flat Road.

The site features moderate to steep rolling topography, with prominent ridgelines, gullies and identified streams contained within. The site is contained within two stormwater catchments – the Kaipara Catchment (western catchment), with the eastern area in the Riverhead Catchment, which flows through Coatesville before eventual discharge via the Rangitoopuni River into the upper Waitemata Harbour.

There are no existing buildings within the site. The site is benefited from several lawful and existing vehicle crossings and forestry roads within, all of which are formed to a rural road standard (compacted gravel, table drains etc).

The location of the subject site is shown below in Figure 2.

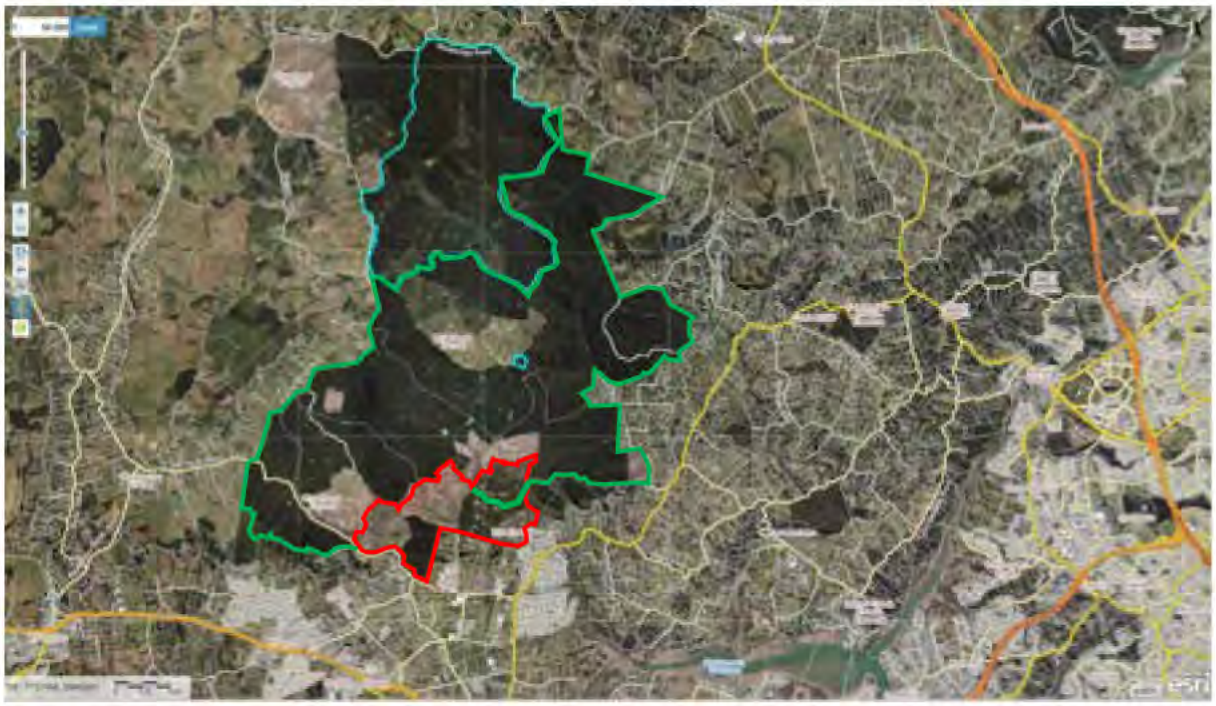


Figure 2: Site Locality Plan - Approximate Lot 1 and 2 boundaries from approved Fast Track in red, Watercare lots in blue, and site extent (Lots 2-8) for the Fast Track shown in green.

There are existing power and communications networks present within or nearby. The site is, however, not serviced by reticulated water, wastewater, or stormwater networks.

1.5 Proposed Development

The Project is of national significance and will deliver a substantial development comprising:

- Approximately 3,446 – 4,212 (+/- 10%) residential bush lots
- Four community hubs, including small scale commercial/retail
- A Te Kawerau ā Maki park / sanctuary / open space network, including regenerating native forest and providing amenity for public use comprising approximately 575 hectares
- All associated activities and infrastructure necessary to enable the development including earthworks, roading, creation of open space areas, stream works, and onsite stormwater, wastewater, and water supply facilities.

The countryside living areas will feature onsite effluent disposal, whilst rain caught water will be the primary means of potable and non-potable water supply. Stormwater will be attenuated as required, before discharge into the various streams and overland flowpaths within the site.

The town centres / community centres will be supported by communal wastewater treatment plant(s), with disposal to ground. Water would be roof caught and could be supplemented if needed by bore and or stream water sources.

The roading network within the site would be for the most part privately owned and formed around the existing forestry roads where possible. Three public road connections will provide key connections across the site and ensure safe and resilient routes during larger rainfall events.

2. EARTHWORKS

Earthworks will be required to form the building platforms within the lots, and for the construction of roads/culverts and associated infrastructure. Widespread recontouring will not be required in support of the countryside living development, although bulk earthworks will be required in support of the Community hubs and other more intensive areas, given the need to adhere to flatter grades within. This approach mirrors that of the Retirement Village component within FTAA-2505-1055.

All future building platforms will be elevated above and removed from the streams and/or identified overland flowpaths and flood hazards. This minimises sediment risk to the receiving catchments. Future substantive application(s) will need to be supported by sediment and erosion control drawings, which will demonstrate how the earthworks will be managed as to comply with GD05.

Resource consent will require that erosion and sediment control measures are implemented and maintained in accordance with the Engineering Drawings.

Silt control measures will need to be installed onsite prior to or during (as specified) earthworks commencement. All silt control measures will be checked and confirmed acceptable by the Engineer before relevant earthworks commence.

2.1 Geotech and Reporting and Design

ENGEO have been engaged and have provided high-level Geotech commentary in support of the referral application, refer ENGEO report for further detail. ENGEO have provided Geotech support and supervision for the approved and now under construction CSL aspect of FTAA-2505-1055. The same approach has been taken to earthwork designs, and ground improvements will be detailed up as required as part of any substantive application(s).

Further Geotech reporting will be provided in support of future resource consent application(s). A review and assessment of the earthwork drawings and design will be undertaken by ENGEO, and the final design will include any recommendations of the Geotech engineer.

Conditions of any consent granted will also require Geotech supervision and the provision of a Geotech Completion Report (GCR) at the completion of any stage of the development.

3. FLOODING AND OVERLAND FLOW

3.1 Overland Flowpaths ('OLFPs')

The overland flowpaths within the site are largely contained to the streams, gullies and associated margins. For the most part these are removed from the development areas and will be maintained as required by the future development. All building platforms and future buildings will be provided with

minimum floor levels that comply with the Stormwater Code of Practice and the New Zealand building code as required.

There are multiple existing culverts that cross the streams and/or overland flowpaths. These will be upgraded in support of the new private and public JOALs, and for attenuation structures. The culverts will be sized and constructed in accordance with best engineering practice, and the NES, unless where these culverts will serve an attenuation function to ensure there is no downstream effects.

3.2 Flooding

There is known flooding both within the site, and in both downstream catchments. As such, flood mitigation and attenuation to ensure there is no downstream effects is one of the key civil engineering matters of the referral; and within any future substantive application(s).

3.2.1 Stormwater Catchments and Receiving Environment

Given the scale of the forest, the development site falls within four catchments. The western half of the forest forms part of the Central Kaipara Catchment, the central southern catchment forms the Riverhead Catchment, the northernmost portion of the forest is contained in the Diary Flat catchment, with the eastern area part of the Rangitoopuni Catchment. The catchment extents and boundaries are shown below within Figure 3, below:

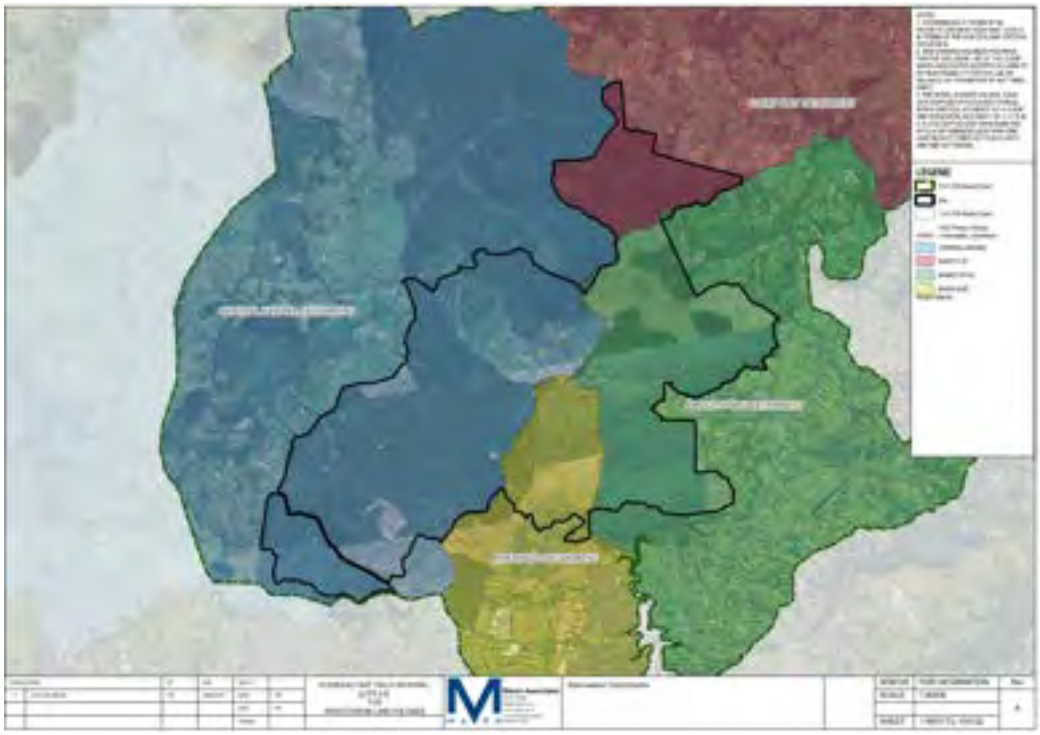


Figure 3: Stormwater Catchment Extents

3.2.2 Overview of Flood Modelling Approach and Assumptions

As per the approved Fast Track consent, the modelling and stormwater mitigation approach will closely mirror that of FTAA-2505-1055. The assumed weight CN value for the pre and post development modelling was an area that was scrutinised heavily as part of the RFI process within FTAA-2505-1055.

Ultimately, Maven's position and assumptions were upheld by the Expert Panel (refer paragraphs 231-239 of decision).

The assumptions within Maven's modelling are still considered to be conservative, of which are clearly illustrated in the below figures:

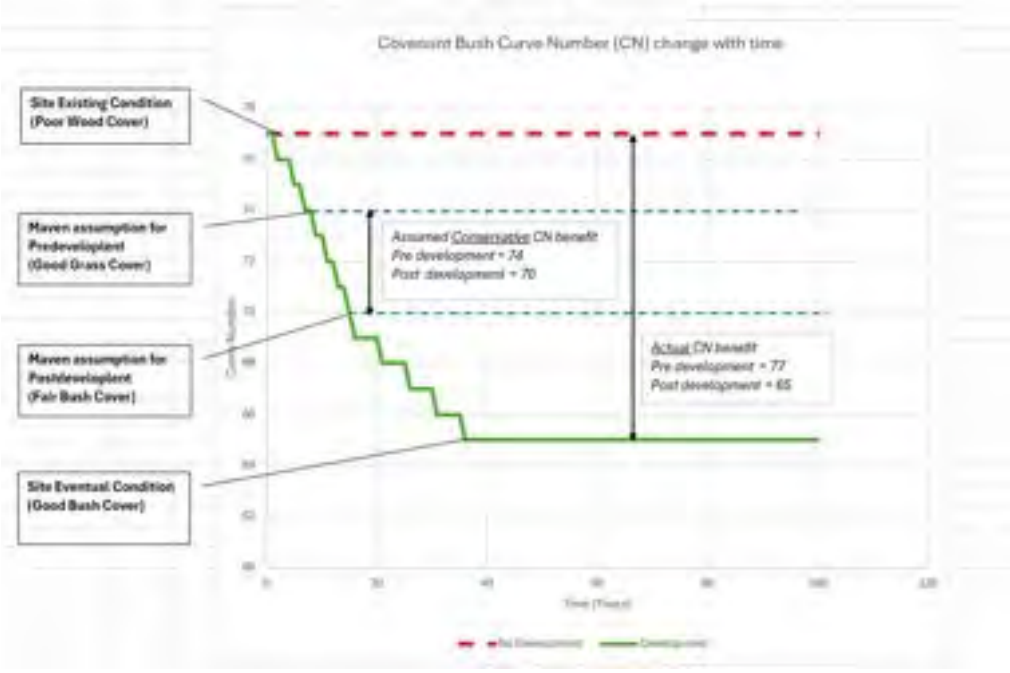


Figure 4: CN Value Change overtime of proposed development vs no development.



Figure 5: CN Value change overtime between proposed development and plantation forestry.

Planting and protecting the balance of private lots, stream margins, and the proposed Rangitoopuni Forest Reserve remains part of the primary flood mitigation strategy. This seeks to introduce native planting and place protection over these areas to ensure their ongoing protection. In doing so, the CN value is reduced from the pre-development (logged forest) state. This provides benefit for the downstream catchments by reducing run-off and increasing abstraction.

3.2.3 Pre-Development Flood Modelling

A pre-development model has been built by Maven using TUFLOW software. This modelling is based on the following assumptions and parameters:

1. Forest cover is CN 74
2. Development in Lot 1 and 2 is existing, including impervious extents and mitigation devices.
3. No culverts and/or pipe networks are modelled at this stage.

The results have provided the base line for our assessment and high-level mitigation proposed in support of the referral application.

3.2.4 Post-Development Flood Modelling

The following sets out the core assumptions for the post-development modelling undertaken to support the referral and will be undertaken to support any future substantive application(s):

- Assessment to pre-development not MPD (like Council modelling and PPC100)
- 100yr for all catchments (for referral only)
- 2, 10 and 100yr for less-sensitive catchments (substantive stage)
- 2, 5, 10, 20, 50 and 100yr for sensitive catchments (substantive stage)
- Reliance on catchment wide solutions, where possible.
- CN Value of 74 for existing plantation forestry.
- CN 70 for planted and protected bush in perpetuity.

3.2.5 Post-Development Land Cover and Impervious Assumptions

The post development flood model has been built from the various land uses shown on the Boffa Miskell Masterplan. The key aspects are outlined below:

Land Use Type	Impervious Allowance	Landscape Allowance (CN 74)	Planted Bush (CN 70)
1ha CSL Lots	1,000m²	1800m²	7,200m²
4500m2 CSL Lots	700m²	660m²	2,640m²
2500m2 CSL Lots	700m²	360m²	1,440m²
Roads	90% Impervious		
Community and Recreation Hubs	100% Impervious		
Rangitoopuni Forest Reserve			100%

Notes:

- Assessment to pre-development not MPD (like Council modelling and PPC100)
- 100yr for all catchments.

Please refer to Appendix B for the preliminary flood modelling outputs, mapping and results.

3.2.6 Preliminary Catchment Mitigation Overview and Discussion

Native Planting and Protection

- Protection via covenant within private lots. Aside from the platform areas, the balance of the lots will be planted in native bush and protected by covenants as per the approved outcome in Lots 1 and 2.

- The creation of Rangitoopuni Forest Reserve (575ha), of which will be fully planted in natives and feature (other than a couple of roads, and walking/biking trails) no impervious area. This provides significant benefits to the western (Kaipara) catchment.

Catchment Wide Attenuation

Flood modelling undertaken to support the referral application has identified and sized the likely mitigation devices that will be provided in support of the proposed development. These attenuation devices outline the required catchment solutions needed to mitigate runoff and ensure no downstream effects. The location of these preliminary devices is shown below within Figure 6:

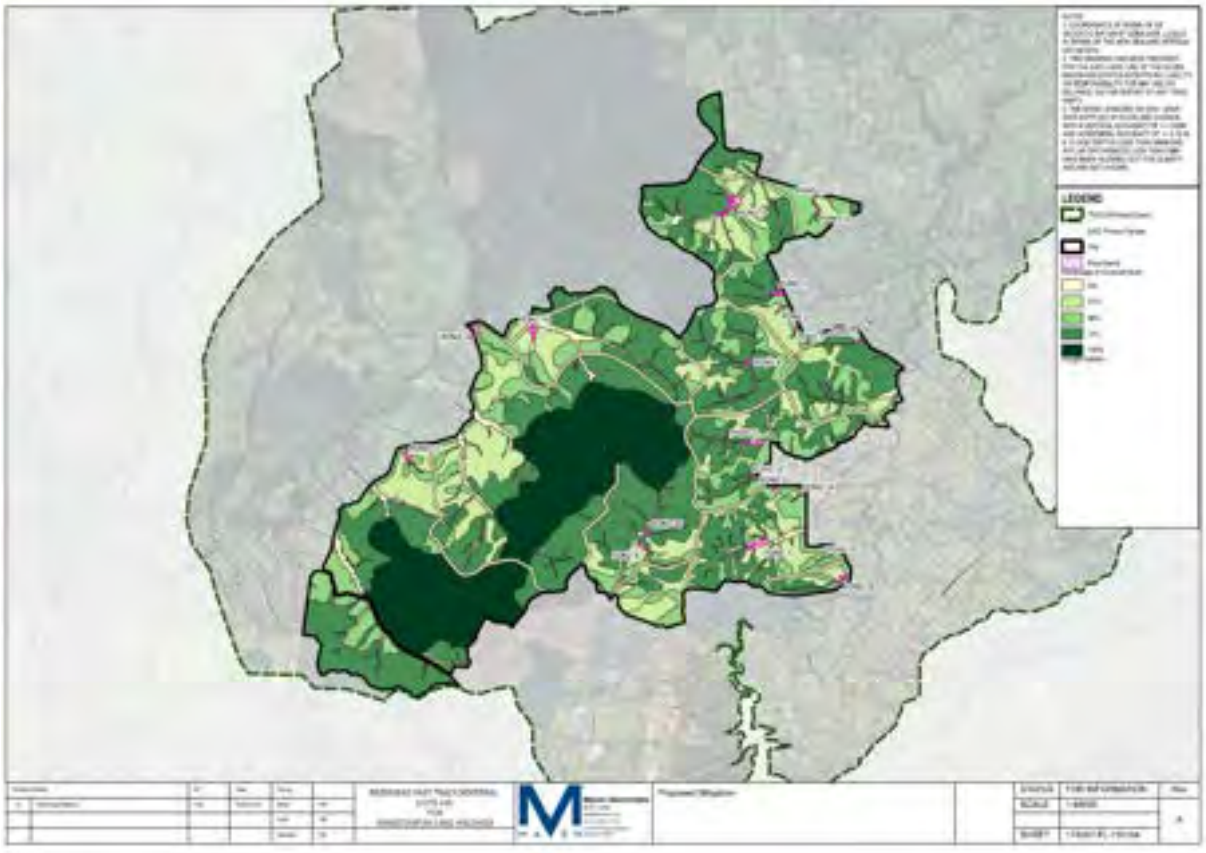


Figure 6: Map showing the Location of Preliminary Catchment Attenuation Devices

Based on the preliminary modelling undertaken, a total of approximately 20 attenuation structures are likely reuqired throughout the wider Forest. These structures are located in all catchments, but are

focused more intensively in the east and south, where increased impervious areas are proposed and the benefits of the Rangitoopuni Forest Reserve are not felt.

Given the size of the site and the catchments, attenuation in different areas has differing degrees of effects. Maven's solution has targeted upper catchments in both the Dairy Flat and Central Kaipara catchments; whereby larger devices provide the most benefit for the entire downstream catchment.

The device locations have been sited where possible over existing forestry tracks and culverts. Like the approved culverts in Lots 1 and 2, the devices will still allow fish passage via a low-flow culvert but will have a specifically designed detention embankments which will provide catchment attenuation during larger rainfall events.

Other than Culvert 9, it is anticipated that the devices will not meet the definition of a dam (I.e. will be less than 4m high and/or not contain 20,000m³ of volume to the crest. However, preliminary modelling has indicated that a larger device is needed in the Dairy Flat catchment, with preliminary sizing suggesting a contained volume of 51,000m³, and thus would be a classified dam. The location of the culvert is shown below within Figure 7:

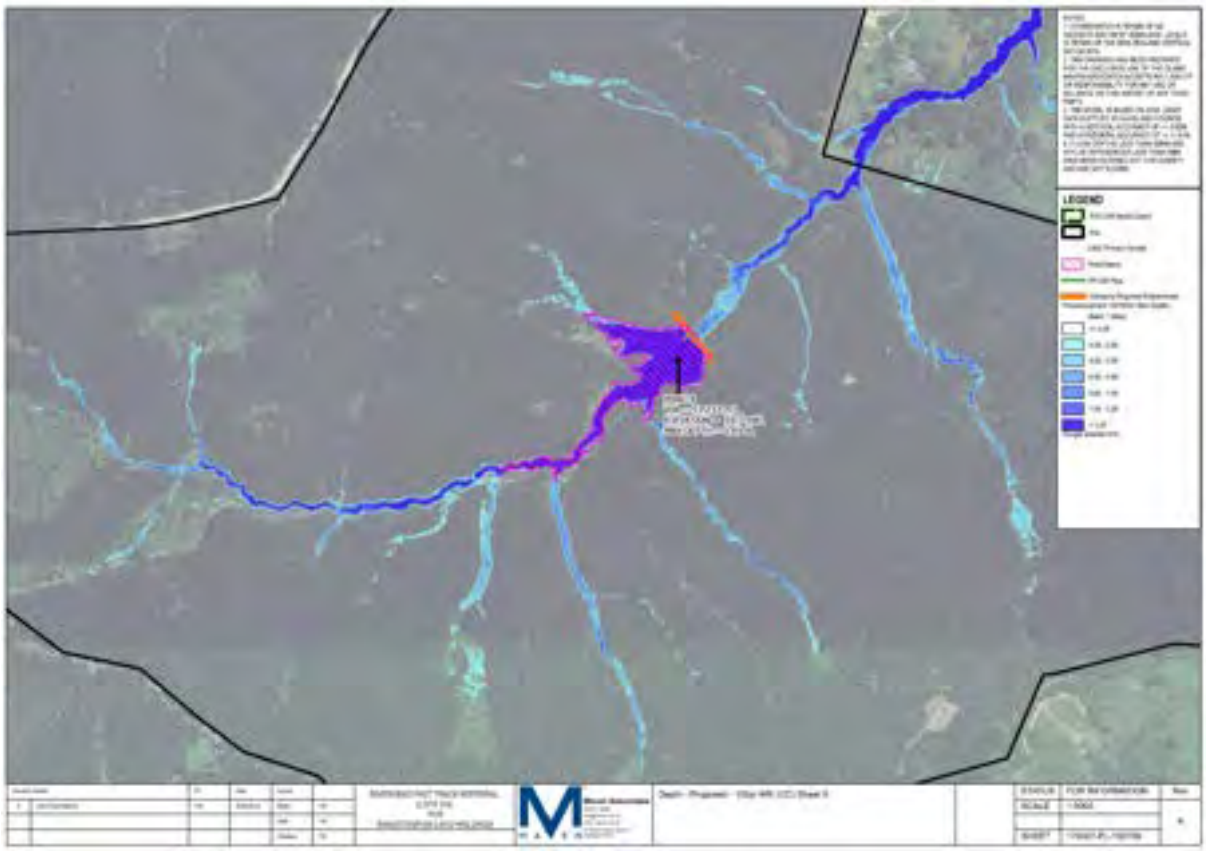


Figure 7: Map showing the Location of Preliminary Catchment Attenuation Devices

Preliminary design inputs have been provided from ENGEO's dam engineer, who has also provided specific dam engineering advice to the culverts in the approved Fast Track, inclusive of Culvert 1-1 which is currently under construction. A PIC assessment and further supporting information would be provided in support of the dam as part of any future substantive application.

3.2.7 Flooding Summary

At a high level, a TUFLOW flood model has been undertaken to assess downstream flooding effects associated with the proposed development. At this preliminary referral stage, modelling has been limited to the 100-year climate change event, consistent with the Auckland Council Stormwater Code of Practice approach referenced in Section 3.8 and Auckland Council's current 3.8°C climate change guidance. The design builds upon the accepted and consented approach taken within FTAA-2505-1055

The modelling is therefore intended to provide a high-level test of the proposed development scenario and the likely effectiveness of the preliminary mitigation measures, rather than a full detailed design assessment, which is considered fit for purpose for the referral stage.

Based on the modelling completed to date, and subject to the implementation of the mitigation measures outlined in Section 3.2.5, adverse downstream flooding effects can be mitigated. Further catchment-specific modelling, device sizing and refinement of the attenuation strategy will be undertaken as part of the future substantive application and detailed design phases.

4. STORMWATER

The Auckland Council Stormwater Code of Practice sets out design and construction standards for stormwater and requires all land development projects to be provided with a means of stormwater disposal and treatment.

The site is not located within the Rural Urban Boundary (RUB) and thus it has been confirmed by Healthy Waters, that the site is not bound by the Region Wide Network Discharge Consent (NDC).

4.1 Stormwater Reticulation

There is no existing stormwater network in the vicinity of the development area. The existing road networks are supported by table drains which discharge into streams / OLFPs.

A new stormwater network will be constructed in support of the development. This will provide a means of disposal for all impervious areas (carparks, common accessways, driveways and buildings).

Roof caught water will be piped into aboveground tanks, which will provide the primary means of potable and non-potable water supply.

The private accessways/ JOALs will feature (where the contour allows) swale drains, which will convey stormwater and provide some pre-treatment. In some steeper areas, or in denser areas, piped networks will need to be constructed to convey flows via catchpits.

Discharge will be via outfalls to existing streams and overland flowpaths. A suitable means of disposal will need to be provided for each lot, and accessway. This will require Geotech input and some specific design to mitigate erosion and stability risks as required. A standard on-lot detail has been appended to this memo.

4.2 Stormwater Capacity

The proposed stormwater connections and private stormwater network will be subject to future Engineering Approval / Building Consent and will be designed to have capacity for the 10-year rainfall event, as is required for Auckland Council. The sizing will be undertaken as part of the developed design process.

Any public network associated with the public roads, will also be sized to convey 10-yr rainfall and will be designed to comply with Auckland Transport's TDM.

It is envisaged that each lot would be provided with a minimum of 4 x 22,500L of tanks, although it is likely that up to 90,000L of capacity may be provided within each lot, depending on number of bedrooms and water demand.

Attenuation of peak flows will be assessed as part of any future resource consent application, and if need be, the tank design can accommodate some detention volume to limit post development flows if/as required.

4.3 Stormwater Quality

As the site is not bound by the NDC, treatment is instead required by the AUP. In this sense, treatment is not specifically required, as the private and public roads will be low volume (less than 5000 v/pd). If any of the community and/or town centre areas have more than 30 parking spaces, treatment will be provided.

Treatment is proposed via swales in the areas of the site which can accommodate this design. All flows will discharge via the stream/wetland networks, which will also provide treatment, with a large replanting / revegetation program included as part of the development.

5. WASTEWATER

5.1 Wastewater Reticulation

There is no existing reticulated wastewater network within the site. The site is not contained within the Urban extent of Auckland, and thus Watercare have no long-term plan to provide reticulated wastewater infrastructure to the area. Instead, the countryside living lots will discharge treated effluent to ground within the lots. The size of the lots (1ha, 4,500m² and 2,500m²) will ensure that there is sufficient space for this to occur, all meeting the minimum requirements of TP-58/GD-06. High-level guidance is provided from GWE, and more detailed reporting in support of the future substantive application(s) will confirm the location for the primary and secondary disposal areas, inclusive of required setbacks from streams, overland flowpaths and flooding.

The Community and Recreational Hubs will likely be supported by a communal wastewater treatment system, which will dispose of treated effluent to ground. The design will be completed by GWE consulting engineers. The underlying size and nature of the site is such that a suitable disposal area can be provided.

5.2 Wastewater Capacity

GWE reporting will outline suitable disposal areas for each house site / lot. This will be based off a 4-bedroom house and will require primary and secondary disposal areas as required.

The communal treatment and disposal area for any village/community areas will be subject to future design, inclusive of emergency storage, and disposal areas. This will be undertaken by GWE consulting engineers, and details will be provided in support of any future substantive application(s).

6. WATER SUPPLY

6.1 Potable Water Reticulation

Although there is a water supply network nearby (Watercare Reservoir and trunk mains in Old North Road), the site is not urban zoned and thus is outside of Watercare's intended service area. As such, the primary potable and non-potable supply of water for the site will be roof caught.

6.1.1 CSL Water Supply

The roof area within each of the lots will form the primary water supply for the future dwelling and ancillary buildings. The roof water will be conveyed to storage tanks. A private pump and treatment will be installed and will supply potable and non-potable use.

A minimum of 4 x 22,500L tanks is assumed, however, the total number of tanks required will be at the future purchaser's discretion (I.e. larger homes will be provided with higher storage volume). There is sufficient space within the lots/platforms to enable suitable supply. The ultimate design will be subject to building consent assessment and approval by Auckland Council.

Overflow from the tanks will be directed to overland flowpaths and/or streams for the level spreader and/or lot connections.

6.1.2 Community and Recreational Hubs

Roof caught water will continue to be the primary supply for potable and non-potable water for these more intensive hubs. It is also possible that additional supply can be provided by groundwater (bore takes) as was done for the Retirement Village in Lot 2. Modelling and reporting by ENGEO's hydrogeologist confirmed that there is capacity in the underlying aquifer. Treatment, storage and reticulation in these areas would be designed at substantive phase and would remain in private ownership.

6.2 Fire Fighting Supply

The minimum firefighting water supply classification for residential developments is FW2. Therefore, any future residential development must meet the following water supply requirements:

The New Zealand Fire Service Firefighting Water Supplies Code of Practice (SNZ PAS 4509:2008) states that 45m³ of water storage must be available within 90m from each dwelling for firefighting purposes within non-reticulated developments, with FW2 water supply classification. The 90m distance is measured from the point where the water supply is available rather than the water source itself (i.e. to the coupling or suction source).

We note that in terms of NZ PAS 4509:2008, a minimum of 45,000 litres is available for Firefighting requirements for a dwelling that is not sprinklered and only 7,000 litres for a sprinklered dwelling.

The required design for firefighting supply will be worked through with Fire and Emergency NZ (FENZ) and will likely result in communal supply point(s) via above ground tanks within the Community and Recreational Hubs. For all other CSL lots, firefighting supply will be provided within each respective lot; as per the agreed and accepted approach with FENZ from the approved development in Lots 1 and 2.

7. OTHER SERVICES

Telecommunications in the area are managed by Chorus. Power supply in the area is managed by Vector. It is understood that services are available, however, upgrades will be required to service the development.

Underground services will be supplied to each lot/unit. A private power and telco network will be constructed within the private accessways, and a point of supply will be provided for each lot/unit created within the development. Current contracts are in place for the first three stages that are under construction. We do not envisage any issues in providing service upgrades to the wider forest.

8. ROADING

8.1 Roading Overview

Although the forest is benefited by a network of existing forestry roads, to support the intended development, these existing roads will be upgraded to the required engineering standards. Three public road connections will provide key connections across the site and ensure safe and resilient routes during larger rainfall events. These roads are summarised below:

1. Forestry Road extended to form the primary north-south connection to Blackbridge Road.
2. An east-west connection from Forestry Road extension to Robinsons Road.
3. An east-west connection from Forestry Road extension to Mill Flat Road.

A network of private JOALs will provide access to all lots and will provide linkages back to Ararimu Valley Road in the west. Public roads will feature a 16m legal width, with the JOALs consisting of 7 or 10m legal widths as per the approved cross-sections of FTAA-2505-1055. The roads would feature a combination of chipseal and or concrete finishes, with swale drains and or piped networks where contour requires.

8.2 Cross-sections

Please refer to the appended roading plans which outlines the key private JOALs, and the proposed public road alignments. Extracts from the appended cross-sections (Appendix A) are below:

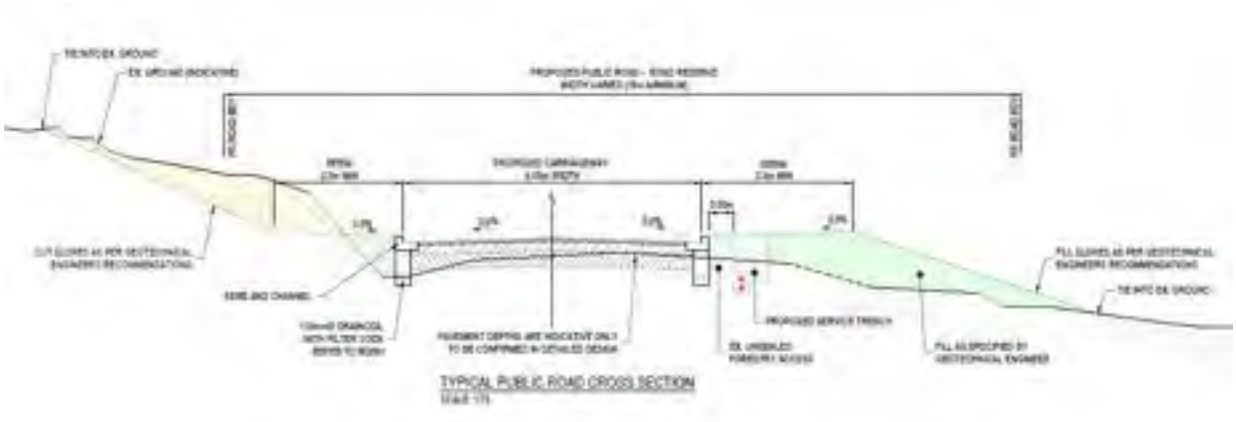


Figure 8: Public Road Cross-section

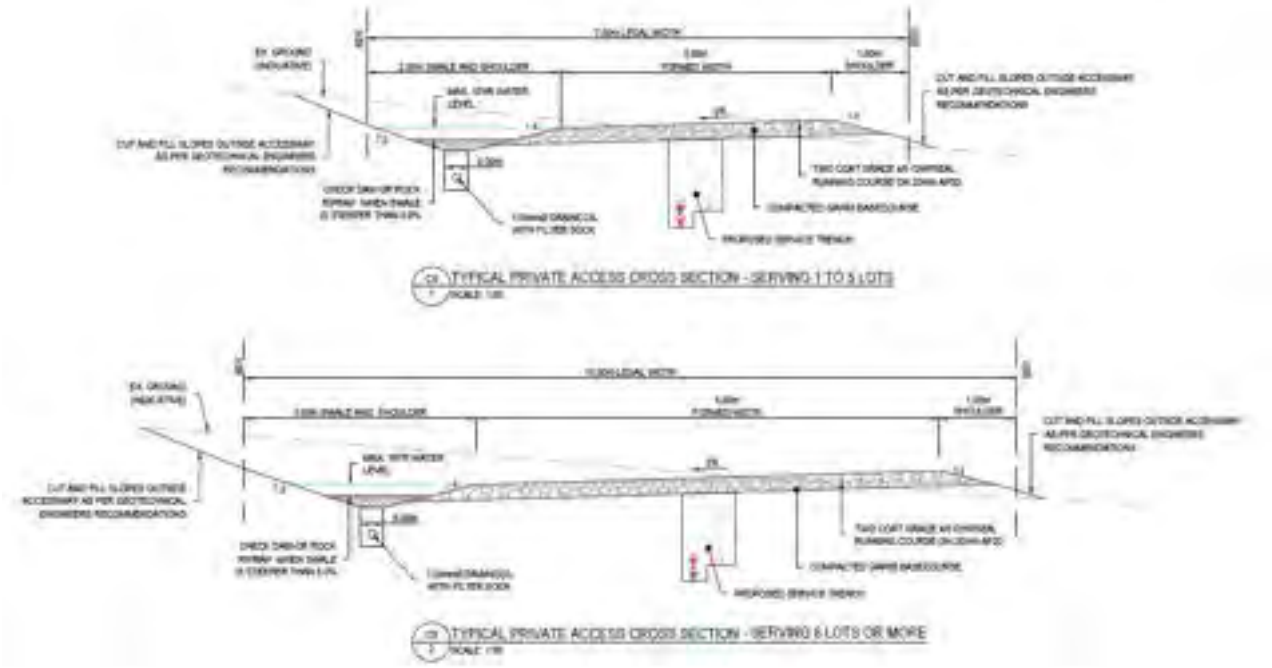


Figure 9: JOAL Cross-sections for Private Accessways

8.3 Roading – Resilience and Flood Access

Flooding in the wider road network during extreme rainfall events is a common issue in all areas of Auckland. There is known flooding of various roads within and around the development site. All new roads within the site will be designed to ensure compliance with AT TDM and the AUP, limiting flooding depths to a maximum of 200mm.

For existing roads, assessment will be made at time of substantive application(s), relative the required upgrades. Upgrades have been identified along Ararimu Valley Road. Culvert and/or road upgrades will need to be assessed against possible downstream impacts, of which will require detailed modelling and design. Other upgrades are likely in surrounding networks, as indicated in Commute's reporting.

Forestry Road will be upgraded as part of the approved Fast Track consent, and this provides a safe and resilient access point into the wider forest. Under this proposal, Forestry Road will be extended, providing a public link to Blackridge Road in the north with separate public roads providing connections to both Mill Flat and Robinsons Road to the east. The Mill Flat Road bridge is currently under construction, with Auckland Transport constructing a new bridge over the Rangitoopuni Stream. At a minimum, there are two resilient access points into the site, which will ensure safe vehicle access is possible to all lots within the development for and during a 100-yr event.

9. CONCLUSION

The report outlines the high-level civil servicing strategy for the intended Fast Track development of Lots 3-8.

The concept plans demonstrate that the development will deliver approximately 3,446 – 4,212 (+/- 10%) residential bush lots, four community hubs, including small scale commercial/retail and the Rangitoopuni Forest Reserve.

Earthworks will be required in support of any future proposal to allow for the construction of building platforms, accessways and services. The final design will be subject to Geotech input, and stability assessment. Specific details relative to sediment and erosion control will be provided in support of any future substantive Fast Track application(s).

A new stormwater network will need to be constructed, and this will provide a means of overflow from all impervious areas within the site. The site is not subject to the NDC, and the bulk of the stormwater networks will remain private, aside from the networks servicing the public roads. Each lot will be provided with a suitable outlet (level spreader) which will convey surface water associated with the accessway, building and parking areas. The final location and design of the outfalls is subject to ecology and Geotech input and will be confirmed as part of the developed design stage.

Potable and non-potable water supply for all lots within the development will be via above ground tanks, which will provide potable and non-potable supply. The Community and Recreational hubs may be supplemented by bore water if additional water demand is required, as per the approved outcome for the Retirement Village within Lot 2. ENGEO has confirmed that sufficient groundwater exists within the site.

Firefighting supply will likely be provided within each countryside living lot, and likely via a communal system/design for the Community and Recreational hubs. The final design will require consultation and approval from FENZ.

There is known flooding and overland flowpaths within the development area. All building platforms will be provided with freeboard in accordance with the NZBC and developable areas are removed from these hazards.

The development site is located within four stormwater catchments. There is known flooding in all catchments. In support of the referral application, flood modelling has been undertaken to assess downstream flooding effects associated with the proposed development. At this preliminary referral stage, modelling has been limited to the 100-year climate change event, consistent with the Auckland Council Stormwater Code of Practice approach referenced in Section 3.8 and Auckland Council's current 3.8°C climate change guidance. The design builds upon the accepted and consented approach taken within FTAA-2505-1055

Based on the modelling completed to date, and subject to the implementation of the mitigation measures outlined in Section 3.2.5, adverse downstream flooding effects can be mitigated. Further catchment-specific modelling, device sizing and refinement of the attenuation strategy will be undertaken as part of the future substantive application and detailed design phases.

Suitable wastewater disposal can be provided for the development. The wastewater will be treated and disposed to land, either within each countryside living lot, or via a communal system in support of the Community and Recreation hubs. The sizing and location of the disposal fields are subject to Geotech assessment, and this will be worked through the developed design stage by GWE as the development progresses.

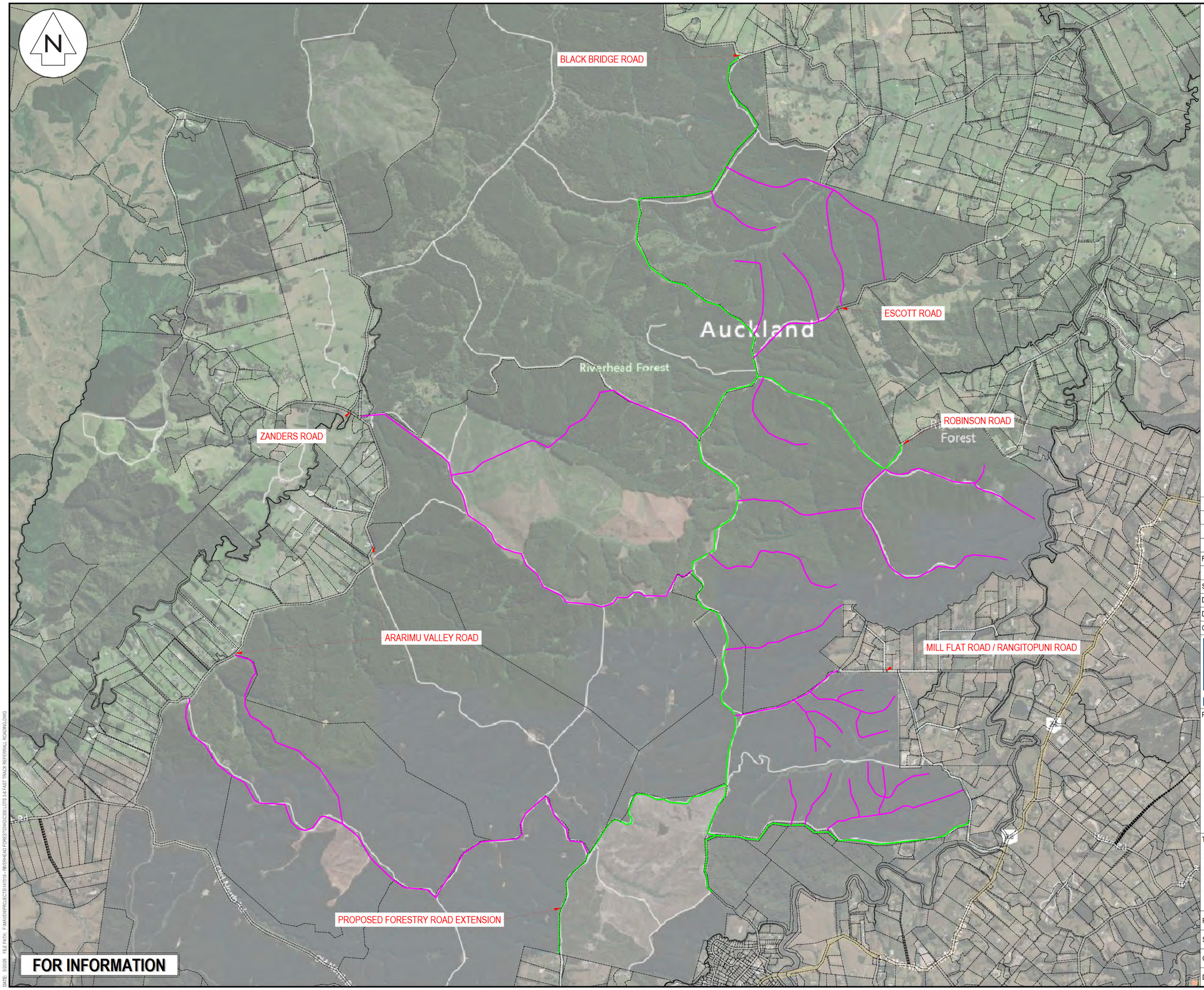
A telecommunications, power and gas network are present in the surrounding area, and it is anticipated that service can be made available to the proposed development, subject to upgrades.

Roading upgrades will be provided in support of the development. Three public roads will provide public connections through the forest, providing improved connectivity and resilience during extreme rainfall events. The balance of the development will be provided with legal and physical access via private JOALs / accessways. These will feature a combination of chipseal and/or concrete finishes.

Information gathered to-date confirms the site is suitable for the proposed development from a civil engineering and infrastructure perspective.

10. APPENDICES

10.i APPENDIX A – CONCEPT ENGINEERING PLANS



LEGEND

- EX BDY
- PROP BDY
- PROP PUBLIC ROAD
- PROP PRIVATE ROAD

Rev	Description	By	Date
A	FOR INFORMATION	AYC	05/2026

	By	Date
Survey	-	-
Design	AYC	05/2026
Drawn	AYC	05/2026
Checked	TM	05/2026

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
5 Owens Road, Epsom
Auckland 1023

Project

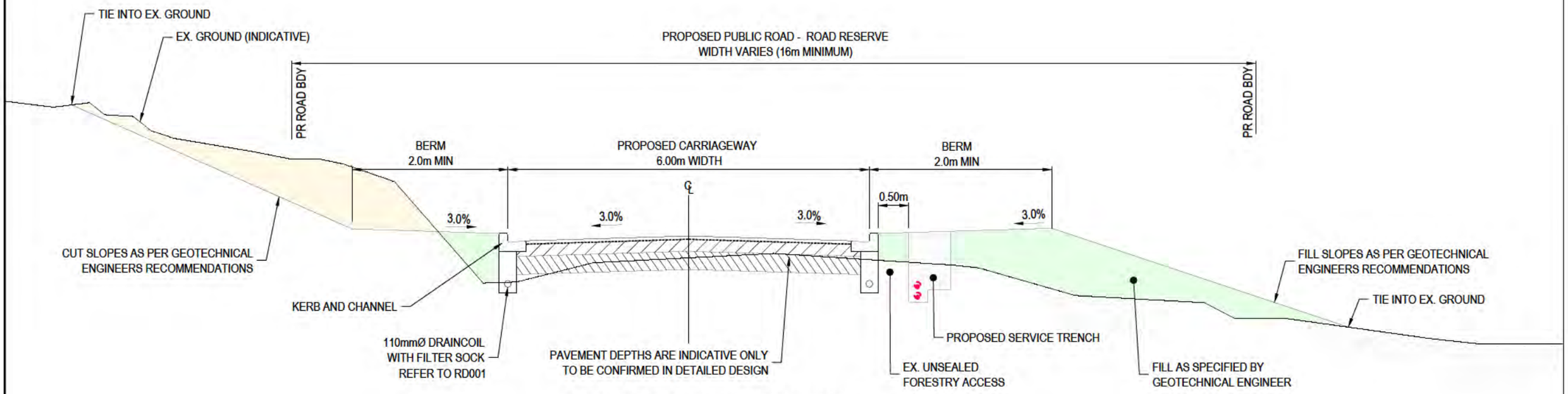
DEVELOPMENT OF RIVERHEAD FOREST FOR RANGITOOPUNI DEVELOPMENTS LIMITED PARTNERSHIP

Title

PROPOSED LOTS 3-8 FAST TRACK REFERRAL RAODING

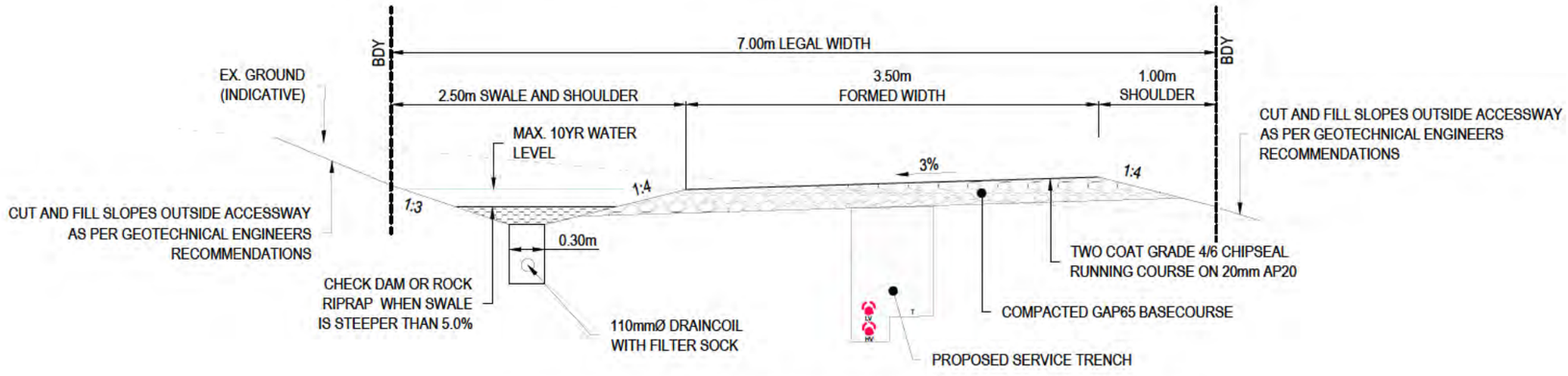
Project no.	147019		
Scale	1:15000 @ A1		
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Drawing no.	C300	Rev	A

DATE: 5/2026 FILE PATH: F:\MAVEN\PROJECTS\147019 - RIVERHEAD FOREST\DWG\C300 LOTS 3-8 FAST TRACK REFERRALL ROADING.DWG



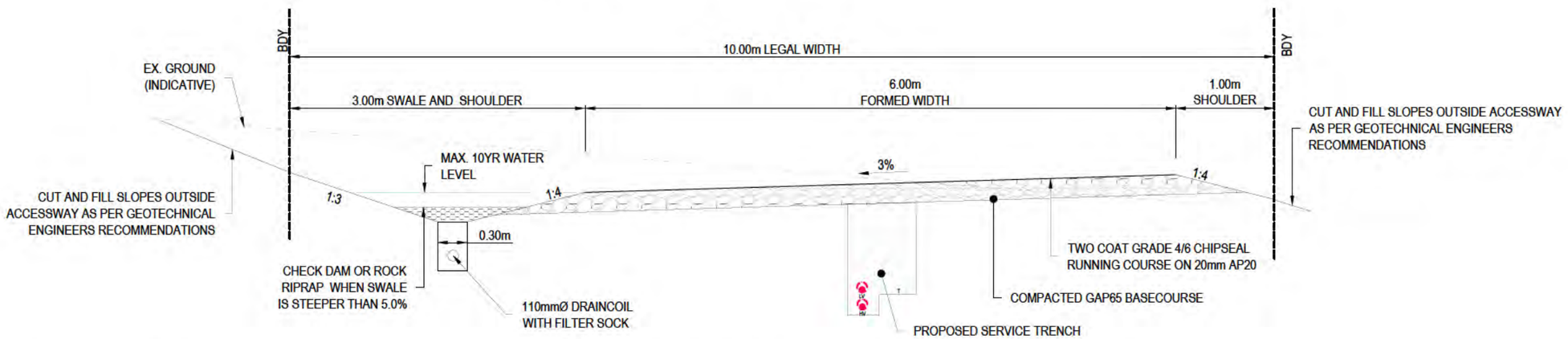
TYPICAL PUBLIC ROAD CROSS SECTION

SCALE: 1:75



TYPICAL PRIVATE ACCESS CROSS SECTION - SERVING 1 TO 5 LOTS

SCALE: 1:50



TYPICAL PRIVATE ACCESS CROSS SECTION - SERVING 6 LOTS OR MORE

SCALE: 1:50

FOR INFORMATION

Rev	Description	By	Date
A	FOR INFORMATION	AYC	05/2026

	By	Date
Survey	-	-
Design	AYC	05/2026
Drawn	AYC	05/2026
Checked	TM	05/2026

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Auckland 1023

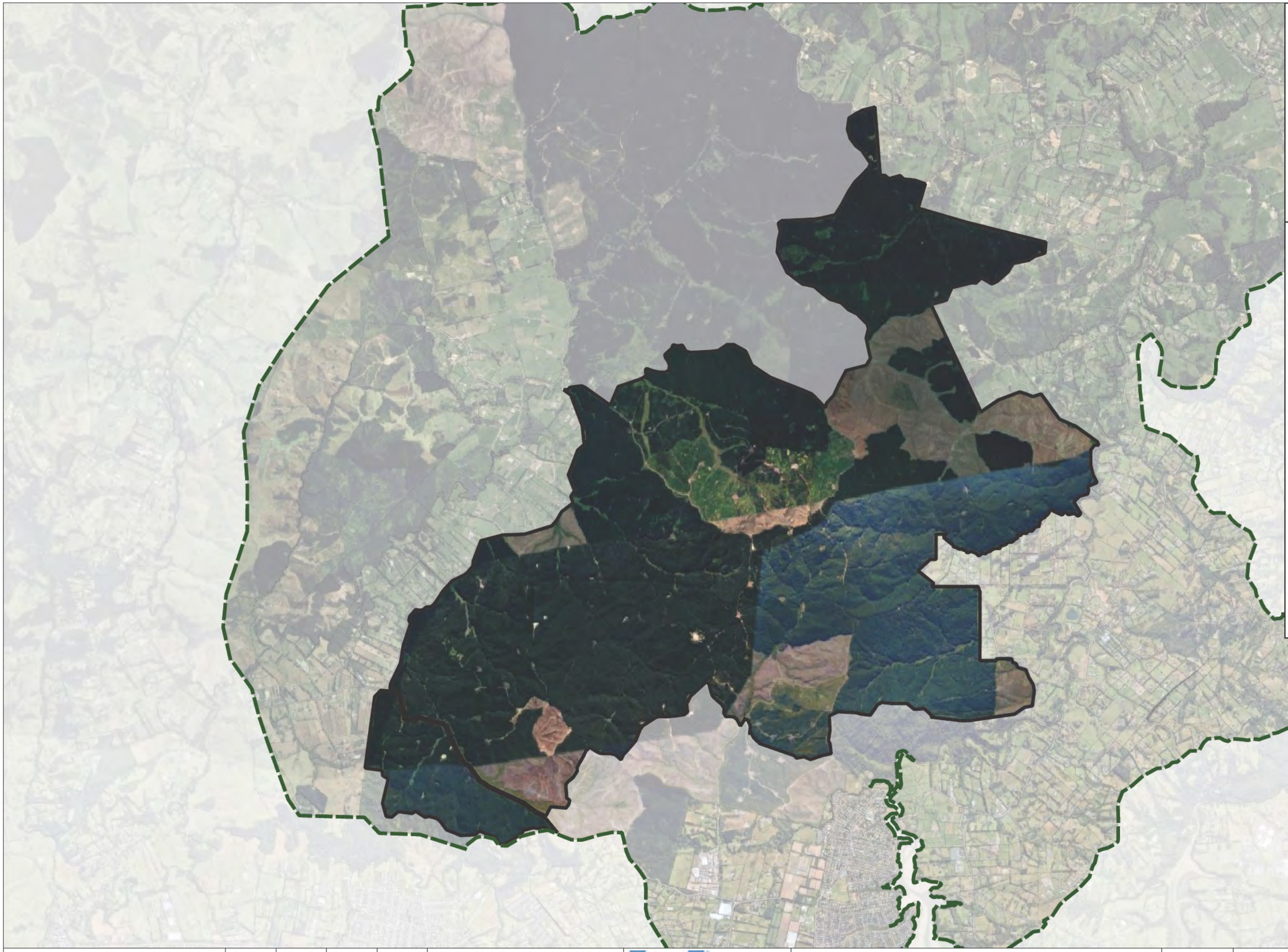
Project
DEVELOPMENT OF RIVERHEAD FOREST FOR RANGITOOPUNI DEVELOPMENTS LIMITED PARTNERSHIP

Title
PROPOSED TYPICAL ROADING CROSS SECTIONS

Project no.	147019		
Scale	AS SHOWN @ A3		
Cad file	C300 LOTS 3-8 FAST TRACK REFERRALL ROADING.DWG		
Drawing no.	C340	Rev	A

DATE: 2/2/26 FILEPATH: E:\MAVEN\PROJECTS\147019 - RIVERHEAD FOREST\PROPOSED LOTS 3-8 FAST TRACK REFERRALL ROADING.DWG

10.ii APPENDIX B – PRELIMINARY FLOOD MODELLING OUTPUTS



NOTES
1. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
2. THIS DRAWING HAS BEEN PREPARED FOR THE EXCLUSIVE USE OF THE CLIENT. MAVEN ASSOCIATES ACCEPTS NO LIABILITY OR RESPONSIBILITY FOR ANY USE OR RELIANCE ON THIS REPORT BY ANY THIRD PARTY.
3. THE MODEL IS BASED ON 2024 LIDAR DATA SUPPLIED BY AUCKLAND COUNCIL WITH A VERTICAL ACCURACY OF +/- 0.02M AND HORIZONTAL ACCURACY OF +/- 0.10 M.
4. FLOOD DEPTHS LESS THAN 50MM AND AFFLUX DIFFERENCES LESS THAN 5MM HAVE BEEN FILTERED OUT FOR CLARITY AND ARE NOT SHOWN.

LEGEND

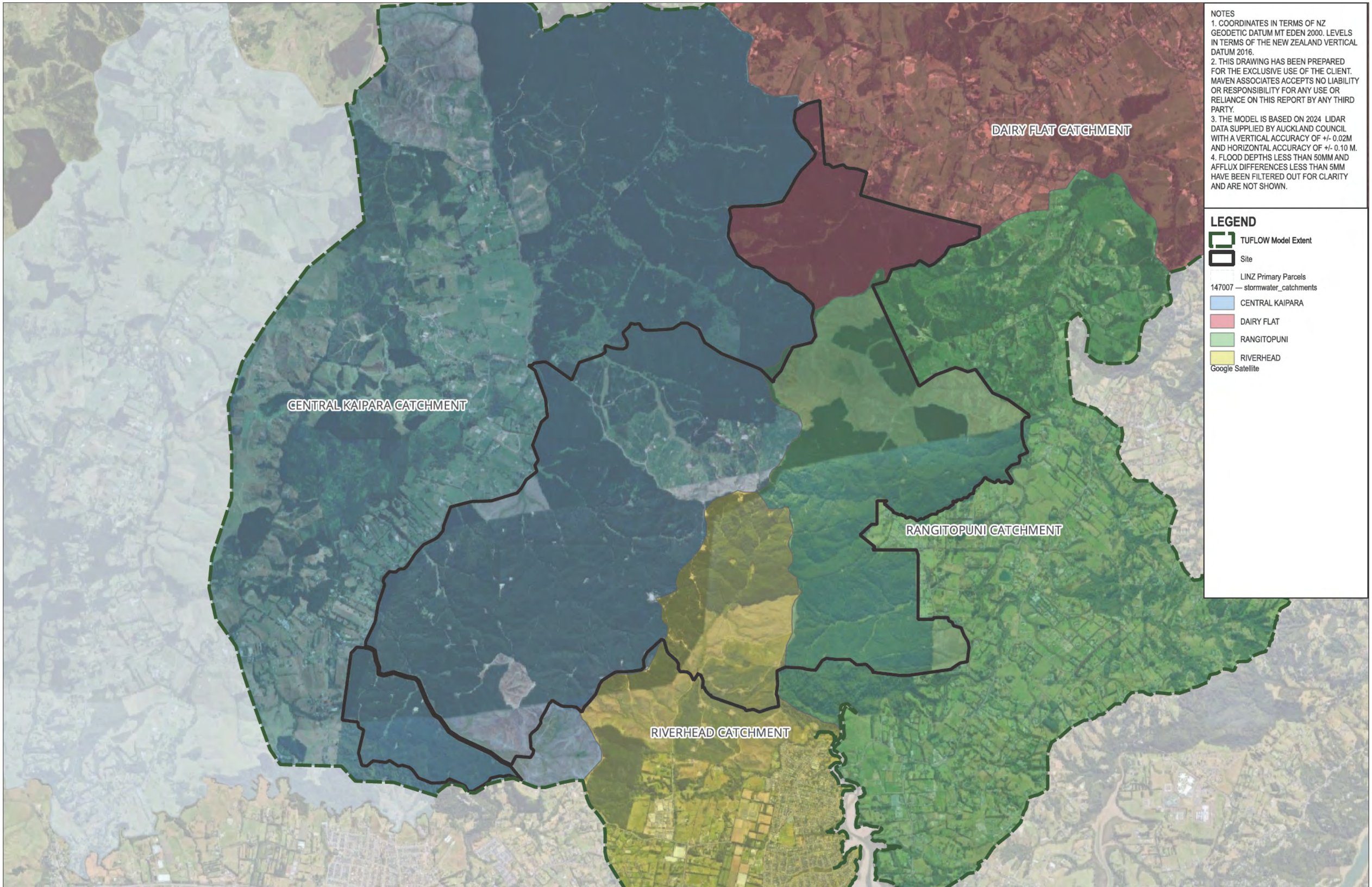
TUFLOW Model Extent

LINZ Primary Parcels

Site

Google Satellite

Revision Details		BY	Date	Survey		RIVERHEAD FAST TRACK REFERRAL (LOTS 3-8) FOR RANGITOOPUNI LAND HOLDINGS	Maven Associates 09 571 0050 info@maven.co.nz www.maven.co.nz 3 Downs Road, Epsom Auckland 1023	Site Extents		STATUS	FOR INFORMATION	Rev
A	Fast Track Referral	YW	2026-05-20	Model	YW					SCALE	1:40000	A
				Draft	YW							
				Checked	TM					SHEET	174007-FL-110101	



NOTES
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4. FLOOD DEPTHS LESS THAN 50MM AND AFFLUX DIFFERENCES LESS THAN 5MM HAVE BEEN FILTERED OUT FOR CLARITY AND ARE NOT SHOWN.

LEGEND

- TUFLOW Model Extent
- Site
- LINZ Primary Parcels

147007 — stormwater_catchments

- CENTRAL KAIPARA
- DAIRY FLAT
- RANGITOPUNI
- RIVERHEAD

Google Satellite

Revision Details		BY	Date	Survey		RIVERHEAD FAST TRACK REFERRAL (LOTS 3-8) FOR RANGITOOPUNI LAND HOLDINGS	Maven Associates 09 571 0050 info@maven.co.nz www.maven.co.nz 3 Owens Road, Epsom Auckland 1023	Stormwater Catchments		STATUS	FOR INFORMATION	Rev
A	Fast Track Referral	YW	2026-05-20	Model	YW					SCALE	1:40000	A
				Draft	YW							
				Checked	TM					SHEET	174007-FL-110102	

NOTES
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4. FLOOD DEPTHS LESS THAN 50MM AND AFFLUX DIFFERENCES LESS THAN 5MM HAVE BEEN FILTERED OUT FOR CLARITY AND ARE NOT SHOWN.

LEGEND

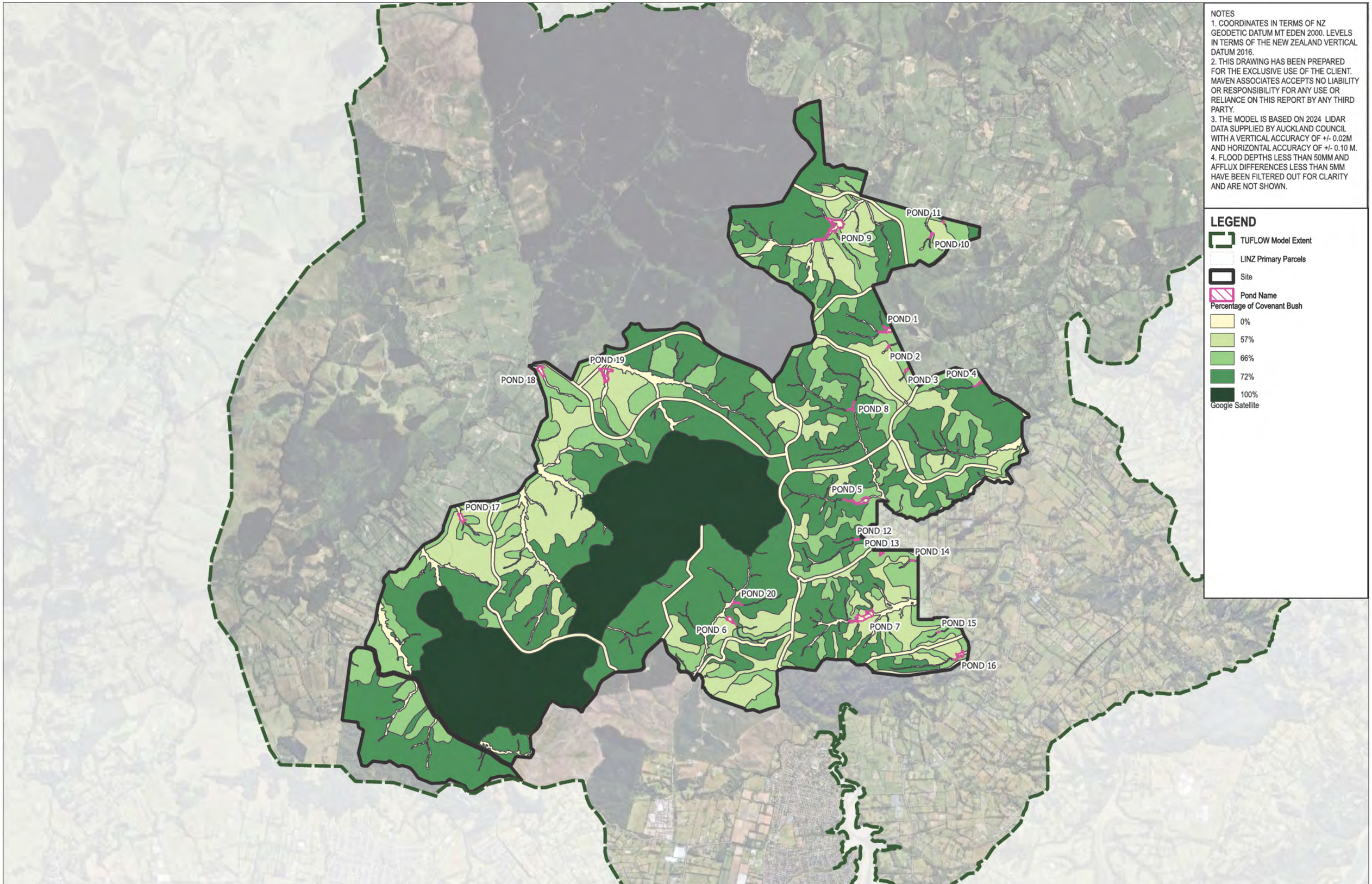
- TUFLOW Model Extent
- LINZ Primary Parcels
- Site
- Pond

Proposed Site Land Cover

- Channel
- Commercial
- 10,000m2 Lot
- 2,500m2 Lot
- 4,000m2 Lot
- Te Kawerau ā Maki Reserve
- Road

Google Satellite

Revision Details		BY	Date	Survey		RIVERHEAD FAST TRACK REFERRAL (LOTS 3-8) FOR RANGITOOPUNI LAND HOLDINGS	Maven Associates 09 571 0050 info@mavenassociates.co.nz www.mavenassociates.co.nz 3 Owens Road, Epsom Auckland 1023	Proposed Development		STATUS	FOR INFORMATION	Rev
A	Fast Track Referral	YW	2026-05-20	Model	YW					SCALE	1:40000	A
				Draft	YW							
				Checked	TM					SHEET	174007-FL-110103	



NOTES
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3. THE MODEL IS BASED ON 2024 LIDAR DATA SUPPLIED BY AUCKLAND COUNCIL WITH A VERTICAL ACCURACY OF +/- 0.02M AND HORIZONTAL ACCURACY OF +/- 0.10 M.
4. FLOOD DEPTHS LESS THAN 50MM AND AFFLUX DIFFERENCES LESS THAN 5MM HAVE BEEN FILTERED OUT FOR CLARITY AND ARE NOT SHOWN.

LEGEND

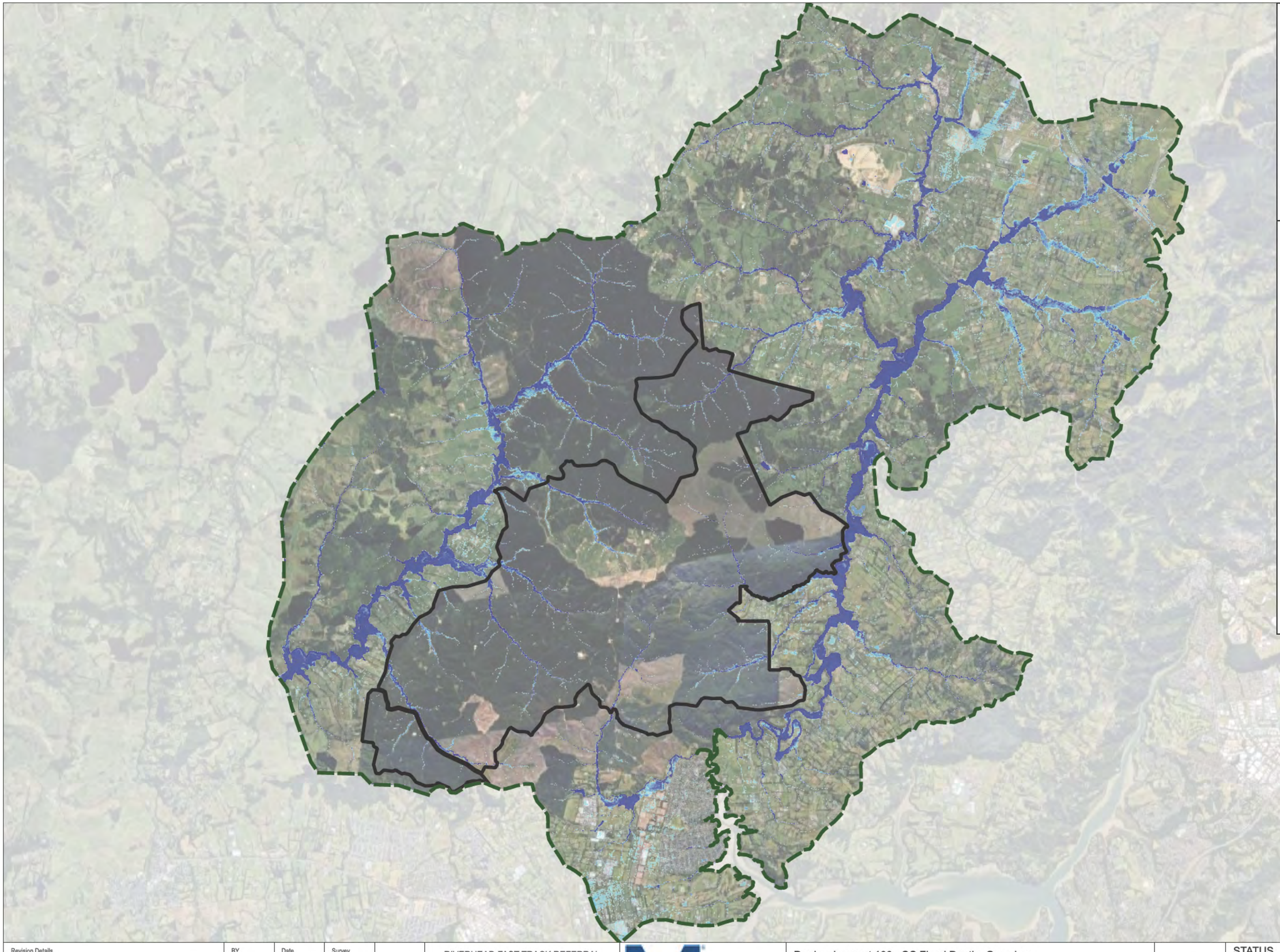
- TUFLOW Model Extent
- LINZ Primary Parcels
- Site
- Pond Name

Percentage of Covenant Bush

- 0%
- 57%
- 66%
- 72%
- 100%

Google Satellite

Revision Details		BY	Date	Survey		RIVERHEAD FAST TRACK REFERRAL (LOTS 3-8) FOR RANGITOOPUNI LAND HOLDINGS	Maven Associates 09 571 0050 info@maven.co.nz www.maven.co.nz 3 Queens Road, Epsom Auckland 1023	Proposed Mitigation		STATUS	FOR INFORMATION	Rev
A	Fast Track Referral	YW	2026-05-20	Model	YW					SCALE	1:40000	A
				Draft	YW							
				Checked	TM					SHEET	174007-FL-110104	



NOTES
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LEGEND

TUFLOW Model Extent
Site
LINZ Primary Parcels
Predevelopment 100YRCC Max Depths
Band 1 (Gray)
<= 0.05
0.05 - 0.30
0.30 - 0.50
0.50 - 0.80
0.80 - 1.00
1.00 - 1.20
> 1.20
Google Satellite 50%

Revision Details		BY	Date	Survey		RIVERHEAD FAST TRACK REFERRAL (LOTS 3-8) FOR RANGITOOPUNI LAND HOLDINGS	Maven Associates 09 571 0050 info@maven.co.nz www.maven.co.nz 3 Chivens Road, Epsom Auckland 1023	Predevelopment 100yrCC Flood Depths Overview		STATUS	FOR INFORMATION	Rev
A	Fast Track Referral	YW	2026-05-20	Model	YW					SCALE	1:60000	A
				Draft	YW							
				Checked	TM					SHEET	174007-FL-110600	