

STORMWATER MANAGEMENT PLAN



Rangitooopuni Development Riverhead, Auckland

PROJECT INFORMATION

CLIENT: Rangitootuni Developments Limited Partnership

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REVISION A

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1. OVERVIEW

1.1 PROJECT

The purpose of this Stormwater Management Plan ('SMP') is to outline the proposed management of stormwater for the Rangitootuni development, which is a proposed Countryside Living subdivision and Retirement Village in the southern portion of the Riverhead Forest. The Site is predominantly located within the Rural – Countryside Living and a small portion within the Rural Production Zones of the Auckland Unitary Plan – Operative in Part ('AUP – OP').

The proposal includes a stormwater discharge consent; and the SMP is being provided to ensure compliance with the various provisions of the AUP. The Site is not located within the Rural Urban Boundary ('RUB') and as such, the rural zoning ensures that the Site and proposed development is not bound by the requirements of the Region Wide Network Discharge Consent ('NDC'), of which covers all future and existing urban areas.

The purpose of this SMP is to ensure that the receiving environment is protected and enhanced as it undergoes change from the current commercial forestry use to the intended development. The outcomes of this SMP will also guide the Resource Consent ('RC') applications required to enable the proposed development.

The strategy for the stormwater management is outcome focused. The SMP provides a solution-based approach for the receiving environment. The plan sets up a clear process to mitigate the effects on the receiving environment, which consists of two stormwater catchments. Lot 1 straddles the Kaipara Catchment (western half), with the eastern area in the Riverhead Catchment. Lot 2 is wholly contained within the Riverhead Catchment. The streams in the Riverhead Catchment flow east, to the rear of the Township, which ultimately discharges into the Rangitootuni River and then into an inlet of the Waitematā Harbour.

Attenuation and control of the post-development runoff forms a key part of the mitigation proposed for the receiving environment. The management plan requires the use of retention and detention throughout the development, with roof caught water providing the primary source of potable and non-potable water supply in both the Retirement Village and the Countryside Living subdivision. Water sensitive design is a driving component of the management plan, with such elements guiding stormwater management within the countryside living lots, retirement village, public spaces and communal planted areas throughout.

The report provides a high-level summary of stormwater management associated with the Rangitootuni Fast Track application, which would see Lot 1 developed with 208, approximately 1 ha Countryside Living lots, and Lot 2 will be developed for a Retirement Village of circa 260 villas and 36 care units and associated amenities.

The overall scheme / staging plan for the site is identified in Figure 1 Overall Scheme Plan (below).

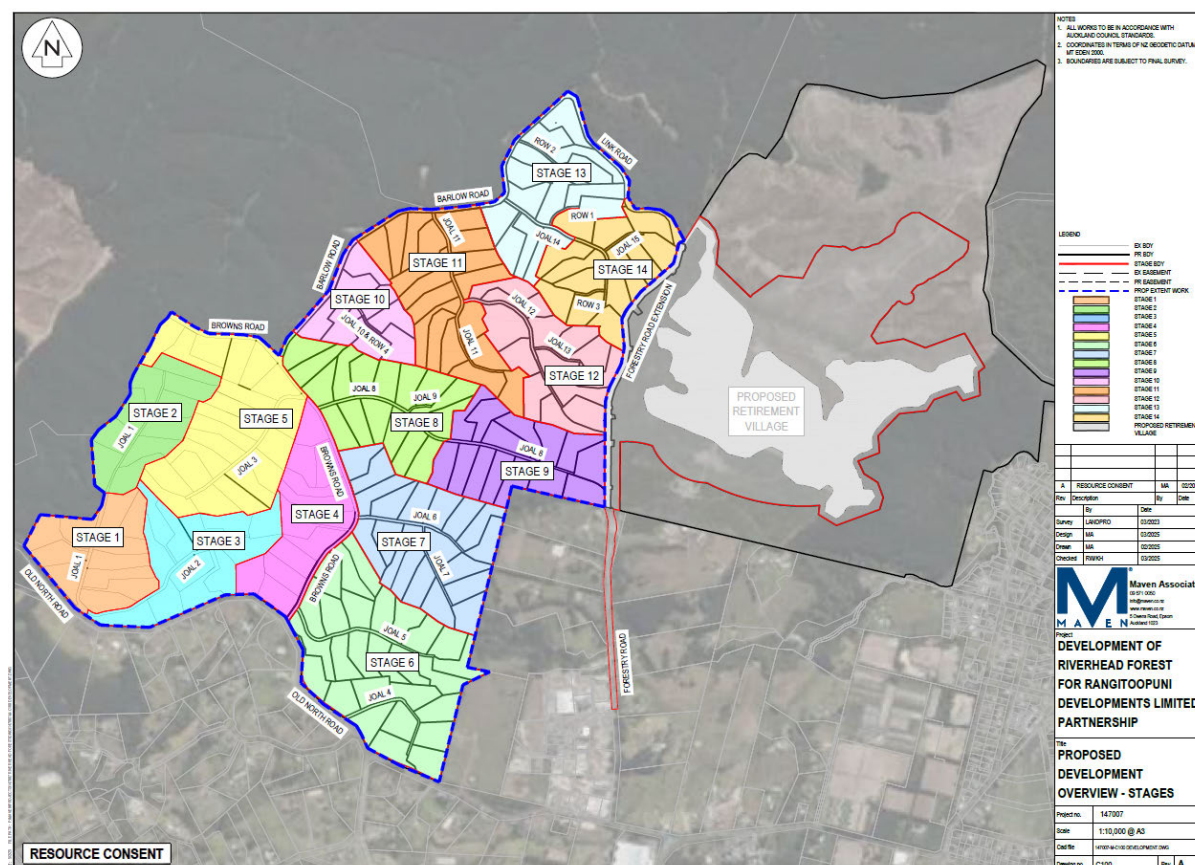


Figure 1: Overall scheme plan and staging plan showing the combined development

This report accompanies the Rangitootupuni Fast Track application, and the framework created within this SMP will guide the future development contained within the site. At detailed design / Engineering Plan Approval ('EPA') stage, compliance will need to be demonstrated, and in doing so will ensure any effects on the receiving environment are suitably mitigated.

1.2 CODE OF CONDUCT STATEMENT

Although this is not a hearing before the Environment Court, I record that I have read and agree to comply with the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2023. I confirm that this report is within my area of expertise, except where I state that I rely upon the evidence or reports of other expert witnesses lodged forming part of the project's application material. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

1.3 LEGAL DESCRIPTION

Applicant	Rangitootupuni Developments Limited Partnership
Record of Title	1129815 and 1129816
Legal Description	Lots 1 and 2 DP 590677
Site Area	222.75 ha (Lot 1), 173.6 ha (Lot 2)

1.4 SITE DESCRIPTION

The subject site forms part of the wider Riverhead (Rangitootuni) Forest holdings owned by Te Kawerau ā Maki. The site is located between Riverhead Township to the east, and Kumeu/Huapai to the south-west. The site is well connected, having ease of connections to SH16 and the Northwestern motorway.

The site features frontage and access from Old North Road (to the south), Deacon Road and Forestry Road. The site has been recently felled and is intended to be developed for residential purposes.

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 – Lot 1 straddles the Kaipara Catchment (western half), with the eastern area in the Riverhead Catchment. Lot 2 is wholly contained within the Riverhead Catchment. The streams in the Riverhead Catchment flow east, to the rear of the Township, before discharge into the Rangitootuni River upstream of the Riverhead-Coatesville Highway bridge.

There are no existing buildings within the site. The site is benefited from several lawful and existing vehicle crossings and forestry roads within, which are formed to a rural road standard.

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



Figure 2: Site Locality Plan (Approximate Lot 1 and 2 boundaries shown in red).

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

1.5 PROPOSED DEVELOPMENT

The intended development will see 210, 1 ha Countryside Living lots created in Lot 1, the balance areas outside of platforms and accessways will be planted in native revegetation. A Retirement Village (circa 260 villas and 36 care units) with associated amenities, such as a café, garden pavilion, amenity building and wellness centre with salon, gym and pool, will be developed in Lot 2. A Retirement Village (circa

260 villas and 36 care units) with associated amenities, such as a café, garden pavilion, amenity building and wellness centre with salon, gym and pool, will be developed in Lot 2.

The Countryside Living subdivision will feature onsite effluent disposal, whilst roof caught rainwater will be the primary means of potable and non-potable water supply. Stormwater disposal from the lots and Jointly Owned Access Lots (JOALs) will be via suitably located level spreaders and outfalls to existing overland flow paths ('OLFPs') and streams.

The Retirement Village will be supported by a communal wastewater treatment plant, with disposal to ground. Roof-caught water will provide the primary source of potable and non-potable water through the dedicated sealed (clean system) and will be supplemented as needed by bore. Stormwater discharge would be via the various tributaries of the Rangitōopuni River.

The roading network within the site would be privately owned, except for proposed Forestry Road extension which will be a public road to vest and formed around the existing forestry roads where possible. The roads would feature a combination of chipseal and/or concrete finishes, with swale drains and/or piped networks where contour requires.

Lot 1 will be accessed via four new vehicle crossings from Old Noth Road. This will provide access to all lots via a combination of JOALs and Right of Ways ('RoWs') and a single driveway for Lot 68. The Retirement Village within Lot 2 will be provided with access via an extension of Forestry Road, which will be a public road to vest. A private JOAL network will extend from Forestry Road and provide access within the Retirement Village itself.

1.6 STAGING, TIMING, RESPONSIBILITY AND FUNDING

1.6.1 Timing

The overall development of the Site will be undertaken in stages and the full development is expected to take approximately 10 years to complete.

The Countryside Living development will be prioritised with civil works expected to commence for Stages 1-3 in 2025/2026 subject to consents being granted. Further stages of the development will occur from then, and will be based on future market demand.

Works associated within the Retirement Village and Forestry Road (public road to vest) are anticipated to start in 2026/2027 earthworks season, although ultimate timing will be subject to obtaining the approvals and various market conditions.

1.6.2 Costs, Funding and Vesting of Assets

The development and construction of the stormwater management devices will be undertaken by the consent holder (Rangitōopuni Developments Limited Partnership), who is undertaking the development of the site.

The stormwater infrastructure will be developed as per the stormwater strategy, and for the most part will be privately owned infrastructure, aside from the public infrastructure associated with Forestry Road extension (public road to vest).

Discussions will be undertaken with Council as to the design of the infrastructure, location and purpose, with all public infrastructure subject to the Engineering Plan Approval ("EPA") process. Two pre-app

meetings have been held with Healthy Waters, and the ownership and general approach regarding the infrastructure was discussed.

The specific details of all private drainage will be detailed within the relevant building consent application(s) for the specific stage and nature of development proposed. This will also include detail and design of the private water and wastewater networks that the Retirement Village is reliant upon.

1.6.3 Delivery of the Stormwater Plan

As the site is rural zoned, there is no requirement to provide a SMP which complies with Schedule 4 of the Region Wide NDC. Instead, the development includes a stormwater discharge consent; of which this SMP sets out the stormwater management framework that will be adhered to by the development, whilst mitigating and/or avoiding effects on the receiving environment.

As the site is located in rural zones, statutory provisions are taken from the AUP; whilst an overall holistic approach has been taken to stormwater management, including run-off and treatment.

Compliance with this SMP will be achieved by the future detailed design phases, with compliance demonstrated via Engineering Plan Approval and/or building consent applications. Consent notices are expected on all Countryside Living lots which will detail specific stormwater management provisions that future lot owners will need to adhere with.

1.7 Consultation

Two pre-application meetings have been held with representatives of Auckland Council and Healthy Waters. These meetings were held on 07 March 2025, and a follow up meeting (specific to stormwater and flooding) was held on 12 March 2025. This was attended by various representatives from Healthy Waters (including the two catchment managers, stream/hydrology specialist and other supporting personal). The high-level approach to stormwater management was provided from Maven.

Specific details relative to the flood modelling and assumptions were also discussed and agreed on.

Some additional information pertaining to stream health and flood modelling assumptions was suggested, and these requests have been incorporated into the various Maven reporting which is supporting the FastTrack application

1.8 Departures

1.8.1 Code of Practice

At time of writing, there are no known departures from the Stormwater Code of Practice ("SWCoP"), or any departures from the relevant sections of the AUP.

1.8.2 Catchment Management Plans, NDCs and Current Relevant Work

There is no current NDC or Catchment Management Plan ("CMP") that Maven has been made aware of.

Maven is aware of the ongoing stormwater modelling and design work that is underway by CKL who is acting for the various parties subject to the ongoing Private Plan Change (PC100). Maven has had meetings within CKL and their client (Fletchers Residential Ltd). Maven is aware of the modelling done in support of the PPC, and have sought to ensure modelling assumptions and outputs are consistent between the two workstreams.

1.8.3 Auckland Unitary Plan (AUP)

There are no known departures from the AUP. Where required by the AUP; treatment has been provided and assessment and consideration of the SW discharge provisions of E8 have been undertaken and are considered to be achieved, refer Appendix C. Compliance with relevant standards of the AUP; ensures impacts are suitably mitigated.

1.9 Operation, Maintenance and Monitoring Plans

Operation and maintenance plans will be provided for all stormwater management devices that will be vested with Council. This will be required as a condition of any approved RC.

It is also anticipated that operational and maintenance plans will be prepared for key private infrastructure including JOAL swales, on-lot private stormwater tanks and outfalls, and culvert upgrades (especially where these form part of the flood mitigation strategies). Conditions of consent will require these plans to be provided at 224c stage of the Countryside Living subdivision.

2. CATCHMENT CONTEXT

The Site is located 27km (by road) from downtown Auckland City, and about 3km west of the Riverhead township. The location in relation to the greater Auckland Region is illustrated in Figure 3, below.

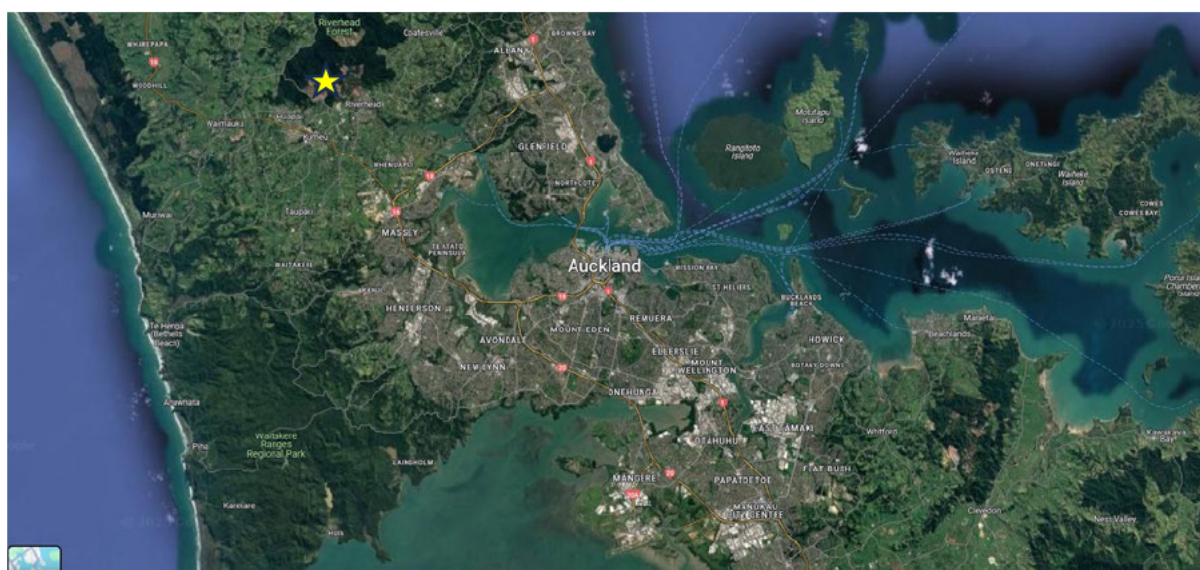


Figure 3: Rangitootuni (site) Location (yellow star). Source: Google Maps

The majority of the Rangitootuni site (396ha) is zoned Rural – Countryside Living under the AUP – OP. A small portion of the northern-most part of the land owned by the applicant is contained within the Rural Production zone.

2.1 Catchment Assessment

2.1.1 Location and Existing Conditions

The Site is contained within two distinct catchments. Figure 4 below shows the western portion of Lot 1, with an area of 72.1ha, straddles the south-eastern corner of the Central Kaipara Catchment, which eventually discharges to the Kaipara River.

The remainder of the eastern portion of Lot 1 and all of Lot 2, with a combined area of 324.3 ha, are located within the middle of the Riverhead Catchment. The receiving environment of the Riverhead Catchment is the Waitematā Harbour via the Rangitooopuni stream (see Figure 5).

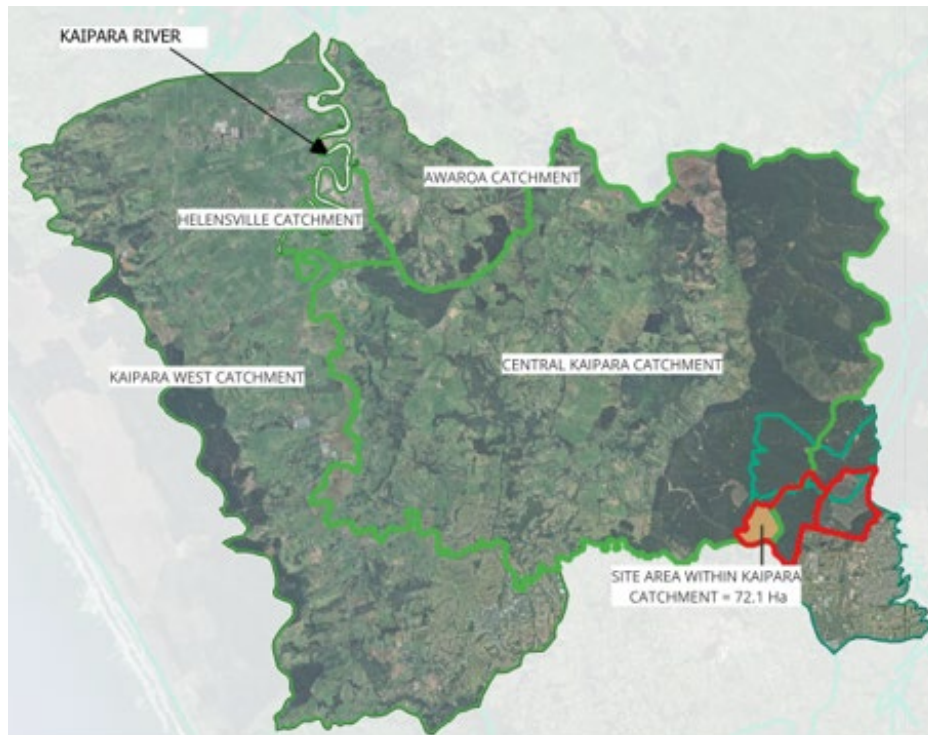


Figure 4: Extent of Site within the Central Kaipara Catchment

The site is bordered by Old North Road to the south-west and Rural - Mixed Rural zoned properties to the south that are currently developed with a mix of dwellings, industrial/commercial park and horticultural activities and are semi-rural in nature. Land zoned Future Urban is located to the south-east, land zoned Residential – Single House Zone is situated to the east (the Riverhead township), and the Rural – Production Zone encompasses all of the land to the north of the site, which is largely covered in pine forest. The properties are generally contiguous, aside from being separated by various forestry roads within.

The catchment contains moderate to steep rolling topography, with prominent ridgelines, gullies and identified streams contained within. The catchment is currently used for forestry purposes. The extent of the development area within the existing catchments is illustrated in Figures 4 (above) and Figure 5, below.

2.1.2 Soil Conditions

Please refer to the two Geotech Reports prepared by ENGEO, report references (20190.000.001). The report outlines that topsoil depths vary between 200-400mm. East Coast Bays Formation soils were encountered within all investigation's boreholes underlying existing fill, Alluvial soils and Albany Conglomerate. Underlying the residually weathered soils of the East Coast Bays Formation comprised extremely weak, to very weak interbedded sequences of siltstone and sandstone.

For the purpose of TP108 calculations, a Group C hydrological soil classification has been adopted, with a 74 CN value for existing landcover and 70 CN value for proposed covenanted planted bush.

2.1.3 Natural Features

The Site has been used predominantly for commercial pine forestry. The site coverage is currently a mix of deforested, clear-felled plantation, 6-year old rotation plantation and 26-year old rotation plantation, which is scheduled for harvest in October 2025. Following this felling, the site is proposed to be developed.

The receiving environment of the Riverhead Catchment is the Waitematā Harbour via the Rangitopuni stream (see Figure 5).

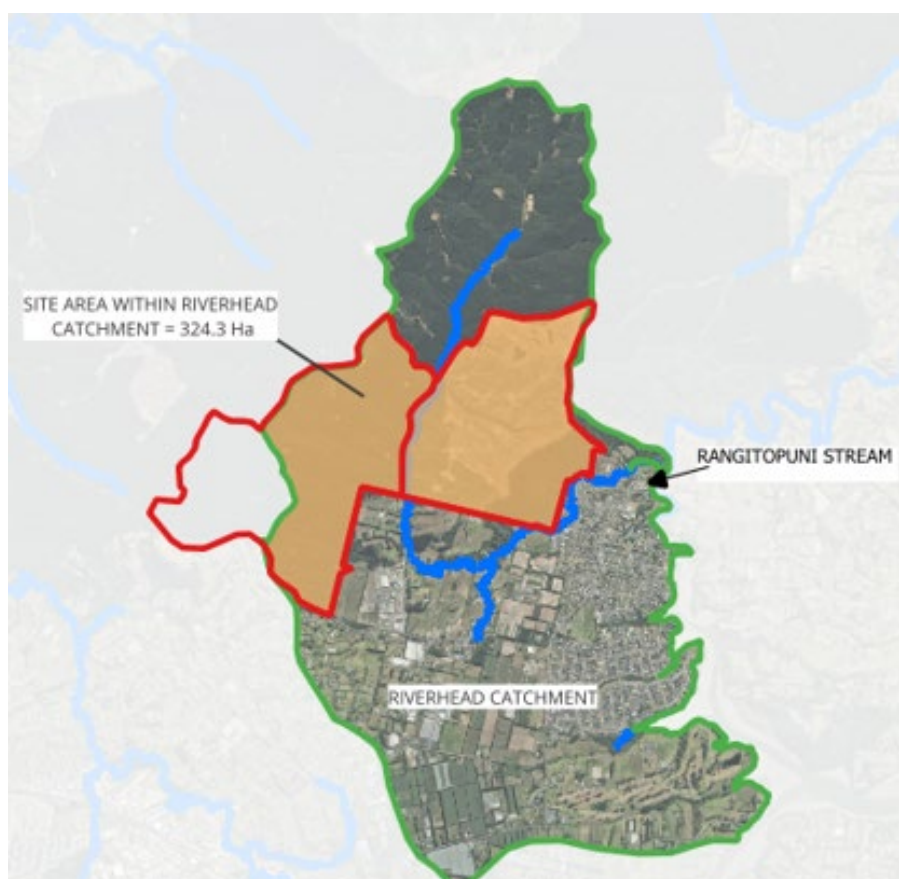


Figure 5: Extent of Site within the Riverhead Catchment

An Ecological Impact Assessment ('EclA') and watercourse survey has been undertaken by Bioresearches. Please refer to the EclA for further details. In summary, a total of 28.8km of stream flows through the Site, of which 11.3km of stream is intermittent and 17.5km of stream is permanent.

The Site contains a mixture of deforested and forested streams that eventually flow either into the Kaipara Harbour, or into the Deacon Stream and then into the Waitematā Harbour. In general, the deforested streams are highly degraded, with extensive slash overlaying the stream bed and are generally considered to be low ecological value. The larger, third order streams are of moderate ecological value. The forested streams, both intermittent and permanent are of higher ecological value, with Deacon Stream considered high ecological value due to the permanent abundance of a variety of aquatic habitat.

The Site also contains four wetlands within Lot 1. Five floodplain sedgelands are situated on the floodplain of Deacon Stream, which are intermittent in nature and considered to be of moderate ecological value. Figure 6 below illustrates the location of the ecological features within the Site.

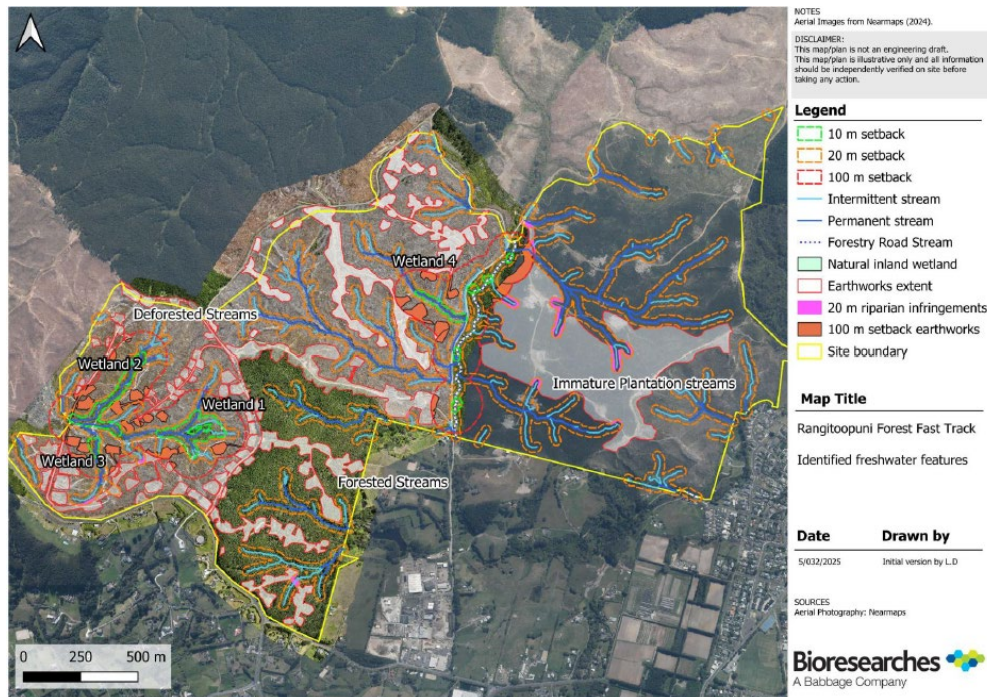


Figure 6: Proposed Site Area and Location of Ecological Features (Source: Bioresearches)

2.1.4 Hydrology

There are several major and minor OLFPs that affect the Site. These OLFPs are identified within Auckland Council's Geomaps viewer, as illustrated in Figure 7, below.

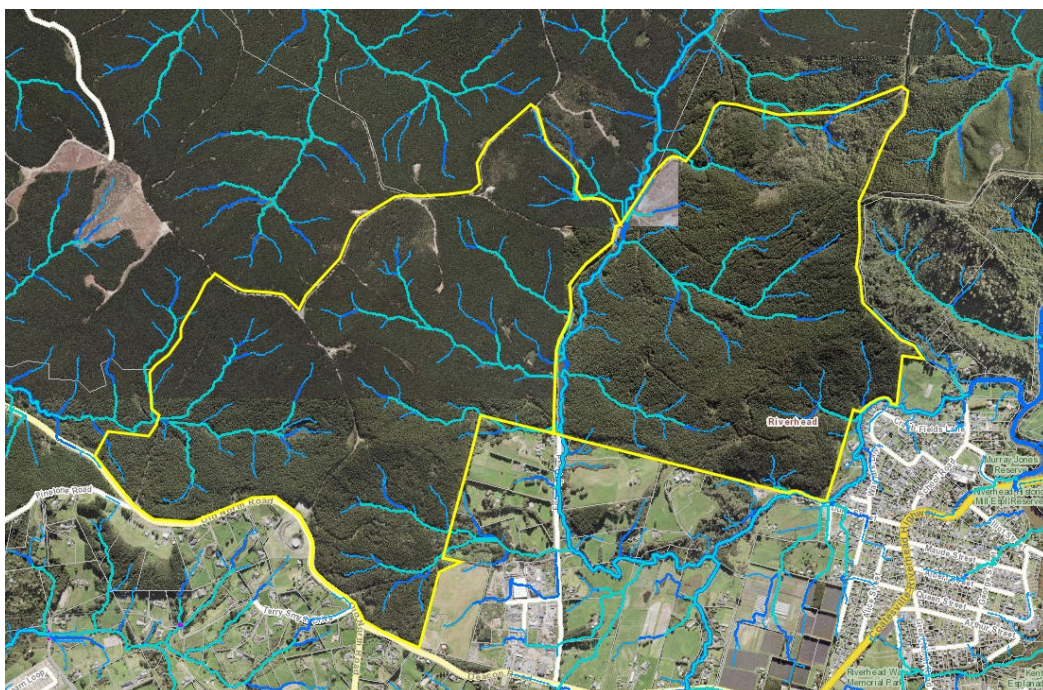


Figure 7: Overland Flow Paths and Streams

These flow paths represent the modified drains, low lying areas and streams – ephemeral, intermittent and permanent that have been mapped and classified by Bioresearchers. The OLFPs and flows under existing and fully developed catchment conditions have been modelled recently in support of the Rangitootupuni development.

2.2 FLOODING AND OVERLAND FLOW

2.2.1 Overview

The subject site is located within two stormwater catchments. The western portion of the site is located at the upper reach of the Central Kaipara Catchment and the eastern catchment is located within the middle of the Riverhead Catchment. The receiving environment of the Riverhead Catchment is the Waitematā Harbour.

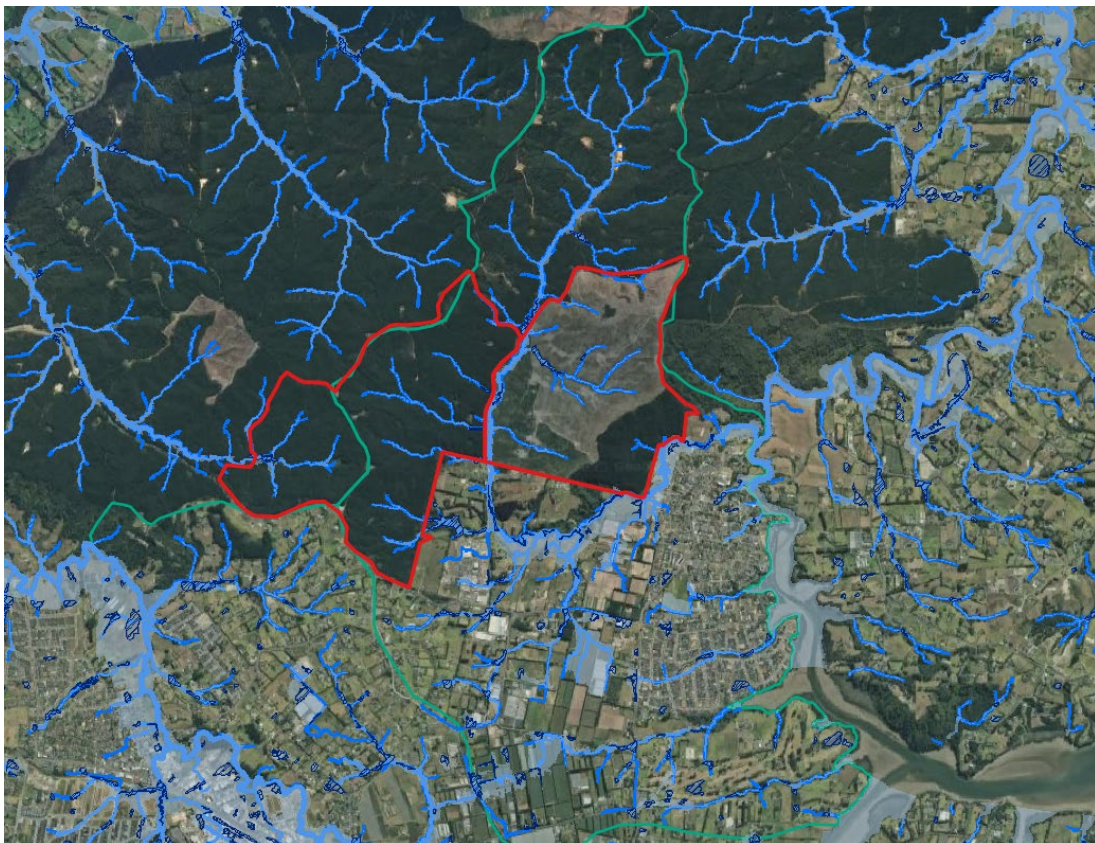


Figure 8: Existing overland flow and flooding (Approximate Lot 1 and 2 boundaries in red).

2.2.2 Existing Flooding

The existing OLFPs and streams feature pockets of flooding within the site. The flooding is largely contained to the streams and margins. Of note, the existing flood waters severely impact Forestry Road, with flood water depths of 1.5m in the 1% AEP flood event. As can also be seen above within Figure 8, there is known downstream flooding which effects properties located adjacent to the stream within the Riverhead Township. As such, the downstream environment is considered sensitive, and increased runoff need to be suitably considered and attenuated.

2.2.3 Existing Overland Flowpaths

The OLFPs within the site are largely contained to the streams and associated margins. For the most part these are removed from the development areas and will be maintained as required by the future development. Diversion of OLFPs within the site is required to avoid building platforms and/or wastewater fields.

It is noted that there are multiple existing culverts that cross the streams and/or OLFPs. These will be upgraded in support of the new private JOALs and Forestry Road upgrade. The culverts will be sized and constructed in accordance with best engineering practice.

3. RANGITOOPUNI STORMWATER MANAGEMENT - OPPORTUNITIES

The primary catchment and receiving environments have been significantly degraded from human impact resulting from the long-standing commercial forestry operation that has existed within the site.

The area contained within this consent application has been recently felled (within the last 1-6 years), and as such there is considerable silt build up, erosion and ongoing stability issues which has affected the aquatic environment and stream health both within the site; and of the downstream catchment.

This presents a unique opportunity for the intended development to improve the stormwater outcomes and stream health within the site. The overall goal of this SMP is to manage the deliverance of the development to ensure improved environmental outcomes whilst mitigating and/or avoiding any impacts resulting from the intended development.

The development of the stormwater strategy takes these principles into account, and these will be applied as the opportunity permits during the implementation stage. The following is a list of the primary principles which the Rangitootupuni SMP is derived from:

- 1) Flood Mitigation – provide 2, 10, and 100-year flood mitigation to pre-development levels. The eastern catchment also provides attenuation for the 5, 20, and 50-yr rainfall events. This will ensure there is no effect from the increased impervious areas; and will result in reduced flows from the assumed MPD within Council and or PPC 100 flood modelling undertaken.
- 2) Treatment of Stormwater – a holistic approach has been taken for the provision of stormwater treatment. This includes both treatment at source (swales, raingardens, proprietary filters) but also through catchment wide solutions which include the native regenerative planting and protection (covenants) proposed over the wider catchment within Lot 1.
- 3) Enhancement and protection of streams and OLFPs. The intended native revegetation and wetland/stream planting and protection will provide significant environment benefits and overall improvement to stream health.
- 4) Stream Health and Erosion Control – ensure stream health is improved through the management of smaller (2-yr rainfall events), ensure outfalls and culverts are protected with erosion controls.
- 5) Fish Passage Improvements – ensuring all culverts are provided with suitable fish passage. This also includes removal of fish barriers as part of the development, where notable perched culverts have been identified in the design process.
- 6) Integration of Landscape values.
- 7) The incorporation of Water Sensitive Design principles
- 8) Integration of the Cultural Impact values relative to improved parawhenuamea outcomes outlined by Te Kawerai Iwi Settlement Trust.
- 9) Slash reduction and removal strategy to reduce culvert blockage and downstream effects.

4. FLOODING

4.1 Overview

There is known downstream flooding within the Riverhead Catchment, and development within the catchment has the potential to increase run-off and downstream flooding. To ensure no downstream effects, flood management and the associated modelling has been a key driver to the overall civil design and response.

4.2 Flood Modelling

Maven Associates has undertaken HEC RAS modelling in support of the development, which has confirmed existing and proposed flood depths, extents, and flows.

The following sections provides an overview of the modelling done, and included relevant permeameters. For a more detailed assessment please refer to the Maven Stormwater Modelling Report. 2025.

4.2.1 Scenarios Assessed

- HEC RAS modelling shall be undertaken for the below scenarios to assess the downstream impact of the proposed development.
- Climate change factors outline in the Stormwater Code of Practice version 4 shall be used. With 3.8° climate change factors to be used for the 1%AEP storm and 2.1° for all other storms.
- Sensitivity checks have been includes;
 - MPD for each storm event
 - 1%AEP storm without Climate Change
 - 1%AEP storm with 50% Blockage

4.2.2 Proposed Impervious Coverage

Within the Site

Approximate pre and post development site coverage are summarised in the table below;

Scenario	Pervious - Forestry / Landscaping (CN = 74)	Pervious - Covenanted Bush (CN = 70)	Impervious (CN = 98)
Predevelopment	100%	0%	0%
Post development (Countryside living)	16%	71%	13%
Post development (Retirement village developed area)	20%	0%	80%

Outside the Site

For all area outside the subject site Maximum proposed development (MPD) impervious coverage for the shall be assumed.

*With regards to **rural zoning areas**, it is noted that a maximum impervious coverage percentage is not specified in the AUP. Assumed impervious coverage percentages are summarised below;*

- *Rural - Country side Living Zone = 10% Impervious Coverage*
- *Rural - Mixed Rural Zone 10% Impervious Coverage*
- *Rural - Rural Production Zone 5% Impervious Coverage*

4.2.3 HEC RAS Model Build Parameters

- The modelled 2d extents shall extend to a downstream boundary condition fixed tidal boundary.
Coastal boundary: the following coastal boundary condition obtained from the Coastal Marine Area Boundary for the Auckland Region
MHWS+1m rise=1.55 +1=2.55 m (NZVD2016)
- 2D flow area is 5m x 5m mesh (with 2m grid break lines)
- Manning n roughness coefficients are summaries below
Stream and rivers = 0.03
Roading = 0.03
All other area = 0.1
- Storm events 2yr (2.1 degrees climate change) , 10yr (2.1 degrees climate change), and 100yr Pre and post with Climate change (3.8 degrees) SW CoP version 4
- The design rainfall data is generated from the standard TP108 24-hour temporal pattern and the average of the TP108 24-hour rainfall depth within the catchment area

Storm event	TP108 Rainfall Depth (mm)	Design Climate Change	Future Rainfall Depth (mm)
50%AEP	80.1	2.1 degrees (15.1%)	90.2
20%AEP	112.0	2.1 degrees (16.4%)	130.4
10%AEP	130.2	2.1 degrees (17.0%)	152.3
5%AEP	156.0	2.1 degrees (17.2%)	182.8
2%AEP	182.0	2.1 degrees (17.6%)	214.0
1%AEP	196.4	3.8 degrees (32.7%)	260.6

4.2.4 Flood Result and Validation

AC HWD has provided flood information associated with the site from the latest 2D flood model. The AC model result was based on MPD condition and rainfall with climate change for 3.8 °C increase. Maven's predevelopment flood model run show peak flows to be within +/- 5% of the HW model.

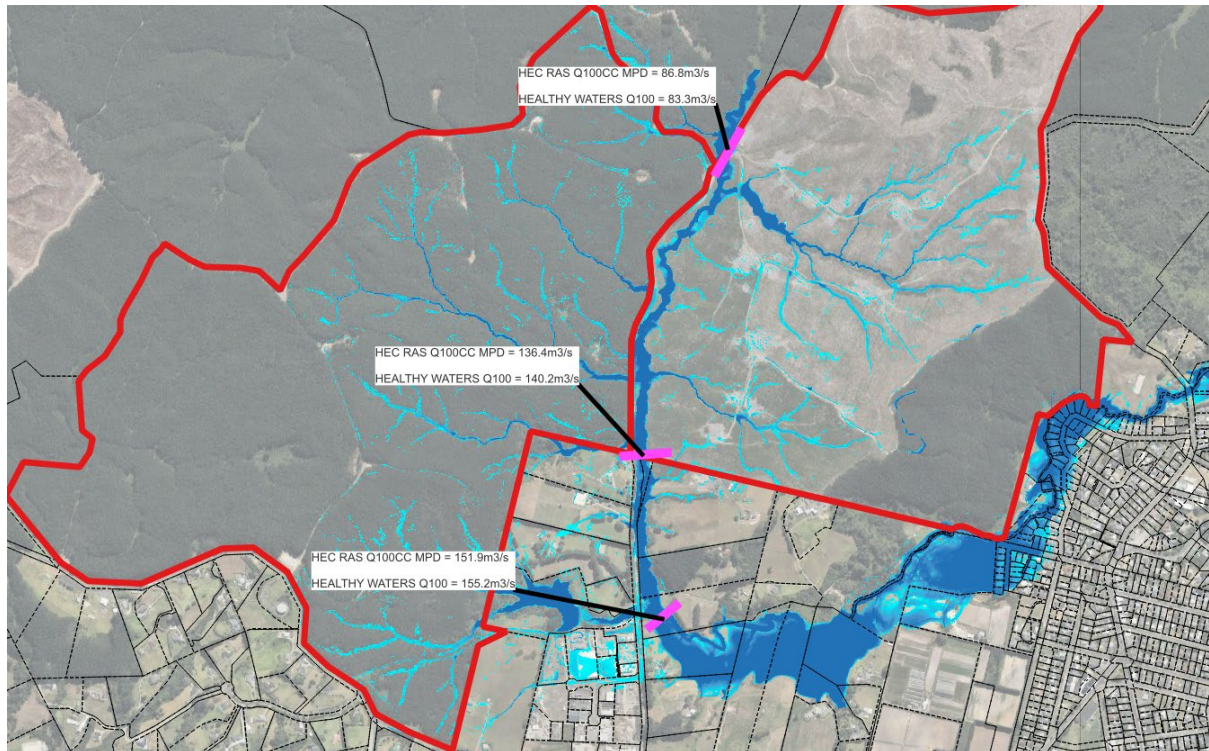


Figure 9: Validation Plan for Maven Flood Model versus Council Flood Model

4.3 Objectives

In general, the objective of the flood management is to meet requirements outlined in the Auckland Unitary Plan E36 Natural Hazards and Flooding ensuring that the development does not increase flood risks to neighbouring properties and incorporates appropriate flood mitigation measures.

With regards to the flood management for the site, the objectives are summarised below;

- Mitigation of adverse effects of downstream properties during 50%, 10% and 1% AEP storm events.
- Ensure post-development peak flow rates do not exceed pre-development levels.
- Ensure no increase in flood levels or flood plain encroachment due to development activities.
- Provide private and public vehicle access improvements as to ensure flood depths and velocity risks are suitably improved and/or managed.

The above objectives are detailed further below as relevant to the different aspects of the overall development.

4.4 Countryside Living Subdivision (Lot 1)

Construction of a specific designed culvert and spillway at the base of JOAL 1 within the western catchment which falls to the Kaipara River. This ensures no increase of flows for the 2, 10 and 100-yr

events and provides downstream mitigation for the western catchment, when combined with the CN improvements from the native planting and protection.

The eastern catchment also provides attenuation for the 5, 20 and 50-year rainfall events.

4.5 Retirement Village (Lot 2)

Construction of a specific designed culvert and spillway at the culvert associated with Accessway 1. This culvert provides attenuation of flood flows.

Construction of a large attenuation basin at the base of the engineered embankment, referred to as the RV stormwater dry pond shall provide 2-yr and 10-yr attenuation for 18Ha of the Lot's catchment.

Whilst planting of the catchment is proposed, as this is not sought to be protected by covenant, a reduced CN value has not been considered in the flood modelling of Lot 2. However, stream health improvements are still expected.

4.5.1 Forestry Road Extension

The existing alignment and levels within Forestry Road was subject to flooding that exceeded allowable depths for a public or private road. The existing flooding extent and levels of the pre-development scenario are set out below within Figure 10.

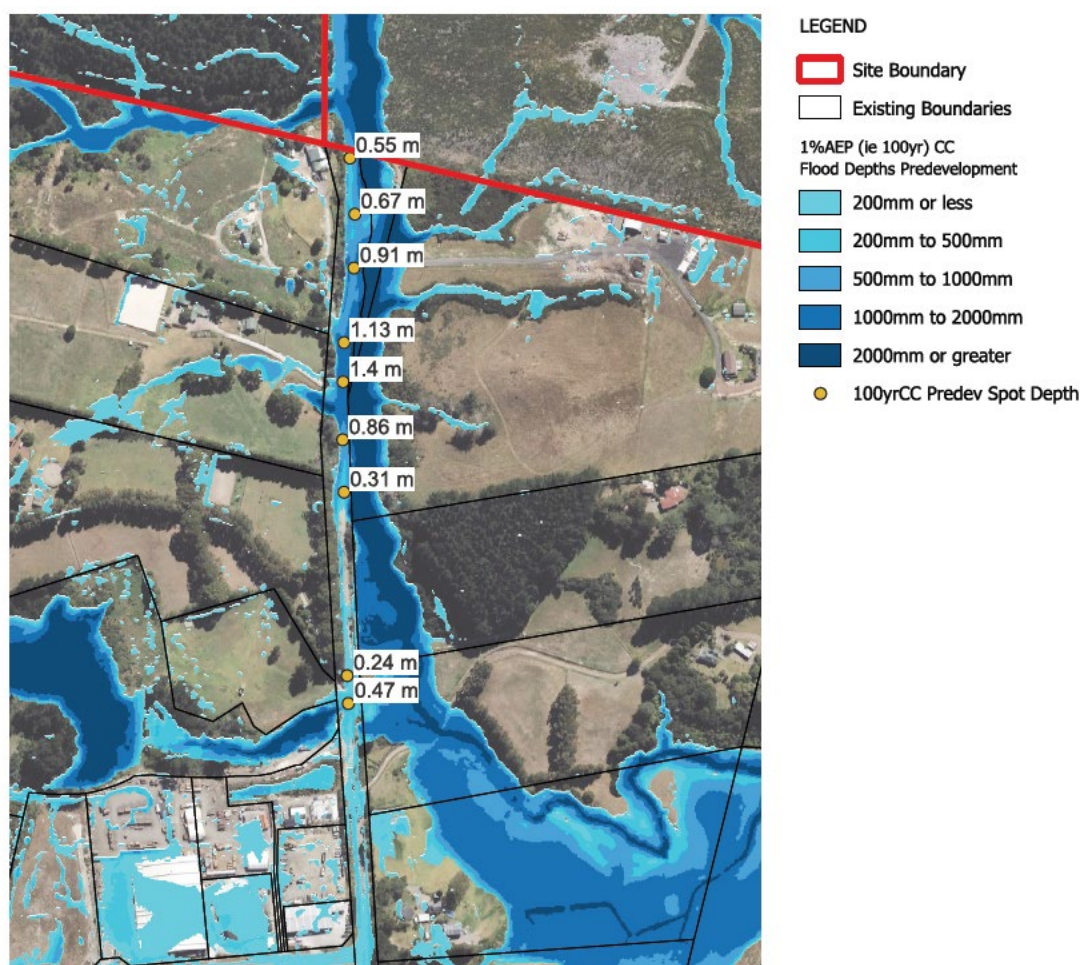


Figure 10: Pre-development Flood Levels in Forestry Road

The Forestry Road extension is a proposed public road to vest and as such, has been designed to ensure compliance with Auckland Transport Design Manual (TDM) and the relevant sections of the Auckland Council SW CoP V4.

The main risk to the existing road users comes during times of flood events. In order to ensure safe vehicle passage in the future, the road level has been lifted, so that maximum ponding depth within the road to vest does not exceed 200mm.

Refer to the appended flood modelling report for additional detail, but Figure 11 below shows the proposed flood depths within Forestry Road extension post-development.

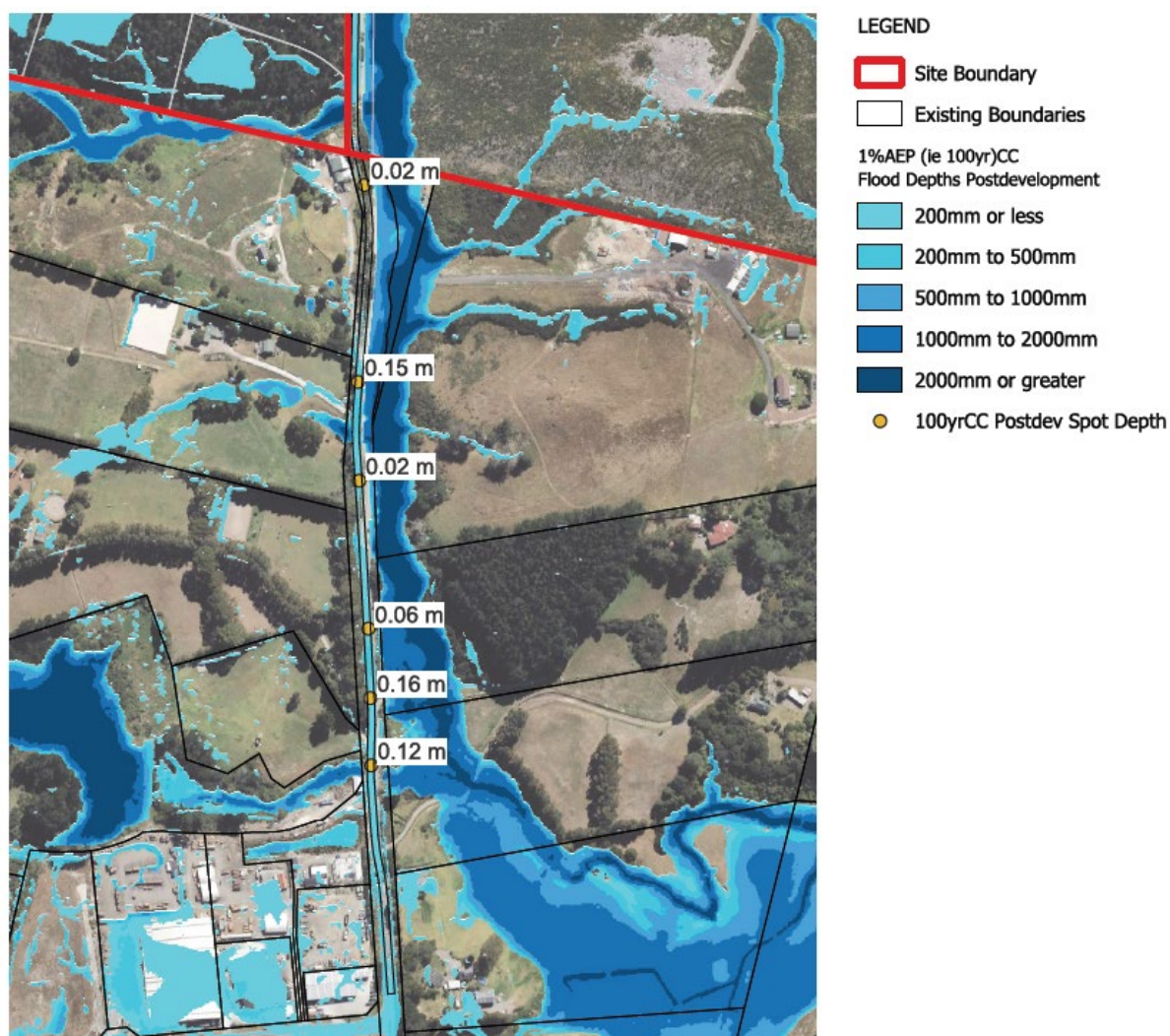


Figure 11: Post-development Flood Levels in Forestry Road

The design of Forestry Road extension has factored in downstream effects. Whilst there is reduction of flood levels along Forestry Road to that of pre-development levels; in one location, where significant - and assumed to be unlawful modification has occurred – there is no ability to avoid a minor increase in flood levels. A maximum ponding depth increase of 80mm is modelled which affects a private accessway, under the 100yr (blocked scenario). Please refer to the Maven Flood Modelling Report for further detail and assessment. The conclusion is that the effects results in less than minor effects.

5. OVERLAND FLOWS

5.1.1 Minimum Floor Levels and Overland Flow

Minimum FFLs for all lots have been provided as required to mitigate any effects. Building platforms have been specifically designed, as to be elevated above any known flooding, and existing and/or proposed overland flowpaths are located away from the designed away from the building platforms.

In some instances, existing overland flowpaths have been diverted, to avoid platforms and/or to provide sufficient space for wastewater disposal fields. Final floor levels will be determined at future building consent(s).

5.1.2 Minimum Floor Levels and Overland Flow

Minimum FFLs for all buildings and villas within the Retirement Village have been set, and these accord with the building code and Auckland Council Stormwater Code of Practice V4 ("SW CoP v4").

The overall building platforms have been specifically designed, as to be elevated above any known flooding. All future overland flowpaths are contained within the private road corridors and away from buildings and are provided with relief points to natural streams and/or OLFPs as required.

Final floor levels will be determined at future building consent(s); however, compliance is achieved by way of the overall earthworks and stormwater networks proposed.

6. STREAM HEALTH (SMAF / 2-YEAR FLOWS)

6.1 Retirement Village

The rainwater harvesting network will provide the primary water source supply for the private water network that will support the Retirement Village. The sealed network has been sized to cater for the 95th percentile rain event for all roof areas within the village. In larger events, the modelling assumes no benefit from tanks (worst-case scenario). The attenuation basin and low-flow culvert also provide attenuation of smaller rainfall events.

6.2 Countryside Living

On-lot tanks will ensure roof caught water is captured, and retention is provided in the catchment via reuse within the future dwellings. It is assumed that a SMAF rainfall event (35mm) is caught in roof tanks, however, for larger events, the modelling assumes no benefit from tanks (as worst-case scenario).

A consent notice (conditioned as part of the resource consent) will require a minimum tank design within each of the lots. This will provide potable and non-potable supply to the building(s), and will also provide for the required firefighting volume.

The wider area within the lots is going to be revegetated and protected in perpetuity with covenants. This will increase infiltration within the catchment and reduce runoff further aiding stream health and outcomes sought.

All flows will discharge via the stream/wetland networks, of which will also provide treatment of water. Improved aquatic health and outcomes will also be achieved by the native revegetation of Lot 1, which aside from the JOAL areas and building platforms will ensure the native vegetation is protected in

perpetuity which will have significant positive effects to the overall stream health within the site and for downstream environments. The extent of planting is indicated within the Boffa Miskell documentation, of which an extract is provided below which shows a typical cross-section and width of planting;

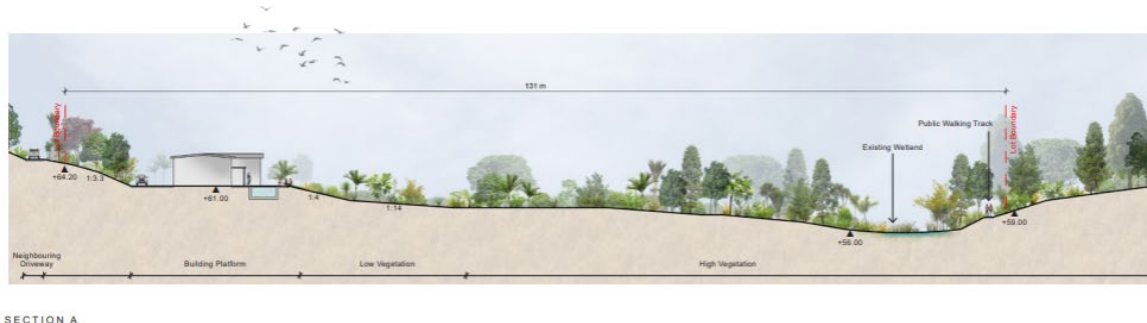
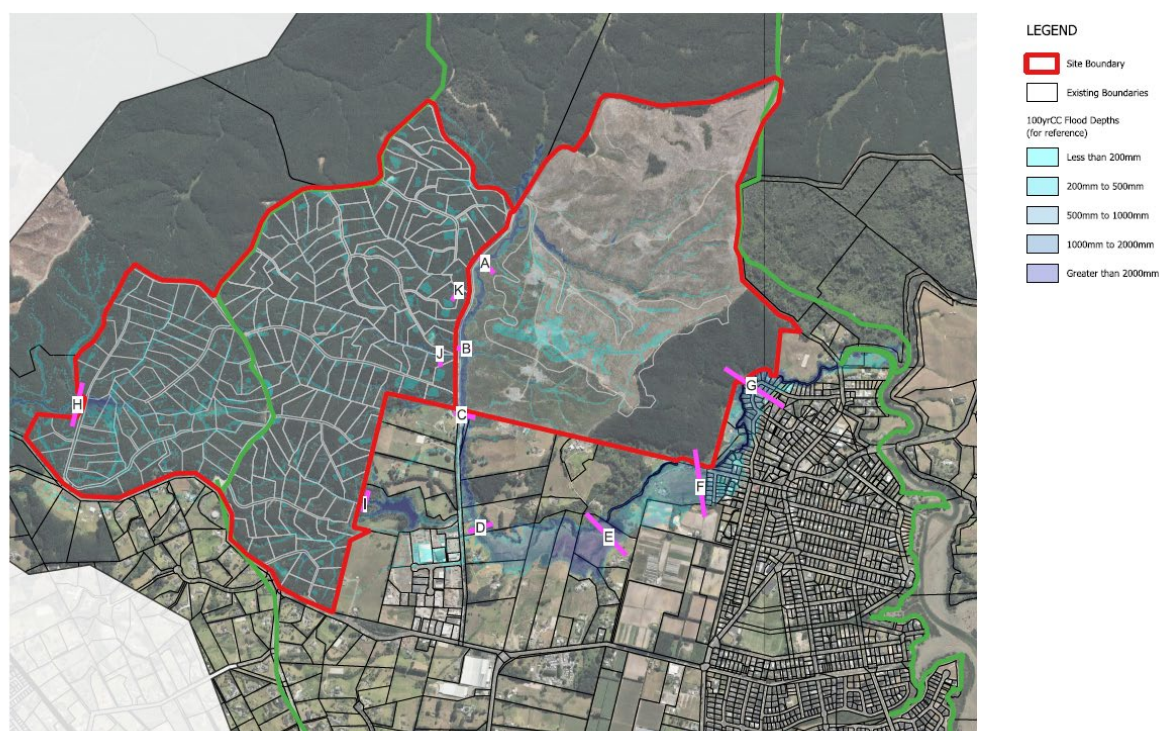


Figure 12: Cross-section from Boffa Miskell Plan set showing native planting within Lot 1

The table below indicated the pre and post 2-year flows which further validates the improved outcomes to the streams when subject to smaller, more frequent rainfall events, at the site boundary along Forestry Road:

Critical Sections



Cross section C

Scenario	Rainfall	Development	Flowrate (m ³ /s)	Flood level (mRL)
1	2yrCC	Pre	17.32	24.530
2	2yrCC	Post	15.59	24.465
3	10yrCC	Pre	49.69	25.330
4	10yrCC	Post	47.39	25.292
5	100yrCC	Pre	132.39	26.155
6	100yrCC	Post	126.93	26.157
7	100yrCC	Pre (50% Blocked)	133.81	26.159
8	100yrCC	Post (50% Blocked)	132.55	26.219
9	100yr	Pre	61.09	25.486
10	100yr	Post	59.16	25.469
11	5yrCC	Pre	36.09	25.075
12	5yrCC	Post	35.33	25.066
13	20yrCC	Pre	65.19	25.572
14	20yrCC	Post	62.49	25.535
15	50rCC	Pre	71.58	25.631
16	50rCC	Post	69.78	25.621

Figure 13: Cross-sections location for flood modelling, and Results from Cross-section C

6.3 Culverts and Erosion Control

The site features numerous existing culverts associated with the forestry access tracks and Forestry Road itself. These will all need upgrading and modifications in support of the development to ensure safe vehicle access, reduce flood levels and for two culverts (Culvert 1-1 and Culvert 7) specific flood attenuation to control runoff from the site in storm events. The locations of the culverts are shown on Maven drawing C480, an extract of which is provided below within Figure 14.

These culverts have been designed to comply – where possible – with the AUP, and the National Environmental Standards for Fresh Water ('NES FW'). The culverts have been designed to comply with the permitted criteria of Section 70 of the NES FWm including culvert widths and the requirement to provide for 100-yr design flows. Please refer to the more detailed assessment against the NES FW contained within the Biosearchers Ecology Assessment Report.

Culvert 1-1 (Stage 1 Countryside Living Subdivision) and Culvert 7 (Accessway 1, Retirement Village) do not achieve compliance with the NES FW, as they are specifically designed to provide flood mitigation needed to ensure no downstream effects. Both culverts are existing and are associated with forestry access tracks. Low flow culverts are included in both instances, whilst the larger (high flow) culverts are elevated above the stream base, providing attenuation before discharging stormwater in rainfall events. This is an appropriate civil design, providing a good balance between improved environmental outcomes (fish passage, reduced erosion) whilst ensuring downstream effects are mitigated.

Please refer to the assessment against the relevant rules of AUP Section E3 within Appendix C of this Report.

6.4 Slash Reduction Strategy

As the site history as a commercial forestry operation, the construction phase will require the removal of slash to enable platform and road constructions. The slash is going to be chipped onsite and will be used for the stabilisation of the earthworked areas and mulching of the planted extents. This will also ensure that the risk of slash being washed down into culverts and stream networks will be removed, and will provide improved resilience for the constructed culverts to ensure longevity and reduce risk of blocking in rainfall events.

7. STORMWATER

The Auckland Council Stormwater Code of Practice v4 sets out design and construction standards for stormwater and requires all land development projects to be provided with a means of stormwater disposal.

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

The following section of the report confirms how the development will be provided with a means of stormwater disposal, treatment and disposal, and how this complies with the overall requirement of the AUP, with specific emphasis applied to the standards contained within E8 (Stormwater Discharge and Diversion).

7.1 Stormwater Reticulation Overview

There is no existing stormwater network in the vicinity of the development area. The 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).

7.2 Stormwater Reticulation – Retirement Village

The Retirement Village will be provided with a dual stormwater network. Clean roof water will be retained in a separate network from that of JOALs and surface runoff.

Roof caught water will be piped in a sealed piped system to collect roof water that will be conveyed into a collection tank servicing the onsite water supply system to be designed by GWE. The sealed roof water network has been sized for the 95th percentile event; with overflow (beyond this) to the dirty water network. The clean water will be contained in a U-PVC or PE network and will be conveyed to collection point(s) (storage tanks), before being treated and reticulated within the village.

A separate stormwater network will be provided for surface runoff. The networks will discharge via new outfalls to existing streams and/or OLFPs as per ecology advice received. These outfalls will be specifically designed and will be provided with rock riprap at point of discharge as per Hydraulic Energy Management: Inlet and Outlet Design for Treatment Devices (TR 2013/18). Please refer to the appended drawings for locations of networks, outfalls and long-sections.

7.2.1 Retirement Village - Stormwater Capacity

The sealed roof system will be sized for the 95th percentile rain event. This sizing has been chosen to provide the balance between sufficient storage replenishment versus oversizing networks. First flush

diverters to be installed on downpipes feeding this system and overflow into the surface water network will be provided by one-way flap valves within the lot themselves.

A few small clusters of units do not feed this system as their location on a peninsula does not allow discharge into the system by means of gravity feed, but the small number of units means this is inconsequential to the overall harvesting capacity (and has been considered within the design of the networks and storage volumes).

The surface water stormwater network will be sized to cater for 10-yr events for the full catchment (including roofs) as required by the Auckland Council SW CoP. This will convey all surface flows including JOALs, carpark areas and any landscape areas. This will also support overflows from the clean water network, when rainfall intensity exceeds the 95th percentile event.

The proposed stormwater connections and private stormwater networks 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.

To ensure there is no downstream flooding effects, attenuation of peak flows will be required. As was discussed in Section 4 of this Report, attenuation of the RV catchment is done via an engineered ponding area upstream of an upgraded culvert (Culvert 7) under Accessway 1; and supplemented by a dry attenuation basin located northwest of the Village, at the base of the engineered embankment.

7.2.2 Retirement Village – Stormwater Treatment

As the site is not bound by the Region Wide NDC, the requirement for treatment is set out within the AUP. In this sense, treatment is not specifically required, as the private roads will be low volume (less than 5000 v/pd), however, treatment would be needed for the communal parking areas which exceed 30 spaces.

However, given the intensity of the intended development, treatment for the primary trafficable areas within the Retirement Village will be provided. Some small JOALs which serve 10 or less units are not provided with treatment.

A combination of propriety devices (stormwater filters) and raingardens are proposed within the Village. Please refer to the attached engineering plans for the indicative design and locations of the treatment devices.

The final design and layout will be subject to detailed design and Building Consent approval from Auckland Council.

Forestry Road Extension

Under the AUP, the proposed Forestry Road extension will be low volume (less than 5000 v/pd) and thus does not specifically require treatment. However, a decision has been made to provide treatment on Forestry Road (for the section contained within the development site); and this has been provided by way of raingardens. Please refer to the appended plans for further detail.

We note that as the treatment devices will only be serving Forestry Road and the devices will be vested to Auckland Transport, who will have to confirm they are supportive of treatment being included, noting that the existing sections of Forestry Road are not currently provided with treatment.

7.3 Stormwater – Countryside Living

The stormwater management for the development of Lot 1 is consistent with development in the Countryside Living zone. Roof caught water provides the source of all potable and non-potable water supply within the future dwelling(s) within the 1 ha lots being created.

Each lot is provided with a suitable disposal point, via a level-spreader (T-bar) or lot connection to a nearby outfall depending on the best solution for any given lot. The overflow from tanks and runoff from private driveway areas will be discharge via the designated outfalls towards existing OLFPs and/or streams. The location of all outfalls has been reviewed by the Geotech engineer (ENGEO), confirming the locations are acceptable from a global stability perspective.

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, a piped network or specific design of the swale has been provided. Refer to the cross-sections appended for additional detail. Outfalls from the swales will be provided to existing streams and OLFPs, and feature erosion protection as per calculations and engineering drawings appended.

A suitable means of disposal will need to be provided for each lot, and accessway. ENGEO have provided input on the stormwater design; and changes as per the recommendations have been made to ensure ongoing stability and compliance with their recommendations.

7.3.1 Countryside Living - Stormwater Capacity

Each individual lot will be provided with sufficient storage volume to allow for potable and non-potable water supply to all future buildings, whilst also adhering to Fire Engineering New Zealand (FENZ) requirements detailed within SNZPAS 4509.

It is envisaged that each lot would be provided with a minimum of 90,000L of tanks, although it is likely that up to 120,000L of capacity may be provided within each lot, depending on number of bedrooms and water demand. The final design will be subject to building consent approval from Auckland Council, and this will also confirm compliance with the FENZ requirements.

The swale drains, culverts, and any lot connections will be sized as required to convey the 10-yr flows as per the Auckland Council SW CoP.

Attenuation of peak flows will be provided within the countryside living subdivision. Please refer to Section 4 of this report for further commentary.

7.3.2 Countryside Living – 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 roads will be low volume (less than 5000 v/pd) aside from the carpark associated with the community facility within Lot 57.

Treatment is proposed via roadside swales in the areas of the site which can accommodate this design. Please refer to the standard road cross-section detail below, which shows the swale drain within the JOALs.

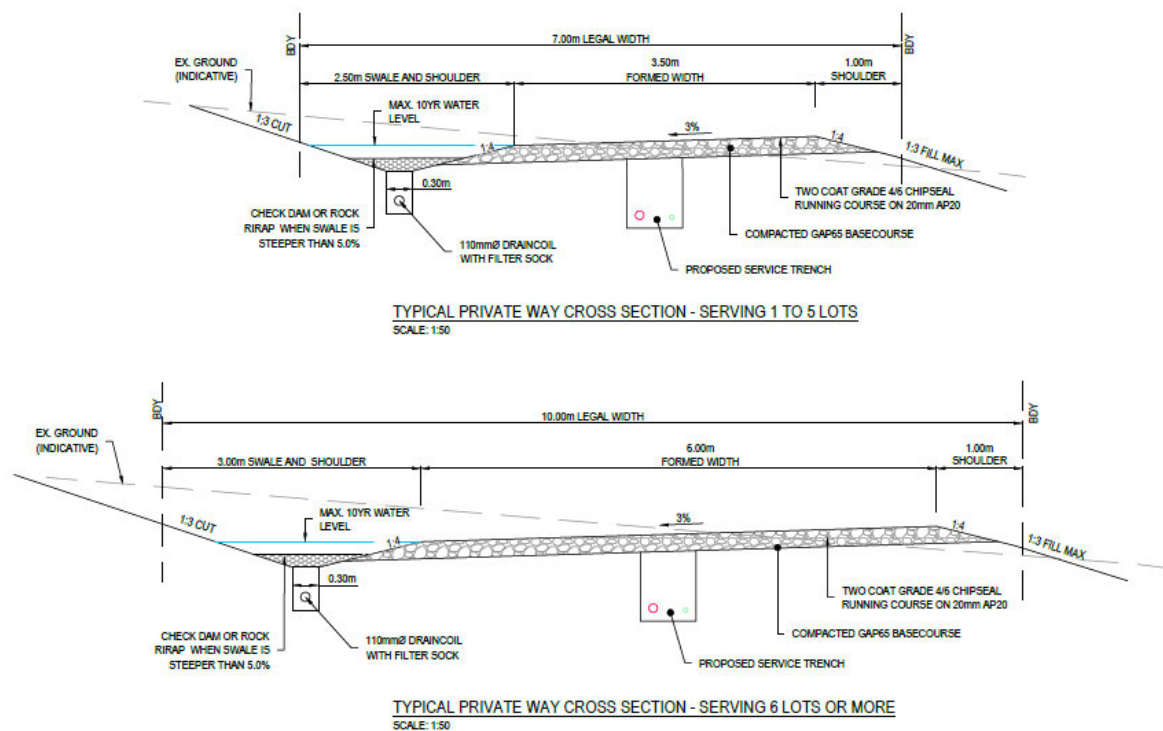


Figure 15: JOAL Standard Cross-sections showing the Grass Swale for Treatment

For steeper sections, treatment will not be possible, although not required by the AUP. Likewise, no treatment is proposed for the private driveways and/or hardstand areas contained within the lots.

All flows will discharge via the stream/wetland networks, of which will also provide treatment of water. Improved aquatic health and outcomes will also be achieved by the native revegetation planting throughout the site.

8. STORMWATER MANAGEMENT FRAMEWORK

TABLE 1: STORMWATER FRAMEWORK FOR THE RANGITOOPUNI SMP:

Stormwater Treatment	Retirement Village	Countryside Living	Forestry Road
	<ul style="list-style-type: none"> Treatment via way of raingardens and/or propriety devices for JOALs and private accessways (more than 10 units) Treatment for all carparking areas with 30+ carparks. No treatment for private driveways / less than 10 units. Native revegetation and stream planting. 	<ul style="list-style-type: none"> Treatment within the JOALs via grass swales where possible. Native revegetation and stream planting, with protection via covenants. Treatment for all carparking areas with 30+ carparks. (Lot 57, Stage 4 community facility) 	<ul style="list-style-type: none"> Treatment via raingardens in the proposed road to vest (within our site only). <p><i>(Subject to AT approval and acceptance)</i></p>
Stormwater Conveyance	Retirement Village	Countryside Living	Forestry Road
	<ul style="list-style-type: none"> Surface runoff and accessway (dirty) network sized for 10-yr event. Clean water (roof) network sized for 95th percentile rain event, and will provide primary non-potable and potable supply in the Village. Outfalls to existing streams and overland flowpaths, with riprap protection as per TR 2013/18 	<ul style="list-style-type: none"> JOAL drainage designed for 10-yr rain event. Outfalls to existing streams and overland flowpaths, with riprap protection as per TR 2013/18. On-lot storage tanks provide supply for potable and non-potable water supply for future buildings. All lots provided with a suitable means of SW overflow via way of level spreader and/or lot connection. 	<ul style="list-style-type: none"> Public Road drainage designed for 10-yr rain event. New culverts constructed under Forestry Road

Flood Mitigation	Retirement Village	Countryside Living	Forestry Road
	<ul style="list-style-type: none"> Retention and reuse of roof water for 95th percentile rain fall event. 2, 10 and 100-yr attenuation provided by way of catchment wide solutions. Eastern catchment also provides 2, 5, 20 and 50-yr attenuation Accessways and JOALs provided with complying ponding depths (less than 200mm) 	<ul style="list-style-type: none"> Retention and reuse of roof water for 95th percentile rain fall event. 2, 10 and 100-yr attenuation provided by way of catchment wide solutions. Eastern catchment also provides 2, 5, 20 and 50-yr attenuation Accessways and JOALs provided with complying ponding depths (less than 200mm) 	<ul style="list-style-type: none"> Forestry Road extension has been lifted, to ensure flooding depths complies with ATCOP and AT TDM. Improved resilience and access for existing users.

9. CONCLUSION

The report outlines the stormwater management framework that will enable the intended development of the site. The overall goal of this stormwater management plan is to mitigate effects of the development whilst trying to deliver positive effects on the receiving environment.

Whilst the site is not located within the extent of the Region Wide NDC, the application includes a stormwater discharge consent, of which requires consideration of the intended stormwater discharge and resulting effects.

Whilst the AUP does not expressly require treatment, high-level of treatment is provided in support of the development, with focus provided on higher use trafficable areas, alongside the wider catchment revegetation planting proposed.

The stormwater design provides for the requirements of the various elements of the overall development. Roof caught water provides for the primary supply of potable and non-potable water for both the countryside living subdivision, and the retirement village components. All future networks are subject to detailed design; and will ensure means of disposal for all lots and impervious areas within the site. The future networks will be designed to comply with the New Zealand Building Code, Auckland Council SW CoP and will be subject to approval under both EPA and Building Consent processes.

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

To ensure there is no downstream effects, flood modelling and catchment wide attenuation solutions have been developed by Maven. This ensures pre-development flows are maintained for the 2, 10 and 100-yr rainfall events.

Subject to future compliance with the principles set out in Section 8 of this SMP, it is considered that adverse effects can be suitably mitigated and managed, and significant benefit to the site and surrounding environment will result post-development.