Wellsford North Plan Change

Stormwater Management Plan

Wellsford
Wellsford Welding Club

Final

Document Control

Project Number	P21-395
Project Name	Stormwater Management Plan
Client	Wellsford Welding Club
Date	02/05/2022
Version	V1
Issue Status	Final
Originator	Tony Wang – Stormwater Engineer 
Reviewer	Bidara Pathirage - Associate Engineer 
Approval	Pranil Wadan – Principal Engineer 
Consultant details	Woods (Wood & Partners Consultants Ltd) Level 1, Building B, 8 Nugent St, Grafton, Auckland 1023 PO Box 6752 Victoria St West, Auckland 1142
	E: info@woods.co.nz P: 09-308-9229
	woods.co.nz
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Executive Summary

Wellsford Welding Club is looking to undertake a Private Plan Change (PPC) in the Wellsford North area. The development is classified as a 'greenfields' development under Schedule 4 of Auckland Council's Regionwide Network Discharge Consent (NDC) and requires a stormwater management plan to be compliant with the NDC requirements.

The purpose of this Stormwater Management Plan is to provide guidance to the applicants and Auckland Council on how stormwater will be managed within the PPC area.

The Wellsford North plan change catchment is shown in Figure E1.

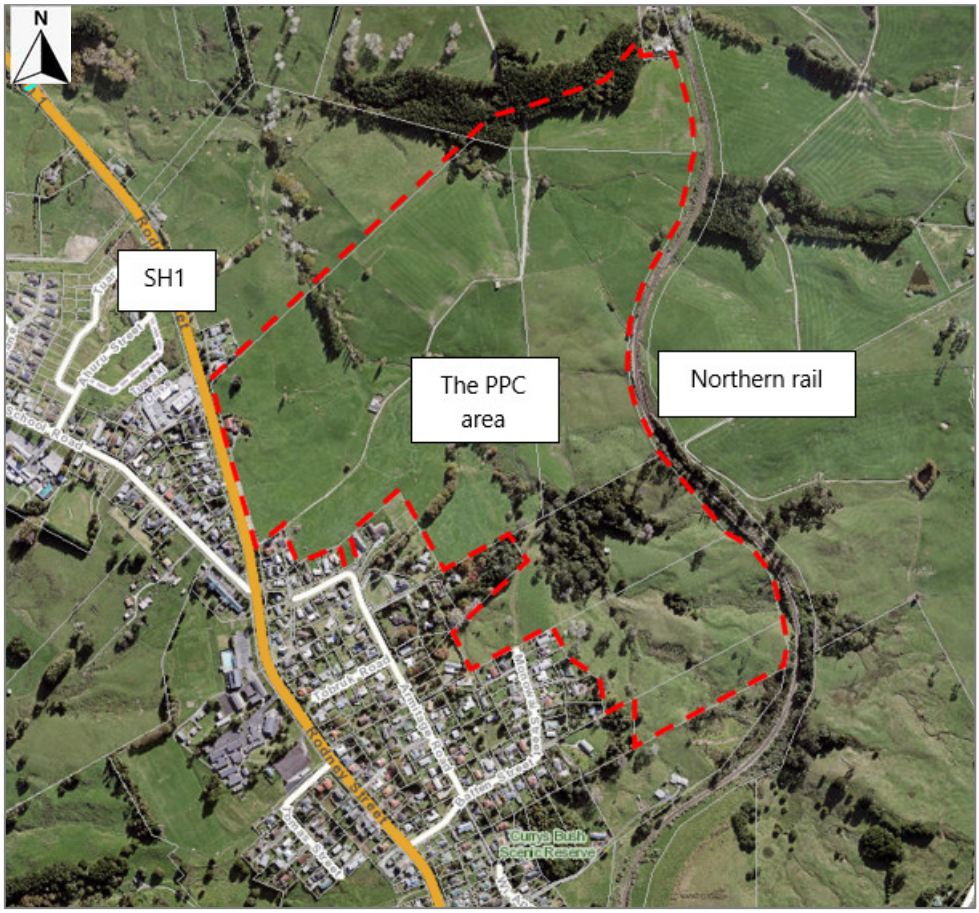


Figure E1: Subject site location (Source: Auckland Council Geomaps)

Several watercourses and wetlands have been identified onsite within the PPC area. The receiving environment for the site is Oruawharo River and Kaipara Harbour.

An integrated stormwater management approach is to be adopted for the Private Plan Change area. A range of stormwater management options has been assessed, and the best practicable option provided in this report to achieve the required objective under Auckland Unitary Plan regulatory policies, Auckland Council's water sensitive guidelines and Network Discharge Consent requirements.

The proposed stormwater management approach provides design guidelines for proposed developments within the PPC area. The proposed stormwater management approach includes:

- Preserve, protect and enhance water bodies and natural wetlands.
- Eliminate and minimise the generation of contaminants.
- Provide 95th percentile, 24hr, hydrological mitigation.
- Ensure the flooding effects within, upstream and downstream of the PPC area are no more than minor.

- Consider future effects of climate change.

A stormwater management toolbox has been developed and is presented in Section 8.2.7 of the SMP. The toolbox sets out the performance standards for stormwater management for different land use activities based on the Auckland Unitary Plan provisions. A range of device options and indicative sizes are provided to achieve the required performance standards; however, the proposed toolbox should not limit the use of other devices or tools proven to be the Best Practicable Option.

Flood modelling has been undertaken for the PPC and surrounding areas including a preliminary analysis of the culvert on State Highway 1. Model results and afflux plots indicate flooding is largely contained within existing water courses with flood extents to be similar between pre- and post- development scenarios. Hazard plots have also been created which indicates flood effects on State Highway 1 are existing with increases as a result of development considered to be no less than minor and note that this has been in principle acknowledged by Waka Kotahi NZTA.

Overall, our assessment has concluded that the potential effects on stormwater anticipated by the PPC are less than minor and will be appropriately mitigated.

1. Introduction

1.1. Background

Wellsford Welding Club is looking to undertake a Private Plan Change (PPC) in the Wellsford North area. The development is classified as a 'greenfields' development under Schedule 4 of Auckland Council's Regionwide Network Discharge Consent (NDC) and requires a stormwater management plan to be compliant with the NDC requirements.

This report outlines the stormwater management plan (SMP) prepared by Woods in support of a PPC in the Wellsford North area. It has been developed in accordance with Auckland Unitary Plan: Operative in Part (AUP) and the requirements as set out in the NDC.

The location of the Wellsford north PPC area is shown in Figure 1.

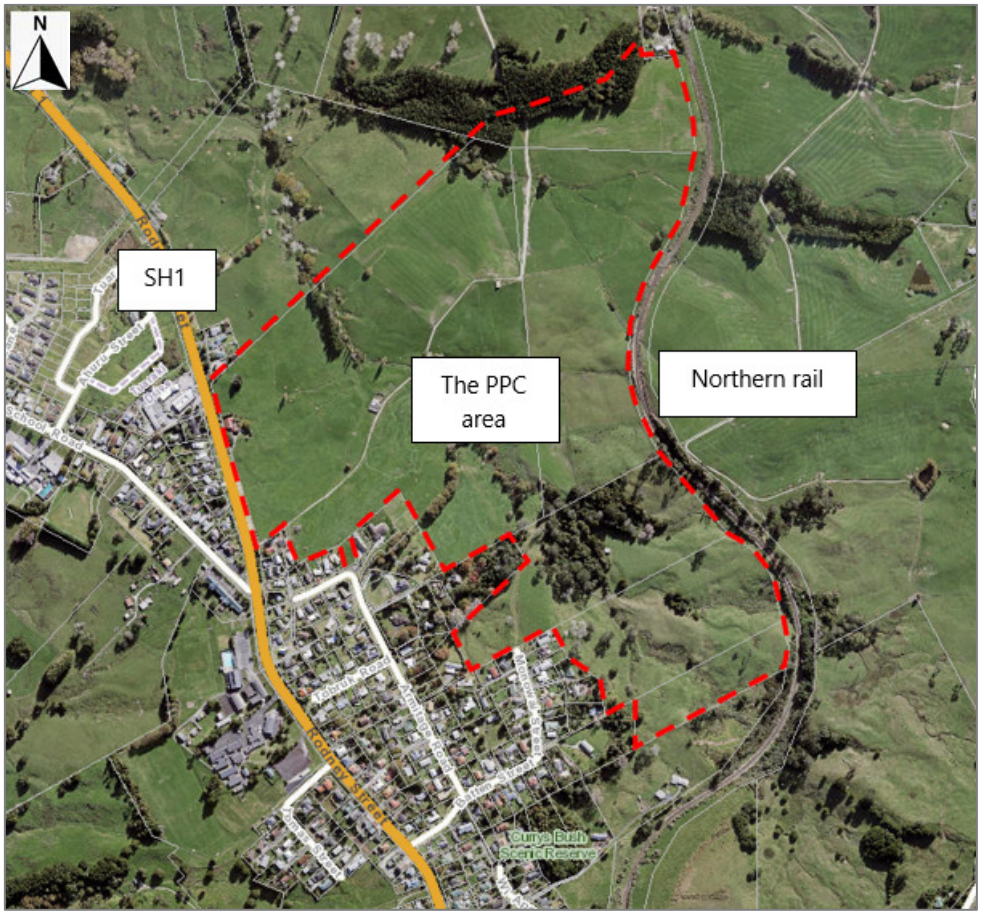


Figure 1: Wellsford North PPC area (Source: Auckland Council Geomaps)

1.2. Purpose and objectives

The overall purpose of this SMP is to provide guidance to the applicant and inform Auckland Council on how stormwater will be managed for the PPC area.

This report highlights how Schedule 4 of the NDC requirements have been met in the development of the SMP. The overarching objectives are to:

- Meet Schedule 4 of the Regionwide NDC;
- Support the PPC;

- Provide stormwater management guidelines for the proposed development and ensure stormwater runoff is to be conveyed in a safe manner to the receiving environment through the primary and secondary networks;
- Provide betterment for the receiving environment via stormwater quality treatment guidelines and avoidance of high contaminant yielding roof and cladding materials; and
- Identify flood risk areas and provide for development without creating adverse flooding effects at properties upstream or downstream of the development site.

2. Existing site appraisal

This section of the report summarises the existing site characteristics and conditions as currently understood and relate to stormwater.

2.1. Summary of data sources and dates

A summary of key background information used in the development of the SMP is provided in Table 1.

Table 1: Data sources and dates

Existing site appraisal item	Source and date of data used
Topography	• Auckland Council supplied LiDAR 2016 • Topographical survey undertaken by Buckton Consulting Surveyors Ltd
Geotechnical / soil conditions	• Auckland Council Soil Maps • Geotechnical Assessment Report by Tonkin & Taylor Ltd
Existing stormwater network	• Auckland Council GeoMaps data • Infrastructure survey undertaken by Woods
Existing hydrological features	• Auckland Council GeoMaps data • Ecological Impact Assessment by Bioresearchers Ltd
Stream, river, coastal erosion	• Auckland Council GeoMaps data
Flooding and flow paths	• Auckland Council GeoMaps data - floodplain layer
Coastal Inundation	• Auckland Council GeoMaps - coastal inundation layer
Ecological / environmental areas	• Ecological Impact Assessment by Bioresearchers Ltd
Cultural and heritage sites	• Archaeological Assessment by Clough & Associated Ltd
Contaminated land	• Preliminary Site Investigation by Environmental Management Solutions Ltd

2.2. Location and general information

The PPC area is located to the north of Wellsford town centre. It is bounded by State Highway 1 (SH1) to the east and Northern rail to the west comprising an area of approximately 58ha.

As per the Auckland Unitary Plan Operative in Part (AUP: OiP), the PPC area is predominantly zoned Future Urban Zone with areas to the south zoned as Rural Countryside Living and area to the northeast zoned as Rural production area. The subject PPC area is located to the east of State Highway 1 and is approximately 80km away from Auckland Central Business District.

Figure 2 shows the existing zoning plan with site elements indicated in Table 2 below.

Figure 2: Existing zoning (Source: Auckland Council Geomaps)

Table 2: Existing site element

Existing site element	
Legal description	Pt Sec 25 Blk XVI Otamatea Survey District DP 9682 Pt Lot 2 DP 26722 Pt Lot 4 DP 9919 Pt Allot 117 Psh Of Oruawharo SO 22925 Pt Allot SE118 Psh Of Oruawharo Lot 1 DP 69586
Current Land Use	Grazed pasture Rural Residential
Historical Land Use	Grazed pasture

2.3. Topography

The existing topography of the PPC area consists of steep undulating ridgelines and several watercourses. The elevations generally vary between 50m RL along the northern railway and SH1 falling to approximately 20m RL along the watercourses. The PPC area slopes less than 20% in general, and the watercourses are relatively incised with steep adjacent banks along some locations. The existing contour and site slopes as shown in Figure 3 and Figure 4, respectively.

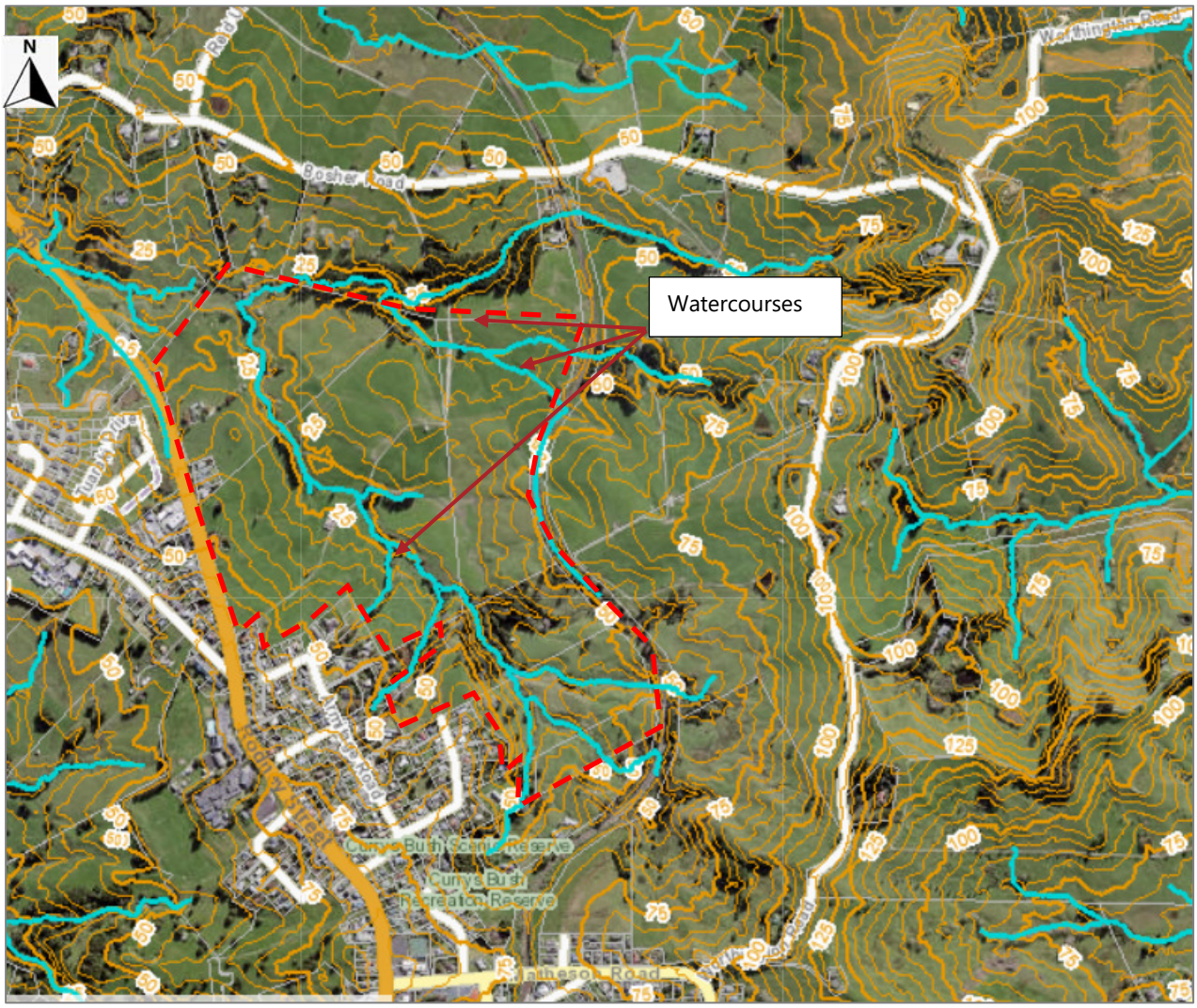


Figure 3: Existing ground contours – (Source: Auckland Council Geomaps)

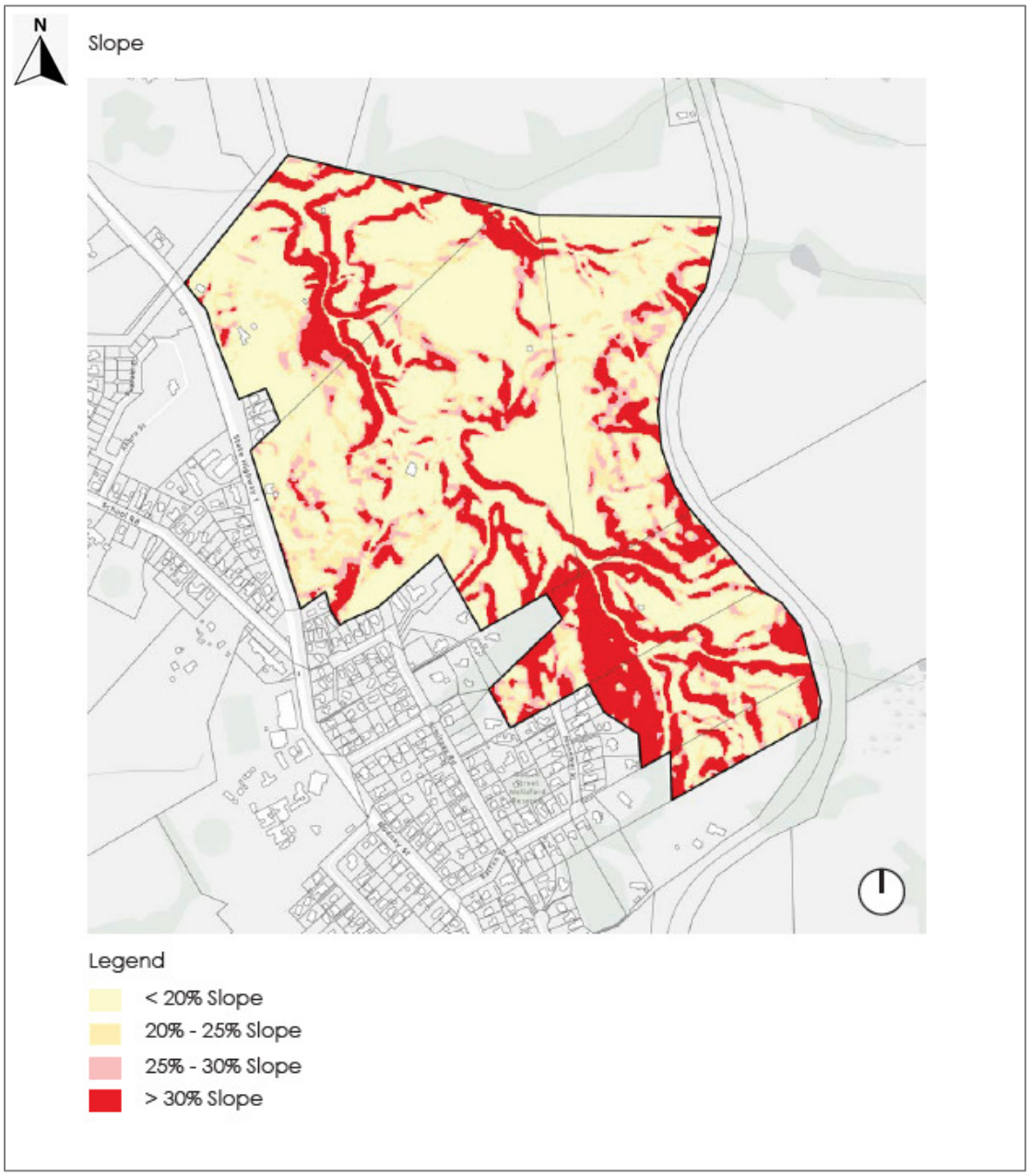


Figure 4: Site terrain (Source: Barker & Associates)

2.4. Geotechnical

Published geological maps for the area obtained from the Auckland Council soils layer indicate the underlying soil to be greywacke and limestone soils with a soil ID C2 which is classified as mudstone/ sandstone as can be seen in Figure 5. Published drainage maps of the PPC area obtained from S-map indicate the subject PPC area is poorly drained, as shown in Figure 6.

A geotechnical assessment prepared by Tonkin & Taylor Ltd indicate the site is underlain with various lithologies of the Northland Allochthon with surficial alluvial deposits also present. Relic dormant features and active slope deformation features have also been observed on site with slope stability potentially being a risk.

Further information can be found in the geotechnical report submitted with the application.

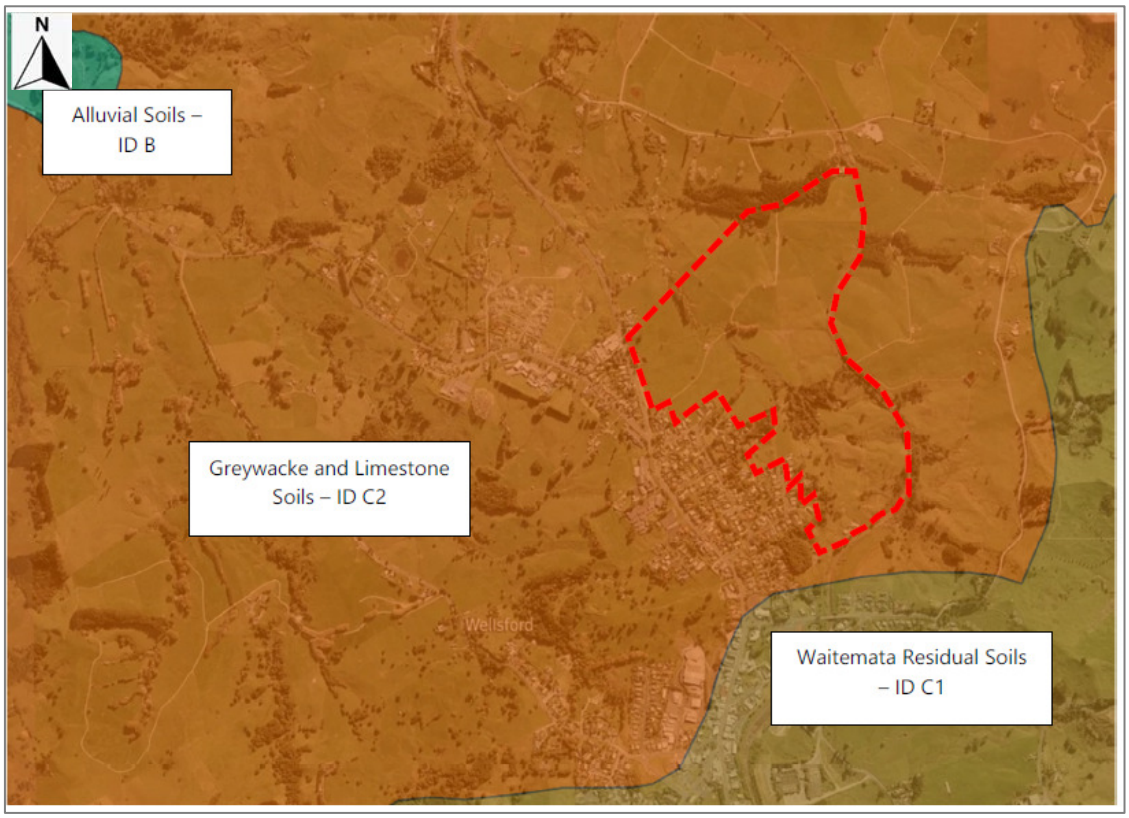


Figure 5: Geology (source: Auckland Council soils layer)

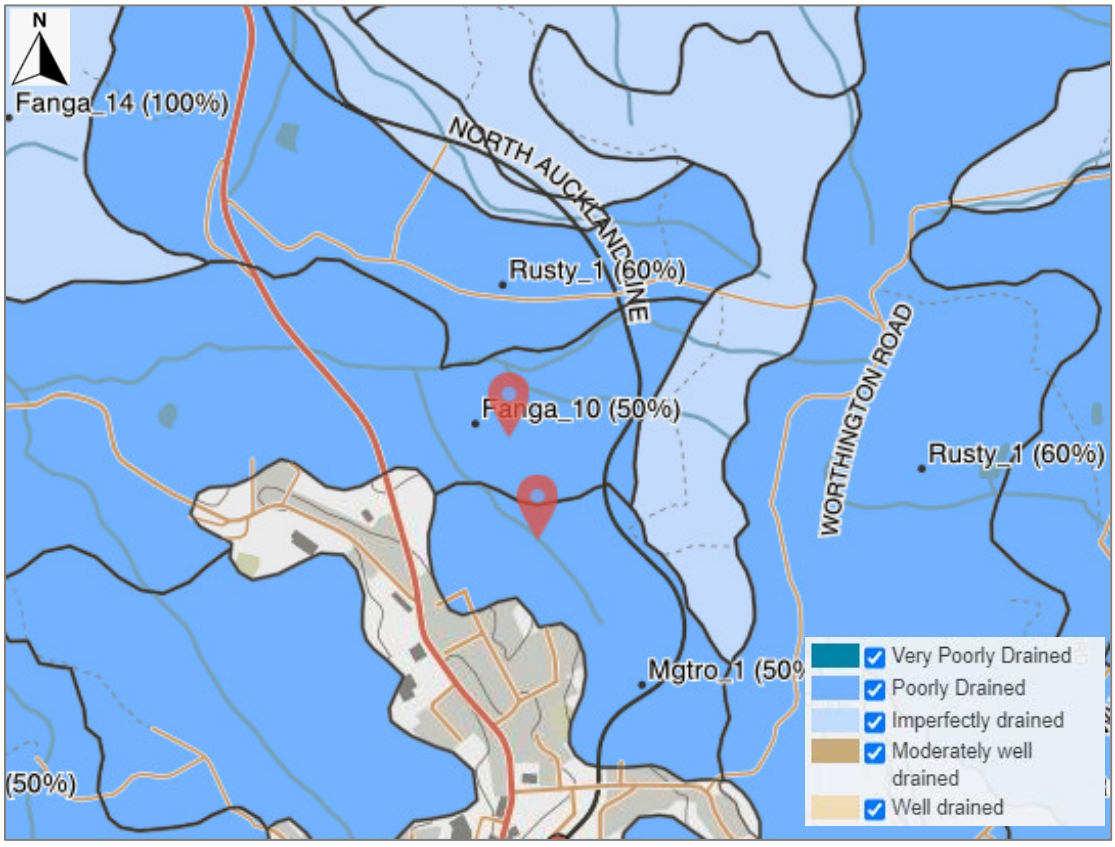


Figure 6: Soil Drainage (Source: S-map)

2.5. Existing drainage features and stormwater infrastructure

2.5.1. Stormwater infrastructure

The primary drainage infrastructure within the PPC area is predominantly provided via existing watercourses and culverts. There are currently several existing private and public culverts/ structures within the PPC area as well as upstream and downstream of the PPC area as shown in Figure 7.

Culverts labelled as 1-3 are located within SH1 whilst culverts/ structures labelled 4-6 are noted to be private. The culverts labelled 7-14 are located along the northern railway line.

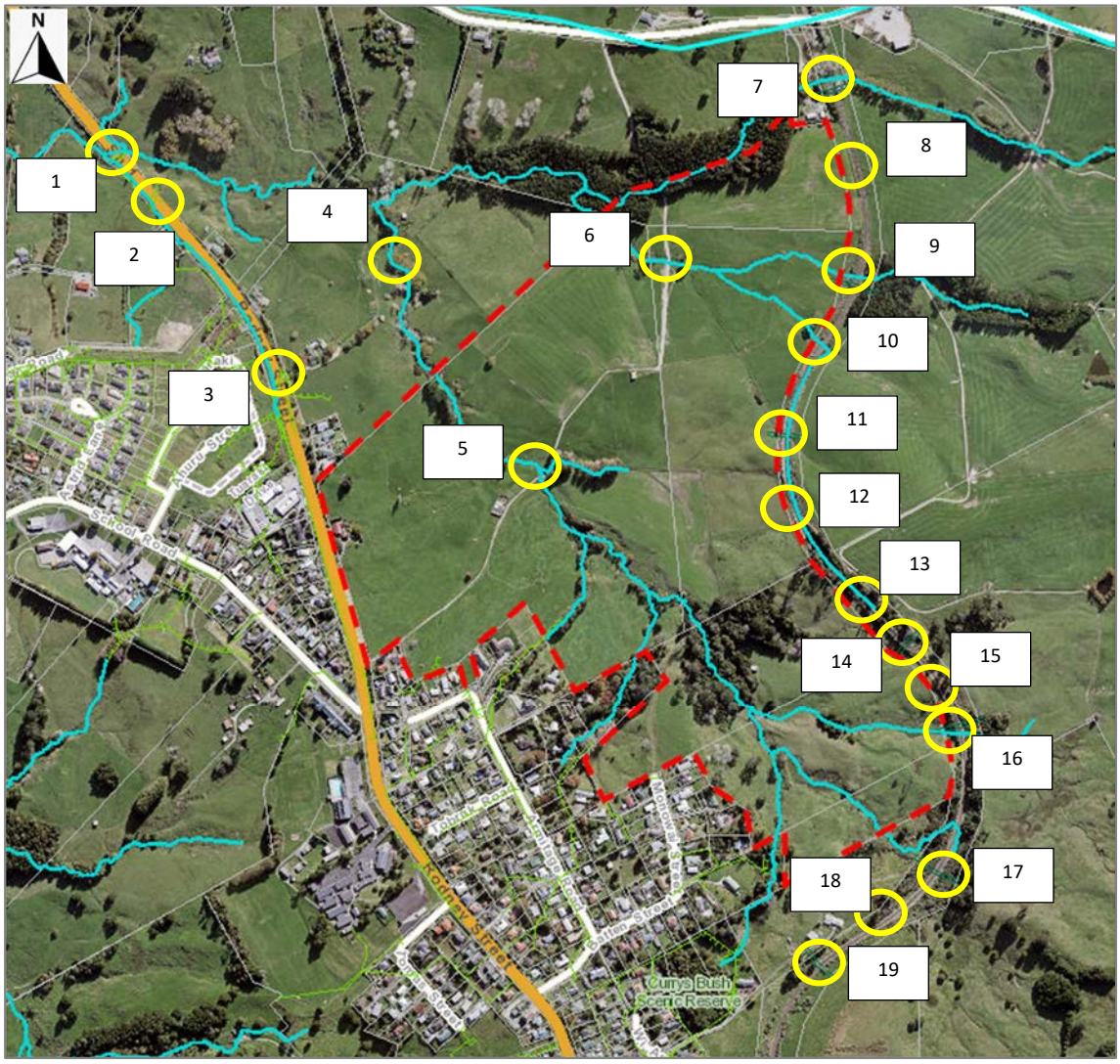


Figure 7: Existing infrastructure (Source: Auckland Council Geomaps)

Woods requested asset information from NZTA, Auckland Council Healthy Waters and Kiwi Rail in regards to the public structures. It is noted culverts/ structures labelled 4-6 are assumed to be private and hence has no public information available.

Auckland Council Healthy Waters have indicated they have no information on the assets other than what is available on Geomaps whilst NZTA and Kiwi Rail have sent through any available information.

Based on the information provided, further survey has been undertaken for key infrastructure. A summary of the information on the key infrastructure is shown in Table 3 below with information and photos of surveyed culverts included in Appendix A.

Table 3: Summary of infrastructure information

Number	Asset type	Asset Owner	Diameter (mm)	Upstream invert level (m RL)	Downstream invert level (m RL)	Source of information	Comments
1	Twin culvert	Waka Kotahi NZTA	2 X 2000	12.725	12.540	Survey Data	-
2	Circular culvert	Waka Kotahi NZTA/ Auckland Transport	450	17.623	17.035	Survey Data	
3	Circular culvert	Waka Kotahi NZTA	450	28.678	27.880	Survey Data	
7	Box Culvert	KiwiRail	1200	35.040	34.774	Survey Data	
8	Circular Culvert	KiwiRail	225	46.392	43.739	Survey Data	
9	Circular Culvert	KiwiRail	450	37.490	36.575	Survey Data	
10	Circular Culvert	KiwiRail	300/375	41.290	39.764	KiwiRail	
11	Circular Culvert	KiwiRail	450	48.932	49.211	Survey Data	
12	Circular Culvert	KiwiRail	225	57.263	49.979	KiwiRail	
13	Circular Culvert	KiwiRail	300	50.455	43.620	Survey Data	
14	Circular Culvert	KiwiRail	300/225	48.980	48.980	KiwiRail	Estimated
15	Circular Culvert	KiwiRail	600	50.125	49.568	Survey Data	
16	Circular Culvert	KiwiRail	450	47.810	46.932	KiwiRail	
17	Circular Culvert	KiwiRail	920	48.178	46.212	KiwiRail	
18	N/A	KiwiRail	300	64.691	61.125	KiwiRail	
19	N /A	KiwiRail	600	65.442	62.182	Auckland Council Geomaps	

2.5.2. Drainage Feature

Auckland Council Geomaps indicates three major watercourses within the PPC area as can be seen in Figure 8. The three watercourses converge to the north of the PPC area draining northwest across the SH1.

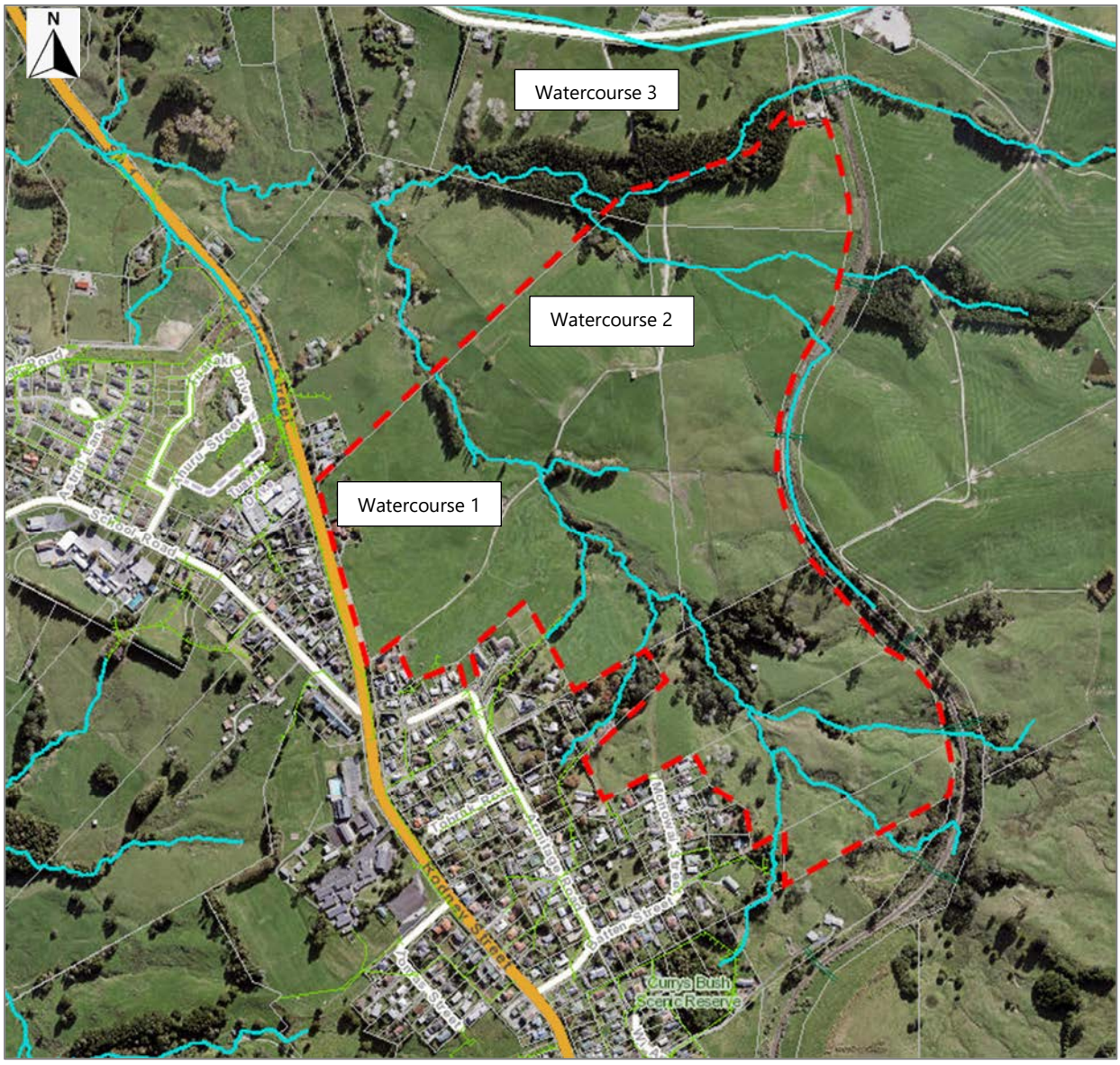


Figure 8: Watercourses (Source: Auckland Council Geomaps)

An Ecological Impact Assessment has been undertaken by Bioresearchers Ltd. Freshwater features, including permanent, intermittent and ephemeral streams and wetland areas have been identified which is shown in Figure 9.

Figure 9: Freshwater features identified on site (source: Bioresearchers Ltd)

The assessment notes S-E, S-L and S-B, are of high ecological value whilst the remainder are of low ecological value. Further information can be found in the Ecological Impacts Assessment submitted with the application.

2.6. Receiving environment

The PPC area is located within the eastern upper reaches of the Kaipara Wellsford catchment discharging to Kaipara Harbour via Oruawharo River as can be seen in Figure 10 below.

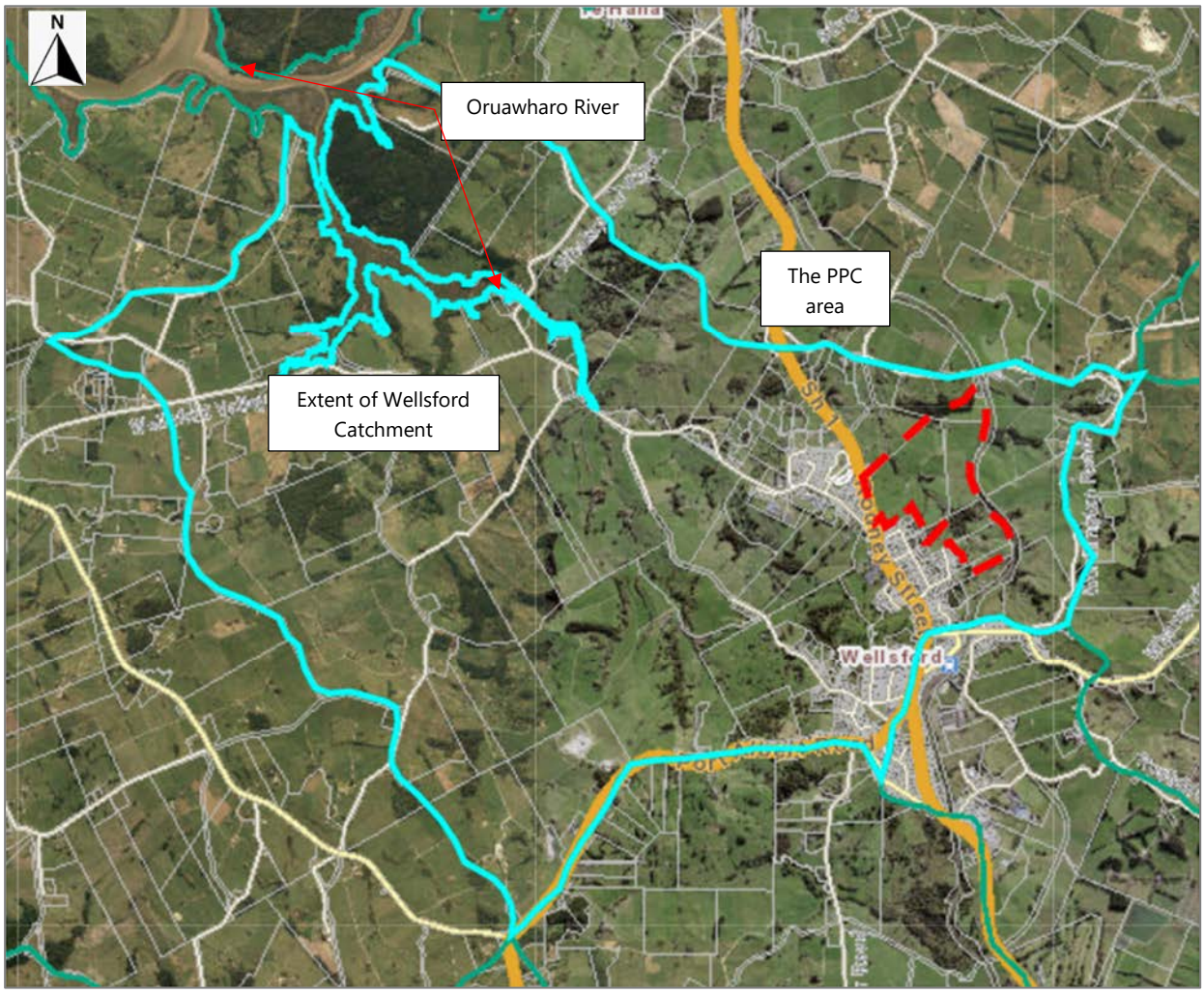


Figure 10: Receiving environment (Source: Auckland Council Geomaps

2.6.1. Oruawharo River

The Oruawharo River flows westward into the Kaipara Harbour west of Wellsford. It forms part of the boundary between the Northland region and the Auckland Region.

The Ecological Impacts Assessment describes Oruawharo River as being a significant high-order stream within Auckland Region.

2.6.2. Kaipara Harbour

Kaipara Harbour is a large enclosed harbour estuary complex connected to the Tasman Sea. Kaipara harbour is the ultimate receiving environment for the subject PPC area and as noted in the Ecological Impacts Assessment, has been negatively impacted by high levels of nutrients and sediments entering the waterways

2.7. Existing hydrological features

The Ecological Impacts assessment identified four wetlands as shown in Figure 9. These have been identified classified using MfE wetland protocols and guidance. The wetlands are noted to be located within existing streams riparian margins/ adjacent to streams.

Further information can be found in the Ecological Impacts Assessment submitted with the application.

2.8. Flooding and flow paths

Auckland Council Geomaps indicates three major overland flow paths (OLFP) and associated floodplains within the PPC area as can be seen in Figure 11. The three overland flow paths converge to the north of the PPC area draining northwest across the SH1 via Culvert 1 where a flood prone area is indicated. The OLFP and associated is noted to be based on the rapid flood hazard assessment of the Auckland Region published in 2008. The updated flood model results could be found in Section 7.

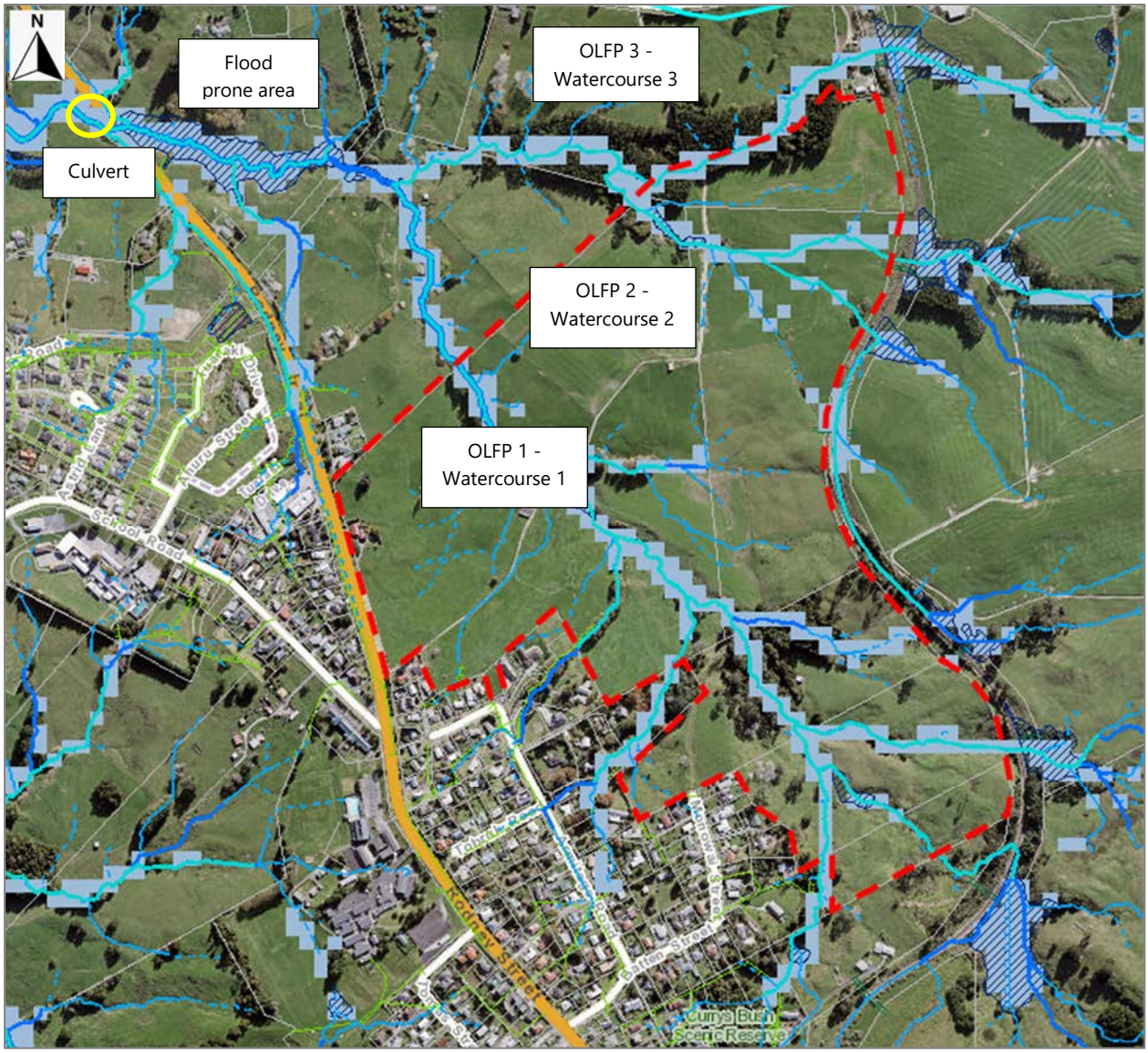


Figure 11: Existing secondary network/ flooding (Source: Auckland Council Geomaps)

2.9. Coastal inundation

The subject site is approximately 38 km east of the Kaipara Harbour. The published flood hazard information in the Auckland Region is documented in Technical Report 2016/017. The stormwater tide elevation adjacent to the subject catchment is shown in Figure 12. The published mean high water spring (MHWS) 10%ile adjacent to the PPC area is shown in Figure 13.

The MHWS and stormwater tide elevation information downstream from the PPC area is shown in Table 4.

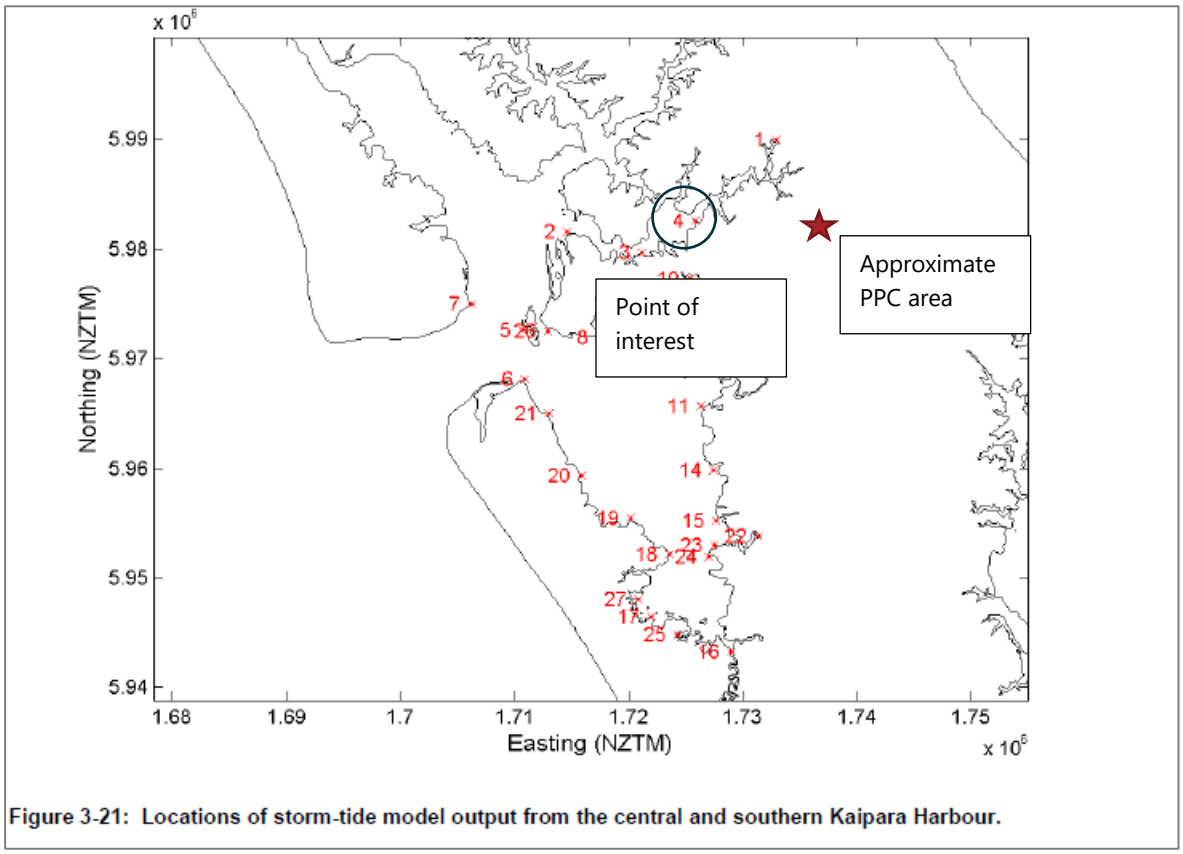


Figure 3-21: Locations of storm-tide model output from the central and southern Kaipara Harbour.

Figure 12: Storm tide model output southern Kaipara Harbour

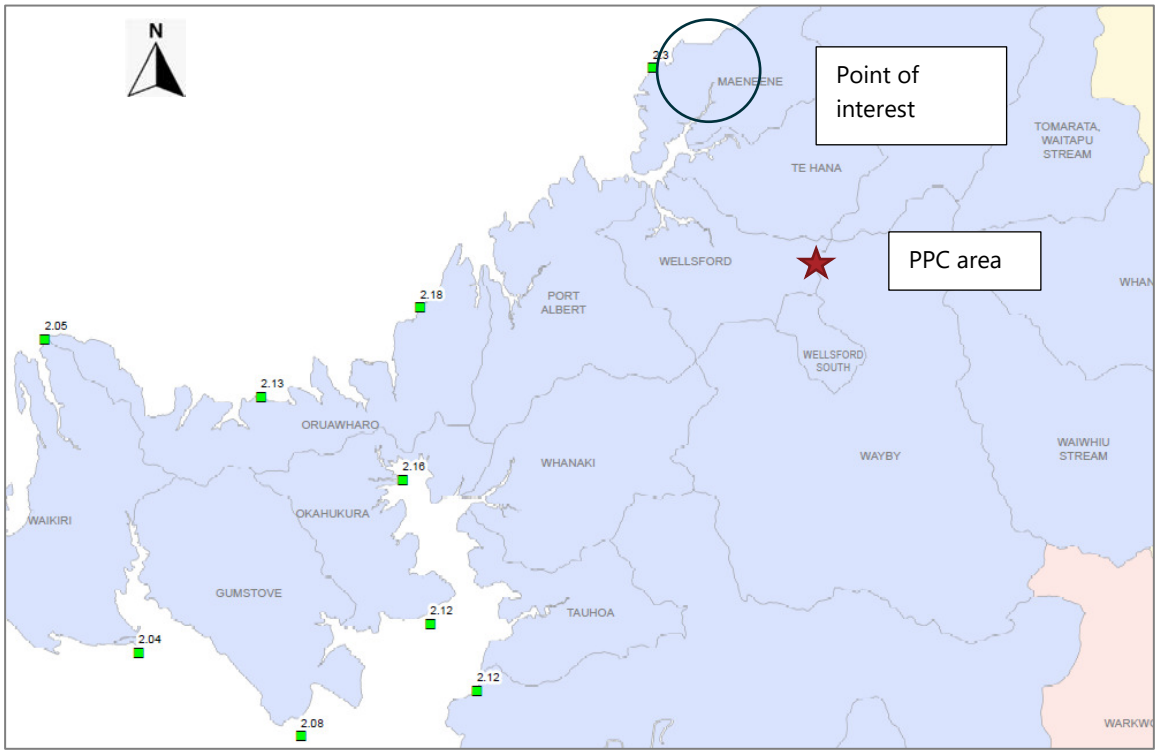


Figure 13: MHWS-Wellsford

Table 4: Costal inundation information

	PPC Area Costal level/ MHWS (AVD-46)
Extreme Sea-level in Kaipara Harbour	2.97 mRL
MHWS	2.3 mRL

2.10. Biodiversity

No significant ecological areas have been identified within the Wellsford North PPC area on the AC GeoMaps AUP management layer.

The stormwater runoff from the subject PPC area ultimately discharges into the Oruawharo River and Kaipara harbour. Oruawharo River is classified as a Significant Ecological Area – Terrestrial as well as a Significant Ecological Area – Marine 2 on the AC GeoMaps AUP management layer.

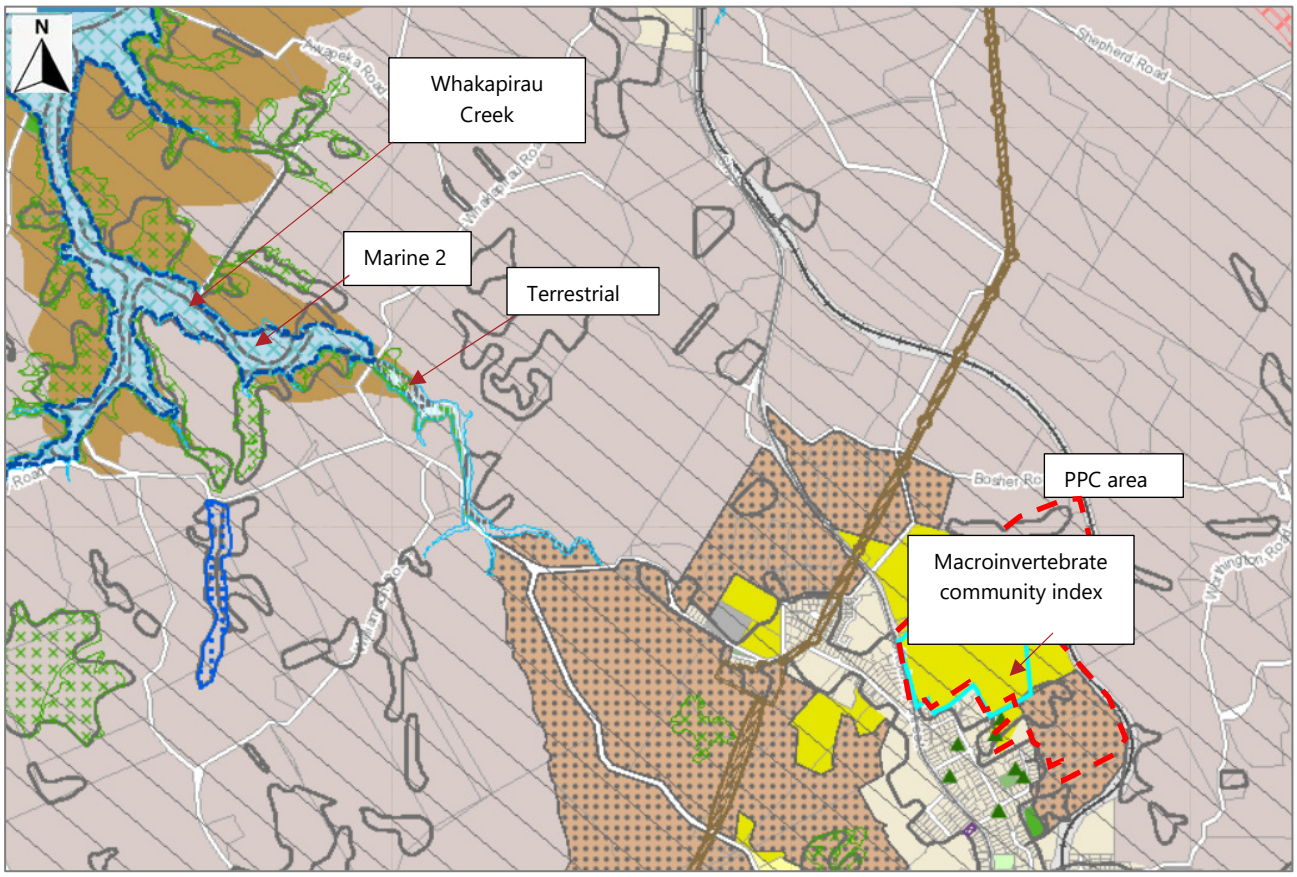


Figure 14: Significant ecological areas – (Sources AC GeoMaps AUP management layer)

Macroinvertebrate community index- exotic and Macroinvertebrate community index- rural are identified within the Wellsford North PPC area on the Auckland Council GeoMaps AUP management layer.

2.11. Cultural and heritage sites

No historical heritage, special character and natural heritage overlayer or places of significance to mana whenua have been identified on the AC GeoMaps AUP management layer within the Wellsford North PPC area. Two notable trees adjacent to the Wellsford North PPC area northern boundary as shown in Figure 15.

Figure 15: Notable trees (Sources AC GeoMaps AUP management layer)

An archaeological assessment has been undertaken which concludes there are no archaeological sites recorded within the PPC area. The area was used for agricultural purposes from the mid 19th century with a few residential subdivisions taking place in the 20th century.

Further information can be found in the Archaeological Assessment report undertaken by Clough & Associated Ltd submitted with the application.

2.12. Contaminated land

A Preliminary Site Investigation (PSI) report has been prepared by Environmental Management Solutions for the site. The report concludes majority of the land within the area is considered fit for intended land sue. However, there are several areas within the area where HAIL activities may have occurred, however detailed site investigations are required prior to site development.

Further information can be found in the Preliminary Site Investigation Wellsford North report submitted with the application.

3. Development summary and planning context

The requirements of the AUP provision and the requirements of the NDC are discussed in detail in the following subsections.

3.1. Regulatory and design requirements

The relevant regulatory and design requirements have been reviewed and listed in Table 5 below. A summary of each listed requirement or policy is presented in sub-sections below.

Table 5: Regulatory and design requirements

Requirement	**Relevant regulatory /design to flow**
Natural resources of the Regional Policy Statement	AUP Chapter B7
Significant ecological areas	AUP Chapter D9
Water quality and integrated management	AUP Chapter E1
Lakes, rivers, streams and wetlands	AUP Chapter E3
Stormwater management devices design	GD01
Application of principles of water sensitive design	GD04
Discharge and diversion	AUP Chapter E8
High contaminant generating areas	AUP Chapter E9
Unitary Plan – SMAF hydrology mitigation	AUP Chapter E10
Existing Catchment Management Plan	N/A
Structure Plan	N/A
Auckland Council Regionwide Network Discharge Consent	Schedule 4
Hydrology in Auckland Region	Auckland Regional Council - Guidelines for Stormwater Runoff Modelling in the Auckland Region – Technical Publication 108 (1999)
Design and Construction of Stormwater systems for Land development and Subdivision	Auckland Council - Auckland Code of Practice: For Land Development and Subdivision (Chapter 4 - Stormwater) (SWCOP)
Diversion, discharges, takes and earthworks associated with freshwater systems (stream and wetlands	Ministry for the Environment Resource Management - National Environmental Standards for Freshwater (2020)
Detail on Stormwater Management including WSD, Flood Risk Management, Freeboard allowance	NZS4404 – Land development and Subdivision infrastructure (2010)

3.1.1. Natural resource of the Regional Policy Statement

AUP Chapter B7 sets out the policies for indigenous biodiversity, freshwater systems, coastal water, freshwater and geothermal water, air.

B7.2.2. Policies

(1) Identify and evaluate areas of indigenous vegetation and the habitats of indigenous fauna in terrestrial and freshwater environments considering the following factors in terms of the descriptors contained in Schedule 3 Significant Ecological Areas – Terrestrial Schedule

(2) Include an area of indigenous vegetation or a habitat of indigenous fauna in terrestrial or freshwater environments in the Schedule 3 of Significant Ecological Areas – Terrestrial Schedule if the area or habitat is significant.

(3) Include an area of indigenous vegetation or a habitat of indigenous fauna in the coastal marine area in the Schedule 4 Significant Ecological Areas – Marine Schedule if the area or habitat is significant.

(4) Avoid adverse effects on areas listed in the Schedule 3 of Significant Ecological Areas – Terrestrial Schedule and Schedule 4 Significant Ecological Areas – Marine Schedule.

B7.3.2. Policies

Integrated management of land use and freshwater systems

(1) Integrate the management of subdivision, use and development and freshwater systems

Management of freshwater systems

(2) Identify degraded freshwater systems.

(3) Promote the enhancement of freshwater systems identified as being degraded to progressively reduce adverse effects.

(4) Avoid the permanent loss and significant modification or diversion of lakes, rivers, streams (excluding ephemeral streams), and wetlands and their margins, unless all of the following apply:

(5) Manage subdivision, use, development, including discharges and activities in the beds of lakes, rivers, streams, and in wetlands,

(6) Restore and enhance freshwater systems where practicable when development, change of land use, and subdivision occur

B7.4.2. Policies

Integrated management

(1) Integrate the management of subdivision, use, development and coastal water and freshwater,

National Policy Statement for Freshwater Management

(2) Give effect to the National Policy Statement for Freshwater Management 2014

(3) Integrate Mana Whenua values, mātauranga and tikanga when giving effect to the National Policy Statement for Freshwater Management 2014

Water quality

(4) Identify areas of coastal water and freshwater bodies that have been degraded by human activities

(5) Engage with Mana Whenua

(6) Progressively improve water quality in areas identified as having degraded water quality through managing subdivision, use, development and discharges

(7) Manage the discharges of contaminants into water from subdivision, use and development to avoid where practicable, and otherwise minimise

Sediment runoff

(8) Minimise the loss of sediment from subdivision, use and development, and manage the discharge of sediment into freshwater and coastal water

Stormwater management

(9) Manage stormwater

Freshwater and geothermal water quantity, allocation and use

(14) Enable the harvesting and storage of freshwater and rainwater to meet increasing demand for water and to manage water scarcity conditions, including those made worse by climate change

3.1.2. Significant ecological areas

AUP Chapter D9 sets out the policies for Significant ecological areas.

D9.3. Policies [rcp/rp/dp]

Managing effects on significant ecological areas – terrestrial and marine

(1) Manage the effects of activities on the indigenous biodiversity values of areas identified as significant ecological areas

(2) Adverse effects on indigenous biodiversity values in significant ecological areas that are required to be avoided, remedied, mitigated or offset

(3) Enhance indigenous biodiversity values in significant ecological areas

(4) Enable activities which enhance the ecological integrity and functioning of significant ecological areas

Vegetation management

(5) Enable the following vegetation management activities in significant ecological areas to provide for the reasonable use and management of land

(6) While also applying Policies D9.3(9) and (10) in the coastal environment, avoid as far as practicable the removal of vegetation and loss of biodiversity in significant ecological areas from the construction of building platforms, access ways or infrastructure

(7) Provide for the role of Mana Whenua as kaitiaki in managing biodiversity, particularly in Treaty Settlement areas, and for cultural practices and cultural harvesting in significant ecological areas where the mauri of the resource is sustained

(8) Manage the adverse effects from the use, maintenance, upgrade and development of infrastructure in accordance with the policies above, recognising that it is not always practicable to locate and design infrastructure to avoid significant ecological areas

Protecting significant ecological areas in the coastal environment

(9) Avoid activities in the coastal environment where they will result in any of the following: please refer to AUP Chapter D9 for information;

(10) Avoid (while giving effect to Policy D9.3(9) above) activities in the coastal environment which result in significant adverse effects, and avoid, remedy or mitigate other adverse effects of activities

(11) In addition to Policies D9.3(9) and (10), avoid subdivision, use and development in the coastal environment where it will result in any of the following: please refer to AUP Chapter D9 for information;

(12) Manage the adverse effects of use and development on the values of Significant Ecological Areas – Marine, in addition to the policies above, taking into account all of the following: please refer to AUP Chapter D9 for information;

(13) In addition to Policies D9.3(9) and (10), avoid structures in Significant Ecological Areas – Marine 1 (SEA-M1)

(14) In addition to Policies D9.3(9) and (10), avoid the extension to, or alteration of, any existing lawful structure in Significant Ecological Areas – Marine 1 (SEA-M1)

(15) Avoid mangrove removal within Significant Ecological Areas – Marine where it will threaten the viability or significance of the ecological values identified.

(16) Avoid mangrove removal within Significant Ecological Areas – Marine 1 (SEAM1) unless the removal

3.1.3. Water quality and integrated management

AUP Chapter E1 sets out the policies for Water quality and integrated management.

E1.3. Policies [rp/rcp/dp]

(1) Manage discharges, until such time as objectives and limits are established in accordance with Policy E1.3(7),

(2) Manage discharges, subdivision, use, and development that affect freshwater systems to: please refer to AUP Chapter E1 for information

(3) Require freshwater systems to be enhanced unless existing intensive land use and development has irreversibly modified them such that it practicably precludes enhancement.

(4) When considering any application for a discharge, the Council must have regard to the following matters

(5) When considering any application for a discharge the Council must have regard to the following matters:

(6) Policies E1.3(4) and (5) apply to the following discharges (including a diffuse discharge by any person or animal):

(7) Develop Freshwater Management Unit specific objectives and limits for freshwater with Mana Whenua, through community engagement, scientific research and mātauranga Māori, to replace the Macroinvertebrate Community Index interim guideline and to give full effect to the National Policy Statement for Freshwater Management

(8) Avoid as far as practicable, or otherwise minimise or mitigate, adverse effects of stormwater runoff from greenfield development on freshwater systems, freshwater and coastal water by: please refer to AUP Chapter E1 for information

(9) Minimise or mitigate new adverse effects of stormwater runoff, and where practicable progressively reduce existing adverse effects of stormwater runoff, on freshwater systems, freshwater and coastal waters during intensification and redevelopment of existing urban areas by all of the following: please refer to AUP Chapter E1 for information

(10) In taking an integrated stormwater management approach have regard to all of the following:

(11) Avoid as far as practicable, or otherwise minimise or mitigate adverse effects of stormwater diversions and discharges, having particular regard to: please refer to AUP Chapter E1 for information

(12) Manage contaminants in stormwater runoff from high contaminant generating car parks and high use roads to minimise new adverse effects and progressively reduce existing adverse effects on water and sediment quality in freshwater systems, freshwater and coastal waters

(13) Require stormwater quality or flow management to be achieved on-site unless there is a downstream communal device or facility designed to cater for the site's stormwater runoff

(14) Adopt the best practicable option to minimise the adverse effects of stormwater discharges from stormwater network and infrastructure including road, and rail having regard to all of the following: please refer to AUP Chapter E1 for information

(15) Utilise stormwater discharge to ground soakage in areas underlain by shallow or highly permeable aquifers provided that: please refer to AUP Chapter E1 for information

(26)) Prevent or minimise the adverse effects from construction, maintenance, investigation and other activities on the quality of freshwater and coastal water by: please refer to AUP Chapter E1 for information

3.1.4. Lakes, rivers, streams and wetlands

AUP Chapter E3 sets out the policies for Lakes, rivers, streams and wetlands.

(1) Avoid significant adverse effects, and avoid where practicable or otherwise remedy or mitigate other adverse effects of activities in, on, under or over the beds of lakes, rivers, streams or wetlands within the following overlays: D4,D5,D6,D9 and D8

(2) Manage the effects of activities in, on, under or over the beds of lakes, rivers, streams or wetlands outside the overlays identified in Policy E3.3(1) by: please refer to AUP Chapter E3 for information.

(3) Enable the enhancement, maintenance and restoration of lakes, rivers, streams or wetlands.

(4) Restoration and enhancement actions, which may form part of an offsetting proposal, for a specific activity should: please refer to AUP Chapter E3 for information.

(5) Avoid significant adverse effects, and avoid, remedy or mitigate other adverse effects of activities in, on, under or over the beds of lakes, rivers, streams or wetlands on: please refer to AUP Chapter E3 for information.

(6) Manage the adverse effects on Mana Whenua cultural heritage that is identified prior to, or discovered during, subdivision, use and development by: please refer to AUP Chapter E3 for information.

(7) Provide for the operation, use, maintenance, repair, erection, reconstruction, placement, alteration or extension, of any structure or part of any structure in, on, under, or over the bed of a lake, river, stream or wetland, and any associated diversion of water, where the structure complies with all of the following: please refer to AUP Chapter E3 for information.

(8) Enable the removal or demolition of any structure or part of any structure in, on, under, or over the bed of a lake, river, stream or wetland, and any associated diversion of water, provided adverse effects are avoided, remedied or mitigated.

(9) Provide for the excavation, drilling, tunnelling, thrusting or boring or other disturbance, and the depositing of any substance in, on or under the bed of a lake, river, stream or wetland, where it complies with all of the following: please refer to AUP Chapter E3 for information.

(10) Enable the planting of any plant, excluding pest species, in, on, or under the bed of a lake, river, stream or wetland where it is suitable for habitat establishment, restoration or enhancement, the maintenance and enhancement of amenity values, flood or erosion protection or stormwater runoff control provided it does not create or exacerbate flooding.

(11) Encourage the planting of plants that are native to the area.

(12) Encourage the incorporation of Mana Whenua mātauranga, values and tikanga in any planting in, on, or under the bed of a lake, river, stream or wetland.

(13) Avoid the reclamation and drainage of the bed of lakes, rivers, streams and wetlands, including any extension to existing reclamations or drained areas unless all of the following apply: please refer to AUP Chapter E3 for information.

(14) Avoid more than minor adverse effects on freshwater and coastal water from livestock grazing.

(15) Protect the riparian margins of lakes, rivers, streams, and wetlands from inappropriate use and development and promote their enhancement to through all of the following: please refer to AUP Chapter E3 for information.

(16)) Protect land alongside streams for public access through the use of esplanade reserves and esplanade strips, marginal strips, drainage reserves, easements or covenants where appropriate and for water quality, ecological and landscape protection purposes.

(17) The loss of extent of natural inland wetlands is avoided, their values are protected, and their restoration is promoted, except where: please refer to AUP Chapter E3 for information.

(18) The loss of river extent and values is avoided, unless the council is satisfied

3.1.5. Water sensitive design (GD04)

GD04 is a guidance document by Auckland Council which introduces principles and objectives for Water Sensitive Design (WSD). These include inter-disciplinary design approach, using at-source stormwater management practices to mimic natural systems and protect functions of natural ecosystems. WSD approaches focus on reducing or eliminating stormwater runoff generation through source control and utilising natural systems and processes to manage stormwater quantity and quality effects. The objectives include:

- Reducing stormwater runoff - reduce stormwater runoff volume and peak flow to predevelopment levels.
- Managing stormwater quality - manage stormwater quality to avoid adverse environmental effects.
- Minimising soil disturbance - minimise sediment in stormwater runoff, especially during construction, and protect site soil resources from modification.
- Promoting ecosystem health - promote the health of regional ecosystems and their associated environmental services through the management of stormwater at the catchment and site scale.
- Delivering best practice - deliver best practice urban design and broader community outcomes as part of stormwater management delivery.
- Maximising return on investment - achieve maximum value from stormwater management through the consideration of a broad range of benefits.

3.1.6. Discharge and diversion

AUP Chapter E1 and E2 sets out the policies for stormwater discharge and diversion. All permitted activities, controlled activities and restricted discretionary activities must meet the following standards, except for activity E8.4.1(A1) Stormwater runoff from lawfully established impervious areas directed into an authorised stormwater network or a combined sewer network.

(1) The design of the proposed stormwater management device(s) must be consistent with any relevant precinct plan that addresses or addressed stormwater matters.

(2) The diversion and discharge must not cause or increase scouring or erosion at the point of discharge or downstream.

(3) The diversion and discharge must not result in or increase the following:

(a) flooding of other properties in rainfall events up to the 10 per cent annual exceedance probability (AEP);

(b) inundation of buildings on other properties in events up to the 1 per cent annual exceedance probability (AEP).

(4) The diversion and discharge must not cause or increase nuisance or damage to other properties.

3.1.7. High contaminant generating areas

AUP Chapter E1 sets out the policies for Stormwater quality – High contaminant generating car parks and high use roads. All activities listed as permitted in Table E9.4.1 Activity table must comply with Standard E9.6.1.1 and the specified permitted activity standards for the activity.

Standard E9.6.1.1. General

(1) Any required stormwater management device or system is built generally in accordance with design specifications and is fully operational within three months of commencement of the high contaminant generating car park or high use road. (2) 'As built' plans for any required stormwater management device or system are provided to the Council within three months of the practical completion of the works.

(2) Any required stormwater management device or system is operated and maintained in accordance with best practice for the device or system.

3.1.8. Hydrological mitigation

The subject PPC area is green field development, as per requirements under Schedule 4 of Network Discharge Consent, A method of achieving equivalent hydrology to pre-development (grassed state) levels is to:

- Provide retention (volume reduction) of a minimum of 5mm runoff depth for all impervious areas; and
- Provide detention (temporary storage) with a drain down period of 24 hours for the difference between the pre-development (grassed state) and post-development runoff volumes from the 95th percentile, 24 hour rainfall event minus the retention volume for all impervious areas.

3.1.9. Natural Hazards and flooding

Section E36 sets out the policies for Natural hazards and flooding.

E36.3. Policies

(1) Identify land that may be subject to natural hazards, taking into account the likely effects of climate change, including all of the following: please refer to AUP Chapter E1 for information

(2) Investigate other natural hazards to assess whether risks to people, property or the environment should be managed through the Plan or otherwise.

(3) Consider all of the following, as part of a risk assessment of proposals to subdivide, use or develop land that is subject to natural hazards: please refer to AUP Chapter E1 for information

(4) Control subdivision, use and development of land that is subject to natural hazards so that the proposed activity does not increase, and where practicable reduces, risk associated with all of the following adverse effects:

Floodplains in urban areas

(13) In existing urban areas require new buildings designed to accommodate more vulnerable activities to be located: (a) outside of the 1 per cent annual exceedance probability (AEP) floodplain; or (b) within or above the 1 per cent annual exceedance probability (AEP) floodplain where safe evacuation routes or refuges are provided.

(14) Require redevelopment of sites where existing more vulnerable activities are located within the 1 per cent annual exceedance probability (AEP) floodplain to address all of the following; please refer to AUP Chapter E1 for information

(15) Within existing urban areas, enable buildings containing less vulnerable activities to locate in the 1 per cent annual exceedance probability (AEP) floodplains where that activity avoids, remedies or mitigates effects from flood hazards on other properties.

3.1.10. Network Discharge Consent

A regionwide resource consent (NDC) has been granted by the Auckland Council to use best practice to manage all public stormwater discharges across Auckland region to protect the environment, people and property - and improve water quality. NDC Schedule 4 sets out the connection's requirements for Greenfields development. A stormwater management plan will be required to be prepared addressing all Schedule 4 matters.

Water quality

- Treatment of all impervious areas by a water quality device designed in accordance with GD01/ TP10 for relevant contaminants.

Stream Hydrology

The site is not located within a Stormwater Management Area Flow (SMAF) overlay as per the AUP: OiP. However, as the site discharges to a stream, the following is required:

- Achieve equivalent hydrology (infiltration, runoff volume, peak flow) to pre-development (grassed state) levels:
    - Provide retention (volume reduction) of a minimum of 5mm runoff depth for all impervious surfaces; and
    - Provide detention (temporary storage) with a drain down period of 24 hours for the difference between pre-development (grassed state) and post-development runoff volumes from the 95th percentile, 24-hour rainfall event minus the retention volume for all impervious areas.

Flooding – Property/ pipe capacity 10% AEP event

- Ensure sufficient capacity in downstream network
- As there are currently no piped stormwater network within the PPC area, the proposed network will be designed in accordance with Auckland Council Stormwater Code of Practice

Flooding – Buildings 1% AEP event

- To be developed to Auckland Council Stormwater Code of Practice

If the above requirements on water quality, stream hydrology and flooding cannot be met, then an alternative level of mitigation can be determined through a SMP that:

- Applies an Integrated Stormwater Management Approach
- Meets the NDC Objectives and Outcomes in Schedule 2
- Is the BPO for the given project.

3.1.11. National Policy Statement of Freshwater Management

The National Policy Statement (NPS) for Freshwater 2020 provides local authorities with updated direction on how they should manage freshwater under the Resource Management Act 1991. This NPS comes into force on 3 September 2020. The NPS sets out the following policies:

(1) Freshwater is managed in a way that gives effect to Te Mana o te Wai.

(2) Tangata whenua are actively involved in freshwater management (including decision making processes), and Māori freshwater values are identified and provided for.

(3) Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.

(4) Freshwater is managed as part of New Zealand's integrated response to climate change.

(5) Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.

(6) There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.

(7) The loss of river extent and values is avoided to the extent practicable.

(8) The significant values of outstanding water bodies are protected.

(9) The habitats of indigenous freshwater species are protected.

(10) The habitat of trout and salmon is protected, insofar as this is consistent with Policy 9.

(11) Freshwater is allocated and used efficiently, all existing over-allocation is phased out, and future over-allocation is avoided.

(12) The national target (as set out in Appendix 3) for water quality improvement is achieved.

(13) The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends. 10 National Policy Statement for Freshwater Management 2020

(14) Information (including monitoring data) about the state of water bodies and freshwater ecosystems, and the challenges to their health and well-being, is regularly reported on and published.

(15) Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement.

3.1.12. National Policy Statement on Urban Development

The NPS-Urban Development (UD) aims to ensure that New Zealand's towns and cities are well-functioning urban environments that meet the changing needs of our diverse communities. Major policies in the NPS-UD are the following:

- Intensification: Council plans will need to enable (but not require) greater height and density, particularly in areas of high demand and access.
- Carparking: Councils will no longer be able to require developers to provide car parking through their district and city plans. However, develops can still provide car parking if they wish. Mobility parking is not affected by this direction.
- Responsiveness: Council must consider private plan changes where they would add significantly to development capacity, good outcomes and are well connected by transport corridors.
- Winder outcomes Councils are directed to giver greater consideration to ensuring that cities work for all people and communities. Particular focus is given to access, climate change and housing affordability.

4. Mana whenua

Engagement correspondence was sent to the nine iwi authorities who have expressed interest in the Plan Change area on 20 July 2021, outlining the details of the proposal. A response was received from both Ngāti Manuhiri and Ngāti Wai. Representatives of these iwi were met on the site on Wednesday 16 February 2022. Ngāti Manuhiri raised no direct concerns with the proposal verbally and have provided a cultural values assessment report. Ngāti Wai raised no direct concerns with the proposal verbally and did not indicate whether they wish to provide written feedback.

Consultation will be ongoing with both iwi, and it is the intention that they will have the opportunity for consultation and involvement as the development progresses.

5. Stakeholder engagement and consultation

Consultation has been undertaken with various stakeholders with the consultation relevant to stormwater summarised in Table 6 below.

Table 6: Stakeholder engagement

Stakeholders	What is the reason for interest?	What engagement has been completed?	Feedback and response
Auckland Council - Healthy Waters	Early consultation with Healthy Waters. Introduction of project and proposed plan change. Overview of modelling work done to date and SW strategy.	Pre lodgement meeting held on 06/04/2022	In general, Healthy Waters were favourable of the strategy proposed and modelling undertaken, however would need to review the modelling and SMP to provide further comments. A few queries were raised and additional model scenarios were requested to be simulated (i.e., without climate change) to understand if effects are a result of climate change or development. Woods have simulated the additional scenarios which is discussed further in Section 7. It is noted consultation with Healthy Waters is ongoing.
Waka Kotahi NZTA	Project introduction, Outline work done to date and findings, namely in relation to hazards identified on State Highway 1.	Meeting held on 21/04/2022	Hazards on State Highway 1 were agreed to be an existing risk with the proposed development not causing any additional adverse effects with mitigation not required. Model information and associated reporting was required to provide additional comments. Consultation is ongoing.

Relevant minutes and presentations are included in Appendix B for reference.

It is noted consultation with Auckland Transport, Auckland Council Parks and Community Facilities is ongoing.

6. Proposed development

The Wellsford North Plan Change seeks to rezone 52.3ha of Future urban, Residential – Single House and Rural – Countryside Living zoned land to Residential – Mixed Housing Suburban zone (34.1ha), Residential – Mixed Housing Urban zone (6.2ha), Residential Large Lot zone (11.1ha) and Business – Neighbourhood Centre zone (0.9ha). The Plan Change also seeks to apply the Subdivision Variation Control to the 11.1ha area zoned Residential – Large Lot zone, to specify a minimum new site area of 3,000m^2.

An extent of the PPC area is shown in Figure 16 below.

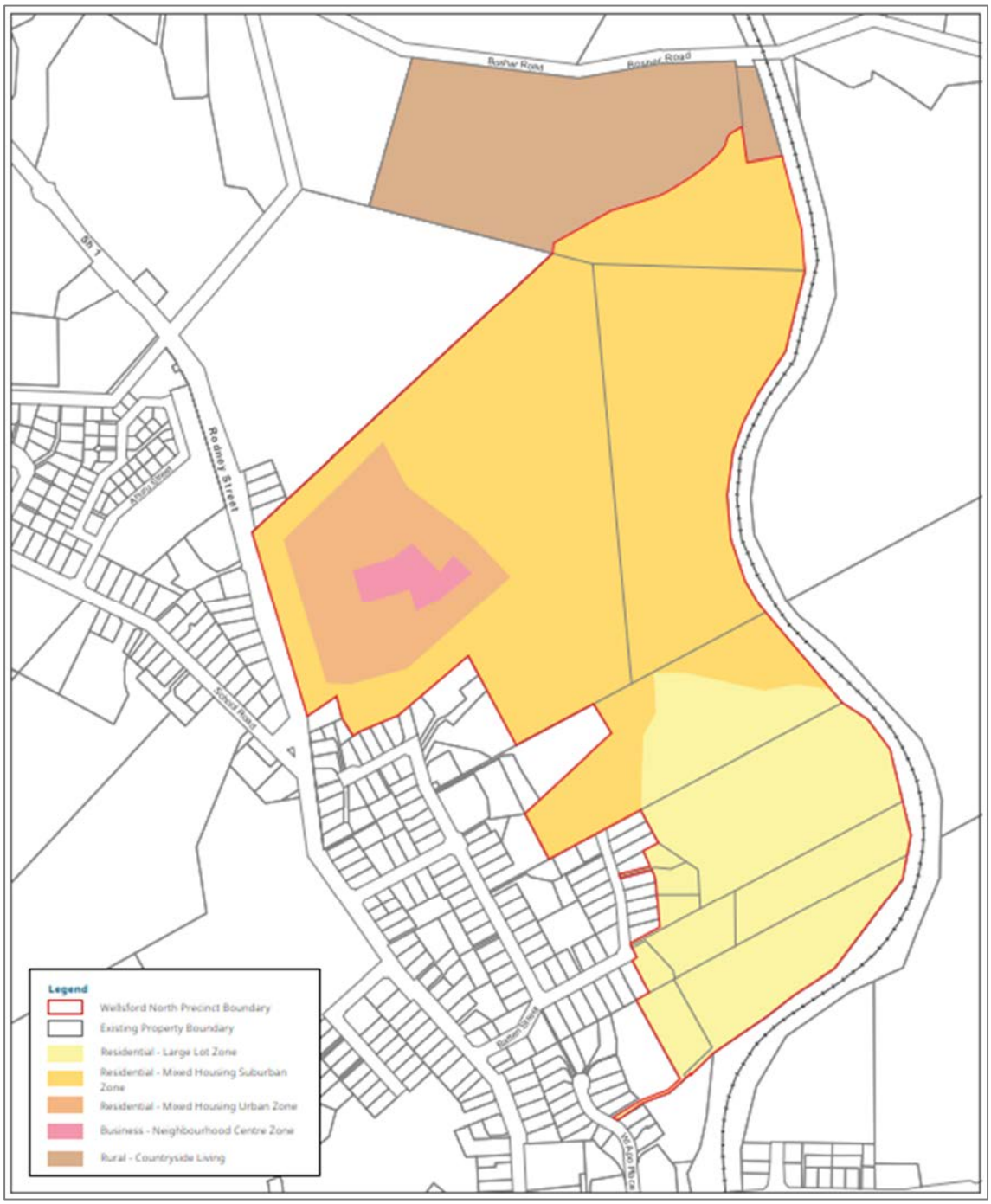


Figure 16: Wellsford North Plan Change

The Wellsford North Structure Plan applies to approximately 77.5ha of land north and east of the existing Wellsford urban area. The Structure Plan has been prepared for the entire area of land zoned Future Urban north of Wellsford, as well as adjacent land zoned Residential – Single House, Rural – Countryside Living and Rural – Rural Production zone and is outlined in Figure 17 below. The extent of the PPC area is located within the Wellsford North Structure Plan area.

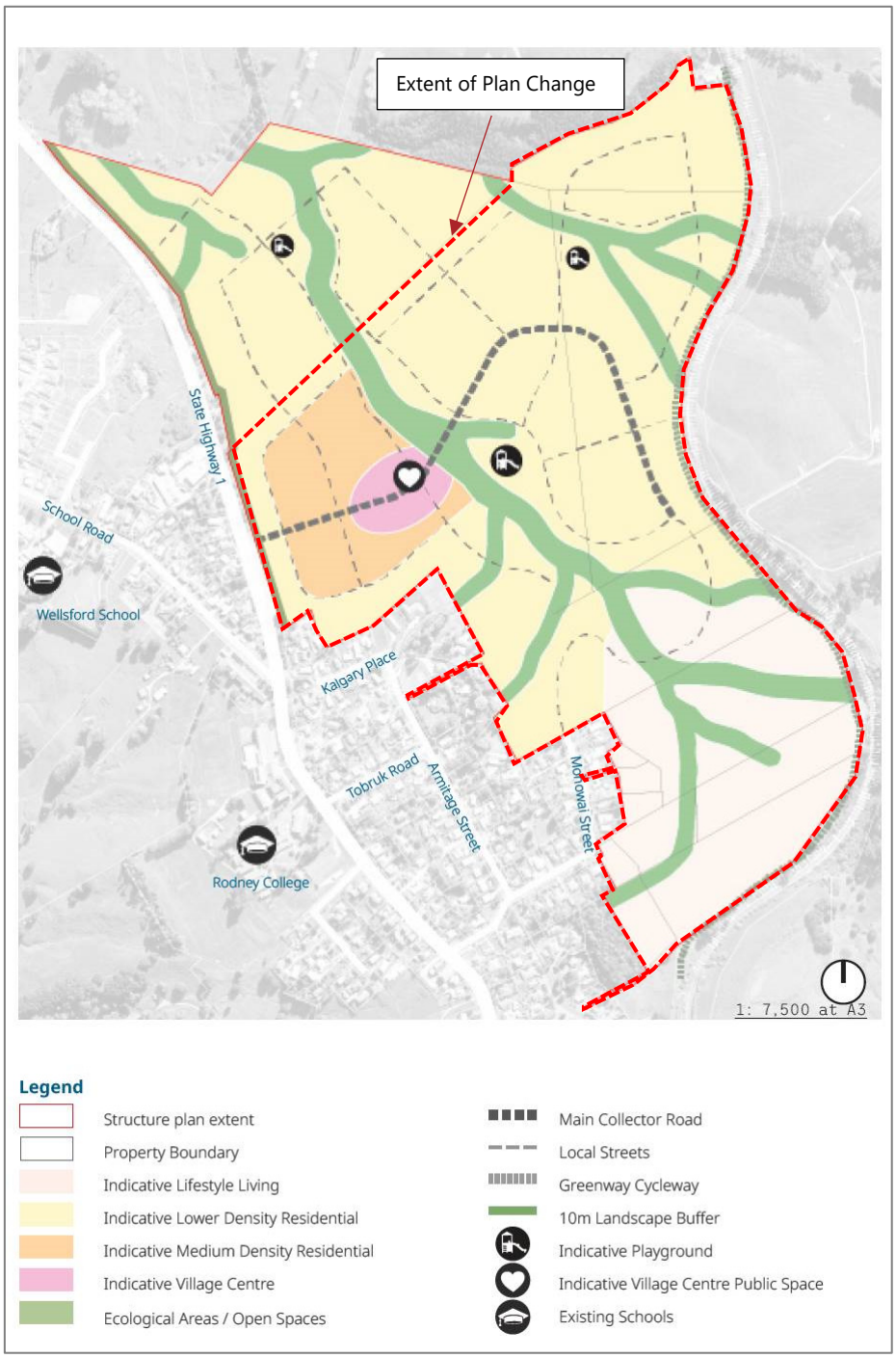


Figure 17: Wellsford North Structure Plan

Flood modelling has been undertaken for the PPC area as well as the Structure Plan area which is detailed in Section 7.

7. Flooding

Woods have undertaken preliminary flood modelling for the PPC and surrounding areas. A preliminary assessment on capacity has been undertaken on key infrastructure, namely Culvert 1 as discussed in 2.5.1.

The flood model has been developed using InfoWorks ICM version 2021. The 1D/ 2D model represents the most relevant open channels in the catchment as 1D river reaches elements, and these were linked to the 1D stormwater network together with 2D mesh surface in the same interface.

Modelling was undertaken for 2-year, 10-year and 100-year ARI scenarios (inclusive of climate change). Following discussions with Healthy Waters, 10- and 100- year ARI scenarios with no climate change has also been simulated.

An overview of scenarios simulated is provided in Table 7 below.

Table 7: Modelled Scenarios

Scenario		Land use	Rainfall	Purpose
Pre-development/ existing development	ED	Existing impervious coverage	2-, 10- 100-year - 3.8°C	Create a base line scenario with 3.8 °C climate change factor. Understand existing deficiencies in infrastructure and effects i.e., SH1 Use as a comparative model to compare relevant post development PPC models.
			10- 100-year - no CC	Create a base line scenario for no climate change
Post-development	ED + PPC	Existing impervious coverage + Private Plan Change (MPD)	2-, 10- 100-year - 3.8°C	Create a base line scenario with 3.8 °C climate change factor. Understand deficiencies in infrastructure and effects i.e., SH1 as a result of PPC. Understand and isolate effects as a result of development within the PPC area only with neighbouring areas at the existing development.
			10- 100-year - no CC	Create a base line scenario for no climate change and to isolate if effects (if any) are a result of climate change or development
Post-development (MPD)	MPD + PPC	Maximum probable development (MPD as per AUP: OiP) + Private Plan Change	2-, 10- 100-year - 3.8°C	Create a base line scenario with 3.8 °C climate change factor Understand deficiencies in infrastructure and effects i.e., SH1 as a result of PPC and MPD coverages Understand cumulative effects as a result of development within the PPC area and MPD coverages in other areas
			10- 100-year - no CC	Create a base line scenario for no climate change and to isolate if effects (if any) are a result of climate change or development.

7.1. Model build

The parameters and data used in the ICM models are presented in the 'Model Build' memorandum included in Appendix C.

The modelled extent is shown in Figure 18 below.

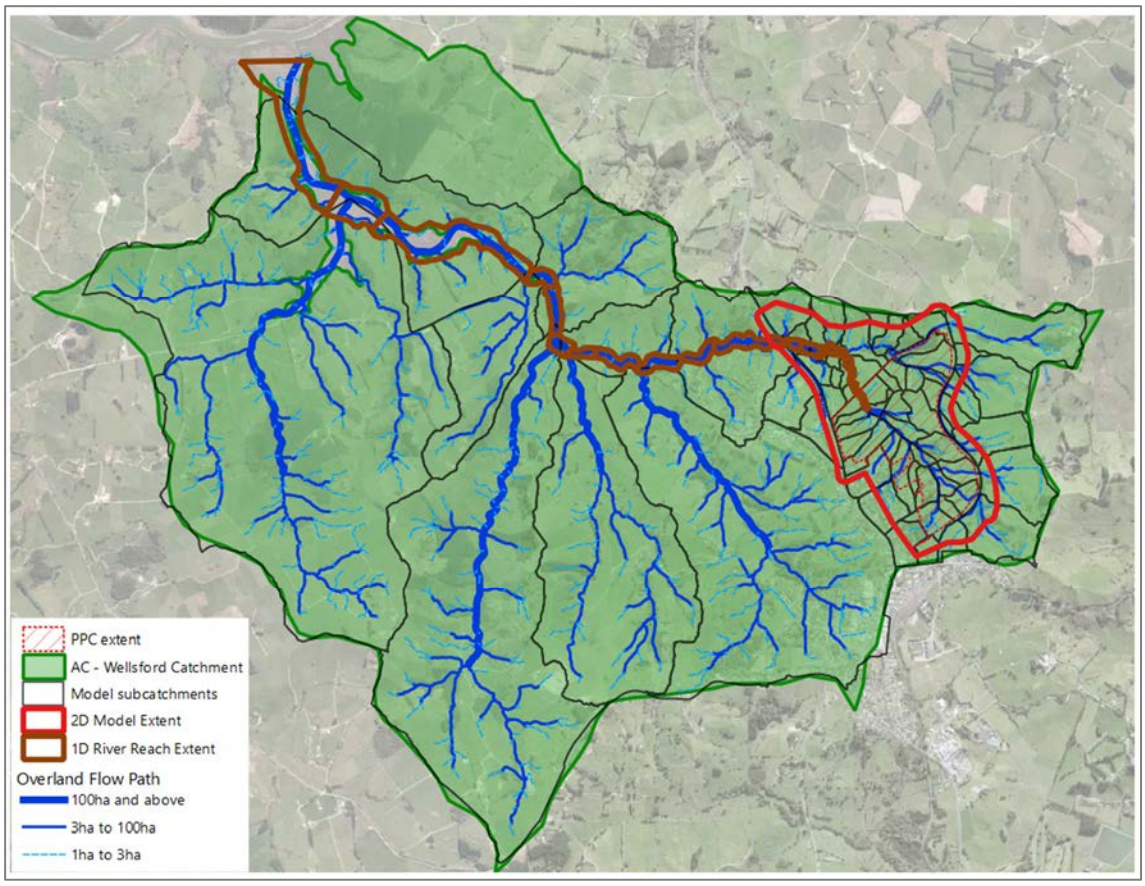


Figure 18: Model extent

7.2. Model Results

Model results were analysed to extract flood extents and the maximum flood depths for each scenario to better understand flood risk in the pre-and post-development scenarios. Afflux plans, indicating differences between depths, were generated to understand the differences in flood impacts.

As can be seen in Figure 18, the modelled extent includes areas downstream of the PPC area discharging to Oruawharo River. However, only model results within the PPC area is discussed in the subsequent sections as there were no observed differences downstream of State Highway 1. Flood depth increases of up to 100mm were noted for some scenarios, however, these were limited to the stream with no increase in flood extents.

A complete set of modelled extents and results of all scenarios are included in Appendix D, with key results discussed in sections below.

It is noted that the masterplan shown in the model results is indicative only and riparian margins shown are subject to change and align with the proposed flood extents. This will be refined at the detailed design stage.

7.2.1. Post-development scenario – Existing development + Private Plan Change

These scenarios were simulated to understand and isolate any effects as a result of development within the PPC area only with neighbouring areas at existing development as can be seen in Figure 19 below.

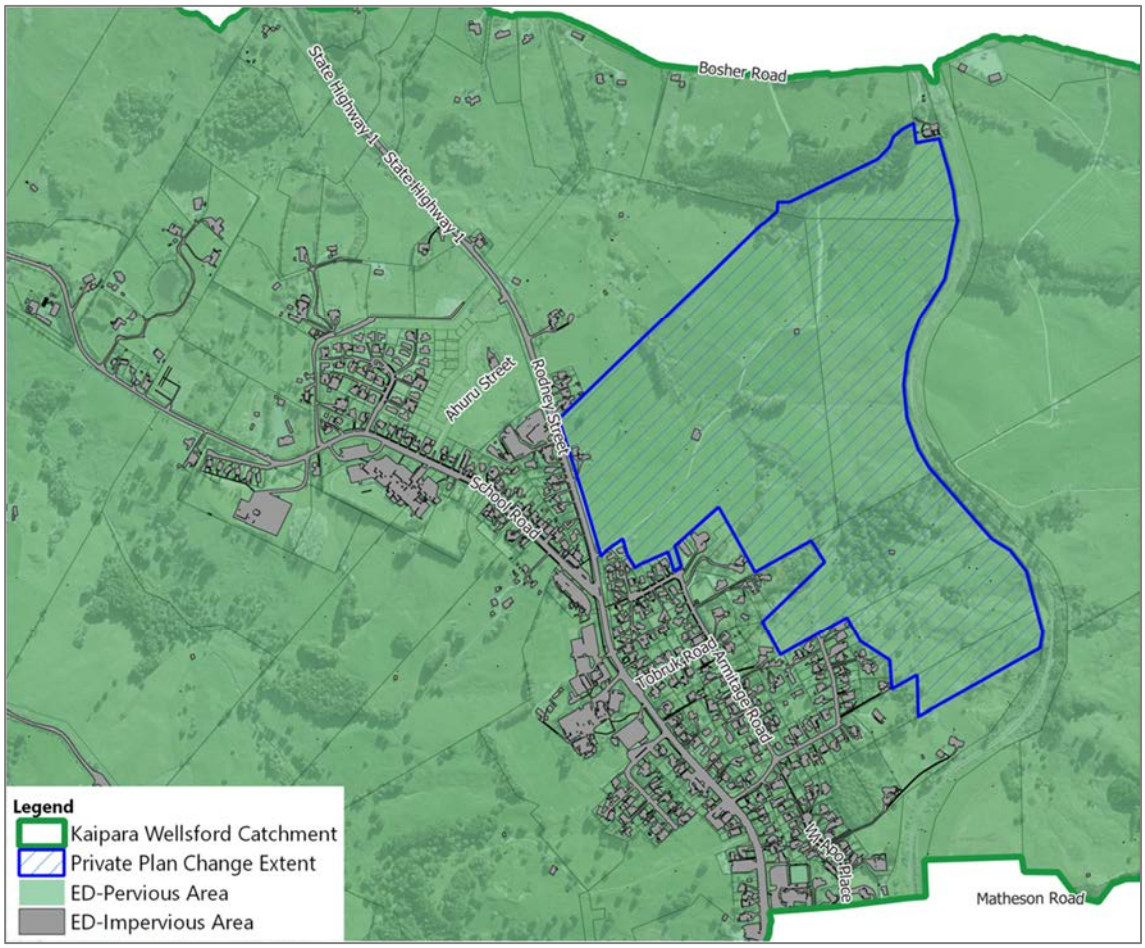


Figure 19: Existing development + Private Plan Change

Flood depth plots for the 100-year event with and without CC is shown in Figure 20 and Figure 21.

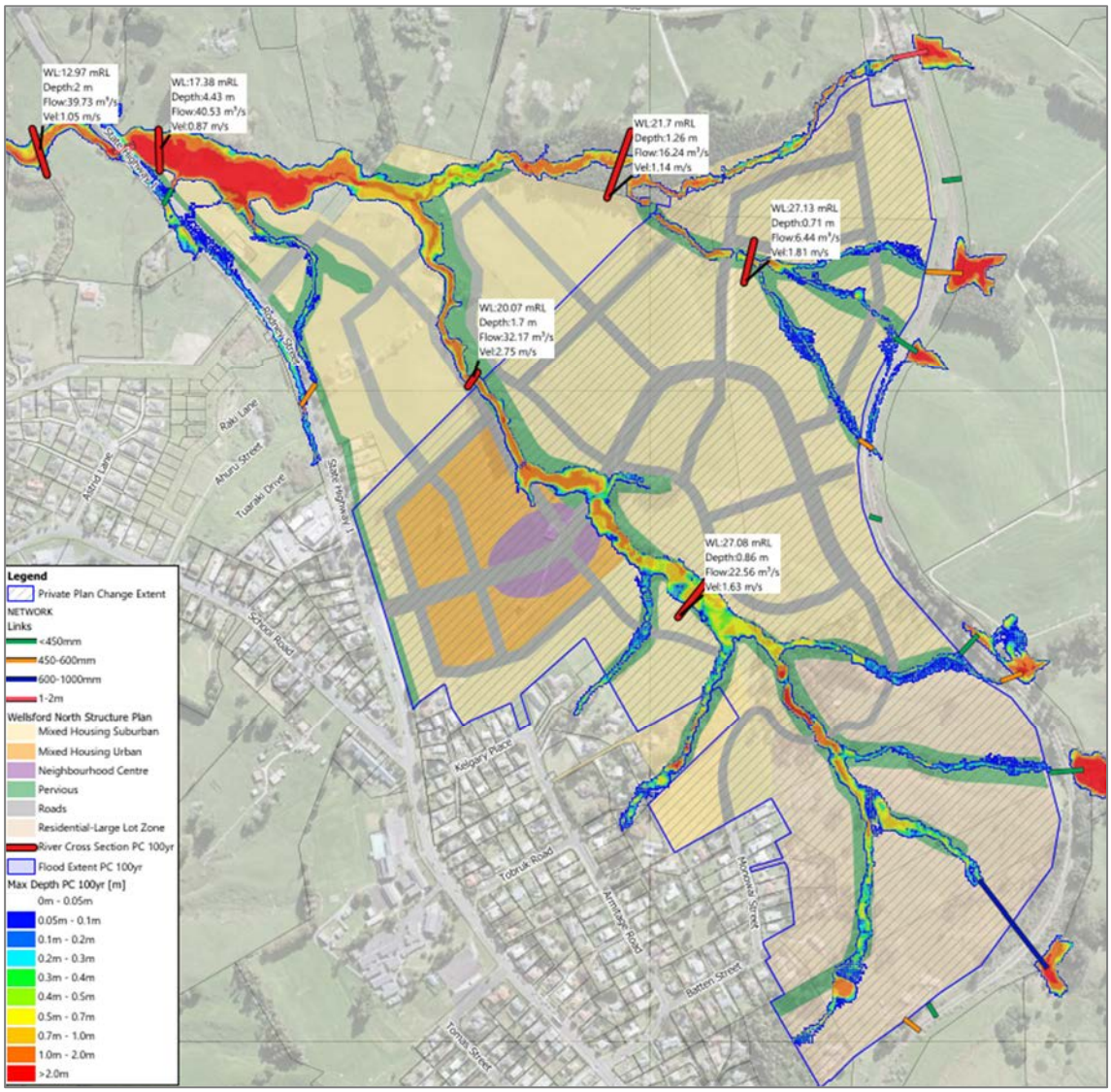


Figure 20: Flood depth- ED + PPC 100yr (No CC)

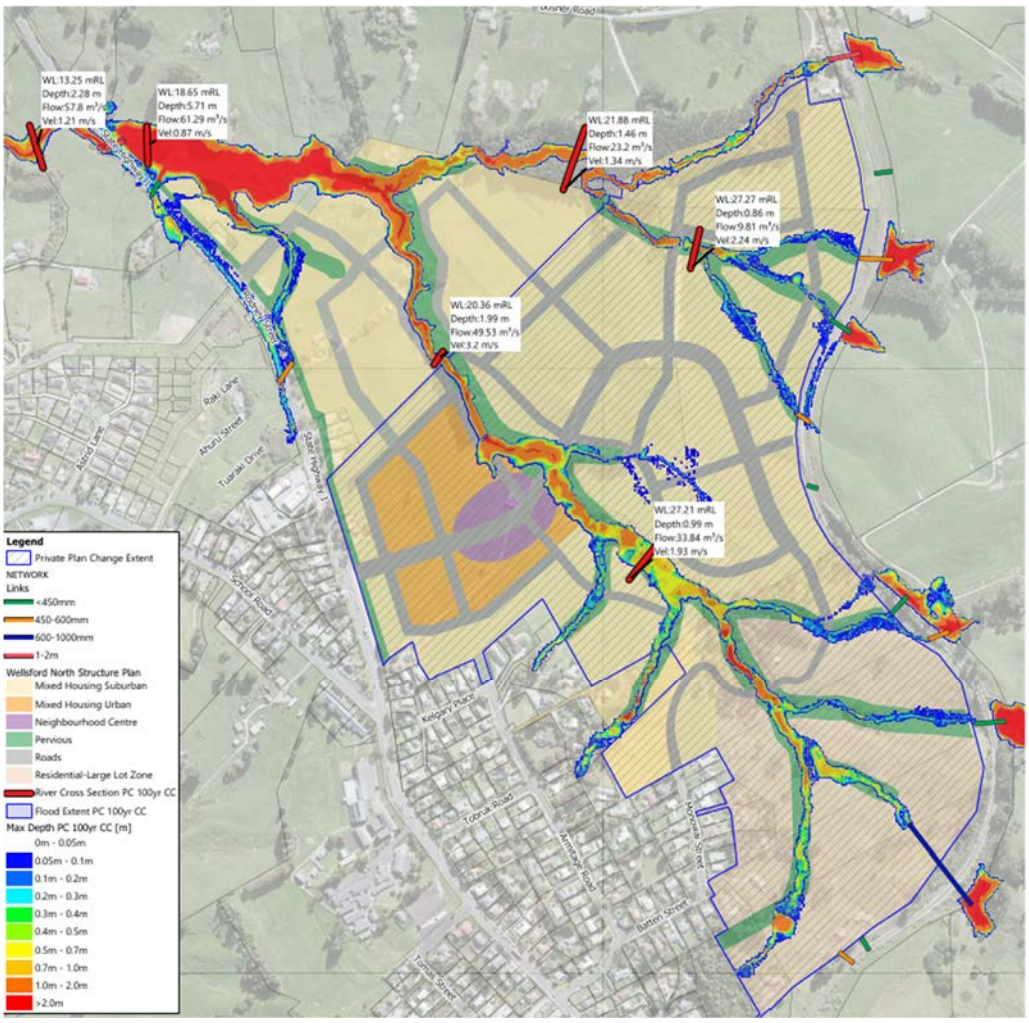


Figure 21: Flood depth- ED + PPC 100yr (3.8^{0}C CC)

The afflux plots indicating differences between existing development and PPC, for the 100-year events with and without CC is shown in Figure 22 and Figure 23.

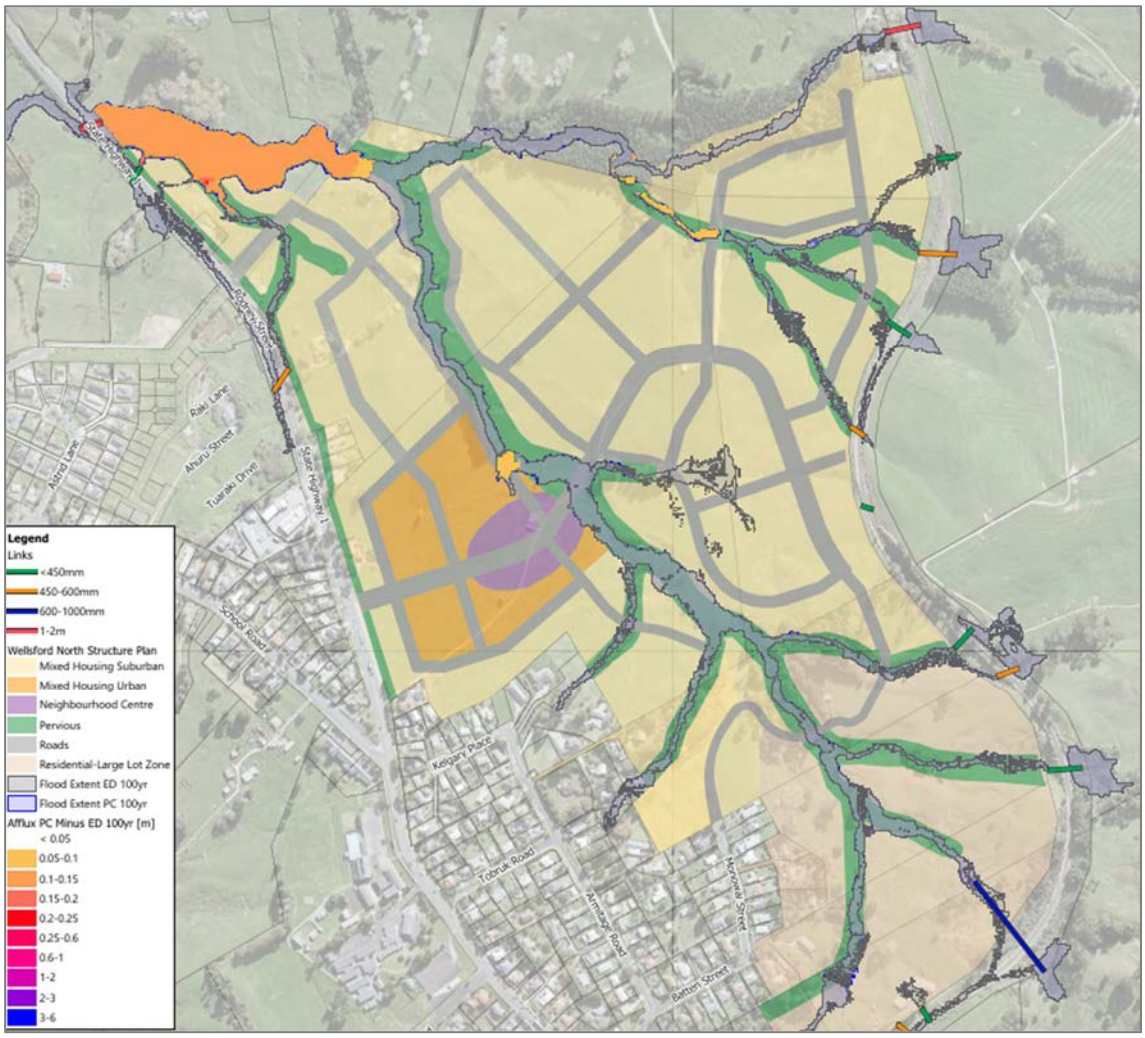


Figure 22: 100-year afflux between pre-development and ED + PPC scenario (No CC)

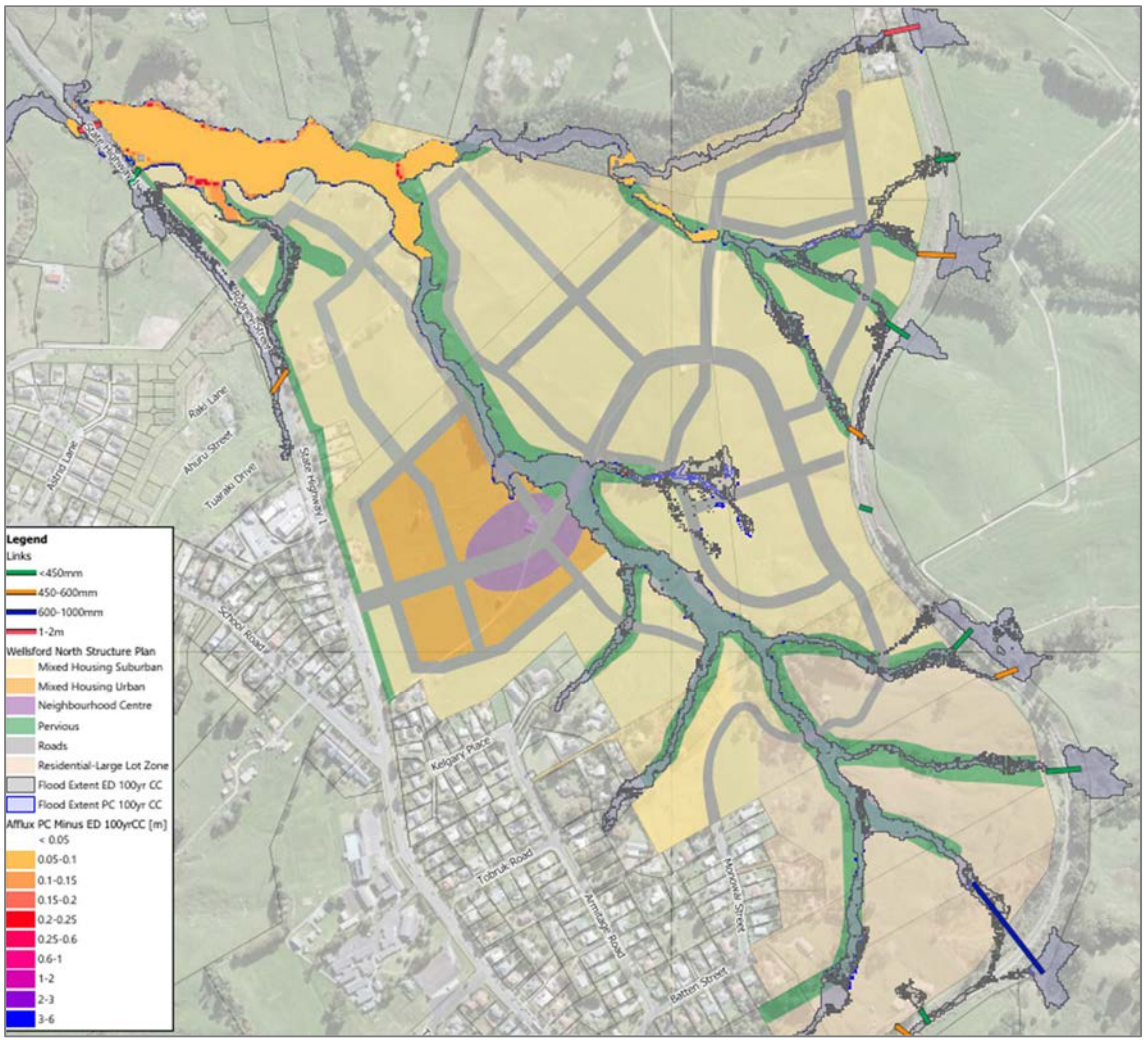


Figure 23: 100-year afflux between pre-development and ED + PPC scenario (3.8^{0}C CC)

The model results indicate that the flood extents are largely similar between the modelled scenarios, and the flooding is contained within the stream areas. This is as expected given the topography of the surrounding landform and typical stream profiles being generally well incised.

The flood depth results and afflux plots for the 10- and 2-year events is included in Appendix D.

7.2.2. Post-development scenario – Maximum Probable Development + Private Plan Change

These scenarios were simulated to understand any cumulative effects as a result of development within the PPC area with neighbouring areas at MPD coverages (permitted as per AUP: OiP) as can be seen in Figure 24.

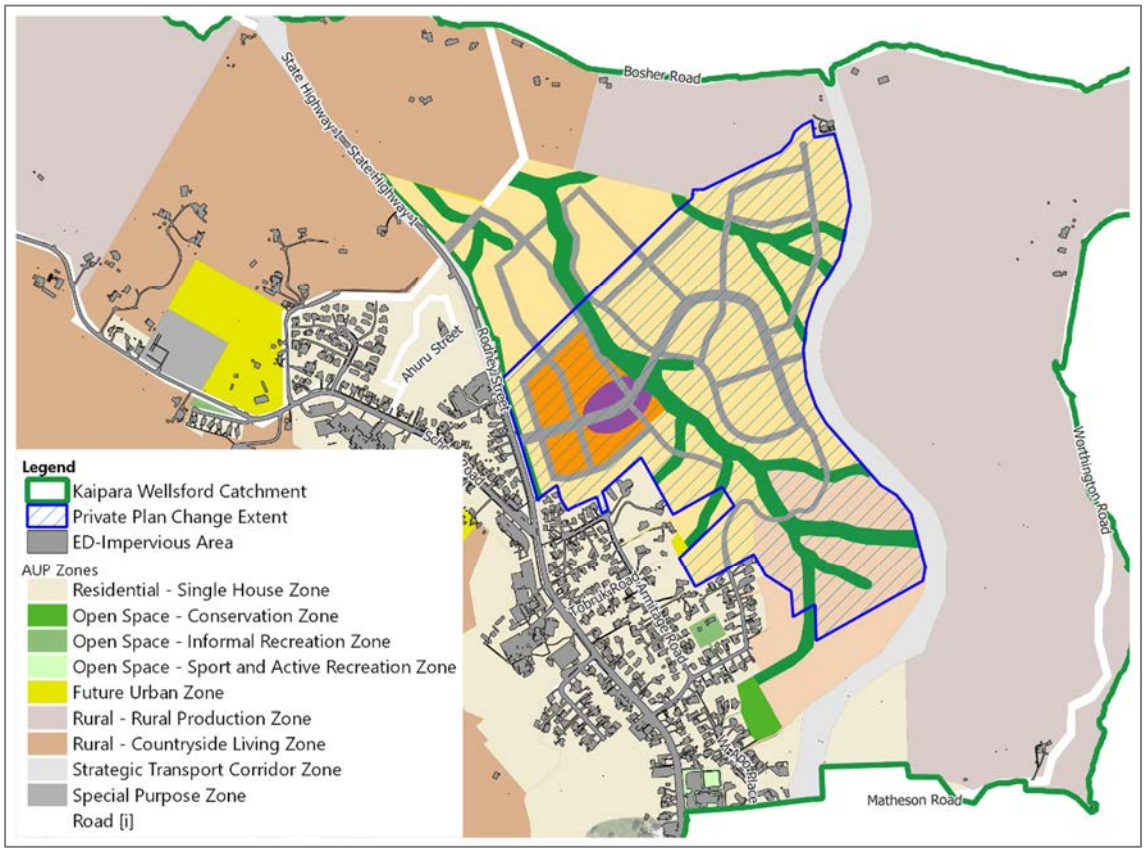


Figure 24: Maximum Probable Development + Private Plan Change

Flood depth plots for the 100-year event with and without CC is shown in Figure 25 and Figure 26.

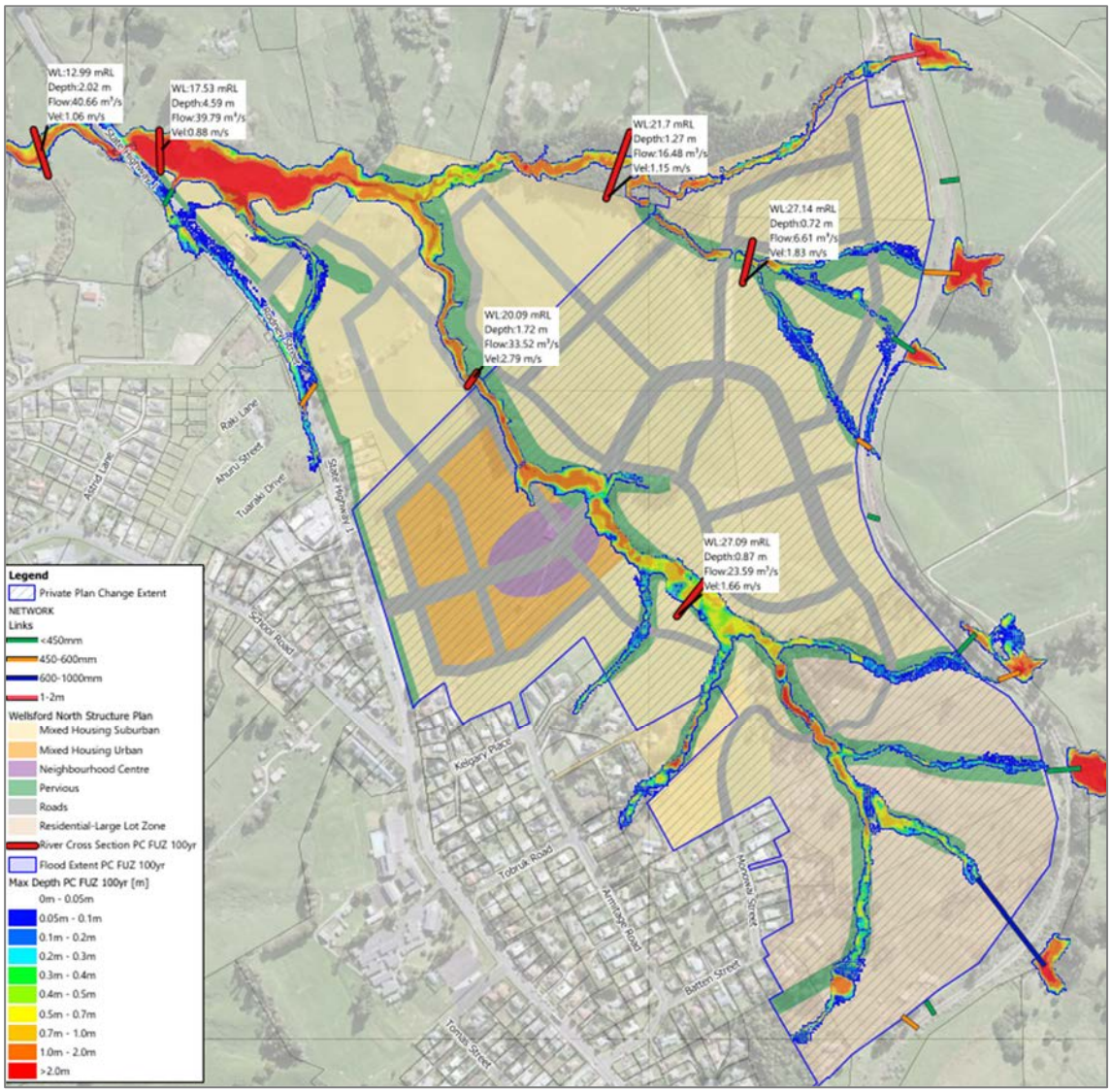


Figure 25: Flood depth- MPD + PPC 100yr (No CC)

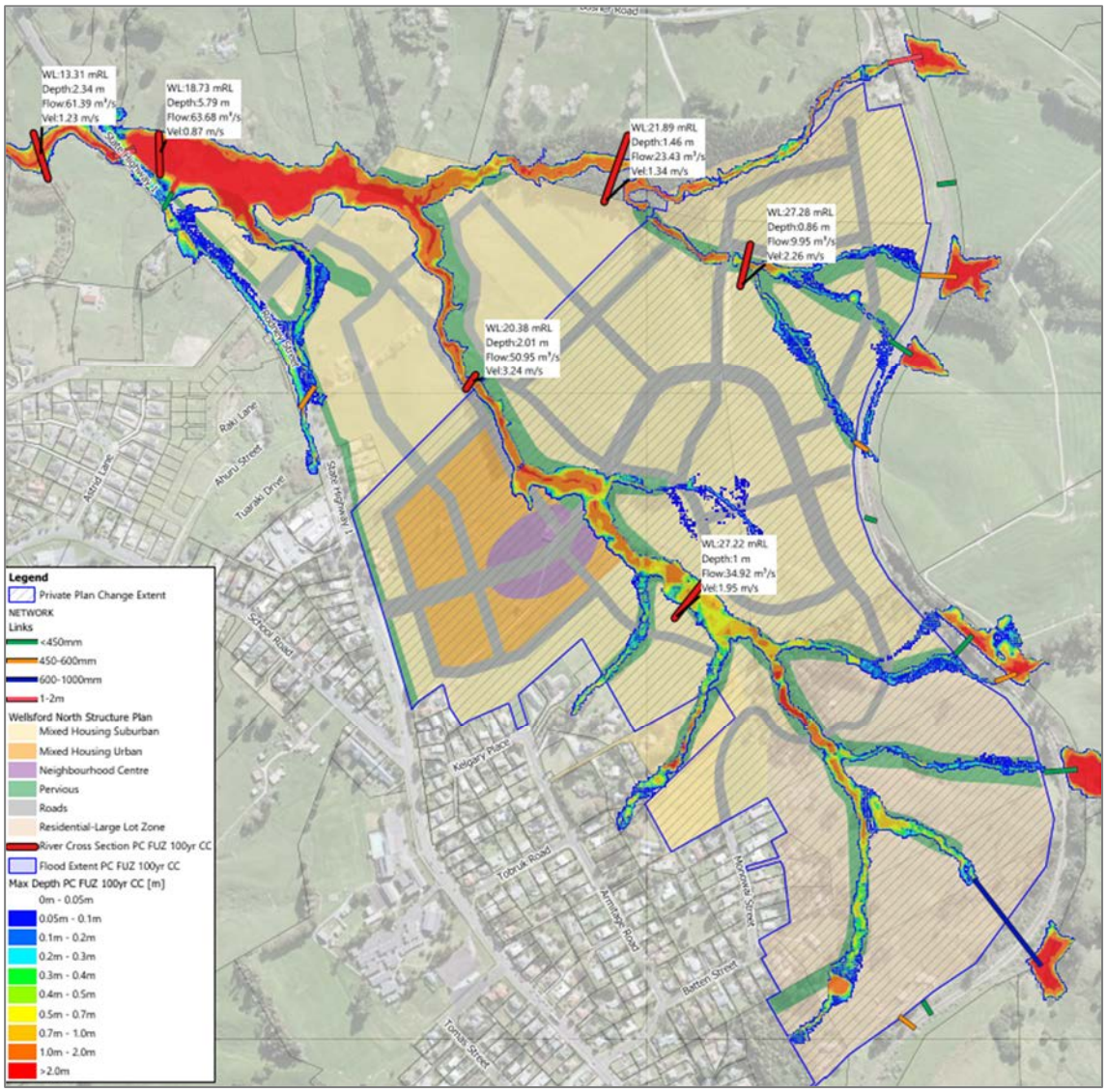


Figure 26: Flood depth- MPD + PPC 100yr (3.8^{0}C CC)

The afflux plots indicating differences between existing development and PPC, for the 100-year events with and without CC is shown in Figure 27 and Figure 28.

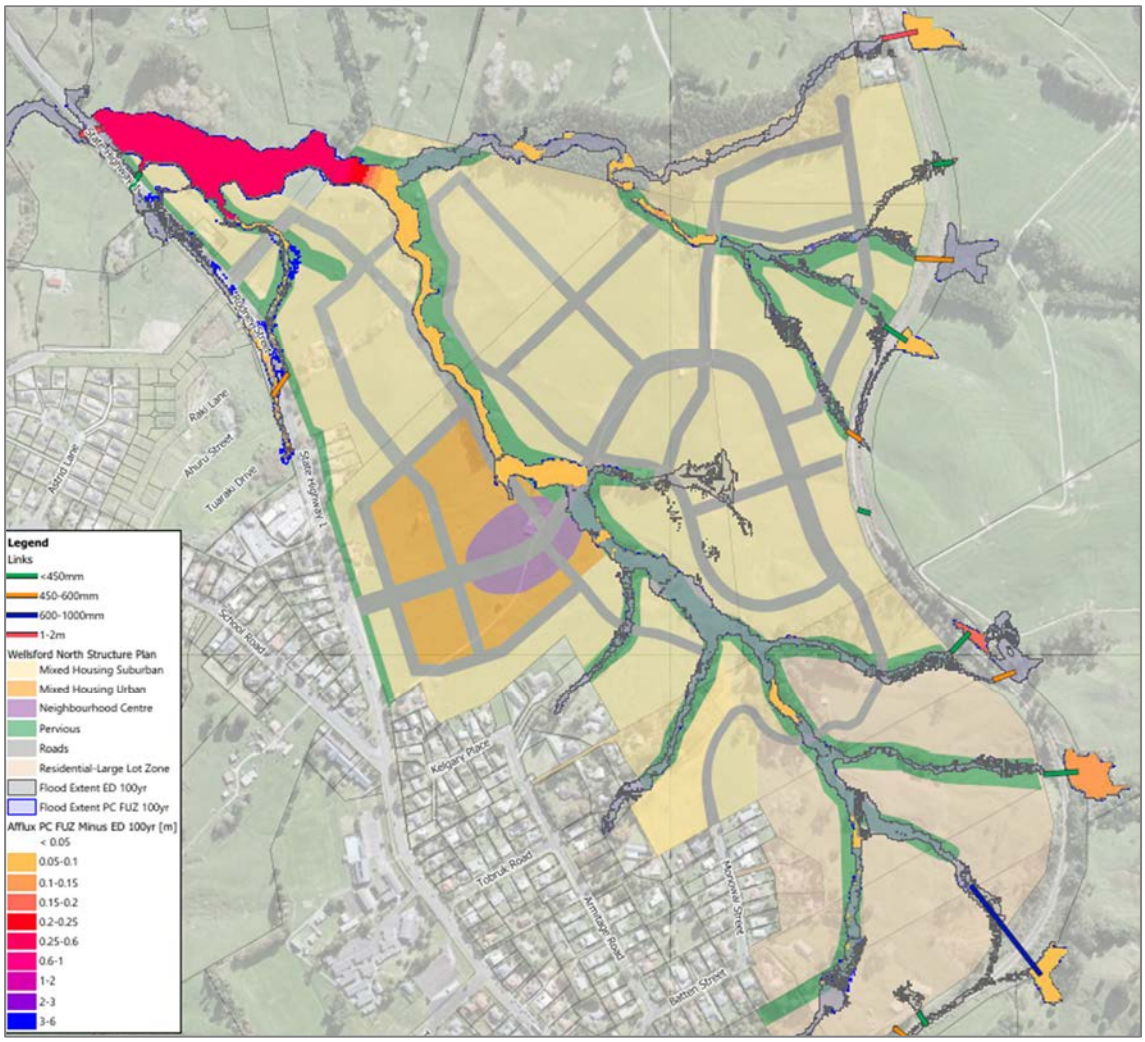


Figure 27: 100-year afflux between pre-development and ED + PPC scenario (No CC)

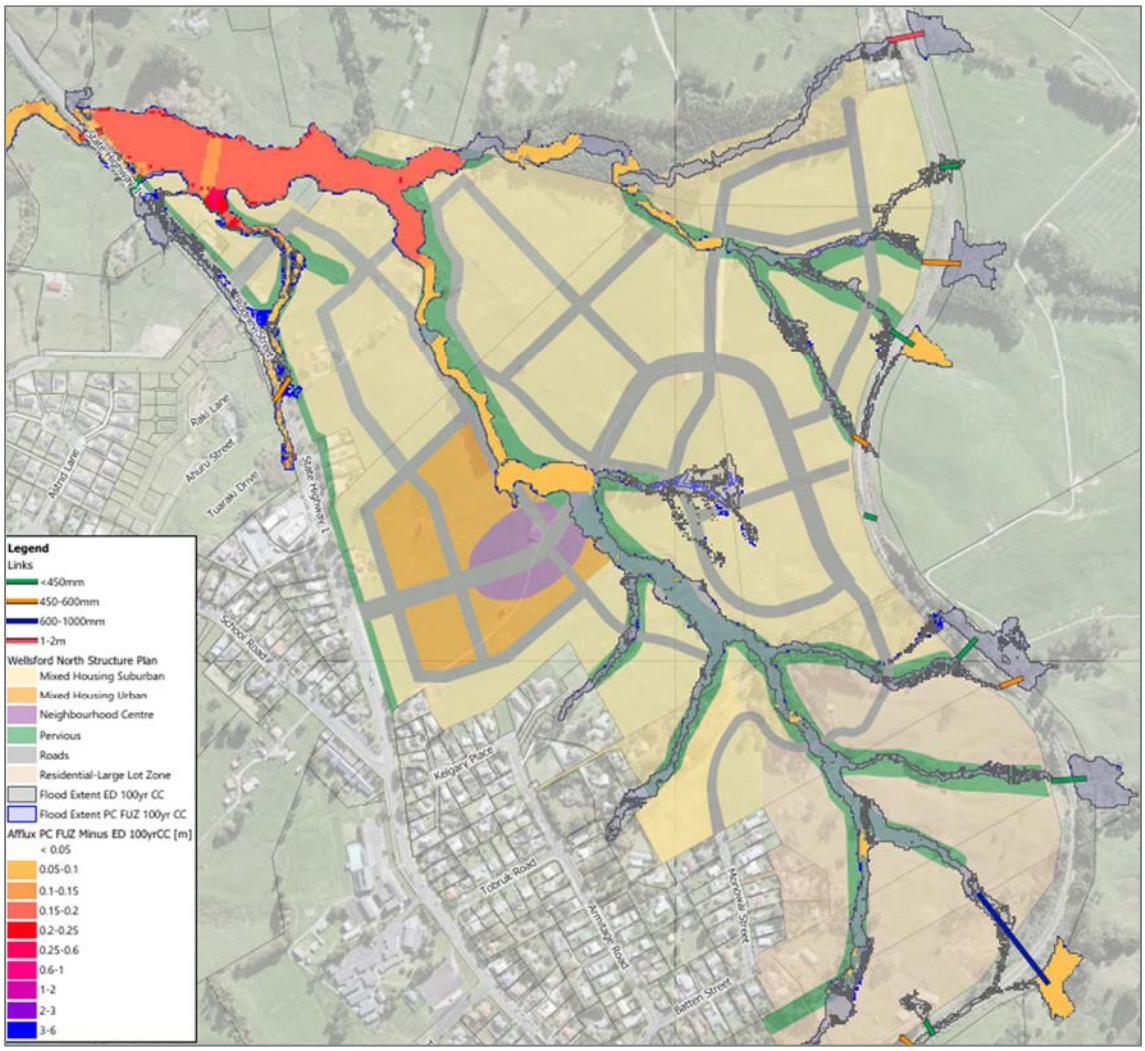


Figure 28: 100-year afflux between pre-development and ED + PPC scenario (3.8^{0}C CC)

The model results indicate that the flood extents are largely similar between the modelled scenarios, and the flooding is contained within the assigned stream. This is as expected given the topography of the surrounding landform and typical stream profiles being generally well incised.

The flood depth results and afflux plots for the 10- and 2-year events is included in Appendix D.

7.2.3. Effects on State Highway 1

Hazard plots have been created to understand if there are any effects on State Highway 1 using Australian Rainfall-Runoff 2016 (ARR) guidelines to identify areas of high flood safety risks.

ARR defines flood hazard vulnerability into six categories as follows:

- H1 – Generally safe for vehicles, people and buildings
- H2 – unsafe for small vehicles
- H3 – Unsafe for vehicles, children and the elderly
- H4 – Unsafe for vehicles and people
- H5 – Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6 – Unsafe for vehicles and people. All building types considered vulnerable to failure

A copy of the flood hazard vulnerability curves and criteria is shown in Figure 29 and Table 8.

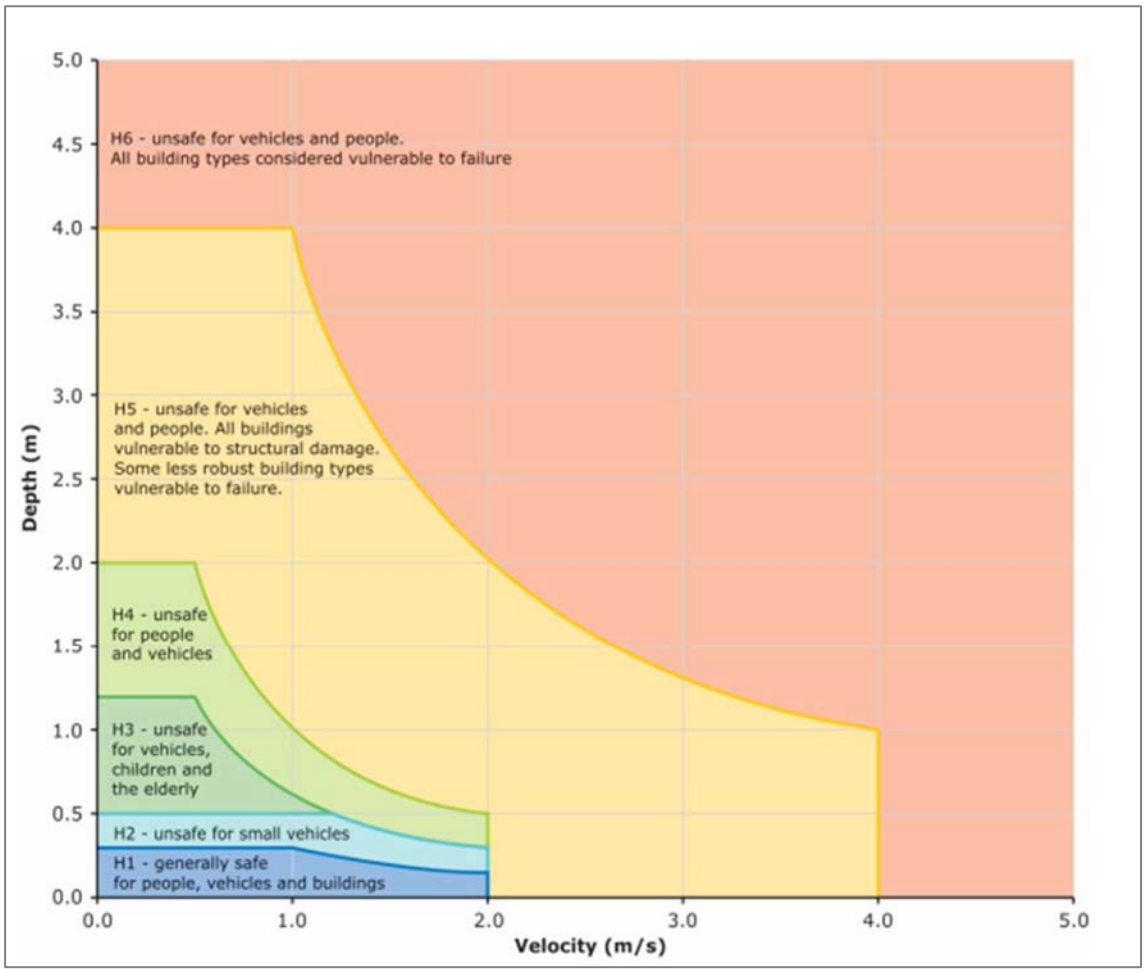


Figure 29: Flood hazard vulnerability curves (source: ARR 2016)

Table 8: Flood hazard criteria (source: ARR 2016)

Hazard Vulnerability Classification	Classification Limit (D & V in combination)	Limiting still water depth (D)	Limiting velocity (V)
H1	D*V≤ 0.3	0.3	2.0
H2	D*V≤ 0.6	0.5	2.0
H3	D*V≤ 0.6	1.2	2.0
H4	D*V≤ 1.0	2.0	2.0
H5	D*V≤ 4.0	4.0	4.0
H6	D*V> 4.0	-	-

The hazard plots for the ED, PPC and MPD + PPC are shown in Figure 30 - Figure 35 with a complete set of results included in Appendix E.

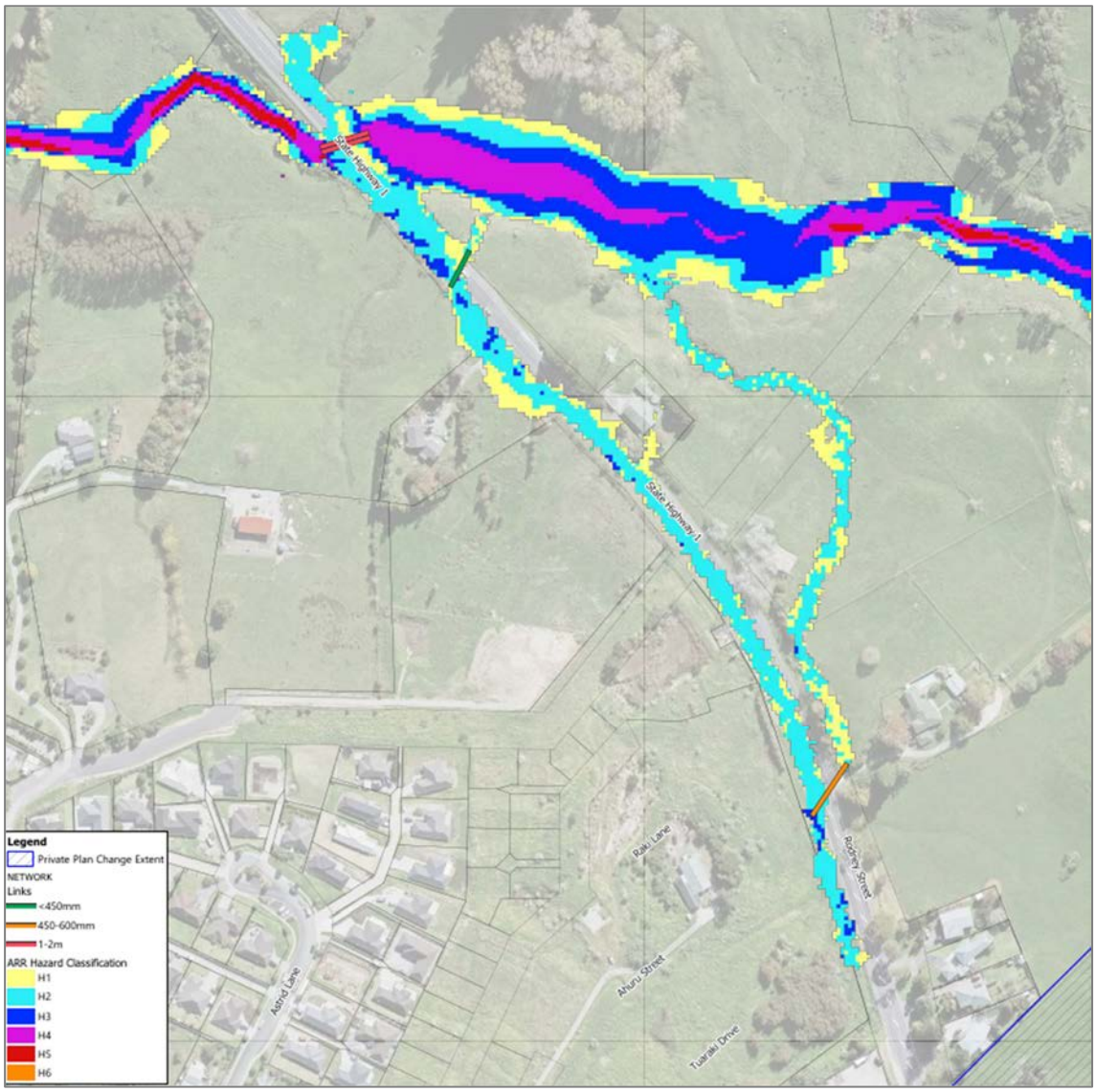


Figure 30: ED 10yr No CC – ARR flood hazards

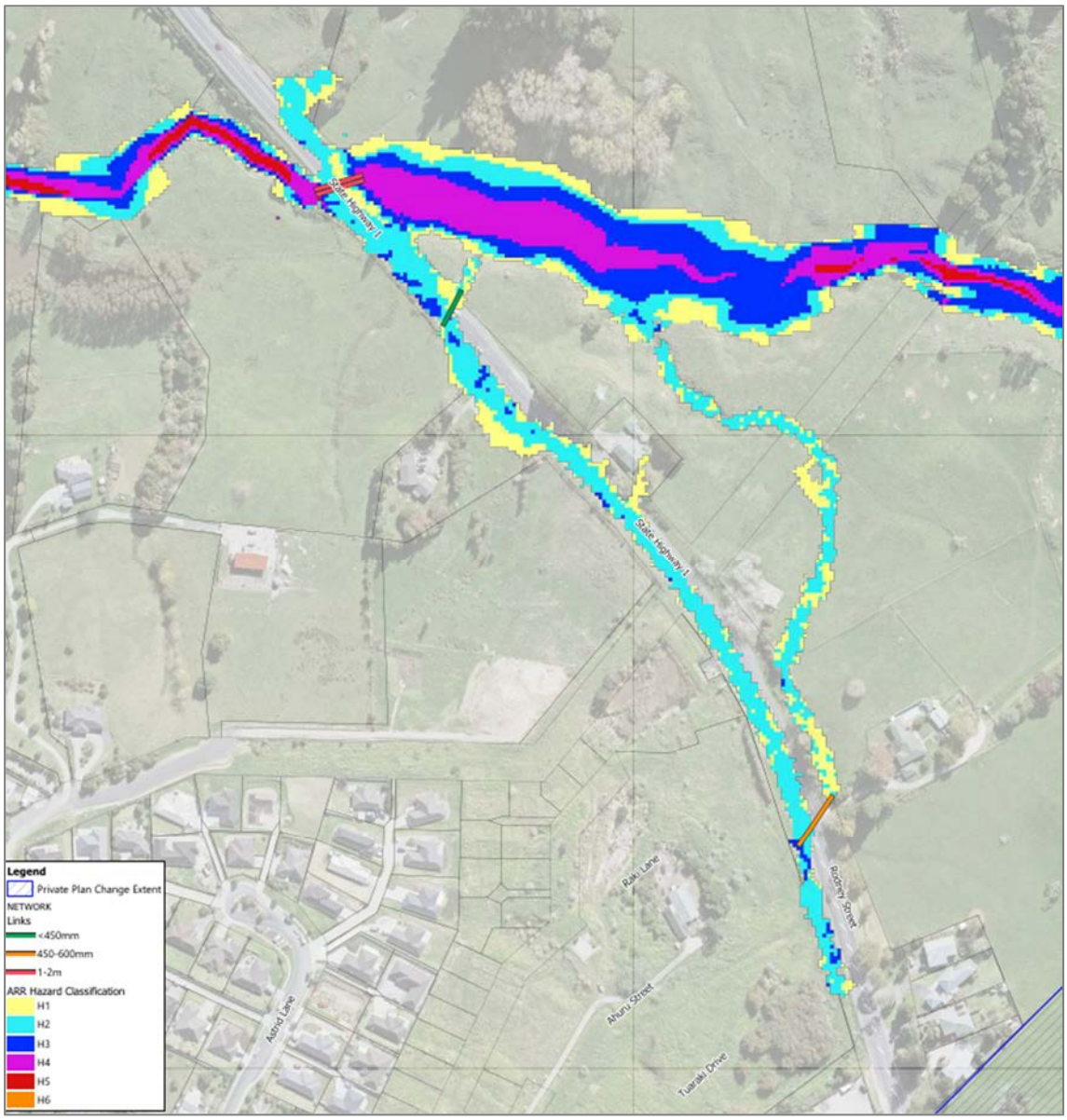


Figure 31: PPC 10yr CC – ARR flood hazards

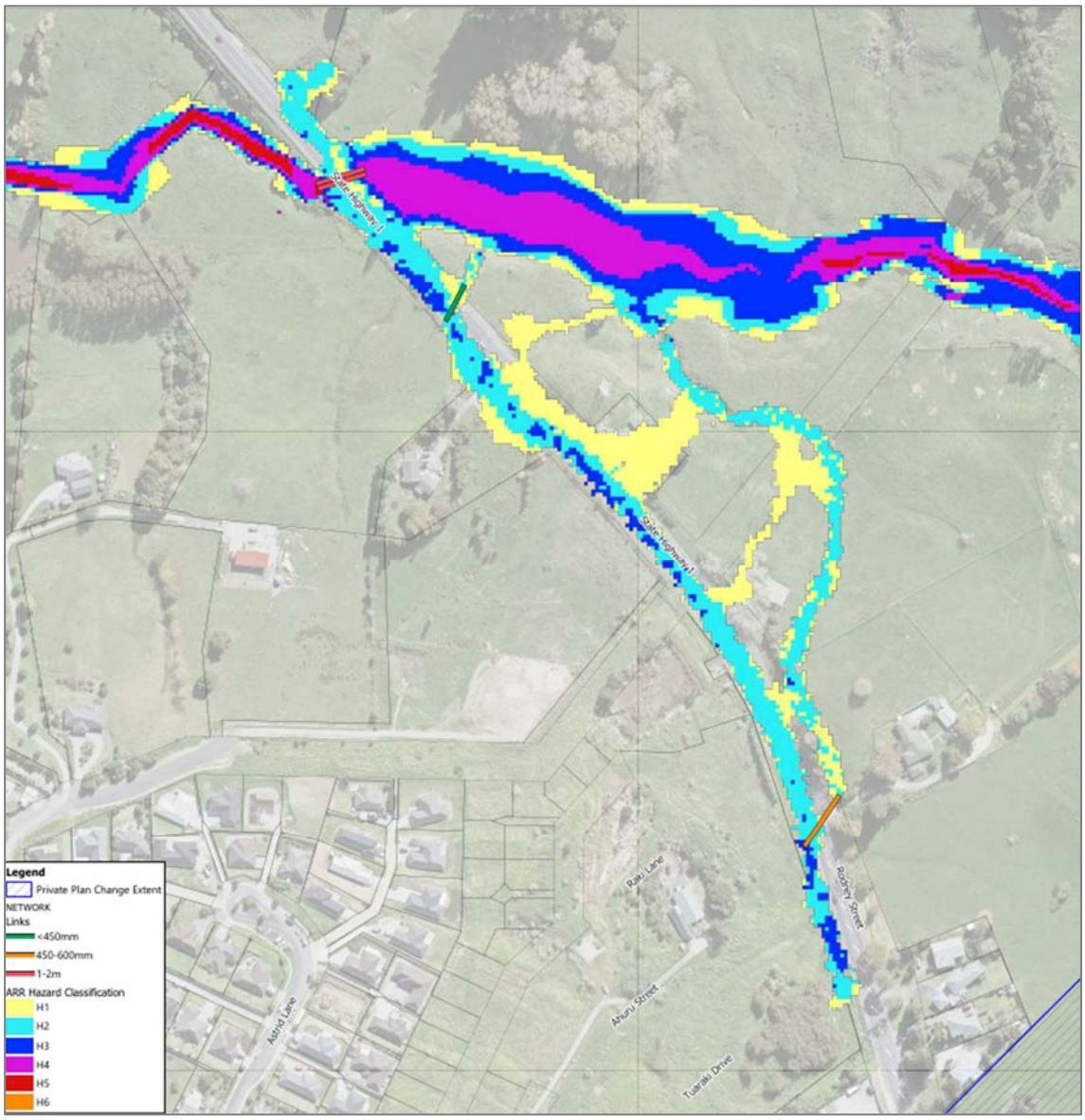


Figure 32: PPC + MPD 10yr CC – ARR flood hazards

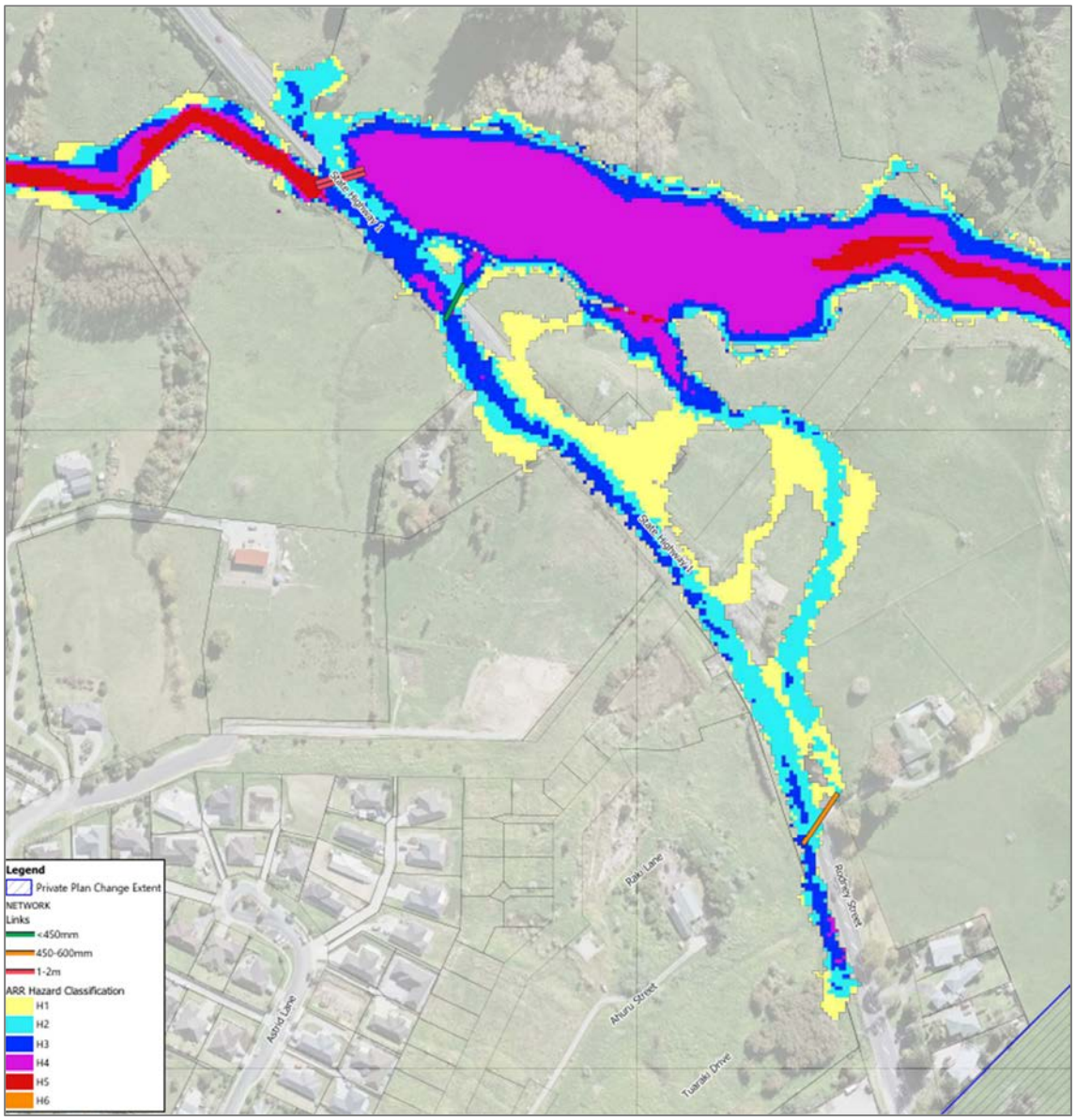


Figure 33: ED 100yr 3.8^{0}C CC – ARR flood hazards

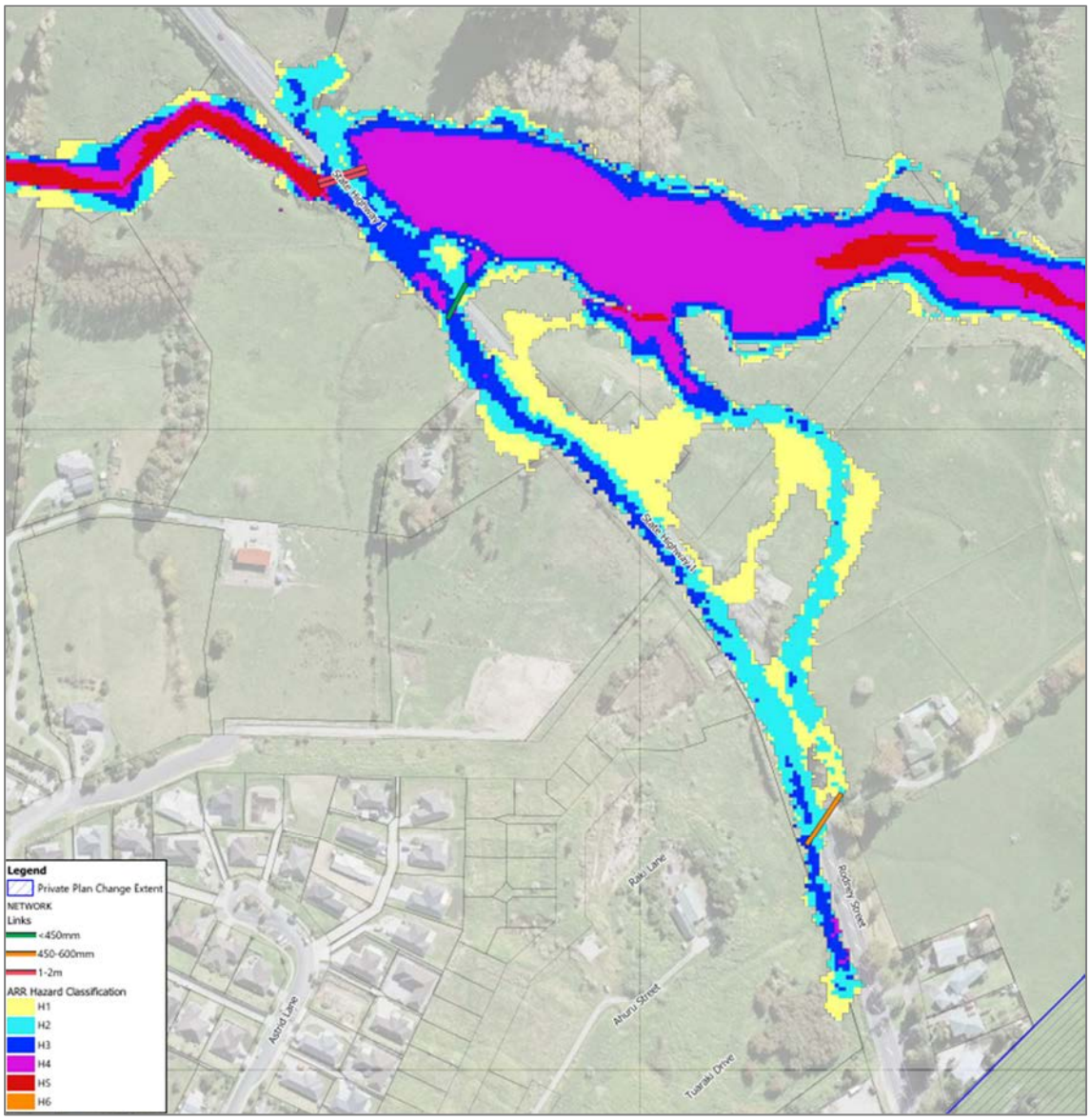


Figure 34: PPC 100yr 3.8^{0}C CC – ARR flood hazards

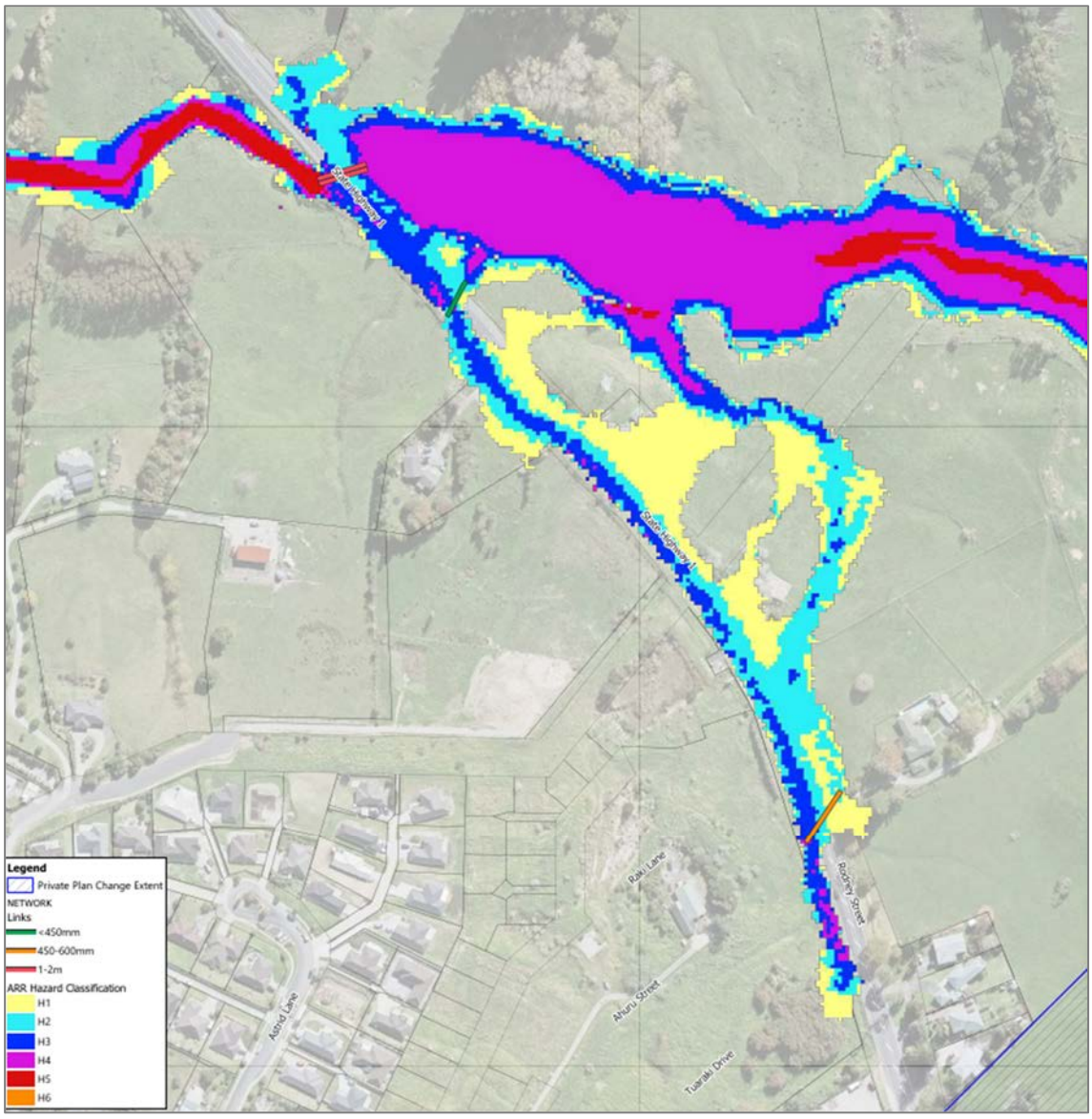


Figure 35: PPC + MPD 100yr 3.8^{0}C CC – ARR flood hazards

The hazard plots indicate there is an existing risk at State Highway 1 which is not adversely affected by development.

Whilst there is a minor difference in flood depths between the modelled scenarios, The risk profile remains predominantly unchanged with PPC and MPD + PPC. This has been discussed with Waka Kotahi NZTA and the hazard is noted to be due to sizing constraints associated with the culvert. Given the existing risk profile, it has acknowledged in principle by Waka Kotahi NZTA that additional mitigation for the PPC is not required to be undertaken, we however that this is subject to review of the flood model and associated information.

Afflux plots showing increases in flood depths for the 100-year event (inclusive of climate change) is shown in Figure 36 and Figure 37. Afflux plots for all other events is included in Appendix F.

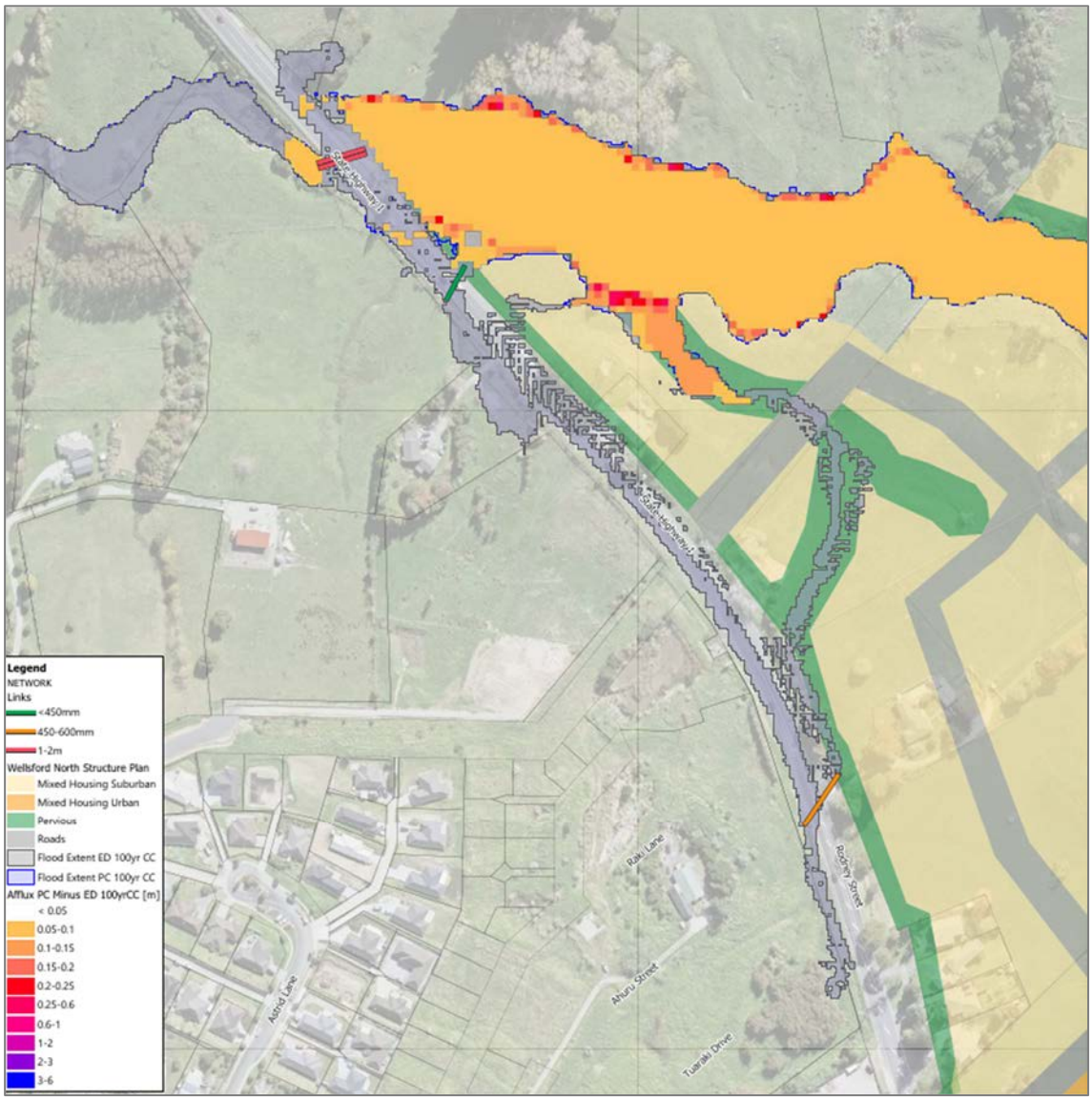


Figure 36: Afflux – ED vs PPC 100yr 3.8^{0}C CC

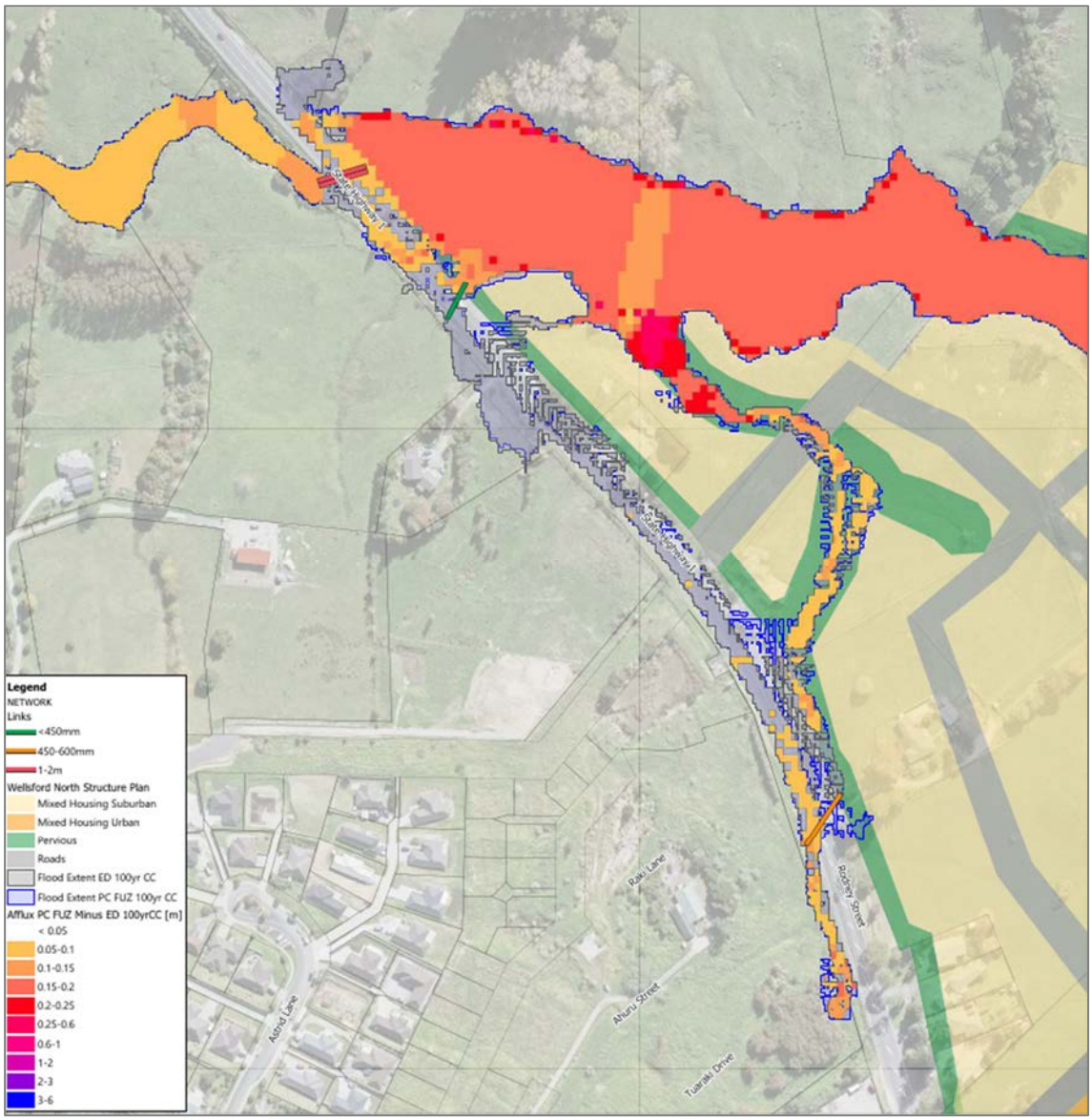


Figure 37: Afflux - ED vs MPD + PPC 100yr 3.8^{0}C CC

8. Stormwater management

This section presents the proposed stormwater management approach for the development. It has been developed to meet the objectives and design requirements of the Regionwide NDC Schedule 4 and the AUP.

This section covers the proposed stormwater discharge, water quality and hydrological mitigation requirements. Flood management is covered in Section 7.

8.1. Principle of stormwater management

The stormwater management principles for the integrated stormwater management approach described below are consistent with:

- The guidance and planning context as identified in Section 3 of this report.
- The AUP policies on integrated stormwater management and the regionwide NDC.

8.1.1. Original principles

The overall objective of the SMP is to implement Best practicable options for stormwater management approach for the PPC area including but not limited to:

- Enabling well-functioning urban environments that meet the changing needs.
- Improving health and well-being of degraded water bodies and freshwater ecosystems, and maintaining the health and well-being of all other water bodies and freshwater ecosystems.
- Maintaining the extent of natural inland wetlands is maintained, protecting their values, and their restoration is promoted.
- Minimising the generation and discharge of contaminants, particularly from high contaminant generating car parks and high use roads and into sensitive receiving environments;
- Minimising or mitigating changes in hydrology, including loss of infiltration.
- Where practicable, minimising or mitigating the effects on freshwater systems arising from changes in water temperature caused by stormwater discharges.
- Providing for the management of gross stormwater pollutants,
- Ensuring the upstream and downstream flood effects are no more than minor

8.1.2. Updated principles

****Not applicable for this SMP****

8.2. Proposed stormwater management

The proposed BPO stormwater management approach are summarised as follows:

8.2.1. Water quality

Treatment of impervious areas connected to a network by a water quality device designed in accordance with GD01/ TP10 for relevant contaminants. If an impervious surface is not directly connected to the network, treatment in accordance with GD01 is not applicable.

Stormwater devices for the PPC area could be in combination but not limited to:

- Use of non-contaminant generating inert, roofing and cladding materials are proposed for all roofed areas.
    - It is noted that the water quality from inert roof runoff is addressed through retention/re-use tanks that are proposed. This is deemed to as the BPO.

- Bioretention devices i.e., raingardens, tree pits etc.
- Grassed/vegetated swales
- Large communal devices i.e., wetlands or large bioretention devices
- Other equivalent devices

8.2.2. Stream hydrology

The PPC area is not located within a Stormwater Management Area Flow (SMAF) overlay as per the AUP: OiP. However, Hydrology mitigation is proposed to be implemented throughout the proposed development to mitigate increased stormwater runoff volume associated with the development of new impervious surfaces.

For a greenfield development, best practice is detention of the 95th percentile rainfall event (discharged over 24 hours) coupled with at least 5mm retention (soakage to ground). Where retention is not achievable consideration is given to rainwater harvesting (typically for non-potable reuse) consistent with the hierarchy stipulated in Table E10.6.3.1.17 of the AUP. If rainwater harvesting is proposed, developments will be required to demonstrate there is suitable water demand to allow for drawdown of retained stormwater prior to the next rainfall event, and where not suitable, full detention can be applied (adding 5mm to the detention volume as is currently proposed).

To achieve equivalent hydrology to pre-development (grassed state) levels, the difference between the predevelopment and post-development runoff volumes from the 95th percentile, 24-hour rainfall event is to be provided. The requirements are shown in Table 9 with calculations provided in Appendix G.

Table 9: 95th Percentile Runoff Depth

	Runoff Depth (mm)
Retention	5
Detention	21.3
95th percentile	26.3

To meet hydrological mitigation objectives, the following management options are proposed:

Retention

- Use of rainwater re-use tanks for collection of roof runoff where there is re-use demand for non-potable uses, e.g., toilet flushing, laundries and gardens
- Infiltration where feasible (infiltration rates greater than 2 mm/hr) and possible in a safe and effective manner using bioretention devices such as raingardens, swales or communal devices.
- Pervious pavement or porous concrete used for hardstand areas such as driveways (private) and carpark areas, footpaths, parking bays (public), and jointly owned access lot driveways.
- Underground storage tanks to infiltrate though where feasible

Detention

- Bioretention devices such as raingardens, planter boxes, swales, living roofs and tree pits to provide detention within private residential property or along road corridors and within public impervious spaces.
- Large communal bioretention devices on public roads, car parks, and public spaces, residential hardstand and jointly owned access lot driveways.
- Aboveground re-use tanks or underground detention tanks within residential lots to provide volumes for re-use and a separate volume for detention.

8.2.3. Communal Devices

It is acknowledged that given the landform that at source devices on roads may not be viable, therefore the use of communal devices along the stream corridor (subject to ground stability) could be adopted. The sizing and placement of these devices would be undertaken during the detailed design stage.

8.2.4. Flooding 10 percent AEP event (Network Capacity)

There are currently no piped stormwater networks within the PPC area. The proposed network will be designed in accordance with the Auckland Council Stormwater Code of Practice.

The primary stormwater runoff is be conveyed through stormwater networks up to 10-year ARI stormwater events.

8.2.5. Flooding 1 percent AEP event (Habitable floors)

Flood and habitable floor are to be developed in accordance with the Auckland Council SWCOP V3.

If the above requirements on water quality, stream hydrology and flooding cannot be met, then an alternative level of mitigation can be determined through a SMP that:

- Applies an Integrated Stormwater Management Approach
- Meets the NDC Objectives and Outcomes in Schedule 2
- Is the BPO for the given project.

8.2.6. Overland flow path and floodplain management

The secondary flow, events greater than a 10-year ARI storm event and up to a 100-year ARI storm, will be conveyed along road corridor, conveyance channels and green spaces as overland flow paths. Overland flow path alignments will be dependent on the overall built environment and maintain existing discharge locations where possible.

The overland flow paths should meet the following design criteria:

- Overland flow paths will be designed with sufficient capacity to accommodate the 100-year ARI storm event for the MPD, including climate change, in accordance with the Auckland Council SWCOP V3.
- They will be unobstructed, with capacity to safely convey runoff through the development.
- Overland flows to follow either road reserves or dedicated green areas. All flow paths are proposed to be located within public areas (roads/parks) where practicable and not over private properties without easement or other approval by Auckland Council.
- Overland flows meet the design criteria outlined in Auckland Council SWCOP V3.

8.2.7. Stormwater management summary

The proposed integrated stormwater management approach is summarised in Table 10.

Table 10: Stormwater management toolbox

Land use	Target	Performance standard	Design options for achieving performance standard		
			At-source	**Communal**	**End of pipe**
High risk contaminant generating areas					
High use Roads (VPD>5000) and High contaminant generating carparks (>30)	Water quality	Provide water quality treatment in a stormwater management device sized and designed in accordance with GD01	Pre-treatment device: • Catchpit with a sump and submerged outlet, filter strip, • swales • Catchpit with gross pollutant traps	Treatment device: • Consolidated bioretention device (device surface area greater than 20m^2) • Proprietary devices	Treatment device: • Wetland • Proprietary units
	Hydrological mitigation	Equivalent to 95th percentile hydrological mitigation	Retention: • Soakage trench • Consolidated bioretention device (device surface area greater than 20m^2) Detention • Underground tanks • Consolidated bioretention device (device surface area greater than 20m^2)	Retention: • Soakage trench • Consolidated bioretention device (device surface area greater than 20m^2) Detention • Underground tanks • Consolidated bioretention device (device surface area greater than 20m^2)	Detention: • Detention basin • Wetland
	Attenuation (if required)	10yr or 100yr	N/A	N/A	Attenuation basin
Hardscape associated with a high risk	Water quality	Elimination at source if possible	Pre-treatment device:	Treatment device:	Treatment device: • Wetland

Land use	Target	Performance standard	Design options for achieving performance standard		
			At-source	**Communal**	**End of pipe**
of contaminant generation.		Specific treatment	• Catchpit with a sump and submerged outlet, filter strip, • swales • Catchpit with gross pollutant traps	• Consolidated bioretention device (device surface area greater than $20m^2$) • Proprietary units	• Proprietary units
	Hydrological mitigation	Equivalent to 95th percentile hydrological mitigation	Retention: • Soakage trench • Consolidated bioretention device (device surface area greater than $20m^2$) Detention • Underground tanks • Consolidated bioretention device (device surface area greater than $20m^2$)		Detention: • Detention basin • Wetland
	Attenuation (if required)	10yr or 100yr	N/A	N/A	Attenuation basin
Medium risk contaminant generating area					
Road (VPD<5000) and Car parks (<30)	Water quality	Provide water quality treatment in a stormwater management device sized and designed in accordance with GD01	Pre-treatment device: • Catchpit with a sump and submerged outlet, filter strip, • swales • Catchpit with gross pollutant traps	Treatment device: • Consolidated bioretention device (device surface area greater than $20m^2$) • Proprietary units	Treatment device: • Wetland • Proprietary units
	Hydrological mitigation	Equivalent to 95th percentile hydrological mitigation	Retention: • Soakage trench	Retention: • Soakage trench	Detention: • Detention basin

Land use	Target	Performance standard	Design options for achieving performance standard		
			At-source	**Communal**	**End of pipe**
			• Consolidated bioretention device (device surface area greater than 20m^2) Detention • Underground tanks • Consolidated bioretention device (device surface area greater than 20m^2)	• Consolidated bioretention device (>20m^2) Detention • Underground tanks • Consolidated bioretention device (device surface area greater than 20m^2)	• Wetland
	Attenuation (if required)	10yr or 100yr	N/A	N/A	Attenuation basin
JOAL driveways and car parks / vehicle hardstands where runoff is collected and reticulated directly to other parts of a public network.	Water quality	Provide water quality treatment in a stormwater management device sized and designed in accordance with GD01	Pre-treatment device: • Catchpit with a sump and submerged outlet, filter strip, • swales • Catchpit with gross pollutant traps BPO	Treatment device: • Consolidated bioretention device (device surface area greater than 20m^2) • Proprietary units BPO	Treatment device: • Wetland • Proprietary units BPO
	Hydrological mitigation	Equivalent to 95th percentile hydrological mitigation	Retention: • Soakage trench • Consolidated bioretention device (device surface area greater than 20m^2) Detention • Underground tanks	Retention: • Soakage trench • Consolidated bioretention device (device surface area greater than 20m^2) Detention • Underground tanks	Detention: • Detention basin • Wetland

Land use	Target	Performance standard	Design options for achieving performance standard		
			At-source	Communal	End of pipe
			• Consolidated bioretention device (device surface area greater than 20m^2)	• Consolidated bioretention device (device surface area greater than 20m^2)	
	Attenuation (if required)	10yr or 100yr	N/A	N/A	Attenuation basin
Low risk contaminant generating area					
Roof and cladding for within the residential and centre zones cladding)	Water quality	Elimination at source	Use of inert building materials to eliminate generation of contaminants. Use of re-use tanks to collect and divert first flush.		
	Hydrological mitigation	Equivalent to 95th percentile hydrological mitigation	Retention: • Reuse tanks • Soakage trench • Bioretention device Detention • Tanks • Bioretention device	Combined Retention: • Reuse tanks • Soakage trench • Bioretention device Combined Detention • Tanks • Bioretention device	Detention: • Detention basin • Wetland
	Attenuation (if required)	10yr or 100yr	N/A	N/A	Attenuation basin
Hardstand other than driveways/carpark associated with residential or communal area	Water quality	Elimination at source and treat runoff where practicable	Treatment: • Filter strip • Equivalent grassed or vegetated area	N/A	N/A
	Hydrological mitigation	Equivalent to 95th percentile hydrological mitigation	Retention:		Detention:

Land use	Target	Performance standard	Design options for achieving performance standard		
			At-source	**Communal**	**End of pipe**
			• Reuse tanks • Soakage trench • Bioretention device Detention • Tanks • Bioretention device		• Detention basin • Wetland
	Attenuation (if required)	10yr or 100yr	N/A	N/A	Attenuation basin
Conveyance					
Primary Conveyance		Convey runoff generated from 10 yr. ARI (inclusive of climate change) rainfall events	Pipe network Swales Open channel		
Secondary Conveyance		Convey runoff generated from 100 yr. (inclusive of climate change) ARI rainfall events	Swales Open channel Road corridor		
Riparian Margins					
Riparian Margins	Stream water quality, hydrology and erosion protection	Enhance water quality, flows, stream channels and their margins and other freshwater values where the current condition is below the relevant thresholds.	Riparian margin enhancement and planting, where necessary to mitigate identified adverse effects • Green outfall from stormwater pipe network to the natural receiving environment		

8.2.7.1. Typical water efficiency device sizes are

Bioretention

Bioretention devices be installed to meet the equivalent to 95% percentile retention and detention requirements from contributing impervious areas, as shown in Table 11.

Table 11: Bioretention area

Impervious Driveway (m^2)	Bioretention device area (m^2)
100	5
200	10
300	15
400	20

Retention/Detention tanks

Stormwater tanks could be installed to meet the equivalent to 95% percentile retention and detention requirements from contributing impervious areas, as shown in Table 12.

Table 12: Tank Volume

Roof (m^2)	Retention(m^3)	Detention(m^3)	Minimum Tank Sizing (m^3)
100	0.5	2.1	2.6
200	1	4.3	5.3
300	1.5	6.4	7.9
400	2	8.5	10.5

Infiltration Trench

A soakage device could be installed to cater for 5mm runoff from driveway areas. The required gravel filled soakage trench volumes (void ratio of 0.35) for a range of connected impervious areas are shown in Table 13.

Table 13: Soakage reduced volume

Impervious area (m^2)	Soakage reduced volume (m^3)
100	1.4
200	2.9
300	4.3
400	5.7

Note: Minimum retention depth is 450mm

8.2.7.2. Attenuation Basins

If required, attenuation basins could be provided to ensure the any additional stormwater runoff associated development is be discharged to the receiving environment a rate no greater than the pre-development scenario.

Flood modelling undertaken to date does not highlight a requirement for attenuation given that the flood effects are considered less than minor.

8.2.8. Development staging

The site is to be developed in multiple stages depending on the objective of the landowners. The development staging is to be assessed at detail design stage.

8.3. Hydraulic connectivity

The primary stormwater runoff is to be conveyed through the stormwater network. The conveyance of secondary stormwater runoff through road corridor and conveyance channels.

****Hydraulic connectivity is to be addressed at Resource Consent****

8.4. Asset ownership

****Asset ownership is to be addressed at Resource Consent****

8.5. Ongoing maintenance requirements

****Maintenance requirements is to be addressed at Resource Consent****

Maintenance and operation manuals for the proposed stormwater management devices are to be provided to Auckland Council for approval as part of the resource consent application. Maintenance for private treatment devices will be the sole responsibility of future lot owners. The publicly vested stormwater infrastructures are expected to be maintained by Auckland Council. Other publicly vested treatment devices within roads and reserves are expected to be maintained by Auckland Transport.

The proposed stormwater management devices are to be maintained in accordance with the maintenance and operation manual.

8.6. Implementation of stormwater network

****Stormwater network implementation is to be addressed at Resource Consent****

8.7. Risks

The risks to the proposed stormwater management within the PPC area are outlined in Table 14. As the application progresses, it is expected this list will be further populated and updated.

Table 14: Risk assessment

What is the risk to the proposed stormwater management?	How can this be mitigated / managed?	What other management / mitigation could be used?	When does this risk need to be addressed?	What is the resultant level of risk?
Unknown soil infiltration rates	Design using minimum regional rate as set out in the AUP Chapter E10 of 2mm/hr	On-site testing	During the design/ Resource Consent phase and construction phases	Low
Ground stability issues affecting design of large communal devices	Further on-site testing	N/A	During design/ Resource Consent phase	Moderate
Overland flow paths	Complete high-level assessment	Reassess during design phase	During design/ Resource Consent phase	Moderate
Floodplain	Complete high-level assessment	Reassess during design phase	During design/ Resource Consent phase	Moderate
Streams and watercourses on site are different to GeoMaps	Undertake site investigation and stream classification study		During the planning phase	Low
Wetlands	Preliminary design (adopt 15% of the catchment area)	Reassess during design phase	During design/ Resource Consent phase	Moderate
Conveyance swale design	Preliminary design	Reassess during design phase	During design/ Resource Consent phase	Moderate
Raingardens	Preliminary design	Reassess during design phase	During design/ Resource Consent phase	Moderate
Impervious coverages	Adopt maximum 70% impervious coverage	Reassess during design phase	During design/ Resource Consent phase	Moderate

9. Departures from regulatory or design codes

The stormwater management approach proposed for the PPC meets the minimum regulatory or design codes standards and is considered the BPO approach.

10. Conclusions

Woods has been engaged to prepare a stormwater manage plan and the submission of an application for a PPC for the Wellsford Urban Zone to Residential. An integrated stormwater management approach is to be implemented across the PCC area. The objective of the SMP includes:

- Preserve, protect and enhance water bodies and natural wetlands.
- Eliminate and minimise the generation of contaminants.
- Provide 95th percentile, 24hr, hydrological mitigation.
- Ensure the flooding effects within, upstream and downstream of the PPC area are no more than minor.
- Consider future effects of climate change.

A stormwater management toolbox has been developed which sets out the performance standards for stormwater management for different land use activities based on the Auckland Unitary Plan provisions. A range of device options and indicative sizes are provided to achieve the required performance standards; however, the proposed toolbox should not limit the use of other devices or tools proven to be the Best Practicable Option.

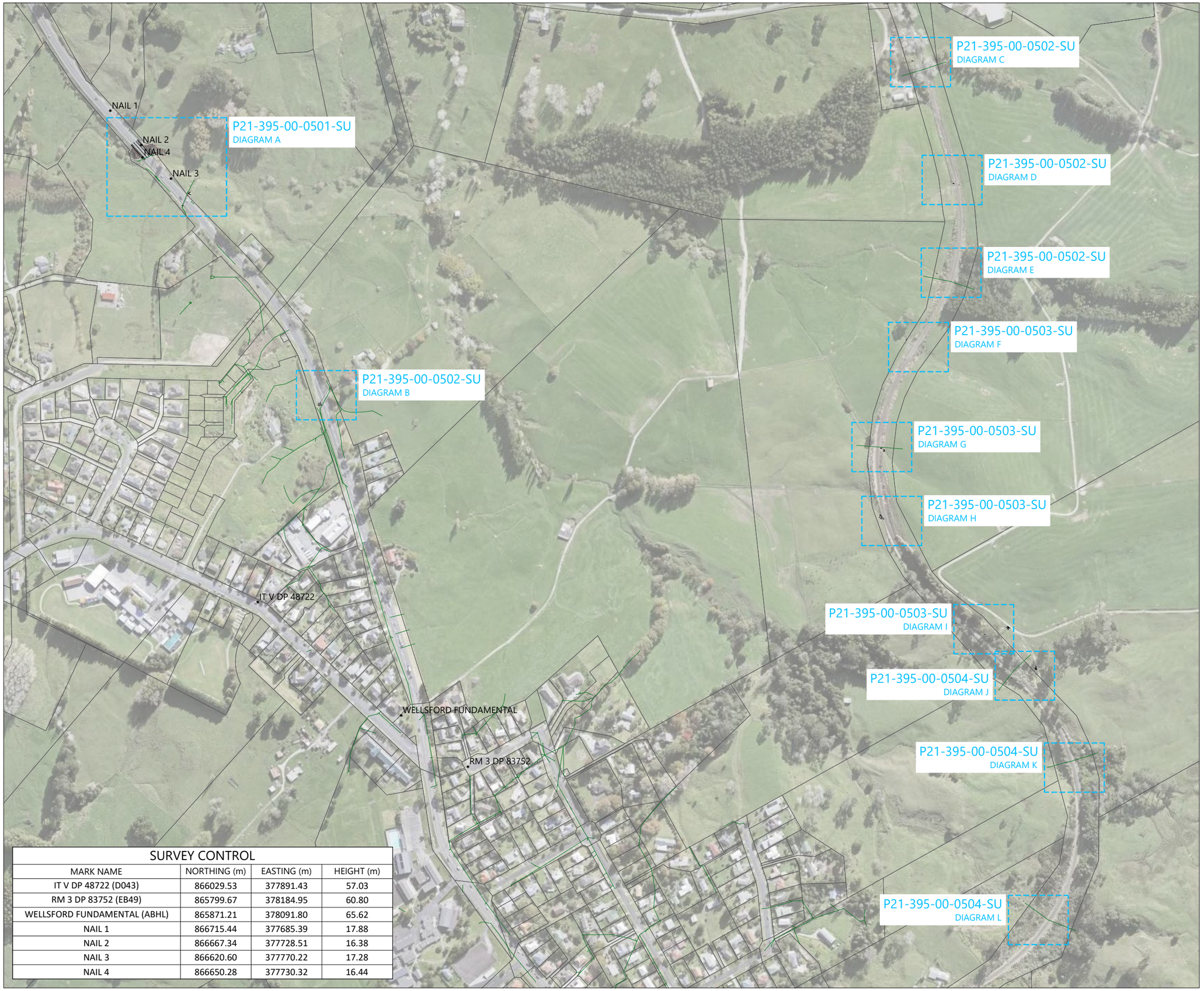
Flood modelling has been undertaken for the PPC and surrounding areas including a preliminary analysis of the culvert on State Highway 1. Model results and afflux plots indicate flooding is largely contained within existing water courses with flood extents to be similar between pre- and post- development scenarios.

Hazard plots have also been created which indicates flood effects on State Highway 1 are existing with increases as a result of development considered to be no less than minor and note that this has been acknowledged in principle by Waka Kotahi NZTA.

Overall, our assessment has concluded that the potential effects on stormwater anticipated by the PPC are less than minor and will be appropriately mitigated.

Appendix A

Surveyed infrastructure



SURVEY CONTROL			
MARK NAME	NORTHING (m)	EASTING (m)	HEIGHT (m)
IT V DP 48722 (D043)	866029.53	377891.43	57.03
RM 3 DP 83752 (EB49)	865799.67	378184.95	60.80
WELLSFORD FUNDAMENTAL (ABHL)	865871.21	378091.80	65.62
NAIL 1	866715.44	377685.39	17.88
NAIL 2	866667.34	377728.51	16.38
NAIL 3	866620.60	377770.22	17.28
NAIL 4	866650.28	377730.32	16.44

WOODS
EST.1970

LEGEND

XML BOUNDARY		TOP OF BANK	
CULVERT INVERT	IL=10.00	BOTTOM OF BANK	
SPOT HEIGHT	67.00	TOP OF WALL	
CESSPIT		BOTTOM OF WALL	
GIS STORMWATER	450 CONC	WATERWAY CENTRELINE	
MAJOR CONTOUR		ROAD CENTRELINE	
MINOR CONTOUR		ROAD EDGE OF SEAL/METAL	
FENCE		ROAD MARKING	

NOTES

1. THE SURVEY IS IN TERMS OF GEODETIC DATUM 2000, MT EDEN CIRCUIT. THE ORIGIN OF COORDINATES "WELLSFORD FUNDAMENTAL" (GD CODE ABHL), SOURCED FROM LINZ DATABASE.
   ~ 865871.21 mN 378091.80 mE
2. THE ORIGIN OF LEVELS IS IN TERMS OF THE AUCKLAND VERTICAL DATUM 1946, ORIGIN OF LEVEL "WELLSFORD FUNDAMENTAL" (GD CODE ABHL), SOURCED FROM LINZ DATABASE.
   ~ 65.62 m RL
3. CONTOURS ARE SHOWN AT 0.20 m INTERVALS.
4. FOR EXISTING SUBJECT EASEMENTS, COVENANTS AND ENCUMBRANCES FOR THE PLAN AREA, PLEASE REFER TO THE CURRENT RECORDS OF TITLE.
5. EVERY EFFORT HAS BEEN MADE TO CORRECTLY IDENTIFY TREE TYPES SHOWN. HOWEVER, THESE MAY REQUIRE CONFIRMATION FROM A SUITABLY QUALIFIED PERSON IF CRITICAL.
6. AERIAL PHOTO SHOWN IN BACKGROUND AND INDICATIVE EXISTING STORMWATER SERVICES HAVE BEEN SOURCED FROM THE AUCKLAND COUNCIL GIS. SERVICE PIPES AND COVERS NOT LOCATED BY SURVEY, ARE APPROXIMATE ONLY AND WILL NEED TO BE CONFIRMED ON SITE.
7. CONTRACTOR IS TO LOCATE AND PROTECT ALL EXISTING SERVICES PRIOR TO COMMENCING ANY WORKS. NO EXCAVATION OF ANY KIND IS TO TAKE PLACE WITHOUT PERMISSION FROM THE RELEVANT SERVICE PROVIDER.

SCALEBAR (m) 0 50 100 250 SCALE | 1:5000 @A3 | 1:2500 @A1|

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	JS	02/05/22

SURVEYED	DN	WELLSFORD AUCKLAND NEW ZEALAND
DESIGNED		
DRAWN	JS	
CHECKED	RH	
APPROVED	RH	WOODS.CO.NZ

N

WELLSFORD NORTH PLAN CHANGE

CULVERT TOPOGRAPHIC SURVEY

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:5000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	P21-395-00-0500-SU	

Plot Date: 2:13:02 pm,2 May 2022, JESSS

File: C:\12DSYNERGY\DATA\WP-PEN-APP-01\P21-395 - WELLSFORD NORTH PLAN CHANGE_10865\CAD\SURV\P21-395-00-0500-SU_CULVERT TOPOGRAPHIC SURVEY.DWG

DIAGRAM A

WOODS
EST.1970

Plot Date: 2:13:03 pm,2 May 2022, JESSS

LEGEND

XML BOUNDARY		TOP OF BANK	
CULVERT INVERT	IL=10.00	BOTTOM OF BANK	
SPOT HEIGHT	10.00	TOP OF WALL	
CESSPIT		BOTTOM OF WALL	
GIS STORMWATER	450 STMC	WATERWAY CENTRELINE	
MAJOR CONTOUR		ROAD CENTRELINE	
MINOR CONTOUR		ROAD EDGE OF SEAL/METAL	
FENCE		ROAD MARKING	

NOTES

1. THE SURVEY IS IN TERMS OF GEODETIC DATUM 2000, MT EDEN CIRCUIT. THE ORIGIN OF COORDINATES "WELLSFORD FUNDAMENTAL" (GD CODE ABHL), SOURCED FROM LINZ DATABASE.
   ~ 865871.21 mN 378091.80 mE
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   ~ 65.62 m RL
3. CONTOURS ARE SHOWN AT 0.20 m INTERVALS.
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REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION	JS	02/05/22

SURVEYED	DN	WELLSFORD AUCKLAND NEW ZEALAND
DESIGNED		
DRAWN	JS	
CHECKED	RH	
APPROVED	RH	WOODS.CO.NZ

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WELLSFORD NORTH PLAN CHANGE

CULVERT TOPOGRAPHIC SURVEY

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	P21-395-00-0501-SU	

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DIAGRAM B

DIAGRAM C

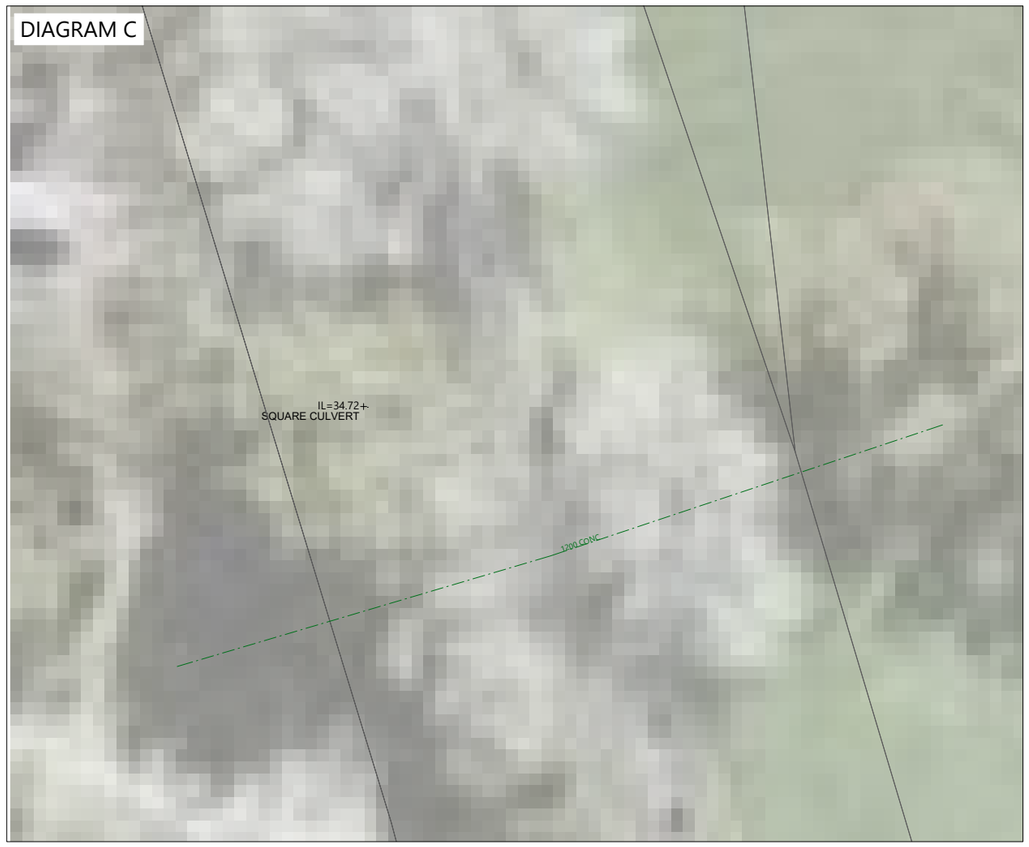
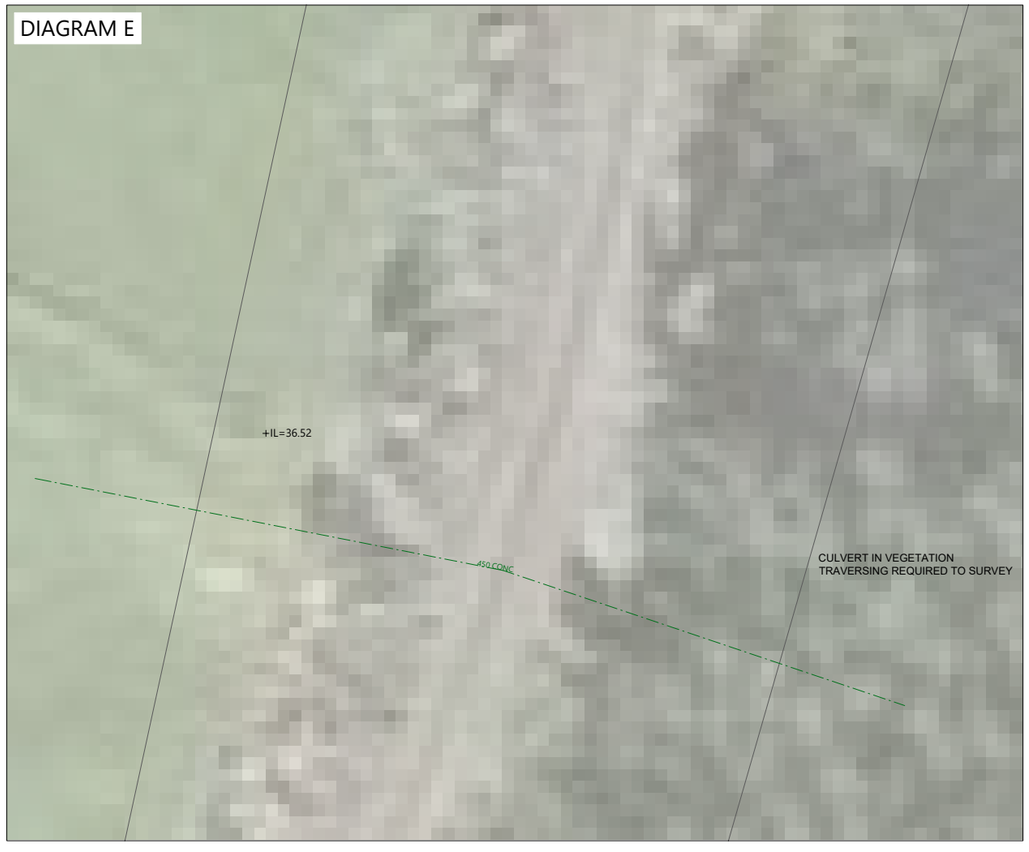


DIAGRAM D

DIAGRAM E



LEGEND

XML BOUNDARY		TOP OF BANK	
CULVERT INVERT	IL=10.00	BOTTOM OF BANK	
SPOT HEIGHT	10.00	TOP OF WALL	
CESSPIT		BOTTOM OF WALL	
GIS STORMWATER	450 CONC	WATERWAY CENTRELINE	
MAJOR CONTOUR		ROAD CENTRELINE	
MINOR CONTOUR		ROAD EDGE OF SEAL/METAL	
FENCE		ROAD MARKING	

NOTES

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WELLSFORD NORTH PLAN CHANGE

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DWG NO	P21-395-00-0502-SU	

Plot Date: 2:13:04 pm,2 May 2022, JESSS

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DIAGRAM F

IL=38.71+

DIAGRAM G

DOWNSTREAM CULVERT IN
VEGETATION OF RAIL CORRIDOR

49.73

450 CONC

IL=48.93

DIAGRAM H

49.47

49.72

49.68

+IL=49.93

UPSTREAM CULVERT ENTRANCE NOT FOUND

DIAGRAM I

+IL=49.29

DENSE VEGETATION

IL=52.25+

+IL=46.61

CONCRETE SQUARE MANHOLE
IL = ~ 3.50
CLEARING REQUIRED TO SURVEY INVERT

INDICATIVE CULVERT
300mmØ

+IL=43.57

WOODS
EST.1970

LEGEND

XML BOUNDARY		TOP OF BANK	
CULVERT INVERT	+IL=10.00	BOTTOM OF BANK	
SPOT HEIGHT	49.00	TOP OF WALL	
CESSPIT		BOTTOM OF WALL	
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WELLSFORD NORTH PLAN CHANGE

CULVERT TOPOGRAPHIC SURVEY

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SCALE	1:500 @ A3	1
COUNCIL	AUCKLAND COUNCIL	
DWG NO	P21-395-00-0503-SU	

Plot Date: 2:13:05 pm,2 May 2022, JESSS

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DIAGRAM J

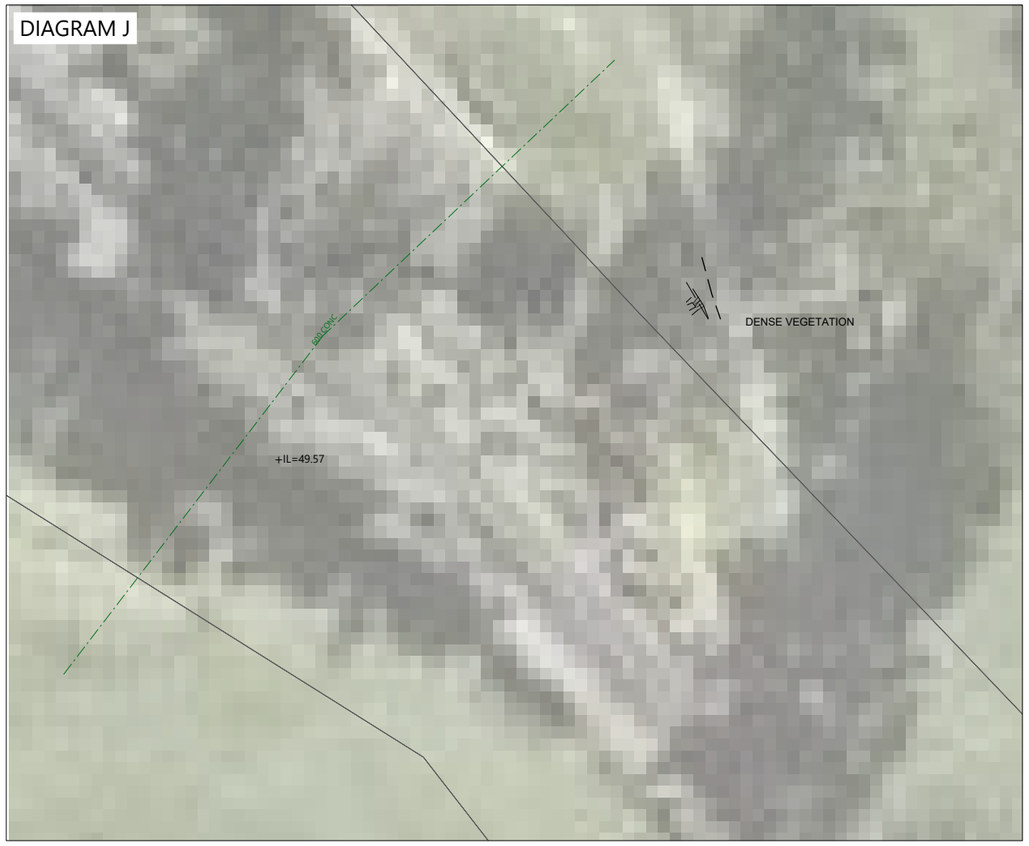
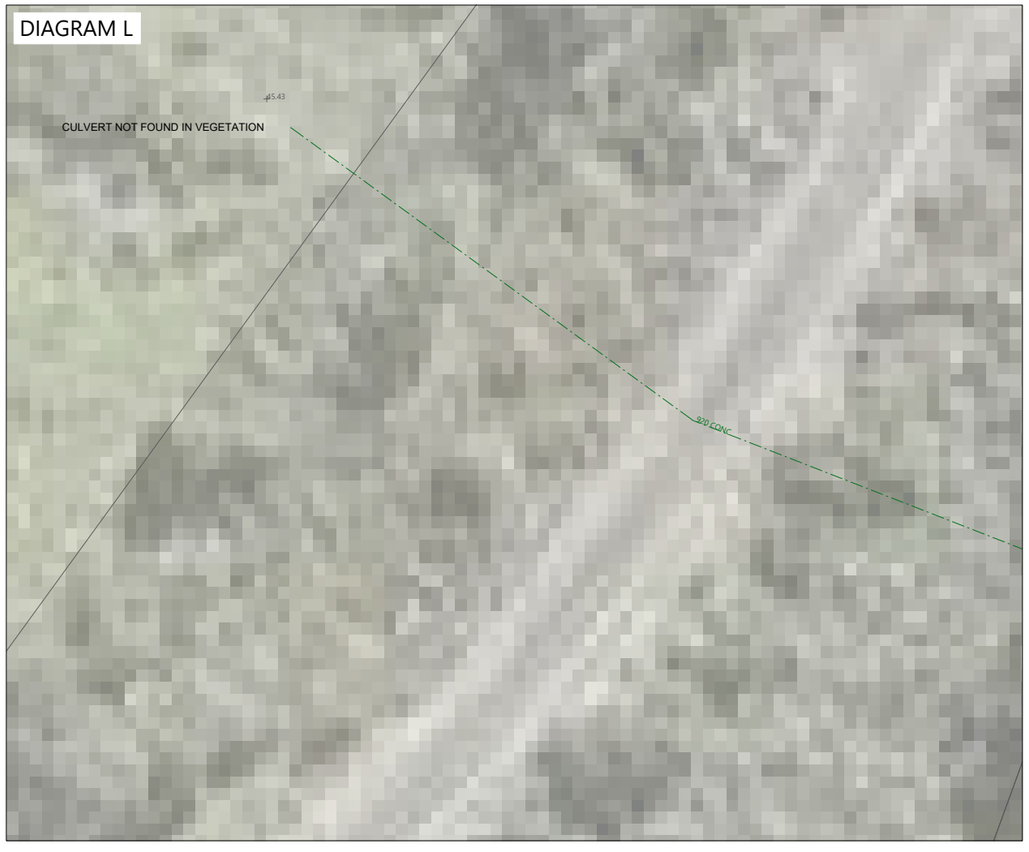


DIAGRAM K

DIAGRAM L



WOODS
EST.1970

LEGEND

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DESIGNED		
DRAWN	JS	
CHECKED	RH	
APPROVED	RH	WOODS.CO.NZ

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WELLSFORD NORTH PLAN CHANGE

CULVERT TOPOGRAPHIC SURVEY

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COUNCIL	AUCKLAND COUNCIL	
DWG NO	P21-395-00-0504-SU	

Plot Date: 2:13:06 pm,2 May 2022, JESSS

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Appendix B

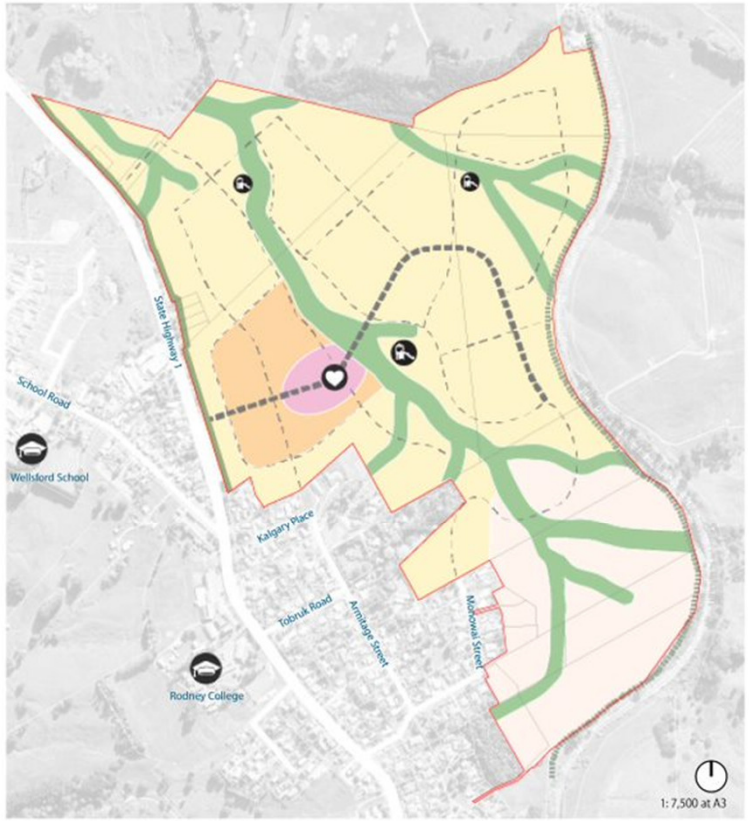
Stakeholder engagement – Minutes and presentations

Wellsford Plan Change – Meeting with Healthy Waters 06/04/2022

Agenda

- Proposed development
- Work undertaken to date:
  - Flood modelling
  - Stormwater management
  - Draft Stormwater Management Plan
- Other matters

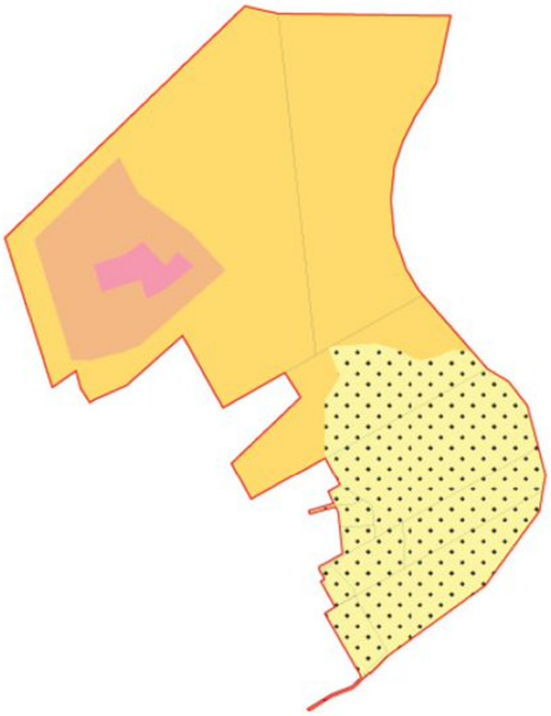
Proposed development



Structure Plan

Legend

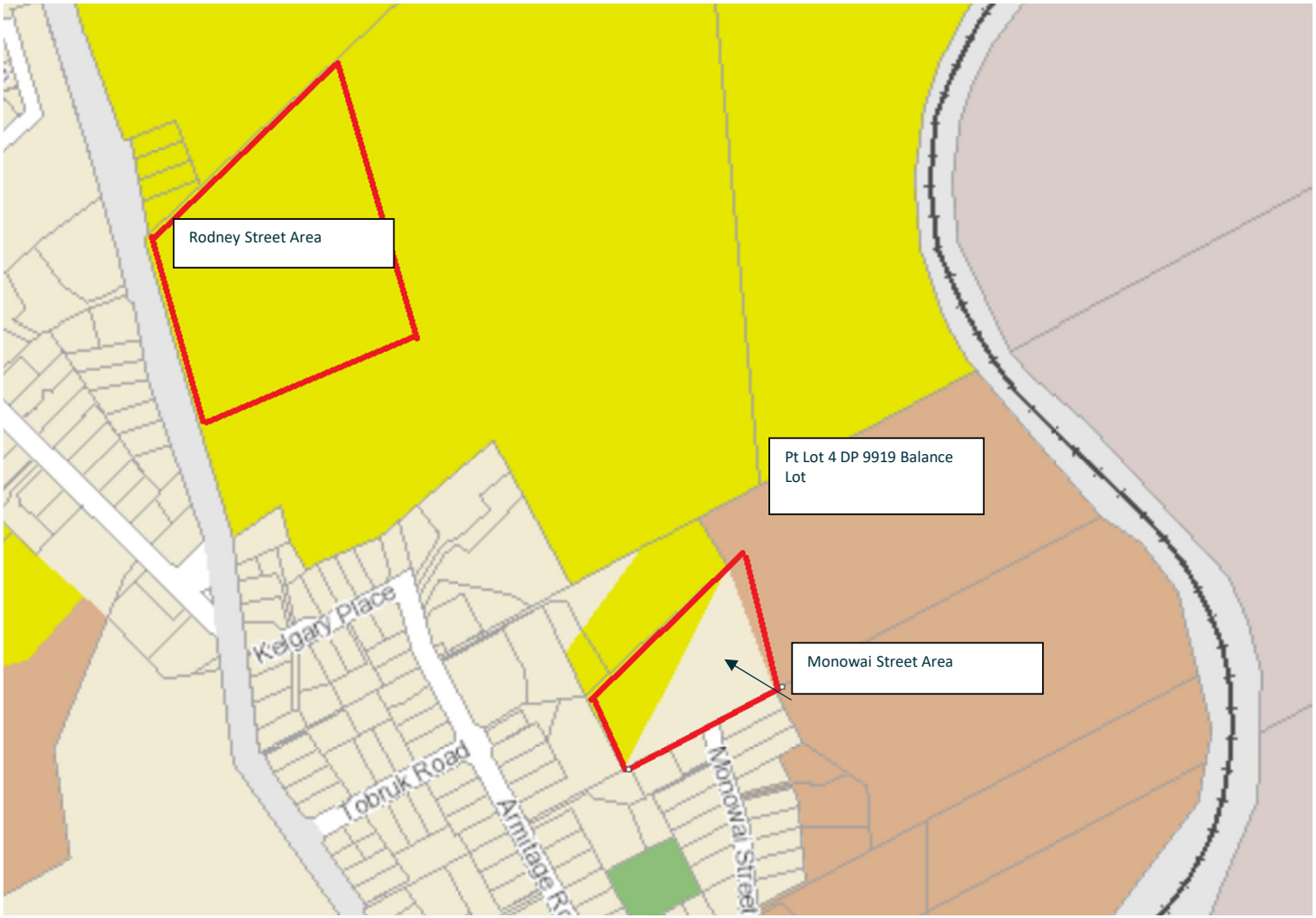
- Structure plan extent
- Property Boundary
- Indicative Lifestyle Living
- Indicative Lower Density Residential
- Indicative Medium Density Residential
- Indicative Village Centre
- Ecological Areas / Open Spaces
- Main Collector Road
- Local Streets
- Greenway Cycleway
- 10m Landscape Buffer
- Indicative Playground
- Indicative Village Centre Public Space
- Existing Schools



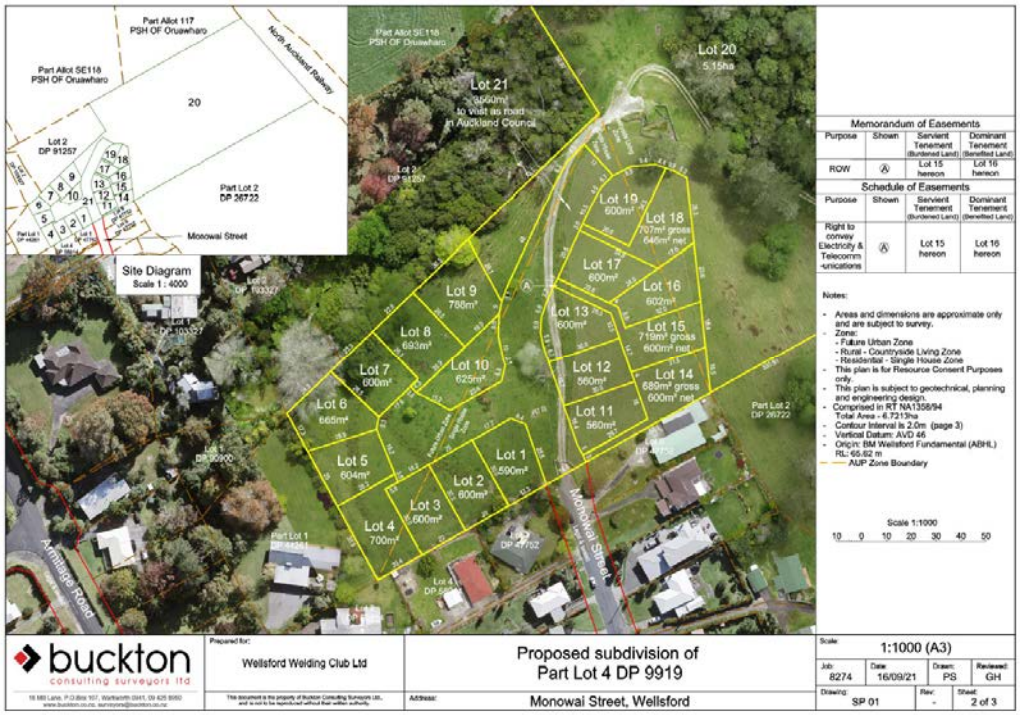
Legend

- Extent
- Existing Property Boundary
- Residential - Large Lot Zone
- Residential - Mixed Housing Suburban Zone
- Residential - Mixed Housing Urban Zone
- Business - Neighbourhood Centre Zone
- Subdivision Variation Control

Fast-Track consent application

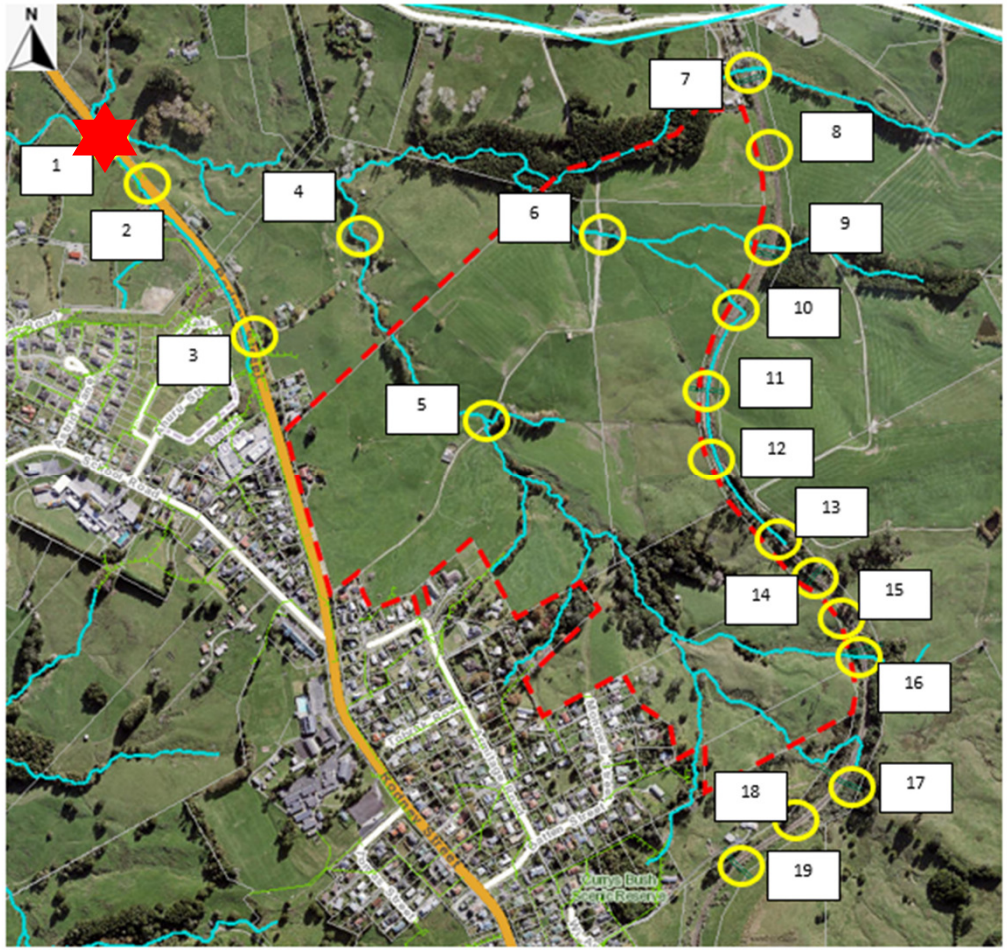


Fast-Track consent application

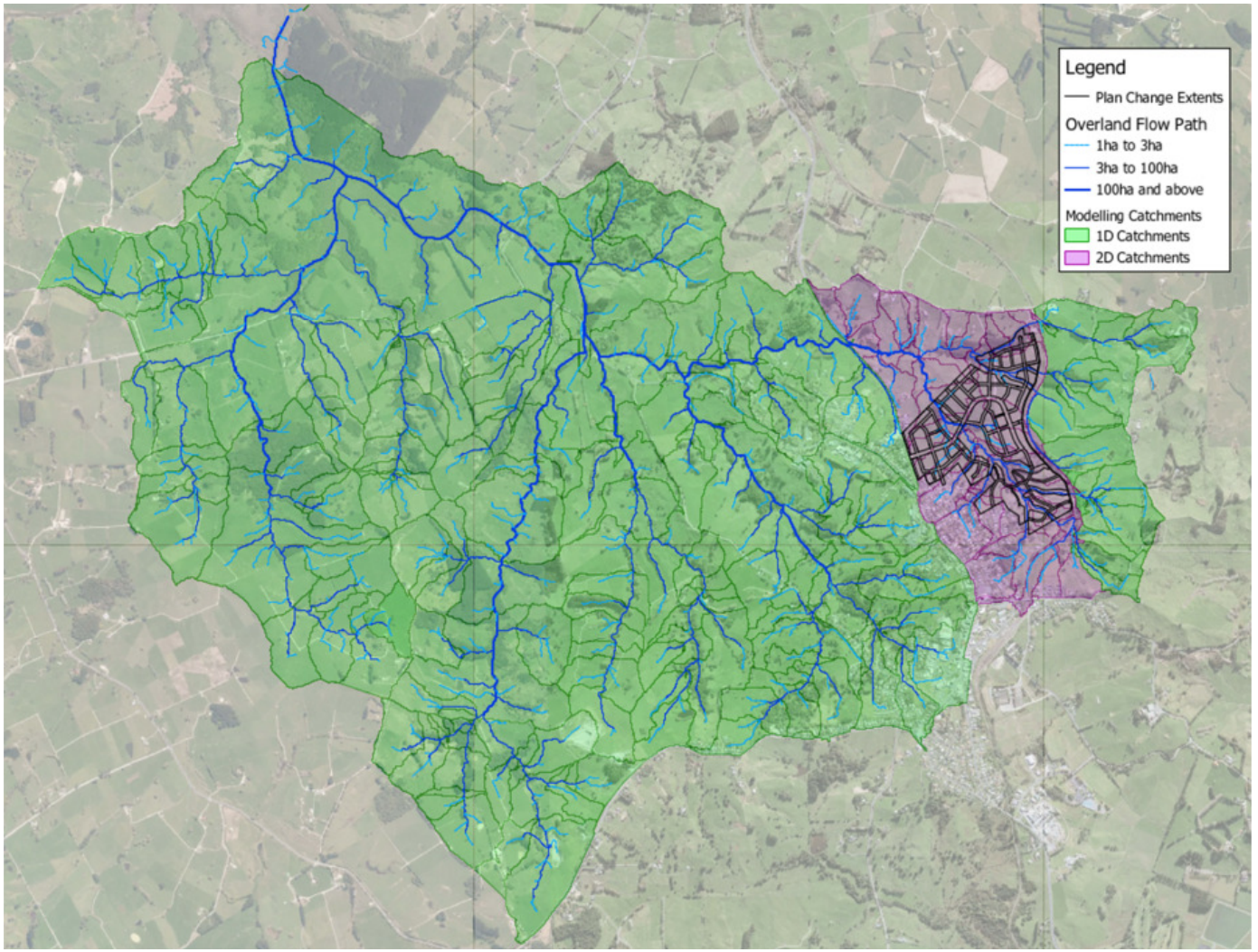


Key infrastructure

- Key infrastructure:
  - 1-3 – NZTA/ Auckland Council/ AT
  - 7-19 – KiwiRail
  - Survey undertaken for SH and Kiwirail culverts where accessible
- Council has no model information for this area
- Flood modelling was therefore undertaken by Woods to assess effects resulting from PPC



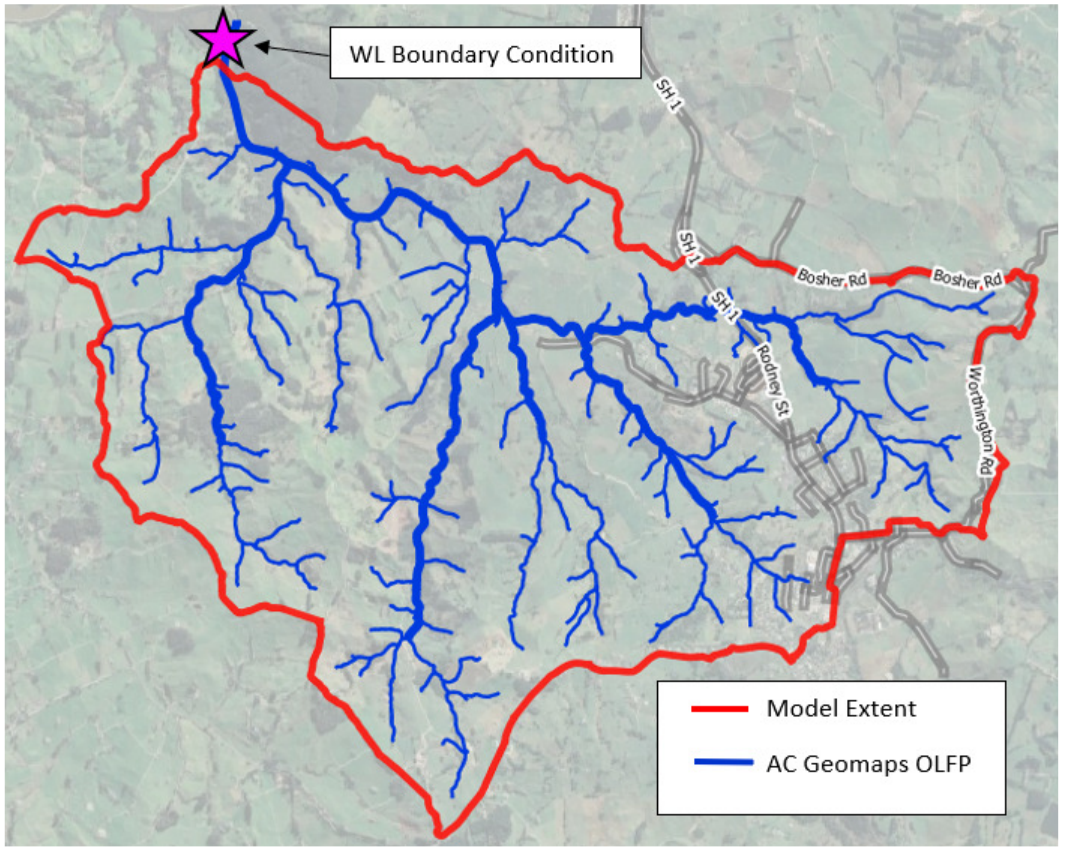
Flood modelling – Extent of model



Flood modelling – Boundary conditions and Rainfall depths

- Coastal tailwater boundary condition applied for all scenarios where Oruawharo River discharges to Kaipara Harbour at a constant water level of 3.3m based on MHWS 10%ile with 1m sea level rise consideration for climate change

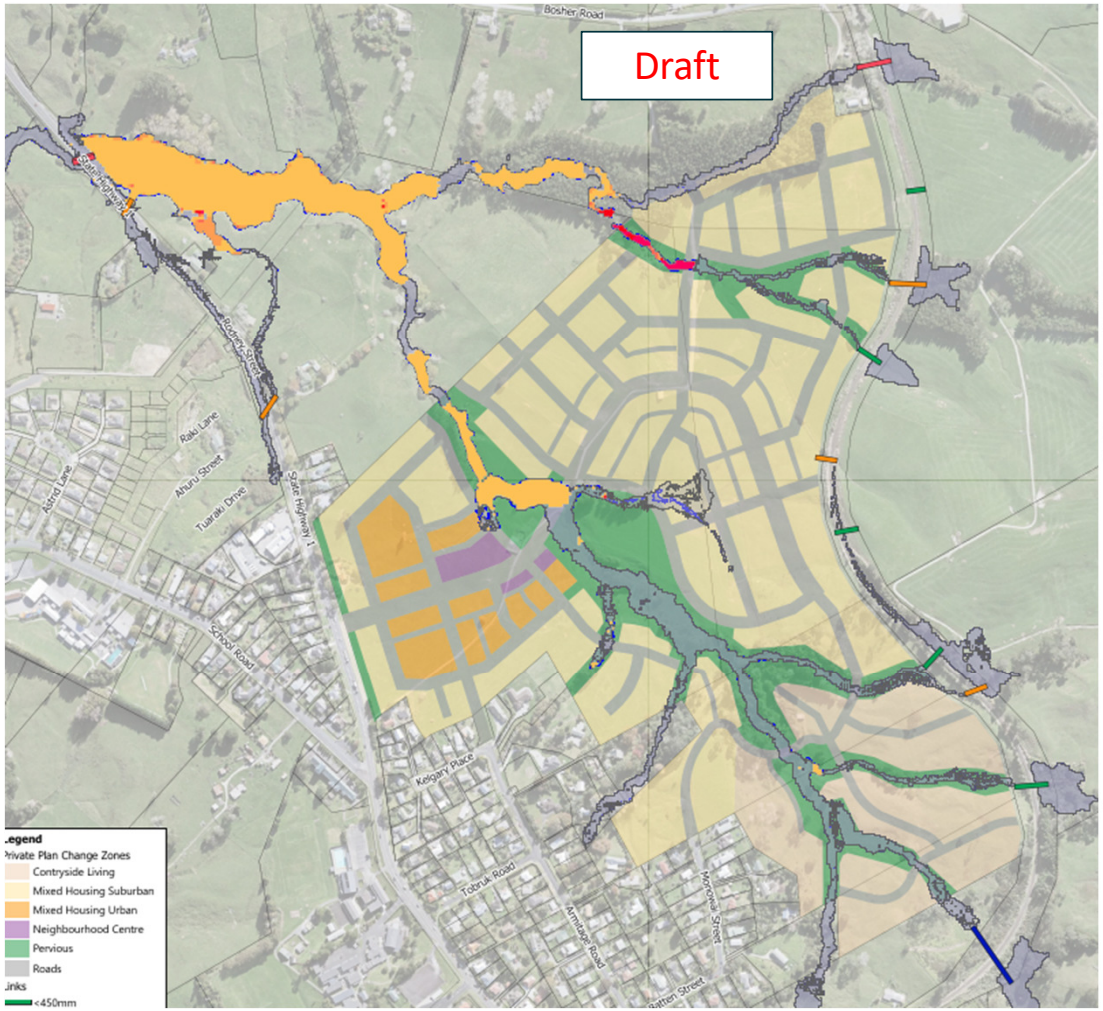
Storm Event	Rainfall Depth (mm)	Rainfall Depth including Climate Change - SWCoP V3 – 3.8^{0}C (mm)
2 year	95	121
10 year	170	222
100 year	260	345

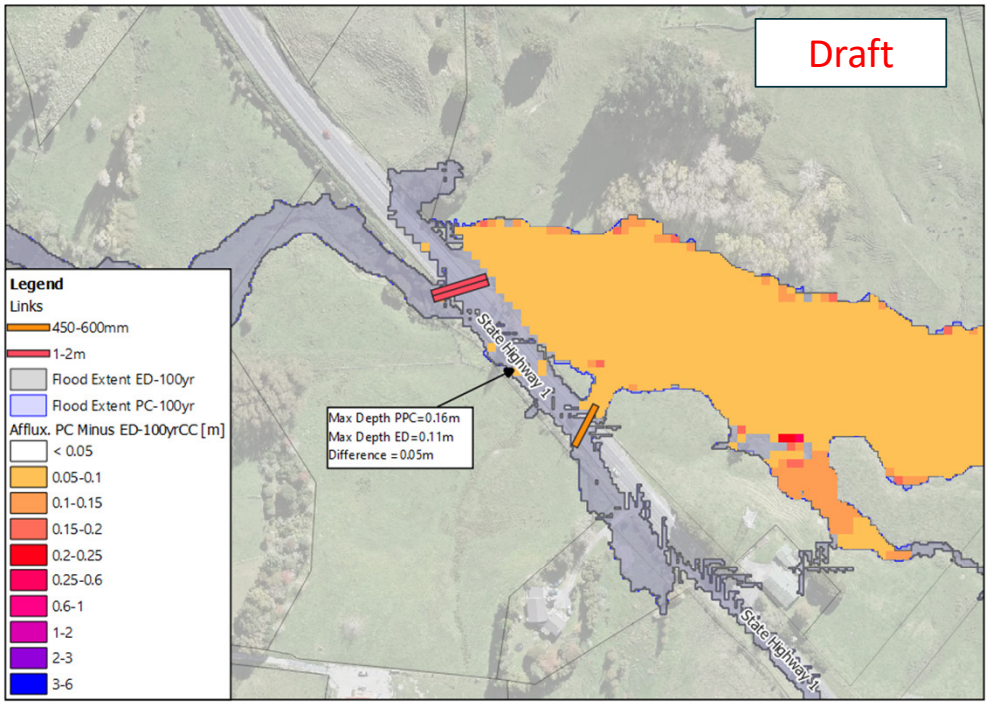


Flood modelling – Modelled scenarios

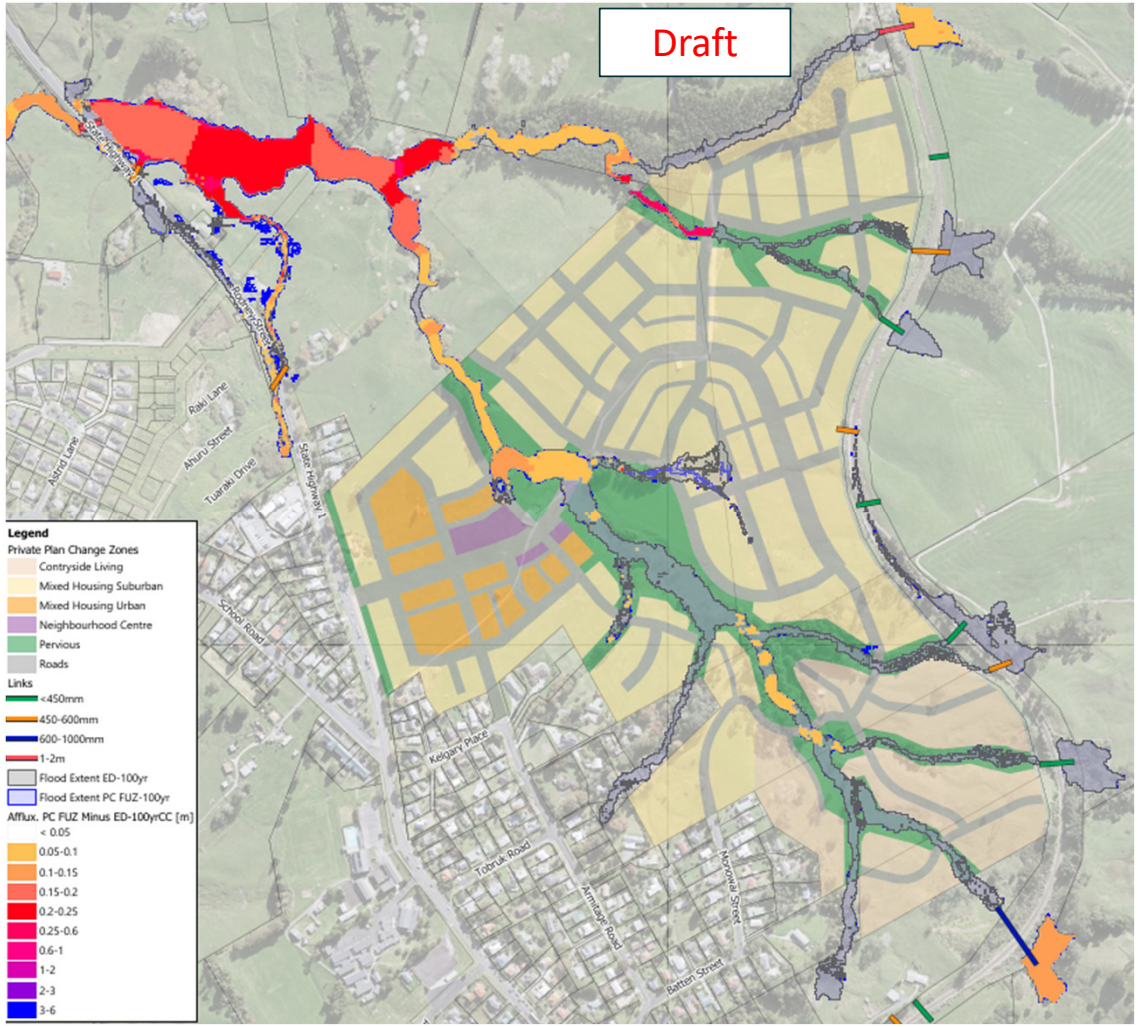
Scenario		Land use	Rainfall	Purpose
Pre-development/ existing development	ED	Existing impervious coverage	2-, 10- 100-year - 3.8°C	Create a base line scenario with 3.8 °C climate change factor. Understand existing deficiencies in infrastructure and effects i.e., SH1 Use as a comparative model to compare relevant post development PPC models.
Post-development	ED + PPC	Existing impervious coverage + Private Plan Change (MPD)	2-, 10- 100-year - 3.8°C	Create a base line scenario with 3.8 °C climate change factor. Understand deficiencies in infrastructure and effects i.e., SH1 as a result of PPC. Understand and isolate effects as a result of development within the PPC area only with neighbouring areas at the existing development.
Post-development (MPD)	MPD + PPC	Maximum probable development (MPD as per AUP: OiP) + Private Plan Change	2-, 10- 100-year - 3.8°C	Create a base line scenario with 3.8 °C climate change factor Understand deficiencies in infrastructure and effects i.e., SH1 as a result of PPC and MPD coverages Understand cumulative effects as a result of development within the PPC area and MPD coverages in other areas

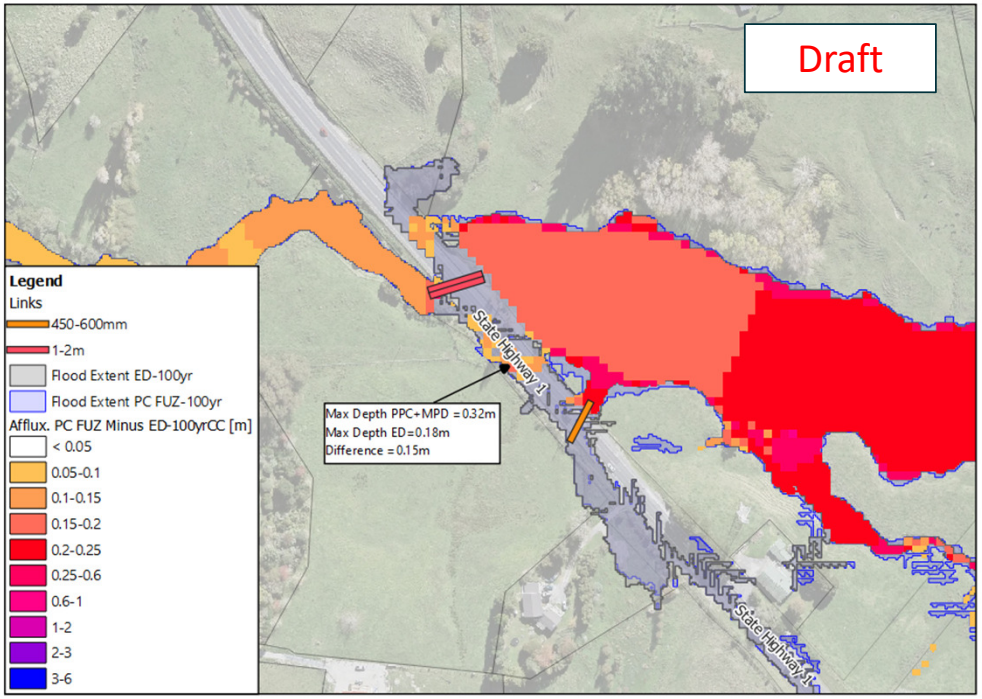
Afflux between ED and ED+ PPC (3.8^{0}C) for 100-year





Afflux between ED and MPD+ PPC (3.8^{0}C) for 100-year





Stormwater management

- In accordance with NDC Schedule 4 for ‘greenfields’:
  - Water quality for all impervious areas
  - Hydrology mitigation (retention and detention)
- Draft Stormwater Management Plan
- Opportunity to have centralised devices along stream edge

Questions/ Next steps

- Lodging Plan Change by end of April and keen to engage with Healthy Waters up to notification to resolve any issues.
- Currently undertaking consultation on Draft Structure Plan.

- Any questions

Location	MS Teams			
Time & Date	2pm	6/04/2022	**Taken by**	Bidara Pathirage
Attendees	**Initials**	**Name**		**Company**
	PW	Pranil Wadan		Woods
	BP	Bidara Pathirage		Woods
	CS	Cosette Saville		Barker & Associates
	NR	Nick Roberts		Barker & Associates
	SA	Susan Andrews		Auckland Council
	KL	Kedan Li		Auckland Council
Apologies	**Initials**	**Name**		**Company**
	TW	Tony Wang		Woods

High level Meeting Minutes – 6/04/2022

Wellsford North Plan Change – Meeting with Healthy Waters

1. Introductions around the table
2. NR and CS provides an introduction to the project, proposed Structure Plan and the Plan Change. It is noted the Plan Change area is smaller than the Structure Plan which is proposed for the FUZ zone north of Wellsford. An introduction to the Fast Track sites are also provided (Rodney Street area and Monowai Street area).
    a. Post meeting note from Auckland Council Kedan Li - The proposed plan change is different from the previous provided information, it is more intense at the top of the catchment. Please provide the accurate information in the SMP.
3. SA raises if mana whenua engagement is underway and CS confirms site visits have been undertaken with interested parties and are generally supportive.
4. PW runs through the stormwater work that has been undertaken to date. It is noted there is some key infrastructure in the area i.e., NZTA culvert/ asset under SH1 and Kiwi rail assets. Accessible assets have been surveyed to aid flood modelling. Healthy Waters have informed there is no flood model for the area.
5. PW discusses the extent of the flood model, boundary conditions and rainfall depths. Climate change allowance of 3.8^0C has been allowed for. 2, 10 and 100-year scenarios have been simulated with modelled scenarios presented.
6. PW discusses 100-year model results (indicative as the updated flood modelling based on a revised structure plan is currently underway). It is noted the streams are generally incised and results indicate that flooding is generally contained within the streams. Effects on SH1 indicate SH1 already overtops in the existing scenario and with the Plan Change, the increase is only approximately 50mm from existing. When compared with MPD (wider structure plan area), the increase is higher at approximately 150mm from existing. Higher water levels are indicated upstream of the culvert within the stream.
7. KL queries the NZTA culvert and sizing. PW/ BP to issue surveyed information to Auckland Council.

8. KL asks whether simulations have been undertaken without climate change. Woods to simulate models without climate change (10- and 100-year events) to understand if effects are a result of climate change or development. KL confirms 3.8^0C runs are adequate and don't require 2.1^0C simulations.

9. KL queries if there are any effects on number 10, SH1. Woods to enquire further in the models and issue information.

10. KL requests velocities and flow information to be provided at critical cross sections. Woods to provide this information to Auckland Council.

11. It is agreed that Woods will undertake further simulations as discussed and provide models, model results and model review form to Auckland Council as one package for review. It is noted that model runs are based on LiDAR 2016.

12. PW goes through the stormwater management strategy and is to be in accordance with 'greenfields' Schedule 4 NDC. PW notes there is an opportunity to have centralised devices along the stream edge. KL notes based on the information provided in the Draft SMP, a bit more detail will be required to understand how the BPO for water quality, detention/ retention can be implemented taking into account scour/ erosion, slope and ground stability etc. KL notes further certainty maybe required for the SMP to understand how devices can be incorporated.

13. KL asks about stream classifications. CS confirms and ecology assessment has been undertaken and is to circulate to Auckland Council. PW and CS note the streams align with the structure plan.

14. Next steps are discussed. NR notes lodgement is planned for end of April and is currently undertaking consultation on the Draft Structure Plan. Keen to engage with Healthy Waters via meetings/ workshops from lodgement till hearings to ensure issues are resolved. PW notes model information and the SMP is to be provided to Healthy Waters and if required, can be amended prior to hearings.

15. Woods to issue a complete package of information with model information and the SMP by the end of the month.

16. KL discusses the flooding on SH1 and whether anything is proposed. PW notes at source attenuation was considered; however, as the issue is existing, the increases as a result of the plan change was less than minor and therefore preference is to pass flows forward. KL notes it highlights current network deficiency. Woods to also consult with NZTA on effects.

17. Question raised regarding vesting of riparian areas. This is to be worked through with Healthy Waters and the Parks team.

List of actions

Action	By	When
Issue survey information	PW/ BP	08/04/2022
Issue Ecology report	CS	06/04/2022
Issue model information and SMP	PW/ BP	29/04/2022