104 Upper Fitzherbert Road
Flood Hazard Assessment

Urban Plus Ltd

04 June 2026

e2 environmental
CONSULTING CIVIL ENGINEERS

Quality Control

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EXECUTIVE SUMMARY

This assessment relates to the property at 104 Upper Fitzherbert Road, Wainuiomata (the site). The 4.0 ha site is currently zoned as Rural Residential Zone and is proposed to be Rural Lifestyle Zone under the Proposed District Plan (as notified). Urban Plus Ltd are acting on behalf of FH Developments 2025 Ltd who have submitted on Hutt City Council's proposed district plan, seeking to rezone the site to Medium Density Residential.

e2Environmental Ltd has been engaged to undertake a flood hazard assessment of the site which is currently subject to overland flows from the upper rural catchment.

A flood model including rain-on-grid hydrology with representation of waterways, stormwater reticulation network, and floodplains was developed to inform this study. This provided detail on the overland flows paths that could be used at a high level to size relevant infrastructure.

The flows from the upper rural catchment are able to be managed within the site by either diverting flows through a realigned channel around residential lots, or by maintaining existing channels provided dwellings are appropriately set back from the waterways. A central stormwater management area has been allowed for within the initial scheme plan as a possible solution to maintain hydraulic neutrality and ensure that off-site effects are acceptable.

Additionally, the developed flood model can be used at resource consenting stage to support the relevant design of infrastructure and ensure that finished ground levels and minimum floor levels are set to appropriate heights.

Overall, it is concluded that the flood hazard at this site can be appropriately managed such the site can be rezoned for residential development. This conclusion is independent of the potential scheme plan such that equivalent outcomes to manage the flood hazard can be achieved irrespective of the final yield of any future development.

CONTENTS

1 INTRODUCTION

1.1 Background

This assessment relates to the property at 104 Upper Fitzherbert Road, Wainuiomata (the site). The 4.0 ha site is currently zoned as Rural Residential Zone (under the Operative District Plan) and Rural Lifestyle under the Proposed District Plan (as notified). Urban Plus Ltd are acting on behalf of FH Developments 2025 Ltd who have submitted on Hutt City Council's (HCC) proposed district plan, seeking to rezone the site to Medium Density Residential Zone (MDRZ).

e2Environmental Ltd (e2) has been engaged to undertake a flood hazard assessment of the site which is currently subject to overland flows from the upper rural catchment. In particular, the assessment documented in this report sets out a feasible design solution to demonstrate that flows through the site can be safely managed and that any potential off-site effects would be acceptable. The details of these design requirements will be confirmed at the resource consent stage and subsequent detailed design.

1.2 Description of the Planned Development Area

The site is located within the Wainuiomata Valley and slopes from the east to the west at a grade of approximately 1 in 50. Black Creek, the primary waterway of Wainuiomata, is located immediately west of the site on the opposite side of Upper Fitzherbert Road which provides access to the site. To the north and east of the site is undeveloped Rural Residential land. To the south of the site is 239 & 252 Wise St which is MDRZ land. 239 Wise St is in the process of being developed. It is expected that the consented development to the south will extend the Wise Street carriageway towards, or potentially to, the southern boundary of the site.

The site is greenfield land and has three overland flow paths and channels which convey runoff flows from the upper hill catchment through the site. The ecological nature and definition of these waterways have been described by others and so has not been documented in this report. These flows discharge into a waterway on 239 & 252 Wise St on the neighbouring side of the southern boundary. Currently, a Ø225 culvert discharges a portion of those flows from that waterway on 239 Wise St into Black Creek with excess flows breaking out of the channel and flowing south through the catchment. As part of the development of 239 Wise St, this waterway will be upgraded and will discharge all inflows it receives into Black Creek via a new outlet structure, preventing break out of flows to the south. The physical works for this waterway upgrade are yet to occur.

The site area and proposed development is shown in Figure 1 below. A photo of the largest on-site overland flow path channel is shown in Figure 2 below. Figure 3 shows the Flood Hazard Overlay from the current District Plan which covers the site. The site is also within the Low Flood Hazard Overlay in the Proposed District Plan (see Figure 4 below). A very small portion of the site along the southern boundary has an area of High Flood Hazard due to the waterway on 239 Wise St next to the property boundary. A potential scheme plan of the planned development that is indicative only and is subject to final design is attached in

Appendix A to provide context to this study. Plans showing existing LiDAR topography are provided in Appendix B.

Figure 1 *Proposed development at 104 Upper Fitzherbert Rd shown in yellow and Black Creek shown by blue polyline*

Figure 2 *Photo of on-site overland flow path channel looking southwest (photo taken 30th April 2026 by Cuttriss Consultants)*

Figure 3 Flood Hazard Overlay in current District Plan (HCC GIS Viewer, 2026)

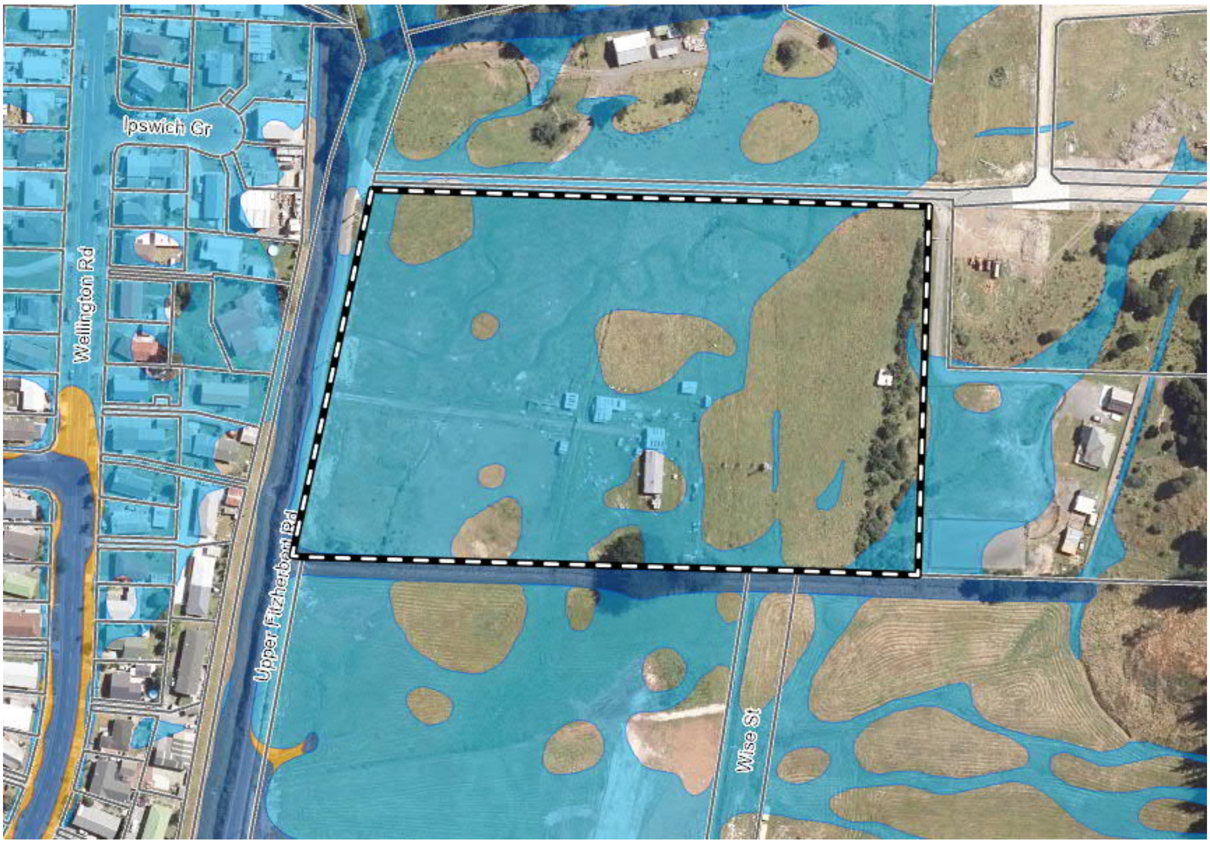


Figure 4 Low Flood Hazard Overlay in Proposed District Plan (HCC, 2026)

1.3 Abbreviations

In reading this report, please note the following abbreviations in Table 1.

Table 1 Description of abbreviations

Abbreviation	Description
AEP	Annual exceedance probability.
10% AEP	References the 10% AEP event which does not include the effects of climate change. A 10% AEP event is equivalent to a 10-year average recurrence interval event.
1% AEP	References the 1% AEP event including the effects of climate change. A 1% AEP event is equivalent to a 100-year average recurrence interval event.
OFP	Overland flow path.
SMA	Stormwater management area.
m RL	All levels are provided in New Zealand Vertical Datum 2016 (NZVD2016).
MFL	Minimum Floor Level. Applies to the underside of timber floor joists or the underside of a concrete floor slab.
FFL	Finished Floor Level.
LiDAR	Light Detection And Ranging.
1D	One-dimensional model elements where water flows in one direction (i.e. pipes and waterways).
2D	Two-dimensional model elements where water can flow in multiple directions (i.e., floodplain). Note waterways can be represented in the 2D model environment.

2 OVERLAND FLOW PATHS

2.1 Description of Upper Catchment

The undeveloped upper catchment of the site is a mix of vegetated hills and rural pastural land at the bottom of those hills. The landcover database classifies the hills as having areas of Manuka and/or Kanuka, indigenous forest, and broadleaved indigenous hardwoods.

The 43.4 ha upper catchment of the primary overland flow path (OFP 1 described in section 2.2 below) entering the site via the north boundary has an average slope of 7.6%, with the hills having an average slope of 17.5% and the lower rural land having a 2% slope. So, due to the steep slopes and catchment length of 1.4 km, the catchment has an estimated time of concentration of approximately 30 minutes[1].

This will result in flashy floods with high peak flows from short duration high intensity rainfall events. These types of events have the ability for flows to overwhelm their natural drainage paths and spill into adjacent OFPs, potentially increasing the volume of floodwaters that will need to be catered for within any development of the site.

[1] Calculated averaging the outputs from the Ramser Kirpich and Bransby Williams equations as detailed in WWL (2019).

2.2 Nature of On-Site Flows and Flood Hazard

Flood modelling undertaken by e2[2] showed that there are four key overland flow paths entering the development site. The location of these four OFPs are shown in Figure 5 below. The peak flow through each OFP is also detailed in Table 2 below.

Within the site, flow velocities in the centre of the existing channels typically reach up to 1.2 m/s and in wider sheet flow areas velocities are typically no more than 0.6 m/s. Similarly, peak water depths in the existing channels are typically less than 1 m and across wider sheet flow areas peak water depths are typically less than 0.4 m. Flood maps of the site are presented in Appendix F.

Figure 5 Peak flood depths and flow extraction lines at 104 Upper Fitzherbert Road

Table 2 Peak flows entering site (m³/s)

OFP	10% AEP	1% AEP
1	1.93	6.73
2	0.13	0.87
3	0.51	1.29
Total along northern boundary (OFP 1, 2 & 3):	2.53	8.84
4	0.67	1.59

[2] Refer to Appendix C for summary of data inputs, Appendix D for a description of the flood modelling, and Appendix E for an assessment of the model confidence.

3 ON-SITE MITIGATIONS

3.1 Management of On-Site Flows from the Northern Boundary

Safe development of the site requires that residential lots are not located within overland flow paths. In the case of OFPs 1, 2 & 3, it would be possible to divert flows around the residential lots towards the central stormwater management area. Filling of the site is likely to be required to ensure flood free building platforms. So, the SMA would be needed to provide some level of flood compensation to account for the effects of filling on-site as well as providing on-site stormwater treatment and attenuation.

The level of flood compensation will be confirmed at resource consenting stage as that will require detailed flood modelling due to the complex dynamics. However, at this stage, it is noted that there is approximately 540 m^3 of ponded water (flow velocity < 0.2 m/s) across the site where filling is expected to occur. If required, the SMA can be sized at the resource consent stage once detailed flood modelling of the post-development situation has been undertaken.

Local stormwater runoff can then be discharged to Black Creek as detailed in evidence by Cuttriss Consultants. However, the larger flows from the upper catchment will be able to spill out over the southern boundary into the waterway on 239 Wise St as it does in the existing situation, thereby maintaining hydraulic neutrality.

The channel to convey the OFPs from the northern boundary to the SMA is intended to be a trapezoidal channel. This would have a 2.0 m base, 1.15 m water depth, 1:2 (vertical: horizontal) side slopes, and some light planting on the banks[3]. With a 0.1 m freeboard depth, this channel would have a 7 m top width which provides room for a 3 m maintenance strip within the 10 m watercourse corridor provided on the indicative scheme plan. However, this channel can be modified in future design stages if required. Either way, it demonstrates that the 8.84 m^3/s flow from the northern boundary in the 1% AEP flood event can be safely conveyed to a central SMA.

Through such a design, the flows from the northern boundary of the site would be able to exit the site at the same location as they currently do, and with the provision of some flood compensation within the central SMA, off-site effects are expected to be acceptable (i.e., no consequential increase of flood risk to neighbouring properties and / or their access). This will be confirmed at resource consenting stage via detailed flood modelling of the post-development situation. The assessment of off-site effects will review any potential changes in flows over the site boundary, and differences in peak water levels, flow velocities and inundation extents.

[3] With a channel slope of 0.86%, Manning's n value of 0.04, and those channel dimensions, the channel is estimated via the Manning's formula to have a capacity of 9.0 m^3/s.

3.2 Management of On-Site Flows from Eastern Boundary

As detailed above, the OFP that enters the site across the eastern boundary has a peak flow of 1.59 m^3/s in the 1% AEP flood event. The indicative scheme plan would allow for these flows to remain within their existing OFP channel and discharge through and out of the site at the back of the residential lots (away from dwellings) situated along the eastern site boundary. This channel would have an easement covering a right to drain water with a covenant to protect the channel from in-fill.

It is anticipated that the existing channel conveying these flows would not be subject to earthworks, whereby off-site effects are expected to be acceptable. This will be confirmed at resource consenting stage via detailed flood modelling of the post-development situation. The assessment of off-site effects will review any potential changes in flows over the site boundary, and differences in peak water levels, flow velocities, and inundation extents.

3.3 Property Access and Egress

Property access and egress is important to maintain during large flood events so that people's safety can be maintained. The indicative design accompanying this rezoning proposal is to either divert flows around residential lots (refer to section 3.1) or maintain existing flow paths at the back of residential lots away from access points (refer to section 3.2). This means that the only floodwater that would be on the roadways within the site during a large flood event would be from on-site stormwater. While these flows will be quantified at future design stages, they are expected to be small and will not prevent property access.

Those future design stages will seek to ensure that any floodwaters on roadways fall within the "H1" hazard category as defined by NSW[4]. This "H1" category is generally safe for people, vehicles and buildings, and is defined as being less than 0.3 m deep for a flow velocity less than 1 m/s and with a velocity x depth less than 0.3 m^2/s up to a flow velocity of 2 m/s (refer Figure 6 to below).

[4] NSW - Department of Planning and Environment. 2023. *Flood hazard – Flood risk management guideline FB03*

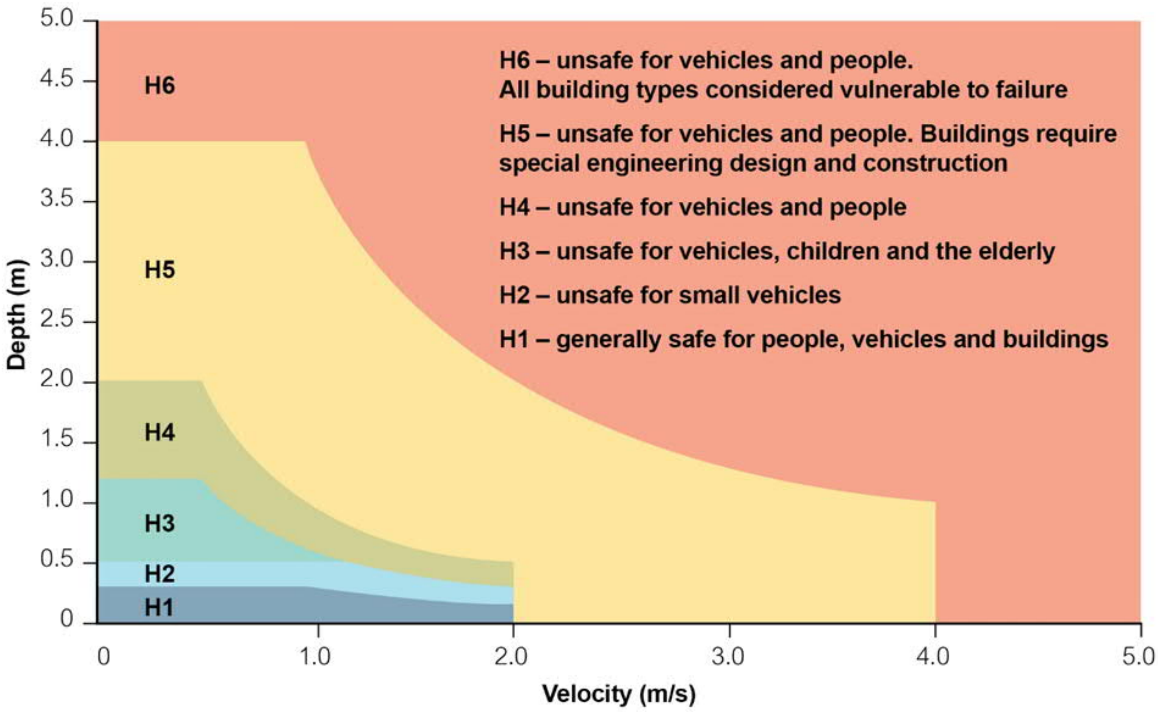


Figure 6 Flood hazard vulnerability curve (NSW, 2023)

3.4 Protecting Lots from Flood Hazard

As described above, overland flows can either be diverted around residential lots to a central SMA or can be conveyed within their existing channels at the back of residential lots away from dwellings. So, to protect lots from flood hazard, it is expected that their finished ground levels would be set above the 1% AEP flood level. These flood levels will be estimated when detailed flood modelling of the post-development situation occurs at resource consenting stage.

Additionally, and in line with the proposed district plan, minimum floor levels will be set based on the 1% AEP flood level plus freeboard. Freeboard is expected to be 200 mm provided detailed flood modelling demonstrates confidence in the estimated flood levels through sensitivity testing. Otherwise, freeboard would be set to 500 mm. This will be confirmed at the resource consenting stage.

3.5 Summary of Proposed On-Site Mitigations

Figure 7 below presents a summary of the intended on-site mitigations described above.

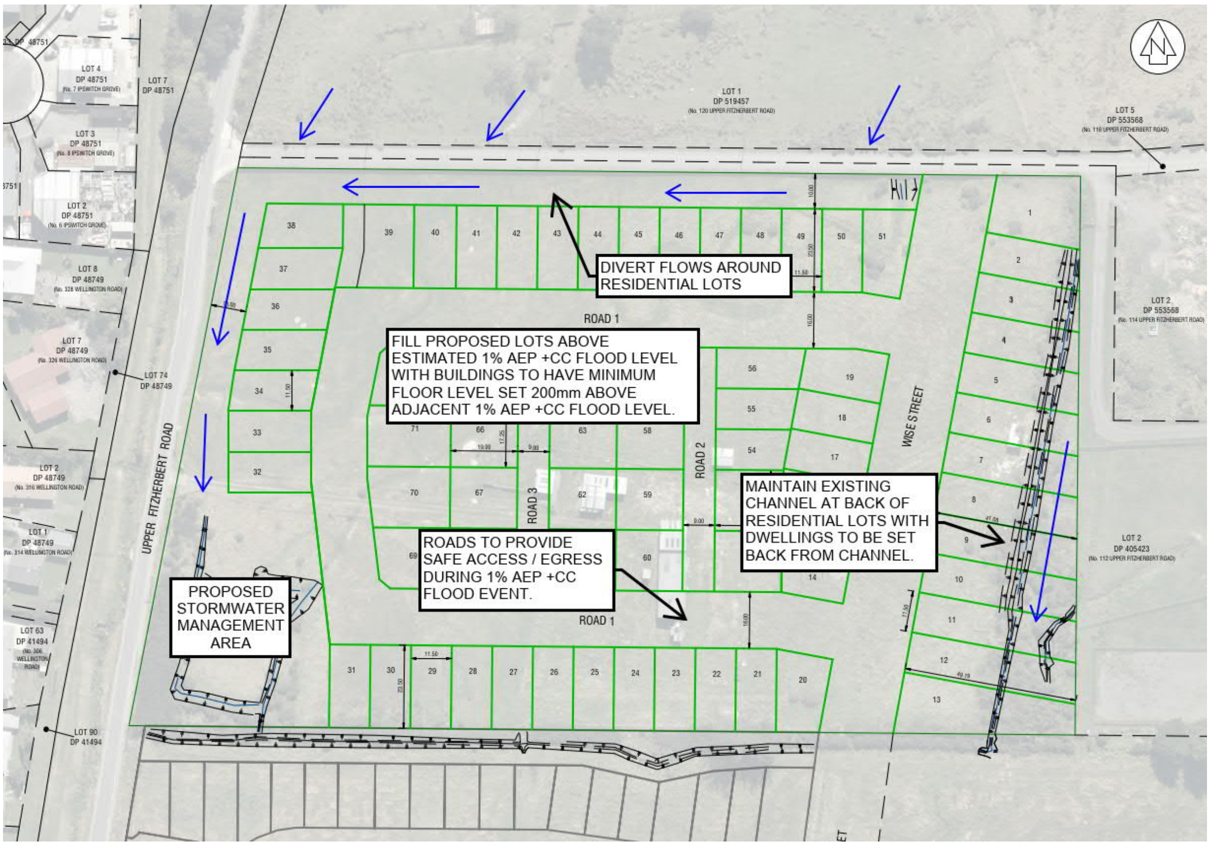


Figure 7 Summary of proposed on-site flood mitigations

4 CONCLUSIONS

In conclusion, overland flows and their associated flood hazard are able to be safely managed if 104 Upper Fitzherbert Rd is rezoned for residential subdivision.

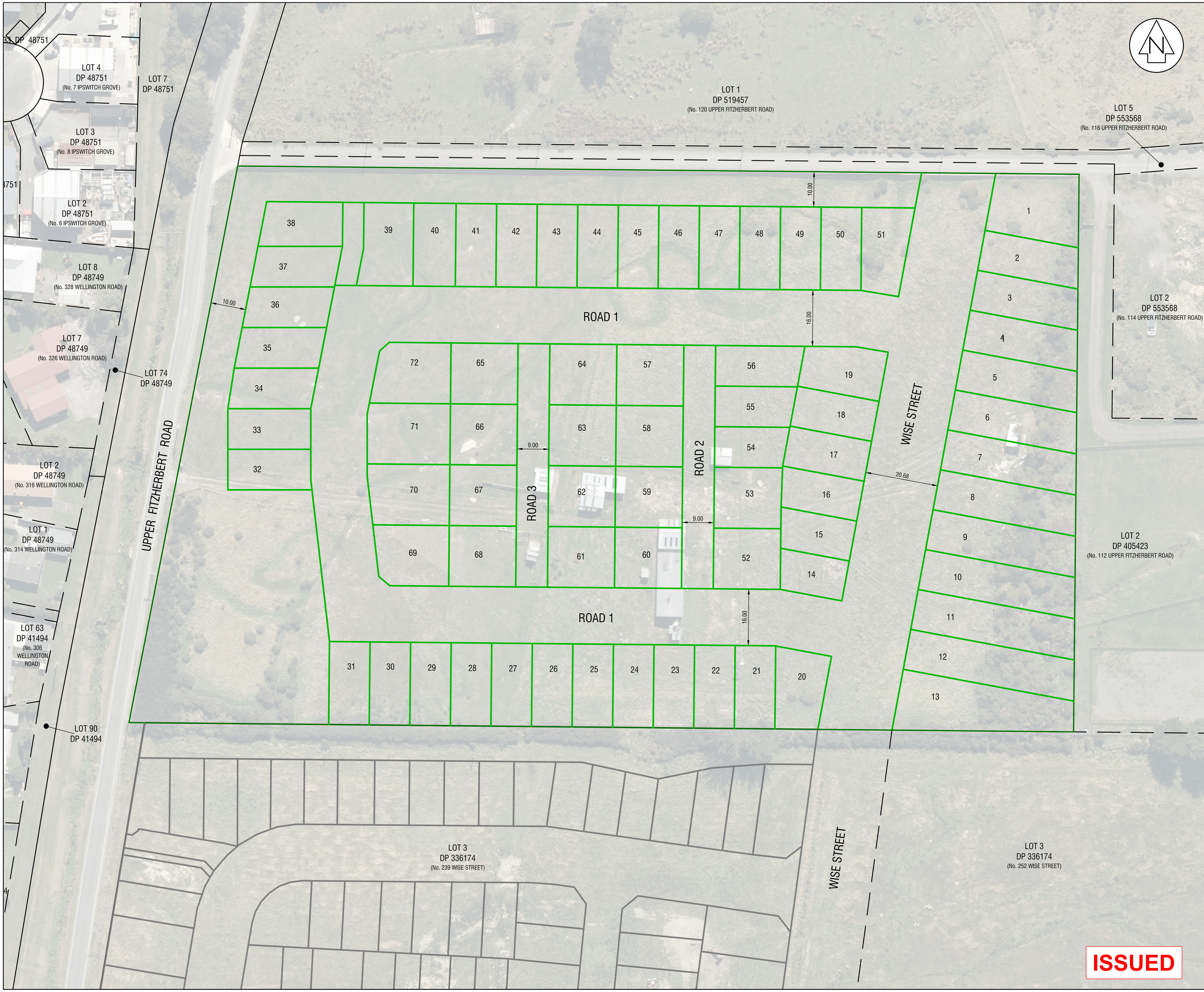
These flows can be managed within the site by either diverting flows through a realigned channel around residential lots, or by maintaining existing channels provided dwellings are appropriately set back from the waterways.

Additionally, the developed flood model can be used at resource consenting stage to confirm that off-site effects are acceptable and that finished ground levels and minimum floor levels are set to appropriate heights.

These conclusions are independent of the potential scheme plan such that equivalent outcomes to manage the flood hazard can be achieved irrespective of the final yield of the future development.

APPENDICES

APPENDIX A – Potential Scheme Plan



REVISION DETAILS		NAME	DATE
A	FOR EVIDENCE	SRG	05/26

NOTES:

1. THIS PLAN IS TO BE USED FOR PLAN CHANGE PURPOSES ONLY & IS NOT TO BE RELIED UPON FOR ANY OTHER PURPOSE WITHOUT THE CONSENT OF CUTTRISS CONSULTANTS LIMITED.
2. BOUNDARY INFORMATION HAS BEEN SOURCED FROM INFORMATION PROVIDED BY GRIP LTD & HAS NOT BEEN VERIFIED ON SITE.

LEGEND

BOUNDARY
PROPOSED BOUNDARY

SCALE BAR 0 10 20 30 40 50m — SCALE 1:500 (A3 1:1000)

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CLIENT
URBAN PLUS LTD

PROJECT
PROPOSED SUBDIVISION
LOT 1 DP 80607
104 UPPER FITZHERBERT ROAD,
LOWER HUTT

SKETCH PLAN

SCALE A1 - 1:500
REDUCED SCALE A3 - 1:1000

	NAME	DATE
FIELDWORK	-	-
DESIGNED	SG	04/26
DRAWN	CG	04/26
CHECKED	SG	04/26

DRAWING NUMBER 31085 SK1
SHEET 1 OF 1 SHEETS
REVISION A

APPENDIX B – Catchment Maps

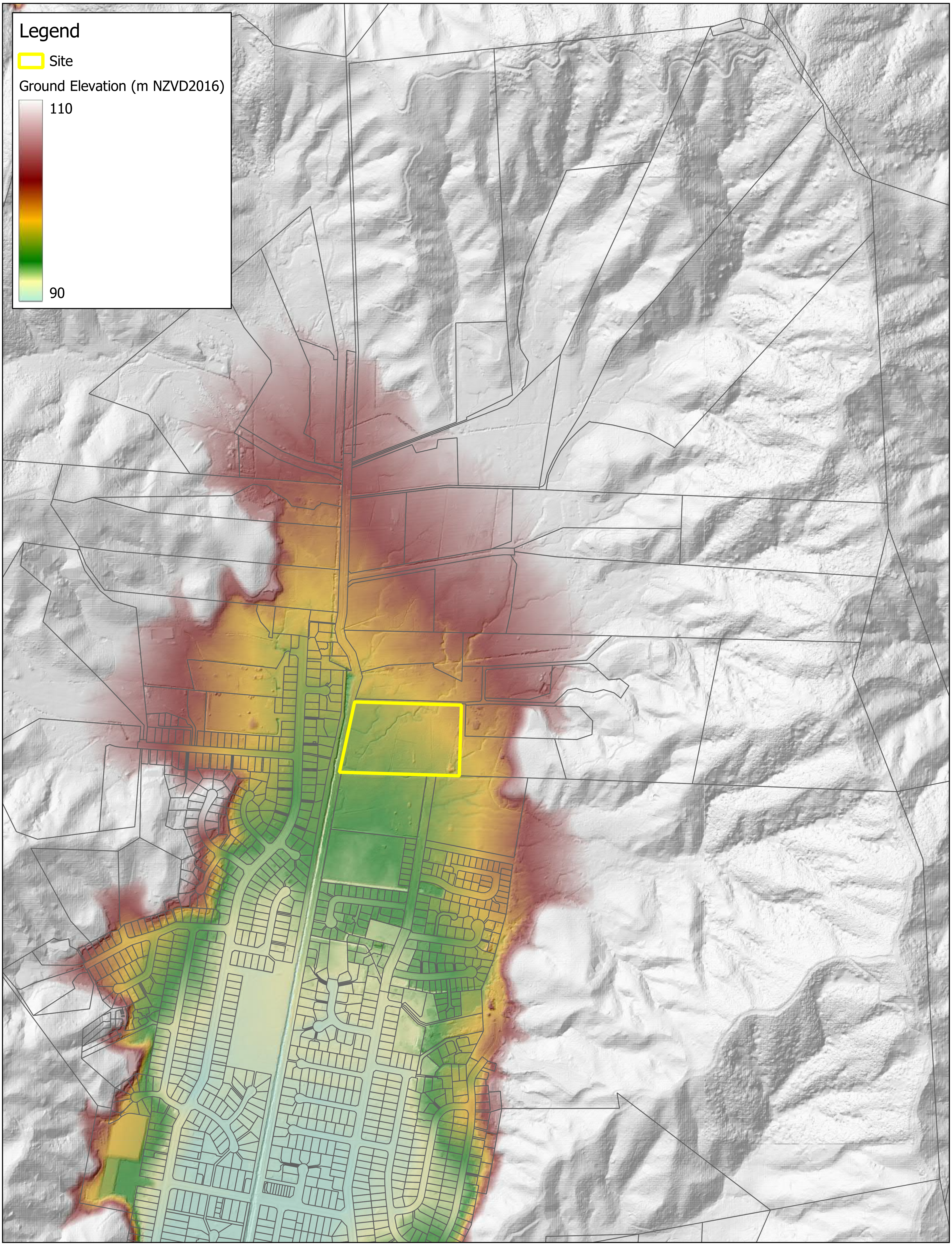
Urban Plus Ltd
104 Upper Fitzherbert Road Flood Hazard Assessment
Wider Catchment Aerial

Paper Size A3
0 90 180 270 360 m
Scale: 1 : 7500 (A3)

N

Job Number	26034
Revision	1
Date	22/05/2026

Christchurch, Wellington, Blenheim, Ashburton www.e2environmental.com



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104 Upper Fitzherbert Road Flood Hazard Assessment

Wider Catchment Topography

Paper Size A3

0 90 180 270 360 m

Scale: 1 : 7500 (A3)

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Job Number	26034
Revision	1
Date	22/05/2026

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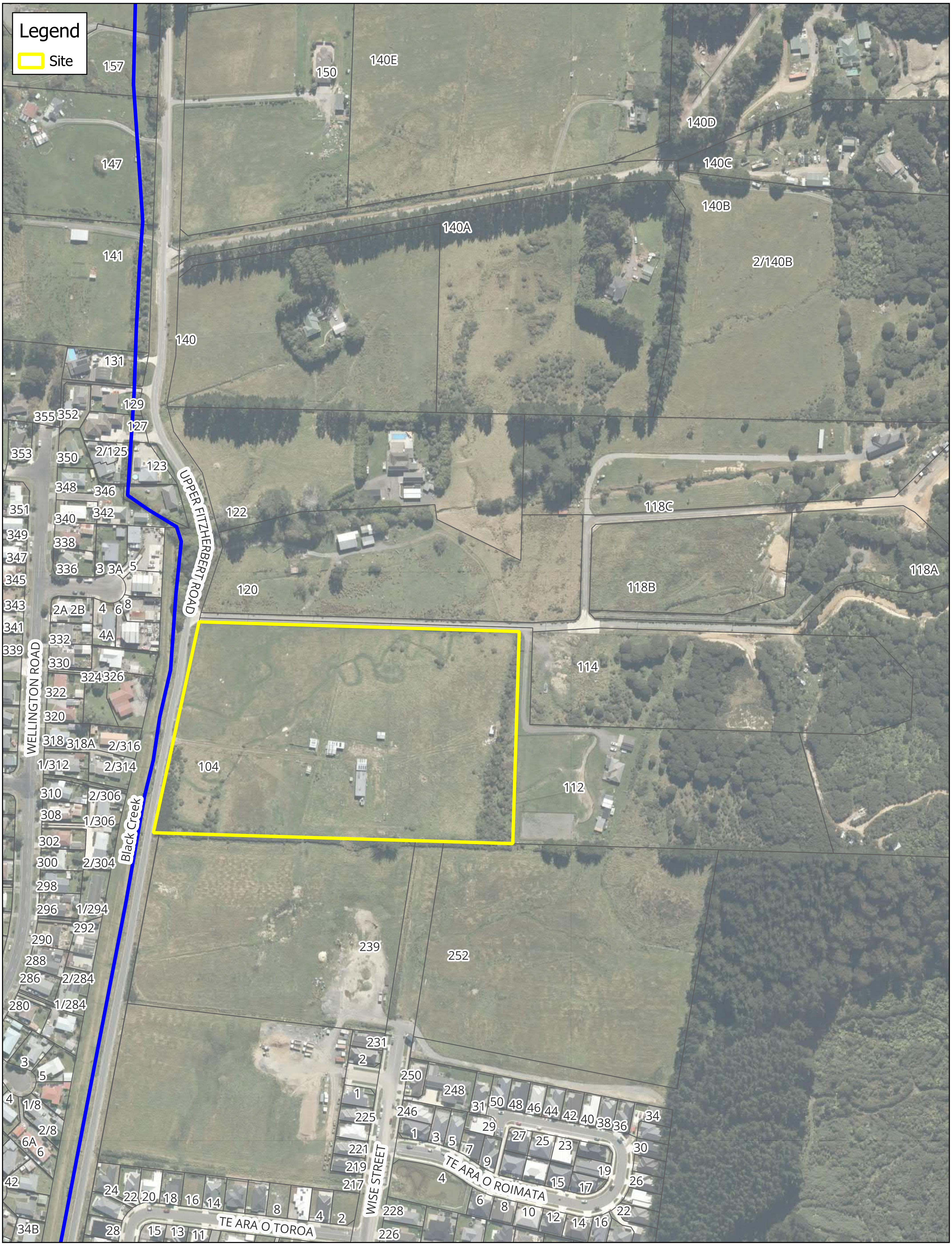

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Urban Plus Ltd
104 Upper Fitzherbert Road Flood Hazard Assessment
Catchment Aerial

Paper Size A3
0 30 60 90 120 m
Scale: 1 : 2500 (A3)

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Job Number	26034
Revision	1
Date	22/05/2026

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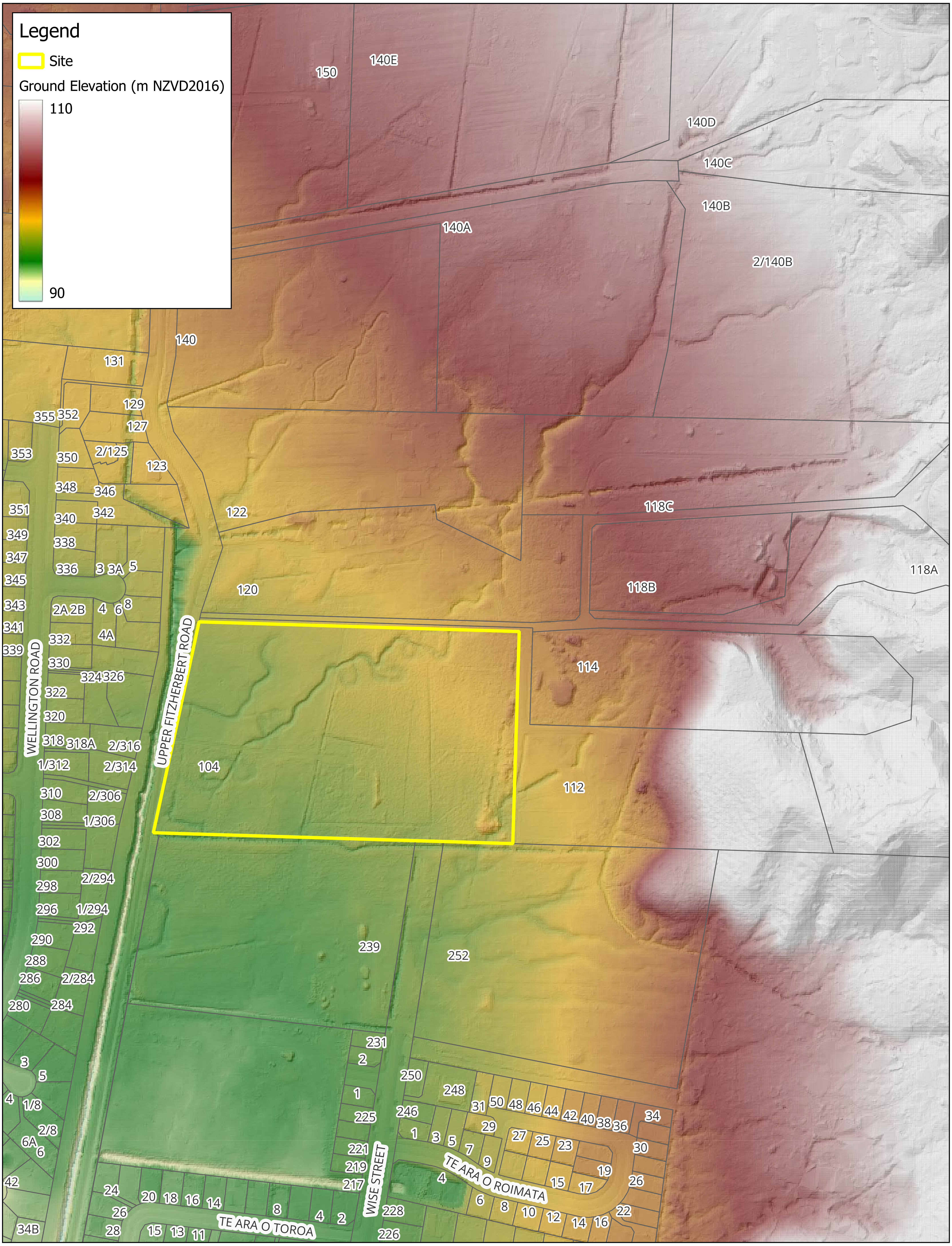

Urban Plus Ltd
104 Upper Fitzherbert Road Flood Hazard Assessment
Catchment Topography

Paper Size A3
0 30 60 90 120 m
Scale: 1 : 2500 (A3)

Job Number	26034
Revision	1
Date	22/05/2026

APPENDIX C – Data Collection and Review

The following sections provide descriptions of important datasets that have been obtained to support the flood hazard assessment.

Topographic Data

The most recent LiDAR Digital Elevation Model (DEM) available is the "Hutt City LiDAR 1m DEM (2025)" obtained from LINZ (Land Information New Zealand) website. This LiDAR dataset does not cover the upper half of the surrounding hills, and so the "Wellington LiDAR 1m DEM (2013-2014)" was used to cover those areas as combined by LINZ in the "New Zealand LiDAR 1m DEM" layer.

The vertical datum of the LiDAR dataset is NZVD2016.

Survey Data

Survey data of the existing ground has been collected by Cuttriss Consultants Ltd for site and will be available for future design stages.

Stormwater Network

Shapefiles of the existing Hutt City Council stormwater reticulation network were downloaded from their open data portal.

Rainfall Data

Design rainfall data was sourced from NIWA's High Intensity Rainfall Design System (HIRDS V4).

Landcover Database Layer

Version 6.0 of the Landcover Database was used to set roughness zones in the model. Roads, buildings and Black Creek were defined separately.

S-Maps Soil Drainage Layer

S-Maps soil drainage data issued in August 2025 were used to set infiltration rates in the flood model.

APPENDIX D – Flood Model Build

Previous Model Review

Wellington Water Limited (WWL) has previously developed models for the Wainuiomata Valley. Their current model was developed to assess the capacity of Black Creek. However, this excluded many of the stormwater pipes surrounding the development site. They have also modified this model to be rain on grid to obtain flood extents for the 1% AEP flood event (I. Kholodov, personal communication, March 20, 2025). These rain on grid model results were provided to e2 including flows entering and exiting the site at key locations.

Additionally, it is understood that WWL are currently waiting for a new Wainuiomata model to be completed. However, this model was not available when this flood hazard assessment was undertaken.

Site Specific Flood Modelling

Site specific flood modelling of the existing situation was undertaken by e2 for the purposes of this study. A rain-on-grid 2D flood model of the site and its wider catchment including representation of the piped (1D) stormwater reticulation network was developed in the TUFLOW modelling software package. The flood model extent covers an area of 4.8 km^2. See Figure 8 below for the model extent. This modelling is detailed in the following sections.

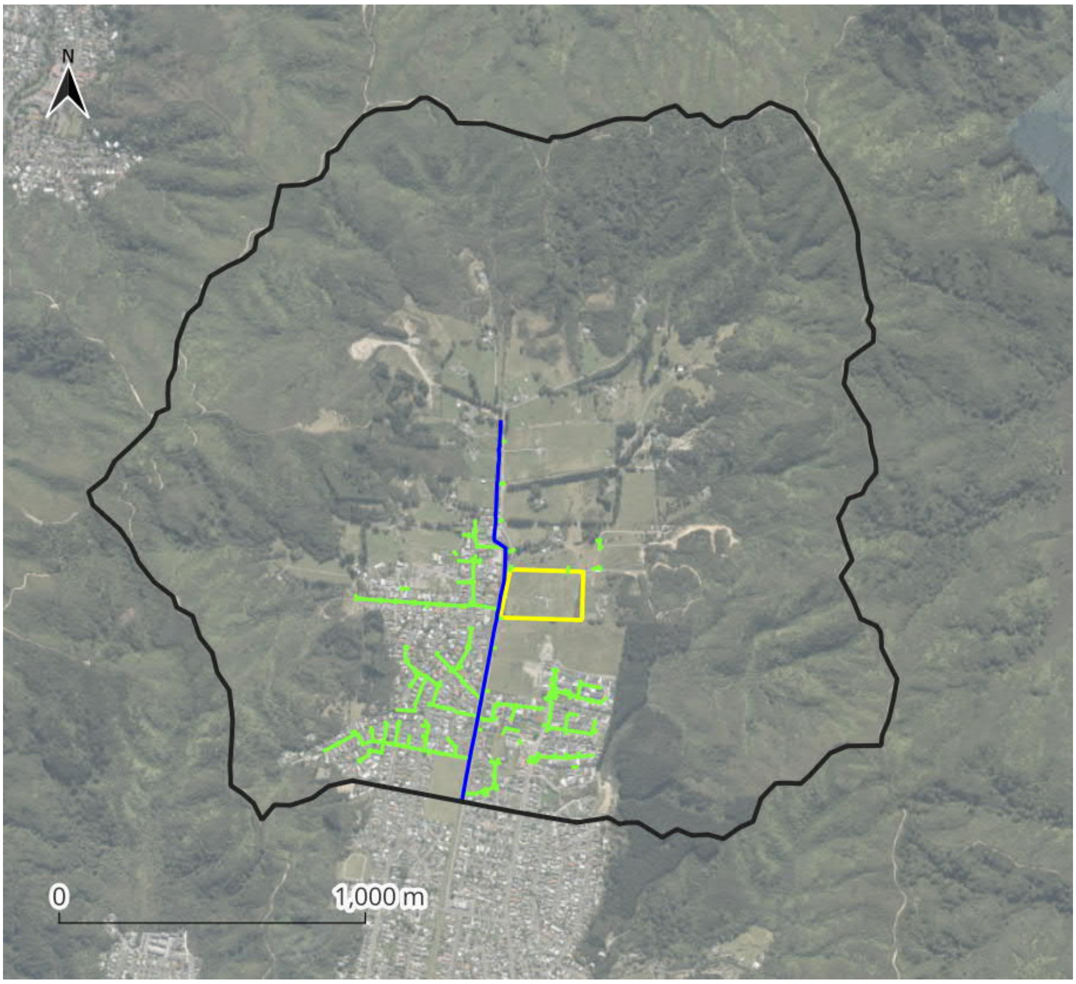

Figure 8 Flood model extent (Black Creek in blue and reticulation pipes in green)

Design Rainfall

The design rainfalls applied were developed using WWL's methodology described in Reference Guide for Design Storm Hydrology dated 9 April 2019. These hyetographs are based on a 12-hr nested stormwater and include an areal reduction factor of 0.97 based on a modelled catchment area of 4.8 km^2. See Figure 9 below for the design rainfall hyetographs used in the model.

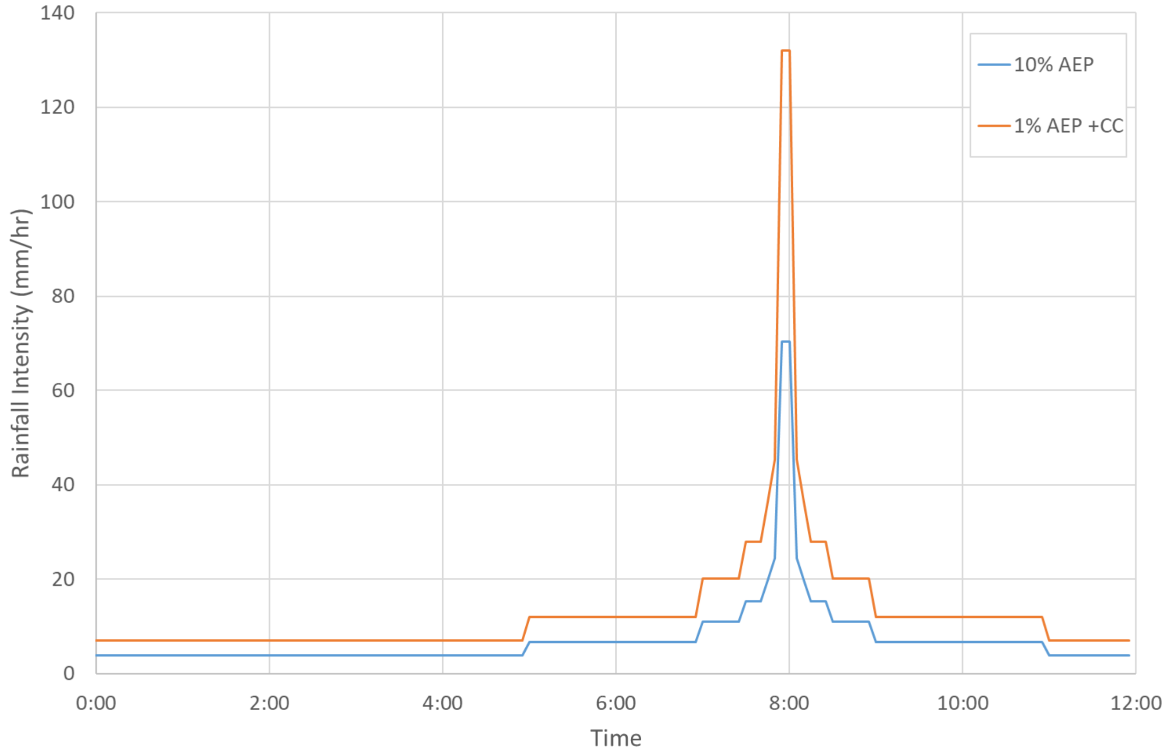

Figure 9 Design rainfall hyetographs

Infiltration

Soil infiltration rates were defined in TUFLOW using Horton's empirical equation. With the rain-on-grid approach, this ensures that overland flow paths are well represented across the floodplain. Specific guidance on this methodology is not provided in WWL's Reference Guide for Design Storm Hydrology as this relates more to rainfall-runoff modelling with the SCS runoff curve number method. Consequently, additional guidance from Christchurch City Council's (CCC) Waterways, Wetlands and Drainage Guide (WWDG) was used to set maximum and minimum infiltration rates, as well as decay rates, based on S-Map's soil information (see Table 3 and Figure 10 below). Undefined infiltration areas were conservatively set to "poor infiltration". Impervious areas had infiltration rates set to 0 mm/hr. Roads, buildings, and Black Creek roughness zones had an impervious value of 1 (i.e., 100% impervious), and 'built-up area (settlement)' excluding buildings had an impervious value of 0.2 (i.e., 20% impervious).

Table 3 Generic and impervious adjusted soil infiltration rates

	Undefined	Poor infiltration	Moderately well-drained infiltration
Initial ponding depth	5 mm		5 mm
Initial infiltration rate	5 mm/hr		10 mm/hr
Ultimate infiltration rate	1 mm/hr		5 mm/hr
Horton decay rate	5.40 hr^{-1} (1.5 hours to near ultimate)		0.36 hr^{-1} (12 hours to near ultimate)

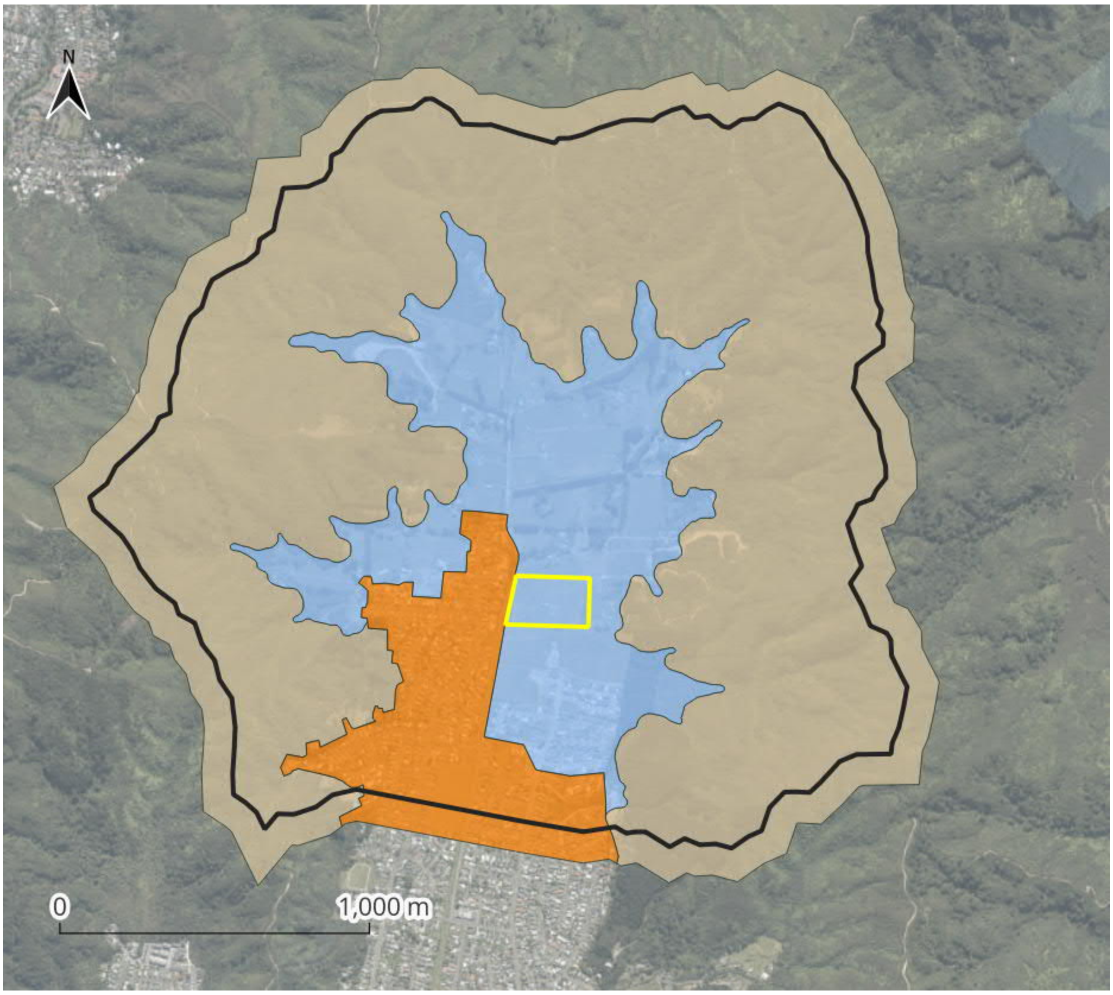

Figure 10 S-Maps soil information within the 2D Zone (moderately-well drained in tan, poorly drained in blue, and undefined in orange)

<u>Downstream Boundary</u>

The downstream water level boundary was set on the Black Creek 610 m south of the planned development area. A constant 89.5 m RL water level boundary condition was applied. This downstream boundary was located further away from the area of interest to avoid potential artificial effects on the model in the area of interest.

Hydraulic Roughness

Table 4 below details the Manning's n values assumed in the flood model. These values were sourced from the WWDG and other publicly available model reports written for Selwyn District Council[5] and Waimakariri District Council[6].

Table 4 Model roughness values

Model Part	Manning's n value
2D Culverts	0.016
Black Creek waterway	0.030
Built-up Area (settlement)	0.083
Roadways	0.020
Urban Parkland / Open Space	0.050
High Producing Exotic Grassland	0.050
Broadleaved Indigenous Hardwoods	0.125
Gorse and / or Broom	0.125
Manuka and/or Kanuka	0.125
Exotic Forest	0.125

Model Validation

As there is no available historic flood data for the site, a calibration of the developed flood model is not possible. However, the catchment has previously been modelled by WWL as described above. Given the different purposes of this study's flood model as well as the different methodology (new LiDAR topographical data, inclusion of the catchment's stormwater pipe network, different modelling software package), the e2 model results will naturally be different. Regardless, the e2 model was validated against the WWL model to ensure that the model results between the two were generally similar or that any differences could be reasonably explained.

Flood maps of the peak water depths in the 1% AEP flood event for both the WWL and e2 models are presented below in Appendix F. These show that the flood depths and inundation extents are generally similar. The flows entering the site through the northern boundary were also compared, as shown below in Figure 11. The chart shows similar peak flows, but different low flows. This is mostly due to e2's model burning in a representative thalweg of the drain north of the site towards Black Creek not captured by the LiDAR data. This results in e2's model diverting lower flows away from the site reducing the total volume that the site needs to cater for. Since the peak flow from e2's model is still higher than WWL's peak flow, the conveyance capacity requirements in any diversion channels of the proposed development will be slightly greater. However, flood compensation storage requirements in the proposed SMA may be lower. This will be confirmed during future design stages.

[5] DHI. 2019. *Regional Policy Statement Modelling for Selwyn District Council – District Plan.*
[6] DHI. 2020. *Flood Hazard Models Update – District and Urban and MIKE FLOOD models*

Overall, the model was considered to be valid for the purposes of this study.

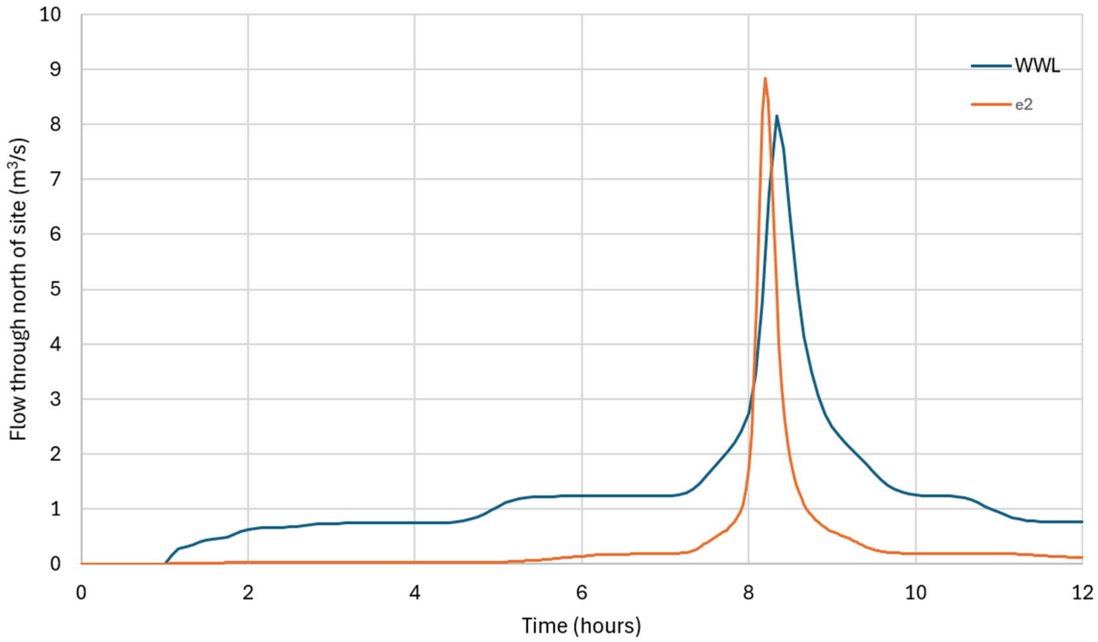

Figure 11 Flows through the northern site boundary in the 1% AEP + CC event

APPENDIX E – Assessment of Model Confidence

Comparison with WWL Model Results

This study's model results of the existing situation in the 1% AEP rainfall event were compared with the rain on grid model results provided by WWL. The comparison showed that this study's model results were broadly in line with the WWL model results and that the e2 model was generally conservative.

Sensitivity Testing

Sensitivity testing was conducted on the 1% AEP event by:

- lowering the Wu 3D eddy viscosity coefficient from 7 to 2 (acceptable range is 1 – 7)
- varying infiltration rates by ±25%
- increasing the cell size in the upper catchments from 4 m to 8 m
- using the GPU double precision solver

Sensitivity Testing Results

The lower eddy viscosity sensitivity test increased the capacity of Black Creek, resulting in decreases in flood depths in and near the creek of 50 – 200 mm. This results in the spillover far downstream of site decreasing, which eventually increases the flood depths at the boundary of the model. There are localised decreases of up to 70 mm on site. These changes are to be expected when changing the eddy viscosity of a model containing a 2D waterway.

No other sensitivity tests altered flood depths on site by more than 15 mm. Flood depths in the Black Creek were affected by up to 30 mm. Two additional areas analysed for sensitivity testing were:

- The water level in Black Creek just downstream of the site's stormwater outfall
    - Water level in the base model is 94.81 m RL.
- The flow leaving the boundary of the site (i.e., flows 5 to 9 from Figure 5).
    - Flow in the base model is 10.41 m^3/s.

The maximum result differences (compared with the base scenario) are summarised below in Table 5. The difference flood map for the lower eddy viscosity is shown in Figure 12 (differences less than 20 mm not shown).

Table 5 Peak sensitivity test differences for the 1% AEP event

Parameter	Low Eddy Viscosity	Infiltration +25%	Infiltration - 25%	8m Cell Size (in hills)	Double Precision
Peak Black Creek Level (m RL)	-0.23	-0.02	+0.02	-0.03	0
Peak Site Outflow (m^3/s)	-0. 50	-0.18	+0.16	-0.25	0

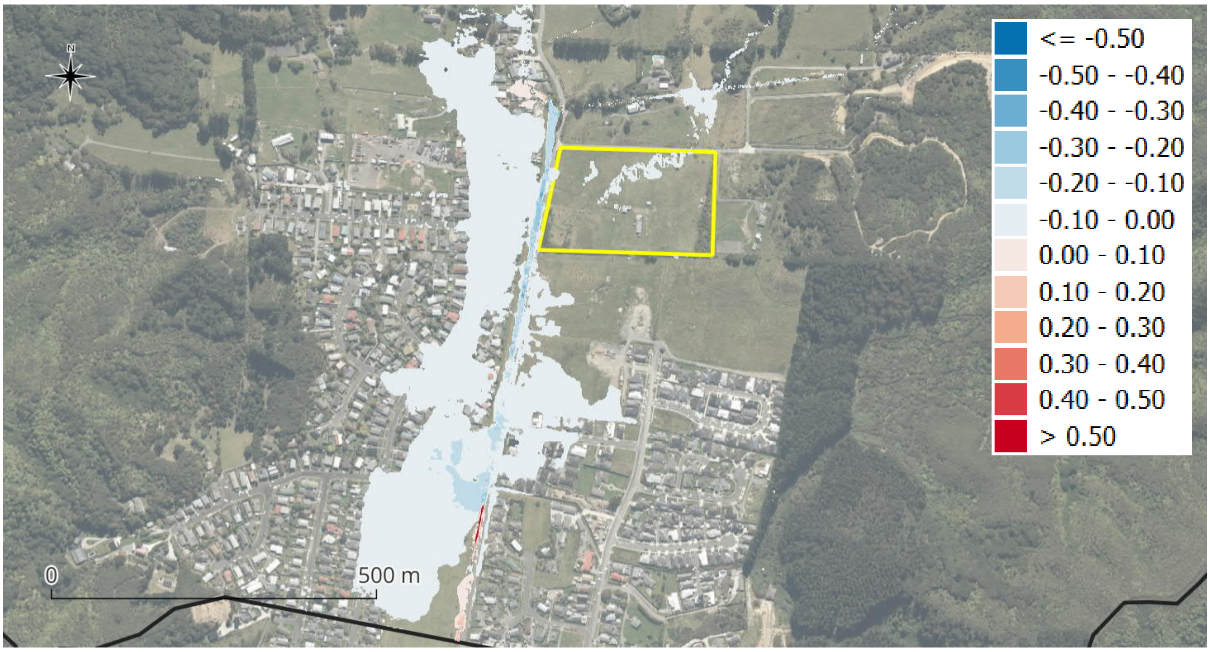

Figure 12 Low Wu eddy viscosity max flood depth difference from baseline (1% AEP)

<u>Conclusion of Sensitivity Testing</u>

The sensitivity testing results demonstrate that there is little variation in the maximum flood depths and flows when altering the infiltration values by ± 25%. The change in eddy viscosity has moderate effects on the conveyance of Black Creek, but only has a small impact on flood levels near the site.

The 1% AEP results demonstrate low sensitivity to infiltration rates in areas of interest near the site, which provides confidence that the model is fit for purpose.

Further model sensitivity testing of the post-development scenario can be carried out during future design stages to confirm the required freeboard for setting minimum floor levels.

APPENDIX F – Flood Maps

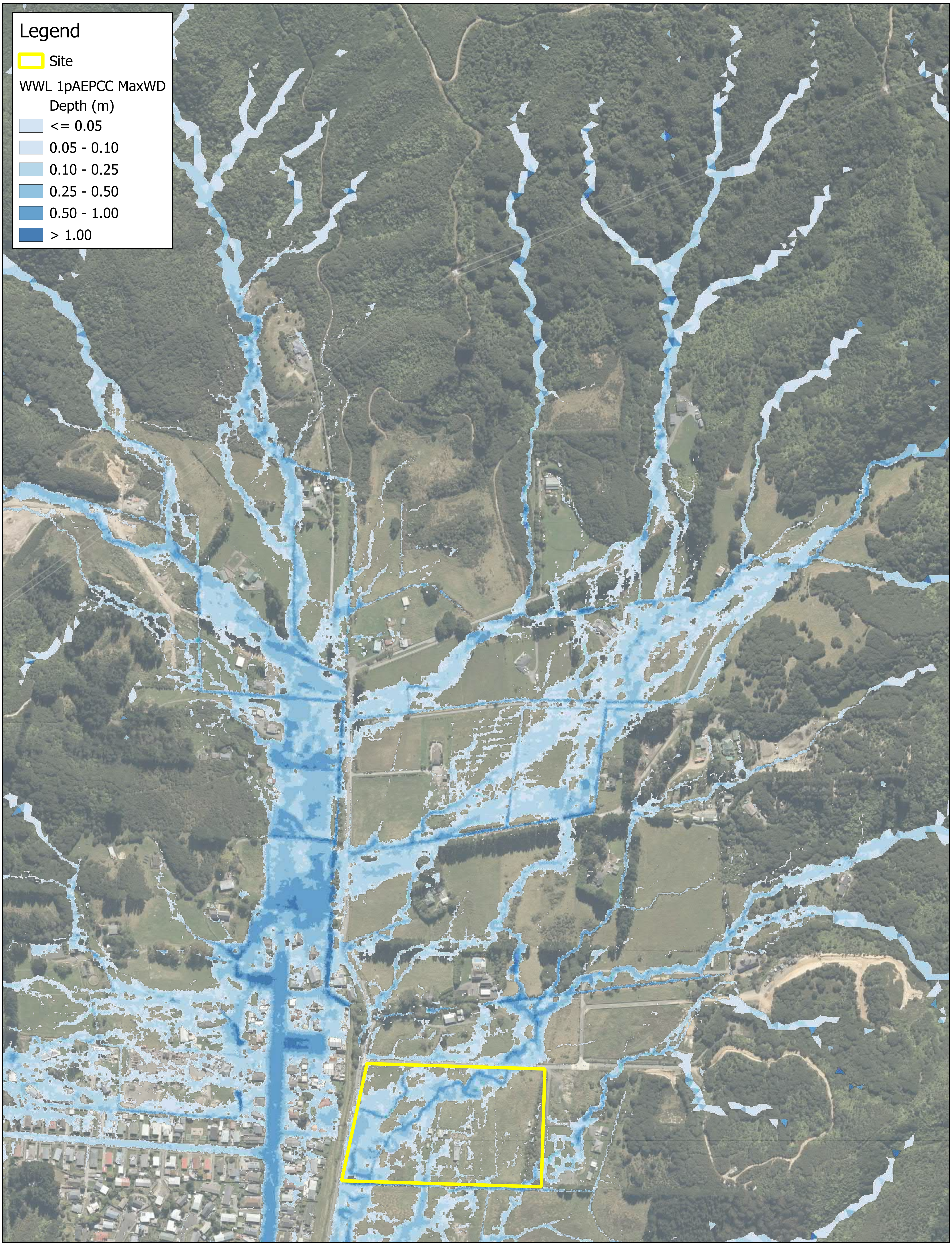

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Figure F1 - 1% AEP +CC Max Water Depths as modelled by Wellington Water

Paper Size A3

0 50 100 150 200 m

Scale: 1 : 4500 (A3)

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Date	26/05/2026

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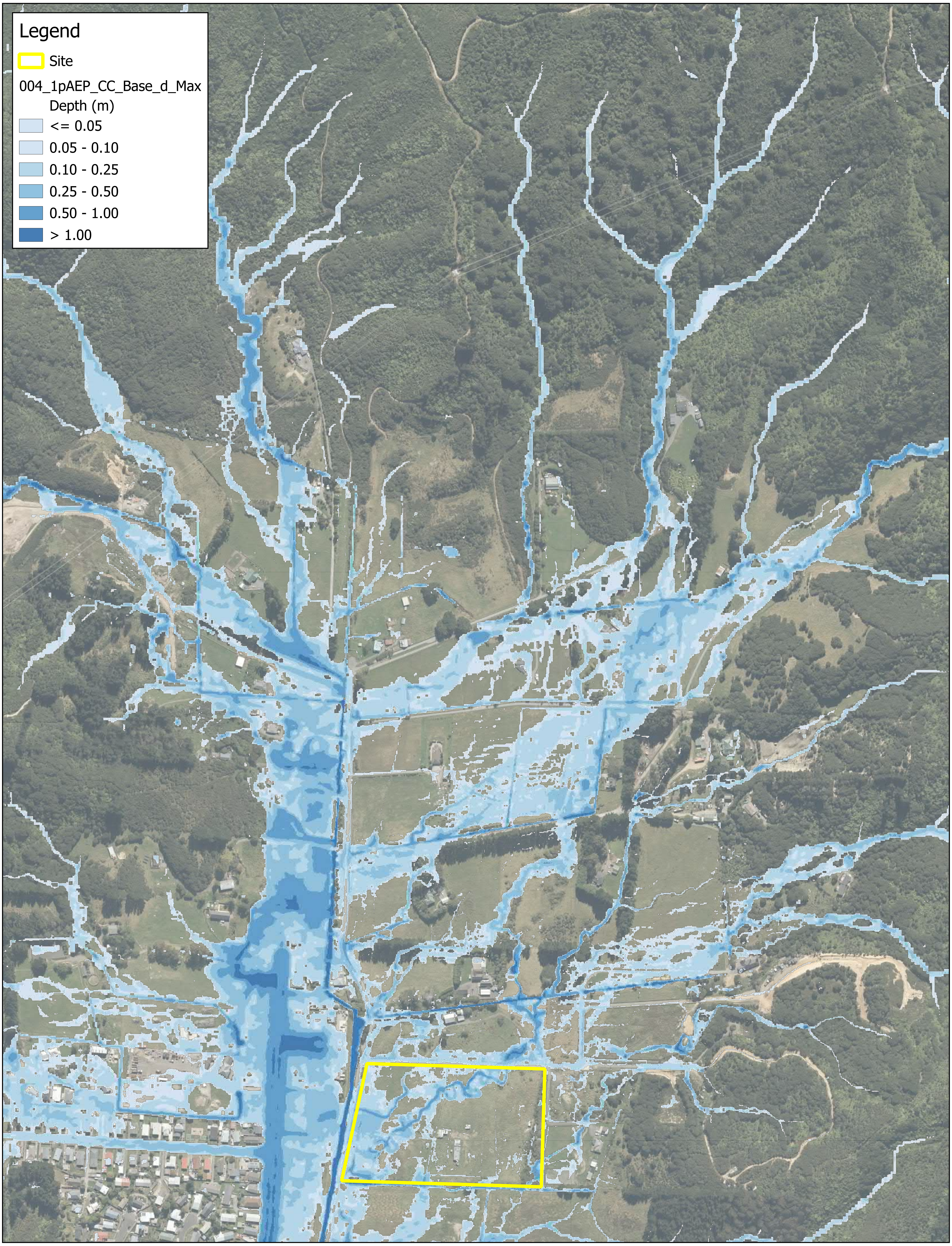

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Figure F2 - 1% AEP +CC Max Water Depths as modelled by e2

Paper Size A3
0 50 100 150 200 m
Scale: 1 : 4500 (A3)

N

Job Number	26034
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Date	26/05/2026

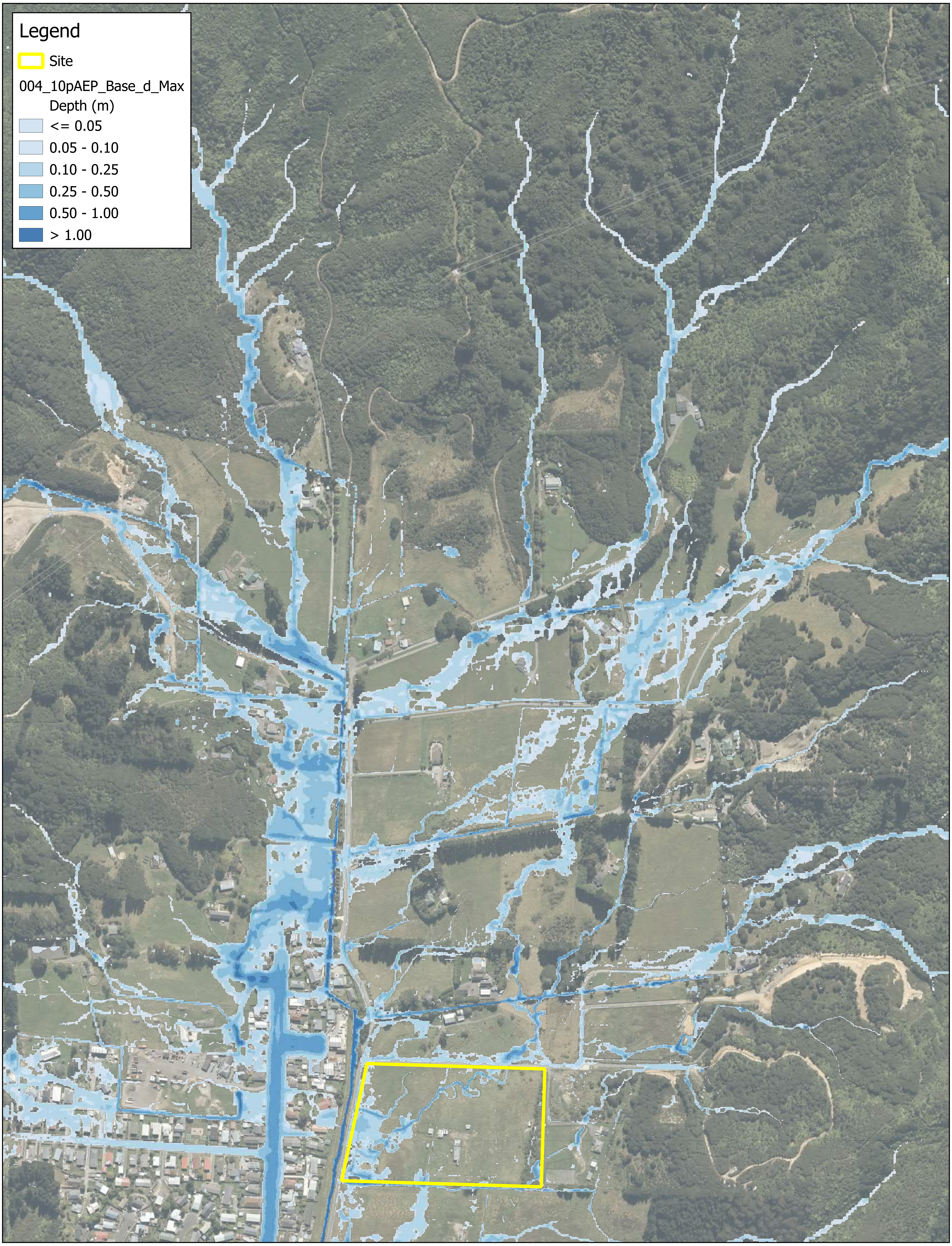

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Figure F3 - 10% AEP Max Water Depths
as modelled by e2

Paper Size A3

0 50 100 150 200 m

Scale: 1 : 4500 (A3)

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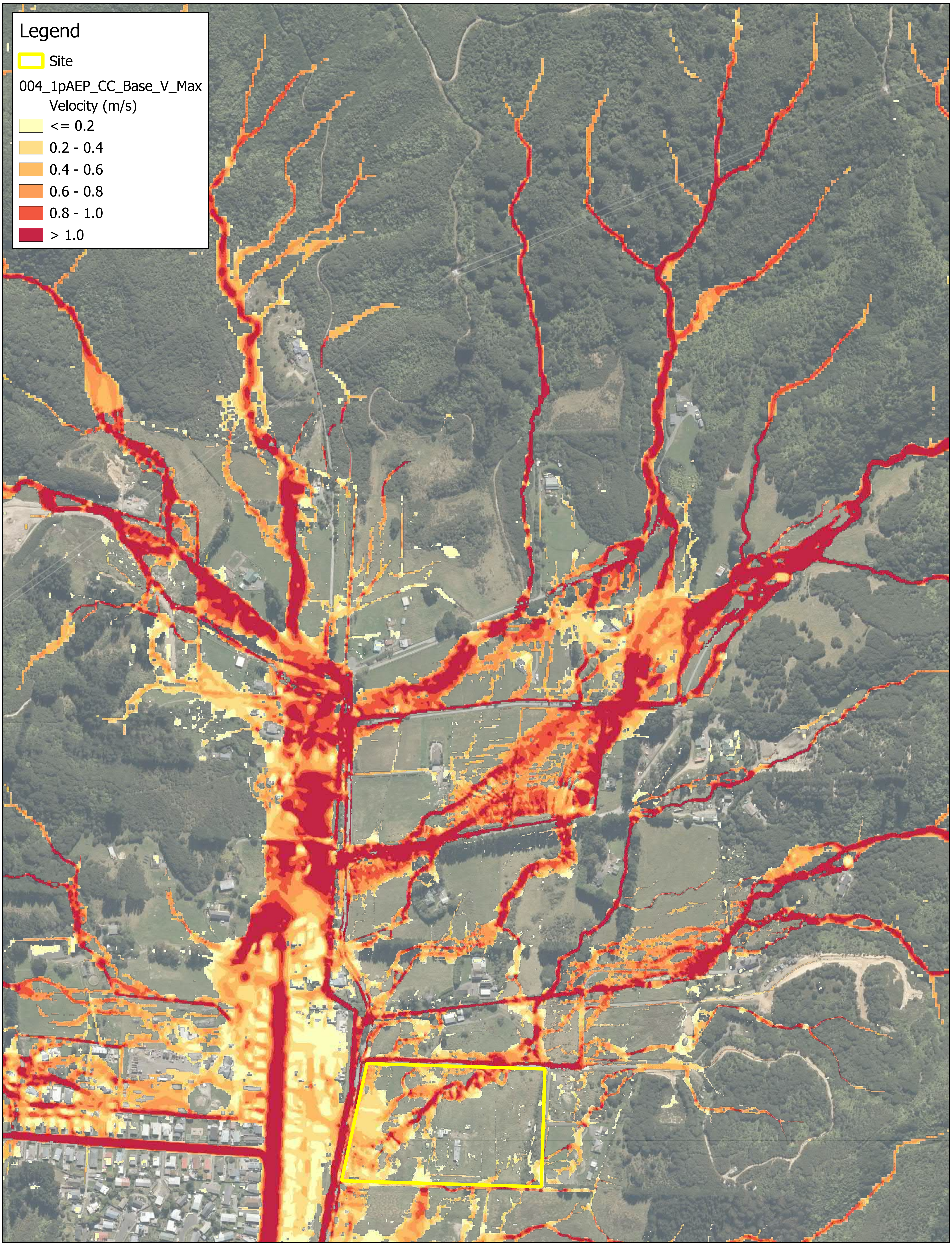

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Figure F4 - 1% AEP +CC Max Flow Velocities
as modelled by e2

Paper Size A3

0 50 100 150 200 m

Scale: 1 : 4500 (A3)

N

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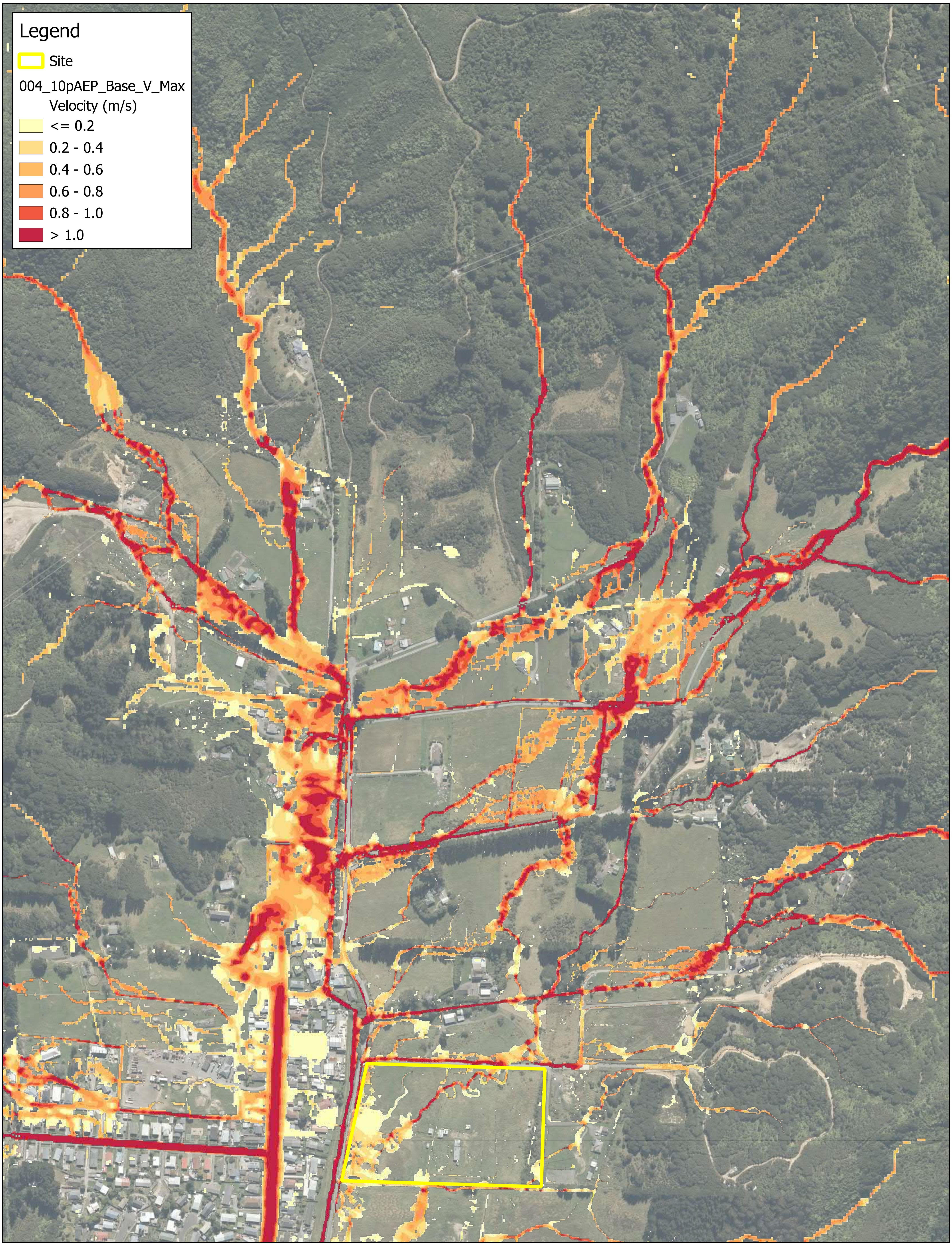

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Figure F5 - 10% AEP Max Flow Velocities
as modelled by e2

Paper Size A3

0 50 100 150 200 m

Scale: 1 : 4500 (A3)

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