

Appendix 11: Stormwater Management Plan

2025

STORMWATER MANAGEMENT PLAN

RIDER PARK PLAN CHANGE

Prepared by

**TE MIRO WATER
CONSULTANTS LTD**



Version Control

Version	Date	Author	Reviewer	Change Description
1	16/12/2022	Saeed Nikghalb and Arun Gopi	Mike Chapman mike@temirowater.co.nz	Draft
2	20/12/2022	Mike Chapman (MEngNZ 1032906)	Mike Chapman mike@temirowater.co.nz	Final Draft
3	09/03/2023	Mike Chapman (MEngNZ 1032906)	Mike Chapman mike@temirowater.co.nz	Revised Version
4	08/08/2023	Mike Chapman (MEngNZ 1032906)	Mike Chapman mike@temirowater.co.nz	Updated with revised layout
5	28/09/2023	Mike Chapman (MEngNZ 1032906)	Mike Chapman mike@temirowater.co.nz	Updated with revised layout
6	05/11/2025	Mike Chapman (MEngNZ 1032906)	Mike Chapman mike@temirowater.co.nz	Updated with latest structure plan

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SUMMARY OF COMPLIANCE

PARAMETER	METHOD OF COMPLIANCE
GEOTECH	Soakage testing across the site (by CMW) shows a range of near surface infiltration rates and the soil conditions indicate that soakage is considered highly feasible as a disposal method.
RECEIVING ENVIRONMENT	The site discharges to a gully (assessed as NPS Wetland) except for catchment 5 + 6. Catchment 5 discharges to council reserve following existing OLFP and catchment 6 discharges to minor tributary stream for a short distance then to Waikato River; therefore, treatment of runoff is required.
WATER QUALITY	Water quality treatment of all catchments will be provided either by soakage, wetland, bioretention, rain tanks or swales or combination thereof. It is recommended that non-contaminant leaching roofing materials be used to prevent zinc or heavy metal pollutants in roof runoff.
INITIAL ABSTRACTION	As soakage is a feasible option, on-lot soakage is proposed as a viable option to mitigate the equivalent la runoff volume. Secondary treatment via a swale or soakage device will also remove volume.
EXTENDED DETENTION VOLUME	Extended detention volume is required to mitigate scour impacts within the receiving stream environment. A range of solutions can provide for EDV such as soakage devices and raingardens.
OVERLAND FLOW PATHS	Safe passage of overland flows in the event of blockage is provided through the construction and designated easement of overland flow path channels and/or within the road network and will be provided for during development of the built form and layout.
PRIMARY STORMWATER DISPOSAL	Primary stormwater disposal is likely to be provided via on-lot soakage. Only spilling above 10-Yr from lots. The road network will be managed via swale and/or pipe reticulation network with sizing adjusted for climate change. Catchment 6 is unique in that the pumice soil may preclude discharge to soakage and hence reuse/detention tanks may be used for all houses and bioretention for roads in Catchment 6 to manage up to EDV flows.
SECONDARY STORMWATER DISPOSAL	Secondary flows up to 100-Yr will be managed through appropriate stormwater management devices to ensure that peak flows are attenuated to existing peak flows. The TUFLOW modelling shows unattenuated post development flows increase stream levels off site in the order of 400mm within the council gully system (no properties at risk), for this reason we taken a precautionary approach whereby post development peak flows are controlled to existing peak flow rates other than for Catchment 6 which outlet directly to the Waikato River via small section of stream.
REGIONAL CONSENT	Likely required for Catchment 6 outlet to stream, since greater than 1 hectare. Also, likely required for outlet structures in the gully (flows > 10-Yr).



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APPENDIX – DRAWING SET

1. INTRODUCTION

Power Up Business Consulting Ltd has engaged Te Miro Water Consultants Ltd to develop a Stormwater Management Plan (SMP) for the Rider Park Plan Change area. The purpose of this report is to support a Plan Change application with Waipa District Council (WDC). The SMP outlines the stormwater assessment for the proposed development. The natural features within the plan change area that will influence the stormwater solution are summarised in the following bullet points:

1. Sensitive receiving environments comprise a gully (wetland under the NPS) which outlets to a bush covered stone bed stream which continues to the Waikato River. The use of the gully area for treatment and attenuation will be explored during resource consent phase of design. There are also viable alternative solutions such as bio retention and soakage basins, swales etc that can be accommodated within the plan change area as part of the future built form and layout.
2. Highly feasible soil conditions for soakage with varying rates controlled by lithology (ancestral river terrace).
3. Soakage devices/swales/attenuation devices are considered an appropriate method to manage runoff from new development to be integrated with the built form following plan change.
4. Soakage testing across the site shows a range of near surface infiltration rates (within top ~2m of the EGL). Different rates were therefore used for each sub-catchment. Final soakage rates will be confirmed at resource consent stage prior to finalising stormwater management devices and their locations using in situ testing at excavated device invert levels.
5. Both 10yr primary and 100yr secondary flows from the road reserves go to appropriate stormwater management devices that ensure peak flows are attenuated to below existing peak flows. Only spill above 10yr from lots go to these devices (up to 10yr is managed via on-lot soakage devices). This approach reduced communal device sizes considerably and on lot soakage is considered feasible given average lot size with space for devices.
6. 2D flood modelling indicates that unattenuated post development flows could increase downstream stream levels by approximately 400mm within the council reserve stream. While no private properties are at direct risk, we recommend 100yr attenuation to existing flow rates within the development or gully to mitigate downstream adverse effects. The RITS and WRC Guidelines recommend managing post-development 100-year ARI peak discharges to ensure that downstream flood levels are not increased. The stormwater design should therefore aim to prevent any adverse effects upstream or downstream, including scour, erosion, sediment deposition, flooding, or other environmental impacts.
7. Preliminary stormwater management volumes have been determined based on accommodating post development flows up to the 100yr with release at existing peak rates. No private properties are at direct risk of flooding and hence matching 80% of the existing flows is not required. Instead, it is proposed to attenuate the post development 100-year flows to match the existing peak flow rates.
8. It should be noted that existing flows to the gully are relatively small due to the existing ponding nature of the catchment with large depression storage shown by 2D modelling – minimal direct flows to the receiving environment. A big difference therefore exists between existing and post development flows to the gully. Stormwater management volumes are such to match existing flow rates.
9. Indicative sub catchments have been delineated based on the structure plan layout provided by Cogswell Surveys Ltd. Catchments 1-4 outlet to the gully, Catchment 5 spills to adjacent council reserve and Catchment 6 will outlet to a small tributary stream which runs a short distance to the Waikato River. Refer to Figure 2 for outlet locations.
10. Catchments 1, 2 and 3 discharge to southern side of the gully, Catchment 4 to the northern side, and Catchment 5 to the existing overland flow path. Catchment 6 will have an outlet to a small tributary stream 80m from the Waikato River.

2. PRELIMINARY STORMWATER MANAGEMENT VOLUMES

Assumptions are made when determining stormwater management volumes to inform the plan change, they include:

1. Working backwards from suitable outlet locations - Splitting the layout into sub catchments that generally represent a reasonable estimate of the post development earthworks and stormwater (pipe grades and orientation) which will lead towards the outlet locations (Figure 2).
2. Assuming 60% impervious for lot areas as the zoning is medium density residential zone, and that both primary and secondary flows along roads make their way to the respective stormwater management devices prior to discharge to the outlet locations. Stormwater management devices may also be located within the gully to be determined at resource consent.
3. Stormwater management volumes corresponding to each Sub catchment are provided in Table 1 below. Sub catchment 6 will outlet to a spring fed stream within the Structure Plan boundary following a short distance before reaching the Waikato River, therefore attenuation above EDV is not necessary.
4. Given good soakage conditions, private lots are likely to have their own soakage (roof + driveways) except sub-catchment 6. Pervious areas for each lot included in the communal stormwater management volumes. Lots in Sub-catchment 6 are likely to rely on re-use/detention tanks to manage flows given geotechnical constraints related to weak pumice soils – this assumption is subject to further geotechnical testing in the future at Resource Consent and Building Consent stages. Typically, in most cases, site-specific geotechnical testing is required at Building Consent stage to confirm ground conditions for building and soakage design.

The preliminary stormwater management volumes required to match existing 100-Yr flows in the gully are provided in Tables 1 and 2. The plan change, by Cogswell Surveys, together with the location of post-developed sub catchments and outlet locations, are shown in Figures 1 and 2. The volumes in Table 1 will assist with the future built form and layout and the earthworks model following plan change.

Table 1: Post development stormwater management volumes per catchment

Catchment	10 Yr Peak Storage Volume (m ³)	100 Yr Peak Storage Volume (m ³)
1	1,200	3,700
2	7,000	13,600
3	5,300	10,300
4	700	1,900
5	700	1,100

Table 2: Matching the 100Yr existing flows with post-developments flows

Catchment	100 Yr post-develop Peak Discharge (m ³ /s)	Existing 100 Yr Peak Discharge (m ³ /s)	Comments (Refer Existing Hydrology table)
1	0.47	0.54	Matches with existing B
2	0.95	1.47	Matches with existing C+D
3	0.50		
4	0.29	0.32	Matches with existing E1
5	0.66	-	

A1

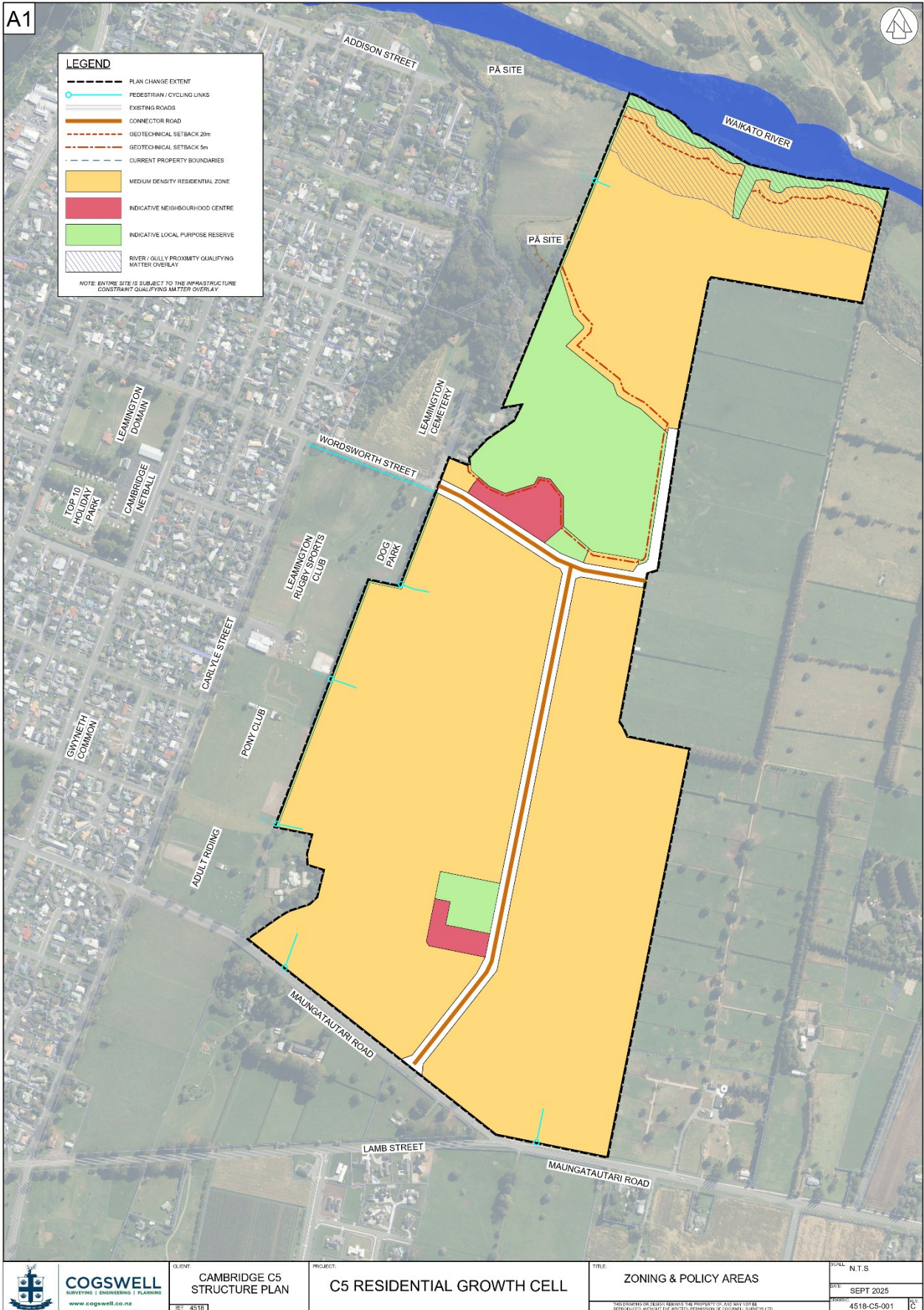


Figure 1: Structure Plan Layout from Cogswell Surveys Ltd

FINAL

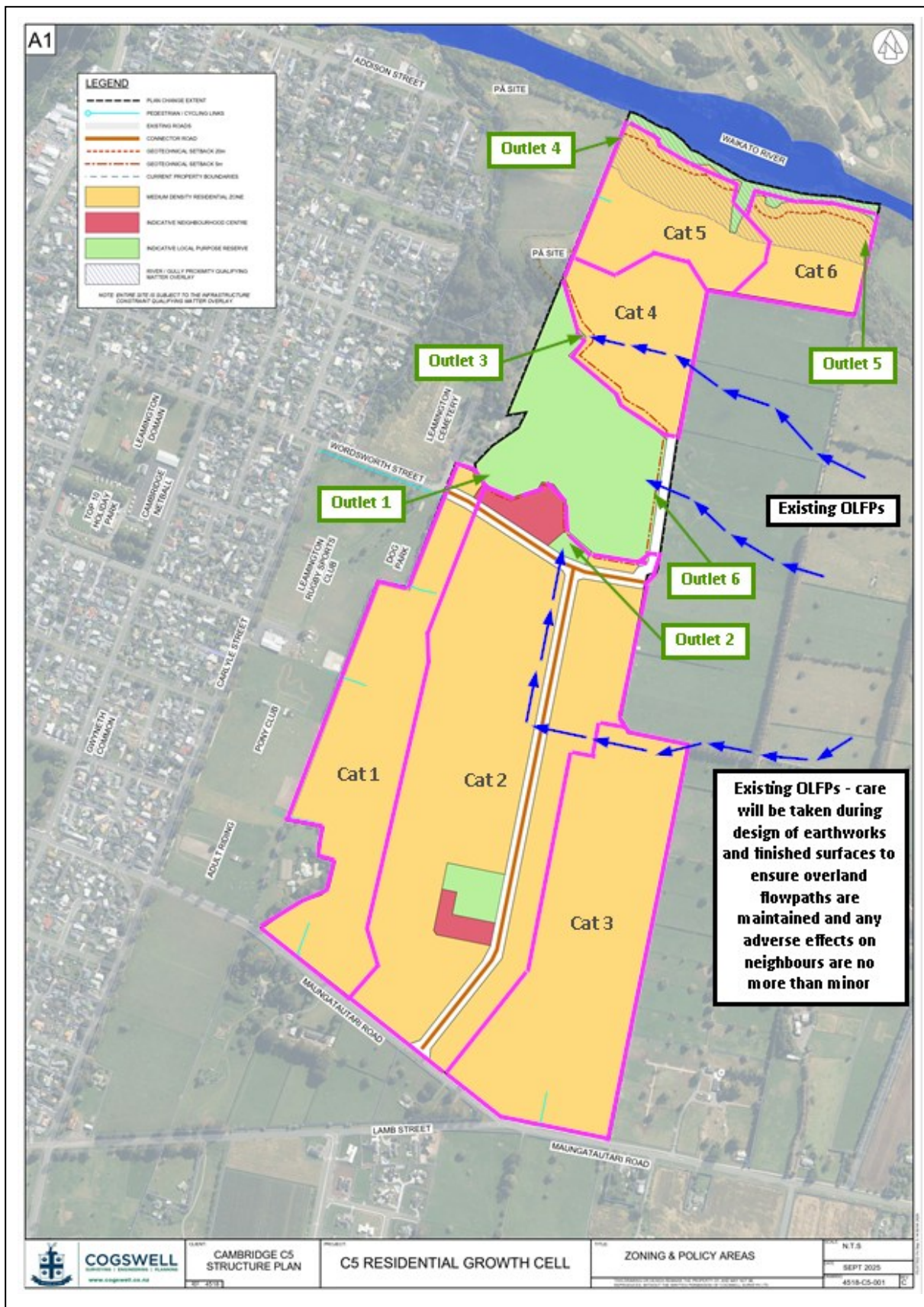


Figure 2: Proposed post-developed catchments and outlet locations

3. FLOOD HAZARD ASSESSMENT

The existing site is predominantly farmland with no identified ecological area (other than the NPS gully wetland) or significant overland flow paths. The existing catchments drain predominately to the north, discharging to the existing gully. However, the large existing catchment A2 shows ponding on site, with no obvious overland flow-path to the gully – ponded water is therefore expected to sit and eventually soak away. Hydrographs for 100yr ARI have been developed for each catchment in HEC HMS and loaded into a TUFLOW 2D model to check the flood extent and maximum depths in the existing Gully and further downstream receiving environment. Figure 3 shows the existing catchments and the loading to the 2D model. Catchment A2 is ponding on site, therefore it has not been considered as a loading input to the gully in the model.

Table 3: Existing hydrology

Catchment	CN (Weighted)	Ia (Weighted)	Area (ha)	Lag Time (min)	Peak 100 Yr Discharge (m3/s)
A1	44.8	15.7	40.1	60	1.63
B	48.5	13.5	17.5	13.5	0.54
C	50.5	12.5	2.3	12.5	0.16
D	44.2	16.0	15.1	12	1.31
E1	43.7	16.4	6.9	20	0.32

- Rainfall depths (mm) 100yr ARI 24Hr - Existing → 157mm
- 100yr ARI 24Hr - RCP6.0 for the period 2081-2100 → 179mm

4. POST DEVELOPED HYDROLOGY

For the post-developed ‘plan change’ scenario, the catchments have been included as new TUFLOW inputs to the gully (to assess impact of unattenuated flow). Post development attenuation volumes are determined using HEC HMS for the new impervious areas. Catchments 5 and 6 have not been considered since they do not contribute to the gully. The indicative layout of the post-developed catchments (noting there is no layout or design surface) together with the specifications, is included in Figure 2 and Table 4. The TUFLOW model will be re-run once a design surface is provided to ensure existing OLFP are maintained safely through the plan change area. TMW expect impacts to be no more than minor because the current area ponds with very little actual conveyance or velocity. It is important to ensure that allowances is made in the layout to ensure no adverse impacts on the neighbouring property through provision of overland flow paths through the development site. This can be accommodated within the site during the built form.

Table 4: Catchments specifications

Catchment	Area (ha)	CN (Weighted)	Ia (Weighted) (mm)	Lag Time (min)
1	13.6	85.8	2.1	6.7
2	32.9	82.0	2.8	6.7
3	21.7	84.7	2.3	6.7
4	7.1	79.1	3.4	6.7

Figures 3 and 4 show the existing catchments and pre-development 100-year ARI flood map for the Rider Park development area.

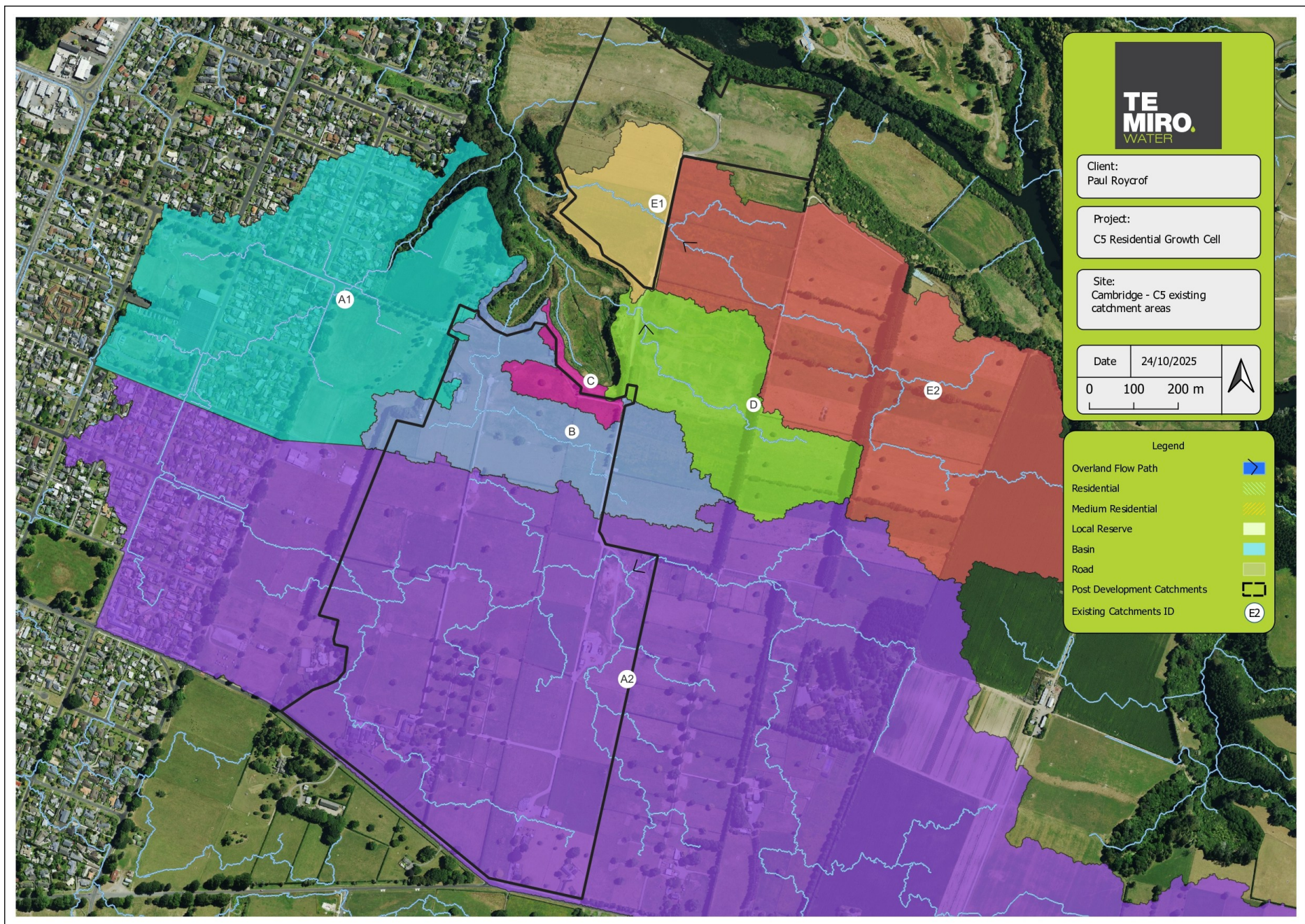


Figure 3: Existing hydrology catchments to check impacts of runoff in the gully



Figure 4: Existing 100-year flood assessment

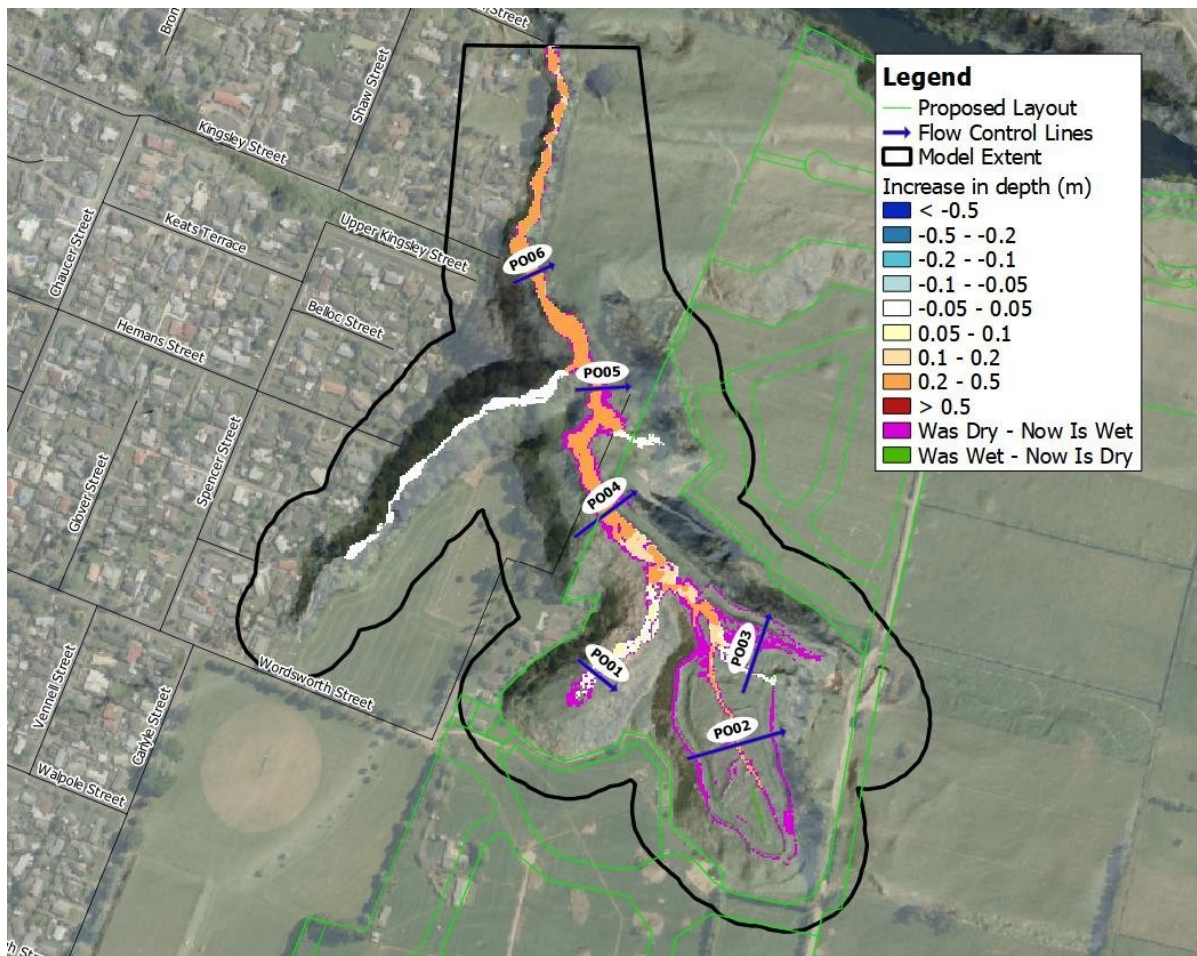
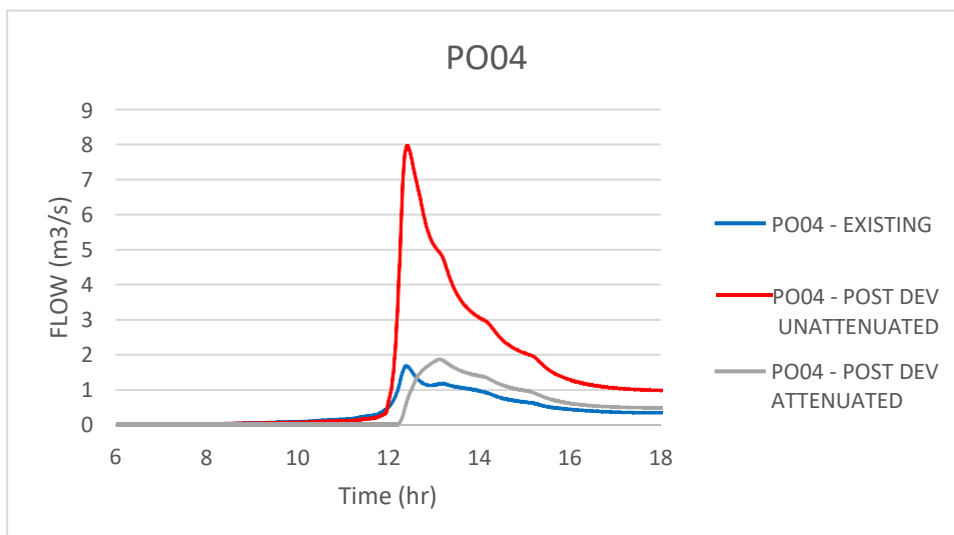
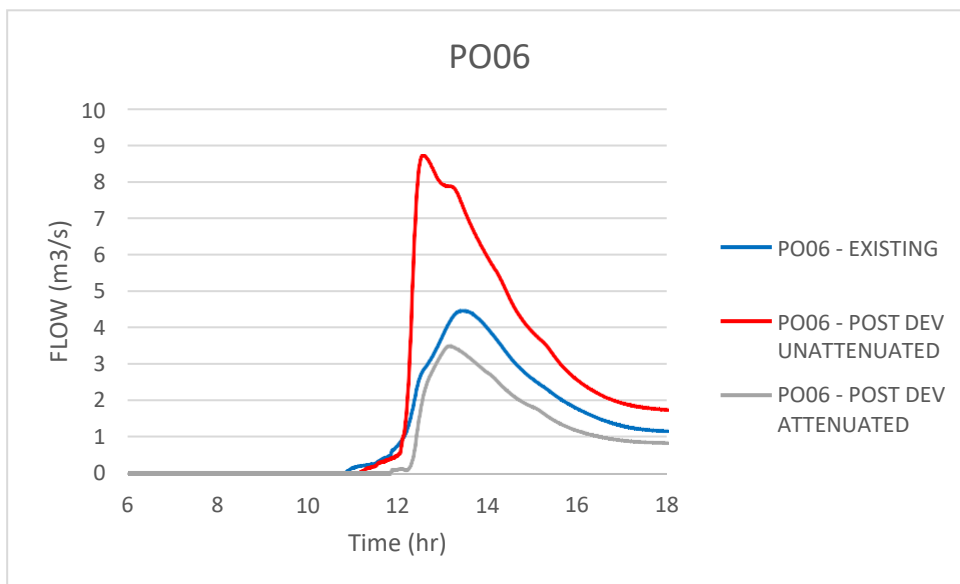
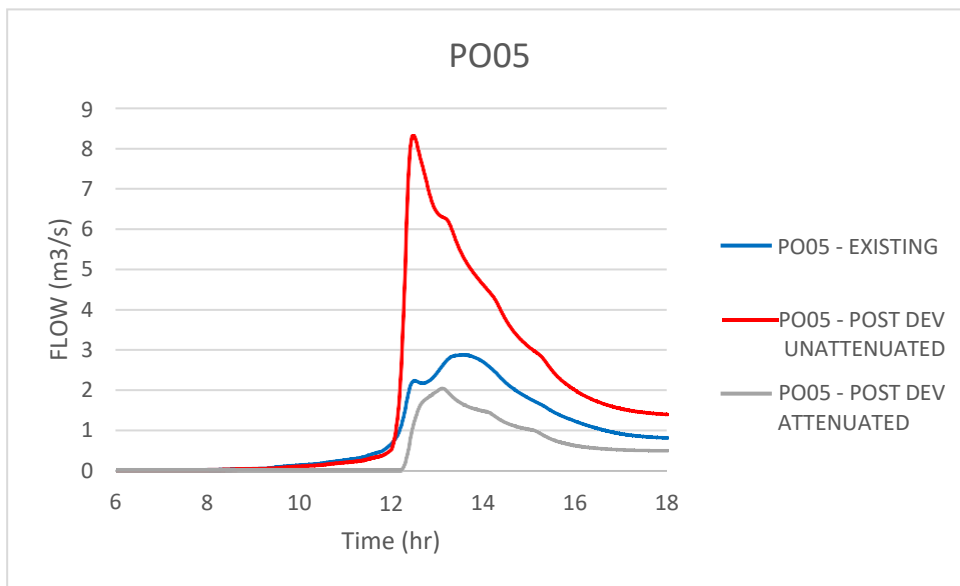


Figure 5: 2D TUFLOW model results

The following hydrographs highlight the increase in post development peak flows in the gully and bush stream. These hydrographs generated the flood difference map and show levels rising in the bush section by upwards of 400mm. Stormwater management devices are designed to throttle 100yr flows to existing peak flows based on the level rises in the receiving environment. The attenuated hydrographs at PO04 and PO05 demonstrate this.





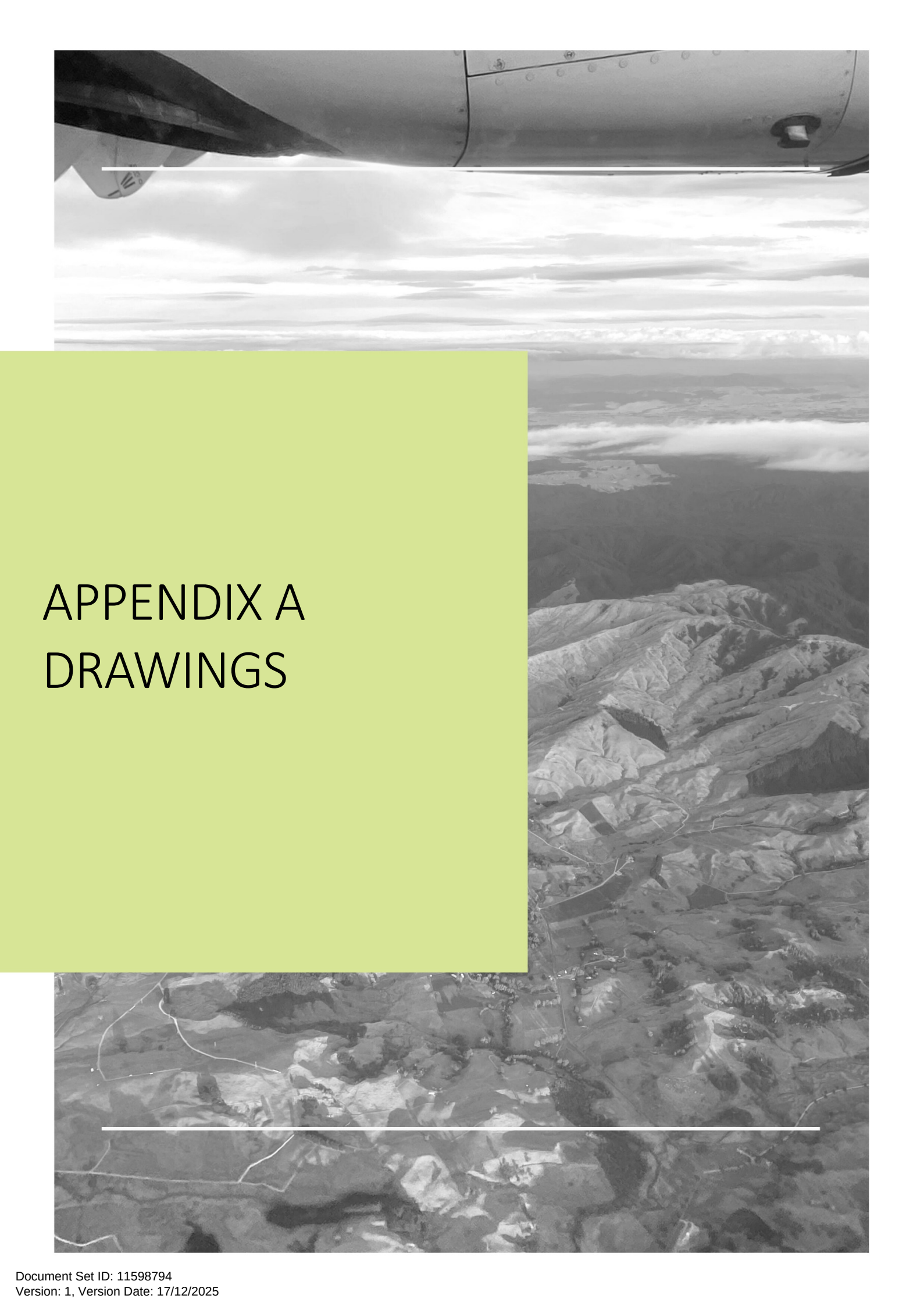
5. CONCLUSIONS

1. The stormwater management approach for the Rider Park development has been formulated to ensure a resilient and sustainable solution that aligns with the site's hydrological characteristics, soil conditions, and receiving environment constraints.
2. The assessment confirms that infiltration-based stormwater management using soakage devices, swales, and attenuation basins is a viable means of stormwater disposal within Rider Park.
3. On lot private soakage for individual houses (roof + driveways).
4. Road network and pervious component of each lot (unable to reach private devices) flow to each communal stormwater management device.
5. Sub-catchment specific infiltration rates have been applied to reflect the variable soil permeability, with final values to be confirmed through in-situ testing at detailed design stage.
6. Infiltration rates from CMW Ltd represent near surface conditions with some silty layers. Soakage is expected to be higher at depth.
7. Catchment 6 is unique in that the pumice soils may preclude discharge to soakage and hence reuse/detention tanks are used for all houses and bioretention for roads in Catchment 6 to manage up to EDV flows. Further geo technical testing in this catchment may show some soakage is feasible to be confirmed at Resource Consent and Building Consent stages.
8. TUFLOW modelling results indicate that while post-development flows increase stream levels within the downstream bush-covered section by approximately 400mm under unattenuated conditions, no existing properties or infrastructure are at flood risk. We have still taken a precautionary approach that it is necessary to provide 100-year attenuation within the development.
9. Likewise, the outlet to the gully and tributary streams will be designed with suitable erosion controls, for example either a headwall and rip rap or potentially bubble up chamber with gabion surround and spillway. The final option depends on the final outlet pipe gradients and velocities indicating erosive force. The intent is to achieve consistency with natural catchment flow paths and protection of sensitive receiving environments, including the gully.
10. Existing catchment overland flow paths will be maintained, and care will be taken during design of earthworks and finished surfaces to ensure any adverse effects on neighbors are no more than minor.
11. Te Miro Water believe that there are no stormwater issues which would preclude the Rider Park Structure Plan area from being developed for Medium Density Residential housing, subject to detailed design.

6. LIMITATIONS

This report has been prepared for the project described to us and its extent is limited to the scope of work agreed between the client and Te Miro Water Limited and the data available for the model build.

No responsibility is accepted by Te Miro Water Consultants Limited, or its directors, servants, agents, staff, employees, or subcontractors related to the inherent flood model limitations, or the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.

An aerial photograph of a mountainous landscape, likely in the Himalayas, showing deep valleys and rugged peaks. A large, semi-transparent green rectangular box is overlaid on the left side of the image, containing the text 'APPENDIX A DRAWINGS'. The sky is filled with clouds, and the foreground shows a valley with some small settlements and roads.

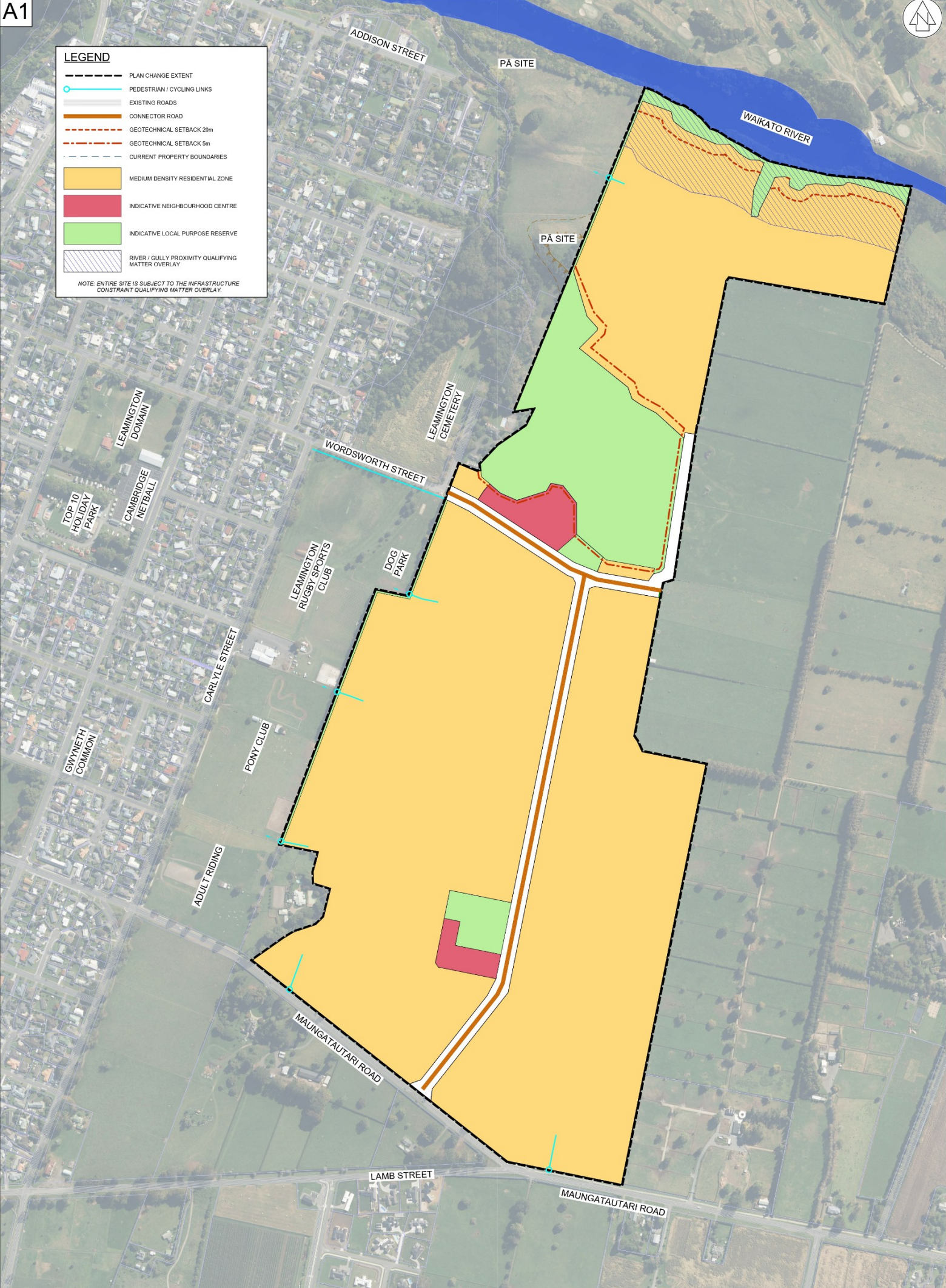
APPENDIX A DRAWINGS

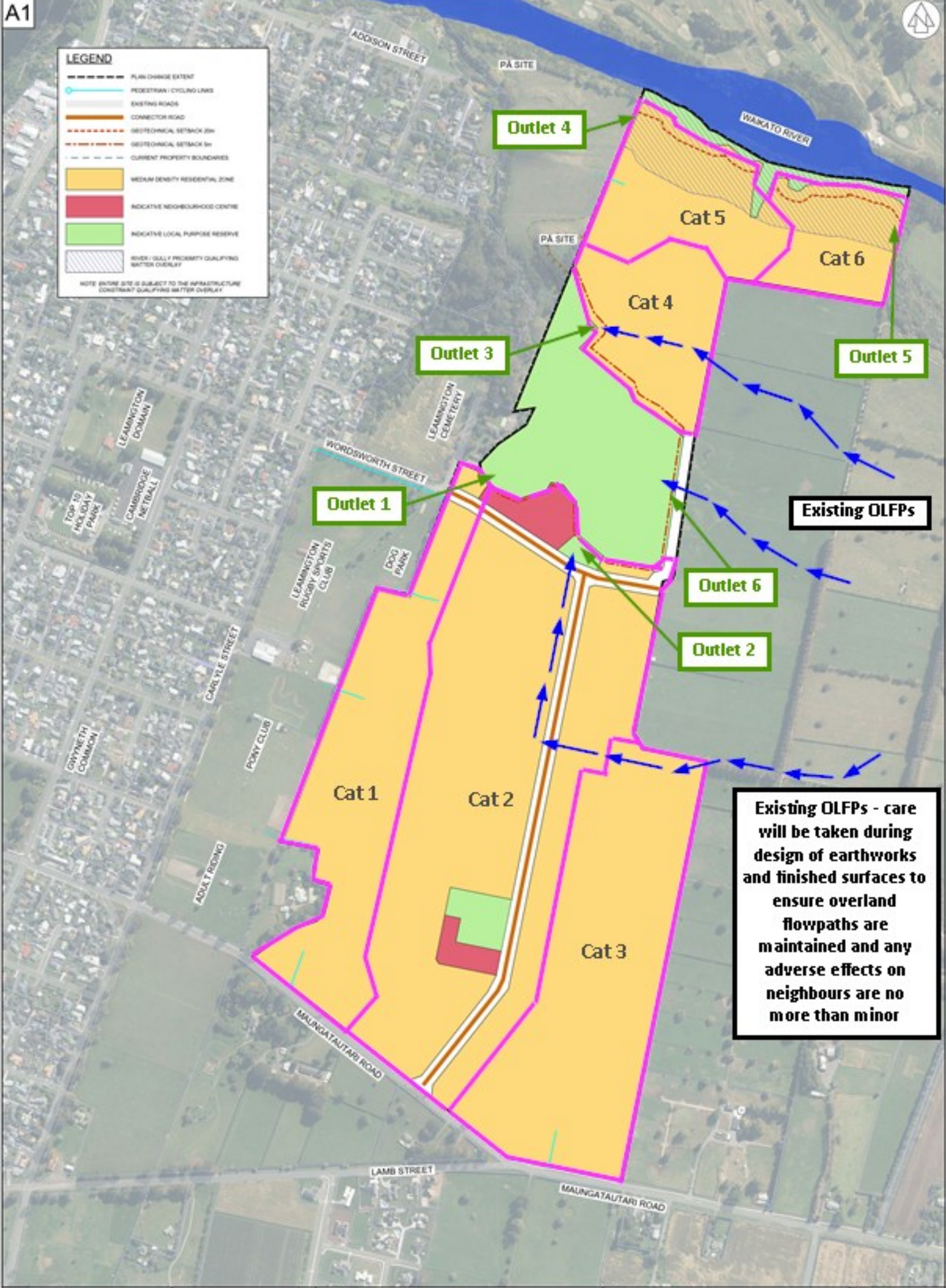


LEGEND

- PLAN CHANGE EXTENT
- PEDESTRIAN / CYCLING LINKS
- EXISTING ROADS
- CONNECTOR ROAD
- GEOTECHNICAL SETBACK 20m
- GEOTECHNICAL SETBACK 5m
- CURRENT PROPERTY BOUNDARIES
- MEDIUM DENSITY RESIDENTIAL ZONE
- INDICATIVE NEIGHBOURHOOD CENTRE
- INDICATIVE LOCAL PURPOSE RESERVE
- RIVER / GULLY PROXIMITY QUALIFYING MATTER OVERLAY

NOTE: ENTIRE SITE IS SUBJECT TO THE INFRASTRUCTURE CONSTRAINT QUALIFYING MATTER OVERLAY.







Client:
Paul Roycrof

Project:
C5 Residential Growth Cell

Site:
Cambridge - C5 existing
catchment areas

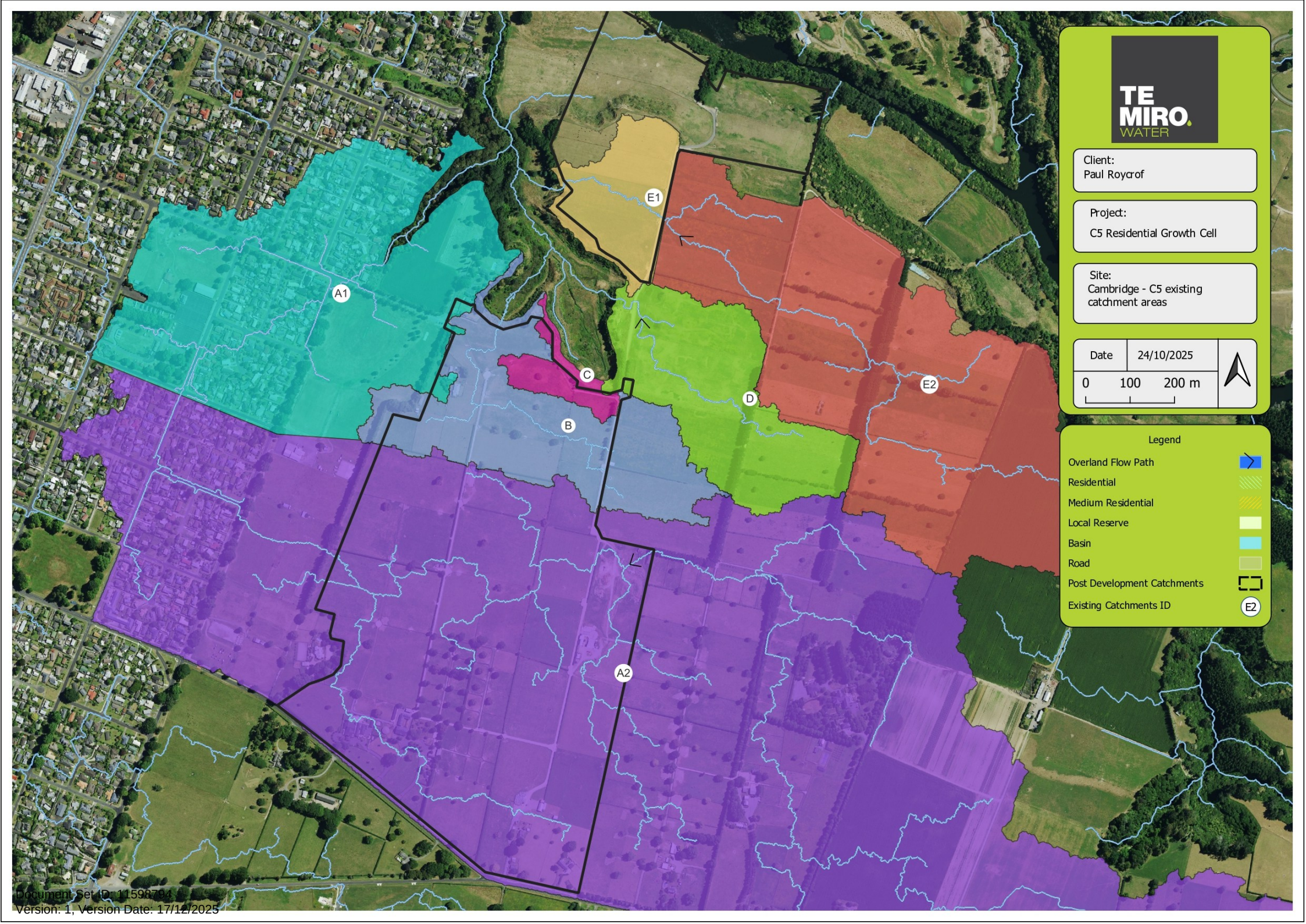
Date 24/10/2025

0 100 200 m



Legend

- Overland Flow Path
- Residential
- Medium Residential
- Local Reserve
- Basin
- Road
- Post Development Catchments
- Existing Catchments ID





Client:
Paul Roycroft

Project:
C5 Residential Growth Cell

Site:
Cambridge - 100 Year flood
depth for existing hydrology

Date 24/10/2021

0 50 100 m



Legend

C5 Site



100 Year Flood Depth (m)

0.05-0.2



0.2 - 0.4



0.4 - 0.6



0.6 - 0.8



0.8 - 1.0



> 1.0

