Water Cycle Management Strategy Report

Planning Proposal, Catherine Field
Catherine Field Precinct

For Springfield Pty Ltd, March 2022

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Issue	Date	Author	Approved
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1 Introduction

1.1 Background

Craig & Rhodes was engaged to prepare a Water Cycle Management Strategy (WCMS) for the Catherine Field Planning Proposal site. The purpose of this report is to assist in establishing the feasibility of the proposed Indicative Plan (IP) prepared by Urbanco. The Plan has been developed to correspond to the broad level design outcomes required by Council and the DPIE.

The strategy comprises key waterway measures for flooding, water quality and geomorphology management within the study area.

A concept design has also been performed for the key flood management and water quality measures proposed for the Precinct to support the planning process and to ensure that there are no adverse impacts on the downstream environment.

1.2 Objective

The purpose of this report is to:

- Undertake a Water Cycle Management Strategy for the purposes of the proposed Indicative Plan;
- Undertake hydrologic, hydraulic and water quality assessment of the site as an integrated approach to flood risk and water cycle management;
- Identify flood impacts for the proposed development precinct for the specified 5%, 1% AEP and Probable Maximum Flood (PMF) event;
- Identify and undertake concept design of the proposed flood detention basins, outlet configurations, and bio-retention basins for flood and water quality management purposes; and
- Adopt the hydrologic and hydraulic models (RAFTS-XP and TUFLOW) from the Camden Council Upper South Creek Regional (USCR) model (WMA, 2020), the Upper South Creek Regional Model User Guide (WMA, 2020), and its specified catchment parameters for the purposes of the flood impact assessment.

1.3 Scope of work

This report addresses the surface water management requirements for the Catherine Field site. It serves to facilitate the enhancement and conservation of biodiversity and ecological health within the existing riparian corridors and provide an integrated natural resource for the community.

The investigations undertaken in this report consist of those agreed in consultation with Camden Council. The scope as understood by Craig & Rhodes is;

- Investigate a range of stormwater management and water sensitive urban design measures suitable for the site, in terms of locations, sizes, and effectiveness;
- Undertake preliminary concept earthworks design and road grading to inform the post-developed flood assessment.

- Undertake hydrological analysis to determine peak flows for 5%, 1% Annual Exceedance Probability (AEP) events and the Probable Maximum Flood (PMF) under post-development conditions;
- Develop a two-dimensional hydraulic flood model for the Precinct using the full USCR RAFTS-XP and TUFLOW models and assess the above-mentioned storm events under post-development conditions;
- Determine the minimum detention storage requirements to attenuate post development flows to pre-development levels;
- Assess different development scenarios within the hydraulic model to determine the potential impact of the development on the flood regime and the impacts of flooding on the development, through an iterative process;
- Prepare preliminary engineering concept designs for the proposed detention basins, bio-retention basins, outlets, roads, and cross drainage within the precinct to satisfy water quantity and quality objectives;
- Prepare a Water Cycle Management Strategy Report to support the rezoning for the Precinct, detailing the investigations, findings, calculations, and design details.

It is noted that this is a high-level report undertaken primarily to assess the feasibility of the proposed Plan. It is acknowledged that further detailing and refinement of the various flood and water quality management elements proposed for the area would be necessary at the Development Application stage, and as part of the design process.

1.4 Guidelines and available data

Available guidelines and data reviewed adopted for the study included the following:

- Growth Centre Development Code (2006);
- Camden Council Engineering Design Specification (2009);
- Draft Engineering Design Manual for Western Sydney (WSCC 2020);
- Guidelines for Controlled Activities on Waterfront Land (Various, NOW 2012);
- Camden Growth Centre Precincts Development Control Plan (2013);
- Upper South Creek Floodplain Risk Management Study and Plan (2014);
- Upper South Creek Regional RAFTS-XP Model;
- Upper South Creek Regional TUFLOW Model; and
- Upper South Creek Regional Model User Guide (WMA, Final Version 30 October 2020).

The USCR RAFTS-XP and TUFLOW regional models under existing catchment conditions were provided for this assessment for the 5% and 1% and PMF AEP events.

The USCR RAFTS-XP and TUFLOW models were subsequently updated in accordance with the proposed ISP and the User Guide under post development conditions for the 5%, 1% AEP and PMF events, and used to assess the potential impacts of the development. This was undertaken with the proposed flood retention and bio-retention basins designed and incorporated in the post-development models.

1.5 Consultation

Craig & Rhodes have undertaken consultation with Camden Council to ensure compliance with respect to the USCR requirements.

The consultation included aspects of hydrological modelling and analysis, basin design, landscape planning, environmental requirements and 3D modelling of the proposed earthworks. It was agreed that the assessment focus on the 5%, 1% Annual Exceedance Probability (AEP) events and the Probable Maximum Flood (PMF) under pre and post-development conditions.

1.6 Planning Status

The Catherine Field Planning Proposal is a Proponent-led proposal that seeks to rezone approximately 105 hectares of land within the Catherine Field Precinct to enable urban development for new housing, open space and recreation, major roads and stormwater management. Under the SWGA Planning status the site is curently not released for planning.

There is a similar Proponent lead planning proposal, to the South of Springfield Road adjacent to this site within the Catherine Fields Precinct (refer to **Figure 2**). It is further anticipated that other parcels of land within the Catherine Fields Precinct will follow suit in forging ahead with proponent initiated planning proposals.

Craig & Rhodes recognise the importance in working with Council to support the planning and design of the broader Catherine Fields Precinct as planning progresses and areas are zoned and released. Due to the proposed planning applications, there may be opportunities to streamline processes and expedite the planning process. Craig & Rhodes shall work to partner with Council to support these processes which in turn will support the areas growth.

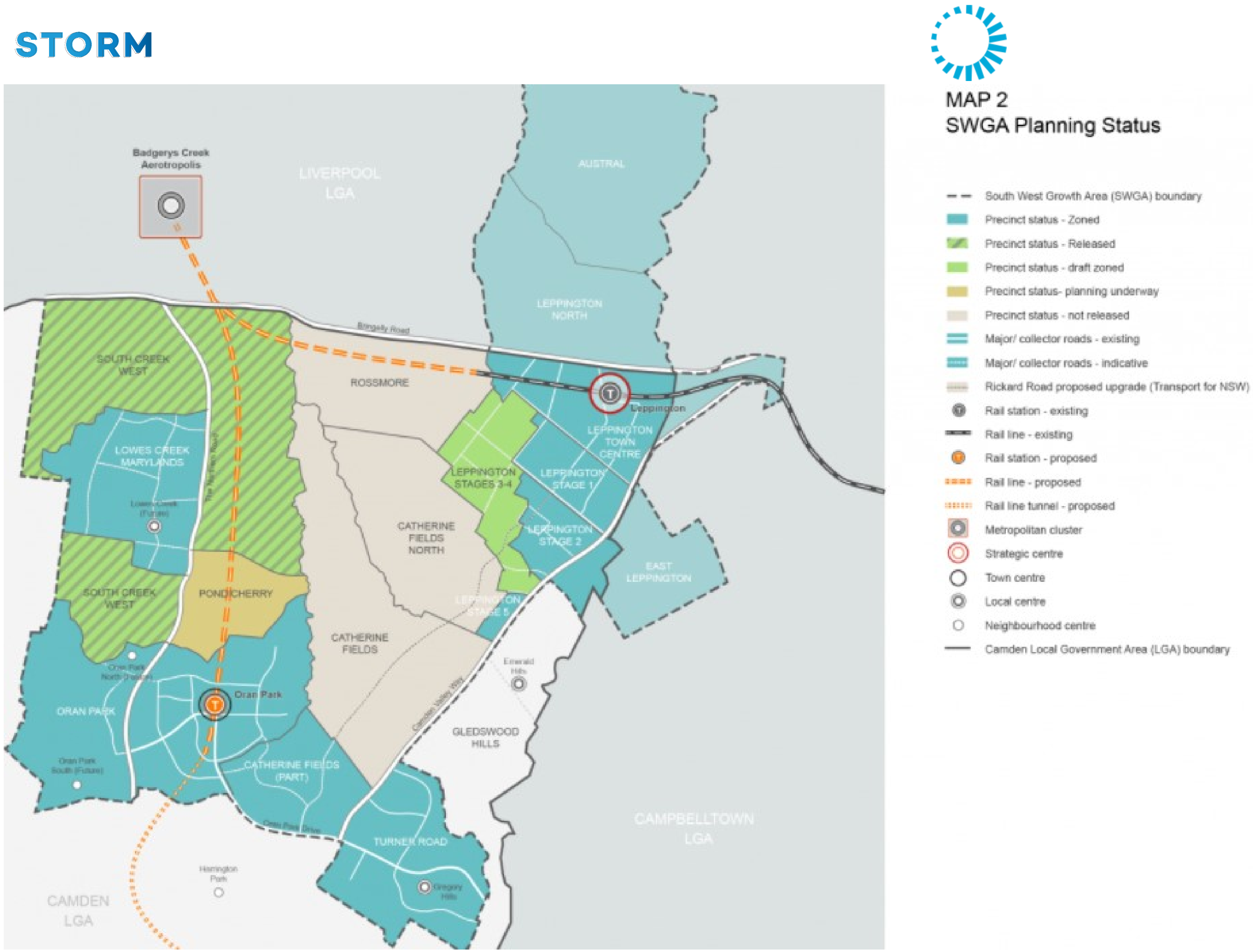


Figure 1 Map 2 SWGA Planning status (State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (Growth Centres SEPP))

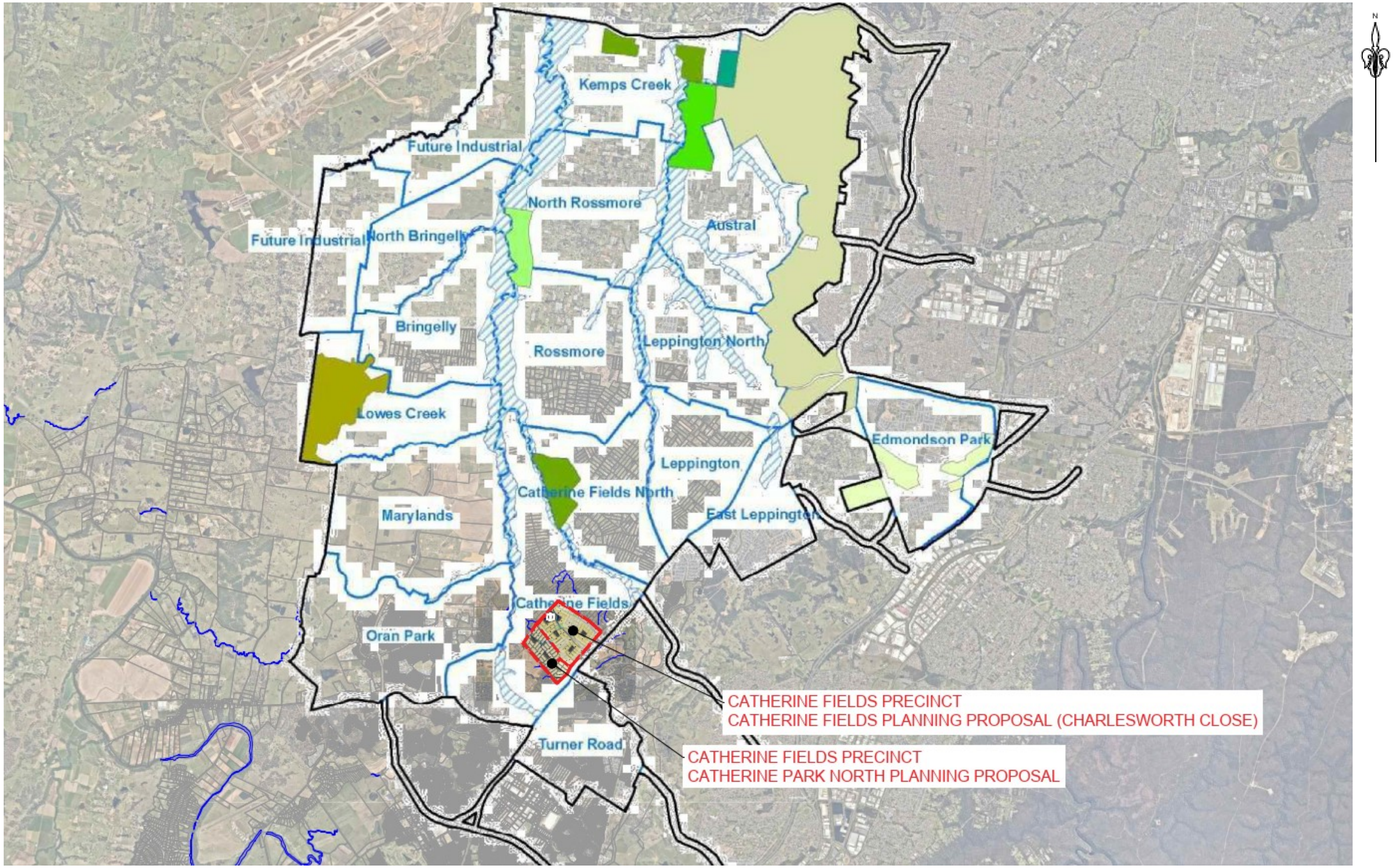


Figure 2 Catherine Field and Catherine Field Planning Proposal Areas

2 Development Description

2.1 Catherine Field Planning Proposal

The Catherine Field area is located in the Southwest Priority Growth Area within the Camden Council Local Government Area (LGA). It lies along the western side of Camden Valley, adjacent to the Springfield Road and Camden Valley Way Intersection, as shown in **Figure 3** and **Figure 4.**

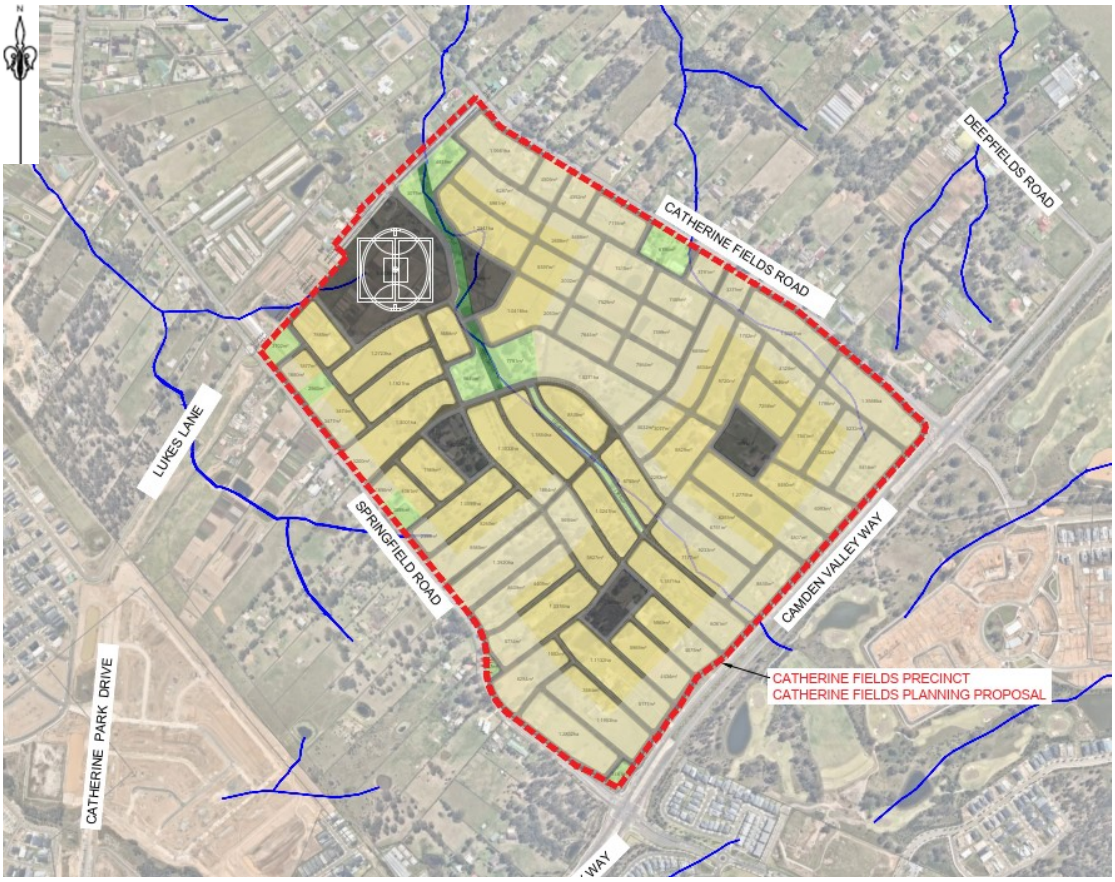


Figure 3 Boundary of Catherine Field Planning Proposal

Figure 4 General location of Catherine Field Site (Google Maps,2022)

2.2 Indicative Structure Plan

A draft Indicative Plan was prepared by Urbanco. The Current Plan is shown in **Figure 5**.

Craig & Rhodes has undertaken refinements of the drainage elements of the indicative layout in collaboration with Springfield Pty Ltd and Camden Council. The drainage layout was updated in response to refinement of the post development landform and to optimise integration of the basins with the adjacent environmental conservation areas.

2.3 Preliminary Concept Drawings

Preliminary concept drawings of the site have been prepared. The drawings outline the basin layouts and catchments. The Preliminary Concept drawings are included in **Appendix A**.

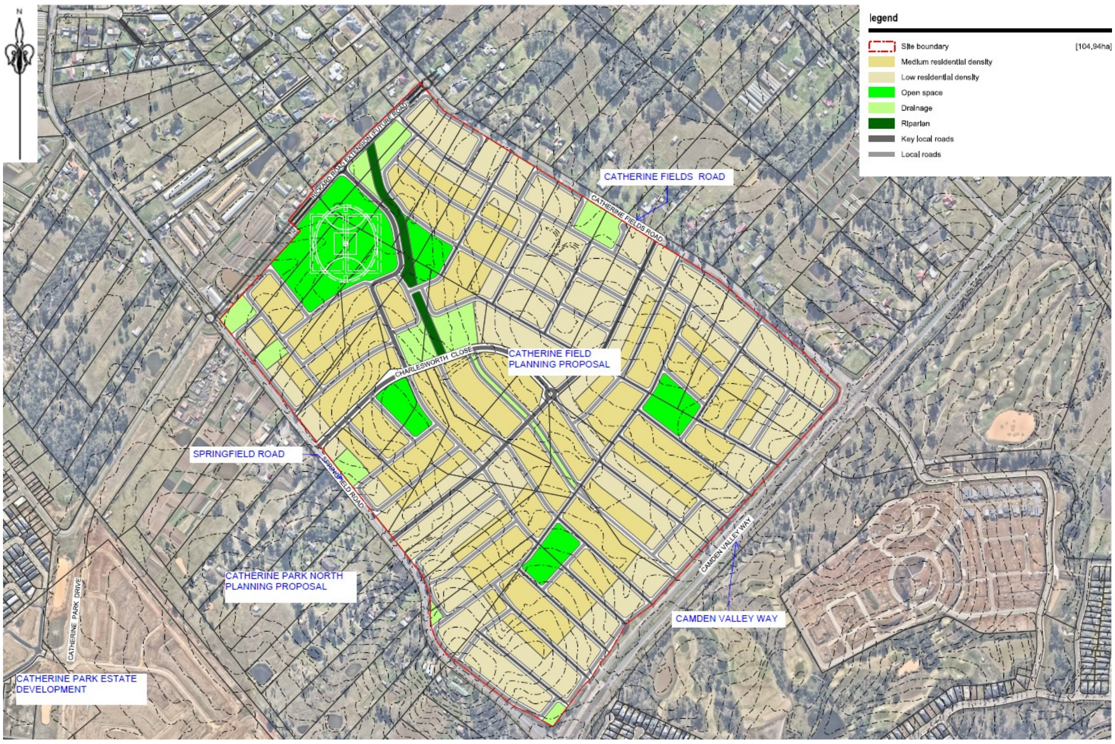


Figure 5: Current Indicative Structure Plan (2022) for Catherine Field

3 Flood Assessment

3.1 Study Area

The Catherine Field catchment delineation was determined through analysis of the LiDAR Digital Elevation Model (DEM) and RAFTS catchments provided in the USCR model. The existing catchment boundary delineation is presented below in **Figure 6,** with the full study area of the USCR model presented in **Figure 7**.

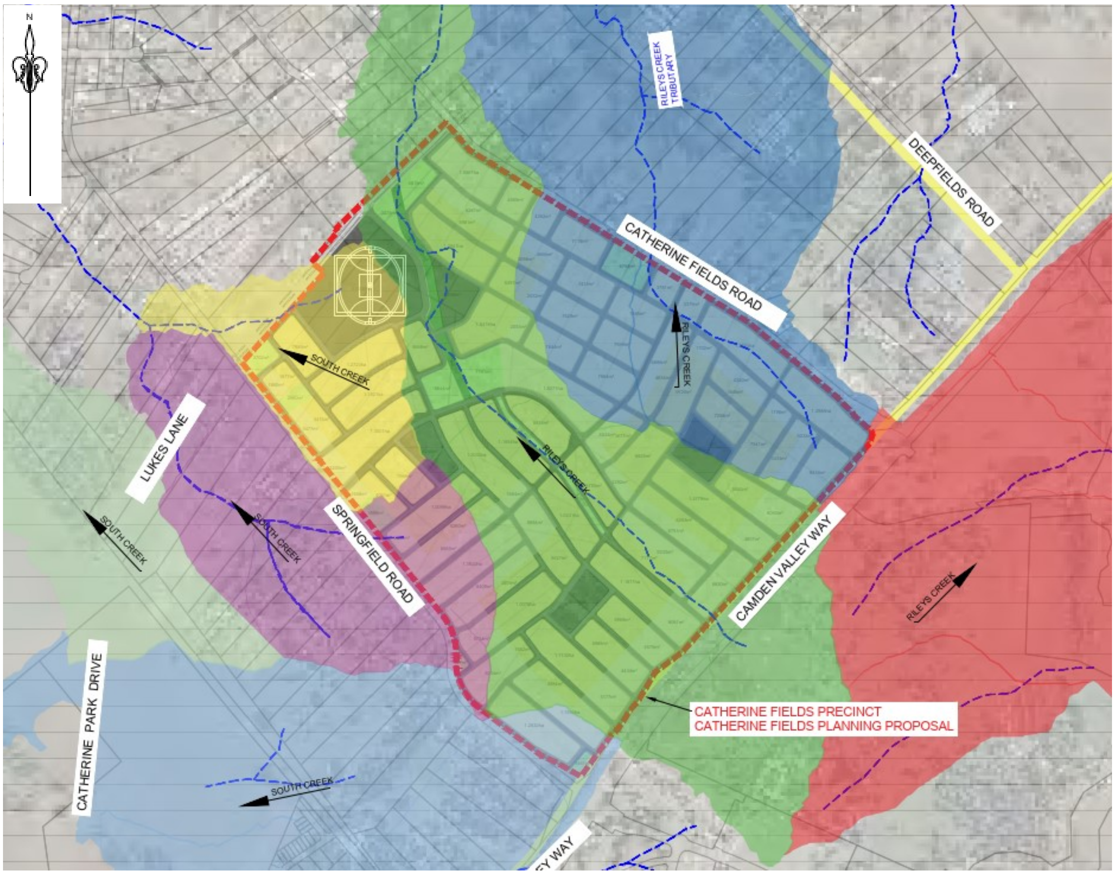


Figure 6 Study Area, Riparian Zones and Catchments

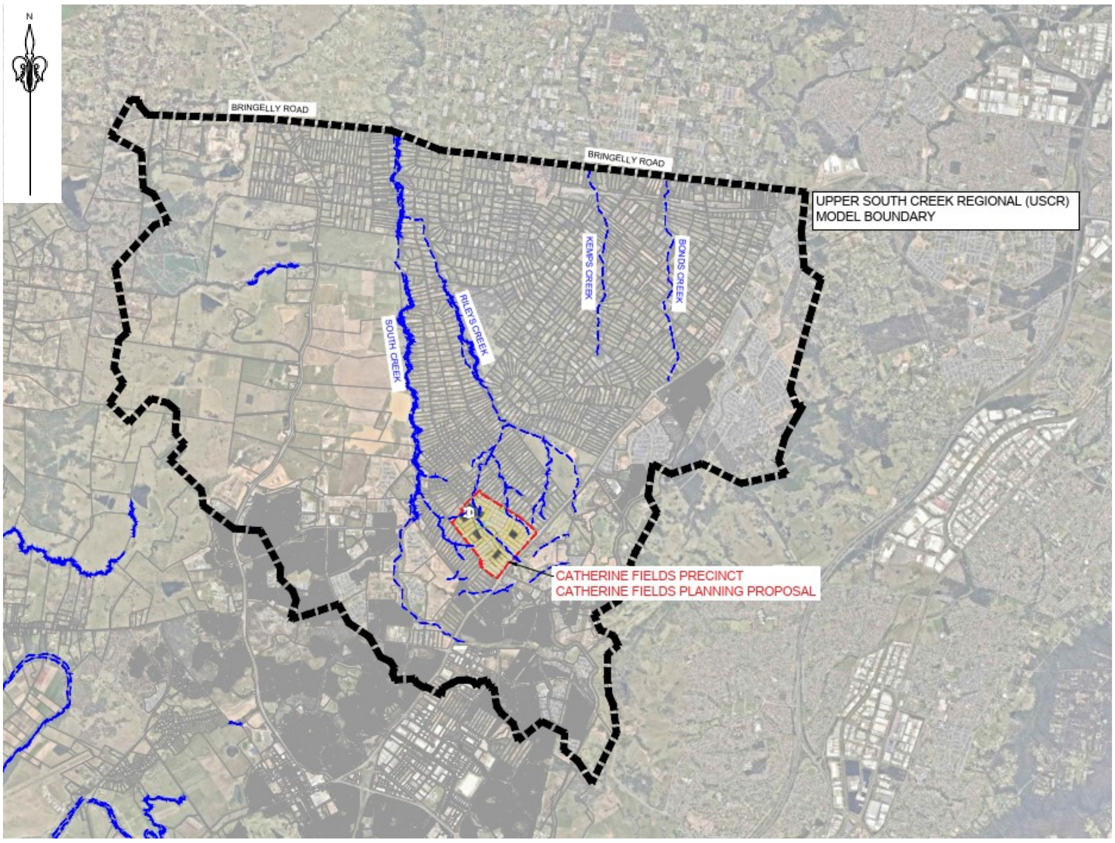


Figure 7: Current Study Area with full USCR Catchment Model to Bringelly Road

3.2 Data Review

3.2.1 Digital Elevation Model

The DEM for the existing conditions within the proposed Catherine Field site as well as that for the entire Upper South Creek catchment are shown in **Figure 8** and **Figure 9**, respectively.

In the post-development elevation models, amendments have been made to include a preliminary design of the proposed upgrade to Springfield Road, Catherine Fields Road and Rickard Road, which fronts the southern, northern and western boundary of the proposed site respectively. It is anticipated the future Rickard Road Connector Road will extend through to the existing Luke's Lane. It is expected that more detailed design of these roads will need to be allowed for in the next stage of grading and design works. The culverts will need to be redesigned and an updated proposed condition scenario will be required for the TUFLOW model.

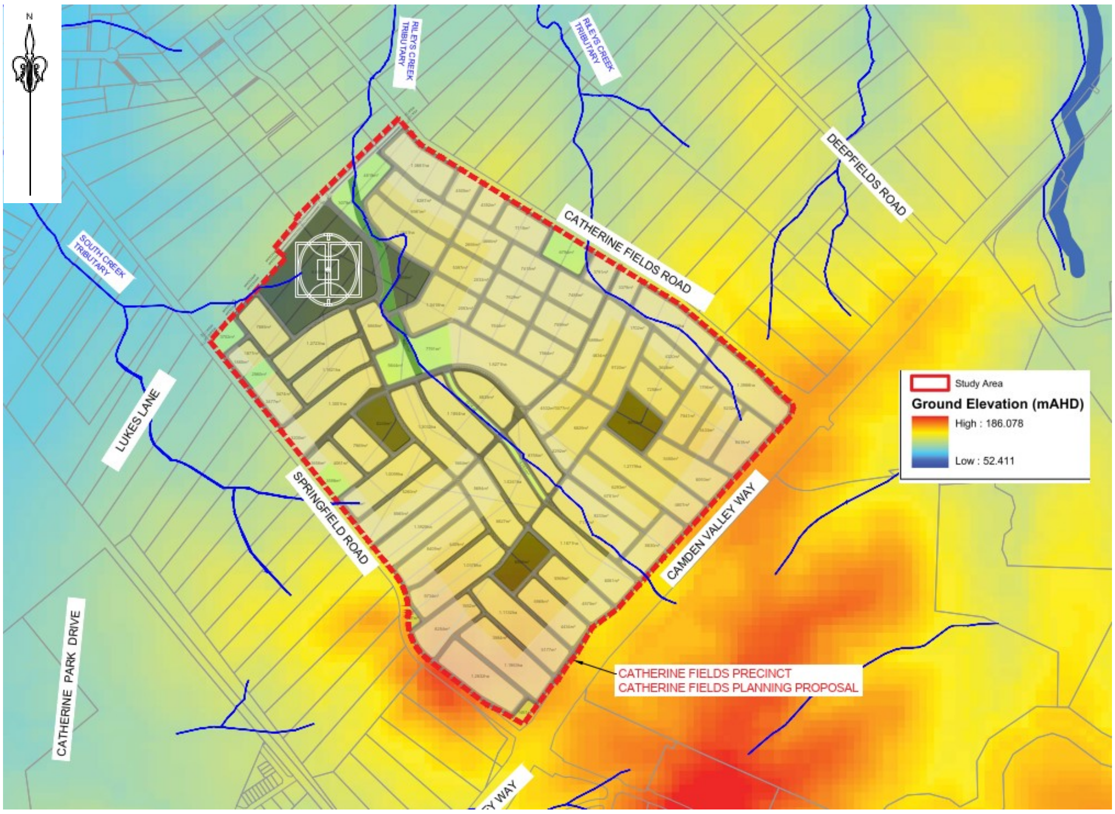


Figure 8 Pre-development Scenario DEM model

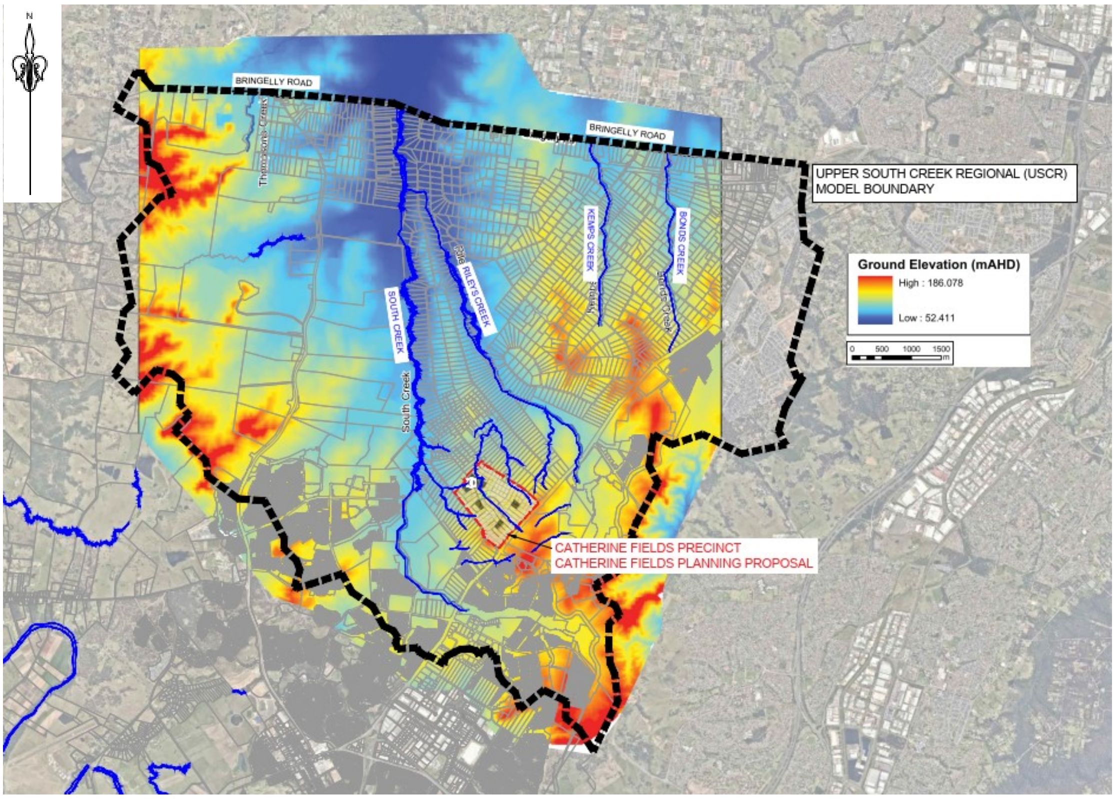


Figure 9: Pre-development Scenario DEM model based on USCR Mode

3.2.2 Existing Farm Dams

Existing farm dams in the vicinity of the site were incorporated into the modelling of the existing flow characteristics in the catchment. To model the farm dams conservatively, it has been assumed that the local dams are full prior to the design storm event.

This is considered a reasonable assumption as it is likely that in reality the modelled design storms would be imbedded in a wider rainfall pattern with preceding rainfall filling the dams to full capacity prior to the design storm.

3.3 Hydrologic Model

'*The Upper South Creek Regional Model User Guide'* (USCR Model User Guide) and the accompanying XP-RAFTS USCR base models by WMAwater provides hydrologic and hydraulic modelling advice for proposed developments within the Upper South Creek catchment. Craig & Rhodes has received the User Guide and the base models to undertake flood assessment for the proposed Catherine Field Planning Proposal.

Hydrologic modelling of the Precinct was undertaken using XP-RAFTS (Version 2018.1.1) in accordance with the USCR Model User Guide by WMAwater. The adopted hydrologic and hydraulic XP-RAFTS parameters are provided in the USCR Model User Guide.

Three XP-RAFTS models were undertaken as discussed in Sections 3.3.1 to 3.3.3.

3.3.1 Calibration Model

The received XP-RAFTS USCR base model 1% AEP results were used to confirm the 2D TUFLOW flood results provided reasonable match with Council's flood results for calibration and checking.

3.3.2 Pre-Development Hydrologic Model

The 'pre-development' scenario is defined as the proposed development in Catherine Field site in an undeveloped state, without proposed site regrading.

Pre-development hydrologic modelling of the Precinct was run using the USCR model, including parameters specified in the USCR model User Guide. Further information on the modelling set up, data inputs and assumptions can be found in the USCR model User Guide (WMAwater, Final Version, 30 October 2020).

The USCR base model catchments within the site boundary have been revised to match the post-development catchment delineation in accordance with the USCR Model User Guide. All other catchments remain unchanged from the USCR base model.

The revised catchment delineation for the pre-development scenario is provided in **Figure 10.**

A tabulated summary of the revised pre-development catchments is provided in Appendix C.

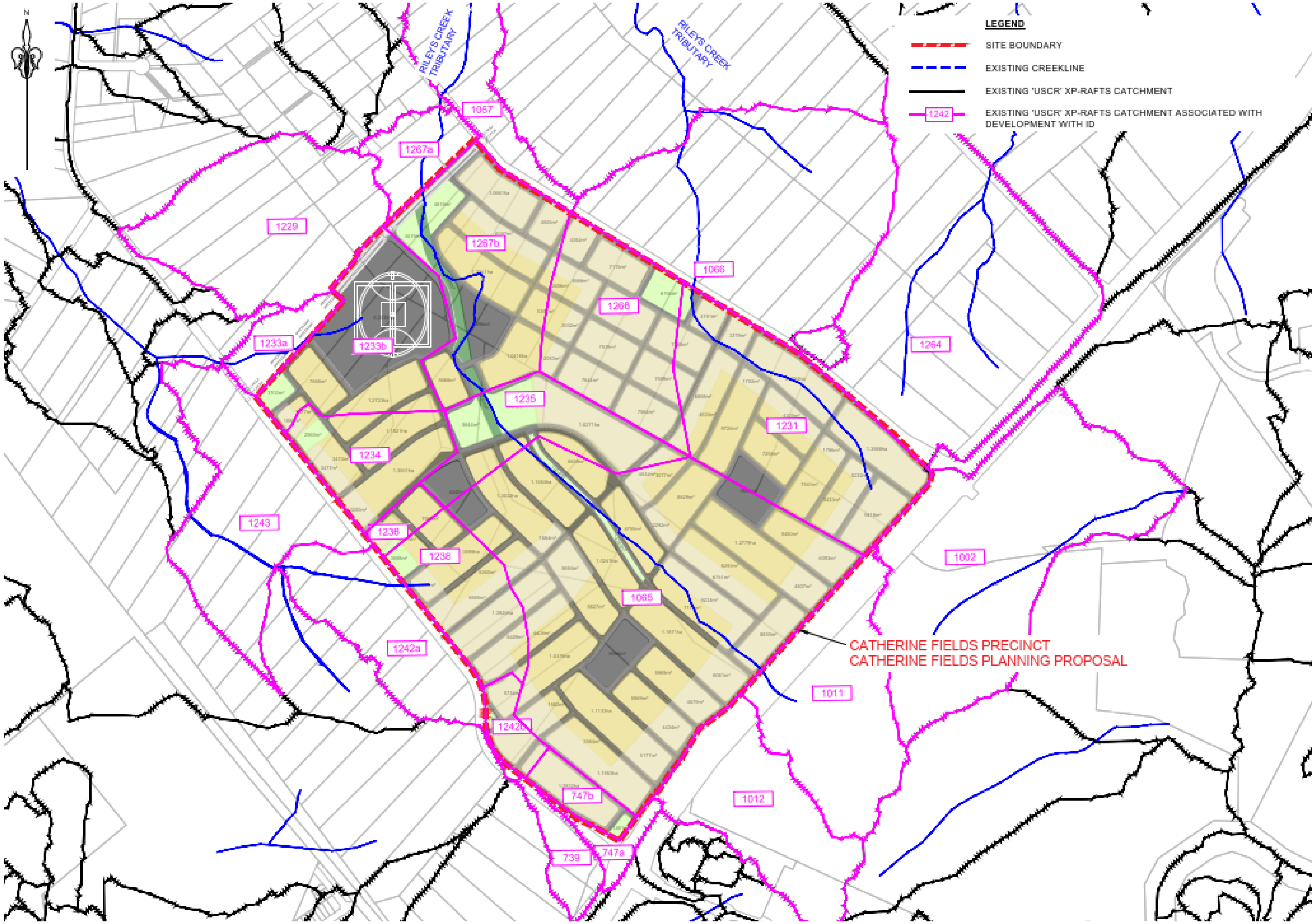


Figure 10: RAFTS-XP Catchment Delineation – Pre-Development Scenario (current study)

3.3.3 Post-Development Hydrologic Model

The 'post-development' scenario is defined as the proposed development in the Catherine Field Planning Proposal in a developed state, with proposed site regrading.

Sub-catchments were delineated based on proposed design topography, road drainage network, land uses and stormwater basins. In particular, the design road network has been used as a guide to orientate stormwater networks and in turn the delineation of sub-catchments.

Where post-development catchments are located over two USCR base case catchments, the parameters of the USCR catchment best representing the post-development catchment have been adopted. All catchment areas outside of the Catherine Field precinct are assumed to remain unchanged.

The updated post-development XP-RAFTS catchments for the Catherine Field precinct corresponds to the proposed ISP in **Figure 5** and is shown in **Figure 11.** For the purposes of this study, some of the sub-catchments and flow locations were refined to suit the new landform and basin locations. The total catchment areas between the USCR base case, pre-development case and post-development case remain consistent.

A tabulated summary of the revised post-developed catchments is provided in Appendix C.

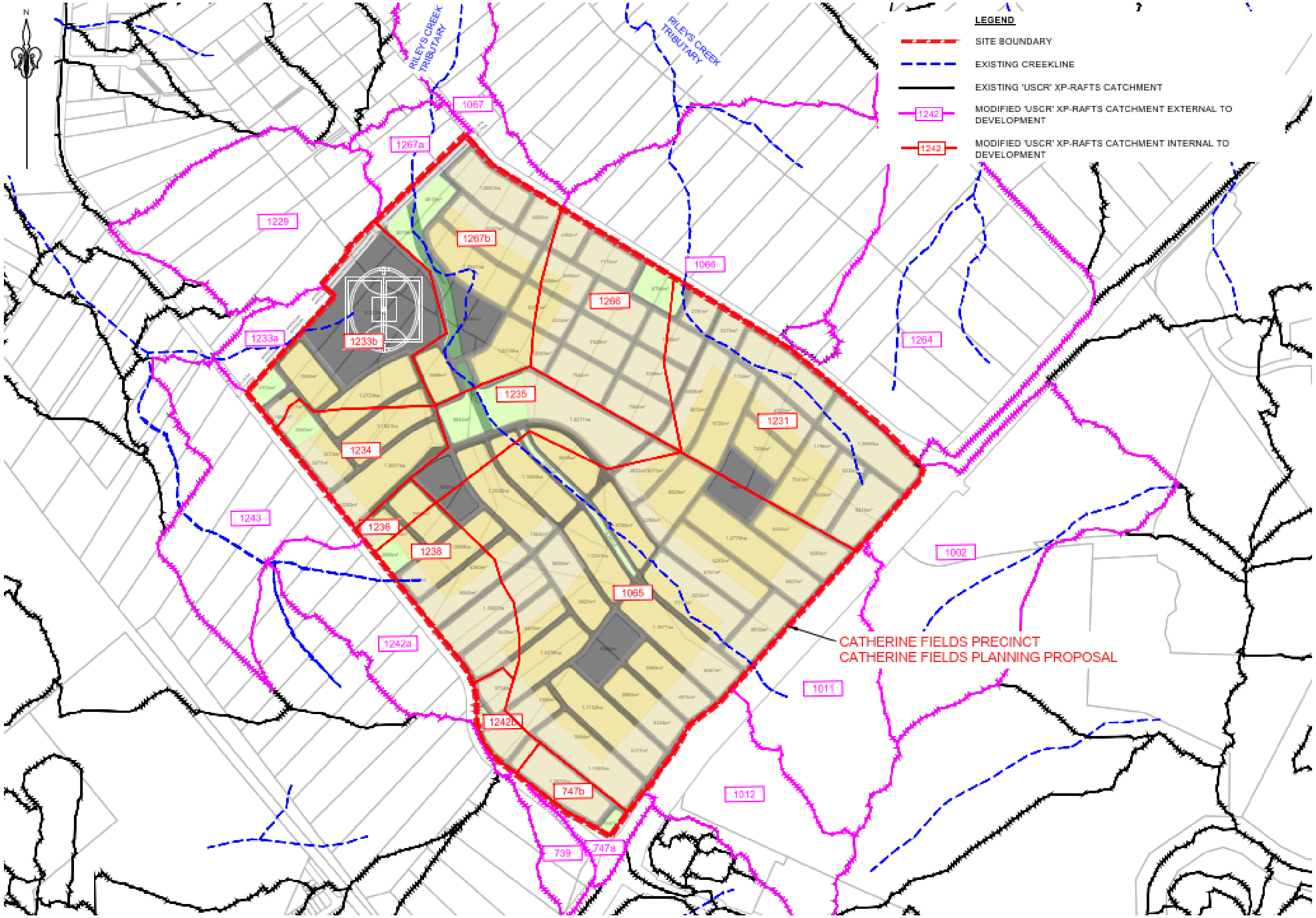


Figure 11: RAFTS-XP Catchment Delineation – Post-Development Scenario (current study)

3.3.4 Critical Duration and Median Temporal Patterns

The model durations and temporal patterns for each storm event specified in the USCR model User Guide were adopted for this study for the 5% AEP, 1% AEP and PMF events. It is noted that in consideration of the catchment size and review of PMF hydrographs that only the 60 min storm for the PMF shall be run for this study. A full PMF modelling regime will be undertaken at a later design stage. Additional details may be referred to in the User Guide.

3.4 Hydraulic Modelling

A two-dimensional TUFLOW hydraulic model of the Upper South Creek catchment was used to model flood behaviour under existing (pre-development) and post development conditions at Catherine Field. The TUFLOW model was based on Council's USCR base model developed for the Upper South Creek catchment which extends to Bringelly Road at the downstream boundary.

The hydraulic modelling was undertaken to confirm existing flows and to assess the potential flood impacts resulting from the proposed development.

3.4.1 Calibration Hydraulic Model

Craig & Rhodes has received the USCR TUFLOW base model as well as the accompanying results for a variety of storm events ranging from the 50% AEP storm to the PMF storm. The USCR base model was run without any amendments to confirm that the 1% AEP flood results match with Council's provided 1% AEP results for calibration and checking purposes. It was confirmed that Craig & Rhodes' base model 1% AEP results are identical to Council's 1% AEP results.

3.4.2 Pre-Development Hydraulic Model

The TUFLOW modelling of the pre-development catchment area was undertaken based on the USCR model. Details on the modelling methodology and parameters can be found in the USCR Model User Guide.

Some minor amendments were made to the base model to provide a more accurate representation of the flood behaviour at the site for impact assessment. The amendments in this "revised base model" include:

- Existing farm dams on and around the site were modelled with an initial water level at the spillway level.
- Existing stormwater culverts around the site were surveyed and culvert invert levels and sizes were updated based on the survey. Details of these culverts are provided in **Figure 12**.
- Post-development sub-catchment delineations were adopted, and subsequently source area (SA) inflow polygons were updated to represent the new catchments, without any changes to the DEM or hydrological parameters in RAFTS.
- Additional PO lines were placed at the site boundaries to assess the flows leaving the site.

All other modelling elements remain unchanged from the USCR base model.

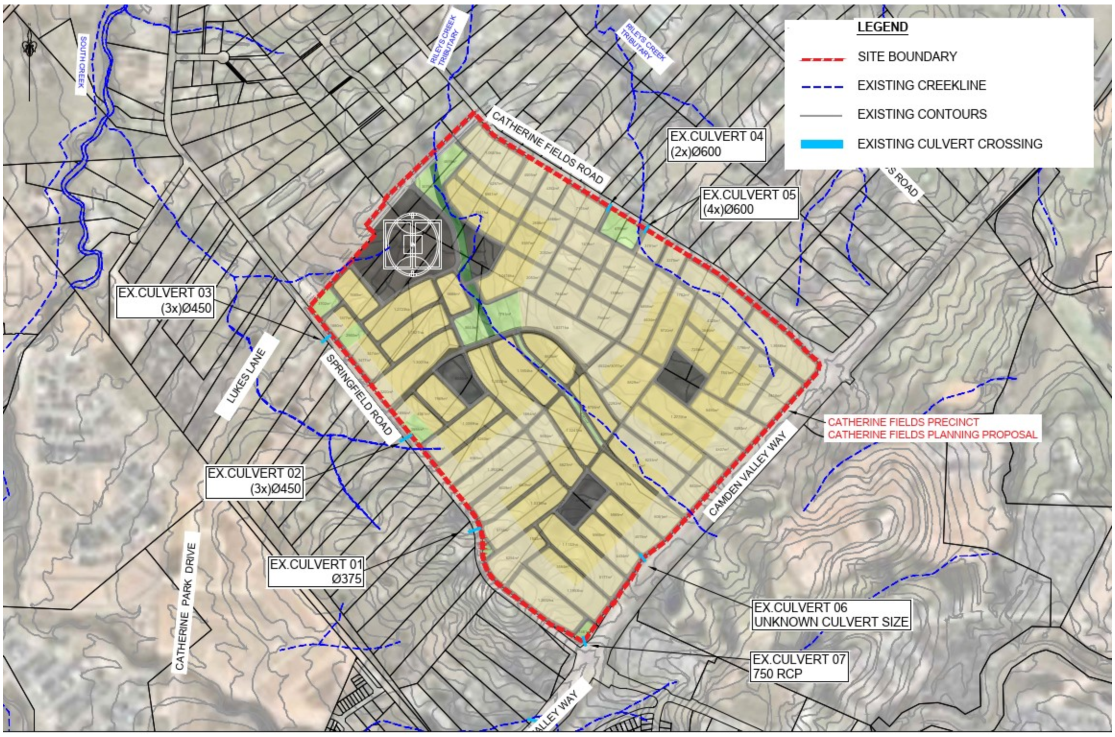


Figure 12 Existing Culvert details at Site Boundary

3.4.3 Post-Development Hydraulic Model

The pre-development hydraulic model was prepared to account for the proposed changes in land use, road alignments, and basin locations under post-development conditions and as per the Indicative Pan. The following model elements were adopted for proposed conditions:

- The TUFLOW topographic grid at the site was modified to represent the proposed development conditions, including all proposed basins and drainage corridors.
- A thin 2D z-line was used to accurately define the spillway level of the proposed basins.
- The site's Manning's roughness zones were updated to represent the proposed design surfaces as per the ISP.
- Minor adjustments were made to some SA inflow boundary conditions for the site catchment where catchment runoff was redirected to a basin or a modified existing culvert. The inflow hydrographs of all proposed site catchments were updated using outputs from the RAFTS model.
- The initial water levels in farm dams on site were removed.
- The 1D network was updated with proposed culverts, and modifications were made to several existing culverts as detailed below.

All other modelling elements remain unchanged from the pre-development model.

Terrain

The flood risk management approach taken for the Precinct is that all developed areas would be filled at or above the Flood Planning Level. This approach is in accordance with the Growth Centres Development Code (NSW Government, 2006) and the engineering specification (Camden Council, 2009). The flood planning level is defined as the 1% AEP plus 500mm freeboard. This approach has several advantages:

- It ensures that the future flood risk is low;
- Reduces the potential risk to life in all flood events up to the 1% AEP. It is noted that the flood risk to life is not completely removed as there is a risk in events greater than the 1% AEP such as the PMF; and
- Properties will not have 1% AEP notifications associated with the lots and ensures building floor levels do not need to be elevated above future ground levels.

The proposed grading design used in the post-development hydraulic model is shown below in **Figure 13** for the Catherine Field Planning Proposal, and relative to the Upper South Creek catchment in **Figure 14**. It is expected that the grading design at the Catherine Field Planning Proposal site would be refined during the later design stages of the project.

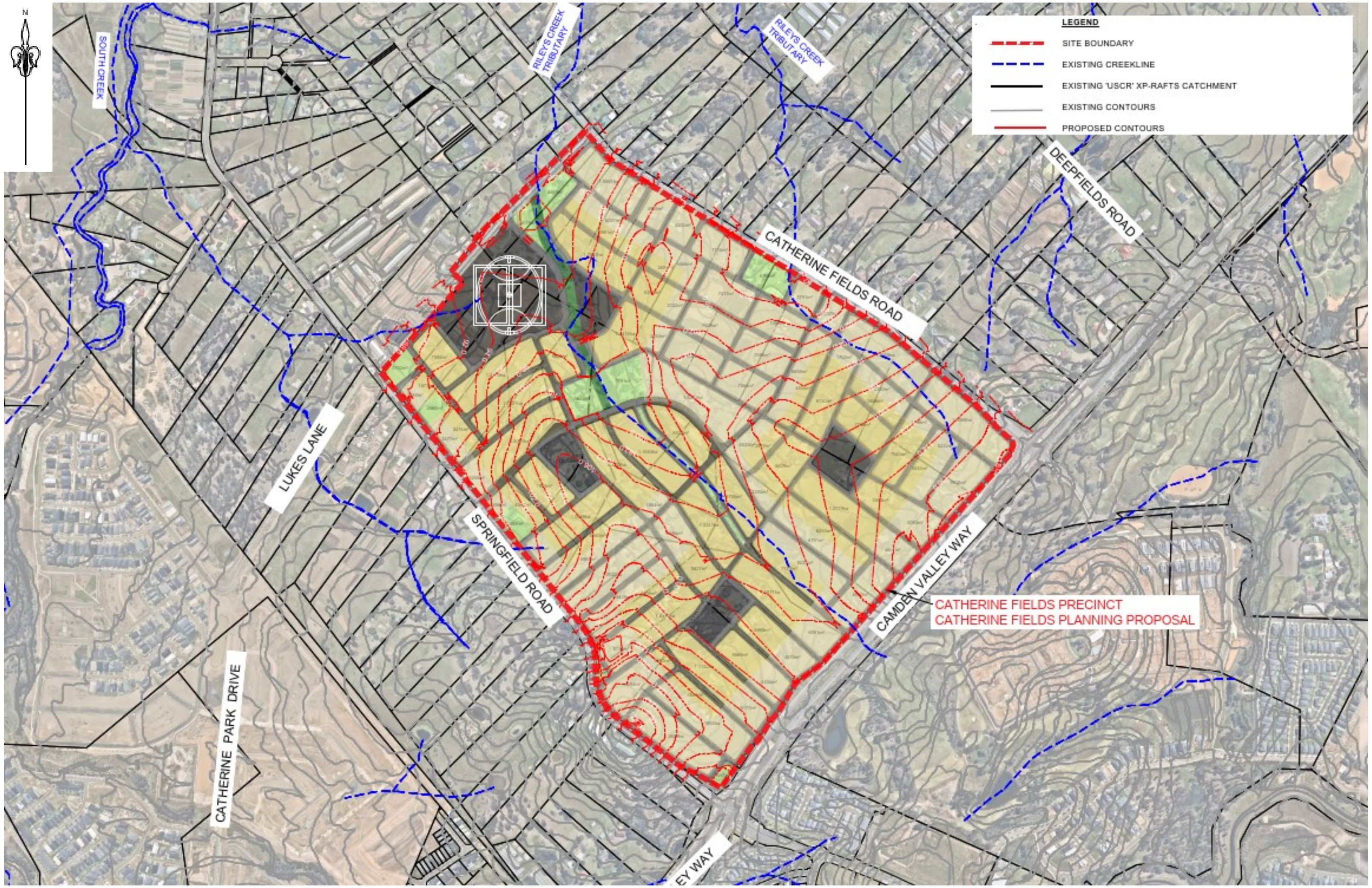


Figure 13 Post Development Terrain and Grading Design at Catherine Field Planning Proposal Site

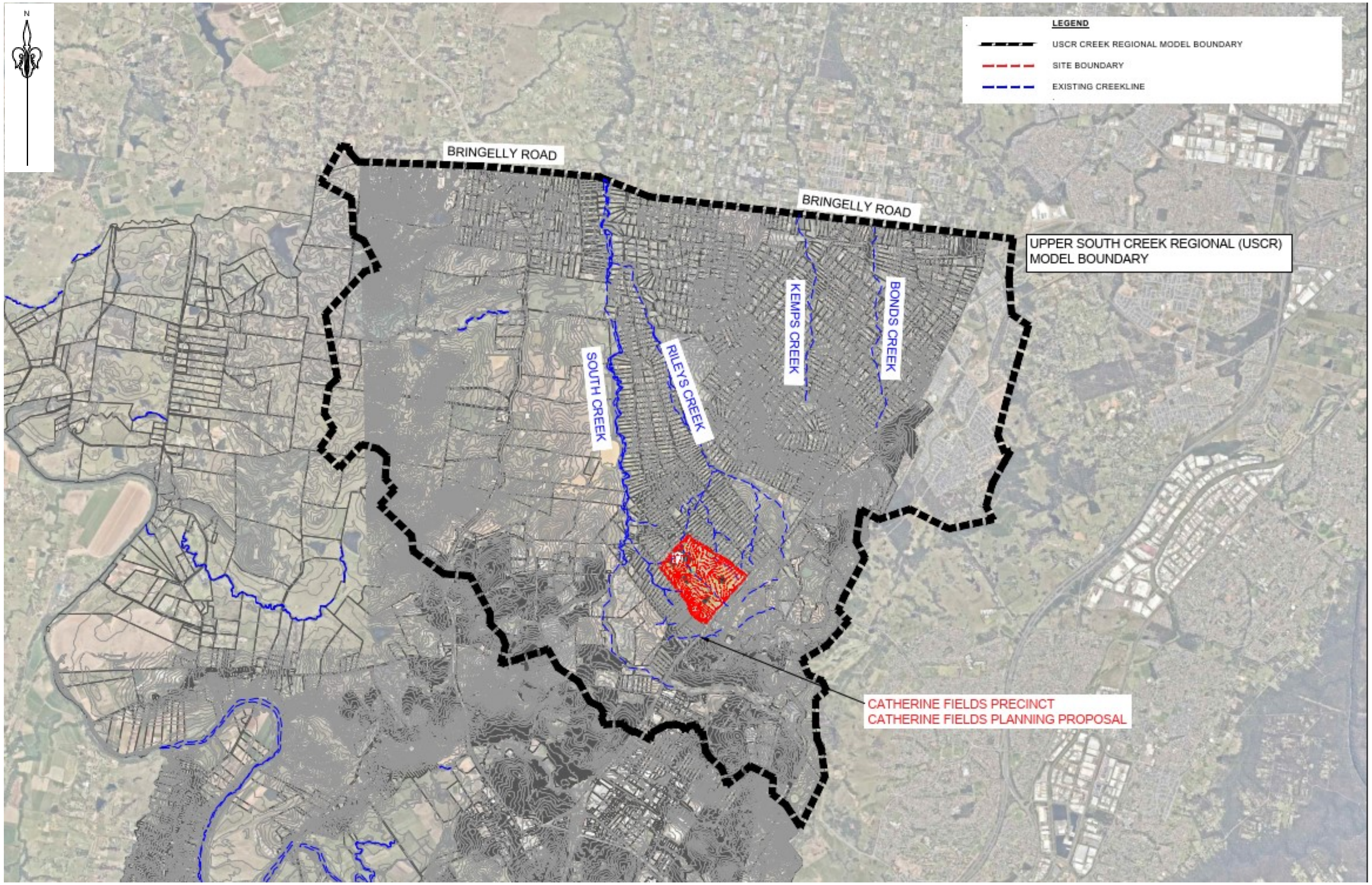


Figure 14: Post Development Catherine Field Planning Proposal DEM relative to Upper South Creek Catchment

Drainage Corridor Works

The approach adopted within Catherine Field site has been to maintain the existing drainage corridor and overland flow route locations with only minimum changes proposed, as necessary. Therefore, there is a drainage corridor proposed through the centre of the site extending from southeast to northwest. Minor farm dams have been removed from the drainage corridors with overland flow paths proposed.

Culverts located along the southern boundary of the site transfer upstream catchment flows under Camden Valley Way and onto the site. The flows are then conveyed to the proposed drainage channels and are discharged at the northern boundary of the site via the online Basin 07. Flows need to be controlled in the channel to not impede on the proposed site.

Hydraulic Structures

There are four proposed road crossings of waterways within the northwest drainage corridor of the proposed Catherine Field site. The details of the culverts under road crossings are provided in **Figure 15**.

Existing road culverts at the site were amended slightly from existing conditions, particularly due to the proposed upgrade of Springfield Road and Catherine Fields Road. The existing culverts underneath Springfield Road were extended to be outside the proposed roadway at the outlet, whereas the upstream inlets were directly connected with the proposed detention basins. Similarly for Catherine Fields Road, an existing culvert leading out of the site was extended further at the downstream end to accommodate the proposed road upgrade, and an existing culvert which would become redundant was removed. Additionally, an existing culvert coming into the site form underneath Catherine Fields Road was extended directly into Basin 04 to simulate the effect of the proposed future stormwater system. The size of existing culverts into the site were all maintained as per existing conditions, however the size of culverts exiting the site were adjusted to control the post-development flow from the basins.

Culverts at the proposed Basins 02, 03, 05 and 06 were designed to match into the existing conditions on the Catherine Park North Planning Proposal site south of the Catherine Field development. It is recommended that potentially in future model runs, detailed information from the downstream Catherine Park North development is used to tie the basin outlets into the proposed stormwater system of the site.

The details of all proposed basin culvert outlets are provided in **Figure 16**. The blockage of all hydraulic structures has been modelled as outlined in Section 4.7 of the USCR Model User Guide.

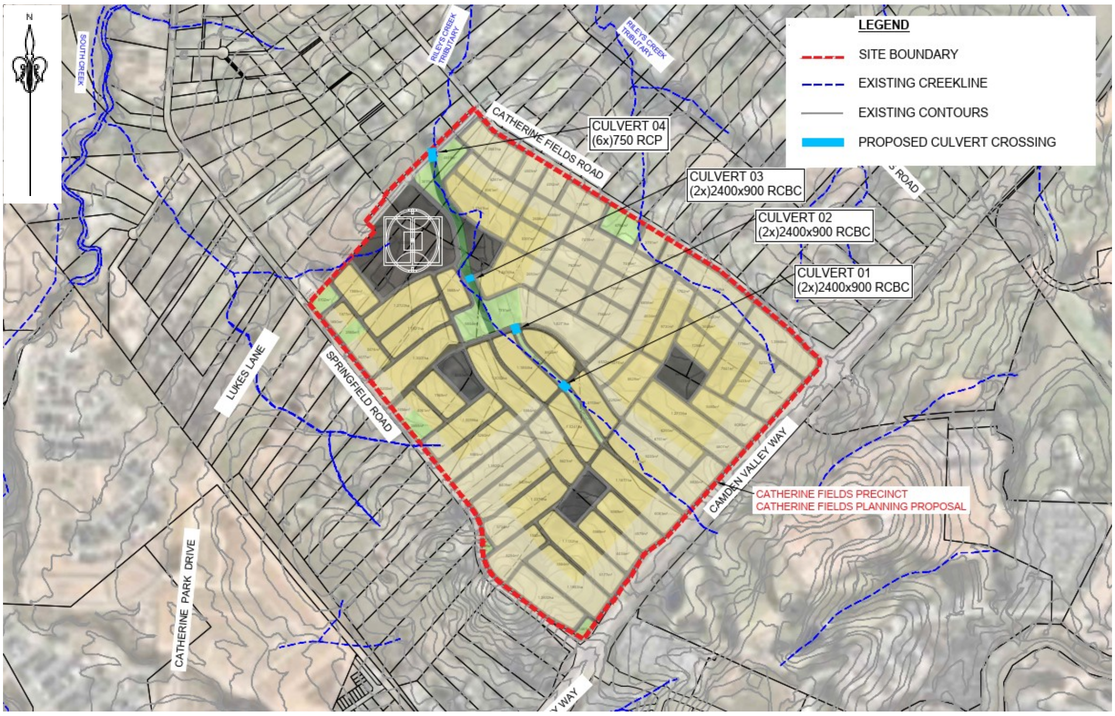


Figure 15 Proposed Culverts at Road Crossings in Post Development TUFLOW model

3.5 Post Development Hydraulic Modelling Results

The post-development TUFLOW modelling was undertaken to simulate the 5% AEP, 1% AEP, and PMF events. Peak flood depth, hazard and afflux mapping for these results are presented in **Appendix D**.

Overall, the flood extents are contained within the proposed drainage corridor and basins including up to the 1% AEP event. There is a minor exception at the proposed roads conveying the upstream catchment flows from the two existing culverts underneath Camden Valley Way at the southern boundary of the site. The flood results show that it is unlikely that the roadway can contain the entire 1% AEP flows, and that it may potentially impede on the lots. Therefore, it is recommended that a stormwater system be implemented in iteration and finalisation of detailed design components to convey these flows to the drainage channel and alleviate the overland flood affectation of the roads and lots.

The afflux results show some minor water level increase in the roadside swales of Camden Valley Way downstream of Basin 02. This afflux extends into the local farm dams further downstream on the Catherine Park North development and occurs mainly due to the concentration of overland flows into the culverts and roadside swales of Camden Valley Way. Under existing conditions these overland flows are conveyed on the Camden Valley Way carriageway, and thus redirecting the flows to dedicated drainage corridors is seen as a more preferable outcome, hence this afflux is considered to be immaterial.

There is also an increase in water levels in a small area at the outlet of Basin 04 north of the site, however this is a localised impact which occurs due to condensing the two existing culverts under Catherine Fields Road into one basin outlet. Generally the water levels in the vicinity of the basin outlet are all improved, and hence the afflux is considered negligible. Overall there are no other areas of material water level impact in the 1% AEP event.

A summary of the post-development flood behaviour is provided in **Table 1.** Additional details for the individual detention basins and bio-retention basins are discussed and presented in Section 4 of this report.

Table 1 Post-development Hydraulic Model Results Summary

Areas	Comments
Basin 01	The 4-pipe culvert outlet from Basin 01 conveys 4.87 m^3/s peak flow into the drainage corridor in the 1% AEP event, with no overtopping of the spillway.
Basin 02	The pipe outlet conveys 0.20 m^3/s peak flow in the 1% AEP event, with no overtopping.
Basin 03	The pipe outlet conveys 0.19 m^3/s peak flow in the 1% AEP event, with no overtopping.
Basin 04	The pipe outlet conveys 2.47 m^3/s peak flow in the 1% AEP event, with no overtopping.
Basin 05	The pipe outlet conveys 0.61 m^3/s peak flow in the 1% AEP event, with no overtopping.
Basin 06	The pipe outlet conveys 0.40 m^3/s peak flow in the 1% AEP event, with no overtopping.
Basin 07	The 6-pipe culvert outlet from Basin 01 conveys 5.32 m^3/s peak flow into the existing waterway downstream in the 1% AEP event, with no overtopping of the spillway.
Basin 08	The pipe outlet conveys 1.28 m^3/s peak flow in the 1% AEP event, with no overtopping.

4 Stormwater Basins Management Strategy

4.1 Introduction

The modelling of the basins has been conducted within the TUFLOW model with unmitigated developed catchment flows being inserted into the two-dimensional model with the basin footprint and embankments included. Basin outlets have been modelled in a one-dimensional domain with blockage factors assigned as per Section 4.7 of the USCR Model User Guide. Overflow weirs were modelled in a two-dimensional domain.

A series of offline and online stormwater detention basins and bioretention basins are proposed for the Catherine Field development. The basins have been sized through an iterative design and modelling process to ensure that discharges from the site do not exceed the pre-development scenario results. It should be noted that the final configuration of these proposed basins are subject to detailed design at a later stage.

A number of the basins are combined detention and bioretention basins. These typically consist of bioretention basins provided to treat the low flows, with excess flows designed to bypass the system and discharge into the detention basins for flood attenuation prior to release into South Creek and Rileys Creek.

The stormwater detention basin and bio-retention basin network proposed for the precinct is shown in **Figure 16**.

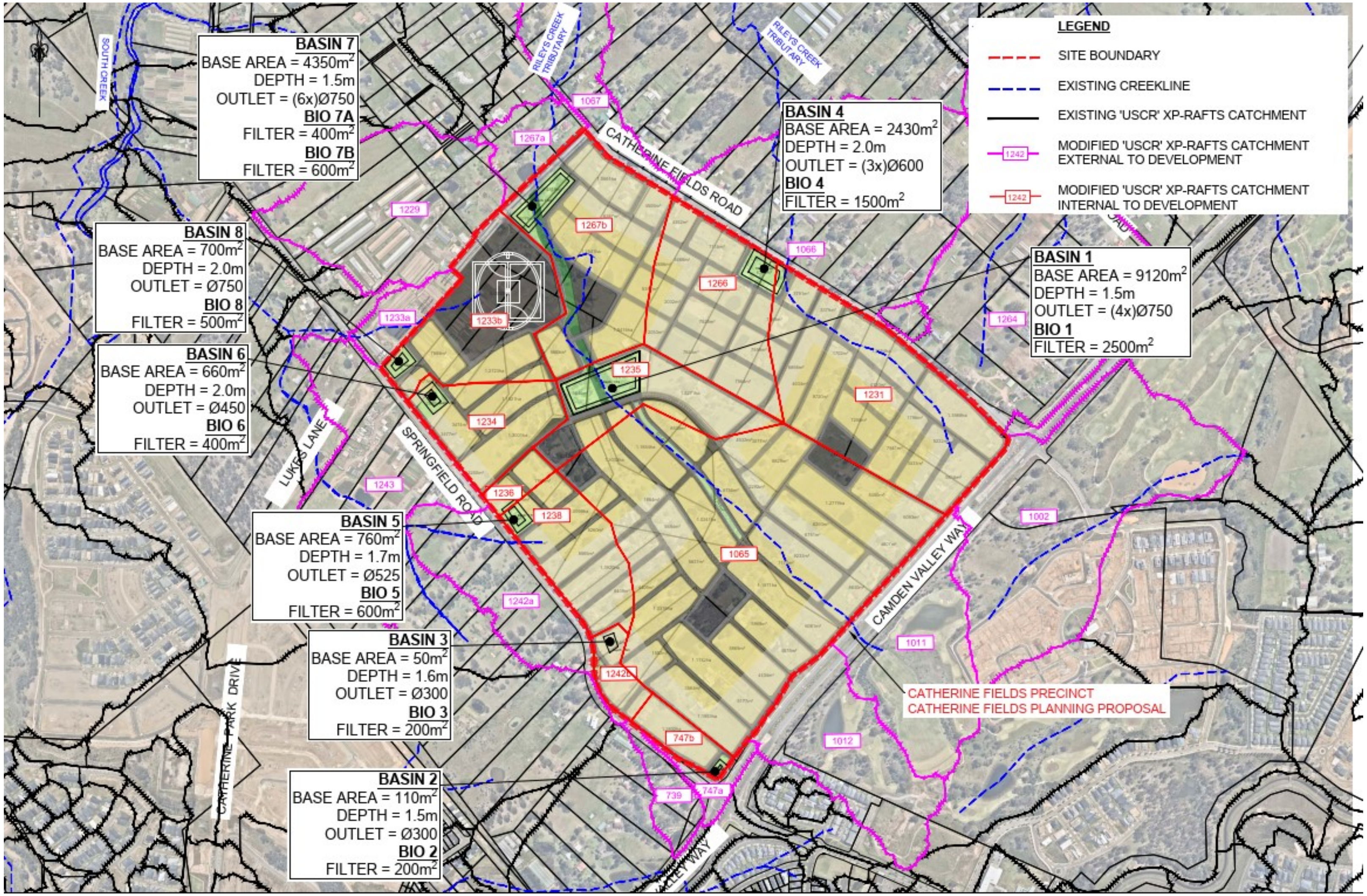


Figure 16 Online and Offline Detention Basin and Bioretention Basin Layout

4.2 Basin Design

The design of the detention basins has been undertaken in collaboration with the client, and in partnership with Camden Council. The design is also guided by the Camden Council Engineering Design Specification (2009) and the (Guidelines for Controlled Activities on Waterfront Land (NOW,2012). A summary of key features is summarised below:

- Basins have been designed to have slopes no steeper than 1 in 4, or 1 in 6 where possible. Side slopes would be lined with normal planting.
- Top bank widths have been set at 3 metres to allow for maintenance vehicle access;
- Basin embankments are designed to satisfy the Flood Planning Level (1% AEP plus 500mm freeboard);
- Online basins have been designed with longitudinal slopes of approximately 0.5-1%;
- Offline basin inverts vary as per each separate design.
- Bioretention basin inverts have been designed to be at or above the 10% AEP mainstream flood level;
- Low flow pipe outlets have been incorporated such that the offline detention basins would function as dry basins; and
- High flow outlets have been designed to discharge the 1% AEP flows mostly as overflow weirs or as secondary pipe outlets.

4.3 Online Detention Basins

There are currently several minor farm dams within the Catherine Field site. The central dam immediately south of Charlesworth Close would be reconfigured into an online basin (Basin 01) connected to a 10m wide drainage corridor at the upstream inlet, and to a 20m wide drainage corridor at the downstream outlet. The northern dams would be removed and form the second online basin (Basin 07) which connects to the bottom of the 20m wide drainage corridor. Basin 07 discharges into an existing downstream constructed waterway channel which leads to Rileys Creek. Refer to **Figure 16** for basin details. Details of the online basin performances are presented in the following sections.

4.3.1 Online Basin 01

Online Basin 01 has been designed to detail stormwater flows for the upstream catchment. The basin details are summarised in **Table 2**. Online Basin 01 concept drawing plans, 416-21-SK-1001, 416-21-SK-1002, 416-21-SK-1003 and 416-21-SK-1004 are included in **Appendix A**.

Table 2 Online Basin 01 Design Details

Parameter	Online Basin 01
Basin Footprint Area	13,352 m^2
Invert Level of Basin Outlet	96.50 m AHD
Embankment Crest Elevation	Min 98.50 m AHD
Low Flow Outlet Details**	4 x 750 mm pipe
Modelled Spillway Weir Width***	20m wide rectangular
Spillway Elevation***	98.00 m AHD
5% AEP Peak Water Level	97.60 m AHD
1% AEP Peak Water Level	97.81 m AHD
5% AEP Volume	11,655 m^3
1% AEP Volume	14,265 m^3

** with mutli-stage high flow outlet *** nominal to be refined during detailed design

4.3.2 Online Basin 07

Online Basin 07 has been designed to detail stormwater flows for the upstream catchment. The basin details are summarised in **Table 3.** Online Basin 07 concept drawing plans, 416-21-SK-1016, 416-21-SK-1017 and 416-21-SK-1018, are included in **Appendix A**.

Table 3 Online Basin 07 Design Details

Parameter	Online Basin 07
Basin Footprint Area	7,724 m^2
Invert Level of Basin Outlet	90.50 m AHD
Embankment Crest Elevation	Min 92.50 m AHD
Low Flow Outlet Details**	6 x 750 mm pipe
Modelled Spillway Weir Width***	20m wide rectangular
Spillway Elevation***	92.00 m AHD
5% AEP Peak Water Level	91.41 m AHD
1% AEP Peak Water Level	91.63 m AHD
5% AEP Volume	4,786 m^3
1% AEP Volume	6,202 m^3

** with mutli-stage high flow outlet *** nominal to be refined during detailed design

4.4 Proposed Offline Detention Basins

A network of offline basins is proposed for the developed catchments to discharge to South Creek and Rileys Creek.

The details of the basins, including peak 5% AEP and 1% AEP flood levels are summarised in **Table 4.** Concept plans for each of the offline detention basins are included in **Appendix A**.

Table 4 Offline Detention Basin Design Details

Parameter	Basin 02	Basin 03	Basin 04	Basin 05	Basin 06	Basin 08
Basin Area (m^2)	868	821	5,446	2,601	2,513	2,633
Basin Invert (mAHD)	111.70	113.50	95.20	97.30	89.90	87.30
Embankment Crest (mAHD)	113.50	115.40	97.50	99.30	92.20	89.60
Low Flow Outlet (diameter, mm)	300	300	3 x 600	525	450	750
Spillway Elevation (mAHD)	113.20	115.10	97.20	99.00	91.90	89.30
5% AEP Water Level (mAHD)*	112.33	114.14	96.27	98.16	90.77	88.01
1% AEP Water Level (mAHD)*	112.68	114.54	96.59	98.48	91.02	88.36

* Water level recorded is located in the detention component of dual use basins (i.e. combined OSD and Bioretention basins)

4.5 Proposed Offline Basin Performance

The offline basin performance has been reviewed to the Site Storage Requirement (SSR) and Permissible Site Discharge (PSD) requirements provided in the Growth Centres DCP as provided in **Table 5**.

Table 5 Stormwater Detention Checks

Parameter	1% AEP
Site Storage Requirement (SSR) target (m^3/Ha)	594
Permissible Site Discharge (PSD) target (m^3/s/Ha)	0.17

The SSD/PSD comparison is limited to only the 1% AEP event. Comparison of the 1% AEP event results with the Growth Centres DCP requirements are presented in **Table 6**. The results indicate the basins do not meet the SSR requirement at all the basins; but generally do meet the PSD requirement.

It is noted that the most robust method of assessing the effectiveness of the OSD basins is in the detailed 2D modelling as undertaken in the current study, and that the pre-to-post comparison of peak flow at critical check points is a better indicator of overall precinct catchment performance. These results are demonstrated in Section 5 below. Thus, the results in **Table 6** are for information and comparison only.

Table 6 Offline Basin Performance in the 1% AEP Event

1% AEP Event	Basin 02	Basin 03	Basin 04	Basin 05	Basin 06	Basin 08
Catchment (Ha)	1.75	1.54	25.02	6.97	5.46	9.37
1% SSR (m^3)	1,040	915	14,862	4,140	3,243	5,566
1% Storage Achieved (m^3)	283	208	4,671	1,459	1,194	1,167
1% PSD (m^3/s)	0.30	0.26	4.25	1.18	0.93	1.59
1% Peak Discharge (m^3/s)	0.20	0.19	2.47	0.61	0.40	1.28

4.6 Bioretention Basins

A network of bioretention basins is proposed for the developed catchments discharging directly to the waterway network. The bioretention basins do not detain significant stormwater flows in the wider catchment as their primary role is water quality treatment, however, they still contribute to the overall capacity of storage within the precinct and thus they are included in the DEM for the combined detention and bioretention basins, which consists of all the offline basins.

The series of bioretention basins external to the detention basins have not been included in the DEM, nor have their outlet control pipes been modelled in the XP-RAFTS or TUFLOW model runs associated with this report. This is due to their relative size and location adjacent to the larger online basins. The discharge control from these smaller basins will have negligible effect on the timing of flow conveyance through the precinct catchment and it is assumed that the proposed sizing of the outlet controls for these small basins can be developed in future detailed design.

Concept plans for each of the bioretention basins are included in **Appendix A**

5 Comparison of Peak Discharge Flows

5.1 Site Outlets

Design flows at the Basin outlets were compared under pre-development and post-development conditions to assess the potential impact of the proposed development and the effectiveness of the flood management strategy. The locations where the result comparisons were made are shown below in **Figure 17**. The results are summarised in subsequent tables relating to each outlet. Refer back to **Figure 16** for more details on the basin outlets.

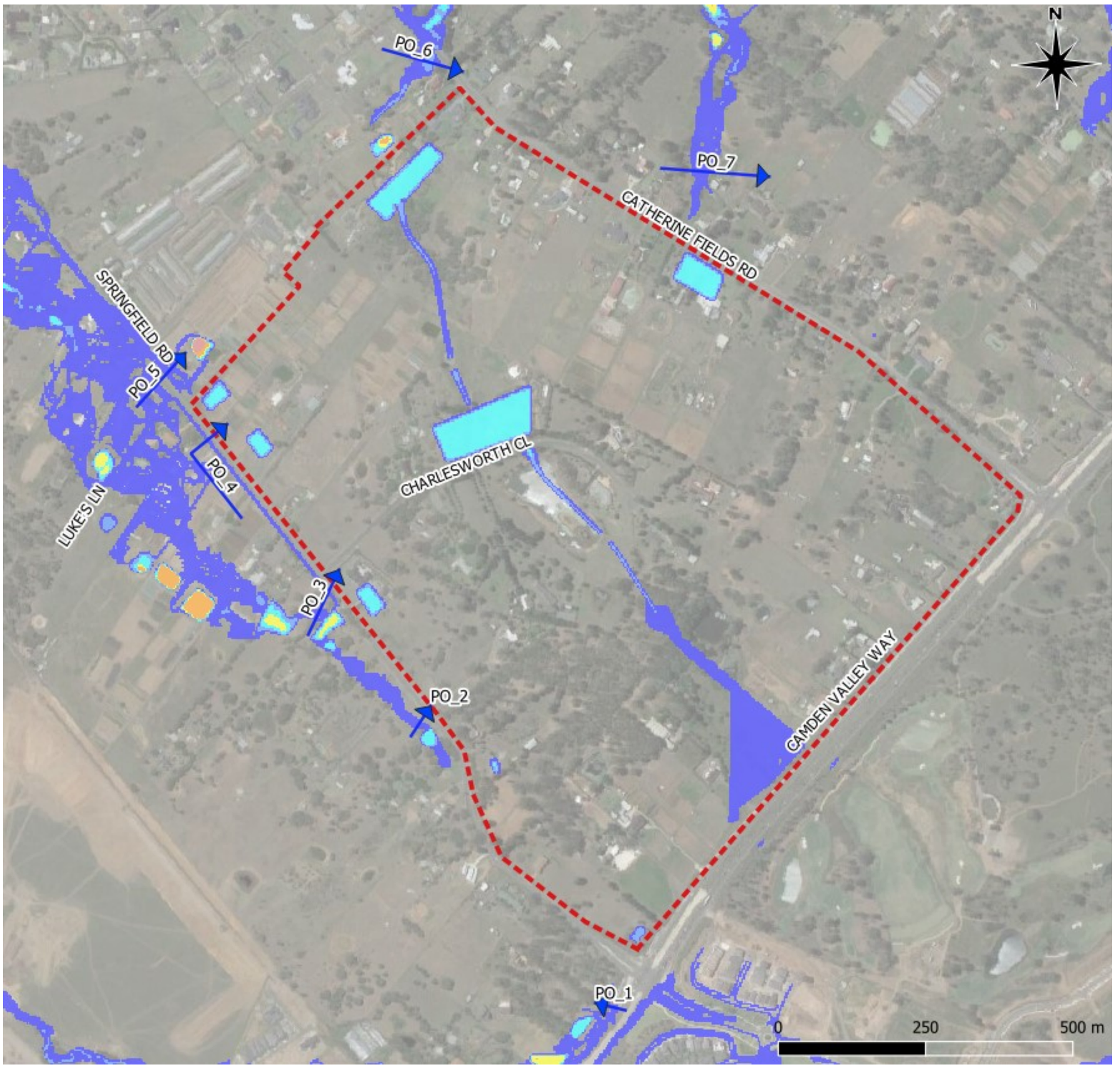


Figure 17: Location of results extracted from USCR model for comparison

5.1.1 Basin 02

Table 7 Peak Flow Comparison downstream of Basin 02 Catchment outlet

5% AEP	Basin 02	
	Pre-development	Post-Development
Duration (min)	PO_1 Flow (m^3/s)	PO_1 Flow (m^3/s)
60	0.46	0.41
360	0.35	0.33
1080	0.35	0.33
Max	**0.46**	**0.41**

1% AEP	Basin 02	
	Pre-development	Post-Development
Duration (min)	PO_1 Flow (m^3/s)	PO_1 Flow (m^3/s)
30	0.73	0.49
360	0.39	0.35
720	0.30	0.30
Max	**0.73**	**0.49**

PMF	Basin 02	
	Pre-development	Post-Development
Duration (min)	PO_1 Flow (m^3/s)	PO_1 Flow (m^3/s)
60	3.04	2.99

In **Table 7** the pre-development flows are based on the revised USCR base model under existing conditions. The post-development flows are those with the proposed Catherine Field development in place. The results at the Basin 02 outlet indicate that the network of detention basins proposed for the post-development scenario is adequate in attenuating the flow to pre-development levels in all modelled events.

5.1.2 Basin 03

Table 8 Peak Flow Comparison downstream of Basin 03 Catchment outlet

5% AEP	Basin 03	
	Pre-development	Post-Development
Duration (min)	PO_2 Flow (m^3/s)	PO_2 Flow (m^3/s)
60	0.19	0.00
360	0.17	0.07
1080	0.17	0.07
Max	**0.19**	**0.07**

1% AEP	Basin 03	
	Pre-development	Post-Development
Duration (min)	PO_2 Flow (m³/s)	PO_2 Flow (m³/s)
30	0.32	0.00
360	0.19	0.17
720	0.14	0.15
Max	**0.32**	**0.17**

PMF	Basin 03	
	Pre-development	Post-Development
Duration (min)	PO_2 Flow (m³/s)	PO_2 Flow (m³/s)
60	1.60	0.46

In **Table 8,** the pre-development flows are based on the revised USCR base model under existing conditions. The post-development flows are those with the proposed Catherine Field development in place. The results at the Basin 03 outlet indicate that the network of detention basins proposed for the post-development scenario is adequate in attenuating the flow to pre-development levels in all modelled events.

5.1.3 Basin 04

Table 9 Peak Flow Comparison downstream of Basin 04 Catchment outlet

5% AEP	Basin 04	
	Pre-development	Post-Development
Duration (min)	PO_7 Flow (m³/s)	PO_7 Flow (m³/s)
60	2.14	2.24
360	2.32	2.21
1080	1.27	1.29
Max	**2.32**	**2.24**

1% AEP	Basin 04	
	Pre-development	Post-Development
Duration (min)	PO_7 Flow (m³/s)	PO_7 Flow (m³/s)
30	2.94	2.47
360	2.74	2.35
720	2.29	2.17
Max	**2.94**	**2.47**

PMF	Basin 04	
	Pre-development	Post-Development
Duration (min)	PO_7 Flow (m³/s)	PO_7 Flow (m³/s)
60	24.94	25.74

In **Table 9,** the pre-development flows are based on the revised USCR base model under existing conditions. The post-development flows are those with the proposed Catherine Field development in place. The results at the Basin 04 outlet indicate that the network of detention basins proposed for the post-development scenario is adequate in attenuating the flow to pre-development levels in all modelled events except for the PMF event where there is a slight increase in the post-development peak flow. It is noted that Basin 04 can be tweaked in the detailed design stage to match pre-development flows further, however as the increase in peak flow is minor relative to the magnitude of flows and only occurs in the PMF event, it is considered negligible.

5.1.4 Basin 05

Table 10 Peak Flow Comparison downstream of Basin 05 Catchment outlet

5% AEP	Basin 05	
	Pre-development	Post-Development
Duration (min)	PO_3 Flow (m^3/s)	PO_3 Flow (m^3/s)
60	0.77	0.55
360	0.79	0.52
1080	0.79	0.52
Max	**0.79**	**0.55**

1% AEP	Basin 05	
	Pre-development	Post-Development
Duration (min)	PO_3 Flow (m^3/s)	PO_3 Flow (m^3/s)
30	1.27	0.60
360	0.85	0.62
720	0.74	0.65
Max	**1.27**	**0.65**

PMF	Basin 05	
	Pre-development	Post-Development
Duration (min)	PO_3 Flow (m^3/s)	PO_3 Flow (m^3/s)
60	8.75	7.25

In **Table 10,** the pre-development flows are based on the revised USCR base model under existing conditions. The post-development flows are those with the proposed Catherine Field development in place. The results at the Basin 05 outlet indicate that the network of detention basins proposed for the post-development scenario is adequate in attenuating the flow to pre-development levels in all modelled events.

5.1.5 Basin 06

Table 11 Peak Flow Comparison downstream of Basin 06 Catchment outlet

5% AEP	Basin 06	
	Pre-development	Post-Development
Duration (min)	PO_4 Flow (m³/s)	PO_4 Flow (m³/s)
60	0.68	0.38
360	0.64	0.36
1080	0.63	0.36
Max	**0.68**	**0.38**

1% AEP	Basin 06	
	Pre-development	Post-Development
Duration (min)	PO_4 Flow (m³/s)	PO_4 Flow (m³/s)
30	1.25	0.41
360	0.73	0.39
720	0.56	0.37
Max	**1.25**	**0.41**

PMF	Basin 06	
	Pre-development	Post-Development
Duration (min)	PO_4 Flow (m³/s)	PO_4 Flow (m³/s)
60	7.26	11.30

In **Table 11,** the pre-development flows are based on the revised USCR base model under existing conditions. The post-development flows are those with the proposed Catherine Field development in place. The results at the Basin 06 outlet indicate that the network of detention basins proposed for the post-development scenario is adequate in attenuating the flow to pre-development levels in all modelled events except for the PMF event, where there is an increase in the post-development peak flow. It is noted that Basin 06 has been conservatively designed for the 5% and 1% AEP events and that the basin outlet size does not accommodate PMF flows. If necessary, the basin can be tweaked in the detailed design stage to match pre-development flows further, however as the increase in peak flow only occurs in the PMF event, it is not considered to be an issue.

5.1.6 Basin 07

Table 12 Peak Flow Comparison downstream of Basin 07 Catchment outlet

5% AEP	Basin 07	
	Pre-development	Post-Development
Duration (min)	PO_6 Flow (m³/s)	PO_6 Flow (m³/s)
60	2.42	3.27
360	5.46	4.70
1080	3.51	3.26
Max	**5.46**	**4.70**

1% AEP	Basin 07	
	Pre-development	Post-Development
Duration (min)	PO_6 Flow (m^3/s)	PO_6 Flow (m^3/s)
30	2.97	3.56
360	7.08	5.35
720	6.11	5.16
Max	**7.08**	**5.35**

PMF	Basin 07	
	Pre-development	Post-Development
Duration (min)	PO_6 Flow (m^3/s)	PO_6 Flow (m^3/s)
60	63.69	64.60

In **Table 12,** the pre-development flows are based on the revised USCR base model under existing conditions. The post-development flows are those with the proposed Catherine Field development in place. The results at the Basin 07 outlet indicate that the network of detention basins proposed for the post-development scenario is adequate in attenuating the flow to pre-development levels in all modelled events except for the PMF event where there is a slight increase in the post-development peak flow. It is noted that Basin 07 can be tweaked in the detailed design stage to match pre-development flows further, however as the increase in peak flow is minor relative to the magnitude of flows and only occurs in the PMF event, it is considered negligible.

5.1.7 Basin 08

Table 13 Peak Flow Comparison downstream of Basin 08 Catchment outlet

5% AEP	Basin 08	
	Pre-development	Post-Development
Duration (min)	PO_5 Flow (m^3/s)	PO_5 Flow (m^3/s)
60	1.29	1.13
360	1.19	1.15
1080	1.16	1.01
Max	**1.29**	**1.15**

1% AEP	Basin 08	
	Pre-development	Post-Development
Duration (min)	PO_5 Flow (m^3/s)	PO_5 Flow (m^3/s)
30	1.96	1.35
360	1.40	1.28
720	1.10	1.03
Max	**1.96**	**1.35**

PMF	Basin 08	
	Pre-development	**Post-Development**
Duration (min)	PO_4 Flow (m^3/s)	PO_4 Flow (m^3/s)
60	7.26	11.30

In **Table 13,** the pre-development flows are based on the revised USCR base model under existing conditions. The post-development flows are those with the proposed Catherine Field development in place. The results at the Basin 08 outlet indicate that the network of detention basins proposed for the post-development scenario is adequate in attenuating the flow to pre-development levels in all modelled events except for the PMF event, where there is an increase in the post-development peak flow. It is noted that Basin 08 has been conservatively designed for the 5% and 1% AEP events and that the basin outlet size does not accommodate PMF flows. If necessary, the basin can be tweaked in the detailed design stage to match pre-development flows further, however as the increase in peak flow only occurs in the PMF event, it is not considered to be an issue.

5.2 Bringelly Road

The pre-development and post development flows are similarly compared at Bringelly Road using the revised USCR base model results in **Table 14**. For the purposes of the modelling and comparison, it is assumed that the existing catchments downstream of the site remain unchanged under post development conditions. The results similarly show that the Catherine Field site, with the proposed basins in place, generally has no adverse impacts on flows all the way down to Bringelly Road in both the 1% AEP and PMF event. Rather, there is a beneficial impact, in the design flows being lower, which is expected to reduce flood inundation in the downstream areas.

In the 5% AEP event a marginal increase in peak flows was observed, however the difference is considered negligible compared to the total magnitude of flow and there is no visible water level impact from the proposed development at Bringelly Road. However, it is noted that the basins can be refined at detailed design stage to introduce a multi-stage discharge system which would further attenuate lower flows such as in the 5% AEP event, and thus eliminate any impacts in smaller storm events. This system would be likely be particularly effective in Basins 04 and 07 as they capture a large portion of the site's flows.

Table 14: Peak Flow Comparison just downstream of Bringelly Road

5% AEP	Bringelly Road	
	Pre-development	**Post-Development**
Duration (min)	G152 Flow (m3/s)	G152 Flow (m3/s)
60	41.68	42.78
360	132.68	133.38
1080	86.02	87.15
Max	**132.68**	**133.38**

1% AEP	Bringelly Road	
	Pre-development	Post-Development
Duration (min)	G152 Flow (m3/s)	G152 Flow (m3/s)
30	47.01	47.87
360	205.84	205.22
720	225.06	224.74
Max	**225.06**	**224.74**

PMF	Bringelly Road	
	Pre-development	Post-Development
Duration (min)	G152 Flow (m3/s)	G152 Flow (m3/s)
60	1673.40	1670.86

6 Flood Emergency Response Strategy

The proposed development at the Catherine Field Planning Proposal site has been designed such that all residential areas would be filled to an elevation above the 1% AEP peak flood level plus 500 mm freeboard. All access roadways and roadways within the proposed development are not expected to be inundated for all events up to at least the 1% AEP event. This is evident in the post-development flood maps presented in Appendix D. Accordingly, no flood emergency response measures are required for the precinct for events up to and including the 1% AEP event.

However, some proposed lots and roadways are likely to be vulnerable to flooding during the PMF event (Appendix D). Key areas that may be affected include the following:

- The road crossings and roads adjacent to the Drainage Corridor. As the drainage corridor and culverts at road crossings are only designed to cater for the 1% AEP event, particularly on the eastern half of the site, it is expected to be overtopped in the PMF event. Once these drainage corridors spill, the road crossings will become inundated at the low points, and the adjacent roads will likely also convey a portion of the flood waters north to Basin 01 and Basin 07.
- Similarly, it is expected that Basins 01 and 07 will also overtop as they are also designed for the 1% AEP event. At Basin 07, the weir spillway will convey the PMF flows towards the drainage channel downstream and towards Basin 01. At Basin 01, it is expected that Rickard Road will become inundated by flood waters. As the water level rises at the low point in the road, it is expected to spill over the northern boundary of the site.
- All of the offline basins are also likely to spill in the PMF event, with minor flooding of local roads adjacent to the basin to be expected.

It is expected that a flood emergency response strategy can be formulated for the precinct under the above conditions to ensure that flood-free access and egress is provided to all residents and visitors during the PMF event. This will be undertaken in consultation with Council and the NSW SES following rezoning of the site.

It is noted that as the design undertaken for the precinct is still preliminary at this stage, opportunities also exist to refine the longitudinal profiles of some of the roads to render them flood free during the PMF, where necessary or crucial. This should be considered by Council and dealt with in future design stages.

7 Water Quality Management

7.1 Pollutant Reduction Targets

Pollutant retention targets were identified in Camden's Growth Centre Precincts Development Control Plan (Section 2.1.2), as shown in **Table 15**. These targets are in line with industry standards and adopted for the purposes of this study.

Table 15 Pollution Reduction Targets

Pollutant	% Reduction Target
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	65%
Total Nitrogen (TN)	45%
Gross Pollutants	90%

7.2 Water Quality Management Strategy

The adopted stormwater quality management strategy includes a provision of a treatment train to treat surface runoff with reflection to the drainage network for the ultimate condition.

A control structure has been provided to bypass the water quality flows into the water quality treatment areas.

The following water quality control assets are proposed for implementation:

a. Proprietary Gross Pollutant Traps- for removal of coarse sediment and large debris, reducing maintenance obligations and pollutant loads on the tertiary treatment controls. Sized generally for the 3–6-month flow.
b. Bioretention systems- for capture of finer sediments and treatment of nutrients.

7.3 Methodology

The stormwater quality management modelling has been prepared using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) Version 6.3. Modelling was completed using Camden City Councils MUSIC-link Data Version 6.34 (Camden Development.mlb).

7.4 Hydrologic Data Inputs

Camden's MUSIC-link mlb. file uses 6 mins rainfall and monthly PET evaporation data from the Rainfall Station -67035 LIVERPOOL(WHITLAM) records with the times series 01/01/1985 to 12/31/1994 used. Rainfall and PET for the period are presented in **Figure 18** below.

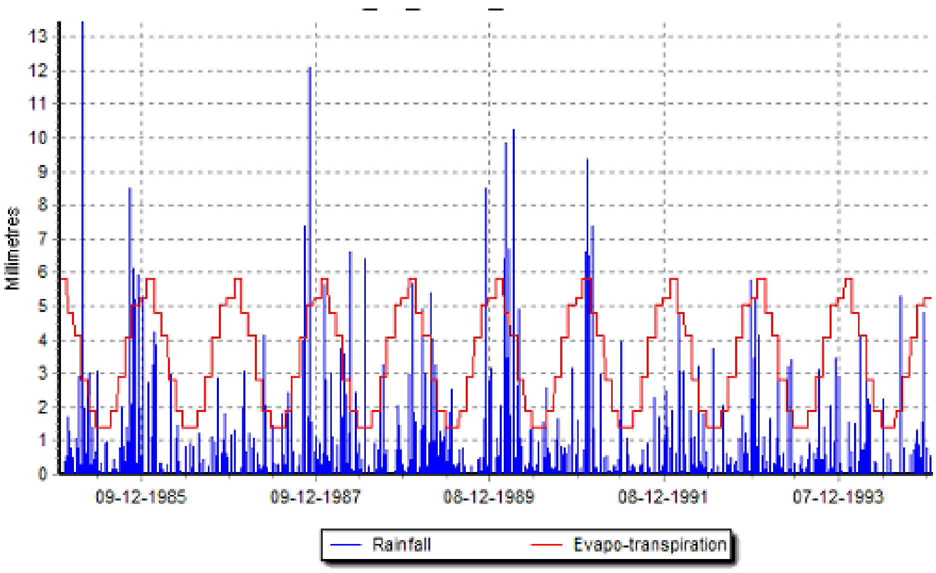


Figure 18 Rainfall and PET graph (MUSIC)

7.4.1 Source Node Data Inputs

Source Node parameters were adopted from Camden City Council's MUSIC-link Data. The following table summarises the source node inputs used within the MUSIC model.

Table 16 Stormwater Quality parameters Source Nodes

Land use Category		Total Suspended Solids (mg/L Log10)		Total Phosphorus (mg/L Log10)		Total Nitrogen (mg/L Log10)	
		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Residential	Mean	2.15	1.2	-0.6	-0.85	0.30	0.11
Pervious Areas	Mean	2.2	1.1	-0.45	-0.82	0.42	0.32

7.4.2 Rainfall-Runoff Parameters

MUSIC rainfall-runoff were adopted from Camden City Council's MUSIC-link Data. The following table summarises the source node inputs used within the MUSIC model.

Table 17 Rainfall-Runoff parameter table

Parameter	Value
Rainfall threshold (mm)	1
Soil storage capacity (mm)	120
Initial Storage (%)	25
Field capacity (mm)	80

Infiltration capacity coefficient a	200
Infiltration capacity coefficient b	1
Initial depth (mm)	10
Daily recharge rate (%)	25
Daily baseflow rate (%)	5
Deep seepage (%)	0

7.4.3 Catchment Details

The proposed development site has been divided into several sub-catchments based on the RAFTS developed model, proposed grading and the land use. The site is divided into 3 categories:

- Medium density residential area;
- Drainage corridor;
- Park area

The road areas were included within the residential catchments. The effective impervious area of the catchment has been calculated based on the NSW MUSIC Modelling Guidelines (BMT WBM, 2015) and is summarised in **Table 18.**

Table 18 Catchment Landuse Characteristics

	Total Impervious Area (%)	EIA Factor	Adopted EIA (%)
Medium/High Density Residential	80	0.6	48
Drainage Corridor	0	-	0
Park	30	0.05	10*

*10% is adopted to assume potential future amenity buildings, footpaths and hard surfaces.

7.4.4 Treatment Train

The stormwater design for the development will use a combination of at source and conveyance controls to treat the stormwater runoff from the site. The following are the treatment trains proposed for this development.

Gross Pollutant Traps

Gross Pollutant Traps (GPTs) are proposed upstream of the bioretention systems. The performance criteria of the GPTs is presented in **Table 19**.

Table 19 Gross Pollutant Trap capture efficiency table

Pollutant	Capture Efficiency
Gross Pollutant (>2000μm)	98%

Total Suspended Solids (TSS) (20 - 2000µm)	75%
Total Phosphorous (TP)	30%
Total Nitrogen (TN)	0%
Total Petroleum/Hydrocarbon/oils	98%

Bioretention Basins

Bioretention systems are proposed for all impervious catchments. The basins will have a high flow bypass to help safely convey the 100-year flow and to treat low flows before they are discharged downstream. **Figure 19** shows a typical section of the bioretention basin.

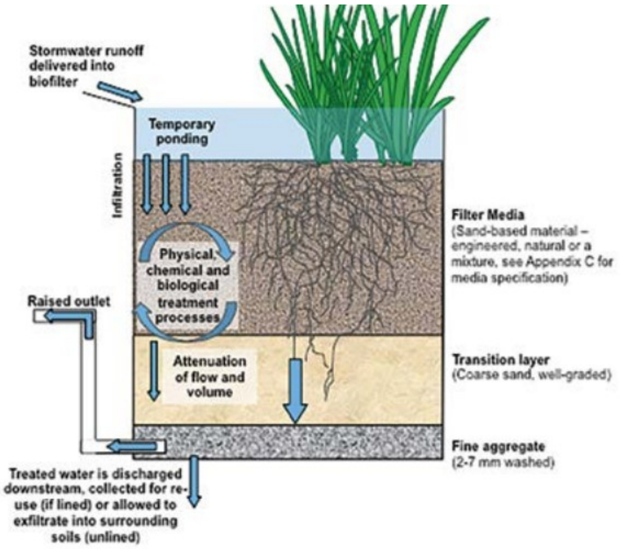


Figure 19 Bioretention system schematic

7.5 Water Quality Treatment Bioretention Basins

The design parameters adopted for the bio-retention systems are shown in **Table 20**. Filter media depths are proposed to be 0.5m. Extended detention depth of all bio-retention basins has been modelled as 0.3m. For bio-retention basins co-located within detention basins, a weir should be constructed to be 0.3m above the base of the bio-retention basin, ensuring at least an extended detention depth of 0.3 m.

Within the MUSIC model, the basin surface area (the surface area at the extended detention depth) has been set equal to the filter media area (basin invert area). This is considered a conservative approach as in reality all basins are likely to have side slopes of at least 1V:4H meaning the surface area will be greater than the filter media area. However, this simplified approach is considered appropriate at this stage as it allows for optimisation of bio-retention design in later detailed design stages.

The bioretention basins proposed across the precinct are shown in **Figure 16**. The filter media areas provided are summarised in **Table 21**. Concept designs for each of the bio-retention basins are included in **Appendix A**.

Table 20 Bioretention Filter Media Areas Provided

Parameters	Value
Saturated Hydraulic Conductivity (mm/hr)	100
Filter Depth (m)	0.5
Extended Detention (m) 0.3	0.3
TN Content (mg/kg) 400	750
Orthophosphate Content (mg/kg) 40	40
Exfiltration Rate (mm/hr) 0.0	0.0
Base Lined	YES

Table 21 Bioretention Filter Media Areas Provided

Bioretention Basin Areas	
Basin Name (Figure 20)	**Filter Media Areas (m^2)**
C-1a	500
C-1b	500
C-1c	1500
C-2	200
C-4	1500
C-5	600
C-6	400
C-7a	400
C-7b	600
C-8	500

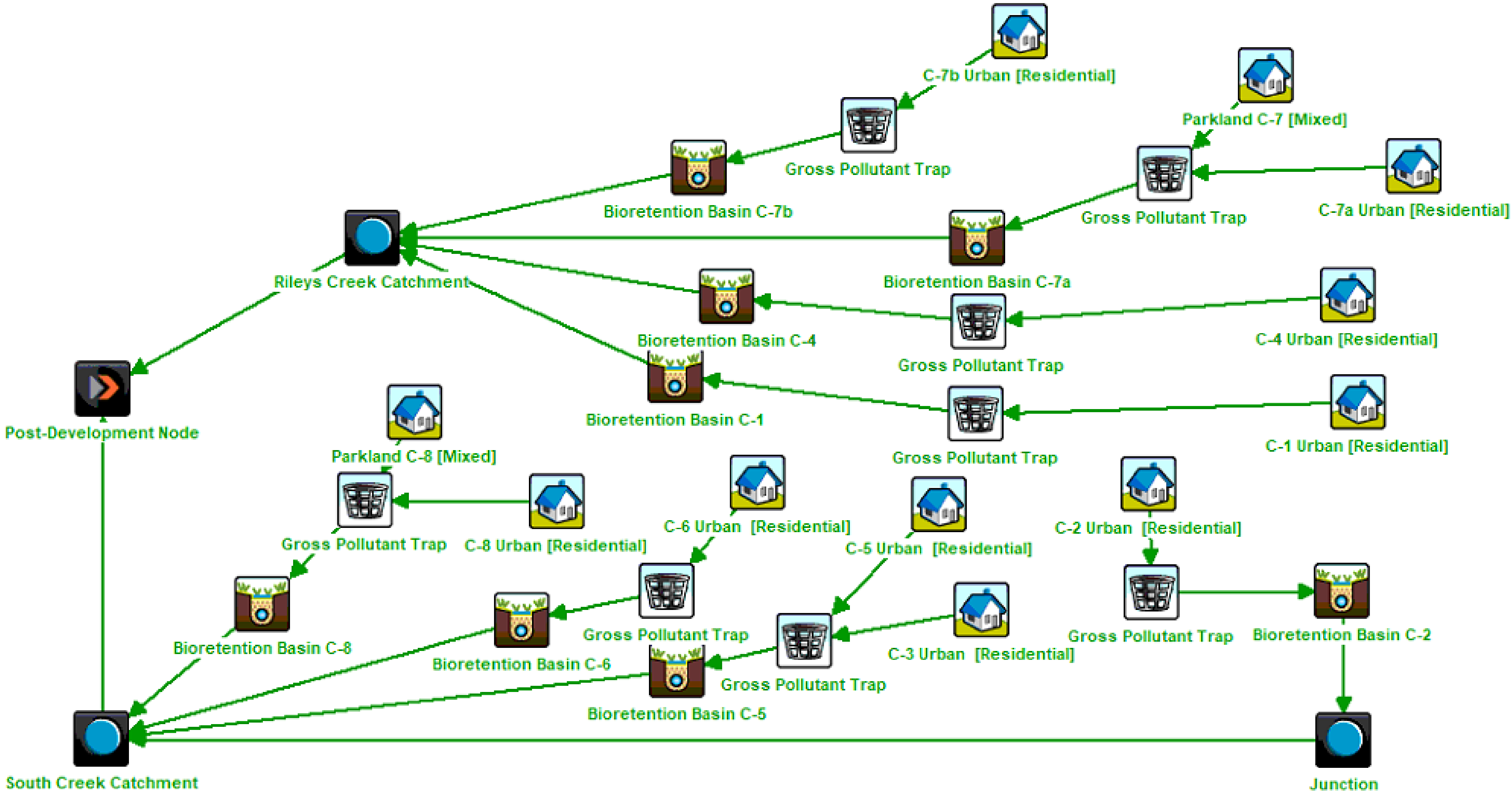


Figure 20 Post Development MUSIC MODEL (REF 416-21_PP_Post Dev001)

7.6 Water Quality Modelling Results

The modelling results analysis in MUSIC indicates that the proposed treatment train provides adequate treatment, which exceeds the typical Council's water quality treatment targets . The results are as presented in Table 6. The targets are exceeded for the Rileys Creek, South Creek and combined post development catchments. The Modelled Results are presented below in **Table 22**, **Table 23** and **Table 24** respectively.

Table 22 Performance Results Rileys Creek (MUSIC Modelling)- PP (REF 416-21_PP_Post Dev001)

Pollutant	Post-Development without Treatment	Post-Development with Treatment	Overall Reduction	Meets Council Objectives
Total Suspended Solids (kg/yr)	56900	6250	89	Yes
Total Phosphorus (kg/yr)	96.9	33.3	65.7	Yes
Total Nitrogen (kg/yr)	718	376	47.6	Yes
Gross Pollutants (kg/yr)	9980	0	100	Yes

Table 23 Performance Results South Creek (MUSIC Modelling)- PP (REF 416-21_PP_Post Dev001)

Pollutant	Post-Development without Treatment	Post-Development with Treatment	Overall Reduction	Meets Council Objectives
Total Suspended Solids (kg/yr)	17000	1250	92.7	Yes
Total Phosphorus (kg/yr)	22.9	9.7	67.6	Yes
Total Nitrogen (kg/yr)	2226	116	48.6	Yes
Gross Pollutants (kg/yr)	2870	0	100	Yes

Table 24 Performance Results Post Development Node (Combined) (MUSIC Modelling)- PP (REF 416-21_PP_Post Dev001)

Pollutant	Post-Development without Treatment	Post-Development with Treatment	Overall Reduction	Meets Council Objectives
Total Suspended Solids (kg/yr)	73900	7500	89.9	Yes
Total Phosphorus (kg/yr)	127	43	66.1	Yes
Total Nitrogen (kg/yr)	944	492	47.9	Yes
Gross Pollutants (kg/yr)	12900	0	100	Yes

8 Concept Design Drawings

The concept design drawing set is provided in **Appendix A** and includes the following plans:

Table 25 Design Drawing Set

DRAWING NO.	DRAWING TITLE	REVISION
416-21-SK-1001	ONLINE BASIN 01 CONCEPT PLAN SHEET 1 OF 2	A
416-21-SK-1002	ONLINE BASIN 01 CONCEPT PLAN SHEET 2 OF 2	A
416-21-SK-1003	ONLINE BASIN 01 SECTIONS SHEET 1 OF 2	A
416-21-SK-1004	ONLINE BASIN 01 SECTIONS SHEET 2 OF 2	A
416-21-SK-1005	OFFLINE BASIN 02 CONCEPT PLAN	A
416-21-SK-1006	OFFLINE BASIN 02 SECTIONS	A
416-21-SK-1007	OFFLINE BASIN 03 CONCEPT PLAN	A
416-21-SK-1008	OFFLINE BASIN 03 SECTIONS	A
416-21-SK-1009	OFFLINE BASIN 04 CONCEPT PLAN	A
416-21-SK-1010	OFFLINE BASIN 04 SECTIONS	A
416-21-SK-1011	OFFLINE BASIN 05 CONCEPT PLAN	A
416-21-SK-1012	OFFLINE BASIN 05 SECTIONS	A
416-21-SK-1013	OFFLINE BASINS 06 & 08 CONCEPT PLAN	A
416-21-SK-1014	OFFLINE BASIN 06 SECTIONS	A
416-21-SK-1015	OFFLINE BASIN 08 SECTIONS	A
416-21-SK-1016	ONLINE BASIN 07 CONCEPT PLAN	A
416-21-SK-1017	ONLINE BASIN 07 SECTIONS SHEET 1 OF 2	A
416-21-SK-1018	ONLINE BASIN 07 SECTIONS SHEET 2 OF 2	A
416-21-SK-1019	DRAINAGE CORRIDOR TYPICAL SECTION	A

9 Next Steps

It is noted that the next steps in progressing the design and delivery of the Catherine Field development may consist of the following:

- Integrating the upgraded Springfield Road design into the ISP of the Catherine Field development and tying the stormwater design and outlet connections from the basins to the downstream Catherine Park North Precinct to the south.
- Integrating the upgraded Rickard Road design into the model.
- Refinement of the stormwater basin discharge controls to further refine a closer relationship between post-development flows to pre-development flows (detailed design).

10 Conclusions

This study for the proposed Indicative Layout Plan (ISP) for the Catherine Field site has been undertaken in accordance with the Upper South Creek Regional (USCR) model, and in consultation with Camden Council.

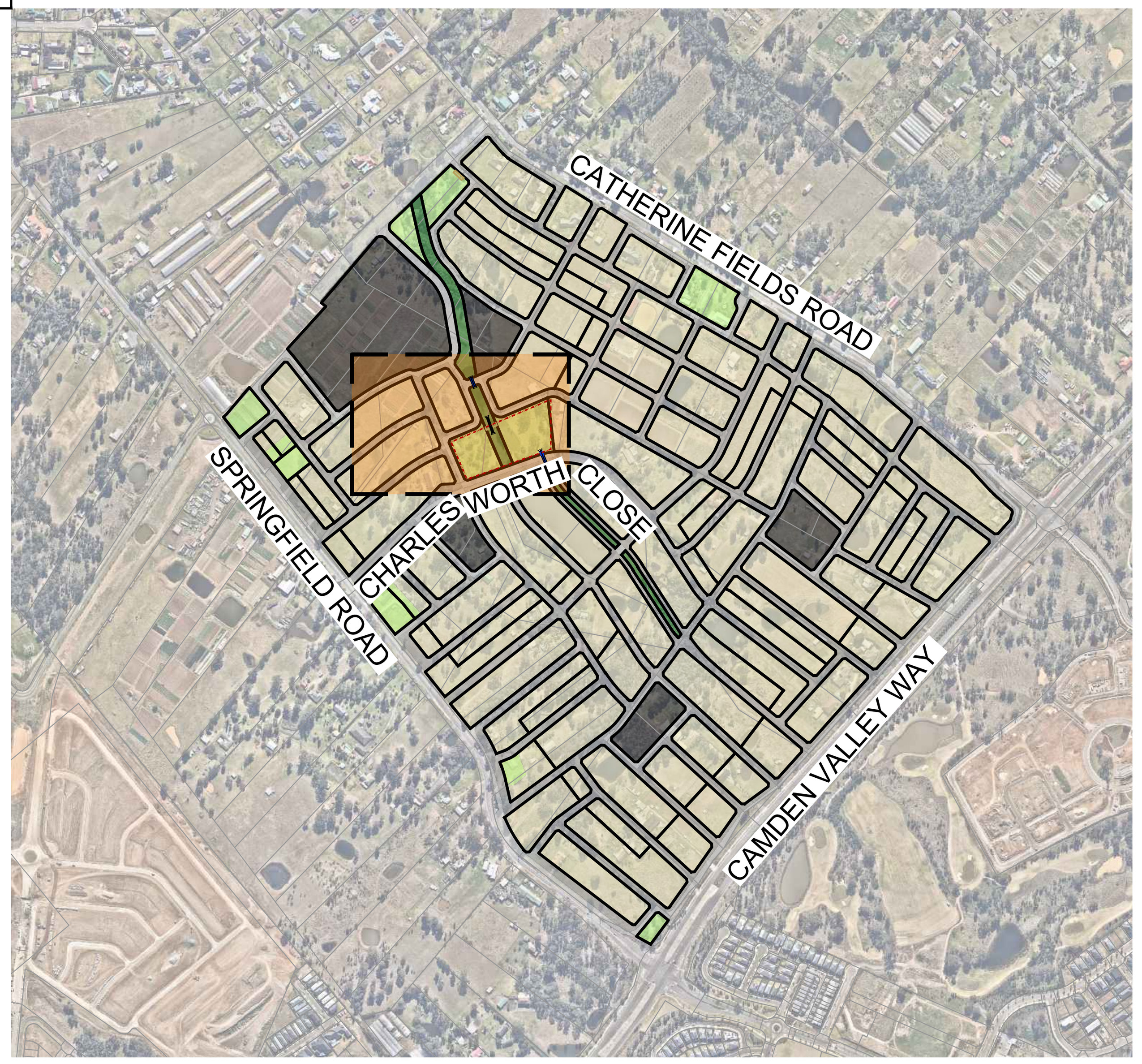
Based on the results of the study, it is concluded that the management measures proposed for the site, including its network of flood detention basins and bioretention basins, are effective in ensuring that there would be no adverse impacts in the entire Upper South Creek catchment from the site to Bringelly Road.

The results of the study indicate that the flow attenuation provided by the proposed detention basins is conservative and generally exceeds that required to maintain existing flow conditions in the downstream catchment. On this basis, it is considered that opportunities exist after the rezoning stage to further refine and optimize the basin sizes provided, with scope to more closely match the overall pre-existing peak discharge flows. This may include reducing the footprint or sizes of the basins or modifying some of the basin batter slopes.

Overall, the proposed ISP is deemed sufficient to support the planning process.

Appendix A – Preliminary Concept Plans

A1



LOCALITY PLAN

SCALE 1:10000

LEGEND

- EXISTING CONTOUR
- DESIGN CONTOUR
- DRAINAGE CORRIDOR
- FILTER AREA

PLAN

SCALE 1:500

0 5 10 15 20 30 40 50m

1:500 @A1

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Signature:

Principal: PROLET

L.G.A. CAMDEN COUNCIL

Scale: AS SHOWN

Datum: AHD

Project:

CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG& RHODES
TAKE THE LEAD

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Drawing Title: ONLINE BASIN 01 CONCEPT PLAN SHEET 1 OF 2

C&R Ref. 000-00

Drawing Ref. 416-21-SK-1001

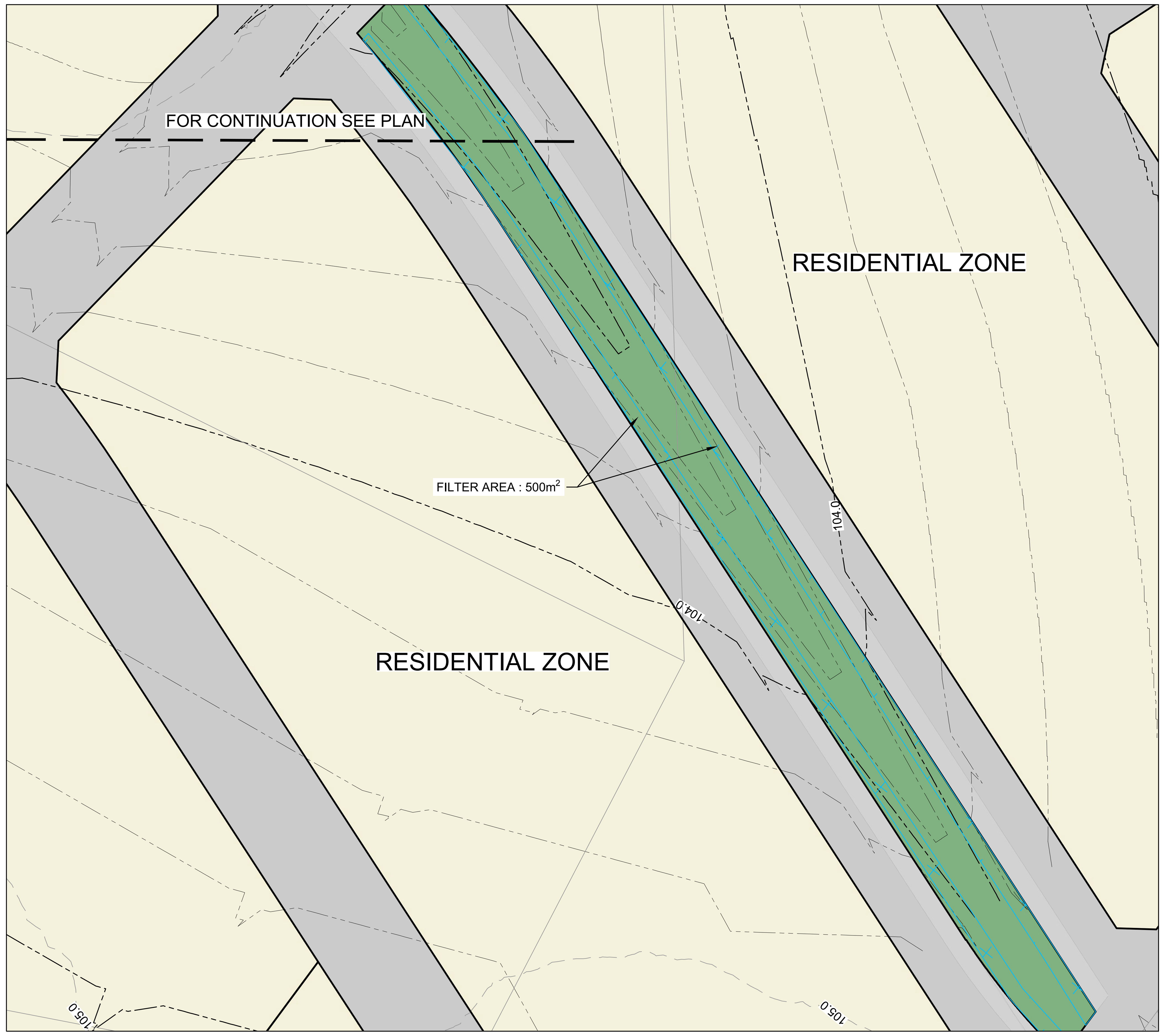
Revision A

LOCALITY PLAN

SCALE 1:10000

LEGEND

- EXISTING CONTOUR
- DESIGN CONTOUR
- DRAINAGE CORRIDOR
- FILTER AREA



INSET 'A'

SCALE 1:500

PLAN

SCALE 1:500

0 5 10 15 20 30 40 50m

1:500 @A1

FOR INFORMTAION

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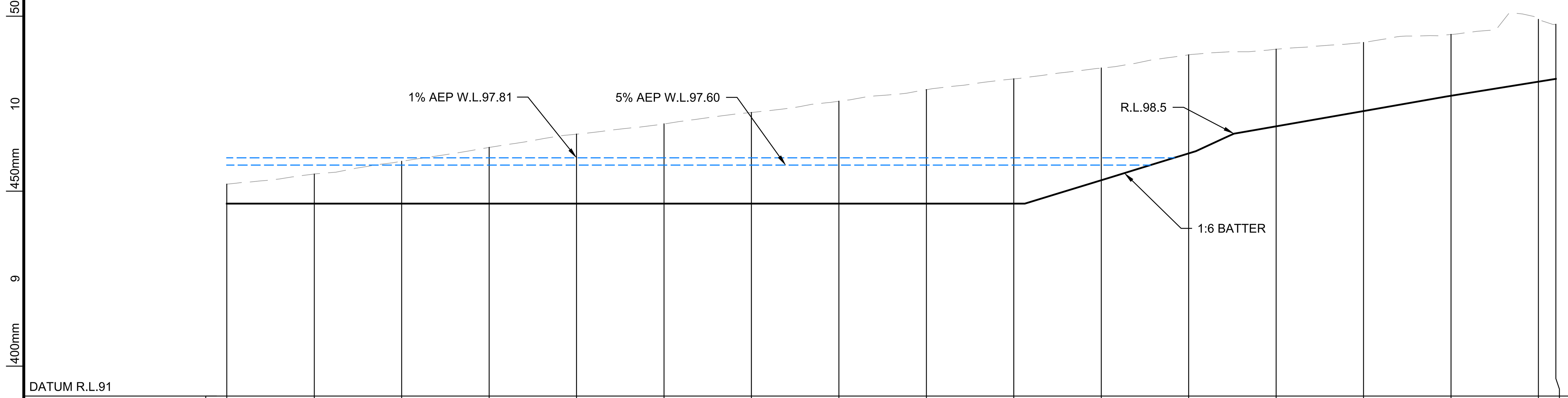
Drawing Title: ONLINE BASIN 01
CONCEPT PLAN
SHEET 2 OF 2

C&R Ref.: 000-00 | Drawing Ref.: 416-21-SK-1002 | Revision: A

A1

LEGEND

DESIGN SURFACE
EXISTING SURFACE



DESIGN LEVEL	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	97.17	97.94	98.71	99.15	99.58	99.98	100.06
EXISTING LEVEL	97.06	97.34	97.71	98.11	98.48	98.78	99.10	99.43	99.76	100.06	100.37	100.75	100.91	101.10	101.33	101.76	101.62
CHAINAGE	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	221

A 1001 LONGITUDINAL SECTION
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

DESIGN LEVEL	102.80	102.73	102.52	102.55	102.69	98.00	97.17	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50
EXISTING LEVEL	103.48	103.18	102.90	102.64	102.26	101.98	101.66	101.31	101.07	100.73	100.18	99.75	99.25	98.85	98.44
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70

DESIGN LEVEL	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50	96.50
EXISTING LEVEL	97.91	97.57	97.24	97.17	97.00	96.78	96.41	96.07	95.90	95.74	95.83	95.99	96.39	96.82	97.06
CHAINAGE	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145

A 1001 LONGITUDINAL SECTION
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

1:100 @A1 (0 1 2 3 4 6 8 10m)
1:200 @A1 (0 2 4 6 8 12 16 20m)

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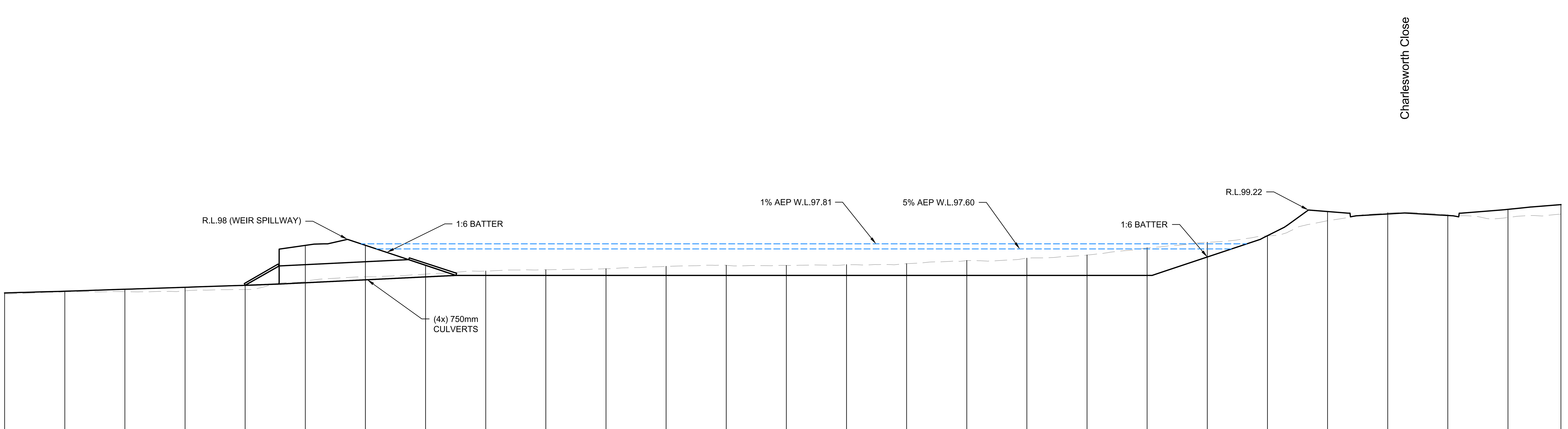
Drawing Title: ONLINE BASIN 01 SECTIONS SHEET 1 OF 2
C&R Ref. 000-00
Drawing Ref 416-21-SK-1003
Revision A

A1

LEGEND

DESIGN SURFACE
EXISTING SURFACE



DATUM R.L.90

DESIGN LEVEL	95.77	95.84	95.92	96.01	96.09	97.75	97.75	96.92	96.50	96.50	96.50	96.50	96.50	96.50
EXISTING LEVEL	95.73	95.82	95.82	95.86	95.91	96.25	96.44	96.55	96.68	96.73	96.77	96.87	96.92	96.91
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65

DESIGN LEVEL	96.50	96.50	96.50	96.50	96.50	96.50	97.27	98.15	99.15	99.05	98.99	99.25	99.44
EXISTING LEVEL	96.94	96.98	97.12	97.22	97.34	97.64	97.87	98.15	98.77	99.10	99.02	98.91	99.05
CHAINAGE	70	75	80	85	90	95	100	105	110	115	120	125	129.41

B 1001 LONGITUDINAL SECTION

HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

0 1 2 3 4 6 8 10m
1:100 @A1
0 2 4 6 8 12 16 20m
1:200 @A1

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SECTIONS
SHEET 2 OF 2

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Revision A

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Drawing Title: OFFLINE BASIN 02 CONCEPT PLAN

C&R Ref.: 000-00

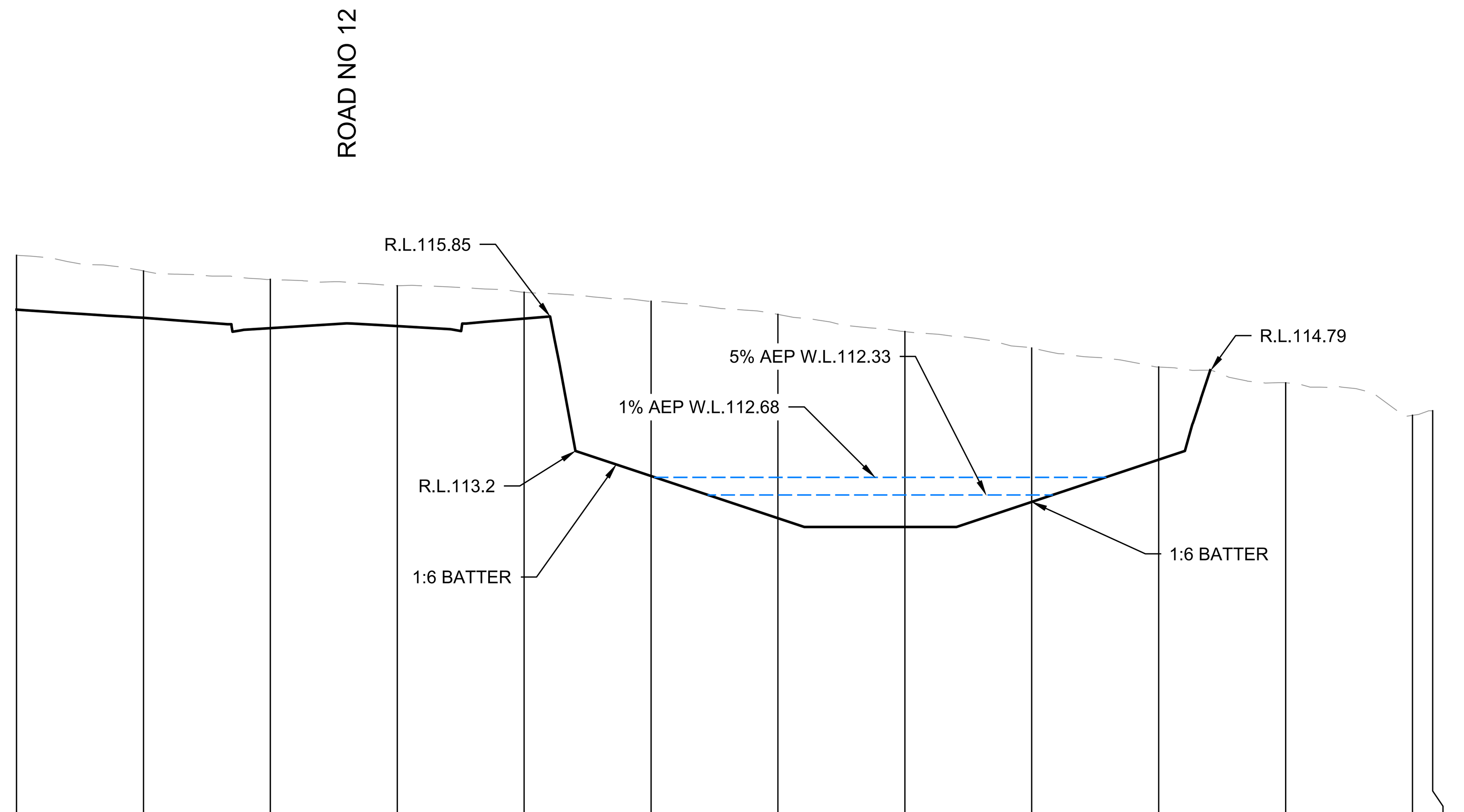
Drawing Ref.: 416-21-SK-1005

Revision: A

A1

LEGEND

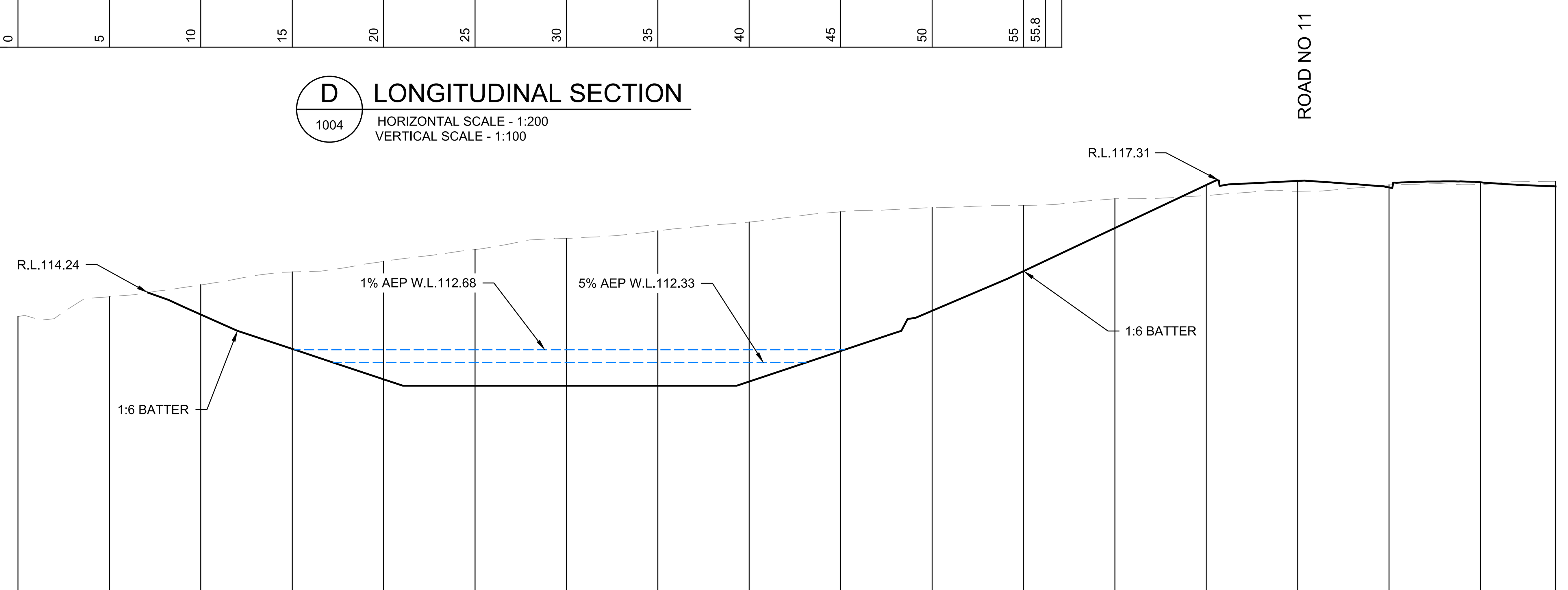
DESIGN SURFACE
EXISTING SURFACE



DATUM R.L.106

DESIGN LEVEL	115.99	115.82	115.62	115.66	115.81	112.70	111.87	111.70	112.19	113.03			
EXISTING LEVEL	117.06	116.75	116.58	116.46	116.33	116.15	115.89	115.55	115.23	114.85	114.54	113.90	113.99
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	55.8

D LONGITUDINAL SECTION
1004
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100



DATUM R.L.106

DESIGN LEVEL			113.65	112.70	111.87	111.70	111.70	111.70	111.81	112.65	113.74	114.83	116.01	117.18	117.29	117.12	117.26	117.14
EXISTING LEVEL	113.59	114.13	114.45	114.81	115.10	115.42	115.72	115.93	116.17	116.45	116.56	116.62	116.80	116.89	117.01	117.18	117.20	117.28
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	84.11

C LONGITUDINAL SECTION
1004
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

0 1 2 3 4 6 8 10m
1:100 @A1
0 2 4 6 8 12 16 20m
1:200 @A1

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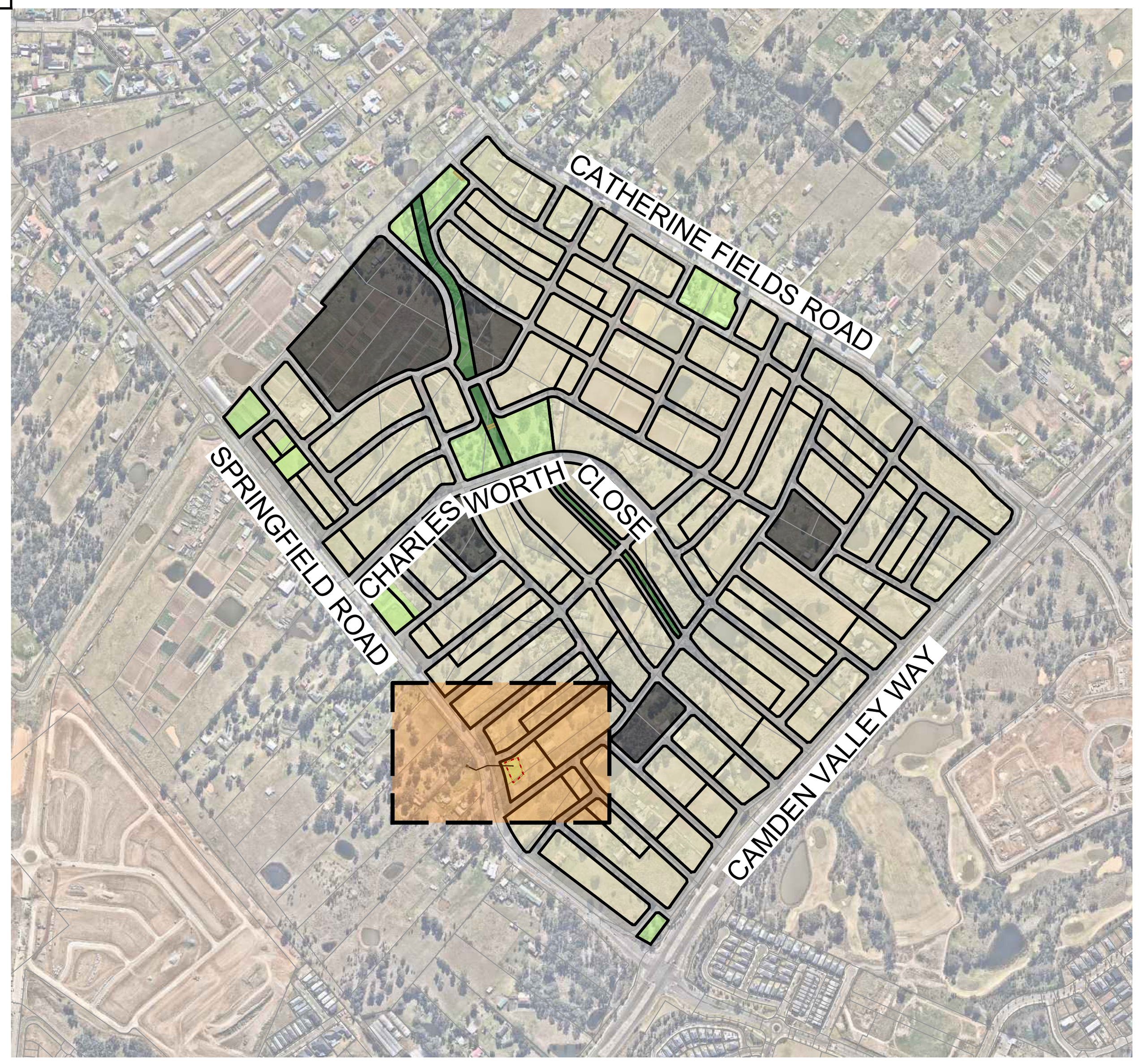
SECTIONS

C&R Ref. 000-00
Drawing Ref. 416-21-SK-1006
Revision A

CAD REF.: Z:\416-21 CHARLESWORTH PP UTILITIES AND WATER CYCLE



LOCALITY PLAN

SCALE 1:10000

LEGEND

- EXISTING CONTOUR
- DESIGN CONTOUR
- DRAINAGE CORRIDOR
- FILTER AREA

PLAN

SCALE 1:500

0 5 10 15 20 30 40 50m
1:500 @A1

FOR INFORMTAION

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A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

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Drawing Title: OFFLINE BASIN 03 CONCEPT PLAN

C&R Ref.: 000-00

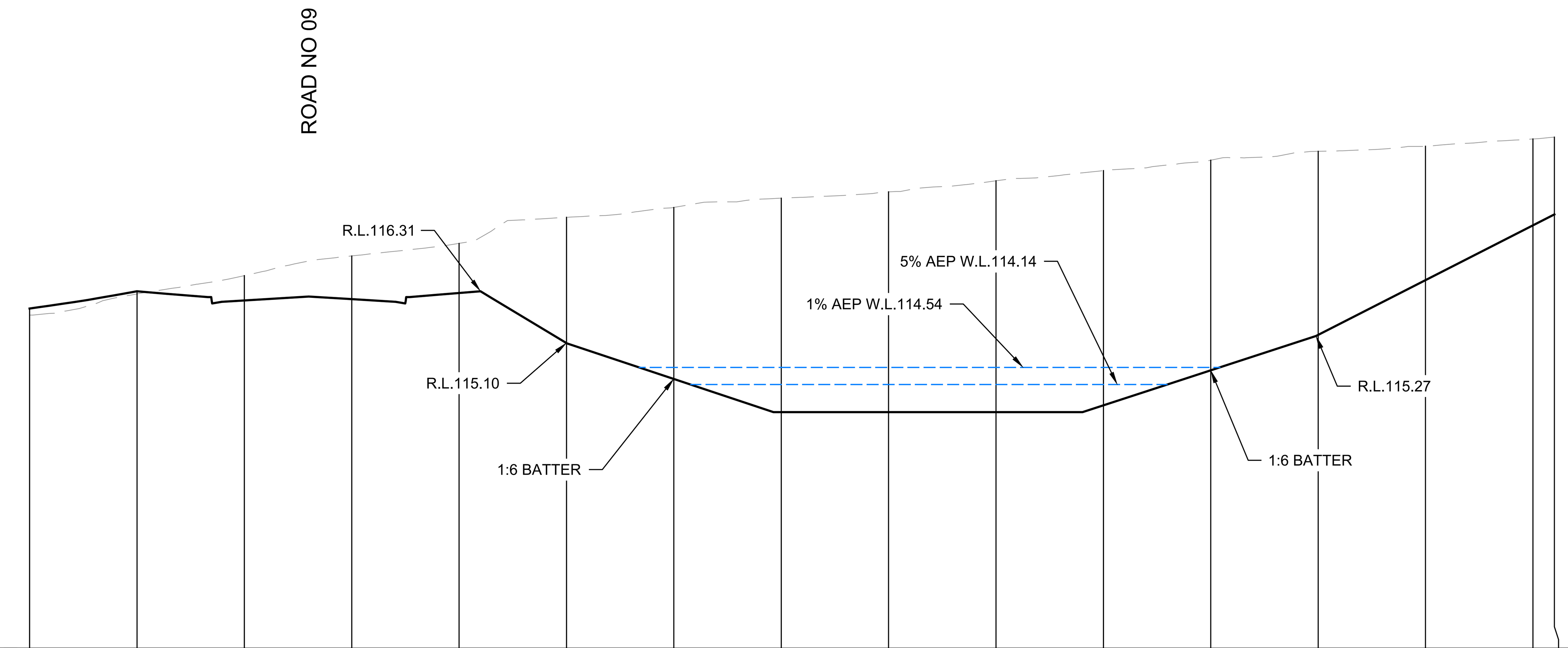
Drawing Ref.: 416-21-SK-1007

Revision: A

A1

LEGEND

- DESIGN SURFACE (solid line)
- EXISTING SURFACE (dashed line)

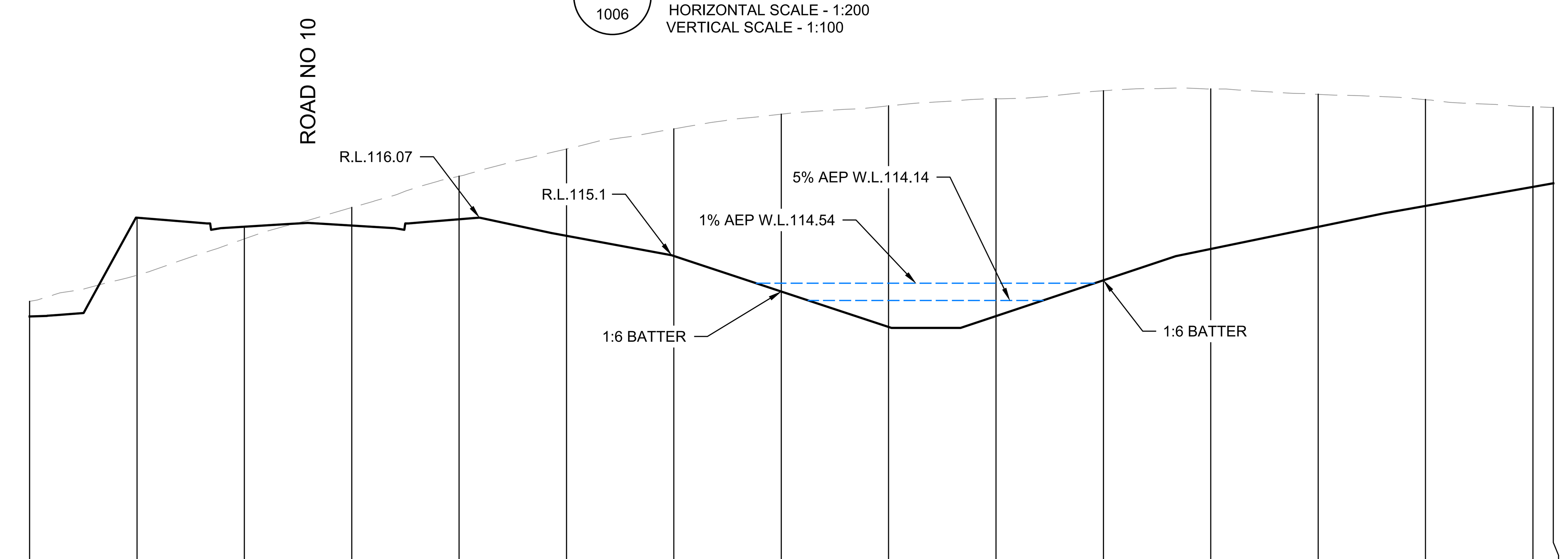


DATUM R.L.108

DESIGN LEVEL	115.91	116.31	116.10	116.13	116.27	115.11	114.27	113.50	113.50	113.50	113.66	114.47	115.29	116.57	117.85	118.10
EXISTING LEVEL	115.76	116.25	116.68	117.14	117.43	118.03	118.27	118.48	118.63	118.89	119.12	119.36	119.57	119.69	119.86	119.90
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	71

F LONGITUDINAL SECTION
1006

HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100



DATUM R.L.108

DESIGN LEVEL	113.77	116.07	115.86	115.89	116.03	115.65	115.18	114.35	113.52	113.77	114.61	115.34	115.85	116.34	116.79	116.87
EXISTING LEVEL	114.12	114.73	115.57	116.31	117.03	117.67	118.14	118.48	118.67	118.84	119.03	119.07	118.94	118.82	118.65	118.64
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	70.95

E LONGITUDINAL SECTION
1006

HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

0 1 2 3 4 6 8 10m
1:100 @A1
0 2 4 6 8 12 16 20m
1:200 @A1

FOR INFORMTAION

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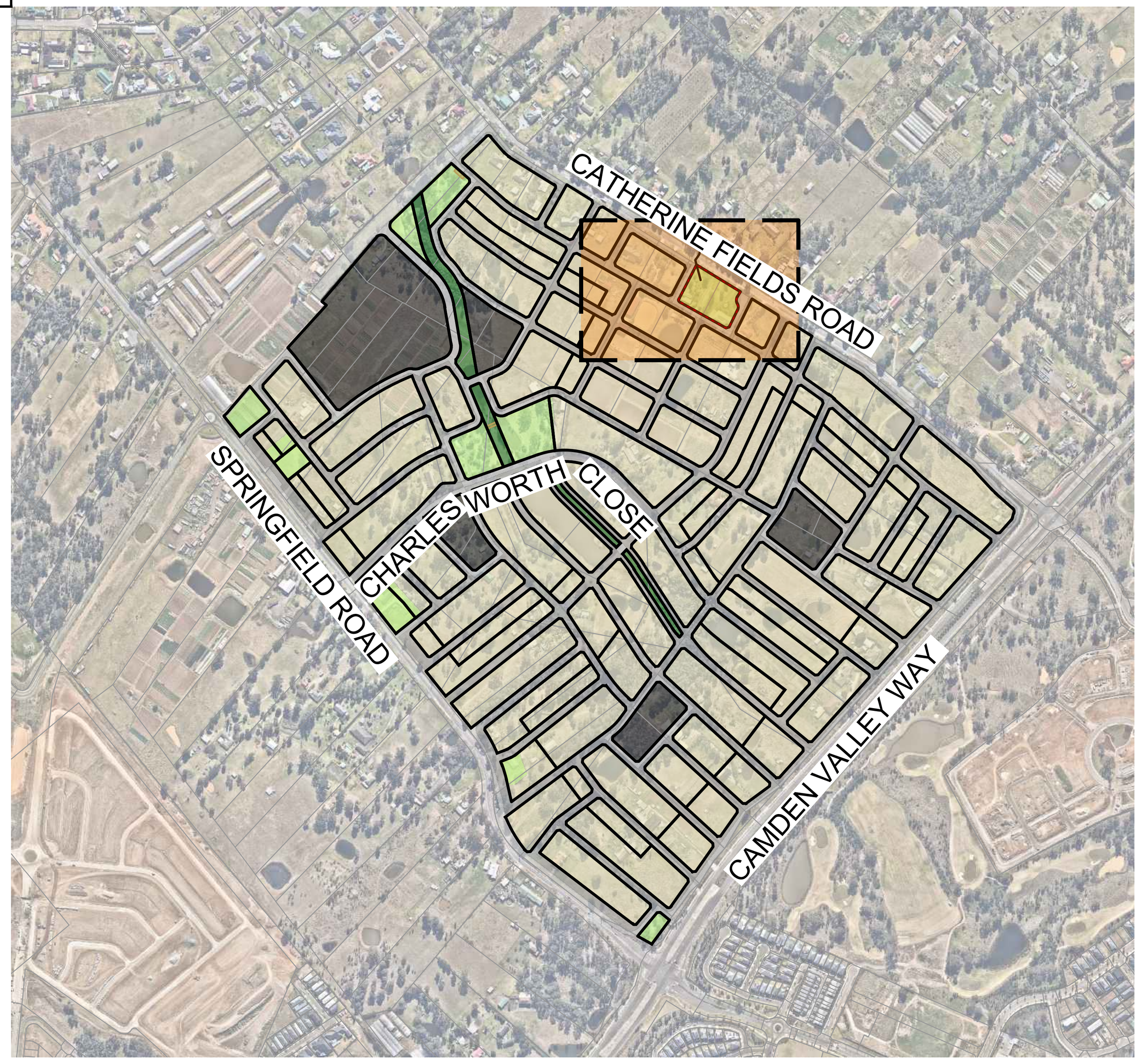
Drawing Ref: 416-21-SK-1008
Revision: A



LOCALITY PLAN
SCALE 1:10000

LEGEND

- EXISTING CONTOUR
- DESIGN CONTOUR
- DRAINAGE CORRIDOR
- FILTER AREA

PLAN
SCALE 1:500

0 5 10 15 20 30 40 50m
1:500 @A1

FOR INFORMTAION

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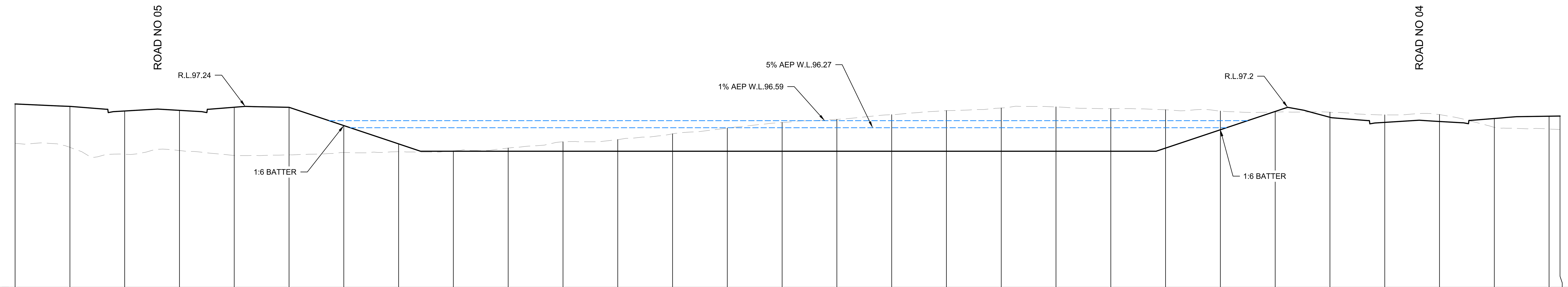
Drawing Title: OFFLINE BASIN 04 CONCEPT PLAN
C&R Ref. 000-00
Drawing Ref. 416-21-SK-1009
Revision A

A1

LEGEND

DESIGN SURFACE

EXISTING SURFACE

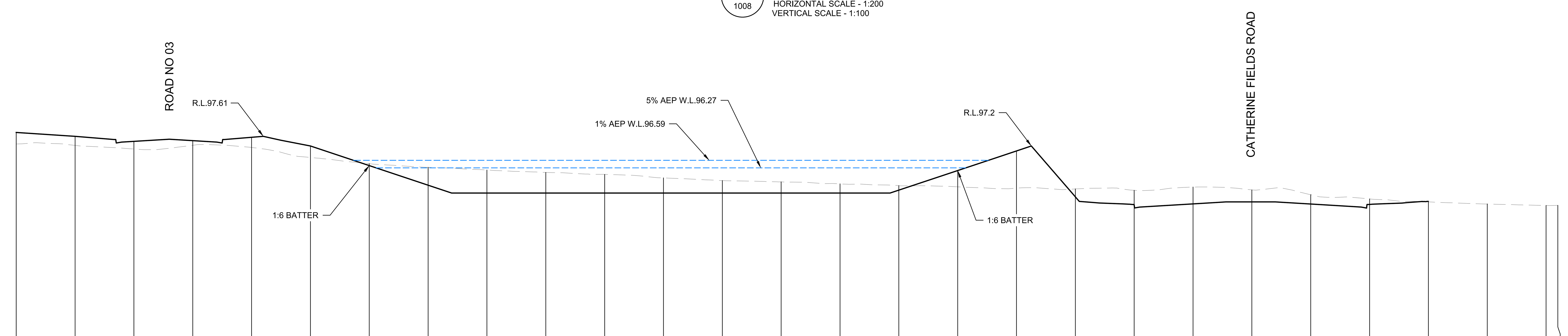


DESIGN LEVEL	97.36	97.24	97.03	97.06	97.20	97.20	96.37	95.53	95.20	95.20	95.20	95.20	95.20	95.20	95.20
EXISTING LEVEL	95.56	95.38	95.06	95.23	95.01	95.03	95.14	95.18	95.22	95.34	95.63	95.73	95.99	96.25	96.51
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70

DESIGN LEVEL	95.20	95.20	95.20	95.20	95.20	95.20	95.34	96.18	97.01	96.74	96.51	96.56	96.69	96.80	96.80
EXISTING LEVEL	96.65	96.86	97.05	97.17	97.22	97.14	97.09	97.03	96.98	96.98	96.85	96.87	96.29	96.21	96.19
CHAINAGE	75	80	85	90	95	100	105	110	115	120	125	130	135	140	141

H (1008) LONGITUDINAL SECTION

HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100



DESIGN LEVEL	97.78	97.61	97.40	97.43	97.57	97.20	96.37	95.53	95.20	95.20	95.20	95.20	95.20	95.20
EXISTING LEVEL	97.29	97.23	97.07	97.23	97.14	96.71	96.45	96.29	96.18	96.08	95.99	95.84	95.73	95.67
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65

DESIGN LEVEL	95.20	95.32	96.16	96.99	95.04	94.68	94.74	94.82	94.73	94.71				
EXISTING LEVEL	95.59	95.51	95.46	95.41	95.37	95.31	95.45	95.33	95.13	94.95	94.82	94.73	94.67	94.67
CHAINAGE	70	75	80	85	90	95	100	105	110	115	120	125	130	131

G (1008) LONGITUDINAL SECTION

HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

0 1 2 3 4 6 8 10m
1:100 @A1
0 2 4 6 8 12 16 20m
1:200 @A1

FOR INFORMTAION

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WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG& RHODES
TAKE THE LEAD

ABN 77 050 209 991 ACN 050 209 991
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PO Box 3220, Rhodes NSW 2138
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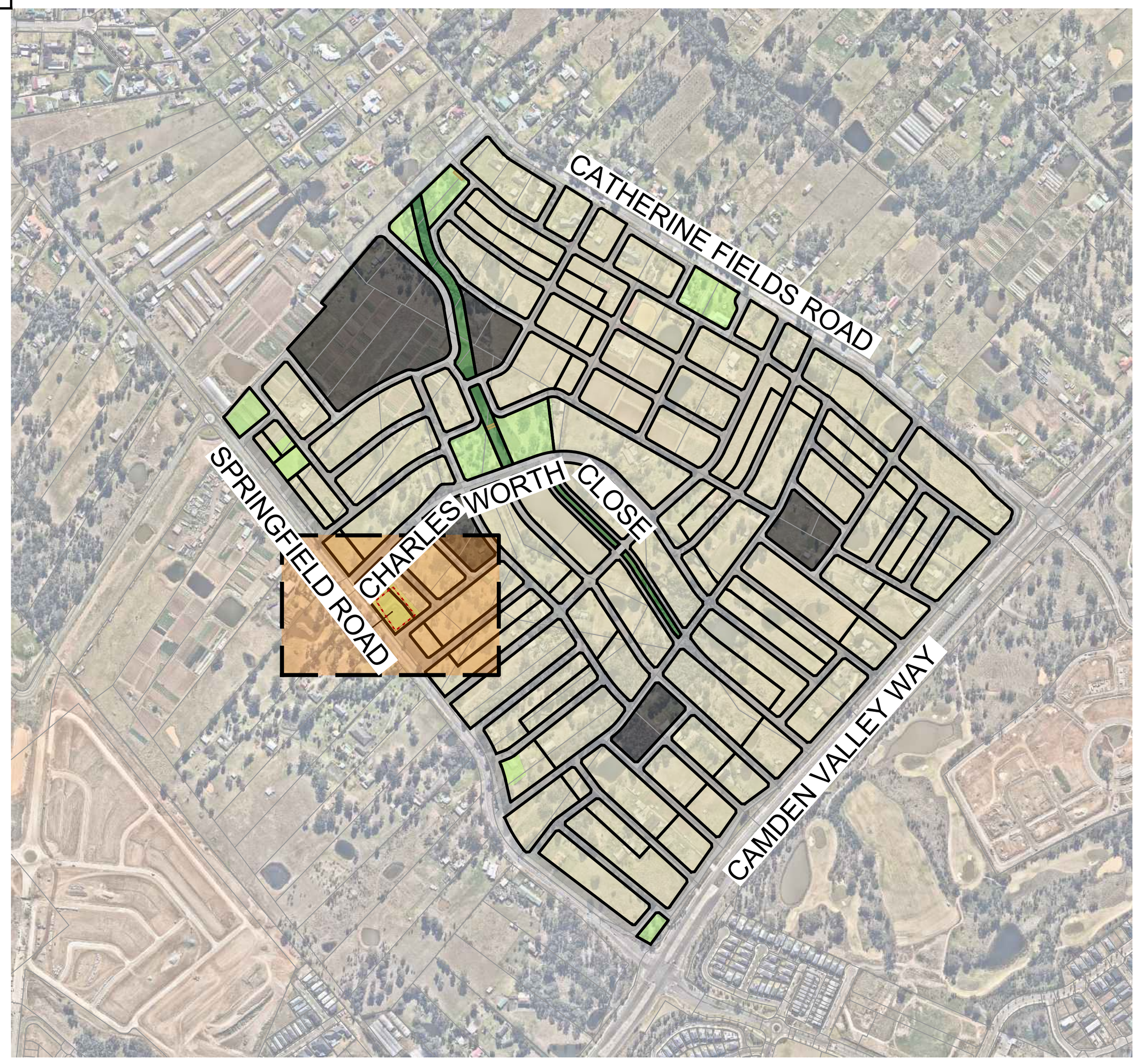
www.craigandrhodes.com.au

Drawing Title: OFFLINE BASIN 04 SECTIONS

C&R Ref: 000-00
Drawing Ref: 416-21-SK-1010
Revision: A



LOCALITY PLAN

SCALE 1:10000

LEGEND

- EXISTING CONTOUR
- DESIGN CONTOUR
- DRAINAGE CORRIDOR
- FILTER AREA

PLAN

SCALE 1:500

0 5 10 15 20 30 40 50m

1:500 @A1

FOR INFORMTAION

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

Authorised for issue by:

Signature:

Principal: PROLET

L.G.A.: CAMDEN COUNCIL

Scale: AS SHOWN

Datum: AHD

Project: CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG & RHODES
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Drawing Title: OFFLINE BASIN 05
CONCEPT PLAN

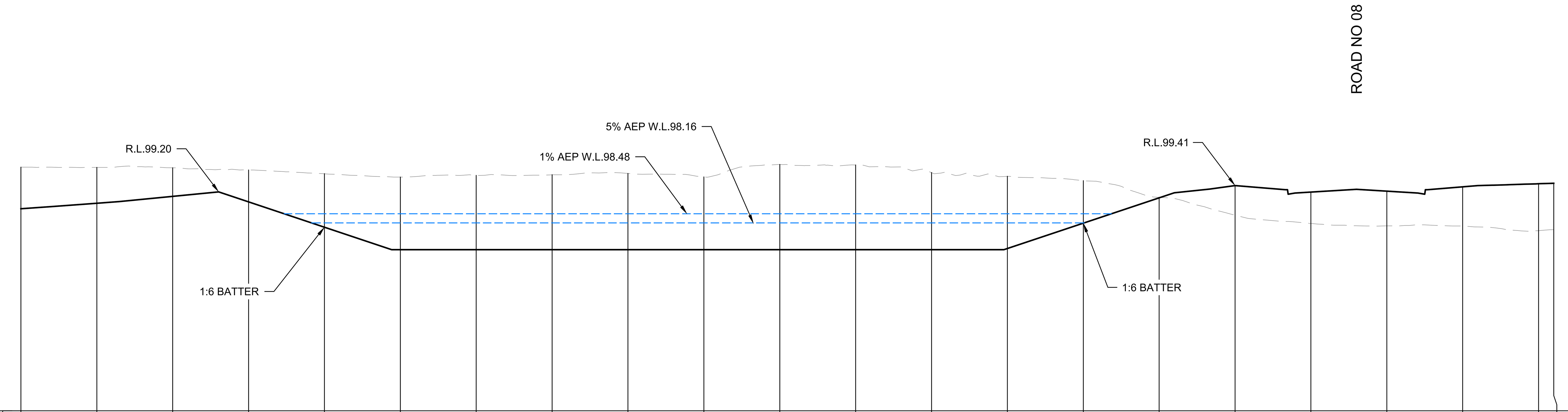
C&R Ref.: 000-00

Drawing Ref.: 416-21-SK-1011

Revision: A

LEGEND

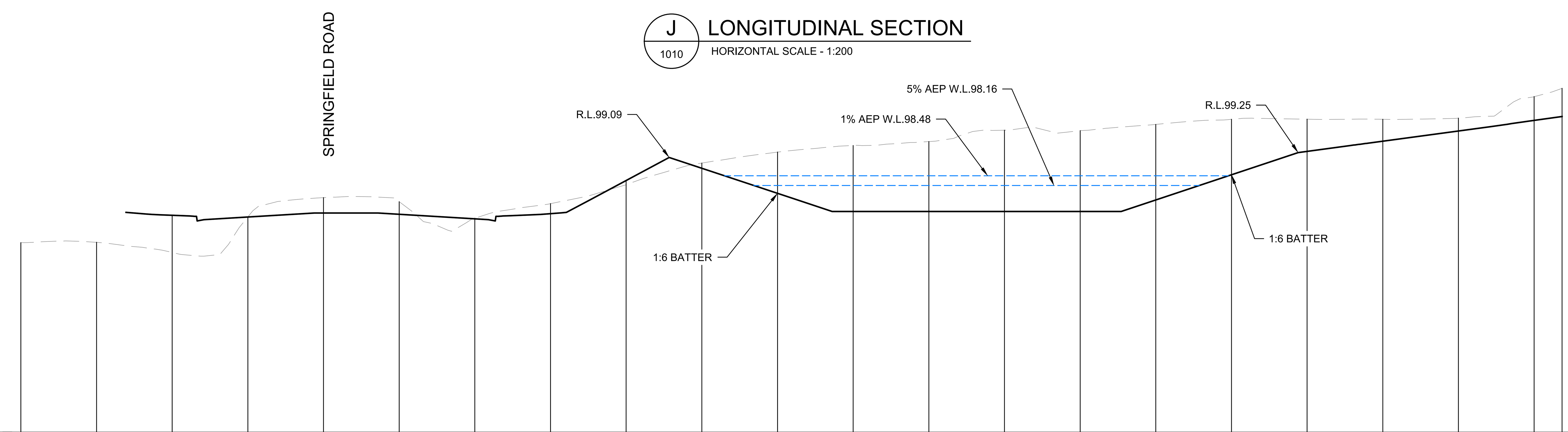
- DESIGN SURFACE
- EXISTING SURFACE



DESIGN LEVEL	98.65	98.83	99.05	98.87	98.04	97.30	97.30	97.30	97.30	97.30	97.30	97.30	97.30	97.34	98.17	99.01	99.41	99.20	99.23	99.37	99.47	99.49
EXISTING LEVEL	100.01	100.01	99.99	99.92	99.80	99.69	99.74	99.76	99.81	99.69	100.10	100.09	99.84	99.71	99.57	99.02	98.43	98.16	98.09	98.08	97.93	97.96
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	101

J / 1010 LONGITUDINAL SECTION

HORIZONTAL SCALE - 1:200



DESIGN LEVEL			97.17	97.12	97.25	97.21	97.06	97.23	98.32	98.73	97.90	97.30	97.30	97.30	97.30	97.68	98.51	99.29	99.62	99.96	100.31	100.44
EXISTING LEVEL	96.26	96.28	95.94	97.12	97.76	97.62	97.08	97.56	98.19	98.90	99.26	99.48	99.61	99.99	99.97	100.18	100.35	100.35	100.35	100.38	101.10	101.37
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	101.85

I / 1010 LONGITUDINAL SECTION

HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

1:100 @A1 (0 1 2 3 4 6 8 10m)
1:200 @A1 (0 2 4 6 8 12 16 20m)

FOR INFORMTAION

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

Authorised for issue by: Signature:

Principal: PROLET
L.G.A. CAMDEN COUNCIL
Scale: AS SHOWN
Datum: AHD

Project: CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG & RHODES TAKE THE LEAD

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Drawing Title: OFFLINE BASIN 05 SECTIONS
C&R Ref. 000-00
Drawing Ref. 416-21-SK-1012
Revision A

LOCALITY PLAN

SCALE 1:10000

LEGEND

(dashed line)	EXISTING CONTOUR
(dash-dot line)	DESIGN CONTOUR
(green fill)	DRAINAGE CORRIDOR
(hatched fill)	FILTER AREA

PLAN

SCALE 1:500

0 5 10 15 20 30 40 50m
1:500 @A1

FOR INFORMTAION

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

Authorised for issue by:

Signature:

Principal: PROLET

L.G.A. CAMDEN COUNCIL

Scale: AS SHOWN

Datum: AHD

Project: CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG& RHODES
TAKE THE LEAD

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Drawing Title: OFFLINE BASINS 06 & 08
CONCEPT PLAN

C&R Ref. 000-00

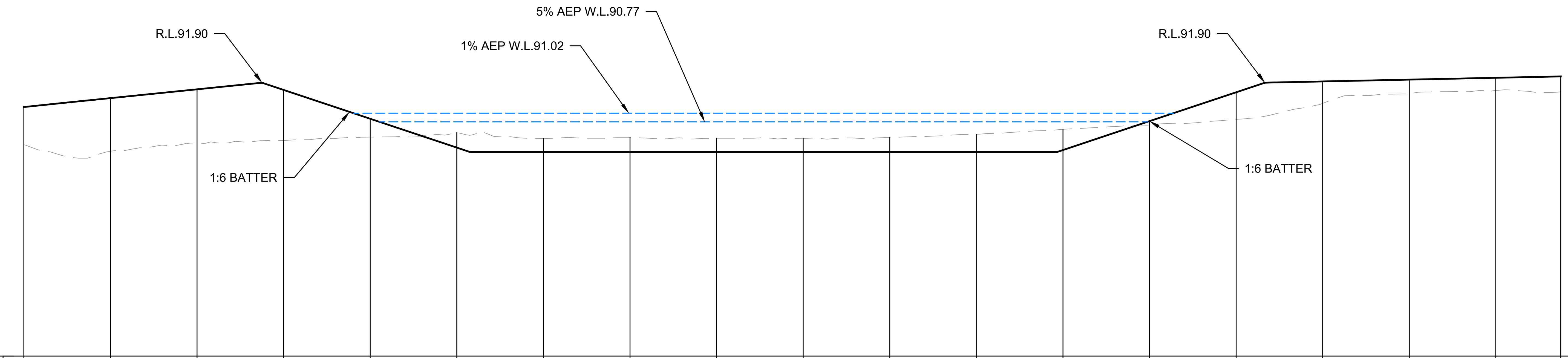
Drawing Ref. 416-21-SK-1013

Revision A

A1

LEGEND

DESIGN SURFACE
EXISTING SURFACE



DATUM R.L.84

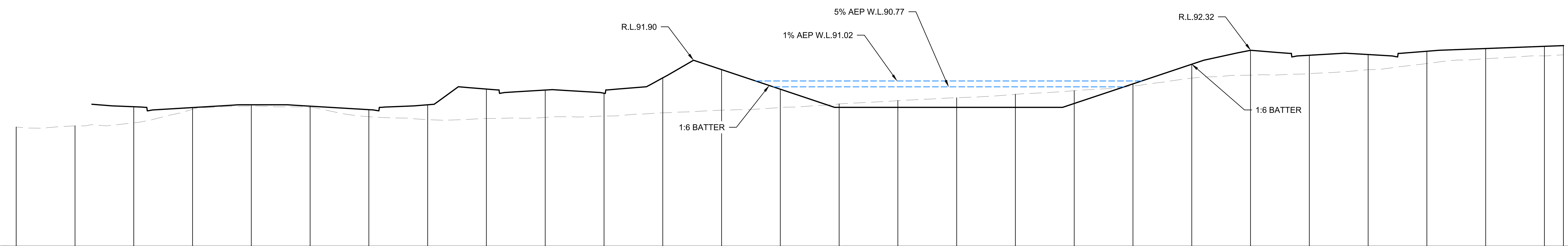
DESIGN LEVEL	91.20	91.45	91.71	91.69	90.86	90.03	89.90	89.90	89.90	89.90	89.90	89.90	89.96	90.79	91.62	91.94	91.99	92.04	92.08
EXISTING LEVEL	90.11	89.92	90.13	90.23	90.33	90.46	90.29	90.32	90.30	90.29	90.32	90.41	90.55	90.68	90.84	91.30	91.59	91.68	91.64
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	88.75

L / 1012 — LONGITUDINAL SECTION
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

SPRINGFIELD ROAD

ROAD NO 06

ROAD NO 07



DATUM R.L.84

DESIGN LEVEL			89.92	89.89	90.01	89.95	89.80	90.01	90.68	90.63	90.50	91.15	91.50	90.67	89.90	89.90	89.90	89.90	90.06	90.90	91.73	92.32	92.11	92.14	92.28	92.40	92.49	92.52
EXISTING LEVEL	89.06	89.11	89.24	89.82	89.95	89.89	89.50	89.37	89.42	89.47	89.53	89.67	89.78	89.89	90.04	90.18	90.31	90.45	90.61	90.80	91.14	91.27	91.33	91.49	91.76	91.97	92.09	92.13
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	131.61

K / 1012 — LONGITUDINAL SECTION
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

0 1 2 3 4 6 8 10m
1:100 @A1
0 2 4 6 8 12 16 20m
1:200 @A1

FOR INFORMTAION

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

Authorised for issue by:
Signature:

Principal: PROLET
L.G.A. CAMDEN COUNCIL
Scale: AS SHOWN
Datum: AHD

Project:
CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG & RHODES
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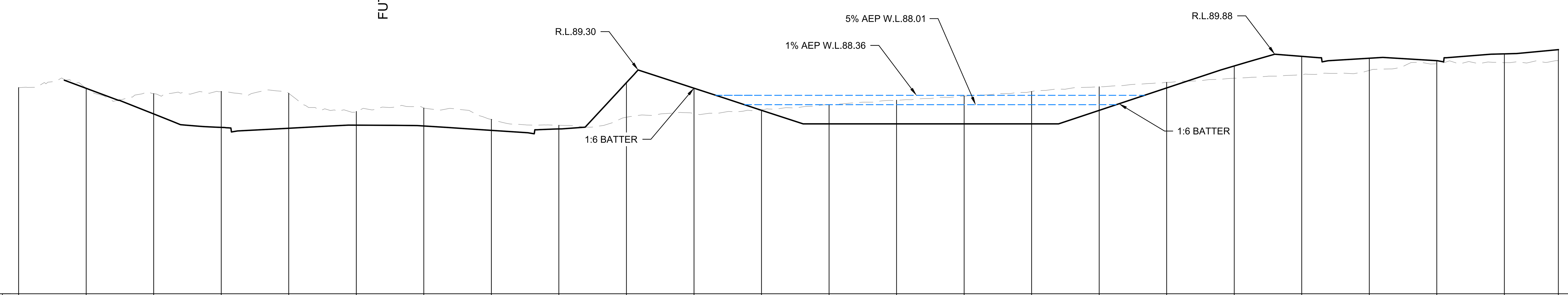
Drawing Title: OFFLINE BASIN 06 SECTIONS
C&R Ref. 000-00
Drawing Ref. 416-21-SK-1014
Revision A

A1

LEGEND

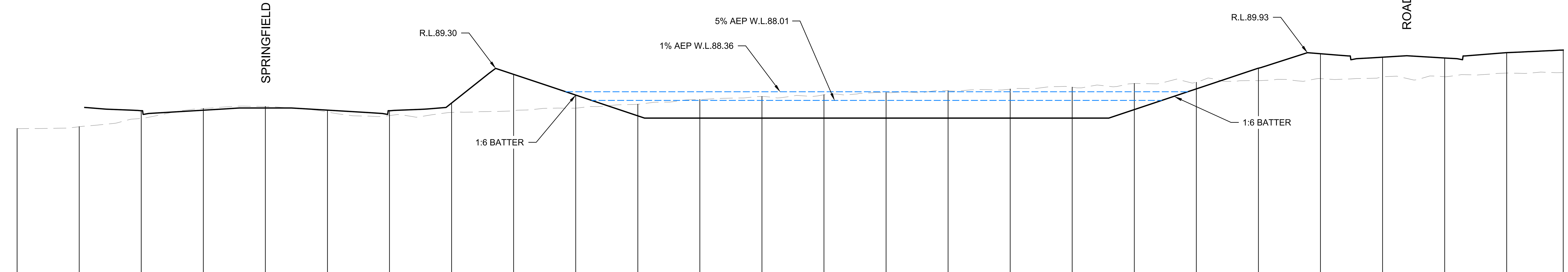
DESIGN SURFACE
EXISTING SURFACE



DATUM R.L.81

DESIGN LEVEL		88.62	87.67	87.17	87.14	87.25	87.22	87.06	87.11	88.83	88.62	87.80	87.30	87.30	87.30	87.30	87.80	88.63	89.45	89.80	89.73	89.64	89.90	90.05
EXISTING LEVEL	88.64	88.63	88.42	88.50	88.43	87.76	87.89	87.46	87.24	87.54	87.68	87.82	88.01	88.18	88.33	88.50	88.67	88.84	88.99	89.13	89.28	89.52	89.57	89.65
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	114

N LONGITUDINAL SECTION
1012
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100



DATUM R.L.81

DESIGN LEVEL			87.60	87.62	87.71	87.62	87.60	87.91	89.06	88.23	87.39	87.30	87.30	87.30	87.30	87.30	87.30	87.30	87.64	88.48	89.31	89.89	89.75	89.72	89.93	90.04
EXISTING LEVEL	86.88	86.95	87.29	87.68	87.76	87.54	87.40	87.53	87.60	87.70	87.85	88.05	88.17	88.24	88.32	88.40	88.46	88.54	88.69	88.74	88.81	88.89	88.96	88.96	89.11	89.13
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	124.55

M LONGITUDINAL SECTION
1012
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

0 1 2 3 4 6 8 10m
1:100 @A1
0 2 4 6 8 12 16 20m
1:200 @A1

FOR INFORMTAION

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

Authorised for issue by:
Signature:

Principal: PROLET
L.G.A. CAMDEN COUNCIL
Scale: AS SHOWN
Datum: AHD

Project:
CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG& RHODES
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Drawing Title
OFFLINE BASIN 08
SECTIONS

C&R Ref. 000-00
Drawing Ref. 416-21-SK-1015
Revision A

LOCALITY PLAN

SCALE 1:10000

LEGEND

- EXISTING CONTOUR
- DESIGN CONTOUR
- DRAINAGE CORRIDOR
- FILTER AREA

PLAN

SCALE 1:500

0 5 10 15 20 30 40 50m
1:500 @A1

FOR INFORMTAION

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

Authorised for issue by:

Signature:

Principal: PROLET

L.G.A. CAMDEN COUNCIL

Scale: AS SHOWN

Datum: AHD

Project: CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG & RHODES
TAKE THE LEAD
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reception@crhodes.com.au
www.craigandrhodes.com.au

Drawing Title: ONLINE BASIN 07 CONCEPT PLAN

C&R Ref. 000-00

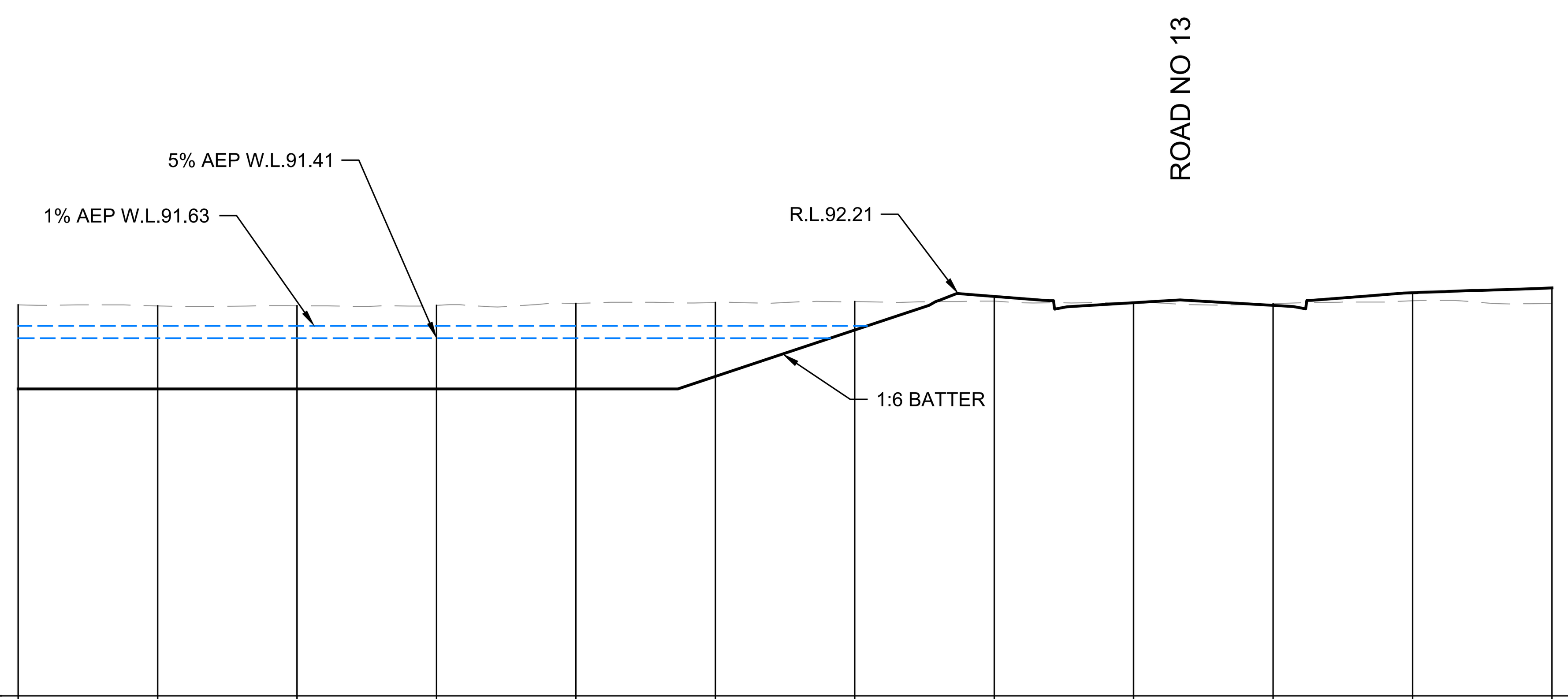
Drawing Ref. 416-21-SK-1016

Revision A

A1

LEGEND

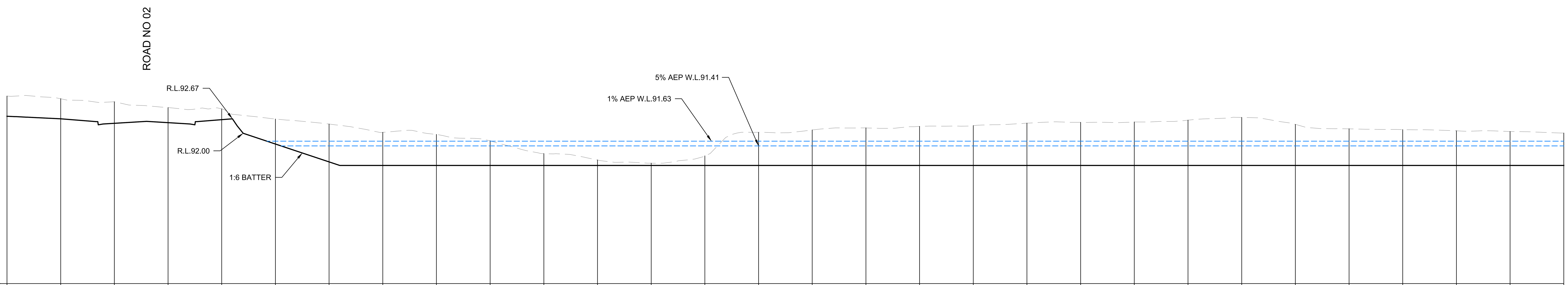
DESIGN SURFACE
EXISTING SURFACE



DATUM R.L.85

DESIGN LEVEL	90.50	90.50	90.50	90.50	90.50	90.72	91.56	92.16	92.05	92.00	92.23	92.31
EXISTING LEVEL	92.01	91.99	91.99	92.00	92.03	92.05	92.07	92.07	92.05	92.03	92.08	92.04
CHAINAGE	145	150	155	160	165	170	175	180	185	190	195	200

O LONGITUDINAL SECTION
1015
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100



DATUM R.L.85

DESIGN LEVEL	92.79	92.67	92.46	92.49	92.63	91.50	90.67	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50
EXISTING LEVEL	93.73	93.61	93.46	93.19	93.14	92.66	92.43	92.04	91.94	91.65	91.05	90.75	90.60	90.94	92.04
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70

DESIGN LEVEL	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50	90.50
EXISTING LEVEL	92.15	92.25	92.32	92.35	92.47	92.51	92.52	92.61	92.74	92.41	92.20	92.17	92.11	92.08	92.01
CHAINAGE	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145

O LONGITUDINAL SECTION
1015
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

FOR INFORMTAION

0 1 2 3 4 6 8 10m
1:100 @A1
0 2 4 6 8 12 16 20m
1:200 @A1

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

Authorised for issue by:
Signature:

Principal: PROLET
L.G.A. CAMDEN COUNCIL
Scale: AS SHOWN
Datum: AHD

Project:
CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG& RHODES
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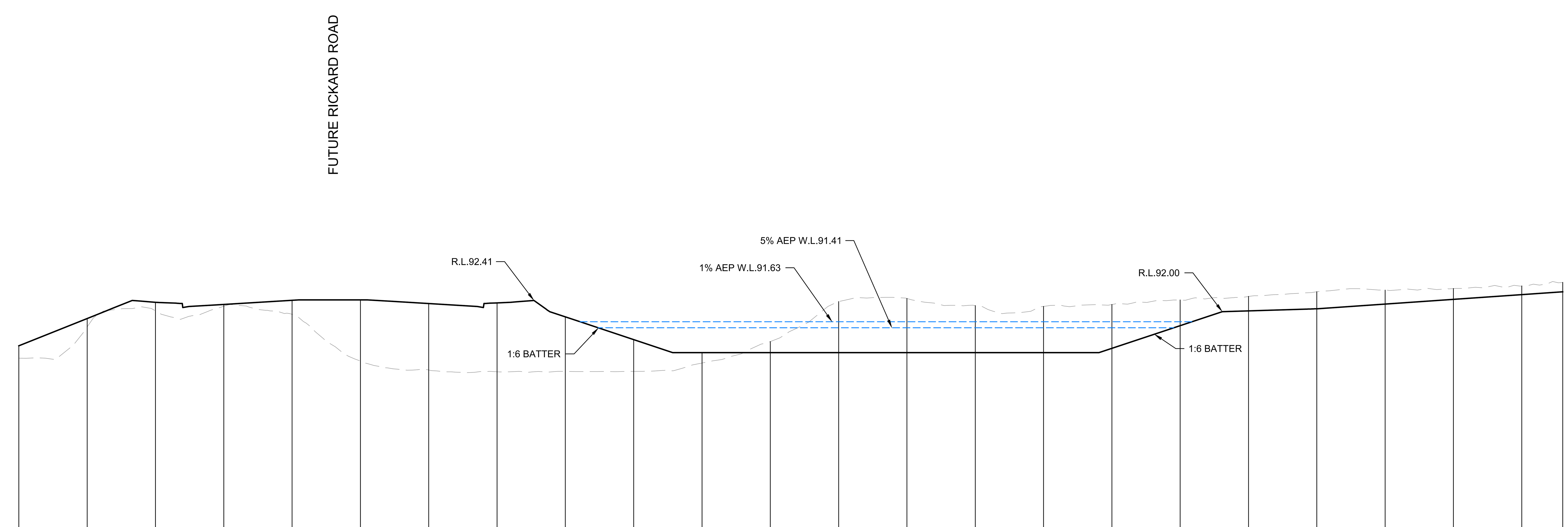
Drawing Title
ONLINE BASIN 07
SECTIONS
SHEET 1 OF 2

C&R Ref. 000-00
Drawing Ref 416-21-SK-1017
Revision A

A1

LEGEND

DESIGN SURFACE
EXISTING SURFACE



DATUM R.L.84

DESIGN LEVEL	90.75	91.75	92.34	92.26	92.41	92.43	92.29	92.32	91.81	90.97	90.50	90.50
EXISTING LEVEL	90.30	91.44	92.03	92.20	91.90	90.19	89.86	89.80	89.81	89.81	90.12	90.90
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55

DESIGN LEVEL	90.50	90.50	90.50	90.50	90.66	91.49	92.03	92.10	92.28	92.45	92.62	92.73
EXISTING LEVEL	92.37	92.48	92.22	92.19	92.26	92.42	92.56	92.73	92.79	92.84	92.94	93.07
CHAINAGE	60	65	70	75	80	85	90	95	100	105	110	113

P / 1015 LONGITUDINAL SECTION
HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

1:100 @A1 (0 1 2 3 4 6 8 10m)
1:200 @A1 (0 2 4 6 8 12 16 20m)

FOR INFORMTAION

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

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Authorised for issue by:
Signature:

Principal: PROLET
L.G.A. CAMDEN COUNCIL
Scale: AS SHOWN
Datum: AHD

Project:
CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG & RHODES
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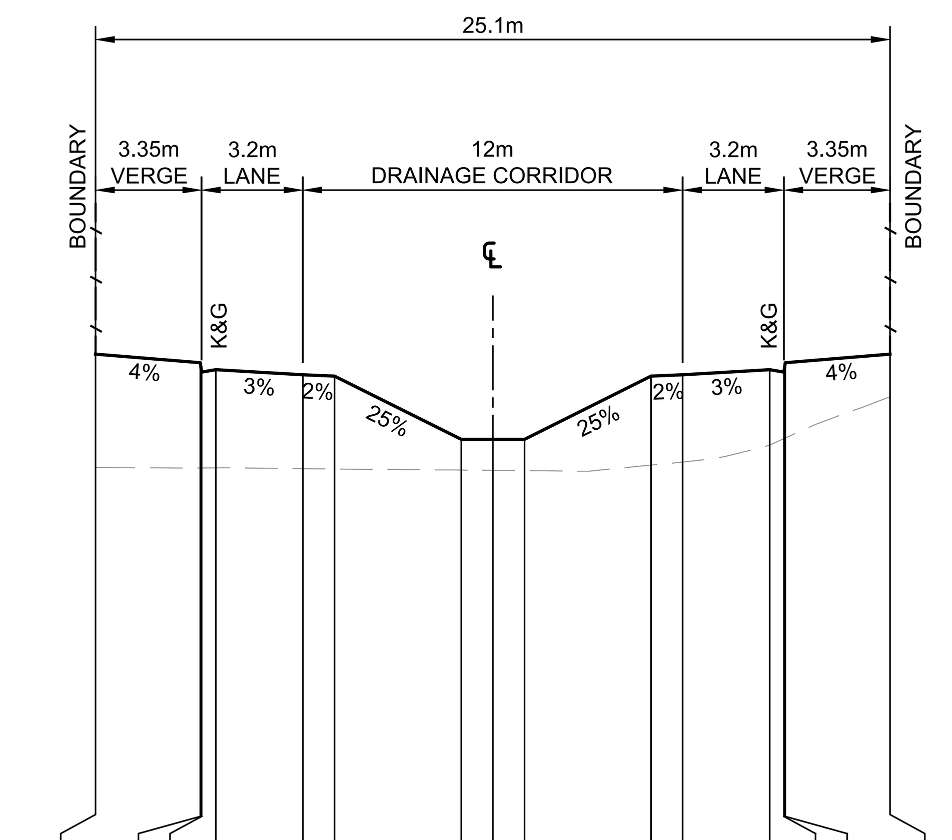
Drawing Title:
ONLINE BASIN 07
SECTIONS
SHEET 2 OF 2

C&R Ref. 000-00
Drawing Ref. 416-21-SK-1018
Revision A

A1

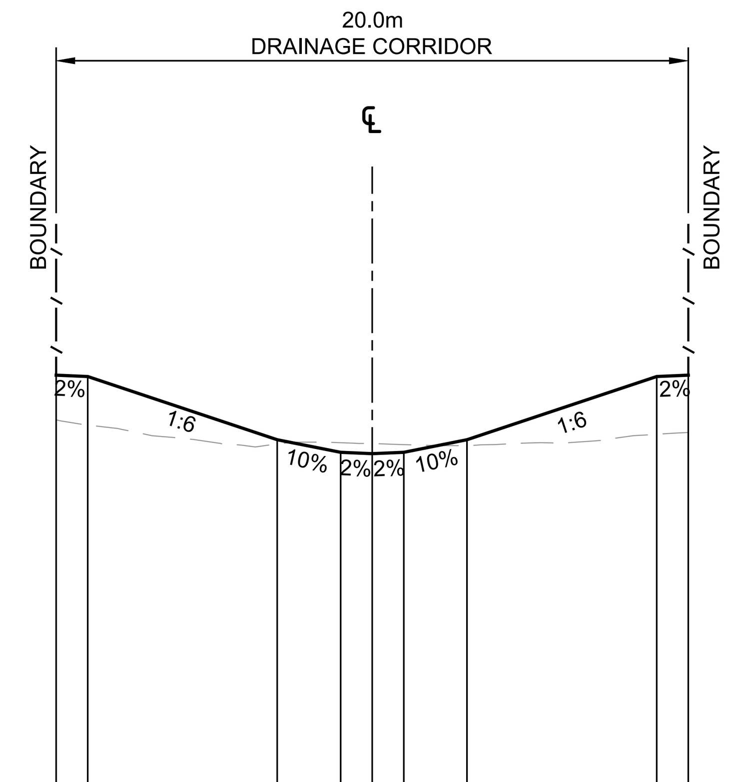


DATUM R.L.0

RELATIVE DIFFERENCE	1.34	1.06	1.06	1.10	1.02	1.00	0.00	0.00	0.00	1.00	1.02	1.10	1.06	1.06	1.34
OFFSET	-12.55	-9.24	-9.2	-8.275	-6.00	-5.00	-1.00	0.00	1.00	5.00	6.00	8.275	9.2	9.24	12.55

CHANNEL TYPICAL SECTION - A

HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100



DATUM R.L.0

RELATIVE DIFFERENCE	1.24	1.22	0.22	0.02	0.00	0.02	0.22	1.22	1.24
OFFSET	-10.00	-9.00	-3.00	-1.00	0.00	1.00	3.00	9.00	10.00

CHANNEL TYPICAL SECTION - B

HORIZONTAL SCALE - 1:200
VERTICAL SCALE - 1:100

FOR CONTINUATION, REFER ABOVE

FOR INFORMTAION

0 1 2 3 4 6 8 10m
1:100

REV.	DATE	AMENDMENT DESCRIPTION	DES.	DRN.
A	25.03.22	CONCEPT DESIGN FOR INFORMATION	M.G.	T.L.

Authorised for issue by:
Signature:

Principal: PROLET
L.G.A. CAMDEN COUNCIL
Scale: AS SHOWN
Datum: AHD

Project:
CATHERINE FIELD
WITHIN THE SOUTH WEST GROWTH AREA
BASIN CONCEPT DESIGN

CRAIG& RHODES
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reception@crhodes.com.au
www.craigandrhodes.com.au

Drawing Title: DRAINAGE CORRIDOR TYPICAL SECTION
C&R Ref. 000-00
Drawing Ref. 416-21-SK-1019
Revision A

Appendix B – Catherine Field Music Link Report (2022)

MUSIC-*link* Report

Project Details		Company Details	
Project:	Catherine Field planning proposal	**Company:**	Craig & Rhodes
Report Export Date:	26-Feb-22	**Contact:**	M.Gaite
Catchment Name:	416-21_PP_WSUD-001_POST DEV	**Address:**	7/3 Rider Blvd, Rhodes NSW 2138
Catchment Area:	105.65ha	**Phone:**	02 9869 1855
Impervious Area*:	45.67%	**Email:**	mgaite@stormconsulting.com.au
Rainfall Station:	67035 LIVERPOOL(WHITLAM		
Modelling Time-step:	6 Minutes		
Modelling Period:	1-01-1985 - 31-12-1994 11:54:00 PM		
Mean Annual Rainfall:	783mm		
Evapotranspiration:	1261mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Camden City Council		
Scenario:	Camden City Council		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Post-Development Node	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	3.43%	Bio Retention Node	8	Urban Source Node	11
TSS	89.9%	GPT Node	8		
TP	66.1%				
TN	47.9%				
GP	100%				

Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention Basin C-1	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin C-1	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention Basin C-2	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin C-2	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention Basin C-4	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin C-4	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention Basin C-5	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin C-5	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention Basin C-6	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin C-6	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention Basin C-7a	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin C-7a	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention Basin C-7b	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin C-7b	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention Basin C-8	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin C-8	PET Scaling Factor	2.1	2.1	2.1
GPT	Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	1
GPT	Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	1
GPT	Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	1
GPT	Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	1
GPT	Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	1
GPT	Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	1
GPT	Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	1
GPT	Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	1
Post	Post-Development Node	% Load Reduction	None	None	3.43
Post	Post-Development Node	GP % Load Reduction	90	None	100
Post	Post-Development Node	TN % Load Reduction	45	None	47.9
Post	Post-Development Node	TP % Load Reduction	65	None	66.1
Post	Post-Development Node	TSS % Load Reduction	85	None	89.9
Urban	C-1 Urban	Area Impervious (ha)	None	None	20.52
Urban	C-1 Urban	Area Pervious (ha)	None	None	22.47
Urban	C-1 Urban	Total Area (ha)	None	None	43
Urban	C-2 Urban	Area Impervious (ha)	None	None	0.954
Urban	C-2 Urban	Area Pervious (ha)	None	None	1.045
Urban	C-2 Urban	Total Area (ha)	None	None	2
Urban	C-3 Urban	Area Impervious (ha)	None	None	0.525
Urban	C-3 Urban	Area Pervious (ha)	None	None	0.574
Urban	C-3 Urban	Total Area (ha)	None	None	1.1
Urban	C-4 Urban	Area Impervious (ha)	None	None	11.93
Urban	C-4 Urban	Area Pervious (ha)	None	None	13.06

Only certain parameters are reported when they pass validation

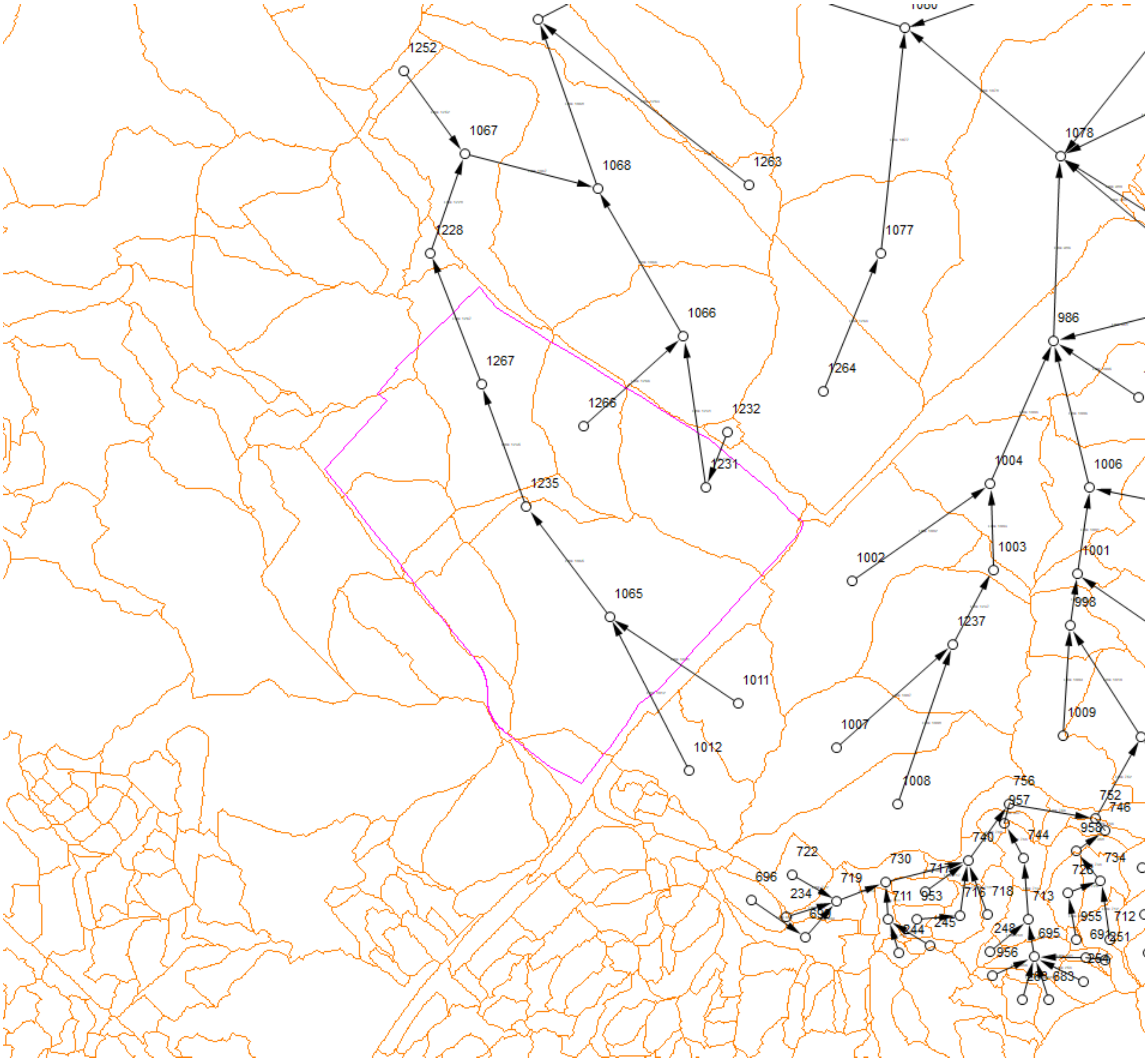
Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C-4 Urban	Total Area (ha)	None	None	25
Urban	C-5 Urban	Area Impervious (ha)	None	None	3.437
Urban	C-5 Urban	Area Pervious (ha)	None	None	3.762
Urban	C-5 Urban	Total Area (ha)	None	None	7.2
Urban	C-6 Urban	Area Impervious (ha)	None	None	3.103
Urban	C-6 Urban	Area Pervious (ha)	None	None	3.396
Urban	C-6 Urban	Total Area (ha)	None	None	6.5
Urban	C-7a Urban	Area Impervious (ha)	None	None	0.716
Urban	C-7a Urban	Area Pervious (ha)	None	None	0.783
Urban	C-7a Urban	Total Area (ha)	None	None	1.5
Urban	C-7b Urban	Area Impervious (ha)	None	None	4.296
Urban	C-7b Urban	Area Pervious (ha)	None	None	4.703
Urban	C-7b Urban	Total Area (ha)	None	None	9
Urban	C-8 Urban	Area Impervious (ha)	None	None	2.148
Urban	C-8 Urban	Area Pervious (ha)	None	None	2.351
Urban	C-8 Urban	Total Area (ha)	None	None	4.5
Urban	Parkland C-7	Area Impervious (ha)	None	None	0.088
Urban	Parkland C-7	Area Pervious (ha)	None	None	0.761
Urban	Parkland C-7	Total Area (ha)	None	None	0.85
Urban	Parkland C-8	Area Impervious (ha)	None	None	0.521
Urban	Parkland C-8	Area Pervious (ha)	None	None	4.478
Urban	Parkland C-8	Total Area (ha)	None	None	5

Only certain parameters are reported when they pass validation

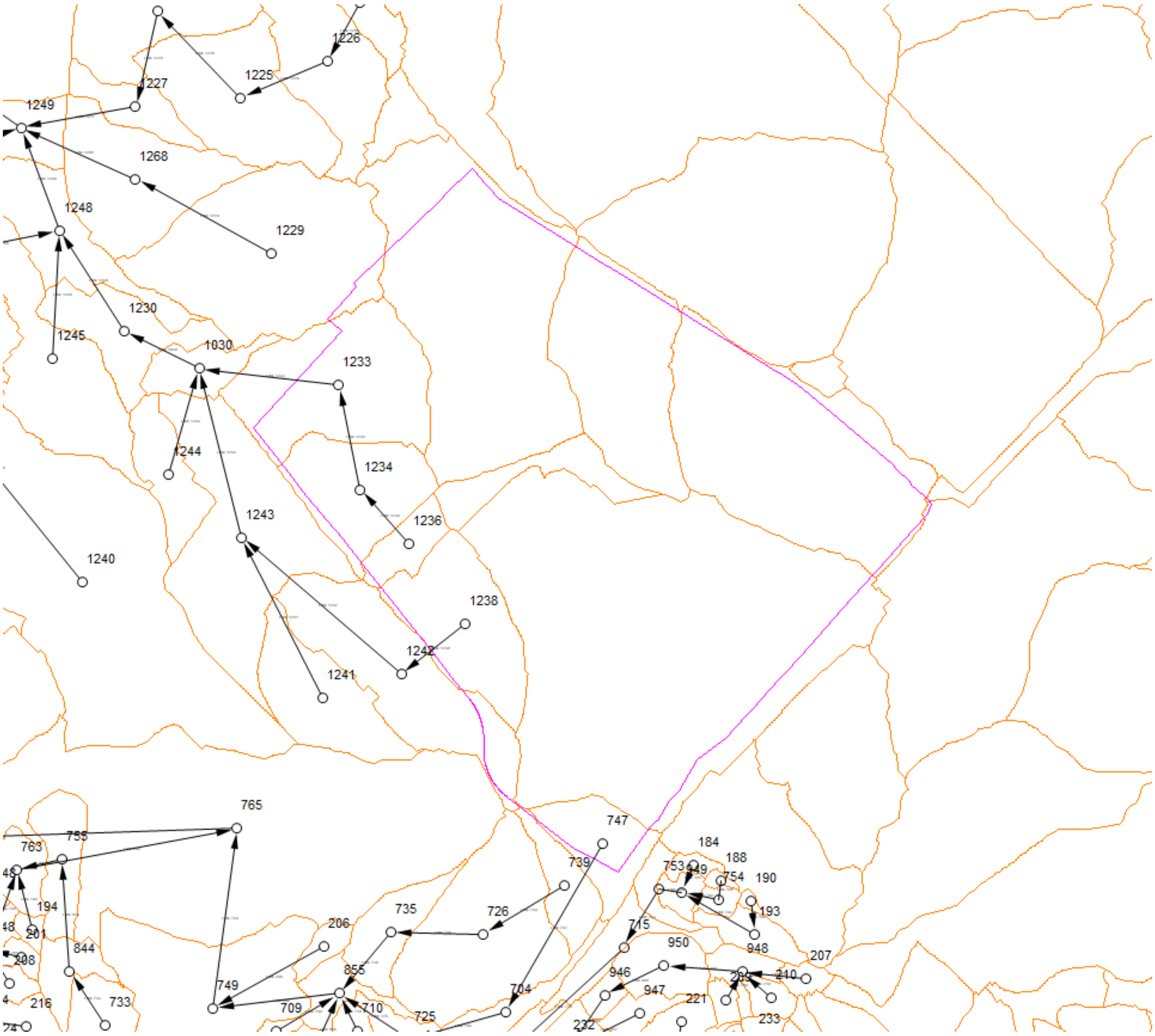
Appendix C – XP-RAFTS Model Information

XP-RAFTS BASE CASE MODEL LAYOUT

Model - EAST



Model – MID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763
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726
193
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948
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844
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946
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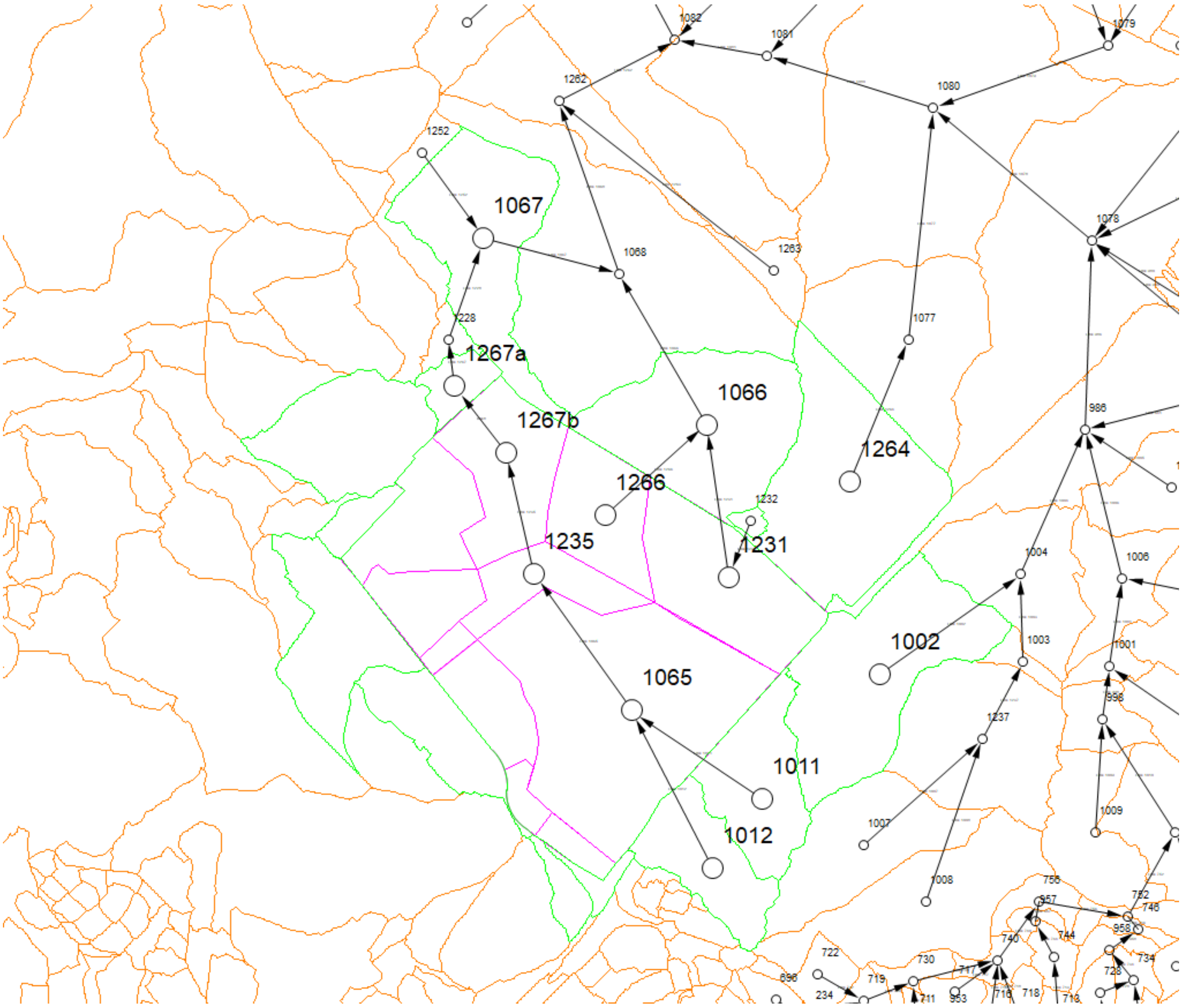
749
704
947
221
216
733
709
710
725
233
232

XP-RAFTS BASE CASE CATCHMENT SUMMARY

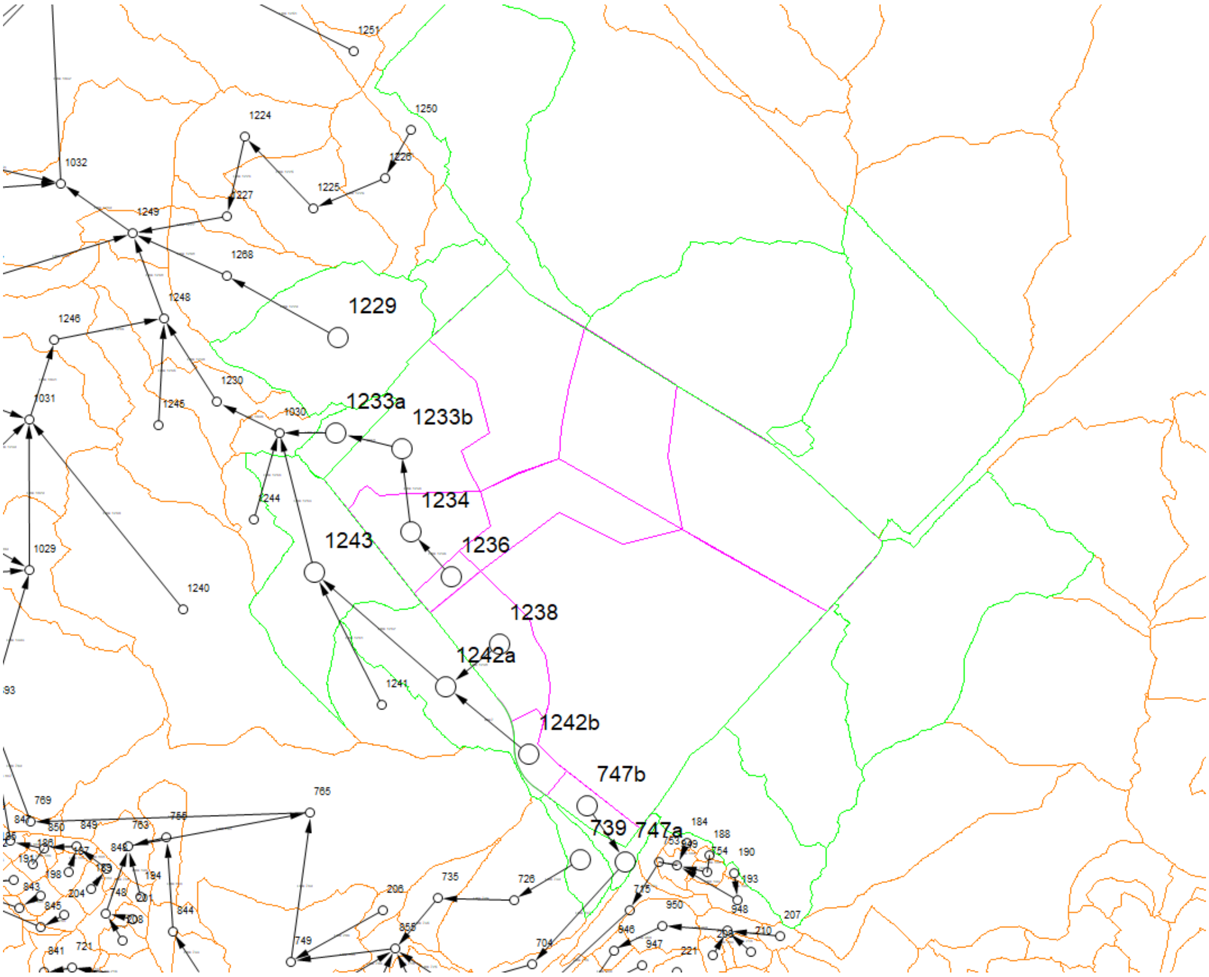
Cat ID	Model	Total Area	Area 1: Perv	Area 2: Imperv	%imp	%slope
739	Mid	2.112	1.901	0.211	10%	5.04%
747	Mid	3.325	3.022	0.303	9%	3.21%
1002	East	22.019	22.008	0.011	0%	3.07%
1011	East	8.919	8.918	0.001	0%	4.28%
1012	East	8.424	6.847	1.577	19%	3.67%
1065	East	40.036	36.305	3.731	9%	1.32%
1066	East	20.77	18.693	2.077	10%	2.25%
1067	East	18.254	16.429	1.825	10%	1.21%
1229	Mid	13.711	12.34	1.371	10%	1.54%
1231	East	17.095	15.389	1.706	10%	2.31%
1233	Mid	9.607	8.646	0.961	10%	1.91%
1234	Mid	5.497	4.947	0.55	10%	3.50%
1235	East	2.662	2.396	0.266	10%	3.32%
1236	Mid	1.672	1.505	0.167	10%	5.56%
1238	Mid	6.361	5.725	0.636	10%	4.14%
1242	Mid	8.776	7.898	0.878	10%	2.31%
1243	Mid	11.757	10.581	1.176	10%	1.46%
1264	East	23.483	21.229	2.254	10%	2.79%
1266	East	9.904	8.914	0.99	10%	2.07%
1267	East	20.53	18.477	2.053	10%	1.02%
TOTAL		**254.9**				

XP-RAFTS PRE-DEVELOPMENT CASE MODEL LAYOUT

Model - EAST



Model - MID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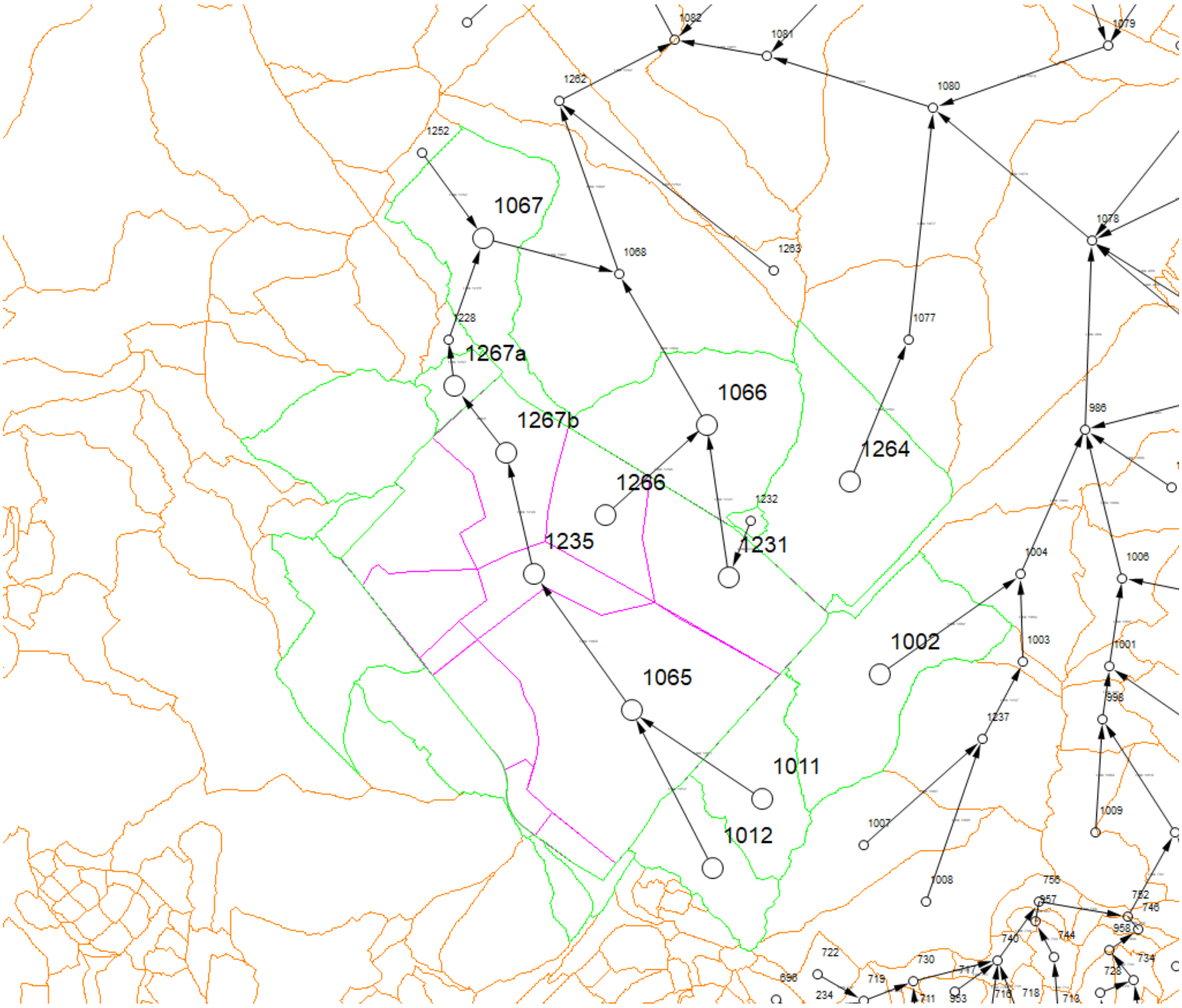
1233a
1233b
1031
1245
1030
1244
1234
1243
1236
1029
1240
1238
1242a
1241
1242b
747b
739
747a
765
769
184
188
190
735
726
206
715
950
704
207

XP-RAFTS PRE-DEVELOPMENT CATCHMENT SUMMARY

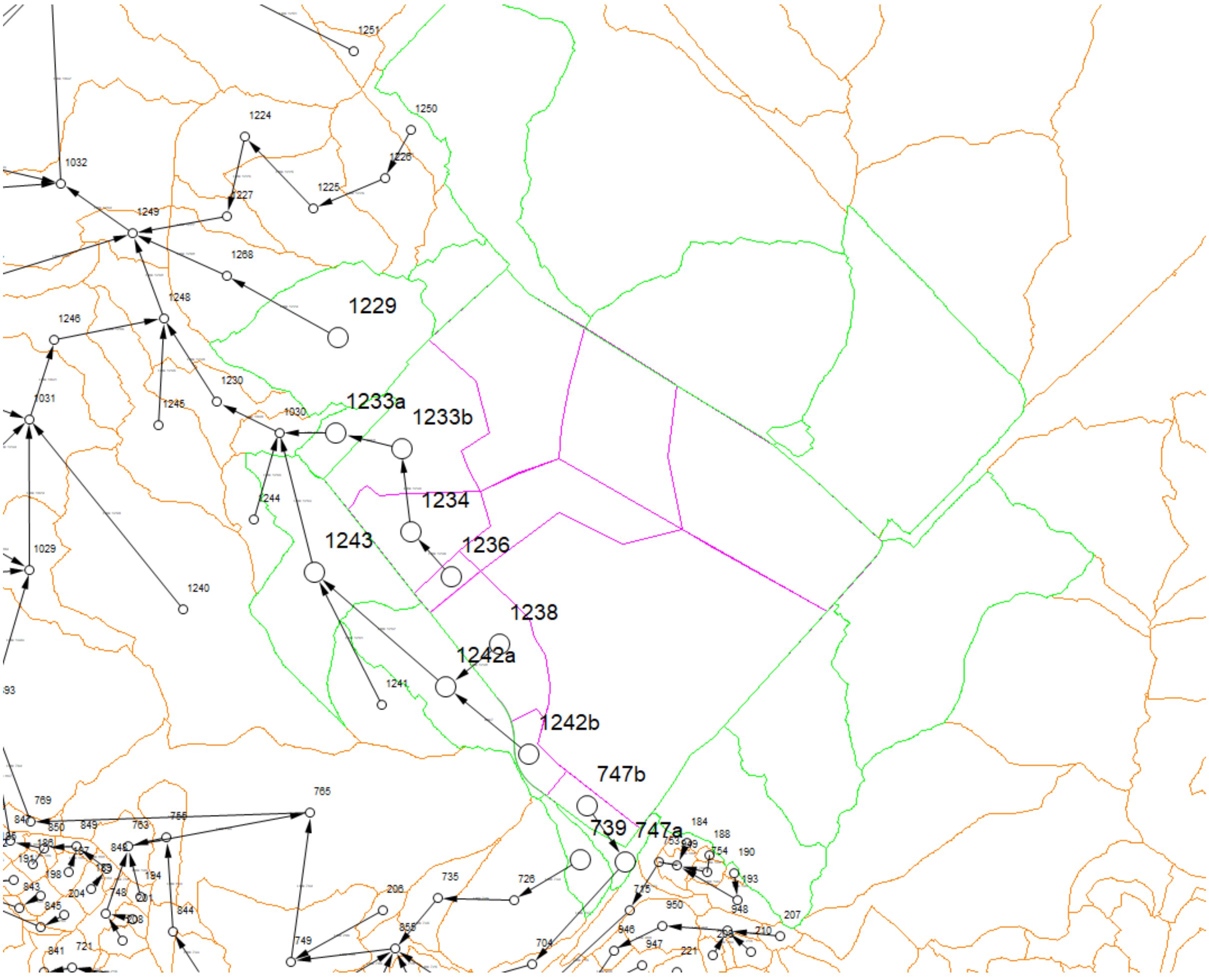
CatID	Model	Landtype	Total Area (ha)	Area 1: Perv	Area 2: Imperv	%Imp
739	Mid	External	2.103	1.893	0.210	10%
747a	Mid	External	1.284	1.168	0.116	9%
747b	Mid	Existing	1.755	1.597	0.158	9%
1002	East	External	22.168	22.157	0.011	0%
1011	East	External	11.396	11.395	0.001	0%
1012	East	External	9.451	7.682	1.769	19%
1065	East	Existing	36.261	32.882	3.379	9%
1066	East	External	21.395	19.256	2.140	10%
1067	East	External	18.619	16.758	1.861	10%
1229	Mid	External	13.164	11.848	1.316	10%
1231	East	Existing	15.363	13.830	1.533	10%
1234	Mid	Existing	5.461	4.915	0.546	10%
1235	East	Existing	6.469	5.823	0.646	10%
1236	Mid	Existing	1.091	0.982	0.109	10%
1238	Mid	Existing	5.881	5.293	0.588	10%
1242a	Mid	External	7.888	7.099	0.789	10%
1242b	Mid	Existing	1.539	1.385	0.154	10%
1243	Mid	External	12.433	11.189	1.244	10%
1264	East	External	25.021	22.619	2.402	10%
1266	East	Existing	9.657	8.692	0.965	10%
1233a	Mid	External	2.206	1.985	0.221	10%
1233b	Mid	Existing	9.369	8.432	0.937	10%
1267a	East	External	2.937	2.643	0.294	10%
1267b	East	Existing	11.939	10.745	1.194	10%
TOTAL			254.9			

XP-RAFTS POST-DEVELOPMENT CASE MODEL LAYOUT

Model - EAST



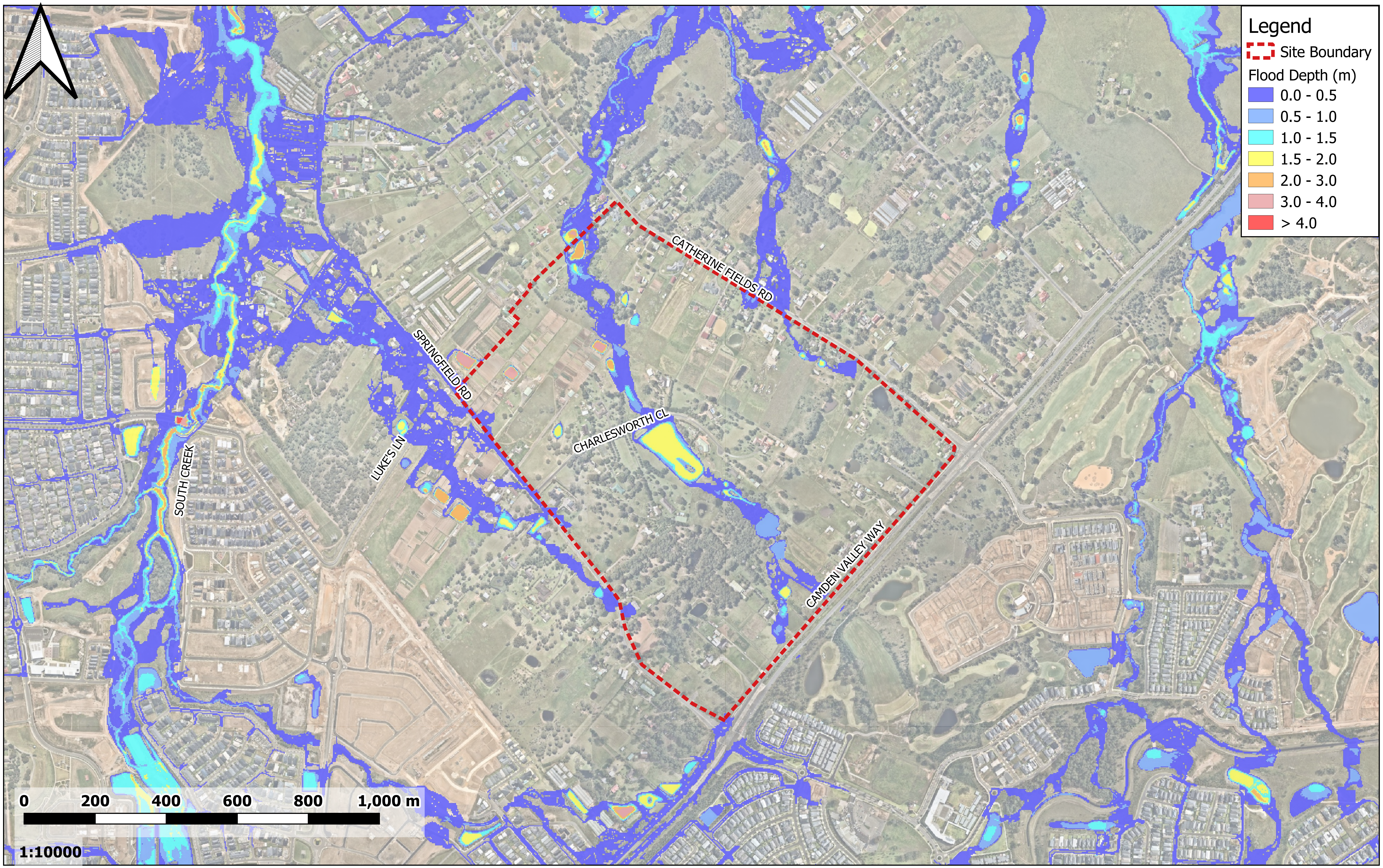
Model - MID


1229
1233a
1233b
1234
1243
1236
1238
1242a
1242b
747b
739
747a

XP-RAFTS POST-DEVELOPMENT CATCHMENT SUMMARY

Cat ID	Model	Landtype	Total Area (ha)	Area 1: Perv	Area 2: Imperv	%Imp	%slope
739	Mid	External	2.103	1.893	0.210	10%	5.04%
747a	Mid	External	1.284	1.168	0.116	9%	3.21%
747b	Mid	Resi	1.755	0.702	1.053	60%	3.21%
1002	East	External	22.168	22.157	0.011	0%	3.07%
1011	East	External	11.396	11.395	0.001	0%	4.28%
1012	East	External	9.451	7.682	1.769	19%	3.67%
1065	East	Resi	36.261	14.504	21.757	60%	1.32%
1066	East	External	21.395	19.256	2.140	10%	2.25%
1067	East	External	18.619	16.758	1.861	10%	1.21%
1229	Mid	External	13.164	11.848	1.316	10%	1.54%
1231	East	Resi/Reserve	15.363	6.145	9.218	60%	2.31%
1234	Mid	Resi/Reserve	5.461	2.184	3.277	60%	3.50%
1235	East	Resi/Reserve	6.469	2.588	3.881	60%	3.32%
1236	Mid	Resi	1.091	0.436	0.655	60%	5.56%
1238	Mid	Resi/Reserve	5.881	2.352	3.529	60%	4.14%
1242a	Mid	External	7.888	7.099	0.789	10%	2.31%
1242b	Mid	Resi/Reserve	1.539	0.616	0.923	60%	2.31%
1243	Mid	External	12.433	11.189	1.244	10%	1.46%
1264	East	External	25.021	22.619	2.402	10%	2.79%
1266	East	Resi/Reserve	9.657	3.863	5.794	60%	2.07%
1233a	Mid	External	2.206	1.985	0.221	10%	1.91%
1233b	Mid	Resi	9.369	3.748	5.621	60%	1.91%
TOTAL			254.9				

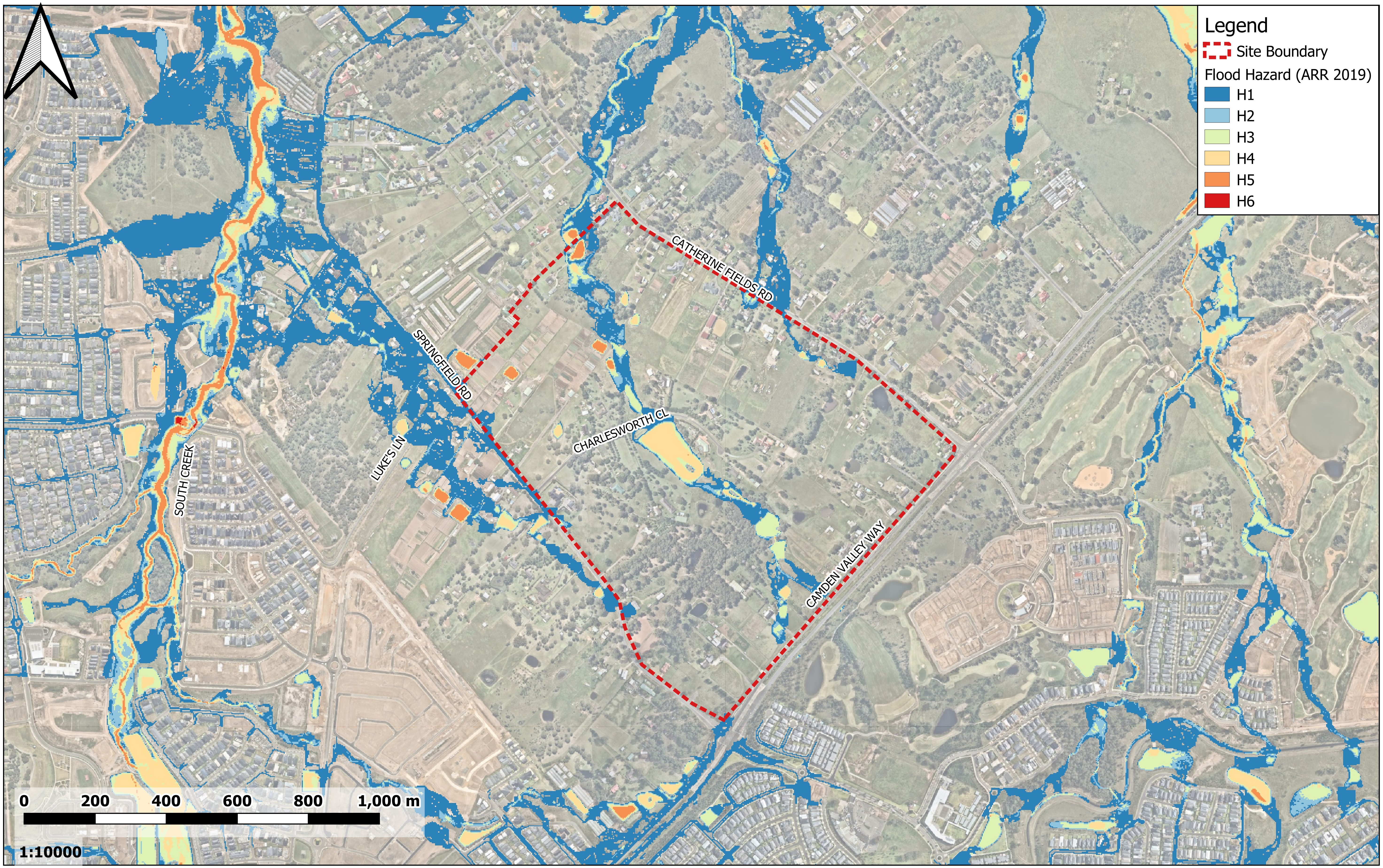
Appendix D – Flood Maps



Storm

Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

Map 01 - Existing Flood Depth
5% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm

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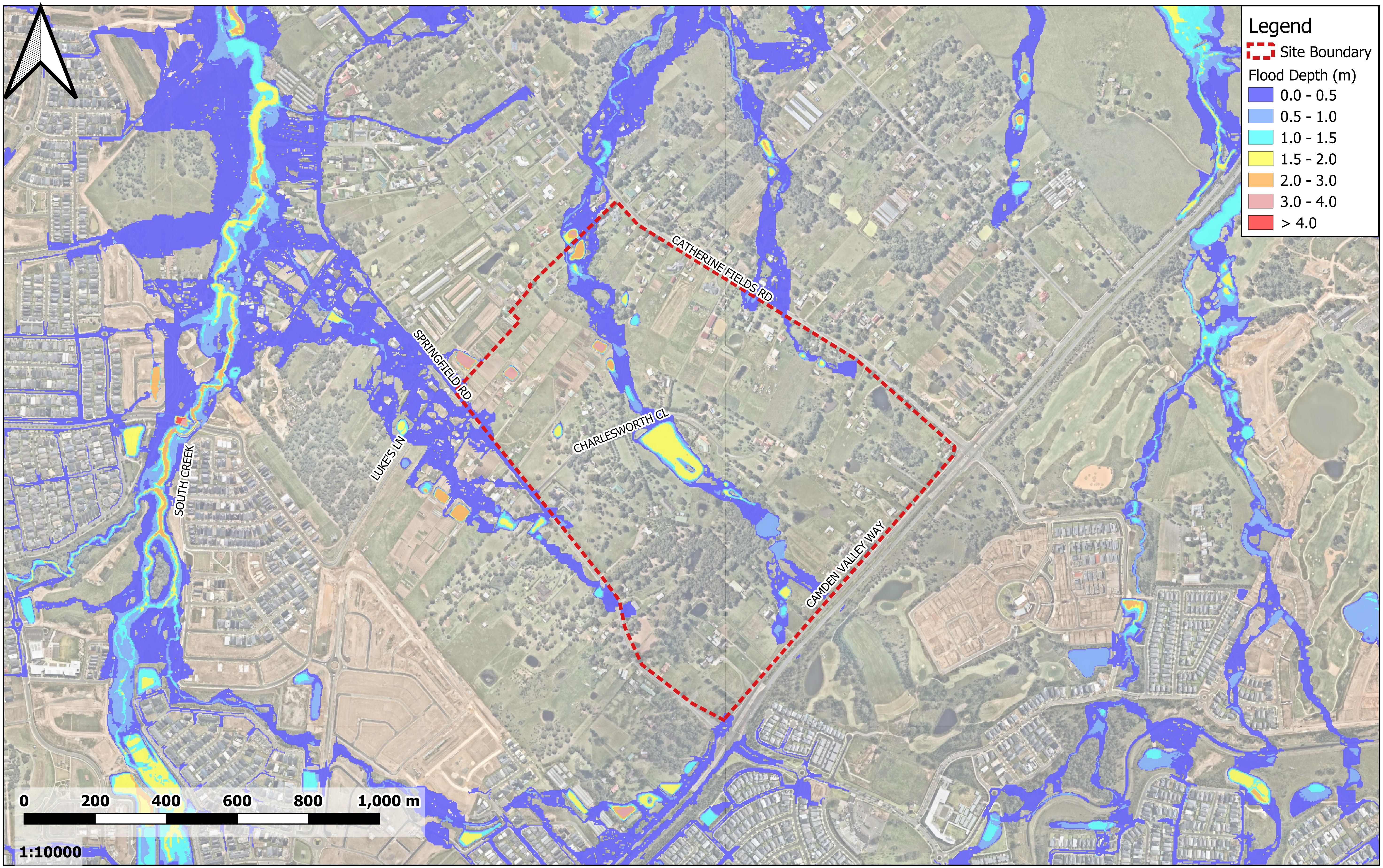
Map 02 - Existing Flood Hazard
5% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



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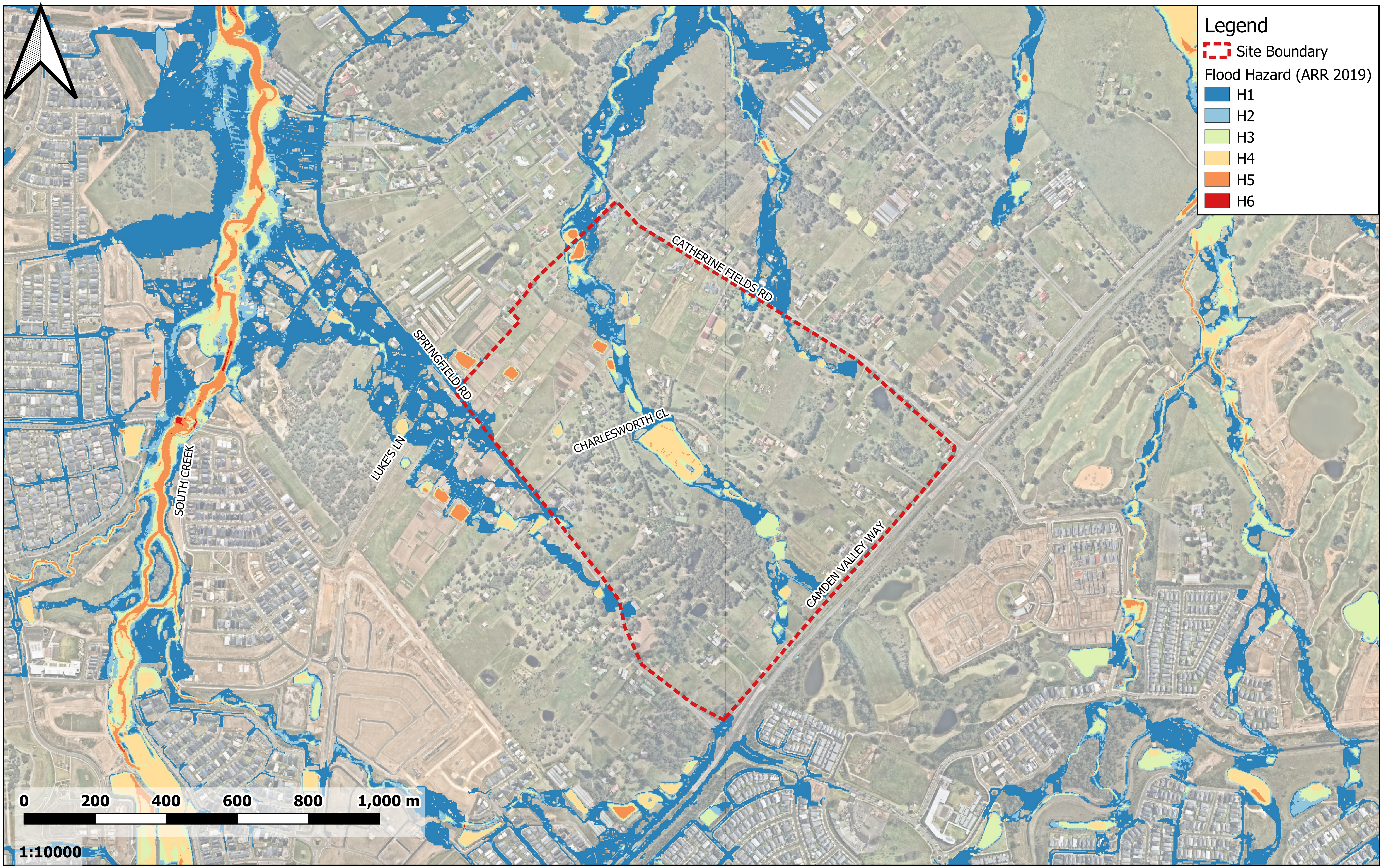
Map 03 - Existing Flood Depth
1% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm

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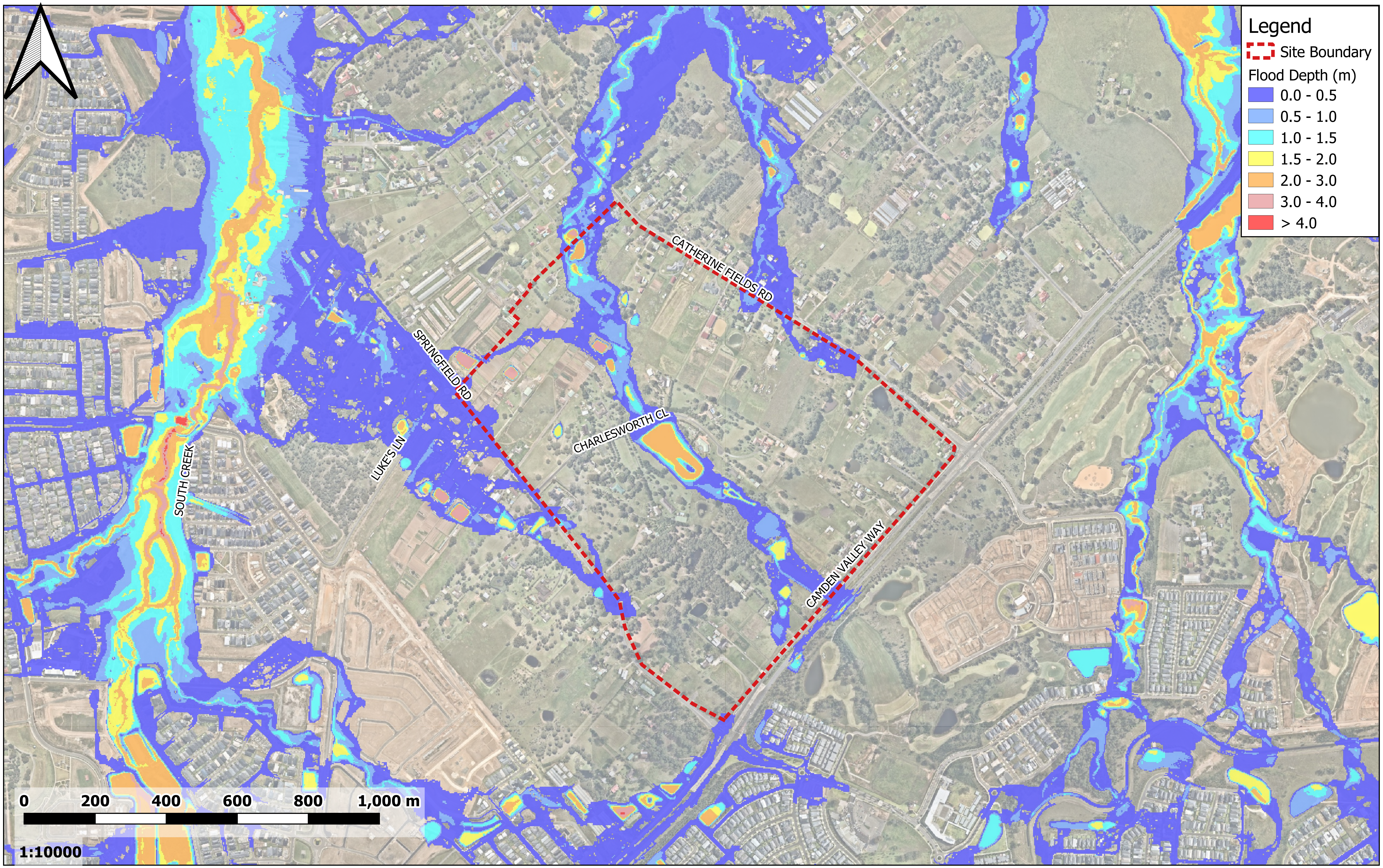
Map 04 - Existing Flood Hazard
1% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm

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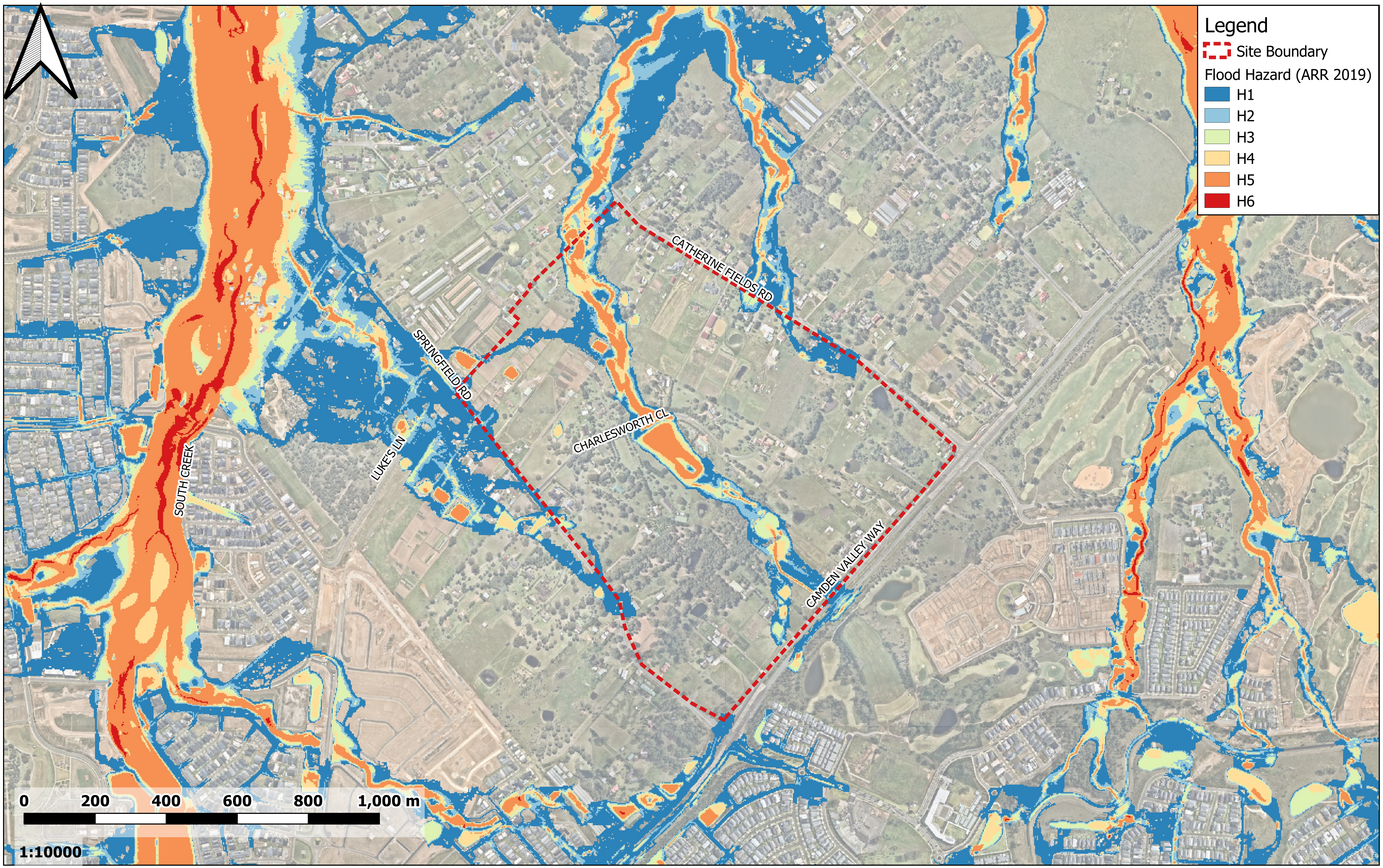
Map 05 - Existing Flood Depth
PMF Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm

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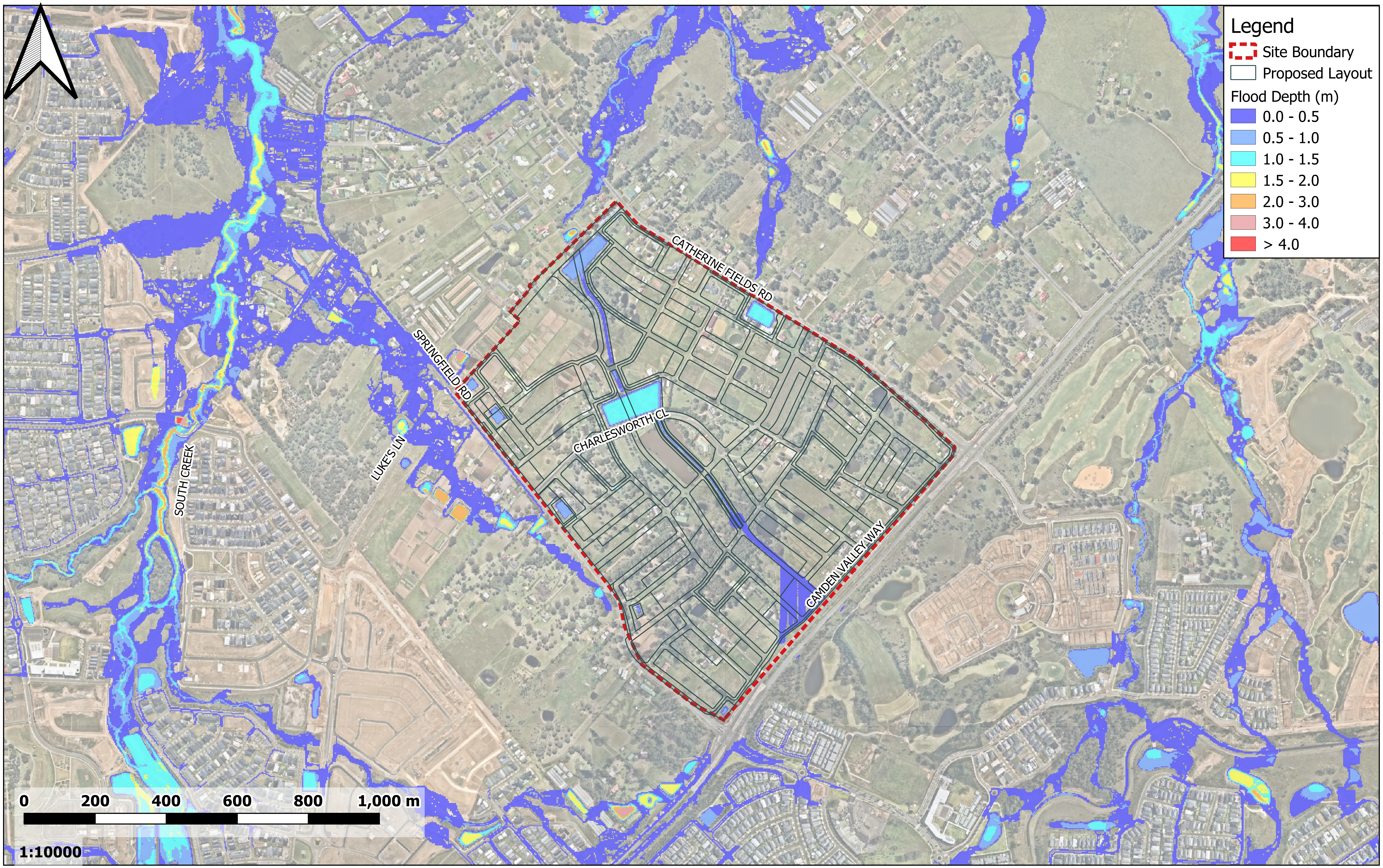
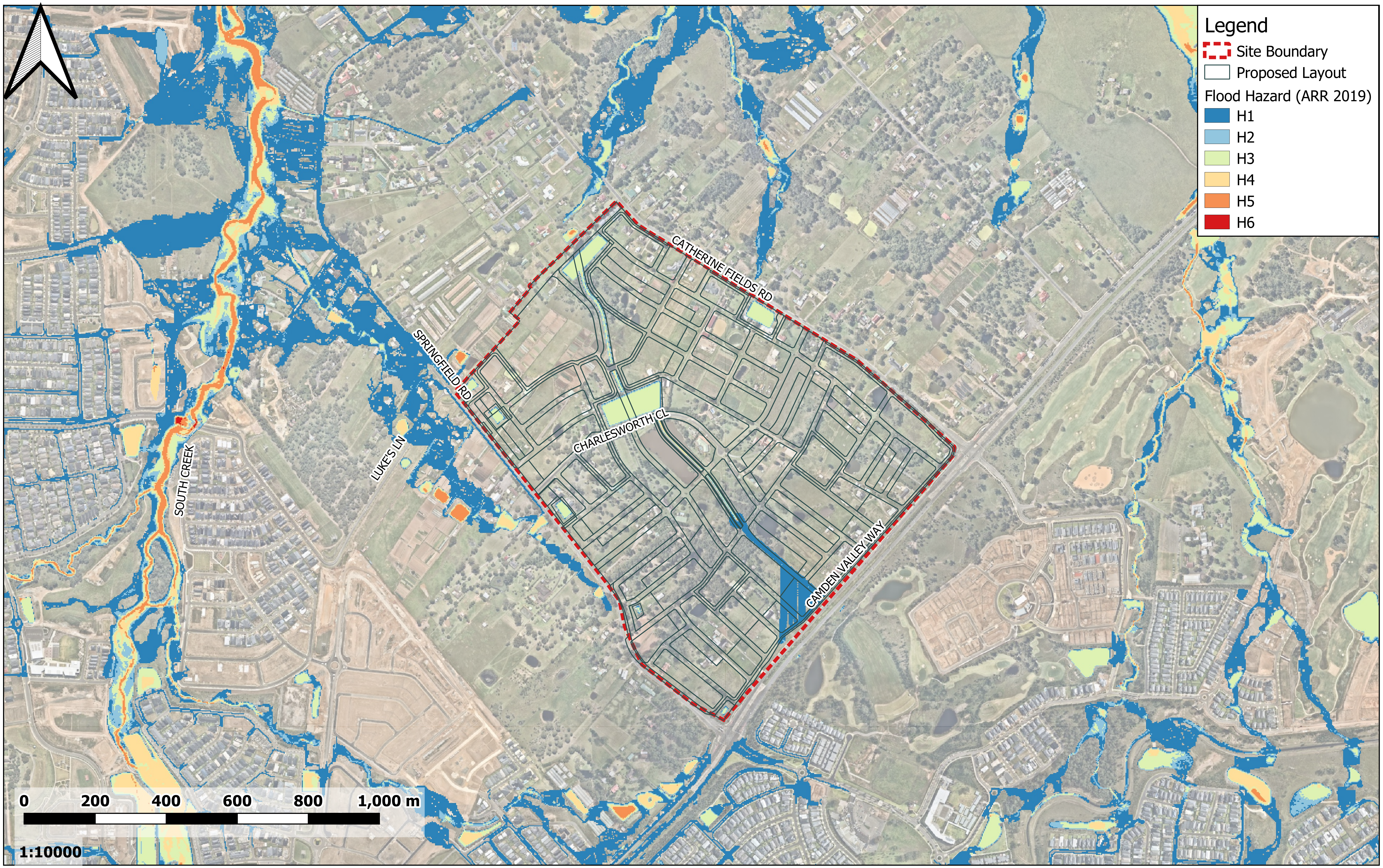
Map 06 - Existing Flood Hazard
PMF Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



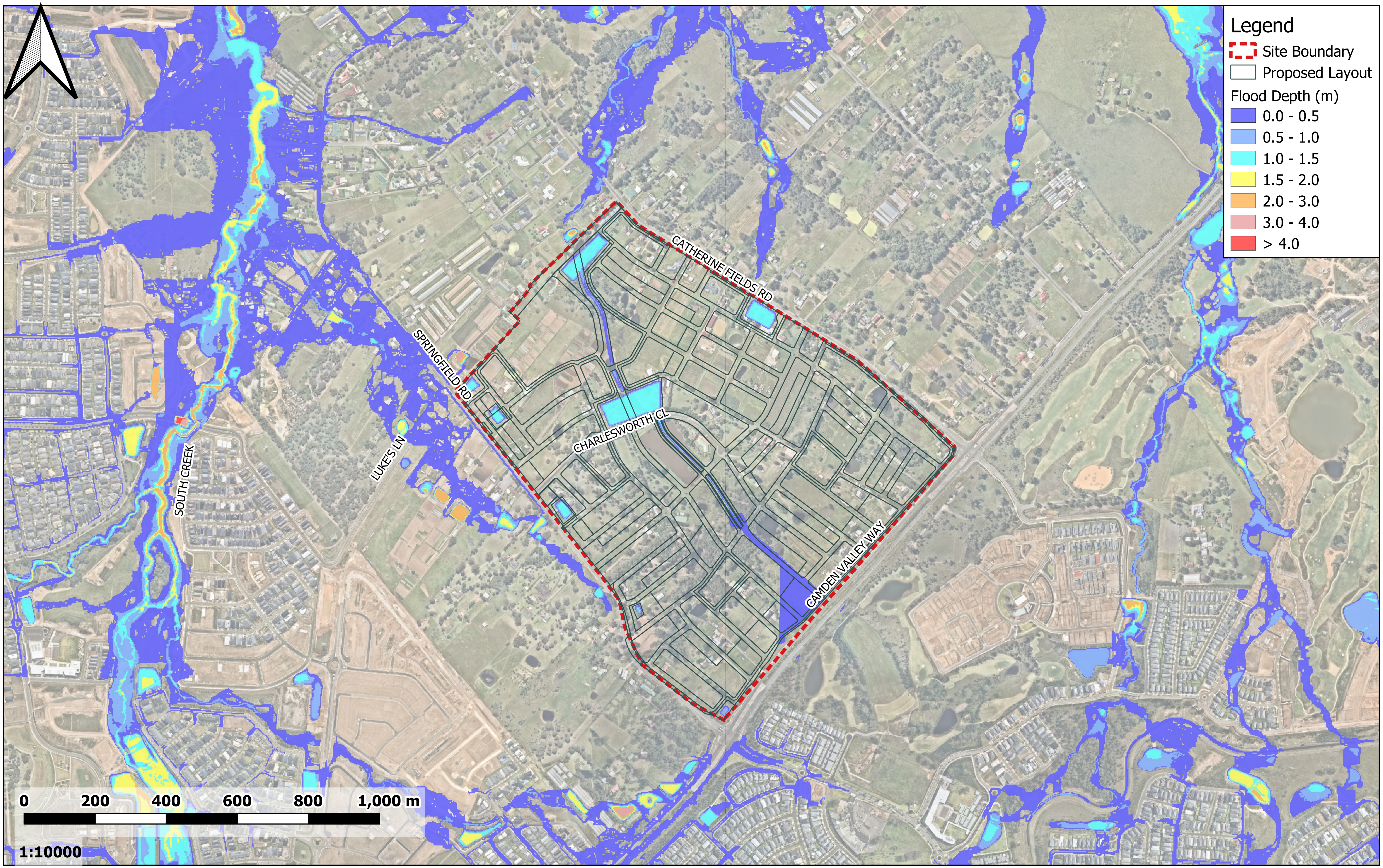
Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

Map 07 - Proposed Flood Depth
5% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



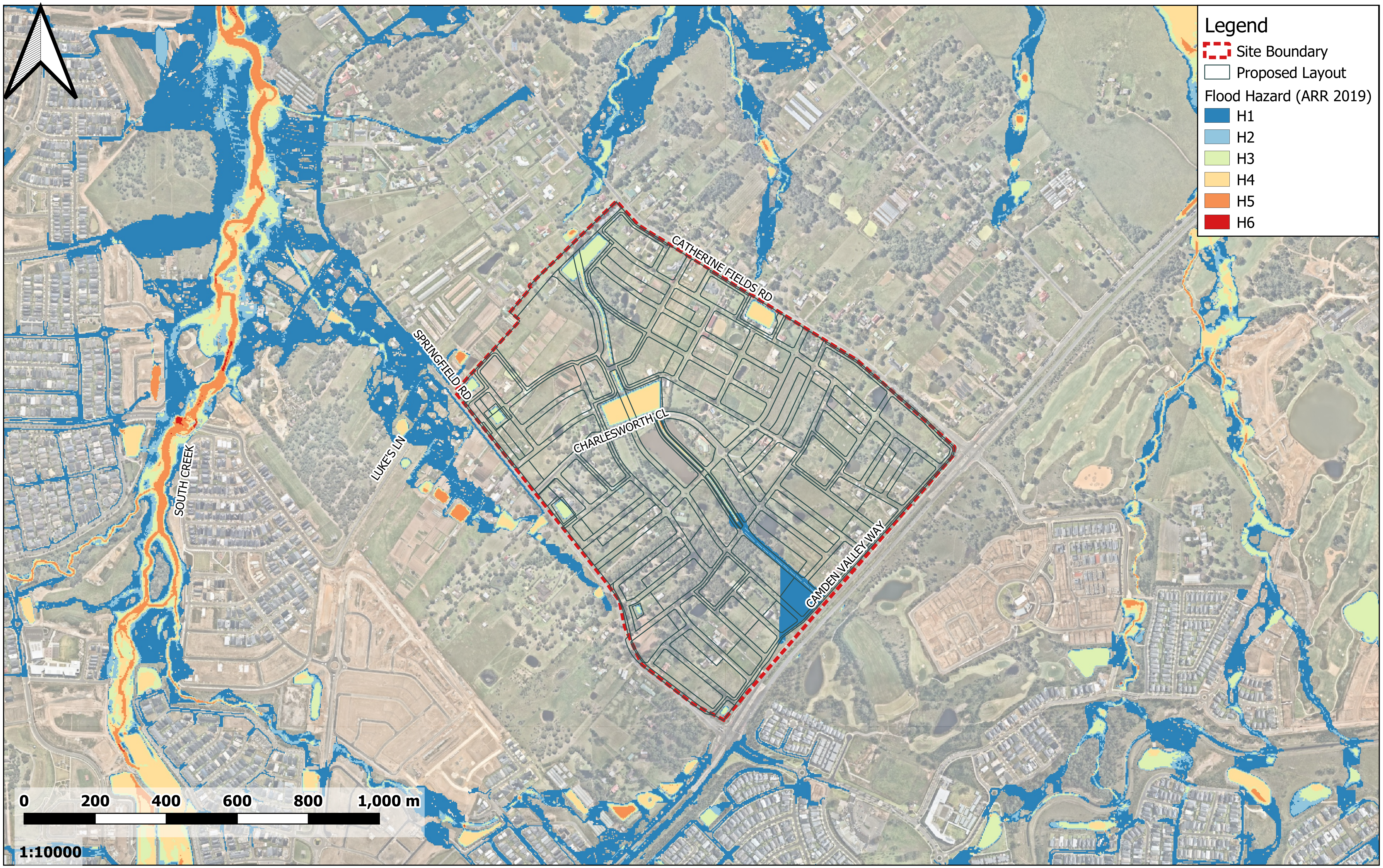
Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

Map 08 - Proposed Flood Hazard
5% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

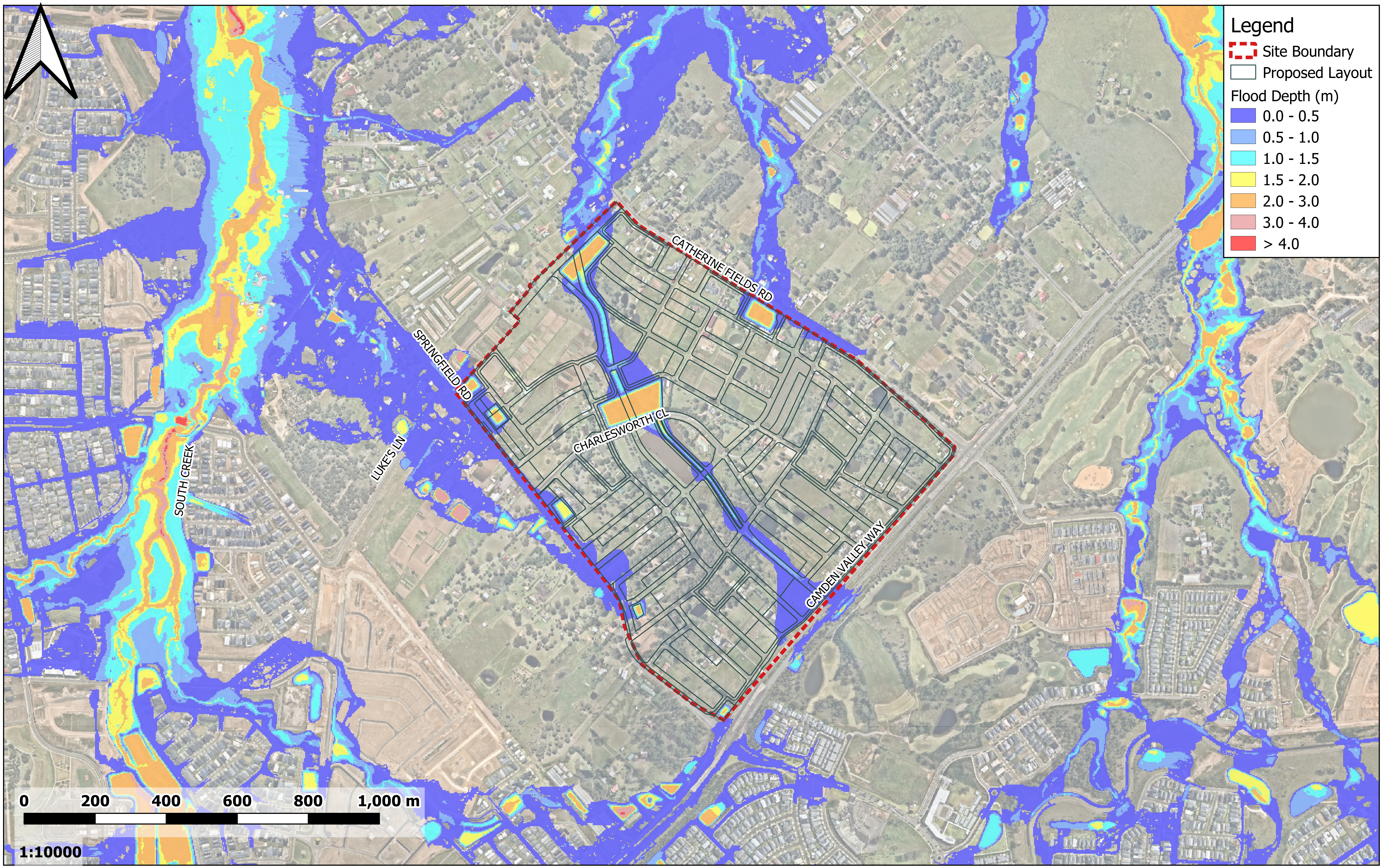
Map 09 - Proposed Flood Depth
1% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



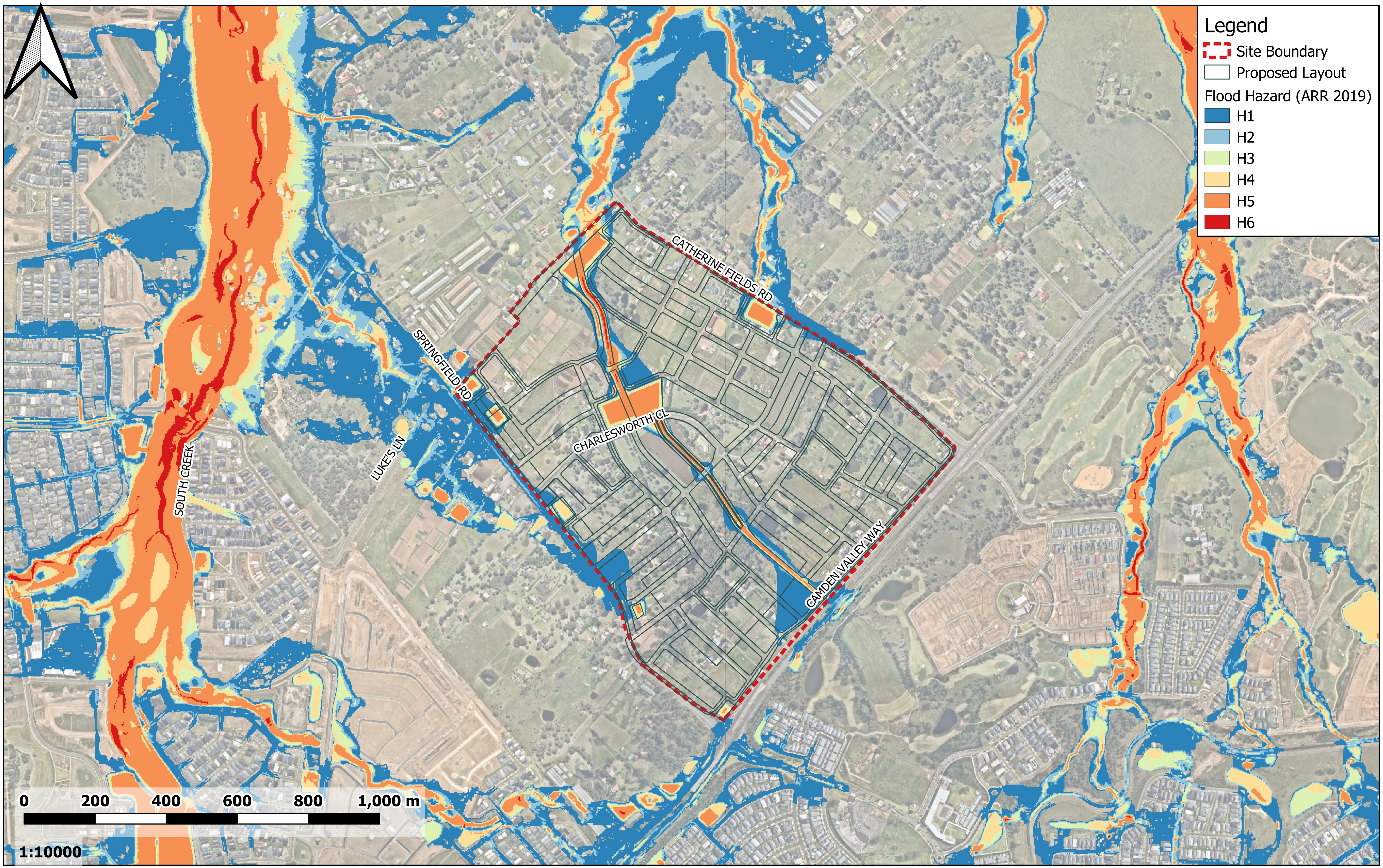
Storm

Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

Map 10 - Proposed Flood Hazard
1% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



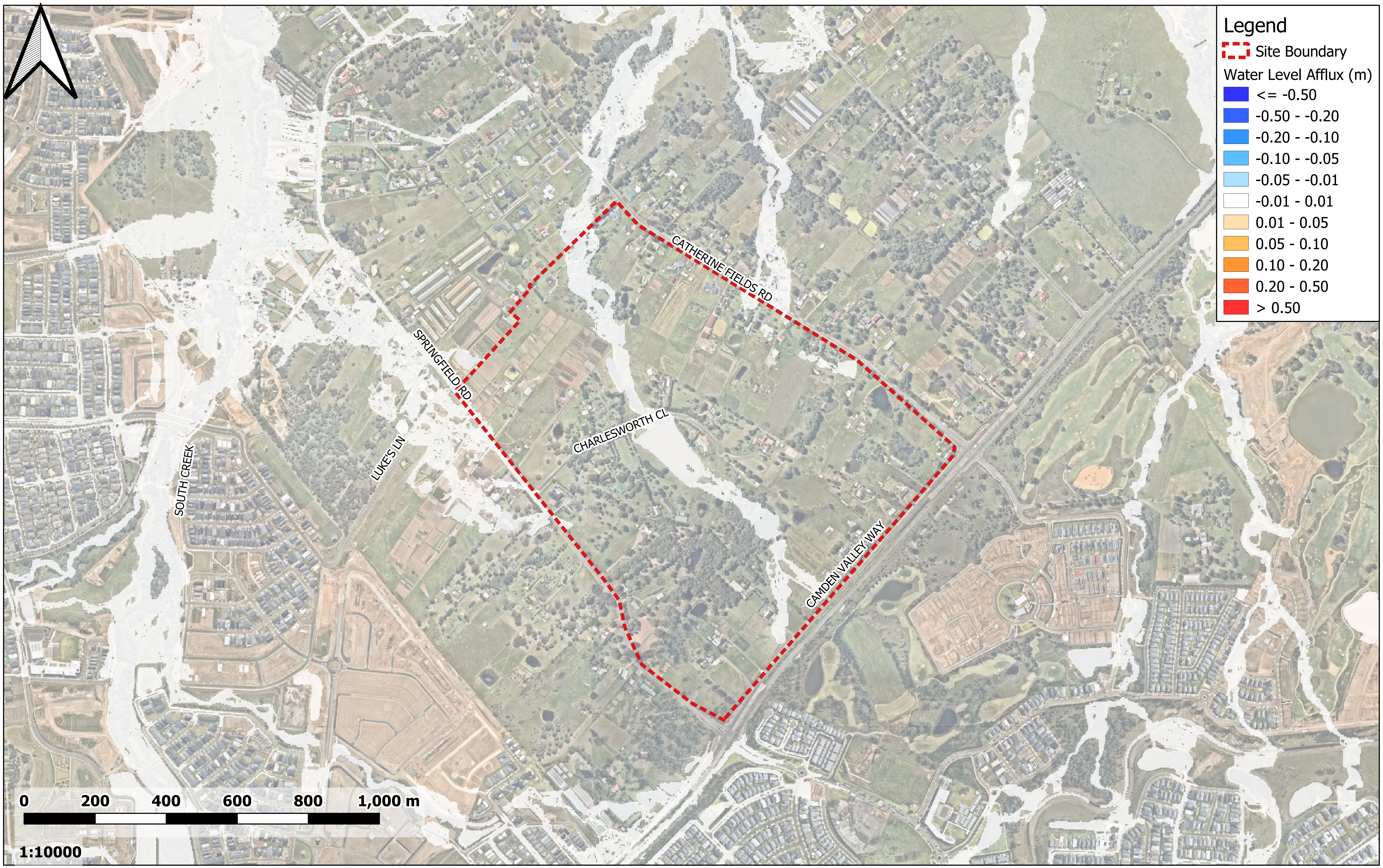
Map 11 - Proposed Flood Depth
PMF Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm

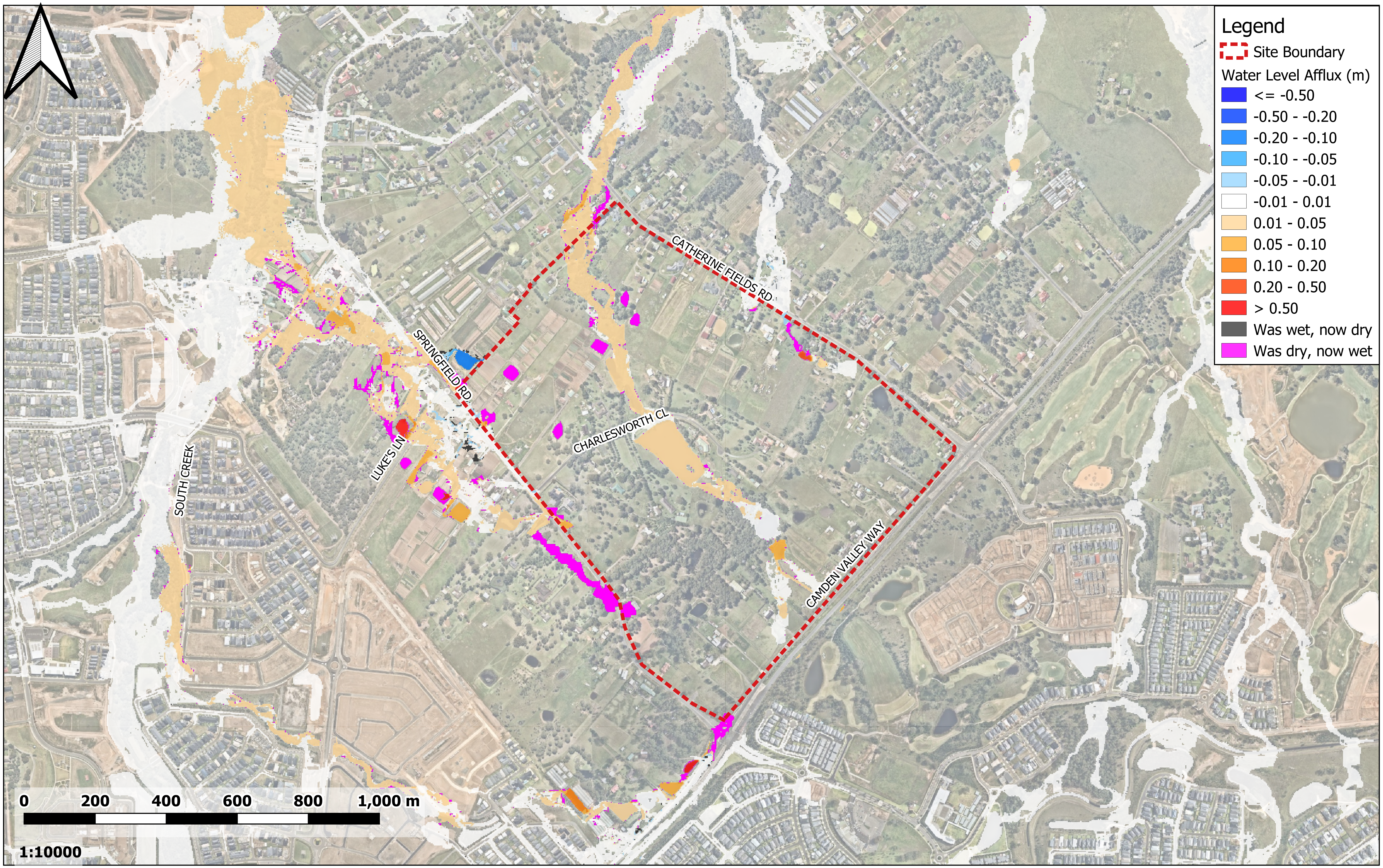
Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

Map 12 - Proposed Flood Hazard
PMF Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

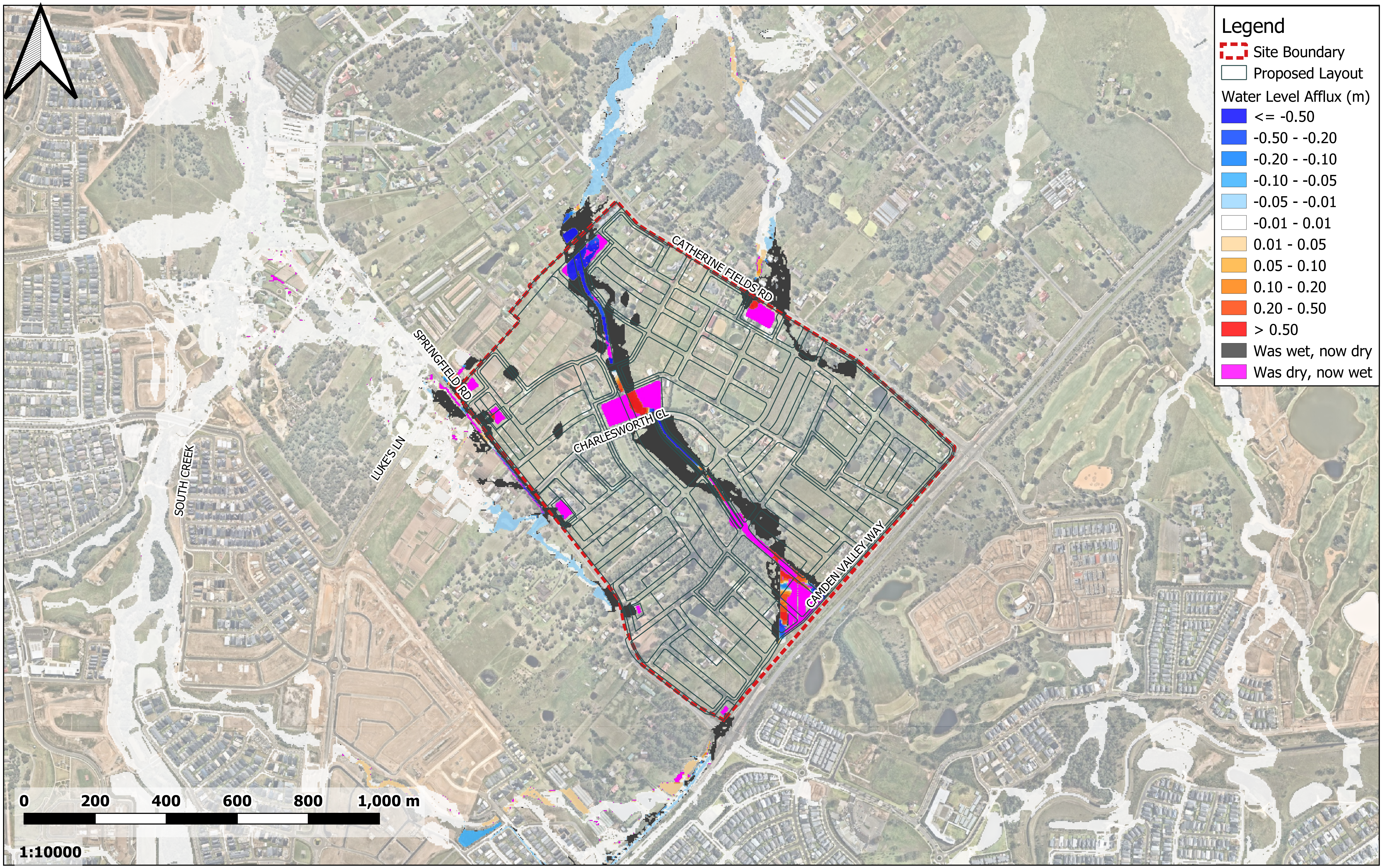
Map 13 - Water Level Afflux (Base Case - Council Results)
1% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm

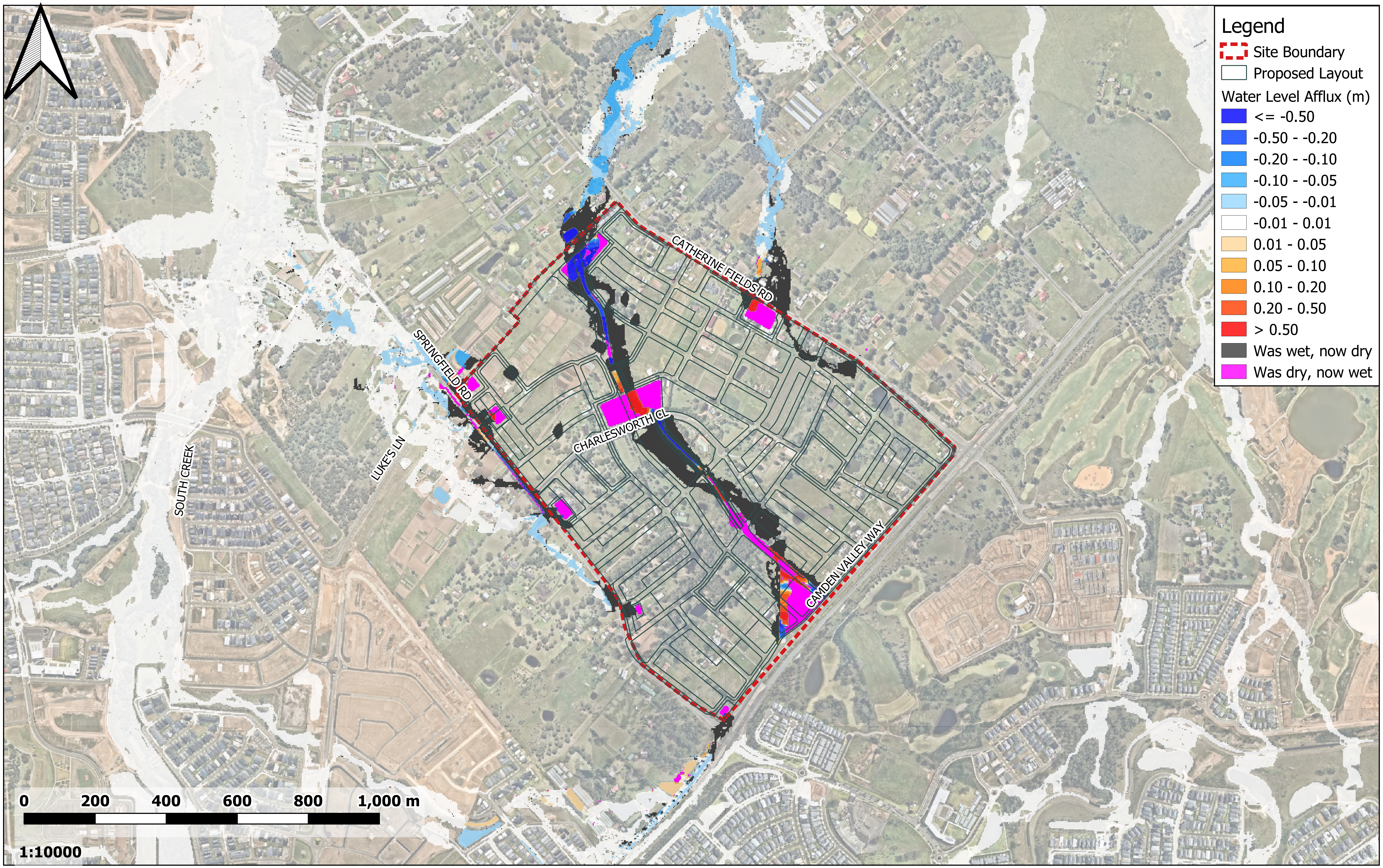
Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

Map 14 - Water Level Afflux (Revised Base Case - Base Case)
1% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

Map 15 - Water Level Afflux (Proposed Scenario - Revised Base Case)
5% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21



Storm endeavours to ensure that the information provided in this map is correct at the time of publication. Storm does not warrant, guarantee or make representations regarding the currency and accuracy of information contained within this map.

Map 16 - Water Level Afflux (Proposed Scenario - Revised Base Case)
1% AEP Maximum Envelope
Catherine Field Planning Proposal, Catherine Field (Camden Council)
Project Number: 416-21