Tallawong Station Precinct South
Deicorp Projects (Tallawong Station) Pty Ltd
16-Apr-2020

Flood Impact Assessment

Tallawong Station Precinct South

State Significant Development Application (SSDA)

Flood Impact Assessment

Tallawong Station Precinct South

Client: Deicorp Projects (Tallawong Station) Pty Ltd

ABN: 73 630 425 955

Prepared by

AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

16-Apr-2020

Job No.: 60618532

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

Quality Information

Document	Flood Impact Assessment
Ref	60618532
Date	16-Apr-2020
Prepared by	William Wong / Andy Toh
Reviewed by	Daniel Fettell

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
001	03-Mar-2020	For Review	Daniel Fettell Principal Engineer – Urban Development Team Leader	
002	16-Apr-2020	For Issue	Daniel Fettell Principal Engineer	

Table of Contents

List of Figures

List of Tables

1.0 Introduction

Tallawong is a key destination within the ever-growing North West Priority Growth Area. As the location for the final Norwest Metro line, Tallawong offers the immediate community direct connection to the city and surrounding key recreational, social and economic facilities.

The site is located:

- Directly adjacent to the Tallawong Metro Station; and
- Adjacent to Schofields Road and Cudgegong Road.

The Tallawong development will deliver residential, commercial and retail services consisting of 987 units. The site area is approximately 70,424m2 with the area shown in Figure 1 below.

This document summarises the design approach, key assumptions, relevant references and standards applied to the development of the civil and stormwater design documentation for the Tallawong Station Precinct South development.

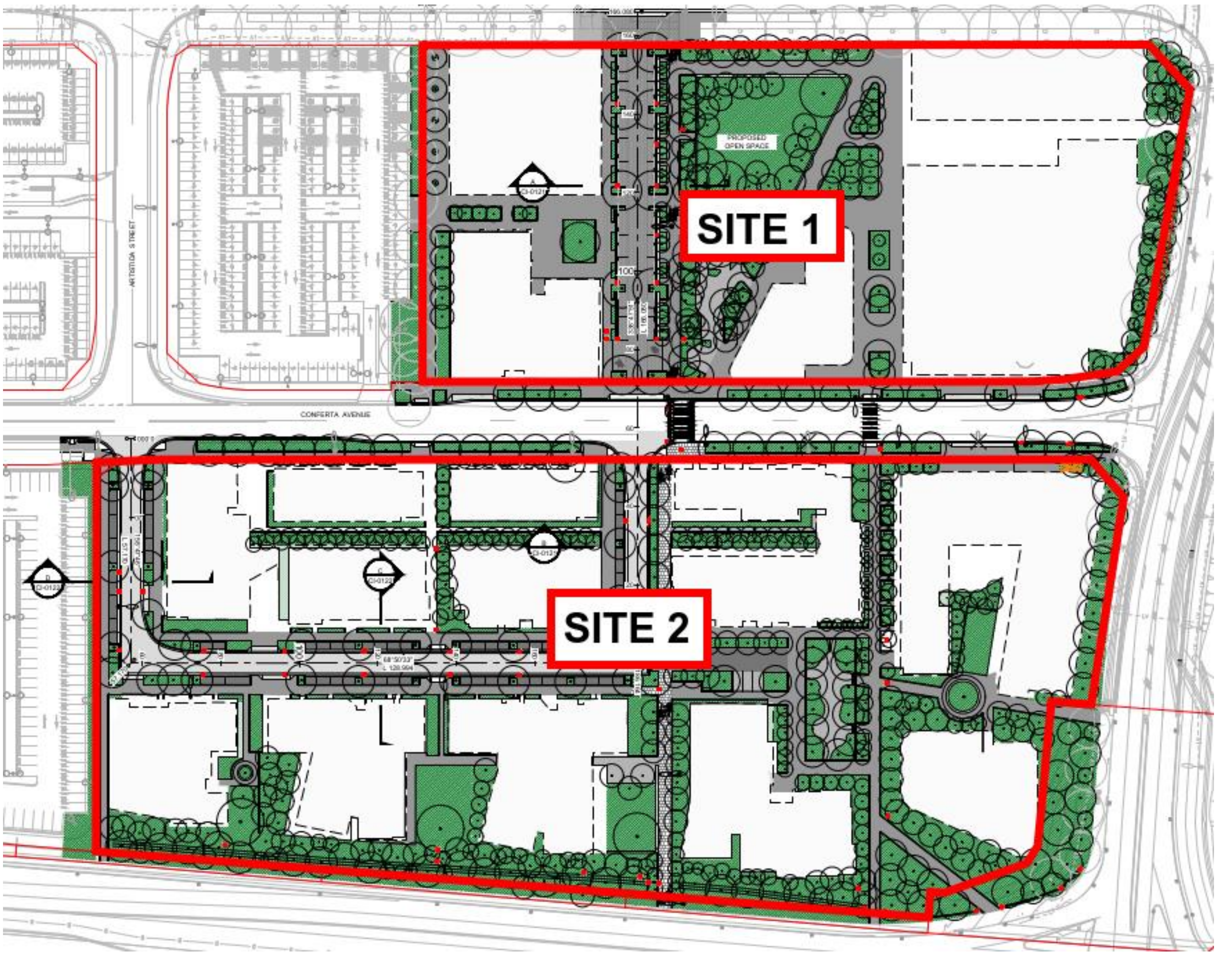


Figure 1 Site Plan

The

Further indicative dedications can be found in the *SSDA Civil Engineering Drawing Package* accompanying this report and the Tallawong Station Precinct South Civil & Stormwater Report.

The concept proposal generally adheres to the State Environmental Planning Policy (SEPP) (Sydney Region Growth Centres, 2006) Indicative Layout Plan (ILP) and Development Control Plan (DCP) for Area 20.

1.1 Planning Requirements

Table 1 below provides a summary of the planning requirements that are addressed within this report, these are from:

- SSD-10425 Secretary's Environmental Assessment Requirements (SEARS);
- Additional recommendations from the Environment, Energy and Science Group (EES); and
- Blacktown City Council (BCC) review of SEARS.

Table 1 Response to SEARs

Item	Description	Action
SEARS	Plans and Documents	The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedules 1 and 2 of the *Environmental Planning and Assessment Regulation 2000* including: • flood impact assessment (including consideration of climate change impacts) and a storm water management strategy including any geotechnical assessment.

2.0 Flood Impact Assessment

2.1 Flood Model Development

2.1.1 Software

The adopted software for this model is TUFLOW. TUFLOW simulates depth-averaged, one and two-dimensional free-surface flows over a regular grid of square elements.

TUFLOW is very flexible in that it can readily input information and output results in a variety of different formats (data files are easily transferable). This allows models to be readily updated with new information such as survey, stormwater infrastructure or building developments/demolitions to keep the model updated. It also makes it easy to adjust the model for future developments and undertake relative impact assessments for different scenarios.

Version 2017-09-AC (Single Precision) of TUFLOW was used for this project.

2.1.2 Rainfall Data and Losses

Rainfall hyetographs are presented in Figure 2 and Figure 3. Initial and continuing loss values were adopted in line with Blacktown City Council’s design criteria and are summarised in Table 2 .

Pervious land uses were delineated according to observed land use in aerial imagery for the existing scenario with adjustments based on land zoning data for the developed scenario. Rainfall data from ARR1987 has been adopted and hyetographs are provided at the end of this report.

Table 2 Adopted rainfall losses

Surface type	Initial Loss (mm)	Continuing Loss (mm/hr)
Rural and riparian corridor	15.0	2.5
Roads and development lots	1.0	0.0
Urban parkland	5.0	2.5

To minimise the volume of runoff trapped within building footprints due to high roughness and uneven terrain, these footprints were excluded from the direct rainfall application polygon. To account for the excluded areas, the rainfall depth for the rest of the direct rainfall application polygon has been proportionally increased in the localised areas where roof drainage is expected to discharge to.

2.1.3 Extent of Grid Size

A cell size of 1 m by 1 m was adopted for this study. The extent of the model is shown in Appendix A Figure A1 and Figure A2.

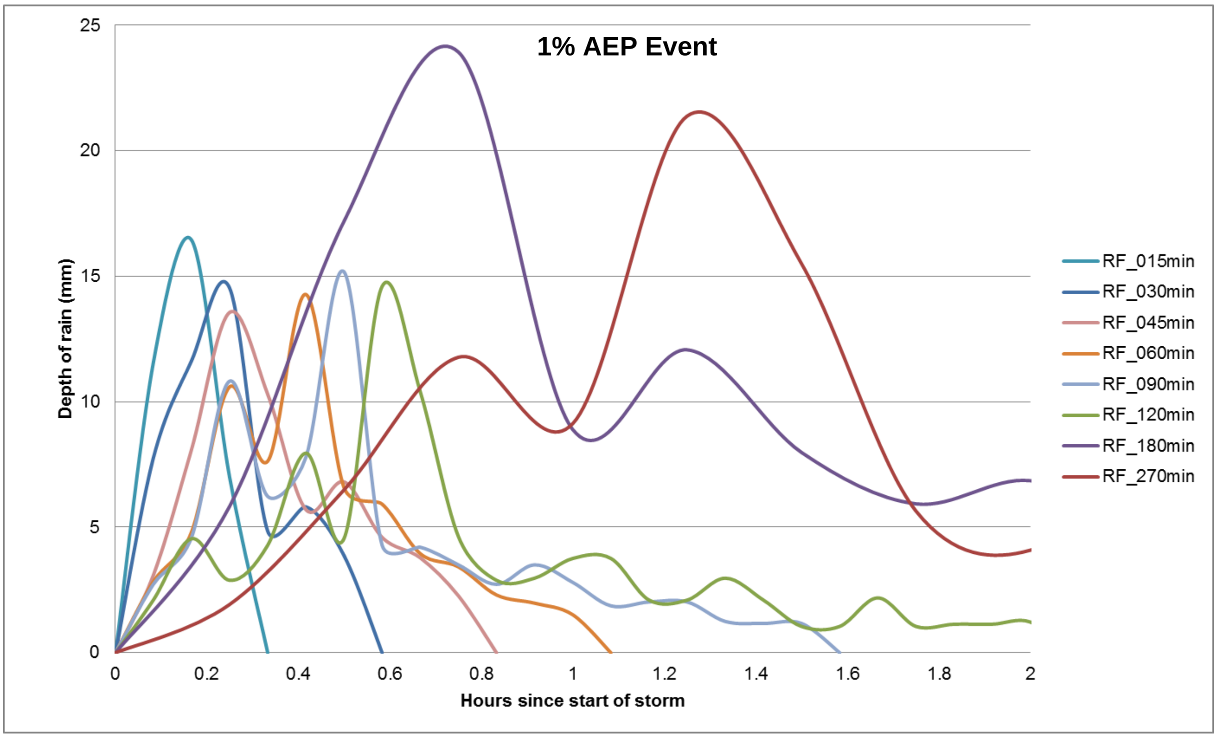


Figure 2 1% AEP hyetographs (ARR1987)

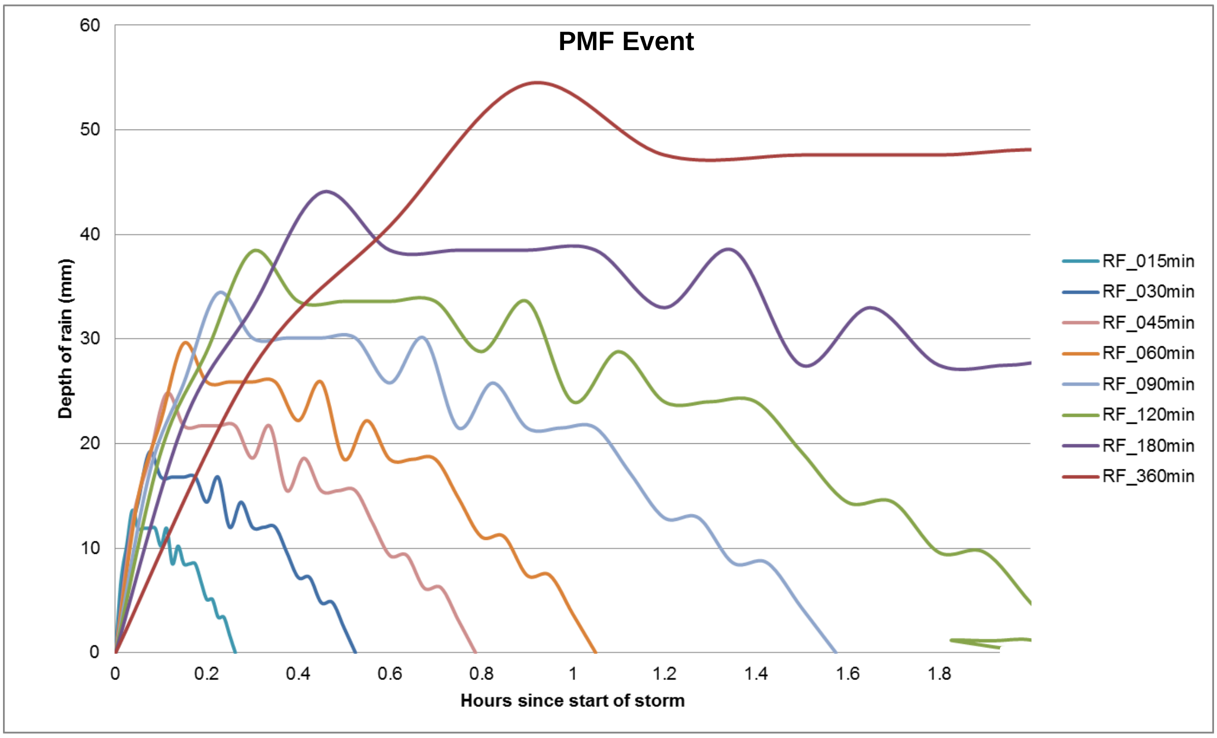


Figure 3 PMF hyetographs (ARR987)

2.1.4 Terrain

The terrain adopted in the TUFLOW model was created using a layered approach to add detail where required from the sources of terrain made available during the model development process. Land and Property Information (LPI) NSW LiDAR dataset flown on 13-14/05/2011 formed the basis for the overall model topography.

Client supplied design TINs from Northwest Rapid Transit (NRT) were used to define the Tallawong Station enabling works, precinct roads and earthworks. The design TINs were also used to represent the proposed development site.

Several terrain modifications were made to represent current site conditions in the model. These included:

- Various road crests and kerbs were enforced in the terrain to ensure their potential hydraulic impact is captured;
- The centreline of selected gullies and other small channels were enforced in the model topography to ensure appropriate representation of overland flow paths along the southern boundary of Area 2;
- The interface between different TINs was smoothed where necessary to allow for unobstructed flow paths and more stable transitions; and
- Runoff from within the proposed station and rail line was precluded from entering Council's networks which is consistent with the NRT drainage approach.

2.1.5 1D Network

The pit and pipe network includes all existing and proposed pits in precinct roads, station enabling works and the development site. These details were taken from as-built surveys or design plans from RMS/NRT or from digital designs in 12d software.

Standard entry and exit loss values were assigned to the pipe network as shown in Table 3. A blockage of 50% was applied to the piped drainage for all scenarios.

Table 3 Adopted entry and exit losses

Variable	Circular Pipe
Entry loss	0.5
Exit loss	1
Width contraction coefficient	1

2.1.6 Surface Roughness and Building Representation

The area of assessment is dominated by roads, car parks, grassed areas and public open space. Downstream areas of the site include grassed areas and floodplain.

Hydraulic roughness in the 2D model domain is applied using GIS layers which define the extent of unique land uses. In the 1D model domain the adopted roughness value is applied to each pipe as one of its attributes. The Manning's "n" values adopted for the study area, including flow paths (overland, pipe and in-channel) are shown in Table 4. The spatially-varying roughness values for the model are shown in Figure A1 and Figure A2.

Note that the modelling approach has been to block out the proposed building footprints to ensure that no flood storage is modelled within buildings which are intended to remain flood free.

Table 4 Adopted hydraulic roughness coefficients

Surface type	Adopted roughness value
Concrete pipes	0.015
Road and car parks	0.02
Grassed, landscaped areas	0.03

Surface type	Adopted roughness value
Public open space parkland	0.045
Floodplain vegetation	0.065 – 0.10
Trees and shrubs	0.06
Commercial	0.025
Fenced properties	0.1

2.1.7 Boundary Conditions

Tail water levels in Second Ponds Creek were modelled as a static water level adopted from modelling carried out as part of the station enabling works assessment. These were taken from NRT flood maps prepared during the enabling works design.

Peak water levels were adopted for the 1% Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF) under existing and climate change scenarios.

Event	Adopted tailwater level (m AHD)
1% AEP	46.8
PMF	48.4

Modelling shows that the development is not sensitive to these levels and adopting a static water level provides a reasonable boundary.

2.1.8 Design Flood Estimation

To determine the critical storm duration across the entire site, modelling of the 1% AEP and PMF event was undertaken for design storm durations ranging from 15 minutes to 360 minutes.

A critical duration of 90 minutes and 15 minutes were found for the 1% AEP and PMF respectively. Being a small catchment, different durations yield very similar maximum flood levels.

2.1.9 Scenarios

Flood Planning Levels

For the purposes of defining flood planning levels, the post development catchment condition includes the development of the Town Centre North, which has the potential to contribute runoff to Area 1 and Area 2 in large storm events.

Flood planning levels are provided for the PMF event and for the 1% annual exceedance probability (AEP) event with 15% increase in rainfall intensity and 50% blockage of all stormwater pipes.

Flood Impact

For the purposes of carrying out flood impacts, the existing development catchment condition includes the Tallawong Station enabling works, Conferta Avenue and Themeda Avenue and upgraded Cudgegong Road and Tallawong Roads.

The post development catchment condition excludes the development of the Town Centre North, which has the potential to contribute runoff to Area 1.

Flood impacts are determined for the critical 1% AEP event assuming ARR1987 rainfall and 50% blockage of all stormwater pipes.

2.2 Flood Model Results and Mapping

2.2.1 Validation of Rainfall on Grid Results

A stand-alone hydrologic model (DRAINS) has been developed to validate the runoff generation in the TUFLOW model. The DRAINS model predicts a peak flow rate of 4.7 m3/s east of Cudgegong Road under developed conditions

The TUFLOW model, which includes more rigorous hydraulic calculations and storage properties, predicts a peak flow rate of 4.9 m3/s across Cudgegong Road.

Given the differences in model structure, a difference of 5% is good agreeance between models. Therefore, the TUFLOW model is considered suitable for flood assessment purposes and for setting habitable floor levels.

2.2.2 Flood Planning Levels

The flood planning levels for the site were determined under the following conditions:

- 50% blockage of stormwater pipes
- Buildings blocked-out of the floodplain
- Car parking in western areas of the site
- Developed catchment conditions north of the station
- No runoff from the station entering Council's stormwater network
- Urban losses for parkland
- 15% increase in 1% AEP rainfall depths to allow for future climate change, per council requirements.
- Proposed drainage swale and overland flow path along the southern boundary of Site 2.

1% AEP flood depths and flood planning levels are shown in Appendix A Figure A3 and the PMF flood levels in Appendix A Figure A4.

2.2.3 Flood Impacts

The flood impacts for the post development site were determined under a 50% blockage condition of all pipes. Both pre and post development conditions assume no development north of the station and rail line, which has the potential to contribute some flows south of the rail line and along Cudgegong Road.

The 1% AEP flood impacts on lands external to the development site are confined to Council roads, current drainage lands (zoned SP2) and on the car park area west of Area 2 as shown in Figure A5. A discussion of these impacts is provided below.

Area 1 – Car Park 2

Under existing 1% AEP flood conditions, overland flow from Car Park 2 is shown to discharge into the south western corner of the proposed development. This results in sheet flow across the development site.

Under developed 1% AEP conditions, the proposed development will divert this overland flow south to the proposed drainage swale along Schofields Road. This will result in 250 mm of flood depth at the edge of the car park and low hydraulic hazard conditions on the NRT metro lands. This impact does not pose a safety risk to cars or pedestrians or private property.

In the future, and as a requirement of the re development of the car park, stormwater drainage will be provided to prevent discharge onto the development site. This impact does not affect the future development potential of the car park lands.

On these grounds, the impact is considered to be acceptable.

Area 2 – Conferta Avenue and Cudgegong Road

Under existing 1% AEP flood conditions, overland flow enters Conferta Avenue in a controlled manner via swales and sediment basins.

Under developed 1% AEP conditions, the volume and flow rate of overland flow entering Conferta Avenue will increase but will be controlled via trunk drainage lines. This results in a minor increase in flow depths (up to 100 mm), a maximum depth of 250 mm within the gutter and low hydraulic hazard conditions along Conferta Avenue.

On these grounds, the impact is considered to be acceptable.

Area 3 – Conferta Avenue and Cudgegong Road Intersection

The modelled 50% blockage scenario shows that additional discharge to Conferta Avenue may cause localised high hydraulic hazard conditions in the very invert of the southern kerb return. This flooding is isolated and surrounded by areas of low hazard which mitigates the risk of cars potentially being washed into buildings or waterways. This also demonstrates that the majority of the street would be trafficable in a 1% AEP event, even with 50% blockage of local pipes.

Given that this is a conservative scenario, the impact is considered to be acceptable.

Area 4 – Schofields Road

Under existing 1% AEP flood conditions, overland flow from Schofields Road will enter the development site across the southern boundary.

The proposed development will include a swale to prevent overland flow entering the site and is shown to result in a 30 mm increase in flow depth within the Schofields Rd kerb. Flow depths in Schofields Road (under a 50% blockage condition) are less than 250 mm and have a low flood hazard.

On these grounds, the impact is considered to be acceptable.

Area 5 – Council Owned SP2 Lands

The proposed development will discharge more runoff to the drainage easement east of Cudgegong Road, resulting in slightly elevated flood levels (30mm increase) when compared to existing conditions. This is associated with a low hydraulic hazard and it is contained within SP2 drainage lands which are designated for a flood and drainage management purpose.

On these grounds, the impact the impact is considered to be acceptable.

2.2.4 Flood Evacuation

The proposed development site sits outside the mainstream flood extents of Second Ponds Creek and there is no associated flood hazard to residents in either 1% or PMF events. Localised flooding will create relatively shallow flooding around proposed buildings in both 1% AEP and PMF events.

PMF flood levels around buildings is shown to be within 500 mm of the 1% AEP peak flood level with allowance for 1% AEP climate change. This means that the habitable floor level should also be above the PMF level and evacuation will not be required. Residents can safely shelter in place. It should be noted that evacuation via Cudgegong Road and Conferta Avenue will be unsafe for passenger vehicles during PMF conditions. As such habitable floor levels 450 mm above the proposed raised ground level are acceptable flood protection for the buildings in the south of the site. As the northern block (Site 1) is not impacted by flooding, floor levels at grade with the proposed ground level are appropriate.

2.2.5 Flood Hazard

The flood hazards based on preliminary hazard as defined in Figure L2 of the Floodplain Development Manual (2005) for the 1% AEP and PMF event were modelled across the existing roads and proposed development under 50% blockage criteria for the stormwater drainage network.

With the exception of the intersection of Conferta Avenue and Cudgegong Road, 1% AEP flood hazards are shown to be low.

Flood depths at the intersection of Conferta Avenue and Cudgegong Road imply unsafe conditions are limited to the very low point of the kerb, but these conditions do not extend across the entire road corridor.

3.0 Conclusion

Responses to design standards and approaches taken to fulfil the requirements are summarised below.

Summary of Responses to SEARs

Table 5 provides a summary of how each of the project SEARS requirements (SSD9063) are addressed in this management plan.

Table 5 Response to SEARs

Item	Action	Response
SEARS Plans and Documents	The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedules 1 and 2 of the *Environmental Planning and Assessment Regulation 2000* including: • flood impact assessment (including consideration of climate change impacts) and a storm water management strategy including any geotechnical assessment;	Please see responses below: • A detailed flood impact assessment has been carried out within this report

Appendix A – Flood Impact Assessment Maps

List of Figures

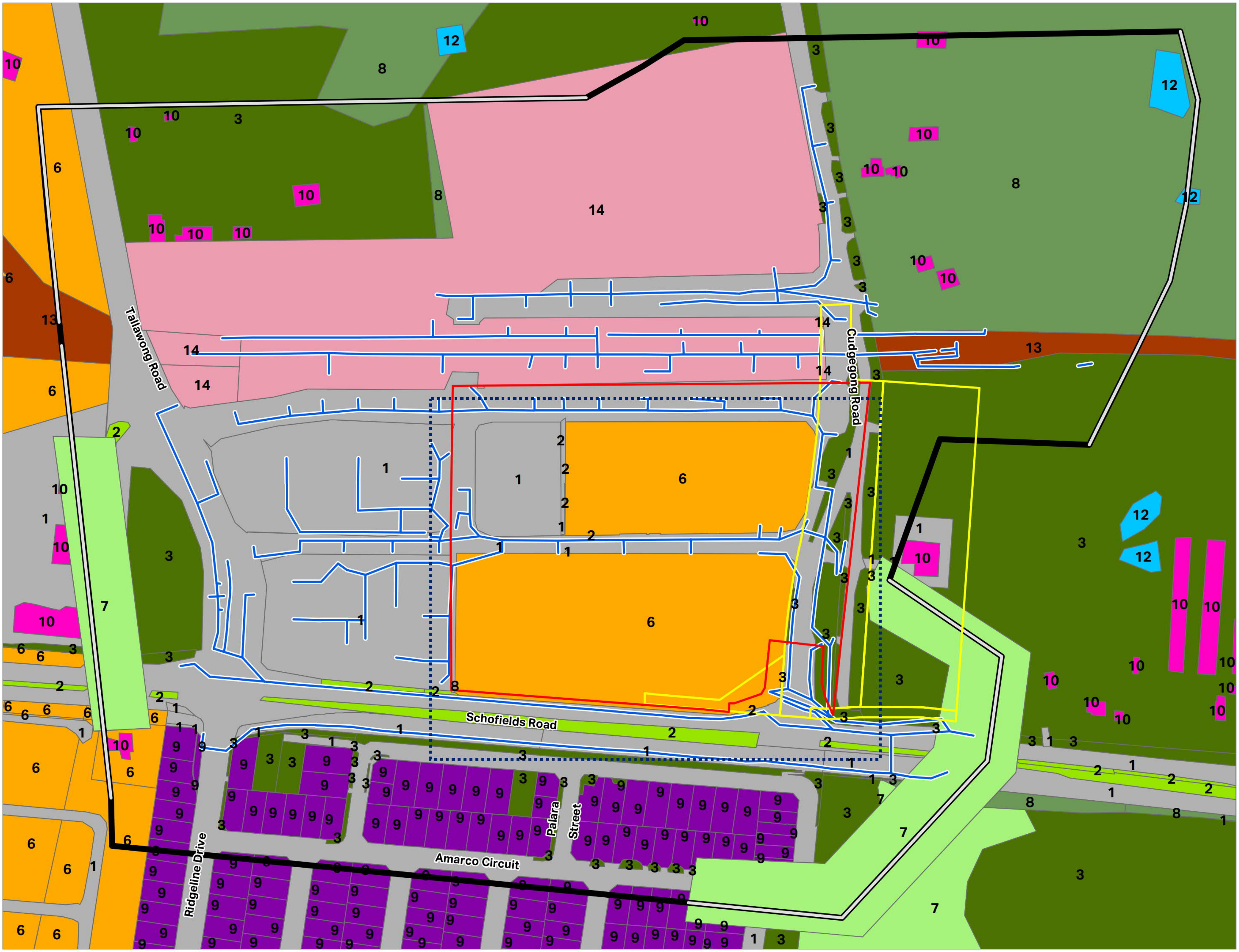


FIGURE A1 TUFLOW MODEL EXISTING CASE

KEY

- Site Boundary
- Limit of mapping
- SP2 zoned land
- Existing stormwater pipe
- 1 Asphalt
- 2 Well Maintained Grass Cover
- 3 Non Maintained Grass Cover
- 6 Sand
- 7 Medium Density Vegetation
- 8 Mildly Dense Vegetation
- 9 Fenced Properties
- 10 Buildings
- 12 Water
- 13 Rails
- 14 Commercial

AECOM

0 50 100 m

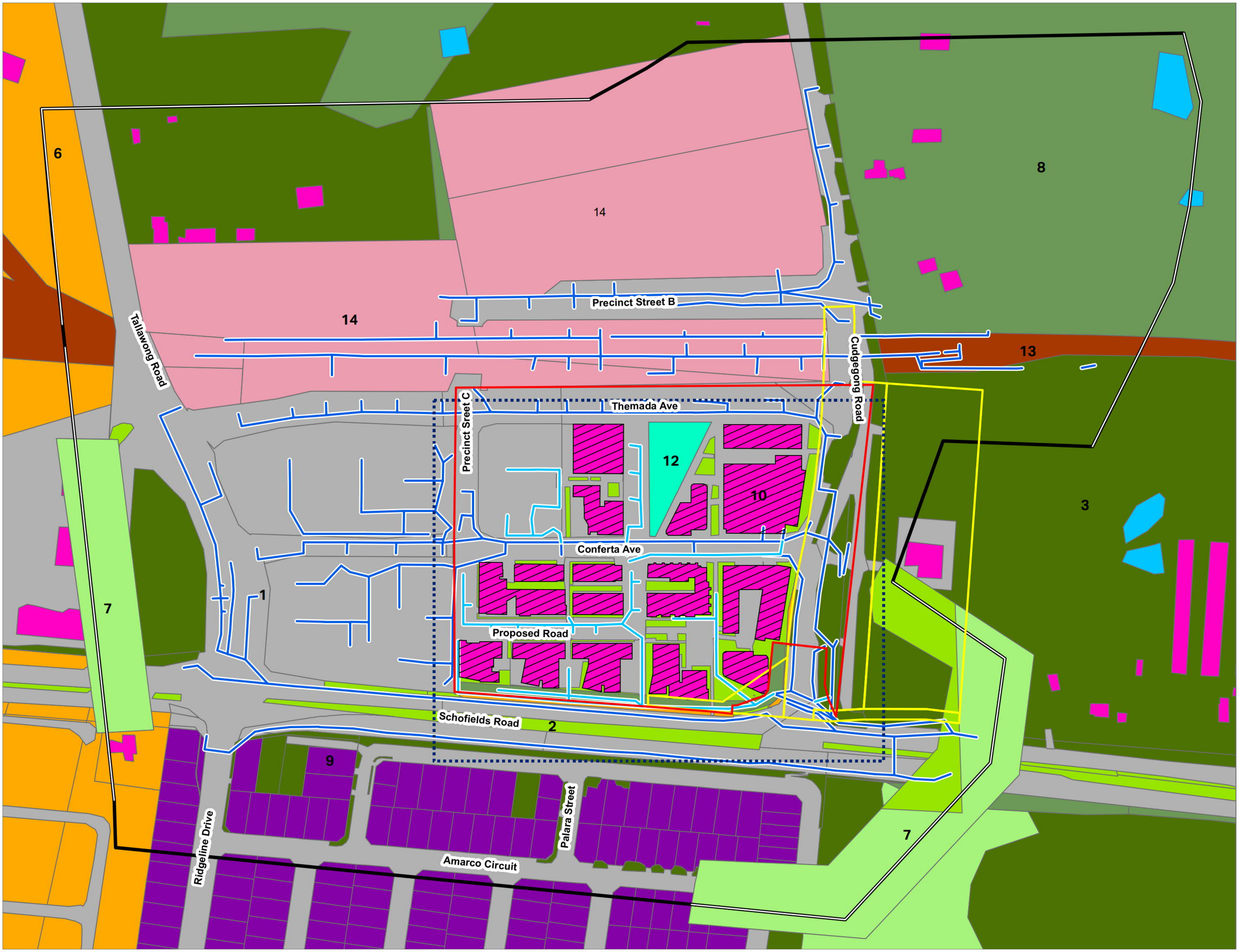


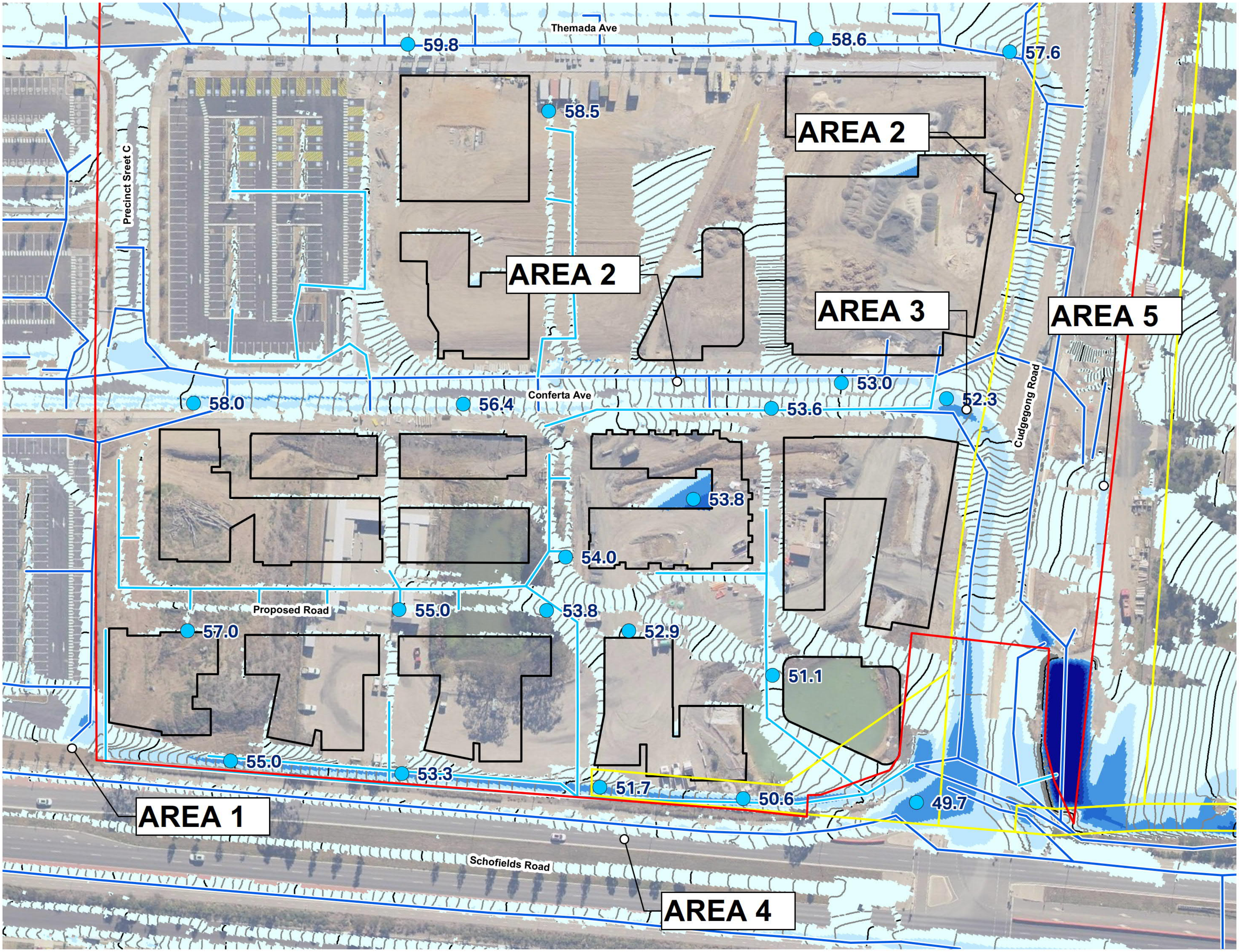
FIGURE A2 TUFLOW MODEL DEVELOPED CASE

KEY

- Site Boundary
- Limit of mapping
- SP2 zoned land
- Buildings outline
- Proposed stormwater pipe
- Existing stormwater pipe
- 1 Asphalt
- 2 Well Maintained Grass Cover
- 3 Non Maintained Grass Cover
- 6 Sand
- 7 Medium Density Vegetation
- 8 Mildly Dense Vegetation
- 9 Fenced Properties
- 10 Buildings
- 12 Water
- 13 Rails
- 14 Commercial

AECOM

0 50 100 m



AECOM GIS Printed:Date: 4/2/2020 \\ausyd1fp001\Projects\605X\60558549\4. Tech Work Area\4.99 GIS\02_Maps\G017_01_A3L_FloodResults_D01_1AEP+15%_200402.mxd

FIGURE A3 FLOOD RESULTS DEVELOPED CASE – 1AEP+15%

KEY

	Flood Level 1m Contour	**Depth (m)**	
	Spot Height		< 0.1
	Site boundary		0.1 - 0.25
	SP2 zoned land		0.25 - 0.5
	Proposed stormwater pipe		0.5 - 0.75
	Existing stormwater pipe		0.75 - 1
			> 1

AECOM

0 25 50 m

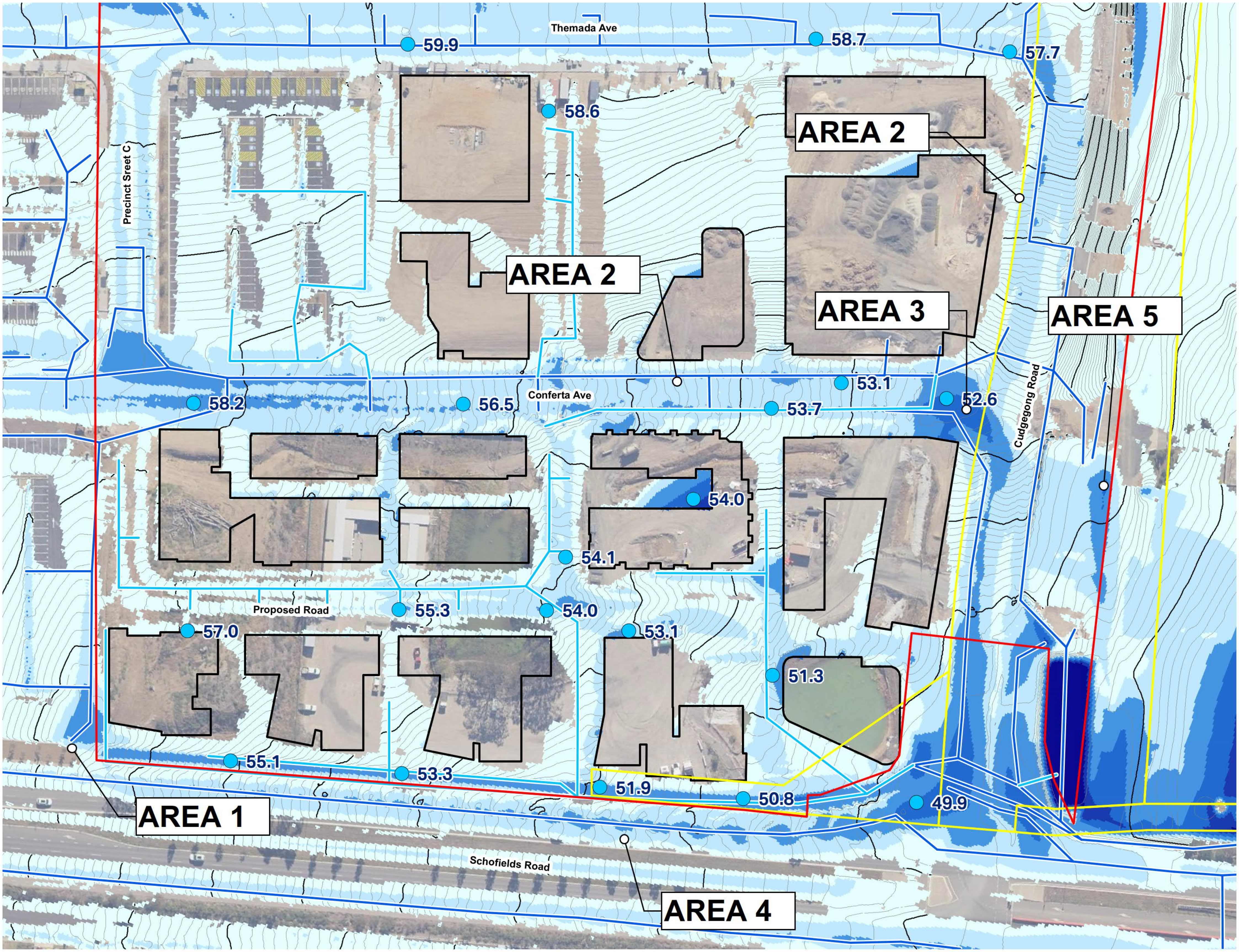


FIGURE A4 FLOOD RESULTS DEVELOPED CASE – PMF

KEY

	Flood Level 1m Contour	**Depth (m)**	
	Spot Height		< 0.1
	Site boundary		0.1 - 0.25
	SP2 zoned land		0.25 - 0.5
	Proposed stormwater pipe		0.5 - 0.75
	Existing stormwater pipe		0.75 - 1
			> 1

AECOM

0 25 50 m

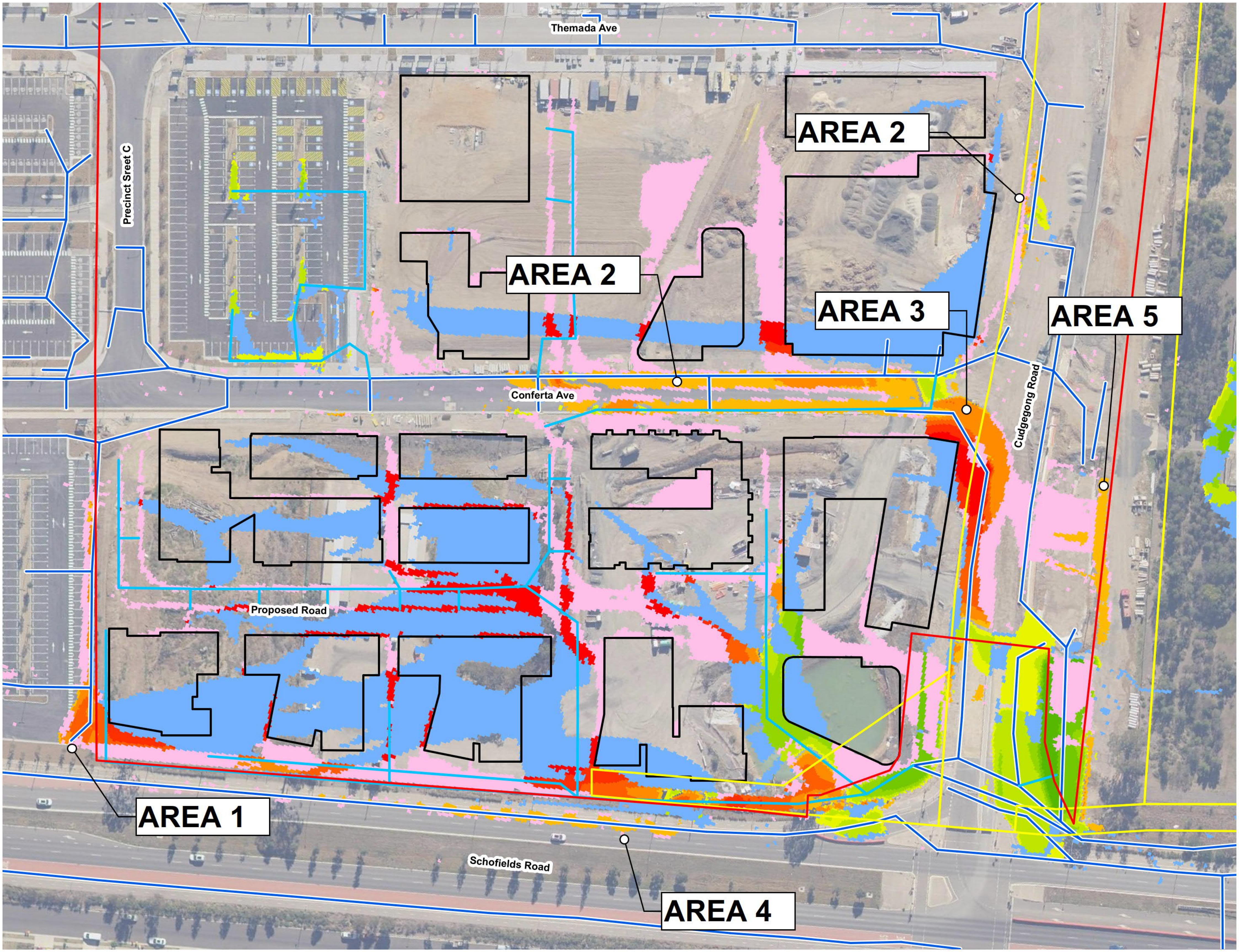


FIGURE A5 FLOOD LEVEL DIFFERENCE – 1% AEP

KEY

- Site Boundary
- SP2 zoned land
- Existing stormwater pipe
- Proposed stormwater pipe

Impacts (m)

- -2.8 - -2.3
- -2.3 - -0.5
- -0.5 - -0.25
- -0.25 - -0.1
- -0.1 - -0.03
- -0.03 - -0.01
- -0.01 - 0.01
- 0.01 - 0.03
- 0.03 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1.2

Wet Dry

- Was wet, now dry
- Was dry, now wet

0 25 50 m

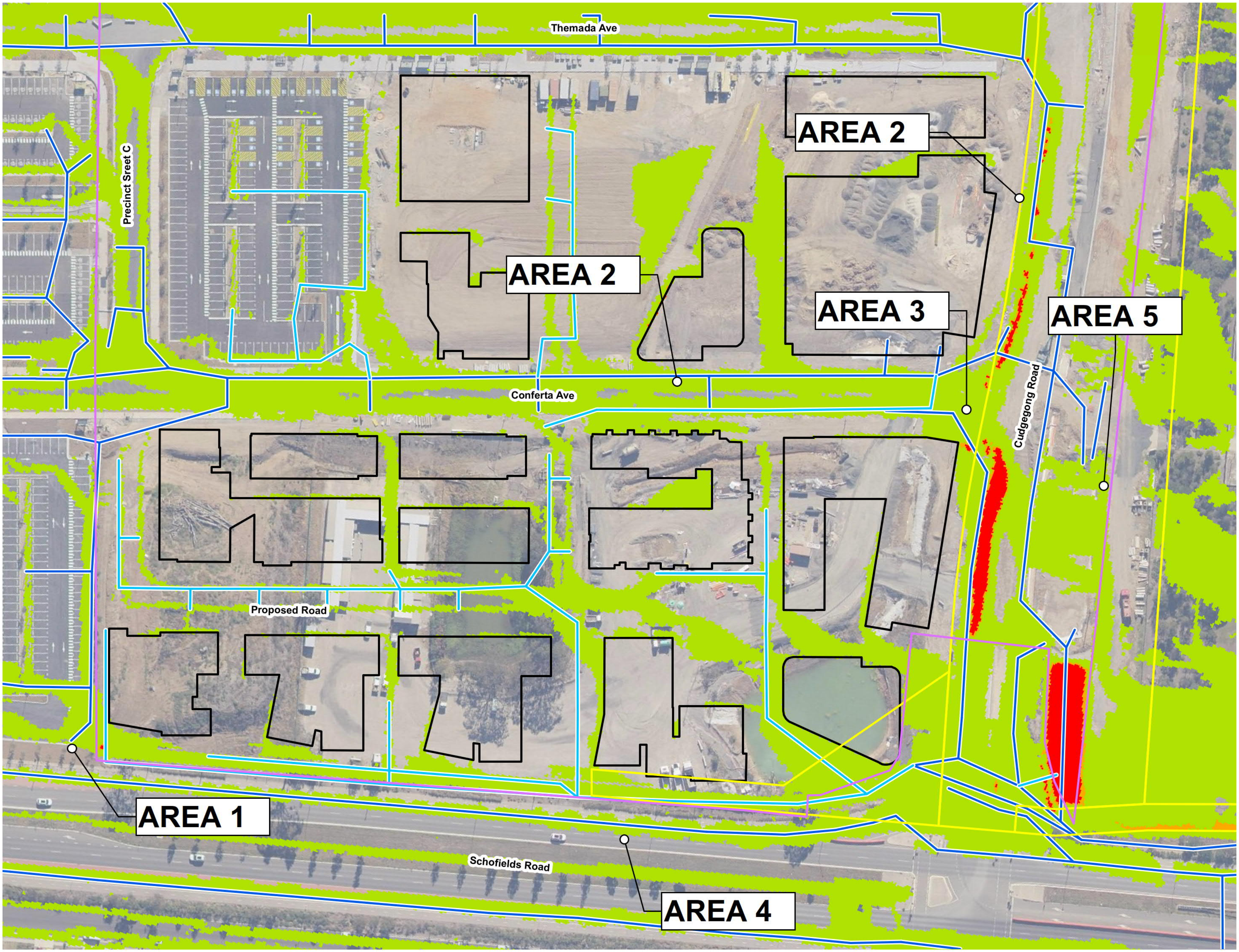


FIGURE A6 FLOOD HAZARDS DEVELOPED CASE – 1% AEP+15%

KEY

- Site Boundary
- SP2 zoned land
- Proposed stormwater pipe
- Existing stormwater pipe

Flood Hazard Category

- Low Hazard
- Intermediate Hazard
- High Hazard

0 25 50 m

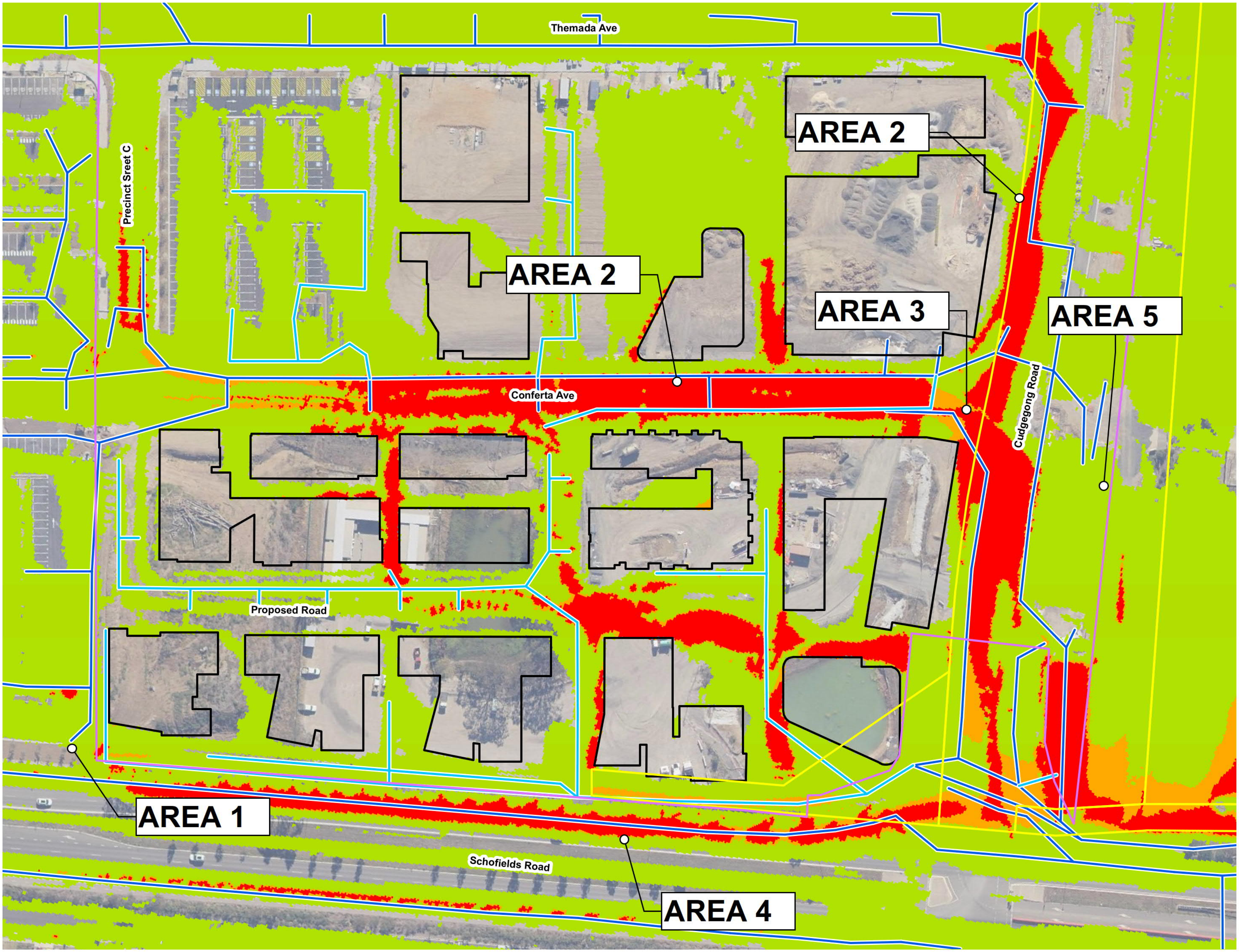


FIGURE A7 FLOOD HAZARDS DEVELOPED CASE – PMF

KEY

- Site Boundary
- SP2 zoned land
- Proposed stormwater pipe
- Existing stormwater pipe

Flood Hazard Category

- Low Hazard
- Intermediate Hazard
- High Hazard

AECOM

0 25 50 m