APPENDIX F

Blind Kemps Creek Assessment

F.1 INTRODUCTION

F.1.1 Introduction

Appendix F has been prepared for the purpose of introducing Blind Kemp Creek into the previously assessed and approved Stage 1 (pre-developed) modelling, and Stage 2 (Revised) post developed model currently under assessment. The introduction and modelling of Blind Kemp Creek within the overall model was a recommendation of Advisian in their Peer Review dated 16 January 2018. The main objective of modelling of Blind Kemp Creek is to confirm overflow conditions on Mamre Road and Erskine Park Road during major storm events and impact on evacuations, and to also confirm there is no effect on flood conditions associated with development of lots within the northern extent of the northern precinct of the study area directly adjacent to Blind Kemp Creek.

It is noted that the modelling output included in the main report body does not include Blind Kemp Creek to remain consistent with the previously approved model arrangement and outcomes. It is also noted that, other than the addition of flow from Blind Kemp Creek, introduction of hydraulic structures at Mamre Road, and Erskine Park Road, and an extension of the DTM along Blind Kemp Creek, the remainder of the model input in and around South Creek and First Estate remains consistent with previously approved modelling.

Data has been obtained from a number of sources and includes information required for input to the numerical models, together with information required for validation of model results and the adequate representation and presentation of those results.

F.1.2 Survey

Survey is required to define the physical attributes of the floodplain topography including the creek cross sections and the associated floodplain levels.

The pre-development scenario survey has been compiled based on information received in the form of ALS survey information. The on-ground survey information was completed in and around the study area to properly define the existing overland flow path cross section and features.

The proposed development site, were then added to the pre-developed survey surface to create a post developed surface to use in the TUFLOW model. This was input into the TUFLOW model as an inactive area to simulate land filling to above the flood level.

The surveys and design surfaces were used as the basis for the digital terrain model (DTM) used in the hydraulic modelling of the pre and post development scenario respectively.

F.1.3 Previous Studies

A previous study of Blind Kemps Creek was produced for Penrith City Council by J.Wyndham Prince - The *Blind Kemps Creek Catchment and Drainage Study (February 2005*). This report, referred to as *The BKC Flood Study* hereon, was obtained by Costin Roe Consulting from Council and components have been utilised in this study. The *The BKC Flood Study* encompasses two components, the first of these focussing on the hydrology and contributing catchments of Blind Kemps Creek and the second focussing on the hydraulic analysis in relation to the Erskine Park Employment Zone development.

The *BKC Flood Study* is a local study that includes the Erskine Park Employment Zone and associated trunk drainage, defining flood level and depths throughout the creek and industrial area.

The *BKC Flood Study* was utilised to validate hydrological and flood surface results produced in our assessment for the pre-developed condition. It can be seen when comparing the flood depth results of the Costin Roe Consulting model with the output from the BCK Flood Study that the results are generally consistent and that the Costin Roe Consulting model is suitable for use in modelling post development scenarios.

F.2 CATCHMENT INVESTIGATION & HYDROLOGY

F.2.1 Contributing Catchment Definition

The contributing upstream catchment associated with Blind Kemps Creek is approximately 530 Ha with a mainstream length of 3 km. The catchment generally comprises rural land which is interspersed with residential and industrial areas.

Figure F1 below shows the catchment breakdown used in *The BKC Flood Study*. The contributing catchment, although now highly development, remains generally consistent with that shown in *The BKC Flood Study* and has been used in the RAFTS modelling prepared by our office.

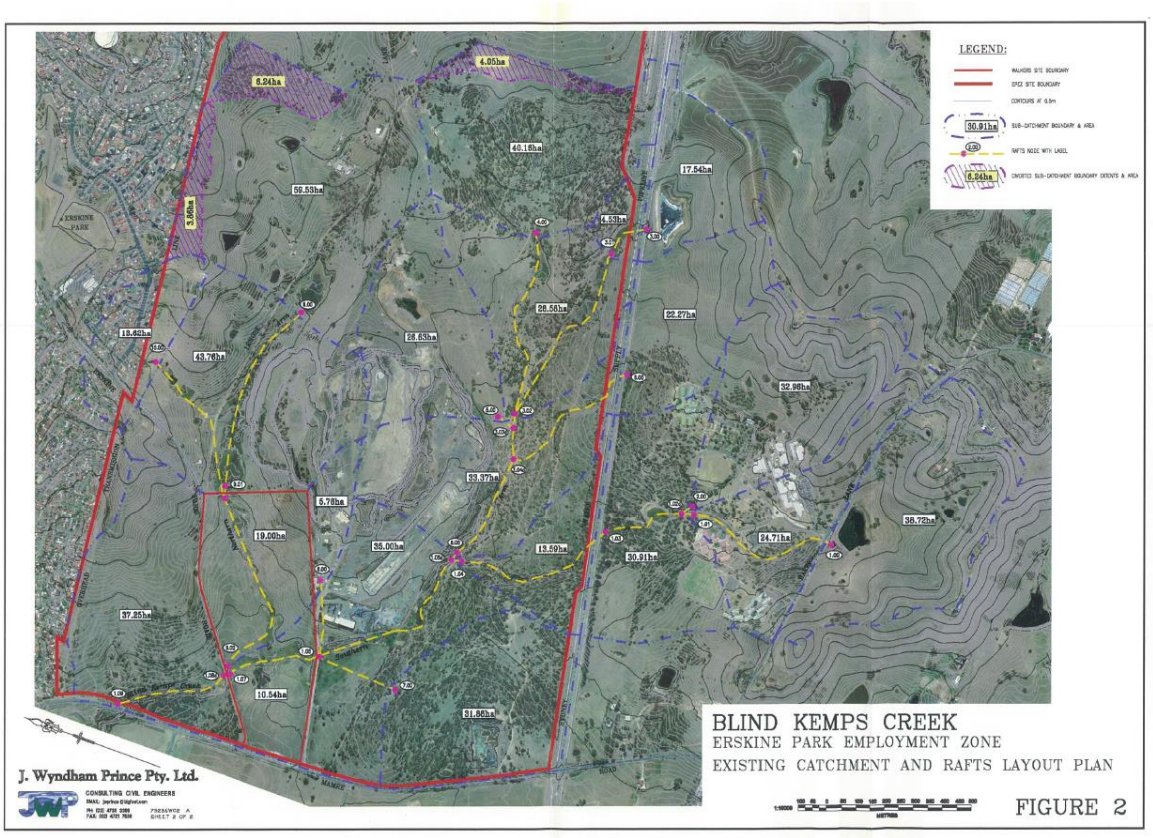


Figure F1. Contributing Catchments (J.Wyndham Prince 2005)

F.2.2 Hydrological Assessment of Existing Catchment

Flood hydrograph for the different flood events were required to be confirmed. Utilising the peak flow defined in *The BCK Flood Study*, a RAFTS Hydrological model was setup to establish the hydrographs for use in the TUFLOW model. The Costin Roe Consulting RAFTS model was calibrated to be in close proximity to the results from *The BCK Flood Study* for the 1% AEP and 5% AEP events. Additional storm events were modelled to establish the inflow hydrographs for use in the TUFLOW model. Rainfall intensities and temporal patterns were derived from the Bureau of Meteorology online IFD tool and Australian Rainfall and Runoff (2016).

The assessment resulted in the following flood hydrograph's of the 1% AEP (**Figure F2**), 5% AEP (**Figure F3**), 0.5% AEP (**Figure F4**) and PMF (**Figure F5**) for Bling Kemps Creek being defined and used in the TUFLOW modelling. The peak flows are consistent with those contained in the Blind Kemps Creek Flood Study for the 1% AEP and 5% AEP events. A further assessment was undertaken to determine the 36 hour storm duration hydrographs to assess the impact on the South Creek flood extent. The 36 hour duration aligns with the critical storm duration for South Creek. The resulting hydrographs for the 5% AEP 36 Hr, 1% AEP 36Hr and PMF 20Hr are shown in **Figure F6**, **Figure F7 and Figure F8** respectively**.**

The critical storm was found to be the 5% AEP event, however this would be unlikely to coincide with a critical flow with south creek. As such the longer 36Hr duration event has also been assessed to align peak flows within Blind Kemp Creek with peak flows within South Creek.

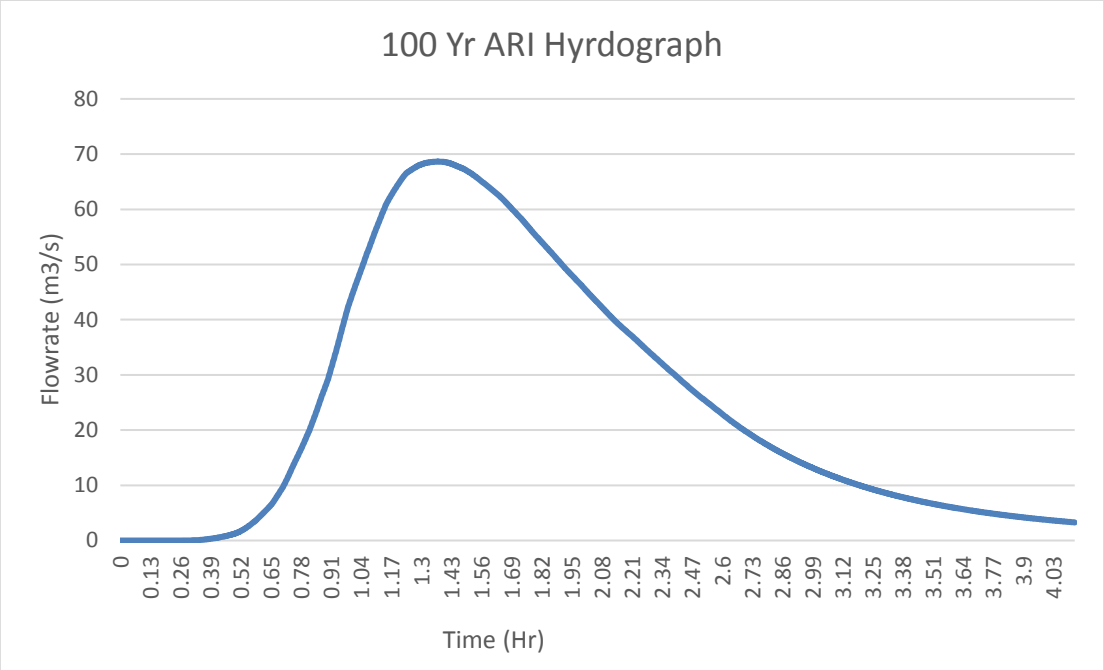


Figure F2 Main Channel 1% AEP Hydrographs (120 Minute Critical Duration)

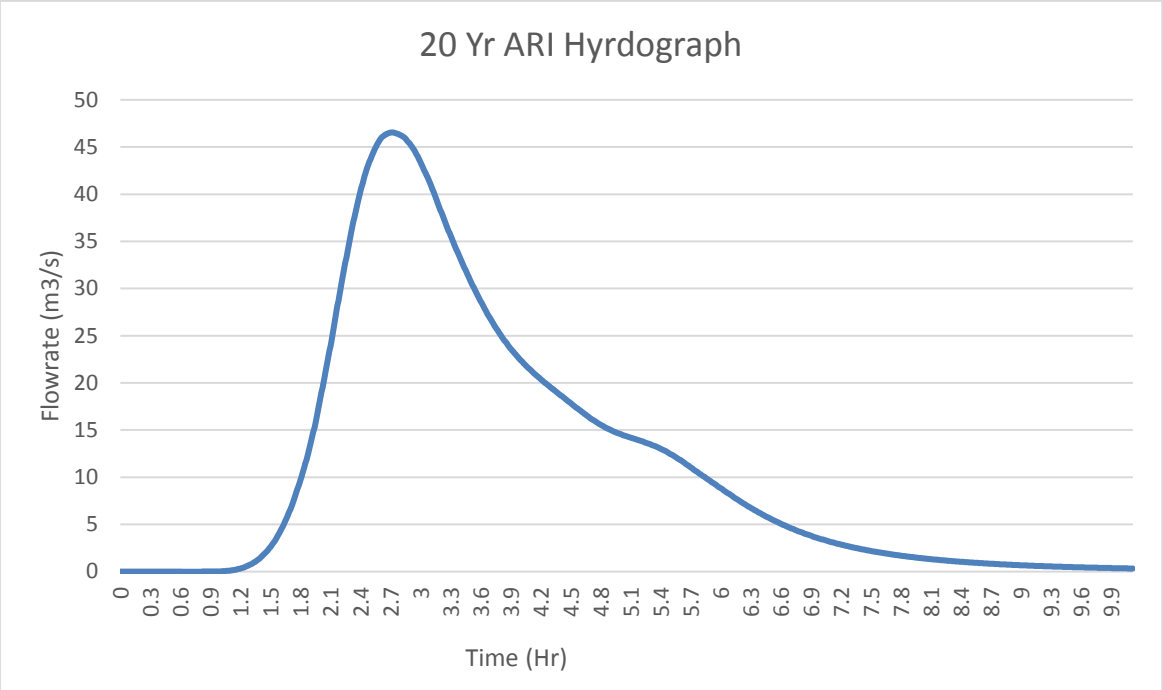


Figure F3 Main Channel 5% AEP Hydrographs (360 Minute Critical Duration)

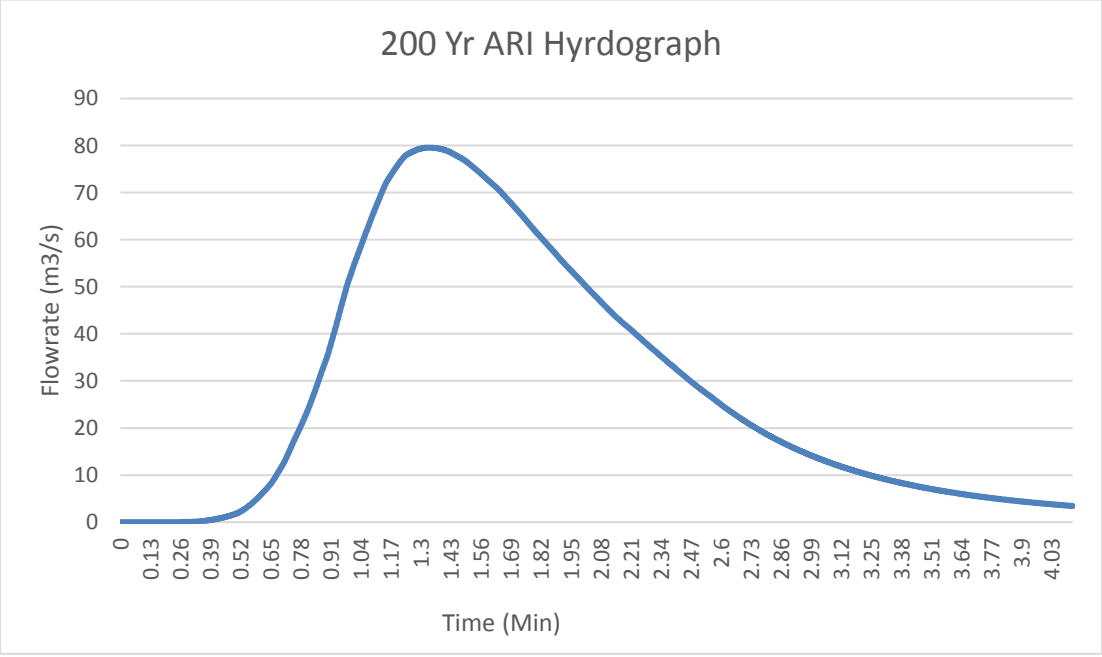


Figure F4 Main Channel 0.5% AEP Hydrographs (120 Minute Critical Duration)

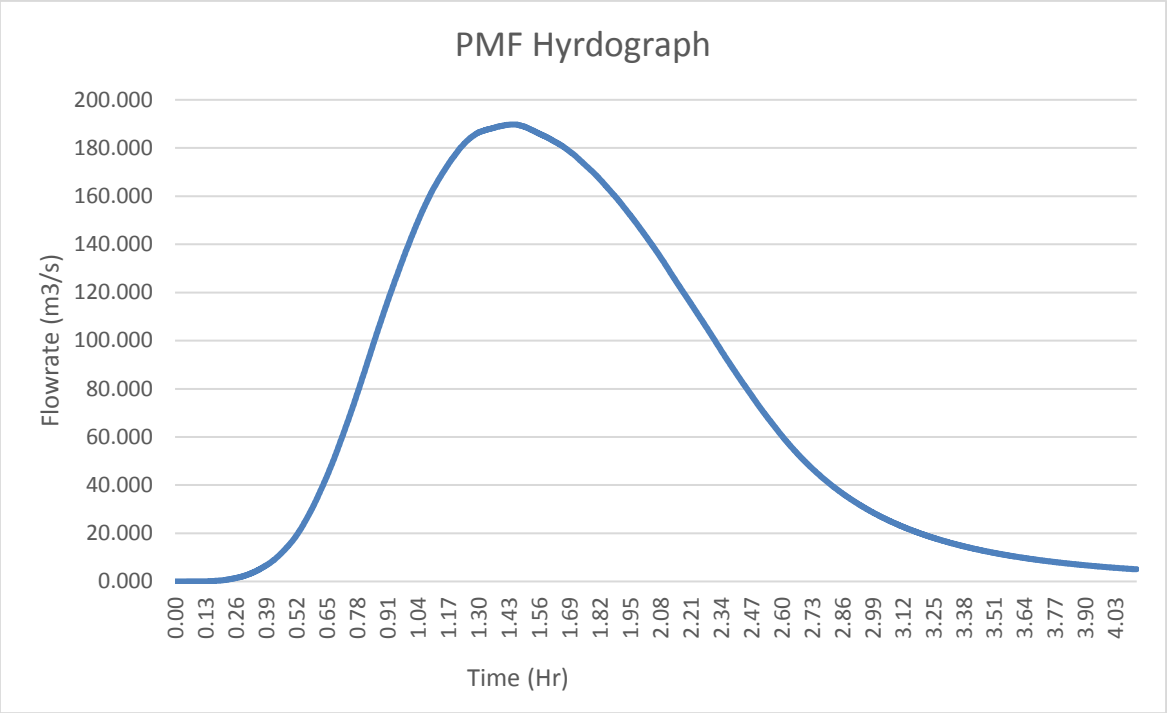


Figure F5 Main Channel PMF Hydrographs (120 Minute Critical Duration)

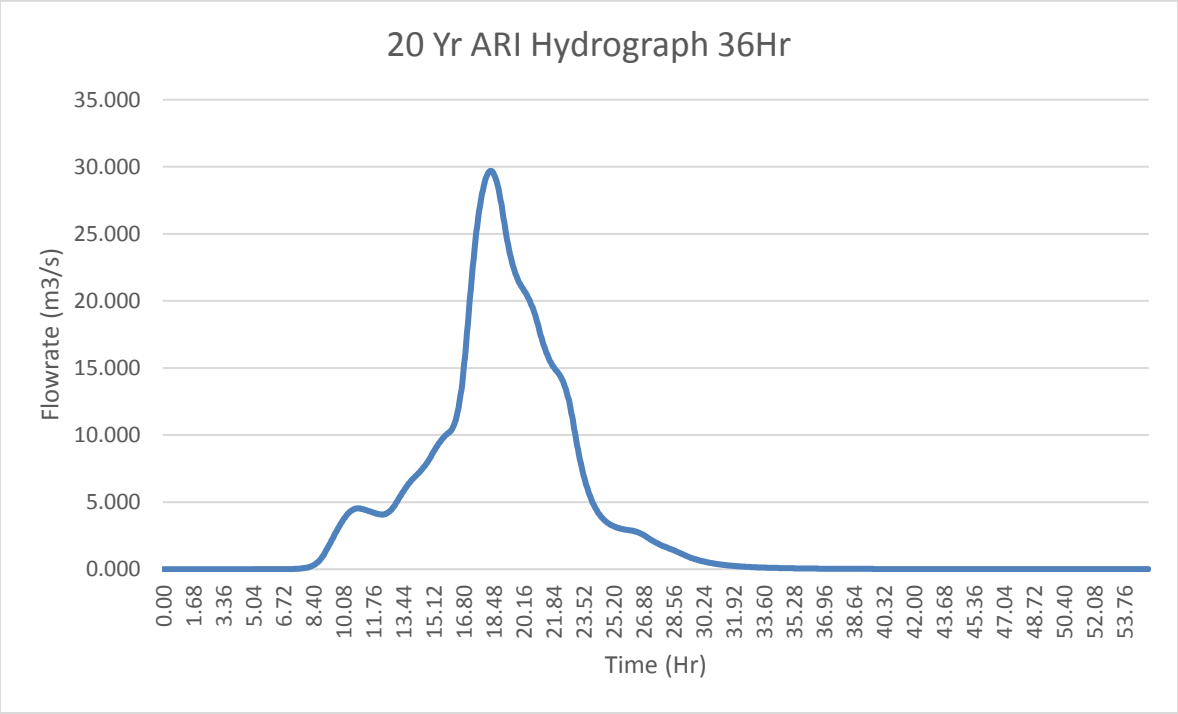


Figure F6 Main Channel 5% AEP Hydrographs (36 Hour Critical Duration)

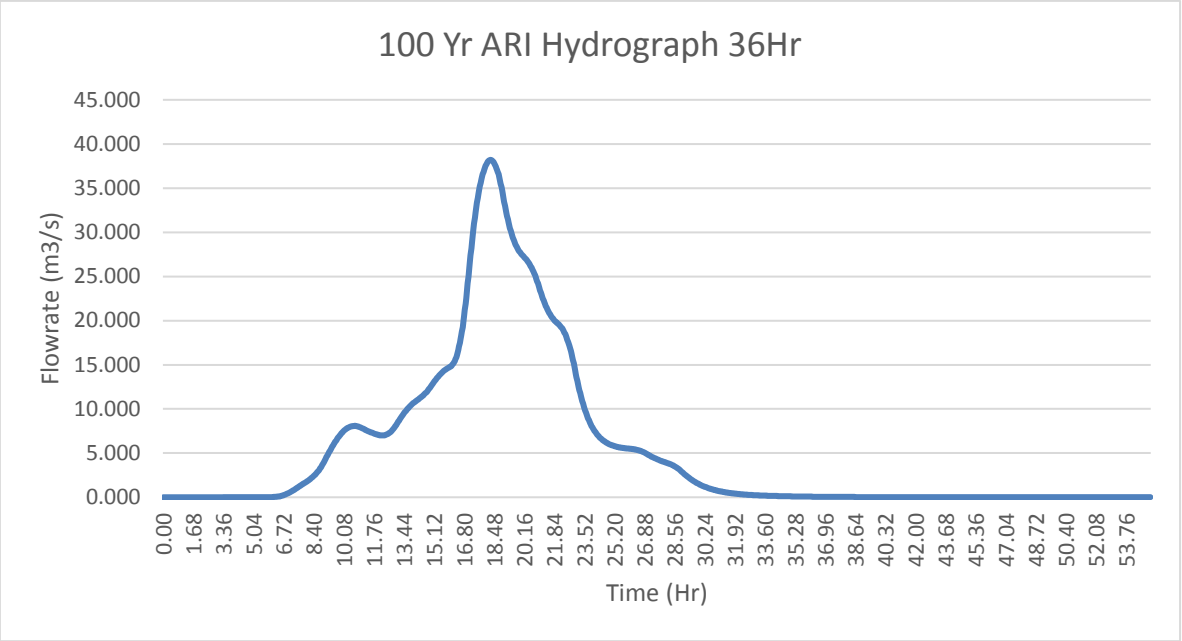


Figure F7 Main Channel 1% AEP Hydrographs (36 Hour Critical Duration)

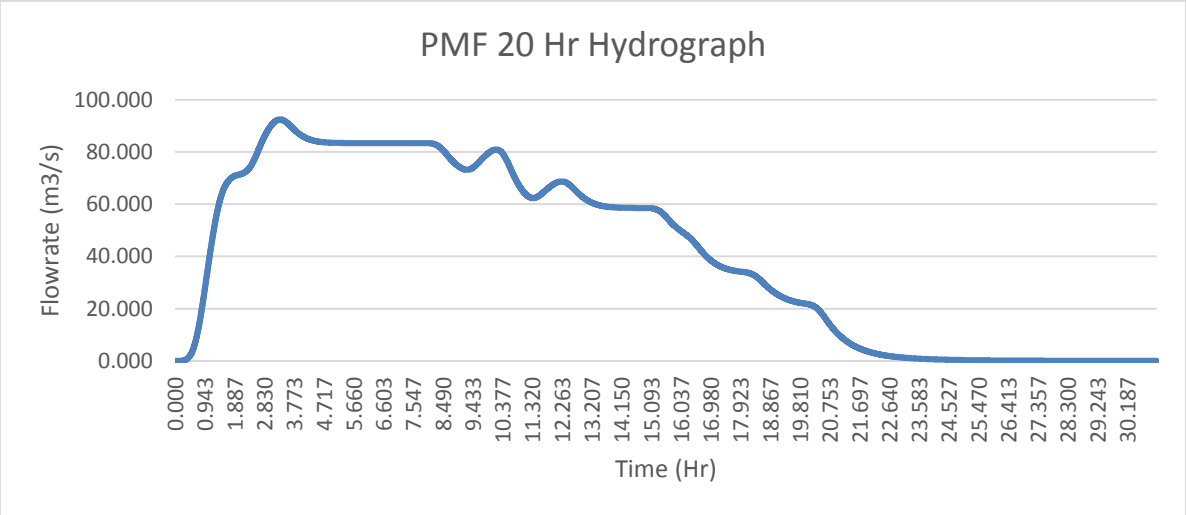


Figure F8 Main Channel PMF Hydrographs (20 Hour Critical Duration)

	Storm Duration (Hrs)			
Storm AEP (%)	**2**	**6**	**20**	**36**
5	N/A	46	N/A	29
1	68	N/A	N/A	38
0.5	79	N/A	N/A	N/A
PMF	189	N/A	92	N/A

Table F1 Peak Hydrograph Flowrate (m3/s)

F.3 HYDRODYNAMIC MODEL DEVELOPMENT

F 3.1 Extent and Topography

The model extent, shown in **Figure F.9** of this appendix, has been extended to include Blind Kemps Creek, beginning approximately 200m upstream of the culverts under Erskine Park Road and extending approximately 1100m to the north of the Mandalong Close Rural Residential Area. The extended DTM is based on a combination of LIDAR and detail survey information.

F.3.2 Boundary Conditions

Inflow Boundaries

Design inflow hydrographs for Blind Kemps Creek have been included at a location approximately 200m upstream of Erskine Park Road and inflows were based on hydrology as discussed in **Section F.2** of this Appendix.

The upstream boundary was located sufficiently upstream of Erskine Park Drive to ensure the extent of predicted impacts from the development would be covered.

Downstream Water Level Boundaries

Downstream boundaries, as per the previously approved assessments have been adopted (i.e. a distance of approximately 1100m downstream of the study area adjacent to where Luddenham Road crosses South Creek).

Refer **Figure F.9** on following page.

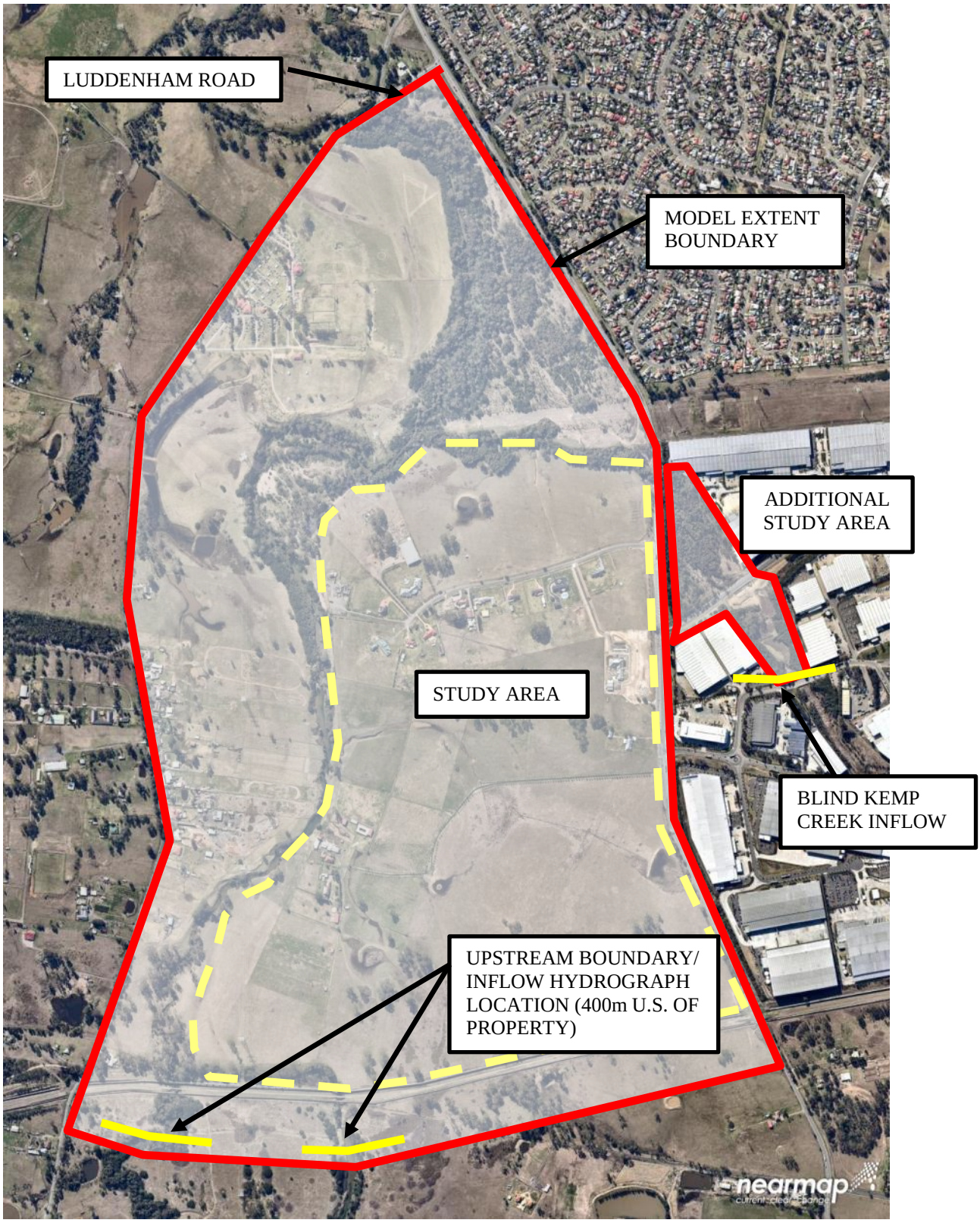


Figure F9. Model Extent and Model Boundary Locations

F.3.3 Channel and Floodplain Roughness

A roughness value of 0.12 has been adopted along the length of the channel, consistent with the generally overgrown conditions within the extended study area.

Otherwise those adopted in the model are as per previously approved assessments.

F.4 MODEL OUTPUT

Model output for pre and post development conditions for the 2hr and 36hour storm events as discussed in earlier sections have been included in the following Figures.

We notes figures represent predicted values at the peak of each event.

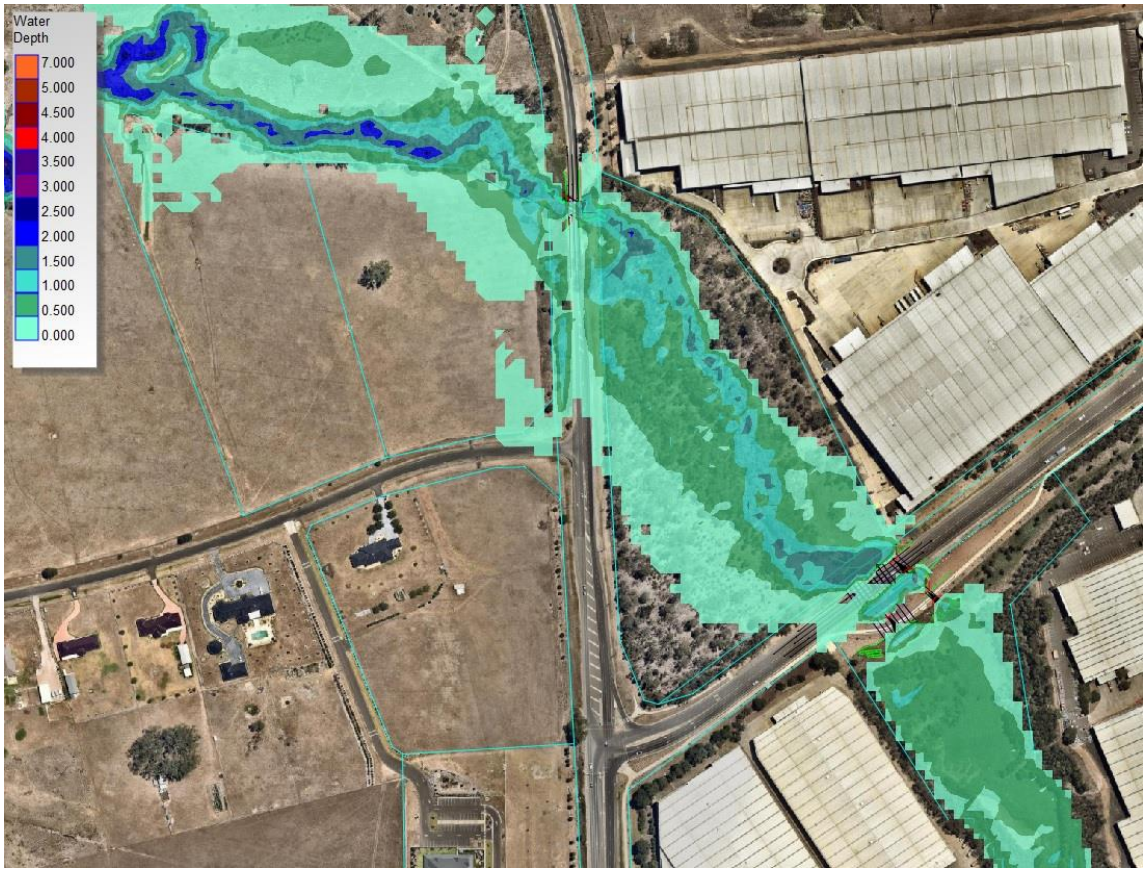


Figure F10 – 5% AEP Flood Depths – Pre-Development

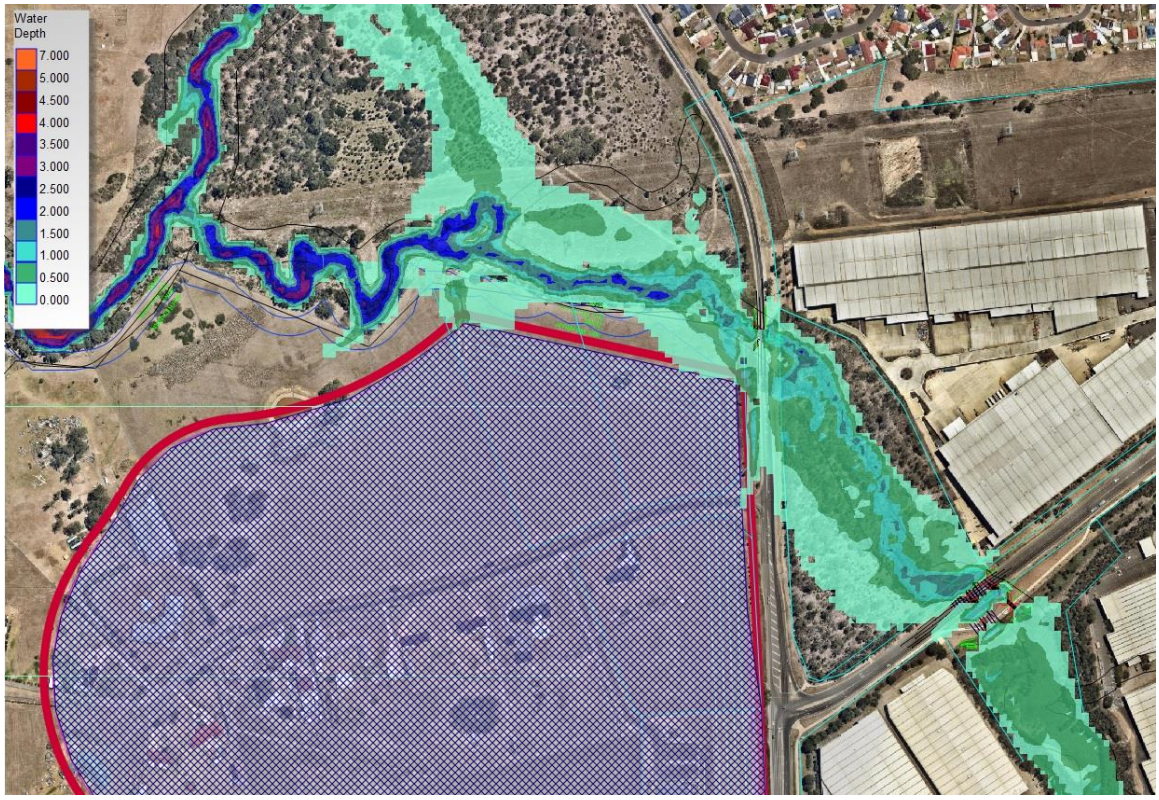


Figure F11 – 5% AEP Flood Depths – Post Development

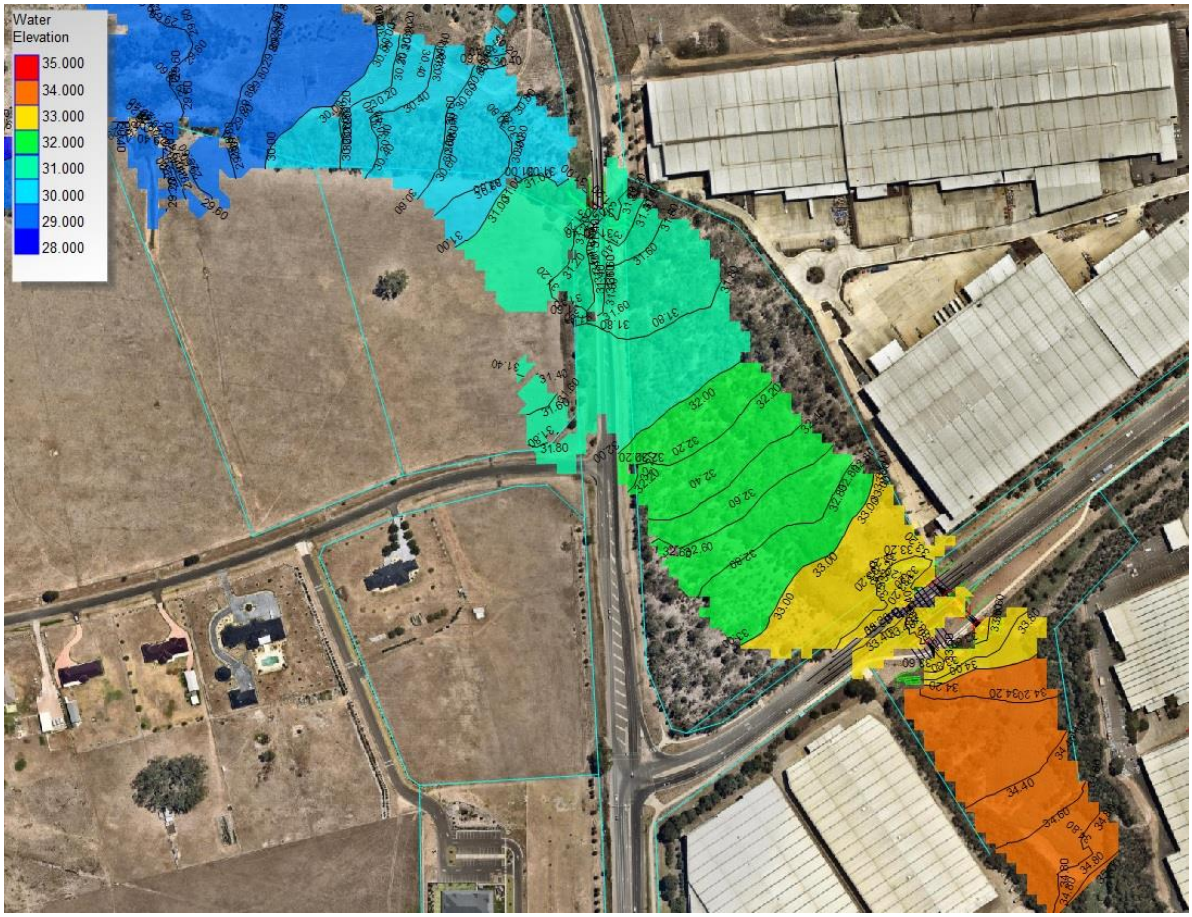


Figure F12 – 1% AEP Flood Levels – Pre-Development

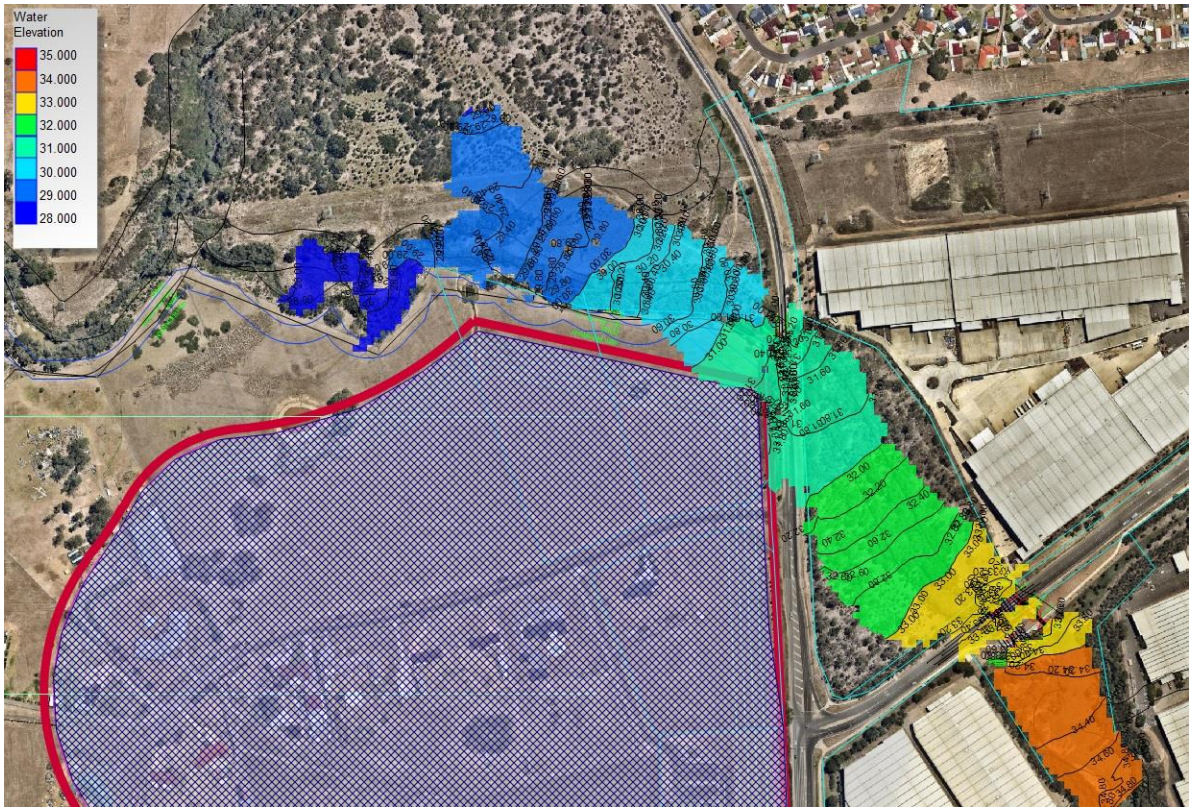


Figure F13 – 1% AEP Flood Levels – Post Development

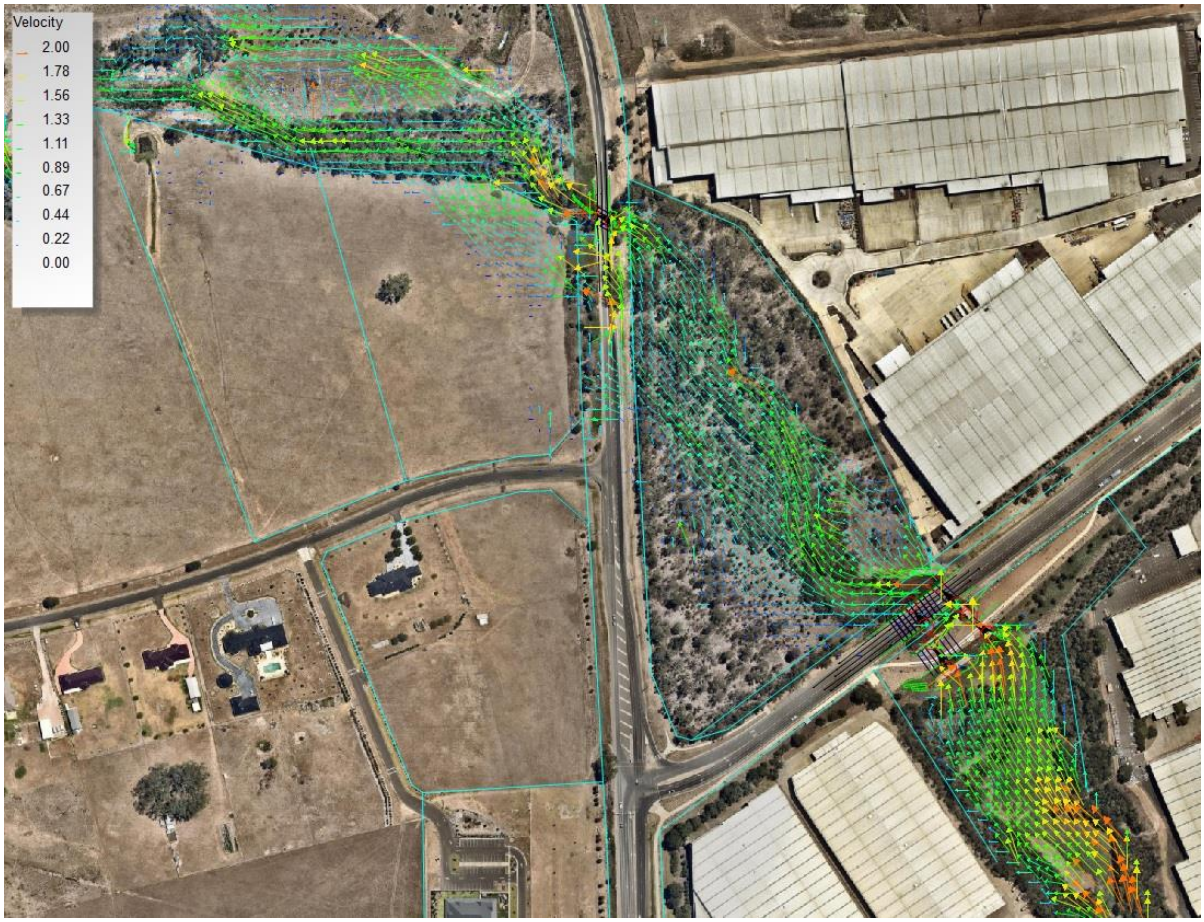


Figure F14 – 1% AEP Flood Velocity – Pre-Development

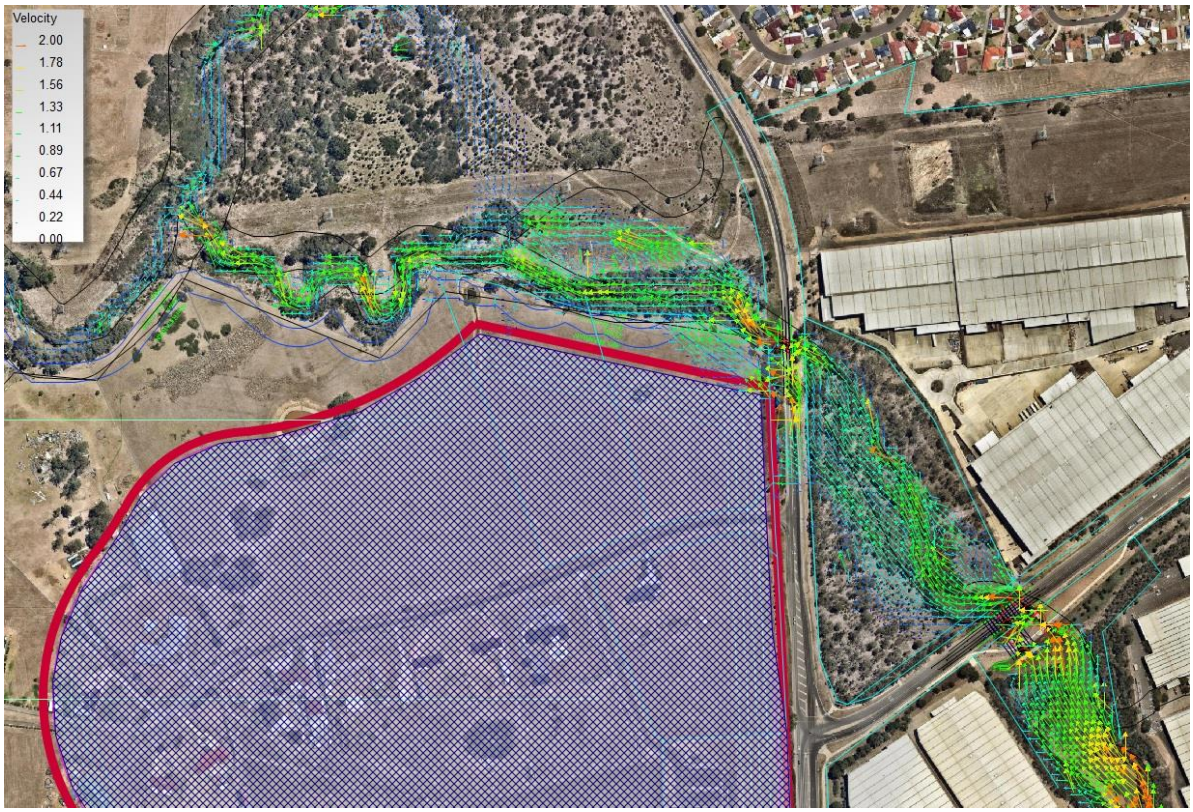


Figure F15 – 1% AEP Flood Velocity – Post Development

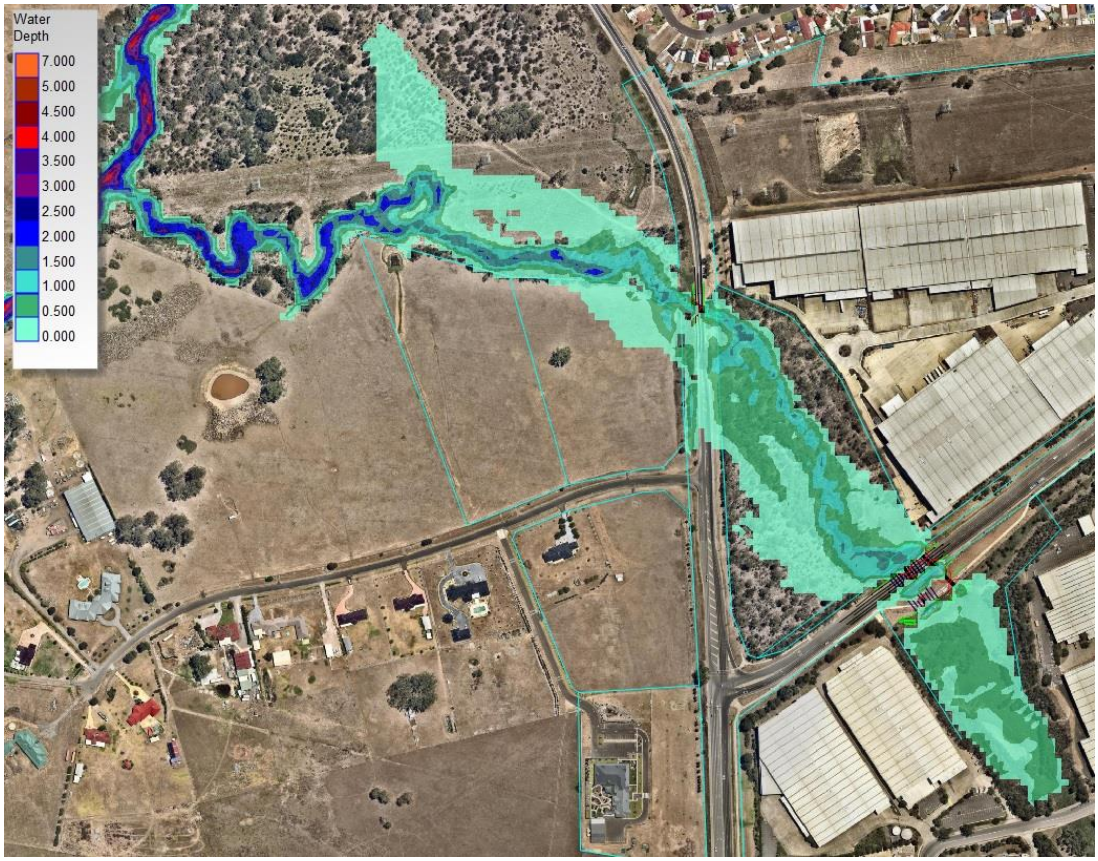


Figure F16 – 5% AEP Flood Depth – Pre-Development

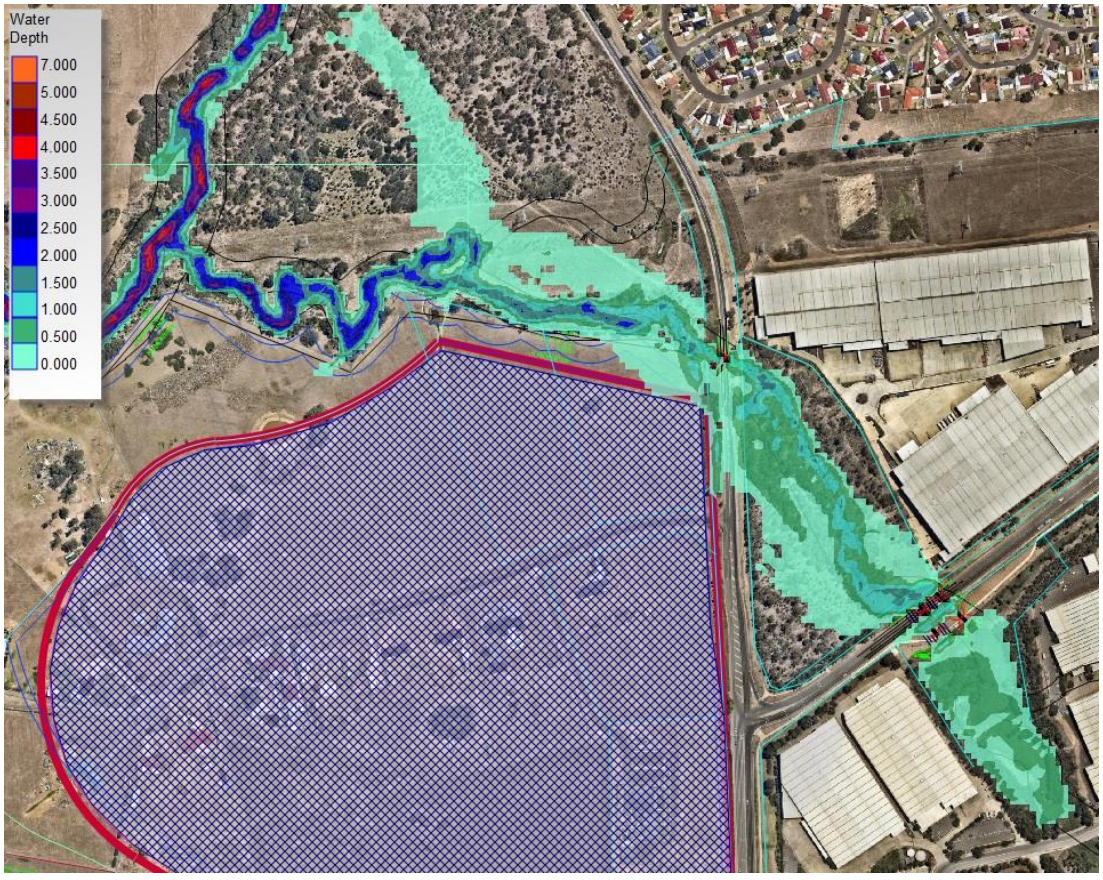


Figure F17 – 5% AEP Flood Depth – Post Development

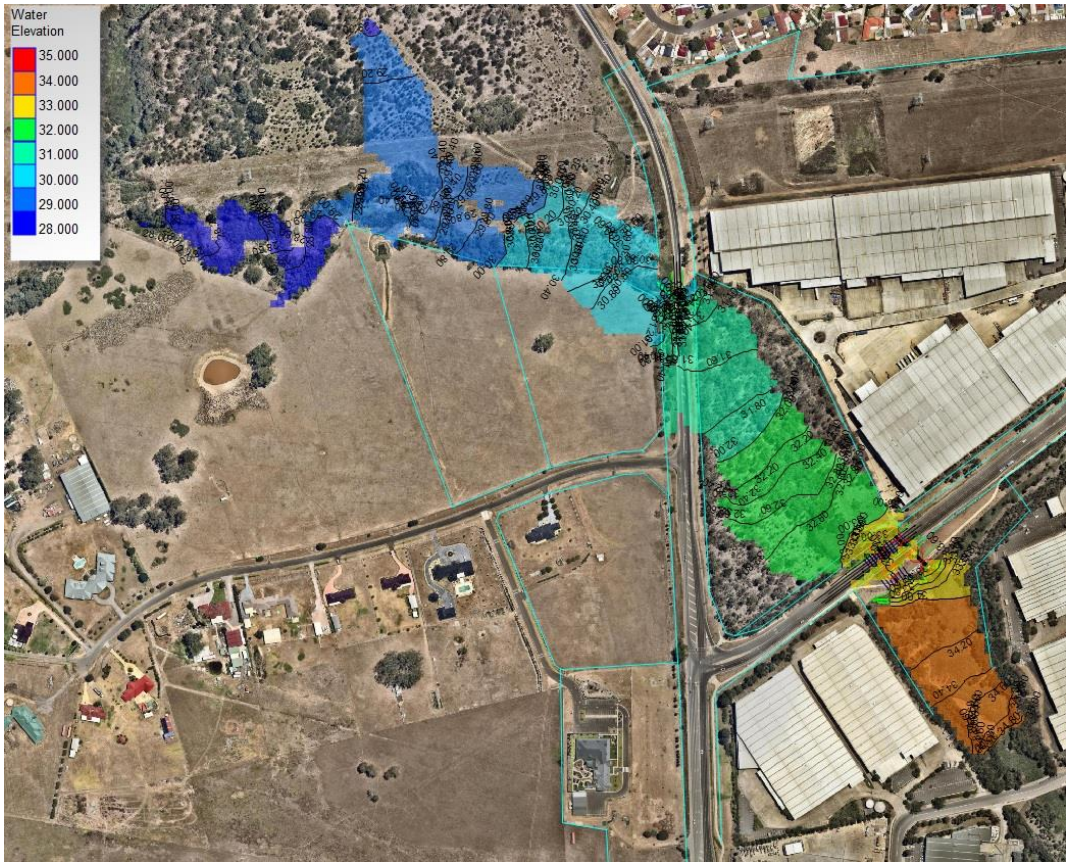


Figure F18– 5% AEP Flood Level – Pre-Development

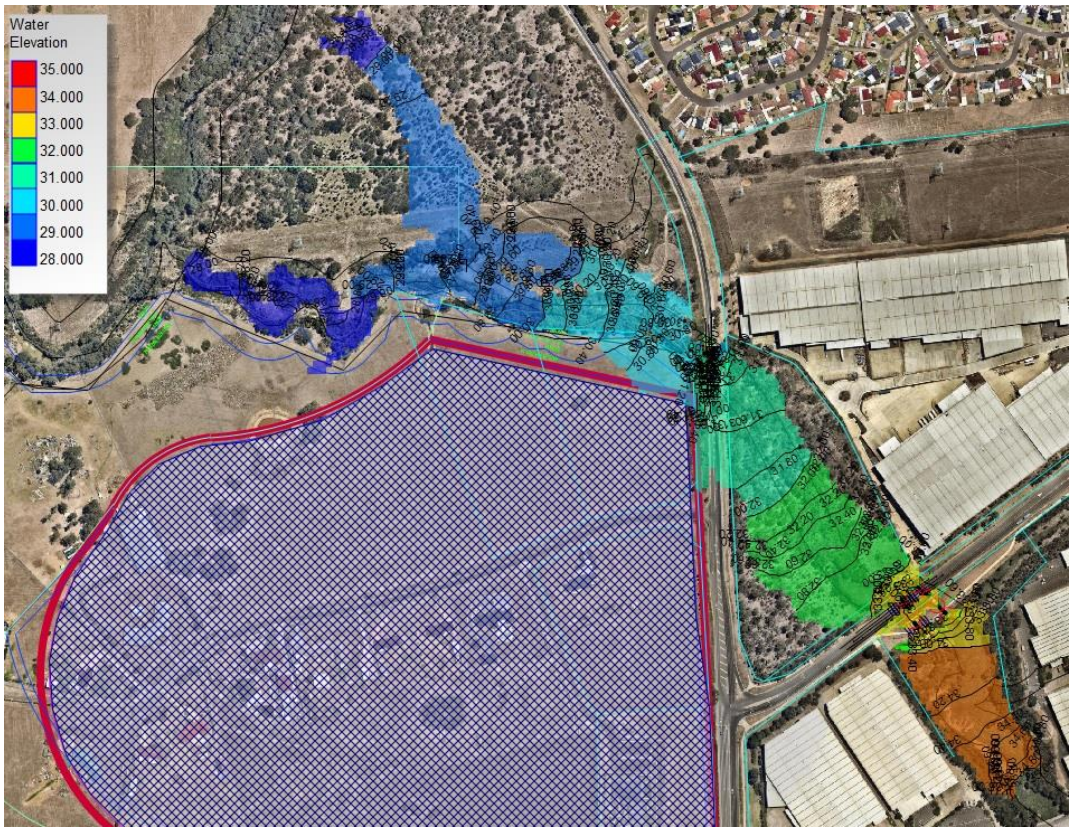


Figure F19 – 5% AEP Flood Level – Post Development

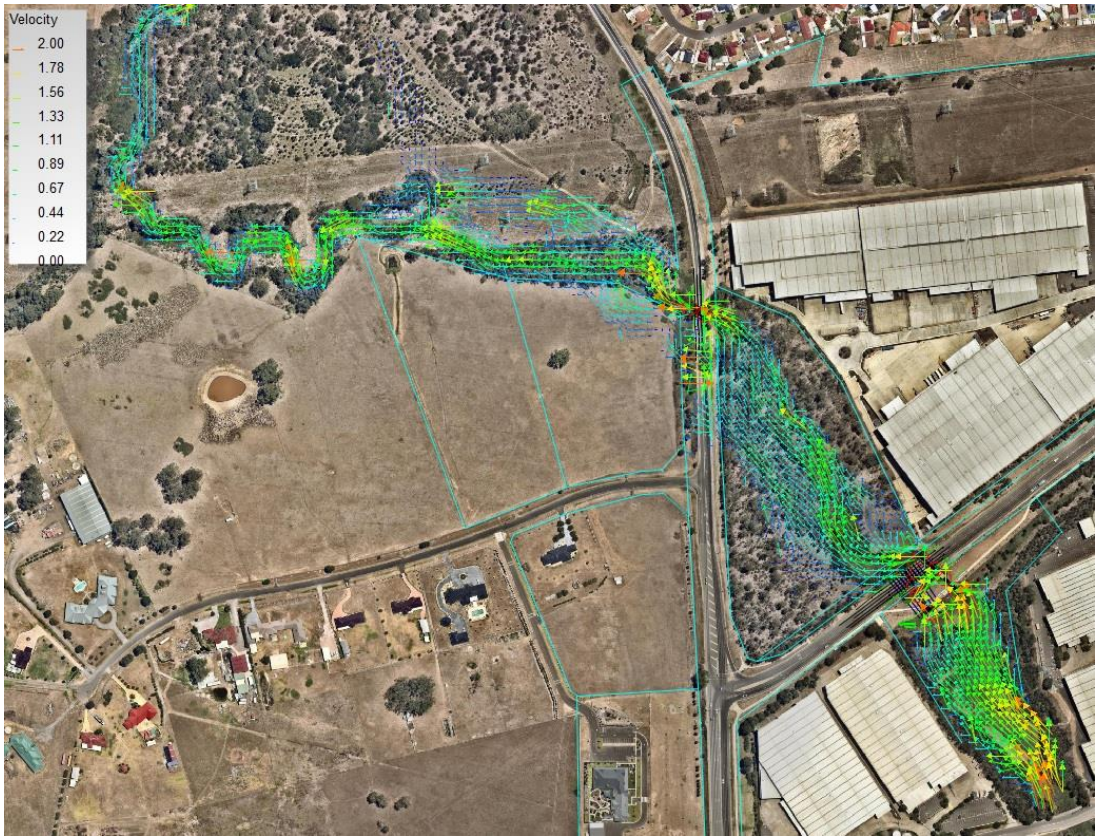


Figure F20 – 5% AEP Flood Velocity – Pre-Development

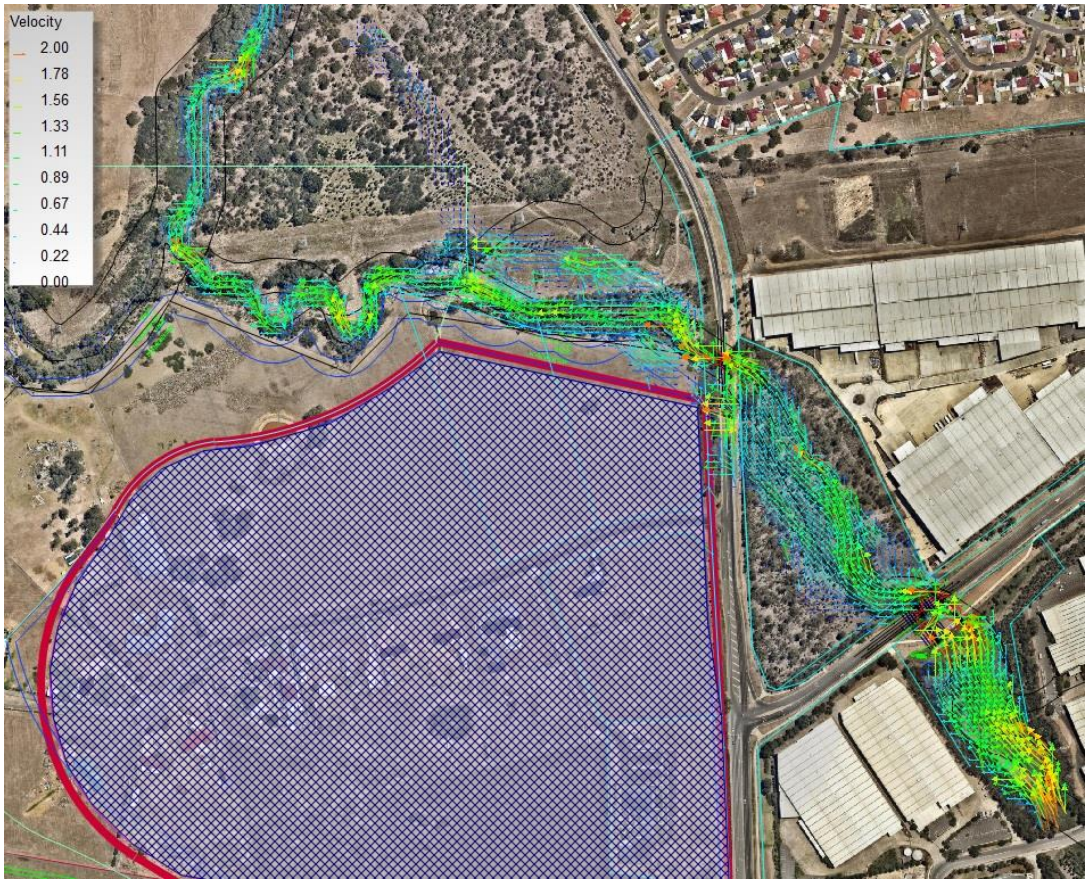


Figure F21 – 5% AEP Flood Velocity – Post Development

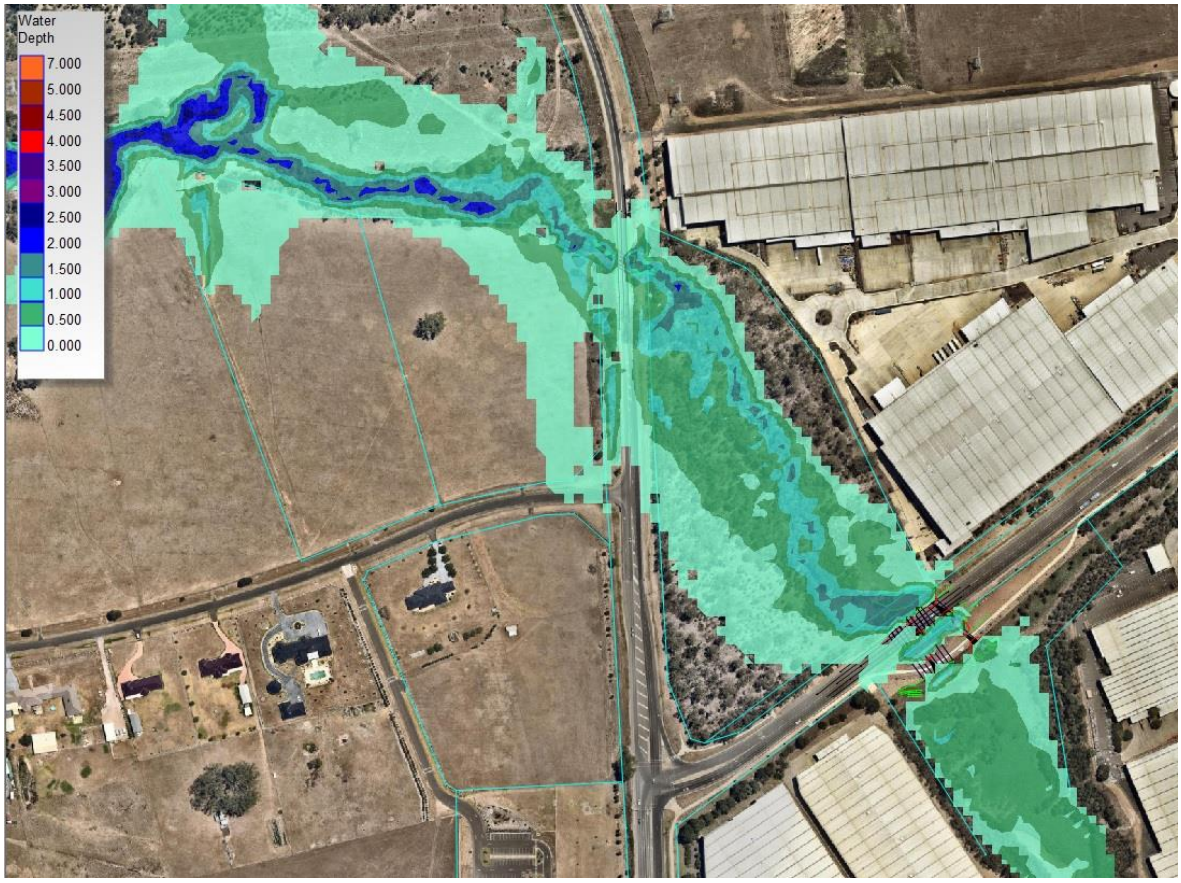


Figure F22 – 0.5% AEP Flood Depth – Pre-Development

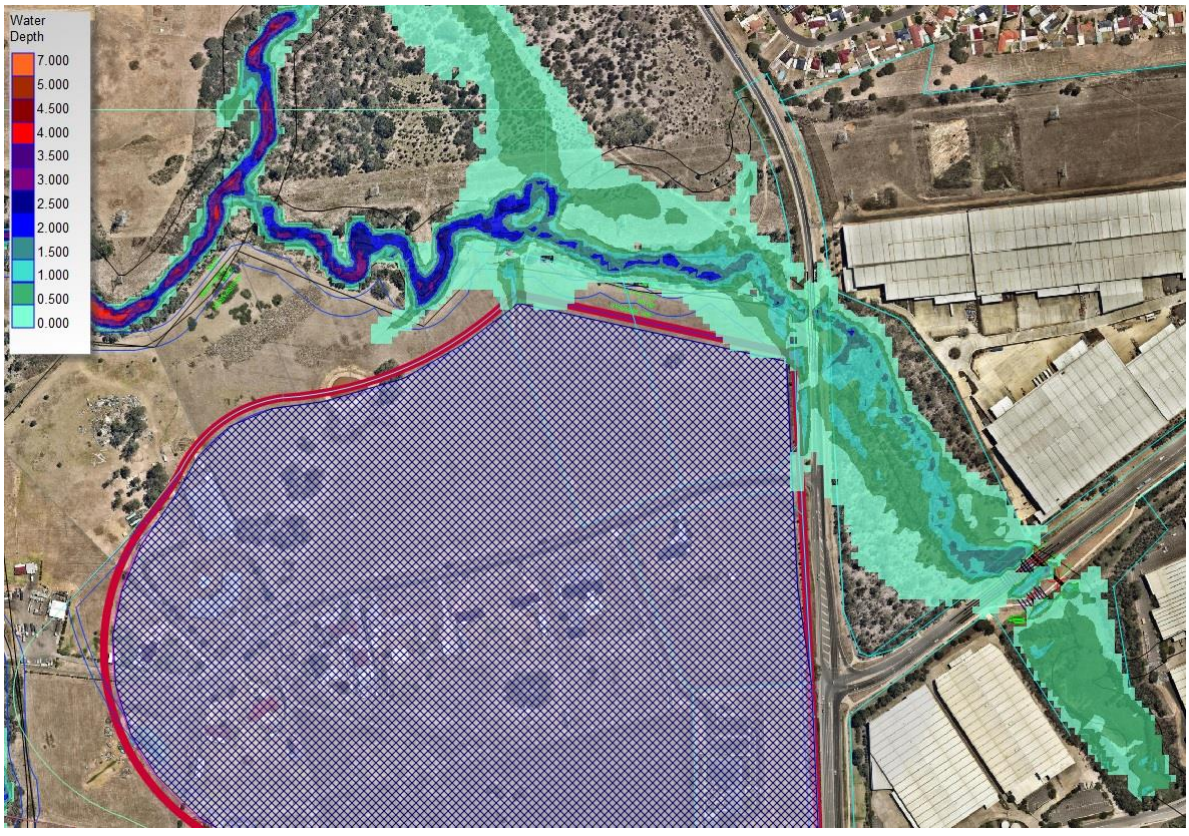


Figure F23 – 0.5% AEP Flood Depth – Post Development

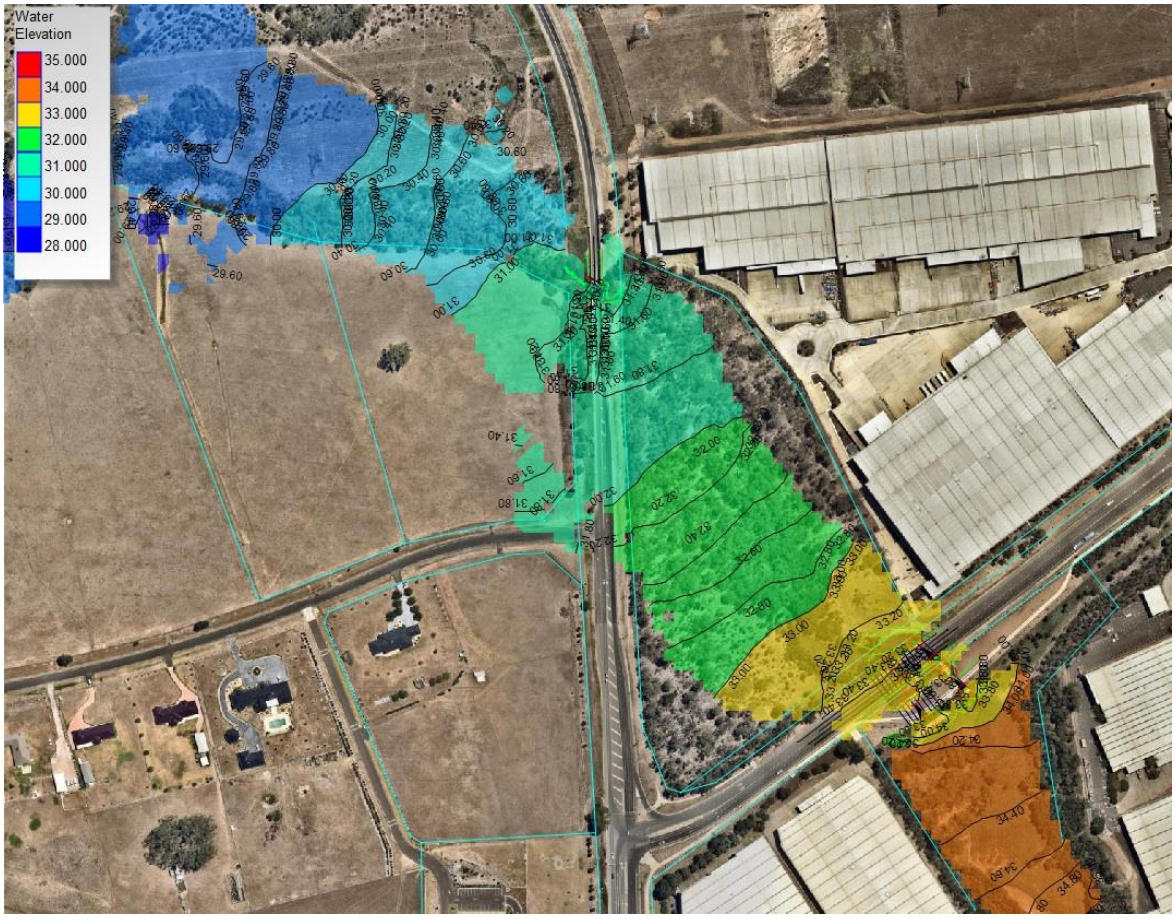


Figure F24 – 0.5% AEP Flood Level – Pre-Development

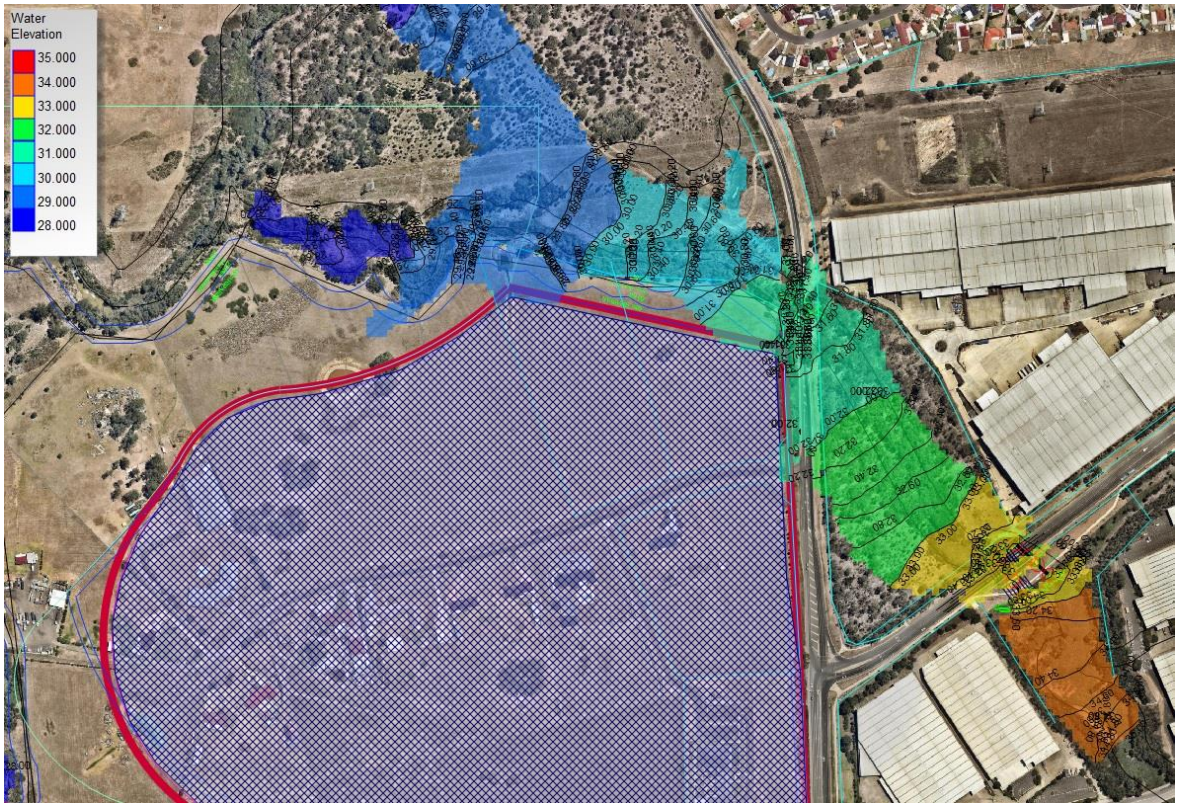


Figure F25 – 0.5% AEP Flood Level – Post Development

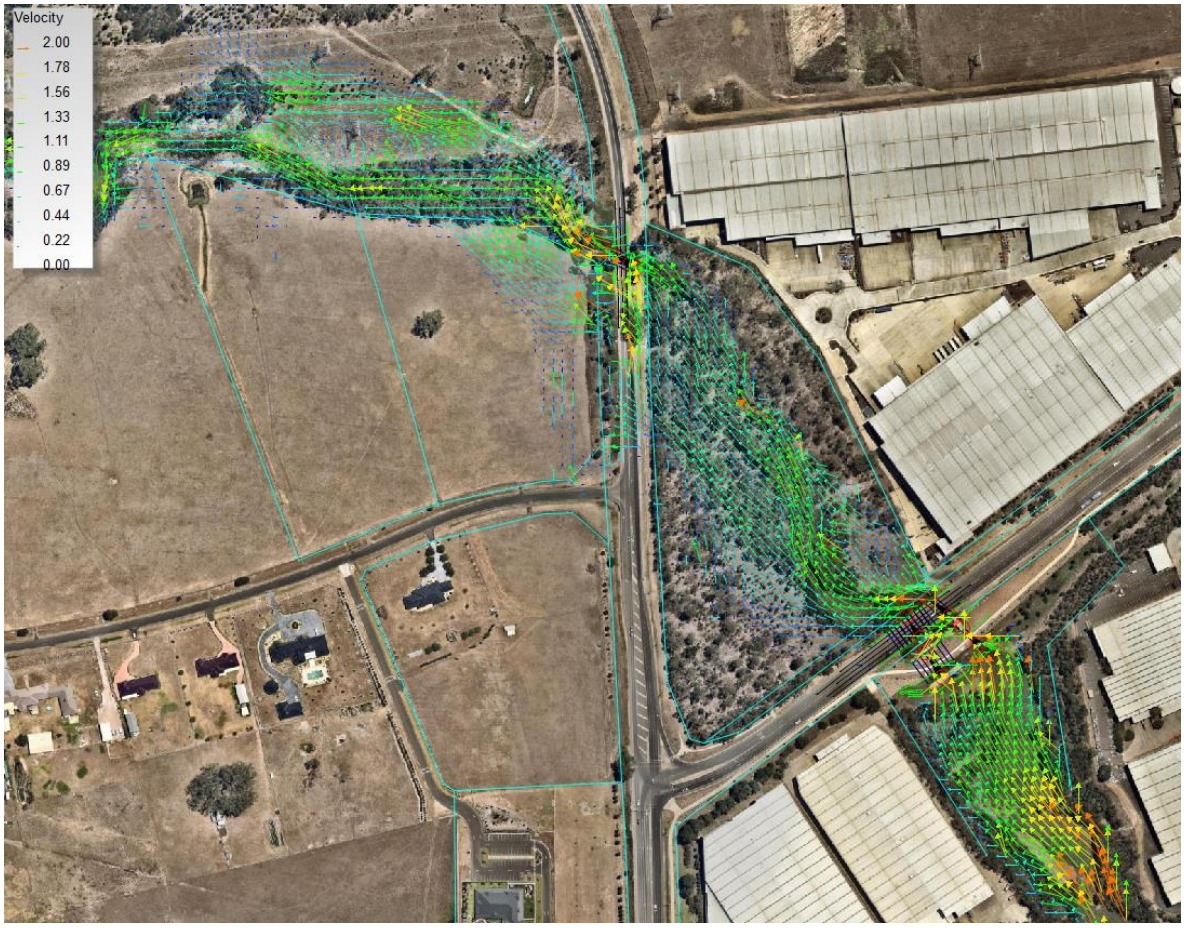


Figure F26 – 0.5% AEP Flood Velocity– Pre-Development

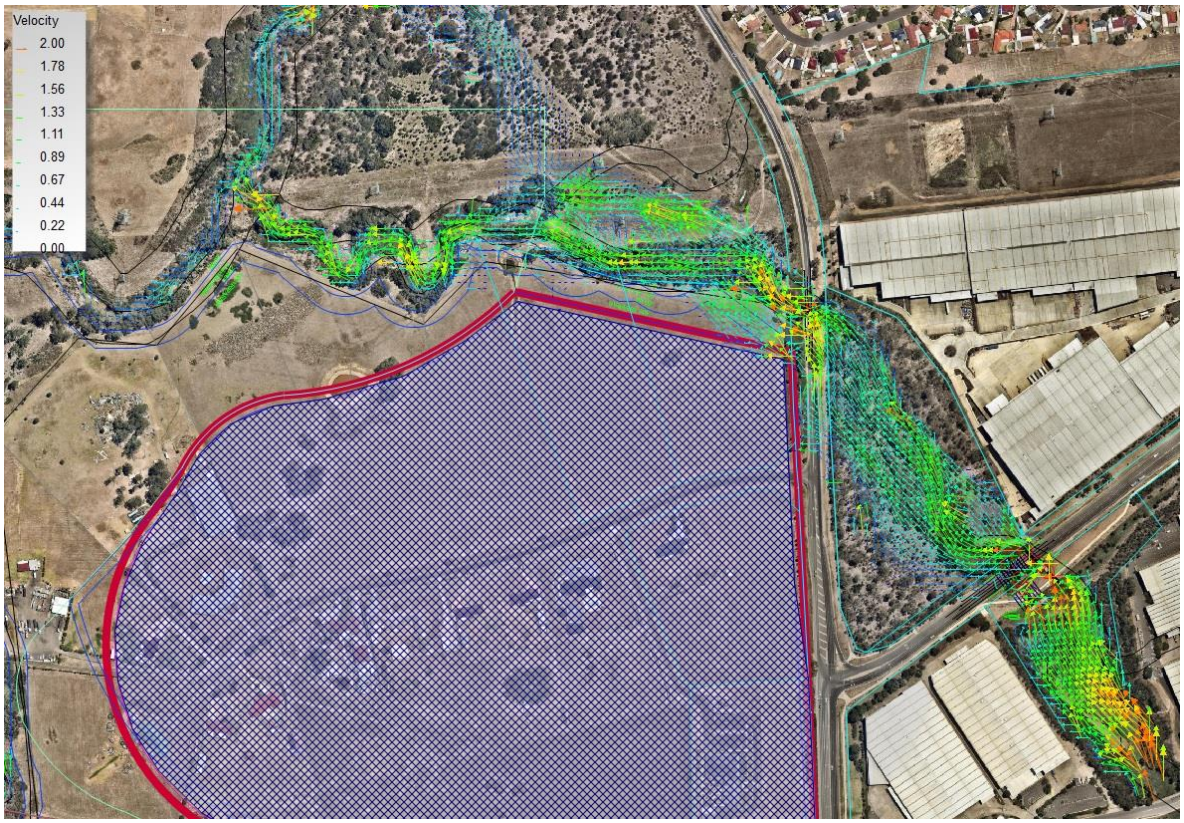


Figure F27 – 0.5% AEP Flood Velocity– Post Development

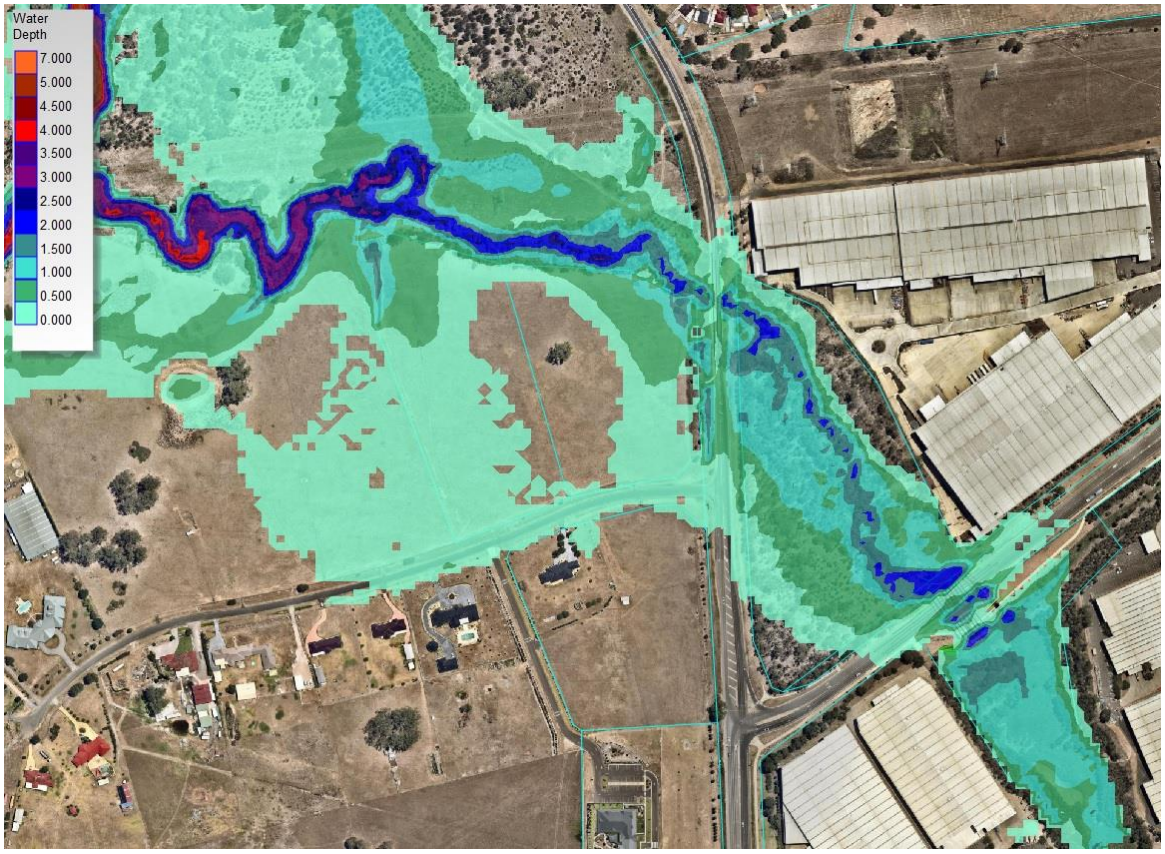


Figure F28 – PMF Flood Depth – Pre-Development

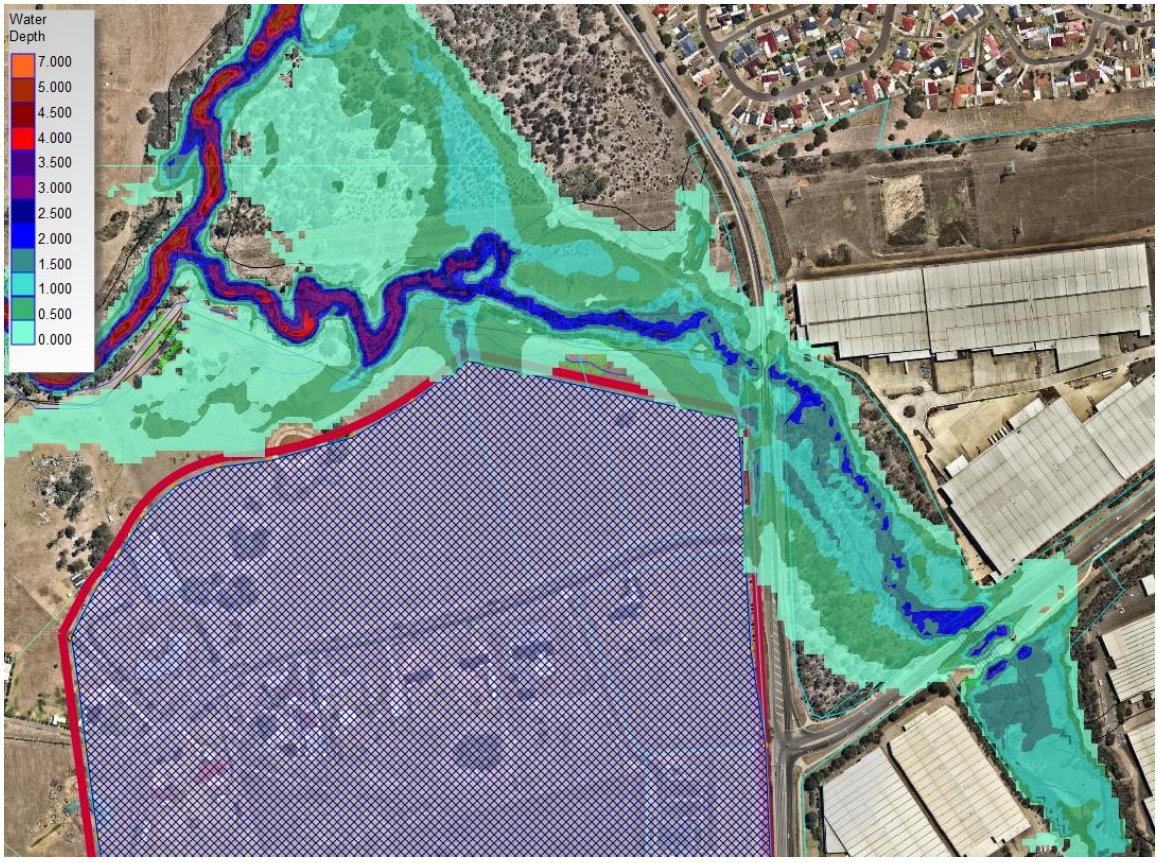


Figure F29 – PMF Flood Depth – Post Development

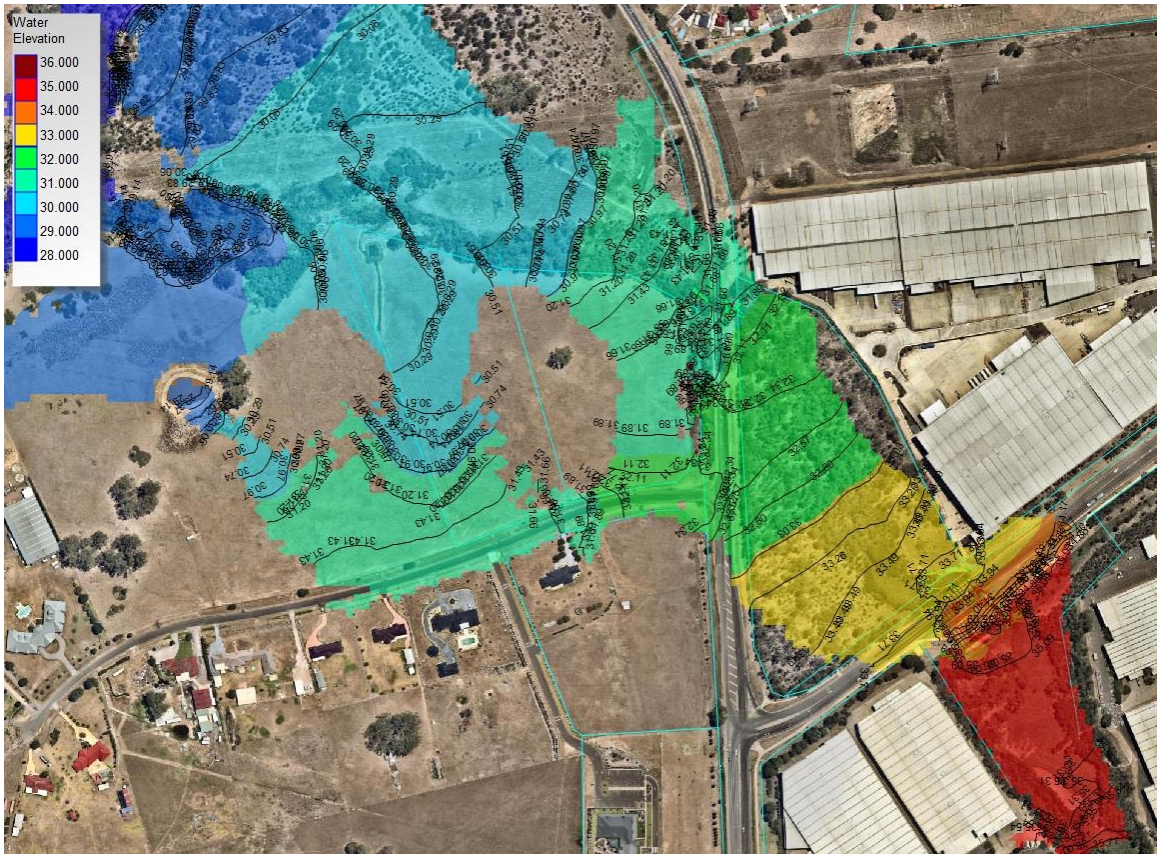


Figure F30 – PMF Flood Level – Pre-Development

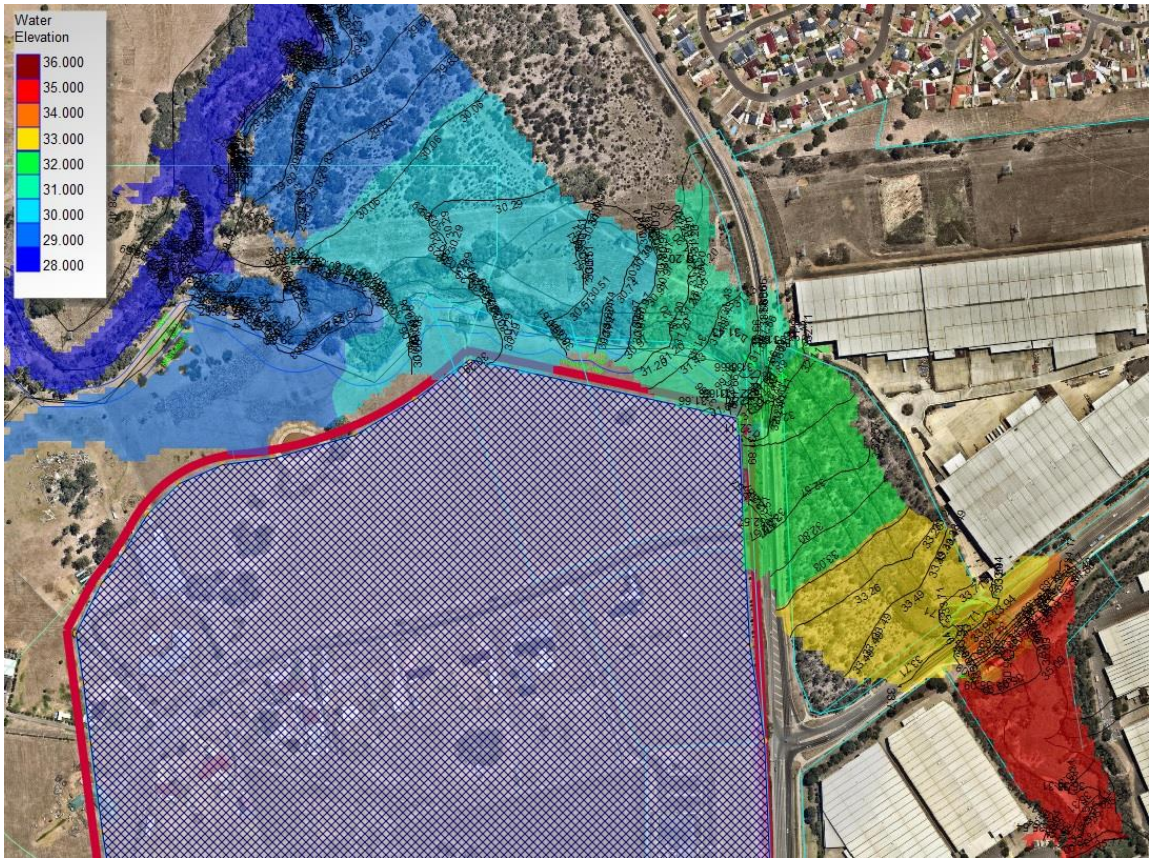


Figure F31 – PMF Flood Level – Post Development

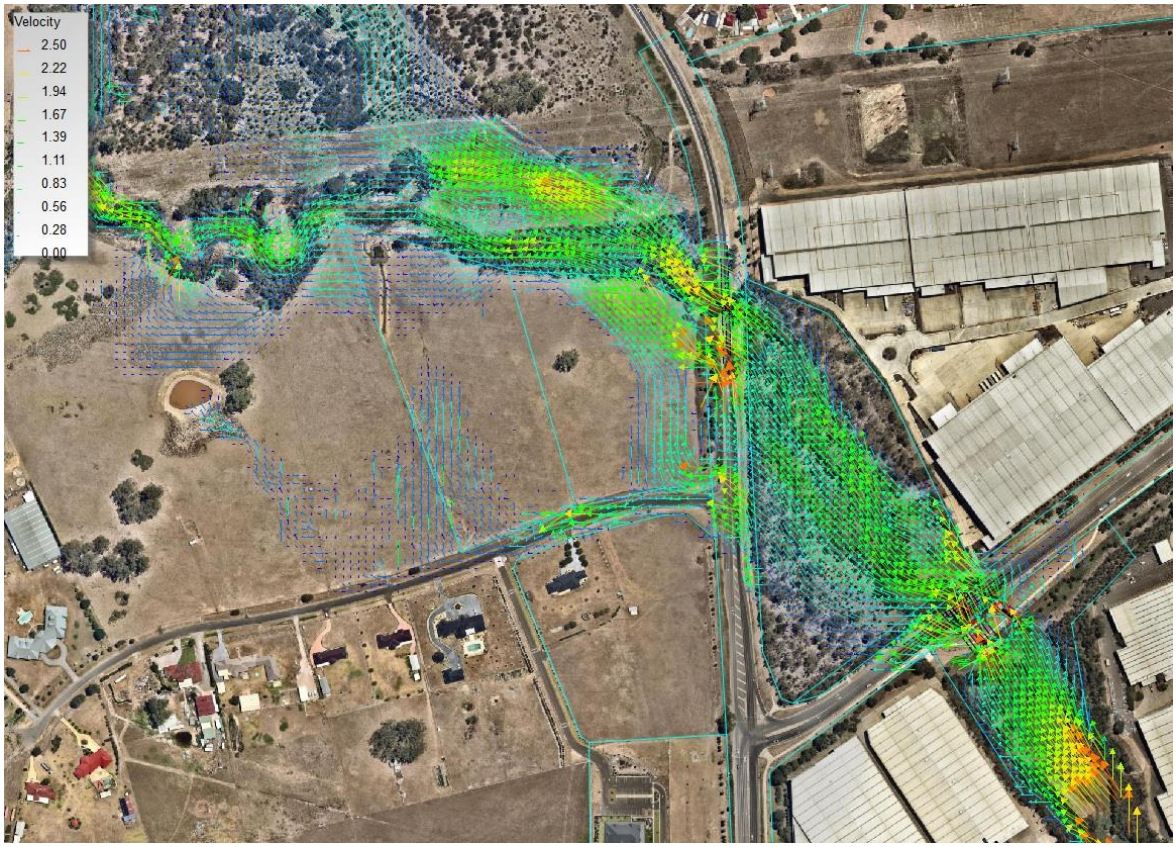


Figure F32 – PMF Flood Velocity – Pre-Development

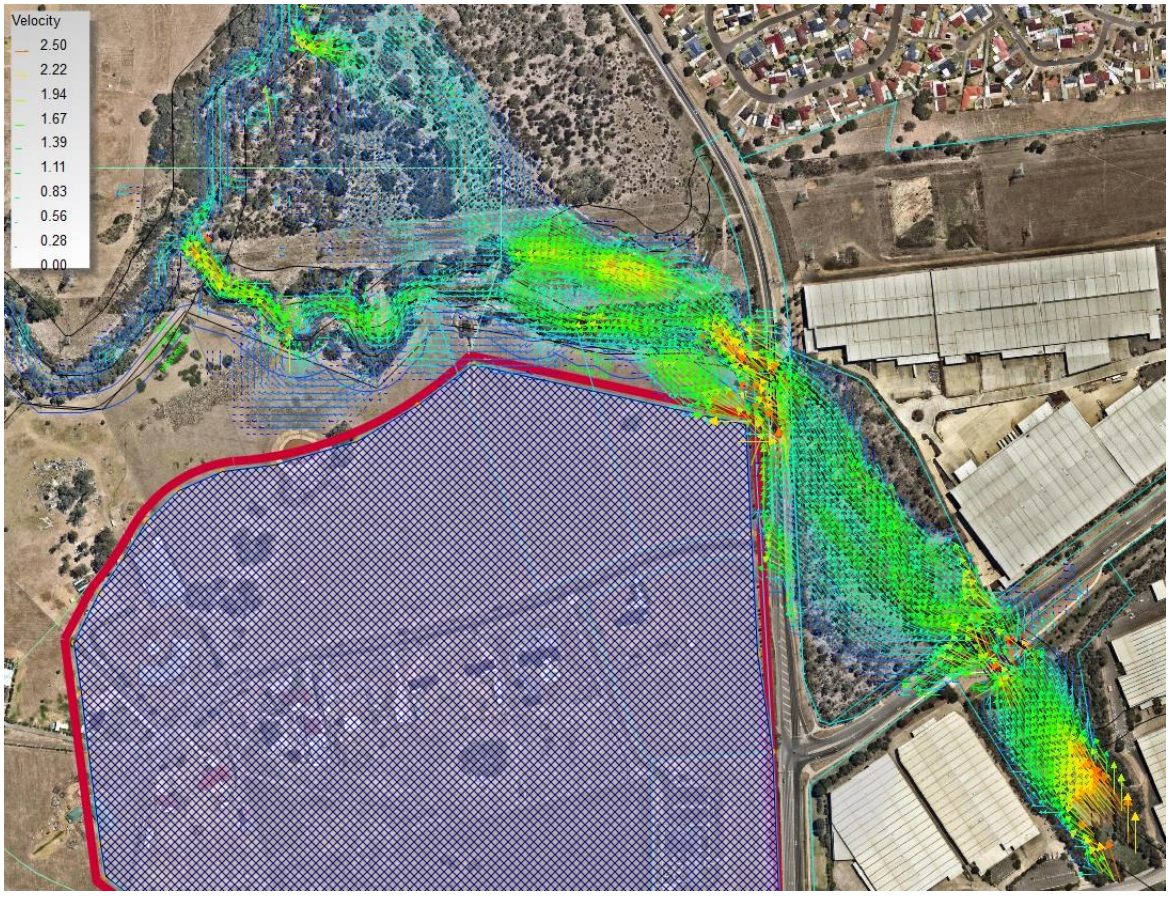


Figure F33 – PMF Flood Velocity – Post Development

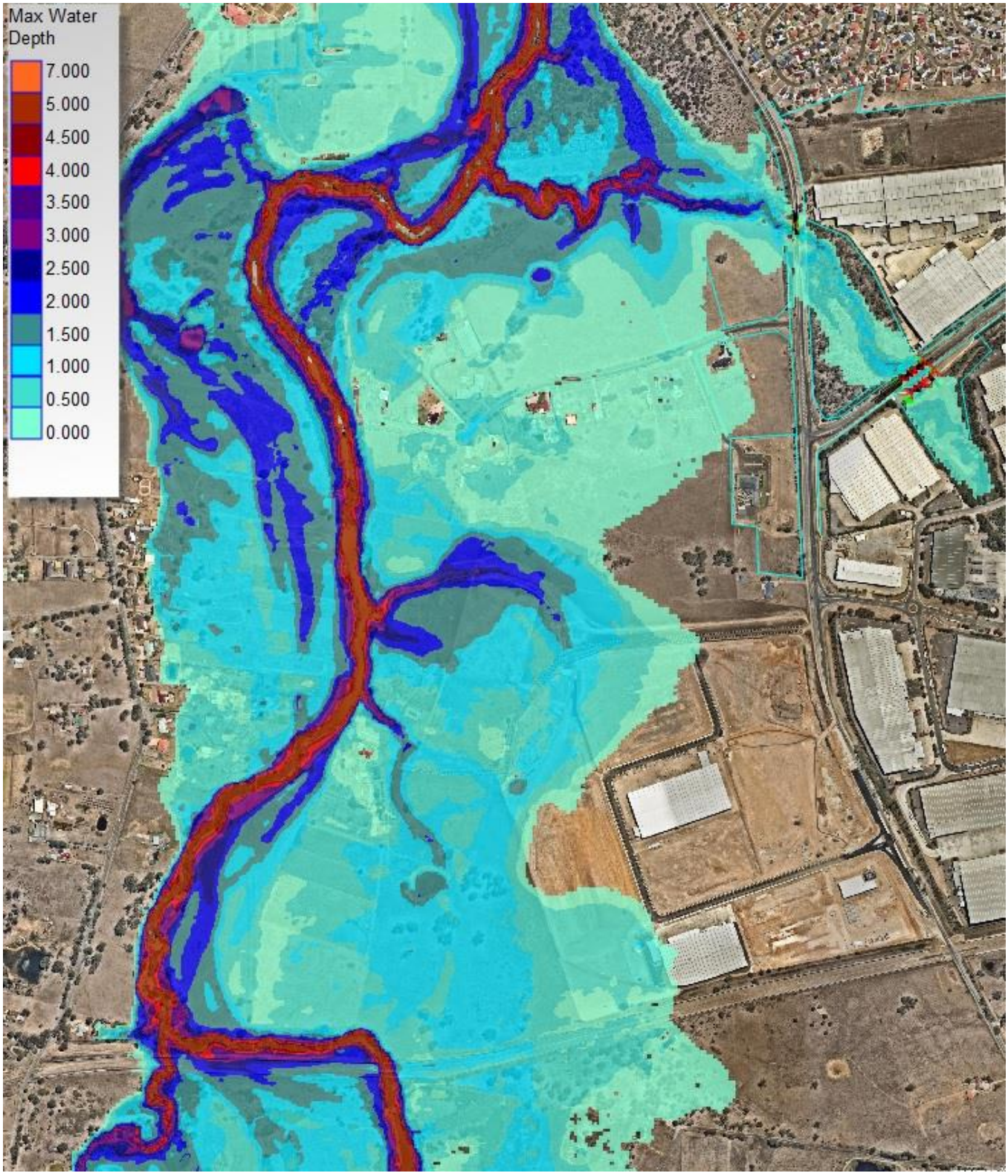


Figure F34 – 1% AEP Flood Depth – Pre-Development 36 Hr Duration

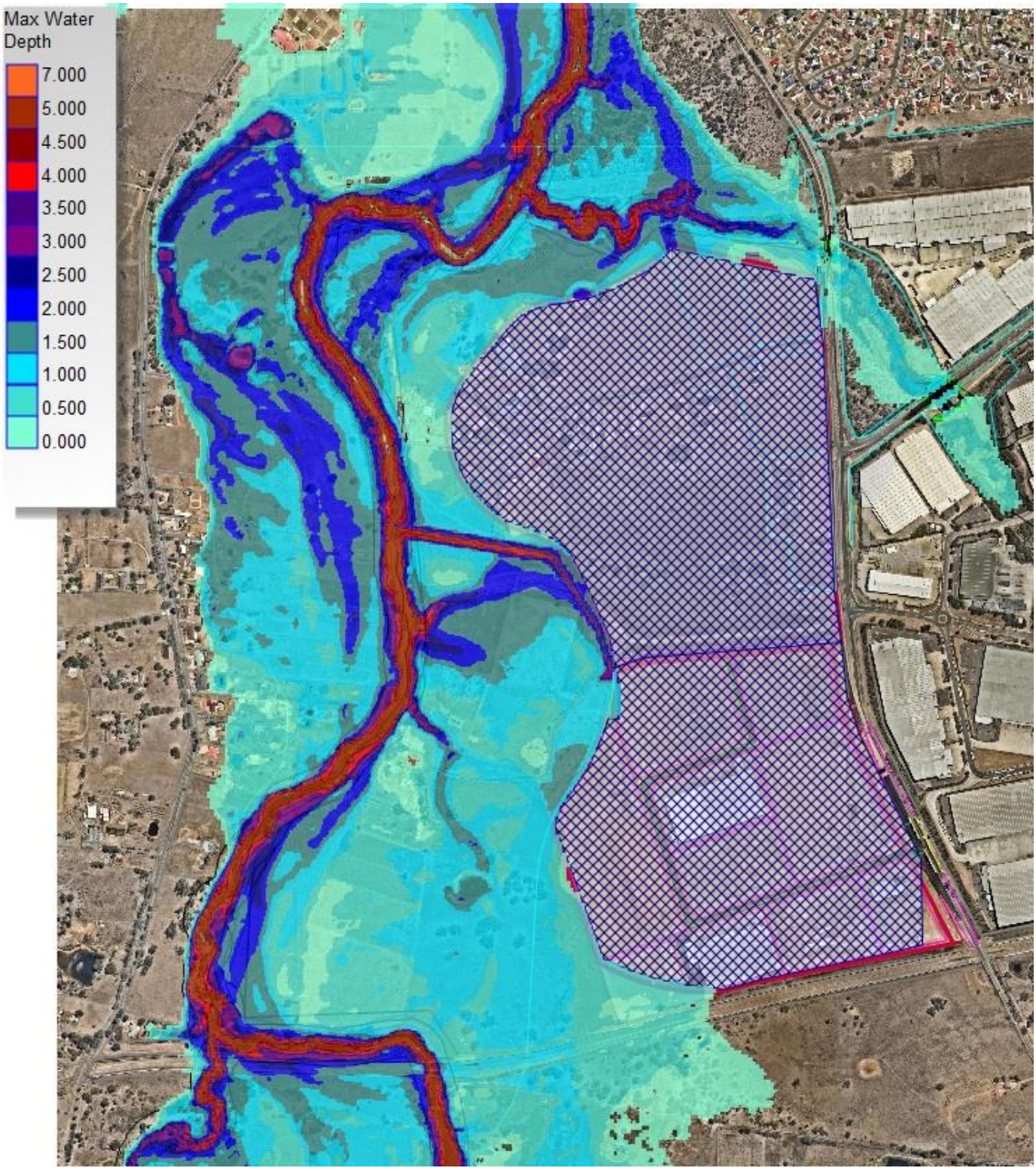


Figure F35 – 1% AEP Flood Depth – Post Development 36 Hr Duration

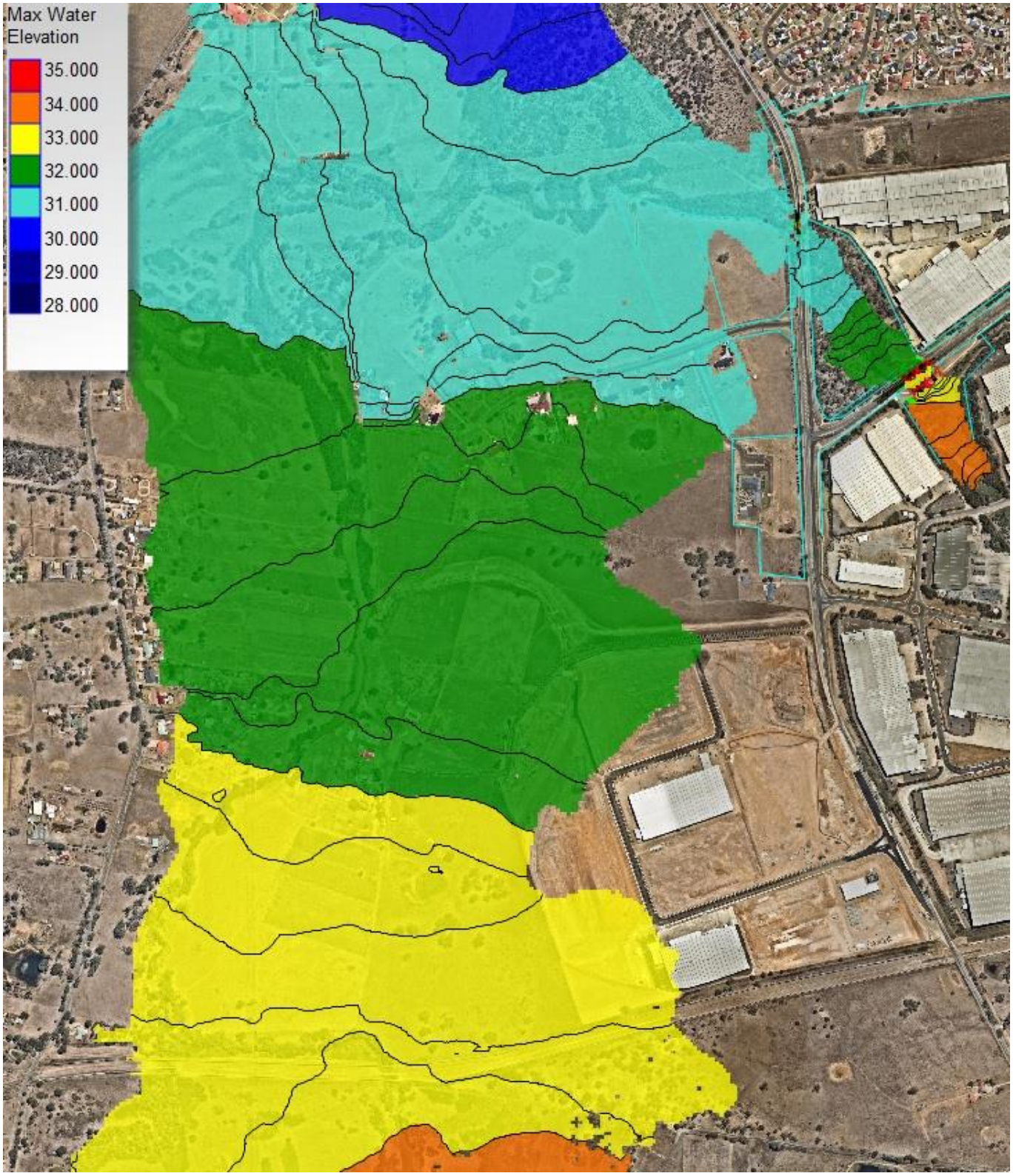


Figure F36 – 1% AEP Flood Level – Pre- Development 36 Hr Duration

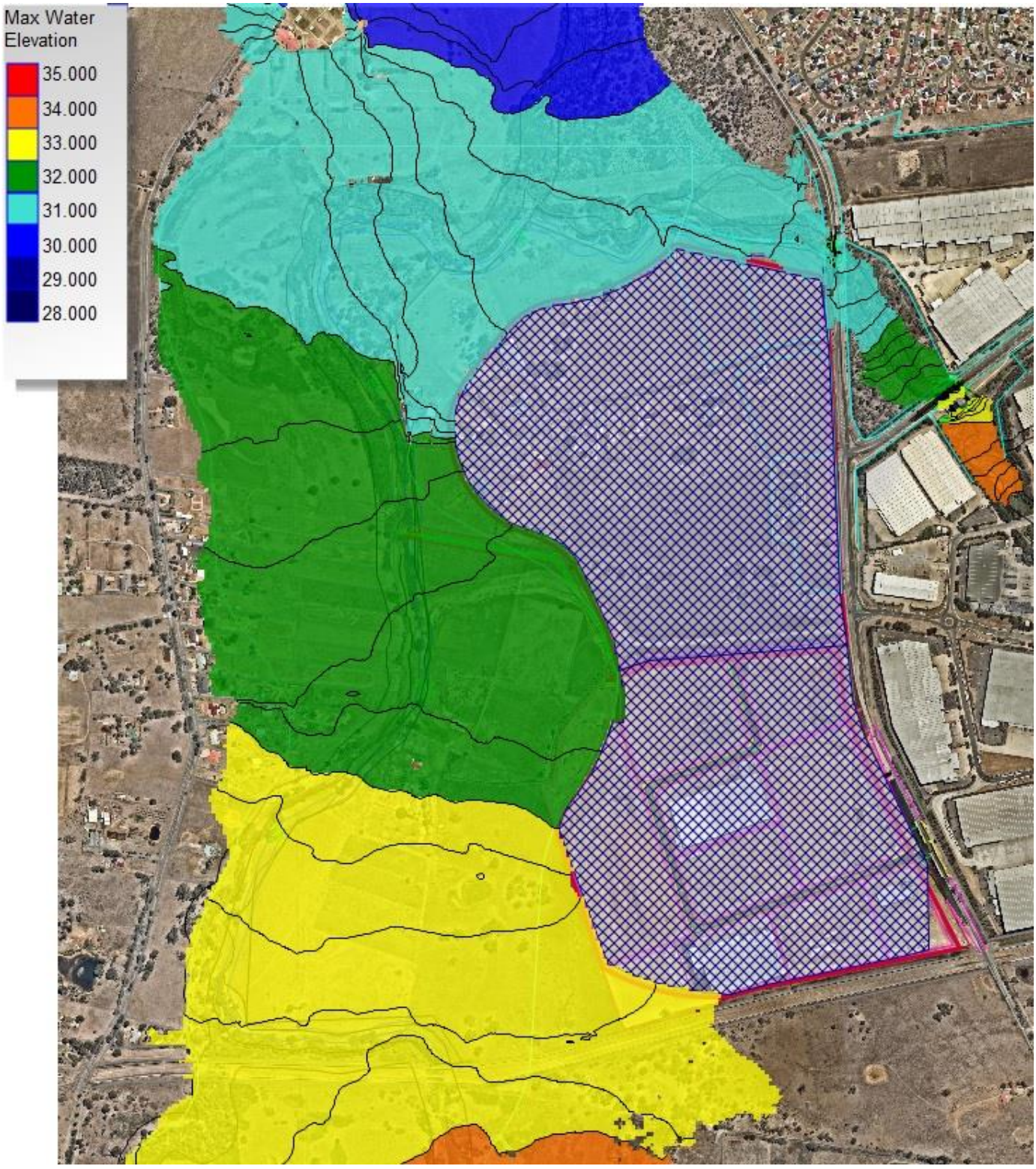


Figure F37 – 1% AEP Flood Level – Post Development 36 Hr Duration

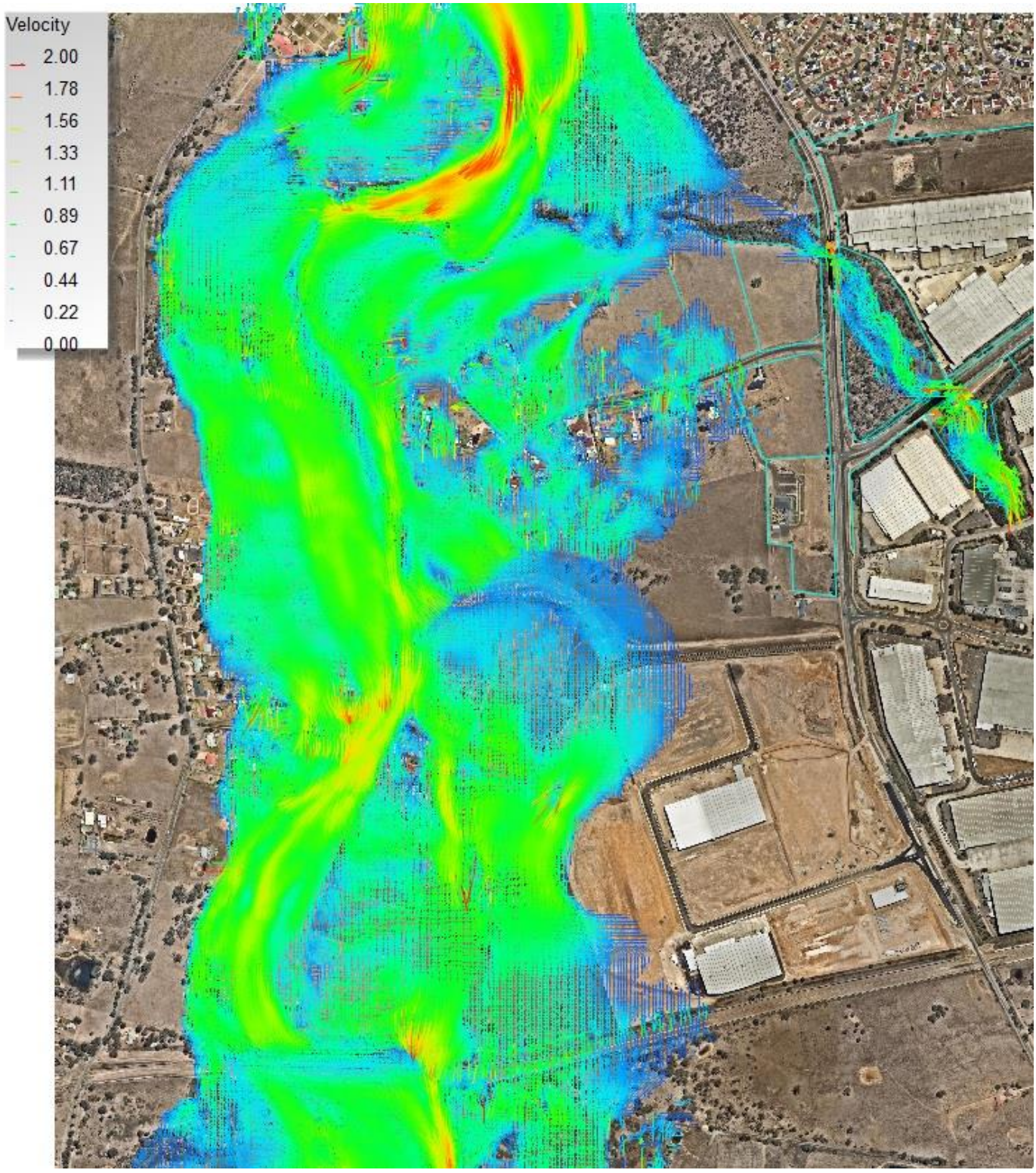


Figure F38 – 1% AEP Flood Velocity - Pre-Development 36Hr Duration

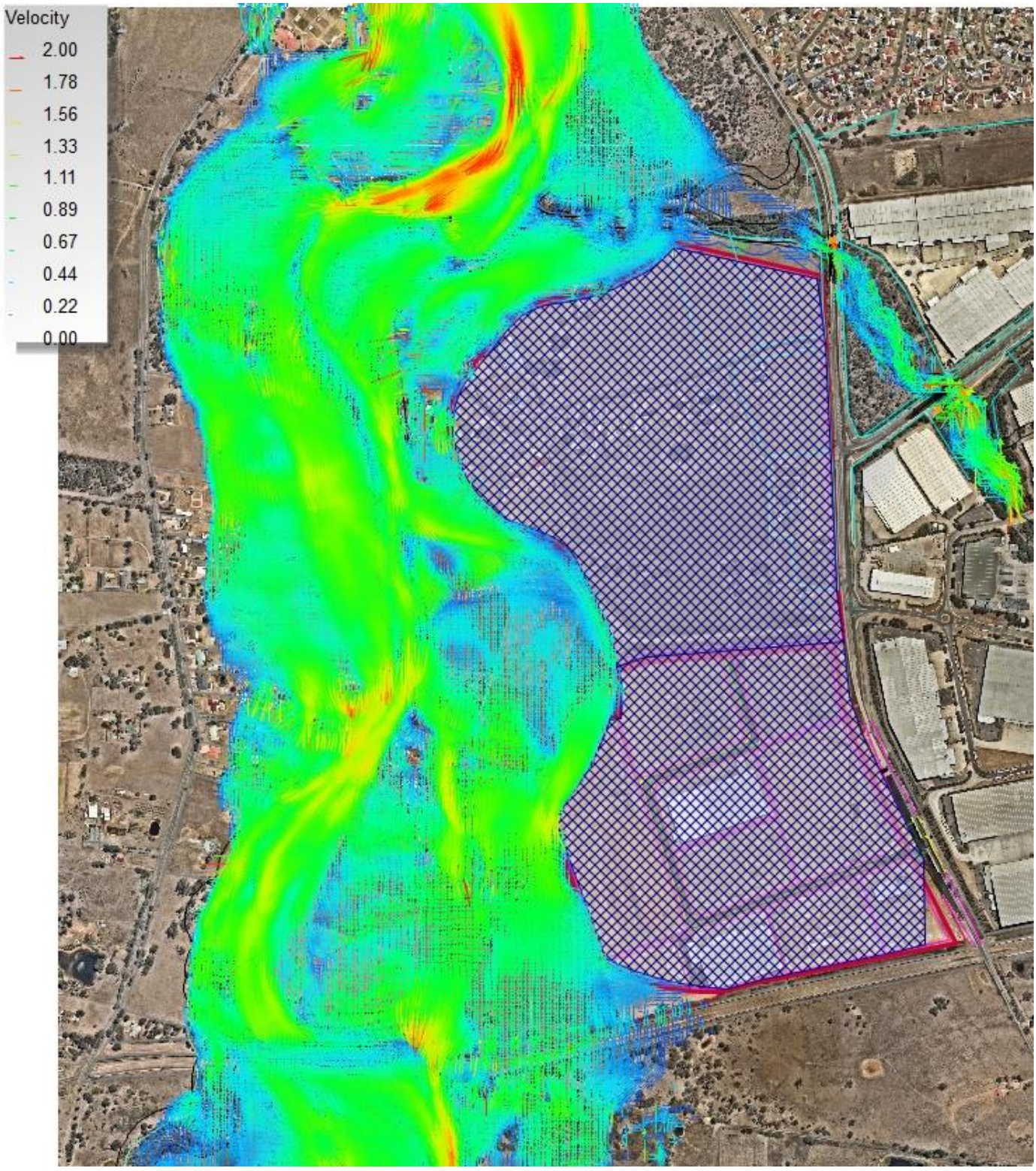


Figure F39 – 1% AEP Flood Velocity – Post Development 36Hr Duration

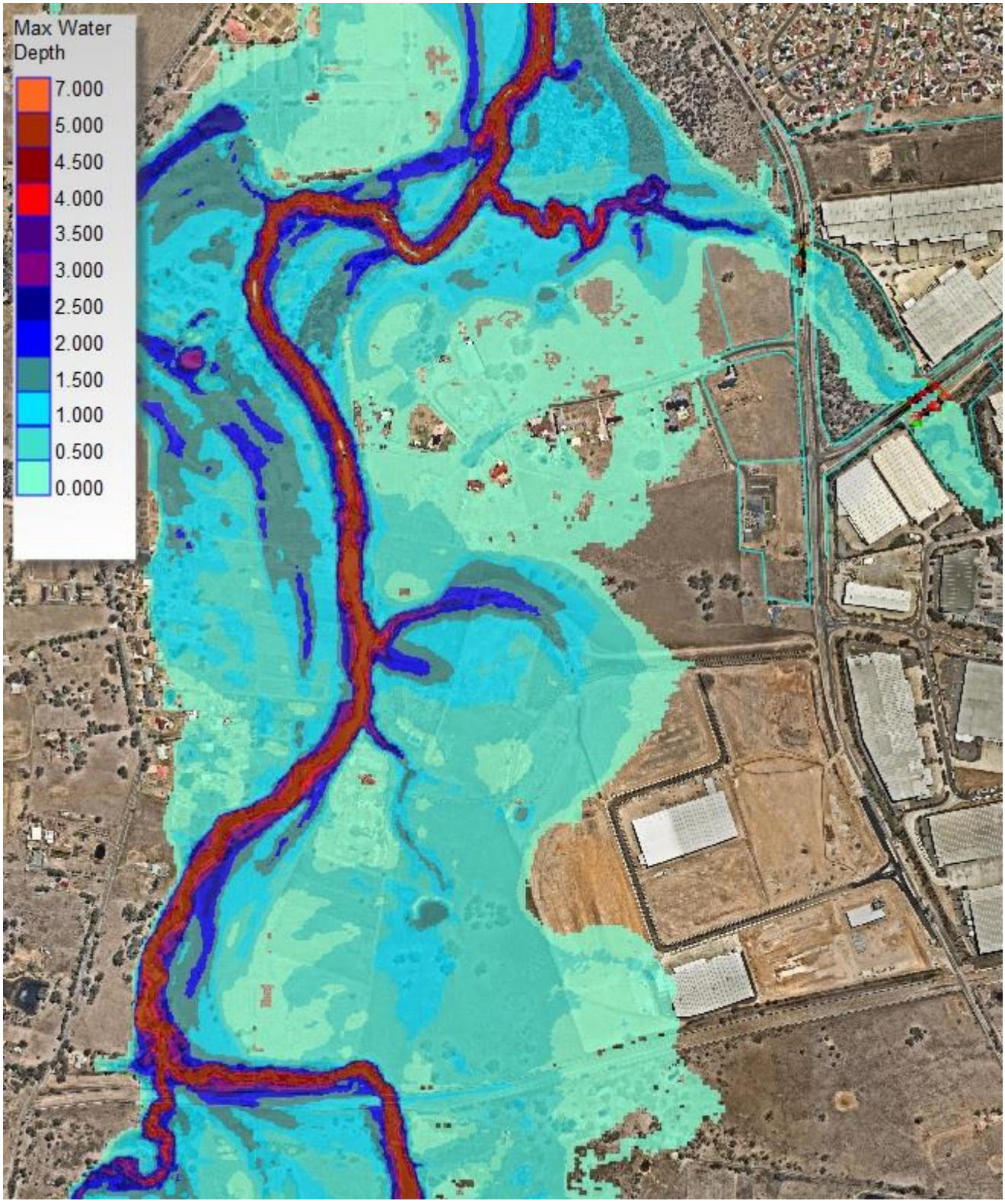


Figure F40 – 5% AEP Flood Depth – Pre-Development 36 Hr Duration

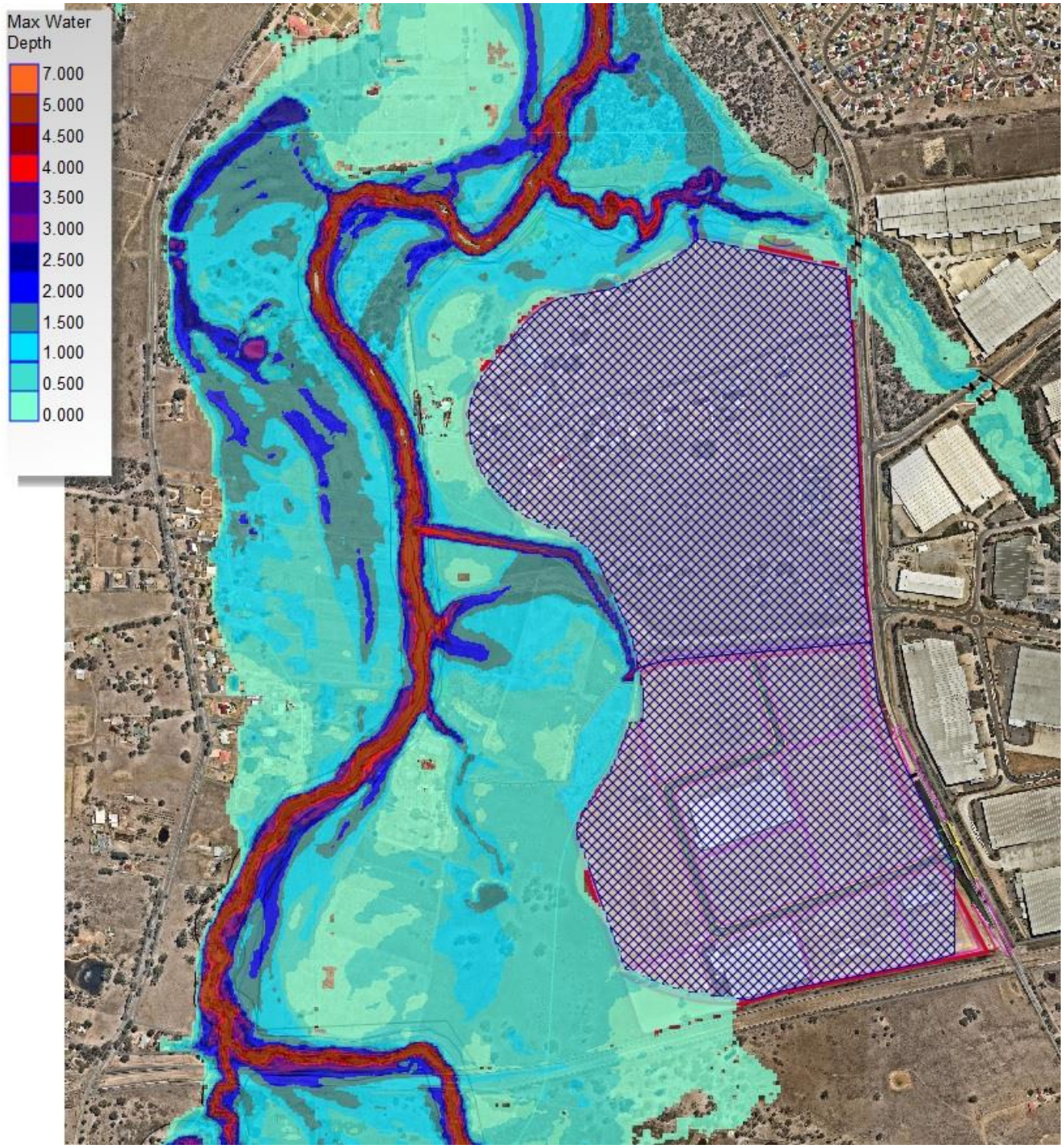


Figure F41 – 5% AEP Flood Depth – Post Development 36 Hr Duration

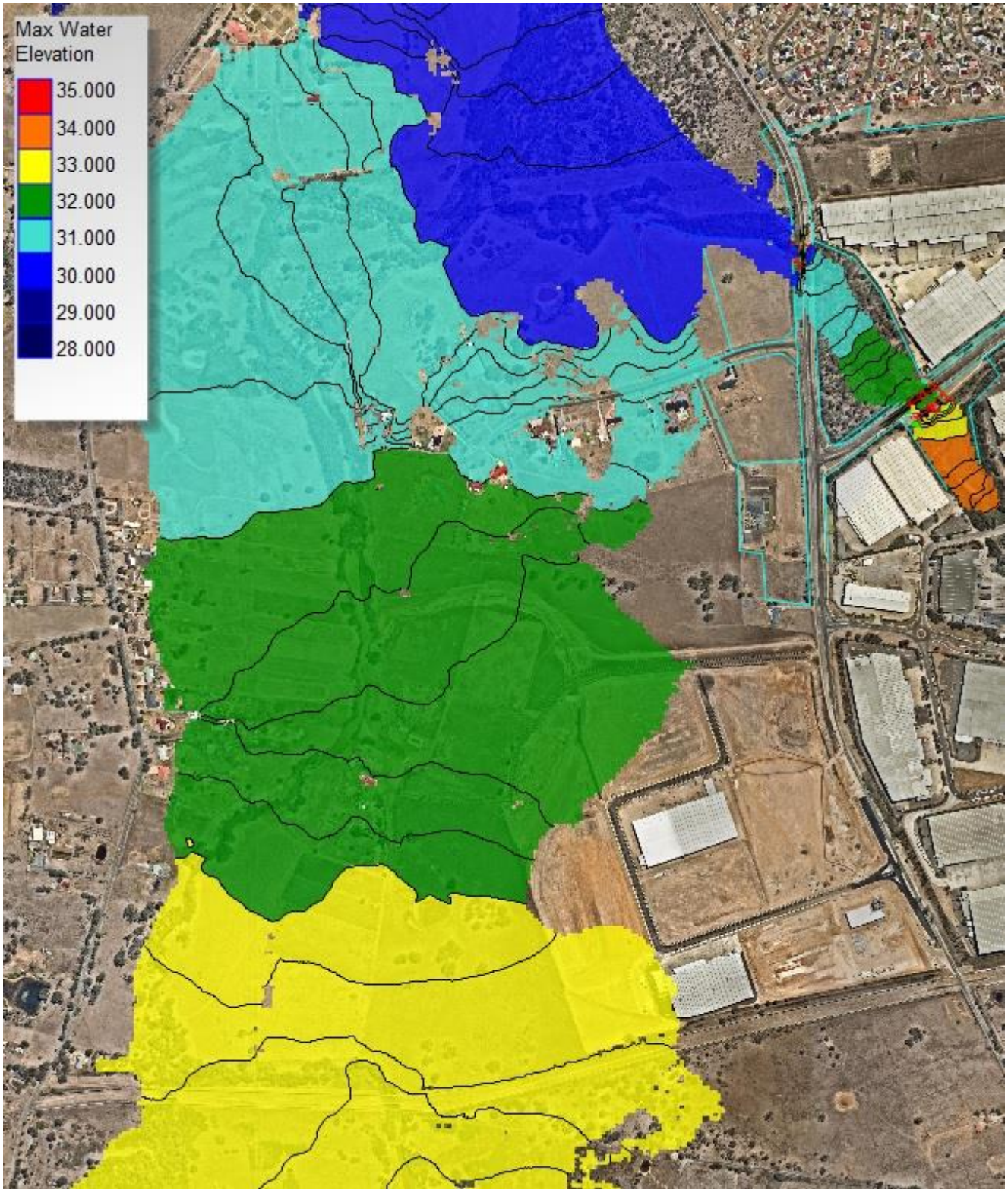


Figure F42 – 5% AEP Flood Level – Pre-Development 36 Hr Duration

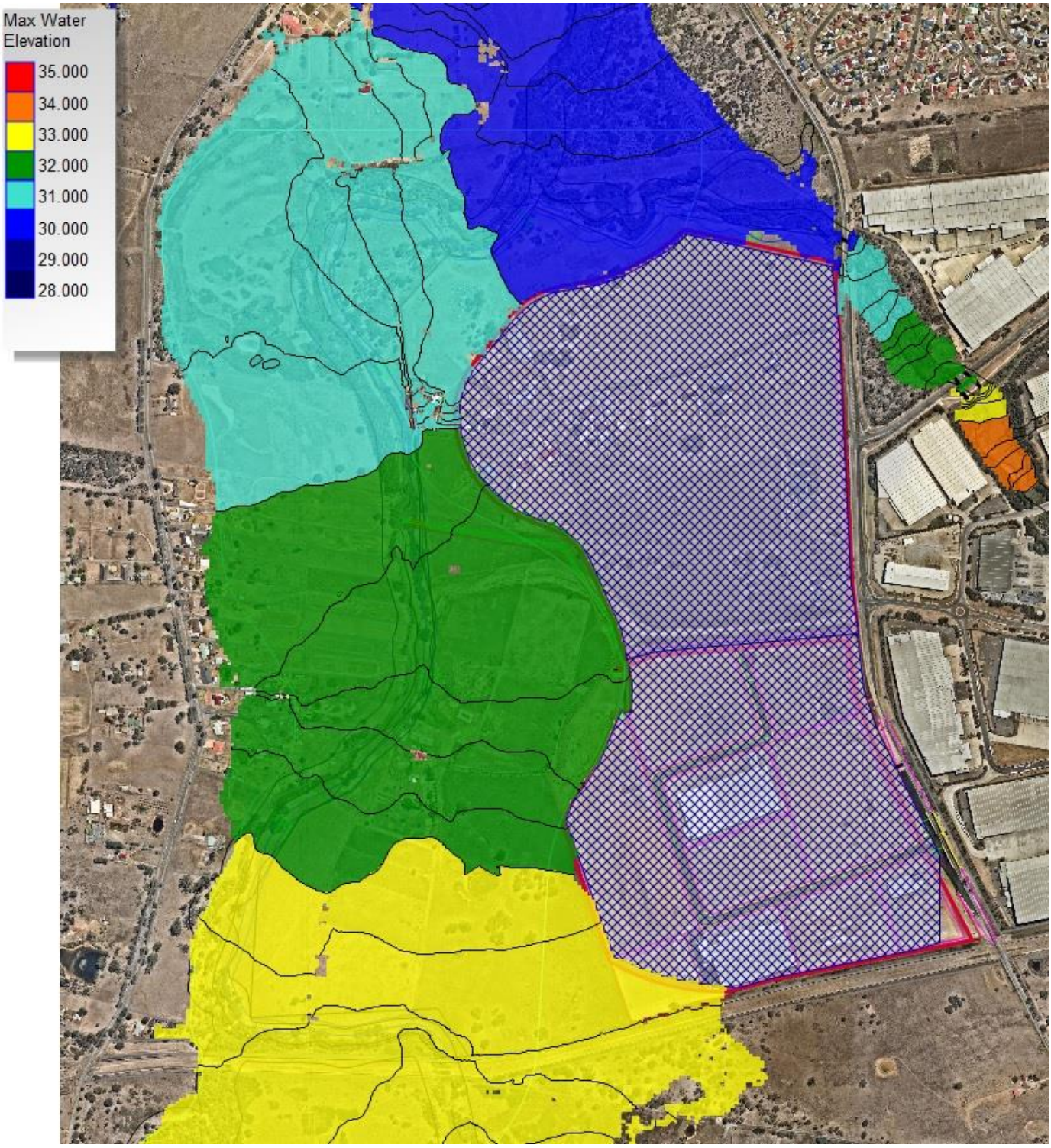


Figure F43 – 5% AEP Flood Level – Post Development 36 Hr Duration

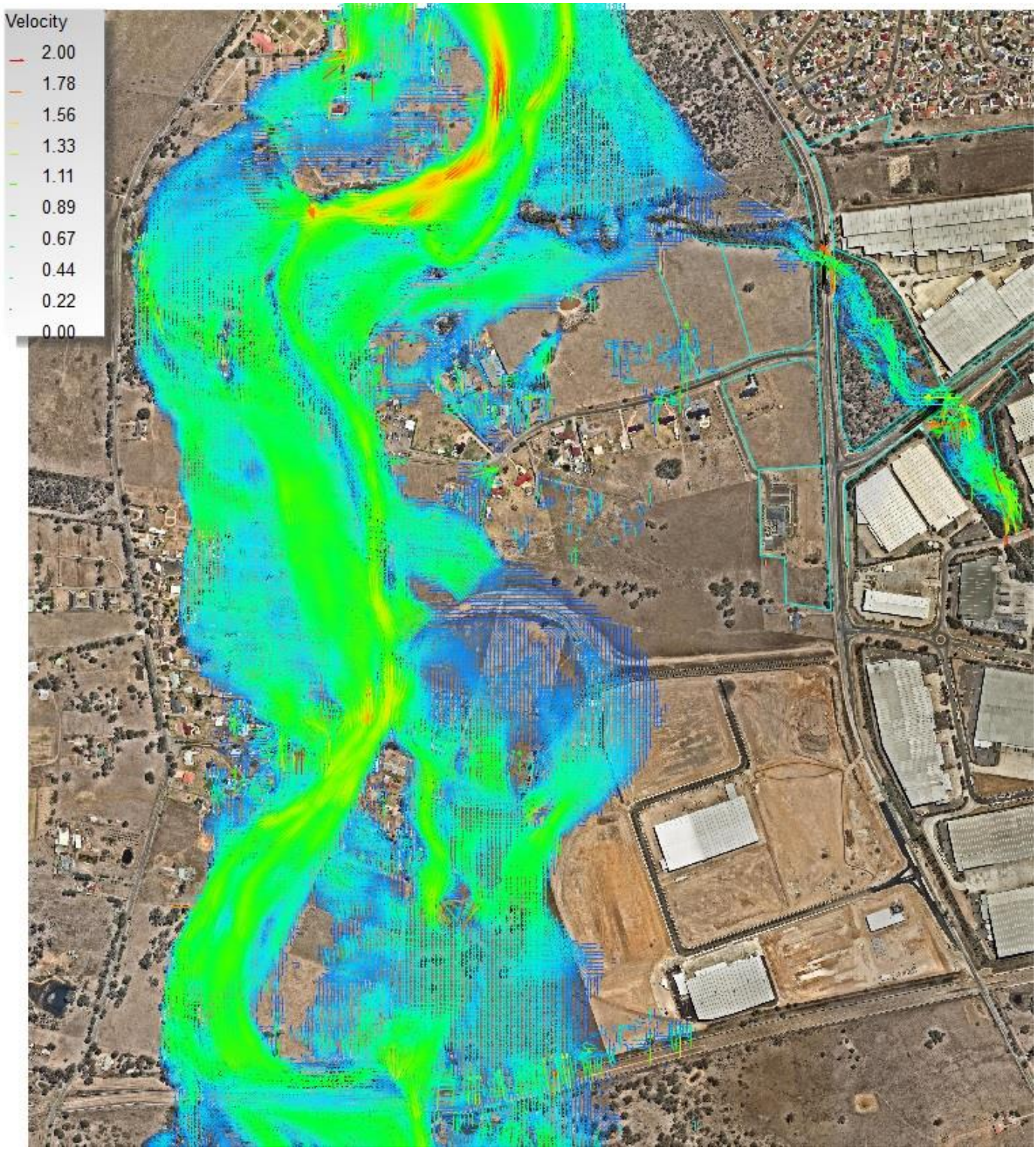


Figure F44 – 5% AEP Flood Velocity – Pre-Development 36 Hr Duration

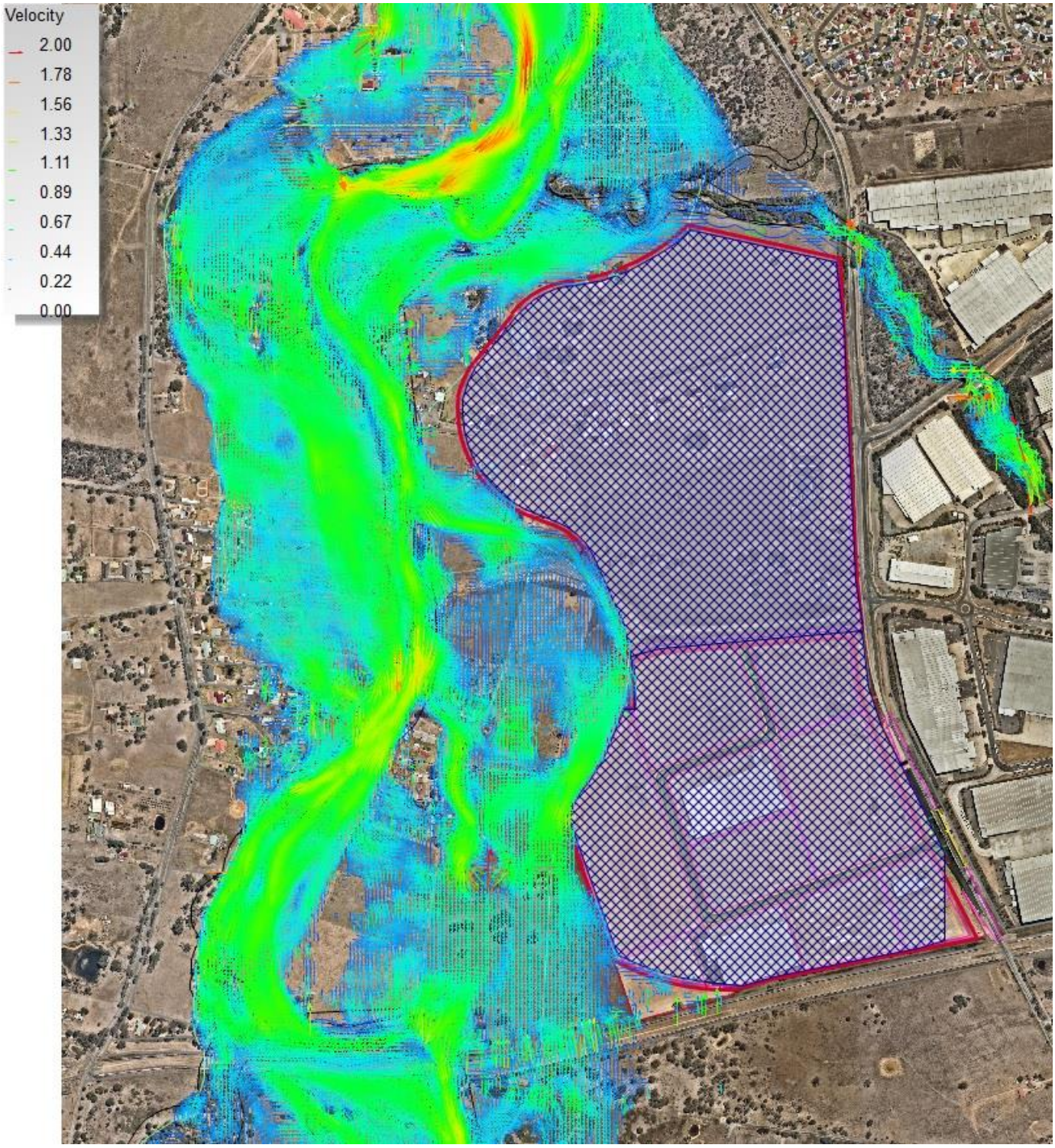


Figure F45 – 5% AEP Flood Velocity – Post Development 36 Hr Duration

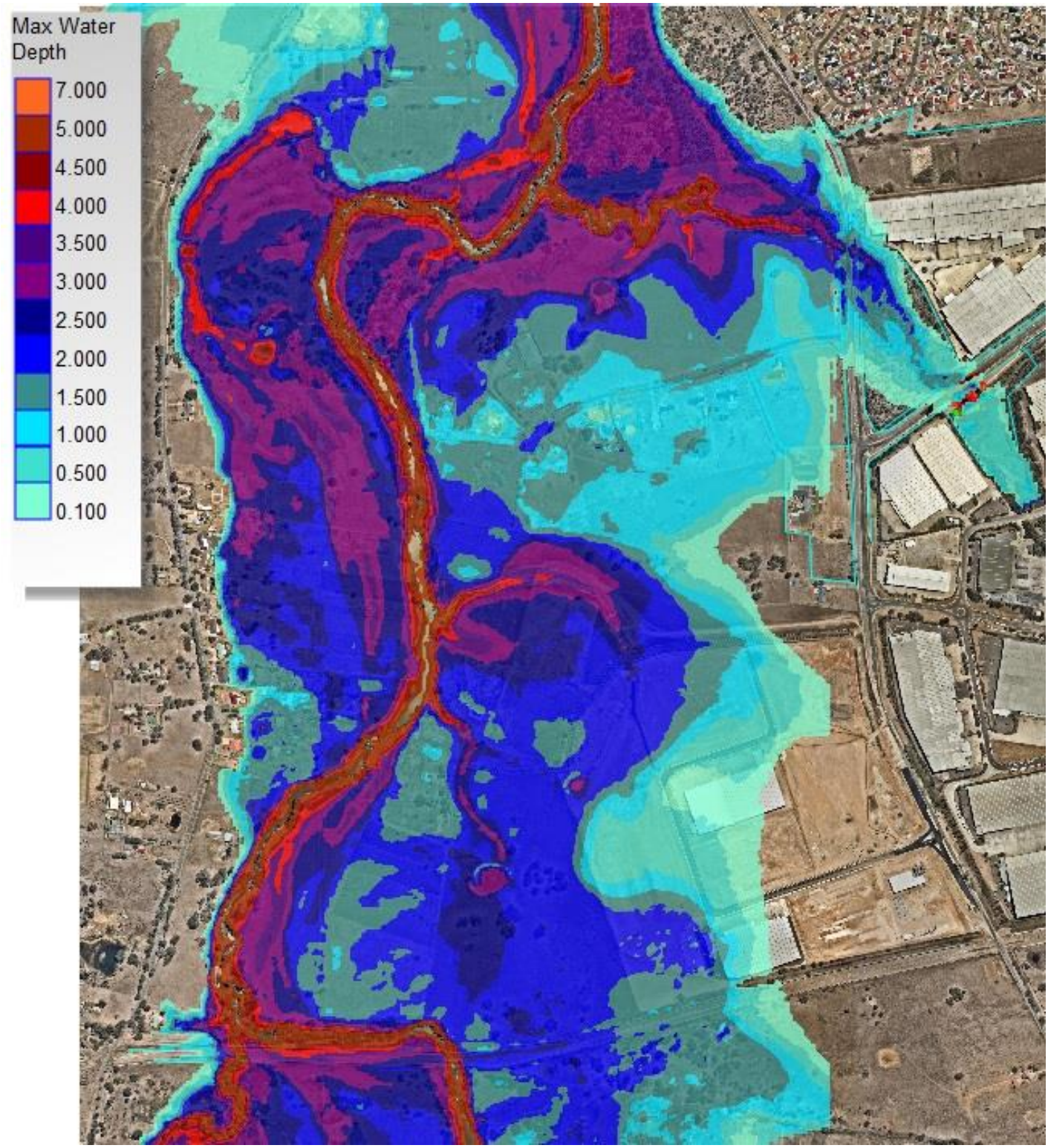


Figure F46 – PMF Flood Depth – Pre-Development 20 Hr Duration

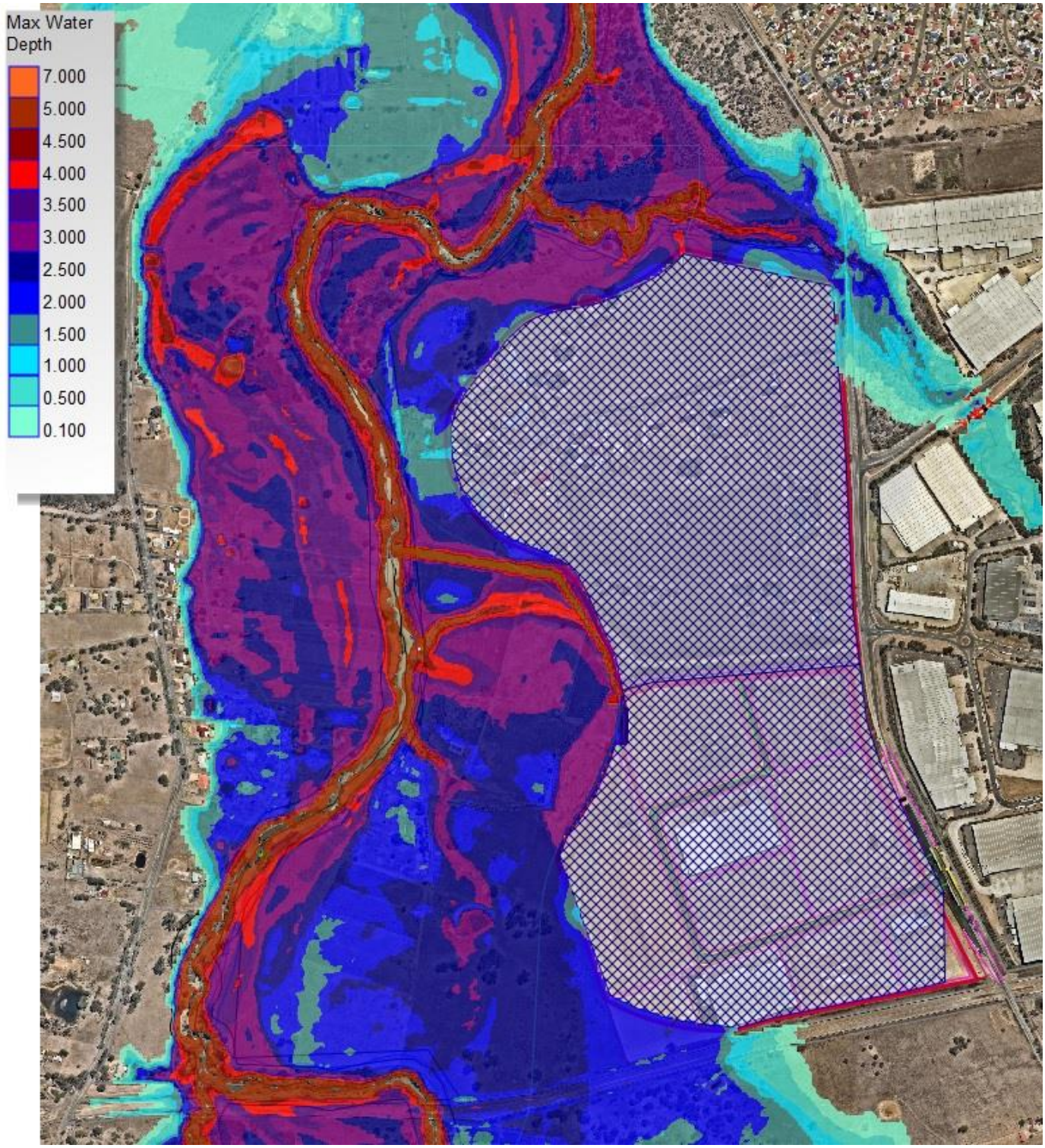


Figure F47 – PMF Flood Depth – Post Development 20 Hr Duration

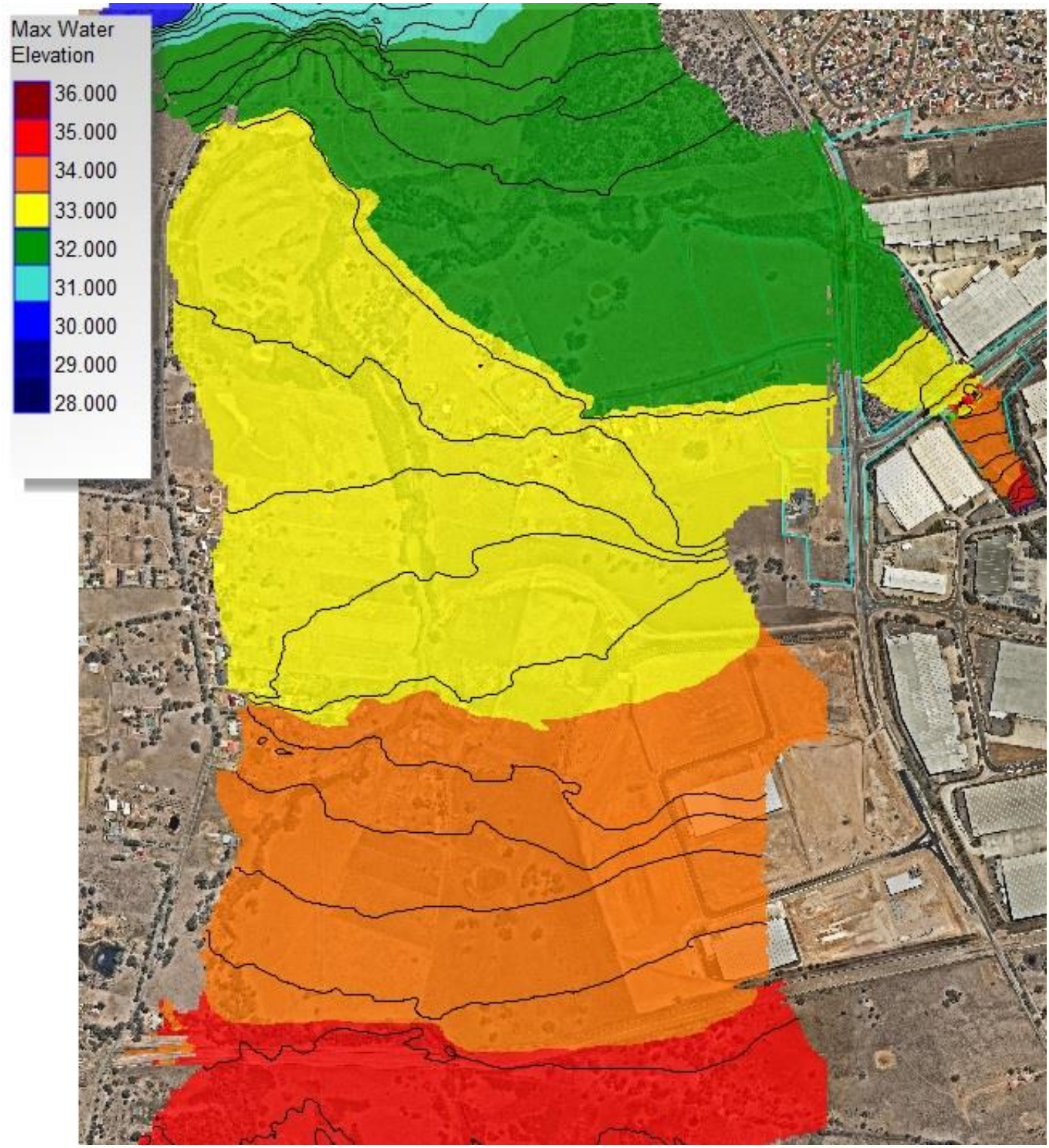


Figure F48 – PMF Flood Level – Pre-Development 20 Hr Duration

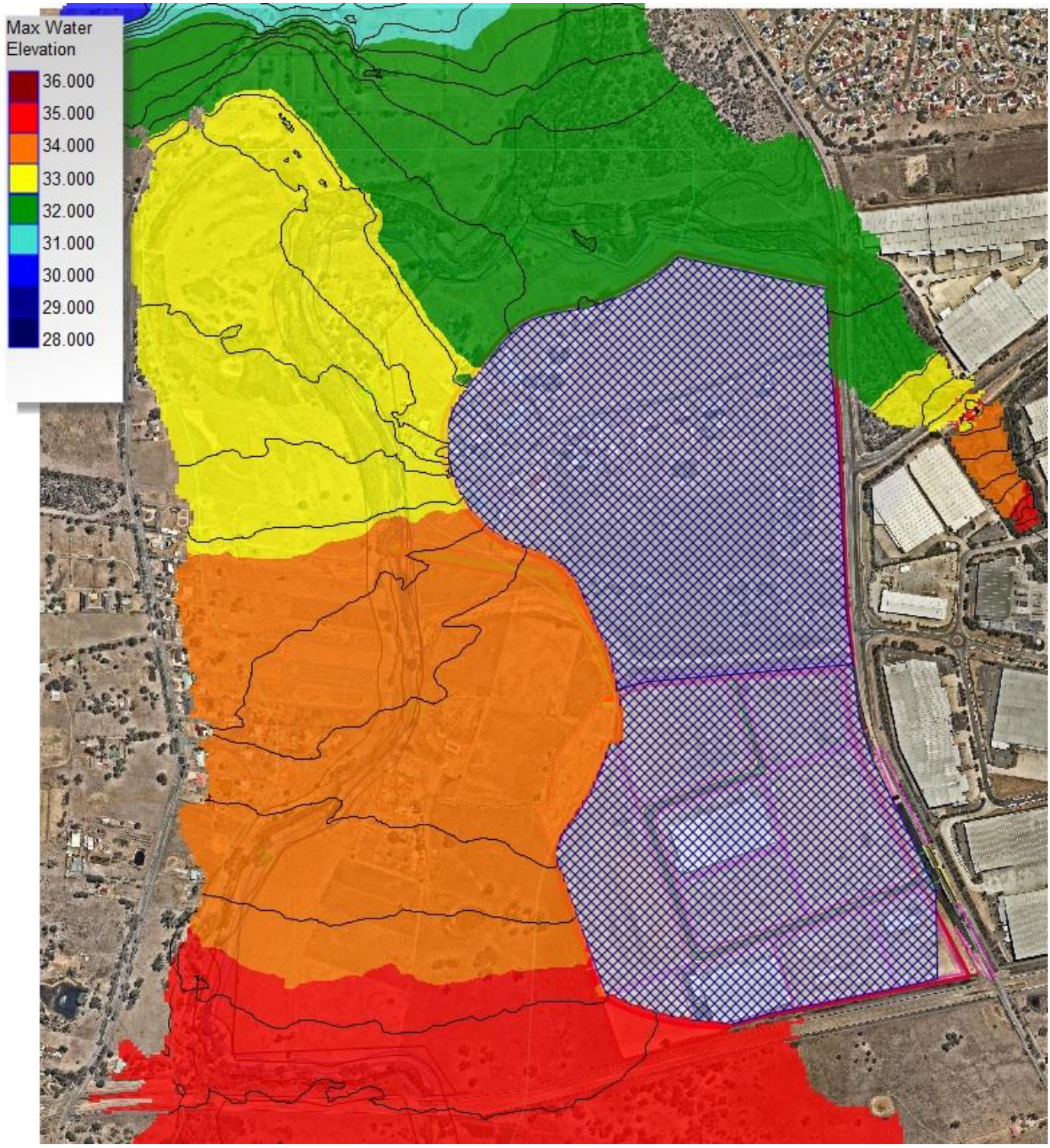


Figure F49 – PMF Flood Level – Post Development 20 Hr Duration

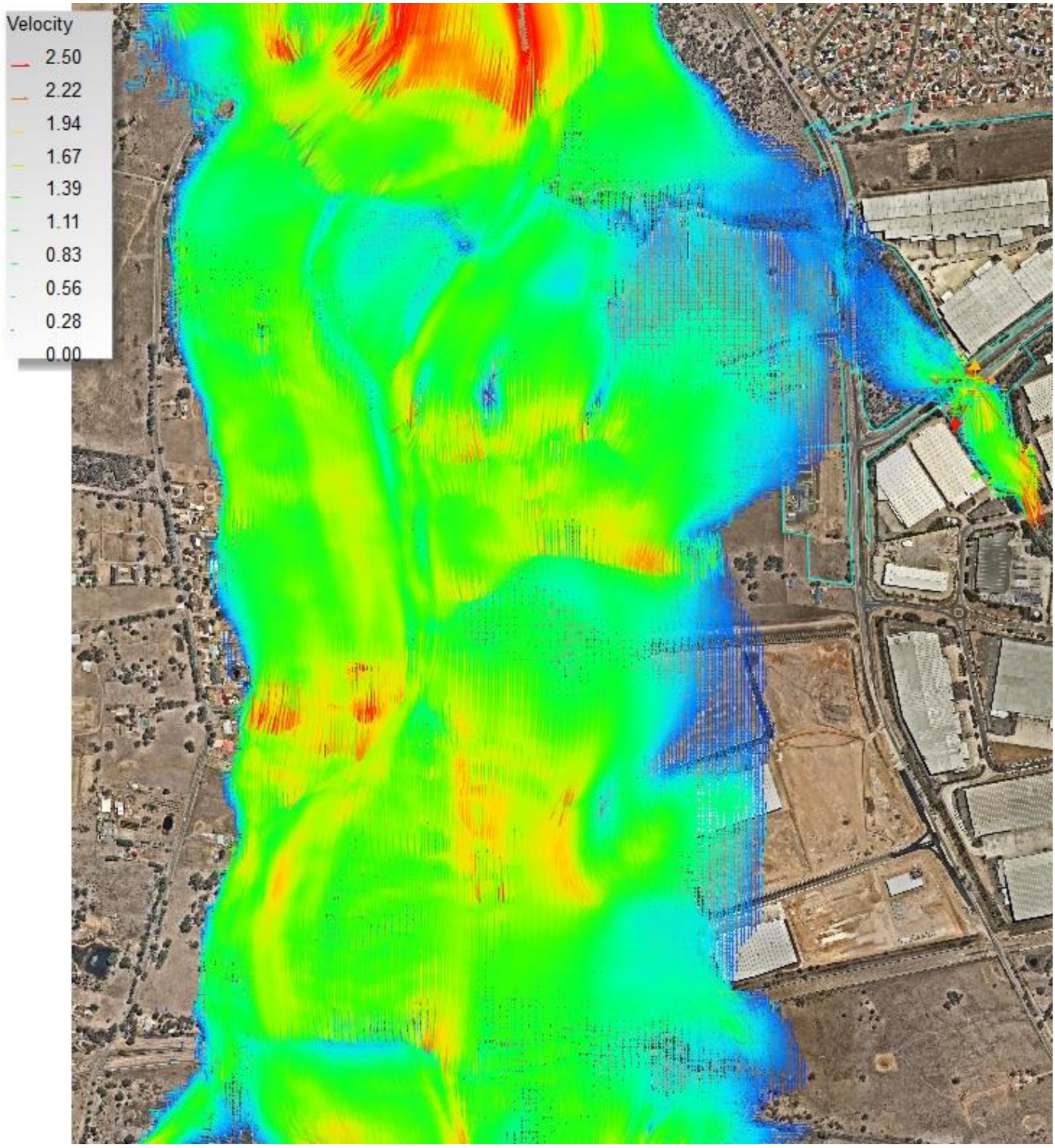


Figure F50 – PMF Flood Velocity – Pre-Development 20 Hr Duration

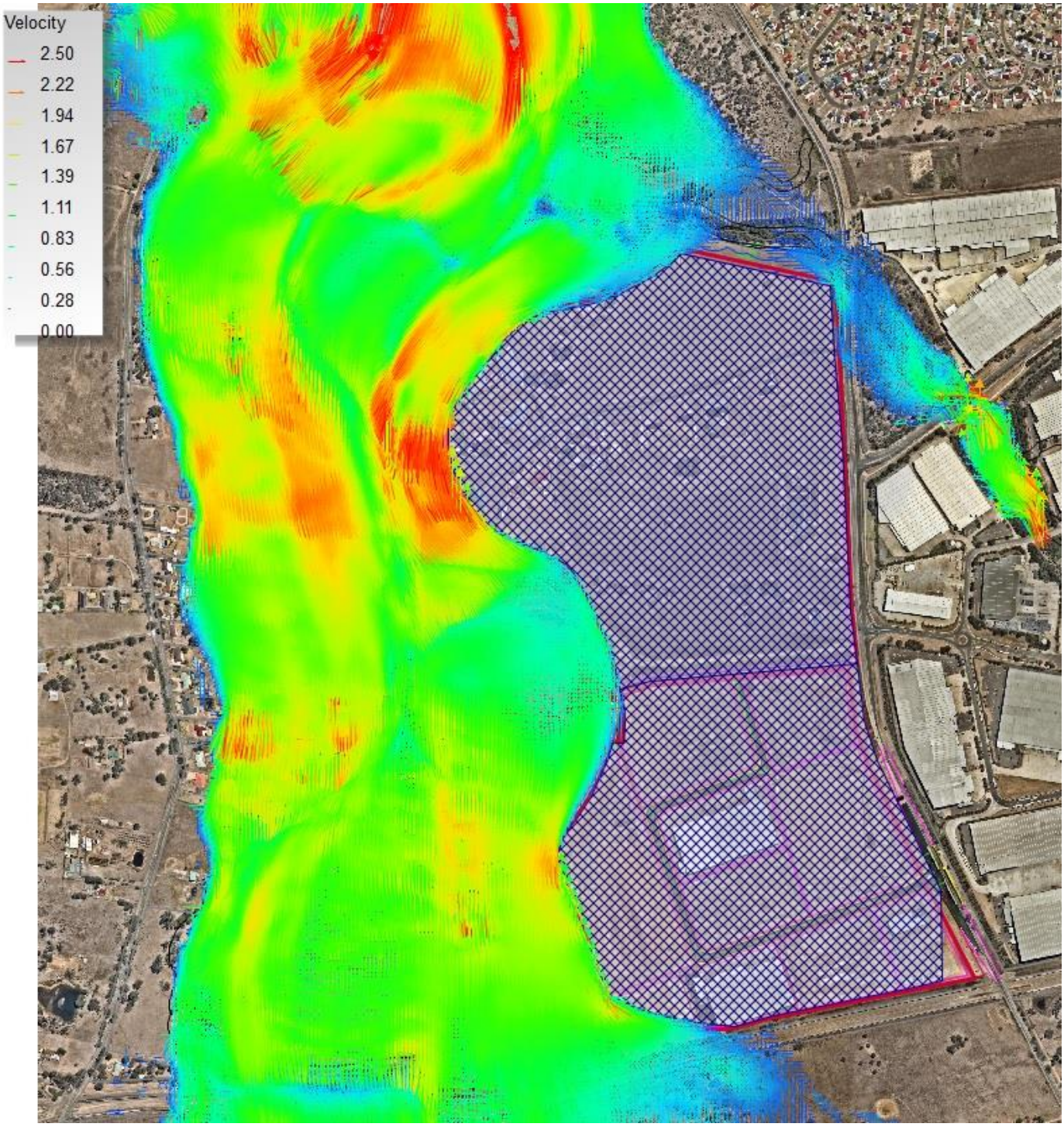
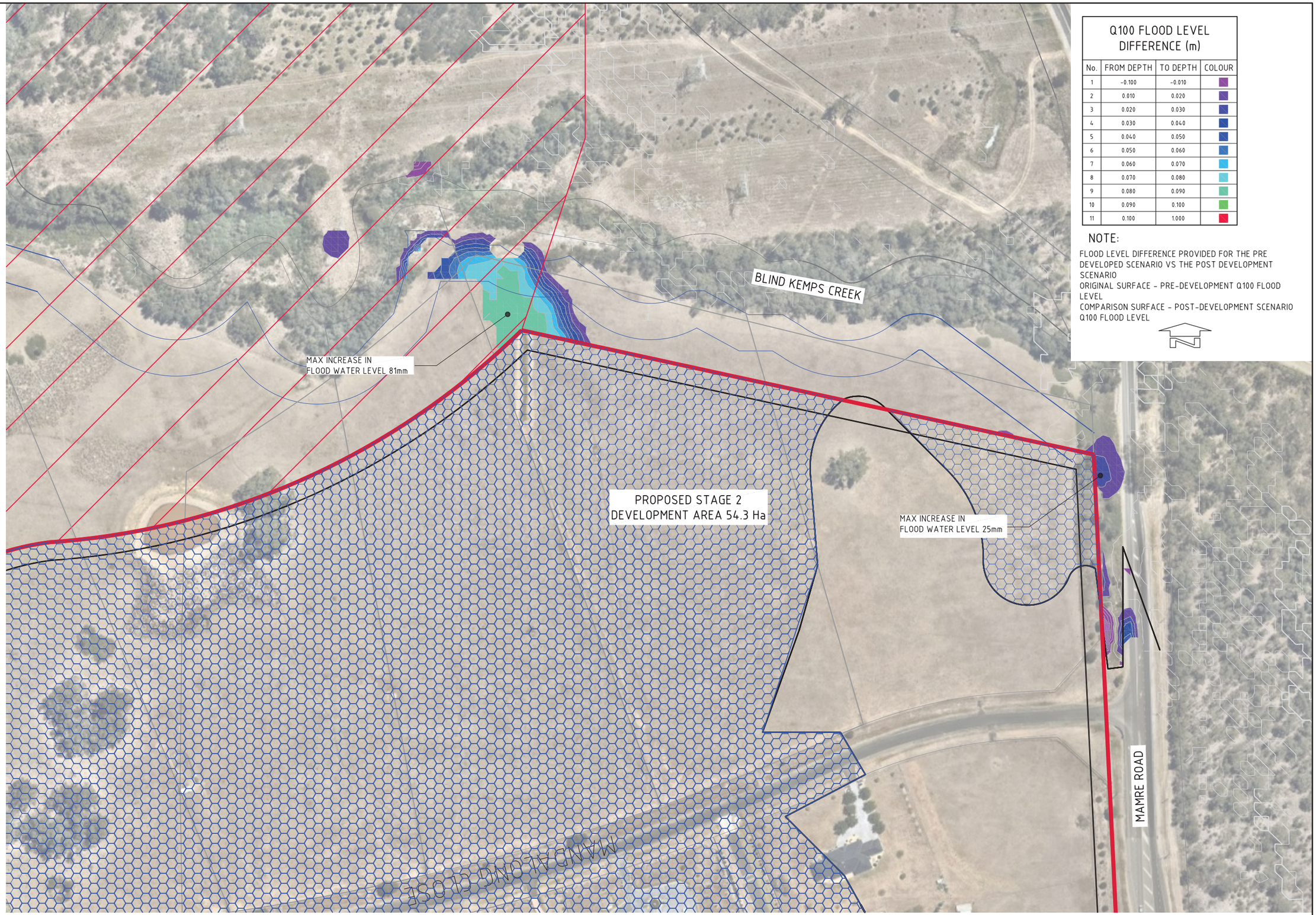


Figure F51 – PMF Flood Velocity – Post Development 20 Hr Duration



Q100 FLOOD LEVEL DIFFERENCE (m)

No.	FROM DEPTH	TO DEPTH	COLOUR
1	-0.100	-0.010	
2	0.010	0.020	
3	0.020	0.030	
4	0.030	0.040	
5	0.040	0.050	
6	0.050	0.060	
7	0.060	0.070	
8	0.070	0.080	
9	0.080	0.090	
10	0.090	0.100	
11	0.100	1.000	

NOTE:

FLOOD LEVEL DIFFERENCE PROVIDED FOR THE PRE DEVELOPED SCENARIO VS THE POST DEVELOPMENT SCENARIO
ORIGINAL SURFACE - PRE-DEVELOPMENT Q100 FLOOD LEVEL
COMPARISON SURFACE - POST-DEVELOPMENT SCENARIO Q100 FLOOD LEVEL

N

FOR INFORMATION ONLY

SCALE 1:1000 AT A1 SHEET SIZE

AMENDMENTS	DATE	ISSUE
FOR INFORMATION ONLY	11.04.18	A

AMENDMENTS	DATE	ISSUE

CLIENT: HB+B property

PROJECT: FLOOD ANALYSIS
SOUTH CREEK NEAR MAMRE ROAD
ORCHARD HILLS, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
M.C	M.C	22.05.17	M.W	A1	AS SHOWN	C012042.05-FC04

Costin Roe Consulting Pty Ltd.
Consulting Engineers ACN 003 696 448
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9251-7699 Fax: (02) 9241-3731
email: mail@costinroe.com.au ©

Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE: Q100 A.R.I FLOOD LEVEL AFFLUX
POST DEVELOPMENT SCENARIO
BLIND KEMPS CREEK-2HR DURATION

DRAWING No: C012042.05-FC04 ISSUE: A

FLOOD LEVEL DECREASE OF 10-15mm
INCLUDING INFLOW FROM BLIND KEMPS CREEK

MANDALONG CLOSE

PROPOSED STAGE 2
DEVELOPMENT AREA 54.3Ha

FILL AREA IN
FLOOD ZONE
37.1Ha

CHANNEL EASEMENT AS
CONSTRUCTED TO
REMAIN

EXTENT OF FILLING ADJUSTED
AROUND NEW CHANNEL

MAX INCREASE IN
FLOOD WATER LEVEL 82mm

LINE DENOTES THE Q100
PRE-DEVELOPMENT FLOOD
EXTENT

FILL AREA IN
FLOOD ZONE
6.3 Ha

PROPOSED STAGE 1
DEVELOPMENT AREA 47.0Ha

FILL AREA IN
FLOOD ZONE
4.4 Ha

AREA LOSS
1.3Ha

EXISTING BASIN

PROPOSED LAND RE-GRADING AREA
REFER TO DRAWINGS AND DETAILS

NEW PROPOSED LOCATION OF ESTATE
DRAINAGE CHANNEL. EXITING ESTATE
CHANNEL TO BE DECOMMISSIONED AND
FILLED TO PRE-EXISTING LEVELS
CHANNEL WIDENED FROM 14m TO 35m

PROPOSED CHANNEL

MAX INCREASE IN
FLOOD WATER LEVEL 100mm
TO CENTER OF CHANNEL

40m RIPARIAN ZONE
20m RIPARIAN ZONE

SOUTH CREEK

HATCHED AREA DENOTES
FLOODWAY ZONE AS PER FIGURE
7.22 OF THE SOUTH CREEK FOOD
STUDY BY WORLEY PARSONS
DATED 30 JANUARY 2015

Q100 FLOOD LEVEL DIFFERENCE (m)

No.	FROM DEPTH	TO DEPTH	COLOUR
1	-0.100	-0.010	
2	0.010	0.020	
3	0.020	0.030	
4	0.030	0.040	
5	0.040	0.050	
6	0.050	0.060	
7	0.060	0.070	
8	0.070	0.080	
9	0.080	0.090	
10	0.090	0.100	
11	0.100	1.000	

NOTE:
FLOOD LEVEL DIFFERENCE PROVIDED
FOR THE PRE DEVELOPED SCENARIO
VS THE POST DEVELOPMENT
SCENARIO
ORIGINAL SURFACE -
PRE-DEVELOPMENT Q100 FLOOD
LEVEL
COMPARISON SURFACE -
POST-DEVELOPMENT SCENARIO
Q100 FLOOD LEVEL

30m 0 50 100 150 200 250 300m
SCALE 1:3000 AT A1 SHEET SIZE

FOR INFORMATION ONLY

AMENDMENTS	DATE	ISSUE
REVISED FOR LAND RE-GRADING	08.06.18	C
REVISED FILLING LINE	27.04.18	B
FOR INFORMATION ONLY	11.04.18	A

CLIENT HB+B property

PROJECT
FLOOD ANALYSIS
SOUTH CREEK NEAR MAMRE ROAD
ORCHARD HILLS, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
M.C	M.C	22.05.17	M.W	A1	AS SHOWN	C012042.05-FC05

Costin Roe Consulting Pty Ltd.
Consulting Engineers ACN 003 696 448
Level 1, 8 Windmill Street
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Costin Roe Consulting
PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
Q100 A.R.I FLOOD LEVEL AFFLUX
POST DEVELOPMENT SCENARIO
BLIND KEMPS CREEK-36Hr DURATION

DRAWING No. C012042.05-FC05 ISSUE C

F.5 CONCLUSION

This Appendix to the Stage 2 (Revised) Overland Flow Report has been prepared to introduce Blind Kemps Creek into modelling associated with the Mamre West Precinct and First Estate development and confirm effects if any on the outcomes presented in the assessment.

The previously approved TUFLOW hydrodynamic flood model of South Creek was extended for the pre and post developed conditions to included Blind Kemp Creek. Peak flows were assessed for the critical 2hr duration and longer 36hr duration which coincides with peak flows within South Creek.

Results of the TUFLOW modelling show negligible differences to the modelled outcome on the western and northern Study Areas when Blind Kemp Creek flows are introduced into the model. Modelling also shows minor increase in flood levels during the 1% AEP post developed during 2hr duration storms and no effect during the 36hr duration events.

Overall the outcomes as noted in the main body report remain consistent when Blind Kemp Creek is considered in the assessment.

Confirmation of evacuation conditions and inundation of potential egress routes during major events has been included in the main body report, as confirmed through the modelling of Blind Kemp Creek.

APPENDIX G

Meeting Minutes

MEETING MINUTES

Meeting – Surface Levelling / Filling Works (Rick Pisaturo)

DATE OF ISSUE *1 February 2018*

PROJECT *Surface Levelling Works – Lot 2172 DP 1153854*

TIME & DATE OF MEETING *9am Tuesday 30th January 2018*

LOCATION OF MEETING *Penrith City Council, 601 High Street Penrith*

NAME	ORGANISATION	INITIAL	EMAIL ADDRESS
ATTENDEES			
Stephen O'Connor	Altis Property Group	SO	Stephen.oconnor@altisproperty.com.au
Mark Wilson	Costin Roe	MW	mark@costinroe.com.au
Adam Wilkinson	Penrith Council	AW	Adam.wilkinson@penrith.city
Peter Wood	Penrith Council	PW	Peter.wood@penrith.city
Nicole Dukinfield	Penrith Council	ND	Nicole.dukinfield@penrith.city
APOLOGIES			
Tim Ireson	HB&B Property	TI	toreson@hbbproperty.com.au
DISTRIBUTION AS ABOVE			

MEETING MINUTES

ITEM	DESCRIPTION	ACTION	DATE
1.0	**Penrith Council Meeting with Rick Pisaturo 13/12/2017**		
1.1	- AW provided commentary on the meeting with Rick Pisaturo, advising that the discussion was around levelling some minor hills and hollows within his property. - AW discussed with Rick the issues around filling within close proximity to South creek as shown on his desired civil works plan. It was noted that council would not support any works within 40m of the creek bank - SO and AW discussed the relocation of the current drainage channel to the northern boundary of Ricks land and that this work would form part of a section 96 modifications to the SSD consent via the DPE	NOTE	N/A
2.0	**Proposed Surface Levelling Works and Penrith Council Requirements**		
2.1	- SO and AW discussed the viability of the works in line with the Penrith Council DCP Part C3, considering that the subject area for the works was within the high hazard floodway. - AW advised that because there would be no importation of fill (or filling above the 1% EAP flood level) associated with the works and what was proposed was only minor levelling works, Penrith Council would agree to the project, providing the following conditions were met - There is no flood impact to any of the adjoining properties or the precinct as a whole. - No works within 40m of the creek bed (South Creek) - The flood storage volumes within the subject area remain the same, pre works to post works. - Filling and cutting works may not exceed 1m in height or depth - Flood modelling is completed to show the works do not exceed the parameters / requirements set out in the Penrith Council DCP (C3), consistent with the approval for Stage 1 - MW confirmed that any flood modelling associated with these works would consider all of Stage 1 and Stage 2 study area. - PW suggested that the surface levelling works should form part of the section 96 modification to the SSD consent along with the channel relocation works. SO advised that this was not the preference, however would seek planning advice on the matter.	NOTE	N/A
3.0	**Stage 2 Flood Modelling**		

3.1	- SO provided AW, PW and ND an update on the progress of the Stage 2 flood modelling, noting that Worley Parsons had completed their peer review and that the flood engineers were meeting 31/1/2018 to work through the points raised. - SO advised that it was proposed that Penrith Council would be presented with the results in the next 2 weeks for their assessment.	SO	NOTE
4.0	**Further Meeting**		
4.1	- AW suggested that a further meeting should be scheduled with Rick Pisaturo in attendance, SO and MW agreed. - SO to speak to Rick Pisaturo and arrange another meeting	SO	Mid Feb

Post Meeting Note:

Altis has sought planning advice from Willowtree Planning on whether it is suitable for the proposed surface levelling works should be included within a section 96 modification of the SSD consent. The advice suggests that it would not be appropriate to include the minor levelling works within the subject application as they are not within the subject SSD Property nor are the works related to the State Significant Development. Considering that the proposed works are minor in nature and are a variation to the Penrith Council DCP, which will ultimately need to be approved by Penrith Council, the most appropriate approval pathway would be via a Development Application with Penrith Council.