Flood Impact Assessment

Development Application

Racecourse Road, West Gosford

CLIENT / Waluya PTY LTD

DATE/ 16/12/2022

CODE/ 22-1063

Commercial in Confidence

Document Registration

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Contents

1. Introduction

1.1. Overview

AT&L Pty Ltd have been engaged by Waluya PTY LTD (the client) and prepared this flood impact assessment to support a development application (DA) for a proposed bus depot on Racecourse Road, West Gosford, NSW (the site), refer to Section 2.1 for a detailed site description. This report documents the findings of hydrology and hydraulic modelling of the site in existing and proposed conditions. Refer to Attachment A for detailed site survey and Attachment B for proposed site layout.

1.2. Project Scope

The project scope and objectives are:

1. Prepare a hydrological model (DRAINS) of the external catchments that drain through and around the site.
2. Prepare a hydraulic model (TUFLOW) and determine site flood characteristics for the 1% Annual Exceedance Probability (AEP) event and the Probable Maximum Flood (PMF) event.
3. Import survey data and grading design to allow detailed hydraulic modelling of the site in existing and proposed conditions.
4. Comment on flood characteristics and model outcomes in existing and proposed conditions.
5. Provide a summary of compliance against the Central Coast Council Floodplain Management development controls.

1.3. Relevant Guidelines

This report has been prepared in accordance with the following guidelines and policies:

1. Central Coast Development Control Plan (DCP) (2022).
2. Central Coast Local Environment Plan (LEP) (2022).
3. Commonwealth of Australia (Geoscience Australia) (2016), Australian Rainfall and Runoff – A Guide to Flood Estimation.
4. NSW Department of Infrastructure, Planning and Natural Resources (2005), Floodplain development manual.

2. Site Characteristics and Overview

2.1. Location and Site Description

The site is approximately 2.12ha and located on Racecourse Road, West Gosford, within the Central Coast Local Government Area (LGA). The site is formed by the following allotments:

- 6/DP801261 and 71/DP810836.
- 72- 74/DP810836.
- 20/82/DP758466 and 18/DP1100223.
- 1/DP651249, 11/82/DP758466, 12/DP110010, 13/DP1100206, 14 - 15/DP1100206 and 16/DP1079150.

Figure 1: site Extent (imagery from Planning Portal, dated 13 December 2022)

2.2. Current Land Use and Zoning

The Site remains largely undeveloped, with a commercial and residential building on site. It is characterised by poorly maintained and highly disturbed soils that were utilised for storage in the early 2010's. Since that period sparce vegetation has regrown in area but it is evident that the soil has become highly compacted with high potential to generate runoff.

The site is zoned as B6 Enterprise Corridor under the Central Coast LEP 2022 with the following development permitted with consent:

Business premises; Community facilities; Garden centres; Hardware and building supplies; Hotel or motel accommodation; Landscaping material supplies; Light industries; Oyster aquaculture; Passenger transport facilities; Plant nurseries; Roads; Sewage reticulation systems; Shop top housing; Tank-based aquaculture; Warehouse or distribution centres; Waste or resource management facilities; Water recycling facilities; Water reticulation systems; Any other development not specified in item 2 or 4.

2.3. Catchment Characteristics

We note the following regarding the catchments upstream and downstream of the site:

- The site is located approximately 400 metres east of Narara Creek and is upstream of *The Entertainment Grounds.*
- The area downstream of the site is subject to the 1% AEP flood level and is likely to be considered flood storage.
- Narara Creek discharges to Brisbane Waters and is prone to mainstream flooding.
- The catchment upstream of the Site is predominately residential, warehouses and densely vegetated bushland on steep slopes >15%. Refer to Figure 2 for catchment plan.

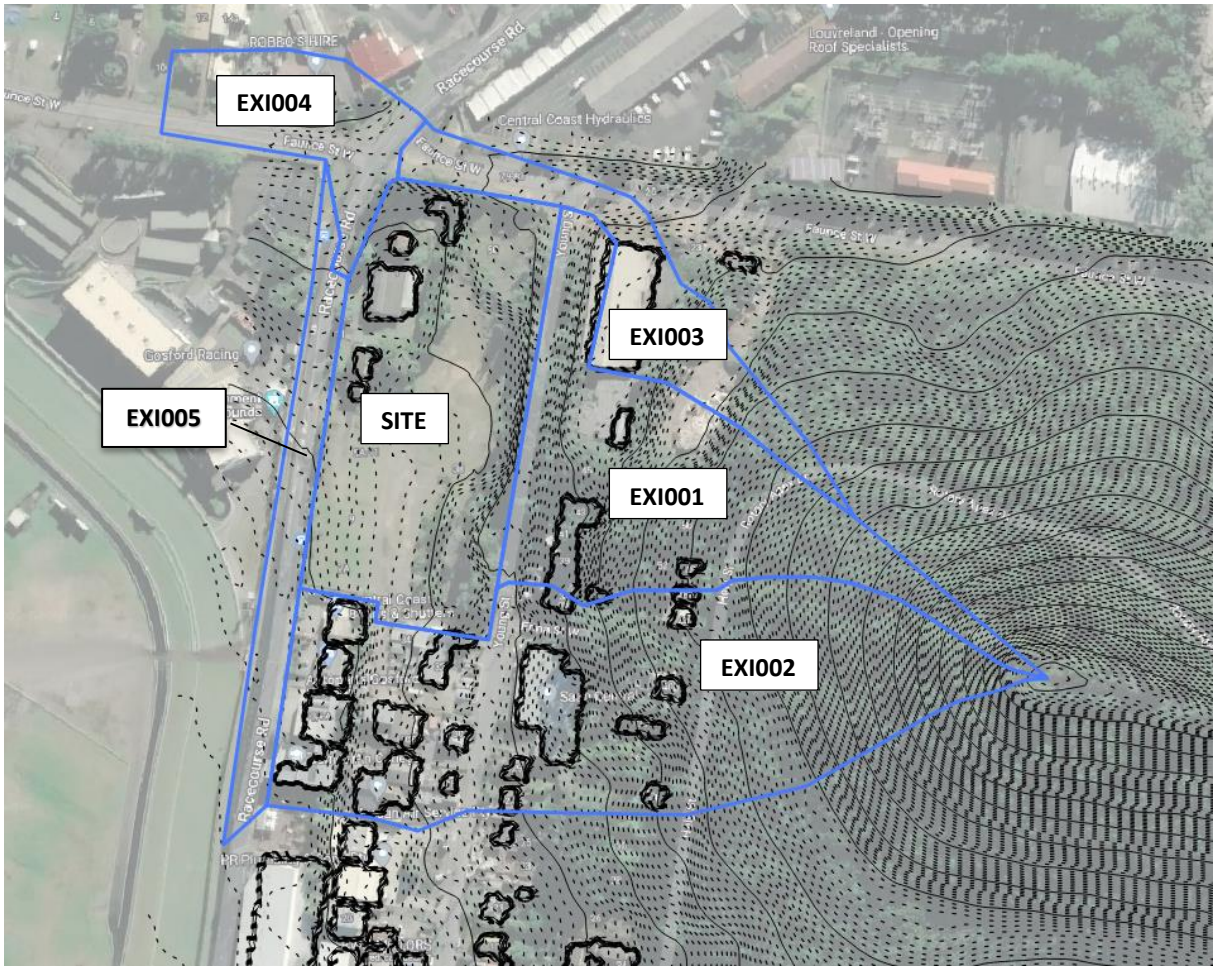


Figure 2: Catchment Plan

2.4. Site Flood Mechanisms

Investigations of the publicly available flood map data suggests that the site is not subject to flood overbank flow from Narara Creek or storm surge causing high ocean levels and upstream flows that back up onto the site. The site is affected by localised overland flows from the upslope catchment to the east. Overland flow generally traverses the site in an east to west direction.

2.5. Available Flood Studies

A review of available flood studies yielded the following information:

- The *Updated Narara Creek Flood Study* (Golder Associates, 2018) documents the extents of flooding within the Narara Creek catchment for a range of design storm events from the 50% AEP to the 0.5% AEP and the PMF.

- The NSW State Emergency Service engaged Cardno (2015) to prepare a Floodplain Risk Management Plan for the Brisbane Water Foreshore. This information is not publicly available and is inaccessible to the general public.

2.6. Proposed Development

A proposed site development layout is provided in Attachment B and includes:

- The creation of two buildings for offices, maintenance and washing.
- A bus parking lot for approximately 94 vehicles.
- A car parking lot for approximately 119 cars.
- A landscape buffer surrounding the property.
- On-site Detention (OSD) designed to attenuate flows for all storms up to and including the 1% AEP in accordance with Councils specifications. (Not included in this assessment)
- A pit and pipe network to convey local flows in accordance with Council specifications (Not included in this assessment).

3. Hydraulic Modelling

3.1. Overview

AT&L have prepared this flood assessment to a support a development application (DA) for a proposed bus depot on Racecourse Road, West Gosford, NSW (the site). This section documents the findings of hydrology and hydraulic modelling of the site in existing and proposed conditions.

3.2. Scenarios

3.2.1. Catchment Conditions

The hydraulic model was setup to represent the following flood condition scenarios:

1. E01: Existing conditions, the catchment in its current state as described in Section 2.3.
2. P01: Proposed conditions, the catchment in its current state as described in Section 2.3 and the site as describes in Section 2.6.

3.2.2. Storm Events

The hydrological modelling Scenarios adopted for this assessment include:

- 1% AEP event.
- PMF event.

Potential impacts of climate change (e.g., increased rainfall intensity, sea level rise) was not included as part of this assessment.

3.3. Catchment Hydrology

The DRAINS software package was used with ILSAX hydrological engine to generate flow rates based on the catchment characteristics described in Section 2.3 and Section 2.6

Modelling assumptions were derived from the following sources:

- Intensity Frequency Duration (IFD) data and pre-burst rainfall depths were derived from the Bureau of Meteorology Datahub in accordance with ARR2019. Longitude: 151.329 Latitude: - 33.422. Refer to Attachment C for IFD Charts.
- The Probably Maximum Precipitation (PMP) intensities and temporal distribution were determined using the Bureau of Meteorology *Generalised Short Duration Method (1994)*.
- Sub-catchment delineation and flow paths have been determined from LIDAR data and survey information. Sub-catchment impervious areas were derived from a combination of Google Street Maps and Nearmap aerial imagery (2022). Refer to Attachment D for Catchment setup.
- ILSAX parameters have been derived from the suggested values in the DRAINS Content Menu for similar catchments and is consistent with parameters used across the industry. Refer to Table 1 for ILSAX parameters.

Table 1: Summary of ILSAX parameters

Element	Value
Impervious area depression storage (mm)	1
Supplementary area depression storage (mm)	1
Pervious area depression storage (mm)	5
Soil Type	3

- Time of concentration values were calculated as an estimate of a combination of flow types in different states being sheet and concentrated flow. Tc's with a value of less than 5 minutes were increased rounded up to a value of 5 minutes as required by modelling timesteps. The following combination flow paths:
  - Sheet flow (Friend's Equation).
  - Concentrated Flow (Manning's Equation).
  - Kerb Flow.
  - Pipe Flow.
  - Downpipes.
- At the time of writing the OSD system has not been detailed. We have assumed that the site will discharge all flows to the OSD and match existing flows for the 1% AEP prior to leaving the site. These flows will then connect to Council's underground pipe on the local council road.

3.3.1. Results

Results for the peak flow rates of each sub-catchment arriving at the site for the critical durations of the 1% AEP and PMF event are summarised in Table 2. The critical duration was determined to be the 15 minutes duration for both events.

Table 2: Summary of peak catchment flow rates.

Catchment ID	1% AEP Peak Q (m^3/s)	PMF Peak Q (m^3/s)
EXI001	0.96	3.64
EXI002	1.85	6.74
EXI003	0.44	1.42
EXI004	0.39	1.27
EXI005	0.32	1.07
site_Exi	1.38	4.14
site_Pro	1.47	4.83

We note that the site has a quick response time due to the steepness of the upstream catchment slopes and roughness. It is unlikely that the overland flows from the site and upstream catchment will coincide with the mainstream flooding of Narara Creek which would likely have a much larger response time. A detailed assessment of Narara Creek lies outside the scope of this assessment. We therefore conclude that a direct hydrograph method is appropriate for this assessment.

3.4. Hydraulic Modelling

TUFLOW 1d/2d Hydraulic model was used to determine the existing and proposed development flood characteristics, including flood water levels, depth and VD products for each scenario nominated in Section 3.2.

3.4.1. Terrain Data

The 3D surface for existing and conditions was generated from a combination of:

- LIDAR Data.
- Detailed survey of the site and surrounding roads by Beveridge Williams (2022) surveyors.
- Proposed earthworks.

3.4.2. TUFLOW Modelling Setup

3.4.2.1. Existing Conditions

The existing conditions model construction consisted of:

a) Creating a 1m x 1m topographic grid based on the available Lidar and survey information outlined in Section 3.4.1.

b) Establishment of model boundary extents which generally align with catchment ridgelines.

c) Establishment of boundary conditions and extents downstream of the site on Racecourse Road. The downstream boundary extent slope has been calculated to be 0.01.

d) Incorporating inflow hydrographs:

   i. Offsite catchment hydrographs applied upstream of the site.

   ii. Existing site catchment hydrograph applied evenly across each cell distributed flow over the nominated surface area.

e) Assigning elevations to existing buildings above the generated topographic grid to model flow obstructions.

f) Assigning a water depth filter of 0.05m, consistent with industry standard to remove flows not considered flood flows.

g) Assigning existing site Manning's roughness coefficients based on Google Street Maps and Nearmap aerial imagery. Manning's Roughness values are summaries in Table 3.

Table 3: Manning's Roughness Values.

Surface Type	Manning's Roughness Value
Asphalt	0.015
Concrete	0.012
Earth Channel Gravelly	0.025
Earth Channel Weedy	0.030
Floodplain Pastures / Average Lawn	0.035
Floodplain Light Brush / Spare Vegetation	0.050
Floodplain Heavy Brush / Dense Vegetation	0.075
Natural Streams / Rivers	0.035
Ponds and other water	0.010
Buildings	1.000

3.4.2.2. Proposed Conditions

All elements and parameters described in Section 3.4.2.1 were used in the proposed scenario with the following additions and modifications:

a) Creating a 1m x 1m topographic grid based on the proposed earthworks and existing case surface.

b) Assigning Manning's roughness coefficients based on Section 2.6.

c) Assigning elevations to buildings above the generated topographic grid to model flow obstructions.

d) Replacing existing site catchment inflows hydrographs with attenuated OSD flows for the 1% AEP and PMF event.

   i. 1% AEP site flows are assumed to be captured by the future drainage pit and pipe and attenuated by an OSD which are conveyed to the underground network. Therefore, no surface flow has been modelled.

   ii. Peak proposed PMF event flow rates have been reduced by the existing peak 1% AEP flow rate. This was done to ensure the OSD volume is utilised in the PMF event. We note that the PMF is approximately 2.5 x the 1% AEP flow rate. Refer to Figure 3 for "modified PMF" hydrograph adopted in TUFLOW.

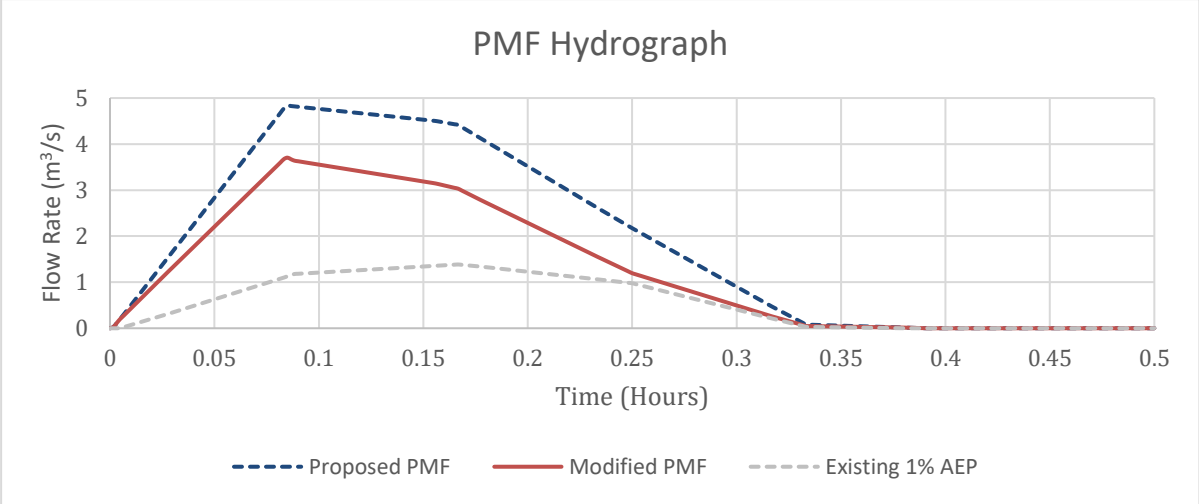


Figure 3: PMF hydrograph adopted for flood modelling.

3.4.3. TUFLOW Modelling Results

Results for the water level, depth, hazard, and impact plot for the 1% AEP and PMF event are provided in Attachment D. Refer to Table 4 for drawing references.

Table 4: Drawing reference

Flood Event	Water Level	Depth	Hazard	Impact
Existing 1% AEP	22-1063-FLD-001	22-1063-FLD-002	22-1063-FLD-003	-
Existing PMF	22-1063-FLD-011	22-1063-FLD-012	22-1063-FLD-013	-
Proposed 1% AEP	22-1063-FLD-101	22-1063-FLD-102	22-1063-FLD-103	22-1063-FLD-110
Proposed PMF	22-1063-FLD-111	22-1063-FLD-112	22-1063-FLD-113	-

3.4.4. Discussion

We note the following regarding the modelled flood behaviour:

3.4.4.1. Existing Conditions

- The primary source of site flooding is overland flows from the upstream catchments east of the site. These flows originate from Waterview Park and travel overland through residential properties, eventually overtopping Young Street onto the site.
- The site does not appear to be affected by tidal tailwater conditions or mainstream flooding from Narara Creek.
- The site discharges uncontrolled flows onto Racecourse Road. These flows overtop Racecourse Road and flow onto the

3.4.4.2. Proposed Conditions

- The proposed redevelopment of the site does not have impacts on upstream or adjacent properties.
- The provision of an OSD system to capture and attenuate flows for events up to and including the 1% AEP design event from the site results in a beneficial outcome for the downstream receiving environment, being Racecourse Road and The Entertainment Grounds.
- Proposed condition flood extents retain the existing condition flood characteristics offsite.
- Proposed condition water depths are largely reduced on Racecourse Road.
- For flood affected areas on site, a minimum 150 mm freeboard for non-habitable areas should be provided consistent with Central Coast Council DCP.

- There is a negligible increase in water depth on Racecourse Road immediately downstream of the site which is attributed to the concentration of flows. This impact affects approximately 90 m2. No private properties are affected.
- There is a large quantity of water depth reduction on Racecourse Road immediately downstream of the site which is attributed to the OSD attenuation.
- Hazards across the site are generally safe and traversable in the 1% AEP and PMF event. The VxD product is less than 0.4 m^2/s.
- There is an increase in hazard categorisation for the PMF event at the proposed driveway on Racecourse Road. Due to the short duration of the storm this hazard is only present for 5 minutes prior to returning to a safe level. We note that this issue can be addressed with an appropriate flood risk management plan at the detailed design stage.

This assessment has considered the impacts generated by the proposed development. AT&L considers the magnitude and scale of the flood impacts from the proposed development are acceptable. The impacts do not materially affect private properties and the consequences of development are consistent with the requirements of the CC LEP (2022).

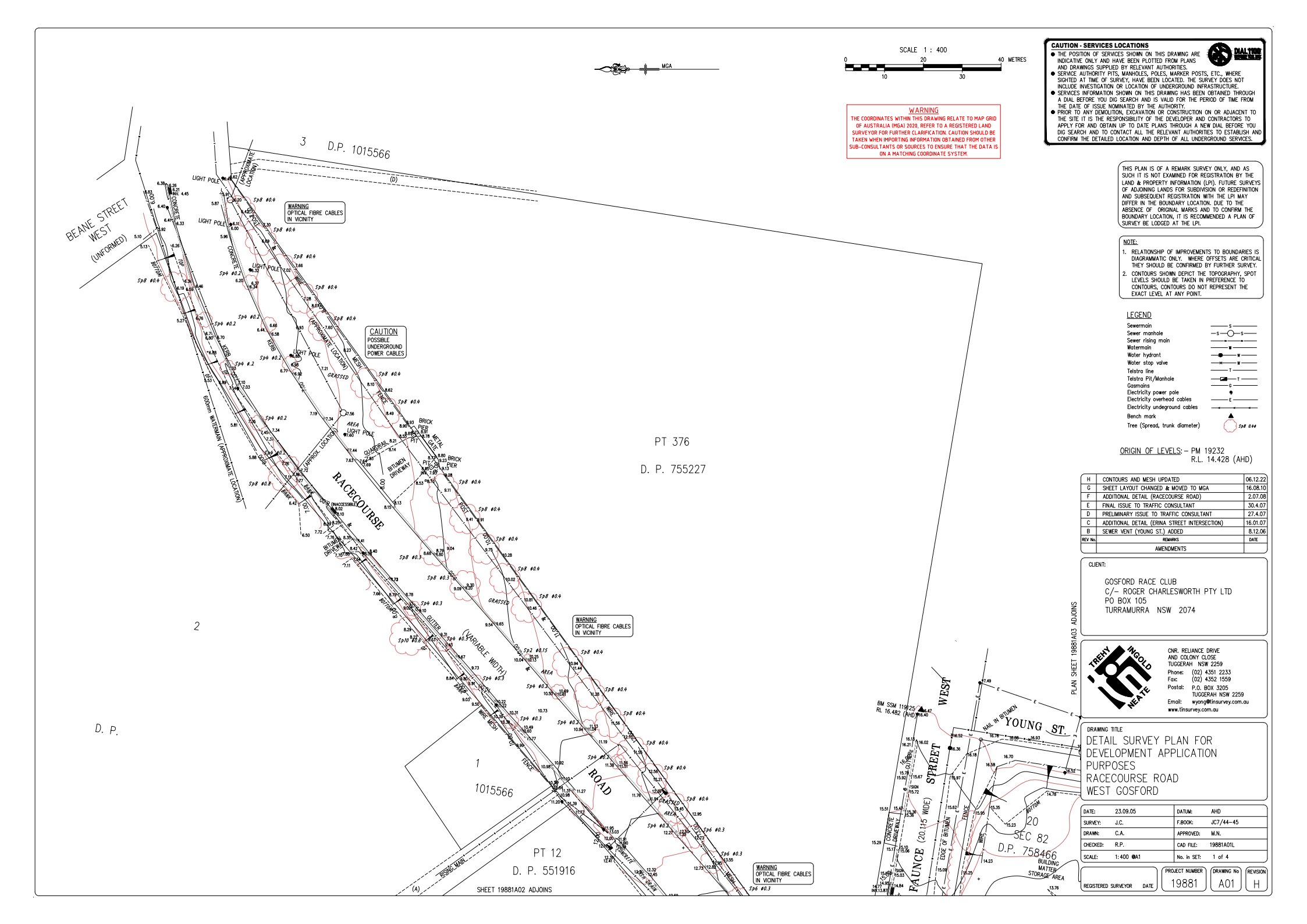
4. Summary and Recommendations

This report demonstrates that the proposed development on site can safely convey standard flood flows across the site. We note that the site has a quick response time due to the steep slopes and rough nature of the upstream catchment. It is unlikely that the overland flows from the site and upstream catchment will coincide with the mainstream flooding of Narara Creek which would likely have a much larger response time. Flood modelling indicates:

1) Flows resulting from the 1% AEP conveyed to the conceptual OSD tank will not have adverse impacts on the downstream receiving environment.
2) PMF event flows can be conveyed across the site safely by way of overland flow.
3) Low Hydraulic hazards for flood flows within the site and improved impacts downstream of the site.
4) Freeboard requirements to the buildings is achievable.

We recommend that following detailed design of the proposed development a detailed hydraulic model be prepared to reaffirm compliance with the Central Coast Council DCP and LEP. This flood model should include the final engineering elements comprised of the earthworks, pavement and landscape design, stormwater pipes (site and road) and OSD.

Attachment A – Survey



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D	PRELIMINARY ISSUE TO TRAFFIC CONSULTANT	27.4.07
C	ADDITIONAL DETAIL (ERINA STREET INTERSECTION)	16.01.07
B	SEWER VENT (YOUNG ST.) ADDED	8.12.06

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DRAWING TITLE

DETAIL SURVEY PLAN FOR DEVELOPMENT APPLICATION PURPOSES RACECOURSE ROAD WEST GOSFORD

DATE:	23.09.05	DATUM:	AHD
SURVEY:	J.C.	F.BOOK:	JC7/44-45
DRAWN:	C.A.	APPROVED:	M.N.
CHECKED:	R.P.	CAD FILE:	19881A01L
SCALE:	1:400 @A1	No. In SET:	1 of 4

REGISTERED SURVEYOR DATE

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LEGEND

- Sewermain
- Sewer manhole
- Sewer rising main
- Watermain
- Water hydrant
- Water stop valve
- Telstra line
- Telstra Pit/Manhole
- Gasmains
- Electricity power pole
- Electricity overhead cables
- Electricity undeground cables
- Bench mark
- Tree (Spread, trunk diameter)

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ORIGIN OF LEVELS:- PM 19232
R.L. 14.428 (AHD)

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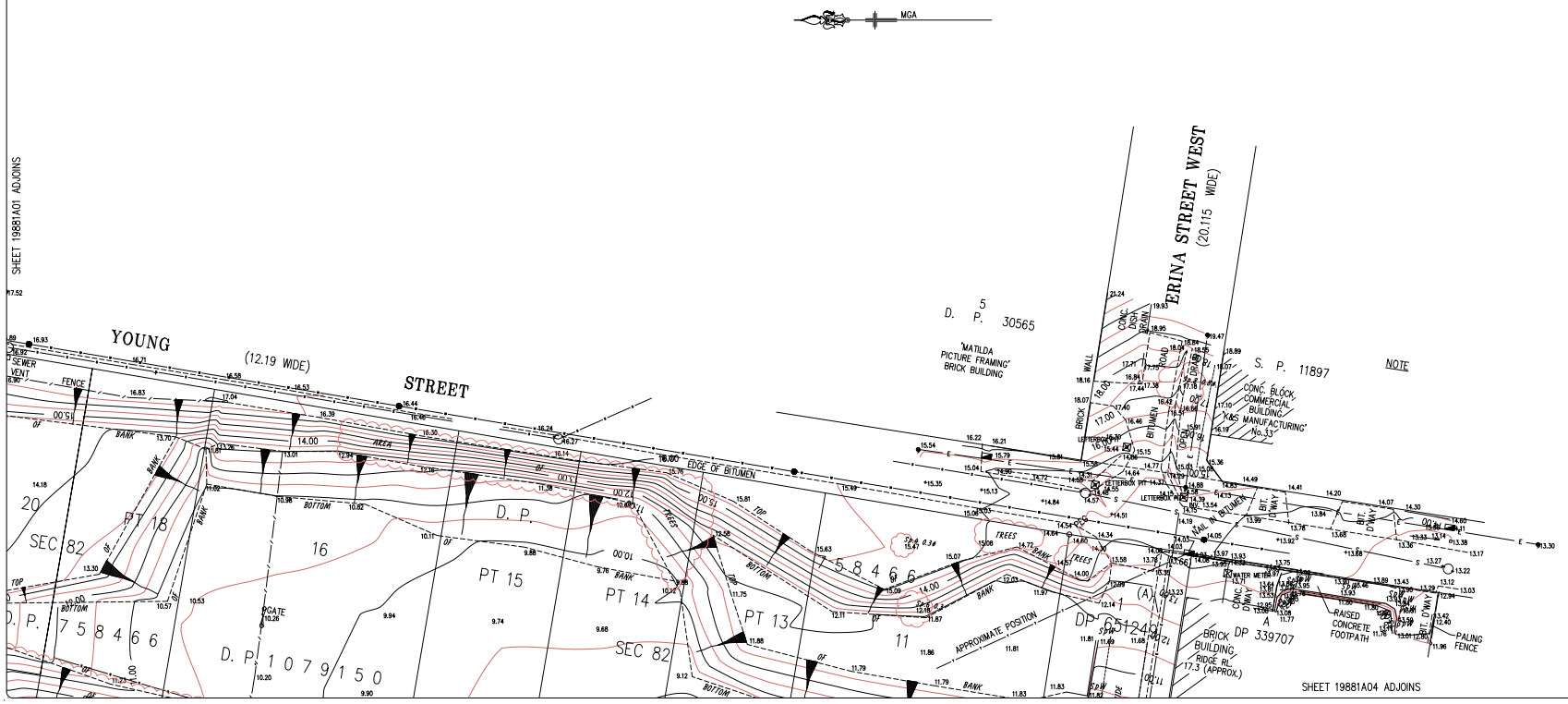

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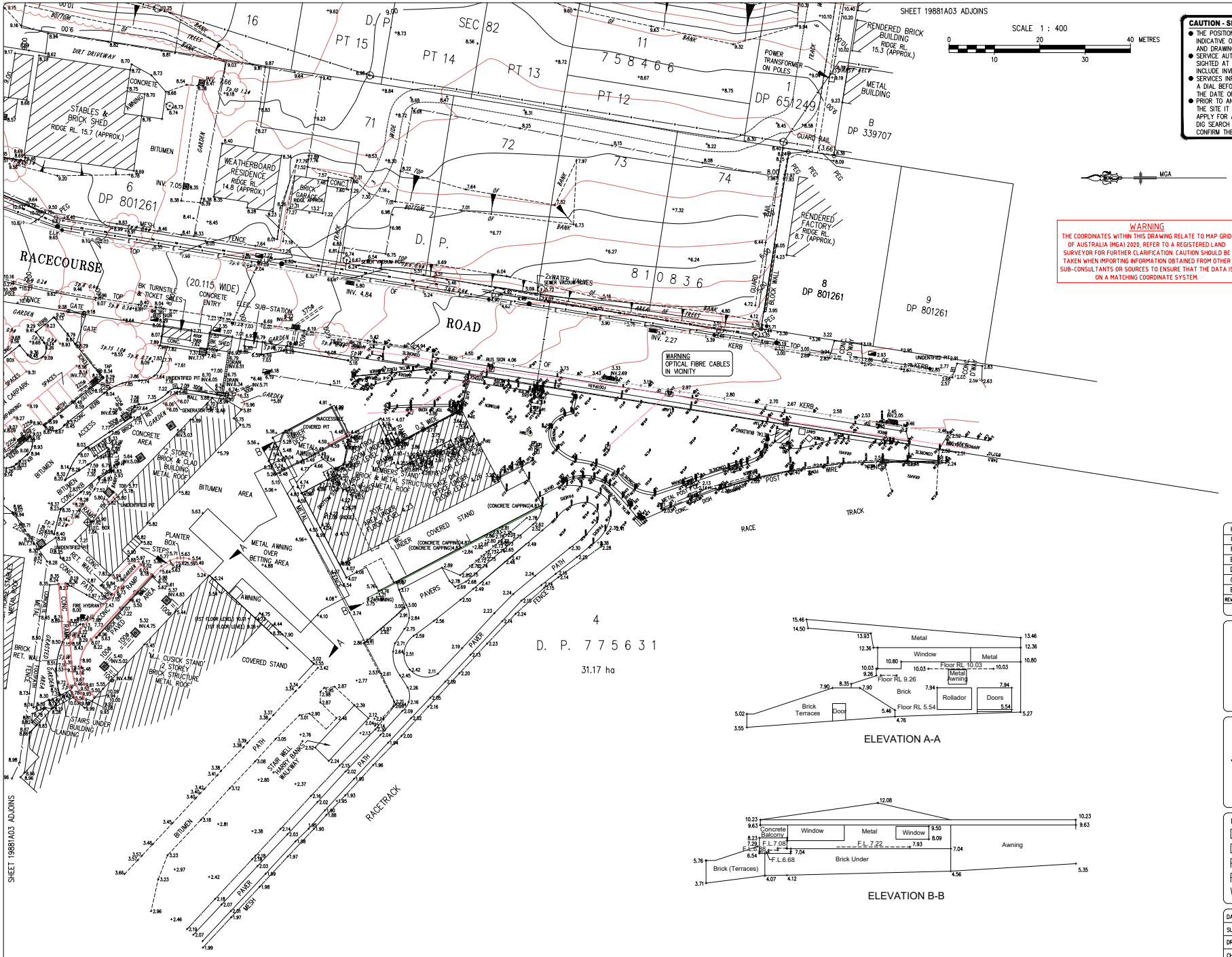


CAUTION - SERVICES LOCATIONS

- THE POSITION OF SERVICES SHOWN ON THIS DRAWING ARE INDICATIVE ONLY AND HAVE BEEN PLOTTED FROM PLANS AND DRAWINGS SUPPLIED BY RELEVANT AUTHORITIES.
- SERVICE AUTHORITY PITS, MANHOLES, POLES, MARKER POSTS, ETC., WHERE SIGHTED AT TIME OF SURVEY, HAVE BEEN LOCATED. THE SURVEY DOES NOT INCLUDE INVESTIGATION OR LOCATION OF UNDERGROUND INFRASTRUCTURE.
- SERVICES INFORMATION SHOWN ON THIS DRAWING HAS BEEN OBTAINED THROUGH A DIAL BEFORE YOU DIG SEARCH AND IS VALID FOR THE PERIOD OF TIME FROM THE DATE OF ISSUE NOMINATED BY THE AUTHORITY.
- PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON OR ADJACENT TO THE SITE IT IS THE RESPONSIBILITY OF THE DEVELOPER AND CONTRACTORS TO APPLY FOR AND OBTAIN UP TO DATE PLANS THROUGH A NEW DIAL BEFORE YOU DIG SEARCH AND TO CONTACT ALL THE RELEVANT AUTHORITIES TO ESTABLISH AND CONFIRM THE DETAILED LOCATION AND DEPTH OF ALL UNDERGROUND SERVICES.

MGA

WARNING

THE COORDINATES WITHIN THIS DRAWING RELATE TO MAP GRID OF AUSTRALIA (MGA) 2020, REFER TO A REGISTERED LAND SURVEYOR FOR FURTHER CLARIFICATION. CAUTION SHOULD BE TAKEN WHEN IMPORTING INFORMATION OBTAINED FROM OTHER SUB-CONSULTANTS OR SOURCES TO ENSURE THAT THE DATA IS ON A MATCHING COORDINATE SYSTEM.

THIS PLAN IS OF A REMARK SURVEY ONLY, AND AS SUCH IT IS NOT EXAMINED FOR REGISTRATION BY THE LAND & PROPERTY INFORMATION (LPI). FUTURE SURVEYS OF ADJOINING LANDS FOR SUBDIVISION OR REDEFINITION AND SUBSEQUENT REGISTRATION WITH THE LPI MAY DIFFER IN THE BOUNDARY LOCATION, DUE TO THE ABSENCE OF ORIGINAL MARKS AND TO CONFIRM THE BOUNDARY LOCATION, IT IS RECOMMENDED A PLAN OF SURVEY BE LODGED AT THE LPI.

NOTE:

1. RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. WHERE OFFSETS ARE CRITICAL THEY SHOULD BE CONFIRMED BY FURTHER SURVEY.
2. CONTOURS SHOWN DEPICT THE TOPOGRAPHY, SPOT LEVELS SHOULD BE TAKEN IN PREFERENCE TO CONTOURS, CONTOURS DO NOT REPRESENT THE EXACT LEVEL AT ANY POINT.

LEGEND

Sewermain
Sewer manhole
Sewer rising main
Watermain
Water hydrant
Water stop valve
Telstra line
Telstra Pit/Manhole
Gasmains
Electricity power pole
Electricity overhead cables
Electricity underground cables
Bench mark
Tree (Spread, trunk diameter)

ORIGIN OF LEVELS:- PM 19232
R.L. 14.428 (AHD)

ELEVATION A-A

ELEVATION B-B

REV No.	REMARKS	DATE
	AMENDMENTS	
H	CONTOURS AND MESH UPDATED	06.12.22
G	SHEET LAYOUT CHANGED & MOVED TO MGA	16.08.10
F	ADDITIONAL DETAIL (RACECOURSE ROAD)	2.07.08
E	FINAL ISSUE TO TRAFFIC CONSULTANT	30.4.07
D	PRELIMINARY ISSUE TO TRAFFIC CONSULTANT	27.4.07
C	ADDITIONAL DETAIL (ERINA STREET INTERSECTION)	16.01.07
B	SEWER VENT (YOUNG ST.) ADDED	8.12.06

CLIENT:

GOSFORD RACE CLUB
C/- ROGER CHARLESWORTH PTY LTD
PO BOX 105
TURRAMURRA NSW 2074

TREHY INGOLD NEATE
CNR. RELIANCE DRIVE AND COLONY CLOSE
TUGGERAH NSW 2259
Phone: (02) 4351 2233
Fax: (02) 4352 1559
Postal: P.O. BOX 3205 TUGGERAH NSW 2259
Email: wyong@tinsurvey.com.au
www.tinsurvey.com.au

DRAWING TITLE

DETAIL SURVEY PLAN FOR DEVELOPMENT APPLICATION PURPOSES RACECOURSE ROAD WEST GOSFORD

DATE:	23.09.05	DATUM:	AHD
SURVEY:	J.C.	F.BOOK:	JC7/44-45
DRAWN:	C.A.	APPROVED:	M.N.
CHECKED:	R.P.	CAD FILE:	19881A01L
SCALE:	1:400 @A1	No. In SET:	4 of 4

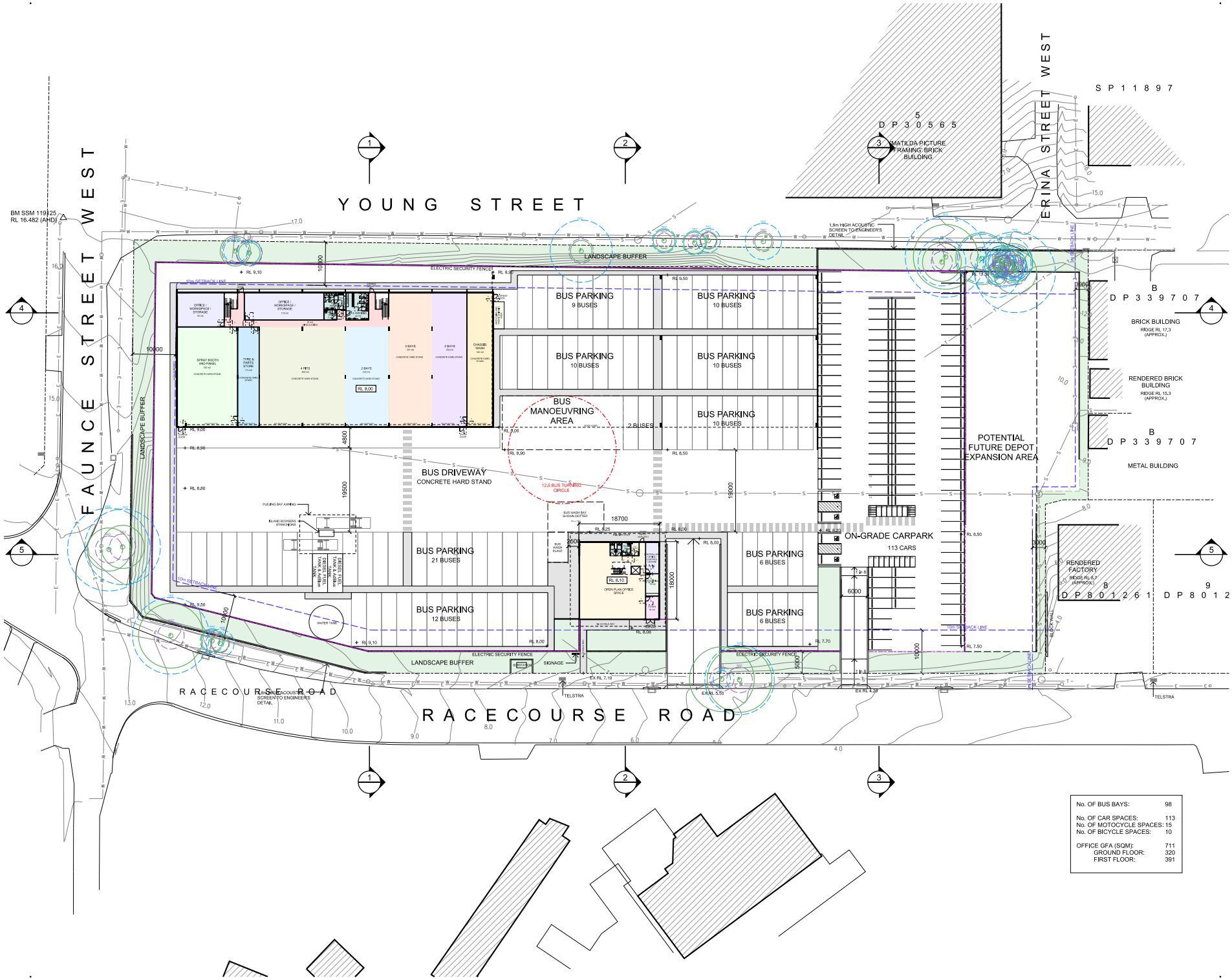
REGISTERED SURVEYOR DATE

PROJECT NUMBER	DRAWING No	REVISION
19881	A04	H

SHEET 19881A03 ADJOINS

Attachment B – Proposed Development

nominated architects: Rudi Valla BArch (Hons) nsw reg no 6582 Jon Pitzey BArch nsw reg no 6567



No. OF BUS BAYS:	98
No. OF CAR SPACES:	113
No. OF MOTOCYCLE SPACES:	15
No. OF BICYCLE SPACES:	10
OFFICE GFA (SQM):	711
GROUND FLOOR:	320
FIRST FLOOR:	391

All miscellaneous items such as stairs, ramps, bollards, benches, seats, handrails, balustrades, water features, playground equipment, fences and the like that are indicated on the drawings, are indicated as design intent only. Refer Structural Engineer's documents for detailed engineering requirements related to all supports /structural aspects of these elements. Where specific support / structural information is not shown in the design documents the Contractor shall allow to provide all necessary structural supports / footings as required to ensure installations are structurally sound and adequate to suit the installation. The Contractor shall be responsible for providing all necessary structural engineering inputs & certifications necessary to satisfy this requirement.

figured dimensions to be taken in preference to scaled dimensions, verify all dimensions on the job before preparing shop drawings or commencing work. dimensions shown are computer generated and the contractor is to apply standard building tolerances.

verified suitable for the use stipulated by the relevant revision/issue only if initialled and checked by an authorised **dem** (aust) pty limited representative.

amendments

			by	chk'd	verified Init	verified chk'd
no.	date	amendment				
-01	12/12/22	FOR COORDINATION	GZ	GZ	JP	JP
-02	13/12/22	FOR REVIEW	GZ	GZ	JP	JP
-03	14/12/22	FOR REVIEW	GZ	GZ	JP	JP

north point

dem

planning, urban design, architecture, landscape architecture, interior design

p: po box 5036 west chatswood nsw 1515
t: (02) 8966 6000
w: www.dem.com.au

project/client

Waluya Pty Ltd Gosford Transport
7A-11 Racecourse Rd, 5-9 Faunce St & Young St, West Gosford, NSW 2250

civil & structural engineer

building service

drawing title

site plan

preliminary

original	scale	drawn	project no.
a1	1:400	gz	4548-00

drawing no. **ar–0200** rev no. -03

Attachment C – IFD Charts

Table | Chart

Unit: mm/h

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	131	150	216	265	317	393	456
2 min	109	126	183	227	272	335	388
3 min	101	116	169	208	249	307	355
4 min	95.1	109	157	194	232	286	331
5 min	89.9	103	148	182	218	269	312
10 min	70.9	81.3	117	143	171	212	246
15 min	59.0	67.7	97.3	119	143	178	206
20 min	50.9	58.5	84.2	104	124	154	179
25 min	45.0	51.7	74.6	91.9	110	137	159
30 min	40.5	46.6	67.3	82.9	99.5	123	144
45 min	31.6	36.4	52.8	65.1	78.2	97.0	113
1 hour	26.4	30.4	44.1	54.4	65.3	81.0	94.2
1.5 hour	20.5	23.5	34.1	42.0	50.3	62.4	72.4
2 hour	17.1	19.6	28.3	34.8	41.7	51.6	59.9
3 hour	13.3	15.3	21.9	26.8	32.1	39.6	45.9
4.5 hour	10.5	12.0	17.0	20.8	24.7	30.5	35.3
6 hour	8.89	10.1	14.3	17.4	20.7	25.5	29.4
9 hour	7.10	8.06	11.3	13.7	16.2	19.9	22.9
12 hour	6.06	6.87	9.59	11.6	13.8	16.8	19.3
18 hour	4.85	5.49	7.66	9.27	11.0	13.4	15.3
24 hour	4.12	4.68	6.53	7.91	9.36	11.4	13.0
30 hour	3.62	4.11	5.76	6.99	8.27	10.0	11.4
36 hour	3.25	3.69	5.19	6.30	7.47	9.03	10.3
48 hour	2.71	3.09	4.37	5.32	6.32	7.62	8.64
72 hour	2.05	2.35	3.36	4.10	4.88	5.87	6.64
96 hour	1.66	1.90	2.72	3.33	3.97	4.76	5.37
120 hour	1.39	1.59	2.27	2.78	3.31	3.97	4.48
144 hour	1.20	1.37	1.94	2.36	2.81	3.37	3.80
168 hour	1.05	1.20	1.67	2.03	2.41	2.89	3.26

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Attachment D – TUFLOW Flood Maps

Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
EXISTING CONDITION
1% AEP FLOOD EVENT
WATER LEVEL (mAHD)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney
NSW 2060
P 02 9439 1777
E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-001

Issue
A

50mm on Original

Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
EXISTING CONDITION
1% AEP FLOOD EVENT
DEPTH (M)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney
NSW 2060
P 02 9439 1777
E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

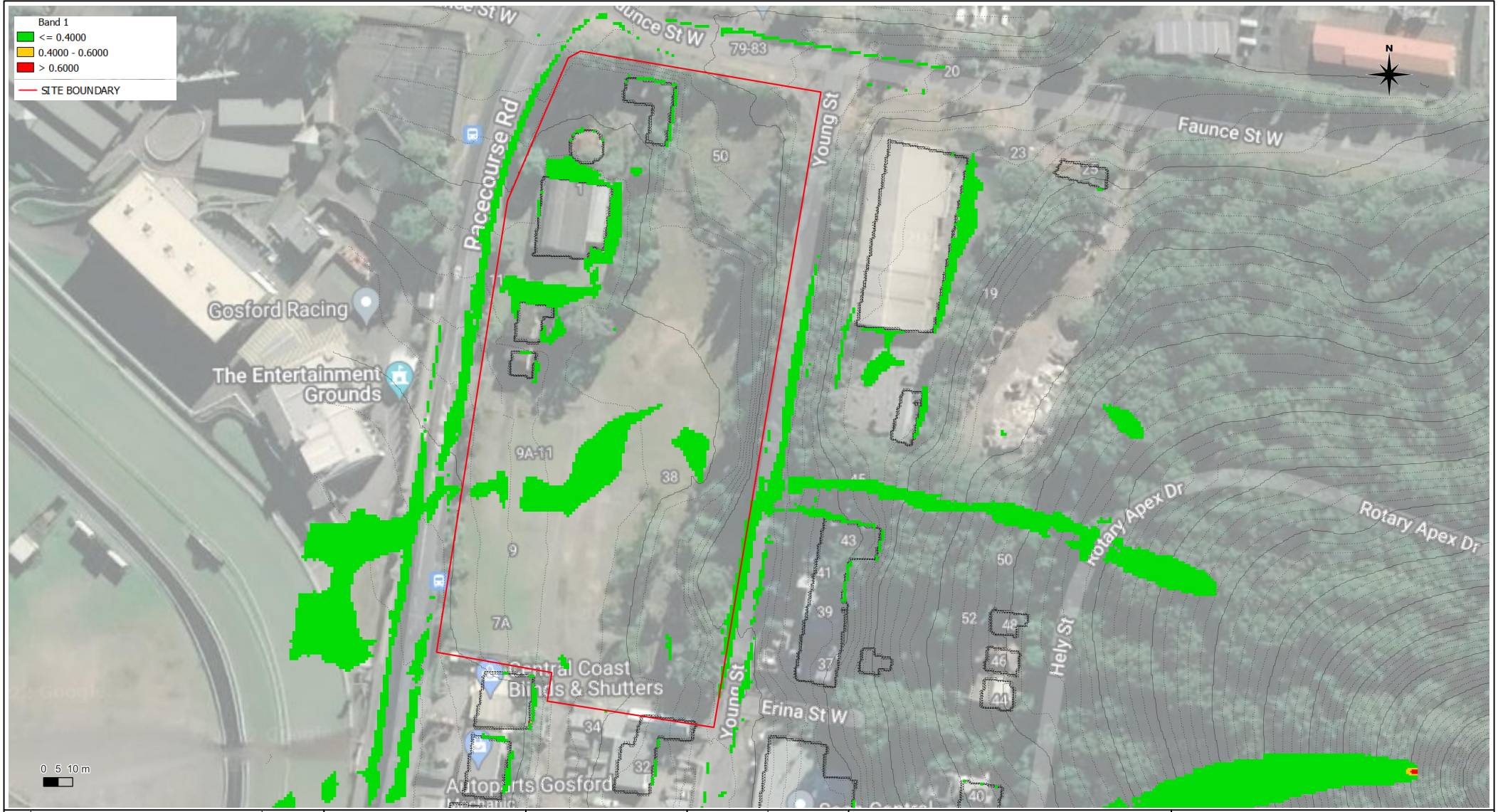
Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-002

Issue
A

50mm on Original



Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
EXISTING CONDITION
1% AEP FLOOD EVENT
HAZARD (VxD)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
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NSW 2060
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www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-003

Issue
A

50mm on Original

Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA
PTY LTD

Scales	N/A	Drawn	N/A
		Designed	DG
Grid	GDA2020	Checked	TM
Height Datum	mAHD	Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
EXISTING CONDITION
PMF EVENT
WATER LEVEL (mAHD)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
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NSW 2060
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E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

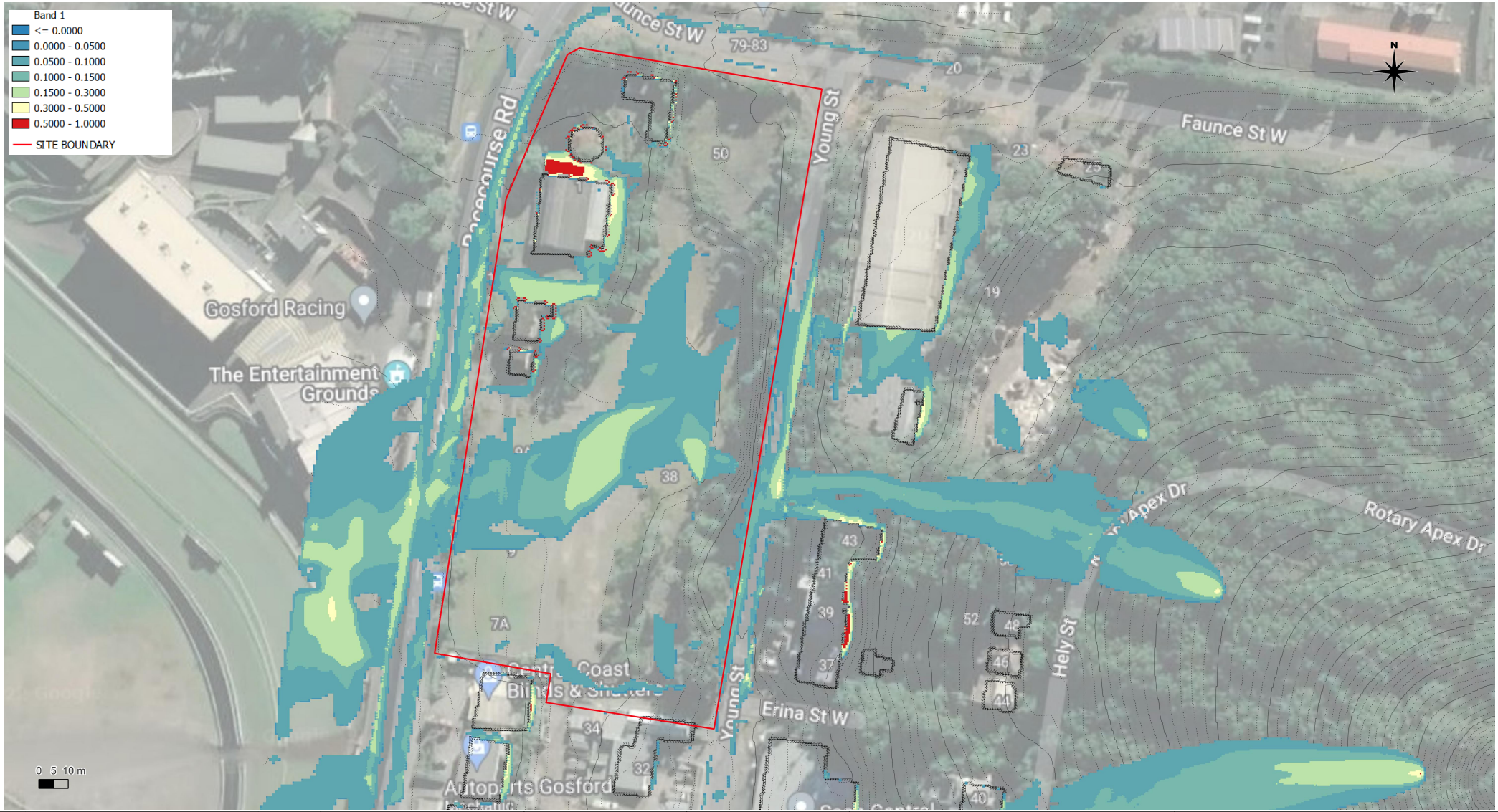
Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-011

Issue
A

50mm on Original



Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
EXISTING CONDITION
PMF EVENT
DEPTH (M)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney
NSW 2060
P 02 9439 1777
E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

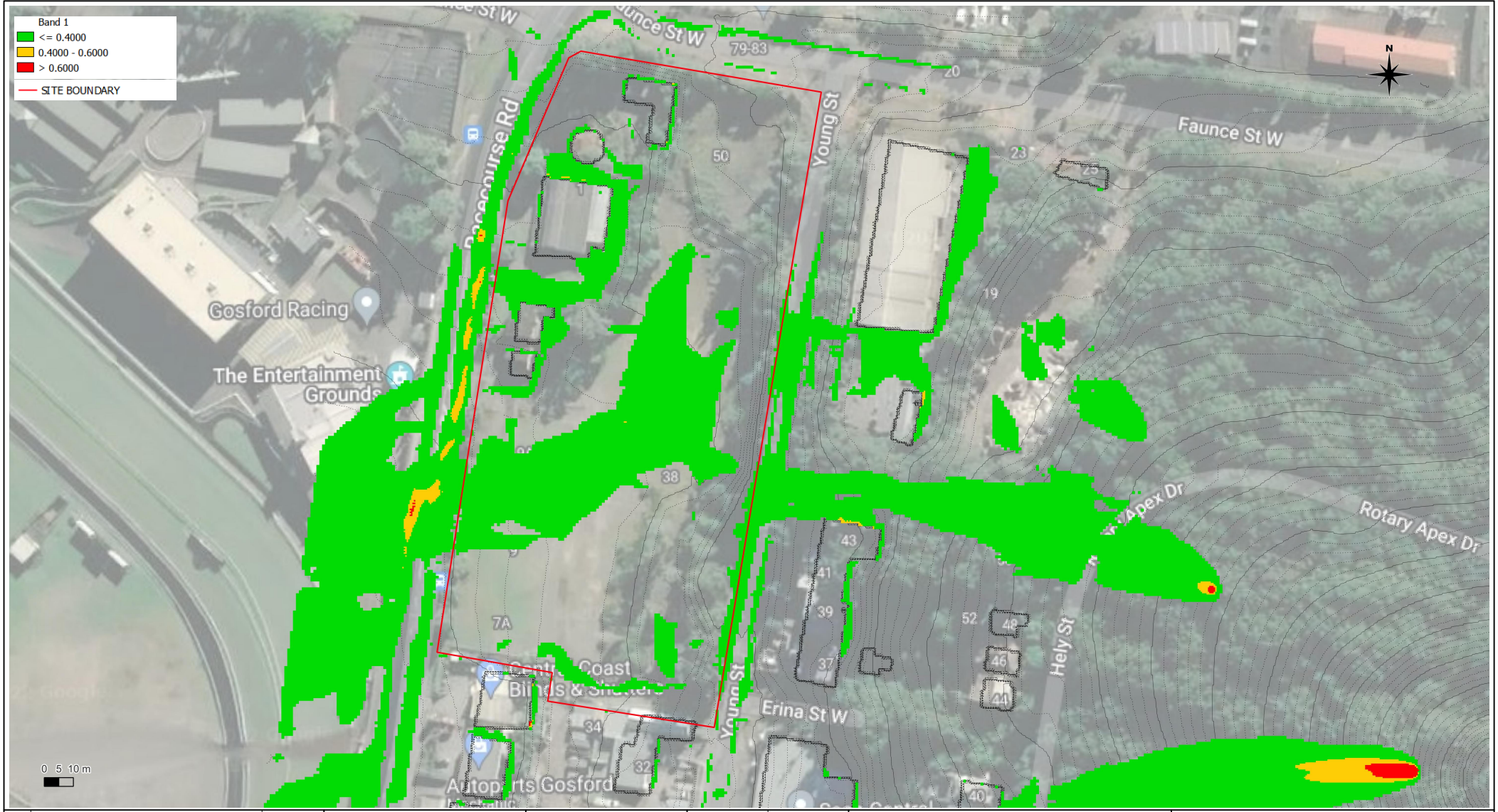
Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-012

Issue
A

50mm on Original



Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA
PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
EXISTING CONDITION
PMF EVENT
EVENT HAZARD (VxD)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
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NSW 2060
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E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-013

Issue
A

50mm on Original

Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
PROPOSED CONDITION
1% AEP FLOOD EVENT
WATER LEVEL(mAHD)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney
NSW 2060
P 02 9439 1777
E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-101

Issue
A

50mm on Original

Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
PROPOSED CONDITION
1% AEP FLOOD EVENT
DEPTH (M)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney
NSW 2060
P 02 9439 1777
E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-102

Issue
A

50mm on Original

Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
PROPOSED CONDITION
1% AEP FLOOD EVENT
HAZARD(VxD)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney
NSW 2060
P 02 9439 1777
E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-103

Issue
A

50mm on Original

A	FOR DEVELOPMENT APPLICATION	16/12/22
Issue	Description	Date

Client
WALUYA PTY LTD

Scales	N/A	Drawn	N/A
		Designed	DG
Grid	GDA2020	Checked	TM
Height Datum	mAHD	Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
PROPOSED CONDITION
PMF EVENT
WATER LEVEL (mAHD)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney
NSW 2060
P 02 9439 1777
E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-111

Issue
A

50mm on Original

Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
PROPOSED CONDITION
PMF EVENT
DEPTH (mAHD)

Civil Engineers and Project Managers
at&l
Level 7, 153 Walker Street
North Sydney
NSW 2060
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ABN 96 130 882 405

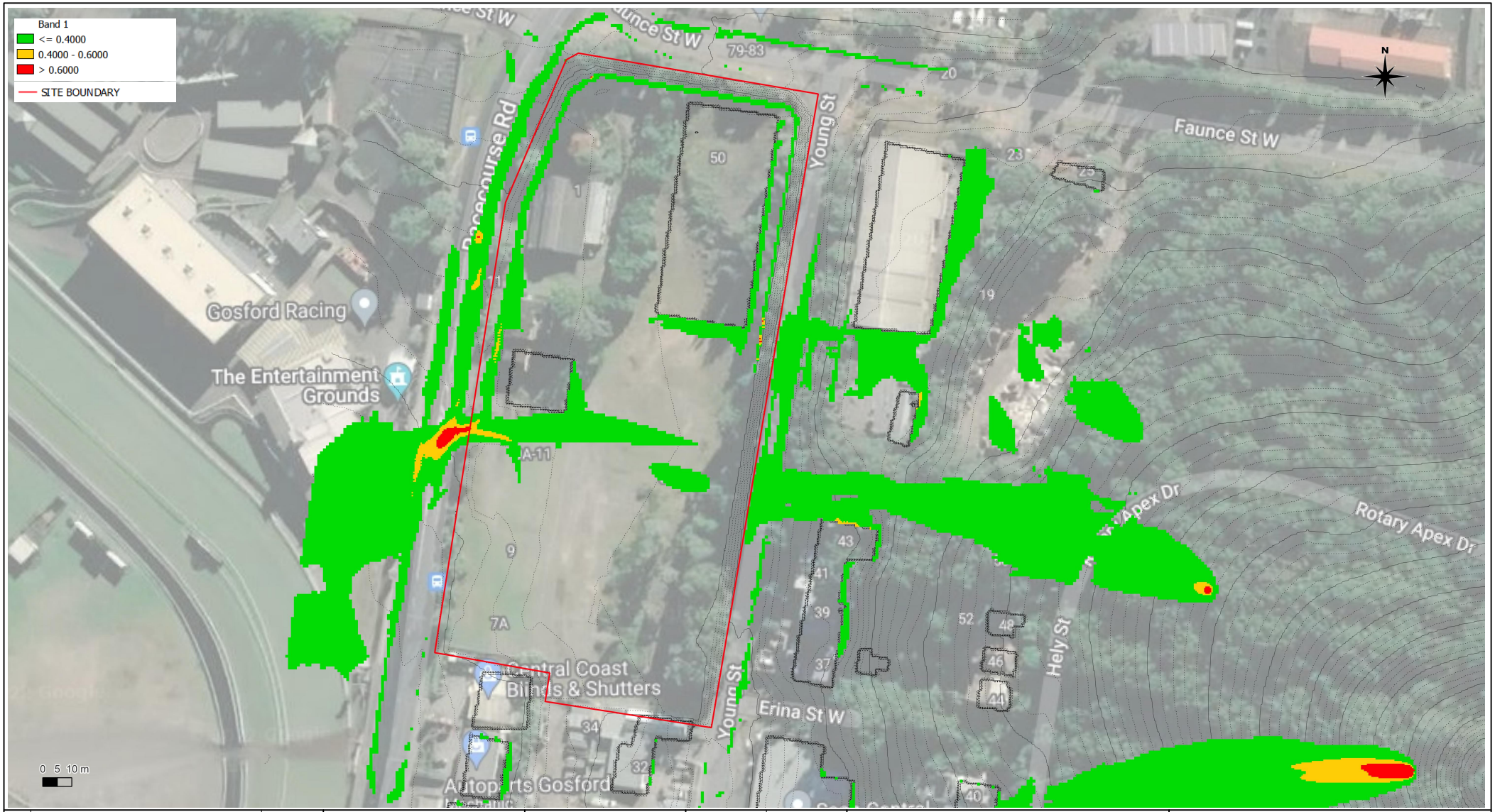
Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-112

Issue
A

50mm on Original



Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A	Drawn	N/A
		Designed	DG
Grid	GDA2020	Checked	TM
Height Datum	mAHD	Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
PROPOSED CONDITION
PMF EVENT
HAZARD (VxD)

Civil Engineers and Project Managers
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E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-113

Issue
A

50mm on Original

Issue	Description	Date
A	FOR DEVELOPMENT APPLICATION	16/12/22

Client
WALUYA PTY LTD

Scales	N/A
Grid	GDA2020
Height Datum	mAHD
Drawn	N/A
Designed	DG
Checked	TM
Approved	GJ

Project
BUS DEPOT,
RACECOURSE ROAD
WEST GOSFORD

Title
PROPOSED CONDITION
1% AEP EVENT
IMPACT (M)

Civil Engineers and Project Managers
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NSW 2060
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E info@atl.net.au
www.atl.net.au
ABN 96 130 882 405

Status
FOR APPROVAL

A4

Project - Drawing No.
22-1063-FLD-300

Issue
A

50mm on Original

at&l

NORTH SYDNEY
LEVEL 7
153 WALKER STREET
NORTH SYDNEY NSW 2060
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BRISBANE
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BRISBANE QLD 4000
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