Rothwell Boys Pty Ltd
C/- Resource Design and Management

Flood Assessment:
The Glades Development,
Lot 1 and 2 DP725785, Pacific Highway,
Moonee Beach, NSW

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P1706361JR01V01
January 2018

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to provide a flood assessment at the subject site in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and Rothwell Boys Pty Ltd C/- Resource Design and Management (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

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Head Office
Suite 201, 20 George Street
Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
Phone: +61-2-9476-9999
Fax: +61-2-9476-8767
Email: mail@martens.com.au
Web: www.martens.com.au

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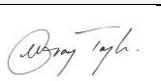
Author(s)	Reviewer(s)	Project Manager	Signature
Paul Dinh	Daniel Dhiacou Daniel Martens	Gray Taylor	

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All enquiries regarding this project are to be directed to the Project Manager.

Executive Summary

Martens & Associates Pty Ltd (MA) have prepared this flood assessment to support a development application (DA) for a proposed low density residential subdivision at Lot 1 and 2 DP 725785 (the site). This report documents the procedures and findings of hydrologic and hydraulic modelling of the site in existing and proposed conditions.

Modelling concluded that:

1. Proposed flood characteristics are largely consistent with existing conditions, and differences due to the proposed development are negligible.

2. The proposed residential development footprint within the site is predominantly flood free in all 1% AEP flood events modelled.

3. The proposed development would have negligible offsite flood impacts.

4. Compliance with Council flood planning level requirements for buildings will be achievable.

5. The proposed development is compatible with the existing floodplain environment.

Contents

1 Introduction

1.1 Overview

Martens & Associates Pty Ltd (MA) have prepared this flood assessment to support a development application (DA) for a proposed residential subdivision at Lot 1 and 2 DP 725785, Pacific Highway, Moonee Beach, NSW (the site, 'The Glades'). Refer to Attachment A for site survey and proposed development layout.

MA previously prepared a flood assessment for this region to support a sub-division at Lot 1 DP1097743, Pacific Highway, Moonee Beach, NSW, which is the lot immediately south of the site. The flood assessment for Lot 1 DP1097743 is documented in MA report P1002663JR08V02 (MA, August 2015). That flood assessment was subject to peer review and has since been approved by Coffs Harbour City Council (CHCC). The hydrologic and hydraulic models used for that assessment have been included and updated to inform the flood assessment at the site.

1.2 Project Scope and Objectives

Project scope and objectives are:

1. Update the previously prepared hydrologic model (RAFTS) for the adjacent site determine the peak flow of the 5% annual exceedance probability (AEP) flood, 1% AEP flood, 1% AEP flood with climate change, and the probable maximum flood (PMF) events.

2. Update the previous hydraulic model (TUFLOW) for the site under existing and proposed conditions.

3. Prepare relevant flood maps including flood extents, depths, levels, velocities, hazards and impacts for the critical 1% AEP flood event.

4. Comment on flood characteristics and model outcomes in existing and proposed conditions.

1.3 Relevant Guidelines

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

1. Coffs Harbour Council (2008), *Climate Change Policy*.

2. Coffs Harbour Council (2009), *Coffs Harbour Engineering Design Guidelines – Stormwater Drainage*.

3. Coffs Harbour Council (2013), *Coffs Harbour Local Environmental Plan (LEP)*.

4. Coffs Harbour Council (2015), *Coffs Harbour Development Control Plan (DCP)*.

5. NSW Department of Environment and Climate Change (2007), *Floodplain Risk Management Guideline Practical Consideration of Climate Change*.

6. NSW Department of Environment and Climate Change (2010), *Flood Risk Management Guide*.

7. NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

1.4 Definitions

AEP	Annual exceedance probability: the probability of a flood event occurring within a year. A 1% AEP flood has a 1% chance of occurring in any given year.
ARI	Average recurrence interval: the average time between flood events occurring. A 100 year ARI flood occurs on average once every 100 years.
ARR	Australian Rainfall & Runoff
BOM	Bureau of Meteorology
Council	Coffs Harbour City Council (CHCC)
DA	Development application
IFD	Intensity frequency duration – design rainfall data for frequent and infrequent storm events.
MA	Martens & Associates Pty Ltd
PMF	Probable maximum flood – the most extreme flood event possible for a certain location, with an approximate ARI of 100,000 to 1,000,000 years.
PMP	Probable maximum precipitation – design rainfall data for extreme storm events.

2 Site Description and Background Data

2.1 Location and Site Description

Existing site description summary is provided in Table 1.

Table 1: Existing site description summary.

Address	Lot 1 and 2 DP 725785, Pacific Highway, Moonee Beach, NSW
Lot / DP	Lot 1 and 2 DP 725785
Site Area	Approximately 92.55 ha
Local Government Area (LGA)	Coffs Harbour City Council (CHCC)
Current Land Use	Vacant
Current Zoning	This land is currently zoned Residential 2A Low Density under Coffs Harbour Local Environmental Plan 2000.
Site Description	The site is currently mostly cleared with some bushland. No structures or intensive land use are currently seen on the site.
Surrounding Land Uses	The site is bordered by the Pacific Highway to the west, partially cleared land to the south, bushland to the north and Moonee Creek to the east.
Site Elevation	Approximately 16 mAHD at western site boundary falling to sea level at the northern and eastern boundaries.
Site Grading & Aspect	Raised in centre of site at 12 mAHD, falling to approximately 4% in northern, eastern, and southern directions.
Site Drainage	Skinners Creek runs along the northern boundary of the site. Bucca Creek runs through the southern portion of the site. Moonee Creek runs along the eastern site boundary.

2.2 Catchment Description

We note the following regarding the catchment upstream of the site:

- The site is located within the Moonee Creek catchment.
- Upstream catchments are primarily bushland and rural residential areas, and include the suburbs of Moonee Beach, Sapphire Beach and Emerald Beach.
- The total upstream catchment area is approximately 4,181 ha, and is shown in Attachment B K000.

2.3 Site Flood Mechanisms

The site is likely affected by the following flood mechanisms:

- Overland flows from the local upstream catchment (refer Section 2.2).

- High tailwater conditions in Moonee Creek causing upstream flows to back up onto the site.

- Storm surge causing high ocean levels and upstream flows to back up onto the site.

2.4 Previous Flood Studies

A review of previous flood investigations was undertaken to assess likely local flood behaviour and characteristics for the site and the Moonee Creek catchment. Review identified four previous flood studies which would be relevant to this assessment.

2.4.1 Paterson Consultants (1998) Moonee Creek Flood Study

Paterson Consultants conducted a flood assessment for this catchment on behalf of Coffs Harbour Council, and summarised the assessment in the report *Moonee Creek Flood Study* (1998), hereafter referred to as the Paterson flood study. As part of their study, Paterson used RORB for hydrologic modelling and MIKE 11 for hydraulic modelling.

A series of flood maps showing flood characteristics for the 1% AEP flood (heights and hazards) were produced that show a peak flood level of approximately 2.8 mAHD in Moonee Creek adjacent to the site. Hazard mapping showed the subject site to be largely outside of existing 1% AEP flood extents, with some portions of the site identified as having a 'Low Hazard' rating. These figures are provided as Figure 1 (flood levels) and Figure 2 (flood hazard).

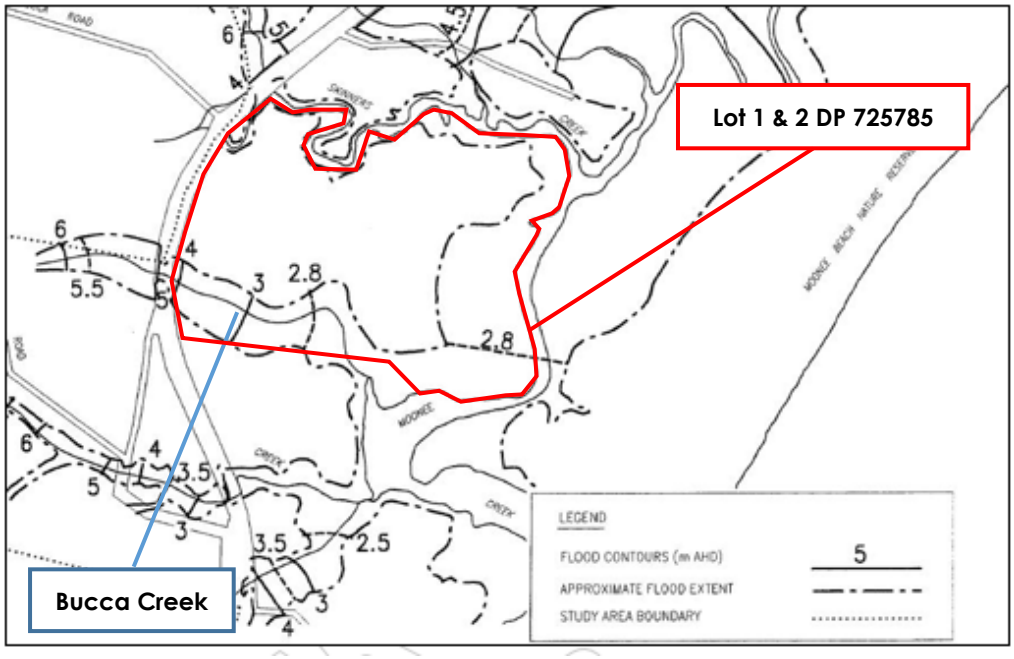

Figure 1: 1% AEP flood level map for Moonee Creek and Bucca Creek in the vicinity of the subject site (Paterson Consultants, 1998).

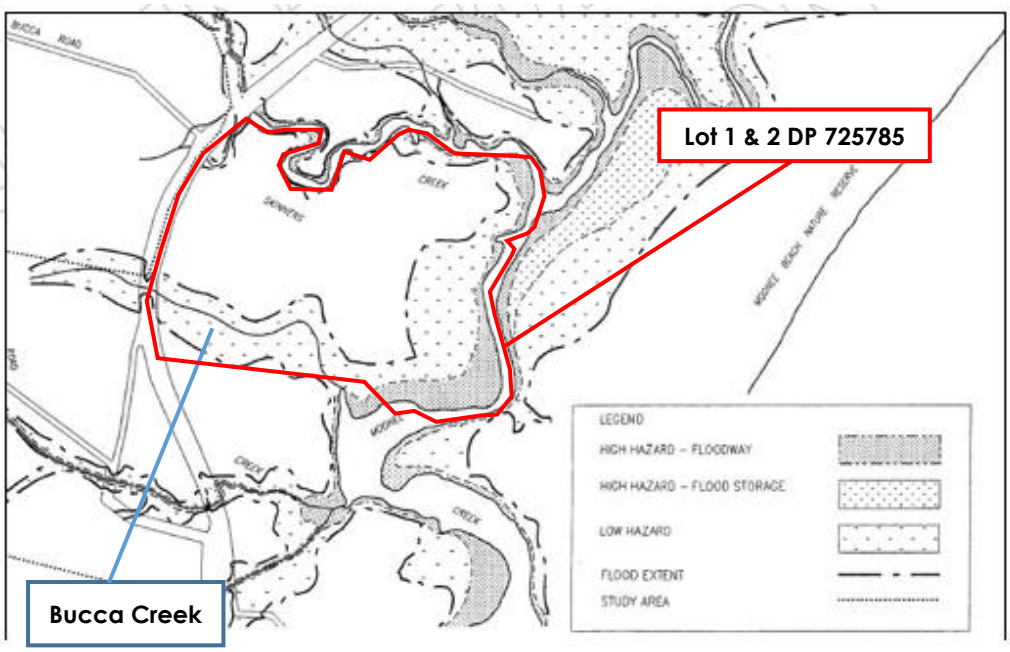

Figure 2: 1% AEP flood hazard map for Moonee Creek and Bucca Creek in the vicinity of the subject site (Paterson Consultants, 1998).

2.4.2 *Bewsher Consulting (2005) Coffs Creek Floodplain Risk Management Plan*

This assessment was completed by Bewsher Consulting on behalf of Coffs Harbour City Council and provides details a floodplain risk management plan for Coffs Creek. Whilst Moonee Creek and its tributaries were not included in this assessment, a flooding and hazard extents map was prepared for areas to the north of Coffs Creek, based on the previous assessment conducted by Paterson Consultants (1998). This map (Figure 3) shows that a portion of the site is affected by the 1 in 100 year ARI peak flood extents.

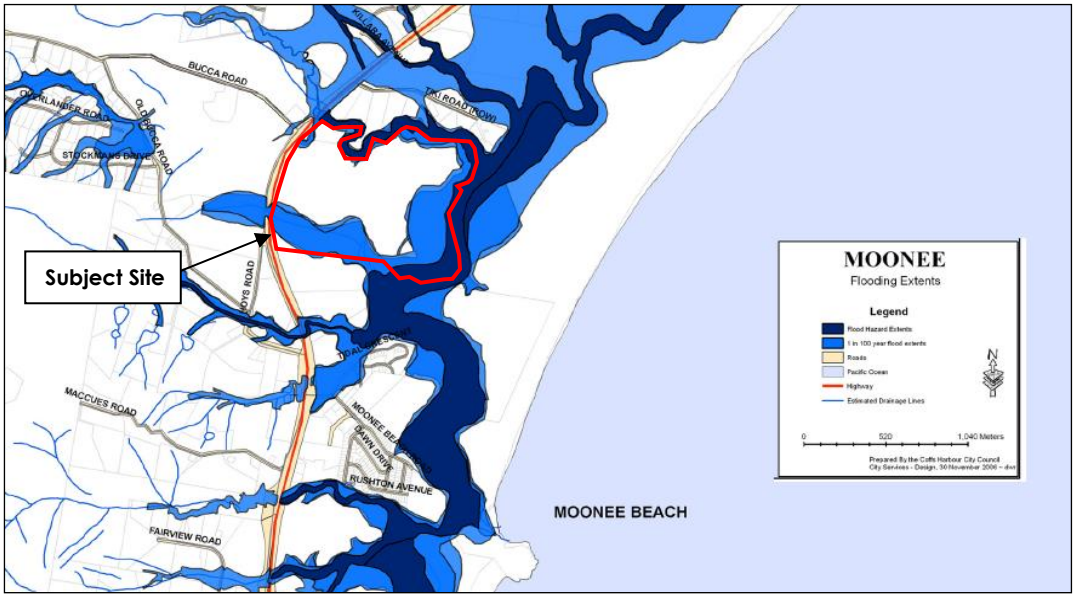

Figure 3: Flood extents mapping for Moonee Creek and tributaries (Bewsher Consulting, 2005).

2.4.3 *Cardno Lawson Treloar (2007) The Glades, Moonee Beach – Hydraulic Assessment*

Cardno Lawson Treloar (CLT) previously developed a detailed MIKE 11 model for the 'The Glades' development (the site).

Full details of the CLT model are provided in the report, *The Glades, Moonee Beach – Hydraulic Assessment,* (Cardno Lawson Treloar, 2007). As part of their study, CLT extended the Paterson Model which utilised RORB for hydrologic modelling and MIKE 11 for hydraulic modelling, updated to the latest version and supplemented with additional cross-sections and the addition of the Pacific Highway bridge over Skinners Creek to improve model accuracy in the vicinity of the development.

The assessment considered three flood simulations (i.e. flood envelope) to determine the 1% AEP flood event envelope curve as follows:

- 1% AEP flood event flows with normal high tide level as boundary conditions (0.6 mAHD).
- 5% AEP flood event flows with 5% AEP tide level as boundary conditions (adopted as 2.3 mAHD).
- 20% AEP flood event flows with 1% AEP tide level as boundary conditions (adopted as 2.6 mAHD).

The development was modelled by assuming that all developed areas would be filled to be above the 1% AEP flood level.

Modelling results for flood levels showed that the effects of the adjacent development on local flooding levels were contained within the relevant site (Lot 1 DP 725785). Modelling results indicated that downslope of Moonee Creek section 6580, peak flood levels resulted from the high tailwater scenarios rather than the peak flood flow scenario.

The CLT model and report have been verified and accepted by Coffs Harbour City Council and has been reviewed by MA. The Cardno report has been evaluated and will be superseded by this report.

2.4.4 Martens and Associates (2015) Flood Assessment: Moonee Beach Sub-division of Lot 1 DP 1097743

Martens and Associates conducted a flood assessment for the area, and summarised the assessment in the report *Flood Assessment: Moonee Beach Sub-division of Lot 1 DP 1097743* (2015), hereafter referred to as the previous MA flood assessment (MA, 2015). As part of the study, MA used XP-RAFTS for hydrologic modelling and TUFLOW for hydraulic modelling. This flood assessment was subject o a peer review and has since been approved by Coffs Harbour City Council (CCHC).

MA have used the previous MA flood assessment as a basis for the preparation of the 'existing conditions' hydraulic model for the site in this study.

2.5 Proposed Development

2.5.1 Subdivision Details

Proposed site subdivision is provided in Attachment A and includes:

- Creation of 555 residential lots with lot sizes ranging from 600 to1,842 m^2.
- A series of internal roads connecting the various stages of the development and linking the site to future developments to the south.

- Parks and recreational areas.

2.5.2 Earthworks Design Details

Proposed site earthworks includes:

- Grading of proposed internals roads.
- Fill for proposed residential areas above flood plain.

2.5.3 Flood design details

Attachment B P1706361PS01 A050 shows 3 x 1.8 m x 2.4 m box culverts are to be provided under 'Road 4' to convey flows from Bucca Creek through the southern portion of the site. These culverts have been sized to minimize offsite flood impacts and maximise flood free areas in the site.

3 Hydrology Modelling

3.1 Overview

The RAFTS software package was used to assess the 5% AEP flood, 1% AEP flood, 1% AEP flood with climate change and PMF peak flow rates for a range of storm durations between 10 minutes and 24 hours.

3.2 Model Setup

Parameters used in the model are provided in Table 2 and Table 3. Model inputs are as follows:

1. Sub-catchment delineation, flow paths and slopes were developed using the 1:25,000 Moonee Beach topographic map from Land and Property Information (2001). Refer to Attachment B PS01-K000 for catchment plan. The unidentified creek line south of Cunninghams Creek is labelled Cunninghams Creek South for the remainder of this report.

2. Sub-catchment impervious areas were adopted based on zoning maps and recent catchment aerials obtained from Nearmaps (2017).

3. Roughness coefficients (PERN) were determined using a weighted average based on the XP-RAFTS (1996) *User's Manual* and each sub-catchment's land use based on recent site aerials obtained from Nearmaps (2017).

4. RAFTS parameters have been derived from the suggested values in the XP-RAFTS (1996) *User Manual*. Sub-catchment surface soils are assumed to be clay loam, based on the NSW Government Environment & Heritage (2017) *eSPADE – NSW Soil and Land Information* website.

5. Intensity Frequency Duration (IFD) data was obtained from Australian Rainfall and Runoff (1987). BOM IFD data is consistent with the previous MA flood model (MA, 2015).

6. 1% AEP rainfall intensities were increased by 10% for the worst-case climate change scenario in accordance with the *Floodplain Risk Management Guideline – Practical Consideration of Climate Change* (2007) for catchments within the Northern Rivers, as was adopted for the previous MA flood study (MA, 2015).

7. Probable Maximum Precipitation (PMP) intensities and temporal distributions were determined using the BOM (2003) *Generalised Short-Duration Method* and BOM (2003) *Generalised Tropical Storm*

Method. Rainfall data are consistent with the previous MA flood model (MA, 2015).

Table 2: Details of sub-catchments used in RAFTS modelling.

Sub-catchment [1]	Area (ha) [1]	Impervious Area (ha) [2]	Pervious Area (ha) [2]	Impervious PERN [3]	Pervious PERN [3]	Slope (%) [1]
Moonee Upper	1,804.9	38.4	1,766.4	0.015	0.089	2.2
Moonee Lower	224.4	16.7	207.7	0.015	0.087	0.3
Skinners Ck	785.6	21.7	763.9	0.015	0.089	3.8
Bucca Ck	78.6	13.5	65.1	0.015	0.062	2.0
Cunninghams Ck	278.0	6.7	271.3	0.015	0.090	4.4
Cunninghams Ck South	82.6	19.0	63.6	0.015	0.063	6.4
Sugar Mill Ck	926.9	70.4	856.6	0.015	0.075	6.3
Total	**4,181.0**	**186.4**	**3,994.6**	**0.015**		

Notes

1. Obtained based on 1:25,000 Moonee Beach topographic map. Refer to Attachment B plan PS01-K000 for site catchment plan.
2. Adopted based on recent catchment aerials obtained from Nearmaps (2017).
3. Obtained from the weighted average land use based on recent catchment aerial photographs obtained from Nearmaps (2017) and the XP-RAFTS User Manual (1996).

Table 3: Probable maximum precipitation data used in RAFTS modelling

PMP Data [1]	Unit	Value
PMP 15 min rainfall intensity	mm/hr	136.1
PMP 30 min rainfall intensity	mm/hr	200.1
PMP 45 min rainfall intensity	mm/hr	254.1
PMP 1 hour rainfall intensity	mm/hr	302.1
PMP 1.5 hour rainfall intensity	mm/hr	353.6
PMP 2 hour rainfall intensity	mm/hr	400.5
PMP 3 hour rainfall intensity	mm/hr	457.8
PMP 6 hour rainfall intensity	mm/hr	588.5
PMP 9 hour rainfall intensity	mm/hr	725.0
PMP 12 hour rainfall intensity	mm/hr	860.0
PMP 18 hour rainfall intensity	mm/hr	1100.0

Notes

1. Obtained using the BOM (2003) Generalised Short-Duration Method and BOM (2003) Generalised Tropical Storm Method.

3.3 Results

Results of peak flow rates for catchments arriving at the site for the critical duration 5% AEP flood event, 1% AEP flood event, 1% AEP flood event with climate change and PMF events are summarised in Table 4.

Additional storm durations were modelled to determine the critical storm duration for the Bucca Creek catchment, in line with the peer reviewer comments from the previous MA flood study (BMT WBM). RAFTS model results for critical storm durations are provided in Table 4 and Table 5.

The critical storm duration for the Moonee Creek catchment was determined to be 9 hours for all modelled flood events. The critical storm duration for the Bucca Creek catchment was determined to be 1.5 hours for all modelled flood events. Results for critical storm duration peak flow rates are provided in Table 4 and Table 5.

Table 4: Peak design storm flow rates for critical duration storms for the Monee Creek catchment estimated by RAFTS modelling for sub-catchment flows.

Event	5% AEP	1% AEP	1% AEP (CC [1])	PMF
Storm Duration Total (hr)	9.0 [2]	9.0 [2]	9.0 [2]	9.0 [2]
Sub-catchment	**Peak Sub-catchment Flow Rates (m^3/s)**			
Moonee Creek Upper	127.5	193.4	215.5	605.5
Moonee Creek Lower	9.3	14.8	16.7	53.3
Skinners Creek	79.5	113.7	125.4	336.9
Bucca Creek	11.3	15.3	16.8	42.5
Cunninghams North	34.0	47.0	51.7	137.1
Cunninghams South	14.2	18.9	20.7	53.1
Sugar Mill Creek	119.6	164.1	180.3	471.6
Total [3]	380.2	548.0	607.8	1,682.8

Notes

1. Based on 10% increased rainfall intensity in accordance with the *Floodplain Risk Management Guideline – Practical Consideration of Climate Change* (2007) for catchments within the Northern Rivers.
2. The 9 hr storm duration is for critical Moonee Creek for all flood events modelled.
3. The offset of the timing of each catchment's hydrograph means the total flow rate is not always equal to the sum of all catchment peak flow rates.

Table 5: Peak design storm flow rates for critical duration storms for the Bucca Creek catchment estimated by RAFTS modelling for sub-catchment flows.

Event	5% AEP	1% AEP	1% AEP (CC [1])	PMF
Storm Duration Total (hr)	1.5 [2]	1.5 [2]	1.5 [2]	1.5 [2]
Sub-catchment	**Peak Sub-catchment Flow Rates (m^3/s)**			
Moonee Creek Upper	50.1	79.8	91.0	375.2
Moonee Creek Lower	12.6	16.0	17.5	49.0
Skinners Creek	41.7	65.5	74.9	295.6
Bucca Creek	12.3	16.4	18.1	58.0
Cunninghams North	21.9	33.8	38.5	141.9
Cunninghams South	20.2	27.1	30.5	101.6
Sugar Mill Creek	80.9	119.4	135.2	494.5
Total [3]	219.6	322.6	366.3	1373.4

Notes

1. Based on 10% increased rainfall intensity in accordance with the *Floodplain Risk Management Guideline – Practical Consideration of Climate Change* (2007) for catchments within the Northern Rivers.
2. The 1.5 hour storm is critical for Bucca Creek for all flood events modelled.
3. The offset of the timing of each catchment's hydrograph means the total flow rate is not always equal to the sum of all catchment peak flow rates.

4 Hydraulic Modelling

4.1 Overview

The TUFLOW hydraulic model was used to determine flood characteristics including flood extents, levels, depths, velocities and hydraulic hazard for the 1% AEP flood (envelope analysis), 1% AEP flood with climate change and probable maximum flood (PMF) events for existing and proposed conditions.

4.2 Scenarios

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

1. Existing condition: the catchment and site in their current state as described in Sections 2.1, 2.2 and 2.3.

2. Proposed condition: the catchment in its current state and the site in its proposed state as described in Section 2.5.

The site is subject to storm surge and high ocean levels as described in Section 2.3. Combinations of catchment flooding and high ocean levels were adopted from Department of Environment, Climate Change & Water (DECC, 2010). Determining the joint probability of each of these events coinciding at the site is outside the scope of this assessment. Each of these scenarios was simulated in the hydraulic model to represent an envelope analysis of possible site flood conditions.

As part of this envelope analysis, critical storm durations for the Moonee Creek catchment and the local Bucca Creek catchment were assessed in line with the peer reviewer's comments from the previous MA flood study (MA, 2015). Details of critical storm durations for these catchments are provided in Section 3.

In addition, climate change scenarios were assessed in accordance with the NSW Department of Environment and Climate Change (2007), *Floodplain Risk Management Guideline Practical Consideration of Climate Change*. This included an increased rainfall intensity of 10% and an increased ocean level of 0.91 m. The combinations of those flood event scenarios were assessed in the hydraulic model as summarised in Table 6.

Table 6: Combinations of catchment and ocean flood events adopted for modelling.

Scenario	Catchment Event [1]	Ocean Event [2]	Peak Ocean Level (mAHD) [2]
1	5% AEP (9 Hour)	1% AEP	2.60
2	1% AEP (9 Hour)	5% AEP	2.25
3	1% AEP (9 Hour)	Neap tide	0.60
4	PMF (9 Hour)	Neap tide	0.60
5	1% AEP + CC [3] (9 hour)	5% AEP (CC [3])	3.16 [3]
6	5% AEP (1.5 hour)	1% AEP	2.60
7	1% AEP (1.5 hour)	5% AEP	2.25
8	1% AEP (1.5 hour)	Neap tide	0.60
9	PMF (1.5 hour)	Neap tide	0.60
10	1% AEP + CC [3] (1.5 hour)	5% AEP (CC [3])	3.16 [3]

Notes

1. Critical duration flood events for Moonee Creek and Bucca Creek catchments as determined by RAFTS modelling, refer Section 3.
2. Ocean levels obtained from Department of Environment, Climate Change & Water (2010), *Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments*.
3. Climate change analysis included a 10% increased rainfall intensity and a 0.91 m increased ocean level, in accordance with NSW Department of Environment and Climate Change (2007), *Floodplain Risk Management Guideline Practical Consideration of Climate Change*.

In summary, a total of 20 scenarios were modelled as part of this assessment (2 flood condition scenarios and 10 flood events each). The proposed conditions surface also included site design grading provided by RDM (2017).

4.3 Terrain Data

3D surfaces for the local floodplain environment used in the TUFLOW model are based on LIDAR provided by LPI (2013) and survey/LIDAR data provided by Resource Design & Management (RDM, 2017) for 'The Glades' development.

4.4 Detailed Existing Model Setup

4.4.1 Existing Conditions Model Setup

TUFLOW model construction for existing conditions consisted of:

1. Development of a 5.0 m topographic grid based on the available data provided in Section 4.3.

2. Establishment of model extents defined from 350 m upstream of Pacific Highway to the east of the site, to upstream of the confluence of Skinners Creek and Moonee Creek approximately 250 m north of the site, to the ocean approximately 2.3 km downstream of the site. Boundary extents were generally located

along catchment ridgelines and connecting catchment high points surrounding the study area.

3. Inclusion of inflow boundary conditions based on the critical duration 5% AEP, 1% AEP, 1% AEP with climate change, and PMF hydrographs from RAFTS for each sub-catchment in Table 4 (see page 16); with inflow locations shown in Attachment B: Flood Assessment Planset.

4. Inclusion of varying ocean water levels for downstream model extent boundary conditions based on DECC (2010) as described in Section 4.2. The tidal events for the 5% AEP, 1% AEP, and 1% AEP with climate change were conservatively modelled with a constant peak water level.

5. Assigning manning's roughness coefficients based on Nearmap Aerials (2017) for hydraulic modelling as shown in Table 7.

6. Inclusion of two bridge crossings under the Pacific Highway as layered flow constrictions. Levels were adopted from RDM survey (2017) and LIDAR, and AECOM SMEC JV (2011), *Bridge Waterway Crossings – Hydrology and Hydraulics study* (BWCHHS). A structural blockage of 0% was adopted based on the assessment procedure in Australian Rainfall and Runoff (Weeks & Rigby, 2016) and as per Council correspondence and recommendation.

7. Inclusion of 2 x 1500 mm concrete pipes at the crossing of Pacific Highway over Bucca Creek. Leveled were adopted from RDM survey (2017). A culvert blockage of 25% was adopted based on the assessment procedure in Australian Rainfall and Runoff (Weeks & Rigby, 2016).

Table 7: Manning's roughness values for TUFLOW modelling.

Catchment Material Type	Manning's Roughness Coefficient [1]
Beach	0.025
Buildings	0.200
Creek	0.04 when depth ≤ 0.3 m
	0.01 when depth > 0.6 m
Bushland / Riparian	0.100
Roads / Concrete	0.013
Rural Residential / Agricultural	0.035
Urban	0.015

Notes
1. Based on typical values from similar catchments and review of Nearmap images (2017).

4.4.2 Proposed Conditions

The following changes were made to the existing conditions flood model to enable detailed modelling of proposed site conditions:

1. Inclusion of the RDM 'Glades' proposed site grading, including internal roads.

2. Updating manning's roughness coefficients for the site to reflect proposed development surfaces.

3. Inclusion of proposed culverts (3 x 1.8 m x 2.4 m rectangular box culverts) at the crossing of Road 4 over Bucca Creek. A culvert blockage of 25% was adopted based on the assessment procedure in Australian Rainfall and Runoff (Weeks & Rigby, 2016). Culvert location is provided in Attachment B: Flood Assessment Planset.

All other model construction elements remained consistent with the existing conditions model.

4.5 Results

Flood mapping results (flood levels, depths, velocities and provisional hazard categories) for the critical duration 1% AEP flood (Scenario 2) in existing and proposed conditions are provided in Attachment B: Flood Assessment Planset, with drawing references summarised in Table 8. These results are provided as they represent the scenario with the worst-case offsite impacts. An additional flood map for the critical duration 1% AEP flood with climate change is also provided as this controls proposed flood planning levels.

Table 8: Flood map drawing references in Attachment B (MA planset P1706361PS01).

Scenario	Flood Event	Water Level & Depth (m)	Water Velocity (m/s)	Provisional Hydraulic Hazard Categories [1]	Water Level Impact (m)
Existing	Scenario 2 [2]	K100	K101	K102	–
Proposed	Scenario 2 [2]	K200	K201	K202	K300
	Scenario 2 [2]	K210	–	–	–

Notes

1. Provisional hydraulic hazard categories are based on NSW Floodplain Development Manual (2005) definitions and are shown in Figure 4.
2. Scenario 2 is the critical duration (9hr) Moonee Creek 1% AEP catchment flood with the 5% AEP ocean level, as described in Table 6.
3. Scenario 5 is the critical duration (9hr) Moonee Creek 1% AEP with climate change event, as described in Table 6. Climate change scenario based on 10% increased rainfall intensity in accordance with the *Floodplain Risk Management Guideline – Practical Consideration of Climate Change* (2007) for catchments within the Northern Rivers.

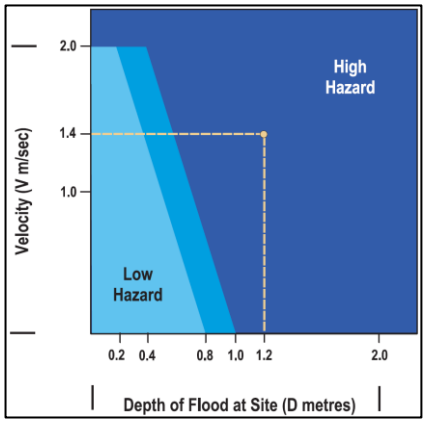

Figure 4: Provisional hydraulic hazard categories (*NSW Floodplain Development Manual*, 2005).

4.6 Discussion

We note the following regarding modelled flood behaviour:

4.6.1 Existing Conditions

1. The primary source of flood affectation at the site is due to the high tailwater condition in Moonee Creek.

2. Flood waters primarily flow through the southwest section of site from west to east in the flow direction of Bucca Creek.

3. Overland flows from the Bucca Creek catchment back up behind Pacific Highway due to the insufficient capacity of the existing 2 x 1,500 mm concrete pipes.

4. Maximum water levels and impacts for all scenarios modelled are governed by the critical duration Moonee Creek events (9 hour

storm) as opposed to the critical duration Bucca creek events (1.5 hour storm).

5. During the critical 1% AEP flood event there are overland flow depths of up to 1.0 m within Bucca Creek. This transitions to ponding at a distance of approximately 130 m downstream of the creek exiting the site, with depths up to 0.8 m. The area immediately adjacent to Bucca Creek is subject to overland flooding and have higher flood levels in the area.

6. Flood velocities for all events up to the critical 1% AEP flood event are generally:

    a. Moderate (<1.0 m/s) in Bucca Creek.

    b. Low (<0.2 m/s) in the area of the site north of Bucca Creek.

    c. Low (<0.4 m/s) in the area of the site south of Bucca Creek.

7. Hydraulic hazard is intermediate to high within the centre of Bucca Creek but is low for all areas outside of creek banks for all events up to the critical 1% AEP flood event.

4.6.2 Proposed Conditions

1. Proposed conditions adjacent to Bucca Creek reduce the area of flood affectation, however the local floodplain characteristics remain largely unchanged from existing conditions.

2. Flow through the existing 2 x 1500 mm concrete pipes in Bucca Creek below Pacific Highway arrive at the site and flow through the 3 x 2.4 x 1.8 m box culverts below proposed Road 4. These culverts are sized to ensure that only a minor degree of overland flow backs up behind the culverts in the critical 1% AEP flood event.

3. The proposed earthworks render the residential footprint largely flood free in the critical 1% AEP flood event. The proposed Road 4 crossing over Bucca Creek is flood free in the 1% AEP flood event, with the road level (5.0 mAHD) 850 mm above the adjacent 1% AEP flood level (4.15 mAHD).

4. None of the proposed roads are affected by flood water in the critical 1% AEP flood event. Of the 555 proposed lots, only 3 are affected by flood waters in the critical 1% AEP flood event – lots 1, 20 and 24 (refer Attachment A). These 3 lots are large (>1000 m^2) and only a small portion of each are affected by shallow, low hazard flood waters. We consider that flood flooding will not be a

major constraint for these lots, as building footprints can be located clear of critical 1% AEP flood extents.

5. The critical 1% AEP flood level ranges from 2.94 to 4.15 mAHD, and proposed earthworks are largely flood free.

6. Flood velocities for all events up to the critical 1% AEP flood event are generally:

    a. Moderate (<1.0 m/s) in Bucca Creek.

    b. Less than 1.7 m/s in the proposed culverts under Road 4.

    c. Eliminated from the development footprint due to the proposed earthworks being above the critical 1% AEP flood event.

7. Hydraulic hazard is intermediate to high within Bucca Creek and is outside the development footprint due to the proposed earthworks. Hydraulic hazard is low within the site up to the 1% AEP flood event with climate change.

8. The PMF flood level varies from 4.5-5.2 mAHD across the site. A shelter-in-place evacuation strategy is recommended for future proposed dwellings with a second story for each building.

4.6.3 Offsite Flood Impacts

1. The proposed development does not have material offsite impacts on water levels. There is a small area of approximately 58 m^2 impact within the Bucca Creek creekline of up to 70 mm in the critical 1% AEP flood event at the sites' western boundary adjacent to Pacific Highway. This impact is negligible considering its small area and its' location within the existing creek.

2. There are no other offsite water level impacts in the critical 1% AEP flood event, and no residential properties are negatively affected. The proposed development therefore has an acceptable impact on the local floodplain environment.

4.6.4 Climate Change Analysis

1. The critical 1% AEP with climate change flood level yields maximum water levels of 3.53 - 4.18 mAHD. To comply with Council's freeboard controls, the proposed flood planning level (FPL) will be 500 mm above the 1% AEP with climate change flood level of 4.03 - 4.68.

2. With the exception of the 3 lots discussed in section 4.6.2, the proposed earthworks are flood free up to the critical 1% AEP flood event with climate change.

3. Table 9 summarises flood levels and the recommended flood planning levels for the proposed development.

Table 9: Flood levels and recommended flood planning level

Scenario	Duration (hr)	Rainfall	Ocean	Flood Level[1] (mAHD)	FPL[1] (mAHD)
2	9.0	1% AEP	5% AEP	2.94 – 4.15	3.44 – 4.65
4	9.0	PMF	Neap Tide	4.51 – 5.22	–
5	9.0	1% AEP + Climate Change	5% AEP + Climate Change	3.53 – 4.18	4.03 – 4.68
7	1.5	1% AEP	5% AEP	2.49 – 4.03	2.99 – 4.53
9	1.5	PMF	Neap Tide	3.76 – 4.66	–
10	1.5	1% AEP + Climate Change	5% AEP + Climate Change	3.29 – 4.06	3.79 – 4.56
				Recommended FPL	4.03 – 4.68 [2]

Notes

1. Flood level and therefore recommended flood planning levels vary across the site. Refer to Attachment B: Flood Assessment Planset for details.
2. We note this is marginally higher than the 4.00 mAHD FPL adopted to the south in the MA 2015 flood report, because this study has adopted slightly higher ocean boundary conditions.

5 Summary and Recommendations

A detailed hydrologic and hydraulic model has been prepared for the site consistent with Council's accepted MA 2015 TUFLOW model provided in MA P1002663JR08V01, with additional site survey and proposed design elements to assess local flood characteristics.

The models were used to determine the existing and proposed flood conditions in the 1% AEP envelope analysis (with and without climate change), and PMF events. Modelling concluded that:

1. The proposed development does not have any material offsite water level impacts.

2. The proposed development area is flood free in the critical 1% AEP flood event with climate change.

3. Compliance with Council flood planning level requirements for future buildings and roads are achievable.

The following recommendations are made:

1. All proposed dwellings are to have a finished floor levels at 4.03 – 4.68 mAHD (0.5m higher than determined flood levels), in accordance with drawing PS01-K210 produced in this report.

2. Should the proposed development footprint change, or significant changes to the proposed design levels and/or culvert design occur (as shown on Drawing PS01-A050), an updated flood model with detailed earthworks should be prepared at Construction Certificate stage.

The proposed development has been designed to ensure compatibility with the existing floodplain environment. As the proposed development has been designed to achieve Council requirements, no further recommendations are considered necessary.

6 References

AECOM SMEC JV (2011), *Bridge Waterway Crossings – Hydrology and Hydraulics Study (BWCHHS)*.

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Bureau of Meteorology (2003), *Generalised Tropical Storm Method.*

Cardno Lawson Treloar (2007) The Glades, Moonee Beach – Hydraulic Assessment.

Coffs Harbour Council (2008), *Climate Change Policy.*

Coffs Harbour Council (2015), *Coffs Harbour Development Control Plan (DCP).*

Coffs Harbour Council (2009), *Coffs Harbour Engineering Design Guidelines – Stormwater Drainage.*

Coffs Harbour Council (2013), *Coffs Harbour Local Environmental Plan (LEP).*

Institute of Engineer's Australia (1987), *Australian Rainfall and Runoff.*

Land and Property Information (2001)*, 1:25,000 Topographic Map, Moonee Beach 9537-4-S.*

Martens & Associates (2015), *Flood Assessment: Proposed Sub-division, Lot 1 DP1097743, Pacific Highway, Moonee Beach, NSW.*

NSW Department of Environment and Climate Change (2007), *Floodplain Risk Management Guideline Practical Consideration of Climate Change.*

NSW Department of Environment, Climate Change & Water (2010), *Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments.*

NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

NSW Government Environment & Heritage (2017) *eSPADE – NSW Soil and Land Information,* www.environment.nsw.gov.au/eSpade2WebApp.

Paterson Consultants (1998), *Moonee Creek Flood Study.*

Weeks, W and Rigby, T (2016), *Blockage of Hydraulic Structures,* Chapter 6 of Book 6 in *Australian Rainfall and Runoff – A Guide to Flood Estimation*.

XP-RAFTS (1996), User's Manual.

7 Attachment A: Site Survey and Lot Layout

"The Glades"

BUCCA ROAD

HIGHWAY

PACIFIC

HOYS RD

LOT 2 on DP 725785
(Area = 3.359 ha)

LOT 1 on DP 725785
(Area = 92.550 ha)

LOT 7
DP 252223

HIGHWAY ACCESS FOR CONSTRUCTION ONLY

POTENTIAL CORNER STORE / RESIDENTIAL SITE

PARK

Skinners Creek

Moonee Creek

Road 1
Road 2
Road 3
Road 4
Road 5
Road 6
Road 7
Road 8
Road 9
Road 10

Access Path Way

1 2 3 4 5 6 7 8 9 10 11

LEGEND

524 — LOT NUMBER
620sq m — LOT AREA
20.0 — LOT LENGTH

RECREATION NODE
(REFER PLAN 6 PATH NETWORK & DEVELOPMENT FACILITIES BY ANNE HARRISON LANDSCAPE ARCHITECTS.)

MAJOR PEDESTRIAN / CYCLE (SHAREWAY)
(REFER PLAN 6 PATH NETWORK & DEVELOPMENT FACILITIES BY ANNE HARRISON LANDSCAPE ARCHITECTS.)

MAJOR PEDESTRIAN / CYCLE BOULEVARD
(REFER PLAN 6 PATH NETWORK & DEVELOPMENT FACILITIES BY ANNE HARRISON LANDSCAPE ARCHITECTS.)

LOCAL CONNECTION PATHWAY
(REFER PLAN 6 PATH NETWORK & DEVELOPMENT FACILITIES BY ANNE HARRISON LANDSCAPE ARCHITECTS.)

updated plan
Issued Jan 2018

Stage	No of Lots
1	67
2	40
3	59
4	61
5	51
6	61
7	48
8	48
9	50
10	42
11	28
TOTAL	**555**

0 20 40 60 80 100 200 metres
1 : 2000 (at A1 before reduction)

amdt no.	date	amendment
F	FEB 09	TEMPORARY INTERSECTION AMENDED
E	DEC 08	PATH NETWORK AND FACILITIES ADDED
D	MAY 08	TOTAL SITE APPLICATION
C	APRIL 08	ENTRY AMENDED
B	OCT 07	DRAWING TITLE AMENDMENT
A	SEPT 07	CONCEPT PLAN & PRECINCT NOTED

PRELIMINARY LOT LAYOUT

AUSPACIFIC ENGINEERS

AUSPACIFIC ENGINEERS PTY LTD
development consultants, civil, structural and hydraulic engineers
3 / 20 Nerang Street
NERANG QLD 4211
T 07 5596 5377
F 07 5596 3443
E auspacifik@austarnet.com.au

scales	AS SHOWN
design	RKH
drawn	JM
date	NOV 2006
signed	

client: THE ROTHWELL BOYS PTY LTD

project: PROPOSED RESIDENTIAL SUBDIVISION MOONEE BEACH COFFS HARBOUR

dwg no. P1

amendment F

8 Attachment B: Flood Assessment Planset

PROJECT: ENGINEERING SERVICES FOR DA - FLOOD ASSESSMENT

PLANSET: FLOOD ASSESSMENT

CLIENT: RESOURCE DESIGN & MANAGEMENT C/- ROTHWELL BOYS

LOCALITY PLAN
N.T.S.

DRAWING LIST		
DWG NO.	REV	DWG TITLE
GENERAL		
PS01-A000	B	COVER SHEET
PS01-A050	B	OVERVIEW PLAN
FLOODING		
PS01-K000	A	CATCHMENT PLAN
PS01-K100	B	1% AEP CATCHMENT + 5% AEP OCEAN EXISTING CONDITION WATER LEVEL (mAHD) & WATER DEPTH (m)
PS01-K101	A	1% AEP CATCHMENT + 5% AEP OCEAN EXISTING CONDITION WATER VELOCITY (m/s)
PS01-K102	A	1% AEP CATCHMENT + 5% AEP OCEAN EXISTING CONDITION PROVISIONAL HYDRAULIC HAZARD CATEGORIES
PS01-K200	B	1% AEP CATCHMENT + 5% AEP OCEAN PROPOSED CONDITION WATER LEVEL (mAHD) & WATER DEPTH (m)
PS01-K201	A	1% AEP CATCHMENT + 5% AEP OCEAN PROPOSED CONDITION WATER VELOCITY (m/s)
PS01-K202	A	1% AEP CATCHMENT + 5% AEP OCEAN PROPOSED CONDITION PROVISIONAL HYDRAULIC HAZARD CATEGORIES
PS01-K210	B	1% AEP CATCHMENT + 5% AEP OCEAN + CLIMATE CHANGE PROPOSED CONDITION WATER LEVEL (mAHD) & WATER DEPTH (m)
PS01-K220	B	PMF CATCHMENT + NEAP OCEAN PROPOSED CONDITION WATER LEVEL (mAHD) & WATER DEPTH (m)
PS01-K300	A	1% AEP CATCHMENT + 5% AEP OCEAN PROPOSED CONDITION WATER LEVEL IMPACT (m)

LGA: COFFS HARBOUR CITY COUNCIL

'GLADES', PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	**MINOR AMENDMENTS**	**25/01/2018**	**PD**	**PD**	**DD**	**DD**
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE

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A1 / A3 LANDSCAPE (A1LC_v02.0.01)

GRID | DATUM | PROJECT MANAGER: GT

CLIENT: RESOURCE DESIGN & MANAGEMENT

PROJECT NAME/PLANSET TITLE
ENGINEERING SERVICES FOR DA
FLOOD ASSESSMENT
PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE: COVER SHEET

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-A000	B

DRAWING ID: P1706361-PS01-R02-A000

KEY

SITE BOUNDARY

PROPOSED LOT BOUNDARIES

PROPOSED CONTOUR —12—

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	25/01/2018	PD	PD	DD	DD
A	INITIAL RELEASE	24/01/2018	KW	PD	DD	DD

SCALE
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A1 (A3) 1:2,500 (1:5,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

CLIENT
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PROJECT NAME/PLANSET TITLE
ENGINEERING SERVICES FOR DA
FLOOD ASSESSMENT
PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

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DRAWING TITLE
OVERVIEW PLAN

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-A050	B

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DRAWING ID: P1706361-PS01-R02-A050

KEY

SITE BOUNDARY

CATCHMENT BOUNDARIES

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	24/01/2018	KW	PD	DD	DD

SCALE

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GRID	DATUM	PROJECT MANAGER
		GT

CLIENT

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PROJECT NAME/PLANSET TITLE

ENGINEERING SERVICES FOR DA

FLOOD ASSESSMENT

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DRAWING TITLE

CATCHMENT PLAN

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K000	A

DRAWING ID: P1706361-PS01-R02-K000

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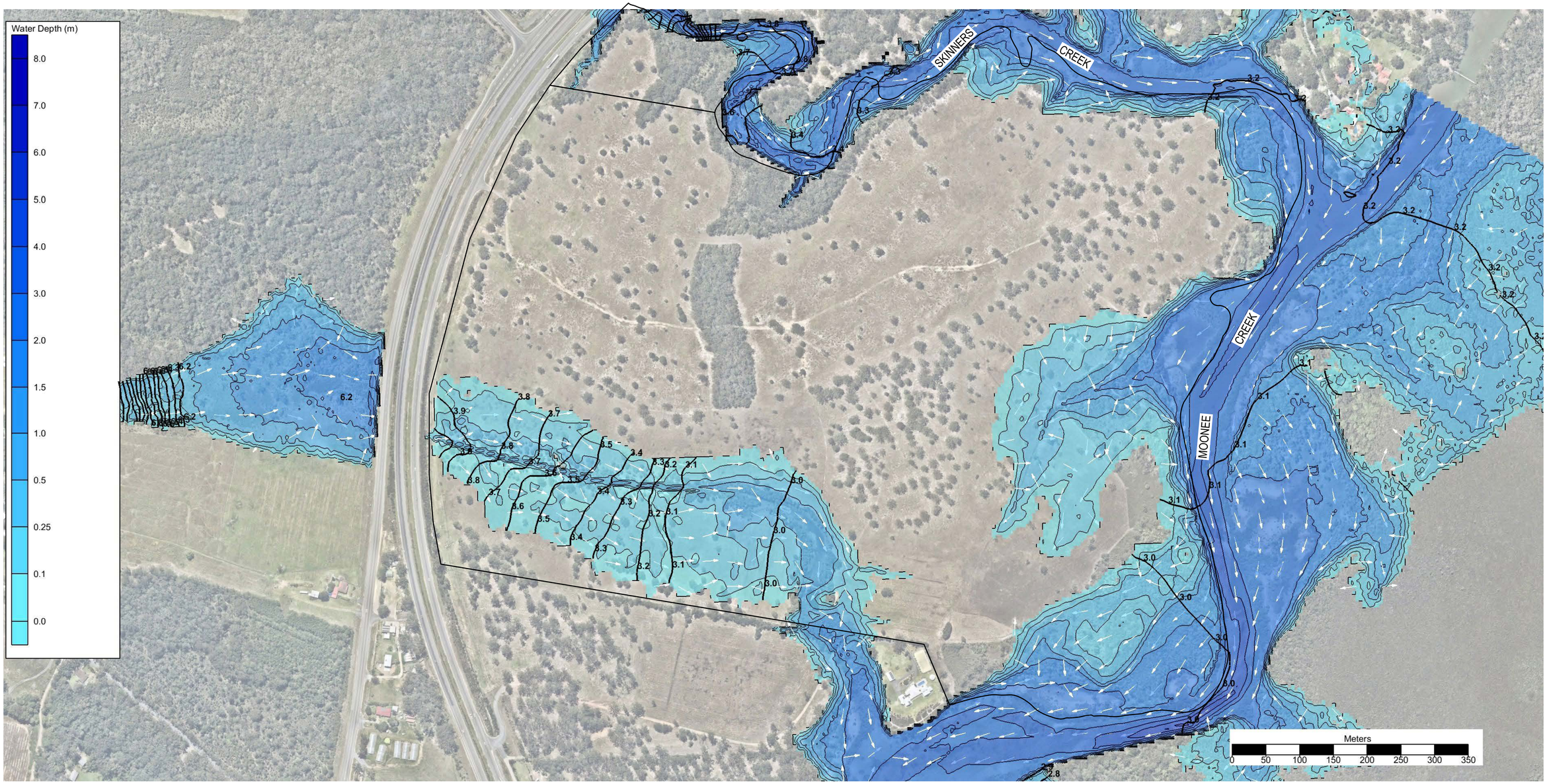

KEY

SITE BOUNDARY

CADASTRE BOUNDARIES

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
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A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

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GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

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DRAWING TITLE
1% AEP CATCHMENT + 5% AEP OCEAN
EXISTING CONDITION
WATER LEVEL (mAHD) & WATER DEPTH (m)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K100	B

DRAWING ID: P1706361-PS01-R02-K100

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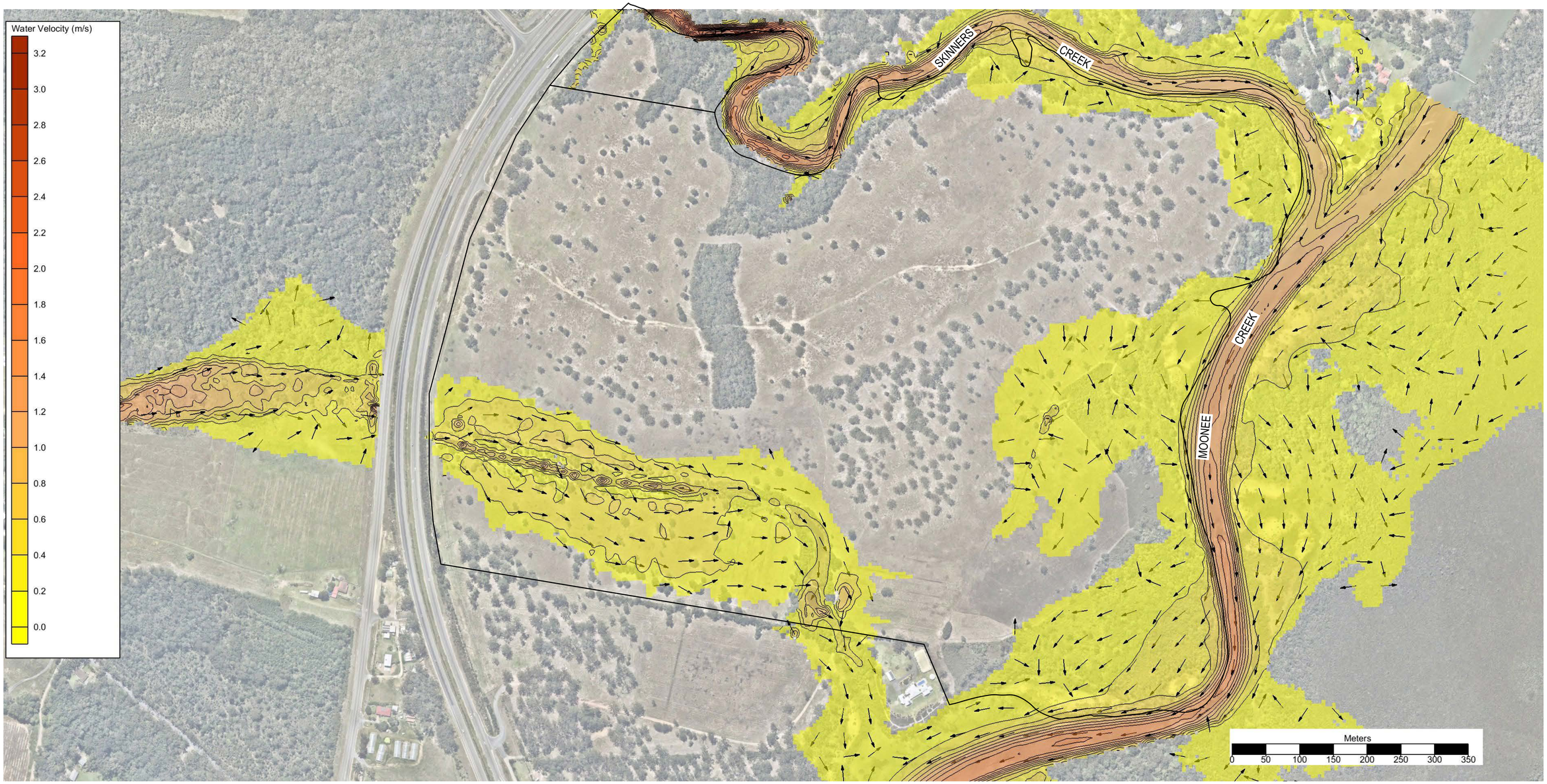

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SITE BOUNDARY

CADASTRE BOUNDARIES

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE: 0 30 60 90 120 150 180 210 240 270 300 METRES
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GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

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DRAWING TITLE
1% AEP CATCHMENT + 5% AEP OCEAN
EXISTING CONDITION
WATER VELOCITY (m/s)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K101	A

DRAWING ID: P1706361-PS01-R02-K101

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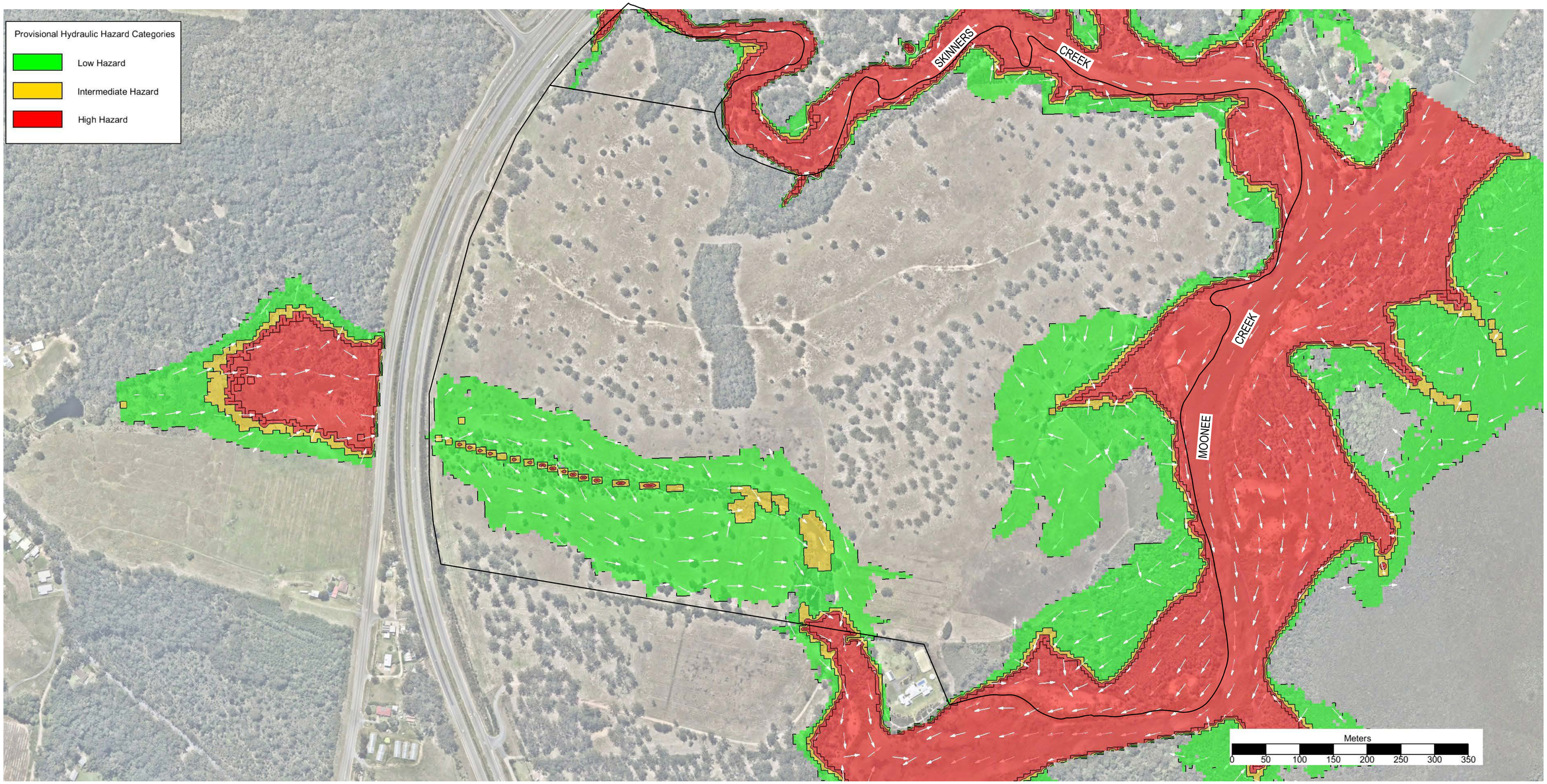

KEY

SITE BOUNDARY

CADASTRE BOUNDARIES

NOTE: HYDRAULIC HAZARD BASED ON NSW GOVERNMENT (2005)
FLOODPLAIN DEVELOPMENT MANUAL PROVISIONAL HYDRAULIC HAZARD CATEGORIES

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE
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A1 (A3) 1:3,000 (1:6,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

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Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
1% AEP CATCHMENT + 5% AEP OCEAN
EXISTING CONDITION
PROVISIONAL HYDRAULIC HAZARD CATEGORIES

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K102	A

DRAWING ID: P1706361-PS01-R02-K102

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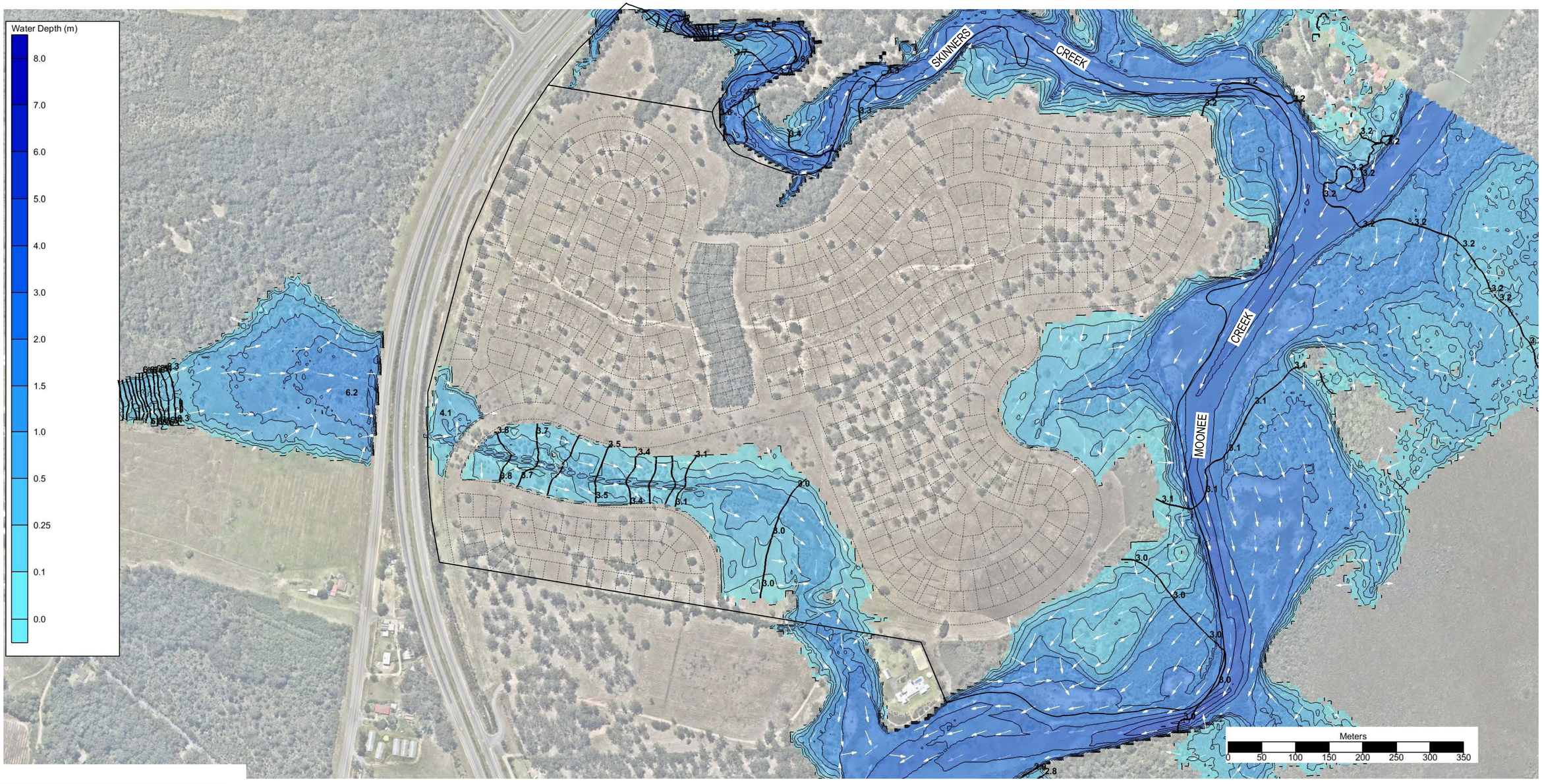

KEY

SITE BOUNDARY

CADASTRE BOUNDARIES

PROPOSED LOT LAYOUT

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	25/01/2018	PD	PD	DD	DD
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE: A1 (A3) 1:3,000 (1:6,000) METRES

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

CLIENT: RESOURCE DESIGN & MANAGEMENT

PROJECT NAME/PLANSET TITLE: ENGINEERING SERVICES FOR DA
FLOOD ASSESSMENT
PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

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Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
1% AEP CATCHMENT + 5% AEP OCEAN
PROPOSED CONDITION
WATER LEVEL (mAHD) & WATER DEPTH (m)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K200	B

DRAWING ID: P1706361-PS01-R02-K200

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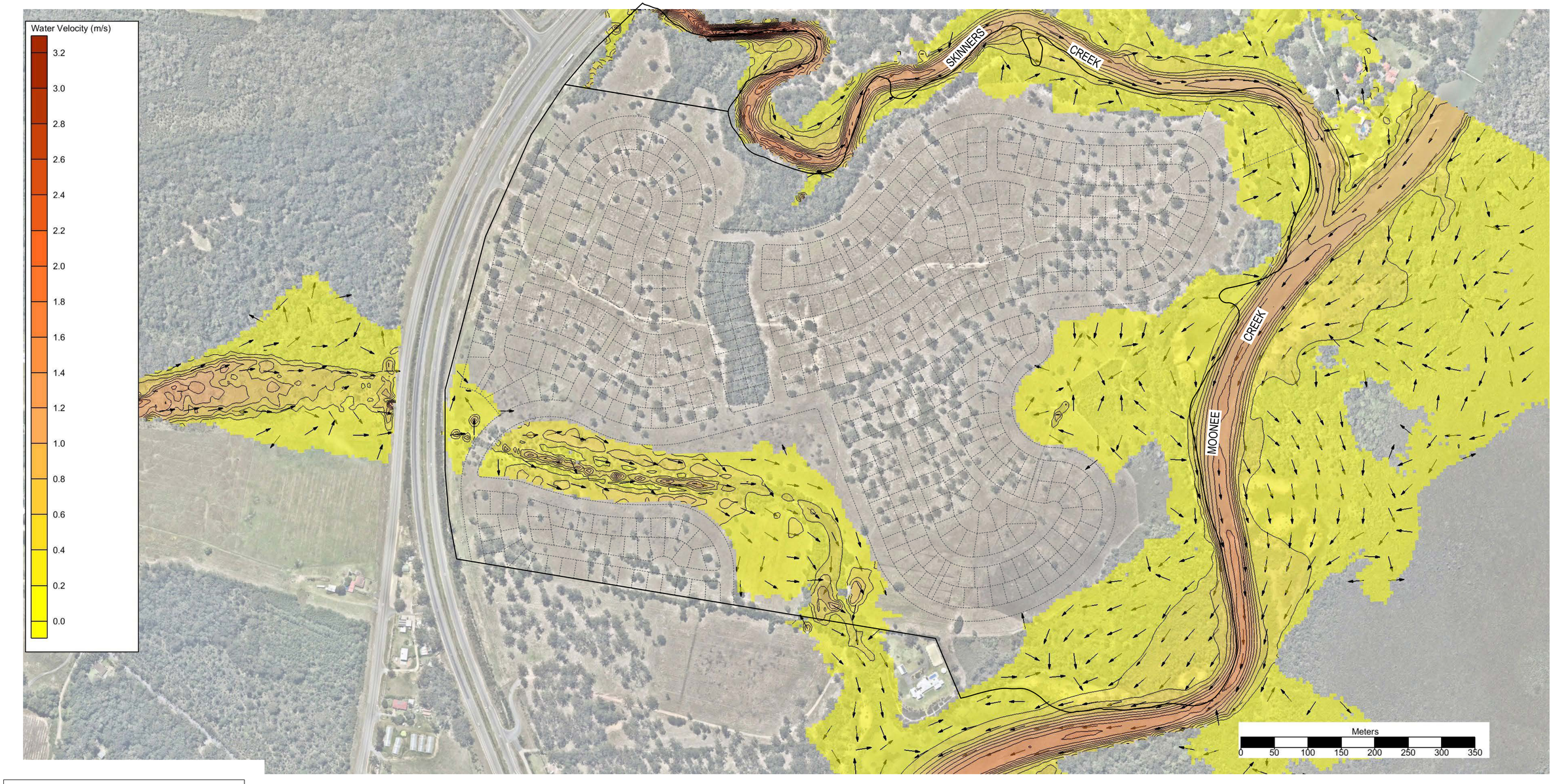
A1 / A3 LANDSCAPE (A1LC_v02.0.01)



KEY

SITE BOUNDARY

CADASTRE BOUNDARIES

PROPOSED LOT LAYOUT

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE
0 30 60 90 120 150 180 210 240 270 300 METRES
A1 (A3) 1:3,000 (1:6,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

CLIENT
RESOURCE DESIGN & MANAGEMENT

PROJECT NAME/PLANSET TITLE
ENGINEERING SERVICES FOR DA
FLOOD ASSESSMENT
PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
1% AEP CATCHMENT + 5% AEP OCEAN
PROPOSED CONDITION
WATER VELOCITY (m/s)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K201	A

DRAWING ID: P1706361-PS01-R02-K201

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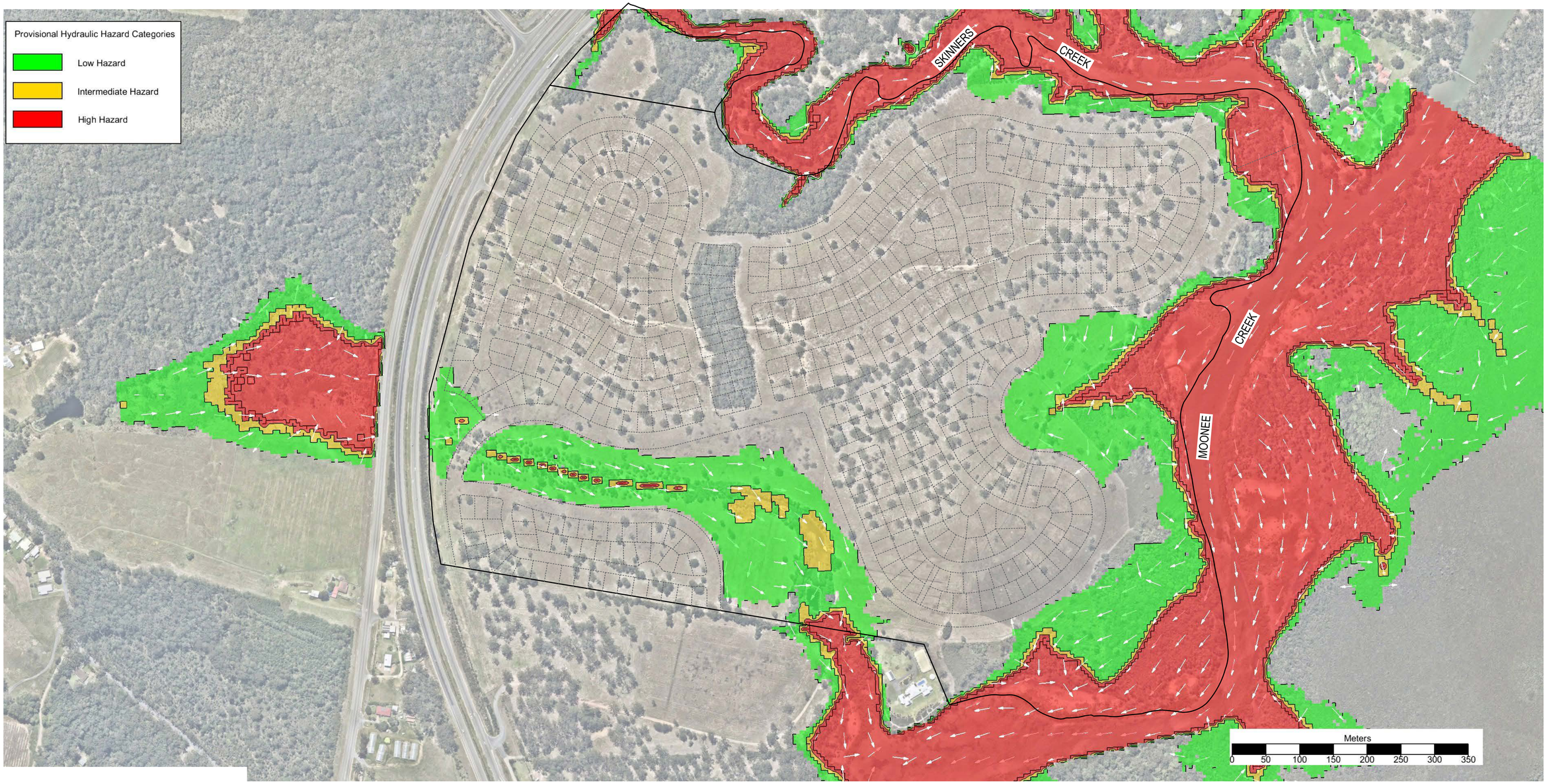

KEY

SITE BOUNDARY

CADASTRE BOUNDARIES

PROPOSED LOT LAYOUT

NOTE: HYDRAULIC HAZARD BASED ON NSW GOVERNMENT (2005)
FLOODPLAIN DEVELOPMENT MANUAL PROVISIONAL HYDRAULIC HAZARD CATEGORIES

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE
0 30 60 90 120 150 180 210 240 270 300 METRES
A1 (A3) 1:3,000 (1:6,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

CLIENT
RESOURCE DESIGN & MANAGEMENT

PROJECT NAME/PLANSET TITLE
ENGINEERING SERVICES FOR DA
FLOOD ASSESSMENT
PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

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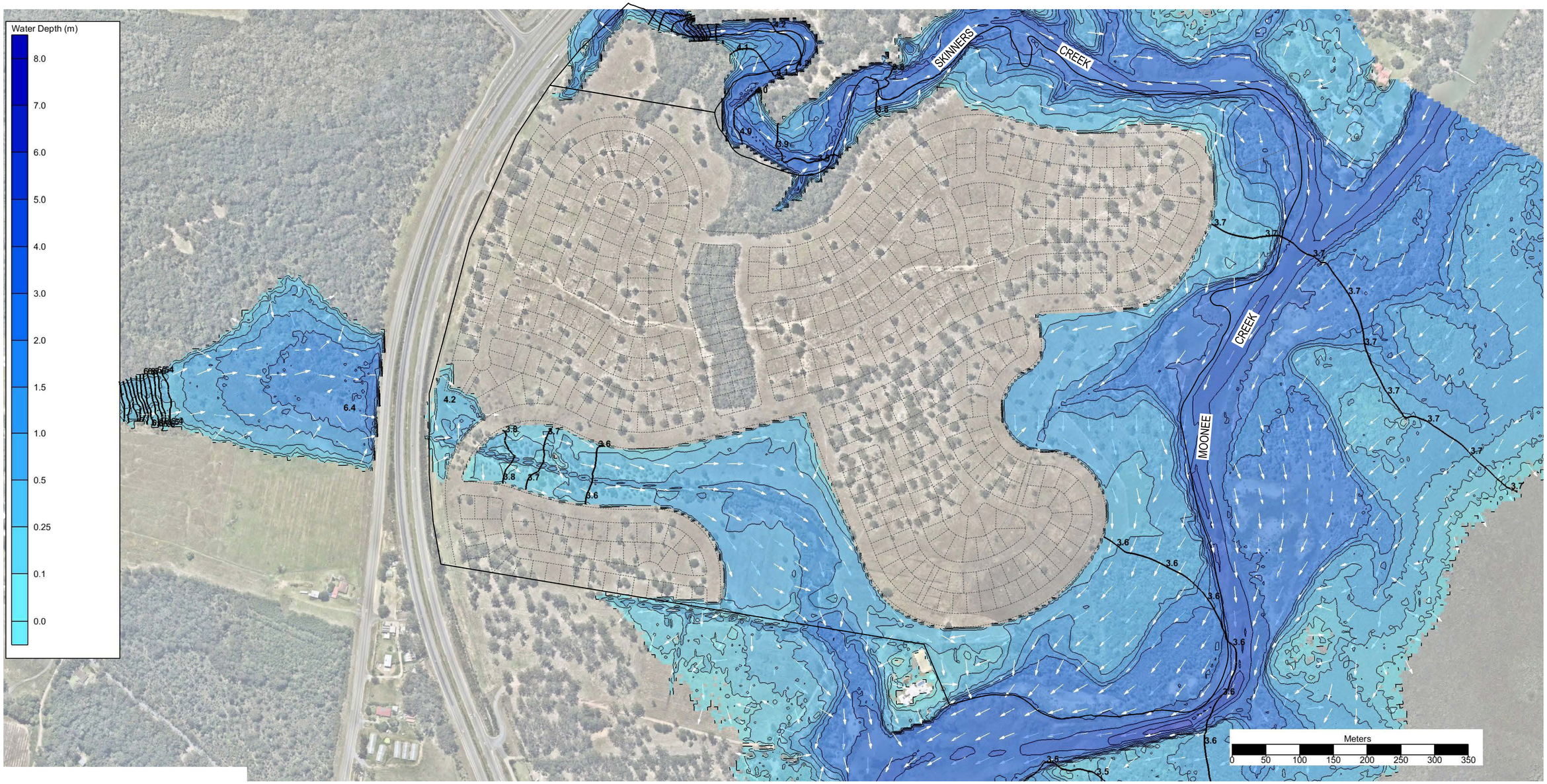
DRAWING TITLE
1% AEP CATCHMENT + 5% AEP OCEAN
PROPOSED CONDITION
PROVISIONAL HYDRAULIC HAZARD CATEGORIES

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K202	A

PRINTED: --- - USER: PDWI
A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1706361-PS01-R02-K202



KEY

SITE BOUNDARY

CADASTRE BOUNDARIES

PROPOSED LOT LAYOUT

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	**MINOR AMENDMENTS**	**25/01/2018**	**PD**	**PD**	**DD**	**DD**
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE: 0 30 60 90 120 150 180 210 240 270 300 METRES
A1 (A3) 1:3,000 (1:6,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

CLIENT: RESOURCE DESIGN & MANAGEMENT

PROJECT NAME/PLANSET TITLE: ENGINEERING SERVICES FOR DA
FLOOD ASSESSMENT
PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

martens & Associates Pty Ltd
Consulting Engineers
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DRAWING TITLE
1% AEP CATCHMENT + 5% AEP OCEAN + CLIMATE CHANGE
PROPOSED CONDITION
WATER LEVEL (mAHD) & WATER DEPTH (m)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K210	B

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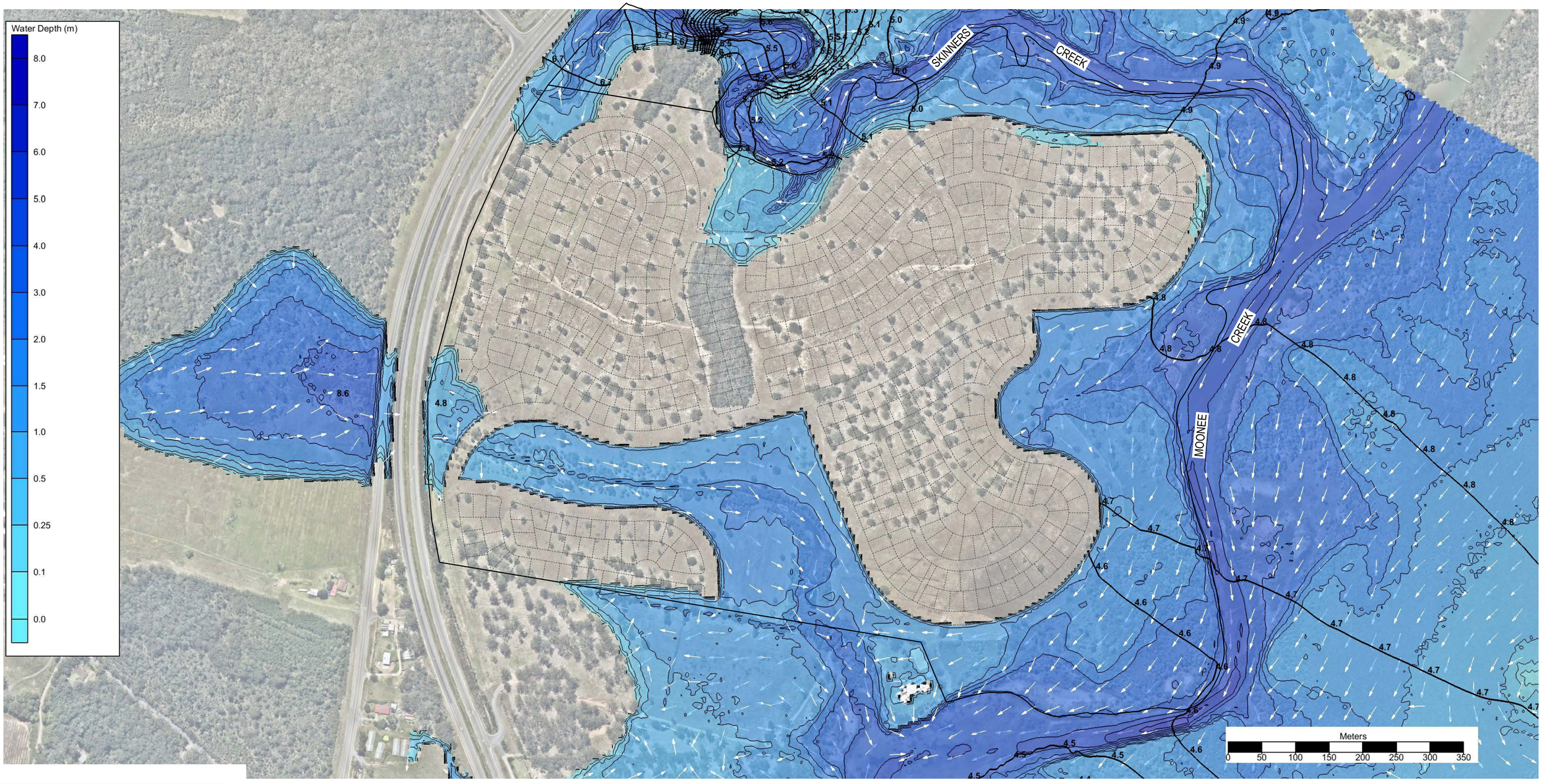
A1 / A3 LANDSCAPE (A1LC__v02.0.01)
DRAWING ID: P1706361-PS01-R02-K210



KEY

SITE BOUNDARY

CADASTRE BOUNDARIES

PROPOSED LOT LAYOUT

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	25/01/2018	PD	PD	DD	DD
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE
0 30 60 90 120 150 180 210 240 270 300 METRES
A1 (A3) 1:3,000 (1:6,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GT

CLIENT
RESOURCE DESIGN & MANAGEMENT

PROJECT NAME/PLANSET TITLE
ENGINEERING SERVICES FOR DA
FLOOD ASSESSMENT
PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

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Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
PMF CATCHMENT + NEAP OCEAN
PROPOSED CONDITION
WATER LEVEL (mAHD) & WATER DEPTH (m)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K220	B

DRAWING ID: P1706361-PS01-R02-K220

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A1 / A3 LANDSCAPE (A1LC_v02.0.01)

KEY

SITE BOUNDARY

CADASTRE BOUNDARIES

PROPOSED LOT LAYOUT

NOTE: AREAS COLOURED WHITE REPRESENT NEGLIGIBLE CHANGE
AREAS COLOURED YELLOW/RED REPRESENT WATER LEVEL INCREASE

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	24/01/2018	RK	PD	DD	DD

SCALE
0 30 60 90 120 150 180 210 240 270 300 METRES
A1 (A3) 1:3,000 (1:6,000)

GRID: MGA | DATUM: mAHD | PROJECT MANAGER: GT

CLIENT: RESOURCE DESIGN & MANAGEMENT

PROJECT NAME/PLANSET TITLE
ENGINEERING SERVICES FOR DA
FLOOD ASSESSMENT
PACIFIC HIGHWAY, MOONEE BEACH, NSW
LOT 1 & 2 DP 725785

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DRAWING TITLE
1% AEP CATCHMENT + 5% AEP OCEAN
PROPOSED CONDITION
WATER LEVEL IMPACT (m)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706361	PS01	R02	PS01-K300	A

DRAWING ID: P1706361-PS01-R02-K300

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