DRAFT 139080 (MJC/BNE)

Land Title Act 1994 ; Land Act 1994
Form 21 Version 4

SURVEY PLAN

Sheet 1 of 2

Stage 1

AMENDED IN RED
By: Jennifer Davison
Date: 25 MARCH 2019

PERMANENT MARKS

PM	BRG	DIST	No.	REMARKS
2-OPM	279°32'40"	56.681	106935	5/SP297847

PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL
Approval no: DEV2018/969
Date: 1 April 2019

Original information compiled from SP297847 in the Department of Natural Resources, Mines and Energy.

Peg placed at all new corners unless shown otherwise.

ESPLANADE

MOORES ROAD

100 1.001 ha

101 3695 m²

Emt A 85 m²

Emt A See Diag.

2 SP297847

DIAGRAM 1 : 250

REFERENCE MARKS

STN	TO	BRG	DIST	REMARKS
1	0 Nail Hole in Kerb	163°25'25"	0.629	IS146475
1	0 Nail in Conc	172°41'	15.563	6/SP297847
1	0 Nail in Conc	179°03'25"	17.182	1/IS179109
1	0 Screw in Kerb	188°28'30"	23.35	6/SP297847
3	0 Screw in Conc	223°00'50"	18.677	55/SP297847

0 50 m 100 m 150 m

RPS Australia East Pty Ltd (ACN 140 292 762) hereby certify that the land comprised in this plan was surveyed by the corporation, by David Andrew ALLEN, surveying graduate, for whose work the corporation accepts responsibility, under the supervision of Andrew Collin GARRETT, cadastral surveyor and that the plan is accurate, that the said survey was performed in accordance with the Survey and Mapping Infrastructure Act 2003 and Surveyors Act 2003 and associated Regulations and Standards and that the said survey was completed on

. . . . . Authorised Delegate

. . . . . Date

PLAN OF

LOTS 100 & 101, and Easement A in Lot 100

Cancelling Lot 1 on SP297847

LOCAL GOVERNMENT: REDLAND CITY

LOCALITY: REDLAND BAY

Meridian: MGA (Zone 56) Vide SP297847

Survey Records NO

Scale: 1 : 1000

Format: STANDARD

SP309514

DRAFT 139080 (MJC/BNE)

Land Title Act 1994 ; Land Act 1994
Form 21 Version 4

SURVEY PLAN

Sheet 1 of 2

Stage 2

AMENDED IN RED
By: Jennifer Davison
Date: 25 MARCH 2019

PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL
Approval no: DEV2018/969
Date: 1 April 2019

PERMANENT MARKS				
PM	BRG	DIST	No.	REMARKS
2-OPM	279°32'40"	56.681	106935	5/SP297847

REFERENCE MARKS				
STN	TO	BRG	DIST	REMARKS
1	O Nail Hole in Kerb	163°25'25"	0.629	IS146475
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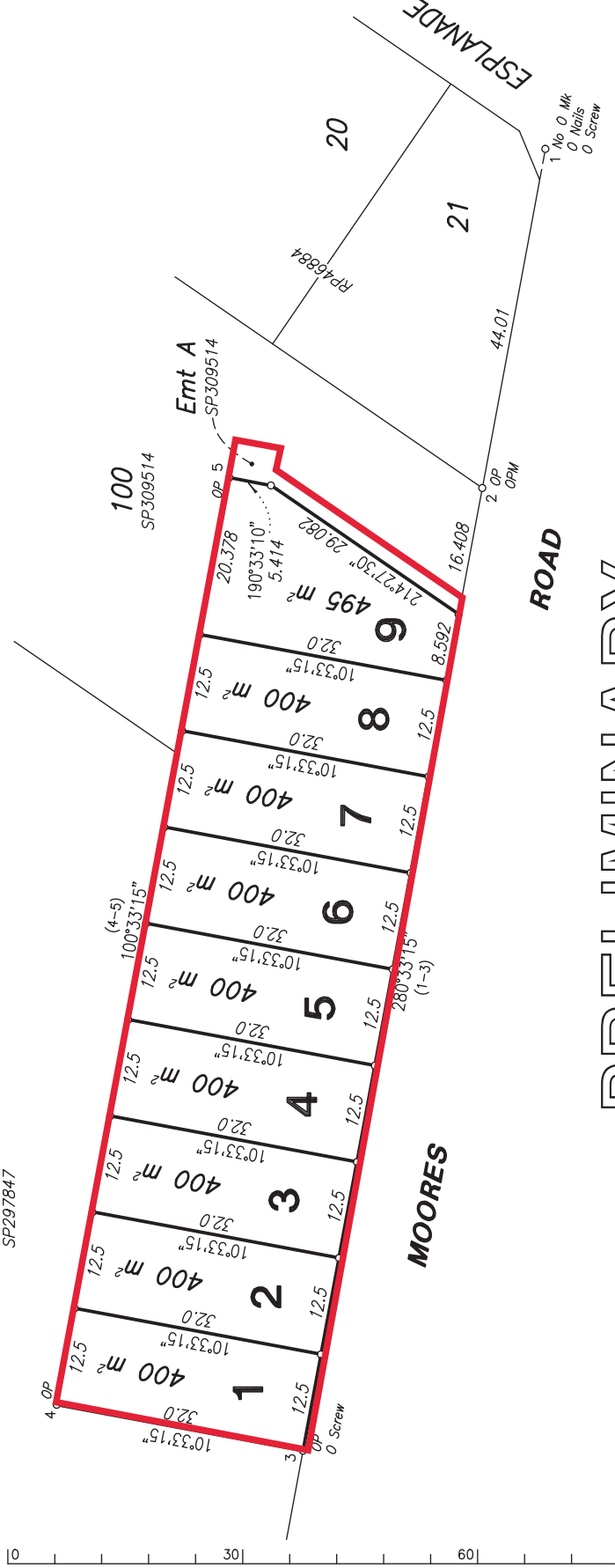
1	O Nail in Conc	179°03'25"	17.182	1/IS179109
1	O Screw in Kerb	188°28'30"	23.35	6/SP297847
3	O Screw in Conc	223°00'50"	18.677	55/SP297847



0 30 60 90 m
0 50 100 150 mm

RPS Australia East Pty Ltd (ACN 140 292 762) hereby certify that the land comprised in this plan was surveyed by the corporation, by David Andrew ALLEN, surveying graduate, for whose work the corporation accepts responsibility, under the supervision of Andrew Collin GARRETT, cadastral surveyor and that the plan is accurate, that the said survey was performed in accordance with the Survey and Mapping Infrastructure Act 2003 and Surveyors Act 2003 and associated Regulations and Standards and that the said survey was completed on

. . . . . Authorised Delegate

. . . . . Date

PLAN OF

LOTS 1 - 9

Cancelling Lot 101 on SP309514

LOCAL GOVERNMENT: REDLAND CITY

LOCALITY: REDLAND BAY

Meridian: MGA (Zone 56) Vide SP297847

Survey Records NO

Scale: 1 : 600

Format: STANDARD

SP297870

PLAN OF DEVELOPMENT (LOTS 1 - 9)

Approved Development (No Further Assessment)

Dwelling House
A dwelling house in accordance with Table 1 is approved development (no further assessment) and can proceed to certification of operational works and building works.

Interpretation
Terms used in this POD have the meaning assigned to those terms by Economic Development Act 2012, the Weinam Creek Development Scheme. If there are any inconsistencies between the definitions in these documents, the inconsistency is to be resolved by using the definition in the following order:
(a) The Act,
(b) The Development Scheme.

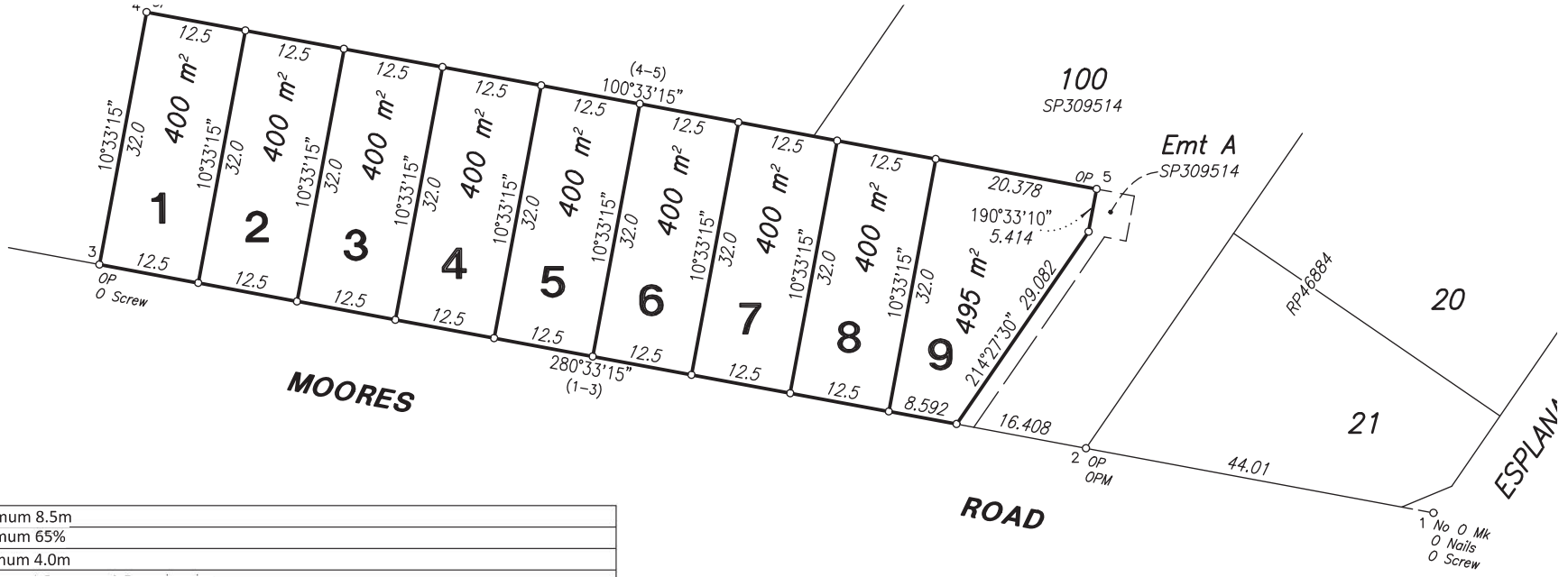


Table 1

Building Height	Maximum 8.5m
Site Cover	Maximum 65%
Front Setback	Minimum 4.0m
Side/Rear Setback	Minimum 1.0m up to 4.5m Minimum 1.5n above 4.5m
Built to Boundary Wall	Non-habitable spaces may be built to boundary where: - A maximum of 9m in length - A maximum of 4.5m in height with a mean height of not more than 3.5m - Not located within 1.0m of a window of a habitable room in an adjoining dwelling

General Notes

1. Unless stated otherwise in the table, development is to be in accordance with the Queensland Development Code (QDC).
2. Built to boundary walls are limited to one side boundary (side may be either boundary).
3. Setback definition as per the Development Scheme:
   For a building or structure other than a swimming pool, the shortest distance measured horizontally from the wall or balustrade of a building or structure to the vertical projection of the boundary of the lot.

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2018/969
Date: 1 April 2019

Queensland Government

LEGEND

- CATCHMENT BOUNDARY
- CATCHMENT NAME (FLOWS INTO CORRESPONDING STRUCTURE)

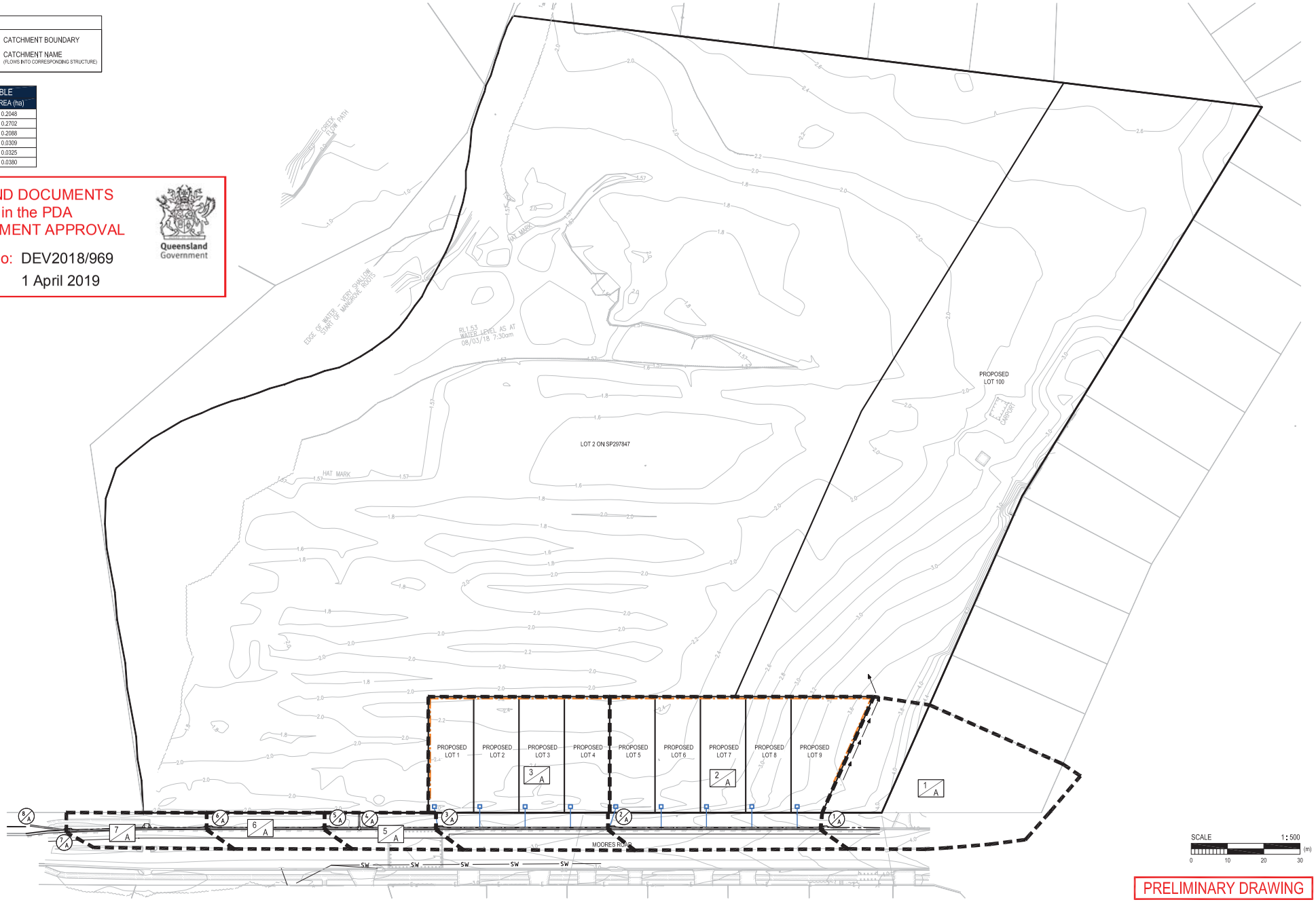
CATCHMENT TABLE	
CATHCMENT	AREA (ha)
1/A	0.2048
2/A	0.2702
3/A	0.2088
5/A	0.0309
6/A	0.0325
7/A	0.0380

PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL

Approval no: DEV2018/969

Date: 1 April 2019

Queensland Government



PRELIMINARY DRAWING

AMENDMENTS

No.	DATE	DESCRIPTION	DRAWN
A	15.11.2018	PRELIMINARY ISSUE	DR

Associated Consultant: RPS GROUP

Surveyor: -

Plan Ref.: -

Level Datum AHD

RP Description: -

Size of Land: -

North

Orig. Drg. Size A1

Approved:

RPEQ. Date:

Drawn: JE | Design: JE | Checked: GT | Supervisor: GT

IMAGERY, CADASTRAL AND SURVEY DATA DISCLAIMER

While every care is taken by NAXOS Engineers Pty Ltd to ensure the accuracy of the data supplied by local authorities, dial before you dig (dbyd) records, as constructed information and detailed survey, we make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred as a result of data being inaccurate or incomplete in any way and for any reason.

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T 1300 598 544

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Ground Floor, Suite 1

424 Upper Roma Street, Brisbane 4000

PO Box 224, Spring Hill QLD 4004

NAXOSENGINEERS.COM.AU

Client: REDLAND INVESTMENT CORPORATION

Project: WIENAM CREEK PDA - 1 INTO 10 ROL

Title: STORMWATER CATCHMENT PLAN

Scale: AS NOTED

Job No.: C18-214

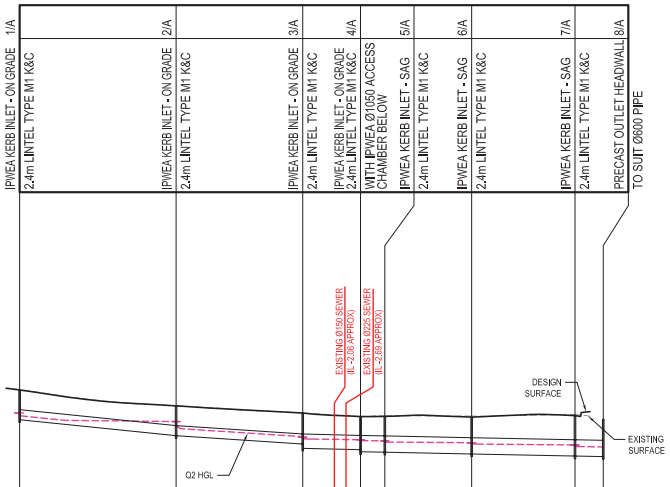
Drawing No.: C251

Revision: A

PRELIMINARY

STRUCTURE NAME	1/A	2/A	3/A	4/A	5/A	6/A	7/A	8/A
STRUCTURE DESCRIPTION	IPWEA KERB INLET - ON GRADE 2.4m LINTEL TYPE M1 K&C	IPWEA KERB INLET - ON GRADE 2.4m LINTEL TYPE M1 K&C	IPWEA KERB INLET - ON GRADE 2.4m LINTEL TYPE M1 K&C	IPWEA KERB INLET - ON GRADE 2.4m LINTEL TYPE M1 K&C	WITH IPWEA Ø1050 ACCESS CHAMBER BELOW	IPWEA KERB INLET - SAG 2.4m LINTEL TYPE M1 K&C	IPWEA KERB INLET - SAG 2.4m LINTEL TYPE M1 K&C	PRECAST OUTLET HEADWALL TO SUIT Ø600 PIPE
PIPE SIZEmm (Class)	375(2)	375(2)	525(2)	600(2)	600(2)	600(2)	600(2)	
PIPE GRADE %	1.02%	0.66%	0.25%	0.20%	0.20%	0.20%	0.20%	
PIPE SLOPE 1 in X	97.69	151.63	400.00	500.00	500.00	500.00	500.00	
FULL PIPE FLOW VELOCITY (m/s)	0.53							
PART FULL FLOW VELOCITY (m/s)	1.44	1.46	1.11	1.03	1.04	1.04	1.05	
DATUM RL -10.0								
WATER LEVEL IN STRUCTURE	2.737 / 2.413	1.828 /	1.731 /	1.690 /	1.619 /	1.537 /	1.460	
HYDRAULIC GRADE LEVEL	2.737 / 2.631 / 2.413	2.259 / 1.828	1.765 / 1.731	1.697 / 1.690	1.645 / 1.619	1.569 / 1.537	1.481 / 1.460	
PIPE FLOW (Cumecs)	0.058	0.126	0.174	0.174	0.181	0.185	0.188	
PIPE CAPACITY AT GRADE (Cumecs)	0.177	0.142	0.225	0.287	0.287	0.287	0.287	
DEPTH TO INVERT	1.111 / 1.117	1.117 / 1.160	1.319 / 1.241	1.317 / 1.339	1.339 / 1.379	1.379 / 1.513	1.513 / 1.400	
INVERT LEVEL OF DRAIN	2.483 / 1.884	1.884 / 1.571	1.412 / 1.358	1.282 / 1.264	1.264 / 1.199	1.199 / 1.121	1.121 / 1.100	
DESIGN SURFACE LEVEL	3.594 / 3.001	2.731 /	2.599 /	2.603 /	2.578 /	2.634 /	2.500	
STRUCTURE SETOUT	E30522.342 N143383.169 / E30464.741 N143373.900	E30418.131 N143392.584	E30396.931 N143387.004	E30387.947 N143388.207	E30355.977 N143394.162	E30317.822 N143400.557	E30307.921 N143404.289	
RUNNING CHAINAGE	0.000 / 58.592	58.592 / 47.412	106.004 / 21.656	127.660 / 9.064	136.724 / 32.520	169.244 / 38.688	207.932 / 10.584	218.516

NOTE:
- ALL FIELD INLETS TO BE "TYPE 2" IN ACCORDANCE WITH IPWEAQ STANDARD DRAWING DS-050 U.N.O.
- ALL FIELD INLET GRATES TO BE CLASS D IN PAVED AREAS AND CLASS B ELSEWHERE U.N.O.
- ALL ROAD DRAINAGE PITS TO BE IN ACCORDANCE WITH IPWEAQ STD DRAWING DS-063 U.N.O.
- ALL MANHOLES TO BE IN ACCORDANCE WITH IPWEAQ STANDARD DRAWING DS-010 U.N.O.



VERTICAL SCALE 1 : 100
0 1 2 3 4 5 (m)

HORIZONTAL SCALE 1 : 1000
0 10 20 30 40 50 (m)

LINE A

PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL
Approval no: DEV2018/969
Date: 1 April 2019

Queensland Government

PRELIMINARY DRAWING

AMENDMENTS

No.	DATE	DESCRIPTION	DRAWN
A	15.11.2018	PRELIMINARY ISSUE	CP

Associated Consultant: RPS GROUP

Surveyor: -
Plan Ref.: -
Level Datum AHD
-

RP Description: -
Size of Land: -

North:
Orig. Drg. Size A1

Approved:
RPEQ. Date:

Drawn: JE | Design: JE
Checked: GT | Supervisor: GT

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424 Upper Roma Street, Brisbane 4000
PO Box 224, Spring Hill QLD 4004
NAXOSENGINEERS.COM.AU

Client: REDLAND INVESTMENT CORPORATION
Project: WIENAM CREEK PDA - 1 INTO 10 ROL
Title: STORMWATER LONGITUDINAL SECTION

Scale: AS NOTED
Job No: C18-214
Drawing No: C252
Revision: A

PRELIMINARY

LEGEND

EXISTING FEATURES

- EXISTING CONTOUR MAJOR (1.0m INTERVALS)
- EXISTING CONTOUR MINOR (0.25m INTERVALS)
- EXISTING EDGE OF BITUMEN

PROPOSED WORKS

- PROPOSED CONTOUR MAJOR (1.0m INTERVALS)
- PROPOSED CONTOUR MINOR (0.1m INTERVALS)
- PL3.40 — PROPOSED PLATFORM LEVEL
- PROPOSED PAD OUTLINE
- × RL3.50 — PROPOSED SURFACE LEVEL
- PROPOSED AREA OF CUT
- PROPOSED AREA OF FILL
- PROPOSED BARRIER KERB AND CHANNEL TYPE B1, REFER IPWEA STD DRG RS-080
- PROPOSED MOUNTABLE KERB AND CHANNEL TYPE M1, REFER IPWEA STD DRG RS-080
- PROPOSED 150mm DEEP SWALE DRAIN
- PROPOSED TOP OF BANK
- PROPOSED BOTTOM OF BANK
- PROPOSED CONCRETE SLEEPER RETAINING WALL

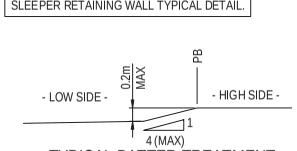
BULK EARTHWORKS NOTES

1. NOTWITHSTANDING THE LIMITS OF CUTTING AND FILLING SHOWN ON THE CROSS SECTIONS, THE ACTUAL LIMITS SHALL BE DETERMINED ON-SITE BY THE SUPERINTENDENT DURING CONSTRUCTION AND SIMILARLY THE FINISHED SURFACE CONTOURS MAY BE ADJUSTED BY WRITTEN DIRECTION OF THE SUPERINTENDENT DURING CONSTRUCTION.
2. SUBGRADE TEST RESULTS TO BE FORWARDED TO THE SUPERINTENDENT FOR DETERMINATION OF BOX DEPTHS PRIOR TO EXCAVATION. TESTS SHALL INCLUDE SOAKED CBR AND/OR OTHER TESTS AS REQUESTED BY THE SUPERINTENDENT.
3. CONTRACTOR TO LIAISE WITH ALL RELEVANT SERVICE AUTHORITIES TO ASCERTAIN SERVICES PRESENT ON-SITE. ANY ALTERATION WORKS TO SERVICES WILL BE CARRIED OUT BY THAT SERVICE AUTHORITY ONLY.
4. THE CONTRACTOR SHALL NOTIFY THE SUPERINTENDENT PRIOR TO COMMENCING THE DEMOLITION OF ANY EXISTING STRUCTURES WITHIN THE SITE AREA.
5. ALL DRAINAGE STRUCTURES TO BE PRESERVED FROM THE EFFECTS OF STRUCTURAL LOADING GENERATED BY THE EARTHWORKS.
6. ALL EXCAVATION AND FILLING SHALL BE COMPACTED TO THE REQUIREMENTS OF AS3798-2007 IN ACCORDANCE WITH THE LOCAL AUTHORITY REQUIREMENTS. LEVEL 1 SUPERVISION IS REQUIRED.
7. ALL CLEARING, GRUBBING AND STRIPPING OF TOPSOIL SHALL BE CARRIED OUT IN STAGES TO ALLOW FOR RELOCATION OF FAUNA, COMMENCING AT THE LOWER AREAS OF THE SITE.
8. CONTRACTOR TO USE INDUSTRY BEST PRACTICE TO ENSURE ADEQUATE DUST CONTROL DURING EARTHWORKS OPERATIONS.
9. ALL CONSTRUCTION ACTIVITIES SHALL COMPLY WITH WORKPLACE HEALTH AND SAFETY REQUIREMENTS.
10. EXPORT OF SPOIL OUT OF THE SUBJECT SITE SHALL COMMENCE ONLY UPON APPROVAL OF THE OPERATIONAL WORKS 'FILLING AND EXCAVATION' AND THE RELATED 'EROSION AND SEDIMENT CONTROL' TO THE SPOIL OR STOCKPILE SITE, WHICH ARE TO BE SUBMITTED AS A STANDALONE APPLICATION.

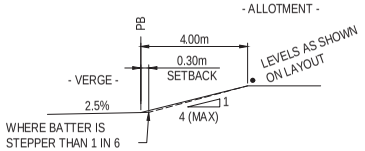
NOTE:
DRAWINGS TO BE READ IN CONJUNCTION WITH:
- APPROVED VEGETATION MANAGEMENT PLAN SPECIFICALLY REGARDING TREE RETENTION SPECIFICATIONS.

NOTE:
REFER 18-003165-201 FOR BULK EARTHWORKS TYPICAL CROSS SEECTIONS.

NOTE:
REFER 18-003165-201 FOR CONCRETE SLEEPER RETAINING WALL TYPICAL DETAIL.

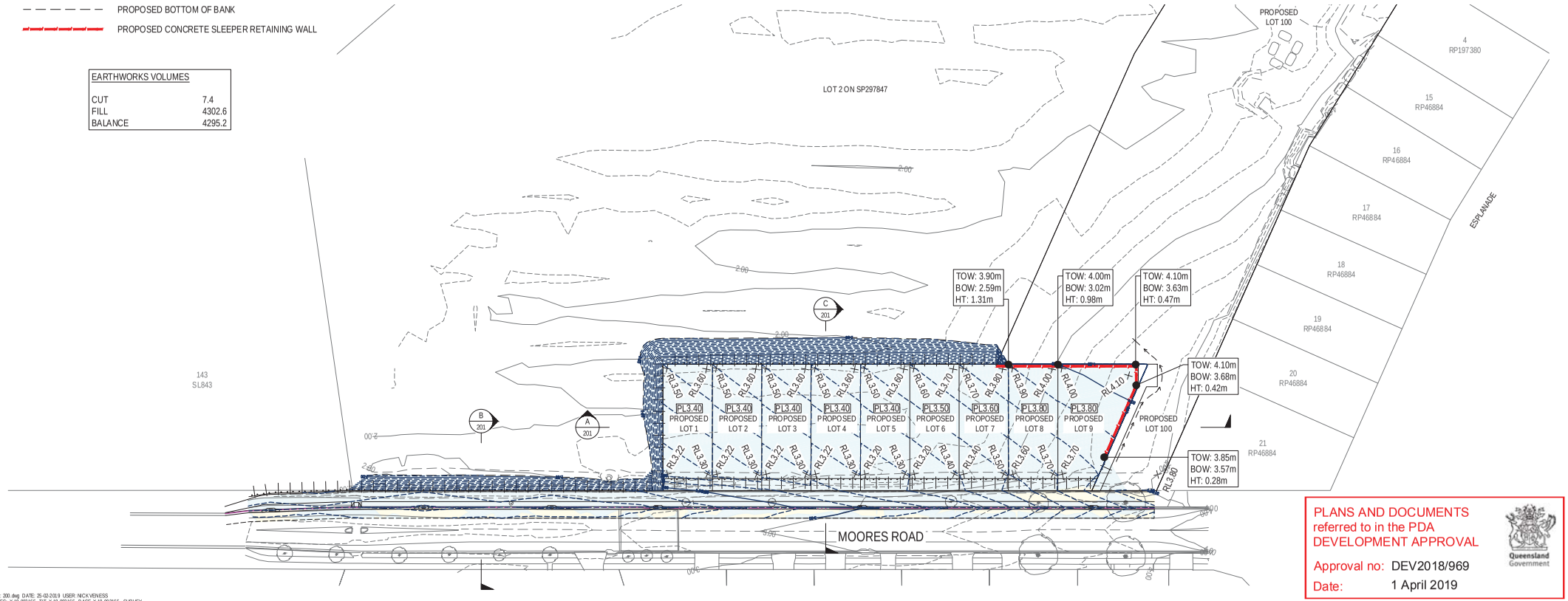


TYPICAL BATTER TREATMENT BETWEEN LOTS
SCALE: 1:100(A1)



TYPICAL PAD SETBACK
SCALE: 1:100(A1)

EARTHWORKS VOLUMES	
CUT	7.4
FILL	4302.6
BALANCE	4295.2



PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL
Approval no: DEV2018/969
Date: 1 April 2019
Queensland Government

FILE: 200.dwg DATE: 25-02-2019 USER: NICK VENESS
XREFS: X 18-003165 - TIT, X 18-003165 - BASE, X 18-003165 - SURVEY

ISSUE	DESIGN	DRAWN	CHECK	APPROVED	DATE	AMENDMENT DETAILS
A	SD	JM	NV	DC	25.02.19	
B	SD	JM	NV	DC	05.03.19	AMENDMENTS TO RETAINING WALLS
C						
D						
E						
F						
G						

STATUS: **PRELIMINARY** NOT FOR CONSTRUCTION
APPROVED: RPEQ - 18631
05-03-2019

SCALE: 0 5 10 15 20 25 30 35 40
SCALE 1:500 (A1) SCALE 1:1000 (A3)

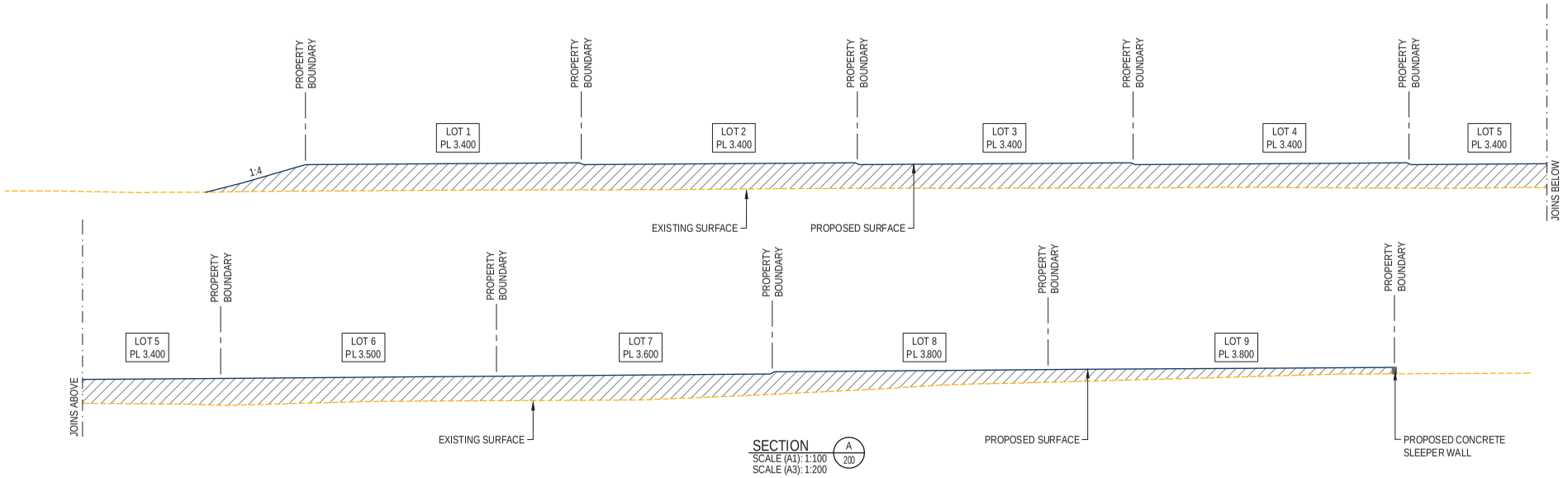
CLIENT: REDLAND INVESTMENT CORPORATION
REDLAND INVESTMENT CORPORATION

Calibre Consulting (QLD) Pty Ltd
Level 3, 16 Innovation Parkway
Birtinya QLD Australia 4575
Telephone 07 5314 2520
Facsimile 07 5314 2522
calibre
© calibregroup.com

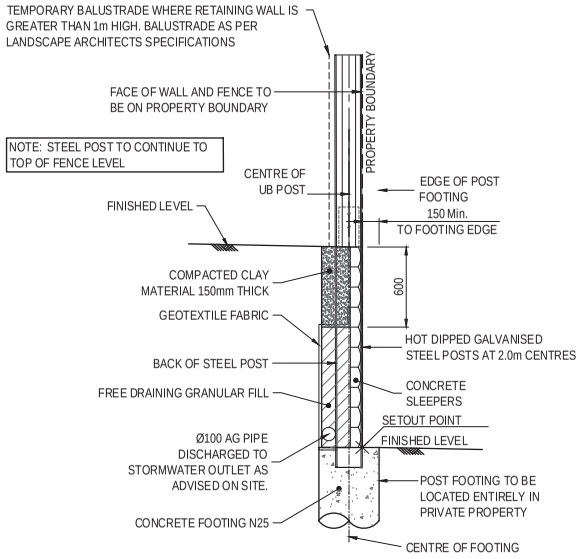
PROJECT: WIENAM CREEK
MOORES ROAD, REDLAND BAY

DRAWING TITLE: BULK EARTHWORKS DETAILS AND LAYOUT PLAN

PROJECT No.	DRAWING No.	REVISION
18-003165	200	A



SECTION A
SCALE (A1): 1:100
SCALE (A3): 1:200



TYPICAL SECTION CONCRETE SLEEPER WITH UB RETAINING WALL AT FENCED BOUNDARIES
SCALE 1:20

NOTE: RETAINING WALL DESIGN AND CONSTRUCTION TO INCORPORATE LOADING FROM ACOUSTIC FENCE WHERE APPLICABLE

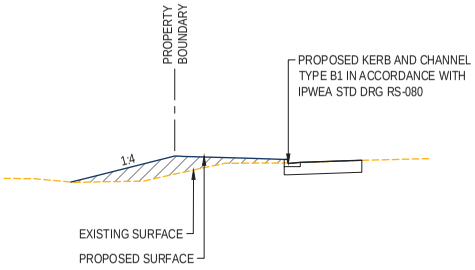
NOTE: ALL STEEL POSTS USED FOR RETAINING WALLS MUST BE COATED WITH PROTECTIVE PAINT AS PER CONDITIONS OF APPROVAL.

MINIMUM DESIGN REQUIREMENTS

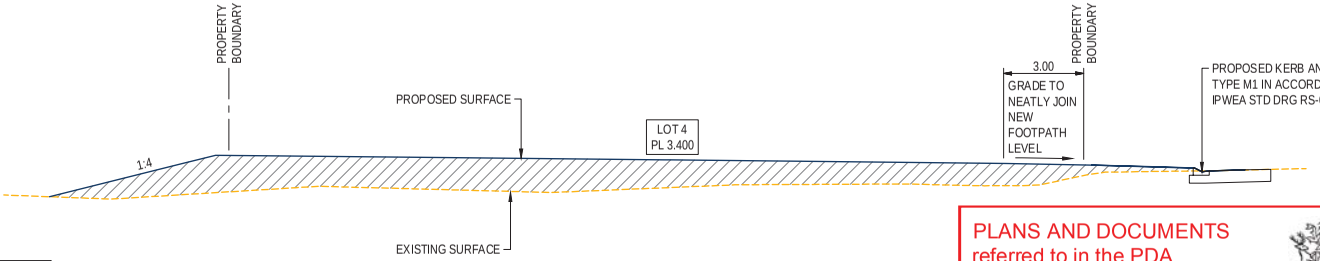
- SURCHARGE LOADING ON BACKFILL : 5KPa
- POST AND FOOTING DESIGN TO ALLOW FOR 1.8m HIGH FENCE
- MAX 1V:4H SLOPE BEHIND WALL

NOTES:

1. RETAINING WALLS TO BE CONSTRUCTED TO MANUFACTURERS SPECIFICATIONS.
2. CONTRACTOR TO PROVIDE STRUCTURAL CERTIFICATION FOR RETAINING WALLS DESIGN AND CONSTRUCTION.
3. POST AND FOOTING DESIGN TO ACCOMODATE APPROVED 1.80m SAFETY FENCE TO ALL WALLS HIGHER THAN 1.0m.
4. FOOTINGS ADJACENT SERVICES ARE TO EXTEND BELOW THE ZONE OF INFLUENCE.
5. POST AND FOOTING TO BE CONSTRUCTED 1.0m EITHER SIDE OF THE SEWER MAIN WHERE APPLICABLE.
6. ALL ELEMENTS TO BE REVIEWED AGAINST CORROSIVITY ZONE C3 AS PER AS4312 AND EXPOSURE CLASSIFICATION B2 AS PER AS3600



SECTION B
SCALE (A1): 1:100
SCALE (A3): 1:200



SECTION C
SCALE (A1): 1:100
SCALE (A3): 1:200

PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL
Approval no: DEV2018/969
Date: 1 April 2019

Queensland Government

FILE: 201.dwg DATE: 31-01-2018 USER: NICK VENESS
XREFS: X 18-003165 - TIF

AMENDMENTS	FIRST ISSUE	DESIGN	DRAWN	CHECK	APPROVED	DATE	AMENDMENT DETAILS
	A	SD	JM	NV	DC	25.02.19	
	B						
	C						
	D	SD	JM	NV	DC	05.03.19	AMENDMENTS TO RETAINING WALLS
	E						
	F						
	G						

STATUS: **PRELIMINARY** NOT FOR CONSTRUCTION

APPROVED: RPEO - 18631
05-03-2019

SCALE
0 1 2 3 4 5 6 7 8
SCALE 1:100 (A1) SCALE 1:200 (A3)
0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0
SCALE 1:200 (A1) SCALE 1:400 (A3)

CLIENT: REDLAND INVESTMENT CORPORATION
REDLAND INVESTMENT CORPORATION

calibre
© calibregroup.com
Calibre Consulting (QLD) Pty Ltd
Level 3, 16 Innovation Parkway
Birtinya QLD Australia 4575
Telephone 07 5314 2520
Facsimile 07 5314 2522

PROJECT: WIENAM CREEK
MOORES ROAD, REDLAND BAY

DRAWING TITLE: BULK EARTHWORKS SECTIONS

PROJECT No.	DRAWING No.	REVISION
18-003165	201	A

COMMISSIONING PROCEDURE

No.	DESCRIPTION	SEWER DIA.	MH No.	MH TYPE	COVER TYPE	LOT	F.S.L	IL	DEPTH
1	REDLAND WATER TO RAISE MANHOLE LIDE TO NEW FSL AT DEVELOPERS EXPENSE.	150	2/1	EXIST	Ⓑ	5	3.300	-2.320	5.620
2	REDLAND WATER TO CONSTRUCT NEW Ø100 uPVC SEWER PROPERTY CONNECTION TO EACH LOT AT DEVELOPERS EXPENSE.								

PROPERTY CONNECTIONS HAVE BEEN DESIGNED TO CONTROL THE BUILDING ENVELOPE ONLY AT A GRADE OF 1:100 UNLESS OTHERWISE STATED

ALL ENVIRONMENT PROTECTION MEASURES SHOULD BE IMPLEMENTED PRIOR TO ANY CONSTRUCTION WORK, INCLUDING CLEARING, COMMENCING.

NAME OF ESTATE		WIENAM CREEK PDA - 1 INTO 10 ROL
SUBDIVIDER		REDLAND INVESTMENT CORPORATION
APPLICATION No.		-
SP DELEGATE APPROVAL DATE		-
DRAWING/PLAN No.		C551 & C552
No. OF ALLOTMENTS		10
AREA IN Ha		1.37Ha
LENGTH OF SEWERS	100mm	11.000m (PC's)
	150mm	

OTHER SERVICE LEGEND

- G — EXISTING GAS MAIN
- SWD — EXISTING STORMWATER
- T — T — EXISTING TELECOMMUNICATIONS
- E — EXISTING ELECTRICITY
- OH — EXISTING OVERHEAD ELECTRICITY
- PL — UNKNOWN PIPELINE
- OF — EXISTING OPTIC FIBRE
- W — EXISTING WATER

SEWERAGE LEGEND

- PROPOSED SEWER MAIN
- S — EXISTING SEWER MAIN
- ABANDON SEWER MAIN
- SRM — PROPOSED RISING SEWER MAIN
- SRM — EXISTING RISING SEWER MAIN
- ABANDON RISING SEWER MAIN
- STRUCTURE NAME (PROPOSED / EXISTING / ABANDON)
- MAINTENANCE HOLE (MH) (PROPOSED / EXISTING / ABANDON)
- END OF LINE (PROPOSED / EXISTING / ABANDON)
- MAINTENANCE SHAFT (MS) (PROPOSED / EXISTING / ABANDON)
- VERTICAL / HORIZONTAL BEND
- STAGE BOUNDARY
- FSL 3.750 — CONTROL LEVEL
- PROPOSED PROPERTY SERVICE
- EXISTING KERB AND CHANNEL

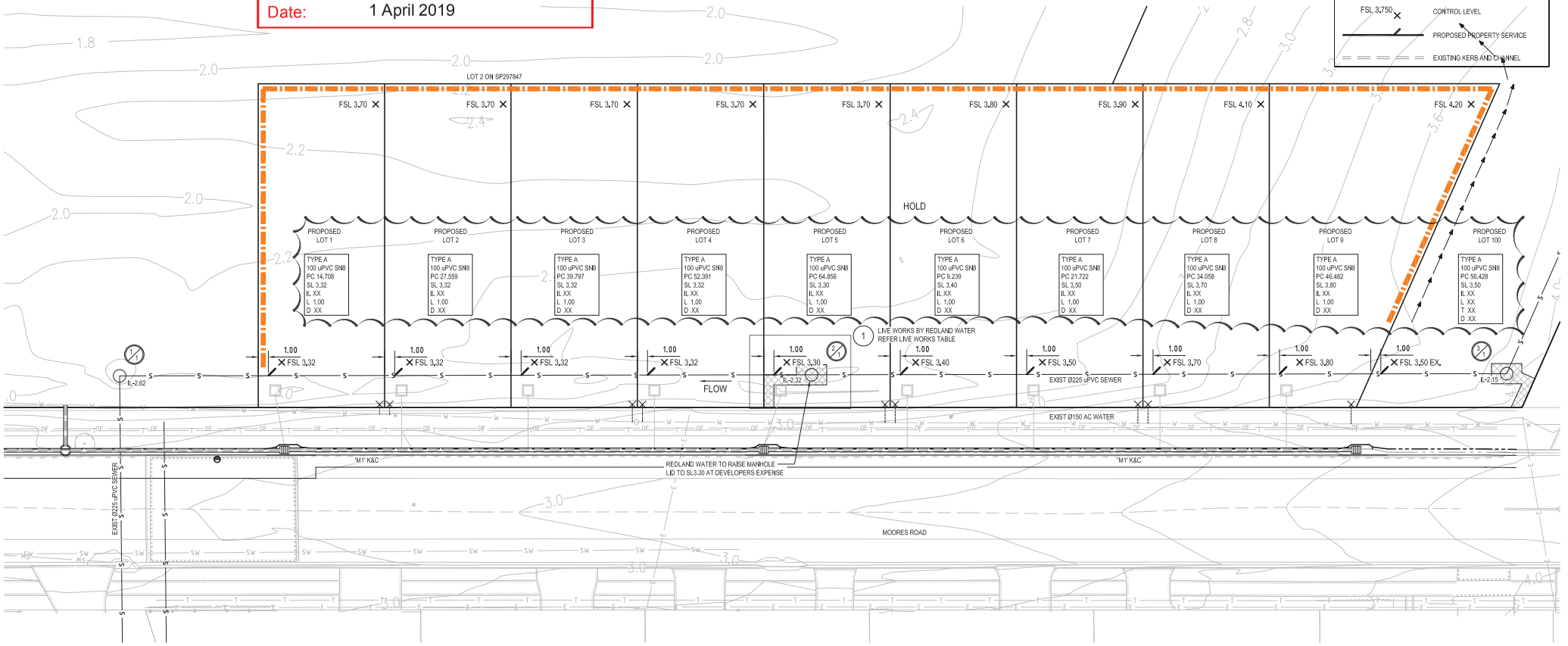
HOLD

PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL

Approval no: DEV2018/969

Date: 1 April 2019

Queensland Government



SCALE 1:200

0 2 4 6 8 10 (m)

PRELIMINARY DRAWING

AMENDMENTS

No.	DATE	DESCRIPTION	DRAWN
A	15.11.2018	PRELIMINARY ISSUE	DR

Associated Consultant: RPS GROUP

Surveyor: - Plan Ref.: - Level Datum AHD -

RP Description: -

Size of Land: -

North

Orig. Drg. Size A1

Approved: RPEQ. Date:

Drawn: JE Checked: GT

Design: JE Supervisor: GT

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Client: REDLAND INVESTMENT CORPORATION

Project: WIENAM CREEK PDA - 1 INTO 10 ROL

Title: SEWERAGE RETICULATION PLAN

Scale: AS NOTED

Job No: C18-214

Drawing No: C551

Revision: A

PRELIMINARY

Redland Investment Corporation

Weinam Creek PDA – Stage 1

Site Based Stormwater Management Plan and Flood Impact Assessment




PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2018/969

Date: 1 April 2019

Queensland Government

November 2018

M7189_001

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PLANS AND DOCUMENTS
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DEVELOPMENT APPROVAL

Approval no: DEV2018/969

Date: 1 April 2019

Queensland Government

M7189_001 WEINAM CK PDA STORMWATER					
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REV	**DESCRIPTION**	**AUTHOR**	**REVIEWER**	**APPROVED BY**	**DATE**
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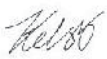
Rev 1	Client Issue	Kelsey Mundt	Mark Page	Mark Page RPEQ 15454	5 September 2018
Rev 2	Client Issue	Kelsey Mundt	Mark Page	Mark Page RPEQ 15454	22 November 2018
Signatures					

CONTENTS

Appendices

List of Tables

List of Figures

1. INTRODUCTION

Engeny Water Management (Engeny) has been engaged by Redland Investment Corporation (RIC) to produce a Site Based Stormwater Management Plan (SBSMP) and Flood Impact Assessment (FIA) for Stage 1 of the Weinam Creek PDA development, comprising:

- Material Change of Use – Car Park and Undefined Use (Bridge).
- Operational Work – Tidal Works, Vegetation Clearing, Filling and Excavation.
- Reconfiguring of a Lot – 1 into 11 lots.

The works as described above are broadly limited to Lot 3 on RP67164, accessed from Moores Road, Redland Bay (the Site). The Redland City Council (RCC) Planning Scheme Version 7.2 (2018) indicates that the Site is affected by the Flood Prone, Storm Tide and Drainage Constrained Land Overlay.

The following is a summary of the scope of this SBSMP and FIA:

- Provide details of the stormwater quantity management strategy for the proposed development.
- Provide details of the stormwater quality management strategy for the proposed development.
- Undertake a flood impact assessment of the proposed earthworks associated with the development.
- Prepare a report on the stormwater management strategy and outcomes from the flood impact assessment.

This report revision is in response to the Information Request (IR) (ref. DEV2018/969, dated 26 October 2018) received from Economic Development Queensland (EDQ). Note that one stormwater management plan has been developed to address both the Carpark MCU and the ROL to allow for cumulative assessment of flood impacts from both the carpark and ROL.

1.1 Existing Site Characteristics and Proposed Development

Lot 3 on RP67164 is currently open space (predominantly), with a history of previous agricultural use. The Stage 1 application involves introducing public car-parking space and a bridge connection to the northern side of Weinam Creek. The development layout is provided in Appendix A. The remainder of the lot will consist of 9 residential lots and a superlot for future development.

2. FLOOD IMPACT ASSESSMENT

The proposed Stage 1 development is located adjacent to Weinam Creek in close proximity to the outlet to Moreton Bay. The development is affected by the Redland City Council (RCC) Flood Prone, Storm Tide and Drainage Constrained Land Overlay, as shown in Figure 2.1. As earthworks are proposed within this mapped overlay, a flood impact assessment is required to indicate that the development has the necessary flood immunity and that no adverse flood impacts are expected following development.

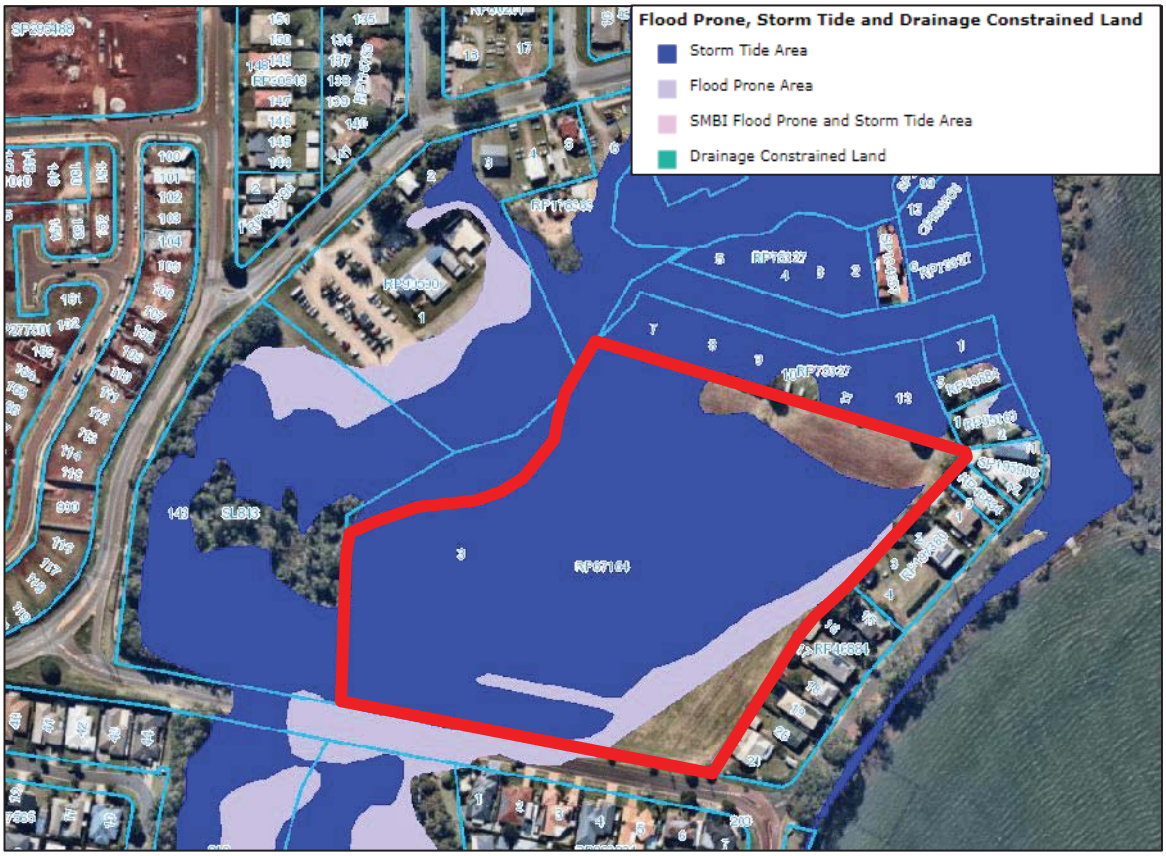


Figure 2.1 RCC Flood Prone, Storm Tide and Drainage Constrained Land Overlay

A TUFLOW 2D hydraulic flood model for Weinam Creek has previously been developed by Engeny in 2016 for RCC as reported in *Moogurrapum & Weinam Creeks Flood Study* (Engeny, 2016). This model has been utilised for the flood impact assessment of the Stage 1 development.

2.1 Existing Scenario and Constraints

The adopted TUFLOW model covers the entirety of the Weinam Creek catchment from Cleveland Redland Bay Road to the creek mouth. The model inflows applied are hydrographs exported from the XPRAFTS hydrologic model built for the *Moogurrapum & Weinam Creeks Flood Study* (Engeny, 2016). The adopted downstream tailwater level

was the Highest Astronomical Tide (HAT) Level for Moreton Bay of 1.57 m AHD. Model details such as adopted Manning's 'n' roughness values, structure details and model layout can be found in the *Moogurrapum & Weinam Creeks Flood Study* report (Engeny, 2016).

2.1.1 Existing Scenario Results

The existing scenario model was simulated for the 1:2, 1:5, 1:10, 1:20, 1:50 and 1:100 AEP flood events for the critical durations in the vicinity of the development; the 90 minute and 120 minute storm durations. The existing scenario flood depth and flood height mapping for the 1:100 AEP flood event is provided in Appendix B.

A summary of the key flood levels applicable to the development are summarised in Table 2.1.

Table 2.1 Key Flooding Constraints

Parameter	Flood Level (m AHD)
1:100 AEP Flood Level	2.7 m AHD to 2.1 m AHD (varies with hydraulic grade of Weinam Creek)
RCC Storm Tide Level	2.4 m AHD
RCC 2100 Storm Tide Level	3.22 m AHD[1]

[1]*Redlands City Plan Version 1.0 (RCC, 2018).*

2.2 Developed Scenario

The only alteration made to the TUFLOW model to reflect the post-development scenario is the proposed earthworks associated with the development. An earthworks model provided by NAXOS Engineers (supplied 27th August 2018) reflecting the proposed development levels was incorporated into the topography of the TUFLOW model and the model was re-simulated to quantify the differences in flood levels and extents for the pre and post development scenarios.

2.2.1 Developed Scenario Results – Flood Immunity

The following sections address the required and modelled flood immunity of the various components of the Stage 1 development.

Car Park

The proposed car park has generally achieved 1:100 AEP creek flood immunity. The 1:100 AEP flood depth and flood height mapping are provided in Appendix C.

A portion of the car park located to the west of the access road and a portion of the access road will be inundated in the 1:100 AEP flood event. However, an assessment has been undertaken on the subsequent depth x velocity (DxV) product in relation to the vehicle safety limits in the *Queensland Urban Drainage Manual (QUDM)* (IPWEAQ, 2017). Table 7.4.5 of *QUDM* specifies a DxV product limit of 0.45 m^2/s for vehicle safety in transverse flow where there is no risk to life. Figure 2.2 shows the subsequent DxV product mapping for the 1:100 AEP flood event over this portion of the car park. Generally the DxV product does not exceed 0.2 m^2/s, with an isolated area in the western-most corner where the DxV product reaches 0.25 m^2/s. Sensitivity analysis on the earthworks level has shown that full immunity (i.e. completely dry) of the access road in the 1:100 AEP flood event cannot be achieved without causing significant flood impacts to Moores Road.

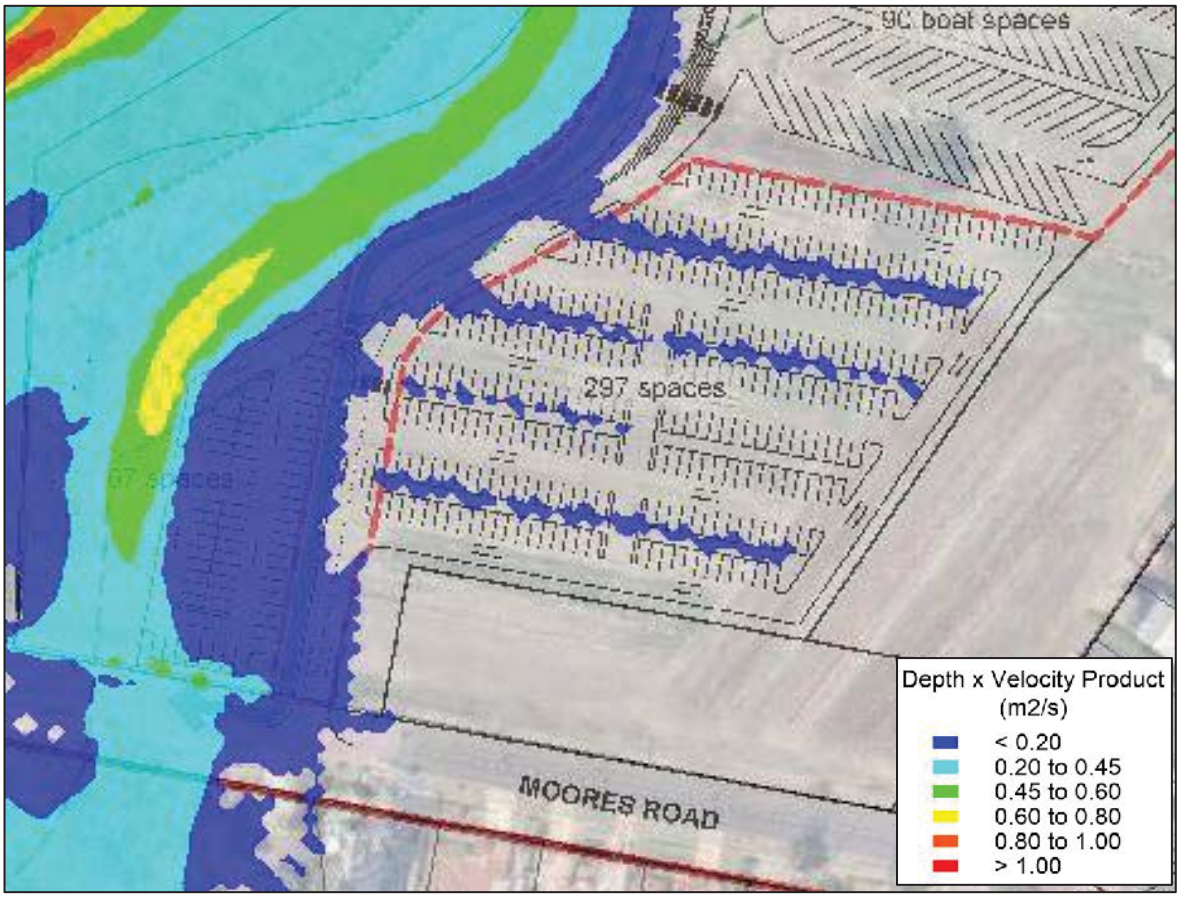


Figure 2.2 1:100 AEP DxV Product Mapping

Furthermore, signage will be provided for this area of the car park indicating that the car park is subject to flooding and that parking is restricted to short term basis. Therefore, the placement of vehicles in this area will not likely result in any private property damage, with the above DxV results indicating that vehicles are unlikely to be displaced and inundation of up to a maximum of 0.4 m in the 1% AEP flood event is expected.

Regarding the Redlands Storm Tide level of 2.4 m AHD, the development layout in Appendix A shows that the car park is generally at 2.4 m AHD or higher. Where some inundation is expected due to storm tide, the extent of inundation will be limited to the swales between the car parking rows and the low velocities expected in such an event will ensure that the DxV product is within the limits specified in *QUDM* (IPWEAQ, 2017). Proposed earthworks for the carpark are illustrated in Appendix A.

Pedestrian Connection

Regarding the immunity of the pedestrian connection, the requirement for 1:2 AEP flood immunity is generally achieved, with safe passage for pedestrians expected up to the 1:100 AEP event due to the DxV product not exceeding 0.4 m^2/s, as specified in section 7.4.6 of *QUDM* (IPWEAQ, 2017). Refer to Figure 2.2 for the 1:100 AEP DxV mapping. The 1:2 AEP flood depth mapping is provided in Figure 2.3.

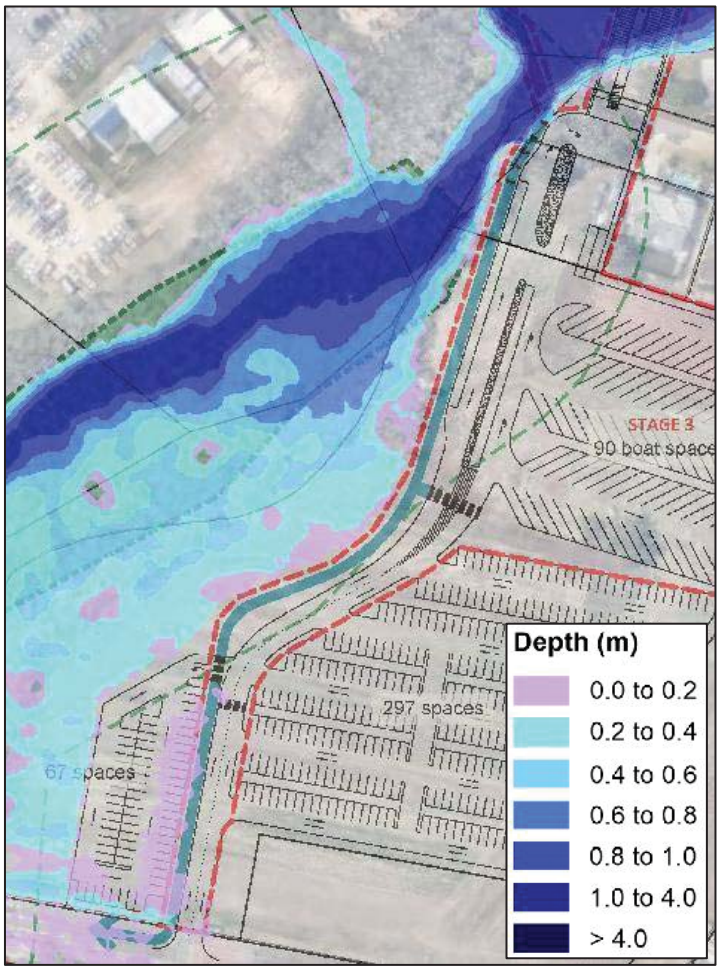


Figure 2.3 1:2 AEP Flood Depth

Internal Road

The internal road has achieved a 1:20 AEP flood immunity, as requested by RCC during the pre-lodgement process. The 1:20 AEP flood depth mapping is provided in Figure 2.4.

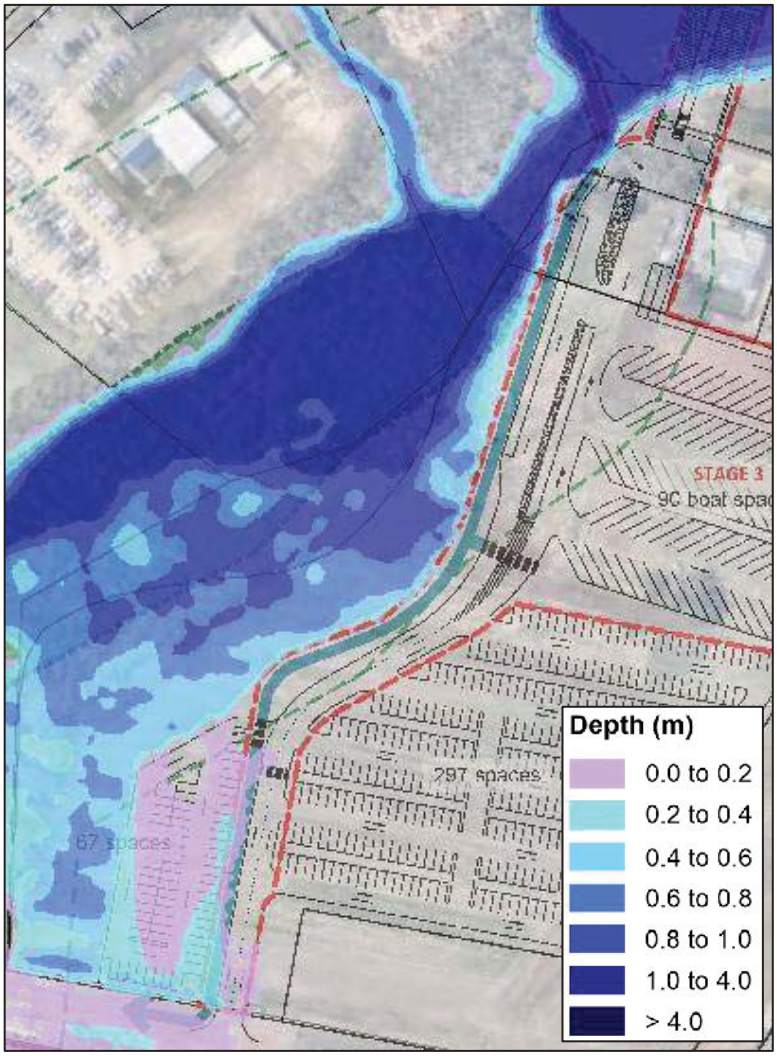


Figure 2.4 1:20 AEP Flood Depth

Residential Lots

The minimum level specified for the pad for both the superlot and the 9 residential lots is 3.22 m AHD, in accordance with the RCC 2100 Storm Surge Level. The future Finished Floor Levels (FFL) of dwellings on these lots will have 300 mm freeboard above the RCC 2100 Storm Surge Level, resulting in a minimum FFL of 3.52 m AHD. Proposed earthworks for these lots are illustrated in Appendix A.

Bridge

The bridge connection from the car park to the northern side of Weinam Creek has been designed so that the entirety of the structure is situated above the 1:100 AEP level, with the underside of the structure at 2.0 m AHD. Thus, the structure is not expected to cause adverse flood impacts. The deck is expected to be at a minimum of 2.4 m AHD to ensure immunity of the structure even in a Storm Tide event causing a water surface level of 2.4 m AHD. The bridge structure is shown conceptually in Figure 2.5.

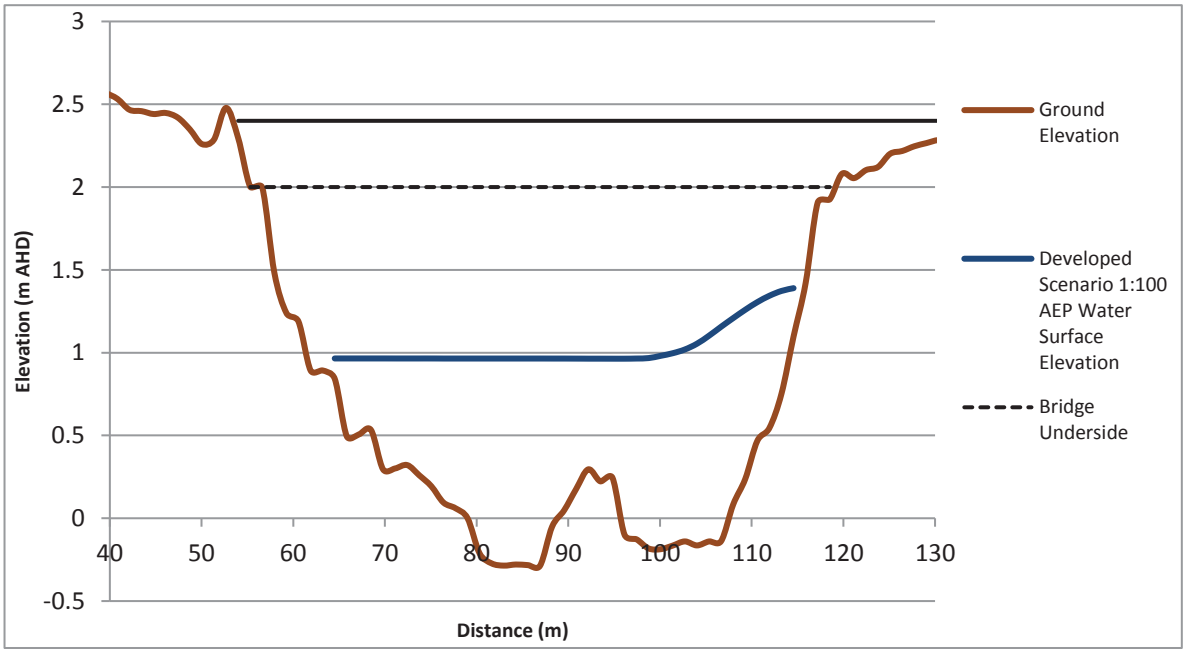


Figure 2.5 Conceptual Bridge Elevation

2.2.2 Developed Scenario Results - Flood Impacts

Flood impact mapping for the full range of flood events can be seen in Appendix C. A summary of the modelled impacts is provided in Table 2.2.

Table 2.2 Summary of Flood Impacts

Flood Event	Observation
1:100 AEP	A minor impact on the northern side of Moores Road is observed up to 14 mm. Moores Road is already inundated in the 1:100 AEP flood event in the existing scenario and the total depth in the 1:100 AEP developed scenario in this location is 140 mm, which indicates that the road is still trafficable in accordance with Table 7.4.4 of QUDM. Impacts are generally contained to Weinam Creek extent with the exception being the local overland flow path from Meissner Street, where impacts up to 210 mm are expected. This location is discussed in greater detail following this table.

Flood Event	Observation
1:50 AEP	Impacts generally confined to the existing Weinam Creek extent of inundation, with the exception of the Meissner Street overland flow path where impacts of 220 mm are observed.
1:20 AEP	Impacts generally confined to the existing Weinam Creek extent of inundation, with the exception of the Meissner Street overland flow path where impacts of 220 mm are observed.
1:10 AEP	Impacts generally confined to the existing Weinam Creek extent of inundation, with the exception of the Meissner Street overland flow path where impacts of 220 mm are observed.
1:5 AEP	Impacts generally confined to the existing Weinam Creek extent of inundation, with the exception of the Meissner Street overland flow path where impacts of 200 mm are observed.
1:2 AEP	Impacts generally confined to the existing Weinam Creek extent of inundation, with the exception of the Meissner Street overland flow path where impacts of 200 mm are observed.

An additional analysis of impacts on a lot-by-lot basis is provided in Table 2.3, which demonstrates why the observed impacts are deemed to be acceptable. Figure 2.6 shows the location of the lots in question.

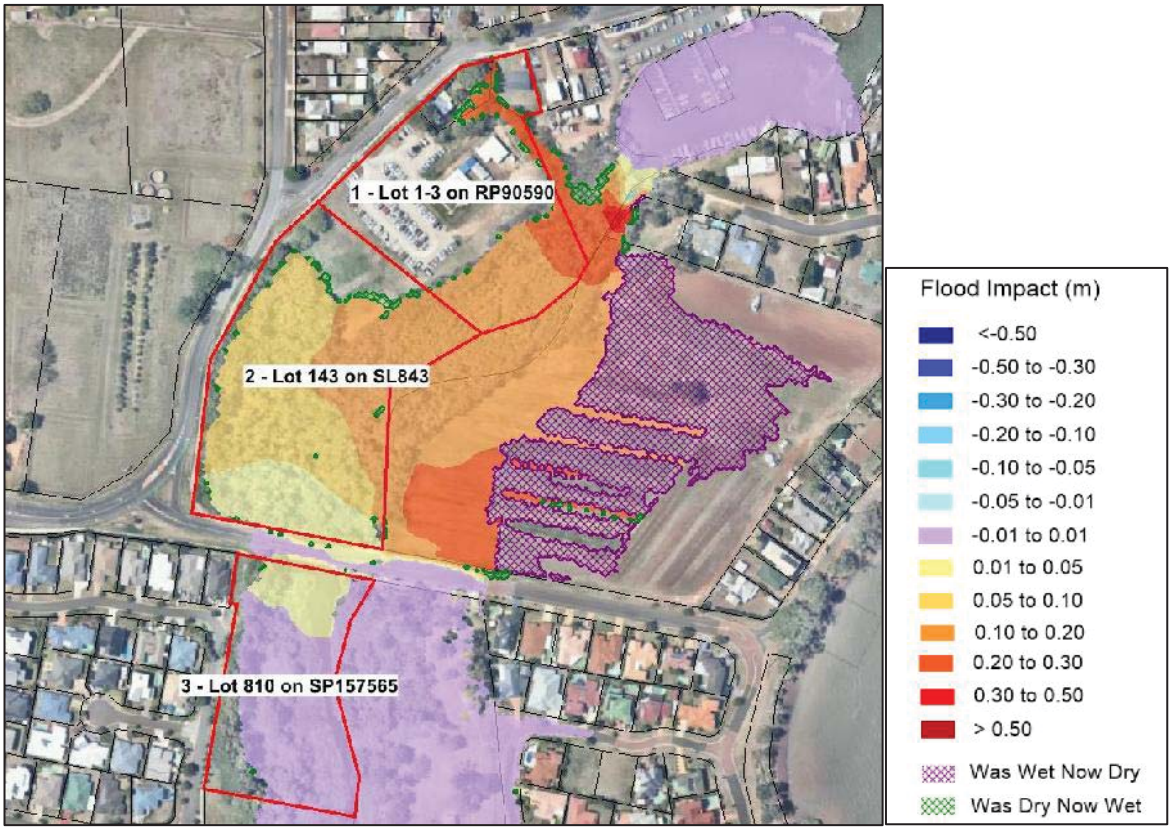


Figure 2.6 Location of Lots for Further Analysis

Table 2.3 Additional Analysis for Flood Impacts

Map ID	Lot Reference	Analysis
1	Lot 1 on RP90590 (RCC owned) Lot 2 on RP90590 (privately owned) Lot 3 on RP90590 (privately owned)	Maximum impact observed is 210 mm in the 1% AEP flood event. The change to the extent of inundation is insignificant following development due to the incised nature of Weinam Creek in this location, and freeboard to current uses on these lots are maintained (as discussed below). Given that this impact has no actionable impact on the current use and that these lots have been identified for re-development as part of the Weinam Creek PDA, this impact is deemed to be acceptable.
2	Lot 143 on SL843 (RCC owned)	Maximum impact observed is 190 mm in the 1% AEP flood event. The change to the extent of inundation is insignificant following development due to the incised nature of Weinam Creek in this location. This lot is current undeveloped and as future development on this lot will also be restricted due to flooding constraints, this impact is deemed to be acceptable.
3	Lot 810 on	Maximum impact observed is 14 mm in the 1% AEP flood event. The change to the extent of inundation is insignificant following development

Map ID	Lot Reference	Analysis
	SP157565 (reserve)	due to the incised nature of Weinam Creek in this location. This lot is currently undeveloped and future development of this lot will also be restricted as it forms part of the Weinam Creek flood extent. As such, this impact is deemed to be acceptable.

Further Commentary – Lot-3 on RP90590

To further support the commentary in Table 2.3 regarding impacts to Lot 1-3 on RP90590, a cross-section of the flood extent is provided in Figure 2.7 which shows the existing and developed 1:100 AEP water surface level and the topography. It can be seen that the 1:100 AEP flood remains well within the defined channel, with minimal change to the extent of inundation. The increase in flood level at this location also does not affect the available freeboard to adjacent dwellings, which is estimated to be approximately 0.8 to 1.8 m. This area has been identified for development in a future stage of the Weinam Ck PDA development, where it will be ensured that such development will have adequate freeboard and overland flow will be managed accordingly.

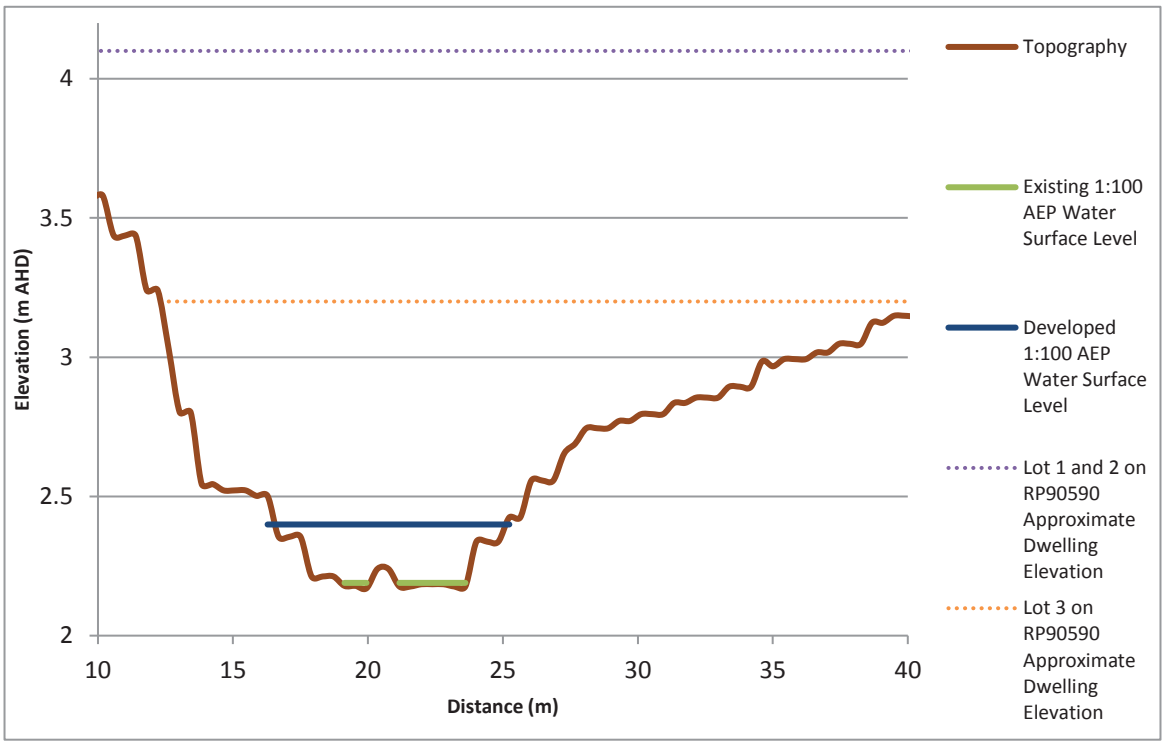


Figure 2.7 1:100 AEP Water Surface Levels – Lot 1-3 on RP90590

3. STORMWATER QUANTITY MANAGEMENT

Due to the placement of the development as discharging directly to Weinam Creek, no detention or mitigation of stormwater runoff is proposed. The following sections expand upon this approach in further detail.

3.1 Lawful Point of Discharge

The Lawful Point of Discharge for the Stage 1 development is Weinam Creek, located directly adjacent to the development.

3.2 Justification of Strategy

The proposed development is situated directly adjacent to Weinam Creek at the creek mouth to Moreton Bay. The Queensland Urban Drainage Manual (QUDM) (IPWEAQ, 2016) identifies some potential problems pertaining to the incorporation of detention basins in developments within the lower half of a catchment. Table 3.1 (below) presents an excerpt of Table BN 5.2.1 from QUDM which identifies potential problems resulting from the use of detention systems.

Table 3.1 Excerpt from QUDM (IPWEAQ, 2016) Table BN 5.2.1 - Potential Problems resulting from the use of Detention/Retention Systems

Problem	Likely Causes	Management Options
Aggravated coincident flood peaks. This action can cause increases in flood levels within the lower reaches of a waterway even though all upstream developments have not increased peak discharges from their sites.	This is often associated with the existence of several basins within a drainage catchment, or basins located within the lower reaches of a waterway.	In some cases, it may be desirable to avoid the use of detention basins within the lower third of a catchment – unless supported by full catchment modelling.

Furthermore, in pre-lodgement meetings held with both RCC and EDQ, in-principal agreement was provided for not including a detention system within the stormwater strategy.

4. STORMWATER QUALITY MANAGEMENT

The proposed stormwater quality management strategy for the Stage 1 development is outlined as follows:

- An opportunistic approach to stormwater quality management will be adopted. Due to the low elevation of the Site, traditional water quality treatment devices such as bio-retention or proprietary devices would not be able to free-drain, rendering the devices inoperable and a burden on Council to maintain. A series of swales throughout the car park will provide treatment of stormwater runoff, however will not achieve the State Planning Policy (SPP) (DGILP, 2017) Water Quality Objectives (WQOs). Furthermore, SPEL StormSack GPT devices will be installed on all inlets to capture gross pollutants. An assessment of the treatment train effectiveness as well as the expected pollutant load from the development in comparison to the total catchment load has also been undertaken to place the water quality impact of the development in context.

Supporting information and modelling for this approach is provided in the following sections.

4.1 Stage 1 Analysis

The State Planning Policy (DGILP, 2017) provides the relevant water quality objectives (WQO) to achieve best practice water quality management for urban purposes in Queensland. The percentage removal efficiency as outlined in the SPP (DGILP, 2017) is summarised Table 4.1.

Table 4.1 Pollutant Removal Targets

Pollutant Type	Percentage Pollutant Removal Efficiency (as per SPP)
Total Suspended Solid (TSS)	80%
Total Phosphorous (TP)	60%
Total Nitrogen (TN)	45%
Gross Pollutant (GP)	90%

Normally, these objectives will be sought to be met for urban development through the incorporation of stormwater treatment devices. The Stage 1 development is located directly adjacent to Weinam Creek, with elevations restricting the depth available for such devices to be installed while achieving a free-draining outlet to Weinam Creek. An initial assessment of the outlet levels required for a bioretention basin or similar indicates that an outlet of -2.0 m AHD would be required, however the bottom of Weinam Creek is

situated above this at -0.8 to -1.0 m AHD. Thus, the only practical treatment of stormwater runoff for the carpark development is through vegetated swales.

An approximate total of 590 m of turfed swale will be constructed in a longitudinal direction to flow between the proposed car parking rows. The majority of runoff from the car park will be directed to these swales, with all stormwater inlets fitted with StormSack GPT devices (27 in total). Typical details for these devices are provided in Appendix E. The proposed residential lots will bypass these swales, and runoff from a portion of the access road along the western edge of the car park will also not flow through these swales. Water quality management will be addressed separately for the superlot when development proceeds for this site.

4.1.1 Music Model Development

The pollutant export loads from the catchment and treatment train effectiveness were assessed using the Cooperative Research Centre for Catchment Hydrology's (CRCCH) Model for Urban Stormwater Improvement Conceptualisation (MUSIC). MUSIC is a decision support tool, used to plan and design appropriate urban stormwater management systems at the conceptual level. MUSIC Version 6.0 was used in this assessment. Model parameters including rainfall runoff and pollutant export parameters were adopted based on the recommendations from the Water by Design "MUSIC Modelling Guidelines for Southeast Queensland".

Climate Data

Climate data for the catchment was sourced from the Bureau of Meteorology (BOM). Rainfall, data was obtained from the Redlands HRS (40265) for the 10 years between 1997 and 2006 at six (6) minute intervals, resulting in a mean annual rainfall of 1088 mm.

Catchment Properties

The catchment area was based on the proposed development layout shown in Appendix A. A lumped catchment approach was considered appropriate and adopted for the assessment. The breakdown of surface type split was adopted based upon the development layout plan. The proposed superlot portion of the development has been excluded from the MUSIC model as water quality treatment for this area will be considered when this lot is developed. The 9 smaller residential lots and a small portion of the car park will bypass the swales. Table 4.2 provides a summary of the MUSIC model catchment parameters and the modelled swale dimensions. A MUSIC catchment layout is provided in Figure 4.1 and the model layout is provided in Figure 4.2.

Rainfall runoff and pollutant export parameters were adopted from the recommended values identified in Tables 3.7 and 3.8 of the MUSIC guidelines.

Table 4.2 MUSIC Catchment Summary

Catchment ID	Area (ha)	Impervious Fraction (%)	MUSIC Node Type
Residential Lot Component	0.377	58	Residential
Car Park	2.054	90	Commercial
Access Road	0.447	90	Commercial
Swale Parameters	Total Combined Length = 591 m Base Width = 1 m Top Width = 3 m Average Slope = 1% Average Depth = 200 mm Vegetation Type = 50 mm (turf)		

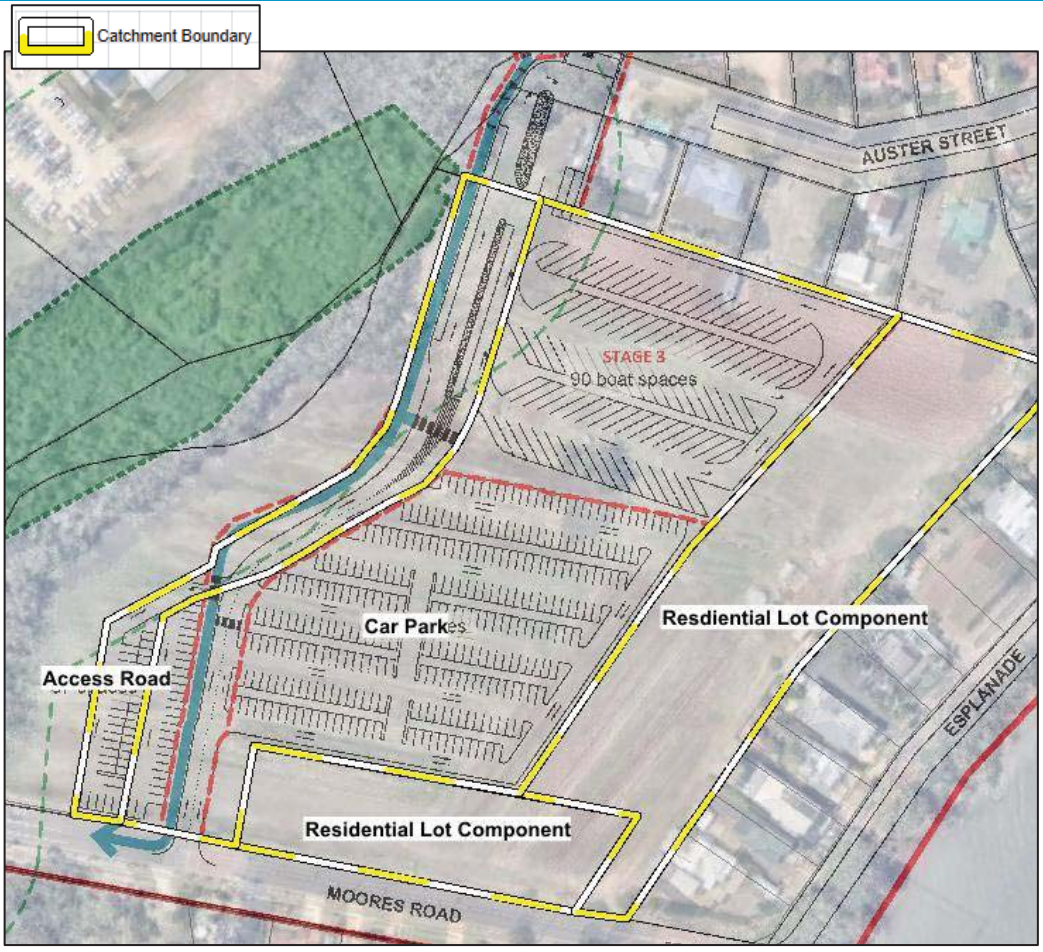


Figure 4.1 MUSIC Catchment Layout

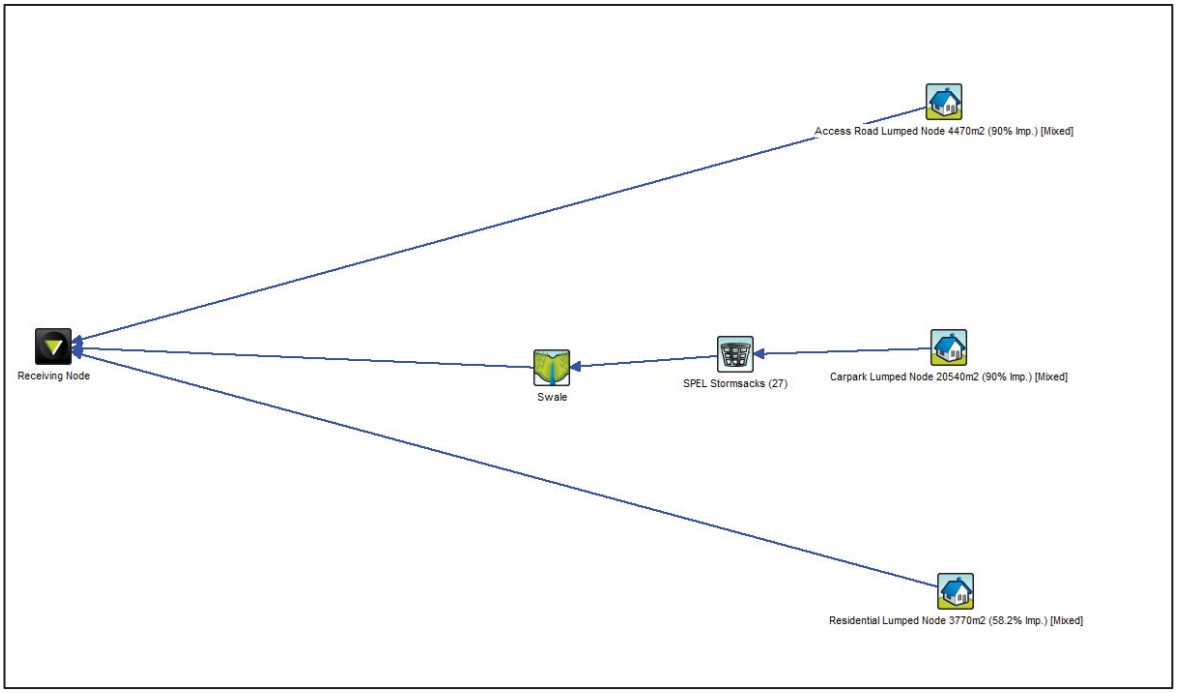


Figure 4.2 MUSIC Model Layout

Water Quality Results

A summary of the treatment train effectiveness of the proposed swales is provided in Figure 4.3. This table shows that the opportunistic treatment measures do not fully achieve the SPP Water Quality Objectives, however, a significant percentage reduction is still achieved.

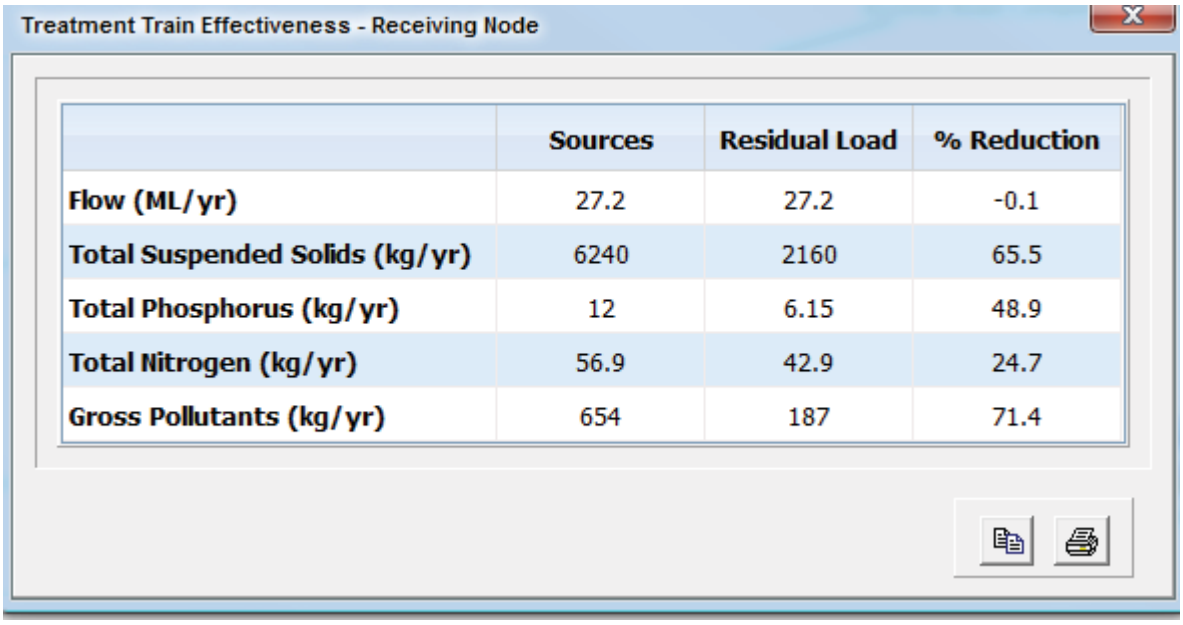


Figure 4.3 MUSIC Model Results

4.2 Whole of Catchment Analysis

Engeny was engaged to undertake MUSIC modelling of the entire Weinam Creek catchment on behalf of Redland City Council in 2013. The details of this assessment are summarised in the *Weinam Creek Stormwater Quality Infrastructure Plan Report* (Engeny, 2013). This report details the modelled pollutant source load for the existing condition of the Weinam Creek catchment. The catchment is currently significantly developed, with a combination of residential, town centre and developing landuses over approximately 80-90% of the catchment. The totals for TSS, TP, TN and gross pollutants in terms of kilograms per year for the whole catchment are able to be compared to the residual pollutant load for the Stage 1 development as calculated in MUSIC and outlined in Section 4.1. A comparison of these totals is provided in Table 4.3. This comparison shows that the expected residual pollutant load from the carpark and 1 into 9 lots ROL is only a very minor portion of the whole of catchment pollutant load and thus the proposed water quality management strategy for the Stage 1 development is appropriate to mitigate any expected water quality impacts.

Table 4.3 Comparison of Stage 1 Source Loads to Whole of Catchment Source Loads

Parameter	Whole of Catchment Source Load*	Stage 1 PDA Residual Load	Percentage Stage 1 Load of Catchment Load (%)
Total Suspended Solids (kg/yr)	216,000	2160	1.0%
Total Phosphorous (kg/yr)	387	6.15	1.6%

Parameter	Whole of Catchment Source Load*	Stage 1 PDA Residual Load	Percentage Stage 1 Load of Catchment Load (%)
Total Nitrogen (kg/yr)	1,990	42.9	2.2%
Gross Pollutants (kg/yr)	25,100	187	0.7%

**Source: Weinam Creek Stormwater Quality Infrastructure Plan Report (Engeny, 2013).*

5. CONCLUSION

A summary of the conclusions from the Site Based Stormwater Management Plan and Flood Impact Assessment for Stage 1 of the Weinam Creek PDA development is as provided in the following sections.

5.1 Flood Impact Assessment

- The TUFLOW 2D hydraulic flood model for Weinam Creek previously developed by Engeny in 2016 for RCC has been utilised for the flood impact assessment of the Stage 1 development.

- The results indicate that flood impacts are generally contained within the Weinam Creek extent. In the 1:100 AEP flood event a minor encroachment of impact on the northern side of Moores Road is observed up to 14 mm. Moores Road is already inundated in the 1:100 AEP flood event in the existing scenario and the total depth in the 1:100 AEP developed scenario in this location is 140 mm, which indicates that the road is still trafficable in accordance with Table 7.4.4 of QUDM. Impacts are also observed at the local overland flow path from Meissner Street in all flood events modelled, where impacts up to 210 mm are expected. This is not expected to impact upon expected freeboard to adjacent dwellings.

- 1:100 AEP creek flood immunity of the car park is generally achieved, with the western portion of the car park and a portion of the access road inundated. DXV mapping shows that these areas are safe for trafficability and vehicle placement. Further mitigation of the inundation risk for the western portion of the car park will be provided through adequate flood. The majority of the car park will be placed above the Storm Tide Level of 2.4 m AHD.

- The minimum level specified for the pad for both the superlot and 9 residential lots is 3.22 m AHD, in accordance with the RCC 2100 Storm Surge Level. The future Finished Floor Levels (FFL) of dwellings on these lots will have 300 mm freeboard above this RCC 2100 Storm Surge Level, resulting in a minimum FFL of 3.52 m AHD.

- The requirement for 1:2 AEP flood immunity for the pedestrian connection is generally achieved, with safe passage for pedestrians expected up to the 1:100 AEP event due to the DxV product not exceeding 0.4 m2/s, as specified in section 7.4.6 of QUDM (IPWEAQ, 2017).

- The proposed bridge structure will be located well above the 1:100 AEP creek flood level, with the deck immune to storm tide also.

5.2 Stormwater Quantity Management

- Due to the placement of the development as discharging directly to Weinam Creek, no detention or mitigation of stormwater runoff is proposed.

5.3 Stormwater Quality Management

- An opportunistic approach to stormwater quality management will be adopted. A series of swales throughout the car park will provide as much treatment as practical of stormwater runoff, but will be unable to meet the State Planning Policy (SPP) (DGILP, 2017) Water Quality Objectives (WQOs). Furthermore, SPEL StormSack GPT devices will be installed on all inlets to capture gross pollutants.

- The results from the MUSIC modelling of the treatment train shows that the opportunistic treatment measures do not fully achieve the SPP Water Quality Objectives, however, a significant percentage reduction is still achieved.

- A comparison of the expected residual pollutant load from the Stage 1 development to the whole of catchment pollutant load shows that the contributing load from the development is negligible and that the proposed water quality management strategy for the Stage 1 development is appropriate to mitigate any expected water quality impacts.

6. QUALIFICATIONS

a. In preparing this document, including all relevant calculation and modelling, Engeny Water Management (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

b. Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

c. Engeny reserves the right to review and amend any aspect of the works performed including any opinions and recommendations from the works included or referred to in the works if:

   (i) Additional sources of information not presently available (for whatever reason) are provided or become known to Engeny; or

   (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

d. Engeny does not give any warranty nor accept any liability in relation to the completeness or accuracy of the works, which may be inherently reliant upon the completeness and accuracy of the input data and the agreed scope of works. All limitations of liability shall apply for the benefit of the employees, agents and representatives of Engeny to the same extent that they apply for the benefit of Engeny.

e. This document is for the use of the party to whom it is addressed and for no other persons. No responsibility is accepted to any third party for the whole or part of the contents of this report.

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g. This report does not provide legal advice.

7. REFERENCES

DILGP (2017), *State Planning Policy.* Department of Infrastructure, Local Government and Planning: July 2017.

Engeny (2013), *Weinam Creek Stormwater Quality Infrastructure Plan.* Engeny Water Management: 3 May 2013.

Engeny (2016), *Moogurrapum & Weinam Creeks Flood Study.* Engeny Water Management: 2 November 2016.

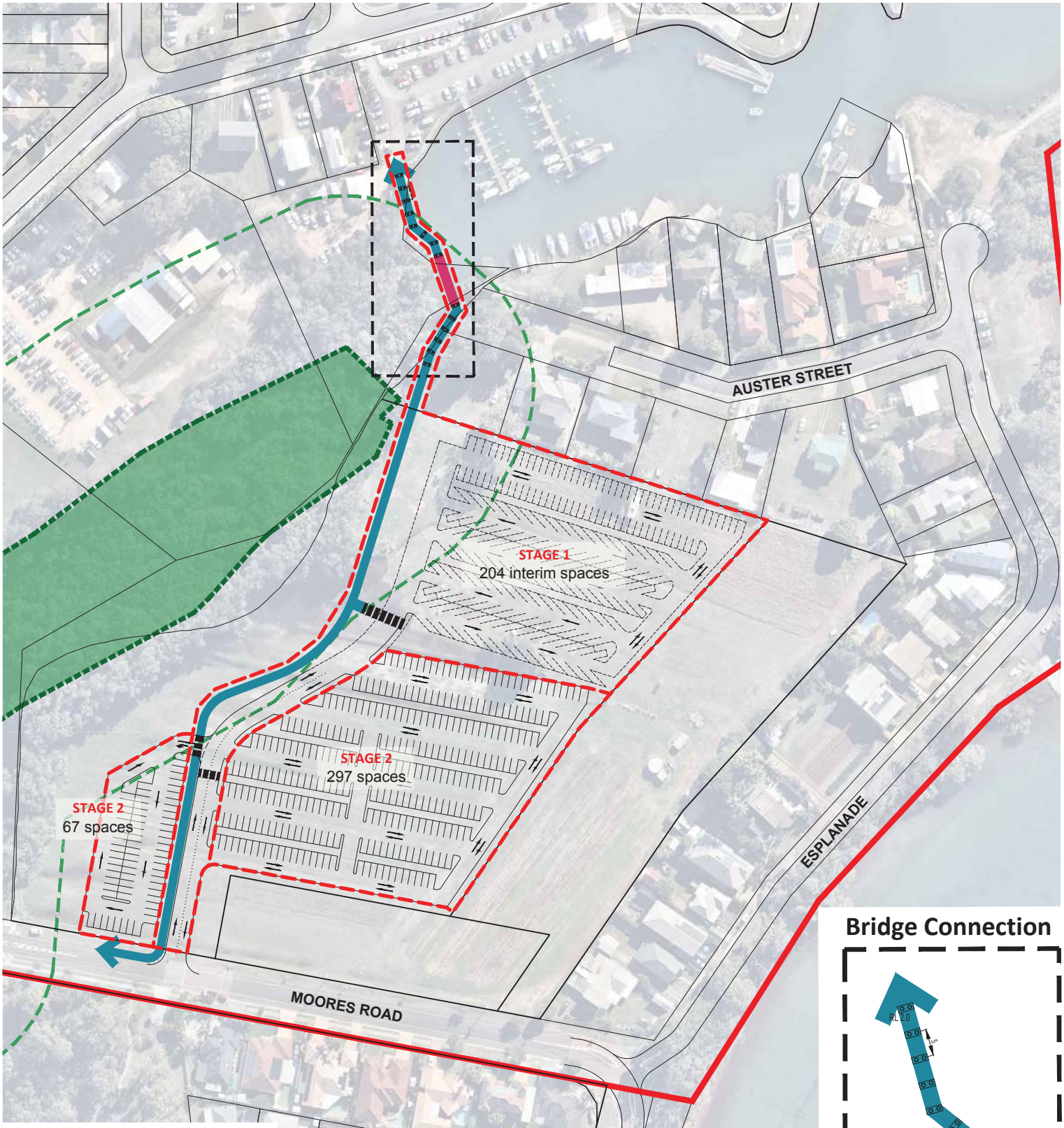
IPWEAQ (2017), *Queensland Urban Drainage Manual.* Institute of Public Works Engineering Australasia, Queensland: 4th Edition.

Redlands City Council (2018), *Redlands Planning Scheme 7.2.*

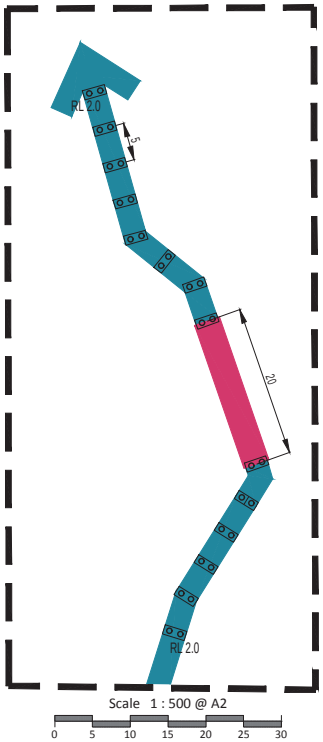
Water By Design (2010) *Music Modelling Guidelines.* Version 1.0 – 2010.

APPENDIX A

Stage 1 Development Plans



Bridge Connection



Legend:

- Weinam Creek PDA Boundary
- Staging Boundary
- Bridge Connection
- 3m Wide Footpath
- Indicative Boardwalk
- Pedestrian Crossing
- HES Wetland + 50m Buffer

Note:
Lot Number, Dimensions and Areas are approximate only, and are subject to survey and Council approval.

Dimensions have been rounded to the nearest 0.1 metres.

Areas have been rounded down to the nearest 5m².

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: Registered Survey Plans.
Adjoining information: DCDB.
Aerial photography: Nearmap
Wetland: BAAM

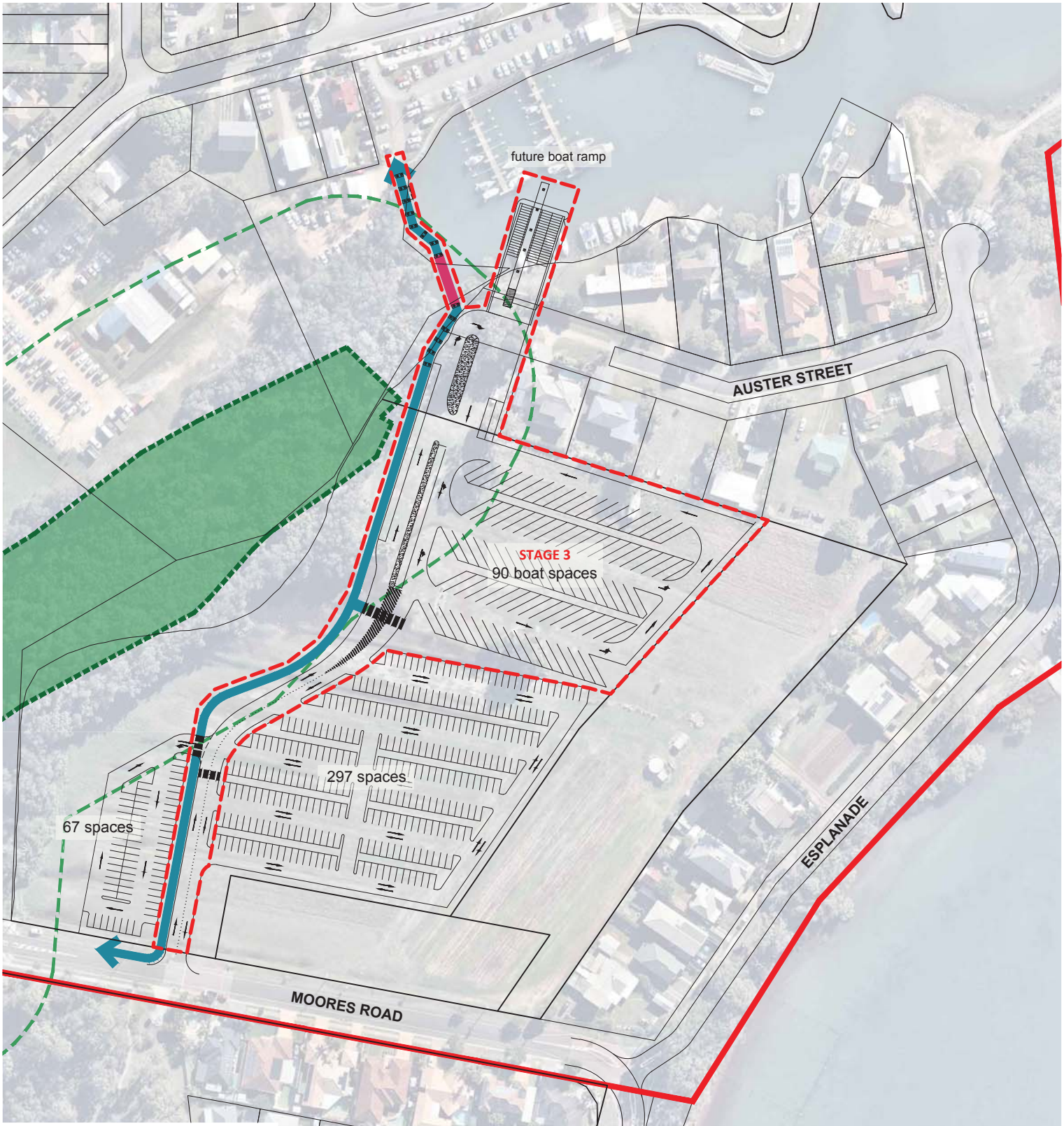
Scale 1 : 1000 @ A2
0 5 10 20 30 40 50 60

Plan Ref **133693 – 12M**

Date: 6 Nov 2018
Client: RIC
Dwg Name: 133693-12
Drawn By: BM
Checked By: PE

Moores Road Carparking Plan with Interim Parking
WEINAM CREEK PDA

Urban Design
Brisbane Design Studio
455 Brunswick Street
Fortitude Valley QLD 4006
T +61 7 3124 9300
F +61 7 3124 9399
W rpsgroup.com.au



Legend:

- Weinam Creek PDA Boundary
- Staging Boundary
- Bridge Connection
- 3m Wide Footpath
- Indicative Boardwalk
- Pedestrian Crossing
- HES Wetland + 50m Buffer

Note:
Lot Number, Dimensions and Areas are approximate only, and are subject to survey and Council approval.

Dimensions have been rounded to the nearest 0.1 metres.

Areas have been rounded down to the nearest 5m².

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: Registered Survey Plans.
Adjoining information: DCDB.
Aerial photography: Nearmap
Wetland: BAAM

Scale 1 : 1000 @ A2

0 5 10 20 30 40 50 60

Plan Ref **133693 – 17A**

Date: 6 Nov 2018
Client: RIC
Dwg Name: 133693-12
Drawn By: BM
Checked By: PE

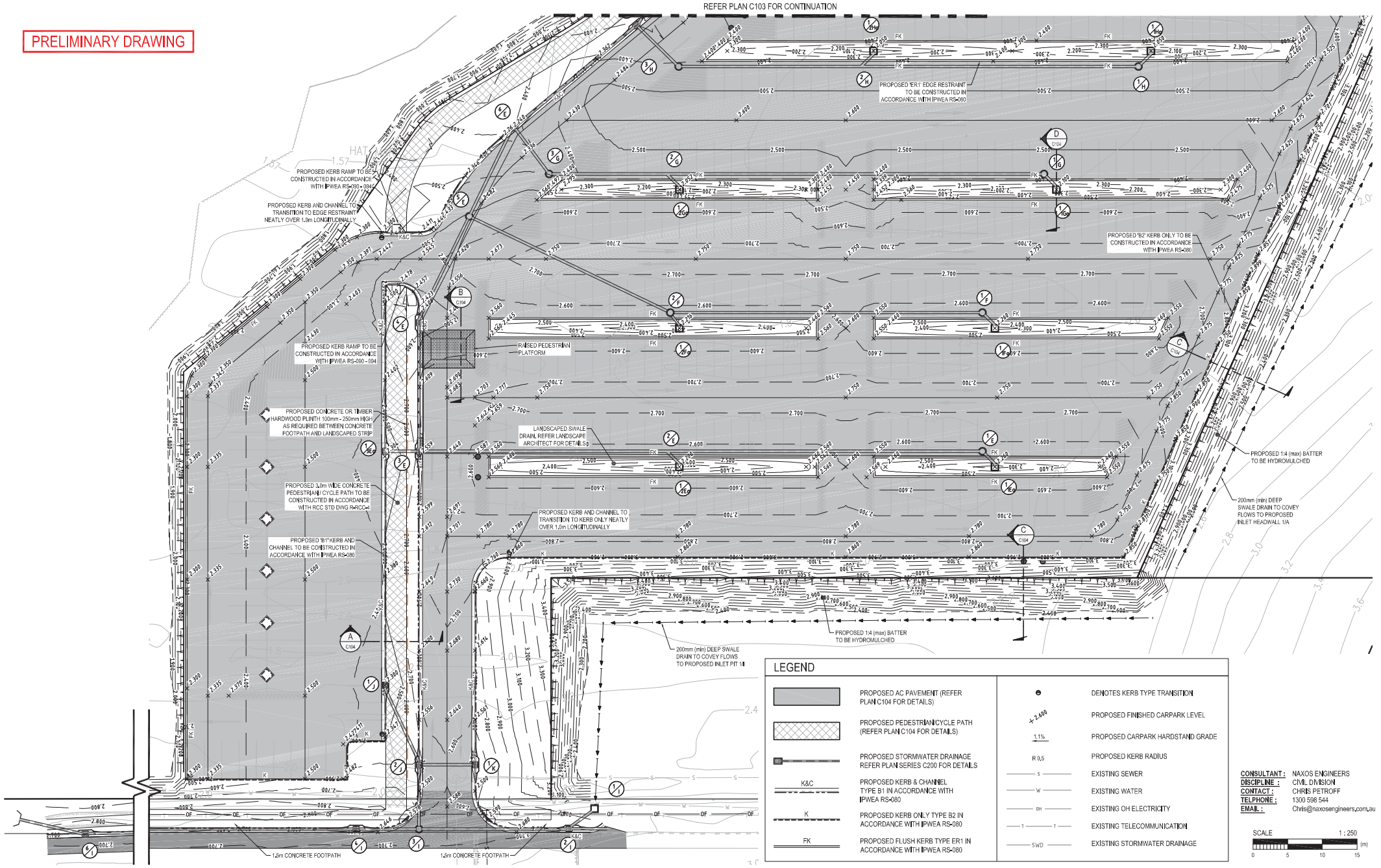
Moores Road Ultimate Carparking Plan with Boat Parking

WEINAM CREEK PDA

Urban Design
Brisbane Design Studio
455 Brunswick Street
Fortitude Valley QLD 4006
T +61 7 3124 9300
F +61 7 3124 9399
W rpsgroup.com.au

RPS

PRELIMINARY DRAWING



CONSULTANT : NAXOS ENGINEERS
DISCIPLINE : CIVIL DIVISION
CONTACT : CHRIS PETROFF
TELPHONE : 1300 598 544
EMAIL : Chris@naxosengineers.com.au

AMENDMENTS

No.	DATE	DESCRIPTION	DRAWN	No.	DATE	DESCRIPTION	DRAWN
A	11.10.2018	PRELIMINARY ISSUE	JE				
B	02.11.2018	PRELIMINARY ISSUE	CP				

Associated Consultant: RPS GROUP

Surveyor: - Plan Ref.: - Level Datum AHD

RP Description: -

North

Size of Land: -

Orig. Drg. Size A1

Approved:

Drawn: AR

Design: AR

Checked: GT

Supervisor: GT

RPEQ. Date:

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PO Box 224, Spring Hill QLD 4004
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Client: REDLAND INVESTMENT CORPORATION

Project: WEINAM CREEK PDA

Title: INTERNAL ROADWORKS AND DRAINAGE PLAN - SHEET 1

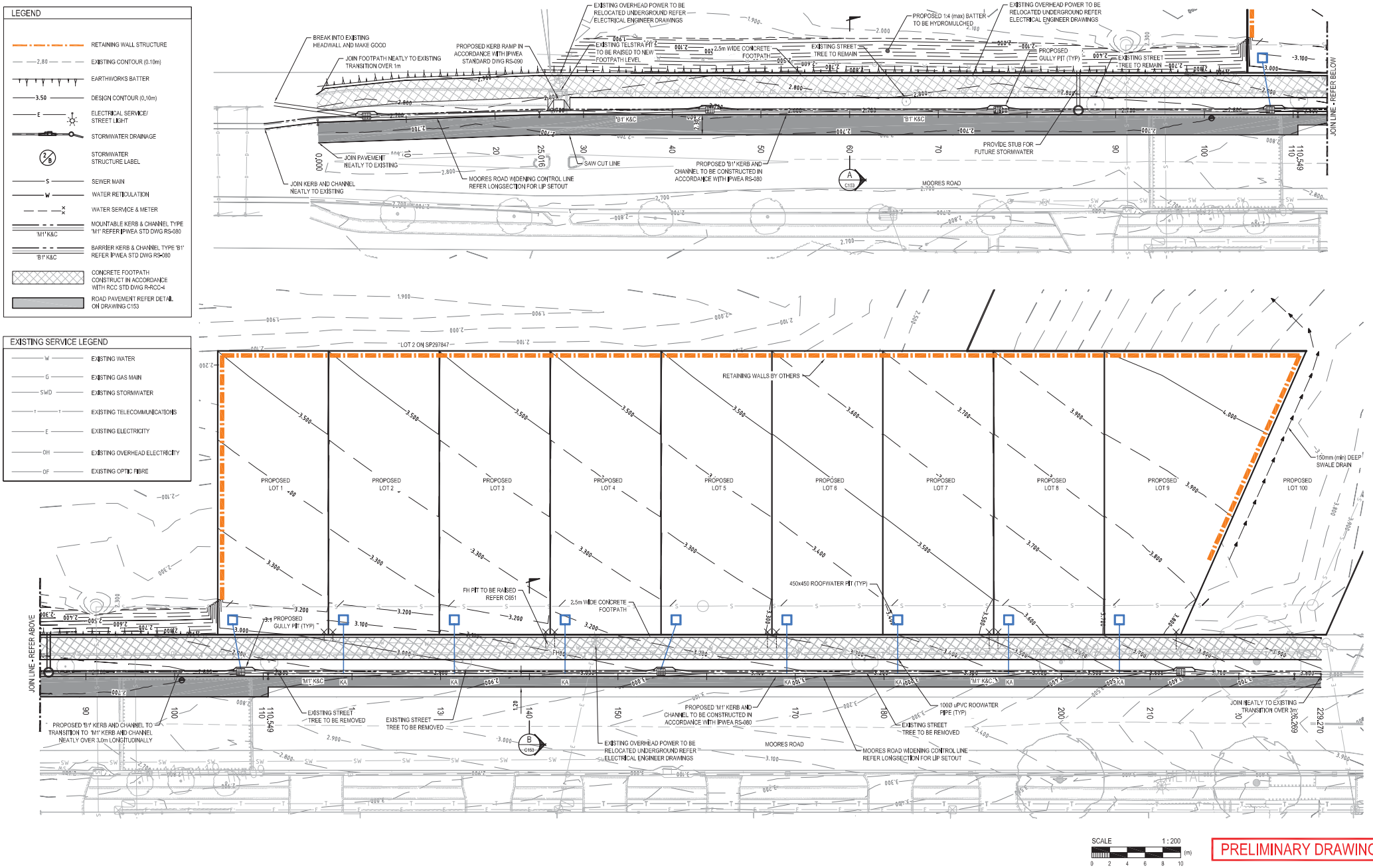
Scale: AS NOTED

Job No.: C18-214

Drawing No.: C102

Revision: B

PRELIMINARY



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Associated Consultant: RPS GROUP

Approved: RPEQ. Date:

Drawn: JE | Design: JE | Checked: GT | Supervisor: GT

Surveyor: - | Plan Ref.: - | Level Datum AHD

RP Description: - | Size of Land: - | North | Orig. Drg. Size A1

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Client: REDLAND INVESTMENT CORPORATION

Project: WIENAM CREEK PDA - 1 INTO 10 ROL

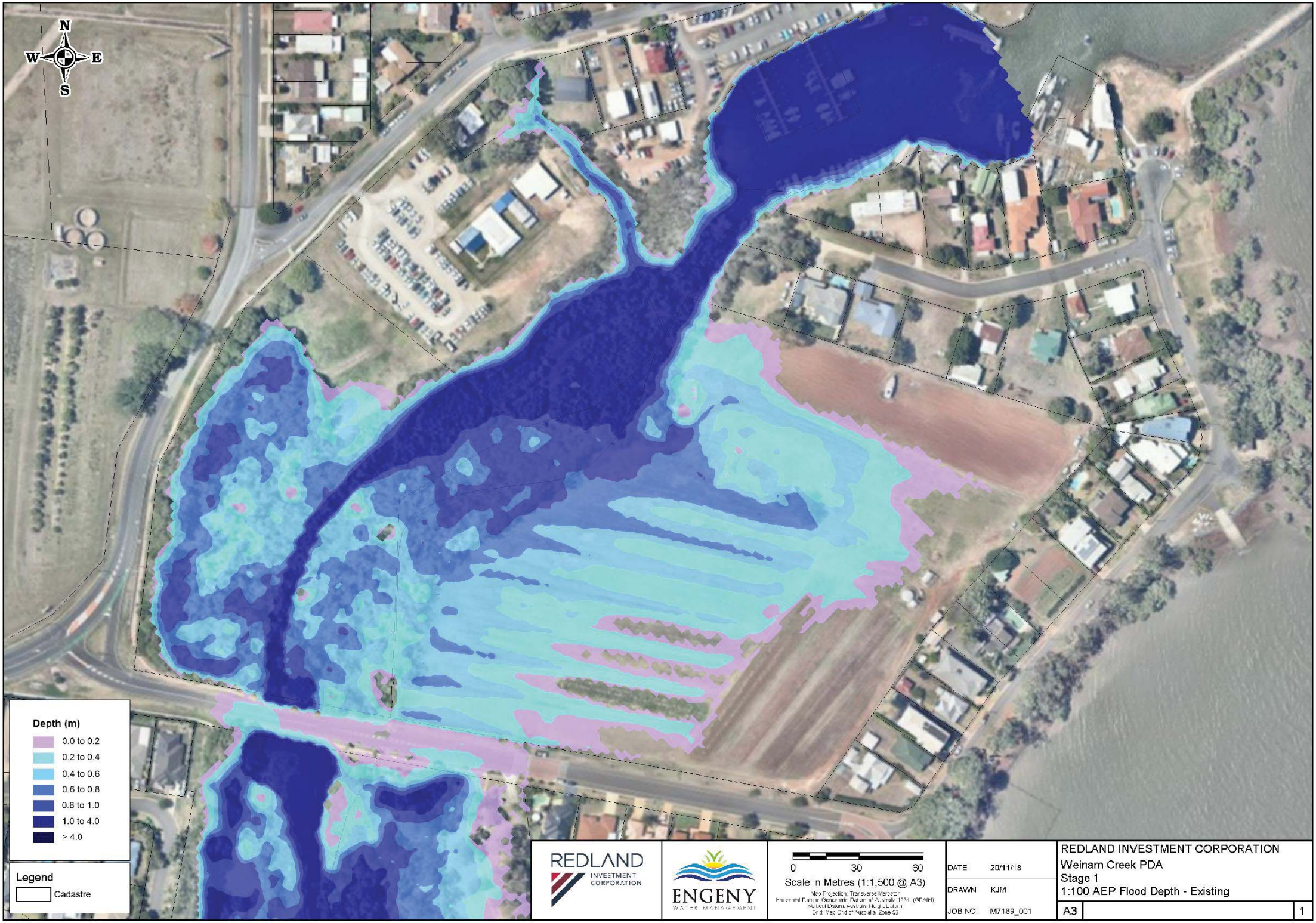
Title: ROADWORKS AND DRAINAGE PLAN

Scale: AS NOTED | Job No.: C18-214 | Drawing No.: C152 | Revision: A

PRELIMINARY

APPENDIX B

Existing Scenario Flood Mapping



REDLAND INVESTMENT CORPORATION

ENGENY WATER MANAGEMENT

0 30 60

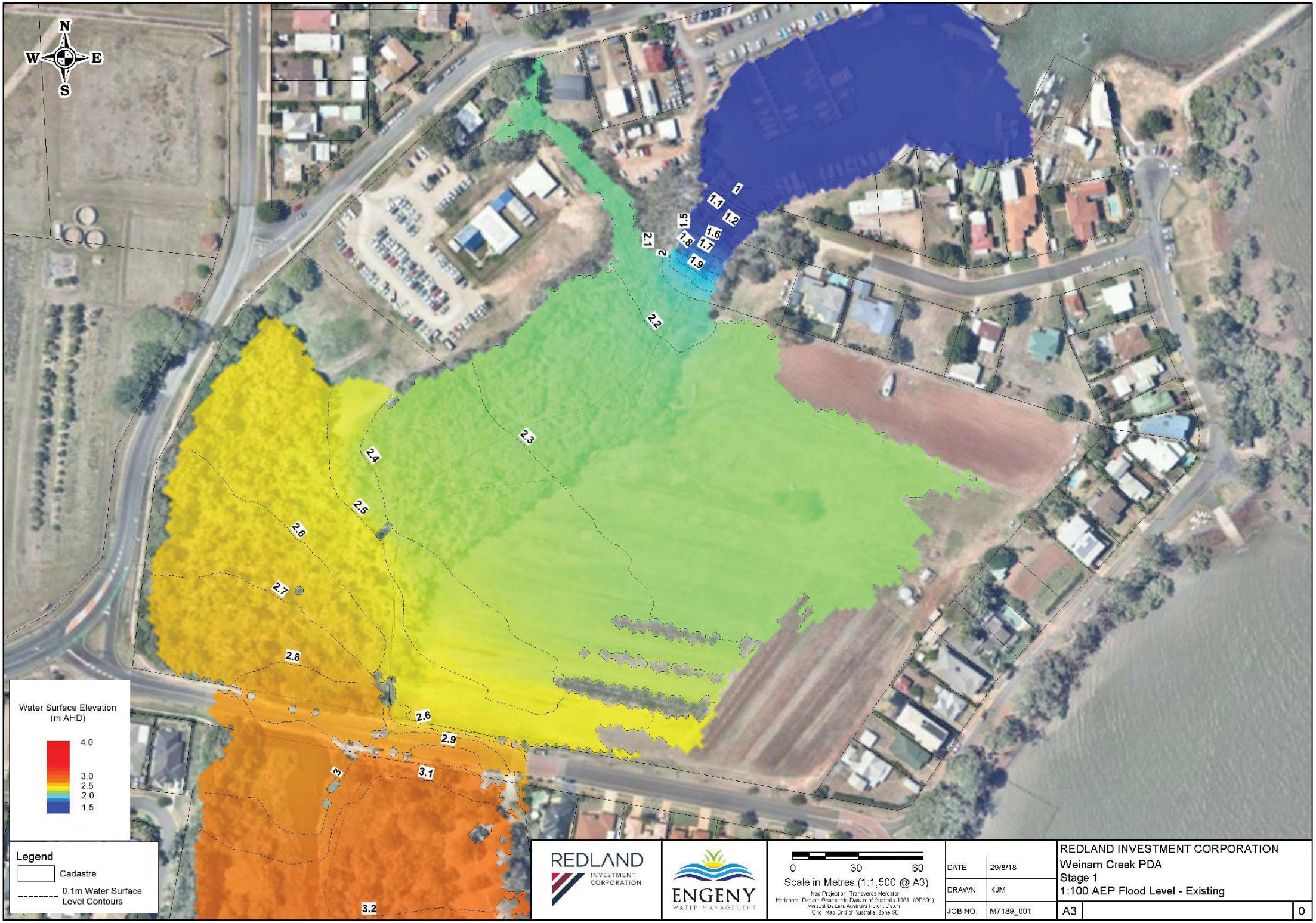
Scale in Metres (1:1,500 @ A3)

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)
Vertical Datum: Australian Height Datum
Grid: Map Grid of Australia Zone 53

DATE	20/11/18
DRAWN	KJM
JOB NO.	M7189_001

REDLAND INVESTMENT CORPORATION
Weinam Creek PDA
Stage 1
1:100 AEP Flood Depth - Existing

A3 | 1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Cadastre
0.1m Water Surface Level Contours
REDLAND INVESTMENT CORPORATION
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Grid: Map Grid of Australia, Zone 56
DATE 29/8/18
DRAWN KJM
JOB NO. M7189_001
REDLAND INVESTMENT CORPORATION
Weinam Creek PDA
Stage 1
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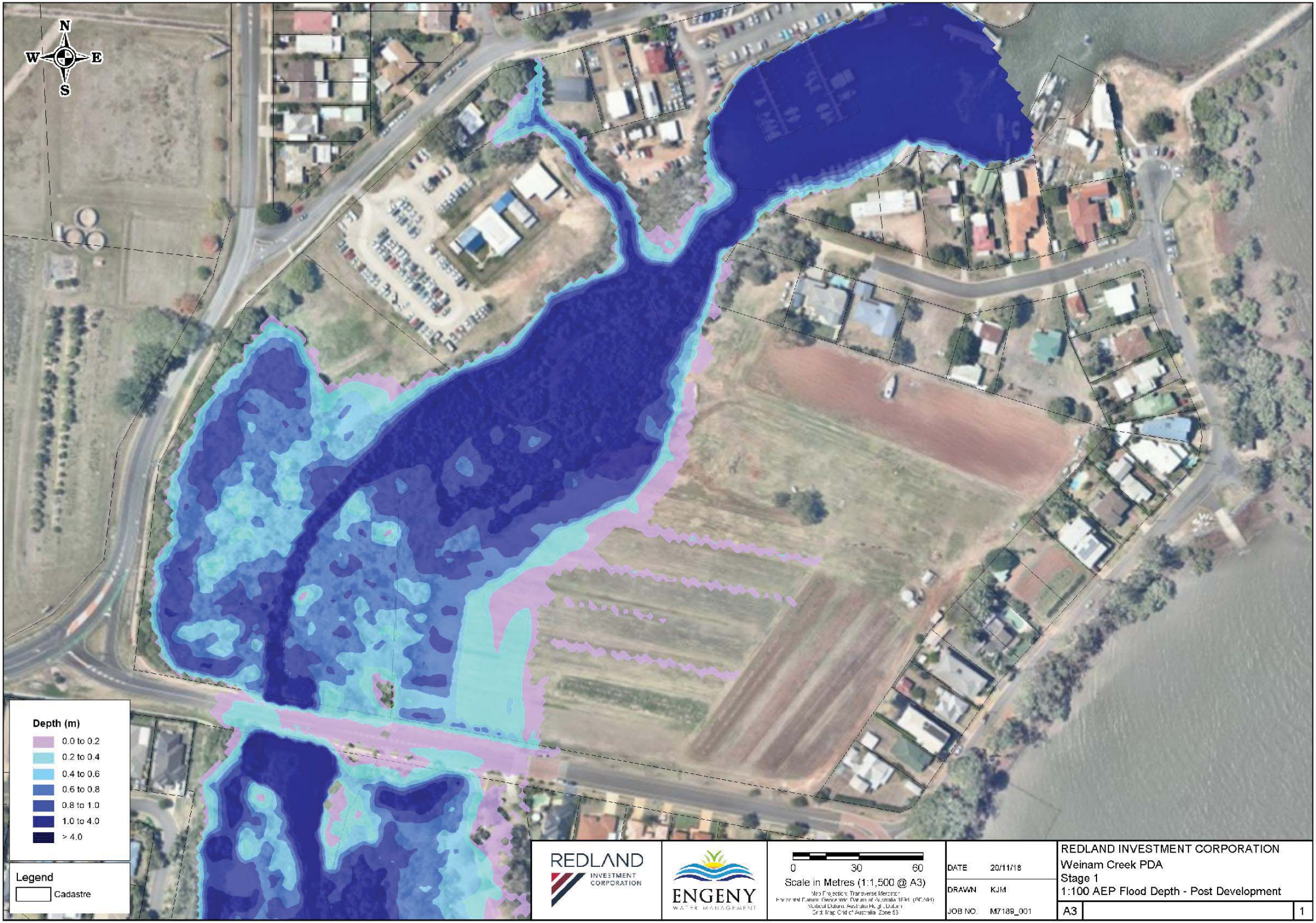
APPENDIX C

Developed Scenario Flood Mapping



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Map Projection: Transverse Mercator
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Vertical Datum: Australian Height Datum
Grid: Map Grid of Australia Zone 53

DATE	20/11/18
DRAWN	KJM
JOB NO.	M7189_001

REDLAND INVESTMENT CORPORATION
Weinam Creek PDA
Stage 1
1:100 AEP Flood Depth - Post Development

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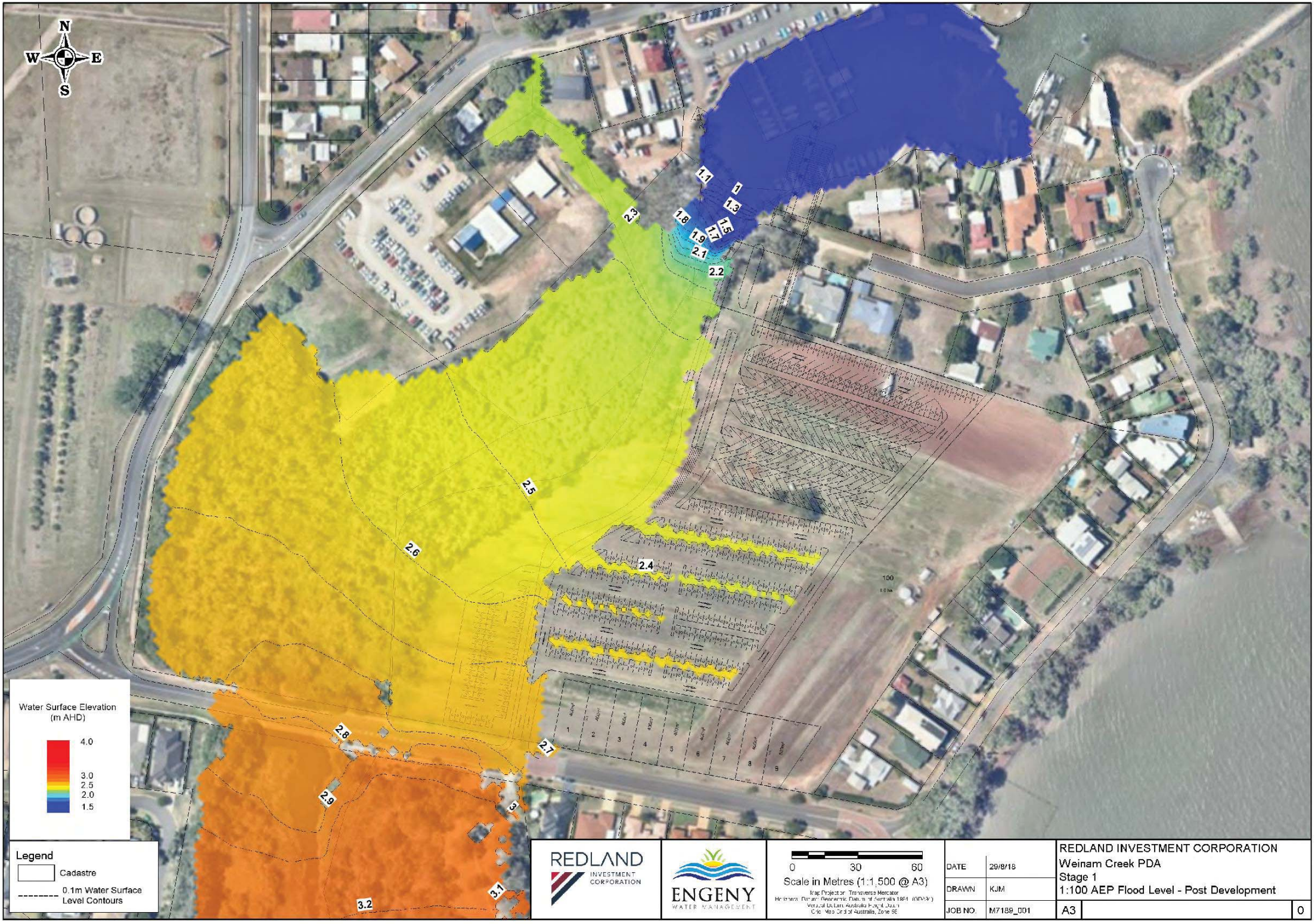
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0.1m Water Surface Level Contours
REDLAND INVESTMENT CORPORATION
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DATE 29/8/18
DRAWN KJM
JOB NO. M7189_001
REDLAND INVESTMENT CORPORATION
Weinam Creek PDA
Stage 1
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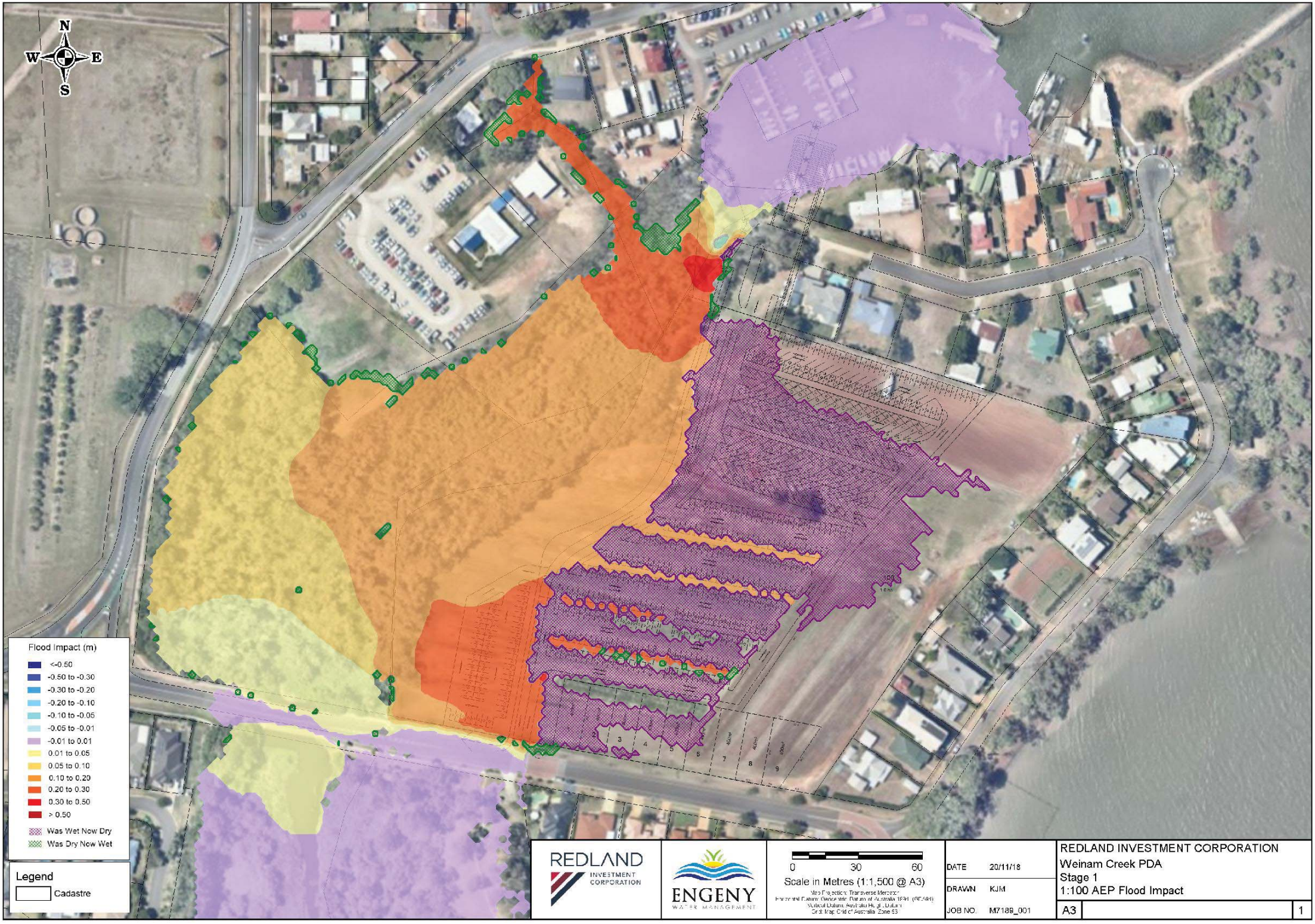
APPENDIX D

Flood Impact Mapping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Was Dry Now Wet
Legend
Cadastre
REDLAND INVESTMENT CORPORATION
ENGENY WATER MANAGEMENT
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Scale in Metres (1:1,500 @ A3)
DATE 20/11/18
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Weinam Creek PDA
Stage 1
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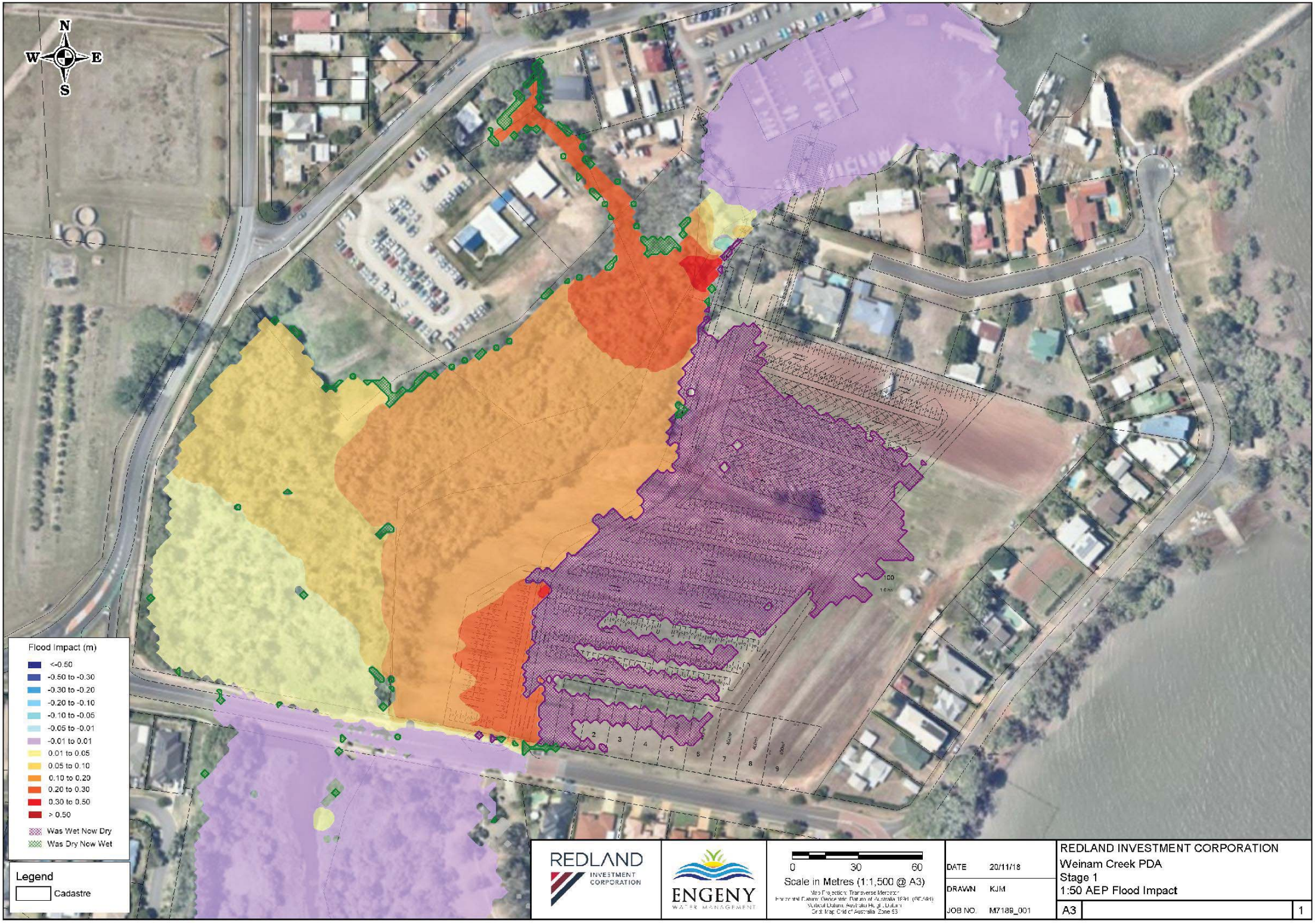
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Legend
Cadastre
REDLAND INVESTMENT CORPORATION
ENGENY WATER MANAGEMENT
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Scale in Metres (1:1,500 @ A3)
DATE 20/11/18
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Weinam Creek PDA
Stage 1
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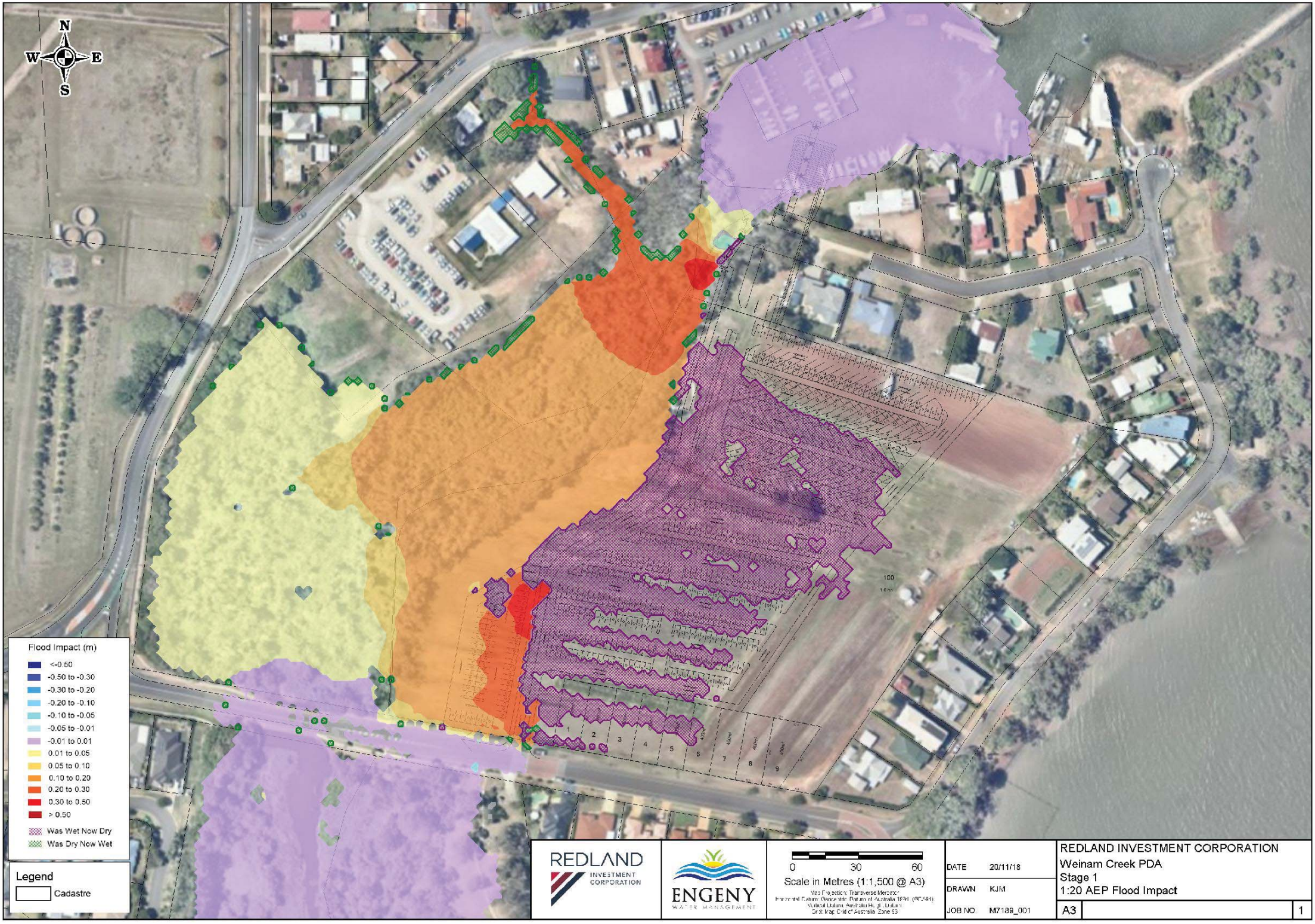
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Legend
Cadastre
REDLAND INVESTMENT CORPORATION
ENGENY WATER MANAGEMENT
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Scale in Metres (1:1,500 @ A3)
DATE 20/11/18
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Weinam Creek PDA
Stage 1
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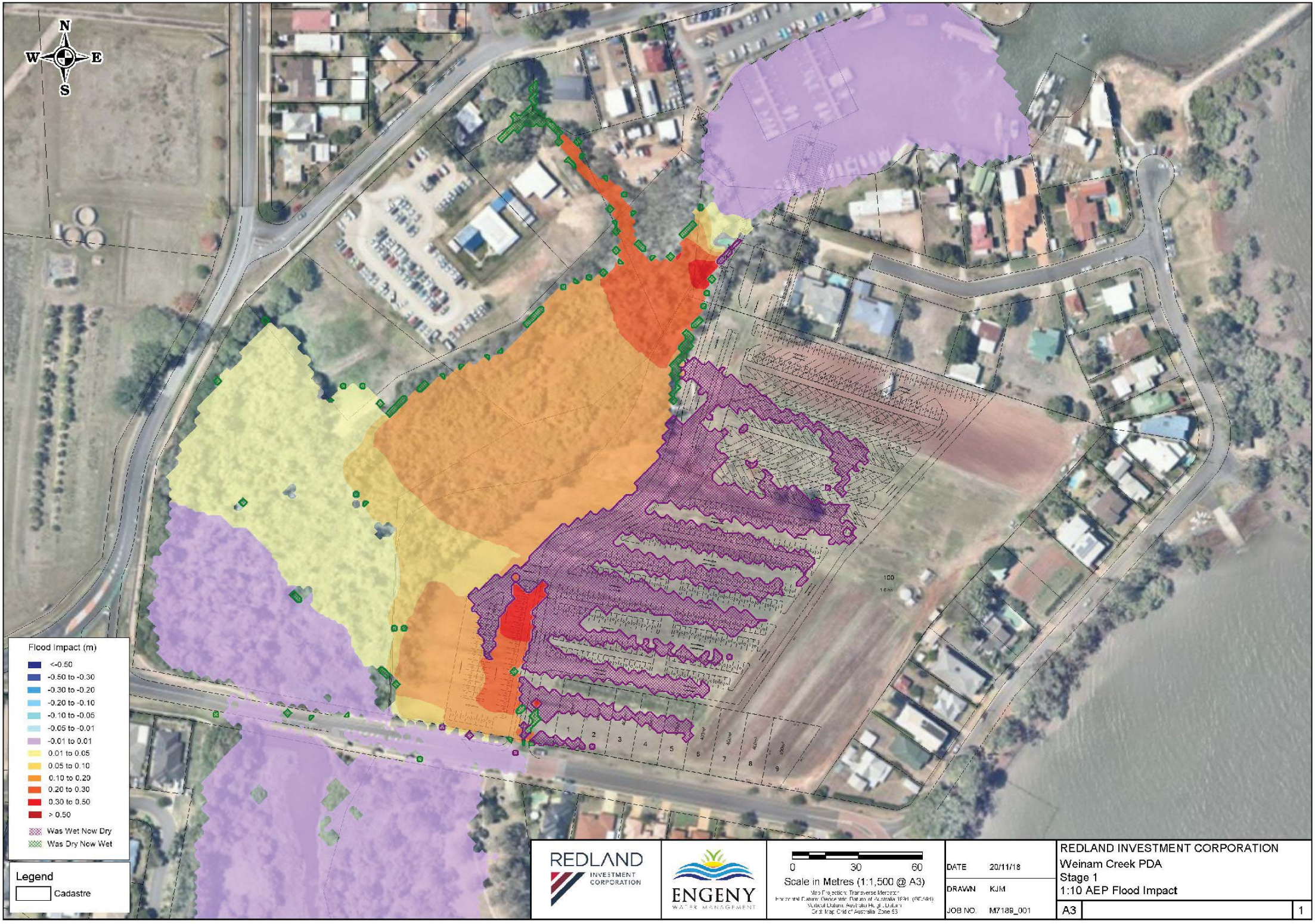
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REDLAND INVESTMENT CORPORATION
ENGENY WATER MANAGEMENT
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Scale in Metres (1:1,500 @ A3)
DATE 20/11/18
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JOB NO. M7189_001
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Weinam Creek PDA
Stage 1
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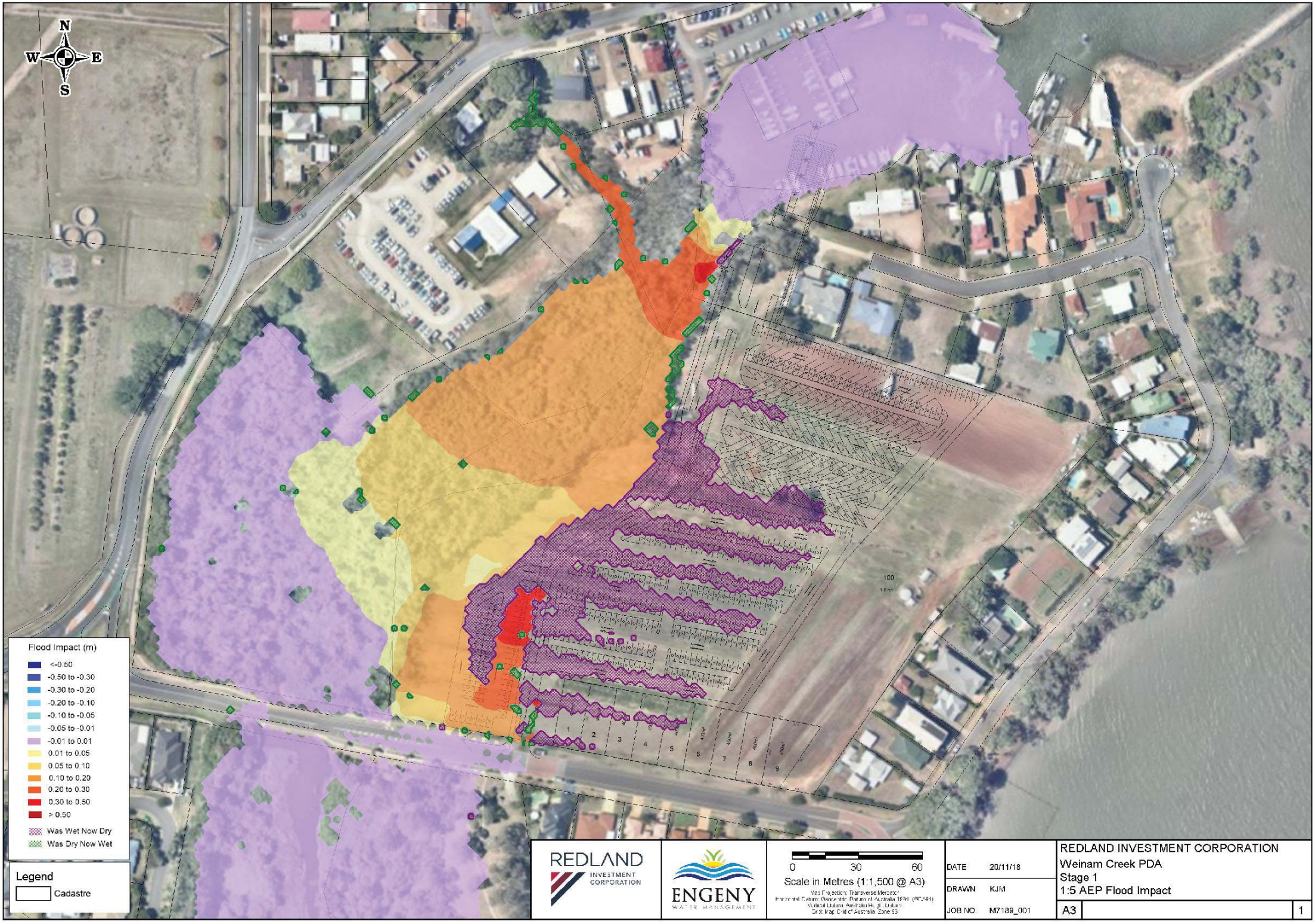
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Was Dry Now Wet
Legend
Cadastre
REDLAND INVESTMENT CORPORATION
ENGENY WATER MANAGEMENT
0 30 60
Scale in Metres (1:1,500 @ A3)
DATE 20/11/18
DRAWN KJM
JOB NO. M7189_001
REDLAND INVESTMENT CORPORATION
Weinam Creek PDA
Stage 1
1:5 AEP Flood Impact
A3
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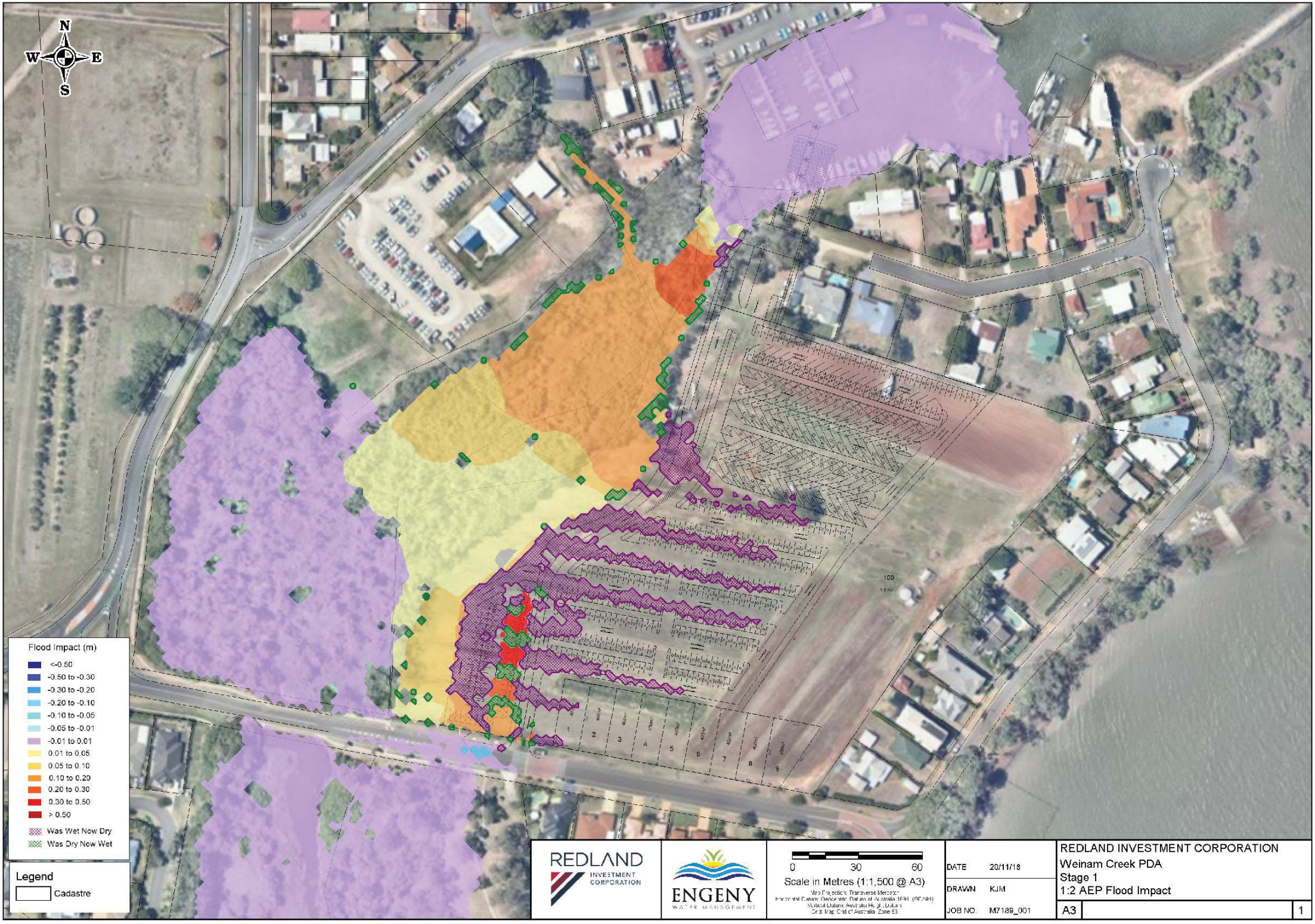
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Was Wet Now Dry
Was Dry Now Wet
Legend
Cadastre
REDLAND INVESTMENT CORPORATION
ENGENY WATER MANAGEMENT
0 30 60
Scale in Metres (1:1,500 @ A3)
DATE 20/11/18
DRAWN KJM
JOB NO. M7189_001
REDLAND INVESTMENT CORPORATION
Weinam Creek PDA
Stage 1
1:2 AEP Flood Impact
A3
1

APPENDIX E

SPEL StormSack Typical Detail

SPEL Stormsack

At-source Gross Pollutant Trap

www.spel.com.au

SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

Stormwater Treatment

An all too common issue with today's highly impervious landscape is how to meet stormwater regulations with limited budgets and tight space constraints.

SPEL StormSack filtration solutions are highly engineered water quality devices that are deployed directly in the stormwater sewer system to capture contaminants close the surface for ease of maintenance. Easily retrofitted into new or existing structures, SPEL StormSack filtration technology is a decentralized approach to stormwater treatment that essentially repurposes traditional site infrastructure and customizes it to meet specific site water quality goals. In this way, it satisfies important objectives of today's LID (Low Impact Development) criteria.

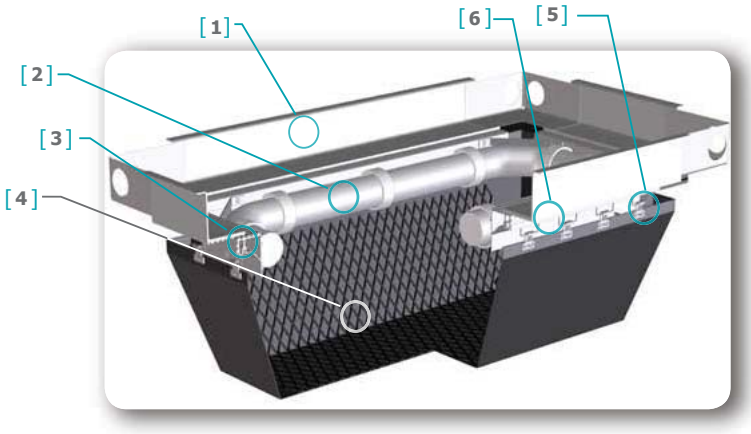
From an operations perspective, catch basins with SPEL Stormsack filters are also easier and quicker to clean out because pollutants are trapped just under the grate.

StormSack

The SPEL StormSack is specifically designed for the capture of gross pollutants: sediment, litter, and oil and grease. Ideally suited for municipal storm drain retrofits, the SPEL StormSack's unique design allows maintenance to be performed using conventional vacuum suction equipment.

Application	Regulatory Issue	Target Pollutants
Council Storm Drain Retrofits	At-source litter capture	Sediment, Litter, O&G
Commercial/Retail/Residential	Stormwater Compliance	Sediment, Litter, O&G
Litter Prone Urban Areas	Cost effective litter control	Litter ≥ 5 mm
Scrap Metal/Solid Waste/Oil Storage/Etc	Industrial Multi-Sector General Permit	Gross Pollutants, O&G
Part of Treatment Train	Council Stormwater Quality Improvement Targets	Sediment, Litter, O&G
Construction Sediment/Erosion	Sediment Control Plan	Sediment/Erosion Control

Features	
1.	Durable, aluminum frame construction has 15 year service life
2.	Integral oil boom effectively captures oil and grease from spills
3.	Patented dovetailed flange – allows 12cm of length/width field adjustment
4.	Polypropylene netting protects sack from suction hose during maintenance
5.	Steel clip with locking tab holds replaceable filter sack in place
6.	Baffled bypass traps floatables



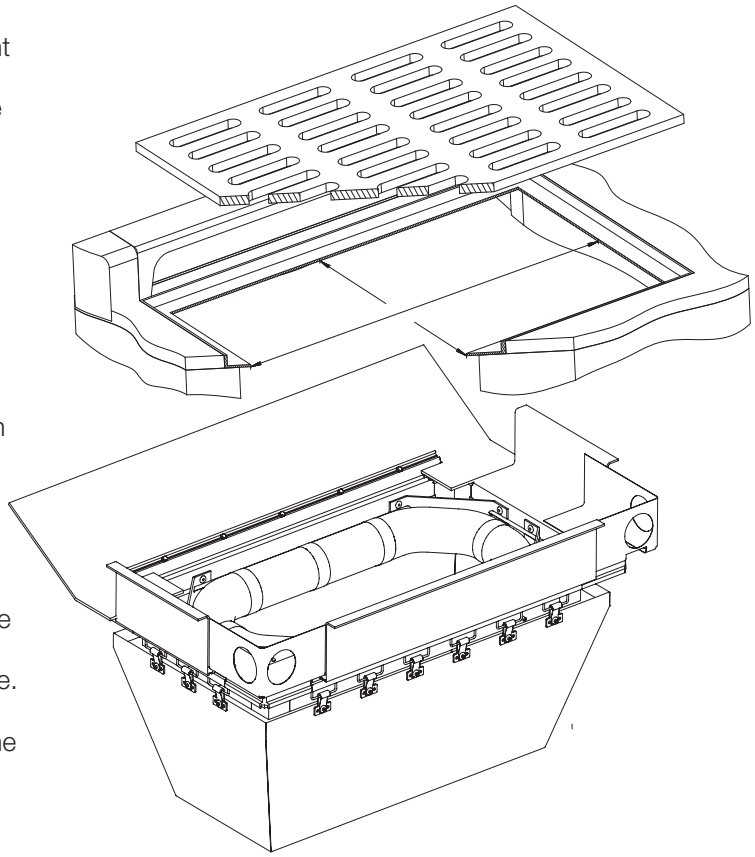
Standard SPEL Stormsack to suit Pit Sizes
450x450mm
600x600mm
900x600mm
900x900mm

Custom sizes (i.e. 1200x900mm) can be manufactured on short lead times

Specifications & Details

General Description

This technology is a post developed stormwater treatment system. The SPEL StormSack provides effective filtration of solid pollutants and debris typical of urban runoff, while utilising the existing or new storm drain infrastructure. The StormSack is designed to rest on the flanges of conventional catch basin frames and is engineered for most hydraulic and cold climate conditions.



Installation And Maintenance

Installation procedures shall include removing the storm grate, cleaning the ledge of debris and solids, measuring catch basin clear opening and adjusting flanges to rest on grate support ledge. Install SPEL StormSack with splash guard under curb opening so the adjustable flanges are resting on the grate support ledge. Install corner filler pieces. Reinstall storm grate directly on support flanges [rise shall be no more than 1/8 inch (3 mm)].

Maintenance: Typically the SPEL StormSack is serviceable from the street level, and therefore maintenance does not require confined space entry into the catch basin structure. The unit is designed to be maintained in place with a vacuum hose attached to a sweeper or a vactor truck. The oil boom is also designed to easily be replaced from the street level. Use only SPEL replaceable parts.

Products

Material and Design

A. Adjustable Flange and Deflector: Aluminum Alloy 6063-T6

B. Splash Guard: neoprene rubber

C. Stormsack: woven polypropylene geotextile with US Mesh 20

D. Corner Filler: Aluminum Allow 5052-H32

E. Lifting Tabs: Aluminum Allow 5052-H32

F. Replaceable Oil Boom: polypropylene 3 inch (76 mm) diameter

G. Mesh Liner: HDPE, diamond configuration

H. Support Hardware: CRES 300 Series

Typical Performance Characteristics

A. Debris capacity: 8.5cu. ft. (0.24 m3)

B. Filtered flow rate: 7.3 cfs (207 lps)

C. Primary baffled bypass flow rate: 4.2cfs (119 lps)

D. Secondary bypass flow rate: 0.4 cfs (10 lps)

E. Total bypass flow rate: 4.6 cfs (130 lps)

F. Oil boom sorption capacity: 376 oz (11 L)

Recommended minimum clearance from bottom of SPEL StormSack to inside bottom of vault is 2 inches (50 mm) Typical frame adjustability range of 5 inches (127 mm) in each direction.

Benefits

- Low cost gross pollutant capture
- Quick & easy installation
- Simple maintenance
- At source capture
- Adjusts to custom pit sizes

Field Performance

The SPEL Stormsack was introduced to the Australian market in 2012 and field testing is underway at several locations in South-east Queensland. Laboratory testing has shown capture of 99.99% of gross pollutants up to the bypass flow rate.* Further results will be provided as they become available.

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0033 SPEL StormSack 2.0

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