CONSULTING ENGINEERS & BUILDING DESIGN
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PORT DOUGLAS QLD 4877

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ABN 95 081 197 006
ACN 081 197 006

QBCC Licence No. 1106533
Builder & Building Design

Our ref: 103-2021/23112021

23 November, 2021

Chief Executive Officer
Douglas Shire Council
PO Box 723,
Mossman Q 4873

Attn: Rebecca Taranto
Development and Environmental Compliance Officer
Environment & Planning, Douglas Shire Council
via email: rebecca.taranto@douglas.qld.gov.au
enqiries@douglas.qld.gov.au

Subject Response to Information Request. OP2021_4382/1
Access Road to Aquafarm on Lots 203 & 204 SP264765

Dear Rebecca

I refer to Council's Information Request dated 19 October, 2021 following our submission addressing all information requested in Section 6 of the Enforcement Notice dated 21 September, 2021.

An RPEQ certified Statement of Compliance for Operational Works Design is attached as requested.

The road has been constructed generally in accordance with Mortons Urban Solutions Drawing 307-01-091.

As constructed engineering plans in accordance with FNQROC are attached as requested. It is understood the Works have been inspected by Douglas Shire's Works Co-ordinator and Team Leader Maintenance Civil and deemed satisfactory.

The pavement design is covered in detail within the RECS engineering assessment report submitted with the operational works permit and complies with FNQROC requirements.

Stormwater drainage analysis and Flood Assessment is contained within BMT WBM report RB21286.001 August 2015 (copy attached).

The report finds:

> From the investigations outlined in this report it, can be demonstrated that the proposed prawn farm extension can be developed in the manner provided by Mortons Urban solutions earthworks design, to provide suitable flood immunity resulting in no predicted adverse impacts external to the site.
>
> Minor impacts that are observed external to the site are quite isolated and are located in areas already inundated and/or over existing mangrove estuary areas. Impacts are generally less than 20mm in magnitude. No habitable dwellings or infrastructure are within these areas.
>
> No impacts are predicted at the Captain Cook Highway.

Further, an increase if any, in road level or increased batter height would result increased drainage channel capacity.

The road profile can be determined by the layer thickness from the material test report. Refer Earth Test report SI 368-21-1/1as well as Douglas Partners geotechnical investigation report DP 77733.01.R001.Rev0 which was previously submitted in the engineering assessment report. Copies attached.

A risk assessment was previously submitted as part of the operational works permit application and engineering assessment report (copy attached).

We trust this satisfies Council information request in full and appreciate Council finalising the matter to allow finalisation of the property transfer.

Yours faithfully

Peter Dutaillis
Director
FIE Aust, CPEng, NER, RPEQ, MEIANZ

FNQROC DEVELOPMENT MANUAL

Council Douglas Shire
(INSERT COUNCIL NAME)

STATEMENT OF COMPLIANCE
OPERATIONAL WORKS DESIGN

This form duly completed and signed by an authorised agent of the Designer shall be submitted with the Operational Works Application for Council Approval.

Name of Development Killaloe Prawn Farm Access

Location of Development Killaloe Prawn Farm Access

Applicant Gold Coast Marine Aquaculture

Designer Mortons Urban Solutions

It is hereby certified that the Calculations, Drawings, Specifications and related documents submitted herewith have been prepared, checked and amended in accordance with the requirements of the FNQROC Development Manual and that the completed works comply with the requirements therein, **except** as noted below.

Compliance with the requirements of the Operational Works Design Guidelines	Non-Compliance refer to non-compliance report / drawing number
Plan Presentation	Complies
Geotechnical requirements	DP 77733.01.R001.Rev0
Geometric Road Design	Complies
Pavements	Complies
Structures / Bridges	N/A
Subsurface Drainage	N/A
Stormwater Drainage	N/A
Site Re-grading	N/A
Erosion Control and Stormwater Management	N/A
Pest Plant Management	N/A
Cycleway / Pathways	N/A

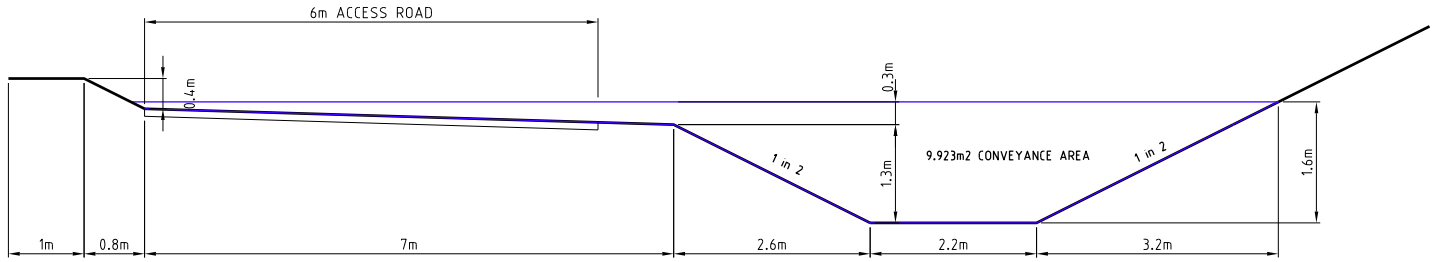
Landscaping	N/A
Water Source and Disinfection/Treatment Infrastructure (if applicable)	N/A
Water Reticulation, Pump Stations and water storages	N/A
Sewer Reticulation and Pump Stations	N/A
Electrical Reticulation and Street Lighting	N/A
Public Transport	N/A
Associated Documentation/ Specification	FNQROC S2 2017
Priced Schedule of Quantities	N/A
Referral Agency Conditions	N/A
Supporting Information (AP1.08)	RECS Engineering Assessment Report Sept 2021
Other	BMT WBM Hydraulic Report, FGF Bitumen Spray sheets

Conscientiously believing the above statements to be true and correct, signed on behalf of:

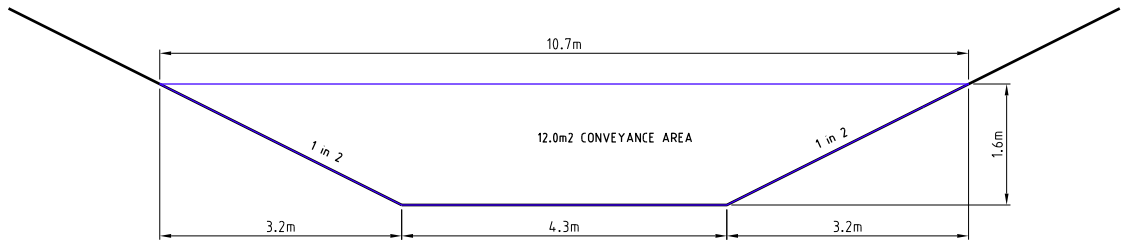
~~Designer~~ Certifier: RECS Consulting Engineers **RPEQ No** 5412

Name in Full Peter Dutaillis

Signature  **Date** 23 November 2021



TYPICAL SECTION
NORTH SIDE SWALE / ROAD PROFILE



TYPICAL SECTION
SOUTH SIDE SWALE / ROAD PROFILE

PROJECT NAME

MOSSMAN

CHANGE OF LEVEL OF LAND
BULK EARTHWORKS-STAGE 01 & 02

R. P. DESCRIPTION

LOT 8, NR153
MOSSMAN FARM

CLIENT

GOLD COAST MARINE AQUACULTURE

0 0.5 1.0 1.5 2.0 2.5m
Scale 1:50 - A1 (1:100 - A3)

ISSUES	DATE	
TENDER		
COUNCIL	23-07-15	
CONSTRUCTION		

PRE	DATE	AMENDMENT
A	23-07-15	COUNCIL ISSUE

ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH 001-NOTES AND 002-LEGEND

ASSOCIATED CONSULTANTS

DRAWING TITLE

TYPICAL SECTIONS
SHEET 02

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As:
Mortons-Urban Solutions
ABN: 39 116 375 065

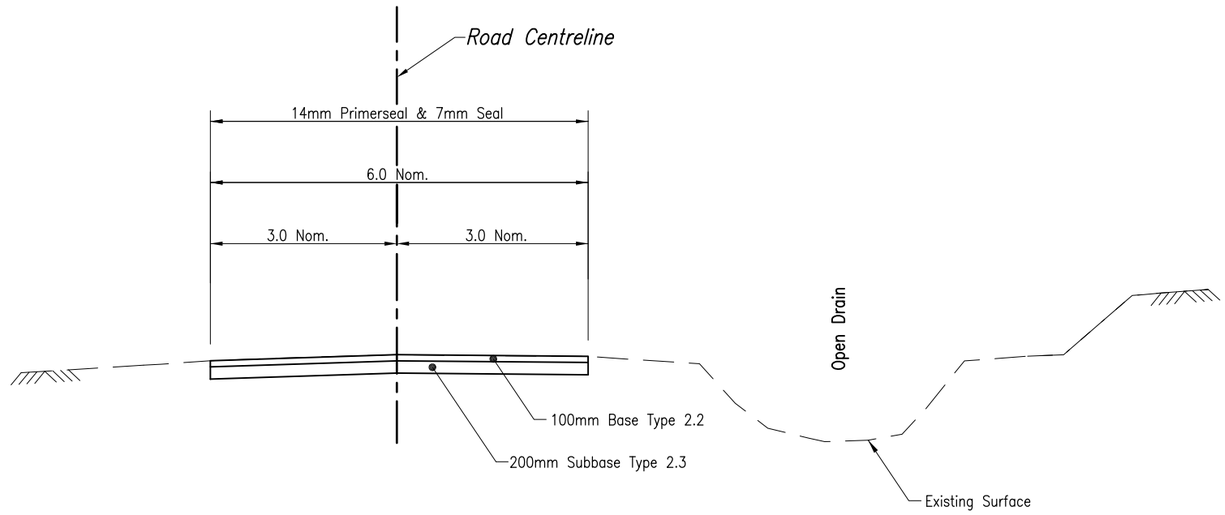
Postal Address
PO Box 2484
Southport QLD 4215

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099
Fax 07 5571 1088

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	RV
APPROVED	RPEQ 4706	DATE	24-06-15

DRAWING NUMBER: 307-01-091
AMEND.: A



A	30/11/21	FOR APPROVAL		TWV	PD
ISSUE	DATE	DESCRIPTION / APPROVED USE		DRAWN	APP'D

CONTRACTORS AND SUBCONTRACTORS MUST VERIFY DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK OR PREPARING SHOP DRAWINGS. USE WRITTEN DIMENSIONS ONLY.

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RPEQ 5412

PROJECT
ACCESS ROAD TO KILLALOE PRAWN FARM
AS CONSTRUCTED DETAILS

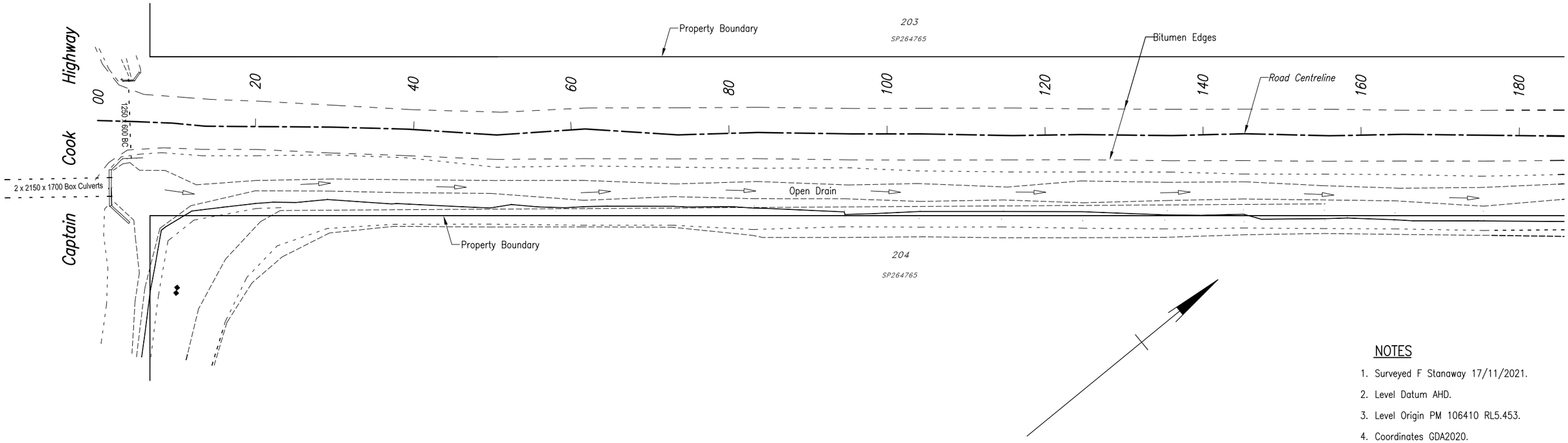
FOR
MAINSTREAM AQUACULTURE

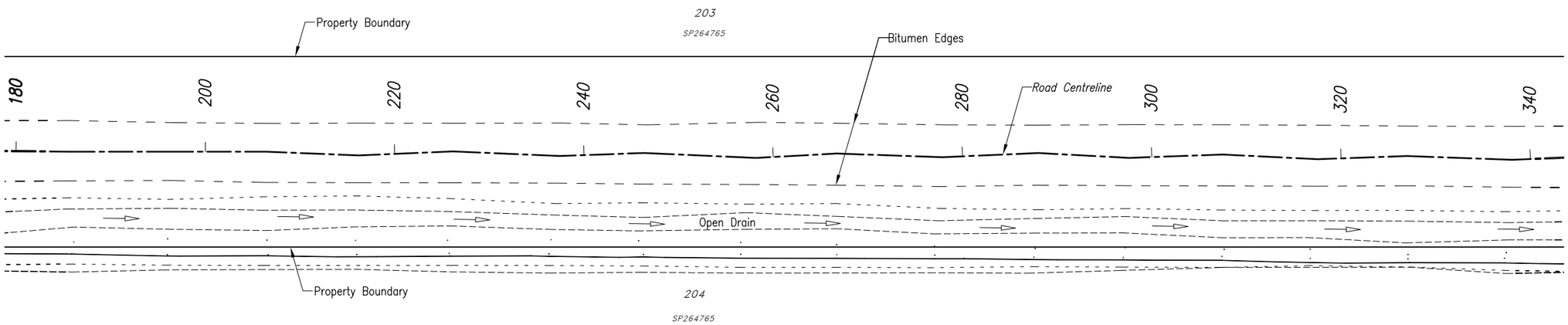
TITLE
TYPICAL SECTION

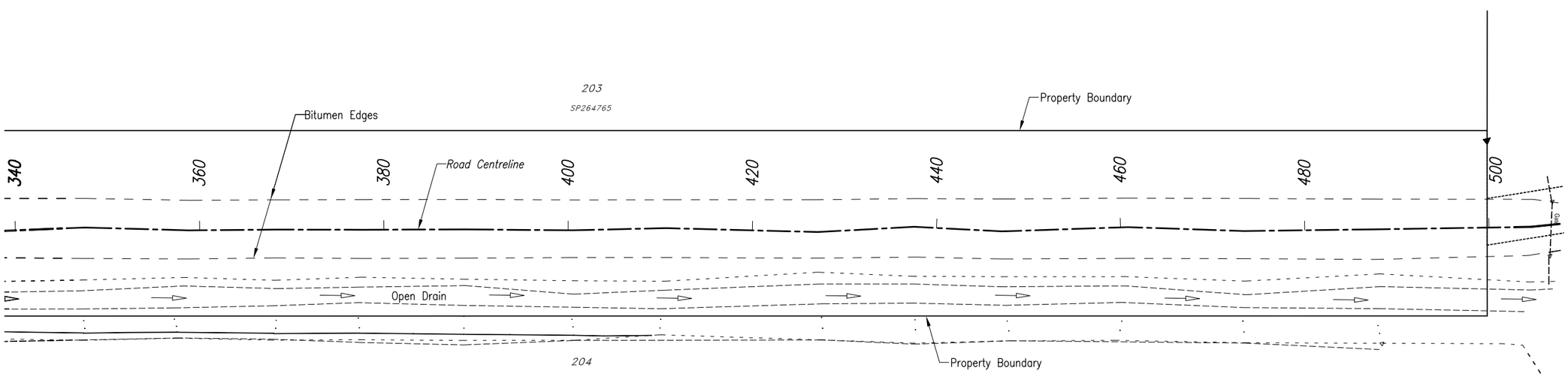
SCALE (A1 FULL SIZE)
NOT TO SCALE

PROJECT NO.
109-2021

DRAWING NO.
C01 A







NOTES

1. Surveyed F Stanaway 17/11/2021.
2. Level Datum AHD.
3. Level Origin PM 106410 RL5.453.
4. Coordinates GDA2020.
5. Origin PM 45007.

2.5 0 5 10m
1 : 250 FULL SIZE A1

ISSUE	DATE	DESCRIPTION / APPROVED USE		DRAWN	APP'D
A	30/11/21	FOR APPROVAL		TWV	PD

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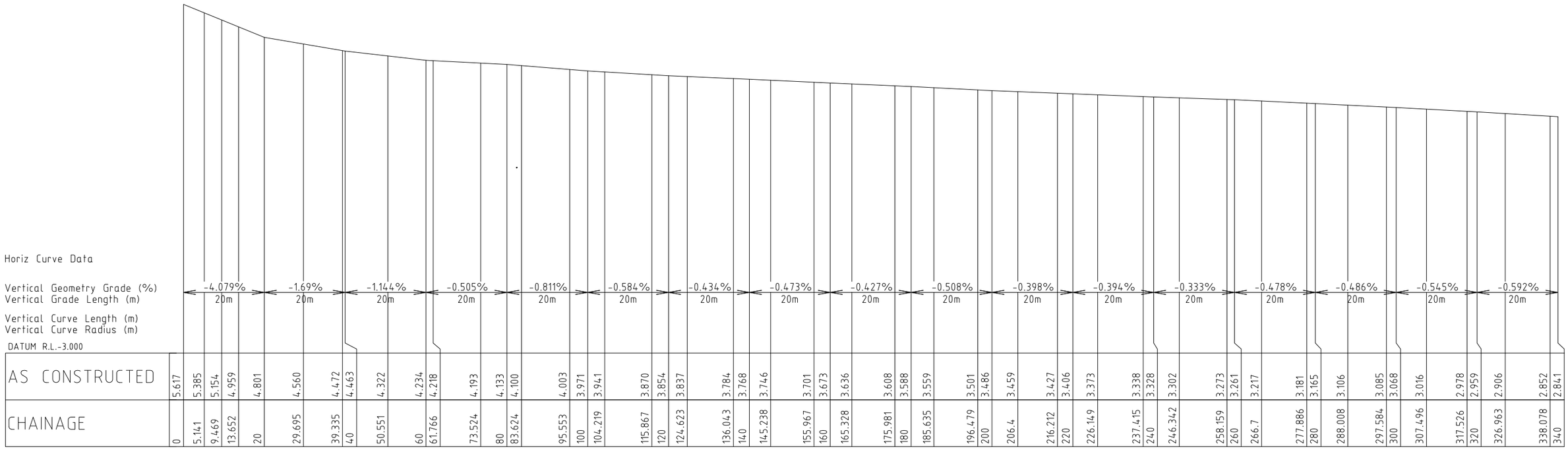
PROJECT
ACCESS ROAD TO KILLALOE PRAWN FARM
AS CONSTRUCTED DETAILS

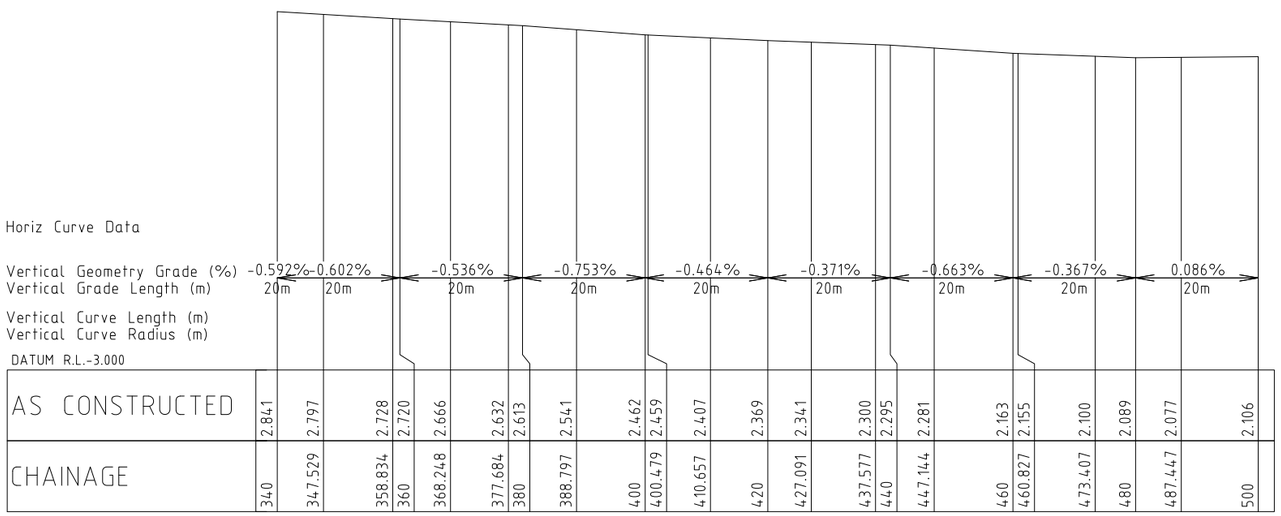
FOR
MAINSTREAM AQUACULTURE

TITLE
LAYOUT

SCALE (A1 FULL SIZE)
1 : 250

PROJECT NO. 109-2021
DRAWING NO. C02 A





HORIZONTAL SCALE 5 0 10 20m
1 : 500 FULL SIZE A1

VERTICAL SCALE 0.5 0 1 2m
1 : 50 FULL SIZE A1

ISSUE	DATE	DESCRIPTION / APPROVED USE		DRAWN	APP'D
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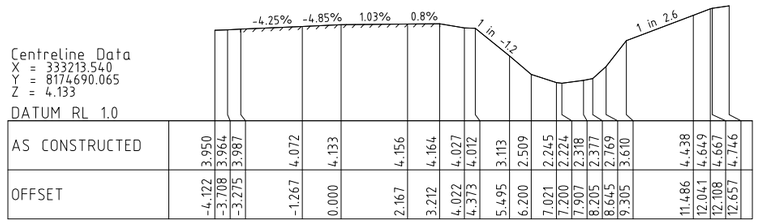
PROJECT
ACCESS ROAD TO KILLALOE PRAWN FARM
AS CONSTRUCTED DETAILS

FOR
MAINSTREAM AQUACULTURE

TITLE
LONGITUDINAL SECTION
ALONG ROAD CENTRELINE

SCALE (A1 FULL SIZE)
AS SHOWN

PROJECT NO. 109-2021
DRAWING NO. C03 A

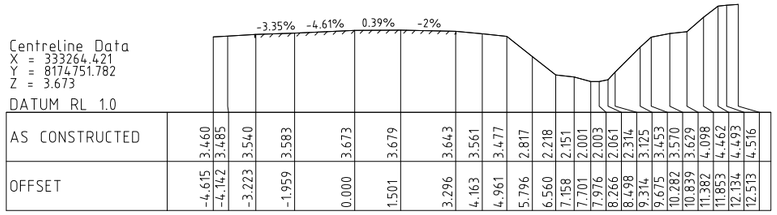


Centreline Data
X = 333213.540
Y = 8174690.065
Z = 4.133

DATUM RL 1.0

AS CONSTRUCTED	3.950	3.964	3.987	4.072	4.133	4.156	4.164	4.027	4.012	3.113	2.509	2.245	2.224	2.318	2.377	2.769	3.610	4.438	4.649	4.667	4.746				
OFFSET	-4.122	-3.708	-3.275	-1.267	0.000	2.167	3.212	4.022	4.373	5.495	6.200	7.021	7.200	7.907	8.205	8.645	9.305	11.486	12.041	12.108	12.657				

CHAINAGE 80.000



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Y = 8174751.782
Z = 3.673

DATUM RL 1.0

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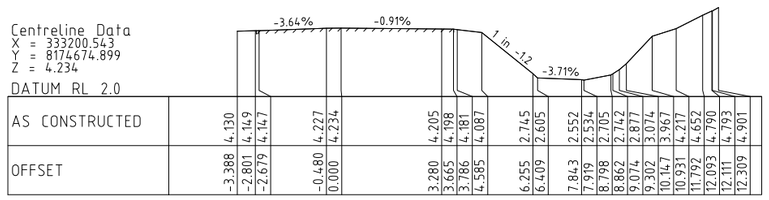
OFFSET	-4.615	-4.142	-3.223	-1.959	0.000	1.501	3.296	4.163	4.961	5.796	6.560	7.158	7.701	7.976	8.266	8.498	9.314	9.675	10.282	10.839	11.382	11.853	12.134	12.513	

CHAINAGE 160.000



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Y = 8174674.899
Z = 4.234

DATUM RL 2.0

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OFFSET	-3.388	-2.801	-2.679	-0.480	0.000	3.280	3.665	3.786	4.585	6.255	6.409	7.843	7.919	8.798	8.862	9.074	9.302	10.147	10.931	11.792	12.093	12.111	12.309		

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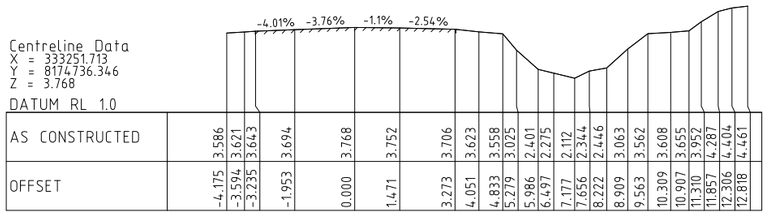

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Y = 8174736.346
Z = 3.768

DATUM RL 1.0

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OFFSET	-4.175	-3.594	-3.235	-1.953	0.000	1.471	3.273	4.051	4.833	5.279	5.986	6.497	7.177	7.656	8.222	8.909	9.563	10.309	10.907	11.310	11.857	12.306	12.818		

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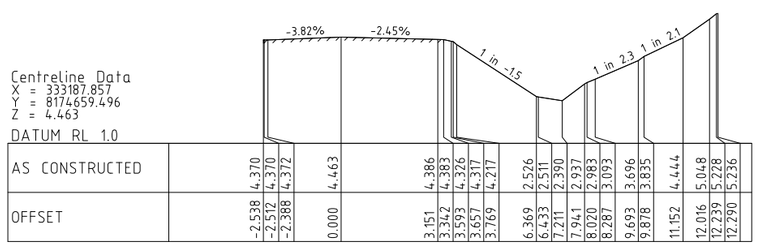

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Z = 4.463

DATUM RL 1.0

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OFFSET	-2.538	-2.512	-2.388	0.000	3.151	3.342	3.593	3.657	3.769	6.369	6.433	7.211	7.941	8.020	8.287	9.693	9.878	11.152	12.016	12.239	12.290				

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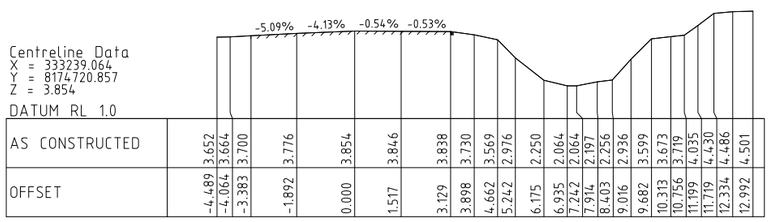

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Y = 8174720.857
Z = 3.854

DATUM RL 1.0

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OFFSET	-4.489	-4.064	-3.383	-1.892	0.000	1.517	3.129	3.898	4.662	5.242	6.175	6.935	7.242	7.914	8.403	9.016	9.682	10.313	10.756	11.199	11.719	12.334	12.992		

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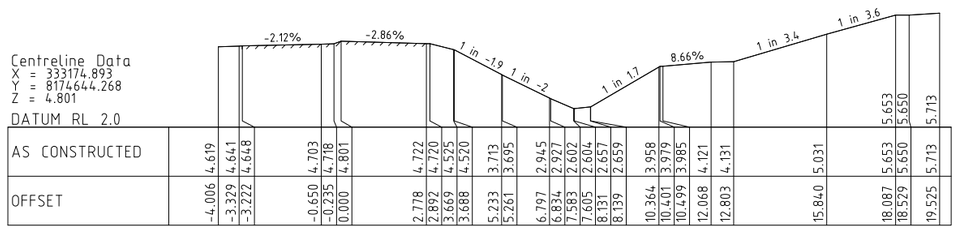

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OFFSET	-4.006	-3.329	-3.222	-0.650	-0.235	0.000	2.778	2.892	3.669	3.688	5.233	5.261	6.797	6.834	7.583	7.605	8.131	8.139	10.364	10.401	10.499	12.068	12.803	15.840	18.087	18.529	19.525		

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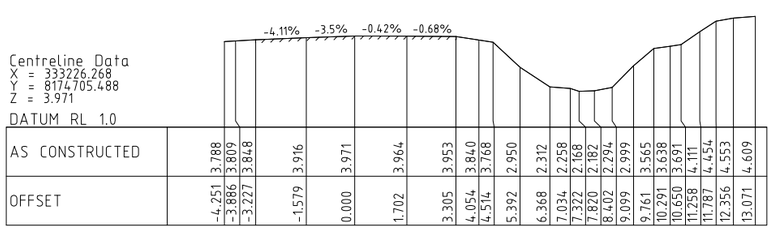

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DATUM RL 1.0

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OFFSET	-4.251	-3.886	-3.227	-1.579	0.000	1.702	3.305	4.054	4.514	5.392	6.368	7.034	7.322	7.820	8.402	9.099	9.761	10.291	10.650	11.258	11.787	12.356	13.071		

CHAINAGE 100.000

1 0 1 2 3 4 5m
1 : 100 FULL SIZE A1

ISSUE	DATE	DESCRIPTION / APPROVED USE		DRAWN	APP'D
A	30/11/21	FOR APPROVAL		TWV	PD

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RPEQ 5412

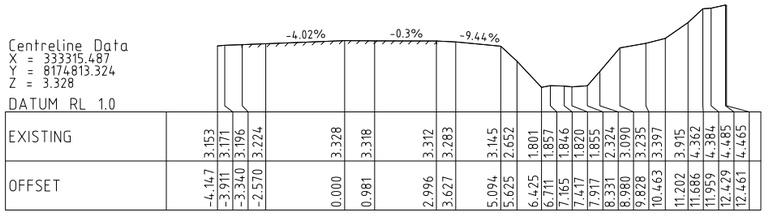
PROJECT
ACCESS ROAD TO KILLALOE PRAWN FARM
AS CONSTRUCTED DETAILS

FOR
MAINSTREAM AQUACULTURE

TITLE
CROSS SECTIONS
ALONG ROAD CENTRELINE
(20 - 160)

SCALE (A1 FULL SIZE)
1 : 100

PROJECT NO. 109-2021
DRAWING NO. C04 A



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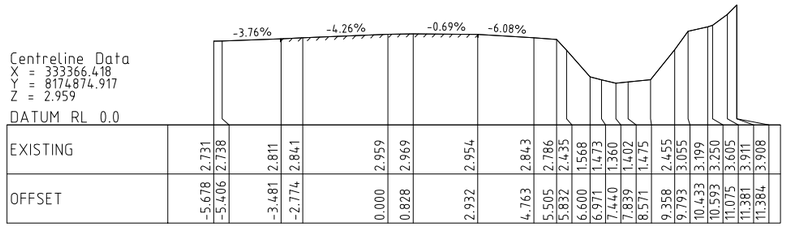

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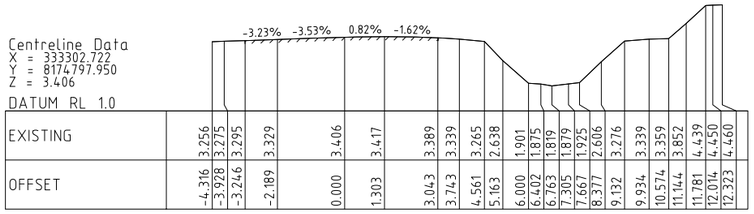

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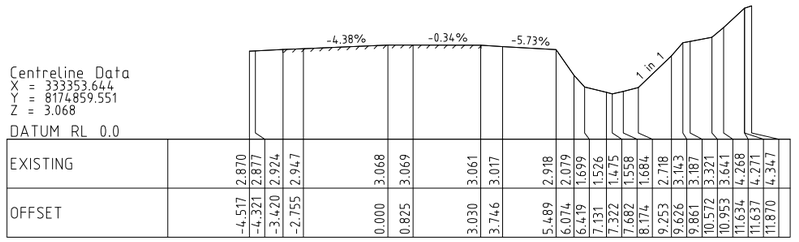

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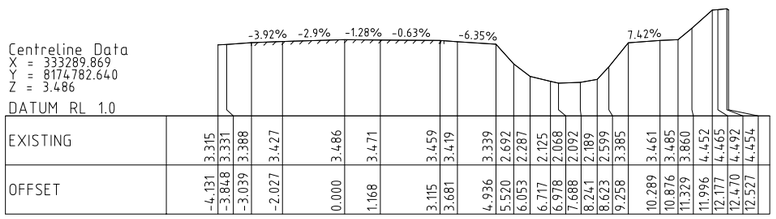

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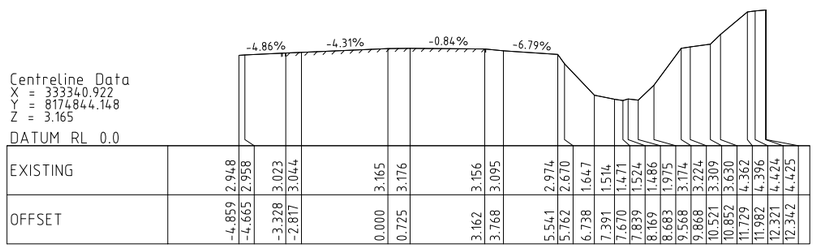

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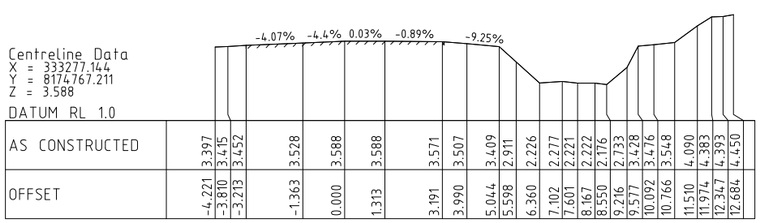

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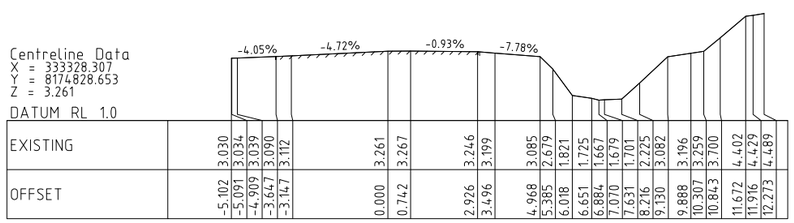

CHAINAGE 260.000

1 0 1 2 3 4 5m
1 : 100 FULL SIZE A1

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RECS CONSULTING ENGINEERS
ABN 95 081 197 006
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RPEQ 5412

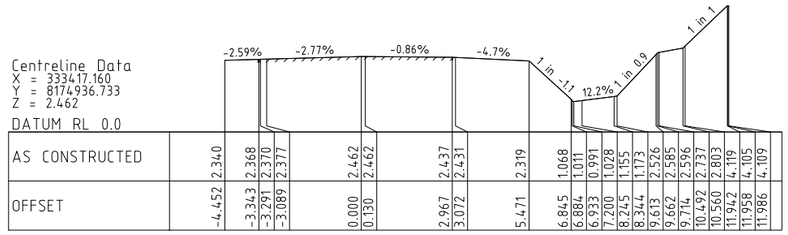
PROJECT
ACCESS ROAD TO KILLALOE PRAWN FARM
AS CONSTRUCTED DETAILS

FOR
MAINSTREAM AQUACULTURE

TITLE
CROSS SECTIONS ALONG ROAD CENTRELINE
(180 - 320)

SCALE (A1 FULL SIZE)
1 : 100

PROJECT NO. 109-2021
DRAWING NO. C05 A



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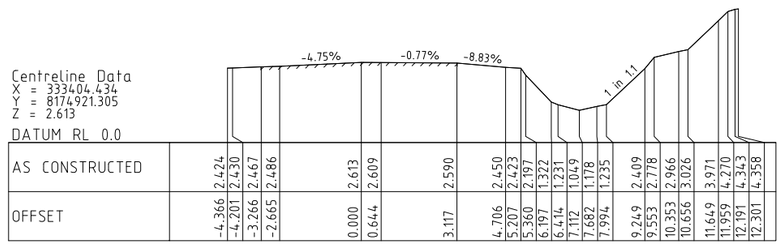

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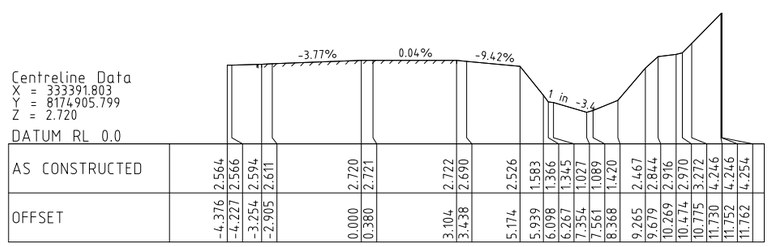

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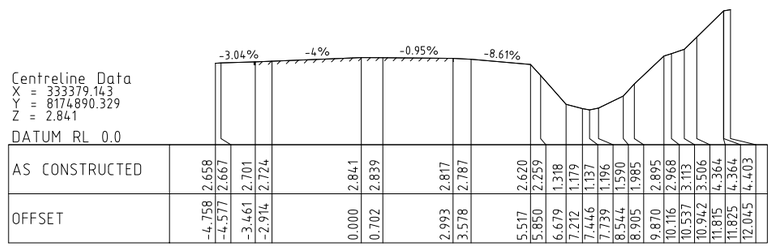

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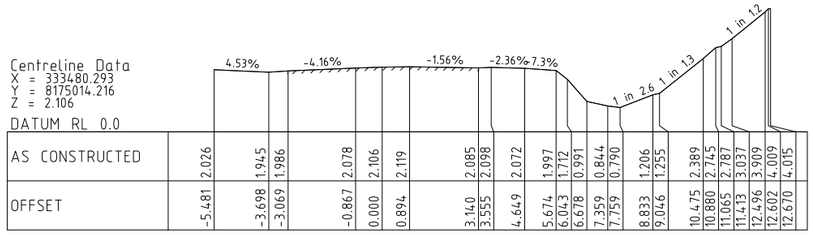

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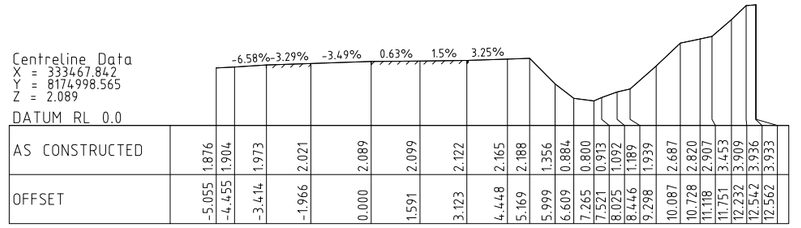

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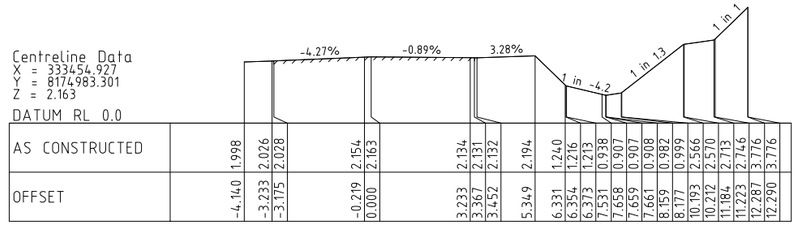

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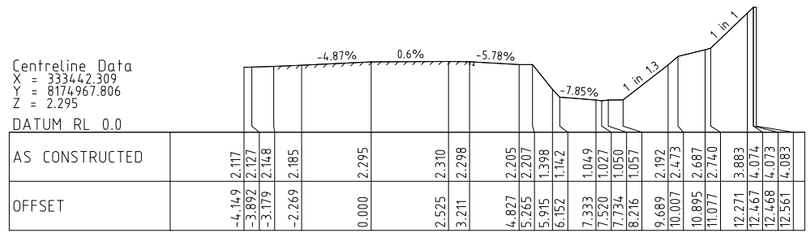

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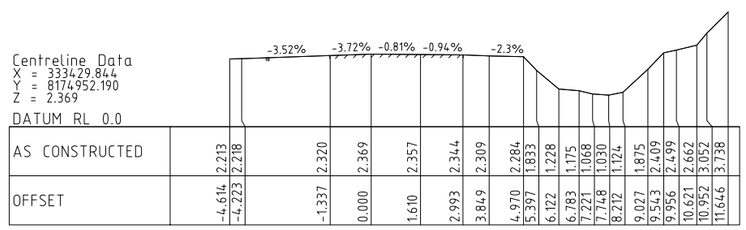

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ISSUE	DATE	DESCRIPTION / APPROVED USE		DRAWN	APP'D
A	30/11/21	FOR APPROVAL		TWV	PD

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RPEQ 5412

PROJECT
ACCESS ROAD TO KILLALOE PRAWN FARM
AS CONSTRUCTED DETAILS

FOR
MAINSTREAM AQUACULTURE

TITLE
CROSS SECTIONS
ALONG ROAD CENTRELINE
(340 - 500)

SCALE (A1 FULL SIZE)
1 : 100

PROJECT NO. 109-2021
DRAWING NO. C06 A

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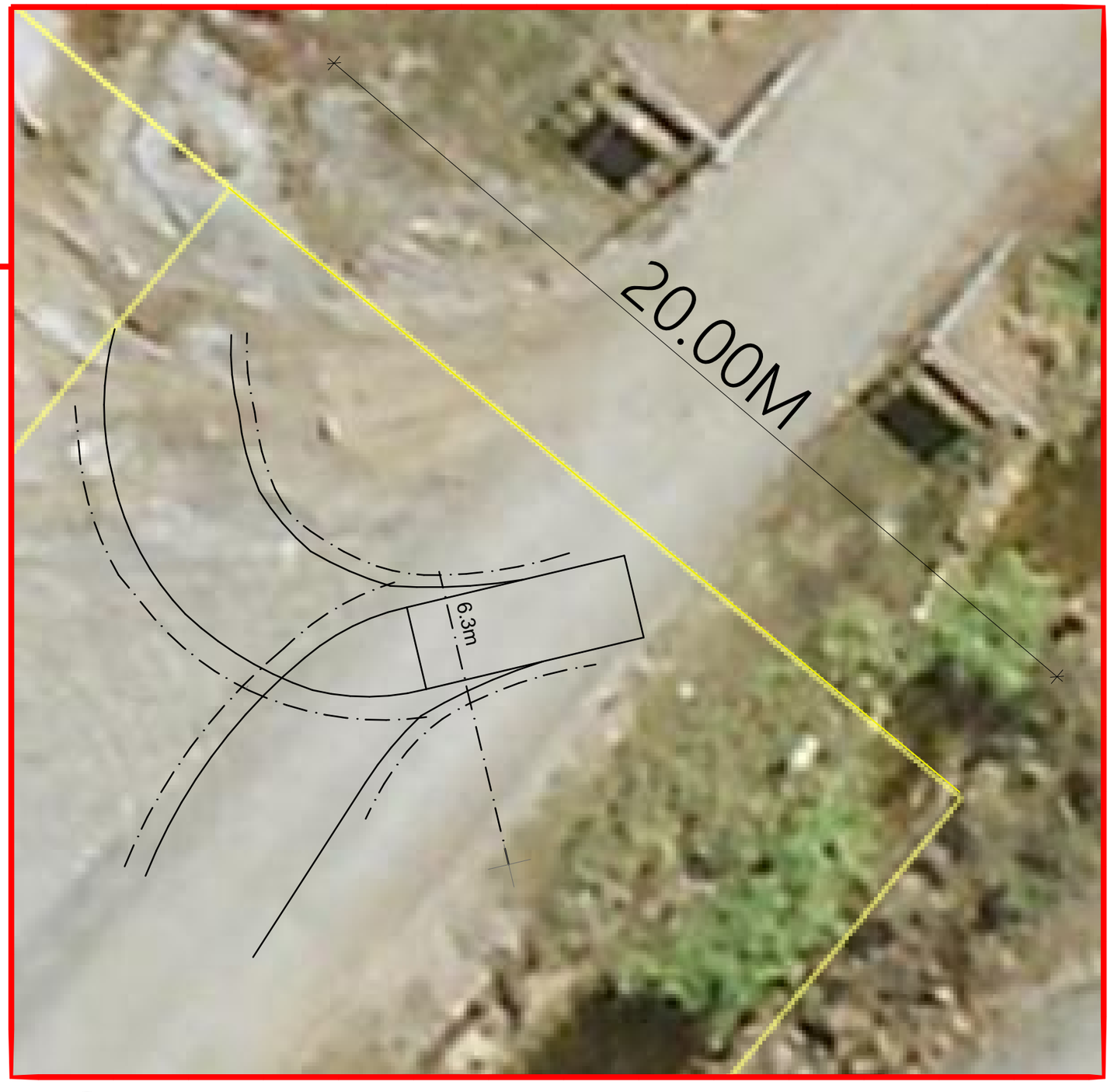

2 TURNING AREA
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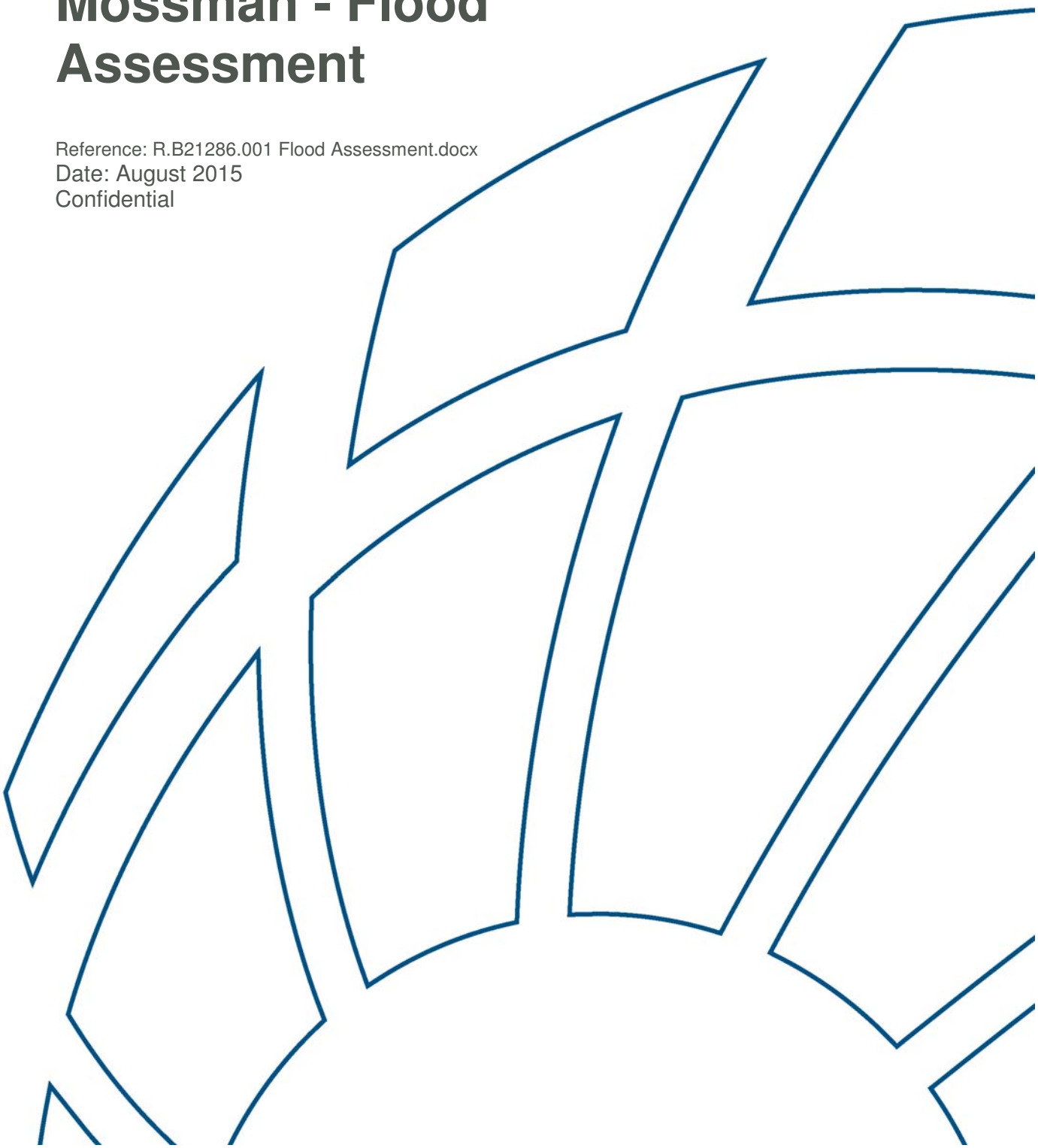
Project MAINSTREAM SITE Location 6458 CAPTAIN COOK HIGHWAY, KILLALOE Client MAINSTREAM AQUACULTURE Project No. 109-2021		RECS CONSULTING ENGINEERS & BUILDING DESIGNERS RPEQ No.5412 QBCC No.1106533 RECS PTY.LTD., SHOP 22 / LEVEL 2, SALTWATER BUILDING 26-30 MACROSSAN STREET, PO BOX 894, PORT DOUGLAS QLD 4877, P: 07 4099 6010 E: ADMIN@RECS.NET.AU ABN:95081197006	CONTRACTORS AND SUBCONTRACTORS MUST VERIFY DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK OR PREPARING SHOP DRAWINGS. USE WRITTEN DIMENSIONS ONLY. COPYRIGHT OF THIS DRAWING OR DESIGN IS HELD BY THE DESIGNER. RECS CONSULTING ENGINEERS. NO PART OF THIS DRAWING OR DESIGN MAY BE REPRODUCED IN ANY FORM WITHOUT THE WRITTEN CONSENT OF THE DESIGNER. THE BUILDER AND SUB CONTRACTORS ARE RESPONSIBLE FOR ARRANGING & COSTS OF ANY NECESSARY INSPECTIONS OF THE WORKS AND OBTAINING ANY NECESSARY COMPLIANCE OR CERTIFICATION DOCUMENTATION. DO NOT SCALE DRAWINGS	ISSUE A TURNING AREA 29-10-2021 ISSUE B ISSUE C ISSUE D ISSUE E DESIGNED BY: TB CHECKED BY: PD PROJECT STATUS : FOR ENGINEERING TURNING AREA	SHEET SK 1 REVISION PRINT DATE 29/10/2021

BMT WBM

Proposed Prawn Farm Expansion, Mossman - Flood Assessment

Reference: R.B21286.001 Flood Assessment.docx
Date: August 2015
Confidential



Proposed Prawn Farm Expansion, Mossman - Flood Assessment

Prepared for:	Gold Coast Marine Aquaculture
Prepared by:	BMT WBM Pty Ltd (Member of the BMT group of companies)

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Document:	R.B21286.001 Flood Assessment.docx
Title:	Proposed Prawn Farm Expansion, Mossman - Flood Assessment
Project Manager:	Neil Collins
Author:	Ian Clark
Client:	Gold Coast Marine Aquaculture
Client Contact:	c/- Gassman Development Perpectives
Client Reference:	
Synopsis:	

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	24/08/15	IQC			

DISTRIBUTION

Destination	Revision										
	0	1	2	3	4	5	6	7	8	9	10
Gold Coast Marine Aquaculture Gassman Development Perpectives BMT WBM File BMT WBM Library	1										

Contents

List of Figures

List of Tables

1 Introduction

This report has been prepared by BMT WBM PTY LTD to provide details into flooding and flood impacts associated with a proposed expansion of the existing Gold Coast Marine Aquaculture farm located at Mossman, Queensland.

BMT WBM was commissioned by Gold Coast Marine Aquaculture (GCMA) to prepare a flooding and flood impacts assessment for the site based on a proposed design layout to support an MCU application for a two stage expansion and an ROL application for a boundary relocation associated with a proposed expansion of the existing GCMA Mossman farm, North Queensland.

This investigation details the use of two-dimensional flood modelling to establish the current flood levels for the site, assess floodplain modifications associated with the proposed expansion to achieve the desired 100 year flood immunity for the site as well as minimising adverse off site impacts.

2 Site Description and Proposal

2.1 Location

The site is located within the Douglas Shire Council area, to the north-east of the Captain Cook Highway. The existing farm is located at Lot 201 SP222765 and is situated on the coastal floodplain of Packers Creek, just west of the Port Douglas peninsula in Northern Queensland.

The site locality is shown in Figure 2-1.

The existing site extends over an area of approximately 54 hectares. The Stage 1 site area is approximately 24 ha and the Stage 2 area is approximately 7.3 ha

2.1.1 Existing Site

The site is located downstream of the Captain Cook Highway on the edge of the mangrove lined tidal estuary, Dixon Inlet. Typical elevations in the Inlet are less than 1m AHD, with existing prawn farm ponds elevated at around 2-4m AHD. Upstream of the highway, the topography rises to over 300m AHD over a distance less that 2km. The steep escarpment is densely vegetated. Runoff from the steeper upper catchment is collected into swales to be drained under the highway through a series of culverts.

2.1.2 Proposed Development

The Stage 1 proposed expansion is located on Lot 8 NR153 whilst the proposed Stage 2 component of the expansion is located on a portion of Lot 7 RP846941.

Design plans for the proposed Prawn Farm expansion were provided by Mortons Urban Solutions. It is proposed that the development will be completed in the stages, as shown on Figure 2-2. This report details the flood impacts associated with the construction of Stages 1 and 2.

Title:

Site Location

Figure: 2-1

Rev: A

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N

0 1.25 2.5km

Approx. Scale

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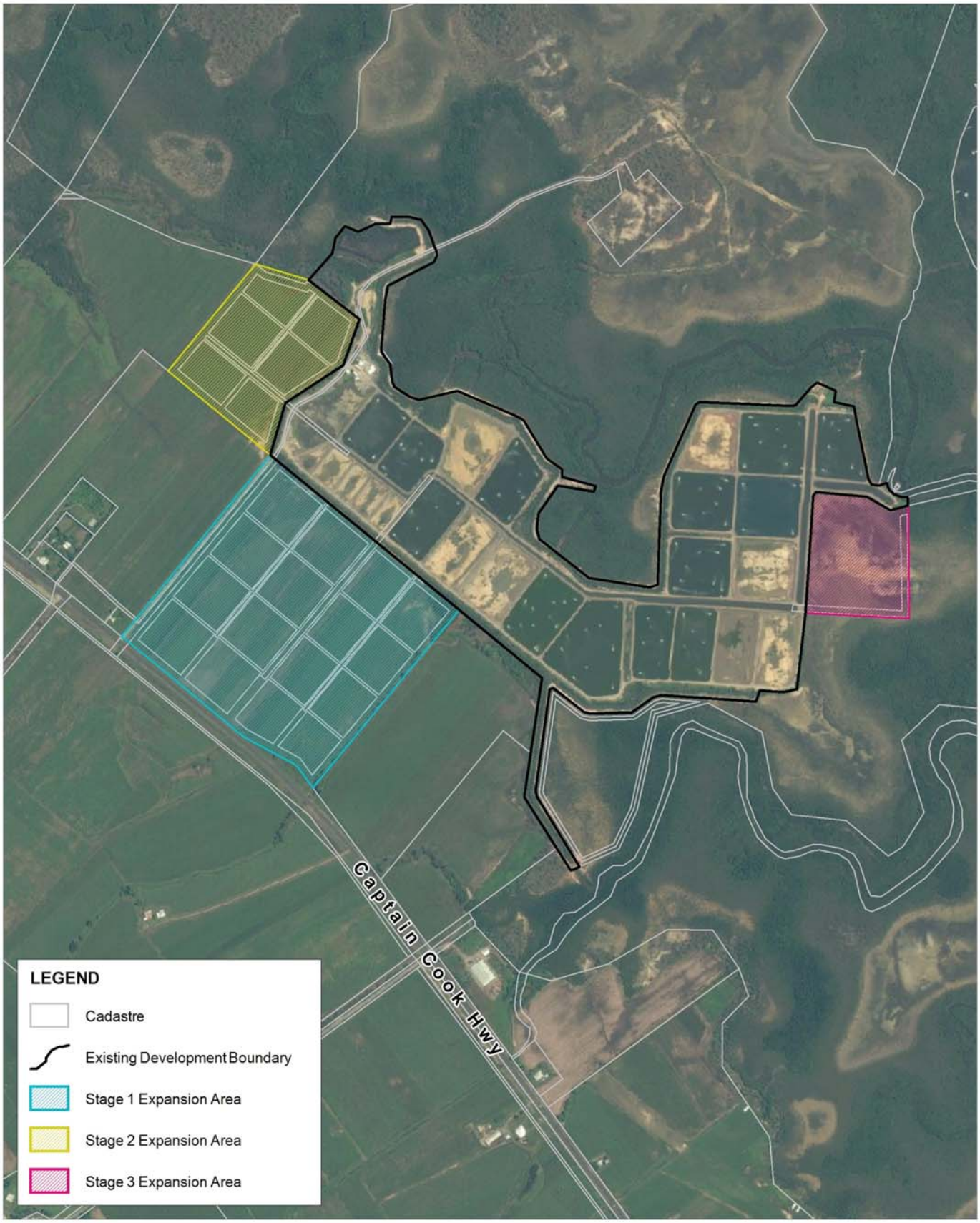

Title:

Proposed Development Layout

Figure: 2-2

Rev: A

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3 Flood Impacts Assessment

3.1 Methodology

To summarise the approach used to conduct this investigation BMT WBM adopted the following methodology:

- Establish a Digital Terrain Model (DEM) of the site and surrounding catchment based on current LIDAR and site specific survey;
- Establish a RAFTS hydrologic model of the catchment to assess run characteristics of the catchment to the site;
- Run the RAFTS model for a range of ARI flood events and durations to enable the extraction of boundary conditions for the hydraulic flood model;
- Construct a TUFLOW two-dimensional (2D) hydraulic flood model encompassing the site and surrounds to enable modelling of the existing site and the proposed farm extension.
- Run the TUFLOW model for a range of flood events to establish baseline flood characteristics for the site;
- Incorporate the proposed development in to the TUFLOW model;
- Run the model to assess potential impacts on peak water levels; and
- Carry out design refinements where necessary to mitigate any adverse offsite impacts.

3.2 Hydrological Model

Runoff-routing software XP-RAFTS was used to generate flow hydrographs for each sub catchment. The model predicts the amount of runoff from rainfall and the attenuation of the flood wave as it travels down the catchment. This process is dependent on catchment area, slope and vegetation; variation in distribution, intensity and amount of rainfall; and antecedent conditions of the catchment.

For design events, rainfall depths are usually determined by the estimation of intensity-frequency-duration (IFD) design rainfall curves for the catchment. Standard procedures for derivation of these curves are defined in AR&R (2001). Table 1 shows design rainfall intensities for the study area for a range of design events.

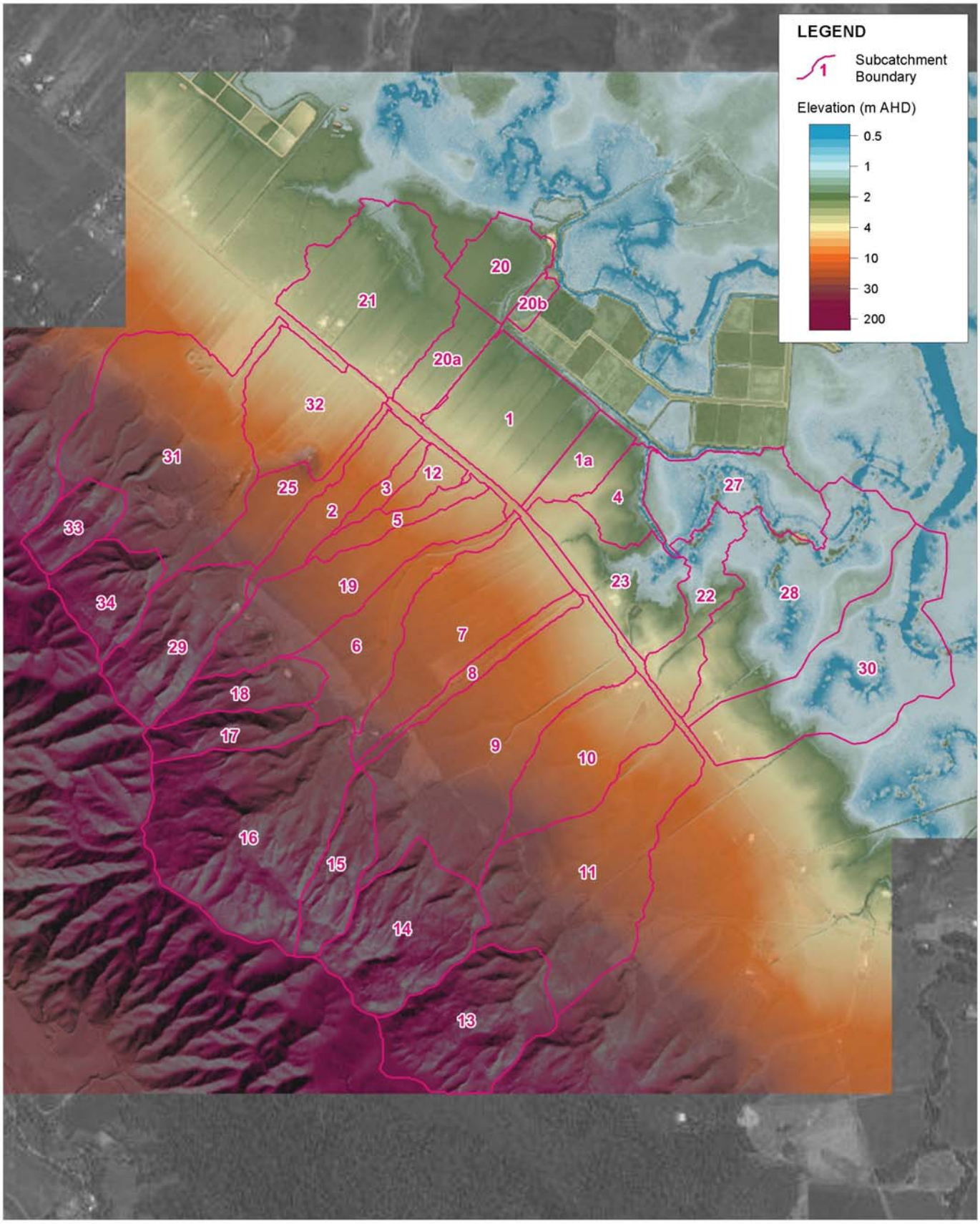
Table 1 Average Design Rainfall Intensities

Duration (hrs)	Design Rainfall (mm/hr)			
	10% AEP	5% AEP	2% AEP	1% AEP
1	82.5	93.1	107	118
2	57.1	65	75.5	83.5
3	45.7	52.4	61.4	68.4
6	31.1	36.2	43.2	48.7
12	21.3	25.1	30.5	34.7
24	14.7	17.5	21.4	24.5

Similarly AR&R defines standard temporal patterns for use in design flood estimation as well as guidance on appropriate initial and continuing losses. For this study, design temporal pattern Zone 3 was and an initial loss of 10mm and continuing loss of 2.5mm/hr were selected in accordance with AR&R recommendations for catchments in Northern Queensland.

The RAFTS sub catchment layout is presented in Figure 3-1.

Design storms were ran for a range of durations – 2hr, 6hr, 9hr and 12hr. Peak flood conditions across the site resulted from various durations, however all peak water level conditions were within around 5mm at the site. More significant differences were noted downstream where volume of runoff becomes more significant in driving peak flood levels, as opposed to peak flow rates. All results presented in this report are for 2 hour duration events.



Title:

Hydrologic Model Layout

Figure: 3-1

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3.3 Hydraulic Model

3.3.1 Topography, Model Layout and Extents

The ability of the model to provide an accurate representation of the flow distribution on the floodplain ultimately depends upon the quality of the underlying topographic model. Topographical data available for this study includes 2010 LiDAR survey and site survey provided by Gassman Development Perspectives.

With consideration to the available survey information and local topographical and hydraulic controls, a 2D model was developed extending from Dixon Inlet at the downstream limit, to upstream of the Captain Cook Highway. The model boundary was extended sufficient distance downstream from the site so flood behaviour at the site would not be influenced.

A TUFLOW 2D model resolution of 4m was adopted for the study area. Drainage channels across the site are typically at least 6m wide. It should be noted that TUFLOW samples elevation points at the cell centres, mid-sides and corners, so a 4m cell size results in DEM elevations being sampled every 2m. The 4m grid resolution appropriately represented of drainage capacity without resulting in excessive computational run times. Sensitivity testing indicated that the 4m resolution model produced comparable flood results to a modelled using a 2m resolution.

Figure 3-2 shows the existing site model topography whilst Figure 3-3 shows the existing TUFLOW model layout and extent.

To assess the proposed prawn farm extension, design tins of the proposed earthworks were provided by MUS and incorporated in to the TUFLOW model based on the same 4m grid resolution.

Figure 3-4 shows the developed site model topography whilst Figure 3-5 shows the developed TUFLOW model layout and extent.

3.3.2 Hydraulic Roughness

The development of the TUFLOW model requires the assignment of different hydraulic roughness zones. These zones are delineated from aerial photography and cadastral data identifying different land-uses (e.g. forest, cleared land, roads, urban areas, etc.) for modelling the variation in flow resistance. The adopted model roughness values are presented in Table 2.

Table 2 Adopted Model Roughness Values

Material Description	Model Roughness (Manning's 'n')
Cleared land	0.06
Medium vegetation / Mangrove	0.08
Heavy vegetation (including densely vegetated drainage channels)	0.10
Road reserve	0.03
Creeks / Clear drainage channels	0.04

It was assumed that for the post development condition, all drainage channels within the site boundary were cleaned of dense vegetation. The existing drainage channel along the south eastern site boundary is off-site and was assumed to remain in its existing, heavily vegetated state for the developed scenario.

3.3.3 Boundary Conditions

The catchment runoff is determined through the XP-RAFTS hydrological model and is applied to the TUFLOW model as flow vs. time inputs. The local or total flow hydrographs for each sub catchment are applied directly onto the 2D domain as 'SA' polygons (source of flow vs. time over an area). If all 2D cells within the polygon are dry, the inflow is applied to the lowest cell, otherwise the inflow is distributed equally over the wet cells within the sub catchment Runoff generated from the upper catchment was applied just upstream of the Captain Cook Highway to simulate attenuation of flows behind the highway embankment. Hydraulic inflows downstream of the highway were applied as the local flow hydrographs generated for individual sub catchments.

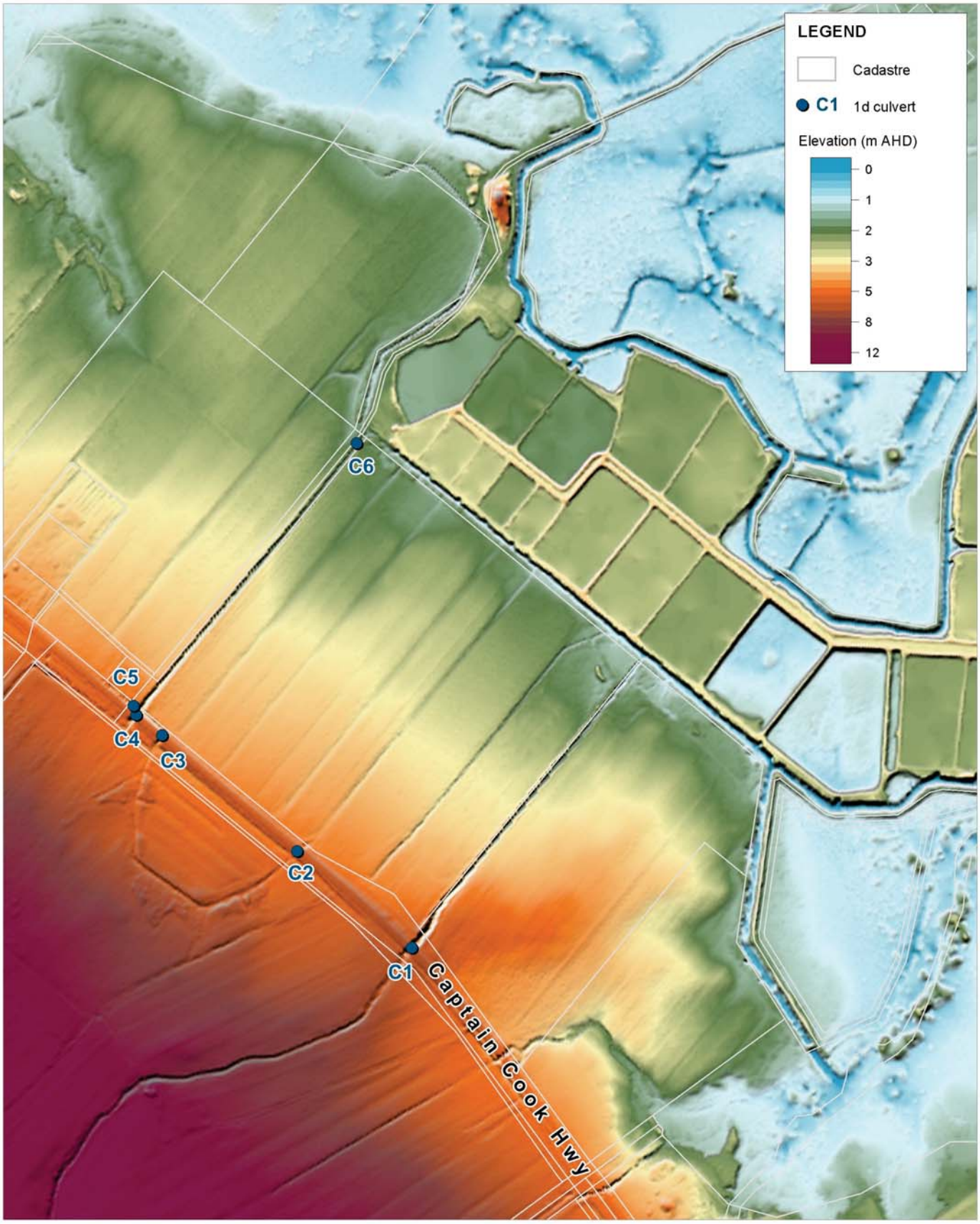
The downstream model limit corresponds to the water level in the ocean. A constant water level boundary of 0.909m AHD was adopted for all model simulations. This corresponds to the Mean High Water Spring (MHWS) level for Port Douglas.

3.3.4 1D Network

Runoff from the upper catchment is drained under the highway and across the site through a series of culverts. Each culvert has been incorporated as a 1D structure within the 2D domain. Table 3 contains the dimensions of the culverts in the vicinity of the study area. The location of the culverts is shown on Figure 3-2. For the developed scenario, it was assumed that culvert C6 would be removed and replaced with a structure of sufficient capacity.

Table 3 Culvert Details

Culvert ID	Dimensions (W x H or Dia, mm)
C1	Two 1900 x 1400 box culverts
C2	Four 1200 x 500 box culverts
C3	Four 1200 x 500 box culverts
C4	One 1200 x 500 box culverts
C5	Two 1900 x 1400 box culverts
C6	One 1200 pipe



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Hydraulic Model Layout - Existing Topography

Figure: 3-2

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Approx. Scale

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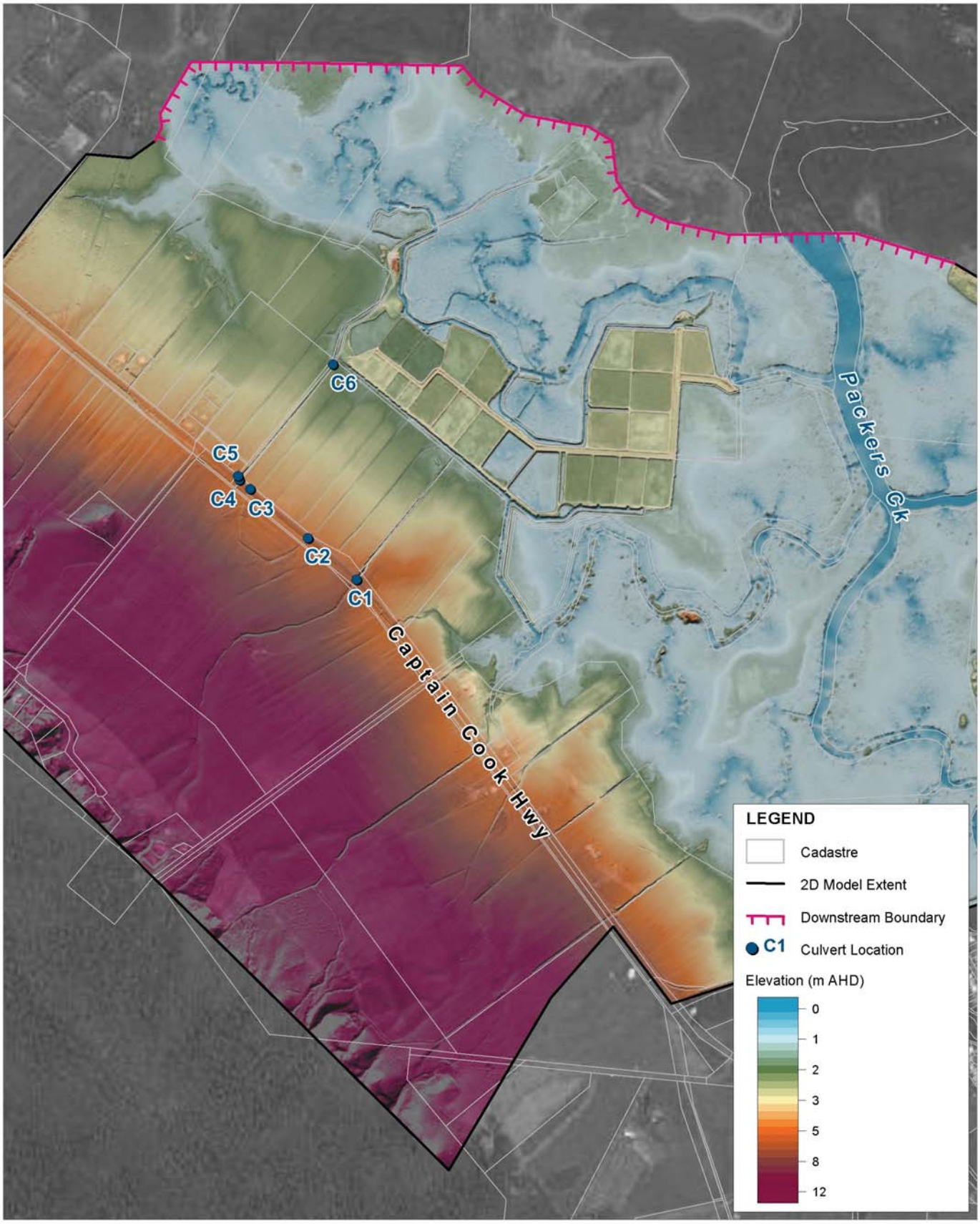

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Hydraulic Model Layout - Existing Topography

Figure: 3-3

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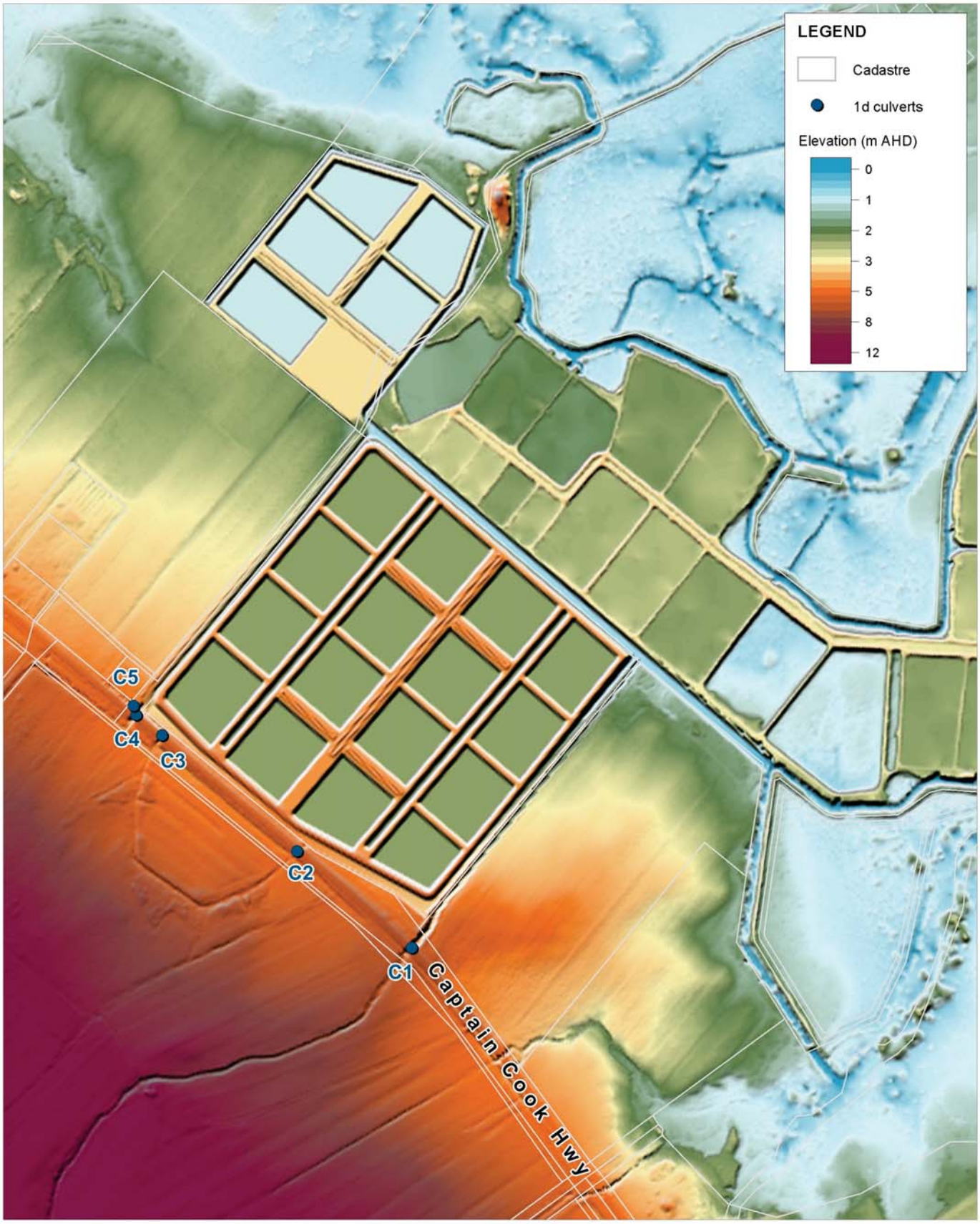

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Hydraulic Model Layout - Developed Scenario

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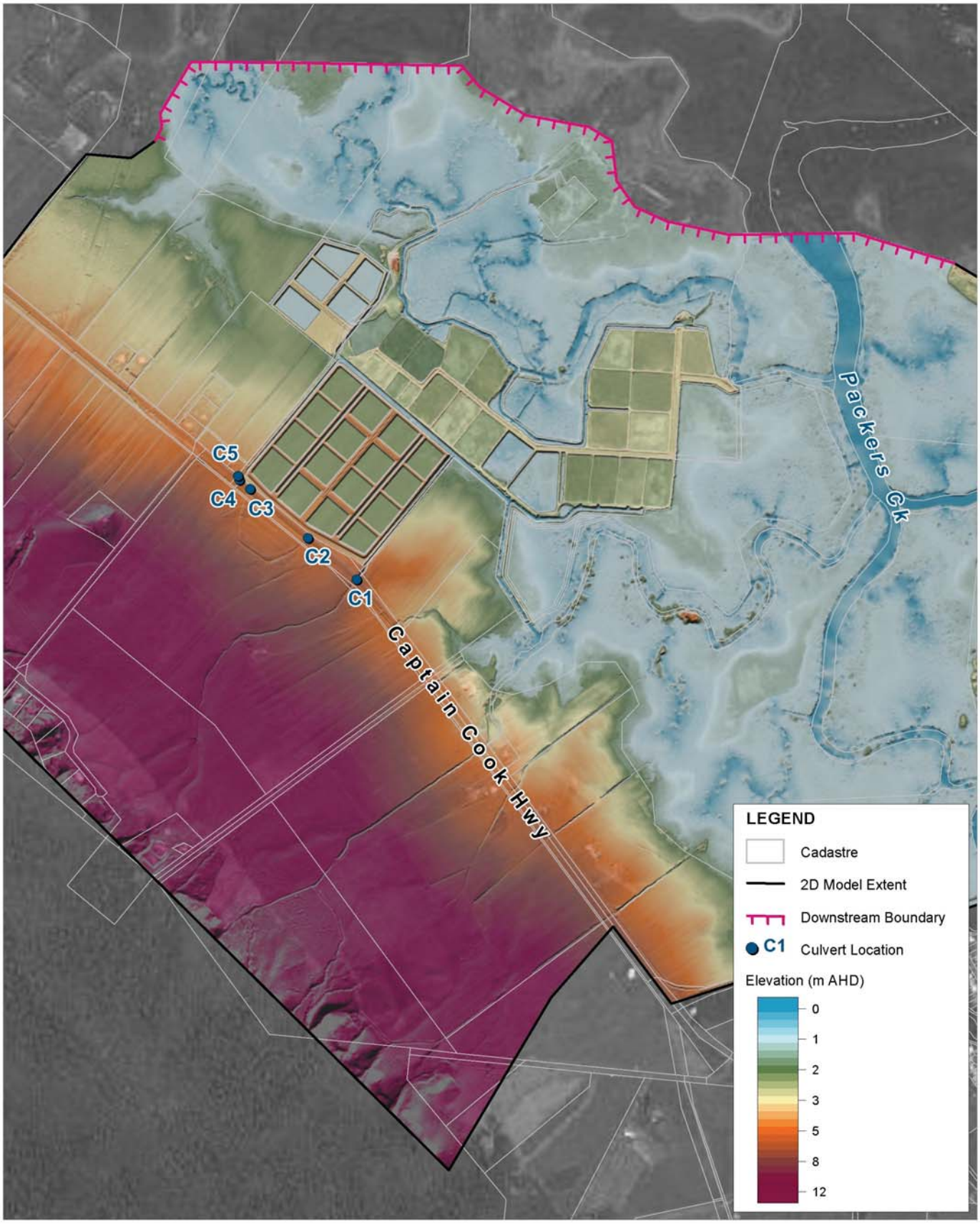

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Hydraulic Model Layout - Developed Scenario

Figure: 3-5

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Approx. Scale

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4 Results

4.1 Existing Situation

Design floods ranging from the 1 year to 100 year ARI storm events were simulated using the model previously described.

Appendix A provides detailed results by way of mapped peak water levels, depths and velocities for the existing site over the full range of ARI flood events.

Figure 4-1 shows the existing peak 100 year flood levels

In summary for the 100 year design flood event, peak water levels range from RL 6.0m AHD upstream of the Captain Cook Highway to approximately RL 2.0m AHD at the outlet discharge location of the farm.

Flow into the site is predominantly governed by the highway culverts from where a series of drains convey the flood flows through the site as well as adjacent properties. Floodplain flow as a result of breakout from these drains is relatively shallow in depth being on the whole less than 300mm.

4.2 Developed Case

Appendix B contains detailed results for the developed site case and provides mapped flood impacts, peak water levels, depths and velocities.

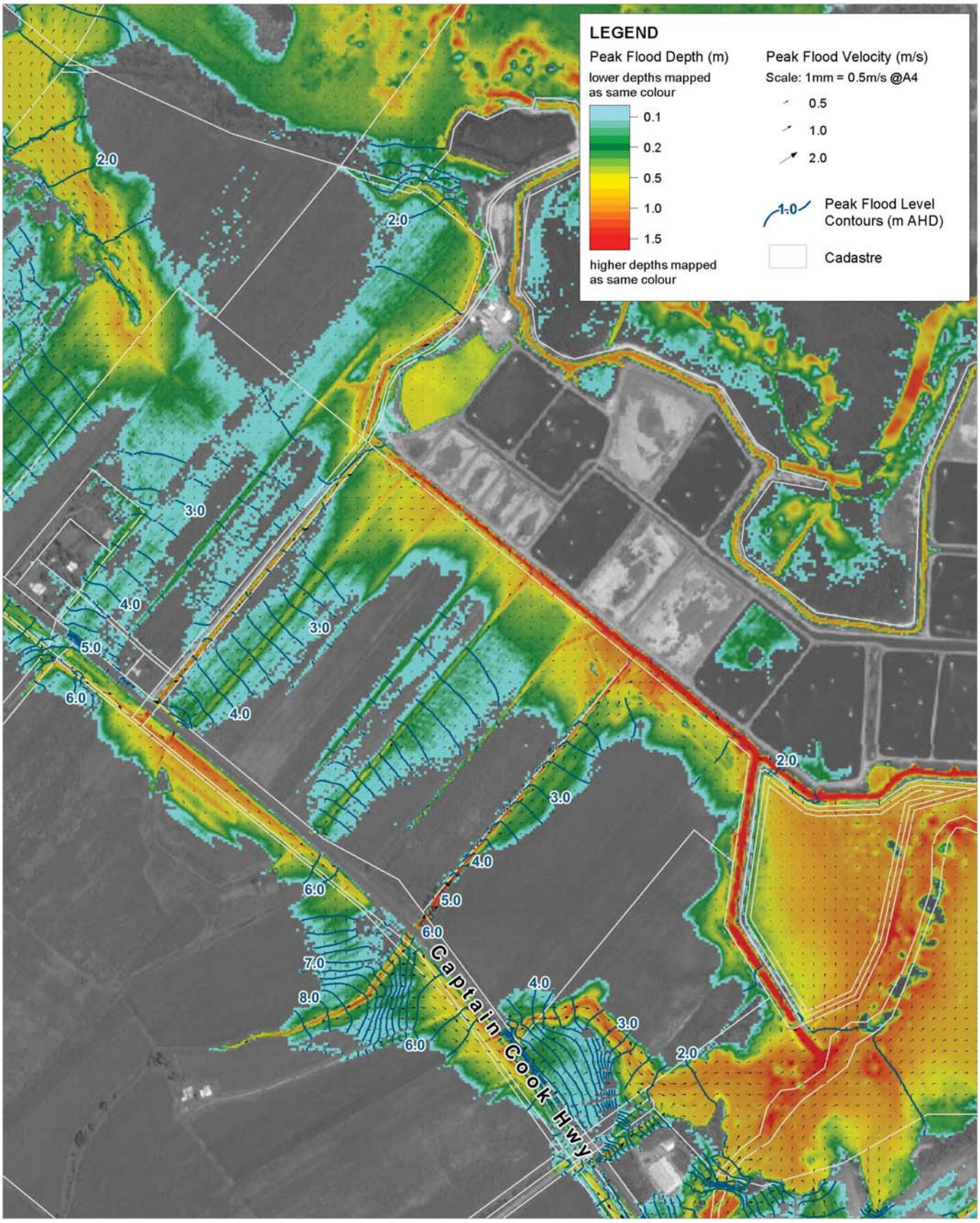
Figure 4-2 presents the peak 100 year ARI flood levels for the developed case.

Predicted flood impacts for the 100 year flood event are presented in Figure 4-3

In summary, the flood impact results for the proposed overall site development demonstrate that that no adverse offsite impacts are predicted to occur for the range of ARI flood events.

The ARI 100 year flood impacts results demonstrate that peak water levels upstream of the Captain Cook Highway are generally reduced as a result of the proposed development. For areas adjacent to the site, impacts are predominantly less than 20mm. The existing drain located at the Stage 1 south-east site boundary shows that impacts are quite confined isolated, occurring over already inundated areas. The impacts observed to the south-east of the farm outlet drain are generally less than 20mm and are situated over already significantly inundated mangrove estuary areas.

Flood impacts for the lower magnitude events show a similar pattern to that of the 100 year flood event with generally reducing level of magnitude.



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1% AEP - Peak Flood Levels, Depths and Velocities Existing Conditions

Figure: 4-1

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Approx. Scale

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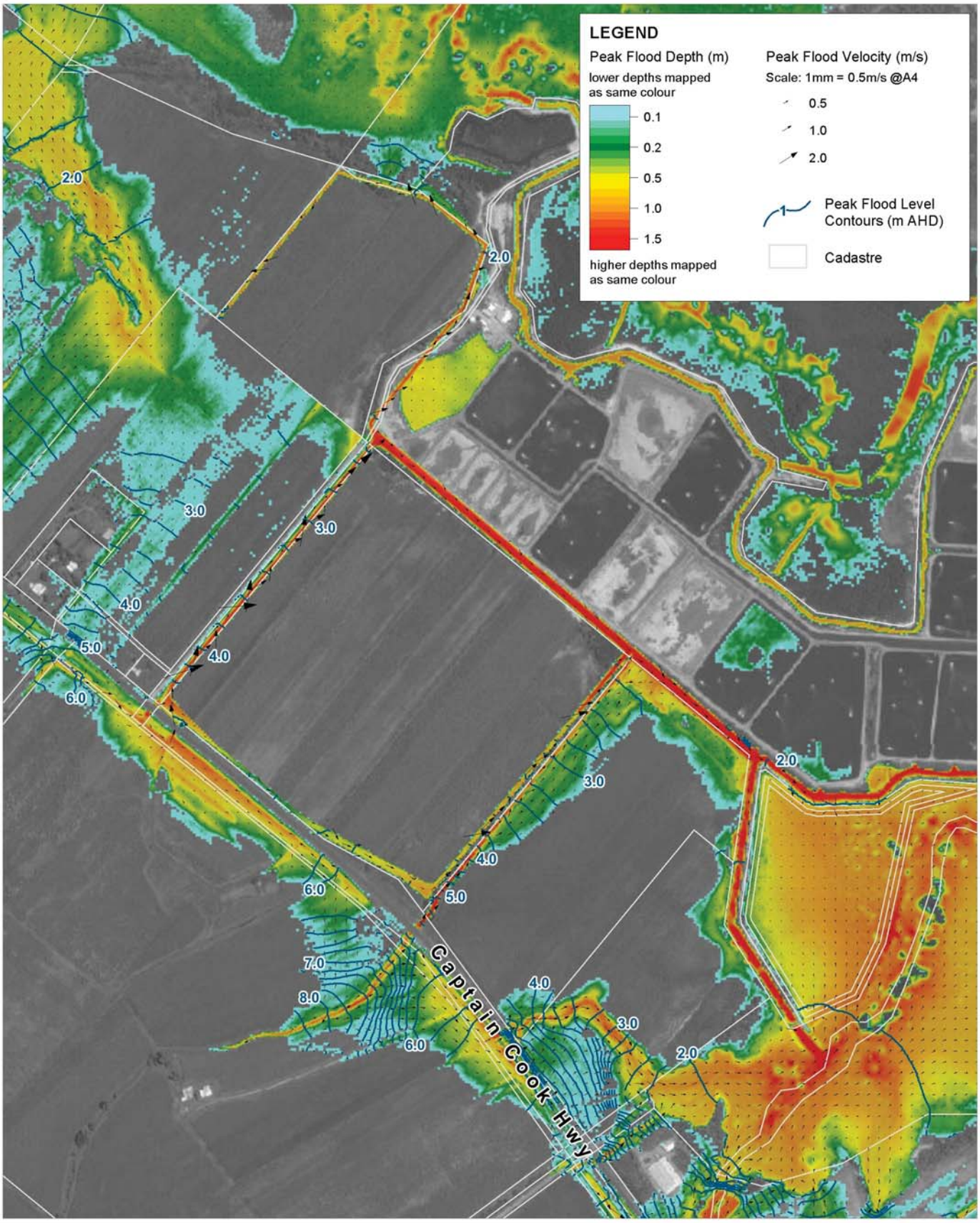

Title:

1% AEP - Peak Flood Levels, Depths and Velocities Developed Scenario

Figure: 4-2

Rev: A

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Approx. Scale

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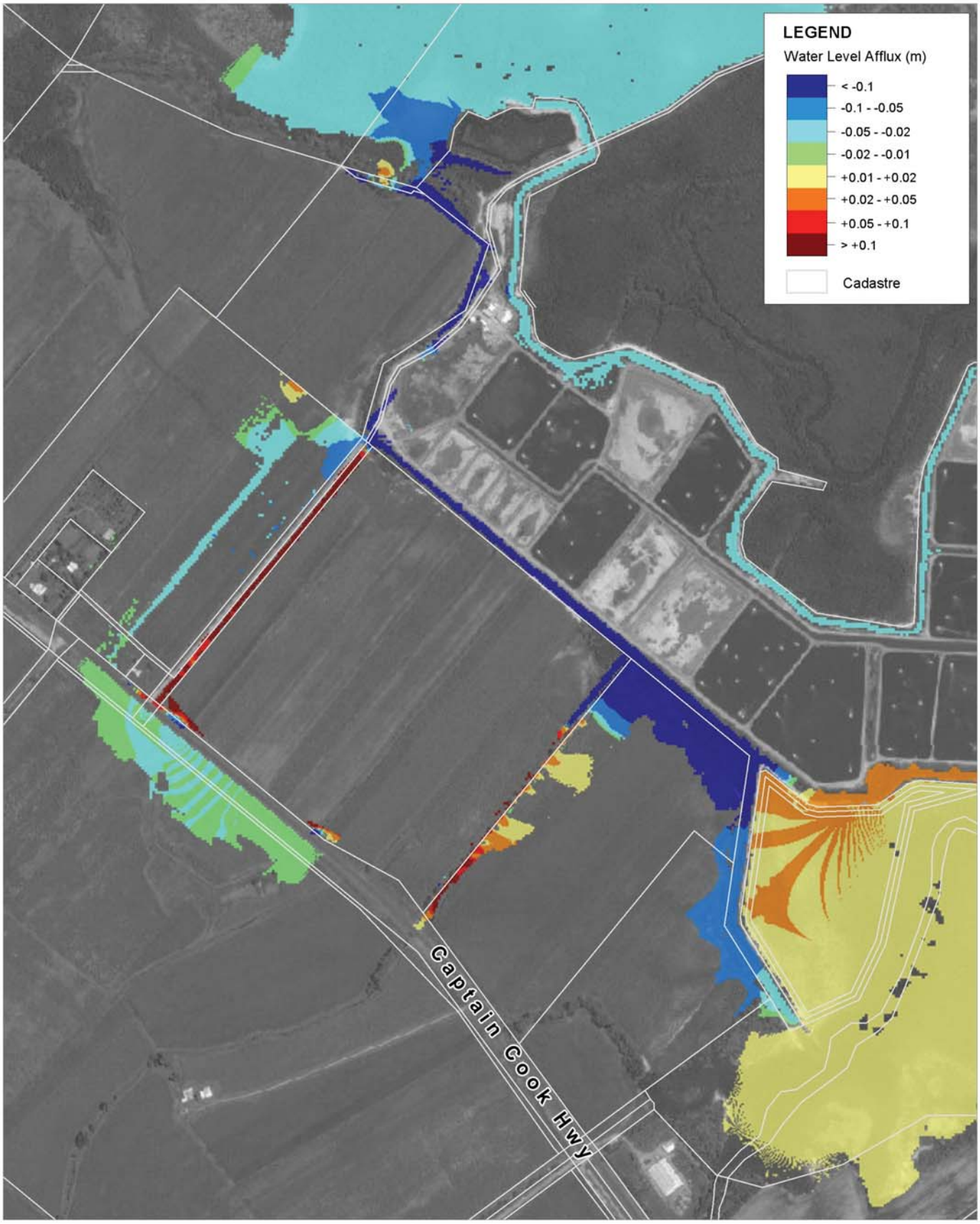

Title:

1% AEP - Peak Flood Level Impact
Developed Scenario minus Existing Conditions

Figure: 4-3

Rev: A

N

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Approx. Scale

BMT WBM

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Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_008_Developed_Q100_WL_Impacts.WOR

5 Conclusions

This report presents a flooding assessment to support an MCU application for a two stage expansion and an ROL application for a boundary relocation associated with a proposed expansion of the existing GCMA Mossman farm, North Queensland.

From the investigations outlined in this report it, can be demonstrated that the proposed prawn farm extension can be developed in the manner provided by Mortons Urban solutions earthworks design, to provide suitable flood immunity resulting in no predicted adverse impacts external to the site.

Minor impacts that are observed external to the site are quite isolated and are located in areas already inundated and/or over existing mangrove estuary areas. Impacts are generally less than 20mm in magnitude. No habitable dwellings or infrastructure are within these areas.

No impacts are predicted at the Captain Cook Highway.

6 Qualifications

This report has been prepared by BMT WBM PTY LTD specifically for Gold Coast Marine Aquaculture (GCMA) and specifically to provide advice on flooding associated with the proposed expansion of the existing Gold Coast Marine Aquaculture farm located at Lot 201 SP222765, Mossman, Queensland.

Our analysis and overall approach has been specifically catered for the particular requirements of Gold Coast Marine Aquaculture, and may not be applicable beyond this scope. For this reason any other third parties are not authorised to utilise this report without further input and advice from BMTWBM.

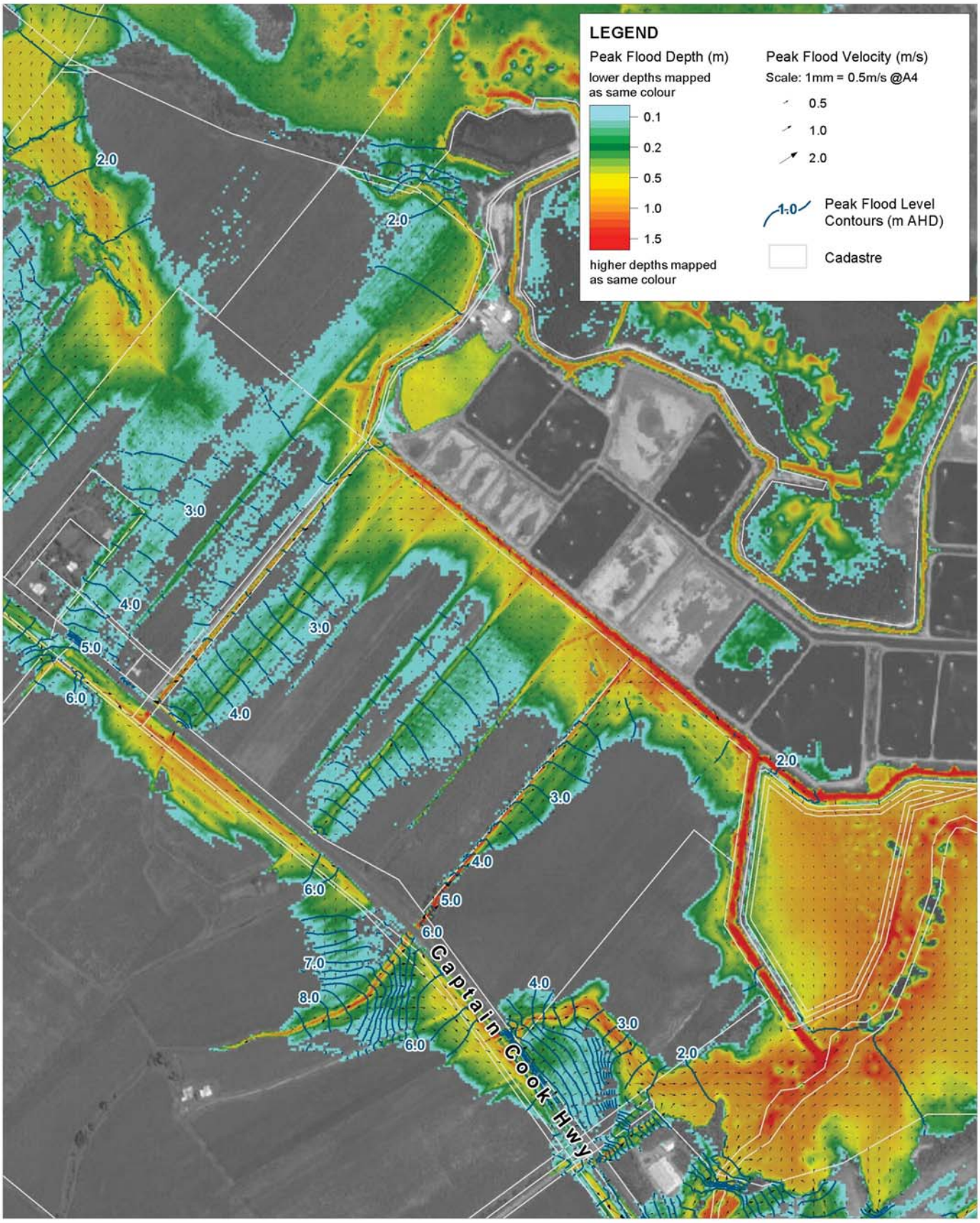
BMTWBM has relied on the following information provided by others:

- 2010 LIDAR DEM provided by Department of Environment and Resource Management
- Site survey supplied by Gassman Development Perspectives
- Developed site proposed ground levels provided by Mortons Urban Solutions

The accuracy of this report is dependent upon the accuracy of this information.

While BMTWBM's report accurately assesses peak flows and flood levels from design storms, it is an ungauged catchment in the vicinity of the site; consequently future observed flows and flood levels may vary from that predicted.

Appendix A Existing Case Model Results



Title:

1% AEP - Peak Flood Levels, Depths and Velocities Existing Conditions

Figure: A-1

Rev: A

N

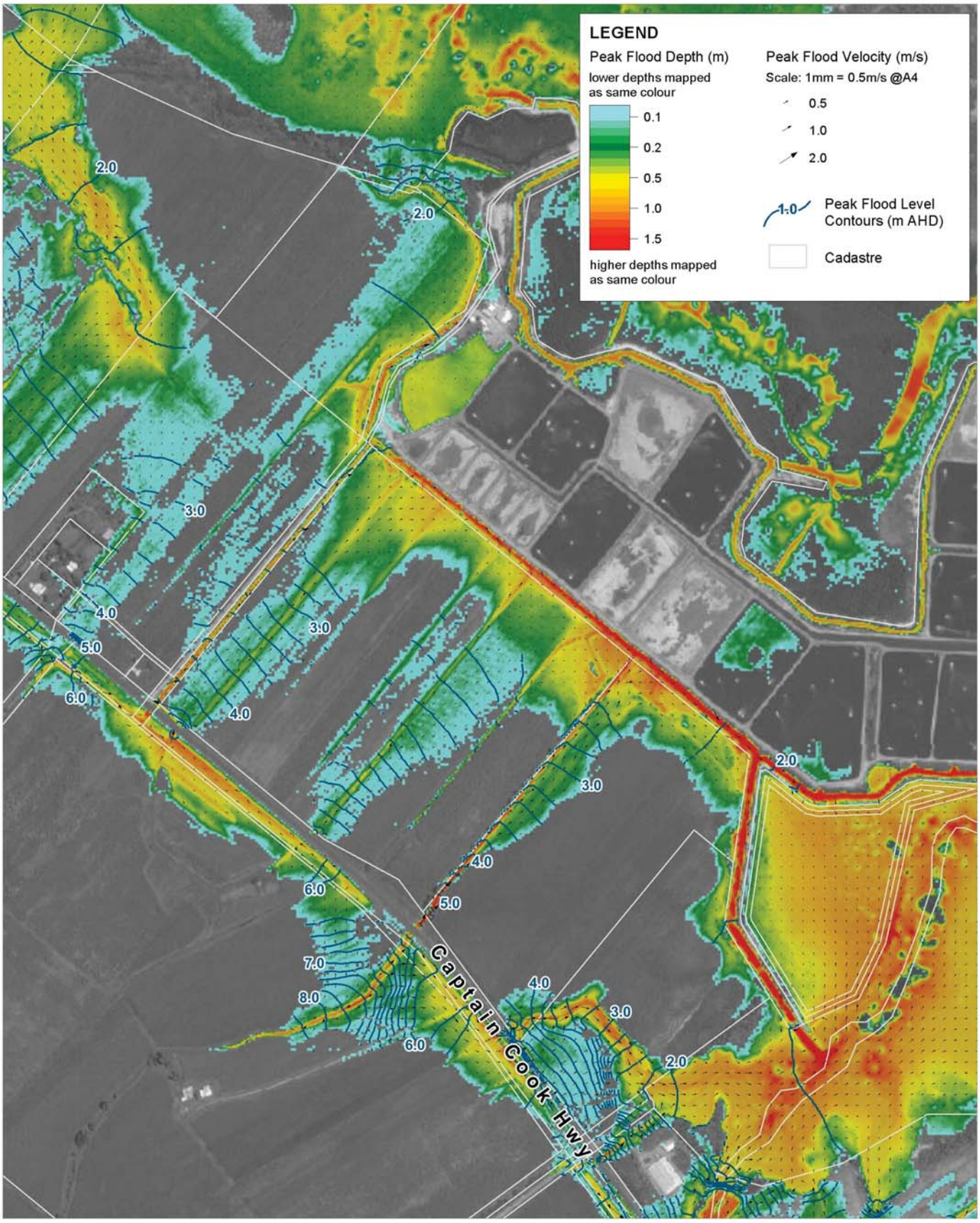
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_006_Existing_Q100_Results.WOR



Title:

2% AEP - Peak Flood Levels, Depths and Velocities Existing Conditions

Figure: A-2

Rev: A

N

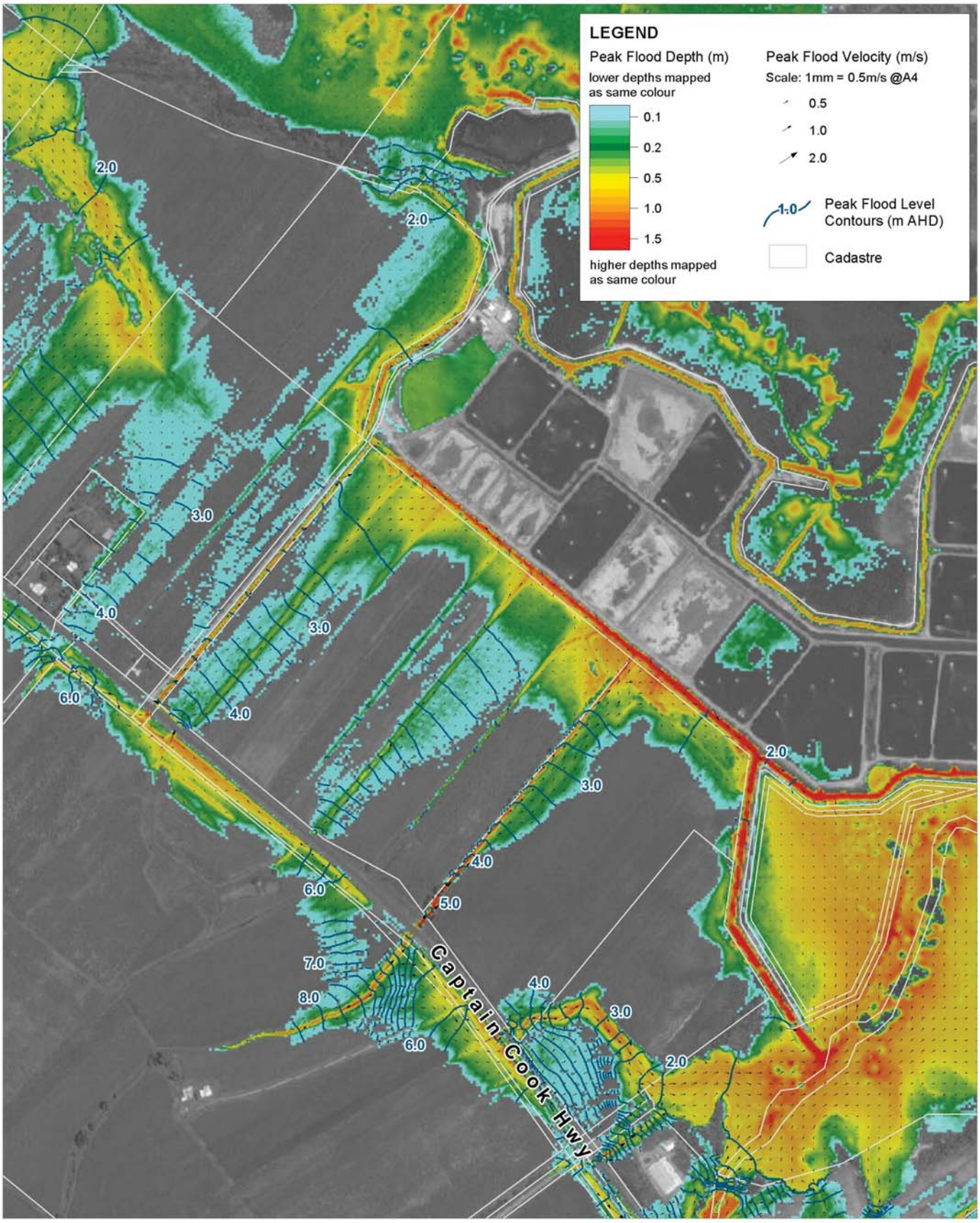
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_009_Existing_Q050_Results.WOR



Title:

5% AEP - Peak Flood Levels, Depths and Velocities Existing Conditions

Figure: A-3

Rev: A

N

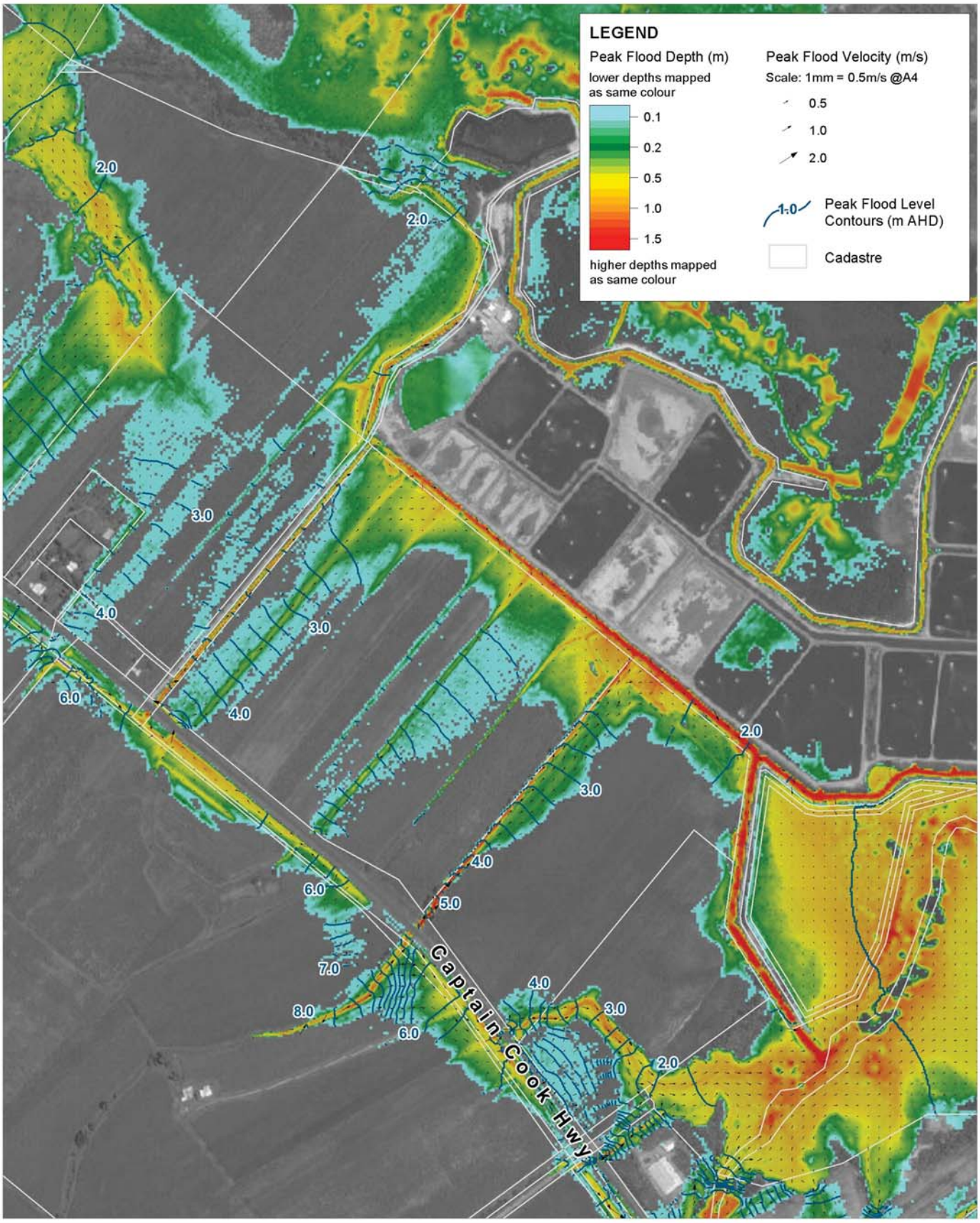
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_012_Existing_Q020_Results.WOR



Title:

10% AEP - Peak Flood Levels, Depths and Velocities Existing Conditions

Figure: **A-4**

Rev: **A**

N

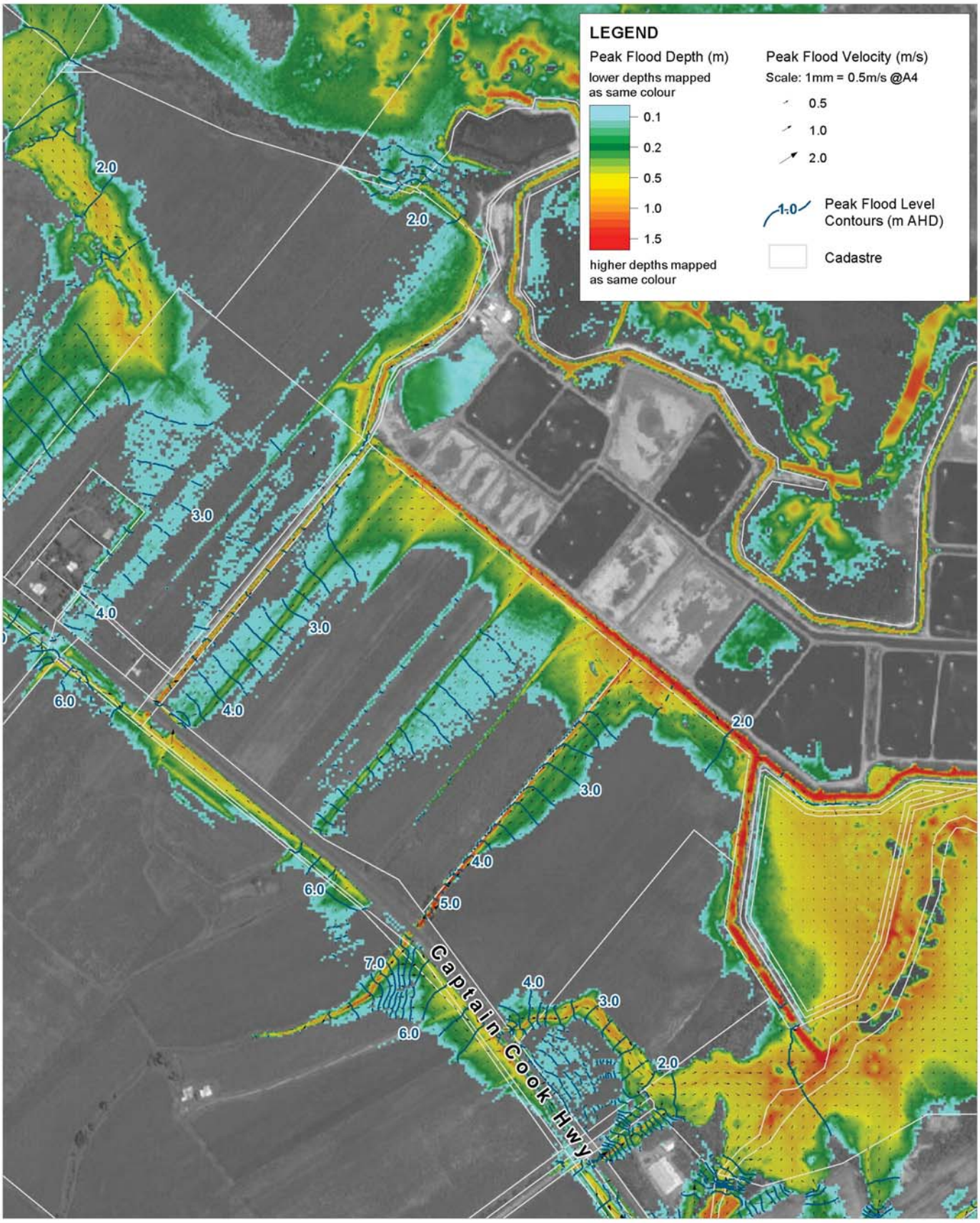
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_015_Existing_Q010_Results.WOR



Title:

20% AEP - Peak Flood Levels, Depths and Velocities Existing Conditions

Figure: A-5

Rev: A

N

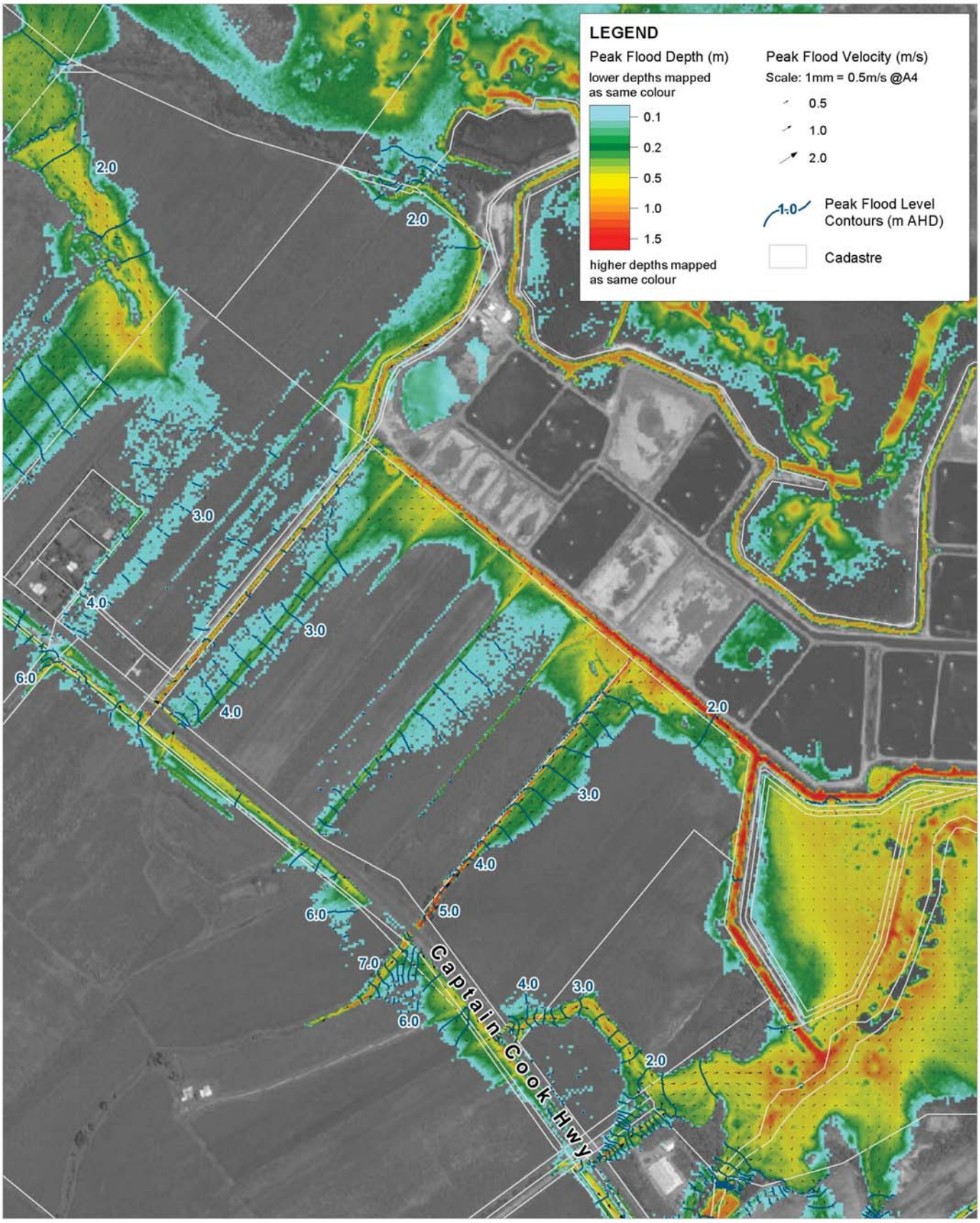
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_018_Existing_Q005_Results.WOR



Title:

50% AEP - Peak Flood Levels, Depths and Velocities Existing Conditions

Figure: A-6

Rev: A

N

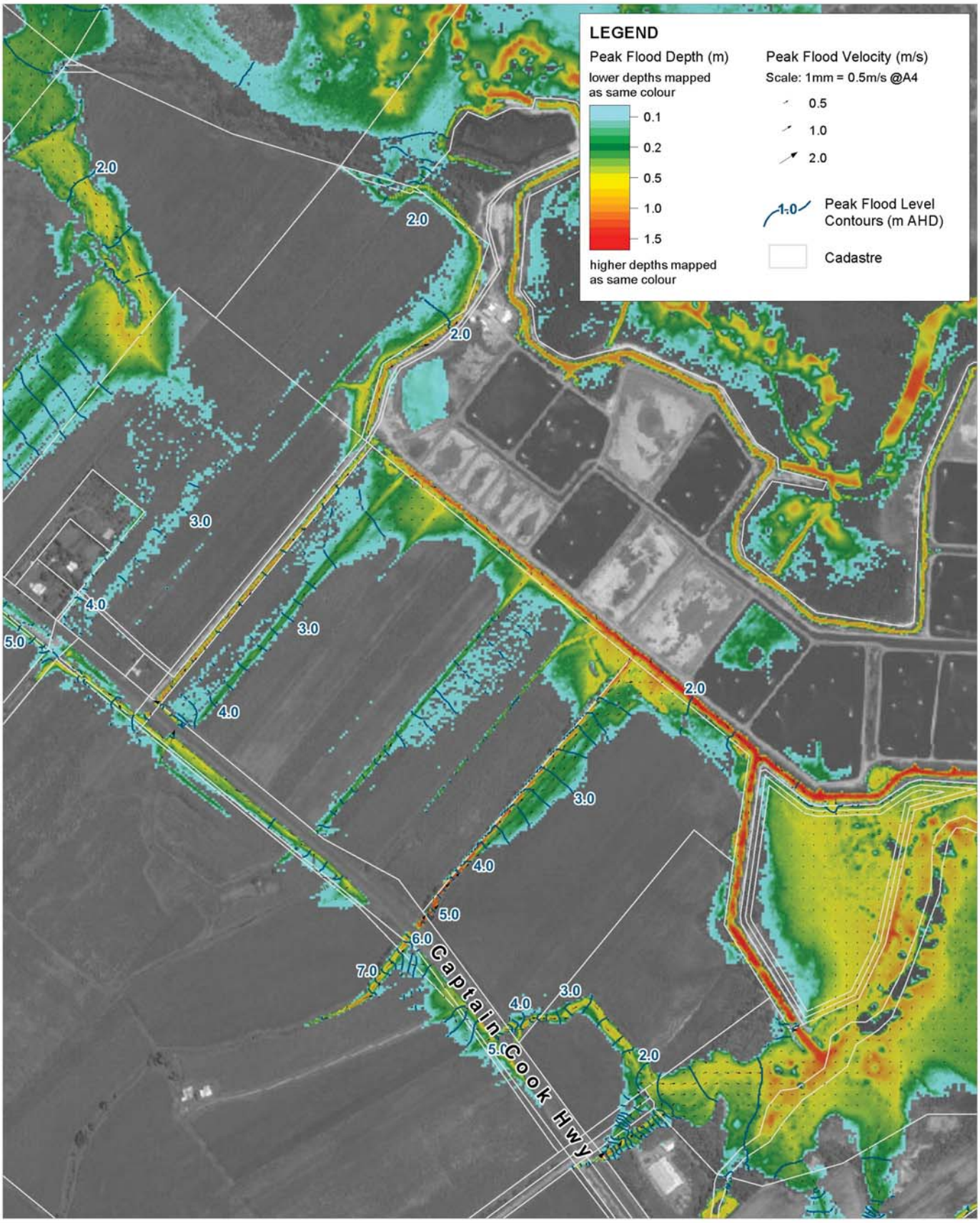
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_021_Existing_Q002_Results.WOR



Title:

1 EY - Peak Flood Levels, Depths and Velocities Existing Conditions

Figure: A-7

Rev: A

N

0 125 250m

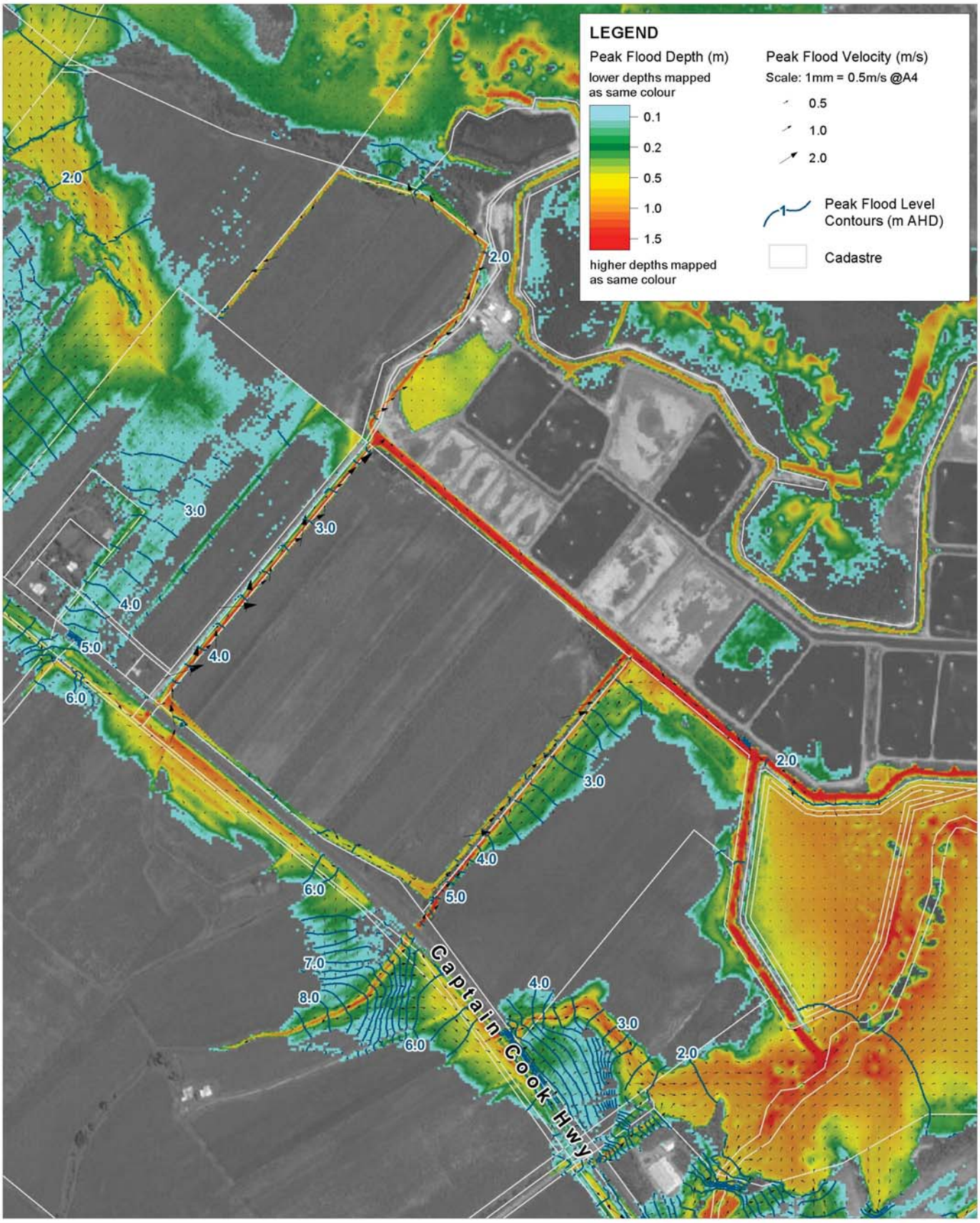
Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_024_Existing_Q001_Results.WOR

Appendix B Developed Case Model Results



Title:

1% AEP - Peak Flood Levels, Depths and Velocities Developed Scenario

Figure: B-1

Rev: A

N

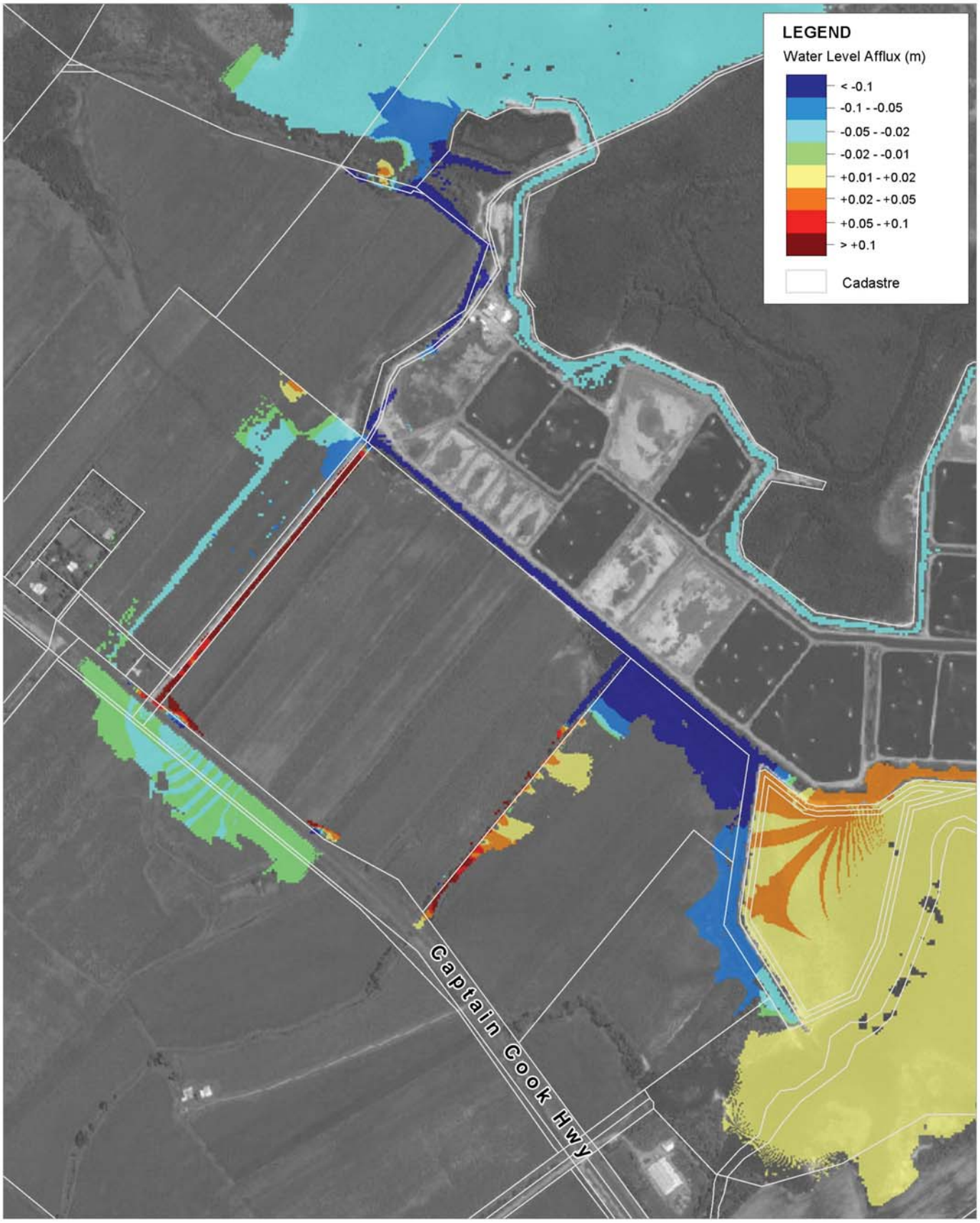
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_007_Developed_Q100_Results.WOR



Title:

1% AEP - Peak Flood Level Impact
Developed Scenario minus Existing Conditions

Figure: **B-2**

Rev: **A**

N

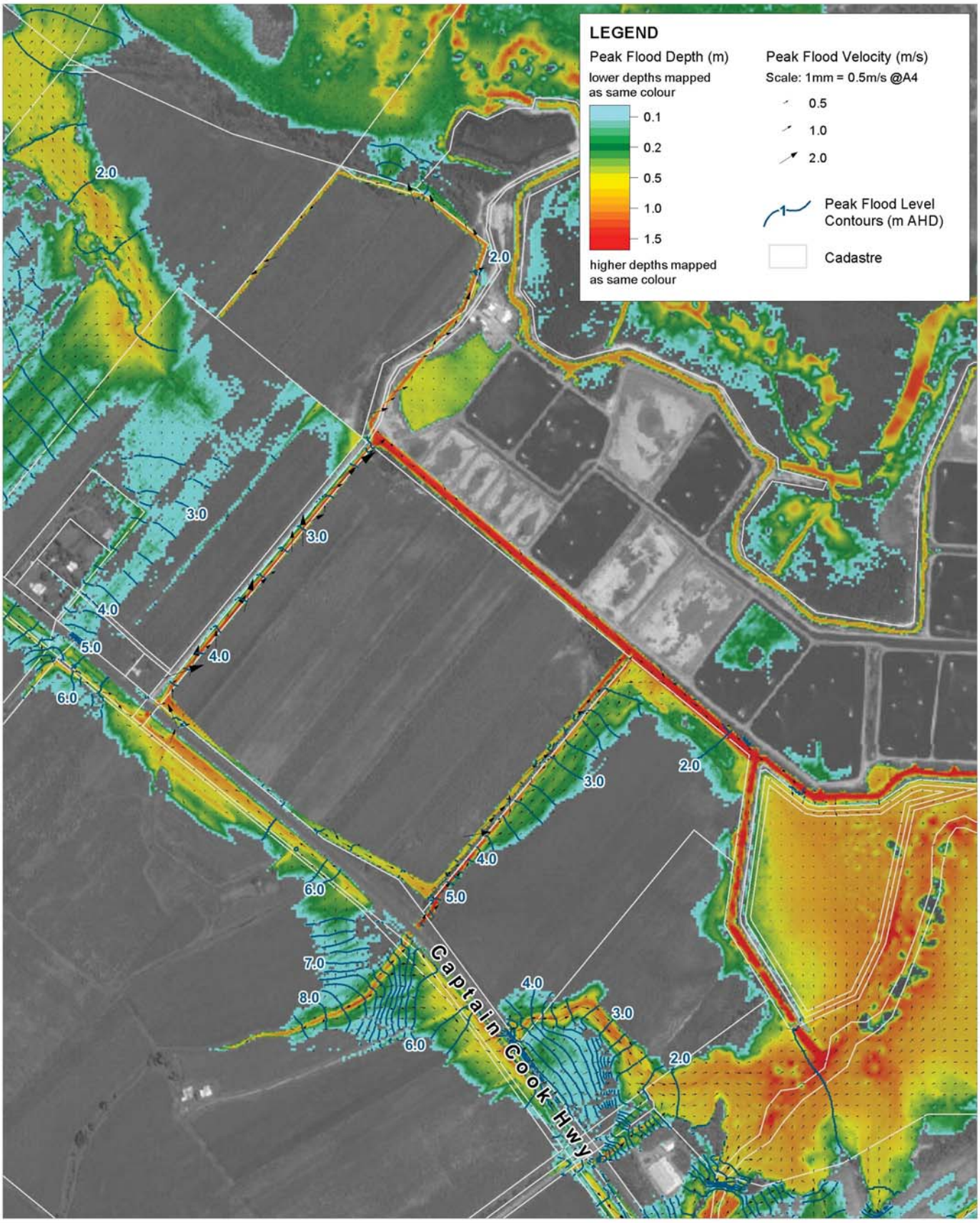
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_008_Developed_Q100_WL_Impacts.WOR



Title:

2% AEP - Peak Flood Levels, Depths and Velocities Developed Scenario

Figure: B-3

Rev: A

N

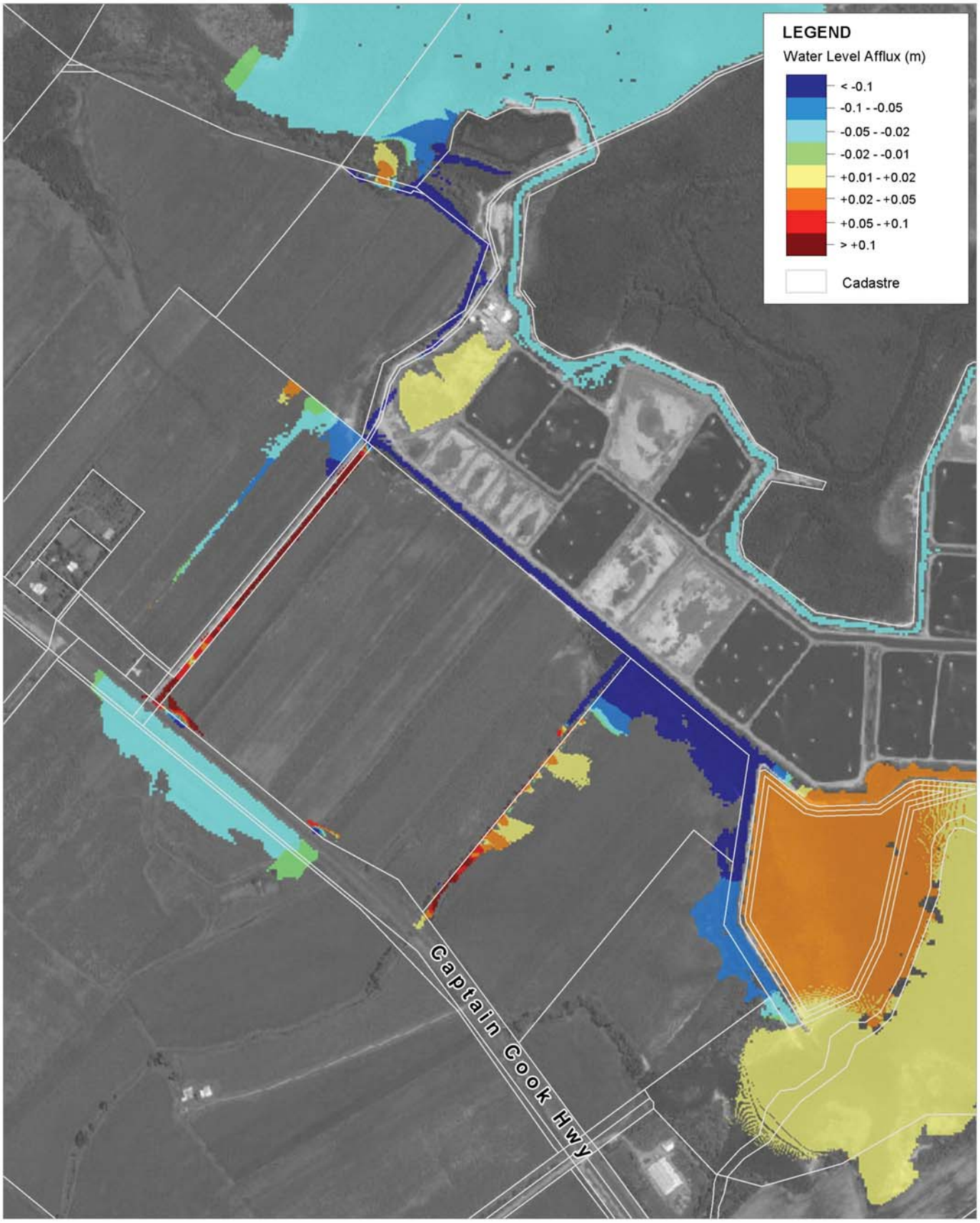
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_010_Developed_Q050_Results.WOR



Title:

2% AEP - Peak Flood Level Impact
Developed Scenario minus Existing Conditions

Figure: **B-4**

Rev: **A**

N

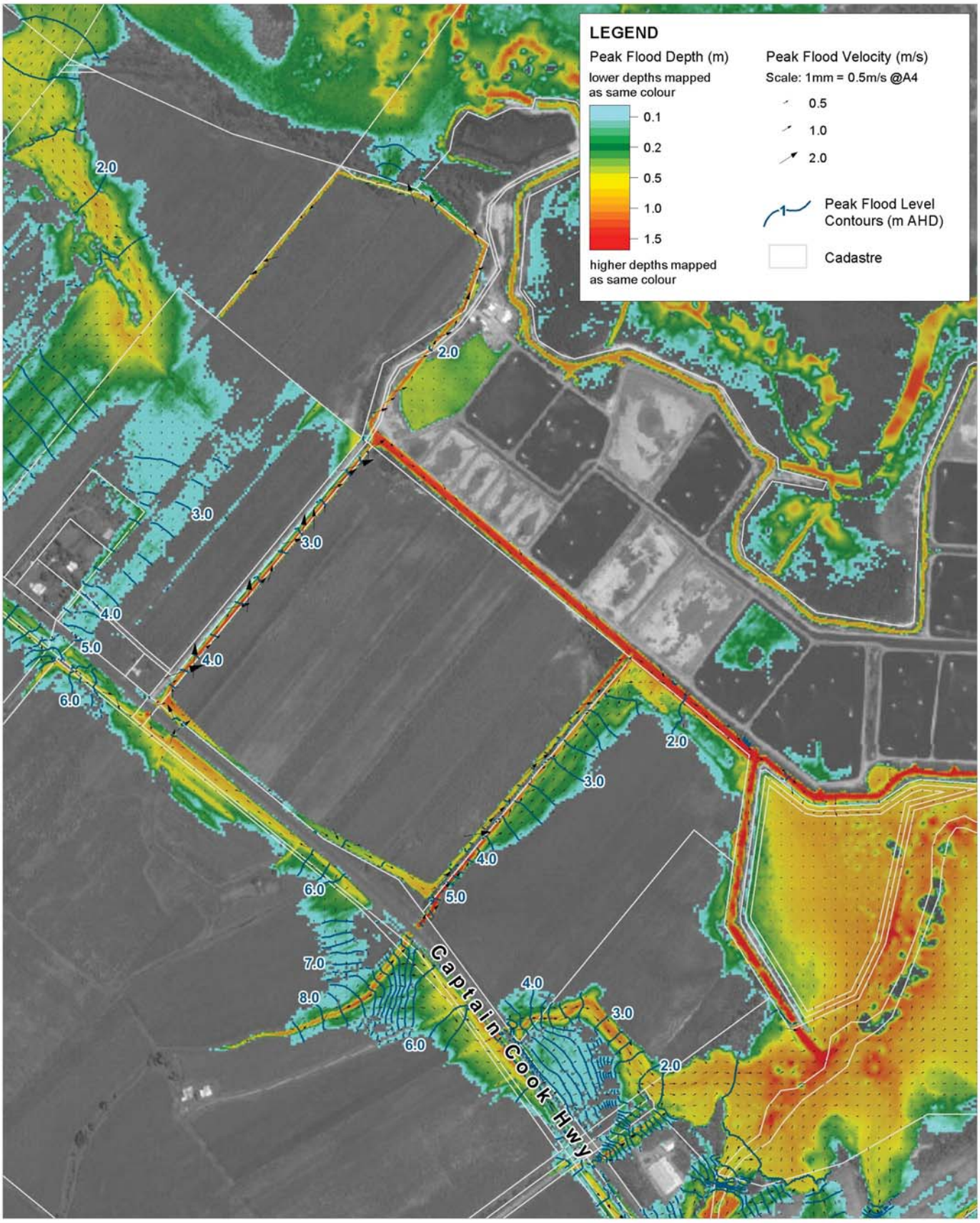
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_011_Developed_Q050_WL_Impacts.WOR



Title:

5% AEP - Peak Flood Levels, Depths and Velocities Developed Scenario

Figure: B-5

Rev: A

N

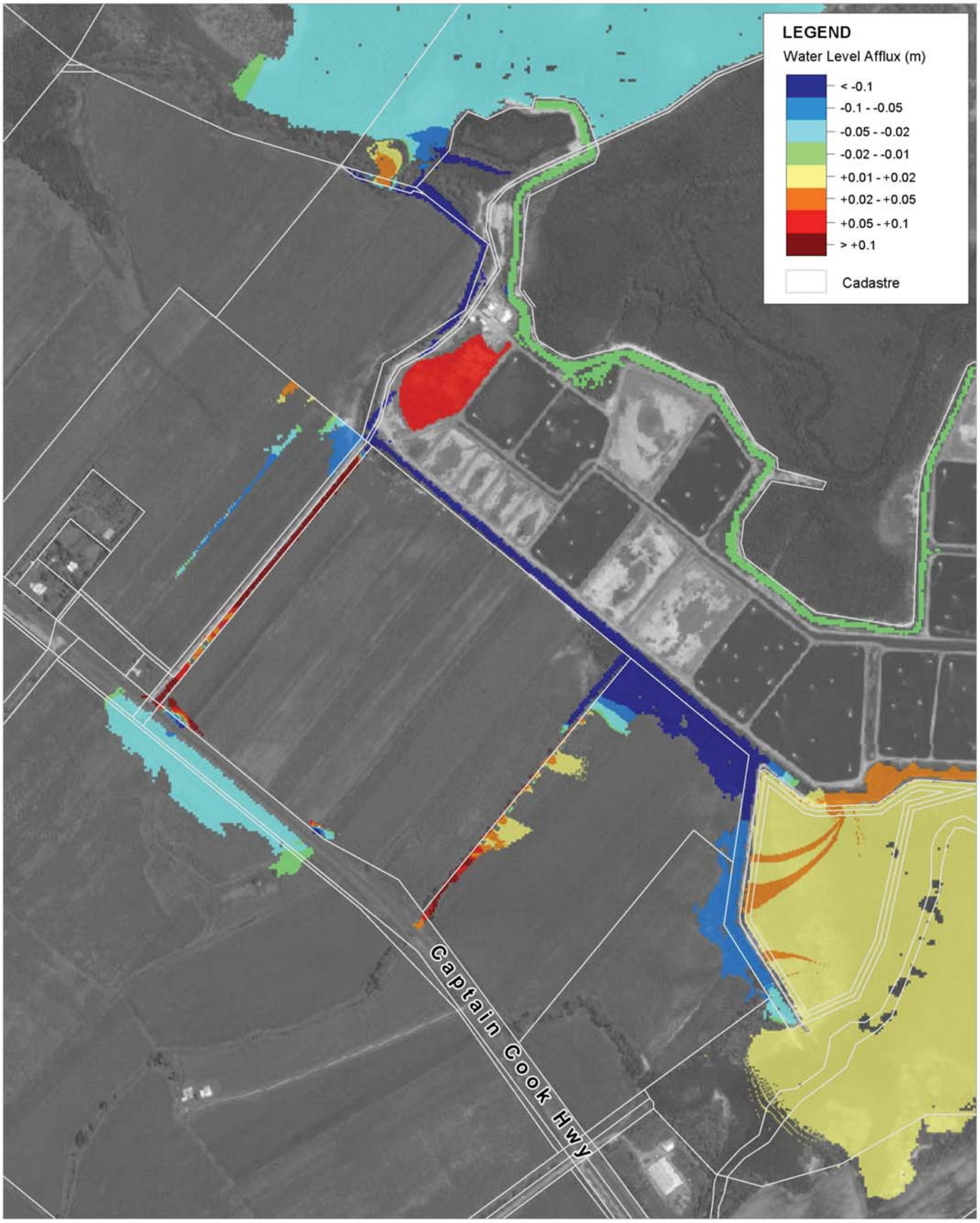
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_013_Developed_Q020_Results.WOR



Title:

5% AEP - Peak Flood Level Impact
Developed Scenario minus Existing Conditions

Figure: **B-6**

Rev: **A**

N

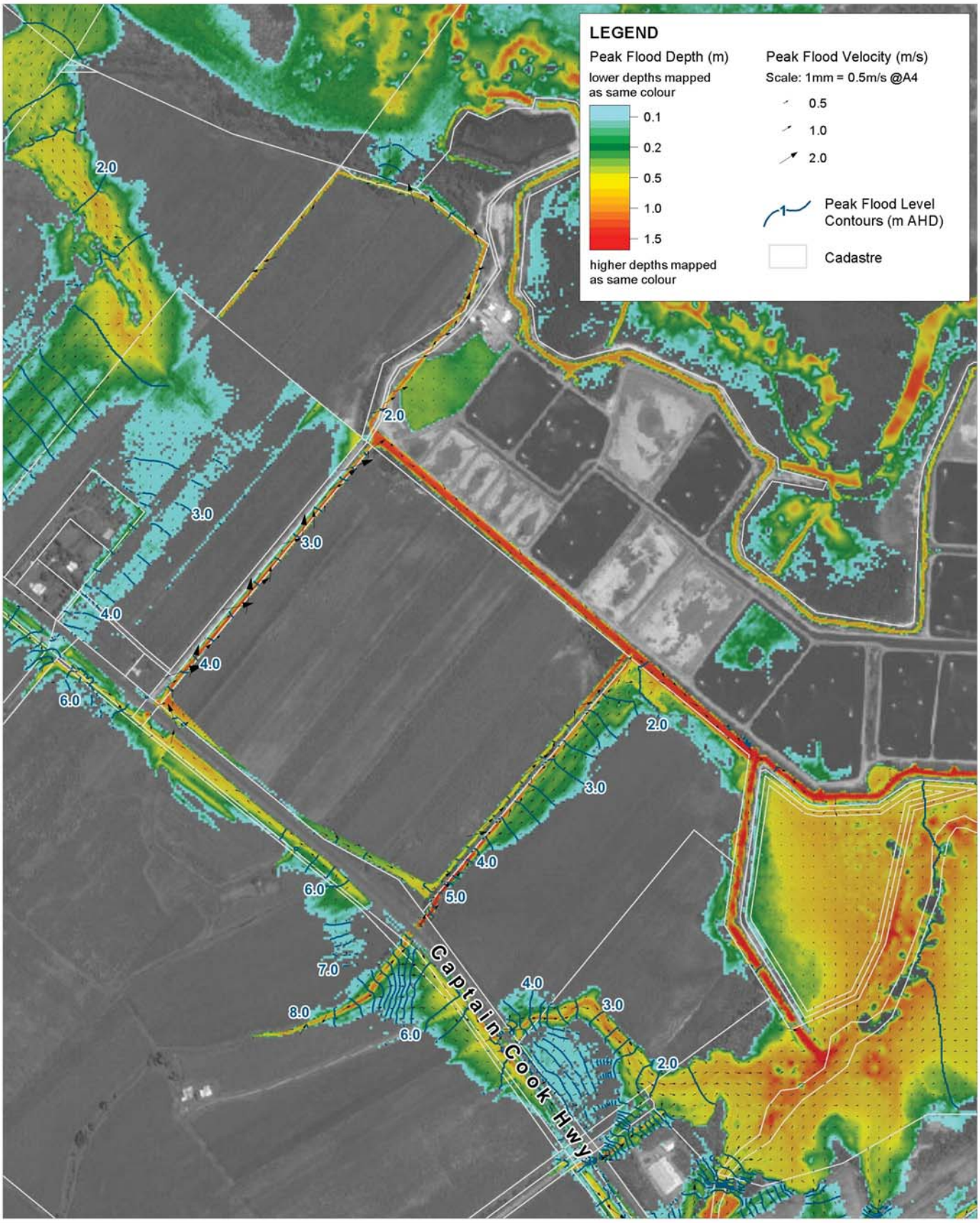
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_014_Developed_Q020_WL_Impacts.WOR



Title:

10% AEP - Peak Flood Levels, Depths and Velocities Developed Scenario

Figure: **B-7**

Rev: **A**

N

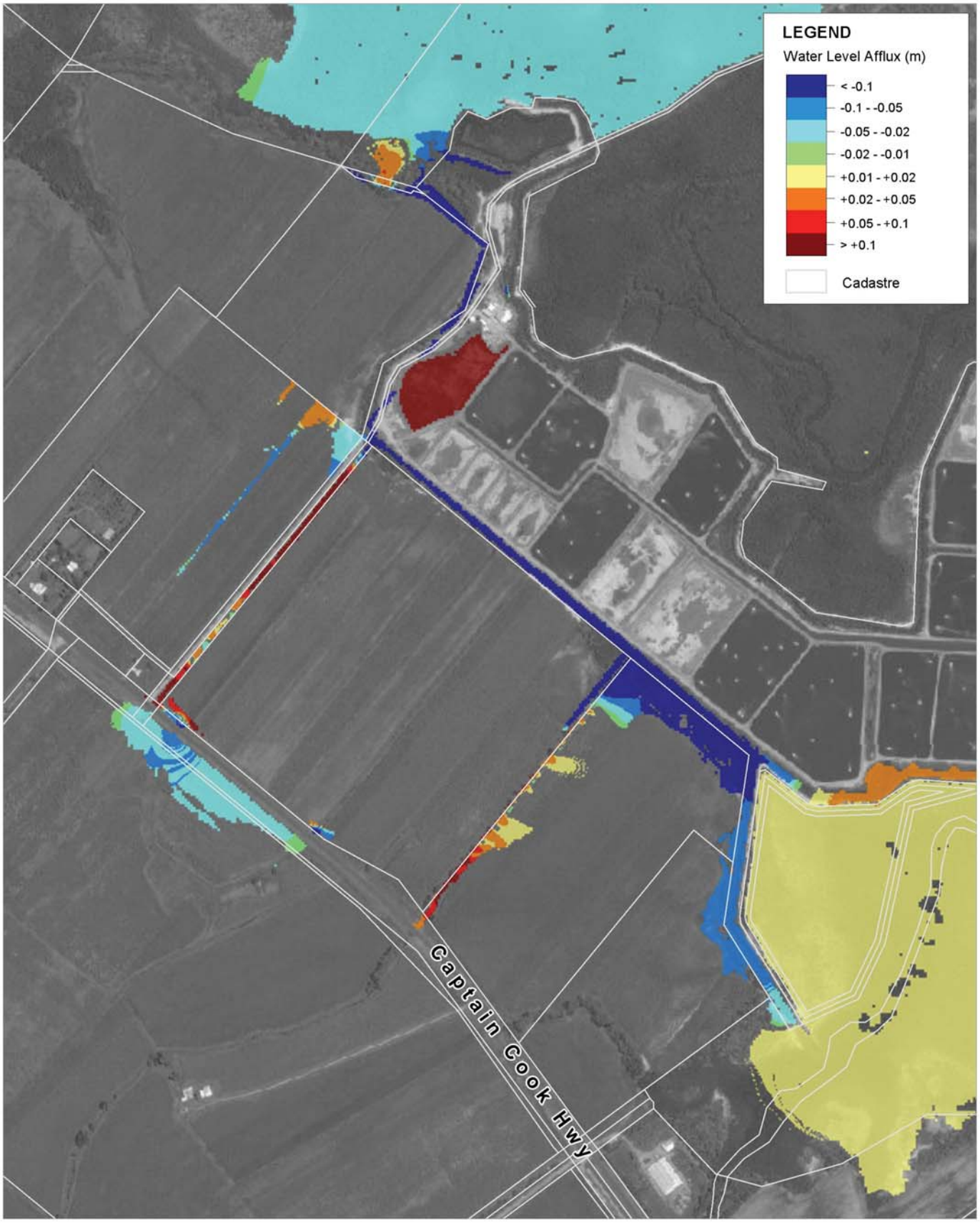
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_016_Developed_Q010_Results.WOR



Title:

10% AEP - Peak Flood Level Impact
Developed Scenario minus Existing Conditions

Figure: **B-8**

Rev: **A**

N

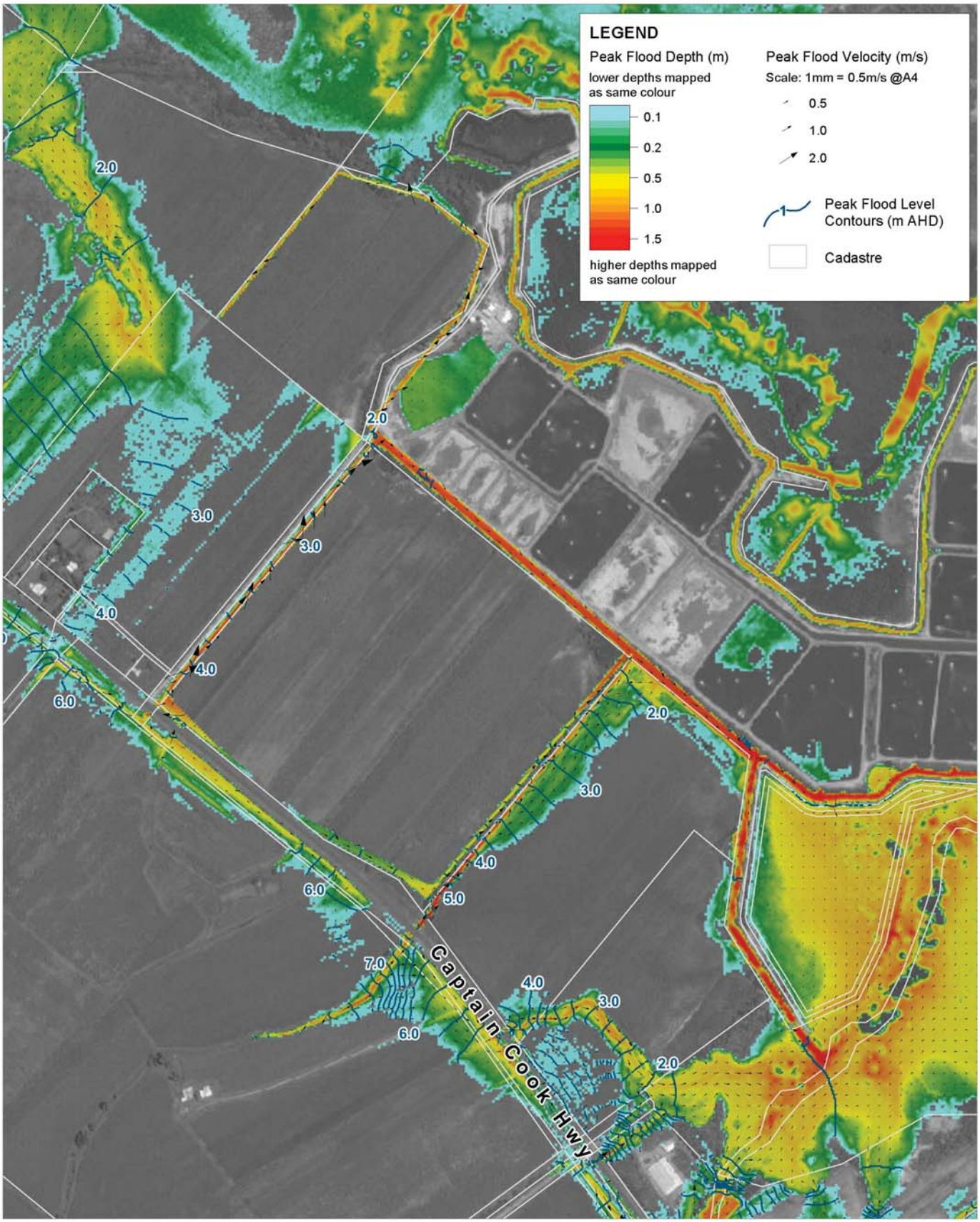
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_017_Developed_Q010_WL_Impacts.WOR



Title:

20% AEP - Peak Flood Levels, Depths and Velocities Developed Scenario

Figure: **B-9**

Rev: **A**

N

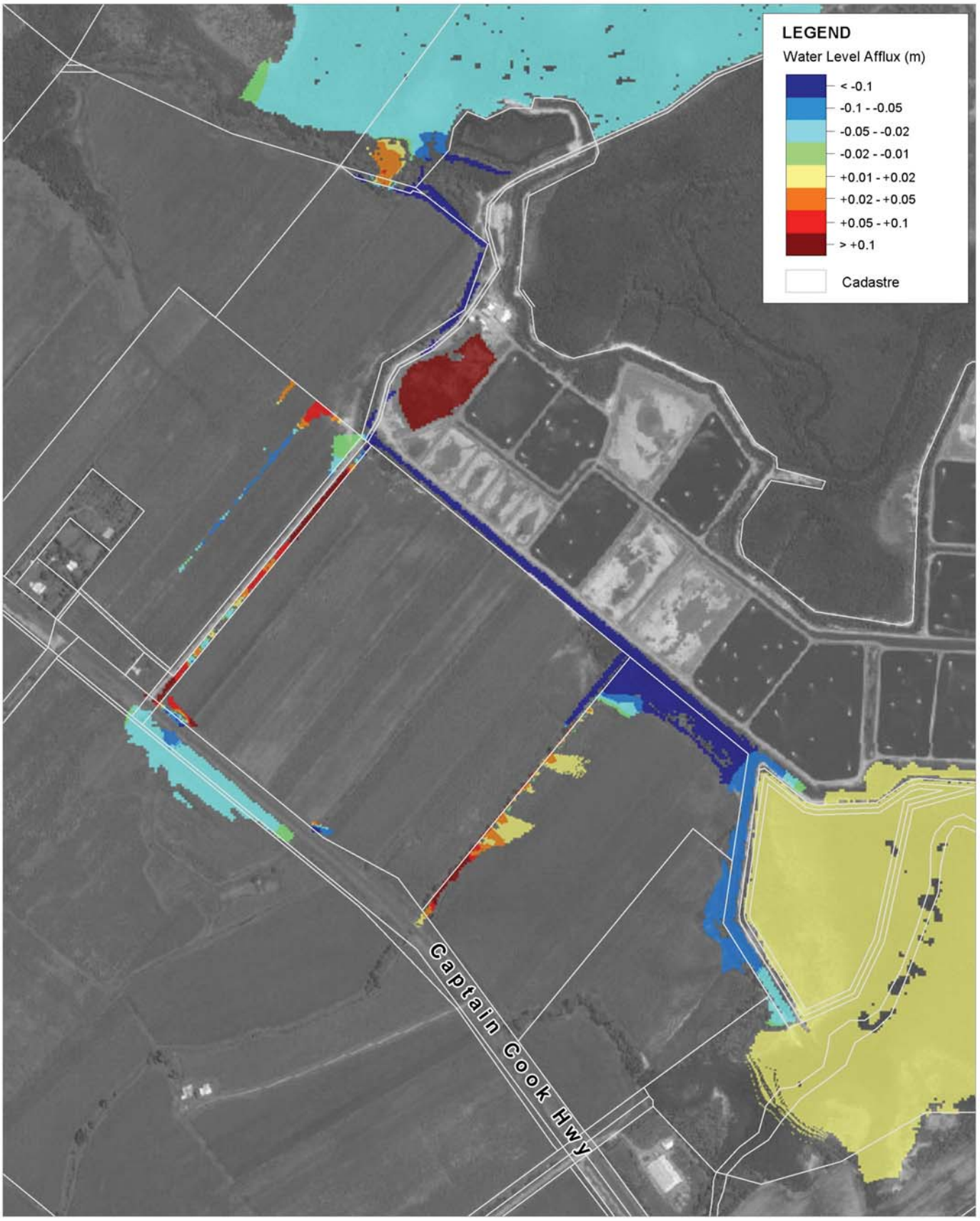
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_019_Developed_Q005_Results.WOR



Title:

20% AEP - Peak Flood Level Impact
Developed Scenario minus Existing Conditions

Figure: **B-10**

Rev: **A**

N

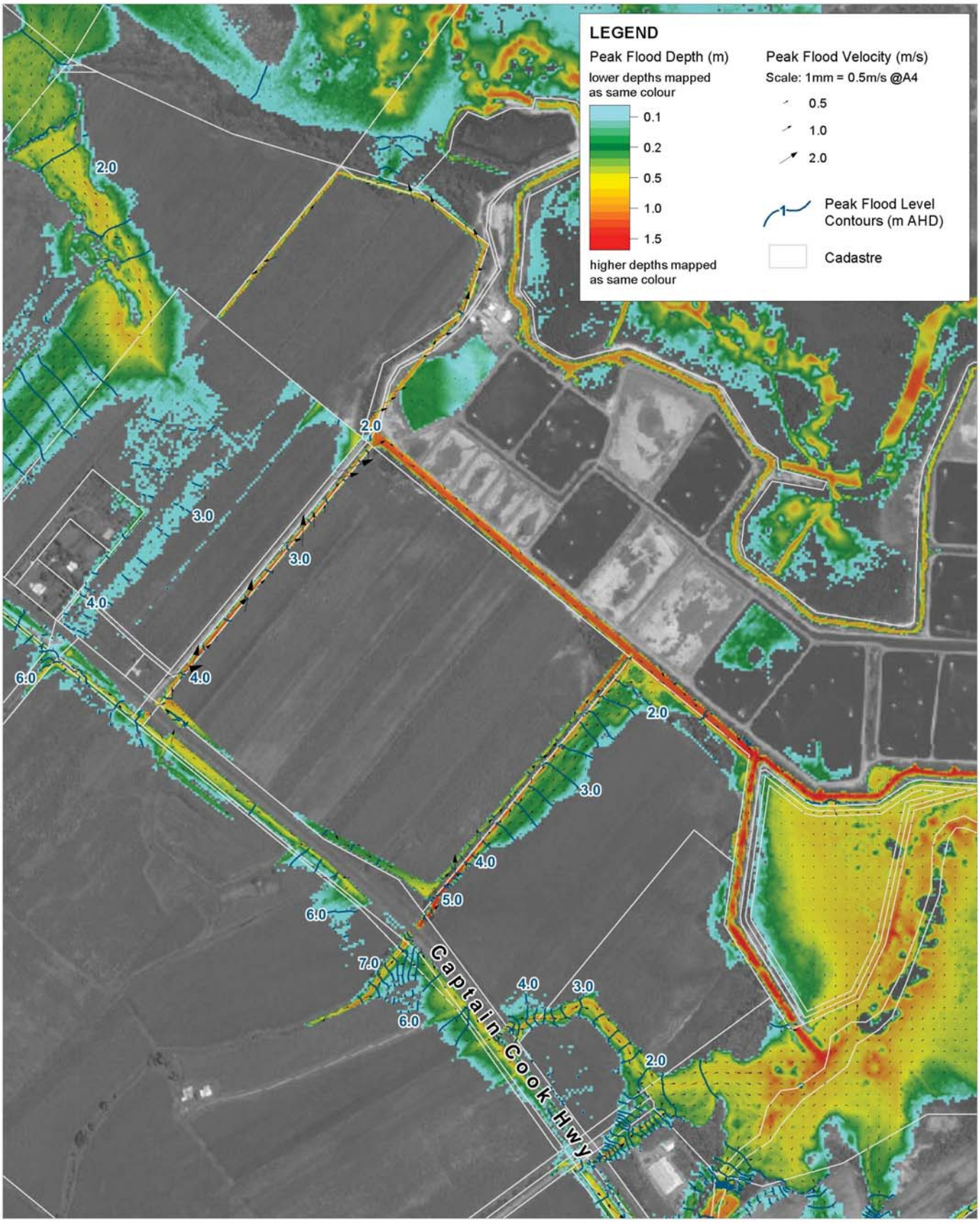
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_020_Developed_Q005_WL_Impacts.WOR



Title:

50% AEP - Peak Flood Levels, Depths and Velocities Developed Scenario

Figure: **B-11**

Rev: **A**

N

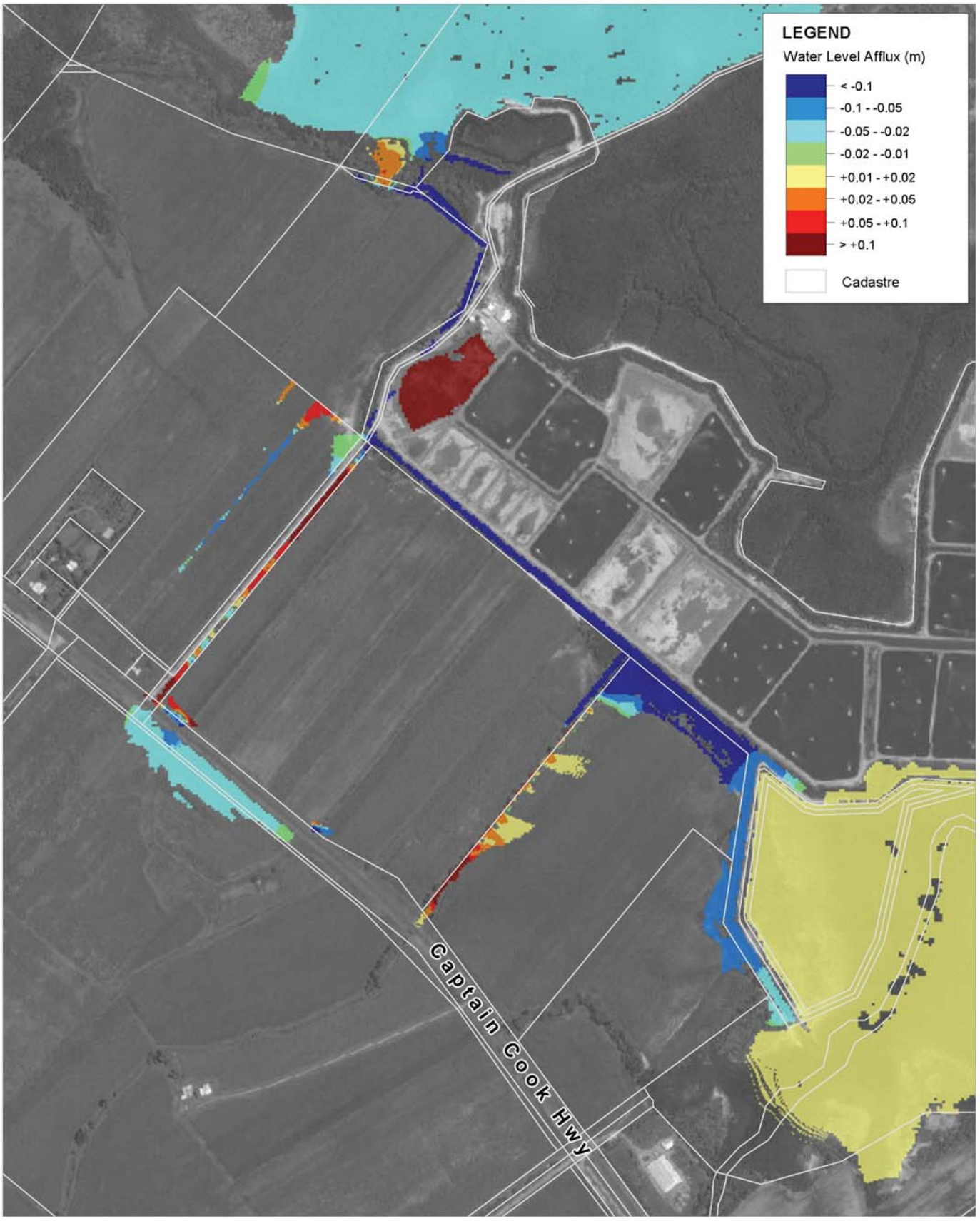
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_022_Developed_Q002_Results.WOR



Title:

50% AEP - Peak Flood Level Impact
Developed Scenario minus Existing Conditions

Figure: **B-12**

Rev: **A**

N

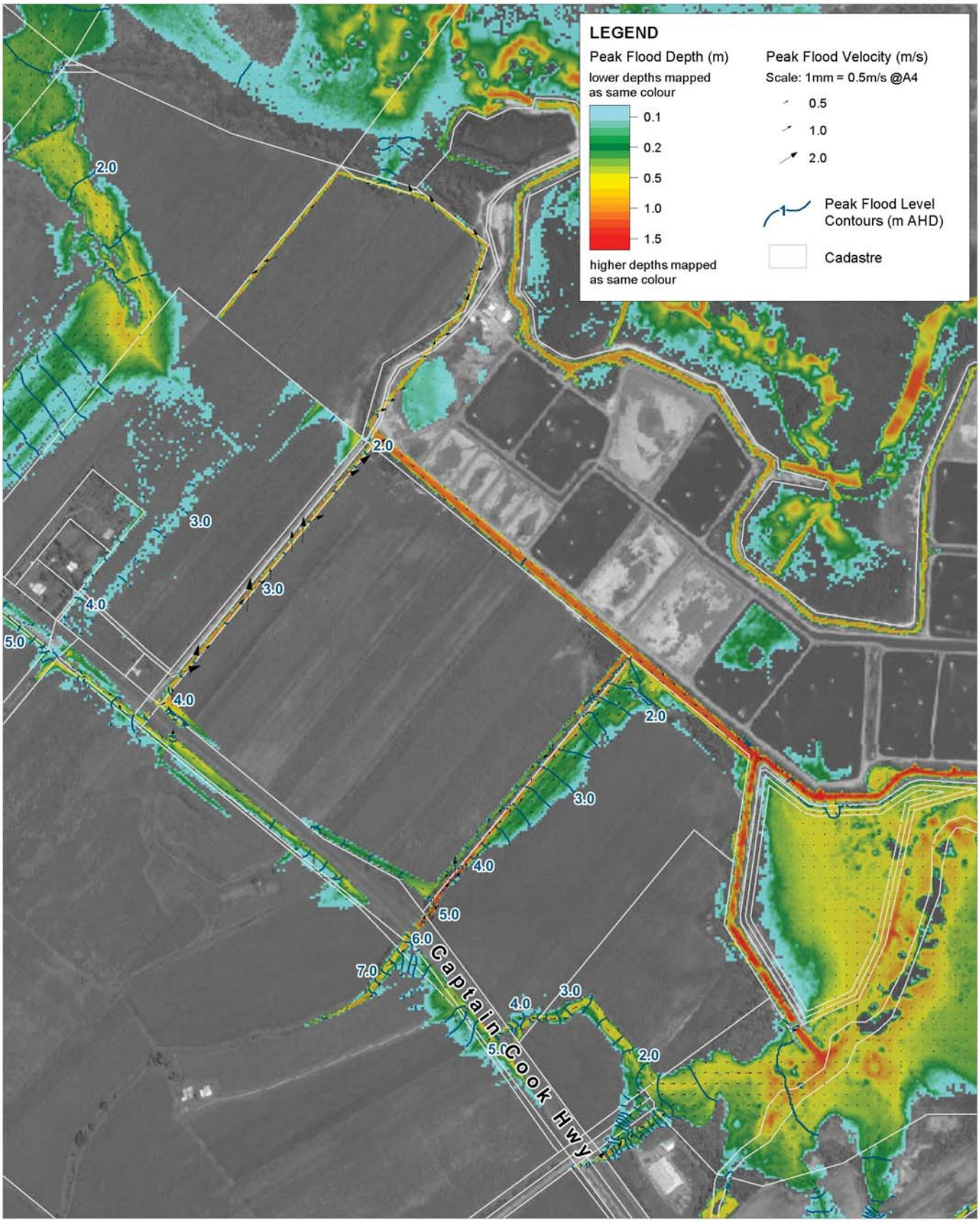
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_023_Developed_Q002_WL_Impacts.WOR



Title:

1 EY - Peak Flood Levels, Depths and Velocities Developed Scenario

Figure: B-13

Rev: A

N

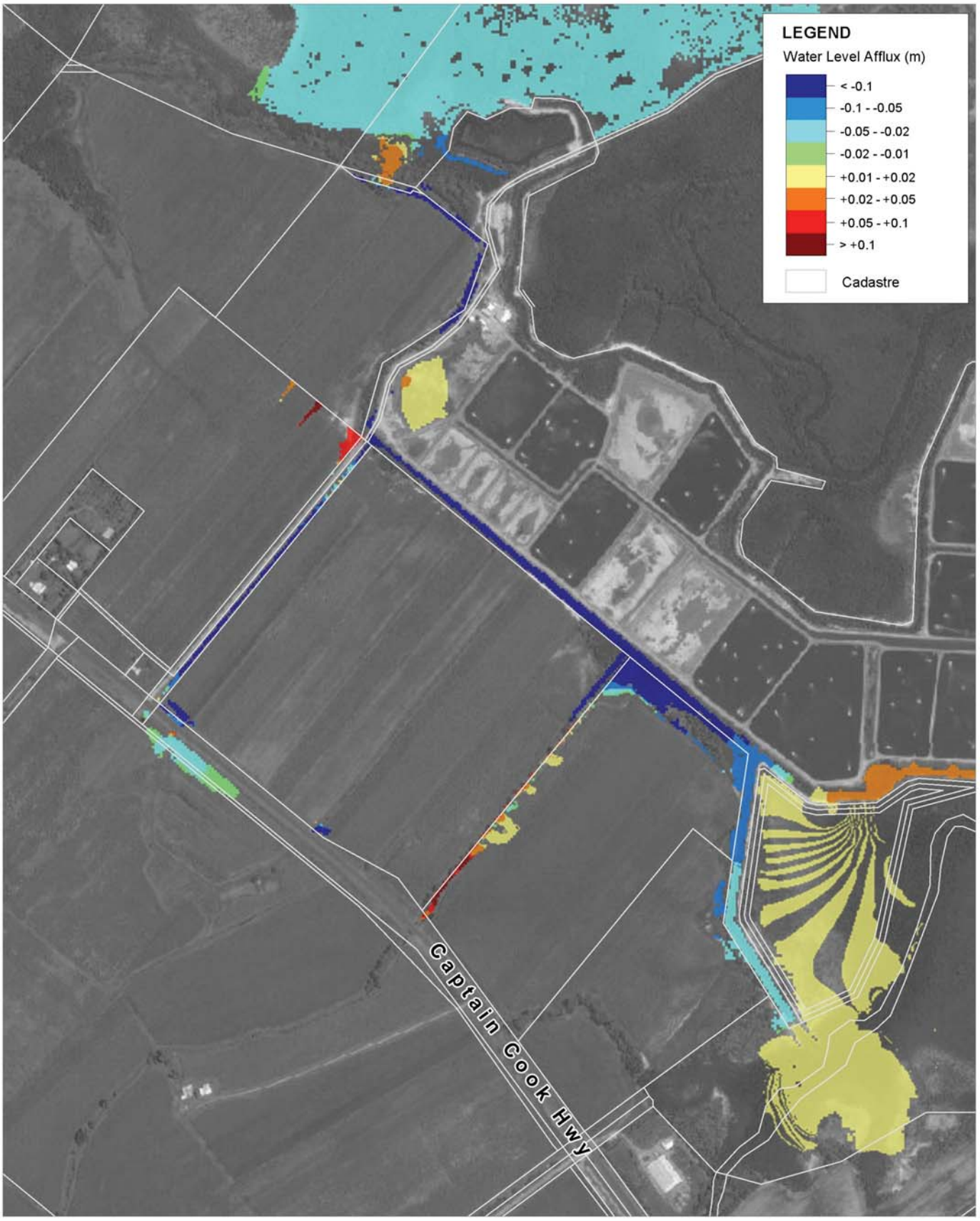
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_025_Developed_Q001_Results.WOR



Title:

1 EY - Peak Flood Level Impact
Developed Scenario minus Existing Conditions

Figure: **B-14**

Rev: **A**

N

0 125 250m

Approx. Scale

BMT WBM

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Filepath : K:\B21286_GCMA_Expansion_Project\MapInfo\Workspaces\DWG_026_Developed_Q001_WL_Impacts.WOR

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Phone: 0740 954 734
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NATA Accreditation No. 18563
ACN: 625 941 139 ABN: 17625941139
QBCC #: 15092731

Density Ratio Report

Client :	**Marrin Pty Ltd**	Report Number:	**SI 368-21 - 1/1**
Address :	**PO Box 760, Mossman, QLD, 4873**	Report Date :	**21/07/2021**
Project Name :	**Pavement Testing**	Order Number :	
Project Number :	**SI 368-21**	Test Method :	**AS1289.5.4.1**
Location:	**Prawn Farm Road , Killaloe**	**Page 1 of 2**	

Sample Number :	T-12387	T-12388	T-12438	T-12439
Test Number :	1	2	1	2
Sampling Method :	289.1.2.1 6.4 (b) Compacted	289.1.2.1 6.4 (b) Compacted	289.1.2.1 6.4 (b) Compacted	289.1.2.1 6.4 (b) Compacted I
Date Sampled :	30/06/2021	30/06/2021	13/07/2021	13/07/2021
Date Tested :	30/06/2021	30/06/2021	13/07/2021	13/07/2021
Material Type :	2.3 Base	2.3 Base	2.2 Base	2.2 Base
Material Source :	Unknown	Unknown	Mossman Quarries	Mossman Quarries
Lot Number :			-	
Sample Location :	Prawn Farm Road, Killaloe 381 2.3m LHS CL Subbase	Prawn Farm Road, Killaloe 210m 1.7m LHS CL Subbase	Prawn Farm Road, Killaloe 440 1.5m RHS CL Base	Prawn Farm Road, Killaloe 325 0.2m LHS CL Base
Test Depth (mm) :	200	200	100	95
Layer Depth (mm) :	200	-	100	100
Maximum Size (mm) :	19.0	19.0	19.0	19.0
Oversize Wet (%) :	2	2	8	6
Oversize Dry (%) :	2	3	8	6
Oversize Density (t/m³) :	1.800	2.100	3.696	2.610
Field Moisture Content (%) :	6.2	6.2	3.0	2.6
MDR Number :	T-12387	T-12388	T-12438	T-12439
Assigned MDR (Y/N) :	No	No	No	No
MDR Method :	AS1289.5.1.1	AS1289.5.1.1	AS1289.5.1.1	AS1289.5.1.1
MDR Date Tested :	2/07/2021	2/07/2021	19/07/2021	19/07/2021
Compactive Effort :	Standard	Standard	Standard	Standard
Field Density Method :	AS1289.5.3.1	AS1289.5.3.1	AS1289.5.3.1	AS1289.5.3.1
Moisture Method :	AS1289.2.1.1	AS1289.2.1.1	AS1289.2.1.1	AS1289.2.1.1
Moisture Ratio (%) :	86.0	88.5	45.5	37.5
Field Dry Density (t/m³) :	2.212	2.211	2.337	2.330
Variation from OMC :	1% dry of omc	1% dry of omc	3.5% dry of omc	4.5% dry of omc
MDD (t/m³) :	2.210	2.231	2.266	2.208
OMC (%) :	7.2	7.0	6.6	6.9
Density Ratio (%) :	**100.0**	**99.0**	**103.0**	**105.5**
Minimum Specification :	Unknown	Unknown	Unknown	Unknown
Moisture Specification :	Unknown	Unknown	Unknown	Unknown
Site Selection :				
Soil Description :				
Remarks :	Test results only appy to the sample tested.			

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

APPROVED SIGNATORY

GN - Senior Technician
NATA Accreditation Number
18563

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Phone: 0740 954 734
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NATA Accreditation No. 18563
ACN: 625 941 139 ABN: 17625941139
QBCC #: 15092731

Density Ratio Report

Client :	**Marrin Pty Ltd**	Report Number:	**SI 368-21 - 1/1**
Address :	**PO Box 760, Mossman, QLD, 4873**	Report Date :	**21/07/2021**
Project Name :	**Pavement Testing**	Order Number :	
Project Number :	**SI 368-21**	Test Method :	**AS1289.5.4.1**
Location:	**Prawn Farm Road , Killaloe**	**Page 2 of 2**	

Sample Number :	T-12440	T-12441		
Test Number :	3	4		
Sampling Method :	289.1.2.1 6.4 (b) Compacted	289.1.2.1 6.4 (b) Compacted		
Date Sampled :	13/07/2021	13/07/2021		
Date Tested :	13/07/2021	13/07/2021		
Material Type :	2.2 Base	2.2 Base		
Material Source :	Mossman Quarries	Mossman Quarries		
Lot Number :				
Sample Location :	Prawn Farm Road, Killaloe 260 1.1m RHS CL Base	Prawn Farm Road, Killaloe 121 0.8m LHS CL Base		
Test Depth (mm) :	100	100		
Layer Depth (mm) :	100	100		
Maximum Size (mm) :	19.0	19.0		
Oversize Wet (%) :	7	6		
Oversize Dry (%) :	7	6		
Oversize Density (t/m³) :	2.588	2.625		
Field Moisture Content (%) :	3.7	2.5		
MDR Number :	T-12440	T-12441		
Assigned MDR (Y/N) :	No	No		
MDR Method :	AS1289.5.1.1	AS1289.5.1.1		
MDR Date Tested :	19/07/2021	19/07/2021		
Compactive Effort :	Standard	Standard		
Field Density Method :	AS1289.5.3.1	AS1289.5.3.1		
Moisture Method :	AS1289.2.1.1	AS1289.2.1.1		
Moisture Ratio (%) :	51.5	35.0		
Field Dry Density (t/m³) :	2.316	2.246		
Variation from OMC :	3.5% dry of omc	4.5% dry of omc		
MDD (t/m³) :	2.268	2.231		
OMC (%) :	7.2	7.1		
Density Ratio (%) :	**102.0**	**100.5**		
Minimum Specification :	Unknown	Unknown		
Moisture Specification :	Unknown	Unknown		
Site Selection :				
Soil Description :				
Remarks :	Test results only appy to the sample tested.			

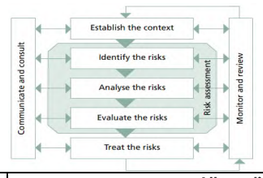
NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

APPROVED SIGNATORY

GN - Senior Technician
NATA Accreditation Number
18563

Killaloe Prawn Farm Road
Project No: 103-2021
By RECS Consulting Engineers



LIKELIHOOD		CONSEQUENCE	
5	Almost certain	5	Severe
4	Likely	4	Major
3	Possible	3	Moderate
2	Unlikely	2	Minor
1	Rare	1	Insignificant

RISK = Likelihood x Consequence

CONSULTING ENGINEERS
BUILDING DESIGN

Hazard Information					Current Arrangement				Alternative Arrangement				Action			Comments / Notes
ID #	Hazard Description	Possible Cause	Persons Affected	Possible Consequences	Current Control Measures	Risk			Improvement Control Options	Risk			Action	Action by	Action Complete	
						Likelihood	Consequence	Risk		Likelihood	Consequence	Risk				
1	Design Speed	No formal design speed	Road user	Uncontrolled vehicle speed	Nil	3	3	H9	Install regulatory speed signage. Brief transport operators on speed limits.	2	2	L4				DSC to determine road speed limit
2	Visibility (Sight distance)	Inadequate visibility due to weather conditions	Road user	hazardous obstacle interactions	REGPs installed	2	2	L4	Decrease REGPs spacing	2	2	L4				
3	Larger than design vehicles using the road		Road user	Road blockage	Nil	2	2	L4	Brief transport operators on acce	2	2	L4				Oversized vehicle entry on public road by TMR permit only
4	Flood water over road	Inadequate flood immunity	Road user	Saturated & damaged pavement	Drainage channel along road edge	3	3	H9	Restrict HV access during period	2	2	L4				BMT WBM Flood Assessment Report indicates low levels of flood water during events.
5	Steep batters	Existing batter slopes	Road user	Errant vehicles in drains	REGPs installed	2	2	L4	Increase road delineation by de	2	2	L4				
6	Vertical drops at culvert headwalls	Existing culvert headwalls	Road user	Vehicles driving off steep slope	Delineated with REGPs	2	2	L4	Monitor incidents	2	2	L4				Culvert widening considered, if required.
7	Inadequate flood immunity	Existing road elevations	Road user	Saturated & damaged pavement	Drainage channel along road edge	3	3	H9	Restrict HV access during period	2	2	L4				
8	Existing overhead services	Existing service pole elevations	Road user	Vehicles in contact with service cables	Service cables installed by service provider to current clearance standards	2	4	H8	Install rotamarkers on overhead	1	4	L4				Rotamarkers can be requested and installed by ERGON Mossman

		Insignificant	Minor	Moderate	Major	Severe
		1	2	3	4	5
Rare	1	1	2	3	4	5
Unlikely	2	2	4	6	8	10
Possible	3	3	6	9	12	15
Likely	4	4	8	12	16	20
Almost Certain	5	5	10	15	20	25

Low
Medium
High
Extreme