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'The Village' Oonoonba, Townsville Flood Investigation to Support an Amended Master Plan

prepared for

Urban Land Development Authority

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December 2012

'The Village' Oonoonba, Townsville Flood Investigation to Support an Amended Master Plan

Prepared For:	Urban Land Development Authority
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1 INTRODUCTION

This report has been prepared by BMT WBM PTY LTD to provide details into flooding and flood impacts associated with a proposed residential development, 'The Village', located within the suburb of Oonoonba in Townsville, Queensland.

BMT WBM was commissioned by the Urban Land Development Authority (ULDA) to prepare a flood study for the site based on a preliminary master plan for the site, incorporating proposed Stages 1 to 17. The study also incorporates the latest revised Ross River Dam flows provided by Townsville City Council.

This investigation details the use of 2 dimensional flood modelling to establish the current ARI 100 year flood levels for the site, based on the revised Ross River Dam outflows, floodplain modifications associated with the proposed development to achieve the desired 100 year flood immunity for the site as well as minimising adverse off site impacts.

Emergency Flood Management is also addressed within the report.

The report supports the current proposed Master Plan for the development (which is included as Figure 2-3 of this report).

Subsequent refinements of the flood assessments and flood management system will be required as the detailed design of the development proceeds.

2 SITE DESCRIPTION AND PROPOSAL

2.1 Existing Site

The subject site is situated within the suburb of Oonoonba, Townsville, Queensland and is approximately 3.5km south of the Townsville city centre. Located within the Townsville City Council local government area the site is approximately 83ha in area.

The Ross River is a dominant feature around the site, bounding the site to the west and the north. The North Coast Railway and Abbott Street form the eastern boundary and the Fairfield Waters residential development makes up the southern boundary.

The majority of the site consists of open space and was formerly the Queensland Government cattle research station.

The current topography levels range from approximately RL2.0m AHD to RL5.8m AHD. A ridge is located centrally within the site whilst an internal drain is located to the west of the ridge, ultimately discharging into the Ross River to the North. The area on the eastern portion of the site is generally quite low lying in nature and abuts the East Coast Rail Line.

Adjacent to the Ross River on the western side of the site is situated and extensive low lying sandbank. The elevation of this sandbank ranges from approximately RL1.3m AHD to RL2.7m AHD.

Figure 2-1 shows the location of the site.

Figure 2-2 provides a more detailed view of the site.

2.2 Proposed Development

The majority of the proposed development will be made up of low-medium density residential lots. The residential area will also be supported by a range of mixed use development consisting of community, retail and recreational facilities.

Figure 2-3 shows an indicative master plan for the site.

The sandbank area situated to the west of the site, adjacent to the Ross River has been deemed unsuitable for development and therefore the developable area for the site is approximately 58ha.

To achieve flood free elevations for the proposed development, filling of the site will be required.

Figure 2-1 Site Location

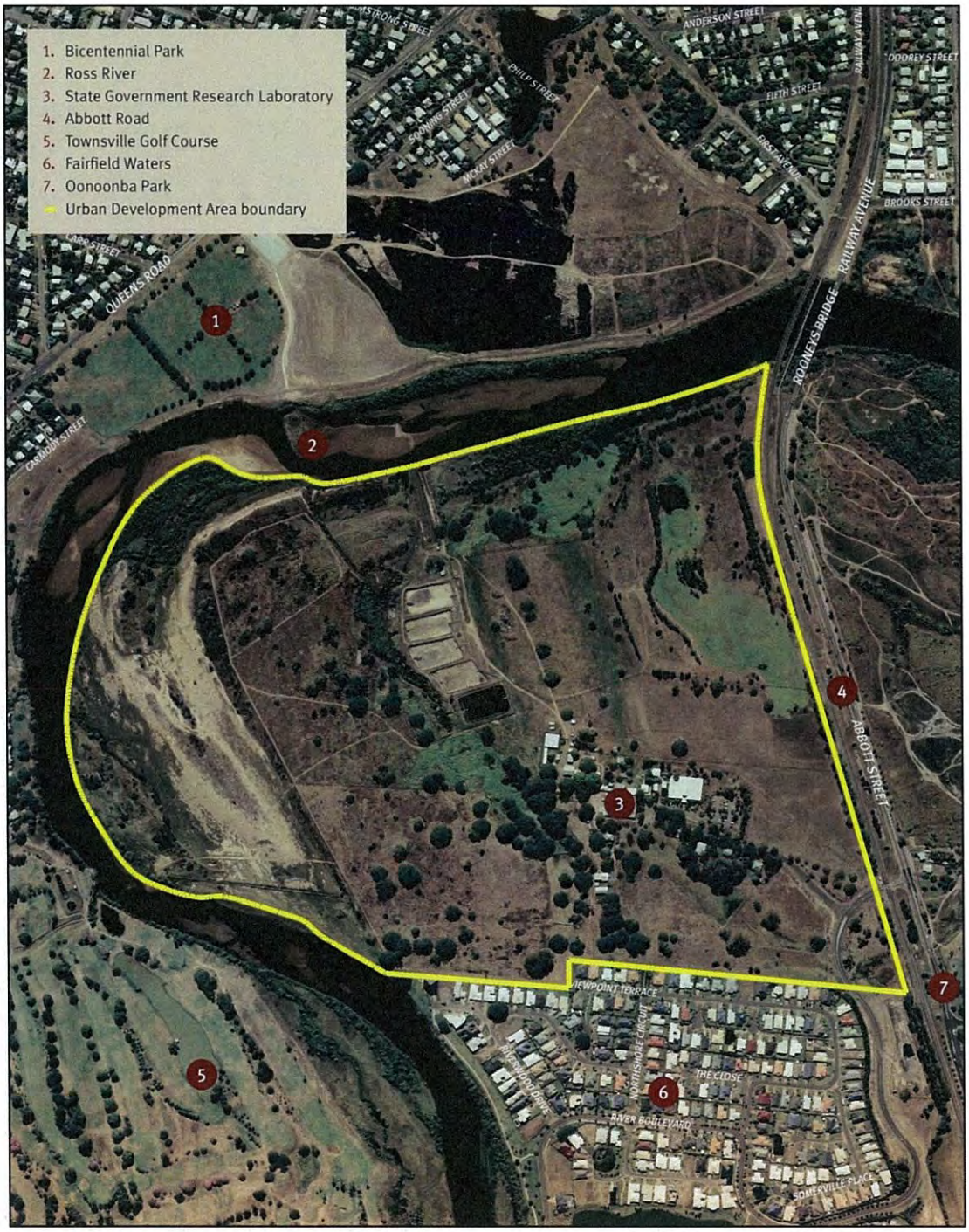


Figure 2-2 The site

LOT TYPE	TOTAL LOTS	
Stage 1		
Premium Traditional 32	15	23.8%
Premium Traditional 25	8	12.7%
Courtyard 32	8	12.7%
Courtyard 25	13	20.6%
Premium Villa 32	1	1.6%
Premium Villa 25	6	9.5%
Villa 32	6	9.5%
Villa 25	4	6.3%
Miscellaneous	2	3.2%
Stage 1 total	**63**	**100**
Stage 2	**39**	
Stage 3 +		%
Premium Traditional 32	17	2.4%
Premium Traditional 25	18	2.2%
Courtyard 32	94	13.3%
Courtyard 25	98	13.9%
Premium Villa 32	133	18.6%
Premium Villa 25	142	19.9%
Villa 32	97	13.6%
Villa 25	72	10.2%
Terrace 25	42	5.9%
Stage 2 + total	**713**	**100**
Future development site	**52**	
TOTAL	**867**	

Figure 2-3 Proposed Development Master plan

3 FLOOD ASSESSMENT

3.1 Methodology

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

- Obtain revised Ross River dam discharges for the ARI 100 year design storm event from Council
- Utilise these flows as boundary conditions and run Councils supplied regional Ross River flood model
- Extract boundary conditions from Council's model to use as sub-model boundary conditions
- Utilise AECOM's previously established fine scale sub-model to establish existing 100 year flood levels for the site
- Use the sub-model to investigate proposed development scenarios.

The hydraulic models used for this investigation were based on the DHI MIKEFLOOD hydraulic modelling system. As indicated above Townsville City council had provided a regional flood model which was used to firstly model the revised Ross River Dam discharge hydrograph and secondly from these results, extract boundary conditions to use within a finer grid sub-model of the site.Figure 3-1 shows the Ross River Dam discharge hydrograph used for the regional flood model.

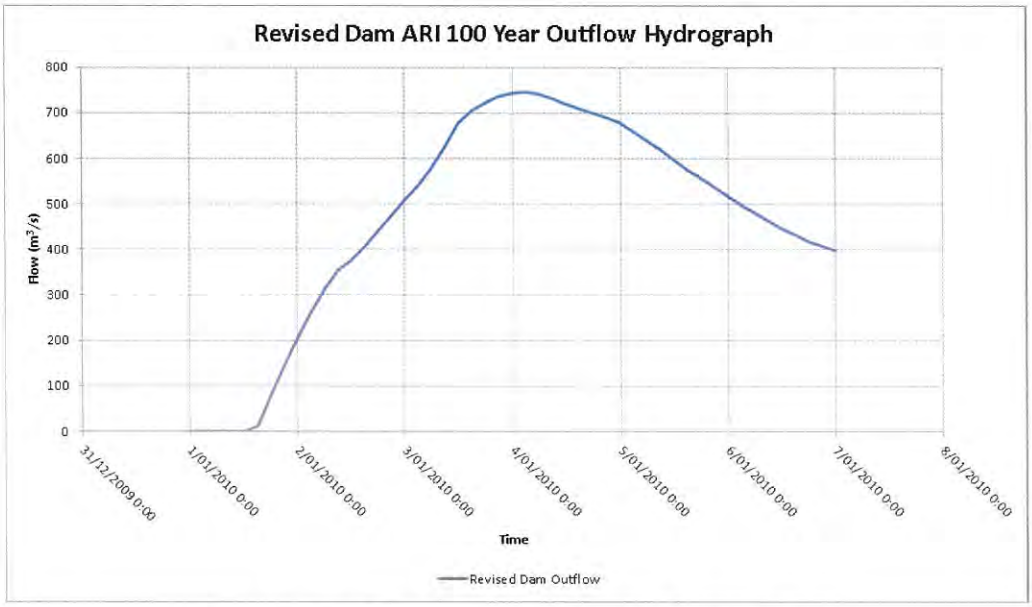


Figure 3-1 Ross River Dam ARI 100 Year Outflow

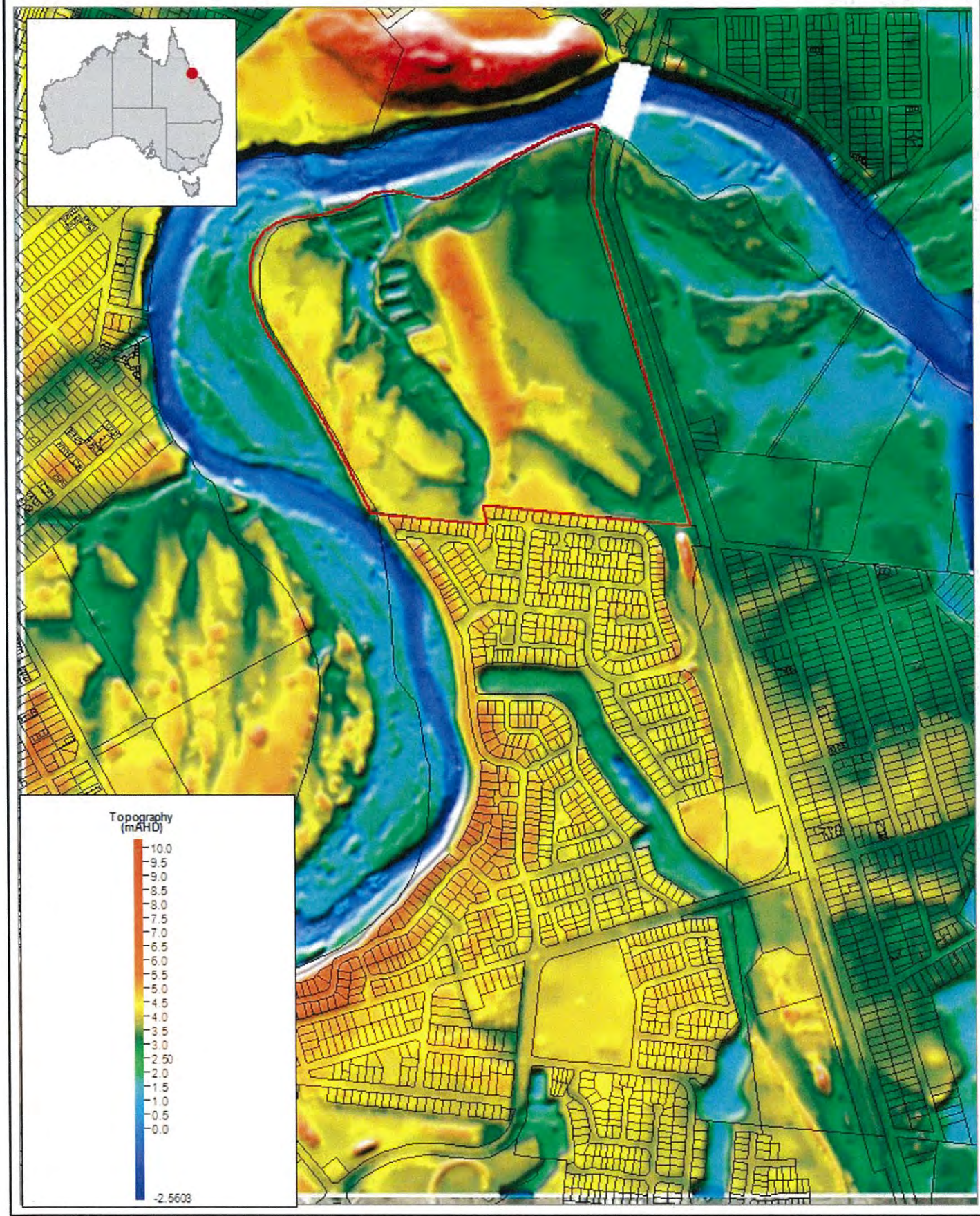
3.2 Existing Case

The sub-model used was provided by AECOM who had previously setup the model to conduct initial concept master plan modelling for the site. The model is based on a 5m topographic grid.

Figure 3-2 shows the sub-model extent and topography.

All model parameters including roughness, structures and local inflows remain virtually unchanged. External boundary conditions (including upstream inflows and downstream water levels) were obtained from the regional flood model. Full documentation of the model development is described in the AECOM report 'Oonoonba Flood and Stormwater Management Study', September 2010.

The model was run for the existing ARI 100 year design storm event initially to establish 100 year existing water levels and then modified to represent the proposed development.



Title: **Oonoonba, Townsville**
Model Topography
Existing Case

Figure: **3-2**

Rev: **1**

N

0 100 200m
Approx. Scale

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3.3 Developed Case

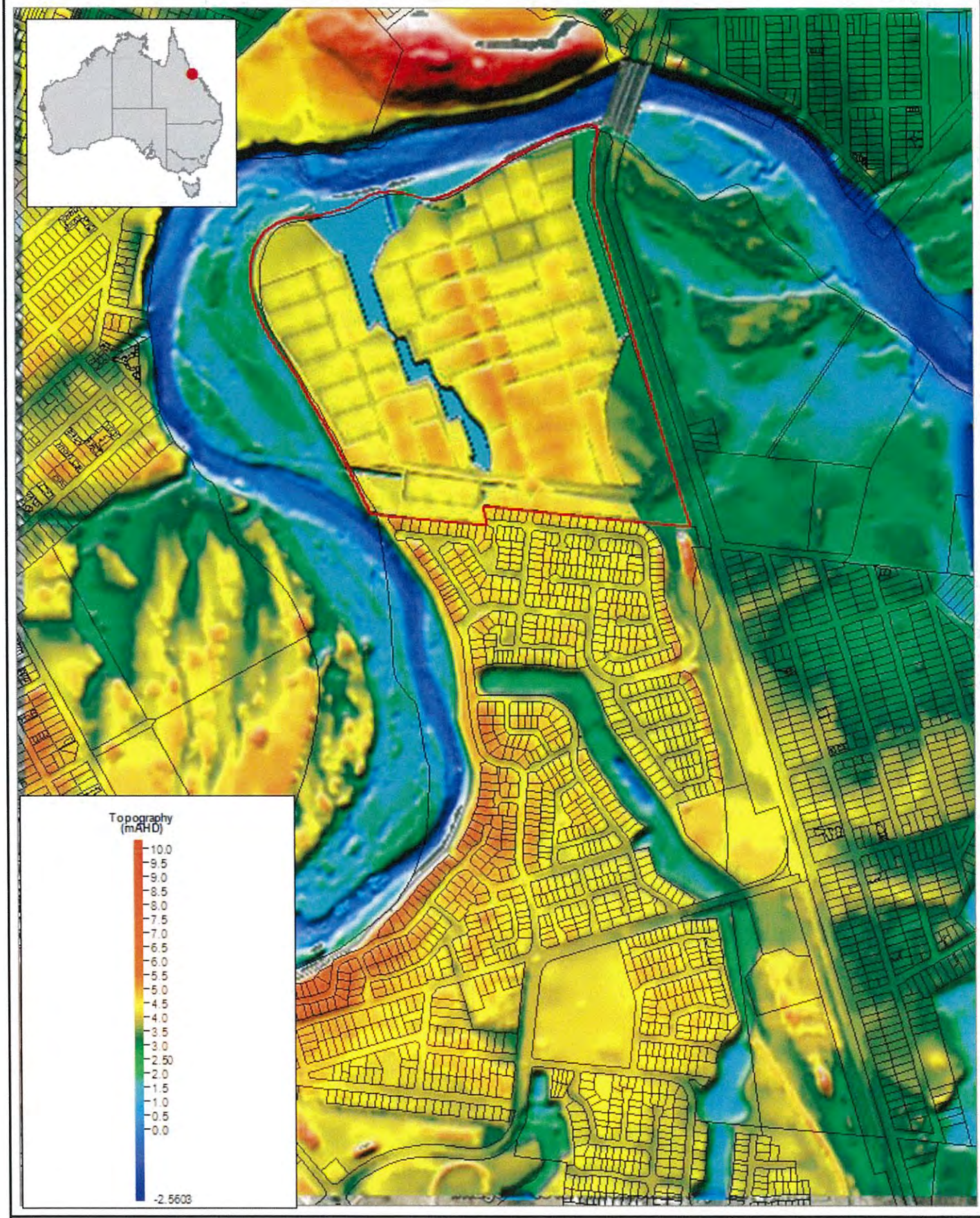
To investigate the proposed development for the site, the base topography was modified to represent the concept master plan. Numerous iterations and model runs were conducted to achieve a development foot print that resulted in 100 year flood immunity for habitable areas whilst achieving a no significant adverse impact on adjacent properties.

In summary, the areas of the site below the 100 year design flood levels are proposed to be filled to provide the required flood immunity. Within the site, the centrally located drain is proposed to be re-shaped in accordance with the proposed development layout, as shown in Figure 2-3.Through the modelling process it has been determined that the drain invert level is required to be maintained at an approximate level of RL 1.25m AHD. This level being at or above MHWS on order to improve flood storage and conveyance within the development. Therefore, some excavation of this drain/waterway is required.

To the east, adjacent to the East Coast Railway, a 50m wide open channel (RL 2.0m AHD) is proposed to maintain conveyance over the this section of floodplain and provide flood storage.

These flood management components were identified and refined jointly with the ULDA.

Figure 3-3 presents the model topography for the proposed case.



Title: **Oonoonba, Townsville**
Model Topography
Developed Case

Figure: **3-3**

Rev: **1**

N

0 100 200m
Approx. Scale

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4 RESULTS

4.1 Existing Situation

Appendix A contains detailed results for the existing situation ARI 100 year flood including peak water surface levels, depths and velocities.

In summary, peak water levels for the site range from RL4.58m AHD at the upstream extent of the site to RL3.79m AHD at the downstream extent of the site. Flooding across the site predominantly occurs within the internal drain and across the eastern and north-eastern portions of the site.

Table 4-1 provides peak ARI 100 year flood levels for specific points around the site.

Reporting point locations are shown in Appendix A.

Table 4-1 Existing ARI 100 Year Peak Water Levels

Reporting Point	Existing Peak Water Level (mAHD)
A	5.026
B	4.783
C	4.564
D	4.478
E	4.257
F	4.081
G	3.776
H	2.966

4.2 Developed Situation

Appendix B contains the detailed results for the site with the proposed development in place including the ARI 100 year flood event impacts, peak water surface levels, depths and velocities.

Table 4-2 details the peak water surface levels and impacts for the reporting points as outlined above.

Table 4-2 Existing ARI 100 Year Peak Water Levels

Reporting Point	Existing Peak Water Level (mAHD)	Developed Peak Water Level (mAHD)	Impact (mm)
A	5.026	5.034	8
B	4.783	4.794	11
C	4.564	4.576	12
D	4.478	4.492	14
E	4.257	4.272	15
F	4.081	4.117	36
G	3.776	3.779	3
H	2.966	2.972	6

In summary, the inclusion of the proposed development and associated earthworks results in less than 15mm impacts on areas adjacent to the development on the opposite bank of the Ross River. A large portion of this area is uninhabited golf course with a smaller area of residential urban area northwards of the golf course west of the site. These areas are already flood affected in the ARI 100 year design storm event.

The dwellings in the affected residential areas are generally high set houses and therefore habitable floors would be generally above the predicted flood level (confirmation of floor levels is recommended). Therefore the predicted impacts of less than 15mm for the 100 year flood event are not predicted to result in significant adverse impacts on these dwellings. Other impacts are contained within the bank of the Ross River.

Model accuracy is typically dependent upon ground survey accuracy, grid averaging and predicted rainfall runoff accuracy. When considering the above impacts off less than 15mm, it could be anticipated that a portion of these impacts may be accounted for by these uncertainties.

Peak velocities and flow patterns remain virtually unchanged as a result of these modifications.

5 EMERGENCY MANAGEMENT

As part of the flood assessment investigation, a review into the emergency management of the site during an extreme flood event has also been conducted. The PMF event, being the most extreme, was investigated.

The report relies on the council PMF flood mapping for the Oonoonba area, which is presented in Appendix C. The map shows extensive inundation surrounding and including the site which virtually isolates the site during an event of this magnitude.

From Council's mapping, PMF peak levels range for RL5.6m AHD to RL4.8m AHD. These levels are generally 1.0m above the predicted peak ARI 100 year water levels. Assuming the proposed residential floor levels will be set at the ARI 100 year peak flood level + 0.5m freeboard, the resulting depth over floors in the PMF event will be approximately 0.5m. Hence, the potential for structural damage or loss of life is low, and first floor refuges are safe under all flood events.

As evacuation from the site is potentially very difficult as a result of the extensive flooding surrounding the site, a 'stay put' option is proposed for residents. It is also proposed that two story dwelling be specified for inclusion throughout the development to provide refuge/shelter during an extreme event should over floor flooding occur.

High, flood free ground is also located centrally within the site which would also provide safe refuge for residents in the event of an extreme flood event.

The emergency flood management planning for the site will be refined at the detailed design stage, adhering to the above concepts.

6 CONCLUSIONS

From the investigations outlined in this report it can be shown that, subject to suitable detailed design, the subject site may be filled to above the Ross River ARI 100 year design flood event level providing two key features are included within the design. These features include:

- A 50m wide channel with invert at RL2.0m AHD located at the eastern side of the site adjacent to the East Coast Railway
- Excavation of the central drainage system to approximately RL 1.25m AHD.

The 50m wide channel allows flow to be maintained in a similar fashion to the existing flows in this area.

The inclusion the above measures results in off-site impacts of generally less than 15mm on adjacent properties during the ARI 100 year flood event. A significant proportion of this area is uninhabited golf course. In the residential areas, the majority of dwellings are high set and, subject to confirmation, are likely to have floor levels above the ARI 100year design flood and are not anticipated to be adversely impacted by predicted water level increase.

7 QUALIFICATIONS

This report has been prepared by BMT WBM PTY LTD specifically for the Urban Land Development Authority and specifically to provide advice on flooding issues associated with 'The Village' Oonoonba, Townville for the Master Planning stage of the project. Subsequent refinements of the flood assessments and flood management system will be required as the detailed design of the development proceeds.

Our analysis and overall approach has been specifically catered for the particular requirements of Urban Land Development Authority, 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:

- Townsville City Council's regional Ross River MIKEFLOOD hydraulic model supplied by Townsville City Council
- Revised Ross River Dam outflows supplied by Townsville City Council
- Detailed site MIKEFLOOD hydraulic model supplied by AECOM
- Preliminary developed site layout supplied by the Urban Land Development Authority
- Preliminary finished site DTM provided by Flanagan and Associates.

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

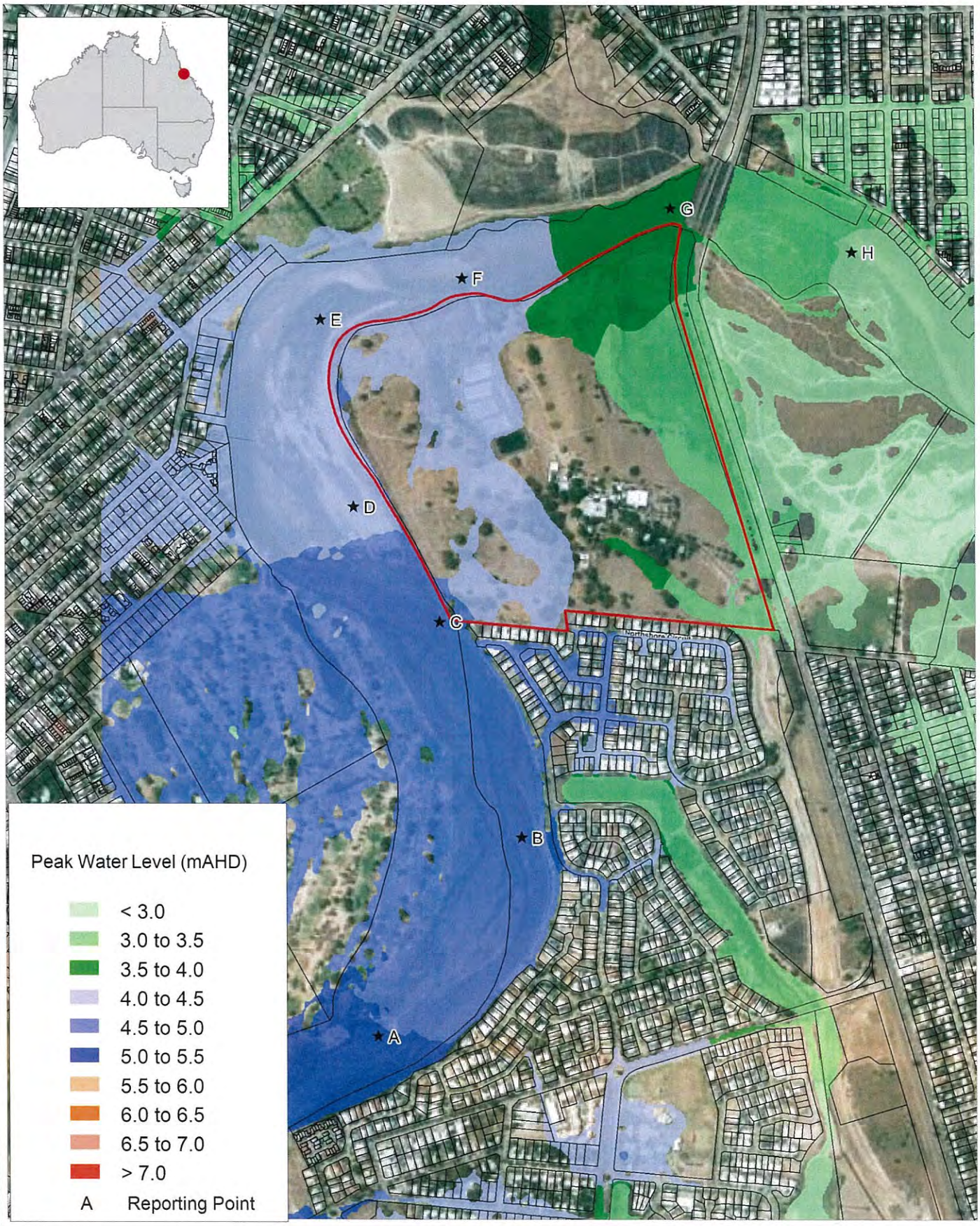
While BMTWBM's report accurately assesses peak flows and flood levels from design storms, it is an ungauged catchment in the vicinity of the site; consequently future observed flows and flood levels may vary from that predicted.

8 REFERENCES

Oonoonba Flood and Stormwater Management Study. AECOM. September 2010

Ross River Flood Study. Base-Line Flooding Assessment. Townsville City Council, April 2011

APPENDIX A: EXISTING CASE MODEL RESULTS



Title: **Oonoonba, Townsville**
ARI 100 Year Peak Water Levels
Existing Case

Figure: **A-1**

Rev: **1**

N

0 100 200m
Approx. Scale

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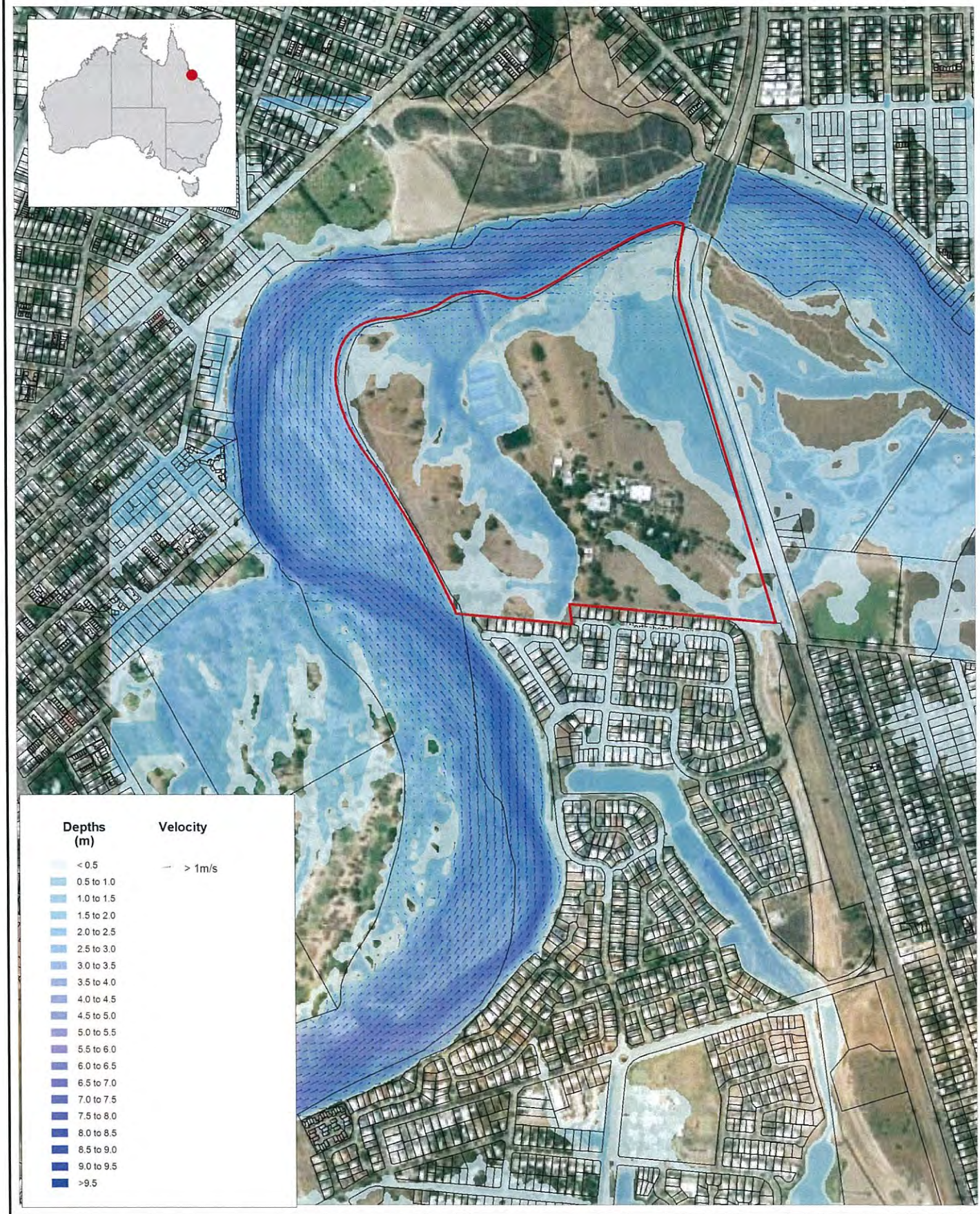

Title: **Oonoonba, Townsville**
ARI 100 Year Peak Depths
Existing Case

Figure: **A-2**

Rev: **1**

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Approx. Scale

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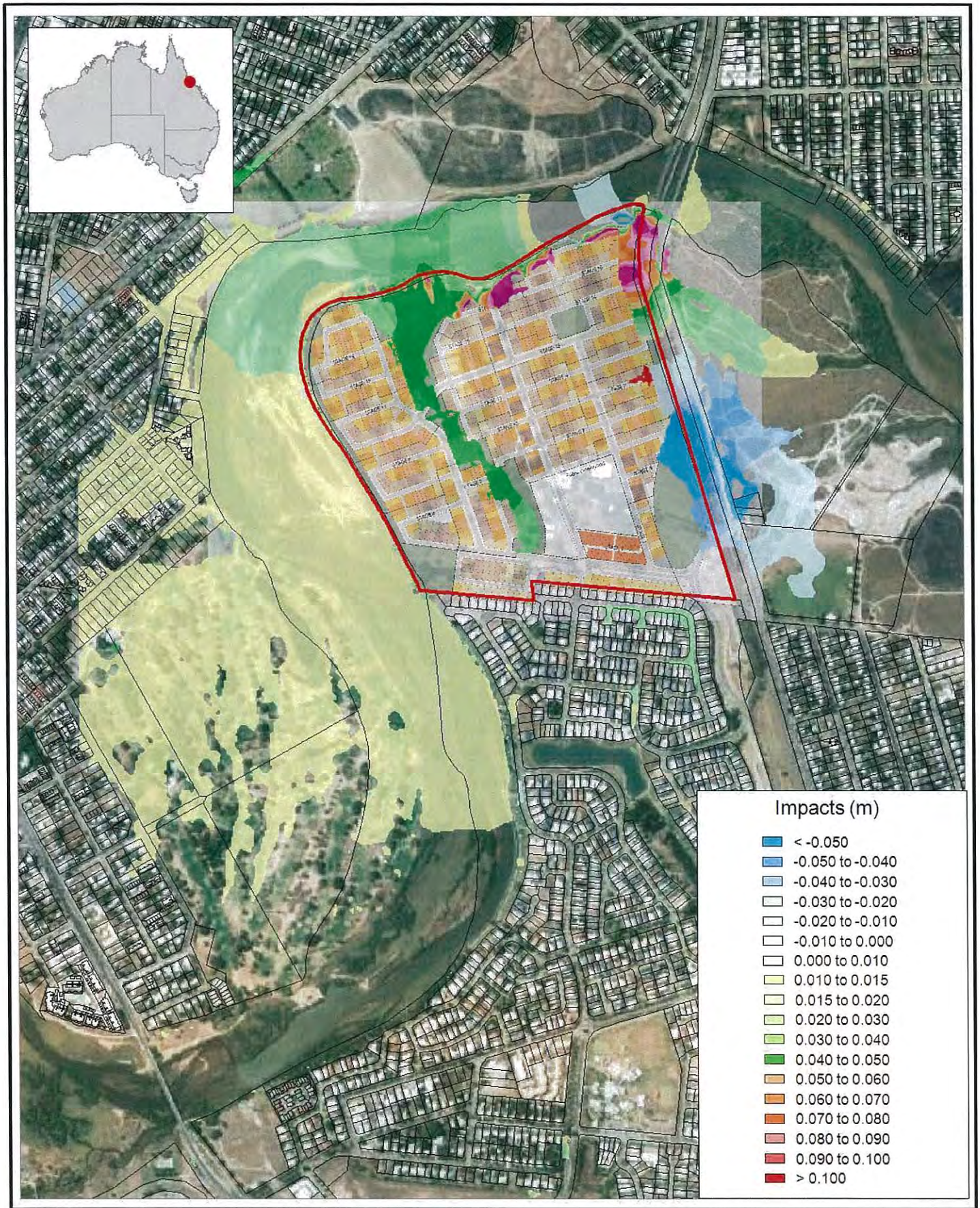
APPENDIX B: DEVELOPED CASE MODEL RESULTS



Title: **Oonoonba, Townsville**
ARI 100 Year Impacts
Developed Case

Figure: **B-1**

Rev: **1**

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Approx. Scale

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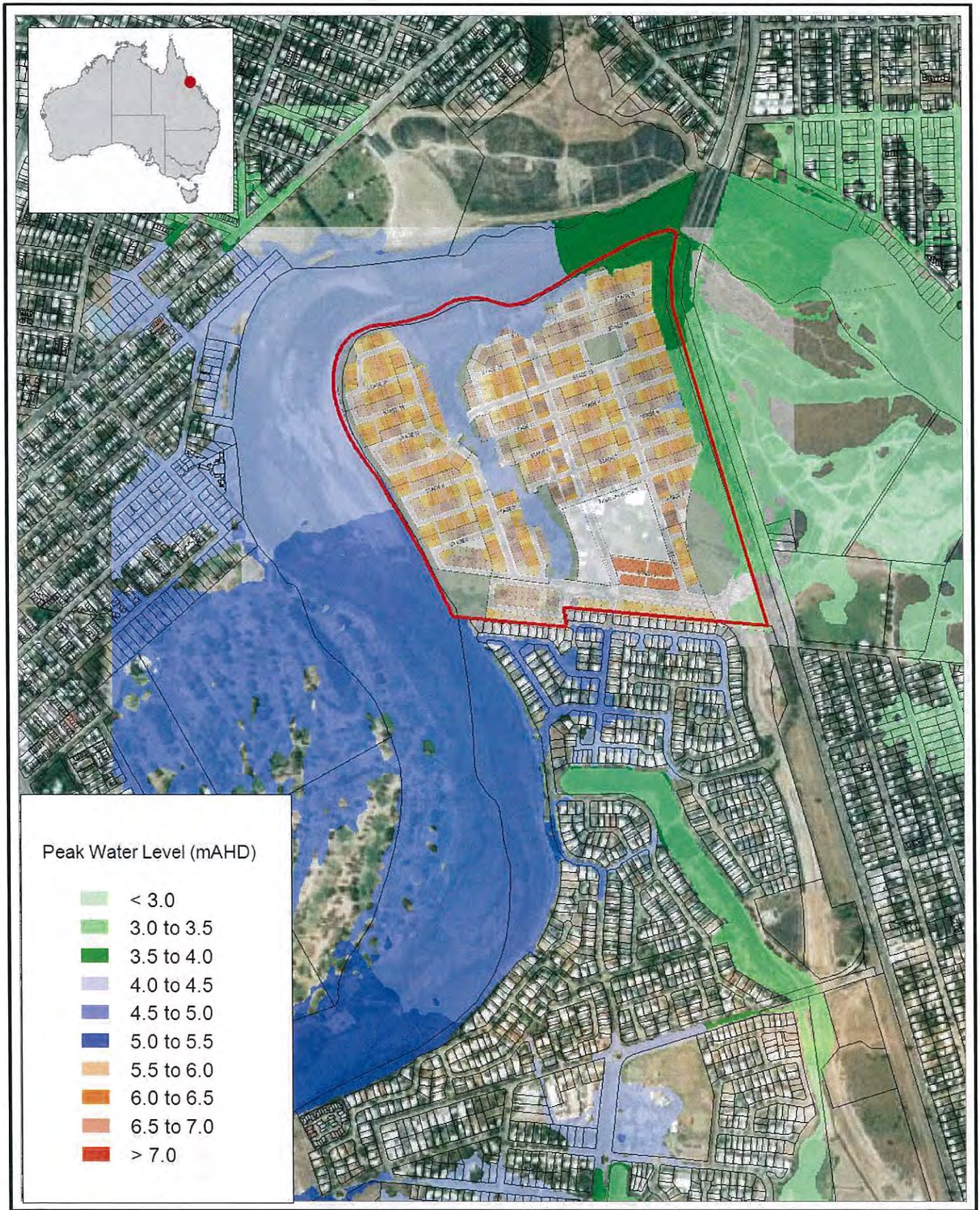

Title: **Oonoonba, Townsville**
ARI 100 Year Peak Water Levels
Developed Case

Figure: **B-2**

Rev: **1**

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0 100 200m
Approx. Scale

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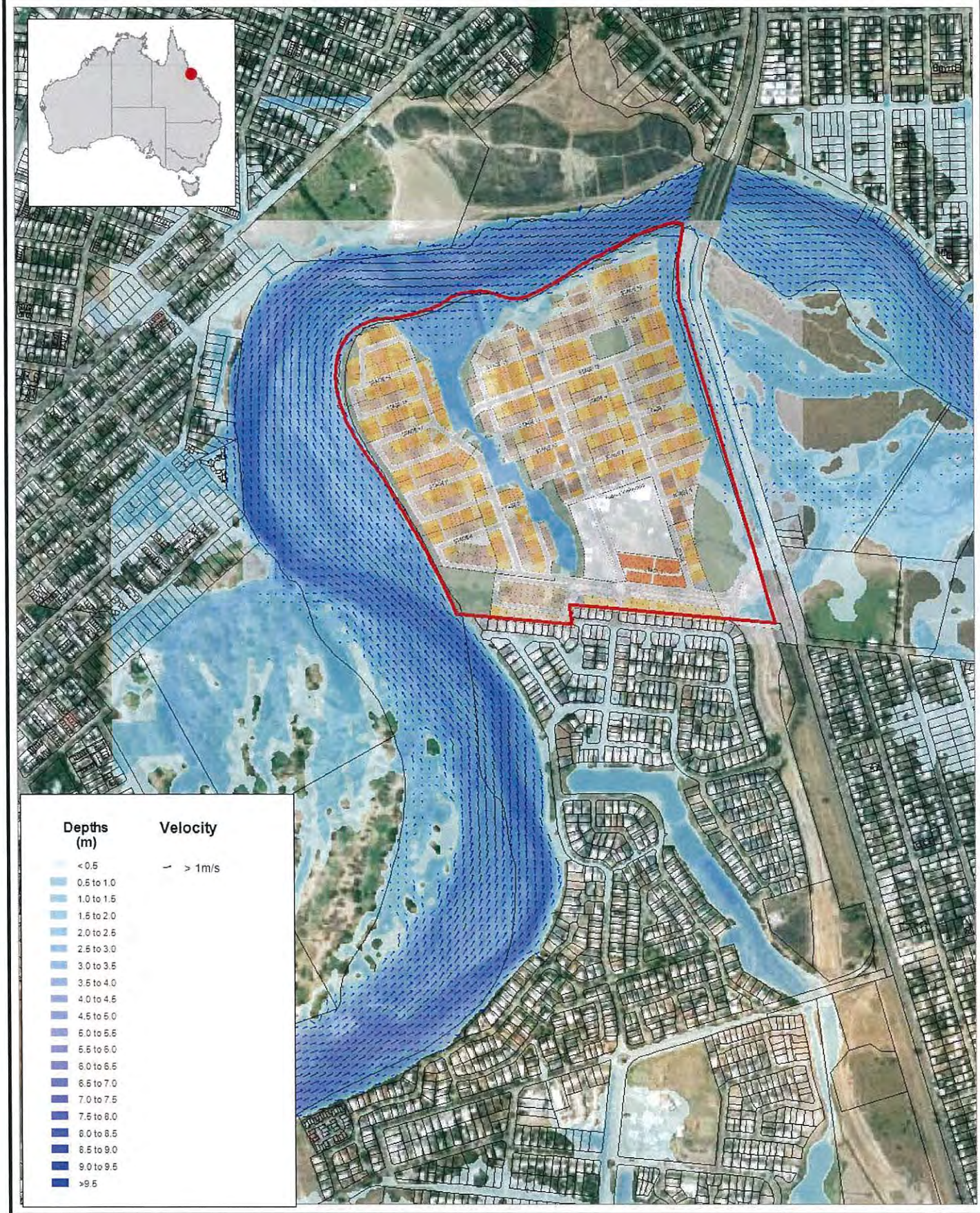

Title: **Oonoonba, Townsville**
ARI 100 Year Peak Depths
Developed Case

Figure: **B-3**

Rev: **1**

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Approx. Scale

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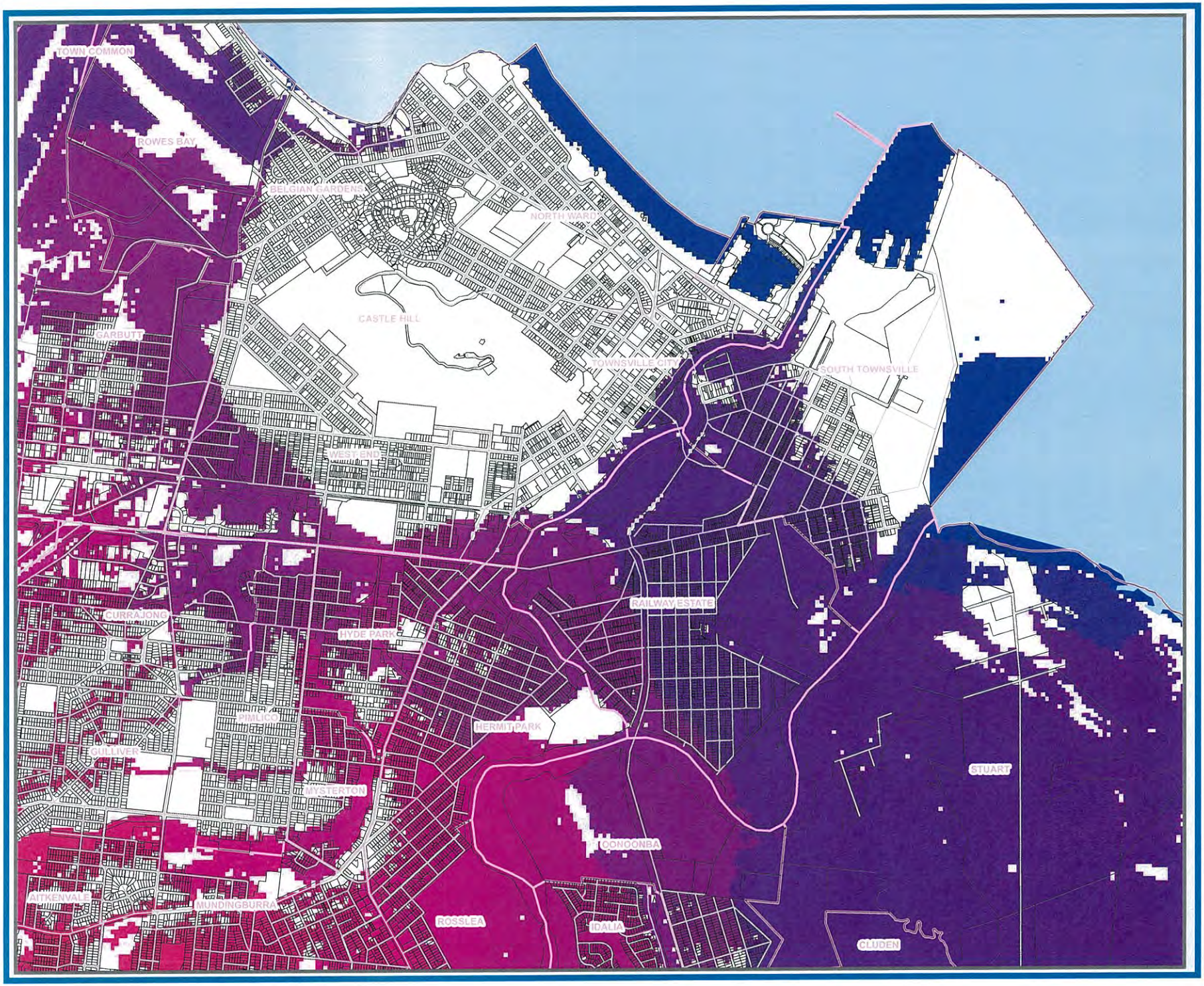
APPENDIX C: PMF FLOOD EXTENT



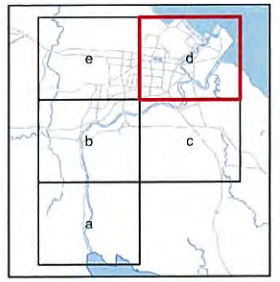
TOWNSVILLE CITY COUNCIL

ROSS RIVER FLOOD STUDY

PMF WATER LEVELS

LEGEND

Water Levels (m AHD)	
< 2	13 - 14
2 - 3	14 - 15
3 - 4	15 - 16
4 - 5	16 - 17
5 - 6	17 - 18
6 - 7	18 - 19
7 - 8	19 - 20
8 - 9	20 - 21
9 - 10	21 - 22
10 - 11	22 - 23
11 - 12	23 - 24
12 - 13	24 - 25
	> 25



N

0.7 0.35 0

Kilometers

SCALE: 1:25,000 @ A3

Strategic Planning Department
PLANNING AND DEVELOPMENT

DATE: 13/04/2011
DRAWN BY: WGB
DIGITAL FILE: mxd

Figure B-22

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