Harwood Marine

Harwood Marine Precinct - Planning Proposal
100yr ARI Flood and Stormwater Assessment

October 2012

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1. Introduction

1.1 Background

This report has been prepared to accompany a planning proposal (a request for Council to commence an LEP amendment to rezone the land) submitted by Harwood Marine, for land adjacent to its existing marine industry on Harwood Island. The planning proposal requests that an area of 42.64 ha be rezoned to IN4 Working Waterfront and W3 Working Waterways under the Clarence Valley Local Environmental Plan 2011. The rezoning will allow marine based industry and associated infrastructure on the subject site.

Whilst future development applications will address earthworks, platforms and building development within the proposed lots, the flood assessment has considered the impact of filling within the lot on the 100-year Average Recurrence Interval (ARI) flood event. Proposed building platforms have been used in the flood model to determine the impact development would have on flood levels, if any. The 100-year ARI storm event was simulated for the pre- and post-development scenarios, using Clarence Valley Councils flood model (Clarence Valley Council, 2004).

In addition to flooding, this assessment investigates management of stormwater at the proposed site, based on Water Sensitive Urban Design. A concept strategy is proposed, recognising the potential development.

1.2 Limitations of this Report

This report has been prepared by GHD for Harwood Marine and may only be used and relied on by Harwood Marine and Clarence valley Council for the purpose agreed between GHD and the Harwood Marine.

GHD otherwise disclaims responsibility to any person other than Harwood Marine arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

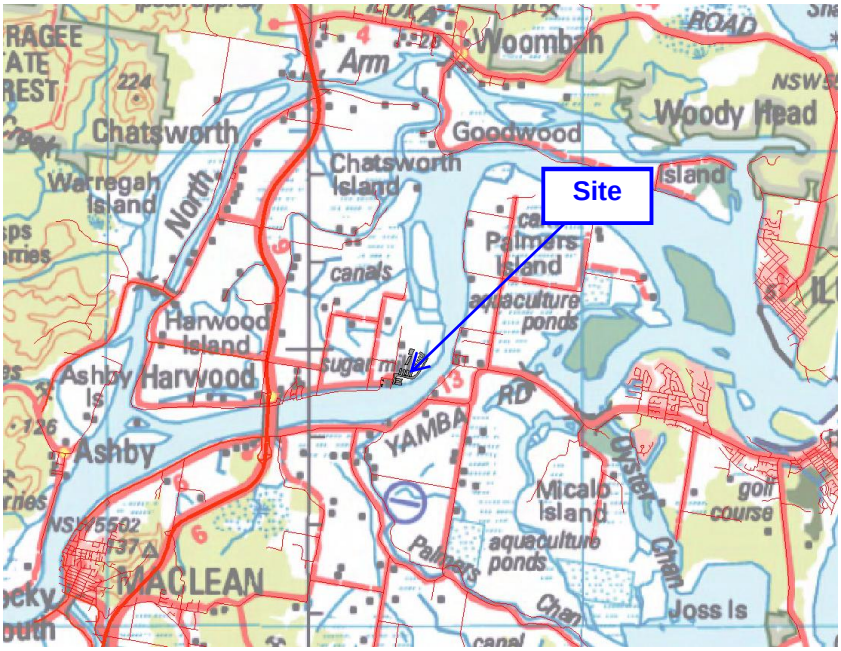
The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD. GHD disclaims liability arising from any of the assumptions being incorrect.

1.3 Existing Drainage at the Site

The proposed development area is located on the northern bank of the Clarence River (Figure 1), east of the Pacific Highway. This area forms part of Harwood Island and is flood affected by the Clarence River. The island is bisected by a number for drainage flood runners/canals, which generally drain the area to the Clarence River.

Figure 1 Locality Map



1.4 Available Data

The flood assessments were based on the Lower Clarence River Flood Study Review undertaken by WBM Oceanics Australia for Clarence Valley Council, dated 2004. This study reviewed flooding in the lower Clarence River using a TUFLOW 2D flood model.

In order to maintain consistency, GHD approached Clarence Valley Council for permission to engage WBM to simulate the proposed development area within the existing flood models. The results were received from WBM and interpreted.

Other data available for the flood assessment comprised topographic levels provided by the Client.

1.5 Assessment Criteria

The guiding documents for this assessment have been the Clarence Valley Council, Industrial Zones DCP 2011, the Development in Environmental Protection, Open Spaces and Special Use Zones, DCP December 2011, the Grafton and Lower Clarence Floodplain Risk Management Plan 2007 and Sustainable Water Information for Applicants, 2004, DCP. The DCP's define Floodplain Management Controls, which have been adopted for the purposes of this assessment. Additionally, the study has considered the following guides, plans, and manuals:

- Australian Rainfall and Runoff - A Guide to Flood Estimation (2001); and
- NSW Floodplain Development Manual (2005).

It is acknowledged that future climate impacts have not been simulated to date. It is estimated that flood impacts associated with the post development PMF and future climate impact should be undertaken as part of any future development applications, and this requirement could be conditioned as part of a future development application.

2. Flood Assessment

2.1 Site Visit

Site visits were undertaken to gain an understanding of the topography, identify drainage and overland flow path routes, constraints, and provide the required background data. Known hydraulic controls and flow path surfaces for hydraulic roughness calculations were of particular interest. Site visits allowed the identification of overflow paths, flow controls upstream and downstream and sections where critical flow conditions might occur.

2.2 Existing Flooding Conditions

The existing flooding conditions for the 100-year ARI event were obtained from the Lower Clarence River Flood Study Review undertaken by WBM Oceanics Australia for Clarence Valley Council. The flood simulation results that defined the existing flooding conditions are provided in Appendix B. The results show that in a 100-year ARI flood event:

- Flood levels (Figure B.1) in the area of the proposed development range from 2.8 to 3.0 m AHD. The figure shows the wide extent of flooding across the Lower Clarence River floodplain, in particular at, and downstream of Harwood Island;
- Flood depths (Figure B.2) in the area of the proposed development are in the order of 0.8m to 1.5 m at the peak of the event. The majority of the proposed buildings are located in an area with higher topography on the floodplain, where flood depths of between 0.8 m and 1.0 m would be expected. It is noteworthy that it is intended to raise buildings above the 100-year ARI event by providing building pads, and as such these flow depths would be expected in areas where no building pads would be provided; and
- Flood velocities (Figure B.3) across much of the site, on the floodplain, average approximately 0.1-0.15 m/s and are thus slow flowing. Towards the centre of the Clarence River floodway, flow velocities increase to approximately 1.5 to 1.7 m/s. These flow velocities are also considered low, and are on account of the broad wide floodplain and flat topographic/bathymetric grades.

Given the majority of the proposed buildings are located in an area with higher topography on the floodplain, where flood depths of between 0.8 m and 1.0 m and flow velocities around 0.1 to 0.15 m/s would be expected, in accordance with the NSW Floodplain Development Manual (NSW Government, 2005), a provisional high hazard would prevail at the time of the peak, entirely due to the flood depth. Once flood depths recede to less than 0.8 m, provisional low hazard conditions would likely prevail.

Notwithstanding, the Clarence Valley Council, 2007, Grafton and Lower Clarence Floodplain Risk Management Plan 2007 notes that *"to some degree the high hazard rating of the Lower Clarence River floodplain is mitigated by the flood warning time available for people to evacuate their homes"*. This study delineates the Lower Clarence River into "General Floodplain" and "Floodways" Flood Management Areas for the purposes of applying planning and development controls. Figure 3.3 of the study identifies the proposed site as a "General Floodplain", and thus is designated as suitable for Commercial & Industrial Land Use in Clarence Valley Council, Industrial Zones DCP 2011, subject to appropriate Development Controls.

2.3 Potential Development Option

Referring to Appendix A, the potential development option is for a number of large sheds located on pads raised to at or above the 100-year ARI levels. This would provide building floor levels located 0.5 m above the 100-year ARI flood level, namely at the flood planning level.

It is also proposed to provide an internal road, raised to the 5-year ARI flood event level, and relocation of on-site dams, with embankments located at the 20-year ARI flood event level

2.4 Developed Flooding Conditions

The proposed development platforms, roads and on-site dams were configured in the Clarence River Flood Study TUFLOW model. Platforms and proposed topography were provided to WBM, who inserted the data and simulated the model. The TUFLOW results files were provided back to GHD for interpretation. The flood impacts as a result of the development are provided in Appendix C, only flood level impacts greater than 10mm are shown in accordance with advice from the modelling software vendor levels of accuracy. The investigation has shown the following:

- The proposed development is expected to have a minimal impact on flood levels, due to the vast extent of the floodplain in the vicinity of the site. Within the existing site a small area is shown to have increased flood levels of up to 0.012 m, while a reduction in flood levels of some 0.015 m is noted adjacent to the proposed buildings. This is likely due to a slight redistribution of flows in the immediate vicinity of the proposed development; and
- Apart from a few minor model inconsistencies, flood velocity changes of more than 0.1 m/s are not expected due to the proposed development, anywhere on the floodplain.

In summary, it is considered that the potential development platforms would provide for development within proposed lots and these would have negligible impacts on flood levels and flow velocities in a 100-year ARI flood event.

2.5 Flood Emergency and Evacuation

Flood levels during significant flood events are expected to gradually rise to the peak over a 2 to 3 day period. Thus adequate time for flood preparedness and evacuation is expected. Notwithstanding, as noted in Section 2.2, flood depths in the order of 0.8 m to 1.5 m are expected at the peak of the flood event, with flow velocities around 0.1 to 0.15 m/s. Thus while high flood hazard is likely to prevail at the time of the peak, once flood depths recede to less than 0.8m, low hazard conditions would likely prevail.

Given that all egress routes are likely to be inundated, a “stay put” evacuation strategy would be appropriate. To further determine the most appropriate strategy, a flood evacuation plan should be prepared for any future development as part of any subsequent development application.

2.6 Compliance Assessment

As noted before, Figure 3.3 in the Grafton and Lower Clarence Floodplain Risk Management Plan identifies the Flood Management Areas as a “General Floodplain”.

A compliance assessment, generally in accordance with relevant Flood Performance Criteria extracts from the Clarence Valley Council, Industrial Zones DCP 2011 and the Development in Environmental Protection, Open Spaces and Special Use Zones DCP, December 2011 has been provided in Appendix D. Prescriptive controls have not been considered at this early planning stage of the project. In general it is considered that compliance with the relevant Clarence Valley Council DCP Flood Performance Criteria can be achieved.

3. Stormwater Management

3.1 Compliance Requirements

Clarence Valley Council requires compliance with three Water Sensitive Urban Design (WSUD) stormwater quality targets prior to approval of Commercial Developments over 500m^2. These targets are documented in the Clarence Valley Council Sustainable Water Information for Applicants, 2004, also referred to the Clarence Valley Council Sustainable Water Policy, 2011.

All developments must comply with a set of objectives based on greatest treatment of stormwater. The key stormwater pollution reduction performance targets set by Clarence Valley Council are listed, amongst others, as:

- Retain 80% of average annual Gross Pollutant Load; and
- Retain 50% of average annual Total Suspended Solid Load (coarse and medium sediments).

For the scale of development proposed, no nutrient targets are specified.

3.2 Stormwater Treatment Measures

Water Sensitive Urban Design (WSUD) encompasses all aspects of integrated urban water cycle management, including water supply, sewerage and stormwater management. In terms of stormwater management in developments, the WSUD philosophy has a number of objectives. These include:

- **Protect natural systems** - protect and enhance natural water systems within urban developments;
- **Integrate stormwater treatment into the landscape** - use stormwater in the landscape by incorporating multiple use corridors that maximise the visual and recreational amenity of urban developments;
- **Protect water quality** - protect the water quality draining from urban developments;
- **Reduce run off and peak flows** - reduce peak flows from urban developments by local detention measures and minimising impervious areas; and
- **Add value while minimising development costs** - minimise the drainage infrastructure cost of urban developments.

For this development a number of source control measures can be implemented.

3.2.1 Rainwater Tanks

Rainwater tanks at lot scale will allow capture of roof rainwater (stormwater harvesting) for outdoor use, toilet flushing and other non-potable uses. Rainwater tanks will be fitted with a first flush device if necessary. Rainwater tanks generally attenuate runoff as well as aiding in pollution capture processes.

3.2.2 Rain Gardens

Rain gardens would provide treatment of stormwater through fine filtration, extended detention and some biological uptake. They would also provide flow retardation and are particularly efficient at removing nitrogen. Runoff will be filtered through a fine media layer as it percolates downwards. It is then collected via a perforated pipe and discharged either directly or via conventional stormwater pipes. Vegetation is a crucial component of rain garden systems.

Above-ground, appropriate vegetation acts to retard and distribute flows and protects the surface of the system. Under these circumstances the vegetation also helps the trap suspended sediments. Below ground the root zone is high in biological activity aiding in pollutant uptake.

3.2.3 Gross Pollutant Trap (GPTs) and Oil and Water Separators

Gross Pollutant traps retain litter, debris and coarse/fine sediment from stormwater. There are a variety of GPT's available to suit a range of requirements for water treatment. Some of these, for example the Humeguard are able to separate oil and water.

3.2.4 Swales and Vegetated Overland Flow Paths

Overland flow buffer strips and vegetated swales provide flow attenuation and pollutant removal. These measures will be used to direct stormwater to the rain gardens.

3.3 Stormwater Quality Management (MUSIC)

Stormwater quality treatment effectiveness has been modelled using the software Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Version 5.0. MUSIC is a widely accepted means of assessing stormwater treatment and has been used to demonstrate compliance with pollution reduction targets at the site.

3.3.1 MUSIC Model Configuration

The MUSIC configuration was based on the Water by Design (2010) MUSIC Modelling Guidelines (WBD, 2010). This recommended typical rainfall-runoff and pollutant generation parameters.

Given the potential development option (Appendix A), and the distribution of pads across the site, Water Sensitive Urban Design facilities could be provided as either of both of the following scenarios:

- On a development scale, where the facilities could treat run-off from a number of building pads; or
- On individual building pads.

On the basis of the proposed layout, it is likely that treatment would be provided on individual building pads and the MUSIC assessment was undertaken for a typical building pad scenario. The predevelopment condition for the site was represented by a single lumped catchment node. In the post-development scenario, the site was subdivided to represent hardstand, roofs and pervious areas. Roof area was approximated at 50% of a typical building pad.

Table 1 below list typical building pad catchments assumed for the MUSIC assessment, for both the pre and post-development scenarios.

Table 1 Pre/Post development impervious surfaces

Land Type	Area (m^2)
Pre-Development	
Natural Ground	600
Post-Development	
Hardstand	180
Roof	300
Ground	120

3.4 Proposed Stormwater Treatment Train

The proposed stormwater treatment train for individual building pads would comprise the following strategy:

- All pads will generally drain to a discharge point and swale/drain which would drain to the Clarence River;
- Each lot will be provided with a rainwater tank collecting runoff from the roof area only. Rainwater tanks will be provided with an overflow pipe generally draining to internal building pad drainage. This would bypass the rain gardens;
- The runoff from hardstand areas would be routed to a rain gardens situated at the low point of the pad; and
- GPT units would be provided before discharging to rain gardens or offsite, if appropriate. Depending on proposed activities on individual building pads, it may be appropriate to include oil and water separation before discharge.

3.5 MUSIC Modelling Results

The MUSIC model results in Table 2 below show that the key post-development pollutant load based targets outlined above in Section 3.1 are met. In addition, nutrient targets would also be met, although no target has been specified in the Clarence Valley Sustainable Water Information for Applicants, 2004, DCP.

Table 2 Pollution reduction

Pollutant	Post-development without treatment	Post-Development with treatment	% Reduction	% Reduction Target
Total Suspended Solids (kg/yr)	86.9	15.1	82.6	50
Total Phosphorus (kg/yr)	0.205	0.13	58.4	N/A
Total Nitrogen (kg/yr)	1.67	1.12	39.7	N/A
Gross Pollutants (kg/yr)	12.9	0.541	100	80

4. Summary and Conclusions

This report has been prepared to accompany a planning proposal (a request for Council to commence an LEP amendment to rezone the land) submitted from Harwood Marine for land adjacent to its existing marine industry on Harwood Island. The planning proposal requests that an area of 42.64 ha be rezoned to IN4 Working Waterfront and W3 Working Waterways under the Clarence Valley Local Environmental Plan 2011. The rezoning will allow marine based industry and associated infrastructure on the subject site.

Whilst future development applications will address earthworks, platforms and building development within the proposed lots, a flood assessment has considered the impact of filling within the lot on the 100-year Average Recurrence Interval (ARI) flood event. Proposed building platforms have been used in the flood model to demonstrate that development within the proposed lots is not restricted by flooding.

The 100-year ARI storm event was simulated for the pre- and post-development scenarios, using Clarence Valley Councils flood model (Clarence Valley Council, 2004). The flood study investigation has shown, amongst others, the following:

- In a 100-year ARI flood event flood levels in the area of the proposed development range from 2.8 to 3.0 m AHD with a wide extent of flooding across the Lower Clarence River floodplain, in particular at, and downstream of Harwood Island. Flood depths in the area of the proposed development are in the order of 0.8 to 1.5 m at the peak of the event. Flood velocities (Figure B.3) across much of the site, on the floodplain average approximately 0.1-0.15 m/s and are thus slow flowing;
- The proposed development is expected to have a minimal impact on flood levels, due to the vast extent of the floodplain in the vicinity of the site. Within the existing site a small area is shown to have increased flood levels of up to 0.012 m, while a reduction in flood levels of some 0.015 m is noted adjacent to proposed buildings. This is likely due to a slight redistribution of flows in the immediate vicinity of the proposed development. Apart from a few minor model inconsistencies, flood velocities changes of more than 0.1 m/s are not expected due to the proposed development, anywhere on the floodplain.
- Flood levels during significant flood events are expected to gradually rise to the peak over a 2 to 3 day period. Thus adequate time for flood preparedness and evacuation is expected. Given that all egress routes are likely to be inundated, a “stay put” evacuation strategy would be appropriate. To further determine the most appropriate strategy, a flood evacuation plan should be prepared for any future development as part of any subsequent development application; and
- A compliance assessment, generally in accordance with relevant Flood Performance Criteria extracts from the Clarence Valley Council, Industrial Zones DCP 2011 and the Development in Environmental Protection, Open Spaces and Special Use Zones DCP, December 2011 has been provided in Appendix D. Prescriptive controls have not been considered at this early planning stage of the project. In general, it is considered that compliance with the relevant Clarence Valley Council DCP Flood Performance Criteria can be achieved.

In summary, it is considered that the potential development pads would provide for development within proposed lots and these would have negligible impacts on flooding.

To manage stormwater discharge from the site, Clarence Valley City Councils Water Sensitivity Urban Design objectives defined by the Clarence Valley Sustainable Water Information for Applicants, 2004, DCP were adopted. Stormwater quality has been modelled using the MUSIC software. Based on the assessment of stormwater at the site, a concept Stormwater Management Strategy outlining potential stormwater management is provided, which proposes:

- All pads will generally drain to a discharge point and swale/drain which would drain to the Clarence River;
- Each lot will be provided with a rainwater tank collecting runoff from the roof area only. Rainwater tanks will be provided with an overflow pipe generally draining to internal building pad drainage. This would bypass the rain gardens;
- The runoff from hardstand areas would be routed to a rain gardens situated at the low point of the pad; and
- GPT units would be provided before discharging to rain gardens or offsite, if appropriate. Depending on the proposed activities on individual building pads, it may be appropriate to include oil and water separation before discharge.

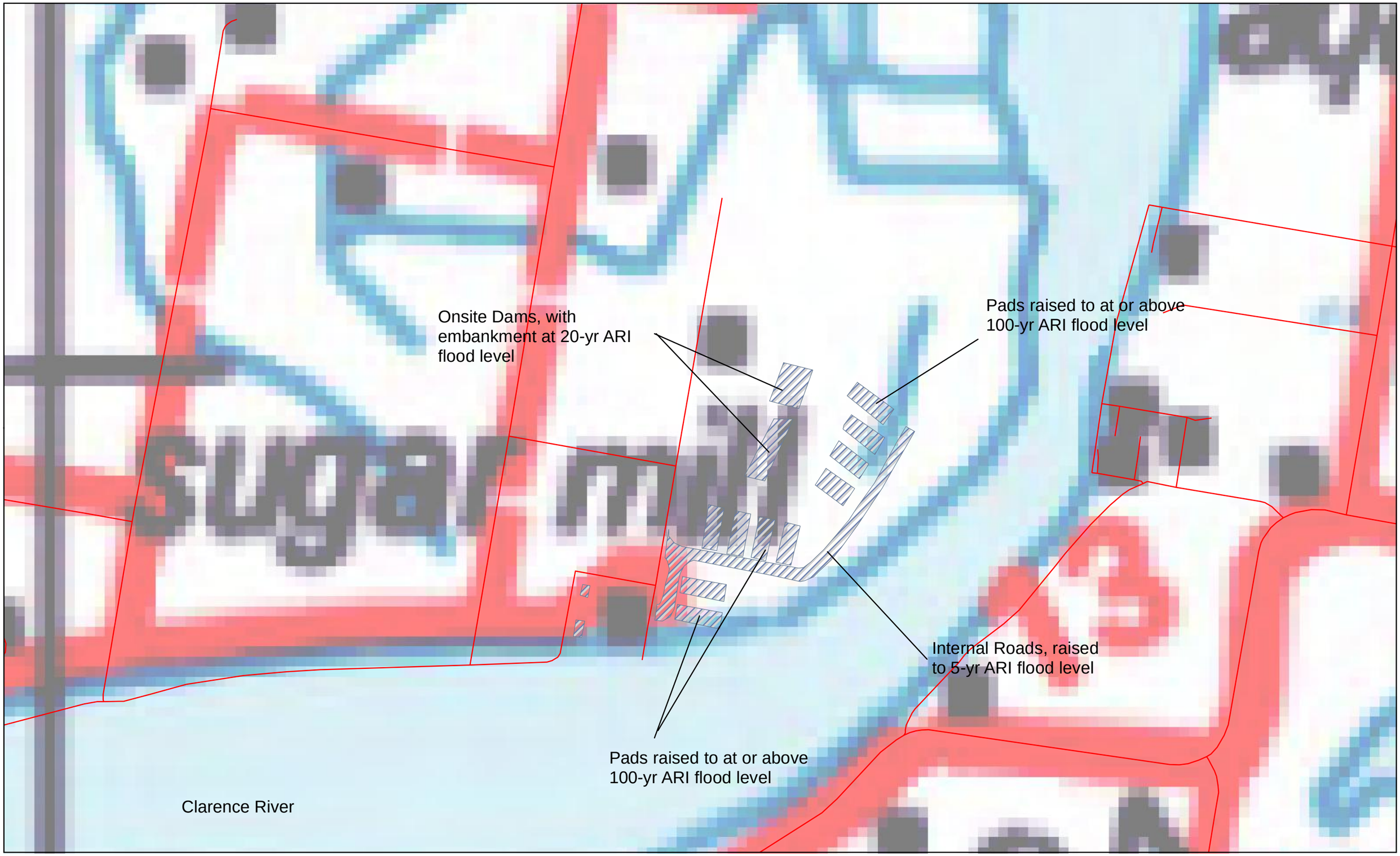
The MUSIC model results show that the key post-development pollutant load based targets are met. In addition, nutrient targets would also be met, although no target has been specified in the Clarence Valley Sustainable Water Information for Applicants, 2004, DCP.

5. References

- NSW Government, 2005, NSW Floodplain Development Manual.
- Clarence Valley Council, 2004, Lower Clarence River Flood Study Review undertaken by WBM Oceanics Australia;
- Clarence Valley Council, 2007, Grafton and Lower Clarence Floodplain Risk Management Plan undertaken by Bewsher Consulting;
- Clarence Valley Council, 2011 Development in Environmental Protection, Open Spaces and Special Use Zones, December 2011;
- Clarence Valley Council, 2004, Sustainable Water Information for Applicants, November 2004;
- Australian Rainfall and Runoff - A Guide to Flood Estimation (1987); and
- Water By Design (2010) – MUSIC Modelling Guidelines for South-East Queensland.

Appendices

Appendix A – Potential Development Option



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0 0.1 0.2 0.4

Kilometres (at A3)

Map Projection:
Horizontal Datum: ADG84
Grid: Zone 56

O

LEGEND

Potential Development Option

Harwood Slipway Marine Precinct - Planning Proposal

Potential Development Option

Job Number	22-16424
Revision	A
Date	10/03/2012

Figure A.1

G:\14\0102799\FINAL TEMPLATES\Rev 001\ArcGIS\GHD-A3-LANDSCAPE.mxt

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: C Pappin

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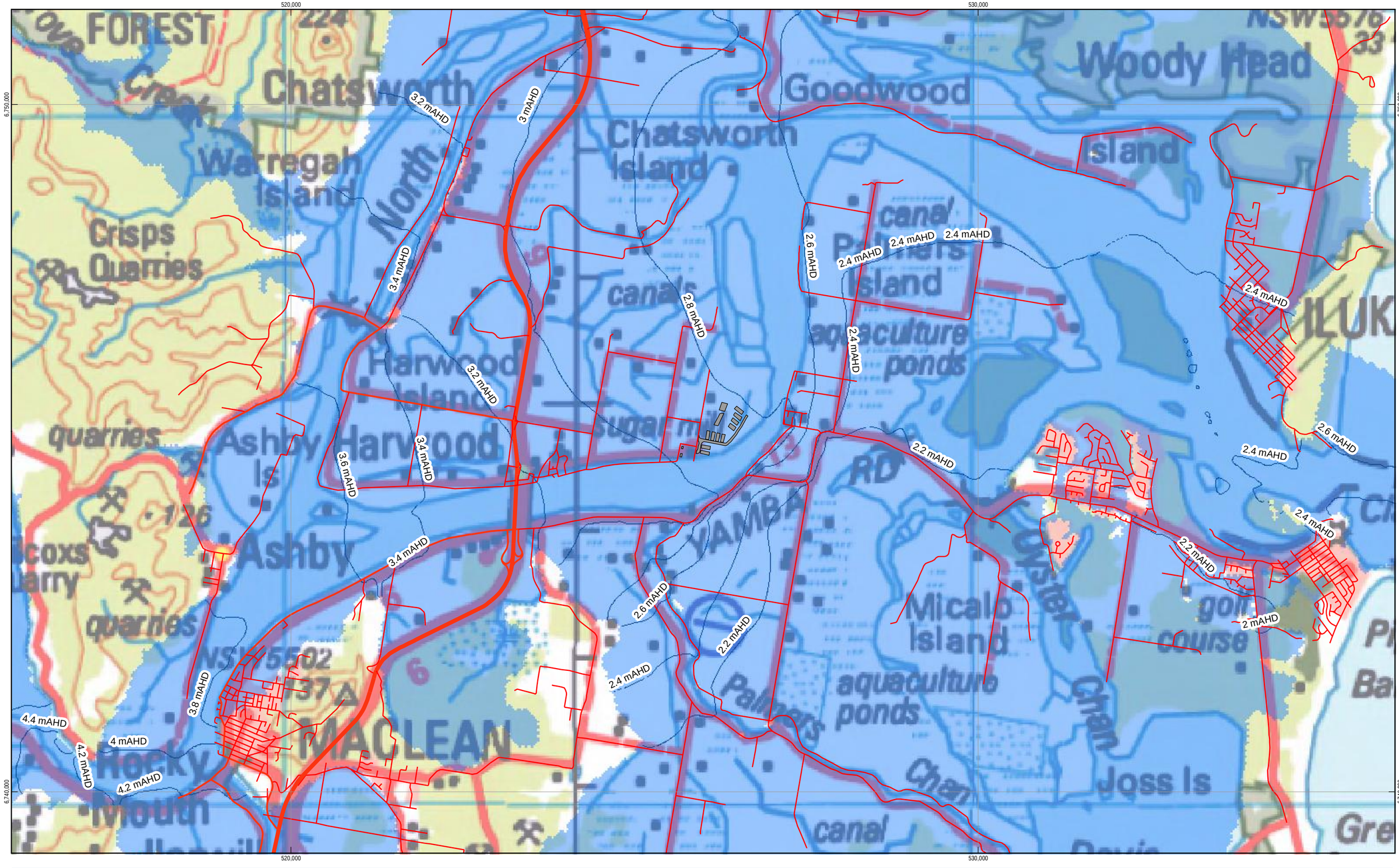
Appendix B – Existing Flood Conditions



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Kilometres (at A3)

Map Projection:
Horizontal Datum: ADG84
Grid: Zone 56

LEGEND

Flood Level Contours

100yr Flood Innundation

Proposed Development

Harwood Slipway Marine Precinct - Planning Proposal

100-year ARI Flood Event Existing Conditions

Job Number	22-16424
Revision	A
Date	10/03/2012

Figure B.1

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1:10,000

0 0.1 0.2 0.4

Kilometres (at A3)

Map Projection:
Horizontal Datum: ADG84
Grid: Zone 56

N

LEGEND

Flood Depth Contour

Flood Depth (m)

0 - 0.5

0.5 - 1

1 - 2

2 - 3

3 - 5

5 - 30

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Harwood Slipway Marine Precinct - Planning Proposal

100-year ARI Flood Event Existing Conditions

Job Number	22-16424
Revision	A
Date	10/03/2012

Figure B.2

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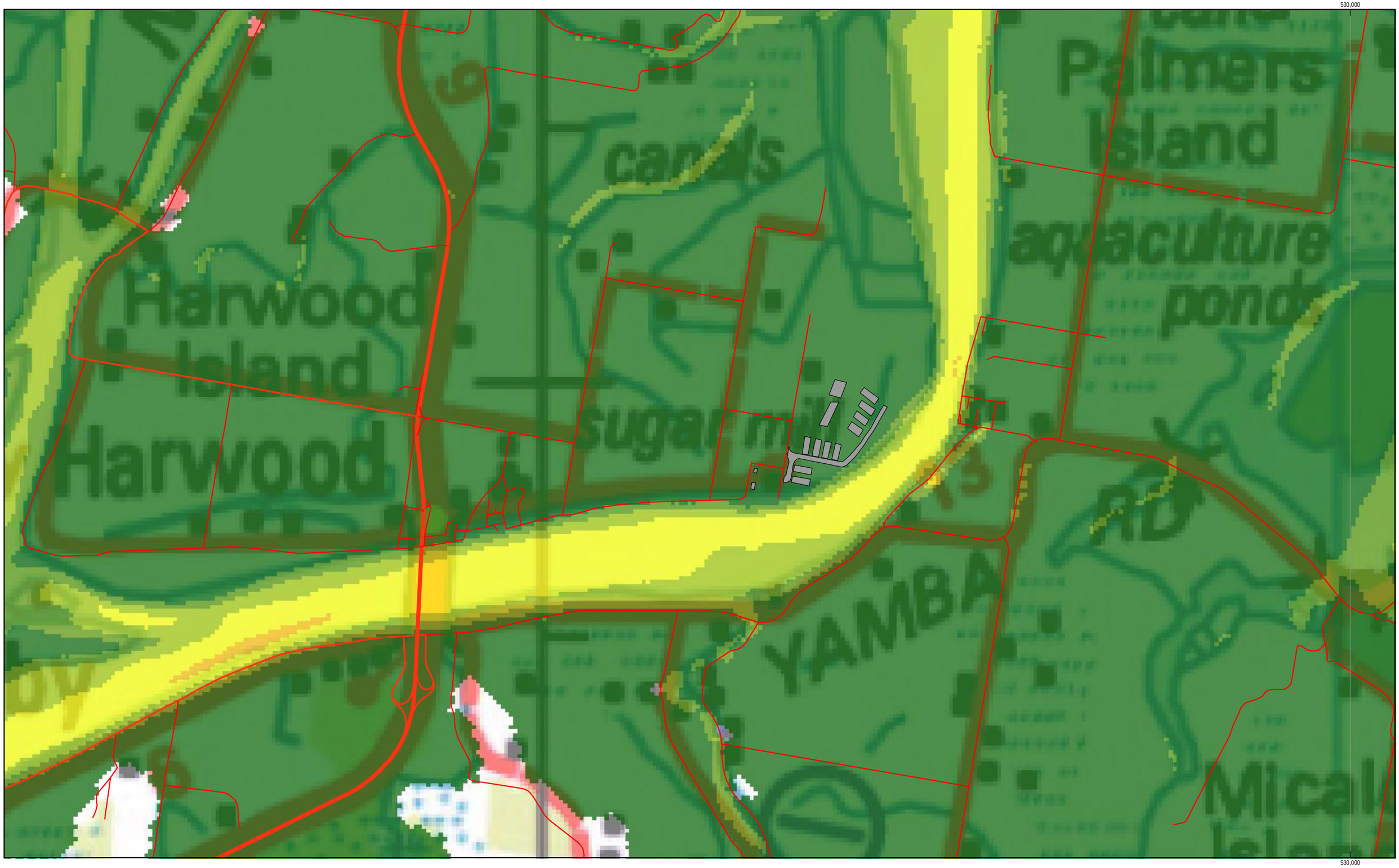

1:25,000

0 0.1 0.2 0.4 0.6 0.8

Kilometres (at A3)

Map Projection:
Horizontal Datum: ADG84
Grid: Zone 56

N

LEGEND

Velocity (m/s)
0 - 0.5
0.5 - 1
1 - 1.5
1.5 - 2
2 - 3
3 - 5
5 - 10

Harwood Slipway Marine Precinct - Planning Proposal

100-year ARI Flood Event Existing Conditions

Job Number	22-16424
Revision	A
Date	10/03/2012

Figure B.3

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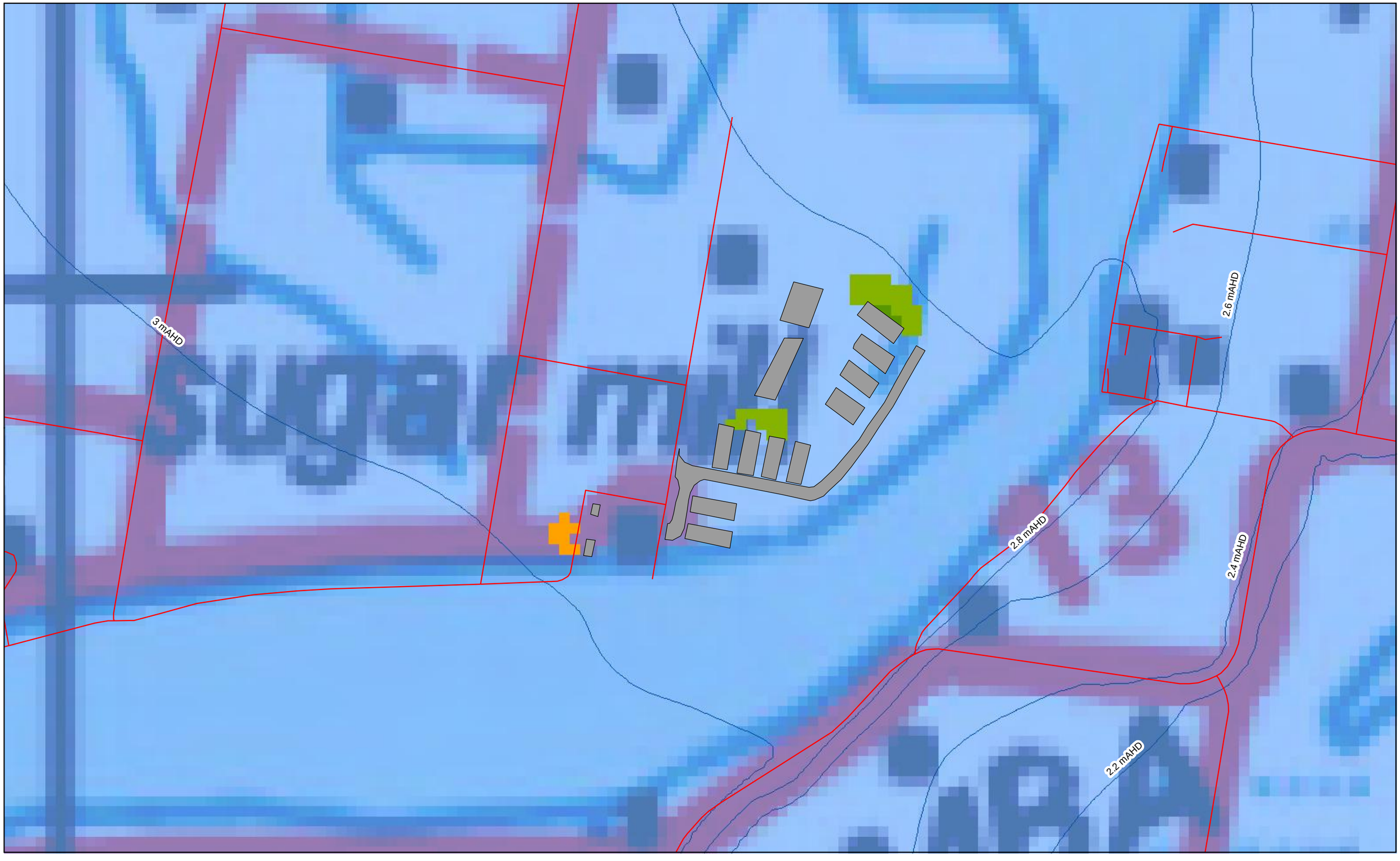
Appendix C – Flood Impacts



1:10,000

0 0.1 0.2 0.4

Kilometres (at A3)

Map Projection:
Horizontal Datum: ADG84
Grid: Zone 56

O

LEGEND

Flood Level Impacts

- gt -0.1m reduction
- -0.1m - -0.05m
- -0.05m - -0.02m
- -0.02m - -0.01m
- -0.01m - -0.005m (not shown)
- -0.005m - 0m (not shown)
- 0m - 0.005m (not shown)
- 0.005m - 0.01m (not shown)
- 0.01m - 0.02m
- 0.02m - 0.05m
- 0.05m - 0.1m
- gt 0.1m increase

Flood Level Contours

100yr Flood Innundation

Proposed Development

Harwood Slipway Marine Precinct - Planning Proposal

100-year ARI Flood Event Existing Conditions

Job Number	22-16424
Revision	A
Date	10/03/2012

Figure C.1

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Appendix D – Compliance Assessment

Performance Criteria	Comments
D3.1	
(a) The proposed development should not result in any increased risk to human life.	Increased risk to human life is not expected, on the condition that the future site will be operated and supported by an appropriate Flood Emergency and Evacuation Plan.
(b) The additional economic and social costs which may arise from damage to property from flooding should not be greater than that which can reasonably be managed by the property owner and general community.	Given the nature and form of the development, it is considered likely that this criteria can be met.
(c) The proposal should only be permitted where effective warning time and reliable access is available for evacuation from an area potentially affected by floods to an area free of risk from flooding. Evacuation should be consistent with any relevant flood evacuation strategy.	Flood levels during significant flood events are expected to gradually rise to the peak over a 2 to 3 day period. Thus adequate time for flood preparedness and evacuation is expected. Notwithstanding, as noted in Section 2.2, flood depths in the order of 1 m to 1.5 m are expected at the peak of the flood event, with flow velocities around 0.1 to 0.15 m/s. Thus while high flood hazard is likely to prevail at the time of the peak, once flood depths recede to less than 0.8 m, low hazard conditions would likely prevail. Given that all egress routes are likely to be inundated, a “stay put” evacuation strategy would be appropriate. To further determine the most appropriate strategy, a flood evacuation plan should be prepared for any future development as part of any subsequent development application.
(d) Development should not detrimentally increase the potential flood effects on other development or properties either individually or in combination with the cumulative impact of development that is likely to occur in the same floodplain.	As discussed in Section 2.4 it is considered that the potential development platforms would provide for development within proposed lots and these would have negligible impacts on flood levels and flow velocities in a 100-year ARI event.
(e) Motor vehicles are able to be relocated, undamaged, to an area with substantially less risk from flooding, within effective warning time.	Given the form of the development and that the pad will be provided with floor levels 0.5m above the 100-year ARI flood level, motor vehicle could be raised in the event of a flood
(f) Procedures would be in place, if necessary, (such as warning systems, signage or evacuation drills) so that people are aware of	It has been recommended that a flood evacuation plan should be prepared for any future development as part of any subsequent

the need to evacuate and relocate motor vehicles during a flood and are capable of identifying an appropriate evacuation route	development application.
(g) Development should not result in significant impacts upon the amenity of an area by way of unacceptable overshadowing of adjoining properties, privacy impacts (eg. By unsympathetic house-raising) or by being incompatible with the streetscape or character of the locality.	Given the location and proposed development this criteria is not considered relevant
(h) Proposed development must be consistent with Ecological Sustainable Development (ESD) principles.	To be determined
(i) Development should not prejudice the economic viability of any Voluntary Acquisition Scheme.	Not applicable
D5.1	
(a) The filling of flood liable land must not increase the flood risk on other land within the floodplain	As discussed in Section 2.4 it is considered that the potential development platforms would provide for development within proposed lots and these would have negligible impacts on flood levels and flow velocities in a 100-year ARI event.
(b) Filling and associated works must not have any unacceptable associated environmental impacts such as detrimental affects on the ecology of riparian corridors	Given impacts to flow velocities is minimal, and the explanation of the aforementioned item, impacts such as detrimental affects on the ecology of riparian corridors are not expected

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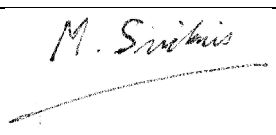
1	R Berg	B. Luffman		M. Svikis		30/10/12

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