Appendix A Flood model inputs

The hydraulic model used for this assessment was developed and calibrated as part of the *Lower Clarence Flood Study Review* (WBM, 2004) and then subsequently updated for Clarence Valley Council by BMT WBM in 2011 and 2013 to include increased model definition in urban areas and to include updated terrain data. The extent of the Lower Clarence flood model is shown in Figure A-1. The following sections outline the model input used by the flood model.

A.1 General setup

The Clarence River Hydraulic model uses TUFLOW modelling software. It is a multi-domain model with areas of higher resolution (finer model grid size) attributed to populated areas. Model domains are shown in Figure A-1 and are as follows:

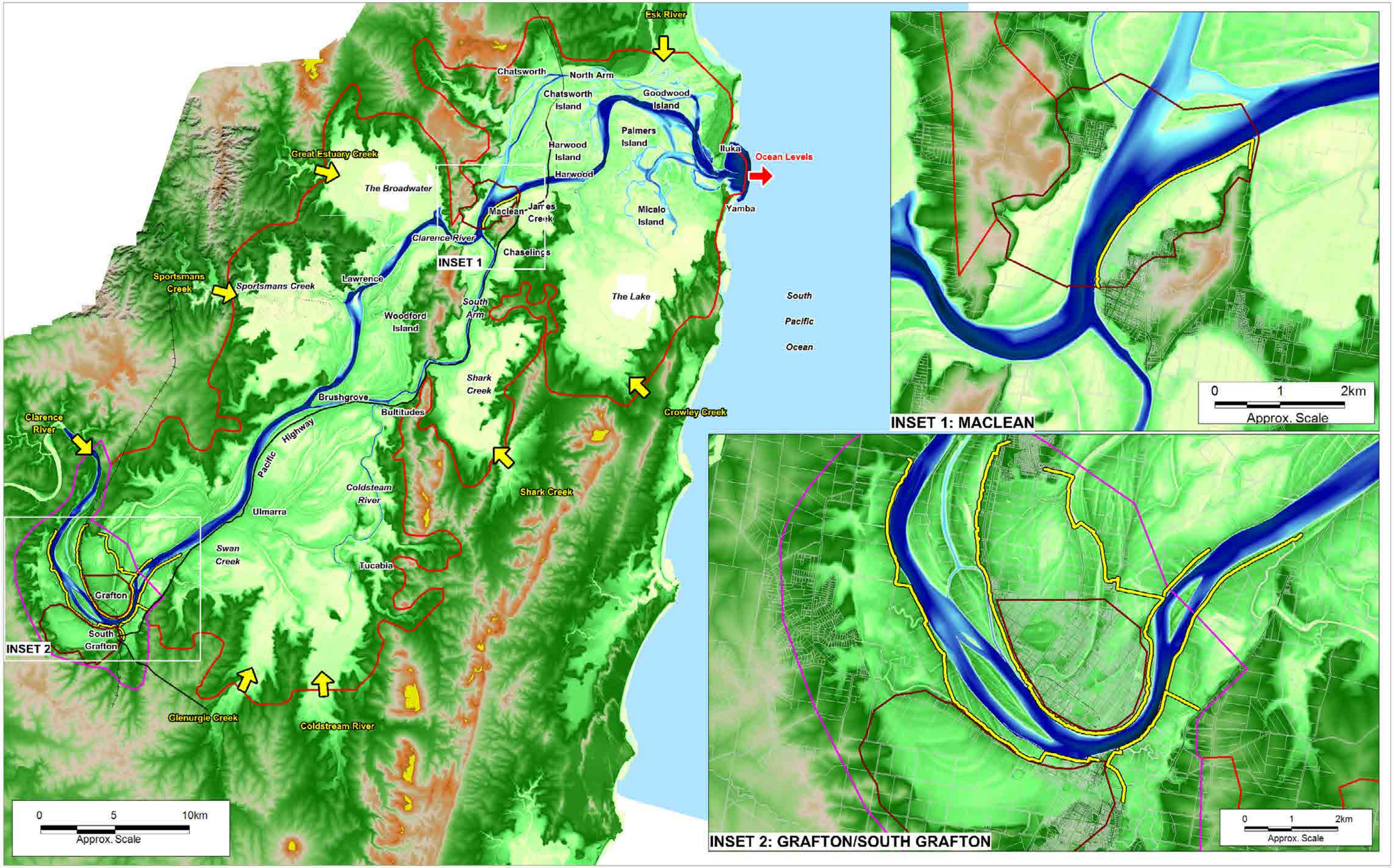
- A 60m grid domain representing the majority of the rural floodplain;
- 10m grid domains for Grafton, South Grafton and Maclean; and
- A 30m domain for the area surrounding Grafton and South Grafton not included in the 10m model domains.

The model runs in TUFLOW version 2012-05.

A.2 Model geometry

The Lower Clarence flood model uses the latest available topographic data. This data therefore forms the base data used in the current assessment and consists of the following principal datasets:

- 2010 LiDAR data captured in 2010 for Clarence Valley Council;
- In bank bathymetry based on Clarence River hydro-surveys undertaken in 1963, 1978 and 1979; and
- Ground survey data of levee elevations (undertaken in 2012 for CVC) for the Grafton, South Grafton, Heber, Alipou, Clarenza and Ulmarra levees.



LEGEND

- Model Inflows
- 60m model domain
- 30m model domain
- 10m model domain
- Railway
- Pacific Highway
- Levee

-20.0 -10.0 0.0 10.0 25.0 50.0 75.0 100.0 125.0 150.0 175.0 200.0

See Inset

Ground Level : Metres AHD

-2.0 0.0 2.0 4.0 6.0 8.0 10.0

Ground Level Inset

Title:

Lower Clarence Flood Model Configuration

Figure: **A-1**

Rev: **A**

N

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Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_043_140122_Flood_Model_Extent.wor"

A.3 Hydraulic roughness

Landuse mapping is used by the hydraulic model to represent the various vegetation types and associated hydraulic roughness within the model. The landuse mapping used for this study is consistent with the data used in the *Lower Clarence Flood Study Update* (BMT WBM, 2013).

In total, 11 areas of different landuse type were defined, based on aerial photography. The Manning's 'n' values adopted for the various defined landuses within the hydraulic model are listed in Table A-1. These values were validated as part of the flood model calibration exercise undertaken in the Flood Model Update study.

Table A-1 Lower Clarence flood model landuse categories

Landuse Type	Manning's n Coefficient
River Bank	0.08
River	0.025
Island Vegetation	0.08
Minor Tributary	0.035
Pasture	0.08
Sugar Cane	0.15
Crops	0.1
Forest	0.2
Urban Blocks	0.3
Parks	0.04
Roads (within 10m model domains)	0.02

A.4 Model boundaries

The Lower Clarence flood model used various input boundary conditions including:

- Flood inflows for the Clarence River at Mountain View;
- Flood inflows for the Clarence River tributaries downstream of Mountain View;
- Lower floodplain rainfall-runoff; and
- Ocean water levels.

Design inflows from the Lower Clarence Flood Study Update model (BMT WBM, 2013) are presented in Table A-2 and are input into the model at the location shown in Figure A-1. These design inflows have been adopted for the current assessment. The derivation and application of each of these inputs during the design event modelling is outlined in the following sections.

Table A-2 Lower Clarence flood model peak design flood inflows

Design Flood Event	Clarence River Inflow (m^3/s)	Tributary Inflows (m^3/s)						
		Glenugie Creek	Coldstream River	Shark Creek	Sportsmans Creek	Great Estuary Creek	Cowley Creek	Esk River
5 year ARI	9,360	223	486	66	458	192	209	780
20 year ARI	16,280	326	708	96	658	276	300	1,110
50 year ARI	18,220	407	877	118	813	341	370	1,361
100 year ARI	19,060	445	957	127	884	367	401	1,462
PMF Event	29,162	715	1538	201	1438	587	641	2,330

A.4.1 Derivation of Clarence River inflows

As part of the Lower Clarence River Flood Study Review (WBM, 2004) the inflows used for the Clarence River at Mountain View in the preceding Lower Clarence Flood Study (PWD, 1988) were reviewed. The basis of this review was the development of rating curves for the Clarence River at Grafton to cover the varying catchment states from the start of records in 1839 to the present.

Four “historical” rating curves were derived to represent four distinct floodplain states throughout the gauged history of the river at Grafton. These curves are presented in Figure A-2. These rating curves were then used to produce a revised series of peak flows based on the recorded flood levels at Prince Street Gauge over a period of more than 150 years.

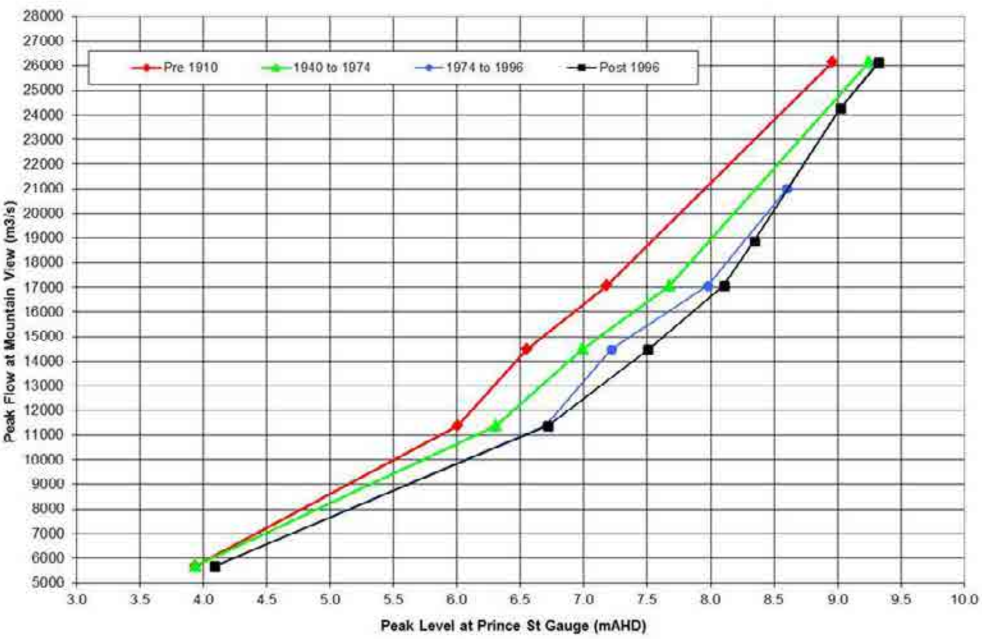

Figure A-2 Clarence River historical rating curve

An annual maximum flood frequency analysis of the 162 years of revised peak inflows was completed using the flood frequency analysis program "FLIKE". As part of the flood frequency analysis two distributions were produced. These were the Generalised Extreme Value (GEV) and Log Pearson 3 (LP3) distributions. Comparing the two methods, the GEV distribution was found to provide the best results. For ARI's greater than 5 years the GEV fits the data satisfactorily. Almost all the data fall within the 90% confidence limits. Figure A-3 shows the results of the GEV flood frequency analysis.

Based on the design flows calculated using the flood frequency analysis, the WBM (2004) study scaled Clarence River inflows at Mountain View using a flood hydrograph corresponding to recorded data for a historic 1974 flood event. The 1974 flood event was chosen as the hydrograph input for this purpose as comparisons with other recorded historic events indicated its shape represented a typical stage hydrograph at the Prince Street Gauge.

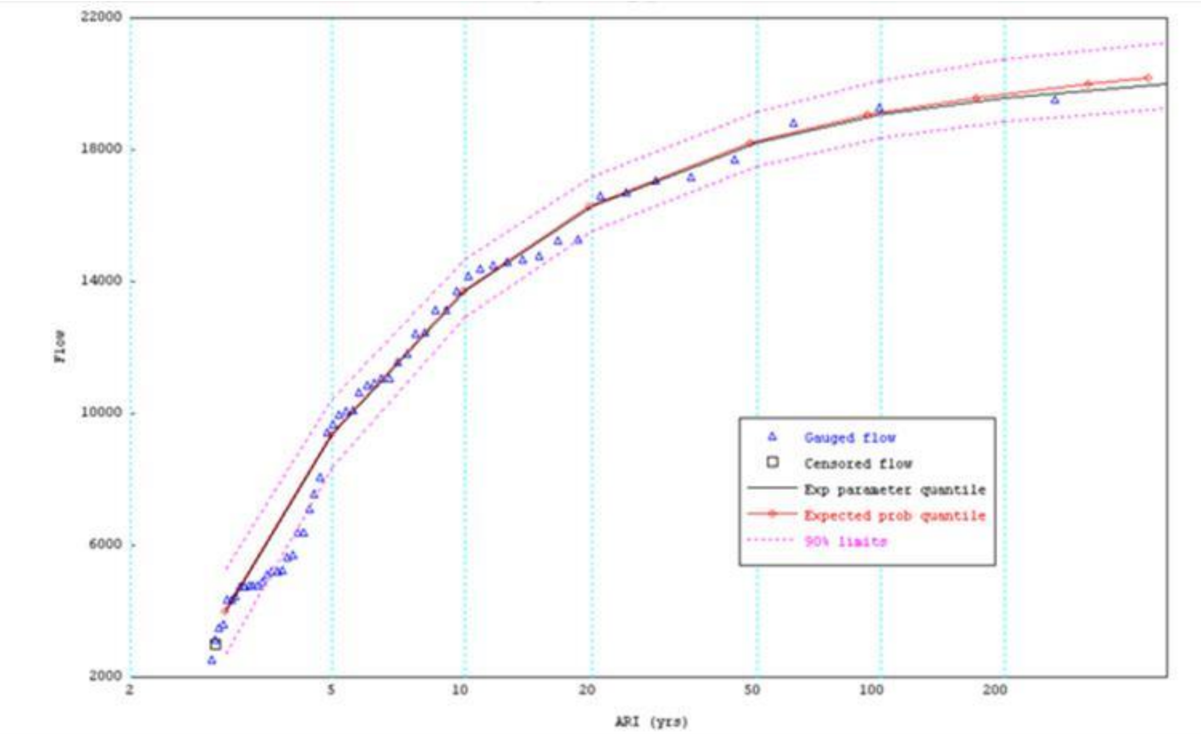

Figure A-3 Flood frequency curve using GEV (Annual Maxima series from 1839 to 2000)

The 2004 (WBM) flood frequency analysis adopted a methodology which is consistent with current *recommendations outlined in the draft Australian Rainfall and Runoff update, "Book 4 Estimation of Peak Discharge"* (Kuczera G and Frank S, 2006). The assessment:

(1) Accounts for non-homogeneity within the recorded flood population, including:

  (a) Changes in catchment conditions[8] which may have a significant impact on the gauge rating curve; and

  (b) Changes in gauge datum – from South Grafton Railway gauge datum to Australian Height datum (mAHD).

[8] For example, the construction of levees containing flow within the river channel.

(2) Uses a sufficient length of record data to reduce uncertainty associated with the extreme value estimates (162 years).

Due to these consistencies with current guidelines, the flood frequency design flows derived during the 2004 (WBM) study have been adopted for this study[9].

A.4.2 Tributary inflows

The design rainfall and temporal patterns for the tributary catchments for the 72 hour design storm, as recommended in Australian Rainfall and Runoff (1987), were used as input to the hydrologic models of these catchments. The 72 hour design storm was adopted because it represents the longest duration event with defined temporal pattern guidance provided by Australian Rainfall and Runoff. Compared to other temporal patterns, the 72 hour event provides the highest flood levels throughout the catchment. For the initial and continuing rainfall losses, values of 30mm and 2mm/hr were used. These losses are typical of values used for design flood assessments of NSW coastal rivers.

A.4.3 Floodplain runoff

The rainfall on the floodplain was simulated as runoff to the 2D flood model by simulating ponding of the rainfall immediately on the floodplain without any flood routing. Similar for the above inflows, for the initial and continuing rainfall losses, values of 30mm and 2mm/hr were used.

A.4.4 Ocean boundary condition

WBM (2004) adopted design flood ocean levels defined by the Lower Clarence River Flood Study (PWD, 1988). These ocean boundaries, shown in Figure A-4, have subsequently been adopted for this study.

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[9] It should however be noted that the design flow estimate statistics currently do not include peak flow information associated with the events which have occurred since 2004. As such, it does not include details for the major flood events which occurred in 2009, 2011 and 2013.

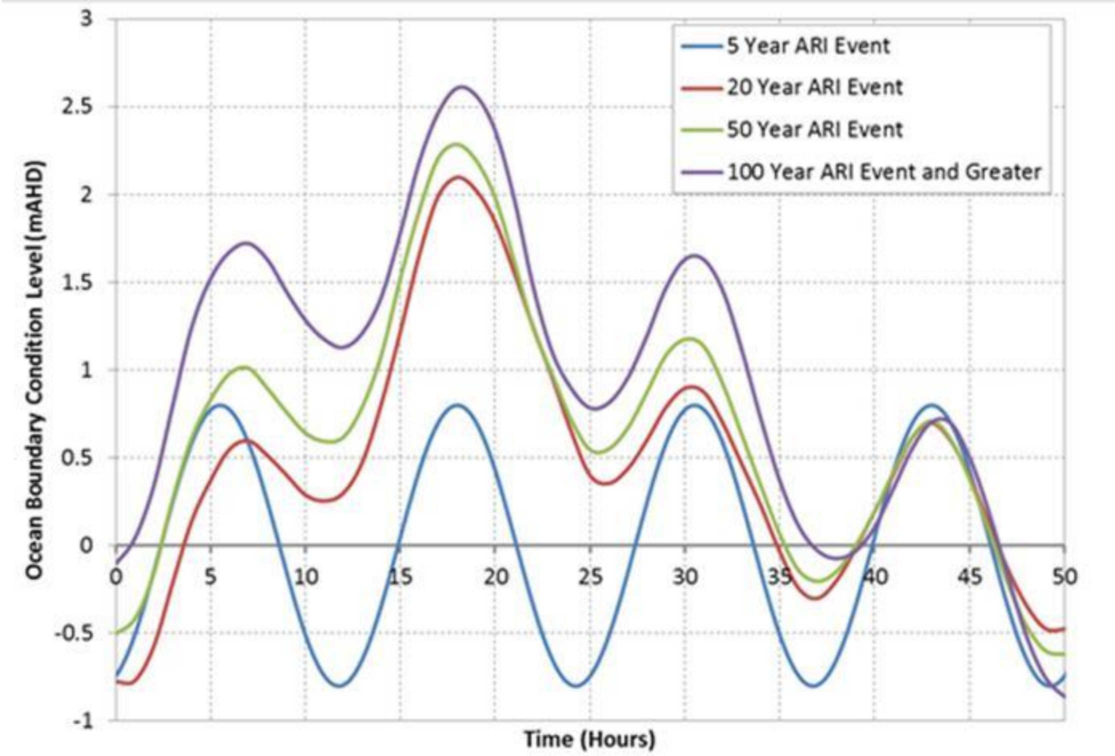


Figure A-4 Lower Clarence flood model design tidal boundaries

These peak tidal boundary levels approximate guideline values specified within 'Floodplain Management Guideline No5 Ocean Boundary Conditions' (DIPNR, 2004). The shape of the boundary condition does however vary from the guideline values. This variation reflects site specific tidal conditions at the Clarence River.

This study assumes that peak rainfall on the main and tributary catchments coincides with the storm tide peak, representing a slow moving storm which crosses the coast and moves inland. This boundary configuration results in backwater storm tide inundation prior to the arrival of catchment flooding in the lower catchment, as demonstrated in Figure A-5.

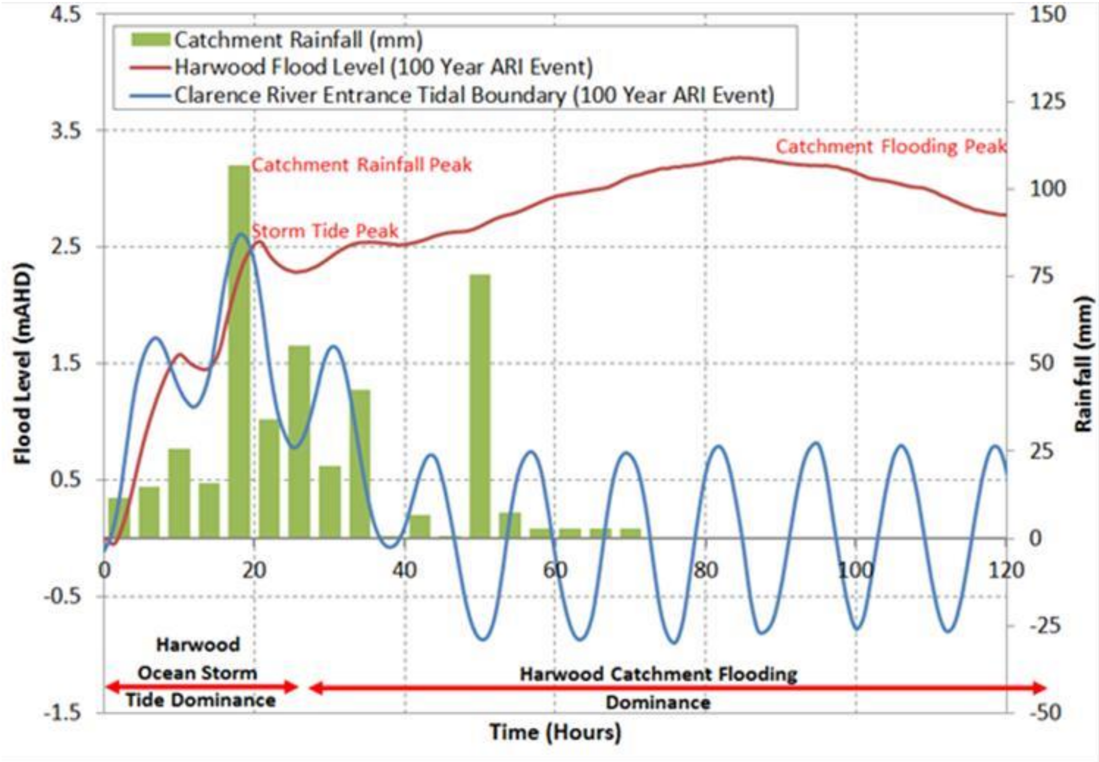


Figure A-5 Storm tide / catchment flooding response time (Harwood)[10]

Due to the significant size of the Clarence, and the associated delayed catchment response, coincident timing of equivalent storm tide and catchment flooding peaks at the river entrance has not been assessed as such a scenario is overly conservative.

A.5 Model calibration

As part of the *Lower Clarence Flood Study Update* (WBM, 2013), calibration of the developed flood model was undertaken for eight historical flood events including the event of January 2013. The calibration events are summarised in Table A-3 and the results for the Prince Street Gauge at Grafton are summarised in Table A-4.

The calibration results summarised in Table A-4 indicate that the model is capable of accurately representing the catchment flood behaviour in Grafton for a range of flood events.

[10] Harwood is located downstream of Maclean on the main branch of the Clarence River

Table A-3 Flood model calibration Events

Historic Flood Event	Prince Street Gauge		
	Peak Flood Level (mAHD)	***Approximate ARI Event Equivalent***	***Comment***
June 1967	7.55	25 year ARI event	Pre 1974 catchment condition rating curve WBM (2004) – refer to Figure A-2
January 1968	6.17	8 year ARI event	
May 1980	6.35	7 year ARI event	1974 -1996 catchment condition rating curve WBM (2004) – refer to Figure A-2
April 1988	6.73	9 year ARI event	
May 1996	7.03	10 year ARI event	
March 2001	7.70	14 year ARI event	Post 1996 catchment condition rating curve WBM (2004) – refer to Figure A-2
May 2009	7.33	12 year ARI event	
January 2013	8.09	27 year ARI event	

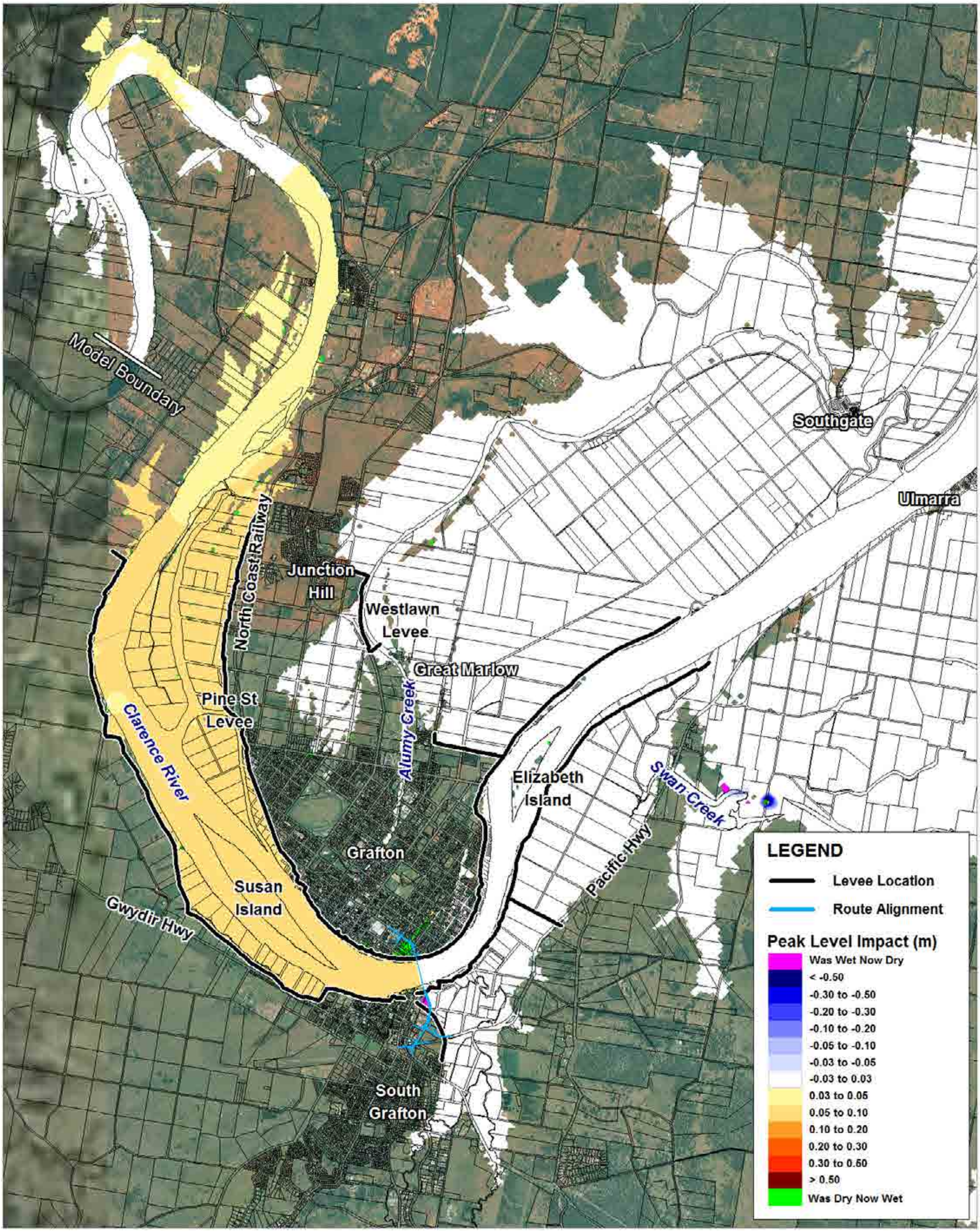
Table A-4 Flood model calibration results (Prince St Gauge, Grafton)

Historic Event	Recorded (mAHD)	Modelled (mAHD)
June 1967	7.6m	7.5m
January 1968	6.2m	6.3m
May 1980	6.4m	6.4m
April 1988	6.8m	6.8m
May 1996	7.0m	7.0m
March 2001	7.6m	7.7m
May 2009	7.3m	7.5m
January 2013	8.1m	8.0m

Appendix B Extended Flood Impact Maps

B.1 Introduction

Appendix B presents supplementary flood impact maps where the impact shown in maps contained in the main body of the report extended to the upstream end of the model boundary. To avoid any doubt as to where the spatial extent of the predicted impacts end, an additional 7km of the Clarence River upstream of Grafton was included in an extended model and the impacts mapped. Appendix B presents these extended model results. Maps have only been presented for modelled scenarios showing impacts extending to the models upstream limit.



Title:

Peak Flood Level Impacts (Unmitigated)
20 Year ARI Event (Extended Model)

Figure: **B-1**

Rev: **A**

N

0km 1.5 3
Approx. Scale

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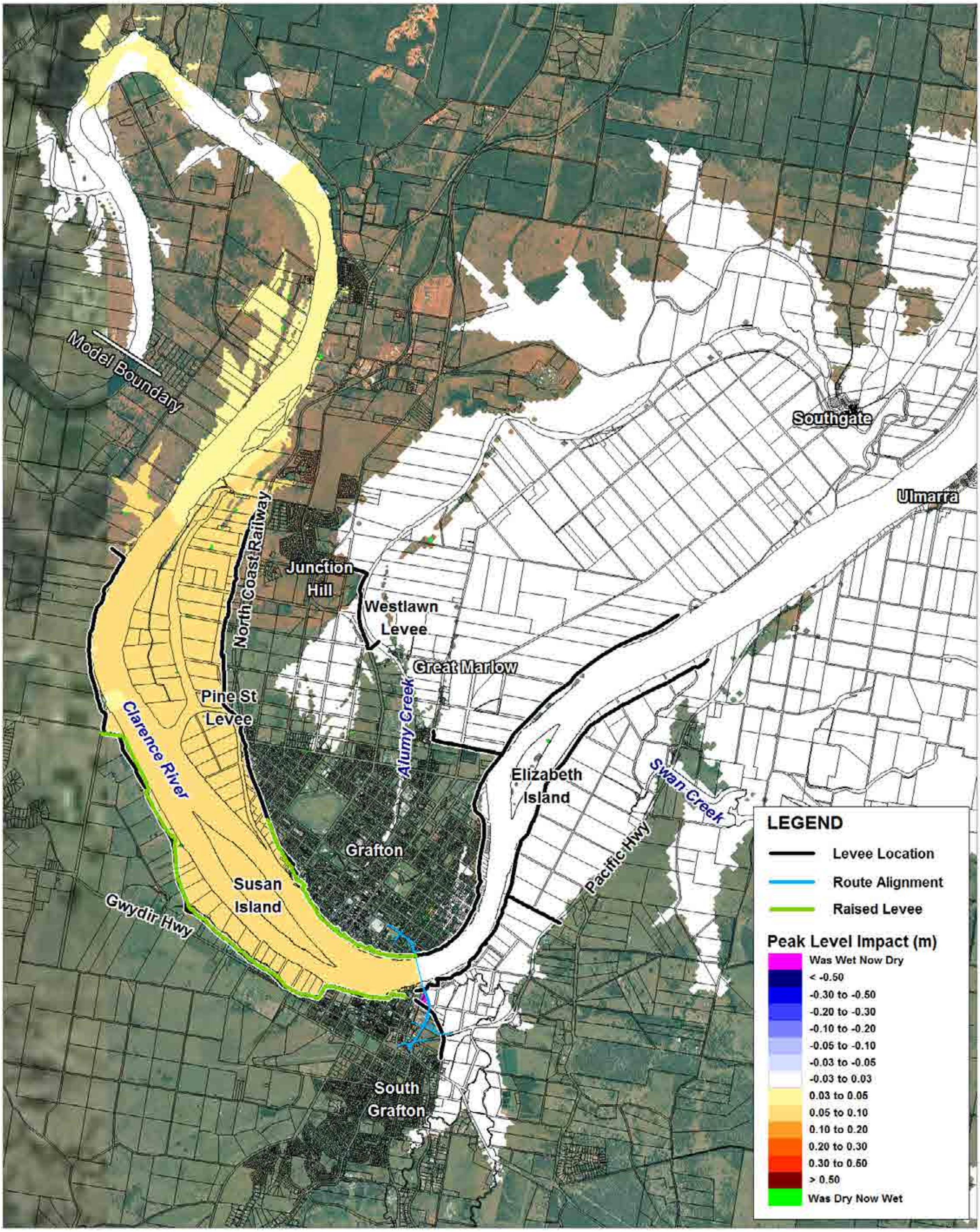
Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_072_140428_Q020_NoMit_Hdiff_268.wor"



Title:

Peak Flood Level Impacts (Mitigation Option 2)
20 Year ARI Event (Extended Model)

Figure: B-2

Rev: A

N

0km 1.5 3
Approx. Scale

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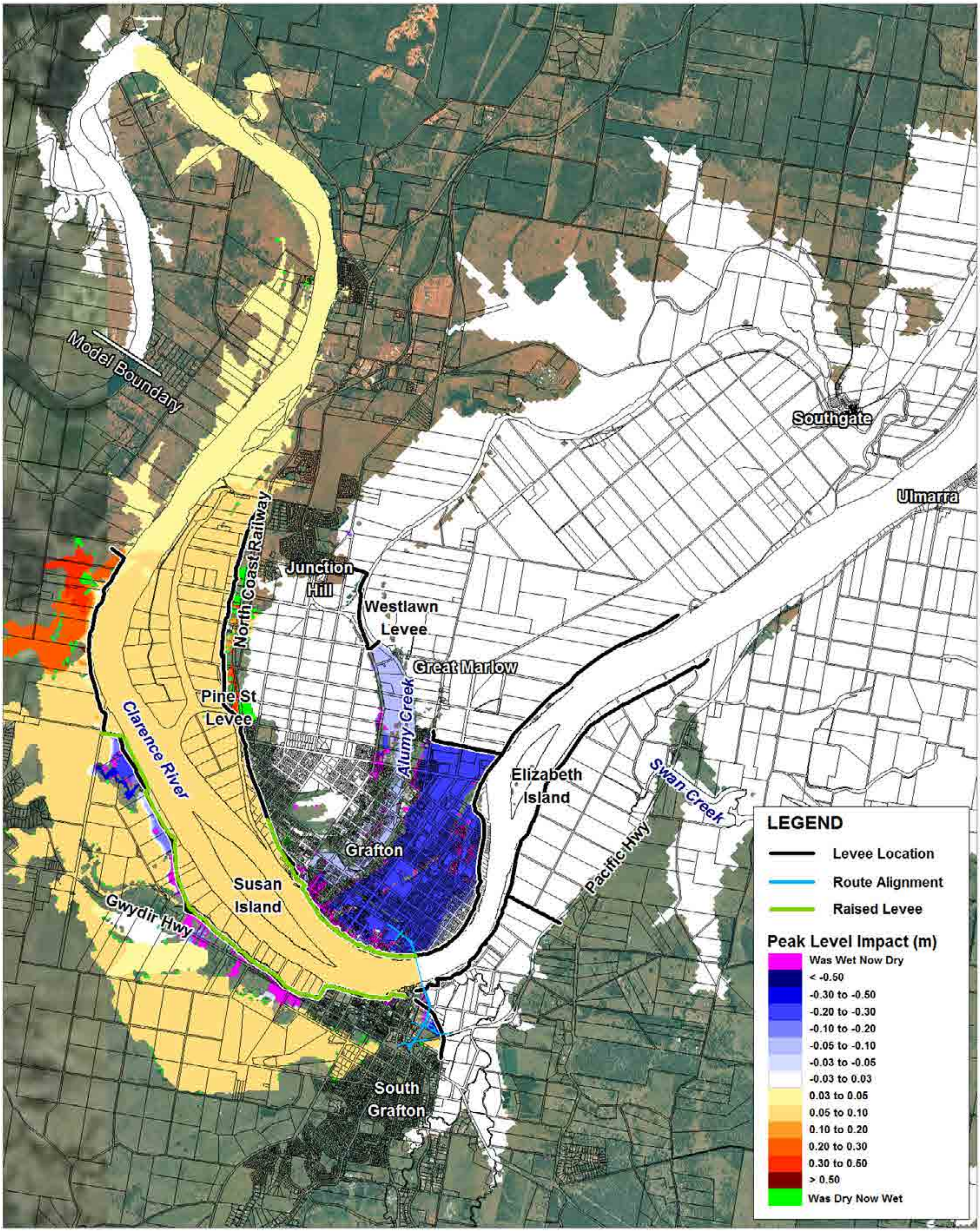
www.bmtwbm.com.au

Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_073_140428_Q020_Mit02_Hdiff_268.wor"



Title:

Peak Flood Level Impacts (Mitigation Option 2)
50 Year ARI Event (Extended Model)

Figure: **B-3**

Rev: **A**

N

0km 1.5 3
Approx. Scale

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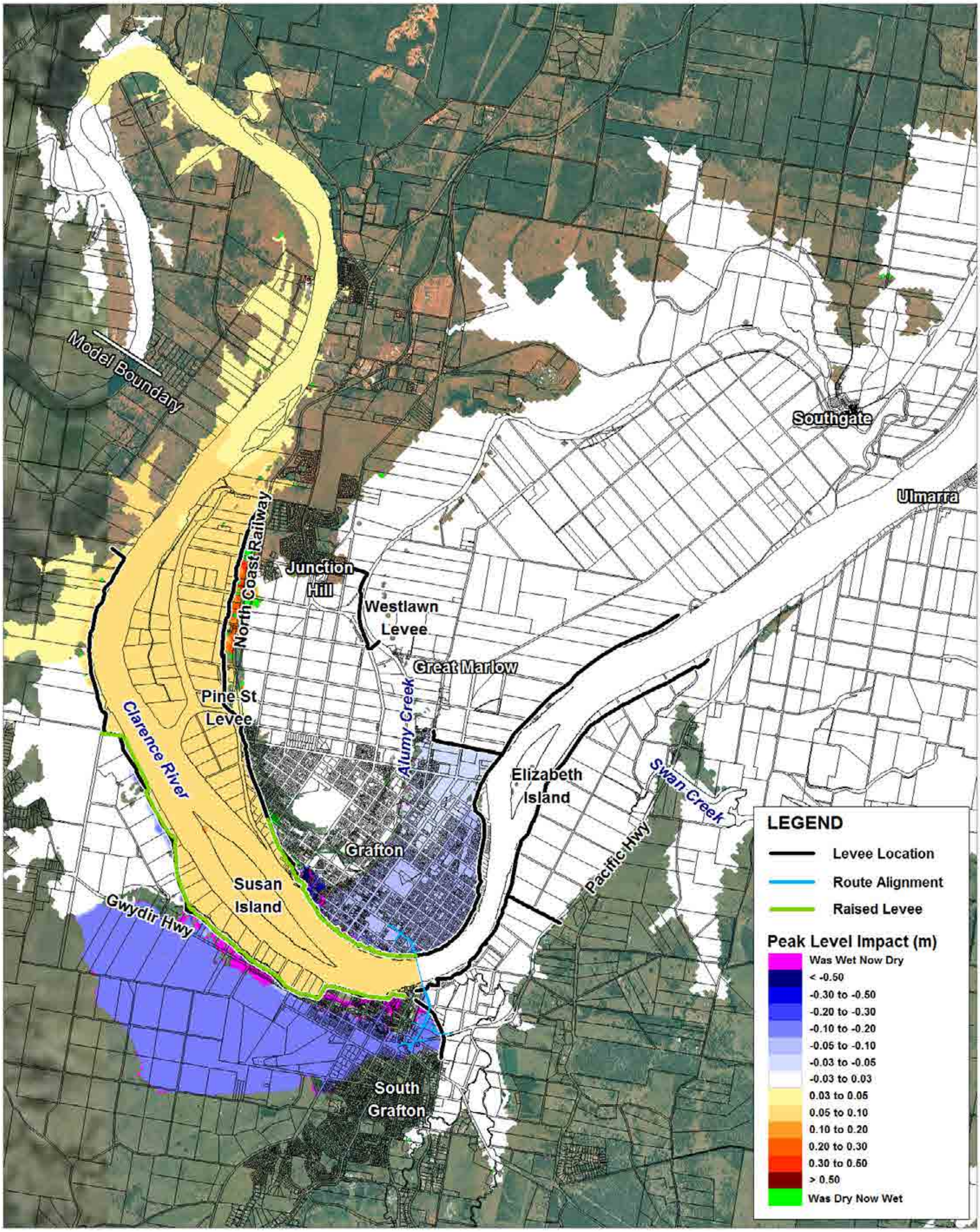
www.bmtwbm.com.au

Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_074_140428_Q050_Mit02_Hdiff_268.wor"



Title:

Peak Flood Level Impact (Mitigation Option 2)
100 Year ARI Event (Extended Model)

Figure: **B-4**

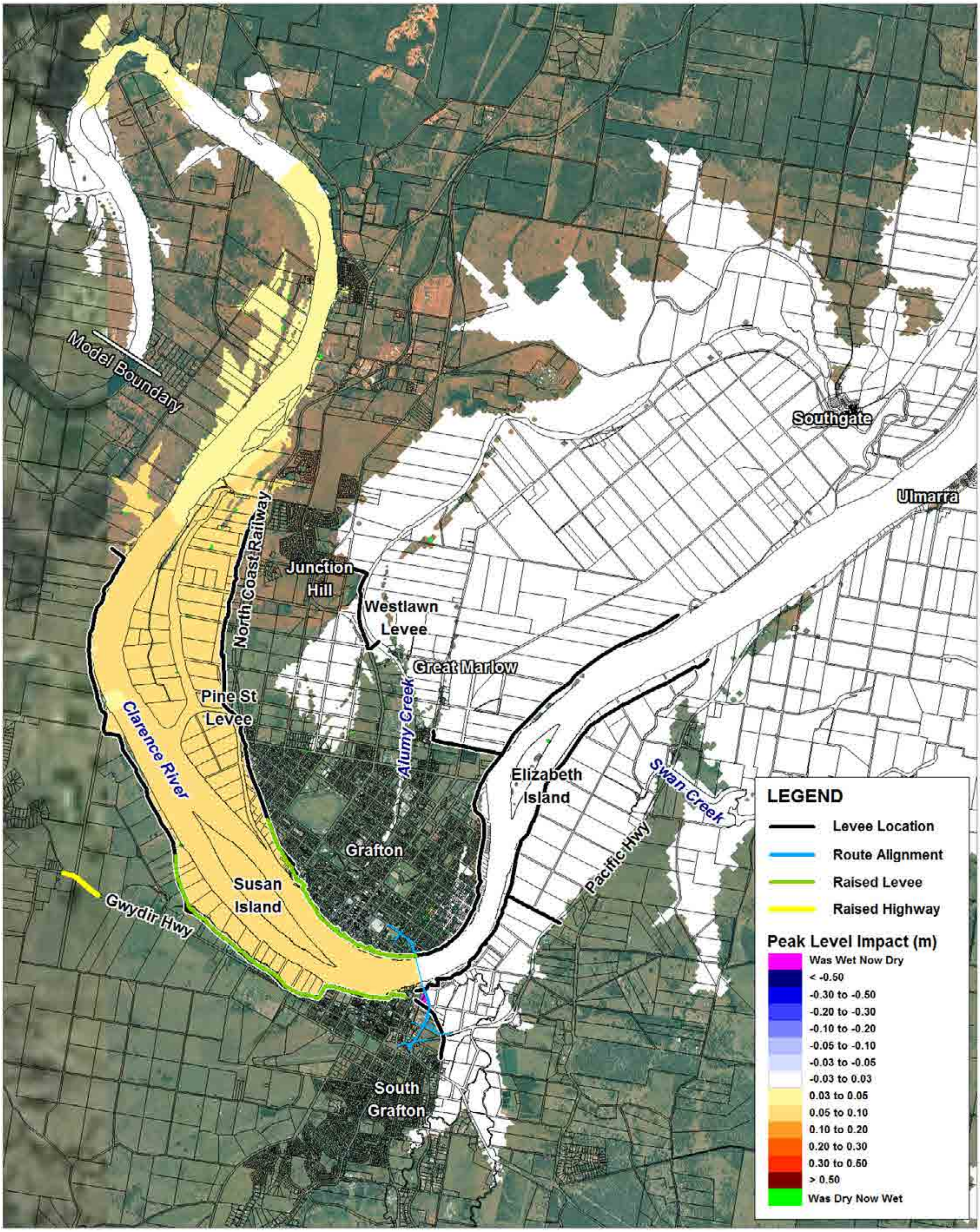
Rev: **A**

N

0km 1.5 3
Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_075_140428_Q100_Mit02_Hdiff_268.wor"



Title:

**Peak Flood Level Impact (Mitigation Option 4)
20 Year ARI Event (Extended Model)**

Figure: **B-5**

Rev: **A**

N

0km 1.5 3
Approx. Scale

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Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_076_140428_Q020_Mit04_Hdiff_268.wor"

Appendix C Local Drainage Assessment

C.1 Background

A requirement of the design criteria is that the main approach roads to the new bridge must be flood immune during a 20 year ARI design flood event (see Section 3). Within Grafton the proposed approach alignment runs under the North Coast Railway viaduct at Pound Street. This is an area known to experience existing local drainage issues. The drainage issues in this part of Grafton are predominantly caused by:

(1) Intense short duration storms, resulting in local drainage catchment runoff exceeding the capacity of the stormwater drainage network; and/or

(2) Long duration events resulting in elevated flood levels within the Clarence River, reducing stormwater network outflow.

A preliminary assessment of the local drainage flood behaviour was undertaken which included development of a local scale hydraulic model. This was to establish the baseline 20 year ARI flood levels and to determine if any mitigation measures were required to achieve a 20 year ARI flood immunity design criteria for the approach road under the viaduct.

Under the proposed design, the arch forming the railway viaduct over Pound Street will be modified to obtain the required clearance for heavy goods vehicles.

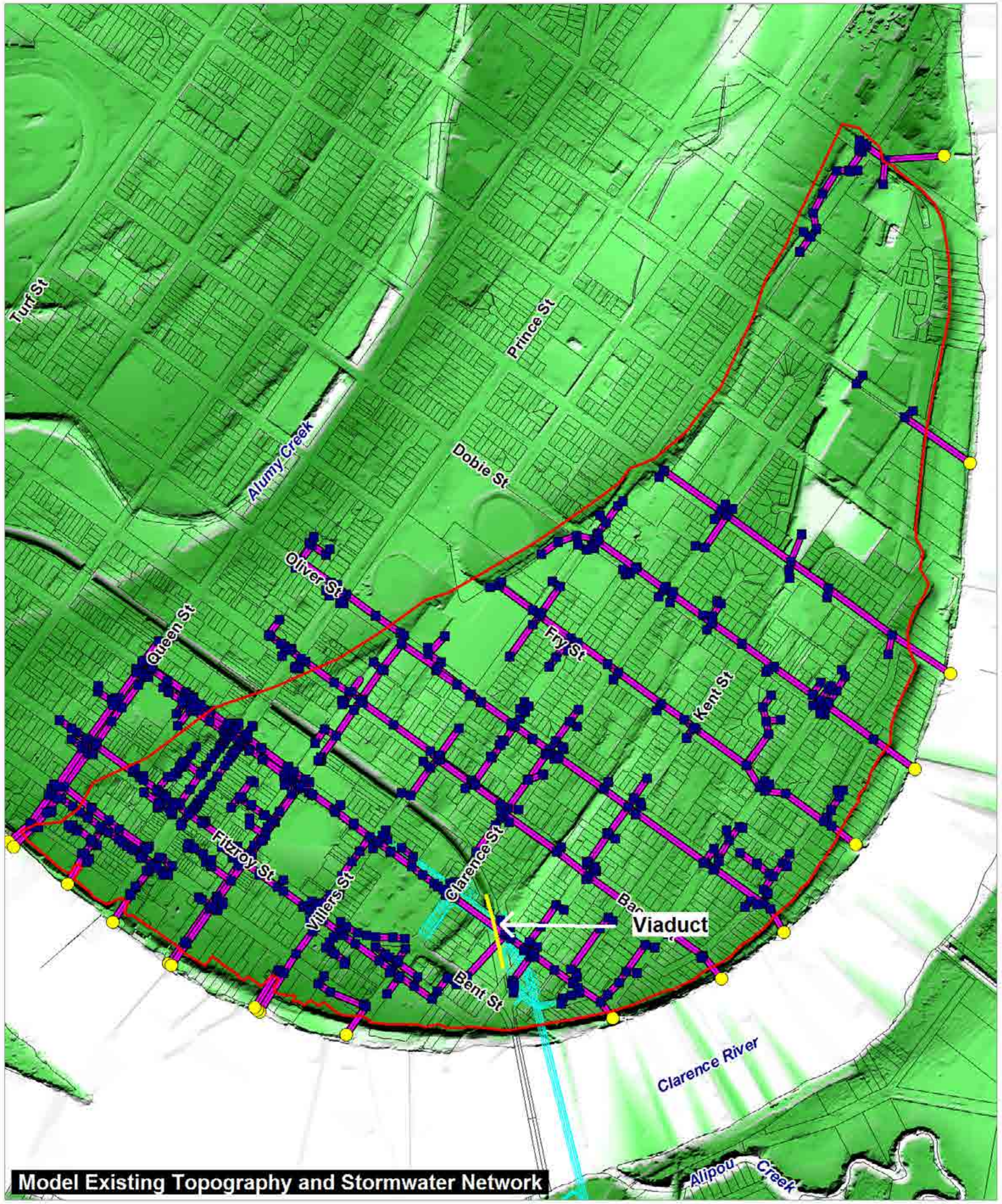
The local drainage model layout is shown in Figure C-1. The model extends beyond the local catchment of the proposed project/railway viaduct crossing. This increased area of assessment was required due to connectivity between neighbouring local drainage catchments via the Grafton stormwater network. A two-dimensional grid resolution of 5m was applied to the entire area, allowing for a detailed representation of the flows within the catchment. One dimensional elements were used to represent the stormwater network within the developed model.

General features represented in the model include:

- The Grafton stormwater pipe network (as supplied by Clarence Valley Council);
- Topographic data obtained from Airborne Laser Survey flown in March of 2010; and
- Refined landuse use mapping digitised from aerial photography, applying Manning's roughness values consistent with the greater Lower Clarence flood model (BMT WBM, 2013).

A 'direct rainfall' approach was used for the inflows to the hydraulic model with a mapping cutoff depth of 50mm. Losses applied to the model are as follows:

- Initial Rainfall Loss = 0mm;
- Continuing Rainfall Losses, Pervious Areas = 2.5mm/h; and
- Continuing Rainfall Losses, Impervious Areas = 0.0mm/h.



LEGEND

- Local Drainage Model Extent
- Stormwater Network
- Stormwater Pit
- Stormwater Outlet
- Route Alignment

Landuse

- Urban Blocks
- Roads
- Maintained Grass
- Unmaintained Grass

Title:	Figure:	Rev:
Grafton Local Drainage Model Layout	**C-1**	**A**

N

0m 300 600
Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_045_140122_Local_DR_Model.wor"

C.2 Boundary conditions

In Grafton, a 3 hour rainfall event is the critical duration event; the duration which ordinarily results in higher flood levels within areas such as Pound Street. However, long duration but less intense rainfall events can cause the Clarence River levels to rise. The increased river levels may, in turn prevent local runoff generated within Grafton from draining to the river.

This assessment has therefore considered the two scenarios of a long duration 20 year ARI rainfall event and a short duration 20 year ARI event. Consideration of both together, i.e. a 20 year ARI river level combined with a 20 year (or greater) ARI short duration storm event would have a combined probability greater than a 20 year ARI event and the assessment of such an event is not required to meet the road design criteria.

A historic rainfall event which occurred in 2009 has been simulated in the existing case model as a verification event to ensure the model is performing adequately.

The three event scenarios modelled as part of this assessment are summarised in Table C-1.

Table C-1 Grafton local drainage model event scenarios

ID	Event Description	Catchment Rainfall Inflow	River Downstream Boundary Condition	Comment
1	Historic 2009 Flood Event	Rainfall data sourced from BoM from South Grafton gauge	River water level boundaries sourced from 2009 event Lower Clarence flood model calibration simulation (BMT WBM, 2013)	Model verification event
2	3 hour 20 Year ARI Event Rainfall combined with a Mean High Water Spring Tide (fixed river boundary)	Rainfall data sourced from BoM Intensity Frequency Duration Program (rainfall volume = 95mm)	Mean high water tide level sourced from Manly Hydraulics	3hrs = Critical storm event duration when Clarence River is not in flood
3	72 hour 20 Year ARI Event Rainfall combined with a 20 Year ARI Clarence River Flood Event (dynamic river boundary)	Rainfall data sourced from BoM Intensity Frequency Duration Program (rainfall volume = 312mm)	River water level boundaries sourced from 20 Year ARI event Lower Clarence flood model	72hrs = Critical storm event duration when Clarence River is in flood

Figure C-2 to Figure C-4 show the model boundary conditions for the event scenarios.

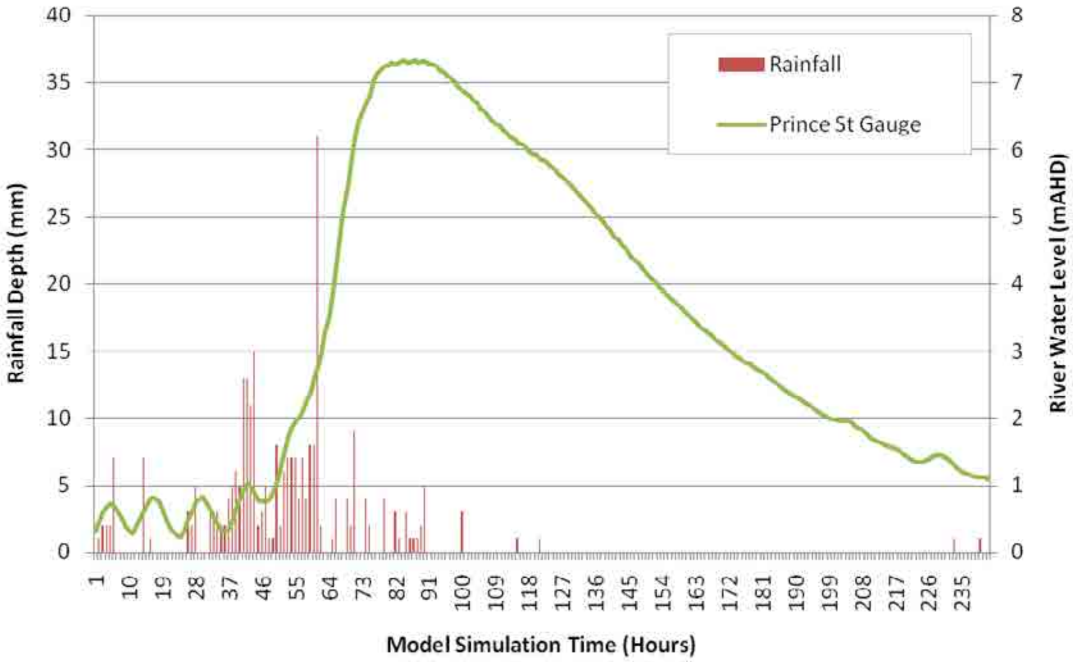


Figure C-2 Grafton local drainage model – 2009 boundary conditions

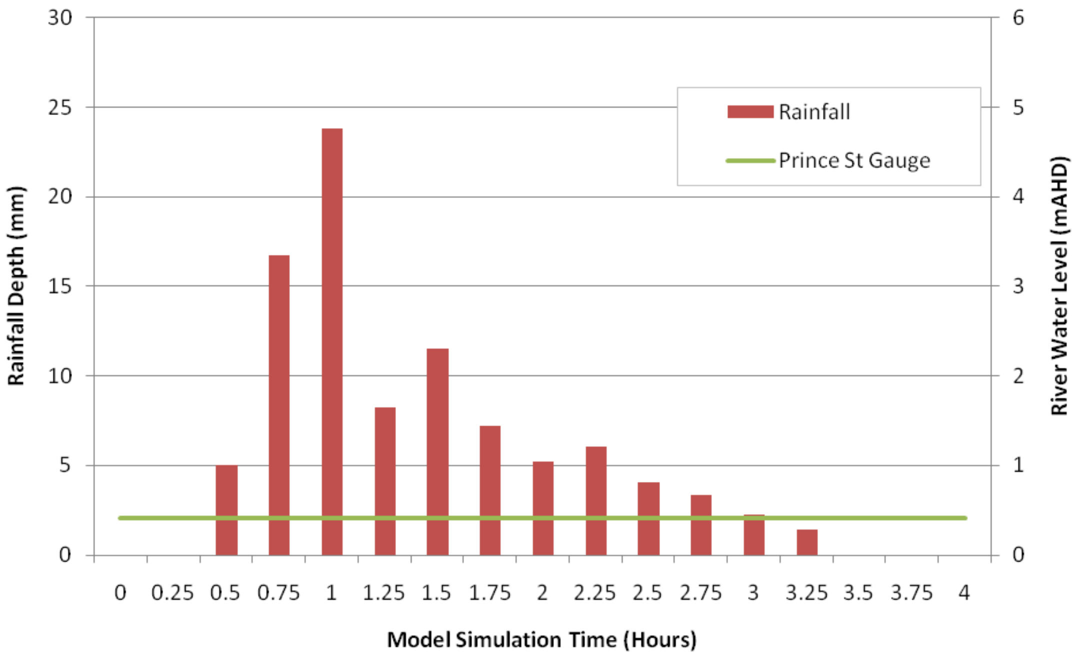


Figure C-3 Grafton local drainage model – 3 hour, 20 year ARI boundary conditions

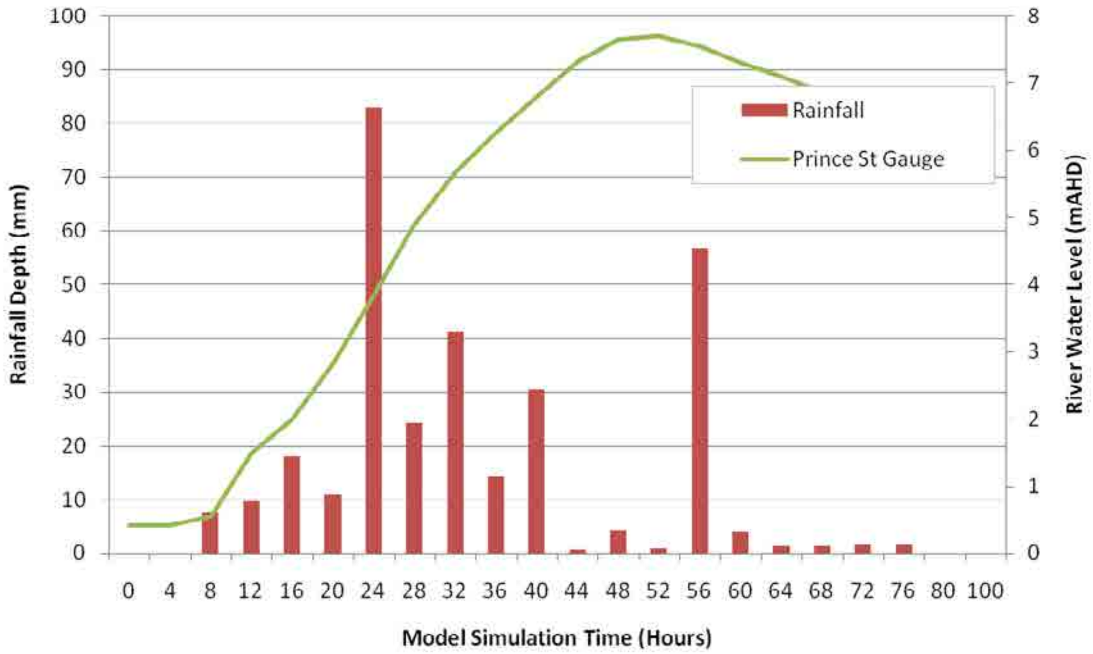


Figure C-4 Grafton local drainage model – 72 hour, 20 year ARI boundary conditions

The rainfall of the 2009 event is approximately equivalent to a 10 year ARI event for a 72 hour duration scenario (when the Clarence River would be expected to be in flood).

C.3 Assessment results

C.3.1 Existing case

The results for the existing case (pre- additional crossing and associated features) are shown in Figure C-5 to Figure C-7. It can be seen that there is significant inundation in the area of interest where Pound Street passes under the railway viaduct.

Flood levels adjacent to the railway viaduct for the assessed event scenarios are summarised below:

(1) Historic Flood Event: Recorded 3.75mAHD; Modelled 3.52mAHD;

(2) 3 hour, 20 year ARI event rainfall combined with a Mean High Water Spring tide: 3.49mAHD; and

(3) 72 hour, 20 year ARI event rainfall combined with a 20 year ARI flood event within the Clarence River: 4.35mAHD.

LEGEND

- Railway Line
- Route Alignment
- 3.52 Modelled Flood Level (mAHD)
- 3.75 Recorded Flood Level (mAHD)
- Cadastral Boundaries

Peak Level (mAHD)

- 1.0 to 2.0
- 2.0 to 3.0
- 3.0 to 4.0
- 4.0 to 5.0
- 5.0 to 6.0
- 6.0 to 7.0
- 7.0 to 8.0
- 8.0 to 9.0

Peak Depth (m)

- 0.0 to 0.5
- 0.5 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- 2.0 to 2.5
- 2.5 to 3.0
- 3.0 to 3.5
- 3.5 to 4.0
- 4.0 to 4.5
- 4.5 to 5.0
- > 5.0

Title:

Grafton Local Drainage Model Validation 2009 Event Results

Figure: C-5

Rev: A

N

0m 100 200

Approx. Scale

BMT WBM
www.bmtwbm.com.au

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LEGEND

- Railway Line
- Route Alignment
- Cadastral Boundaries

Peak Level (mAHD)
1.0 to 2.0
2.0 to 3.0
3.0 to 4.0
4.0 to 5.0
5.0 to 6.0
6.0 to 7.0
7.0 to 8.0
8.0 to 9.0

Peak Depth (m)
0.0 to 0.5
0.5 to 1.0
1.0 to 1.5
1.5 to 2.0
2.0 to 2.5
2.5 to 3.0
3.0 to 3.5
3.5 to 4.0
4.0 to 4.5
4.5 to 5.0
> 5.0

Title:

Existing Case Grafton Local Drainage Model
3 Hour 20 Year ARI Event Results (MHWS River Level)

Figure: **C-6**

Rev: **A**

N

0m 100 200

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_047_140122_Local_DR_Q20_3hr.wor"

LEGEND

- Railway Line
- Route Alignment
- Cadastral Boundaries

Peak Level (mAHD)
1.0 to 2.0
2.0 to 3.0
3.0 to 4.0
4.0 to 5.0
5.0 to 6.0
6.0 to 7.0
7.0 to 8.0
8.0 to 9.0

Peak Depth (m)
0.0 to 0.5
0.5 to 1.0
1.0 to 1.5
1.5 to 2.0
2.0 to 2.5
2.5 to 3.0
3.0 to 3.5
3.5 to 4.0
4.0 to 4.5
4.5 to 5.0
> 5.0

Title:
Existing Case Grafton Local Drainage Model
72 Hour 20 Year ARI Event Results (Combined River Flooding)

Figure: **C-7**

Rev: **A**

N

0m 100 200
Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_048_140122_Local_DR_Q20_72hr.wor"

C.3.2 Developed case

The lowest road elevation along the proposed bridge approach is 3.7mAHD. As a result, with no mitigation, the road would be inundated during the 20 year ARI for the long duration 72 hour event, and be close to being inundated from the short duration 20 year ARI event.

The proposed mitigation aims to create additional storage in the form of a detention basin on the southern side of Pound Street. Flow will be conveyed under Pound Street and the new approach road and into the basin by a series of culverts. Installation of the culverts will intercept the existing piped drainage network under Pound Street. It is proposed to redirect the piped local drainage at this location into the detention basin. The basin also intercepts a local drainage pipe from the west. This will also be diverted into the detention basin. The basin then drains out to the Clarence River via a new outlet pipe with a floodgate.

For short duration (3 hour) events the basin and its associated new outlet will provide sufficient storage/conveyance to significantly lower the 20 year peak flood level to be below the road surface. During these short duration events the water level in the Clarence River will typically be around normal levels and the detained water will drain from the basin via gravity. For long duration (72 hour) events, the Clarence River will most likely be in flood and the basin will detain the water from where it is pumped to the river.

Optimisation of the design has shown that the following arrangement achieves the design criteria:

- A detention basin with a volume of approximately 1,500m^3 located on the southern side of Pound Street;
- Pump/s with a combined capacity of up to 2m^3/s; and
- A series of culverts under Pound Street with a cross sectional flow area[11] up to 3.75m^2.

Table C-2 summarises the resulting peak flood levels following mitigation for the approach road at Pound Street.

Table C-2 Mitigated peak flood levels at Grafton approach road

20 year ARI 3 Hour Event	20 year ARI 72 Hour Event
2.6mAHD	2.9mAHD

It should be noted that with further refinement there is scope to reduce the basin size and/or required pumping capacity but the above arrangement demonstrates that a solution can be achieved. Figure C-8 and Figure C-9 present the resulting peak flood levels and change in levels from the existing case for the 20 year ARI 3 hour and 72 hour storm durations respectively.

[11] For hydraulic design purposes a 20% blockage has been assumed by modelling a cross sectional area of 3.0m^2.

LEGEND

- Railway Line
- Route Alignment
- Cadastral Boundaries

Peak Level (mAHD)
1.0 to 2.0
2.0 to 3.0
3.0 to 4.0
4.0 to 5.0
5.0 to 6.0
6.0 to 7.0
7.0 to 8.0
8.0 to 9.0

Peak Level Impact (m)
Was Wet Now Dry
< -1.00
-1.00 to -0.50
-0.50 to -0.25
-0.25 to -0.10
-0.10 to 0.10
0.10 to 0.25
0.25 to 0.50
0.50 to 1.00
> 1.00
Was Dry Now Wet

Title:

Developed Case Grafton Local Drainage Model
3 Hour 20 Year ARI Event Results (MHWS River Level)

Figure: **C-8**

Rev: **A**

N

0m 100 200

Approx. Scale

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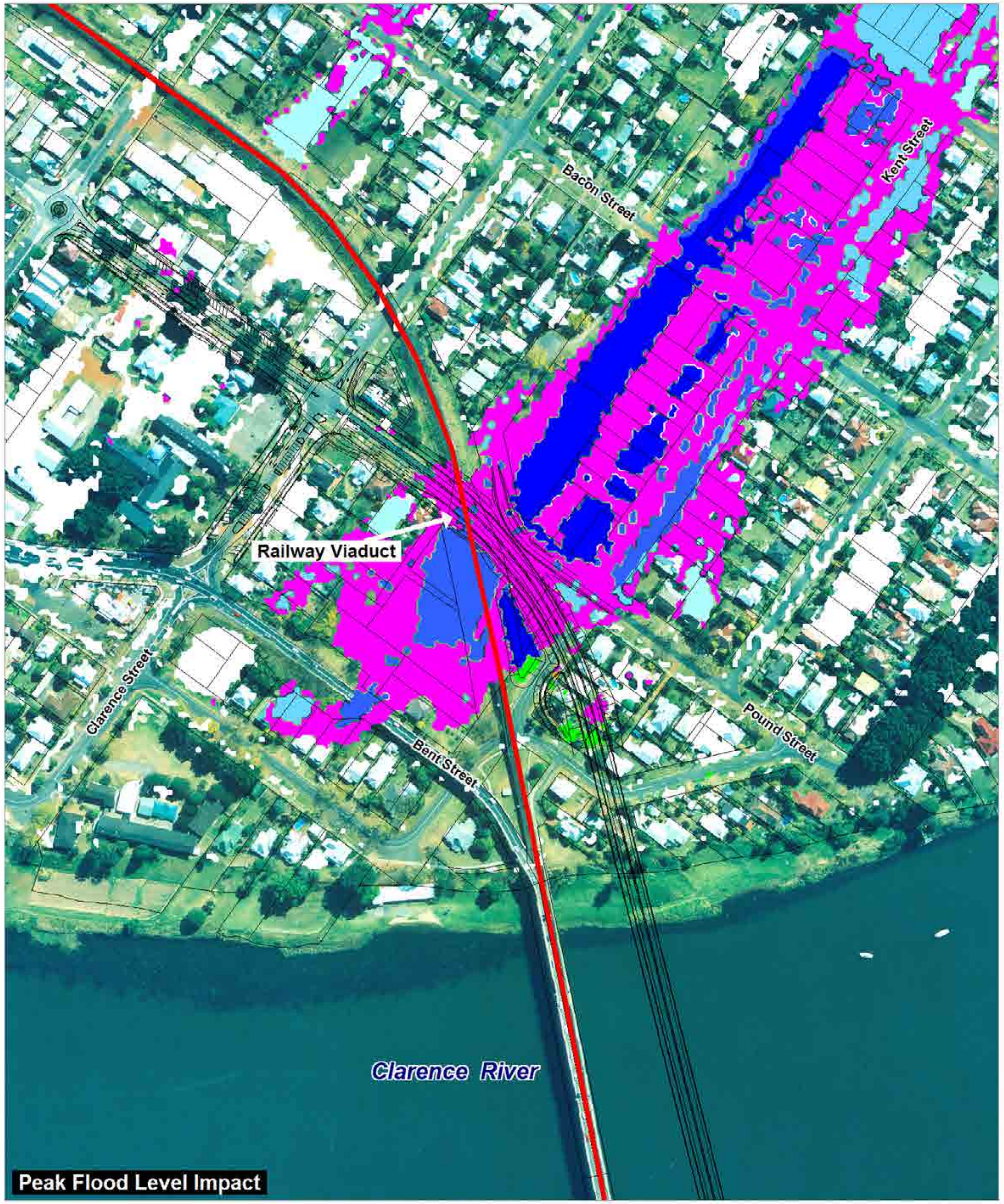
Filepath : "I:\B17815_I_Summerland_Way\DRG\EIS\FLD_049_140122_Local_DR_Q20_3hr_Impact.wor"



LEGEND

- Railway Line
- Route Alignment
- Cadastral Boundaries

Peak Level (mAHD)
1.0 to 2.0
2.0 to 3.0
3.0 to 4.0
4.0 to 5.0
5.0 to 6.0
6.0 to 7.0
7.0 to 8.0
8.0 to 9.0

Peak Level Impact (m)
Was Wet Now Dry
< -1.00
-1.00 to -0.50
-0.50 to -0.25
-0.25 to -0.10
-0.10 to 0.10
0.10 to 0.25
0.25 to 0.50
0.50 to 1.00
> 1.00
Was Dry Now Wet

Title:

Option C Grafton Local Drainage Model
72 Hour 20 Year ARI Event Results (Combined River Flooding)

Figure: **C-9**

Rev: **A**

N

0m 100 200
Approx. Scale

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